

Chapter 2

Alternatives

NEPA and CEQA require consideration of the potential effects of a range of action alternatives that would feasibly attain the majority of a project’s basic objectives and accomplish the specified project purpose and need, while avoiding and/or minimizing adverse environmental impacts, in addition to the No-Action/No-Project Alternative. The purpose of including alternatives in an EIS is to offer a clear basis for choice by decision makers and the public about whether to proceed with a proposed action or project.

NEPA requires that alternatives be evaluated at a comparable level of detail (40 Code of Federal Regulations (CFR) 1502.14(b)). Similarly, the Council on Environmental Quality regulations for implementing NEPA (40 CFR 1502.14) require a range of reasonable alternatives to be objectively evaluated in an EIS so that each alternative is evaluated at an equal level of detail. Alternatives that cannot reasonably meet the project purpose and need do not require detailed analysis.

CEQA requires that the lead agency consider alternatives that would avoid or reduce one or more of the significant impacts identified for a project in an EIR. The State CEQA Guidelines state that an EIR needs to describe and evaluate only those alternatives necessary to permit a reasonable choice and to foster informed decision making and informed public participation (Section 15126.6(f)). Consideration of alternatives focuses on those that can either eliminate significant adverse environmental impacts, or reduce them to less-than-significant levels; alternatives considered in this context may include those that are more costly, and those that could impede, to some degree, the attainment of all the project objectives (Section 15126.6(b)). CEQA does not require the alternatives to be evaluated at the same level of detail as a proposed project.

NEPA and CEQA require consideration of future conditions No-Action/No Project Alternative as a basis of comparison with the action alternatives.

This chapter documents compliance with NEPA requirements for alternatives analysis and the alternatives development process, and describes the six alternatives evaluated in detail in this DEIS. This chapter is also generally consistent with CEQA requirements. This chapter includes the following sections:

- **Section 2.1, Alternatives Development Process**, describing the overall plan formulation process and phases for the SLWRI, project

- 1 objectives, planning constraints and considerations, management
2 measures, and development and refinement of alternatives.
- 3 • **Section 2.2, No-Action Alternative**, describing the No-Action/No
4 Project alternative, representing a scenario in which a project is not
5 implemented.
 - 6 • **Section 2.3, Action Alternatives**, describing the comprehensive plans
7 (action alternatives) evaluated in this DEIS, including major
8 components, potential benefits, operations and maintenance, and
9 physical features/construction activities for each action alternative.
 - 10 • **Section 2.4, Alternatives Considered and Eliminated from Further**
11 **Analysis**, describing alternatives considered but eliminated from
12 further development and consideration during formulation of initial
13 alternatives and comprehensive plans.
 - 14 • **Section 2.5, Summary of Potential Benefits of Action Alternatives**,
15 summarizing the major potential benefits of proposed comprehensive
16 plans (action alternatives).
 - 17 • **Section 2.6, Preferred Alternative and Rationale for Selection**,
18 describing the basis for selecting a plan for recommendation, including
19 the criteria and considerations used in selecting a recommended course
20 of action by the Federal Government.

21 **2.1 Alternatives Development Process**

22 This section describes the alternatives development process for the SLWRI. A
23 more detailed description of this process is included in the Plan Formulation
24 Appendix.

25 **2.1.1 Plan Formulation Process**

26 Consistent with NEPA, the plan formulation process for Federal water resources
27 studies and projects identified in the *Economic and Environmental Principles*
28 *and Guidelines for Water and Related Land Resources Implementation Studies*
29 (P&G) (WRC 1983) begins with identifying existing and projected future
30 resources conditions likely to occur in a study area. This is followed by
31 defining water resources problems, needs, and opportunities to be addressed,
32 and developing planning objectives, constraints, and criteria.

1 For the SLWRI, the above process was separated into five phases, of which the
2 first three have been completed. These planning phases are shown in Figure 2-1
3 and described below:

- 4 • **Mission Statement Phase** – This study phase consisted of projecting
5 without-project future conditions, defining resulting resource problems
6 and needs, defining a specific set of planning objectives, and
7 identifying constraints and criteria for addressing the planning
8 objectives. These activities were documented in the 2003 *SLWRI*
9 *Mission Statement Milestone Report*.
- 10 • **Initial Alternatives Phase** – This phase included developing a number
11 of potential management measures, or project actions or features
12 designed to address planning objectives. These measures were then
13 used to formulate a set of plans that were conceptual in scope (concept
14 plans). These initial plans were evaluated and compared to the
15 planning objectives to identify the most suitable plans for further
16 development. This phase concluded with the release of the 2004
17 *SLWRI Initial Alternatives Information Report* describing the
18 formulation and evaluation of management measures and initial plans.
- 19 • **Comprehensive Plans Phase** – The measures and concept plans
20 carried forward were further refined and developed with more
21 specificity to formulate comprehensive alternative plans to address the
22 planning objectives. These plans were then evaluated and compared.
23 This phase included the release of the 2007 *SLWRI Plan Formulation*
24 *Report* describing the formulation, evaluation, and comparison of
25 comprehensive plans.
- 26 • **Plan Refinement Phase** – This phase focuses on further refinement of
27 the comprehensive plans to identify a plan suitable to be recommended
28 for implementation. This phase includes preparing and circulating a
29 Draft Feasibility Report, which was completed in November 2011 and
30 released to the public in February 2012, and this Draft EIS.
- 31 • **Recommended Plan Phase** – The next phase of the SLWRI planning
32 process will focus on identifying a recommended plan, preparing a
33 Biological Assessment, and confirming Federal and non-Federal
34 responsibilities. This phase will conclude with the preparation and
35 processing of a Final Feasibility Report to support a Federal decision,
36 and a Final EIS.

37 Public and stakeholder outreach was performed concurrently with the above
38 phases, as shown in Figure 2-1. Major reports include the *SLWRI Strategic*
39 *Agency and Public Involvement Plan*, published in 2003 (Reclamation), and the
40 *SLWRI Environmental Scoping Report*, published in 2006 (Reclamation).

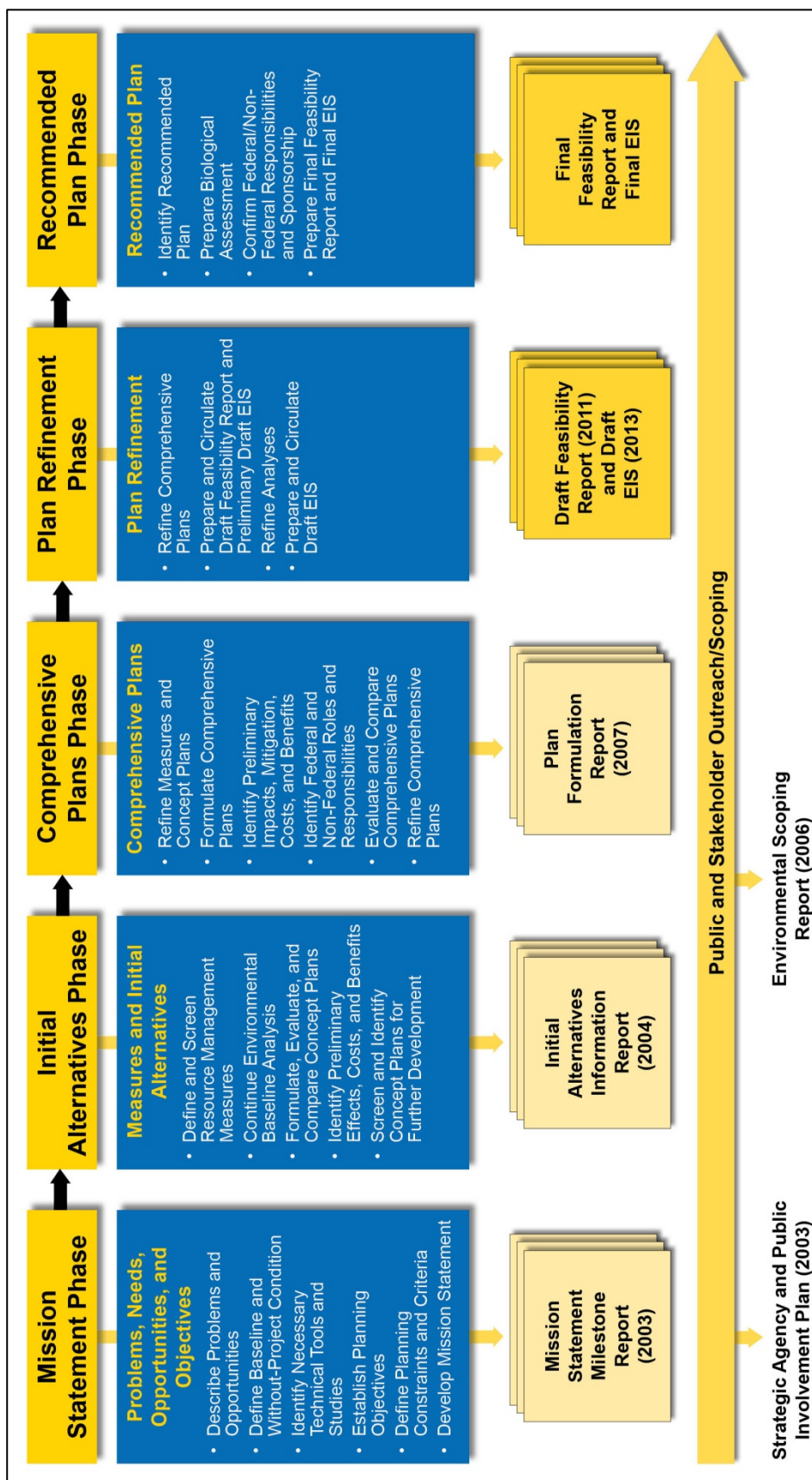


Figure 2-1. Plan Formulation Phases

2.1.2 Project Objectives

On the basis of the problems, needs, and opportunities identified in the plan formulation process, study authorities, and other pertinent direction, including information contained in the CALFED Bay-Delta Program (CALFED) Record of Decision (ROD) (CALFED 2000), primary and secondary project objectives (also referred to as planning objectives) were developed. Primary objectives are those which specific alternatives are formulated to address. The primary objectives are considered to have equal priority, with each pursued to the maximum practicable extent without adversely affecting the other. Secondary objectives are considered to the extent possible through pursuit of the primary objectives.

- **Primary Objectives:**

- Increase the survival of anadromous fish populations in the Sacramento River, primarily upstream from the Red Bluff Pumping Plant (RBPP)
- Increase water supply and water supply reliability for agricultural, municipal and industrial (M&I), and environmental purposes to help meet current and future water demands, with a focus on enlarging Shasta Dam and Reservoir

- **Secondary Objectives:**

- Conserve, restore, and enhance ecosystem resources in the Shasta Lake area and along the upper Sacramento River
- Reduce flood damage along the Sacramento River
- Develop additional hydropower generation capabilities at Shasta Dam
- Maintain and increase recreation opportunities at Shasta Lake
- Maintain or improve water quality conditions in the Sacramento River downstream from Shasta Dam and in the Delta

2.1.3 Planning Constraints and Other Considerations

The P&G provides fundamental guidance for the formulation of Federal water resources projects. In addition, basic constraints and considerations specific to this investigation were developed and identified. Following is a summary of the constraints and considerations relevant to the SLWRI. These planning constraints and considerations are described in more detail in the Plan Formulation Appendix.

1 **Planning Constraints**

2 Planning constraints help guide the plan formulation process. Some planning
3 constraints are more rigid than others. Examples of more rigid constraints
4 include congressional direction in study authorizations; other current applicable
5 laws, regulations, and policies; and physical conditions (e.g., topography,
6 hydrology). Other planning constraints are less restrictive but are still
7 influential in guiding the process. Examples include water resource planning
8 efforts such as the CALFED ROD.

9 **Planning Considerations**

10 Planning considerations were specifically identified to help formulate, evaluate,
11 and compare initial plans and, later, detailed alternatives:

- 12 • Alternative plans should incorporate results of coordination with other
13 Federal and State agencies such as the USFWS; NMFS; USFS; U.S.
14 Department of Interior, Bureau of Indian Affairs; U.S. Department of
15 Interior, Bureau of Land Management (BLM); DWR; and CDFW.
- 16 • A direct and significant geographical, operational, and/or physical
17 dependency must exist between major components of alternatives.
- 18 • Alternative plans should address, at a minimum, each of the identified
19 primary planning objectives and, to the extent possible, the secondary
20 planning objectives.
- 21 • Measures to address secondary planning objectives should be either
22 directly or indirectly related to the primary planning objectives (i.e.,
23 plan features should not be independent increments).
- 24 • Alternatives should strive to first avoid potential adverse effects to
25 environmental resources, or then should include features to mitigate for
26 unavoidable adverse effects through enhanced designs, construction
27 methods, and/or facilities operations.
- 28 • Alternatives should avoid any increases in flood damage or other
29 significant, adverse hydraulic effects to areas downstream along the
30 Sacramento River.
- 31 • Alternatives should strive to first avoid potential adverse effects to
32 present or historical cultural resources, or then include features to
33 mitigate unavoidable adverse effects.
- 34 • Alternatives should not result in significant adverse effects to existing
35 and future water supplies, hydropower generation, or related water
36 resources conditions.

- 1 • Alternatives should strive to balance increased water supply reliability
2 between agricultural and M&I uses.

- 3 • Alternatives should not result in a reduction in existing recreation
4 capacity at Shasta Lake.

- 5 • Alternatives are to consider the purposes, operations, and limitations of
6 existing projects and programs and be formulated to not adversely
7 impact those projects and programs.

- 8 • Alternatives are to be formulated and evaluated based on a 100-year
9 period of analysis.

- 10 • Construction costs for alternatives are to reflect current prices and price
11 levels, and annual costs are to include the current Federal discount rate
12 and an allowance for interest during construction.

- 13 • Alternatives are to be formulated to neither preclude nor enhance
14 development and implementation of other elements included in the
15 CALFED ROD or other water resources programs and projects in the
16 Central Valley.

- 17 • Alternatives should have a high certainty for achieving intended
18 benefits and not significantly depend on long-term actions (past the
19 initial construction period) for success. Alternatives that require future
20 and ongoing action specific for success have a higher uncertainty than
21 other plans.

22 **2.1.4 Management Measures**

23 Following development of objectives, constraints, and other considerations for
24 the SLWRI, the next major step in plan formulation was to identify and evaluate
25 potential management measures. A management measure is any structural or
26 nonstructural project action or feature that could address the objectives and
27 satisfy the other applicable planning considerations. Numerous potential
28 management measures were identified based on coordination with agencies,
29 public and stakeholder outreach activities, and previous studies, programs, and
30 projects. These measures were developed through study team meetings, field
31 inspections, outreach, and environmental scoping for the SLWRI. Management
32 measures are listed in Table 2-1 and described in detail in the Plan Formulation
33 Appendix.

34

Table 2-1. Management Measures to Address Objectives

Objectives		Management Measure	Retained	Deleted
Primary Objectives				
Increase Anadromous Fish Survival	Improve Fish Habitat	Restore abandoned gravel mines along the Sacramento River		X
		Construct instream aquatic habitat downstream from Keswick Dam	X	
		Replenish spawning gravel in the Sacramento River	X	
		Construct instream fish habitat on tributaries to the Sacramento River		X
		Remove instream sediment along Middle Creek		X
		Rehabilitate inactive instream gravel mines along Stillwater and Cottonwood creeks		X
	Improve Water Flows and Quality	Make additional modifications to Shasta Dam for temperature control	X	
		Enlarge Shasta Lake cold-water pool	X	
		Modify storage and releases operations at Shasta Dam	X	
		Modify ACID diversions to reduce flow fluctuations		X
		Increase instream flows on Clear, Cow, and Bear creeks		X
		Construct a storage facility on Cottonwood Creek to augment spring instream flows		X
		Transfer existing Shasta Reservoir storage from water supply to cold-water releases		X
		Remove Shasta Dam and Reservoir		X
	Improve Fish Migration	Improve fish trap below Keswick Dam		X
		Screen diversions on Old Cow and South Cow creeks		X
		Remove or screen diversions on Battle Creek		X
		Construct a migration corridor from the Sacramento River to the Pit River		X
		Cease operating or remove the Red Bluff Diversion Dam		X
		Reoperate the CVP to improve overall fish management		X
Construct a fish ladder on Shasta Dam			X	
Reintroduce anadromous fish to areas upstream from Shasta Dam			X	
Increase Water Supply Reliability	Increase Surface Water Storage	Increase conservation storage space in Shasta Reservoir by raising Shasta Dam	X	
		Construct new conservation storage reservoir(s) upstream from Shasta Reservoir		X
		Construct new conservation storage on tributaries to the Sacramento River downstream from Shasta Dam		X
		Construct new conservation offstream surface storage near the Sacramento River downstream from Shasta Dam		X
		Construct new conservation surface water storage south of the Delta		X
		Increase total or seasonal conservation storage at other CVP facilities		X
		Dredge bottom of Shasta Reservoir		X

Table 2-1. Management Measures to Address Objectives (contd.)

Objectives		Management Measure	Retained	Deleted
Increase Water Supply Reliability (continued)	Reoperate Reservoir	Increase effective conservation storage space in Shasta Reservoir by increasing efficiency of reservoir operation for water supply reliability	X	
		Increase the conservation pool in Shasta Reservoir by encroaching on dam freeboard		X
		Increase conservation storage space in Shasta Reservoir by reallocating space from flood control		X
	Improve Conjunctive Water Management	Develop conservation offstream surface storage near the Sacramento River downstream from Shasta Dam		X
		Develop conservation groundwater storage near the Sacramento River downstream from Shasta Dam		X
		Develop additional conservation groundwater storage south of the Delta		X
	Coordinate Operation and Precipitation Enhancement	Improve Delta export and conveyance capability through coordinated CVP and SWP operations		X
		Implement additional precipitation enhancement		X
	Reduce Demand	Implement water use efficiency methods	X	
		Retire agricultural lands		X
	Improve Water Transfers and Purchases	Transfer water between users		X
	Expand Delta Export and Conveyance Facilities	Expand Banks Pumping Plant		X
		Construct Delta-Mendota Canal/California Aqueduct intertie		X
	Improve Surface Water Treatment	Implement treatment/supply of agricultural drainage water		X
		Construct desalinization facility		X

Table 2-1. Management Measures to Address Objectives (contd.)

Objectives		Management Measure	Retained	Deleted
Secondary Objectives				
Conserve, Restore, and Enhance Ecosystem Resources	Improve Cold-Water and Warm-Water Fishery Habitat	Construct shoreline fish habitat around Shasta Lake	X	
		Construct instream fish habitat on tributaries to Shasta Lake	X	
		Increase instream flows on the lower McCloud River		X
		Reduce acid mine drainage entering Shasta Lake		X
		Reduce motorcraft access to upper reservoir arms		X
		Increase instream flows on the Pit River		X
	Restore and Conserve Riparian and Wetland Habitat	Restore riparian and floodplain habitat along the Sacramento River	X	
		Restore wetlands along the Fall River and Hat Creek		X
		Conserve upper Pit River riparian areas		X
		Restore riparian and floodplain habitat on lower Clear Creek		X
		Promote Great Valley cottonwood regeneration along the Sacramento River		X
		Conserve riparian corridor along Cow Creek		X
		Remove and control nonnative vegetation in the Cow Creek and Cottonwood Creek watersheds		X
	Improve Other Fish and Wildlife Habitat	Create a parkway along the Sacramento River		X
		Enhance forest management practices to conserve bald eagle nesting habitat		X
		Remove and control nonnative plants around Shasta Lake		X
		Control erosion and restore affected habitat in the Shasta Lake area		X
		Develop geographic information system for Shasta to Red Bluff reach		X
	Implement erosion control in tributary watersheds		X	
Reduce Flood Damage		Update Shasta Dam and Reservoir flood management operations	X	
		Increase flood management storage space in Shasta		X
		Implement nonstructural flood damage reduction measures		X
		Implement traditional flood damage reduction measures		X
		Route PMF from top of conservation pool		X

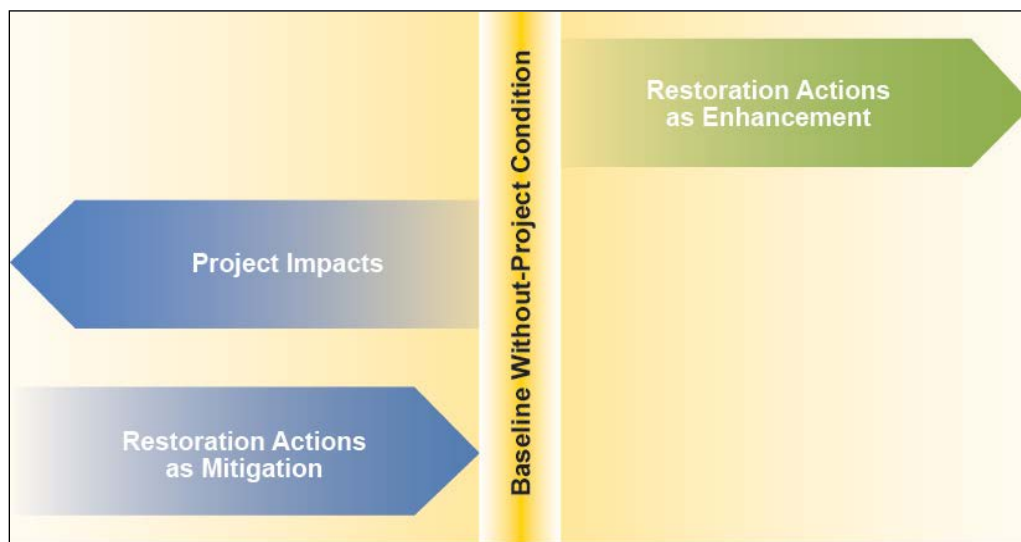
Table 2-1. Management Measures to Address Objectives (contd.)

Objectives	Management Measure	Retained	Deleted
Develop Additional Hydropower Generation	Modify existing/construct new generation facilities at Shasta Dam to take advantage of increased hydraulic head	X	
	Construct new hydropower generation facilities		X
Maintain and Increase Recreation Opportunities	Maintain and enhance recreation capacity, facilities, and opportunities	X	
	Develop new NRA recreation plan		X
	Reoperate reservoir for recreation	X	
Maintain or Improve Water Quality	Improve operational flexibility for Delta water quality by increasing storage in Shasta Reservoir	X	

Key:

- ACID = Anderson-Cottonwood Irrigation District
- Banks Pumping Plant = Harvey O. Banks Pumping Plant
- CVP = Central Valley Project
- Delta = Sacramento-San Joaquin Delta
- NRA = National Recreation Area
- PMF = probable maximum flood
- SWP = State Water Project

1 In the context of SLWRI management measures and project actions, the term
2 “enhancement” specifically refers to restoration actions that improve
3 environmental conditions above the baseline (without-project condition).
4 Correspondingly, the term “mitigation” refers to restoration actions that
5 improve environmental conditions toward the baseline to compensate for
6 unavoidable adverse project impacts. The relationship between enhancement and
7 mitigation is illustrated in Figure 2-2.



8
9
10 **Figure 2-2. Conceptual Schematic of Restoration Actions as Enhancement Versus Restoration Actions as Mitigation**

11 The SLWRI study team and stakeholders reviewed the management measures
12 for their ability to address the primary and secondary objectives. Retained
13 management measures were combined to formulate concept plans. As detailed
14 in the Plan Formulation Appendix, measures are retained for possible inclusion
15 in an alternative plan or deleted from further consideration for various reasons.
16 One important factor for retention in alternative plans is the potential for a
17 measure to directly address an objective without adversely impacting other
18 objectives.

19 Of the management measures listed in Table 2-1, eight measures addressing
20 primary objectives were selected for further consideration and potential
21 inclusion in alternative plans. In addition, eight measures addressing secondary
22 objectives were also selected for potential inclusion in alternative plans.
23 Measures that have been carried forward are believed to best address the project
24 objectives, with consideration of planning constraints and criteria. It should be
25 noted that measures that have been deleted from consideration in this phase may
26 be reconsidered in the future as mitigation measures.

1 **2.1.5 Initial Alternatives Phase**

2 The retained measures were used to formulate a preliminary set of plans that
3 were conceptual in scope. Each concept plan was reviewed for impacts, costs,
4 and benefits and compared to objectives to determine whether the plan should
5 be eliminated or carried forward into the comprehensive plans phase. The
6 purpose of this phase of the formulation process was to (1) explore an array of
7 different strategies to address the primary objectives, constraints, and criteria,
8 and (2) identify concept plans that would warrant further development in the
9 comprehensive plans phase.

10 First, two sets of plans were developed that focused on either anadromous fish
11 survival (AFS) or water supply reliability (WSR) as the single primary
12 objective. Three AFS plans and four WSR plans were developed. Although the
13 AFS and WSR plans focused on single objectives, each generally contributed to
14 both primary objectives. In the three AFS plans, for example, emphasis was
15 placed on combinations of measures that could best address the fish survival
16 goals while considering incidental benefits to water supply reliability, if
17 possible. Second, five plans were developed that included measures to address
18 both primary and, to a lesser degree, secondary objectives, termed combined
19 objective (CO) plans. All 12 concept plans are listed in Table 2-2, and are
20 explained in detail in the Plan Formulation Appendix.

1 **Table 2-2. Summary of Concept Plan Features**

Plan	Features											
	Dam Raise	Primary Objective Focus						Secondary Objectives Addressed ⁴				
		Water Supply Reliability ²		Anadromous Fish Survival				Environmental Restoration		Flood Control and Hydropower		
	Raise Shasta Dam ¹ (feet)	Increase Conservation Storage	Perform Conjunctive Water Management ³	Reoperate Shasta Dam	Modify TCD	Replenish Spawning Gravel	Enlarge Shasta Lake Cold-Water Pool	Increase Minimum Flows ³	Restore Shoreline Aquatic Habitat	Restore Tributary Aquatic Habitat	Restore Riparian Habitat	Modify Flood Control Operations and Implement Shasta Public Safety ³ Features
AFS-1	6.5	*		Changes to water supply operations and modification of the TCD would likely be included, to some extent, in any alternative that includes raising Shasta Dam.		X					Changes to flood control operations at Shasta Dam, Public Safety, ³ and hydropower facilities would likely be part of any alternative that includes physically modifying Shasta Dam; the degree and details of these changes will be included in feasibility level alternative plans.	
AFS-2	6.5	*				*	X					
AFS-3	6.5	*				X	*	X				
WSR-1	6.5	X					*					
WSR-2	18.5	X					*					
WSR-3	202.5	X					*					
WSR-4	18.5	X	X				*					
CO-1	6.5	X				X	X					
CO-2	18.5	X				X	X					
CO-3	18.5	X				X	X	X				
CO-4	6.5	X	X			X	X		X	X		X
CO-5	18.5	X	X			X	X		X	X		X

Notes:

¹ Raising Shasta Dam provides both water supply and temperature benefits, regardless of how the additional storage is exercised. While the anadromous fish survival measures focus on use of the additional space for anadromous fish survival, they also provide water supply benefits. Similarly, the water supply reliability measures focus on water supply reliability but the reservoir enlargements also provide benefits to anadromous fish.

² All concept plans will include water demand reduction.

³ These measures were used for evaluation because they were retained at the time of plan formulation. However, they have since been removed from consideration.

⁴ Water quality and recreation were added as secondary objectives after development of concept plans, and are not considered in this table.

Key:

* Coincidental benefit, although not a primary focus of the concept plan.

AFS-x = anadromous fish survival

CO-x = combined objectives

TCD = temperature control device

WSR-x = water supply reliability

X = Primary focus of concept plan

1 The 12 concept plans were compared considering two basic planning criteria:
2 effectiveness and efficiency. Effectiveness is the extent to which an alternative
3 alleviates problems and achieves objectives; efficiency is the measure of how
4 efficiently an alternative alleviates identified problems and meets specified
5 objectives to protect the Nation’s environment. These, along with completeness
6 and acceptability, are the four general criteria identified in the *Federal Water
7 Resources Council Principles and Guidelines for Water and Related Land
8 Resources Implementation Studies* (WRC 1983). Based on this comparison, and
9 the relative ability of plans to address both primary objectives, five of the
10 concept plans were initially recommended for further development as
11 comprehensive plans: WSR-1, WSR-2, WSR-4, CO-2, and CO-5. None of the
12 AFS plans were recommended for further development because AFS-1 did not
13 contribute to the primary objective of increasing water supply reliability, and
14 evaluations indicated that AFS-2 and AFS-3 would result in less benefits to
15 anadromous fish survival than any of the WSR and CO plans. This is because
16 AFS-2 and AFS-3 focused on increasing minimum flows in the upper
17 Sacramento River, which resulted in a reduced cold-water pool during drought
18 periods in comparison to WSR and CO plans.

19 Through subsequent evaluations, CO-2 was also eliminated from further
20 consideration because continued evaluation concluded that restoration of
21 existing gravel mines would have a low efficiency and likelihood of
22 successfully benefiting salmon resources. Subsequent analysis of WSR-4 and
23 the conjunctive use component of CO-5 indicated tradeoffs between conjunctive
24 use water supply benefits and critical gains in fisheries benefits. The resulting
25 reduction in benefits to fisheries operations in dry and critical years¹ was
26 deemed unacceptable in terms of meeting primary project objectives. Thus,
27 WSR-4 and the conjunctive use component of CO-5 were eliminated from
28 further consideration.

29 The eight concept plans eliminated from further consideration are described in
30 Section 2.5, “Alternatives Considered and Eliminated from Further
31 Consideration.” Although these concept plans were not further considered as
32 stand-alone plans, major features of some of these plans were refined for further
33 development into alternatives. Concept plans eliminated from further
34 consideration, and rationale for their elimination, are discussed in greater detail
35 in the Plan Formulation Appendix.

36 **2.1.6 Development and Refinement of Comprehensive Plans**

37 Through continued refinement of management measures and concept plans
38 carried forward, the following plan types were identified for further
39 development into comprehensive plans:

¹ Throughout this document, water year types are defined according to the Sacramento Valley Index Water Year Hydrologic Classification unless specified otherwise.

- 1 • Plan(s) to raise Shasta Dam between 6.5 feet and 18.5 feet, focusing on
2 both water supply reliability and anadromous fish survival but with
3 benefits to various secondary objectives

- 4 • Plan(s) to raise Shasta Dam by about 18.5 feet, focusing on
5 anadromous fish survival, but also including water supply reliability
6 and other various secondary objectives

- 7 • Plan(s) to raise Shasta Dam by about 18.5 feet, focusing on all
8 objectives

9 Considering results of initial plan formulation efforts, the approach was to first
10 formulate plans focusing on different dam raise heights within the range of 6.5
11 feet to 18.5 feet to address the first plan type listed above. A dam raise of 12.5
12 feet was chosen because it represented a midpoint between the smallest and
13 largest likely and practical dam raises. Next, the approach was to identify the
14 most efficient and effective of the identified dam raise heights, and formulate
15 comprehensive plans to focus on anadromous fish survival and other objectives
16 at this height.

17 ***Comprehensive Plans in the Draft Feasibility Report and Supporting***
18 ***Documents***

19 Using the general rationale described above, and incorporating input from the
20 public scoping process and continued coordination with resource agencies and
21 other interested parties, five comprehensive plans were developed for the Draft
22 Feasibility Report and Preliminary DEIS:

- 23 • **Preliminary Comprehensive Plan 1 (PCP1)** – 6.5-foot dam raise,
24 enlarging the reservoir by 256,000 acre-feet, focusing on both
25 anadromous fish survival and water supply reliability.

- 26 • **Preliminary Comprehensive Plan 2 (PCP2)** – 12.5-foot dam raise,
27 enlarging the reservoir by 443,000 acre-feet, focusing on both
28 anadromous fish survival and water supply reliability.

- 29 • **Preliminary Comprehensive Plan 3 (PCP3)** – 18.5-foot dam raise,
30 enlarging the reservoir by 634,000 acre-feet, focusing on both
31 anadromous fish survival and water supply reliability.

- 32 • **Preliminary Comprehensive Plan 4 (PCP4)** – 18.5-foot dam raise,
33 enlarging the reservoir by 634,000 acre-feet, focusing on anadromous
34 fish survival while increasing water supply reliability.

- 35 • **Preliminary Comprehensive Plan 5 (PCP5)** – 18.5-foot dam raise,
36 enlarging the reservoir by 634,000 acre-feet, a combination plan
37 focusing on all objectives.

1 Because of the large number of possibilities for increasing anadromous fish
2 survival, additional analyses were conducted to determine the combination of
3 actions that would provide the greatest overall benefits within PCP4. These
4 analyses are described below.

5 **Refinement of Plan for Anadromous Fish Survival Focus with Water**
6 **Supply Reliability** Primarily using the SALMOD model, and based on output
7 from the water operations (CalSim-II), reservoir temperature, and river
8 temperature models, a suite of flow- and temperature-focused actions
9 (scenarios) were investigated to assess which combination of actions would
10 likely result in the maximum increase in fish populations.

11 To formulate PCP4, three dam height raises were considered (6.5 feet, 12.5 feet,
12 and 18.5 feet), resulting in 256,000 acre-feet, 443,000 acre-feet, and 634,000
13 acre-feet of increased storage, respectively. For each of these proposed dam
14 raises, several combinations for allocating the increased storage were analyzed.
15 For instance, assuming a dam raise of 12.5 feet, three options were considered:
16 (1) no increase in the minimum pool, (2) an increase in the minimum pool
17 similar to a 6.5-foot dam raise, and (3) all of the increased space dedicated to
18 increased fisheries. The combinations considered represent scenarios developed
19 to focus on increasing the cold-water pool, and are listed in Table 2-3.

20 **Table 2-3. Scenarios Considered for Cold-Water Storage – Anadromous Fish**
21 **Survival Focus with Water Supply Reliability**

Scenario	Dam Raise (feet)	Enlarged Reservoir	Description
A	6.5	256,000 acre-feet	No increase in minimum pool.
B	6.5	256,000 acre-feet	Dedicate 256,000 acre-feet of water from increased storage to increase the size of the cold-water pool for fishery benefit.
C	12.5	443,000 acre-feet	No increase in minimum pool.
D	12.5	443,000 acre-feet	Dedicate 187,000 acre-feet of the additional water from increased storage to increase the size of the cold-water pool for fishery benefit.
E	12.5	443,000 acre-feet	Dedicate 443,000 acre-feet of water from increased storage to increase the size of the cold-water pool for fishery benefit.
F	18.5	634,000 acre-feet	No increase in minimum pool.
G	18.5	634,000 acre-feet	Dedicate 191,000 acre-feet of the additional water from increased storage to increase the size of the cold-water pool for fishery benefit.
H	18.5	634,000 acre-feet	Dedicate 378,000 acre-feet of the additional water from increased storage to increase the size of the cold-water pool for fishery benefit.
I	18.5	634,000 acre-feet	Dedicate 634,000 acre-feet of water from increased storage to increase the size of the cold-water pool for fishery benefit.

1 Additional scenarios focusing on increasing Sacramento River flows with an
2 18.5-foot raise were also analyzed. The flow combinations were based
3 primarily on flows identified as part of the Anadromous Fish Restoration Plan
4 (USFWS 2001). These scenarios are listed in Table 2-4.

5 **Table 2-4. Scenarios Considered to Augment Flows – Anadromous Fish**
6 **Survival Focus Plan**

Flow Augmentation Scenario	Dam Raise (feet)	Enlarged Reservoir	Description
1	18.5	634,000 acre-feet	October – March AFRP flows or 500 cfs increase, whichever is less.
2	18.5	634,000 acre-feet	October – March AFRP flows or 750 cfs increase, whichever is less.
3	18.5	634,000 acre-feet	October – March AFRP flows or 1,000 cfs increase, whichever is less.
4	18.5	634,000 acre-feet	Increase August flows to 10,000 cfs and September flows to 6,000 cfs for temperature control.

Key:
AFRP = Anadromous Fish Restoration Plan (USFWS 2001)
cfs = cubic feet per second

7 Quantitative analysis indicated that increasing the minimum pool in Shasta
8 Reservoir would have the greatest net fishery benefit. By increasing the
9 minimum pool, the allowable carryover pool storage would increase in the
10 reservoir. This carryover would act to conserve cold water that could be
11 managed to better benefit anadromous fish. Scenarios 1, 2, 3, and 4 (flow
12 augmentation scenarios) showed limited benefits to anadromous fish compared
13 with other scenarios, and were eliminated from further analysis. Scenarios B, E,
14 and I would not contribute to increased water supply reliability. Although
15 PCP4 focuses on anadromous fish survival, because these three scenarios would
16 not contribute to a primary objective, they were deleted from further
17 consideration. Of the remaining scenarios, Scenarios D and H were deemed to
18 be the most cost-effective. Based on further analysis, Scenario H was chosen to
19 represent reservoir operations in PCP4 because this scenario would provide the
20 greatest benefit to anadromous fish and still meet the primary objective of water
21 supply reliability. Scenario comparison and selection are discussed further in
22 the Plan Formulation Appendix.

23 ***Refinement of Comprehensive Plans for the DEIS***

24 Comprehensive plans were further refined for the DEIS based on several
25 factors, including updates to CVP and SWP water operations and stakeholder
26 input. Since the release of the Draft Feasibility Report and Preliminary DEIS,
27 water operations modeling in CalSim-II and related analyses were updated to
28 include the following:

- 29 • The USFWS 2008 *Formal Endangered Species Act Consultation on the*
30 *Proposed Coordinated Operations of the CVP and SWP* (2008 USFWS
31 *Biological Opinion (BO)*) (USFWS 2008)

- The NMFS 2009 *BO and Conference Opinion on the Long-Term Operations of the CVP and SWP* (2009 NMFS BO) (NMFS 2009)
- Additional changes in CVP and SWP facilities and operations, such as the enlarged Los Vaqueros Reservoir and implementation of the San Joaquin River Restoration Program

Preliminary analyses based on these updated operations indicated shifts in the distribution of water supply benefits from M&I to agricultural uses, resulting in decreased M&I water supply benefits for the Draft Feasibility Report comprehensive plans.

To improve the balance between agricultural and M&I water supply benefits, a portion of the increased storage capacity in Shasta Reservoir was reserved to specifically focus on increasing M&I deliveries during dry and critical years under Comprehensive Plan 1 (CP1), Comprehensive Plan 2 (CP2), Comprehensive Plan 4 (CP4), and Comprehensive Plan 5 (CP5). Operations targeting increased M&I deliveries were based on existing and anticipated future demands, operational priorities, and facilities of the SWP, which provides M&I water to a majority of the State's population.

In addition, to provide a greater range of focus and operations within the set of comprehensive plans, water supply operations for Comprehensive Plan 3 (CP3) were focused on agricultural water supply reliability and anadromous fish survival. Accordingly, for CP3, none of the increased storage capacity in Shasta Reservoir was reserved for increasing M&I deliveries.

Based on these refinements, this DEIS includes the following five comprehensive plans:

- **CP1** – 6.5-foot dam raise, enlarging the reservoir by 256,000 acre-feet, focusing on both anadromous fish survival and water supply reliability.
- **CP2** – 12.5-foot dam raise, enlarging the reservoir by 443,000 acre-feet, focusing on both anadromous fish survival and water supply reliability.
- **CP3** – 18.5-foot dam raise, enlarging the reservoir by 634,000 acre-feet, focusing on both agricultural water supply reliability and anadromous fish survival.
- **CP4** – 18.5-foot dam raise, enlarging the reservoir by 634,000 acre-feet, focusing on anadromous fish survival while increasing water supply reliability.
- **CP5** – 18.5-foot dam raise, enlarging the reservoir by 634,000 acre-feet, a combination plan focusing on all objectives.

1 Comprehensive plans for this DEIS are described in detail in Section 2.4 below.

2 **2.2 No-Action Alternative**

3 NEPA and CEQA require the analysis of a baseline alternative, representing a
4 scenario in which the project is not implemented. For all Federal feasibility
5 studies of potential water resources projects, the NEPA No-Action Alternative
6 is intended to account for existing facilities, conditions, land uses, and
7 reasonably foreseeable actions expected to occur in the study area. Reasonably
8 foreseeable actions include actions with current authorization, secured funding
9 for design and construction, and environmental permitting and compliance
10 activities that are substantially complete.

11 Under CEQA, the No-Project Alternative is similar to NEPA’s No-Action
12 Alternative, but it involves the review of two scenarios: the existing condition
13 baseline, which represents only current conditions at the time the Notice of
14 Preparation is published, and “reasonably foreseeable” future conditions
15 without the project (which is equivalent to the NEPA No-Action Alternative).

16 For the SLWRI, the No-Action/No-Project Alternative is based on CVP and
17 SWP operational conditions described in the 2008 *Biological Assessment on the*
18 *Continued Long-Term Operations of the CVP and SWP* (2008 OCAP BA), and
19 the BOs issued by USFWS and NMFS in 2008 and 2009, respectively. The No-
20 Action Alternative also includes key projects assumed to be in place and
21 operating in the future, including the Freeport Regional Water Project, Delta
22 Water Supply Project, South Bay Aqueduct Improvement and Enlargement
23 Project, a functional equivalent of the Vernalis Adaptive Management Plan, full
24 restoration flows under the San Joaquin River Restoration Program, and full
25 implementation of the Grassland Bypass Project. Table 2-1 of the Modeling
26 Appendix describes the existing condition, and shows which actions were
27 assumed to be part of the future condition (or No-Action /No-Project
28 Alternative) in the SLWRI 2012 Benchmark CalSim-II model.

29 For this DEIS, the No-Action Alternative is considered to be the basis for
30 comparison with potential action alternatives, consistent with NEPA and P&G
31 guidelines. Thus, if no proposed action is determined to be feasible, the No-
32 Action Alternative is the default option.

33 Under the No-Action Alternative, the Federal government would continue to
34 implement reasonably foreseeable actions, as defined above, but would not take
35 additional actions toward implementing a plan to raise Shasta Dam to help
36 increase anadromous fish survival in the upper Sacramento River, nor help
37 address the growing water supply and reliability issues in California. The
38 following discussions highlight the consequences of implementing the No-
39 Action Alternative, as they relate to the project objectives.

2.2.1 Anadromous Fish Survival

Much has been done to address anadromous fish survival problems in the upper Sacramento River. Solutions have ranged from changes in the timing and magnitude of releases from Shasta Dam to constructing and operating the temperature control device (TCD) at the dam. Actions also include site-specific projects, such as introducing spawning gravel to the Sacramento River, and work to improve or restore spawning habitat in tributary streams. However, some actions have had an adverse effect on Sacramento River habitat, including implementing requirements of the Trinity River ROD, as amended (Reclamation 2000), which reduced flows from the Trinity River basin into Keswick Reservoir and then into the Sacramento River. Water diverted from the Trinity River is generally cooler than flows released from Shasta Dam. Accordingly, since implementation of the Trinity River ROD, some of the benefits derived from flow changes and the Shasta TCD have been offset by the reduction in cooler water from the Trinity River. Increased demand for water for agricultural, M&I, and environmental uses is also expected to reduce the reliability of cold water for anadromous fish. Prolonged drought that depletes the cold-water pool in Shasta Reservoir could put populations of anadromous fish at risk of severe population decline or extirpation in the long-term (NMFS 2009). The risk associated with a prolonged drought is especially high in the Sacramento River because Shasta Reservoir is operated to maintain only 1 year of carryover storage.

Under the No-Action Alternative, it is assumed that actions to protect fisheries and benefit aquatic environments would continue, including maintaining the TCD, ongoing spawning gravel augmentation programs, and satisfying other existing regulatory requirements.

2.2.2 Water Supply Reliability

Demands for water in the Central Valley and throughout California exceed available supplies, and the need for additional supplies is expected to grow. There is growing competition for limited system resources among various users and uses, including agricultural, M&I, and environmental. M&I water demands and environmental water requirements have each increased, resulting in greater competition for limited water supplies. As mentioned, the population of California is expected to increase by more than 60 percent above 2005 levels by 2050. Significant increases in population also are expected to occur in the Central Valley, nearly 130 percent above 2005 levels by 2050. As these population increases occur, and are coupled with the need to maintain a healthy and vibrant industrial and agricultural economy, the demand for water would continue to significantly exceed available supplies. Competition for available water supplies would intensify as water demands increase to support this population growth.

Water conservation and reuse efforts are expected to substantially increase, and forced conservation resulting from increasing water shortages would continue. Without developing cost-effective new sources, however, the growing urban

1 population would increasingly rely on shifting water supplies from such areas as
2 agricultural production to satisfy M&I demands. It is likely that with continued
3 and deepening shortages in available water supplies, adverse economic impacts
4 would increase over time in the Central Valley and elsewhere in California.
5 One example could include higher water costs, resulting in a further shift in
6 agricultural production to areas outside California and/or outside the United
7 States. Under the No-Action Alternative, Shasta Dam would not be modified
8 and the CVP would continue operating similarly to existing conditions.

9 The No-Action Alternative would continue to meet water supply demands at
10 levels similar to existing conditions, but would not be able to meet the expected
11 increased demand in California.

12 **2.2.3 Ecosystem Resources, Flood Management, Hydropower Generation,** 13 **Recreation, and Water Quality**

14 As opportunities arise, some efforts would likely continue to improve
15 environmental conditions on tributaries to Shasta Lake and along the upper
16 Sacramento River. However, overall, future environmental conditions in these
17 areas would likely be similar to existing conditions. The quantity, quality,
18 diversity, and connectivity of riparian, wetland, and riverine habitats along the
19 Sacramento River have been limited by confinement of the river system by
20 levees, reclamation of adjacent lands for farming, bank protection, channel
21 stabilization, and land development.

22 Shasta Dam and Reservoir have greatly reduced flood damage along the
23 Sacramento River. Shasta Dam and Reservoir were constructed at a total cost of
24 about \$36 million. During flood events in 1983, 1986, and 1997, Shasta Dam,
25 in combination with the Sacramento River Flood Control Project, prevented an
26 estimated \$14 billion in property losses due to flooding. Accordingly, from a
27 flood damage perspective only, Shasta Dam has far more than paid for itself.
28 However, residual risks to human life, health, and safety along the Sacramento
29 River remain. Development in flood-prone areas has exposed the public to the
30 risk of flooding. Storms producing peak flows, and volumes greater than the
31 existing flood management system was designed for, can occur, and result in
32 extensive flooding along the upper Sacramento River. Under the No-Action
33 Alternative, the threat of flooding would continue, and may increase as
34 population growth continues.

35 California's demand for electricity is expected to substantially increase in the
36 future. Under the No-Action Alternative, no actions would be taken to help
37 meet this growing demand.

38 As California's population continues to grow, demands would grow
39 substantially for water-oriented recreation at and near the lakes, reservoirs,
40 streams, and rivers of the Central Valley. This increase in demand would be
41 especially pronounced at Shasta Lake.

1 To address the impact of water quality deterioration on the Sacramento River
2 basin and Delta ecosystems and endangered and threatened fish populations,
3 several environmental flow goals and objectives in the Central Valley
4 (including the Delta) have been established through legal mandates aimed at
5 maintaining and recovering endangered and threatened fish and wildlife, and
6 protecting designated critical habitat. Despite these efforts, under the No-
7 Action Alternative, these resources would continue to decline and ecosystems
8 would continue to be impacted. In addition, Delta water quality may continue to
9 decline.

10 **2.3 Action Alternatives**

11 The five comprehensive plans designated as the action alternatives for the
12 purpose of this DEIS include:

- 13 • **CP1** – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water
14 Supply Reliability
- 15 • **CP2** – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water
16 Supply Reliability
- 17 • **CP3** – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and
18 Anadromous Fish Survival
- 19 • **CP4** – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water
20 Supply Reliability
- 21 • **CP5** – 18.5-Foot Dam Raise, Combination Plan

22 Management measures and environmental commitments common to all action
23 alternatives are described first, in Sections 2.3.1 and 2.3.2. Then, major
24 components, potential benefits, and operations and maintenance for each action
25 alternative are described in Sections 2.3.3 through 2.3.7. Physical features and
26 related construction activities for each action alternative are described in
27 Section 2.3.8. Detailed discussions of potential effects and proposed mitigation
28 measures for each action alternative are included in Chapters 4 through 25 of
29 the DEIS. If any action alternative was authorized by Congress, Reclamation
30 would implement the components of the plans, environmental commitments,
31 mitigation measures, and permit and approval conditions, as described
32 throughout this DEIS and in any permits or approvals issued for
33 implementation.

34 **2.3.1 Management Measures Common to All Action Alternatives**

35 Eight of the management measures retained during the alternatives development
36 process are included, to some degree, in all of the action alternatives. These
37 measures were included because they (1) would either be incorporated or

1 required with any dam raise, (2) were logical and convenient additions that
2 would significantly improve any alternative, or (3) should be considered with
3 any new water increment developed in California. The eight measures include
4 enlarging the Shasta Lake cold-water pool, modifying the TCD, increasing
5 conservation storage, reducing demand, modifying flood operations, modifying
6 hydropower facilities, maintaining or increasing recreation opportunities, and
7 maintaining or improving water quality.

8 ***Enlarge Shasta Lake Cold-Water Pool***

9 Cold water released from Shasta Dam significantly influences water
10 temperature conditions in the Sacramento River between Keswick Dam and the
11 RBPP. At a minimum, all comprehensive plans include enlarging the cold-water
12 pool by raising Shasta Dam to enlarge Shasta Reservoir. Some alternatives also
13 increase the seasonal carryover storage in Shasta Lake.

14 ***Modify Temperature Control Device***

15 For all action alternatives, the TCD would be modified to account for an
16 increased dam height and to reduce leakage of warm water into the structure.
17 Minimum modifications to the TCD include raising the existing structure and
18 modifying the shutter control. This measure would increase the ability of
19 operators at Shasta Dam to meet downstream temperature requirements, and
20 provide more operational flexibility to achieve desirable water temperatures
21 during critical periods for anadromous fish.

22 ***Increase Conservation Storage***

23 All action alternatives include increasing the amount of space available for
24 water conservation storage in Shasta Reservoir by raising Shasta Dam.
25 Conservation storage is the portion of the reservoir capacity available to store
26 water for subsequent release to increase water supply reliability for agricultural,
27 M&I, and environmental purposes. All action alternatives include a range of
28 dam enlargements and increases in conservation space.

29 ***Reduce Demand***

30 All action alternatives include a water conservation program for new water
31 supplies that would be created by the project to augment current water use
32 efficiency practices. The proposed program would consist of a 10-year initial
33 program to which Reclamation would allocate approximately \$1.6 million to
34 \$3.8 million to fund water conservation efforts. Funding would be proportional
35 to additional water supplies delivered and would focus on assisting project
36 beneficiaries (agencies receiving increased water supplies because of the
37 project), with developing new or expanded urban water conservation,
38 agricultural water conservation, and water recycling programs. Program actions
39 would be a combination of technical assistance, grants, and loans to support a
40 variety of water conservation projects, such as recycled wastewater projects,
41 irrigation system retrofits, and urban utilities retrofit and replacement programs.
42 The program could be established as an extension of existing Reclamation
43 programs, or as a new program through teaming with cost-sharing partners.

1 Combinations and types of water use efficiency actions funded would be
2 tailored to meet the needs of identified cost-sharing partners, including
3 consideration of cost-effectiveness at a regional scale for agencies receiving
4 funding.

5 ***Modify Flood Operations***

6 Potential modification of flood operations would be considered for all action
7 alternatives. Enlargement of Shasta Reservoir would require alterations to
8 existing flood operation guidelines or rule curves, to reflect physical
9 modifications, such as an increase in dam/spillway elevation. The rule curves
10 would be revised with the goal of reducing flood damage and enhancing other
11 objectives to the extent possible.

12 ***Modify Hydropower Facilities***

13 Under each action alternative, enlargement of Shasta Dam would likely require
14 various minimum modifications, commensurate with the magnitude of the
15 enlargement, to the existing hydropower facilities at the dam to enable their
16 continued efficient use. These modifications, in conjunction with increased lake
17 surface elevations, may provide incidental benefits to hydropower generation.
18 Although modifications could also be included to further increase the power
19 production capabilities of the reservoir (e.g., additional penstocks and
20 generators), they are believed to be a detail beyond the scope of this
21 investigation and are not considered further at this level of planning.

22 ***Maintain and Increase Recreation Opportunities***

23 In addition to the measures described above, all action alternatives address, to
24 some extent, the secondary objective of maintaining or increasing recreation
25 opportunities at Shasta Lake. Outdoor recreation, and especially recreation at
26 Shasta Lake, represents a major source of enjoyment to millions of people
27 annually and is a major source of income to the northern Sacramento Valley.
28 Shasta Dam and Reservoir are within the Shasta Unit of the Whiskeytown-
29 Shasta-Trinity National Recreation Area (NRA). Recreation within these lands
30 is managed by USFS. As part of this administration, USFS either directly
31 operates and maintains, or manages through special use permits, numerous
32 public campgrounds, marinas, boat launching facilities, and related water-
33 oriented recreation facilities. Enlarging Shasta Dam and Reservoir would affect
34 some of these facilities. Consistent with the position of USFS, and planning
35 conditions described in this chapter, all of the action alternatives include
36 features to, at a minimum, maintain the overall recreation capacity of the
37 existing facilities. All action alternatives also provide for modernization of
38 relocated recreation facilities, including, at a minimum, modifications to comply
39 with current standards of health and safety.

40 ***Maintain or Improve Water Quality***

41 All action alternatives could contribute to improved Delta water quality
42 conditions and Delta emergency response. Additional storage in Shasta
43 Reservoir would provide improved operational flexibility. Shasta Dam has the

1 ability to provide increased releases and high-flow releases to improve Delta
2 water quality. Improved Delta water quality conditions could provide benefits
3 for both water supply reliability and ecosystem restoration by potentially
4 increasing Delta outflow during drought years and reducing salinity during
5 critical periods.

6 **2.3.2 Environmental Commitments Common to All Action Alternatives**

7 Reclamation and/or its contractors would incorporate certain environmental
8 commitments and best management practices (BMP) into any plan identified for
9 implementation to avoid or minimize potential impacts. Reclamation would also
10 coordinate planning, engineering, design and construction, operation, and
11 maintenance phases of any authorized project modifications with applicable
12 resource agencies.

13 The following environmental commitments would be incorporated into any
14 action alternative for any project-related construction activities.

15 ***Develop and Implement Construction Management Plan***

16 Reclamation would develop and implement a construction management plan to
17 avoid or minimize potential impacts on public health and safety during project
18 construction, to the extent feasible. The construction management plan would
19 inform contractors and subcontractors of work hours, modes and locations of
20 transportation and parking for construction workers; location of overhead and
21 underground utilities; worker health and safety requirements; truck routes;
22 stockpiling and staging procedures; public access routes; terms and conditions
23 of all project permits and approvals; and emergency response services contact
24 information.

25 The plan would also include construction notification procedures for the police,
26 public works, and fire department in the cities and counties where construction
27 occurs. Notices would also be distributed to neighboring property owners.

28 ***Comply with Permit Terms and Conditions***

29 If any action alternative is approved and authorized for construction,
30 Reclamation would require its contractors and suppliers, its general contractor,
31 and all of the general contractor's subcontractors and suppliers to comply with
32 all of the terms and conditions of all required project permits, approvals, and
33 conditions attached thereto. If necessary, additional information (e.g., detailed
34 designs and additional documentation) may be prepared and provided for
35 review by decision makers and the public. Compliance with applicable laws,
36 policies, and plans for this project is discussed in Section 26.6 of this DEIS.

37 ***Provide Relocation Assistance through Federal Relocation Assistance 38 Program***

39 All Federal, State, local government agencies, and others receiving Federal
40 financial assistance for public programs and projects that require the acquisition
41 of real property must comply with the policies and provisions set forth in the

1 Uniform Relocation Assistance and Real Property Acquisition Policies Act of
2 1970, as amended (Uniform Act) (49 CFR 24). All relocation and property
3 acquisition activities, such as those associated with temporary easements during
4 construction or with permanent changes in the study area, would be performed
5 in compliance with the Uniform Act. Any individual, family, or business
6 displaced by implementation of any of the action alternatives would be offered
7 relocation assistance services for the purpose of locating a suitable replacement
8 property, to the extent consistent with the Uniform Act.

9 Under the Uniform Act, relocation services for residences would include
10 providing a determination of the housing needs and desires, a determination of
11 the amount of replacement housing each individual or family qualifies for, a list
12 of comparable properties, transportation to inspect housing referrals, and
13 reimbursement of moving costs and related expenses. For business relocation
14 activities, relocation services would include providing a determination of the
15 relocation needs and requirements; a determination of the need for outside
16 specialists to plan, move, and reinstall personal property; advice as to possible
17 sources of funding and assistance from other local, State, and Federal agencies;
18 listings of commercial properties, and reimbursement for costs incurred in
19 relocating and reestablishing the business. No relocation payment received will
20 be considered as income for the purpose of the Internal Revenue Code.

21 ***Develop and Implement Comprehensive Mitigation Strategy***

22 Reclamation would develop and implement a comprehensive mitigation strategy
23 (CMS) to minimize potential impacts to physical, biological, and
24 socioeconomic resources described in this DEIS. The CMS described in this
25 section is still under development at this stage in the planning process. The
26 CMS is being developed consistent with the guidance provided in Council on
27 Environmental Quality (CEQ) Regulations for Implementing Procedural
28 Provisions of NEPA (40 CFR Parts 1500–1508) and consistent with CEQA
29 requirements (CEQA Guidelines 15096, 15097) for lead, responsible, and
30 trustee agencies. The CMS is intended to minimize the potential adverse
31 impacts associated with action alternatives described in this chapter as required
32 under NEPA and/or CEQA and to provide a means to reduce significant CEQA
33 impacts to the extent possible.

34 The CMS will be multi-faceted in terms of spatial and temporal scales. Based
35 on the nature of some impacts described in this DEIS, the CMS may include
36 one or more of the following types of mitigation as defined under CEQ
37 Guidelines, Section 1508.20–Mitigation:

- 38 • Avoiding the impact altogether by not taking a certain action or parts of
39 an action.
- 40 • Minimizing the impact by limiting the degree or magnitude of the
41 action and its implementation.

- 1 • Rectifying the impact by repairing, rehabilitating, or restoring the
2 affected environment.
- 3 • Reducing or eliminating the impact over time through preservation and
4 maintenance operations during the life of the action.
- 5 • Compensating for the impact by replacing or providing substitute
6 resources or environments.

7 At this stage in the planning process, the following components are being
8 considered for the CMS:

- 9 • Land acquisition
- 10 • Conservation easements
- 11 • Upland habitat improvements
- 12 • Wetland mitigation
- 13 • Riparian habitat improvements (riparian reserves)
- 14 • Aquatic habitat improvements (river and tributaries)
- 15 • Water quality actions (metals, temperature, sediment)
- 16 • Visuals and aesthetics actions

17 Reclamation will address CEQ's guidance on establishing, implementing, and
18 monitoring mitigation which specifies that when environmental analyses are
19 premised on commitments to mitigate environmental impacts of action
20 alternatives, agencies should adhere to those commitments during project
21 implementation and monitor the implementation and effectiveness of mitigation
22 (CEQ 2011). The CMS will incorporate elements intended to comply with
23 these requirements, specifically those requirements directing agencies to also
24 publicly report on these efforts. The CMS, including a framework for
25 mitigation implementation and monitoring, will be included in the Final EIS.

26 ***Cultural Resources***

27 If a project is authorized, Reclamation would follow the process in the
28 implementing regulations at 36 CFR part 800 to identify historic properties,
29 assess effects, and resolve adverse effects through the consultation process.
30 Consulting parties for the National Historic Preservation Act Section 106
31 process will include the State Historic Preservation Office (SHPO), the
32 Advisory Council on Historic Preservation (if they choose to participate), other
33 federal agencies where applicable, tribal representatives, and other interested
34 parties (including non-Federally recognized Native Americans, members of the

1 public, and other state or local agencies) to develop methods to avoid,
2 minimize, or mitigate impacts. Measures to avoid, minimize, or mitigate
3 impacts will be funded through the project. Reclamation may enter into a
4 Programmatic Agreement with the Advisory Council on Historic Preservation,
5 the SHPO, and other consulting parties that would identify how the Section 106
6 process would be completed for the authorized project. The Programmatic
7 Agreement may include alternative methods for compliance or phased
8 identification efforts/phased finding of effects efforts, as agreed upon with the
9 consulting parties. Any human remains, funerary objects, sacred objects, or
10 objects of cultural patrimony that are removed from federally managed lands
11 during any project activities would be treated consistent with the Native
12 American Graves Protection and Repatriation Act. If human remains are
13 removed from non-federally managed lands, they would be subject to the
14 California Public Resources Code regarding the treatment of human remains
15 outside a dedicated cemetery.

16 ***Develop and Implement Erosion and Sediment Control Plan***

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

25 ***Develop and Implement Stormwater Pollution Prevention Plan***

26 Any project authorized for construction would be subject to construction-related
27 stormwater permit requirements of the Federal Clean Water Act (CWA)
28 National Pollutant Discharge Elimination System program. Reclamation would
29 obtain any required permits through the Central Valley Regional Water Quality
30 Control Board before any ground-disturbing construction activity. According to
31 the requirements of Section 402 of the CWA, Reclamation and/or its contractors
32 would prepare and implement a Stormwater Pollution Prevention Plan (SWPPP)
33 before construction, identifying BMPs to prevent or minimize the discharge of
34 sediments and other contaminants with the potential to affect beneficial uses or
35 lead to violations of water quality objectives of surface waters. The SWPPP
36 would include development of site-specific structural and operational BMPs to
37 prevent and control impacts on runoff quality, and measures to be implemented
38 before each storm event. The SWPPP would contain a site map that shows the
39 construction site perimeter, existing and proposed buildings, lots, roadways,
40 stormwater collection and discharge points, general topography both before and
41 after construction, and drainage patterns across the project. Additionally, the
42 SWPPP must contain a visual monitoring program, a chemical monitoring
43 program for “non-visible” pollutants to be implemented if a BMP fails, and a
44 sediment monitoring plan if the site discharges directly to a water body listed on
45 the CWA 303(d) list for sediment. BMPs for the project could include, but

1 would not be limited to, silt fencing, straw bale barriers, fiber rolls, storm drain
2 inlet protection, hydraulic mulch, and stabilized construction entrances.

3 **Develop and Implement Feasible Spill Prevention and Hazardous**
4 **Materials Management** As part of the SWPPP, Reclamation and/or its
5 contractors would develop and implement a spill prevention and control plan to
6 minimize effects from spills of hazardous, toxic, or petroleum substances for
7 project-related construction activities occurring in or near waterways. The
8 accidental release of chemicals, fuels, lubricants, and nonstorm drainage water
9 into water bodies would be prevented to the extent feasible. Spill prevention kits
10 would always be in close proximity when hazardous materials would be used
11 (e.g., crew trucks and other logical locations). Feasible measures would be
12 implemented so that hazardous materials would be properly handled and the
13 quality of aquatic resources would be protected by all reasonable means during
14 work in or near any waterway. No fueling would be done within the ordinary
15 high-water mark, immediate floodplain, or full pool inundation area, unless
16 equipment stationed in these locations could not be readily relocated. Any
17 equipment that could be readily moved out of the water body would not be
18 fueled in the water body or immediate floodplain. As for stationary equipment,
19 for all fueling done at the construction site, containments would be installed so
20 that any spill would not enter the water, contaminate sediments that may come
21 in contact with the water, or damage wetland or riparian vegetation. Any
22 equipment that could be readily moved out of the water body would not be
23 serviced within the ordinary high-water mark or immediate floodplain.

24 Additional BMPs designed to avoid spills from construction equipment and
25 subsequent contamination of waterways would also be implemented. These may
26 include, but would not be limited to, the following:

- 27 • Storage of hazardous materials in double-containment and, if possible,
28 under a roof or other enclosure.
- 29 • Disposal of all hazardous and nonhazardous products in a proper
30 manner.
- 31 • Monitoring of on-site vehicles for fluid leaks and regular maintenance
32 to reduce the chance of leakage.
- 33 • Containment (using a prefabricated temporary containment mat, a
34 temporary earthen berm, or other measure can provide containment) of
35 bulk storage tanks.

36 ***Fisheries Conservation***

37 The measures discussed below would be implemented to minimize potential
38 adverse effects on fish species.

1 **Implement In-Water Construction Work Windows** Reclamation would
2 identify and implement feasible in-water construction work windows in
3 consultation with NMFS, USFWS, and CDFW. In-water work windows would
4 be timed to occur when sensitive fish species were not present or would be least
5 susceptible to disturbance (e.g., July through September).

6 **Monitor Construction Activities** A qualified biologist would monitor
7 potential impacts to important fishery resources throughout all phases of project
8 construction. Monitoring may not be necessary during the entire duration of the
9 project if, based on the monitor's professional judgment (and with concurrence
10 from Reclamation), a designated on-site contractor would suffice to monitor
11 such activities and would agree to notify a biologist if aquatic organisms are in
12 danger of harm. However, the qualified biologist must be available by phone
13 and Internet and be able to respond promptly to any problems that arise.

14 **Perform Fish Rescue/Salvage** If spawning activities for sensitive fish species
15 were encountered during construction activities, the biologist would be
16 authorized to stop construction activities until appropriate corrective measures
17 were completed or it was determined that the fish would not be harmed.

18 A qualified biologist would identify any fish species that may be affected by the
19 project. The biologist would facilitate rescue and salvage of fish and other
20 aquatic organisms that become entrapped within construction structures and
21 cofferdam enclosures in the construction area. Any rescue, salvage, and
22 handling of listed species would be conducted under appropriate authorization
23 (i.e., incidental take statement/permit for the project, Federal Endangered
24 Species Act Section 4(d) scientific collection take permit, or a Memorandum of
25 Understanding). If fish are identified as threatened with entrapment in
26 construction structures, construction would be stopped and efforts made to
27 allow fish to leave the project area before resuming work. If fish are unable to
28 leave the project area of their own volition, then fish would be collected and
29 released outside the work area. Fish entrapped in cofferdam enclosures would
30 be rescued and salvaged before the cofferdam area was completely dewatered.
31 Appropriately sized fish screens would be installed on the suction side of any
32 pumps used to dewater in-water enclosures.

33 **Reporting** A qualified biologist would prepare a letter report detailing the
34 methodologies used and the findings of fish monitoring and rescue efforts.
35 Monitoring logs would be maintained and provided, with monitoring reports.
36 The reports would contain, but not be limited to, the following: summary of
37 activities; methodology for fish capture and release; table with dates, numbers,
38 and species captured and released; photographs of the enclosure structure and
39 project site conditions affecting fish; and recommendations for limiting impacts
40 during subsequent construction phases, if appropriate.

1 **Water Quality Protection**

2 The measures discussed below would be implemented to minimize potential
3 adverse effects to water quality.

4 **Implement In-Water Construction Work Windows** All construction
5 activities along the Sacramento River would be conducted during months when
6 instream flows are managed outside the flood season (e.g., June to September).

7 **Comply with All Water Quality Permits and Regulations** Project activities
8 would be conducted to comply with all additional requirements specified in
9 permits relating to water quality protection. Relevant permits anticipated to be
10 obtained for the proposed action include a California Fish and Game Code 1602
11 Lake and Streambed Alteration Agreement, Regional Water Quality Control
12 Board Section 401 certification, and CWA Section 404 compliance through the
13 USACE.

14 **Implement Water Quality Best Management Practices** BMPs that would be
15 implemented to avoid and/or minimize potential impacts associated with dam
16 construction and the 10-year-long spawning gravel augmentation program are
17 described below.

18 *Handle Spawning Gravel to Minimize Potential Water Quality Impacts* Gravel
19 would be sorted and transported in a manner that minimizes potential water
20 quality impacts (e.g., management of fine sediments). Gravel would be washed
21 at least once and have a cleanliness value of 85 or higher based on California
22 Department of Transportation (Caltrans) Test No. 227. Gravel would also be
23 completely free of oils, clay, debris, and organic material.

24 *Minimize Potential Impacts Associated with Equipment Contaminants* For in-
25 river work, all equipment would be steam-cleaned every day to remove
26 hazardous materials before the equipment entered the water.

27 *Minimize Potential Impacts Associated with Access and Staging* Existing
28 access roads would be used to the extent possible. Equipment staging areas
29 would be located outside of the Sacramento River ordinary high water mark or
30 the Shasta Dam full pool inundation area, and away from sensitive resources.

31 *Remove Temporary Fills as Appropriate* Temporary fill for access, side
32 channel diversions, and/or side channel cofferdams, would be completely
33 removed after completion of construction.

34 *Remove Equipment from River Overnight and During High Flows*
35 Construction contractors would remove all equipment from the river on a daily
36 basis at the end of the workday. Construction contractors would also monitor
37 Reclamation's Central Valley Operations Office Web site daily for forecasted
38 flows posted there to determine and anticipate any potential changes in releases.
39 If flows are anticipated to inundate a work area that would normally be dry, the
40 contractor would immediately remove all equipment from the work area.

1 ***Revegetation Plan***

2 Reclamation, in conjunction with cooperating agencies and private landowners,
3 would prepare a comprehensive revegetation plan to be implemented in
4 conjunction with other management plans (e.g., erosion and sediment control
5 plan). This plan would apply to any area included as part of an action
6 alternative, such as inundation, relocation, or mitigation activities. Overall
7 objectives of the plan would be to reestablish native vegetation to control
8 erosion, provide effective ground cover, minimize opportunities for nonnative
9 plant species to establish or expand; and provide habitat diversity over time.
10 Reclamation would work closely with cooperating agencies, private
11 landowners, and revegetation specialists to develop the sources of native
12 vegetation, site-specific planting patterns and species assemblages necessary for
13 a revegetation effort of this magnitude.

14 ***Invasive Species Management***

15 Reclamation would develop and implement a control plan to prevent the
16 introduction of zebra/quagga mussels and other invasive species to project
17 areas. The control plan would cover all workers, vehicles, watercraft, and
18 equipment (both land and aquatic) that would come into contact with Shasta
19 Reservoir, the shoreline of Shasta Reservoir, the Sacramento River, and any
20 riverbanks, floodplains, or riparian areas. Plan activities may include, but would
21 not be limited to, the following:

- 22 • Preinspection and cleaning of all construction vehicles, watercraft, and
23 equipment before being shipped to project areas
- 24 • Reinspection of all construction vehicles, watercraft, and equipment on
25 arrival at project areas
- 26 • Inspection and cleaning of all personnel before work in project areas

27 All inspections would be conducted by trained personnel and would include
28 both visual and hands-on inspection methods of all vehicle and equipment
29 surfaces, up to and including internal surfaces that have contacted raw water.

30 Approved cleaning methods would include a combination of the following:

- 31 • **Precleaning** – Draining, brushing, vacuuming, high-pressure water
32 treatment, thermal treatment
- 33 • **Cleaning** – Freezing, desiccation, thermal treatment, high-pressure
34 water treatment, chemical treatment

35 On-site cleanings would require capture, treatment, and/or disposal of any and
36 all water needed to conduct cleaning activities.

1 **Construction Material Disposal**
2 Reclamation’s contractors would take measures to recycle or reuse demolished
3 materials, such as steel or copper wire, concrete, asphalt, and reinforcing steel,
4 as required and where practical. Other demolished materials would be disposed
5 of in compliance with applicable requirements.

6 **Asphalt Removal**
7 Per California Fish and Game Code 5650 Section (a), all asphaltic roadways
8 and parking lots inundated by project implementation would be demolished and
9 removed according to Shasta County standards. Asphalt would be disposed of at
10 an approved and permitted waste facility. Dirt roads inundated by project
11 implementation would remain in place.

12 **2.3.3 CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply**
13 **Reliability**

14 CP1 consists primarily of enlarging Shasta Dam by raising the crest 6.5 feet and
15 enlarging the reservoir by 256,000 acre-feet.

16 **Major Components of CP1**

17 CP1 includes the following major components:

- 18 • Raising Shasta Dam and appurtenant facilities by 6.5 feet
- 19 • Implementing the set of eight common management measures
20 described above
- 21 • Implementing the common environmental commitments described
22 above

23 By raising Shasta Dam 6.5 feet, from a crest elevation of 1,077.5 feet to 1,084.0
24 feet (based on the National Geodetic Vertical Datum 1929 (NGVD29)),² CP1
25 would increase the height of the reservoir full pool by 8.5 feet. The additional 2-
26 foot increase in the height of the full pool above the dam raise height would
27 result from spillway modifications, including replacing the three drum gates
28 with six sloping, fixed-wheel gates. This increase in full pool height would add
29 approximately 256,000 acre-feet of additional storage to the overall reservoir
30 capacity. Accordingly, the overall full pool storage would increase from 4.55
31 million acre feet (MAF) to 4.81 MAF. Table 2-5 summarizes major physical
32 features associated with CP1.

33

² Dam crest elevations are based on NGVD29. All current feasibility-level designs and figures for Shasta Dam and appurtenant structures are based on NGVD29.

Table 2-5. Physical Features of Action Alternatives

Main Features	Action Alternatives				
	CP1	CP2	CP3	CP4	CP5
Dam and Appurtenant Structures					
Shasta Dam					
<i>Crest Raise (feet)</i>	6.5	12.5	18.5	18.5	18.5
<i>Full Pool Height Increase (feet)</i>	8.5	14.5	20.5	20.5	20.5
<i>Elevation of Dam Crest (feet)¹</i>	1084.0	1090.0	1096.0	1096.0	1096.0
<i>Elevation of Full Pool (feet)²</i>	1,078.2	1,084.2	1,090.2	1,090.2	1,090.2
<i>Capacity Increase (acre-feet)</i>	256,000	443,000	634,000	634,000	634,000
<i>Main Dam</i>	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.	Raise dam crest. Construct new parapets and utility gallery. Raise existing elevator tower and hoist tower.
<i>Wing Dams</i>	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.	Raise to meet dam crest. Build new visitor center along left wing dam. Relocate gantry crane on right wing dam.
<i>Spillway</i>	Raise crest and extend piers. Replace 3 drum gates with 6 sloping wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping wheel gates.	Raise crest and extend piers. Replace 3 drum gates with 6 sloping wheel gates.
<i>River Outlets</i>	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.	Replace 4 lower-tier tube valves with jet flow gates.
<i>Temperature Control Device</i>	Raise/modify controls.	Raise/modify controls.	Raise/modify controls.	Raise/modify controls.	Raise/modify controls.
Shasta Powerplant/Penstocks	Raise penstock hoists.	Raise penstock hoists.	Raise penstock hoists.	Raise penstock hoists.	Raise penstock hoists.
Pit 7 Dam/Powerhouse	Install a tailwater depression system.	Install a tailwater depression system.	Install a tailwater depression system.	Install a tailwater depression system.	Install a tailwater depression system.
Reservoir Area Clearing	Clear 150 acres completely and 220 acres with overstory removal.	Clear 240 acres completely and 350 acres with overstory removal.	Clear 340 acres completely and 500 acres with overstory removal.	Clear 340 acres completely and 500 acres with overstory removal.	Clear 340 acres completely and 500 acres with overstory removal.
Reservoir Area Dikes and Railroad Embankments	Construct 3 railroad embankments and 2 new dikes.	Construct 3 railroad embankments and 3 new dikes.	Construct 3 railroad embankments and 4 new dikes.	Construct 3 railroad embankments and 4 new dikes.	Construct 3 railroad embankments and 4 new dikes.
Relocations					
Roadways	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.	Match replacement widths to existing paved roads to be replaced.

Table 2-5. Physical Features of Action Alternatives (contd.)

Main Features	Action Alternatives				
	CP1	CP2	CP3	CP4	CP5
<i>Length of Relocated Roadway (linear feet)</i>	17,409	29,054	33,788	33,788	33,788
<i>Number of Road Segments Affected</i>	10	21	30	30	30
Vehicle Bridges	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.	Relocate 4 bridges, modify 1 bridge.
Railroad	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge	Relocate 2 bridges and realign track in-between, modify 1 bridge
Recreation Facilities	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 202 campsites/day-use sites/RV sites, 2 USFS facilities, 8.1 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 261 campsites/ day-use sites/RV sites, 2 USFS facilities, 9.9 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 328 campgrounds/day-use areas/RV sites, 2 USFS facilities, 11.6 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 328 campgrounds/day-use areas/RV sites, 2 USFS facilities, 11.6 miles of trail, and 2 trailheads.	Modify or replace 9 marinas, 6 public boat ramps, 6 resorts, 328 campgrounds/day-use areas/RV sites, 2 USFS facilities, 11.6 miles of trail, and 2 trailheads. Add 6 trailheads and 18 miles of new hiking trails.
Utilities	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.	Relocate inundated utilities. Construct wastewater treatment facilities.
Ecosystem Enhancements	None	None	None	Reserve 378 TAF of the additional storage for cold-water supply for anadromous fish. Implement adaptive management plan to benefit anadromous fish. Augment spawning gravel in the upper Sacramento River at the rate of up to 10,000 tons per year. Restore riparian, floodplain, and side channel habitat along the upper Sacramento River.	Construct shoreline fish habitat around Shasta Lake. Enhance aquatic habitat in tributaries to Shasta Lake to improve fish passage. Augment spawning gravel in the upper Sacramento River at the rate of up to 10,000 tons per year. Restore riparian, floodplain, and side channel habitat along the upper Sacramento River.

Notes:

¹ Dam crest elevations are based on the National Geodetic Vertical Datum of 1929 (NGVD29). All current feasibility-level designs and figures for Shasta Dam and appurtenant structures are based on NGVD29.

² Full pool elevations are based on the North American Vertical Datum of 1988 (NAVD88), which is 2.66 feet higher than NGVD29. All current feasibility-level designs and figures for reservoir area infrastructure modifications and relocations to accommodate increased water levels are based on a 2001 aerial survey of the reservoir using NAVD88.

Key:
CP = comprehensive plan

RV = recreational vehicle

TAF = thousand acre-feet
USFS = U.S. Department of Agriculture, Forest Service

1 Under CP1, the additional storage in Shasta Reservoir would be used to increase
2 water supply reliability and to expand the cold-water pool for downstream
3 anadromous fisheries. This alternative (and all comprehensive plans) involves
4 extending the existing TCD for efficient use of the expanded cold-water pool.
5 Operations for water supply, hydropower, and environmental and other
6 regulatory requirements would be similar to existing operations, except during
7 dry and critical years when a portion of the increased storage capacity in Shasta
8 Reservoir would be reserved to specifically focus on increasing M&I deliveries.
9 In dry years, 70,000 acre-feet of the 256,000 acre-feet increased storage
10 capacity in Shasta Reservoir would be reserved for increasing M&I deliveries.
11 In critical years, 35,000 acre-feet of the increased storage capacity would be
12 reserved for increasing M&I deliveries.

13 CP1 would also include the potential to revise the operational rules for flood
14 control at Shasta Dam and Reservoir, which could reduce the potential for flood
15 damage, and benefit recreation. Although the volume of the flood control pool
16 would remain the same as under existing operations (1.3 MAF), the bottom of
17 the flood control pool elevation would likely be increased based on increased
18 dam height and reservoir capacity. Because of reservoir geometry, this would
19 decrease the depth of the flood control pool, allowing higher winter and spring
20 water levels. Increased reservoir capacity could have further flood damage
21 reduction benefits in years when water levels are below the new flood control
22 pool elevation.

23 In some years, when the flood control requirements guides reservoir releases,
24 potential also exists for changes in flood control rules to allow more operational
25 flexibility in reservoir drawdown requirements in response to storms, resulting
26 in a net increase in the rate of spring reservoir filling during some years.

27 In addition, higher spring water levels, reduced drawdown (distance to water)
28 during the recreation season, and associated increases in reservoir surface area
29 would benefit recreation.

30 ***Potential Benefits of CP1***

31 Major potential benefits of CP1, related to contributions to the project
32 objectives and broad public services, are described below.

33 **Increase Anadromous Fish Survival** Water temperature is one of the most
34 important factors in achieving recovery goals for anadromous fish in the
35 Sacramento River. CP1 would increase the ability of Shasta Dam to make
36 cold-water releases and regulate water temperatures for fish in the upper
37 Sacramento River, primarily in dry and critical water years. This would be
38 accomplished by raising Shasta Dam 6.5 feet, thus increasing the depth of the
39 cold-water pool in Shasta Reservoir and resulting in an increase in seasonal
40 cold-water volume below the thermocline (layer of greatest water temperature
41 and density change). Cold water released from Shasta Dam significantly
42 influences water temperature conditions in the Sacramento River between

1 Keswick Dam and the RBPP. Hence, the most significant water temperature
2 benefits to anadromous fish would occur upstream from the RBPP. It is
3 estimated that under CP1, improved water temperature and flow conditions
4 could result in an average annual increase in the salmon population of about
5 61,300 out-migrating juvenile Chinook salmon.

6 **Increase Water Supply Reliability** CP1 would increase water supply
7 reliability by increasing firm water supplies for CVP and SWP irrigation and
8 M&I deliveries. This action would contribute to replacement of supplies
9 redirected to other purposes in the Central Valley Project Improvement Act
10 (CVPIA). CP1 would help reduce estimated future water shortages by
11 increasing firm yield for agricultural and M&I deliveries by at least 47,300
12 acre-feet per year and average annual yield by about 31,000 acre-feet per year.
13 For this DEIS, firm yield is considered equivalent to the estimated increase in
14 the reliability of supplies during dry and critical periods. The majority of
15 increased firm yield (42,700 acre-feet) would be for south-of-Delta agricultural
16 and M&I deliveries. In addition, water use efficiency could help reduce current
17 and future water shortages by allowing a more effective use of existing supplies.
18 As population and resulting water demands continue to grow and available
19 supplies continue to remain relatively static, more effectively using these
20 supplies could reduce potential critical impacts on agricultural and urban areas
21 resulting from water shortages. Under CP1, approximately \$1.6 million would
22 be allocated over an initial 10-year period to fund agricultural and M&I water
23 conservation programs, focused on agencies benefiting from increased
24 reliability of project water supplies.

25 **Develop Additional Hydropower Generation** Higher water surface
26 elevations in the reservoir would result in an increase in power generation of
27 about 54 gigawatt-hours (GWh) per year. This generation value is the expected
28 increased generation from Shasta Dam and other CVP/SWP facilities.

29 **Maintain and Increase Recreation Opportunities** CP1 includes features to
30 at least maintain the existing recreation capacity at Shasta Lake. Although CP1
31 does not include specific features to further increase recreation capacity,
32 benefits to the water-oriented recreation experience at Shasta Lake would likely
33 occur because of the increase in average lake surface area, reduced drawdown
34 during the recreation season, and modernization of recreation facilities. The
35 maximum surface area of the lake would increase by about 1,110 acres (4
36 percent), from 29,700 acres to about 30,800 acres. The average surface area of
37 the lake during the recreation season from May through September would
38 increase by about 800 acres (3 percent), from 23,900 acres to 24,700 acres.
39 There is also limited potential to provide additional benefits to recreation by
40 allowing more reliable filling of the reservoir during the spring.

41 **Benefits Related to Other Project Objectives** CP1 could also provide
42 benefits related to flood damage reduction, ecosystem restoration, and water
43 quality. Enlarging Shasta Dam would provide for incidental increased reservoir

1 capacity to capture flood flows, which could reduce flood damage along the
2 upper Sacramento River. Improved fisheries conditions as a result of CP1, as
3 described above, and increased flexibility to meet flow and temperature
4 requirements, could also enhance overall ecosystem resources in the
5 Sacramento River. For example, CP1 would result in improved flow and water
6 temperature conditions, particularly during drought periods, in the upper
7 Sacramento River for other resident fish species, such as the Sacramento
8 splittail. Furthermore, CP1 could potentially benefit ecosystem restoration
9 through improved Delta water quality conditions by increasing Delta outflow
10 during drought years and reducing salinity during critical periods. CP1 may also
11 contribute to improving Delta water quality through increased Delta emergency
12 response capabilities. When Delta emergencies occur, additional water in Shasta
13 Reservoir could improve operational flexibility for increasing releases to
14 supplement existing water sources to reestablish Delta water quality. In
15 addition to Delta emergency response, increased storage in Shasta Reservoir
16 could increase emergency response capability for CVP/SWP water supply
17 deliveries.

18 ***Construction for CP1***

19 Construction activities associated with physical features under CP1 would
20 include land-based construction activities associated with the following:

- 21 • Clearing vegetation from portions of the inundated reservoir area
- 22 • Constructing the dam, appurtenant structures, reservoir area dikes, and
23 railroad embankments
- 24 • Relocating roadways, bridges, recreation facilities, utilities, and
25 miscellaneous minor infrastructure

26 Construction activities for CP1 are described in Section 2.3.8, “Comprehensive
27 Plan Construction Activities.”

28 ***Operations and Maintenance for CP1***

29 Shasta Dam is operated in conjunction with other CVP facilities and SWP
30 facilities to manage floodwater, storage of surplus winter runoff for irrigation in
31 the Sacramento and San Joaquin valleys, M&I use, maintenance of navigation
32 flows, protection and conservation of fish in the Sacramento River and Delta,
33 and generation of hydroelectric energy. Storage in Shasta Reservoir fluctuates
34 greatly throughout the year; storage is typically highest in April and May, as the
35 need for flood control reservation space in the reservoir decreases. Storage is
36 typically at its lowest in September and October, after the irrigation season and
37 before winter refill begins. Shasta Reservoir capacity is currently 4,552 TAF,
38 with a maximum objective release capacity of 79,000 cubic feet per second
39 (cfs). Storage levels are lowest by October to provide sufficient flood risk
40 reduction and capture capacity during the following wet months. The storage
41 target gradually increases beginning in October to full pool in May; storage is

1 then withdrawn for high water demand (e.g., agricultural, M&I, fishery, and
2 water quality uses) during summer.

3 A series of rules and regulations in the form of flood control requirements, flow
4 requirements, water quality requirements, and water supply commitments
5 governs operations at Shasta Dam. Federal and State laws, regulations,
6 standards, and plans regulating Shasta Dam operations are described in detail in
7 Chapter 6, “Hydrology, Hydraulics, and Water Management,” and include the
8 following:

- 9 • 2009 NMFS BO (NMFS 2009)
- 10 • 2008 USFWS BO (USFWS 2008)
- 11 • CVPIA Programmatic EIS (Reclamation 1999)
- 12 • CVP long-term water service contracts (see the Hydrology, Hydraulics,
13 and Water Management Technical Report, Table 1-25, in the Physical
14 Resources Appendix)
- 15 • Trinity River ROD (Reclamation 2000)
- 16 • Reclamation’s 2008 OCAP BA (Reclamation 2008)
- 17 • Flood management requirements in accordance with the Water Control
18 Manual (USACE 1977)
- 19 • State Water Resources Control Board (SWRCB) Orders 90-05 and 91-
20 01
- 21 • CDFG Reclamation Memorandum of Agreement (CDFG and
22 Reclamation 1960)
- 23 • Water Quality Control Plan for the San Francisco Bay/San Joaquin
24 Delta Estuary (SWRCB 1995)
- 25 • SWRCB Water Right Revised Decision 1641 (SWRCB 2000)
- 26 • CVP and SWP Coordinated Operations Agreement (Reclamation and
27 DWR 1986)

28 In addition, Shasta Dam and Reservoir are operated according to the *Standing*
29 *Operating Procedures for Shasta Dam and Reservoir*. However, due to
30 sensitivity regarding this information, including security and public health and
31 safety concerns, this document is not available to the general public.

32 Under CP1, the additional storage would be retained to increase water supply
33 reliability and to expand the cold-water pool in Shasta Reservoir for fisheries

1 benefits. Shasta Dam operational guidelines would continue unchanged, except
2 during dry and critical years, when 70,000 acre-feet and 35,000 acre-feet,
3 respectively, of the 256,000 acre-feet increased storage capacity in Shasta
4 Reservoir would be operated primarily to increase M&I deliveries. Operations
5 targeting increased M&I deliveries were based on existing and anticipated
6 future demands, operational priorities, and facilities of the SWP, which provides
7 M&I water to a majority of the State’s population. For this DEIS, these
8 operations were simulated in CalSim-II by using the reserved storage capacity
9 to provide deliveries for previously unmet SWP demands during dry and critical
10 years. For CP1, existing water quality and temperature requirements would
11 typically be met in most years; therefore, additional water in storage would be
12 released primarily for water supply purposes. Accordingly, minimal increases
13 in flow would be expected in months when Delta exports were constrained, or
14 when flow was not required for water supply purposes.

15 In comparison to current operations, CP1 would store some additional flows
16 behind Shasta Dam during periods when downstream needs would have already
17 been met, but flows would have been released because of storage limitations.
18 The resulting increase in storage would be released downstream when there
19 were opportunities for beneficial use of the water, either to meet water supply
20 reliability demands or to improve Reclamation’s abilities to meet its
21 environmental objectives. The additional water in storage would also expand
22 the cold-water pool and increase end-of-September carryover storage in Shasta
23 Reservoir, increasing the ability of Shasta Dam to improve water temperatures
24 for anadromous fish in the upper Sacramento River.

25 Conversely, if water in storage were insufficient to meet all of the project
26 purposes, the first increment to be reduced would be deliveries to water service
27 contractors. Releases from Shasta Dam under CP1 would typically increase in
28 the summer months, corresponding with the periods of greatest agricultural
29 demands. Similarly, releases would be reduced in the winter months, when the
30 increased storage space could be used to capture additional runoff rather than
31 releasing water to the downstream river, as would occur under Shasta
32 Reservoir’s current operations.

33 Maintenance of facilities related to the proposed dam and reservoir enlargement
34 would be similar to maintenance activities currently conducted at Shasta Dam
35 and Reservoir.

36 **2.3.4 CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply**
37 **Reliability**

38 CP2 consists primarily of enlarging Shasta Dam by raising the crest 12.5 feet
39 and enlarging the reservoir by 443,000 acre-feet.

40 ***Major Components of CP2***

41 CP2 includes the following major components:

- 1 • Raising Shasta Dam and appurtenant facilities by 12.5 feet.
- 2 • Implementing the set of eight common management measures
- 3 previously described.
- 4 • Implementing the common environmental commitments previously
- 5 described.

6 A dam raise of 12.5 feet was chosen because it represents a midpoint between
7 the likely smallest dam raise considered and the largest practical dam raise that
8 would not require relocating the Pit River Bridge. By raising Shasta Dam from
9 a crest elevation of 1,077.5 feet to 1,090.0 feet (based on NGVD29), CP2 would
10 increase the height of the reservoir's full pool by 14.5 feet. The additional 2-
11 foot increase in the height of the full pool above the dam raise height would
12 result from spillway modifications similar to the modifications proposed under
13 CP1. This increase in full pool height would add approximately 443,000 acre-
14 feet of storage to the reservoir's capacity. Accordingly, storage in the overall
15 full pool would increase from 4.55 MAF to 5.0 MAF. Table 2-5 summarizes
16 major physical features associated with CP2.

17 Under CP2, the additional storage in Shasta Reservoir would be used to increase
18 water supply reliability and to expand the cold-water pool for downstream
19 anadromous fisheries. The existing TCD would also be extended for efficient
20 use of the expanded cold-water pool. Operations for water supply, hydropower,
21 and environmental and other regulatory requirements would be similar to
22 existing operations, except during dry and critical years when a portion of the
23 increased storage in Shasta Reservoir would be reserved to specifically focus on
24 increasing M&I deliveries. In dry years, 120,000 acre-feet of the 443,000 acre-
25 feet increased storage capacity in Shasta Reservoir would be reserved for
26 increasing M&I deliveries. In critical years, 60,000 acre-feet of the increased
27 storage capacity would be reserved for increasing M&I deliveries.

28 As described for CP1, this alternative would also include the potential to revise
29 flood control operational rules, which could reduce the potential for flood
30 damage and benefit recreation.

31 ***Potential Benefits of CP2***

32 Major potential benefits of CP2, related to contributions to the project
33 objectives, are described below.

34 **Increase Anadromous Fish Survival** Water temperature is one of the most
35 important factors in achieving recovery goals for anadromous fish in the
36 Sacramento River. CP2 would increase the ability of Shasta Dam to make cold-
37 water releases and regulate water temperatures for fish in the upper Sacramento
38 River, primarily in dry and critical water years. This would be accomplished by
39 raising Shasta Dam 12.5 feet, thus increasing the depth of the cold-water pool in
40 Shasta Reservoir and resulting in an increase in seasonal cold-water volume

1 below the thermocline (layer of greatest water temperature and density change).
2 Cold water released from Shasta Dam significantly influences water
3 temperature conditions in the Sacramento River between Keswick Dam and the
4 RBPP. Hence, the most significant water temperature benefits to anadromous
5 fish would occur upstream from the RBPP. It is estimated that improved water
6 temperature and flow conditions under CP2 could result in an average annual
7 increase in the salmon population of about 379,200 out-migrating juvenile
8 Chinook salmon.

9 **Increase Water Supply Reliability** CP2 would increase water supply
10 reliability by increasing firm water supplies for CVP and SWP irrigation and
11 M&I deliveries. This action would contribute to replacement of supplies
12 redirected to other purposes in the CVPIA. CP2 would help reduce estimated
13 future water shortages by increasing the reliability of firm water supplies for
14 agricultural and M&I deliveries by at least 77,800 acre-feet per year and
15 average annual yield by about 51,300 acre-feet per year. For this DEIS, firm
16 yield is considered equivalent to the estimated increase in the reliability of
17 supplies during dry and critical periods. The majority of increased firm yield
18 (67,100 acre-feet) would be for south-of-Delta agricultural and M&I deliveries.
19 In addition, water use efficiency could help reduce current and future water
20 shortages by allowing a more effective use of existing supplies. As population
21 and resulting water demands continue to grow and available supplies continue
22 to remain relatively static, more effectively using these supplies could reduce
23 potential critical impacts on agricultural and urban areas resulting from water
24 shortages. Under CP2, approximately \$2.6 million would be allocated over an
25 initial 10-year period to fund agricultural and M&I water conservation
26 programs, focused on agencies benefiting from increased reliability of project
27 water supplies.

28 **Develop Additional Hydropower Generation** Higher water surface
29 elevations in the reservoir would result in a net increase in power generation of
30 about 90 GWh per year. This generation value is the expected increased
31 generation from Shasta Dam and other CVP/SWP facilities.

32 **Maintain and Improve Recreation Opportunities** CP2 includes features to,
33 at minimum, maintain the existing recreation capacity at Shasta Lake. Although
34 CP2 does not have specific features to further increase recreation capacity,
35 benefits to the water-oriented recreation experience at Shasta Lake would likely
36 occur because of the increase in average lake surface area, reduced drawdown
37 during the recreation season, and modernization of recreation facilities. The
38 maximum surface area of the lake would increase by about 1,900 acres (6
39 percent), from 29,700 acres to about 31,600 acres. The average surface area of
40 the lake during the recreation season from May through September would
41 increase by about 1,300 acres (5 percent), from 23,900 acres to 25,200 acres.
42 There is also limited potential to provide additional benefits to recreation by
43 allowing more reliable filling of the reservoir during the spring.

1 **Benefits Related to Other Project Objectives** CP2 could also provide
2 benefits related to flood damage reduction, ecosystem restoration, and water
3 quality, as described for CP1, but to a greater extent because of increased
4 capacity and associated overall system flexibility.

5 **Construction for CP2**

6 Construction activities associated with physical features under CP2 would
7 include land-based construction activities associated with the following:

- 8 • Clearing vegetation from portions of the inundated reservoir area
- 9 • Constructing the dam, appurtenant structures, reservoir area dikes, and
10 railroad embankments
- 11 • Relocating roadways, bridges, recreation facilities, utilities, and
12 miscellaneous minor infrastructure

13 Construction activities for CP2 are described in Section 2.3.8, “Comprehensive
14 Plan Construction Activities.”

15 **Operations and Maintenance for CP2**

16 Operations under CP2 are governed by the same regulatory constraints as
17 described for CP1. Similar to CP1, the additional storage would be retained to
18 increase water supply reliability and to expand the cold-water pool in Shasta
19 Reservoir for fisheries benefits. Shasta Dam operational guidelines would
20 continue unchanged, except during dry years and critical years, when 120,000
21 acre-feet and 60,000 acre-feet, respectively, of the 443,000 acre-feet increased
22 storage capacity in Shasta Reservoir would be operated primarily to increase
23 M&I deliveries. Operations targeting increased M&I deliveries were based on
24 existing and anticipated future demands, operational priorities, and facilities of
25 the SWP. For CP2, existing water quality and temperature requirements would
26 typically be met in most years; therefore, additional water in storage would be
27 released primarily for water supply purposes. Accordingly, minimal increases
28 in flow would be expected in months when Delta exports were constrained, or
29 when flow was not usable for water supply purposes.

30 In comparison to current operations, CP2 would store some additional flows
31 behind Shasta Dam during periods when downstream needs would have already
32 been met, but flows would have been released because of storage limitations.
33 The resulting increase in storage would be released downstream when there
34 were opportunities for beneficial use of the water, either to meet water supply
35 reliability demands or to improve Reclamation’s abilities to meet its
36 environmental objectives. The additional water in storage would also expand
37 the cold-water pool and increase end-of-September carryover storage in Shasta
38 Reservoir, increasing the ability of Shasta Dam to improve water temperatures
39 for anadromous fish in the upper Sacramento River.

1 Conversely, if water in storage were insufficient to meet all of the project
2 purposes, the first increment to be reduced would be deliveries to water service
3 contractors. Releases from Shasta Dam under CP2 would typically increase in
4 the summer months, corresponding with the periods of greatest agricultural
5 demands. Similarly, releases would be reduced in the winter months, when the
6 increased storage space could be used to capture additional runoff rather than
7 releasing water to the downstream river, as would occur with Shasta Reservoir's
8 current operations.

9 Maintenance of facilities related to the proposed dam and reservoir enlargement
10 would be similar to maintenance activities currently conducted at Shasta Dam
11 and Reservoir.

12 **2.3.5 CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and** 13 **Anadromous Fish Survival**

14 CP3 focuses on increasing agricultural water supply reliability and increasing
15 anadromous fish survival by raising Shasta Dam 18.5 feet and enlarging Shasta
16 Reservoir by 634,000 acre-feet.

17 ***Major Components of CP3***

18 CP3 includes the following major components:

- 19 • Raising Shasta Dam and appurtenant facilities by 18.5 feet
- 20 • Implementing the set of eight common management measures
21 previously described
- 22 • Implementing the common environmental commitments previously
23 described

24 By raising Shasta Dam 18.5 feet, from a crest elevation of 1,077.5 feet to
25 1,096.0 feet (based on NGVD29), CP3 would increase the height of the
26 reservoir full pool by 20.5 feet. The additional 2-foot increase in the height of
27 the full pool above the dam raise height would result from spillway
28 modifications similar to the modifications proposed under CP1. This increase in
29 full pool height would add approximately 634,000 acre-feet of storage to the
30 reservoir's capacity. Accordingly, storage in the overall full pool would increase
31 from 4.55 MAF to 5.19 MAF. Although higher dam raises are technically and
32 physically feasible, 18.5 feet is the largest dam raise that would not require
33 extensive and costly reservoir area relocations, such as relocating the Pit River
34 Bridge, Interstate 5 (I-5), and the Union Pacific Railroad (UPRR) tunnels.
35 Table 2-5 summarizes major physical features associated with CP3.

36 Because CP3 focuses on increasing agricultural water supply reliability and
37 anadromous fish survival, none of the increased storage capacity in Shasta
38 Reservoir would be reserved for increasing M&I deliveries. Operations for
39 water supply, hydropower, and environmental and other regulatory

1 requirements would be similar to existing operations. The additional storage
2 would be retained for water supply reliability and to expand the cold-water pool
3 for downstream anadromous fisheries. The existing TCD would also be
4 extended for efficient use of the expanded cold-water pool.

5 As described for the above alternatives, this alternative would also include the
6 potential to revise flood control operational rules, which could reduce the
7 potential for flood damage and benefit recreation.

8 **Potential Benefits of CP3**

9 Major potential benefits of CP3, related to contributions to the project
10 objectives, are described below.

11 **Increase Anadromous Fish Survival** Water temperature is one of the most
12 important factors in achieving recovery goals for anadromous fish in the
13 Sacramento River. CP3 would increase the ability of Shasta Dam to make cold-
14 water releases and regulate water temperatures for fish in the upper Sacramento
15 River, primarily in dry and critical water years. This would be accomplished by
16 raising Shasta Dam 18.5 feet, thus increasing the depth of the cold-water pool in
17 Shasta Reservoir and resulting in an increase in seasonal cold-water volume
18 below the thermocline (layer of greatest water temperature and density change).
19 Cold water released from Shasta Dam significantly influences water
20 temperature conditions in the Sacramento River between Keswick Dam and the
21 RBPP. Hence, the most significant water temperature benefits to anadromous
22 fish would occur upstream from the RBPP. It is estimated that improved water
23 temperature and flow conditions under CP3 could result in an average annual
24 increase in the Chinook salmon population of about 207,400 out-migrating
25 juvenile fish.

26 **Increase Water Supply Reliability** CP3 would increase water supply
27 reliability by increasing firm water supplies for CVP irrigation deliveries. This
28 action would contribute to replacement of supplies redirected to other purposes
29 in the CVPIA. CP3 would help reduce estimated future water shortages by
30 increasing the reliability of firm water supplies for agricultural deliveries by at
31 least 63,100 acre-feet per year and average annual yield by about 61,700 acre-
32 feet per year. For this DEIS, firm yield is considered equivalent to the
33 estimated increase in the reliability of supplies during dry and critical periods.
34 Almost half of the increased firm yield (28,000 acre-feet) would be for south-
35 of-Delta agricultural deliveries, with the remainder for north-of-Delta
36 agricultural deliveries. In addition, water use efficiency could help reduce
37 current and future water shortages by allowing a more effective use of existing
38 supplies. As population and resulting water demands continue to grow and
39 available supplies continue to remain relatively static, more effectively using
40 these supplies could reduce potential critical impacts to agricultural and urban
41 areas resulting from water shortages. Under CP3, approximately \$3.1 million
42 would be allocated over an initial 10-year period to fund agricultural water

1 conservation programs, focused on agencies benefiting from increased
2 reliability of project water supplies.

3 **Develop Additional Hydropower Generation** Higher water surface
4 elevations in the reservoir would result in a net increase in power generation of
5 about 90 GWh per year. This generation value is the expected increased
6 generation from Shasta Dam and other CVP/SWP facilities.

7 **Maintain and Increase Recreation Opportunities** CP3 includes features to,
8 at a minimum, maintain the existing recreation capacity at Shasta Lake.
9 Although CP3 does not include specific features to further increase recreation
10 capacity, benefits to the water-oriented recreation experience at Shasta Lake
11 would likely occur because of the increase in average lake surface area, reduced
12 drawdown during the recreation season, and modernization of recreation
13 facilities. The maximum surface area of the lake would increase by about 2,600
14 acres (9 percent), from 29,700 acres to about 32,300 acres. The average surface
15 area of the lake during the recreation season from May through September
16 would increase by about 2,000 acres (8 percent), from 23,900 acres to 25,900
17 acres. There is also limited potential for reservoir reoperation to provide
18 additional benefits to recreation by allowing more reliable filling of the
19 reservoir during the spring.

20 **Benefits Related to Other Project Planning Objectives** CP3 could also
21 provide benefits related to flood damage reduction, ecosystem restoration, and
22 water quality, as described for CP1, but to a greater extent because of increased
23 capacity and associated overall system flexibility.

24 ***Construction for CP3***

25 Construction activities associated with physical features under CP3 would
26 include land-based construction activities associated with the following:

- 27 • Clearing vegetation from portions of the inundated reservoir area
- 28 • Constructing the dam, appurtenant structures, reservoir area dikes, and
29 railroad embankments
- 30 • Relocating roadways, bridges, recreation facilities, utilities, and
31 miscellaneous minor infrastructure

32 Construction activities for CP3 are described in Section 2.3.8, “Comprehensive
33 Plan Construction Activities.”

34 ***Operations and Maintenance for CP3***

35 Operations under CP3 are governed by the same regulatory constraints as
36 described for CP1. Under CP3, Shasta Dam operational guidelines would
37 continue unchanged, with the additional storage retained for agricultural water
38 supply reliability and to expand the cold-water pool in Shasta Reservoir for

1 fisheries benefits. Unlike CP1 and CP2, none of the increased storage space in
2 Shasta Reservoir would be reserved for increasing M&I deliveries under CP3.
3 Existing water quality and temperature requirements would be met in most
4 years; therefore, additional water in storage would be released primarily for
5 water supply purposes. Accordingly, minimal increases in flow would be
6 expected in months when Delta exports were constrained, or when flow was not
7 usable for water supply purposes.

8 In comparison to current operations, CP3 would store some additional flows
9 behind Shasta Dam during periods when downstream needs would have already
10 been met, but flows would have been released because of storage limitations.
11 The resulting increase in storage would be released downstream when there
12 were opportunities for beneficial use of the water, either to meet water supply
13 reliability demands or to improve Reclamation's abilities to meet its
14 environmental objectives. The additional water in storage would also expand
15 the cold-water pool and increase end-of-September carryover storage in Shasta
16 Reservoir, increasing the ability of Shasta Dam to improve water temperatures
17 for anadromous fish in the upper Sacramento River.

18 Conversely, if water in storage were insufficient to meet all of the project
19 purposes, the first increment to be reduced would be deliveries to water service
20 contractors. Releases from Shasta Dam under CP3 would typically increase in
21 the summer months, corresponding with the periods of greatest agricultural
22 demands. Similarly, releases would be reduced in the winter months, when the
23 increased storage space could be used to capture additional runoff rather than
24 releasing water to the downstream river, as would occur with Shasta Reservoir's
25 current operations.

26 Maintenance of facilities related to the proposed dam and reservoir enlargement
27 would be similar to maintenance activities currently conducted at Shasta Dam
28 and Reservoir.

29 **2.3.6 CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply** 30 **Reliability**

31 CP4 focuses on increasing anadromous fish survival by raising Shasta Dam 18.5
32 feet while also increasing water supply reliability.

33 ***Major Components of CP4***

34 CP4 includes the following major components:

- 35 • Raising Shasta Dam and appurtenant facilities by 18.5 feet
- 36 • Reserving 378,000 acre-feet of the increased storage in Shasta Lake for
37 maintaining cold-water volume or augmenting flows as part of an
38 adaptive management plan for anadromous fish survival
- 39 • Augmenting spawning gravel in the upper Sacramento River

- 1 • Restoring riparian, floodplain, and side channel habitat in the upper
2 Sacramento River
- 3 • Implementing the set of eight common management measures
4 previously described
- 5 • Implementing the common environmental commitments previously
6 described

7 By raising Shasta Dam 18.5 feet, from a crest elevation of 1,077.5 feet to
8 1,096.0 feet (based on NGVD29), CP4 would increase the height of the
9 reservoir full pool by 20.5 feet. The additional 2-foot increase in the height of
10 the full pool above the dam raise height would result from spillway
11 modifications similar to the modifications proposed under CP1. This increase in
12 full pool height would add approximately 634,000 acre-feet of storage to the
13 reservoir's capacity. Accordingly, storage in the overall full pool would be
14 increased from 4.55 MAF to 5.19 MAF.

15 The additional storage created by the 18.5-foot dam raise would be used to
16 improve the ability to meet temperature objectives and habitat requirements for
17 anadromous fish during drought years and increase water supply reliability. Of
18 the increased reservoir storage space, about 378,000 acre-feet would be
19 dedicated to increasing the supply of cold water for anadromous fish survival
20 purposes. Table 2-5 summarizes major physical features associated with CP4.

21 Operations for the remaining portion of increased storage (approximately
22 256,000 acre-feet) would be the same as in CP1, with 70,000 acre-feet reserved
23 in dry years and 35,000 acre-feet reserved in critical years to specifically focus
24 on increasing M&I deliveries. The existing TCD would also be extended to
25 achieve efficient use of the expanded cold-water pool.

26 As described for the above alternatives, this alternative also would include the
27 potential to revise the operational rules for flood control for Shasta Dam and
28 Reservoir, which could reduce the potential for flood damage and benefit
29 recreation.

30 CP4 also includes an adaptive management plan for the cold-water pool, and
31 augmenting spawning gravel and restoring riparian, floodplain, and side channel
32 habitat at one or more sites in the upper Sacramento River.

33 **Adaptive Management of Cold-Water Pool** The adaptive management plan
34 may include operational changes to the timing and magnitude of releases from
35 Shasta Dam to benefit anadromous fish, as long as there are no conflicts with
36 current operational guidelines or adverse impacts on water supply reliability.
37 Adaptive management of the cold-water pool for anadromous fish is discussed
38 further below under "Operations and Maintenance for CP4."

39 **Augment Spawning Gravel in Upper Sacramento River** Gravel suitable for
40 spawning has been identified as a significant influencing factor in the recovery

1 of anadromous fish populations in the Sacramento River (USFWS 2001, NMFS
2 2009). Under CP4, spawning-sized gravel would be placed at multiple locations
3 along the Sacramento River between Keswick Dam and the RBPP.

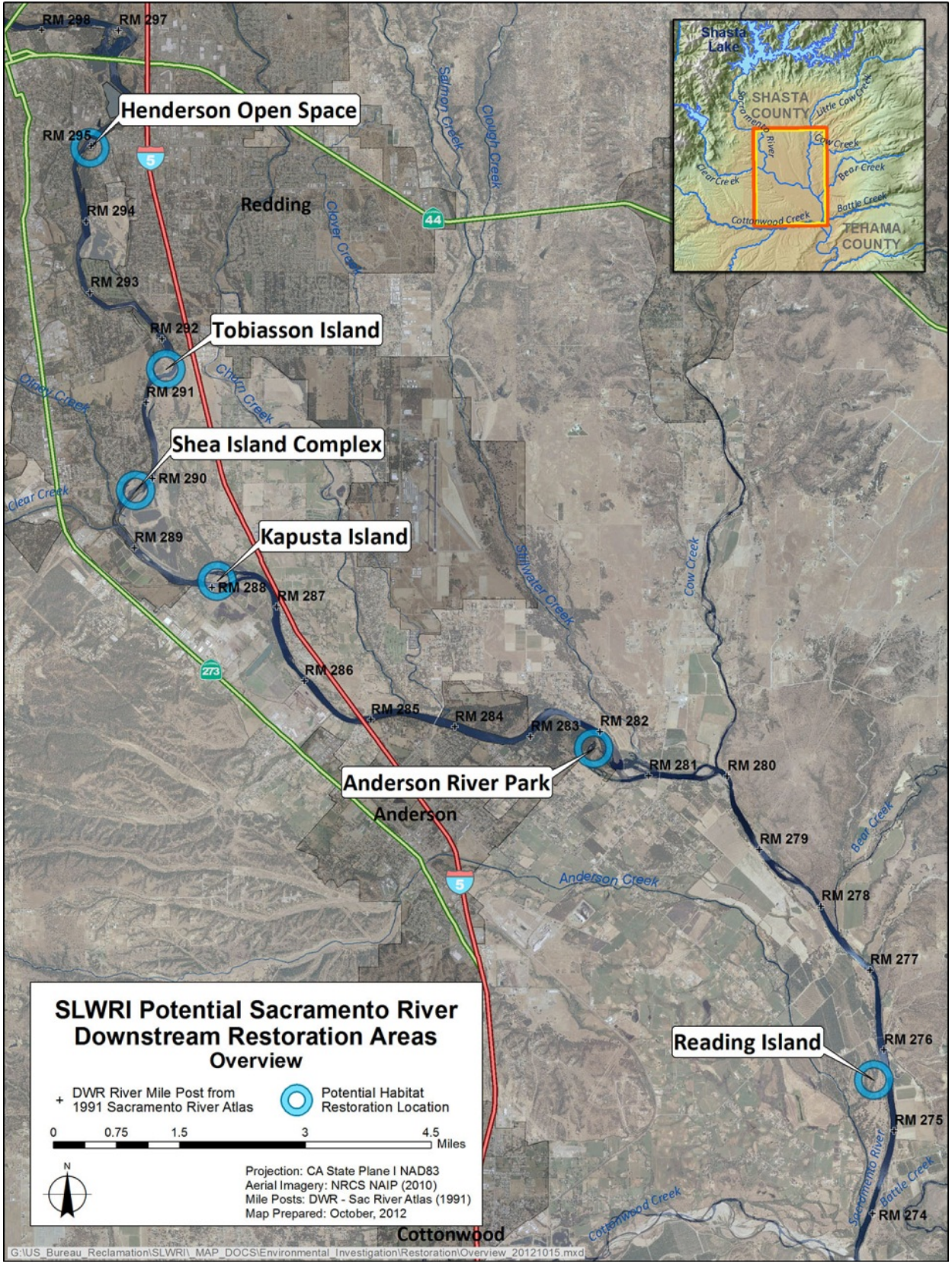
4 Gravel augmentation would occur at one to three locations every year, for a
5 period of 10 years, unless unusual conditions or agency requests precluded
6 placement during a single year. This program, in combination with the ongoing
7 CVPIA gravel augmentation program, would help address the gravel deficit in
8 the upper Sacramento River. However, this reach may continue to be gravel-
9 limited in the future. Therefore, the proposed gravel augmentation program
10 would be reevaluated after the 10-year period to assess the need for continued
11 spawning gravel augmentation, and to identify opportunities for future gravel
12 augmentation actions or programs.

13 On average, 5,000 to 10,000 tons of gravel would be placed each year, although
14 the specific quantity of gravel placed in a given year may vary from that range.
15 Gravel would be obtained as uncrushed, rounded river rock, free of debris and
16 organic material, from local, commercial sources. To maximize the benefit to
17 anadromous fish, gravel would be washed and sorted to meet specific size
18 criteria. To minimize impacts on salmonid spawning activity, gravel placement
19 within the active river channels would occur between August and September
20 each year, consistent with the time frame for the ongoing CVPIA gravel
21 augmentation program.

22 Fifteen preliminary locations for spawning gravel augmentation were identified
23 in the Sacramento River between Keswick Dam and Shea Island. Each site
24 would be eligible for gravel placement one or more times during the 10-year
25 program. Selection of these locations was based on potential benefits to
26 anadromous fish and site accessibility. Gravel placement would provide either
27 immediate spawning habitat or long-term recruitment.

28 Although preliminary sites have been identified, specific gravel augmentation
29 site(s) and volume(s) would be selected each year in the spring or early summer
30 through discussions among Reclamation, USFWS, CDFW, and NMFS. The
31 discussions would include topics such as avoiding redundancy with planned
32 CVPIA gravel augmentation activities in a given year; identifying hydrology or
33 morphology issues that could affect the potential benefit of placing gravel at any
34 particular site; identifying changes in spawning trends based on ongoing CVPIA
35 monitoring efforts; evaluating potential new sites; and appropriately distributing
36 selected gravel sites along the river reach(es).

37 **Restore Riparian, Floodplain, and Side Channel Habitat** Under CP4,
38 riparian, floodplain, and side channel habitat restoration would occur at one or a
39 combination of potential locations along the upper Sacramento River.
40 Restoration measures for six potential sites, referred to collectively as “upper
41 Sacramento River restoration sites”, are described below. The sites under
42 consideration for habitat restoration are shown in Figure 2-3.



1
 2

Figure 2-3. Potential Sacramento River Habitat Restoration Areas

1 *Henderson Open Space* The City of Redding Henderson Open Space area is
2 located south of Cypress Bridge on the east side of the Sacramento River at
3 River Mile (RM) 295. Riparian and side channel restoration at the Henderson
4 Open Space site could consist of enhancing an existing side channel to activate
5 the frequency and duration of flows for Chinook salmon spawning habitat
6 throughout the side channel. This potential modification would create up to
7 2,000 more linear feet of spawning habitat near areas of the Sacramento River
8 that are actively used by anadromous fish for spawning.

9 *Tobiasson Island* Tobiasson Island is located downstream from South
10 Bonnyview Bridge in the center of the Sacramento River at RM 292. Riparian,
11 floodplain, and side channel habitat enhancement at this site would involve
12 creating a side channel through the island to be activated at Sacramento River
13 flows for Chinook salmon spawning. Riparian vegetation would be established
14 along the course of the new side channel, adding approximately 1,350 linear
15 feet of spawning and floodplain habitat to this section of the Sacramento River.

16 *Shea Island Complex* The Shea Island Complex is located on the west side of
17 the Sacramento River upstream from the river's confluence with Clear Creek at
18 RM 291. Restoration at the Shea Island Complex to improve side channel,
19 riparian, and floodplain habitat would involve enhancing a major side channel
20 through the site to keep the side channel hydraulically connected with the main
21 stem of the Sacramento River at a broader range of flows. Adding channel
22 complexity and enhancing riparian vegetation throughout the length of the side
23 channel would improve Chinook salmon habitat along an additional 1,930 feet
24 of the Sacramento River.

25 *Kapusta Island* Kapusta Island is located adjacent to the Kapusta Open Space
26 area upstream from the I-5 crossing of the Sacramento River at RM 288.
27 Restoration of riparian, side channel and floodplain habitat at Kapusta Island
28 would involve enhancing an existing side channel by allowing it to carry water
29 at a broader range of flows specifically to increase spawning habitat for winter-
30 run and spring-run Chinook salmon. Allowing flow through the island, and
31 increasing floodplain habitat would increase potential spawning habitat in this
32 area of the river by about 1,590 linear feet.

33 *Anderson River Park* Anderson River Park is an open space area on the south
34 bank of the Sacramento River downstream from Churn Creek, and upstream
35 from the Deschutes Road crossing at RM 283. Restoration at this site would
36 involve hydraulically reconnecting a remnant Sacramento River side channel
37 with the Sacramento River. Regularly flowing water throughout the length of
38 this side channel would increase anadromous fish rearing habitat along 4,750
39 feet of side channel in this section of the river.

40 *Reading Island* Reading Island lies along the Sacramento River just north of
41 Cottonwood Creek at RM 274. The channel for Anderson Creek, a remnant
42 Sacramento River side channel, defines the western edge of Reading Island.

1 Construction of a levee on Anderson Creek has blocked the channel's
2 connectivity with the Sacramento River and has created Anderson Slough, an
3 area of still water. Riparian, floodplain, and side channel restoration on Reading
4 Island would involve restoring flows in Anderson Creek and through Anderson
5 Slough. These activities, alongside removal of invasive aquatic vegetation in the
6 channel and reestablishment of riparian vegetation would aid in restoring
7 rearing habitat for winter-run Chinook, and spawning habitat for steelhead
8 along 4,225 feet of channel in this area of the river.

9 ***Potential Benefits of CP4***

10 Major potential benefits of CP4, related to the project objectives, are described
11 below.

12 **Increase Anadromous Fish Survival** Water temperature is one of the most
13 important factors in achieving recovery goals for anadromous fish in the
14 Sacramento River. CP4 would significantly increase the ability of Shasta Dam
15 to make cold-water releases and regulate water temperature in the upper
16 Sacramento River, primarily in dry and critical water years. This would be
17 accomplished by raising Shasta Dam 18.5 feet, thus increasing the depth of the
18 cold-water pool in Shasta Reservoir and resulting in an increase in seasonal
19 cold-water volume below the thermocline (layer of greatest water temperature
20 and density change). Cold water released from Shasta Dam significantly
21 influences water temperature conditions in the Sacramento River between
22 Keswick Dam and the RBPP. Hence, the most significant water temperature
23 benefits to anadromous fish would occur upstream from the RBPP. It is
24 estimated that improved water temperature and flow conditions under CP4
25 could result in an average annual increase in Chinook salmon population of
26 nearly 812,600 out-migrating juvenile fish.

27 Under CP4, an increase in the cold-water pool would allow Reclamation to
28 operate Shasta Reservoir to provide not only a more reliable source of water
29 during dry and critical water years, but also to provide more cool water for
30 release into the Sacramento River to improve conditions for anadromous fish.
31 Of the increased storage space, about 378,000 acre-feet (60 percent) would be
32 dedicated to increasing the cold-water supply for anadromous fish survival
33 purposes.

34 In addition, CP4 includes a gravel augmentation program. Gravel augmentation
35 would occur on average at one or more locations in the Sacramento River
36 between Keswick Dam and the RBPP for a period of 10 years. On average,
37 5,000 to 10,000 tons of gravel would be placed each year, although the specific
38 quantity of gravel placed in a given year may vary from that range. Spawning
39 gravel augmentation is expected to positively influence anadromous fish
40 populations in the Sacramento River.

41 Potential benefits to anadromous fish survival through conserving, restoring,
42 and enhancing ecosystem resources are described below.

1 **Increase Water Supply Reliability** CP4 would increase water supply
2 reliability by increasing firm water supplies for CVP and SWP irrigation and
3 M&I deliveries. This action would contribute to replacement of supplies
4 redirected to other purposes in the CVPIA. CP4 would help reduce estimated
5 future water shortages by increasing the reliability of firm water supplies for
6 agricultural and M&I deliveries by at least 47,300 acre-feet per year and
7 average annual yield by about 31,000 acre-feet per year. For this DEIS, firm
8 yield is considered equivalent to the estimated increase in the reliability of
9 supplies during dry and critical periods. The majority of increased firm yield
10 (42,700 acre-feet) would be for south-of-Delta agricultural and M&I deliveries.
11 In addition, water use efficiency could help reduce current and future water
12 shortages by allowing a more effective use of existing supplies. As population
13 and resulting water demands continue to grow and available supplies continue
14 to remain relatively static, more effectively using these supplies could reduce
15 potential critical impacts to agricultural and urban areas resulting from water
16 shortages. Under CP4, approximately \$1.6 million would be allocated over an
17 initial 10-year period to fund agricultural and M&I water conservation
18 programs, focused on agencies benefiting from increased reliability of project
19 water supplies.

20 **Develop Additional Hydropower Generation** Higher water surface
21 elevations in the reservoir would result in a net increase in power generation of
22 about 133 GWh per year. This generation value is the expected increased
23 generation from Shasta Dam and other CVP/SWP facilities.

24 **Conserve, Restore, and Enhance Ecosystem Resources** In the upper
25 Sacramento River, the addition of spawning gravel and the restoration of
26 riparian, floodplain, and side channel habitat are expected to improve the
27 complexity of aquatic habitat and its suitability for anadromous salmonid
28 spawning and rearing habitat. Riparian areas provide habitat for a diverse array
29 of plant and animal communities along the Sacramento River, including several
30 threatened or endangered species. Riparian areas also provide shade and woody
31 debris that increase the complexity of aquatic habitat and its suitability for
32 spawning and rearing. Lower floodplain areas, river terraces, and gravel bars
33 play an important role in the health and succession of riparian habitat.
34 Restoration would support the goals of the Sacramento River Conservation Area
35 Forum and other programs associated with riparian restoration along the
36 Sacramento River. In addition, improved fisheries conditions as a result of
37 cold-water carryover storage in CP4, as described above, and increased
38 flexibility to meet flow and temperature requirements, could also enhance
39 overall ecosystem resources in the Sacramento River. Side channels can
40 support important habitat for anadromous salmonids, including rearing and
41 spawning habitat. Side channel habitats also provide refuge from predators and
42 productive foraging habitat for juvenile anadromous salmonids.

43 **Maintain and Increase Recreation Opportunities** CP4 includes features to,
44 at a minimum, maintain the existing recreation capacity at Shasta Lake.

1 Potential recreation benefits would be as stated for CP3. Although CP4 does
2 not include specific features to further increase recreation capacity, benefits to
3 the water-oriented recreation experience at Shasta Lake would likely occur
4 because of the increase in average lake surface area, reduced drawdown during
5 the recreation season, and modernization of recreation facilities. The maximum
6 surface area of the lake would increase by about 2,600 acres (9 percent), from
7 29,700 acres to about 32,300 acres. The average surface area of the lake during
8 the recreation season from May through September would increase by about
9 2,600 acres (11 percent), from 23,900 acres to 26,500 acres. There is also
10 limited potential to provide additional benefits to recreation by allowing more
11 reliable filling of the reservoir during the spring.

12 **Benefits Related to Other Project Objectives** CP4 could also provide
13 benefits related to flood damage reduction and water quality, similar to CP1.

14 ***Construction for CP4***

15 Construction activities associated with physical features under CP4 would
16 include land-based construction activities associated with the following:

- 17 • Clearing vegetation from portions of the inundated reservoir area
- 18 • Constructing the dam, appurtenant structures, reservoir area dikes, and
19 railroad embankments
- 20 • Relocating roadways, bridges, recreation facilities, utilities, and
21 miscellaneous minor infrastructure
- 22 • Augmenting spawning gravel in the upper Sacramento River
- 23 • Restoring riparian, floodplain, and side channel habitat

24 Construction activities for CP4 are described in Section 2.3.8, “Comprehensive
25 Plan Construction Activities.”

26 ***Operations and Maintenance for CP4***

27 Operations under CP4 are governed by the same regulatory constraints as
28 described for CP1. Under CP4, the additional storage would be retained to
29 increase water supply reliability and to expand the cold-water pool in Shasta
30 Reservoir for fisheries benefits. Of the 634,000 acre-feet of additional storage,
31 378,000 acre-feet of water (60 percent) would be dedicated to increasing the
32 cold-water supply for anadromous fish survival purposes. This would be in
33 addition to any storage targets set by regulations described in Chapter 6,
34 “Hydrology, Hydraulics, and Water Management.” Similar to CP1, Shasta Dam
35 operational guidelines would continue unchanged under CP4, except during dry
36 and critical years, when 70,000 acre-feet and 35,000 acre-feet, respectively, of
37 the increased storage capacity in Shasta Reservoir would be operated primarily
38 to provide increased M&I deliveries. Operations targeting increased M&I

1 deliveries were based on existing and anticipated future demands, operational
2 priorities, and facilities of the SWP.

3 As modeled, the 378,000 acre-feet of additional water would be the first
4 increment of the reservoir filled after the reservoir was enlarged. This amount of
5 water would be available as additional water for the cold-water pool each year
6 regardless of water year type, unless Reclamation elected to use the additional
7 water to augment flows protecting anadromous fish in the Sacramento River, as
8 part of a proposed adaptive management plan, as explained below. An
9 additional 256,000 acre-feet of the increased storage space would be used
10 primarily to improve water supply reliability; operations of Shasta Dam related
11 to the 256,000 acre-feet of storage would be similar to operations under CP1.

12 As stated above, of the total 634,000 acre-feet of additional storage, 378,000
13 acre-feet of water would be used to increase the cold-water pool for fisheries.
14 Reclamation is currently working with NMFS, USFWS, and CDFW through the
15 Sacramento River Temperature Task Group (SRTTG), a multiagency group
16 established to adaptively manage flows and water temperatures in the
17 Sacramento River to improve and stabilize Chinook salmon populations in the
18 upper Sacramento River. The additional 378,000 acre-feet of cold-water pool
19 would be managed by Reclamation in coordination with the SRTTG.

20 Current analysis indicates that the most beneficial use of the additional 378,000
21 acre-feet of storage for fisheries protection is as an expanded cold-water pool;
22 however, Reclamation has agreed to adaptively manage the 378,000 acre-feet of
23 water, as appropriate, to increase benefits to anadromous fish as part of CP4.
24 Adaptive management is an approach allowing decision makers to take
25 advantage of a variety of strategies and techniques that are adjusted, refined,
26 and/or modified based on an improved understanding of system dynamics.
27 Adaptive management, if applied appropriately, allows for flexible operations
28 based on best available science and new information as it becomes available.

29 The adaptive management plan may include operational changes to the timing
30 and magnitude of releases primarily to improve the quality and quantity of
31 aquatic habitat. These changes may include increasing minimum flows, timing
32 releases from Shasta Dam to mimic more natural seasonal flows, meeting flow
33 targets for side channels, or retaining the additional 378,000 acre-feet of water
34 in storage to meet temperature requirements. Reclamation would work
35 cooperatively with the SRTTG to determine the best use of the cold-water pool
36 each year under an adaptive management plan. Reclamation would manage the
37 cold-water pool and operate Shasta Dam each year based on recommendations
38 from the SRTTG. Because adaptive management is predicated on using best
39 available science and new information to make decisions, a monitoring program
40 would be implemented as part of the adaptive management plan. SRTTG
41 members would conduct monitoring, develop monitoring protocols, and set
42 performance standards to determine the success of adaptive management
43 actions.

1 Under the currently proposed operations, the 378,000 acre-feet of additional
2 storage would be the first increment of water in the reservoir to fill after dam
3 enlargement. This water would be available each year independent of water year
4 type if used exclusively to enlarge the cold-water pool. If the 378,000 acre-feet
5 of stored water is used to augment flows based on recommendations from the
6 SRTTG, this water would not be guaranteed to be available for use the
7 following year because of uncertainty in hydrologic conditions. Once water was
8 released to augment flows as part of the adaptive management plan, the 378,000
9 acre-feet of additional storage space would be refilled after the 256,000 acre-
10 feet of additional storage space was filled for the primary purpose of increasing
11 water supply reliability. Each year that the 378,000 acre-feet of additional
12 water was held in storage as part of an increase in the cold-water pool, the
13 allocated amount would be available as long as the cold-water pool continued to
14 provide benefits to fisheries.

15 SALMOD modeling and related analysis indicate that in most cases, providing
16 an increased cold-water pool benefits Chinook salmon populations in the Upper
17 Sacramento River more than increasing flows. Therefore, the impacts and
18 benefits of increasing flows under CP4 are not presented in this DEIS. Per
19 recommendations in Title 43 of the CFR, Part 46, Section 46.145, substantive
20 increases in flows associated with the adaptive management plan would be
21 evaluated in subsequent NEPA analysis.

22 Maintenance of facilities related to the proposed dam and reservoir enlargement
23 would be similar to maintenance activities currently conducted at Shasta Dam
24 and Reservoir.

25 **2.3.7 CP5 – 18.5-Foot Dam Raise, Combination Plan**

26 CP5 primarily focuses on increased water supply reliability, anadromous fish
27 survival, Shasta Lake area environmental resources, and increased recreation
28 opportunities.

29 ***Major Components of CP5***

30 CP5 includes the following major components:

- 31 • Raising Shasta Dam and appurtenant facilities by 18.5 feet
- 32 • Constructing additional resident fish habitat in Shasta Lake and along
33 the lower reaches of its tributaries (Sacramento River, McCloud River,
34 and Squaw Creek)
- 35 • Constructing shoreline fish habitat around Shasta Lake
- 36 • Augmenting spawning gravel in the upper Sacramento River
- 37 • Restoring riparian, floodplain, and side channel habitat in the upper
38 Sacramento River

- 1 • Increasing recreation opportunities at Shasta Lake
- 2 • Implementing the set of eight common management measures
- 3 previously described
- 4 • Implementing the common environmental commitments previously
- 5 described

6 By raising Shasta Dam 18.5 feet, from a crest elevation of 1,077.5 feet to
7 1,096.0 feet (based on NGVD29), CP5 would increase the height of the
8 reservoir full pool by 20.5 feet. The additional 2-foot increase in the height of
9 the full pool above the dam raise height would result from spillway
10 modifications similar to the modifications proposed under CP1. This increase in
11 full pool height would add approximately 634,000 acre-feet of storage to the
12 reservoir's capacity. Accordingly, storage in the overall full pool would be
13 increased from 4.55 MAF to 5.19 MAF. Table 2-5 summarizes major physical
14 features associated with CP5.

15 Under CP5, the additional storage in Shasta Reservoir would be used to increase
16 water supply reliability and to expand the cold-water pool for downstream
17 anadromous fisheries. The existing TCD would be extended to achieve efficient
18 use of the expanded cold-water pool. Operations for water supply, hydropower,
19 and environmental and other regulatory requirements would be similar to
20 existing operations, except during dry and critical years when a portion of the
21 increased storage in Shasta Reservoir would be reserved to specifically focus on
22 increasing M&I deliveries. In dry years, 150,000 acre-feet of the 634,000 acre-
23 feet increased storage capacity in Shasta Reservoir would be reserved for
24 increasing M&I deliveries. In critical years, 75,000 acre-feet of the increased
25 storage capacity would be reserved for increasing M&I deliveries.

26 As described for the above alternatives, this alternative also would include the
27 potential to revise the flood control operational rules for Shasta Dam and
28 Reservoir, which could reduce the potential for flood damage and benefit
29 recreation.

30 CP5 also involves (1) restoring resident fish habitat in Shasta Lake; (2) restoring
31 fisheries and riparian habitat at several locations along the lower reaches of the
32 tributaries to Shasta Lake; (3) augmenting spawning gravel in the upper
33 Sacramento River; (4) restoring riparian, floodplain, and side channel habitat in
34 the upper Sacramento River; and (5) increasing recreation opportunities at
35 Shasta Lake.

36 **Construct Reservoir Shoreline Enhancement** The ecosystem enhancement
37 goal for the shoreline environment of Shasta Lake is to improve warm-water
38 fish habitat associated with the transition between the reservoir's aquatic and
39 terrestrial habitats. Shoreline enhancement entails a range of enhancement
40 opportunities along the Shasta Lake shoreline below the full pool elevation of

1 1,090 feet (based on the North American Vertical Datum of 1988 (NAVD88))³
2 that would occur with an 18.5-foot dam raise. This area is typically between 0.1
3 mile and 1.5 miles upslope from the current full pool elevation of 1,070 feet
4 (based on NAVD88). The shoreline is defined as the area encompassing
5 nearshore aquatic habitat within the reservoir itself and vegetation and other
6 habitat components adjacent to the reservoir.

7 Two categories of potential nearshore warm-water fish habitat enhancement
8 activities are (1) structural enhancements, which entail placing artificial
9 structures in the Shasta Lake littoral zone; and (2) vegetative enhancements,
10 which entail planting and seeding to provide submerged and partly submerged
11 vegetative cover when the reservoir is at full pool capacity during the
12 winter/spring months.

13 Construction activities common to all action alternatives include stockpiling
14 manzanita for fish habitat (see Section 2.3.2). CP5 would involve clearing
15 additional manzanita from above the new full pool inundation zone to create
16 further structural enhancements for fish habitat in the Shasta Lake littoral zone.

17 Vegetative enhancements associated with CP5 would include planting willows
18 (*Salix*) to enhance nearshore fish habitat, and single-treatment aerial and hand
19 seeding of annual cereal grains to treat shoreline areas at Shasta Lake.
20 Treatment with cereal grains provides only short-term cover, but is cost-
21 effective across large areas and can be implemented quickly and efficiently.
22 The annual cereal grain grasses provide cover for young fish and also nutrients
23 for plankton as the grasses decompose. The plankton in turn are a valuable food
24 source for juvenile fish.

25 **Construct Reservoir Tributary Aquatic Habitat Enhancement** The
26 primary goal for the enhancement of aquatic habitat in the watershed is to
27 improve the connectivity for native fish species and other aquatic organisms
28 between Shasta Lake and its tributaries. Two categories of potential aquatic
29 habitat enhancement in tributaries are (1) fish passage enhancements, which
30 entail identifying and correcting barriers to fish passage, particularly at culverts
31 and other human-made barriers; and (2) aquatic habitat enhancements, which
32 entail identifying and implementing feasible habitat improvements intended to
33 conserve or restore degraded aquatic and riparian habitat in tributaries to Shasta
34 Lake.

35 Fish passage enhancements associated with CP5 include opportunities to restore
36 and/or enhance five perennial stream crossings. Barriers to fish passage in the
37 watersheds above Shasta Lake are associated primarily with culverts or other
38 types of stream crossings.

³ Shasta Lake water surface elevations are based on NAVD88. All current feasibility-level designs and figures for reservoir area infrastructure modifications and relocations to accommodate increased water levels are based on a 2001 aerial survey of the reservoir which was completed using NAVD88.

1 Aquatic habitat enhancements associated with CP5 involve enhancing aquatic
2 connectivity and reducing sediment related to roads constructed across
3 intermittent streams. The preliminary site survey identified opportunities to
4 enhance 14 intermittent stream crossings. Based on the information obtained in
5 the survey, these crossings provide opportunities for meeting the objectives of
6 enhancing aquatic connectivity and/or reducing the potential for road-related
7 sediment. Two sites have been identified in the Salt Creek watershed, two sites
8 have been identified in the Sugarloaf Creek watershed, and 10 sites have been
9 identified in the McCloud River Arm watershed.

10 **Augment Spawning Gravel in Upper Sacramento River** As described in
11 CP4, spawning gravel would be added to the upper Sacramento River. This
12 measure is identical to that proposed under CP4.

13 **Restore Riparian, Floodplain, and Side Channel Habitat** As described in
14 CP4, riparian, floodplain, and side channel habitat restoration would occur at
15 suitable locations along the Sacramento River. This measure is identical to that
16 proposed under CP4.

17 **Recreation Enhancements** A total of 18 miles of new hiking trails and
18 6 trailheads would be constructed to enhance recreation under CP5.

19 ***Potential Benefits of CP5***

20 Major potential benefits of CP5, related to the project objectives, are described
21 below.

22 **Increase Anadromous Fish Survival** Water temperature is one of the most
23 important factors in achieving recovery goals for anadromous fish in the
24 Sacramento River. CP5 would increase the ability of Shasta Dam to make cold-
25 water releases and regulate water temperature in the upper Sacramento River,
26 primarily in dry and critical water years. This would be accomplished by raising
27 Shasta Dam 18.5 feet, thus increasing the depth of the cold-water pool in Shasta
28 Reservoir and resulting in an increase in seasonal cold-water volume below the
29 thermocline (layer of greatest water temperature and density change). Cold
30 water released from Shasta Dam significantly influences water temperature
31 conditions in the Sacramento River between Keswick Dam and the RBPP.
32 Hence, the most significant water temperature benefits to anadromous fish
33 would occur upstream from the RBPP. It is estimated that improved water
34 temperature and flow conditions under CP5 could result in an annual average
35 increase in the Chinook salmon population of about 377,800 out-migrating
36 juvenile fish.

37 **Increase Water Supply Reliability** CP5 would increase water supply
38 reliability by increasing firm water supplies for CVP and SWP irrigation and
39 M&I deliveries. This action would contribute to replacement of supplies
40 redirected to other purposes in the CVPIA. CP5 would help reduce estimated
41 future water shortages by increasing the reliability of firm water supplies for

1 agricultural and M&I deliveries by at least 113,500 acre-feet per year, and
2 average annual yield by about 75,900 acre-feet per year. For this DEIS, firm
3 yield is considered equivalent to the estimated increase in the reliability of
4 supplies during dry and critical periods. The majority of increased firm yield
5 (88,300 acre-feet) would be for south-of-Delta agricultural and M&I deliveries.
6 In addition, increased water use efficiency could help reduce current and future
7 water shortages by allowing a more effective use of existing supplies. As
8 population and resulting water demands continue to grow and available supplies
9 continue to remain relatively static, more effective use of these supplies may
10 reduce potential critical impacts to agricultural and urban areas resulting from
11 water shortages. Under CP5, approximately \$3.8 million would be allocated
12 over an initial 10-year period to fund agricultural and M&I water conservation
13 programs, focused on agencies benefiting from increased reliability of project
14 water supplies.

15 **Develop Additional Hydropower Generation** Higher water surface
16 elevations in the reservoir would result in a net increase in power generation of
17 about 117 GWh per year. This generation value is the expected increased
18 generation from Shasta Dam and other CVP/SWP facilities.

19 **Conserve, Restore, and Enhance Ecosystem Resources** CP5 would provide
20 for habitat improvements both in the reservoir area and downstream from
21 Shasta Dam on the upper Sacramento River.

22 Along the Shasta Lake shoreline, shallow warm-water fish habitat would be
23 improved by using manzanita cleared from above the inundation zone to create
24 structural enhancements, planting willows to enhance nearshore fish habitat,
25 and seeding of cereal grains (native grasses) to treat shoreline areas. Once
26 established, the willows and native grasses would provide submerged and partly
27 submerged vegetative cover when the reservoir is at full pool during the
28 winter/spring months. These improvements would help provide favorable
29 spawning conditions, and juvenile fish leaving the tributaries would benefit
30 from improved adjacent shoreline habitat. Placing manzanita brush structures
31 near the shoreline would enhance the diversity of structural habitat available for
32 the warm-water fish species that occupy Shasta Lake. Establishing vegetation
33 also could benefit terrestrial species that inhabit the shoreline of Shasta Lake.

34 The lower reaches of perennial tributaries to Shasta Lake would be the focus for
35 aquatic restoration under CP5 because they provide year-round fish habitat.
36 Native fish species require connectivity to the full range of habitats offered by
37 Shasta Lake and its tributaries. Improved fish passage addresses the requirement
38 to provide access and/or modify barriers to improve ecological conditions that
39 support these native fish assemblages. Aquatic habitat improvements include
40 enhancing aquatic connectivity and reducing sediment related to roads
41 constructed across intermittent streams.

1 In the upper Sacramento River, the addition of spawning gravel and the
2 restoration of riparian, floodplain, and side channel habitat are expected to
3 improve the complexity of aquatic habitat and its suitability for spawning and
4 rearing. Riparian areas provide habitat for a diverse array of plant and animal
5 communities along the Sacramento River, including numerous threatened or
6 endangered species. Riparian areas also provide shade and woody debris that
7 increase the complexity of aquatic habitat and its suitability for spawning and
8 rearing. Lower floodplain areas, river terraces, and gravel bars play an
9 important role in the health and succession of riparian habitat. Restoration
10 would support the goals of the Sacramento River Conservation Area Forum and
11 other programs associated with riparian restoration along the Sacramento River.
12 Side channels can support important habitat for anadromous salmonids,
13 including rearing and spawning habitat. Side channel habitats also provide
14 refuge from predators and productive foraging habitat for juvenile anadromous
15 salmonids.

16 **Maintain and Increase Recreation Opportunities** CP5 includes features to,
17 at a minimum, maintain the existing recreation capacity at Shasta Lake. In
18 addition, this alternative involves construction of 18 miles of new trails and 6
19 trailheads to enhance recreation opportunities at Shasta Lake. As with the other
20 alternatives, benefits to the water-oriented recreation experience at Shasta Lake
21 would likely occur because of the increase in average lake surface area, reduced
22 drawdown during the recreation season, and modernization of recreation
23 facilities. The maximum surface area of the lake would increase by about 2,600
24 acres (9 percent), from 29,700 acres to about 32,300 acres. The average surface
25 area of the lake during the recreation season from May through September
26 would increase by about 1,900 acres (8 percent), from 23,900 acres to 25,800
27 acres. There is also limited potential for reservoir reoperation to provide
28 additional benefits to recreation by allowing more reliable filling of the
29 reservoir during the spring.

30 **Benefits Related to Other Project Objectives** CP5 could also provide
31 benefits related to flood damage reduction and water quality, similar to CP3.

32 ***Construction for CP5***

33 Construction activities associated with physical features under CP5 would
34 include land-based construction activities associated with the following:

- 35 • Clearing vegetation from portions of the inundated reservoir area
- 36 • Constructing the dam, appurtenant structures, reservoir area dikes, and
37 railroad embankments
- 38 • Relocating roadways, bridges, recreation facilities, utilities, and
39 miscellaneous minor infrastructure
- 40 • Augmenting spawning gravel in the upper Sacramento River

- Restoring riparian, floodplain, and side channel habitat
- Enhancing Shasta Lake and tributary shoreline

Construction activities for CP5 are described in Section 2.3.8, “Comprehensive Plan Construction Activities.”

Operations and Maintenance for CP5

Operations under CP5 are governed by the same regulatory constraints as described for CP1. Similar to CP1, the additional storage would be retained to increase water supply reliability and to expand the cold-water pool in Shasta Reservoir for fisheries benefits. Similar to CP1, Shasta Dam operational guidelines would continue unchanged, except during dry and critical years, when 150,000 acre-feet and 75,000 acre-feet, respectively, of the 634,000 acre-feet increased storage capacity in Shasta Reservoir would be operated primarily to provide increased M&I deliveries. Operations targeting increased M&I deliveries were based on existing and anticipated future demands, operational priorities, and facilities of the SWP. For CP5, existing water quality and temperature requirements would typically be met in most years; therefore, additional water in storage would be released primarily for water supply purposes. Accordingly, minimal increases in flow would be expected in months when Delta exports were constrained, or when flow was not usable for water supply purposes.

In comparison to current operations, CP5 would store some additional flows behind Shasta Dam during periods when downstream needs would have already been met, but flows would have been released because of storage limitations. The resulting increase in storage would be released downstream when there were opportunities for beneficial use of the water, either to meet water supply reliability demands or to improve Reclamation’s abilities to meet its environmental objectives. The additional water in storage would also expand the cold-water pool and increase end-of-September carryover storage in Shasta Reservoir, increasing the ability of Shasta Dam to improve water temperatures for anadromous fish in the upper Sacramento River.

Conversely, if water in storage were insufficient to meet all of the project purposes, the first increment to be reduced would be deliveries to water service contractors. Releases from Shasta Dam under CP5 would typically increase in the summer months, corresponding with the periods of greatest agricultural demands. Similarly, releases would be reduced in the winter months, when the increased storage space could be used to capture additional runoff rather than releasing water to the downstream river, as would occur with Shasta Reservoir’s current operations.

Maintenance of facilities related to the proposed dam and reservoir enlargement would be similar to maintenance activities currently conducted at Shasta Dam and Reservoir.

2.3.8 Comprehensive Plan Construction Activities

Construction activities under all comprehensive plans would include land-based construction activities associated with the following:

- Clearing vegetation from portions of the inundated reservoir area
- Constructing the dam, appurtenant structures, reservoir area dikes, and railroad embankments
- Relocating roadways, bridges, recreation facilities, utilities, and miscellaneous minor infrastructure

CP4 and CP5 would also include construction activities associated with gravel augmentation and restoring riparian, floodplain, and side channel habitat. Additional construction activities associated with Shasta Lake and tributary shoreline enhancements are included under CP5. Construction activities under the proposed action alternatives are described below.

Clearing Portions of Inundated Reservoir Area

A portion of the acreage inundated at the new reservoir full pool would need to be cleared. This would involve removing trees and other vegetation from around the reservoir shoreline at select areas. Willows, cottonwoods, and buttonbush would not be removed in and along riparian areas. Manzanita removed in cleared areas would be stockpiled and used for fish habitat structures placed in designated locations. Structures, utilities, and other infrastructure would also need to be removed and/or relocated, as described below in more detail.

Fifteen vegetation management areas have been delineated to facilitate efficient removal of vegetation around the reservoir perimeter, including 11 areas of complete vegetation removal and 4 areas of overstory removal (see Figure 2-4). The acreages of each vegetation management area affected by identified reservoir clearing treatments are summarized in Table 2-6 below.

Vegetation management activities would need to be complete before inundation of new areas created by enlarging the reservoir. A single staging area (landing) would serve each vegetation management area. Access for vegetation removal activities would most likely be limited to late summer and fall, when water levels are low and recreation use has decreased. Removal by helicopter would generally be limited to spring and fall because of the limited availability of helicopters during the summer fire season. Vegetation removal would also be limited during bird nesting season, typically early spring through mid-summer. Breeding bird surveys in suitable habitats would be performed to determine the appropriate time frame for vegetation removal activities. Because of distance and/or safety constraints, helicopters would not be used in the following vegetation management areas: Bridge Bay, Lakeshore East, Pit Arm, and McCloud Arm. Slash burning could take place during the winter seasons following vegetation treatment and would comply with all regulations set forth by the Shasta County Air Quality Management District. Methods for clearing the reservoir area are summarized below.

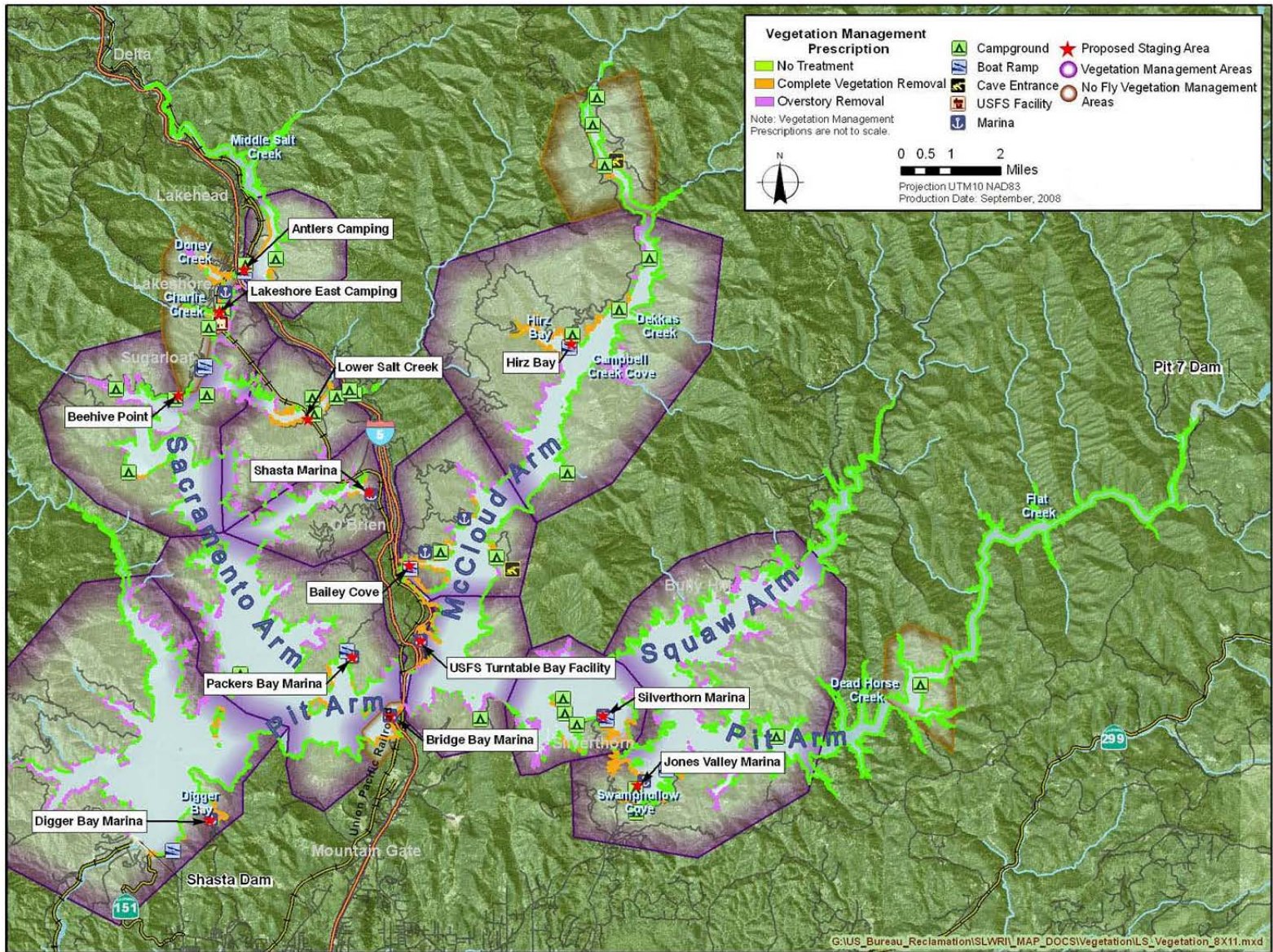


Figure 2-4. Vegetation Management Areas

Table 2-6. Reservoir Clearing Treatment Applied By Action Alternative

Landing Location	CP1				CP2				CP3, CP4, and CP5			
	Complete Removal (acres)	Complete Removal Quantity (board feet)	Overstory Removal (acres)	Overstory Removal Quantity (board feet)	Complete Removal (acres)	Complete Removal Quantity (board feet)	Overstory Removal (acres)	Overstory Removal Quantity (board feet)	Complete Removal (acres)	Complete Removal Quantity (board feet)	Overstory Removal (acres)	Overstory Removal Quantity (board feet)
Antlers	8	48,600	5	33,400	12	76,600	8	52,700	17	109,300	12	75,100
Bailey Cove	17	148,400	7	40,600	26	234,000	11	64,000	37	333,700	15	91,300
Beehive Point	3	5,400	24	102,300	4	8,500	38	161,300	6	12,100	54	230,100
Bridge Bay	9	51,800	0	0	14	81,600	0	0	20	116,400	0	0
Digger Bay	8	27,700	31	92,600	13	43,700	49	146,000	19	62,400	70	208,300
Hirz Bay	22	211,200	22	169,500	35	333,000	34	267,300	49	474,900	49	381,200
Jones Valley	17	81,700	51	328,000	26	128,800	81	517,100	38	183,700	116	737,500
Lakeshore East	17	58,800	2	12,500	27	92,800	4	19,700	39	132,300	5	28,100
Lower Salt Creek	14	96,300	15	62,700	22	151,800	24	98,900	31	216,500	35	141,100
McCloud Arm	4	14,900	0	0	7	23,500	0	0	10	33,500	0	0
Packers Bay	7	29,200	22	78,800	11	46,000	35	124,200	16	65,600	50	177,100
Pit Arm	2	22,400	0	0	3	35,300	0	0	4	50,400	0	0
Shasta Marina	1	17,900	13	89,400	2	28,200	21	141,000	2	40,200	30	201,100
Silverthorn	17	117,900	18	115,100	26	185,900	29	181,400	37	265,200	41	258,800
Turntable	5	33,100	8	88,700	8	52,200	13	139,900	11	74,400	19	199,500
Total	150	965,300	220	1,213,600	236	1,521,900	347	1,913,500	337	2,170,600	495	2,729,200

Key:

CP = comprehensive plan

1 **Complete Vegetation Removal** Complete vegetation removal would clear all
2 existing vegetation from the designated treatment area and would generally be
3 applied to locations along and adjacent to developed recreation areas, including
4 boat ramps, day use areas, campgrounds, marinas, and resorts. Exceptions
5 would be made in areas with high shoreline erosion potential, or habitat for
6 special-status species.

7 Timber would be harvested and removed to landings by ground-skidding
8 equipment if road access is available and slopes are less than 35 percent;
9 otherwise, trees would be yarded by helicopter and residual vegetation and
10 activity-created slash would be piled and burned by hand. Where possible, trees
11 would be felled into the reservoir during removal to minimize damage to
12 reservoir embankments. Tree stumps would be cut to within 24 inches of the
13 ground surface and brush stumps would be cut flush to the ground. Stumps
14 would be left in place to reduce shoreline erosion. Complete vegetation removal
15 is intended to maximize shoreline access and minimize the risk to visitors from
16 snags and water hazards.

17 **Overstory Removal** Overstory removal involves removing all trees from the
18 treatment area that are greater than 10 inches in diameter at breast height, or 15
19 feet in height, generally in houseboat mooring areas or narrow arms of the
20 reservoir where snags pose the greatest risk to boaters. Trees would be
21 harvested and removed to landings by ground-skidding equipment if road access
22 is available and slopes are less than 35 percent; otherwise, trees would be
23 yarded by helicopter and activity-created slash would be piled and burned by
24 hand. The remaining understory vegetation would be left in place. As for
25 complete vegetation removal, where possible, trees would be felled into the
26 reservoir during removal to minimize damage to reservoir embankments. Tree
27 stumps would be cut to within 24 inches of the ground surface. Stumps would
28 be left in place to reduce shoreline erosion. Overstory removal is intended to
29 minimize the risk to visitors from snags and water hazards.

30 **No Treatment** Designated areas of the inundation zone would be left
31 untreated with no vegetation removed. This prescription would generally be
32 applied to stream inlets, the upper end of major drainages, the shoreline of
33 wider arms of the reservoir, and special habitat areas. This treatment is intended
34 to maximize the habitat benefits of inundated and residual vegetation.

35 **Construction of Dam and Appurtenant Structures**

36 This section summarizes major features associated with enlarging Shasta Dam
37 and Reservoir and modifying its appurtenances for all comprehensive plans
38 (action alternatives). Total surface area that would be required for work limits
39 and permanent features, and an estimate of materials needed to modify Shasta
40 Dam and its appurtenances under each comprehensive plan are shown in Table
41 2-7. For more detailed explanations of design considerations, please refer to the
42 Engineering Summary Appendix.

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Table 2-7. Physical Features for Proposed Modifications of Shasta Dam and Appurtenances for Action Alternatives

Physical Features	CP1	CP2	CP3, CP4, and CP5
Quantity of Concrete (cubic yards)	57,000	77,300	100,800
Quantity of Cement (tons)	128,600	170,500	213,000
Quantity of Metalwork (pounds)	19,654,400	20,435,900	21,751,200
Volume of Imported Fill Material (cubic yards)	61,200	94,400	130,500
Volume of Excavation to Waste Material (cubic yards)	1,600	1,600	1,600
Quantity of Demolished Material (cubic yards)	25,400	29,200	31,600
Area of Permanent Structures (square feet)	412,600	412,600	412,600
Area of Work Limits (square feet)	460,900	460,900	460,900

Key:
 CP = comprehensive plan

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Dam Crest Structure Removal Before any enlargement of Shasta Dam, existing structures on the dam crest would need to be removed. These structures include the gantry crane, existing spillway drum gates and frames, the spillway bridge, concrete in the spillway crest and abutments, upstream parapet walls, sidewalks, curbing, crane rails, and control equipment. This preparatory work would be similar for all comprehensive plans.

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Modifying the main dam would require the demolition, removal, and transportation of top-of-dam materials to an approved disposal area. This would include the demolition and removal of the upstream reinforced-concrete parapet wall and curb. Sawcuts would be used to aid in removing the upstream reinforced-concrete parapet wall and curb. In addition, sawcuts would be required along the upstream face and crest of the dam to embed a polyvinyl chloride waterstop. The existing dam crest would be prepared by using a high-pressure water jet on the concrete surface. Existing roadway drains would be backfilled with cement grout.

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Drain holes would be drilled from two different locations: from the existing dam crest to drain the surface contact and from the existing dam crest for surface drainage at the downstream overhang. A vertical shaft would be excavated through the concrete from the existing dam crest to the hoist gallery to install electrical conduit.

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The existing spillway drum gates and piers would require removal according to a phased construction plan that would minimize impacts to reservoir operations during construction. Two drum gates and one pier would be removed to construct three new piers and install three new sloping fixed-wheel gates. This would be followed by removal of the remaining drum gate and pier to construct two new piers and install three new sloping fixed-wheel gates.

The spillway bridge and dam crest access road would be out of service for an extended period of time (over two years) during construction of the new spillway and dam crest raise. A detour route would be provided below the dam across an existing bridge. Modifications to the TCD would be performed to minimize impacts to reservoir operations to the extent possible, but supplemental cold water releases may be required through the river outlets during a portion of the construction period. Control equipment for the TCD would be removed, stored, and reinstalled for the higher dam crest. The elevator tower would be out of service for about 4 months for construction of the dam crest raise and for replacement of the elevator car and hoist equipment.

Main Gravity Dam and Wing Dams Enlargement of Shasta Dam under all action alternatives would require raising Shasta Dam (the main gravity dam) and its left and right wing dams as indicated in Table 2-8. Construction activities to raise the main gravity dam and the left and right wing dams are summarized below.

Table 2-8. Physical Features for Proposed Modifications of Shasta Dam and Appurtenances for Action Alternatives

Feature	Existing	CP1	CP2	CP3, CP4, CP5
Main Gravity Dam				
Crest Raise (feet)	0	6.5	12.5	18.5
Crest Elevation ¹	1077.5	1,084.0	1,090.0	1,096.0
Upstream Parapet Wall Elevation ¹	1079.1	1,087.5	1,093.5	1,099.5
Full Pool Elevation ²	1069.7	1,078.2	1,084.2	1,090.2
Left Wing Dam				
Crest Raise (feet)	0	8.5	14.5	20.5
Crest Elevation ¹	1077.5	1,086.0	1,092.0	1,098.0
Upstream Parapet Wall Elevation ¹	1079.1	1,089.5	1,095.5	1,101.5
Right Wing Dam				
Crest Raise (feet)	0	6.5	12.5	18.5
Crest Elevation ¹	1077.5	1,084.0	1,090.0	1,096.0
Upstream Parapet Wall Elevation ¹	1079.1	1,087.5	1,093.5	1,099.5
Spillway				
Crest Raise (feet)	0	0.5	6.5	12.5
Crest Elevation ¹	1037.0	1,037.5	1,043.5	1,049.5

Notes:

¹ Main dam and wing dam crest elevations are based on the National Geodetic Vertical Datum of 1929 (NGVD29). All current feasibility-level designs and figures for Shasta Dam and appurtenant structures are based on NGVD29.

² Full pool elevations are based on the North American Vertical Datum of 1988 (NAVD88), which is 2.66 feet higher than NGVD29. All current feasibility-level designs and figures for reservoir area infrastructure modifications and relocations to accommodate increased water levels are based on a 2001 aerial survey of the reservoir using NAVD88.

Key:

CP = comprehensive plan

Shasta Dam would be raised by placing mass concrete corresponding in width to the existing dam monolith blocks on the existing dam crest (concrete gravity section and spillway crest section). Structural concrete would be placed for the top of the dam, including for the roadway, the upstream and downstream

1 parapets, and the walkway. Reinforcing bars would be used around the utility
2 gallery, and nominal temperature steel would be used for the exposed structural
3 concrete surfaces. Steel top-of-dam drains would be furnished and installed in
4 each block to drain to the upstream face. Surface area and features of the new
5 dam crest would be similar to the existing dam crest, including gantry crane
6 rails and surface drains. A new upstream parapet wall would provide flood
7 protection. The dam raise would include a new utility gallery.

8 Zoned embankment wing dams were originally constructed on both abutments
9 of the main dam to protect the contact between the concrete and the excavated
10 foundation surface. The left wing dam would be raised to maintain the same
11 height above the top of joint-use storage, as for existing conditions. This would
12 involve extending the existing reinforced-concrete core wall to the raised dam
13 crest, and placing a thick layer of large rockfill downstream from the core wall.
14 The upstream face would consist of a reinforced concrete or mechanically
15 stabilized earth wall, and a concrete parapet wall. The road from the concrete
16 dam crest would be ramped up through the left wing dam to the new
17 embankment crest. Roadways and security features on the existing dam crest
18 would be relocated to the new dam crest. The existing rotunda on the left
19 abutment of the dam would be removed and reconstructed.

20 A building housing a visitor center and Reclamation offices, a parking lot,
21 picnic areas, and vista points have been incorporated into the abutment design.
22 The visitor center building would provide adequate space for visitors, storage,
23 staff, and security functions, and feature a panoramic view of all facilities. The
24 existing roadways, lawns, sidewalks, trees, and other features on the left wing
25 dam crest would be restored to a configuration similar to existing conditions.
26 Existing facilities would be removed from the site before construction, and
27 replaced after the raise is completed.

28 The right wing dam would be raised to match the main gravity dam crest.
29 Concrete was selected for the right wing dam in lieu of embankment to facilitate
30 construction. The new right wing dam crest would provide surface area and
31 features similar to the existing dam crest, including gantry crane rails and
32 surface drains. A new upstream parapet wall would provide flood protection.
33 The right wing dam would include a new utility gallery and a foundation
34 drainage curtain. Right abutment access roads would be modified to match the
35 new dam crest.

36 **Spillway** Structural concrete would be used to raise the existing spillway crest
37 and to shape the raised spillway crest as indicated in Table 2-8. The existing
38 spillway bridge, two existing spillway piers, cantilever wall sections, and three
39 existing drum gates and operating equipment would be removed. Five new
40 spillway piers would be constructed at locations within the spillway, designed to
41 avoid existing overflow block contraction joints, and a new concrete spillway
42 crest would be constructed between them. The locations of the new piers would
43 result in different widths of spillway gates. The three existing 110-foot by 28-

1 foot drum gates would be replaced with six sloping, fixed-wheel gates. The
2 total spillway crest length would be reduced from 330 feet to 300 feet as a
3 result. A new bridge would be required over the spillway to allow for vehicular
4 traffic and for a gantry crane to travel from one end of the dam to the other.

5 **Temperature Control Device** Modifications to the TCD would be needed for
6 all action alternatives. Modifications would primarily involve extending the
7 main steel structure to the new full pool elevation; raising the TCD operating
8 equipment, including gate hoists, electrical equipment, miscellaneous
9 metalwork, and hoist platform above the new top of joint-use elevation;
10 installation of additional cladding on the existing and raised sections of the
11 TCD; and lengthening/replacing shutter operating cables.

12 **Shasta Powerplant Penstock Intake and Penstock Modifications** The
13 centerline of the existing penstock intakes would remain at the current level, but
14 the gate hoists would require relocation with a higher dam crest. The existing
15 steel penstock pipes have been determined to be adequate for the higher
16 reservoir loads and no penstock modifications are anticipated.

17 **Pit 7 Dam Powerhouse** The Pit 7 Dam and Powerhouse, which is owned and
18 operated by Pacific Gas and Electric Company (PG&E), is located on the upper
19 Pit River at the northeast end of Shasta Lake. The complex consists of three
20 main features: a main dam with integral spillway, a two-unit hydroelectric
21 powerhouse immediately downstream from the main dam, and an afterbay dam.
22 The only expected modifications to the Pit 7 Powerhouse associated with any
23 action alternative include installing a tailwater depression system. During high
24 flows, a tailwater depression system would introduce compressed air into the
25 turbine runner pit to depress the tailwater to a level that does not interfere with
26 turbine operation, thereby allowing continued turbine operation.

27 The tailwater depression system would include air compressors, air discharge
28 piping with control valves, water-level sensors, power supply, and electrical
29 controls. Air compressors would be of the high-volume, low-pressure type,
30 referred to as “blowers.” Blowers would be driven by electric motors supplied
31 with available power from the Pit 7 Powerhouse.

32 ***Reservoir Area Dikes and Railroad Embankments***

33 The physical features for the proposed dikes and railroad embankments under
34 each comprehensive plan are shown in Table 2-9. The proposed dikes would be
35 constructed using common earthmoving equipment and methods. Additional
36 excavation to provide working surfaces and keys for the embankment fill would
37 be required along the slope of the upstream foundation for some of the proposed
38 dikes. Ground treatment and/or over-excavation may be necessary in some areas
39 to remove and/or treat pervious material. Riprap would be placed on the
40 upstream face of each dike to the crest of the dike to protect against wave run-
41 up and erosion. Reservoir area dikes and railroad embankments are further
42 described in the Engineering Summary Appendix.

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Table 2-9. Physical Features for Proposed Dikes and Railroad Embankments by Action Alternative

Dike Features	CP1	CP2	CP3, CP4, and CP5
Lakeshore Dikes/Railroad Embankments			
Doney Creek Dike			
Volume of Fill Material (core, drain, filter) (cubic yards)	-	12,200	75,000
Volume of Riprap (cubic yards)	-	1,000	5,900
Volume of Excavated Material (cubic yards)	-	3,100	10,200
Site Clearing and Grubbing Below Dike (acres)	-	1.5	7.2
Antlers Dike			
Volume of Fill Material (core, drain, filter) (cubic yards)	-	-	4,900
Volume of Riprap (cubic yards)	-	-	400
Volume of Excavated Material (cubic yards)	-	-	300
Site Clearing and Grubbing Below Dike (acres)	-	-	0.9
North Railroad Embankment			
Volume of Fill Material (core, filter) (cubic yards)	17,100	17,100	17,100
Volume of Riprap (cubic yards)	400	400	400
Volume of Excavated Material (cubic yards)	1,500	1,500	1,500
Site Clearing and Grubbing Below Dike (acres)	1.2	1.2	1.2
Middle Railroad Embankment			
Volume of Fill Material (core, filter) (cubic yards)	13,400	13,400	13,400
Volume of Riprap (cubic yards)	300	300	300
Volume of Excavated Material (cubic yards)	4,000	4,000	4,000
Site Clearing and Grubbing Below Dike (acres)	2.9	2.9	2.9
South Railroad Embankment			
Volume of Fill Material (core, filter) (cubic yards)	101,900	101,900	101,900
Volume of Riprap (cubic yards)	2,500	2,500	2,500
Volume of Excavated Material (cubic yards)	8,500	8,500	8,500
Site Clearing and Grubbing Below Dike (acres)	6.2	6.2	6.2
Bridge Bay Dikes			
West Dike			
Volume of Fill Material (core, drain, filter) (cubic yards)	3,000	7,700	69,000
Volume of Riprap (cubic yards)	200	800	23,600
Volume of Excavated Material (cubic yards)	2,100	5,000	15,300
Site Clearing and Grubbing Below Dike (acres)	0.8	1.4	2.2
East Dike			
Volume of Fill Material (core, drain, filter) (cubic yards)	1,000	3,000	40,100
Volume of Riprap (cubic yards)	40	160	7,400
Volume of Excavated Material (cubic yards)	900	2,000	16,900
Site Clearing and Grubbing Below Dike (acres)	0.4	0.6	1.1

Key:
 - = not applicable
 CP = comprehensive plan

Relocations

As a result of the proposed Shasta Dam raise under the comprehensive plans, the following major features would be inundated by the increase in full pool elevation:

- Roadways
- Vehicle bridges
- Railroad bridges
- Recreation facilities
- Utilities and miscellaneous minor infrastructure

Existing infrastructure affected by enlarging Shasta Dam and Reservoir under any of the comprehensive plans would need to be removed and/or relocated.

Roadways Physical features associated with proposed road relocations under each comprehensive plan are shown by major focus area in Table 2-10. Road design criteria and construction characteristics are discussed in detail in the Engineering Summary Appendix.

Table 2-10. Physical Features for Proposed Road Relocations by Major Road Focus Area for Action Alternatives

Road Relocation Features	CP1	CP2	CP3, CP4, and CP5
Lakeshore Drive			
Number of Road Segments Affected	4	6	8
Length (linear feet)	8,100	13,100	13,700
Clearing and Grubbing (acres)	4	7	7
Excavation to Embankment (cubic yards)	46,100	55,100	55,500
Embankment Fill (cubic yards)	95,900	145,900	149,300
Closure Expected	No	No	No
Turntable Bay Area			
Number of Road Segments Affected	3	3	3
Length (linear feet)	6,200	6,200	6,200
Clearing and Grubbing (acres)	2	2	2
Excavation to Embankment (cubic yards)	19,000	19,100	19,000
Embankment Fill (cubic yards)	71,500	71,500	71,500
Closure Expected	Yes	Yes	Yes

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Table 2-10. Physical Features for Proposed Road Relocations by Major Road Focus Area for Action Alternatives (contd.)

Road Relocation Features	CP1	CP2	CP3, CP4, and CP5
Gillman Road			
Number of Road Segments Affected	-	3	3
Length (linear feet)	-	1,200	1,200
Clearing and Grubbing (acres)	-	1	1
Excavation to Embankment (cubic yards)	-	0	0
Embankment Fill (cubic yards)	-	28,500	28,500
Closure Expected	-	Yes	Yes
Jones Valley and Silverthorn Area			
Number of Road Segments Affected	1	1	4
Length (linear feet)	2,000	2,000	3,600
Clearing and Grubbing (acres)	1	1	2
Excavation to Embankment (cubic yards)	0	0	1,500
Embankment Fill (cubic yards)	41,300	41,300	54,500
Closure Expected	Yes	Yes	Yes
Salt Creek Road			
Number of Road Segments Affected	-	4	5
Length (linear feet)	-	4,300	5,100
Clearing and Grubbing (acres)	-	1	1
Excavation to Embankment (cubic yards)	-	4,100	5,500
Embankment Fill (cubic yards)	-	34,600	34,600
Closure Expected	-	Yes	Yes
Remaining Road Relocations			
Number of Road Segments Affected	2	4	7
Length (linear feet)	230	2,300	3,900
Clearing and Grubbing (acres)	0.4	1	2
Excavation to Embankment (cubic yards)	15	120	600
Embankment Fill (cubic yards)	34,200	76,100	89,300
Closure Expected	No	No	No

Key:
 - = not applicable
 CP = comprehensive plan

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Roadway construction activities would involve, but not be limited to, demolition of existing roadways as required; clearing, grubbing, and site preparation of work areas, as required; grading road alignments to meet finished grades; placing road subgrade; paving operations; installing storm drain culverts; constructing retaining wall systems; installing road appurtenances such as guardrails; performing construction-related traffic control; and establishing and maintaining a SWPPP. Noisy equipment, such as pile drivers, is anticipated for road construction work. Typical noise would result from trucks and diesel-powered equipment.

1 Replacement roadways would be constructed by excavating the existing up-
2 grade slope to provide fill material for the embankment fill portion of road
3 construction; bench-excavating into the up-grade slope above the existing
4 roadway to establish the new road finished grade; building the new road on an
5 engineered fill embankment from imported borrow material; or building the
6 new road directly above the existing road on an engineered fill embankment
7 from imported borrow material. A road alignment may either use a single
8 method of construction for the entire alignment, or use all four methods at
9 different locations along an alignment. To limit impacts on existing roadways,
10 road closures would be avoided whenever possible.

11 Estimated work limits for road segment relocation are described in the
12 Engineering Summary Appendix. Estimated work limits depend on the
13 surrounding terrain, and vary from a minimum of 5 feet to 30 feet wide,
14 measured from the extent of earthwork. Where the road would be constructed as
15 an embankment fill against an existing steep hillside, a 5-foot-wide minimum
16 work area would be used. Where the terrain beyond the limit of earthwork was
17 flat enough to be used as work areas for construction equipment, the work limits
18 would range from 15 feet to 30 feet wide.

19 **Vehicle Bridges** As a result of raising Shasta Dam for any of the action
20 alternatives, the following local road vehicle bridges would be replaced:

- 21 • Charlie Creek Bridge
- 22 • Doney Creek Bridge
- 23 • McCloud River Bridge
- 24 • Didallas Creek Bridge

25 Criteria and assumptions considered in determining structure type and length for
26 the replacement structures are included in the Engineering Summary Appendix.
27 Based on the design criteria and assumptions, and considering preliminary
28 horizontal alignments and profile grades developed for the relocated roadways,
29 Table 2-11 summarizes proposed bridge characteristics for the four road bridges
30 requiring replacement under all comprehensive plans.

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Table 2-11. Physical Features of Proposed Vehicular Bridge Relocations Common to All Action Alternatives

Bridge Feature	Charlie Creek Bridge	Doney Creek Bridge	McCloud River Bridge	Didallas Creek Bridge
Bridge Length (linear feet)	782	760	490	115
Number of Abutments	2	2	2	2
Number of Piers	4	4	4	0
Pier Diameter (linear feet)	14	14	6	N/A
Volume of Backfill (cubic yards)	480	400	530	180
Volume of Concrete (cubic yards)	3,530	3,320	2,320	760
Quantity of Steel (tons)	575	516	380	104
Number of Class 140 Piles	24	24	24	24
Number of 24-inch Cast-In-Steel-Shell Piles	72	72	32	N/A
Volume of Excavated Material (cubic yards)	1,200	550	820	440
Quantity of Demolished Material (cubic yards)	3,500	3,300	2,300	800

Key:
 N/A = not applicable
 SLWRI = Shasta Lake Water Resources Investigation

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Construction would take place during the low-water season, and is expected to last between 6 and 8 months. The waterway would remain clear for navigation during construction. Bridge construction would begin with piers and abutments. To allow underwater construction of pier foundations, steel pile shells would be driven into the lake bed to create a temporary cofferdam. It may be necessary to dewater the shells during drilling if water seeps in. A hole would then be drilled to the specified foundation depth. Reinforcing steel would be installed within the shells before concrete was poured. After completion of the piers and abutments, construction of the superstructure and bridge deck would begin via the balanced cantilever method. This process entails forming and constructing the horizontal structure outward from the piers in each direction, in equal (balanced) proportions, until the superstructure/deck segments meet at midspan.

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Traffic would continue on the existing bridges during construction. It is likely that barges would be used extensively for vehicular bridge foundation construction, bridge assembly, transport of materials, workers, and equipment, and demolition of the existing bridges. Concrete would be poured from barges. A staging area would be required on the lakeshore, from which barges could be loaded and unloaded.

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Although Fender's Ferry Bridge would not need to be replaced as a result of the Shasta Dam raises, modifications to the bridge would be necessary. The Fender's Ferry Bridge is a three-span structure with a steel plate girder superstructure supported on riveted steel tower bents and reinforced concrete piers with spread footings. As a result of differences in east and west riverbank topography, the western pier steel tower is supported at a much lower elevation

1 than the eastern pier tower. Thus, at the proposed full pool elevations, the
2 eastern pier steel tower would be inundated.

3 The existing reinforced concrete pier and footing would be enlarged and
4 extended, and the existing steel tower modified to prevent inundation as a result
5 of the higher full pool levels associated with the dam raise alternatives under
6 consideration. Proposed modifications include the following:

- 7 • Enlarging the existing reinforced concrete footing
- 8 • Enlarging and extending the existing reinforced concrete columns and
9 pier wall
- 10 • Removing some of the lower portion of the eastern pier steel tower
11 (based on location of existing cross bracing)
- 12 • Reusing the existing steel bearing assemblies

13 Quantities for the major items of work are estimated in the Engineering
14 Summary Appendix.

15 Construction activities would likely be completed from the existing
16 embankment without constructing cofferdams around the pier because average
17 water surface elevations are below the existing eastern pier bottom-of-footing
18 elevation for all months, with the exception of April and May. Construction of
19 temporary bents to support the superstructure would be necessary to facilitate
20 construction of the pier modifications. During construction activities, temporary
21 traffic controls may be needed to facilitate delivery of materials and
22 construction of temporary support bents.

23 **Railroad Bridges**

24 *Pit River Bridge Pier Modification* The Pit River Bridge is a multipurpose
25 structure, carrying both UPRR and I-5 traffic. The bridge is both a steel-through
26 truss and a deck truss. UPRR and Caltrans have joint operation and maintenance
27 responsibility. The new full pool elevations would inundate the existing bridge
28 bearings and low-chord steel truss members. To prevent the existing steel
29 bearings and lower portions of the steel truss members from being submerged, a
30 watertight concrete tub structure (bearing protection structure) would be
31 required. The reinforced concrete structure would be attached to the top of two
32 existing concrete piers. The structure footprint would be rectangular, with the
33 top of the structure above the full pool elevation. Elevations for the top of the
34 bearing protection structure and material quantities for Pit River Bridge
35 modifications under each comprehensive plan are shown in Table 2-12.

Table 2-12. Physical Features for Proposed Bearing Protection Structure for Action Alternatives

Item	CP1	CP2	CP3, CP4, and CP5
Top of Bearing Protection Structure Elevation (feet) ¹	1082.2	1088.2	1094.2
Concrete (cubic yards)	2,100	2,900	4,000
Reinforcing Steel (pounds)	618,000	876,000	1,200,000

Notes:

¹ Bearing protection structure elevations are based on the North American Vertical Datum of 1988 (NAVD88), which is 2.66 feet higher than the National Geodetic Vertical Datum of 1929. All current feasibility-level designs and figures for reservoir area infrastructure modifications and relocations to accommodate increased water levels are based on a 2001 aerial survey of the reservoir using NAVD88.

Key:

CP = comprehensive plan

Because the existing bridge superstructure and top-of-pier are exposed to the elements, a structure cover would not be required; however, two submersible sump pumps would be installed to keep the water level in the new concrete protective structure from rising near the bearings. Check valves and ball valves would prevent pumped water from draining out of the line back into the sump. Protective grates would prevent large objects from entering the sump area.

Union Pacific Railroad Bridges The superstructures for the existing Sacramento River Second Crossing and Doney Creek railroad bridges consist of deck truss bridges with a single track. The piers and abutments were designed to accommodate a future parallel single-track superstructure. Portions of both bridges would be submerged for any reservoir raise and would need to be replaced with new, higher superstructures. Structural analyses of the existing bridge piers under design earthquake loads indicated that new bridge piers would be required. Minimal changes would be required for the railroad vertical alignment. The feasibility designs would permit uninterrupted rail service during construction.

The proposed new bridge superstructures would be composite superstructures consisting of steel plate girders and a reinforced concrete deck. In general, the bridge superstructures would be designed to be continuous over the piers. However, with a requirement for 16 feet of vertical clearance between the two westernmost piers for the Sacramento River Second Crossing railroad bridge (with a minimum width of 30 feet), to allow for the passage of houseboats, this span is a simply supported span. No minimum clearance for houseboat traffic would be required for the Doney Creek railroad bridge; large-diameter concrete columns with drilled shafts would support the superstructure and be founded on bedrock. The Sacramento River Second Crossing railroad bridge would require nine spans, with a total length of 982 feet between concrete abutments. The Doney Creek railroad bridge would require five spans, with a total length of 537.5 feet between concrete abutments. Construction quantities for major items of work for these features under comprehensive plans are summarized in Table 2-13.

Table 2-13. Physical Features of Proposed Railroad Bridges Common to All Action Alternatives

Item	Sacramento River Second Crossing Bridge Quantities	Doney Creek Bridge Quantities
Steel Truss Bridge Removal (lb)	3,300,000	2,000,000
Concrete Removal (cubic yards)	15,310	4,570
Excavation (cubic yards)	2,100	630
Backfill (cubic yards)	1,900	2,200
Concrete, including Shafts (cubic yards)	11,700	7,080
Reinforcing Steel (lb)	3,420,000	1,760,000
Structural Steel in Girders (lb)	4,750,000	2,250,000

Key:
lb = pound
SLWRI = Shasta Lake Water Resources Investigation

The proposed relocation of the UPRR bridges would require that the railroad tracks be realigned between the two bridges. This realignment would parallel the existing tracks with a 25-foot offset to the east. Construction quantities for major items of work for the railroad realignment between the UPRR bridges are summarized in Table 2-14. Any required embankments for this realignment are described under the “Reservoir Area Dikes and Railroad Embankments” section above.

Table 2-14. Physical Features of Proposed Railroad Realignment Common to All Action Alternatives

Item	Railroad Realignment Between Bridges
Length of Track Realignment (linear feet)	8,400
Railroad Track Removal (tons)	370
Ballast Removal (tons)	6,400
Excavation (cubic yards)	35,000
Compacted Backfill (cubic yards)	7,500
Railroad Track (tons)	390
Ballast (tons)	26,500

Key:
SLWRI = Shasta Lake Water Resources Investigation

Recreation Facilities Any raise of Shasta Dam would have some effect on the many recreation features found along the reservoir shoreline. These features include marinas/boat ramps, resorts, campgrounds/day use areas, cabins, trails, and USFS facilities. Areas for potential recreation relocations (referred to as windows) and corresponding relocation plans for each window have been developed. Figure 2-5 details the location of these windows and existing recreation sites with proposed modification, expansion, or relocation activities.

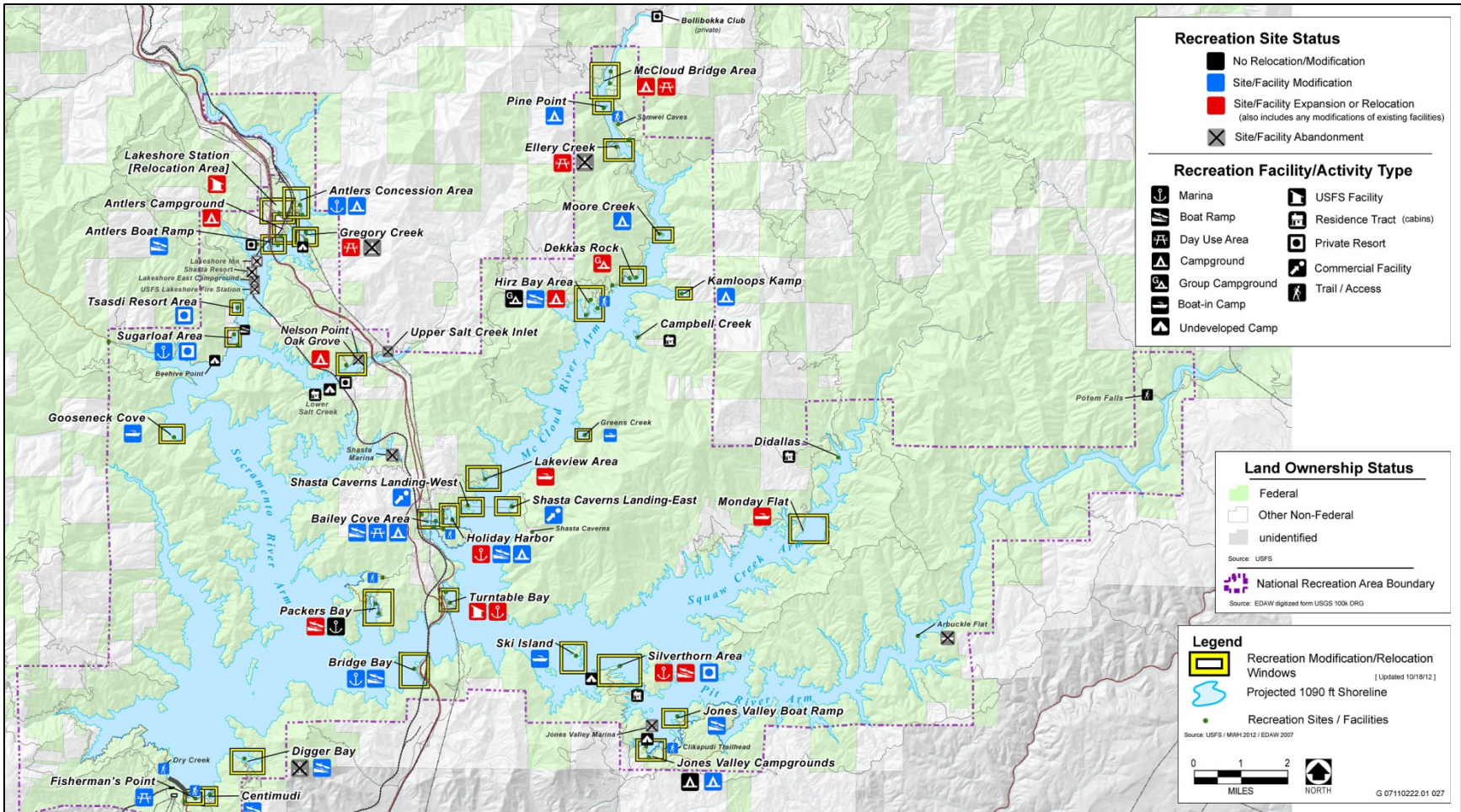


Figure 2-5. Recreation Study Windows

1 The primary goal of the relocation plans is to verify that with any dam raise, the
 2 existing recreation capacity could be maintained. Reclamation and USFS will
 3 continue to work together to refine recreation relocations and develop a
 4 recreation plan that is suitable for the NRA. For recreation facilities on Federal
 5 lands, the USFS will consider relevant laws, regulations, policy, special use
 6 permits and master development plans to develop and/or provide final approval
 7 for any proposed recreation facility relocations. Action alternatives would, at
 8 minimum, maintain the existing recreation capacity at Shasta Lake. Inundated
 9 recreation facilities and associated utilities would be relocated before
 10 demolition to the extent practicable. Scheduling and sequencing of recreation
 11 facility relocation construction activities will strive to minimize or avoid
 12 interruption to public recreation activities and access to recreation sites.
 13 Recreation facilities proposed for relocation are included below in the detailed
 14 description of each action alternative. Table 2-15 presents a summary of the
 15 recreation facilities to be modified or relocated under each comprehensive plan.
 16 Quantities of demolition and construction materials associated with
 17 modification and relocation of recreation facilities are listed in Table 2-16.

18 **Table 2-15. Recreation Facilities to be Modified or Relocated Under Action**
 19 **Alternatives**

Recreation Facilities	CP1	CP2	CP3 and CP4	CP5
Marinas/Public Boat Ramps				
Number of Affected Facilities (marinas/boat ramps)	9/6	9/6	9/6	9/6
Relocation Needed ¹ (acres)	8.5	8.5	8.5	8.5
Replacement Structures (square feet)	49,900	49,900	49,900	49,900
Campsites and Day-Use Sites				
Number of Affected Facilities (resorts/campsites and day-use sites)	202	261	328	328
Relocation Needed ¹ (acres)	32	34	39	39
Replacement Structures (square feet)	6,200	6,200	6,200	6,200
Resorts/USFS Facilities				
Number of Affected Facilities (resorts/USFS facilities)	6/2	6/2	6/2	6/2
Relocation Needed ¹ (acres)	19	19	19	19
Replacement Structures (square feet)	41,000	52,800	68,900	68,900

20

1 **Table 2-15. Recreation Facilities to be Modified or Relocated Under Action**
 2 **Alternatives (contd.)**

Recreation Facilities	CP1	CP2	CP3 and CP4	CP5
Trailheads/Trails				
Number of Affected Facilities (trailheads/trails)	2/9	2/9	2/9	2/9
Relocation Needed ¹ (miles)	8.1	9.9	11.6	11.6
Recreation Enhancement ³ (trailheads/trails[miles])	-	-	-	6/18

Note:

¹ Does not include on-site modification of facilities.

² For some trails, trailheads are integrated into other recreation facilities. Estimates for standalone trailheads only.

³ Additional recreation facilities for Alternative CP5 only.

Key:

- = not applicable

CP = comprehensive plan

USFS = U.S. Department of Agriculture, Forest Service

3 **Table 2-16. Recreation Demolition and Construction Material Quantities**
 4 **for Action Alternatives**

Material	CP1	CP2	CP3, CP4, and CP5
Recreation Facilities			
Imported Fill (cubic yards)	236,200	384,200	552,800
Excavation to Waste (cubic yards)	592,300	430,600	315,400
Structure Demolition (square feet)	130,700	146,700	164,200
Demolition Waste (cubic yards)	99,200	102,100	105,200

Key:

CP = comprehensive plan

5 *Marina/Public Boat Ramp Modifications* Several marinas around Shasta Lake
 6 would be affected by raising Shasta Dam. Typically, marinas consist of a
 7 parking area, a boat ramp, various structures (e.g., retail, restrooms,
 8 maintenance facilities, storage, administration), and utilities (power, water, and
 9 septic). Most of the effects of the dam raise would result from the inundation of
 10 boat ramps, parking lots, structures, and utilities. Boat ramps would be modified
 11 in place, on fill, where possible. Parking areas would be replaced on fill, or
 12 relocated above the new reservoir elevation. Existing structures that would be
 13 inundated would be demolished, and either replaced above the reservoir
 14 elevation (upslope or on placed fill), or moved to a floating structure on the
 15 water to provide better access for recreational users. Any access roads would be
 16 relocated above the new full pool for continued access around the marinas.
 17 Existing septic systems that would be inundated would be demolished and

1 removed from the area or relocated. New facilities could also be connected to
2 new localized wastewater treatment facilities. Power lines would be installed to
3 accommodate new structures.

4 Marinas and public boat ramps that could not be modified in place would be
5 relocated to adjacent areas that can provide the necessary grade and access for
6 ramps. To maintain current recreation capacity of public boat ramps and/or
7 marinas, the following potential new or expanded areas could be used:

- 8 • Antlers Boat Ramp and Adjacent Marina Area
- 9 • Silverthorn Marina Area
- 10 • Turntable Bay Area
- 11 • Holiday Harbor

12 *Resort Modifications* Raising Shasta Dam would affect approximately six
13 resorts around the reservoir to some degree. Inundated structures and structures
14 within 3 vertical feet of the new full pool would be demolished. Septic systems
15 would also be demolished, and remaining structures would either be connected
16 to new localized wastewater treatment facilities or be relocated to other septic
17 systems. To maintain the current recreation capacity of the resorts, the Antlers
18 Concession Area could be used.

19 *Campground/Day Use Area Modifications* Many undeveloped areas have been
20 identified as potential campgrounds to replace capacity lost because of
21 inundation. While some inundated campgrounds would be relocated on fill at
22 their existing location, others would be moved around the reservoir to new
23 locations identified as potential campground sites. To maintain the current
24 recreation capacity of campgrounds, the following potential new or expanded
25 areas could be used:

- 26 • Antlers Campground
- 27 • Oak Grove Campground
- 28 • Hirz Bay Campground
- 29 • McCloud Bridge Area

30 The following potential new or expanded areas could be used to meet the need
31 for boat-in campgrounds:

- 32 • Lakeview Marina Area
- 33 • Monday Flat Boat-In Camp

1 The following potential new or expanded areas could be used to meet the need
 2 for day-use areas:

- 3 • Ellery Creek Campground
- 4 • Gregory Creek Campground
- 5 • McCloud Bridge Area

6 *USFS Facilities Modifications* Recreation within the NRA is managed by
 7 USFS, which has several facilities located throughout the reservoir area. USFS
 8 facilities consist of various storage and maintenance buildings and equipment,
 9 fire protection equipment, customer service facilities, office space, and
 10 employee living facilities. Two USFS facilities would be inundated and would
 11 require relocation or replacement. The station located in the Lakeshore area
 12 would be inundated by a Shasta Dam raise, and would be relocated to an area
 13 above the new full pool. The new facility would contain all of the features that
 14 exist at the current facility. The inundated facility would be demolished, and
 15 hauled to waste. Turntable Bay, another USFS facility, would be inundated by a
 16 Shasta Dam raise. Additional space at Turntable Bay would allow the facility to
 17 be relocated on fill in its current location.

18 **Nonrecreation Structures** Under all SLWRI comprehensive plans,
 19 nonrecreational residential and commercial structures affected by inundation
 20 would require demolition. These structures would be demolished by
 21 appropriately licensed contractors. All utilities would be disconnected, capped,
 22 and/or removed per permit requirements and governing utility standards. The
 23 structure and foundation would then be demolished. Asbestos material, if
 24 discovered, would be removed and taken to an approved landfill for disposal per
 25 permit requirements. General demolition waste would also be removed and
 26 trucked to an approved landfill. Table 2-17 shows the total volume of
 27 demolished material for nonrecreational structures by comprehensive plan.

28 **Table 2-17. Nonrecreation Structures Demolition Quantities for Action**
 29 **Alternatives**

Demolition	CP1	CP2	CP3, CP4, and CP5
Structure Demolition (square feet)	8,700	21,500	27,000
Total Volume of Material (cubic yards)	1,300	3,200	4,000

Key:
 CP = comprehensive plan

30 **Utilities and Miscellaneous Minor Infrastructure** Gas/petroleum facilities,
 31 potable water facilities, power and telecommunications infrastructure, and
 32 wastewater facilities would be relocated if affected physically by inundation or
 33 if the facilities (such as septic systems) would no longer meet Shasta County

1 Development Standards. The relocation numbers or lengths of facility features
 2 to be relocated during proposed utility relocations are shown for each
 3 comprehensive plan in Table 2-18. New facilities would be designed and
 4 constructed in accordance with applicable Federal, State, and local codes and
 5 requirements. Relocated facilities would be of the same types, sizes, and
 6 materials as existing facilities where feasible. For relocation of wastewater
 7 treatment facilities, new septic systems may be constructed on the property if
 8 they meet Shasta County requirements for separating septic systems from the
 9 lake. Otherwise, the comprehensive plans include facilities for pressurized
 10 sewer collection systems to transport wastewater flows to centralized package
 11 wastewater treatment plants.

12 Demolished facilities would not be reused to construct relocated facilities.
 13 Demolished and relocated utilities are summarized as part of the detailed
 14 description of each action alternative. The approach and methodology for
 15 demolition, design, and relocation criteria for each category of utilities are
 16 discussed in greater detail in the Engineering Summary Appendix.

17 **Table 2-18. Physical Features for Proposed Utilities Relocations for**
 18 **Action Alternatives**

Utility Type	CP1	CP2	CP3, CP4, and CP5
Potable Water Facilities			
Length of Waterlines Relocated (linear feet)	7,200	8,500	11,000
Wells/Tanks Relocated (number)	12	13	10
Pump Stations Relocated (number)	2	2	3
Length of Waterline Demolished (linear feet)	8,900	11,200	14,800
Wells/Tanks Demolished (number)	16	28	25
Pump Stations Demolished (number)	2	2	3
Gas/Petroleum Facilities			
Tanks Relocated (number)	7	10	10
Tanks Demolished (number)	7	10	10
Wastewater Facilities			
Septic Systems Relocated ¹ (number)	14	19	19
Vault/Pit Toilets Relocated (number)	2	2	2
Pump Stations Relocated (number)	1	1	1
Length of Wastewater Pipe Relocated (linear feet)	400	400	430
Septic Systems Demolished ² (number)	211	239	266
Vault/Pit Toilets Demolished (number)	2	2	2
Pump Stations Demolished (number)	2	2	2
Length of Wastewater Pipe Demolished (linear feet)	2,300	2,300	2,400
Package Wastewater Treatment Plants ³ (number)	Up to 6	Up to 6	Up to 6

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Table 2-18. Physical Features for Proposed Utilities Relocations for Action Alternatives (contd.)

Utility Type	CP1	CP2	CP3, CP4, and CP5
Power Distribution Facilities			
Power Lines Relocated (linear feet)	30,300	36,300	37,800
Power Towers Relocated (number)	6	6	6
Power Lines Demolished (linear feet)	26,400	33,700	36,200
Power Towers Demolished (number)	6	6	6
Telecommunications			
Copper Wire Relocated (linear feet)	27,900	30,200	33,400
Fiber-Optic Cable Relocated (linear feet)	4,300	5,800	5,800
Copper Wire Demolished (linear feet)	23,600	27,800	31,200
Fiber-Optic Cable Demolished (linear feet)	3,600	5,200	5,200

Note:

¹ Does not include septic systems replaced with new sewer connections.

² Includes demolition of septic systems to be relocated, replaced with new sewer connections, and removed without relocation or replacement.

³ Includes additional lift stations, force main, laterals, and holding tank pumps/valves not shown.

Key:

CP = comprehensive plan

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Spawning Gravel Augmentation Under CP4 and CP5

Under CP4 and CP5, gravel augmentation would occur at one to three locations between Keswick Dam and the RBPP every year for a period of 10 years, unless unusual conditions or agency requests precluded placement during a single year. Construction activities would vary significantly by location, but generally would include clearing, grubbing, and some grading of new access routes to allow construction vehicles to access the river. At several locations, clearing and grubbing of the riverbank would be required to allow gravel to be placed on the bank for recruitment. Gravel would be delivered to the locations by dump trucks. In most cases, gravel would be stockpiled in a staging area and moved with bulldozers, loaders, and/or excavators. Dust control trucks would be present during all construction activities.

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Several locations would require in-water construction work. Generally, this involves building gravel out into the river channel “step-wise,” meaning that gravel is dumped and leveled, and the leveled area serves as a working platform for the next step of construction. This practice is common for spawning gravel placement, and minimizes the extent to which construction vehicles drive directly through an active river channel. One or two locations, however, would require construction activity in the active river channel, where construction vehicles would deposit gravel and raise the grade of the river near existing riffles.

1 ***Riparian, Floodplain, and Side Channel Habitat Restoration Under CP4***
2 ***and CP5***

3 Under CP4 and CP5, riparian, floodplain, and side channel habitat restoration
4 would be constructed at one or more suitable locations along the upper
5 Sacramento River to benefit anadromous fish and other aquatic and riparian
6 species. Several potential sites exist along the upper Sacramento River between
7 Keswick Dam and RBPP that would be suitable for these restoration measures.
8 Construction activities for riparian, floodplain, and side channel habitat
9 restoration would vary depending on the location or locations selected and type
10 of restoration measure to be implemented at the site. In general, construction
11 activities would include earth moving activities with bulldozers, loaders,
12 excavators, and/or compactors. Vegetation removal may also be necessary at
13 some sites, either for channel deepening/widening, or where water with aquatic
14 vegetation is present in a channel pending modification.

15 Special precautions for restoration at these sites will primarily involve:

- 16 • Maintaining the active spawning areas in proximity to the site
- 17 • Avoiding the creation of habitat for predacious fish
- 18 • Minimal disruptions to navigability of the river
- 19 • Preventing the spread of invasive, non-native plant species
- 20 • Ensuring the safety of homes located along the Sacramento River
21 downstream of the sites

22 The following are examples of construction measures proposed for restoration
23 of riparian, floodplain, and side channel habitat at each of the potential
24 restoration sites.

25 **Henderson Open Space** An existing side channel to the main stem of the
26 Sacramento River would be enhanced to activate the frequency and duration of
27 flows for Chinook salmon spawning habitat throughout a portion of Henderson
28 Open Space Park. The enhancement would involve modifying the northern
29 opening to the existing side channel to restore connectivity with the river at
30 flows greater than 8,000 cfs. Minor grading and channel slope modification
31 would be necessary to rework the existing (sometimes inundated) channel to a
32 point at which flows may be activated for spawning habitat.

33 The existing Henderson Open Space side channel is heavily vegetated.
34 Floodplain terraces and adjacent riparian areas would be replanted with native
35 vegetation after the completion of earth-moving activities. A more detailed site
36 analysis would determine the mix, composition, and density of the riparian
37 vegetation plantings. To varying degrees, temporary fencing and irrigation
38 would be necessary to protect and sustain newly established riparian vegetation.

1 **Tobiasson Island** A regularly flowing side channel would be created to
2 increase spawning habitat for all runs of Chinook salmon at Tobiasson Island.
3 Creating this side channel would involve excavating a trapezoidal-shaped
4 channel, the base of which would correspond to an elevation that would allow
5 flows of 5,000 cfs or greater to enter the side channel, hence hydraulically
6 connecting it to the Sacramento River. If created, this new side channel would
7 add approximately 1,350 linear feet of salmonid spawning habitat to this section
8 of the Sacramento River.

9 The potential site for the channel to be cut does not currently have flowing
10 water or riparian vegetation: therefore, vegetation removal would not be
11 necessary. However, upon completion of earth-moving activities, it would be
12 necessary to establish native vegetation throughout the side channel on the
13 newly created floodplain terraces. A more detailed site analysis would
14 determine the mix, composition, and density of the riparian vegetation
15 plantings. Temporary irrigation and fencing for vegetation planting at this site is
16 not feasible because the site lacks water supply and electricity.

17 **Shea Island Complex** Restoration at the Shea Island Complex would involve
18 lowering a section of the upstream end of the major side channel through the
19 site. The objective would be to keep water moving through the channel when
20 the Sacramento River reaches flows of 10,000 cfs or greater, thus enhancing
21 salmonid spawning habitat.

22 Additionally, removal of vegetation and debris would be necessary in both the
23 excavated portion of the channel and other portions of the channel to insure the
24 connectivity of flows. Minor grading activity could increase channel complexity
25 along the length of the corridor. Upon completion of earth-moving activities, it
26 would be necessary to establish native vegetation throughout the side channel
27 on the newly created floodplain terraces. A more detailed site analysis would
28 determine the mix, composition, and density of the riparian vegetation
29 plantings. Temporary irrigation and fencing for vegetation planting at this site
30 is because the site lacks a water supply and electricity.

31 **Kapusta Island** An existing side channel on Kapusta Island would be
32 enhanced to increase spawning habitat for winter-run and spring-run Chinook
33 salmon in the Sacramento River. This enhancement would involve lowering the
34 channel bed so that the channel may be hydraulically connected to the
35 Sacramento River when the river is flowing in excess of 10,000 cfs.

36 A trapezoidal cut would need to occur along the course of the side channel,
37 which is inundated only infrequently; in addition, vegetation and debris would
38 need to be removed. Upon completion of earth-moving activities, establishing
39 vegetation on new floodplain terraces and adjacent riparian areas with native
40 plants would be necessary. A more detailed site analysis would determine the
41 mix, composition, and density of the riparian vegetation plantings. Temporary
42 fencing or irrigation at this site for newly established riparian vegetation is

1 highly infeasible and a planting mix would need to be selected with this
2 limitation in mind.

3 **Anderson River Park** Restoring floodplain, riparian and side channel habitat
4 at Anderson River Park would involve altering a relic Sacramento River side
5 channel located in the southeastern portion of the park at river flows of, or
6 above 8,000 cfs or more. The side channel rearing habitat would be created by
7 altering the upstream end of the side channel to capture flows. At present, the
8 side channel is seasonally inundated, but likely by way of seepage from the
9 river through alluvial material. Riparian vegetation and appurtenant biota are at
10 this site; therefore, removal of vegetation to lower the channel bed would be
11 necessary, followed by post excavation replanting of native riparian vegetation.

12 **Reading Island** Restoring floodplain, riparian, and side channel habitat at
13 Reading Island would involve hydraulically reconnecting Anderson Creek with
14 the Sacramento River at flows ranging between 4,000 cfs and 6,000 cfs. To
15 restore Sacramento River flows through Anderson Creek, it would first be
16 necessary to breach the levee that creates Anderson Slough. Additionally,
17 clearing and excavation of the side channel would be necessary to ensure flows
18 through the channel. This would involve removing vegetation and debris and
19 deepening the existing channel.

20 After excavation, floodplain terraces and adjacent riparian areas would need to
21 be vegetated with native plants. This would require temporary irrigation and
22 fencing to sustain plantings and keep livestock off site. A more detailed site
23 analysis would determine the mix, composition, and density of the riparian
24 vegetation plantings.

25 ***Shasta Lake Tributary and Shoreline Enhancement Under CP5***

26 Structural enhancements associated with CP5 include placing brush structures
27 constructed from whiteleaf manzanita (*Arctostaphylos manzanita*) in the Shasta
28 Lake littoral zone. Because of manzanita's density, installation would not
29 require using anchor or cabling techniques that could result in ancillary negative
30 impacts (e.g., maintenance, hazards to boaters). The brush structures would be
31 assembled in the drawdown zone of the reservoir in an area that would be
32 inundated as the reservoir surface elevation rises in fall. The brush structures are
33 expected to be about 1,800 cubic feet in size. The establishment period would
34 be the first year after construction; life span of the brush structures is projected
35 to be 10 years.

36 Table 2-19 identifies the general area, number, and size of proposed structural
37 enhancement locations for the main body of Shasta Lake, and the Pit,
38 Sacramento, McCloud, Big Backbone, and Squaw arms. Selection of specific
39 locations has been deferred so that enhancement locations are consistent with
40 other project objectives. The level of proposed treatment is based on the
41 proportion of available manzanita surrounding Shasta Lake. In general terms,
42 these locations would incorporate available material at locations with preferred

1 topographic features; preferred locations are coves that offer steep drawdown
2 areas during the primary use period (spring, early summer).

3 **Table 2-19. Proposed Structural Enhancement of Shasta Lake’s Main**
4 **Body and by Arms Under CP5**

Area	Area Treated (acres)	Number of Locations
Main Body	17	595
Pit	12	420
Sacramento	43	1,505
McCloud	8	280
Big Backbone	3	105
Squaw	17	595
Total	100	3,500

5 Vegetative enhancements associated with CP5 include planting willows to
6 enhance nearshore fish habitat, and aerial and hand seeding of annual cereal
7 grains to treat shoreline areas at Shasta Lake.

8 More than 30 acres could be available to enhance the willow recruitment
9 adjacent to Shasta Lake. Rooted willows would be planted in draws and other
10 moist sites, such as springs, to provide long-term live cover. The establishment
11 period for willows would be the first year after construction; life span is
12 projected to be 5 to 50 years. The establishment period for cereal grains would
13 also be the first year of construction, with the life span projected to be 1 to 3
14 years. This approach would require native seed and nursery stock; several years
15 of advanced preparation would be needed before planting could take place.

16 Table 2-20 summarizes proposed enhanced treatment with native willows and
17 grasses for the main body of Shasta Lake and by the lake’s arms.

18 **Table 2-20. Proposed Vegetative Enhancement Treatment of Shasta**
19 **Lake’s Main Body and Arms under CP5**

Area	Willow Planting (acres)	Native Grass Seeding (acres)
Main Body	1	2
Pit Arm	1	4
Sacramento Arm	7	4
McCloud Arm	1	2
Big Backbone Arm	3	2
Squaw Arm	1	2
Total	14	16

20 ***Construction Staging***

21 Reclamation would establish staging areas for equipment storage and
22 maintenance, construction materials, fuels, lubricants, solvents, and other
23 possible contaminants in coordination with the resource agencies. Staging areas
24 would likely be located within disturbed areas or at existing facilities that are

1 expected to be inundated, such as campgrounds, recreation parking facilities,
2 the top of Shasta Dam, and the parking area along the left wing dam, where
3 feasible.

4 Staging areas would have a stabilized entrance and exit and would be located at
5 least 100 feet from bodies of water, if possible. Should an off-road site be
6 chosen, qualified biological and cultural resources personnel would survey the
7 selected site to verify that no sensitive resources would be disturbed by staging
8 activities. Should sensitive resources be found, an appropriate spatial and
9 temporal buffer zone would be staked and flagged to avoid impacts. Where
10 possible, no equipment refueling or fuel storage would take place within 100
11 feet of a body of water.

12 **Construction Schedule, Equipment, and Workforce**

13 The total duration of construction for major facilities is estimated to range from
14 4.5 to 5 years for all comprehensive plans. An overlap is expected in the timing
15 of some of the construction components. Construction would be phased, when
16 feasible, to avoid environmental impacts.

17 Construction would typically occur during daylight hours, Monday through
18 Friday. However, construction contractors may extend these hours and schedule
19 construction work on weekends, if necessary, to complete aspects of the work
20 within a given time frame. Construction would require typical heavy
21 construction equipment including excavators, backhoes, bulldozers, scrapers,
22 graders, water trucks, front-end loaders, dump trucks, drill rigs, pump trucks,
23 truck-mounted cranes, pickup trucks, barges, helicopters, and miscellaneous
24 equipment.

25 Daily highway truck trips would be required to bring construction material to
26 the site, and carry construction debris and waste material to a suitable landfill.
27 Estimated daily highway truck trips for each comprehensive plan are shown in
28 Table 2-21. Table 2-21 also shows the estimated construction period and annual
29 construction labor force for each comprehensive plan.

30 **Table 2-21. Estimated Construction Period, Truck Trips, and Construction**
31 **Labor Force for Action Alternatives**

Construction Item	CP1	CP2	CP3	CP4	CP5
Construction Period (years)	4.5	5	5	5	5
Construction Labor Force (number/year)	300	300	350	350	360
Daily Truck Trips for Materials (trips/day)	95	118	168	175	177
Daily Truck Trips for Waste (trips/day)	75	56	52	53	54
Total Daily Truck Trips (trips/day)	170	173	220	228	230

Key:
CP = comprehensive plan

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Borrow Sources

Multiple borrow sources are available to meet project needs for concrete, sand and gravel, core and homogenous fill, shell fill, riprap, and filter and drain materials for reservoir area embankments. Potential borrow sources were examined at a preliminary level and would need further sampling and testing to determine suitability and refine quantity estimates. Potential borrow sources include areas of the dike construction sites, areas located below the reservoir’s inundation zone, and commercial sources. Commercial sources are located within approximately 2 to 30 miles of the Bridge Bay site, and within approximately 15 to 43 miles of the Lakeshore sites. Potential borrow sources are identified in Figure 2-6. Available fill material from potential borrow sources are described in the Engineering Summary Appendix.

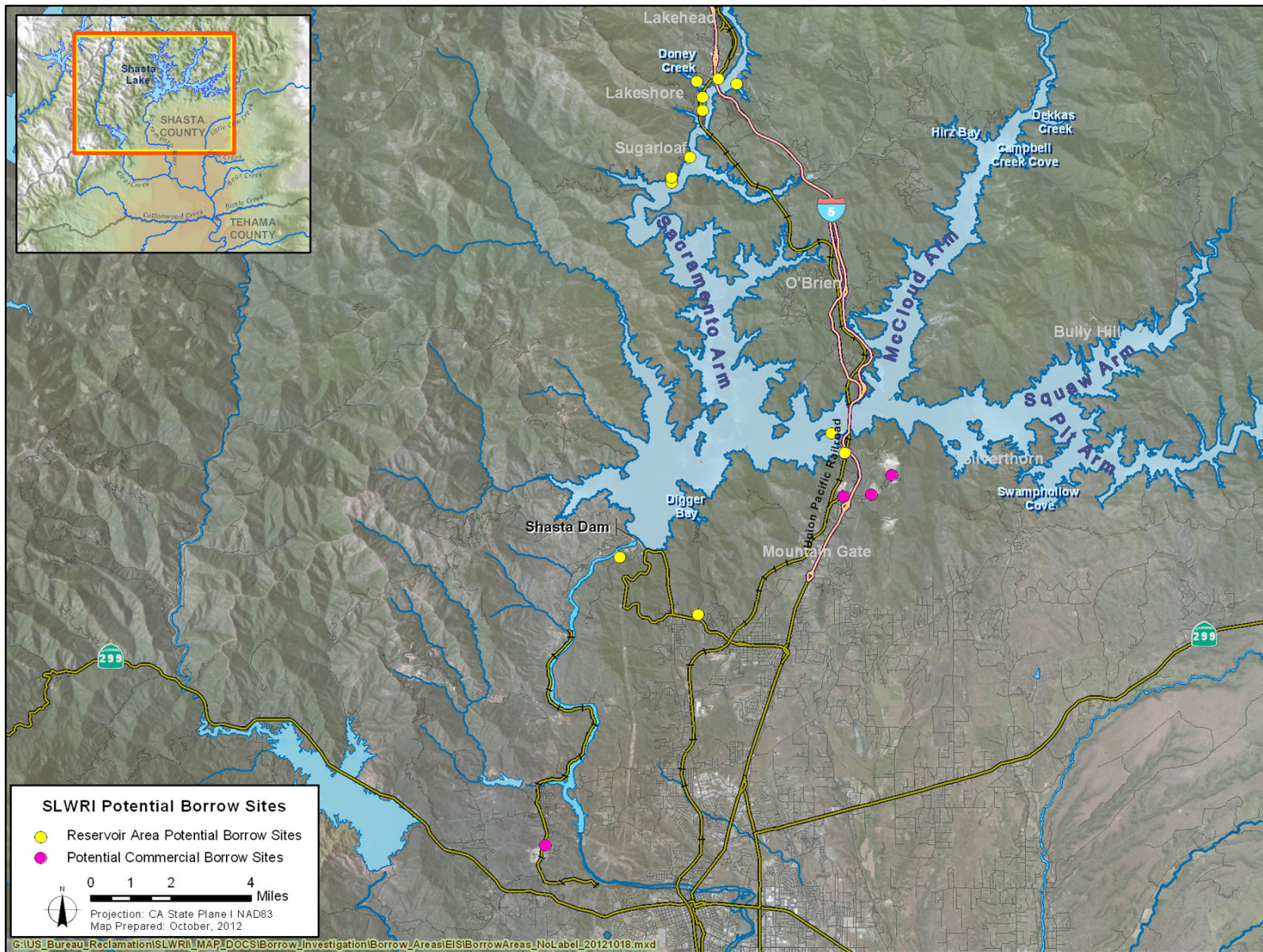


Figure 2-6. Potential Borrow Sources

2.4 Alternatives Considered and Eliminated from Further Analysis

Alternatives considered but eliminated from further analysis are described below. The plans described were developed during the initial plans phase, and the comprehensive plans phase, consistent with the alternatives development process discussed previously.

In addition to the alternatives described below, more than 60 potential management measures, shown in Table 2-1, were identified, evaluated, and screened as part of the SLWRI plan formulation process to address the primary and secondary planning objectives and satisfy the other applicable planning constraints, considerations, and criteria. These management measures included constructing new reservoirs in other locations, such as on the Sacramento River upstream from Shasta Reservoir, on tributaries downstream from Shasta Dam (e.g., Cottonwood Creek and Auburn Dam Projects), and offstream near the Sacramento River downstream from Shasta Dam (e.g., Sites Reservoir). Management measures deleted from further consideration were summarized previously and are described in detail in the Plan Formulation Appendix, along with reasons for deleting measures from further consideration and development.

2.4.1 Initial Alternatives Phase

The following concept plans were eliminated from further consideration as stand-alone plans.

- **AFS-1 – Increase Cold Water Assets with Shasta Operating Pool Raise (6.5 feet).** AFS-1 focused on maintaining cooler water temperatures in the upper Sacramento River by increasing the minimum end-of-October carryover storage target. This would allow additional cold water to be stored for use in the following year. No changes would be made to the existing seasonal temperature targets for anadromous fish on the upper Sacramento River, but the ability to meet these targets would be improved.

It was found that AFS-1 had a significant potential to benefit anadromous fish in the upper Sacramento River, but there would be no additional increase in water supply reliability. This plan had two major components: (1) Raising Shasta Dam by 6.5 feet for the primary purpose of enlarging the cold-water pool and regulating water temperature in the upper Sacramento River; and (2) increasing the size of the minimum operating pool to 880,000 acre-feet.

AFS-1 was not retained for further development as a stand-alone plan because, although it had considerable benefits for anadromous fish

1 survival, it did not meet the primary planning objective of increasing
2 water supply reliability.

- 3 • **AFS-2 – Increase Minimum Anadromous Fish Flow with Shasta**
4 **Enlargement (6.5 feet).** AFS-2 focused on the primary planning
5 objective of anadromous fish survival by using the additional reservoir
6 storage to increase minimum seasonal flows in the upper Sacramento
7 River from the current 3,250 cfs to about 4,200 cfs. The primary
8 component of AFS-2 included raising Shasta Dam by 6.5 feet for the
9 primary purpose of enlarging the volume of water available to meet
10 minimum flows for winter-run Chinook salmon on the upper
11 Sacramento River. No changes would be made to the carryover target
12 volume or minimum operating pool.

13 Subsequent evaluation indicated that although increasing minimum
14 flows would be beneficial for fish at various stages of development, it
15 would be detrimental at other life stages. Accordingly, this plan was
16 deleted from further development.

- 17 • **AFS-3 – Increase Minimum Anadromous Fish Flow with Shasta**
18 **Enlargement (6.5 feet) and Restore Aquatic Habitat.** AFS-3 was
19 similar to AFS-2, except that it also involved acquiring, restoring, and
20 reclaiming one or more inactive gravel mines along the upper
21 Sacramento River to restore about 150 acres of aquatic and floodplain
22 habitat. AFS-3 had two major plan components: (1) Raising Shasta
23 Dam by 6.5 feet for the primary purpose of enlarging the volume of
24 water available to meet minimum flows for winter-run Chinook salmon
25 on the upper Sacramento River: and (2) acquiring, restoring, and
26 reclaiming one or more inactive gravel mining operations along the
27 upper Sacramento River to restore about 150 acres of aquatic and
28 floodplain habitat.

29 Increasing minimum flows was not found to significantly benefit to
30 anadromous fish, and concerns were expressed regarding significant
31 uncertainties about offstream areas being able to successfully support
32 viable fish spawning and rearing. Further, during public scoping
33 activities in late 2005, little to no interest was demonstrated for
34 restoring inactive gravel mines along the Sacramento River above the
35 current location of the RBPP. Accordingly, this plan element was
36 deleted from further consideration at this time.

- 37 • **WSR-3 – Increase Water Supply Reliability with Shasta**
38 **Enlargement (High Level).** WSR-3 focused on water supply
39 reliability by increasing the volume of water stored in Shasta Lake by
40 the maximum amount technically feasible. WSR-3 had two major
41 components: (1) Raising Shasta Dam by about 202.5 feet for the
42 primary purpose of creating 9.3 MAF of additional storage available for

1 water supply: and (2) major modifications to or replacing, dam
2 appurtenances, including hydropower facilities and the TCD.

3 Raising the dam to this level would require extensive and very costly
4 reservoir area relocations such as moving the Pit River Bridge, I-5, and
5 UPRR tracks, and would require modifying Keswick Dam and its
6 powerplant. This plan would provide a major increase in water supply
7 reliability, anadromous fish, hydropower, flood damage reduction, and
8 recreation resources. However, the plan is not financially feasible
9 because the construction cost is estimated at more than \$6 billion (at
10 October 2008 price levels). Accordingly, WSR-3 was deleted from
11 further development.

- 12 • **WSR-4 – Increase Water Supply Reliability with Shasta**
13 **Enlargement (18.5 feet) and Conjunctive Water Management.**
14 WSR-4 focused on the primary objective of water supply reliability by
15 raising Shasta Dam 18.5 feet in combination with conjunctive water
16 management. WSR-4 had two major components: (1) Raising Shasta
17 Dam by 18.5 feet for the primary purpose of creating 636,000 acre-feet
18 of additional storage available for water supply and (2) implementing a
19 conjunctive water management program, consisting largely of contracts
20 between Reclamation and certain Sacramento River basin water users.
21 The conjunctive water management component included downstream
22 facilities, such as additional river diversions and transmission and
23 groundwater pumping facilities, to facilitate exchanges. Reclamation
24 would provide additional surface supplies to participating CVP users
25 in wet and normal water years, in exchange for reducing deliveries in
26 dry and critical years, when users would rely more on groundwater
27 supplies.

28 Preliminary estimates of the conjunctive water management component
29 associated with this alternative indicated that water supply yield could
30 be increased by between 10 and 20 percent. However, few to no
31 fishery benefits would result and no strong indication of non-Federal
32 participation in a conjunctive water management component was
33 identified. Accordingly, WSR-4 was deleted from further
34 consideration.

- 35 • **CO-1 and CO-2 – Increase Anadromous Fish Habitat and Water**
36 **Supply Reliability with Shasta Enlargement (6.5 feet and 18.5 feet).**
37 CO-1 and CO-2 addressed both primary objectives by restoring
38 anadromous fish habitat and raising Shasta Dam. Both CO-1 and CO-2
39 would dedicate some of the added reservoir space from the dam raise to
40 increasing the minimum carryover storage in Shasta Reservoir to make
41 more cold-water releases for regulating water temperature in the upper
42 Sacramento River. CO-1 and CO-2 had three major components: (1)
43 Raising Shasta Dam by 6.5 feet (CO-1) or 18.5 feet (CO-2), for the

1 purposes of expanding the cold-water pool and creating 260,000 acre-
2 feet (CO-1) or 630,000 acre-feet (CO-2) of additional storage available
3 for water supply; (2) acquiring, restoring, and reclaiming one or more
4 inactive gravel mining operations along the upper Sacramento River to
5 create about 150 acres of aquatic and floodplain habitat, and (3)
6 revising flood control operations to benefit water supply reliability by
7 managing floods more efficiently.

8 For reasons similar to those described for AFS-3, both CO-1 and CO-2
9 were eliminated as stand-alone plans, and the gravel mine restoration
10 components of both plans were deleted from further consideration.

- 11 • **CO-3 – Increase Anadromous Fish Flow/Habitat and Water Supply**
12 **Reliability with Shasta Enlargement (18.5 feet).** CO-3 is similar to
13 CO-2, except that a portion of the additional storage would be
14 dedicated to managing flows for winter-run Chinook salmon on the
15 upper Sacramento River. Under this preliminary plan, approximately
16 320,000 acre-feet would be dedicated to increasing minimum flows
17 from approximately 3,250 cfs to about 4,200 cfs between October 1 and
18 April 30.

19 Subsequent evaluation indicated that although increasing minimum
20 flows would be beneficial for fish at various stages of development, it
21 would be detrimental at other life stages. Accordingly, CO-3 was
22 deleted from further development.

- 23 • **CO-4 – Multipurpose with Shasta Enlargement (6.5 feet).** This plan
24 addressed both the primary and secondary objectives through a
25 combination of measures, raising Shasta Dam, restoring habitat, and
26 adding recreation facilities in the Shasta Lake area. Enlargement of the
27 reservoir and limited reservoir reoperation would also help improve
28 operations for flood management and recreation. Major components of
29 CO-4 involved increasing water supply reliability with a 6.5-foot dam
30 raise, increasing anadromous fish survival by increasing cold-water
31 pool depth and volume in Shasta Reservoir, and restoring inactive
32 gravel mines and floodplain habitat along the Sacramento River. CO-4
33 involved further investigation of and potential modifications to the
34 existing TCD at Shasta Dam for enhanced temperature management,
35 and increasing the operational efficiencies of Shasta Dam and
36 Reservoir for water supply reliability and flood control. Finally, the
37 plan involved implementing conjunctive water management, as in
38 WSR-4, constructing shoreline and tributary fish habitat improvements
39 in the Shasta Lake area, and restoring one or more riparian habitat areas
40 between Redding and the current location of the RBPP on the
41 Sacramento River.

1 CO-4 was eliminated from further consideration primarily because of
2 its low effectiveness and efficiency and redundancies with WSR-1 and
3 CO-5, both of which were recommended for further development.

4 **2.4.2 Comprehensive Plans Phase**

5 The scenarios presented in Tables 2-22 and 2-23, related to the formulation of
6 the anadromous fish survival focus plan (CP4), were eliminated from further
7 consideration during the comprehensive plans phase.

8 **Table 2-22. Eliminated Scenarios Considered to Augment Flows – Anadromous**
9 **Fish Survival Focus Plan**

Scenario	Description	Reason for Elimination
1	Dam raise of 18.5 feet. Additional 634,000 acre-feet of storage. October – March AFRP flows or 500 cfs increase, whichever is less.	Analysis indicated limited benefits to fish compared with overall cost of the project.
2	Dam raise of 18.5 feet. Additional 634,000 acre-feet of storage. October – March AFRP flows or 750 cfs increase, whichever is less.	Analysis indicated limited benefits to fish compared with overall cost of the project.
3	Dam raise of 18.5 feet. Additional 634,000 acre-feet of storage. October – March AFRP flows or 1,000 cfs increase, whichever is less.	Analysis indicated limited benefits to fish compared with overall cost of the project.
4	Dam raise of 18.5 feet. Additional 634,000 acre-feet of storage. Increase August flows to 10,000 cfs and September flows to 6,000 cfs for temperature control.	Analysis indicated limited benefits to fish compared with overall cost of the project.

Source: USFWS 2001

Key:

AFRP = Anadromous Fish Restoration Plan

cfs = cubic feet per second

Table 2-23. Eliminated Scenarios Considered for Cold-Water Storage – Anadromous Fish Survival Focus Plan

Scenario	Description	Reason for Elimination
B	Dam raise of 6.5 feet. Additional 256,000 acre-feet of storage. Dedicating 256,000 acre-feet of water from increased storage to increase the size of the cold-water pool for fishery benefit.	Although this scenario had considerable benefits for anadromous fish survival, it did not considerably contribute to other objectives.
D	Dam raise of 12.5 feet. Additional 443,000 acre-feet of storage. Dedicating 187,000 acre-feet of the additional water from increased storage to increase the size of the cold-water pool for fishery benefit.	Although this scenario had considerable benefits for anadromous fish survival, it was not as cost-effective as an 18.5-foot raise.
E	Dam raise of 12.5 feet. Additional 443,000 acre-feet of storage. Dedicating 443,000 acre-feet of water from increased storage to increase the size of the cold-water pool for fishery benefit.	Although this scenario had considerable benefits for anadromous fish survival, it did not considerably contribute to other objectives.
G	Dam raise of 18.5 feet. Additional 634,000 acre-feet of storage. Dedicating 191,000 acre-feet of the additional water from increased storage to increase the size of the cold-water pool for fishery benefit.	Although this scenario had considerable benefits for anadromous fish survival, it was redundant with Scenario H and provided less benefit.
I	Dam raise of 18.5 feet. Additional 634,000 acre-feet of storage. Dedicating 634,000 acre-feet of water from increased storage to increase the size of the cold-water pool for fishery benefit.	Although this scenario had considerable benefits for anadromous fish survival, it did not considerably contribute to other objectives.

Further information about the SLWRI plan formulation process, including detailed descriptions of deleted and retained measures, initial plans, and scenarios used to formulate CP4, are presented in the Plan Formulation Appendix.

2.5 Summary of Potential Benefits of Action Alternatives

Table 2-24 summarizes the overall potential benefits of all comprehensive plans. The quantified benefits were based on modeling efforts that are described in several parts of the DEIS: Chapter 6, “Hydrology, Hydraulics, and Water Management”; Chapter 11, “Fisheries and Aquatic Resources”; Chapter 23, “Power and Energy”; and the Modeling Appendix.

1 **Table 2-24. Summary of Major Benefits of Action Alternatives**

Item	CP1	CP2	CP3	CP4	CP5
Raise Shasta Dam (feet)	6.5	12.5	18.5	18.5	18.5
Total Increased Storage (TAF)	256	443	634	634	634
Benefits					
Increase Anadromous Fish Survival					
Dedicated Storage (TAF)	-	-	-	378	-
Production Increase (thousand fish) ¹	61	379	207	813	378
Spawning Gravel Augmentation (tons) ²				10,000	10,000
Side Channel Rearing Habitat Restoration				Yes	Yes
Increase Water Supply Reliability					
Total Increased Firm Water Supplies (TAF/year) ³	47.3	77.8	63.1	47.3	113.5
Increased Firm Water Supplies NOD (TAF/year) ³	4.5	10.7	35.2	4.5	25.2
Increased Firm Water Supplies SOD (TAF/year) ³	42.7	67.1	28.0	42.7	88.3
Increased Water Use Efficiency Funding	Yes	Yes	Yes	Yes	Yes
Increased Emergency Water Supply Response Capability	Yes	Yes	Yes	Yes	Yes
Reduce Flood Damage					
Increased Reservoir Capacity for Capture of High Flood Flows	Yes	Yes	Yes	Yes	Yes
Develop Additional Hydropower Generation					
Increased Hydropower Generation (GWh/year)	54	90	90	133	117
Conserve, Restore, and Enhance Ecosystem Resources					
Shoreline Enhancement (acres)	-	-	-	-	130
Tributary Aquatic Habitat Enhancement (miles) ⁴	-	-	-	-	6
Riparian, Floodplain, and Side Channel Restoration Habitat	-	-	-	Yes	Yes
Increased Ability to Meet Flow and Temperature Requirements Along Upper Sacramento River	Yes	Yes	Yes	Yes	Yes
Maintain or Improve Water Quality					
Improved Delta Water Quality	Yes	Yes	Yes	Yes	Yes
Increased Delta Emergency Response Capability	Yes	Yes	Yes	Yes	Yes
Maintain and Increase Recreation					
Recreation (increased user days, thousands) ⁵	89	134	205	370	175
Modernization of Relocated Recreation Facilities	Yes	Yes	Yes	Yes	Yes

Notes:

¹ Average annual increase in juvenile Chinook salmon surviving to migrate downstream from the RBPP. Numbers were derived from SALMOD.

² Average amount per year for 10-year period.

³ Total drought period reliability for Central Valley Project and State Water Project deliveries. Does not reflect benefits related to water use efficiency actions included in all comprehensive plans.

⁴ Tributary aquatic enhancement provides for the connectivity of native fish species and other aquatic organisms between Shasta Lake and its tributaries. Estimates of benefits reflect only connectivity with perennial streams and do not reflect additional miles of connectivity with intermittent streams.

⁵ Annual recreation visitor user days were estimated using two methodologies. The maximum value is reported to capture the largest potential effects from increased visitation. These values do not account for increased visitation due to modernization of recreation facilities associated with all comprehensive plans. Annual visitation for National Economic Development analysis may be refined for the Draft Feasibility Report.

Key:

- = not applicable

CP = comprehensive plan

Delta = Sacramento-San Joaquin Delta

GWh/year = gigawatt-hours per year

NOD = north of Delta

SOD = south of Delta

SLWRI = Shasta Lake Water Resources Investigation

RBPP = Red Bluff Pumping Plant

TAF = thousand acre feet

2.6 Preferred Alternative and Rationale for Selection

A plan recommending Federal action should be the plan that best addresses the targeted water resources problems considering public benefits relative to costs. The basis for selecting the recommended plan/preferred alternative is to be fully reported and documented, including the criteria and considerations used in selecting a recommended course of action by the Federal Government. It is recognized that most of the activities pursued by the Federal Government will require assessing trade-offs by decision makers and that in many cases, the final decision will require judgment regarding the appropriate extent of monetized and nonmonetized effects.

The needed rationale to support Federal investment in water resources projects is described in the 2009 Council on Environmental Quality's Draft *Proposed National Objectives, Principles, and Standards for Water and Related Resources Implementation Studies (CEQ 2009)*:

The presentations shall summarize and explain the decision rationale leading from the identification of need through the recommendation of a specific alternative. This shall include the steps, basic assumptions, analysis methods and results, criteria and results of various screenings and selections of alternatives, peer review proceedings and results, and the supporting reasons for other decisions necessary to execute the planning process. The information shall enable the public to understand the decision rationale, confirm the supporting analyses and findings, and develop their own fully-informed opinions and/or decisions regarding the validity of the study and its recommendations.

Opportunities shall be provided for public reaction and input prior to key study decisions, particularly the tentative and final selection of recommended plans. The above information shall be presented in a decision document or documents, and made available to the public in draft and final forms. The document(s) shall demonstrate compliance with the National Environmental Policy Act (NEPA) and other pertinent Federal statutes and authorities.

Consistent with the above CEQ guidance and NEPA guidelines, the preferred alternative for implementation will be identified in the Final EIS. The preferred alternative is not identified in this DEIS. Because the preferred alternative has not been determined at this time, the potential effects of all alternatives are described at a similar level of detail.

The preferred alternative will be identified in the Final EIS in consideration of public, stakeholder, and agency comments on this DEIS. Ultimately, the

1 alternative that best meets the stated objectives and maximizes net public
2 benefits will be identified with supporting rationale and documentation. The
3 alternative recommended for implementation may or may not be identified as
4 the “Environmentally Preferable Alternative” consistent with NEPA, the
5 “National Economic Development (NED) Plan” consistent with the Economic
6 and Environmental Principles and Guidelines for Water and Related Land
7 Resources Implementation Studies, the “Least Environmentally Damaging
8 Practicable Alternative” consistent with the CWA, and the “Environmentally
9 Superior Alternative” consistent with CEQA.

10

1 Chapter 3 2 Considerations for Describing Affected 3 Environment and Environmental 4 Consequences

5 3.1 Introduction

6 Chapters 4–25 of this DEIS are organized by environmental resource area. Each
7 chapter discusses the affected environment and potential environmental
8 consequences (short- and long-term impacts, direct and indirect impacts, and
9 mitigation measures, and cumulative impacts) that could result from
10 implementing the proposed action alternatives. Additional details about the
11 affected environment are available for some resource areas in the technical
12 reports; see the appendices to this DEIS.

13 3.2 Chapter Contents and Definition of Terms

14 Chapters 4–25 are organized into the following resource and issue areas:

- 15 • **Chapter 4** – Geology, Geomorphology, Minerals, and Soils
- 16 • **Chapter 5** – Air Quality and Climate
- 17 • **Chapter 6** – Hydrology, Hydraulics, and Water Management
- 18 • **Chapter 7** – Water Quality
- 19 • **Chapter 8** – Noise and Vibration
- 20 • **Chapter 9** – Hazards and Hazardous Materials and Waste
- 21 • **Chapter 10** – Agriculture and Important Farmlands
- 22 • **Chapter 11** – Fisheries and Aquatic Ecosystems
- 23 • **Chapter 12** – Botanical Resources and Wetlands
- 24 • **Chapter 13** – Wildlife Resources

- 1 • **Chapter 14** – Cultural Resources
- 2 • **Chapter 15** – Indian Trust Assets
- 3 • **Chapter 16** – Socioeconomics, Population, and Housing
- 4 • **Chapter 17** – Land Use and Planning
- 5 • **Chapter 18** – Recreation and Public Access
- 6 • **Chapter 19** – Aesthetics and Visual Resources
- 7 • **Chapter 20** – Transportation and Traffic
- 8 • **Chapter 21** – Utilities and Service Systems
- 9 • **Chapter 22** – Public Services
- 10 • **Chapter 23** – Power and Energy
- 11 • **Chapter 24** – Environmental Justice
- 12 • **Chapter 25** – Wild and Scenic River Considerations for McCloud
13 River

14 For some of these resource and issue areas, there is also an appendix containing
15 a technical report of the same name. The technical reports describe the affected
16 environment in more detail than the summarized information presented in the
17 main body of this DEIS. Related modeling results are presented, where
18 appropriate, in the Modeling Appendix.

19 **3.2.1 NEPA Requirements**

20 Council on Environmental Quality (CEQ) regulations for implementing NEPA
21 include the following requirements for an EIS (Title 40, Section 1502.15 of the
22 Code of Federal Regulations (40 CFR 1502.15)):

23 *[An] EIS shall succinctly describe the environment of the*
24 *area(s) to be affected or created by the alternatives under*
25 *consideration. The descriptions shall be no longer than is*
26 *necessary to understand the effects of the alternatives. Data and*
27 *analyses in a statement shall be commensurate with the*
28 *importance of the impact, with less important material*
29 *summarized, consolidated, or simply referenced.*

30 On February 18, 2010, CEQ issued guidance on including greenhouse gas
31 (GHG) emissions and climate change impacts in environmental review
32 documents under NEPA. CEQ guidance suggests that Federal agencies consider

1 opportunities to reduce GHG emissions caused by proposed Federal actions,
2 adapt their actions to climate change impacts throughout the NEPA process, and
3 address these issues in the agencies' NEPA procedures. The following are the
4 two main factors to consider when addressing climate change in environmental
5 documentation:

- 6 • Effects of a proposed action and alternative actions on GHG emissions
- 7 • Impacts of climate change on a proposed action or alternatives

8 CEQ notes that “significant” national policy decisions with “substantial” GHG
9 impacts require analysis of their GHG effects. That is, the GHG effects of a
10 Federal agency’s proposed action must be analyzed if the action would cause
11 “substantial” annual direct emissions; would implicate energy conservation or
12 reduced energy use or GHG emissions; or would promote cleaner, more
13 efficient renewable-energy technologies.

14 **3.2.2 Approach to Affected Environment**

15 Chapters 4–25 provide an overview of the existing physical environment and
16 socioeconomic conditions that could be affected by the five action alternatives
17 and the No-Action alternative considered in this DEIS. This information was
18 obtained from technical studies prepared by Reclamation for some resource and
19 issue areas; those studies are attached to this DEIS. Additional information was
20 obtained from published environmental and planning documents, books, Web
21 sites, journal articles, field surveys, and communications with technical experts.
22 Descriptions of the affected environment are organized by geographic region.
23 Conditions in the primary study area – Shasta Lake and vicinity and the upper
24 Sacramento River (Shasta Dam to Red Bluff) – are described first. These
25 discussions are followed by descriptions of conditions in the extended study
26 area, which consists of the lower Sacramento River and Delta and CVP/SWP
27 facilities and water service areas.

28 In certain resource areas, the geographic regions are organized slightly
29 differently than how they are defined in Chapter 1. For example, when effects
30 would occur solely because of operational changes, the Trinity, American, and
31 Feather rivers may all be discussed with the geography for CVP/SWP facilities
32 and service areas, because the impacts would be similar in nature.

33 **3.2.3 Methods and Assumptions**

34 Chapters 4–25 analyze the direct and indirect effects of the No-Action
35 Alternative and comprehensive plans (i.e., action alternatives) for each
36 environmental resource area. Direct effects are those that would be caused by
37 the action and would occur at the same time and place. Indirect effects are
38 reasonably foreseeable consequences that may occur at a later time or at a
39 distance from the project area. Examples of indirect effects are growth

1 inducement or other effects related to changes in land use patterns, population
2 density, or growth rate, and related effects on the physical environment.

3 The effects of the No-Action Alternative and action alternatives were
4 determined by comparing estimates of resulting conditions with baseline
5 conditions. These baseline conditions differ between NEPA and CEQA. Under
6 NEPA, the No-Action Alternative (i.e., expected future conditions without the
7 project) is the baseline to which the action alternatives are compared; the No-
8 Action Alternative is also compared to existing conditions. Under CEQA,
9 existing conditions are the baseline to which alternatives are compared.

10 An environmental document prepared to comply with NEPA must consider the
11 context and intensity of the environmental effects that would be caused by, or
12 result from, the proposed action. Under NEPA, the significance of an effect is a
13 determining factor in whether an environmental impact statement must be
14 prepared. An environmental document prepared to comply with CEQA must
15 identify the significance of the environmental effects of a proposed project. As
16 stated in Section 15382 of the State CEQA Guidelines, a “[s]ignificant effect
17 on the environment” means a substantial, or potentially substantial, adverse
18 change in any of the physical conditions within the area affected by the project.”

19 ***CVP and SWP Operational Assumptions***

20 Reclamation and DWR use CalSim-II, a specific application of the Water
21 Resources Integrated Modeling System (WRIMS) to Central Valley water
22 operations, to study operations, benefits, and effects of new facilities and
23 operational parameters for the CVP and SWP. In this DEIS, the quantitative
24 assessment of actions related to water resources relied primarily on two CalSim-
25 II baselines for CEQA and NEPA:

- 26
- 27 • “Existing Conditions,” based on a 2005 level of demand and current
facilities (a 2005 baseline)
 - 28 • “Future Conditions (No-Action Alternative),” expected future
29 conditions without the project based on forecasted 2030 demands and
30 reasonably foreseeable future projects and facilities (a 2030 baseline)

31 Operational assumptions for refinement, modeling, and evaluation of potential
32 effects of the No-Action Alternative and action alternatives included in this
33 DEIS were derived from the:

- 34
- 35 • The Reclamation 2008 *Biological Assessment on the Continued Long-
36 Term Operations of the CVP and SWP* (2008 OCAP BA) (Reclamation
2008)
 - 37 • The USFWS 2008 *Formal ESA Consultation on the Proposed
38 Coordinated Operations of the CVP and SWP* (2008 USFWS BO)
39 (USFWS 2008)

- 1 • The NMFS 2009 *BO and Conference Opinion on the Long-Term*
2 *Operations of the CVP and SWP* (2009 NMFS BO) (NMFS 2009)

- 3 • Coordinated Operations Agreement between Reclamation and DWR
4 for the CVP and SWP, as ratified by Congress (Reclamation and DWR
5 1986)

6 As Reclamation has advanced the SLWRI, the environmental, hydrologic, and
7 regulatory conditions in the Sacramento River basin and Delta have changed
8 considerably. Among these changes have been substantial declines in the
9 populations of key fish species that use the basin’s waterways and the Delta,
10 such as the delta smelt and Chinook salmon. These changes have led to a series
11 of documents and decisions that have affected CVP and SWP operations. This
12 section describes historical decisions related to CVP and SWP operations and
13 the ways in which they have influenced the SLWRI.

14 In June 2004, Reclamation prepared the 2004 Operations Criteria and Plan
15 (OCAP) to provide a description of facilities and the operating environment of
16 the CVP and SWP. Using operational information presented in the 2004 OCAP,
17 Reclamation and DWR developed the 2004 OCAP Biological Assessment
18 (BA), prepared as part of the consultation process required by Section 7 of the
19 Federal Endangered Species Act (ESA).

20 Reclamation consulted with NMFS and USFWS on the 2004 OCAP, and the
21 two agencies issued the 2004 NMFS Biological Opinion (BO) (NMFS 2004)
22 and 2005 USFWS BO (USFWS 2005), respectively. In 2007, the District Court
23 for the Eastern District of California (District Court), in *Natural Resources*
24 *Defense Council v. Kempthorne*, found the 2005 USFWS BO to be unlawful
25 and inadequate. In May 2008, in *Pacific Coast Federation of Fishermen’s*
26 *Associations v. Gutierrez*, the District Court found the 2004 NMFS BO to be
27 unlawful and inadequate. The District Court remanded both BOs to the fishery
28 agencies.

29 In August 2008, Reclamation reinitiated consultation with the fishery agencies
30 based on the 2008 OCAP BA. USFWS issued the 2008 USFWS BO, finding
31 that the long-term operations of the CVP and SWP would jeopardize the
32 continued existence of the delta smelt (USFWS 2008). In June 2009, NMFS
33 issued the 2009 NMFS BO (NMFS 2009), finding that the same operations
34 would jeopardize populations of listed salmonids, steelhead, green sturgeon, and
35 orcas. Because both agencies made jeopardy determinations, both agencies
36 included a Reasonable and Prudent Alternative (RPA) in their BOs.

37 Several lawsuits were filed challenging the 2008 USFWS BO, the 2009 NMFS
38 BO, and Reclamation’s acceptance of the RPA included with each BO
39 (*Consolidated Salmonid Cases, Delta Smelt Consolidated Cases*). On
40 November 13, 2009, and March 5, 2010, the District Court concluded that

1 Reclamation had violated NEPA by failing to perform any NEPA analysis
2 before provisionally adopting the 2008 USFWS RPA and 2009 NMFS RPA. On
3 December 14, 2010, and September 20, 2011, the District Court remanded the
4 2008 USFWS BO and the 2009 NMFS BO, respectively, to the fishery
5 agencies. The District Court ordered USFWS and Reclamation to prepare a final
6 BO and associated final NEPA document by December 1, 2013. Similarly, the
7 District Court ordered NMFS and Reclamation to prepare a final BO and
8 associated final NEPA document by February 1, 2016.

9 These legal challenges have resulted in uncertainty with regard to operational
10 constraints for the CVP and SWP. As a result, evaluations of potential effects
11 of the alternatives in the Preliminary DEIS were based on available modeling
12 analysis at that time, which reflected operations described in the 2004 OCAP
13 BA and the Coordinated Operations Agreement between Reclamation and
14 DWR for the CVP and SWP. These analyses were suitable for comparison
15 purposes, and reflected expected variation among the alternatives, including the
16 type and relative magnitude of anticipated impacts and benefits.

17 In 2012 Reclamation updated the operational assumptions and modeling for the
18 SLWRI to reflect operations described in the 2008 OCAP BA, the 2008
19 USFWS BO, and the 2009 NMFS BO. These assumptions were used to guide
20 refinement, modeling, and evaluation of alternatives and were used as the basis
21 of analysis in this DEIS. Despite the uncertainty resulting from the ongoing
22 reconsultation process, the 2008 OCAP BA and the 2008 and 2009 BOs issued
23 by the fishery agencies contain the most recent estimate of potential changes in
24 water operations that could occur in the near future. Furthermore, it is currently
25 anticipated that the final BOs issued by the resource agencies will contain
26 similar RPAs. If ongoing reconsultation results change operational conditions
27 that deviate substantially from the 2008 OCAP BA and the 2008 and 2009 BOs,
28 these changes may be considered in future SLWRI documents.

29 **3.2.4 Significance Criteria**

30 Significance criteria for each resource area are provided in each resource
31 chapter of this DEIS. These criteria are based on the checklist presented in
32 Appendix G of the State CEQA Guidelines; factual or scientific information and
33 data; and regulatory standards of Federal, State, and local agencies. These
34 criteria also encompass the factors taken into account under NEPA to determine
35 the significance of an action in terms of the context and the intensity of its
36 effects.

37 **3.2.5 Impact Comparisons and Definitions**

38 Mechanisms that could cause impacts are discussed for each issue area. General
39 categories of impact mechanisms are construction and activities related to future
40 operation and maintenance, as described in Chapter 2, "Alternatives." Project-
41 related impacts are categorized as follows, to describe the intensity or duration
42 of the impact:

- 1 • A **temporary** impact would last less than 3–4 years and typically
2 would occur only during construction.
- 3 • A **short-term** impact could occur during construction and could last
4 from the time construction ceases to within 3–5 years after
5 construction.
- 6 • A **long-term** impact would last longer than 5 years after the completion
7 of construction. In some cases, a long-term impact could be a
8 permanent impact.
- 9 • A **direct** impact is an impact that would be caused by an action and
10 would occur at the same time and place as the action.
- 11 • An **indirect** impact is an impact that would be caused by an action but
12 would occur later in time or at another location, yet is reasonably
13 foreseeable in the future.
- 14 • A **cumulative** impact is a project’s impacts combined with impacts
15 from other past, present, and reasonably foreseeable future projects. A
16 project’s incremental impacts are not “cumulatively considerable”
17 solely because other projects would have a significant cumulative
18 impact; rather, the project would also need to contribute considerably to
19 a significant cumulative impact (State CEQA Guidelines, Section
20 15064(h)(1)).

21 3.2.6 Impact Levels

22 The terminology listed below is used to denote the significance of
23 environmental impacts of the No-Action Alternative and action alternatives.
24 This section is intended to allow the use of this DEIS for CEQA purposes.

- 25 • **No impact** would occur if the construction, operation, and maintenance
26 of the alternative under consideration would not have any direct or
27 indirect effects on the environment. “No impact” means no change
28 from existing conditions. This impact level does not need mitigation.
- 29 • An impact that would not result in a substantial and adverse change in
30 the environment would be **less than significant**. This impact level does
31 not require mitigation under CEQA, even if applicable measures are
32 available.
- 33 • A **significant** impact is defined by California Public Resources Code
34 (PRC) Section 21068 as “a substantial, or potentially substantial,
35 adverse change in the environment.” Levels of significance can vary by
36 project, based on the change in the existing physical condition. This
37 DEIS uses the CEQA definition of “significant impact.”

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- A **potentially significant** impact is one that, if it were to occur, would be considered a significant impact as described above; however, the occurrence of the impact cannot be immediately determined with certainty. For CEQA purposes, a potentially significant impact is treated as if it were a significant impact. Therefore, under CEQA, feasible mitigation measures or alternatives to the proposed action must be identified, where applicable, to reduce the magnitude of potentially significant impacts.
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- A **significant and unavoidable** impact is a substantial or potentially substantial adverse effect on the environment that cannot be reduced to a less-than-significant level even with any feasible mitigation. Under CEQA, a project with significant and unavoidable impacts could proceed, but the lead agency would be required to do the following:
 - Conclude in findings that there are no feasible means of substantially lessening or avoiding the significant impact in accordance with Section 15091(a)(3) of the State CEQA Guidelines (i.e., California Code of Regulations (CCR) Title 14, Section 15091(a)(3)).
 - Prepare a statement of overriding considerations, in accordance with Section 15093 of the State CEQA Guidelines, explaining why the lead agency would proceed with a project in spite of the potential for significant impacts.
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- A **significant cumulative** impact would occur when the project would make a “cumulatively considerable incremental contribution” to an overall significant cumulative impact. If an overall cumulative impact would not be significant, even when the project would make a cumulatively considerable incremental contribution to the cumulative impact, then it is determined that the project would not cause a significant cumulative impact.
- 30
- 31
- A **beneficial** impact is a positive change or improvement in the environment and for which no mitigation measures are required.
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- 39
- 40
- An impact may have a level of significance that is too uncertain to be reasonably determined. Such an impact would be designated **too speculative for meaningful evaluation**, in accordance with Section 15145 of the State CEQA Guidelines. Where some degree of evidence points to the reasonable potential for a significant effect, the EIS may explain that a determination of significance is uncertain, but is still assumed to be “potentially significant,” as described above. In other circumstances, after thorough investigation, the determination of significance may still be too speculative to be meaningful. This is an

1 effect for which the degree of significance cannot be determined for
2 specific reasons. For example, aspects of the impact itself may be
3 unpredictable or the severity of consequences cannot be known at this
4 time.

5 **3.2.7 Mitigation Development Process and Objectives**

6 Mitigation measures are presented where feasible to avoid, minimize, rectify,
7 reduce, or compensate for significant and potentially significant impacts of the
8 proposed action and alternatives, in accordance with Section 15126.4 of the
9 State CEQA Guidelines and NEPA regulations (40 CFR 1508.20). Each
10 mitigation measure is identified numerically to correspond with the number of
11 the impact being mitigated by the measure. No mitigation measures are needed
12 when an impact is determined to be “less than significant” or “beneficial,” or
13 where no impact would occur. Where sufficient feasible mitigation is not
14 available to reduce an impact to a less-than-significant level, the impact is
15 identified as “significant and unavoidable.”

16 **3.2.8 Significance After Mitigation**

17 For every impact that would be significant or potentially significant, mitigation
18 is applied, if feasible, to avoid or reduce the impact to a less-than-significant
19 level and one of two conclusions is reached:

- 20 • The mitigation would reduce the impact to a less-than-significant level.

21 OR

- 22 • No feasible mitigation exists to reduce the impact to a less-than-
23 significant level, and thus the impact would be significant and
24 unavoidable.

25 Impact significance is reevaluated after application of mitigation in this DEIS.

26 **3.2.9 Cumulative Effects**

27 This section provides an analysis of overall cumulative effects of the project
28 alternatives and the No-Action Alternative. Cumulative effects are determined
29 by analyzing the potential for project impacts to combine with the impacts of
30 other past, present, and reasonably foreseeable future projects to produce
31 project-related impacts (as defined above). This analysis follows applicable
32 guidance provided by CEQ in *Considering Cumulative Effects under the*
33 *National Environmental Policy Act* (CEQ 1997) and *Guidance on the*
34 *Consideration of Past Actions in Cumulative Effects Analysis* (CEQ 2005).

35 ***Definitions of Cumulative Effects***

36 The CEQ regulations that implement NEPA provisions define a cumulative
37 effect as “the impact on the environment which results from the incremental
38 impact of the action when added to other past, present, and reasonably

1 foreseeable future actions regardless of what agency (federal or nonfederal) or
2 person undertakes such other actions” (40 CFR 1508.7).

3 Cumulative impacts can result from individually minor but collectively
4 significant actions over time, and they differ from indirect impacts (40 CFR
5 1508.8). They are caused by the incremental increase in total environmental
6 effects that occurs when the evaluated project is added to other past, present,
7 and reasonably foreseeable future actions. Cumulative effects can thus arise
8 from causes that are totally unrelated to the project being evaluated, and the
9 analysis of cumulative effects looks at the life cycle of the effects, not the
10 project at issue. These effects can be either adverse or beneficial.

11 Cumulative impacts are defined in the State CEQA Guidelines (14 CCR Section
12 15355) as “two or more individual effects which, when considered together, are
13 considerable or which compound or increase other environmental impacts.” A
14 cumulative impact occurs from “the change in the environment which results
15 from the incremental impact of the project when added to other closely related
16 past, present, and reasonably foreseeable future projects. Cumulative impacts
17 can result from individually minor but collectively significant projects taking
18 place over a period of time” (14 CCR Section 15355(b)).

19 Consistent with the State CEQA Guidelines (14 CCR Section 15130(a)), the
20 discussion of cumulative impacts in Chapters 4–25 focuses on significant and
21 potentially significant cumulative impacts. The State CEQA Guidelines (14
22 CCR Section 15130(b)) state that:

23 *The discussion of cumulative impacts shall reflect the severity*
24 *of the impacts and their likelihood of occurrence, but the*
25 *discussion need not provide as great detail as is provided for*
26 *the effects attributable to the project alone. The discussion*
27 *should be guided by the standards of practicality and*
28 *reasonableness, and should focus on the cumulative impact to*
29 *which the identified other projects contribute rather than the*
30 *attributes of other projects which do not contribute to the*
31 *cumulative impact.*

32 **Effects of Project Implementation with Climate Change**

33 Each resource area evaluates the effects of SLWRI actions combined with
34 predicted effects of climate change. The ways that the SLWRI could affect
35 GHG production are described in Chapter 5, “Air Quality and Climate.” The
36 Climate Change Projection Appendix provides a summary of global climate
37 forecasts and a discussion of the implications of climate change for California
38 water resources. This appendix also includes quantitative analyses of climate
39 change for selected comprehensive plans on resource areas. The discussion of
40 climate change implications provided in the Climate Change Projection
41 Appendix provides context for consideration of cumulative conditions.

1 ***Relationship to CALFED Programmatic Cumulative Impacts Analysis***

2 The analysis of cumulative effects in this DEIS considers but does not tier from
3 the cumulative effects assessment in the CALFED Bay-Delta Program
4 (CALFED) Programmatic EIS/EIR. The “Shasta Lake Enlargement” project
5 was included in the cumulative impacts analysis of the CALFED Programmatic
6 EIS/EIR as a project in CALFED’s Storage Program (CALFED 2000).

7 This project-specific analysis considers, but stands alone from and refines, the
8 analysis of cumulative effects in the CALFED Programmatic EIS/EIR
9 (CALFED 2000). This analysis focuses on issues resulting from the effects of
10 the SLWRI combined with other reasonably foreseeable future projects. This
11 DEIS considers CALFED projects that have been implemented, are being
12 implemented, or are reasonably foreseeable future projects. The projects that
13 have been implemented are considered as part of existing conditions; reasonably
14 foreseeable future projects are considered as part of future conditions.

15 ***Methods and Assumptions***

16 For purposes of this DEIS, cumulative impacts of an action alternative would be
17 significant if implementing the alternative would make a considerable
18 incremental contribution to a significant cumulative effect. The alternative’s
19 contribution is evaluated in combination with the effects of other past, present,
20 and reasonably foreseeable future projects to determine whether (1) the overall
21 cumulative effect would be significant and (2) the alternative’s contribution
22 would be considerable. Cumulatively significant impacts would do any of the
23 following:

- 24 • Cause a significant adverse effect on a resource (using the criteria for
25 significance described in the “Environmental Consequences and
26 Mitigation Measures” sections of Chapters 4–25 of this DEIS)

- 27 • Adversely affect a resource that already has a degraded or declining
28 condition because of substantial adverse effects that have already
29 occurred

- 30 • Cause effects that initially were not significant, but would be part of an
31 irreversible degrading or declining trend

32 Following CEQ guidance, Reclamation has identified associated actions (past,
33 present, or future) that, when viewed with the proposed or alternative actions,
34 may have significant cumulative impacts. Table 3-1 lists the plans, projects, and
35 programs that were considered for each resource area.

36 The State CEQA Guidelines identify two basic methods for establishing the
37 cumulative environment in which the project is to be considered: using a list of
38 past, present, and probable future projects (the “list approach”) or using adopted
39 projections from a general plan, other regional planning document, or certified
40 EIR for such a planning document (the “plan approach”). For this analysis of

1 cumulative impacts, the list approach and the plan approach have been
2 combined in quantitative and qualitative assessments to generate the most
3 comprehensive future projections possible. The methodology for each of these
4 assessments is described following Table 3-1.

5

Table 3-1. Present and Reasonably Foreseeable Future Actions Included in the Analysis of Cumulative Impacts, by Resource Area

Cumulative Projects
Quantitative
Forecasted 2030 Level of Demands for Water Supplies
Freeport Regional Water Project
Delta Water Supply Project
DWR South Bay Aqueduct Improvement and Enlargement Project
Vernalis Adaptive Management Plan
San Joaquin River Restoration Program – Full Restoration Flows
Grassland Bypass Project
Qualitative Assessment of Actions Related to Water/ Natural Resource Management and Restoration
Central Valley Project Improvement Act
Clear Creek Actions of the CVPIA Anadromous Fish Restoration Program
CALFED Ecosystem Restoration Program
Qualitative Assessment of Actions Related to the 2009 NMFS Biological Opinion
Clear Creek Actions: -Spawning Gravel Augmentation -Spring Creek Temperature Control Curtain -Adaptively Manage to Habitat Suitability/IFIM Study
Fish Passage Program (Action V) at Shasta and Folsom Dams
Sacramento River Basin Salmonid Rearing Habitat Improvements: -Restoration of Floodplain Rearing Habitat -Near Term Actions at Liberty Island/Lower Cache Slough and Lower Yolo Bypass -Lower Putah Creek Enhancements
Giant Garter Snake Recovery Plan
The Water Quality Control Plan for the California Regional Water Quality Control Board: Central Valley Region, the Sacramento River Basin and San Joaquin River Basin
The California Air Resources Board Climate Change Scoping Plan: A Framework for Change
Bay Delta Conservation Plan
San Joaquin River Restoration Program
Trinity River Mainstem Fishery Restoration Program
Sacramento River Conservation Area Forum Program
Iron Mountain Mine Restoration Plan
Draft Invasive Non-Native Plant (Weed) Management Plan for the Mouth of Cottonwood Creek Wildlife Area
Deer Creek Flow Enhancement Program
Lower Deer Creek Falls Fish Passage Improvement Project
Battle Creek Salmon and Steelhead Restoration Project
Butte Regional Conservation Plan
North-of-Delta Offstream Storage Investigation

Table 3-1. Present and Reasonably Foreseeable Future Actions Included in the Analysis of Cumulative Impacts, by Resource Area (contd.)

Cumulative Projects
Fremont Landing Conservation Bank
Yuba Salmon Forum Fish Passage Studies (Upper Yuba River Studies Program)
Davis-Woodland Water Supply Project
North Bay Aqueduct Alternative Intake Project
Lower Clear Creek Anadromous Fish Restoration and Management Project
North Delta Flood Control and Ecosystem Restoration Project
Two-Gates Fish Protection Demonstration Project
Franks Tract Project
Dutch Slough Tidal Marsh Restoration Project
Suisun Marsh Management, Preservation, and Restoration Plan
In-Delta Storage Program (Delta Wetlands Project)
Los Vaqueros Reservoir Expansion Project
East Bay Municipal Utility District Water Supply Management Program 2040
Bay Area Regional Desalination Project
Upper San Joaquin River Basin Storage Investigation (Temperance Flat Reservoir)
San Luis Drainage Reevaluation Program
Central Valley Salinity Alternatives for Long-Term Sustainability Initiative
San Joaquin River Salinity at Vernalis Salt and Boron TMDL and Basin Plan Amendment
B.F. Sisk Dam Corrective Action Project
San Luis Reservoir Low Point Improvement Project
Qualitative Assessment of Actions Related to Flood Management
Central Valley Flood Protection Plan
CALFED Levee System Integrity Program
Sacramento River Bank Protection Project
Folsom Dam Joint Federal Project
Natomas Levee Improvement Program Landslide Improvement Project
West Sacramento Levee Improvement Program
Delta Islands and Levees Feasibility Study

Table 3-1. Present and Reasonably Foreseeable Future Actions Included in the Analysis of Cumulative Impacts, by Resource Area (contd.)

Cumulative Projects
Qualitative Assessment of Actions Related to Energy
Increased Hydropower Generation Capacity at Lewiston Dam
Pacific Gas & Electric Company Pit River 3, 4 & 5 Hydroelectric Projects License Implementation
Pacific Gas & Electric Company McCloud and Pit Rivers 6 and 7 FERC Relicensing
California Department of Water Resources Oroville Facilities FERC Relicensing
Sacramento Municipal Utility District Upper American River Project
Qualitative Assessment of Actions Related to Land Use Planning and Infrastructure
Antlers Bridge Replacement
Jellys Ferry Bridge Replacement

Key:

CALFED = CALFED Bay-Delta Program

CVPIA = Central Valley Project Improvement Act

FERC = Federal Energy Regulatory Commission

IFIM = Instream Flow Incremental Methodology

NMFS = National Marine Fishery Service

TMDL = total maximum daily load

1 **Quantitative Assessments** Quantitative assessments were completed for each
2 of the resource areas in this DEIS, where feasible. The effects of actions related
3 to water resources and effects of development projects were assessed
4 quantitatively. Quantitative changes to water resources and air quality were
5 considered qualitatively in the consideration of cumulative impacts on related
6 resources. The methodologies for the quantitative assessments are described
7 below.

8 *Quantitative Assessment of Actions Related to Water Resources* In this DEIS,
9 the quantitative assessment of actions related to water resources relied primarily
10 on CalSim-II modeling of hydrologic conditions that could affect the
11 environment. The model was run using two different baselines:

- 12 • “Existing conditions,” based on 2005 facilities and demands (a 2005
13 baseline)
- 14 • “Future conditions,” based on forecasted 2030 demands and reasonably
15 foreseeable future projects and facilities (a 2030 baseline)

16 The 2030 baseline does not account for potential changes in water demands
17 resulting from the effects of climate change. Potential changes in water demand
18 due to climate change are described qualitatively in the “Qualitative
19 Assessments” section. The 2030 baseline includes the following reasonably
20 foreseeable future projects and conditions, described separately below:

- 21 • Forecasted 2030 level of demands for water supplies
- 22 • Freeport Regional Water Project
- 23 • Delta Water Supply Project
- 24 • DWR South Bay Aqueduct Improvement and Enlargement Project
- 25 • Vernalis Adaptive Management Plan (VAMP)
- 26 • San Joaquin River Restoration Program (SJRRP) – Full Restoration
27 Flows
- 28 • Grassland Bypass Project

29 *Forecasted 2030 Level of Demands for Water Supplies* Reclamation and
30 DWR developed assumptions for evaluating systemwide hydrologic and water
31 supply conditions with CalSim-II under existing and future conditions. Detailed
32 descriptions of the CalSim-II model, the modeling methodology used in
33 evaluations, and key assumptions (including forecasted 2030 facilities and
34 demands) are provided in the Modeling Appendix. For a summary of the

1 analysis and modeling results, see the Hydrology, Hydraulics, and Water
2 Management Technical Report (in the Physical Resources Appendix).

3 To quantify cumulative effects on hydrologic conditions, modeling runs with
4 No-Action Alternative (2030) conditions were compared to modeling runs with
5 existing (2005) conditions. For example, the No-Action Alternative (2030
6 baseline) was compared to existing conditions (2005 baseline) to identify the
7 cumulative impacts of reasonably foreseeable future projects and conditions on
8 hydrologic conditions. Similarly, project alternatives were compared to existing
9 conditions (thus satisfying CEQA requirements) and to the No-Action
10 Alternative (2030) (satisfying NEPA requirements) to identify the combined
11 cumulative effect of project alternatives and other foreseeable projects and
12 facilities. The No-Action Alternative (2030) includes forecasted year-2030
13 demands for water. These forecasted demands are considered to be reasonably
14 foreseeable for determining cumulative impacts.

15 *Freeport Regional Water Project* The Freeport Regional Water Project is
16 intended to provide water for East Bay Municipal Utility District (EBMUD)
17 customers in dry years and needed water for the Sacramento region by drawing
18 water from the Sacramento River near the town of Freeport. The project
19 consists of a new 185-million-gallon-per-day water intake structure and
20 pumping plant on the Sacramento River, a new large-diameter pipeline to
21 transport water eastward from the intake to a new Sacramento County Water
22 Agency water treatment plant and to the existing Folsom South Canal. The
23 Freeport Regional Water Project is included only in future conditions for the
24 SLWRI.

25 *Delta Water Supply Project* The Delta Water Supply Project provides a
26 new supplemental high-quality water supply for the Stockton metropolitan area.
27 The completed project is intended to replace declining surface water resources,
28 protect groundwater supplies, and provide for current and future water needs in
29 the Stockton metropolitan area. The project includes a new intake and pump
30 station that will divert water from the San Joaquin River through miles of
31 underground pipeline to a new 30-million-gallon-per-day water treatment plant.
32 The project will help meet Stockton's water needs, as detailed in the City of
33 Stockton's general plan, through 2025. The Delta Water Supply Project is
34 included only in future conditions for the SLWRI.

35 *DWR South Bay Aqueduct Improvement and Enlargement Project* The
36 South Bay Aqueduct conveys water from the Delta through more than 40 miles
37 of pipelines and canals to the Zone 7 Water Agency and the Alameda County
38 and Santa Clara Valley water districts. Those three water districts, in turn, serve
39 the cities of Livermore, Dublin, Pleasanton, San Ramon, Fremont, Newark,
40 Union City, Milpitas, Santa Clara, and San Jose.

41 The first conveyance facility constructed for the SWP, the South Bay Aqueduct
42 was designed for a capacity of 300 cfs. Recent flow tests and studies have

1 shown that the actual capacity is 270 cfs. The purpose of the South Bay
2 Aqueduct Enlargement Project is to increase the aqueduct's capacity to 430 cfs
3 to meet the Zone 7 Water Agency's future needs and provide operational
4 flexibility to reduce the SWP's peak power consumption.

5 The following are the principal features of this project:

- 6 • Add four 45 cfs pumps to the South Bay Pumping Plant, and expand
7 the existing plant structure and add a new service bay and switchyard.
- 8 • Construct a third (Stage 3) Brushy Creek pipeline and surge tank
9 parallel to the existing two barrels.
- 10 • Construct a 500-acre-foot reservoir (425 acre-feet of active storage) to
11 be served by the Stage 3 Brushy Creek Pipeline.
- 12 • Raise the height of the canal embankments, canal lining, and canal
13 overcrossing structures and bridges along the Dyer, Livermore, and
14 Alameda canals and at the Patterson Reservoir.
- 15 • Modify check structures and siphons along the Dyer, Livermore, and
16 Alameda canals.
- 17 • Construct new drainage overcrossing structures to eliminate drainage
18 into the canals.

19 Construction is proceeding on enlargement of the South Bay Pumping Plant to
20 make room for the four new pump units (DWR 2011a). The South Bay
21 Aqueduct Improvement and Enlargement Project is included only in future
22 conditions for the SLWRI.

23 *Vernalis Adaptive Management Plan* The VAMP was proposed under the
24 1998 San Joaquin River Agreement, which was adopted by the State Water
25 Resources Control Board (SWRCB) in Water Right Decision 1641 (December
26 1999).

27 The 12-year VAMP provided for additional flows in the lower San Joaquin
28 River during a 31-day pulse-flow period during April and May. The predicted
29 April 15 San Joaquin River flows at Vernalis were increased by 1 to 2
30 predefined "steps," ranging from 1,200 cubic feet per second (cfs) to 1,300 cfs
31 between each step. If the average of water-year conditions for the current year
32 and the previous year was a below-normal, dry, or critical condition, then the
33 flows would only be increased to the next step. However, if the average of
34 water-year conditions for the current year and the previous year was a wet,
35 above-normal, or average (i.e. between above normal and below normal)
36 condition, then the flows would be increased by two steps. During a multiple
37 year drought, when the current and previous two water years were comprised of

1 either (1) three critical years or (2) two critical years and one dry year, there
2 would be no required flow increases under VAMP. VAMP flow requirements
3 typically were met either through additional releases or through reductions in
4 demands from the Merced Irrigation District, Oakdale Irrigation District,
5 Mendota Pool Exchange Contractors, Modesto Irrigation District, and Turlock
6 Irrigation District.

7 Although the VAMP and San Joaquin River Agreement expired in 2011,
8 Reclamation intends to continue implementing actions similar to the VAMP for
9 the foreseeable future, or until the SWRCB adopts new, permanent objectives
10 for San Joaquin River flows that replace the current program. Reclamation is
11 currently implementing a “single-step” VAMP, in which flows are increased by
12 only one step in all water year types. As an interim solution, all flow increases
13 to meet single-step VAMP flow targets are being provided by Merced Irrigation
14 District under a 2-year agreement with Reclamation (covering spring 2012 and
15 spring 2013).

16 Single-step VAMP operations are reflected in the SLWRI’s modeling of
17 existing conditions. Based on the SWRCB’s October 2011 Technical Report, it
18 is anticipated that new flow objectives will require that a certain percentage of
19 unimpaired inflow (e.g., 20–60 percent) be dedicated for fishery purposes in the
20 February through June time frame on the Stanislaus, Tuolumne, and Merced
21 rivers to accomplish a narrative fish doubling goal consistent with the Central
22 Valley Project Improvement Act (CVPIA) (SWRCB 2011). (See the discussion
23 of the CVPIA in “Qualitative Assessment of Actions Related to Water
24 Resources,” later in this chapter.)

25 Future SWRCB objectives will likely be as protective as the original VAMP
26 requirements and are anticipated to remain in place through 2030. Accordingly,
27 the SLWRI’s modeling of future conditions has incorporated full VAMP flow
28 requirements.

29 *San Joaquin River Restoration Program – Full Restoration Flows* The
30 SJRRP was established in 2006 to implement the Stipulation of Settlement in
31 *NRDC, et al., v. Kirk Rodgers, et al.* (Settlement) (See also the discussion of the
32 SJRRP in “Qualitative Assessment of Actions Related to Water Resources,”
33 later in this chapter.) Federal authorization for implementing the Settlement is
34 provided in the San Joaquin River Restoration Settlement Act, included in
35 Public Law 111-11.

36 The Settlement calls for releases of water from Friant Dam to the confluence of
37 the Merced River, referred to as Interim and Restoration flows; a combination
38 of channel-related and structural modifications along the San Joaquin River
39 below Friant Dam; and reintroduction of Chinook salmon. Restoration Flows
40 are specific volumes of water to be released from Friant Dam during different
41 year types, according to Exhibit B of the Settlement. Interim Flows are
42 experimental flows that will continue until full Restoration Flows begin, and

1 will collect relevant data about flows, temperatures, fish needs, seepage losses,
2 recirculation, recapture, and reuse.

3 The release of Interim Flows began in October 2009; however, the release of
4 Interim Flows is limited by channel capacity constraints between Friant Dam
5 and the Merced River confluence. Interim Flows will continue as SJRRP actions
6 are implemented to increase channel capacity, until full Restoration Flows begin
7 (anticipated January 1, 2014), as constrained by then-existing channel capacity
8 (Reclamation 2012). Restoration Flows will include releases from Friant Dam
9 of up to 840 thousand acre-feet, depending on year type. In some years, peak
10 releases from Friant Dam could reach as much as 8,000 cfs for several hours,
11 within the constraints of channel capacity. For the SLWRI, existing conditions
12 include Interim Flows and future conditions include full Restoration Flows.

13 *Grassland Bypass Project* The Grassland Bypass Project is a stakeholder
14 initiative designed to improve water quality in the channels used to deliver
15 water to the San Joaquin River and wetland areas in the Grassland watershed.
16 Irrigation of soils containing high levels of salt and selenium has caused high
17 levels of selenium to leach into the subsurface drainage water in the 97,000-acre
18 Grassland Drainage Area. Before the Grassland Bypass Project began, this
19 agricultural drainage water ultimately discharged into the San Joaquin River
20 through Salt Slough, Mud Slough, and other channels used to deliver water to
21 wetland areas in the Grassland watershed. The San Joaquin River is included on
22 the Clean Water Act (CWA) Section 303(d) list of impaired waters as impaired
23 for 18 different pollutants, with total maximum daily load (TMDL) set for 6 of
24 these pollutants within the watershed (selenium, dissolved oxygen, diazinon,
25 chlorpyrifos, salt, and boron). Approximately 8,200 acres of Grasslands
26 watershed marshes, a portion of the lower San Joaquin River (from the
27 confluence with Mud Slough to the Merced River confluence), and Mud Slough
28 are listed on the CWA Section 303(d) list of impaired waters for exceeding
29 water quality objectives for selenium.

30 The Grassland Bypass Project has been implementing agricultural best
31 management practices and measures to reroute drainage water to reduce total
32 selenium loading to impaired waters. The objectives of the project have been to
33 achieve short-term load reductions by 2010 (partial implementation) and to
34 prohibit all discharges exceeding selenium objectives by 2019 (full
35 implementation). Between 1998 and 2009, best management practices
36 implemented by Grassland area farmers prevented the discharge of more than
37 22,000 pounds of selenium to listed waters. As a result, Salt Slough and a
38 portion of the lower San Joaquin River have been removed from the 303(d) list
39 of impaired waters. In 2012, the volume of agricultural drainage water
40 discharged from the Grassland Drainage Area into the San Luis Drain was
41 reduced by 12,000 acre-feet through displacement across the San Joaquin River
42 Water Quality Improvement Project reuse area.

1 For the SLWRI, the water operations models for existing conditions and future
2 conditions include partial implementation and full implementation, respectively,
3 of the Grassland Bypass Project.

4 *Quantitative Assessment of Effects on Air Quality* For this analysis of
5 cumulative impacts, regional impacts on air quality are analyzed quantitatively
6 using the plan approach. As described in Chapter 5, “Air Quality and Climate,”
7 significance thresholds for the Shasta County Air Quality Management District
8 (SCAQMD) are defined in the *Shasta County General Plan* (SCAQMD 2004).
9 The analysis of local cumulative impacts is based on both the plan approach,
10 which defines impact thresholds, and the list approach, which identifies projects
11 that may emit pollutants in the same area as the SLWRI. SCAQMD standards
12 for criteria pollutants have been established to limit the emissions of individual
13 projects when considering the cumulative effect of all projects on regional
14 pollutant concentrations. Therefore, a significant direct project impact would
15 also be a cumulatively considerable incremental contribution to a significant
16 cumulative impact.

17 The 2007 Urban Emissions model (URBEMIS) was used to estimate emissions
18 of pollutants from construction activities. Among the inputs to the model for
19 construction analysis were the types and quantities of construction equipment to
20 be used, along with the hours of use; areas of land to be graded; number of truck
21 trips and trip distances for export of spoils and import of materials; volumes of
22 buildings to be demolished; areas of buildings to be built; and areas of land to
23 be paved. For postconstruction activities, the principal inputs were the number
24 of vehicle trips and average trip distances. The methods and results of this
25 analysis are described in greater detail in Chapter 5, “Air Quality and Climate.”

26 **Qualitative Assessments** Past, present, and reasonably foreseeable future
27 actions were assessed qualitatively. Information on current and historical
28 conditions was used to evaluate the combined effects of past actions on resource
29 areas and issues. For present and reasonably foreseeable future actions, a list of
30 related actions was compiled. The combined effects of past, present, and
31 reasonably foreseeable future actions were then evaluated with effects of the
32 project.

33 A large number of past actions have occurred in the study area. These past
34 actions have strongly influenced existing conditions, and some past actions
35 created “legacies” that are still affecting resources. Among the legacies is the
36 sediment released by hydraulic mining and the metal contamination that is still
37 being generated by abandoned mines. The following are the most important
38 combined effects of these past actions:

- 39 • Population growth and associated development of socioeconomic
40 resources and infrastructure

- 1 • Conversion of natural vegetation to agricultural and developed land
2 uses
- 3 • Introduction of nonnative plant and animal species
- 4 • Resource extraction (e.g., mining, grazing, and timber harvests)
- 5 • Development of water supply, particularly the construction and
6 operation of Shasta Dam, the rest of the CVP, and the SWP

7 Present projects and reasonably foreseeable future projects include projects that
8 are currently under construction, approved for construction, or in the final
9 stages of formal planning. The present and reasonably foreseeable future actions
10 considered in this analysis of cumulative impacts are those actions located
11 within the primary or extended study area that have been identified as
12 potentially affecting resources that also may be affected by the SLWRI.

13 A preliminary list of actions was compiled by reviewing available information
14 regarding planned projects (including agency Web sites). Actions were then
15 reviewed for inclusion in the cumulative impacts analysis based on three
16 criteria:

- 17 • The action has an identified sponsor actively pursuing project
18 development; the sponsor has completed or issued NEPA and/or CEQA
19 compliance documents such as a DEIS or DEIR; and the action appears
20 to be “reasonably foreseeable,” given other considerations such as
21 public and stakeholder controversy.
- 22 • Available information defines the action in sufficient detail to allow
23 meaningful analysis.
- 24 • The action could affect resources that would be potentially affected by
25 action alternatives.

26 Any action that could affect resources that would be potentially affected by
27 action alternatives and is under construction was also considered “reasonably
28 foreseeable.”

29 Based on this review, the effects of the actions described below were considered
30 qualitatively in the assessment of cumulative effects of action alternatives. This
31 list is organized into four categories of actions: water resources, resource
32 management and restoration, levee, and development actions. Some unknown
33 subset of the following projects, though not strictly meeting the criteria above,
34 would likely be implemented, such as the Bay Delta Conservation Plan (and
35 associated alternative Delta conveyance facilities), the North-of-Delta
36 Offstream Storage Facility (Sites Reservoir), and the Upper San Joaquin River
37 Basin Storage Investigation (Temperance Flat Reservoir). It would be

1 speculative to consider these projects at any more than a conceptual level
2 because these projects and their effects are not defined in sufficient detail to
3 allow meaningful analysis.

4 The combined effects of past actions and the list of related present and
5 reasonably foreseeable future projects are described further below.

6 *Qualitative Assessment of Actions Related to Water/Natural Resource*
7 *Management and Restoration* In addition to the water resources actions
8 described above in the section “Quantitative Assessment of Actions Related to
9 Water Resources,” the water/natural resources–related management and
10 restoration actions described below were identified as present or reasonably
11 foreseeable.

12 *Central Valley Project Improvement Act* The CVPIA (Title 34, Sections
13 3401 through 3408(h) of Public Law 102-575) is concerned with restoring
14 anadromous fish populations, providing water supplies for Federal and State
15 refuges, mitigating effects of the CVP on other fish and wildlife, and retiring
16 drainage-impaired farmlands. To fulfill these provisions, the CVPIA established
17 an ongoing program creating a fund for restoration actions. The program is
18 financed by the CVP’s water and power users and administered by Reclamation.
19 Funds are contributed to multiple restoration actions annually to finance
20 restoration of aquatic, riparian, and other habitats and modify CVP operations.

21 The CVPIA directs the Secretary of the Interior to develop and implement a
22 program that makes all reasonable efforts to double natural production of
23 anadromous fish in Central Valley streams (Section 3406(b)(1)). The general
24 objectives of the CVPIA Anadromous Fish Restoration Program are as follows:

- 25 • Improve anadromous fish habitat through physical habitat parameters
26 as well as suitable flow parameters.
- 27 • Reduce the entrainment of juvenile fish at diversions.
- 28 • Collect fisheries data in a way that provides for the evaluation of
29 restoration actions.
- 30 • Integrate restoration efforts with harvest and hatchery management.
- 31 • Involve stakeholders in the implementation and evaluation of
32 restoration actions.

33 The Clear Creek Actions of the CVPIA Anadromous Fish Restoration Program
34 involve modifying flow releases and replenishing gravels in the river
35 downstream from Whiskeytown Dam to enhance spawning, egg incubation, and
36 emigration by spring-, fall-, and late fall–run Chinook salmon. These actions
37 also include gravel restoration, spring flushing, temperature control, and

1 channel maintenance. Additionally, requirements of the Clear Creek Actions –
2 all implemented to benefit anadromous fish habitat – include restoring habitat
3 damaged by gravel mining in the area, decommissioning McCormick-Saeltzer
4 Dam, developing a stream corridor protection program to prevent habitat
5 degradation caused by sedimentation and urbanization, and developing a
6 watershed management and analysis plan.

7 *CALFED Ecosystem Restoration Program* USFWS and NMFS
8 implement CALFED’s Ecosystem Restoration Program (ERP) with guidance
9 from the Delta Stewardship Council and the Delta Plan, and in coordination
10 with the Sacramento–San Joaquin Delta Conservancy. The ERP works to
11 improve the ecological health of the Bay-Delta watershed by restoring and
12 protecting habitats, ecosystem functions, and native species. Since the
13 program’s inception, ERP agencies have identified more than 600 programmatic
14 actions and 119 milestones throughout the Bay-Delta watershed. The program
15 includes all projects authorized, funded, and permitted (even if not constructed)
16 to date, particularly in the Delta, that aim to do any of the following:

- 17 • Recover at-risk native species dependent on the Delta, Suisun Bay, and
18 San Francisco Bay
- 19 • Minimize the downward population trends of native species that are not
20 listed
- 21 • Protect and restore functional habitat types in the Bay-Delta estuary
22 and its watershed for ecological and public values
- 23 • Prevent the establishment of additional nonnative invasive species and
24 reduce the negative ecological and economic impacts of established
25 nonnative species in the Bay-Delta estuary
- 26 • Improve and/or maintain water and sediment quality conditions that
27 fully support healthy and diverse aquatic ecosystems in the Bay-Delta
28 estuary and watershed

29 *2009 NMFS Biological Opinion Sacramento River Habitat Restoration*
30 *and Enhancement and Fish Passage Actions* The 2009 NMFS BO included
31 Reasonable and Prudent Alternatives to improve conditions for anadromous fish
32 in the Sacramento River basin. These RPAs included revised water operations,
33 habitat restoration and enhancement actions, and fish passage actions. Water
34 operations defined in RPAs were included in the modeling evaluations for both
35 existing and future conditions, and therefore were included in cumulative
36 effects analyses. However, the following restoration and enhancement actions
37 and fish passage actions for the Sacramento River and its tributaries were not
38 included in existing or future conditions operations modeling. The actions
39 related to the 2009 NMFS BO described below were identified as present or
40 reasonably foreseeable actions.

1 Clear Creek Actions

2 Clear Creek RPAs were designed to prevent spring-run Chinook salmon from
3 hybridizing with fall-run Chinook salmon in the Sacramento River. To prevent
4 this hybridization, the following projects have been developed to attract early
5 spring-run adults far upstream in Clear Creek where reservoir holding has
6 maintained cooler water temperatures throughout the summer:

- 7
- 8 • **Spawning Gravel Augmentation** – This effort includes the continued
9 augmentation of spawning gravels in Clear Creek to enhance spawning
10 habitat for fall-run, late fall-run, and spring-run Chinook salmon as
11 well as steelhead.
 - 12 • **Spring Creek Temperature Control Curtain** – This project is the
13 replacement of the Spring Creek Temperature Control Curtain in
14 Whiskeytown Lake, in an effort to maintain the Spring Creek Tunnel’s
15 releases of cold water to Keswick Reservoir for winter-run Chinook
salmon spawning and incubation.
 - 16 • **Adaptively Manage to Habitat Suitability/ Instream Flow**
17 **Incremental Methodology Study Results** – This action is to develop a
18 state-of-the-art scientific analysis of habitat suitability to enable the
19 continuation of flows adequate for anadromous fish migration and the
20 maintenance of spawning gravels and suitable water temperatures for
21 anadromous fish survival.

22 Fish Passage Program (Action V) at Shasta and Folsom Dams

23 The elements identified in the Fish Passage Program are near-term and long-
24 term goals to provide passage for Sacramento River winter-run, spring-run, and
25 Central Valley steelhead above Shasta and Folsom dams. Substantial areas of
26 high-quality habitat exist above these dams, with colder water in high-elevation
27 areas that represents a suitable refuge for cold-water fish in the face of climate
28 change. The assessment will develop information necessary for consideration
29 and development of fish passage options for the Basalt and Porous Lava Groups
30 of Central Valley steelhead and spring-run Chinook salmon and Sacramento
31 River winter-run Chinook salmon.

32 Sacramento River Basin Salmonid Rearing Habitat Improvements

33 This suite of actions consists of near-term and long-term actions to restore
34 floodplain rearing habitat for juvenile winter-run, spring-run, and Central
35 Valley steelhead in the lower Sacramento River basin. These actions are
36 consistent with Reclamation’s broad authorities in the CVPIA. The objective
37 may be achieved at the Yolo Bypass, as part of the Bay Delta Conservation Plan
38 (BDCP), or among other actions. The following actions in this suite were not
39 included in modeling analyses for existing conditions, the No-Action
40 Alternative, and proposed action alternatives:

- 1 • **Restoration of Floodplain Rearing Habitat** – The intent of this action
2 is to restore floodplain rearing habitat for juvenile winter-run, spring-
3 run, and Central Valley steelhead through a substantial increase in
4 acreage of seasonal floodplain rearing habitat.

- 5 • **Near-Term Actions at Liberty Island/Lower Cache Slough and**
6 **Lower Yolo Bypass** – These actions include the steps necessary to
7 enhance the use of Liberty Island/Lower Cache Slough by juvenile
8 salmonids.

- 9 • **Lower Putah Creek Enhancements** – These enhancements, to be
10 completed by the end of 2015, include stream realignment and
11 floodplain restoration for fish passage improvement and multispecies
12 habitat development on existing public lands.

13 Reduction of Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon at
14 Fremont Weir and Other Structures in the Yolo Bypass Actions

15 This action involves the completion of planning-related and physical
16 modifications that will provide high-quality, reliable migratory passage through
17 the Yolo Bypass for Sacramento River basin adult and juvenile anadromous
18 fishes. These actions may include steps to provide fish passage by altering
19 Fremont Weir and/or other facility-related or operational requirements of the
20 Sacramento River Flood Control Project or Yolo Bypass facility.

21 *Giant Garter Snake Recovery Plan* USFWS is required by Section
22 4(c)(2) of the ESA to conduct a status review of each listed species at least once
23 every 5 years. A draft recovery plan for the giant garter snake was produced in
24 1999 (USFWS 1999). The known range of giant garter snake has changed little
25 since the time of its listing (USFWS 2006).

26 *The Water Quality Control Plan for the California Regional Water*
27 *Quality Control Board: Central Valley Region, the Sacramento River Basin and*
28 *San Joaquin River Basin* The preparation and adoption of water quality control
29 plans (basin plans) is required by the California Water Code (Section 13240)
30 and supported by the Federal CWA. State law also requires that basin plans
31 conform to the policies set forth in the California Water Code, beginning with
32 Section 13000, and any State policy for water quality control. Because
33 beneficial uses, together with their corresponding water quality objectives, can
34 be defined per Federal regulations as water quality standards, the basin plans are
35 regulatory references for meeting the State and Federal requirements for water
36 quality control (40 CFR 131.20). The *Water Quality Control Plan for the*
37 *California Regional Water Quality Control Board: Central Valley Region, the*
38 *Sacramento River Basin and San Joaquin River Basin* (Basin Plan) covers the
39 entire Sacramento and San Joaquin River basins. The Basin Plan was first
40 adopted in 1975. In 1989, a second edition was published. The third edition,
41 published in 1994, incorporated all amendments approved between 1989 and
42 1994, included new State policies and programs, edited and restructured the

1 Basin Plan to make it consistent with other regional and State plans, and
2 substantively amended sections dealing with beneficial uses, objectives, and
3 implementation programs. The Basin Plan was last revised in October 2011
4 (CVRWQCB 2011).

5 *The California Air Resources Board Climate Change Scoping Plan: A*
6 *Framework for Change* The Global Warming Solutions Act of 2006
7 (Assembly Bill 32) required the California Air Resources Board to prepare a
8 scoping plan to achieve reductions in California’s GHG emissions. The scoping
9 plan was originally approved in 2008. In 2011, the Functional Equivalent
10 Document for the scoping plan was amended. The scoping plan, including the
11 final supplement to the Functional Equivalent Document, was reapproved by
12 the California Air Resources Board on August 24, 2011. The scoping plan
13 provides the outline for actions to reduce California’s GHG emissions (ARB
14 2008).

15 *Bay Delta Conservation Plan (and Alternative Delta Conveyance*
16 *Facilities)* The BDCP is currently being developed. The BDCP consists of
17 conservation measures that include components for water conveyance facilities
18 combined with water conveyance operations; conservation components
19 including land acquisition for major habitat restoration efforts in the Delta; and
20 components related to reducing other stressors on the San Francisco
21 Bay/Sacramento–San Joaquin Delta (Bay-Delta) ecosystem. The BDCP
22 conservation measures are specific actions that would be implemented to
23 achieve the biological goals and objectives of the proposed plan, and are a
24 component of the BDCP conservation strategy. The conservation measures and
25 effects assessment related to achieving the BDCP’s overall planning goals are
26 incorporated by reference into the EIR/EIS, which is expected to be publicly
27 released in spring 2013. The BDCP conservation strategy consists of multiple
28 components that are designed to collectively achieve the overall BDCP planning
29 goals of ecosystem conservation and water supply reliability. The conservation
30 strategy includes biological goals and objectives; conservation measures;
31 avoidance and minimization measures; and a monitoring, research, and adaptive
32 management program.

33 Four broad concepts have been studied to address urban water quality, water
34 supply reliability, and environmental concerns in the Delta: physical barriers,
35 hydraulic barriers, through-Delta facilities, and isolated facilities. Several
36 alternative Delta conveyance facilities are being evaluated as part of the plan.
37 Depending on the alternative, the water conveyance facility components would
38 create a new conveyance mechanism to divert water from the north Delta to
39 existing SWP and CVP export facilities in the south Delta, interacting with
40 operational guidelines to achieve the planning goal outlined above. Among
41 these alternatives is an isolated facility that would convey water around the
42 Delta for local supply and export through a hydraulically isolated channel. This
43 isolated facility could improve water quality for urban and agricultural water
44 users, while eliminating reverse flow in the Delta and improving Delta water

1 quality and flow by releasing water to south Delta channels. Because the intake
2 gate for this facility would be upstream from much of the Delta along the
3 Sacramento River, it would substantially reduce effects of bromide and
4 agricultural drainage on water delivered to urban water purveyors.

5 *Trinity River Mainstem Fishery Restoration Program* The Trinity River
6 Mainstem Fishery Restoration Program is located in the CVP service area at
7 Lewiston Dam on the Trinity River. This program is designed to benefit
8 anadromous salmonids and their habitat by developing a properly functioning,
9 diverse floodplain and riverine habitat. The program's plan has two restoration
10 goals: reestablish the natural physical processes that create and maintain high-
11 quality aquatic habitat; and create spawning and rearing conditions downstream
12 from the dams, including adequate water temperatures to best compensate for
13 lost habitat upstream.

14 The plan includes direct in-channel actions, continued watershed restoration
15 activities, replacement of bridges and structures within the floodplain, and a
16 program to monitor and improve restoration activities. Some of the actions and
17 activities have been implemented and are operational. The pending phases of
18 the projects incorporated into the DEIR encompass work at 29 rehabilitation
19 sites in Trinity County along the 40-mile reach of the mainstem Trinity River
20 from Lewiston Dam to the North Fork Trinity River. The remaining 6 Phase 1
21 sites are concentrated between Lewiston and Douglas City (about a 16-mile
22 reach) and the 23 Phase 2 sites are located between Rush Creek and the North
23 Fork Trinity River near Helena, California.

24 *San Joaquin River Restoration Program* As described previously (see the
25 discussion of full SJRRP Restoration Flows in "Quantitative Assessment of
26 Actions Related to Water Resources," above), the SJRRP was established based
27 on the 2006 Settlement of the *Natural Resources Defense Council et al., v.*
28 *Rodgers, et al.* lawsuit. The program would restore and maintain fish
29 populations in "good condition" in the mainstem San Joaquin River below
30 Friant Dam to the confluence of the Merced River, including naturally
31 reproducing and self-sustaining populations of salmon and other fish; and
32 reduce or avoid adverse water supply impacts on all of the Friant Division long-
33 term contractors that may result from the Interim Flows and Restoration Flows
34 provided for in the Settlement.

35 The Settlement followed an 18-year lawsuit that involved the U.S. Departments
36 of the Interior and Commerce, the Natural Resources Defense Council, and the
37 Friant Water Users Authority. The Settlement received Federal court approval
38 in October 2006. Federal legislation was passed in March 2009 authorizing
39 Federal agencies to implement the Settlement. The SJRRP consists of releases
40 of water from Friant Dam to the confluence of the Merced River (Interim and
41 Restoration flows), a combination of channel and structural modifications along
42 the San Joaquin River below Friant Dam, and reintroduction of Chinook
43 salmon. The SJRRP's channel and structural modifications include

1 modifications to channel and flow-control structures and habitat along the San
2 Joaquin River and Lower San Joaquin Flood Control Project between Friant
3 Dam and the Merced River confluence. They also involve constructing and
4 operating new infrastructure to facilitate the recapture of Interim and
5 Restoration flows on the San Joaquin River below the confluence of the Merced
6 River.

7 *Sacramento River Conservation Area Forum Program* The nonprofit
8 Sacramento River Conservation Area Forum works to protect, restore, and
9 enhance the fisheries and riparian habitat along the Sacramento River in the
10 primary and extended study areas, from Keswick Dam downriver to Verona.
11 This is a cooperative effort to ensure that habitat restoration and management
12 addresses not only the dynamics of riparian ecosystems, but also the realities of
13 local agricultural and recreational issues associated with land use changes
14 occurring along the river. The program (Resources Agency 2003) has goals to
15 protect, restore, and enhance fisheries and riparian habitat along the Sacramento
16 River and its tributaries. The Sacramento River Conservation Area Forum
17 develops and implements site-specific and subreach plans for areas within the
18 conservation area.

19 *Iron Mountain Mine Restoration Plan* The Iron Mountain Mine
20 Restoration Plan identifies restoration actions to address injuries to or lost use of
21 natural resources caused by acid mine drainage from the Iron Mountain Mine
22 complex, located west of the upper Sacramento River in the primary study area.
23 The plan involves restoring salmonid populations, riparian habitat, and instream
24 ecological functions, as well as implementing restoration projects to compensate
25 for the lost use of public areas and public services. The aquatic and riparian
26 habitats affected by releases of hazardous substances at or from the Iron
27 Mountain Mine site include the site's creeks (Boulder, Slickrock, Flat, and
28 Spring) and the mainstem and tributaries of the Sacramento River from
29 Keswick Reservoir to Red Bluff. As additional compensation for damage to
30 natural resources, this project includes an option for the Federal government to
31 acquire approximately 1,250 acres to be transferred into public ownership and
32 administered by the U.S. Department of the Interior, Bureau of Land
33 Management (BLM) (IMMTC 2002; NOAA 2009). The Iron Mountain Mine
34 Trustee Council has allocated funds to several projects designed to meet the
35 goals of the *Iron Mountain Mine Restoration Plan*.

36 *Draft Invasive Non-Native Plant (Weed) Management Plan for the Mouth*
37 *of Cottonwood Creek Wildlife Area* The Mouth of Cottonwood Creek Wildlife
38 Area is located in south-central Shasta County. CDFW acquired lands in this
39 wildlife area to protect, restore, and enhance riparian and wetland habitats. The
40 *Invasive Non-Native Plant (Weed) Management Plan for the Mouth of*
41 *Cottonwood Creek Wildlife Area* provides a preliminary strategy for managing
42 the highest priority invasive nonnative plants on lands in the Mouth of
43 Cottonwood Creek Wildlife Area.

1 *Deer Creek Flow Enhancement Program* The Deer Creek Irrigation
2 District is located in southeastern Tehama County, approximately 20 miles
3 north of Chico in Butte County and 22 miles south of Red Bluff and 2 miles east
4 of the community of Vina in Tehama County. Deer Creek drains portions of the
5 Sierra Nevada and is a tributary to the Sacramento River. Deer Creek is one of
6 California’s largest undammed watersheds in the Sacramento River basin.
7 Several unique habitat features within Deer Creek make it an important resource
8 for anadromous fish in the Sacramento Valley, particularly spring-run Chinook
9 salmon and steelhead trout.

10 The Deer Creek Flow Enhancement Program is a component of the conceptual
11 framework for the Deer Creek Flow Enhancement Program. The project is the
12 implementation of Phase One of the Memorandum of Agreement between Deer
13 Creek Irrigation District, DWR’s Northern Region, and CDFW for the
14 construction, operation, maintenance and monitoring of a flow enhancement
15 program on Deer Creek. Phase One of DWR’s conceptual framework for the
16 Deer Creek Flow Enhancement Program is a water exchange project intended to
17 provide salmonid passage flows for adult spawners and outmigrant young in
18 Deer Creek. Specifically, Phase One includes the following components:

- 19 • The bypassing of 10 cfs of surface water from Deer Creek during
20 critical migration periods
- 21 • Installation of two water supply wells or retrofit of two existing wells
22 for irrigation purposes
- 23 • Deer Creek Annual Monitoring Program

24 The Memorandum of Agreement provides for the installation of two new
25 groundwater wells for agricultural water supply and/or the refurbishment of two
26 existing wells to extract up to 10 cfs of groundwater for irrigation purposes
27 during critical migration periods. The installation of the wells would enable
28 irrigators to switch from using stream flow to groundwater, thus leaving, or
29 “bypassing,” water in Deer Creek during critical spring (April–June) and fall
30 (October–November) migration periods. Maintaining instream flows during
31 these critical periods would allow fish to reach areas upstream from the
32 Stanford Vina Diversion Dam in Deer Creek. Ultimately, the 10-year
33 Memorandum of Agreement and flow enhancement program would improve
34 access by salmonids to and from approximately 25 miles of Deer Creek
35 upstream from the diversion dam.

36 The proposed project also includes a Deer Creek Annual Monitoring Program.
37 This monitoring program provides groundwater level criteria, water quality
38 criteria, and reporting requirements. The Deer Creek Annual Monitoring
39 Program also monitors fish passage conditions over a range of water year types
40 to determine the timing and effectiveness of the Deer Creek Flow Enhancement

1 Program's operations and to determine the need for pulse flows, riffle
2 modifications, water temperature standards, and reporting requirements.

3 *Lower Deer Creek Falls Fish Passage Improvement Project* The Lower
4 Deer Creek Falls Fish Passage Improvement Project will improve access to 5.75
5 stream miles for fall-run, late fall-run, and spring-run Chinook salmon as well
6 as steelhead. Work is under way by Deer Creek Irrigation District, DWR, and
7 CDFW to develop an environmental flow enhancement program in lower Deer
8 Creek. The goal of the program is to increase fish transportation flows
9 downstream from Deer Creek Irrigation District. More than 25 miles of prime
10 spawning habitat are available upstream from the Deer Creek Irrigation District
11 diversion dam. Detailed topographic surveys of the area and preliminary
12 engineering investigations have been suspended until additional funding
13 becomes available.

14 *Battle Creek Salmon and Steelhead Restoration Project* The intent of the
15 Battle Creek Salmon and Steelhead Restoration Project is to create habitat that
16 can sustain additional populations of winter-run Chinook salmon to minimize
17 the species' high risk of extinction. Upon its completion, the project will have
18 reestablished approximately 42 miles of prime salmon and steelhead habitat on
19 Battle Creek, plus an additional 6 miles on its tributaries; removed several
20 hydroelectric dams; and developed and implemented a long-term adaptive
21 management plan with dedicated funding sources to ensure the continued
22 success of restoration efforts. The project is to be completed no later than 2019.

23 *Butte Regional Conservation Plan* The Butte Regional Conservation Plan
24 (BRCP) is both a Federal habitat conservation plan and a State natural
25 communities conservation plan. The BRCP, a voluntary plan coordinated by the
26 Butte County Association of Governments, covers approximately the western
27 half of Butte County, including the all of the county's vernal pool landscapes.
28 The BRCP will provide streamlined ESA permitting for transportation projects,
29 land development, and other covered activities over the 30- to 50-year term of
30 the permits. It will also provide comprehensive species, wetlands, and
31 ecosystem conservation and contribute to the recovery of endangered species
32 within the plan area.

33 The development of the BRCP is a complex multiyear effort that will replace
34 the existing environmental permitting process. The plan has been broken down
35 into five phases. Phase Four tasks are currently under way and consist of a
36 second administrative draft of the BRCP, an administrative draft EIS/EIR, and
37 public workshops. Phase Five is scheduled for 2013 and will include the
38 development of a final plan, a final EIS/EIR, public workshops, and adoption of
39 the plan.

40 *North-of-Delta Offstream Storage Investigation* The North-of-Delta
41 Offstream Storage Investigation is a feasibility study being performed by
42 Reclamation and DWR, in partnership with local interests. Pursuant to the

1 CALFED solution principles, storage locations that would not add a new dam
2 on a major stream were considered and evaluated. As its name indicates, the
3 North-of-Delta Offstream Storage Investigation focuses on offstream storage
4 north of the Delta – specifically, potential projects for offstream storage of
5 surface water at Sites Reservoir in the upper Sacramento River basin.

6 Offstream storage located north-of-the-Delta would require conveying water
7 from the Sacramento River or one of its major tributaries to the new storage
8 location. An offstream storage conveyance system could use either existing
9 diversions and canals or new diversions and conveyance. Water would be
10 diverted during periods of relatively higher flow through the conveyance
11 system, into the new offstream storage reservoir, and stored until it is needed to
12 meet the planning objectives.

13 Such storage could increase water supply reliability for all beneficial uses
14 (agricultural, urban, and environmental). The Sites Reservoir Project could
15 contribute to cumulative effects on water supplies and associated resources. The
16 project could increase water supplies available for export in years when export
17 supplies otherwise would be limited. This project also could modify the timing
18 and magnitude of upstream reservoir releases in wet years.

19 A notice of intent/notice of preparation for this project was issued in November
20 2001 and public scoping for the environmental document occurred in January
21 2002. The complete plan formulation report was published in September 2008
22 and the Final EIS/EIR/Feasibility Report is scheduled to be completed in 2013.

23 *Fremont Landing Conservation Bank* The 100-acre Fremont Landing
24 Conservation Bank in Yolo County functions as a mitigation bank providing
25 credits for riparian floodplain forest or shaded riverine aquatic habitat. The
26 mitigation bank serves portions of Tehama, Shasta, Glenn, Butte, Colusa,
27 Sutter, Yuba, Yolo, Placer, Solano, Sacramento, Amador, Contra Costa, San
28 Joaquin, Calaveras, Alameda, Stanislaus, Tuolumne, Merced, and Mariposa
29 counties. Credits may be designated to provide habitat for special-status
30 anadromous salmonids – Sacramento River winter-run, Central Valley spring-
31 run, and Central Valley fall/late fall–run Chinook salmon as well as Central
32 Valley steelhead. NMFS approved the site as part of an umbrella agreement that
33 covers several Central Valley mitigation banking sites (Conservation Fund
34 2010). A mitigated negative declaration was issued in 2009 (BDCP 2012).

35 *Yuba Salmon Forum Fish Passage Studies (Upper Yuba River Studies*
36 *Program)* The purpose of the Yuba Salmon Forum Fish Passage Studies is to
37 take two sets of actions concurrently: (1) identify, evaluate, recommend, and
38 seek to achieve implementation of effective near-term and long-term actions to
39 achieve viable salmonid populations in the Yuba River watershed to contribute
40 to recovery goals; and (2) consider other beneficial uses of water resources and
41 habitat values in neighboring watersheds, as part of Central Valley salmonid
42 recovery actions. The Yuba Salmon Forum adopted the *Draft Yuba River*

1 *Salmon Forum Studies* on June 24, 2011. These six studies provide information
2 to Yuba Salmon Forum members that they may find useful in making decisions
3 about the introduction of anadromous salmonids (Chinook salmon
4 (*Oncorhynchus tshawytscha*) and central Valley steelhead (*O. mykiss*)) into the
5 Yuba River basin upstream from USACE's Englebright Dam.

6 *Davis-Woodland Water Supply Project* The Davis-Woodland Water
7 Supply Project will replace deteriorating groundwater supplies with safer, more
8 reliable surface water supplies from the Sacramento River. The three primary
9 objectives of the project are to provide a reliable water supply to meet existing
10 and future needs, to improve water quality for drinking water supplies, and to
11 improve the quality of treated wastewater effluent discharged by the project
12 partners (the Cities of Woodland and Davis and the University of California,
13 Davis) through 2040. Once complete, the project will serve more than two-
14 thirds of the urban population of Yolo County.

15 Project plans include a jointly owned and operated intake on the Sacramento
16 River, raw-water pipelines connecting the intake to a new regional water
17 treatment plant, and separate pipelines delivering treated water to the project
18 partners. Improvements to existing water supply systems will vary for
19 Woodland and Davis and will include facilities such as distribution pipelines,
20 water storage tanks, and booster pump stations.

21 The project will divert up to 45,000 acre-feet of water per year from the
22 Sacramento River. Water rights were granted in March 2011 and will be subject
23 to conditions imposed by the State. Water diversions will be limited during
24 summer and other dry periods. A more senior water right for 10,000 acre-feet
25 was purchased to provide summer water supply. Groundwater will continue to
26 be used by Woodland and Davis when demand for water cannot be met by
27 surface water supplies alone. The regional water supply project is currently
28 under design, with construction planned between 2013 and 2015 and operations
29 beginning in 2016.

30 *North Bay Aqueduct Alternative Intake Project* DWR proposes to
31 implement the North Bay Aqueduct Alternative Intake Project to improve water
32 quality and to provide reliable deliveries of SWP supplies to its contractors, the
33 Solano County Water Agency and the Napa County Flood Control and Water
34 Conservation District. This proposed project would include the construction and
35 operation of an alternative intake on the Sacramento River, generally upstream
36 from the Sacramento Regional Wastewater Treatment Plant, and connect it to
37 the existing North Bay Aqueduct system by a new segment of pipe. The
38 proposed alternative intake would be operated in conjunction with the existing
39 North Bay Aqueduct intake at Barker Slough. The North Bay Aqueduct
40 Alternative Intake Project would include the following facilities:

- 41 • A new alternative intake structure and pump station on the Sacramento
42 River with state-of-the-art, positive-barrier fish screens

- 1 • A new pipeline segment to convey the water from the alternative intake
- 2 to a point of connection with the existing North Bay Aqueduct near the
- 3 North Bay Regional Water Treatment Plant

- 4 • Other project-related support facilities such as surge tanks

5 The notice of preparation for the North Bay Aqueduct Alternative Intake Project
6 EIR was published in November 2009 (DWR 2009). A scoping report was
7 released in February 2010 (ESA 2010). It is anticipated that the public review
8 draft EIR will be available in early 2013.

9 *Lower Clear Creek Anadromous Fish Restoration and Management*
10 Project The anadromous fish restoration and management actions of the Lower
11 Clear Creek Anadromous Fish Restoration and Management Project will occur
12 on public and private lands in the lower Clear Creek watershed, located west of
13 Redding in Shasta County. The CVPIA funds most of the actions proposed in
14 the environmental assessments produced for these efforts.

15 Beginning in the early 1990s, multiple Federal, State, and local agencies and
16 private stakeholder groups concerned about lower Clear Creek began to plan
17 and implement watershed restoration activities to reverse the effects of
18 Whiskeytown Dam, Saeltzer Dam, placer and dredger gold mining, instream
19 aggregate mining, road-related erosion, and decades of fire suppression. Since
20 that time, the groups that formed the Clear Creek Restoration Team have
21 implemented multiple resource inventories and restoration projects, including
22 dam removal, gravel augmentation, flow augmentation, channel and floodplain
23 restoration, erosion control, fuels reduction, and control of nonnative
24 vegetation.

25 *North Delta Flood Control and Ecosystem Restoration Project* DWR
26 certified the EIR for the North Delta Flood Control and Ecosystem Restoration
27 Project in 2010 and filed a notice of determination with the Governor’s Office
28 of Planning and Research on November 9, 2010. This project will implement
29 flood control improvements in the north Delta, principally on and around
30 McCormack-Williamson Tract, Dead Horse Island, and Grizzly Slough, in a
31 manner that benefits aquatic and terrestrial habitats, species, and ecological
32 processes. Flood control improvements are needed to reduce damage to land
33 uses, infrastructure, and the Bay-Delta ecosystem caused by catastrophic levee
34 failures in the Delta.

35 *Two-Gates Fish Protection Demonstration Project* Reclamation is
36 currently studying the proposed Two-Gates Demonstration Project, a 5-year
37 experiment to validate a new behavioral model for delta smelt and study the
38 effects of modifying Delta flows to protect delta smelt and other sensitive
39 aquatic species from entrainment in CVP and SWP export pumps. Research
40 suggests that the pre-spawning migration of adult delta smelt is tied to sediment
41 and suspended particles in the water (turbidity). Temporary gates would be

1 placed across Old River and Connection Slough in the central Delta. These
2 gates would operate at two times of year: from December to March, to keep
3 turbid water away from the CVP and SWP export pumps, thus keeping adult
4 delta smelt away from the pumps; and in March and June, to prevent
5 entrainment of larvae and juvenile delta smelt by the export pumps.

6 *Franks Tract Project* Reclamation and DWR propose to implement the
7 Franks Tract Project to improve water quality and fisheries conditions in the
8 Delta. Reclamation and DWR are evaluating installing operable gates to control
9 the flow of water at key locations (Threemile Slough and/or West False River)
10 to limit the entry of fish species of concern and higher salinity water into Franks
11 Tract and other areas of the Delta with high fish mortalities. In addition to
12 improving water quality, the gates would limit migration of delta smelt into the
13 central and south Delta, where their survival rates are reduced. By protecting
14 fish resources, this project also would improve the operational reliability of the
15 CVP and SWP because curtailments (pumping restrictions) in project operations
16 would likely be less frequent.

17 A plan of study for the Franks Tract Project was completed in August 2007. The
18 notice of intent was published September 22, 2008, and the Initial Alternatives
19 Information Report was completed in February 2010, and the Plan Formulation
20 Report was completed in 2013. The project is still under consideration by
21 Reclamation and DWR.

22 *Dutch Slough Tidal Marsh Restoration Project* This proposed project is a
23 cooperative partnership between DWR, CALFED, the California Coastal
24 Conservancy, landowners, the Natural Heritage Institute, the City of Oakley,
25 Ironhouse Sanitary District, and private consultants. The project entails
26 restoring wetlands and uplands and providing public access to the 1,166-acre
27 Dutch Slough property owned by DWR. The property comprises three parcels,
28 separated by narrow human-made sloughs, that were historically used for
29 agricultural uses and grazing.

30 The primary goal of the Dutch Slough Tidal Marsh Restoration Project is to
31 provide ecosystem benefits, including habitats for sensitive aquatic species. The
32 project will be designed to maximize opportunities to assess the development of
33 those habitats and measure ecosystem responses so that future Delta restoration
34 projects will be more successful. This proposed project also provides an
35 important opportunity to improve planners' understanding of restoration science
36 in tidal marsh wetland ecosystems in the region (DWR 2010). Construction is
37 scheduled to begin in summer 2013 with levee breaching anticipated in 2014.

38 *Suisun Marsh Management, Preservation, and Restoration Plan* Federal
39 and State agencies jointly developed this comprehensive 30-year regional plan
40 to address the use of resources on about 52,000 acres of wetland and upland
41 habitats in Suisun Marsh near Fairfield. The focus of the *Suisun Marsh*
42 *Management, Preservation, and Restoration Plan* is to achieve an acceptable

1 multiple-stakeholder approach to the restoration of tidal wetlands and the
2 enhancement of managed wetlands and their functions. The plan balances
3 implementation of the CALFED Program, the Suisun Marsh Preservation
4 Agreement, and other management and restoration programs for Suisun Marsh
5 and is based on voluntary participation by private landowners.

6 DWR and Reclamation have collaboratively prepared the environmental
7 documents with NMFS, CDFW, and the Suisun Resource Conservation District.
8 The notice of intent/notice of preparation was published in November 2003. The
9 Final EIS/EIR was made available in December 2011 (DOI et al. 2011).

10 *In-Delta Storage Program (Delta Wetlands Project)* DWR, in
11 coordination with the California Bay-Delta Authority and with technical
12 assistance from Reclamation, completed the State feasibility study for the In-
13 Delta Storage Program in the south Delta, within the extended study area. The
14 In-Delta Storage Project would provide capacity to store approximately 217
15 thousand acre-feet of water in the south Delta for a wide array of water supply,
16 water quality, and ecosystem benefits. The project would consist of two storage
17 islands (Webb Tract and Bacon Island) and two habitat islands (Holland Tract
18 and Bouldin Island), an embankment design, consolidated inlet and outlet
19 structures, project operations, and habitat management plans. The objectives of
20 the project are to enhance water supply reliability and the operational flexibility
21 of the CVP/SWP system, contribute to ecosystem restoration, and provide water
22 for the Environmental Water Account (DWR 2011b). Detailed planning work
23 by the State on the In-Delta Storage Project has been suspended since July 2006
24 when State funding was cut (DWR 2011b); however, a final EIR was certified
25 in 2012 by Semitropic Water Storage District and other environmental
26 documentation is under way.

27 *Los Vaqueros Reservoir Expansion Project* Los Vaqueros Reservoir was
28 completed in 1997 to provide 100,000 acre-feet of offstream water storage to
29 improve water quality and provide emergency storage for Contra Costa Water
30 District (CCWD) customers. The purpose of this project is to enhance the Delta
31 environment and improve the Bay Area's water supply reliability and water
32 quality by developing water supplies for environmental water management and
33 helping to meet municipal and industrial water demands during drought and
34 emergency periods, by expanding the existing reservoir.

35 To date, the project has consisted of an expansion of Los Vaqueros Reservoir
36 from 100,000 acre-feet to 160,000 acre-feet, which required a dam raise, the
37 relocation of recreation facilities, and an upgrade of the pumps at the Transfer
38 Pump Station. The dam raise to 160,000 acre-feet was completed in 2012 and
39 mitigation activities are scheduled for completion in 2013. Los Vaqueros
40 Reservoir could be further expanded up to a total of 500,000 acre-feet. New
41 Delta intakes, pumps, and pipelines would be required to fill the additional
42 reservoir capacity, and water deliveries would be made from the expanded
43 reservoir to Bay Area beneficiaries through new conveyance facilities.

1 Completion of the Draft Federal Feasibility Report is planned for 2014 and a
2 final report is to be completed in 2015. A final decision on further expansion of
3 the reservoir beyond 160,000 acre-feet is expected to occur in 2016, depending
4 on the level of participation by other Bay Area water agencies, Reclamation,
5 and DWR. Project implementation will also consider the CCWD Board
6 Principles and the additional assurances, commitments, and requirements
7 adopted by the CCWD Board on June 25, 2003.

8 *East Bay Municipal Utility District Water Supply Management Program*
9 *2040* The Water Supply Management Program 2040 (WSMP 2040) is a
10 program-level effort that estimates EBMUD's water supply needs over a 30-
11 year planning horizon and proposes a diverse portfolio of policy initiatives and
12 potential projects to ensure that those needs can be met in dry years. On October
13 13, 2009, the EBMUD Board of Directors approved the WSMP 2040. The
14 CEQA analysis was challenged in court, and in a ruling issued on April 11,
15 2011, EBMUD was directed to analyze certain plan components in more detail.
16 On May 24, 2011, the EBMUD Board set aside certification of the WSMP 2040
17 Program EIR and directed staff members to revise the program. That revision
18 effort has since been completed, and on April 24, 2012, the EBMUD Board of
19 Directors certified the revised program EIR and adopted the revised final plan
20 for the WSMP 2040 (EBMUD 2012).

21 *Bay Area Regional Desalination Project* The Bay Area's largest water
22 agencies (CCWD, EBMUD, the San Francisco Public Utilities Commission, the
23 Santa Clara Valley Water District, and the Alameda County Flood Control and
24 Water Conservation District – Zone 7) are working together to develop a
25 regional desalination project to serve the needs of more than 5.6 million
26 residents and businesses in the region. The project under consideration would
27 use water from the Delta withdrawn at CCWD's Mallard Slough Pump Station,
28 located in eastern Contra Costa County, to produce 20 million gallons per day
29 of desalinated water for delivery to residential and business customers in the
30 region. Water produced by this project could be blended with supplies from
31 CCWD, EBMUD (Mokelumne Aqueduct), or both. Other parties would receive
32 project water through transfers or wheeling. The water from the Bay Area
33 Regional Desalination Project could be fully treated (two-pass reverse osmosis)
34 or require further treatment (one-pass reverse osmosis), depending on the
35 delivery point into either the CCWD or EBMUD system. The project would
36 operate continuously in all water year types, with the possibility of storing water
37 (including by exchange or transfer) in CCWD's Los Vaqueros Reservoir when
38 demand is less than plant capacity.

39 *Upper San Joaquin River Basin Storage Investigation (Temperance Flat*
40 *Reservoir)* The Upper San Joaquin River Basin Storage Investigation is a
41 feasibility study being performed by Reclamation and DWR. The purpose of the
42 Upper San Joaquin River Basin Storage Investigation is to determine the type
43 and extent of Federal, State, and regional interests in a potential project in the
44 upper San Joaquin River watershed with the following goals: expand water

1 storage capacity; improve water supply reliability and flexibility for
2 agricultural, urban, and environmental uses; and enhance San Joaquin River
3 water temperature and flow conditions to support efforts for anadromous fish
4 restoration. This investigation is one of five surface water storage studies
5 recommended in the record of decision for the CALFED final programmatic
6 EIS/EIR (August 2000). A plan formulation report for the project was released
7 in October 2008 (Reclamation and DWR 2008). A public draft feasibility report
8 is anticipated in September 2013.

9 *San Luis Drainage Reevaluation Program* The San Luis Unit (drainage
10 study area) was authorized by Congress in Public Law 86-488 (74 Statutes 156),
11 June 3, 1960, and amended by Section 101(e) of the Act of October 18, 1986,
12 Public Law 99-500. The project purpose is to provide agricultural drainage
13 service to the San Luis Unit to achieve a long-term, sustainable salt and water
14 balance in the root zone of irrigated lands in the San Luis Unit and adjacent
15 areas. Of the 730,000 acres in the drainage study area, about 379,000 acres are
16 drainage-impaired and constitute the drainage service area. Reclamation
17 estimates that installing subsurface drainage systems in two-thirds of this area
18 by the end of the 50-year planning horizon would maintain the arability of the
19 root zone throughout the entire 379,000 acres. The alternatives are the In-
20 Valley/Drainage-Impaired Area Land Retirement Alternative and the In-
21 Valley/Water Needs Land Retirement Alternative. Common features proposed
22 for both alternatives are a drainage collection system, regional drainage reuse
23 facility, conveyance system, selenium biotreatment, evaporation ponds,
24 mitigation facilities, and land retirement.

25 *Central Valley Salinity Alternatives for Long-Term Sustainability (CV-*
26 *SALTS)* The CV-SALTS initiative is a collaborative effort among 26
27 stakeholder groups to realize reductions in salt accumulation in the Central
28 Valley. These groups represent a broad coalition of agriculture, municipalities,
29 industry, and regulatory agencies. Represented by the Central Valley Salinity
30 Coalition, they are working with the Central Valley Regional Water Quality
31 Control Board (CVRWQCB) to address the valley's salinity problems. The goal
32 of the CV-SALTS initiative is to adopt long-term solutions to salt management
33 that will enhance water quality and economic sustainability in the valley. The
34 CV-SALTS initiative has completed pilot studies on the sources and effects of
35 salts in 13 percent of the affected areas; working in partnership with
36 Reclamation, it will complete salts studies for the east and west sides of the San
37 Joaquin River.

38 *San Joaquin River at Vernalis Salt and Boron TMDL and Basin Plan*
39 *Amendment* The CV-SALTS stakeholder initiative was created to develop new
40 approaches to protect soils and water from salt that has been slowly and steadily
41 accumulating in the San Joaquin River watershed. The CV-SALTS stakeholder
42 initiative will initiate a research effort that will review and determine the
43 appropriate salinity concentration for the San Joaquin River in order to maintain
44 all of the beneficial uses of the river. Reclamation is currently collaborating

1 with CV-SALTS and the Regional Water Board to implement a real-time
2 salinity management system that will satisfy the TMDL requirement for San
3 Joaquin River salinity concentration.

4 *B. F. Sisk Dam Corrective Action Project* B.F. Sisk Dam (also known as
5 San Luis Dam) is a 300-foot-high, compacted earthfill embankment located on
6 the west side of the Central Valley approximately 12 miles west of Los Banos.
7 Owned by Reclamation and operated by DWR, the dam is more than 3.5 miles
8 long. B.F. Sisk Dam impounds San Luis Reservoir, which has a total capacity of
9 more than 2 million acre-feet. The dam was built between 1963 and 1967 to
10 provide supplemental storage of irrigation water for the CVP and municipal and
11 industrial water for the SWP. The Gianelli Pumping-Generating Plant lifts water
12 from both the California Aqueduct and the Delta-Mendota Canal (via O’Neill
13 Forebay) into San Luis Reservoir for storage.

14 The dam and reservoir are located in an area of high potential for severe
15 earthquakes on active faults, primarily the Ortigalita Fault, which crosses the
16 reservoir. A series of studies and analyses that culminated in a seismic-risk
17 analysis completed in 2006 found justification to act to reduce the risk to the
18 downstream public of seismic damage to the dam. The current phase of the
19 Safety of Dams project is referred to as a corrective action study and is expected
20 to be complete in 2013. The study will include feasibility-level designs,
21 environmental documentation, selection of a preferred alternative, and a
22 modification report to the Federal Office of Management and Budget and the
23 U.S. Congress.

24 *San Luis Reservoir Low Point Improvement Project* Reclamation is
25 investigating 3 alternatives to address water quality problems within the CVP’s
26 San Felipe Division (Santa Clara and San Benito counties) that arise when San
27 Luis Reservoir levels drop below 300 thousand acre-feet during late summer in
28 dry water years, resulting in large algal blooms. Santa Clara Valley Water
29 District has proposed the San Luis Reservoir Low Point Improvement Project to
30 maintain a high-quality, reliable, and cost-effective water supply for the water
31 district and other contractors of the San Felipe Division. Santa Clara Valley
32 Water District wants to ensure that it and other San Felipe Division contractors
33 receive their annual CVP contract allocations at the time and the level of quality
34 needed to meet water supply commitments. The project objectives are as
35 follows:

- 36 • Avoid supply interruptions when water is needed by increasing the
37 certainty of meeting the requested delivery schedule throughout the
38 year to south-of-Delta contractors dependent on San Luis Reservoir.
- 39 • Increase the reliability and quantity of yearly allocations to south-of-
40 Delta contractors dependent on San Luis Reservoir.

- 1 • Minimize the downward population trends of native species that are not
2 listed.
- 3 • Announce higher allocations earlier in the season to south-of-Delta
4 contractors dependent on San Luis Reservoir without sacrificing
5 accuracy of the allocation forecasts.

6 *Qualitative Assessment of Actions Related to Flood Management* The actions
7 related to flood management described below were identified as present or
8 reasonably foreseeable.

9 *Central Valley Flood Protection Plan* Legislation passed in 2007 directs
10 DWR to develop three documents that will guide improvement of integrated
11 flood management:

- 12 • *State Plan of Flood Control Descriptive Document* to inventory and
13 describe the flood management facilities, land, programs, conditions,
14 and mode of operations and maintenance for the State/Federal flood
15 protection system in the Central Valley.
- 16 • *Flood Control System Status Report* to assess the status of the facilities
17 included in the State Plan of Flood Control Descriptive Document,
18 identify deficiencies, and make recommendations.
- 19 • *Central Valley Flood Protection Plan (CVFPP)* to describe a
20 sustainable, integrated flood management plan that reflects a
21 systemwide approach for protecting areas of the Central Valley that
22 currently receive protection from flooding by existing facilities of the
23 State Plan of Flood Control. It is supported by the *State Plan of Flood
24 Control Descriptive Document*, the *Flood Control System Status
25 Report*, and the *CVFPP Final Program Environmental Impact Report*.

26 The CVFPP is a sustainable, integrated flood management plan that describes
27 the existing flood risk in the Central Valley and recommends actions to reduce
28 the probability and consequences of flooding. Produced in partnership with
29 Federal, tribal, local, and regional partners and other interested parties, the
30 CVFPP also identifies the mutual goals, objectives, and constraints important in
31 the planning process; distinguishes plan elements that address mutual flood
32 risks; and recommends improvements to the State/Federal flood protection
33 system. The 2012 CVFPP was completed by DWR and adopted by the Central
34 Valley Flood Protection Board in July 2012 (DWR 2012). It is currently being
35 implemented through two basinwide feasibility studies for the Sacramento and
36 San Joaquin river basins, respectively.

37 *CALFED Levee System Integrity Program* DWR, CDFW, and USACE
38 implement the CALFED Levee System Integrity Program, which maintains and
39 improves the integrity of the Bay-Delta estuary's levee system. The goal of the

1 Levee System Integrity Program is to reduce risks to land use and associated
2 economic activities, water supply, agricultural and residential uses,
3 infrastructure, and the ecosystem from the effects of catastrophic breaching of
4 Delta levees. Resources protected by the program include water quality,
5 ecosystem health, infrastructure such as utilities and transportation corridors,
6 agriculture, and recreational industries.

7 Protection and maintenance of nearly 700 miles of Delta levees has increased
8 since 2000. Maintenance has been ongoing along more than 600 miles of
9 eligible project and nonproject levees, and levee stability has been improved for
10 more than 45 additional miles of levees. Large levee rehabilitation projects have
11 been undertaken on numerous islands. Projects have also been implemented to
12 grow native vegetation, reuse more than 2 million cubic yards of dredged
13 material for levee stability and habitat development, and develop approximately
14 50 acres of riparian and wetland habitat and 3,000 linear feet of shaded riverine
15 aquatic habitat (CALFED 2011).

16 *Sacramento River Bank Protection Project* The Sacramento River Bank
17 Protection Project is a continuing construction project authorized by Section
18 203 of the Flood Control Act of 1960. USACE is responsible for
19 implementation of this project in conjunction with its non-Federal partner, the
20 Central Valley Flood Protection Board. The project's purpose is to provide
21 protection to the existing levee and flood control facilities of the Sacramento
22 River Flood Control Project. The project is to be completed in three phases. To
23 date, a total of about 820,000 feet of riverbank has been stabilized under the
24 project. During Phase III, USACE and the Central Valley Flood Protection
25 Board will consider multiple objectives – not only controlling bank erosion, but
26 also addressing other threats to the flood risk management system such as
27 through-seepage, underseepage, and levee height deficiencies, while providing
28 ecosystem restoration. Implementing Phase III will be critical to ensure that
29 project levees seriously threatened by erosion will continue to receive corrective
30 measures to prevent levee failure, catastrophic damage, and possible loss of life.
31 Planning and development of Phase III began recently and will include a
32 comprehensive sediment study, a thorough economic analysis, continued
33 biological studies, a comprehensive cultural resources survey, a detailed real
34 estate plan, and an updated mitigation site inventory. Phase III is expected to be
35 completed in 2013.

36 *Folsom Dam Joint Federal Project* Folsom Dam regulates flows in the
37 American River for flood control, and releases from Folsom Reservoir are used
38 for irrigation, power, municipal and industrial, fish and wildlife, water quality,
39 and other purposes. The “Folsom Facility” comprises Folsom Dam and
40 Reservoir, left and right earthfill wing dams, Mormon Island Auxiliary Dam,
41 and eight earthfill dikes that protect the surrounding communities, Folsom and
42 Granite Bay.

1 The Folsom Joint Federal Project is a collaborative effort by Reclamation and
2 USACE to address the hydrologic risk related to dam safety at the Folsom
3 Facility, and to improve flood protection. This project includes construction of a
4 new auxiliary spillway southwest of the existing main concrete dam. When
5 completed in 2017, the auxiliary spillway will include a 1,000-foot-long
6 approach channel beginning in Folsom Reservoir, a concrete control structure
7 with 6 gates, a 2,100-foot-long auxiliary spillway chute, and a stilling basin that
8 will act as an energy dissipation structure as water discharges enter the
9 American River below the main concrete Folsom Dam. The new facility will
10 allow Reclamation's dam operators to better manage large floods by safely
11 releasing more water from Folsom Reservoir earlier during a large storm
12 through both the spillway gates on Folsom Dam and the new control structure's
13 six gates, thus reducing hydrologic risk and leaving more storage capacity in the
14 reservoir. Improvements to Folsom Dam also include construction of a 3.5-foot
15 dam raise, which began in December 2007 and is expected to be completed in
16 2015.

17 *Natomas Levee Improvement Program Landside Improvement Project*
18 The Sacramento Area Flood Control Agency, acting in conjunction with
19 USACE, is implementing the multiple-phase Natomas Levee Improvement
20 Program Landside Improvements Project along the lower Sacramento River in
21 the extended study area. The project involves improving the perimeter levee
22 system of the Natomas basin in Sutter and Sacramento counties and modifying
23 associated landscaping and irrigation/drainage infrastructure. The project
24 objectives are to provide at least a 100-year level of flood protection to the
25 Natomas basin as quickly as possible, provide "200-year" protection to the
26 basin over time, and avoid any substantial increase in expected annual damages
27 as new development occurs in the basin (SAFCA 2007).

28 Multiple CEQA and NEPA documents have been issued by the Sacramento
29 Area Flood Control Agency and USACE for various phases of this project since
30 2008. The Final EIS for Phase 4a of the project was issued by USACE in
31 February 2010. Some phases of the project have been completed. Further
32 construction and completion of the project is contingent on Federal funding.

33 *West Sacramento Levee Improvement Program* The West Sacramento
34 Levee Improvement Program involves constructing improvements to the levees
35 that protect West Sacramento to meet local and Federal flood protection criteria.
36 The program area includes the entire boundaries of the West Sacramento Area
37 Flood Control Agency, which encompass portions of the Sacramento River, the
38 Yolo and Sacramento bypasses, and the Sacramento Deep Water Ship Channel.
39 The levee system associated with these waterways includes more than 50 miles
40 of levees in Reclamation Districts 900, 537, and 811; DWR's Maintenance Area
41 4; and the Sacramento Deep Water Ship Channel. These levees completely
42 surround West Sacramento. The Final EIS/EIR for the West Sacramento Levee
43 Improvements Program has been completed (City of West Sacramento 2012).
44 Construction began in 2008 and is ongoing.

1 *Delta Islands and Levees Feasibility Study* The Delta Islands and Levees
2 Feasibility Study is USACE's mechanism to participate in a cost-shared
3 solution to address ecosystem restoration needs, flood risk management
4 problems, and related water resources in the Delta and Suisun Marsh area. A
5 Feasibility Cost Share Agreement was executed on May 26, 2006 with DWR,
6 the non-Federal sponsor. The USACE-DWR study team meets regularly to
7 move the study forward and holds periodic agency coordination meetings with
8 associated Federal, State, and local agencies. The study will culminate in a
9 feasibility report that will make recommendations on construction projects
10 and/or additional studies for authorization by Congress (USACE 2012). The
11 project is on USACE's priority list and the scope is currently being revised.

12 *Qualitative Assessment of Actions Related to Energy* The actions related to
13 energy that are described below were identified as present or reasonably
14 foreseeable.

15 *Increased Hydropower Generation Capacity at Lewiston Dam* In March
16 2011, the U.S. Department of the Interior released the results of an internal
17 study that shows it could generate up to 1,000 gigawatt-hours of electricity
18 annually by adding hydropower capacity at 70 of its existing dams, canals,
19 tunnels, and other water-handling facilities. The report, *Hydropower Resource*
20 *Assessment at Existing Reclamation Facilities*, studied 530 sites throughout
21 Reclamation's jurisdiction and preliminarily identified the 70 facilities with the
22 most potential to add hydropower. The Trinity Public Utilities District and
23 Reclamation intend to boost the power-generating capacity at the Lewiston Dam
24 from the existing 350 kilowatts. This upgrade would allow for better control of
25 the flow from the dam to the river, and would provide an increase in revenue
26 from power generation (DOI et al. 2007).

27 *Federal Energy Regulatory Commission Project Licensing* The Federal Energy
28 Regulatory Commission (FERC) regulates non-Federal hydropower projects.
29 FERC is responsible for the issuance of licenses for new hydropower projects,
30 the continuance of existing projects (relicensing), and oversight of all ongoing
31 project operations. Ongoing operations include dam safety inspections and
32 environmental monitoring. Additionally, FERC may issue a preliminary permit
33 for up to 3 years, which does not authorize construction but maintains the
34 priority of application for license while the permittee studies the site and
35 prepares to apply for a license. The permittee must submit periodic reports on
36 the status of its studies. It is not necessary to obtain a permit to apply for or
37 receive a license.

38 Shasta Dam is a Federal project and thus is not subject to FERC oversight;
39 however, numerous hydropower projects in the primary and extended study
40 areas are subject to this oversight and permitting process.

41 *Pacific Gas & Electric Company Pit River 3, 4 & 5 Hydroelectric Projects*
42 *License Implementation* The Pit River 3, 4 & 5 Hydroelectric Projects' license

1 implementation involves three developments with a total of four dams, four
2 reservoirs, and three powerhouses. Pit River 3, 4 & 5 is a 312.33-megawatt
3 project located on the Pit River (the Sacramento River's largest tributary) that
4 occupies 4,330 acres of both publicly owned and privately owned land.

5 *Pacific Gas & Electric Company McCloud and Pit Rivers 6 and 7 FERC*
6 *Relicensing* The McCloud and Pit Rivers 6 and 7 FERC Relicensing includes
7 the McCloud and Iron Canyon storage reservoirs, the Pit River 6 and 7
8 regulating reservoirs, the Pit 7 afterbay, two tunnels, three powerhouses, and
9 transmission facilities. In 2010, the FERC final EIS recommended the
10 relicensing of the McCloud-Pit hydroelectric project, a total of 382 megawatt-
11 hours, on the McCloud and Pit rivers in Shasta County. The McCloud and Pit 6,
12 7 is currently being operated under a preliminary permit.

13 *California Department of Water Resources Oroville Facilities FERC*
14 *Relicensing* The 762-megawatt project is located on the Feather River in Butte
15 County and occupies 6,240 acres of Federal lands. The final EIR and notice of
16 determination were issued in July 2008. The final EIS was issued in May 2007
17 (DWR 2007). DWR is currently undergoing the relicensing process with FERC.

18 *Sacramento Municipal Utility District Upper American River Project*
19 *FERC Relicensing* The Sacramento Municipal Utility District's Upper
20 American River Project is a hydroelectric facility located on the western slope
21 of the Sierra Nevada. The facility is composed of several reservoirs and
22 powerhouses located along streams and rivers within the American River basin.
23 The proposed FERC relicensing includes the Iowa Hill Pumped Storage
24 Development, a 400-megawatt pumped storage generating facility using the
25 Slab Creek Reservoir as the lower reservoir and a new reservoir to be located on
26 the top of Iowa Hill. The size of the Iowa Hill reservoir is under consideration
27 and will range from 2,100 to 6,400 acre-feet.

28 *Qualitative Assessment of Actions Related to Land Use Planning and*
29 *Infrastructure* Land use plans and policies are described in Chapter 17, "Land
30 Use and Planning". Inconsistency with land use plans and policies does not
31 necessarily indicate that adverse effects on the environment would occur.
32 However, land use plans and policies guide development and land management
33 activities that would affect the physical environment, and SLWRI actions could
34 have additive or combined effects.

35 *Antlers Bridge Replacement* The California Department of
36 Transportation (Caltrans), in cooperation with the Federal Transit
37 Administration, is replacing Antlers Bridge over Shasta Lake, which is located
38 on Interstate 5 near the community of Lakehead in Shasta County, in the
39 primary study area. This project involves constructing a 1,942-foot, 5-lane
40 segmental bridge with deep-pile foundations measuring 12 feet in diameter. The
41 project also involves realigning a 0.4-mile-long segment of Interstate 5, which
42 requires hillside excavation, construction of a 5-lane freeway section, and

1 demolition of the existing 1,500 feet of steel deck truss bridge. The new bridge
2 is being constructed next to the existing bridge, which will remain open to
3 traffic until the new bridge is completed. This project will affect visual
4 resources, fish and wildlife, and water quality standards. However,
5 incorporation of mitigation will reduce these impacts to a less-than-significant
6 level. The project is not expected to have any other significant impacts (Caltrans
7 and FHWA 2007). Construction began in 2009 and is expected to be completed
8 in 2015.

9 *Jelly's Ferry Bridge Replacement* The Tehama County Department of
10 Public Works (County) in cooperation with Caltrans is proposing to replace the
11 existing the Jellys Ferry Bridge over the Sacramento River, north of Red Bluff,
12 in northern Tehama County, California. After conducting a seismic assessment,
13 as part of the Local Bridge Seismic Safety Retrofit Program (LSSRP), the
14 bridge was classified structurally and seismically deficient (Quincy 1997).
15 Based on the results of the assessment, the County determined (with Caltrans
16 concurrence) to replace rather than retrofit the existing bridge. The bridge will
17 span the Sacramento River with abutments on adjacent sides of the river.

18 **3.3 Resources Eliminated from Further Consideration**

19 CEQA and the State CEQA Guidelines provide for identification and
20 elimination from detailed study of the issues that are not significant or that have
21 been covered by prior environmental review (PRC Section 21002.1; State
22 CEQA Guidelines, Section 15143). The NEPA regulations provide similar
23 provisions (40 CFR 1501.7(a)(3)).

24 During initial scoping with the public and governmental agencies, and based on
25 information obtained through literature review, agency correspondence,
26 consultations, and field data collection, it was determined that no resource areas
27 could be eliminated from detailed study. Therefore, all resource areas covered
28 by NEPA and CEQA are addressed in this DEIS.

29 **3.4 Regulatory Framework**

30 The following section generally describes the Federal, State, and local
31 regulatory framework for the SLWRI. For a more detailed discussion of the
32 "Regulatory Framework" by resource area, see Chapters 4-24. In addition,
33 Chapter 26 "Other Required Disclosures" further describes the Federal and
34 State laws, rules and regulations, Executive Orders, and compliance
35 requirements that may be required if an alternative is selected for
36 implementation.

1 **3.4.1 Federal**

2 ***National Environmental Policy Act***

3 NEPA is the nation’s broadest environmental law, applying to all Federal
4 agencies and most of the activities they manage, regulate, or fund that affect the
5 environment. This law requires Federal agencies to disclose and consider the
6 environmental implications of their proposed actions. NEPA establishes
7 environmental policies for the nation, provides an interdisciplinary framework
8 for Federal agencies to avoid or minimize environmental impacts, and contains
9 action-forcing procedures to ensure that Federal agency decision makers take
10 environmental factors into account.

11 ***Clean Water Act***

12 **Section 404** Section 404 of the CWA requires that a permit be obtained from
13 USACE for the discharge of dredged or fill material into “waters of the United
14 States, including wetlands.” Waters of the United States are wetlands and lakes,
15 rivers, streams, and their tributaries. Waters of the United States are defined for
16 regulatory purposes, at 33 CFR 328.3, as follows:

17 *(1) All waters which are currently used, or were used in the*
18 *past, or may be susceptible to use in interstate or foreign*
19 *commerce, including all waters which are subject to the ebb*
20 *and flow of tide; (2) All interstate waters, including interstate*
21 *wetlands; (3) All other waters such as intrastate lakes, rivers,*
22 *streams, mudflats, sandflats, wetlands, sloughs, prairie*
23 *potholes, wet meadows, playa lakes, or natural ponds, the use,*
24 *degradation or destruction of which could affect interstate or*
25 *foreign commerce; (4) All impoundments of waters otherwise*
26 *defined as waters of the United States under the definition; (5)*
27 *Tributaries of waters identified in paragraphs 1–4 in this*
28 *section; (6) The territorial seas; and (7) Wetlands adjacent to*
29 *waters identified in paragraphs 1–6 in this section.*

30 CWA Section 404(b) requires that USACE process permits in compliance with
31 guidelines developed by the U.S. Environmental Protection Agency (EPA).
32 These guidelines (the CWA Section 404(b)(1) Guidelines) require the analysis
33 of available alternatives that meet the project’s purpose and need, including
34 those alternatives that avoid and minimize discharges of dredged or fill
35 materials in waters. Once alternatives deemed to be practicable have been
36 identified, the only action that USACE can permit must be the least
37 environmentally damaging practicable alternative.

38 Actions typically subject to Section 404 requirements are those that would take
39 place in wetlands or stream channels, including intermittent streams, even if
40 they have been realigned. For actions occurring within stream channels, a
41 permit under Section 404 would be needed for any discharge activity below the
42 ordinary high-water mark. (The ordinary high-water mark is the line on the

1 shore established by the fluctuations of water. It is indicated by physical
2 characteristics such as a clear, natural line impressed on the bank; shelving;
3 changes in the character of soil; destruction of terrestrial vegetation; or the
4 presence of litter or debris.)

5 The record of decision for the CALFED final programmatic EIS/EIR includes a
6 CWA Section 404 memorandum of understanding signed by Reclamation, EPA,
7 USACE, and DWR. Under the terms of the memorandum of understanding,
8 when a project proponent applies for a Section 404 individual permit for
9 CALFED projects, the proponent is not required to reexamine program
10 alternatives already analyzed in the programmatic EIS/EIR. USACE and EPA
11 will focus on project-level alternatives that are consistent with the CALFED
12 programmatic EIS/EIR when they select the least environmentally damaging
13 practicable alternative at the time of a Section 404 permit decision.

14 **Section 401** Under CWA Section 401, applicants for a Federal license or
15 permit to conduct activities that may discharge a pollutant into waters of the
16 United States must obtain certification from the state in which the discharge
17 would originate. If appropriate, the certification must be obtained from the
18 interstate water pollution control agency with jurisdiction over affected waters
19 at the point where the discharge would originate. Therefore, all projects that
20 have a Federal component and may affect state water quality (including projects
21 that require approval from a Federal agency, such as issuance of a Section 404
22 permit) must also comply with CWA Section 401.

23 In California, the authority to grant water quality certification has been
24 delegated to the SWRCB. Applications for water quality certification under
25 CWA Section 401 are typically processed by the regional water quality control
26 board with local jurisdiction – in this case, the CVRWQCB. For a project to
27 receive water quality certification, the project’s potential impacts must be
28 evaluated in light of water quality standards and CWA Section 404 criteria that
29 govern discharges of dredged and fill materials into waters of the United States.

30 ***Endangered Species Act***

31 USFWS and NMFS share responsibility for implementing the ESA. Generally,
32 USFWS manages terrestrial and freshwater species, while NMFS manages
33 marine and anadromous species such as Chinook salmon. Both agencies ensure
34 that ESA requirements are followed and evaluate projects that may affect the
35 continued existence of a Federally listed (threatened or endangered) species.

36 Section 9 of the ESA prohibits the take of Federally listed species. “Take” is
37 defined under the ESA, in part, as killing, harming, or harassing. Under Federal
38 regulations, take is further defined to include habitat modification or
39 degradation where it actually results in death or injury to wildlife by
40 significantly impairing essential behavioral patterns – breeding, feeding, or
41 sheltering.

1 Section 7 of the ESA outlines procedures for Federal interagency cooperation to
2 conserve Federally listed species and designated critical habitat. Section 7(a)(2)
3 requires Federal agencies to consult with USFWS to ensure that they are not
4 undertaking, funding, permitting, or authorizing actions likely to jeopardize the
5 continued existence of listed species. NMFS also ensures that projects will not
6 adversely affect essential fish habitat, as defined in the 1996 Sustainable
7 Fisheries Act (Public Law 104-297). The goal is to stop or reverse the continued
8 loss of fish habitats by protecting, conserving, and enhancing habitat.

9 ***Magnuson-Stevens Fishery Conservation and Management Act***

10 The Magnuson-Stevens Fishery Conservation and Management Act (commonly
11 known as Magnuson-Stevens Act) establishes a management system for
12 national marine and estuarine fishery resources. This legislation requires
13 Federal agencies to consult with NMFS regarding actions or proposed actions
14 permitted, funded, or undertaken that may adversely affect “essential fish
15 habitat.” Essential fish habitat is defined as “waters and substrate necessary to
16 fish for spawning, breeding, feeding, or growth to maturity.”

17 The Magnuson-Stevens Act states that migratory routes to and from the
18 spawning grounds of anadromous fish are considered essential fish habitat. The
19 phrase “adversely affect” refers to the creation of any impact that reduces the
20 quality or quantity of essential fish habitat.

21 The concept of essential fish habitat is similar to that of “critical habitat” under
22 the ESA; however, measures recommended by NMFS to protect essential fish
23 habitat are advisory, not prescriptive. Federal activities that occur outside of
24 essential fish habitat but that may nonetheless affect waters and substrate that
25 constitute essential fish habitat must also be considered in the consultation
26 process.

27 Under the Magnuson-Stevens Act, effects on habitat managed under the *Pacific*
28 *Salmon Fishery Management Plan* must also be considered. The Magnuson-
29 Stevens Act states that where appropriate, consultation regarding essential fish
30 habitat should be consolidated with the interagency consultation, coordination,
31 and environmental review procedures required by other Federal statutes, such as
32 NEPA, the Federal Wildlife Coordination Act, the CWA, and the ESA.

33 ***Fish and Wildlife Coordination Act***

34 Coordination under the Fish and Wildlife Coordination Act is intended to
35 promote conservation of fish and wildlife resources by preventing their loss or
36 damage. It also provides for development and improvement of fish and wildlife
37 resources in connection with water projects. Federal agencies that undertake
38 water projects must fully consider recommendations made by USFWS, NMFS,
39 and the appropriate fish and wildlife agency – in this case, CDFW – in their
40 project reports and include measures to reduce impacts on fish and wildlife in
41 project plans.

1 **Rivers and Harbors Appropriation Act of 1899**

2 The Rivers and Harbors Appropriation Act of 1899 (commonly known as the
3 Rivers and Harbors Act) addresses activities that involve constructing dams,
4 bridges, dikes, or other obstructions across any navigable water. To place any
5 obstruction to navigation outside established Federal lines, or to excavate from
6 or deposit material in such waters, a permit must be obtained from USACE.
7 Navigable waters are defined in 33 CFR 329.4 as follows:

8 *Those waters that are subject to the ebb and flow of the tide*
9 *and/or are presently used, or have been used in the past, or may*
10 *be susceptible for use to transport interstate or foreign*
11 *commerce. A determination of navigability, once made, applies*
12 *laterally over the entire surface of the waterbody, and is not*
13 *extinguished by later actions or events which impede or destroy*
14 *navigable capacity.*

15 Sections of the River and Harbors Act applicable to the SLWRI are described
16 below.

17 **Section 9** Section 9 (33 USC 401) prohibits the construction of any dam or
18 dike across any navigable water of the United States without consent from
19 Congress and approval of the plans by the Chief of Engineers and the Secretary
20 of the Army. Where the navigable portions of the water body lie wholly within
21 the limits of a single state, the structure may be built under authority of that
22 state’s legislature if the location and plans, or any modification thereof, are
23 approved by the Chief of Engineers and by the Secretary of the Army.

24 **Section 10** Section 10 (33 USC 403) prohibits the unauthorized obstruction or
25 alteration of any navigable water of the United States. Construction of any
26 structure in or over any navigable water of the United States, or the
27 accomplishment of other work affecting the course, location, condition, or
28 physical capacity of such waters, is unlawful unless the work has been
29 authorized by the Chief of Engineers.

30 **Section 13** Section 13 (33 USC 407) states that the Secretary of the Army may
31 permit the discharge of refuse into navigable waters if the Chief of Engineers
32 has determined that the discharge will not injure anchorage and navigation.
33 Discharges of refuse are prohibited unless a permit has been obtained. Although
34 the prohibition in this section – known as the Refuse Act – is still in effect, the
35 Secretary of the Army’s permit authority has been superseded by the permit
36 authority given to the EPA Administrator and the states under Sections 402 and
37 405 of the CWA, respectively.

38 **Safe Drinking Water Act**

39 The Safe Drinking Water Act mandates that EPA establish regulations to
40 protect human health from contaminants in drinking water. This law authorizes
41 EPA to develop national standards for drinking water and to create a joint

1 Federal/state/tribal system to ensure compliance with these standards. The law
2 also directs EPA to protect underground sources of drinking water by
3 controlling the underground injection of liquid wastes.

4 EPA has developed primary and secondary drinking water standards under its
5 Safe Drinking Water Act authority. EPA and authorized states and tribes
6 enforce the primary drinking water standards, which are contaminant-specific
7 concentration limits that apply to certain public supplies of drinking water. The
8 primary standards consist of two elements: goals for maximum contaminant
9 levels, which are nonenforceable health-based goals; and maximum
10 contaminant levels, which are enforceable limits set as close to the maximum
11 contaminant level goals as possible, considering the cost and feasibility of
12 attainment.

13 ***Federal Water Project Recreation Act***

14 The Federal Water Project Recreation Act requires that Federal agencies with
15 authority to approve water projects include recreation development as a
16 condition of approving permits. Recreation development must be considered
17 along with any navigation, flood control, reclamation, hydroelectric, or
18 multipurpose water resource project. The act states that “consideration shall be
19 given to the opportunities, if any, which the project affords for outdoor
20 recreation and for fish and wildlife enhancement...wherever any such project
21 can reasonably serve either or both of these purposes consistently” (Title 16,
22 Section 460l-12 of the U.S. Code (16 USC 460l-12)).

23 ***Federal Clean Air Act***

24 The Federal Clean Air Act (CAA) was enacted to protect and enhance the
25 nation’s air quality to promote public health and welfare and the productive
26 capacity of the nation’s population. The CAA requires that Federal actions be
27 evaluated to determine their potential impacts on air quality in the project
28 region. California has a corresponding law, which also must be considered
29 during the EIS/EIR process.

30 For specific projects, Federal agencies must coordinate with the appropriate air
31 quality management district and EPA. This coordination determines whether the
32 project conforms to the CAA and the state implementation plan.

33 Section 176 of the CAA prohibits Federal agencies from engaging in or
34 supporting an action or activity that does not conform to an applicable state
35 implementation plan. Actions and activities must conform to the plan’s
36 purposes of eliminating or reducing violations of national ambient air quality
37 standards, reducing the severity of violations, and attaining those standards
38 expeditiously.

39 ***National Historic Preservation Act***

40 Section 106 of the National Historic Preservation Act of 1966 and its
41 implementing regulations (36 CFR Part 800, as amended in 2004) requires

1 Federal agencies to consider the effects of their actions, or those they fund or
2 permit, on properties that are listed or eligible for listing in the National
3 Register of Historic Places (NRHP). The NRHP is a register of districts, sites,
4 buildings, structures, and objects of significance in American history,
5 architecture, archaeology, engineering, and culture. The regulations provided in
6 36 CFR Part 60.4 describe the criteria to evaluate cultural resources for
7 inclusion in the NRHP. Cultural resources can be significant on the national,
8 state, or local level. Properties may be listed in the NRHP if they possess
9 integrity of location, design, setting, materials, workmanship, feeling, and
10 association, and meet any one of the following criteria:

- 11 1. Are associated with events that have made a significant contribution to
12 the broad patterns of our history
- 13 2. Are associated with the lives of persons significant in our past
- 14 3. Embody the distinctive characteristics of a type, period, or method of
15 construction, or represent the work of a master, or possess high artistic
16 values, or represent a significant and distinguishable entity whose
17 components may lack individual distinction
- 18 4. Have yielded, or may be likely to yield, information important in
19 prehistory or history

20 Generally, properties are not considered eligible for the NRHP if they have
21 achieved significance within the past 50 years. Certain exceptions are made in
22 the regulation, such as a religious property deriving primary significance from
23 its architectural distinction, or a grave of a historical figure of outstanding
24 importance if there is no appropriate site directly associated with his productive
25 life.

26 ***Farmland Protection Policy Act***

27 The Farmland Protection Policy Act requires that a Federal agency examine the
28 potential impacts of a proposed action on Prime Farmland and Unique
29 Farmland, as defined by the U.S. Natural Resources Conservation Service. If
30 the action would adversely affect farmland preservation, the Federal agency
31 must consider alternatives to lessen the adverse effects.

32 ***Migratory Bird Treaty Act***

33 The Migratory Bird Treaty Act, first enacted in 1918, implements domestically
34 a series of treaties between the United States and Great Britain (on behalf of
35 Canada), Mexico, Japan, and the former Soviet Union that provide international
36 protection of migratory birds. The act authorizes the Secretary of the Interior to
37 regulate the taking of migratory birds. It is unlawful, except as permitted by
38 regulations, “to pursue, take, or kill any migratory bird, or any part, nest or egg
39 of any such bird...” (16 USC 703). This prohibition includes both direct and
40 indirect acts, although harassment and habitat modification are not included

1 unless they result in the direct loss of birds, nests, or eggs. Several hundred
2 species, essentially including all native birds, are currently protected by the
3 Migratory Bird Treaty Act. The act offers no statutory or regulatory mechanism
4 for obtaining an incidental take permit for the loss of nongame migratory birds.

5 ***Bald and Golden Eagle Protection Act***

6 The Bald and Golden Eagle Protection Act, enacted in 1940 and amended
7 multiple times since, prohibits the taking of bald and golden eagles without a
8 permit from the Secretary of the Interior. Similar to the ESA, the Bald and
9 Golden Eagle Protection Act defines “take” to include “pursue, shoot, shoot at,
10 poison, wound, kill, capture, trap, collect, molest or disturb” (16 USC 668-
11 668c). Any disturbance that would injure an eagle, decrease productivity, or
12 cause nest abandonment – including habitat alterations that could have these
13 results – is considered take and can result in civil or criminal penalties.

14 ***National Forest Management Act***

15 The National Forest Management Act requires USFS to “provide for a diversity
16 of plant and animal communities” (16 USC 1604(g)(3)(B)) as part of its
17 multiple-use mandate. USFS must maintain “viable populations of existing
18 native and desired nonnative species in the planning area” (36 CFR 219.19).
19 The Sensitive Species program is designed to meet this mandate and to
20 demonstrate USFS’s commitment to maintaining biodiversity on National
21 Forest System lands.

22 A key requirement of the National Forest Management Act is preparation of
23 land and resource management plans that establish the goals, objectives, and
24 standards and guidelines for managing the lands and resources of National
25 Forest System lands managed by the various National Forests.

26 ***Federal Land Policy and Management Act***

27 Sections 201 and 202 of the Federal Land Policy and Management Act of 1976
28 (FLPMA) (43 USC 1711–1712) and the regulations in 43 CFR 1600 provide
29 guidance and direction for implementing BLM’s land use planning
30 requirements, as established by resource management plans. Resource
31 management plans and subsequent planning decisions are the basis for every
32 on-the-ground action undertaken by BLM.

33 Resource management plans ensure that public lands are managed in
34 accordance with the intent of Congress as stated in the FLPMA, under the
35 principles of multiple use and sustained yield. As required by the FLPMA and
36 BLM policy, public lands must be managed in a manner that will do all of the
37 following:

- 38 • Protect the quality of ecological and scientific values
- 39 • Preserve and protect certain public lands in their natural condition,
40 where appropriate

- 1 • Provide food and habitat for fish and wildlife and domestic animals
- 2 • Provide for outdoor recreation and human occupancy and use
- 3 • Recognize the nation’s need for domestic sources of minerals, food,
- 4 timber, and fiber from the public lands by encouraging collaboration
- 5 and public participation throughout the planning process

6 Resource management plans are among the primary mechanisms for guiding
7 BLM activities to achieve compliance with the FLPMA.

8 ***National Wild and Scenic Rivers Act***

9 The National Wild and Scenic Rivers Act of 1968, as amended (Public Law
10 90-542; 16 USC 1271–1287), established the National Wild and Scenic Rivers
11 System. This system identifies distinguished rivers of the nation that possess
12 outstandingly remarkable scenic, recreational, geologic, fish and wildlife,
13 historic, cultural, or other similar values. The National Wild and Scenic Rivers
14 Act preserves the free-flowing condition of designated rivers and protects their
15 local environments. Section 5(d)(1) of the act requires Federal agencies to
16 consider potential national wild, scenic, and recreational river areas when
17 planning for the use and development of water and related land resources. Wild,
18 scenic, and recreational river areas are defined as follows:

- 19 • “*Wild*” river areas are rivers or sections of rivers that are free of
20 impoundments and generally inaccessible except by trail, with
21 watersheds or shorelines essentially primitive and waters unpolluted.
22 These represent vestiges of primitive America.
- 23 • “*Scenic*” river areas are rivers or sections of rivers that are free of
24 impoundments, with shorelines or watersheds still largely primitive and
25 shorelines largely undeveloped, but accessible by roads in places.
- 26 • “*Recreational*” river areas are rivers or sections of rivers that are
27 readily accessible by road or railroad, that may have some development
28 along their shorelines, and that may have undergone some
29 impoundment or diversion in the past.

30 Designation as a National Wild and Scenic River explicitly prohibits the Federal
31 government from licensing or permitting new hydroelectric dams or major
32 diversions on these rivers. Federal agencies are also prohibited from assisting
33 any water resource projects that may directly affect the resources for which the
34 river was designated. Public lands within a corridor averaging one-quarter mile
35 on both sides of the rivers are managed to protect resources designated as
36 outstandingly remarkable for their scenic, recreational, historical/cultural, fish,
37 wildlife, ecological, geological, or hydrologic value.

1 **Indian Trust Assets**

2 All Federal agencies have a responsibility to protect Indian trust assets. Indian
3 trust assets are legal interests in assets held in trust by the Federal government
4 for Native American tribes or individuals. Assets may be owned property,
5 physical assets, intangible property rights, a lease, or the right to use something.
6 Typically, they include lands, minerals, water rights, hunting and fishing rights,
7 natural resources, money, and claims.

8 **Executive Order 11988 (Flood Hazard Policy)**

9 Executive Order 11988 is a flood hazard policy for all Federal agencies that
10 manage Federal lands, sponsor Federal projects, or provide Federal funds to
11 state or local projects. The order requires that Federal agencies take necessary
12 action to reduce the risk of flood loss; restore and preserve the natural and
13 beneficial values served by floodplains; and minimize the impacts of floods on
14 human safety, health, and welfare.

15 **Executive Order 11990 (Protection of Wetlands)**

16 Executive Order 11990 is an overall wetlands policy for all Federal agencies
17 that manage Federal lands, sponsor Federal projects, or provide Federal funds to
18 state or local projects. The order requires that Federal agencies follow
19 avoidance, mitigation, and preservation procedures with public input before
20 they propose new construction in wetlands. Executive Order 11990 can restrict
21 the sale of Federal land containing wetlands; however, it does not apply to
22 Federal discretionary authority for non-Federal projects (other than funding) on
23 non-Federal land.

24 **Executive Order 12898 (Environmental Justice Policy)**

25 Executive Order 12898 requires Federal agencies to identify and address the
26 disproportionately high and adverse human health and environmental effects of
27 Federal programs, policies, and activities on minority and low-income
28 populations. The requirements of Executive Order 12898 apply to all Federal
29 actions that are located on Federal lands, sponsored by a Federal agency, or
30 funded with Federal monies and may affect minority or low-income
31 populations.

32 **Executive Order 13007 (Indian Sacred Sites) and April 29, 1994, Executive
33 Memorandum**

34 Executive Order 13007 (May 24, 1996) requires Federal agencies with land
35 management responsibilities to accommodate access to and ceremonial use of
36 Indian sacred sites by Indian religious practitioners and avoid adversely
37 affecting the physical integrity of such sacred sites. Where appropriate, agencies
38 are to maintain the confidentiality of sacred sites. Among other things, Federal
39 agencies must provide reasonable notice of proposed actions or land
40 management policies that may restrict future access to or ceremonial use of, or
41 adversely affect the physical integrity of, sacred sites. The agencies must
42 comply with the April 29, 1994, executive memorandum, “Government-to-
43 Government Relations with Native American Tribal Governments.”

Executive Order 13112 (National Invasive Species Management Plan)

Executive Order 11312 directs all Federal agencies to prevent and control introductions of invasive nonnative species in a cost-effective and environmentally sound manner to minimize their economic, ecological, and human health impacts. Executive Order 11312 established the national Invasive Species Council, made up of Federal agencies and departments, and the supporting Invasive Species Advisory Committee, composed of state, local, and private entities. The Invasive Species Council and Advisory Committee oversee and facilitate implementation of the executive order, including preparation of a national invasive-species management plan.

Federal Transit Administration

To address the human response to ground-borne vibration, the Federal Transit Administration has set forth guidelines for maximum-acceptable vibration criteria for different types of land uses (FTA 2006):

- 65 vibration decibels for land uses where low ambient vibration is essential for interior operations (e.g., hospitals, high-tech manufacturing, and laboratory facilities)
- 80 vibration decibels for residential uses and buildings where people normally sleep
- 83 vibration decibels for institutional land uses with primarily daytime operations (e.g., schools, churches, clinics, and offices)

Standards have also been established to address the potential for ground-borne vibration to cause structural damage to buildings. These standards were developed by the Committee of Hearing, Bio Acoustics, and Bio Mechanics at the request of EPA (FTA 2006). For fragile structures, this committee recommends a maximum limit of 0.25 inch per second peak particle velocity (FTA 2006). (Peak particle velocity is a measure of the intensity of ground vibration, specifically the time rate of change of the amplitude of ground vibration.)

Federal Land Use Policies

Federal land use policies apply only to actions on or affecting the uses of Federal lands. The following are the Federal lands located in the vicinity of the study area:

- National Forest System lands administered by the Shasta-Trinity National Forest
- Reclamation-owned lands along the Sacramento River, just south of Shasta Dam
- BLM-owned lands along the Sacramento River, just north of Red Bluff

1 Encroachment within these Federal properties would require approval from
2 these entities.

3 ***Shasta-Trinity National Forest Land and Resource Management Plan***

4 The *Shasta-Trinity National Forest Land and Resource Management Plan* was
5 most recently revised in 1995 (USFS 1995). This document is revised every 10–
6 15 years; it supersedes any previous forest plans, timber management plans, or
7 National Recreation Area (NRA) plans. It contains the goals and objectives for
8 Shasta-Trinity National Forest, its standards and guidelines, management
9 prescriptions to be applied to land areas, and management area direction. It also
10 sets forth requirements for monitoring and implementation of the plan. The
11 allocations associated with this plan not only reflect the capability and
12 suitability of the land for various uses, but also respond to the public issues
13 (such as recommendations for Wild and Scenic River designations) and
14 development opportunities identified during the planning process.

15 ***Whiskeytown-Shasta-Trinity National Recreation Area Management Plan***

16 The Whiskeytown-Shasta-Trinity NRA consists of the Shasta and Trinity units
17 on the Shasta-Trinity National Forest (managed by the USFS) and the
18 Whiskeytown Unit located outside the National Forest (managed by the
19 National Park Service). The Whiskeytown-Shasta-Trinity NRA was established
20 on November 8, 1965 with the signing of Public Law 89-336 by President
21 Lyndon Johnson. The legislation provides that administration of the NRA be
22 carried out under separate management plans, and that these plans are to be
23 reviewed and revised periodically. The *Management Guide: Shasta and Trinity*
24 *Units of the Whiskeytown-Shasta-Trinity NRA* (USFS 1996) provides a general
25 framework to guide management of the Shasta and Trinity Units of the NRA,
26 and by which to evaluate and gauge the appropriate NRA management efforts
27 and analysis. This guide is not a decision document or an assessment under
28 NEPA, and does not implement site-specific projects.

29 The NRA Guide relies on the Forest Plan for a broad umbrella of direction and
30 is incorporated by reference into the Forest Plan. The periodic updates to the
31 NRA Guide respond to changes in environmental conditions, public concern,
32 and recreation use patterns, providing better management of the resources in the
33 NRA and continued implementation of the management direction in the Forest
34 Plan. The Guide was recently reviewed and updated and is in draft form.

35 ***Redding Resource Management Plan***

36 BLM owns lands along the Sacramento River just north of Red Bluff. This land
37 is managed by BLM in accordance with the *Redding Resource Management*
38 *Plan*, which covers more than 250,000 acres in north-central California in Butte,
39 Shasta, Siskiyou, Tehama, and Trinity counties. Many Areas of Critical
40 Environmental Concern and National Wild and Scenic River corridors are
41 included within these easily accessed and heavily used public lands. Completed
42 in 1993, the *Redding Resource Management Plan* primarily addresses
43 recreation, land tenure, access, and forest management.

Federal Energy Regulatory Commission

Changes to hydroelectric facilities on the Pit River – instream flow releases or modifications to downstream structures – may necessitate an amendment to a FERC license. Typical modifications that require an amendment to a license or exemption include capacity changes, design changes, operational changes, land status changes, and time extensions. Before issuing a license amendment, FERC ensures that proposed changes to hydropower facilities comply with NEPA. For noncapacity-related amendments, other factors – the nature of the proposed change, project type (based on proposed capacity), and construction status – determine which items outlined in the FERC Division of Hydropower Administration and Compliance’s *Compliance Handbook* to include in the amendment application. If any item in the original license would be modified as a result of the project, a revised version must be filed along with the amendment application.

Once the need for an amendment is determined, the appropriate resource agencies are consulted. The extent of agency consultation depends on whether the amendment is capacity-related or noncapacity-related. After pre-filing consultation is completed, the licensee files the amendment application. The FERC Division of Hydropower Administration and Compliance then determines whether a public notice is warranted and whether NEPA review is required. NEPA review entails preparing an environmental assessment and/or an EIS. The license amendment process is detailed in the *Compliance Handbook*.

3.4.2 State

California Environmental Quality Act

Prompted by the passage of NEPA in 1969, CEQA was signed into law in 1970 as California’s counterpart to NEPA. CEQA requires State and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. The objectives of CEQA are to do all of the following:

- Disclose to decision makers and the public the significant environmental effects of proposed activities
- Identify ways to avoid or reduce environmental damage
- Prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures
- Disclose to the public the reasons for agency approval of projects with significant environmental effects
- Foster interagency coordination in the review of projects

- Enhance public participation in the planning process

California Endangered Species Act

Pursuant to the California Endangered Species Act (CESA), a permit from CDFW is required for projects that could result in the take of a plant or animal species that is State-listed as threatened or endangered. Under the CESA, “take” is defined as an activity that would directly or indirectly kill an individual of a species, but the CESA definition of take does not include “harming” or “harassing,” as the Federal ESA definition does. As a result, the threshold for take is higher under the CESA than under the ESA (i.e., habitat modification is not necessarily considered take under the CESA).

Sections 3503 and 3503.5 of the California Fish and Game Code state that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, or to take, possess, or destroy any raptors (i.e., species in the orders Falconiformes and Strigiformes), including their nests or eggs. Destruction of active nests caused by removal of vegetation in which the nests are located is a typical violation of these codes. Violation of Section 3503.5 could also include failure of active raptor nests that results from disturbance of nesting pairs by nearby project construction. This statute does not provide for the issuance of any type of incidental take permit.

California Fish and Game Code – Fully Protected Species

Protection of fully protected species is described in Sections 3511, 4700, 5050, and 5515 of the California Fish and Game Code. These statutes prohibit take or possession of fully protected species. CDFW is unable to authorize incidental take of fully protected species when activities are proposed in areas inhabited by those species. CDFW has informed non-Federal agencies and private parties that they must avoid take of any fully protected species in carrying out projects.

California Fish and Game Code Section 1602 – Streambed Alteration

All diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFW under Section 1602 of the California Fish and Game Code. Under Section 1602, it is unlawful for any person, governmental agency, or public utility to do the following without first notifying CDFW:

...substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake.

A stream is defined as a body of water that flows at least periodically or intermittently through a bed or channel that has banks and supports fish or other

1 aquatic life. This definition includes watercourses with a surface or subsurface
2 flow that supports or has supported riparian vegetation. CDFW’s jurisdiction
3 within altered or artificial waterways is based on the value of those waterways
4 to fish and wildlife.

5 **California Fish and Game Code Sections 5900–5904, 5930–5948, 7261,**
6 **and 7370 – Fish Passage**

7 The California Fish and Game Code includes the following provisions intended
8 to protect fish passage:

- 9 • *Sections 5900–5904* prohibit constructing or maintaining any device or
10 contrivance in any stream that prevents, impedes, or tends to prevent or
11 impede the passing of fish upstream and downstream.

- 12 • *Sections 5930–5948* require CDFW to inspect California’s dams to
13 ensure that dam owners are maintaining fish passage. CDFW may
14 require dam owners to install a suitable fishway if passage is impeded.

- 15 • *Section 7261* authorizes the California Fish and Game Commission to
16 designate as “Heritage Trout Waters” any waters that provide anglers
17 with an opportunity to catch native trout, consistent with the
18 conservation of the California native trout. The McCloud River
19 redband trout occurs in the McCloud River upstream from McCloud
20 Dam.

- 21 • *Section 7370* prohibits taking or possessing for commercial purposes,
22 buying or selling, or offering to buy or sell all or part of any sturgeon,
23 including its eggs, unless the sturgeon was cultured, taken from another
24 state, or taken pursuant to a sport fishing license. Green sturgeon occurs
25 in the primary and extended study areas in the Sacramento River, its
26 tributaries, and the Delta.

27 **California Water Commission**

28 In November 2009, California enacted a comprehensive water package to
29 improve the state’s water supply reliability and restore the Sacramento- San
30 Joaquin River Delta ecosystem. The package included the Safe, Clean, and
31 Reliable Drinking Water Supply Act which, if approved by voters in 2014, will
32 direct the California Water Commission to develop tools and methods for the
33 quantification of public benefits of water storage projects including CALFED
34 surface storage, groundwater storage, conjunctive use and reservoir reoperation,
35 and local and regional storage.

36 **Delta Stewardship Council**

37 In November 2009 the Sacramento-San Joaquin Delta Reform Act was passed
38 by the California Legislature and signed by Governor Schwarzenegger. It
39 established state policy of coequal goals for the Delta and created the Delta
40 Stewardship Council as a new, independent state agency that will delineate

1 exactly how to meet these goals through development and implementation of
2 the Delta Plan.

3 The Council’s principal task is to develop and implement the Delta Plan, a
4 legally enforceable document that will include all the actions necessary to
5 ensure the state’s coequal goals for the Delta are met (Delta Stewardship
6 Council 2013).

7 ***Central Valley Flood Protection Board Encroachment Permit***

8 Under CCR Title 23, the Central Valley Flood Protection Board (formerly
9 called the State of California Reclamation Board) issues encroachment permits
10 to maintain the integrity and safety of flood control project levees and
11 floodways that were constructed according to the flood control plans adopted by
12 the board or the California Legislature.

13 ***California Water Rights***

14 A water right is a legally granted and protected right to take possession of water
15 and put it to beneficial use. As authorized by the California Water Code, the
16 SWRCB allocates surface water rights and permits the diversion and use of
17 water throughout the state. Through its Division of Water Rights, the SWRCB
18 issues permits to divert water for new appropriations, change existing water
19 rights, or store water for a certain length of time. The SWRCB attaches
20 conditions to these permits to ensure that the water user prevents waste,
21 conserves water, does not infringe on the rights of others, and puts the State’s
22 water resources to the most beneficial use in the best interest of the public.

23 ***California Public Resources Code***

24 PRC Section 5093.542, established through enactment of the California Wild
25 and Scenic Rivers Act, as amended (Sections 5093.50 through 5093.70), aims to
26 preserve designated rivers that possess extraordinary scenic, recreation, fishery,
27 or wildlife values. With the act’s passage, the California system protected
28 segments of the Smith and Klamath rivers and their tributaries, and the Scott,
29 Salmon, Trinity, Eel, Van Duzen, and American rivers. Segments of the
30 McCloud River, Deer Creek, and Mill Creek were subsequently protected under
31 the act in 1989 and 1995, respectively, although these segments were not
32 formally designated as components of the State’s Wild and Scenic Rivers
33 System.

34 No dam, reservoir, diversion, or other water impoundment facility may be
35 constructed on any river segment included in the State system. No water
36 diversion facility may be constructed on any river segment included in the State
37 system unless the Resources Secretary determines that the facility is needed to
38 supply domestic water to local residents and that the facility will not adversely
39 affect the river’s free-flowing condition and natural character. In reference to
40 the McCloud River, PRC Section 5093.542(c) states the following:

1 *Except for participation by the [California] Department of*
 2 *Water Resources in studies involving the technical and*
 3 *economic feasibility of enlargement of Shasta Dam, no*
 4 *department or agency of the state shall assist or cooperate with,*
 5 *whether by loan, grant, license, or otherwise, any agency of the*
 6 *federal, state, or local government in the planning or*
 7 *construction of any dam, reservoir, diversion, or other water*
 8 *impoundment facility that could have an adverse effect on the*
 9 *free-flowing condition of the McCloud River, or on its wild*
 10 *trout fishery.*

11 Designation as a Wild and Scenic River does not affect existing water rights and
 12 facilities. Proposed changes in existing rights and facilities or applications for
 13 new water rights and facilities on designated segments are subject to the
 14 domestic-use restriction and the nondegradation standard. Designated segments
 15 are considered fully appropriated streams by the SWRCB.

16 PRC Section 5093.542 shares similar criteria and definitions in regard to the
 17 purpose of protecting rivers with the National Wild and Scenic Rivers Act:
 18 identifying free-flowing rivers with extraordinary values suitable for protection,
 19 establishing a study process to include rivers in the system, and classifying river
 20 segments as either wild, scenic, or recreational based largely on the degree of
 21 development along each river segment included in the system. The primary
 22 purpose of both the Federal Wild and Scenic Rivers Act and the California
 23 Public Resources Code is to prohibit new water impoundments on designated
 24 rivers.

25 The California Public Resources Code also contains several other sections
 26 relevant to the project. Some examples include PRC Section 5096.225 (the
 27 California Park and Recreational Facilities Act of 1984), PRC Section 5094 (the
 28 Federal Water Project Recreation Act), and the CWA.

29 ***California Harbors and Navigation Code***

30 The California Harbors and Navigation Code details the jurisdiction of the
 31 California Department of Boating and Waterways, which is focused on the
 32 development of public access to waterways, the safety of vessels and boating
 33 facilities, and on-the-water safety.

34 ***Porter-Cologne Water Quality Control Act***

35 Under the Porter-Cologne Water Quality Control Act, “waters of the State” fall
 36 under the jurisdiction of the appropriate regional water quality control board (in
 37 this case, the CVRWQCB). Under the act, the regional water quality control
 38 board must prepare and periodically update basin plans. Each basin plan sets
 39 forth water quality standards for surface water and groundwater, and actions to
 40 control nonpoint and point sources of pollution to achieve and maintain these
 41 standards. Projects that affect wetlands or waters must meet the regional water

1 quality control board’s waste discharge requirements, which may be issued in
2 addition to a water quality certification under Section 401 of the CWA.

3 ***California Land Conservation Act of 1965 (Williamson Act)***

4 The California Land Conservation Act of 1965, commonly known as the
5 Williamson Act, is the principal method for encouraging preservation of
6 agricultural lands in California. The Williamson Act enables local governments
7 to enter into contracts with private landowners that restrict specific parcels of
8 land to agricultural or related open-space use for 10 years. In return, landowners
9 receive property tax assessments that are based on farming and open space uses
10 rather than full market value. Local governments receive an annual subvention
11 (subsidy) of forgone property tax revenues from the State via the Open Space
12 Subvention Act of 1971.

13 The Williamson Act empowers local governments to establish “agricultural
14 preserves” consisting of lands devoted to agricultural uses and other compatible
15 uses. When establishing such preserves, the locality may offer to owners of
16 included agricultural land the opportunity to enter into annually renewable
17 contracts that restrict the land use for at least 10 years. In return, the landowner
18 is guaranteed a relatively stable tax base, founded on the value of the land for
19 agricultural/open space use only and unaffected by its development potential.

20 Cancelling a Williamson Act contract requires the landowner to undergo an
21 extensive review and approval process and pay fees of up to 12.5 percent of the
22 property value. The local jurisdiction approving the cancellation must find that
23 the cancellation is consistent with the purpose of the California Land
24 Conservation Act or is in the public interest. Several subfindings must be made
25 to support either finding, as defined in Section 51282 of the California
26 Government Code.

27 ***California Clean Air Act***

28 The California Clean Air Act of 1988 requires nonattainment areas to achieve
29 and maintain the State ambient air quality standards by the earliest practicable
30 date. Local air districts must develop plans for attaining the State standards for
31 ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide.

32 ***California Native Plant Protection Act***

33 In addition to the CESA, the California Native Plant Protection Act provides
34 protection to endangered and rare plant species, subspecies, and varieties of
35 wild native plants in California. The definitions of “endangered” and “rare” in
36 the California Native Plant Protection Act closely parallel the CESA definitions
37 of “endangered” and “threatened” plant species.

38 ***California Surface Mining and Reclamation Act***

39 The California Surface Mining and Reclamation Act of 1975 (SMARA) (PRC
40 Section 2710 et seq.) addresses surface mining. Among the activities subject to
41 SMARA are the mining of minerals, gravel, and borrow material. SMARA

1 requires mitigation to reduce adverse impacts on public health, property, and the
2 environment. Because the SLWRI may obtain borrow material for project
3 construction from sites not previously permitted, Reclamation must comply
4 with SMARA. SMARA applies to an individual or entity that would disturb
5 more than 1 acre or remove more than 1,000 cubic yards of material through
6 surface mining activities, including the excavation of borrow pits for soil
7 material. SMARA is implemented through permitting ordinances developed by
8 local government “lead agencies” that provide the regulatory framework under
9 which local mining and reclamation activities are conducted. The State Mining
10 and Geology Board reviews the local ordinances to ensure that they meet the
11 procedures established by SMARA.

12 ***California Native Plant Society Species Designations***

13 The California Native Plant Society is a statewide nonprofit organization that
14 seeks to increase understanding of California’s native flora and to preserve this
15 rich resource for future generations. The organization has developed and
16 maintains lists of vascular plants of special concern in California. Species listed
17 by the California Native Plant Society have no formal legal protection, but the
18 values and importance of these lists are widely recognized.

19 ***California Scenic Highway Program***

20 The Scenic Highways Element is an optional element of the *California*
21 *Highway Designs Manual* authorized by Section 65303 of the Government
22 Code. The stated intent (Streets and Highways Code, Section 260) of the
23 California Scenic Highway Program is to protect and enhance California’s
24 natural scenic beauty and to protect the social and economic values provided by
25 the state’s scenic resources. For a highway to receive official designation, the
26 local jurisdiction must enact a scenic corridor protection program that protects
27 and enhances scenic resources. A properly enforced program can do all of the
28 following:

- 29 • Protect against encroachment of inappropriate land uses
- 30 • Mitigate uses that detract from scenic values by proper siting,
31 landscaping, or screening
- 32 • Make development more compatible with the environment by requiring
33 building siting, height, colors, and materials that are harmonious with
34 the surroundings
- 35 • Regulate grading to cause minimal alteration of existing contours and
36 to preserve important vegetative features along the highway

37 ***State Lands Commission Land Use Lease***

38 The California State Lands Commission has the authority and responsibility to
39 manage and protect the important natural and cultural resources on certain
40 public lands in the state and the public’s rights to access these lands. Two

1 distinct types of public lands are under the commission’s jurisdiction: sovereign
2 lands and school lands. Sovereign lands encompass approximately 4 million
3 acres. These lands include the beds of California’s naturally navigable rivers,
4 lakes, and streams, and the state’s tidal and submerged lands along the
5 coastline, extending from the shoreline out to 3 miles offshore.

6 ***State of California General Plan Guidelines***

7 The State of California has developed land-use compatibility guidelines for
8 community-noise environments. The *State of California General Plan*
9 *Guidelines*, published by the Governor’s Office of Planning and Research (OPR
10 2003), provides guidance for the acceptability of projects within specific
11 community-noise-equivalent-level/day-night noise level (L_{dn}) contours. With
12 regard to the SLWRI, water recreational uses are considered acceptable in areas
13 where exterior noise levels do not exceed 75 A-weighted decibels community
14 noise equivalent level/ L_{dn} . Water recreational uses are normally unacceptable in
15 areas exceeding 70 A-weighted decibels L_{dn} and clearly unacceptable in excess
16 of 80 A-weighted decibels L_{dn} . The guidelines also present adjustment factors
17 that may be used to arrive at noise-acceptability standards that reflect the
18 particular community’s noise-control goals, sensitivity to noise, and assessment
19 of the relative importance of noise issues.

20 ***California Department of Transportation***

21 Caltrans recommends thresholds of 0.2 inch per second peak particle velocity
22 for normal residential buildings and 0.08 inch per second peak particle velocity
23 for old or historically significant structures (Caltrans 2002). These standards are
24 more stringent than the Federal standard established by the Committee of
25 Hearing, Bio Acoustics, and Bio Mechanics, presented above under “Federal
26 Transit Administration.”

27 Caltrans is responsible for planning, designing, construction, operating, and
28 maintaining all State-owned roadways in California. The *Caltrans Highway*
29 *Design Manual* establishes uniform policies and procedures to carry out
30 Caltrans’s highway design functions. The highway design criteria and policies
31 in the manual provide a guide for applying standards in the design of projects
32 and, rather than implementing enforceable regulations, present information and
33 guidance.

34 **3.4.3 Regional and Local**

35 ***Shasta County Air Quality Management District’s Authority to Construct***
36 ***and Permit to Operate***

37 Facilities with equipment that may emit air pollution or would be used for
38 controlling air pollution are subject to SCAQMD permit requirements.
39 SCAQMD grants two types of permits: Authority to Construct and Permit to
40 Operate. An Authority to Construct permit must be obtained before building or
41 installing a new emissions unit or modifying an existing emissions unit that

1 requires a permit. A Permit to Operate is issued after all construction is
2 completed and the emission unit is ready for operation.

3 ***Other Local Permits and Requirements***

4 Several other local permits and requirements may apply to the SLWRI. Shasta
5 and Tehama counties and their public works departments will require
6 compliance with local plans and ordinances, such as the county general plan,
7 zoning ordinances, grading plan, and various use permits. Utility easements and
8 various encroachments also may be required.

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