Contents

Chapter 1 Introduction 1-1
Purpose, Scope, and Organization of Final Feasibility Report 1-1
Study Overview and Status 1-2
Organization of Final Feasibility Report 1-3
Study Authorization and Guidance 1-4
Guidance in the CALFED Programmatic Record of Decision 1-5
CALFED Tiering 1-6
Summary of Problems, Needs, Opportunities, and Planning Objectives 1-7
Problems, Needs, and Opportunities 1-7
SLWRI Planning Objectives 1-8
Background 1-9
Study Area 1-10
Related Studies, Projects, and Programs 1-15
Activities of Federal Agencies 1-15
Activities of State Agencies 1-24
Joint Activities of Federal and State Agencies 1-30
Activities of Regional and Local Entities/Agencies 1-37

Chapter 2 Water Resources and Related Conditions 2-1
Water and Related Resources Problems, Needs, and Opportunities 2-1
Anadromous Fish Survival 2-1
Water Supply Reliability 2-5
Ecosystem Resources 2-10
Flood Management 2-12
Hydropower 2-14
Recreation 2-14
Water Quality 2-14
Existing and Likely Future Resources Conditions in Study Area 2-15
Existing Conditions Summary 2-16
Summary of Likely Future Conditions 2-41

Chapter 3 Plan Formulation 3-1
Planning Objectives 3-4
National Planning Objectives 3-4
SLWRI-Specific Planning Objectives 3-5
Planning Constraints and Other Considerations 3-5
Criteria 3-10
Management Measures 3-10
Measures Considered 3-10
Concept Plans 3-30
Plans Focused on Anadromous Fish Survival 3-33

Plans Focused on Water Supply Reliability 3-34
Plans Focused on Combined Objectives 3-35
Comprehensive Plan Development and Influencing Factors 3-37
Formulation of Comprehensive Plans 3-37

Chapter 4 No-Action Alternative and Comprehensive Plans 4-1
No-Action Alternative (No Additional Federal Action) 4-1
Anadromous Fish Survival 4-2
Water Supply Reliability 4-2
Ecosystem Resources, Flood Management, Hydropower Generation, Recreation, and Water Quality 4-3
Comprehensive Plans 4-4
Management Measures Common to All Comprehensive Plans 4-5
Environmental Commitments Common to All Comprehensive Plans 4-7
Major Components of Comprehensive Plans 4-17
CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability 4-22
CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability 4-49
CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival 4-55
CP4 and CP4A– 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability 4-62
CP5 – 18.5-Foot Dam Raise, Combination Plan 4-74
Consistency of Comprehensive Plans with Other Programs 4-83
Central Valley Project Improvement Act 4-83
CALFED Bay-Delta Program 4-84
Consistency with Department of Interior Climate Change Policy 4-88

Chapter 5 Plan Evaluation, Comparison, and Selection 5-1
Summary of Comprehensive Plan Evaluation 5-1
National Economic Development Account 5-1
Environmental Quality Account 5-11
Regional Economic Development Account 5-17
Other Social Effects Account 5-19
Comparison of Comprehensive Plans 5-20
Completeness 5-26
Effectiveness 5-26
Efficiency 5-27
Acceptability 5-27
Summary of Comparisons 5-27
Rationale for Plan Selection 5-29

Chapter 6 National Economic Development Plan and Implementation Requirements 6-1
NED Plan 6-1
Major Components 6-1

Major Benefits 6-4
National Economic Development Benefits 6-6
Feasibility Determination for the NED Plan 6-6
Technical Feasibility 6-7
Environmental Feasibility 6-7
Economic Feasibility 6-8
Financial Feasibility 6-8
Risk and Uncertainty 6-25
Hydrology and Climate Change 6-25
Water Supply Reliability and Demands 6-26
Anadromous Fish Populations 6-27
Water System Operations Analysis 6-28
Cost Estimates 6-30
Construction Schedule and Funding 6-31
Monetizing Project Benefits 6-31
Unresolved Issues 6-32
Non-Federal Cost-share Partners 6-32
Native American and Cultural Resources 6-32
Implementation Requirements 6-33
Advanced Planning and Design Activities 6-42
Project Construction and Transfer to O&M Status 6-43
Federal and Non-Federal Responsibilities 6-43
Federal Responsibilities 6-43
Non-Federal Responsibilities 6-44
Timeline and Status of Feasibility Study 6-44

Chapter 7 Coordination and Public Involvement 7-1
Strategic Agency and Public Involvement Plan 7-1
Outreach 7-2
Information Dissemination 7-3
Agency Coordination 7-4
Stakeholder Outreach 7-5
Initial Stakeholder Engagement 7-5
Environmental Scoping 7-6
Ongoing Stakeholder and Agency Briefings 7-6
Field Surveys and Investigations 7-7
Tribal Government Coordination 7-8
Native American Coordination 7-9
Public and Agency Review and Comment 7-9
Major Topics of Interest 7-10

Chapter 8 Findings and Conclusions 8-1
Need for the Project 8-1
Multiple Cost Effective Plans 8-1
National Economic Development Plan – CP4A – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability 8-2
Costs of National Economic Development Plan 8-2

Benefits of National Economic Development Plan 8-3
Feasibility of the National Economic Development Plan 8-4
Federal Interest 8-6
Consistency with CALFED and CVPIA 8-6
Environmental Compliance and Regulatory Requirements for Project Implementation 8-6

Chapter 9 Recommendations 9-1

Chapter 10 References 10-1

Tables

Table 2-1. Estimated Water Demands, Supplies, and Shortages Under Existing Conditions 2-6
Table 2-2. Estimated Water Demands, Supplies, and Shortages for 2030 2-7
Table 2-3. Estimated Annual Change in Water Demand in California for 2050 Considering Different Population Growth Scenarios 2-8
Table 2-4. Pertinent Data – Shasta Dam and Reservoir and Keswick Dam and Reservoir 2-17
Table 2-5. Mean Monthly Inflow, Outflow, and Storage at Shasta Reservoir 2-24
Table 2-6. Historical Shasta Dam and Reservoir Flood Management Releases 2-28
Table 3-1. Management Measures Addressing Primary Planning Objective of Increasing Anadromous Fish Survival 3-12
Table 3-2. Management Measures Addressing Primary Planning Objective of Increasing Water Supply Reliability 3-14
Table 3-3. Management Measures Addressing Secondary Planning Objective of Conserving, Restoring, and Enhancing Ecosystem Resources 3-17
Table 3-4. Management Measures Addressing Secondary Planning Objectives of Reducing Flood Damage, Developing Additional Hydropower Generation, Maintaining and Increasing Recreation, and Maintaining or Improving Water Quality 3-19
Table 3-5. Final Measures to Address Planning Objectives 3-31
Table 3-6. Summary of Concept Plan Features 3-32
Table 3-7. Scenarios Considered for Cold-Water Storage – Anadromous Fish Survival Focus Plan 3-40
Table 3-8. Scenarios Considered to Augment Flows – Anadromous Fish Survival Focus Plan 3-40
Table 3-9. Scenarios Considered for Refinement of Final EIS Comprehensive Plans 3-43
Table 4-1. Summary of Physical Features of Comprehensive Plans 4-18
Table 4-2. Summary of Potential Features and Benefits of Comprehensive Plans (Compared to No-Action Alternative) 4-23
Table 4-3. Summary of Additional Broad Public Benefits 4-25

Table 4-4. Comparison of Comprehensive Plans Relative to Beneficial Uses of Water in California 4-25
Table 4-5. Increases in CVP and SWP Water Deliveries for Comprehensive Plans 4-30
Table 4-6. Summary of Proposed Mitigation Measures for Comprehensive Plans 4-33
Table 4-7. Estimated Construction and Annual Costs of the Comprehensive Plans 4-47
Table 4-8. Average Annual Economic Benefit Summary 4-48
Table 4-9. Summary of Contributions of SLWRI Comprehensive Plans to CALFED Bay-Delta Program Goals 4-85
Table 4-10. Comparison of Comprehensive Plans Relative to CALFED Goals and CALFED Storage Program Objectives 4-86
Table 4-11. Summary of Simulated Changes in Decade-Mean Hydroclimate for Two Subbasins in the Sacramento and San Joaquin River Basins 4-89
Table 5-1. Least Cost Alternative Estimates of Average Annual Salmon Production for Comprehensive Plans 5-3
Table 5-2. Estimated Increases in Irrigation and M&I Deliveries and Water Supply Reliability Benefits for Comprehensive Plans 5-4
Table 5-3. Summary of Estimated Hydropower Benefits of Comprehensive Plans 5-7
Table 5-4. Average Annual Estimated Change in Visitor Days and Recreational Values 5-8
Table 5-5. Summary of Estimated Comprehensive Plan Economic Benefits 5-9
Table 5-6. Estimated Construction and Annual Costs of Comprehensive Plans 5-10
Table 5-7. Summary of Estimated Annual Costs, Annual Benefits, and Net Benefits for Comprehensive Plans 5-11
Table 5-8. Summary of Potential Environmental Effects in the Environmental Quality Account 5-13
Table 5-9. Summary of Estimated Annual Employment Benefits for RED Account 5-18
Table 5-10. Summary of Estimated Annual Income Effects for RED Account 5-18
Table 5-11. Estimated Increase in Shasta Lake Available Storage Space of Comprehensive Plans Relative to the No Action Alternative (Average Monthly) 5-19
Table 5-12. Summary of Potential Benefits and Costs of Comprehensive Plans 5-21
Table 5-13. Summary Comparison of Comprehensive Plans 5-23
Table 5-14. Summary Comparison of No-Action and Comprehensive Plans 5-29
Table 6-1. Existing Authorities for Federal Financial Participation for Monetized Benefit Categories of the NED Plan 6-10
Table 6-2. Initial Construction Cost Allocation Summary for CP4A ($ millions) 6-12
Table 6-3. Initial Construction Cost Assignment for the NED Plan1 ($ millions) 6-13
Table 6-4. Ability to Pay Results for Four Representative CVP Agricultural Contractors 6-15
Table 6-5. NED Plan Allocated Irrigation Water Supply Costs ($ million) 6-16
Table 6-6. CVP Irrigation Construction Cost Repayment Status as of End of Fiscal Year 2012 6-18
Table 6-7. Average Payment Capacity Results for Representative Municipal and Industrial Contractors 6-20
Table 6-8. NED Plan Allocated Municipal and Industrial Water Supply Costs ($ million) 6-21

Table 6-9. CVP Power Rates, Restoration Charges, and Power Market Rates 6-23
Table 6-10. Sensitivity Analysis Comparison of Annual Benefits for CP4A ($ millions/year) 6-32
Table 6-11. Summary of Potential Major Permits and Approvals for Project Implementation 6-35
Table 6-12. Summary of Applicable Laws, Policies, Plans, and Permits Potentially Required 6-37
Table 6-13. Water Right Permits for Storage in Shasta Reservoir 6-40
Table 6-14. Potential Federal and Non-Federal Responsibilities for Various Project Component O&M 6-44
Table 6-15. Timeline and Status of Feasibility Study 6-45
Table 8-1. Estimated Costs and Benefits for Comprehensive Plans ($ millions) 8-2
Table 8-2. Estimated Costs for the NED Plan 8-3
Table 8-3. Summary of Estimated Benefits for the NED Plan 8-3
Table 8-4. Initial Construction Cost Assignment for NED Plan 8-5

Figures

Figure 1-1. Location of Shasta Dam and Reservoir 1-1
Figure 1-2. Shasta Dam Under Construction 1-9
Figure 1-3. Present Shasta Dam 1-10
Figure 1-4. Primary Study Area—Shasta Lake Area and Sacramento River from Shasta Dam to Red Bluff Pumping Plant 1-11
Figure 1-5. Central Valley Project and State Water Project Water Facilities and Service Areas 1-13
Figure 1-6. Major Central Valley Project and State Water Project Facilities 1-14
Figure 2-1. Chinook Salmon Historic Spawning Populations in Sacramento River 2-2
Figure 2-2. Shasta Dam and Reservoir Looking North Toward Mount Shasta 2-16
Figure 2-3. Shasta Reservoir Area-Capacity Relationships (elevations based on NAVD88) 2-20
Figure 2-4. Historical Streamflow in Sacramento River Below Keswick Dam 2-26
Figure 2-5. Monthly Average Storage in Shasta Reservoir 2-27
Figure 2-6. Sacramento River Overflow Basins and Bypasses South of the Red Bluff Pumping Plant 2-30
Figure 2-7. Shasta Lake Recreation Facilities 2-39
Figure 3-1. Plan Formulation Phases 3-3
Figure 3-2. CALFED Surface Water Storage Investigations Screening 3-7
Figure 3-3. Conceptual Schematic of Restoration Actions as Enhancement Versus Restoration Actions as Mitigation 3-11
Figure 4-1. Major Features Common to All Comprehensive Plans in Shasta Lake Area 4-21
Figure 4-2. Simulated Exceedence Probability Relationship of Maximum Annual Storage in Shasta Lake for Future Level of Development (2030) 4-27
Figure 4-3. Simulated Shasta Reservoir Storage from 1972 to 2003 for the No-Action Alternative and CP1 4-28

Figure 4-4. Comparison of Increased CVP and SWP Water Deliveries by Year Type for Comprehensive Plans 4-29
Figure 4-5. Estimated Maximum Inundation in the Lakeshore Area for 6.5-foot, 12.5-foot, and 18.5-foot Dam Raises 4-43
Figure 4-6. McCloud River Extent of Maximum Inundation for 6.5-foot Raise and 18.5-foot Raise 4-45
Figure 4-7. Simulated Sacramento River Flow Above Red Bluff Pumping Plant in Wet, Above- and Below-Normal, and Dry and Critical Years for No-Action and CP1 and CP4 4-46
Figure 4-8. Simulated Shasta Reservoir Storage from 1972 to 2003 for the No-Action Alternative and CP2 4-52
Figure 4-9. Simulated Sacramento River Flow Above Red Bluff Pumping Plant in Wet, Above- and Below-Normal, and Dry and Critical Years for No-Action, CP2, and CP4A 4-54
Figure 4-10. Minimum Clearance for Boat Traffic at Pit River Bridge, Full Pool with 18.5-foot Dam Raise 4-56
Figure 4-11. Simulated Shasta Reservoir Storage from 1972 to 2003 for the No-Action Alternative and CP3 4-59
Figure 4-12. Simulated Sacramento River Flow Above Red Bluff Pumping Plant in Wet, Above- and Below- Normal, and Dry and Critical Years for No-Action and CP3 4-61
Figure 4-13. Potential Sacramento River Restoration Areas 4-67
Figure 4-14. Percent Change in Outmigrating Chinook Salmon for CP4 and CP4A 4-69
Figure 4-15. Simulated Shasta Reservoir Storage from 1972 to 2003 for CP4 and CP4A Compared to the No-Action Alternative 4-73
Figure 4-16. Simulated Shasta Reservoir Storage from 1972 to 2003 for the No-Action Alternative and CP5 4-80
Figure 4-17. Simulated Sacramento River Flow Above Red Bluff Pumping Plant in Wet, Above- and Below-Normal, and Dry and Critical Years for No-Action and CP5 4-82
Figure 5-1. Comparison of Ability of Comprehensive Plans to Address Planning Objectives 5-28
Figure 6-1. Cost of CVP Power in Relation to Power Market Rate 6-24
Figure 6-2. Shasta Reservoir Water Rights, Historical Storage, and Representative Storage Volumes 6-41
Figure 6-3. Shasta Lake Water Resources Investigation Project Timeline 6-47

Appendices

Economic Valuation Appendix

Cost Allocation Appendix

Analysis of Consistency with Clean Water Act Section 404 Requirements Appendix

Key Terms and Definitions Appendix

Abbreviations and Acronyms

°F	degrees Fahrenheit
2004 NMFS BO	2004 Biological Opinion on the Long-Term CVP and SWP OCAP
2004 OCAP	2004 Long-Term CVP Operations Criteria and Plan
2004 OCAP BA	2004 Long-Term CVP and SWP OCAP Biological Assessment
2005 USFWS BO	2005 Reinitiation of Formal and Early Section 7 ESA Consultation on the Coordinated Operations of the CVP and SWP and the OCAP to Address Potential Critical Habitat Issues
2008 Long-Term Operation Biological Assessment	2008 Biological Assessment on the Continued Long-Term Operations of the CVP and SWP
2008 USFWS BO	2008 Proposed Coordinated Operations of the CVP and SWP
2009 NMFS BO	2009 BO and Conference Opinion on the Long-Term Operations of the CVP and SWP
ACHP	Advisory Council on Historic Preservation
ACID	Anderson-Cottonwood Irrigation District
AF	acre-feet
AFRP	Anadromous Fish Restoration Program
APA	Administrative Procedure Act
AFS	anadromous fish survival
BA	biological assessment
Bay Area	San Francisco Bay Area
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta
BDCP	Bay Delta Conservation Plan
BIA	Bureau of Indian Affairs

BLM	Bureau of Land Management
BMP	best management practice
BO	biological opinion
CALFED	CALFED Bay-Delta Program
Cal Fire	California Department of Forestry and Fire Protection
CalSim-II	California Statewide Simulation Model
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CNPS	California Native Plant Society
CO	combined objective
CP	Comprehensive Plan
cu-yd	cubic yard
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
CWC	California Water Code
Delta	Sacramento-San Joaquin Delta
DEC	Design, Estimating and Construction
DEIR/S	Draft Environmental Impact Report/Statement
DEIR	Draft Environmental Impact Report
DEIS	Draft Environmental Impact Statement
District Court	District Court for the Eastern District of California
DMC/CA	Delta-Mendota Canal/California Aqueduct
DOI	Department of the Interior
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
elevation xxx	elevation in feet above mean sea level
EPA	U.S. Environmental Protection Agency
EQ	environmental quality
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
FR	Federal Register

FWCA	Fish and Wildlife Coordination Act
GIS	geographic information system
GWh	gigawatt-hour
GWh/yr	gigawatt-hour per year
hhld	household
HMBP	Hazardous Materials Business Plan
hp	horsepower
I-5	Interstate 5
IDC	interest during construction
IMPLAN	IMpact analysis for PLANning
Interior	U.S. Department of the Interior
Investigation	Shasta Lake Water Resources Investigation
I/O	input/output
IRWMP	Integrated Regional Water Management Plans
JPOD	joint points of diversion
kW	kilowatts
LEDPA	Least Environmentally Damaging Practicable Alternative
LTGen	LongTermGen
M&I	municipal and industrial
MAF	million acre-feet
MOA	Memorandum of Agreement
MW	megawatt
NA	not applicable
NAVD88	North American Vertical Datum of 1988
NED	national economic development
NEPA	National Environmental Policy Act
NGVD29	National Geodetic Vertical Datum of 1929
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOD	north-of-Delta
NODOS	North-of-Delta Offstream Storage
NOI	Notice of Intent
NOP	Notice of Preparation
NRA	National Recreation Area
O&M	operations and maintenance
OMB	Office of Management and Budget
OSE	other social effects

P&G	Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies
PAM	Planning Aid Memorandum
PCA	Project Cooperation Agreement
PCT	Project Coordination Team
PEIS/R	Programmatic Environmental Impact Statement/Report
PG&E	Pacific Gas and Electric Company
PLSS	Public Land Survey System
PM	particulate matter
PRC	California Public Resources Code
R	river
RBPP	Red Bluff Pumping Plant
RCD	Resource Conservation District
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RED	regional economic development
Regional Water Board	Regional Water Quality Control Board
RM	River Mile
ROD	Record of Decision
RPA	Reasonable and Prudent Alternative
RV	recreational vehicle
RWQCB	Regional Water Quality Control Board
SALMOD	Salmonid Population Model
SB	Senate Bill
SCAQMD	Shasta County Air Quality Management District
SC-RB	Separable Costs-Remaining Benefits
SHPO	State Historic Preservation Office
SLWRI	Shasta Lake Water Resources Investigation
SMT	Study Management Team
SOD	south-of-Delta
sq-mi	square mile
SRCAF	Sacramento River Conservation Area Forum
SRTTG	Sacramento River Temperature Task Group
State	State of California
State Water Board	State Water Resources Control Board
STNF	Shasta-Trinity National Forest
SVAB	Sacramento Valley Air Basin
SVWMP	Sacramento Valley Water Management Program
SWP	State Water Project

SWPPP	Stormwater Pollution Prevention Plan
TAF	thousand acre-feet
TCD	temperature control device
TWG	Technical Working Groups
Uniform Act	Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USFS	U.S. Department of Agriculture, Forest Service
USFWS	U.S. Department of the Interior, Fish and Wildlife Service
WAPA	Western Area Power Administration
WRIMS	Water Resources Integrated Modeling System
WSR	water supply reliability
yr	year