TABLE OF CONTENTS

Note: The Supplemental Plan Formulation Report and Supplemental EIS/EIR has been integrated into one document to meet both the Corps planning and environmental requirements. Sections noted with a "" are required for compliance with the NEPA and sections noted with a "#" are required for compliance with CEQA.*

***SUMMARY S-1**
S.1 Introduction S-1
S.2 Major Conclusions S-5
S.3 Federally Supportable Plans S-10
S.4 Summary of Potential Environmental Effects and Proposed Mitigation S-14
S.5 Implementation S-19

CHAPTER 1.0 INTRODUCTION 1-1
*1.1 Purpose and Need 1-1
1.2 Authorization 1-2
1.3 Study Location 1-4
1.4 Background 1-4
1.5 National Environmental Policy Act and California Environmental Quality Act 1-6
1.6 Public Review of Draft Report 1-7
1.7 Public Concerns 1-7
1.8 Report Organization 1-9

#*CHAPTER 2.0 AFFECTED ENVIRONMENT 2-1
2.1 Facilities and Projects 2-1
2.2 Topography and Climate 2-6
2.3 Hydrology and Hydraulics 2-7
2.4 Geology, Seismology, and Soils 2-11
2.5 Water Supply 2-13
2.6 Hydropower 2-15
2.7 Land Use and Socioeconomics 2-15
2.8 Recreation 2-19
2.9 Fisheries 2-27
2.10 Vegetation 2-32
2.11 Wildlife 2-42
2.12 Water Quality 2-50
2.13 Cultural Resources 2-55
2.14 Traffic and Circulation 2-57
2.15 Air Quality 2-61
2.16 Noise 2-65
2.17 Visual Resources 2-69
2.18 Public Health and Safety 2-74
2.19 Public Services 2-75

2.20 Without-Project Future Conditions 2-78

CHAPTER 3.0 PROBLEMS AND OPPORTUNITIES 3-1
3.1 Flood Risk with Current Improvements 3-1
3.2 System Inadequacies 3-1
3.3 Flood Characteristics 3-2
3.4 Future Without-Project Flood Risk and Damage 3-2
3.5 Ecosystem Restoration Problems and Opportunities 3-4

CHAPTER 4.0 PLAN FORMULATION AND SCREENING OF FLOOD DAMAGE REDUCTION MEASURES 4-1
4.1 Plan Formulation Process 4-1
4.2 Planning Objectives 4-1
4.3 Planning Constraints and Criteria 4-2
4.4 Flood Damage Reduction Measures 4-2
4.5 Combining Measures 4-21
4.6 Alternatives to Be Considered in Detail 4-21

#*CHAPTER 5.0 FLOOD CONTROL ALTERNATIVES 5-1
5.1 Alternative 1: No Action 5-1
5.2 Alternative 2: 3.5-Foot Dam Raise/478-Foot Flood Pool Elevation 5-3
5.3 Alternative 3: Seven-Foot Dam Raise/482-Foot Flood Pool Elevation 5-11
5.4 Alternative 4: Twelve-Foot Dam Raise/487-Foot Flood Pool Elevation 5-17
5.5 Alternative 5: Stepped Release to 160,000 cfs 5-23
5.6 Alternative 6: Stepped Release to 160,000 cfs and New Outlet at Folsom Dam 5-31
5.7 Alternative 7: Stepped Release to 180,000 cfs 5-33
5.8 Alternative 8: Stepped Release to 160,000 cfs and Seven-Foot Dam Raise/482-Foot Flood Pool Elevation 5-38

#*CHAPTER 6.0 ECOSYSTEM RESTORATION FOR FLOOD PLAIN AND FISHERIES RESOURCES 6-1
6.1 Flood Plain Restoration 6-1
6.2 Fisheries Restoration 6-28
6.3 Selection of the NER Plan 6-41

#*CHAPTER 7.0 ENVIRONMENTAL EFFECTS AND MITIGATION 7-1
7.1 Hydrology and Hydraulics 7-1
7.2 Geology, Seismicity, and Soils 7-11
7.3 Water Supply 7-21
7.4 Hydropower 7-27
7.5 Land Use and Socioeconomics 7-33
7.6 Recreation 7-44
7.7 Fisheries 7-62
7.8 Vegetation 7-73

7.9 Wildlife 7-89
7.10 Water Quality 7-105
7.11 Cultural Resources 7-114
7.12 Traffic and Circulation 7-138
7.13 Air Quality 7-150
7.14 Noise 7-161
7.15 Visual Resources 7-172
7.16 Public Health and Safety 7-186
7.17 Public Services 7-195
7.18 Summary 7-202

CHAPTER 8.0 EVALUATION AND COMPARISON OF FLOOD CONTROL ALTERNATIVES 8-1
8.1 Alternative 2: 3.5-Foot Dam Raise/478-Foot Flood Pool Elevation 8-1
8.2 Alternative 3: Seven-Foot Dam Raise/482-Foot Flood Pool Elevation 8-2
8.3 Alternative 4: Twelve-Foot Dam Raise/487-Foot Flood Pool Elevation 8-3
8.4 Alternative 5: Stepped Release to 160,000 cfs 8-4
8.5 Alternative 6: Stepped Release to 160,000 cfs and New Outlet at Folsom Dam 8-4
8.6 Alternative 7: Stepped Release to 180,000 cfs 8-5
8.7 Alternative 8: Stepped Release to 160,000 cfs and Seven-Foot Dam Raise/482-Foot Flood Pool Elevation 8-5
8.8 Summary Comparison of Flood Damage Reduction Alternatives 8-6

CHAPTER 9.0 CUMULATIVE AND GROWTH-INDUCING EFFECTS AND OTHER REQUIRED DISCLOSURES 9-1
9.1 Introduction 9-1
*#9.2 Cumulative Effects 9-1
*#9.3 Growth-Inducing Effects 9-12
*9.4 Other Required Disclosures 9-13
9.5 Compliance with Applicable Laws, Policies, and Plans 9-18

CHAPTER 10.0 RECOMMENDED PLAN AND IMPLEMENTATION REQUIREMENTS 10-1
10.1 National Economic Development and National Ecosystem Restoration Plans 10-1
10.2 Recommended Plan 10-2
10.3 Environmental Mitigation 10-7
10.4 Operation and Maintenance (O&M) 10-10
10.5 Real Estate Plan 10-11
10.6 Ecosystem Restoration 10-11
10.7 Recommended Plan Accomplishments 10-13
10.8 Future Actions 10-15
10.9 Implementation Requirements 10-17
10.10 Project Cooperation Agreement 10-17

10.11 Federal and Non-Federal Responsibilities 10-17

CHAPTER 11.0 CONCLUSIONS AND RECOMMENDATIONS 11-1

#*CHAPTER 12.0 COMMENTS AND RESPONSES 12-1
12.1 Introduction 12-1
12.2 Federal Agencies 12-5
12.3 State and Local Agencies 12-25
12.4 Special Interest Groups 12-47
12.5 Individuals 12-55
12.6 Public Hearing 12-81
12.7 Pertinent Correspondence 12-87

***LIST OF PREPARERS**

***DOCUMENT RECIPIENTS**

REFERENCES

***INDEX**

GLOSSARY

DETERMINING RISK AND UNCERTAINTY

ACRONYMS AND ABBREVIATIONS

***APPENDIX A.ENVIRONMENTAL**
(Bound separately. Available from the U.S. Army Corps of Engineers on request.)

APPENDIX B. ECONOMICS
(Bound separately. Available from the U.S. Army Corps of Engineers on request.)

APPENDIX C. ENGINEERING
(Bound separately. Available from the U.S. Army Corps of Engineers on request.)

APPENDIX D.REAL ESTATE
(Bound separately. Available from the U.S. Army Corps of Engineers on request.)

LIST OF TABLES

Table **Follows Page**

S-1 Summary of Benefits and Costs of Plan Alternatives S-8

S-2 Risk and Uncertainty Figures for Alternatives S-8

S-3 Summary of Significant Effects and Mitigation Measures S-16

S-4 Recommended Plan S-18

1-1 Important NEPA and CEQA Terms 1-10

2-1 Existing Hydrologic Conditions at Folsom Reservoir during Various Flood Events 2-2

2-2 Probable Maximum Flood Mean 3-Day Flow American River above Folsom ..... on 2-11

2-3 Existing Diversion Points and Service Areas 2-14

2-4 Fish Species Occurring in the Lower American River 2-28

2-5 Special-Status Plants that Occur or Have the Potential to Occur in the Project Area 2-36

2-6 Special-Status Wildlife that Are Known to Occur or Could Occur in the Project Area 2-44

2-7 Level of Service Criteria for Freeways ..... on 2-58

2-8 Peak Period Person-Miles of Travel on LOS F Roadways ..... on 2-59

2-9 Average Daily Traffic Volumes on Selected Roadways 2-60

2-10 Federal and State Ambient Air Quality Standards 2-64

2-11 Summary of Carbon Monoxide, Ozone, and PM10 Monitoring Data 2-64

2-12 Noise Level Performance Standards for New Projects and Development ..... on 2-69

2-13 Critical Elevations of EID Sewage Lift Stations ..... on 2-77

3-1 Probability of Nonfailure from Specific Events under Without-Project Conditions 3-2

4-1 Summary of Flood Control Measures 4-22

5-1 Accomplishments and Residual Risk of Alternative 1 ..... on 5-3

5-2 Accomplishments and Residual Risk of Alternative 2 ..... on 5-11

5-3 Accomplishments and Residual Risk of Alternative 3 ..... on 5-17

5-4 Accomplishments and Residual Risk of Alternative 4 ..... on 5-22

5-5 Summary of Drainage Facilities ..... on 5-24

5-6 Drainage Facilities Requiring Modifications ..... on 5-25

5-7 Water Intake Facilities Modifications ..... on 5-26

5-8 PNP Mitigation Areas and Amounts ..... on 5-27

5-9 Recommended Levee Fixes for Hydraulic Mitigation 5-28

5-10 Accomplishments and Residual Risk of Alternative 5 ..... on 5-31

5-11 Accomplishments and Residual Risk of Alternative 6 ..... on 5-33

5-12 Accomplishments and Residual Risk of Alternative 7 ..... on 5-37

5-13 Accomplishments and Residual Risk of Alternative 8 ..... on 5-39

6-1 Initial Screening–Ecosystem Restoration Measures – Urrutia Site 6-26

6-2 Initial Screening–Ecosystem Restoration Measures – Woodlake Site 6-26

6-3 Initial Screening–Ecosystem Restoration Measures – Bushy Lake Site 6-26

6-4 Initial Screening–Ecosystem Restoration Measures – Arden Bar Site 6-26

6-5 Initial Alternatives (Best Buy Plans for Urrutia) 6-27

6-6 Initial Alternatives (Best Buy Plans for Woodlake) 6-27

6-7 Initial Alternatives (Best Buy Plans for Bushy Lake) 6-27

6-8 Initial Alternatives (Best Buy Plans for Arden Bar) 6-27

6-9 Estimated (from Modeling) Annual Early-Life-Stage Salmon Mortality (%) in Relation to Various Water Temperature Shutter Control Configurations and Methods at Folsom Dam, by General Water Year-Type ..... on 6-39

6-10 Initial Alternatives (Best Buy Plans for Fisheries Ecosystem Restoration) ..... on 6-40

6-11 Fisheries Ecosystem Restoration Measure ..... on 6-41

6-12 National Ecosystem Restoration Plan 6-41

7-1 Hydrologic Conditions at Folsom Reservoir during Various Flood Events under Alternative 1: No Action 7-4

7-2 Hydrologic Conditions at Folsom Reservoir during Various Flood Events under Alternative 2: 3.5-Foot Dam Raise/478-Foot Flood Pool Elevation 7-4

7-3 Hydrologic Conditions at Folsom Reservoir during Various Flood Events under Alternative 3: Seven-Foot Dam Raise/482-Foot Flood Pool Elevation 7-4

7-4 Hydrologic Conditions at Folsom Reservoir during Various Flood Events under Alternative 4: Twelve-Foot Dam Raise/487-Foot Flood Pool Elevatoin 7-6

7-5 Hydrologic Conditions at Folsom Reservoir during Various Flood Events under Alternative 5: Stepped Release to 160,000 cfs 7-6

7-6 Hydrologic Conditions at Folsom Reservoir during Various Flood Events under Alternative 6: Stepped Release to 160,000 cfs and New Outlet at Folsom Dam 7-8

7-7 Hydrologic Conditions at Folsom Reservoir during Various Flood Events under Alternative 7: Stepped Release to 180,000 cfs 7-8

7-8 Hydrologic Conditions at Folsom Reservoir during Various Flood Events under Alternative 8: Stepped Release to 160,000 cfs and Seven-Foot Dam Raise/482-Foot Flood Pool Elevation 7-10

7-9 Agricultural Land Uses Affected in the Yolo and Sacramento Bypasses 7-40

7-10 Estimated Inundation Levels of Recreation Facilities at Folsom Reservoir 7-52

7-11 Vegetation Types Affected by Construction- and Operation-Related Activities 7-78

7-12 Total Estimated Number of Construction-Related Vehicles Generated by each Alternative 7-138

7-13 Regional and Local Access to Restoration Sites 7-148

7-14 Construction Vehicle Trip Generation 7-148

7-15 Estimated Emissions Generated during Construction of Each Project Alternative ..... on 7-154

7-16 Estimated Emissions Generated during Construction of Alternative 9.1 through 9.4 ..... on 7-159

7-17 Noise Emission Levels Typical for Construction Equipment ..... on 7-163

7-18 Estimated Construction Noise in the Project Area ..... on 7-163

7-19 Estimated Blasting Noise in the Project Area ..... on 7-170

7-20 Summary of Effects and Mitigation Measures of Project Alternatives 1 through 8 7-202

7-21 Summary of Effects and Mitigation Measures of Project Alternatives 9.1 through 9.5 7-202

8-1 Estimated Costs of Alternative 2 (3.5-Foot Dam Raise/478-Foot Flood Pool Elevation) 8-2

8-2 Benefits and Costs of Alternative 2 (3.5-Foot Dam Raise/478-Foot Flood Pool Elevation) 8-2

8-3 Estimated Costs of Alternative 3 (Seven-Foot Dam Raise/482-Foot Flood Pool Elevation) 8-2

8-4 Benefits and Costs of Alternative 3 (Seven-Foot Dam Raise/482-Foot Flood Pool Elevation) 8-2

8-5 Estimated Costs of Alternative 4 (Twelve-Foot Dam Raise/487-Foot Flood Pool Elevation) 8-4

8-6 Benefits and Costs of Alternative 4 (Twelve-Foot Dam Raise/487-Foot Flood Pool Elevation) 8-4

8-7 Estimated Costs of Alternative 5 (Stepped Release to 160,000 cfs) 8-4

8-8 Benefits and Costs of Alternative 5 (Stepped Release to 160,000 cfs) 8-4

8-9 Estimated Costs of Alternative 6 (Stepped Release to 160,000 cfs and New Outlet at Folsom Dam) 8-4

8-10 Benefits and Costs of Alternative 6 (Stepped Release to 160,000 cfs and New Outlet at Folsom Dam) 8-4

8-11 Estimated Costs of Alternative 7 (Stepped Release to 180,000 cfs) 8-6

8-12 Benefits and Costs of Alternative 7 (Stepped Release to 180,000 cfs) 8-6

8-13 Estimated Costs of Alternative 8 (Stepped Release to 160,000 cfs and Seven-Foot Dam Raise/482-Foot Flood Pool Elevation) 8-6

8-14 Benefits and Costs of Alternative 8 (Stepped Release to 160,000 cfs and Seven-Foot Dam Raise/482-Foot Flood Pool Elevation) 8-6

8-15 Summary Comparison of the Detention Dam Plan, No Action Plan and Project Alternatives 8-6

8-16 Summary Comparison of Plans 8-8

8-17 Derivation for the Federally-Supportable Folsom Enlargement Plan 8-8

8-18 Derivation for the Federally-Supportable Downstream Levee Modification Plan 8-10

10-1 National Ecosystem Restoration Cost Sharing for Recommended Plans ($ thousand) 10-2

10-2 Recommeded Plan Cost & Accomplishments 10-14

10-3 Estimated Cost Sharing of Recommended Plan (Seven-Foot Dam Raise/ 482-Foot Flood Pool Elevations) ($ thousand) 10-14

LIST OF PLATES

Plate

S-1 Project Area

1-1 Location and Vicinity Map

1-2 Schedule and Flood Risk of Lower American River Watershed Project

2-1 Existing Flood Control Features in the Sacramento Area

2-2 Frequency Curves, American River at Fair Oaks, Without-Project Advance Release Scenarios

2-3 Recreation Areas at Folsom Reservoir

2-4 Wind Rose Depicting Average Wind Speed and Directional Frequency at Mather Air Force Base

2-5 Land Use Compatibility for Community Noise

2-6 Folsom Dam and Reservoir Variable Space Flood Control Diagram

3-1 American River Flood Plain

4-1 Detention Dam and Vicinity

5-1 Folsom Enlargement Plan

5-2 Dam Raise Sections

5-3 Folsom Dam Raise Alternatives

5-4 Typical Embankment Raising Sections

5-5a Folsom Dam Enlargement Peninsula Borrow Area

5-5b Mississippi Bar Borrow Area

5-6a Temporary Construction Bridge

5-6b Temporary Construction Bridge Profile

5-7 Hydrograph for 1 in 200 Year Event American River at Fair Oaks Raise Plans with Pre-Release

5-8 Frequency Curves American River at Fair Oaks Raises Plans with Pre-Release

5-9a Exceedance Frequency per 100 Years without Advance Release

5-9b Exceedance Frequency per 100 Years with Advance Release

5-10 Photosimulation of Alternative 4, Twelve-foot Folsom Dam Raise

5-11 Levee and Floodwall Details Typical Sections

5-12 Typical Schematic of Sump Lower American River

5-13 Sacramento Weir Plan and Section

5-14 Hydraulic Mitigation Stepped Release Alternatives

5-15 Hydraulic Mitigation Levee Sections

5-16 145-160,000 cfs Stepped Release Plan Lower American River Plan Components

5-17 Hydrographs for 1 in 200 Year Event American River at Fair Oaks Step Plans with Pre-Release

5-18 Frequency Curves American River at Fair Oaks Step Plans with Pre-Release

5-19 145-180,000 cfs Stepped Release Plan Lower American River Plan Components

5-20 Howe Avenue Bridge Relocation

5-21 UPRR Trestle Modifications and New Flood Gate Plan, Profile, and Section

5-22 Guy West Bridge Modifications Elevation, Section, and Detail

6-1 Ecosystem Restoration Sites

6-2 Urrutia Site Without-Project Conditions

6-3 Urrutia Site Problems and Opportunities

6-4 Woodlake Site Without-Project Conditions

6-5 Woodlake Site Problems and Opportunities

6-6 Bushy Lake Site Without-Project Conditions

6-7 Bushy Lake Site Problems and Opportunities

6-8 Arden Bar Site Without-Project Conditions

6-9 Arden Bar Site Problems and Opportunities

6-10 Urrutia Site Best Buy Plan

6-11 Woodlake Site Best Buy Plan

6-12 Bushy Lake Site Best Buy Plan

6-13 Arden Bar Site Best Buy Plan

7.1-1 Hydrograph for 1-in-20 Year Event, American River at Fair Oaks, Raise Plan with Prerelease

7.1-2 Hydrograph for 1-in-50 Year Event, American River at Fair Oaks, Raise Plan with Prerelease

7.1-3 Hydrograph for 1-in-100 Year Event, American River at Fair Oaks, Raise Plan with Prerelease

7.1-4 Hydrograph for 1-in-150 Year Event, American River at Fair Oaks, Raise Plan with Prerelease

7.1-5 Hydrograph for 1-in-200 Year Event, American River at Fair Oaks, Raise Plan with Prerelease

7.1-6 Hydrograph for 1-in-250 Year Event, American River at Fair Oaks, Raise Plan with Prerelease

7.1-7 Hydrograph for 1-in-500 Year Event, American River at Fair Oaks, Raise Plan with Prerelease

7.1-8 Hydrograph for 1-in-20 Year Event, American River at Fair Oaks, Step Plan with Prerelease

7.1-9 Hydrograph for 1-in-50 Year Event, American River at Fair Oaks, Step Plan with Prerelease

7.1-10 Hydrograph for 1-in-100 Year Event, American River at Fair Oaks, Step Plan with Prerelease

7.1-11 Hydrograph for 1-in-150 Year Event, American River at Fair Oaks, Step Plan with Prerelease

7.1-12 Hydrograph for 1-in-200 Year Event, American River at Fair Oaks, Step Plan with Prerelease

7.1-13 Hydrograph for 1-in-250 Year Event, American River at Fair Oaks, Step Plan with Prerelease

7.1-14 Hydrograph for 1-in-500 Year Event, American River at Fair Oaks, Step Plan with Prerelease

7.6-1 Browns Ravine

7.6-2 Folsom Point (Dike 8)

7.6-3 Beals Point

7.6-4 Granite Bay

7.8-1 Vegetation Cover Types 3.5-Foot Dam Raise/478-Foot Flood Pool Elevation

7.8-2 Vegetation Cover Types 7-Foot Dam Raise/482-Foot Flood Pool Elevation

7.8-3 Vegetation Cover Types 12-Foot Dam Raise/487-Foot Flood Pool Elevation

7.8-4a Step Release Plan Impacts on Vegetation, Lower American River Miles 0 to 5

7.8-4b Step Release Plan Impacts on Vegetation, Lower American River Miles 5 to 13

7.8-4c Step Release Plan Impacts on Vegetation, Lower American River Miles 13 to 20

7.8-4d Step Release Plan Impacts on Vegetation, Lower American River Miles 20 to 23

7.11-1 Cultural Resource Survey, Folsom Reservoir, Goose Flat Area

7.11-2 Cultural Resource Survey, Folsom Reservoir, Granite Bay Area

7.11-3 Cultural Resource Survey, Folsom Reservoir, Beals Point

7.11-4 Cultural Resource Survey, Folsom Reservoir, Beeks Bight

7.11-5a Cultural Resource Survey along Lower American River

7.11-5b Cultural Resource Survey along Lower American River

7.11-5c Cultural Resource Survey along Lower American River

7.11-5d Cultural Resource Survey along Lower American River

7.11-5e Cultural Resource Survey along Lower American River

7.11-5f Cultural Resource Survey along Lower American River

7.11-5g Cultural Resource Survey along Lower American River

7.11-6a Cultural Resource Survey, Yolo and Sacramento Bypasses Project Area

7.11-6b Cultural Resource Survey, Yolo and Sacramento Bypasses Project Area

7.11-6c Cultural Resource Survey, Yolo and Sacramento Bypasses Project Area

7.11-6d Cultural Resource Survey, Yolo and Sacramento Bypasses Project Area

7.11-6e Cultural Resource Survey, Yolo and Sacramento Bypasses Project Area

7.14-1 Noise Receptors along the Temporary Bridge Alignment

7.14-2 Noise Receptors near Dikes 1, 2, and 3

7.14-3 Noise Receptors near Dikes 4, 5, and 6 and Right Wing Dam

7.14-4 Noise Receptors near Dikes 7 and 8 and Mormon Island Dam

10-1 Typical Construction Schedule for all Folsom Dam Raise Alternatives

G-1 Example of Monte Carlo Simulation to Determine Flood Risk