Appendix 2A Alternatives Screening and Evaluation

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This appendix is Appendix 2A, *Alternatives Screening Process*, from the 2017 Sites Reservoir Project Draft Environmental Impact Report/Environmental Impact Statement (2017 Draft EIR/EIS). The appendix describes the extensive screening process for project alternatives, presents the rationale for eliminating potential alternatives, and describes the alternatives that were evaluated in the 2017 Draft EIR/EIS. The chapters, tables, and figures referenced in this appendix correspond to those contained in the 2017 Draft EIR/EIS.

APPENDIX 2A
Alternatives Screening Process

2A.1 Introduction

The purpose of this appendix is to describe the range of reservoir storage alternatives considered in the development of the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Sites Reservoir Project (Project) by the Sites Project Authority (Authority) and Bureau of Reclamation (Reclamation). This appendix describes how conceptual alternatives to provide additional surface and groundwater storage in the western Sacramento Valley were developed, screening criteria used to identify the range of reasonable alternatives, and the results of the application of the screening criteria to the range of conceptual alternatives.

Development of a range of alternatives to provide additional storage in the western Sacramento Valley has been considered for more than 100 years. The current Project was initiated in 1998 as part of the CALFED Integrated Storage Investigation process, and was subsequently analyzed as part of the California Department of Water Resources (DWR) and Reclamation Surface Water Storage Investigation. The results of these studies and screening analyses, as summarized in this appendix, have been considered as part of this EIR/EIS to select Sites Reservoir as the most appropriate reservoir location for additional surface water storage in the western Sacramento Valley.

2A.2 Organization of this Appendix

This appendix provides the following:

- Description of the background of the development of alternatives to provide additional water storage in the western Sacramento Valley prior to the CALFED Bay-Delta Program (CALFED)[1] process.
- Brief description of the range of water storage concepts considered as part of the CALFED alternatives screening process between 1995 and 2000, and the results of the preliminary alternatives evaluation completed under the CALFED Integrated Storage Investigation and the CALFED EIS/EIR.
- Results of the evaluation of alternatives completed under the DWR and Reclamation Surface Water Storage Investigation process starting in 2001, which resulted in the selection of the Project for further evaluation in this EIR/EIS.

2A.3 Basis of Alternatives Development Process

Potential alternatives for the EIR/EIS were identified in accordance with the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). The Authority is the CEQA lead agency, and Reclamation is the NEPA lead agency.

[1] State and federal agencies, including DWR and Reclamation, signed a Framework Agreement in 1995 to establish a joint state/federal CALFED Bay-Delta Program (CALFED) to prepare a comprehensive plan to address resource problems of the Delta. CALFED identified 10 overall alternatives to address Bay-Delta issues, including water supply, water system vulnerability, ecosystem quality, and water quality. One of the 10 overall alternatives to address these issues included "New Storage to Improve Delta Flow."

Under CEQA, the action alternatives (not including the No Project Alternative) must meet the following criteria:

- Be potentially feasible.
- Attain most of the basic objectives (and goals) of the Project.
- Avoid or substantially lessen potentially significant effects of the Project, including methods that could reduce attainment of some of the objectives and goals or be more costly.

The range of alternatives considered under CEQA law do not need to consider every conceivable feasible alternative, and a range of alternatives that provide a range between "bookends" from those with the fewest to the most adverse impacts can be used in the development of the alternatives (CEQA Guidelines §15126.6)

The Department of the Interior (DOI) (including Reclamation) relies upon the NEPA legislation and NEPA guidance presented in the Council on Environmental Quality (CEQ) publication entitled "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" as published in 46 Federal Register 18026 (CEQ, 1987), and relies upon additional regulations published in 43 Code of Federal Regulations (CFR) Section 46.415(b). The CEQ guidance states that the basis of a range of reasonable alternatives may depend on the nature of the proposed federal action, and the range may include alternatives not within the jurisdiction of the federal lead agency. The CEQ guidance also allows for an approach using "bookends" to analyze a range of alternatives with varying impacts on the environment. DOI adopted additional regulations (43 CFR Section 46.415(b)) that state that the action alternatives in an EIS must:

- Be reasonable.
- Meet the Purpose and Need of the Project.
- Address one or more potentially significant issues related to the Project.

For both CEQA and NEPA, the primary Goals and Objectives and Purpose and Need statements are to provide surface water storage north of the Delta in order to:

- Enhance water management flexibility in the Sacramento Valley.
- Reduce water diversion on the Sacramento River during critical fish migration periods.
- Increase reliability of water supplies for a significant portion of the Sacramento Valley.
- Provide storage and operational benefits for programs to enhance water supply reliability, benefit Delta water quality, and improve ecosystems by providing:
  - Net improvements in ecosystem conditions in the Sacramento River system and Delta.
  - Net improvements in water quality conditions in the Sacramento River system and Delta.
  - Net improvements in water supply reliability for agricultural and urban uses to help meet water demands during drought periods and emergencies or to address shortages because of regulatory and environmental restrictions.
  - Net improvements in water supply reliability for fish protection, habitat management, and other environmental water needs.

The secondary Goals and Objectives and Purpose and Need statements are as follows:

- Allow for flexible hydropower generation, in order to support the integration of renewable energy sources.
- Develop additional recreation opportunities.
- Provide incremental flood damage reduction opportunities.

2A.4 Development of a Range of Conceptual Alternatives

The need for water storage in the Sacramento Valley has been considered several times by the state of California over the past 100 years. Reservoirs were constructed on numerous tributaries on the eastern side of the Sacramento Valley to capture runoff from melting snowfall in the Cascade Range and the Sierra Nevada for water supply, hydroelectric generation, sediment control, and flood control. Additionally, groundwater has been increasingly used as a source of water particularly during drought, and is recognized as an important component of the overall water supply.

On the western side of the Sacramento Valley, numerous reservoirs were evaluated over the past 100 years; however, only four moderate-sized reservoirs have been constructed on western tributaries to the Sacramento River, including the following:

- **East Park Reservoir on Little Stony Creek:** 48,211-acre-foot reservoir completed in 1910 as part of the Reclamation Orland Project for irrigation water supply (Reclamation, 2017a).
- **Stony Gorge Reservoir on Stony Creek:** 50,000-acre-foot reservoir completed in 1926 as part of the Reclamation Orland Project for irrigation water supply (Reclamation, 2017b).
- **Lake Berryessa on Putah Creek:** 48,400-acre-foot reservoir completed in 1957 as part of the Reclamation Solano Project for water supply (Reclamation, 2017b).
- **Black Butte Reservoir on Stony Creek:** 143,700-acre-foot reservoir completed in 1963 as part of the 1944 U.S. Army Corps of Engineers (USACE) Sacramento River Basin flood control project (a portion of the water flows into the Reclamation Orland Project and is used for irrigation water supply) (DWR, 2014a and 2014b; USACE, 1977).

The need for additional storage on the western side of Sacramento Valley has been evaluated in studies completed by DWR in the 1950s through the 2000s, and by CALFED in the 1990s.

2A.4.1 Studies Completed Prior to the CALFED Process

DWR and other agencies have evaluated storage alternatives in several studies since the initial U.S. Geological Survey study in 1901 on Newville Reservoir (CALFED, 2000b).

2A.4.1.1 1957 California Water Plan

The 1957 DWR Bulletin Number 3 (1957 California Water Plan) identified new facilities to provide flood control in northern California and water supplies to the San Francisco Bay Area, San Joaquin Valley, San Luis Obispo and Santa Barbara counties in the Central Coast Region, and Southern California (DWR, 1957). The proposed reservoirs located in the western Sacramento Valley included the following:

- Golden Gate Reservoir (now known as Sites Reservoir) on Stone Corral and Funks creeks, which is a 48,000-acre-foot reservoir.
- Newville Reservoir on North Fork Stony Creek, which is a 950,000-acre-foot reservoir. This reservoir would be located downstream of East Park Reservoir and provide additional storage in the Stony Creek watershed.
- Paskenta Reservoir on Thomes Creek, which is a 67,000-acre-foot reservoir to be located upstream of the Newville Reservoir site.
- Schoenfield Reservoir on Redbank Creek, which is a 174,000-acre-foot reservoir.
- The 1957 California Water Plan evaluated the operations of these reservoirs in an integrated manner with the Black Butte Reservoir.

2A.4.1.2 1960s and 1970s DWR and Reclamation Water Storage Studies in the Western Sacramento Valley

Subsequent studies completed by DWR in the 1960s evaluated the potential for 17 small reservoirs on several western tributaries to provide up to 50,000 acre-feet of storage to reduce flooding in the Colusa Basin, including two reservoirs near Sites Reservoir (a 5,800-acre-foot reservoir on Stone Corral Creek and a 7,600-acre-foot reservoir on Funks Creek) (DWR, 1962 and 1964; CALFED, 2000b). However, the numerous small flood control-only reservoirs also would require additional levee improvements; therefore, they were not considered as economical as the plan that only included levee improvements (DWR, 2001).

In the 1960s, Reclamation evaluated construction of a 1.2 million-acre-foot Sites Reservoir to provide water supplies to serve lands located along an extended Tehama-Colusa Canal downstream of Funks Reservoir (DWR, 1980 and 1996a).

In 1964, DWR evaluated the 1.2 million-acre-foot Paskenta-Newville Project, which would have included the Paskenta Reservoir on Thomes Creek and the Newville Reservoir on North Fork Stony Creek (DWR, 1964). The water was proposed to be used to increase water supplies for the North Coastal Area of California, which included portions of Shasta, Tehama, Glenn, Colusa, Solano, and Yolo counties, and would provide additional surface water supplies to the State Water Project (SWP). This project was proposed to be expanded to form the 8.6 million-acre-foot Glenn Reservoir Project. Water could be conveyed from the Eel River and Clear Lake into the new reservoirs.

In 1970, USACE proposed two large reservoirs on Cottonwood Creek to reduce flood damage along the Sacramento River and Butte Basin, and to develop water supplies for SWP (CALFED, 2000b). The reservoirs were authorized by Congress in the Flood Control Act of 1970. However, following additional studies, it was determined in 1985 that these reservoirs would be more expensive than the Red Bank Reservoir Complex.

In 1973, Reclamation prepared a Status Report, *Paskenta-Newville Unit, Central Valley Project, California, Status Report on a Plan for Water Supply Development*, that evaluated use of a 129,800-acre-foot Paskenta Reservoir on Thomes Creek and a 2,896,700-acre-foot Newville Reservoir on North Fork Stony Creek (Reclamation, 1973). The potential Paskenta Reservoir was analyzed to be located to the northwest of the potential Newville Reservoir location evaluated as part of the North-of-the-Delta Water Storage Investigation. These reservoirs were considered to increase the amount of water available for the

Central Valley Project (CVP) water agricultural water users located near these potential reservoirs, additional CVP water supplies for users located to the south of the Delta during dry periods, flood protection for the areas downstream of the potential reservoirs, recreational opportunities, and water for fish and wildlife enhancement. The analysis also included an evaluation of operations of the two potential reservoirs with a third potential reservoir, Glenn Reservoir on Stony Creek, and existing Black Butte Reservoir. The potential Paskenta and Newville reservoirs were evaluated to store water from local watersheds and water diverted from the Sacramento, Trinity, and Eel rivers. The results of this study indicated that the need for these reservoirs would not occur until additional water demands occur for areas located south of the Delta.

In 1975, DWR prepared a Progress Report, *Major Surface Water Development Opportunities in the Sacramento Valley*, that evaluated the Colusa Reservoir (DWR, 1975).

In 1978, DWR Bulletin 76 included evaluations of several offstream reservoirs in the western Sacramento Valley to provide additional water supplies to SWP and CVP as well as local flood control, irrigation water supplies, recreation, and fish enhancement benefits (DWR, 1978). The report considered 12 reservoir locations, including several that had been evaluated in prior reports (i.e., the Cottonwood Creek Project; the Colusa [including Sites Reservoir footprint], Gallatin, Glenn, Millville, Nashville, Newville, Rancheria, Schoenfield, Tuscan Buttes, and Wing reservoirs; and enlarged Lake Berryessa). Most of the reservoirs were not evaluated in detail because the results of Bulletin 76 indicated that the following three projects could provide more benefits with less adverse environmental effects:

- Cottonwood Creek Project would include the Dutch Gulch and Tehama reservoirs on Cottonwood Creek with storage volumes of 1.1 and 0.9 million acre-feet, respectively, to be developed by the USACE.
- Glenn Reservoir would include the Rancheria Dam on Stony Creek and Newville Dam on North Fork Stony Creek to form a 8.7 million-acre-foot reservoir. This reservoir also was planned to store water from Thomes Creek that would be diverted at a dam located west of Paskenta, and water diverted from the Sacramento River into the Tehama-Colusa Canal. The reservoir was to be operated interactively with Black Butte Reservoir.
- Colusa Reservoir would include Sites Reservoir and the Colusa Cell reservoir with dams on Willow, Logan, Hunters, Funks, and Stone Corral creeks to form a 3.2 million-acre-foot reservoir. This reservoir also would store water diverted from the Sacramento River into the Tehama-Colusa Canal and the Glenn-Colusa Irrigation District Main Canal. This concept was developed by Reclamation.

Bulletin 76 also evaluated other additional Sacramento Valley water supply concepts, including enlargement of Shasta Lake.

2A.4.1.3 1980 DWR Study of Glenn and Thomes-Newville Reservoirs

After Bulletin 76 was published, DWR conducted further studies for the Glenn and Thomes-Newville reservoirs in 1980 (DWR, 1980). The Glenn Reservoir would be formed by Newville Dam on the North Fork Stony Creek and Rancheria Dam on Stony Creek. Flows from Thomes Creek would be captured in Glenn Reservoir. However, flows from Thomes and Stony creeks would not be adequate to fill this 9 million-acre-foot reservoir. Therefore, water would be pumped and conveyed from the Tehama-Colusa Canal Authority Red Bluff Diversion Dam on the Sacramento River to Black Butte Reservoir, and the water would be subsequently pumped and conveyed into the Glenn Reservoir through a Tehama

Reservoir. Water would be released at Newville Dam and conveyed to Black Butte Reservoir for further conveyance to the Sacramento River, Tehama-Colusa Canal, or a Glenn-Colusa Irrigation District canal. The study evaluated construction of Glenn Reservoir in a single stage, and in two stages with construction of the Thomes-Newville and Millsite reservoirs only being constructed in the first stage.

The Thomes-Newville Reservoir was the northern portion of the larger Glenn Reservoir previously analyzed by DWR. The 1.4- to 1.9 million-acre-foot reservoir also would be formed by Newville Dam on the North Fork Stony Creek. Water would be diverted from Thomes and Stony creeks into the reservoir. The water from Stony Creek would be diverted directly from or upstream of Black Butte Reservoir. The study also considered conveyance of water from the Sacramento River to the Thomes-Newville Reservoir through the Tehama-Colusa Canal if a separate project did not use the canal to convey water to the Sites Reservoir location. Water would be released from the Newville Dam into Stony Creek and delivered to the Tehama-Colusa Canal or the Glenn-Colusa Irrigation District canals. The preliminary environmental analysis indicated that implementation of this reservoir would inundate cattle ranches and displace approximately 70 permanent residents and a herd of migratory deer. The recommended project included a 1.84 million-acre-foot Thomes-Newville Reservoir that would be developed as a single unit and, therefore, would not be developed for future expansion into the Glenn Reservoir.

2A.4.1.4 1980s and 1990s Studies of Sites Reservoir

Following the 1987-1992 drought, a long-range water master plan was completed by Glenn-Colusa Irrigation District, which considered construction of a 870,000-acre-foot Sites Reservoir (DWR, 1996a). In July 1996, DWR also published the *Reconnaissance Survey, Sites Offstream Storage Project* to evaluate implementation of Sites/Colusa Reservoir with storage ranging in size from 1.2 to 3.02 million acre-feet (DWR, 1996b). This study assumed water would be delivered to the reservoir from the Sacramento River through the Glenn-Colusa Irrigation District and Tehama-Colusa Canal Authority canals. This study relied upon findings from previous studies, as described above. The purpose of this study was to provide information that would support a request to the State to conduct feasibility and environmental studies to evaluate the potential for implementation of Sites Reservoir, including a 1.8 million-acre-foot reservoir to provide water supplies during droughts.

Also in the 1980s, Reclamation evaluated alternatives for enlarging Shasta Lake with a possible implementation of Sites or Colusa reservoirs (DWR, 1996a).

2A.4.1.5 Summary of Results from Studies Completed Prior to CALFED

The studies completed prior to the CALFED EIS/EIR evaluated numerous reservoir locations for multi-purpose reservoirs to provide flood control, water supply, and recreation opportunities. Many of the studies considered use of the reservoirs to store additional water transferred into the Sacramento River watershed from the Trinity and Eel rivers. The new reservoirs were considered for use by local agricultural water users as well as water users located south of the Delta. The studies recognized the need for additional water supplies in the future; however, at the time of these studies, the SWP and CVP facilities were either under development or recently implemented. Therefore, the immediate need for additional water supplies was limited; and the objectives of these studies was focused on screening potential reservoir locations to be considered in the future as projected water demands would occur. The results of these studies described the need for continued evaluation of Thomes-Newville, Colusa-Sites, Glenn, and Cottonwood Creek reservoirs because these reservoirs would be located near the Sacramento

River, which would contribute to the water supply, and the size of the reservoirs would be sufficient to provide benefits at appropriate economic values.

2A.4.2 Development of a Range of Alternatives for Water Storage in the Western Sacramento Valley under CALFED

In December 1994, multiple federal, state, and local agencies signed the Bay-Delta Framework Agreement, which led to the adoption of the Bay-Delta Accord and initiation of CALFED in 1995. CALFED was established to "develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system" (CALFED, 2000a). The CALFED objectives were as follows:

- To restore the ecological health of a fragile and depleted Bay-Delta estuary.
- To improve the water supply reliability for the State's farms and growing cities that draw water from the Delta and its tributaries, including 7 million acres of the world's most productive farmland.
- To protect the drinking water quality of the 27 million Californians who rely on the Delta for their supplies.
- To protect the Delta levees that ensure its integrity as a conveyance and ecosystem. Surface storage was part of an overall water management strategy that incorporated other CALFED actions, such as conservation, water use efficiency, conveyance, transfers, groundwater storage and conjunctive use, and habitat restoration, to meet CALFED objectives.

In November 1996, the voters of California approved Proposition 204, *Safe, Clean, Reliable Water Supply Act*, including $10 million to conduct feasibility and environmental studies of offstream storage projects upstream of the Delta that would provide storage and flood control benefits (Chapter 6 Surface Water Resources, Article 2). The analyses conducted under Proposition 204 funding and CALFED were integrated by CALFED and DWR.

2A.4.2.1 Phase I CALFED Storage and Conveyance Studies

The objective of Phase I was to define problems in the Bay and Delta, identify CALFED objectives, and identify actions to resolve the problems and meet the objectives (CALFED, 1996). The primary objectives were to provide good water quality for all beneficial uses, improve and increase aquatic and terrestrial habitats and improve Bay-Delta ecological functions, reduce the "mismatch" of Bay-Delta water supplies and beneficial uses, and reduce risk due to catastrophic breaching of Delta levees. The objectives in Phase I were used to develop actions through an extensive workshop process conducted between August 1995 and June 1996.

Initially, 49 categories of potential actions were identified. Subsequently, the workshop participants identified 46 Core Actions that were considered for inclusion in a range of alternatives. With respect to improved water supplies, the Core Actions focused on water transfers, drought contingency plans, and increased use of conjunctive use. The Core Actions did not include increased surface water storage options.

Through subsequent workshops, participants identified 32 separate approaches and 100 preliminary alternatives to resolve the conflicts among four major categories of Core Actions: Fisheries and Diversions, Habitat and Land Use and Flood Protection, Water Supply Availability and Beneficial Uses,

and Water Quality and Land Use. The 100 preliminary alternatives were consolidated and balanced through an extensive set of public workshops and scoping meetings. The results of this process identified the following six components that would be used to identify the range of alternatives to be evaluated in the CALFED EIS/EIR:

- Common Programs – Included in All CALFED Alternatives
  - Water Use Efficiency
  - Water Quality
  - Levee System Integrity
  - Ecosystem Restoration
- Variable Components – Included in only a portion of the CALFED Alternatives
  - Delta Conveyance
  - Storage (including additional surface water storage upstream of the Delta, in the Delta, south of the Delta; and additional storage in groundwater aquifers)

Through the workshop process, the following criteria were developed for upstream surface water storage alternatives:

- Divert water only following peak flood flow events while maintaining beneficial geomorphological effects of highest flows.
- Release water to supplement instream flows and water supplies, including releases to reduce historic diversions from the Sacramento River and the Delta, especially during environmentally sensitive periods.
- Release excess carry-over storage in Shasta Lake and Lake Oroville to increase groundwater storage through groundwater banking or conjunctive use and, therefore, increase ability to store flood flows.
- Increase the benefits of upstream storage with Delta conveyance modifications to convey water during environmentally acceptable times.

Examples of upstream storage presented in the Phase I Study included implementation of a 0.5- to 3.0 million-acre-foot Colusa-Sites Reservoir or enlargement of the existing Lake Berryessa.

The Phase I Study compiled the concepts into the following three alternatives to be evaluated in detail in Phase II:

- **Alternative 1: Existing System Conveyance and Increased Storage plus Common Programs -** Upstream storage would be increased by up to 1.5 million acre-feet to manage Delta inflows.
- **Alternative 2: Modified Delta Conveyance and Increased Storage plus Common Programs -** Upstream storage would be increased by up to 1.5 million acre-feet to manage Delta inflows.
- **Alternative 3: Dual Delta Conveyance and Increase Storage plus Common Programs -** Upstream storage would be increased by up to 3.0 million acre-feet to manage Delta inflows, instream Sacramento River flows, and diversions from the Sacramento River. This alternative discussed implementation of additional upstream surface water storage using excess capacity in the Glenn-Colusa Irrigation District and Tehama-Colusa Canal Authority canals to convey water from the Sacramento River to the reservoirs.

2A.4.2.2 Phase II CALFED Studies and Groundwater Storage

- During Phase II, CALFED did not include specific analysis of groundwater storage alternatives. The CALFED Draft Conjunctive Use Program (CALFED, 1998) described groundwater use and regulations at that time. The Draft Conjunctive Use Program discussed the benefits of conjunctive use and groundwater transfer programs, including use of groundwater to reduce Delta exports and potential associated improved ecosystem quality. The objectives of the Draft Conjunctive Use Program were as follows: Ensure that conjunctive use projects are voluntary.
- Provide funding support for feasibility studies.
- Ensure local water needs are met prior to groundwater transfers.
- Develop appropriate compensation parameters for transferred water.
- Coordinate development of pilot projects.
- Identify third-party impacts related to reduced well yields, subsidence, water quality degradation, increased pumping costs or need to deepen nearby wells, and changes in streamflow.

The CALFED Record of Decision (ROD) supported CALFED Agencies to facilitate and fund locally supported, managed, and controlled groundwater and conjunctive use projects with a total of 0.5 to 1.0 million acre-feet of additional storage capacity. The ROD indicated that CALFED would support voluntary, locally controlled groundwater projects that are designed to address local water needs first, before considering regional or statewide benefits. It was envisioned that these projects would include a combination of purchase, lease, or sharing storage space with others, and would include consideration of existing groundwater storage facilities. Future groundwater storage was considered over approximately 1,500 acres in the Sacramento and San Joaquin valleys, as well as in the Delta and Southern California to provide 0.25 to 0.5 million acre-feet of additional groundwater storage (CALFED, 2000a).

The ROD also supported groundwater management programs at the groundwater sub-basin level to improve groundwater conditions and increase local benefits from conjunctive use management.

2A.4.2.3 Phase II CALFED Surface Water Storage and Conveyance Studies

During Phase II, CALFED identified 17 sub-alternatives under the three primary alternatives identified in the Phase I report (CALFED, 1997a). Storage concepts in the Sacramento River watershed upstream of the Delta were only included in 10 of the 17 sub-alternatives. The range of sub-alternatives included up to 3.0 million acre-feet of new upstream storage with facilities to divert and discharge up to 5,000 cubic feet/second (cfs) from and to the Sacramento River.

The Phase II study also included criteria to not allow diversions or discharges involving the Sacramento River between Keswick and Chico Landing until a 60,000 cfs mean daily flow event occurred at Chico Landing to preserve natural fluvial geomorphology. This criteria does not apply to diversion and discharge locations downstream of Chico Landing.

Under the Phase II process, 52 storage components were identified (13 in the western Sacramento Valley, 15 in the eastern Sacramento Valley, two in the Delta, 12 located south of the Delta near the California Aqueduct, and 10 in other portions of the San Joaquin Valley).

Based upon information from the previous studies, 23 storage and conveyance components were selected to be evaluated in prefeasibility studies. Results related to physical characteristics, environmental considerations, and estimated costs were summarized for these components.

The following two-step decision process was developed by CALFED (CALFED, 1997b) to further refine the range of alternatives:

- **Step 1 – Alternatives Narrowing** –eliminated or modified alternatives with technical problems or that achieved the same Delta conveyance functions.
- **Step 2 – Detailed Evaluation** –conducted prefeasibility studies that included environmental, engineering, and cost analyses; and ranked the alternatives with respect to these criteria.

The prefeasibility studies and subsequent screening processes were conducted under Proposition 204 and CALFED to evaluate storage and conveyance components, including 13 upstream storage concepts in the western Sacramento Valley based upon studies completed prior to CALFED and Proposition 204 (CALFED, 1997c and 1997d), including the following:

- Colusa Reservoir (3.3 million-acre-foot offstream storage on Funks Creek)
- Cottonwood Creek Reservoir Complex (1.6 million-acre-foot onstream and offstream storage on Cottonwood Creek)
- Fiddlers Reservoir (0.31- to 0.545 million-acre-foot onstream storage on Middle Fork Cottonwood Creek)
- Gallatin Reservoir (0.183 million-acre-foot onstream storage on Elder Creek)
- Glenn Reservoir (8.206 million-acre-foot offstream storage on Stony Creek)
- Hulen Reservoir (0.096- to 0.244 million-acre-foot onstream storage on North Fork Cottonwood Creek)
- Lake Berryessa Enlargement (4.4- to 11.7 million-acre-foot offstream storage on Putah Creek)
- Red Bank Reservoir Complex (0.354 million-acre-foot onstream and onstream storage on South Fork Cottonwood Creek)
- Rosewood Reservoir (0.155 million-acre-foot onstream storage on Salt and Dry creeks)
- Shasta Lake Enlargement (up to additional 9.75 million-acre-foot onstream storage on Sacramento River)
- Sites Reservoir (1.2- to 1.9 million-acre-foot offstream storage on Funks and Stone Corral creeks)
- Thomes-Newville Complex (1.84- to 3.08 million-acre-foot offstream storage on Thomes and Stoney creeks)
- Trinity Lake Enlargement (up to 4.8 million-acre-foot onstream storage – Trinity River)

Reservoirs that would result in less than 0.200 acre-foot of additional surface water storage were eliminated from further consideration because of the potential for effects on habitat at the reservoir location as compared to the water supply benefits (CALFED, 2000b), including Gallatin and Rosewood reservoirs.

Other reservoirs were eliminated from further consideration based upon conflicts with CALFED objectives (see Section 2A.2.3.1) and solution principles, including methods to reduce conflicts, be equitable, be affordable, be durable, be implementable, and have no significant redirected impacts. Based upon results of the initial studies, it was determined that the following reservoirs would not be evaluated in detail for the following reasons (CALFED, 2000b):

- **Cottonwood Creek Reservoir Complex** would inundate 29 miles of stream and riparian habitat on the largest currently undammed tributary in the upper Sacramento River watershed. Cottonwood Creek also is a substantial source of sediment to the Sacramento River that contributes to geomorphological characteristics of the river. At the time of the study, National Marine Fisheries Service (NMFS) and Pacific Fisheries Management Council (PFMC) were considering designating Cottonwood Creek as Essential Fish Habitat. Therefore, the studies determined that implementation of Cottonwood Creek Reservoir Complex would be in direct conflict with CALFED objectives related to ecosystem restoration.

- **Fiddlers Reservoir** was considered as an alternative to the Cottonwood Creek Reservoir Complex or in combination with Hulen Reservoir and the Dippingvat portion of the Red Bank Reservoir Complex. Fiddlers Reservoir was determined to likely block sediment flow to the Sacramento River, and as discussed for Cottonwood Creek Reservoir Complex, NMFS and PFMC were considering designating Cottonwood Creek as Essential Fish Habitat. Therefore, the studies determined that implementation of Cottonwood Creek Reservoir Complex would be in direct conflict with CALFED objectives related to ecosystem restoration. In addition, it was determined that Fiddlers Reservoir independently or in conjunction with other reservoirs would result in less water supply benefits than Cottonwood Creek Reservoir Complex or Red Bank Reservoir Complex.

- **Glenn Reservoir** would consist of reservoirs created by Rancheria Dam and Newville Dam that would inundate up to 50,000 acres, including grasslands, oak savannah, oak-pine woodland, chaparral, riparian vegetation, and vernal pools. A portion of this habitat would include winter range for an estimated 1,100 deer of the Thomes Creek (Lake Hollow) herd and displacement of over 600 migratory and resident deer. The reservoir also would block migration routes for mule deer. The dams also would block fish migration routes and spawning areas or delay migration activities on Stony Creek. The reservoir also would potentially affect 223 prehistoric sites, 35 ethnographic sites, and 70 significant historic sites.

- During the analysis of Glenn Reservoir, CALFED received local opposition related to displacing the town of Elk Creek and several ranches, inundation of Grindstone Indian Rancheria, potential water quality impacts, and potential seismic issues due to the larger size of the Glenn Reservoir.

- The analysis indicated that construction of only the Newville Reservoir portion of the Glenn Reservoir would result in less impacts to habitat, including the winter range of the Thomes Creek (Lake Hollow) herd and fish migration routes and spawning areas. However, the Newville Reservoir would displace the migratory and resident deer and block migration routes for mule deer as under the Glenn Reservoir.

- Therefore, the studies determined that Glenn Reservoir would not be implementable because of the extensive impacts, lack of public support, and extremely large size of the reservoir complex.

- **Hulen Reservoir** on Cottonwood Creek was eliminated from further analysis for the same reasons as the Fiddlers Creek Reservoir.

- **Lake Berryessa Enlargement** would increase the existing 1.6 million-acre-foot reservoir to a total gross capacity of 6.0 to 13.3 million acre-feet. This project also would include construction of a 12,000-foot-long tunnel to convey the water between Lake Berryessa and the Sacramento River. The expanded reservoir would inundate an additional 15,600 to 43,600 acres of habitat, including foothill woodland, scrub, grassland, agricultural lands, riparian vegetation, disturbed areas, and warm water stream habitat. The additional water storage also would inundate existing development around Lake Berryessa. Because this reservoir concept would be the largest of the concepts considered, the amount of water from the Sacramento River would be the greatest for this concept. Therefore, the studies determined that the Lake Berryessa Enlargement would result in significant redirected impacts and would not be implementable because of impacts, lack of public support, and extremely large size of the reservoir.
- **Trinity Lake Enlargement** would increase the existing 2.4 million-acre-foot reservoir to a total gross capacity of 7.2 million acre-feet. This project would require relocation of all or portions of the communities of Trinity Center, Coffee Creek, and Coveington Mill as well as several resort and recreational facilities located along 20 miles of State Highway 30. The expanded reservoir would inundate habitat, including coniferous-hardwood forest, meadow, and riparian habitats. The project also would result in less flows in the Trinity River during specific periods of time. Therefore, the studies determined that the Trinity Lake Enlargement would not be affordable or implementable because of environmental impacts.

Results of the Phase II CALFED Storage Screening Analysis

The results of the Phase II CALFED screening analysis related to surface water storage in the western Sacramento Valley identified the following reservoirs for further consideration in the CALFED EIS/EIR process (CALFED, 2000b).

- Red Bank Reservoir Complex
- Thomes-Newville Reservoir Complex
- Colusa Reservoir
- Sites Reservoir
- Shasta Lake Enlargement

2A.4.3 Evaluation of Water Storage Alternatives in the Western Sacramento Valley under the CALFED Integrated Storage Investigation

Additional feasibility study analyses were completed under the CALFED Integrated Storage Investigation and the Proposition 204 program, including analyses for the Red Bank Reservoir Complex, Thomes-Newville Complex, Colusa Reservoir, Sites Reservoir, and Shasta Lake Enlargement storage alternatives in the western Sacramento Valley (CALFED, 2000c; Reclamation and DWR, 2006). The results of these evaluations are briefly described below.

2A.4.3.1 Red Bank Reservoir Complex

The Red Bank Reservoir Complex would be located approximately 18 miles west-southwest of Red Bluff, and would include the 0.104 million-acre-foot Dippingvat Reservoir on South Fork Cottonwood Creek and the 0.250 million-acre-foot Schoenfield Reservoir on Red Bank Creek plus two smaller reservoirs formed by the Lanyan and Bluedoor dams on small tributaries of Red Bank Creek (CALFED, 2000c; Reclamation and DWR, 2006). The reservoir complex would inundate 4,579 acres and provide

total storage of over 0.350 million acre-feet. Red Bank Reservoir Complex was the smallest of the western Sacramento Valley reservoir alternatives considered under CALFED.

Water supply for this reservoir complex would be provided only from South Fork Cottonwood Creek and Red Bank Creek, and the water would be discharged into the Tehama-Colusa Canal. Dippingvat Dam would block access to approximately 132 square miles of South Fork Cottonwood Creek watershed and the associated anadromous fishery habitat.

Most of the flows in the South Fork Cottonwood Creek would be captured in Dippingvat Reservoir and conveyed approximately 4 miles to Schoenfield Reservoir for long-term storage and ultimate release down Red Bank Creek (CALFED, 2000c; Reclamation and DWR, 2006). The water would be conveyed through an 8-foot-diameter, 0.5-mile-long, concrete-lined tunnel and 1-mile unlined canal from Dippingvat Reservoir to the 1,200-acre-foot Lanyan Reservoir on Lanyan Creek. The water would then flow through a 0.5-mile canal from Lanyan Reservoir to the 3,500-acre-foot Bluedoor Reservoir the upper North Fork Red Bank Creek. The water continues in a short canal Schoenfield Reservoir. No fish screen is planned for placement at the entrance of the conveyance system from Dippingvat Reservoir because anadromous fish could not pass upstream of Dippingvat Dam.

Water Resources

Cottonwood Creek is the largest undammed tributary in the upper Sacramento River basin and is the most important source of sediments to the Sacramento River to support river meander and riparian rejuvenation that is important to the CALFED Environmental Restoration Program (ERP). As described above, Cottonwood Creek was being considered at the time by NMFS and PFMC to be designated as Essential Fish Habitat. The creek provides spawning for fall-run and late-fall-run Chinook salmon and supports spring-run Chinook salmon in some years.

South Fork Cottonwood Creek at Dippingvat Dam has a drainage area of 132 square miles. Red Bank Creek at the gage near Red Bluff has a drainage area of 91.8 square miles.

Land Use and Demographics

The dominant land uses in the inundation areas include year-round and winter/spring cattle grazing, a small walnut orchard, and a small area of irrigated pasture.

Aquatic Resources

Prior to 2000, fish observed in Cottonwood Creek by California Department of Fish and Wildlife (DFW) included hardhead and Sacramento pikeminnow throughout Cottonwood Creek. Bluegill and green sunfish were more common in the lower reaches, and steelhead was common in the higher reaches of the Cottonwood Creek watershed.

Fish in Red Bank Creek within the inundation area of Schoenfield Reservoir included California roach, Sacramento pikeminnow, largemouth bass, and steelhead.

Wetland Delineation

Riparian areas, primarily along South Fork Cottonwood Creek and South Fork Red Bank Creek, comprise 92 percent of the wetlands in the inundation areas, and seasonal and emergent wetlands comprise the remaining 9 percent of the wetlands. Many of the emergent wetlands are located within or adjacent to small stockponds or are associated with saturated spring-fed areas. Clay soils are relatively rare within the

steep terrain that dominates both the Schoenfield and Dippingvat reservoirs inundation areas. Jurisdictional wetlands and waters of the U.S. at the Red Bank Reservoir Complex as surveyed by 2000 are summarized in Table 2A-1.

Table 2A-1
Jurisdictional Wetlands and Waters of the U.S. Delineation in the Reservoir Locations

Wetlands Type	Acreage by Reservoir Location			
	Sites	**Colusa***	**Thomes-Newville**	**Red Bank**
Alkaline	19	35 in Colusa Cell 54 Total	3	0
Emergent	2	0 in Colusa Cell 2 Total	6	included with seasonal
Riparian	22	11 in Colusa Cell 33 Total	77	76
Seasonal	153	263 in Colusa Cell 416 Total	304	7
Total Jurisdictional Wetlands	**196**	**309 in Colusa Cell 505 Total**	**390**	**83**
Streams	159	111 in Colusa Cell 270 Total	165	118
Ponds	16	24 in Colusa Cell 40 Total	66	34
Other Waters	**175**	**135 in Colusa Cell 310 Total**	**231**	**152**
Total Waters of U.S.	**371**	**444 in Colusa Cell 815 Total**	**621**	**235**
Reservoir Area	**14,162**	**13,664 in Colusa Cell 27,826 Total**	**17,073**	**4,905**

*Colusa Reservoir would include the footprint of Sites Reservoir.

Botanical Resources

Foothill pine woodland is the dominant vegetation at the Red Bank Reservoir Complex, and occurs over 63 percent of the land. The remaining vegetation includes oak woodland (20 percent), chaparral scrub (2 percent), and annual grasslands (12 percent). DFW surveys indicated that there were no vernal pool or alkaline wetland habitats. Dominant vegetation communities at the Red Bank Reservoir Complex as surveyed in 2000 are summarized in Table 2A-2.

Table 2A-2
Acreage Estimates of the Dominant Vegetation Communities Mapped in the Reservoir Locations

Vegetation Community	Acreage by Reservoir Location			
	Sites	**Colusa[a]**	**Thomes-Newville**	**Red Bank**
Grassland	12,602	13,540 in Colusa Cell 26,142 Total	14,492	565
Woodland (oak)	923	20 in Colusa Cell 943 Total	1,839	899
Woodland (foothill pine)	0	0 in Colusa Cell 0 Total	0	2,826
Chaparral	5	0 in Colusa Cell 5 Total	363	98
Riparian	52	37 in Colusa Cell 89 Total	64	73
Vegetated wetland	23	15 in Colusa Cell 38 Total	0	1
Cultivated grain	277	0 in Colusa Cell 277 Total	0	0
Vegetation Subtotal	**13,882**	**13,612 in Colusa Cell 27,494 Total**	**16,758**	**4,462**
Other[b]	280	51 in Colusa Cell 331 Total	315	142
Total Reservoir Acreage	**14,162**	**13,663 in Colusa Cell 27,825 Total**	**17,073**	**4,604**

[a] Colusa Reservoir would include the footprint of Sites Reservoir.

[b] Other classification refers to disturbed/developed acreage within the inundation elevations.

Special-status Shrimp Habitat

The terrain at Red Bank Reservoir Complex site is characterized by well-drained soils and slopes that are too steep to support habitat suitable for special-status shrimp species. Additionally, this location is considered outside the known range of special-status shrimp species. There were no special-status shrimp species habitat observed at the Red Bank Reservoir Complex as surveyed before 2000 as summarized in Table 2A-3.

Table 2A-3
Total Acreage of Potential Special-status Shrimp Species Habitat in the Reservoir Locations

Reservoir Location	Total Extent of Potential Special-status Shrimp Species Habitat (Acres)		
	1998 Survey	**1999 Survey**	**Difference**
Red Bank	0.0	0.0	0.0
Thomes-Newville	26 in Colusa Cell 99 Total	26 in Colusa Cell 97 Total	0 in Colusa Cell 2 Total
Sites	73	71	2
Colusa*	12	12	0

* Colusa Reservoir would include the footprint of Sites Reservoir.

Valley Elderberry Longhorn Beetle

No emergence holes and no adult beetles were found at the 1,001 elderberry stems within the Dippingvat Reservoir and Schoenfield Reservoir sites.

Avian Resources

An adult and an immature Bald eagle were observed together within the Red Bank Reservoir alternative area during late April 1998 by DFW. No indication of nesting other than these two sightings during the breeding season were observed. Habitats within the inundation areas provide very limited opportunities for wintering or migration use by Aleutian Canada goose, Greater sandhill crane, Mountain plover, Peregrine falcon, and Willow flycatcher. Special-status avian species that may occur in the Red Bank Reservoir Complex as defined in 2000 are listed in Table 2A-4. The potential density of the birds in this area is summarized in Table 2A-5.

Table 2A-4
State-listed, Federally Listed, and Special Concern Avian Species in the Reservoir Locations

Species	Status[a]	Reservoir Location			
		Sites	Colusa[b]	Thomes-Newville	Red Bank
Aleutian Canada Goose	FT				
American bittern	MNBMC				
American white pelican	CSSC				
Bank swallow	ST		X		
Barrow's goldeneye	CSSC				
Bell's sage sparrow	MNBMC				
Burrowing owl	CSSC, MNBMC	X	X	X	
California gull	CSSC	X			
California horned lark	CSSC, MNBMC	X	X	X	X
Common loon	CSSC, MNBMC				
Cooper's hawk	CSSC	X	X	X	X
Double-crested cormorant	CSSC		X		
Ferruginous hawk	CSSC, MNBMC	X	X only in Sites Reservoir		
Golden eagle	CSSC	X	X	X	X
Grasshopper sparrow	MNBMC		X		
Greater sandhill crane	ST		X		
Hermit warbler	MNBMC				
Lark sparrow	MNBMC	X	X	X	X
Lawrence's goldfinch	MNBMC		X		X
Least bittern	MNBMC				
Loggerhead shrike	CSSC, MNBMC	X	X	X	X
Long-billed curlew	CSSC, MNBMC	X	X	X	
Long-eared owl	CSSC	X	X	X	X

Species	Status[a]	Reservoir Location			
		Sites	Colusa[b]	Thomes-Newville	Red Bank
Merlin	CSSC	X	X only in Sites Reservoir	X	X
Mountain plover	CSSC, MNBMC				
Northern goshawk	CSSC, MNBMC				
Northern harrier	CSSC	X	X	X	X
Northern spotted owl	FE, SE				
Osprey	CSSC				X
Peregrine falcon	SE				
Prairie falcon	CSSC	X	X	X	X
Purple martin	CSSC				
Sharp-shinned hawk	CSSC	X	X		X
Short-eared owl	CSSC, MNBMC				
Southern bald eagle	SE, FT	X	X	X	X
Swainson's hawk	ST				
Tri-colored blackbird	CSSC, MNBMC	X	X	X	
Vaux's swift	CSSC, MNBMC				
Western snowy plover	CSSC, MNBMC				
Western yellow-billed cuckoo	SE, MNBMC				
White-faced ibis	CSSC, MNBMC				
White-faced kite	MNBMC	X	X only in Sites Reservoir		
Willow flycatcher	SE				
Yellow warbler	CSSC	X	X only in Sites Reservoir		
Yellow-breasted chat	CSSC				

[a] Listing status as of 2000 when initial surveys were completed.

[b] Colusa Reservoir would include the footprint of Sites Reservoir.

Key:

CSSC = California Species of Special Concern
FE = Federal Endangered
FT = Federal Threatened
FPT = Federal Proposed Threatened
MNBMC = Migratory Nongame Birds of Management Concern (USFWS)
SE = State Endangered
ST = State Threatened
X = Observed at reservoir site

Table 2A-5
Red Bank Reservoir Complex Avian Transect Results
(Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
Cooper's hawk		0.07	0.16	0.26
Garden eagle	0.09	0.25	0.30	0.32
Lark sparrow	NS	NS	0.18	4.79
Lawrence's goldfinch			0.36	0.78
Merlin				0.07
Northern harrier		0.08	1.07	0.26
Osprey				0.13
Prairie falcon			0.0	0.13
Sharp-shinned hawk		0.19	0.40	0.06
Southern bald eagle		0.11	0.05	0.26
Miles of transect per season	25.5	53.0	55.0	68.0

Note:

NS = Not Sampled

Mammals

As of 2000, Pallid bat, Western red bat, and Yuma myotis were observed within the Red Bank Reservoir Complex. Special-status mammalian species that may occur in the Red Bank Reservoir Complex as defined in 2000 are listed in Table 2A-6.

Table 2A-6
Sensitive Mammals Observed in the Reservoir Locations

Species	Sites	Colusa*	Thomes-Newville	Red Bank
Pallid bat	X	X	X	X
Ringtail	X	X only in Sites Reservoir	X	
San Joaquin pocket mouse			X	
Western red bat	X	X only in Sites Reservoir		X
Yuma myotis	X	X only in Sites Reservoir	X	X

*Colusa Reservoir would include the footprint of Sites Reservoir.

Amphibian Surveys

DFW conducted studies in the Red Bank Reservoir Complex area in 1986 and in 1997 to 1999. The major objectives of these surveys were to search for California red-legged frogs, which are listed as federally threatened, and to conduct general herpetology surveys. Two species listed as federal species of concern and California species of special concern that could potentially occur in the area, the Foothill yellow-legged frog and Western spadefoot toad, were searched for during these surveys. A California red-legged frog was found in Sunflower Gulch, a tributary to Red Bank Creek in two different years. Extensive searches failed to find other red-legged frogs in the study area. It is probable that the population of red-legged frogs is very small at the site of the Red Bank Reservoir Complex.

Reptile Surveys

During the DFW studies, reptiles observed in the Red Bank Reservoir Complex included Common garter snake, Common king snake, Gopher snake, Southern alligator lizard, Western fence lizard, Western pond turtle, Western racer, Western rattlesnake, Western sagebrush lizard, Western skink, and Western terrestrial garter snake.

Cultural Resources

The record search for the Red Bank Reservoir Complex indicated that the project area had not been surveyed for cultural resources and no site records were present in the State database. The CALFED initial evaluation of this location resulted in 31 sites recorded within the inundation area. Twenty-eight sites were prehistoric, and three were historic. Nine sites appeared to meet the criteria for eligibility to the National Register of Historic Places (NRHP), 16 sites were of undeterminable significance without further work, and six sites were not eligible for listing on the NRHP and were therefore determined to not be significant.

The prehistoric sites in the Red Bank Reservoir alternative were generally small and the artifact distribution relatively sparse. The sites were probably associated with seasonal upland hunting, fishing, and gathering activities. The larger permanent settlements were situated further downstream on the banks of the perennial streams and along the Sacramento River.

No cultural resource issues were identified as a result of the survey of the Red Bank Reservoir alternative that would be serious enough to prevent construction of that alternative.

Recreation

Commercial hunting operations for Feral pig, Blacktailed deer, and Wild turkey occur within the Red Bank Reservoir Complex. Several landowners operate hunting clubs, and at least one fee-for-fishing recreational operation is currently in business on a small lake within the Red Bank Reservoir Complex.

The recreation potential at Schoenfield Reservoir would be greater than at Dippingvat Reservoir due to the flatter terrain around the reservoir. Schoenfield Reservoir could be developed for fishing, camping, picnicking, boating, hiking, and hunting.

2A.4.3.2 Thomes-Newville Reservoir Complex

The Thomes-Newville Reservoir Complex would be located approximately 18 miles west of Orland and 6 miles upstream of existing Black Butte Lake, and it would include the 1.9 million-acre-foot Newville reservoir on the North Fork Stony Creek upstream of Black Butte Lake, pumping plant and facilities to convey water to Black Butte Lake, up to a 1.2 million-acre-foot reservoir on Thomes Creek, and a pumping plant and facilities to convey water to and from the Sacramento River through the Tehama-Colusa Canal Authority and/or Glenn-Colusa Irrigation District canals (CALFED, 2000c; Reclamation and DWR, 2006). The Thomes-Newville Reservoir Complex would inundate 31,500 acres. Water supply for this reservoir complex would be provided from Stony and Thomes creeks and the Sacramento River. The dam on Thomes Creek would block fish passage. The project also would require relocation of the roads that serve Paskenta, Round Valley, and Elk Creek.

Water Resources

Streams draining the Thomes-Newville Reservoir inundation area are ephemeral with little or no flow from July through October. However, these streams tend to respond rapidly to significant rainfall events.

Land Use and Demographics

The dominant land uses in the inundation areas include year-round and seasonal livestock grazing, firewood harvest in some areas, and 20 ranch sites.

Aquatic Resources

Prior to 2000, fish observed in lower Thomes Creek and Stony Creek included adult and juvenile Chinook salmon. Juvenile steelhead were observed in lower Thomes Creek.

Wetland Delineation

Riparian areas, primarily along Thomes Creek and Stony Creek, comprise 18 percent of the wetlands in the inundation areas, including 77 acres of high-quality riparian habitat. Seasonal wetlands comprise the remaining 74 percent of the wetlands. A small alkaline wetland was observed within Salt Creek watershed. Vernal pool complexes occurred in concentrated pools and connecting swales in the inundation area. These vernal pools were of higher quality than at other potential reservoir locations. Jurisdictional wetlands and waters of the U.S. at the Thomes-Newville Reservoir Complex as surveyed by 2000 are summarized in Table 2A-1.

Botanical Resources

California annual grassland is the dominant vegetation at the Thomes-Newville Reservoir Complex. The remaining vegetation includes valley and blue oak woodland (over 11 percent) and vernal pool flora. Dominant vegetation communities at the Thomes-Newville Reservoir Complex as surveyed in 2000 are summarized in Table 2A-2.

Special-status Shrimp Habitat

In the inundation area of the Thomes-Newville Reservoir Complex, grasslands and vernal pools occur on clays soils and Lodo shale in foothill-type terrain. Approximately 26 acres of vernal pools and ephemeral stock ponds occur within the inundation area. The special-status shrimp species habitat observed at the Thomes-Newville Reservoir Complex as surveyed before 2000 is summarized in Table 2A-3.

Valley Elderberry Longhorn Beetle

Emergence holes were found in 42 of the 552 elderberry stems observed; however, no adult beetles were found within the Thomes-Newville Reservoir Complex.

Avian Resources

Adult and immature Bald eagles were observed within the Newville Reservoir area along Stony Creek. There was evidence that the Thomes Reservoir area along Thomes Creek was used by wintering Bald eagles. Two bank swallow colonies were observed along Thomes Creek outside of the inundation areas. There were no indications of nesting habitat for Greater sandhill crane, Northern spotted owl, Peregrine falcon, Willow flycatcher, and Yellow-billed cuckoo within the inundation area. Marginal Swainson's hawk nesting/foraging habitat occurred within the inundation area. Habitats within the inundation area offer limited opportunity for wintering or migration use by Greater sandhill crane, Mountain plover,

Peregrine falcon, and Willow flycatcher. Special-status avian species that may occur in the Thomes-Newville Reservoir Complex as defined in 2000 are listed in Table 2A-4. The potential density of the birds in this area is summarized in Table 2A-7.

Table 2A-7
Thomes-Newville Reservoir Avian Transect Results
(Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
California horned lark	NS	NS	0.52	0.75
Cooper's hawk	NS	NS	0.17	
Golden eagle	NS	NS	0.10	0.13
Lark sparrow	NS	NS	7.64	1.50
Loggerhead shrike	NS	NS	2.05	0.90
Merlin	NS	NS	0.04	
Northern harrier	NS	NS	0.15	0.06
Prairie falcon	NS	NS	0.05	0.12
Southern bald eagle	NS	NS	0.08	
Tri-colored blackbird	NS	NS	0.69	2.41
Miles of transect per season			58.5	58.5

Note:
NS = Not Sampled

Mammals

As of 2000, San Joaquin pocket mouse, Pallid bat, Western mastiff bat, and Yuma bat were observed within the Thomes-Newville Reservoir Complex. Special-status mammalian species that may occur in the Thomes-Newville Reservoir Complex as defined in 2000 are listed in Table 2A-6.

Amphibian Surveys

DFW conducted studies in the Thomes-Newville Reservoir Complex area. The species observed were Black salamander, Bullfrog, California red-legged frog, California slender salamander, Foothill yellow-legged frog, Pacific tree frog (Pacific chorus frog), Western spadefoot toad, and Western toad.

Reptile Surveys

During the DFW studies, reptiles observed in the Thomes-Newville Reservoir Complex included Western fence lizard and Western pond turtle.

Cultural Resources

The evaluation for the Thomes-Newville Reservoir Complex observed 240 prehistoric components that were eligible for designation as NRHP, 65 historic sites, and two cemeteries.

Recreation

The recreation potential at the Thomes-Newville Reservoir Complex could be developed for motorboats, sailboats, houseboats, hiking and riding trails, and fishing.

2A.4.3.3 Colusa Reservoir

The Colusa Reservoir would be located approximately 10 miles west of Maxwell, and would include the 1.2 million-acre-foot Sites Reservoir on Funks and Stone Corral creeks and the 1.8 million-acre-foot Colusa Cell located immediately north of the Sites Reservoir, use of the existing or enlarged Funks Reservoir as a regulating reservoir, and facilities to convey water to and from the Sacramento River through a new facility or the Tehama-Colusa Canal Authority and/or Glenn-Colusa Irrigation District canals (CALFED, 2000c). Water supply for this reservoir complex would be provided from Funks and Stone Corral creeks and the Sacramento River.

Water Resources

Streams draining the Sites and Colusa Reservoir inundation areas are ephemeral with little or no flow from July through October. However, these streams tend to respond rapidly to significant rainfall events.

Land Use and Demographics

The dominant land uses in the inundation areas include livestock production, year-round and seasonal livestock grazing, dryland grain production, residential community of Sites, several ranches, and firewood harvest in some areas. A small commercial rock quarry is located outside of the inundation area to the east.

Aquatic Resources

Prior to 2000 in the Sites Reservoir area, Green sunfish, Bluegill, Sacramento pikeminnows, and Hitch were observed in Stone Corral Creek. Hitch were observed in Antelope Creek. Largemouth bass, Hitch, and several other fish were observed in some reaches of Funks Creek.

In the Colusa Cell, mosquitofish and Green sunfish were observed in Hunters Creek, and Hitch was observed in Minton and Logan creeks. Game and nongame fish were observed in the Colusa Basin Drain.

Wetland Delineation

Seasonal wetlands comprise 76 percent of the wetlands in the Sites Reservoir inundation area, including 2 acres of emergent wetlands. Narrow riparian areas provide 24 percent of the wetlands. Seasonal wetlands comprise over 84 percent of the wetlands in the Colusa Cell. Small areas of alkaline wetlands occur along the Salt Lake Fault in the Sites Reservoir and Colusa portions of the Colusa Reservoir. Jurisdictional wetlands and waters of the U.S. at the Colusa Reservoir as surveyed by 2000 are summarized in Table 2A-1.

Botanical Resources

California annual grassland is the dominant vegetation at the Sites Reservoir and Colusa Cell areas. The remaining vegetation includes oak woodland, chaparral, and wetlands (less than 10 percent) and vernal pool flora. Dominant vegetation communities at the Colusa Reservoir as surveyed in 2000 are summarized in Table 2A-2.

Special-status Shrimp Habitat

In the inundation area of the Colusa Reservoir, grasslands and vernal pools occur on heavy clay soils in basin terrain. The special-status shrimp species habitat observed at Colusa Reservoir as surveyed before 2000 are summarized in Table 2A-3.

Valley Elderberry Longhorn Beetle

Emergence holes were found in 18 of the 672 elderberry stems observed; however, no adult beetles were found within the Sites Reservoir area.

In the Colusa Cell, no emergence holes or adult beetles were observed in the 38 stems within the inundation area.

Avian Resources

Adult and immature Bald eagles were observed within the Sites Reservoir area. Winter use by Bald eagles occurred at Funks Reservoir. There were no indications of nesting habitat for Greater sandhill crane, Northern spotted owl, Peregrine falcon, Willow flycatcher, and Yellow-billed cuckoo within the inundation area. Marginal Swainson's hawk nesting/foraging habitat occurred within the inundation area. Habitats within the inundation area offer limited opportunity for wintering or migration use by Greater sandhill crane, Mountain plover, Peregrine falcon, and Willow flycatcher.

No suitable Bald eagle nesting habitat is present in the vicinity of the Colusa Cell. A single sighting of a Bank swallow occurred in September 1998 approximately 2.5 miles east of the Colusa Cell area, which could be a transient or migrating Bank swallow rather than a breeding season use. Five Sandhill cranes were observed flying over the Colusa Cell during November 1997; however, no actual habitat use was observed. This observation occurred on a very foggy day. There were no indications of nesting habitat for Greater sandhill crane, Northern spotted owl, Peregrine falcon, Willow flycatcher, and Yellow-billed cuckoo. Marginal Swainson's hawk nesting/foraging habitat occurred within the inundation area. Habitats within the inundation areas offer very limited opportunity for wintering or migration use by Greater sandhill crane, Mountain plover, Peregrine falcon, and Willow flycatcher.

Special-status avian species that may occur in the Colusa Reservoir as defined in 2000 are listed in Table 2A-4. The potential density of the birds in this area are summarized in Table 2A-8.

Table 2A-8
Colusa Reservoir Avian Transect Results*
(Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
Bank swallow		0.14 in Colusa Cell 0.14 Total		
Burrowing owl	0 in Colusa Cell 0.24 Total	0.14 in Colusa Cell 0.19 Total		0.03 in Colusa Cell 0.03 Total
California horned lark	85.00 in Colusa Cell 89.83 Total	7.38 in Colusa Cell 8.96 Total	22.63 in Colusa Cell 25.53 Total	36.66 in Colusa Cell 43.23 Total
Cooper's hawk		0.14 in Colusa Cell 0.17 Total	0.27 in Colusa Cell 0.27 Total	0 in Colusa Cell 0.06 Total
Double-crested cormorant				0.10 in Colusa Cell 0.10 Total
Ferruginous hawk			0 in Colusa Cell 0.12 Total	

Species	Summer	Fall	Winter	Spring
Golden eagle	0.22 in Colusa Cell 0.45 Total	0.32 in Colusa Cell 0.52 Total	0.24 in Colusa Cell 0.50 Total	0.30 in Colusa Cell 0.62 Total
Lark sparrow	NS in Colusa Cell NS Total	NS in Colusa Cell NS Total	0 in Colusa Cell 0.47 Total	0.80 in Colusa Cell 2.26 Total
Loggerhead shrike	0.89 in Colusa Cell 1.82 Total	2.15 in Colusa Cell 3.75 Total	1.84 in Colusa Cell 3.01 Total	2.82 in Colusa Cell 3.29 Total
Long-billed curlew			0 in Colusa Cell 14.59 Total	4.53 in Colusa Cell 5.79 Total
Northern harrier	1.00 in Colusa Cell 1.05 Total	0.67 in Colusa Cell 1.17 Total	0.87 in Colusa Cell 2.4 Total	0.50 in Colusa Cell 1.08 Total
Prairie falcon		0.14 in Colusa Cell 0.14 Total		
Sandhill crane		0.67 in Colusa Cell 0.67 Total		
Sharp-shinned hawk		0.14 in Colusa Cell 0.54 Total		0 in Colusa Cell 0.03 Total
Southern bald eagle		0.04 in Colusa Cell 0.04 Total	0.03 in Colusa Cell 0.10 Total	0.10 in Colusa Cell 0.10 Total
Tri-colored blackbird	41.50 in Colusa Cell 41.50 Total			20.32 in Colusa Cell 25.7 Total
White-tailed kite	0 in Colusa Cell 0.12 Total			0 in Colusa Cell 0.12 Total
Miles of transect per season	20.0 in Colusa Cell 57.5 Total	74.5 in Colusa Cell 162.50 Total	38.0 in Colusa Cell 113 Total	87.5 in Colusa Cell 238 Total

*Colusa Reservoir would include the footprint of Sites Reservoir.

Note:

NS = Not Sampled

Mammals

As of 2000, Pallid bat and San Joaquin pocket mouse were observed in the Sites Reservoir inundation area and along the relocated road alignments. Bats and deer herds were observed along the ridges where roads could be constructed. Ringtail, badger, and American pronghorn antelope were observed near the pipeline between the Sacramento River and Funks Reservoir. As of 2000, Pallid bats were observed within the Colusa Cell. Special-status mammalian species that may occur in the Colusa Reservoir as defined in 2000 are listed in Table 2A-6.

Amphibian Surveys

DFW conducted studies in the Sites Reservoir area and Colusa Cell. The species observed were Bullfrog, California newt, California slender salamander, Pacific tree frog (Pacific chorus frog), and Western toad.

Reptile Surveys

During the DFW studies, reptiles observed in the Sites Reservoir area and Colusa Cell included Western fence lizard, Western pond turtle, Common garter snake, and Gopher snake.

Cultural Resources

The evaluation for the Sites Reservoir observed prehistoric villages, 27 historic components eligible for NRHP designation, and three cemeteries. The evaluation for the Colusa Cell inundation areas recorded one prehistoric component, one historic component, and two historic ranches.

Recreation

The recreation potential at Sites Reservoir and Colusa Cell would occur at new recreation sites developed along the relocated roads for boating, camping, and hiking and riding trails.

2A.4.3.4 Sites Reservoir

The Sites Reservoir would be located approximately 10 miles west of Maxwell, and would include the 1.2 million-acre-foot Sites Reservoir on Funks and Stone Corral creeks, use of the existing or enlarged Funks Reservoir as a regulating reservoir, and facilities to convey water to and from the Sacramento River through a new facility or the Tehama-Colusa Canal Authority and/or Glenn-Colusa Irrigation District canals (CALFED, 2000c). The Project would inundate 14,000 acres. Water supply for this reservoir complex would be provided from Funks and Stone Corral creeks and the Sacramento River.

Water Resources

Streams draining the Sites Reservoir inundation area are ephemeral with little or no flow from July through October. However, these streams tend to respond rapidly to significant rainfall events.

Land Use and Demographics

The dominant land uses in the inundation areas include livestock production, year-round and seasonal livestock grazing, dryland grain production, residential community of Sites, several ranches, and firewood harvest in some areas. A small commercial rock quarry is located outside of the inundation area to the east of the inundation area.

Aquatic Resources

Prior to 2000 in the Sites Reservoir area, Green sunfish, Bluegill, Sacramento pikeminnows, and Hitch were observed in Stone Corral Creek. Hitch were observed in Antelope Creek. Largemouth bass, Hitch, and several other fish were observed in some reaches of Funks Creek.

Wetland Delineation

Seasonal wetlands comprise 76 percent of the wetlands in the Sites Reservoir inundation area, including 2 acres of emergent wetlands. Narrow riparian areas provide 24 percent of the wetlands. A small area of alkaline wetlands occurs along the Salt Lake Fault in the Sites Reservoir inundation area. Jurisdictional wetlands and waters of the U.S. at the Sites Reservoir as surveyed by 2000 are summarized in Table 2A-1.

Botanical Resources

California annual grassland is the dominant vegetation at the Sites Reservoir inundation areas. The remaining vegetation includes oak woodland, chaparral, and wetlands (less than 10 percent) and vernal pool flora. Dominant vegetation communities at the Sites Reservoir area as surveyed in 2000 are summarized in Table 2A-2.

Special-status Shrimp Habitat

In the inundation area of the Sites Reservoir, grasslands and vernal pools occur on heavy clay soils in basin terrain. The special-status shrimp species habitat observed at Sites Reservoir as surveyed before 2000 are summarized in Table 2A-3.

Valley Elderberry Longhorn Beetle

Emergence holes were found in 18 of the 672 elderberry stems observed; however, no adult beetles were found within the Sites Reservoir area.

Avian Resources

Adult and immature Bald eagles were observed within the Sites Reservoir area. Winter use by Bald eagles occurred at Funks Reservoir. There were no indications of nesting habitat for Greater sandhill crane, Northern spotted owl, Peregrine falcon, Willow flycatcher, and Yellow-billed cuckoo within the inundation area. Marginal Swainson's hawk nesting/foraging habitat occurred within the inundation area. Habitats within the inundation area offer limited opportunity for wintering or migration use by Greater sandhill crane, Mountain plover, Peregrine falcon, and Willow flycatcher.

Special-status avian species that may occur in the Sites Reservoir as defined in 2000 are listed in Table 2A-4. The potential density of the birds in this area is summarized in Table 2A-9.

Table 2A-9
Sites Reservoir Avian Transect Results
(Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
Burrowing owl	0.24	0.05		
California horned lark	4.83	1.58	2.90	6.57
Cooper's hawk		0.03		0.06
Ferruginous hawk			0.12	
Golden eagle	0.23	0.20	0.26	0.32
Lark sparrow	NS	NS	0.47	1.46
Loggerhead shrike	0.93	1.60	1.17	0.47
Long-billed curlew			14.59	1.26
Northern harrier	0.05	0.50	1.53	0.58
Sharp-shinned hawk		0.40		0.03
Southern bald eagle			0.07	
Tri-colored blackbird				5.38
White-tailed kite	0.12			0.12
Miles of transect per season	37.5	88.0	75.0	150.5

Note:

NS = Not Sampled

Mammals

As of 2000, Pallid bat and San Joaquin pocket mouse were observed in the Sites Reservoir inundation area and along the relocated road alignments. Bats and deer herds were observed along the ridges where roads could be constructed. Ringtail and American pronghorn antelope were observed near the pipeline between the Sacramento River and Funks Reservoir. Special-status mammalian species that may occur in the Sites Reservoir as defined in 2000 are listed in Table 2A-6.

Amphibian Surveys

DFW conducted studies in the Sites Reservoir area. The species observed were Bullfrog, California newt, California slender salamander, Pacific tree frog (Pacific chorus frog), and Western toad.

Reptile Surveys

During the DFW studies, reptiles observed in the Sites Reservoir area included Western fence lizard, Western pond turtle, Common garter snake, and Gopher snake.

Cultural Resources

The evaluation for the Sites Reservoir inundation area recorded prehistoric villages, 27 historic components eligible for NRHP designation, and three cemeteries.

Recreation

The recreation potential at Sites Reservoir would occur at new recreation sites developed along the relocated roads for boating, camping, and hiking and riding trails.

2A.4.3.5 Shasta Lake Enlargement

Three sub-alternative concepts were considered to raise Shasta Dam by 6.5, 102.5, and 202.5 feet (CALFED, 2000c). Under the largest sub-alternative, the existing 4.5 million-acre-foot Shasta Lake would be increased by up to an additional 4.5 million acre-feet and would inundate 30,000 acres of the Shasta-Trinity National Recreation area, 4 miles of the McCloud River, 6 miles of the Sacramento River, and 42 miles of tributaries. This sub-alternative would require relocation of 800 homes, 800 camp sites, 100 picnic sites, several marinas, 14 resorts, the Pacific Gas & Electric Company Pit No. 7 Power Plant, and portions of Interstate 5 and Southern Pacific Railroad tracks. These impacts would be substantially reduced if Shasta Dam was only raised 6.5 feet, which would result in an additional 0.256 million acre-feet of storage. Because of these extensive impacts, only a small Shasta Lake Enlargement was determined to be consistent with CALFED objectives. It was determined in the prefeasibility studies that the most significant of the potential impacts would be associated with the inundation of portions of the McCloud River.

A portion of the McCloud River would be inundated even with the smaller expansion concept. The California Legislature declared that "*the McCloud River possesses extraordinary resources in that it supports one of the finest wild trout fisheries in the state*" (California Pubic Resources Code Section 5093.542). The Public Resources Code Section also states: "*No dam, reservoir, diversion, or other water impoundment facility shall be constructed on the McCloud River from Algoma to the confluence with huckleberry Creek, and 0.25 mile downstream from the McCloud Dam to the McCloud River Bridge: nor shall any such facility be constructed on Squaw Valley Creek from the confluence with Cabin Creek to the confluence with the McCloud River*." However, the Legislature recognized that Reclamation may need to enlarge Shasta Lake in the future; therefore, the Public Resources Code also states: "*Except for participation by the Department of Water Resources in studies involving the technical and economic feasibility of enlargement of Shasta Dam, no department or agency of the state shall assist or cooperate with, whether by loan, grant, license, or otherwise, any agency of the federal, state, or local government in the planning or construction of any dam, reservoir, diversion, or other water impoundment facility that could have an adverse effect on the free-flowing condition of the McCloud River, or on its wild trout fishery.*"

2A.4.3.6 Summary of the Evaluation of Water Storage Alternatives in the Western Sacramento Valley under the CALFED Integrated Storage Investigation

Following analysis of the five alternative concepts for water storage alternatives in the Western Sacramento Valley, only two alternative concepts were considered for inclusion in the CALFED EIS/EIR: Shasta Lake Enlargement and Sites Reservoir (CALFED, 2000c). Red Bank Reservoir Complex, Thomes-Newville Reservoir Complex, and Colusa Reservoir were determined to not significantly contribute to CALFED goals and objectives at the time of the CALFED EIS/EIR; however, it was indicated that these concepts may be appropriate for further consideration as water demands and water supplies change.

The CALFED EIS/EIR did not specifically evaluate project-specific issues associated with Shasta Lake Enlargement or Sites Reservoir. Instead, the CALFED EIS/EIR evaluated programmatic changes in environmental resources based upon overall increased water storage in the western Sacramento Valley, as well as increased storage within the Delta and south of the Delta.

The recommended storage program in the CALFED ROD recommended that total storage in the first phase of the CALFED implementation should only include up to 0.95 million acre-feet of new surface water storage and 0.5 to 1.0 million acre-feet of additional groundwater storage. The recommendations recognized the potential benefits of both groundwater and surface storage (with neither being mutually exclusive). Both approaches were recommended for further investigation as well as the potential for conjunctive use of both in combination to maximize potential benefits where possible. The CALFED ROD recommended Shasta Lake Enlargement with a 6- to 8-foot raise of Shasta Dam (0.3 million acre-feet), new In-Delta storage (0.25 million acre-feet), and expanded Los Vaqueros Reservoir in the Delta (0.4 million acre-feet). Sites Reservoir was recommended for pursuit in the next CALFED stage if local cost-sharing partnerships could be developed, and if additional technical work and environmental analyses were completed.

Red Bank Reservoir Complex, including the Schoenfield Reservoir, was eliminated because the benefits to aquatic resources from this reservoir complex were diminished when the Red Bluff Diversion Dam was replaced by the Red Bluff Pumping Plant. The Red Bank Reservoir also would affect California red-legged frog, would block anadromous fish passage from a portion of Cottonwood Creek, and would reduce sediment transport from Cottonwood Creek to the Sacramento River. The Red Bank Reservoir would affect less acreage than the other reservoir concepts; however, the proportional level of impacts for the 0.35 million-acre-foot Red Bank Reservoir Complex was substantially greater related to the water supplies as compared to the 3.08 million-acre-foot Thomes-Newville Reservoir Complex, 3.0 million-acre-foot Colusa Reservoir, and 1.2 million-acre-foot Sites Reservoir.

Thomes-Newville Reservoir Complex and Colusa Reservoir were eliminated because the environmental impacts would be greater than the Sites Reservoir, and the additional water storage was not determined to be needed at that time of the CALFED EIS/EIR.

2A.4.4 Evaluation of Water Storage Alternatives in the Western Sacramento Valley under the DWR Surface Water Storage Investigation

Following the completion of the CALFED EIS/EIR, DWR and Reclamation initiated feasibility studies and environmental documents to further evaluate the recommended water storage alternatives recommended in the CALFED EIS/EIR. Reclamation initiated the Shasta Lake Water Resources Investigation to further evaluate the Shasta Lake Enlargement concept. DWR and Reclamation initiated

the North-of-the-Delta Water Storage Investigation to further evaluate Sites Reservoir and Thomes-Newville Reservoir.

As summarized below, Reclamation considered use of Sites Reservoir as an alternative to the enlargement of Shasta Lake; and DWR and Reclamation considered the use of Shasta Lake Enlargement as an alternative to Sites Reservoir.

2A.4.4.1 Consideration of Sites Reservoir as a Substitute for Shasta Lake Enlargement

The CALFED EIS/EIR ROD identified the objective for the Shasta Lake Water Resources Investigation (SLWRI) as "*Expand CVP storage in Shasta Lake by approximately 300 TAF* [0.300 million acre-feet]. *Such an expansion will increase the pool of cold water available to maintain lower Sacramento River temperatures needed by certain fish and provide other water management benefits, such as water supply reliability*" (Reclamation, 2013).

To achieve this overall objective for the Shasta Lake Enlargement, the following SLWRI Planning Objectives were identified as part of the Plan Formulation:

- Increase the survival of anadromous fish populations in the Sacramento River, primarily upstream from the Red Bluff Pumping Plant. (Primary Planning Objective)
- Increase water supply and water supply reliability for agricultural, municipal and industrial, and environmental purposes to help meet current and future water demands, with a focus on enlarging Shasta Dam and Reservoir. (Primary Planning Objective)
- Conserve, restore, and enhance ecosystem resources in the Shasta Lake area and along the upper Sacramento River. (Secondary Planning Objective)
- Reduce flood damage along the Sacramento River. (Secondary Planning Objective)
- Develop additional hydropower generation capabilities at Shasta Dam. (Secondary Planning Objective)
- Maintain and increase recreation opportunities at Shasta Lake. (Secondary Planning Objective)
- Maintain or improve water quality conditions in the Sacramento River downstream from Shasta Dam and in the Delta. (Secondary Planning Objective)

Reclamation considered a range of alternative concepts as part of the SLWRI Plan Formulation Report, including three reservoir locations upstream of Shasta Lake to provide an additional 0.18 to 0.80 million acre-feet, Cottonwood Creek Reservoir and two reservoirs on the eastern side of the Sacramento Valley, Sites Reservoir and other reservoirs considered under the North-of-the-Delta project, increased storage located south of the Delta, and increased storage in existing Shasta Lake through dredging of sediment. These alternatives were not analyzed in detail because the economic costs as compared to the benefits were greater than for the Shasta Lake Enlargement, and/or the alternative concepts would not meet the Primary and Secondary Objectives of the SLWRI.

Specifically, Sites Reservoir was analyzed to provide 1.8 million acre-feet of storage for water from Funks and Stone Corral creeks and the Sacramento River. The Sites Reservoir concept considered under the SLWRI included the following objectives:

- Increase water supply reliability of Sacramento Valley water users and CVP and SWP water users.
- Improve Delta water quality.
- Contribute to ecosystem restoration.
- Provide water to support the CALFED Environmental Water Account program, which includes acquisition and transfer of water through the Delta to reduce the impacts of CALFED reductions in Delta water diverted by the CVP and SWP to improve aquatic resources. (Note: Environmental Water Account is no longer being implemented at the time of preparation of this EIR/EIS.)

These Sites Reservoir objectives were determined to be different than the objectives of the Shasta Lake Enlargement project because the benefits related to Shasta Lake and the upper Sacramento River upstream of Red Bluff Pumping Plant would not be as great under the Sites Reservoir alternative concept as under the Shasta Lake Enlargement alternative concept. Therefore, it was determined that Sites Reservoir and the other North-of-the-Delta Offstream Storage alternatives would not be considered as a substitute for Shasta Lake Enlargement.

2A.4.4.2 Consideration of Alternative Concepts for Western Sacramento Valley Reservoirs

Following the completion of the CALFED EIS/EIR and ROD, DWR and Reclamation published the Notice of Preparation and Notice of Intent, respectively, to initiate the scoping process (see Appendix 36A Scoping Report). Throughout the scoping process, 60 comments were received related to surface water storage reservoir alternative concepts for the western Sacramento Valley. The comments related to reservoir locations primarily addressed either the Newville or Sites reservoir locations. Most of the comments specific to the Newville Reservoir alternative opposed Newville Reservoir because of the impacts on the fish and wildlife habitat, cultural resources and historical resources, and 70 permanent residents within the inundation area and along the relocated roads that would be constructed around the reservoir.

Following the scoping process, DWR and Reclamation adopted a set of screening criteria and applied the screening criteria to the reservoir alternative concepts considered in the CALFED Integrated Storage Investigation for the western Sacramento Valley reservoirs, including Red Bank, Newville, Colusa, and Sites reservoirs and Shasta Lake Enlargement (CALFED 2000c; Reclamation and DWR, 2006). The analysis did not include the 1.2 million-acre-foot Thomes Reservoir of the Thomes-Newville Reservoir because of the substantial environmental impacts, including blocking of fish migration on Thomes Creek.

Screening Criteria

The screening criteria were developed to be applied in a three-phase sequential analysis.

First Screening Criterion

The First Screening Criterion was based upon the ability of the alternatives to meet the Project Objectives and Purpose and Need Statements to enhance water management flexibility and improve water supply reliability and water quality, reduce water diversions on the Sacramento River during critical fish

migration periods and improve ecosystem conditions, provide recreation and flood damage reduction opportunities, and provide hydropower generation flexibility.

The Project Objectives and Purpose and Need Statements at that time in the project were as follows:

- Increasing water supplies, water supply reliability, and Sacramento Valley water management flexibility for agricultural, municipal and industrial, and environmental purposes, including CALFED programs such as Delta water quality, the Environmental Water Account, and the ERP, to help meet California's current and future water demands, with a focus on offstream storage. (Primary Objective)
- Increasing the survival of anadromous fish populations in the Sacramento River, as well as the health and survivability of other aquatic species. (Primary Objective)
- Providing ancillary hydropower benefits to the statewide power grid. (Secondary Objective)
- Developing additional recreational opportunities in the study area. (Secondary Objective)
- Creating incremental flood control storage opportunities in support of major northern California flood control reservoirs. (Secondary Objective)

Second Screening Criterion

The Second Screening Criterion was related to avoiding or reducing adverse effects with a focus on reductions in jurisdictional wetlands and other waters of the U.S. and potential impacts on sensitive aquatic and terrestrial habitats.

Third Screening Criterion

The Third Screening Criterion was related to avoiding or reducing adverse effects and/or providing benefits using more detailed analyses with a focus on cultural resources, aquatic and terrestrial biological resources, jurisdictional wetlands and other waters of the U.S., energy use and greenhouse gas emissions related to pumping of water into the reservoir, and flood management opportunities.

Application of Screening Criteria to the Range of Alternatives

The screening criteria were in a three-phase sequential analysis. If a reservoir alternative concept did not comply with an earlier screening criterion, it was not analyzed under subsequent criterion. For example, if an alternative concept was not consistent with the First Screening Criterion, it was not analyzed under the Second or Third Screening Criteria.

Results of Applying the First Screening Criterion

The four reservoir alternatives located in the western foothills of the Sacramento Valley are consistent with the First Screening Criterion. However, the Shasta Lake Enlargement project was determined to not fully meet the project objectives for this Project. The Shasta Lake Enlargement project focused on benefits in Shasta Lake and the upper Sacramento River with only a Secondary Planning Objective for improved water quality conditions in the lower reaches of the Sacramento River and in the Delta, whereas the First Screening Criterion addressed improvements over a broader geographic area of the Sacramento Valley.

Results of Applying the Second Screening Criterion

Under the Second Screening Criterion, the Colusa Reservoir and Red Bank Reservoir were eliminated from detailed analysis.

Colusa Reservoir was eliminated because of the extent of impacts on wetlands and sensitivity habitats that would be greater than under the Sites and Newville reservoirs alternatives. The extent of disturbance on wetlands and sensitivity habitats for Sites and Newville reservoirs appeared to be relatively similar at the level of detail considered in the second step of the screening process.

The Red Bank Reservoir was eliminated from further detailed analysis because the benefits to aquatic resources from this reservoir complex were diminished when the Red Bluff Diversion Dam was replaced by the Red Bluff Pumping Plant. The Red Bank Reservoir also would affect California red-legged frog, would block anadromous fish passage from a portion of Cottonwood Creek, and would reduce sediment transport from Cottonwood Creek to the Sacramento River. The Red Bank Reservoir would affect less acreage than the other reservoir concepts; however, the proportional level of impacts for the 0.35 million-acre-foot Red Bank Reservoir was substantially greater related to the water supplies as compared to the larger Newville and Sites reservoirs.

Results of Applying the Third Screening Criterion

Under the Third Screening Criterion, additional investigations were conducted under the North-of-the-Delta Surface Water Storage Investigation to compare Newville and Sites reservoirs. The more detailed analyses focused on Cultural Resources, Terrestrial Biological Resources, Botanical Resources, Aquatic Resources, Energy and Greenhouse Gas Emissions, and Flood Management. The results of these comparisons are as follows:

- **Cultural Resources** – Cultural resources evaluations were conducted only for the inundation area of Newville Reservoir and for the entire disturbed area for Sites Reservoir (e.g., inundation area, recreation areas, road relocations, water conveyance facilities to transfer water to and from the reservoir, and a terminal regulating reservoir). Although the area considered for the Newville Reservoir did not include the appurtenant facilities as compared to the Sites Reservoir analysis, the adverse impact of the analyzed area for Newville Reservoir was greater than for Sites Reservoir, as shown in Table 2A-10.

Table 2A-10
Comparison of Potential Cultural Resource Impacts Associated with the Sites Reservoir and Newville Reservoir Alternatives

Cultural Resource	Number of Cultural Resources Identified	
	Sites Reservoir Alternative	Newville Reservoir Alternative*
Historic and prehistoric sites*	147	250
Cemeteries	2	2
Middens	57	80

*Newville Reservoir Alternative survey data for reservoir footprint only.

- **Terrestrial Biological Resources –** As shown in Table 2A-11, the impacts to terrestrial biological resources at Newville Reservoir would be greater than at Sites Reservoir because the Newville Reservoir location currently has greater habitat and structural diversity.

Table 2A-11
Potential Permanent Habitat Loss Comparison between the Sites Reservoir and Newville Reservoir Alternatives

Habitat Type	Potential Permanent Habitat Loss (acres)*	
	Sites Reservoir Alternative	Newville Reservoir Alternative
Annual grassland	16,311	17,556
Blue oak woodland	924	2,532
Wetlands	249	525
Riparian	75	476
Chaparral	1	422
Agricultural	250	1,744
Valley oak woodland	4	104
Juniper woodland	0	36
Shale barren	0	268
Blue oak/foothill pine	494	1,203
Total acreage	18,308	24,886

*Acreage values include all project features such as reservoirs, dams, road relocations, and conveyance routes where habitat would be permanently modified.

- Several invertebrate species protected under the federal Endangered Species Act have the potential to occur at or near both the Sites Reservoir and Newville Reservoir locations, including valley elderberry longhorn beetle, vernal pool fairy shrimp, Conservancy fairy shrimp, and vernal pool tadpole shrimp. Protocol-level surveys conducted at the Sites Reservoir location indicate that none of the federally listed vernal pool invertebrates are present. Vernal pools at the Newville Reservoir location were not surveyed.

- Protocol-level surveys for Valley Elderberry Longhorn Beetle presence were conducted at Newville and Sites reservoirs locations. The results indicate that nearly twice as many elderberry stems would be affected, and that the presence of the valley elderberry longhorn beetle is much higher (based on surveyed emergence holes) at the Newville Reservoir Alternative location than at the Sites Reservoir Alternative location, as shown in Table 2A-12.

Table 2A-12
Valley Elderberry Longhorn Beetle Survey Results Comparison between the Newville Reservoir and Sites Reservoir Alternatives

VELB Survey Criteria	Number Observed per Location	
	Sites Reservoir Alternative	Newville Reservoir Alternative
Total elderberry stems	672	1201
Elderberry stems with emergence holes	18	264

Note:

VELB = valley elderberry longhorn beetle

- **Botanical Resources –** The Newville Reservoir location currently contains greater numbers of rare plant species and species of concern than the current location of Sites Reservoir, as shown in Table 2A-13.

Table 2A-13
Comparison of Rare Plant Species and Populations at the Sites and Newville Reservoir Alternatives

Listing Status	Number of Rare Plants Observed (species/populations)	
	Sites Reservoir Alternative	Newville Reservoir Alternative
State or federal threatened or endangered	0	0
State or federal species of concern	0	3 Species 57 Populations
CNPS 1A	0	0
CNPS 1B	0	5 Species 122 Populations
CNPS 2	0	0
CNPS 3	0	0
CNPS 4	4 Species 37 Populations	7 Species 183 Populations

Note:
CNPS=California Native Plant Society List

- Comparison of the Newville and Sites reservoirs alternatives indicates that the Newville Reservoir would impact significantly greater amounts of wetlands and waters of the U.S., including jurisdictional wetlands, than the Sites Reservoir Alternative, as shown in Table 2A-14.

Table 2A-14
Comparison of Potential Impacts to Wetlands and Waters of the U.S. between the Sites and Newville Reservoir Alternatives

Resource	Wetlands and Waters of the U.S. Potentially Impacted (acres)	
	Sites Reservoir Alternative	Newville Reservoir Alternative
Wetlands	196	390
Waters of the U.S.	175	231
Total wetlands and waters*	**371**	**621**

*Reservoir footprint data comparisons

- **Aquatic Resources –** The Newville Reservoir would include a small diversion on Thomes Creek. The focused analyses of this diversion indicated that it would be difficult to operate a fish passage on this stream because of the high volume of sediment on Thomes Creek. Therefore, implementation of Newville Reservoir would result in adverse effects on anadromous fish. Stone Corral and Funks creeks are ephemeral and do not support anadromous fish populations, and no fish passage would be required for Sites Reservoir implementation.

- **Energy and Greenhouse Gas Emissions -** The Newville Reservoir Alternative would require more energy for pumping than the Sites Reservoir Alternative because minimum conveyance distances would be greater (18 to 23 miles for Newville Reservoir as compared to 1 to 13 miles for Sites

Reservoir) and because the pumping elevations would be higher (approximately 400 feet higher pumping elevation for Newville Reservoir as compared to the Sites Reservoir). Higher conveyance-related energy requirements associated with the Newville Reservoir Alternative would result in relatively greater operational greenhouse gas emissions than for the Sites Reservoir Alternative. In addition, because of its greater embankment volume (35 million cubic yards for the Newville Reservoir Alternative vs. 22 million cubic yards for the Sites Reservoir Alternative), the Newville Reservoir Alternative would result in greater construction equipment hours and, therefore, greater greenhouse gas emissions potential during construction.

- **Flood Management -** The Sites Reservoir Alternative could provide some local flood management benefits to lands that are currently prone to flooding during high flow events on Funks and Stone Corral creeks. The Newville Reservoir Alternative would have little flood management potential because the reservoir would be located upstream of Black Butte Reservoir; and diversion facilities on Thomes Creek would have little or no ability to store water or provide downstream flood protection.

Therefore, under the Third Screening Criteria, Newville Reservoir was eliminated from further consideration because of the extent of disturbance on cultural resources, aquatic and terrestrial resources, jurisdictional wetlands and other waters of the U.S., and energy use and potential for greenhouse gas emissions.

2A.5 Summary of the Application of Screening Criteria to the Range of Alternatives

Development of a range of alternatives to provide additional storage in the western Sacramento Valley has been considered for more than 100 years. The current Project was initiated in 1998 as part of the CALFED Integrated Storage Investigation process, and was subsequently analyzed as part of the DWR and Reclamation Surface Water Storage Investigation. The results of these studies and screening analyses, as summarized in this appendix, have been considered as part of this EIR/EIS to select Sites Reservoir as the most appropriate reservoir location for additional surface water storage in the western Sacramento Valley.

2A.5.1 Summary of the Basis of Alternatives Development Process

Potential alternatives for the EIR/EIS were identified in accordance with the requirements of CEQA and NEPA. Under CEQA, the action alternatives must meet the following criteria:

- Be potentially feasible.
- Attain most of the basic objectives (and goals).
- Avoid or substantially lessen potentially significant effects of the Project, including methods that could reduce attainment of some of the objectives and goals or be more costly.

Under NEPA, the action alternatives in an EIS must meet the following criteria:

- Be reasonable.
- Meet the Purpose and Need.
- Address one or more potentially significant issues related to the Project.

Therefore, to be consistent with the requirements of both CEQA and NEPA, the action alternatives considered in detail in this EIR/EIS were determined to need to be feasible, reasonable, and meet the Goals and Objectives and Purpose and Need of the Project.

The Goals and Objectives and Purpose and Need of the Project are focused on developing surface water storage on the western Sacramento Valley to provide water management flexibility and increased reliability for water supplies in the Sacramento Valley, improve ecosystem and water quality in the Sacramento River system and Delta, provide for flexible hydropower generation, develop recreational opportunities, and provide incremental flood damage reduction.

2A.5.2 Summary of the Development of a Range of Conceptual Alternatives

Surface water storage alternatives for the western Sacramento Valley considered by the State and federal agencies over the past 100 years were reviewed to determine the range of possible alternative locations for new reservoirs. As described in Section 2A.4.1, Newville Reservoir was first analyzed in 1901. In the next 95 years, Newville, Paskenta, Sites, Glenn, Colusa, Red Bank, and Cottonwood reservoir concepts were analyzed as well as a range of smaller projects. The alternatives considered also included enlargement of existing reservoirs, including Trinity Lake, Shasta Lake, and Lake Berryessa. Many of the reservoirs only provided storage for small watersheds that were tributary to the Sacramento River, or for additional flows to be diverted from the Trinity and Eel rivers.

During this same time period, the State and federal agencies also evaluated reservoir locations in the eastern Sacramento Valley, within the Delta, and south of the Delta. However, this Project is focused on projects in the western Sacramento Valley that can improve water resources and ecosystem conditions in the Sacramento Valley and Delta.

The studies completed prior to 1995 and the initiation of the CALFED EIS/EIR evaluated numerous reservoir locations for multi-purpose reservoirs to provide flood control, water supply, and recreation opportunities. The new reservoirs were considered for use by local agricultural water users as well as water users located south of the Delta. The studies recognized the need for additional water supplies in the future; however, at the time of these studies, the SWP and CVP facilities were either under development or recently implemented. Therefore, the immediate need for additional water supplies was limited; and the objectives of these studies were focused on screening potential reservoir locations to be considered in the future as projected water demands would occur. The results of these studies described the need for continued evaluation of Thomes-Newville, Colusa-Sites, Glenn, and Cottonwood Creek reservoirs because these reservoirs would be located near the Sacramento River, which would contribute to the water supply, and the size of the reservoirs would be sufficient to provide benefits at appropriate economic values. These reservoirs and others previously evaluated were considered in the development of the CALFED EIS/EIR.

2A.5.3 Summary of the Evaluation of a Range of Alternatives for Water Storage in the Western Sacramento Valley under CALFED

The CALFED EIS/EIR alternatives considered the concept of additional water storage in a portion of the range of alternatives. The reservoir concepts included additional water storage in the western and eastern Sacramento Valley, within the Delta, and south of the Delta, as well as additional groundwater aquifer storage. The CALFED Phase I studies considered 23 storage and conveyance concepts to increase water storage upstream of the Delta by up to 3.0 million acre-feet. These concepts were developed based upon review of previous studies. The results of the evaluation were analyzed to determine if the reservoir

concepts would be consistent with CALFED objectives, including to improve ecological health of the Delta, to improve water supply reliability and quality for users of Delta water, and to not result in redirected adverse impacts. The results of the Phase I studies and Phase II screening analysis indicated that Red Bank Reservoir Complex, Thomes-Newville Reservoir Complex, Colusa Reservoir, Sites Reservoir, and Shasta Lake Enlargement should be considered further. Additional feasibility study analyses were completed for these reservoirs under the CALFED Integrated Storage Investigation and the Proposition 204 program.

The results of the analyses completed under the CALFED Integrated Storage Investigation and the Proposition 204 program indicated that only Shasta Lake Enlargement and Sites Reservoir should be considered under the CALFED EIS/EIR analyses. Red Bank Reservoir Complex, Thomes-Newville Reservoir Complex, and Colusa Reservoir were determined to not significantly contribute to CALFED goals and objectives at the time of the CALFED EIS/EIR; however, it was indicated that these concepts may be appropriate for further consideration as water demands and water supplies change (see Section 2A.4.3).

The CALFED EIS/EIR did not specifically evaluate project-specific issues associated with Shasta Lake Enlargement or Sites Reservoir. Instead, the CALFED EIS/EIR evaluated programmatic changes in environmental resources based upon overall increased water storage in the western Sacramento Valley, as well as increased storage within the Delta and south of the Delta.

The recommended storage program in the CALFED ROD recommended that total storage in the first phase of the CALFED implementation should only include up to 0.95 million acre-feet of new surface water storage and 0.5 to 1.0 million acre-feet of additional groundwater storage. The recommendations recognized the potential benefits of both groundwater and surface storage (with neither being mutually exclusive). Both approaches were recommended for further investigation as well as the potential for conjunctive use of both in combination to maximize potential benefits where possible. The CALFED ROD recommended Shasta Lake Enlargement with a 6- to 8-foot raise of Shasta Dam (0.3 million acre-feet), new In-Delta storage (0.25 million acre-feet), and expanded Los Vaqueros Reservoir in the Delta (0.4 million acre-feet). Sites Reservoir was recommended for pursuit in the next CALFED stage if local cost-sharing partnerships could be developed and if additional technical work and environmental analyses were completed.

Red Bank Reservoir Complex, including the Schoenfield Reservoir, was eliminated because the benefits to aquatic resources from this reservoir complex were diminished when the Red Bluff Diversion Dam was replaced by the Red Bluff Pumping Plant. The Red Bank Reservoir also would affect California red-legged frog, would block anadromous fish passage from a portion of Cottonwood Creek, and would reduce sediment transport from Cottonwood Creek to the Sacramento River. The Red Bank Reservoir would affect less acreage than the other reservoir concepts; however, the proportional level of impacts for the 0.35 million-acre-foot Red Bank Reservoir Complex was substantially greater related to the water supplies as compared to the 3.08 million-acre-foot Thomes-Newville Reservoir Complex, 3.0 million-acre-foot Colusa Reservoir, and 1.2 million-acre-foot Sites Reservoir.

Thomes-Newville Reservoir Complex and Colusa Reservoir were eliminated because the environmental impacts would be greater than the Sites Reservoir, and the additional water storage was not determined to be needed at the time of the CALFED EIS/EIR.

2A.5.4 Summary of the Evaluation of Surface Water Storage Alternatives in the Western Sacramento Valley under the DWR Surface Water Storage Investigation

Following the completion of the CALFED EIS/EIR, DWR and Reclamation initiated feasibility studies and environmental documents to further evaluate the recommended water storage alternatives recommended in the CALFED EIS/EIR. Reclamation initiated the Shasta Lake Water Resources Investigation to further evaluate the Shasta Lake Enlargement concept. DWR and Reclamation initiated the North-of-the-Delta Water Storage Investigation to further evaluate Sites Reservoir and Thomes-Newville Reservoir.

Following the completion of the CALFED EIS/EIR and ROD, DWR and Reclamation analyzed a range of surface water storage alternatives for the western Sacramento Valley. The range was developed through review of the concepts considered in the development of the CALFED EIS/EIR and comments submitted during the scoping process for this EIR/EIS. The alternative concepts that were selected for further review in the development of alternatives for this EIR/EIS included Red Bank, Newville, Colusa, and Sites reservoirs and Shasta Lake Enlargement. The alternative concepts did not include the 1.2 million-acre-foot Thomes Reservoir of the Thomes-Newville Reservoir because of the substantial environmental impacts, including blocking of fish migration on Thomes Creek.

A set of screening criteria were developed and applied to these potential alternatives using information compiled through the CALFED EIS/EIR process. The results of the screening process are summarized as follows:

- Shasta Lake Enlargement was eliminated from consideration under this EIS/EIR because the purpose and need of the Shasta Lake Enlargement project being developed concurrently by Reclamation focused on improving environmental conditions in Shasta Lake and the upper Sacramento River, as compared to the project objectives of this Project to improve conditions over a broader geographic region of the Sacramento Valley.
- Colusa Reservoir was eliminated because of the extent of impacts on wetlands and sensitivity habitats that would be greater than under the Sites and Newville reservoirs alternatives. The Colusa Reservoir would inundate approximately 28,000 acres.
- The Red Bank Reservoir was eliminated from further detailed analysis because the benefits to aquatic resources from this reservoir complex were diminished when the Red Bluff Diversion Dam was replaced by the Red Bluff Pumping Plant. The Red Bank Reservoir also would affect California red-legged frog, would block anadromous fish passage from a portion of Cottonwood Creek, and would reduce sediment transport from Cottonwood Creek to the Sacramento River. The Red Bank Reservoir would affect less acreage than the other reservoir concepts (approximately 4,600 acres); however, the proportional level of impacts for the 0.35 million-acre-foot Red Bank Reservoir was substantially greater related to the water supplies as compared to the larger Newville and Sites reservoirs.
- Newville Reservoir was eliminated from further consideration because of the extent of disturbance on cultural resources, aquatic and terrestrial resources, jurisdictional wetlands and other waters of the U.S., and energy use and potential for greenhouse gas emissions. The Newville Reservoir would inundate up to 31,500 acres depending upon the extent of storage on Thomes Creek.
- Sites Reservoir would result in less adverse impacts than the other reservoir concepts and continue to meet the Project Objectives and Purpose and Need. The Sites Reservoir concept would inundate approximately 14,000 acres.

Sites Reservoir was selected as the alternative reservoir concept to be analyzed in more detail in this EIR/EIS. The results of this western Sacramento Valley Surface Water Storage Investigation indicated that further analyses would be required to identify appropriate conveyance, hydropower, recreation, and access routes. In addition, further analyses would be required to develop approaches and any necessary mitigation measures to reduce the adverse effects of implementation of the Project. These further analyses were completed as part of this EIR/EIS, as described in Chapters 1 through 36 of this EIR/EIS.

2A.6 References

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