UPPER SAN JOAQUIN RIVER BASIN STORAGE INVESTIGATION PHASE 1 INVESTIGATION REPORT

EXECUTIVE SUMMARY

The Upper San Joaquin River Basin Storage Investigation (Investigation) is a joint feasibility study by the Bureau of Reclamation and the California Department of Water Resources (DWR). The Investigation is being performed in accordance with the CALFED Programmatic Environmental Impact Statement / Environmental Impact Report (EIS/EIR) Record of Decision (ROD), which recommended evaluating water storage in the upper San Joaquin River basin to "contribute to restoration of and water quality for the San Joaquin River and to facilitate additional conjunctive management and exchanges that improve the quality of water deliveries to urban areas."

The feasibility study is being completed in two phases. The Phase 1 Investigation Report describes initial study activities that have been completed toward preparing the feasibility report. Phase 2 will include completing the feasibility report and associated EIS/EIR. Figure ES-1 shows the location of the upper San Joaquin River basin and the study area for the Investigation.

Purpose of the Phase 1 Report

- Define problems and opportunities
- Establish study objectives
- Identify potential water storage options
- Present findings of Phase 1 technical analyses
- Provide focus for Phase 2 activities

MAJOR FINDINGS AND CONCLUSIONS

Reclamation and DWR find sufficient potential for additional water storage in the upper San Joaquin River basin to warrant further study. Major findings and conclusions from Phase 1 include the following:

- Water supply in the upper San Joaquin River basin is available and could be developed with additional storage
- Water supply developed with additional storage in the upper San Joaquin River basin could contribute to restoring the San Joaquin River, improving water quality in the San Joaquin River, and increasing water supply reliability
- Six surface storage options appear technically feasible and will be further considered in Phase 2 of the feasibility study
- Preliminary costs for surface storage options are within the range of other reservoirs under consideration in California
- Public support is strong for continued evaluation of water storage in the upper San Joaquin River basin
- Regional interest in additional conjunctive management of surface water and groundwater resources is high

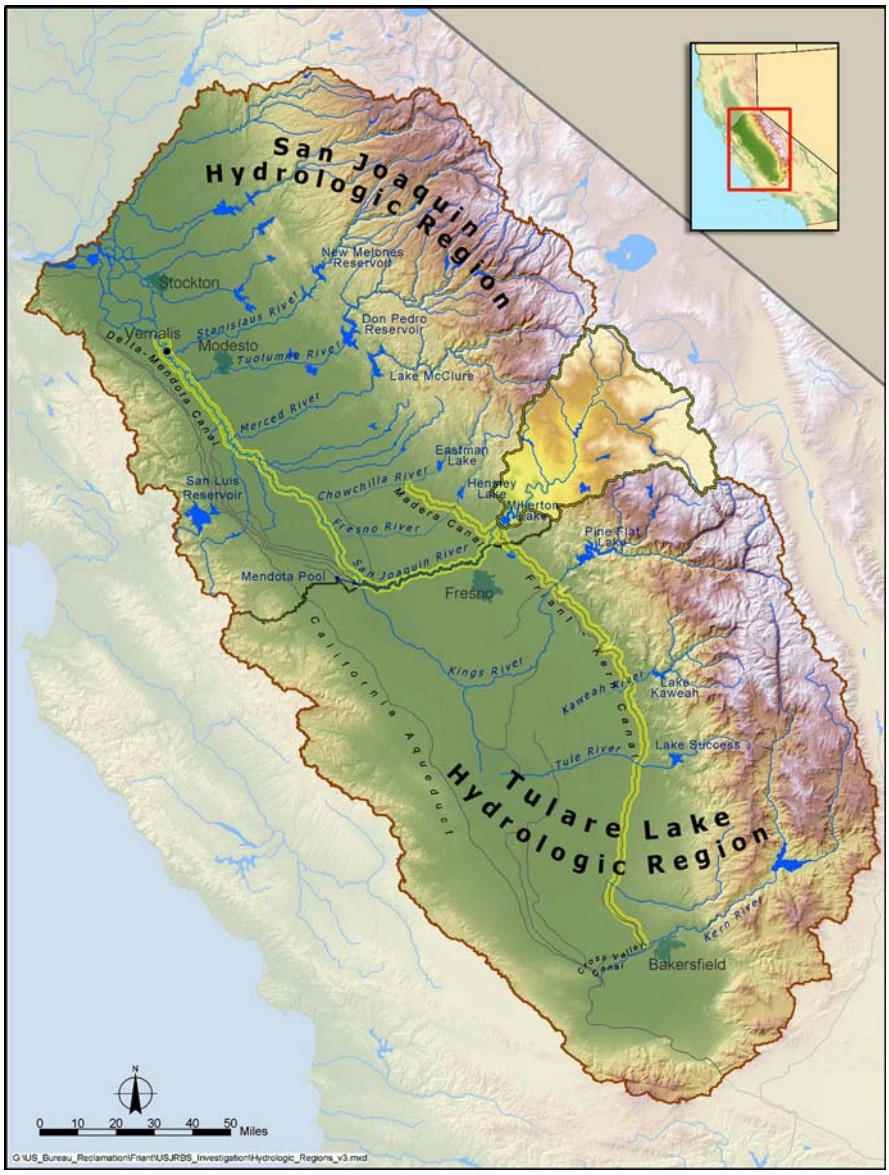


FIGURE ES-1. STUDY AREA EMPHASIS

STUDY AUTHORIZATION

Federal authorization for the feasibility study was provided in PL 108-7, the omnibus appropriations legislation for fiscal year 2003. Reclamation is the responsible Federal agency for preparing this report.

PROBLEMS AND OPPORTUNITIES

Water resources problems in the San Joaquin Valley are related to changing water needs, hydrologic variations in water availability, and the capacity of current water storage and conveyance facilities. Problems and opportunities addressed by the Investigation, described in the following sections, were identified in the CALFED ROD and from stakeholder input.

Problems

- San Joaquin River ecosystem
- San Joaquin River water quality
- Water supply reliability

Opportunities

- Flood control
- Hydropower generation
- Recreation
- Delta inflow

San Joaquin River Ecosystem

The reach of the San Joaquin River from Friant Dam to the Merced River confluence does not support a continuous natural riparian and aquatic ecosystem. After completion of Friant Dam, most of the water supply in the river has been diverted for agricultural and urban uses, with the exceptions of releases to satisfy riparian water rights upstream of Gravelly Ford and flood releases. Consequently, the reach from Gravelly Ford to Mendota Pool is often dry.

San Joaquin River Water Quality

Water quality in portions of the San Joaquin River has been a problem for several decades due to low flow, and discharges from agricultural areas, wildlife refuges, and municipal and industrial treatment plants. Requirements for water quality in the San Joaquin River have become more stringent and the number of locations along the river at which specific water quality objectives are identified has increased. One location of water quality concern is near Vernalis, where the San Joaquin River enters the Delta.

Water Supply Reliability

The CALFED program identified water supply reliability as a key problem, due to a mismatch between Bay-Delta supplies and beneficial uses that depend on the Bay-Delta system. Water supply reliability problems in the study area are evident as severe groundwater overdraft. Additional storage in the upper San Joaquin River basin could increase the reliability of deliveries to Central Valley Project (CVP) contractors or other water users who could receive water through CVP facilities, resulting in a reduction in groundwater overdraft. This improved supply reliability would provide opportunities for exchanges with urban water users that improve the quality of urban water deliveries.

Flood Control

Major storms during the past two decades have demonstrated that Friant Dam, among many other dams in the Central Valley, may not provide the level of flood protection intended at the time the flood management system was designed. Increased water storage capacity in the upper San Joaquin River basin would capture additional flood volume and reduce the frequency and magnitude of damaging flood releases from Friant Dam.

Hydropower

Although the economic feasibility of hydropower-only projects may be limited, developing new storage for water supply, water quality, ecosystem restoration, and flood damage reduction creates opportunities to add hydropower features.

Delta Inflows

Additional storage in the upper San Joaquin River basin could result in increased magnitude, duration, or frequency of inflows to the Delta from river releases intended to improve the San Joaquin River ecosystem or water quality.

INITIAL SCREENING OF SURFACE STORAGE OPTIONS

Figure ES-2 shows the locations of surface storage options in the eastern San Joaquin Valley that were first considered. Initial screening focused on potential construction-related issues that could preclude building required facilities, create environmental impacts that could not be mitigated, or create conditions under which permits issued by regulatory agencies or approved by decision-makers would be unlikely. Initial screening did not consider reservoir operations modeling or construction cost estimates.

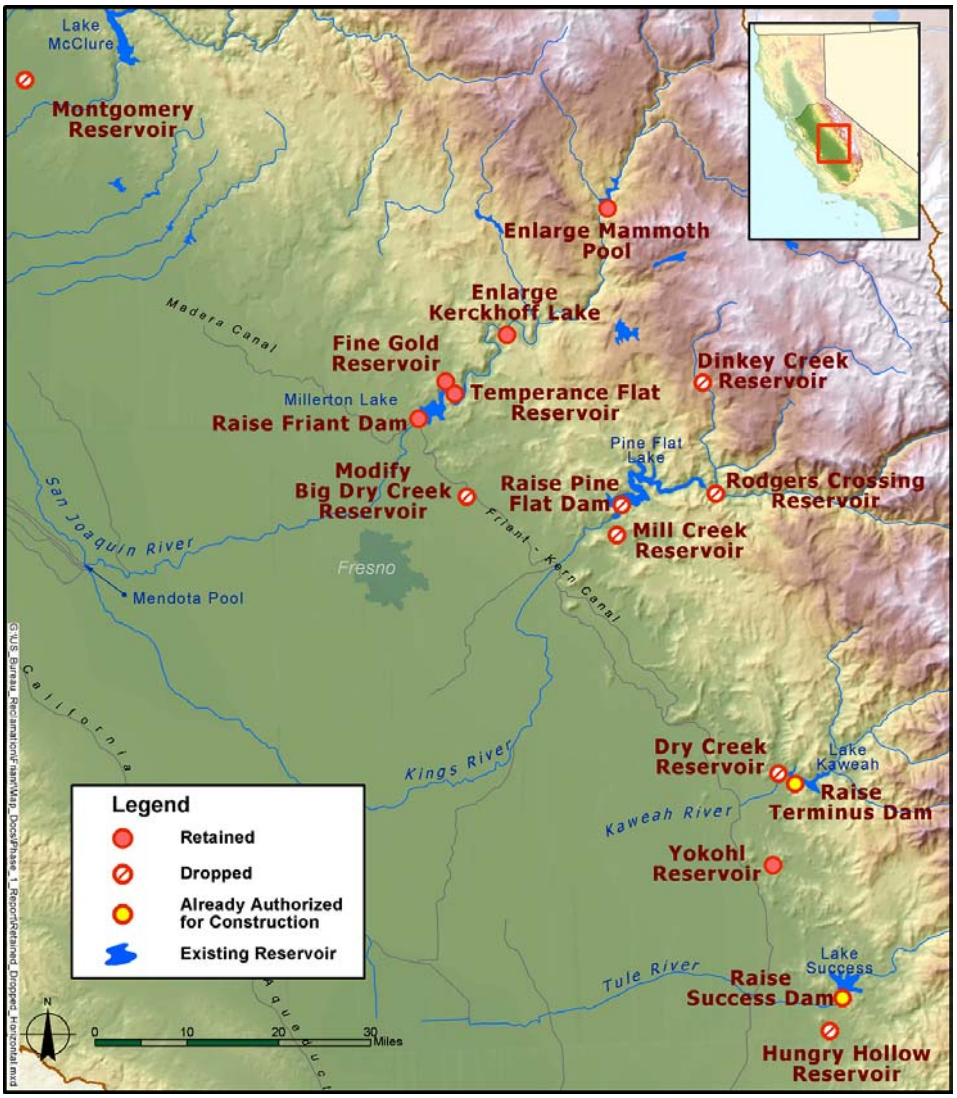


FIGURE ES-2. SURFACE STORAGE OPTIONS CONSIDERED

Table ES-1 lists surface storage options that were identified and results of initial screening. A Technical Memorandum (TM) was prepared for each surface storage option considered. As indicated in Table ES-1, six surface storage sites were retained for further analysis in Phase 2 of the feasibility study. Although cost was not a criterion for initial screening, cost information is provided in all of the TMs, which are included as appendices of the Phase 1 Report.

TABLE ES-1 INITIAL SCREENING OF SURFACE STORAGE OPTIONS

Watershed / Reservoir Site	Max Cap[1] (TAF)	Engineering Issues			Environmental Issues					Result of Initial Screening
		DS	SG	WQ	Bot	WL	AB	Rec	LU	
Merced River Watershed										
Montgomery Reservoir	241									Dropped
San Joaquin River Watershed										
Raise Friant Dam	870									Retained
Fine Gold Creek	800									Retained
Temperance Flat RM 274	2,100									Retained
Temperance Flat RM 279	2,750									Retained
Temperance Flat RM 286 (Enlarge Kerckhoff Lake)	1,400									Retained
Enlarge Mammoth Pool	35									Retained[2]
Big Dry Creek Watershed										
Big Dry Creek Dam	30									Dropped
Kings River Watershed										
Raise Pine Flat Dam	124									Dropped[3]
Mill Creek	200									Dropped
Rodgers Crossing	295									Dropped
Dinkey Creek	90									Dropped
Kaweah River Watershed										
Enlarge Lake Kaweah	n/a									Dropped[4]
Dry Creek	70									Dropped
Yokohl Valley	800									Retained
Tule River Watershed										
Enlarge Lake Success	n/a									Dropped[4]
Hungry Hollow	800									Dropped

Key to Engineering Issues	
DS	Safety of existing dam
SG	Soils and geology
WQ	Quality of developed water

Key to Environmental Issues	
AB	Aquatic biology & water quality
Bot	Botany
LU	Land use
Rec	Recreation
WL	Wildlife

Key to Assessments	
	Unfavorable engineering or operational condition
	Potential environmental effects not determined
	Low or no likely adverse environmental effects
	Potential adverse effects; mitigation to be determined
	Potential unmitigable adverse environmental effects

Notes

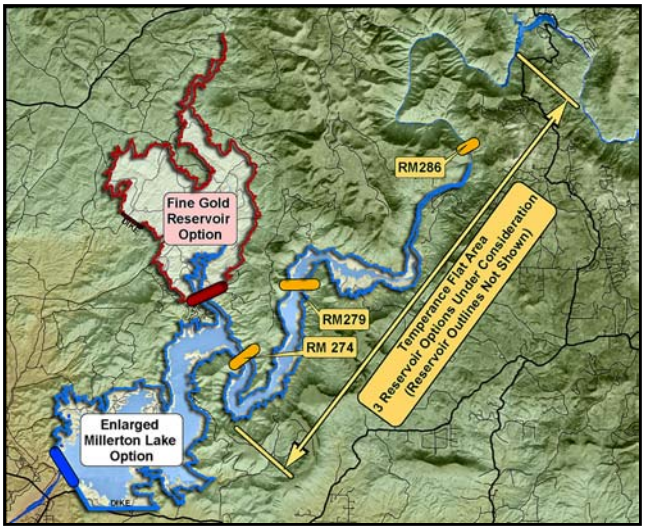
1. Maximum new storage capacity (thousand acre-feet).
2. Under review by others; will not be considered in Phase 2.
3. Potential partner not interested in pursuing project.
4. Authorized for construction by U.S. Army Corps of Engineers.

SUMMARY OF SURFACE STORAGE OPTIONS ANALYSES

Surface storage options that were retained were evaluated to identify potential accomplishments, costs, and impacts. Each option was evaluated using computer models to identify potential new water supplies and to estimate power generation and use, and cost estimates were prepared for major components.

Surface Storage Options Retained for Further Study

Options to be evaluated in greater detail as the feasibility study continues include the following:



Raise Friant Dam. Friant Dam is a 319-foot-high concrete gravity dam on the San Joaquin River about 20 miles northeast of Fresno. A dam raise of up to 140 feet would enlarge Millerton Lake by up to 870 thousand acre-feet (TAF).

Fine Gold Creek Reservoir. Fine Gold Creek Reservoir would be located on a small tributary of the San Joaquin River that enters Millerton Lake. Water would be pumped from Millerton Lake into Fine Gold Reservoir and released as needed. Reservoir sizes of up to 800 TAF are being considered.

Temperance Flat Reservoir. Temperance Flat is a wide, bowl-shaped area in the upper portion of Millerton Lake approximately 13 miles upstream of Friant Dam. Temperance Flat Reservoir would capture the flow of the San Joaquin River downstream of Kerckhoff Dam. Three potential dam sites are under consideration: at river mile (RM) 274, RM 279, and RM 286. Multiple sizes and dam types are under consideration at each site.

Yokohl Valley Reservoir. Yokohl Valley Reservoir, as shown in Figure ES-2, would be located approximately 15 miles east of Visalia. This reservoir would operate as a pump-back storage reservoir served by the Friant-Kern Canal. It would require construction of a 260-foot-high earthfill dam and two small saddle dams.

Water Supplies from Additional Storage

The CALSIM model was used to estimate the new water supply that each retained option could provide. New water supply is water that could be made available at Friant Dam, over and above the amount currently made available for delivery. CALSIM simulates the operation of major water projects throughout California and is widely used to identify how potential projects and actions would affect system-wide operations. During Phase 1, CALSIM was revised to reflect the decision-making process used to allocate water supplies at Friant Dam based on hydrologic conditions, and to estimate the availability of water for release to the San Joaquin River or diversion to the Friant-Kern and Madera canals.

Single-Purpose Operational Scenarios

For each surface storage option, single-purpose operational scenarios were evaluated for multiple reservoir sizes. Model simulations identified the quantity of water that would be available for each Investigation purpose (river restoration, river water quality, and water supply reliability) if the additional water supply created by new storage were operated solely to contribute to that purpose. To identify how new storage could contribute to each Investigation purpose without causing an unaccounted reallocation of existing supplies, restoration and water quality single-purpose analyses were constrained to estimate the annual amount of water that would be available without increasing or decreasing average annual deliveries to current water users.

Analysis of single-purpose operational scenarios demonstrated that even under operational scenarios focused on a particular purpose, benefits could be provided to help meet multiple purposes. For example, releases to the San Joaquin River for restoration would also improve water quality in the river, and depending on operations at Mendota Pool, could increase water supply reliability to south-of-Delta water users or increase Delta inflow. Table ES-2 shows the types of benefits that would result under operational scenarios considered. The range of water supplies developed by each storage option is provided in Table ES-3.

TABLE ES-2 POTENTIAL BENEFITS OF ADDITIONAL WATER SUPPLY AT FRIANT DAM

Potential Effect	Single–Purpose Operational Scenario[1]		
	San Joaquin River Restoration	San Joaquin River Water Quality	Water Supply Reliability
Total Friant Division water deliveries	0	0	+
Class 2 Friant Division water deliveries	+	+	+
Delivery of unstorable water (Section 215)	-	-	-
Reduction in regional groundwater overdraft	+	+	+
Water supply at Mendota Pool	+	+	-
Water quality at Mendota Pool	+	+	-
South-of-Delta supplies and/or Delta inflow	+	+	-
Year-round river releases from Friant Dam	+	+	0
Seasonal river releases from Friant Dam	+	+	0

Key:
+ positive effect
- negative effect
0 no change

Notes:
1. Phase 1 included single-purpose operational scenarios only. Phase 2 evaluations will include multiple-purpose operational scenarios.

Other Operational Considerations

Millerton Lake is operated as an annual reservoir. Each year, all available water supplies are allocated to contract deliveries based on planned evacuation of water from active storage space. Initial evaluations did not include water carried over from one year to the next. If carryover storage were included in the operation, the wide variation in water quantities between different year types would be reduced, the average new supply would be less, and more water would likely be available during critically dry years. Strategies to include carryover storage will be considered in greater detail as the feasibility study continues.

Although initial evaluations did not consider changes to flood storage rules, results show that additional storage would significantly reduce the magnitude and frequency of flood releases from Friant Dam to the San Joaquin River. As the feasibility study proceeds, potential changes to flood storage requirements and associated benefits will be evaluated.

TABLE ES-3 WATER SUPPLIES AND ESTIMATED CONSTRUCTION COSTS OF SURFACE STORAGE OPTIONS

Reservoir Site		Net Additional Storage (TAF)	Average Annual New Water Supply (TAF/year)	Estimated Construction Cost ($Million)
Raise Friant Dam		125 - 870	25 – 150	150 – 840[1]
Temperance Flat Area	River Mile 274	450 – 2,100	95 – 225	610 – 1,000
	River Mile 279	450 – 2,700	95 – 235	510 – 1,750
	River Mile 286	450 – 1,350	95 - 190	410 – 790
Fine Gold Creek		120 - 800	15 –115	200 – 540
Yokohl Valley		450 - 800	70 - 100	350[2]

1. Raise Friant Dam costs include land acquisition costs because of the relative significance of residential development at Millerton Lake. Cost estimates for other options do not include land acquisition.
2. Cost for a 450 TAF reservoir was updated from a study completed in 1975. Costs for an 800 TAF reservoir are under development.

Estimated Construction Costs

Construction costs were estimated for retained surface storage options. In most cases, previous estimates either did not exist or were considered too old to be confidently updated. Costs were based on prefeasibility-level designs and contain provisions for uncertainties. For most options, costs were estimated for different dam types and reservoir sizes.

Field costs for construction were estimated at 2003 price levels. Field costs represent the estimated costs for identified features, plus allowances for mobilization (5 percent), unlisted items (15 percent), and contingencies (25 percent). Field costs were increased by 25 percent to account for investigations, designs, administration, and construction management to obtain total estimated construction costs. Costs for road construction, relocations of existing facilities, environmental mitigation, land requirements, reservoir clearing, and finance interest during construction will be prepared during Phase 2. Table ES-3 summarizes the range of potential costs for surface storage options.

Environmental Issues

Environmental issues considered as part of Phase 1 reviews included potential impacts to terrestrial and aquatic vegetation and wildlife, recreational resources, and land uses. Initial screening did not include consultations with environmental, resource, or permitting agencies. The Phase 1 environmental review indicated that potential impacts are largely mitigable; however, further review is needed to identify specific impacts and mitigation measures. Table ES-4 summarizes Phase 1 environmental review results.

TABLE ES-4 ENVIRONMENTAL REVIEW OF SURFACE STORAGE OPTIONS

Surface Storage Option	Summary of Preliminary Environmental Review
Raise Friant Dam	• Listed aquatic and terrestrial species and species of special concern. Potential opportunities for mitigation. • Potential recreation impacts at Millerton Lake, Temperance Flat, and San Joaquin River Gorge Management Area. • Land use and cultural resources impacts on residences, former homesteads, and historic resources.
Temperance Flat Reservoir	• Listed aquatic and terrestrial species and species of special concern. Potential opportunities for mitigation. • Potential recreation impacts at Millerton Lake, Temperance Flat, San Joaquin River Gorge Management Area, and Kerckhoff Lake. • Land use and cultural resources impacts on residences, former homesteads, and historic resources.
Fine Gold Creek Reservoir	• Listed aquatic and terrestrial species and species of special concern. Potential for opportunities for mitigation. • Inundation of relatively pristine wetland and riparian habitat areas. • Potential affects of operations on aquatic species in Millerton Lake.
Yokohl Valley Reservoir	• Listed terrestrial species. Potential opportunities for mitigation. • Potential cultural resource impacts on prehistoric Native American sites and former homesteads. • Potential land use impacts.

Hydropower Issues

The San Joaquin River watershed upstream of Millerton Lake is highly developed for hydroelectric generation. In this area, Pacific Gas & Electric (PG&E) and Southern California Edison (SCE) own several hydropower generation facilities. Both the PG&E and SCE systems consist of a series of diversion reservoirs that provide water through tunnels to downstream powerhouses. Phase 1 included preliminary estimates of current generating capacity that would be affected by constructing surface storage options, potential pumping energy required for operation of off-stream surface storage options, and potential energy generation output from new powerhouses, as summarized in Table ES-5.

TABLE ES-5 POTENTIAL ENERGY GENERATION AND USE FOR RETAINED SURFACE STORAGE OPTIONS

Dam Site	Average Annual Energy Generation Potentially Affected (GWh)	Potential Average. Annual Energy Generation (GWh)	Potential Average Annual Pumping Energy (GWh)
Raise Friant Dam	530 – 580	Not analyzed[1]	n/a [2]
Temperance Flat RM 274	580 - 1,125	160 –270	n/a
Temperance Flat RM 279	1,125	330 –450	n/a
Temperance Flat RM 286	545 – 1,125	630 –740	n/a
Fine Gold Creek Reservoir	n/a	70 - 100	130 – 170
Yokohl Valley Reservoir	n/a	80 – 110	180 – 220

1. Change in power generation at Friant power plants not analyzed in Phase 1.
2. Pumping energy not applicable for this option.

Preliminary hydropower evaluations indicate that the Raise Friant Dam option and all of the Temperance Flat options would affect the operations of existing hydropower project facilities. Raising Friant Dam would affect energy generation at the PG&E Kerckhoff Project. Although an analysis of Friant power generation was not completed during Phase 1, it does not appear likely that additional generation at Friant powerhouses resulting from any raise of Friant Dam could replace the lost energy generation from the Kerckhoff Project.

Depending on the location and height of the dam, a Temperance Flat reservoir would have the potential to affect up to five powerhouses and two diversion dams upstream of Millerton Lake. Potential impacts to installed generating capacity increase as storage capacity increases at each site. Existing generation facilities would not be affected by developing Fine Gold Creek or Yokohl Valley reservoirs. However, these facilities would require power to pump water into storage. Energy generation from released water would be less than pumping requirements.

CONJUNCTIVE MANAGEMENT OPTIONS

The Investigation is also evaluating opportunities for the conjunctive management of surface water and groundwater resources. Conjunctive management actions can increase available water supplies through additional active or in-lieu recharge or development of groundwater banking projects.

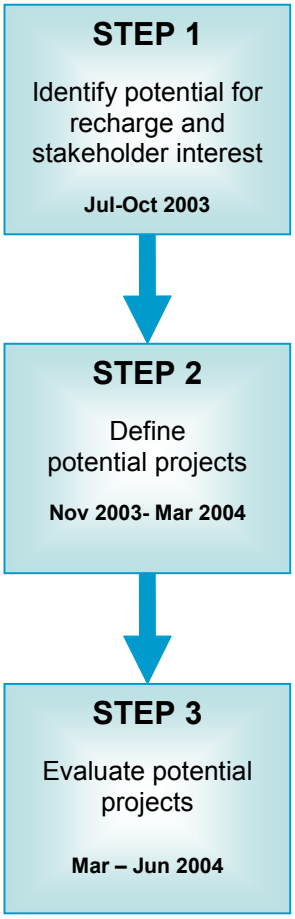
A structured approach has been established to identify and evaluate conjunctive management opportunities that have the potential to support Investigation purposes. The Investigation is proceeding with a three-step evaluation, consistent with the CALFED policy of supporting voluntary, locally controlled groundwater projects.

Step 1. The study team began by identifying potential for recharge and the level of stakeholder interest; this step is largely complete. A theoretical analysis of potential recharge, given the physical constraints, indicated that the potential exists to recharge groundwater using otherwise uncaptured water from the San Joaquin River.

Stakeholders were interviewed to determine their interest in participating in regional conjunctive management and to more thoroughly define potential opportunities they have already identified. Many stakeholders demonstrated a high level of interest in regional, cooperative opportunities for groundwater storage and banking, however no specific projects were identified that could be incorporated into the Investigation. Stakeholders also stated that physical and legal constraints could affect implementation.

Step 2. During Phase 2, DWR will lead working sessions with stakeholders to better define potential constraints; project review criteria; potential projects and policy actions; and specific project components and operations. Participants will include water managers (i.e., organizations with the capacity to carry out conjunctive management projects) and other interested parties.

Step 3. Conjunctive management projects and actions identified through this process will be evaluated using hydrologic, physical, institutional, and legal criteria to assess accomplishments and implementation requirements. Projects and actions that satisfy the criteria and would support Investigation purposes (contribute to river restoration, improve river water quality, and increase water supply reliability) will be incorporated into the Phase 2 evaluations.



Conjunctive Management Evaluation Approach

PUBLIC PARTICIPATION

Phase 1 was supported by a structured public information and stakeholder participation process that was integrated with the progress of technical analysis. The study team initially engaged stakeholders concerned with local and regional water resource planning issues. As the Investigation proceeded, interested parties continued to participate in the process. Stakeholders brought a high level of experience and local knowledge and provided a variety of recommendations, responses, and reviews that aided planning. Figure ES-3 illustrates the Phase 1workshop process.

FIGURE ES-3. PHASE 1 STAKEHOLDER WORKSHOP PROCESS

In addition to public workshops, a variety of communication tools are in place to provide timely information and comment opportunities to the public through completion of the feasibility study and environmental review. The Phase 1 public involvement program featured both interactive and outreach components that included the following:

- Coordination with governmental agencies and non-governmental organizations
- Briefings for tribal representatives
- Briefings for elected officials
- Coordination with local water resources planning and management groups
- Interviews with water management agency representatives
- Tours of Millerton Lake and the upper San Joaquin River
- Informative brochures, fact sheets, and documents that provided Investigation background and progress updates
- Distribution of Investigation documents via a Web site

STAKEHOLDER VIEWS

Local support is strong for continued study of additional surface water storage in the upper San Joaquin River basin that would support Investigation purposes and provide other regional benefits. Local, state and Federal elected officials, representatives from the local business community, and county and municipal government leaders have expressed interest in the potential benefits of increased storage. During summer 2003, the San Joaquin River Resources Management Coalition, a group primarily composed of landowners along the San Joaquin River, hosted several boat tours on Millerton Lake. The tours informed participants about water supply and river restoration benefits that could be provided by additional storage.

Also participating in the public process are representatives of the environmental community, who have stated their support for river restoration and have expressed a preference for operational changes, other nonstructural actions, and conjunctive management to develop new water supplies.

The public process has engaged a large, diverse group of interested parties during Phase 1. As the feasibility study progresses, other interests, such as agencies managing land use and flood control, and hydropower operators, will become more engaged in the process. Reclamation and DWR are committed to completing the feasibility and environmental documentation process in a manner that is open to all concerned parties and fully discloses beneficial and adverse impacts of increasing storage in the upper San Joaquin River basin.

INFORMATIONAL MATERIALS AND DOCUMENT ACCESS

During Phase 1, the study team prepared and distributed a variety of informational materials, including brochures and fact sheets. A mailing list of interested parties was compiled and used to distribute postcard notifications of workshops and document releases. The project Web site, hosted by Reclamation at www.usbr.gov/mp/sccao/storage, has been a key feature in outreach efforts.

PLAN FOR PHASE 2 OF THE FEASIBILITY STUDY

Phase 2 of the feasibility study will include the necessary technical analyses to evaluate alternatives, prepare a feasibility report and supporting EIS/EIR, and identify a recommended action for consideration by decision-makers.

During Phase 2, retained surface storage options will be studied further, conjunctive management options will be identified and considered, and alternatives will be formulated and evaluated. Alternatives will be formulated as combinations of storage options and operational objectives. Following review of the costs and benefits of initial alternatives, a set of final alternatives will be defined that will be evaluated in detail in the feasibility report and associated environmental review documents.

Figure ES-4 shows the major milestones and planned schedule for completing the Upper San Joaquin River Basin Storage Investigation Feasibility Report and EIS/EIR. This plan and schedule would complete the feasibility study and environmental review to meet the 2006 schedule included in the CALFED Bay-Delta Program ROD.

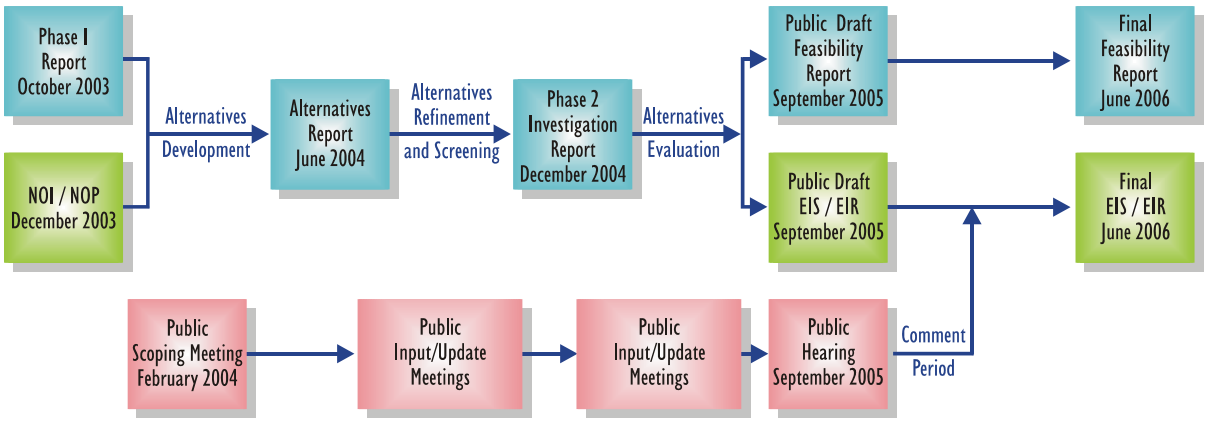


FIGURE ES-4. PHASE 2 MILESTONES

THIS PAGE LEFT BLANK INTENTIONALLY