

# Upper San Joaquin River Basin Storage Investigation



## Rodgers Crossing Reservoir

Surface Storage Option Technical Appendix to the Phase 1 Investigation Report

**A Joint Study by:**



**Bureau of Reclamation  
Mid-Pacific Region**



**California Department  
of Water Resources**

**In Coordination with:**



**The California Bay-Delta Authority**

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**Prepared by:**



**MWH**

October 2003



# **SURFACE WATER STORAGE OPTION TECHNICAL MEMORANDUM**

## **RODGERS CROSSING RESERVOIR**

### **UPPER SAN JOAQUIN RIVER BASIN STORAGE INVESTIGATION**

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## Acronyms and Abbreviations List

CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFRF	concrete-faced rockfill
cfs	cubic feet per second
Corps	United States Army Corps of Engineers
elevation	number of feet above mean sea level
HEP	Habitat Evaluation Procedure
IECO	International Engineering Company, Inc.
Investigation	Upper San Joaquin River Basin Storage Investigation
KRCD	Kings River Conservation District
MW	megawatt
NEPA	National Environmental Policy Act
PG&E	Pacific Gas and Electric
RCC	roller-compacted concrete
Reclamation	Bureau of Reclamation
ROD	Record of Decision
TAF	thousand acre-feet
TM	Technical Memorandum
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

## EXECUTIVE SUMMARY

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The Upper San Joaquin River Basin Storage Investigation (Investigation) considered several potential storage options in the eastern San Joaquin Valley. This document describes a potential dam at Rodgers Crossing on the main stem of the Kings River at river mile 116, approximately one-half mile upstream of its confluence with the North Fork. Two dam options had been studied previously by others: a roller-compacted concrete embankment dam up to 660 feet above streambed level that would create a reservoir of up to 950 thousand acre-feet (TAF), and a 400-foot-high concrete arch dam that would create a reservoir of up to 295 TAF. The larger dam would inundate about 12 miles of upstream river, and the smaller option would inundate about 8 miles of river. Stored water would be released to the Kings River to offset releases from Millerton Lake.

Foundation conditions at the potential dam site appear suitable, and raw material for a concrete dam is available. Several potential quarry sites were identified from which concrete aggregate could be obtained. Electric power distribution facilities are present in the area, and construction staging would be possible at upstream and downstream locations.

Environmental impacts associated with this storage option would be significant. The Kings River is one of the least disturbed large rivers in California and its wild trout population is considered one of the finest in the State. The California Department of Fish and Game (CDFG) designated the stretch upstream of Pine Flat Lake to the confluence of the Middle and South Forks as a Wild Trout Fishery. The river is also a Federally designated Wild and Scenic River starting about 9.2 miles above the potential dam site. The inundation area of the larger reservoir option considered would extend into the Wild and Scenic portion of the river. Both reservoir options would inundate portions of the Kings River Special Management Area. Inundation of either the Wild and Scenic reach or the Special Management Area would require Congressional approval.

Construction of a reservoir at Rodgers Crossing would be expected to cause unmitigable impacts to recreational resources in the area. Four United States Forest Service campgrounds are located along the river and commercial and private whitewater rafting is conducted on the main stem of the Kings River above Pine Flat Reservoir. Extensive riparian habitat would also be lost by creation of a Rodgers Crossing reservoir, which would pose a mitigation challenge because of the amount of habitat that would need to be restored or enhanced to compensate for the loss. An important spawning area for several native fish species designated as State Species of Special Concern by CDFG in Mill Flat Creek, about 2 miles upstream of the potential dam site, would be adversely affected.

This option was dropped from further consideration in the Investigation for several reasons. The extent of recreational impacts that would result from constructing Rodgers Crossing Reservoir may be unmitigable and the ability to mitigate fishery impacts appears low. Also, an act of Congress would be required to permit inundation of the Kings River Special Management Area.

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# CHAPTER 1. INTRODUCTION

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The Bureau of Reclamation, in cooperation with the California Department of Water Resources, is completing the Upper San Joaquin River Basin Storage Investigation (Investigation) consistent with the CALFED Bay-Delta Program Record of Decision (ROD), August 2000. The Investigation will consider opportunities to develop water supplies to contribute to water quality improvements in and restoration of the San Joaquin River, and to enhance conjunctive management and exchanges to provide high-quality water to urban areas. The ROD indicated that the Investigation should consider enlarging Friant Dam or developing an equivalent storage program to meet Investigation objectives.

The Investigation identified several potential surface storage sites to be initially considered through prefeasibility-level studies of engineering and environmental issues. This Technical Memorandum (TM), which was prepared as a technical appendix to The Phase I Investigation Report, presents findings from a prefeasibility-level review of the potential Rodgers Crossing Dam and Reservoir.

## OPTION SUMMARY

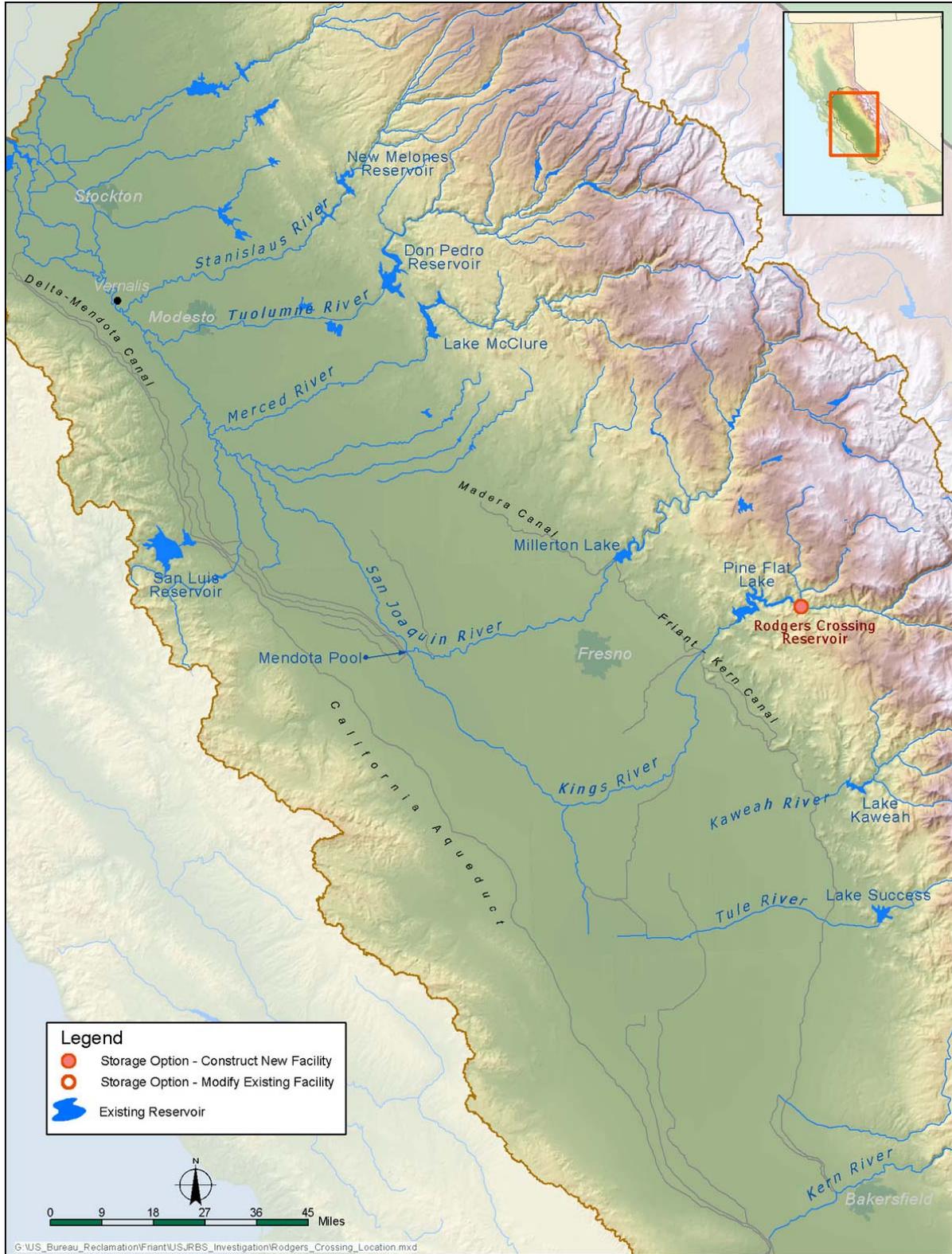
The potential Rodgers Crossing Dam site is located in Fresno County, near Balch Camp, about 40 miles east-northeast of Fresno (Figure 1-1). The dam site is located upstream of Pine Flat Reservoir on the main stem of the Kings River, approximately 1 mile upstream of its confluence with the North Fork of the Kings River (Figure 1-2).

As proposed in 1974, constructing a 400-foot-high dam at Rodgers Crossing would create up to 295 thousand acre-feet (TAF) of storage capacity. This option would be able to produce new hydroelectric energy from two 105 megawatt (MW) generating units.

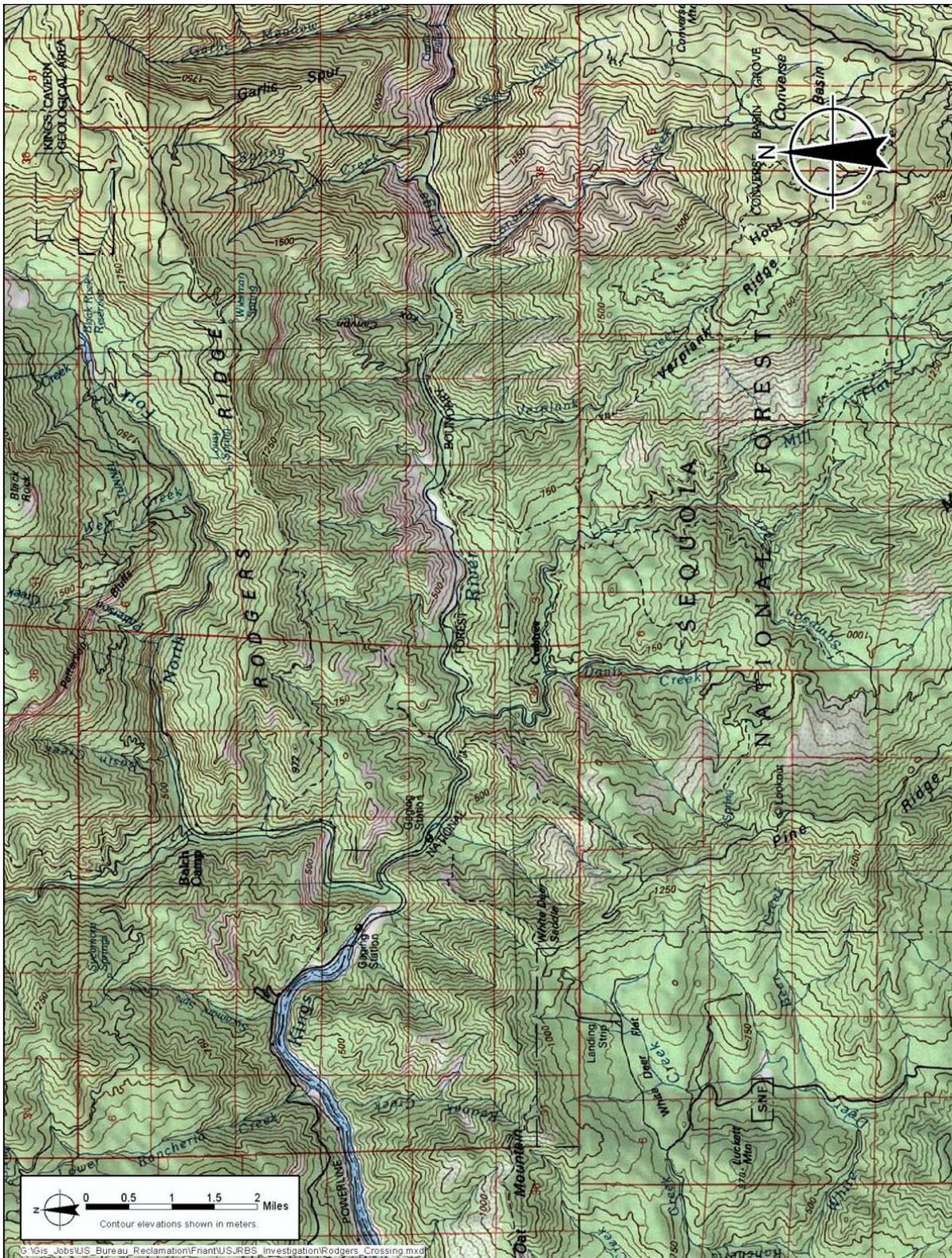
Water stored in Rodgers Crossing Reservoir would be released to the Kings River. Releases would be exchanged for water diverted from Millerton Lake or would offset Millerton releases to the San Joaquin River.

## EXISTING FACILITIES

No water storage facility presently exists at the site. Pacific Gas and Electric (PG&E) operates three hydroelectric power projects in the Kings River basin: the Kings River Project, the Balch Project, and the Helms Pumped Storage Project, which uses Wishon Reservoir as the afterbay and Courtwright Reservoir as the forebay.



**FIGURE 1-1. RODGERS CROSSING SITE LOCATION MAP**



**FIGURE 1-2. RODGERS CROSSING VICINITY**

## **SUMMARY OF PREVIOUS INVESTIGATIONS**

In 1965, a Committee of Engineers issued a Progress Report on the Kings River Water Utilization Projects upstream from Pine Flat Reservoir for the Kings River Water Association. This report evaluated three alternative storage sites, including Junction Dam on the main stem of the Kings River just downstream of its confluence with the North Fork, Rodgers Crossing Dam on the main stem just upstream of the North Fork confluence, and Mill Creek Dam on Mill Creek, which joins the Kings River from the south just downstream of Pine Flat Dam.

Of the three sites evaluated, only the 295 TAF Rodgers Crossing site was considered economically feasible. However, based on power sales alone, this option was not considered economically feasible; it was concluded that this option would have to be supported by irrigation interests and/or be constructed in conjunction with other power projects.

In 1974, a Master Plan of the Kings River Service Area was prepared for the Kings River Conservation District (KRCD) by International Engineering Company, Inc. (IECO). The Master Plan recommended a course of action that would 1) provide a balanced water supply; 2) minimize flood damage; and 3) conserve and develop water and power resources. One alternative evaluated was a 400-foot-high thick concrete arch dam at Rodgers Crossing. The report concluded that the KRCD service area was deficient in water, and that unless additional water supplies were obtained, groundwater would be overdrafted such that a large segment of the agricultural service area would ultimately have to revert to dry farming.

To address the issue, IECO concluded that a staged development of the recommended alternatives be pursued. The Rodgers Crossing Dam alternative was not considered economically feasible at the time of the investigation, but was retained as an alternative because future economic conditions might render it feasible.

A study conducted for the Friant Water Users Authority and Natural Resources Defense Council Coalition considered a roller-compacted concrete (RCC) embankment dam up to 660 feet high at Rodgers Crossing. A structure of this size would create a reservoir with a storage capacity of over 950 TAF (URS, 2000). The maximum gross pool water surface elevation for such a reservoir would be approximately 1,650 feet above mean sea level (elevation 1,650). The study contained no designs for this larger dam option, and limited technical information.

## **POTENTIAL IMPROVEMENTS CONSIDERED**

Due to the limitations of the available information regarding the larger 660-foot embankment dam concept and the more severe environmental impacts such an option would create, this TM focuses on the 400-foot concrete arch dam proposed in the 1974 KRCD Master Plan. The engineering analysis in Chapter 5 pertains only to the 400-foot-high arch dam proposal. However, some discussion of the environmental aspects of the larger dam concept is included in Chapter 7.

As proposed in the 1974 KRCD Master Plan, the Rodgers Crossing Dam would be a 400-foot-high, thick concrete arch dam. The dam crest would be at elevation 1,400, resulting in a dam height of approximately 400 feet above the riverbed. At this elevation, the crest length would be about 1,660 feet and the maximum reservoir level would be at about elevation 1,390 (Figure 1-3). The reservoir would be able to store up to 295 TAF of water.

A power plant was planned for beneath the flip bucket spillway. The powerhouse would contain two 105 MW generating units. A 4-mile steel tower transmission line would connect with a switchyard at the existing PG&E line at Balch Camp. Switching facilities would be provided at both ends.

## **APPROACH AND METHODOLOGY**

This TM was prepared from a brief review of the prior studies listed above, an engineering field reconnaissance on 13 June 2002 (Appendix A), and an environmental field reconnaissance of the dam and reservoir on 29 May 2002 (Appendix B).

During the June 2002 field trip, engineers and geologists examined the site under consideration. Locations of existing and potential structures were visually assessed. Topography, geology, geotechnical conditions, and utilities were noted. Access routes and possible borrow, staging, and lay-down areas were considered.

During the May 2002 environmental field visit, specialists in botany, wildlife, aquatic biology, recreational resources, and cultural resources visually assessed existing environmental resources. Additional research was conducted, making use of prior studies and available literature, the California Natural Diversity Database, topographic maps, and aerial photographs. This information was used to preliminarily identify the extent to which potential environmental impacts might constrain storage options under consideration. Where evident, opportunities for improving environmental resources or mitigating adverse effects were also noted. Surveys were not conducted and consultations with external resource management or environmental agencies were not held.

The seismotectonic evaluation conducted by Reclamation (2002) for this study was based on readily available information and is considered appropriate for prefeasibility-level designs only. Detailed, site-specific seismotectonic investigations have not been conducted and aerial/remotely sensed imagery was not evaluated.

For prefeasibility-level planning studies, designs and analyses are typically quite general. Extensive efforts to optimize the design have not been done, and only limited value engineering techniques have been used at this level of study.



## **CHAPTER 2. TOPOGRAPHIC SETTING**

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In the area of the potential dam, the terrain consists of a steep canyon incised into rugged mountains. The canyons of the watershed have been cut by southwest- to west-flowing rivers and associated large tributaries. The Kings River is the main river in the area. The topography of the Kings River basin is the most rugged in the entire Sierra Nevada, rising to over elevation 14,000 in the upper watershed.

Elevations in the immediate area range from about elevation 1,000 to nearly elevation 4,000. The dam site is located in a section of river that passes through a narrow, northwest-trending V-shaped bedrock canyon. The right abutment slope rises steeply (2:1 horizontal to vertical) to a ridge of nearly elevation 2,700. The left abutment slope rises at a steeper 1.5:1 inclination to a ridge of elevation 2,480.

### **AVAILABLE TOPOGRAPHIC MAPPING**

Topographic maps of the study area are publicly available from the United States Geological Survey (USGS). It is presumed that topographic maps of the reservoir and dam site are available from the United States Army Corps of Engineers (Corps) at an unknown scale and contour interval.

### **AVAILABLE AERIAL PHOTOGRAPHY**

Aerial photography of various scales and imagery is available from the archive files of the USGS. Additional aerial imagery may also be available from the United States Department of Agriculture, Reclamation, and the Corps. A specific search of the available photography was not conducted for this TM nor was any existing aerial photography reviewed.

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## **CHAPTER 3. GEOLOGIC AND SEISMIC SETTING**

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The Kings River basin is located within a complex geologic area containing metamorphosed sedimentary and volcanic rocks that have been folded, faulted, and intruded by granitic rocks of three different ages. Volcanism, followed by glaciation and recent stream down-cutting, have modified the topography to essentially the present day landscape. Major geologic structures trend to the northwest. Bedding and foliation of the rock units typically strike northerly and dip steeply west. Degree of weathering and jointing is variable, depending on rock type.

Overall, seismic hazard potential at the site is low. Preliminary earthquake loading analysis, for this prefeasibility-level study considered two types of potential earthquake sources: fault sources and areal/background sources (Reclamation, 2002).

Twenty-two potential fault sources for the site were identified. They include those associated with the San Andreas fault, seven western Great Valley faults, seven eastern Sierra Nevada faults, the White Wolf fault of the southern San Joaquin Valley, and six faults of the Sierra Nevada Foothills system. No major through-going or shear zones have been identified in this area of the Sierra Nevada and historic seismicity rates are low.

The areal/background seismic source considered was the South Sierran Source Block, the region surrounding the site. This region possesses relatively uniform seismotectonic characteristics.

Probabilistic seismic hazard analysis performed indicates that peak horizontal accelerations to be expected at the site are 0.13g with a 2,500-year return period, 0.17g with a 5,000-year return period, and 0.23g with a 10,000-year return period.

### **SITE GEOLOGY**

The potential dam site is located in a relatively steep, narrow, V-shaped canyon of the Kings River (Figures 1-2 and 1-3). The general area is characterized by Mesozoic granitics and pre-Cretaceous meta-sedimentary rocks.

In the area of the right abutment, meta-sedimentary rocks outcrop in several places and are exposed in the road cut and in small rills and rivulets trending downslope. The narrow river channel contains alluvial sand, gravel, cobbles, and boulders overlying meta-sedimentary bedrock. This bedrock is exposed near the edge of the water on both sides of the river. Therefore, the alluvium is not believed to be deep. The left abutment is also underlain by meta-sedimentary rocks, consisting mainly of interbedded quartzite and quartz mica schist with scattered quartz seams, aplite dikes, and locally altered intrusive quartz dikes. As with the right abutment, these rocks outcrop and are exposed in rivulets and at the road cut (IECO, 1974).

The area of the potential reservoir is characterized by pre-Cretaceous meta-sedimentary and some meta-volcanic rocks intruded by Mesozoic granitic rocks, as shown on the Fresno Sheet of the Geologic Map of California (CDMG, 1966). Some limestone beds trending slightly west of north have also been mapped within the reservoir area a few miles upstream of the potential dam site. Bedrock is exposed over much of the area; however, deposits of slope wash, talus, alluvial fan, and alluvium to various depths occur locally. Seepage through zones of fractured bedrock or limestone should present no major problem, nor would problems be anticipated from landslides or rockfalls after the reservoir is filled.

No significant faults or fault zones are known to exist within the reservoir basin or dam site.

### **SITE GEOTECHNICAL CONDITIONS**

In the proposed right abutment, the foliation/bedding strikes northerly, nearly parallel to the river, and dips into the abutment at a 50 to 65 degree angle to horizontal. Where exposed in rivulets, the rock is typically unweathered, very hard, and either massive or slightly fractured. In the road cut, the rock ranges from unweathered to moderately weathered and is fractured and moderately hard. The bedrock is overlain by a thin mantle of slope wash and talus, which may be much deeper in local areas where slumping has occurred (IECO, 1974).

In the proposed left abutment, light gray quartzite beds are typically very hard, brittle, slightly fractured, and slightly weathered at the surface. While the quartz mica schist beds have a wide range of physical properties, the quartzite is generally weathered brown, moderately hard to locally friable and closely fractured. Foliation/bedding dips out of the left abutment toward the river at a 50 to 65 degree angle from horizontal. This orientation, combined with the major joint pattern occurring at nearly right angles, creates a blocky to cubic breaking pattern for most of the rock. Other fractures occur at various orientations. Overlying the bedrock are scattered, shallow deposits of slope wash and talus. Locally, these deposits are deeper, particularly in areas of highly weathered schist. Fill material from road construction generally masks the bedrock to river level (IECO, 1974).

There is no apparent change in the attitude of foliation/schistosity across the river to indicate faulting in the channel (IECO, 1974).

## **CHAPTER 4. HYDROLOGIC SETTING**

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The Kings River watershed upstream of the potential Rodgers Crossing Dam covers approximately 952 square miles, ranging over elevations from about elevation 1,000 at the potential dam site, to elevation 14,000. The Kings River has three primary branches: the North, Middle, and South forks. The Rodgers Crossing site is located on the main stem, just upstream of its confluence with the North Fork. The main stem becomes the Middle and South forks further upstream.

### **RAINFALL**

Rainfall in this Mediterranean climate region varies from about 8 or 9 inches per year in the valley to about 60 inches per year in the Sierra Nevada. About 90 percent of runoff-producing precipitation occurs from November through April.

Precipitation usually occurs as rain below elevation 4,000 and as snow at higher elevations. Snow has occurred in the San Joaquin Valley, however, and rain sometimes occurs above elevation 10,000. The snow pack accumulates during the winter and early spring and generally starts melting in April.

### **EROSION, RUNOFF, AND RECHARGE**

Specific soils/erosion potential information for the site was not identified. It is expected that the soils in the Kings River basin could be broadly classified into two types. One type is shallow, well-drained, slightly acidic, rocky, medium-textured, and developed on slates, schists, volcanic debris, and serpentine bedrock. Soils of this type are reasonably stable with adequate vegetation.

The other soil type would be moderately deep, moderately coarse-textured, well-drained, slightly acidic, and granitic. Soils of this type are subject to severe erosion. Farther southwest along the Kings River, the flood plain area would consist of moderately deep, nearly level to gently rolling, well-drained loams underlain with hardpan.

Streamflow data have been collected at gaging stations in the Kings River basin by the USGS, Corps, and local agencies for a varying number of years. Data from the stream gage near the Rodgers Crossing site are available from October 1926 to December 1928 and October 1931 to September 1971. To create a complete record extending back to October 1922, missing data were derived by correlating the Rodgers Crossing gage records with those from the gaging station on the Kings River near Hume, located upstream of Rodgers Crossing and downstream of the Middle and South forks. The average annual flow at the Rodgers Crossing gaging station (1923 through 1972) is 1,328 cubic feet per second (cfs). The gage at Piedra, below Pine Flat Dam, has been in operation since 1895, providing the longest continuous set of flow data available.

## AVAILABLE FLOOD DATA

Winter rain floods, which occur during the period from November through March, are caused by heavy rains and are characterized by sharp, high peaks of short duration and comparatively small volumes. Snowmelt floods occur from March through June. While not producing the high peak flows of winter-type floods, they have a much larger runoff volume.

The history of flooding in the Kings River basin extends to 1895. Flood years were 1966, 1969, and 1978. The snowmelt in 1966 was 290 percent of normal. The snowmelt in 1969 exceeded all previous recorded years. Flood control releases to the San Joaquin River in 1969 totaled 1,017 TAF. Pine Flat Dam was operated to control outflow to a maximum of 17,100 cfs (Corps, 1989a).

Over the past 48 years, Pine Flat Dam has not provided the high degree of flood protection that was originally intended. This is due to unanticipated precipitation and runoff in the Kings River Basin, which included the largest 30-day inflow of record (1986) and the largest snowmelt of record (April-July 1969).

Based on recent trends toward greater precipitation and runoff in the Kings River Basin, investigations show that flood-producing storms greater than those of the past are expected to occur in the future. Three of the most severe rainfloods during the 85-year period from 1895 to 1980 have occurred since Pine Flat Dam was completed, and water-year runoff has exceeded the 85-year mean 11 times. Due to development in the floodplain, more recent floods have caused substantial damage to roads and bridges, homes, businesses, public utilities, recreational facilities, and highly developed agricultural land.

## CHAPTER 5. STORAGE STRUCTURES AND APPURTENANT FEATURES

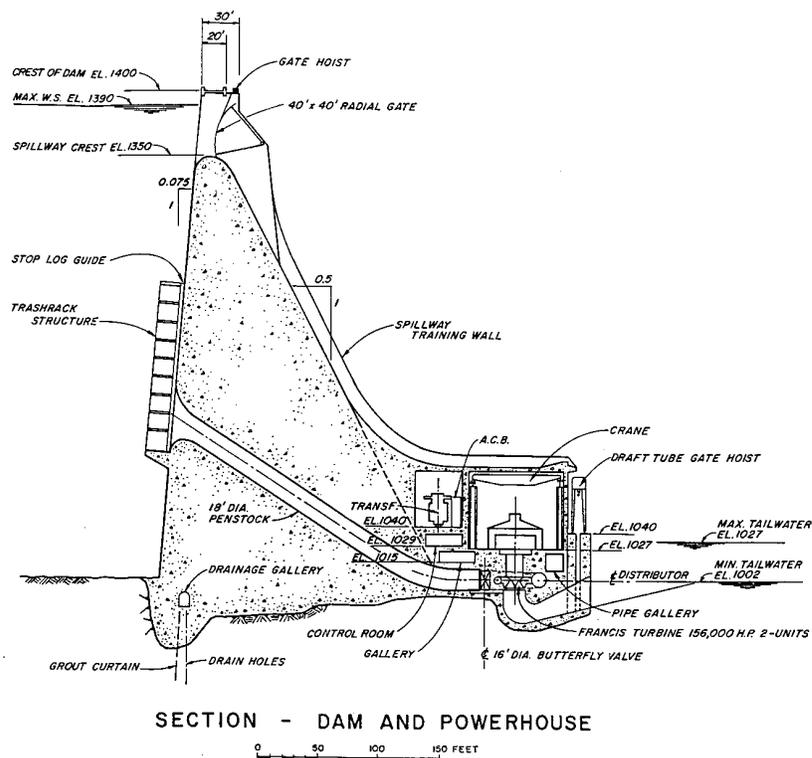
This chapter describes the recommended storage structure and appurtenant features for the Rogers Crossing site, and the constructibility, cost, and systems operations for this option.

### STORAGE STRUCTURE

In the IECO (1974) study, a thick concrete arch dam was adopted as the most suitable for the site, since impervious fill material is not available locally. Future studies, however, could consider an RCC gravity dam or a concrete-faced rockfill (CFRF) dam.

The 1974 IECO study established the dam crest at elevation 1,400, resulting in a dam height of approximately 400 feet above the riverbed. At this elevation, the crest length would be about 1,660 feet and the maximum reservoir level would be at about elevation 1,390.

Figure 5-1 is a cross section of the concrete arch dam from the 1974 IECO study.

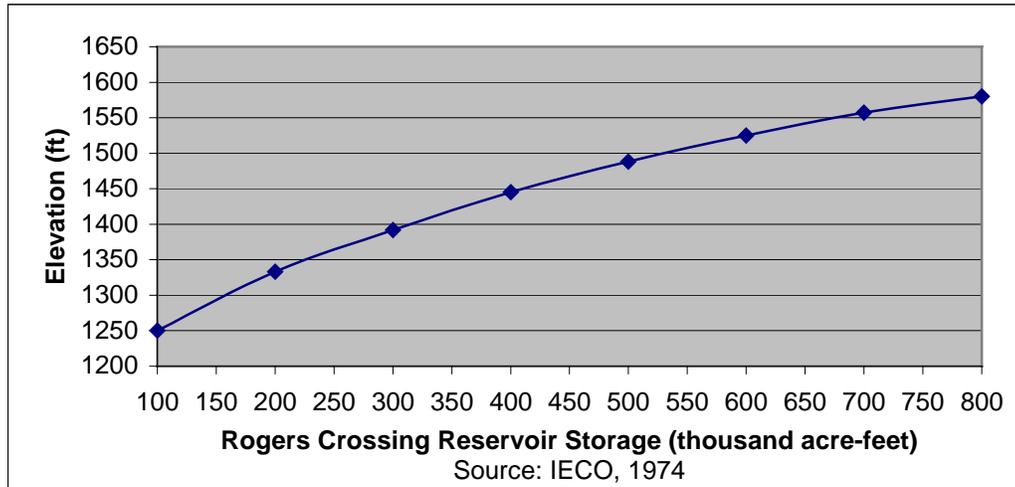


Source: IECO, 1974

**FIGURE 5-1. CROSS SECTION OF POTENTIAL CONCRETE ARCH DAM**

## RESERVOIR ELEVATION/CAPACITY CURVE

A reservoir storage volume versus elevation curve from the 1974 IECO report is shown in Figure 5-2.



**FIGURE 5-2. RESERVOIR ELEVATION VS. CAPACITY CURVE**

## APPURTENANT FEATURES

This section describes major appurtenant features that would be associated with the dam.

### Conveyance

Water would be conveyed downstream in the existing river channel. No new conveyance facilities are included in this option.

### Pumping Plants

No pumping plants are needed for this option.

## CONSTRUCTIBILITY

This section discusses issues of concern related to constructing the dam, reservoir, and appurtenant facilities.

## **Land, Rights-of-Way, Access, and Easements**

Permanent access is provided from Piedra, located below Pine Flat Dam and about 30 miles from the Rodgers Crossing site, by a two-lane paved road along the right side of Pine Flat Reservoir. Approximately one-half mile downstream of the potential dam site, but immediately upstream of the confluence with the North Fork, Bailey Bridge crosses the main stem of the Kings River. Unpaved United States Forest Service (USFS) access roads parallel the river on either bank past the potential dam site.

## **Borrow Sources/Materials**

Construction materials, with the exception of impervious earthfill material, can generally be obtained within a reasonable distance of the dam site. No substantial deposits of impervious material are within an economic haul distance.

Numerous outcrops of hard, resistant bedrock occur in the vicinity of the dam site. All are potential quarry sites from which riprap, rockfill, and concrete aggregate could be obtained.

## **Foundations**

The foundation for the Rodgers Crossing Dam is expected to be hard metamorphic and granitic rock suitable for CFRF, concrete arch, gravity, or RCC dams.

## **Power Sources**

Power could be accessed from either the Balch Camp or Kings River PG&E generating units.

## **Staging and Lay-Down Area**

Contractor staging and lay-down areas are available where the canyon widens just upstream and downstream of the dam site.

## **Contractor Availability and Resources**

There are several regional general contractors capable of performing the work necessary to construct the dam.

## **Construction Schedule and Seasonal Constraints**

With the diversion tunnel, construction could continue year-round. At elevation 1,400, there would be no seasonal constraints.

## **Flood Routing During Construction**

The river would be diverted during construction by an upstream cofferdam with a crest at elevation 1,040, a downstream cofferdam with a crest at elevation 1,035, and an 1,860-foot-long, 35-foot-wide, unlined horseshoe-shaped tunnel that would extend through the left abutment.

## Environmental Impacts During Construction

Environmental impacts during construction could be mitigated with proper planning and implementation of best management practices. The work site is remote from any urban development; therefore, few humans would be affected by the noise and visual impacts would be minimal. Air quality issues could be mitigated by dust control measures for quarrying, material processing, and construction on the dam. Any blasting that might be required on the abutments would require both noise and vibration monitoring of the dam. A cultural survey would have to be conducted to identify any ancestral American Indian or historic artifacts and construction activities would be restricted in those areas.

Importing building materials from distant sources could cause traffic impacts, but with proper planning and coordination with Caltrans and USFS, the major impacts could be mitigated. All construction equipment should have spark arresters and fire control equipment should be kept readily accessible during construction. Construction water would have to be controlled as well as provisions made for runoff and erosion control. A spew control plan would be needed to control any construction-related fuels, lubricants, and other materials.

## Permits

Both Federal and non-Federal entities would sponsor construction of the dam and reservoir. This joint sponsorship could complicate the permitting process as Federal projects are not subjected to the same level of permitting required for non-Federal projects.

Given the probable duality of sponsorship, and potential environmental and cultural impacts identified, at a minimum, certain permits could be required from the permitting agencies listed in Table 5-1.

**TABLE 5-1. POSSIBLE PERMITS REQUIRED**

Permit	Permitting Agency
Permit to Construct	DSOD, Fresno County
Encroachment	Caltrans, Fresno County
Air Quality	CARB, Fresno County
Low/No Threat NPDES	RWQCB
Waste Discharge	RWQCB
401 Certification	SWRCB
Blasting	Fresno County
Streambed Alteration	CDFG
Fire/Burn	CDF, Fresno County
Key: CARB California Air Resources Board CDF California Department of Forestry CDFG California Department of Fish and Game DSOD Department of Safety of Dams NPDES National Pollutant Discharge Elimination System RWQCB Regional Water Quality Control Board SWRCB State Water Resource Control Board	

In addition, the following agencies could be involved in reviewing permit conditions:

- Bureau of Indian Affairs
- Bureau of Land Management
- State Historic Preservation Office
- Advisory Council on Historic Preservation
- United States Fish and Wildlife Service (USFWS)

In obtaining these various permits, several plans would have to be prepared and submitted to the responsible agencies for review and approval:

- Construction Plan and Summary Documents
- Quality Control Inspection Plan
- Highway Notification Plan
- Blasting Plan
- Noise Monitoring Plan
- Water Quality Monitoring Plan
- Noxious Weed Control Plan
- Bat Protection Plan
- Management Plan for Avoidance and Protection of Historic and Cultural Properties
- Storm Water Pollution Prevention Plan
- Spill Prevention/Containment Plan
- Visual Quality Control Plan
- Dust Control and Air Quality Plan

Another important regulatory requirement involves compensation/mitigation for habitat loss. In October 1998, the USFWS issued its draft Coordination Act Report and Habitat Evaluation Procedure (HEP Analysis). The HEP Analysis delineates how compensation for adversely affected baseline habitat and wildlife conditions is to be determined.

In addition, if power generation is included in a project or is modified for an existing project, the Federal Energy Regulatory Commission may become involved in the permitting process.

## **COSTS**

Based on the 1974 IECO cost estimate, the cost estimate for the potential Rodgers Crossing Dam and Reservoir was prepared and updated to April 2002 unit costs using Reclamation Construction Cost Trends. Costs were also evaluated and modified as needed to reflect current material costs and standards of practice, especially with respect to seismic requirements.

### Initial Construction Costs

The estimated first cost of the potential Rodgers Crossing Dam and Reservoir is \$526 million. Summaries of estimated costs are presented below in Table 5-2 and also in Appendix C. Field costs represent the estimated cost to construct identified features, plus provisions for unlisted items (15 percent), contingencies (25 percent), and mitigation (5 percent). Land costs are excluded from this prefeasibility-level estimate. Additional study of land requirements would be needed to determine their costs. Total costs include field costs plus estimated costs for future analyses and planning documentation, development of designs, and construction management (15 percent).

**TABLE 5-2.  
SUMMARY OF FIRST COSTS**

<b>Component</b>	<b>Estimated Cost (\$Million)</b>
Dam and Spillway	251
Outlet Works	12
Coffer Dams / Diversion of River	3
Power Plant	26
Transmission	11
Unlisted Items	45
Contingency	87
Mitigation	22
<b>Total Field Cost</b>	<b>457</b>
Investigation/Design/CM	69
<b>Total First Cost</b>	<b>526</b>

### Operations and Maintenance Costs

Operations and maintenance costs were not evaluated in any previous studies of the potential Rodgers Crossing Dam and Reservoir and have not been estimated for this report.

### SYSTEMS OPERATIONS

Water stored in Rodgers Crossing Reservoir would be released to the Kings River. Releases would be exchanged for water diverted from Millerton Lake or would offset Millerton releases to the San Joaquin River.

## **CHAPTER 6. HYDROELECTRIC POWER OPTIONS**

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Various hydroelectric power options were considered for each surface storage site, including Rogers Crossing.

### **PUMPED STORAGE CONSIDERATIONS**

The potential Rogers Crossing Dam and Reservoir would not result in a pumped storage option.

### **ADDED HYDROELECTRIC POWER TO EXISTING STRUCTURES**

There are no existing structures at the Rogers Crossing site.

### **NEW HYDROELECTRIC POWER**

A powerhouse containing two 105 MW generating units would be located at the downstream toe of the dam, under the flip bucket spillway. This arrangement is indicated because of the narrowness of the canyon. The turbines would be of the Francis type, rated at 156,000 horsepower with a net effective head of 144 to 288 feet. Main transformers would be located inside the powerhouse. An erection deck would be provided at the right abutment end of the powerhouse. The switchyard would be located near the right end of the powerhouse.

The power intakes and trash racks would be located on the upstream face of the dam. The 18-foot-diameter penstocks would extend through the dam from the intake to the powerhouse. A 16-foot diameter butterfly valve would be located just upstream from each turbine scroll case to permit emergency shutdown of the unit.

### **TRANSMISSION AND DISTRIBUTION**

A single circuit, 138 kilovolt, steel tower transmission line about 4 miles long would connect the Rogers Crossing switchyard with an existing PG&E line at Balch Camp. Switching facilities would be provided at both ends of the line.

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## CHAPTER 7. ENVIRONMENTAL CONSIDERATIONS

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This chapter describes existing environmental resources at the site and qualitatively describes potential effects of reservoir development. The discussion in this chapter is intended to indicate the extent to which expected or potential environmental effects from the storage options under consideration might pose a constraint to their development. Where evident, opportunities for improving environmental resources or mitigating adverse effects have been noted. Analysis focused on botany, terrestrial wildlife, aquatic biology, water quality, recreational resources, cultural resources, and existing land uses. Mining and other known past activities that might affect site conditions are also briefly discussed, along with the potential presence of hazardous or toxic materials. Temporary construction-related disruptions and impacts are discussed in Chapter 5.

Identification of constraints was conducted at a preliminary, prefeasibility-level of planning, consistent with the current phase of the Investigation. Criteria considered were based, in part, on criteria commonly used to evaluate environmental impacts of projects under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The application of criteria that may be used for NEPA or CEQA evaluation does not imply that the analysis is at a level necessary to support an Environmental Impact Statement or Environmental Impact Report. Considerations included presence of special status species (e.g. species listed as endangered or threatened), species of concern, or sensitive habitats; relative amounts of affected riparian or wetland habitat; effects on native or game fish; conflict with established recreational uses or land uses; presence of nationally registered historic places, sacred Native American sites, or Traditional Cultural Properties; permanent disruption or division of established communities; and loss of energy production facilities.

At the time that the preliminary environmental analysis was initiated in May 2002, both the larger dam concept (up to 660-foot dam with maximum pool at elevation 1,650) and the smaller dam option (400-foot dam with maximum pool at elevation 1,390) that had been identified in previous studies were under consideration. Consequently, the discussion in this chapter encompasses the potential effects of both options. Where the need to distinguish between the larger and smaller reservoirs is clear, the distinction has been made. In most places, however, the discussion is qualitative and no distinction between the dam sizes is needed. Usually, the greater the extent of potential inundation, the greater the corresponding environmental effect. In other cases, the creation of a reservoir at elevation 1,390 or greater would surpass a threshold effect that would apply to a reservoir of either size.

### **BOTANY**

Oak woodland, chaparral, and perhaps some mixed Sierran forest habitats are found in the area of the site. Substantial riparian habitat is present along Kings River, and lesser amounts are likely in some tributaries. Seeps and springs may also be present.

Four special status plant species have been recorded in the area: Muir's raillardella, American mannagrass, Madera linanthus, and Kings River buckwheat. None are listed as threatened or endangered, but three have California Native Plant Society List 1B status. Suitable habitat for tree anemones is probably present, but the site is well south and east of known locations of this species.

### **Constraints**

Special-status species are not likely to be an issue for Rodgers Crossing Reservoir. There would be a substantial loss of riparian habitat, and possibly wetlands as well. Riparian loss would be the greatest constraint for this site.

### **Opportunities**

Mitigation obligations could be large for riparian habitat and would probably have to be conducted off site.

## **WILDLIFE**

The main stem of the Kings River above Pine Flat is a regionally important unencumbered river. It has well-developed riparian habitat along its banks, but this is limited by seasonal runoff scouring. Adjacent upland slopes are vegetated with foothill pine – blue oak woodlands. The area supports a diverse wildlife community and several sensitive species, although only the valley elderberry longhorn beetle is listed as threatened or endangered. Foothill yellow-legged frogs, western pond turtles, and golden eagles and prairie falcons are known to be in the general area and may be found along this river and/or its tributaries.

### **Constraints**

A dam on this river would cause a substantial loss of wildlife habitat and convert an important river to an impounded body of water. Potential effects downriver could also create a constraint if existing habitats and wildlife communities were further affected.

## **AQUATIC BIOLOGY/WATER QUALITY**

The Kings River in the potential Rodgers Crossing Dam area is a large mountain river with excellent fish habitat. The California Department of Fish and Game (CDFG) has classified this section of river as a Wild Trout stream and the Sierra Nevada Ecosystem Project has proposed to classify it as an Aquatic Diversity Management Area (SNEP, 1996). Above Rodgers Crossing, portions of the Kings River have been designated as a National Wild and Scenic River. The Kings River is one of the least disturbed large rivers in California and its wild trout population is considered one of the best in the state.

The upper reach of the channel above the potential inundation area runs through a fairly straight, deep canyon. The channel widens in the potential inundation area and becomes more meandering. Long pools connected by shorter, turbulent riffles are the predominant habitat types. Mill Flat Creek, a large tributary, joins Kings River about 2 miles upstream of the potential dam site. This creek is an important spawning stream for several native fishes in the Kings River (SNEP, 1996).

Native fish fauna of Kings River include rainbow trout, Sacramento sucker, California roach, hardhead, Sacramento pike minnow, riffle sculpin and Kern brook lamprey. The hardhead, Kern brook lamprey, and California roach in San Joaquin Valley are designated as State Species of Special Concern by CDFG.

### **Constraints**

At maximum pool, the reservoir created by a 660-foot dam would inundate about 12 miles of the Kings River and the lowest reaches of several tributaries, including about 3 miles of Mill Flat Creek. The reservoir created by a 400-foot dam would inundate nearly 8 miles of the Kings River and about 1¾ mile of Mill Flat Creek.

The principal constraint of this measure is the elimination of a designated Wild Trout Stream and habitat for several California Species of Special Concern. Also, Mill Flat Creek is an important spawning area for native fishes.

The large, deep new reservoir would alter the flow and water temperature regimes of Kings River downstream of the new dam. However, this section of the river is fairly short because Pine Flat Reservoir is a short distance below the potential dam site. Depending on its water level, Pine Flat Lake may be within a mile or several miles downstream. Effects of changes in volume and water temperature of inflow to Pine Flat Lake are difficult to evaluate and would require further analysis.

The new dam and reservoir would create important barriers to fish migrations in the Kings River. Fish moving from Pine Flat Reservoir and the North Fork Kings River would be blocked by Rodgers Crossing Dam, while fish moving downstream from the upper river would likely be inhibited from moving downstream by changed habitat conditions.

Construction of the new dam and service roads would potentially result in increases in sedimentation and turbidity in Kings River and upper Pine Flat Lake. Sedimentation adversely affects trout, particularly by smothering their spawning beds. These impacts could be mitigated through use of best management practices.

### **Opportunities**

The principal opportunity afforded by this measure is substantial new fish habitat created by the reservoir. This reservoir would provide excellent conditions for both cold-water and warm-water fisheries. Most fisheries would probably be successfully self-sustaining, but production could be increased by regular stocking.

If existing vegetation in the potential Rodgers Crossing Reservoir inundation area were not removed prior to building the dam, after inundation it would provide a short-term increase in nutrient levels in the reservoir and enhance habitat structure. Both effects would likely benefit fish production.

Fish habitat in the new reservoir could be greatly improved if the dam were operated to minimize water level fluctuations, at least during times of year important for fish spawning and rearing.

## RECREATION

A reservoir with a surface at elevation 1,390 would inundate about 8 miles of the Kings River, terminating about ½ mile upstream of Fox Canyon Creek. A larger reservoir would probably not be allowed because about 2 miles upstream of Fox Canyon Creek, at Cabin Creek, the Kings River is designated as a National Wild and Scenic River.

The main Kings River in the potential Rodgers Crossing Reservoir reach is relatively undeveloped and traverses public lands of the Sequoia and Sierra National Forests and is managed by the USFS. A paved county road, Trimmer Springs Road, provides access to the area just below Rodgers Crossing. From there, an unpaved road parallels the north side of the river to Garnet Dike Campground.

The portion of Kings River that would be inundated if a Rodgers Crossing Dam were constructed is heavily used by anglers and boaters and provides a variety of other recreation activities, including picnicking, camping, swimming, wading, hiking, and nature viewing. The USFS has developed four campgrounds and two parking areas to accommodate visitors participating in these activities, as follows:

- Camp 4½ Campground
- Camp 4 Campground
- Mill Flat Campground
- Garnet Dike Campground
- Rodgers Ridge Trail Parking and Trailhead
- Kings River National Recreation Trail Parking and Trailhead

Dispersed camping and day use activities also occur along the entire reach. Several hiking trails provide access to the river and surrounding terrain: Rodgers Ridge trail, which traverses slopes north of Kings River to a scenic vista on Rodgers Ridge, and the Kings River National Recreation Trail, which parallels the north bank of the Kings River west and east of Fox Canyon.

The river is boated privately and commercially. The most popular run, referred to as Garnet Dike Run or Banzai Run, extends from Garnet Dike Campground to Kirch Flat Campground. The run is 10 miles long and ranges in difficulty from Class III to Class IV, depending on flow. Commercial outfitters have established a number of base camps to accommodate their boating operations.

### **Constraints**

A reservoir with a maximum surface at elevation 1,390 would inundate about 8 miles of the Kings River, inundating most or all developed campgrounds, group areas, day use areas, parking areas, trailheads, access roads, and trails in the area. In addition, it would submerge a popular fishing area and a classic boating run. In this case, a new reservoir is not considered a benefit because Pine Flat Lake already provides ample flat-water recreation opportunities. Loss of 8 miles of river and the opportunities it provides would be considered a substantial impact. Furthermore, no mitigation measures are available to reduce impacts to a level that is less substantial.

From about 2 miles upstream of Fox Canyon Creek, the Kings River is designated as a Wild and Scenic River under the National Wild and Scenic River Act. A reservoir with a surface at elevation 1,650, which would be created by a 660-foot dam, would begin to inundate the Wild and Scenic portion of the Kings River. This would conflict with USFS management objectives, which is a major constraint. It is unlikely that this larger reservoir option could be implemented.

### **CULTURAL RESOURCES**

The Rodgers Crossing area is within the traditional territory of the Wobonuch people, Numic-speaking relatives of the Northfork Mono along San Joaquin River. The Wobonuch lived in small settlements along the larger watercourses. Wobonuch people now live in Dunlap, a community on the upper end of the Mill Creek drainage, along with Entimbich people (Spier 1978).

Specific information is presently unavailable regarding archaeology of the Rodgers Crossing area. The location in the foothill pine/blue oak woodland along the Kings River suggests a high probability of prehistoric archaeological sites, including bedrock milling stations, hunting and fishing camps, and seasonal village sites.

Specific information is presently unavailable regarding history of the Rodgers Crossing area. A variety of sites is likely to be present associated with mining, logging, recreation, and other activities.

## **Constraints**

Numerous cultural resources are known to be present. Inundation of archaeological sites (prehistoric or historic) can result in loss of important scientific data. An unknown number of archaeological sites would be adversely affected by constructing the Rodgers Crossing Dam. More than one potential dam size has been proposed. The 660-foot dam would do maximum damage; smaller dam configurations would presumably inundate fewer sites. No properties eligible for the National Register of Historic Places are known to be present, but future study is likely to identify such properties. No Native American sacred sites or Traditional Cultural Places are known to occur, but Wobonuch Mono concerns would be expected.

## **Opportunities**

Inundation damage to archaeological sites can be mitigated with scientific data recovery programs. Reservoir projects also provide an opportunity for public interpretation of the past. Ancillary facilities, such as roads, power lines, or other structures, may provide opportunity for avoiding impact to archaeological sites through design or facility placement.

## **LAND USE**

This option is located in the Sequoia National Forest. No private residences or other non-recreation related uses occur in the dam vicinity, other than USFS residences. However, public lands may be subject to inundation.

## **Constraints**

The Kings River's Wild and Scenic River designation is discussed under recreation.

Both reservoir options would inundate portions of the Kings River Special Management Area. Inundation of either the Wild and Scenic reach or the Special Management Area would require an act of Congress.

## **MINING AND OTHER PAST ACTIVITIES**

There is no evidence of mining activities in the area of the potential dam and reservoir. The remains of an apparent old homestead and corral were observed in the Camp 4½ area.

## **Constraints**

No constraints have been identified.

## **HAZARDOUS AND TOXIC MATERIALS**

No evidence was noted of potential hazardous or toxic materials.

## **Constraints**

No constraints have been identified.

## CHAPTER 8. FINDINGS AND CONCLUSIONS

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This TM describes a potential dam at Rodgers Crossing on the main stem of the Kings River at river mile 116, approximately one-half mile upstream of its confluence with the North Fork. Two dam options had been studied previously by others: an RCC embankment dam up to 660 feet above streambed level that would create a reservoir of up to 950 TAF, and a 400-foot-high concrete arch dam that would create a reservoir of up to 295 TAF. The larger dam would inundate about 12 miles of upstream river, and the smaller option would inundate about 8 miles of river. Stored water would be released to the Kings River to offset releases from Millerton Lake.

Foundation conditions at the potential dam site appear suitable and raw material for a concrete dam is available. Several potential quarry sites were identified from which concrete aggregate could be obtained. Electric power distribution facilities are present in the area, and construction staging would be possible at upstream and downstream locations.

Environmental impacts associated with this storage option would be significant. The Kings River is one of the least disturbed large rivers in California and its wild trout population is considered one of the finest in the state. CDFG designated the stretch upstream of Pine Flat Lake to the confluence of the Middle and South Forks as a Wild Trout Fishery. The river is also a Federally designated Wild and Scenic River starting about 9.2 miles above the potential dam site. The inundation area of the larger reservoir option considered would extend into the Wild and Scenic portion of the river. Both reservoir options would inundate portions of the Kings River Special Management Area. Inundation of either the Wild and Scenic reach or the Special Management Area would require Congressional approval.

Construction of a reservoir at Rodgers Crossing would be expected to cause unmitigable impacts to recreational resources in the area. Four USFS campgrounds are located along the river and commercial and private whitewater rafting is conducted on the main stem of the Kings River above Pine Flat Reservoir. Extensive riparian habitat also would be lost by creation of a Rodgers Crossing reservoir, which would pose a mitigation challenge because of the amount of habitat that would need to be restored or enhanced to compensate for the loss. An important spawning area for several native fish species designated as State Species of Special Concern by CDFG in Mill Flat Creek, about 2 miles upstream of the potential dam site, would be adversely affected.

This option was dropped from further consideration in the Investigation for several reasons. The extent of recreational impacts that would result from constructing Rodgers Crossing Reservoir may be unmitigable and the ability to mitigate fishery impacts appears low. Also, an act of Congress would be required to inundate the Kings River Special Management Area.

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## CHAPTER 9. LIST OF PREPARERS

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### ACKNOWLEDGEMENTS

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## **APPENDIX A**

**Engineering Trip Report**

**Rodgers Crossing Reservoir**



Field Trip Log			
<b>Trip Log Number:</b>	14	<b>Project No.:</b>	1003032.01180502
<b>Dates:</b>	6/13/02	<b>Times:</b>	1315-1345
<b>Site Name:</b>	New Rodgers Crossing	<b>Location:</b>	Balch Camp
<b>Prepared By:</b>	DKR/JMH/WAM	<b>Reviewed By:</b>	
<b>Date:</b>	6/13/02	<b>Date:</b>	

Attendees/Visitors Name	Organization/Phone/Email
DKR	MWH, 925.685.6275 x125, david.k.rogers@mwhglobal.com
JMH	MWH, 925.685.6275 x143, james.m.herbert@mwhglobal.com
WAM	MWH, 425.602.4025 x1060, william.a.moler@mwhglobal.com

<b>Weather Conditions:</b>	Clear, warm (mid 80s), light breeze
----------------------------	-------------------------------------

<b>Access Route (attach map):</b>	Highway 99, Ventura Av / State highway 180 (E) through Fresno to Centerville, to Trimmer
-----------------------------------	--

Springs Rd (N/E), to Rodgers Crossing Rd (E)

<b>Attachments:</b>	Yes	No
<b>Photo Log</b>	✓	
<b>Photos</b>	✓	
<b>Video Log (available)</b>	✓	
<b>Dictation Log (available)</b>	✓	
<b>Topographic Map</b>	✓	

**Purpose:**

Review potential location of new dam site.

**Field Observations:**

**Existing Structures/Cultural Features:**

A U.S. Forest Service residence, campgrounds, and an old homestead (cattle corral and shacks) were observed in the area just upstream of the potential new dam.

**Right of Way/Access Restrictions:**

Public and Forest Service roads lead to the new Rodgers Crossing Dam and Reservoir area.

**Overhead/Buried Utilities:**

None noted.

**Description of Potential Structures (attached a field sketch or sketch on a topo map):**

Per URS, the potential dam at Rodgers Crossing would be located on the Kings River, ~1/2-mile upstream of its confluence with the North fork of the Kings River. The dam would a roller compacted concrete embankment having a height of up to 660 feet above streambed level, that would store up to 950,000 ac-ft of water, and spillway and outlet works. Water would come from natural run-off from the ~952 sq mi Kings River watershed above the North Fork (URS, 2000).

An earlier IECO alternative at the same location consisted of a 400-ft high, 1,660-ft long, thick concrete arch dam with a central gated crest spillway. A construction diversion tunnel would pass through the ridge of the right abutment. Normal full reservoir capacity was estimated at 295,000 ac-ft (IECO, 1974).

**Description of Appurtenant Features (spillways, tunnels, pumping plants, flood routing/coffer dams/dewatering during construction, outlet works, switch yards, transformer yards, transmission lines, conveyance pipelines/canals, access roads, security, operation/maintenance):**

The potential IECO dam would consist of a thick concrete arch structure with a central spillway, a twin 105-MW generating unit power plant, transmission lines and access roads.

**Briefly Describe Geologic/Geotechnical Site Conditions:**

New Rodgers Crossing Dam and Reservoir would be located in the Sierra Nevada foothills well above the Great Valley. The state geologic map shows that Mesozoic granitics (tonalite and diorite) and pre-Cretaceous meta-sedimentary rocks underlie the dam site and reservoir area. Limestone units within the meta-sedimentary rocks occur both upstream and downstream of the dam site (CDMG, 1965).

The IECO report (1974) describes the damsite as being in a narrow, v-shaped valley with meta-sedimentary rocks of quartzite and quartz mica-schist. "Bedding" strikes roughly parallel with the river canyon and dips toward the right abutment at ~ 50 to 60 degrees. The river channel contains bars of sand, gravel, and boulders that were considered to be "not excessively deep" (IECO, 1974).

As with most sites in the region, studies indicate that there are no faults in the area capable of producing ground motions greater than those generated by four known regional sources that include the San Andreas fault system, the Sierra Frontal fault system, the White Wolf fault, and the Garlock fault (USCOE, 1990).

**Location/Description of Nearest Borrow Areas (attach map or show on topo map):**

Impervious materials are not situated within a reasonable haul distance. Pervious and semi-pervious materials can reportedly be found in proximity to the site, as can bedrock outcrops of hard, resistant rock for riprap, rockfill, and concrete aggregate (IECO, 1974).

**Location/Description of Equipment/Material Staging and Lay Down Areas (attach map or show on topo map):**

Potential staging and laydown areas may be found in areas along the river downstream of the proposed dam site.

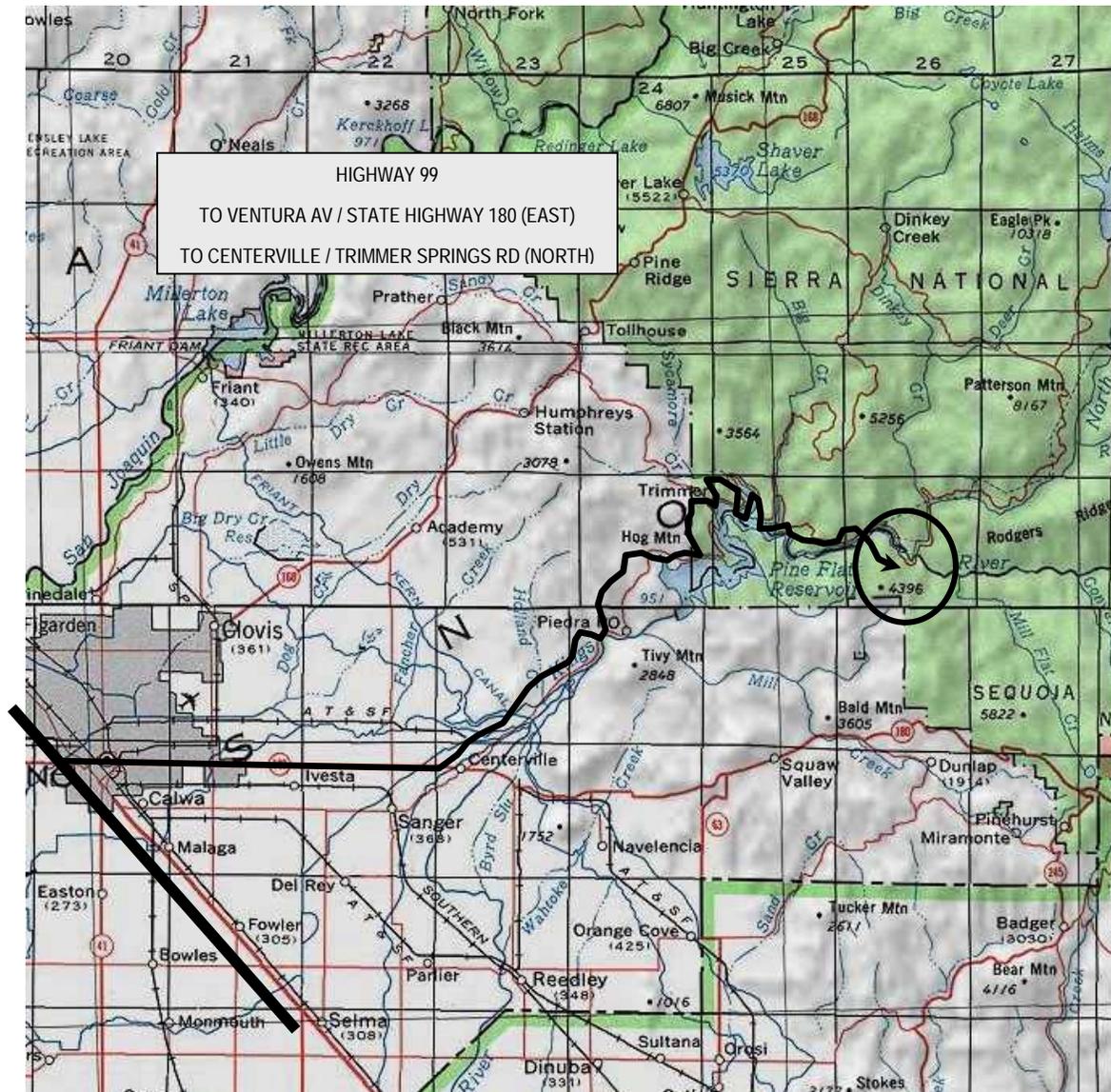
**Identification of Environmental Sensitive Areas (wetlands, springs, rivers, streams, endangered/threatened species habitats, etc.):**

A riparian habitat is found along Kings River. Oak woodland habitats are found on the valley walls.

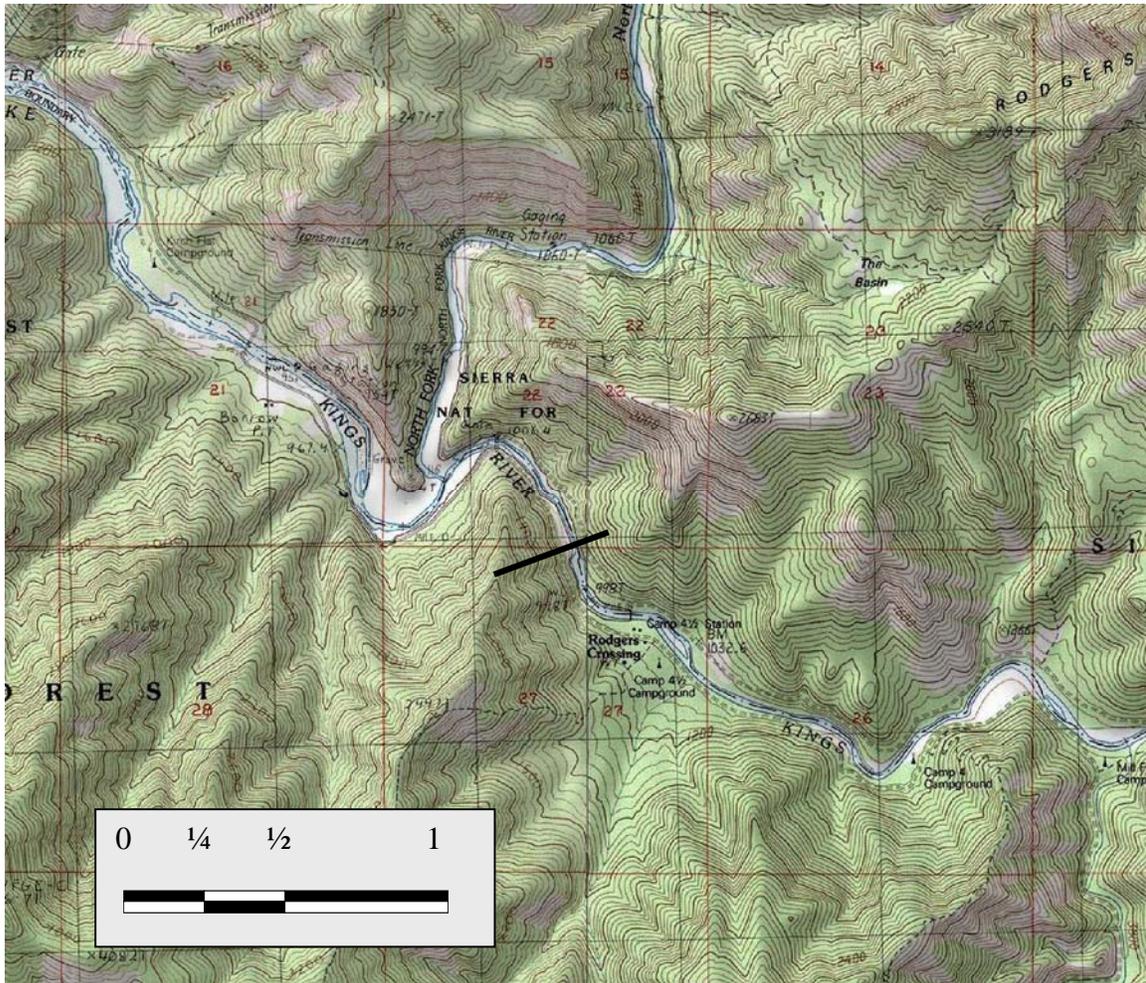
The Kings River in this area has been designated as Wild and Scenic, and is actively used by a number of river rafting enterprises. As such, this option would be extremely difficult to permit (URS, 2000).

**Description of Mining or Other Anthropologic Activities:**

None were noted.



VICINITY MAP



**LOCATION OF POTENTIAL DAM**



Rodgers Crossing –  
Cross-valley view of  
right abutment of  
potential dam

Cross-valley view of  
right abutment of  
potential dam



Upstream view of  
right abutment of  
potential dam

## **APPENDIX B**

### **Environmental Trip Report**

# **Rodgers Crossing Reservoir**



## **ENVIRONMENTAL TRIP REPORT - RODGERS CROSSING RESERVOIR**

A team of environmental specialists completed an initial field trip to the potential Rodgers Crossing Dam and Reservoir site on May 29, 2002. The field trip was the first task in the environmental study of several potential surface storage options identified for initial review during the Upper San Joaquin River Basin Storage Investigation. For initial consideration, the environmental review focused mainly on construction and potential upstream impacts associated with surface storage sites. The site visit provided an opportunity to conduct preliminary reconnaissance of existing resources at the various locations for the following resource areas: terrestrial biology; aquatic biology and water quality; recreation; cultural resources; and land use. Remote sites were viewed by airplane. Observations for these sites are concomitant with this viewing limitation.

This appendix includes a brief overview of the resource specialists' observations, trip logs prepared by team members, photographs taken during the field trip, and maps used to identify and review existing resources.

### **SUMMARY OF FIELD OBSERVATIONS**

This option would involve constructing a new dam on the main Kings River at Rodgers Crossing which is located just upstream of Pine Flat Reservoir. The area that would be inundated is relatively undeveloped and is comprised mainly of public lands managed by the Sierra and Sequoia National Forests. Existing facilities in the area include developed campgrounds, Forest Service buildings, trails and trail heads, paved and unpaved roads.

#### **Botany**

There is a wide river channel with varying amounts of riparian habitat. Steep canyon slopes are vegetated with blue oaks, ceanothus, manzanita, and chaparral. This measure would result in significant losses of wetland and possibly riparian habitat. Effects on special status plants are unknown but could be low.

#### **Wildlife**

There are likely to be sensitive species supported by river system such as western pond turtles, Valley Elderberry Longhorn Beetle (VELB).

The feasibility of building a dam on a wild river needs to be studied. This would cause significant loss of upland habitats.

#### **Aquatic Biology/Water Quality**

The Kings River upstream of Rodgers Crossing is a large mountain river with excellent fish habitat.

The river and its tributaries have substantial amounts of riparian vegetation.

The Kings River is a popular trout fishing destination.

Construction of reservoir would replace a stream fishery dominated by native species with a lake fishery probably dominated by exotic species.

The reservoir would likely increase downstream summer water temperatures with possible adverse effects on fisheries of Pine Flat Reservoir.

Inundation of abandoned mines, if any are present, could result in water quality degradation.

### **Recreation**

The Main Kings supports a variety of activities including developed and dispersed camping, fishing, hiking and whitewater boating.

This measure would inundate a portion of the Kings that is boated both commercially and privately.

It may also inundate a portion of the river that is designated a Wild and Scenic River. Further research is needed to determine whether the feasibility of this measure would be affected by the river's designation as a Wild and Scenic River.

### **Cultural Resources**

Foothill Pine/Blue Oak woodland along the Kings River would have provided diverse resources.

There is a high probability of prehistoric archaeological sites including BRM stations, hunting and fishing camps, and seasonal village sites.

Historic sites are likely, associated with mining, logging, recreation and other activities.

### **Land Use**

There are no residences or other non-recreation related uses in the vicinity of the dam location. However public lands may be subject to inundation.

Field Trip Log - Botany		
<b>Trip Log Number:</b>	S7	<b>Project No.:</b> 8004094
<b>Dates:</b>	May 29, 2002	
<b>Site Name:</b>	New Rodgers Crossing Dam	
<b>Location:</b>	Main Kings River at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir	
<b>Prepared By:</b>	Jeff Glazner/Barry Anderson/David Stevens	
<b>Date:</b>	June 5, 2002	

<b>Weather Conditions:</b>	Hot and dry	
<b>Areas Covered (attach map with notations)</b>		
<b>Attachments</b>		
<b>Photo Log</b>	Yes	
<b>Photos</b>	Yes	
<b>Topographic Map(s)</b>	No	

**Field Observations:**

**Existing Facilities:**

None.

**Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)**

There is a wide river channel with varying amounts of riparian habitat. Substantial

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amounts of riparian habitat along the Kings River; smaller amounts in tributaries. Surrounding vegetation consists of oak woodland and forest and chaparral. Steep canyon slopes vegetated also with ceanothus, and Manzanita. Seeps, springs, and other wetlands could be present as well.

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**Need for additional (engineering/hydrological, or other) information on measures**

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Geology or soils information  
Spillway elevation and limits of inundation  
Location of any new diversion structures and conveyances  
Location of work pads, access roads, and other construction areas

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**Additional data needs (within each specific discipline)**

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CNDDDB report  
CNPS report  
Ceres report  
Field surveys for wetlands and special status species and habitats

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Field Trip Log – Wildlife		
<b>Trip Log Number:</b>	S7	<b>Project No.:</b> 8004094
<b>Dates:</b>	May 29, 2002	
<b>Site Name:</b>	New Rodgers Crossing Dam	
<b>Location:</b>	Main Kings River at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir	
<b>Prepared By:</b>	Dave Stevens, Stephanie Murphy	
<b>Date:</b>	June 5, 2002	

<b>Weather Conditions:</b>	Hot and dry
<b>Areas Covered (attach map with notations)</b>	
<b>Attachments</b>	
<b>Photo Log</b>	
<b>Photos</b>	
<b>Topographic Map(s)</b>	

**Field Observations:**

**Existing Facilities:**

None

**Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)**

There is a wide river channel with varying amounts of riparian habitat. Steep canyon slopes vegetated with blue oaks, ceanothus, manzanita, and chaparral. There are likely to

be sensitive species supported by river system such as western pond turtles, VELB etc. The possible constraints include the river being a wild river and damming would cause significant loss of upland habitats.

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**Need for additional (engineering/hydrological, or other) information on measures**

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Need inundation levels, seasonal storage regimes, etc.

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**Additional data needs (within each specific discipline)**

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Need to coordinate with resource agency biologists and agency files on known distribution of sensitive species for this area.

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<b>Field Trip Log – Fish and Water Quality</b>		
<b>Trip Log Number:</b>	S7	<b>Project No.:</b> 8004094
<b>Dates:</b>	May 29, 2002	
<b>Site Name:</b>	New Rodgers Crossing Dam	
<b>Location:</b>	Main Kings River at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir	
<b>Prepared By:</b>	Philip Unger	
<b>Date:</b>	June 10, 2002	

<b>Weather Conditions:</b>	Hot and dry	
<b>Areas Covered (attach map with notations)</b>	Main Kings River	
<b>Attachments</b>		
<b>Photo Log</b>	No	
<b>Photos</b>	No	
<b>Topographic Map(s)</b>	Yes	

**Field Observations:**

**Existing Facilities:**

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This project would involve constructing a new dam on the mainstem Kings River, at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir and the North Fork confluence. The area that would be inundated is relatively undeveloped. Existing facilities in the area include developed campgrounds, Forest Service buildings, trails and trail heads, paved and unpaved roads.

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**Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)**

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The Kings River upstream of Rodgers Crossing is a large mountain river with excellent fish habitat. Substantial amounts of riparian vegetation occur along the river and tributaries. The surrounding vegetation consists of oak woodland and forest and chaparral.

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**Need for additional (engineering/hydrological, or other) information on measures**

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Need information on exact area that would be submerged by reservoir.

Need information on seasonal flow conditions in the Kings River.

Need the following estimates for potential reservoir:

Mean depth for each month, April – October.

Mean surface area of shallow water habitat (less than 15 feet deep) in each month, April – October.

Mean rate of water level fluctuation for each month, April – October.

Would a dam at Rodgers Crossing affect the operation of Pine Flat Reservoir or reservoirs on the North Fork Kings River? If so, how?

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**Additional data needs (within each specific discipline)**

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Need information on summer water temperatures in the Kings River Creek and list of fish species present. Also, any other existing water quality information and information on the location and types of active and abandoned mines in the inundation zone of the potential reservoir.

Need information on fish species residing in Pine Flat Reservoir and the Kings River downstream.

What is the regulatory status of the trout fishery in the Kings River?

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Field Trip Log – Recreation		
<b>Trip Log Number:</b>	S7	<b>Project No.:</b> 8004094
<b>Dates:</b>	May 29, 2002	
<b>Site Name:</b>	New Rodgers Crossing Dam	
<b>Location:</b>	Main Kings River at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir	
<b>Prepared By:</b>	Sandra Perry	
<b>Date:</b>	June 3, 2002	

<b>Weather Conditions:</b>	Hot and dry	
<b>Areas Covered (attach map with notations)</b>	Main Kings River	
<b>Attachments</b>		
<b>Photo Log</b>	No	
<b>Photos</b>	No	
<b>Topographic Map(s)</b>	Yes	

**Field Observations:**

**Existing Facilities:**

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This option would involve constructing a new dam on the main Kings River, at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir. The area that would be inundated is relatively undeveloped and is comprised mainly of public lands managed by the Sierra and Sequoia National Forests. Existing facilities in the area include developed campgrounds, Forest Service buildings, trails and trail heads, paved and unpaved roads.

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**Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)**

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The Main Kings River traverses public lands managed by the Sequoia and Sierra National Forests. This portion of the Kings River provides a variety of recreation opportunities including fishing, picnicking, swimming, wading, hiking, nature viewing, camping and whitewater boating. A dam at Rodgers Crossing would likely inundate a popular, classic, boating run which extends from Garnet Dike Campground to Kirch Flat Campground. This run is boated both privately and commercially. A dam at Rodgers Crossing might also inundate portions of the river that are protected under the Wild and Scenic Rivers Act and the Kings River National Recreation Trail.

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**Need for additional (engineering/hydrological, or other) information on measures**

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Need information on exact area that would be submerged by a dam at Rodgers Crossing. Would a dam at Rodgers Crossing affect the operation of Pine Flat Reservoir or upstream reservoirs? If so, how?

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**Additional data needs (within each specific discipline)**

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Need the following recreation-related information:

Exact location of existing recreation facilities along the Main Kings River with respect to inundation area

Use levels by activity for developed recreation facilities the main Kings River.

Use estimates for dispersed activities including whitewater boating and angling.

Commercial boating records, including use levels and season of use

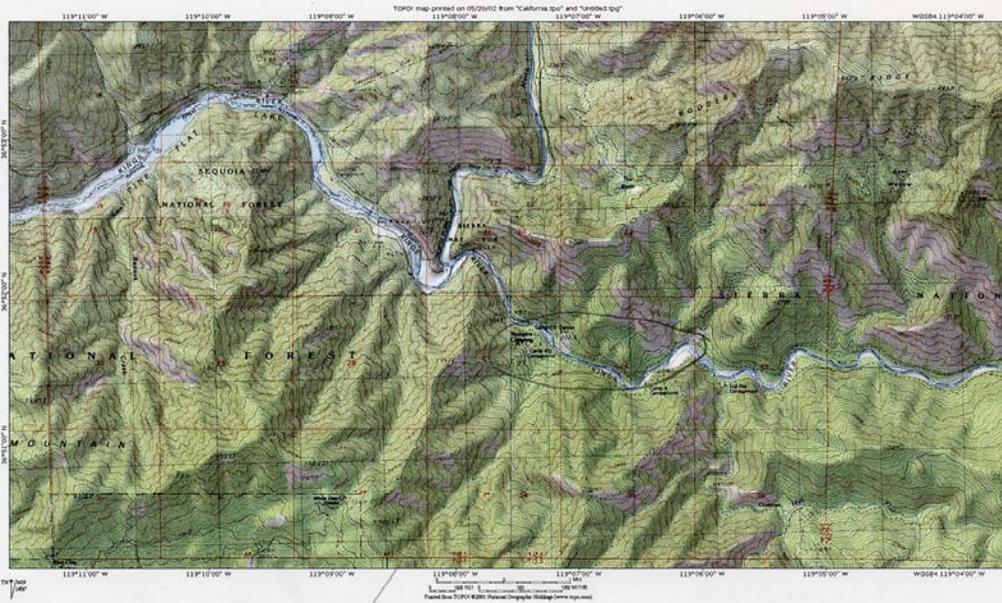
Need to determine how the option would affect the Kings River designation as a Wild and Scenic River.

Need to determine how the option would affect the Kings River National Recreation Trail

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Roger crossing  
7.5

- Class I w/ Boating Run on main keys
- Put-in = GRANET DIKE
- Take-out = FIREH PLOT
- CLASS III - IV
- Boated primary is commercially
- Class II boating on North Fork (Ballett Camp to main)



- Heavy Recreation Use
- Boating
  - Fishing
  - Hiking
  - Swimming

- Campgrounds & Day Use Areas
- gravel flat
  - Bear wallow
  - mill flat
  - green cabin
  - parking

W & SR SEGMENT  
UPSTREAM →

NATIONAL RECREATION  
TRAIL upstream →

Special FS Management Area



Field Trip Log –Land Use		
<b>Trip Log Number:</b>	S7	<b>Project No.</b> 8004094
<b>Dates:</b>	May 29, 2002	
<b>Site Name:</b>	New Rodgers Crossing Dam	
<b>Location:</b>	Main Kings River at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir	
<b>Prepared By:</b>	Irina Torrey	
<b>Date:</b>	June 12, 2002	

<b>Weather Conditions:</b>	Hot and dry
<b>Areas Covered (attach map with notations)</b>	Main Kings River
<b>Attachments</b>	
<b>Photo Log</b>	No
<b>Photos</b>	No
<b>Topographic Map(s)</b>	No

**Field Observations:**

**Existing Facilities:**

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This option would involve constructing a new dam on the main Kings River, at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir. The area that would be inundated is relatively undeveloped and is comprised mainly of public lands managed by the Sierra and Sequoia National Forests. Existing facilities in the area include developed campgrounds, Forest Service buildings, trails and trail heads, paved and unpaved roads.

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**Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)**

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The Main Kings River traverses public lands managed by the Sequoia and Sierra National Forests. There are no residences or other privately owned buildings in the immediate vicinity of the dam location.

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**Need for additional (engineering/hydrological, or other) information on measures**

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No additional information is needed.

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**Additional data needs (within each specific discipline)**

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No additional information would be needed.

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Field Trip Log – Cultural Resources		
<b>Trip Log Number:</b>	S7	<b>Project No:</b> 8004094
<b>Dates:</b>	May 29, 2002	
<b>Site Name:</b>	New Rodgers Crossing Dam	
<b>Location:</b>	Main Kings River at Rodgers Crossing, which is located just upstream of Pine Flat Reservoir	
<b>Prepared By:</b>	David White	
<b>Date:</b>	May 29 2002	

<b>Weather Conditions:</b>	Hot & dry	
<b>Areas Covered (attach map with notations)</b>	Aerial reconnaissance May 29	
<b>Attachments</b>		
<b>Photo Log</b>	Yes – MWH 0205	
<b>Photos</b>	Yes – nos. 26-27	
<b>Topographic Map(s)</b>	Verplank Ridge quad	

**Field Observations:**

**Existing Facilities:**

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No existing dam; are recreational facilities along the Kings River

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**Existing Environmental Features as Appropriate to Discipline (hydrology; aquatic-water quality; terrestrial—plants; wildlife; recreation; cultural resources; land use; aesthetic)**

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Cultural resources:

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Prehistoric: Foothill Pine/Blue Oak woodland along the Kings River would have provided diverse resources. High probability of prehistoric archaeological sites including BRM stations, hunting & fishing camps, seasonal village sites.

Historic sites likely, associated with mining, logging, recreation and other activities.

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### **Need for additional (engineering/hydrological, or other) information on measures**

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Need precisely mapped footprint of reservoir, with various potential dam levels; also need footprint of all associated ground disturbance areas, to include but not be limited to offices and maintenance buildings, construction set-up and lay-down areas, access roads, electric transmission lines, water conveyance structures, and all other facilities.

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### **Additional data needs (within each specific discipline)**

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Archaeological records search with California Historic Resources Inventory System (CHRIS) information center. Clearinghouse: Southern San Joaquin Valley Info Center, CSU-Bakersfield.

Consultation with USFS cultural resource specialists (Sequoia National Forests) regarding sites that may not be recorded with the CHRIS information center.

Brief review of archaeological and ethnographic literature pertaining to the area. Minimal level of effort: (1) to identify types of archaeological remains expected, time periods represented; and (2) to identify Native American tribes historically occupying the area.

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Picture: P5290037 Rodgers Crossing vicinity, May 29, 2002, afternoon



Picture: P5290038 Rodgers Crossing vicinity, May 29, 2002, afternoon



Picture: P5290069 Air photo of Roger Crossing looking upstream (northeast) Kings River



Picture: P5290070 Air photo of Roger Crossing looking downstream (northwest) Kings River

## **APPENDIX C**

### **Cost Estimate Summary**

# **Rodgers Crossing Dam and Reservoir**



## Upper San Joaquin River Basin Storage Investigation

### Cost Estimate

<b>RODGERS CROSSING DAM AND RESERVOIR</b>		
295,000 AF storage; 400' high, 1,660' long 20' wide, u/s-d/s cofferdams and 1,860' long diversion tunnel		
<b>FIRST COST ITEMS</b>		<b>COST (2002 DOLLARS)</b>
DAMS	Diversion of River / Cofferdams	\$ 3,000,000
	Main Dam and Spillway	\$ 250,680,000
	Outlet Works	\$ 11,510,000
<b>SUBTOTAL</b>		<b>\$ 265,190,000</b>
CONVEYANCE FACILITIES		
	Power intake, tunnels & penstocks	\$ -
	Tunnel	\$ -
	Canals/Pipelines	\$ -
	Pumping Stations	\$ -
	Regulating Reservoirs	\$ -
<b>SUBTOTAL</b>		<b>\$ -</b>
PERMANENT OPERATING EQUIPMENT		
	Powerplants, generators & turbines	\$ 26,000,000
	Transmission Lines, switchyards, & substns.	\$ 11,000,000
<b>SUBTOTAL</b>		<b>\$ 37,000,000</b>
<b>TOTAL, LISTED ITEMS (rounded)</b>		<b>\$ 302,200,000</b>
<b>UNLISTED ITEMS (15%; rounded)</b>		<b>\$ 45,300,000</b>
<b>TOTAL, CONSTRUCTION ITEMS (rounded)</b>		<b>\$ 348,000,000</b>
<b>CONTINGENCIES ON CONSTRUCTION (25%; rounded)</b>		<b>\$ 87,000,000</b>
<b>TOTAL, CONSTRUCTION COST</b>		<b>\$ 435,000,000</b>
<b>MITIGATION (5%; rounded)</b>		<b>\$ 22,000,000</b>
<b>TOTAL FIELD COSTS</b>		<b>\$ 457,000,000</b>
<b>INVESTIGATION, DESIGN, &amp; CONSTRUCTION MNGMT (15%; rounded)</b>		<b>\$ 69,000,000</b>
<b>TOTAL FIRST COST</b>		<b>\$ 526,000,000</b>

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