FACILITIES DESCRIPTIONS AND UPDATED COST ESTIMATES FOR LOS BANOS GRANDES

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INTRODUCTION

The *Facility Descriptions and Updated Cost Estimates for Los Banos Grandes* has been prepared as part of the Storage and Conveyance Component Refinement Task of the CALFED Bay-Delta Program (CALFED or Program). CALFED's mission is to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) system.

This report summarizes the principal features, estimated costs, and environmental considerations of constructing the Los Banos Grandes project, which would provide additional off-stream storage capacity south of the Sacramento-San Joaquin Delta (Delta). Two alternative facility configurations are presented in this evaluation. This evaluation and others being performed by CALFED are intended to provide a facilities evaluation and updated cost estimates of representative storage and conveyance components. The objectives of the Los Banos Grandes evaluation are (1) to provide an updated cost estimate which represents a cost within the range expected if the project were to be constructed today and (2) to enable CALFED to compare this project against other projects that might be considered as part of a long-term CALFED solution strategy.

The cost estimate for the Los Banos Grandes project was determined by escalating the costs presented in the California Department of Water Resources (DWR) December 1990 *Los Banos Grandes Facilities Feasibility Report, Appendix A: Design and Cost Estimates, Part I.* The cost estimates performed by DWR in 1990 were reviewed and adopted for this evaluation; minor modifications were made to reflect current design and safety standards.

A preliminary evaluation of the environmental considerations associated with this proposed project has also been included in this report. Fish, wildlife, plant, and cultural resources that could be affected have been described and potential impacts have been identified. The information for the evaluation of environmental considerations was gathered from existing literature and databases.

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PROJECT BACKGROUND

Off-stream reservoir sites south of the Delta which could provide regulatory storage for the California Aqueduct have been investigated by DWR since the 1950s. The U.S. Bureau of Reclamation had recognized the need for such storage as early as the 1940s. In 1968, the San Luis Reservoir was completed as a joint-use off-stream storage facility for the State Water Project (SWP) and federal Central Valley Project (CVP). Even before the completion of the San Luis Reservoir, however, the need for additional off-stream storage south of the Delta had been recognized. As a result, a Delta off-stream storage development project was initiated in 1963 which analyzed potential off-stream storage sites south of the Delta. Under this program, the Kettleman Plain, Los Banos Grandes (LBG), and Sunflower reservoir sites were identified for in-depth evaluation. The Kettleman Plain and Sunflower sites were dropped from further consideration after reconnaissance-level reviews identified undesirable characteristics, including (1) high evaporation rates, (2) marginal dam foundation conditions, (3) lack of nearby suitable construction materials, and (4) high construction costs. The LBG site was recommended for further study.

By the mid- and late 1970s, the value of off-stream storage south of the Delta had once again become apparent. Re-evaluation of off-stream storage sites resulted in the selection of the Los Vaqueros, LBG, and Sunflower reservoir sites for further study. The Los Vaqueros site was included in DWR's proposed Delta Program as part of Senate Bill 346 (1977-78) in which LBG was considered as an alternative to Los Vaqueros. After SB 346 failed to pass, Los Vaqueros was included with the Peripheral Canal program in SB 200, which was later voted down in 1982 by a state-wide referendum.

The 1982 SB 200 referendum further increased interest in storage south of the Delta for the purpose of facilitating diversions from the Delta during less environmentally critical winter months. In 1983, the concept of off-stream storage south of the Delta had gained widespread support in California, and DWR once again initiated reconnaissance studies of alternative sites. In 1984, the State Legislature approved AB 3792, which authorized the proposed LBG project as part of the SWP. This authorization included feasibility-level investigations, which were reported by DWR in 1990 in *Los Banos Grandes Facilities Feasibility Report.* This report is the most comprehensive document available on the LBG project and provides the basis for the information presented in this evaluation. The *Los Banos Grandes Facilities Feasibility Report,* identified

LBG as the most viable option for improving operational flexibility and reliability of the SWP, reducing fisheries impacts in the Delta, and improving water quality for the SWP.

FACILITIES DESCRIPTION

This section provides an overview of the major features included in the proposed LBG project. The principal reference used for this synopsis is the DWR 1990 report, *Los Banos Grandes Facilities Feasibility Report, Appendix A: Design and Cost Estimates, Part 1.*

PROJECT LOCATION

The LBG project would be located in Merced County about six miles west of the California Aqueduct and 80 miles south of the Sacramento-San Joaquin Delta (see Figure 1). The dam site would be located on Los Banos Creek where a narrow canyon more than 500 feet deep has been cut through sandstone and conglomerate layers of the Panoche Formation which compose this region of the Coastal Range. The broad Los Banos Valley, which extends several miles upstream of the dam site, would form this off-stream storage facility immediately south of the existing San Luis Reservoir. The San Luis Reservoir and the existing Los Banos Reservoir, located just downstream of the LBG dam site, are joint SWP and CVP facilities.

PROJECT DESCRIPTION

The LBG project would consist of an off-stream storage reservoir, pumping-generating plants, and conveyance canals. The existing Los Banos Reservoir would be modified for use as a regulating facility for the LBG Reservoir. The project would store available flows diverted from the Delta at the SWP's Banks Pumping Plant and possibly, the CVP's Tracy Pumping Plant. Water diverted from the Delta would be conveyed to the existing Los Banos Reservoir through the California Aqueduct and the Delta-Mendota Canal, SWP and CVP facilities respectively. From the Los Banos Reservoir, water would be pumped into the LBG Reservoir for storage.

Water stored in the LBG Reservoir would be released into the Los Banos Reservoir and the California Aqueduct through a series of pumping-generating facilities. The operation of the LBG project would be similar to that of the San Luis Reservoir facilities.

The primary purpose of the LBG project would be to reduce the frequency and magnitude of water shortages for water users dependent on the Delta by increasing the reliability of supplies available to these users. In addition to improving reliability, the additional storage capacity created by the LBG Reservoir would add flexibility to the SWP and CVP delivery systems and permit shifting Delta diversions toward months with fewer Delta impacts. According to previous investigations by the DWR, the LBG project would provide the following general benefits:

- **Reduced impacts from Delta diversions to salmon, steelhead, and striped bass populations.** This would be accomplished by increasing diversions during periods of high Delta flows or periods when fish are generally less abundant in the Delta. The water stored during these periods would increase the operational flexibility of Delta diversion operations by shifting the pattern of Delta diversions without reducing the reliability of Delta water supplies.

- **Generation of power through a pumped-storage operation.** Water stored in the LBG Reservoir could be released to generate high-value energy during peak periods and later pumped back to storage using low-value energy during off-peak periods.

- **Increased flood protection for farmlands adjacent to Los Banos Creek and for the community of Los Banos.** The LBG project would increase flood protection to a level above that required for the Probable Maximum Flood as currently defined by the U.S. Army Corp of Engineers.

- **Additional recreational opportunities to complement those of the San Luis Reservoir facilities.** DWR estimates from the 1990 feasibility report indicate that the LBG project would initially support 402,000 recreation days annually, with a projected increase to 617,000 recreation days by the year 2035.

PRINCIPAL FACILITIES

The following section provides details on the two alternative LBG facilities presented in this evaluation. The information provided in this section and subsequently used to develop updated cost estimates was taken from the 1990 DWR *Los Banos Grandes Facilities Feasibility Report.* The two alternatives chosen for this evaluation correspond to the SWP Formulation and the

SWP/CVP Formulation described in the 1990 DWR report; alternatives with storage capacities of 1.73 million acre-feet (maf) and 2.03 maf, respectively. Figure 2 illustrates the facilities associated with both alternatives. The DWR report also identified a third alternative, the SWP/Utility Pumped-Storage Formulation. This alternative had the same storage volume as the SWP/CVP Formulation, but incorporated larger pumping-generating capabilities for more efficient operation as a pumped-storage facility. This alternative was not considered in this evaluation.

In this report, the SWP Formulation alternative with 1.73 maf of storage is referred to as the Small Los Banos Grandes Alternative; the SWP/CVP Formulation with 2.03 maf of storage is referred to as the Large Los Banos Grandes Alternative. A schematic showing a profile of both LBG alternatives is shown on Figure 3. Area-capacity curves for the proposed dam site are provided in Figure 4.

The proposed LBG project would be connected to the California Aqueduct by two pumping-generating plants, two conveyance channels, and the existing Los Banos Detention Dam and Reservoir. The detention dam, originally constructed by the Bureau of Reclamation to protect the California Aqueduct from flood flows carried by Los Banos Creek, would be improved to accommodate the proposed pumped-storage operations of LBG Reservoir. Table 1 provides a summary of the physical characteristics of both alternatives.

Small Los Banos Grandes Alternative

Los Banos Grandes Dam and Reservoir

The facilities associated with the LBG Dam would include the dam embankment, the spillway and emergency outlet complex, and the inlet-outlet works. The LBG Reservoir would be formed by constructing a zoned earthfill dam with a volume of 13,231,000 cubic yards and a total height of 414 feet above the streambed. The crest of the dam would be 40.0 feet wide and 1,760 feet long. The crest of the dam would be at 783 feet above mean sea level (MSL). At normal pool, the reservoir would have a water surface elevation of 763 feet above MSL and a surface area of approximately 12,900 acres. For the feasibility-level investigations performed by the DWR in 1990, embankment slopes of 3.5:1 on the upstream side and 3:1 on the downstream side were used. The LBG Dam would include the following features:

- An upstream gravel shell
- A 20-foot-thick upstream filter shell
- A 20-foot-thick upstream filter
- An impervious core
- A 12-foot-thick downstream filter
- A 12-foot-thick drain material zone
- A 20-foot-thick shell zone
- The downstream random zone
- A horizontal blanket layer of drain material about six feet thick

The embankment foundation would be mainly conglomerate and sandstone rock of the Panoche Formation, which is judged to provide an adequate foundation for the dam heights considered for either LBG alternative.

All materials for the construction of the embankment could be obtained either from borrow areas located within the reservoir inundation area or from excavations required for various features at the dam site. The primary types of material needed for the embankment include impervious material for the dam core, pervious soils for filters and drains, free-draining sands and gravels for the shell zone, and random fill material for the downstream stabilization zone.

The spillway and emergency outlet works would be located on the left abutment of the dam. The spillway inlet would be an ungated, 30-foot-diameter glory hole structure with a crest elevation of 764 feet above MSL. The spillway intake would discharge to a 16-foot-diameter vertical shaft which would transition to a 14-foot-diameter spillway tunnel. The spillway tunnel would extend about 14,840 feet to a concrete-lined open chute section of the spillway which would extend about 340 feet to a stilling basin. The emergency outlet works would be designed to evacuate 10 percent of the maximum reservoir depth in ten days in the event of a potential emergency situation. The resulting emergency peak drawdown capacity would be 24,600 cubic feet per second (cfs), which would be passed through the emergency outlet portion of the spillway with a capacity of 8,600 cfs and through two bypasses in the inlet-outlet works with a combined capacity of 16,000 cfs.

The inlet-outlet works for LBG Dam would be designed to transfer up to 4,650 cfs between LBG Reservoir and Pumping-Generating Plant No. 2 during generating operations and up to 3,500 cfs

during pumping operations. This facility would also have the capacity to release 16,000 cfs during an emergency drawdown. The main features of the inlet-outlet works would be a free-standing intake tower with an overall height of 308 feet, a concrete-lined pressure tunnel with a full-length steel liner, and the Pumping-Generating Plant No. 2 penstocks.

The inlet-outlet tunnel would be sized for the required discharge with a velocity of no more than 15 feet-per-second (fps). From the upstream portal, the tunnel would be a 10-foot-diameter, concrete-lined horseshoe for about 490 feet which would expand to a 24.5-foot-diameter, excavated horseshoe housing a 20-foot-diameter circular pressure conduit. From the downstream portal, a 20-foot-diameter penstock would extend to the manifold of Pumping-Generating Plant No. 2.

Saddle Dams

Three saddle dams would be required to develop a storage capacity of 1.73 maf. The largest of these saddle dams would be the Salt Creek Saddle Dam, located about 2.5 miles southeast of the LBG dam site. The two remaining saddle dams, Harper Lane and San Carlos Saddle Dams, would be located at the northwest and southeast corners of the reservoir, respectively. The general location of the saddle dams can be seen in Figure 2.

The Salt Creek Saddle Dam would be a rolled earthfill embankment dam with an estimated volume of 13,360,000 cubic yards. The dam would have a crest width of 40 feet, a length of 4,500 feet, and a height of 231 feet. The zoning of this dam would be similar to that of the LBG Dam. A 36-inch-diameter steel outlet conduit would be placed along the bed of Salt Creek to divert the stream during construction and for stream releases during normal reservoir operations. The outlet would be remotely controlled by a guard valve placed at the inlet and a fixed regulating cone dispersion valve with a capacity of 240 cfs located at the control structure at the downstream end of the conduit. The embankment would be set on bedrock consisting of shale, sandstone, and possibly conglomerate of the Panoche Formation.

The San Carlos Saddle Dam would be a zoned earthfill embankment structure with a crest height of 59 feet and a length of 650 feet. A 600-foot-long dike with a height of about 20 feet would be required in a higher saddle location about 900 feet to the west. The combined volume of both

embankments is estimated to be about 160,000 cubic yards. The dike west of the saddle dam would be a modified homogeneous embankment with a concave curved axis.

The Harper Lane Saddle Dam would be a zoned earthfill dam with a crest height of 56 feet and a length of 900 feet. Billie Wright Road would be relocated along the 40-foot-wide dam crest. The estimated embankment volume of this saddle dam is 400,000 cubic yards. The upstream slope would be protected by a 3.0-foot-thick layer of riprap.

Los Banos Detention Dam and Reservoir

The existing Los Banos Detention Dam and Los Banos Reservoir were designed and constructed by the Bureau of Reclamation in the 1960s as flood control structures to protect the California Aqueduct. The current flood control reservation of 14,000 acre-feet would be moved to the proposed LBG Reservoir and an equivalent volume would be utilized in the existing reservoir as active storage for pumping-generating operations.

The existing detention dam is a zoned earthfill embankment with a height of 167 feet and a crest length of 1,370 feet. Modifications required to facilitate the proposed pumped-storage operation for LBG Reservoir would include: (1) replacement of the upstream dam shell to facilitate anticipated reservoir fluctuations, (2) construction of a larger spillway, and (3) construction of new inlet-outlet works.

The existing upstream shell of the Los Banos Detention Dam is composed of a sandy, silty gravel considered to have insufficient permeability to be free-draining under drawdown rates anticipated for the proposed pumping-storage operation. To correct this problem, a portion of the existing shell material upstream of the impervious core would be removed and replaced with more pervious material obtained from a downstream borrow source.

The existing spillway would be supplemented with a new spillway located on the right abutment of Los Banos Detention Dam. The spillway would limit the reservoir elevation to 360 feet MSL and have a maximum release capacity of 17,600 cfs. The release capacity of the spillway would be sized to meet the maximum discharge resulting from an emergency drawdown at LBG Reservoir of 24,600 cfs. This discharge would be handled by passing 1,000 cfs through the existing spillway, 6,000 cfs through a bypass system, and 17,600 cfs through the new spillway.

Conveyance Facilities

Two conveyance channels would be required to move water from the California Aqueduct to the LBG Reservoir. The channels would transfer water in either direction. Channel No. 1 would be located between the Los Banos Detention Dam and California Aqueduct and Channel No. 2 would be located between the LBG Dam and the Los Banos Reservoir.

Channel No. 1 is designed to carry flows in either direction between the California Aqueduct and Los Banos Reservoir. The concrete-lined channel would be 1.1 miles long with a level invert. The cross section of the channel would be trapezoidal with side slopes of 1.5:1. The operating capacity of Channel No. 1 would be 3,500 cfs in the pumping mode and 4,650 cfs in the generating mode. The primary features of this channel include the Los Banos Creek outlet culvert, emergency drawdown channel, confluence facility, turnout structure from the California Aqueduct, a bridge for the crossing of Interstate 5, Canyon Creek bridge, and animal crossings. The freeway bridge would be a 100-foot-wide and 240-foot- long structure.

Channel No. 2 is designed to carry flows in either direction between LBG Reservoir and the Los Banos Reservoir. The unlined channel would 1.4 miles long with a trapezoidal cross section. The side slopes of the channel would be 2:1. The invert of this channel would be level to facilitate reversible flows. The operating capacity of this channel would be 3,500 cfs in the pumping mode and 4,650 cfs in the generation mode.

Pumping-Generating Plants

Pumping-Generating Plants No. 1 and No. 2 would have similar configurations; each plant containing four vertical Francis-type pump-turbine units. Pumping-Generating Plant No. 1 would convey water from the California Aqueduct to the Los Banos Reservoir. The maximum plant power requirement in the pumping mode would be about 42 megawatts with a maximum flow of 3,500 cfs. The maximum plant generation would be 40 megawatts with a maximum flow of 4,650 cfs.

Pumping-Generating Plant No. 2 would lift water from the Los Banos Reservoir to the LBG Reservoir and would recover energy during LBG Reservoir releases. The reversible units in this facility would require a maximum of 128 megawatts in the pumping mode with a maximum flow

of 3,500 cfs. The maximum plant generation would be 127 megawatts with a maximum flow of 4,650 cfs.

Relocations, Roads, and Utilities

Construction of the Small LBG project would require the relocation or reconstruction of 12.5 miles of roads and construction of nearly 20 miles of new roads for recreation and facilities access. A 500 kV PG&E transmission line would also need to relocated north of the Harper Lane Saddle Dam. A 20-inch and 16-inch crude oil pipeline owned by Texaco and Chevron, respectively, would need to be relocated, as would a 26-inch natural gas pipeline owned by Stanpac.

Large Los Banos Grandes Alternative

The Large LBG Alternative would be very similar to the Small LBG Alternative described above. The reservoir storage capacity would increased to 2.03 maf through the addition of 22 feet of height to the main dam and the saddle dams.

Los Banos Grandes Dam and Reservoir

The LBG dam would be constructed to a total height of 436 feet above the stream bed with a crest length of 2,160 feet at an elevation of 806 feet above MSL. The embankment would require 16,073 million cubic yards of material. At normal pool, the reservoir would have a water surface elevation of 786 feet above MSL and a surface area of approximately 13,810 acres.

The spillway configuration and emergency outlet facilities would be similar to those described for the Small LBG Alternative. The total emergency release flow for this alternative would be 26,000 cfs.

Saddle Dams

Salt Creek Saddle Dam, San Carlos Saddle Dam, and Harper Lane Saddle Dam would be constructed 22 feet higher than those described in the Small LBG Alternative. The two sections of the San Carlos Saddle Dam would be joined as one continuous embankment.

Los Banos Detention Dam and Reservoir

The Los Banos Dam would be modified in the same manner as in the Small LBG Alternative; a portion of the existing shell would be removed and replaced with more permeable material. The spillway of the detention dam would be increased to accommodate the greater emergency release criteria.

Conveyance Facilities

The facilities of Conveyance Channel No. 1 would remain the same as in the Small LBG Alternative. Conveyance Channel No. 2 would be designed to carry a greater generation flow of 5,800 cfs. All other features of this facility would remain the same as in the Small LBG Alternative.

Pumping-Generating Plants

Except for increased unit capacities, the layout and configuration of Pumping-Generating Plants No. 1 and No. 2 would be the same as in the Small LBG Alternative. Pumping-Generating Plant No. 1 would have a maximum power requirement of 54 megawatts in the pumping mode with a maximum flow of 4,500 cfs. The maximum plant generation capacity would be 50 megawatts with a maximum flow of 5,800 cfs.

Pumping-Generating Plant No. 2 would have a maximum power requirement of 174 megawatts in the pumping mode with a maximum flow of 4,500 cfs. The maximum plant generation would be 167 megawatts with a maximum flow of 5,800 cfs.

Relocations, Roads, and Utilities

All relocation and road construction would be the same as in the Small LBG Alternative.

COST ESTIMATE

The cost estimate for the facilities described above are based on previous estimates performed by DWR. Only items included in the previous estimates are included in the present cost estimate and

are expressed in October 1996 dollars. This cost estimate does not include estimated costs of preparing environmental documentation, operations and maintenance, power, reservoir filling, and interest during construction.

COST ESTIMATE METHODOLOGY

The cost estimates for the Los Banos Grandes alternatives are determined by escalating the costs found in the 1990 DWR report entitled *Los Banos Grandes Facilities Feasibility Report, Appendix A: Designs and Cost Estimates.* The costs have been escalated to October 1996 dollars by using the Bureau of Reclamation's Construction Cost Trends (CCT) indices. Table 2a provides a detailed breakdown of the estimated costs of the Small LBG Alternative and Table 2b provides the estimated costs of the Large LBG Alternative. These tables include an updated cost estimate for each cost item identified in the previous cost estimates, along with the quantities of the cost item or an indication that the estimated cost has been developed through a lump sum approach. The table also includes the CCT index for the month and year in which the estimated cost was developed and for October 1966. These CCT indices are used to factor the previous cost estimate to October 1996 dollars.

Right-of-Way Costs

Rights-of-way costs of $1,500 per acre are based on land use costs developed by the Bureau of Reclamation, Land Resources Branch (pers. comm. February 1997). Tables 3a and 3b provide additional details on the calculation of right-of-way costs for the Small and Large LBG Alternatives, respectively.

Pumping-Generating Plant Cost

The pumping-generating plant cost estimates are based on actual construction costs for the Waddell Pumping-Generating Plant in Arizona, which was completed in 1994 and is similar in size and scope to the LBG pumping-generating plants. To revise the cost for the LBG pumping-generating plants, the actual construction cost of the Waddell Pumping-Generating Plant (escalated to October 1996 dollars) was factored by the following empirical equation:

$$\frac{(Cost)_1}{(Cost)_2} = \frac{HP_1^{6/10}}{HP_2^{6/10}}$$

This formula is valid over moderate ranges in horsepower; the validity over larger ranges is undetermined. The impact of any error resulting from utilizing this ratio beyond its valid range is expected to be within the range of the accuracy of the estimate.

Contingencies and Other Costs

All contingencies and engineering, construction management, and administrative factors were determined by historical engineering judgment based on similar level of cost estimation. Contingencies were chosen to be 20 percent, and engineering, construction management, and administration were chosen to be 35 percent. A cost range was developed for the project by subtracting 10 percent from the estimated capital cost for the low end cost and adding 15 percent to the estimated capital cost for the high end.

Preliminary Cost Findings

Costs of constructing either the Small or Large LBG Alternatives and their supporting facilities have been updated to an October 1996 basis as described above. The estimated cost of the Small LBG Alternative would range from $1,101 million to $1,407 million. The estimated cost of the Large LBG Alternative would range from $1,297 million to $1,657 million. Table 4 summarizes estimated costs within selected project categories. The pumping-generating plants would constitute roughly 25 percent of the total estimated project construction costs for either the Small or Large LBG Alternative.

ENVIRONMENTAL CONSIDERATIONS

This portion of the report provides a summary of environmental considerations related to the proposed development of the LBG project. Fish, wildlife, plant, and cultural resources that could be affected by the proposed project and, where possible, the extent of the effect on the project on these resources are described. For the most part, the information presented in this section was

gathered from existing literature, with limited original research. No field work was conducted for this analysis.

WILDLIFE

Depending on the reservoir size selected, the project could inundate up to 13,000 acres of terrestrial wildlife habitat and 13 miles of intermittent stream and associated habitat. The most significant loss of wildlife habitat would be approximately 700 acres of mature riparian habitat, comprised primarily of sycamores. This stand of native sycamores provides habitat for many species of reptiles, amphibians, birds, and mammals.

Fish, Amphibians, Reptiles, and Invertebrates

Los Banos Creek, its tributaries, and the existing Los Banos Reservoir provide habitat for freshwater fish species. Representative game fish species include largemouth bass, green sunfish, redear sunfish, channel catfish, white catfish, and brown bullhead. Representative nongame fish species include Sacramento squawfish, Sacramento sucker, mosquito fish, and threadfin shad.

The fishery in the existing intermittent streams and creeks within the LBG project area is minor, and fish should be able to locate suitable habitat in the new reservoir. The fishery in the existing Los Banos Reservoir would not be significantly impacted if the reservoir is operated as in the present. However, the proposed pumped-storage operation would cause extensive water level fluctuations, resulting in water quality changes and lower food availability and reproductive success for resident game species, such as largemouth bass, sunfish, and catfish.

Several species of common amphibians and reptiles have been observed in the proposed project area. Those observed include bullfrog, Pacific tree frog, California toad, western fence lizard, side-blotched lizard, Pacific gopher snake, coast and aquatic gopher snake, and Pacific rattlesnake.

General Wildlife

Lands within the project area support a diverse faunal assemblage. Common mammals found in the area include opossum, shrew, mole, cottontail, hare, squirrel, gopher, mouse, coyote, red fox,

raccoon, weasel, badger, skunk, mountain lion, bobcat, feral pig, black-tailed mule deer, and feral goat. At least 31 species of mammals would be directly affected by construction of the proposed reservoir. The success of benefits to aquatically oriented mammals such as beaver or muskrat would depend on the operation of the reservoir. For most mammal species, the impact would be adverse as a result of loss of breeding and foraging habitat and escape cover.

Previous surveys recorded 189 different species of birds in the area. Some of the common birds most frequently found include starling, finch, blackbird, goldfinch, swallow, and sparrow. Game found in the area include California quail, ring-necked pheasant, chuckar, wild turkey, and mourning dove. The riparian zones along Los Banos Creek provide nesting habitat for several of these species and a rookery for the great blue heron.

Sensitive and Listed Fish and Wildlife Species

No special-status fish species are known to exist within the area of the proposed LBG Reservoir.

According to the California Department of Fish and Game's (CDFG) California Natural Diversity Data Base records (CNDDB) Version 8/96, there are five wildlife species that are State or federally listed and 19 species that are either candidates for listing or species designated by CDFG as species of special concern that could potentially occur within the LBG Project site.

The five listed species that could be affected by the proposed reservoir include Valley elderberry longhorn beetle (federal threatened), blunt-nosed leopard lizard (federal endangered/State endangered), bald eagle (federal threatened/State endangered), Swainson's hawk (State threatened); and San Joaquin kit fox (federal endangered/State threatened).

Surveys to determine the presence of the Valley elderberry longhorn beetle found that there were none in the project area; however, two specimens of coastal elderberry longhorn beetle were collected.

Two historical sightings of the blunt-nosed leopard lizard have occurred near the project area. However, none were observed during recent surveys of the project site.

Bald eagle has been observed during winter roosting in the sycamores and cottonwoods along Los Banos Creek and in the oaks in the western portions of the project site. The project would provide new foraging habitat, but would remove the roosting sites.

The Swainson's hawk has been known to nest in the riparian area along Los Banos Creek. These hawks have also used the project site as a foraging area on their spring migration to the north. Reservoir inundation would preclude the Swainson's hawk potential nesting and reduce its foraging habitat.

San Joaquin kit fox has been documented in the area. Previous telemetry studies tracked the movement of 28 kit foxes in and adjacent to the Los Banos Grandes reservoir sites. Reservoir construction could result in the loss of 50 known kit fox dens and 425 other potential dens. An additional impact to the kit fox population in the area could result if the reservoir construction blocks their north-south movement, isolating a large portion of kit fox habitat north of the area.

Other listed species that were not found in the CNDDB, but have been observed using the riparian and grassland areas within the project site for foraging include the greater sandhill crane (State threatened), the peregrine falcon (federal endangered/State endangered), and the willow flycatcher (federal endangered/State endangered).

Wildlife species that are either candidates for State or federal listing or considered species of special concern by the CDFG and that could be affected by the proposed LBG project include California tiger salamander, foothill yellow-legged frog, southwestern pond turtle, San Joaquin whipsnake, tricolored blackbird, Townsend's big-eared bat, western mastiff bat, and great blue heron (all federal candidates and CDFG species of special concern); California red-legged frog (federal proposed endangered/CDFG species of special concern); western spadefoot, California horned lizard, silvery legless lizard, yellow warbler, prairie falcon, golden eagle, burrowing owl, and pallid bat (all CDFG species of special concern); and Yuma myotic and small-footed myotis (both federal candidates).

VEGETATION

Vegetation at the Los Banos Grandes site consists primarily of grasslands, with approximately 12,210 acres in the valley portion and approximately 110 acres of scattered oaks on the hills to

the west and southwest. There are approximately 700 acres of riparian area along Los Banos Creek. About 430 acres of this riparian area have been defined as Central California Sycamore Alluvial Woodland (CCSAW) and designated by the CNDDB as a "rare" natural community. The stand at the LBG project site is one of 17 known sites that support this type of community and represents approximately 20 percent of the total acreage of CCSAW in the southern part of the Central Valley. Other vegetation types at the project site include alkaline areas, aquatic marsh, chaparral, savannah, and scrub.

D

Sensitive and Listed Plant Species

No federal- or State-listed plant species are known to occur in the LBG project area.

R

Candidate plant species for federal listing that may occur in the project area include Lost Hills crownscale, hairless popcorn flower, Arbura Ranch jewelflower, heartscale, recurved larkspur, hispid bird's-beak, and Hall's bush mallow, which is listed by the California Native Plant Society as being rare.

A

During previous surveys of the project site, botanists found over 20 populations of the Arbura Ranch jewelflower. Two of these populations, which account for 5 percent of the total population, will suffer some inundation effects if the proposed reservoir exceeds a maximum water surface elevation of 760 feet.

F

A population of western recurved larkspur is known to occur along the southwest portion of Salt Creek. This population is the only one reported in Merced County. Construction and inundation at Salt Creek could potentially result in the loss of 75 percent of this population.

WETLANDS

T

Most of the creeks in the LBG project area have at least one seasonally wet meadow at some location along its length. These wet areas occur both naturally along the creek bed and artificially in areas where impoundments have been constructed across the creek. The project area contains approximately 240 acres of seasonal wetlands. Other Section 404 jurisdictional sites in the project area include about 180 acres of narrow channels, 120 acres of wide channels, and 20 acres of farm ponds.

CULTURAL RESOURCES

Thirty-five prehistoric and six historic sites have been recorded within the area that would be affected by the proposed LBG reservoir. Six prehistoric sites were found ineligible for nomination to the National Register, 14 sites are significant enough to be eligible for nomination to the National Register, and the remaining 15 sites require additional data before a determination of eligibility can be made.

A number of the prehistoric sites within the project area have lost some integrity, primarily through undocumented collection of items and extensive rodent disturbance. The sites within the lower Los Banos Creek drainage have suffered significant disturbance from gravel mining operations in the creek bed. The sites in this portion of the project area are very large with extensive components and/or have areas of intact subsurface deposits. Even though there is disturbance, they qualify for nomination.

Of the six historic sites that were found in the study area, one is eligible for listing on the National Register, one is not, and the remaining four sites require additional data.

D-004664

BIBLIOGRAPHY

Bureau of Reclamation and California Department of Water Resources, February 1988, *Enlarging Shasta Lake Investigation*, Office Report, Appendix C.

Bureau of Reclamation, Land Resources Branch, February 1997, personal communication, Graham McMullen, Department of the Interior.

Department of Fish and Game, Bay-Delta Project, September 1988, *Los Banos Grandes Project Fish and Wildlife Resources Final Report*, State of California.

Department of Fish and Game, Natural Diversity Data Base, Update Version: 8/96, State of California.

Department of Fish and Game, Natural Heritage Division, March 1996, *The Definition and Location of Sycamore Alluvial Woodland in California*, Draft Report, State of California.

Department of Water Resources, June 1986, *Los Banos Grandes Study Area, Progress Report, Vegetation Studies, 1985-1986*, State of California.

Department of Water Resources, Division of Planning, August 1990, *Los Banos Grandes Facilities Physical Features*, State of California.

Department of Water Resources, September 1990, *Los Banos Grandes Facilities Alternative Analysis*, Memorandum Report, State of California.

Department of Water Resources, December 1990, *Los Banos Grandes Facilities - Draft Environmental Impact Report*, State of California.

Department of Water Resources, December 1990, *Los Banos Grandes Facilities Feasibility Report*, State of California.

Department of Water Resources, December 1990, *Los Banos Grandes Facilities Feasibility Report: Appendix A: Designs and Cost Estimates, Part 1*, State of California.

Department of Water Resources, Division of Planning, *Los Banos Grandes Facilities: Technical Summary of Engineering Features*, State of California.

U.S. Fish and Wildlife Service, National Wetlands Inventory Program.

U.S. Geological Survey, National Aerial Photography Program.

U.S. Geological Survey, Topographic Maps: Los Banos Valley; San Luis Dam; Ortigalita Peak NW; Mariposa Peak; and Pacheco Pass.

Table 1
SUMMARY OF PHYSICAL CHARACTERISTICS
LOS BANOS GRANDES

	Small LBG	Large LBG
LBG Reservoir	1,728,000	2,035,000
Volume (acre-feet)	12,780	13,808
Surface Area (feet)		
Dams		
LBG		
Height (feet)	414	436
Dam Volume (cubic yards)	13,231,000	16,073,000
Crest Length (feet)	1,760	2,160
Salt Creek		
Height (feet)	231	253
Dam Volume (cubic yards)	13,360,000	17,400,000
Crest Length (feet)	4,500	4,700
San Carlos		
Height (feet)	59	78
Dam Volume (cubic yards)	160,000	922,000
Crest Length (feet)	1,250	1,680
Harper Lane		
Height (feet)	56	78
Dam Volume (cubic yards)	400,000	810,000
Crest Length (feet)	900	1,130
Pumping-Generating Plant		
No. 1		
Pump Capacity (MW)	42	54
Pump Flow (cfs)	3,500	4,500
Generating Capacity (MW)	40	50
Generating Flow (cfs)	4,650	5,800
No. 2		
At High Speed:		
Pump Capacity (MW)	128	174
Pump Flow (cfs)	3,500	4,500
Generating Capacity (MW)	127	167
Generating Flow (cfs)	4,650	5,800
At Low Speed:		
Pump Capacity (MW)	82	101
Pump Flow (cfs)	3,000	3,710
Generating Capacity (MW)	77	89
Generating Flow (cfs)	3,990	4,780

Table 2a
ESTIMATED COSTS
SMALL LOS BANOS GRANDES RESERVOIR (1.73 MAF ALTERNATIVE)

DESCRIPTION	QUANTITY	UNIT[a]	USBR INDEX OCT.89	USBR INDEX OCT.96	TOTAL COST OCT.89	TOTAL COST OCT.96
Los Banos Grandes Dam	JOB	LS	153	176	$70,561,000	$81,168,000
Salt Creek Saddle Dam	JOB	LS	153	176	$78,072,000	$89,808,000
Harper Lane Saddle Dam	JOB	LS	153	176	$3,537,000	$4,069,000
San Carlos Saddle Dam	JOB	LS	153	176	$1,586,000	$1,824,000
Los Banos Detention Dam Embankment Modifications	JOB	LS	153	176	$1,356,000	$1,560,000
Spillway and Emergency Outlet Works	JOB	LS	165	186	$13,509,000	$15,228,000
Los Banos Detention Dam Spillway	JOB	LS	165	186	$12,263,000	$13,824,000
General Reservoir Costs	JOB	LS	178	217	$13,830,000	$16,860,000
Access Roads						
Reach 1 - Jasper Sears (upgraded)	JOB	LS	193.5	228	$852,000	$1,004,000
Reach 2 - P/G Plant No. 2 Access	JOB	LS	193.5	228	$6,852,000	$8,074,000
Reach 3 - Main Dam Crest Access	JOB	LS	193.5	228	$540,000	$636,000
Reach 3A - Main Dam Crest Access (Secondary)	JOB	LS	193.5	228	$785,000	$925,000
Reach 4 - Salt Creek Saddle Dam Access	JOB	LS	193.5	228	$1,215,000	$1,432,000
Reach 5 - P/G Plant 1 & 2 Connecting	JOB	LS	193.5	228	$4,101,000	$4,832,000
Reach 6 - Salt Creek Saddle Dam Service	JOB	LS	193.5	228	$1,379,000	$1,625,000
Future Recreation Roads						
Reach 7 - Chilaneo Creek Recreation	JOB	LS	193.5	228	$1,881,000	$2,216,000
Reach 8 - Basalt Hill to Relocated Billy Wright	JOB	LS	193.5	228	$2,049,000	$2,414,000
Road Relocations						
Billy Wright	JOB	LS	193.5	228	$5,160,000	$6,080,000
Main Dam Inlet - Outlet Works	JOB	LS	179	206	$64,462,000	$74,185,000
Los Banos Detention Dam Inlet - Outlet Works	JOB	LS	179	206	$19,634,000	$22,596,000
Salt Creek Saddle Dam Outlet Works	JOB	LS	179	206	$1,336,000	$1,538,000
Pumping - Generating Facilities						
Plant No. 1 (Q=3,500cfs, TDH=126, eff=75%,66,700 HP)						
Structure, Equipment and Electrical, Complete	JOB	LS			$104,187,000	$104,187,000
Penstocks	JOB	LS	182	222	$5,488,000	$6,694,000
Plant No. 2 (Q=3,500cfs, TDH=383, eff=75%, 202,780 HP)						
Structure, Equipment and Electrical, Complete	JOB	LS			$203,098,000	$203,098,000
Penstocks	JOB	LS	182	222	$6,437,000	$7,852,000

Table 2a
ESTIMATED COSTS
SMALL LOS BANOS GRANDES RESERVOIR (1.73 MAF ALTERNATIVE)

DESCRIPTION	QUANTITY	UNIT[a]	USBR INDEX OCT.89	USBR INDEX OCT.96	TOTAL COST OCT.89	TOTAL COST OCT.96
Conveyance Channel No. 1	JOB	LS	160	199	$15,842,000	$19,703,000
Conveyance Channel No. 2	JOB	LS	160	199	$5,513,000	$6,857,000
Emergency Release Distribution Facilities						
Conveyance Channel No. 1	JOB	LS	160	199	$814,800	$1,013,000
Garzas Weir	JOB	LS	164	213	$891,300	$1,158,000
Orestimba Outlet	JOB	LS	164	213	$677,400	$880,000
Salt Creek Weir @ California Aqueduct	JOB	LS	164	213	$568,700	$739,000
Salt Creek Weirs @ Delta Mendota Canal	JOB	LS	164	213	$1,414,800	$1,838,000
Utility Relocations						
PG&E 500 kV Electrical Line	JOB	LS	198	217	$3,739,800	$4,099,000
20-Inch Texaco Oil Line	JOB	LS	182	222	$243,900	$298,000
I-5 Pipelines	JOB	LS	182	222	$284,600	$347,000
Initial Recreation Development	JOB	LS	178	217	$13,520,000	$16,482,000
Rights-of-Way	JOB	LS				$28,186,600
SUBTOTAL						$755,329,600
CONTINGENCY @ 20%						$151,066,000
ESTIMATED CONSTRUCTION COST						$906,395,600
ENGR., LEGAL, AND ADMIN. @ 35%						$317,238,000
ESTIMATED CAPITAL COST						$1,223,633,600
ESTIMATED CAPITAL COST RANGE						
LOW (-10%)						$1,101,000,000
HIGH (+15%)						$1,407,000,000

[a]LS=lump sum

Source: California Department of Water Resources, *Los Banos Grandes Facilities Report, Appendix A: Designs and Cost Estimates*, December 1990.

Table 2b
ESTIMATED COSTS
LARGE LOS BANOS GRANDES RESERVOIR (2.03 MAF ALTERNATIVE)

DESCRIPTION	QUANTITY	UNIT[a]	USBR INDEX OCT.89	USBR INDEX OCT.96	UNIT COST OCT. 96	TOTAL COST OCT.89	TOTAL COST OCT.96
Los Banos Grandes Dam	JOB	LS	153	176		$88,164,730	$101,418,000
Salt Creek Saddle Dam	JOB	LS	153	176		$104,863,000	$120,627,000
Harper Lane Saddle Dam	JOB	LS	153	176		$6,077,000	$6,991,000
San Carlos Saddle Dam	JOB	LS	153	176		$7,376,000	$8,485,000
Los Banos Detention Dam Embankment Modifications	JOB	LS	153	176		$1,356,000	$1,560,000
Spillway and Emergency Outlet Works	JOB	LS	165	186		$13,478,000	$15,193,000
Los Banos Detention Dam Spillway	JOB	LS	165	186		$13,708,000	$15,453,000
General Reservoir Costs (Clearing)	JOB	LS	178	217		$13,930,000	$16,982,000
Access Roads							
Reach 1 - Jasper Sears (upgraded)	JOB	LS	193.5	228		$852,000	$1,004,000
Reach 2 - P/G Plant No. 2 Access	JOB	LS	193.5	228		$6,852,000	$8,074,000
Reach 3 - Main Dam Crest Access	JOB	LS	193.5	228		$540,000	$636,000
Reach 3A - Main Dam Crest Access (Secondary)	JOB	LS	193.5	228		$785,000	$925,000
Reach 4 - Salt Creek Saddle Dam Access	JOB	LS	193.5	228		$1,215,000	$1,432,000
Reach 5 - P/G Plant 1 & 2 Connecting	JOB	LS	193.5	228		$4,101,000	$4,832,000
Reach 6 - Salt Creek Saddle Dam Service	JOB	LS	193.5	228		$1,379,000	$1,625,000
Future Recreation Roads							
Reach 7 - Chilaneo Creek Recreation	JOB	LS	193.5	228		$1,881,000	$2,216,000
Reach 8 - Basalt Hill to Relocated Billy Wright	JOB	LS	193.5	228		$2,049,000	$2,414,000
Road Relocations - Billy Wright	JOB	LS	193.5	228		$5,422,000	$6,389,000
Main Dam Inlet - Outlet Works	JOB	LS	179	206		$68,896,000	$79,288,000
Los Banos Detention Dam Inlet - Outlet Works	JOB	LS	179	206		$23,193,000	$26,691,000
Salt Creek Saddle Dam Outlet Works	JOB	LS	179	206		$1,336,000	$1,538,000
Pumping - Generating Facilities							
Plant No. 1 (Q=4,500cfs, TDH=126, eff=75%, 85,770 HP)							
Structure, Equipment, and Electrical, Complete	JOB	LS				$121,331,000	$121,331,000
Penstocks	JOB	LS	182	222		$6,842,000	$8,346,000
Plant No. 2 (Q=4,500cfs, TDH=403, eff=75%, 274,340 HP)							
Structure, Equipment, and Electrical, Complete	JOB	LS				$242,663,000	$242,663,000
Penstocks	JOB	LS	182	222		$6,960,000	$8,490,000
Conveyance Channel No. 1	JOB	LS	160	199		$15,842,000	$19,703,000

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Table 2b
ESTIMATED COSTS
LARGE LOS BANOS GRANDES RESERVOIR (2.03 MAF ALTERNATIVE)

DESCRIPTION	QUANTITY	UNIT[a]	USBR INDEX OCT.89	USBR INDEX OCT.96	UNIT COST OCT. 96	TOTAL COST OCT.89	TOTAL COST OCT.96
Conveyance Channel No. 2	JOB	LS	160	199		$6,673,000	$8,300,000
Emergency Release Distribution Facilities							
Conveyance Channel No. 1	JOB	LS	160	199		$814,800	$1,013,000
Garzas Weir	JOB	LS	164	213		$891,300	$1,158,000
Orestimba Outlet	JOB	LS	164	213		$677,400	$880,000
Salt Creek Weir @ California Aqueduct	JOB	LS	164	213		$568,700	$739,000
Salt Creek Weirs @ Delta Mendota Canal	JOB	LS	164	213		$1,414,800	$1,838,000
Utility Relocations							
PG&E 500 kV Electrical Line	JOB	LS	198	217		$3,739,800	$4,099,000
20-Inch Texaco Oil Line	JOB	LS	182	222		$243,900	$298,000
I-5 Pipelines	JOB	LS	182	222		$284,600	$347,000
Initial Recreation Development	JOB	LS	178	217		$13,520,000	$16,482,000
Rights-of-Way	JOB	LS				$69,775,000	$30,047,000
SUBTOTAL PROJECT COST							$889,507,000
CONTINGENCY @ 20%							$177,901,000
CONTRACT COST SUBTOTAL							$1,067,408,000
ENGR., LEGAL, AND ADMIN. @ 35%							$373,593,000
TOTAL PROJECT COST							$1,441,001,000
TOTAL PROJECT COST RANGE							
LOW (-10%)							$1,297,000,000
HIGH (+15%)							$1,657,000,000

[a]LS=lump sum

Source: California Department of Water Resources, *Los Banos Grandes Facilities Report, Appendix A: Designs and Cost Estimates*, December 1990.

Table 3a
RIGHTS-OF-WAY COST SUMMARY
SMALL LOS BANOS GRANDES RESERVOIR (1.73 MAF ALTERNATIVE)

DESCRIPTION	QUANTITY	UNIT[a]	UNIT COST	TOTAL COST
Reservoir (Includes Buffer Area Factor of 1.32)	16,990	AC	1,500	$ 25,485,000
Access & Recreation Roads				
Reach 1 Jasper-Sears (Upgraded)	36.40	AC	1,500	$ 54,600
Reach 2 P/G Plant No. 2 Access	36.40	AC	1,500	$ 54,600
Reach 3 Main Dam Crest Access	9.10	AC	1,500	$ 13,650
Reach 3A Main Dam Crest Access (Secondary)	12.10	AC	1,500	$ 18,150
Reach 4 Salt Creek Saddle Dam Access	12.10	AC	1,500	$ 18,150
Reach 5 P/G Plants 1 & 2 Connecting	72.70	AC	1,500	$ 109,050
Reach 6 Salt Creek Saddle Dam Service	25.50	AC	1,500	$ 38,250
Reach 7 Chilaneo Creek Recreation	32.70	AC	1,500	$ 49,050
Reach 8 Basalt Hill to Relocated Billy Wright	36.40	AC	1,500	$ 54,600
Intake Channel	161.00	AC	1,500	$ 241,500
Recreation Areas	1,200.00	AC	1,500	$ 1,800,000
Utility Relocations				
PG&E 500kV Tower Line	Job	LS	250,000	$ 250,000
				$ 28,186,600

[a]AC=acre; LS=lump sum

Source: California Department of Water Resources, *Los Banos Grandes Facilities Report, Appendix A: Designs and Cost Estimates,* December 1990.

Table 3b
RIGHTS-OF-WAY COST SUMMARY
LARGE LOS BANOS GRANDES RESERVOIR (2.03 MAF ALTERNATIVE)

DESCRIPTION	QUANTITY	UNIT[a]	UNIT COST	TOTAL COST
Reservoir (Includes Buffer Area Factor of 1.32)	18,230	AC	1,500	$27,345,000.00
Access & Recreation Roads				
Reach 1 Jasper-Sears (Upgraded)	36.40	AC	1,500	$54,600.00
Reach 2 P/G Plant No. 2 Access	36.40	AC	1,500	$54,600.00
Reach 3 Main Dam Crest Access	9.10	AC	1,500	$13,650.00
Reach 3A Main Dam Crest Access (Secondary)	12.10	AC	1,500	$18,150.00
Reach 4 Salt Creek Saddle Dam Access	12.10	AC	1,500	$18,150.00
Reach 5 P/G Plants 1 & 2 Connecting	72.70	AC	1,500	$109,050.00
Reach 6 Salt Creek Saddle Dam Service	25.50	AC	1,500	$38,250.00
Reach 7 Chilaneo Creek Recreation	32.70	AC	1,500	$49,050.00
Reach 8 Basalt Hill to Relocated Billy Wright	36.40	AC	1,500	$54,600.00
Intake Channel	161.00	AC	1,500	$241,500.00
Recreation Areas	1,200.00	AC	1,500	$1,800,000.00
Utility Relocations				
PG&E 500kV Tower Line	Job	LS	250,000	$250,000.00
TOTAL RIGHTS-OF-WAY COSTS				$30,047,000.00

[a]AC=acre; LS=lump sum

Source: California Department of Water Resources, *Los Banos Grandes Facilities Report, Appendix A: Designs and Cost Estimates,* December 1990.

Table 4
SUMMARY OF ESTIMATED COSTS
LOS BANOS GRANDES RESERVOIR

Cost Item	Estimated Cost ($Millions) 1.73 maf		2.03 maf	
Main Dam (Los Banos Grandes Dam)				
Dam	$81		$101	
Inlet-Outlet Works	74		79	
Spillway and Emergency Outlet Works	15		15	
Subtotal:		170		195
Saddle Dam				
Dams	96		136	
Outlet Works	2		2	
Subtotal:		98		138
Los Banos Detention Dam				
Dam Embankment Modifications	2		2	
Spillway	14		15	
Inlet-Outlet Works	23		27	
Subtotal:		39		44
Pumping-Generating Facilities				
Plant No. 1	111		130	
Plant No. 2	211		251	
Subtotal:		322		381
Conveyance Channels				
Channel No. 1	20		20	
Channel No. 2	7		8	
Subtotal:		27		28
Emergency Release Distribution Facilities		6		6
General Reservoir Costs		17		17
Access Roads		23		23
Relocations				
Roads	6		6	
Utility	5		5	
Subtotal:		11		11
Initial Recreation Development		16		16
Rights of Way		28		30
SUBTOTAL		755		890
Contingencies (20%)		151		178
ESTIMATED CONSTRUCTION COST		906		1,067
Engineering, Legal, and Project Administration (35%)		317		374
ESTIMATED CAPITAL COST		1,224		1,441
Capital Cost Range (minus 10% - plus 15%)	$1,101 - $1,407		$1,297 - $1,657	

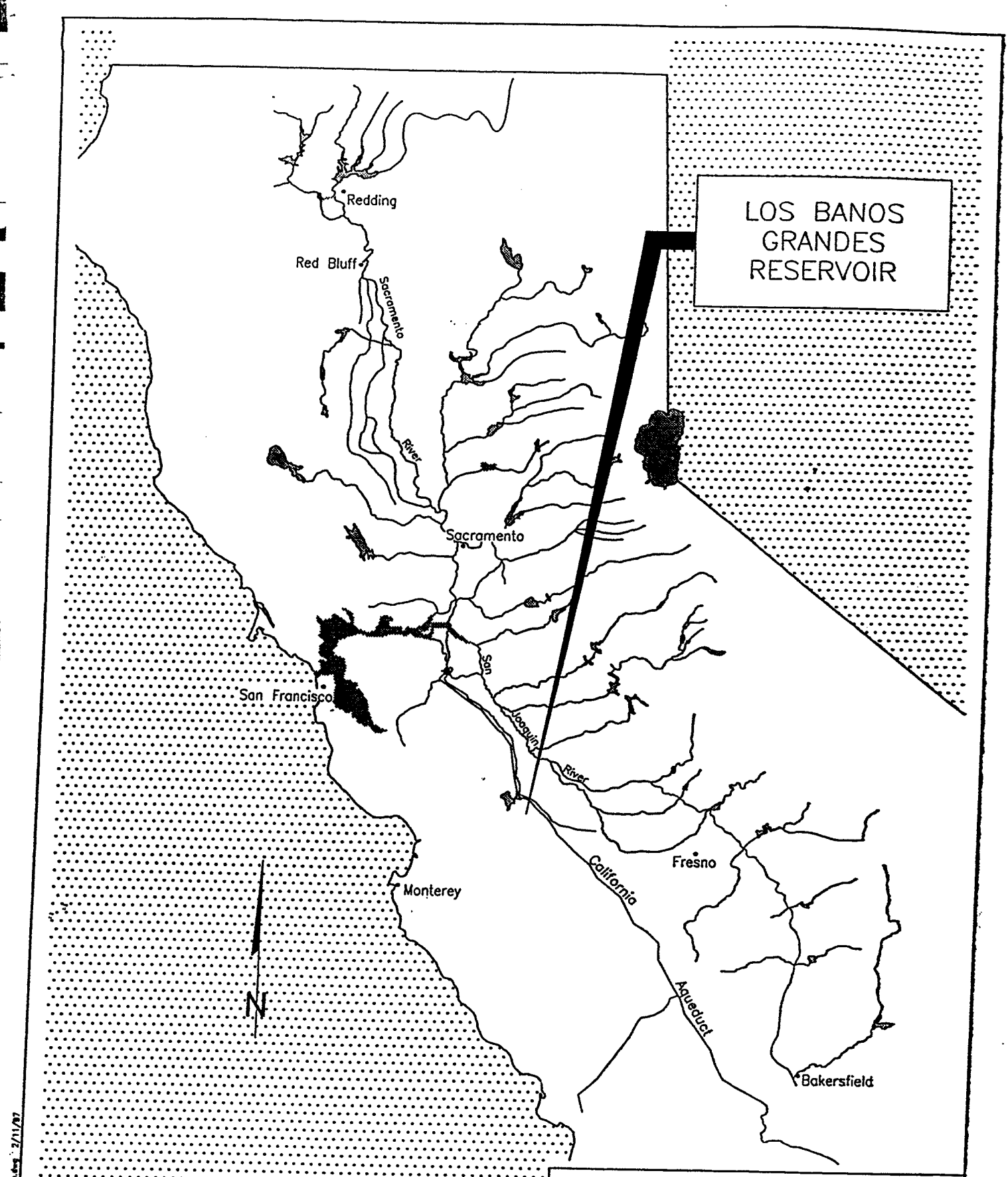

Figure 1
Project Location Map
Los Banos Grandes Reservoir

CALFED BAY-DELTA PROGRAM

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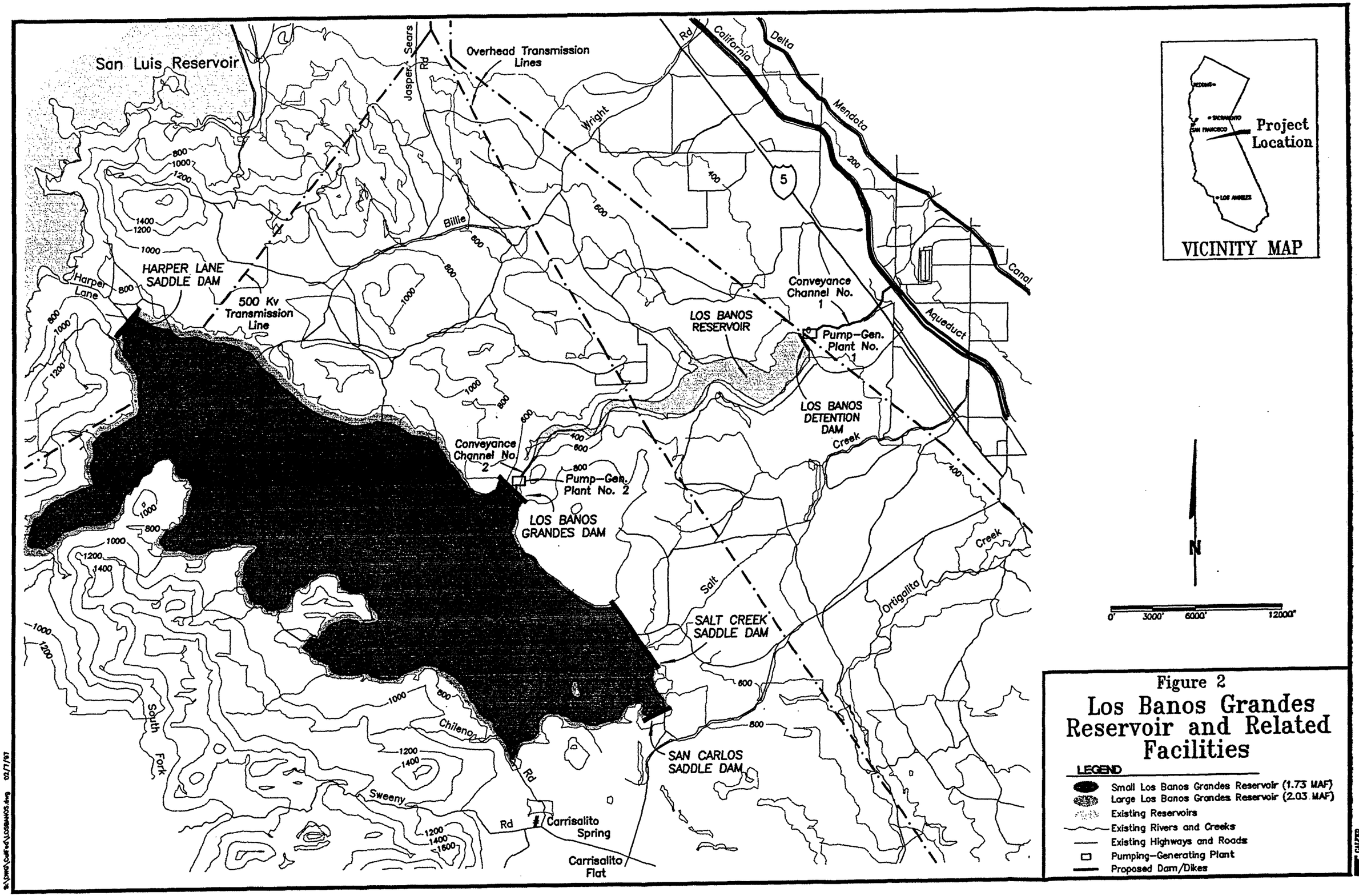

Figure 2

Los Banos Grandes Reservoir and Related Facilities

LEGEND

- Small Los Banos Grandes Reservoir (1.73 MAF)
- Large Los Banos Grandes Reservoir (2.03 MAF)
- Existing Reservoirs
- Existing Rivers and Creeks
- Existing Highways and Roads
- Pumping–Generating Plant
- Proposed Dam/Dikes

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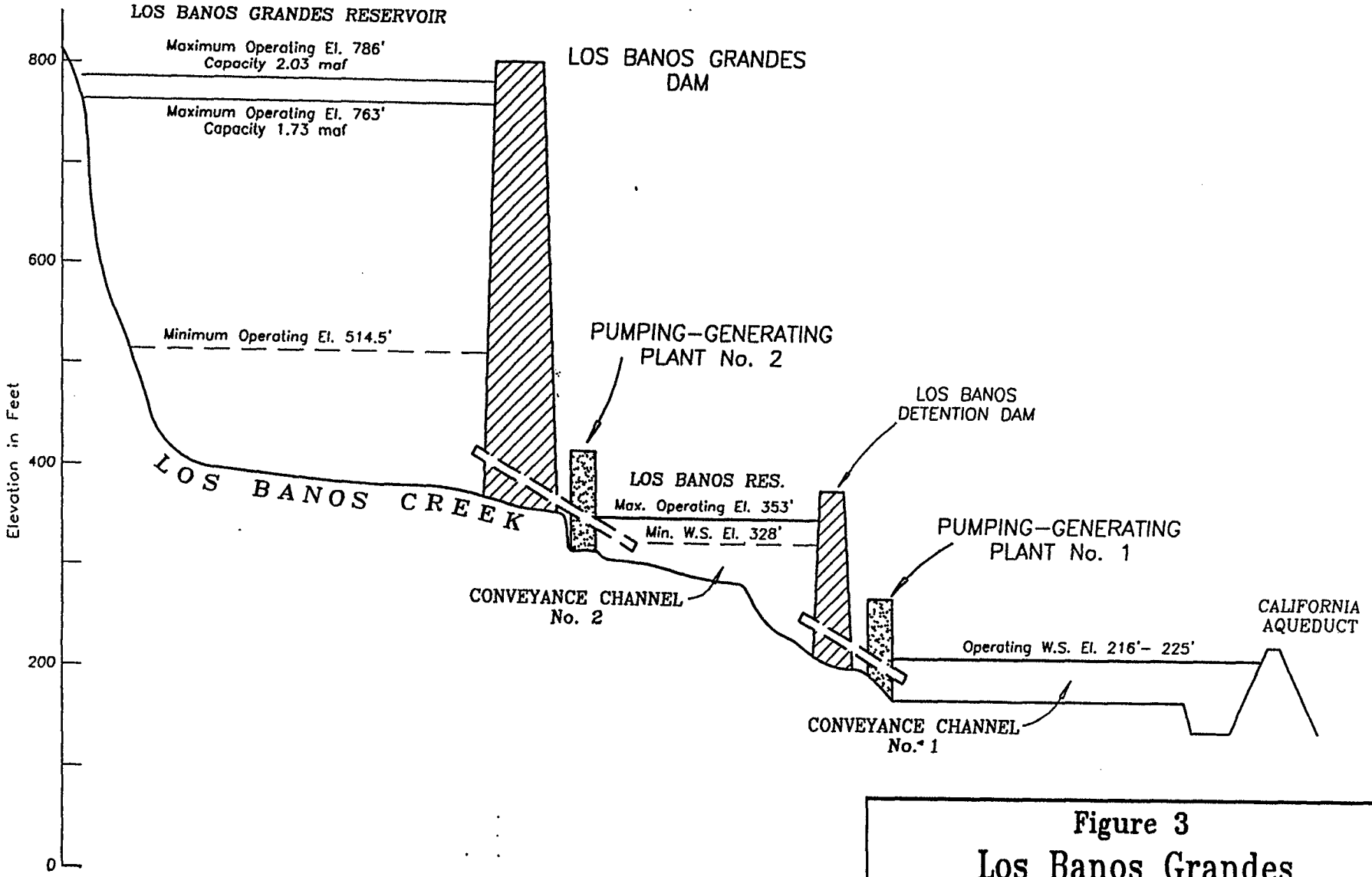

Figure 3

Los Banos Grandes Reservoir and Related Facilities

Schematic Profile

CALFED BAY–DELTA PROGRAM

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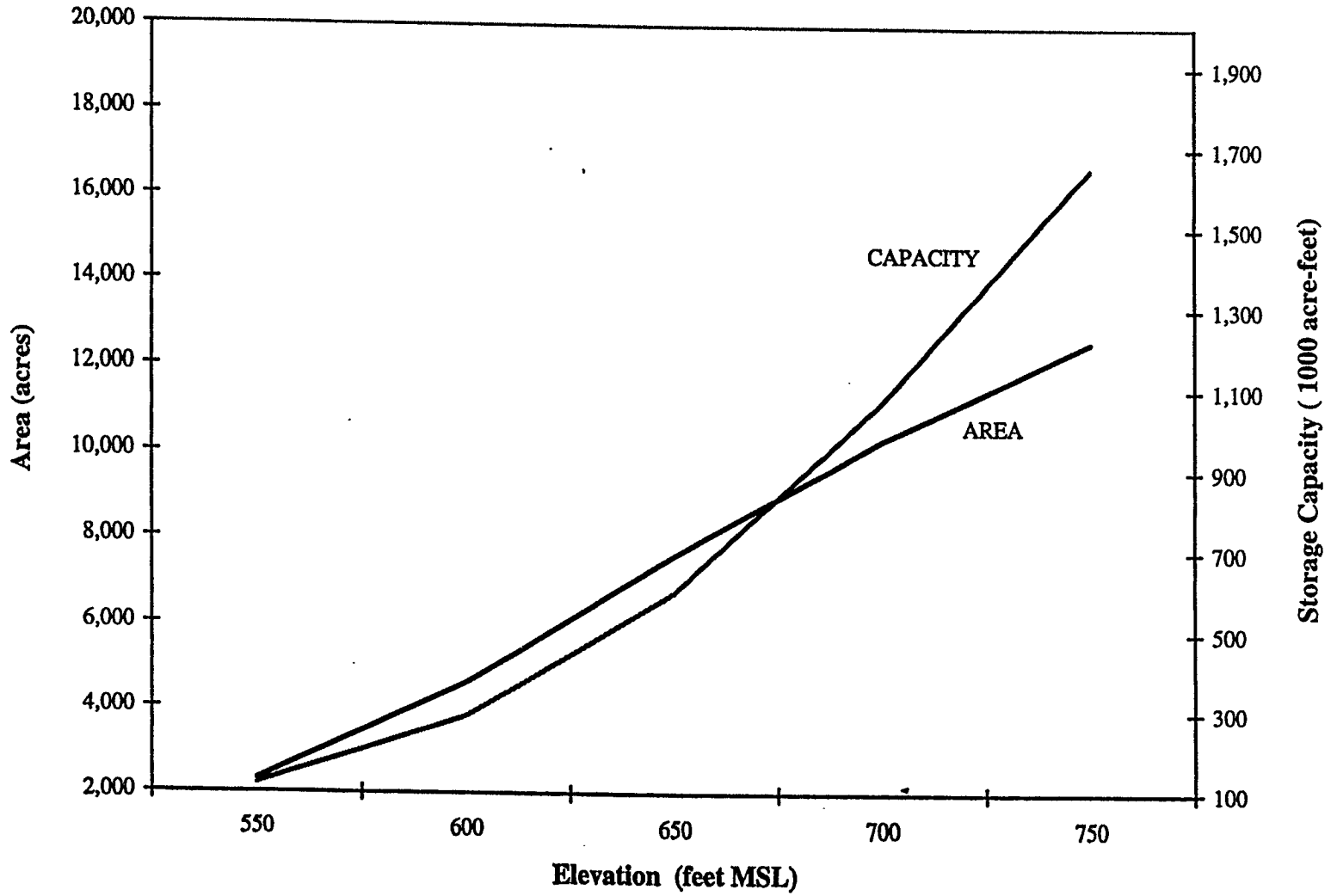
Figure 4
AREA-CAPACITY CURVES
LOS BANOS GRANDES RESERVOIR



AREA-CAPACITY Los Banos Grandes 2/12/97