EAST BAY MUNICIPAL UTILITY DISTRICT

PARDEE RESERVOIR ENLARGEMENT PROJECT
PRELIMINARY DESIGN REPORT

Volume 1

SUMMARY TECHNICAL REPORT

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Prepared for

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EXECUTIVE SUMMARY

ABSTRACT

New studies of enlarging EBMUD's Pardee Reservoir carried out in 1996/97, have resulted in a modified concept that improves the feasibility of this supplemental water supply option.

In 1993, a 150,000 ac-ft (150 TAF) reservoir enlargement concept was evaluated as a potential water supply component in the Water Supply Management Program (WSMP) Environmental Impact Report (EIR). This concept would have raised the maximum summer level of the reservoir by 57 ft. to El. 625 ft. - periodically inundating the lower reach of the Electra whitewater rafting run. This impact downgraded the ranking of this component relative to others considered in the EIR.

The new concept avoids this impact by only raising the summer operating level 33 ft. to El. 601 ft. During flood season up to 12 ft. of additional flood control storage will be available which will not impact whitewater recreation.

To gain the needed storage, some new capacity will be created downstream of the present dam by replacing it with a new dam about ¾ mile downstream - within the upper reach of Camanche Reservoir. Capacity will increase by 172 TAF sufficient to meet the District's projected net demand for additional water through year 2020 (228 MGD[1]). In addition to addressing whitewater recreation impacts, the new concept also has significant environmental, cost, constructibility and operational advantages.

The estimated project cost is $261.5 million in 1997 dollars. The project will take at least 6½ years to complete, assuming 3 years for regulatory approvals and a 3½ year construction schedule.

It is recommended that EBMUD preserve this resource as a water supply option for the future.

A list of specific actions is recommended in the report.

INTRODUCTION

This report, presents a summary of the findings of investigations of enlarging Pardee Reservoir carried out in the period July 1996 through December 1997. Its goal is to provide engineering and cost data needed to support EBMUD's planning and decision-making processes with respect to meeting its customers' water needs.

Studies were carried out under an agreement dated July 22, 1996 between EBMUD and HCG[2], Details of the studies, are presented in a series of supporting reports which comprise this Preliminary Design Report.

Preliminary environmental studies carried out contemporaneously by ENTRIX are documented in a separate report entitled *Sizing & Siting Environmental Study for the Pardee Reservoir Enlargement Project*. Principal findings of these environmental studies that affect project design have been incorporated into this summary report.

BACKGROUND

EBMUD supplies water to over 1.2 million people in a 325 square mile service area located east of San Francisco Bay.

Searching beyond limited local sources of supply EBMUD chose to import water from the pristine Sierra watershed of the Mokelumne River. In 1929, Pardee Reservoir was built in the foothills of the Sierras to store and divert some of the seasonal streamflow of the Mokelumne into a 90-mile long aqueduct system across the Central Valley to the East Bay.

7-3

[1] MGD = Million gallons per day.

[2] HCG Pardee Project Team – Engineering and geotechnical team comprised of HDR Engineering Inc., Christensen Associates Inc., GEI Consultants, Inc. & specialty subconsultants.

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As population grew, two additional aqueducts were added, and Camanche Reservoir was constructed to increase the Mokelumne supply and provide flood control benefits. Today, approximately 95% of EBMUD's water supply comes from the Mokelumne system. The balance stems from local runoff into five terminal reservoirs located in the East Bay hills.

Today, EBMUD's water supply is insufficient to meet customer needs during droughts despite aggressive water conservation and recycling programs.

As part of its WSMP, EBMUD has explored a wide range of options to improve drought security and meet future needs. In 1993, enlargement of Pardee Reservoir was included as a component of "Composite Program V", one of six program alternatives, evaluated in the WSMP EIR. The Pardee enlargement concept was based on previous studies of enlarging Pardee carried out for EBMUD by Kaiser-Calpine in 1991. The Pardee surface storage component involved increasing the capacity of the reservoir some 150 TAF by raising the maximum storage elevation some 57 ft..

The Board of Directors decided to pursue a preferred program that included groundwater storage/conjunctive use (i.e. Composite Program II) because this alternative was considered to be environmentally superior. Regarding Composite Program V, it was concluded that:

> *Composite Program V would have a number of operational advantages to the District, and it would maintain the District's all-Mokelumne water source. There would be a number of known environmental impacts including periodic inundation of two acres of wetlands and a stretch of free-flowing river upstream which includes a section of whitewater. It would be in the mid-range of costs.*

In 1995, following a lack of progress in implementing the groundwater option, EBMUD Board adopted Motion 192-95, which directed staff to take a number of actions related to updating the WSMP Action Plan. The updated plan focused on four supplemental water supply options:

1. Folsom South Canal Connection to the American River.
2. San Joaquin County Conjunctive-Use.
3. Sacramento Conjunctive-Use.
4. Surface Storage

Following further studies of these options the District decided to also pursue a Joint-American River Diversion Project in partnership with the City and County of Sacramento. The project entails diverting water from the American River, near its confluence with the Sacramento River to an enlarged Fairbairn Treatment Plant. Additional water for the County would be delivered from the treatment plant via their existing distribution system. Water for EBMUD would be pumped through a new pipeline to the Folsom South Canal and be delivered to the Mokelumne Aqueduct via a new connection between the terminus of the canal and the aqueduct system. A draft EIS/EIR[3] for the Supplemental Water Supply Project was issued in November 1997 and discussions with government agencies and stakeholders are in progress.

In 1997, investigations of enlarging Pardee Reservoir were suspended following progress reached in negotiating agreements needed to implement the Joint-Project. Enlarging Pardee Reservoir remains a resource option for meeting the District's future needs.

WATER NEEDS

As the 21st century approaches EBMUD faces the challenge of maintaining a reliable supply of high quality water for its customers in an era of intense competition for water supplies to meet human and ecosystem needs.

EBMUD's current supply is insufficient to meet customer needs in droughts despite water conservation and recycling programs. During the most recent 1987 – 1992 drought, the District's customers were subject to water restrictions each year. Without additional supplies, water supply

[3] EIS/EIR Joint Environmental Impact Statement and Environmental Impact Report

restrictions are expected to occur more frequently in the future.

Over the next 20 years, the population within EBMUD's service area and associated demand for water are expected to increase, although rates of increase are expected to be lower than in the past due to aggressive demand management programs. Normalized[4] average demand for water is projected to increase from a 1990 level of 220 MGD to 250 MGD in the year 2020. This represents an average annual growth rate of 0.4%.

With proposed WSMP water conservation and reclamation programs in place the net demand is forecast to be 228 MGD in year 2020.

PARDEE FACILITY

Pardee Reservoir (shown on Exhibit S-1) has a total storage capacity of about 198 TAF and covers a surface area of about 2250 acres. The reservoir comprises three main arms. The east arm extends about 8 miles up the Mokelumne River Canyon. The North and South Arms are each about 2 miles long. The reservoir was impounded by construction of Pardee Dam, a 350 ft. high concrete curved gravity dam sited in a narrow canyon. A separate uncontrolled spillway structure located south of the dam discharges flood flows to the Mokelumne River via Mexican Gulch.

The District diverts water from the South Arm through a concrete intake tower into Pardee Tunnel which carries water two miles southwest to the head of the Mokelumne aqueduct pipelines at Campo Seco. A lakeshore recreation facility with boat ramp and marina is located at the head of the North Arm. Body contact recreation is prohibited to protect water quality.

Camanche Reservoir, located just downstream of Pardee, is larger than Pardee and is operated in conjunction with Pardee to meet flood control requirements, and required flow releases to the lower Mokelumne River. Constructed in 1964, Camanche has a capacity of 417 TAF and covers a surface area of about 7620 acres.

EBMUD operates the Pardee-Camanche Reservoir system to provide a dependable high quality water supply, provide downstream flood protection, manage water quality, accommodate water recreation and to sustain flows in the Lower Mokelumne River.

ALTERNATIVES INVESTIGATED

Initially HCG re-evaluated the concept of enlarging Pardee Reservoir by raising the height of Pardee Dam. HCG explored the feasibility of enlarging the Reservoir from its present capacity of 198 TAF to a size in the range of 350 TAF to 540 TAF.

ENTRIX, the District's environmental consultant, compiled a preliminary inventory of natural and cultural resources in the potential inundation area up to El. 675 ft. These studies confirmed that the most significant environmental constraints were potential loss of the Electra whitewater run on the Mokelumne River upstream of the Highway 49 Bridge, and inundation of Wildermuth House - a cultural resources site near the South Arm of the reservoir.

Preliminary engineering and geotechnical studies identified significant constructibility and cost issues related to raising Pardee Dam. Geotechnical investigations of the area immediately downstream of the dam and spillway indicated that deep excavation to sound rock would be required to provide an adequate foundation for raising and extending the dam. This created concerns about constructibility, additional costs to stabilize the dam and spillway during construction, and impacts of temporary reservoir drawdown during construction on the District's water supply.

HCG developed an innovative solution that addresses these issues as follows:

- ***Replacement Dam*** - Replacing the present dam with a structure located ¾ mile downstream of the present dam at the upstream end of Camanche Reservoir. This reduces the elevation

[4] Normalized demand is the projected demand of customers based upon water use prior to the 1987-1992 drought.

of the raised reservoir water surface by utilizing the storage capacity of the river canyon between Pardee Dam and Camanche Reservoir. It was also concluded that replacing the dam will reduce construction contingencies and operation risks.

- *Modified Reservoir Operations Plan* - A new plan for operating Pardee and Camanche Reservoirs was developed. The total storage capacity of the system will be increased by creating both additional water supply and flood control storage in Pardee Reservoir and reallocating some Camanche flood control storage to water supply. This further reduces the maximum water level of Pardee during summer.

The proposed reservoir enlargement will have a maximum water supply level of El. 601 ft. which will be 33 ft. higher than the present level and will not impact summer use of the Electra whitewater run. During infrequent winter and spring floods, the maximum reservoir water level will reach a maximum level of El. 614 ft. providing downstream flood control benefits.

Preliminary cost comparisons of either replacing or raising Pardee Dam indicated that replacing the dam will be slightly less expensive on a cost per acre-ft storage basis than raising it.

PROPOSED ENLARGEMENT

The proposed design concept is described below. The overall project layout is shown on Exhibit S-1 and key data are summarized on the Project Data Sheet attached to this summary

- *Pardee Dam & Spillway* - Pardee dam and spillway will be replaced with a 42 ft. higher (i.e. Crest El. 617 ft. vs. El 575 ft.) concrete dam and spillway to be constructed about ¾ of a mile downstream of the existing dam. The existing dam will be breached to allow free water passage.
- *Saddle Dams* - To contain the enlarged reservoir two saddle dams will be constructed on the reservoir perimeter to the North of the main dam. Two saddle dams will also be constructed on the divide between the Mokelumne and Jackson Creek.
- *Intake Tower* - The existing Pardee water intake tower will be strengthened and raised to service the larger reservoir.
- *Pardee Tunnel* The tunnel will be refurbished as part of the enlargement project and a new underground water pressure control facility will be constructed to regulate water pressure in the Mokelumne aqueduct system.
- *Hydro Powerplant* - Pardee powerhouse will be replaced by a new facility constructed at the toe of the larger dam. Existing overhead power transmission lines will be relocated and a new access road will be constructed down a gulch on the south side of the River.
- *Roads & Bridges* Pardee Dam Road and Stoney Creek Road will be relocated west around the new reservoir shoreline.
  At the upstream end of the reservoir, the Highway 49 bridge crossing will be replaced with a new higher structure located adjacent to the present bridge. Middle Bar Bridge, which is closed to traffic due to structural deterioration, will be removed. Turn-around areas at the ends of Gwin Mine and Middle Bar Roads at the reservoir will be improved.
- *Pardee Recreation Area* - Pardee recreation and boating facilities will be relocated above the new shoreline of the reservoir.

ENVIRONMENTAL IMPACTS

Preliminary environmental studies have identified the following potential impacts, all of which appear to be mitigable to less-than-significant level.

- Periodic inundation of up to 1 mile of the Mokelumne river channel during summer and infrequent inundation of up to an additional ½ mile during winter/spring floods. *Summer use of the Electra whitewater run will be protected by maintaining water levels below El. 601 ft. Potential impacts to fish habitat and riparian vegetation will be mitigated by enhancement of on-site or off-site resources.*
- Periodic inundation of about 77 acres of special plant communities. *This will be mitigated by enhancement of on-site or off-site resources.*
- Middle Bar Bridge, which is used for fishing, will be inundated. *The bridge will be removed,*

and as mitigation, a fishing pier will be constructed near the head of the reservoir.

- A number of eligible cultural resources sites will be inundated. *Mitigation measures such as data recovery, research, excavation & consultation with Native American groups will be implemented.*
- Recreation opportunities on the reservoir will increase. *New recreation facilities and opportunities will be provided.*

BENEFITS

The primary benefit of the proposed project will be the addition of 172 TAF of water supply storage. Pursuant to the gainsharing provision of the Lower Mokelumne River Joint Settlement Agreement, it has been assumed that 20 TAF of Pardee storage will be reserved for enhancement of low flow in the lower Mokelumne River during droughts.

Additional reservoir capacity will also bring water quality benefits. It will improve the reservoir's function as a large settling basin that reduces suspended solids and turbidity in inflow from the Mokelumne River. For example, in 1996 during the January storms, water supply from Pardee Reservoir was shutdown for over 60 days due to high turbidity.

Additional capacity and depth will also enhance the reservoir's function as an "ice-box" that stores cold winter and spring runoff for release through Camanche into the Lower Mokelumne River during summer and fall to benefit the downstream fishery.

Higher reservoir levels and control of water pressure at the upstream end of the Mokelumne aqueduct will improve gravity flow and reduce energy used periodically at Walnut Creek Pumping Plant to boost water delivery. Average annual energy generation from Pardee Powerhouse will increase from 83 GWh/yr. to an estimated 102 GWh/yr. resulting in additional revenue to offset project costs.

The new spillway configuration will improve flood control operation by giving better control of Pardee storage operations during floods.

The project will also provide additional recreation opportunities including a new lakeside recreation facility that will provide for anticipated increases in fishing and boating use of the larger reservoir.

COSTS

A summary of the estimated project cost[5] of enlarging Pardee Reservoir at December 1997 price levels is given in the following table.

PROJECT COST ESTIMATE
(1997$M)

ITEM	COST
Land Purchase	3.0
Reservoir Clearing/Recreation Facs	4.1
Roads/Bridges	8.7
Dams	131.4
Intakes	11.8
Penstock	2.8
Hydro Powerhouse	16.9
Subtotal	**178.6**
Engineering & Administration	35.7
Other Mitigation	3.6
Contingency	43.6
TOTAL	**261.5**
Unit cost of storage ($/ac-ft)	*$1,520*

The estimated cost of enlarging Pardee Reservoir is comparable to that previously used in the WSMP process. In 1992, the estimated unit capital cost of an additional 150 TAF of Pardee storage was $204-million or $1360/ac-ft which is equivalent to $1520/ac-ft at December 1997 price levels.

Replacing the 70 year old Pardee dam, spillway and powerhouse and refurbishing the intake tower and tunnel will renew the facility and will avoid

[5] The total cash cost of building the project in 1997 dollars including project construction, engineering, & administration costs and contingency allowances but excluding interest during construction, future inflation of prices and project financing costs.

future costs of rehabilitation to comply with modern regulatory and dam safety standards. For example, rehabilitating the present spillway is estimated to cost about $12-million and seismic strengthening of the existing intake tower and repair of the tunnel may cost about $5-million.

IMPLEMENTATION

HCG estimates that the earliest this option could be operational is within 6½ years. Permitting and other preparatory activities will take at least 3 years, followed by an estimated 3½-year construction period.

The main schedule risk is uncertainty of the time needed for permitting. The three years shown for permitting and regulatory approvals on the schedule below is based on the assumption that permitting will be expedited by negotiating settlement agreements with resource agencies and principal stakeholders during preparation of joint NEPA/CEQA[6] documentation.

Given the current statewide focus on the CALFED[7] Bay-Delta process, permitting of the project may be facilitated by formulating it as part of an overall solution to improving the Lower Mokelumne River/Sacramento-San Joaquin Delta ecosystem. Such a partnership project will involve refining the project design to best meet multiple goals, and developing participation agreements with other potential beneficiaries.

It should be noted that through ownership of Pardee Reservoir and much of the surrounding land, the District already has acquired a majority of the land rights needed for enlarging this facility. This helps to assure the District's future control of this resource.

The length of the construction period will be affected by the contracting approach, weather and Mokelumne streamflow conditions. Under an expedited construction program with favorable weather/streamflow conditions this period could be reduced by up to one year.

RECOMMENDATION

Enlarging Pardee Reservoir provides the District with a unique and valuable option for improving the reliability of its high quality Mokelumne water supply. However, there are risks in delaying this option. Potential exposure includes effects of changes in laws, permitting procedures, or new environmental constraints such as endangered species or wild & scenic river listings.

HCG recommends that the District endeavor to preserve and enhance the option of enlarging Pardee Reservoir in the future through the following six actions:

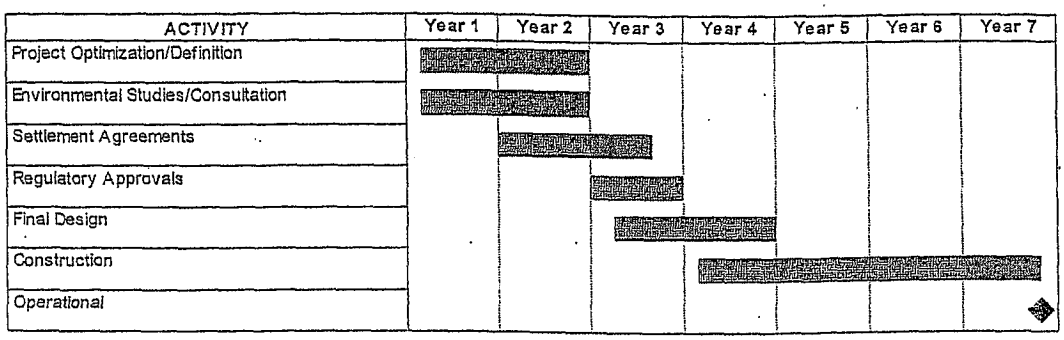
1. Maintain enlarging Pardee Reservoir as a viable water supply development option in the District's ongoing resource planning program.
2. Further explore the potential for permitting and future implementation of this option as part of a regional solution.
3. Complete the detailed inventory of biological, recreational and cultural resources in the project area.
4. Review water rights and develop a plan for maintaining Mokelumne entitlements.
5. Acquire property rights needed for construction of the downstream alternative.
6. Continue to monitor and participate in proceedings related to:
   - Land rights and use.
   - Water rights
   - Licensing of the Middle Bar Project.
   - PG&E's Mokelumne Project
   - Changes in Federal, State and Local laws, regulations or specific listings that may impact future implementation.
   - Bay-Delta Process and potential opportunities for co-implementing surface-storage projects.

[6] NEPA/CEQA National Environmental Policy Act/California Environmental Quality Act

[7] CALFED A task force of Federal and State regulatory agencies.

- Other related projects or proceedings.

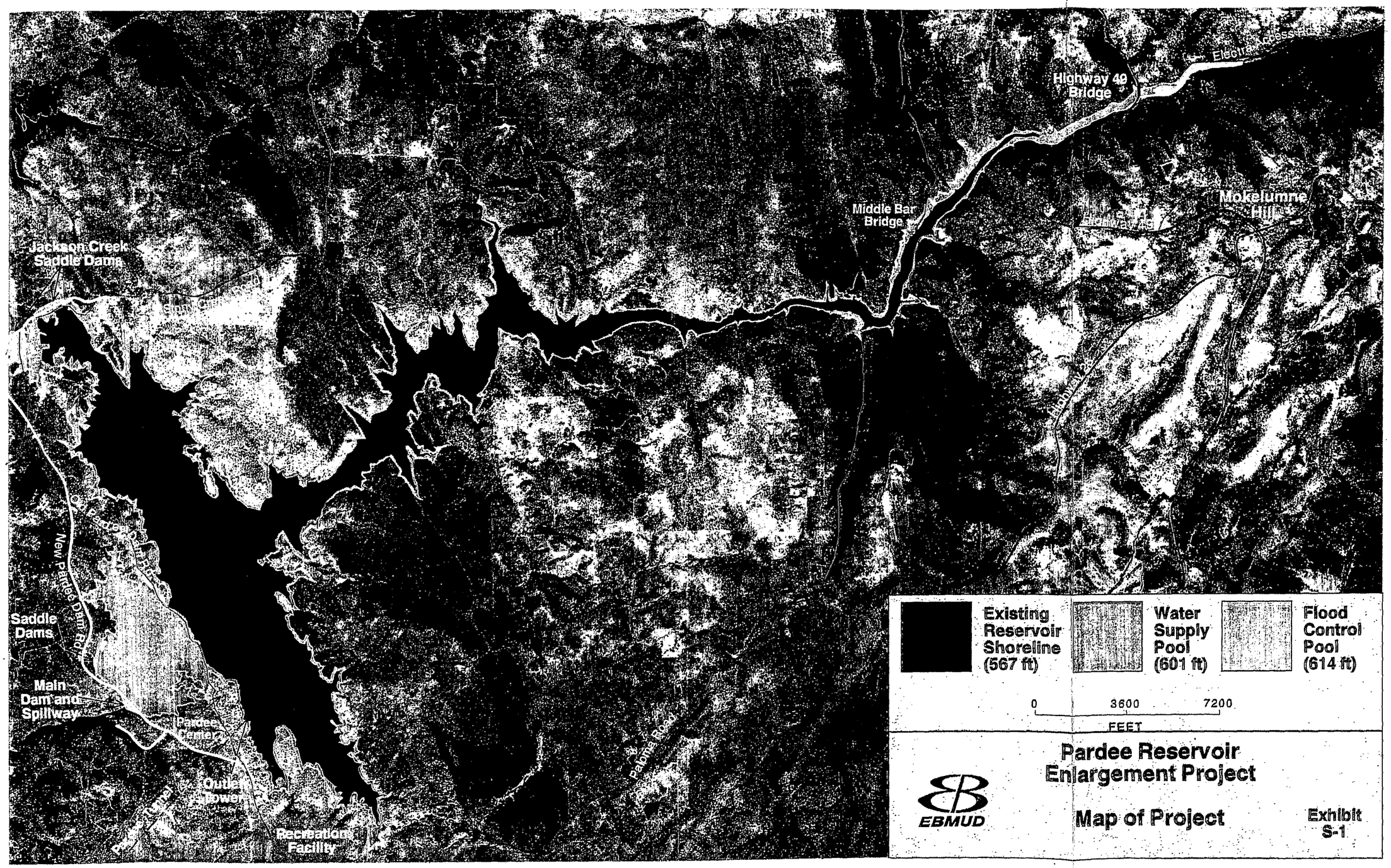
PROJECT SCHEDULE



RECOMMENDED PARDEE RESERVOIR ENLARGEMENT PROJECT

PROJECT DATA SHEET

FACILITY	UNITS	EXISTING RESERVOIR	ENLARGED RESERVOIR
RESERVOIR			
Top of Water Supply Pool	Ft.	568	601
Reservoir Area	Ac.	2250	3180
Gross Storage	TAF	198	326
Top of Flood Control Pool	Ft.	568	614
Reservoir Area	Ac.	2250	3480
Gross Storage	TAF	198	370
MAIN DAM			
Type		Curved Gravity Concrete	Gravity RCC
Crest Elevation	Ft.	580	617
Structural Height	Ft.	350	402
Length	Ft.	1330	1970
SPILLWAY			
Type		Uncontrolled	Gated
Total Length	Ft.	800	148
Capacity @ PMF	Cfs	175,000	163,700
SADDLE DAMS			
Number		1	4
Type		Conc. Gravity & Embankment	Zoned Earth/Rock Embankment
Maximum Height	Ft.	37	110
Total Length	Ft.	1360	4100
WATER SUPPLY INTAKE			
Intake		Tower/shaft	Raised Tower/Shaft
Height		193	228
Tunnel		Concrete Lined Horseshoe	Existing Tunnel Refurbished
Diameter	Ft.	8	8
Length	Ft.	10,800	10,800
POWERHOUSE			
Number of Units		3	2
Total Capacity	Mw	28.6	30
Average Annual Generation	GWh	83	102



EBMUD

Pardee Reservoir Enlargement Project

Map of Project

Exhibit S-1

Produced 04/28/98