State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
Division of Planning

LOS BANOS GRANDES FACILITIES FORMULATION STUDIES

MEMORANDUM REPORT

November 1989

D-054112

D-054112

State of California | The Resources Agency

Memorandum

Date : December 27, 1989

To : Kathlin Johnson
John Silveira

From : Steve Yaeger
Department of Water Resources

Subject: Los Banos Grandes Formulation Studies

Attached is the formulation studies memorandum report for the Los Banos Grandes Facilities. The comparative economic analysis is presented which formed the basis for our recommendation for project formulation. Supporting information for the investigations of alternative sizing and development has been provided by the following divisions:

Division of Planning provided operation simiulation studies of the SWP and LBG Facilities, estimates of yield, estimates of comparative costs of alternative developments, and benefit analysis using the economic risk model (main participants were Jake Holderman, Sina Darabzand, Ray Hoagland, and Steve Cowdin).

Division of Design and Construction provided feasibility level designs and cost estimates for several alternative plan combinations.

Division of Land and Right of Way provided mapping and cost estimates for reservoir land acquisition and utility relocation.

Division of Operation and Maintenance provided estimates of energy requirements and resources, estimates of monitary unit values for energy, and annual cost of operation and maintenance of LBG Facilities.

The report recommends that future studies emphasizing water operation for the SWP exclusively (with only incidental power) focus on a Los Banos Grandes Reservoir in the range of 1.73 maf with a pumping plant capacity of 3500 cfs. The basis of this recommendation is discussed in Chapter II. Further studies of a utility-participation pumped-storage power development project are in progress, which could have an effect on the installed capacity of the LBG plant.

SURNAME	Steve Yaeger			

DWR 155 (Rev. 2/86)

Los Banos Grandes
Project Formulation Studies

D-054114

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I. Introduction

The Los Banos Grandes Offstream Storage Facilities (LBG) are proposed facilities of the State Water Project (SWP). These facilities were authorized by the Legislature in AB 3792. Storage south of the Delta is an attractive addition to the SWP because it allows SWP water supply reliability to be enhanced without increasing Delta diversions during periods of time that are the most critical to the Delta fishery.

LBG sizing studies performed by the State Water Project Facilities Planning Branch in 1985 and 1986 focused on the most cost-effective reservoir size from a unit cost of yield viewpoint. Those studies determined that a LBG reservoir in the range of capacities between 1.0 and 1.5 million acre-feet "would provide either firm new yield or average annual deliveries at the least unit cost for the SWP." [1/] Planning activities were directed toward a reservoir size of 1.25 MAF, chosen because that size provided the lowest unit cost of water for that study. While a low unit cost of yield is always a goal of any facility sizing study, choosing the facility size that provides the lowest unit cost of yield may lead to an ineffective use of resources since this technique leaves a volume of water undeveloped which can provide benefits in excess of the cost of developing that volume. A more effective use of resources is achieved by the traditional approach of choosing the facility size that maximizes net benefits (composite benefits less net capitalized cost). This criteria ensures that a site is developed to its maximum potential by sizing the reservoir such that the cost of the last incremental acre-foot of water developed just equals the benefit derived from that increment of water.

The series of sizing studies discussed in this report were undertaken with the goal of examining the range of LBG reservoir sizes above 1.25 MAF to determine the reservoir size which maximizes net benefits and fully develops the water supply benefits of the site.

Traditional cost estimating and economic analysis techniques were employed in determining net capitalized cost. Economic benefits of the alternative sizes were evaluated using DWR's Economic Risk Model (ERM) developed by the Division of Planning. Both of these techniques are described in detail in Section IV of this report.

1/ Los Banos Grandes Investigation - Progress Report on Project Formulation and Sizing Studies, Walling, June 1986.

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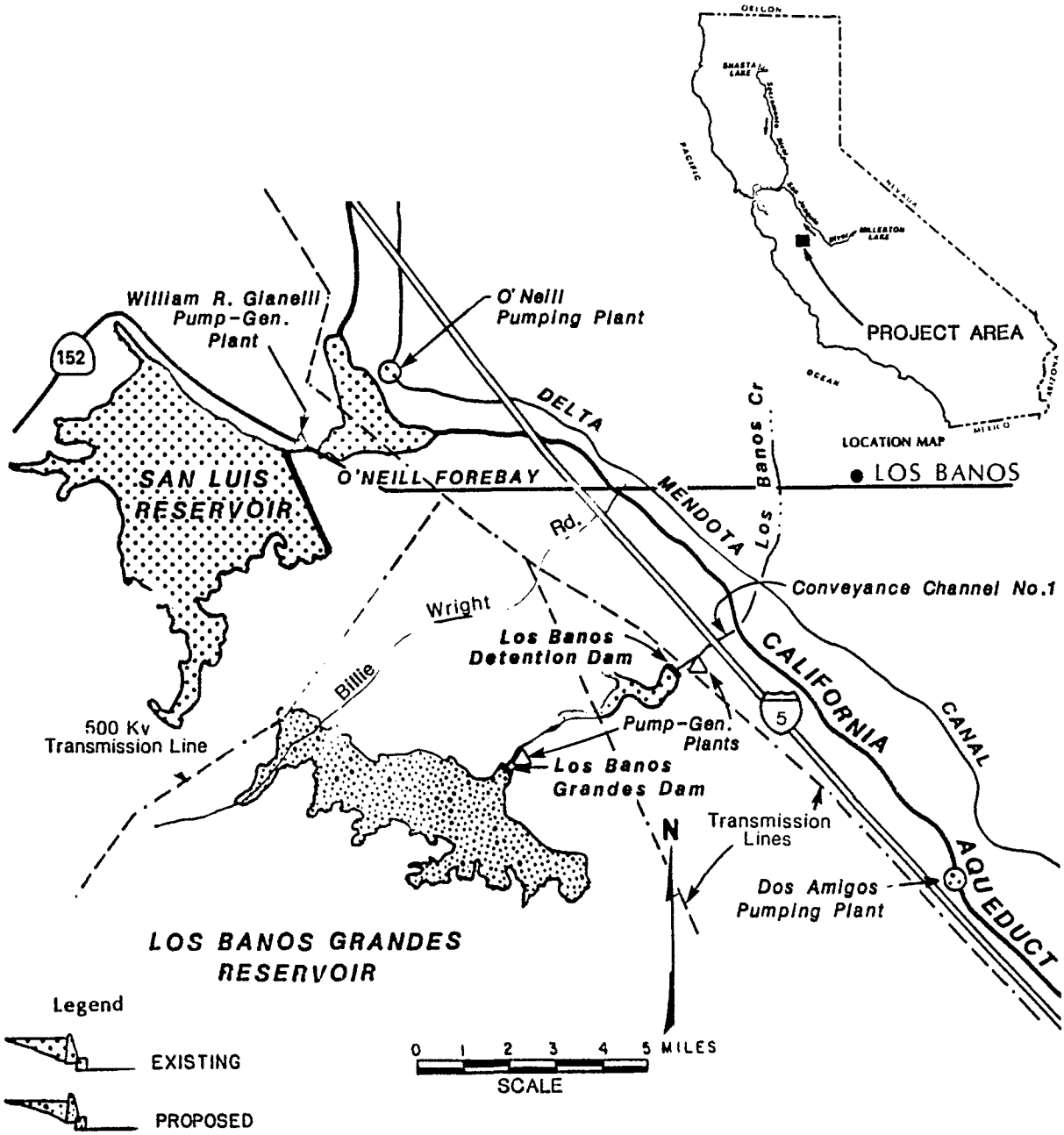
Figure I-1. LOS BANOS GRANDES FACILITIES LOCATION



II. Findings

1. The water supply accomplishments of LBG facilities are heavily dependent on the construction of South Delta Improvements (SDI) and the consequent increased Banks Pumping Plant capabilities which will be available when present permits are modified. Without SDI, winter diversions to LBG are restricted to an extent that the full water supply accomplishments of LBG are not realized. Consequently, the analysis presented herein assumes that SDI have been constructed and that Banks Pumping Plant can divert up to 10,300 cfs except when D-1485 standards or DWR commitments preclude that rate.

2. The average annual diversion of surplus winter Delta flows to LBG is highly dependent upon the assumptions made in the operation studies performed - which used SWRCB Decision D-1485 criteria. Any significant revisions in diversion criteria at Banks Pumping Plant and/or Delta water quality standards may require reanalysis of LBG water supply accomplishments.

3. The water supply accomplishments of LBG Facilities are dependent upon the interrelationships of three factors:

   a. The availability, frequency, and distribution of uncontrolled surplus winter flows in the Delta above and beyond that which can be diverted with existing SWP facilities;

   b. The availability, frequency, and distribution of Banks Pumping Plant Capacity above and beyond that which can be diverted with existing SWP facilities; and

   c. The magnitude of Pumping/Generating Plant capacity available at LBG.

4. Given the unpredictable nature of winter surplus Delta outflows (SDO) and a projected 10,300 cfs maximum Banks pumping capacity once present permits are revised, the incremental average annual SDO which can be pumped to offstream storage (divertable SDO) increases uniformly with increasing LBG plant capacity up to a plant capacity of about 3,500 cfs. Thereafter, incremental divertable SDO decreases until it approaches zero near 5,500 cfs plant capacity. Consequently, average annual water supply accomplishments of LBG exhibit diminishing returns as LBG plant capacity exceeds 3,500 cfs. Average annual water supply accomplishments increase very little with increasing plant capacity once 5,500 cfs is exceeded.

5. The SWP water supply benefits which can be attributed to LBG is constrained by 1) the physical and operational attributes of the LBG facilities; 2) the demand level which is assumed

as the maximum SWP target delivery; 3) the staging of new SWP facilities such as Kern Water Bank and North Delta Facilities (NDF); and 4) the remaining conveyance capacity of Banks Pumping Plant and reaches 1 through 12 of the California Aqueduct. The interrelationship between the staging of NDF and the assumed maximum SWP target delivery level is particularly important. If LBG is staged before NDF at target delivery levels of 4.2 MAF or lower, the average annual LBG yield is higher. This follows from the fact that full demands are met in about 28 percent of the years in the 57-year historic sequence at a 4.2 MAF demand level with the SWP configured with full Through Delta Facilities and a 1.0 MAF Kern Water Bank. This falls to 19% when the SWP is configured without full Through Delta Facilities -with South Delta Improvements and Kern Water Bank only. The additional years that are available for LBG to contribute toward meeting full demands increases the average annual yield attributable to the project.

6. First cost of LBG facilities increases linearly with reservoir size. The estimated first cost of the 1.73 MAF reservoir with a pumping capacity of 3,500 cfs is $662 million. First cost of the 2.3 MAF reservoir with 3500 cfs pumping plant capacity is estimated to be $753 million.

7. Net benefits to the SWP Water Contractors from the LBG facilities (benefits less net capitalized cost) when staged after NDF increase with added reservoir storage between reservoir sizes of 1.19 and 1.75 MAF and level out thereafter up to a reservoir size of 2.3maf. This indicates that the incremental benefits derived from reservoirs larger than 1.75 MAF just equal the incremental cost of the additional storage. It should be noted that this net benefits curve is unique to a SWP configured with new facilities consisting of full Through Delta Facilities, a 1.0 MAF Kern Water Bank, and LBG Facilities.

8. When LBG is staged before NDF, net benefits to the SWP Contractors also increase with added reservoir storage in the range of reservoir sizes between 1.19 and 1.75 MAF. However, the slope of this net benefits curve becomes slightly negative after a reservoir size of 1.75 MAF is surpassed, indicating that there are not substantual marginal benefits to a reservoir size greater than 1.75 MAF with the assumed SWP configuration - the existing SWP system with new facilities consisting of SDI, 1.0 maf KWB, and LBG.

III. Recommendations

1. An analysis of a range of P/G plant capacities from several approaches - yield, net benefits as a function of pumping plant capacity, recovery energy, and operational considerations - leads to a recommendation that a P/G plant with nominal pumping capacity in the range of 3500 cfs at design head be constructed at LBG P/G plants 1 and 2 (the corresponding design capacity in the generating mode would be about 4,650 cfs).

2. LBG Facilities should be formulated with a 1.73 MAF reservoir and 3,500 cfs P/G Plant capacity. This recommendation is appropriate for the following combination of new SWP facilities:

   a. 1.0 MAF Kern Fan Element of the Kern Water Bank
   b. South Delta Improvements
   c. North Delta Facilities
   d. Los Banos Grandes Facilities

3. Should the Kern Fan Element of the Kern Water Bank be delayed so that those facilities would be constructed after LBG, further investigation should be made into constructing larger LBG facilities in order to maximize net benefits to the SWP contractors.

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IV. Criteria for Comparison of Alternatives

These economic analyses were undertaken with two goals:

1. To determine the range of reservoir sizes which are economically justifiable, and

2. To determine the reservoir size which provides maximum net benefits to the SWP.

General

To be economically justified, 1) the economic benefits which result from the offstream storage program must exceed the total economic costs, and 2) the benefits from each project purpose must at least equal its separable costs. Preliminary to the inquiry into economic justification, economic benefits and economic costs were developed for a range of reservoir sizes between 1.19 MAF and 2.3 MAF as an aid to determining the appropriate reservoir capacity. Previous studies have determined that reservoir sizes of 1.0 MAF or less have marginal economic utility. In the remainder of this section, the procedures used to develop these costs and benefits will be discussed in more detail.

Economic Costs

Each alternative LBG plan investigated included: (1) a specified size of LBG Reservoir; (2) a selected conveyance capacity; and (3) a selected operation mode for pumping-generating plant operation (i.e., continuous operation or peaking operation). In these present studies, all alternative reservoirs were operated to simulate the current SWP Water Delivery Risk Analysis operation mode for determination of water supply accomplishments. A range of pumping capacities between 2250 cfs and 5600 cfs was examined in combination with reservoir sizes ranging from 1.19 MAF to 2.3 MAF. The rationale for selecting these conveyance and storage ranges is discussed in detail in Section VI.

Summary sheets identifying the elements of cost analysis for each of the alternative plans are contained in Appendix A. All costs estimated for construction, operation, maintenance, and replacement costs are at 1988 prices. Present-worth values for future costs, power revenues and water yield accomplishments are referenced to the initial year of project operation, using a discount rate of 6 percent per year and a 50-year period of analysis. Pumping energy rates and recovery energy revenue rates were escalated for projected energy value which exceeds general inflation for the 50-year service life using recent Department of Energy projections of future energy rates. The Department's current policy on the appropriate discount rate for economic analysis, including cost-effectiveness analysis, is set forth in two memoranda which are reproduced in Appendix A. As noted, this policy is subject to annual review and revision.

The economic cost of each of the alternative reservoir sizes compared in this analysis was calculated as the sum of the following component costs:

1. Present worth of capital costs (indexed to the date of initial water delivery), composed of the following cost items:

    a. Contract costs - 1988 (September) Cost Index
    b. Design and construction supervision costs
    c. Operation and maintenance costs during construction and start-up
    d. Planning costs
    e. Right of way and relocations costs
    f. Operating (energy) costs during initial reservoir fill period
    g. Mitigation costs (order of magnitude estimates)

2. Present Worth of Annual Operating Costs and Power Revenues:

    a. Fixed O&M costs
    b. Replacement costs
    c. Variable pumping electrical costs
    d. Value of net generation energy lost at Oroville and San Luis due to LBG operations (as a result of lower heads at Oroville and more efficient peaking of generation at San Luis)
    e. Less a deduction for revenue from power generation at LBG Plant Nos. 1 and 2

Wildlife mitigation plans and costs for wildlife, botanical, and cultural resources are still being developed at this time. However, it is known that the bulk of mitigation costs are incurred at reservoir sizes less than 1.19 MAF. In addition, the preliminary analyses completed to date indicate that mitigation costs for reservoir sizes 1.19 MAF to 2.3 MAF vary only slightly with increasing reservoir size. Therefore, only estimated incremental mitigation costs have been considered in comparing alternatives in the 1.19 MAF to 2.3 MAF range.

The present worth of capital costs and annual costs to the time of initial water delivery are detailed in Appendix Tables A1 through A14. Annual operating costs and revenues for the various alternative reservoir sizes are detailed in Appendix Tables A1a through A14a.

Contract costs and annual costs for the 1.19 MAF (formerly 1.25 MAF) reservoir size [1/] and the 1.73 MAF reservoir size [1/] were taken from cost estimates prepared by Design and Construction in November 1988. Cost curves for the various project components

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1/ Revised Area-Capacity Curves reduced former 1.25 MAF to 1.19 MAF and former 1.8 MAF to 1.73 MAF.

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were developed from these D&C estimates for a full range of reservoir sizes from 1.19 MAF to 2.3 MAF and for pumping/ generating plant capacities varying between 2250 cfs/3000 cfs and 4500 cfs/ 6000 cfs (5600 cfs/7400 cfs for the 1.7 MAF reservoir). Reservoir sizes less than 1.19 MAF were not investigated in this analysis since studies performed in 1986 indicated that sizes equal to or greater than 1.19 MAF are the most cost-effective reservoir sizes. Contract costs for the 1.19 MAF, 1.6 MAF, 1.73 MAF, 1.8 MAF, 2.0 MAF, and 2.3 MAF reservoir sizes were developed from these curves for three separate pumping/generating plant capacities--2250 cfs/3000 cfs, 3500 cfs/4350 cfs and 4500 cfs/6000 cfs (5600 cfs/ 7450 cfs for the 1.7 MAF size). All capacities quoted are nominal pumping/ generating capacities at design head.

Planning costs, right of way costs, and O&M and replacement costs were taken from estimates made by the DWR Divisions of Planning, Land and Right of Way, and Operations and Maintenance, respectively. Quantities of electrical power and energy consumed and generated were taken from power studies performed by O&M's Project Operations Studies Branch. Costs and revenues associated with those energy quantities were calculated using the year by year unit costs for on-peak and off-peak energy and capacity provided by the Energy Division (see Appendix A).

A summary of economic costs for the various reservoir sizes which were examined is presented in Table VI-3.

Economic Benefits

Relative economic benefits for each of the alternative reservoir sizes were developed using DOP's Economic Risk Model. This model operates on a 57-year delivery schedule produced from an operation study run on DWRSIM for the 57-year historic hydrology, simulated to produce year-by-year delivery schedules for the SWP configured with a selected LBG reservoir size.

The Economic Risk Model (ERM) was developed to evaluate the economic benefits of additional development of the SWP. The model is designed to evaluate the economic consequences of changes in the year-to-year availability of water supplies. This eliminates the need to rely on summary quantities such as firm or average yield which do not convey important information about costs to water users which result from variation in deliveries. The model can use operations studies based on historical record hydrology or on synthetically-generated hydrology.

Because shortage management is the focus of this approach, the model measures benefits by estimating the ability of the facilities being evaluated to mitigate local costs and losses associated with a shortage. To do this, assumptions about the long-term and contingency shortage management strategies which would be employed by the SWP service areas are incorporated in the model along with estimates of the costs and effectiveness of these

measures. Conservation measures are employed as the first measure of shortage management and an assessment made of the ability to meet water demands with the conservation measures imposed before further shortage management measures are employed.

Economic losses which cannot be avoided by shortage management measures are quantified by the use of a parabolic loss function. The basis for the use of this function is the assumption that the value of an increment of water increases as the shortfall becomes larger. This follows from the fact that (1) the uses of water which are curtailed first tend to be those which would result in the least damage or inconvenience and (2) the uses which are the last to be curtailed are orders of magnitude greater in value than those to be curtailed first. A residential user survey recently prepared by the State Water Contractors (SWC) for the Bay-Delta Hearing and presented as SWC Exhibit No. 51, "Economic Value of Reliable Water Supplies", was used to verify the reasonableness of the economic loss function.

The model accounts for the value of deliveries greater than current consumptive needs from both the SWP and Colorado River system. If storage capacity exists in the M&I Contractors' distribution systems, it allows the "excess" deliveries to be stored to reduce the economic impact of future shortages. The model also accounts for costs associated with any ground water banking or reservoir carry-over storage programs. Current contractor distribution system storage and planned banking, terminal reservoir storage, and water transfer programs are operated on an annual basis by the ERM as part of the shortage management program.

The model was designed to: (1) compare alternative project operations, (2) show the integration of a proposed project in an overall water management plan, (3) show the value of "banking" programs, (4) look at the potential for extreme economic losses, and (5) test the sensitivity of results to changes in assumptions. The model currently evaluates benefits directly for urban uses in the South Coastal service area and for agricultural uses in SWP service areas in the San Joaquin Valley and in the South Coastal service area. The ERM currently assumes that benefits equal costs for all contractors listed in Table IV-2(b).

The output of the ERM consists of a tabulation of projected economic losses that would be experienced by the SWP South Coast M&I contractors and by the SWP San Joaquin and South Coastal agricultural water contractors, averaged over the 57-year historic hydrologic cycle for a specified demand level as a result of projected deliveries being less than projected demands. The expected annual operation costs to the M&I contractors are tabulated along with savings to Ag contractors from decreased SWP pumping costs. A sample of this output from the ERM is shown in Table IV-1 for a sample reservoir alternative study. This table illustrates how the economic benefit of the alternative size being studied is derived for the specified demand level. The difference

between the M&I contractors' economic loss in the base case (i.e., existing SWP facilities) and the loss with the study alternative is added to the difference between the Ag contractors' economic loss in the base case and the loss with the study alternative. Table IV-1 demonstrates how this data is used to produce a composite benefit for the reservoir size under investigation.

Table IV-1
Sample Economic Risk Model Output
(All values are $x1,000 on average annual basis)

Total Request = 4221.00 AG Request = 1248.00
MI Request = 2905.00 System Loss = 68.00 Supply Increment = 0

		w/LBG	w/o LBG	Difference (Benefit)
Expected M&I loss	=	119000.0	192139.0	73139.0
Expected cost of M&I operation	=	272863.0	259166.0	-13697.0
Expected AG loss	=	13420.0	23832.0	10412.0
Expected AG cost avoided	=	5053.0	8974.0	3921.0
			Total Annual Benefit	73775.0

To the combination of the M&I and Ag direct benefits adjustments are made for savings to the Ag contractors due to decreased SWP aqueduct use (Ag cost avoided). Further adjustments are made for the increased cost of SWP aqueduct use resulting from the incremental delivery of the alternative being studied, for the cost of recharging banked supplies (when a portion of the incremental delivery is devoted to banking), the cost of conservation programs and other water management programs, and for the cost of treating banked water once it is extracted for use as M&I water (difference between the M&I operation cost in the study compared to the base case). In summary, the economic benefit at the specified demand level of the study alternative, when compared to the base case, equals the combination of:

1. The M&I contractor economic loss which is avoided.
2. The Ag contractor economic loss which is avoided.
3. The cost of Ag contractor pumping energy for the incremental water supply (variable costs only).
4. The increased M&I contractor pumping energy cost (negative).
5. The cost which is avoided for M&I contractor programs for management of scarce supplies or developing alternative supplies.

Table IV-2(a)
Economic Risk Model Benefit Areas

Contracting Agencies Whose Benefits are
Calculated Directly by the Economic Risk Model (ERM)

Contracting Agency	Maximum SWP Entitlement (AF)
SAN JOAQUIN VALLEY AREA	
1. County of Kings	4,000
2. Devils Den Water District	12,700
3. Dudley Ridge Water District	57,700
4. Empire West Side Irrigation District	3,000
5. Kern County Water Agency	1,153,400
6. Oak Flat Water District	5,700
7. Tulare Lake Basin Water Storage District	118,500
Subtotal	1,355,000
SOUTH COASTAL AREA	
8. San Bernardino Valley Municipal Water District	102,600
9. San Gabriel Valley Municipal Water District	28,800
10. San Gorgonio Pass Water Agency	17,300*
11. The Metropolitan Water District of Southern California	2,011,500
12. Ventura County Flood Control District	20,000
13. Castaic Lake Water Agency	41,500
14. Crestline - Lake Arrowhead Water Agency	5,800
Subtotal	2,218,850
Total	3,573,850 (85%)

* Approximately one-half of Agency covered in ERM.

Table IV-2(b)
Economic Risk Model Benefit Areas (Cont.)

Contracting Agencies Whose Benefits are Calculated Indirectly by the Economic Risk Model

Contracting Agency	Maximum Annual Entitlement (AF)
UPPER FEATHER AREA	
1. City of Yuba City	9,600
2. County of Butte	27,500
3. Plumas County Flood Control and Water Conservation District	2,700
Subtotal	39,800
NORTH BAY AREA	
4. Napa County Flood Control and Water Conservation District	25,000
5. Solano County Flood Control and Water Conservation District	42,000
Subtotal	67,000
SOUTH BAY AREA	
6. Alameda County Flood Control and Water Conservation District, Zone 7	46,000
7. Alameda County Water District	42,000
8. Santa Clara Valley Water District	100,000
Subtotal	188,000
CENTRAL COAST AREA	
9. San Luis Obispo County Flood Control and Water Conservation District	25,000
10. Santa Barbara County Flood Control and Water Conservation District	45,486
Subtotal	70,486

Table IV-2(b) (Cont.)
Economic Risk Model Benefit Areas

Contracting Agencies Whose Benefits are Calculated Indirectly by the Economic Risk Model

Contracting Agency	Maximum Annual Entitlement (AF)
SOUTH COAST AREA	
11. Antelope Valley-East Kern Water Agency	138,400
12. Coachella Valley Water District	23,100
13. Desert Water Agency	38,100
14. Littlerock Creek Irrigation District	2,300
15. Mojave Water Agency	50,800
16. Palmdale Water District	17,300
17. San Gorgonio Pass Water Agency	17,300*
Subtotal	278,650
Total	643,936 (15%)

* Approximately one-half of Agency covered in ERM.

Thus derived, the economic benefit for an alternative reservoir size at a particular demand level (i.e., 4.2 MAF) must be combined with benefits at other levels, distributed throughout the 50-year period of analysis, and the present worth of the series taken to arrive at the worth of the benefits referenced to the date of initial deliveries from the reservoir. In this study we evaluated two demand levels, 4.2 MAF and 3.7 MAF. After an examination of entitlement requests from Bulletins 132-87 and 132-88 and Bulletin 160-87, the 3.7 MAF demand level was assigned to the date of initial deliveries (approximately 2002) and the 4.2 MAF demand level assigned to 2020. An exponential growth function was applied to the benefits in the years between 2002 and 2020. Benefits after 2020 were assumed to remain constant since the 4.2 MAF maximum entitlement has been reached. The benefit thus derived for an alternative reservoir size represents the benefits for 85 percent of the SWP entitlement requests, as is illustrated in Table IV-2. This represents the full entitlement requests from the SWP contractors who fall within the portions of the service area modeled by the ERM. The economic benefits to the remaining 15 percent of the contractors are taken by ERM as equal to their allocated cost for the alternative. Fully detailed worksheets of the benefit analysis can be found in Appendix A at the end of this report.

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V. Description of Alternatives

A range of reservoir sizes and pumping/generating plant capacities were analyzed for their economic cost and economic benefit. The pumping -generating plant capacity combinations and alternative designations are shown below:

Table V-1
Reservoir Sizes and Pumping/Generating Plant Capacities Investigated

	Alternative Number		
	Plant Capacity (cfs)*	Plant Capacity (cfs)*	Plant Capacity (cfs)*
(MAF)	2,250/3,000	3,500/4,650	4500/6000
1.19	1	2	-
1.60	3	4	-
1.7	-	-	5**
1.73	6	7	8
1.80	-	9	10
2.00	-	11	12
2.30	-	13	14

* Capacity shown as Pumping/Generating and P/G Plants 1 and 2 sized with equivalent capacity

** P/G Capacity 5600/7450 cfs

Table V-2
Base Data for
Alternative Reservoir Sizes

Alternative Nos.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pumping Plant Capacity														
2250 cfs	x		x			x								
3500 cfs		x		x			x		x		x		x	
4500 cfs								x		x		x		x
5600 cfs					x									
Reservoir Capacity (1,000 AF)	1190		1600		1728				1800		2000		2300	
Normal Water Surface Elev. (ft)	723		753		763				769		784		805	
Surface Area (acres)	11,270		12,474		12,870				13,070		13,700		14,580	
Height of Main Dam (ft)	374		404		414				420		435		456	
Volume of Main Dam (mill cu yd	9.9*		12.4*		13.2				13.8*		15.2*		17.3*	
Maximum Pump Lift from California Aqueduct (ft)	506		536		546				552		567		588	
Height of Salt Cr Saddle Dam (ft)	191		221		231				237		252		273	
Volume of Salt Cr Dam (mill cu yd)	7.9*		12.0*		13.4				14.2*		16.2*		19.2*	
Volume of Other Saddle Dams (mill cu yds)	NIL		0.4*		0.6				0.8		1.3*		2.0*	

* Interpolated Estimates

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Major structural components of the LBG alternative plans are listed as follows:

Dam and Reservoir

(a) Main Dam
(b) Saddle Dams
(c) Spillway
(d) Outlet Facilities (Outlet facility requirements will vary with reservoir size and conveyance plans.)
(e) Reservoir Clearing and Preparation
(f) Road Construction and Relocation
(g) Land and Right of Way Acquisition
(h) Utility Relocation

Conveyance System

(a) Conveyance Canal No. 1 (below the existing Los Banos Detention; includes connection facility to California Aqueduct and crossing at Interstate 5).

(b) Pumping-Generating Plant No. 1 (plant and waterways)

(c) Modifications to the existing Los Banos Detention Dam Spillway (required in case of emergency drawdown at Los Banos Grandes).

(d) Conveyance Channel No. 2 (below Los Banos Grandes Dam)

(e) Pumping-Generating Plant No. 2 (plant and waterways)

The size and cost of the components of these alternatives vary according to reservoir size or pump-generate plant capacity, as detailed in Table V-3.

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Table V-3

Facility Component
Sizing Criteria

Alternative Facility	Facility Size and Cost Varies According to: Reservoir Capacity	Facility Size and Cost Varies According to: P/G Plant Capacity
1. LBG Main Dam and Saddle Dam	Y	N
2. LBG Spillway Facility	N*	Y
3. LBG Inlet and Outlet Works	N*	Y
4. Intake Channel No. 2	N*	Y
5. Pumping/Generating Plant No. 2	N**	Y
6. LBD Inlet and Outlet Works	N	Y
7. LBD Right Abutment Spillway	N*	Y
8. Intake Channel No. 1	N*	Y
9. Pumping/Generating Plant No. 1	N**	Y
10. Road, Utility Relocation, and General Reservoir Costs	Y	N

* The size of this facility is controlled in part by emergency drawdown criteria independent of reservoir size

** Pumping/Generating facility sizing was selected for each alternative

The costs of the 14 alternatives evaluated in this report were developed by using facility size and cost curves developed from the memorandum reports of the Division of Design and Construction, entitled "Los Banos Grandes Offstream Storage Project" dated August 1988 through November 1988. These reports contained project descriptions and cost estimates for four alternative configurations of reservoir size and pumping/generating capacity as shown in Table V-4. Cost curves were developed from these estimates from which the cost of the 14 alternatives were derived.

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Table V-4
Reservoir Sizes and P/G Plant Capacities
Assumed in Base Cost Estimates
(Used as Basis of Cost Curves)

Reservoir Capacity (MAF)	P/G Plant #1 Capacity (cfs)	P/G Plant #2 Capacity (cfs)	Operational Regime
1.19 1/	2250/3000	2250/3000	Continuous flow incidental power
1.19 1/	2250/3000	4500/5800	Continuous (#1) Peaked power (#2)
1.19 1/	4500/5800	4500/5800	Off Peak Pumping On Peak Generation Both P/G Plants
1.73 2/	2250/3000	10800/14400	Continuous (#1) Pumped Storage (#2)

1/ In previous studies and estimates this alternative was called 1.25 MAF. More recent area/capacity data down-grades capacity to 1.19 MAF.

2/ In previous studies and estimates this alternative was called 1.80 MAF. More recent area/capacity data down-grades capacity to 1.73 MAF.

Where required, cost data, indexed to 1988, were taken from the September 1985 "Reconnaissance Study and Cost Estimate for Los Banos Grandes Project" and used as supplemental points to verify cost curves and facility sizing curves developed from the 1988 reports. Cost curves are presented in Appendix A.

Further discussion of facilities included in the 1988 D&C reports are available in those memorandum reports. Reservoir sizes less than 1190 TAF were not considered in this analysis, based on the 1986 LBG investigation results showing that the most cost-effective yield occurs at storages greater than 1190 TAF. Studies of pumpable surplus Delta outflows show that incremental pumpable diversions to LBG decline for LBG P/G plant capacities greater than 3500 cfs and approach zero near 5500 cfs. Consequently, P/G plant capacities greater than 5600 cfs were not evaluated in this study. Equivalent sized plants for both P/G plants were used in these studies based on the conclusions of the Division of

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Operations and Maintenance's Power Studies and the analysis by the Energy Division of power benefits. The Los Banos Creek alignment for conveyance facilities were used for all 14 of the alternatives. Previous studies have discounted the utility of the Lone Oak conveyance scheme (through San Luis Reservoir). Water supply operation studies also support larger pumping capacity for additional average yield and dry period supply.

It should be noted that the project components listed above would be required for the purposes of water supply development and power recovery. These are the key items for consideration in these project formulation and sizing studies at LBG. The project, when completed, will include recreation facilities, mitigation measures due to inundation impacts, and some flood control modifications (Los Banos Detention Dam spillway modifications). Since recreation costs and flood control modification costs are still being developed, these items were not included in these sizing studies but will be accounted for in the final feasibility analysis of the selected plan.

A large part of the impacts from inundation on wildlife, riparian habitats, and cultural resources occur with the first increment of impoundment and a major portion of the impacts are associated with impoundments up to 1.19 MAF. The plans for mitigating the initial impoundment impacts are still being developed and thus the costs associated with such impacts are unknown at this time. However, impacts on sensitive plant communities, grasslands, streambeds, and farm ponds from increasing reservoir sizes above the 1.19 MAF size up to 2.3 MAF are more easily predicted. Therefore, for the purpose of comparing alternative reservoir sizes we have included estimates of incremental mitigation costs.

VI. Discussion of Analyses

Pumping/Generating Plant Capacity

The annual LBG water release/refill cycle, and consequently the water supply accomplishments, of LBG facilities are constrained by three factors:

1. The availability, distribution, and frequency of surplus winter flows in the Delta as well as the Delta water quality standards affecting diversion rates.

2. The availability of pumping capacity at Banks Pumping Plant (and its attendant capacity in the California Aqueduct) beyond that required for operation of the remainder of the SWP.

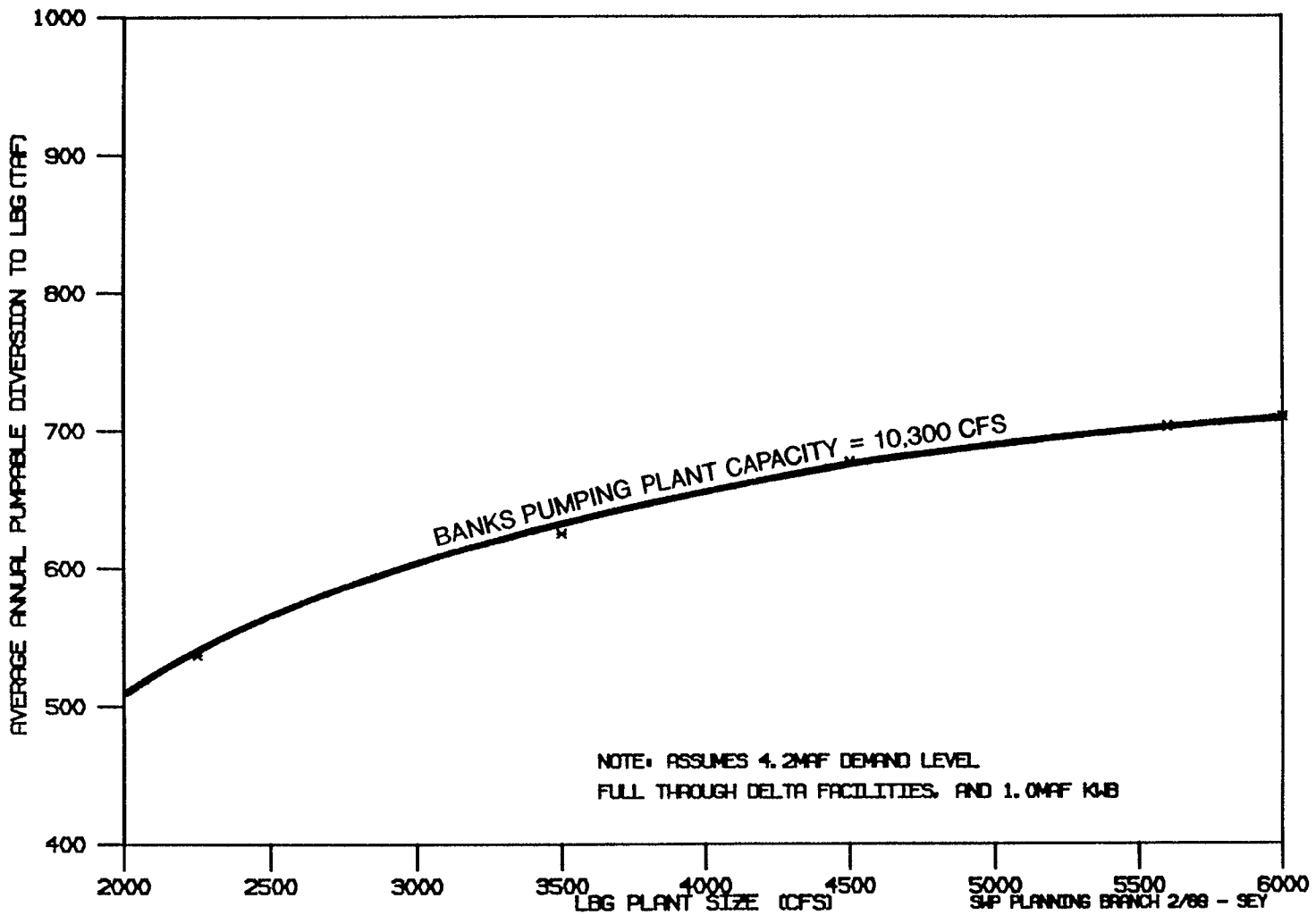
3. The magnitude of pumping capacity available at LBG Pumping/ Generating Plants 1 and 2 and the LBG Reservoir size.

The interrelationship of these three factors define the probability of diverting a given volume of water through the aqueduct to offstream storage at the LBG facilities. The complex relationship of the first two factors can only be predicted through an operation study of the SWP and CVP systems performed on a simulation model such as DWRSIM. Several such operation studies were performed as part of this LBG formulation investigation in order to predict surplus delta outflow (SDO) and Banks available capacity under several differing conditions. The third factor - the effect of LBG P/G plant capacity on divertable water - was studied from the output of these DWRSIM operation studies. As Figure VI-1 shows, average annual pumpable diversion to LBG (assuming 10,300 cfs Banks Pumping capacity operated with D-1485 restrictions) rises linearly as a function of LBG plant size until a plant capacity near 3,500 cfs is reached. Thereafter, the incremental pumpable diversion decreases as plant size increases until it approaches zero near a plant size of 5,500 cfs. To state this differently, after a plant size of 3,500 cfs is reached, a decreasing amount of water can be diverted per increment of additional LBG plant capacity.

The reasons for these diminishing diversions are related to the interaction of the above mentioned constraints on LBG water supply accomplishments. Up to a LBG pumping capacity of 3,500 cfs the SDO which is pumpable at Banks exceeds the capacity of LBG plant to pump. After 3,500 cfs plant capacity is passed the decreasing available pumping capacity at Banks constrains the ability of the LBG pumping plants to divert additional uncontrolled Delta water to LBG. Only on infrequent occasions is there SDO pumpable at Banks that could be diverted to LBG if additional LBG pumping capacity were available. Beyond a LBG plant capacity of about 5,500 cfs, increasing LBG plant size does not yield much additional average annual diversion since nearly all SDO which is pumpable at Banks has been diverted to LBG.

FIGURE VI-1

AVERAGE ANNUAL PUMPABLE SURPLUS DELTA DIVERSION TO LBG
WITH 10300 CFS BANKS PUMPING CAPACITY AND VARIOUS LBG PUMPING CAPACITIES



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As additional support to the contributions toward average annual water delivery that the larger pumping plant capacities make (above the minimum 2,200 cfs nominal at design head), larger plant capacities provide a margin of dry period yield. Studies of the 1928 through 1934 critical dry period indicate that with a pumping plant capacity of 3,500 cfs an additional 130 TAF can be diverted to storage in LBG over that which could be diverted with 2,250 cfs plant capacity. This additional dry period yield results from the capacity which is available to divert the brief high volume flood flows that occasionally occur during protracted dry periods.

In addition to the incremental average yield and dry period incremental yield benefits of larger Pumping/Generating Plant capacity, a 1989 study prepared by the Energy Division determined that additional economic benefits and operational benefits will result from installing larger plant capacity.

Figure VI-1 demonstrates the relative water supply accomplishments of pumping plant capacities greater than 2250 cfs. A frequency plot of divertable surplus Delta outflow is presented in Figure VI-2 for several LBG Pumping Plant capacities. Reservoir refill characteristics for a range of pumping plant capacities and a range of annual draft volumes are shown in Figures VI-3 and VI-4.

The net benefits analysis for a 1.73 MAF reservoir and a range of pumping plant sizes between 2,250 cfs and 4,500 cfs is presented in Figure IV-5. Net benefits maximize near 3,000 cfs when LBG is staged after North Delta Facilities and near 3,500 cfs when LBG is staged before North Delta Facilities. Based on these analyses, a 3500 cfs pumping plant capacity is proposed for both pumping/ generating plants after a consideration of both net benefits and reservoir operation and refill cycles. Equal capacity at both plants is proposed since previous studies have indicated that there are substantial water supply and power benefits from both LBG plants having the same capacity.

It should be emphasized that these investigations have reconfirmed the importance of the proposed South Delta Improvements to the water supply accomplishments of LBG. All studies have assumed that with the completion of SDI, the Corps permit for Banks will be modified to allow a pumping rate of 10,300 cfs at Banks during all months except when D-1485 pumping restrictions are in effect. Further, these studies have imposed a 2,000 cfs limit on Banks during May and June when storage withdrawals are being made at Lake Oroville in accordance with the DWR letter agreement with the Department of Fish and Game. This agreement provides that DWR will impose these restrictions as long as decision D-1485 is still in effect.

FIGURE VI-2
LOS BANOS GRANDES FORMULATION STUDIES
SURPLUS DELTA OUTFLOW DIVERTIBLE TO LBG WITH VARIOUS P-G PLANT SIZES

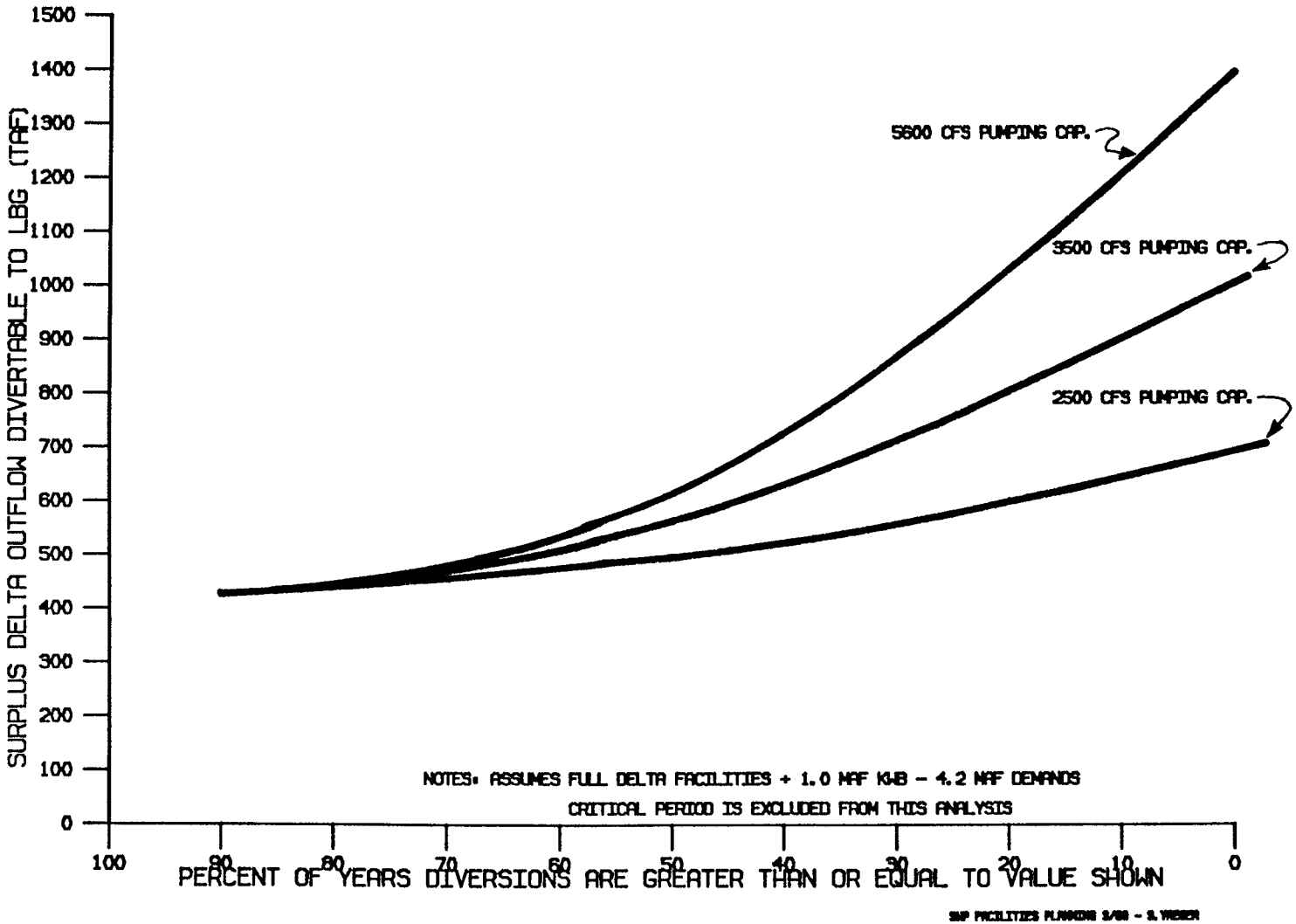

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FIGURE VI-3

LOS BANOS GRANDES FORMULATION STUDIES

RESERVOIR REFILL VERSES ANNUAL DRAFT AND PUMPING PLANT CAPACITY

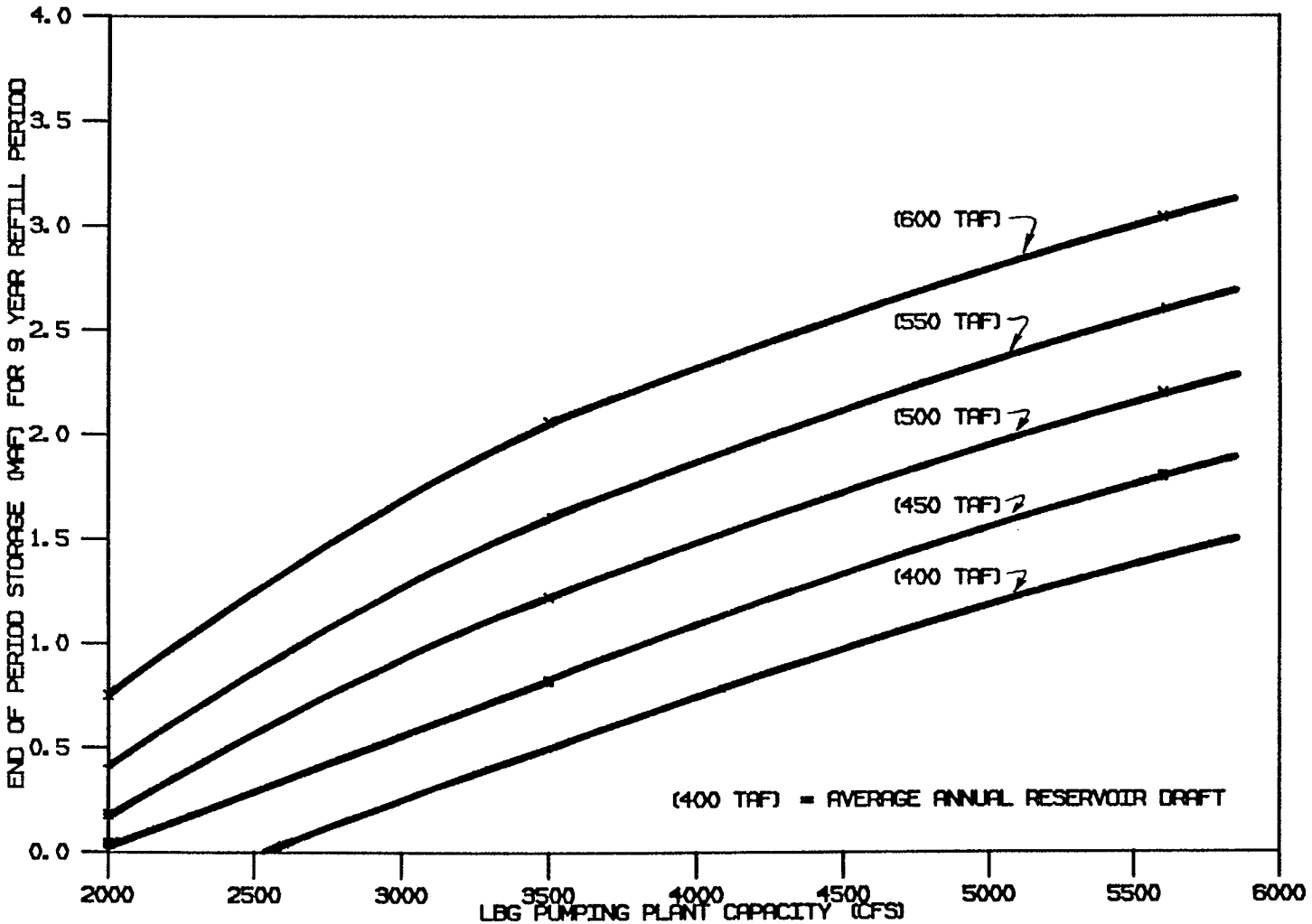

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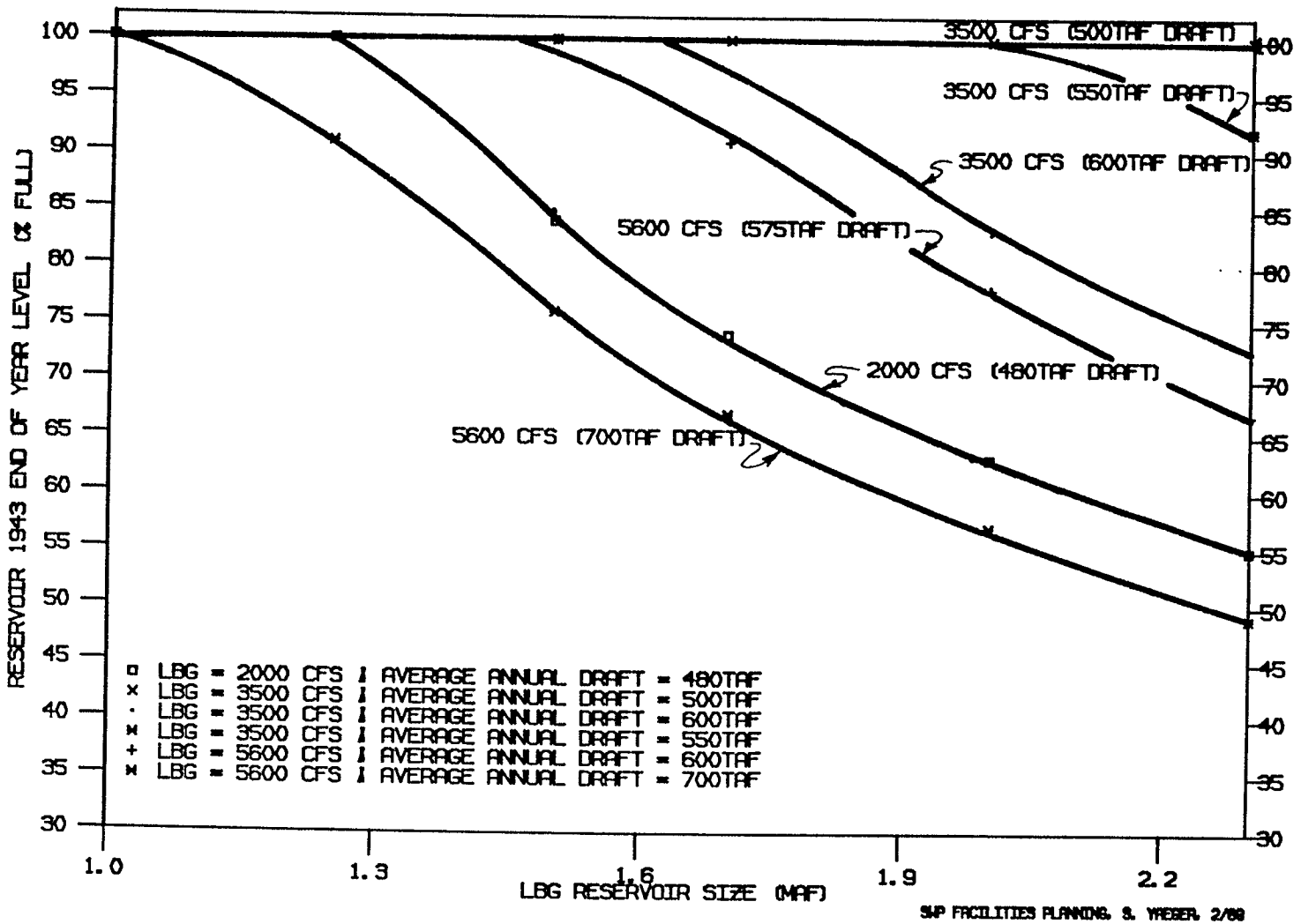
FIGURE VI-4

LOS BANOS GRANDES RESERVOIR SIZING STUDIES

RESERVOIR RECOVERY FROM 1934 FOR VARIOUS SIZE RESERVOIRS AND VARIOUS AVERAGE ANNUAL DRAFTS (TAF)

FOR BANKS CAPACITY = 10300CFS & VARIOUS LBG CAPACITIES



SWP FACILITIES PLANNING, S. WEBER, 2/80

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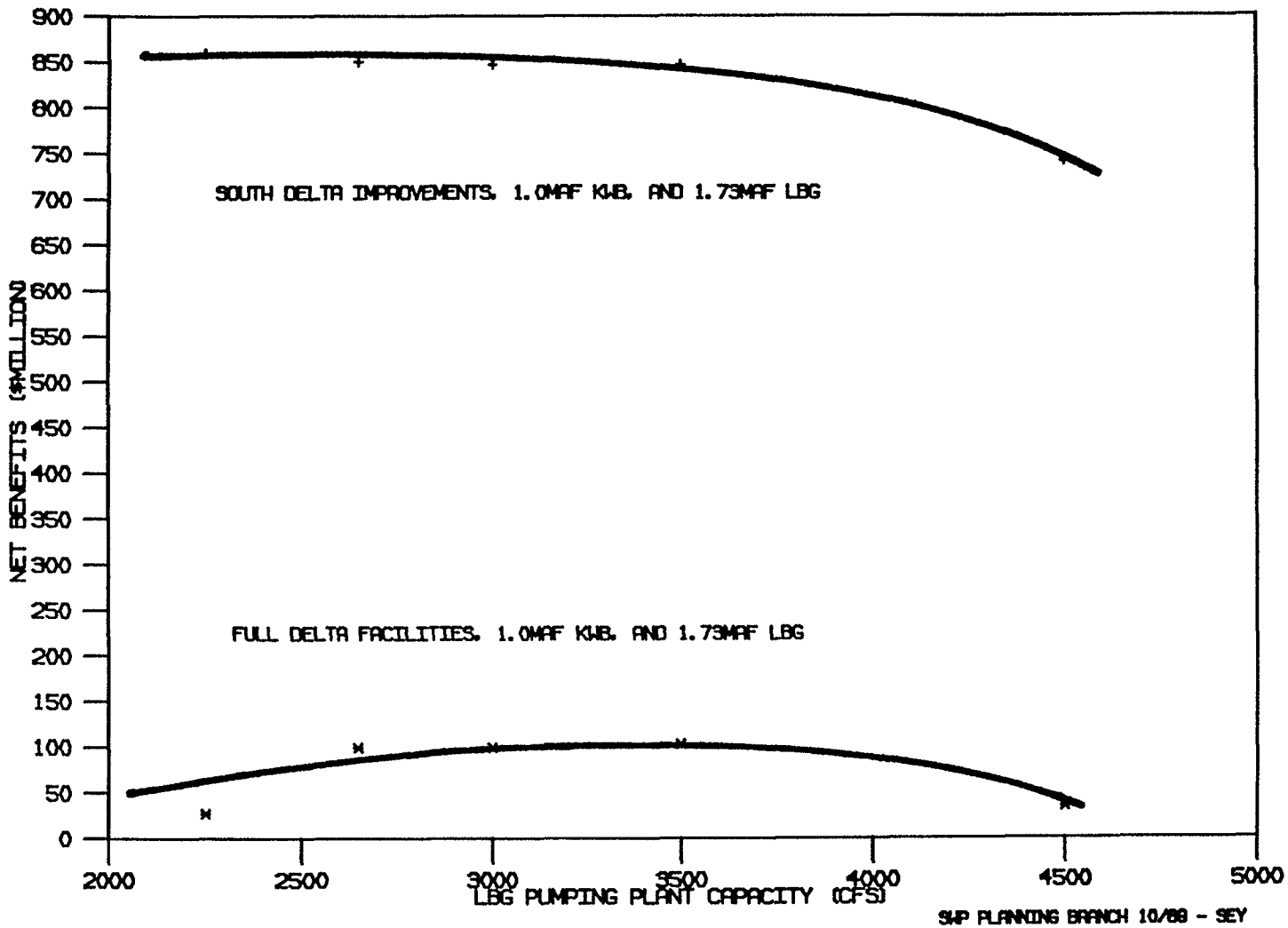
FIGURE VI-5
LOS BANOS GRANDES PROJECT FORMULATION STUDIES
NET BENEFIT ANALYSIS OF VARIOUS PUMPING PLANT CAPACITIES



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Reservoir Operation

The initial step in any reservoir sizing study is to select an operation mode. Early studies of LBG evaluated water supply accomplishments from three distinct types of operations of LBG: 1) Operation for maximum annual delivery; 2) Operation for maximum dry period supply; and 3) an operation midway between the two which reserves one-half of the maximum dry period supply and then maximizes annual delivery with the remainder (called 1/2 Firm Operation).[1] These studies were performed using DWR's Water Delivery Risk Analysis[1] criteria. These operating criteria produce average annual deliveries which tend to be near the mid-range between a firm yield mode of operation and an operation which tries to maximize average annual delivery.

This Risk Analysis criteria is applied to new SWP facilities by molding the target storages at Oroville, San Luis, and LBG such that the level of risk through the dry period approximates the level of risk imposed by the current Risk Analysis Operation. Initial screenings of benefits using the ERM showed that the current Risk Analysis Operation is more beneficial to the SWP contractors than other operational modes and therefore, Risk Analysis Operation was selected for these studies. An operating range must be selected for DWRSIM studies of LBG, even with a Risk Analysis mode of operation, since LBG's ratio of inlet/outlet capacity to storage is so much lower than San Luis Reservoir or Lake Oroville. Since the Risk Analysis operation considers the total carry-over storage of Oroville, San Luis, Kern Water Bank, and LBG when making a delivery level decision, the additional system storage LBG provides allows higher deliveries to be made from other SWP facilities with higher inlet/outlet to storage ratios. Thus the carry-over storage requirements of Risk Analysis operation are met even though LBG is operated through a lower range than San Luis Reservoir.

A series of 57-year operation studies with historic hydrology was run on DWRSIM for several LBG reservoir sizes (1.19 MAF, 1.73 MAF, and 2.0 MAF) with 3500 cfs pumping plant capacity and all operated through an annual 550 TAF range (hereafter referred to as operating storage). These studies were run for both a 3.7 MAF demand level and a 4.2 MAF demand level. Operation studies for the remaining reservoir sizes and pumping plant capacities studied were then run on a PC based model using DWRSIM data as the starting point. PC model runs used an annual operating storage for each reservoir size that produced a constant level of deliveries through the critical period.

1/ "State Water Project Water Delivery Risk Analysis and Criteria for 1989", DWR, December 1988.

Yield

As discussed above, the selected operational mode for these LBG formulation studies is the DWR Risk Analysis operational criteria. This mode of operation balances the risk of operating for maximum average delivery against the risk of operating for maximum dry period supply.

The plot in Figure VI-6 shows the relationship of two types of yield (incremental average annual delivery and incremental SWP dry period supply attributable to LBG) to LBG reservoir size for the Risk Analysis mode of operation. These curves are specific for a 4.2 MAF demand level, 3500 cfs P/G plant capacity at LBG, and the SWP configured with full Through Delta Facilities, a 1.0 MAF Kern Water Bank, and full 10,300 cfs pumping capacity at Banks Pumping Plant. This full Banks capacity is assumed for all months except May, June and July when D-1485 striped bass pumping restrictions were imposed as well as a 2,000 cfs limit in May and June when storage withdrawals are being made at Lake Oroville.

As Figure VI-6 shows, the incremental average annual delivery due to LBG would be about 10 to 15 percent greater if LBG were constructed before NDF.

The plot for dry period supply rises linearly with increasing reservoir size as would be expected. Average annual delivery is linear against reservoir size for the smaller reservoir sizes. For the larger reservoirs the incremental average annual delivery realized with increasing reservoir size declines at an ever increasing rate. The decreasing slope of the average annual delivery curve can be attributed to the fact that at the 4.2 MAF demand level a major part of the SWP shortages of one and two year durations have been satisfied by LBG contributions. Since a major component of the proposed reservoir is short-term carry-over storage to meet the one and two year duration dry periods, increasing LBG reservoir size above 1.75 MAF shows diminishing returns in contributions toward alleviating SWP shortages.

It should be noted, again, that should Kern Water Bank or NDF be staged after LBG or be constructed to provide SWP yields lower than those assumed in these studies there would then exist a greater opportunity for a LBG larger than 1.75 MAF to contribute to SWP shortages. Under these conditions LBG would produce a higher average annual delivery for the larger reservoir sizes.

Economic Benefits

Economic benefits were calculated on the ERM using as input the SWP deliveries generated in the operations studies described in the previous section entitled "Reservoir Operations". SWP deliveries from these studies were processed through the ERM to derive benefits to the SWP contractors from each reservoir size. A summary of the composite economic benefits for the various reservoir sizes is shown in Table VI-1, following.

FIGURE VI-6
LOS BANOS GRANDES RESERVOIR SIZING STUDIES
YIELD ANALYSIS - INCREMENTAL SWP YIELD DUE TO LBG
AVERAGE ANNUAL YIELD (RISK ANALYSIS CURVE OPERATION) AND DRY PERIOD YIELD

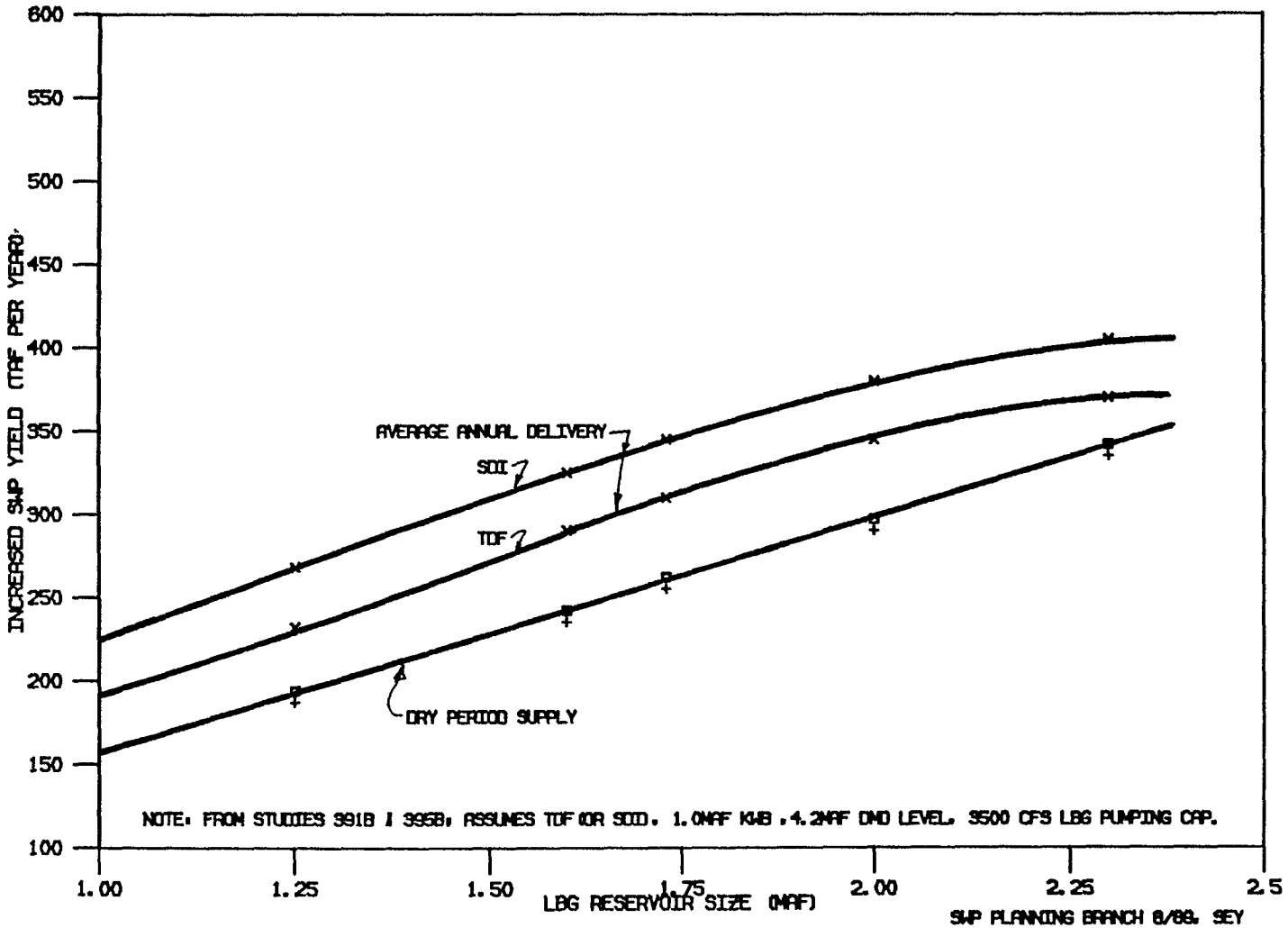

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TABLE VI-1

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LBG ECONOMIC BENEFIT STUDIES - CALC OF COMPOSITE BENEFIT
Full Through Delta Facilities, 1.0maf KWB & LBG(3500cfs Pumping Capacity)

2010 DEMAND STUDIES						2035 DEMAND STUDIES					AVG
RESERV SIZE (taf)	AVG. ANNUAL M&I LOS ($1000)	AVG. ANNUAL M&I COST ($1000)	AVG. ANNUAL AG LOSS ($1000)	AVG. ANNUAL AG COS ($1000)	VG ANNUAL OMPOSITE BENEFIT ($1000)	RESERV SIZE (taf)	AVG. ANNUAL M&I LOSS ($1000)	AVG. ANNUAL M&I COST ($1000)	AVG. ANNUAL AG LOSS ($1000)	AVG. ANNUAL AG COST ($1000)	ANNUAL CMPOSITE BENEFIT ($1000)
base	41378	233543	15797	5948	0	base	192139	259166	23832	8974	0
1000	19511	238024	8492	3198	27441	1000	149257	266902	20489	7715	39748
1190	17911	238345	7634	2875	29901	1190	141603	268180	19748	7436	47144
1600	13866	239127	6267	2360	35046	1600	129552	270034	18480	6959	59086
1728	14960	239100	6624	2494	33488	1728	125142	271369	17903	6741	62956
1800	14211	239106	5855	2205	35289	1800	124843	271385	17902	6741	63240
2000	14435	239191	5442	2049	35549	2000	121727	272098	17427	6562	66297
2300	14043	239483	4940	1860	36340	2300	117460	273098	16696	6287	70570

LBG ECONOMIC BENEFIT STUDIES - CALC OF COMPOSITE BENEFIT
SDI,KWB & LBG (3500cfs) - NO NORTH DELTA FACIL.
All Values are $1000

2010 DEMAND STUDIES						2035 DEMAND STUDIES					AVG
RESERV SIZE	AVG. ANNUAL M&I LOS	AVG. ANNUAL M&I COST	AVG. ANNUAL AG LOSS	AVG. ANNUAL AG COS	VG ANNUAL OMPOSITE BENEFIT	RESERV SIZE	AVG. ANNUAL M&I LOSS	AVG. ANNUAL M&I COST	AVG. ANNUAL AG LOSS	AVG. ANNUAL AG COST	ANNUAL CMPOSITE BENEFIT
base	56384	223042	18994	7152	0	base	261819	247513	28655	10790	0
1190	18645	236674	8882	3345	38026	1190	147553	266761	19245	7247	107971
1600	15320	234780	7426	2801	45245	1600	140171	268306	18223	6862	115215
1728	14087	238637	6931	2610	43308	1728	136321	269845	17195	6475	118941
2000	15096	238282	6195	2333	43665	2000	134590	269790	17253	6497	120647
2300	14612	238735	5505	2073	44646	2300	131816	270370	16927	6374	123290

Composite benefits from the 3.7 MAF demand level studies (year 2010) and the 4.2 MAF demand level studies (year 2020) were used to derive a stream of benefits through the 50-year service life of the facility, and the present worth of the stream taken. The present worths of the benefit stream for the various reservoir sizes are presented in Table VI-2.

These benefits for the various reservoir sizes are also plotted in Figure VI-7. As can be seen from this plot, increments of LBG reservoir storage above about 1.75 MAF produce rather limited incremental benefits when the SWP is configured with new facilities consisting of full Through Delta Facilities, 1.0 MAF Kern Water Bank, and a Los Banos Grandes Reservoir. This trend follows from the fact that as the 1.75 MAF reservoir size is approached, long-term carry-over storage - storage beyond the 550 TAF annual operating storage plus 50 TAF minimum power pool - reaches the point where nearly all of the SWP shortages are filled for the one and two year drought sequences. Shortages for drought sequences which last longer than two years are not fully met with LBG carry-over storage, but since such sequences are rare in the historic hydrology, the impact on average benefits from these sequences is much less than the benefits from the one and two year duration dry periods.

Table VI-2
Present Worth of Benefits*
for Various Reservoirs Sizes

Reservoir Size (MAF)	Alternative Number	Present Worth of SWP Benefits ($ millions) with full Delta Facil.**	Present Worth of SWP Benefits ($ millions) with SDI only**
1.19	2	817.1	1618.2
1.6	4	997.3	1743.2
1.73	7	1054.0	1796.7
2.0	11	1105.7	1826.6
2.3	13	1172.5	1875.8

* Referenced to the year of initial water delivery from LBG using 6 percent discount rate and a 50-year period of analysis.

** Benefits for SWP Contractors calculated with 3,500 cfs pumping capacity at LBG and SWP configured with 1.0 MAF Kern Water Bank and Delta facilities as shown.

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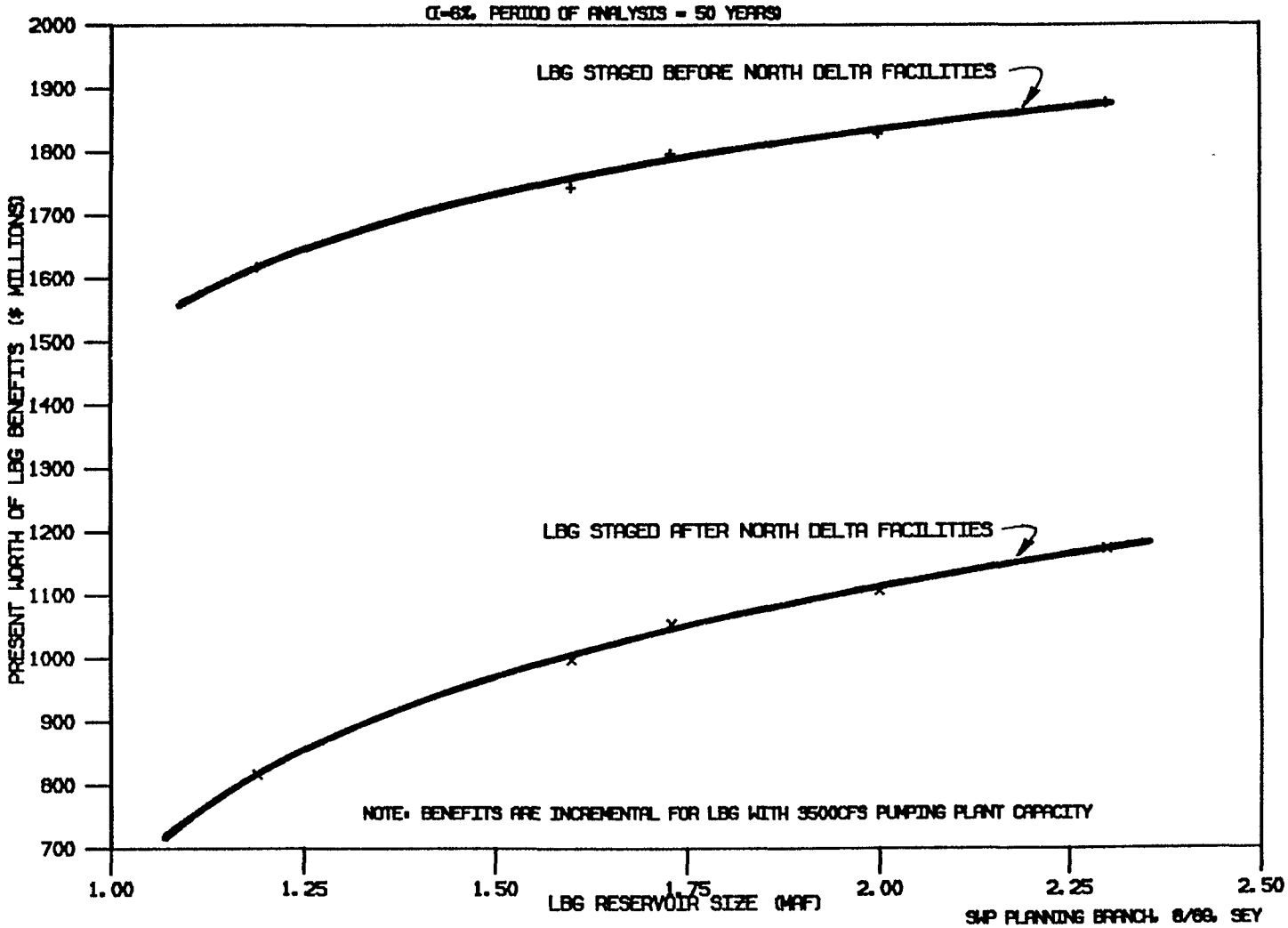
FIGURE VI-7

LOS BANOS GRANDES RESERVOIR SIZING STUDIES
ECONOMIC ANALYSIS
PRESENT WORTH OF BENEFITS ATTRIBUTABLE TO LBG
(I=6%, PERIOD OF ANALYSIS = 50 YEARS)



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This trend can be seen in Figure VI-7 as incremental benefits from adding additional long-term carry-over storage begin to decrease after reservoir sizes increase beyond 1.2 MAF and become linear as a reservoir size of 1.75 MAF is reached. Stated differently, there are slightly decreasing benefits from adding additional long-term carry-over storage beyond the 1.75 MAF reservoir size when the SWP is configured with full Through Delta Facilities and a 1.0 MAF Kern Water Bank.

If only SDI and a 1.0 MAF Kern Water Bank were added to the SWP prior to LBG, benefits attributable to LBG would be greater than when LBG is staged after full Through Delta Facilities (see Figure VI-7). This can be attributed to the higher occurrence of one and two year duration dry periods in which the base facilities cannot meet all the shortages. In these periods additional COS at LBG makes a distinct contribution to SWP benefits.

Costs of Alternative Reservoir Sizes

The first cost of LBG facilities is essentially a linear function in the range of reservoir sizes between 1.19 MAF and 2.3 MAF. Figure VI-8 demonstrates this linearity for both first cost and first cost plus interest during construction.

Table VI-3
First Cost of Various Reservoir Sizes

Reservoir Size (MAF)	Alternative Number	First Cost * ($million)	Present Worth of Expenditures to Initial Delivery ($ million)
1.19	2	569.7	757.8
1.6	4	637.0	842.4
1.73	7	662.0	876.4
2.0	11	706.1	938.4
2.3	13	752.9	1005.3

* All alternatives include 3500 cfs P/G plant capacity

Table VI-3 summarizes project first costs, and the present worth of total expenditures to the point of initial delivery from the reservoir for the various alternatives with P/G Plant Capacities of 3500/4650 cfs. Reservoir filling costs, and other miscellaneous costs to the point of initial water delivery as well as full detail on contract costs are shown in Table VI-4.

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TABLE VI-4
SUMMARY OF TABLES A1 TO A14

8/28/89

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES: SUMMARY
(MILLIONS 1988 $)

ALTERNATIVE No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PROJECT DESCRIPTION	1.19 MAF 2250 CFS	1.19 MAF 3500 CFS	1.80 MAF 2250 CFS	1.80 MAF 3600 CFS	1.70 MAF 5600 CFS	1.73 MAF 2250 CFS	1.73 MAF 3500 CFS	1.73 MAF 4500 CFS	1.80 MAF 3500 CFS	1.80 MAF 4500 CFS	2.00 MAF 3500 CFS	2.00 MAF 4500 CFS	2.30 MAF 3500 CFS	2.30 MAF 4500 CFS
CONTRACT ACTIVITIES														
MAIN AND SADDLE DAMS	114.6	114.6	157.4	157.4	160.0	171.6	171.6	171.6	180.1	180.1	201.5	201.5	231.4	231.4
CHANNEL 01	15.6	16.0	15.6	16.0	19.0	15.6	16.0	17.0	16.0	17.0	16.0	17.0	16.0	17.0
CHANNEL 02	4.4	6.2	4.4	6.2	9.2	4.4	6.2	7.6	6.2	7.6	6.2	7.6	6.2	7.6
INLET-OUTLET (LBO)	21.1	27.9	21.1	27.9	39.3	21.1	27.9	33.3	27.9	33.3	27.9	33.3	27.9	33.3
INLET-OUTLET (LBG)	46.4	64.9	50.7	70.9	111.2	52.1	72.9	90.1	74.1	91.6	77.1	95.2	81.4	100.3
PUMP-GENERATOR PLANT 01	32.0	40.3	32.0	40.3	75.7	32.0	40.3	61.4	40.3	61.4	40.3	61.4	40.3	61.4
PUMP-GENERATOR PLANT 02	65.4	93.7	68.5	98.0	145.9	69.5	101.6	124.8	100.2	123.5	102.2	125.9	104.9	129.2
LBO SPILLWAY (1)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
LBG SPILLWAY	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
ROAD AND UTILITY RELOCATION	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3
GENERAL RESERVOIR	16.1	17.5	17.0	18.5	20.7	17.4	18.9	20.4	19.1	20.4	19.6	20.5	20.4	20.7
CONTRACT SUBTOTAL	365.9	440.2	417.0	494.3	640.1	434.0	514.5	577.3	523.0	586.0	549.9	613.5	587.6	652.0
ANNUAL EXPENDITURES														
DESIGN AND CONSTRUCTION	88.7	106.7	101.1	119.9	155.2	105.2	124.8	140.0	126.8	142.1	133.4	148.8	142.5	158.1
MITIGATION, O&M ACTIVITIES (2)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
PLANNING	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
RIGHT OF WAY	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
ANNUAL SUBTOTAL	111.5	129.5	123.9	142.7	178.0	128.0	147.6	162.8	149.6	164.9	156.2	171.6	165.3	180.9
TOTAL CONTRACT AND ANNUAL COSTS (3)	477.4	569.7	540.9	637.0	818.1	562.0	662.1	740.1	672.6	750.9	706.1	785.1	752.9	832.9
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (3)	609.3	724.0	687.0	806.4	1,031.5	712.8	837.1	934.2	850.1	947.5	891.1	989.4	948.5	1,048.0
INITIAL FILLING ENERGY COSTS	35.1	32.8	41.9	34.9	36.3	45.4	38.1	37.2	40.0	39.0	45.6	44.5	54.6	53.4
F.W. INITIAL FILLING ENERGY COSTS	36.1	33.8	43.3	36.0	37.5	47.0	39.3	38.4	41.4	40.3	47.3	46.1	56.8	55.5
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (3)	645.4	757.8	730.3	842.4	1,069.0	759.8	876.4	972.6	891.5	987.8	938.4	1,035.5	1,005.3	1,103.5

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.

(4) EXCLUDES MITIGATION COSTS.

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FIGURE VI- 8
LOS BANOS GRANDES RESERVOIR SIZING STUDIES
COST ANALYSIS
FIRST COST, AND FIRST COST PLUS COST TO INITIAL DELIVERY

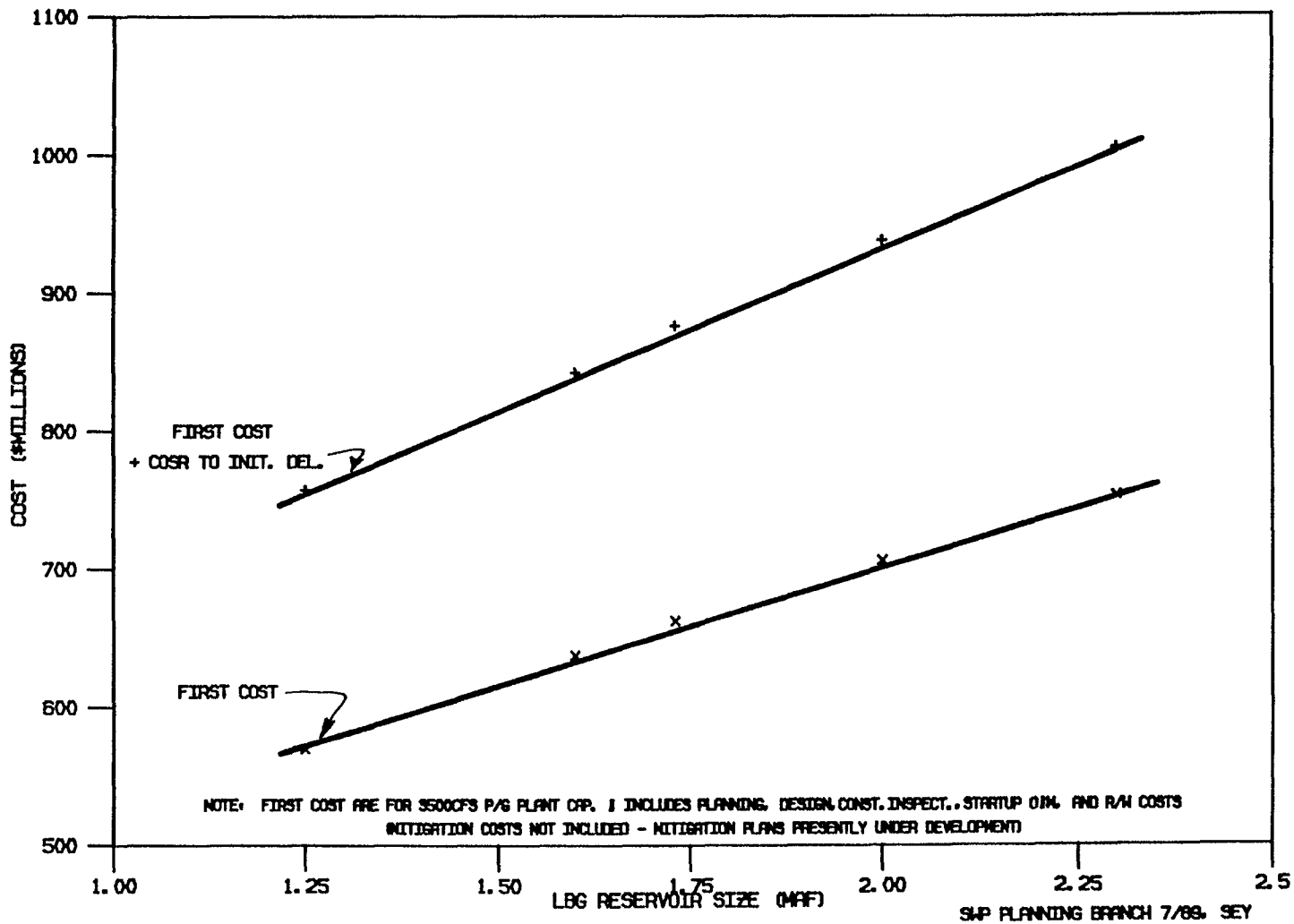

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TABLE VI-5
LOS BANOS GRANDES STUDIES
COST OF ALTERNATIVES: SUMMARY OF NET CAPITALIZED COSTS
(MILLIONS 1968 $)

ALTERNATE NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14
COST COMPONENT DESCRIPTION | RESER. SIZ	1.19 MAF		1.6 MAF		1.7 MAF	1.73 MAF			1.8 MAF		2.0 MAF		2.3 MAF	
|P/G PLANT CAP.	2250 CFS	3500 CFS	2250 CFS	3500CFS	5600 CFS	2250 CFS	3500 CFS	4500 CFS	3500 CFS	4500 CFS	3500 CFS	4500 CFS	3500 CFS	4500 CFS
Future Worth of Total Expenditures to Initial Deliveries	645.4	757.8	730.3	842.4	1,069.0	759.8	876.4	972.6	891.5	987.8	938.4	1,035.5	1,005.3	1,103.5
Present Worth of Operational Expense During 50 Year Service Life (1)	116.6	85.2	116.7	80.6	90.0	118.2	82.6	83.4	82.5	84.2	82.6	83.5	80.7	81.5
Subtotal	762.0	843.0	847.0	923.0	1,159.0	878.0	959.0	1,056.0	974.0	1,072.0	1,021.0	1,119.0	1,086.0	1,185.0
Present Worth of Incremental Mitigation Costs During 50 Year Service Life (2)	0.0	0.0	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5	2.2	2.2	2.8	2.8
NET CAPITALIZED COST	762.0	843.0	848.2	924.2	1,160.5	879.5	960.5	1,057.5	975.5	1,073.5	1,023.2	1,121.2	1,088.8	1,187.8

(1) Incremental Mitigation Costs Beyond the Mitigation Cost Associated With the 1.25 maf Reservoir
(2) Operational Expense includes :
a) Present worth (PW) of future fixed O&M costs
b) PW of future replacement costs
c) PW of future variable electrical costs (for pumping) at LBG Plants 1 and 2
d) PW of differential energy at Oroville and San Luis
e) Less PW of revenues from future electrical power generation

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Projected operating and maintenance cost, replacement costs, and power costs (less revenues from projected power sales), as well as incremental mitigation costs are summarized in Table VI-5 along with the Net Capitalized Cost for the various reservoir sizes and pumping plant capacities examined. Figure VI-9 presents a plot of Net Capitalized Cost vs reservoir size for 3500 cfs pumping capacity. As can be seen, this relationship is nearly linear as reservoir size increases with only small incremental increases which can be attributed to increasing reservoir fill costs and operating costs.

Net Benefits

Summaries of Benefits, NCC and Net Benefits for each reservoir size are shown in Table VI-6. Figures VI-10 and VI-11 show the relationships between net benefits and LBG reservoir capacity.

Table VI-6
Summary of Net Capitalized Cost
and Net Benefits for Various Reservoir Sizes

				w/Full Delta Facilities	
Alt. No.	Reser. Size (MAF)	NCC ($ mill)	NCC Allocated to SWP Contractors ($ mill)	P. W. of SWP Contr. Benefits ($ mill)	Net SWP Contr. Benefits ($ mill)
2	1.19	843.6	834.6	817.1	-17.5
4	1.6	924.2	915.0	997.3	82.3
7	1.73	960.5	950.9	1054.0	103.1
11	2.0	1023.2	1013.0	1105.7	92.7
13	2.3	1088.8	1077.9	1172.5	94.6

				w/South Delta Facilities	
Alt. No.	Reser. Size (MAF)	NCC ($ mill)	only NCC Allocated to SWP Contractors ($ mill)	P. W. of SWP Contr. Benefits ($ mill)	Net SWP Contr. Benefits ($ mill)
2	1.19	843.6	834.6	1618.2	783.6
4	1.6	924.2	915.0	1743.2	828.2
7	1.73	960.5	950.9	1796.7	845.8
11	2.0	1023.2	1013.0	1828.6	815.6
13	2.3	1088.8	1077.9	1875.8	797.9

Note: All Costs and Benefits are for P/G Plant Capacity = 3500/4650 cfs

FIGURE VI-9

LOS BANOS GRANDES RESERVOIR SIZING STUDIES

COST ANALYSIS FOR VARIOUS RESERVOIR SIZES

NET CAPITALIZED COST

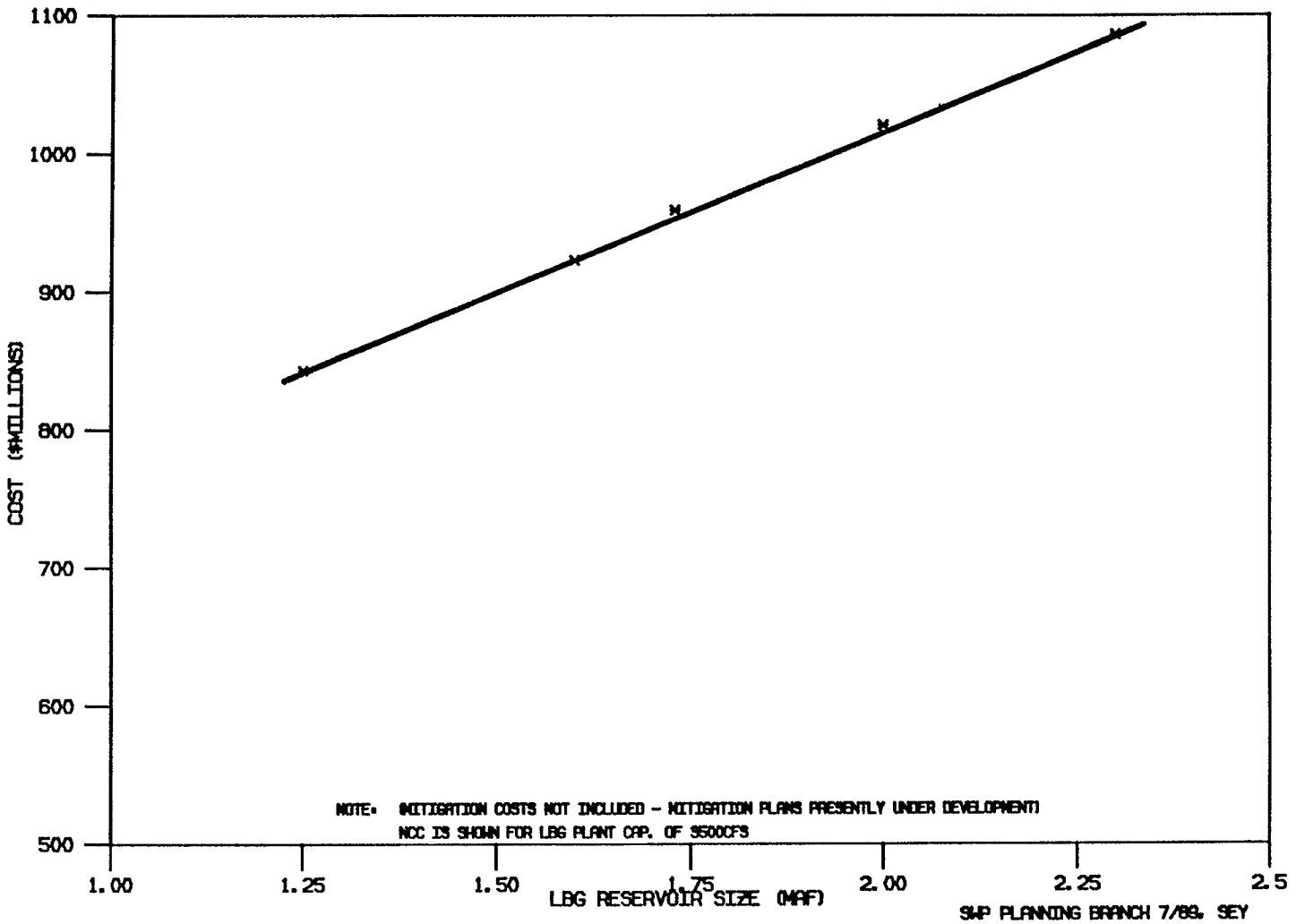

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FIGURE VI-10
LOS BANOS GRANDES RESERVOIR SIZING STUDIES
ECONOMIC ANALYSIS
NET BENEFITS ATTRIBUTABLE TO LBG (WHEN STAGED AFTER NORTH DELTA FACITITIES)

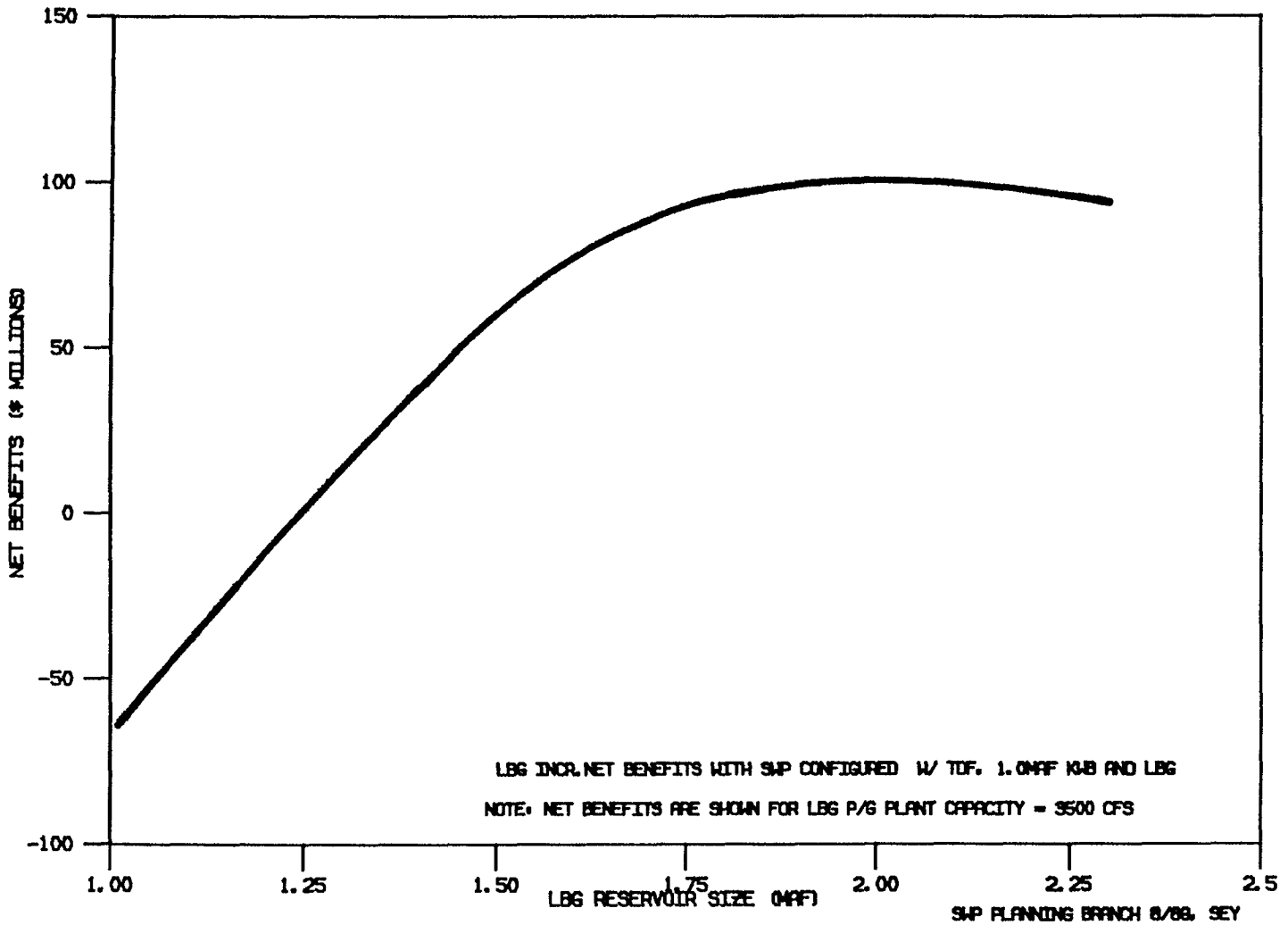

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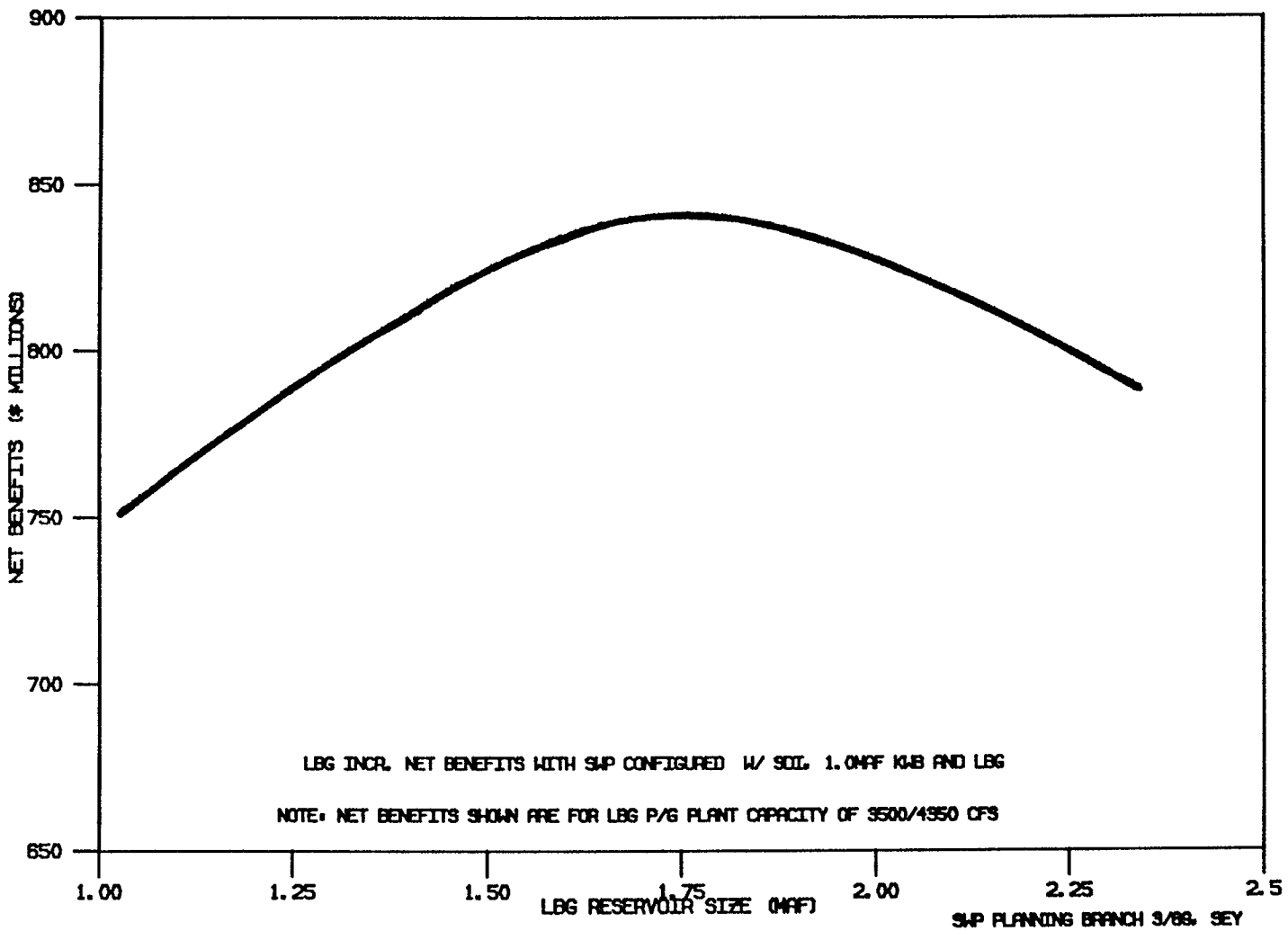
FIGURE VI-11
LOS BANOS GRANDES RESERVOIR SIZING STUDIES
ECONOMIC ANALYSIS
NET BENEFITS ATTRIBUTABLE TO LBG (WHEN STAGED BEFORE NORTH DELTA FACITITIES)



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As can be seen from Figures VI-10 and VI-11, a goal of maximizing Net Benefits leads to a LBG reservoir size of approximately 1.75 MAF when the SWP is configured with a 1.0 MAF Kern Water Bank and South Delta Improvements. With full Through Delta Facilities, the optimum size for LBG Reservoir is indicated to be 1.75 MAF or larger. However, the incremental net benefits beyond the 1.75 MAF size are minimal. Accordingly, the optimum size of LBG Reservoir is indicated to be in the range of 1.75 MAF. A selection of a LBG size in the range of 1.75 MAF leads to the recommendation of normal water surface elevation 763.0, which equates to a reservoir size of 1.73 MAF. In past studies this water surface elevation was associated with the much-studied reservoir size of 1.8 MAF. More recent topographic mapping and area/capacity curves have downgraded storage at this water surface elevation to 1.73 MAF.

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Appendix A

Economic Cost Data Detail and Economic Benefit Analysis Detail

Appendix A - Table of Contents

1. Capital Cost Summaries for Alternatives 1 - 14
2. Annual Operating Costs for Alternatives 1 - 14
3. Cost Curves for Capital Components
4. Basis of Discount Rate
5. Composite Benefits from the ERM for Alternatives 1 - 14 for 3.7 and 4.2 MAF demand levels.
6. Benefits Analysis for Alternatives 2, 4, 7, 11, and 13

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TABLE VI-4
SUMMARY OF TABLES A1 TO A14

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LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES: SUMMARY
(MILLIONS 1988 $)

ALTERNATIVE No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PROJECT DESCRIPTION	1.19 MAF		1.60 MAF		1.70 MAF	1.73 MAF			1.80 MAF		2.00 MAF		2.30 MAF	
	2250 CFS	3500 CFS	2250 CFS	3500 CFS	5600 CFS	2250 CFS	3500 CFS	4500 CFS	3500 CFS	4500 CFS	3500 CFS	4500 CFS	3500 CFS	4500 CFS
CONTRACT ACTIVITIES														
MAIN AND SADDLE DAMS	114.6	114.6	157.4	157.4	168.8	171.6	171.6	171.6	180.1	180.1	201.5	201.5	231.4	231.4
CHANNEL #1	15.6	16.8	15.6	16.8	19.0	15.6	16.8	17.8	16.8	17.8	16.8	17.8	16.8	17.8
CHANNEL #2	4.4	6.2	4.4	6.2	9.2	4.4	6.2	7.6	6.2	7.6	6.2	7.6	6.2	7.6
INLET-OUTLET (LBD)	21.1	27.9	21.1	27.9	39.3	21.1	27.9	33.3	27.9	33.3	27.9	33.3	27.9	33.3
INLET-OUTLET (LBG)	46.4	64.9	50.7	70.9	111.2	52.1	72.9	90.1	74.1	91.6	77.1	95.2	81.4	100.3
PUMP-GENERATOR PLANT #1	32.0	48.3	32.0	48.3	75.7	32.0	48.3	61.4	48.3	61.4	48.3	61.4	48.3	61.4
PUMP-GENERATOR PLANT #2	65.4	93.7	68.5	98.0	145.9	69.5	101.6	124.8	100.2	123.5	102.2	125.9	104.9	129.2
LBD SPILLWAY (1)	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
LBG SPILLWAY	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
ROAD AND UTILITY RELOCATION	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3
GENERAL RESERVOIR	16.1	17.5	17.0	18.5	20.7	17.4	18.9	20.4	19.1	20.4	19.6	20.5	20.4	20.7
CONSTRUCTION SUBTOTAL	365.9	440.2	417.0	494.3	640.1	434.0	514.5	577.3	523.0	586.0	549.9	613.5	587.6	652.0
ANNUAL EXPENDITURES														
DESIGN AND CONSTRUCTION	88.7	106.7	101.1	119.9	155.2	105.2	124.8	140.0	126.8	142.1	133.4	148.8	142.5	158.1
MITIGATION, O&M ACTIVITIES (2)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
PLANNING	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
RIGHT OF WAY	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
ANNUAL SUBTOTAL	111.5	129.5	123.9	142.7	178.0	128.0	147.6	162.8	149.6	164.9	156.2	171.6	165.3	180.9
TOTAL CONSTRUCTION & ANNUAL COSTS (3)	477.4	569.7	540.9	637.0	818.1	562.0	662.1	740.1	672.6	750.9	706.1	785.1	752.9	832.9
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (3)	609.3	724.0	687.0	806.4	1,031.5	712.8	837.1	934.2	850.1	947.5	891.1	989.4	948.5	1,048.0
INITIAL FILLING ENERGY COSTS	35.1	32.8	41.9	34.9	36.3	45.4	38.1	37.2	40.0	39.0	45.6	44.5	54.6	53.4
F.W. INITIAL FILLING ENERGY COSTS	36.1	33.8	43.3	36.0	37.5	47.0	39.3	38.4	41.4	40.3	47.3	46.1	56.8	55.5
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (3)	645.4	757.8	730.3	842.4	1,069.0	759.8	876.4	972.6	891.5	987.8	938.4	1,035.5	1,005.3	1,103.5

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.

(4) EXCLUDES MITIGATION COSTS.

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TABLE A1

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.28 MAF 2,250 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													12.6	26.4	28.7	26.4	20.6		114.6
CHANNEL #1													2.0	3.9	3.9	3.0	2.8		15.6
CHANNEL #2													1.0	1.8	1.6				4.4
INLET-OUTLET (LBD)													6.8	7.6	6.8				21.1
INLET-OUTLET (LBG)												10.2	16.7	.5	3.7	11.6	3.7		46.4
PUMP-GENERATOR PLANT #1													4.8	6.1	6.1	9.0	6.1		32.0
PUMP-GENERATOR PLANT #2													13.1	11.8	13.7	11.1	13.1	2.6	65.4
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												5.5	6.4	4.2					16.1
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	25.3	77.6	76.6	71.2	66.2	46.3	2.6	365.9
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	4.5	5.5	7.9	9.8	9.3	9.6	9.2	11.0	11.2	5.6	3.0	88.7
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	5.0	6.0	7.9	12.6	12.1	9.6	9.2	11.0	13.2	8.6	3.0	111.8
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	5.0	6.0	7.9	12.6	37.4	87.2	85.8	82.2	79.4	54.9	5.6	477.5
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	9.0	10.1	12.6	19.0	53.1	116.7	108.4	97.9	89.2	58.2	5.6	609.3
INITIAL FILLING ENERGY COSTS																	17.2	17.9	35.1
F.W. INITIAL FILLING ENERGY COSTS																	18.2	17.9	36.1
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	9.0	10.1	12.6	19.0	53.1	116.7	108.4	97.9	89.2	76.5	23.5	645.4

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VF5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.19
MAXIMUM W.S. ELEVATION (FT)	718
P-G DESIGN HEAD NO. 2 (FT)	351 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	2250/3000
P-G NO. 2	2250/3000

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TABLE A2

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LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.19 MAF 3,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													12.6	26.4	28.7	26.4	20.6		114.6
CHANNEL #1													2.2	4.2	4.2	3.2	3.0		16.8
CHANNEL #2													1.4	2.6	2.2				6.2
INLET-OUTLET (LBD)													8.9	10.0	8.9				27.9
INLET-OUTLET (LBG)												14.3	23.4	.6	5.2	16.2	5.2		64.9
PUMP-GENERATOR PLANT #1													7.2	9.2	9.2	13.5	9.2		48.3
PUMP-GENERATOR PLANT #2													18.7	16.9	19.7	15.9	18.7	3.7	93.7
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												6.0	7.0	4.6					17.6
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29.9	95.7	88.9	84.9	80.5	56.8	3.7	440.2
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	5.4	6.6	9.5	11.8	11.2	11.5	11.1	13.2	13.5	7.0	3.8	106.7
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	5.9	7.1	9.5	14.6	14.0	11.5	11.1	13.2	15.5	10.0	3.8	129.6
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	5.9	7.1	9.5	14.6	43.9	107.2	100.0	98.1	95.9	66.8	7.5	569.8
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	10.6	12.0	15.1	22.0	62.2	143.4	126.2	116.8	107.8	70.8	7.6	724.0
INITIAL FILLING ENERGY COSTS																	16.0	16.8	32.8
F.W. INITIAL FILLING ENERGY COSTS																	17.0	16.8	33.8
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	10.6	12.0	15.1	22.0	62.2	143.4	126.2	116.8	107.8	87.8	24.3	757.8

(1) PROJECT OPERATION BEGINS THIS YEAR.
(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.
(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.
(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.19
MAXIMUM W.S. ELEVATION (FT)	718
P-G DESIGN HEAD NO. 2 (FT)	349 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	3500/4650
P-G NO. 2	3500/4650

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TABLE A3

8/28/89

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.60 MAF 2,250 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	FISCAL YEARS 1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													17.3	36.2	39.4	36.2	28.3		157.4
CHANNEL #1													2.0	3.9	3.9	3.0	2.8		15.6
CHANNEL #2													1.0	1.8	1.6				4.4
INLET-OUTLET (LBD)													6.8	7.6	6.8				21.1
INLET-OUTLET (LBG)												11.2	18.3	.5	4.1	12.7	4.1		50.7
PUMP-GENERATOR PLANT #1													4.8	6.1	6.1	9.0	6.1		32.0
PUMP-GENERATOR PLANT #2													13.7	12.3	14.4	11.6	13.7	2.7	68.5
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												5.8	6.8	4.4					17.0
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	26.6	84.8	87.3	82.9	77.7	55.0	2.7	417.0
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	5.2	6.3	9.0	11.2	10.6	10.9	10.5	12.5	12.7	6.6	3.5	101.1
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	5.7	6.8	9.0	14.0	13.4	10.9	10.5	12.5	14.7	9.6	3.5	123.9
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	5.7	6.8	9.0	14.0	40.0	95.8	97.8	95.4	92.4	64.6	6.3	540.9
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	10.1	11.4	14.3	21.1	56.7	128.2	123.5	113.7	103.8	68.4	6.3	687.0
INITIAL FILLING ENERGY COSTS																	23.5	18.4	41.9
F.W. INITIAL FILLING ENERGY COSTS																	24.9	18.4	43.3
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	10.1	11.4	14.3	21.1	56.7	128.2	123.5	113.7	103.8	93.3	24.7	730.3

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VF5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.6
MAXIMUM W.S. ELEVATION (FT)	753
P-G DESIGN HEAD NO. 2 (FT)	383 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	2250/3000
P-G NO. 2	2250/3000

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TABLE A4

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LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.60 MAF 3,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													17.3	36.2	39.4	36.2	28.3		157.4
CHANNEL #1													2.2	4.2	4.2	3.2	3.0		16.8
CHANNEL #2													1.4	2.6	2.2				6.2
INLET-OUTLET (LBD)													8.9	10.0	8.9				27.9
INLET-OUTLET (LBG)												15.6	25.5	.7	5.7	17.7	5.7		70.9
PUMP-GENERATOR PLANT #1													7.2	9.2	9.2	13.5	9.2		48.3
PUMP-GENERATOR PLANT #2													19.6	17.6	20.6	16.7	19.6	3.9	98.0
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPILLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												6.3	7.4	4.8					18.5
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	31.5	103.8	99.8	96.9	92.5	65.6	3.9	494.3
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	6.1	7.4	10.7	13.3	12.6	12.9	12.5	14.9	15.1	8.0	4.3	119.9
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	6.6	7.9	10.7	16.1	15.4	12.9	12.5	14.9	17.1	11.0	4.3	142.7
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	6.6	7.9	10.7	16.1	46.9	116.7	112.3	111.8	109.6	76.9	8.3	637.0
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	11.8	13.4	17.0	24.2	66.5	156.2	141.7	133.2	123.2	81.5	8.3	806.4
INITIAL FILLING ENERGY COSTS																	17.8	17.1	34.9
F.W. INITIAL FILLING ENERGY COSTS																	18.9	17.1	36.0
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	11.8	13.4	17.0	24.2	66.5	156.2	141.7	133.2	123.2	100.3	25.4	842.4

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITAGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.6
MAXIMUM W.S. ELEVATION (FT)	753
P-G DESIGN HEAD NO. 2 (FT)	381 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	3500/4650
P-G NO. 2	3500/4650

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TABLE A5

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LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.70 MAF 5,600 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	FISCAL YEARS 1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													18.6	38.8	42.2	38.8	30.4		168.8
CHANNEL #1													2.5	4.8	4.8	3.6	3.4		19.0
CHANNEL #2													2.0	3.9	3.3				9.2
INLET-OUTLET (LBO)													12.6	14.1	12.6				39.3
INLET-OUTLET (LBG)												24.5	40.0	1.1	8.9	27.8	8.9		111.2
PUMP-GENERATOR PLANT #1													11.4	14.4	14.4	21.2	14.4		76.7
PUMP-GENERATOR PLANT #2													29.2	26.3	30.6	24.8	29.2	5.8	145.9
LBO SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												7.0	8.3	5.4					20.7
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	41.1	138.7	123.1	123.6	121.5	86.3	5.8	640.1
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	7.9	9.6	13.8	17.2	16.3	16.8	16.1	19.2	19.6	10.8	5.8	155.2
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	8.4	10.1	13.8	20.0	19.1	16.8	16.1	19.2	21.6	13.8	5.8	178.0
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	8.4	10.1	13.8	20.0	60.2	155.5	139.3	142.8	143.0	100.1	11.7	818.1
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	15.1	17.1	22.0	30.1	85.4	208.1	175.8	170.1	160.7	106.1	11.7	1,031.5
INITIAL FILLING ENERGY COSTS																	19.6	16.7	36.3
F.W. INITIAL FILLING ENERGY COSTS																	20.8	16.7	37.5
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	15.1	17.1	22.0	30.1	85.4	208.1	175.8	170.1	160.7	126.9	28.4	1,069.0

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITAGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VF5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.7
MAXIMUM W.S. ELEVATION (FT)	761
P-G DESIGN HEAD NO. 2 (FT)	392 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	5600/7450
P-G NO. 2	5600/7450

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TABLE A6

8/28/89

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.73 MAF 2,250 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	FISCAL YEARS 1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													18.9	39.5	42.9	39.5	30.9		171.6
CHANNEL #1													2.0	3.9	3.9	3.0	2.8		15.6
CHANNEL #2													1.0	1.8	1.6				4.4
INLET-OUTLET (LBD)													6.8	7.6	6.8				21.1
INLET-OUTLET (LBG)												11.5	18.8	.5	4.2	13.0	4.2		52.1
PUMP-GENERATOR PLANT #1													4.8	6.1	6.1	9.0	6.1		32.0
PUMP-GENERATOR PLANT #2													13.9	12.5	14.6	11.8	13.9	2.8	69.5
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												5.9	7.0	4.5					17.4
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	27.0	87.3	90.9	86.8	81.5	57.8	2.8	434.0
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	5.4	6.5	9.4	11.7	11.1	11.4	10.9	13.1	13.3	6.9	3.7	105.2
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.5
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	5.9	7.0	9.4	14.5	13.9	11.4	10.9	13.1	15.3	9.9	3.7	128.1
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	5.9	7.0	9.4	14.5	40.9	98.6	101.8	99.8	96.7	67.8	6.5	562.1
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	10.5	11.9	14.9	21.8	57.9	132.0	128.5	118.9	108.7	71.8	6.5	712.8
INITIAL FILLING ENERGY COSTS																	26.8	18.6	45.4
F.W. INITIAL FILLING ENERGY COSTS																	28.4	18.6	47.0
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	10.5	11.9	14.9	21.8	57.9	132.0	128.5	118.9	108.7	100.2	25.1	759.8

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITAGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.73
MAXIMUM W.S. ELEVATION (FT)	763
P-G DESIGN HEAD NO. 2 (FT)	394 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	2250/3000
P-G NO. 2	2250/3000

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TABLE A7

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LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.73 MAF 3,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													18.9	39.5	42.9	39.5	30.9		171.6
CHANNEL #1													2.2	4.2	4.2	3.2	3.0		16.8
CHANNEL #2													1.4	2.6	2.2				6.2
INLET-OUTLET (LBD)													8.9	10.0	8.9				27.9
INLET-OUTLET (LBG)												16.0	26.2	.7	5.8	18.2	5.8		72.9
PUMP-GENERATOR PLANT #1													7.2	9.2	9.2	13.5	9.2		48.3
PUMP-GENERATOR PLANT #2													20.3	18.3	21.3	17.3	20.3	4.1	101.6
LBD SPILLWAY (E)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												6.4	7.6	4.9	---	--			18.9
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	32.1	107.0	103.8	101.4	96.9	69.2	4.1	514.5
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	6.4	7.7	11.1	13.8	13.1	13.5	13.0	15.5	15.7	8.4	4.5	124.8
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY	---	---	---	---	---	---	---	---	---	---	2.8	2.8	---	--					5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	6.9	8.2	11.1	16.6	15.9	13.5	13.0	15.5	17.7	11.4	4.5	147.6
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	6.9	8.2	11.1	16.6	48.0	120.4	116.8	116.9	114.6	80.7	8.6	662.1
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	12.3	13.9	17.7	25.0	68.1	161.2	147.5	139.2	128.8	85.6	8.6	837.1
INITIAL FILLING ENERGY COSTS																	20.8	17.3	38.1
F.W. INITIAL FILLING ENERGY COSTS																	22.0	17.3	39.3
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	12.3	13.9	17.7	25.0	68.1	161.2	147.5	139.2	128.8	107.6	25.9	876.5

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITAGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VF5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.73
MAXIMUM W.S. ELEVATION (FT)	763
P-G DESIGN HEAD NO. 2 (FT)	392 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	3500/4650
P-G NO. 2	3500/4650

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TABLE A8

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.73 MAF 4,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	FISCAL YEARS 1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													18.9	39.5	42.9	39.5	30.9		171.6
CHANNEL #1													2.3	4.5	4.5	3.4	3.2		17.8
CHANNEL #2													1.7	3.2	2.7				7.6
INLET-OUTLET (LBD)													10.7	12.0	10.7				33.3
INLET-OUTLET (LBG)												19.8	32.4	.9	7.2	22.5	7.2		90.1
PUMP-GENERATOR PLANT #1													9.2	11.7	11.7	17.2	11.7		61.4
PUMP-GENERATOR PLANT #2													25.0	22.5	26.2	21.2	25.0	5.0	124.8
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												6.9	8.2	5.3					20.4
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	36.4	122.5	113.8	112.6	109.0	77.9	5.0	577.3
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	7.1	8.7	12.5	15.5	14.7	15.1	14.6	17.4	17.6	9.6	5.2	140.0
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.6	9.2	12.5	18.3	17.5	15.1	14.6	17.4	19.6	12.6	5.2	162.8
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.6	9.2	12.5	18.3	53.9	137.6	128.4	130.0	128.7	90.5	10.2	740.1
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (82) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	13.7	15.5	19.9	27.6	76.4	184.2	162.1	154.8	144.6	96.0	10.2	934.2
INITIAL FILLING ENERGY COSTS																	20.3	16.9	37.2
F.W. INITIAL FILLING ENERGY COSTS																	21.5	16.9	38.4
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (82) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	13.7	15.5	19.9	27.6	76.4	184.2	162.1	154.8	144.6	117.5	27.1	972.7

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.73
MAXIMUM W.S. ELEVATION (FT)	763
P-G DESIGN HEAD NO. 2 (FT)	392 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	4500/5985
P-G NO. 2	4500/5985

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TABLE A9

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LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.80 MAF 3,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													19.8	41.4	45.0	41.4	32.4		180.1
CHANNEL #1													2.2	4.2	4.2	3.2	3.0		16.8
CHANNEL #2													1.4	2.6	2.2				6.2
INLET-OUTLET (LBD)													8.9	10.0	8.9				27.9
INLET-OUTLET (LBG)												16.3	26.7	.7	5.9	16.5	5.9		74.1
PUMP-GENERATOR PLANT #1													7.2	9.2	9.2	13.5	9.1		48.3
PUMP-GENERATOR PLANT #2													20.0	18.0	21.0	17.0	20.0	4.0	100.2
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPILLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												6.5	7.6	5.0					19.1
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	32.4	108.1	105.6	103.3	98.9	70.6	4.0	523.0
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	6.5	7.9	11.3	14.1	13.3	13.7	13.2	15.7	16.0	8.6	4.6	126.8
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.0	8.4	11.3	16.9	16.1	13.7	13.2	15.7	18.0	11.6	4.6	149.6
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.0	8.4	11.3	16.9	48.5	121.8	118.8	119.1	116.9	82.2	8.6	672.6
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	12.5	14.1	18.0	25.4	68.8	163.0	150.0	141.8	131.4	87.1	8.6	850.1
INITIAL FILLING ENERGY COSTS																	22.7	17.3	40.0
F.W. INITIAL FILLING ENERGY COSTS																	24.1	17.3	41.4
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	12.5	14.1	18.0	25.4	68.8	163.0	150.0	141.8	131.4	111.2	25.9	891.5

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.8
MAXIMUM U.S. ELEVATION (FT)	769
P-G DESIGN HEAD NO. 2 (FT)	398 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	3500/4650
P-G NO. 2	3500/4650

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TABLE A10

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
1.80 MAF 4,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													19.8	41.4	45.0	41.4	32.4		180.1
CHANNEL #1													2.3	4.5	4.5	3.4	3.2		17.8
CHANNEL #2													1.7	3.2	2.7				7.6
INLET-OUTLET (LBD)													10.7	12.0	10.7				33.3
INLET-OUTLET (LBG)												20.2	33.0	.9	7.3	22.9	7.3		91.6
PUMP-GENERATOR PLANT #1													9.2	11.7	11.7	17.2	11.7		61.4
PUMP-GENERATOR PLANT #2													24.7	22.2	25.9	21.0	24.7	4.9	123.5
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												6.9	8.2	5.3					20.4
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	36.7	123.7	115.6	114.6	111.1	79.3	4.9	586.0
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	7.2	8.8	12.6	15.8	14.9	15.3	14.8	17.6	17.9	9.8	5.3	142.1
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.7	9.3	12.6	18.6	17.7	15.3	14.8	17.6	19.9	12.8	5.3	164.9
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.7	9.3	12.6	18.6	54.4	139.1	130.4	132.2	131.0	92.1	10.2	750.9
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	13.9	15.7	20.2	27.9	77.2	186.1	164.6	157.5	147.2	97.6	10.2	947.5
INITIAL FILLING ENERGY COSTS																	22.1	16.9	39.0
F.W. INITIAL FILLING ENERGY COSTS																	23.4	16.9	40.3
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	13.9	15.7	20.2	27.9	77.2	186.1	164.6	157.5	147.2	121.1	27.1	987.8

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITAGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	1.8
MAXIMUM W.S. ELEVATION (FT)	769
P-G DESIGN HEAD NO. 2 (FT)	398 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	4500/5985
P-G NO. 2	4500/5985

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LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
2.00 MAF 3,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													22.2	46.3	50.4	46.3	36.3		201.5
CHANNEL #1													2.2	4.2	4.2	3.2	3.0		16.8
CHANNEL #2													1.4	2.6	2.2				6.2
INLET-OUTLET (LBO)													8.9	10.0	8.9				27.9
INLET-OUTLET (LBG)												17.0	27.8	.8	6.2	19.3	6.2		77.1
PUMP-GENERATOR PLANT #1													7.2	9.2	9.2	13.6	9.2		48.3
PUMP-GENERATOR PLANT #2													20.4	18.4	21.5	17.4	20.4	4.1	102.2
LBO SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPLLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												6.7	7.8	5.1					19.6
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	33.2	112.2	111.0	109.3	104.9	75.1	4.1	549.9
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	6.8	8.3	11.9	14.8	14.0	14.4	13.9	16.5	16.8	9.1	4.9	133.4
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.3	8.8	11.9	17.6	16.8	14.4	13.9	16.5	18.8	12.1	4.9	156.2
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.3	8.8	11.9	17.6	50.0	126.6	124.9	125.9	123.7	87.2	9.0	706.1
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	13.1	14.8	18.9	26.5	71.0	169.4	157.7	149.9	139.0	92.4	9.0	891.1
INITIAL FILLING ENERGY COSTS																	27.8	17.8	45.6
F.W. INITIAL FILLING ENERGY COSTS																	29.5	17.8	47.3
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	13.1	14.8	18.9	26.5	71.0	169.4	157.7	149.9	139.0	121.9	26.8	938.3

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITAGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VI-5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	2
MAXIMUM W.S. ELEVATION (FT)	784
P-G DESIGN HEAD NO. 2 (FT)	414 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	3500/4650
P-G NO. 2	3500/4650

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TABLE A12

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
2.00 MAF 4,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													22.2	46.3	50.4	46.3	36.3		201.5
CHANNEL #1													2.3	4.5	4.5	3.4	3.2		17.8
CHANNEL #2													1.7	3.2	2.7				7.6
INLET-OUTLET (LBD)													10.7	12.0	10.7				33.3
INLET-OUTLET (LBG)												20.9	34.3	1.0	7.6	23.8	7.6		95.2
PUMP-GENERATOR PLANT #1													9.2	11.7	11.7	17.2	11.7		61.4
PUMP-GENERATOR PLANT #2													25.2	22.7	26.4	21.4	25.2	5.0	125.9
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPILLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												7.0	8.2	5.3					20.5
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	37.5	127.9	121.0	120.7	117.4	83.9	5.0	613.5
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	7.6	9.2	13.2	16.5	15.6	16.1	15.5	18.4	18.7	10.3	5.5	140.8
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	8.1	9.7	13.2	19.3	18.4	16.1	15.5	18.4	20.7	13.3	5.5	171.6
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	8.1	9.7	13.2	19.3	56.0	144.0	136.5	139.2	138.1	97.2	10.6	785.1
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	14.5	16.4	21.1	29.0	79.4	192.7	172.3	165.8	155.2	103.1	10.6	989.4
INITIAL FILLING ENERGY COSTS																	27.2	17.3	44.5
F.W. INITIAL FILLING ENERGY COSTS																	28.8	17.3	46.1
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	14.5	16.4	21.1	29.0	79.4	192.7	172.3	165.8	155.2	131.9	27.9	1,035.5

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VF5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	2
MAXIMUM W.S. ELEVATION (FT)	784
P-G DESIGN HEAD NO. 2 (FT)	414 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	4500/5985
P-G NO. 2	4500/5985

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TABLE A13

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
2.30 MAF 3,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
	FISCAL YEARS																		
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													25.5	53.2	57.9	53.2	41.7		231.4
CHANNEL #1													2.2	4.2	4.2	3.2	3.0		16.8
CHANNEL #2													1.4	2.6	2.2				6.2
INLET-OUTLET (LBD)													8.9	10.0	8.9				27.9
INLET-OUTLET (LBG)												17.9	29.3	.8	6.5	20.4	6.5		81.4
PUMP-GENERATOR PLANT #1													7.2	9.2	9.2	13.5	9.2		48.3
PUMP-GENERATOR PLANT #2													21.0	18.9	22.0	17.8	21.0	4.2	104.9
LBD SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPILLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												6.9	8.2	5.3					20.4
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	34.5	117.9	118.7	117.7	113.4	81.3	4.2	587.6
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	7.3	8.8	12.7	15.8	15.0	15.4	14.8	17.7	18.0	9.6	5.3	142.5
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.8	9.3	12.7	18.6	17.8	15.4	14.8	17.7	20.0	12.6	5.3	165.3
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	7.8	9.3	12.7	18.6	52.2	133.2	133.5	135.4	133.3	94.2	9.5	752.9
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	13.9	15.8	20.2	28.0	74.1	178.3	168.5	161.3	149.8	99.8	9.5	948.5
INITIAL FILLING ENERGY COSTS																	36.3	18.3	54.6
F.W. INITIAL FILLING ENERGY COSTS																	38.5	18.3	56.8
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (62) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	13.9	15.8	20.2	28.0	74.1	178.3	168.5	161.3	149.8	138.3	27.8	1,005.3

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITIGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VF5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	2.3
MAXIMUM U.S. ELEVATION (FT)	805
P-G DESIGN HEAD NO. 2 (FT)	436 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	3500/4650
P-G NO. 2	3500/4650

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TABLE A14

8/28/89

LOS BANOS GRANDES STUDY
1988 COST OF ALTERNATIVES
2.30 MAF 4,500 CFS
(MILLIONS 1988 $)

PROJECT DESCRIPTION	FISCAL YEARS 1984-85 -17	1985-86 -16	1986-87 -15	1987-88 -14	1988-89 -13	1989-90 -12	1990-91 -11	1991-92 -10	1992-93 -9	1993-94 -8	1994-95 -7	1995-96 -6	1996-97 -5	1997-98 -4	1998-99 -3	1999-00 -2	2000-01 -1	2001-02 0 (1)	TOTAL
CONTRACT ACTIVITIES																			
MAIN AND SADDLE DAMS													25.5	53.2	57.9	53.2	41.7		231.4
CHANNEL #1													2.3	4.5	4.5	3.4	3.2		17.8
CHANNEL #2													1.7	3.2	2.7				7.6
INLET-OUTLET (LBO)													10.7	12.0	10.7				33.3
INLET-OUTLET (LBG)												22.1	36.1	1.0	8.0	25.1	8.0		100.3
PUMP-GENERATOR PLANT #1													9.2	11.7	11.7	17.2	11.7		61.4
PUMP-GENERATOR PLANT #2													25.8	23.3	27.1	22.0	26.8	5.2	129.2
LBO SPILLWAY (2)														3.0	3.9	3.9			10.8
LBG SPILLWAY													2.9	4.0	2.9	1.3			11.2
ROAD AND UTILITY RELOCATION												9.6	11.3	7.4					28.3
GENERAL RESERVOIR												7.0	8.3	5.4					20.7
CONSTRUCTION SUBTOTAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	38.7	133.8	128.6	129.3	126.1	90.4	5.2	652.0
ANNUAL EXPENDITURES																			
DESIGN AND CONSTRUCTION							2.0	8.1	9.8	14.1	17.6	16.6	17.1	16.4	19.6	19.9	11.0	5.9	158.1
MITIGATION, O&M ACTIVITIES (3)																2.0	3.0		5.0
PLANNING	1.5	1.5	1.4	2.1	1.8	1.9	1.0	.5	.5										12.2
RIGHT OF WAY											2.8	2.8							5.6
ANNUAL SUBTOTAL	1.5	1.5	1.4	2.1	1.8	1.9	3.0	8.6	10.3	14.1	20.4	19.4	17.1	16.4	19.6	21.9	14.0	5.9	180.9
TOTAL CONSTRUCTION & ANNUAL COSTS (4)	1.5	1.5	1.4	2.1	1.8	1.9	3.0	8.6	10.3	14.1	20.4	58.1	150.8	145.0	148.9	148.0	104.4	11.1	832.9
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, EXCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	15.3	17.4	22.4	30.6	82.5	201.9	183.1	177.4	166.3	110.7	11.1	1,040.0
INITIAL FILLING ENERGY COSTS																	38.5	17.9	53.4
F.W. INITIAL FILLING ENERGY COSTS																	37.6	17.9	55.5
F.W. OF TOTAL EXPENDITURES TO INITIAL DELIVERIES, INCLUDING ENERGY COSTS (6%) (4)	4.1	3.9	3.4	4.7	3.8	3.8	5.7	15.3	17.4	22.4	30.6	82.5	201.9	183.1	177.4	166.3	148.3	29.0	1,103.5

(1) PROJECT OPERATION BEGINS THIS YEAR.

(2) COST OF LBG SPILLWAY MAY BE SHARED WITH U.S.B.R. BECAUSE OF A REQUIREMENT TO INCREASE THE EMERGENCY FLOOD CONTROL CAPABILITY. THUS, THE TOTAL CONTRACT COST MAY BE REDUCED.

(3) TOTAL MITAGATION COSTS TO BE DETERMINED UNDER CURRENT STUDIES FOR 1.73 MAF RESERVOIR SIZE. INCREMENTAL MITIGATION COSTS ARE PRESENTED IN TABLE VF5.

(4) EXCLUDES MITIGATION COSTS.

PHYSICAL DATA FOR ALTERNATIVES

STORAGE CAPACITY (MAF):	2.3
MAXIMUM W.S. ELEVATION (FT)	808
P-G DESIGN HEAD NO. 2 (FT)	436 GEN.
P-G Q AT DESIGN HEAD (CFS)	
P-G NO. 1	4500/5985
P-G NO. 2	4500/5985

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TABLE A1a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 1

Reservoir Capacity		1190 Tac-ft.
Reservoir Normal Water Surface Elevation		718 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	2250 cfs	
Pump-Gen #2	2250 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen. #1	28,300 kw	25,700 kw
Pump-Gen #2	81,900 kw	77,600 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	81.3 10^6 kwh/yr	50.2 10^6 kwh/yr
Pump-Gen #2	220.7 10^6 kwh/yr	144.0 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-)2.6 10^6 kwh/yr	(-)62.3 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 645.2	Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5	
P.W. of future replacement costs	$ 12.9	
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 236.9	
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 55.6	
Total capitalized cost	$ 982.1	
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 219.9	
Net Capitalized Cost (P.W. at beginning of delivery)	$ 762	Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam; Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A2a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 2

Reservoir Capacity		1190 Tac-ft.
Reservoir Normal Water Surface Elevation		718 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	3500 cfs	
Pump-Gen #2	3500 cfs	
	Pumping	**Generation**
Design Capacity		
Pump-Gen #1	44,000 kw	39,800 kw
Pump-Gen #2	126,700 kw	119,700 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	91.0 10^6 kwh/yr	56.1 10^6 kwh/yr
Pump-Gen #2	254.0 10^6 kwh/yr	170.0 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 62.8 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 757.8 Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5
P.W. of future replacement costs	$ 18.8
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 255.4
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 56.8
Total capitalized cost	$ 1120.3
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 277.1
Net Capitalized Cost (P.W. at beginning of delivery)	$ 843 Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A3a Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 3

Reservoir Capacity		1600 Tac-ft.
Reservoir Normal Water Surface Elevation		753 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1 2250 cfs		
Pump-Gen #2 2250 cfs		
	Pumping	Generation
Design Capacity		
Pump-Gen #1	28,300 kw	25,700 kw
Pump-Gen #2	89,100 kw	84,700 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	81.3 10^6 kwh/yr	50.2 10^6 kwh/yr
Pump-Gen #2	240.0 10^6 kwh/yr	157.0 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 2.6 10^6 kwh/yr	(-) 62.8 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 730.3 Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5
P.W. of future replacement costs	$ 13.3
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 251.9
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 55.6
Total capitalized cost	$ 1082.6
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 235.9
Net Capitalized Cost (P.W. at beginning of delivery)	$ 847 Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A4a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 4

Reservoir Capacity		1600 Tac-ft.
Reservoir Normal Water Surface Elevation		753 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	3500 cfs	
Pump-Gen #2	3500 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	44,000 kw	39,800 kw
Pump-Gen #2	137,800 kw	130,600 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	91.0 10^6 kwh/yr	56.1 10^6 kwh/yr
Pump-Gen #2	276.4 10^6 kwh/yr	185.6 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 62.8 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 842.4	Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5	
P.W. of future replacement costs	$ 19.4	
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 270.5	
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 56.8	
Total capitalized cost	$ 1220.6	
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 297.3	
Net Capitalized Cost (P.W. at beginning of delivery)	$ 923	Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A5a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 5

Reservoir Capacity		1700 Tac-ft.
Reservoir Normal Water Surface Elevation		761 ft
Los Banos Detention Reservoir Capacity		345 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	5600 cfs	
Pump-Gen #2	5600 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	70,300 kw	63,700 kw
Pump-Gen #2	225,600 kw	214,200 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	92.8 10^6 kwh/yr	57.2 10^6 kwh/yr
Pump-Gen #2	293.2 10^6 kwh/yr	195.7 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 1069.0 Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5
P.W. of future replacement costs	$ 29.4
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 282.7
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 57.6
Total capitalized cost	$ 1470.2
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 311.3
Net Capitalized Cost (P.W. at beginning of delivery)	$ 1159 Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam; Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A6a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 6

Reservoir Capacity		1728 Tac-ft.
Reservoir Normal Water Surface Elevation		763 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	2250 cfs	
Pump-Gen #2	2250 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	28,300 kw	25,700 kw
Pump-Gen #2	91,500 kw	87,100 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	81.3 10^6 kwh/yr	50.2 10^6 kwh/yr
Pump-Gen #2	246.7 10^6 kwh/yr	161.6 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 759.8	Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5	
P.W. of future replacement costs	$ 13.5	
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 257.1	
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 56.9	
Total capitalized cost	$ 1118.8	
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 241.3	
Net Capitalized Cost (P.W. at beginning of delivery)	$ 878	Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A7a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 7

Reservoir Capacity		1728 Tac-ft.
Reservoir Normal Water Surface Elevation		763 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1 3500 cfs		
Pump-Gen #2 3500 cfs		
	Pumping	Generation
Design Capacity		
Pump-Gen #1	44,000 kw	39,800 kw
Pump-Gen #2	141,700 kw	134,400 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	91.0 10^6 kwh/yr	56.1 10^6 kwh/yr
Pump-Gen #2	284.1 10^6 kwh/yr	190.9 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 2.6 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 876.5 Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5
P.W. of future replacement costs	$ 19.6
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 277.7
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-)57.6
Total capitalized cost	$ 1262.9
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 303.5
Net Capitalized Cost (P.W. at beginning of delivery)	$ 959 Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A8a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 8

Reservoir Capacity		1728 Tac-ft.
Reservoir Normal Water Surface Elevation		763 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	4500 cfs	
Pump-Gen #2	4500 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	56,500 kw	51,300 kw
Pump-Gen #2	182,200 kw	173,400 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	92.8 10^6 kwh/yr	57.2 10^6 kwh/yr
Pump-Gen #2	291.2 10^6 kwh/yr	196.2 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 972.7	Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5	
P.W. of future replacement costs	$ 24.4	
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 281.1	
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 57.6	
Total capitalized cost	$ 1367.3	
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 311.0	
Net Capitalized Cost (P.W. at beginning of delivery)	$ 1056	Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A9a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 9

Reservoir Capacity	1,800 Tac-ft.
Reservoir Normal Water Surface Elevation	769 ft
Los Banos Detention Reservoir Capacity	34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/	
Pump-Gen #1 3500 cfs	
Pump-Gen #2 3500 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	44,000 kw	39,800 kw
Pump-Gen #2	143,800 kw	136,400 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	91.0 10^6 kwh/yr	56.1 10^6 kwh/yr
Pump-Gen #2	288.3 10^6 kwh/yr	193.9 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 24.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 891.5 Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5
P.W. of future replacement costs	$ 19.7
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 280.8
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 57.6
Total capitalized cost	$ 1281.1
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 306.8
Net Capitalized Cost (P.W. at beginning of delivery)	$ 974 Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam; Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A10a Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 10

Reservoir Capacity		1800 Tac-ft.
Reservoir Normal Water Surface Elevation		769 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	4500 cfs	
Pump-Gen #2	4500 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	56,500 kw	51,300 kw
Pump-Gen #2	184,800 kw	176,100 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	92.8 10^6 kwh/yr	57.2 10^6 kwh/yr
Pump-Gen #2	295.5 10^6 kwh/yr	199.3 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 987.8	Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5	
P.W. of future replacement costs	$ 24.5	
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 285.2	
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 57.6	
Total capitalized cost	$ 1386.6	
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 314.5	
Net Capitalized Cost (P.W. at beginning of delivery)	$ 1072	Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam; Pump-Gen #2 plant site is below Los Banos Grandes Dam.
2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A11a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 11

Reservoir Capacity		2000 Tac-ft.
Reservoir Normal Water Surface Elevation		784 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	3500 cfs	
Pump-Gen #2	3500 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	44,000 kw	39,800 kw
Pump-Gen #2	149,000 kw	141,900 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	91.0 10^6 kwh/yr	56.1 10^6 kwh/yr
Pump-Gen #2	299.5 10^6 kwh/yr	201.7 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 938.3 Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5
P.W. of future replacement costs	$ 20.0
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 289.0
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 57.6
Total capitalized cost	$ 1336.4
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 315.8
Net Capitalized Cost (P.W. at beginning of delivery)	$ 1021 Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam; Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A12a

Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 12

Reservoir Capacity		2000 Tac-ft.
Reservoir Normal Water Surface Elevation		784 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	4500 cfs	
Pump-Gen #2	4500 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	56,500 kw	51,300 kw
Pump-Gen #2	192,000 kw	183,000 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	92.8 10^6 kwh/yr	57.2 10^6 kwh/yr
Pump-Gen #2	307.0 10^6 kwh/yr	207.3 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 1035.5	Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5	
P.W. of future replacement costs	$ 24.9	
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 293.6	
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 57.6	
Total capitalized cost	$ 1443.1	
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 324.5	
Net Capitalized Cost (P.W. at beginning of delivery)	$ 1119	Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A13a Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER. 13

Reservoir Capacity		2300 Tac-ft.
Reservoir Normal Water Surface Elevation		805 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	3500 cfs	
Pump-Gen #2	3500 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	44,000 kw	39800 kw
Pump-Gen #2	157,000 kw	149,500 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	91.0 10^6 kwh/yr	56.1 10^6 kwh/yr
Pump-Gen #2	314.9 10^6 kwh/yr	212.4 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 1005.3 Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5
P.W. of future replacement costs	$ 20.3
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 300.4
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 57.6
Total capitalized cost	$ 1415.1
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 329.6
Net Capitalized Cost (P.W. at beginning of delivery)	$ 1086 Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

TABLE A14a Date: _____, 1989

Los Banos Grandes (LBG)
Summary of Cost Analysis
Cost Index (date) = 1988
Interest Rate = 6% Pd. of Analysis = 50 years

PLAN NO ALTER 14

Reservoir Capacity		2300 Tac-ft.
Reservoir Normal Water Surface Elevation		805 ft
Los Banos Detention Reservoir Capacity		34.5 Tac-ft
Pumping Plant Capacities at Design Head 1/		
Pump-Gen #1	4500 cfs	
Pump-Gen #2	4500 cfs	

	Pumping	Generation
Design Capacity		
Pump-Gen #1	56,500 kw	51,300 kw
Pump-Gen #2	201,900 kw	192,900 kw
Average Energy Amounts (Water Yield Oper)		
Pump-Gen #1	92.8 10^6 kwh/yr	57.2 10^6 kwh/yr
Pump-Gen #2	322.8 10^6 kwh/yr	218.3 10^6 kwh/yr
Diff. at Oroville/San Luis (+ or -)	(-) 4.0 10^6 kwh/yr	(-) 63.6 10^6 kwh/yr 2/

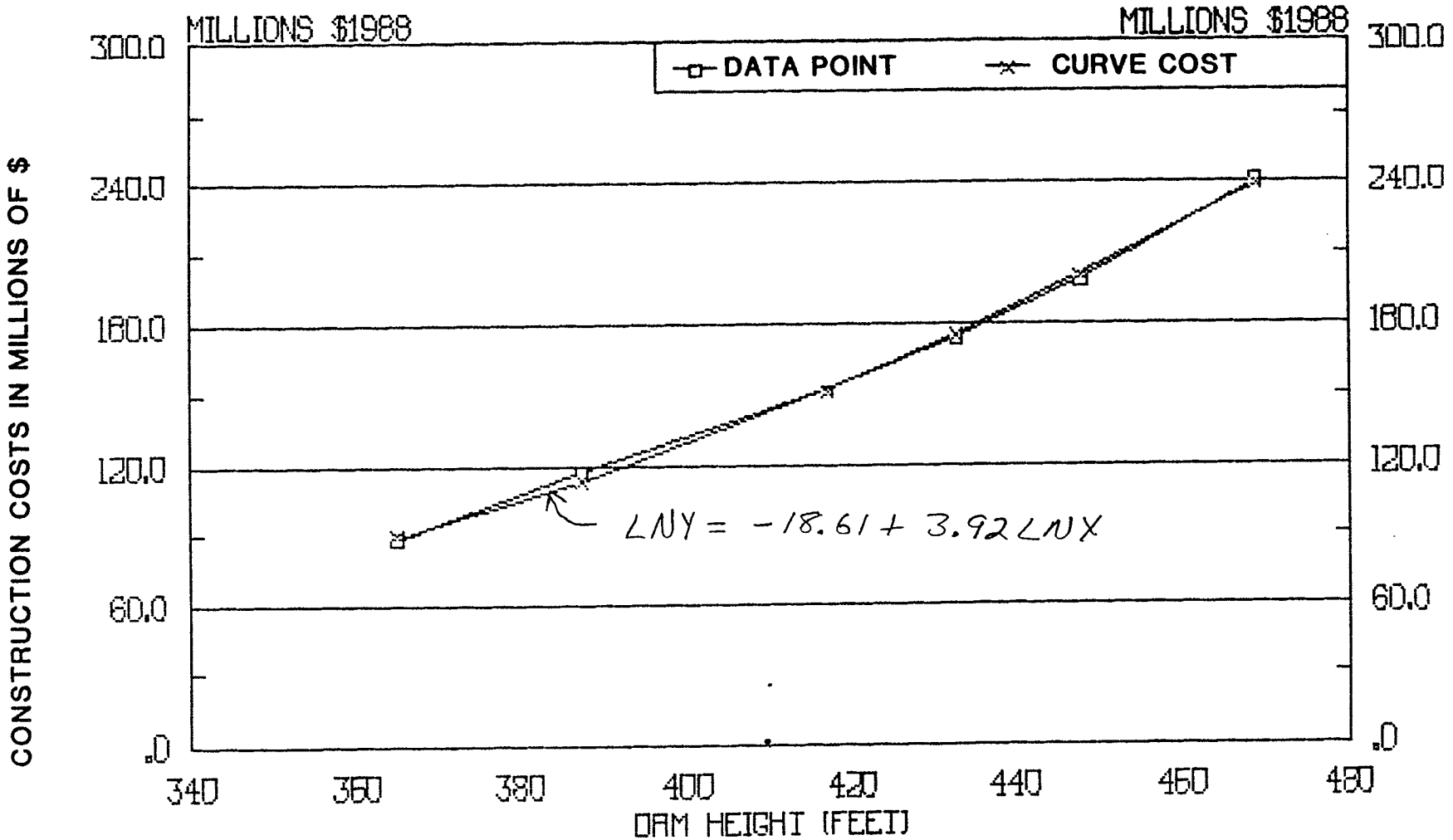
Total Cost at Beginning of Delivery (Equals project first cost, interest and initial filling energy)	$ 1103.5 Million
Present Worth (P.W.) of future fixed O&M costs	$ 31.5
P.W. of future replacement costs	$ 25.3
P.W. of future variable electrical costs (for pumping) At Pump-Gen #1 & Pump-Gen #2	$ 305.2
P.W. of diff. energy (pump/gen) at Oro./San Luis (+ or -)	$ (-) 57.6
Total capitalized cost	$ 1523.1
P.W. of future electrical power generation At Pump-Gen #1 & Pump-Gen #2 (water deliv. to CA Aqueduct)	$ 337.9
Net Capitalized Cost (P.W. at beginning of delivery)	$ 1185 Million

1/ Pump-Gen #1 plant site is below Los Banos Detention Dam;
Pump-Gen #2 plant site is below Los Banos Grandes Dam.

2/ Includes off-peak "Return" energy at Oroville under current Southern California Edison contract when generating capacity would be reduced due to conjunctive operation with LBG.

LOS BANOS GRANDES
MAIN AND SADDLE DAM COSTS

LOGARITHMIC REGRESSION



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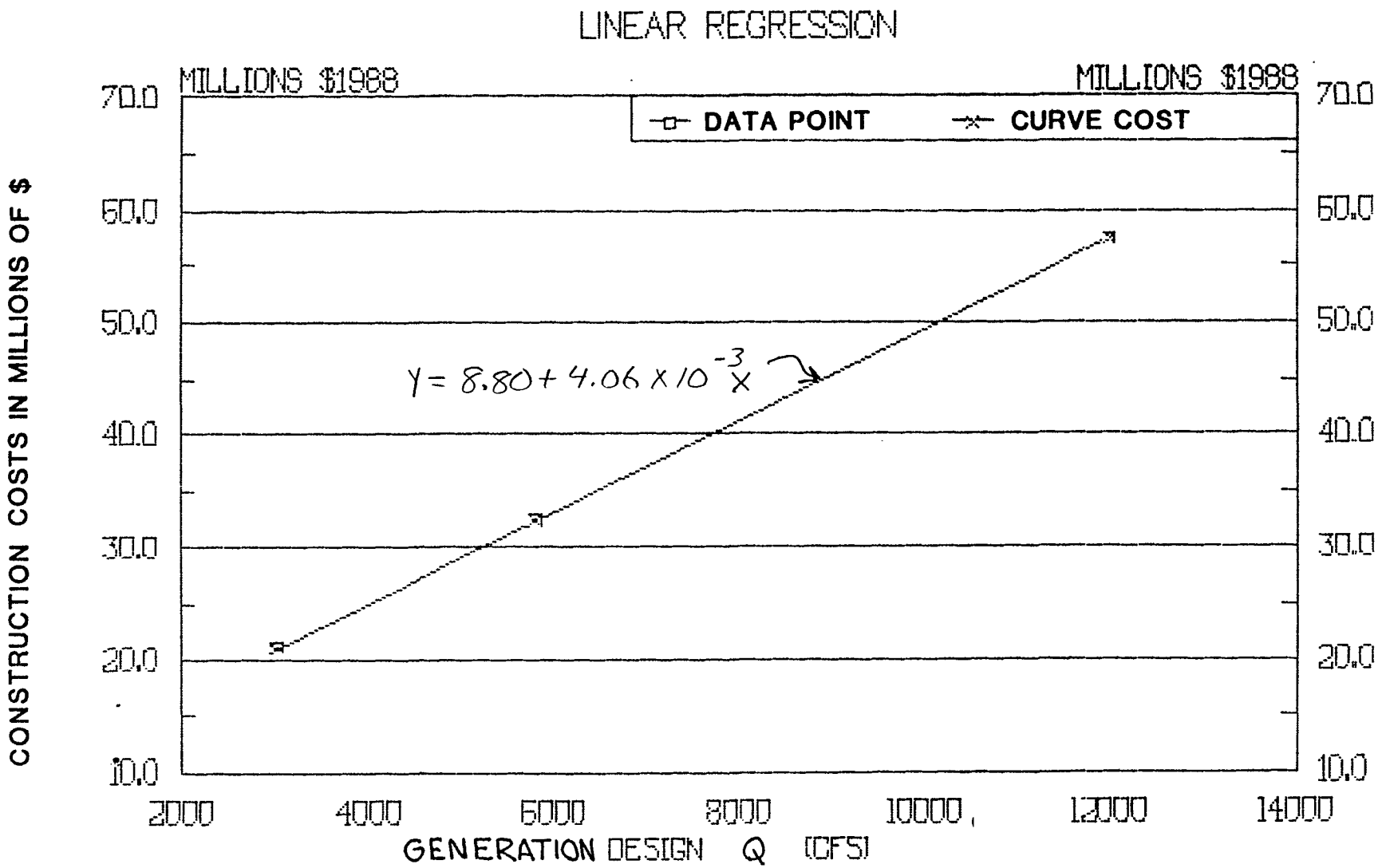
LOS BANOS GRANDES
INLET-OUTLET WORKS (LBD)



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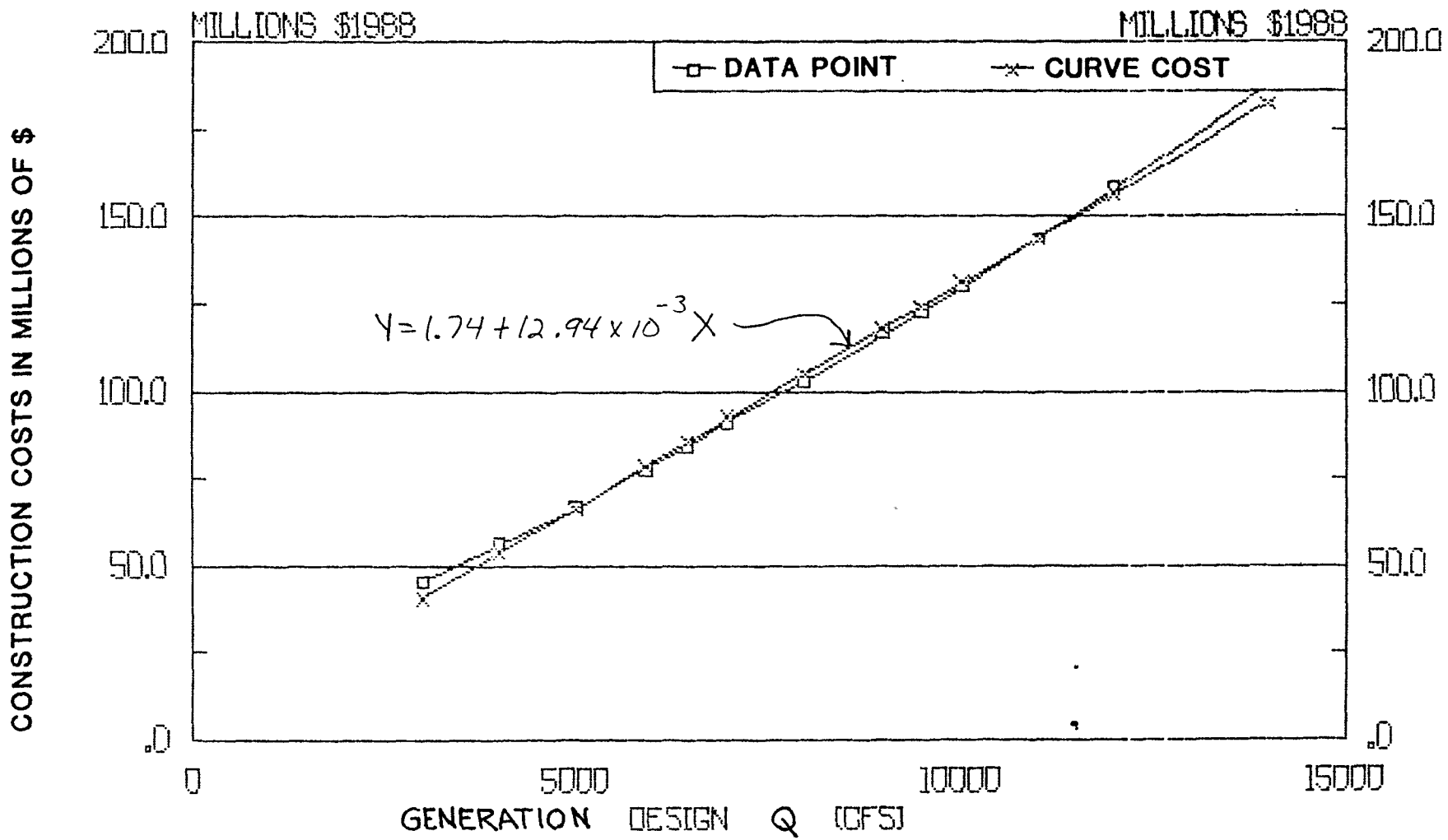
LOS BANOS GRANDES
INLET-OUTLET WORKS (LBG)

LINEAR REGRESSION



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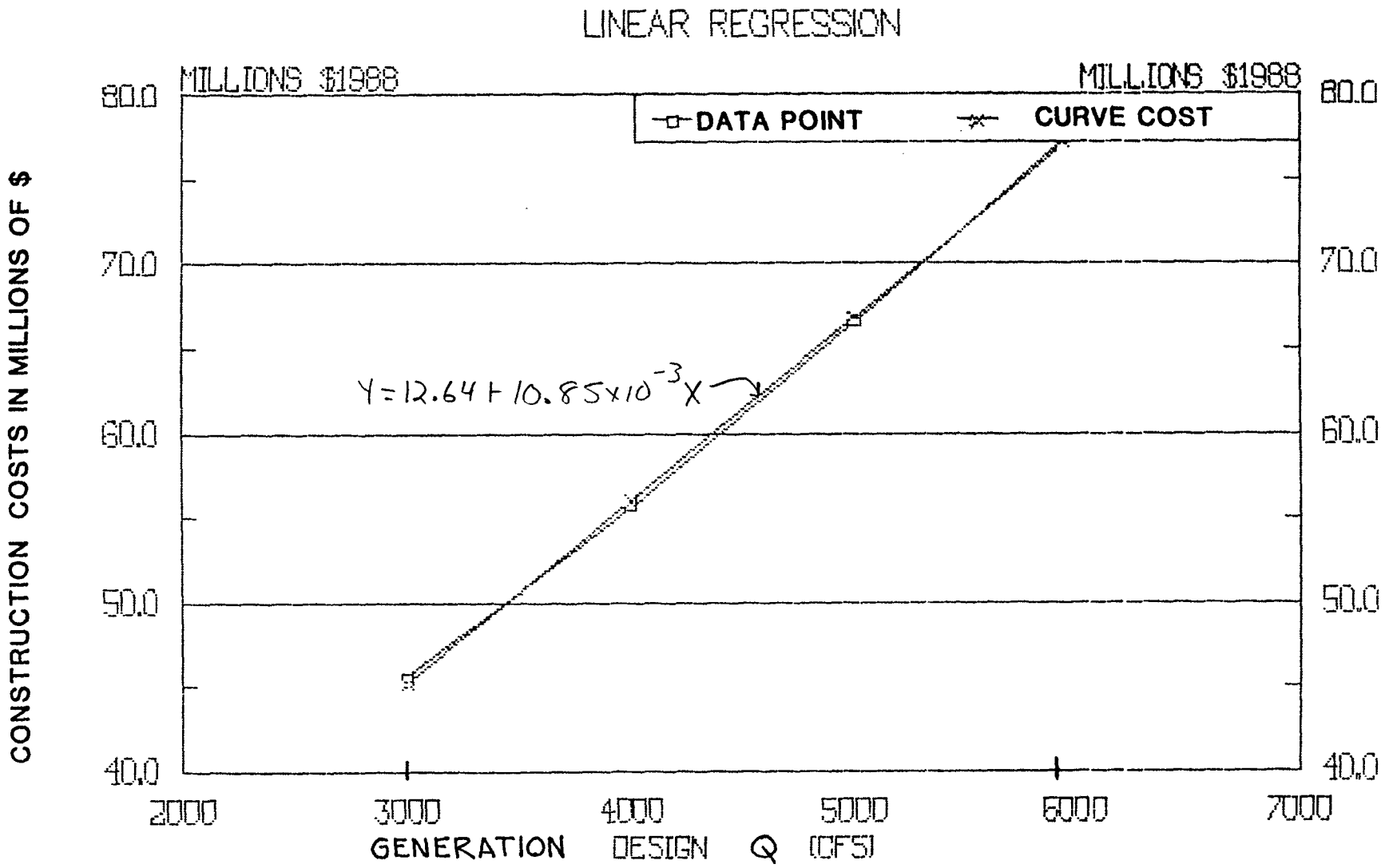
LOS BANOS GRANDES
INLET-OUTLET WORKS (LBG): 3000-5950 CFS



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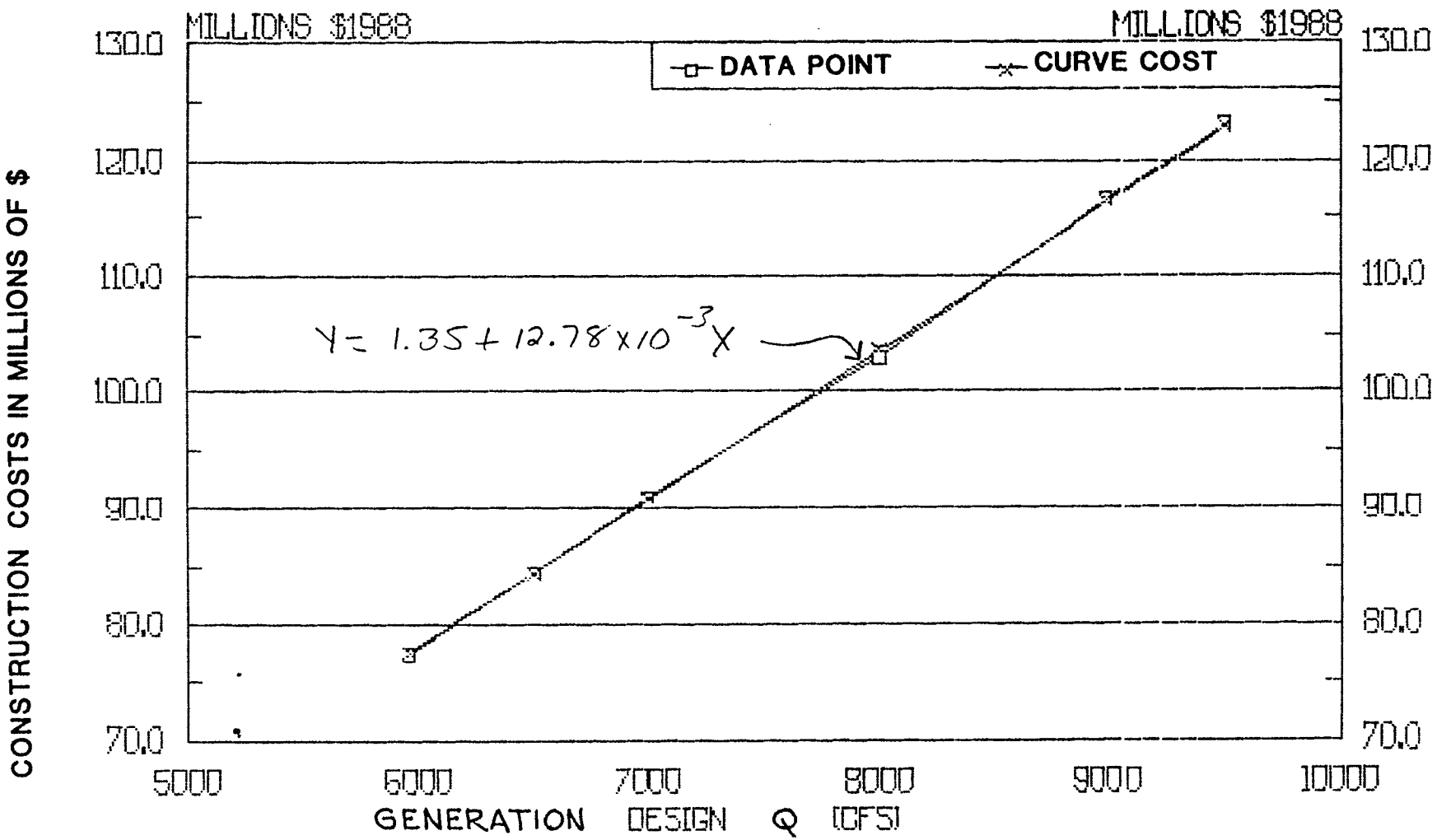
LOS BANOS GRANDES
INLET-OUTLET WORKS (LBG): 5951-9500 CFS

LINEAR REGRESSION



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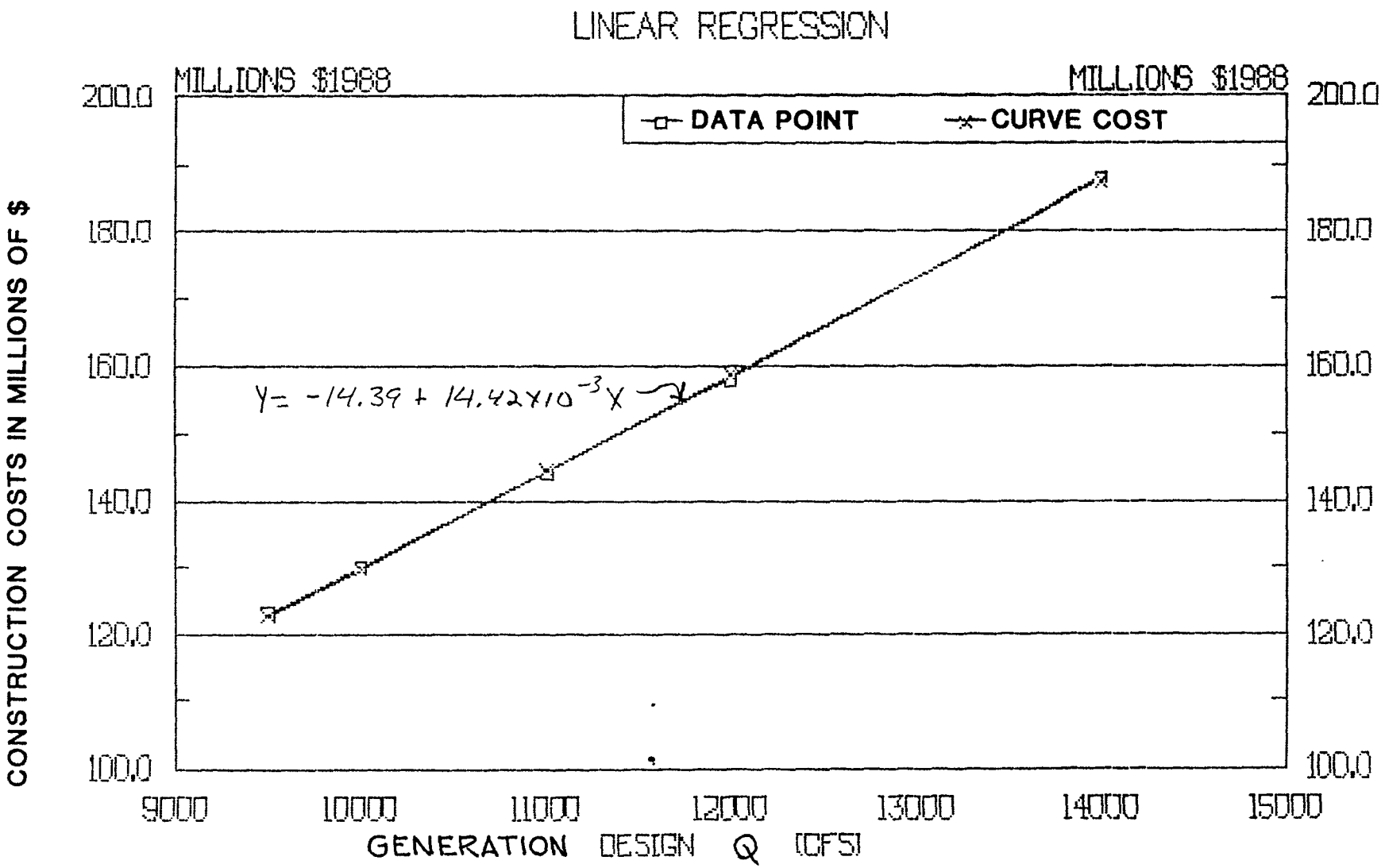
LOS BANOS GRANDES
INLET-OUTLET WORKS (LBG): 9501-14000 CFS



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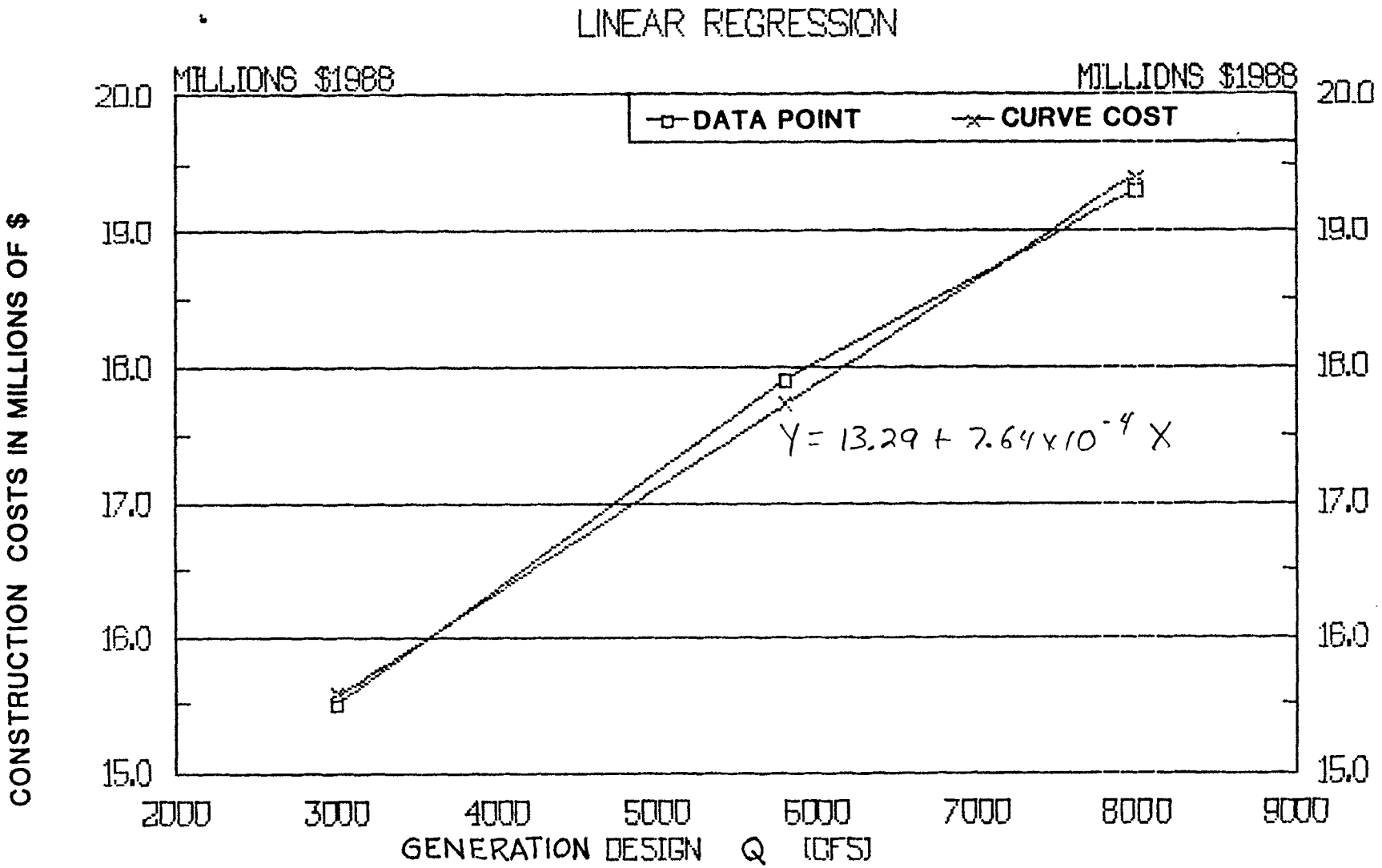
LOS BANOS GRANDES CHANNEL #1



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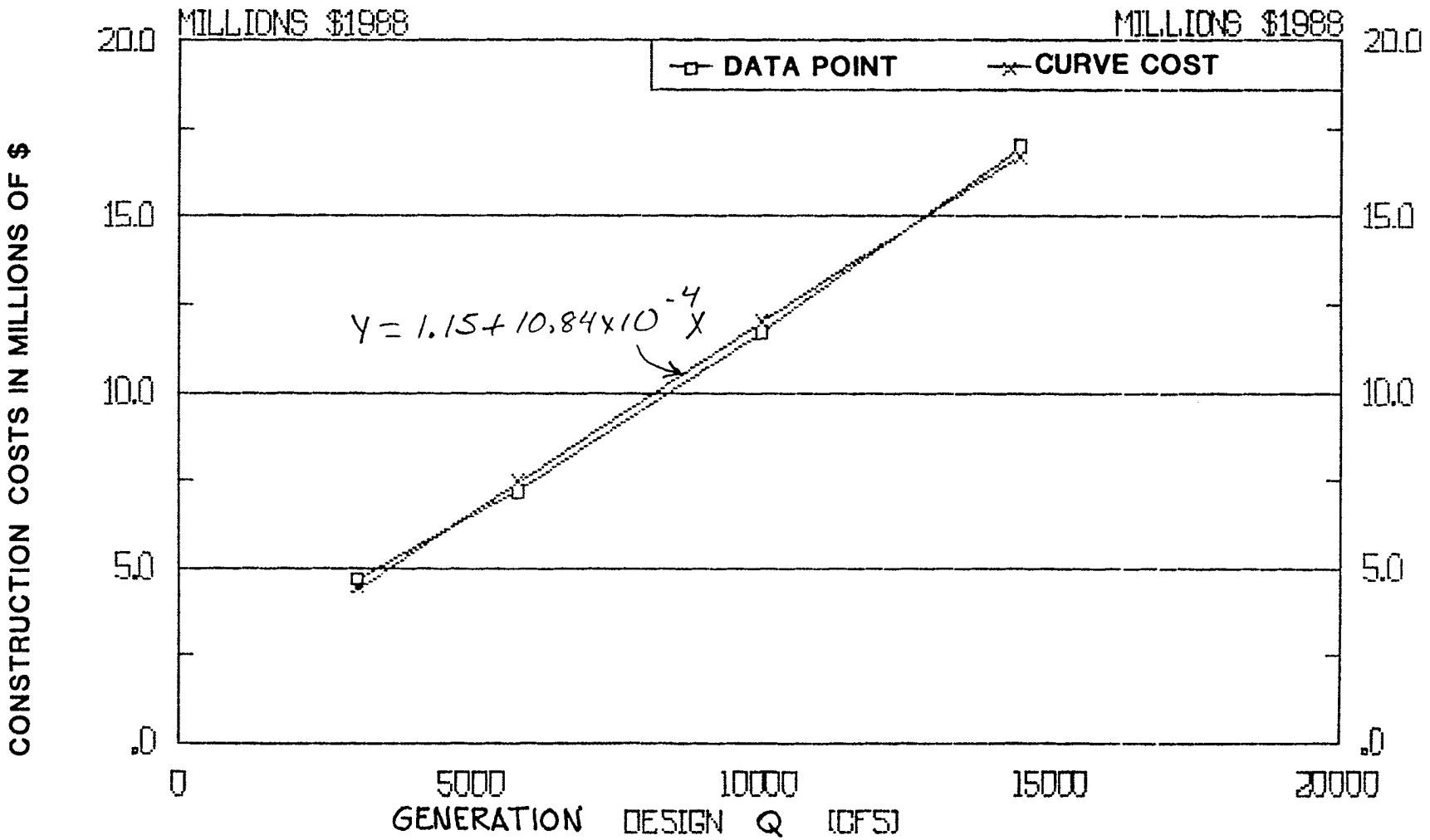
LOS BANOS GRANDES CHANNEL #2

LINEAR REGRESSION



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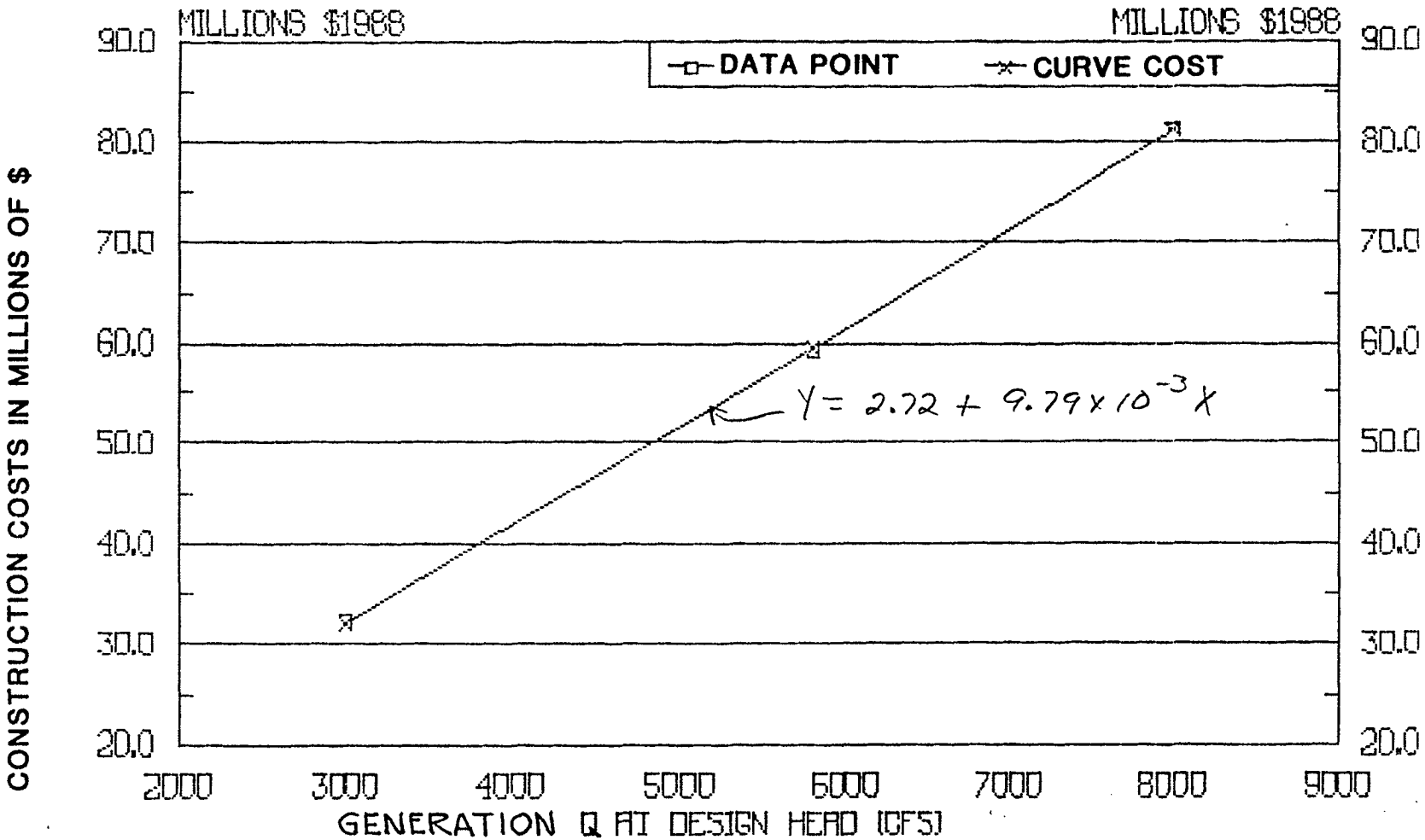
LOS BANOS GRANDES
PUMP–GENERATOR PLANT #1

LINEAR REGRESSION



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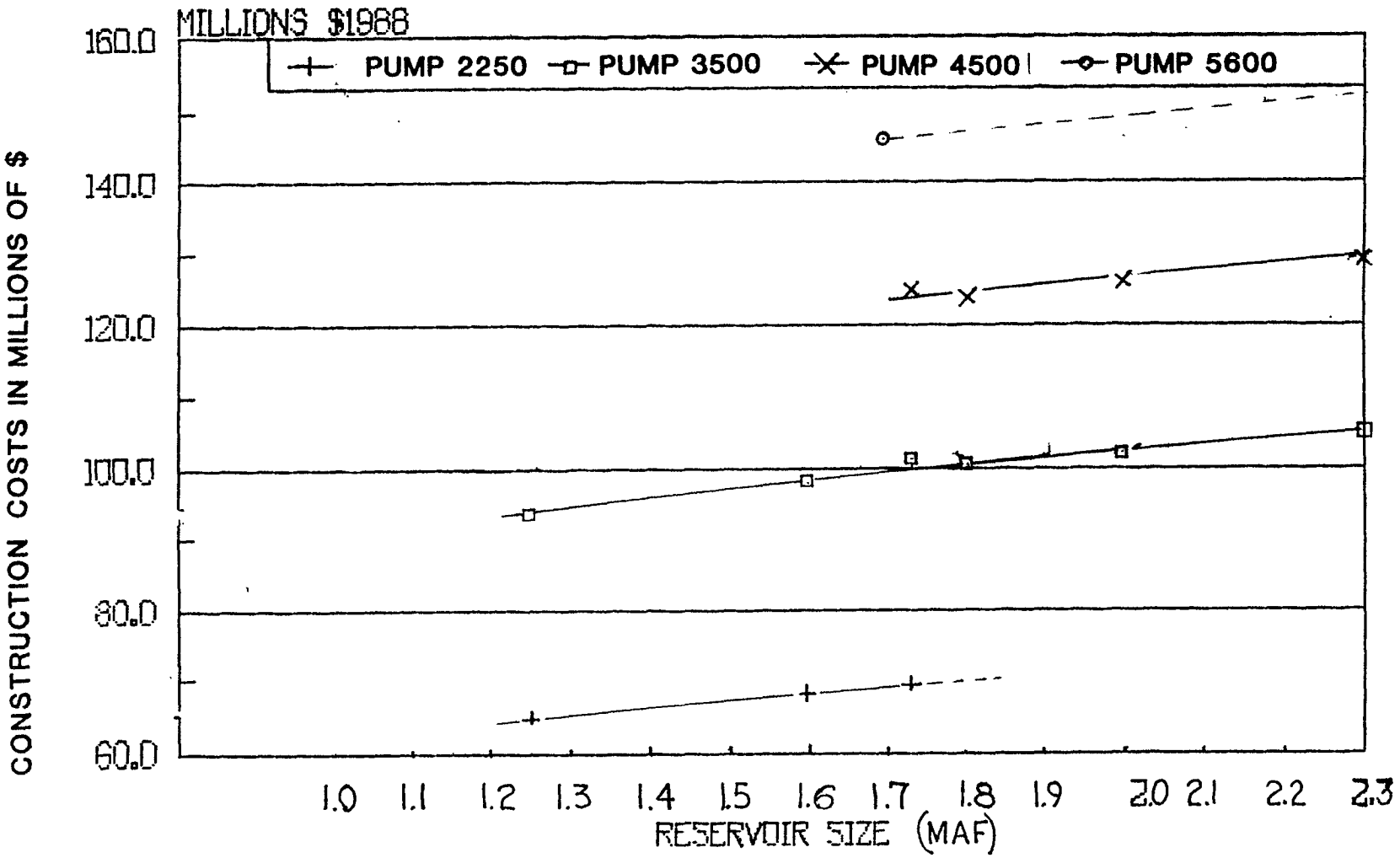
LOS BANOS GRANDES
PUMP–GENERATOR PLANT #2



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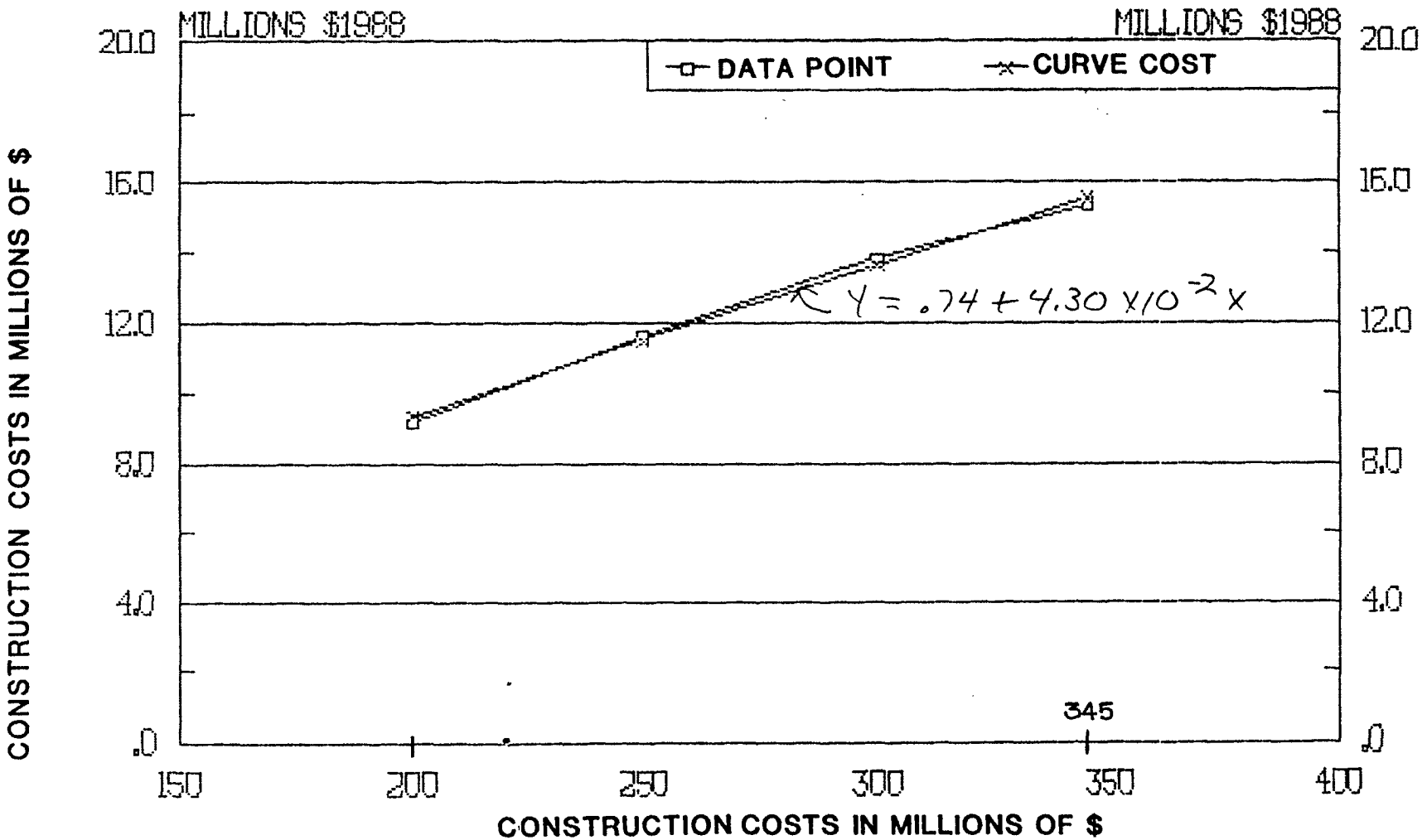
LOS BANOS GRANDES

GENERAL RESERVOIR



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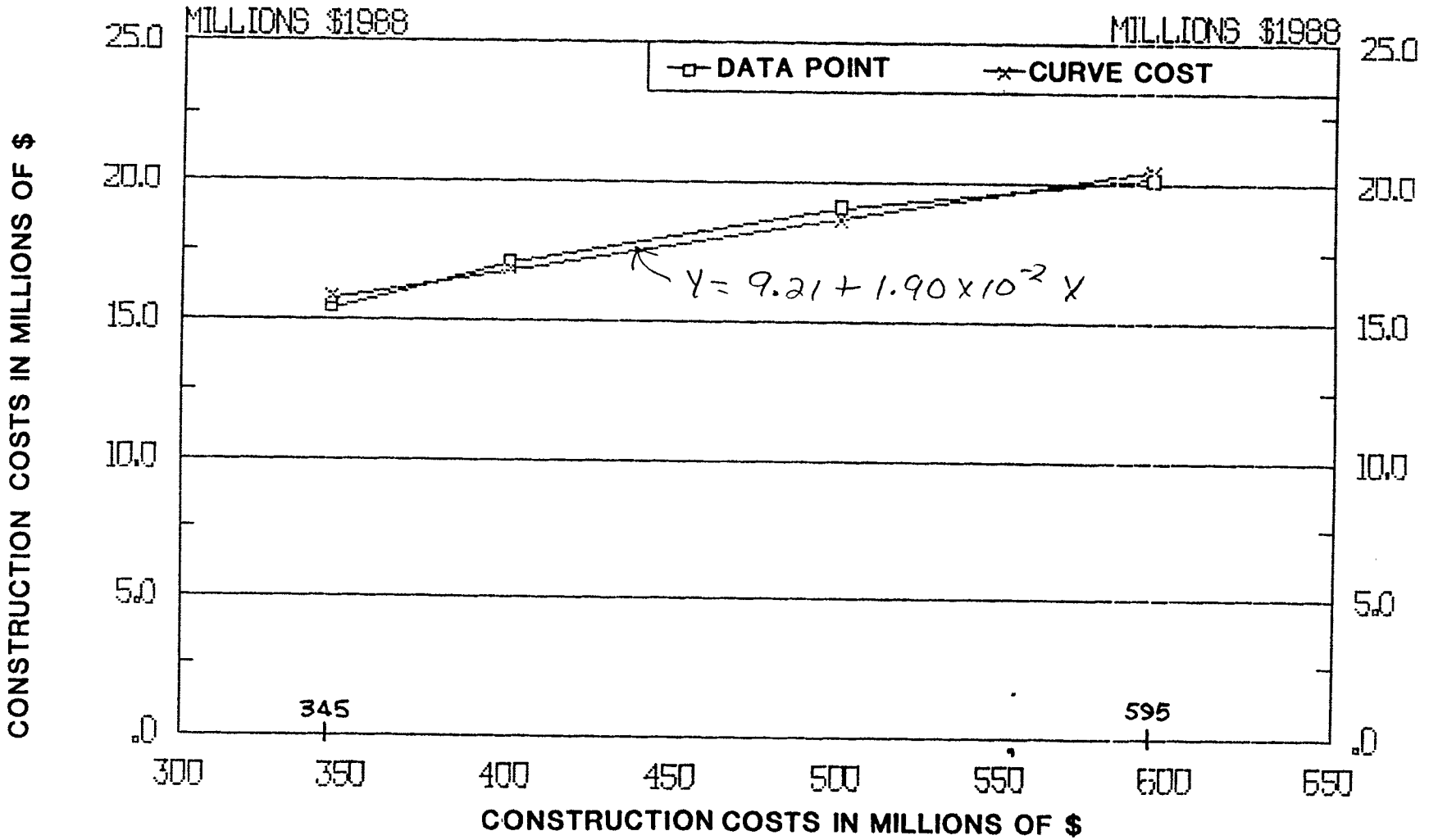
LOS BANOS GRANDES

GENERAL RESERVOIR



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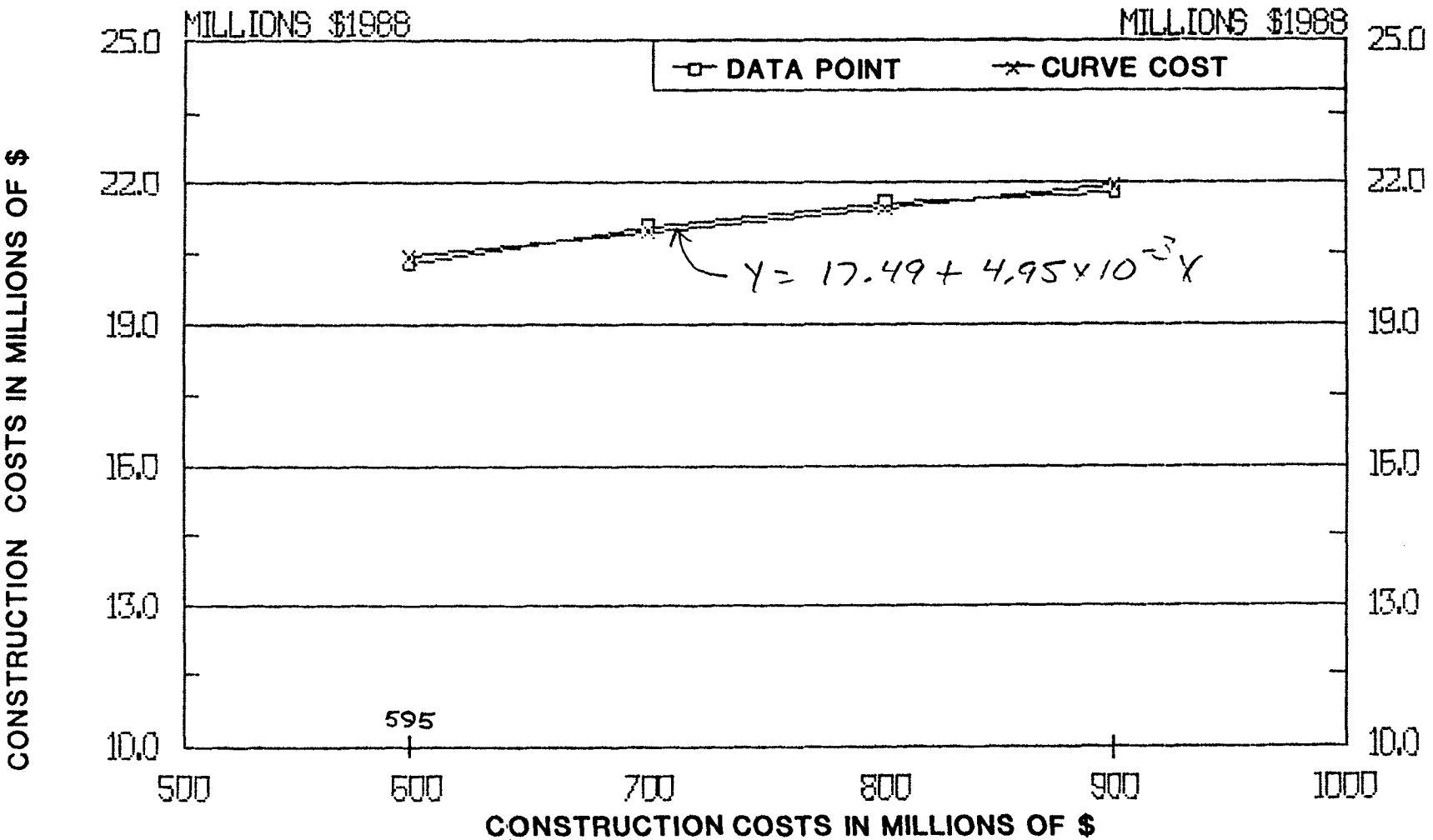
LOS BANOS GRANDES

GENERAL RESERVOIR



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D-054201

State of California | The Resources Agency

Memorandum

Date : October 29, 1985

To : 1. Bob Potter
2. Arthur Gooch
3. Bob Whiting
4. David Kennedy

From : Ray Hoagland
Department of Water Resources

Subject: Changing the Discount Rate

Your approval is requested to change the Department's existing discount rate and related policy. The last such change was made in June 1982 and tied the Department's rate to that used by federal water agencies. Currently, that rate is 8-5/8 percent.

A formal review of the discount rate was undertaken as part of the sizing and cost allocation aspects of the Los Banos Grandes investigation. This coincided with the views of an increasing number of analysts within the Department questioning the appropriateness of the federal rate. The result of the review, along with recommendations, is summarized below.

Because of the nature of water projects as economic investments, DWR discount rates are appropriately derived from the yields* of taxable, long term, low risk securities, both public and private. In recent months the average yields for these securities have been in the 11 to 12 percent range. These yields reflect investors' expectations for long-term inflation, as well as perceptions about risk and other factors. Generally, Department economic studies, as well as studies by federal agencies, are made in terms of constant (i.e. inflation-adjusted) dollars. As a consequence, the discount rate used must be an inflation-adjusted rate.** (The inflation-adjusted rate is called a real discount rate; unadjusted, it is called a nominal discount rate.)

At this time, the most reasonable estimate for average long term inflation is 5 percent. Multiplying the nominal factor of 1.115 (corresponding to the midpoint of the 11 to 12 percent range cited above) by the inflation adjustment factor of 1/1.05 gives a factor of 1.062. This latter

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* Yields, as opposed to interest rates at issue, are determined by the resale value of bonds.

** Economic analyses are not to be confused with financial repayment analyses which are shorter-term and are based on inflated dollars and the interest rates at issue of tax-free bonds.

SURNAME RHoagland

D-054202

factor corresponds to a rate of 6.2 percent. On this basis, 6 percent* is recommended as the real discount rate to be assumed for Department economic analyses. If it is required that an economic study be done in terms of inflated dollars for a specific reason, then an 11 percent* nominal discount rate should be used.

A word about the federal discount rate. Federal criteria specify that the rate will be adjusted annually based on "...the average yield during the proceeding Fiscal Year on interest-bearing marketable securities of the United States which, at the time of the computation is made, have terms of 15 years or more remaining to maturity...". Based on rates of return over the past year, this would suggest a discount rate in the neighborhood of 11 percent. However, the federal criteria also state that "in no event shall the rate be raised or lowered more than one-quarter of one percent for any year". As a consequence, the current federal discount rate of 8-5/8 percent does not reflect "full" rates of return on United States securities nor is it a real rate adjusted for inflation. It is felt that the gap between the federal rate and either a real rate or the going rate on securities warrants a departure from federal criteria.

In view of the above, it is recommended that:

1. The Department adopt a 6 percent discount rate for use in its planning studies. Said rate is to be considered a "real" rate that is, a rate that has been adjusted for inflation. Future benefits and costs would be projected in constant dollars (no increase due to inflation).

2. In the event that inflation is included in the analysis, a 5 percent inflation rate will be assumed. Future benefits and costs will be factored up at this rate. The appropriate "nominal" discount rate would include inflation and be 11 percent. (In effect, for long term planning purposes, a 6 percent real rate is equivalent to an 11 percent nominal rate.)

3. These discount rates would not apply to cooperative studies with the Federal Government if it was decided that federal criteria would be used.

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* Rounded for computational convenience

4. Due to the many uncertainties surrounding the factors influencing the determination of discount rates and long term inflation rates, the Department's policy shall be reviewed annually.

RECOMMEND APPROVAL:

Arthur Gooch, Chief
Division of Planning

Date: 11/4/85

RECOMMEND APPROVAL:

Robert E. Whiting
Deputy Director

Date:

APPROVED:

David N. Kennedy
Director

Date: 11-5-85

10/30/89

LBG ECONOMIC BENEFIT STUDIES - CALC OF COMPOSITE BENEFIT
Full Through Delta Facilities, 1.0maf KWB & LBG(3500cfs Pumping Capacity)

2010 DEMAND STUDIES

RESERV SIZE (taf)	AVG. ANNUAL M&I LOSS ($1000)	AVG. ANNUAL M&I COST ($1000)	AVG. ANNUAL AG LOSS ($1000)	AVG. ANNUAL AG COST ($1000)	AVG ANNUAL COMPOSITE BENEFIT ($1000)
base	41378	233543	15797	5948	0
1000	19511	238024	8492	3198	27441
1190	17911	238345	7634	2875	29901
1600	13866	239127	6267	2360	35046
1728	14960	239100	6624	2494	33488
1800	14211	239106	5855	2205	35289
2000	14435	239191	5442	2049	35549
2300	14043	239483	4940	1860	36340

2035 DEMAND STUDIES

RESERV SIZE (taf)	AVG. ANNUAL M&I LOSS ($1000)	AVG. ANNUAL M&I COST ($1000)	AVG. ANNUAL AG LOSS ($1000)	AVG. ANNUAL AG COST ($1000)	AVG ANNUAL CMPOSITE BENEFIT ($1000)
base	192139	259166	23832	8974	0
1000	149257	266902	20489	7715	39748
1190	141603	268180	19748	7436	47144
1600	129552	270034	18480	6959	59086
1728	125142	271369	17903	6741	62956
1800	124843	271385	17902	6741	63240
2000	121727	272098	17427	6562	66297
2300	117460	273098	16696	6287	70570

LBG BENEFITS ANALYSIS 10/18/89

RESERVOIR SIZE= 1.19 MAF

3500 cfs pumping capacity

3.7 level benefit=	29901
4.2 level benefit=	47144
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%)	85 %
(used to allocate Net Capitalized Cost)	

present worth of benefit series(So.Coast&Ag)=	691940
net capitalizd cost($x1000)of reser(maf)	843000
ncc allocated to recre.(1%)	8430
ncc allocatd to South Coast Area&Ag(see % above)	709385
ncc allocated to all other contractors	125186
pres. worth of benefit to all other contractors	125186
pres. worth of total benefits to all contractors	817126
net benefit ($x1000) of project	-17444

LBG BENEFITS ANALYSIS 10/30/89

RESERVOIR SIZE= 1.60 MAF

3500cfs pumping capacity

3.7 level benefit=	35046
4.2 level benefit=	59086
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%) (used to allocate Net Capitalized Cost)	85

present worth of benefit series(So.Coast&Ag)=	860011
net capitalizd cost($x1000)of 1.6 maf reser=	924200
ncc allocated to recre.(1%)	9242
ncc allocatd to South Coast Area&Ag(see % above)	777714
ncc allocated to all other contractors	137244
pres. worth of benefit to all other contractors	137244
pres. worth of total benefit to all contractors	997255
net benefit ($x1000) of project	82297

LBG BENEFITS ANALYSIS 10/16/89

RESERVOIR SIZE= 1.73 MAF

3500cfs pumping capacity

3.7 level benefit=	35658
4.2 level benefit=	62956
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%)	85 %
(used for allocation of Net Capitalized Cost)	
present worth of benefit series(So.Coast&Ag)=	911347
net capitalizd cost($x1000)of 1.73 maf reser=	960500
ncc allocated to recre.(1%)	9605
ncc allocatd to South Coast Area&Ag(see % above)	808261
ncc allocated to all other contractors	142634
pres. worth of benefit to all other contractors	142634
pres. worth of total benefit to all contractors	1053982
net benefit ($x1000) of project	103087

LBG BENEFITS ANALYSIS 10/27/89

RESERVOIR SIZE= 2.00 MAF

3500 cfs pumping capacity

3.7 level benefit=	35549
4.2 level benefit=	66297
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%)	85 %
(used to allocate Net Capitalized Cost)	
present worth of benefit series(So.Coast&Ag)=	953776
net capitalizd cost($x1000)of 2.0 maf reser=	1023200
ncc allocated to recre.(1%)	10232
ncc allocatd to South Coast Area&Ag(see % above)	861023
ncc allocated to all other contractors	151945
pres. worth of benefit to all other contractors	151945
pres. worth of total benefit to all contractors	1105722
net benefit ($x1000) of project	92754

LBG BENEFITS ANALYSIS 10/27/89

RESERVOIR SIZE= 2.30 MAF

3500 cfs pumping capacity

All benefit and cost values are in $1000

3.7 maf demand level benefit=	36340
4.2 maf demand level benefit=	70570
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%) (used to allocate Net Capitalized Cost)	85

present worth of benefit series(So.Coast&Ag)=	1010800
net capitalizd cost($x1000)of 2.3 maf reser=	1088800
ncc allocated to recre.(1%)	10888
ncc allocatd to South Coast Area&Ag(see % above)	916225
ncc allocated to all other contractors	161687
pres. worth of benefit to all other contractors	161687
pres. worth of total benefit to all contractors	1172487
net benefit ($x1000) of project	94575

LBG ECONOMIC BENEFIT STUDIES - CALC OF COMPOSITE BENEFIT
SDI,KWB & LBG (3500cfs) - NO NORTH DELTA FACIL.
All Values are $1000

2010 DEMAND STUDIES						2035 DEMAND STUDIES						AVG
RESERV SIZE	AVG. ANNUAL M&I LOSS	AVG. ANNUAL M&I COST	AVG. ANNUAL AG LOSS	AVG. ANNUAL AG COST	AVG ANNUAL COMPOSITE BENEFIT	RESERV SIZE	AVG. ANNUAL M&I LOSS	AVG. ANNUAL M&I COST	AVG. ANNUAL AG LOSS	AVG. ANNUAL AG COST	ANNUAL CMPOSITE BENEFIT
base	56384	223042	18994	7152	0	base	261819	247513	28655	10790	0
1190	18645	236674	8882	3345	38026	1190	147553	266761	19245	7247	107971
1600	15320	234780	7426	2801	45245	1600	140171	268306	18223	6862	115215
1728	14087	238637	6931	2610	43308	1728	136321	269845	17195	6475	118941
2000	15096	238282	6195	2333	43665	2000	134590	269790	17253	6497	120647
2300	14612	238735	5505	2073	44646	2300	131816	270370	16927	6374	123290

LBG BENEFITS ANALYSIS - no North Delta Facilities

RESERVOIR SIZE= 1.19 MAF

3500 cfs Pumping Capacity

10/25/89

3.7 level benefit=	37547
4.2 level benefit=	107971
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%) (used to allocate Net Capitalized Cost)	85 %
present worth of benefit series(So.Coast&Ag)=	1492971
net capitalizd cost($x1000)of reser(maf)	843000
ncc allocated to recre.(1%)	8430
ncc allocatd to South Coast Area&Ag(see % above)	709385
ncc allocated to all other contractors	125186
pres. worth of benefit to all other contractors	125186
pres. worth of total benefit to all contractors	1618157
net benefit ($x1000) of project	783587

LBG BENEFITS ANALYSIS - no North Delta Fa

10/26/1989

RESERVOIR SIZE= 1.60 MAF

3500 cfs Pumping Capacity

Modified operation for 1934 delivery criteria

All costs and benefits are shown in $1000

3.7 level benefit=	44387
4.2 level benefit=	115215
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%) (used for allocation of Net Capitalized Cost)	85

present worth of benefit series(So.Coast&Ag)=	1605952
net capitalizd cost($x1000)of 1.73 maf reser=	924200
ncc allocated to recre.(1%)	9242
ncc allocatd to South Coast Area&Ag(see % above)	777714
ncc allocated to all other contractors	137244
pres. worth of benefit to all other contractors	137244
pres. worth of total benefit to all contractors	1743196
net benefit ($x1000) of project	828238

LBG BENEFITS ANALYSIS - no North Delta Facilities

10/26/1989

RESERVOIR SIZE= 1.73 MAF

3500 cfs Pumping Capacity

Modified operation for 1934 delivery criteria

All costs and benefits are shown in $1000

3.7 level benefit=	44531
4.2 level benefit=	118941
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%)	85
(used for allocation of Net Capitalized Cost)	

present worth of benefit series(So.Coast&Ag)=	1654058
net capitalizd cost($x1000)of 1.73 maf reser=	960500
ncc allocated to recre.(1%)	9605
ncc allocatd to South Coast Area&Ag(see % above)	808261
ncc allocated to all other contractors	142634
pres. worth of benefit to all other contractors	142634
pres. worth of total benefit to all contractors	1796692

net benefit ($x1000) of project	845797

LBG BENEFITS ANALYSIS - no North Delta Facilities

RESERVOIR SIZE= 2.00 MAF
3500 cfs Pumping Capacity
Modified Operation to meet 1934 delivery criteria
10/26/1989
All costs and benefits are shown in $1000

3.7 level benefit=	44791
4.2 level benefit=	120647
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%)	85 %
(used to allocate Net Capitalized Cost)	

present worth of benefit series(So.Coast&Ag)=	1676659
net capitalizd cost($x1000)of 2.0 maf reser=	1023200
ncc allocated to recre.(1%)	10232
ncc allocatd to South Coast Area&Ag(see % above)	861023
ncc allocated to all other contractors	151945
pres. worth of benefit to all other contractors	151945
pres. worth of total benefit to all contractors	1828604
net benefit ($x1000) of project	815636

LBG BENEFITS ANALYSIS -no North Delta Facilities

10/26/89

RESERVOIR SIZE= 2.30 MAF

3500 cfs pumping capacity

Modified Operation for 1934 delivery criteria

All costs and benefits are shown in $1000

3.7 maf demand level benefit=	46021
4.2 maf demand level benefit=	123290
interest rate=	.06
term (years) =	50
SWP Service Area included in Economic Study (%) (used to allocate Net Capitalized Cost)	85

present worth of benefit series(So.Coast&Ag)=	1714127
net capitalizd cost($x1000)of 2.3 maf reser=	1088800
ncc allocated to recre.(1%)	10888
ncc allocatd to South Coast Area&Ag(see % above)	916225
ncc allocated to all other contractors	161687
pres. worth of benefit to all other contractors	161687
pres. worth of total benefit to all contractors	1875814
net benefit ($x1000) of project	797902