CHAPTER VII
CONCEPT PLANS

This chapter describes a set of concept plans that were formulated from the retained resource management measures presented in **Chapter VI**. Because a large array exists of potential measure combinations and sizes, the planning approach was not to develop an exhaustive list of alternatives or to optimize outputs. Rather, the purpose of this phase of the formulation process is (1) to explore a group of different strategies to address the planning objectives, constraints, and criteria and (2) to identify concept plans that may warrant further development into initial alternatives and later into comprehensive alternative plans. The concept plans described herein are intended to promote discussion and provide a background for formulating alternative plans in the remainder of the feasibility study, with input from participating agencies, stakeholders, and the public.

The plans described in this chapter represent a range of potential actions to address the planning objectives of the Los Vaqueros Expansion Investigation (LVE), formulated by combining the retained resource management measures. First, concept plans were developed that focus on single project objectives: water supply reliability or Environmental Water Account (EWA) water replacement. A third set of plans was then developed that includes a mixture of measures to address all of the objectives of the LVE, termed combined objective plans. The plans are numbered to facilitate discussion, but neither the numbering, nor the order in which the plans appear, is indicative of their performance or standing.

This chapter begins with a discussion of the Federal No-Action plan, followed by a description of common physical features associated with enlarging Los Vaqueros Reservoir and related facilities. This is followed by a brief description of each of the concept plans. The chapter concludes with a summary of estimated benefits and costs for each of the concept plans.

NO-ACTION PLAN (NO FEDERAL ACTION)

Under the No-Action plan, the Federal Government would take no-action toward implementing a specific plan to address water supply reliability or developing a less-costly replacement supplies for the EWA. The following summarizes the consequences of implementing the No-Action plan in relation to the objectives of the LVE.

Bay Area Water Supply Reliability and Quality

Within the State of California (State), the demand for water in the future will significantly exceed available supplies. Competition for finite water supplies will intensify as water demands increase to support municipal and industrial (M&I) needs, urban growth, and the State's agricultural and industrial economy. During drought years, statewide water shortages could be as high as 10 million acre-feet (MAF) by 2040. Within the primary study area, the demand for M&I water supplies also is expected to significantly exceed supplies. No additional water supplies or storage facilities would be developed in the study area under the No-Action plan. Water shortages will continue to increase beyond 2020, particularly in dry periods, even if

planned supplies identified in the various urban water management plans are successfully secured. Projects and programs to help conserve and reuse more water are expected to continue, but the incidence of forced conservation will increase. Without the development of new water supplies, pressure will increase to shift water use from agriculture to meet urban demands. Over time, decreases in water supplies available for agricultural uses in the Central Valley of California will result in increased water rates and a shifting in the type and amount of crops grown and resulting goods and services produced. The overall socioeconomic and environmental impacts to the Central Valley and elsewhere in California resulting from this shift in water use and related agricultural production is speculative.

The quality of water in the Sacramento-San Joaquin Delta (Delta) is expected to remain as under existing conditions. In addition, the quality of local surface and groundwater supplies is expected to remain relatively constant. Water users in the study area who rely on the Delta will find that local blending programs are less effective, Delta supplies are less suitable for recharge and environmental uses, and M&I water is more costly to treat. These trends will contribute to increased water shortages in the future.

Long-Term EWA

It is expected that some form of the EWA will continue in the future with a primary focus on offsetting water delivery reductions resulting from regulatory actions that curtail Delta pumping to protect at-risk fish. However, as demand and competition for water increases throughout the State, driven primarily by forecasted major increases in urban population, the cost of available supplies for exchanges or transfers will increase dramatically. Because the EWA relies heavily on transfer market purchases and short-term transfer agreements, the cost of the program is expected to significantly increase in the future.

CONCEPT PLAN COMMON FEATURES

This section begins by describing measures or features that are common to many of the concept plans. **Table VII-1** summarizes how the retained measures were combined to form concept plans that focus on San Francisco Bay Area (Bay Area) water supply reliability, EWA replacement supply, or combined objectives. As shown in the table, most of the concept plans include enlarging Los Vaqueros Reservoir, enlarging diversion and conveyance facilities from the Delta to Los Vaqueros Reservoir, and conveying water from Los Vaqueros Reservoir to project beneficiaries. Following is a highlight of these common features, while features that are specific to an individual concept plan are described later with each plan.

Los Vaqueros Reservoir Enlargement

Engineering studies have estimated that Los Vaqueros Reservoir could be expanded by as much as 400,000 acre-feet. **Plate 6** illustrates the relationship between reservoir stage, area and capacity for a range of potential enlargements. For the purpose of this initial alternatives study, two enlargement options are under consideration: a 15-foot dam raise to create a reservoir with up to about 125,000 acre-feet, and removal and reconstruction of the dam to create a reservoir with up to about 500,000 acre-feet. Basic facilities and features of an enlarged Los Vaqueros Project are shown in **Plate 7** and described below.

TABLE VII-1
SUMMARY OF CONCEPT PLAN FEATURES

Concept Plans	Resource Management Measures						
	Raise Los Vaqueros Dam In-Place	Enlarge Los Vaqueros Reservoir	Enlarge Delta Pumping/ Convey-ance	Los Vaqueros with Dyer Canal Intertie	Los Vaqueros - Bethany Reservoir Intertie	Desal-ination Plant	Water Quality Reop-eration
Bay Area Water Supply Reliability Focus							
1 Raise Los Vaqueros Dam In-Place for Water Supply Reliability	✓		✓	✓			
2 Enlarge Los Vaqueros Dam and Reservoir for Water Supply Reliability		✓	✓	✓			
3 Desalination with Storage (Enlarged Los Vaqueros Reservoir) for Water Supply Reliability		✓	✓	✓		✓	
EWA Replacement Supply Focus							
4 Enlarge Los Vaqueros Reservoir with Dyer Canal Intertie for EWA		✓	✓	✓			
5 Enlarge Los Vaqueros Reservoir with Bethany Reservoir Intertie for EWA		✓	✓		✓		
Combined Objective Focus							
6 Water Supply / EWA Combination with Dyer Canal Intertie		✓	✓	✓			
7 Water Supply / EWA Combination with Bethany Reservoir Intertie		✓	✓		✓		
8 Water Supply / EWA Combination with Water Quality Improvements		✓	✓	✓			✓

KEY: EWA = Environmental Water Account

Dam and Reservoir

Preliminary studies indicate that Los Vaqueros Dam could be raised in-place by as much as 15 feet without major dam and abutment reconstruction, creating up to about 25,000 acre-feet of additional storage. Larger expansion of the reservoir would require demolishing the existing dam and constructing a new dam about 500 feet upstream. The new dam would have a similar earthfill design and be constructed parallel to the existing dam. **Plate 8** shows a plan and section view of a new earthfill dam for a 500,000-acre-foot reservoir, the largest practical expansion of Los Vaqueros Reservoir. **Table VII-2** summarizes various physical features and construction components associated with these reservoir expansion options.

TABLE VII-2
PHYSICAL FEATURES OF RESERVOIR ENLARGEMENT SCENARIOS

Item	Total Reservoir Capacity (acre-feet)			
	100,000 (existing)	**125,000 (dam raise)**	**300,000**	**500,000**
Los Vaqueros Dam				
Type	Earthfill	Earthfill	Earthfill	Earthfill
Embankment Volume (million cubic yards)	2.85	3.88	10.75	18.50
Crest Elevation (feet)	487	502	587	656
Height Above Downstream Toe (feet)	190	205	290	360
Crest Length (feet)	980	1,095	1,850	2,300
Crest Width (feet)	40	40	40	40
Los Vaqueros Reservoir				
Water Surface Elevation (feet)				
Gross Pool (maximum water surface)	472	487	567	636
Increase in Gross Pool	-	15	140	164
Minimum Operating Pool	380	380	380	380
Capacity (1,000 acre-feet)				
Total at Gross Pool	100	125	300	500
Capacity Increase	-	26	200	400
Minimum Operating Pool [2]	44	44	44	44
Surface Area (acres) at Gross Pool	1,500	1,640	2,600	3,300
Spillway & Outlet Works				
Type	Ogee	Ogee	Ogee	Ogee
Length (feet)	2,000	2,000	2,000	2,000
Width (feet)	15	15	TBD	TBD
Crest Elevation (feet)	481	481	TBD	TBD
Probable Maximum Flood (cfs) [1]	21,500	Same	Same	Same
Spillway Capacity (cfs) [1]	1,420	Same	Same	Same

KEY: cfs = cubic feet per second TBD = to be determined

Notes:

1. *The Probable Maximum Flood (PMF) is used in planning and design of the dam, reservoir, spillway, and appurtenance. Although it will be reviewed during future studies, it is not expected to differ significantly from existing estimates.*
2. *The minimum operating pool of 44 TAF represents the normal range of reservoir operations; capacity between 44 TAF and dead storage (4 TAF) is reserved as emergency storage for CCWD.*

Spillway

As shown in **Table VII-2**, the spillway for an enlarged reservoir would have a total capacity of 1,420 cubic feet per second (cfs), which is sufficient to accommodate the Probable Maximum Flood (PMF) with a peak reservoir inflow of 21,500 cfs. For a 15-foot dam raise, the existing spillway would not require significant modification and would remain about 15 feet wide and 2,000 feet long with an ogee-shaped crest. The spillway for a larger reservoir expansion would likely have a similar design.

Inlet and Outlet Facilities

A 15-foot dam raise would likely use existing inlet and outlet facilities. Separate inlet and outlet facilities would be constructed for a larger reservoir expansion to allow simultaneous delivery to, and releases from, the reservoir. The separate inlet facility also would provide water quality benefits by improving mixing within the reservoir. Inlet facilities would consist of an inlet control structure located at the downstream face of the dam, a tunnel throughout the dam abutment, and a vertical gate shaft connecting to the tunnel immediately upstream of the axis of the dam. Outlet facilities would consist of a multilevel intake structure in the reservoir, an outlet tunnel, an outlet control structure, and connection to a water delivery pipeline. The location of outlet facilities, either adjacent to the dam or elsewhere on the reservoir, would depend on the alignment of the delivery pipeline. Potential also exists to interconnect the inlet and outlet facilities with delivery conveyance features to allow Delta diversions to be provided directly to the South Bay Aqueduct (SBA) or to Bethany Reservoir (see below). These, and other potential arrangements, will be considered in future studies.

Reservoir Enlargement Impacts

Table VII-3 summarizes potential relocations and other reservoir area impacts associated with enlarging Los Vaqueros Reservoir to a capacity of 500,000 acre-feet. These impacts would generally be proportionally similar for other enlargement scenarios. The potential inundation area for enlarging the reservoir up to 500,000 acre-feet is shown in **Plate 9**. Enlarging the reservoir would cause direct impacts due to inundation, and indirect impacts related to facilities access, operation, and maintenance. General types of impacts would include loss of up to 1,960 acres of grasslands, oak woodland, chaparral, and wetland vegetation. Existing recreation facilities and access around the reservoir also would be impacted.

Delta Diversion, Conveyance, and Appurtenance

Additional pertinent facilities related to the expansion of Los Vaqueros Reservoir include (1) new screened intakes in the Delta, (2) new pumping capacity in the Delta to deliver supplies to the reservoir, and (3) new conveyance pipelines to deliver water from the new Delta intake and pump station to the enlarged reservoir. Other elements would include a small forebay or balancing reservoir (for larger reservoir expansion options), a flow control structure, and flood control features to support the diversion and conveyance facilities.

TABLE VII-3
RESERVOIR AREA IMPACTS ASSOCIATED WITH 500,000-ACRE-FOOT ENLARGEMENT OF LOS VAQUEROS RESERVOIR

Facility Types	Description
Recreation Facilities	
Boating	Marina Complex: • Docks and boathouse • 59 parking stalls • Restrooms • Concession stand • Miscellaneous picnic and visitor facilities
Fishing	• 4 fishing piers • Miscellaneous shoreline access
Picnic & Parking	Los Vaqueros Staging Area: • 61 parking stalls • 1 restroom Oak Point and Knoll picnic areas: • 18 parking stalls • 25 picnic tables
Trails	10.7 miles existing trails
Roads	Access road to marina
Wildlife Habitat	1,960 acres total (grassland, oak woodland, and chaparral/scrub)
Aquatic Habitat	0.5 acres (existing wetland)
Other	175 acres (created as a mitigation for the existing reservoir project)

New screened Delta intakes located along Old River or other locations in the central Delta would be required to provide additional water diversions for conveyance to the enlarged reservoir. General locations for the intake facilities are illustrated in **Figure VII-1**. Future studies on potential diversion facility sites will consider cost comparisons, improvements in the quality of water supplies in the central Delta (as opposed to along Old River), area impacts, and flexibility in the timing and duration of the increased diversions. Estimated total capacities needed for the new intakes would range from about 500 cfs to 1,750 cfs. State-of-the-art fish screens would be mounted to the face of the intakes to prevent entrainment of juvenile and adult fish in the intakes and reduce entrainment of debris and sediment in the system.

FIGURE VII-1 – POTENTIAL LOCATION OF NEW CENTRAL DELTA INTAKE FACILITIES

The Los Vaqueros enlargement concept plans would include a new pumping station to lift water

to the expanded Los Vaqueros Reservoir. The size of the pump station would be based on a combination of the conveyance flow rate to the reservoir and the maximum reservoir water level. Because of the volume of flow and increase in pumping head associated with an enlarged reservoir, the concept plans would include new pipeline(s) connecting the Delta pumping station to the expanded Los Vaqueros Reservoir. The pipeline(s) would have capacities ranging from about 500 cfs to 1,750 cfs. A new transfer facility and balancing reservoir would be constructed to allow deliveries from the new Delta diversion either to Los Vaqueros Reservoir or to the Contra Costa Canal via the existing Transfer and Los Vaqueros pipelines.

Los Vaqueros Reservoir Delivery Conveyance

Concept plans that include enlarging Los Vaqueros Reservoir also would include facilities to deliver water from Los Vaqueros to SBA agencies or other project beneficiaries. Two potential intertie options have been identified in previous studies: a pumped pipeline to the Dyer Canal segment of the SBA, or a gravity pipeline to Bethany Reservoir. Potential pipeline alignments for the gravity and pumped interties are illustrated in **Figure VII-2**.

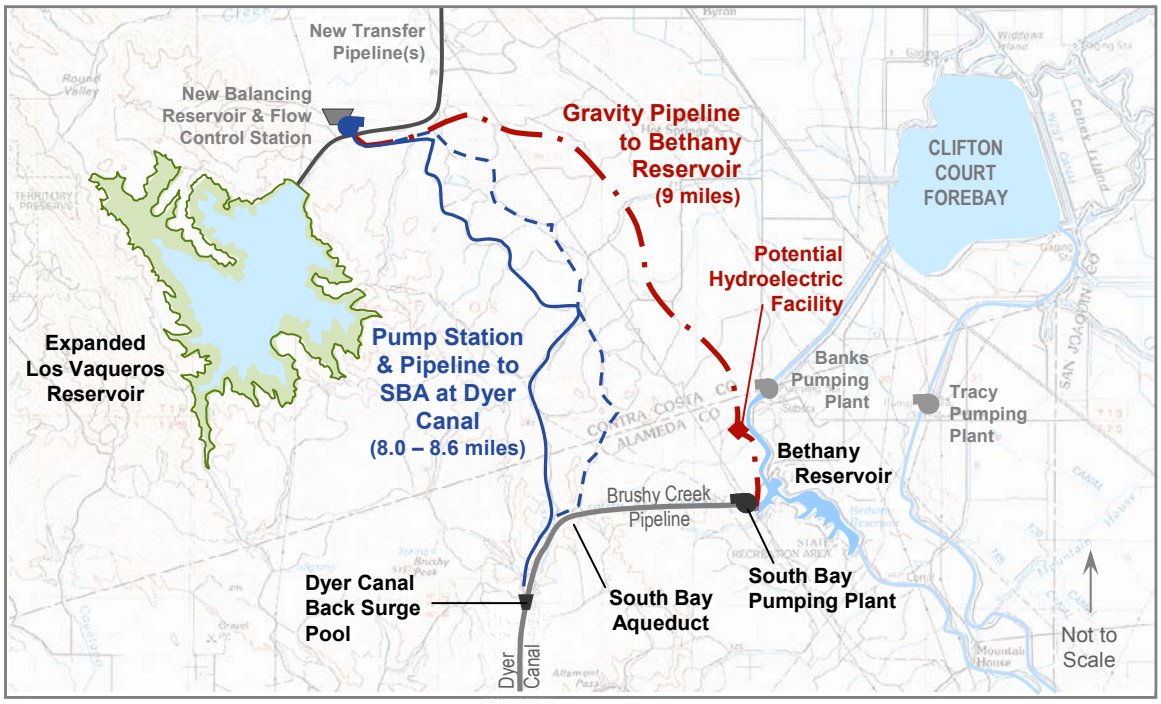


FIGURE VII-2 – POTENTIAL LOS VAQUEROS RESERVOIR INTERTIE OPTIONS

Various potential pipeline alignments exist from Los Vaqueros Reservoir to the Dyer Canal Back Surge Pool, located at the beginning of the Dyer Canal segment of the SBA. A connection to this location would require a 90-inch-diameter pipeline and a pump station to lift water from Los Vaqueros Reservoir to the Dyer Canal (illustrated in **Figure VII-3**). The most promising alignments would originate near the reservoir inlet (located adjacent to the dam), and travel between 8.0 and 8.6 miles to the Dyer Canal. The pump station for this route would have a capacity matching the capacity of the SBA of 430 cfs, including 10 pumps with a total of 36,000 horsepower. The advantage of this intertie option is that further pumping would not be required to deliver water to SBA user agencies.

The second option would be to deliver water from Los Vaqueros Reservoir to the existing Bethany Reservoir at the head of the SBA. Bethany Reservoir has an elevation of 245 feet, which would allow water to flow from Los Vaqueros via gravity. The intertie would connect to the South Bay Pumping Plant in a manner that preserved the water quality benefits of the project by delivering directly to the pumping plant intake, preventing mixing of higher quality Los Vaqueros water with lower quality water in Bethany Reservoir prior to delivery to SBA users. In addition, the elevation difference could facilitate a small hydropower generation facility to help offset some of the energy required to pump water from the Delta to an enlarged Los Vaqueros Reservoir.

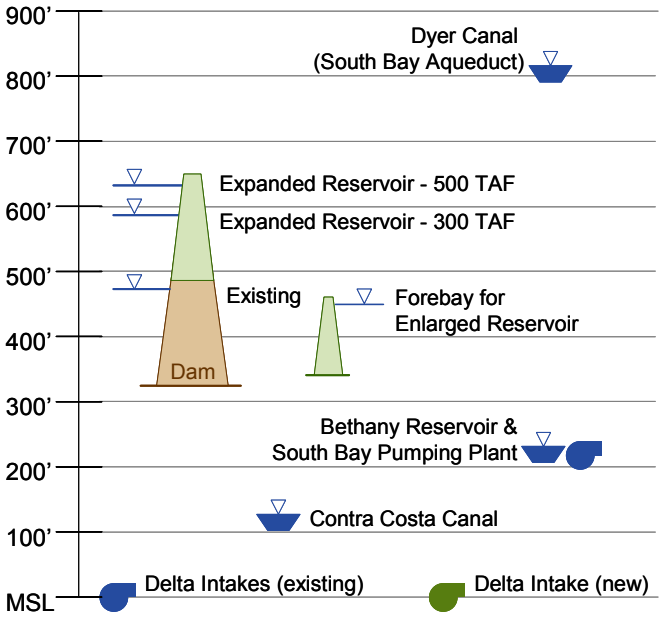


FIGURE VII-3 –FACILITY ELEVATIONS

An intertie from Los Vaqueros to Bethany Reservoir would be advantageous for concept plans focused on developing an EWA replacement supply. An intertie to Bethany would allow greater flexibility in the delivery of EWA supplies to SBA users via the existing South Bay Pumping Plant or to other water users via the California Aqueduct. EWA replacement supplies developed by a project with an intertie to the Dyer Canal would be limited by the existing capacity of the SBA. Although additional analysis is needed, it appears that a connection to Bethany Reservoir for water supply reliability for SBA water users would not be cost-effective due to the additional pumping required.

It should be mentioned that a project including an intertie from Los Vaqueros to Bethany Reservoir would not gain local acceptability without certain operating constraints or restrictions that would satisfy the CCWD Principles of Participation (described in **Chapter II**), in particular that the project would provide for long-term environmental benefits in the Delta by supplying water for the EWA. Water could be supplied for the EWA through either reductions in Delta pumping to benefit fish or replacing south of Delta EWA purchases. In addition, such a project could not be operated in conjunction with a peripheral canal or to increase the export of water from Northern California. Just as would be required in the case of a Dyer Canal intertie, permit terms and conditions, as well as contractual arrangements, would be required to ensure that the CCWD principles are satisfied.

CONCEPT PLANS FOCUSED ON BAY AREA WATER SUPPLY RELIABILITY

As shown in **Table VII-1**, three concept plans were formulated from management measures retained to address the objective of increasing water supply reliability (LVE planning objectives are discussed in **Chapter V**). Following is a summary of each concept.

1 - Raise Los Vaqueros Dam In-Place for Bay Area Water Supply Reliability

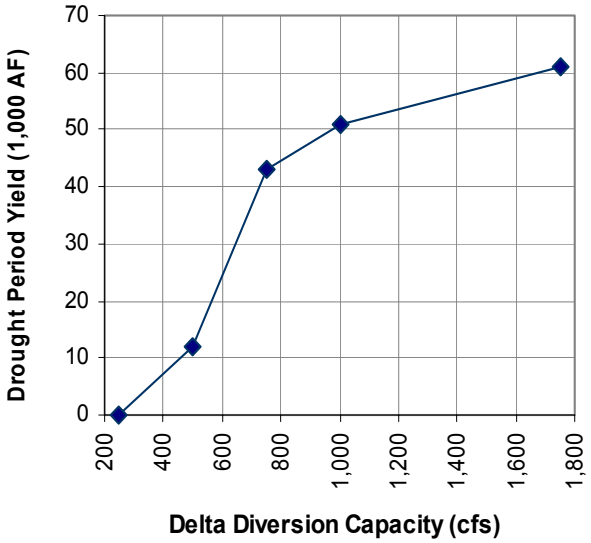
This concept plan focuses on raising the existing Los Vaqueros Dam up to about 15 feet. The existing dam was not designed to allow a significant raise without reconstructing the dam core. However, it is believed that a minor raise of about 10 to 15 feet could be accomplished without demolition and reconstruction of the existing structure. Significant analysis and coordination, especially with the State Division of Safety of Dams, is needed concerning foundation and embankment conditions to confirm the physical feasibility of raising Los Vaqueros Dam in-place. A potential dam raise of 15 feet was selected for this concept plan, as described in the following summary of plan features, accomplishments, and economics.

Primary Features

Primary features of this concept plan include the following:

- Raising Los Vaqueros Dam from a crest elevation of 487 feet to 502 feet and enlarging Los Vaqueros Reservoir from 100,000 acre-feet up to about 125,000 acre-feet.
- Increasing diversion and conveyance capacity from the Delta to the enlarged reservoir, which would include maintaining the existing pumping capacity at Old River of 250 cfs and constructing an additional diversion and pumping facility in the central Delta of about 500 cfs. Total Delta diversion capacity under this concept plan would be about 750 cfs.
- Constructing conveyance facilities from the outlet of the expanded reservoir to the Dyer Canal segment of the SBA.

Under this concept, the existing Los Vaqueros Dam would be raised by increasing the height of the impervious core of the existing dam and applying a layer of material at a slightly steeper slope on the upstream and downstream faces of the dam. The existing spillway would likely be used with minor modification or gated to allow for the increased dam height. However, future analysis may indicate the need to raise the spillway crest. Again, significant analysis is needed to estimate the scope of effort needed to raise the existing dam in-place by any amount.



Note: Yield for specific total capacities would vary depending on relative combination of delta diversion and pumping plant sizes.

FIGURE VII-4 – POTENTIAL RANGE IN DROUGHT PERIOD YIELD FOR 15-FOOT DAM RAISE IN COMBINATION WITH VARIOUS DELTA DIVERSION CAPACITIES

Accomplishments

A plot of increases in water supply reliability for a 15-foot raise of Los Vaqueros Dam with Delta pumping capacity increases up to about 1,750 cfs is shown in **Figure VII-4**. Depending on Delta diversion and pumping

capacity, this concept plan could potentially increase drought period yield in the Bay Area through the SBA to over 60,000 acre-feet per year.

For concept plan evaluation and comparison purposes, if storage in Los Vaqueros Reservoir were increased by 25,000 acre-feet in combination with about 500 cfs additional Delta diversion/pumping capacity (750 cfs total), this plan could increase water supply reliability during drought periods by about 43,000 acre-feet per year. This would reduce Bay Area drought period water shortages by about 28 percent.[1] The Delta diversion capacity increase identified for this concept was selected because it appeared to result in the lowest cost per unit of increased water yield of the sizes considered. Because the focus of this plan is on water supply reliability, there would be no specific benefits to replacing water supplies to support the EWA. In terms of water quality, average annual chloride concentrations would decrease by about 11 milligrams per liter (mg/L) (18 percent) over without-project conditions.[2] In addition, a reduction would occur in maximum or peak concentrations of about 147 mg/L (80 percent).

Impacts and Mitigation

A 25,000-acre-foot increase in the size of the existing Los Vaqueros Reservoir would increase the surface area at gross pool from about 1,460 acres to approximately 1,600 acres. Major types of reservoir area relocations and other impacts related to enlarging Los Vaqueros Reservoir would be similar to, although less than, those shown previously in **Table VII-3**. Detailed impacts and mitigation measures were not identified for the concept plans, but will be evaluated in future studies as detailed alternative plans emerge. Preliminary impacts and mitigation features presented in this report are based on existing and available information.

Costs

The preliminary estimated cost (first cost) and anticipated benefits for representative sizes of each concept plan are summarized in **Table VII-4**. The first cost is the estimated total cost at current prices to construct the project including allowances for contingencies, engineering and design, and construction supervision and administration. These costs are based largely on information contained in the April 2004 *Planning Report*, updated to October 2004 price levels (see discussion of preliminary costs in **Chapters VIII** and **IX**). As shown in the table, the estimated first cost for this concept plan is about $470 million.

2 - Enlarge Los Vaqueros Dam and Reservoir for Bay Area Water Supply Reliability

This concept primarily consists of enlarging Los Vaqueros Reservoir for the purpose of increasing water supply reliability. A general layout of this concept is presented in **Plate 7**. Following is a summary of its primary features, accomplishments, and economics.

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[1] Percentage is based on a preliminary estimate of the 2020 average annual drought period shortage for the region of about 152,000 acre-feet and is used for the purpose of comparing the relative benefits of the concept plans. Future studies are required to better quantify potential shortages in the study area, as noted in Chapter III.

[2] Reduction represents the long-term average decrease in salinity for deliveries to the South Bay Aqueduct as compared to salinity in Clifton Court Forebay.

TABLE VII-4
SUMMARY OF CONCEPT PLAN BENEFITS AND FIRST COSTS

Concept Plans	Total Reservoir & Diversion Capacities (TAF / cfs)	Increase in Water Supply Reliability[1] (TAF/Year)	EWA Replacement Supply[2] (TAF/year)	Decrease in SBA Chloride (mg/L)[3]	First Costs (millions)[4]
Bay Area Water Supply Reliability Focus					
1 – Raise LV Dam In-Place	125 / 750	43	-	11	470
2 – Enlarge LV Dam & Reservoir	500 / 750	95	-	15	1,060
3 – Desalination with Storage (Enlarge LV)	500 / 750	110	-	13	1,260
EWA Replacement Supply Focus					
4 – Enlarge LV Reservoir with Dyer Canal Intertie	500 / 1,000	-	140	16	1,170
5 – Enlarge LV Reservoir with Bethany Reservoir Intertie	500 / 1,750	-	190	16	1,470
Combined Objective Focus					
6 – Water Supply / EWA Combination with Dyer Canal Intertie	500 / 1,750	34	142	17	1,540
7 – Water Supply / EWA Combination with Bethany Reservoir Intertie	500 / 1,750	19	173	15	1,470
8 – Water Supply / EWA Combination with Water Quality Improvements	500 / 1,750	47	81	44	1,540

KEY: cfs = cubic feet per second; LV = Los Vaqueros Reservoir; SBA = South Bay Aqueduct; EWA = Environmental Water Account; mg/L = milligrams per liter; TAF = thousand acre-feet

Notes:
1. *Increase in water supply reliability measured as average increase during drought year conditions (1987- 1992).*
2. *Long-term average annual EWA replacement supply provided by the concept plan.*
3. *Decrease in average annual chloride concentrations in delivered water to South Bay Aqueduct.*
4. *Costs reflect October 2004 price level.*

Primary Features

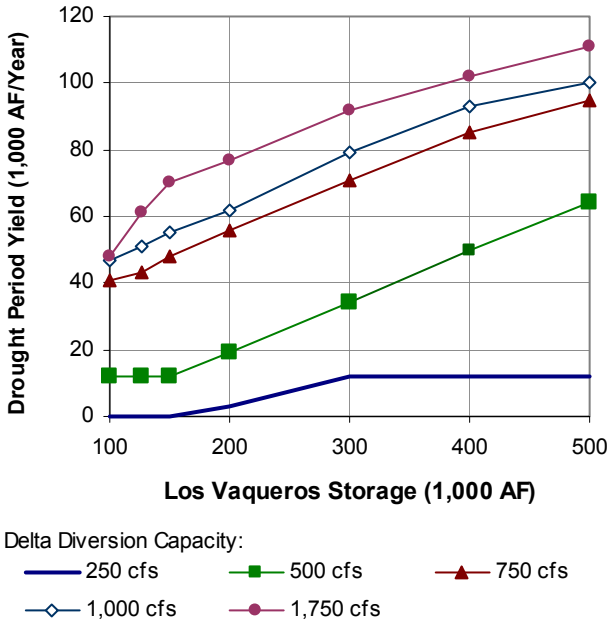
The primary features of this concept plan include the following:

- Reconstructing Los Vaqueros Dam from a crest elevation of 487 feet to 587 feet and enlarging Los Vaqueros Reservoir from 100,000 acre-feet to 500,000 acre-feet.
- Increasing the diversion and conveyance capacity from the Delta to the enlarged Los Vaqueros Reservoir from 250 cfs to 750 cfs.
- Constructing conveyance facilities from the outlet of Los Vaqueros Reservoir to the SBA at the Dyer Canal Back Surge Pool.

Numerous potential combinations exist of increased storage in Los Vaqueros Reservoir and Delta diversion capacity, each of which could provide different contributions to the study objectives. Further, many factors can influence the potential efficiencies of these combinations.

Although additional study is needed to confirm specific facility sizes, this concept plan was formulated to generally represent a combination of features and sizes believed to be relatively effective in addressing the stated plan objectives.

Figure VII-5 shows a plot of estimated increases in drought period water supply reliability for various increases in storage in Los Vaqueros (ranging from 100,000 acre-feet to 500,000 acre-feet) and for various Delta diversion capacities. A comparison of facility costs and estimated increases in water supply reliability indicates that a 500,000-acre-foot reservoir in combination with 750 cfs total Delta diversion capacity (250 cfs from the existing pumping plant and 500 cfs from a new central Delta diversion) might represent the most efficient combination. These facility sizes were chosen to represent this concept plan primarily because it appears that significantly larger or smaller facilities sizes would result in higher costs per unit for water supplies. Should this concept plan be carried forward, facility sizes would be optimized in more detailed studies.



Note: Yield would vary depending on relative combination of Delta diversion/pumping plant sizes for specific total capacities.

FIGURE VII-5 – INCREASE IN WATER SUPPLY RELIABILITY FOR VARIOUS COMBINATIONS OF LOS VAQUEROS ENLARGEMENT AND DELTA PUMPING CAPACITY

Accomplishments

Enlarging Los Vaqueros Reservoir by 400,000 acre-feet, increasing diversion capacities from the Delta by about 500 cfs, and connecting the reservoir with the SBA would increase water supplies during drought year conditions by about 95,000 acre-feet per year. This would result in an estimated 63 percent reduction in 2020 water shortages in the study area (see footnote 1 on page VII-10).

Although this plan would focus on Bay Area water supply reliability through developing drought year supplies, incidental EWA replacement supplies could be developed under this concept plan. Further, it is estimated that this concept plan could decrease average annual chloride concentrations by about 15 mg/L over without-project conditions (24 percent) (see footnote 2 on page 10). Maximum salinity concentrations would be reduced by about 140 mg/L (76 percent).

Impacts and Mitigation

The general types and scope of major reservoir area impacts related to enlarging Los Vaqueros Reservoir are summarized in **Table VII-3**.

Costs

The preliminary estimated first cost for this plan is $1.06 billion (see **Table VII-4)**.

3 - Desalination with Storage (Enlarge Los Vaqueros Reservoir) for Bay Area Water Supply Reliability

This concept also includes enlarging Los Vaqueros Reservoir, increasing the capacity of Delta diversion facilities, and constructing an intertie to the SBA primarily for improving Bay Area water supply reliability. In addition, however, it includes constructing a desalination facility within the Bay-Delta Estuary. The desalination facility would be used to supplement water supplies from the Delta diversion facilities. The desalination facility would include diverting brackish water from the estuary, treating the water to remove salts and other constituents, and either supplying potable water directly to Bay Area municipal customers, or to storage for later distribution when demands exceed normal supplies. This concept could support desalination efforts in the Bay Area as part of the Bay Area Regional Desalination Project, a joint effort of CCWD, SCVWD, San Francisco Public Utilities District (SFPUC), and East Bay Municipal Utility District (EBMUD). Although desalination remains relatively costly compared with other water sources, it is considered a highly reliable, local supply because seawater is not subject to hydrologic uncertainties.

Primary Features

To help increase water supply reliability to the four Bay Area water agencies consistent with the planning objectives, this concept could be formulated in several basic ways. It could consist of multiple, small desalination plants delivering water directly to the distribution systems of ACWD, CCWD, SCVWD, and Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7). Alternately, this concept could include a single, large desalination plant with independent conveyance systems to each of the districts. Desalination facilities are most efficient when they are operated at generally a constant capacity. Accordingly, under either of the above scenarios and during periods of excess supplies within the districts, water from the desalting plant(s) would be temporarily stored in local storage facilities or used conjunctively to decrease reliance on another water supply source (such as groundwater). Although studies by others have considered these scenarios, more detailed evaluation would be required to determine the most cost-effective way for a desalination facility to contribute to LVE objectives.

For the purpose of initial comparison, this concept plan includes a single, large brackish water desalination plant. As mentioned, the plant would supplement other Delta diversion facilities, but with a high enough quality to be provided directly to the CCWD distribution system or be stored in Los Vaqueros Reservoir for later use. **Figure VII-6** shows a general layout of this concept. Depending on its placement, pumping may not be limited by the timing of current diversions from the existing Old River Pumping Plant.

Several potential brackish water desalination plant sizes were considered in developing this concept plan, ranging from 10 to 40 million gallons per day (mgd). Preliminary analysis indicates that that a 20 mgd (31 cfs) plant combined with a 500,000-acre-foot expansion of Los Vaqueros Reservoir and 750 cfs Delta diversion capacity may be the most cost-effective

combination of facilities. Smaller sizes of reservoir and diversion capacities could be considered. However, when considered as a complete project, larger reservoir expansions appear to be more cost-efficient. Further, as new storage capacity becomes smaller, the effectiveness of the additional Bay-Delta diversion at the desalination plant is reduced.

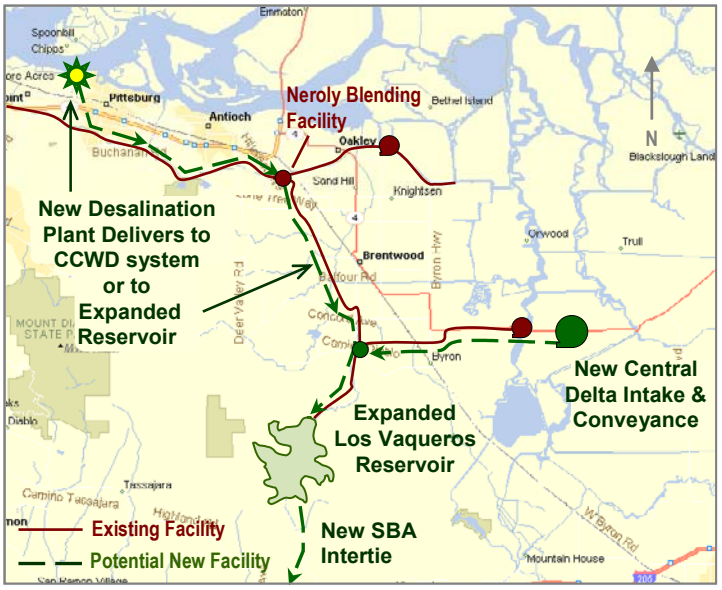


FIGURE VII-6 – SCHEMATIC OF DESALINATION PLANT AND APPURTENANT FACILITIES

Primary features of this concept plan would include the following:

- Intake, pretreatment, desalination, power supply, brine disposal, and ancillary facilities for a 20 mgd brackish water desalination treatment plant. For purposes of this concept, the desalination plant would be located at, or near, the Mirant Pittsburgh site identified in the Bay Area Regional Desalination Project.
- New conveyance facilities (pump stations, pipelines, interties, and/or mixing facilities) to deliver water from the desalination plant to existing distribution facilities for immediate use of storage. As shown in **Figure VII-6**, this concept includes transmission facilities from the desalination plant to the existing Neroly Blending facility, and a pumping station and conveyance from that location to the new pipeline to Los Vaqueros Reservoir.
- Reconstruction of Los Vaqueros Dam from a crest elevation of 487 feet to 587 feet, and enlarging Los Vaqueros Reservoir from 100,000 acre-feet to 500,000 acre-feet.
- Increasing the diversion and conveyance capacity from the Delta to Los Vaqueros Reservoir from 250 cfs to 750 cfs.
- Construction of conveyance facilities from the enlarged reservoir to the SBA at the Dyer Canal Back Surge Pool.

Accomplishments

Constructing a 20 mgd desalination plant (including acquiring additional water rights), enlarging Los Vaqueros Reservoir by 400,000 acre-feet, increasing Delta diversion capacity by about 500 cfs, and connecting the reservoir to the SBA would yield about 110,000 acre-feet per year during drought year conditions. This would result in an estimated 72 percent reduction in 2020 water shortages in the study area (see footnote 1 on page VII-10). An advantage of desalination is that it is less subject to hydrologic uncertainty than other water supplies and reduces dependence on imported and local water resources. However, the higher reliability of a desalinated supply is

offset somewhat by uncertainties regarding its cost per unit of output, which is highly sensitive to changes in the cost of power.

Desalination would reduce some of the water quality constituents that are problematic in Delta water supplies, namely chloride and bromide. Desalinated water could be blended with other water sources to reduce the salinity of delivered supplies. The primary beneficiary of water quality improvements would be CCWD. Average annual water quality for other Bay Area agencies that received water from the project also would improve. However, it should be noted that desalinated water stored in Los Vaqueros Reservoir for future use during dry periods would require re-treatment before being introduced into the water supply system.

Impacts and Mitigation

Major reservoir area relocation and other impacts related to enlarging Los Vaqueros Reservoir are summarized in **Table VII-3**. Other potential impacts related to desalination primarily concern the environmental impacts of feedwater intake and disposal of the high-salinity concentrate (brine) that is a byproduct of desalination. The amount of water potentially recoverable from brackish water sources using current reverse-osmosis treatment technology is about 60 to 85 percent. Based on this, a 20 mgd desalination plant could generate from 3 to 12 mgd of waste concentrate. In addition to the biological impacts of introducing high salinity waste into the environment, disposal of waste concentrate is further complicated by the high temperatures associated with desalination treatment processes. Disposal options range from surface water disposal, deep well injection, evaporation or salt processing ponds, land application, and disposal to sewage treatment facilities. It is assumed for this concept plan that brine waste would be reintroduced to the Bay-Delta.

Costs

As with other water sources, it is difficult to estimate the true range of costs and benefits for desalination without a highly detailed evaluation of factors such as plant siting, treatment process, energy consumption, brine disposal, and source water quality. Based on preliminary assumptions and available information on existing and planned desalination facilities, the estimated first cost for this concept plan is about $1.26 billion (see **Table VII-4**). This total cost is most sensitive to the cost of the desalination plant, for which a detailed estimate would be required. One of the most costly aspects of desalination is energy consumption for treatment and delivery, which is subject to power market conditions. These costs are reflected in the estimate of economic efficiency described in **Chapter VIII**.

Preliminary cost estimates for the desalting plant portion of the concept plan in this report are based on information from Reclamation's *Desalting Handbook for Planners*, 3rd edition, July 2003. These costs are for a plant that would be supplied with brackish water with an average total dissolved solids (TDS) of about 3,000 mg/L (seawater has an average concentration of about 35,000 mg/L). It should be mentioned that the average TDS concentration in the portion of the Bay-Delta considered for this concept is about 6,000 TDS and varies widely depending on hydrologic conditions. Accordingly, it is likely that through more detailed evaluations the costs specific to construct the 20 mgd desalting plant would be significantly greater than developed for this report (about $130 million).

CONCEPT PLANS FOCUSED ON DEVELOPING EWA REPLACEMENT SUPPLIES

As shown in **Table VII-1**, two concept plans were formulated to address the planning objective of developing less-costly EWA replacement water supplies. Each includes diverting surplus flows from the Delta to an expanded Los Vaqueros Reservoir, and constructing delivery facilities to Central Valley Project (CVP) and State Water Project (SWP) water users affected by EWA pumping curtailments. The facilities associated with these concept plans would generally be similar to those previously described for Concept Plan 2 – Enlarge Los Vaqueros Dam and Reservoir for Water Supply Reliability. In both of the concept plans, deliveries would be made to SBA water users from the expanded reservoir; the resulting pumping reduction at Banks Pumping Plant then could be used either to deliver EWA supplies south of the Delta or to directly accommodate EWA fish actions (pumping curtailments) at the export facilities.

To provide a measure of the relative accomplishments of the concept plans, an average annual EWA purchase of 225,000 acre-feet per year, consistent with the Operations Criteria and Plan (OCAP), was used. During dry years, the majority of EWA supplies are purchased from sources north of the Delta where more water is typically available. During wet years, the program typically obtains all supplies from sources south of the Delta. Because the impacts of pumping curtailments are more evident during average and wet years, the supplies developed in these concept plans would primarily replace EWA south-of-Delta purchases.

A primary unit of measurement for determining EWA replacement supply benefits in this study is acre-feet yield over long-term average annual conditions. This differs from the drought period yield used to estimate benefits for the water supply reliability concept plans. This is because the major benefit of the EWA is the ability to reduce pumping from the Delta often, in both average and wet years.

The two concept plans described below are similar; however, the first delivers water from Los Vaqueros Reservoir to the SBA at the Dyer Canal Back Surge Pool, while the second delivers water to Bethany Reservoir.

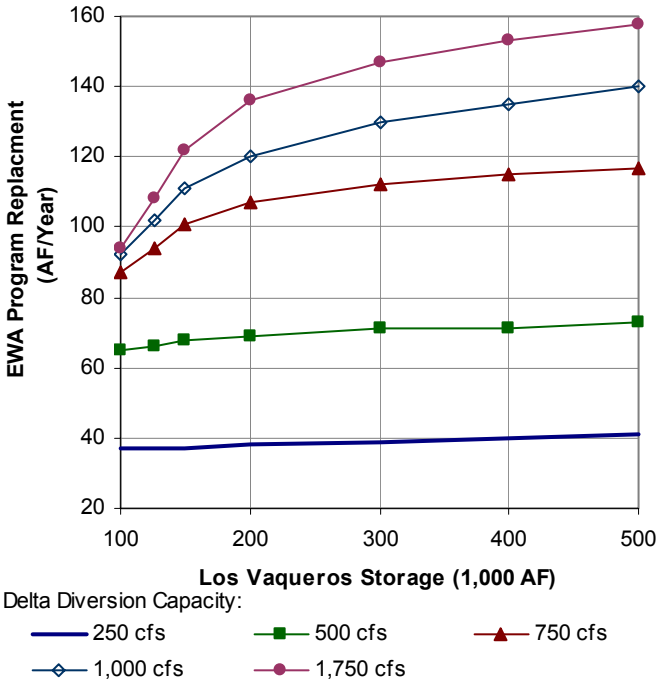
4 - Enlarge Los Vaqueros with Dyer Canal Intertie for EWA

This concept plan includes expansion of Los Vaqueros Reservoir and Delta diversion capacity, and transmission facilities from an expanded Los Vaqueros Reservoir directly to the SBA at the Dyer Canal Back Surge Pool. The plan would address the EWA replacement supply objective by developing water supplies in Los Vaqueros Reservoir for delivery to SBA users during periods of EWA pumping curtailment at Banks Pumping Plant. Water that would have been pumped to the SBA from Bethany Reservoir during periods of EWA pumping curtailment could then be directed elsewhere in the CVP/SWP system to compensate other impacted water users. The potential EWA replacement supplies developed from this concept plan would be limited by the existing capacity of the SBA.

Primary Features

As with previously described plans, numerous potential combinations of Los Vaqueros Reservoir enlargement and Delta diversion capacity exist, and additional study would be required to

determine the most appropriate facility sizes for each plan. **Figure VII-7** shows a plot of estimated average annual EWA replacement yield resulting from various Los Vaqueros Reservoir enlargements (ranging from 100,000 acre-feet to 500,000 acre-feet) and Delta diversion capacities. The replacement amounts shown in the figure were derived using CALSIM II with average annual EWA demands ranging up to 225,000 acre-feet. Comparing the relationships in **Figure VII-7** with possible costs for various sizes of projects suggests that a concept plan consisting of (1) enlarging the Delta diversion/pumping capacity to approximately 1,000 cfs would be the most cost-efficient of the sizes considered and (2) enlarging Los Vaqueros Reservoir up to 500,000 acre-feet would result in significant additional EWA replacement supply benefits at only marginally increased costs. Accordingly, the primary features of this concept plan are as follows:



Note: EWA replacement supply for specific reservoir capacities varies depending on relative combination of Delta diversion/pumping sizes.

FIGURE VII-7– EWA REPLACEMENT SUPPLIES DEVELOPED UNDER VARIOUS LOS VAQUEROS ENLARGEMENTS AND DELTA PUMPING CAPACITY COMBINATIONS (DYER CANAL INTERTIE)

- Reconstructing Los Vaqueros Dam from a crest elevation of 487 feet to 656 feet, and enlarging Los Vaqueros Reservoir from 100,000 acre-feet to 500,000 acre-feet.
- Increasing the diversion and conveyance capacity from the Delta to Los Vaqueros Reservoir to 1,000 cfs. The capacity of the existing 250 cfs Old River facility would likely be increased by 250 cfs and supplemented with a new 750 cfs central Delta pumping facility.
- Constructing conveyance facilities from Los Vaqueros Reservoir to the SBA at the Dyer Canal Back Surge Pool.

As mentioned, future studies are needed to consider the relative advantages of a new central Delta diversion facility as opposed to increasing the capacity at or near the existing Old River facility. In addition, future studies will consider numerous pumping and pipeline configurations from the Delta to Los Vaqueros Reservoir and from the reservoir to the SBA or to Bethany Reservoir (see Concept Plan 5).

Accomplishments

As shown in **Figure VII-7**, enlarging Los Vaqueros Reservoir by 400,000 acre-feet, increasing diversion capacities from the Delta to 1,000 cfs, and constructing an intertie to the SBA Dyer

Canal could replace about 140,000 acre-feet per year (average annual yield) of EWA purchases. This represents about 62 percent of the EWA's average annual water acquisition target.[3]

In addition to potentially providing a less-costly supply for the EWA, this concept plan would also provide additional flexibility and reliability to the program. Currently, the EWA relies on surplus capacity in reservoirs such as Oroville or San Luis reservoirs to store acquired water supplies; these supplies typically have low priority, and are first to spill from the reservoirs. The EWA also relies partly on surplus pumping capacity at Banks and Tray pumping plants to move EWA supplies south of the Delta; as demands in the Central Valley continue to grow, surplus pumping capacity may be available to the EWA less often. This concept plan would provide dedicated storage and conveyance facilities for the EWA, improving operational flexibility and reliability. In addition, an expanded Los Vaqueros Reservoir would be supplied by a new Delta intake with more efficient screens than those at the south Delta export facilities, thereby reducing impacts to Delta fisheries caused by moving EWA water supplies.

Although this concept plan would focus on EWA water supply replacement, some increase would occur in drought period water supply reliability for Bay Area agencies. However, the water supply reliability benefits are considered incidental. This concept could decrease average annual chloride concentrations by about 16 mg/L (25 percent) over without-project conditions, and reduce the maximum salinity concentrations in delivered water by about 152 mg/L (83 percent).

Impacts and Mitigation

Major reservoir area relocations and other impacts related to enlarging Los Vaqueros Reservoir by 400,000 acre-feet are summarized in **Table VII-3**.

Costs

The preliminary estimated first cost for this plan is about $1.2 billion (see **Table VII-4**).

5 - Enlarge Los Vaqueros Reservoir with Bethany Reservoir Intertie for EWA

This concept also would focus on providing a less-costly replacement water supply for the EWA. It would be similar to the concept above, except a gravity pipeline would convey water from Los Vaqueros Reservoir to Bethany Reservoir instead of to the Dyer Canal. Existing facilities could then be used to deliver EWA replacement supplies from Bethany Reservoir, effectively replacing south of Delta EWA purchases. The primary advantage of a Bethany Reservoir intertie is the potential to offset a larger portion of EWA acquisitions than pumping directly to the SBA. Unlike the previous plan, the capacity or demands of the SBA would not restrict EWA deliveries under this concept plan. In addition, a potential exists for the Bethany Reservoir intertie to be less-costly to construct or operate.

[3] For the purpose of comparing concept plants, contribution to EWA is based on an average annual EWA water acquisition target of 225,000 acre-feet consistent with the Operations Criteria and Plan (OCAP). The EWA typically purchases from 200,000 to 300,000 acre-feet per year.

This concept plan would not gain local acceptability without certain operating constraints or restrictions that would satisfy the CCWD Principles of Participation (described in **Chapter II**), in particular that the project would provide for long-term environmental benefits in the Delta by supplying water for the EWA. Water could be supplied for the EWA through either reductions in Delta pumping to benefit fish, or replacing south of Delta EWA purchases. In addition, such a project could not be operated in conjunction with a peripheral canal or to increase the export of water from Northern California. Just as would be required in the case of a Dyer Canal intertie, permit terms and conditions, as well as contractual arrangements, would be required to ensure that the CCWD principles are satisfied.

Primary Features

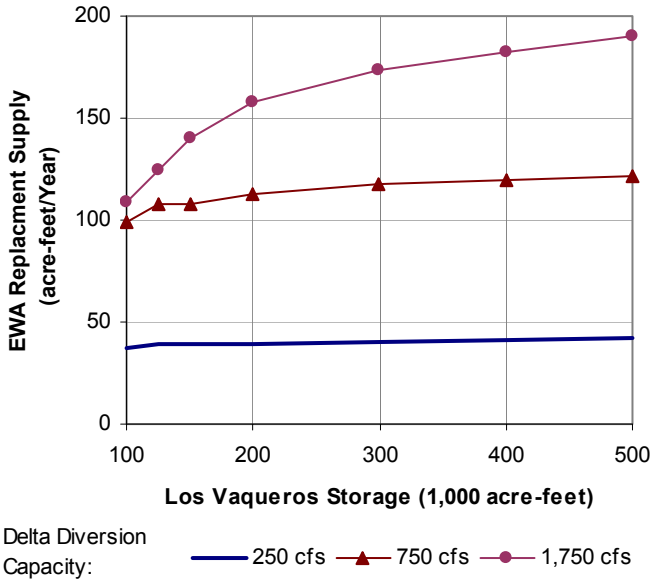
Primary features of this concept plan are listed below. As noted previously, facility sizes are preliminary and would be refined in future studies, if this concept plan is carried forward.

- Reconstructing Los Vaqueros Dam from a crest elevation of 487 feet to 656 feet to increase storage capacity from 100,000 acre-feet to 500,000 acre-feet.
- Increasing diversion and conveyance capacity from the Delta to the enlarged Los Vaqueros Reservoir from 250 cfs to 1,750 cfs (the existing Old River Pumping Plant increased to 750 cfs and supplemented with a new 1,500 cfs central Delta pumping facility).
- Constructing conveyance facilities from the expanded reservoir to Bethany Reservoir. This would include a check structure to prevent higher quality water from Los Vaqueros Reservoir from mixing with lower quality water in Bethany Reservoir prior to delivery to SBA agencies.

Accomplishments

As shown in **Figure VII-8**, enlarging Los Vaqueros Reservoir by 400,000 acre-feet, increasing Delta diversion capacity to 1,750 cfs, and connecting the reservoir to the SBA at Bethany Reservoir would yield about 190,000 acre-feet per year (average annual) EWA replacement supplies. This represents about 84 percent of the average annual water acquisition target for the EWA of about 225,000 acre-feet per OCAP (see footnote 3 on page VII-18).

Although this concept would focus on developing EWA replacement supplies, some increase in drought period water



Note: EWA replacement supply for specific reservoir capacities varies depending on relative combination of Delta diversion/ pumping plant sizes.

FIGURE VII-8 – EWA REPLACEMENT SUPPLIES DEVELOPED UNDER VARIOUS COMBINATIONS OF LOS VAQUEROS RESERVOIR ENLARGEMENT AND DELTA PUMPING CAPACITY (BETHANY INTERTIE)

supply reliability would occur. However, this contribution is considered incidental. Further, with this concept plan, average annual chloride concentrations would decrease by about 16 mg/L (25 percent) over without-project conditions, and the maximum salinity concentration would decrease by about 151 mg/L (82 percent) (see footnote 2 on page VII-10).

Impacts and Mitigation

Primary reservoir area relocations and other impacts related to enlarging Los Vaqueros Reservoir by 500,000 acre-feet are summarized in **Table VII-3**.

Costs

The preliminary estimated first cost for this plan is about $1.47 billion (see **Table VII-4**).

CONCEPT PLANS FOCUSED ON COMBINED OBJECTIVES

Retained measures could be combined in numerous ways, with many potential facility size combinations. However, three concept plans were formulated to represent a reasonable balance between the objectives of water supply reliability, EWA replacement supply, and water quality. Each of the combined objective concept plans consists of enlarging Los Vaqueros Reservoir and associated Delta diversion and conveyance facilities primarily for the purposes of increasing water supply reliability and developing EWA replacement supplies.

As with other concept plans, numerous potential combinations and sizes of the various system components exist. For example, **Figure VII-9** shows potential average annual contributions to EWA and drought period yield for water supply reliability for various sizes of an enlarged Los Vaqueros Reservoir and increased Delta diversion capacities under a scenario of water delivery to the SBA at the Dyer Canal. Similar relationships would be indicated for a water delivery scenario to Bethany Reservoir but, as noted below, the contribution to EWA replacement supplies would be larger.

However, for comparison purposes in this report, each of the combination concept plans was formulated with the following major components:

- Reconstructing Los Vaqueros Dam from a crest elevation of 487 feet and enlarging Los Vaqueros Reservoir from 100,000 acre-feet to 500,000 acre-feet.
- Increasing the diversion and conveyance capacity from the Delta to the enlarged Los Vaqueros Reservoir from 250 cfs to 1,750 cfs. Under each concept plan, the Old River facility would be expanded to a capacity of 750 cfs and a new central Delta facility would provide an additional 1,000 cfs capacity.
- Construct new pumping and conveyance facilities from the central Delta diversion to Los Vaqueros Reservoir.

There are numerous other combinations of facilities and facility sizes that will need to be evaluated in future studies should these concept plans be carried forward for development into detailed alternative plans.

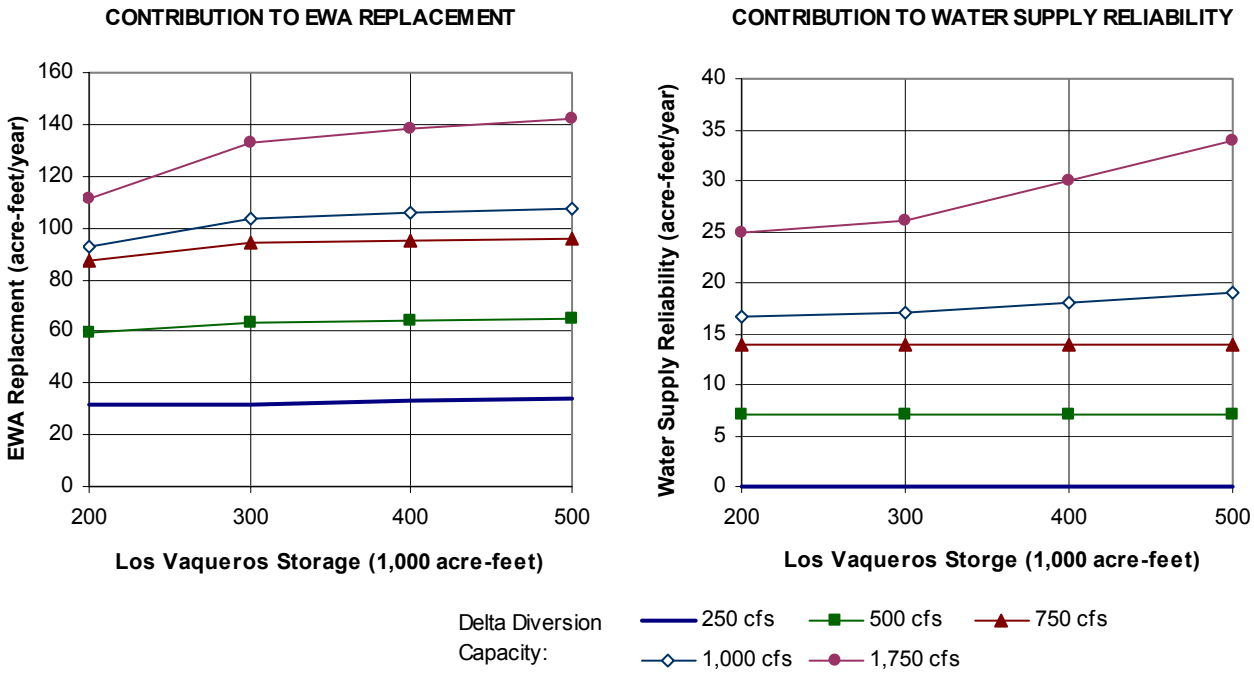


FIGURE VII-9 – POTENTIAL CONTRIBUTIONS TO EWA SUPPLY REPLACEMENT AND DROUGHT PERIOD WATER SUPPLY RELIABILITY FOR VARIOUS COMBINATIONS OF LOS VAQUEROS RESERVOIR ENLARGEMENT AND DELTA DIVERSION CAPACITY (DYER CANAL INTERTIE) FOR COMBINED OBJECTIVE PLAN

6 - Water Supply / EWA Combination with Dyer Canal Intertie

This concept was formulated for the purposes of providing EWA replacement supplies and improving Bay Area water supply reliability. It is similar to Concept Plan 4 described previously, except a portion of the increased space in Los Vaqueros would be dedicated to water supply reliability. As mentioned, the facility sizes for this concept were chosen primarily for comparison consistency with the other combination concept plans. The accomplishments and economics of this concept plan are summarized below.

Accomplishments

Enlarging Los Vaqueros Reservoir by 400,000 acre-feet to 500,000 acre-feet, increasing diversion capacity from the Delta, and connecting the reservoir with the SBA at the Dyer Canal appear to provide the maximum increase in drought year reliability and EWA replacement supply. This plan could yield as much as 34,000 acre-feet per year during drought periods, and replace about 142,000 acre-feet per year (average annual) EWA purchases. This would result in an estimated 22 percent reduction in 2020 water shortages in the study area (see footnote 1 on page VII-10), and an estimated 63 percent of the total average annual acquisition target of the EWA (see footnote 3 on page VII-18). Further, average annual chloride concentrations would decrease by about 17 mg/L (26 percent) (see footnote 2 on page VII-10) over without-project

conditions, and maximum salinity concentrations would decrease by about 152 mg/L (82 percent).

Impacts and Mitigation

Major reservoir area relocation and other impacts related to enlarging Los Vaqueros Reservoir by 400,000 acre-feet are summarized in **Table VII-3**.

Costs

The preliminary estimated first cost for this concept plan is $1.54 billion (see **Table VII-4**).

7 - Water Supply / EWA Combination with Bethany Reservoir Intertie

This concept plan primarily consists of enlarging Los Vaqueros Reservoir for the purposes of increasing Bay Area water supply reliability and replacing EWA assets. It is similar to the combination concept plan described above, but it includes a gravity pipeline to convey water from Los Vaqueros Reservoir to Bethany Reservoir rather than to the Dyer Canal. Existing facilities would be used to deliver EWA supplies to CVP and SWP users primarily on the SBA. Unlike Concept Plan 6, the capacity or demands of the SBA would not limit the amount of EWA supplies that could be developed under this concept plan.

This concept plan would not gain local acceptability without certain operating constraints or restrictions that would satisfy the CCWD Principles of Participation (described in **Chapter II**), in particular that the project would provide for long-term environmental benefits in the Delta by supplying water for the EWA. Water could be supplied for the EWA through either reductions in Delta pumping to benefit fish, or replacing south of Delta EWA purchases. In addition, such a project could not be operated in conjunction with a peripheral canal or to increase the export of water from Northern California. Just as would be required in the case of a Dyer Canal intertie, permit terms and conditions, as well as contractual arrangements, would be required to ensure that the CCWD principles are satisfied.

There are numerous potential combinations of facility sizes for this concept plan. As with the previous concept plan, facility sizes were chosen such that the plan contributed to each primary objective, resulted in a relatively low unit water cost for each objective, and was comparable with the other concept plans.

Accomplishments

Enlarging Los Vaqueros Reservoir by 400,000 acre-feet to 500,000 acre-feet, increasing diversion capacity from the Delta, and connecting Los Vaqueros Reservoir to Bethany Reservoir would provide the maximum drought year water supplies and EWA replacement supplies for this concept plan. Drought year yield from the project could be as high as 19,000 acre-feet per year, and average annual EWA replacement yield as high as 173,000 acre-feet per year. This would represent a 13 percent reduction in 2020 water shortages in the study area (see footnote 1 on page VII-10), and an estimated 77 percent of the total average annual water acquisition target for the EWA (see footnote 3 on page VII-18). Further, average annual chloride concentrations

would decease by about 15 mg/L (23 percent) (see footnote 2 on page VII-10) over without-project conditions, and maximum (peak) salinity concentrations would decrease by about 152 mg/L (82 percent).

Impacts and Mitigation

Major reservoir area relocation and other impacts related to enlarging Los Vaqueros Reservoir by 400,000 acre-feet are summarized in **Table VII-3**.

Costs

The preliminary estimated first cost for this concept plan is $1.47 billion (see **Table VII-4**).

8 - Water Supply / EWA Combination with Water Quality Improvements

This concept plan is similar to Concept Plan 6, which focuses on increasing Bay Area water supply reliability and replacing EWA supplies. However, the completed project for this concept plan would be operated to improve the quality of water developed for both supply reliability and EWA purposes. In addition to increasing the capacity of Los Vaqueros Reservoir to 500,000 acre-feet and the Delta diversion and pumping capacity to 1,750 cfs, this concept consists of conveyance facilities from the outlet of Los Vaqueros Reservoir to the SBA at Dyer Canal, as in Concept Plan 6.

Each of the previous concept plans, on average, improves the quality of water delivered to SBA water users and developed for EWA replacement. However, occasions occur when the quality of water delivered by the project would be slightly worse than what would be delivered under existing conditions, as illustrated by the lower (blue) line in **Figure VII-10**. The objective of this concept plan is to achieve equivalent or better delivered water quality than under without-project conditions at all times, as illustrated by the upper (red) line in **Figure VII-10**. The primary impact of these operational changes for water quality is a reduction in the amount of water available for EWA replacement and a slight increase in the drought period yield for water supply reliability.

Accomplishments

Enlarging Los Vaqueros Reservoir by 400,000 acre-feet to 500,000 acre-feet, increasing diversion capacity from the Delta, connecting the reservoir with the SBA at the Dyer Canal, and operating the project to enhance water quality would improve water supply reliability during drought years and develop EWA replacement supplies. It is estimated that the drought year yield could be as much as 47,000 acre-feet per year, and the project would develop about 80,000 acre-feet per year (average annual) EWA replacement supply. This would result in a 31 percent reduction in 2020 water shortages in the study area (see footnote 1 on page VII-10), and 36 percent of the total average annual water acquisition target for the EWA (see footnote 3 on page VII-18). Further, the quality of water available for water supply reliability and EWA replacement would consistently improve.

Impacts and Mitigation

Major reservoir area relocations and other impacts related to enlarging Los Vaqueros Reservoir by 400,000 acre-feet are summarized in **Table VII-3**.

Costs

The preliminary estimated first cost for this concept plan is $1.54 billion (see **Table VII-4**).

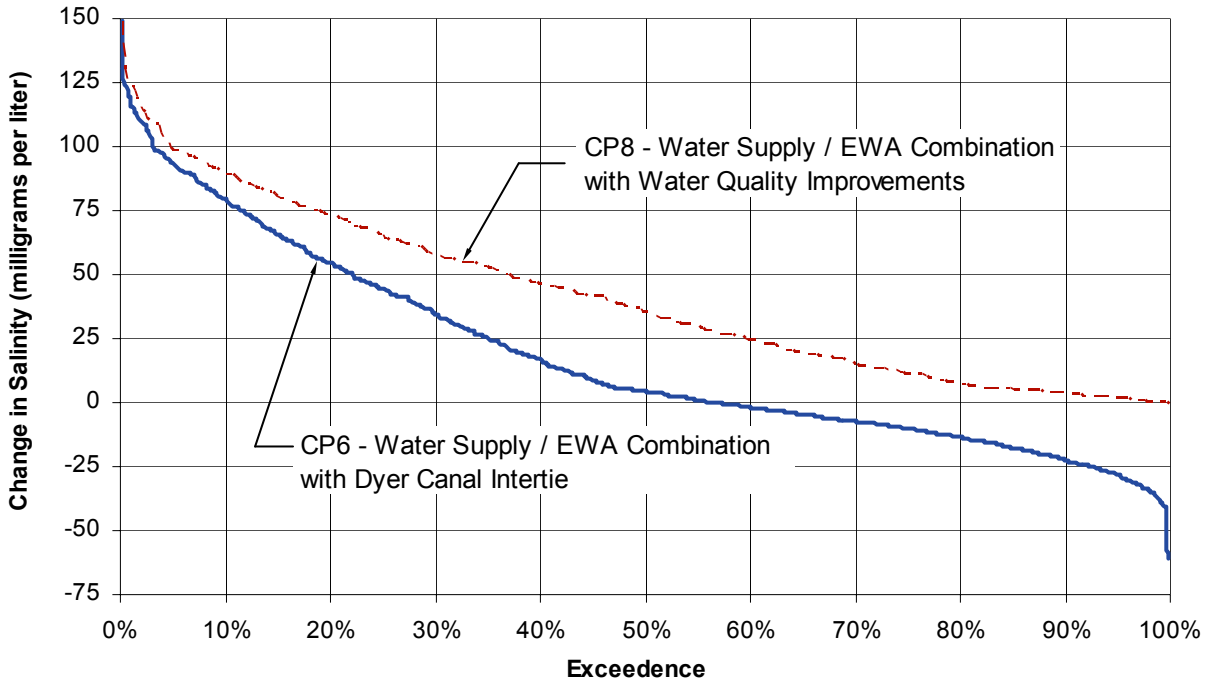


FIGURE VII-10 – FREQUENCY DISTRIBUTION PLOT ILLUSTRATING THE DIFFERENCE IN WATER QUALITY FOR CONCEPT PLANS 6 AND 8