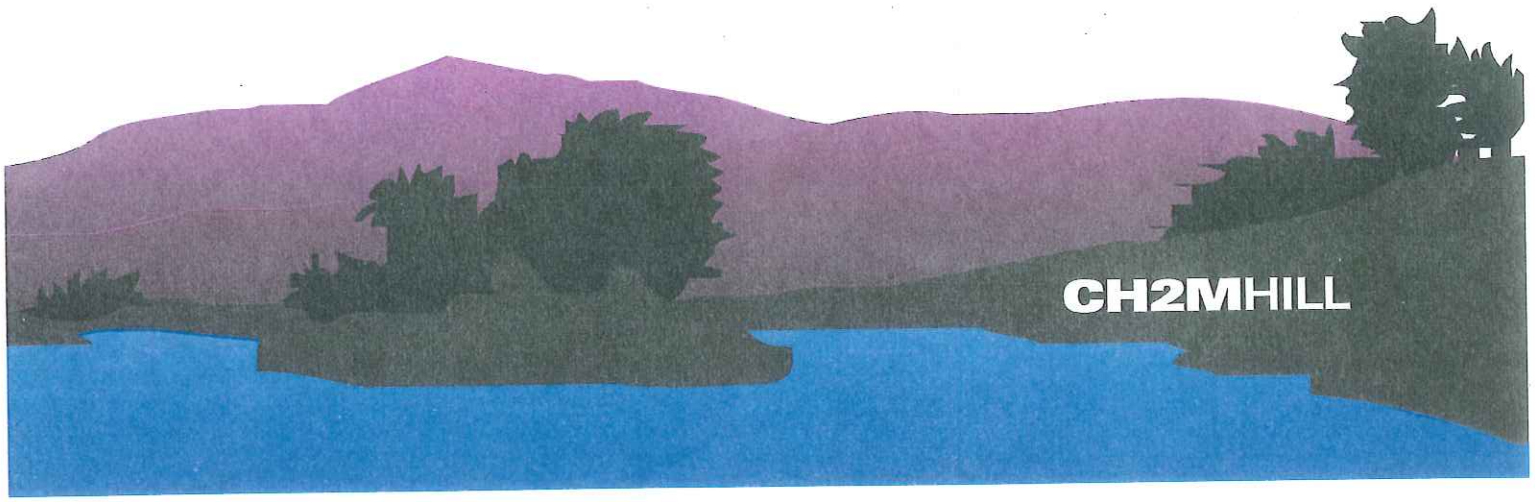
Phase II East County Water Supply Management Study

Summary Report

PREPARED FOR

East County Water Management Association

SEPTEMBER 1996



CH2MHILL

Contents

Contents (Continued)

Appendixes

Tables

Figures

Acknowledgments

The following persons and agencies are acknowledged for their participation in this project.

Governing Board Representatives

Bette Boatmun, Chair	Contra Costa Water District
Greg Sherman, Vice Chair	City of Brentwood
John Tasker, Treasurer	City of Antioch
Mark Franco, Secretary	Byron-Bethany Irrigation District
Len Herendeen	City of Antioch
Jerry Tennant	Byron-Bethany Irrigation District
Quintin Kidd	City of Brentwood
Tom Torlakson	Contra Costa County Water Agency
Mark DeSaulnier	Contra Costa County Water Agency
Noble Elcenko	Contra Costa Water District
Joe Canciamilla	Delta Diablo Sanitation District and City of Pittsburg
Elizabeth Rimbault	Delta Diablo Sanitation District
Leonard Celoni	Diablo Water District
V. Wallace Allen	Diablo Water District
Bill Brandt	Diablo Water District
Glenn Stonebarger	East Contra Costa Irrigation District
Mark Dwelley	East Contra Costa Irrigation District
Dwight Meadows	Ironhouse Sanitary District
Bill Tice	Ironhouse Sanitary District
Lori Anzini	City of Pittsburg

Joint Managers' Committee

Paul Causey, Chair	Delta-Diablo Sanitation District and Contra Costa County Sanitation District #19
Mike Yeraka, Vice-Chair	Diablo Water District
Stan Davis, Treasurer	City of Antioch
Rick Gilmore	Byron-Bethany Irrigation District
Jay Corey	City of Brentwood

Marc Goto	City of Brentwood
Roberta Goulart	Contra Costa County Water Agency
Walter Bishop	Contra Costa Water District
Fran Garland	Contra Costa Water District
Larry Preston	East Contra Costa Irrigation District
David Bauer	Ironhouse Sanitary District
John Edwards	City of Pittsburg

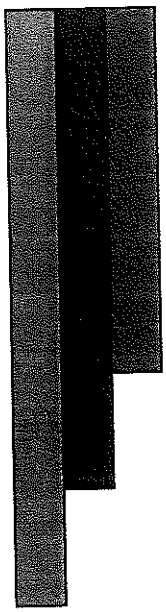
Project Team

Ron Ott	CH2M HILL
Gary Nuss	CH2M HILL
Saquib Najmus	CH2M HILL
Vijay Kumar	CH2M HILL
George Cairo	CH2M HILL
Leslie Dumas	CH2M HILL
Lucy Hinojosa	CH2M HILL

Acronyms/Abbreviations

AB	Assembly Bill
ABAG	Association of Bay Area Governments
ac-ft/yr	acre-feet per year
ASR	aquifer storage and recovery
BBID	Byron-Bethany Irrigation District
BMP	Best Management Practice
CCCSD	Contra Costa County Sanitation District
CCCSD-Discovery Bay	Contra Costa County Sanitation District #19
CCI	Construction Cost Index
CCWD	Contra Costa Water District
cfs	cubic feet per second
CEQA	California Environmental Quality Act
CP	Conservation Program
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DDSD	Delta Diablo Sanitation District
DWD	Diablo Water District
DWR	Department of Water Resources
EBMUD	East Bay Municipal Utility District
ECCID	East Contra Costa Irrigation District
ECWMA	East County Water Management Association
EIR	Environmental Impact Report
ENR	*Engineering News-Record*
FUA	Future Urban Area
FWSS	Future Water Supply Study
GAC	granular activated carbon
GBR	Governing Board Representatives

gpm	gallons per minute
ISD	Ironhouse Sanitary District
JMC	Joint Managers' Committee
JMM	James M. Montgomery
JPA	Joint Powers Authority
LVP	Los Vaqueros Project
MF	microfiltration
M&I	municipal and industrial
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
NEPA	National Environmental Protection Act
NPV	net present value
O&M	operations and maintenance
RD	Reclamation District
RO	reverse osmosis
RWSA	Raw Water Service Area
SCADA	supervisory control and data acquisition
SDWA	Safe Drinking Water Act
SRIP	Seismic Reliability Improvement Project
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TWSA	Treated Water Service Area
ULL	Urban Limit Line
USBR	United States Bureau of Reclamation
WTP	water treatment plant
WWTP	wastewater treatment plant



Executive Summary

Executive Summary

Introduction

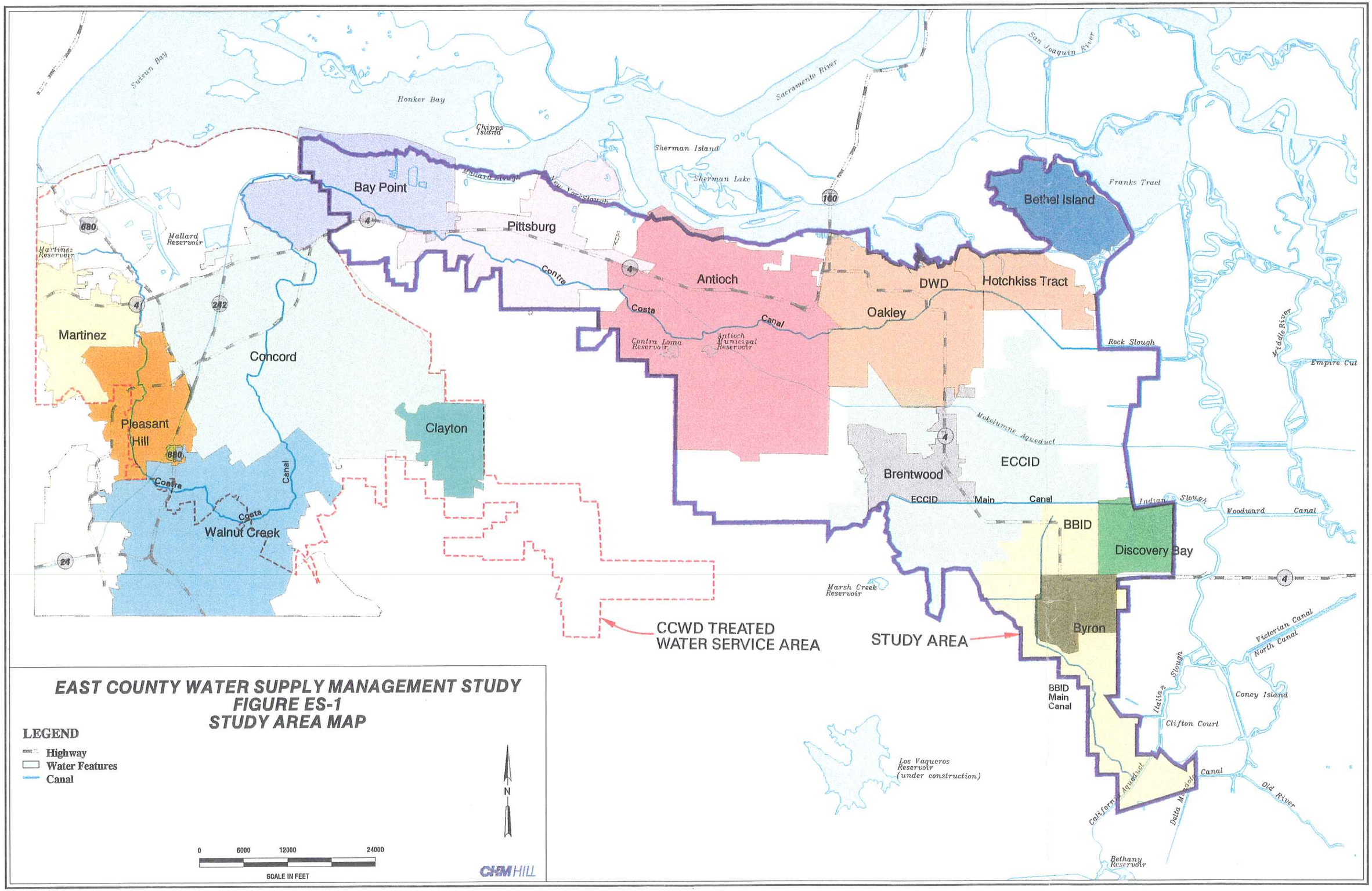
According to projections by the Association of Bay Area Governments (ABAG), Contra Costa County will grow from 800,000 residents to more than 1.1 million residents by 2010. ABAG also projects that most of the population growth will occur in the eastern communities of Antioch, Oakley, and Brentwood. Brentwood is one of the fastest growing communities in California. When population projections for Pittsburg are included, eastern Contra Costa County (East County) is expected to account for more than half of the total projected growth in Contra Costa County by the year 2010. This report focuses on the water resources and water treatment and supply infrastructure needed to respond to the increased water demands associated with the urbanization of East County and identifies potential water management strategies that can be used to meet future water needs.

This study is being conducted by the East County Water Management Association (ECWMA), a consortium of 11 water agencies in the study area (see Figure ES-1). The study activities are managed by the Joint Managers' Committee (JMC), a group of the General Managers or their designees from ECWMA. Policy-level guidance was provided by the Governing Board Representatives (GBR); the Board consists of an elected official (and alternate) from each member group.

ECWMA Member Agencies

- City of Antioch
- City of Brentwood
- Byron-Bethany Irrigation District (BBID)
- Contra Costa County Sanitation District No. 19
- Contra Costa County Water Agency
- Contra Costa Water District (CCWD)
- Delta Diablo Sanitation District (DDSD)
- Diablo Water District (DWD)
- East Contra Costa Irrigation District (ECCID)
- Ironhouse Sanitary District (ISD)
- City of Pittsburg

The East County Water Supply Management Study was divided into two phases. Phase I, completed in 1994, provided a preliminary analysis of future demand, water supplies, existing infrastructure, and general issues related to cooperative water resources management. Phase II focused on developing, evaluating, and recommending alternatives for providing cost-effective and reliable water supplies to the study area through the year 2040.



EAST COUNTY WATER SUPPLY MANAGEMENT STUDY
FIGURE ES-1
STUDY AREA MAP

LEGEND

- Highway
- Water Features
- Canal

N

0 6000 12000 24000

SCALE IN FEET

CH2M HILL

/b/eccc/plots/city2.aml
September 11, 1996 11:01 PM

Water Demands and Supply

East County is subject to significant growth pressures. As shown in Figure ES-2, the urban water need in this area is projected to more than double from 37,200 acre-feet in 1990 to about 99,700 acre-feet in the year 2040.

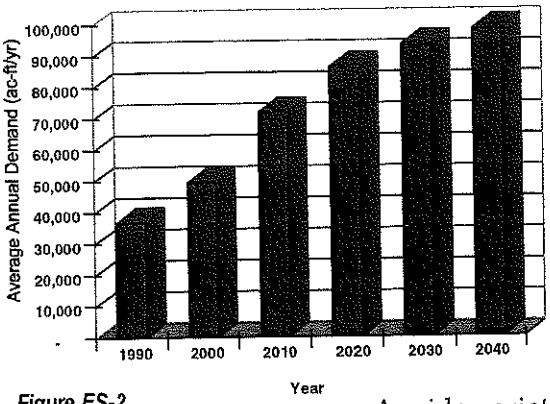


Figure ES-2
East County Urban Demands

On the other hand, agricultural demands are projected to decrease from about 73,500 acre-feet in 1990 to about 48,600 acre-feet in 2040 (Figure ES-3). The industrial demand in the Phase II study area remains constant at 20,000 acre-feet during the 1996-2040 study period. The total municipal, industrial, and agricultural demand in the Phase II study area in the year 2040 is about 168,300 acre-feet.

A wide variety of potential supplies is available to meet the water demands of the East County study area. Potential sources of water supplies include:

- In-county surface water
- In-county groundwater
- Conjunctive-use development
- Reclaimed water
- Outside-county water transfers
- Water conservation

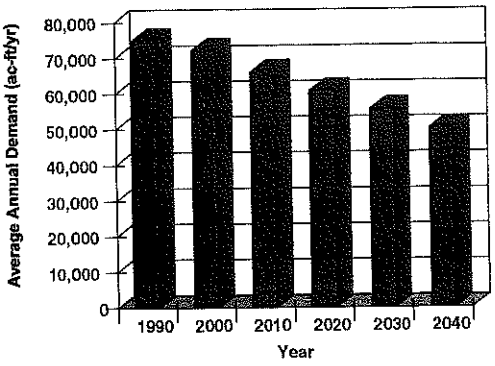


Figure ES-3
East County Agricultural Demands

In-county surface water supplies provide the most significant source of water supply to meet the study area needs. Yield estimates of in-county surface water supplies range from a maximum of 343,100 acre-feet in a normal hydrologic year to 271,200 acre-feet under drought conditions, as shown above.

Summary of In-County Surface Water Supplies

Source	Normal-Year Supply (ac-ft/yr)	Drought-Year Supply (ac-ft/yr)
CCWD's CVP Contract	195,000	161,200
Agricultural Water Rights	110,000	110,000
River Divisions	38,100	0
Total	343,100	271,200

The service areas of in-county surface water supplies, listed above, span beyond the borders of East County. Since these supplies cannot be geographically segregated, the total water supplies were evaluated to meet water needs for an area larger than East County. In addition to East County, this area includes CCWD's Treated Water Service Area (TWSA) and industrial customers of CCWD. This combined area, called the expanded study area in this report, is shown

in Chapter 1 (Figure 1-1); it corresponds to the Service Area E of the Future Water Supply Study, as discussed in Chapter 2.

The East County area has access to a significant amount of surface water supplies through Central Valley Project (CVP) contracts and agricultural, riparian, and appropriative water rights. In-county surface water supplies could meet the future water demands for the expanded study area in a normal hydrologic year, as shown in Figure ES-4.

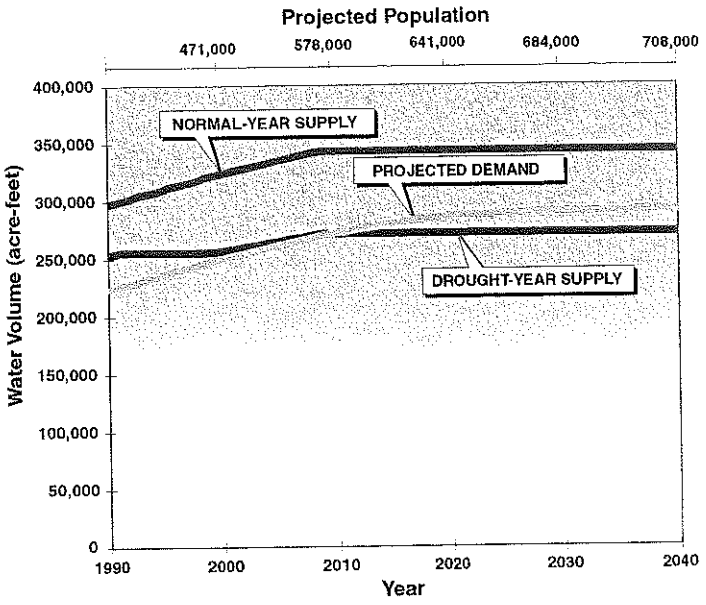


Figure ES-4
Water Demand and Local Surface Water Supply

There are legal and institutional constraints, such as limits on place of use, purpose of use, and point of diversion, associated with these sources of supply. These constraints reduce flexibility in the use of the available surface water supplies, which leads to deficits, especially under drought conditions.

The concept of "maximized surface water supply pooling" has been developed to overcome these limitations. The annual water demands for the expanded study area are projected to grow from 223,200 acre-feet in 1990 to 250,000 acre-feet in the year 2000 to 290,600 acre-feet in the year 2040. The demand shown is the demand for the Phase II study area and CCWD's TWSA including CCWD's industrial customers, as discussed above.

Without maximized pooling, significant additional water supplies are needed in both normal and drought years. ECWMA members are resolving water rights and institutional issues associated with pooling of local surface water supplies.

"Maximized pooling" means combining all surpluses in surface water supplies of ECWMA members into one common supply pool to meet

Current groundwater use in the study area amounts to 14,500 acre-feet per year (ac-ft/yr). Some areas (such as Brentwood, Discovery Bay, Bethel Island, and Hotchkiss Tract) depend entirely on groundwater. Others areas (such as Pittsburg, Antioch, and DWD) use groundwater to supplement their surface water supply. Existing groundwater quality problems in East County may limit future groundwater development. Total dissolved solids limitations have been noted in the Pittsburg, Antioch, and some DWD service areas. Nitrate limitations have been recorded in the Brentwood area. Discovery Bay's groundwater supply is showing levels of manganese concentrations exceeding secondary standards.

A preliminary evaluation of groundwater resources indicates that an in-county conjunctive-use program could be developed to mitigate

drought shortages. Conjunctive use implies the joint operation of surface water and groundwater supplies to maximize the total water supply through wet and dry hydrologic cycles; in conjunctive-use operations, excess surface water supplies from wet periods are stored in the groundwater aquifer for later use in dry years.

Other supplemental supplies identified in the study—increased water conservation, reclaimed water development, and outside-county water transfers—provide differing levels of water supply with commensurate implementation issues.

Water Supply Alternatives

The development of water supply alternatives began with an assessment of broad water supply scenarios for the study area. Water supply scenarios were developed to provide a framework within which more detailed alternatives, dealing specifically with recommended methods of providing water supply, could be developed. Based on this analysis, three water supply scenarios were developed for the East County area:

- Scenario 1—Maximized local pooling of surface water supplies
- Scenario 2—Continued groundwater pumping with maximized local pooling of surface water supplies
- Scenario 3—Continued groundwater pumping with existing levels of local pooling

Base Supply for Water Supply Scenarios

Scenario	Maximized Pooling	Current Pooling	Current Level of Groundwater Pooling
1	●		
2	●		●
3		●	●

The concept of "maximized local pooling" of surface water supplies was developed to address the potential benefits associated with fully using the water supply in East County. Maximized pooling of surface water supplies uses locally available surface water supplies to the greatest extent possible to meet the East County's combined water needs.

Implementing the maximized pooling concept would require new agreements for the long-term transfer of surplus water supplies from the two agricultural districts (ECCID and BBID) to the agencies serving East County urban areas.

Some variation in normal-year supply under future conditions was identified during analysis of potential supplies. CCWD's CVP supply, with a current contractual supply of 195,000 ac-ft/yr, may be reduced in the future. The supply could be reduced for many reasons, ranging from the effects of implementation of the Central Valley Project Improvement Act to the outcomes of the State Water Resources Control Board water rights hearings and the CALFED process, a joint state/federal evaluation of the Bay-Delta system. To account for the potential reduction of CVP supplies, the study developed two optional normal-year water supply levels:

- Option A--CCWD CVP water supply contract maintained at a current level of 195,000 ac-ft/yr from 1990 to 2040
- Option B--CCWD CVP water supply contract reduced to 166,000 ac-ft/yr (15 percent reduction) at contract renewal in 2010.

A wide range of water supply surplus and deficit occurred through the comparison of total available supplies to demands for both normal- and drought-year conditions using the three water supply scenarios described above. The water supply surplus and deficit for all scenarios based on projected conditions in 2040 is summarized in Table ES-1.

Table ES-1 indicates the significant difference between the water supply surplus or deficit depending on the assumption used for the reduction in the CCWD supply. This illustrates the importance of CCWD's CVP supply assumptions for future conditions.

TABLE ES-1
Water Supply Surplus and Deficit at 2040 Conditions

Scenario	Surplus (+) or Deficit (-) Normal Year (ac-ft/yr)	Drought Year (ac-ft/yr)
No Reduction in CCWD's CVP Supply		
1	+52,500	-19,400
2	+67,000	-4,900
3	+28,100	-43,800
15% Reduction in CCWD's CVP Supply in Year 2010		
1	+23,300	-41,300
2	+37,800	-26,800
3	-1,100	-65,700

Critical Success Factors (Screening Criteria) for Water Supply Alternatives

1. **Cost Effectiveness**
   Alternatives should be cost-effective for all participants, when considered as a program, although not necessarily for each component.
2. **Reliability—Adequate Water Quantity/Quality**
   Alternatives must have adequate water quantity, water quality, and reliability to meet projected demand.
3. **Implementability**
   Alternatives must be implementable and sustainable over time.
4. **Institutional Independence**
   Alternatives should enable each entity to move forward within the framework of the overall plan.
5. **Cooperation/Flexibility**
   Alternatives should provide operational flexibility to take advantage of opportunities and to meet member needs.
6. **Customer Satisfaction**
   Alternatives must achieve customer satisfaction.

Within this framework of three water supply scenarios, 30 alternatives were developed to meet the water supply needs of the study area. The water supply alternatives addressed the numerous methods available for securing adequate supplies to meet the deficits projected in Table ES-1.

A water supply alternatives cost model was developed to prepare cost estimates for the water supply alternatives. The cost model integrated the projected demands for water with the methods of providing normal-year and drought-year water supplies. These alternatives were screened for a relative ranking. The process used to screen these alternatives was as follows:

1. Screening criteria were developed in a workshop setting with the GBR.
2. The screening criteria were applied to the water supply scenarios.
3. The best apparent water supply scenario was selected for more detailed screening.
4. The screening criteria were applied to the water supply alternatives associated with the selected scenario.

Scenario 2 ranked the highest among the three scenarios. This scenario provides a 15 percent buffer for municipal and industrial demands against potential regulatory cuts and

Scenario 2 was selected because it:

- *Has the smallest supply deficits*
- *Has the narrowest cost range*
- *Received all good and moderate ratings in the screening process*

requires additional supply only during drought conditions. Spot water transfers and short-term demand management are the best methods for providing drought supply for this scenario. This is the recommended alternative.

The water supply alternatives analysis illustrated the potential advantages of the maximized pooling concept. The analysis of water rights issues and laws conducted as part of this study indicates that the maximized pooling of surface water supplies under the recommended alternative is implementable; however, observation of the current water rights environment indicates that this issue will be carefully observed by others and may be contested.

Treatment Facility Improvements

The growth in East County's future water demand will come primarily from increased urban water use. Urban water use in East County is projected to more than double by 2040. As a consequence, East County's existing water treatment facilities will not be able to meet treated water needs.

To address these needs, the Phase II study evaluated five water treatment options for East County. However, recommending the best treatment option was not the purpose of this analysis. Instead, detailed technical and financial information is provided in this report for ECWMA members' use in selecting a preferred option.

Infrastructure requirements for delivering treated water to Antioch, Bethel Island, Brentwood, Discovery Bay, Cowell Ranch, Diablo Water District, and Hotchkiss and Veale Tracts were evaluated. The total treated water demand, existing plant capacity, and additional required treatment capacity for this service area are shown in Figure ES-5. Additional treated water needs can be met by expanding existing plants or by building new water treatment plants. The five water treatment and delivery options were developed to provide this additional treatment capacity.

Treatment Options Analyzed in Phase II Study

Option 1: Greatly expanded Randall-Bold WTP serves DWD, East Antioch, Brentwood, and Discovery Bay. No expansion of Antioch WTP.

Option 2: Expanded Antioch and Randall-Bold WTPs.

Option 3: New East County WTP for Brentwood and Discovery Bay. Expanded Antioch WTP; no expansion at Randall-Bold.

Option 4: New larger East County WTP serves East Antioch, Brentwood, and Discovery Bay; no expansion at Antioch WTP or Randall-Bold.

Option 5: New East County WTP serves Brentwood only; new BBID plant serves Discovery Bay; expanded Antioch serves City of Antioch; no expansion of Randall-Bold.

Recommendations and Implementation Strategies

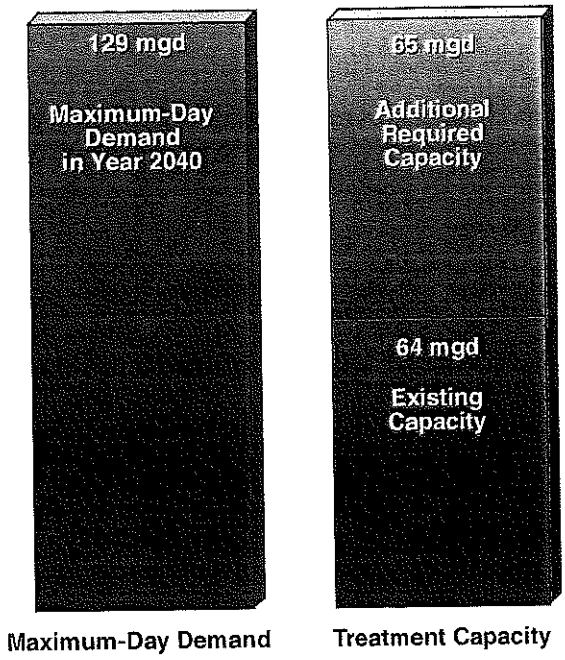


Figure ES-5
Treated Water Demand and Capacity for Antioch, Brentwood, DWD, and Discovery Bay

Recommendations for water supply development, future investigations/ activities, and administrative/ institutional activities for the study area were developed and are listed below.

- The recommended method of water supply development involves maximum utilization of local surface water supplies in the project area and continued use of groundwater supplies at the current level.
- A comprehensive groundwater study of the East County area should be commissioned by the ECWMA. The study should focus on the groundwater quantity and quality and interactions between surface water and groundwater supplies. Priority should first be given to the Brentwood/ Discovery Bay/Byron area, followed by the DWD/Delta Island areas.
- Development of an in-county conjunctive-use program should be evaluated to mitigate dry-year shortages. Conjunctive-use can be accomplished by developing (1) an aquifer storage and recovery (ASR) system; (2) surface recharge basins, and (3) in-lieu recharge programs.
- Development of an ASR system should be investigated in the Randall-Bold Water Treatment Plant area, should a requirement for stopping diversions from the Delta for 30 days be imposed on CCWD's Rock Slough and Old River diversions.
- The ECWMA should commission updates of the Water Supply Study every 5 years, allocating 1 year in the planning schedule for each update. ECWMA staff can update the study, with or without consultant assistance.
- Significant cooperation among ECWMA members has developed throughout this study; therefore ECWMA should maintain its viability while the agencies implement the Phase II study recommendations.
- An ECWMA library should be established at a location mutually acceptable to all ECWMA members.

- ECWMA members should implement a dual water distribution system program for all water service areas within East County. The program should be structured to accomplish objectives similar to Contra Costa County's ordinance for the unincorporated areas (91-19).
- Interties between WTP service areas increase reliability and flexibility during emergencies. The Cities of Pittsburg and Antioch, the CCWD, and the DWD should discuss potential intertie benefits associated with CCWD's Seismic Reliability Improvements Project.
- ECWMA should actively participate in appropriate forums to ensure that the area of origin and Delta Protection Act preferences provided for in state law are applied to allocations made under CCWD's CVP contract.
- The San Joaquin River water rights points of diversion should be relocated to the Contra Costa Canal intake. These relocated points of diversion should be considered additional points of diversion that will supplement the current points of diversion; they would not replace the current points of diversion.

Strategies for implementing these recommendations have also been developed. Figure ES-6 presents the long-term plan for implementing the recommendations and strategies from the Phase II study.

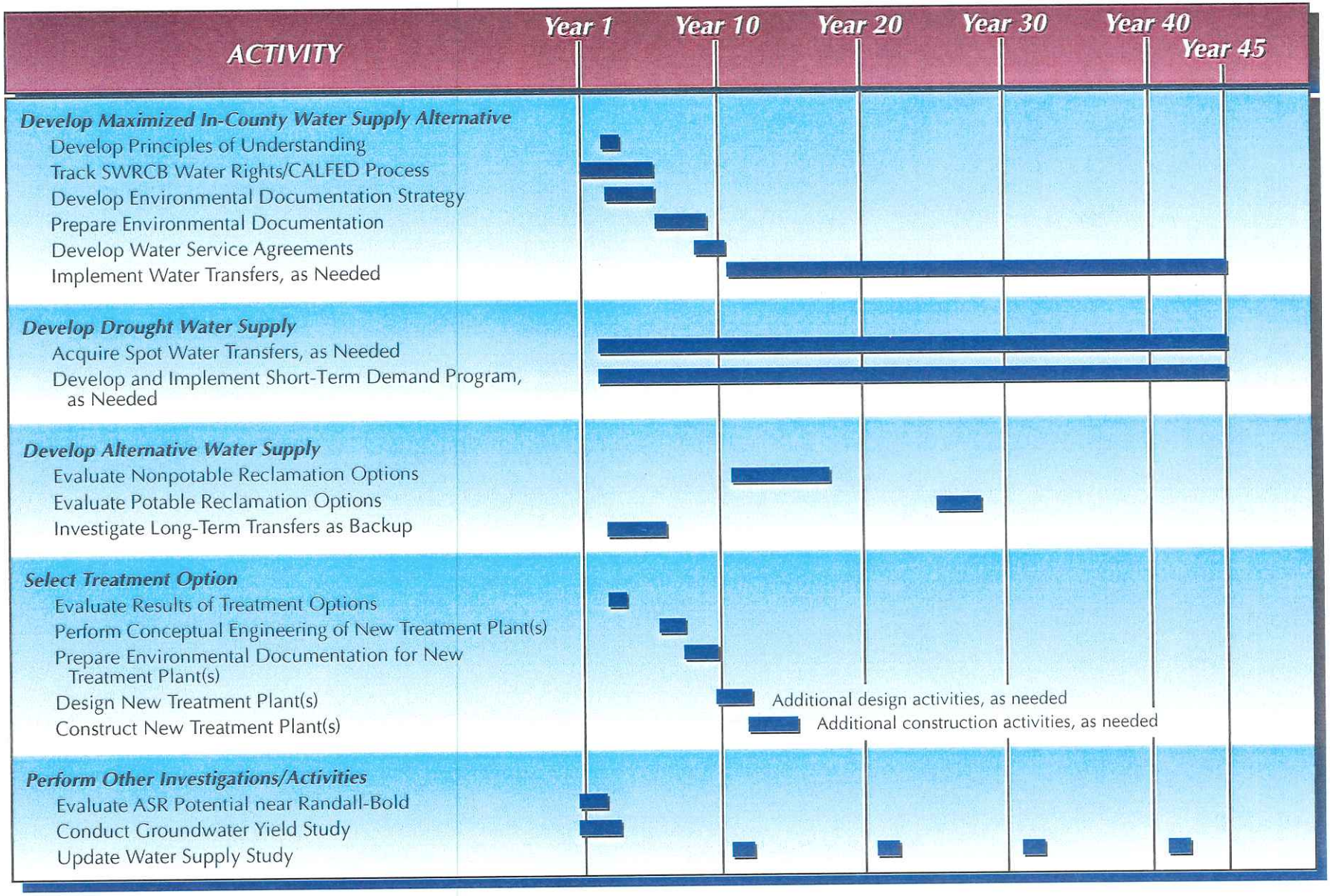
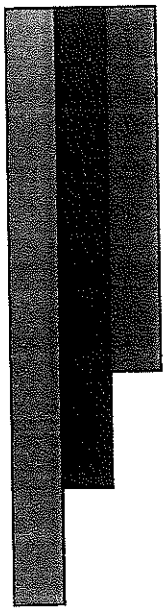


Figure ES-6

Implementation Plan

Phase II East County Water Supply Management Study

CH2MHILL



Chapter 1—Introduction

Chapter 1—Introduction

1.1 Purpose of the Project

The purpose of the East County Water Supply Management Study is to evaluate water supply management options for meeting future water needs in eastern Contra Costa County (East County). The study area, shown in Figure 1-1, consists of the cities of Antioch, Brentwood, and Pittsburg; the unincorporated communities of Bethel Island, Byron, Discovery Bay, Oakley, and Bay Point; Diablo Water District; East Contra Costa Irrigation District; Byron Bethany Irrigation District; and the rural portion of East County.

East County is subject to significant growth pressures; the municipal water need in this area is projected to more than double from 37,200 acre-feet in 1990 to about 99,670 acre-feet in year 2040 (shown to the right).

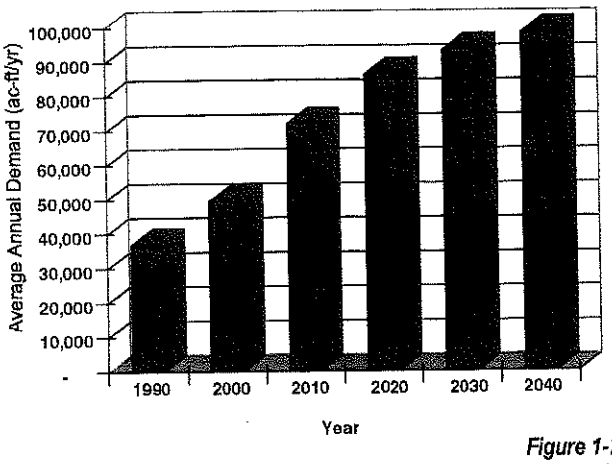


Figure 1-2
East County Urban Demands

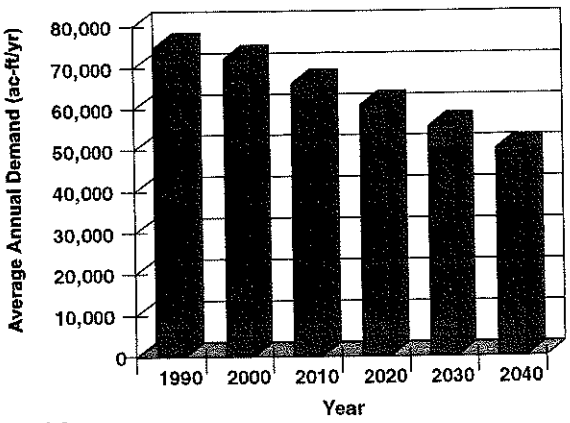


Figure 1-3
East County Agricultural Demands

In contrast, agricultural water need is projected to decrease from about 73,500 acre-feet in 1990 to about 48,600 acre-feet in 2040 (shown left), while the industrial water demand remains constant at 20,000 acre-feet. As a result, East County needs to develop water and infrastructure supply plans to meet future water needs as well as to treat and deliver water to meet municipal and industrial (M&I) demands.

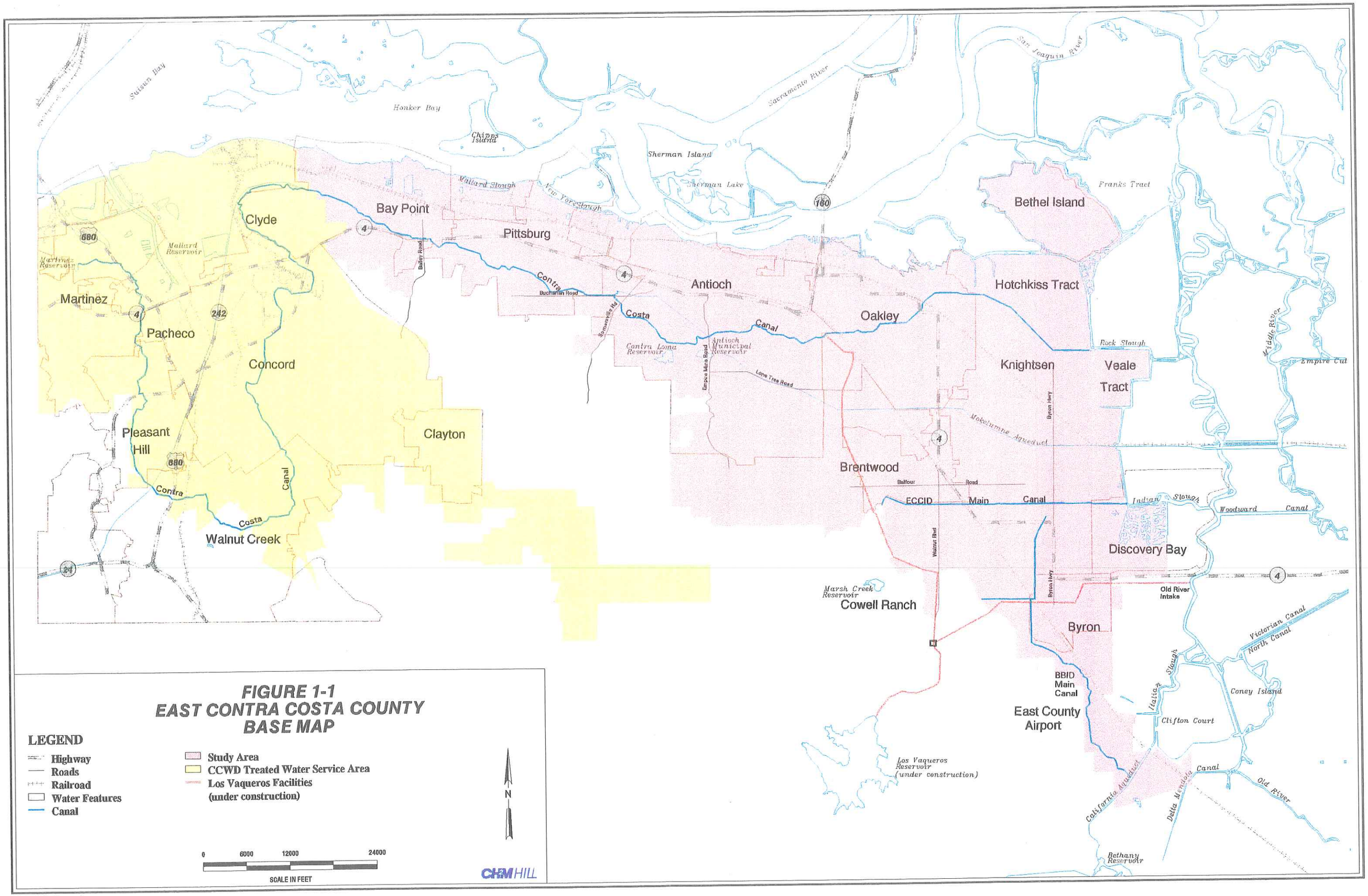


FIGURE 1-1
EAST CONTRA COSTA COUNTY
BASE MAP

LEGEND

- Highway
- Roads
- Railroad
- Water Features
- Canal
- Study Area
- CCWD Treated Water Service Area
- Los Vaqueros Facilities (under construction)

N

0 6000 12000 24000

SCALE IN FEET

CH2M HILL

/b/eccc/plots/base.aml
September 10, 1996 7:43 PM

The East County Water Supply Management Study comprises two phases. Phase I, completed in 1994, provided a preliminary analysis of future demand, water supplies, existing infrastructure, and general issues related to cooperative water resources management (Contra Costa Water District, 1994). Phase II, the subject of this Summary Report, was conducted to develop, evaluate, and recommend alternatives for providing cost-effective and reliable water supplies to East County through the year 2040 and to develop implementation strategies and cost estimates for the water infrastructures required to deliver treated water.

The focus of the Phase II study was on the development of water supply alternatives and water treatment options, not on the development of water supply and water demand data. Water demand and supply data available from past and concurrent studies were synthesized and refined based on recent planning information provided by the Joint Managers' Committee (JMC).

1.2 Project Background

According to projections by the Association of Bay Area Governments (ABAG), Contra Costa County will grow from 800,000 residents to more than 1.1 million residents by 2010. ABAG also projects that most of the population growth will occur in the eastern communities of Antioch, Brentwood, and Oakley. Brentwood is one of the fastest growing communities in California. When population projections for Pittsburg are included, East County is expected to account for more than half of the total projected growth in Contra Costa County by the year 2010.

Against this backdrop, the East County Water Management Association (ECWMA) has undertaken this study to develop a regional water supply management plan for East County. The ECWMA consists of 11 member agencies:

- City of Antioch
- City of Brentwood
- Byron Bethany Irrigation District (BBID)
- Contra Costa County Sanitation District No. 19 (CCCSD—Discovery Bay)
- Contra Costa County Water Agency
- Contra Costa Water District (CCWD)
- Delta Diablo Sanitation District (DDSD)
- Diablo Water District (DWD—Oakley and surrounding area)
- East Contra Costa Irrigation District (ECCID)
- Ironhouse Sanitary District (ISD —Oakley and Bethel Island)
- City of Pittsburg

1.3 Project Scope

Phase II encompassed the development and analysis of water supply alternatives to meet regional and individual water agency water needs through the year 2040. The ECWMA developed a comprehensive issue matrix (provided in Appendix A) of short-term (year 2000), mid-term (year 2010), and long-term (year 2040) water supply issues; the major issues are summarized below:

- Feasibility of regional cooperation, such as pooling of surface water supplies.
- Reliability of water supply for ECWMA members during normal and dry years.
- Availability of water rights for ECWMA members.
- Ability to implement a strategy to best use the ECCID and BBID water rights.
- Feasibility of using the Randall-Bold Water Treatment Plant (WTP) to meet treated water needs in East County, as opposed to constructing a new treatment facility in the Brentwood vicinity.
- Ability to expand the Randall-Bold WTP beyond 80 million gallons per day (mgd); it is currently designed for expansion up to 80 mgd.
- Cost-effectiveness of obtaining supply from a regional WTP, such as Randall-Bold, or from new or expanded local WTPs.
- Availability and usability of reclaimed water and ability to implement a reclamation system.
- Maximum use of groundwater without causing overdraft or degradation of water quality.
- Legal, institutional, and infrastructural arrangements to ensure adequate supply for East County.

To address these issues, the Phase II scope was subdivided into six elements.

Element 1: Study Management and Communication

This element provides for the coordination and review of all technical and policy issues. The project team met with the JMC every month during the project and conducted six workshops with the Governing Board Representatives (GBR) to discuss progress, study assumptions and data, project approach, and alternatives development and screening.

Element 2: Water Demands and Supply

This element involved synthesis and refinement of water demand and supply data. The Phase II scope did not include the development of water demands from land-use and population projections. Instead, water demand estimates developed as part of Phase I and the CCWD's

Future Water Supply Study (FWSS) were reviewed and refined for Phase II use. Similarly, data on water supply sources developed in Phase I and the FWSS were used to estimate available East County supplies. The water supply sources were evaluated for availability, reliability, and use in a specific demand area. Available information on East County groundwater resources was synthesized and evaluated for long-term reliability and usability. Potential reclaimed water options for East County were developed by synthesizing previously developed reclamation planning projects for East County reclamation plants.

Element 3: Water Treatment and Delivery Options

Options were evaluated for delivering treated water to different demand sites. The required improvements to, and construction of, raw water facilities, treated water facilities, and delivery system facilities were identified, and feasibility-level cost estimates were developed for delivering water to the distribution systems.

Element 4: Short-Term Water Management Strategies

Short-term water management strategies were developed for meeting ECWMA's near-term needs and for identifying long-term planning alternatives.

Element 5: Mid- and Long-Term Water Service Alternatives

Mid- and long-term regional water management strategies were developed for meeting East County's future water needs. Alternatives were evaluated, and a recommended water service alternative with many possible options for implementation was developed.

Element 6: Implementation Plan

An implementation plan was developed to integrate the most effective short-term strategies and the highest ranked long-term water service alternatives. Project activities for implementing the recommendations were identified, and an implementation schedule was developed.

1.4 Other Related Studies

The Phase II study incorporates information from several related studies that have been conducted or are being conducted on East County water resources issues, including water master plans of the ECWMA members and other recent studies on water supply, demand, and treatment. Studies and reports used in the current Phase II study are summarized in Appendix B.

Two ongoing CCWD studies are particularly important to the Phase II work: the FWSS and the Seismic Reliability Improvement Project (SRIP). The FWSS has developed a comprehensive analysis of future water needs in north-central and eastern Contra Costa County and has

evaluated alternatives to meet these needs through the year 2040. The SRIP is evaluating the feasibility of a treated/raw water pipeline to connect the Bollman and Randall-Bold Water Treatment Plants; this intertie would provide additional overall reliability for CCWD's water supply system.

1.5 Project Publications

This Summary Report summarizes the major findings and results of the Phase II study. In addition, the following two documents were prepared:

- Technical Report: A compendium of technical memorandum containing technical details of the work conducted under the Phase II study. Copies of this report are available at each ECWMA member agency.
- Public Document: A four-page color brochure outlining Phase II's major conclusions and recommendations.

Chapter 2—Water Demands and Supply

Chapter 2—Water Demands and Supplies

While developing water supply alternatives to meet estimated future East County water demand was a primary task of the Phase II study, analysis of future water demand from land-use and population projections was not within the study scope. As a result, the water demand projections used in this study were derived initially from the FWSS, a concurrent study conducted by CCWD. The FWSS has developed a comprehensive analysis of future urban water demands in north-central and eastern Contra Costa County. The initial estimates from the FWSS were corroborated with demand estimates from existing water supply master plans, and necessary refinements were made following consultation with ECWMA members. A similar approach was used in estimating available water supply for East County. The development of water demand and water supply data for the Phase II study is summarized below. A more detailed discussion can be found in Technical Memorandum No. 2.

2.1 Development of Water Demands

Background

The land-use and water-use analysis from CCWD's FWSS formed the initial basis for estimating East County's water demands. The FWSS developed future municipal water needs for individual water service areas in Contra Costa County using current data and trends and the following demand forecast variables: service area size; rate, pattern, and density of growth; land development potential; future land-use types and water consumption by land use; population characteristics; and water use habits.

Savings from water conservation are included in water demand projections.

The FWSS demand projections included consideration of savings from existing state, federal, and local water conservation ordinances. Assuming gradual market penetration of water conservation and conformance with newer plumbing codes over time, conservation savings were estimated to be 2, 4, 6, 8, and 10 percent for the years 2000, 2010, 2020, 2030, and 2040, respectively.

Water supply master plans of ECWMA members provided another source of water demand data. Demand estimates from this source were compared with FWSS estimates. The differences were identified, investigated, and resolved through consultation with ECWMA members' staff. The process used to develop water demand data for the Phase II study is summarized in Figure 2-1.

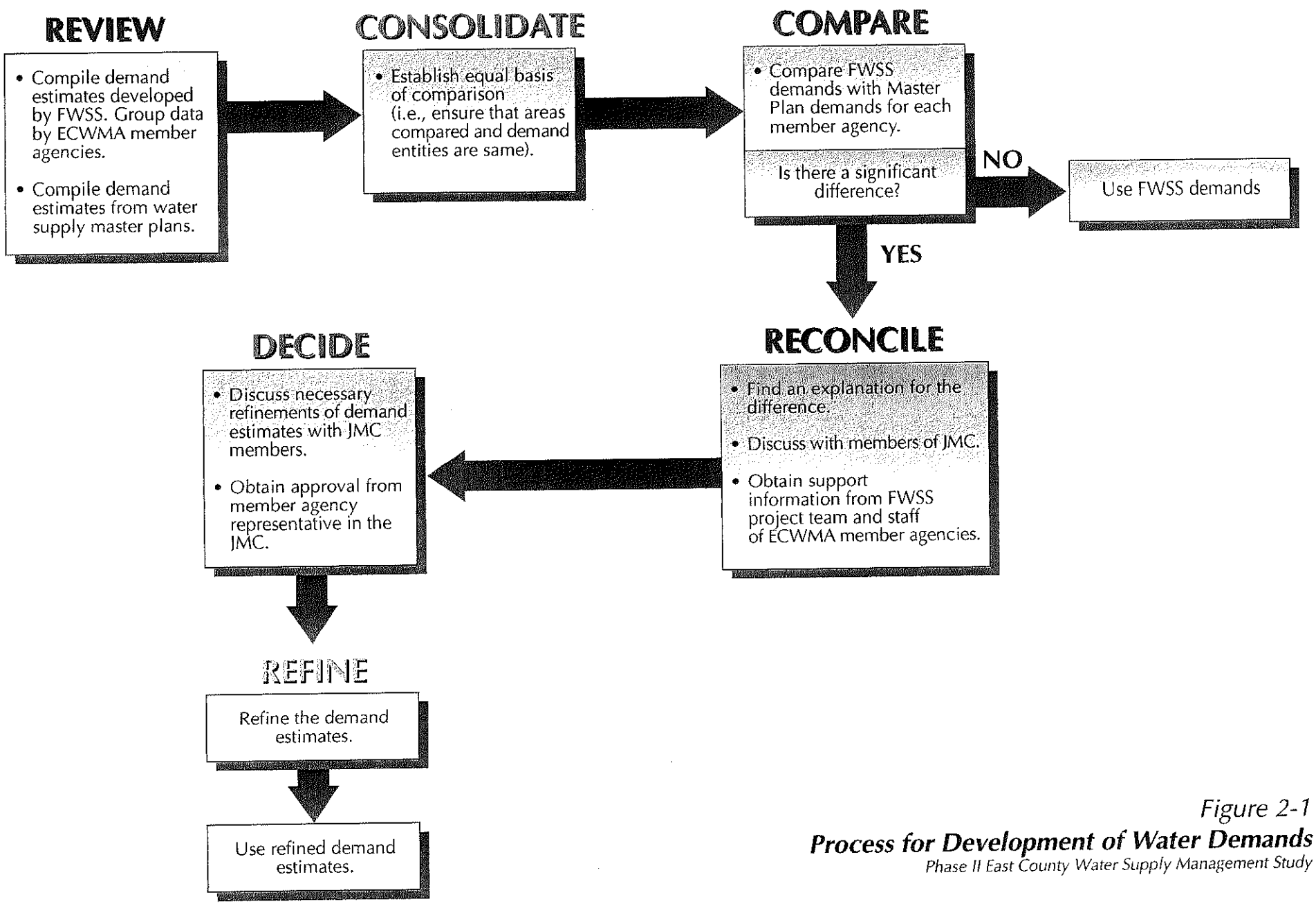


Figure 2-1

Process for Development of Water Demands

Phase II East County Water Supply Management Study

CH2MHILL

Industrial demand projections were developed by the FWSS based on historical consumption records (canal sales, river diversions) and interviews with industry representatives. Agricultural demands for the agricultural area were not included in the FWSS.

Two primary agricultural areas in East County are ECCID and BBID. Current and future East County agricultural demands were estimated from current and planned land-use data and from planned land-use conversions resulting from development in the agricultural area.

Summary of Demands by Service Area

The estimated water demand associated with each water service area, shown in Figure 1-1, is presented in Table 2-1. Total East County water demand is projected to increase from about 142,900 acre-feet in the year 2000 to about 168,300 acre-feet in the year 2040. Table 2-1 also includes demand for other FWSS areas. These areas were included to provide an equivalent basis for comparison with FWSS water demand estimates, which are provided for six large geographical areas. The combined equivalent area represented in Table 2-1 corresponds to FWSS Service Area E; it includes East County, CCWD's Treated Water Service Area (TWSA), and CCWD's industrial customers. This combined area is called the expanded study area in this report.

The total municipal and industrial demand for the expanded study area is projected to increase from 179,500 acre-feet in the year 2000 to 242,000 acre-feet in the year 2040. The agricultural demand for the combined equivalent area is projected to decrease from about 70,500 acre-feet in the year 2000 to 48,600 acre-feet in the year 2040. This change in the water demand pattern between 2000 and 2040 is shown in Figure 2-2.

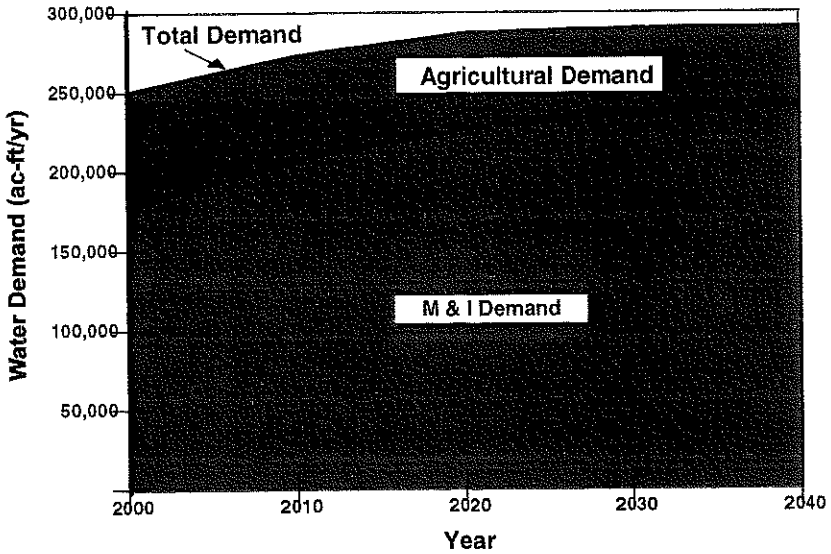


Figure 2-2
Total Water Demand for Expanded Study Area

TABLE 2-1
Water Demand Summary (ac-ft/year)

Service Area		2000	2010	2020	2030	2040
East County						
Bay Point						
Municipal[a]		4,000	4,850	5,500	5,600	5,500
	Subtotal	4,000	4,850	5,500	5,600	5,500
Pittsburg						
Municipal[b]		13,190	15,850	17,010	17,360	17,460
Industrial (USS Posco)		6,800	6,800	6,800	6,800	6,800
	Subtotal	19,990	22,650	23,810	24,160	24,260
Antioch						
Municipal[c]		19,460	22,850	24,090	24,180	24,010
Industrial (Gaylord)		10,700	10,700	10,700	10,700	10,700
Future Urban Area (FUA)-1		130	2,000	3,300	4,600	5,800
FUA-2		240	600	1,000	1,100	1,100
	Subtotal	30,530	36,150	39,090	40,580	41,610
Diablo Water District						
Municipal		6,960	8,920	10,880	12,840	14,800
Industrial		1,000	1,000	1,000	1,000	1,000
Bethel Island & Hotchkiss Tract		860	1,720	2,580	3,440	4,300
Knightsen & Veale Tract		40	80	120	160	200
	Subtotal	8,860	11,720	14,580	17,440	20,300
Brentwood[d]						
Municipal		4,300	9,800	16,000	18,150	20,600
	Subtotal	4,300	9,800	16,000	18,150	20,600
ECCID						
Agricultural (Ag)		32,600	30,200	27,800	25,400	23,000
	Subtotal	32,600	30,200	27,800	25,400	23,000
BBID						
Industrial		1,500	1,500	1,500	1,500	1,500
Agricultural		37,900	34,300	31,400	28,500	25,600
	Subtotal	39,400	35,800	32,900	30,000	27,100
Discovery Bay						
Municipal		2,300	3,400	3,900	3,900	3,900
	Subtotal	2,300	3,400	3,900	3,900	3,900
Other						
Byron		350	500	600	700	700
East County Airport		590	1,100	1,200	1,200	1,300
	Subtotal	940	1,600	1,800	1,900	2,000
	Total Study Area	**142,920**	**156,170**	**165,380**	**167,130**	**168,270**
Other Areas—FWSS[e]						
TWSA		56,500	58,900	60,400	61,200	61,000
Shell Oil		14,800	14,800	14,800	14,800	14,800
Tosco Oil		13,400	13,400	13,400	13,400	13,400
Unincorporated RWSA[f]		--	--	--	--	--
Martinez		7,300	7,400	7,300	7,200	7,100
Unincorporated inside ULL		1,300	4,800	5,600	5,800	5,800
Unincorporated outside ULL[g]		1,100	4,700	7,300	7,600	7,500
Canal losses		7,000	7,000	7,000	7,000	7,000
Other industrial demands[h]		5,700	5,700	5,700	5,700	5,700
	Other Area Subtotal	**107,100**	**116,700**	**121,500**	**122,700**	**122,300**
Total Demand (M&I and Ag)		**250,000**	**272,870**	**286,880**	**289,830**	**290,570**
Total M&I demand (no Ag)		**179,520**	**208,370**	**227,680**	**235,930**	**241,970**

[a]Includes 30 percent of unincorporated Raw Water Service Area (RWSA) demand from FWSS.
[b]Includes 35 percent of unincorporated RWSA.
[c]Includes 35 percent of unincorporated RWSA demand for FWSS.
[d]Demand for Cowell included.
[e]Inclusion of these areas with East County provides equivalence for comparison with FWSS Service Area E.
[f]Based on GIS overlay maps, non-industrial demand was apportioned: Pittsburg (35%), Bay Point (30%), and Antioch (35%).
[g]Not specifically allocated to any community.
[h]Adjustment for differences in historic canal sales to industries between a critically dry year and a wet year (CCWD, 1996).

Comparison Between Phase II and FWSS Demand Estimates

Table 2-2 compares East County water demand estimates with FWSS Service Area E water demand estimates. As shown, Phase II demand estimates without agriculture differ from FWSS demand estimates (which exclude agriculture) by only 3 to 6 percent. These differences are insignificant given the level of accuracy of the demand estimates, land-use projections, and population projections.

TABLE 2-2
Comparison of Phase II Demands with FWSS Service Area E Demands

Year	Phase II Demands with Agriculture (ac-ft/yr)	Phase II Demands w/o Agriculture (ac-ft/yr)	FWSS Service Area E Demands[a] (ac-ft/yr)	Percent Difference[b]
2000	250,000	178,000	184,900	4
2010	272,900	206,900	219,400	6
2020	286,900	226,200	237,300	5
2030	289,800	234,400	245,300	5
2040	290,600	240,500	247,600	3

[a]FWSS demands do not include agricultural demands.
[b]Percent difference between Phase II demands without agriculture and FWSS demands that do not include agriculture.

Though the total water demand estimates for Service Area E are remarkably close in both the FWSS and Phase II studies, the individual area water demands sometimes vary significantly. This variation can be explained largely by differences in the methods used to aggregate component area demands for a given service area. To assess facility improvements needed to meet future water demands, the general categories of water demand noted in the FWSS were allocated to specific service areas of the Phase II study area. In many instances, this allocation resulted in additional demands beyond the demands shown in existing master plans. These differences are discussed in Technical Memorandum No. 2. In addition, in some cases, more recently refined estimates were available from ECWMA members. These discrepancies in individual area demands between the Phase II study and the FWSS are discussed in detail in Technical Memorandum No. 2; a summary discussion is provided in Table 2-3.

TABLE 2-3
Comparison of Phase II and FWSS Water Demand by Service Area

Service Area	Water Master Plan	FWSS	Phase II Study	Remarks
Bay Point	--	3,100 ac-ft/yr in year 2040.	Use FWSS demand estimate. Add 30 percent of total municipal demand (8,000 acre-feet) in CCWD unincorporated Raw Water Service Area (RWSA). Total Demand = 5,500 ac-ft/yr in 2040.	Unincorporated RWSA demand includes industrial demands (Shell Oil, Tosco Oil, USS Posco, and Gaylord) and future municipal demands from potential development in RWSA. Municipal portion of this demand is about 8,000 ac-ft/yr in 2040. Overlay mapping analysis resulted in 30 percent allocation to Bay Point.
Pittsburg	14,400 acre-feet in 2010. No water conservation savings.	13,850 ac-ft/yr in 2010; 14,700 ac-ft/yr in 2040. Includes conservation savings.	Use FWSS demand estimate. Add 35 percent of total municipal demand (8,000 ac-ft) in unincorporated RWSA. Total demand = 17,500 ac-ft/yr in 2040.	Same as for Bay Point. Overlay mapping analysis resulted in 35 percent allocation to Pittsburg.
Antioch	28,400 ac-ft/yr in 2030.	27,100 ac-ft/yr in 2030. Includes conservation savings.	Use FWSS demand estimate for City of Antioch. Add FUA-1 demand. Add FUA-2 demand. Add 35 percent of total municipal demand (8,000 acre-feet) in unincorporated RWSA.	Same as for Bay Point. Overlay mapping analysis resulted in 35 percent allocation to Antioch.
DWD (includes demands in Oakley, Bethel Island, and Hotchkiss Tract)	20,300 ac-ft/yr in 2040.	31,690 ac-ft/yr in 2040.	Use Master Plan estimates.	After discussions with FWSS consulting team, CCWD, and DWD, it was decided that Water Master Plan estimates are more representative of actual planning conditions. The higher demand estimates of FWSS are attributed primarily to two factors: (1) higher estimated population in FWSS, and (2) higher land-use acreage in FWSS.

TABLE 2-3
Comparison of Phase II and FWSS Water Demand by Service Area

Service Area	Water Master Plan	FWSS	Phase II Study	Remarks
City of Brentwood (includes Cowell)	20,600 ac-ft/yr in 2040 in city's infrastructure master plan (1994). Water supply study (1990) estimates a 2040 demand of 14,600 ac-ft/yr in Brentwood's Sphere of Influence, which excludes Cowell (4,000 ac-ft). Demand is 18,600 ac-ft/yr when Cowell is included.	14,800 ac-ft/yr in 2040 for Brentwood and Cowell.	Use Infrastructure Master Plan numbers.	Based on discussions with Brentwood staff, it was decided that Infrastructure Master Plan numbers represent actual planning conditions.
Discovery Bay	3,000 ac-ft/yr at buildout, according to 1990 Master Plan (Luhdorff and Scalmanini, 1990). Current estimated demand is 3,900 ac-ft/yr (CCCSD #19, personal communication).	5,150 ac-ft/yr.	Use current estimate from CCCSD #19.	Current estimate used 521 gpd per equivalent residential unit (ERU). FWSS used 696 gpd/ERU.
ECCID	--	Not included.	1990 agricultural demand was 35,000 ac-ft/yr. Reduction of 12,000 ac-ft/yr demand assumed to occur linearly from 1990 to 2040. Total demand in 2040 = 23,000 ac-ft/yr.	ECCID delivers approximately 4 ac-ft/acre to agricultural lands. ECCID expects to convert about 3,000 acres of agricultural land to urban uses over the planning horizon.
BBID	--	Not included.	Currently delivers 40,000 ac-ft. Reduction in agricultural demand to be approximately 13,400 ac-ft by 2040. Total demand in 2040 = 25,600 ac-ft/yr.	Reduction in agricultural demand is associated with developments such as Discovery Bay West, Kaufman and Broad, and Mountain House.

2.2 Development of Water Supplies

The following water supplies were explored relative to meeting East County water needs:

- In-county surface water
- In-county groundwater
- Conjunctive use development
- Reclaimed water
- Outside-county water transfers
- Water conservation

These potential supplies are discussed in the following sections.

To comprehensively compare water supplies to water demands, the potential supplies from both the north-central and eastern portions of Contra Costa County were analyzed. The resulting supply coincides with the demands shown for the service areas in Table 2-1.

In-County Surface Water

Surface water supplies in East County consist of water rights (riparian and appropriative) and water service contracts in the Sacramento-San Joaquin Delta. These supplies do not yield a constant amount of water every year because of hydrologic and water quality conditions in the Delta. The primary in-county surface water sources evaluated in this study were:

- CCWD's Central Valley Project (CVP) contract
- ECCID's and BBID's pre-1914 appropriative water rights
- San Joaquin River diversions from City of Antioch, Gaylord Industries, Tosco Corporation, USS Posco, and Dupont, and CCWD's diversion from Mallard Slough

The amount of water entitlements associated with each of these sources is presented in Table 2-4, along with an estimate of reliable supply during normal and dry hydrologic conditions. A brief discussion of these supply sources is provided below. For additional details, refer to Technical Memorandum No. 2.

Contra Costa Water District CVP Contract

CCWD's primary water supply is the U.S. Bureau of Reclamation's (USBR) CVP entitlement (Water Rights Permits 12726 and 12725). The current contract, effective through 2010, provides that the USBR will supply up to 195,000 acre-feet/year (ac-ft/yr) to CCWD at Rock Slough or at Old River Intake, subject to the following shortage provision: *during regulatory restrictions, which may occur due to hydrologic conditions or environmental requirements, CCWD will receive the greater of 75 percent*

TABLE 2-4
Surface Water Supply Sources in East Contra Costa County

Source	Water Entitlement (ac-ft/yr)	Assumed Maximum Reliable Normal-Year Supply (ac-ft/yr)	Assumed Minimum Reliable Drought-Year Supply (ac-ft/yr)
CCWD-CVP Contract	195,000[a]	195,000[b]	161,200[c]
ECCID Water Rights	50,000	50,000	50,000
BBID Water Rights	60,000	60,000	60,000
City of Antioch: San Joaquin River Supply	7,840[d]	4,300[e]	0[f]
Gaylord Industries: San Joaquin River Supply	28,000	10,700[g]	0[f]
Tosco Corporation: San Joaquin River Supply	16,500	9,050[e]	0[f]
Dupont : San Joaquin River Supply	1,405	770[e]	0[f]
CCWD: Mallard Slough	26,700	6,500[h]	0[f]
USS Posco	12,900[i]	6,800[j]	0[f]
Total	398,345	343,120	271,200

[a]As per the current contract (valid through the year 2010). However, it is possible that due to the implementation of the Central Valley Project Improvement Act (CVPIA) this contract entitlement may be reduced at the time of contract renewal in 2010. For the purpose of this study, a reduced CCWD CVP supply was analyzed using a 15% reduction in contract entitlement in 2010, resulting in CCWD's CVP entitlement of 166,000 acre-feet. In addition, before CCWD makes deliveries greater than 148,000 acre-feet, it must consult with the U.S. Fish and Wildlife Service on potential impacts to Delta smelt from increased pumping under the terms of the LVP biological opinion for Delta smelt. CCWD plans to initiate this consultation in 1997.
[b]CVP supply to CCWD cannot exceed the actual water need. In 2040, the actual need for CCWD service area exceeds 195,000 ac-ft ; however, in earlier years, the actual need is less than 195,000 ac-ft.
[c]The contract states this amount to be a minimum of 75% of contract entitlement and 85% of historical use, but never to be less than 75 % of historical use. See also the discussion in Section 2.2.
[d]City of Antioch does not have a quantity limitation on its appropriation from the San Joaquin River (Brown and Caldwell, 1991). For the purpose of this study, the entitlement is assumed to be the same as the current capacity of 7 mgd (or 7,840 ac-ft/yr). The city is currently planning to increase this capacity to 9 mgd, which may result in additional supplies.
[e]Normal year supplies for the San Joaquin River sources are obtained by multiplying the entitlement amount by the ratio (200/365) to represent number of days of satisfactory water quality at the diversion site. See discussion in Section 2.2
[f]For planning purposes, it was assumed that in drought years, no water is available for the San Joaquin River diverters in the Delta.
[g]Gaylord Industry entitlement multiplied by the ratio (200/365) gives 15,350 ac-ft; however, Gaylord Industry demand is 10,700 ac-ft. Due to difficulty in changing industrial entitlement to municipal entitlement and also in transferring water rights, the available supply is assumed to be the minimum of the demand and the usable water. See discussion in Section 2.2.
[h]An average amount based on 1974 to 1993 historic diversions.
[i]This entitlement is not listed with SWRCB. This estimate is based on past diversion records (CCWD, 1996)
[j]USS Posco entitlement multiplied by the ratio (200/365) gives 7,070 acre-feet; however, USS Posco demand is 6,800 acre-feet. Due to difficulties in changing industrial entitlement to municipal entitlement and in transferring water rights, available supply is assumed to be the minimum of the demand and the usable water.

of the contract entitlement or 85 percent of historical use; during water shortages, such as during drought years, CCWD will receive no less than the lesser of 75 percent of the contract entitlement or 85 percent of historical use, but not less than 75 percent of historical use. Historical use is defined as the average quantity of CVP water put to beneficial use within the service area during the last 3 years of water deliveries not affected by water shortages, plus the average amount of river diversions by Gaylord Industries, the City of Antioch, and CCWD at Mallard Slough.

CCWD's CVP contract with the USBR also contains provisions for the operation of Los Vaqueros Reservoir and for diversions from locations on Old River to supply water to the reservoir and to the CCWD service area directly. These provisions generally allow CCWD to manage its water supplies to meet water quality objectives within its service area. The Los Vaqueros Project (LVP) does not add any water supplies for the service area.

ECCID Water Rights

ECCID holds a pre-1914 water right from the Delta at Indian Slough for irrigation and other purposes. The California Department of Water Resources (DWR) has acknowledged this water right with a contractual agreement to furnish ECCID with up to 50,000 ac-ft/yr from the Delta. The average diversion during the 1975-1992 period was 34,700 ac-ft/yr, with a maximum of 49,200 acre-feet in 1976.

ECCID and CCWD entered into an agreement in 1990 to transfer 21,000 ac-ft/yr to CCWD for municipal and industrial uses within the ECCID service area. In 1995, CCWD and the City of Brentwood entered into an agreement that allows for the transfer of 7,000 acre-feet of this supply to Brentwood. ECCID's water right is not subject to regulatory deficiencies and, therefore, neither is the portion of the water that may be transferred to CCWD.

BBID Water Rights

BBID holds a pre-1914 water right for Delta diversions for an unquantified (i.e., no agreement with a state or federal water agency) amount from the California Aqueduct intake channel for irrigation and domestic use. In the absence of an agreement, DWR interprets pre-1914 water rights based on the historical diversion pattern, which averaged about 40,000 ac-ft/yr during the 1959-1994 period and was at a maximum of 55,000 acre-feet in 1976. Discussions with BBID indicate that a total supply of approximately 60,000 ac-ft/yr may be available. This amount is used as the BBID entitlement in this study.

San Joaquin River Diversions

Entitlements for different river diverters are presented in Table 2-4. Diversions from the San Joaquin River near the Delta can be limited by river salinity, which is indicated by chloride concentrations in the water.

The water entitlements can be fully exercised only in very wet years, when chloride concentrations are satisfactory. Therefore, the river diverters seek other sources for replacement supply for blending with the river water or direct use. Other diverters, such as Tosco Oil and USS Posco, rely more on the Contra Costa Canal water at times of poor salinity conditions in the San Joaquin River. Some diverters, such as Gaylord Industries and the City of Antioch, have obtained a contractual guarantee from DWR to provide satisfactory water quality (i.e., below corresponding chloride threshold values) for a minimum number of days (200 days for Gaylord, 208 days for the City of Antioch) in non-drought years.

Due to the lack of an established reliability index associated with San Joaquin River diversion in the Delta, this study assumed that satisfactory salinity conditions will be met for at least 200 days in non-drought years for the San Joaquin River diverters. As a result, the reliable supply estimates for the river diversions, as shown in Table 2-3, are computed by multiplying the entitlement amount by (200/365).

There are three exceptions to this rule: Gaylord Industries, USS Posco, and CCWD at Mallard Slough. In the first two cases, reliable supplies from the San Joaquin River are further limited to future water demands because of the potential problems associated with the transfer of excess supply from industrial customers to other users. The Phase II study recognizes that Gaylord Industries has recently discontinued operation; however, for the purposes of planning, it was assumed that an industry with comparable water needs would use this water right. The reliable supply estimate for CCWD's Mallard Slough was 6,500 ac-ft/yr. This estimate was based on average historic diversions between 1974 and 1993.

Other Water Rights

Other water right holdings in East County (shown in Table 2-5) are either appropriative water rights or water rights statements. These were not considered for the East County supply because they are small private water rights or their place of use is outside of the East County demand area.

These other water rights, which are described in Table 2-5, may be used creatively to augment East County's water supplies, provided that the legal and institutional issues regarding water transfers (e.g., real water versus paper water, and many others) can be resolved. For example, Reclamation District 830 (RD830) water rights for Jersey Island consist of 40.22 cubic feet per second (cfs) of appropriative water rights from March 1 to November 1, which is a total of 8 months. At full utilization, this entitles RD830 to divert an annual total of 19,500 acre-feet during the diversion period. A portion of this entitlement can be made available for transfer by using reclaimed water from ISD in lieu of water diverted under this water right. At ultimate buildout, the projected flow

TABLE 2-5
Other East County Water Rights

Name	Place of Use	Annual Diversion Right (ac-ft)[a]
Water Rights Statements		
John Bloomfield, et al.	Orwood Tract	10,830
Alvin R. Orman	Brentwood	510
Ernest C. Burroughs	Brentwood	1,310
The Burroughs Trust	Jersey Island	4,740
Ernest C. Burroughs, et al.	Jersey Island	3,090
Oscar N. Burroughs, et al.	Jersey Island	5,390
Oscar N. Burroughs, et al.	Jersey Island	5,390
Emerson Dairy, Inc.	Jersey Island	2,070
Appropriative Rights		
Delta Farms Reclamation District #2024	Orwood Tract	14,730
Delta Farms Reclamation District #2025	Holland Tract	26,860
Delta Farms Reclamation District #2026	Webb Tract	34,880
William M. Looney, et al.	Orwood Tract	4,690
Mantell Brothers	Orwood Tract	1,090
Church of Jesus Christ of Latter Day Saints	Byron Tract	17,160
Church of Jesus Christ of Latter Day Saints	Byron Tract	10,140
Palm Tract Company	Palm Tract	22,300
Edna M. Fallman	Orwood Tract	1,450
H. John Bloomfield, et al.	Orwood Tract	8,510
Sheldon G. Moore, Nancy D. Moore, and Daren D. Moore	Orwood Tract	4,530
Alba C. Houston Orchard Company	Byron Tract	490
Jersey Island Reclamation District #830	Jersey Island	19,500

[a]Diversion amounts represent maximum diversion amounts and do not reflect actual consumptive use amounts that would be available for transfer.
Source: Future Water Supply Study (CCWD, 1996).

at ISD is 8 mgd (8,960 ac-ft/yr), which would make about 6,000 acre-feet available for transfer between March 1 and November 1, assuming an average daily flow condition; the actual amount would depend on the wastewater flow pattern at ISD. In addition, if Brentwood conveys 6 to 8 mgd of its wastewater flow to ISD, as is currently being considered, the total available water for transfer could be as great as 11,000 acre-feet.

CCWD has a permit to store or divert up to 9,640 ac-ft/yr from Kellogg Creek, on which the Los Vaqueros Reservoir is located. Los Vaqueros Reservoir, currently under construction, is a 100,000-acre-foot storage facility that will store primarily CCWD's CVP water diverted from Old River. The purpose of the LVP is not water supply development but water quality improvement for CCWD's customers and the provision of emergency water storage. The Kellogg Creek diversion permit approved for CCWD is subject to prior water rights and the terms and conditions in Los Vaqueros Project Decision 1629 (State Water Resources Control Board [SWRCB], 1994).

If used as a fully shared resource, the combined surface water supplies alone can meet ultimate demands in normal hydrologic years; additional supplies will be required in drought years.

Summary of Surface Water Resources

Total in-county surface water supplies available to meet the water demand are shown in Figure 2-3. From a resource viewpoint, the combined in-county surface water supplies alone can meet the ultimate demand in normal hydrologic conditions as shown in Figure 2-3. However, in drought years, the demand exceeds available surface water supplies and additional supplies will be required to meet water shortages. From a practical viewpoint, institutional and water rights issues will determine the actual availability in a given year. Chapter 4 summarizes the development of water supply alternatives with consideration to these constraints.

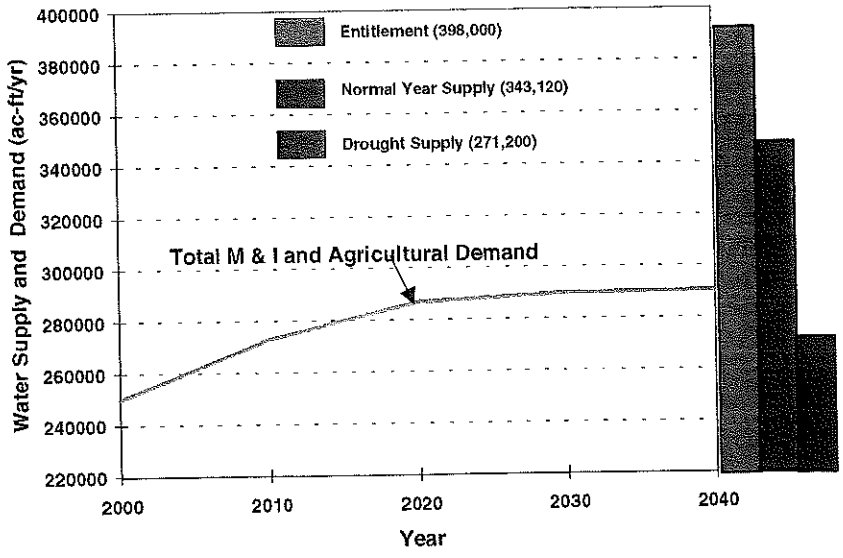


Figure 2-3
Comparison of Surface Water Supply and Total Demand

In-County Groundwater

Groundwater is a reliable water supply as long as its usage is limited to the safe yield of the groundwater basin. Quantifiable estimates of the safe yields of the groundwater basins in East County are limited. Available information on safe yields and current pumping levels were used in this study to evaluate the potential groundwater supply available within the county. A summary of the in-county groundwater supply and quality is presented below; additional information on the hydrogeologic characteristics of the various groundwater basins, including groundwater quality, is provided in Technical Memorandum No. 3.

Current East County groundwater production is summarized in Table 2-6. Total groundwater production in the area is about 14,500 ac-ft/yr. At present, some areas, such as Brentwood, Discovery Bay, Bethel Island, and Hotchkiss Tract, are entirely dependent on groundwater. Other areas, such as Pittsburg, Antioch, and DWD, use groundwater to supplement their surface water supply.

TABLE 2-6
Summary of Potential In-County Groundwater Supply

Groundwater Area	Current Groundwater Pumping (ac-ft/yr)
Pittsburg	2,000
Antioch	600
DWD	500
Bethel Island/Hotchkiss Tract	2,200
Brentwood and ECCID	7,000
BBID	500
Discovery Bay	1,700
Total	**14,500**

Existing groundwater quality problems in East County may limit future groundwater development. Groundwater quality in the Pittsburg/ Antioch area is marginal to poor, with high total dissolved solids (TDS), manganese, and iron concentrations; in addition, problems with saline intrusion have been noted in this area. Groundwater quality in DWD is also classified as marginal to poor, with relatively high nitrate concentrations in the southeastern part of the district. In addition, selected wells in the DWD area have demonstrated high concentrations of TDS and chlorides.

Water quality in the Brentwood area was historically good; however, at present, 40 percent of the wells in Brentwood have nitrate concentrations higher than the maximum contaminant limit of 45 milligrams per liter (mg/L). TDS concentrations have periodically exceeded the secondary standard of 500 mg/L. The quality of water from deeper wells is generally satisfactory for domestic use; the quality of water in the shallower wells is suitable for agricultural use.

Groundwater quality from Discovery Bay wells meets the primary (health-based) drinking water standards. However, some secondary (aesthetic) standards are not met. For example, TDS concentrations in wells range from 530 to 600 mg/L, compared to the secondary standard of 500 mg/L for TDS; manganese concentrations range from 0.08 to 0.14 mg/L, compared to the secondary standard of 0.05 mg/L for manganese. Iron was noted as exceeding the secondary standard of

0.3 mg/L in one well (Luhdorff and Scalmanini, 1993). While observed levels of TDS concentrations above the secondary standard are not unusual, iron and manganese concentrations pose a more significant potential problem due to possible regulation for the treatment of iron and manganese in the near future. Discovery Bay is currently operating some of its wells under a waiver of State Health and Safety Code secondary standards.

In summary, quantifiable estimates of long-term yields from groundwater aquifers are limited. Therefore, current groundwater pumping was used in this study as an estimate of available in-county groundwater supplies. A detailed groundwater monitoring program should be developed, including an evaluation of overall groundwater yields and available supplies for East County.

Conjunctive-Use Development

Conjunctive use implies the joint operation of surface water and groundwater supplies to maximize the available water supply. In a conjunctive-use operation, excess surface water supplies from wet periods are stored in the groundwater basin for later use in dry years. Surface water supplies can be recharged through various mechanisms, including recharge basins, injection wells, or in lieu methods.

The most implementable in-county conjunctive-use program would involve converting current agricultural users of surface water to the use of groundwater during dry years. ECCID is a likely candidate, since it currently has an appreciable level of groundwater use. In this case, groundwater wells would be installed to pump additional water supplies from the local aquifer for delivery to the existing distribution canal system. The surface water supplies normally used by ECCID would then be transferred to urban users for subsequent treatment and use. During periods of above-average runoff, agricultural pumping (about 3,000 ac-ft/yr) would be replaced by surface water use. Although this example was developed for agricultural users in ECCID, a similar example could be developed for BBID. Increased development of the existing groundwater in BBID would be necessary for the effective implementation of a conjunctive-use program in BBID; in some instances, this potential will be constrained due to the groundwater supply limitations in certain portions of BBID.

Because of the low levels of groundwater use in East County and the general lack of estimates of safe groundwater yield, in-county conjunctive use was not developed as a water supply alternative. However, pending the conclusions of the recommended groundwater investigations, an in-county conjunctive-use program could be developed to mitigate drought shortages.

Conjunctive-use programs with sources from outside the county are difficult to implement. Complications result from multiple-party involvement, groundwater export ordinances for the project area, and uncertainties relative to impacts from environmental regulations outside the county.

The East Bay Municipal Utility District (EBMUD) is currently developing a conjunctive-use program in San Joaquin and Sacramento Counties. Although out-of-county conjunctive-use development is not considered as an alternative in this study, continued monitoring of EBMUD's program by East County interests is recommended.

Reclaimed Water

ECWMA members are evaluating and developing plans for use of reclaimed water within their service areas.

Development of reclaimed water supplies to meet East County water demands is another potential source of water supply. ECWMA members are currently evaluating and developing plans for the use of reclaimed water within their service areas.

Several wastewater treatment plants exist in the study area. These treatment plants process domestic wastewater and generally discharge to surface water receiving streams and to land disposal sites. Current and future reclaimed water supplies from area wastewater treatment plants are presented in Table 2-7.

TABLE 2-7
Summary of Potential Reclaimed Water Supplies

Facility	Current Supply (ac-ft/yr)	Future Supply (ac-ft/yr)
DDSD	18,500	24,000
ISD	2,500	9,000
CCCSD 19 (Discovery Bay)	1,300	2,700
Brentwood	2,200	12,300
Byron	100	2,700
Total	**24,600**	**50,700**

The largest potential supplier of reclaimed water in the study area is the DDSD reclamation plant. Several planning studies were conducted to evaluate both industrial water recycling and urban irrigation water recycling (JMM, 1989; Montgomery Watson, 1993). The current DDSD treatment facility can produce 1 mgd of reclaimed water treated to levels suitable for unrestricted nonpotable reuse, but it is not currently used.

Current effluent disposal at ISD is limited to grass field irrigation and pasture irrigation. ISD's reclaimed water can be used in Jersey Island in lieu of river water right of RD830; this in-lieu use would make about 6,000 ac-ft of water available for transfer as discussed in Section 2.2.

Traditional water supply development using reclaimed water involves nonpotable reuse for either landscape or agricultural irrigation or

industrial use. Several water reclamation studies have been conducted for the East County study area, and specific reclamation projects have been identified during those studies to provide reclaimed water as a substitute, on a long-term basis, for other water supply sources.

Another method of developing reclaimed water supplies is potable reuse, which can be direct or indirect (i.e., after dilution with other non-reclaimed water supply sources). Although direct potable reuse is not practiced in the United States, indirect potable reuse does occur in many areas, especially in communities dependent on surface water. Methods of implementing indirect potable reuse include surface water discharge and blending with normal stream flows in the receiving water body or blending with canal flows and groundwater recharge with subsequent extraction in other parts of the aquifer.

The primary constraint to developing reclaimed water supplies is economic due to additional treatment requirements for unrestricted reuse. Additionally, there are regulatory and implementation issues associated with reclaimed water, such as Delta Protection Commission regulations prohibiting the use of reclaimed water or biosolids in the Delta Primary Area.

As described in Chapter 4, water supply alternatives involving non-potable and indirect potable reuse are developed for this study. These projects would provide normal- and drought-year water supply. In addition to discussing the development of normal-year water supply using reclaimed water, Chapter 4 discusses a potential method for developing a drought-year water supply alone, using reclaimed water. Development of reclaimed water to provide drought-year supplies only is generally cost-prohibitive.

Outside-County Water Transfers

This study was conducted to develop a regional solution for water management; as a result, emphasis is placed on the use of in-county water supply sources through transfer agreements among ECWMA members. The ability to transfer water supplies from outside East County has been analyzed as part of CCWD's FWSS. This information was used in this study to assess the potential for water transfers as part of the overall water supply mix.

Two types of water transfers are considered in the FWSS: permanent and spot. Permanent water transfers are the long-term purchase of water supply from water rights holders. This provides buyers with the right to use the corresponding entitlement every year. Permanent transfers are used to meet increasing demand or to replace water shortages that may occur due to a permanent reduction in water supplies. Spot surface water transfers are the periodic purchase of water during dry periods only.

Permanent and spot transfers differ in cost and feasibility. The legal feasibility and procedures associated with a permanent transfer depend on the type of water right that generates the supply being transferred. The transfer of supplies from pre-1914 appropriative rights is not subject to State Water Resources Control Board (SWRCB) approval, but it can still be challenged in court. Supplies from riparian water rights cannot be transferred under existing state law. However, it may be possible to transfer Delta riparian water, made available by foregoing use, to other in-Delta users under the area of origin provisions of the state water code. Transfers of CVP contract water are subject to federal rules promulgated under the Central Valley Project Improvement Act (CVPIA). Under current guidelines, these transfers must be approved by the USBR. Spot water transfers have been available through the state's Drought Water Bank, and state law provides temporary urgency change and temporary change procedures for approval of annual transfers under jurisdiction of the SWRCB.

The FWSS evaluated numerous potential water transfers based on their physical and legal feasibility and potential water yield. Five out-of-county water transfers are currently considered for the study area; these water transfers are summarized in Table 2-8. These possible transfers are identified only for this study; this identification does not imply a willingness among interested parties, nor does it imply availability of water.

TABLE 2-8
Outside-County Water Transfers Currently Considered Most Implementable in the FWSS

Water Source	Agency/County	Permit Rights (ac-ft/yr)	CVP Contract (ac-ft/yr)
South Fork Feather River and Slate Creek	Oroville-Wyandotte Irrigation District/Butte/Yuba	30,000	None
Yuba River	Yuba County Water Agency/Yuba	332,700	None
Sacramento River	Sutter Mutual Water Company/Sutter	172,900	95,000
Sacramento River	Reclamation District 108/Colusa	199,000	33,000
Sacramento River	Natomas Mutual Water Company/Sacramento	98,200	22,000

Note:
Potential transfers are listed for identification purposes only; this listing does not imply a willingness among interested parties or the availability of water. Also specific actions need to be taken to make water available for transfer; actions may include crop fallowing, release from reservoir, and substitution by groundwater.

In addition to institutional, legal, and environmental issues associated with these transfers, certain actions need to take place to make water available for transfer, such as crop fallowing, substitution by groundwater, and release from the reservoir storage. All potential transfers of state permit water in Table 2-8 would be subject to SWRCB approval, and water yield would be limited by any requirement on the ratio of Delta inflow to exports. Transfers of the CVP contract water would be subject to rules promulgated under the CVPIA.

Water Conservation

Baseline demands include up to 10 percent savings at ultimate buildout from water conservation. Additional conservation measures can save up to 12 percent more water.

Long-term conservation reduces the future water demand and has the same effect as increased water supplies. Therefore, conservation has been considered for developing the East County water supply.

The existing demand estimates discussed previously in this chapter include conservation savings that would result from programs mandated by existing state and federal laws and from the normal replacement of water-using devices and appliances. The estimated water savings, shown as the baseline case in Table 2-9, are 4 percent in the year 2010, and 10 percent in the year 2040. In addition to the baseline scenario, three alternative conservation programs are considered in the FWSS; the corresponding water savings, beyond that achieved by the baseline scenario, are shown in Table 2-9. In Conservation Program 1 (CP1), increased conservation (above current levels) would save 5 percent more water by 2040, compared to existing programs. Conservation Program 2 (CP2) assumes increased implementation of water-saving measures. Conservation Program 3 (CP3) assumes earlier and more aggressive implementation of conservation measures, new Best Management Practices (BMPs), and more restrictive conservation requirements and landscaping standards.

TABLE 2-9
Conservation Program Savings and Drought Conservation Potential

	Percent Savings			
	Normal Years (permanent conservation)		Drought Years[a] (savings in addition to permanent conservation)	
Scenario	2010	2040	2010	2040
Baseline	4	10	21	15
CP1	7	15	18	10
CP2	11	19	14	6
CP3	14	22	11	3

[a]This is additional drought conservation savings after implementation of a permanent conservation measure.

Permanent conservation measures result in similar water savings every year after they are implemented. After implementation of permanent conservation, fewer conservation measures remain available for drought conservation, and they tend to be more costly. This phenomenon is called demand hardening, and it is depicted by data on reduced ability for drought conservation (Table 2-9).

Demand hardening is a phenomena that reduces the ability for short-term demand management (such as drought conservation or rationing) due to implementation of permanent conservation measures.

2.3 Summary

East County's total water demand is expected to increase from 142,900 acre-feet in the year 2000 to 168,300 acre-feet in the year 2040. The growth in East County water demand comes primarily from municipal use, which is expected to more than double from 37,200 acre-feet in the year 1990 to about 99,700 acre-feet in the year 2040, thereby doubling East County's need for treated water. The municipal water demand is expected to grow to 52,400 acre-feet in the the year 2000. The industrial demand in the Phase II study area remains constant at 20,000 acre-feet during the entire study period. The agricultural demand in East County reduces from 70,500 acre-feet in year 2000 to 48,600 acre-feet in the year 2040. The combined water demand for the Phase II study area, CCWD's TWSA, and other industries is expected to increase from 179,520 acre-feet in the year 2000 to 290,570 acre-feet in the year 2040. These demand estimates include consideration of water savings from currently mandated conservation programs, which provide as much as 10 percent savings at ultimate buildout.

In-county surface water supplies available to the combined service area are 343,100 acre-feet in a normal hydrologic year and 271,200 acre-feet in a drought year. As a result, from a resource analysis standpoint, surface water supplies alone can meet the buildout water demand for the area in a normal hydrologic year, provided that all surface water sources can be used as a single pool of supply for the entire area without any institutional or legal restrictions. However, institutional and legal barriers do exist, and they reduce the availability of surface water supplies to ECWMA members. The issue of cooperative agreements to share in-county surface water supplies is addressed in Chapter 4.

The groundwater development potential for the project area cannot be evaluated due to lack of adequate information. As a result, the current groundwater pumping of 14,500 ac-ft/yr was used as an estimate for available groundwater supplies.

Conjunctive-use opportunities exist, both outside and inside the Phase II study area; however, in-county programs are preferred because they are generally easier to implement, they do not involve approval coordination with outside parties, and they do not require any groundwater export ordinance.

The existing in-county water reclamation projects can generate up to 50,700 ac-ft/yr of reclaimed water; this can be used for agricultural and urban irrigation and for industrial purposes. ECWMA members are currently evaluating and developing plans for the use of reclaimed water.

Significant potential supplies have been identified for consideration as out-of-county water transfers. However, considerable legal, institutional, and environmental issues are associated with implementing these transfers.

Water conservation is a key element of the current water supply program of each ECWMA member. The water demand estimates used in this study include the water savings from the currently mandated programs. In addition, other local, ongoing conservation programs are being conducted by members. Additional water conservation programs that can save an additional amount of up to 12 percent are also evaluated.

Chapter 3—Water Treatment and Delivery Options

Chapter 3—Water Treatment and Delivery Options

The growth in East County's future water demand will come primarily from increased municipal water use. As presented in Chapter 2, municipal water use in East County is projected to more than double by 2040. As a consequence, East County will experience a tremendous increase in treated water need, which cannot be met by the existing water treatment facilities in the area. As noted in Chapter 1, the delivery of treated water and tradeoffs associated with different water treatment and delivery options are key concerns of many ECMWA members. To address these concerns and issues, the Phase II study evaluated the water treatment options for East County. The results of this evaluation are summarized in this chapter. A cost analysis and a discussion of the tradeoffs among the options are also presented. For a detailed discussion, refer to Technical Memorandum 3.1.

Water treatment options were developed to address the issues and concerns of the ECWMA members regarding future treated water deliveries to their service areas. (The ECWMA's issue matrix is presented in Appendix A and is summarized in Chapter 1.) These treatment options were developed in the Phase II study to deliver treated water to Antioch, DWD, Brentwood, Cowell, and Discovery Bay. Pittsburg and Bay Point were excluded because the treatment plants serving these two areas have adequate capacity to meet their buildout demand for treated water.

3.1 Existing Water Facilities

Existing East County water infrastructure includes canals, pump stations, pipelines, and water treatment plants shown in Figure 3-1. These facilities are discussed in detail in Technical Memorandums 3.0 and 3.1 and are summarized below.

Raw Water Conveyance Facilities

Four primary raw water conveyance facilities are associated with the water treatment options developed in this study:

- Contra Costa Canal
- LVP Facilities
- ECCID Intake and Main Canal
- BBID Intake and Main Canal

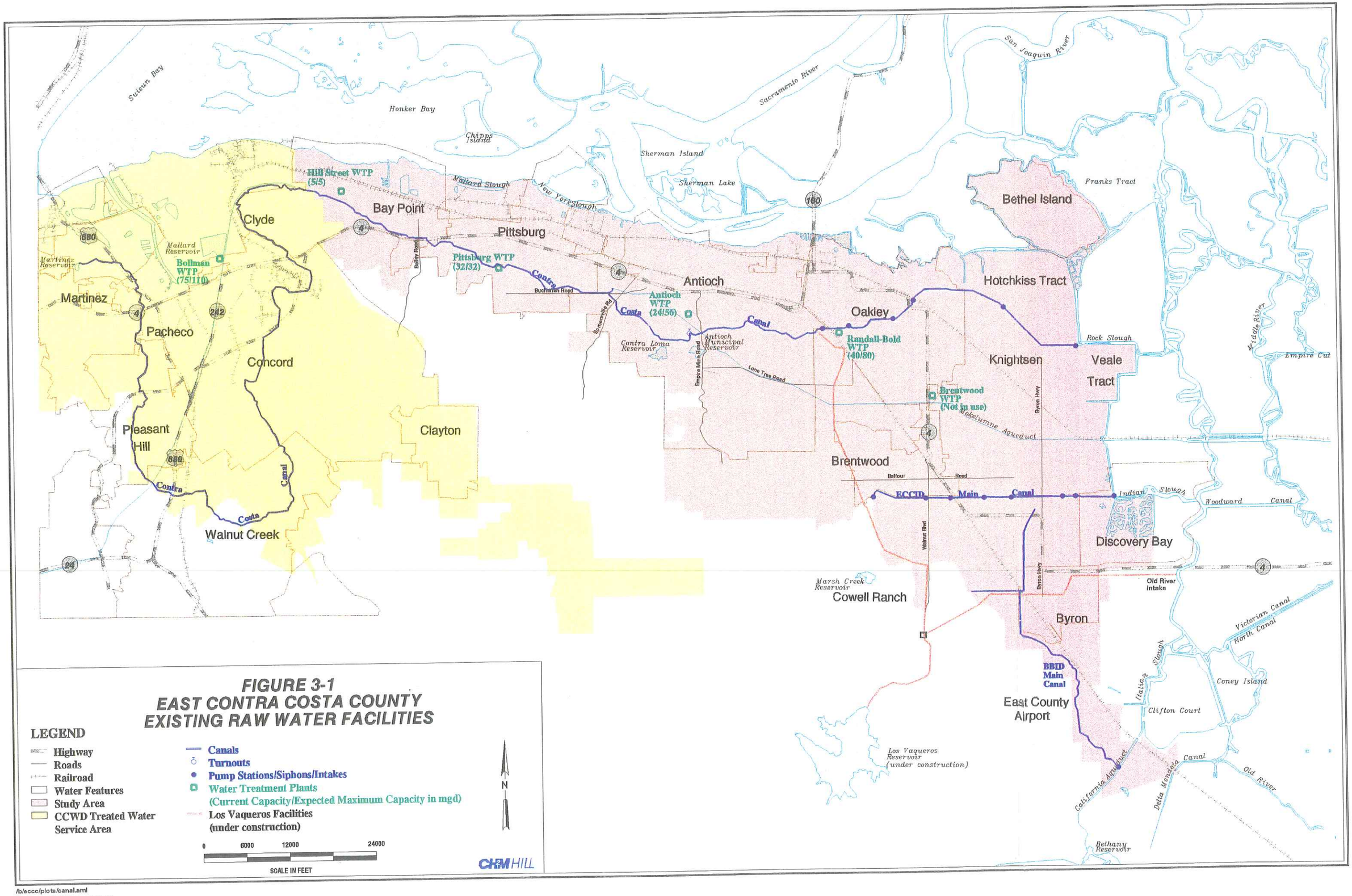


FIGURE 3-1
EAST CONTRA COSTA COUNTY
EXISTING RAW WATER FACILITIES

LEGEND

- Highway
- Roads
- Railroad
- Water Features
- Study Area
- CCWD Treated Water Service Area
- Canals
- Turnouts
- Pump Stations/Siphons/Intakes
- Water Treatment Plants (Current Capacity/Expected Maximum Capacity in mgd)
- Los Vaqueros Facilities (under construction)

N

0 6000 12000 24000

SCALE IN FEET

CH2M HILL

/b/eccc/plots/canal.aml
September 10, 1996 8:01 PM

Contra Costa Canal

The Contra Costa Canal is the major conveyance facility that carries CCWD's raw water (CVP entitlement) from Rock Slough to several distribution turnout points. The canal capacity varies from 350 cfs at Mile 0 in Oakley to approximately 25 cfs at Mile 48 in Martinez. This canal system is owned by the USBR and is operated and maintained by CCWD.

The Contra Costa Canal conveys raw water to WTPs for municipal use; it also delivers raw water to industrial and agricultural customers. Raw water is delivered to the Randall-Bold WTP, the City of Antioch WTP, the City of Pittsburg WTP, the Bollman WTP, and the Hill Street (Bay Point) WTP. The major industrial deliveries are to Gaylord Industries, USS Posco, Tosco Oil, and Shell Oil. There are also other numerous turnouts along the canal for municipal, industrial, and agricultural water deliveries. The Contra Costa Canal terminates into the Martinez Reservoir in Martinez.

The current canal capacity is not adequate to take CCWD's full CVP entitlement of 195,000 acre-feet at Rock Slough. However, CCWD has indicated that no capacity upgrades are planned for the Contra Costa Canal upstream of Pump Station No. 4 because of its ability to use LVP facilities to divert and convey its CVP water.

The ongoing SRIP, conducted by CCWD and some of its raw water customers, addresses the capacity and seismic reliability of CCWD's water delivery systems. This study is developing facilities that parallel the Contra Costa Canal, with the intent of connecting the Bollman and Randall-Bold WTPs to provide additional capacity required for the Contra Costa Canal and to increase existing system reliability.

Los Vaqueros Project Facilities

Los Vaqueros Reservoir, currently under construction, is a 100,000-acre-foot facility on Kellogg Creek in the southeastern portion of Contra Costa County. This reservoir will store water to improve the water quality of CCWD's supply by blending and to improve reliability by providing emergency storage. The LVP facilities will enable CCWD to divert its CVP water at the Old River intake and to use the LVP pipeline to convey diverted water to the Contra Costa Canal and the Randall-Bold WTP.

ECCID Intake and Main Canal

ECCID diverts water from Indian Slough in the Sacramento-San Joaquin Delta. This water is distributed to the north and south from the ECCID main canal, a dredged channel owned and operated by ECCID. ECCID also owns and operates six groundwater wells used primarily in the early spring and late fall of each year, when irrigation demands are light and do not warrant operation of the main pumping plants. The wells are also used to meet peak demands when needed (ECCID, 1994).

BBID Intake and Main Canal

BBID has dual-intake pump stations just upstream of the California Aqueduct intake channel and downstream of the Skinner fish screen facility. The South Pump Station supplies the South Main Canal, and the North Pump Station supplies the North Main Canal. Hydraulic bottlenecks in the existing system configuration limit the canal system from any additional capacity.

Water Treatment Facilities

Currently, the five water treatment plants shown in Figure 3-1 serve Pittsburg, Bay Point, Antioch, CCWD's TWSA, and DWD. In addition, wellhead chlorination of groundwater is used to develop potable water supplies for Brentwood and Discovery Bay.

The current and expected maximum capacities of these plants are summarized in Table 3-1. A detailed discussion of each of the WTPs is provided in Technical Memorandum 3.1. The Bollman WTP serves CCWD's TWSA, the Hill Street WTP serves the Bay Point area, and the Pittsburg WTP serves the City of Pittsburg.

TABLE 3-1
Summary of Existing Water Treatment Plants

Treatment Plant	Treatment Process	Current Rated Capacity (mgd)	Expected Maximum Capacity of Existing Site (mgd)[a]
Bollman	Conventional with GAC	75	110
Hill Street	Pressure filtration	5	5
Pittsburg	Conventional with GAC	32	32[b]
Antioch	Conventional/GAC added to filtration	24[c]	55 to 66[c]
Randall-Bold	Ozone and deep-bed filtration with GAC	40	80[d]

[a]Treatment plants might be able to operate beyond listed capacities by increasing throughput; however, long-term operation beyond the rated capacities is not reliable for planning purposes.
[b]The hydraulic design capacity at Pittsburg WTP is 40 mgd. As a result, the addition of treatment units can generate up to 40 mgd of treated water from this plant.
[c]Refer to the Antioch WTP description in Technical Memorandum No. 3.1 for discussion of plant capacity.
[d]Design treatment capacity is 80 mgd, and design hydraulic capacity is 120 mgd. Refer to Technical Memorandum 3.1 for determination of the maximum capacity.

3.2 Treated Water Needs

The total East County water demand is presented in Chapter 2. This total water demand includes requirements for municipal, agricultural, and industrial purposes. The treated water need, however, consists of municipal demands only.

Municipal water demand is not uniform throughout the year. For example, municipal water demand is higher in summer than it is in winter. In addition, the demand on a given day is not the same as on any other day, even within the same season and month. To accommodate this variation in demand patterns, WTPs are sized based on a maximum-day demand (i.e., the highest demand on any day within a year). The maximum-day demand for treated water in East County was computed using the average-day demand and the maximum-day peaking factors reported in the ECWMA members' master plans. Table 3-2 shows the average-day and maximum-day water demands for the years 2010 and 2040 for Antioch, DWD, Brentwood, Cowell, and Discovery Bay, which have additional need for treatment capacity.

The total treated water demand, existing plant capacity, and additional required treatment capacity for this service area are shown in Figure 3-2. The 64-mgd existing capacity shown represents 40 mgd at Randall-Bold WTP and 24 mgd at Antioch WTP.

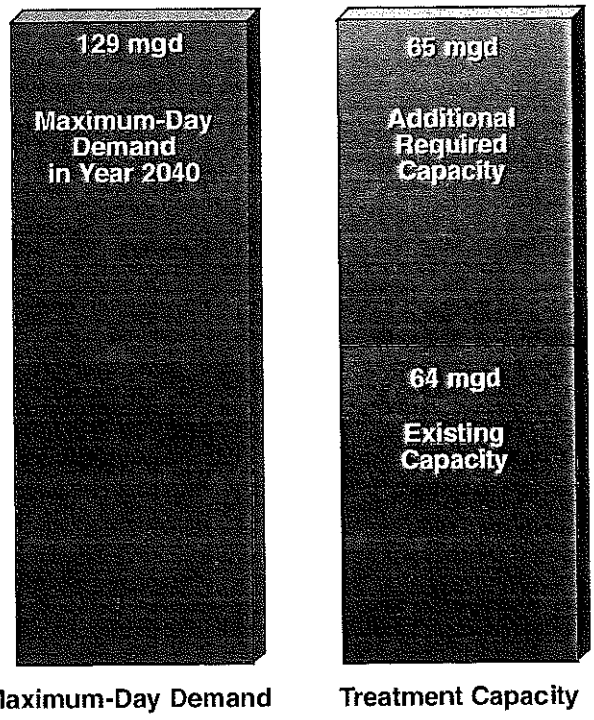


Figure 3-2
Treated Water Demand and Capacity for Antioch, Brentwood, DWD, and Discovery Bay

TABLE 3-2
Summary of Treated Water Demands

Area	Average-Day Demand (mgd) 2010	2040	Peaking Factor[a]	Maximum-Day Demand (mgd) 2010	2040
Antioch[b]	22.7	27.6	2.0	45.4	55.2
DWD[c]	10.5	18.1	1.7	17.9	30.8
Brentwood and Cowell	8.8	18.4	2.0	17.6	36.8
Discovery Bay	3.0	3.5	1.6	4.8	5.6
Total	**45.0**	**67.6**		**85.7**	**128.4**

[a]The peaking factor for each area is taken from the corresponding water master plans.
[b]Includes FUA1 and FUA2.
[c]Includes Bethel Island, Hotchkiss Tract, Knightsen, and Veale Tract.
Note: Demands for Bay Point and Pittsburg are not included because their ultimate treated water needs could be met by treatment plants serving them.

3.3 Development of Treatment Options

Water treatment options were developed to deliver treated water for municipal use to Antioch, DWD, Brentwood, and Discovery Bay. Pittsburg and Bay Point area were excluded because the treatment plants serving those areas have adequate capacity to meet their ultimate demand.

Basis of Treatment Options

Two WTPs, Antioch and Randall-Bold, serve Antioch and DWD. These two plants have a combined current capacity of 64 mgd, which is 65 mgd short of East County's ultimate treated water need of 129 mgd, as shown in Table 3-2.

Five water treatment options were developed to address ECWMA issues regarding future water supply (see Appendix A) and to meet the additional 65-mgd treated water need in East County. The basis for the development of the five treatment options is summarized in Table 3-3.

Five Water Treatment Options

Option 1: Greatly expanded Randall-Bold WTP serves DWD, East Antioch, Brentwood, and Discovery Bay. No expansion at Antioch WTP.

Option 2: Expanded Antioch and Randall-Bold WTPs.

Option 3: New East County WTP for Brentwood and Discovery Bay. Expanded Antioch WTP; no expansion at Randall-Bold WTP.

Option 4: New larger East County WTP serves East Antioch, Brentwood, and Discovery Bay; no expansion at Antioch WTP or at Randall-Bold.

Option 5: New East County WTP serves Brentwood only; new BBID plant serves Discovery Bay; expanded Antioch serves City of Antioch; no expansion at Randall-Bold.

TABLE 3-3
Basis for Development of Treatment Options

Treatment Option	Basis for Option Development	Issues	Remarks
1A and 1B	• Expand Randall-Bold WTP to 105 mgd to meet all additional treated water needs (65 mgd) • No expansion of Antioch WTP • Maximize Randall-Bold WTP expansion capacity	• Separation of water from Los Vaqueros Reservoir • Purchase of CCWD's 25-mgd share in the existing 40-mgd Randall-Bold WTP • Excess capacity at Randall-Bold site due to maximized Randall-Bold WTP expansion. There is no excess capacity in Option 1A. In Option 1B, an 80-mgd plant serves only 62 mgd to DWD and Antioch.	Randall-Bold WTP can receive water from Los Vaqueros Reservoir, but that water cannot be delivered to non-LVP participants, such as Brentwood and Discovery Bay. This issue can be resolved in two ways: (1) Expand the Los Vaqueros service area by cost-sharing agreements, in which case a regional WTP at the Randall-Bold site serves DWD, Brentwood, Discovery Bay, and East Antioch (Option 1A), or (2) Build a separate WTP with separate intake facilities and process train at Randall-Bold site to deliver water to Brentwood and Discovery Bay (Option 1B)
2A and 2B	• Maximize Antioch WTP expansion to serve entire city of Antioch (55 mgd) • Expand Randall-Bold WTP to meet remaining (74-mgd) treated water needs • Maximize Randall-Bold WTP expansion (80 mgd)	• Separation of water from Los Vaqueros Reservoir • Purchase of CCWD's 25-mgd share in the existing 40-mgd Randall-Bold WTP • Excess capacity at Randall-Bold site due to maximized Randall-Bold WTP expansion. In Option 2A, an 80-mgd plant serves 74 mgd to DWD, Brentwood and Discovery Bay. In Option 2B, an 80-mgd plant serves only 31 mgd to DWD.	Randall-Bold WTP can receive water from Los Vaqueros Reservoir, but that water cannot be delivered to non-LVP participants, such as Brentwood and Discovery Bay. This issue can be resolved in two ways: (1) Expand Los Vaqueros service area by cost-sharing agreements, in which case a regional WTP at Randall-Bold site serves DWD, Brentwood, and Discovery Bay (Option 2A), or (2) Build a separate WTP with separate intake facilities and process train at Randall-Bold site to deliver water to Brentwood and Discovery Bay (Option 2B).
3	• Build a new WTP in East County for Brentwood and Discovery Bay (43 mgd) • Maximize Antioch WTP expansion to serve entire City of Antioch (55 mgd) • No expansion at Randall-Bold WTP; it will be used to meet DWD's ultimate need (31 mgd)	• Excess capacity at Randall-Bold site, because a 40-mgd plant will only serve DWD (31 mgd)	This option does not fully utilize the available capacity or the expansion capabilities of the Randall-Bold WTP. The additional capacity could be integrated into the supply for the rest of the treated water service area of CCWD (through the treated/raw water pipeline considered in the SRIP study), or used elsewhere, or left unused. A location for the new WTP in East County is chosen for this study on the basis of a reconnaissance-level site selection effort for the purpose of cost analysis. Other locations could also be chosen.

TABLE 3-3
Basis for Development of Treatment Options

Treatment Option	Basis for Option Development	Issues	Remarks
4	• Build new WTP in East County for East Antioch, Brentwood, and Discovery Bay (74 mgd) • No expansion at Antioch WTP • No expansion at Randall-Bold WTP; it will be used to meet DWD's ultimate need (31 mgd)	• Excess capacity at Randall-Bold site, because a 40-mgd plant will only serve DWD (31 mgd)	This option does not fully utilize the available capacity or the expansion capabilities of the Randall-Bold WTP. The additional capacity could be integrated into the supply for the rest of the treated water service area of CCWD (through the treated/raw water pipeline considered in the SRIP study), or used elsewhere or, left unused. A location for the new WTP in East County is chosen for this study on the basis of a reconnaissance-level site selection effort for the purpose of cost analysis. Other locations could also be chosen.
5	• Build a new WTP in East County to serve Brentwood only (37 mgd) • No expansion at Randall-Bold WTP; it will be used to meet DWD's ultimate need (31 mgd) • Maximize Antioch WTP expansion to serve entire City of Antioch (55 mgd) • Build another new BBID WTP to serve Discovery Bay (6 mgd) • Provide an additional option to BBID plant to serve Byron and East County Airport (4 mgd); this demand is not included in the 129-mgd treated water demand used in this study	• Excess capacity at Randall-Bold site, because a 40-mgd plant will only serve DWD (31 mgd)	This option does not fully utilize the available capacity or the expansion capabilities of the Randall-Bold WTP. The additional capacity could be integrated into the supply for the rest of the treated water service area of CCWD (through the treated/raw water pipeline considered in the SRIP study), or used elsewhere, or left unused. A location for the new WTP in East County is chosen for this study on the basis of a reconnaissance-level site selection effort for the purpose of cost analysis. Other locations could also be chosen.

The water treatment options developed in this study meet the goals of providing a total of 129 mgd of treated water to Antioch, DWD, Brentwood, and Discovery Bay. However, the total capacity of the WTPs associated with each treatment option is higher than 129 mgd because of physical and institutional constraints, as discussed in the next section. As a result, treated water contributions from the plants differ from one option to another, as shown in Table 3-4.

TABLE 3-4
Treated Water Contributions from WTPs for Treatment Options

Treatment Option	Randall-Bold		Antioch WTP (mgd)	New East County WTP (mgd)	New BBID WTP (mgd)	Total Treated Water (mgd)
	Existing WTP (mgd)	New WTP (mgd)				
1A	105[a]	None	24[b]	None	None	129
1B[c]	62[d]	43[e]	24[b]	None	None	129
2A	74[f]	None	55[g]	None	None	129
2B[c]	31[h]	43[e]	55[g]	None	None	129
3	31[h]	None	55[g]	43[c]	None	129
4	31[h]	None	24[b]	74[f]	None	129
5	31[h]	None	55[g]	37[f]	6[f]	129

[a]Serves DWD (31), Brentwood (37), Discovery Bay (6), and East Antioch (31).
[b]Serves existing Antioch.
[c]Two separate plants at Randall-Bold site to separate Los Vaqueros water from Contra Costa Canal water.
[d]Serves DWD (31) and East Antioch (31).
[e]Serves Brentwood (37) and Discovery Bay (6).
[f]Serves DWD (31), Brentwood (37), and Discovery Bay (6).
[g]Serves the entire City of Antioch.
[h]Serves DWD only.
[i]Serves Brentwood only.
[j]Serves Discovery Bay only. This plant has an option to be sized to 10 mgd to deliver an additional 4-mgd treated water (not part of 129-mgd demand) to Byron and East County Airport.

Options 1 and 2 each have two sub-options, A and B, depending on how the issue of separating the Los Vaqueros water is resolved (see Table 3-3 for a discussion of this issue). In Sub-Option A, the Los Vaqueros water is shared and a single treatment plant is built at the Randall-Bold WTP site, whereas in Sub-Option B, the Los Vaqueros water is kept separate and two treatment plants are built at the Randall-Bold WTP site.

The City of Pittsburg WTP currently has a surplus treatment capacity that can be used to serve the East County treated water demand area (e.g., the City of Antioch) if CCWD builds the raw/treated water pipeline proposed in the SRIP. This pipeline will parallel the Contra Costa Canal and will connect the Randall Bold WTP with the Bollman WTP. The City of Pittsburg WTP has a current rated capacity of 32 mgd;

however, its hydraulic design capacity is 40 mgd. As a result, the addition of treatment units can generate up to 40 mgd of treated water from this plant. On the other hand, the maximum day demands for Pittsburg in years 2000 and 2040 are 24 mgd and 31 mgd, respectively, including the demand allocation for the unincorporated Raw Water Service Area (RWSA) (see Table 2-3). Hence, the City of Pittsburg WTP can meet part of the treated water need in East County.

Treatment Plant Sizing

New water treatment plants were sized to meet the treated water need in the corresponding service area. The expansions of existing water treatment plants were sized on the basis of additional treated water demand at the plant, as well as to accommodate the capacities of existing treatment modules due to practical consideration of design, construction, operation, and maintenance. For example, in Option 2A, the contribution from Randall-Bold WTP is only 74 mgd (see Table 3-4); however, Randall-Bold WTP would be expanded to 80 mgd as planned in the original design of the plant. Similarly, in Options 1B and 2B, Randall-Bold would be expanded to 80 mgd though its contribution is 62 mgd to Antioch and DWD, and 31 mgd to DWD, respectively.

As a result, the capacities of the expanded WTPs under the five treatment options do not equal the amounts of treated water the WTPs contribute to East County. The capacities of each of the WTPs under the five options are shown in Table 3-5. Figures 3-3 through 3-7 illustrate facility configurations for each of five water treatment options. The plant capacities shown in Table 3-5 were used in the cost analyses. However, costs were adjusted for these treatment plant capacities to provide an equivalent basis for cost comparison of the five treatment options. These cost adjustments are discussed in Section 3.4 of this report.

Treatment Process Selection

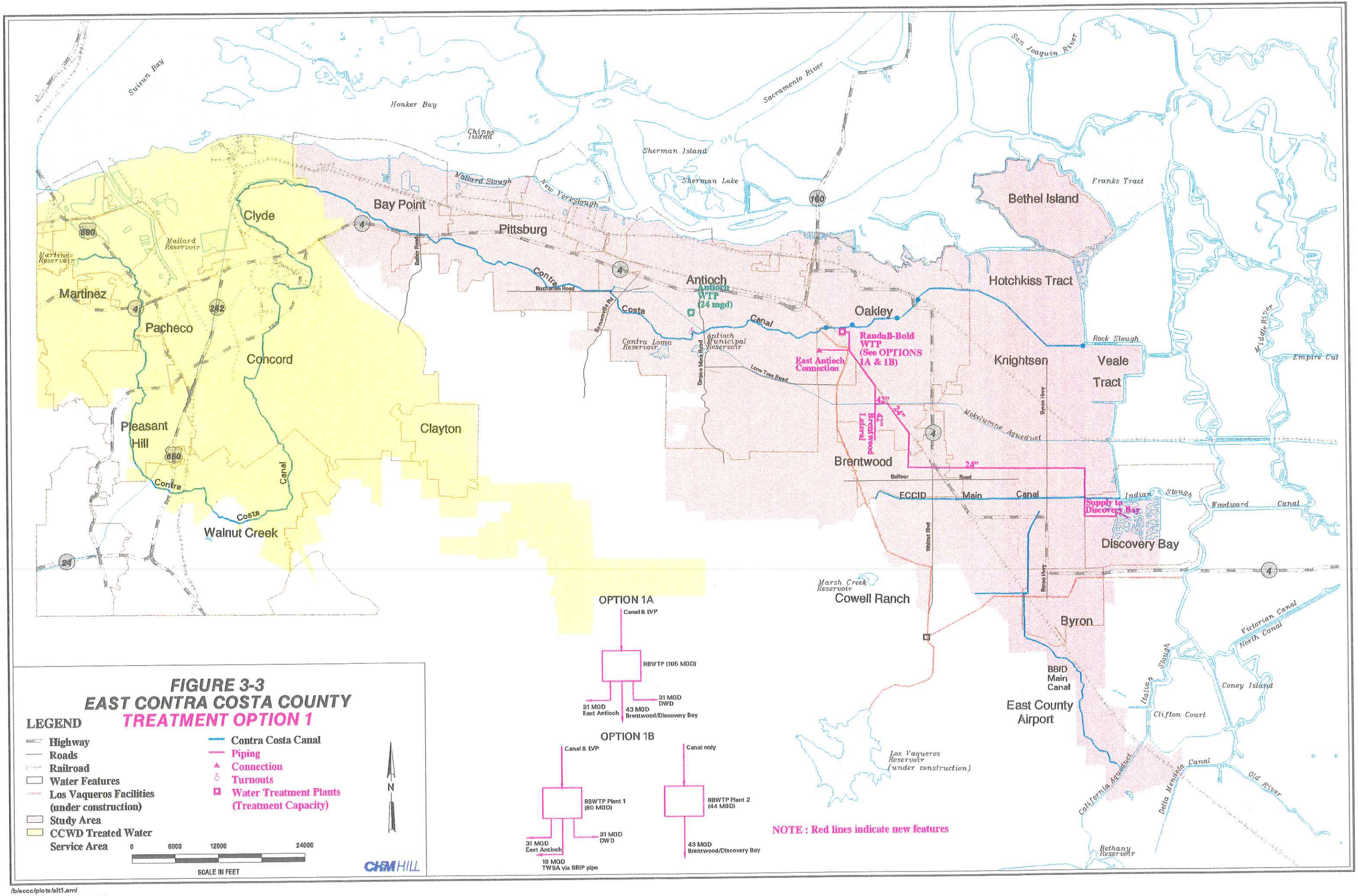
Costs associated with the water treatment plants depend on the treatment process. WTPs can be either conventional plants or ozonation plants. The conventional process and the ozone plus deep-bed filtration process both meet current drinking water standards set forth by the federal government through the Safe Drinking Water Act (SDWA) and its amendments. Because substantial capital costs have been invested in existing WTPs, it is assumed that any expansion of an existing WTP will continue the use of the existing treatment process to maximize the existing facilities. Thus, any expansion of the Antioch WTP will use the conventional treatment process at that WTP while any expansion of the Randall-Bold WTP will continue the use of the ozonation plus deep-bed filtration process.

TABLE 3-5
Treatment Capacities of Existing, Expanded, and New WTPs

Treatment Option	Randall-Bold WTP		Antioch WTP (mgd)	New East County WTP (mgd)	New BBID WTP (mgd)	Total Treated Water Production (mgd)	Location of Facility Configurations Shown in Figures
	Existing WTP (mgd)	New WTP (mgd)					
1A	40 (existing) 65 (expansion)	--	24 (existing)	--	--	129[a]	Figure 3-3
1B	40 (existing) 40[c] (expansion)	44[c] (new)	24 (existing)			148[d]	Figure 3-3
2A	40 (existing) 40[e] (expansion)	--	24 (existing) 32[f] (expansion)	--	--	136[g]	Figure 3-4
2B	40[h] (existing) 40[i] (expansion)	44[c] (new)	24 (existing) 32[f] (expansion)	--	--	180[j]	Figure 3-4
3	40[h] (existing)	--	24 (existing) 32[f] (expansion)	44[c] (new)	--	140[k]	Figure 3-5
4	40[h] (existing)	--	24 (existing)	74[l] (new)	--	138[m]	Figure 3-6
5	40[h] (existing)	--	24 (existing 32[f] (expansion)	38[n] (new)	10[o] (new)	144[p]	Figure 3-7

[a]No excess treatment capacity in this option.
[b]A 22-mgd expansion would be adequate (see Table 3-4); however, due to the maximization of the Randall-Bold expansion goal of Treatment Option 1 (see Table 3-3), Randall-Bold will be expanded to 80 mgd, resulting in 18 mgd of excess capacity that can serve CCWD in TWSA.
[c]A 43-mgd plant will suffice (see Table 3-4); however, 44 mgd is chosen to accommodate treatment module sizes available in the market, resulting in 1 mgd of excess capacity.
[d]19 mgd of excess capacity (18 mgd at Randall-Bold WTP 1, and 1 mgd at Randall-Bold WTP 2).
[e]A 34-mgd expansion at Randall-Bold will suffice (see Table 3-4); however, from practical consideration and maximization of Randall-Bold expansion, a 40-mgd expansion is chosen, resulting in 6 mgd of excess capacity that may be used by CCWD's TWSA.
[f]A 31-mgd expansion at Antioch will suffice; however, due to treatment module sizing issues, a 32-mgd expansion is chosen, resulting in 1 mgd excess capacity.
[g]A 7-mgd excess capacity (6 mgd at Randall-Bold and 1 mgd at Antioch). See also Notes [e] and [f].
[h]A 31-mgd plant is sufficient to meet DWD's demand, but the current capacity is 40 mgd.
[i]This 40-mgd expansion is in accordance with the maximization of Randall-Bold expansion goal of Treatment Option 2 (see Table 3-3). This excess capacity can be used for CCWD's TWSA.
[j]51 mgd of excess capacity, with 49 mgd at Randall-Bold existing plant, 1 mgd at the new Randall-Bold plant, and 1 mgd at Antioch WTP.
[k]11 mgd of excess capacity, with 9 mgd at Randall-Bold, 1 mgd at Antioch, and 1 mgd at the East County WTP.
[l]No excess capacity (see Table 3-4).
[m]9 mgd of excess capacity at Randall-Bold.
[n]A 37-mgd plant will suffice (see Table 3-4); 1 mgd of excess capacity is due to treatment module sizing issues.
[o]A 6-mgd plant will suffice for Discovery Bay (see Table 3-4). A sub-option to supply an additional 4 mgd to Byron and East County Airport resulted in a 10-mgd WTP.
[p]15 mgd of excess capacity, with 9 mgd at Randall-Bold, 1 mgd at Antioch, 1 mgd at new East County, and 4 mgd at new BBID.

FIGURE 3-3
EAST CONTRA COSTA COUNTY
TREATMENT OPTION 1



OPTION 1A

OPTION 1B

NOTE : Red lines indicate new features

LEGEND

- Highway
- Roads
- Railroad
- Water Features
- Los Vaqueros Facilities (under construction)
- Study Area
- CCWD Treated Water Service Area
- Contra Costa Canal
- Piping
- Connection
- Turnouts
- Water Treatment Plants (Treatment Capacity)

N

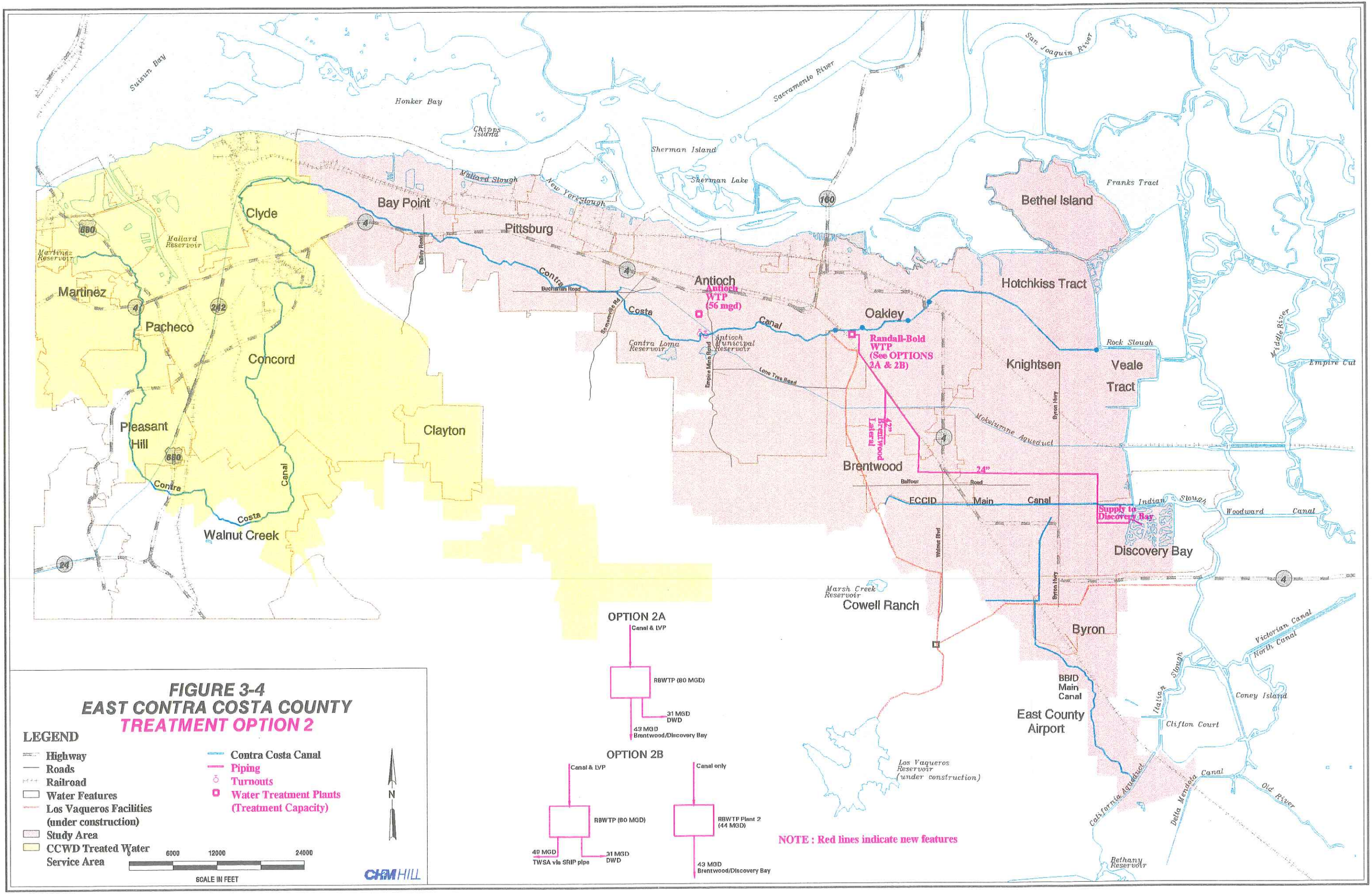
0 6000 12000 24000

SCALE IN FEET

CH2M HILL

/b/eccc/plots/alt1.aml
September 10, 1996 8:14 PM

FIGURE 3-4
EAST CONTRA COSTA COUNTY
TREATMENT OPTION 2



OPTION 2A

OPTION 2B

NOTE : Red lines indicate new features

LEGEND

- Highway
- Roads
- Railroad
- Water Features
- Los Vaqueros Facilities (under construction)
- Study Area
- CCWD Treated Water Service Area
- Contra Costa Canal
- Piping
- Turnouts
- Water Treatment Plants (Treatment Capacity)

N

6000 12000 24000

SCALE IN FEET

CH2M HILL

/b/eccc/plots/alt2.aml
September 10, 1996 8:16 PM

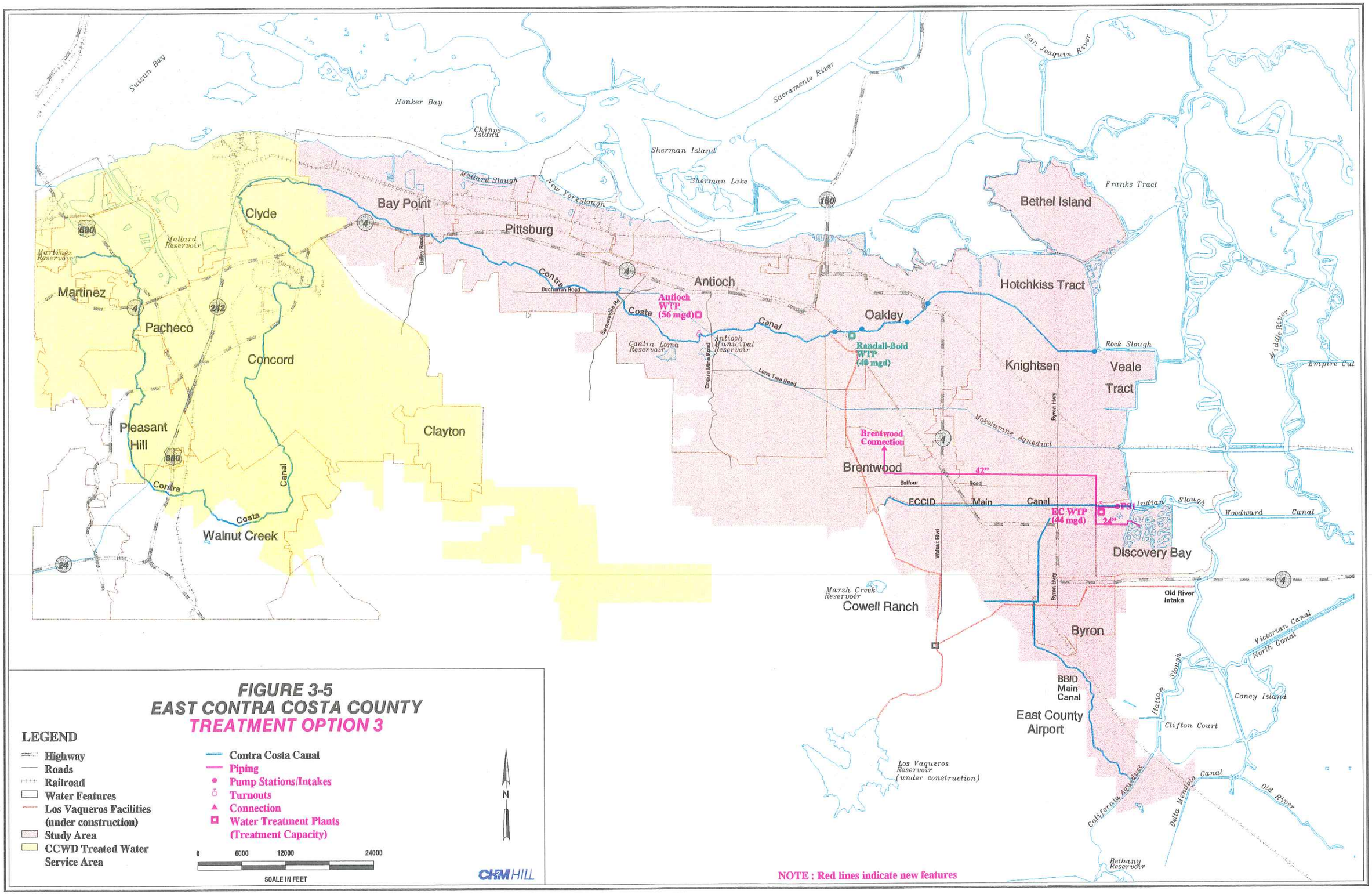


FIGURE 3-5
EAST CONTRA COSTA COUNTY
TREATMENT OPTION 3

LEGEND

- Highway
- Roads
- Railroad
- Water Features
- Los Vaqueros Facilities (under construction)
- Study Area
- CCWD Treated Water Service Area
- Contra Costa Canal
- Piping
- Pump Stations/Intakes
- Turnouts
- Connection
- Water Treatment Plants (Treatment Capacity)

N

0 6000 12000 24000

SCALE IN FEET

CH2MHILL

NOTE : Red lines indicate new features

/b/eccc/plots/alt3.aml
September 10, 1996 8:23 PM

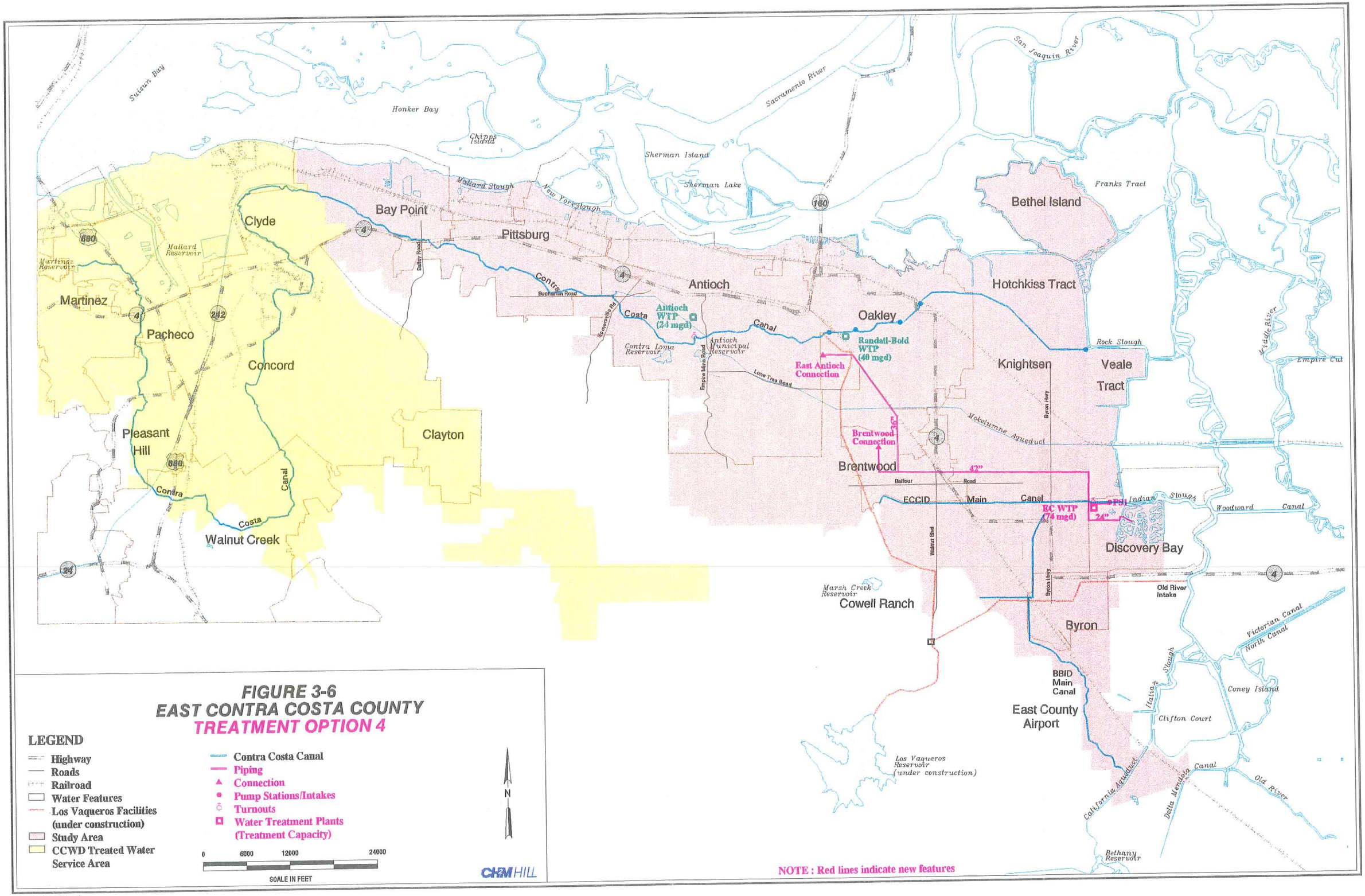


FIGURE 3-6
EAST CONTRA COSTA COUNTY
TREATMENT OPTION 4

LEGEND

- Highway
- Roads
- Railroad
- Water Features
- Los Vaqueros Facilities (under construction)
- Study Area
- CCWD Treated Water Service Area
- Contra Costa Canal
- Piping
- Connection
- Pump Stations/Intakes
- Turnouts
- Water Treatment Plants (Treatment Capacity)

N

0 6000 12000 24000

SCALE IN FEET

CH2M HILL

NOTE : Red lines indicate new features

/b/eccc/plots/alt4.aml
September 10, 1996 9:01 PM

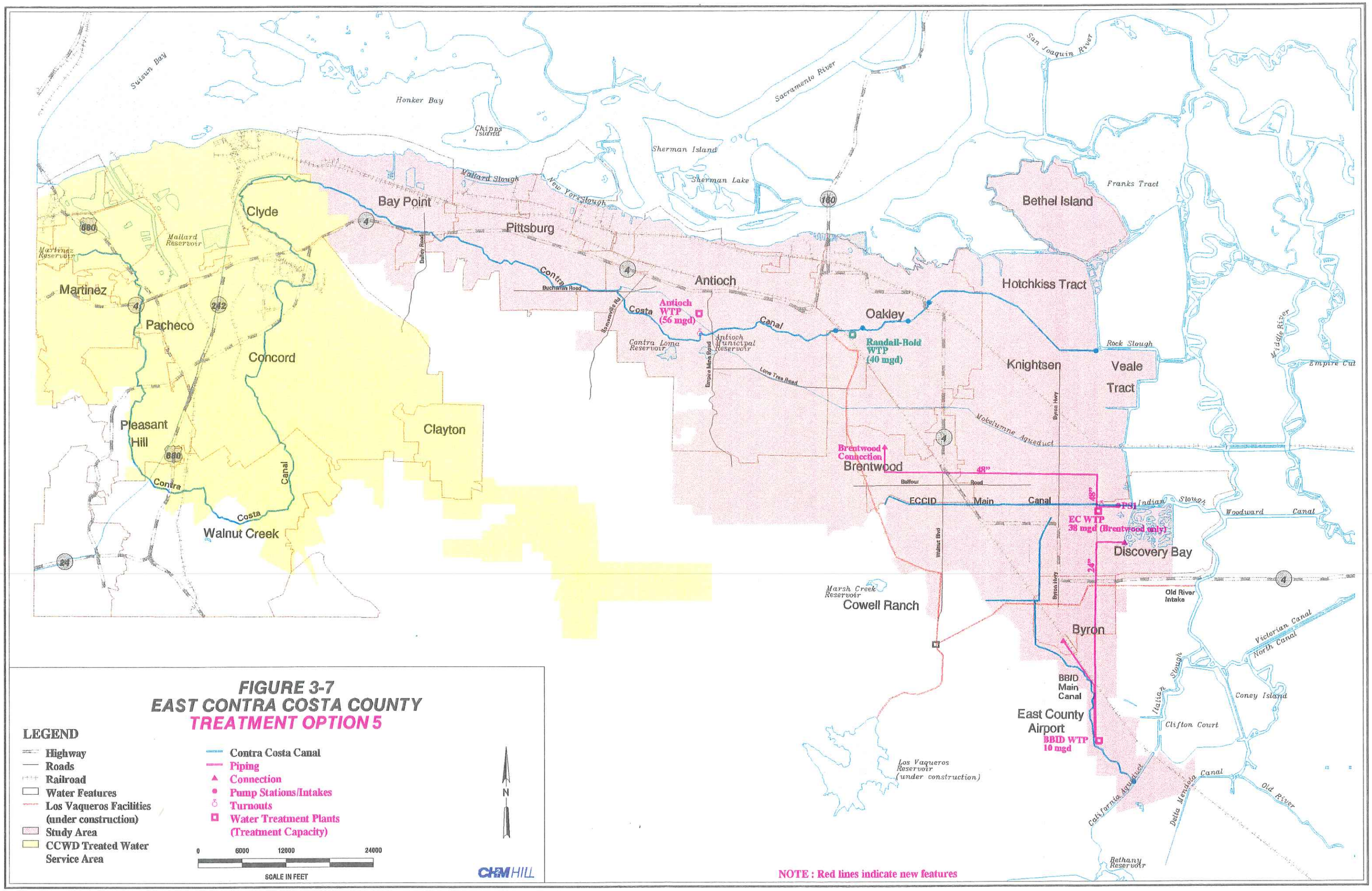


FIGURE 3-7
EAST CONTRA COSTA COUNTY
TREATMENT OPTION 5

LEGEND

- Highway
- Roads
- Railroad
- Water Features
- Los Vaqueros Facilities (under construction)
- Study Area
- CCWD Treated Water Service Area
- Contra Costa Canal
- Piping
- Connection
- Pump Stations/Intakes
- Turnouts
- Water Treatment Plants (Treatment Capacity)

N

0 6000 12000 24000

SCALE IN FEET

CH2M HILL

NOTE : Red lines indicate new features

/b/eccc/plots/alt5.aml
September 10, 1996 9:02 PM

New WTPs can use an ozonation plus deep-bed filtration process or a conventional granulated activated carbon (GAC) treatment process. Cost estimates were developed for both types of WTPs because conventional treatment processes may not meet future water quality objectives set forth by regulatory agencies.

3.4 Cost Analysis of Treatment Options

Cost estimates at facility-plan level were prepared for each facility associated with the treatment options. These estimates are approximate; they were made without detailed engineering designs. The estimates are based on cost curves, actual and estimated costs from similar water projects, preliminary estimated costs for major facility components, treatment plant budgets, observations during field trips, and consultation with participating agency staff and treatment plant operators. An estimate of this type is expected to be accurate from +30 percent to -15 percent.

The cost estimates were prepared for guidance in project evaluation and implementation on the basis of information available at the time of the estimate. The final costs of the projects and their resulting feasibility will depend on the actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, and other variables. As a result, final project costs will vary from the estimates presented here. Because of these factors, project feasibility, benefit cost ratios, risks, and funding needs must be carefully reviewed prior to making specific financial decisions or establishing project budgets.

Costs for each of the treatment options are summarized below. A detailed cost analysis of each treatment option is presented in Technical Memorandum No. 3.1.

Capital Costs

Capital cost refers to building new facilities or expanding existing facilities. The capital costs are developed in 1995 dollars using an *Engineering News-Record* (ENR) Construction Cost Index (CCI) of 6,700 for the San Francisco Bay area. The construction cost indices account for increases in construction costs due to inflation and changes in labor and material costs; these indices vary from one geographical region to another.

In developing capital costs, a contingency of 25 percent was used for construction; an additional 25 percent was used for engineering and administration. The contingency, which accounts for possible future changes to the scope for each facility and for the refinement of design details, was added to the subtotal construction costs to establish total construction costs. The engineering and administration cost of 25 percent was applied to the total construction costs to obtain the total capital costs.

Operations and Maintenance (O&M) Costs

O&M costs were developed for new water conveyance facilities, WTPs, and treated water delivery facilities. The total O&M cost has two components: fixed costs, which include labor, benefits, and building maintenance, and variable costs, which include power and chemicals. The current operating budgets of the Randall-Bold and Antioch WTPs were used to estimate an O&M cost per mgd of treated water production.

Replacement Costs

Replacement costs refer to complete replacement of mechanical and electrical components of a facility. For WTPs, replacement costs include components such as pumps, compressors, ozone generators, supervisory control and data acquisition (SCADA) systems, motorized valves, and electrical equipment. Approximate replacement costs for WTPs were assumed to be 55 percent of capital costs, based on an analysis using Randall-Bold WTP as a pilot plant. For pump stations, it was assumed that the replacement cost would be 65 percent of the capital cost, based on CH2M HILL project experience.

Cost Adjustment for Existing Facilities

Treatment option costs developed in the Phase II study include costs only for new facilities and for expansion and upgrade of existing facilities. However, some of the facilities were not owned by the recipients of treated water. For example, Randall-Bold WTP is jointly owned by CCWD and DWD and its current capacity of 40 mgd is shared between them (25 mgd for CCWD, 15 mgd for DWD). However, in Option 1, the CCWD's 25-mgd share is used to meet the demand for Antioch, Brentwood, and Discovery Bay. Other treatment options also use the CCWD's share in varying amounts. Similarly, in Options 1B and 2B, the Contra Costa Canal will be used for raw water delivery to a new treatment plant adjacent to Randall-Bold, which serves Brentwood and Discovery Bay. For the purpose of cost comparisons among treatment options on an equivalent basis, cost estimates were adjusted on a value of use basis, as described below.

For use of Contra Costa Canal by Brentwood and Discovery Bay in Options 1B and 2B, the value of use was assumed to be equivalent to the cost of a new pipeline from Rock Slough to Randall-Bold. For use of CCWD's share of Randall-Bold WTP's existing capacity, the value of use was assumed to be equivalent to the actual incurred per mgd cost of the 40-mgd Randall-Bold WTP. It should be noted these cost adjustments were used only for the purposes of cost comparisons; they are used uniformly in all treatment options. Actual cost will be negotiated and may be substantially different from the value of use estimates used in this study.

Water Treatment Option Cost Estimates

Capital costs for treatment options range from $143 million to $170 million in 1995

Detailed cost estimates and facility phasing of each treatment option are discussed in Technical Memorandum No. 3.1. The phasing of the treatment facilities was determined based on the growth patterns in service area demands for each treatment plant. It should be noted that the costs are presented in 1995 dollars for the purposes of comparison; the facilities are built or expanded at different times depending on the growth in the treated water need. Major facility costs in 1995 dollars for the five treatment options are listed in Table 3-6 on the following page; total costs with and without adjustments for the volume of use of the existing facilities are shown separately in that table.

Net Present Value Analysis

A net present value (NPV) analysis was performed on the capital costs, O&M costs, and facility replacement costs. The NPV analysis of the five water treatment options provides a basis for comparing their costs. The NPV computed here is a single dollar amount that accounts for all costs (capital, O&M, and replacement) incurred over the 1995-2040 project period; it includes consideration of inflation and discount rates.

The economic parameters used in the analysis are presented in Table 3-7. The same inflation and discount rates are used for all treatment options to provide an equal basis for comparison.

The present worth values of capital improvement costs during the 1996-2040 project period for the five treatment options are presented in Table 3-8. Because of different bases of treatment option development and design considerations, the amounts of additional treatment capacity generated by the five options are not the same. Hence, the unit present values per mgd of additional treatment capacity are provided in Table 3-8; these unit values can be used as a measure of relative cost-merit of one treatment option over another. The corresponding 1995 dollar costs for capital improvements are also provided in Table 3-8. NPVs represent the impact of timing of the capital improvements during the 1996-2040 study period.

The present worth values of capital improvements, capital replacements, and total O&M costs during the 45-year project period are presented for the five water treatment options in Table 3-9.

TABLE 3-6
Comparison of Capital Costs for Treatment Options[a]
(Capital costs in 1995 dollars rounded to the nearest million)[b]

	Treatment Options						
Treatment Option Component	**1A**	**1B**	**2A**	**2B**	**3**	**4**	**5**
Raw Water Conveyance							
Upgrade Antioch turnout and supply line	-	-	6	6	6	-	6
New pipeline from Rock Slough to Randall-Bold WTP No. 2[c]	-	10	-	10	-	-	-
New supply line to new East County WTP	-	-	-	-	2	3	2
New supply line to new BBID WTP	-	-	-	-	-	-	3
Subtotal	**$ 0**	**$ 10**	**$ 6**	**$ 16**	**$ 8**	**$ 3**	**$ 11**
Water Treatment							
Randall-Bold WTP expansion to 80 mgd	49	49	49	49	-	-	-
Randall-Bold WTP expansion (80 to 105 mgd)	32	-	-	-	-	-	-
Antioch WTP expansion from 24 to 56 mgd	-	-	37	37	37	-	37
New Randall-Bold WTP No. 2 (44 mgd)	-	68	-	68	-	-	-
New 74-mgd East County WTP	-	-	-	-	-	99	-
New 38-mgd East County WTP	-	-	-	-	-	-	59
New 44-mgd East County WTP	-	-	-	-	66	-	-
New 10-mgd BBID WTP	-	-	-	-	-	-	14[d]
Subtotal	**$ 81**	**$117**	**$ 86**	**$154**	**$103**	**$ 99**	**$110**
Treated Water Delivery							
Randall-Bold WTP delivery to DWD	4	4	4	4	4	4	4
New pipeline to Brentwood and Discovery Bay	21	21	21	21	13	13	-
New pipeline to Antioch East	8	8	-	-	-	18	-
Delivery to TWSA via SRIP pipeline	-	0	-	0	-	-	-
New pipeline to Brentwood	-	-	-	-	-	-	10
New pipeline to Discovery Bay	-	-	-	-	-	-	8
Subtotal	**$ 33**	**$ 33**	**$ 25**	**$ 25**	**$ 17**	**$ 35**	**$ 22**
Total Capital Cost[e]	**$114[e]**	**$160[e]**	**$117[e]**	**$195[e]**	**$128**	**$137**	**$143**
Cost Adjustments for Existing Facilities[f]	35	10	26	(29)[g]	22	22	22
Total Adjusted Capital Costs[h]	**$149**	**$170**	**$143**	**$168**	**$150**	**$159**	**$165**

[a]Capital costs for expansion and new construction; includes 25% engineering/administration and 25% contingency.
[b]Costs are presented in 1995 dollars to facilitate comparison; the facilities are built in multiple phases at different times in the future according to the growth in treated water demand.
[c]Value of use of Contra Costa Canal by the new WTP at Randall-Bold site. Actual cost will depend on future negotiations.
[d]Prorated cost for 6 mgd only because 4-mgd delivery to Byron and East County Airport are not included in other options. Cost for 10-mgd plant is $23 million.
[e]Costs shown do not include costs for storage requirement from 30-day restriction on Delta diversion (see Section 3.5)
[f]Value of use of CCWD's current share of 25 mgd at Randall-Bold WTP (see discussion in Section 3.4). The value of use is $1.38 million per mgd at ENR CCI of 6,700 based on actual incurred cost of $49.2 million at ENR CCI of 5,991. Actual cost will depend on future negotiations.
[g]This option does not use any of CCWD's current 25-mgd share; instead, it generates 24 mgd of surplus capacity. As a result, a cost credit is given on the basis of per mgd expansion cost at Randall-Bold WTP. Actual cost will depend on future negotiations.
[h]After adjustments for the value of use of Randall-Bold WTP are made.

TABLE 3-7

Summary of Economic Parameters

Parameter	Value
Project life	45 years (1996-2040), with replacement of electrical/ mechanical equipment every 30 years.
Capital cost escalation factor (inflation rate)[a]	4%[b]
O&M and replacement cost escalation factor[a]	4%[b]
Discount Rate[a]	6.5%[b]

[a]Source: Future Water Supply Study (CCWD, 1996).
[b] Inflation rates used in recent economic analyses of water projects range from 4 to 5 percent; it is also not uncommon to use a separate inflation rate for capital and O&M costs, such as 4 percent for capital costs and 5 percent for O&M costs. The discount rate used in recent economic analyses range from 6.5 percent to 9 percent, with 8 percent being the most common.

TABLE 3-8

Net Present Values of Capital Improvements

Treatment Option	Additional Treatment Capacity Generated (mgd)	Capital Improvement Costs (1995 $M)	Net Present Value of Capital Improvements ($M)	Unit[a] Present Value ($M/mgd)
1A	65	114	88	1.35
1B	84	160	138	1.64
2A	72	117	93	1.29
2B	116	195	160	1.38
3	76	128	104	1.37
4	76	137	119	1.57
5	76	143	127	1.67

[a]The unit present values were determined by dividing the total NPV by the total amount of the additional treatment capacity generated.

TABLE 3-9

Net Present Values of Treatment Options ($M)

Treatment Option	Capital Improvement	Capital Replacement	O&M Cost	Adjustments[a]	Total
Treatment Option 1A	88[b]	22	305	35	450
Treatment Option 1B	138[b]	36	369	10	553
Treatment Option 2A	93[b]	25	306	26	450
Treatment Option 2B	160[b]	44	370	(29)[c]	545
Treatment Option 3	104	32	314	22	472
Treatment Option 4	119	25	321	22	487
Treatment Option 5	127	38	344	22	531

[a]Adjustments are due to the value of use of CCWD's share of 25 mgd at Randall-Bold WTP.
[b]Costs shown here do not include costs for storage requirement resulting from potential 30-day restriction on Delta diversion (see Section 3-5).
[c]This option generates surplus capacity at Randall-Bold WTP; as a result, adjustment is a credit. See footnote g of Table 3-6.

Cost Comparison among Treatment Options

The net present values for the five treatment options are similar; they are within 15 percent of each other. As a result, it is difficult to use net present value to rank the treatment options on the basis of costs. However, certain tradeoffs in facilities can be determined from the results of this economic analysis and from Technical Memorandum No. 3.1. These tradeoffs are summarized below.

Costs for serving East Antioch development from either an expanded Antioch WTP or an expanded Randall-Bold are almost equivalent.

Cost Tradeoffs Between Antioch and Randall-Bold WTPs

There would be no significant advantage or disadvantage to delivering treated water to East Antioch by expanding the Randall-Bold WTP (Option 1) or the Antioch WTP (Option 2). Total capital costs for the treatment plant expansions and distribution system improvements for Options 1A and 2A are $149 million and $143 million, respectively, in 1995 dollars (refer to Table 3-6). The O&M costs for both treatment options are also similar, with a net present value of $305 million and $306 million, respectively, for an operation period of 1996-2040. These cost comparisons do not include the costs associated with the treated water distribution system.

The current analysis does not include potential cost impacts from the planned improvements associated with CCWD's SRIP. If CCWD constructs a treated/raw water pipeline connecting the Randall-Bold WTP with the Bollman WTP, it might provide Antioch with a cost-effective means of using the available capacity at Randall-Bold.

Development of Treated Water Supplies for Discovery Bay

The capital costs associated with the treatment and delivery to Discovery Bay from Randall-Bold WTP would range from $19 million to $22 million (1995 dollars). This estimate is based on $1.2 million to $1.7 million per mgd for water treatment (depending on the choice of Option 1A or 1B) and $11.7 million for a 12-mile-long delivery pipeline. Capital costs associated with treatment and delivery to Discovery Bay from the East County WTP would range from $13 million to $14 million (1995 dollars). This estimate is based on $1.5 million (ozonation plant) to $1.7 million (conventional plant) per mgd for water treatment and $3.8 million for a 2.7-mile-long delivery pipeline.

On the other hand, capital costs associated with groundwater delivery with additional treatment for trace metals (such as iron and manganese) would range from $3.2 million to $4.7 million (1995 dollars) for a 5.6-mgd plant. This estimate is based on a recent study that evaluated three alternatives for supplying Discovery Bay with treated groundwater (DDSD, 1994).

These cost estimates are for meeting the maximum-day demand of 5.6 mgd in Discovery Bay at the 2040 level of development; they do not include costs for treatment and/or storage for fire flow. The storage requirement for fire flow in Discovery Bay would range from 540,000 gallons to 1 million gallons (MG), based on maintaining 3,000 to 4,000 gpm for 3 to 4 hours. This fire flow storage could be achieved in a groundwater treatment option for less than $1 million.

Discovery Bay: Treated Water Delivery Costs	
Randall-Bold WTP Supply	$19 - $22 million
East County WTP	$13 - $14 million
Treated Groundwater Supply *(subject to water quality and long-term yield constraints)*	$3.2 - $4.7 million

Annual O&M costs at a groundwater treatment plant could range from $3,000 to $15,000 per mgd, whereas the variable component of the O&M costs at Randall-Bold WTP or East County WTP would range from $48,000 per mgd (ozonation) to $51,000 per mgd (conventional).

Based on these initial cost estimates, groundwater delivery with additional treatment would be the most cost-effective means for meeting the treated water needs of Discovery Bay. However, continued groundwater pumping is subject to the constraints of water quality and long-term yield of the aquifer. Based on previous studies, adequate water supplies should be available to provide for the future demands in this area. Future project activities should verify the safe yield of the Tulare Formation in the area of Discovery Bay.

Development of Treated Water Supplies in the Byron Area

Costs of developing treated water supplies for the Byron area can be inferred from the cost analysis presented in Technical Memorandum No. 3.1. Byron has a projected demand of 4 mgd, which could be met at a treatment plant cost component of about $6 million to $7 million (assuming $1.5 million to $1.7 million per mgd cost at the East County WTP). In addition, there are costs for developing a completely new distribution system (current domestic water supplies are provided by onsite wells).

Given these relatively high costs of treated surface water for Byron, the most cost-effective initial approach would be to continue to use treated groundwater. However, as urbanization continues in the Byron and East County Airport areas, developing a local water treatment facility should be considered. A WTP would provide a better quality of water supply that is less susceptible to changes in the groundwater quality resulting from surrounding development. Funding of the necessary facilities would require additional analyses that are beyond the scope of this study.

3.5 Additional Project Implementation Issues

Water Quality Effects on Non-LVP Participants

The purpose of the LVP, which is under construction, is to provide improved water quality and emergency water supply storage, not water supply development. LVP cost participants are the CCWD, the City of Pittsburg, the City of Antioch, and DWD. Because Brentwood, Discovery Bay, and Byron are not LVP cost participants, they cannot use water from the Los Vaqueros Reservoir unless new cost sharing agreements are signed and an additional environmental analysis is completed.

As a result, separate treatment plants are required to effectively segregate deliveries to nonproject participants from the supplies stored in Los Vaqueros Reservoir. At the Randall-Bold WTP, parallel treatment facilities would be constructed for these deliveries (as described for Options 1B and 2B). Separate raw water and treated water plumbing would be required for the parallel plants, though the control building, laboratory, etc., can be shared.

Raw water supplies delivered to the non-LVP participants would continue to be diverted at Rock Slough; no Los Vaqueros Reservoir water will be available for blending during periods of reduced water quality in Rock Slough. The historic quantification of this water quality effect is under revision, due to the ongoing Bay-Delta program, the dedication of water in CVPIA, and the SWRCB water rights hearings process. Absolute quantification of this water quality effect is outside the scope of this study and not possible until the potential impacts from these other programs are known. Therefore, for this study, the total water quality effect on non-LVP entities will remain relatively unknown.

Restrictions on Diversions

According to LVP permits, a 30-day restriction on diverting water from Rock Slough and Old River is imposed on CCWD. *"During April 1-30, CCWD will avoid diversions from the Delta and will instead release up to 12,500 af of water (equivalent to CCWD's projected critical-year buildout demands in April) from the LVR to meet demands in the CCWD service area. These releases will occur only if storage in the reservoir is above emergency storage levels and will continue until reservoir emergency storage levels (70,000 af in wet, above normal, and below normal years and 44,000 af in dry and critical years) are reached. When emergency storage levels are reached, CCWD will, without limitation, be able to continue or initiate diversions from the Delta for direct use within the CCWD service area."* (USFWS, Los Vaqueros Project Biological Opinion for Delta Smelt, September 24, 1993; CCWD, Los Vaqueros Project Final Environmental Impact Report/Environmental Impact Statement, 1993; NMFS, Los Vaqueros Project Biological Opinion for Winter-Run Chinook Salmon, March 18,

1993; CESA Memorandum of Understanding, Reference 9339, 1994; and SWRCB, Decision No. 1629, Los Vaqueros Project of Contra Costa Water District and U.S. Bureau of Reclamation). According to the contract terms, the Department of Fish and Game, United States Fish and Wildlife Service, or National Marine Fisheries Service can require modification in the time period mentioned above to protect endangered or threatened species.

A significant issue relative to this 30-day restriction is whether it may also apply to other diversions from Rock Slough or Old River. For example, Option 1 includes continued diversion of water from Rock Slough and treatment at a segregated treatment facility for Brentwood, Discovery Bay, and Cowell. Because these entities are non-LVP participants, they do not accrue water storage benefits in Las Vaqueros Reservoir. Therefore, they must either continue to pump from Rock Slough or provide for storage of approximately 30 days of flow adjacent to the Randall-Bold WTP.

Because it is not yet resolved whether the 30-day restriction would apply to other diversions from Rock Slough or Old River, costs presented in this study do not provide for storage. Storage could be provided in an above-ground storage reservoir (like Contra Loma) or through an aquifer storage and recovery (ASR) system. Preliminary hydrogeologic evaluations of East County indicated that the Sand Hill area near Oakley has some potential for short-term ASR.

Costs of an ASR system will depend on the number of ASR wells required to meet the maximum-day demand of Brentwood and Discovery Bay. The maximum-day demand of 43 mgd would require a total wellfield pumping capacity of about 30,000 gallons per minute (gpm).

Depending on the choice of ASR site and well yield, about 20 to 30 ASR wells should be able to meet the raw water need at the treatment plant. Capital costs for such an ASR facility will range from $10 million to $24 million based on a cost of $500,000 to $800,000 per ASR well. How ever, more field investigations are necessary to verify this preliminary determination of number of wells and cost. It appears the ASR approach probably would be more cost-effective than an aboveground reservoir and easier to implement, given the current level of development around the Randall-Bold WTP.

The 30-day storage requirement for Brentwood, Cowell, and Discovery Bay would be 660 million gallons, or about 2,000 acre-feet (based on a 22-mgd average-day demand at the 2040 level of development). At times outside of the restriction period, raw water from Rock Slough would be conveyed through Contra Costa Canal to the proposed storage reservoir. During the restriction period (April), stored water would be pumped to the Contra Costa Canal for delivery to the Randall-Bold WTP. Capital costs for a storage reservoir near Contra Costa Canal

would be approximately $38 million (1995 dollars). This cost estimate includes excavation, lining, appurtenance structures, fence, access road, land purchase, site work, and a pump station and pipeline to connect the storage reservoir with the Contra Costa Canal.

Incorporation of SRIP Improvements

CCWD's SRIP study, which is being conducted to address the seismic reliability of the water delivery system, is nearing completion. This study is evaluating the feasibility of treated/raw water pipeline facilities that would parallel the Contra Costa Canal and connect the Bollman and Randall-Bold WTPs, thus providing additional overall system reliability. In addition, this connection pipeline could take advantage of the available treatment capacity at Randall-Bold WTP, thereby offsetting expansion requirements at Bollman WTP. This connection pipeline also can convey the unused capacity of the City of Pittsburg WTP.

Depending on the outcome of the SRIP study, this study's cost analysis may need to be revised. For example, if CCWD constructs the pipeline to connect the Randall-Bold WTP with the Bollman WTP, the cost of delivering treated water to East Antioch from Randall-Bold WTP would be reduced. This reduction might be significant enough to affect the decision on future expansion of the Antioch WTP.

Because the purpose of the Phase II Study treatment option analysis is not to recommend treatment options, but to provide information regarding the relative tradeoffs of decisions for treated water delivery to be made by the ECWMA members, the unknown effect of the SRIP does not prevent the Phase II program from proceeding. Rather, it is important to note that the SRIP study will have a significant bearing on ECWMA members' future decisions regarding water supply facilities. This impact should be evaluated as ECWMA members move forward in implementing the overall recommendations of this study.

Chapter 4—Water Supply Alternatives

Chapter 4—Water Supply Alternatives

The development and evaluation of water supply alternatives for East County is a primary objective of the Phase II study. Chapter 2 summarizes the development of the projected water demands and the potential available water supply sources. This chapter presents the results of the water supply alternatives analysis for East County. The potential alternatives are presented, along with the estimated water supply development costs. The results of the screening workshops with the JMC and GBR are also summarized .

4.1 Development of Water Supply Alternatives

As noted in Chapter 2, East County has a wide range of water supply sources to meet its water demand. In fact, analysis has shown that there is ample total supply in East County to meet the normal-year demands through the end of the year 2040. Drought-year demands, however, will not be met without additional supplies because available surface water supplies from key sources, specifically CCWD's CVP contract and San Joaquin River diversions, will be reduced during a drought.

"Maximized pooling" means combining all surpluses in surface water supplies of ECWMA members into one common supply pool.

In developing the water supply alternatives, this abundant total water supply was evaluated in detail. A concept of "maximized pooling" of the water supplies was developed to address the potential benefits associated with fully using the water supply in East County. The concept of "maximized pooling" of surface water supplies refers to the use of all locally available surface water supplies to the greatest extent possible to meet East County's combined water needs .

Practical implementation of the maximum pooling concept would require new agreements for the long-term transfer of surplus water supplies from the two agricultural districts (ECCID and BBID) to the agencies serving East County urban areas. Currently, a water transfer approach is being implemented on a smaller scale. CCWD and ECCID have entered into a water service agreement that allows the transfer of 21,000 ac-ft/yr of ECCID's agricultural water supplies over the long-term to CCWD for urban use within the ECCID service area.

Some variation in normal-year supply under future conditions was identified during the analysis of potential supplies. As noted in Chapter 2, CCWD currently has a contract for water supply from the USBR through the CVP. This water supply contract provides for a total supply of 195,000 ac-ft/yr, subject to drought restrictions and regulatory reductions. These water shortage provisions of CCWD's CVP contract

are discussed in Chapter 2. As shown in Table 2-4, shortage provisions during drought years reduce the amount of available CVP supply to 161,200 ac-ft/yr (in year 2040). In addition, CCWD's CVP supply can be reduced further in the future because of potential contractual changes; any change in the contract will affect both normal-year and drought-year supplies. Discussions with CCWD indicate that CCWD's planning assumptions for the CVP contract include a potential reduction of 15 percent of the total contract in the year 2010, when the current contract will be up for renewal. The reasons for this potential reduction range from the effects of the implementation of CVPIA to the outcomes of the SWRCB water rights hearings and the CALFED process for the Bay-Delta system.

Savings from baseline conservation were factored into the demand projections and do not appear in the supply scenarios. Some ECWMA members' conservation programs will increase savings beyond baseline levels. This savings would further reduce study area demand.

To account for the potential reduction of CVP supplies, this study developed two optional normal-year water supply levels:

- Option A--CCWD CVP water supply contract maintained at a current level of 195,000 ac-ft/yr from 1990 to 2040.
- Option B--CCWD CVP water supply contract reduced to 166,000 ac-ft/yr (15 percent reduction) at contract renewal in 2010.

To develop the range of water supply alternatives available for East County, three broad water supply scenarios were configured. These scenarios, summarized below, compared the total water demands in East County and CCWD's TWSA to total water supplies under normal-year and drought-year conditions. It was necessary to compare total water supplies to total demands, including areas outside of East County (CCWD's TWSA), to evaluate the effects of water shortages on the overall expanded study area.

Scenario 1 uses local surface water resources exclusively, and to the maximum extent possible, to meet the future water needs. The use of groundwater as a supply source is limited to periods when local surface water supplies are inadequate to meet water needs.

Allocation of Shortages Between Agencies

Projections of water supply and demand have been developed for a study area that includes both the north-central and eastern portions of Contra Costa County. This area was selected because it includes CCWD's TWSA.

Comparisons of water supply to water demands, and the subsequent development of water supply alternatives, were done for this expanded area. The allocation of water supply surplus or deficit between ECWMA members was not done in this study.

The allocation of water supply surplus or deficit between the ECWMA members requires the definition of how CCWD's CVP supply is distributed in drought years. Current CCWD practice is to distribute its available supply to its treated and raw water service areas proportionally. Allocations of this supply could continue in a similar manner in the future, or be the subject of discussions and negotiation with the affected ECWMA members. Definition of this allocation under future conditions should be considered in subsequent activities of the ECWMA.

Scenario 2 uses local surface water resources to the maximum extent possible and also uses local groundwater at the current level of pumping to meet future water needs. As a result, groundwater is not available to meet water shortages in periods of drought or regulatory supply reduction, unless the pumping level is increased beyond the baseline level of groundwater pumping.

Current pooling means the status quo on internal surface water transfers among ECWMA members and the use of existing pooling arrangements only among ECCID, CCWD, and Brentwood.

Scenario 3 uses local surface water resources within the limits of existing surface water sharing agreements (current pooling); no new water transfers are assumed among the local water rights holders. The use of groundwater is continued at the current level of pumping to meet the future water needs.

The resulting surplus or deficit in total water supply for each scenario in a normal year is summarized in Figure 4-1. It is assumed that there will be no additional reductions in CCWD's CVP supply (i.e., the CVP contract amount of 195,000 ac-ft/yr is assumed throughout the study period). The surplus water supply shown in Figure 4-1 indicates that in normal years, there is adequate total water supply to meet the projected total demands in both the north-central and eastern portions of the county under all three water supply scenarios . The total supply surplus ranges from 28,100 ac-ft/yr for Scenario 3 to 67,000 ac-ft/yr for Scenario 2 (at the 2040 projected conditions).

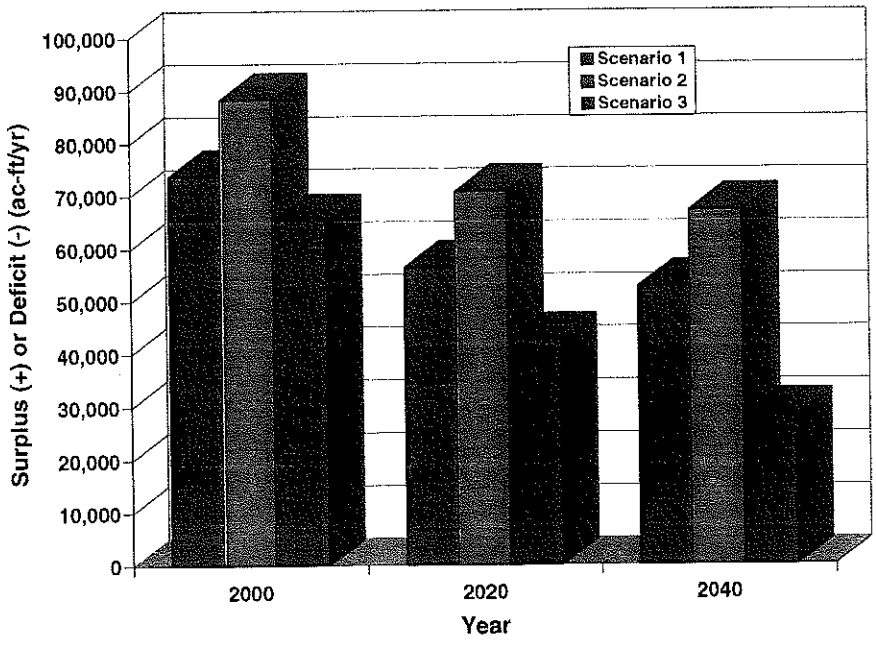


Figure 4-1
Water Supply Surplus in Normal Year without CCWD Reduction (Option A)

In a similar fashion, Figure 4-2 summarizes the projected surplus or deficit in total supply during a drought year, assuming that CCWD's CVP supply is not reduced. In Figure 4-2, deficits in supply (reported as negative values) are indicated for all scenarios at the year 2020 conditions and beyond. A surplus in supply is projected for the year 2000 conditions for Scenarios 1 and 2 (6,600 and 21,100 ac-ft/yr, respectively). The maximum deficit is projected to be 43,800 ac-ft/yr for Scenario 3 at the 2040 conditions.

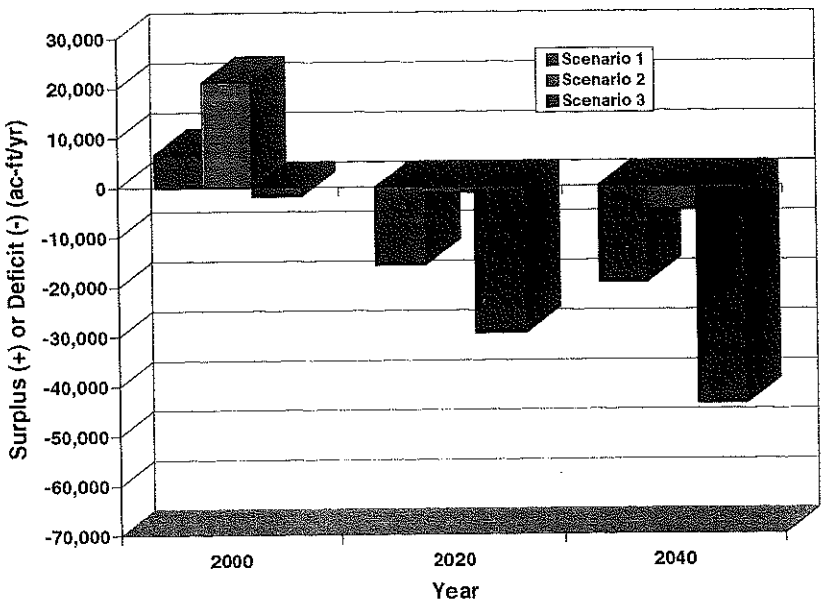


Figure 4-2
Water Supply Surplus/Deficit in Drought Year without CCWD Reduction (Option A)

Figure 4-3 summarizes the projected surplus or deficit in total supply during a normal year under the assumption that CCWD's CVP contract will be reduced in the future. As previously described, the baseline assumption used to assess the impacts of the potential reduction in the CVP contract amount results in a total normal year supply of 166,000 ac-ft/yr. This represents a 15 percent reduction from the current contract amount. Figure 4-3 indicates that once again there is a surplus in available supply for the normal-year condition, with one exception. A slight deficit in supply (on the order of 1,000 ac-ft/yr) is projected for the 2040 condition with Scenario 3. Compared to the total amount of water supply and demand (on the order of 300,000 ac-ft/yr), this deficit is insignificant.

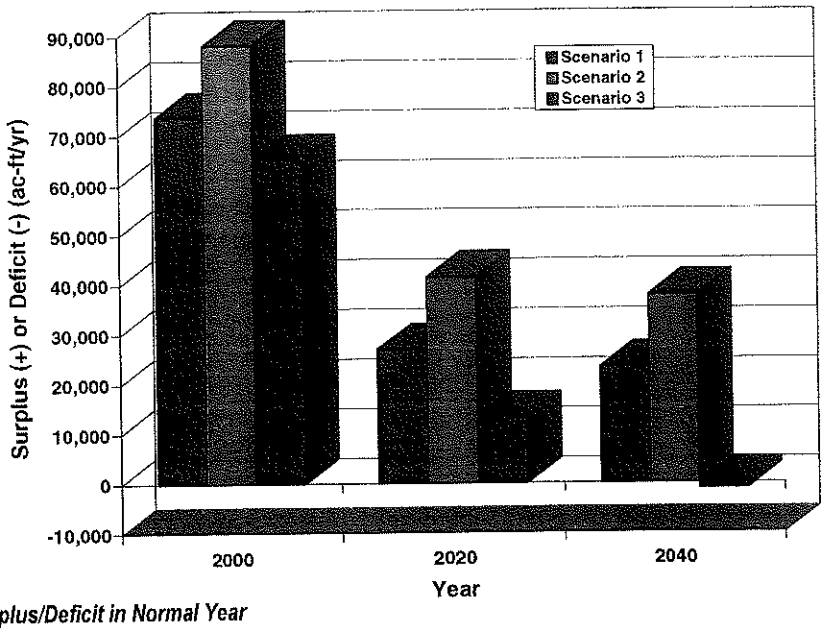


Figure 4-3
Water Supply Surplus/Deficit in Normal Year with CCWD Reduction (Option B)

Figure 4-4 provides a summary of the projected water supply surplus or deficit for each scenario under a drought condition, assuming CCWD's CVP contract is reduced as previously described. Under these conditions, the maximum amount of water supply deficit is projected. Although a surplus is still projected for the year 2000 conditions using the Scenario 1 and 2 assumptions, the maximum deficit in 2040 has increased to approximately 65,700 ac-ft/yr for Scenario 3. This differs significantly from the deficits shown in Figure 4-2 and illustrates the importance of the results of the study to CCWD's CVP supply assumptions for future conditions.

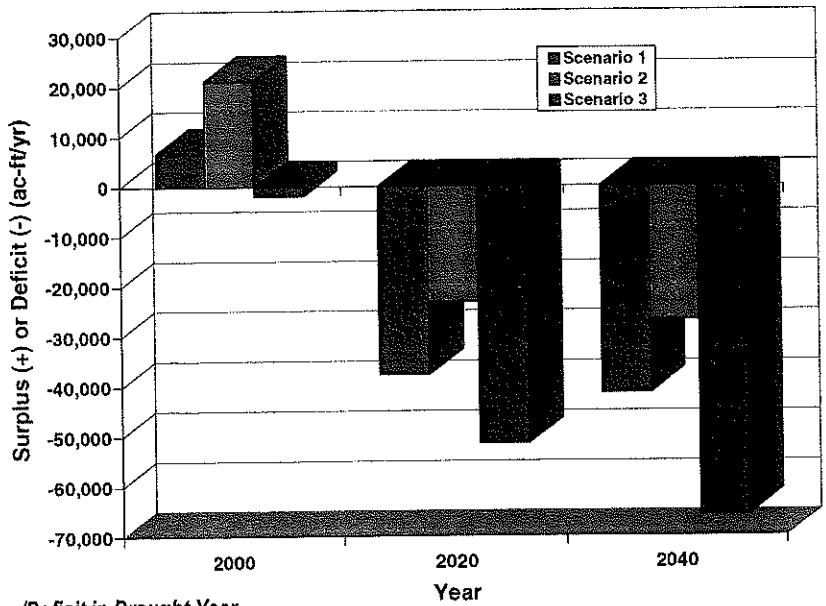


Figure 4-4
Water Supply Surplus/Deficit in Drought Year with CCWD Reduction (Option B)

Water Rights Issues Associated with the Maximum Pooling Concept

The ability to implement the maximized local pooling concept is predicated on the ability of the various agencies to reach agreement and resolve certain water rights issues sufficiently to withstand the most likely legal challenges that may be brought by others. Based on discussions with ECWMA's water rights legal counsel (Stuart Somach), the pooling concept is considered implementable.

The "no injury rule" is key to determining the feasibility of implementing the pooling concept. The "no injury rule" allows pre-1914 water rights holders to modify their place of use, time of use, and type of use, as long as no injury occurs to downstream users. Post-1914 water rights holders enjoy the same privileges. However, the pooling of post-1914 water rights water will require the approval of various state agencies, whereas the pooling of pre-1914 water requires no state involvement.

The proof of "no injury" would also require CEQA compliance. Significant issues to be addressed in a CEQA document include:

- Public trust issues
- Public interest
- General environmental concerns
- Reclaimed water and associated return flows

The current water rights environment indicates that the pooling concept will be observed carefully by others and may be contended vigorously. The basic water rights law upon which the maximized pooling concept is based is not new and does not pose any unique issues that have not been dealt with historically. The timing, location, and current focus on water and environmental issues within or near the Bay-Delta, however, will undoubtedly cause political/legal challenges that will have to be anticipated and addressed.

As shown in Figures 4-1 and 4-3, the normal-year supply under all water supply scenarios is adequate to meet the projected full demands of north-central and eastern areas (with the exception of the slight deficit projected for Scenario 3 under a reduced CCWD supply assumption). However, in a normal year, CCWD's CVP contract is still subject to a potential regulatory reduction of up to 15 percent under water shortage provisions. Therefore, a buffer of normal-year supply is needed to provide for this regulatory reduction and to maintain adequate deliveries.

In consideration of this potential regulatory reduction, it was recommended that all water supply alternatives should have a reliable normal-year water supply in excess of East County's total projected water demand. The following criterion was used to determine how much additional normal year supply is required:

> *Normal year total water supply for each alternative should be greater than the total water demand by approximately 15 percent of the municipal and industrial demand.*

Application of this criterion resulted in supplemental water needs in normal years, beyond the base water supply available for the water supply scenarios shown in Figures 4-1 and 4-3. The normal-year supplemental water requirement can be obtained through several mechanisms:

- Long-term water transfer agreements
- Water reclamation (nonpotable and potable)
- Long-term water conservation

Chapter 2 presents information on the implementability of each of these mechanisms. All were deemed suitable for developing normal-year water supplies. However, long-term water conservation can result in demand hardening, which reduces the area's ability to respond to drought restrictions through short-term demand management.

As presented in Figures 4-2 and 4-4, in drought years, the need for supplemental water ranges from zero to 65,700 acre-feet. For the purpose of this study, a critical drought was assumed to occur once in every 7 years during the study period starting in year 2004; this assumption is consistent with the FWSS assumptions and with the California DWR Planning Criteria. The amount of drought-year supplies necessary in any one year was based on providing the projected East County water demand documented in Chapter 2. As presented in Chapter 2, East County's projected demands include an urban water conservation level of 10 percent, achieved in 2 percent increments each decade from 1990 to 2040.

Numerous methods are available for obtaining drought-year supplies for East County . The following methods were analyzed as part of this study:

- Spot water transfers
- Short-term demand management/water conservation
- Continued groundwater pumping (only up to the limits of current extractions)
- Short-term water reuse projects
- Groundwater banking

Water supply alternatives were developed to address all of these methods of obtaining drought-year supply. Figure 4-5 summarizes the water supply alternatives that were developed to evaluate the various methods of obtaining both additional normal-year supply (when applicable) and drought-year supply.

4.2 Estimation of Water Supply Alternative Costs

A water supply alternatives cost model was developed to prepare the cost estimates for the water supply alternatives. The cost model integrated the projected demands for water with the various methods of providing normal-year and drought-year water supplies. The model was configured to account for timing of water supply development, inflation, and amount of water supply development. Details of the cost estimating procedures and the detailed model output are provided in Technical Memorandum No. 5.

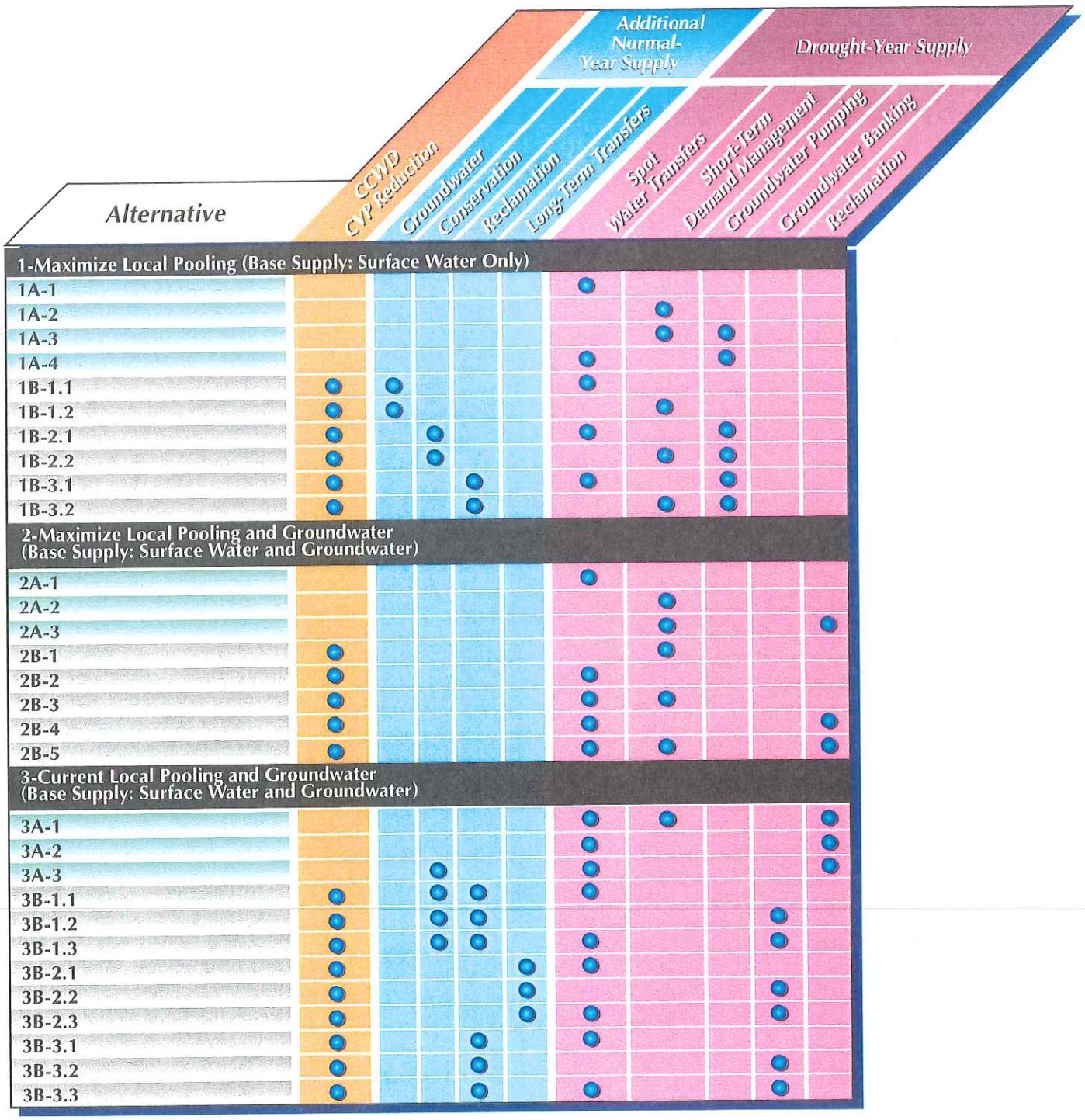


Figure 4-5

Water Supply Alternatives

Phase II East County Water Supply Management Study

CH2MHILL

The water supply alternatives do not include costs for CCWD's CVP supply, because that is the same for all alternatives.

Costs were estimated for water transfers, drought measures, and reclamation facilities. Costs of transfer includes the cost for water only; it does not include other associated costs, such as permitting, environmental mitigation, potential legal costs, or associated water facilities, because they cannot be estimated now. Costs for alternatives with reclamation include both the capital and O&M costs of reclamation facilities. The water supply alternatives do not include costs for CCWD's CVP supply, because that is the same for all alternatives. All costs were combined to prepare a net present value cost for use in comparing the alternatives. Economic factors used in the net present worth evaluation were:

- Capital cost escalation factor: 4 percent
- Annual cost escalation factor: 4 percent
- Discount rate: 6.5 percent

Table 4-1 summarizes the cost factor assumptions that were used in developing the water supply alternative costs.

TABLE 4-1
Cost Factor Assumptions

Description	Value ($/ac-ft)	Basis
Internal Surface Water Transfers (Existing Contracts)		
Current cost of agricultural supply to urban agency	$20	ECCID and CCWD agreement
Current standby charge prior to transfer	$4	ECCID and CCWD agreement
Internal Surface Water Transfers (Future)		
Future cost of agricultural supply to urban agency	$175	FWSS long-term transfer cost
Future standby charge prior to transfer	$4	1994/95 Drought Bank option
Long-Term Conservation	$113	CP-2 from FWSS
Long-Term Transfer	$175	FWSS long-term transfer cost
Reclamation (nonpotable)	$800 to $1,200	Annual amortized cost plus O&M, based on Reclamation Options 2 and 4 (refer to TM No. 3)
Reclamation (potable)	$1,500	Annual amortized cost plus O&M, based on detailed CH2M HILL study
Groundwater Pumping	$48	CVPIA-Preliminary Environmental Impact Statement agricultural economics study, plus back-check with current pumping practices
Spot Water Transfer	$175	CVPIA Water Augmentation Study
Short-Term Demand Management	$175	CVPIA Water Augmentation Study
Groundwater Banking	$80	CVPIA Water Augmentation Study

As described in Chapter 2, several potential reclaimed water projects have been studied in the project area. As part of this study, previous reclamation work was reviewed and used to prepare costs associated with developing reclaimed water supplies. A detailed description of this analysis is provided in Technical Memorandum No. 3.

The cost analysis included the two reclamation options found to be the most applicable in meeting the water needs for the alternative water supply scenarios. These options are the DDSD Reclamation Option and the Ironhouse/Brentwood Option. Their facility layouts are shown in Figure 4-6. The DDSD Option uses reclaimed water from DDSD for industrial reuse and urban irrigation in the Pittsburg and Antioch areas. The potential industrial users of the reclaimed water are USS Posco, Dow Chemical, and Gaylord Industries (or equivalent replacement). The Ironhouse/Brentwood Option uses reclaimed water from ISD and Brentwood to irrigate agricultural lands in the ECCID. As noted in Table 4-1, the range of costs (amortized) for developing these options is $800 to $1,200 per acre-foot.

A potential exists to use reclaimed water as a drought supply, as well. For developing drought supplies using reclaimed water, an option similar to the Ironhouse/Brentwood Option was developed. It was assumed that a pipeline would be installed to connect the ISD and Brentwood WTPs to ECCID's main canal. In a drought, it was assumed that reclaimed water would be delivered to the ECCID canal in exchange for surface water supplies. Due to the infrequent use of this system, the costs would be high compared to other drought-supply options. The cost of this reclamation drought supply would be approximately $2,300/acre-foot.

Some alternatives were configured for possible potable reclamation in the later years of the study period. Implementation of potable reuse in the study area is not considered feasible in the foreseeable future, but it may be a viable water supply option later in the study period. For this reason, it was included in this analysis. To obtain a cost estimate for potable reuse, it was assumed that highly treated reclaimed water from DDSD would be delivered to the Contra Costa Canal for reuse. The treatment process train for implementing potable reuse includes traditional secondary treatment with filtration, microfiltration, reverse osmosis, decarbonation, and disinfection. Brine disposal through falling film vapor compression evaporation and forced circulation crystallization (resulting in salt production) was assumed.

Table 4-2 summarizes the results of the cost estimate analysis for the water supply alternatives as reflected in the unit present worth cost of these alternatives. The alternatives are grouped by the water supply scenarios and segregated between those with and without reclamation. Detailed information on each supply alternative is provided in Technical Memorandum No. 5.

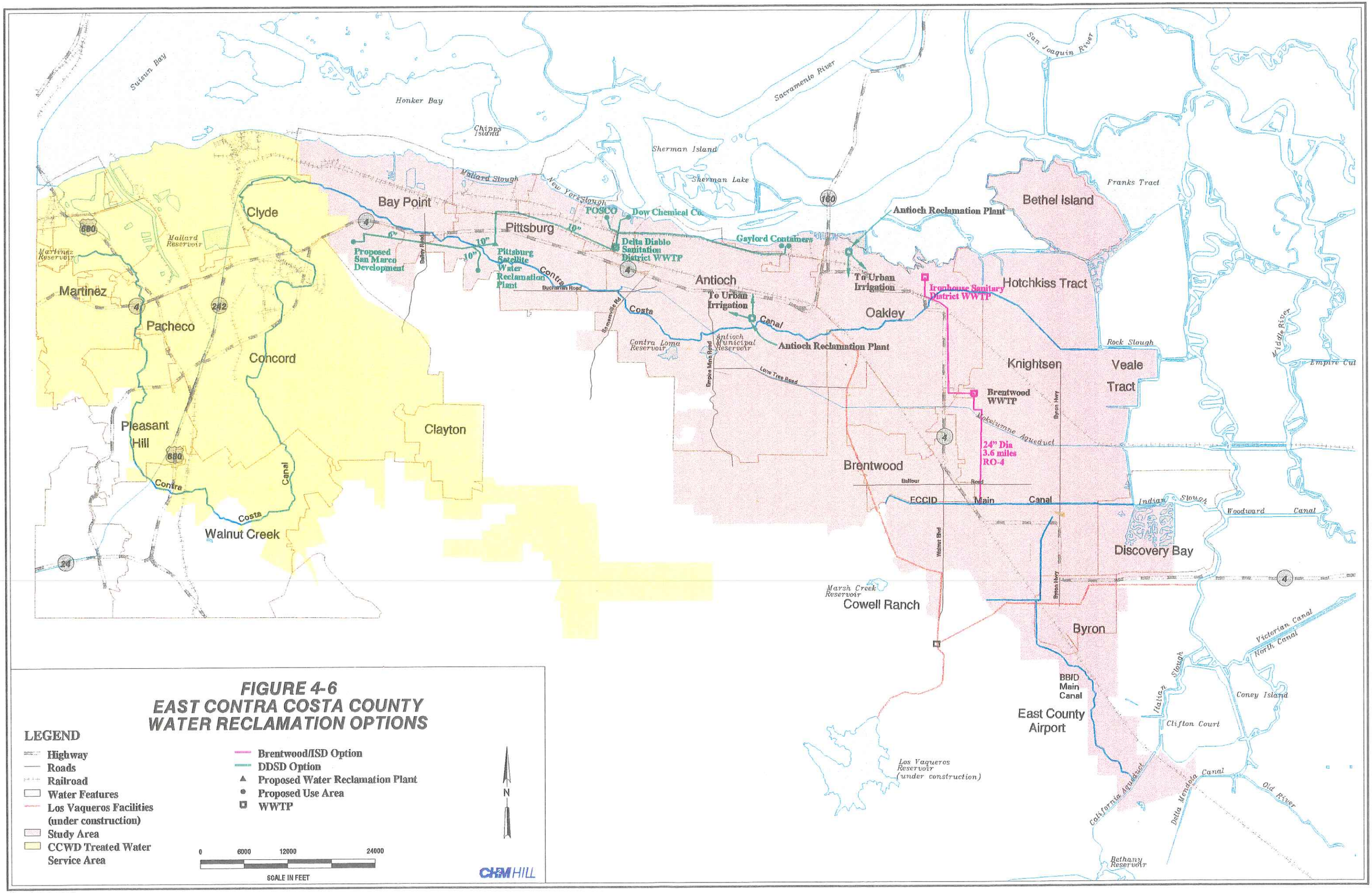


FIGURE 4-6
EAST CONTRA COSTA COUNTY WATER RECLAMATION OPTIONS

LEGEND

- Highway
- Roads
- Railroad
- Water Features
- Los Vaqueros Facilities (under construction)
- Study Area
- CCWD Treated Water Service Area
- Brentwood/ISD Option
- DDSD Option
- Proposed Water Reclamation Plant
- Proposed Use Area
- WWTP

N

0 6000 12000 24000

SCALE IN FEET

CH2M HILL

/b/eccc/plots/rec1.aml
September 10, 1996 9:19 PM

TABLE 4-2
Unit Present Value of Water Supply Alternatives

Alternative	With Reclamation ($/ac-ft)	Without Reclamation ($/ac-ft)
1A	N/A	43 to 47
1B	142	42 to 47
2A	54	40
2B	61	42
3A	46 to 50	N/A
3B	111 to 197	42 to 44

Note: The unit present value of water supply alternatives represents the cost of acquiring additional water supplies or transferring existing water supplies during the planning period. Costs associated with the purchase of CCWD's CVP supply is not included because it is the same for all alternatives.

The unit present values were determined by dividing the total net present value by the total amount of water developed over the study period of 1996 to 2040. It should be noted that the water supply amount acquired through different programs varies from year to year for different alternatives. Due to the timing of when various water supply components are added to an alternative, the cash flows for implementing alternatives that develop the same amount of total water supply are different. These different cash flows result in different present worth values for the same amount of total water. For comparative purposes, the unit present values shown here approximate the cost tradeoffs between alternatives.

As shown in Table 4-2, the costs in terms of net present worth for the water supply alternatives range from $40 to $197 per acre-foot of water. Higher costs are associated with using reclaimed water for drought supply or implementing potable reuse.

In general, alternatives associated with Scenario 2 are lower in cost. It should be noted that these costs are for water supply development and do not include treatment or distribution. Costs associated with treatment and distribution are presented in Chapter 3. Costs of acquiring current supplies (such as CCWD's CVP water supply) are not included either because they are the same for all alternatives.

4.3 Screening of Water Supply Alternatives

Process for Screening Water Supply Alternatives

Numerous water supply alternatives were developed for this study. The four-step process used to screen these alternatives is listed on the following page.

1. Develop screening criteria in a workshop setting with GBR.
2. Apply screening criteria to the water supply scenarios.
3. Select apparent best water supply scenario for more detailed screening.
4. Apply the screening criteria to the water supply alternatives associated with the selected scenario.

The following sections document the results of this process.

Criteria for Screening Water Supply Alternatives

Criteria for screening the water supply alternatives were developed by the GBR and JMC early in the project based on six "critical success factors" defined in the initial workshop. The development of these criteria and the measures and rating method are described in Technical Memorandum No. 5.

Screening of Water Supply Scenarios

As a first step in screening the water supply alternatives, the alternatives were grouped into the water supply scenarios. Each scenario was screened in a workshop session with the JMC on February 27, 1996. The resulting screening matrix is presented in Figure 4-7.

Critical Success Factors (Screening Criteria) for Water Supply Alternatives

1. **Cost Effectiveness**
   Alternatives should be cost-effective for all participants, when considered as a program, although not necessarily for each component.
2. **Reliability—Adequate Water Quantity/Quality**
   Alternatives must have adequate water quantity, water quality, and reliability to meet projected demand.
3. **Implementability**
   Alternatives must be implementable and sustainable over time.
4. **Institutional Independence**
   Alternatives should enable each entity to move forward within the framework of the overall plan.
5. **Cooperation/Flexibility**
   Alternatives should provide operational flexibility to take advantage of opportunities and to meet member needs.
6. **Customer Satisfaction**
   Alternatives must achieve customer satisfaction.

A summary of the tradeoffs between the alternatives relative to each criterion is presented below.

- **Cost-Effectiveness**. Scenario 3 ranked consistently higher in cost, with the exception of Alternatives 3B-2.1, 2.2, and 2.3. These alternatives used long-term transfers to provide the additional water supplies. Based on the assumptions used for cost estimating, the long-term transfer costs were similar to internal transfer costs later in the study period. Scenarios 1 and 2 were generally equivalent in costs.

Water Supply Scenario	Cost-Effectiveness	Reliability		Implement-ability	Institutional Independence	Cooperation/ Flexibility	Customer Satisfaction
		Adequate Water Supply	Adequate Water Quality				
1-Maximize surface water pooling	G	M	G	M	P	G	G
2-Continue groundwater pumping and maximize surface water pooling	G	G	M	M	M	G	G
3-Continue groundwater pumping and current surface water pooling	P	P	M	P	G	P	P

Scenario 2A Alternatives

Alternative	Drought Supply	Cost-Effectiveness	Reliability		Implement-ability	Institutional Independence	Cooperation/ Flexibility	Customer Satisfaction
			Adequate Water Supply	Adequate Water Quality				
2A-1	Spot Water Transfers	G	G	M	G	G	M	M
2A-2	Short-Term Demand Management	G	G	G	M	M	P	P
2A-3	Reclamation & Short-Term Demand Management	P	G	M	P	P	M	P/M

G = Good

M = Moderate

P = Poor

Figure 4-7

Criteria Screening Matrix for Water Supply Scenarios

Phase II East County Water Supply Management Study

CH2MHILL

- **Reliability—Adequate Water Quantity**. Scenario 3 required the most water, so it received a poor rating. Scenario 2 resulted in the lowest requirement for additional water supply due to the continued use of groundwater, so it received a good rating.

- **Reliability—Adequate Water Quality**. Scenario 1 resulted in the highest amount of surface water supply because groundwater supplies were used for drought relief only. Due to the differences in water quality between surface water and groundwater supplies, Scenario 1 was ranked high. The groundwater supplies would still provide adequate water quality for domestic uses; however, it is clear that the quality would be generally less, with respect to total salts and certain specific constituents.

- **Implementability**. Scenario 3 was rated poor because this scenario required negotiations for additional supplies from outside the project area. Scenarios 1 and 2 were deemed to be equivalent, since both resulted in negotiations between ECWMA members to maximize water supplies in the study area.

- **Institutional Independence**. Because maximizing the pooling of water supplies in the study area generally resulted in less institutional independence (due to the need to work more closely as an association), Scenario 1 was ranked lower than Scenarios 2 and 3. Scenario 3 would provide the highest level of institutional independence, since each agency would be required to obtain water resources for itself in the open marketplace.

- **Cooperation/Flexibility**. Scenarios 1 and 2 would provide the maximum amount of cooperation and operational flexibility because they embody the concept of maximized pooling of water supplies in the study area. Scenario 3 would result in less cooperation and flexibility.

- **Customer Satisfaction**. Although no rate effects were quantified, it was generally assumed that lower overall water costs would have less potential impact on rates. None of the alternatives would be likely to have significant socio-cultural impacts; therefore, this factor did not affect the ranking. However, Scenarios 1 and 2 would reduce uncertainties in water supply, so they were ranked higher than Scenario 3.

Based on this analysis, Scenario 2 was selected. This scenario has:

- Smallest supply deficits
- Narrowest cost range
- Best ratings in screening process

Screening of Selected Water Supply Alternatives

Following the selection of Scenario 2, the associated water supply alternatives were analyzed. The water supply alternatives associated with Scenario 2 are similar for each option; therefore, for simplicity, only Option A was carried forward. If CCWD's CVP water supply is reduced in the future, additional water supplies would be developed through internal transfers.

The Scenario 2A alternatives were evaluated and reviewed with the GBR at the March 27 workshop. Figure 4-7 summarizes the screening matrix results for these alternatives. A summary of the tradeoffs between the alternatives relative to each criterion is presented below.

- **Cost-Effectiveness**. Alternatives 2A-1 and 2A-2 exhibited lower costs. Alternatives that included the use of reclamation to develop drought supplies were more expensive.
- **Reliability—Adequate Water Quantity**. No major difference was noted among the alternatives. All of the developed alternatives provided the necessary water supplies.
- **Reliability—Adequate Water Quality**. Alternative 2A-2, short-term demand management, was not affected by drought, whereas the other two alternatives were affected equally in a drought.
- **Implementability.** Spot water transfers were viewed as being relatively easy to implement, so Alternative 2A-1 received a good rating. Implementation of a reclamation program for drought supplies required more capital and environmental documentation, so Alternative 2A-3 received a poor rating. Short-term demand management was also easier to implement than reclamation, but it was more complex than spot water transfers, resulting in a moderate ranking for Alternative 2A-2.
- **Institutional Independence**. Implementing reclamation involves more agency coordination and financing, so Alternative 2A-3 received a poor rating. Acquisition of spot water transfers results in the maximum amount of independence between agencies, resulting in a good rating for Alternative 2A-1.
- **Cooperation/Flexibility**. Implementing reclamation for drought supply provides maximum flexibility, because it is easy to begin to use the system once the infrastructure and agreements are in place. Short-term demand management requires the implementation of conservation-enhancing measures by the agencies, so it is less flexible.
- **Customer Satisfaction**. Implementing short-term demand management is less satisfying to customers because it involves increased cost and effort on the part of the customers.

Chapter 5—Recommendations and Implementation Strategies

This chapter summarizes the study recommendations for the development of a water management plan to meet East County future water needs. Implementation strategies for water treatment and distribution facilities are also presented.

5.1 Recommendations

Water Supply Development Recommendations

The recommended method for water supply development involves maximizing utilization of local surface water supplies in the project area and continuing to use groundwater supplies at the current level. This concept of "maximized pooling," where ECWMA members' surface supply surpluses are combined into one common supply pool for use by any member, would provide East County with sufficient normal-year supplies to meet projected needs and minimize the need for additional supplies during drought.

Maximized pooling, combined with continued groundwater pumping at the current level, is the best method for meeting future water needs.

Successful implementation of the maximized pooling concept will depend on the ability of the agencies to reach agreement on resource sharing and to resolve water rights issues, so that potential legal challenges by other interested parties can be met.

Treatment Options Presentation

The Phase II study involved conducting an extensive analysis of the water treatment options for East County and developing detailed cost estimates for five options (see Chapter 3 and Technical Memorandum No. 3.1). However, recommending the best treatment option is not the purpose of this analysis. Instead, detailed technical and financial information on facilities is provided in this report for ECWMA members' use in selecting a preferred option. Information on the implementation strategies for these options is also provided in this report.

Treatment Option Implementation Issues

Three significant issues were defined and considered during the development of the water treatment options. They are described below.

Water Quality Effects on Non-LVP Participants

Brentwood, Byron, and Discovery Bay are not participants of the LVP. As a result, their treated water quality will not accrue any benefit from Los Vaqueros Reservoir storage. One option discussed by the JMC is

modifying the LVP to allow Brentwood, Discovery Bay, and Byron to participate in the project to the extent that they would receive the benefits of Los Vaqueros Reservoir storage. This modification has serious implications for LVP facilities operation and would require substantial California Environmental Quality Act (CEQA) and National Environmental Protection Act (NEPA) documentation, as indicated by CCWD. Should the non-LVP participants pursue inclusion in the LVP, Treatment Options 1 and 2 include provisions for centralized treatment at the Randall-Bold WTP (Options 1A and 2A). Without modification of the Los Vaqueros service area, the separate WTPs (Options 1B and 2B) at Randall-Bold will provide treated water for the area.

Restrictions on Delta Diversions

The CCWD's Los Vaqueros permit imposes a 30-day restriction on diversion from Rock Slough or from the Old River intake. It is not clear whether the other ECWMA members (Brentwood, Discovery Bay) wishing to develop treated water supplies from the Delta would be subject to the same restriction. If a similar 30-day restriction is imposed, water storage would be required to meet demands during those 30-day periods.

Surface storage may be more costly than ASR (see Chapter 4). Therefore, an ASR system should be considered. Should ASR be chosen, treatment options that locate new treatment facilities in the Sand Hill area of DWD should be favored; this would minimize the costs of ASR by using the high transmissivity of the underlying aquifer.

Incorporation of SRIP Improvements

As part of the SRIP, CCWD has determined that facilities paralleling the Contra Costa Canal would increase the reliability of the water system. The primary facility under consideration is a raw/treated water pipeline between the Randall-Bold WTP and the Bollman WTP. If CCWD elects to construct this pipeline, the cost of delivering treated water to the Antioch WTP from the Randall-Bold WTP could be reduced substantially, depending on cost-sharing provisions. This cost reduction might be significant enough to affect the decision on the Antioch WTP expansion.

Cost Tradeoffs Between Antioch and Randall-Bold WTPs

Given that cost differences are insignificant, other factors (such as the "critical success factors" used in this study) should be considered in determining which facility (Antioch WTP or Randall-Bold WTP) to expand to meet East Antioch's needs.

Cost impacts of the potential SRIP raw/treated water pipeline were not evaluated. This pipeline might be able to deliver treated water to the Antioch WTP from the Randall-Bold WTP and reduce the total delivery

cost for Treatment Option 1. When determining whether to expand the Antioch WTP, the City of Antioch should discuss with CCWD the potential for savings by connecting to the SRIP pipeline.

Treated Water Supplies for Discovery Bay

Supplying treated surface water to Discovery Bay will be expensive. The most cost-effective method analyzed involved a new East County WTP, at a capital cost of approximately $13 million to $14 million (treatment and distribution); this cost contrasts to an estimated cost of approximately $3.2 million to $4.7 million for a groundwater treatment facility.

These cost estimates are for meeting the maximum-day demand of 5.6 mgd in Discovery Bay at the 2040 level of development; they do not include costs for treatment and/or storage for fire flow. The storage requirement for fire flow in Discovery Bay would range from 540,000 gallons to 1 million gallons, based on maintaining 3,000 to 4,000 gpm for 3 to 4 hours. This fire flow storage could be achieved in a groundwater treatment option system for less than $1 million.

Treatment Option 5 includes the cost of a water treatment facility in the Byron area. Additional distribution facilities would be necessary to deliver water from the Byron area to Discovery Bay. This option was not evaluated in detail, though it might provide a lower surface water treatment cost, depending on cost-sharing provisions. Cost-sharing discussions should be held between Brentwood and Discovery Bay regarding the potential new East County WTP; a conceptual cost analysis should be performed for the Discovery Bay/Byron option.

Treated Water Supplies for Byron

Developing treated surface water supplies for the Byron area will cost approximately $6 million to $7 million (see Chapter 4). Because Byron lacks a centralized potable water distribution system, installing the needed distribution system would involve additional costs. Current development plans for Mountain House in the BBID service area require the construction of a surface WTP within this development area. Unfortunately, the location of the proposed WTP within the Mountain House development precludes its cost-effective expansion to meet Byron's capacity requirements. If this WTP is located closer to Byron, it might be possible to achieve economies of scale in treatment capacity and provide the Byron area with treated surface water supplies. BBID should discuss this possibility with San Joaquin County and the Mountain House developers.

Other Recommended Investigations/Activities

During this study, several other recommended investigations or activities were identified. These are summarized below.

Evaluate ASR Potential Near Randall-Bold WTP

Any diverter of potable water supplies from the Rock Slough or Old River Intake can be required to stop diversions for a 30-day period (see Section 3.5). This requirement would be similar to the LVP permit requirement, which may establish a precedence. One option for meeting related storage requirements is to develop an ASR system, which involves injecting water into a suitable aquifer through a well when water is available and recovering that water from the same well when it is needed. More than 20 ASR projects are currently operable in the United States, including several in California, and several ASR investigations are underway locally. ASR provides cost-effective water storage with minimal water quality impacts and eliminates evaporation loss that occurs with surface storage. ECWMA should investigate the feasibility of ASR in the area of the Randall-Bold WTP. Preliminary hydrogeologic assessment indicated that this location had the best characteristics for an ASR project. There are many locations in the United States where ASR programs are currently operational, such as: the cities of Pasadena and Goleta and the Calleguas Municipal Water District in California; the Las Vegas Valley Water District in Nevada; and the cities of Peace River, Cocoa, and Boynton Beach in Florida.

Perform Groundwater Yield Study

Information is not sufficient on the allowable groundwater yield in the study area. This is a significant concern, given the importance of groundwater supplies to the study area. ECWMA should commission a comprehensive groundwater study of the East County area.

This assessment would involve consideration of groundwater quantity and quality and the interactions between surface water and groundwater supplies. A unified groundwater monitoring program would provide valuable input to the knowledge base on groundwater in East County, which would be useful in a groundwater yield study. A comprehensive groundwater monitoring program could be managed by ECWMA and formulated along an Assembly Bill (AB) 3030 approach. AB 3030, the California Groundwater Management Act, encourages local public water agencies to develop and implement groundwater management plans to maximize their total water supply while protecting groundwater quality and facilitates those efforts. If funding is limited, the study should be focused on the Brentwood/Discovery Bay/Byron area initially and then on the DWD/Delta Island areas, based on area groundwater extractions, groundwater quality concerns, and the relative importance of groundwater development to the area.

Update Water Supply Study

Regular updating of long-term planning documents is the most effective way to continue to anticipate the impacts of changes in planning assumptions, demographics, development plans, and external factors. ECWMA should commission updates of the Water Supply Study every

5 years, allocating 1 year in the planning schedule for each update. ECWMA member staff could update the study with or without consultant assistance.

Administrative/Institutional Recommendations

Maintain East County Water Management Association

Significant cooperation among ECWMA members has developed throughout this study, and ECWMA should maintain its viability while the agencies implement Phase II recommendations. Legal advice is recommended regarding ECWMA structure. A more formalized organization (e.g., a Joint Powers Authority) could also be formed if that would maximize the benefits of cooperative association.

Regular ECWMA meetings and continued provision for a Chairman, Vice-Chairman, and Secretary/Treasurer are encouraged. Positions could be rotated among ECWMA participants every 1 to 2 years. Regular funding of ECWMA activities by relatively small ECWMA assessments should be considered. Special assessments would be appropriate to fund additional technical analyses.

An ECWMA library should be established at a mutually acceptable location.

Implement Dual Plumbing System for Future Reuse

Contra Costa County has implemented an ordinance (91-19) supporting the establishment of dual water system areas, designated areas that have dependable supplies of nonpotable water. This ordinance is applicable to the unincorporated areas of the county.

East County expansion is increasing wastewater flows and the demand for potable water, including water for residential landscape irrigation. ECWMA members should implement a dual water distribution system for all water service areas within East County. This strategy would make it easier and less costly to develop future water reuse projects .

A dual water distribution system is defined by the American Water Works Association as:

> *A water distribution facility that distributes two grades of water to the same service area: one potable and the other perhaps nonpotable. The quality, quantity, and pressure available in each system are functions of the sources and intended uses for each grade of water.*

Installing a dual water system during construction is more cost-effective than converting an installed irrigation system to reclaimed water use later. During construction, an irrigation system can be installed in conformance with guidelines for reclaimed water irrigation use; potable water can be used until reclaimed water becomes available.

Maximize Reclaimed Water Use for Construction

Reclaimed water can be used for construction and obtained from filling stations at reclamation or remote facilities. Requiring reclaimed water for construction may increase construction costs due to increased hauling distances. To mitigate this effect, the requirement could be lifted for construction sites too remote from reclaimed water supplies.

ECWMA members should develop applicable ordinances for the use of reclaimed water for construction, where practical. Implementation of this strategy would not adversely affect any of the long-term alternatives being considered.

Provide Water System Interties

Interties between WTP service areas increase reliability and flexibility during emergencies. ECWMA members are developing or have developed interties between Pittsburg, Antioch, Brentwood, and DWD. As part of the SRIP, a raw/treated water pipeline between the Randall-Bold and Bollman WTPs is being considered. This pipeline could provide additional reliability to the Antioch and Pittsburg WTPs. The Cities of Pittsburg and Antioch, the CCWD, and the DWD should discuss potential intertie benefits associated with the SRIP.

Secure Area of Origin and Delta Water Rights Preferences for CVP Water Use

The USBR's procedures for allocating water under its state-granted water rights for the CVP water do not conform with the principles outlined in the area of origin and Delta Protection Act provisions of the State Water Code. The USBR's allocation procedures export water from the Delta that is needed in the areas of origin and the Delta service area, which violates state water rights principles. ECWMA and individual agencies should participate in appropriate forums to ensure that the area of origin and Delta Protection Act preferences provided for in state law are applied to allocations made under the CCWD's CVP contract. CCWD has submitted comments on this to the USBR for its interpretation of the area of origin statutes and for its water shortage policies. Antioch, Pittsburg, and DWD submitted comments and provided testimony at the March 12, 1996, SWRCB workshop requesting that the SWRCB require the USBR to make available for purchase by its contractors whatever quantity of water is necessary to meet the reasonable requirements of the users of water on lands in the Delta during all years. Other ECWMA members should consider joining Antioch, Pittsburg, and DWD in the SWRCB's upcoming Delta hearings for the purpose of presenting a united effort toward convincing the SWRCB to enforce the statutory preference given to water users in the Sacramento-San Joaquin Delta. Other avenues should also be pursued to achieve this goal.

Relocate San Joaquin River Water Rights Points of Diversion to the Contra Costa Canal Intake

San Joaquin River water rights are held by two ECWMA members (CCWD and City of Antioch) and two industries (Gaylord and Dupont). The usefulness of these water rights is severely restricted in low-water periods due to poor water quality at the originally authorized diversion points. The relocation of these points of diversion to the intake of the Contra Costa Canal, where the water quality is more acceptable, would permit the use of this water during drought periods. The relocation of these points of diversion should be considered as additional points of diversion that will supplement the current points of diversion; it would not constitute a replacement of the current points of diversion. Such a change would require the consent of DWR because of the water rights settlement contracts and might provide water only when DWR would permit it.

5.2 Implementation Strategies

Strategies for implementing the recommendations developed in this study are described in this section. A long-term plan for implementing these strategies is illustrated in Figure 5-1.

Develop Maximized In-County Water Supply Alternative

Implementing the maximized pooling recommendation to obtain water supplies for the future will require water service agreements between agricultural and urban agencies. Considerable environmental documentation and water rights analyses will be required. Related strategies and implementation steps are summarized below.

Prepare Statement of Principles for Maximizing In-County Use of Water Supplies

East County will maximize its use of available water and derive significant benefits from a water exchange agreement. A recent presentation to the GBR by ECWMA's special water rights counsel, Stuart Somach, has verified the merits of the maximized pooling approach. The significant legal question associated with implementing this approach is whether "the change in purpose or place of use causes no injury to others" (Water Code Section 1706). Although the change in purpose and/or place of use of BBID and ECCID pre-1914 water rights is expected to be problematic, at least one legal opinion, provided for BBID, indicates that this change is possible.

A unified approach by Contra Costa County interests will be required to maximize pooling. Preparation of a statement of principles is the recommended first step in developing this unified approach. Meetings and negotiations between ECWMA's members must continue. These discussions should be initiated at the JMC level, with periodic review and

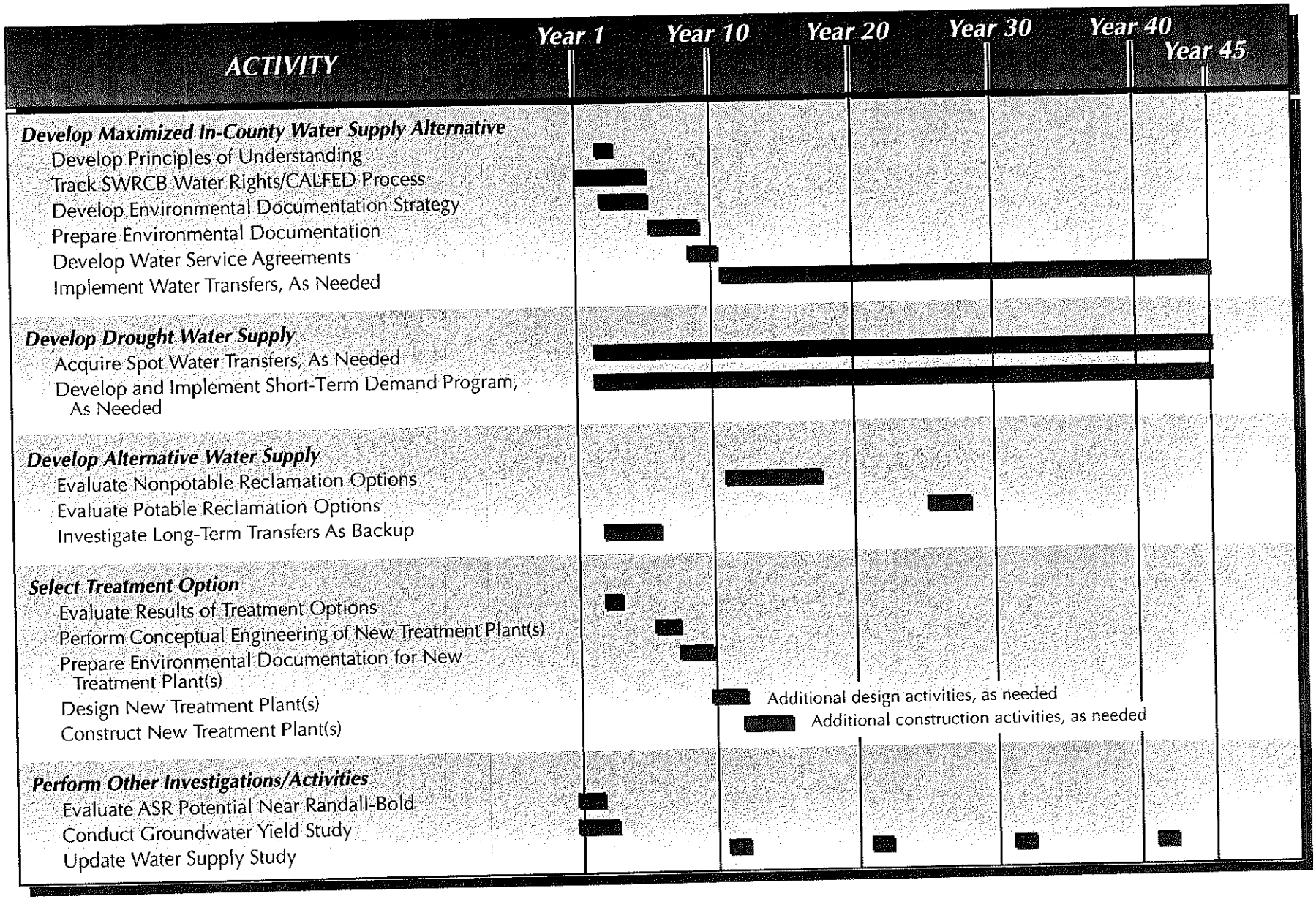


Figure 5-1

Implementation Plan

Phase II East County Water Supply Management Study

CH2MHILL

concurrence by the GBR. The current administrative framework for Phase II should be continued to implement this strategy. Advice from water rights counsel regarding implementation hurdles and strategies is recommended. After initial strategies are developed, further technical analyses should focus on determining potential impacts on other water rights holders and Delta diverters.

Track SWRCB Water Rights/ CALFED Process

The water rights process underway at the SWRCB is determining what modifications to water rights, if any, should be implemented to improve state water resource management, including meeting the public trust requirements in the Delta. This effort could significantly affect this study's recommendations.

Concurrent with the water rights evaluation, the state and federal governments are engaged in the CALFED process, which involves a joint evaluation of the Bay-Delta system. The goal of this process is the development of a means to "fix the Delta." Because East County is within and adjacent to the Delta, CALFED process developments will affect the area's future water resources management.

While some ECWMA members are actively involved in both of these processes, this involvement should be expanded to include the common needs of the entire ECWMA. If this is not possible, the ECWMA should consider an approach to obtain involvement in the processes from the perspective of the entire East County. If available, ECWMA member staff should be used to obtain this involvement. Otherwise, legal or water resource professionals' counsel is recommended.

Develop Environmental Documentation Strategy

The maximum pooling concept can be further developed and implemented in numerous ways. Potential challenges to implementation are most likely to focus on the "injury" that will be caused to other water users or to the environment. As a consequence, the best way to pursue the maximum pooling concept is to develop environmental documentation that analyzes issues involved in successful implementation. In particular, impacts to third parties and the environment that result from water-use changes contemplated in the maximum pooling concept should be fully evaluated. Assuming adverse impacts are identified, mitigation measures can be identified. (This might involve modifying basic elements of the concept.) In this way, the final alternative could, in fact, be developed to fully incorporate solutions to potential problems associated with the concept. Proceeding in this way would also allow the environmental review process to act as it was intended: potential areas of concern could be identified early.

Prepare Environmental Documentation

Implementation of the maximized pooling concept may require a joint CEQA/NEPA document. The required joint CEQA/NEPA document should be prepared by a professional consultant.

Develop Water Service Agreements

Following preparation of the principles of understanding and completion of environmental documentation, water service agreements could be negotiated. Timing, amount, and price for transferred water would be the primary topics involved.

Implement Water Transfers As Needed

Following negotiation of the water service agreements, the transfer of water supplies could be scheduled to meet East County's requirements. Because current demands are less than projected in this study, sufficient time should be available before transfers are required.

CCWD has negotiated an agreement with ECCID to use up to 21,000 ac-ft/yr of ECCID water to supply M&I demands within the ECCID service area. Another agreement with the City of Brentwood provides for the transfer of 7,000 acre-feet of this 21,000 ac-ft/yr to Brentwood to meets its future water needs.

Develop Drought Water Supply

Acquire Spot Water Transfers as Needed

Spot water transfers may be needed during droughts. At buildout conditions, drought spot water transfer needs may be as much as 65,700 acre-feet. During the early years, sufficient water supplies will be available for drought needs, as shown in Chapter 2. Later in the study period, however, additional drought supplies will be needed. When the transfer of local water supplies is insufficient to meet drought requirements, additional water supplies will have to be acquired from the Drought Water Bank or other sources.

Develop and Implement Short-Term Demand Management Program

Urban water conservation programs effectively reduce short- and long-term water demand in many urban California areas. Short-term demand management relies extensively on temporary habit changes, focusing on discretionary uses. During drought conditions, voluntary and mandatory regulations will be invoked.

ECWMA members have prepared the plans for efficient water use required by the State Urban Water Management Planning Act of 1993. ECWMA should form a technical team to compile a comprehensive short-term demand management program for East County that would include best management practices and an implementation plan.

Develop Alternative Water Supply

Evaluate Nonpotable Reclamation Options

Given current constraints and slowly changing public perceptions of potable reuse, implementing potable reuse is not reasonable until relatively late in the planning period, despite evolving technology. Therefore, a 2020 target date has been selected for the potential implementation of potable reuse.

Although not specifically recommended by this study, continued evaluation of nonpotable reclamation is encouraged. Under any alternative, industrial reuse should be pursued in the area of the DDSD WWTP. Industrial use of reclaimed water would reduce industrial need to obtain supplies from other sources during droughts. Although costs associated with reuse are greater than costs for acquiring equivalent supplies from the Drought Water Bank, payment by industries could reduce the cost differential.

Water planning assumptions may change in the future, and reclamation may become more favorable. As shown in Figure 5-1, evaluation of nonpotable reclamation is scheduled to coincide with the first review of the Water Supply Study.

Evaluate Potable Reclamation Options

Because of current constraints and slowly changing public perceptions of potable reuse, a 2020 target date has been selected for its potential implementation.

Public acceptance of potable reuse will only be obtained if all other potential sources of water have been allocated for other uses. Given the planning assumptions used today, sufficient water can be acquired without implementing potable reuse in the study area. Therefore, this incentive is not projected for the future. Nevertheless, given the variable nature of the planning assumptions, potable reuse should not be removed from the long-term water supply picture.

Investigate Long-Term Transfers as Backup

The "no injury" rule may not be answered to the satisfaction of the SWRCB, which could limit internal transfers. If this occurs, long-term transfers from outside the county should be considered. Five sources of water were identified in the FWSS for potential long-term transfer. Discussions with these agencies would be necessary to determine the feasibility and terms of a long-term water transfer.

Select Treatment Option

Five water treatment options, associated component costs, and implementation strategies are provided to ECWMA members to help them determine the best treatment option for their service areas.

Evaluate Results of Treatment Options

ECWMA members should evaluate the benefits of each treatment option for each agency and for the group. For instance, the cost per million gallons of treated water under each option, as presented in Chapter 3 , does not apply equally to all participants. Costs can be higher for certain participants than for others because of specific infrastructure connections. Individual agency costs can be determined from the detailed cost tables presented in Technical Memorandum No. 3.1.

Initiate Activities for New Treatment Plant(s)

Once a treatment option is selected, several actions should be initiated; some actions should be pursued simultaneously.

Organizational Structure

The organizational structure of the project proponents should be defined. This group needs to select an option, prepare a cost-sharing mechanism, and identify the required capacities for the raw water supply and the treatment and distribution systems. This action could be accomplished during JPA development.

Feasibility Study

Potential environmental, technical, economic, social, and other issues to be addressed in the environmental assessment must be identified and documented. For new facilities, preliminary design criteria, location(s) of the raw water supply system, location of the treatment plant, and preliminary alignment of treated water supply lines must be selected, and a preliminary cost must be estimated. This study will identify connection points for supplying treated water to participating agencies' water distribution systems. More site-specific information will be provided by this feasibility study than by the Phase II study; this site-specific information is needed to adequately define permitting requirements, environmental impacts, and necessary mitigation strategies.

Water Allocation/Diversion

If a selected option needs approval from the SWRCB, the application and supporting documents must be submitted to the SWRCB early in the process because the SWRCB approval process can be lengthy.

Environmental Impact Report (EIR)

An EIR for the proposed option must be prepared to meet CEQA requirements.

Financing Plan

A financing plan must be prepared to analyze funding and financing alternatives, revenue requirements, and modifications to water rates and charges and to identify funding sources.

Environmental Permitting

Approvals or permits must be obtained from local, state, and federal agencies for water diversion, zoning, and land-use issues.

Funding

A bond consultant and bond counsel should be retained to prepare and implement proceedings to obtain project funding. A schedule should be established for City Council or water district meetings to amend water connection fees and charges as a way of providing revenue for debt repayment and to meet operational and maintenance costs.

Engineering Design

A professional engineering firm(s) should prepare preliminary and final design drawings/specifications/contract documents for raw water conveyance, treatment plant, and treated water supply facilities. To expedite design and construction, a Program Manager should be retained to coordinate the project. The Program Manager could be selected from ECWMA staff.

Award Construction Contract

It will be necessary to advertise bids for construction, review contractors' submittals, select a contractor, obtain bond and insurance documents from the contractor, and issue a notice to proceed.

Construction and Operation

A Construction Manager should be retained to facilitate facility construction. After initial startup, facilities should be turned over to operation and maintenance staff.

Perform Other Investigations/Activities

Evaluate Groundwater Resources/ Safe Yield Analysis

A comprehensive groundwater assessment of the study area should be performed. Depending on the level of effort ECWMA desires, a budget of $100,000 to $500,000 should be allocated to this activity.

Evaluate ASR Potential Near Randall-Bold WTP

A feasibility assessment and the conceptual design of an ASR program is recommended to determine the general feasibility of the ASR process at the specific aquifer under investigation. Depending on the level of effort ECWMA requests, a budget of $80,000 to $120,000 should be planned for the ASR assessment.

Tasks associated with a feasibility assessment include the following:

- Compile and review existing hydrologic data to develop a conceptual model of the potential area. Data for existing wells should be reviewed and inventoried to identify a well that could be used for ASR testing.
- Develop a conceptual model of the area that describes depth and thickness of aquifers, hydraulic conductivity, storage coefficients, continuity of aquitards, gradients, water chemistry, and projected well performance.
- Conduct fieldwork on existing wells including aquifer testing and spinner logging, water quality sampling, and filter testing.
- Develop operational scenarios for a demonstration test and full-scale operations. These scenarios would form the basis for conceptual numeric groundwater modeling.

- Perform preliminary groundwater modeling to obtain a better understanding of the movement and fate of injected water prior to ASR testing.
- Perform preliminary well and wellfield designs and prepare order-of-magnitude costs.
- Evaluate institutional and regulatory issues. Discussions with the appropriate regulatory agencies would be part of this work.
- Prepare a report that documents the results of the work.

Depending on the outcome of the feasibility level ASR study, a pilot ASR field study can be conducted; this can be followed by the development of an ASR program in the study area.

Update Water Supply Study

An update of the Water Supply Study is recommended every 5 years during the study period. This update should take approximately 1 year to perform. Depending on the level of effort requested by the ECWMA, a budget of $150,000 to $250,000 should be planned.

Chapter 6—References

Chapter 6—References

ABAG (Association of Bay Area Governments). 1994. Projection 94, and Digital Census Tract Data for Contra Costa County.

Black and Veatch. 1991. *Oakley Water District Master Water Plan, Update 1991*. Prepared for Oakley Water District. October.

Brown and Caldwell. 1991. *Water System Master Plan Update*. Prepared for City of Antioch. July.

Camp Dresser and McKee, Inc. 1992. *Antioch Satellite Wastewater Recycling Facility Development Plan (Draft)*. Prepared for Delta Diablo Sanitation District. February.

CH2M HILL. 1989. *Canal Facility Plan, Volumes 1 & 2*. Prepared for Contra Costa Water District. December.

CCWD (Contra Costa Water District). 1989. *Milepost at Structure Sites*.

_____. 1993. Los Vaqueros Project Final Environmental Impact Report/Environmental Impact Statement.

_____. 1994. *East County Water Supply Management Study, Phase I - Supply and Demand*. January.

_____. 1996. *Future Water Supply Study, Draft Report*.

CCWD and City of Brentwood. 1990. *City of Brentwood Water Supply Study*. October.

CCWD and USBR (U.S. Bureau of Reclamation). 1993. *Final Environmental Impact Report/Environmental Impact Statement for the Los Vaqueros Project, Contra Costa County, California*. September.

CESA (California Endangered Species Act). 1994. Memorandum of Understanding, Reference 9339.

DDSD (Delta Diablo Sanitation District). 1994. *Technical Memorandum on Iron and Manganese Removal, Discovery Bay Water Treatment*.

ECCID (East Contra Costa Irrigation District). 1994. *ECCID Strategic Plan, Base Document*. February.

Ellis, Gregory. 1994. *East Contra Costa Irrigation District Strategic Plan*. Prepared for East Contra Costa Irrigation District (Base Document). February.

Henneman, Kenneth, and David Keith Todd, Consulting Engineers, Inc. 1995. *Initial Groundwater Evaluation for the BBID/SD #19 Groundwater Management Program*. Prepared for Byron-Bethany Irrigation District,

Alameda County Flood Control and Water Conservation District, and Delta Diablo Sanitation District. February.

JMM (James M. Montgomery, Consulting Engineers). 1990. *Delta Diablo Sanitation District, Wastewater Reclamation Facilities Plan*. Prepared for Delta Diablo Sanitation District. December.

James M. Montgomery, Consulting Engineers and Black and Veatch. 1984. *Water Reclamation Study*. Prepared for Delta Diablo Sanitation District. June.

_____. 1989. *Preliminary Design Study, Joint Water Treatment Plant*. Prepared for Contra Costa Water District/Oakley Water District. January.

John Carollo Engineers. 1995. *Interim Water Supply Alternatives Study, Administrative Draft*. Prepared for City of Brentwood. February.

Luhdorff and Scalmanini, Consulting Engineers. 1990. *Master Plan for Water Supply and Water System Operation, Discovery Bay*. Prepared for The Hofmann Company. January.

_____. 1993. *Water Requirements and Supply, Discovery Bay West*. Prepared for The Hofmann Company. November.

Montgomery Watson. 1993. *DDSD/CCWD Industrial Water Recycling Project*. Prepared for Delta Diablo Sanitation District and Contra Costa Water District. May.

_____. 1996. *Seismic and Reliability Improvements Project*. Prepared for Contra Costa Water District.

NMFS (National Marine Fisheries Service). 1993. Los Vaqueros Project Biological Opinion for Winter-Run Chinook Salmon. March 18.

Oakley Water District. 1989. *The Urban Water Management Plan of Oakley Water District*. February.

_____. 1991. *Oakley Water District Water Shortage Contingency Plan*. Prepared for State of California, Department of Water Resources. November.

Pittsburg, City of. 1992. *City of Pittsburg Water Shortage Contingency Plan*. February.

SWRCB (State Water Resources Control Board), 1994. Decision No. 1629, Los Vaqueros Project of Contra Costa Water District and U.S. Bureau of Reclamation.

USFWS (U.S. Fish and Wildlife Service). 1993. Los Vaqueros Project Biological Opinion for Delta Smelt. September 24.

Appendix A
East County Phase II Study: Issues Matrix

APPENDIX A
East County Phase II Study : Issues Matrix

Agency	Short-Term (2000)	Mid-Term (2010)	Long-Term (2040)
Brentwood	Evaluate the use of available surface water, groundwater, and conservation to meet demands in addition to wheeling ECCID water through Randall-Bold and DWD's system. Look at the feasibility of forming a JPA for the construction and operation of a new far East County plant. Develop alternatives for serving Cowell.	Feasibility of using Randall-Bold or the staged construction of a new treatment facility to serve an expanding city, Cowell, Discovery Bay, Antioch, Pittsburg, and others.	Feasibility of using Randall-Bold compared to a new treatment facility in far East County. How can ECCID and BBID water be used in a cost-effective manner.
CCCSD #19 (Discovery Bay)	Feasibility of utilizing available surface water supplies to augment groundwater. Feasibility of utilizing Randall-Bold and/or participating in constructing another facility. Evaluate the use of existing groundwater and reclamation to serve anticipated increase in demands.	Feasibility of using Randall-Bold and/or participating in the staged construction of an East County treatment facility. How best to use ECCID and/or BBID water. Re-evaluate water rights issues in individual areas. Feasibility of groundwater recharge through reclamation. Safe yield of groundwater. East County policy regarding reclaimed water.	What water rights are available for a treatment facility located in East County.

Agency	Short-Term (2000)	Mid-Term (2010)	Long-Term (2040)
ECCID	In conjunction with the City of Brentwood, maximize use of ECCID-CCWD agreement to ensure beneficial use of water, surplus to the needs of agriculture, in ECCID's general service area as defined in 1981 contract with the Department of Water Resources; maximize the use of supplemental groundwater supplies in lieu of using surface water supplies.	In conjunction with the City of Brentwood, maximize use of ECCID-CCWD agreement to ensure beneficial use of water, surplus to the needs of agriculture, in ECCID's general service area as defined in 1981 contract with the Department of Water Resources; maximize the use of supplemental groundwater supplies in lieu of using surface water supplies; explore and begin implementing multiple-agency strategies to reflect changing patterns of demand as well as new institutional and environmental realities.	Implement multiple-agency strategies to ensure on-going supplies of irrigation water for reduced agricultural demand, as well as increased municipal and industrial demand, in ECCID's general service area as defined in 1981 contract with the Department of Water Resources.
BBID	Provide surface water to meet critical or immediate needs to the City of Brentwood, Cowell, and the Discovery Bay area. Develop a water exchange arrangement among water agencies in the East County area.	Feasibility of utilizing Los Vaqueros Old River intake conveyance and/or storage facilities to deliver BBID water to Randall-Bold for delivery to an expanding Cowell, Brentwood, Byron, Discovery Bay, or other East County entities.	Evaluate the feasibility of constructing a new far East County plant, possibly at the BBID North Intake, once capacity at Randall-Bold is exceeded, and send treated water to far East County through a regional agency.
CCWD	Would like to see cost comparisons of new treatment facilities in far East County versus use of Randall-Bold.	Same as short-term. Feasibility of using and/or expanding CCWD facilities to serve the same area as a regional facility for delivery of water to Cowell, Brentwood, etc.	Recognizes in Phase I study that additional treatment will need to be built. Evaluate the expansion of Randall-Bold beyond 80 mgd.

APPENDIX A
East County Phase II Study : Issues Matrix

Agency	Short-Term (2000)	Mid-Term (2010)	Long-Term (2040)
ISD	What can be done with ISD's reclaimed water. Look at cost for large diameter, short pipes with small laterals to serve areas near plant. What are uses.	Extend the large diameter mains that serve areas south and east of Oakley.	Utilize wastewater to its fullest extent possible. What is the geographic boundary for the ultimate reclaimed water that will be available.
DDSD	What does CCWD future water supply study foresee as use of DDSD's reclaimed water. Costs for delivery.	Look at applicable uses of reclaimed water for golf courses in south Antioch and Cowell.	What is the ultimate use for 7.5 to 9 mgd of reclaimed water that DDSD has.
Antioch	Knows the cost for going from 24 to 32 mgd. What cost to tie into Randall-Bold.	How does use of Randall-Bold compare with the City's estimates for expanding its plant beyond 32 mgd. Where will reliable supply of water come from.	Would like to see costs associated with using Randall-Bold at buildout versus using capacity in a new East County plant for buildout. Where will reliable supply of water come from.
Pittsburg		Wants most cost-effective source of high quality raw water.	Wants most cost-effective source of high quality raw water. Has treatment plant capacity for the mid- and long-term.

Agency	Short-Term (2000)	Mid-Term (2010)	Long-Term (2040)
Contra Costa County Water Agency	Need assurance that water is available from a supply and infrastructure perspective for current residents and businesses, and for future growth as outlined in the County General Plan. Consideration of potential for surface water as backup to groundwater, and emergency inter-ties, as necessary. Address legal and institutional issues. Additional information related to groundwater availability, reasonable yield in Discovery Bay area.	Reasonable, reliable yield established for areas served by groundwater. Consideration of potential for surface water as backup to groundwater, and emergency inter-ties, as necessary. Work toward solution of legal and institutional issues to enable supply and infrastructure opportunity. Evaluation of current, future water quality issues.	Legal, institutional, infrastructural arrange-ments made to insure adequate supply for the East County area. Assurance of water availability, from supply and infrastructure perspective.
DWD		What would be cost benefits in purchasing water from a new East County treatment facility as opposed to buying additional capacity in Randall-Bold. Need firm water supplies available to serve water from Randall-Bold. Would like to purchase water directly from ECCID through a groundwater exchange.	What would be cost benefits in purchasing water from a new East County treatment facility as opposed to buying additional capacity in Randall-Bold. Need firm water supplies available to serve water from Randall-Bold. Would like to purchase water directly from ECCID through a groundwater exchange.

Appendix B
Summary of Applicable Reports Used for Phase II Study

Appendix B
Summary of Applicable Reports Used for Phase II Study

Name of Report	Prepared by	Prepared for	Report Summary
Milepost at Structure Sites, Contra Costa Water District, 1989	Contra Costa Water District	Contra Costa Water District	Provided a detailed description of various structural elements of the Contra Costa Canal from Rock Slough intake to Martinez Reservoir (47.77 miles).
Canal Facility Plan, Volumes 1 & 2, December 1989	CH2M HILL	Contra Costa Water District	Provided a brief assessment of the major issues related to the canal system's operations; updated mapping of the canal facilities, right-of-way, and adjacent lands; assessed potential problems from seismic and other geographical conditions in or near the canal right-of-way.
Contra Costa Water District/Oakley Water District, Preliminary Design Study, Joint Water Treatment Plant, January 1989	James M. Montgomery Consulting Engineers & Black and Veatch	Contra Costa Water District & Oakley Water District	Compared the cost of individual treatment plants vs. a joint treatment for the two water districts. Concluded that construction of a joint WTP near the Neroly meets the needs of each district. Developed preliminary design criteria and a facility lay out for the proposed WTP with an initial capacity of 40 mgd and an ultimate capacity of 80 mgd.
The Urban Water Management Plan of Oakley Water District, February 1989	Oakley Water District (now Diablo Water District)	Oakley Water District (now Diablo Water District)	An Urban Water Management plan was prepared and adopted by the Diablo Water District pursuant to the Urban Water Management Planning Act (California Water Code, Section 10610 et seq). This plan identified measures to achieve water conservation and efficient use of water resources.
Master Plan for Water Supply and Water System Operation, Discovery Bay, January 1990	Luhdorff and Scalmanini Consulting Engineers	The Hofmann Company	Estimated a maximum day demand of 8.8 mgd (including fire flow) at the build out of Discovery Bay (3700 equivalent dwelling units). Recommended the preparation of a groundwater management program to investigate the reliability of the water system and potential groundwater quality degradation. Suggested that a site for the sixth well should be selected for construction of a backup or replacement well. Also, recommended modifications or improvements to the pump station and distribution system.
City of Brentwood Water Supply Study, October 1990	City of Brentwood & Contra Costa Water District	City of Brentwood & Contra Costa Water District	Evaluated alternative sources of water supply to meet Brentwood's treated water demand of 13 to 14 mgd in 2020; Recommended to utilize the groundwater resource up to the point where the sustained yield of the system was matched or water quality considerations precluded further development of new groundwater sources. To augment local supplies, it was recommended to obtain treated water from the Randall-Bold WTP and wheel it through the Oakley Water District system to the City of Brentwood. Over time, a new pipeline connecting the Randall-Bold and the City of Brentwood will be constructed.

Appendix B
Summary of Applicable Reports Used for Phase II Study

Name of Report	Prepared by	Prepared for	Report Summary
Delta Diablo Sanitation District, Wastewater Reclamation Facilities Plan, December 1990	James M. Montgomery Consulting Engineers	Delta Diablo Sanitation District	Evaluated the potential to supply reclaimed water to USS/POSCO (5.8 mgd) and Dow Chemical (0.3 mgd). Estimated cost ranged from $190 to $650 per acre-foot in 1992 dollars. This cost was compared with raw water supply cost of $500 per acre-foot. Due to insufficient data about user's water quality needs, specific recommendation for the overall reclamation project was not identified.
City of Antioch, Water System Master Plan Update, July 1991	Brown and Caldwell	City of Antioch	Identified required facilities for water supply through the year 2030; Projected a population 114,000 in 2010 and 154,000 in 2030; Projected a maximum day demand of 51 mgd in 2030; Recommended using San Joaquin River water as much as possible (subject to water quality) and depend on the Contra Costa Canal for the remaining periods; Prior to building new facilities to meet additional demand, it was recommended to obtain treated water supply costs from the Contra Costa Water District to decide whether to 'build' or 'buy'.
Master Water Plan, Update 1991, Oakley Water District, October 1991	Black and Veatch	Oakley Water District (now Diablo Water District)	Master Plan updated various land use planning since 1985 and projected a population of 40,000 within the sphere of influence of Diablo Water District; projected ultimate average day water demand of 3.9 mgd for Bethel Island/Hotchkiss Tract; recommended a transition plan to obtain treated water from the Randall-Bold WTP.
Oakley Water District, Water Shortage Contingency Plan, November 1991	Oakley Water District (now Diablo Water District)	State of California, Department of Water Resources	This plan was an amendment of the Urban Water Management Plan of Oakley Water District dated February 22, 1989. This was prepared and adopted in compliance with section 10621 (a) of the California Water Code. Developed drought emergency regulations restricting the quantity and use of water supplied by the district to its customers.
City of Pittsburg Water Shortage Contingency Plan, February 1992	City of Pittsburg	City of Pittsburg	Prepared short-term water management practices required during a drought to comply with State Assembly Bill No. 11 which required water purveyors to develop a water shortage contingency plan. In case of water shortage, four stages of action, ranging from 10 percent voluntary reduction to 35 to 50 percent mandatory restriction of water use have been identified.
Antioch Satellite Wastewater Recycling Facility Development Plan, February 1992 (Draft)	Camp Dresser and McKee, Inc.	Delta Diablo Sanitation District	Presented a preliminary assessment of reclaimed water demand for landscape irrigation in the City of Antioch. Also, assessed the feasibility of locating a satellite treatment and distribution system in areas such as East Antioch and Lone Tree Valley.
DDSD/CCWD Industrial	Montgomery Watson	Delta Diablo Sanitation	Evaluated treatment alternatives to provide (2.5 mgd) high quality recycled water

Appendix B
Summary of Applicable Reports Used for Phase II Study

Name of Report	Prepared by	Prepared for	Report Summary
Water Recycling Project, May 1993		District & Contra Costa Water District	from DDSD's secondary effluent for industrial use. Four variations of Reverse Osmosis (RO) treatment system were evaluated such as Lime Precipitation/RO, Direct Filtration/RO, Ferric Precipitation/RO and Microfiltration/RO. Microfiltration/RO process was recommended with an estimated total recycled water unit cost of $1,250/acre-ft.
Final Environmental Impact Report/Environmental Impact Statement for the Los Vaqueros Project, Contra Costa County, California, September 1993	Lead Agencies include Contra Costa Water District and Bureau of Reclamation	(To comply with the California Environmental Quality Act and the National Environmental Policy Act)	Analyzed the impacts of the proposed 10,000 acre-feet (Los Vaqueros) reservoir within the Kellog Creek watershed in the Contra Costa County including new supplemental Delta intake location, pumping and conveyance facilities. The purposes of Los Vaqueros project include water quality improvements and emergency water supply reliability.
Water Requirements and Supply, Discovery Bay West, November 1993	Luhdorff and Scalmanini Consulting Engineers	The Hofmann Company	Developed a maximum day water demand of 10.8 mgd (including fire flow) for the build out projection of Discovery Bay and Discovery Bay West (total 5700 equivalent dwelling units). Recommended 3 or 4 additional groundwater wells to meet the ultimate demand.
East County Water Supply Management Study, Phase I - Supply and Demand, January 1994	Contra Costa Water District	Contra Costa Water District	Identified water demands from 1990 to 2050 and potential water supplies for East Contra Costa County; prepared an outline of institutional options to match supply with future demand; suggested appropriate interim measures to facilitate development of future water systems for the communities of Antioch, Brentwood, Pittsburg, Byron, Oakley, Discovery Bay, Bay Point, Bethel Island and rural East County.
East Contra Costa Irrigation District Strategic Plan (Base Document), February 1994	Gregory Ellis	East Contra Costa Irrigation District	Described the historic and present status of the ECCID and provided a basic explanatory framework on which future policy decisions and specific plans can be made.
City of Brentwood, Interim Water Supply Alternatives Study, Administrative Draft, February 1995	John Carollo Engineers	City of Brentwood	Evaluated short-term and long-term water supply needs; projected a maximum day demand of 10 mgd in 2003; recommended that the City of Brentwood obtain treated water from Contra Costa Water District and Oakley Water District to meet its interim water demand.

Appendix B
Summary of Applicable Reports Used for Phase II Study

Name of Report	Prepared by	Prepared for	Report Summary
Initial Groundwater Evaluation for the BBID/SD #19 Groundwater Management Program, February 1995	Kenneth Henneman, Water Resources Consultant in association with David Keith Todd, Consulting Engineers, Inc.	Byron-Bethany Irrigation District in cooperation with Alameda County Flood Control and Water Conservation District, and Delta Diablo Sanitation District	Evaluated whether significant groundwater resource is available in the Kellog Creek, Brushy Creek and Mountain House Creek areas. Concluded that there is significant groundwater resource in the Kellog Creek area and recommended preparation of a groundwater management plan meeting the Water Code Division 6 (also known as AB 3030) .
Seismic and Reliability Improvements Project, 1996	Montgomery Watson	Contra Costa Water District	Identified a combination of capital and operational improvements that would allow the CCWD to provide reliable service to present and future raw and treated water customers in the most cost-effective and environmentally responsive manner.
Future Water Supply Study, August 1996	EDAW, Inc.	Contra Costa Water District	Developed a comprehensive analysis of future water needs in north-central and eastern Conta Costa County and evaluated alternatives to meet these needs through the year 2040.