

**Appendix F. Recycled Water Feasibility Study –  
Executive Summary**

## **Executive Summary**

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### **ES.1 Background**

Redwood City (the City) is 100% reliant on one source of potable water supply, the San Francisco Hetch Hetchy regional water system. Currently, the City is consuming approximately 1,000 acre-feet per year (AF/yr) over the contractual (wholesale) supply assurance of 12,243 AF/yr. The Redwood City Water Use Forecast for 2000 to 2020, dated June 20, 2002 (prepared by John Whitcomb, PhD), includes water supply projections associated with future housing, employment, and population, etc. The Water Use Forecast explores future water supply scenarios including the “worst case” scenario that excludes any water conservation and a scenario that takes into account passive water conservation. The potential water supply savings associated with an active water conservation scenario are addressed in the City’s Urban Water Management Plan. Based on these forecasts and planning, the City will need additional water supplies to meet both current and future needs.

The City has four options to reduce current demands on the Hetch Hetchy supply, in order to comply with the supply assurance and provide supply for future growth:

1. Negotiate water transfers from other agencies that use the Hetch Hetchy regional system
2. Negotiate a new source of potable water supply via the regional system (“wheeling”)
3. Implement water conservation measures
4. Implement a water recycling program for landscape irrigation and industrial uses

This study builds upon the joint recycled water pilot project being operated in Redwood Shores by the South Bayside System Authority (SBSA) and the City, and on the Water Recycling Feasibility Study for the Redwood Shores Area (Kennedy/Jenks Consultants, January 22, 2002).

### **ES.2 Market Assessment**

Three geographical areas within the City were reviewed relative to providing a new market for recycled water use. The areas generally include Redwood Shores, the “Greater Bayfront Area” and Central Redwood City. Potential recycled water uses are primarily for landscape irrigation in Redwood Shores and Central Redwood City. Some industrial uses, and potential for internal uses such as toilet flushing, exist primarily in the Greater Bayfront area and, to a lesser extent, Central Redwood City.

To facilitate subsequent evaluations in this report, the potential customers were grouped into four classifications:

#### Priority 1 Customers:

- Existing First Step Project customers (dedicated landscape irrigation meters)
- Customers with agreements in place for service
- Potential customers or groups of customers that have relatively large irrigation or industrial demands, and are adjacent to potential transmission pipeline corridors

#### Priority 2 Customers:

- Potential customers or groups of customers that have small to medium-sized demands, and are adjacent to or relatively near potential transmission pipeline corridors

#### Priority 3 Customers:

- Potential customers or groups of customers with relatively small demands, that are either remote from potential transmission pipeline corridors, or may have higher customer site retrofit costs
- Proposed future developments or re-development sites, or existing customer sites that are served by private wells or the California Water Service Company

#### Priority 4 Customers:

- Landscaped sites that are not presently irrigated or other uses that have very low demands
- Sites that are very remote from potential transmission pipeline corridors, require significant additional pumping because of site elevation, or appear to have very challenging/expensive customer site retrofit costs

Priority 1 and 2 customers represent the most viable customers that are ready to be served, if the City implements a mandatory use ordinance or obtains individual agreements for service. The annual recycled water demand from Priority 1 and 2 customers represents the most reasonable minimum estimate of potential “new water supply” for integrated water supply planning. Some portion of Priority 3 customer demands appear able to be cost-effectively served, however, service in many cases is dependent upon establishing institutional agreements to replace a current water supplier or future development or redevelopment activities. Priority 4 customers do not appear viable for a number of reasons. Although they were considered initially, their demands do not appear to be a source of “new water supply” for the City.

The potential recycled water demand for Priority 1, 2, and 3 customers in Redwood City appears to range between about 1,100 and 3,172 acre feet per year (AF/yr), for a Redwood Shores only project and a City-wide project, respectively. Within these projections, about 582 AF/yr is for future developments or redevelopment projects that are in various stages of planning.

### **ES.3 Alternatives Development and Evaluation**

Eight preliminary alternatives were developed for hydraulic analysis. The eight alternatives encompass a full range of possible system configurations, so different levels of service to the three geographical areas and customer priority levels could be investigated. In addition, both centralized and decentralized storage and pumping options were included to investigate the cost-effectiveness of different system configurations. The alternatives ranged from small systems (Priority 1 and 2 customers in Redwood Shores only) to City-wide systems (Priority 1, 2, and 3 customers in all three geographical areas) providing a range of new water supply from just over 1,100 AF/yr up to approximately 3,172 AF/yr.

Preliminary estimates of capital costs and cost effectiveness (cost per acre-foot of water delivered) were developed for the eight preliminary alternatives based on pipeline sizes and lengths, storage and pumping capacity, treatment costs, and standby connections. The conclusions drawn from the preliminary alternatives analysis are as follows:

- The cost effectiveness of City-wide alternatives that serve only Priority 1 and 2 customers tends to be much lower than for alternatives that include Priority 3 customers. When the Priority 3 customers are added to City-wide distribution systems, the cost-effectiveness increases by about 35%. This is because Priority 3 customers make up a large percentage of total potential recycled water demand outside the Redwood Shores, and the transmission pipeline system becomes more cost-efficient when the Priority 3 customer demands are included.
- Preliminary alternatives with centralized storage and pumping at SBSA are more cost effective than the alternatives with decentralized storage and pumping. The cost required for decentralized pump stations is greater than the cost savings realized by reduced pipeline sizes in the transmission system.
- In an attempt to improve cost-effectiveness of a City-wide project while maintaining a substantial recycled water supply, fine-tuning was performed by eliminating distribution pipelines to customers that appeared to be relatively expensive on a cost per AF/yr delivered basis. A slight improvement in cost effectiveness was realized in this fine-tuning.

Based on the results of the preliminary alternatives evaluation, final alternatives were developed to meet the range of the City's projected water supply needs, while providing the best value and preserving flexibility for future system growth and expansion. All of the final alternatives included some level of service to Priority 3 customers. The four Final Alternatives A through D are summarized in Figures ES-1 through ES-4. To preserve flexibility for future expansion of the recycled water system, the transmission pipelines are sized under each final alternative to serve all of the Priority 1, 2, and 3 customers in each of the three geographical areas (as in Alternative B).

### **ES.4 Recommended Project**

Based on an evaluation of cost-effectiveness, water supply, and future flexibility considerations, Project Alternative D is recommended to the City for use in project planning and implementation, determining a financing strategy, and in developing an initial rate and revenue

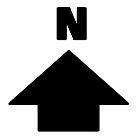
plan. Refer to Figure ES-1 for a schematic plan of Alternative D. The primary reason for recommending Alternative D is that it is the most cost-effective project configuration that provides an adequate water supply (1,955 AF/yr) to:

1. Reduce existing demands on the San Francisco Hetch Hetchy regional water system to be within the City's contractual supply assurance.
2. Provide a source of future water supply for potential new developments within the City.

Alternative D also provides significant flexibility for the future, so the City can continue to explore the benefits of additional water conservation measures, overall water supply reliability and drought tolerance issues, water transfers and other water supply management options. If the City requires additional recycled water supply in the future, the pipelines provided under Alternative D are oversized to allow the system to expand across Bayshore Highway 101 into Central Redwood City for a City-wide project (3,172 AF/yr as in Alternative B). The system could also support expansion into adjacent communities to meet future needs if the City were to negotiate agreements for transmission of water from SBSA to other retail water suppliers.

Additional benefits and considerations associated with recommending Alternative D are included in Section 5 of this report.

The total estimate of probable capital cost, including facilities construction, service connections and site retrofits, engineering, construction management, administration and a 20% project contingency is approximately \$36,819,000. The portion of this cost associated with providing oversized pipelines for future flexibility is approximately \$4,891,000. Alternative D capital costs are summarized in Table ES-1.



SBSA TREATMENT, STORAGE,  
AND PUMPING

MOST COST-EFFECTIVE  
PROJECT

SUPPLY: 1,955 AF/YR

BELMONT  
SPORTS COMPLEX

RMC PACIFIC

PACIFIC SHORES

HIGHWAY 101

CALTRANS

STAFFORD PARK

LIBRARY/  
CITY HALL

HOOVER  
ELEMENTARY

TAFT ELEMENTARY

RED  
MORTON  
PARK

PALM PARK

MENLO COUNTRY CLUB/  
WOODSIDE HIGH SCHOOL

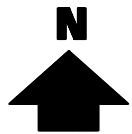
Kennedy/Jenks Consultants

City of Redwood City  
Water Recycling Feasibility Study

**Recycled Water Distribution System  
Recommended Project-Alternative D**

K/J Job No. 020506.03  
August 7, 2002

**Figure ES-1**

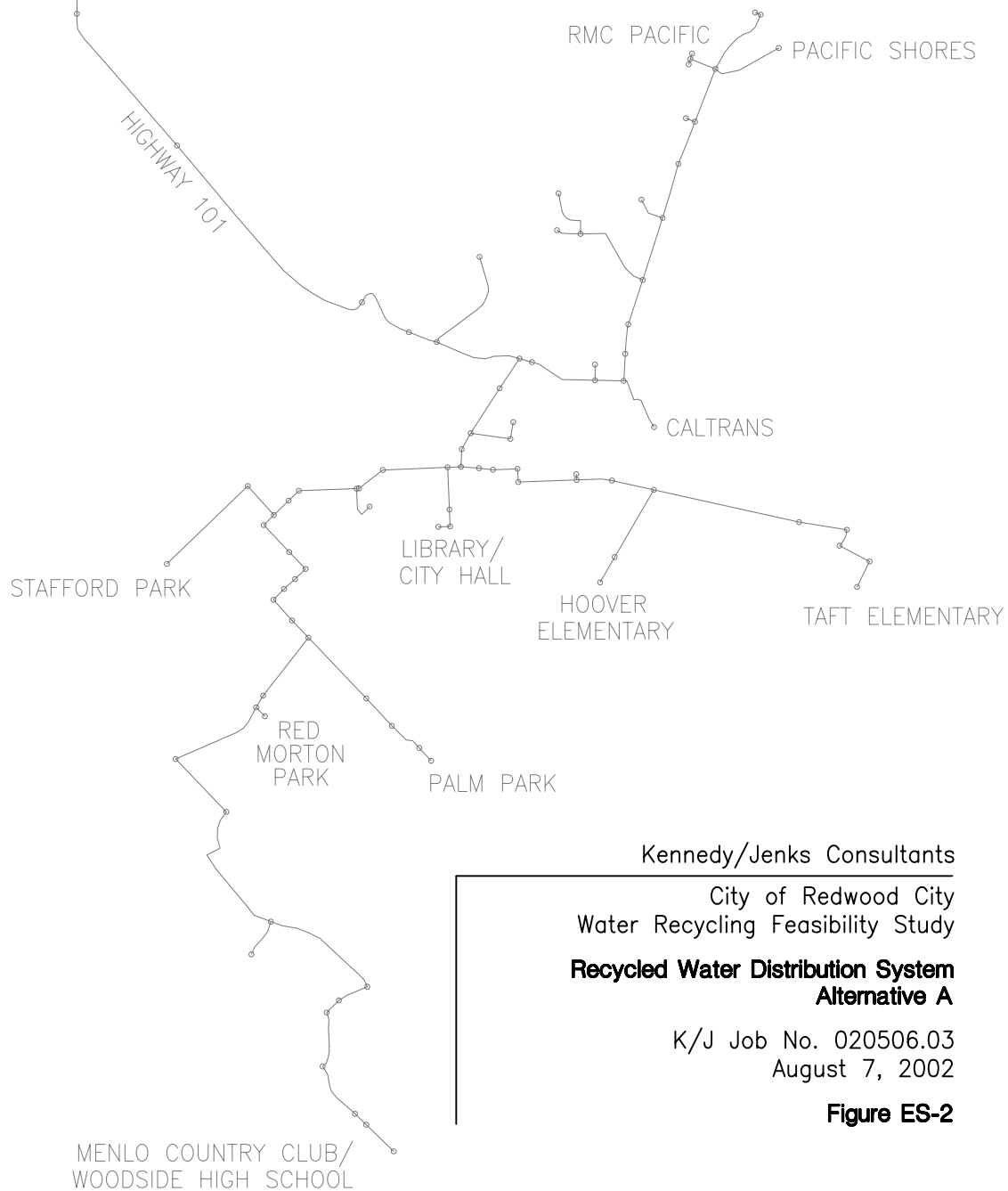


SBSA TREATMENT, STORAGE,  
AND PUMPING

BELMONT  
SPORTS COMPLEX

REDWOOD SHORES ONLY  
PROJECT, SERVING ALL  
PRIORITY 1, 2, AND 3  
CUSTOMERS

SUPPLY: 1,246 AF/YR



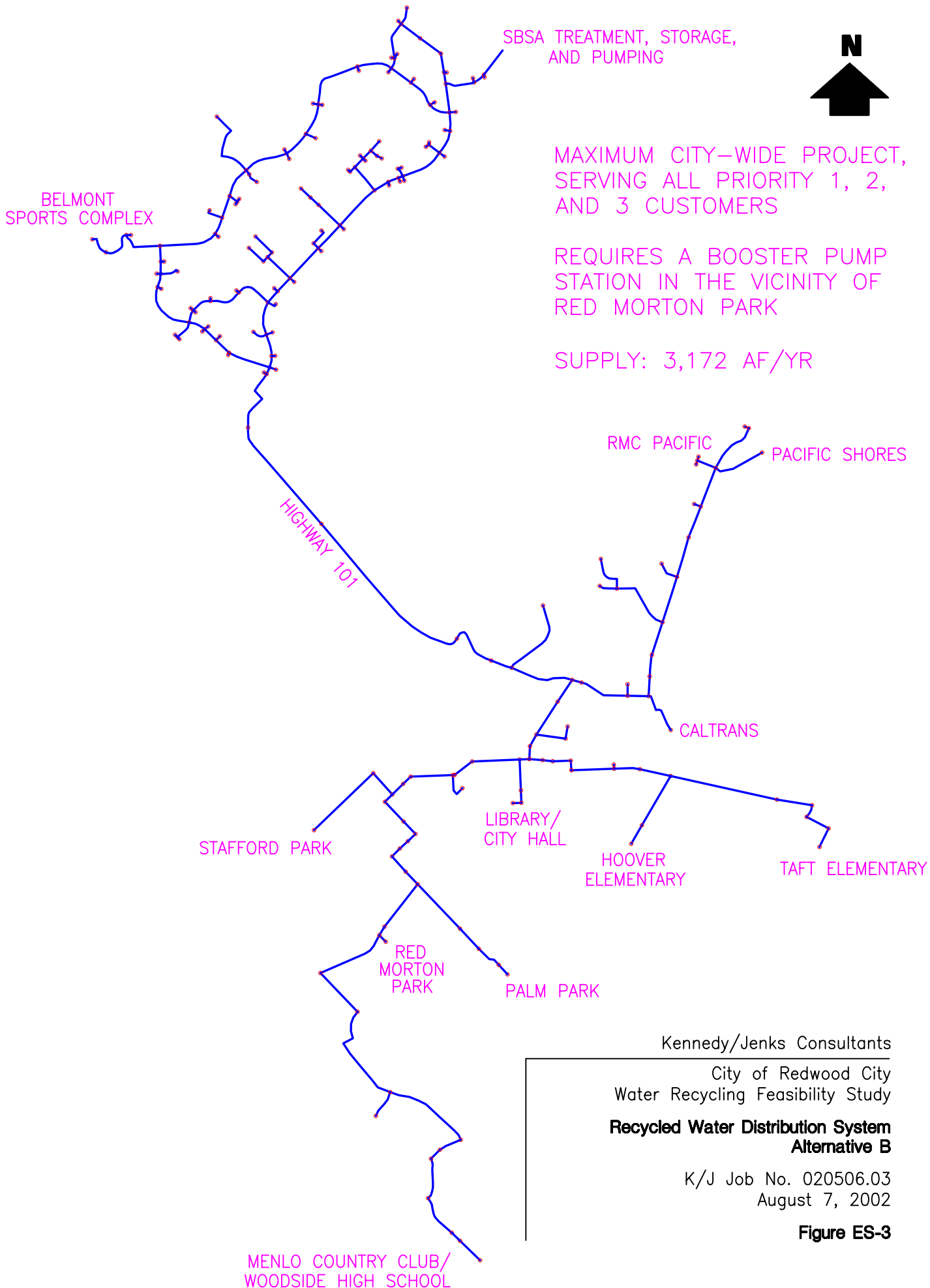
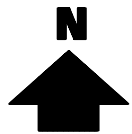
Kennedy/Jenks Consultants

City of Redwood City  
Water Recycling Feasibility Study

**Recycled Water Distribution System  
Alternative A**

K/J Job No. 020506.03  
August 7, 2002

**Figure ES-2**



MAXIMUM CITY-WIDE PROJECT,  
SERVING ALL PRIORITY 1, 2,  
AND 3 CUSTOMERS

REQUIRES A BOOSTER PUMP  
STATION IN THE VICINITY OF  
RED MORTON PARK

SUPPLY: 3,172 AF/YR

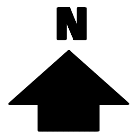
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City of Redwood City  
Water Recycling Feasibility Study

**Recycled Water Distribution System  
Alternative B**

K/J Job No. 020506.03  
August 7, 2002

**Figure ES-3**



SBSA TREATMENT, STORAGE,  
AND PUMPING

REDUCED CITY-WIDE PROJECT  
TO IMPROVE COST-  
EFFECTIVENESS

REQUIRES A BOOSTER PUMP  
STATION IN THE VICINITY OF  
RED MORTON PARK

SUPPLY: 2,580 AF/YR

BELMONT  
SPORTS COMPLEX

RMC PACIFIC

PACIFIC SHORES

HIGHWAY 101

CALTRANS

STAFFORD PARK

LIBRARY/  
CITY HALL

HOOVER  
ELEMENTARY

TAFT ELEMENTARY

RED  
MORTON  
PARK

PALM PARK

Kennedy/Jenks Consultants

City of Redwood City  
Water Recycling Feasibility Study

**Recycled Water Distribution System  
Alternative C**

K/J Job No. 020506.03  
August 7, 2002

**Figure ES-4**

MENLO COUNTRY CLUB/  
WOODSIDE HIGH SCHOOL

**Table ES-1: Recommended Project (Alternative D) Capital Cost Summary**

Item	Description	Cost
1	Storage and Standby Potable Connections	\$ 5,704,000
2	Pumping	\$ 1,320,000
3	Transmission Pipeline	\$ 15,248,000
4	Special Crossings by Jack and Bore	\$ -
5	Treatment Facilities	\$ 1,636,000
<b>Subtotal Facilities</b>		<b>\$ 23,908,000</b>
6	Service Connections and Retrofit (10% of Facilities Cost)	\$ 2,391,000
<b>Subtotal Facilities &amp; Connections</b>		<b>\$ 26,299,000</b>
Engineering, CM, and Administration (20%)		\$ 5,260,000
Contingency (20%)		\$ 5,260,000
<b>TOTAL</b>		<b>\$ 36,819,000</b>

## **ES.5 Implementation Strategy**

The basic implementation strategy for Alternative D water supply and capital improvement program is summarized in Table ES-2. The implementation concept is to simultaneously build backbone infrastructure facilities such as treatment, pumping, storage and transmission pipelines, while aggressively preparing in detail for customer connections and site retrofit. Based on the experiences of other Bay area projects, customer coordination and site retrofit requirements are typically underestimated, and actual recycled water use has fallen short of original projections.

The proposed project could be implemented in multiple phases. Treatment, storage, pumping, and pipeline transmission facilities to serve the Redwood Shores Area could be constructed in fiscal year (FY) 2003/2004, and customer services and site retrofits could be constructed over a three-year period between 2003 and 2006, so full supply benefits are obtained during the 2007 irrigation season. The Greater Bayfront Area project phase may be driven by future developer schedules, but it is tentatively planned that the 5-mile transmission line from SBSA to the Whipple Avenue/Highway 101 Interchange could be in place by the year 2006, while the entire Greater Bayfront Area could be served by 2009. In this scenario, the entire Alternative D project could be in place by 2009, which may be advantageous to the City as the Master Sales Agreement between San Francisco and suburban purchasers will be renegotiated in 2009/2010 (contract expiration).

**Table ES-2: Phased Implementation Capital Cost and Recycled Water Supply Summary**

Fiscal Year	Incremental Water Supply Added (AF/yr)		Total Water Supply (AF/yr) <sup>1</sup>	Capital Costs <sup>2</sup>		
	RWS	GBF		RWS	GBF	Cost
2002/2003	0.0	0.0	50.5	1/3 treatment 1/3 transmission 1/3 pumping & storage	1/2 Highway 101 Pipeline	\$ 763,000 \$ 4,103,000 \$ 3,266,200 \$ 1,120,000 <b>\$ 9,252,200</b>
2003/2004	32.3	0.0	82.8	2/3 treatment 2/3 transmission 2/3 pumping & storage 1/3 customer retrofit	1/2 Highway 101 Pipeline	\$ 1,527,000 \$ 8,206,000 \$ 6,532,400 \$ 1,030,000 \$ 1,120,000 <b>\$18,415,400</b>
2004/2005	409.2	0.0	492.0	1/3 customer retrofit		\$ 1,030,000 <b>\$ 1,030,000</b>
2005/2006	376.9	0.0	869.0	1/3 customer retrofit	1/2 transmission In-system standby connection 1/3 customer retrofit	\$ 1,030,000 \$ 3,399,000 \$ 35,000 \$ 86,000 <b>\$ 4,550,000</b>
2006/2007	376.9	236.4	1482.2		1/2 transmission 1/3 customer retrofit	\$ 3,399,000 \$ 86,000 <b>\$ 3,485,000</b>
2007/2008	0.0	236.4	1718.6		1/3 customer retrofit	\$ 86,000 <b>\$ 86,000</b>
2008/2009	0.0	236.4	1954.9			<b>\$ 0</b>
2009/2010	0.0	0.0	1954.9			<b>\$ 0</b>
2010/2011	0.0	0.0	1954.9			<b>\$ 0</b>

**GRAND TOTAL                      \$36,819,000**

**Note 1:** Water supply includes existing First Step customers

**Note 2:** Including treatment, storage, pumping, transmission piping, service laterals, site retrofit, engineering and construction services, administration, and 20% project contingency

Table ES-2 Abbreviations: RWS – Redwood Shores Area  
GBF – Greater Bayfront Area