CARMICHAEL WATER DISTRICT

District Master Plan 2003 -2103

September 9, 2003

Kennedy/Jenks Consultants

Engineers & Scientists

In association with *The Reed Group, Inc.*
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Carmichael Water District
Master Plan

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In Association with

The Reed Group, Inc.
Curtis Spencer, P.E.

Prepared for

Carmichael Water District
7837 Fair Oaks Boulevard
Carmichael, CA. 95608

K/J Project No. 022510.00

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A Water Forum Agreement
B 2000 Urban Water Management Plan—Water Projections
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Section 1: Executive Summary

1.1 Pre-Amble

This Master Plan was adopted in principle by the Carmichael Water District on May 19, 2003 and served as the foundation for implementing a five-year rate resolution (Resolution Number 05192003-2) reflecting a modified capital improvement schedule in the initial years of the Capital Improvement Plan presented in this document.

The modified capital improvement schedule included the following changes:

1. Fair Oaks Boulevard Project Pipeline Replacement Project design and construction is delayed up to 10 years. Adopted rate provides for possible borrowing to complete the project should the County of Sacramento resolve alignment and configuration alternatives and obtain additional funding needed to proceed with the work.

2. La Vista Reservoir rehabilitation project deferred to fiscal year 08-09 and 09-10. Rehabilitation may include removal and replacement of steel tank verses reconstruction of existing tank due to deferred maintenance.

The recommendations in this Master Plan range from specific to general and are based on the apparent conditions at the time the plan was adopted in principle on May 19, 2003. The rate resolution adopted June 23rd, 2003 continues moving the Carmichael Water District to an on-going pay-as-you-go capital replacement program addressing the long-term sustainability of a safe and reliable water supply. The recommendations of the Master Pan have not been revised from that version adopted in principle, other than to incorporated a discussion of the delay in the Fair Oaks Boulevard Pipeline Project and delay in proceeding with issuance of Certificates of Participation to fund near term CIP projects. No borrowing for CIP projects is anticipated.

The Master Plan is a guidance document and provides the best opinion of the combined team of consultants, District staff, and Board members who participated in drafting the document. As such, the document is considered a living document and will require the careful and deliberate implementation as conditions change. An example of this is the staff and Board debate and passage of a resolution establishing a rate level to support the modified capital improvement schedule described above, forgoing the commitment to debt financing pending the outcome of significant State and County transportation budget issues.

1.2 Introduction

The Carmichael Water District (District) has undertaken this District Master Plan (Master Plan) to document planning objectives addressing the long-term sustainability of District infrastructure while remaining committed to programs, such as meter retrofit, water conservation, and regional planning goals. The District is also committed to obtaining rate stability and addressing customer interests in rate control. This Master Plan defines the condition and replacement liability associated with District Infrastructure over the life of the facilities and has identified capital projects to address the District assets, some of which are at or beyond their useful life.

The Master Plan provides recommendations for infrastructure sustainability that have been incorporated into alternative schedules through a capital replacement plan. The capital replacement plan includes options with differing levels of rate impacts ranging from a large initial year increase to lesser multi-year increases. All alternatives reflect rate increases declining to a stable rate tied to inflation pressures more than project-related drivers over a period not exceeding 10 years.

Operator Plant Tour – Bajamont Water Treatment Plant

The Master Plan findings note that the District infrastructure liability still exceeds the revenue base necessary to replace assets as they wear out. Significant improvements have been completed with respect to water supply, transmission, and level of service; however, more work needs to be done. The remaining challenges include recognizing the buried infrastructure/production facilities life cycle costs, remaining committed to regional goals and metering, and positioning the District financially to be able to reach its objectives in an orderly fashion which can be supported by the District customers.

1.3 Scope of Master Plan

This Master Plan provides a holistic review of the District water supply production facilities, buried infrastructure, organization and practices, and historical planning efforts. In addition, this Master Plan includes a review of strategic water supply issues related to protecting the District resources for both Carmichael and possible regional benefits.

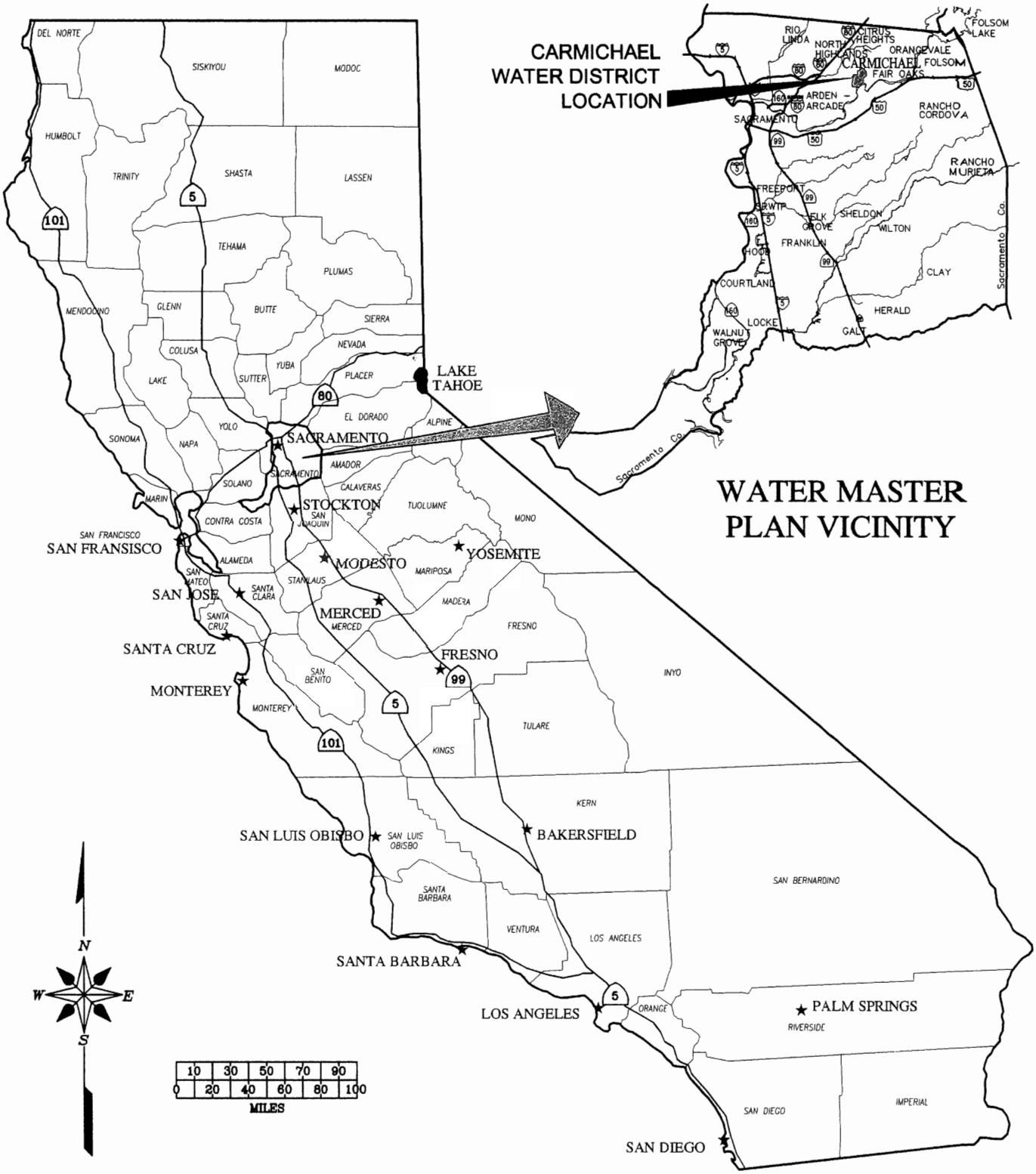
The work includes a financial business plan element addressing alternative approaches to meeting the capital demands on the rate payer and consideration of reserve fund policies to create benefits taking advantage of the time value of money. Life cycle analysis was used to estimate the long-range liabilities for financial planning and focused on the 100-year service life of the Districts standard pipe material, ductile iron.

1.3.1 Project Authorization

This Master Plan was prepared by Kennedy/Jenks Consultants, Inc. under agreement with the District, Task Order 15.

1.3.2 District Location

The District is located in unincorporated Sacramento County, California as shown in Figure 1-1. The District is adjacent to several adjoining water providers as shown in Figure 1-2.



Kennedy/Jenks Consultants

CARMICHAEL WATER DISTRICT
CARMICHAEL, CALIFORINA

CARMICHAEL WATER MASTER PLAN

VICINITY MAP
AUGUST 2002
FIGURE 1-1
K/J 022510.00

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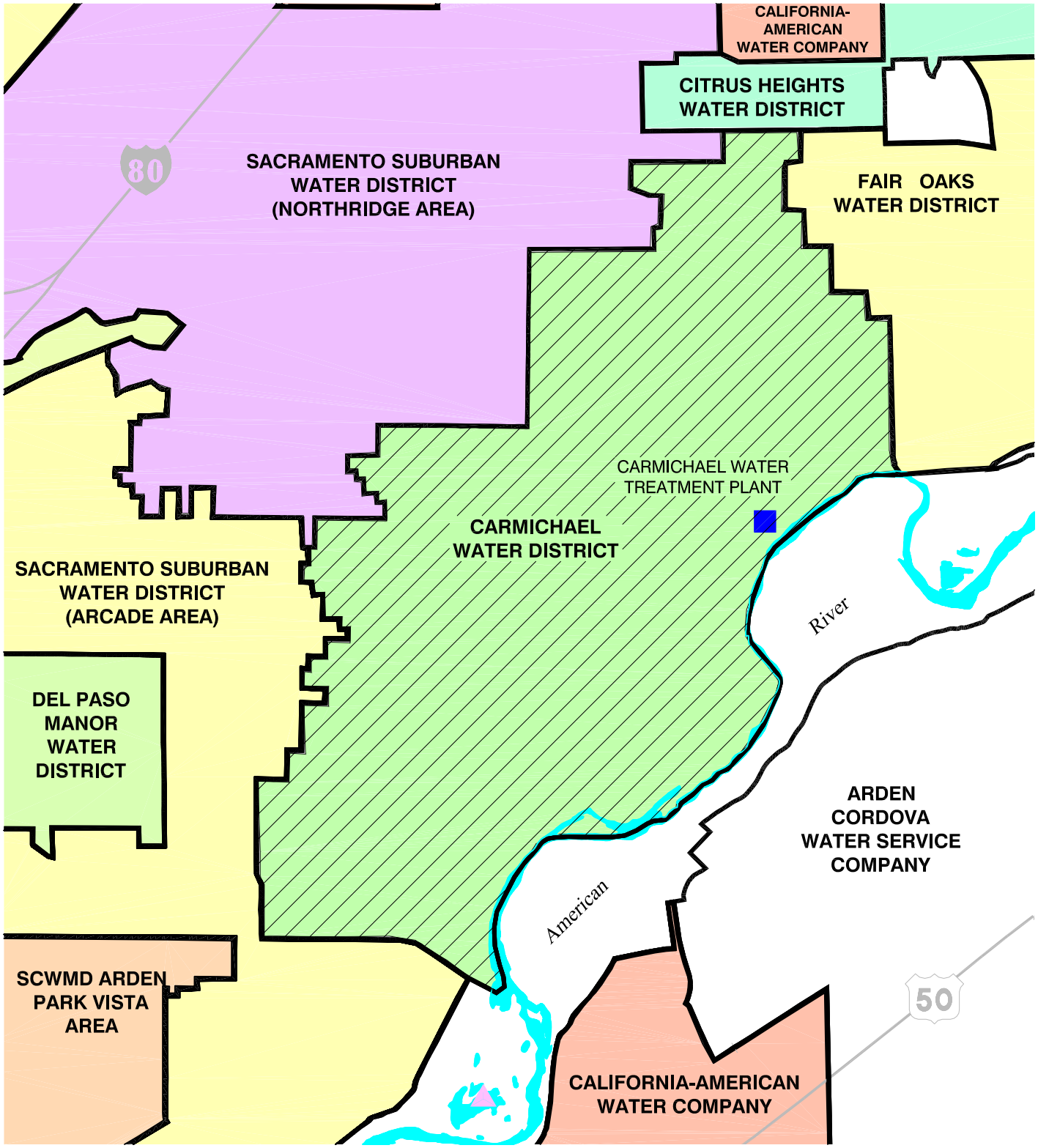

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Kennedy/Jenks Consultants

CARMICHAEL WATER DISTRICT
CARMICHAEL, CALIFORINA

CARMICHAEL WATER MASTER PLAN

ADJECENT WATER DISTRICTS

APRIL 2003

FIGURE 1-2

K/J 022510.00

1.3.3 Board Workshops

The District's Board of Directors appointed an ad-hoc committee tasked with participation in three ad-hoc workshops to provide an opportunity for the project team to present to the interim findings. The ad-hoc committee provides Board oversight as to progress and initial findings of the work. These workshops occurred at the critical milestones of the draft capital improvement plan, identification of strategic water issues, and draft financial plan.

Public Board Workshops followed each ad-hoc workshop to provide a comprehensive review of the developing issues, findings and draft recommendations to the Board and attending public. The workshops were structured to encourage discussion and interaction. The workshops were typically four hours in length and were held in the District Office Board Room.

1.3.4 Project Team

The Project Team consisted of three principal consultants, District Staff, and the ad-hoc committee as listed below:

Ad-Hoc Committee:

Paul Selsky – Division 5

Sanford Koslen – Division 1

District Staff:

LaNell Little – General Manager

Steve Nugent – Assistant General Manager

Consultants:

Alex Peterson, P.E., Project Manager (Kennedy/Jenks Consultants, Inc.)

Robert Reed, Financial/Rate Consultant (The Reed Group)

Curtis Spencer, P.E., Water Supply Consultant (Curtis Spencer)

1.4 Water Use and Demand Management

The District has completed Water Forum negotiations, participated in the Regional Water Master Plan, and produced the required California Department of Water Resources Urban Water Management Plans addressing water use and demand management objectives. This document restates those findings and action items.

The District is near buildout and growth is expected to be approximately 0.6% annually for the next 25 years. Water conservation and leak reduction through pipe replacement is expected to control increasing water demands due to growth and provides opportunity for demand reductions over time.

This Master Plan focuses on maintaining the existing production facilities necessary for a conjunctive water supply base using 15 to 20% groundwater and 80 to 85% surface water. This

objective provides for possible long-term regional benefits to the aquifer as well as providing a reliable supply for Carmichael.

1.5 Facilities Replacement Planning

Facilities replacement planning addresses both the water production facilities and the buried pipeline infrastructure.

1.5.1 Water Production Facilities

The water production facilities include District wells, steel reservoirs, booster pump stations, and surface water facilities. The Master Plan focuses on the replacement of aging facilities as needed to maintain the conjunctive goals of a combined surface water and groundwater supply.

The finds show that the surface water facilities are new or recently rehabilitated and in excellent shape. The wells however range for moderately new to beyond service life and in need of abandonment. The District has proceeded with abandonment of several of its older, low producing wells and appears to have solid remaining groundwater production capacity. The expected remaining service life of the existing wells ranges for less than 10 years to approximately 30 years.

The Master Plan provides recommendations for construction of replacement wells and assumes that by 2017 all new wells will require treatment for either groundwater contaminates or due to changed drinking water standards. Specific recommendations are provided in the body of the text.

Removal of Above Ground Portion of Ranney Collector in Progress *– photograph courtesy of Peggy Berry, District Resident*

1.5.2 Buried Pipeline Infrastructure

Significant projects have been completed in recent years by the District. As a result, the number of complaints has dramatically reduced through improved water quality and delivery pressure. The District has aggressively pursued replacement of the worst condition pipes and is experiencing a decline in emergency leak repair calls and water conservation benefits. However, the existing buried infrastructure (pipes and valves) includes very old steel mains that have exceed their useful life and should be replaced. In addition, the most common pipe material in the District is asbestos cement pipe (transite) and will begin reaching the end of its useful life within 20 years.

This Master Plan developed a Geographic Information System (GIS) database of the pipeline diameter and materials and based on assigned ages, a probable failure occurrence histogram for the various materials. A review of District leak history records confirmed the near term

occurrence of steel pipe failures as the primary problem and seventy-two projects were developed with specific pipe replacement plans produced. Each project plan includes a scaled drawing of the project limits and appurtenances such as fire hydrants and valves. The project plans were used to develop detailed cost estimates for the steel pipeline replacement effort.

Projects for replacement of asbestos cement pipelines and ultimately the PVC, concrete, and ductile iron (DI) mains were not produced. However, recommendations for an inspection and monitoring program coupled with development of a GIS database for tracking records were provided. This approach allows the District to address the near term demand to replace the failing steel pipes while collecting data and instituting possible mitigation programs to extend pipe life over the next 10 years. Replacement of all District pipelines was scheduled over the period 2003 to 2104 with replacement of all facilities.

1.6 Capital Improvement Plan

The master plan provides a Capital Improvement Plan (CIP) consolidating the recommendations for system wide replacement of all assets over a life cycle based on the District pipe material standard DI pipe. For the purposes of this plan, the assumed life cycle for DI pipe is 100 years. During that period many of the District assets will require replacement more than once, however, using the DI standard provided a basis for a holistic look at the largest District unknown: how to sustain the buried infrastructure in a planned and financially responsible manner.

American River Microtunnel Crossing – 48-inch Diameter Pipe *– photograph courtesy of Peggy Berry, District Resident*

Consideration of a 100 year CIP must be made with the idea that the farther into the future projects exist, the less specific and accurate will be schedule and costs. For this reason, this CIP is structured with three implementation periods as follows:

- 10-year CIP reflecting specific project recommendations and schedules with known locations and quantifiable features.
- 25-year CIP reflecting specific project recommendations and programmatic schedules for alternative project elements and locations.
- 100-year CIP reflecting programmatic impacts of major project elements requiring planned program development and financial positioning. Project elements, locations and schedules are conceptual.

The CIP includes elements for production facilities, buried infrastructure, operation and maintenance, and programmatic elements (storage fund, metering, vehicles). Expanding the CIP beyond a classical construction project based plan was done to support the Financial

Business Plan concept discussed in Section 8 where the CIP is modeled for rate impacts with development of fund and reserve policy recommendations. Multiple options for implementation of the CIP were developed and are discussed in detail in Section 8.

1.7 Strategic Water Issues

The Master Plan includes a review and summary of possible strategic water issues facing the community and the District. The strategic water issues can be presented in the form of strengths, weaknesses, opportunities, and threats as listed below. The strengths and weaknesses are primarily internal to the District, while opportunities and threats are more external in nature.

Strengths

- Excellent water rights on the American River
- Water Forum Agreement complete
- New treatment plant, modern facilities
- Productive, high quality groundwater basin
- Progressive, competent staff, board
- Participant in regional cooperation
- Ahead of the curve on treatment efficacy
- Conservation in place, metering underway

Weaknesses

- Lack of storage agreement for summer diversions in severe drought
- Deterding collector, Ancil Hoffman Park service unresolved
- Neighbor partnerships/interties limited
- Local groundwater pollution
- Some infrastructure is old and beyond its useful life

Opportunities

- Expansion of treatment plant to 22 mgd
- Renewal/licensing of water rights permit
- Joint project at Ancil Hoffman Park
- Expansion of water rights place of use: water rights for regional benefit
- Groundwater banking
- Partnering with neighbors on interties, other facilities

Threats

- Severe drought affecting American River diversions
- Pollutant plumes from Aerojet

- Competition for water statewide
- Flood damage risk in the American River

In summary, the Master Plan effort finds the District is in an enviable position within the region, possessing strong water resource assets and a proactive approach to meeting its many challenges. Specific recommendations and possible approaches to protecting supply issues are presented in the body of the text.

1.8 District Organization, Administration, and Data Management

The Master Plan summarizes the existing organizational structure of the District departments and a review of duties. Consideration of increasing effort required for meter reading, water conservation, and regulatory/water quality monitory were identified as duties that may require additional staff or contract labor.

Also included in this section is a discussion of the Districts recent development of GIS records and the Master Plan provide general recommendations to continue development of a user focused GIS system. The goal of the system would be to reduce redundant activities within the District with regard to document processing and report generation by providing greater access to information.

1.9 Financial Business Plan

The Financial Business Plan element combines the Capital Improvement Plan with the annual operation and maintenance costs to assess potential future rate impacts. The Financial Business Plan also reviews District fund and reserve policies and provides recommendations for creation of balances for supporting a “pay as you go” Capital Improvement Plan. The plan discusses advantages to debt financing for large or peak one time cost projects as a way to reduce rate volatility. Seven optional scenarios were developed with this Master Plan with regard to implementing the Capital Improvement Plan and presented to the Board in a two-session workshop.

1.9.1 Reserve and Fund Recommendations

It is recommended that the District establish and maintain several reserves to (1) minimize the adverse annual and multi-year impacts of anticipated and unanticipated District expenses and revenue fluctuations, (2) enhance the financial stability and improve security with respect to long-term financial obligations, and (3) improve long-term rate stability, while sustaining the District’s infrastructure in a cost-effective and forward-looking manner. The adequacy of target reserves and/or annual contributions should be reviewed annually during the budgeting process, and may be revised accordingly, as necessary.

Operating Reserve

1. Purpose: To ensure the District's Operating Fund maintains an adequate balance for working capital requirements, as well as unanticipated expenditures for operations, maintenance, or asset acquisition.

2. Target Amount: The District shall maintain a minimum operating reserve equal to 25% of budgeted operating and maintenance costs, excluding debt service.

3. Use of Funds: The District shall not adopt a budget that would result in an Operating Fund balance that is lower than the target minimum operating reserve. The Board of Directors shall approve use of funds that would result in an Operating Fund balance lower than the operating reserve target minimum, unless an emergency condition exists.

4. Contributions: The District's financial resources shall be allocated to the operating reserve after all other reserves are funded, as specified by District policy or Board action.

Rate Stabilization Fund

1. Purpose: To provide additional security in meeting debt service coverage requirements under the District's Installment Sale Agreement related to the 1999 COPs (and/or subsequent debt issue).

2. Target Amount: Resolution 6192000-1 authorized establishing a Rate Stabilization Fund of up to $500,000. In FY 01-02, the District contributed $150,000 into the fund. The District shall maintain money in the Rate Stabilization Fund until such time as the debt service coverage calculated for any fiscal year exceeds 1.75 and is not expected to fall below this level.

3. Use of Funds: Funds withdrawn from the Rate Stabilization Fund are available to the District for general purposes (added to Operating Fund), and the amount can be included in revenues for purposes of debt service coverage calculation.

4. Contributions: Contributions to the Rate Stabilization Fund can be made from any generally available funds. Amount contributed must be deducted from revenues for the year contributed for purposes of debt service coverage calculation.

Revenue Balancing Reserve

1. Purpose: To enhance financial stability when extraordinary changes in customer demand or specifically identified costs (e.g., electricity costs) exceed a pre-determined range or amount.

2. Target Amount: The amount, mechanism, and function of the revenue balancing reserve shall be evaluated in the future, once a majority of the District's customers pay for water service based on metered water rates.

3. Use of Funds: It is anticipated that funds in this reserve will be used to offset lost revenues or extraordinary costs subject to criteria to be determined in the future.

4. Contributions: It is anticipated that rate surcharges would apply to customer water bills to replenish the revenue balancing reserve subject to criteria to be determined in the future.

Installment Payment Account

1. Purpose: To accumulate money to be used for debt service payments. This account is maintained by a trustee.

2. Target Amount: Prior to each installment (debt service) payment date, the District shall deposit an amount such that the balance in the account is at least equal to the installment payment then due.

3. Use of Funds: Money deposited in the installment payment account shall only be used as specified in the Installment Sale Agreement.

4. Contributions: Contributions to the installment payment account shall be made from revenues or available funds that can be used for debt service payments.

Installment Payment Reserve Account

1. Purpose: To ensure there are adequate funds to make required installment (debt service) payments. This account is maintained by a trustee.

2. Target Amount: An amount equal to the reserve requirement shall be maintained in the Installment Payment Reserve Account, in accordance with provisions of the Installment Sale Agreement.

3. Use of Funds: In the event that money in the Installment Payment Account is insufficient to make a required installment payment, then funds in the Installment Payment Reserve Account shall be used for this purpose.

4. Contributions: The Installment Payment Reserve Account was funded with proceeds from the issuance of 1999 COPs.

Capital Replacement Reserve

1. Purpose: To provide funds in support of the District's ongoing capital replacement program, and to minimize or avoid the need for future long-term debt.

2. Target Amount: The District shall seek to maintain an amount in the Capital Replacement Reserve sufficient to cover annual capital replacement program costs, as scheduled, with consideration of annual contributions to the reserve.

3. Use of Funds: Funds in the Capital Replacement Reserve shall be used exclusively for capital replacement projects planned and approved by the District.

4. Contributions: The District shall establish an annual transfer of funds from the Operating Fund at a level sufficient to achieve the required target amount as identified in long-term

financial planning analyses. Water capital facility fee revenue shall also be deposited into the Capital Replacement Reserve.

Acquisition and Construction Account

1. Purpose: To account for future debt proceeds used to acquire and/or construct water system improvements as identified in any future Installment Sale Agreement or similar financing instrument.

2. Target Amount: Net debt proceeds shall be deposited into the account in accordance with the Installment Sale Agreement.

3. Use of Funds: Fund in this account shall only be used to acquire and/or construct the "project" as defined in the Installment Sale Agreement, or similar financing instrument.

4. Contributions: Net debt proceeds shall be deposited into the account in accordance with the Installment Sale Agreement.

Surface Water Storage Reserve

1. Purpose: To accumulate funds for the future acquisition of surface water storage capacity or stored surface water.

2. Target Amount: The District shall work to accumulate $1 million in the surface water storage reserve by FY 12-13.

3. Use of Funds: Funds shall be used, with the approval of the Board of Directors, to acquire, contract, or reserve surface water storage capacity or stored surface water for the purpose of providing dry year water supplies.

4. Contributions: The District shall transfer available funds into the surface water storage reserve in accordance with long-range financial plans, subject to meeting other reserve requirements, including maintaining the minimum operating reserve.

As noted previously, some of the reserves listed already exist, as they are required under the Installment Sale Agreement of the 1999 COPs. Others are recommended to help the District effectively manage the financial obligations of the capital replacement program and to help ensure financial stability and operational flexibility.

1.9.2 Capital Improvement Plan Implementation Recommendations

The recommendations adopted in principle by the District May 19,2003 proposed implementing Option No. 6 as presented in Section 8. Subsequent to adoption in principle, the apparent progress of the Sacramento County Fair Oaks Boulevard Road Widening Project became suspect due to rising right of way costs and a projected multi-million dollar project deficit. In response, the District re-evaluated the need to proceed with the Fair Oaks Pipeline and La Vista Project on the more aggressive schedule provided in Option No. 6.

The revised recommendations reflect Option No. 2 with the deletion of the Fair Oaks Pipeline. The near term project goals are as listed below.

- Meter retrofit program completed in 10 years, requiring about 600 retrofit meter installations per year.
- General pipeline replacement projects as scheduled, but at a level of lower than required over the long-term (pipeline replacement expenditures would increase over time).
- Contribute $200,000 per year to the surface water storage reserve from FY 08-09 through FY 12-13 in a graduated schedule.
- Other Master Plan projects, as scheduled.

1.9.3 Meter Installation Approach

The meter installation program has completed most non-residential installations leaving condominiums and single family residential to be metered. In order to efficiently and cost-effectively install retrofit meters, it is recommended that the District complete the following tasks:

- Incorporate water meter installations as part of all pipeline replacement projects.
- Dedicate meter retrofit crews to a planned, orderly approach to metering each street and each neighborhood. The process and sequencing should be determined by staff, with the following priorities:
  - Complete infill pockets in areas that are already partially metered. This will facilitate more efficient meter reading and limit questions such as “Why do I have a meter and my neighbor does not?”
  - Prioritize areas with known service line problems.
  - Consider contracting for areas known or believed to have uniform conditions likely to be metered quickly and efficiently (e.g., subdivision built by a single developer).
  - Focus District crews on difficult areas characterized by gradual infill development, non-uniform parcel size and shapes, well established landscapes, unknown site conditions, etc.
  - The last areas to be metered should be those with backyard water mains with limited access. The District may find, at that time, that radio read meters are warranted.
  - Continue efforts to provide meters to customers who voluntarily request them.

The installation of meters and conversion of meters at condominiums will require outreach and discussion with the impacted owners and homeowners associations. Alternatives approaches are discussed in Section 8.

1.9.4 Transition to Metered Rates

We recommend that the District implement metered water rates for residential customers in a two-step process. First, during the period of retrofit metering, the District should allow any residential customer to voluntarily switch to metered billing, and all new water service connections should immediately be placed on the metered water rate. Second, at the completion of the meter retrofit program, customers should be provided with water use data and comparative billing (flat rate vs. metered rate) information covering a 12-month period prior to mandatory conversion to metered water rates.

Section 2: Historical and Recent District Planning

"It is evident to all of you that if the water situation in the [Carmichael] Colonies goes on for but a few more seasons more than it has in the past, disaster will quickly overtake us, individually and collectively. We must have relief…"

– Fair Oaks Citizen newspaper, November 1, 1915

2.1 Carmichael Water District

The District planning objectives address the long-term sustainability of District infrastructure while remaining committed to programs, such as meter retrofit, water conservation, and regional planning goals. The District is also committed to obtaining rate stability and addressing customer interests in rate control. The District Master Plan is defining the condition and replacement liability associated with District Infrastructure over the life of the facilities and has identified capital projects to continue addressing the oldest District assets that are at or beyond their useful life.

Bajamont Membrane Filtration Process Equipment
– photograph courtesy of Peggy Berry, District Resident

The Master Planning recommendations for infrastructure sustainability have been incorporated into alternative schedules for implementing a capital replacement program. Each alternative reflects differing levels of rate impacts ranging from a large initial year increase to lesser multi-year increases. All alternatives reflect rate increases declining to a stable rate tied to inflation pressures more than project-related drivers over a period not exceeding 10 years.

The Master Plan findings note that the District infrastructure liability still exceeds the revenue base necessary to replace assets as they deteriorate. Significant improvements have been completed with respect to water supply, transmission, and level of service; however, more work needs to be done. The remaining challenges will include recognizing the buried infrastructure/production facilities life cycle costs, remaining committed to regional goals and metering, and positioning the District financially to be able to reach its objectives in an orderly fashion which can be supported by the District customers.

2.2 District Master Plan

The District has undertaken a District Master Plan (Master Plan) intended to encompass several aspects of District planning. The following is an abstract of the efforts undertaken by this Master Plan:

2.2.1 Historical Planning

This Master Plan provides a summary of the strategic planning efforts completed within the last 13 years and the District implemented recommendations of the 1990 Master Plan and responded to changing requirements for surface water treatment and regional resource planning. This summary provides a historical perspective to build upon with this 2003 Master Plan.

2.2.2 Water Use and Demand Management

Significant effort has been completed in the planning of the Bajamont Way Water Treatment Plant, through the Water Forum and Regional Water Master Plan processes, and in preparing the District Urban Water Management Plan. The District is near build-out and issues of conservation and resource sustainability are paramount. Key elements of the prior work are summarized in this Master Plan along with specific measures identified by the District for conservation through demand management.

2.2.3 Facilities Replacement Plan

Significant projects from 1998 to 2002 have resulted in positioning the District to be able to provide a reliable treated water supply for the foreseeable future using the Bajamont Water Treatment Plant and associated transmission mains. Hydraulic improvements within the District have balanced pressures and improved service. Remaining issues are the asset liability of maintaining an aging infrastructure primarily comprised of buried pipes.

The focus of this element of the Master Plan is on the condition, and replacement liability associated with the District Infrastructure. In addition, this Master Plan provides an estimated schedule for replacement and a detailed Capital Improvement Plan project list. The District assets were separated into buried infrastructure identified as “Pipeline Replacement Planning” and water supply facilities called “Production Facilities Replacement Planning”.

2.2.3.1 Pipeline Replacement Planning

The existing District pipelines vary from direct buried 70-year old steel materials to new poly-sheet wrapped ductile iron. The Master Plan effort focused on identifying where the different pipe materials exist and what is the estimated in-service age. GIS was used to document these conditions and integrated with a range of expected services life to estimate when to schedule replacement efforts. The strategy is to establish a proactive response to expiring infrastructure and avoid a reactive burden resulting from failing infrastructure.

New 24” Transmission Main – 2000

2.2.3.2 Production Facilities Replacement Planning

The production facilities include the Bajamont Water Treatment Plant, wells, tanks, and booster pump stations. The

existing assets range from the new facilities at the Bajamont site and the Dewey pump station to old facilities requiring abandonment such Cottage, Jan and Paddock Wells. The Master Plan focused on maintaining the balance of surface water and groundwater use identified as within the safe yield of the groundwater basin, while also developing a scheduled replacement plan consistent with the reliability goals of the District. Specific project recommendations and schedules were developed for incorporation into the Capital Improvement Plan.

2.2.3.3 Capital Improvement Plan

This Master Plan includes a detailed Capital Improvement Plan (CIP) providing project specific goals for the next 25 years. In addition, the CIP extends through the 100-year life cycle of the recently installed 20 and 24-inch ductile iron water transmission pipelines. This extended view of asset replacement coupled with projections of operation and maintenance liabilities formed the foundation for the Financial Business Plan discussed below.

2.2.4 Strategic Water Issues

Consideration of developments within the Water Forum, Regional Master Plan, Bay Delta Hearings, and many other significant water supply considerations galvanized the need for a review of possible strategic water issues facing the District. This effort was integrated into the Master Plan to allow consideration of staffing and funding of possible strategies to maintain not just the District interest but possible regional interests in a reliable water supply.

2.2.5 District Organization, Administration and Data Management

The current District organization is summarized in this Master Plan with a limited review of issues causing an increased demand for staff time such as conservation, meter reading, and water quality monitoring. In addition, this section of the Master plan includes a discussion of a geographic information system (GIS) connecting the different District activities and departments with the intent of streamlining existing tasks an extending the abilities of doing more with the same number of people.

Stock on Hand Copper Meter Fittings

2.2.6 Financial Business Plan

Binding all of the above elements together is the Financial Business Plan element providing estimates of rate impacts for various implementation alternatives and recommending fund and reserve policies to allow for the managed response to the liabilities described above. The goal of this element is to provide an opportunity to sustain a reliable and high quality water system while responsibly managing the public trust in the District.

2.3 Historical Setting

Carmichael has a relatively brief recorded history in the region. Prior to European settlements, the area was home to the Maidu Indians, and archaeological sites have been identified in the area, especially close to the American River.

With the onset of European settlement, land ownership in the area was vested through Mexican land grants. Two land grants encompassed most of the area of Sacramento County north of the American River and east of the Sacramento River, including the area now known as Carmichael. One was the Rancho del Paso Grant, 44,371 acres located between the old Marysville Road and Manzanita Avenue, and its southerly extension along Fair Oaks Boulevard to the American River. The other was the Rancho San Juan Grant, 19,982 acres extending east from Manzanita Avenue to about Folsom Dam, and extending north well beyond Carmichael's boundaries.

The San Juan Grant lands began to be broken up in about 1875 and the Rancho del Paso Grant in about 1908. Some of the lands were leased for farming prior to 1900. Jacob Heintz moved to California about 1870 and settled in the northern area of Carmichael, leasing about 4,400 acres within the two land grants on much of what was to become Carmichael. The John and William Barrett family came to the area about 1900, farming approximately 80 acres along Barrett Road.

Among other early settlers of Carmichael were Charles W. and Mary A. Deterding, who purchased 425 acres along the north bank of the American River in 1907. A major portion of their Deterding Ranch was eventually sold and is now Ancil Hoffman Park.

In 1909, a real estate developer by the name of Dan Carmichael purchased 2,000 acres of the San Juan Grant lands, lands that became Carmichael Colony No. 1. Two years later, Dan Carmichael purchased 1,000 of the Rancho del Paso Grant, adjoining his prior purchase. The second purchase was Carmichael Colony No. 2. (Cowan, 1975)

Dan Carmichael divided the 3,000 acres into 10-acre parcels, and placed ads in mid-western and eastern newspapers: "Lots for sale in Carmichael, California – 10 acre tracts for $1,500 with 10% down on terms of $10 a month at 6% interest. In the shelter of rolling foothills, secure from frosts, the woods hereabouts are stocked with game birds, quail, etc., and the streams are stocked with trout for rod and ducks for gun."

Dan Carmichael never lived in his Carmichael Colonies, instead making his home in Sacramento, where he served a term as mayor from 1917-1919, along with many other civic activities. He left the area in 1923 and later settled in San Francisco.

The origin of the District dates to July 3, 1915, when the Carmichael Colonies Improvement Club appointed a committee to investigate the possible formation of an irrigation district, constructing a 10-mile pipeline to bring water directly to Carmichael from an upstream penstock, and pumping water for irrigation purposes from the American River. The committee hired Albert Givan, Civil Engineer, of Sacramento to study the engineering feasibility of the projects.

The committee report was completed October 28, 1915, and printed as a supplement to the Fair Oaks Citizen newspaper on November 1. The report provides some insight into the impetus for

the committee's work: ". An inspection of the distributing system of the American Irrigation Company will readily determine that this system was laid out to supply the Fair Oaks Colonies and was never intended when built to accommodate the various colonies and subdivisions that it is now attempting to supply; the same conditions hold good for the distributing system in Carmichael Colony in regard to Carmichael Colony No. 2." "It is evident to all of you that if the water situation in the Colonies goes on for but a few more seasons more than it has in the past, disaster will quickly overtake us, individually and collectively. We must have relief…".

Albert Givan's engineering report was published as part of the committee's report. The report analyzed three main alternatives for Carmichael's water supply: the penstock alternative, requiring a 10-mile pipeline to an upstream penstock where adequate American River supplies could be obtained; a river supply, involving pumping water from the American River at Carmichael; and a combined supply, where the American Irrigation Company (which bought foreclosed assets of the North Fork Ditch Company in 1914) would be relied on for a continuous supply of 4 cfs, and the major irrigation supply would be pumped from the American River at Carmichael for 16 hours per day during the six-month irrigation season.

This third (combined supply) alternative, being the most cost-effective, was recommended and adopted; the formation of the irrigation district was initiated; and Albert Givan filed for 15 cfs water rights from the American River on behalf of the District. The Carmichael Irrigation District was formed in early 1916 and held its first official meeting on February 8, 1916.

2.4 Historical Planning Documents

The following sections provide a historical review of prior planning and studies that have guided the District in the past.

2.4.1 Water Infrastructure Planning Documents

This element summarizes infrastructure planning and implementation of technical recommendations that have occurred following the previous Master Plan.

2.4.1.1 20-Year Master Water Plan of November 1990

The 20-Year Master Water Plan of November 1990 recommended a number of measures for the District's Capital Improvement program. Progress has been made but not all recommendations have been implemented. Below is a summary of the recommendations that have been implemented by the District.

Water Supply Recommendations

- Recommendation: Enter into negotiations with the U.S. Bureau of Reclamation (USBR) so that a Water Rights Settlement Agreement can be reached which would allow the District to continue pumping from the American River Ranney Collectors 1, 2, and 3 under drought conditions.

  District Implementation: An initial discussion has taken place. However, no settlement agreement has been reached. Issues regarding the Central Valley Improvement Act and

a moratorium on new settlement agreements resulted in a halt to the initial negotiations. See Section 6 for further discussion of this issue.

- Recommendation: Meet with California Department of Health Services (DHS) to define an analytical program to properly evaluate the need to treat water pumped from Collectors 1, 2, and 3.

  District Implementation: Ultimately, a 17 mgd microfiltration Water Treatment Plant was built to address the DHS issues. See Section 2.2.1.2 for further discussion of this issue.

Distribution System Recommendations

- Recommendation: Maintain a leak record map to insure that pipeline replacements are made in the highest priority locations.

  District Implementation: Work orders have been maintained; however, a leak record map does not exist. Recent progress to implement a GIS map system can be build on to allow the District to graphically track future leak repairs and other associated data.

- Recommendation: Continue to require 8-inch minimum size mains.

  District Implementation: District Improvement Standards have been produced and a minimum 8-inch water pipe size in one of the standards.

Financial Considerations

- Recommendation: Finance all capital improvements except a potential treatment plant out of working capital (net income plus depreciation).

  District Implementation: 17 mgd microfiltration Water Treatment Plant financed; all other work has been on a pay as you go basis.

- Recommendation: Authorize a new AB 1600 Compliance Report to determine a more reasonable unit "connection" charge to insure that new connections pay their fair share of plant and equipment costs.

  District Implementation: Compliance Report was completed and adoption delayed pending resolution of the surface water treatment issues. A second Compliance Report has been prepared and is scheduled for adoption in May of 2003.

2.4.1.2 1996 Bajamont Way Membrane Filtration Plant – Preliminary Design Report

The District furnishes potable water to its customers from two water sources: (1) water taken from three Ranney Collectors located on the south bank of the American River; and (2) pumped groundwater. The DHS, through its enactment of the Surface Water Treatment Rule (SWTR), considers the water from the District Ranney Collectors as "… groundwater under the direct influence of surface water …" and as such, this water must receive the same degree of pathogenic removal/inactivation as surface water. Through the SWTR, surface waters require multi-barrier treatment (i.e., filtration for particulate and microbiological removal and disinfection

for microbiological inactivation) prior to consumer consumption. District's then current practice of furnishing potable water from the Ranney Collectors, with disinfection via chlorination only, did not comply with the SWTR. Thus, on August 24, 1993, the DHS issued a Compliance Order that required the District to comply with the SWTR by November 1, 1997. This Compliance Order was amended in September 1994 to require proper disinfection by November 1997 and full filtration by 2003.

Bajamont Water Treatment Plant Clearwell under Construction – 2000
– photograph courtesy of Peggy Berry, District Resident

In response to the Compliance Order, the District commissioned a Water Supply Alternatives study to determine if continued use of the Ranney Collector supply was the best fiscal and technical solution to the DHS mandate. After proper and careful consideration of numerous water supply alternatives, the District Board of Directors voted to have the "Preferred Project" defined as follows:

- Continued use of the Ranney Collector surface water supply at diversion levels comparable to historical levels.
- Construction of an 11 mgd first phase, 22 mgd ultimate capacity, membrane filtration plant on Bajamont Way on property owned by the District.
- Construct the 11 mgd first phase facility as soon as soon as possible to ensure supply of safe drinking water to the District's customers in a timely manner.

2.4.1.3 1998 Production Facilities and Distribution System Evaluation

A system side evaluation was conducted in 1998 to consider a holistic view of the District improvement needs. The evaluation resulted in the recommendations listed below. Also listed is the implementation status for the work recommended.

- Construct the membrane plant to full capacity at 22 mgd. District increased the capacity of the recommended membrane plant from 11 mgd to 17 mgd, expandable to 22 mgd.
- Construct one (1) new well in the vicinity of Ancil Hoffman Park. District has not completed this work and Sacramento County is pursuing possible wells in this area to serve the Ancil Hoffman golf course.
- Segregate the District service area into three pressure zones. District completed this work.
- Reconstruct Dewey Booster Pump Station. District completed this work.
- Rehabilitate La Vista Booster Pump Station and Reservoir. District has not completed this work.

- Construct improved water conveyance to La Vista Reservoir. District has not completed this work.

- Install backup power capacity at five (5) wells. District installed backup capacity at Dewey Booster Pump Station and at the Bajamont Water Treatment Plant.

- Construct north area transmission mains from the Bajamont Water Treatment Plant across Sutter Avenue to Lincoln Avenue. The District has completed this work.

A byproduct of the 1998 production facilities evaluation was the development of a calibrated computerized water system model allowing testing of alternative recommendations. The District maintains the water model and has confirmed through compliance of constructed facilities with design criteria, that the model accurately reflects the District pipe network.

2.4.1.4 Non-District Efforts

Other on-going planning efforts have been undertaken by different interests and some of the key studies are identified below.

2.4.1.4.1 Sacramento County-Wide Water Plan – 1976

The County-Wide Water Plan was prepared for the Sacramento County Department of Public Works, Water Resources Division. Based on the report, the Board of Supervisors of Sacramento County acting ex officio as Board of Directors of the Sacramento County Water Agency adopted policies pertinent to the District water management program as follows:

- Groundwater overdraft must be halted by the year 2000.

- Conjunctive use of ground and surface waters with the objective of stabilizing ground water levels is the primary water management goal within Sacramento County.

- Water purveyors in the northeast area including the District shall develop their own water plan for their area.

2.4.1.4.2 Sacramento County Water Agency Water Plan Supplement – 1989

The Sacramento County Water Agency Water Plan Supplement – 1989 supplements the Sacramento County Water Plan. The study area for the Water Plan Supplement (WPS) included most of Sacramento County except for the delta leg and the eastern foothill area. The study area was divided into 16 subareas for study purposes, one of which was the Carmichael Subarea with boundaries identical to that of the Carmichael Irrigation District (sic).

For the Carmichael Subarea, the WPS develops water requirements and groundwater safe yield, and discusses surface water rights, annual entitlements, and contractual needs. Comparison of pertinent WPS data and the data as used in the report are presented herein.

The WPS develops a total required current water demand (year 1987) for the Carmichael Subarea of 15,063 acre-feet (AF) including a 5% conveyance loss. The actual use reported by

the District for 1987 was 4.65 billion gallons, or 14,260 AF. Since the District measures the water production at the source, conveyance losses are included in the District's value.

A year 2015 water need of 16,400 AF was projected for the Carmichael Subarea in the WPS Report. This value is approximately 8-½% higher than the year 2010 value of approximately 15,100 AF developed for this report.

A groundwater estimated safe yield of 4,000 AF per year was calculated in the WPS for the Carmichael Subarea. It is emphasized in the report that the safe yield estimates were calculated values and that the existing groundwater data are insufficient to accurately determine the groundwater safe yield. The 4,000 AF value is approximately 26% of the year 2010 projected water demand of 15,100 AF used in the November 1990 Master Water Plan. Based on previous studies for the Sacramento County Water Plan, 30% groundwater conjunctive use was used in studies for that report.

The Contractual and Water Rights Entitlements for the Carmichael Subarea are given in WPS Table 4-1 as 10,800 AF, with an additional need of 4,200 AF. These values are incorrect. As given in WPS Table 2-2, the District surface water entitlement at this time is 32,600 AF. However, the Department of Water Resources has indicated that when application for licensing of District Permit No. 7356 is made, a limitation on the annual entitlement would likely be imposed. Generally, the annual entitlement has been limited to 50% of the amount that would occur if the water were used continuously at the permit rate. If such a limit is placed on Permit No. 7356, the District surface water entitlement would be 25,000 AF.

The WPS Report does not address the District's surface water entitlement under critical drought conditions when no water is available in the American River under the appropriative water rights of the District. During these periods, the total water requirements in the Carmichael Subarea would have to be met either from the groundwater or a contract entered into with the USBR to firm up the existing appropriative rights. The WPS report, Table 5-1, shows no USBR control for surface water for the Carmichael Subarea, so it would be assumed that the WPS Report plans envision drought water demands in the Carmichael Subarea to be met from the groundwater.

2.4.2 Water Supply Planning Documents

This element summarizes supply related planning efforts addressing regulatory requirements and cooperative efforts to responsibly manage the shared water resources of the community.

2.4.2.1 1995 – 2000 Urban Water Management Plans

California Water Code Section 10610 et seq. requires urban water suppliers to prepare an Urban Water Management Plan and to update the plan on a five (5) year cycle. The intent of this regulation is in part to require public agencies to consider resource planning and how they will respond to drought. The District has complied with the water code requirements and the California Department of Water Resources has approved the most recent Urban Water Management Plan. A copy of the document is available at the District office.

2.4.2.2 Water Forum Agreement

The Water Forum Agreement was the culmination of an exhaustive effort to resolve water resource planning issues in the greater Sacramento Metropolitan area for the benefit of business, environment, government, and water purveyors. The result of the effort was a landmark agreement stipulating supply criteria for a range of hydrologic events ranging from severe drought to normal supply.

The District participated in the planning efforts and is signatory to the Water Forum Agreement. A copy of the Water Forum Agreement is provided in Appendix A.

2.4.2.3 Regional Water Master Plan

The American River Basin Cooperating Agencies (Cooperating Agencies) was formed to sponsor a Regional Water Master Plan (RWMP) to explore opportunities for cooperative actions as an implementation step building on the Water Forum Agreement. The District is an active member of the Cooperating Agencies and supports the planning efforts. Additional participating members are as follows:

- Carmichael Water District
- California-American Water Company
- Citrus Heights Water District
- City of Folsom
- City of Roseville
- City of Sacramento
- Fair Oaks Water District
- Rio Linda/Elverta Community Water District
- Sacramento County
- San Juan Water District
- Sacramento Suburban Water District

In addition to the Cooperating Agencies, a significant number of other agencies have expressed their support for the RWMP. These “collaborating” agencies include:

- Natomas Central Mutual Water Company
- Orange Vale Water Company
- Placer County Water Agency
- Sacramento Area Water Forum
- Sacramento Metropolitan Water Authority
- Sacramento North Area Groundwater Management Authority
- California Department of Water Resources
- Mid-Pacific Region of the U.S. Bureau of Reclamation
- Sacramento District of the U.S. Army Corps of Engineers

The RWMP process has produced a report and grant applications for the initial phase projects. The District currently does not have any active RWMP projects within its service area.

2.4.3 Financial Planning

2.4.3.1 Water Rate Structure Study

The District completed a water rate structure review in 1997 and revised the rate structure based on recommendations provided therein. The rate structure existing in 1997 was a single flat rate based on an assumed one-inch meter. The purpose of the review was to assess approaches to a more equitable rate structure based on service size and establish a base schedule suitable for migration to a metered commodity based rate.

The District adopted a new rate schedule based on customer classes and service size and is committed to full implementation of a metered rate system.

2.4.3.2 Annual Water Budget Analysis and Rate Schedule

The District currently conducts an annual budget analysis for the coming year and develops rate schedule recommendations based on the budget projections. Rates are currently adopted annually.

Section 3: Water Use and Demand Management

The statement "Whiskey is for drinking and water is for fighting over…" captures the challenges facing Carmichael Water District as water use, and conservation management shape the consumptive practices with the District into the future.

3.1 Water Use and Demand Management

This section of the Master Plan discusses the water use patterns of the District and measures being taken to manage that consumption as the District moves into a period of limited expansion due to buildout.

3.2 Water Use

Ranney Collector at Ancil Hoffman Park (1959)

Carmichael's annual groundwater use was about 3,000 acre-feet per year (afy) from 1972-1985, comprising about 15%-25% of the District's total supply. In 1986, a major flood on the American River damaged the collectors, and the six-year drought of 1987-1992 followed. The District's reliance on groundwater was greater from 1986-1993, averaging about 6,000 acre-feet per year.

In 1993, studies of the connectivity of the Ranney Collectors with the American River water demonstrated that the collectors closely reflected river water temperature and chemical quality, and that the filtration efficacy of the collectors was impaired. The District reduced its surface water use further to assure adequate chlorine contact time between the collectors and the first service connection. From 1994 until the treatment plant came on line in 2001, the District's reliance on groundwater increased to as much as 9,000 acre-feet per year, and groundwater represented 35%-60% of water use.

Now that the plant is on-line, it is anticipated that annual groundwater pumping will be in the 2,000 afy range, representing about 15%-25% of water use.

During the years when the District's reliance on groundwater increased, the depth to groundwater also increased, indicating localized overdraft of the basin. In the 18-month period since the plant was placed in operation, the groundwater table has recovered considerably, indicating that a local pumping rate of 2,000 afy should allow recharge to exceed withdrawals, at least within the District.

The groundwater basin provides numerous benefits to the District. Over the past decade, operation of the wells allowed the District to meet demands and assure safe drinking water until the treatment plant could be placed on-line. The wells also provide an emergency source in the event the river diversion facilities are damaged, as occurred in the 1986, 1993, and 1997 floods.

Submerged Electrical Vault 1997 Flood

The wells will allow the District to reduce plant production for maintenance purposes in off-peak seasons. The groundwater basin and wells provide some storage benefits, and allow the District to maintain a somewhat smaller volume of aboveground storage in tanks.

The balance between surface water and groundwater is a complex function of water demand over time, practical limits on plant capacity, water rights, the Water Forum Agreement, long-term reliability of groundwater quality, amenability of groundwater to treatment if pollutant plumes affect quality, the safe yield of the groundwater basin, conjunctive use objectives, community affordability constraints, and other factors.

3.2.1 Water Use Type

The breakdown of the District's service profile reflecting approximately 11,093 water accounts as follows: 91.4% Residential, 1.5% Multi-Housing, and 7.1% Commercial. Table 3-1 presents the past, current and projected water use for the District.

Table 3-1
Past, Current, and Projected Water Use

Water Use By Sector	1990	1995	2000	2005	2010	2015	2020
Residential	10,996	11,010	11,575	11,735	11,430	12,055	12,411
Commercial	840	842	885	897	873	921	949
Institutional/Government							
Landscape/Recreational	500	500	500	1,000	2,000	2,000	2,000
Losses (4%)	514	514	540	568	597	624	640
Totals	12,850	12,866	13,500	14,200	14,900	15,600	16,000

Units of Measurement: Acre-feet/year

3.2.1.1 Residential

The population served within the District is estimated at 39,339, with an estimated water use per person of 288 gallons per capita per day. Based on the reported 3.5 persons per household reported in the 1995 UWMP update, there are approximately 11,240 residential services. The Residential sector is growing at about 0.6% driven primarily by the lot splits and other redevelopment of land within the District.

All new development as of January 1, 1992 is required by state law to be metered. The District has been installing water meters with over 3,400 residential meters installed in the District. This is up from the 55 meters existing in 1995. The District is continuing with meter retrofit and will be fully metered in the future.

3.2.1.2 Commercial

The District has a complex mix of commercial customers, ranging from antique stores, insurance offices, beauty shops, gas stations, shopping centers, restaurants, and other facilities serving the Community of Carmichael. The sector is growing at about 0.5% per year, driven by redevelopment in the area, and is expected to continue through the year 2020. The Commercial sector is fully metered and billed at a metered rate. There are estimated to be 739 commercial metered accounts.

3.2.1.3 Industrial/Institutional/Government

The District does not have a significant Industrial sector and any industrial use would be included in the Commercial sector above.

Currently, the District has a stable Institutional/Governmental sector, primarily schools and County facilities. There are currently 7 parks and 8 schools within the District and all are metered. No significant increase in this sector is expected in the future.

3.2.1.4 Landscape/Recreational

Landscape and recreational customer demand is expected to remain stable in the future due to the almost fully developed character of the District. Prior inquiries indicate the County is expected to increase their current 500-afy demand to 1,000 afy by the year 2003, and to 2,000 afy following the year 2005. Thus, the County will continue to be the District's largest single customer and largest irrigation water user.

3.2.1.4.1 Sacramento County – Ancil Hoffman Golf Course Demand

Recent efforts by Sacramento County include investigation of two irrigation wells serving the single largest irrigation demand, Ancil Hoffman Park. The County, however, has not provided any details or timetable for completion of their well project(s) and the District has assumed the projected increases as listed above still apply.

3.2.2 Historical Water Use

Historical District water demands on an annual basis have been presented in the 2000 Urban Water Management Plan and are included as Appendix B. A graphical plot of this data, presented in Appendix B, highlights an average demand of about 11.8 mgd.

3.3 Population and Growth

Population statistics and growth projections within Sacramento County are developed and updated by the Sacramento Area Council of Governments (SACOG). Their projections dated March 28, 2001 were used for this study.

The District boundaries do not fall along minor zone boundaries in all cases. As a result, an estimate was made regarding growth rate and is presented below. The SACOG growth projections begin with the historical population as of 1990 and include population projections every five years from 2005 through 2025. The 2000 and 2025 numbers were selected for analysis to cover the 100-year period of this Master Plan and reflect a nominal 0.6% growth rate.

Table 3-2 shows the housing and population projections for the SACOG zones and include areas outside the District.

Table 3-2
Population and Housing Estimates and Projections [(a)]

Year	Housing Units	Population	Change	Annual % Growth
1990	17,560	41,523	--	--
1995	18,012	42,191	668	0.5%
2000	18,216	44,787	2,596	1.25%
2005	18,913	47,730	2,943	1.25%
2010	19,241	49,361	1,631	0.6%
2015	19,569	50,993	1,632	0.6%
2020	19,897	52,625	1,632	0.6%
2025	20,225	54,257	1,632	0.6%

(a) Based on January 2002 SACOG Data

3.4 Water Demand

District average water demands on an annual basis are historically about 11.8 mgd. The annual average is approximately 13,300 afy. The monthly variation in water demand was used to develop the ratio of the average day demand during the maximum month of the year to the average day demand for the year. Present water system demands are shown in Table 3-3 with their appropriate demand multiplier identified.

Table 3-3
Projected District Water Demands

Item	Present Water Demand (mgd)	2020 Water Demand (mgd)	Basis for Water Demand
Annual Average Demand	11.8	16.2	25 years of record (1970-1995) + 2,000 afy in Parks
Average Day Demand in the Maximum Month	21.8	30.0	Annual Average Demand times 1.85
Estimated Maximum Day Demand	24.0	32.0	Average Day Demand in the Maximum Month times 1.1 (approximately 2.04 times average day demand)
Estimated Peak Hour Demand	40.8	50.0	Maximum Day Demand times 1.7 (approximately 3.46 times average day demand)

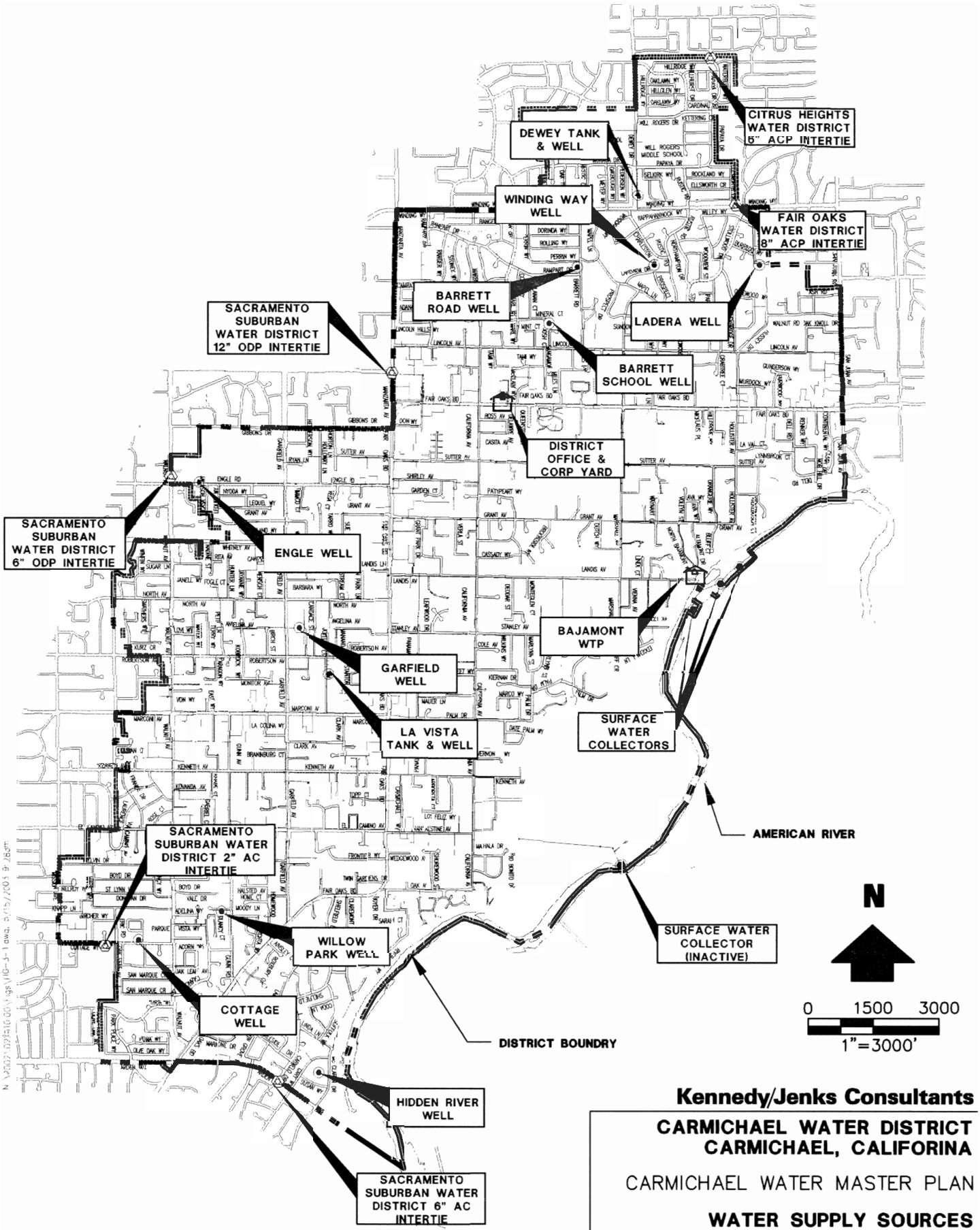
3.5 Water Supply Sources

The District has two distinct, normally available, water sources: groundwater from District wells and surface water diverted from beneath the Lower American River through Ranney Collectors. The District has the potential of new supplies from additional groundwater development and possible conjunctive supplies from additional groundwater development and possible conjunctive use supplies through nearby water purveyors with seasonal transmission capacity available to the District. Seasonal transmission refers to possible winter supplies of surface water as being considered by the RWMP efforts.

The District potable water supply, treatment and storage system is comprised of three Ranney Collectors on the southeasterly side of the Lower American River; the Bajamont Water Treatment Plant on the opposite side of the river; 10 wells currently in operation; one 1-million gallon storage reservoir and booster pump station; and one 3-million storage reservoir and booster pump station. In addition, the water treatment plant has a two-million gallon reservoir available for meeting peak demands. The District water supply sources are shown in Figure 3-1.

Bajamont Water Treatment Facility

The District membrane water treatment plant has a production capacity of 17 million gallons per day (mgd) currently, with the ability to expand to 22 mgd in the future. The wells range in output from 250 to 2,000 gallons per minute. The wells can provide a peak delivery capability of about 10,400 gallons per minute,



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CARMICHAEL WATER MASTER PLAN

WATER SUPPLY SOURCES

APRIL 2003
FIGURE 3.1
K/J 022510.00

or approximately 15 mgd. The combined water supply capacity is currently estimated as 32 mgd. Additional pumping from storage provides the peak hour demand.

The District has three storage facilities as listed above. The two storage reservoirs not at the treatment plant are typically operated so that 50% of their capacity is held in reserve: 25% for peak hour needs and 25% for emergency demands. The treatment plant storage is maintained full, if possible, and drawn down when needed to meet peak demands. The normal distribution system pressures range from a minimum of 45 pounds per square inch (psi) to a maximum of 90 psi through average and peak demand periods.

The District delivers potable water supplies through its pressurized distribution system of approximately 135 miles of pipeline. A leak detection survey of the District was completed in 1995. Results from the survey indicate the condition of the pipelines to be in generally good condition with an average life expectancy of about 25 years with a detected system loss rate of about 4% of production.

The system is comprised of three pressure zones allowing the management of system pressures to avoid both areas with high and low pressure conditions.

3.5.1 Surface Water

The District has been diverting flows from the American River since the issuance of its first water license in 1915. Over the years, use within the District has shifted from primarily an irrigation demand to a residential demand. Initial diversions consisted of direct intakes to allow surface water to be pumped to Carmichael. In the late 1950's, after the construction of Folsom Dam, the District initiated a program to install four Ranney Collectors to improve water quality of the surface water diversions. Ranney Collectors are comprised of horizontal infiltration pipelines installed in the gravel formations of the American River riverbed. The purpose of the Ranney Collectors was to use the natural filtering capability of the riverbed to improve diverted water quality.

Although the Ranney Collectors continued to serve the District well, with three providing potable water and one providing irrigation supply, changes in federal/state surface water treatment regulations required additional treatment. In addition, flood flows in the Lower American River in 1986 and again in 1997 caused enough damage to the collectors to impact their filtration performance. In 1994, the District's Interim Operations Plan approved by DHS cut seasonal production from the Ranney Collectors by as much as 40% of available capacity (8,340 gpm of 13,900 gpm) to maintain acceptable turbidity and disinfection levels.

Since 1994, the District has been limited to about 7,000 afy from surface water under DHS interim-operating constraints on the use of surface water supplied through the Ranney Collectors. For this reason the District has constructed a membrane micro-filtration water treatment plant and is no longer under DHS operating constraints. The District's potable water supply is currently approved for full use of its available water rights of 14,000 afy.

The District currently maintains three Ranney Collectors and is considering abandonment of the fourth collector. The fourth collector abandonment will not impact surface water supply

diversion capacity. The three remaining collectors have been reconditioned and inspected and are in excellent condition.

3.5.2 Groundwater

Since 1991, the District has been pumping about 5,530 afy from its wells. Depending on well locations and pumping levels, the groundwater can be high in iron and manganese. On a system-wide basis, the general water quality of the wells is acceptable to DHS and is within current, regulated drinking water standards.

The groundwater basin serving the District is generally described to be in an overdraft condition. Overdraft referring to the condition where the groundwater extraction exceeds the recharge and a decline in the water table is occurring. Regional planning efforts have established a maximum basin groundwater utilization goal of no more than 40% of the annual supply being provided by groundwater.

The District maintains existing groundwater facilities with the capability of producing the full 40% regional groundwater extraction goal should a surface water shortage condition occur. Forty percent of the annual total system demand is approximately 6,400 afy. For the purposes of this report, the groundwater supply available will be reported as 6,400 afy.

The District had been managing its groundwater supply, as it deems necessary to meet demands while complying with the DHS interim operating constraints on the District's surface water supply. The DHS interim operating constraints were no longer applicable once the new membrane water treatment plant came on-line in the summer of 2001. The District, through the use of the new membrane water treatment plant, will continue to be within the 40% maximum groundwater extraction goal and the projected normal year groundwater extraction is less than 30% of the annual supply.

3.5.3 Water Supply Reliability

Under the terms of the Water Forum Agreement, the District has agreed to reduce its long-tem diversions from 14,000 afy to 12,000 afy in return for a reliable supply from the American River in nearly all years. Under some drought conditions, however, the SWRCB has the authority to reduce diversions from surface water sources. Some risk still exists that the District could have its diversions restricted in the summer months of severe droughts.

The District can protect against such possible diversion reductions by several means. It could arrange for upstream storage of its water through an agreement with the USBR or other reservoir owner. It could arrange for dry year water transfers from upstream reservoir operators such as SMUD and Placer County Water Agency. It could contract for a small supply from the USBR that would be available in dry years. It could explore the possibility of sharing supplies with the City of Sacramento based on the shared place of use, Area D of the City's water rights to the SMUD water.

Many dams in California that include power generation as a project purpose received operating licenses from the Federal Energy Regulatory Commission (FERC) nearly 50 years ago. Many of those licenses are up currently for renewal, and many agencies are actively working through

the complex and lengthy relicensing process. There may be opportunities for the District to provide mutual support in that process in return for some storage capacity.

In the years following the completion of Folsom and Nimbus Dams in 1956, the bed of the American River downstream of the dam has gradually degraded. The District's 33-inch diameter river crossing pipeline, originally buried about four feet below the river bed, has been exposed above the bed of the river since the 1986 floods. Degradation can be expected to continue, especially in major flood events, as the dams retain nearly all of the larger sediment particles, and release relatively clean water to the river.

In major flood events, the gravel bed of the river fluidizes to a depth of many feet below the normal channel bottom, that is the gravel churns and moves downstream under the force of high water flows. The river gravels may move downstream at a speed much slower than the surface flow, but with considerable force. This bed movement has abraded the surface of the 33-inch river crossing pipelines, and has exposed some of the reinforcing steel on the upstream side of the pipe.

Temporary repairs have been made in prior years to preserve the pipeline. The pipeline is still present in the river, but is no longer in use. The new river crossing was tunneled at least 20 feet below the lowest point in the riverbed to preclude future flood damage.

The combined flood flows and bed movement affect the Ranney collectors as well, increasing the risk of flood damage during high flows. This downstream movement of gravels and gradual degradation of the streambed is of concern to the District in terms of its Ranney Collectors and their laterals, as well as in terms of fish habitat. As the streambed gradually lowers, the Ranney Collectors will gradually become higher relative to major flood flows, and the lateral forces on the collectors could become greater over time.

Also, the riverbed degradation may eventually damage or expose the Ranney laterals, admitting sediment, and adversely affecting fishery resources in the unlikely event that the laterals become exposed to the river channel itself.

The periodic river floods tend to damage and move the rock gabions placed around the Ranney Collectors to protect them from flood damage. The gabions, river rock enclosed in heavy-duty chain link wire baskets, are designed to be sacrificial protection for the collectors against the river floods. Periodic repairs are an expected aspect of providing this form of flood protection within the river channel.

The following recommended activities will support a clear understanding of flood and riverbed related risk and provide for a sound future decision process.

- The District should maintain an annual monitoring program of the riverbed in the vicinity of the collectors, performing a cross-section measurement each year to record and document long-term changes in the riverbed.

- As the riverbed changes over time, the District should consider commissioning a structural stability study of the Ranney Collectors to assure that they can withstand major flood flows at least as large as the 135,000 cfs that flowed through that reach of the river in 1986.

- The District should periodically inspect the Ranney laterals and repair or replace damaged laterals. The District may also wish to monitor Ranney Collector production and compensate for changes in infiltration by reconstructing and lengthening some laterals, especially those left incomplete in the initial construction in 1959.

- The District should maintain appropriate erosion protection for each of the Ranney Collectors, renewing or replacing the existing rock gabions as dictated by engineering evaluations and periodic flood events in the river. It should also assure continual access rights and the ability to perform repairs promptly following flood events.

- The District should develop a plan for addressing the abandoned 33-inch American River pipeline crossing in case it fails in a flood event or becomes a hazard to recreational navigation on the river.

3.6 Conservation

Conservation is an increasingly important aspect of urban water supply management in the face of increasing competition for available water supplies. The District through customer education has practiced conservation measures through most of its history. During the 1977 and 1991 drought years, customers reduced their summer water use by about 25%, and reduced annual use by more than 15%.

The District regularly publishes advice on water conservation in its "Water Ways" customer newsletter, participates actively in the Regional Water Authority (RWA) Conservation Committee program, and works directly with parks and schools to encourage conservation.

In particular, the District has embarked on a metering program to have all customers metered consistent with the Water Forum Agreement. The metering program will provide a consistent basis for billing customers based on their water use, and should stimulate additional conservation efforts.

Conservation, and especially metering, is expected to reduce water demands gradually over the next two decades. An overall decrease of about 15% is expected as residential customers implement additional conservation in response to proposed Sacramento County landscape efficiency ordinances, plumbing retrofit, and other conservation measures. This decrease in use will also be stimulated as residences begin being billed based on metered rates, providing a financial incentive for conservation.

The current CALFED Program has as one of its major elements the Water Use Efficiency (WUE) Program. The program has as its ultimate goal "to develop a set of programs and assurances that contribute to CALFED goals and objectives, has broad stakeholder acceptance, fosters efficient water use, and helps support a sustainable economy and ecosystem. The goals of the WUE element will be met by providing technical and financial assistance to local water suppliers and water users to improve water use efficiency. In addition, the WUE element will develop credible assurances and science-based performance measures to demonstrate that CALFED agencies are implementing an appropriate level of water use efficiency actions."

The CALFED Record of Decision committed to the following action: "…CALFED agencies will work with the California State Legislature to develop legislation for introduction and enactment in the 2003 legislative session requiring the appropriate measurement of all water uses in the State of California." The focus of the CALFED work group includes measuring groundwater use and discussion of the applicability of metering, among many other aspects of measurement of water use.

The District should anticipate that legislation expanding the existing residential and commercial metering requirements in California may eventually emerge from this CALFED program on water use efficiency, and that those legislative mandates could affect the rate at which the District is currently implementing metering.

Among other potential actions, it is possible that the Legislature will add more requirements to the urban water management plans, including state approval of conservation programs, to increase the conservation of water resources in California.

The District should monitor the CALFED water use efficiency program and subsequent draft legislation through the RWA and Association of California Water Agencies (ACWA) with respect to impacts on its metering and conservation programs.

The District has already expanded its conservation efforts as a result of the Water Forum Agreement, as discussed below.

3.6.1 Conservation Derived Supply Objectives

Saving water through improved efficiency can lessen the need to withdraw ground or surface water supplies for municipal or industrial demands. In addition, sound water use practices reduce the amount of stress that we place on our resources by limiting water withdrawals. Conserving water reduces wear and tear on major infrastructure such as water treatment plants and the distribution systems that deliver water to consumers, and can postpone or eliminate investments in new infrastructure. Using less water helps us to become more flexible during times when there is a water shortage.

3.6.1.1 Conservation Demand Reduction

Conservation is an increasingly important aspect of urban water supply management in the face of increasing competition for available water supplies. The District, through customer education, has practiced conservation measures through most of its history. During the 1977 and 1991 drought years, customers reduced their summer water use by about 25%, and reduced annual use by more than 15%.

The District regularly publishes advice on water conservation in its "Water Ways" customer newsletter, participates actively in the RWA and the Sacramento Area Water Works programs, and works directly with parks and schools to encourage conservation.

3.6.1.2 Conservation Derived Supply

The District has embarked on an accelerated metering program to have all customers metered before 2016. The metering program will provide a consistent basis for billing customers based on their water use, and should stimulate additional conservation efforts.

Conservation, and especially metering, is expected to reduce water demands gradually over the next two decades. An overall decrease of about 15% is expected as residential customers implement additional conservation in response to proposed Sacramento County landscape efficiency ordinances, plumbing retrofit, and other conservation measures. This decrease in use will also be stimulated as residences begin being billed based on metered rates, providing a financial incentive for conservation.

3.6.2 Recycled Water

The County of Sacramento (County Sanitation District No. 1) collects and treats the wastewater generated within the County at a regional wastewater treatment plant located 15 miles south of the District operated by the Sacramento Regional County Sanitation District. Although the Sacramento Regional County Sanitation District is undertaking a recycled water program, the necessary pumping to return water to the District's surface area is considered prohibitive.

3.7 Demand Management

Demand management emphasizes the focus of conservation efforts on the consumer and is subtle change from the older terminology of Best Management Practices (BMP). The subtlety of the term addresses the cause/effect aspects of implanting a BMP, with the water supplier responsible for the conservation outcome, verses the concept of a Demand Management Measure (DMM) with the consumer responsible for the outcome.

This Master Plan uses both terms, BMPs and DMMs, interchangeably and has integrated the practices and measures defined in the Water Forum Agreement and the DWR Urban Water Management Plan requirements.

3.7.1 BMPs and DMMs

The District supports the published Best Management Practices of the Water Forum Water Conservation Plan. The Water Forum BMPs include 16 specific practices with participating water purveyors having the option to implement using Water Forum criteria, or using customized criteria. The customized BMP criteria needs to be evaluated as part of an integrated review of the entire BMP package and result in a practice at least as effective as the Water Forum Criteria. Table 3-4 lists the Water Forum BMPs and the District's implementation approach.

Table 3-4
District/Water Forum BMPs

	Water Forum BMP Title	District Implementing Using Water Forum Criteria	District Implementing Using Customized Criteria
BMP 1:	Interior and Exterior Water Audits and Incentive Programs for Single-Family Residential, Multi-Family Residential, and Institutional Customers		Yes
BMP 2:	Plumbing Retrofit of Existing Residential Accounts		Yes
BMP 3:	Distribution System Water Audits, Leak Detection, and Repair	Yes	
BMP 4:	Non-Residential and Residential Meter Retrofit		Yes[(a)]
BMP 5:	Large Landscape Water Audits and Incentives for Commercial, Industrial, Institutional, and Irrigation Accounts		Yes
BMP 6:	Landscape Water Conservation Requirements for New/Existing Commercial, Industrial, Institutional, and Multi-Family Developments		Yes
BMP 7:	Public Information		Yes
BMP 8:	School Education		Yes
BMP 9:	Commercial and Industrial Water Conservation		Yes
BMP 10:	Not Used		
BMP 11:	Conservation Pricing		Yes
BMP 12:	Landscape Water Conservation for New/Existing Single-Family Homes		Yes
BMP 13:	Water Waste Prohibition	Yes	
BMP 14:	Water Conservation Coordinator		Yes
BMP 15:	Not Used		
BMP 16:	Ultra-Low Flush Toilet Replacement Program for Non-Residential and Residential Customers		Yes

(a) The residential meter retrofit is consistent with the Water Forum Agreement

A copy of the Water Forum Agreement and BMPs is provided in Appendix A. The District's customized BMPs are provided in Appendix A.

For the purposes of responding to the DWR Urban Water Management Planning Act, the District has addressed the 14 Demand Management Measures and the corresponding BMP(s) in the following sections. The descriptions below summarize the actual BMPs and the reader is referred to the appendix for the actual documents.

3.7.1.1 DMM 1 – Water Survey Programs (Formerly Interior and Exterior Water Audits for Single-Family and Multi-Family Customers)

This DMM is consistent with the District's BMP 1.

Implementation Description: The District will offer water audits to all newly metered customers and provide water conservation measures based on the results of the audits. Once the District is 100% metered, water use records will be used to identify the 20% of water users for water audits if not previously audited under the meter program. The District will also make available interior and exterior water audit materials and seasonal irrigation schedules by hydrozone to its customers.

Implementation Schedule: The District will be fully implementing the program described above no later than the beginning of the fourth year after signing the Water Forum Agreement. The Water Forum Agreement was signed by the District in 2000.

Methods to Evaluate Effectiveness: The District will survey past program participants to determine if audit recommendations were implemented.

3.7.1.2 DMM 2 – Residential Plumbing Retrofit

This DMM is consistent with the District's BMP 2.

Implementation Description: The District will provide customers with information about achieving water savings by retrofitting plumbing fixtures. The District will offer toilet leak test kits to all customers who request one at the District office. In addition, when feasible, the District will partner with other agencies to provide information and materials that would achieve water savings.

Implementation Schedule: This measure is ongoing at this time.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified.

3.7.1.3 DMM 3 – System Water Audits, Leak Detection and Repair

This DMM is consistent with the Water Forum BMP 3 presented in the Appendix and adopted by the District.

3.7.1.4 DMM 4 – Metering with Commodity Rates

This DMM is consistent with the District's BMP 4.

Implementation Description: The District is conducting a meter retrofit program exceeding 5.0% of customers per year and all metered customers will be billed on a consumption basis within one year of meter installation. The District will provide newly metered customers with information on how to read their meter and calculate a consumption-based billing amount.

Implementation Schedule: The District will install a minimum of 603 meters/year with the initial focus on completing the metering of all CII and MF accounts by the end of 2001. The District will be fully metered in 2016. All metered customers will be billed on a consumption basis following meter installation. The District will provide newly metered customers with information on how to read their meter and calculate a consumption-based billing amount.

Methods to Evaluate Effectiveness: See DMM 1.

3.7.1.5 DMM 5 – Large Landscape Conservation Programs

This DMM is consistent with the District's BMPs 5 and 6.

Implementation Description: The District will identify all "large" irrigation customers. The RWA Conservation Committee's Commercial Outreach program will be advertised via RWA efforts and District efforts to all non-residential accounts. The District will advise all customers of the need to seasonally adjust sprinkler timers and encourage the use of the CIMIS station information to assist with wise water use for landscaping. In addition, see DMM 4.

Implementation Schedule: This DMM is ongoing at this time.

Methods to Evaluate Effectiveness: See DMM 1.

3.7.1.6 DMM 6 – High-Efficiency Washing Machine Rebate Programs

The District does not currently offer a high-efficiency washing machine rebate program. The District will reconsider such a program following further implantation of the meter retrofit program and as water consumption figures are developed.

3.7.1.7 DMM 7 – Public Information Programs

This DMM is consistent with the District's BMP 7.

Implementation Description: The District will be a full participant in the RWA Conservation Committee and continue its own public information program. The Districts own program includes, but is not limited to, publishing a newsletter three times a year, bill stuffing, and materials available at the District Office.

Implementation Schedule: This is an ongoing program at this time.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified.

3.7.1.8 DMM 8 – School Education Programs

This DMM is consistent with the District's BMP 8.

Implementation Description: The District will be a full participant in the RWA Conservation Committee and continue its own public information program. The District will continue to respond to requests for speakers or educational materials from schools within the District.

Implementation Schedule: This is an ongoing program at this time.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified.

3.7.1.9 DMM 9 – Conservation Programs for Commercial, Industrial and Institutional

This DMM is consistent with the District's BMP 9.

Implementation Description: The District will offer water audits to all metered customers, advise all commercial and industrial customers of the RWA programs and encourage their participation, and make available DWR commercial/Industrial water-use materials.

Implementation Schedule: The District will be fully implementing the program described above no later than the beginning of the fourth year after signing the Water Forum Agreement. The Water Forum Agreement was signed by the District in 2000.

Methods to Evaluate Effectiveness: See DMM 1.

3.7.1.10 DMM 10 – Wholesale Agency Programs

The District does not provide wholesale water supplies and DMM is not applicable.

3.7.1.11 DMM 11 – Conservation Pricing

This DMM is consistent with the District's BMP 11.

Implementation Description: Quantity based rates were established in 1998 and the District bills metered customers accordingly.

Implementation Schedule: The meter retrofit program will result in the District being fully metered in 2016 and all metered customers will be billed on a consumption basis within one year of meter installation.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified at this time.

3.7.1.12 DMM 12 – Water Conservation Coordinator

This DMM is consistent with the District's BMP 14.

Implementation Description: The District will provide adequate resources to implement, administer, and monitor the conservation efforts. The District will have a staff member who is

an American Water Works Association (AWWA) Certified Water Conservation Practitioner (Level II) as the Water Conservation Coordinator.

Implementation Schedule: The District will be fully implementing the program described above no later than the beginning of the third year after signing the Water Forum Agreement. The Water Forum Agreement was signed by the District in 2000.

Methods to Evaluate Effectiveness: No specific method of evaluating the effectiveness of this BMP has been identified at this time.

3.7.1.13 DMM 13 – Water Waste Prohibition

This DMM is consistent with the Water Forum BMP 13 presented in the Appendix and adopted by the District.

3.7.1.14 DMM 14 – Residential Ultra-Low-Flush Toilet Replacement Programs

This DMM is consistent with the District's BMP 16.

Implementation Description: The District would participate in an Ultra-Low-Flush Toilet (ULFT) replacement program established by the regional sanitation district on in cooperation with surrounding agencies. It is not cost effective for the District to implement a program on its own at this time. Information regarding ULFT replacement opportunities will be gathered during water audits.

Implementation Schedule: The District will consider establishing a ULFT replacement program in 2016 when the District is fully metered.

Section 4: Facilities Replacement Planning

Facilities replacement planning requires defining the condition and replacement liability associated with District Infrastructure over the life of the facilities and identified capital projects to continue addressing the oldest District assets while preparing to address all facilities as they reach replacement.

4.1 Introduction

This section of the Master Plan provides a description of the infrastructure condition assessment and development of recommendations for replacement. Section 5 provides specific recommendations and project identification as part of the Capital Improvement Plan. This Section 4 also provides recommendations for continued record keeping and data collection as part of the ongoing operation and maintenance efforts.

Open Cut River Crossing at Rossmore Bar (1959)

4.2 Production Facilities Replacement Planning

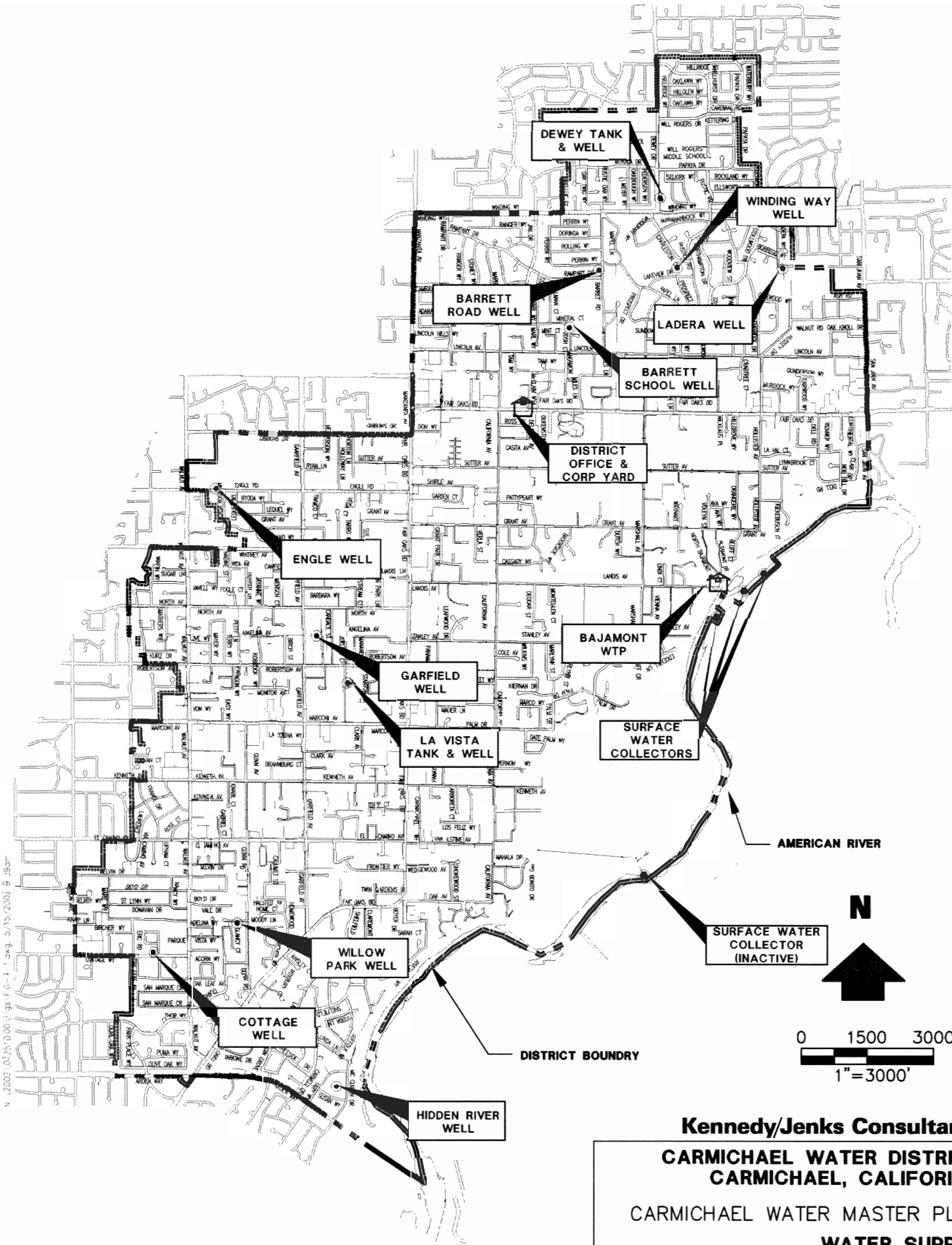
The District water production facilities include groundwater wells, surface water raw water and treated water processes, and above ground storage and booster pumping. Figure 4-1 shows the locations of the District production facilities.

The historic water use of the District has been a conjunctive combination of surface water and groundwater. It has long been the District philosophy to maintain a balance use of the water resources and this plan continues that approach to water supply. The production facilities replacement planning methodology addresses the age and remaining life, location of facilities with respect to source quality, and production quantity necessary to maintain a balanced conjunctive water use plan.

4.2.1 Operational Conditions and Criteria

Production facilities are required to meet the following critical service conditions:

A. Maximum Day Demand Condition – Typically occurring during extended hot periods of the summer and around summer holidays. Maximum day refers to the highest 24-hour average flow reported in gallons per minute. California Title 22 Water Works Standards requires that a water purveyor be capable of sustaining the maximum day flow indefinitely. The current Maximum Day Demand of the District is 25.5 million gallons per day (mgd) or 17,710 gallons per minute (gpm).



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CARMICHAEL WATER MASTER PLAN

WATER SUPPLY
PRODUCTION FACILITIES

APRIL 2003

FIGURE 4.1

K/J 022510.00

B. Peak Hour Demand Condition – Typically occurring during an extended hot period of the summer. Peak hour refers to the highest 60-minute water use of the District and is reported in gpm. Peak demand is typically meet from storage. The District has three types of storage available as follows:

   1. Aboveground steel storage reservoirs with booster pumping. Current capacity is a nominal 4 million gallons comprised of emergency storage, fire flow storage, and operational storage. The net operational storage is estimated at 1.5 million gallons.

   2. Below grade concrete clearwell storage at the Bajamont Water Treatment Plant. The installed treated water pumps limit current peak hour pumping capacity.

   3. Groundwater aquifer storage accessible by water production wells.

C. Average Day Demand – The average day demand is a theoretical number calculated based on the total estimated water used in year, divided by 365 days. This number is used to develop water resource plans, projections of groundwater extraction use versus yield, and other strategic planning considerations.

The current existing production facilities of the District include 10 groundwater production wells, two surface storage reservoirs, and one surface water treatment plant. In addition, the District is separated into three pressure zones. The water demands for the Average Day, Maximum Day, and Peak Hour demand conditions are presented in Table 4-1. Table 4-2 provides a breakdown of the demand by pressure zone and lists the minimum system pressure objectives.

Table 4-1
Water Demand Total

Water Demand Period	Gallons Per Minute (gpm)	Million Gallons Per Day (mgd)	Peaking Factor
Average Day Demand	8,053 gpm	11.6 mgd	1.0
Maximum Day Demand	17,710 gpm	25.5 mgd	2.2
Peak Hour Demand	22,250 gpm	32.0 mgd	2.8

Table 4-2
Water Demand By Pressure Zone

Water Demand Period	Zone 1 – North of Winding Way	Zone 2 – Central District	Zone 3 – South of El Camino Avenue	Minimum Desired System Pressure
Average Day Demand	460 gpm	8,420 gpm	1,570 gpm	60 psi
Maximum Day Demand	995 gpm	13,330 gpm	3,385 gpm	45 psi
Peak Hour Demand	1,415 gpm	16,960 gpm	3,875 gpm	30 psi

System operational and design criteria used to assess the performance of the production facilities including the ability to maintain the required supply at or above the minimum pressures

listed in Table 4-3. In addition, the District has set the objective of maintaining a prudent redundant capacity to account for unscheduled mechanical failures or service disruptions. The following redundancy has been considered in assessing the production replacement schedule.

Table 4-3
System Redundancy

Production Facility	Planned Redundancy
Bajamont Water Treatment Plant	One Standby Treated Water Pump One Standby Raw Water Pump Backup electrical generation for partial capacity
Booster Pump Stations (storage)	One Standby Booster Pump per site Backup drive equipment (natural gas) or electrical generation capacity
Groundwater Production Wells	Two Standby Wells at approximately 1,200 gpm to 1,400 gpm each

4.2.2 Production Facilities Replacement Considerations

All facilities wear out and need to be replaced. The useful period of service for equipment varies with the process, maintenance, and service conditions. For example, a submersible well pump will typically not last as long as aboveground vertical turbine well pumps. This evaluation, however, is not focusing on the mechanical equipment as much as on the production capacity.

The replacement approach for the District production capacity is described below:

4.2.2.1 Groundwater Production Wells

There are currently 10 operating wells in the District. Four are beyond the typical useful period of service. In addition, two of the wells have poor water quality and do not operate under normal conditions. The net remaining groundwater production capacity is 4,950 gpm (7.1 mgd). The water treatment plant capacity is currently a nominal 16 mgd.

The net sustainable supply available to meet the Maximum Day Demand is 23 mgd and is 2 to 3 mgd short of the minimum required. The shortfall is made up through reliance on the three older wells. For this reason, it is recommended that in next few years, the District construct a minimum of two, and possibly three, new wells.

Table 4-4 and 4-5 reflect the existing well facilities and recommended 10-year Capital Improvement Plans.

The second phase of the Capital Improvement Plan is for the period 2012 to 2027. In a similar evaluation, the older wells are recommended to be phased out and three new wells constructed. It is anticipated that the wells in the north central District will require treatment for iron, manganese, dissolved gasses (hydrogen sulfide, carbon dioxide), and possibly organics, such as PCE or other solvent pollutants. A central treatment plant located near the three new wells is recommended to economize on the capital expense, operation and maintenance needs, and impact to the community. Table 4-6 provides a summary of the recommended 2013 to 2027 capital improvements.

The third phase of the Capital Improvement Plan for groundwater well replacement is from 2027 to 2102. The single largest challenge facing the District with the third phase is the availability of well sites in the future. The site requirements should assume treatment for unforeseen regulations that may apply 25 to 100 years in the future.

It is recommended that the District secure agreements or acquire in fee title a minimum of five new well sites. Each site should be approximately 1/2 acre in size and consideration given to the surrounding land use and drinking water source vulnerability.

Table 4-4
Groundwater Production Facilities
Existing Facilities

Well Name	Production - gpm	Year Constructed	Typical Well Life - Years	Age	Demolition Date
Willow Park Well	1,400	1993	30	9	2023
Winding Way Well	1,350	1959	30	43	1989
La Vista Well	1,400	1980	30	22	2010
Barrett School Well	1,300	1989	30	13	2019
Barrett Road	850	1989	30	13	2019
Hidden River Vista Well	250	1968	30	34	1998
Dewey Drive Well	Poor Quality	1980	30	22	2010
Ladara Well	Poor Quality	1989	30	13	2019
Garfield Well	1,100	1946	30	56	1976
Engle Wells	Gas Engine	1959	30	43	1989
Existing Installed Capacity	7,650				
Emergency Backup (Ladara, Dewey, Engle)	3,400				
Total Installed Capacity	11,050				

Table 4-5
10-Year Capital Improvements
Groundwater Production Facilities
2002 - 2012

Well Name	Production - gpm	Year Constructed	Typical Well Life - Years	Demolition Date
Maintain Willow Park Well	1,400	1993	30	2023
Maintain La Vista Well	1,400	1980	30	2010
Maintain Barrett School Well	1,300	1989	30	2019
Maintain Barrett Road	850	1989	30	2019
Maintain Ladara Well	Poor Quality	1989	30	2019
Construct New Maddox Park Well	1,400	2005	30	2035
Construct New Garfield Well No. 2	1,400	2008	30	2038
Construct New Hidden River Vista Well No. 2	1,400	2012	30	2042
Planned Installed Capacity (gpm)	9,150			
Emergency Backup (Ladara, Winding Way)	2,550			
Total Well Capacity - gpm	11,700			

Additional Improvements:

Demolish Dewey Well

Demolish Hidden River Well

Demolish Garfield Well

Table 4-6
25-Year Capital Improvements
Groundwater Production Facilities
2013 - 2027

Well Name	Production - gpm	Year Constructed	Typical Well Life - Years	Demolition Date
See 10-Year CIP for First Phase Projects				
Maintain Willow Park Well	1,400	1993	30	2023
Maintain Maddox Park Well	1,400	2005	30	2035
Maintain Garfield Well No. 2	1,300	2008	30	2038
Maintain Hidden River Vista Well No. 2	850	2012	30	2042
Construct New Barrett School Well No. 2	1,400	2020	30	2050
Construct New Barrett School Well No. 3	1,400	2020	30	2050
Construct New Winding Way Well No. 2	1,400	2020	30	2050
Construct Piping and Centralized Groundwater Treatment Facility North	Installed 4,600 gpm capacity	2021-2022		
Planned Installed Capacity (gpm)	9,150			
Emergency Backup (Garfield Well, Willow Park Well)	2,800			
Total Well Capacity - gpm	11,950			

Additional Improvements:

Demolish Winding Way Well

Demolish Ladara Well

Demolish Barrett School Well

Demolish Barrett Road Well

4.2.2.2 Water Storage Facilities

The existing District water storage, as discussed earlier, consists of three components: surface steel reservoirs, buried concrete clearwell, and groundwater aquifer. The groundwater production facilities discussed above assume groundwater is used for maximum day supply only and does not provide the supplemental flows needed to meet the peak demand. Peak hour demand is planned to be met from the constructed storage facilities.

The District has two aboveground reservoirs: Dewey Tank (1 MG) and the La Vista Tank (3 MG). Each facility is equipped with a booster pumping plant and alternative drive capacity to meet the redundancy objectives also listed above.

4.2.2.2.1 Dewey Tank and Booster Pump Station

The Dewey Tank and Booster Pump Station was recently rehabilitated and reconstructed. The tank has been recoated and equipped with a cathodic protection system to extend the remaining life of the tank. The pump station should provide 50 years of service with routine maintenance and scheduled replacement of equipment. The steel reservoir will require recoating within 15 years and it may be economical to replace the tank at that time. A replacement capital improvement project will be included in the period 2012 to 2027.

4.2.2.2.2 La Vista Tank and Booster Pump Station

The La Vista Tank and Booster Pump Station have not received any significant rehabilitation or improvements for several years. In addition, the pumping facilities capacities tend to underutilize the tank storage available. This District installation includes a well pumping directly into a 3.0 million gallon steel storage reservoir and a booster pump station pumping from the reservoir to the system.

The existing operations plan for this well site was to run the well constantly during the summer and use the tank storage and booster pump capacity to supplement peak system demands. With the completion of the Bajamont surface water treatment plant the emphasis has changed and the goal is to use the reservoir to store treated surface water and extend the Bajamont plant production to allow reduced reliance on the La Vista well.

Several elements are needed to successfully shift the La Vista facility from a groundwater source to a dual source facility with surface water as the primary supply. The main elements are as follows:

- Rehabilitate existing La Vista Steel Storage Reservoir.
- Reconfigure site piping to allow the reservoir to fill from the system during non-peak periods.
- Reconstruct booster pump station matching peak hour demand conditions and providing backup power capacity.
- Install SCADA telemetry and programming to allow the La Vista Booster Pump Station to be controlled by the Bajamont Treatment Plant SCADA.

The steel tank rehabilitation, booster pumps, SCADA and related facilities replacement and site improvements are recommended to provide a reliable station.

1. Reconstruct/repair portions of the 3.0 million gallon reservoir to eliminate areas of severe corrosion. It is recommended that the District consider removing the corroded roof plates, knuckle transition to the walls and supports beams as part of the rehabilitation. This is based on prior inspections and the findings of the Dewey Rehabilitation Project in the later 1990's. The Dewey project expanded during construction to address more severe corrosion problems visible once the existing painting system was removed.

2. Recoat interior and exterior of reconstructed/repaired reservoir. This effort will need to include the containment of the tank work area and removal and disposal of the existing paint system containing lead. It was assumed that a shot blast method would be used however, alternate approached such as a high-pressure hydro blast system could be considered as the District moves forward with the project.

3. Demolish and reconstruct existing booster pump station with a new facility equipped as follows:

    a. Three 1,500 gpm duty pumps equipped with variable frequency drive (VFD) motors. One of the three pumps will provide 1,500 gpm of maximum day supply by pumping through the reservoir the La Vista Well supply if necessary to supplement the surface water supply. The peak supply capacity is targeted at 4,500 gpm with a target tank turnover of 1.25 MG.

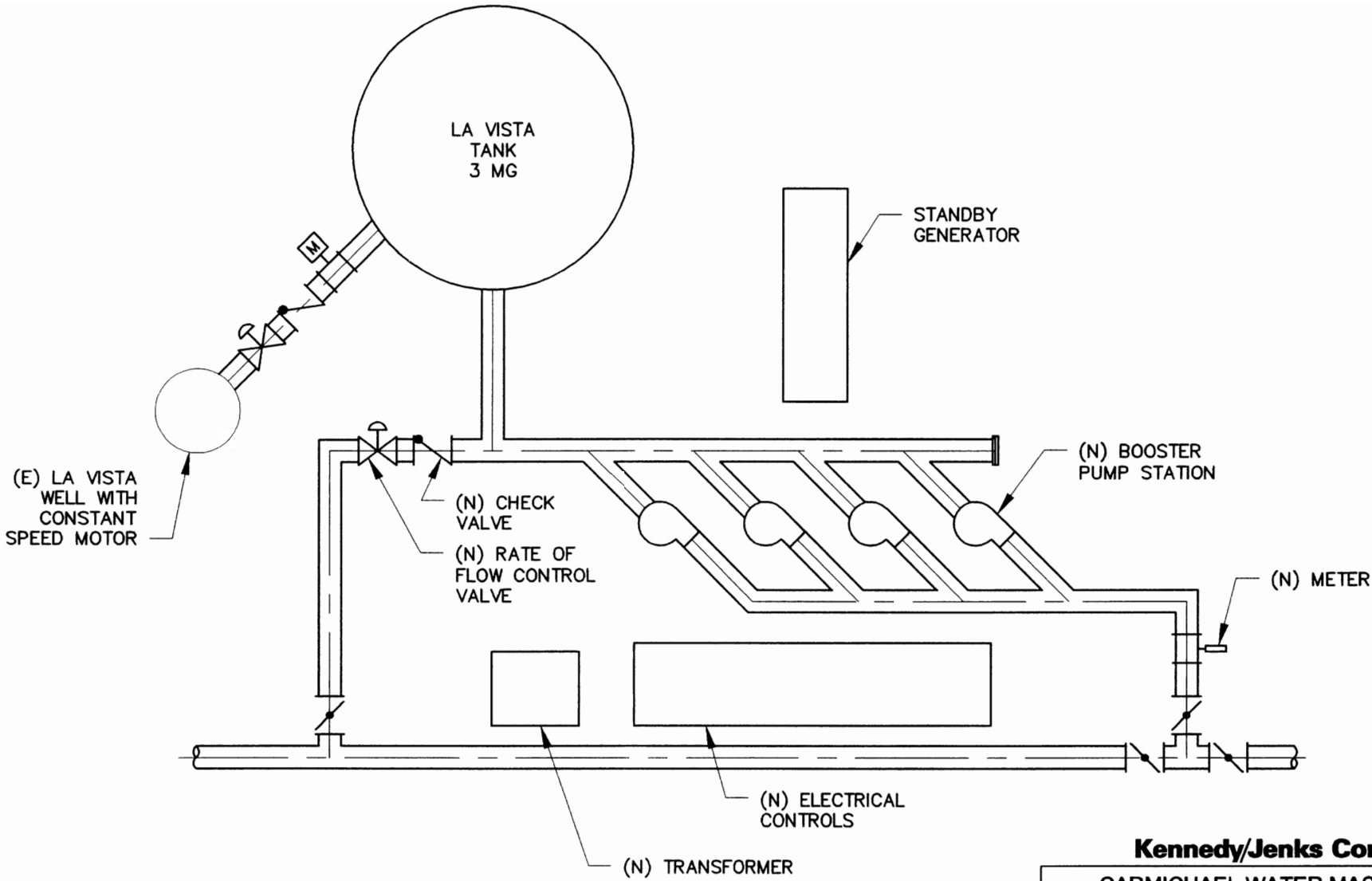
    b. One 1,500 gpm backup pump equipped with variable frequency drive (VFD).

    c. Standby electrical generation capacity suitable for a minimum of three pumps and the Well.

4. Install SCADA control with central plant telemetry to allow coordination of tank peak pumping verses off peak filling with surface water. Control strategy should provide for maintaining the Bajamont pumps at full capacity while reducing flows from La Vista to maximize surface water production. Control of La Vista would be based on pressure in the vicinity of the station.

Figure 4-2 shows a conceptual diagram of the La Vista project.

The existing District piped distribution system was designed without consideration for transmission of surface water to the La Vista Site and consists of an inconsistent collection of smaller pipes crossing Fair Oaks Boulevard. The existing conditions result in a hydraulic limitation limiting the increased use of surface water at La Vista. It is therefore recommendation that a water transmission pipeline extension be constructed to strengthen the capacity from the Bajamont Treatment Plant and also allow peak flow conveyance away from the tank. This project is identified as the Fair Oaks Pipeline Project and is discussed in greater detail in the pipe replacement sections to follow.



NOTES:
DEMOLITION TO INCLUDE EXISTING PUMP STATION, BLOCK BUILDING AND STANDBY GAS ENGINE DRIVE.

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CARMICHAEL WATER MASTER PLAN

LA VISTA BOOSTER PUMP STATION
CONCEPTUAL LAYOUT

MARCH 2003
FIGURE 4-2
K/J 022510.00

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The capital improvement schedule is to complete the La Vista work within the first 10-year period. Once completed, the facility should provide a reliable 50 years of service with scheduled maintenance and equipment replacement. Ultimately, the tank will need to be replaced as part of the 100-year plan. As discussed earlier, pump and motor replacement schedules, operation and maintenance schedules and other non-capital construction related project costs are included in the Financial Business Plan and not discussed here.

4.2.2.2.3 Bajamont Water Treatment Plant Clearwell

There are three existing treated water pumps installed at the clearwell. Each pump is capable of providing 5,100 gpm to 5,300 gpm. The existing pumps are designed to pump current plant maximum day production capacity using two pumps and allowing one pump to remain as a standby/backup pump. There is one additional pump bay available for an installed fourth pump.

Bajamont WTP Clearwell Treated Water Pumps

Although installed and operational, the standby pump has not been considered available because a back pump cannot also provide a reliable lead supply. A fourth pump is recommended in order to use the summer storage capacity of the clearwell. The timing of the fourth pump is in part contingent on the timing of the La Vista and groundwater recommended improvements.

4.3 Distribution System Replacement Planning

4.3.1 Pipeline System Inventory

The existing District piped water system consists of several types of pipe materials ranging from the used boiler tubing installed prior to 1950 to the ductile iron pipe installed as a District standard today. The intended service condition of the pipe system also varies depending on the pipe size. Larger pipelines tend to be transmission mains without service connections; smaller lines are distribution mains providing service tap locations and local fire flow capacity. Lastly, the pipeline system includes the service laterals consisting of small diameter lines from the main line to the service valve.

The pipeline replacement methodology focuses on the distribution and transmission pipeline elements. The service laterals are included in the Capital Improvement Plan; however, a detailed evaluation of a replacement strategy is discussed later with the meter retrofit planning approach.

4.3.2 Operational Conditions and Criteria

Pipeline facilities are required to meet the following critical service conditions:

A. Water Transmission – Water transmission mains consist of larger pipelines intended to transfer large volumes of water from a central source of supply to various parts of the District. These pipelines typically are installed without service connections to limit the possibility of a pipeline shutdown to repair a service. Transmission mains typically are installed with a parallel smaller distribution main available for local water service.

   The District water supply consists of both a distributed supply and a central supply as follows:

   1. Distributed Supply: The groundwater production wells and storage reservoirs are located throughout the District. Transmission pipelines in the vicinity of these sources of supply are not necessary. Twelve-inch and larger pipes may be needed to limit peak flow velocity; however, limiting service connections to these pipelines is not necessary. Transmission mains are not needed to connect and distribute supply from the distribution sources.

   2. Centralized Supply: The Bajamont surface water treatment plant is a centralized supply providing up to a future capacity of 22 million gallons per day. Transmission pipelines delivering this water supply are recommended and to a large degree exist within the District. The existing transmission mains include 20- to 36-inch steel pipelines and 20- to 24-inch ductile iron pipelines.

24-inch transmission main (left) with 8-inch distribution main (right) in common trench.

B. Water Distribution Mains – The bulk of the buried infrastructure consists of water distribution mains ranging in size from 4-inch to 18-inch pipe. The following is an overview of the existing distribution pipeline system components.

   1. The 4-inch and smaller pipes are the oldest components in the system. The 4-inch and smaller pipelines are both steel and asbestos cement material. Development over the years has resulted in the use of some 4-inch irrigation services for multiple service taps. Typically, the multi-service small diameter pipelines are back lot line installations or follow private roads making maintenance and repairs difficult. Replacement of multi-service and small diameter back lot water mains is a high priority for the pipe replacement program.

2. The 4-inch to 18-inch pipelines vary in materials from different types of steel pipe to asbestos cement (AC), PVC and ductile iron (DI). Installation trends show that the steel material is the oldest followed by AC pipe, PVC, and most recently DI pipe.

    a. Much of the steel material is reaching or exceeding the typical useful service life and are showing an increasing occurrence of leaks.

    b. The AC pipe is providing reliable service; however, it is also the most prevalent in the District. Failure of the AC pipes are expected to start increasing in the next 15 to 20 years with a possible significant replacement program being needed by the year 2035.

    c. The PVC pipe is expected to provide a reliable 75 years of service and replacement is not projected until the years 2050 and later.

    d. The DI pipe being installed as the current District standard should provide a reliable 100 years of service and a replacement strategy for the years 2080 to 2110 has been developed.

C. Minimum Service Conditions – The pipeline network needs to provide a reliable water supply with adequate hydraulic capacity to meet the following criteria:

    1. Maximum Day Demand: Minimum Pressure, 40 psi.

    2. Maximum Day Demand plus Fire Flow: Minimum Pressure, 20 psi.

    3. Peak Hour Demand: Minimum Pressure, 30 psi.

    In addition, the pipeline sizing should result in internal flow velocities under the maximum day flow conditions of not greater than 5 feet per second (fps). Possible exceptions are for fire flow where velocities may exceed 10 fps if the minimum pressure is maintained.

4.3.3 Existing Pipeline Condition Summary

District records indicate an increasing number of repairs with the increased system pressure following startup of the water treatment plant. A detailed review of 30% of the maintenance records indicated that the majority of the pipe repairs in recent years have been to steel pipelines. This review confirmed the assumption that age and predicted useful service life are suitable indicators for predicting replacement schedules.

A pipeline replacement decision matrix addressing the following conditions is recommended for tracking and projecting pipe replacement using existing and future data. The key conditions are as follows:

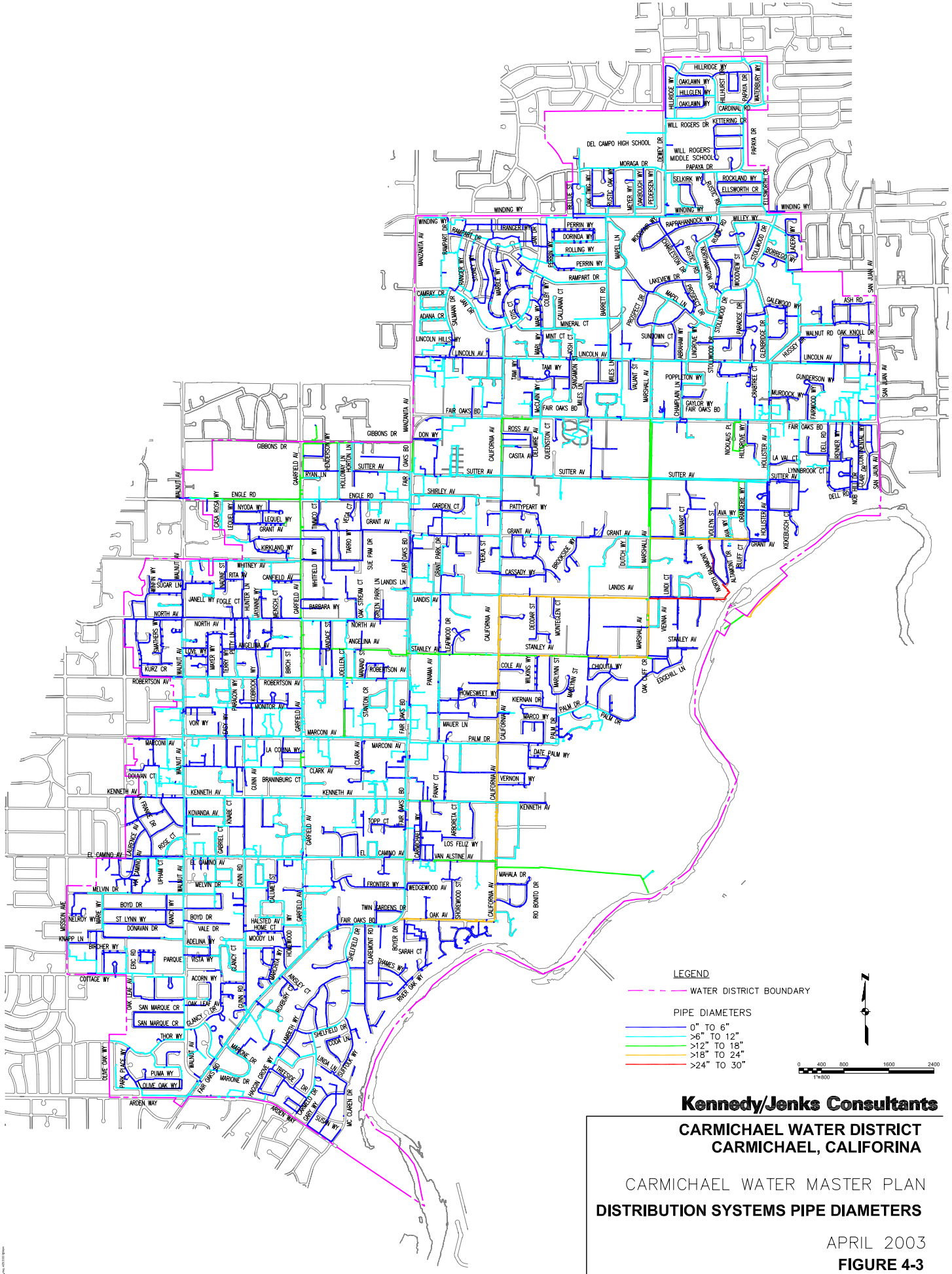
Type of Pipe	Steel, AC, PVC, DI indicates susceptibility to corrosion and failure.
Age of Pipe	Combined with expected useful life indicates replacement schedule.

Maintenance History	Pipe with known problems are given a higher priority. (These pipes are included in the 10-Year CIP.)
Inspection and Monitoring Findings	Based on findings from inspection and testing of selected pipeline reaches and supplemental reports.
Multiple Service	Prioritized replacement and pipe size increase for locations with multiple services on small diameter pipelines.
County Projects	Prioritized replacement based on County road projects that will either impact pipes by construction loads or limit access due to new pavement cutting moratorium.
Developer Project	Prioritized replacement based on developer projects that would either impact pipes by construction loads increase demand (fire flow) or limit access due to new pavement cutting moratorium.
Other Conditions	Overriding considerations, such as adding a marginal pipe to a project for an economy of scale project, or to increase capacity.

The initial 10-year pipe replacement CIP addresses many multiple services, very old pipelines, and high leak occurrence lines. The 25-year CIP (2012 to 2027) pipeline project will rely on additional information to be obtained during the initial 10-year CIP to prioritize replacement locations. Seventy-two projects have been identified for replacement and are provided in Appendix C. The remaining portion of the 100-year replacement plan is based on expected useful life.

The pipe diameter and installed total footages for the different materials are shown in Table 4-7. AC and steel pipe are the two most common materials and make up over 80% of the District system. Figure 4-3 shows the diameter of the distribution system. Figure 4-4 shows the pipe materials in the distribution system. Both Figures 4-3 and 4-4 are also provided as 22 x 34 plates and can be found in the back of the Master Plan. The replacement size will be 8-inch, corresponding to the District minimum pipe size.

Table 4-8 provides an estimate of the expected useful service life of the pipe materials installed in the District. A range of periods has been assumed based on the differing service conditions, control of installation, and the fact that pipes of the same material will age differently. The range of ages was used to develop a statistical period where the pipelines could be expected to show increased failure rates.



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CARMICHAEL WATER DISTRICT
CARMICHAEL, CALIFORINA

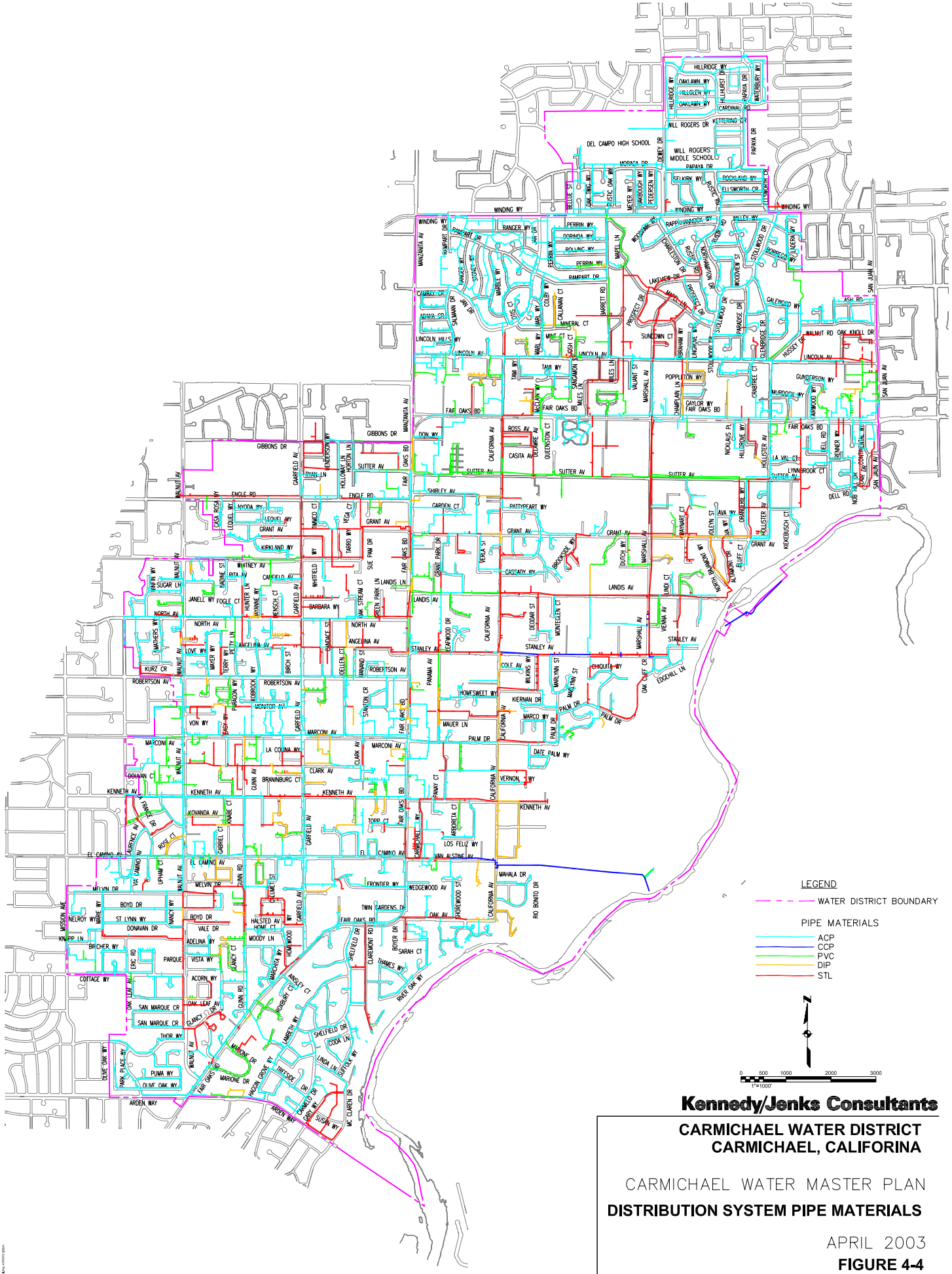
CARMICHAEL WATER MASTER PLAN

DISTRIBUTION SYSTEMS PIPE DIAMETERS

APRIL 2003

FIGURE 4-3

K/J 022510.00



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CARMICHAEL WATER DISTRICT
CARMICHAEL, CALIFORINA

CARMICHAEL WATER MASTER PLAN

DISTRIBUTION SYSTEM PIPE MATERIALS

APRIL 2003

FIGURE 4-4

K/J 022510.00

The installation dates for pipelines is not well known. What is known is that the District developed in spurts and that one type of pipe generally was installed during each high growth period. The assumed pipe installation periods are as follows:

Steel Pipe	Pre-1950 for all small diameter pipes.
AC Pipe	1950 to 1975 predominantly AC pipe was used.
PVC	1975 to 1990
DI	1990 to present

The assumed installation dates were combined with the projected useful life range to predict the failure occurrence curve shown in Figure 4-5. It can be seen that the small diameter steel pipelines are all beyond their predicted useful life and should be replaced in the near future. This is consistent with the development of the 10-year CIP projects. As can also be seen with this graphic, the AC pipe constitutes the largest share of the pipe failures. We recommend a preventative replacement approach be considered and that pipelines be replaced at a rate to stay ahead of the predicted failures. Based on this approach, all AC pipes should be replaced by approximately year 2050.

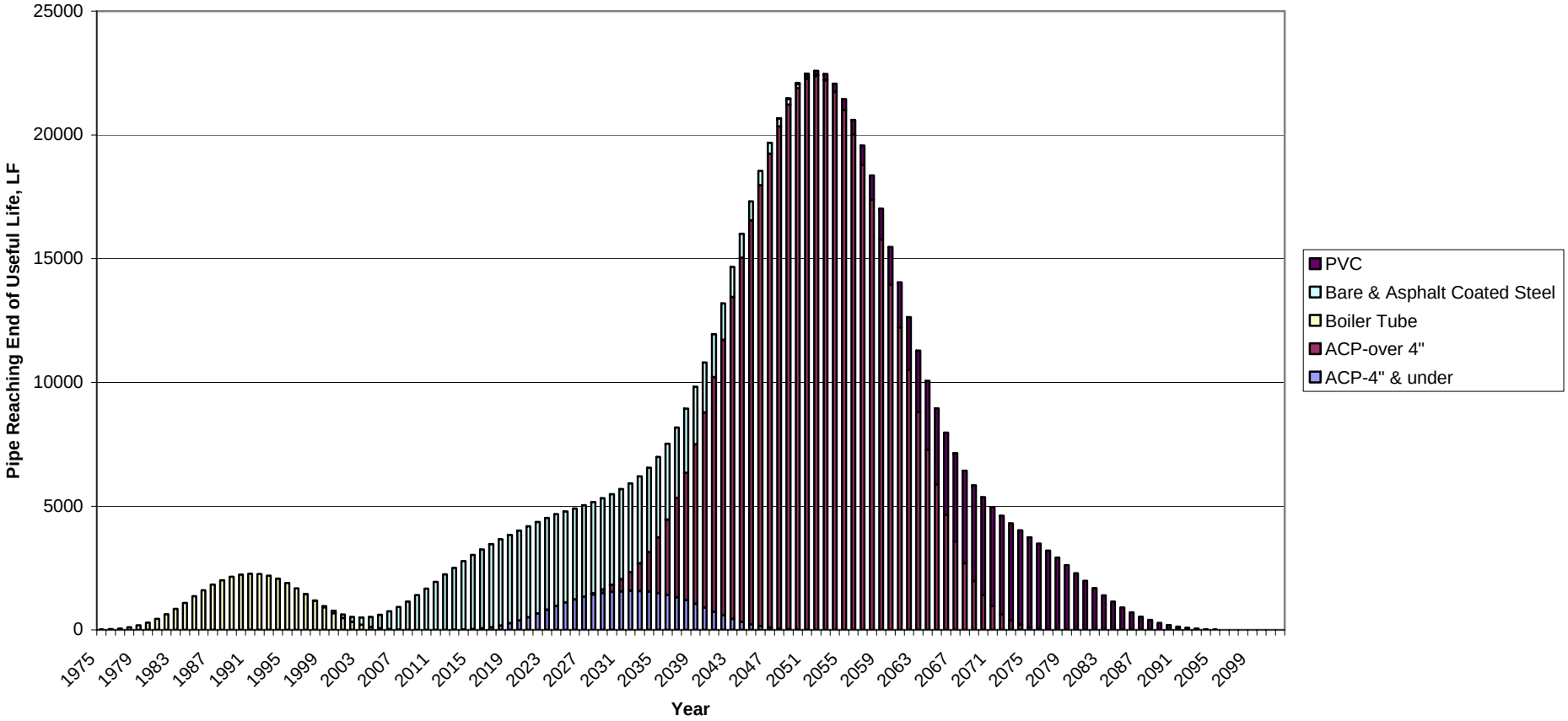
Table 4-7
Estimated Pipeline Length Breakdown by Pipe Size and Material
(Lineal Feet)

	Pipe Type					
Pipe Diameter, Inches	**Asbestos Cement Pipe**	**Concrete Cylinder Pipe**	**Ductile Iron Pipe**	**Poly Vinyl Chloride Pipe**	**Steel Pipe**	**Totals By Pipe Size**
Under 4	100	0	0	1,500	5,200	6,800
4	28,600	0	0	2,200	27,500	58,300
6	249,600	0	1,800	1,900	62,400	315,700
8	122,400	0	32,700	47,100	14,000	216,200
10	44,100	0	3,000	14,800	6,800	68,700
12	35,200	0	7,200	13,300	4,700	60,400
14	3,900	0	700	100	16,600	21,300
18	0	0	800	0	6,200	7,000
20	0	0	6,100	0	3,200	9,300
22	0	0	0	0	2,500	2,500
24	0	0	8,400	0	3,400	11,800
30	0	0	0	0	3,300	3,300
48	0	2,300	0	0	0	2,300
Totals by Pipe Type	483,900	2,300	60,700	80,900	155,800	783,600

Table 4-8
Expected Useful Life Range of Pipelines by Material

Pipe Material	Useful Life Range		
	Minimum	Average	Maximum
Asbestos Cement Pipe			
4-inch and under	50	60	70
6-inch and over	60	75	90
Concrete Cylinder Pipe			
All sizes	60	75	90
Ductile Iron Pipe			
All sizes	100	115	130
Poly Vinyl Chloride Pipe			
All sizes	60	75	75
Steel Pipe			
Bare Steel	35	50	65
Asphalt Coated	50	65	80
Boiler Tube	25	35	45
Cement Mortar Lined and Coated	60	75	90

Figure 4-5[(a)]
Pipelines Reaching End of Useful Life by Year



(a) Based on maximum useful life range from Table 4-2.

4.3.4 10-Year CIP

Seventy-two projects have been identified for the initial 10-year Capital Improvement Plan addressing known pipelines with problems, planned County projects and replacement of major transmission mains to provide reliability. The 10-year CIP calls for approximately 9,000 lineal feet a year of pipeline to be installed. All 72 projects will not be completed at the 9,000 lineal feet a year rate and any unfinished efforts should roll into the 25-year CIP period.

4.3.5 25-Year CIP

The 25-year CIP encompasses the beginning of the spike in AC pipe failures as approximately half the installed AC pipe reaches the end of its useful life. It is recommended that the 9,000 feet per year replacement rate be increased to 10,000 to 15,000 lineal feet per year. The actual locations of replacement pipes will include whole neighborhoods where AC pipe is the only material in place. The field conditions and replacement priorities should be updated in 2012 to 2015 using information gathered as part of the maintenance and monitoring plan.

4.3.6 100-year CIP

The 100-year replacement strategy is to continue replacing pipe at a rate to avoid the cost of high maintenance repairs due to failing pipe. It is expected that 10,000 to 15,000 lineal feet of pipe per year will need to be replaced during the period 2027 through 2065 to complete the replacement of the AC pipes and all steel lines. In addition, this rate assumes replacement of all PVC by 2065. Ductile Iron pipe installed in the 1990's is expected to provide service through 2090 and is shown being replaced at the later part of this century.

4.4 Condition Monitoring

Given the state of the District's water distribution system, steel pipe and asbestos cement pipe will be the greatest concern for replacement, both long term and short term. Steel, comprising just under 20% of the total linear footage within the District, is the more immediate concern because it is older and more deteriorated. Asbestos cement pipes will present a challenge because they amount for over 60% of the total linear footage and may begin deteriorating in significant quantities within the next 10 to 20 years. It is, therefore, recommended that the District adopt a leak occurrence and condition monitoring program.

The objectives of the monitoring program will be:

- To identify aging pipelines in need of immediate replacement;
- Predict timeframe for replacement of aging pipelines;
- Provide data that can be used to evaluate the cost effectiveness of strategies to extend the useful life of pipelines; and
- Evaluate the cost effectiveness of strategies implemented to extend the useful life of pipelines.

Steel Pipe Monitoring Program

The steel pipe monitoring program will consist of coupon sampling and ultrasonic testing. Each year during the 10-Year Capital Improvement Program, the District should:

- Excavate 30 sites per year based on soil conditions, type of pipe coatings, etc. Take care not to damage the pipeline during excavation and backfill. Each exposed location should be tested and a record developed for the following items:
  - Expose the entire circumference of the pipe for inspection and clean the external surface of dirt.
  - Visually inspect the pipe; photographically record the condition; note condition of coating, any cracks, corrosion ovality, or other visual defects.
  - Ultrasonically test the pipe to determine wall thickness, depth of pits, etc.
- At 10 of the locations for the first five years and five thereafter, remove a coupon sample for visual inspection and laboratory analysis. Coupons will be used to calibrate and validate the results of the ultrasonic monitoring.
- Each pipeline will be monitored at least twice within the 10-year period. Each successive monitoring of the pipeline should be as close to the previous sites as possible, but not include the same zone to minimize the chance the monitoring activity affects subsequent results.

When any steel pipeline is repaired or replaced, sections up to one foot shall be removed and brought back to the shop for visual inspection and possible testing. Pipe sections should be labeled as to the following:

- GIS pipe segment number.
- Estimated installation date.
- Trench condition (wet, dry, native backfill, import backfill).
- Sample date.
- Reason for sampling and associated work order number.

Asbestos Cement Monitoring Program

Because the primary component of asbestos cement pipe is portland cement, it can be degraded similarly to other portland cement products. Asbestos cement is degraded by low pH, low alkalinity conditions. Fortunately, the District maintains favorable water quality conditions. The asbestos cement monitoring program will consist of:

- Sampling of 30 sites per year;
- Excavating to uncover and remove sections of ACP;

- Visual inspection of the pipe; photographically record the condition; note condition of pipe for cracks, corrosion, ovality or other visual defects;

- Phenolphthalein staining to determine the remaining usable pipe wall thickness; and

- When an asbestos cement pipeline is removed, a foot-long section of the pipe being replaced should be collected by the District for visual testing and phenolphthalein staining. Pipe section removal should be labeled as directed above and brought to the shop for inspection.

Any pipeline being replaced, even for sections as short as a section for installation of a valve should be inspected and the condition noted and recorded in a readily accessible electronic format.

Record Keeping and GIS Database Development

The District completed a system-wide mapping upgrade in 2001, with all known pipes depicted electronically as individual elements suitable for migration to a GIS database. Valves, fire hydrants and other pipe features were also uniquely identified electronically for future GIS purposes. This Master Plan utilized elements of the existing GIS mapping and populated a limited number of fields for the District's buried assets; however, the opportunity to establish a comprehensive data reporting, storage and retrieve system exists.

It is recommended that the District develop GIS interface menus and templates for use by the distribution staff in reporting, tracking and displaying leak history, repair records, inspection reports and monitoring results using the existing District GIS map as the foundation. This element of a GIS program should be considered as one branch or spoke of a broader centralized GIS database providing services to all District departments.

Section 5: Capital Improvement Plan

The Capital Improvement Plan must consider the buried infrastructure/production facilities life cycle costs, be consistence with the District commitment to regional goals and metering, and position the District to address the long-term sustainability of District infrastructure.

5.1 Capital Improvement Plan

This Capital Improvement Plan (CIP) consolidates the recommendations for system wide replacement of all assets over a life cycle based on the District pipe material standard of DI pipe. For the purposes of this plan, the assumed life cycle for DI pipe is 100 years. During that period many of the District assets will require replacement more than once, however, using the DI standard provided a basis for a holistic look at the largest District unknown; how to sustain the buried infrastructure in a planned and financially responsible manner.

American River Microtunnel Crossing – 48-inch Diameter Pipe
– photograph courtesy of Peggy Berry, District Resident

Consideration of a 100 year CIP must be made with the idea that the farther into the future projects exist, the less specific and accurate will be schedule and costs. For this reason, this CIP is structured with three implementation periods as follows:

- 10-year CIP reflecting specific project recommendations and schedules with known locations and quantifiable features.
- 25-year CIP reflecting specific project recommendations and programmatic schedules for alternative project elements and locations.
- 100-year CIP reflecting programmatic impacts of major project elements requiring planned program development and financial positioning. Project elements, locations and schedules are conceptual.

The CIP includes elements for production facilities, buried infrastructure, operation and maintenance, and programmatic elements (storage fund, metering, vehicles). Expanding the CIP beyond a classical construction project based plan was done to support the Financial Business Plan concept discussed in Section 8 where the CIP is modeled for rate impacts with development of fund and reserve policy recommendations. Multiple options for implementation of the CIP were developed and are discussed in detail in Section 8. Table 5-1 provides a summary of the primary options for the CIP that were developed.

Table 5-1
CIP Options

Capital Improvement Plan Options	Description
Option 1 – Full CIP based on Pipe Conditions with Six Year Metering Program Completion, Fair Oaks Pipeline Project	$1,500,000 first year pipe replacement, 1000 meters per year
Option 2 – 5-year Ramped CIP with 10-year Metering Program	$420,000 first year pipe replacement, 600 meters per year
Option 3 – 10-year Ramped CIP with 15 year Metering Program	$420,000 first year pipe replacement, 290 meters year 1- 10 followed by 1000 meters per year for 5 years
Option 4 – 5-year Ramped CIP with 10-year Metering Program (Debt Financing option)	Same as Option 2 with debt financing – see Section 8 Financial Business Plan
Option 5 - 5-year Ramped CIP with 10-year Metering Program (Debt Financing option)	Same as Option 2 with addition of La Vista Reservoir Rehabilitation years 1 through 4 and debt financing - see Section 8 Financial Business Plan
Option 6 – 7	Funding alternative options - see Section 8 Financial Business Plan

5.2 Basis of Cost

The Capital Improvement Plan cost estimates were prepared using prior construction bids, current materials pricing, estimating guides, and engineering judgment. The costs are opinions of probable cost and reflect a conceptual level of accuracy. The estimates include a 25 percent contingency for unforeseen conditions, a 15 percent cost for engineering, administrative and legal costs, and 10 percent cost for environmental review. The environmental review contingency also includes the cost of obtaining Sacramento County approvals to construct within public right of ways.

All opinions of cost are in current 2003 dollars and are based on an Engineering News Records 20-Cities Construction Cost Index of 6635. The Financial Business Plan considers inflation in its analysis.

5.3 Schedule and Consolidate Cost Estimates

The Capital Improvement Plan cost estimates reflect the following categories of improvements.

- Meters and Services:

  The remaining meters to be installed are primarily residential and range from potentially difficult back lot installations to uniform standard subdivision infill. Due to the character of the District we have assumed that the bulk of the installations will be more difficult. Experience of the District and comparisons with the City of Roseville and Fair Oaks Water District meter installation cost, reflects an average cost of approximately $1,000 including a new service line from the main.

The CIP includes a line item for installation of the meter and service line replacements. The rate of installation has been varied as part of developing the different options for the Financial Business Plan. A fixed annual cost of $100,000 has been earmarked for meter replacement and servicing each year following installation.

- Vehicles, Equipment and Buildings:

  An annual allocation of $350,000 is provided in the CIP for maintaining the District vehicle fleet, tools, heavy equipment and miscellaneous building repairs. This liability is reflected in the cost to support the District capital project crews and is needed for the Financial Business Plan rate impact calculations.

- Pipe Replacement:

  The pipe replacement schedule is based on completion of the initial 72 identified projects in the first 25 years, followed by a planned replacement of the asbestos cement pipelines with completion around 2050. Following 2050, most District pipelines should have been replaced with ductile iron pipe and the replacement costs reflect a drop to about $200,000 per year.

  Pipe replacement costs reflect abandonment in place of existing pipelines, full valving and compliance with the District Standards and restoration of existing roadways, landscaping and surfaces.

  Pipeline Replacement

  The initial 10 years project schedule options vary from maintaining a replacement level of $0.5 million per year to maintain District capital replacement crews active, to a full minimum $1.0 million contract services with the $0.5 million District crew efforts. No alternative was developed increasing the level of projects earmarked for District Crews.

  The Fair Oaks Pipeline Project is a combination replacement project and transmission improvement project to be constructed in Fair Oaks Boulevard. Initial planning considered scheduling of the CIP project to coincide with the Sacramento County road project, however, possible budget impacts at the County may delay the project and for that reason it is recommended the Fair Oaks Pipeline Project remain on the District schedule and not be accelerated at this time to correspond with the County work. The Master Plan document adopted in principle in May 2003 included recommendations for proceeding with the Fair Oaks Pipeline project in the first three years of the CIP and those recommendations have been amended to reflect the changing County project uncertainty.

The District is encouraged to explore joint project options with the County should the Fair Oaks Road Widening project proceed ahead of the District CIP project schedule.

- Existing Wells:

  Capital liability with the existing wells includes servicing and replacement of pumps, motors, electrical, and control systems. Scheduled maintenance can extend the service life and provide some notice of pending failure. However, recurring costs can be expected and have been included at a rate of $100,000 every three years assuming a ten-year service life for most equipment. Well rehabilitation has not been included as a maintenance item and it is assumed that if a well, such as the Dewey Well, requires significant rehabilitation it will be abandoned and a new well constructed. Cost for new well construction is in the next line item.

- New Wells:

  New well construction projects assume a block building, vertical turbine pump, standby power, and SCADA telemetry back to the Bajamont Treatment Plant. Land acquisition is not included in the 10-year plan with the assumption that existing sites would be used or a negotiated site with the local park district. The estimated cost for drilling and equipping a new well approximately 490 feet deep is $1.6 million.

- Groundwater Treatment:

  Groundwater treatment is assumed for new wells by 2017. This is based on the assumption that a combination of increased groundwater contamination and new regulatory requirements will result in the need to treat all new groundwater supplies within the District. $1.2 million dollars has been allocated per site for future groundwater treatment and assumes a pressure treatment system similar to a granular activated carbon method with possible air stripping for development of cost estimates.

- Surface Water Intakes:

  The Ranney collector surface water intakes were reconditioned in 2000-2001 and should provide reliable service for at least 10 years. The CIP assumes a re-inspection and maintenance cleaning in 2014, 2024 followed by a major reconstruction in 2034. $250,000 has been allocated for the re-inspection and cleaning efforts. $15,000,000 has been allocated for the major reconstruction effort in 2034. The life cycle considerations continue with the 10-year maintenance cleaning and a 60-year life on the new structure. A second $15,000,000 major reconstruction was included for the year 2094 based on a 60-year service life.

- Membranes:

  The District is currently paying for membrane replacement elements, however, long term operation and maintenance liability of membrane systems has not been firmly defined given the recent development of the technology. For this reason, and to be conservative regarding risk, the CIP includes $191,000 per year for process equipment annual service costs.

- Surface Plant:

  The CIP costs associated with this element include items such as a 10-year equipment rehabilitation in 2010, raw water pump rehabilitation in 2016, treated water pump rehabilitation in 2031, periodic electrical and SCADA upgrades etc. A plant expansion and fourth treated water pump are not included in the CIP. Regional opportunities may provide a driver for an expansion project and it is assumed such a project would have outside funding considerations beyond this Master Plan.

- River Crossing:

  The CIP has no capital projects associated with the 48-inch diameter river crossing until 2026, when the crossing will have had 25 years of service. At that time the CIP reflects the start of a 10-year recurring $250,000 inspection, cleaning, and joint repair program. It is assumed that the crossing will need to be relined in 2096 and $5,000,000 has been allocated for that effort.

American River Crossing – Microtunnel Shaft

- Reservoir Storage:

  Reservoir storage includes the recurring cost of repairs, recoating and pump replacement at the La Vista and Dewey facilities. The initial project includes the La Vista tank and booster pump station followed by rehabilitations of the Dewey system in 2022. At that point there are recurring projects 2031-33, 2051-53, 2061-63, etc. The recurring projects include $2,150,000 for tank replacement and pump station reconstruction.

- Surface Water Storage Fund:

  This element is provides $1,000,000 for emergency water supply purchases should a severe drought result in extreme in stream flow reductions in the American River resulting in reduced diversion for the District. This fund is assumed to be established one time and is not shown as a recurring cost in the CIP schedule.

- Master Plan Update:

  The CIP includes a recurring line item for Master Plan updates every 10 years. The allocated cost is $200,000 in today's dollars.

The specific CIP schedules of the five options described above are provided at the end of this section.

5.4 Regional Considerations

The Regional Water Master Plan was reviewed for possible initiatives requiring infrastructure improvements associated with the District. No specific quantities of water or locations for delivery were identified or included in this Master Plan and the Capital Improvement Plan proposed reflects in-District needs only.

5.5 Capital Improvement Plan – Option Cost Schedules

The specific CIP schedules included in the May 2003 Master Plan as adopted in principle are provided at the end of this section. Appendix D includes the optional cost schedules and list of pipeline replacement projects as presented in the May 2003 document adopted in principle. It should be noted that the recommendations in this Master Plan range from specific to general and are based on the apparent conditions at the time the plan was adopted in principle on May 19, 2003. The rate resolution adopted June 23rd, 2003 continues moving the Carmichael Water District to an on-going pay-as-you-go capital replacement program addressing the long-term sustainability of a safe and reliable water supply. The recommendations of this Master Plan have not been amended in detail, other than to describe the possible delay in the County Fair Oaks Road Widening Project and its corresponding impact of the near term CIP schedule.

The Master Plan is a guidance document and provides the best opinion of the combined team of consultants, District staff, and Board members who participated in drafting the document. As such, the document is considered a living document and will require the careful and deliberate implementation as conditions change.

Carmichael Water District -- Master Plan Study
Option 1 -- Full CIP with Six-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2004	Pipeline Project 1 and 2 (CWD Forces); Pipeline Projects (Contractor); 1000 Meters and Services; Unit 5 Replacement; GIS Population	$ 1,000,000	$ 350,000	$ 1,500,000					$ 191,000				$ 100,000		$ 3,141,000
2005	Pipeline Project 53 (CWD Forces); Fair Oaks Pipeline - Project 6a and 6b; 1000 Meters and Services; Plant Equipment	$ 1,000,000	$ 350,000	$ 2,227,000					$ 186,300				$ 100,000		$ 3,863,300
2006	Pipeline Project 54 (CWD Forces); Fair Oaks Pipeline - Project 5a and 5b; 1000 Meters and Services; Plant Equipment	$ 1,000,000	$ 350,000	$ 2,206,000					$ 181,800				$ 100,000		$ 3,837,800
2007	Pipeline Project 10 (CWD Forces); Pipeline Projects (Contractor);1000 Meters and Services; Plant Equipment	$ 1,000,000	$ 350,000	$ 1,500,000					$ 177,400				$ 100,000		$ 3,127,400
2008	Pipeline Project 11 (CWD Forces); Pipeline Projects (Contractor); 1000 Meters and Services; Plant Equipment; Well Repairs; La Vista Design	$ 1,000,000	$ 350,000	$ 1,500,000	$ 100,000				$ 173,000			$ 75,000	$ 100,000		$ 3,298,000
2009	Pipeline Project 12 (CWD Forces); Pipeline Projects (Contractor); 1000 Meters and Services; Plant Equipment; New Well (Maddox Ranch) Design and Year 1; La Vista Facilities Year 1	$ 1,000,000	$ 350,000	$ 1,500,000		$ 200,000			$ 168,800			$ 750,000	$ 100,000		$ 4,068,800
2010	Pipeline Project 14 (CWD Forces); Pipeline Projects (Contractor); 250 Meters and Services; Plant Equipment; La Vista Facilities Year 2;New Well (Maddox Ranch) Year 2	$ 250,000	$ 350,000	$ 1,500,000		$ 1,400,000			$ 164,700			$ 1,500,000	$ 100,000		$ 5,264,700
2011	Pipeline Project 18 (CWD Forces); Pipeline Projects (Contractor); Meters/Services Repairs; Plant Equipment; Well Repair; New Well (Hidden River) Design; La Vista Facilities Year 3; Decommission Deterding Collector	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000	$ 200,000		$ 400,000	$ 30,000			$ 75,000	$ 100,000		$ 2,855,000
2012	Pipeline Project 29 (CWD Forces); Pipeline Projects (Contractor); New Well (Hidden River) Construction; Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000			$ 30,000	$ 250,000			$ 100,000	$ 200,000	$ 3,930,000
2013	Pipeline Project 32 (CWD Forces); Pipeline Projects (Contractor); Meters/Services Repairs; Plant Equipment; Surface Plant 10 Year Equipment Rehabilitation; New Well (Garfield) Design	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000	$ 2,000,000			$ 100,000		$ 4,280,000
2014	Pipeline Project (CWD Forces); Pipeline Projects (Contractor);Meters/Services Repairs; Plant Equipment; Well Repair; Inspect and Clean Ranney Collectors, New Well (Garfield) Construction	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000	$ 1,400,000		$ 250,000	$ 30,000						$ 3,730,000
2015	Pipeline Project (CWD Forces); Pipeline Projects (Contractor); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2016	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment; Raw Water Pump Rehabilitation; New Well (Barrett School 2) Design and Year 1	$ 100,000	$ 350,000	$ 1,500,000		$ 300,000			$ 30,000	$ 1,500,000					$ 3,780,000
2017	Pipeline Project (CWD Forces); Pipeline Projects (Contractor);Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment (Barrett School 2) Year 2; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000	$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000					$ 4,930,000
2018	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2019	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2020	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2021	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; New Well (Barrett School 3) Year 1; Dewey Upgrade Year 1	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000			$ 75,000			$ 2,255,000
2022	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well (Barrett School 3) and Treatment Year 2; Dewey Upgrade Year 2	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000		$ 1,500,000		$ 200,000	$ 6,530,000
2023	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Dewey Upgrade Year 3	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000			$ 500,000			$ 2,580,000
2024	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Inspect and Clean Ranney Collectors	$ 100,000	$ 350,000	$ 1,500,000				$ 250,000	$ 30,000						$ 2,230,000
2025	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2026	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000		$ 250,000				$ 2,330,000
2027	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades: New Well (Winding Way 2) with Treatment	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000	$ 250,000					$ 2,430,000

Carmichael Water District – Master Plan Study
Option 1 – Full CIP with Six-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2028	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; New Well (Winding Way 2) with Treatment	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 1,200,000		$ 30,000						$ 4,580,000
2029	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2030	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,600,000					$ 30,000						$ 2,080,000
2031	Capital Replacement Projects; Surface Water Plant Treated Water Pump Rehab.; New Storage Year 1	$ 100,000	$ 350,000	$ 1,700,000					$ 191,000	$ 1,500,000		$ 75,000			$ 3,916,000
2032	Capital Replacement Projects;Surface Water Plant Control Upgrades; Well Repairs; New Storage Year 2	$ 100,000	$ 350,000	$ 1,800,000	$ 100,000				$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 3,491,000
2033	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Storage Year 3	$ 100,000	$ 350,000	$ 1,900,000					$ 191,000	$ 2,000,000		$ 1,500,000			$ 6,041,000
2034	Capital Replacement Projects; Reconstruct Ranney Collectors; New Storage Year 4	$ 100,000	$ 350,000	$ 1,950,000				$ 15,000,000	$ 191,000			$ 75,000			$ 17,666,000
2035	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,950,000	$ 100,000				$ 191,000						$ 2,691,000
2036	Capital Replacement Projects; New Well Year 1;Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000		$ 200,000			$ 191,000		$ 250,000				$ 3,091,000
2037	Capital Replacement Projects;Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 2,000,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 6,791,000
2038	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2039	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2040	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2041	; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2042	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 250,000				$ 200,000	$ 3,091,000
2043	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2044	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000			$ 250,000	$ 191,000						$ 2,991,000
2045	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2046	Capital Replacement Projects; Surface Water Plant Piping Rehabilitation; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 1,500,000	$ 250,000				$ 4,391,000
2047	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000	$ 250,000					$ 1,991,000
2048	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2049	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2050	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000						$ 1,741,000
2051	Capital Replacement Projects; Surface Water Plant Electrical Upgrade; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 3,500,000		$ 75,000			$ 4,966,000
2052	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 2,341,000
2053	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,941,000
2054	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000				$ 250,000	$ 191,000			$ 75,000			$ 1,666,000
2055	Capital Replacement Projects	$ 100,000	$ 350,000	$ 650,000					$ 191,000						$ 1,291,000
2056	Capital Replacement Projects; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 600,000	$ 100,000				$ 191,000		$ 250,000				$ 1,591,000
2057	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 550,000					$ 191,000	$ 250,000					$ 1,441,000
2058	Capital Replacement Projects	$ 100,000	$ 350,000	$ 500,000					$ 191,000						$ 1,141,000
2059	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 450,000	$ 100,000				$ 191,000						$ 1,191,000
2060	Capital Replacement Projects	$ 100,000	$ 350,000	$ 400,000					$ 191,000						$ 1,041,000
2061	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Well Year 1; Storage Rehabilitation	$ 100,000	$ 350,000	$ 350,000		$ 500,000			$ 191,000	$ 1,500,000		$ 75,000			$ 3,066,000
2062	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 300,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,891,000
2063	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 250,000					$ 191,000			$ 1,500,000			$ 2,391,000
2064	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 250,000	$ 191,000			$ 75,000			$ 1,166,000
2065	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2066	Capital Replacement Projects; New Well Year 1; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000		$ 250,000				$ 1,591,000
2067	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 4,991,000
2068	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2069	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2070	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2071	Capital Replacement Projects; New Well Year 1; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000						$ 1,441,000

Carmichael Water District -- Master Plan Study

Option 1 -- Full CIP with Six-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2072	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,191,000
2073	Capital Replacement Projects; Surface Water Plant Equipment Replacement	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 2,000,000					$ 2,841,000
2074	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000						$ 1,191,000
2075	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2076	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000	$ 250,000				$ 2,591,000
2077	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2078	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2079	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2080	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2081	Capital Replacement Projects; New Well Year 1; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000			$ 75,000			$ 1,516,000
2082	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,691,000
2083	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000			$ 1,500,000			$ 2,341,000
2084	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000			$ 75,000			$ 1,266,000
2085	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2086	Capital Replacement Projects; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000		$ 250,000				$ 1,091,000
2087	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 250,000					$ 1,191,000
2088	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2089	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2090	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2091	Capital Replacement Projects, Surface Water Plant Equipment Replacement; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000		$ 75,000			$ 2,416,000
2092	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 1,791,000
2093	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,441,000
2094	Capital Replacement Projects; Reconstruct Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 15,000,000	$ 191,000			$ 75,000			$ 15,916,000
2095	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2096	Capital Replacement Projects; Well Repairs; Rehabilitate Raw Water Pipelines	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000		$ 5,000,000				$ 5,941,000
2097	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2098	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2099	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2100	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2101	Capital Replacement Projects; New Well Year 1	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000						$ 1,341,000
2102	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,291,000
2103	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2104	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
		$ 15,650,000	**$ 35,350,000**	**$ 92,483,000**	**$ 3,200,000**	**$ 20,800,000**	**$ 18,600,000**	**$ 32,150,000**	**$ 15,977,000**	**$ 27,250,000**	**$ 6,750,000**	**$ 15,225,000**	**$ 1,000,000**	**$ 2,000,000**	**$ 286,435,000**

25-yr avg	$ 3,229,667
25-yr min	$ 1,980,000
25-yr max	$ 6,530,000
100-yr avg	$ 2,835,990
10-Yr Total	$ 37,666,000

Carmichael Water District -- Master Plan Study
Option 2 -- 5-Year Ramped CIP with 10-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2004	Pipeline Project 1 and 2 (CWD Forces); 600 Meters and Services; Unit 5 Replacement; GIS Population; La Vista Design	$ 600,000	$ 250,000	$ 420,000					$ 191,000			$ -			$ 1,461,000
2005	Pipeline Project 53 (CWD Forces); Fair Oaks Pipeline - Project 6a and 6b; 600 Meters and Services; Plant Equipment; La Viste Facilities Year 1	$ 600,000	$ 350,000	$ 2,206,000					$ 186,300			$ -			$ 3,342,300
2006	Pipeline Project 54 (CWD Forces); Fair Oaks Pipeline - Project 5a and 5b; 600 Meters and Services; Plant Equipment; La Vista Facilities Year 2	$ 600,000	$ 350,000	$ 2,227,000					$ 181,800			$ -			$ 3,358,800
2007	Pipeline Project 10 (CWD Forces); Pipeline Project 4 (Robertson); 600 Meters and Services; Plant Equipment; La Vista Facilities Year 3	$ 600,000	$ 350,000	$ 1,105,000					$ 177,400			$ -			$ 2,232,400
2008	Pipeline Project 11 (CWD Forces); Pipeline Project 28 (Donavan); 600 Meters and Services; Plant Equipment; Well Repairs	$ 600,000	$ 350,000	$ 897,000	$ 100,000				$ 173,000			$ 75,000			$ 2,195,000
2009	Pipeline Project 12 (CWD Forces); 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 262,000					$ 168,800			$ 750,000	$ 200,000		$ 2,330,800
2010	Pipeline Project 14 (CWD Forces); 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 171,000					$ 164,700			$ 1,500,000	$ 200,000		$ 2,985,700
2011	Pipeline Project 18 (CWD Forces); 600 Meters and Services; Plant Equipment; Well Repair; New Well (Maddox Ranch) Design and Year 1; Decommission Deterding Collector	$ 600,000	$ 350,000	$ 238,000	$ 100,000	$ 200,000		$ 400,000	$ 30,000			$ 75,000	$ 200,000		$ 2,193,000
2012	Pipeline Project 29 (CWD Forces); New Well Maddox Ranch Year 2; 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 325,000		$ 1,400,000			$ 30,000	$ 250,000			$ 200,000	$ 200,000	$ 3,355,000
2013	Pipeline Project 32 (CWD Forces); 600 Meters and Services; Plant Equipment; Surface Water Plant Control Upgrades	$ 600,000	$ 350,000	$ 439,000					$ 30,000	$ 2,000,000			$ 200,000		$ 3,619,000
2014	Pipeline Project (CWD Forces); Pipeline Project 9, 16, 27 (Grant, Sue Pam, Whitney); 250 Meters/Services; Plant Equip.; Well Repair; Inspect/Clean Ranney Collectors; Surface Plant 10-Year Equip. Rehab.	$ 250,000	$ 350,000	$ 1,400,000	$ 100,000			$ 250,000	$ 30,000	$ -					$ 2,380,000
2015	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 500,000					$ 30,000						$ 980,000
2016	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment; Raw Water Pump Rehabilitation; New Well (Garfield) Design and Year 1	$ 100,000	$ 350,000	$ 500,000		$ 300,000			$ 30,000	$ 1,500,000					$ 2,780,000
2017	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment (Garfield) Year 2; Well Repairs	$ 100,000	$ 350,000	$ 500,000	$ 100,000	$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000					$ 3,930,000
2018	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2019	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2020	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2021	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; New Well Year 1; Dewey Upgrade Year 1	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000			$ 75,000			$ 2,255,000
2022	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Dewey Upgrade Year 2	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000		$ 1,500,000		$ 200,000	$ 6,530,000
2023	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Dewey Upgrade Year 3	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000			$ 500,000			$ 2,580,000
2024	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Inspect and Clean Ranney Collectors	$ 100,000	$ 350,000	$ 1,500,000				$ 250,000	$ 30,000						$ 2,230,000
2025	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2026	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000		$ 250,000				$ 2,330,000
2027	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000	$ 250,000					$ 2,430,000
2028	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 2,500,000		$ 30,000						$ 5,880,000
2029	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2030	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,600,000					$ 30,000						$ 2,080,000
2031	Capital Replacement Projects; Surface Water Plant Treated Water Pump Rehab.; New Well Year 1; New Storage Year 1	$ 100,000	$ 350,000	$ 1,700,000					$ 191,000	$ 1,500,000		$ 75,000			$ 3,916,000

Carmichael Water District -- Master Plan Study
Option 2 -- 5-Year Ramped CIP with 10-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2032	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; New Storage Year 2	$ 100,000	$ 350,000	$ 1,800,000	$ 100,000				$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 3,491,000
2033	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Storage Year 3	$ 100,000	$ 350,000	$ 1,900,000					$ 191,000	$ 2,000,000		$ 1,500,000			$ 6,041,000
2034	Capital Replacement Projects; Reconstruct Ranney Collectors; New Storage Year 4	$ 100,000	$ 350,000	$ 1,950,000				$ 15,000,000	$ 191,000			$ 75,000			$ 17,666,000
2035	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,950,000	$ 100,000				$ 191,000						$ 2,691,000
2036	Capital Replacement Projects; New Well Year 1;Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000		$ 200,000			$ 191,000		$ 250,000				$ 3,091,000
2037	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 2,000,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 6,791,000
2038	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2039	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2040	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2041	; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2042	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 250,000				$ 200,000	$ 3,091,000
2043	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2044	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000			$ 250,000	$ 191,000						$ 2,991,000
2045	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2046	Capital Replacement Projects; Surface Water Plant Piping Rehabilitation; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 1,500,000	$ 250,000				$ 4,391,000
2047	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000	$ 250,000					$ 1,991,000
2048	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2049	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2050	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000						$ 1,741,000
2051	Capital Replacement Projects; Surface Water Plant Electrical Upgrade; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 3,500,000		$ 75,000			$ 4,966,000
2052	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 2,341,000
2053	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,941,000
2054	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000				$ 250,000	$ 191,000			$ 75,000			$ 1,666,000
2055	Capital Replacement Projects	$ 100,000	$ 350,000	$ 650,000					$ 191,000						$ 1,291,000
2056	Capital Replacement Projects; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 600,000	$ 100,000				$ 191,000		$ 250,000				$ 1,591,000
2057	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 550,000					$ 191,000	$ 250,000					$ 1,441,000
2058	Capital Replacement Projects	$ 100,000	$ 350,000	$ 500,000					$ 191,000						$ 1,141,000
2059	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 450,000	$ 100,000				$ 191,000						$ 1,191,000
2060	Capital Replacement Projects	$ 100,000	$ 350,000	$ 400,000					$ 191,000						$ 1,041,000
2061	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Well Year 1; Storage Rehabilitation	$ 100,000	$ 350,000	$ 350,000		$ 500,000			$ 191,000	$ 1,500,000		$ 75,000			$ 3,066,000
2062	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 300,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,891,000
2063	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 250,000					$ 191,000			$ 1,500,000			$ 2,391,000
2064	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 250,000	$ 191,000			$ 75,000			$ 1,166,000
2065	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2066	Capital Replacement Projects; New Well Year 1; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000		$ 250,000				$ 1,591,000
2067	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 4,991,000
2068	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2069	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2070	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2071	Capital Replacement Projects; New Well Year 1; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000						$ 1,441,000
2072	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,191,000
2073	Capital Replacement Projects; Surface Water Plant Equipment Replacement	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 2,000,000					$ 2,841,000
2074	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000						$ 1,191,000
2075	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000

Carmichael Water District -- Master Plan Study
Option 2 -- 5-Year Ramped CIP with 10-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2076	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000	$ 250,000				$ 2,591,000
2077	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2078	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2079	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2080	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2081	Capital Replacement Projects; New Well Year 1; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000			$ 75,000			$ 1,516,000
2082	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,691,000
2083	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000			$ 1,500,000			$ 2,341,000
2084	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000			$ 75,000			$ 1,266,000
2085	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2086	Capital Replacement Projects; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000		$ 250,000				$ 1,091,000
2087	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 250,000					$ 1,191,000
2088	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2089	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2090	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2091	Capital Replacement Projects, Surface Water Plant Equipment Replacement; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000		$ 75,000			$ 2,416,000
2092	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 1,791,000
2093	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,441,000
2094	Capital Replacement Projects; Reconstruct Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 15,000,000	$ 191,000			$ 75,000			$ 15,916,000
2095	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2096	Capital Replacement Projects; Well Repairs; Rehabilitate Raw Water Pipelines	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000		$ 5,000,000				$ 5,941,000
2097	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2098	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2099	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2100	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2101	Capital Replacement Projects; New Well Year 1	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000						$ 1,341,000
2102	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,291,000
2103	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2104	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
		$ 15,250,000	**$ 35,250,000**	**$ 81,240,000**	**$ 3,200,000**	**$ 17,600,000**	**$ 19,900,000**	**$ 32,150,000**	**$ 15,977,000**	**$ 27,250,000**	**$ 6,750,000**	**$ 15,225,000**	**$ 1,000,000**	**$ 2,000,000**	**$ 272,792,000**

Option 2 -- 5-Year Ramped CIP with 10-Year Metering Program, No New Debt

Option 4 -- 5-Year Ramped CIP with 10-Year Metering Program, $5.0 Million Debt for FOB Pipeline Replacement

Option 5 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation

Option 6 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation

25-yr avg	$ 2,724,370
25-yr min	$ 980,000
25-yr max	$ 6,530,000
100-yr avg	$ 2,700,911
10-Yr Total	$ 27,073,000

Carmichael Water District -- Master Plan Study
Option 3 -- 10-Year Ramped CIP with 15-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2004	Pipeline Project 1 and 2 (CWD Forces); 290 Meters and Services; Unit 5 Replacement; GIS Population	$ 290,000	$ 250,000	$ 420,000					$ 191,000						$ 1,151,000
2005	Pipeline Project 53 (CWD Forces); Fair Oaks Pipeline - Project 6a and 6b; 290 Meters and Services; Plant Equipment	$ 290,000	$ 350,000	$ 1,513,000					$ 186,300						$ 2,339,300
2006	Pipeline Project 54 (CWD Forces); Fair Oaks Pipeline - Project 5a and 5b; 290 Meters and Services; Plant Equipment	$ 290,000	$ 350,000	$ 1,358,000					$ 181,800						$ 2,179,800
2007	Pipeline Project 10 (CWD Forces); Pipeline Project 4 (Robertson); 290 Meters and Services; Plant Equipment	$ 290,000	$ 350,000	$ 1,105,000					$ 177,400						$ 1,922,400
2008	Pipeline Project 11 (CWD Forces); Pipeline Project 28 (Donavan); 290 Meters and Services; Plant Equipment; Well Repairs; La Vista Design	$ 290,000	$ 350,000	$ 897,000	$ 100,000				$ 173,000			$ 75,000			$ 1,885,000
2009	Pipeline Project 12 (CWD Forces); 290 Meters and Services; Plant Equipment; La Vista Facilities Year 1	$ 290,000	$ 350,000	$ 262,000					$ 168,800			$ 750,000	$ 100,000		$ 1,920,800
2010	Pipeline Project 14 (CWD Forces); 290 Meters and Services; Plant Equipment; La Vista Facilities Year 2	$ 290,000	$ 350,000	$ 171,000					$ 164,700			$ 1,500,000	$ 150,000		$ 2,625,700
2011	Pipeline Project 18 (CWD Forces); 290 Meters and Services; Plant Equipment; Well Repair; New Well (Maddox Ranch) Design and Year 1; La Vista Facilities Year 3; Decommission Deterding Collector	$ 290,000	$ 350,000	$ 238,000	$ 100,000	$ 200,000		$ 400,000	$ 30,000			$ 75,000	$ 200,000		$ 1,883,000
2012	Pipeline Project 29 (CWD Forces); New Well Maddox Ranch Year 2; 290 Meters and Services; Plant Equipment; Surface Water Plant Control Upgrades	$ 290,000	$ 350,000	$ 325,000		$ 1,400,000			$ 30,000	$ 250,000			$ 250,000	$ 200,000	$ 3,095,000
2013	Pipeline Project 32 (CWD Forces); 290 Meters and Services; Plant Equipment; Surface Plant 10 Year Equipment Rehabilitation	$ 290,000	$ 350,000	$ 439,000					$ 30,000	$ 2,000,000			$ 300,000		$ 3,409,000
2014	Pipeline Project (CWD Forces); Pipeline Project 9, 16, 27 (Grant, Sue Pam, Whitney); 300 Meters and Services; Plant Equipment; Well Repair; Inspect and Clean Ranney Collectors	$ 300,000	$ 350,000	$ 1,400,000	$ 100,000			$ 250,000	$ 30,000						$ 2,430,000
2015	Pipeline Project (CWD Forces); 1000 Meters and Services; Plant Equipment; Pipeline Project (contractor) Fair Oaks Blvd.	$ 1,000,000	$ 350,000	$ 1,500,000					$ 30,000						$ 2,880,000
2016	Pipeline Project (CWD Forces);1000 Meters and Services; Plant Equipment; Raw Water Pump Rehabilitation; New Well (Garfield) Design and Year 1	$ 1,000,000	$ 350,000	$ 500,000		$ 300,000			$ 30,000	$ 1,500,000					$ 3,680,000
2017	Pipeline Project (CWD Forces); 1000 Meters and Services; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment (Garfield) Year 2; Well Repairs	$ 1,000,000	$ 350,000	$ 500,000	$ 100,000	$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000					$ 4,830,000
2018	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2019	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2020	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2021	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; New Well Year 1; Dewey Upgrade Year 1	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000			$ 75,000			$ 2,255,000
2022	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Dewey Upgrade Year 2	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000		$ 1,500,000		$ 200,000	$ 6,530,000
2023	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Dewey Upgrade Year 3	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000			$ 500,000			$ 2,580,000
2024	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Inspect and Clean Ranney Collectors	$ 100,000	$ 350,000	$ 1,500,000				$ 250,000	$ 30,000						$ 2,230,000
2025	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2026	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000		$ 250,000				$ 2,330,000
2027	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000	$ 250,000					$ 2,430,000
2028	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 2,500,000		$ 30,000						$ 5,880,000

Carmichael Water District -- Master Plan Study
Option 3 -- 10-Year Ramped CIP with 15-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2029	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2030	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,600,000					$ 30,000						$ 2,080,000
2031	Capital Replacement Projects; Surface Water Plant Treated Water Pump Rehab.; New Well Year 1; New Storage Year 1	$ 100,000	$ 350,000	$ 1,700,000					$ 191,000	$ 1,500,000		$ 75,000			$ 3,916,000
2032	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; New Storage Year 2	$ 100,000	$ 350,000	$ 1,800,000	$ 100,000				$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 3,491,000
2033	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Storage Year 3	$ 100,000	$ 350,000	$ 1,900,000					$ 191,000	$ 2,000,000		$ 1,500,000			$ 6,041,000
2034	Capital Replacement Projects; Reconstruct Ranney Collectors; New Storage Year 4	$ 100,000	$ 350,000	$ 1,950,000				$ 15,000,000	$ 191,000			$ 75,000			$ 17,666,000
2035	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,950,000	$ 100,000				$ 191,000						$ 2,691,000
2036	Capital Replacement Projects; New Well Year 1;Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000		$ 200,000			$ 191,000		$ 250,000				$ 3,091,000
2037	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 2,000,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 6,791,000
2038	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2039	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2040	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2041	; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2042	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 250,000				$ 200,000	$ 3,091,000
2043	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2044	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000			$ 250,000	$ 191,000						$ 2,991,000
2045	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2046	Capital Replacement Projects; Surface Water Plant Piping Rehabilitation; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 1,500,000	$ 250,000				$ 4,391,000
2047	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000	$ 250,000					$ 1,991,000
2048	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2049	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2050	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000						$ 1,741,000
2051	Capital Replacement Projects; Surface Water Plant Electrical Upgrade; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 3,500,000		$ 75,000			$ 4,966,000
2052	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 2,341,000
2053	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,941,000
2054	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000				$ 250,000	$ 191,000			$ 75,000			$ 1,666,000
2055	Capital Replacement Projects	$ 100,000	$ 350,000	$ 650,000					$ 191,000						$ 1,291,000
2056	Capital Replacement Projects; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 600,000	$ 100,000				$ 191,000		$ 250,000				$ 1,591,000
2057	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 550,000					$ 191,000	$ 250,000					$ 1,441,000
2058	Capital Replacement Projects	$ 100,000	$ 350,000	$ 500,000					$ 191,000						$ 1,141,000
2059	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 450,000	$ 100,000				$ 191,000						$ 1,191,000
2060	Capital Replacement Projects	$ 100,000	$ 350,000	$ 400,000					$ 191,000						$ 1,041,000
2061	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Well Year 1; Storage Rehabilitation	$ 100,000	$ 350,000	$ 350,000		$ 500,000			$ 191,000	$ 1,500,000		$ 75,000			$ 3,066,000
2062	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 300,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,891,000
2063	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 250,000					$ 191,000			$ 1,500,000			$ 2,391,000
2064	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 250,000	$ 191,000			$ 75,000			$ 1,166,000
2065	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2066	Capital Replacement Projects; New Well Year 1; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000		$ 250,000				$ 1,591,000
2067	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 4,991,000
2068	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2069	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2070	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2071	Capital Replacement Projects; New Well Year 1; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000						$ 1,441,000

Carmichael Water District -- Master Plan Study
Option 3 -- 10-Year Ramped CIP with 15-Year Metering Program, No New Debt

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2072	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,191,000
2073	Capital Replacement Projects; Surface Water Plant Equipment Replacement	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 2,000,000					$ 2,841,000
2074	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000						$ 1,191,000
2075	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2076	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000	$ 250,000				$ 2,591,000
2077	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2078	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2079	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2080	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2081	Capital Replacement Projects; New Well Year 1; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000			$ 75,000			$ 1,516,000
2082	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,691,000
2083	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000			$ 1,500,000			$ 2,341,000
2084	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000			$ 75,000			$ 1,266,000
2085	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2086	Capital Replacement Projects; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000		$ 250,000				$ 1,091,000
2087	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 250,000					$ 1,191,000
2088	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2089	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2090	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2091	Capital Replacement Projects, Surface Water Plant Equipment Replacement; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000		$ 75,000			$ 2,416,000
2092	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 1,791,000
2093	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,441,000
2094	Capital Replacement Projects; Reconstruct Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 15,000,000	$ 191,000			$ 75,000			$ 15,916,000
2095	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2096	Capital Replacement Projects; Well Repairs; Rehabilitate Raw Water Pipelines	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000		$ 5,000,000				$ 5,941,000
2097	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2098	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2099	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2100	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2101	Capital Replacement Projects; New Well Year 1	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000						$ 1,341,000
2102	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,291,000
2103	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2104	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
		$ 14,900,000	**$ 35,250,000**	**$ 80,678,000**	**$ 3,200,000**	**$ 17,600,000**	**$ 19,900,000**	**$ 32,150,000**	**$ 15,977,000**	**$ 27,250,000**	**$ 6,750,000**	**$ 15,225,000**	**$ 1,000,000**	**$ 2,000,000**	**$ 271,880,000**

25-yr avg	$ 2,690,593
25-yr min	$ 1,151,000
25-yr max	$ 6,530,000
100-yr avg	$ 2,691,881
10-Yr Total	$ 22,411,000

Carmichael Water District -- Master Plan Study
Option 4 -- 5-Year Ramped CIP with 10-Year Metering Program, $5.0 Million Debt for FOB Pipeline Replacement

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2004	Pipeline Project 1 and 2 (CWD Forces); 600 Meters and Services; Unit 5 Replacement; GIS Population; La Vista Design	$ 600,000	$ 250,000	$ 420,000					$ 191,000			$ -			$ 1,461,000
2005	Pipeline Project 53 (CWD Forces); Fair Oaks Pipeline - Project 6a and 6b; 600 Meters and Services; Plant Equipment; La Viste Facilities Year 1	$ 600,000	$ 350,000	$ 2,206,000					$ 186,300			$ -			$ 3,342,300
2006	Pipeline Project 54 (CWD Forces); Fair Oaks Pipeline - Project 5a and 5b; 600 Meters and Services; Plant Equipment; La Vista Facilities Year 2	$ 600,000	$ 350,000	$ 2,227,000					$ 181,800			$ -			$ 3,358,800
2007	Pipeline Project 10 (CWD Forces); Pipeline Project 4 (Robertson); 600 Meters and Services; Plant Equipment; La Vista Facilities Year 3	$ 600,000	$ 350,000	$ 1,105,000					$ 177,400			$ -			$ 2,232,400
2008	Pipeline Project 11 (CWD Forces); Pipeline Project 28 (Donavan); 600 Meters and Services; Plant Equipment; Well Repairs	$ 600,000	$ 350,000	$ 897,000	$ 100,000				$ 173,000			$ 75,000			$ 2,195,000
2009	Pipeline Project 12 (CWD Forces); 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 262,000					$ 168,800			$ 750,000	$ 200,000		$ 2,330,800
2010	Pipeline Project 14 (CWD Forces); 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 171,000					$ 164,700			$ 1,500,000	$ 200,000		$ 2,985,700
2011	Pipeline Project 18 (CWD Forces); 600 Meters and Services; Plant Equipment; Well Repair; New Well (Maddox Ranch) Design and Year 1; Decommission Deterding Collector	$ 600,000	$ 350,000	$ 238,000	$ 100,000	$ 200,000		$ 400,000	$ 30,000			$ 75,000	$ 200,000		$ 2,193,000
2012	Pipeline Project 29 (CWD Forces); New Well Maddox Ranch Year 2; 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 325,000		$ 1,400,000			$ 30,000	$ 250,000			$ 200,000	$ 200,000	$ 3,355,000
2013	Pipeline Project 32 (CWD Forces); 600 Meters and Services; Plant Equipment; Surface Water Plant Control Upgrades	$ 600,000	$ 350,000	$ 439,000					$ 30,000	$ 2,000,000			$ 200,000		$ 3,619,000
2014	Pipeline Project (CWD Forces); Pipeline Project 9, 16, 27 (Grant, Sue Pam, Whitney); 250 Meters/Services; Plant Equip.; Well Repair; Inspect/Clean Ranney Collectors; Surface Plant 10-Year Equip. Rehab.	$ 250,000	$ 350,000	$ 1,400,000	$ 100,000			$ 250,000	$ 30,000	$ -					$ 2,380,000
2015	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 500,000					$ 30,000						$ 980,000
2016	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment; Raw Water Pump Rehabilitation; New Well (Garfield) Design and Year 1	$ 100,000	$ 350,000	$ 500,000		$ 300,000			$ 30,000	$ 1,500,000					$ 2,780,000
2017	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment (Garfield) Year 2; Well Repairs	$ 100,000	$ 350,000	$ 500,000	$ 100,000	$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000					$ 3,930,000
2018	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2019	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2020	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2021	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; New Well Year 1; Dewey Upgrade Year 1	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000			$ 75,000			$ 2,255,000
2022	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Dewey Upgrade Year 2	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000		$ 1,500,000		$ 200,000	$ 6,530,000
2023	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Dewey Upgrade Year 3	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000			$ 500,000			$ 2,580,000
2024	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Inspect and Clean Ranney Collectors	$ 100,000	$ 350,000	$ 1,500,000				$ 250,000	$ 30,000						$ 2,230,000
2025	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2026	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000		$ 250,000				$ 2,330,000
2027	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000	$ 250,000					$ 2,430,000
2028	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 2,500,000		$ 30,000						$ 5,880,000
2029	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2030	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,600,000					$ 30,000						$ 2,080,000
2031	Capital Replacement Projects; Surface Water Plant Treated Water Pump Rehab.; New Well Year 1; New Storage Year 1	$ 100,000	$ 350,000	$ 1,700,000					$ 191,000	$ 1,500,000		$ 75,000			$ 3,916,000

Carmichael Water District -- Master Plan Study

Option 4 -- 5-Year Ramped CIP with 10-Year Metering Program, $5.0 Million Debt for FOB Pipeline Replacement

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2032	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; New Storage Year 2	$ 100,000	$ 350,000	$ 1,800,000	$ 100,000				$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 3,491,000
2033	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Storage Year 3	$ 100,000	$ 350,000	$ 1,900,000					$ 191,000	$ 2,000,000		$ 1,500,000			$ 6,041,000
2034	Capital Replacement Projects; Reconstruct Ranney Collectors; New Storage Year 4	$ 100,000	$ 350,000	$ 1,950,000				$ 15,000,000	$ 191,000			$ 75,000			$ 17,666,000
2035	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,950,000	$ 100,000				$ 191,000						$ 2,691,000
2036	Capital Replacement Projects; New Well Year 1;Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000		$ 200,000			$ 191,000		$ 250,000				$ 3,091,000
2037	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 2,000,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 6,791,000
2038	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2039	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2040	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2041	; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2042	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 250,000				$ 200,000	$ 3,091,000
2043	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2044	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000			$ 250,000	$ 191,000						$ 2,991,000
2045	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2046	Capital Replacement Projects; Surface Water Plant Piping Rehabilitation; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 1,500,000	$ 250,000				$ 4,391,000
2047	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000	$ 250,000					$ 1,991,000
2048	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2049	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2050	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000						$ 1,741,000
2051	Capital Replacement Projects; Surface Water Plant Electrical Upgrade; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 3,500,000		$ 75,000			$ 4,966,000
2052	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 2,341,000
2053	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,941,000
2054	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000				$ 250,000	$ 191,000			$ 75,000			$ 1,666,000
2055	Capital Replacement Projects	$ 100,000	$ 350,000	$ 650,000					$ 191,000						$ 1,291,000
2056	Capital Replacement Projects; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 600,000	$ 100,000				$ 191,000		$ 250,000				$ 1,591,000
2057	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 550,000					$ 191,000	$ 250,000					$ 1,441,000
2058	Capital Replacement Projects	$ 100,000	$ 350,000	$ 500,000					$ 191,000						$ 1,141,000
2059	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 450,000	$ 100,000				$ 191,000						$ 1,191,000
2060	Capital Replacement Projects	$ 100,000	$ 350,000	$ 400,000					$ 191,000						$ 1,041,000
2061	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Well Year 1; Storage Rehabilitation	$ 100,000	$ 350,000	$ 350,000		$ 500,000			$ 191,000	$ 1,500,000		$ 75,000			$ 3,066,000
2062	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 300,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,891,000
2063	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 250,000					$ 191,000			$ 1,500,000			$ 2,391,000
2064	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 250,000	$ 191,000			$ 75,000			$ 1,166,000
2065	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2066	Capital Replacement Projects; New Well Year 1; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000		$ 250,000				$ 1,591,000
2067	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 4,991,000
2068	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2069	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2070	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2071	Capital Replacement Projects; New Well Year 1; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000						$ 1,441,000
2072	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,191,000
2073	Capital Replacement Projects; Surface Water Plant Equipment Replacement	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 2,000,000					$ 2,841,000
2074	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000						$ 1,191,000
2075	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000

Carmichael Water District -- Master Plan Study

Option 4 -- 5-Year Ramped CIP with 10-Year Metering Program, $5.0 Million Debt for FOB Pipeline Replacement

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2076	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000	$ 250,000				$ 2,591,000
2077	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2078	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2079	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2080	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2081	Capital Replacement Projects; New Well Year 1; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000			$ 75,000			$ 1,516,000
2082	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,691,000
2083	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000			$ 1,500,000			$ 2,341,000
2084	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000			$ 75,000			$ 1,266,000
2085	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2086	Capital Replacement Projects; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000		$ 250,000				$ 1,091,000
2087	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 250,000					$ 1,191,000
2088	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2089	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2090	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2091	Capital Replacement Projects, Surface Water Plant Equipment Replacement; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000		$ 75,000			$ 2,416,000
2092	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 1,791,000
2093	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,441,000
2094	Capital Replacement Projects; Reconstruct Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 15,000,000	$ 191,000			$ 75,000			$ 15,916,000
2095	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2096	Capital Replacement Projects; Well Repairs; Rehabilitate Raw Water Pipelines	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000		$ 5,000,000				$ 5,941,000
2097	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2098	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2099	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2100	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2101	Capital Replacement Projects; New Well Year 1	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000						$ 1,341,000
2102	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,291,000
2103	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2104	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
		$ 15,250,000	**$ 35,250,000**	**$ 81,240,000**	**$ 3,200,000**	**$ 17,600,000**	**$ 19,900,000**	**$ 32,150,000**	**$ 15,977,000**	**$ 27,250,000**	**$ 6,750,000**	**$ 15,225,000**	**$ 1,000,000**	**$ 2,000,000**	**$ 272,792,000**

Option 2 -- 5-Year Ramped CIP with 10-Year Metering Program, No New Debt	25-yr avg	$ 2,724,370
	25-yr min	$ 980,000
Option 4 -- 5-Year Ramped CIP with 10-Year Metering Program, $5.0 Million Debt for FOB Pipeline Replacement	25-yr max	$ 6,530,000
Option 5 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation	100-yr avg	$ 2,700,911
Option 6 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation	10-Yr Total	$ 27,073,000

Carmichael Water District -- Master Plan Study

Option 5 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2004	Pipeline Project 1 and 2 (CWD Forces); 600 Meters and Services; Unit 5 Replacement; GIS Population; La Vista Design	$ 600,000	$ 250,000	$ 420,000					$ 191,000			$ 75,000			$ 1,536,000
2005	Pipeline Project 53 (CWD Forces); Fair Oaks Pipeline - Project 6a and 6b; 600 Meters and Services; Plant Equipment; La Viste Facilities Year 1	$ 600,000	$ 350,000	$ 2,206,000					$ 186,300			$ 750,000			$ 4,092,300
2006	Pipeline Project 54 (CWD Forces); Fair Oaks Pipeline - Project 5a and 5b; 600 Meters and Services; Plant Equipment; La Vista Facilities Year 2	$ 600,000	$ 350,000	$ 2,227,000					$ 181,800			$ 1,500,000			$ 4,858,800
2007	Pipeline Project 10 (CWD Forces); Pipeline Project 4 (Robertson); 600 Meters and Services; Plant Equipment; La Vista Facilities Year 3	$ 600,000	$ 350,000	$ 1,105,000					$ 177,400			$ 75,000			$ 2,307,400
2008	Pipeline Project 11 (CWD Forces); Pipeline Project 28 (Donavan); 600 Meters and Services; Plant Equipment; Well Repairs	$ 600,000	$ 350,000	$ 897,000	$ 100,000				$ 173,000			$ -			$ 2,120,000
2009	Pipeline Project 12 (CWD Forces); 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 262,000					$ 168,800			$ -	$ 100,000		$ 1,480,800
2010	Pipeline Project 14 (CWD Forces); 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 171,000					$ 164,700			$ -	$ 150,000		$ 1,435,700
2011	Pipeline Project 18 (CWD Forces); 600 Meters and Services; Plant Equipment; Well Repair; New Well (Maddox Ranch) Design and Year 1; Decommission Deterding Collector	$ 600,000	$ 350,000	$ 238,000	$ 100,000	$ 200,000		$ 400,000	$ 30,000			$ -	$ 200,000		$ 2,118,000
2012	Pipeline Project 29 (CWD Forces); New Well Maddox Ranch Year 2; 600 Meters and Services; Plant Equipment	$ 600,000	$ 350,000	$ 325,000		$ 1,400,000			$ 30,000	$ -			$ 250,000	$ 200,000	$ 3,155,000
2013	Pipeline Project 32 (CWD Forces); 600 Meters and Services; Plant Equipment; Surface Water Plant Control Upgrades	$ 600,000	$ 350,000	$ 439,000					$ 30,000	$ 250,000			$ 300,000		$ 1,969,000
2014	Pipeline Project (CWD Forces); Pipeline Project 9, 16, 27 (Grant, Sue Pam, Whitney); 250 Meters/Services; Plant Equip.; Well Repair; Inspect/Clean Ranney Collectors; Surface Plant 10-Year Equip. Rehab.	$ 250,000	$ 350,000	$ 1,400,000	$ 100,000			$ 250,000	$ 30,000	$ 2,000,000					$ 4,380,000
2015	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 500,000					$ 30,000						$ 980,000
2016	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment; Raw Water Pump Rehabilitation; New Well (Garfield) Design and Year 1	$ 100,000	$ 350,000	$ 500,000		$ 300,000			$ 30,000	$ 1,500,000					$ 2,780,000
2017	Pipeline Project (CWD Forces); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment (Garfield) Year 2; Well Repairs	$ 100,000	$ 350,000	$ 500,000	$ 100,000	$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000					$ 3,930,000
2018	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2019	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2020	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2021	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; New Well Year 1; Dewey Upgrade Year 1	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000			$ 75,000			$ 2,255,000
2022	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Dewey Upgrade Year 2	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 1,200,000		$ 30,000	$ 250,000		$ 1,500,000		$ 200,000	$ 6,530,000
2023	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Dewey Upgrade Year 3	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000			$ 500,000			$ 2,580,000
2024	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Inspect and Clean Ranney Collectors	$ 100,000	$ 350,000	$ 1,500,000				$ 250,000	$ 30,000						$ 2,230,000
2025	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000					$ 30,000						$ 1,980,000
2026	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000		$ 250,000				$ 2,330,000
2027	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 1,500,000		$ 200,000			$ 30,000	$ 250,000					$ 2,430,000
2028	Pipeline Project (CWD Forces $0.5 Mil); Pipeline Project (Contractor, $1.0 Mil); Meters/Services Repairs; Plant Equipment;	$ 100,000	$ 350,000	$ 1,500,000		$ 1,400,000	$ 2,500,000		$ 30,000						$ 5,880,000
2029	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,500,000	$ 100,000				$ 30,000						$ 2,080,000
2030	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,600,000					$ 30,000						$ 2,080,000
2031	Capital Replacement Projects; Surface Water Plant Treated Water Pump Rehab.; New Well Year 1; New Storage Year 1	$ 100,000	$ 350,000	$ 1,700,000					$ 191,000	$ 1,500,000		$ 75,000			$ 3,916,000

Carmichael Water District -- Master Plan Study

Option 5 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2032	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; New Storage Year 2	$ 100,000	$ 350,000	$ 1,800,000	$ 100,000				$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 3,491,000
2033	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Storage Year 3	$ 100,000	$ 350,000	$ 1,900,000					$ 191,000	$ 2,000,000		$ 1,500,000			$ 6,041,000
2034	Capital Replacement Projects; Reconstruct Ranney Collectors; New Storage Year 4	$ 100,000	$ 350,000	$ 1,950,000				$ 15,000,000	$ 191,000			$ 75,000			$ 17,666,000
2035	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,950,000	$ 100,000				$ 191,000						$ 2,691,000
2036	Capital Replacement Projects; New Well Year 1;Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000		$ 200,000			$ 191,000		$ 250,000				$ 3,091,000
2037	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 2,000,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 6,791,000
2038	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2039	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2040	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2041	; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000				$ 191,000						$ 2,741,000
2042	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 250,000				$ 200,000	$ 3,091,000
2043	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2044	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 2,000,000	$ 100,000			$ 250,000	$ 191,000						$ 2,991,000
2045	Capital Replacement Projects	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000						$ 2,641,000
2046	Capital Replacement Projects; Surface Water Plant Piping Rehabilitation; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 2,000,000					$ 191,000	$ 1,500,000	$ 250,000				$ 4,391,000
2047	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000	$ 250,000					$ 1,991,000
2048	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2049	Capital Replacement Projects	$ 100,000	$ 350,000	$ 1,000,000					$ 191,000						$ 1,641,000
2050	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 1,000,000	$ 100,000				$ 191,000						$ 1,741,000
2051	Capital Replacement Projects; Surface Water Plant Electrical Upgrade; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 3,500,000		$ 75,000			$ 4,966,000
2052	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 750,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 2,341,000
2053	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,941,000
2054	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 700,000				$ 250,000	$ 191,000			$ 75,000			$ 1,666,000
2055	Capital Replacement Projects	$ 100,000	$ 350,000	$ 650,000					$ 191,000						$ 1,291,000
2056	Capital Replacement Projects; Well Repairs; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 600,000	$ 100,000				$ 191,000		$ 250,000				$ 1,591,000
2057	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 550,000					$ 191,000	$ 250,000					$ 1,441,000
2058	Capital Replacement Projects	$ 100,000	$ 350,000	$ 500,000					$ 191,000						$ 1,141,000
2059	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 450,000	$ 100,000				$ 191,000						$ 1,191,000
2060	Capital Replacement Projects	$ 100,000	$ 350,000	$ 400,000					$ 191,000						$ 1,041,000
2061	Capital Replacement Projects; Surface Water Plant Equipment Replacement; New Well Year 1; Storage Rehabilitation	$ 100,000	$ 350,000	$ 350,000		$ 500,000			$ 191,000	$ 1,500,000		$ 75,000			$ 3,066,000
2062	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 300,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,891,000
2063	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 250,000					$ 191,000			$ 1,500,000			$ 2,391,000
2064	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 250,000	$ 191,000			$ 75,000			$ 1,166,000
2065	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2066	Capital Replacement Projects; New Well Year 1; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000		$ 250,000				$ 1,591,000
2067	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000					$ 4,991,000
2068	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2069	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2070	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2071	Capital Replacement Projects; New Well Year 1; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000						$ 1,441,000
2072	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,191,000
2073	Capital Replacement Projects; Surface Water Plant Equipment Replacement	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 2,000,000					$ 2,841,000
2074	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000						$ 1,191,000
2075	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000

Carmichael Water District -- Master Plan Study

Option 5 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation

Fiscal Years	Description of Work	Meters and Services	Vehicles, Equip., & Bldgs.	Pipe Replacement	Existing Wells	New Wells	Groundwater Treatment	Surface Water Intakes	Membranes	Surface Plant	River Crossing	Reservoir Storage	To Surface Water Storage Fund	Master Plan Update	Total Cost
2076	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000	$ 250,000				$ 2,591,000
2077	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2078	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2079	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2080	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2081	Capital Replacement Projects; New Well Year 1; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 500,000			$ 191,000			$ 75,000			$ 1,516,000
2082	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000		$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 5,691,000
2083	Capital Replacement Projects; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000			$ 1,500,000			$ 2,341,000
2084	Capital Replacement Projects; Inspect and Clean Ranney Collectors; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000			$ 250,000	$ 191,000			$ 75,000			$ 1,266,000
2085	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2086	Capital Replacement Projects; Inspect and Repair River Crossing	$ 100,000	$ 350,000	$ 200,000					$ 191,000		$ 250,000				$ 1,091,000
2087	Capital Replacement Projects; Surface Water Plant Control Upgrades; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 250,000					$ 1,191,000
2088	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2089	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2090	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2091	Capital Replacement Projects, Surface Water Plant Equipment Replacement; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 1,500,000		$ 75,000			$ 2,416,000
2092	Capital Replacement Projects; Surface Water Plant Control Upgrades; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000		$ 500,000		$ 200,000	$ 1,791,000
2093	Capital Replacement Projects; Surface Water Plant Equipment Replacement; Well Repairs; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000	$ 2,000,000		$ 1,500,000			$ 4,441,000
2094	Capital Replacement Projects; Reconstruct Ranney Collectors; Storage Rehabilitation	$ 100,000	$ 350,000	$ 200,000				$ 15,000,000	$ 191,000			$ 75,000			$ 15,916,000
2095	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2096	Capital Replacement Projects; Well Repairs; Rehabilitate Raw Water Pipelines	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000		$ 5,000,000				$ 5,941,000
2097	Capital Replacement Projects; Surface Water Plant Control Upgrades	$ 100,000	$ 350,000	$ 200,000					$ 191,000	$ 250,000					$ 1,091,000
2098	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2099	Capital Replacement Projects; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000				$ 191,000						$ 941,000
2100	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2101	Capital Replacement Projects; New Well Year 1	$ 100,000	$ 350,000	$ 200,000		$ 500,000			$ 191,000						$ 1,341,000
2102	Capital Replacement Projects; Surface Water Plant Control Upgrades; New Well and Treatment Year 2; Well Repairs	$ 100,000	$ 350,000	$ 200,000	$ 100,000	$ 1,400,000	$ 2,500,000		$ 191,000	$ 250,000				$ 200,000	$ 5,291,000
2103	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
2104	Capital Replacement Projects	$ 100,000	$ 350,000	$ 200,000					$ 191,000						$ 841,000
		$ 15,250,000	**$ 35,250,000**	**$ 81,240,000**	**$ 3,200,000**	**$ 17,600,000**	**$ 19,900,000**	**$ 32,150,000**	**$ 15,977,000**	**$ 27,250,000**	**$ 6,750,000**	**$ 15,225,000**	**$ 1,000,000**	**$ 2,000,000**	**$ 272,792,000**

Option 2 -- 5-Year Ramped CIP with 10-Year Metering Program, No New Debt

Option 4 -- 5-Year Ramped CIP with 10-Year Metering Program, $5.0 Million Debt for FOB Pipeline Replacement

Option 5 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation

Option 6 -- 5-Year Ramped CIP with 10-Year Metering Program, $7.8 Million Debt for FOB Pipeline Replacement and La Vista Reservoir Rehabilitation

25-yr avg	$ 2,724,370
25-yr min	$ 980,000
25-yr max	$ 6,530,000
100-yr avg	$ 2,700,911
10-Yr Total	$ 25,073,000

Section 6: Strategic Water Issues

"The Challenge facing Carmichael is the continued protection of its high quality water supplies, the responsible management of limited resources for the benefit of the community, and continued vision with regard to regional benefits through strategic water supply planning."

6.1 Introduction

This section of the Master Plan addresses the strategic water supply issues facing the District in the coming years. Issues include protecting the District's surface water rights and source water quality; protecting groundwater quality; and addressing opportunities for regional cooperation and integration of resources.

A number of external challenges are facing the District. The increasing competition for water in California will put pressure on the District to protect its valuable water rights and continue to pursue conservation measures. Groundwater contamination from inappropriate disposal of industrial solvents in areas adjacent to the District will require action to assure that groundwater continues to be a viable water supply source.

Bajamont Treated Water Pumps

Various Sacramento regional cooperation initiatives, including the Water Forum Successor Effort and the American River Basin Cooperating Agencies planning process, continue to provide opportunities for the District to increase the use of its water resources for mutual benefit.

This section of the Master Plan discusses surface water management, groundwater management, regional initiatives, and concludes with a summary of the principal strengths, weaknesses, opportunities, and threats facing the District in the coming years. It defines the issues, challenges, and opportunities facing the District and provides recommendations dealing with each.

6.2 Water Supply Management

Water supply management is discussed in the next several subsections and addresses both a historical perspective and a strategic forward-looking view.

6.2.1 Water Development Context in California

With the discovery of gold in the American River watershed by James Marshall in 1848, mining for gold drew increasing numbers of prospectors and supporting services to California. In the

Sierra foothills, water was re-channeled to sluice for gold, and hydraulic mining became a major industry from the late 1850s until a federal court prohibited the practice in 1884.

From 1849 to 1969, a primary objective of the growing population was to harness water resources to support economic development and growth, extract mineral resources, reclaim lands from wetlands, introduce irrigation to arid lands, and expand the distribution of water, often without regard for the collateral losses.

The 1884 court decision barring the discharge of mining waste into the streams of the state was a beginning in recognizing the impacts of these development actions. However, it was not until the passage of the federal National Environmental Policy Act (NEPA) in 1969 and the passage of a companion act in California in 1970, the California Environmental Quality Act (CEQA), that systematic in-depth assessment of the impacts of water resources development became part of the decision-making process.

The passage of the Central Valley Improvement Act in 1993, which set aside part of the yield of the federal Central Valley Project (CVP) for fishery purposes, among other environmental changes in project operations, marked further action to recognize and mitigate environmental damage associated with water resources development.

The signing of the Bay-Delta Accord in 1995 was another milestone, establishing joint federal-state participation in planning, program development, and implementation of actions to restore the ecological health of the Sacramento-San Joaquin Delta. The signing of the accord initiated the CALFED Bay-Delta Program in 1995, which brings some 20 federal and state agencies together to protect environmental, agricultural, and urban water interests through coordinated actions in four broad categories of actions:

- Water Supply Reliability – Expand water supplies and ensure efficient use of the resource;

- Ecosystem Restoration and Watershed Management – Improve the health of the Bay-Delta system through restoring and protecting habitats and native species;

- Water Supply Reliability – Improve water quality from source to tap for the 22 million Californians whose drinking water supplies come from the Bay-Delta watershed; and

- Levee System Integrity – Improve flood protection, ecosystem benefits, and water supplies by reducing the threat of levee failure.

As water users on one of the streams tributary to the Delta, Carmichael is drawn into the CALFED sphere of influence, and will be increasingly affected by actions to manage the Delta, as well as actions to manage statewide water demands, as described in further detail later in this master plan.

As the future unfolds, the trend towards greater protection of resources and conservation of limited water resources will likely intensify. As will be seen from the discussions below, a new urgency is emerging to share scarce water resources to support a growing population in the face of decreasing availability of water supplies.

6.2.2 Intensifying Competition for Water

In 2003, new challenges are emerging for the District to address. The expanding market for water in California, a decreasing available supply, continuing population growth, and a growing quest for northern California water for transfer across the Sacramento-San Joaquin Delta to southern California users are evidence of the intensifying competition for water in California.

These external forces will affect northern California water resources by increasing the demand for exports from the north and increasing pressure for conservation and redistribution of available supplies.

For example, California has been receiving about 5.2 million acre-feet of water from the Colorado River for many years, much of which was surplus water that has been used by the Metropolitan Water District of Southern California (MWDSC). Under the seven-state Colorado River Compact, California is entitled to only 4.4 million acre-feet each year. Negotiations were underway over the past few years to negotiate a soft landing, whereby California would reduce its use to that amount over the next 15 years. The negotiations did not reach an acceptable conclusion at the end of 2002, and federal approval of the use of any surplus water was eliminated at January 1, 2003 because California did not develop an approved plan to achieve the reduction.

MWDSC has the lowest priority to the 4.4 million acre-feet, and its supply was affected materially by elimination of access to the surplus Colorado River water. MWDSC initiated a Colorado River Contingency Program to purchase up to 200,000 acre-feet from northern California sources in 2003 to help offset the cutback of Colorado River water. Just over 130,000 acre-feet was purchased under the program.

Negotiations are continuing to develop an acceptable “4.4 plan” that might restore the availability of surplus Colorado River water to California. At present, however, an historical drought on the Colorado River may affect the availability of any surplus water, and the eventual (or continuing) implementation of the “4.4 plan” to reduce California’s annual draw on Colorado River water will intensify this competition for northern California water supplies. MWDSC is expected to continue seeking transfers from northern California to help meet the demands of the growing southern California region in the face of this decreasing supply.

Sacramento-San Joaquin Delta water quality issues also affect the demand for water supplies from northern California. The 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1995 Bay-Delta Plan) established flow objectives for meeting those water quality standards. The SWRCB has been conducting an eight-phase series of hearings to assign responsibility to water right holders for meeting those flow objectives. Phases 1-7, which have been completed, dealt with a variety of issues including interim compliance, the responsibilities of agencies on the San Joaquin River and its tributaries, Suisun Marsh, and other related matters.

Phase 8 addressed the responsibilities of remaining parties, primarily Sacramento basin holders of post-1914 appropriative water rights. Carmichael is one of the agencies that was included in the hearing process.

A group of agricultural interests among the affected Phase 8 parties developed a proposed settlement agreement to avoid the two-year long formal hearing process that would otherwise be needed to allocate these flow responsibilities. The settlement agreement is a framework for negotiating responsibility and implementing projects that will make water available for Delta flows, but does not specify an allocation of the parties' responsibility.

The interim settlement proposes to make additional water available to the Delta from the agricultural interests' water rights and groundwater resources to meet water quality-related flow objectives in all except wet years. The agreement provides for up to 92,500 acre-feet of settlement water to meet flow objectives, plus up to an additional 92,500 acre-feet for local use or transfer, depending on hydrology. The settlement also provides a 10-year period in which the parties will negotiate further to establish the responsibility for meeting the flow objectives and was signed by over 40 water suppliers in the Sacramento Valley. As a result of the agreement, the Phase 8 hearing process was automatically dismissed by the SWRCB.

The settlement agreement establishes the Sacramento Valley Water Management Program that will be the vehicle for providing the water to meet the flow objectives. The signatories of the settlement agreement will approve or disapprove project-specific agreements involved in providing water under the program.

The CALFED Bay-Delta Program, a cooperative effort of more than 20 federal and state agencies to develop a long-term plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system, involves programs to acquire water in northern California. The Environmental Water Account (EWA) acquires water to benefit threatened and endangered fish species, including Chinook salmon and Delta smelt.

The SWP and CVP export pumps are throttled back when the fish are present, increasing Delta outflow and decreasing exports. The EWA water is provided to the SWP and CVP to facilitate a more fish-friendly operation of the Delta export pumps and compensate the projects for pumping foregone in the Delta to benefit the fish. The EWA may acquire about 75,000-275,000 acre-feet in northern California each year in the coming years under this program, depending on hydrology and cross-Delta transfer capacity.

Under both the 1995 Bay-Delta Plan and the CALFED EWA Program, more water is being made available to environmental uses, and additional transfers of northern California water resources are making up the water that would otherwise be lost to exports to south-of-Delta users.

Dry years place an increasing stress on existing water supplies. The California Department of Water Resources has been initiating Dry Year Water Purchase Programs on an annual basis since 2001 to help water-short agencies. These programs purchase northern California water for transfer to users downstream of the Delta export pumps.

These water transfers focus more attention on northern California water supplies. Diversions from over-allocated streams, such as the American River, will be scrutinized more carefully by the SWRCB, and other parties interested in making water supplies available for other uses will take a greater interest in water right actions, especially when permits are being renewed.

Underlying these trends is the continuing population growth in California. Every year, the state gains about three-quarters of a million people. Most of this growth is from native births, and immigration accounts for the remainder. This growing population is placing an increasing demand on water supplies statewide.

All of these factors will focus additional attention on existing water users throughout California, especially when water right permits come up for renewal. The reasonableness of use, absence of waste, and actual development of beneficial use will be important considerations in maintaining permits and converting them to licenses.

The following section defines Carmichael's water rights, addresses how the District needs to approach renewal of its permit, and emphasizes the importance of proactive management of the valuable American River water rights. Assuring the security of the District's water supplies, both surface and groundwater, is a priority water management goal, along with participation in management of the region's water resources.

Recommendation: The District should monitor through news reports and ACWA the progress of the Colorado 4.4 Plan, MWDSC water transfers from northern California, the Sacramento Valley Water Management Program that will implement the Phase 8 settlement process, DWR dry year water purchase programs, and the CALFED Environmental Water Account water purchase activity (especially from the American River watershed) to maintain a sense of changes in the water transfers market as it affects northern California.

6.2.3 Surface Water Management and Rights

6.2.3.1 Permit Renewal/Conversion to License

The District has appropriative rights to the natural flow of the American River of up to 50 cfs, depending on the season. These rights are vested under California law through the State Water Resources Control Board, which issues the permits and licenses governing water rights.

California laws governing the rights to surface water are detailed and complex. Groundwater, on the other hand, is considered a local supply with little state regulation, unless the courts have intervened to apply rules through an adjudication proceeding.

In California, water belongs to the people of the state. A water right is a usufruct right, meaning that licensees may use the water and enjoy the benefits from its use, but they do not own the water. Waste or unreasonable use of water is prohibited.

Surface water rights are generally characterized as follows:

- Riparian Rights:
    - Incident of land ownership adjacent to a stream.

- Appropriative Rights:
    - Pre-1914 rights (perfected by mid-1914); and
    - Post-1914 rights (require a permit or license from the SWRCB).

Riparian rights are available to owners of property adjacent to streams in California. Because the vast majority of District customers are not adjacent to the river, riparian rights are not available for the community as a whole.

Appropriative rights, however, are applicable to the District. Appropriative rights are those granted to beneficial users of water by the State of California through the State Water Resources Control Board (SWRCB). Although Carmichael did begin use of American River water by at least 1910, and did have established use prior to 1914, the District apparently did not perfect or pursue those rights as pre-1914 rights. Instead, the District applied in November 1915 to the State Water Commission (the predecessor to the SWRCB), together with the $0.50 filing fee for a license to divert water from the American River under the appropriative water rights system initiated in 1914.

Under California water rights law, the earliest established uses of water have priority over more recent uses. This principle is termed "first in time, first in right." However, if appropriative rights are not used for a period of five years, they can be lost.

Licenses and permits issued by the SWRCB indicate the type of beneficial use to which the water will be applied, the place or specific area where the water can be used, the point of diversion where the water will be removed from the stream, and the place of storage, if the water is to be stored in a reservoir for more than 30 days.

The District obtained two licenses and a permit over the years, and now has rights to 50 cfs of flow, half under license, and half under permit. The licenses and permit require the District to report annually on its use of water. The licenses are good indefinitely as long as the District uses the water. A permit, however, is similar to a hunting license. Under its permit, the District has been granted a series of 10-year periods under which to develop beneficial use of the water within its authorized place of use, which is within the District boundaries. The licenses and permit are described below.

- License Number 67, issued in 1915, grants the District 15 cfs from the American River for the full year. (10,857 acre-feet maximum)
- License Number 2498, issued in 1925, grants the District an additional 10 cfs from May 1 to November 1. (3,640 acre-feet maximum)
- Permit Number 7356, issued in 1958, grants the District an additional 25 cfs for the year, with agriculture the designated use from March 15 to October 15, and domestic use for the balance of the year. (7,486 acre-feet domestic use maximum, 10,609 acre-feet irrigation use maximum)

Figure 6-1 illustrates the combined structure of the two licenses and one permit.

Table 6-1
Carmichael Water District Water Rights

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				Permit No. 7356 25 cfs							
< Domestic ><				Irrigation						>< Domestic >	
				License No. 2498 10 cfs Domestic							
License No. 67 15 cfs Domestic											

The 25 cfs permit has not yet been converted to a license. It was last renewed in July 1996 for a 10-year term that expires in December 2005. An important project for the District is to:

- Demonstrate how the water covered by the permit can be put to beneficial use in the community;
- Obtain an additional extension or extensions to implement the use plans;
- Implement and document the beneficial uses; and
- Convert the permit to a license by documenting the beneficial use.

The District's last request for extension, which was granted for a 10-year period, noted that the District was dealing with treated water quality issues and was minimizing American River water use until a new treatment plant was on-line. The District's application cited a number of ways in which the water could be put to beneficial use. They included:

- Completion of a treatment plant ultimately sized at 22 mgd, with an interim sizing of 11 mgd (actual installed capacity is 17 mgd with ultimate sizing at 22 mgd);
- Modification of Ranney Collector No. 4 (Deterding collector) to serve Ancil Hoffman Park (the collector is currently off-line);
- Pursuit of regional water planning through the Sacramento Water Forum and Sacramento Metropolitan Water Agency;
- Indication of a goal of providing untreated surface water for irrigation of Ancil Hoffman Park (currently irrigated by treated water);
- Recognition that two new parks would be provided at Sutter Avenue and Grant Avenue, requiring additional water supplies; and
- Continued flexibility in conjunctive use of groundwater and surface water supplies.

Additional reasons and opportunities are evident to support additional surface water use in the future:

- Continued water quality issues with some groundwater wells in the District;
- An approaching trichloroethylene (TCE) plume believed to have originated on the Aerojet General site in Ranch Cordova, and currently located under Fair Oaks Water District, heading towards Carmichael;
- A large plume of perchlorate and nitrodimethylamine (NDMA) believed to have originated on the Aerojet General site in Ranch Cordova, and currently located under the Arden Cordova Water Company across the American River from Carmichael;
- The need to have surface supplies ready to replace groundwater supplies should the plumes continue their current movements unchecked;
- The planned expansion of the treatment plant to allow greater flexibility in managing water supplies and benefiting groundwater overdraft in the northern portion of Sacramento County; and
- The possibility of expanding the District's place of use to address regional water planning issues and address emergency replacement of supplies for agencies affected by the pollutant plumes.

The District is able to demonstrate 30 days of continuous use of about 32 cfs of American River water, based on records in the 1970s. The expansion of the treatment plant capacity to 22 mgd would require a plant inflow of 34 cfs. The addition of untreated facilities at Ancil Hoffman Park for irrigation purposes would add another 2 cfs for a total of 36 cfs.

Current maximum day demands are about 25.5 mgd, or 39.45 cfs. At best, the District could prove up on about 40 cfs if the maximum day demand were to continue for a month and were to be met entirely through its licensed and permitted surface water sources. Projected in-District demands are insufficient to provide full use of the 50 cfs in water rights.

Future conservation and implementation of Water Forum Best Management Practices is expected to further reduce annual District water demand, including demands on the American River, although peak demand periods may still require significant surface water supplies.

From the preceding analyses, it appears that the District will be constrained in its ability to demonstrate beneficial use of the full 50 cfs in its permit and licenses. If the place of use for the water rights were expanded, however, as part of regional initiatives to share resources, such as through the Water Forum, then full use of the rights would become more likely.

6.2.3.2 SMUD Water Rights

The Sacramento Municipal Utility District (SMUD) has water rights for storage and power production in the upper American River watershed. The City of Sacramento has the right to divert this water and use it for municipal purposes within designated areas of use in the

Sacramento region. One of these areas, Area D, overlaps part of the District along Walnut Avenue. Thus, this portion of the District is located within two overlapping areas of use.

According to the 1978 Master Water Plan for the District (Dewante & Stowell, July 1978), there are approximately 390 acres of the District within Area D. The report indicates that 4.42 cfs could be available to the District under those water rights subject to the District reaching an agreement with the City of Sacramento for sharing of those resources.

The City of Sacramento has a water rights settlement contract with the USBR that provides for the City making payments to the USBR in return for storage rights and re-regulation of their water supply. The City has also entered into agreements with other local water agencies that are within the areas of use for the City-SMUD water rights to provide water to such areas.

Recommendation: The District should explore the expansion of the place of use for its water rights to preserve the asset for the broader Sacramento region and assist in meeting overall regional water demands consistent with the Water Forum Agreement as it evolves in the future. Potential for expansion of the place of use can be explored with:

- Arden-Cordova Water Company as replacement water for contaminated wells;
- Sacramento Suburban Water District to enhance conjunctive use and reduce groundwater overdraft;
- Citrus Heights Water District to reduce Folsom Lake diversions, reduce demand on the Peterson Treatment Plant, and enhance American River flows; and
- Fair Oaks Water District to reduce Folsom Lake diversions, reduce demand on the Peterson Treatment Plant, and enhance American River flows.

Recommendation: The District will need to address these potential reasons and opportunities with water rights counsel to determine which are relevant to the 2005 application for extension. It will also need to review its use records and present a full application to the SWRCB.

Recommendation: As the deadline for filing the application draws closer, the District should be in contact with staff of the SWRCB to assess the then-current regulatory climate with respect to permit renewals. It is anticipated that the increasing competition for water resources will lead to a more stringent analysis of applications for time extensions of water right permits.

Recommendation: The District should work with Sacramento County to achieve a satisfactory method for serving Ancil Hoffman Park with surface water supplies that are creditable to the District's water rights permit.

Recommendation: The District should explore groundwater recharge using treated water as discussed in the groundwater section of this master plan. A recharge program may offer an additional avenue to demonstrate beneficial use of its permitted water rights, provide a vehicle for water exchanges, and provide regional groundwater benefits. It may not be a practical method of increasing the District's peak diversion rate for water right perfection purposes, because the full plant capacity would likely be devoted to system supply during the peak summer months when maximum use would most likely be documented.

Recommendation: The District should file its application for water right permit renewal in 2005, incorporating its decision to perfect (license) part or all of the permit if appropriate.

6.2.3.3 Treatment Plant Expansion

Future expansion of the Bajamont Way microfiltration water treatment plant to 22 mgd was envisioned in the planning and construction of the facility. The plant footprint is designed to accommodate the expansion with addition of filter units, pumps, and plumbing to accommodate the added increment.

Expansion of the plant to serve the District would further reduce dependence on groundwater for peaking and enhance the recovery of the regional groundwater basin from many years of overdraft. Expansion would also reduce the impact on the District if the pollutant plumes from the Aerojet site remove groundwater wells from service.

The additional increment would be used primarily in the summer months when demands exceed the current 17 mgd plant capacity. The off-peak season capacity could be productively used to treat water for other agencies or for groundwater recharge, if an acceptable program is developed.

Other expansion opportunities exist in context with regional cooperation, as mentioned in the Water Rights discussion above, and discussed in greater detail in the section on Regional Opportunities. Such opportunities include treating water diverted under the water rights of other agencies, treating water for other agencies under the District's water rights that would be provided under an expanded place of use, or providing replacement supplies to agencies that have lost supplies due to contamination.

Implementation of a joint project at Ancil Hoffman Park that would use untreated river water for park and golf course irrigation would reduce the demand on the treatment plant and thereby could lessen the need for expansion, extend the time until expansion is required or reduce the magnitude of the expansion. The park currently draws most of its treated water for irrigation purposes between 10:00 p.m. and 6:00 a.m.

Recommendation: The District should pursue discussions with all of its neighbors on their potential interest in participating in the next phase of treatment plant expansion, recognizing that the regulatory, permitting, institutional, and infrastructure constraints will require considerable time to resolve. The District should also present the potential regional benefits of an expanded treatment plant in association with the District's water rights assets before the Water Forum. The District will also need to assess its own internal needs and timing for plant expansion consistent with financing constraints.

6.2.3.4 Transfers

Once the District has perfected additional water rights, it could have the opportunity to transfer water from time to time. Transfers would need to be based on conserved water or based on using an alternate supply source. Once the District has established its licensed water use rate, it could reduce that use and transfer the difference for short or long periods.

For example, if it were to reduce its use over time through its metering program and other conservation techniques, it could transfer the conserved water to an agency at the confluence of the American and Sacramento Rivers or downstream. It would need to leave any transferred water as flow in the American River until it had "…served its purpose of assisting fish flow releases in the Lower American River" (Water Forum Agreement).

The District could also increase its reliance on well water and transfer the conserved river diversions. Such an action would be possible within the Water Forum Agreement general goal of 30%-35% maximum reliance on groundwater (currently 15%-25%), although customer water quality may be an issue when increasing well use, especially in the summer time. The SGA may have some additional guidance and regulations affecting groundwater extraction targets over time.

Most potential buyers would want the water to be transferred in the summer to meet their summer demands or to be able to transfer the water across the Sacramento-San Joaquin Delta when the Delta is in balance and the transfer can be accomplished. Current prices for transfer water upstream of the Delta are ranging from $75-$125 per acre-foot, depending on hydrology.

The District might also be able to develop creative water transfer opportunities through its reduced pumping of groundwater or through a well injection-recharge program.

The District would need to evaluate whether reducing its river diversions to accomplish a water transfer would affect customer water quality, affect pollutant plume movement, and be cost-effective in the long term.

6.2.3.5 Deterding/Hoffman Park Diversions

As discussed briefly in Water Rights above, the District should work to continue providing surface water supplies to Ancil Hoffman Park and golf course. Sacramento County has reportedly been seeking to develop its own water supply facilities, specifically by drilling and operating groundwater wells.

There is a risk that operation of additional wells may trigger or hasten the movement of the perchlorate and NDMA plume in Ranch Cordova towards Carmichael's groundwater basin, and eventually allow it to move into Sacramento Suburban Water District's groundwater basin.

There is an advantage to the District in maintaining service to the entire park facility for water rights purposes, as well as for regional supply and water quality benefits. The Deterding Ranney Collector, which historically supplied the park as well as the rest of the water system, has been separated from the community supply system since sustaining flood damage in 1986. Following repair of flood damage, the collector supplied untreated irrigation supply to the park and golf course for a time. Further damage by floods in 1993 apparently allowed riverbed materials to enter the collector and be passed into the irrigation system. The collector has been unused for several years.

Recommendation: The District should explore joint solutions to redevelop the collector and related piping to allow resumption of the use of the Deterding Collector for irrigation supply to Ancil Hoffman Park and golf course. One alternative might be to create a lined pond or lake (water hazard) and pump at a relatively constant rate from the collector to the lake. Sacramento

County could then operate its irrigation system using booster pumps drawing from the lake to apply water during desired evening watering hours.

Such a solution could offer lower water bills over future years to the park in return for Sacramento County sharing in the capital cost of the collector and piping rehabilitation and creation of the lake. The regional groundwater quality would be better protected by such an option rather than drilling and operating wells.

The Deterding Collector potentially could be a second source of supply to the Carmichael Community with construction of an associated small membrane filtration plant at the edge of the park. The feasibility and need for such a facility would be most likely be related to an expansion in the place of use of the District's water rights.

The Deterding Collector also potentially could be a source of supply for areas south of the American River that have lost the use of groundwater wells due to the perchlorate plume. Micro-tunneling and considerable piping would be required, and the water would need to be treated before domestic use.

Recommendation: The District should explore a range of potential uses for the Deterding Collector if it cannot be used to benefit Ancil Hoffman Park, or if there is additional capacity from the collector. The District should be extremely reluctant to decommission or demolish the Deterding Collector.

Recommendation: The District should consider the feasibility of constructing a small package membrane water treatment plant to provide treated surface water to the system in conjunction with provision of untreated irrigation supply to Ancil Hoffman Park.

6.2.3.6 Protecting American River Water Quality (Watershed Protection)

The District has one of the better quality water supply sources in the State of California. The American River is low in dissolved solids, has very few upstream urban discharges, and is considered "generally excellent" in the most recent American River Watershed Sanitary Survey. All regulated drinking water parameters fall below maximum contaminant level standards. The District's plant provides state-of-the-art treatment to assure microbiological safety and a high degree of filtration, exceeding the current and proposed Surface Water Treatment Rules.

Urban runoff and recreation use are cited as sources of the fecal coliform bacteria found in the untreated river water in concentrations that increase in the downstream direction. In 1980, the District detected TCE in its raw water supply in the Ranney Collectors and Hidden River Vista well, apparently originating from a river seep near the Aerojet General site in Rancho Cordova.

After many years of remedial groundwater pumping, aeration to remove the volatile organics, and re-injection of the partially-treated water, the seep has apparently disappeared, and no TCE has been detected in the river for the last decade.

However, additional discharges to the American River from the Aerojet site are now approved through Buffalo Creek, a tributary that joins the American River upstream of the District's intakes. The nature of the residual chemicals in that discharge is generally unknown. While

considerable dilution will occur, the discharge may contribute some unknown or undetected chemicals into the river that will be picked up in urban water supplies.

Recommendation: The District should monitor the remediation efforts at the Aerojet General site to assure that the discharges do not adversely affect water quality. Contact with USEPA, the RWQCB, and affected water agencies should be maintained on a regular basis to obtain current knowledge and encourage remediation.

The District may be able to help protect its source water quality from further degradation through the California Source Water Assessment and Protection Program. The program is a federally funded information-gathering program that assists communities in protecting their drinking water supplies. The source assessment is the first step in developing a complete drinking water source protection program. Protection is accomplished by:

- Determining the source water protection area for the water system;
- Conducting an inventory of actual and potential contaminant sources within the source water protection area;
- Determining the susceptibility of the source area and water system to contamination;
- Reporting the findings to the water utility, its customers, and the community; and
- Working with the community and other stakeholders to implement source water protection measures that safeguard and sustain the water supply into the future.

In California, approximately $7,500,000 is available statewide for the source assessment activities of the program, with an average of a few hundred dollars available to assess each of the 16,000 active drinking water sources in the state. DHS is responsible for the completion of all assessments by May 2003. In completing its federal mandate, DHS will be using simple analytical tools to assess relatively large areas.

The District may be able to develop additional protections for its supply sources if it pursues a more detailed assessment than is being conducted by DHS. It may also be able to better address the Aerojet General discharges to the American River through participation in this program.

Recommendation: The District should oppose relaxation of discharge requirements for all upstream discharges to protect its water supply. It should also participate in the California Source Water Assessment and Protection Program.

Ten Sacramento, Placer, and El Dorado County agencies joined forces in 1998 to prepare the most recent update to the American River Watershed Sanitary Survey, which assesses watershed quality, drinking water facilities and quality, a full range of potential contaminant sources, and recommends management efforts to protect quality.

The survey describes the general effects on water quality of major storms, recreation, wastewater discharges, including septic systems, industrial discharges (such as landfills and Superfund sites, including Aerojet), urban runoff, and transportation and pipeline corridors.

Recommendations include ways in which water agencies must treat their water supplies, as well as watershed management methods.

Recommendation: The District should continue its participation in the American River Watershed Sanitary Survey series that is updated every five years, and ensure that the risks of the Aerojet General discharges are addressed, as well as all other watershed risks. The sanitary survey is scheduled for update in 2003.

6.2.3.7 Phase 8 of the SWRCB Bay-Delta Water Rights Hearing

As described in Section 6.2.2, Phase 8 of the SWRCB hearings to assign responsibility to water right holders for meeting Sacramento-San Joaquin Delta water quality-related flow objectives was automatically dismissed in January 2003 following execution of a settlement agreement between the parties. The resulting Sacramento Valley Water Management Program, comprised of over 40 Sacramento Valley water interests, will be implementing the settlement agreement by making water available for Delta water quality, local use, and transfer. Because Carmichael was one of the agencies included in the Phase 8 hearing process, the progress and success of the Sacramento Valley Water Management Program can impact the District in future years.

Recommendation: The District should monitor through news reports, the Northern California Water Association web page, DWR Water Transfers web page, and ACWA the progress of the Sacramento Valley Water Management Program. The District should monitor current and proposed transfer activity, the development of projects to meet the 185,000 acre-feet of interim capacity contemplated in the agreement, and the ultimate negotiation of responsibility for meeting the standards that is anticipated to occur near the end of the 10-year term of the settlement agreement.

6.2.3.8 Water Forum Best Management Practices

As an integral part of signing the Water Forum Agreement, the District prepared a Water Forum Water Conservation Plan consisting of package of Best Management Practices (BMPs). The District developed its own customized program to provide the most effective program possible considering the size of the District, its staff resources, and its financial constraints.

The program emphasizes a metering program that is planned for completion well ahead of Water Forum Agreement timelines, participating in the regional resources of the Regional Water Authority (incorporating the Sacramento Area Water Works), and public education. These BMPs consist of the following:

- Interior and exterior water audits and incentive programs, phased in over four years;
- Provide customer information on plumbing retrofit benefits and toilet leak detection kits;
- Complete a system leak detection survey, audit, and repair program;
- Implement a meter retrofit program with at least 600 residential meters per year;
- Implement full metering of commercial and multi-family accounts by 2001 (completed);

- Work with large landscape water users to audit use;
- Support Sacramento County landscape water efficiency ordinance proposals;
- Participate in the regional Sacramento Area Water Works Conservation Committee program to publicize conservation efforts;
- Publicize conservation through District newsletters and bill stuffers;
- Participate in the regional Sacramento Area Water Works Conservation Committee program in school outreach;
- Metered commercial and multi-family customers are billed on a consumption basis;
- Provide information on water-wise landscaping and water saving practices to all customers; and
- Have a staff member that is an AWWA Certified Water Conservation Practitioner (Level II) if the certification program becomes an industry standard.

The District is in the process of implementing the BMPs and other related actions to continue conservation efforts.

Recommendation: The District should continue its active conservation programs consistent with its established programs and the Water Forum BMPs.

6.2.4 Groundwater Management

The District overlies a groundwater basin that supplies a significant amount of the water supply used by agencies in Sacramento County north of the American River. The District has relied on the groundwater basin for a portion of its water supply since early in its history.

The District has the right to extract water from the basin because it overlies the basin. Groundwater in Sacramento County has not been adjudicated, but there is a regional agreement, an outcome of the Water Forum, covering the management of the north area groundwater basin. The Sacramento Groundwater Authority will provide the implementation of the groundwater management program.

From 1972 to 1985, the District emphasized use of the American River surface supplies as its source for about 80% of its water supply, using the wells for the other 20%. The wells were used primarily in the summer for peaking, and at times as the principal water supply source to serve the upper pressure zone, which is the higher-elevation area of the District north of Lincoln Avenue.

The 1986 floods damaged the collectors, and the 1987-1992 drought reduced flows in the American River, leading the District to increase the proportion of its supplies furnished by the wells to about 40%. In 1993, the District determined that the Ranney Collectors were influenced strongly by river water quality under the Surface Water Treatment Rule, and the production from

the Ranney Collectors was further reduced to increase chlorine contact time to assure satisfactory water quality.

The regional withdrawals from the groundwater basin have exceeded natural recharge since at least 1950 in the northern Sacramento County, and the water table has been dropping, with the greatest decline centered in the vicinity of McClellan Air Force Base. Figures 6-1, 6-2, and 6-3 show groundwater levels and the decline in water elevations from 1955 to 1975. The overdraft issue has been addressed many times over the years, including an extensive planning effort by the County of Sacramento that culminated in the Sacramento County-Wide Water Plan in 1976.

That 1976 plan proposed that the groundwater extraction from all areas of Sacramento County be reduced from about 50% of total water supply to about 33% of supply, or about 350,000 acre-feet of groundwater extraction per year County-wide. The plan also outlined institutional and financial arrangements to implement and enforce the plan. Those implementation and enforcement measures were never completely implemented, and the goal of reducing groundwater pumping was not met.

The 1976 plan was updated in 1989, in the Sacramento County Water Agency Water Plan Supplement. That update identified a Carmichael sub-area with boundaries identical to those of the District. The plan estimated a safe yield of 4,000 acre-feet per year for the Carmichael sub-area, which is about 30% of the District's annual water use.

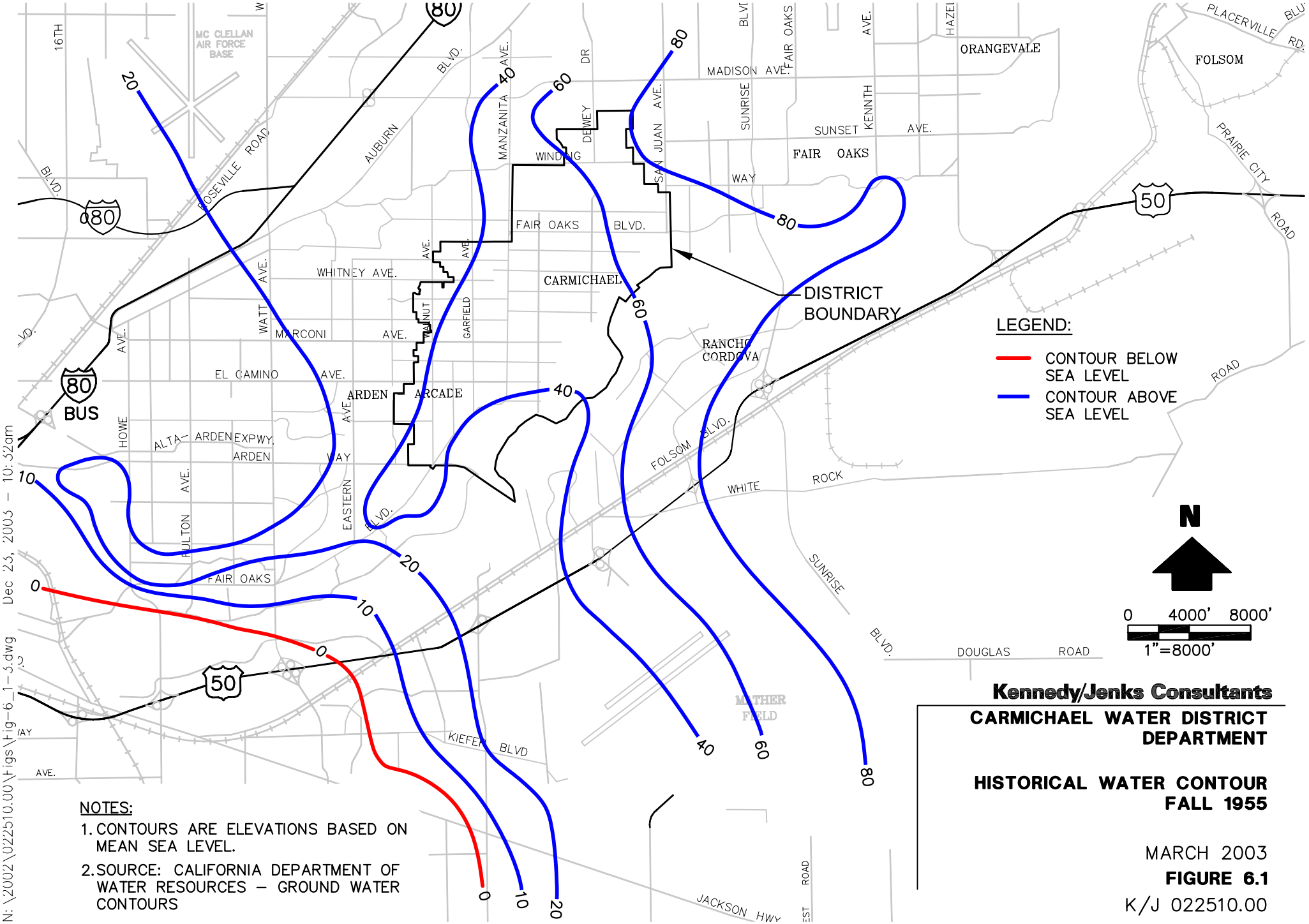
A plan to control the overdraft and manage the basin has emerged as the Groundwater Management Element of the Water Forum Agreement. The element estimates a countywide sustainable yield of 519,000 acre-feet without causing an undesirable effect. The plan calls for conjunctive use and surface water imports to reduce pumping to the recommended quantities.

The Groundwater Management Element estimates a sustainable annual yield of 131,000 acre-feet for the northern Sacramento groundwater basin without causing an undesirable effect. That amount corresponds to the quantity of groundwater pumped in 1990, and represents about 30%-35% of total water demand projected for the urban areas overlying the northern Sacramento County groundwater basin from the City of Folsom to the Sacramento River, and north of the American River.

Regionally, progress has been made in reducing groundwater extraction. San Juan Water District supplies treated surface water to Fair Oaks, Citrus Heights, Orange Vale Water Company, and the City of Folsom. For some of those agencies, the introduction of surface supplies reduced past dependence on groundwater.

Surface water imports to the Sacramento Suburban Water District service area through the San Juan Water Agency via an arrangement with Placer County Water Agency over the past few years have also helped stabilize groundwater levels in the area to the west of Carmichael.

The City of Sacramento and Sacramento Suburban Water District are also developing facilities to increase the availability of American River surface water from the City's treatment plants.



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CARMICHAEL WATER DISTRICT DEPARTMENT

HISTORICAL WATER CONTOUR FALL 1955

MARCH 2003

FIGURE 6.1

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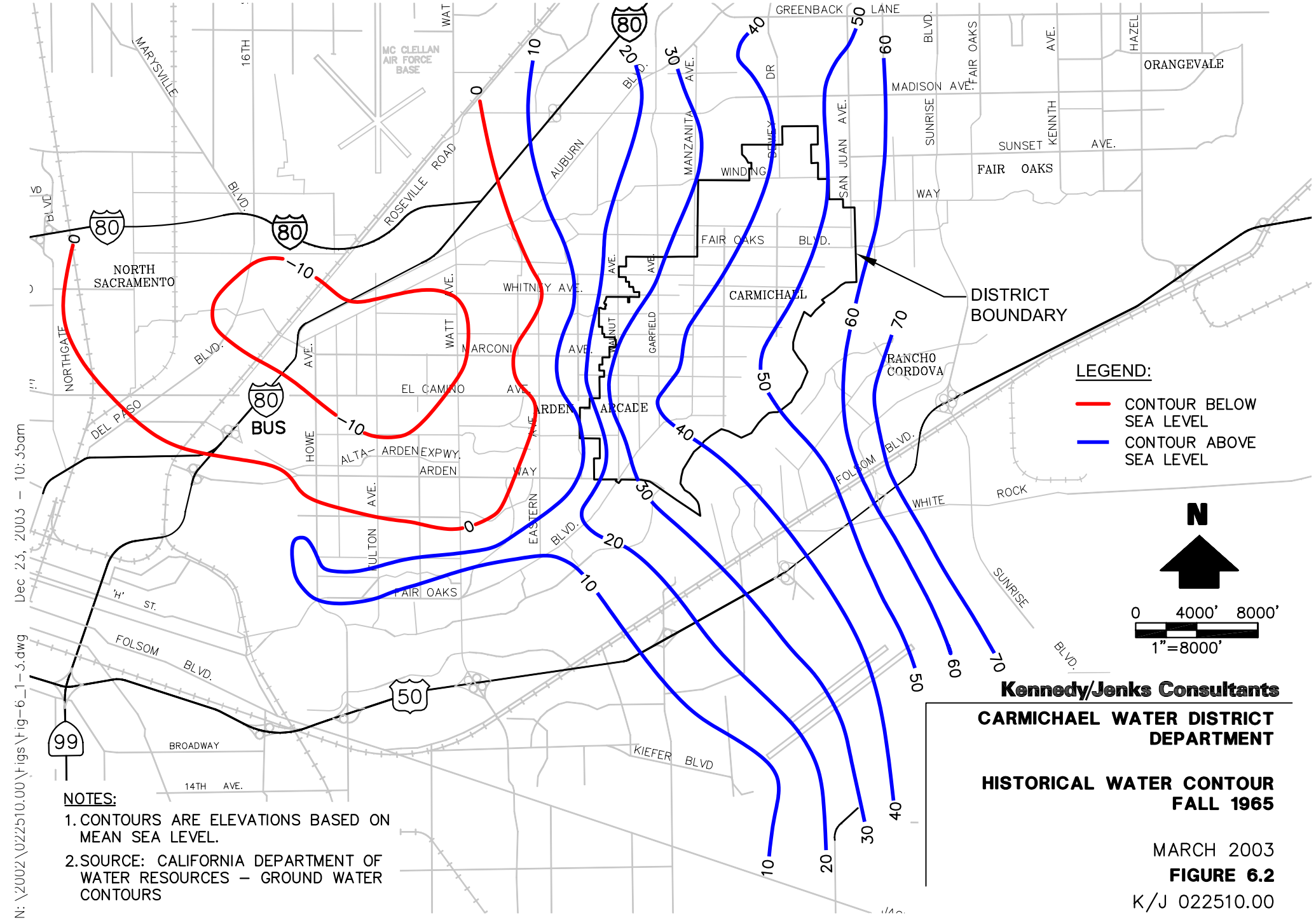

NOTES:

1. CONTOURS ARE ELEVATIONS BASED ON MEAN SEA LEVEL.
2. SOURCE: CALIFORNIA DEPARTMENT OF WATER RESOURCES – GROUND WATER CONTOURS

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CARMICHAEL WATER DISTRICT DEPARTMENT

HISTORICAL WATER CONTOUR FALL 1965

MARCH 2003

FIGURE 6.2

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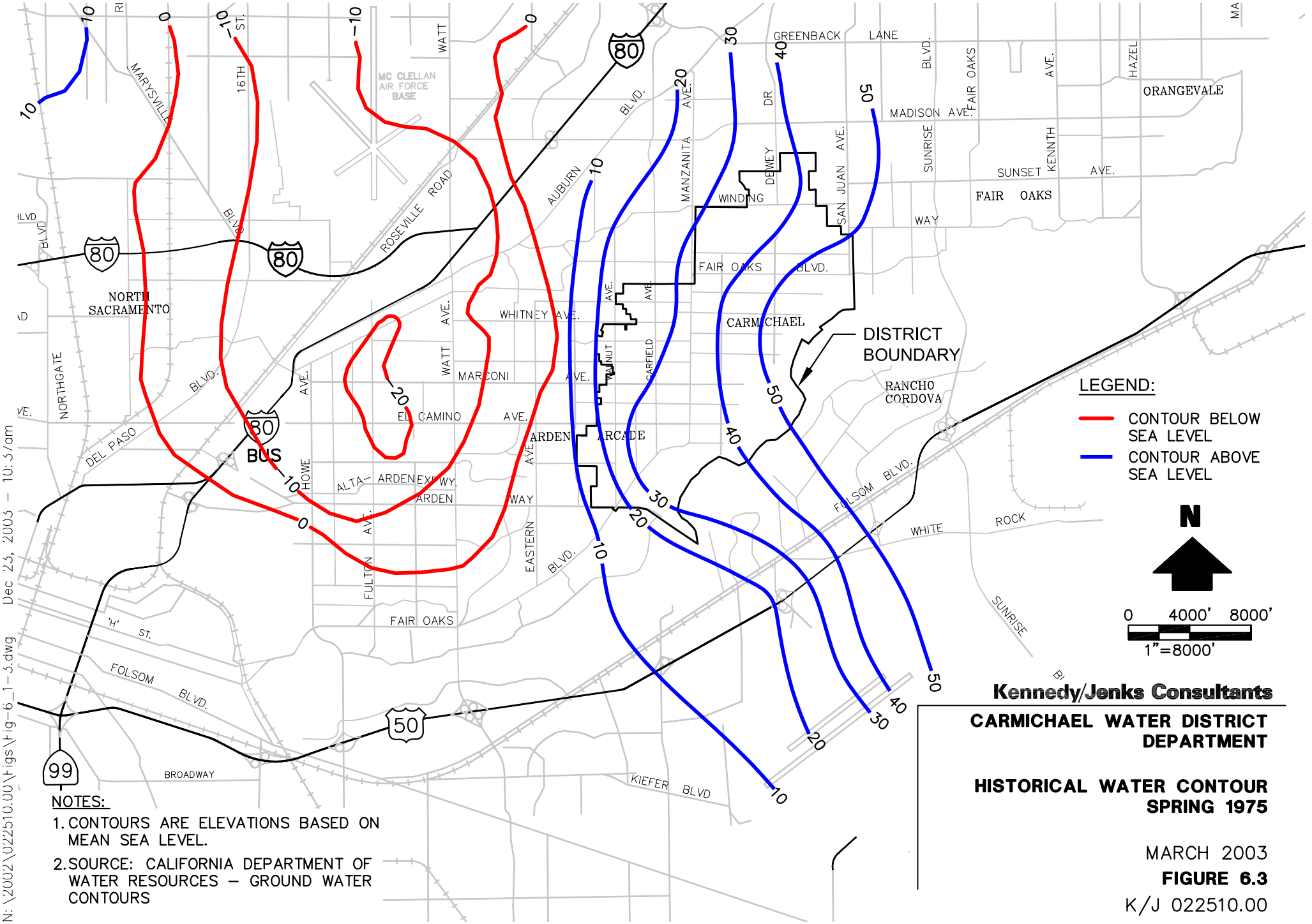
DISTRICT BOUNDARY
LEGEND:
CONTOUR BELOW SEA LEVEL
CONTOUR ABOVE SEA LEVEL
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0 4000' 8000'
1"=8000'
NOTES:
1. CONTOURS ARE ELEVATIONS BASED ON MEAN SEA LEVEL.
2. SOURCE: CALIFORNIA DEPARTMENT OF WATER RESOURCES – GROUND WATER CONTOURS
Kennedy/Jenks Consultants
CARMICHAEL WATER DISTRICT DEPARTMENT
HISTORICAL WATER CONTOUR SPRING 1975
MARCH 2003
FIGURE 6.3
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6.2.4.1 Sacramento Groundwater Authority

To implement the groundwater element of the Water Forum Agreement, the Cities of Folsom, Citrus Heights, and Sacramento, the County of Sacramento, and 13 water agencies in 1998 formed the Sacramento North Area Groundwater Management Authority, since renamed the Sacramento Groundwater Authority (SGA). The SGA can exercise the powers of the cities and county to manage the groundwater basin over the long term to assure that average withdrawals are within the limits specified in the Water Forum Agreement.

The SGA has the following powers, as described in its Rules and Procedures:

- Collect, monitor, and analyze groundwater data, including extraction and quality information;
- Establish and administer a conjunctive use program to maintain the sustainable yield of the basin;
- Buy and sell water on other than a retail basis;
- Exchange water;
- Distribute water in exchange for ceasing or reducing groundwater extractions;
- Spread, sink, and inject water into the north area basin;
- Store, transport, recapture, recycle, purify, treat, or otherwise manage and control water for beneficial use;
- Implement any conjunctive use program SGA deems necessary to maintain the sustainable yield of the north area basin; and
- Study and plan ways to implement any or all of the foregoing powers.

In addition, the SGA has the right of eminent domain, the right to obtain water rights, store water within or without the basin, import water, and other powers relevant to implementation of the goals of the SGA.

The SGA has participated in the formulation of a contract between some of its member agencies and the Environmental Water Account (EWA), a CALFED program, to forego some of their planned American River diversions and draw upon the groundwater basin. The conserved surface water supplies were then transferred to the EWA in return for payment of about $75 per acre-foot, providing funding for the operational aspects of the transfer and local groundwater management planning.

In other areas, the SGA is still in the planning phases, developing its program for implementing the management of the local groundwater basin.

Recommendation: The District should continue its active role in the SGA and support the implementation of the regional management of the groundwater resources to achieve the goals defined in the Water Forum Agreement.

6.2.4.2 Groundwater Recharge/Injection Pilot Program Potential

Groundwater recharge of the basin in the Carmichael area occurs naturally from the American River and from inflow to the basin from the east. As described earlier, the basin has been in an overdraft status for many years, and is being brought into a stable condition under the Water Forum Agreement by the SGA.

Clay layers underlie much of the Carmichael area, significantly reducing the potential for groundwater recharge from precipitation. If the District desired to increase recharge of the groundwater basin by direct percolation, it would need to do so in areas to the east outside of its boundaries. Alternatively, it could pursue direct injection of treated water into the ground through wells.

Recharge to the basin helps achieve the objectives of the Water Forum Agreement and the SGA to stabilize groundwater extractions at 131,000 afy. Additional recharge above natural recharge amounts would effectively add to the allowable extractions or contribute to groundwater level recovery if not offset by added pumping.

The District will have some unused treatment plant capacity in the late fall, winter, and early spring, because demands are less than plant capacity in those periods. The District could use that capacity to recharge the groundwater basin, providing both local and regional benefits. Such a program would involve substantial costs, and would require appropriate funding to allow its implementation. The compatibility of the injected treated water with the native groundwater would need to be evaluated by physical testing or a pilot injection program. Chemical incompatibility can result in reduction or loss of recharge and extraction capability in the affected well.

If the recharge were performed for regional benefit through the SGA, possibly with supplemental grant funding, it would be a direct benefit to the entire basin and help achieve the overall conjunctive use goals, consistent with the powers of the SGA.

A recharge program was proposed for Carmichael in a 1974 study by W.A. Wahler & Associates, Appraisal of Groundwater Recharge and Storage. The study estimated that about 4 cfs could be delivered to four deep recharge wells for a six-month period each year, and that the wells could be used for production for the rest of the year. They estimated that the recharge cost would be about 80% of what it would cost to extract water from the wells.

Injection was also examined by Montgomery Watson as part of Alternative No. 7 in the Revised Draft Water Supply Alternatives Study, March 1, 1993. That report discusses in greater depth some of the challenges in developing a successful injection program, and references pilot work on injection undertaken by the Arcade Water District in the late 1970s.

Recommendation: The District should quantify the theoretical groundwater yield it is entitled to under the Water Forum Agreement, identify the quantity it plans to extract, and seek to gain recognition and credit through the SGA for the District's share of the yield it does not extract. It

should also identify, using well information, the theoretical yield of the groundwater basin under Carmichael, which is the level of groundwater extraction that maintains a relatively constant static water level in the wells.

Recommendation: The District should explore the practicality of developing a well injection program that would provide regional groundwater benefits, provided that a financial benefit to the District can be demonstrated, the cost of the program (including pilot studies) will be borne regionally, and the program would be practical to implement and manage. The District should pursue this opportunity through the Water Forum and DWR's grant programs, drawing on RWA grants staff. It should identify the beneficiaries and explore participation opportunities.

6.2.4.3 Groundwater Quality Management

The quality of the groundwater under the District varies from excellent to fair. Many wells, especially those closer to the American River, have water quality similar to the American River. The Hidden River Vista well even tested positive for TCE for a brief period when the Aerojet seep was active in the 1980s, indicating a reasonably direct influence of the river. (The concentrations detected were substantially less than the levels detected in the river.)

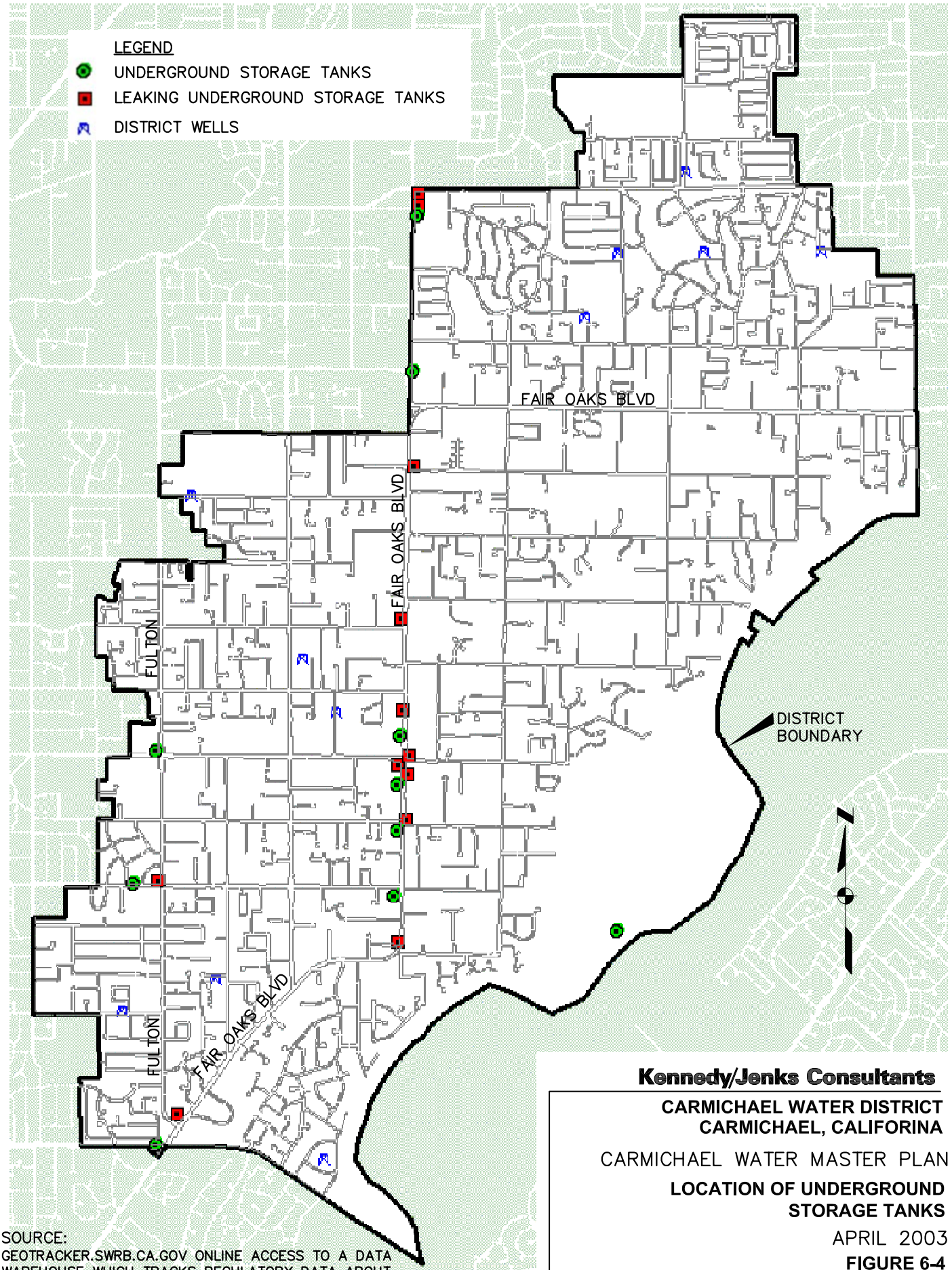
Other wells have iron and manganese, hydrogen sulfide, carbon dioxide, and higher concentrations of dissolved solids. A few wells experience periodic traces of PCE, a common dry cleaning fluid, at very low concentrations. Over time, as the wells are pumped, the substance is no longer detected.

In the future, more wells may require treatment, due to decreasing quality in terms of the foregoing substances, increasing contamination from industrial discharges, or increased water quality requirements. For example, there are currently 12 known leaking underground storage tanks with the District as shown in Figure 6-4.

Recommendation: The District should acquire and retain sufficient land to allow well treatment and new well construction to maintain the District's conjunctive use program.

Recommendation: The District should pursue identification of parties responsible for the disposal of PCE to the soil and pursue remediation through the RWQCB.

As discussed earlier in Surface Water Management, the District may be able to help protect its source water quality from further degradation through the California Source Water Assessment and Protection Program. In completing its federal mandate, the DHS will be using simple analytical tools to assess relatively large areas. The District may be able to develop additional protections for its groundwater supply sources if it pursues a more detailed assessment than is being conducted by DHS. It may be able to better address the PCE contamination that is detected intermittently in a few wells using a more detailed approach.



SOURCE:
GEOTRACKER.SWRB.CA.GOV ONLINE ACCESS TO A DATA WAREHOUSE WHICH TRACKS REGULATORY DATA ABOUT UNDERGROUND FUEL TANKS, FUEL PIPELINES, AND PUBLIC DRINKING WATER SUPPLIES

Kennedy/Jenks Consultants

CARMICHAEL WATER DISTRICT
CARMICHAEL, CALIFORINA

CARMICHAEL WATER MASTER PLAN

LOCATION OF UNDERGROUND STORAGE TANKS

APRIL 2003

FIGURE 6-4

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Recommendation: The District should participate actively in the California Source Water Assessment and Protection Program being administered by DHS with the goal of achieving greater protection of its source water supplies and addressing existing PCE contamination within the District. The District should consider performing part of the groundwater assessment itself to assure proper attention to local conditions. The program may also provide additional resources in protecting the District's water supply from the contaminant plumes outside the District, as discussed below.

As discussed earlier in this Master Plan, there are two plumes of pollutants that appear to pose long-term threats to the quality of the groundwater underlying the District. The first of these is primarily TCE that originated from the Aerojet General site in Rancho Cordova, and has crossed under the American River and been detected in several locations under the Fair Oaks Water District. The plume appears headed directly toward Carmichael.

The second plume contains perchlorate and NDMA from the Aerojet site. In the 1980s, Aerojet undertook a pump-and-treat program that removed most of the TCE and other volatile organics from the extracted water. The treated water was then reinjected onsite. The reinjected water apparently contained perchlorate, and the plume has migrated west of the site and is heading towards the American River in the vicinity of Carmichael. The plume is deep enough to easily pass under the river and enter the groundwater basin underlying Carmichael.

In a worst-case scenario, Carmichael could be forced to abandon wells or install expensive treatment to remove identified contaminants. TCE, perchlorate, and NDMA are likely the most easily detected components within the two contaminant plumes. It is possible that other undetected chemicals, some of which could have resulted from chemical reactions after leaving the Aerojet site, are also a part of the plume, and may not be amenable to treatment. Every effort should be made to keep these plumes from reaching the District's water supply wells.

Recommendation: The District should monitor the movement of these pollutant plumes through the USEPA and RWQCB, as well as any monitoring available through Aerojet and neighboring water purveyors, and press for mitigation and protection from loss of water supply. According to the Attorney General's office, the District has intervenor status in the Aerojet site and can become active in seeking remedial action.

Recommendation: The District should oppose groundwater extraction proposals that would appear to influence movement of the contaminant plumes unless the proponent can demonstrate, through credible plume influence modeling, that there would be no adverse effect from the pumping.

Recommendation: The District should investigate the potential benefits of in-lieu recharge (increased surface water use and decreased groundwater use) and direct recharge (well injection) on plume movement. If practical, the District should press for funding and implementation of such programs through Aerojet General or the USEPA and SWRCB.

6.3 Regionalization Opportunities

This section of the report reviews the numerous initiatives being pursued to implement regional cooperation and interdependencies among the Sacramento County water agencies and identifies opportunities for the District to contribute to and participate in regional benefits.

Many of these opportunities have been discussed in some form in the foregoing sections, especially the Water Forum Agreement. This section brings these initiatives together and places them in a common context.

6.3.1 Water Forum Successor Effort

The Water Forum Successor Effort continues to pursue regional cooperation goals and to seek resolution of remaining challenges in Sacramento County and adjoining counties related to the American River, Sacramento River, and adjacent groundwater basins. Current challenges are the development of a flow standard for the American River that will provide appropriate habitat for steelhead and salmon in a more protective and flexible manner than provided in current regulations.

The development of the flow standard was one of the Water Forum elements, and the effort to complete the standard, which began in late 1994, is nearing completion. The goal is to develop an ecologically-based flow management plan that provides appropriate water temperatures, aquatic habitat, and flows to benefit the fishery. When completed, the new flow standard will be submitted to the SWRCB for adoption, replacing D-893 requirements that set minimum flows at 250-500 cfs, far below fish needs and far below current flows in the river.

The flow standard is not expected to materially alter the management of flows in the river from their current state. The District has been monitoring development of the new standard, and sees no effect on other aspects of the Water Forum Agreement and no effect on its diversion quantities. The District withdraws its water downstream of the majority of the spawning habitat in the river. The Ranney Collectors are fish-friendly diversion facilities that do not affect the fish at any life stages.

Another major challenge for the Water Forum Successor Effort is the development of groundwater management governance and planning structures for the South Area and Galt Area basins. Although the north Sacramento basin is now being managed by the SGA as an outgrowth of the Water Forum Agreement, there is as yet no comparable governance structure in either of these south Sacramento basins.

The Water Forum Successor Effort provides all of the member agencies with a forum for resolving water resources challenges that reach outside of their borders. For Carmichael, the Water Forum Successor Effort provides a venue to explore participation in sharing of its water rights on a regional basis as one tool to resolve contamination issues. The Forum also provides a way to address groundwater management issues and other regional needs.

Recommendation: The District should continue to participate in the Water Forum Successor Effort, and continue to support regional water resource management efforts.

6.3.2 Water Forum Agreement integration into the Master Plan

The Water Forum began deliberations in 1994 to seek to forestall water shortages and craft a long-term approach to achieving two co-equal objectives:

- Provide a reliable and safe water supply for the region's economic health and planned development to the year 2030; and

- Preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.

During six years of negotiations, the water agencies along the American River watershed, business and agricultural leaders, citizen groups, environmentalists, and local governments crafted an agreement that sets in motion actions to achieve those objectives.

As a signatory agency to the Water Forum Agreement, the District has agreed to a broad range of actions, and receives in return water supply assurances. The purveyor-specific agreement for the District is attached as Appendix A. In brief, the agreement provides:

- The District will complete its treatment plant, with initial capacity of 17 mgd and ultimate capacity of 22 mgd;

- The District's baseline diversions through 1995 are recognized as 12,000 acre-feet per year;

- The District will divert up to 14,000 acre-feet per year in all year types, except when unimpaired inflow to Folsom Reservoir is projected to be less than 400,000 acre-feet;

- In those years of less than 400,000 acre-feet inflow, the District will participate in a conference with other stakeholders on how the available water should be managed;

- By 2030, it is expected that the District's water use will have declined to the 12,000 acre-foot baseline amount; and

- The District retains the right to transfer water that it may legally transfer after it has served its purpose of assisting fish flow releases in the Lower American River.

In addition, each water purveyor that is a signatory to the agreement agrees to an additional list of 23 points addressing their conduct under the agreement, the term of the agreement, mutual support of other signatories' actions pursuant to the agreement, support of the Lower American River flow standards, support of other common elements, and agreement to include the basic terms of the Water Forum Agreement in master plans and urban water management plans. The District (along with the other water purveyors signatory to the Agreement) also agrees to implement a series of Best Management Practices, or BMPs, as described in Appendix B.

Recommendation: The District should continue to participate in the Water Forum Successor Effort and support the agreement among the member agencies, and work cooperatively in solving the remaining water resources challenges being addressed in the Water Forum.

6.3.3 Interties with Neighboring Agencies

The District may be able to share its water rights outside of its current place of use as part of developing solutions to the water availability issues facing other agencies. These water rights are a major asset, and should be put to use within the region if at all possible. For example, the Arden Cordova Water Company has lost use of many of its wells to the perchlorate and NDMA plume underlying a major segment of their service area. One source of back-up supply for that agency would be water from Folsom Lake. An alternative that would allow the water to remain in the river for much of its length could involve the following steps:

- Expand the place of use for Carmichael's water rights to include the Arden Cordova area;
- Arrange for the City of Sacramento to divert and treat the water at its Fairbairn Water Treatment Plant;
- Pipe the water from the Fairbairn plant to the Arden Cordova area to replace the well water;
- Develop the concepts and agreements for this type of action through the Water Forum Successor Effort; and
- Take the proposal to the SWRCB with regional support through the Water Forum Successor Effort.

Other possible options for sharing of Carmichael's water rights for regional benefit through an expansion of its place of use could include Sacramento Suburban Water District, Fair Oaks Water District, Citrus Heights Water District, or other entities as identified through the Water Forum Successor Effort.

Recommendation: As discussed above, the District should continue to explore ways in which its water rights can be used on a more regional basis for the mutual benefit of the region.

As discussed earlier, the District has the opportunity to partner with its neighbors to expand its interties, including the addition of booster pumps to enable two-way transfer of water regardless of differential system pressures. The District can also explore other ways to share facilities, such as the concept of a cooperative well water treatment plant in the northern part of the District. Such a facility could benefit Citrus Heights Water District, Sacramento Suburban Water District, and Citizens Utilities, as well as Fair Oaks Water District.

The District could also explore expanding the Bajamont water treatment plant as a joint project with its neighbors. Possible partners/beneficiaries might include:

- Arden Cordova Water Company, as part of an arrangement with Aerojet for replacement water;
- Fair Oaks Water District, as a benefit to American River Flows or
- Citrus Heights, as a benefit to American River Flows.

- Sacramento Suburban Water District, to reduce groundwater pumping in the southern portion of their district.

6.3.4 Regional Groundwater Banking, including External Transactions

With the RGA now in existence, a managed groundwater basin can offer groundwater banking opportunities to its members. The SGA has established, through some of its members, a groundwater transaction basis, with a sale of previously banked groundwater to the Environmental Water Account in 2002. It is expected that additional transactions that rely on groundwater banking may occur in the future.

The District is capable of extracting less water from the groundwater basin in nearly every year than would be permitted under basin-wide goals. It should be able to develop some credits for this reduced reliance on groundwater because it will be doing more than its share to help the basin achieve its sustained average yield goal of 131,000 acre-feet per year.

Also, as discussed earlier, the District could pursue a direct well injection program as the centerpiece of a groundwater banking program.

6.4 Recommendations

Table 6-2 provides a summary of the strategic water issues and recommendations.

Table 6-2
Summary of Strategic Water Supply Issues and Recommendations

Water Supply Topic	Strategic Issues	Recommended Strategy
Surface Water Management		
Intensifying Competition for Water	Colorado River 4.4 Plan	Monitor agreements and MWDSC water transfers from northern California.
	Bay-Delta Water Rights Hearing Phase 8: Sacramento Valley Water Management Program	Monitor agreements, transfers, projects, and possible American River supply negotiations.
	DWR Dry Year Water Purchase Program	Investigate similar agreements for Carmichael for critically dry year supply.
	CALFED Environmental Water Account	Monitor transfers from the American River watershed and the local groundwater basin.

Table 6-2
Summary of Strategic Water Supply Issues and Recommendations

Water Supply Topic	Strategic Issues	Recommended Strategy
Water Rights	Existing Licensed Surface Water Rights	Explore expansion of place of use for regional benefit through Water Forum.
	Permit Renewal	Prepare strategy, technical support, and data for permit renewal in 2005.
		Contact SWRCB for guidance and information on permit renewal approach.
		Work with Sacramento County on Ancil Hoffman Park service.
		Explore groundwater recharge opportunities as part of beneficial use.
		Document planned water resource uses and file for permit renewal in 2005.
Treatment Plant Expansion	Conjunctive Use, Supply Reliability, Regional Benefits, Water Rights	Pursue discussions with neighboring districts on participation; explore through Water Forum; assess local needs and timing.
Water Supply Reliability	State Water Resources Control Board Authority over Dry and Critically Dry Year American River Diversions	Explore possible water rights settlement agreement with USBR.
		Explore dry year water transfers and identify possible participating interests.
		Consider seeking storage opportunities as part of FERC relicensing proceedings.
		Determine next steps on court action against SWRCB EIR on 1995 Bay-Delta Plan.
	American River Bed Degradation, Loss of Gravels, and Flood Risk	Monitor riverbed cross-section and gravel cover over Ranney collectors through yearly surveys.
		Perform a structural stability study of the collectors in high flood events.
		Inspect Ranney laterals periodically and repair or replace damaged laterals.

Table 6-2
Summary of Strategic Water Supply Issues and Recommendations

Water Supply Topic	Strategic Issues	Recommended Strategy
		Maintain erosion protection at all river facilities and protect access to facilitate prompt repairs.
		Develop a plan to resolve future of 33-inch abandoned river crossing.
Ancil Hoffman Park Surface Water Diversions	Deterding Collector Rehabilitation	Pursue rehabilitation of Deterding collector for irrigation supply to Ancil Hoffman Park.
		Pursue joint project opportunities with Sacramento County to maintain surface supplies to the park.
		Document treated water supply potential from Deterding collector.
American River Water Quality	Protecting American River Water Quality	Participate in the American River Watershed Sanitary Survey updates.
		Monitor remediation efforts of Aerojet General Corporation and its compliance with discharge requirements.
		Participate in California Drinking Water Source Water Assessment and Protection Program. See below
Line format? ^		Oppose relaxation of discharge requirements for all upstream pollution sources.
		We say this twice…
Water Forum Agreement	Maintaining Water Forum Benefits, Protecting Water Rights	Continue to participate in the Water Forum and support on-going regional water resource management efforts.
Conservation	Implementation of Water Forum Best Management Practices, Protecting Water Rights	Monitor CALFED Water Use Efficiency Program through RWA and ACWA to monitor Legislative action on conservation.
		Continue to implement conservation programs.
		Continue to implement Water Forum Best Management Practices as documented for the District in the agreement.

Table 6-2
Summary of Strategic Water Supply Issues and Recommendations

Water Supply Topic	Strategic Issues	Recommended Strategy
Groundwater Management		
Sacramento Groundwater Authority	Groundwater Management Planning	Participate in and support groundwater management planning through SGA.
Groundwater Extraction Capacity	Maintain Existing Wells	Monitor well performance, water quality, and static water levels.
	Construction of New Wells	Secure strategic sites to replace District wells.
		Select sites to provide best quality or where treatment is available or planned.
	Conjunctive Use Benefits	Document unused groundwater yield and theoretical recharge within District place of use.
Groundwater Recharge	In-Lieu Recharge through Use of Surface Water Supply	Document annual theoretical recharge.
	Possible Assignment of Benefits	Explore assignment of theoretical recharge benefits and regional cost participation and grant funding.
	Active Recharge	Identify potential benefactors and explore participation opportunities.
Groundwater Quality	Naturally Occurring Mineral Contaminants	Secure adequate real estate to construct treatment facilities.
	Contaminant Plumes Originating Within District Boundaries	Participate in California Drinking Water Source Water Assessment and Protection Program.
		Request investigation into known contaminant source cleanup and press for active mitigation.
	Contaminant Plumes Not Originating Within District Boundaries: Data Acquisition	Request investigation into known contaminant source cleanup and press for active mitigation.
		Monitor plume movement through USEPA and the RWQCB and press for active mitigation.
	Contaminant Plumes Not Originating Within District Boundaries: Protection of Water Supplies	Document possible benefits of existing intervenor status with Attorney General's Office with regard to Aerojet General site.

Table 6-2
Summary of Strategic Water Supply Issues and Recommendations

Water Supply Topic	Strategic Issues	Recommended Strategy
		Press USEPA and SWRCB to develop plans to prevent plumes from reaching Carmichael and plans to mitigate if plumes do reach Carmichael.
		Oppose additional groundwater resource development without documented plume influence modeling.
	Contaminant Mitigation Through Recharge (In-Lieu and Active)	Identify Potential Benefactors and Explore Participation Opportunities.
		Support Groundwater Recharge and Contaminant Plume Mitigation Planning.
Regionalization Opportunities		
Water Forum Successor Effort	Regional Participation	Continue to participate in the Water Forum and support on-going regional water resource management efforts.
ARBCA	Regional Participation	Continue to participate in the ARBCA and support completion of the Phase 2 report.
Regional Sharing of Water Resources	Regional Participation, Water Rights	Continue to explore how the District's water rights can be used for mutual benefit regionally.

Section 7: District Organization, Administration and Data Management

Meeting District goals for high quality water, reliable service, and customer satisfaction requires operational commitment, timely maintenance, and employee expertise.

7.1 Introduction

This section of the Master Plan discusses the organization of the District, operation and maintenance responsibilities, and general practices of the District. In addition, this section provides a review of management of information and provides recommendations for future improvements to data management and records access.

Carmichael Water District Office

7.2 District Organizational Structure

Carmichael Water District was formed as Carmichael Irrigation District under California law in 1916 (See Section 2.3). In the 1980's, it changed its name to Carmichael Water District, though it remains an irrigation district in organizational structure. The District is a public agency with an elected five member Board of Directors. The Board is elected based on Divisions of approximately equal customer representation.

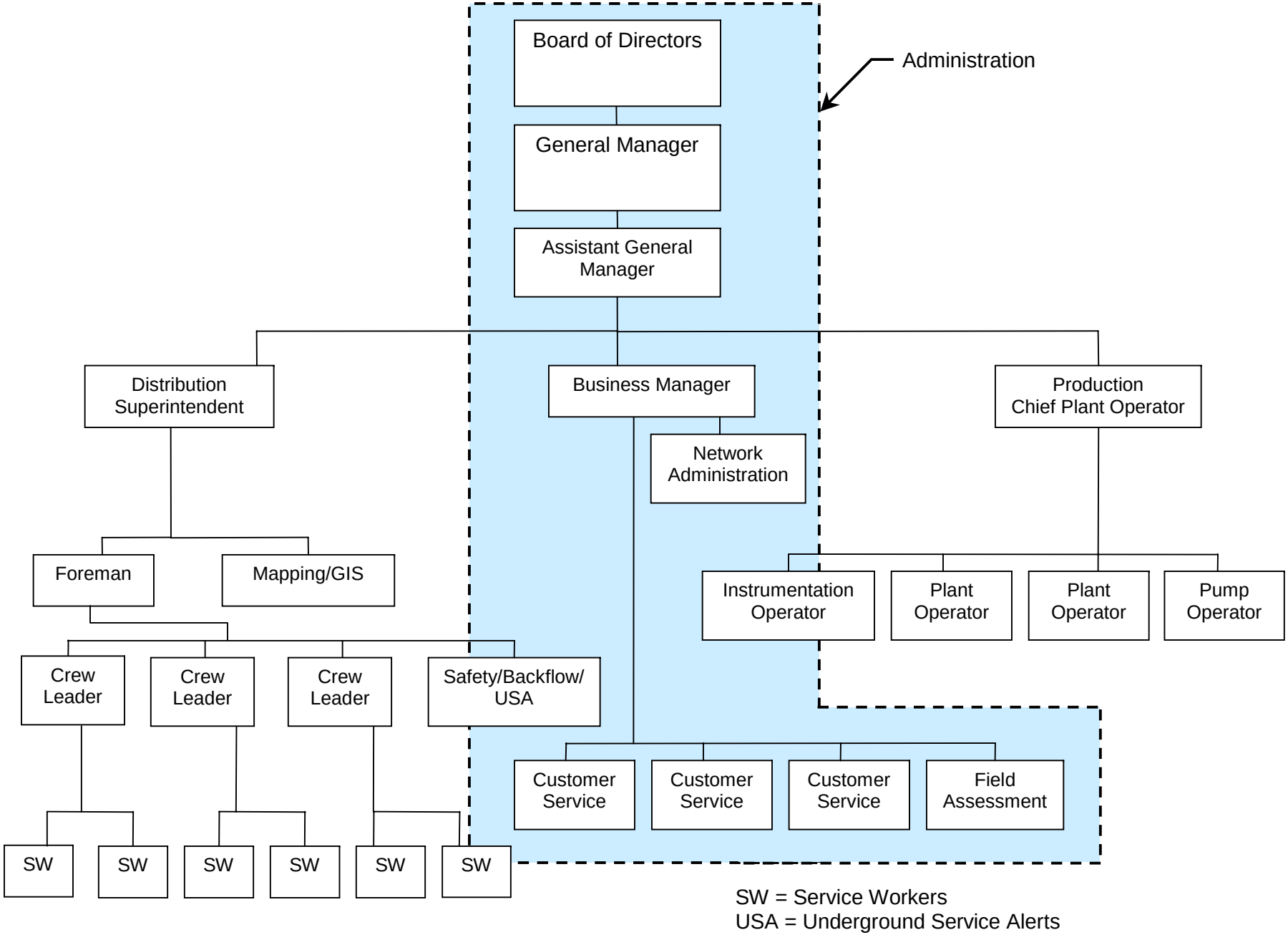
The District is organized into three major departments reflecting the three principle activities of the District. The departments include Administration, Production, and Distribution, and together they provide for all activities. The District currently employs 26 individuals.

Figure 7-1 reflects the current Organization Chart and the positions in each department.

7.2.1 Administration Department

The Administration Department provides the human resources to keep the District operating from answering the telephones, to filing regulatory compliance reports and maintaining customer outreach. Project/staff management, customer service (billing and collection), accounting, Board support, administrative support, field inspection/meters, and conservation activities all fall under the jurisdiction of this department. The key positions of the Administrative Department are discussed below.

Figure 7-1: Carmichael Water District Current Organizational Chart



The General Manager is responsible for all aspects of the District operation and is the key liaison between the elected Board and the District staff. The General Manager is responsible for implementing Board actions and policies and for providing outreach to the community as a visible representative of the organization.

The Assistant General Manager is responsible for support the activities of the General Manager, as well as the daily operational decisions for all departments within the District. In addition, the Assistant General Manager is responsible for regulatory compliance monitoring, capital projects management, labor negotiations and many other tasks required to maintain services on a daily basis. The Assistant General Manager is also responsible for development of the annual budget alternatives following the direction of the General Manager.

The Business Manager is responsible for the administration of District accounts, payroll, purchasing and audits. The Business Manager also coordinates the activities of the Network Administrator, and Customer Service representatives. In addition, the Business Manager supports the activities of the General Manager and the Assistant General Manager.

The Network Administrator is responsible for the planning, operation, troubleshooting, and upgrade of the automated District administrative activities. The District maintains a computer network linking different activities and providing an opportunity for centralized data storage and acquisition.

Customer and Field Service Representatives are responsible for the initial contact with the customers, processing of correspondences, support of Administrative activities, such as reproduction, Board correspondence, emergency dispatch, and public outreach.

7.2.1.1 Possible Future Organizational Changes

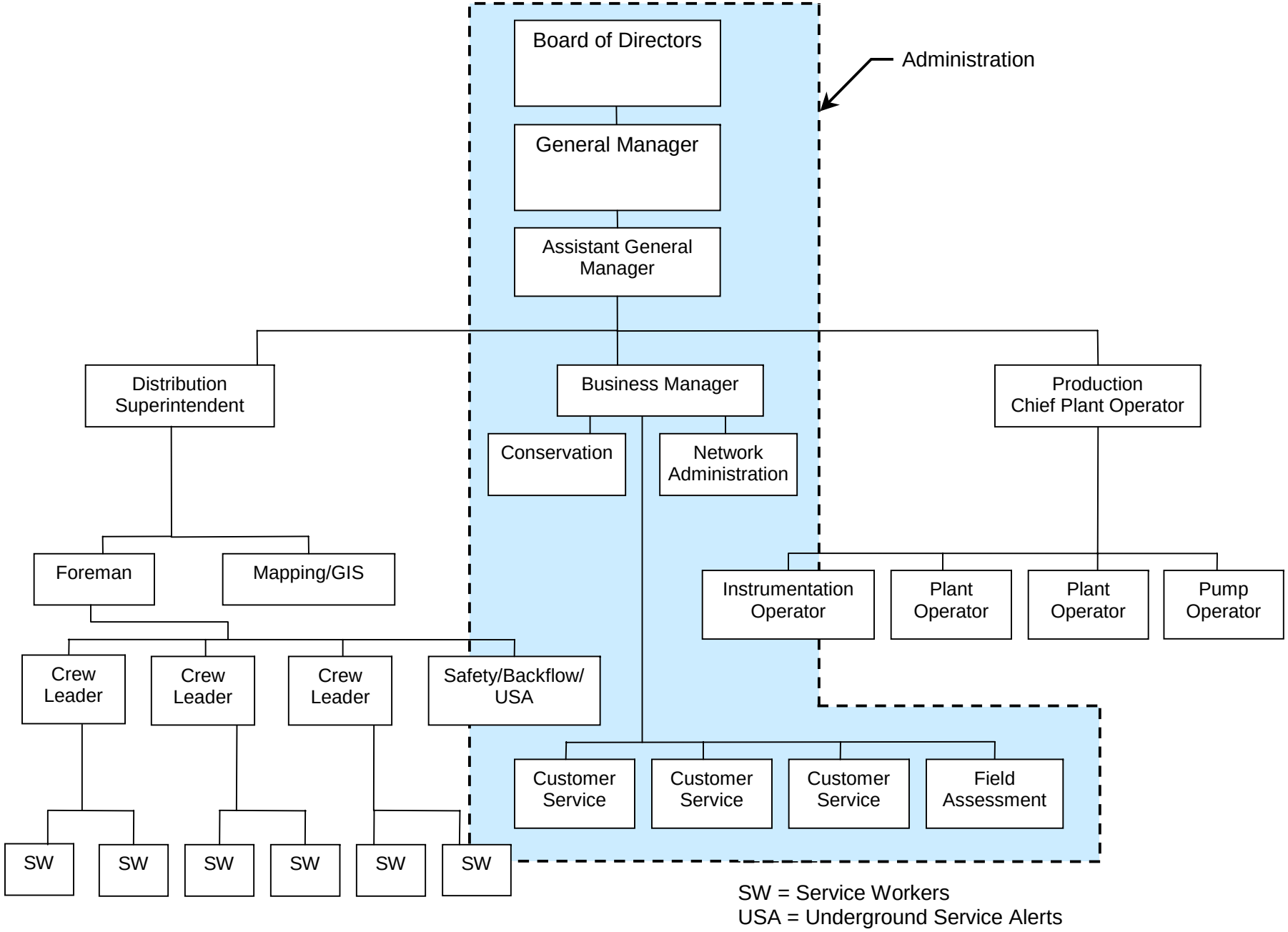
Possible future organizational changes may be needed to address the increased staff time demand for Water Conservation programs. Other changing staff resources demands may be addressed through continued training and certification programs and possible contracting out of services. For example, contracting out of meter reading appears to be a fiscally responsible approach to addressing an increasing district activity.

Figure 7-2 reflects the possible future addition of a conservation program staff number.

Migration of the District to a possible information Web-based data access system could require training of the Network Administrator in the operation, maintenance and troubleshooting of new systems. However, the more complex information technology duties may most efficiently be addressed through contracting out.

Potential increases in the level of research and monitoring compliance documentation review for the Aerojet contaminant plume and possible other groundwater issues could require future staff addition. However, these issues are also regional issues and may be adequately supported by the RWA and the SGA.

Figure 7-2: Carmichael Water District Future Organizational Chart



7.2.2 Production Department

The Production Department provides for the treatment, storage, pumping, and testing of the District's water supply. District facilities falling under the responsibility of the Production Department include the Bajamont Way Membrane Filtration Water Treatment Plant, all District wells, well pumps, storage reservoirs and booster pump stations. State Certification as a Water Treatment Operator and specialized training is required for the employees of this Department.

The Production Department includes a Chief Plant Operator responsible for the activities of four plant operators. One of the plant operators has specialized training as an Instrumentation Operator supporting the SCADA systems in addition to the operation of facilities.

The Production Department is responsible for maintaining the mechanical aspects of equipment ranging from small chemical feed pumps through multiphase variable frequency drive pumps providing thousands of gallons per minute of supply. In addition, the department operates and maintains all the chemical feed systems within the District and is trained in handling hazardous chemicals. The department also supports the District Supervisory Control and Data Acquisition (SCADA) systems for both the water treatment plant and distribution system monitoring.

The Production Department is responsible for preventative maintenance for all mechanical, electrical, chemical feed and SCADA systems, the distribution system-flushing program, and compliance with the DHS water quality testing programs.

The Production Department staff activities support the following four areas: maintenance, water quality, chemicals, and control.

7.2.2.1.1 Maintenance

Maintenance includes the electrical and electrical control system, chemical storage and feed equipment, and mechanical equipment, such as pump maintenance.

Electrical and electrical control system maintenance includes cleaning contacts; tightening connections; measuring voltage and amperage loads; and replacing starters, relays, circuit breakers and fuses.

Chemical feed equipment maintenance includes cleaning the pump Internals and solution lines; replacing diaphragms; and checking valves, chemical solution lines and injection point devices.

Mechanical equipment maintenance includes oil and filter changes; charging system check and replacement; efficiencies testing; bearing replacement; motor rewinding; cleaning of Y strainers and diaphragms; and speed, travel and pressure adjustment for control valves.

7.2.2.1.2 Water Quality

Water quality is broken out into five sub categories: bacteriological testing, groundwater testing, EPA/DHS, flushing program, and water quality calls.

Bacteriological Testing includes sampling at the river Ranney Collectors and sampling for lead and copper at various locations in the District.

Groundwater Testing includes sampling for VOC, IOC, Gross Alpha, SOC, Gen. Mineral, Physical, Nitrate, Nitrite, Phase 2/5, Perchlorite, and MTBE, as well as other regulated and unregulated parameters required by law.

EPA/DHS testing for Giardia, Cryptosporidium, pH, Turbidity, Particle Counting, VOC, IOC, Gross Alpha, SOC, Gen. Mineral, Physical, Nitrate, Nitrite, Phase 2/5, and Perchlorite at the treatment plant.

Flushing Program includes flushing dead-end mains to reduce sedimentation and taste and odor complaints. This effort includes valve exercising and inspection as opportunities allow.

Water Quality Calls – The Department is responsible for sending service workers to the field to investigate water quality issues reported by its customers.

7.2.2.1.3 Chemicals

Activities include ordering, receiving, loading and delivery of sodium hypochlorite and polyphosphate to all sites; operation of feed systems; testing, training and emergency response planning.

7.2.2.1.4 Control System and Testing

This department supports the SCADA and telemetry system maintenance and programming. The central processing equipment and operated interface is located at the Bajamont Water Treatment Plant.

Efficiency and motor testing is completed by an outside agency.

7.2.2.2 Possible Future Organizational Changes

The Bajamont Water Treatment Plant is an automated facility and is not manned 24 hours a day, 7 days a week. This approach is supported in part with remote accessibility to the SCADA system for monitoring the plant from home or elsewhere should alarms occur requiring operator actions. Expansion of access and ease of operator interface through remote or secure Web access to operations may allow for increased efficiency of staff. For example, remote access allows an operator to determine if an alarm is an emergency condition or non-emergency condition when deciding to complete a task already underway or dropping that task and rushing to the plant to address the alarm.

7.2.3 Distribution Department

The Distribution Department is responsible for the buried infrastructure providing transmission and distribution for delivery of water throughout the District. These activities include the inspection of all new construction, replacement and repair of water mains, fire hydrants, water services, meters, and valves. In addition, the department is responsible for inspection of all potential cross-connections and to administer the corrections on those cross-connections.

The Distribution Department also completes the installation of new water mains and moderate sized capital improvement projects as part of the ongoing effort to replace old pipelines instead of continually installing repair bands to the same reach of pipe.

The Distribution Department is also responsible for responding to Underground Service Alerts calls for locating the buried water facilities. The Distribution Department also maintains the District water system maps and provides mapping, technical and geographic information system support for the field crews locating water lines.

The Distribution Department includes the following key positions:

Distribution Superintendent is responsible for assignments of resources, project scheduling, training, inventory, equipment fleet and maintaining the corporation yard. The Distribution Superintendent reports to the Assistant General Manager.

Mapping/GIS staff is responsible for the District record drawing files, contractor submittal review and comments, construction inspection support, and inspection records. In addition, this position coordinates plan checking, fire flow analysis requests and responds to requests for information by developers regarding the District facilities and physical connection requirements.

The Foreman is responsible for the operation of three distribution service crews. Each crew consists of three persons: a crew leader and two service workers. The Foreman is also responsible for the Safety/Backflow and USA persons who alternate as crew leaders.

7.3 Data Management

The District currently generates data in the form of reports, bills, logs, and records in each different department. This data is used differently and can tend to be duplicated as each department tracks the data most useful to them. This duplication of work presents an opportunity to reduce labor by coordinating the data generation and management using a centralized approach. This section presents a general approach to a central data management system and provides recommendations for how to proceed with migration to such a system.

The continuing development of faster and more robust computer hardware and software combined with the ease of Web technology makes possible an efficient data centered management strategy. With this technology, the District can expand the geographic information system framework developed through the system mapping effort, CWD customer database, and integration of the Sacramento County assessor parcel georeferenced data. It is recommended that the expansion follow an “outside-in” approach to data sharing amongst various departments, operations, engineering, administrative, etc.

An outside-in “customer data centric” structure assigns responsibility for maintenance of District data to the data generators. In the District’s case, the data generators are the departments. Each department would be tasked with updating and inputting information which would then be linked to a central data-hub accessible to all users as departments link into the hub to retrieve and share information. This type of configuration leaves the parties with the knowledge of the data the responsibility of maintaining the data. Moreover, it reduces the need for dedicated information technology (IT) staff and hence reduces overhead IT costs.

The network administrator and possible external information solutions provider would maintain the hub, the linkage and communication protocols. The assignment of data ownership to the departments frees the network staff from a model of data upkeep for which they have typically no intuitive basis for knowing if they are keeping useful information and purging useless garbage. Ultimately, garbage in means garbage out and with GIS data, there is a great potential of useless information and money unnecessarily being spent in managing that information.

The District has made progress in deliberate steps towards a system pipeline and customer GIS with firm milestone deliverables. To date, the following milestones have been reached:

- Conversion and update of system pipeline maps to GIS compatible electronic files;
- Indexing and electronic linkage to GIS maps of the District hand-drawn historical maps;
- Georeferencing of all District facilities to the County of Sacramento Survey Control NAD 83 and linkage to the County GIS assessors parcel database;
- Development of electronic and hardcopy map books for field crews with indexed service address reference; and
- Assignment of unique feature identification numbers for all pipes, valves, meters, services, hydrants and known features. All features are georeferenced back to the NAD 83 datum.

Draft milestones have been utilized in the preparation of this Master Plan, including evaluation of pipe material types, diameters and age by location; service classification and metering status; and identification of geographic blocks containing a target number of annual meter installations.

The recommended next steps to continue the migration to GIS are listed below:

1. Conduct a Technical Needs Assessment reviewing the operations of each department and the generation of data useful to the District. For example, the Distribution Department could generate service report, leak repairs, inventory, outage, and work order requests.
2. Convert District Springbrook customer database to a GIS database with georeferencing to the District Map.
3. Identify Department interaction and mutual use of data and program data templates for each department and produce test system for District testing.
4. Review and assess the successes and shortcomings of the test system and proceed to the full program.
5. Conversion of selected archive records to electronic medium for integration into the system.

These recommendations are intended to allow a modest schedule for moving to a GIS Web-based system with distinct interim milestones at which point the progress and direction of the program can be reassessed. This approach should reduce the need to redevelop or redo work as the District moves to GIS.

Section 8: Financial Business Plan

8.1 Introduction

The economic challenge facing the District is meeting the capital replacement program recommendations for sustaining the District infrastructure while optimizing, through financial planning, the use of customers' rate payments.

With the relatively recent completion of the membrane water treatment plant, the District has turned a significant corner in its growth and evolution. In recent years, the District focused its efforts on major initiatives to improve treated water quality and water pressures, and position the District as a leader within the region. As the preceding sections of the Master Plan have indicated, the District's future capital improvement needs will focus predominately on replacing and upgrading the existing water system. To compliment this shift of focus, the District seeks a financial strategy commensurate with anticipated future needs.

District Office and Corporation Yard

With the adoption of the FY 02-03 budget and water rates, issues associated with meeting current debt obligations and funding an ongoing capital replacement program came to the front. While the largest capital projects are now behind the District, a comprehensive ongoing replacement program must be combined with a financial strategy to address how the District can sustain the District's infrastructure in a cost effective manner from a ratepayer perspective.

The key to long-term financial stability is the ability to anticipate and prepare for significant financial obligations. The District's water service customers ultimately must bear the costs of maintaining the District's water system infrastructure, as well as ongoing operations. By taking a long-term view of its financial obligations, the District will establish water rates that are predictable, stable, and reasonable. One of the objectives of the development of this Master Plan is to develop a Financial Business Plan that will lead to improved financial and rate stability.

8.1.1 Financial Business Plan Development

The successful implementation of the Master Plan and recommended capital replacement program is dependent upon the development of a financial strategy to accomplish Master Plan goals, as well as sustain ongoing operations and other obligations. While the Master Plan identifies capital replacement needs for 100 years, the Financial Business Plan focuses on the period through 2030 – a relatively long period of time for financial planning purposes.

The recommended Financial Business Plan presents a financial strategy that reflects the District's annual operating costs, debt obligations, capital replacement program, water rates and other revenues, and reserves and reserve policies. The recommended Financial Business Plan and financial strategy reflects quantitative analyses, as well as input from staff and the Board of Directors.

A significant focus of the development of a financial strategy was to move the District toward an ability to support ongoing capital replacement program needs on a pay-as-you-go basis using current revenues and reserves, and avoiding or minimizing the need for future long-term debt and associated financing costs.

A financial planning model was developed to examine the financial needs and obligations of the District through 2030. However, analyses and recommendations focus primarily on a 10-year planning period considered to be a transition period to a position of long-term sustainability. Within the 10-year planning period, specific recommendations have been developed related to:

- Financing of specific near-term capital projects;
- Implementation of recommended reserve policies;
- Estimated annual water rate increases;
- Updating capital facility fees; and
- Continued implementation of the meter retrofit program and transition to metered water rates for all customers.

Development of the Financial Business Plan included a meeting with the District's Ad Hoc Master Plan Committee and a two-session public workshop with the District's Board of Directors.

8.2 Financial Business Plan Framework

The framework for development of the Financial Business Plan and evaluation of financial strategies includes the following:

1. Description of a fund and reserve structure that facilitates financial analysis, as well as putting financial issues in an easy-to-understand context;
2. Description of the District's current financial situation; and
3. Description of underlying assumptions used in the financial analyses.

8.2.1 Fund/Reserve Structure

As a governmental entity, the District accounts for its operations and presents financial information in accordance with regulations of the Governmental Accounting Standards Board (GASB). Financial reporting plays a major role in fulfilling the District's duty to be publicly

accountable and maintain the trust of District ratepayers. Governmental accounting systems are organized and operated on a fund basis. A fund is defined as follows:

"A fiscal and accounting entity with a self-balancing set of accounts recording cash and other financial resources, together with all related liabilities and residual equities or balances, which are segregated for the purpose of carrying on specific activities or attaining certain objectives."

The accounting records of the District are organized as an enterprise fund. The enterprise fund is used to account for the District's water operations that are financed and operated in a manner similar to a private business, where the intent is that the costs (expenses, including depreciation) of providing service to the general public on a continuing basis be financed or recovered primarily through user charges. Enterprise fund accounting is also appropriate where the periodic determination of revenues earned, expenses incurred, and/or net income is appropriated for capital maintenance, public policy, management control, accountability, and other purposes.

The District's fund and account structure is generally referred to as an Operating Fund. Within the Operating Fund are accounts for revenues, expenditures, assets, liabilities, and fund equity. Within the fund equity portion of the Operating Fund are reserves. Reserves are specific accounts that record a portion of the fund equity that is segregated for some future use or special purpose and is, therefore, not available for further general appropriation or expenditure. The Operating Fund provides the vehicle for the accumulation of the water rates, revenues, capital facility fees, and interest earned while providing for the cost of operation and maintenance (O&M), capital improvements, debt service payment, and reserve policy liabilities.

To better understand the financial obligations of the District, it is useful to view the District's existing Operating Fund as two distinct components, each with defined reserves. The components are as follows:

1. Operating Reserve

2. Debt Service Reserve

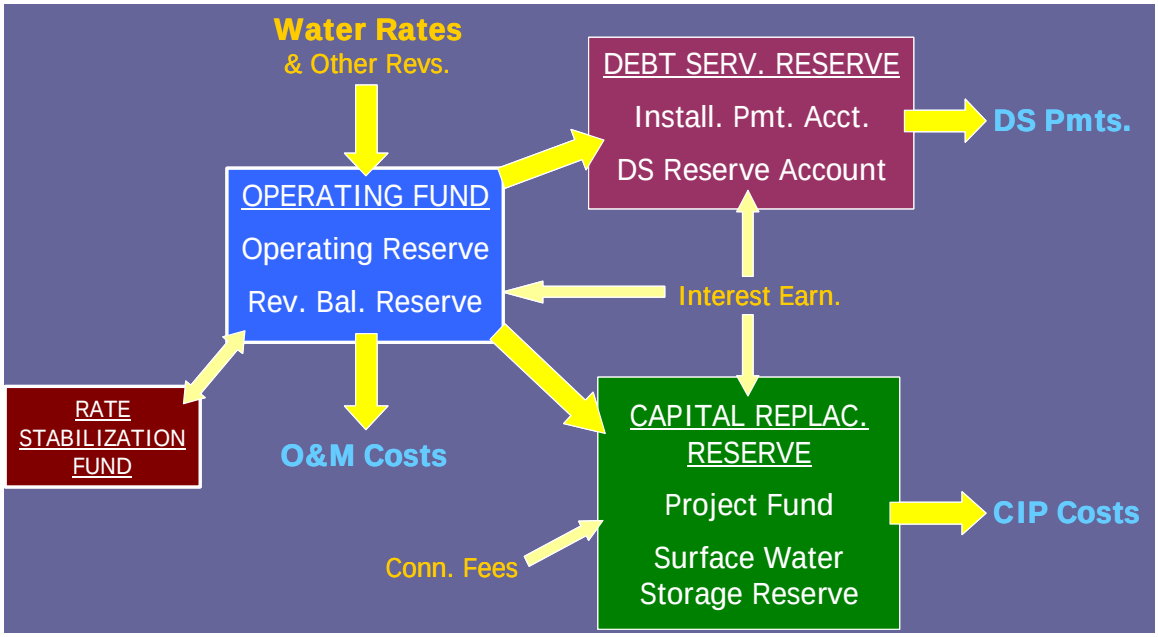
A third component addressing the liability of capital projects has been added for discussion as follows:

3. Capital Replacement Reserve

Figure 8-1 graphically illustrates a fund/reserve structure used for financial analyses and development of the Financial Business Plan. With this structure, operating costs, debt service obligations, and capital program needs are each compartmentalized with associated revenues, expenditures, and fund/reserve balances.

A Rate Stabilization Fund is shown as a fourth component in Figure 8-1 and serves a special purpose related to meeting debt service coverage obligations, as described later in this section.

Figure 8-1
Fund/Reserve Structure and Cash Flow Diagram



8.2.2 Financial Business Plan – Model

The financial business planning model developed for the District is a cash flow model that differs from the formal accounting structure used by the District and reported in formal financial statements. Fund and reserve balances in the financial planning model represent cash (and cash equivalent) balances, which differ from equity balances contained in financial statements. The District's annual operating, debt, and capital program needs are reflected on a cash basis, without consideration for non-cash items, such as depreciation, contributed capital, and retained earnings. A description of the fund/reserve structure shown in Figure 8-1, as well as major cash flows into, out of, and between them is provided below. The financial planning model developed for the District follows this structure and reflects revenues, expenditures, transfers, and fund/reserve balances for each year of the planning period.

Specific recommendations pertaining to formalizing reserves and reserve policies are presented later in this section.

8.2.2.1 Operating Fund

The Operating Fund (as used herein) is the primary fund for the District's day-to-day operations. Most of the water system revenues, including water rate revenues, flow into the Operating Fund and all operating and maintenance expenditures are paid out of this fund. The Operating Fund includes an operating reserve and a rate stabilization fund (as described below). Funds in excess of the operating reserve and rate stabilization reserve are identified as an uncommitted fund balance, and are available for general purposes, including transfers to other reserves.

Operating Reserve – The purpose of an Operating Reserve is to provide sufficient funds for working capital, as well as funds for continued operation in the event of unplanned operating and maintenance expenditures or for buffering revenue volatility. At present, the District does not have a formal operating reserve policy to define a minimum operating reserve, although this was a subject of consideration during development of the Financial Business Plan.

Rate Stabilization Fund – The District formally established a Rate Stabilization Fund with Resolution 6192000-1 in June 2000. The rate stabilization fund is allowed under terms of the Installment Sale Agreement for the 1999 Water Revenue Certificates of Participation (2003 COPs). Its purpose is to provide a means of assisting in meeting debt service coverage requirements. Under the terms of the Installment Sale Agreement, the District must maintain net revenues (defined as gross revenues less operating and maintenance expenses) in excess of 120% of annual debt service. Money placed into a Rate Stabilization Fund is excluded from gross revenues in the year it is placed into the fund. The money can subsequently be used to make up a revenue deficiency in a future year in order to assist in meeting the debt service coverage requirement. In FY 01-02, the District deposited $150,000 into the Rate Stabilization Fund for this purpose.

Revenue Balancing Reserve – The future establishment of a Revenue Balancing Reserve is a recommendation stemming from the financial planning analyses described herein. Further information about the reserve is presented later in this section.

8.2.2.2 Debt Service Reserve

The Debt Service Reserve, as presented in the financial planning model, reflects funds designated for debt service payments, as well as funds set aside to provide security for debt obligations. Specific accounts for debt service purposes are required under terms of the Installment Sale Agreement for the 1999 COPs.

Installment Payment Account – The Installment Payment Account is maintained by a trustee to make installment payments (COP debt service payments) under the terms of the COPs. In effect, the District is responsible for depositing money into this account in advance of debt service payments. For purposes of financial planning, annual transfers from the Operating Fund are made into this account equal to annual debt service payments, net of interest earnings on funds within the Debt Service Reserve.

Installment Payment Reserve Account – The Installment Payment Reserve Account is maintained by a trustee with an amount equal to the reserve requirement. Under the terms of the 1999 COPs, the reserve requirement is the lesser of: (1) maximum annual debt service payment, (2) 125% of the average debt service payment, or (3) 10% of the composite reoffering price of the certificates to the public. Effectively, the Debt Service Reserve requirement is the amount of the largest remaining annual debt service payment under 1999 COPs. This amount of money is maintained in the Installment Payment Reserve Account as security to ensure that the District is able to make scheduled debt service payments. Interest accruing to the reserve account is applied against debt service payments to the extent that funds in the account exceed the reserve requirement.

Any future borrowing will require creation of additional Installment Payment Reserve Accounts in accordance with the requirements of the borrowing agreement.

8.2.2.3 Capital Replacement Reserve

At present, the District does not have a Capital Replacement Reserve. However, we recommend that one be established and the financial planning analyses contained herein includes such a reserve as an integral component for evaluating financial strategies for meeting future capital replacement program needs. The proposed Capital Replacement Reserve would be used to account for and track the use of funds needed for the replacement, rehabilitation, and upgrade of the water system. The Capital Replacement Reserve receives money through transfers from the Operating Fund and possibly from connection fees and interest earned. Money in the reserve is used to pay for capital projects identified in the capital replacement program.

Acquisition and Construction Account (Project Fund) – Debt proceeds (from any future COPs) would be deposited into an Acquisition and Construction Account, as required by the Installment Sale Agreement. Money in the Acquisition and Construction Account would be used specifically for the capital projects for which the debt is issued. For purposes of financial planning analyses, an Acquisition and Construction Account is shown as a component of the Capital Replacement Reserve and the funds therein are used exclusively for defined projects.

Surface Water Storage Reserve – The creation of a Surface Water Storage Reserve is a recommendation stemming from the financial planning analyses described herein. Further information about the reserve is presented later in this section.

8.2.3 Reserve Policy Recommendations

Section 8.2.1 provided a description of the fund and reserve structure used in financial planning analyses. Specific recommendations defining the purpose, target amount, and use of funds for each reserve are presented below. Each of these recommendations has been incorporated in the financial planning analyses described herein.

It is recommended that the District establish and maintain several reserves to (1) minimize the adverse annual and multi-year impacts of anticipated and unanticipated District expenses and revenue fluctuations, (2) enhance the financial stability and improve security with respect to long-term financial obligations, and (3) improve long-term rate stability, while sustaining the District's infrastructure in a cost-effective and forward-looking manner. The adequacy of target reserves and/or annual contributions should be reviewed annually during the budgeting process, and may be revised accordingly, as necessary.

Operating Reserve

1. Purpose: To ensure the District's Operating Fund maintains an adequate balance for working capital requirements, as well as unanticipated expenditures for operations, maintenance, or asset acquisition.

2. Target Amount: The District shall maintain a minimum operating reserve equal to 25% of budgeted operating and maintenance costs, excluding debt service.

3. Use of Funds: The District shall not adopt a budget that would result in an Operating Fund balance that is lower than the target minimum operating reserve. The Board of Directors

shall approve use of funds that would result in an Operating Fund balance lower than the operating reserve target minimum, unless an emergency condition exists.

4. Contributions: The District's financial resources shall be allocated to the operating reserve after all other reserves are funded, as specified by District policy or Board action.

Rate Stabilization Fund

5. Purpose: To provide additional security in meeting debt service coverage requirements under the District's Installment Sale Agreement related to the 1999 COPs (and/or subsequent debt issue).

6. Target Amount: Resolution 6192000-1 authorized establishing a Rate Stabilization Fund of up to $500,000. In FY 01-02, the District contributed $150,000 into the fund. The District shall maintain money in the Rate Stabilization Fund until such time as the debt service coverage calculated for any fiscal year exceeds 1.75 and is not expected to fall below this level.

7. Use of Funds: Funds withdrawn from the Rate Stabilization Fund are available to the District for general purposes (added to Operating Fund), and the amount can be included in revenues for purposes of debt service coverage calculation.

8. Contributions: Contributions to the Rate Stabilization Fund can be made from any generally available funds. Amount contributed must be deducted from revenues for the year contributed for purposes of debt service coverage calculation.

Revenue Balancing Reserve

1. Purpose: To enhance financial stability when extraordinary changes in customer demand or specifically identified costs (e.g., electricity costs) exceed a pre-determined range or amount.

2. Target Amount: The amount, mechanism, and function of the revenue balancing reserve shall be evaluated in the future, once a majority of the District's customers pay for water service based on metered water rates.

3. Use of Funds: It is anticipated that funds in this reserve will be used to offset lost revenues or extraordinary costs subject to criteria to be determined in the future.

4. Contributions: It is anticipated that rate surcharges would apply to customer water bills to replenish the revenue balancing reserve subject to criteria to be determined in the future.

Installment Payment Account

1. Purpose: To accumulate money to be used for debt service payments. This account is maintained by a trustee.

2. Target Amount: Prior to each installment (debt service) payment date, the District shall deposit an amount such that the balance in the account is at least equal to the installment payment then due.

3. Use of Funds: Money deposited in the installment payment account shall only be used as specified in the Installment Sale Agreement.

4. Contributions: Contributions to the installment payment account shall be made from revenues or available funds that can be used for debt service payments.

Installment Payment Reserve Account

1. Purpose: To ensure there are adequate funds to make required installment (debt service) payments. This account is maintained by a trustee.

2. Target Amount: An amount equal to the reserve requirement shall be maintained in the Installment Payment Reserve Account, in accordance with provisions of the Installment Sale Agreement.

3. Use of Funds: In the event that money in the Installment Payment Account is insufficient to make a required installment payment, then funds in the Installment Payment Reserve Account shall be used for this purpose.

4. Contributions: The Installment Payment Reserve Account was funded with proceeds from the issuance of 1999 COPs.

Capital Replacement Reserve

1. Purpose: To provide funds in support of the District's ongoing capital replacement program, and to minimize or avoid the need for future long-term debt.

2. Target Amount: The District shall seek to maintain an amount in the Capital Replacement Reserve sufficient to cover annual capital replacement program costs, as scheduled, with consideration of annual contributions to the reserve.

3. Use of Funds: Funds in the Capital Replacement Reserve shall be used exclusively for capital replacement projects planned and approved by the District.

4. Contributions: The District shall establish an annual transfer of funds from the Operating Fund at a level sufficient to achieve the required target amount as identified in long-term financial planning analyses. Water capital facility fee revenue shall also be deposited into the Capital Replacement Reserve.

Acquisition and Construction Account

1. Purpose: To account for future debt proceeds used to acquire and/or construct water system improvements as identified in any future Installment Sale Agreement or similar financing instrument.

2. Target Amount: Net debt proceeds shall be deposited into the account in accordance with the Installment Sale Agreement.

3. Use of Funds: Fund in this account shall only be used to acquire and/or construct the "project" as defined in the Installment Sale Agreement, or similar financing instrument.

4. Contributions: Net debt proceeds shall be deposited into the account in accordance with the Installment Sale Agreement.

Surface Water Storage Reserve

1. Purpose: To accumulate funds for the future acquisition of surface water storage capacity or stored surface water.

2. Target Amount: The District shall work to accumulate $1 million in the surface water storage reserve by FY 12-13.

3. Use of Funds: Funds shall be used, with the approval of the Board of Directors, to acquire, contract, or reserve surface water storage capacity or stored surface water for the purpose of providing dry year water supplies.

4. Contributions: The District shall transfer available funds into the surface water storage reserve in accordance with long-range financial plans, subject to meeting other reserve requirements, including maintaining the minimum operating reserve.

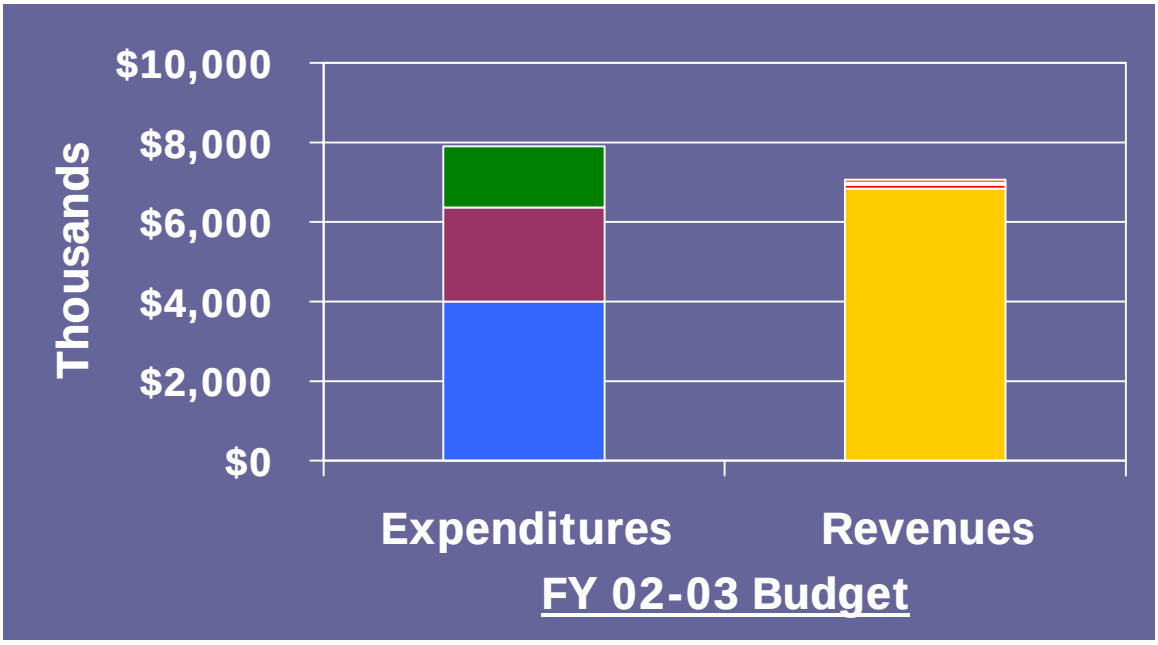
As noted previously, some of the reserves listed already exist, as they are required under the Installment Sale Agreement of the 1999 COPs. Others are recommended to help the District effectively manage the financial obligations of the capital replacement program and to help ensure financial stability and operational flexibility.

8.2.4 Current Financial Situation

The District's current financial situation, as reflected in the FY 02-03 budget, reflects the completion of major capital project expenditures (financed largely through the 1999 COPs) and the obligations of debt service payments. Because the District relied on proceeds from the 1999 COPs to support a significant portion of its capital improvement program, current revenues are generally insufficient to meet ongoing capital program needs. For the time being, available reserves are being used to support a significant portion of current capital program needs. However, reserves are limited and one of the purposes of the Financial Business Plan is to develop a strategy for sustaining capital program needs in the future, while also maintaining a prudent reserve policy.

Figure 8-2 provides a graphic summary of the District's current financial situation, based on the FY 02-03 budget.

Figure 8-2
Current Financial Situation



The expenditures bar reflects the following:

- The District's operating budget is about $4.0 million.
- The District has a $2.4 million annual debt service obligation related to the 1999 COPs. This obligation will continue at the present level until 2030.
- The FY 02-03 budgeted capital program totals about $1.5 million.

Therefore, total annual costs for the District in FY 02-03 is about $7.9 million.

Water rates for FY 02-03 are expected to generate about $6.8 million in revenues. Interest earnings, connection fees, and other minor revenues are expected to generate about $200,000. The amount of remaining revenue after making allowances for continued operations and debt service obligations is approximately $600,000. A sustainable pay-as-you-go type capital replacement program using a balanced financial approach would be limited to the $600,000 and is far less than that necessary to address the current and projected cost associated with maintaining the District infrastructure.

The FY 02-03 capital program totaled about $1.5 million. As can be seen, expenditures will exceed revenues in FY 02-03 by about $900,000. At the beginning of FY 02-03, the District had about $4.3 million in available reserves, exclusive of the debt service reserve (held in trust). This Master Plan and the recommended capital replacement program suggests that average

capital program expenditures will need to increase to an average of about $3.2 million over the next 10 years.

The manner in which the District should confront the financial obligations of not only continued operations and current debt service obligations, but also the capital replacement program (defined earlier in this report) necessary to sustain the District's infrastructure was the key objective in developing the Financial Business Plan.

8.2.5 Financial Analysis Assumptions

The Financial Business Plan and financial strategy were developed using an Excel-based financial planning model prepared for the District. The financial planning model is based on the District's current (FY 02-03) budget and reflects the District's budget and account structure at the line-item level of detail. Existing debt obligations are based on debt service payment schedules and other obligations contained in the Official Statement for the 1999 COPs. The capital replacement program included in the financial planning model reflects the capital program recommendations contained in previous sections of this Master Plan. The timing of select projects was adjusted as we examined various financial scenarios in order to provide multiple alternatives for presentation at District workshops with staff, the Board and the public. The financial planning model reflects a number of underlying assumptions that were reviewed with staff and the Board of Directors for reasonableness.

As with all long-range planning models, the results are a reflection of underlying assumptions. Results may be reasonably relied upon for a few years; however, as the planning horizon increases, the accuracy of the model will diminish. This does not, however, detract from the value of developing long-range estimates. The analyses are particularly helpful and useful when comparing the relative impacts for various decisions or courses of action. The financial planning model should be used as a planning and management tool, but should not be relied upon as an exact predictor of the future.

Some of the assumptions contained in the financial planning model include:

- Annual inflation rate of 2.5%.
- Annual interest rate on fund/reserve balances 2.0% per year, applied to the beginning-of-year balance of each fund/reserve.
- Annual customer growth rate of 0.5%.
- Annual water conservation savings of 0.5% per account.
- Operation and maintenance costs increase annually at the rate of inflation, plus:
    - Energy and chemical costs also adjust based on change in total demand;
    - Customer service and general administrative costs increase based on growth in customer base;

- Water conservation program costs of $25,000 in FY 02-03 increased to $250,000 by FY 06-07, then annually increased based on inflation thereafter; and

- Contract meter reading costs of $0.65 per read begins in FY 03-04 with bi-monthly reading of 4,000 meters increasing by 1,000 meter per year until all meters are installed and being read.

- Annual principal and interest debt service payments equal about $2.38 million and remain constant until 2030.

  - Minimum debt service coverage requirement is 1.20[1];

  - Interest accruing to Debt Service Reserve and payment accounts are used to help make annual debt service payments;

  - Existing COPs are not pre-paid or refinanced; and

  - Any future debt would be another 30-year COP with a 5.0% interest rate, with issuance costs of 4.0% to 5.0% of the issue (depending on size, for issues less than $10 million). A Debt Service Reserve would be funded with debt proceeds.

- Capital replacement program costs are presented in current dollars and escalated to year of construction at a 2.5% annual inflation rate.

  - See prior sections of this report for explanation of need, timing, and cost assumptions for individual projects.

The challenge facing the District is to find a way to meet the financial obligations created by ongoing operations, debt service, and capital program needs. Water rate revenues comprise about 97% of the District's total revenues, and this fact is not likely to change significantly even if the District considers policies affecting other revenues. Current revenues are sufficient to cover ongoing operations and debt service, but only a limited portion of capital program needs. As described in detail below, the development of the Financial Business Plan focused on adequately funding capital program needs while being sensitive to the financial burden borne by the District's ratepayers. Ultimately, however, the water system buried infrastructure will wear out and the District is committed to being prepared for the reinvestment necessary to sustain a high quality and reliable water supply.

8.3 Financial Business Plan – Strategy Development

Development of the Financial Business Plan entailed identifying sufficient revenues to meet the combined impact of operating costs, debt service obligations, and capital program needs. Annual debt service costs are fixed, stable, and known through 2030. Ongoing operating costs will fluctuate to a limited extent, and will likely increase over time due to the effects of inflation and growth within the District's service area. Both of these cost components are relatively predictable.

[1] The District's net revenues (defined as gross revenue less operating and maintenance expenses) must be at least 120% of annual debt service payments.

Capital program costs, in contrast, can vary dramatically from one year to the next. From now until 2030, annual capital replacement program costs, as reflected in this Master Plan, are expected to range from a low of $1.0 million to a high of $6.5 million, and average about $2.75 million (all in current dollars) over the 30 years. Near-term recommendations result in an average of about $3.2 million per year program through 2010. It would be unreasonable to expect that revenues could vary each year with the variability of the capital replacement program.

While many utilities use long-term debt to finance capital projects during peak expenditure periods, such an approach is not necessarily economically efficient for an ongoing long-term capital replacement program. Taking a fiscally conservative approach, the District's Board of Directors recognizes that the most cost-effective approach to long-term infrastructure replacement is through a pay-as-you-go financing strategy. This approach relies on revenues and reserves to meet ongoing capital program needs. By establishing a capital replacement reserves policy and funding it sufficiently to address variations in the program costs, interest and other financing costs can be avoided. In addition, by recognizing peak year liabilities in advance, revenue can be banked and interest accrued to help offset the future cost of replacement.

During the process of identifying a preferred financial strategy, we examined seven different capital program/financing "options" using the financial planning model. Four of the options were developed by the consultant to illustrate a range of possibilities; then three others were identified by the Board and staff, during financial business planning workshops, as variations that might better achieve policy objectives.

A description of each option is presented in the pages that follow. All options reflect the reserve policies that have been recommended in the preceding portions of this chapter, and all ultimately achieve the same financial, infrastructure sustainability, and rate stability objectives.

8.3.1 Financial Business Plan Scenarios

During the workshop with the Board of Directors on January 13, 2003, four financial scenarios, or options, were presented to illustrate various approaches to addressing the District's long-term capital program needs. Based on comments made during the workshop, three additional options were developed and presented during a second financial business planning workshop on February 4, 2003. Each of the seven options is described below. Additional information about specific capital replacement projects is provided in other sections of this report.

8.3.1.1 Option No. 1 – Immediate Implementation of Full Capital Program

This option presents the financial impacts of immediately implementing the full capital replacement program, as originally developed during the master planning process. Specific elements of this option include:

- Meter retrofit program completed in six years, requiring about 1,000 retrofit meter installations per year.

- Fair Oaks Boulevard pipeline replacement as scheduled, prior to County road widening and resurfacing project, in FY 04-05 and FY 05-06.

- General pipeline replacement projects (due to age/condition) at a level of $1.5 million per year.

- Contribute $100,000 per year to the surface water storage reserve for the next 10 years.

- Other Master Plan projects, as scheduled.

To support the capital replacement program as presented in this option without additional long-term debt, as well as meet current and anticipated operating costs and debt obligations, the District would need to increase water rates an estimated 12% in FY 03-04, followed by 36% in FY 04-05. After these two significant increases, water rates would stabilize with annual water rate increases estimated in the 1% to 3% range for the remainder of the planning period.

Advantages and disadvantages of this option include:

Advantages

- Capital replacement program needs are fully met, immediately.
- Additional long-term debts, and associated financing costs, are avoided.
- Long-term rate stability, at or below the rate of inflation, is achieved after two years.
- The meter retrofit program is completed in just six years.

Disadvantages

- Two years of significant rate increases are required.

8.3.1.2 Option No. 2 – Five-Year Ramped Capital Program

This option presents the financial impacts of delaying, where feasible, some elements of the near-term capital replacement program in order to mitigate the significant rate increases required in the Option No. 1. Specific elements of this option include:

- Meter retrofit program completed in 10 years, requiring about 600 retrofit meter installations per year.

- Fair Oaks Boulevard pipeline replacement as scheduled, prior to County road resurfacing project, in FY 04-05 and FY 05-06.

- General pipeline replacement projects as scheduled, but at a level of lower than required over the long-term (pipeline replacement expenditures would increase over time).

- Contribute $200,000 per year to the surface water storage reserve from FY 08-09 through FY 12-13.

- Other Master Plan projects, as scheduled.

To support the capital replacement program as presented in this option, without additional long-term debt, as well as meet current and anticipated operating costs and debt obligations, the District would need to increase water rates an estimated 10% to 12% for the next four years. After this transition period, water rates would stabilize with annual water rate increases estimated in the 1% to 3% range for the remainder of the planning period.

Advantages and disadvantages of this option include:

Advantages

- Capital replacement program needs are fully met, but with a somewhat delayed initial implementation.
- Additional long-term debt, and associated financing costs, is avoided.
- Long-term rate stability, at or below the rate of inflation, is achieved after four years.

Disadvantages

- Four years of moderately high rate increases are required.
- The meter retrofit program would require about 10 years to complete.

8.3.1.3 Option No. 3 – Ten-Year Ramped Capital Program

This option presents the financial impacts of further delaying some elements of the near-term capital replacement program in order to minimize water rate increases, while still avoiding new long-term debt. Specific elements of this option include:

- Meter retrofit program completed in 15 years, with half the meters being installed in the last three years.
- Partial Fair Oaks Boulevard pipeline replacement, prior to County road resurfacing project, with some sections of the replacement deferred until 2015.
- General pipeline replacement projects as scheduled, but at a level of lower than required over the long-term (pipeline replacement expenditures would increase over time).
- Contribute to the surface water storage reserve from FY 08-09 through FY 12-13 in a graduated schedule.
- Other Master Plan projects, as scheduled.

To support the capital replacement program as presented in this option, without additional long-term debt, as well as meet current and anticipated operating costs and debt obligations, the District would need to increase water rates an estimated 5% to 8% for the next five years. After this transition period, water rates would stabilize with annual water rate increases estimated in the 1% to 3% range for the remainder of the planning period.

Advantages and disadvantages of this option include:

Advantages

- Capital replacement program needs are met, but with a somewhat delayed initial implementation.
- Additional long-term debt, and associated financing costs, is avoided.
- Near-term rate increases are minimized.
- Long-term rate stability, at or below the rate of inflation, is achieved after five years.

Disadvantages

- Portions of the Fair Oaks Boulevard pipeline would not be replaced prior to the County's road widening and resurfacing project, resulting in increased risk and potential higher cost.
- The meter retrofit program would require about 15 years to complete (although still meeting Water Forum commitments).

8.3.1.4 Option No. 4 – Five-Year Ramped Capital Program with $5.0 Million Debt Financing

This option presents the financial impacts of implementing the capital replacement program presented in Option No. 2, but issuing about $5.0 million in COPs to finance the Fair Oaks Boulevard Pipeline Project. Specific elements of this option include:

- Meter retrofit program completed in 10 years, requiring about 600 retrofit meter installations per year.
- Fair Oaks Boulevard pipeline replacement as scheduled, prior to County road widening and resurfacing project, in FY 04-05 and FY 05-06.
    - Issuance of a $5.0 million COP in 2004 (to finance the pipeline project) with a 30-year term and 5.0% interest rate. Annual debt service would be about $325,000.
- General pipeline replacement projects as scheduled, but at a level of lower than required over the long-term (pipeline replacement expenditures would increase over time).
- Contribute to the surface water storage reserve from FY 08-09 through FY 12-13 in a graduated schedule.
- Other Master Plan projects, as scheduled.

The Fair Oaks Boulevard pipeline replacement project is a significant near-term capital expenditure, which poses a near-term "hurdle" for implementing the capital program. By financing this project, the District could mitigate the near-term impacts presented in Option No. 2. With this option, the District would need to increase water rates an estimated 5% to 8% for the next eight years. After this transition period, water rates would stabilize with annual water rate increases estimated in the 1% to 3% range for the remainder of the planning period.

Advantages and disadvantages of this option include:

Advantages

- Capital replacement program needs are fully met, but with a somewhat delayed initial implementation.
- Near-term rate impacts mitigated by issuing additional COP for financing the Fair Oaks Boulevard pipeline replacement project.
- Long-term rate stability, at or below the rate of inflation, is achieved after eight years.

Disadvantages

- Eight years of moderate rate increases are required.
- The District would incur interest and other financing costs associated with long-term debt.
- The meter retrofit program would require about 10 years to complete.

8.3.1.5 Option No. 5 – Five-Year Ramped Capital Program with $7.8 Million Debt Financing

This option presents the financial impacts of implementing the capital replacement program presented in Option No. 2, but includes issuing about $7.8 million in COPs to finance the Fair Oaks Boulevard pipeline replacement project, as well as the La Vista Reservoir rehabilitation project. Specific elements of this option include:

- Meter retrofit program completed in 10 years, requiring about 600 retrofit meter installations per year.
- La Vista Reservoir rehabilitation project completed sooner than planned due to coincide with availability of debt proceeds.
- Fair Oaks Boulevard pipeline replacement as scheduled, prior to County road resurfacing project, in FY 04-05 and FY 05-06.
    - Issuance of a $7.8 million COP in 2004 (to finance the pipeline project and La Vista Reservoir rehabilitation) with a 30-year term and 5.0% interest rate. Annual debt service would be about $507,000.
- General pipeline replacement projects as scheduled, but at a level of lower than required over the long-term (pipeline replacement expenditures would increase over time).
- Contribute to the surface water storage reserve from FY 08-09 through FY 12-13 in a graduated schedule.
- Other Master Plan projects, as scheduled.

The Fair Oaks Boulevard pipeline replacement project is a significant near-term capital expenditure, which poses a near-term “hurdle” for implementing the capital program. The

La Vista Reservoir replacement project is a second significant project. Although not originally scheduled until about FY 08-09 and FY 09-10, the reservoir is in need of rehabilitation now. By financing both projects, the District could achieve accomplishing two important capital program goals while mitigating some of the near-term rate impacts. With this option, the District would need to increase water rates an estimated 5% in FY 03-04 and 15% in FY 04-05. After this two-year transition period, water rates would stabilize with annual water rate increases estimated in the 1% to 4% range for the remainder of the planning period.

Advantages and disadvantages of this option include:

Advantages

- Capital replacement program needs are fully met; two critical projects completed within the next few years.
- Near-term rate impacts mitigated by issuing additional COP to finance the Fair Oaks Boulevard pipeline replacement project and the La Vista Reservoir rehabilitation project.
- Long-term rate stability, near or below the rate of inflation, is achieved after two years.

Disadvantages

- One year of moderate rate increase and one year with a high rate increase is required.
- The District would incur interest and other financing costs associated with long-term debt.
- The meter retrofit program would require about 10 years to complete.

8.3.1.6 Option No. 6 – Five-Year Ramped Capital Program with $7.8 Million Debt Financing

Option No. 6 is the same as Option No. 5, except rate increases for the first two years are adjusted, such that the larger increase occurs within the first year. The advantages and disadvantages of this option are basically the same as the Option No. 5. The decision of when to increase rates to meet a specific financial strategy is a policy call.

8.3.1.7 Option No. 7 – Delay Fair Oaks Boulevard Pipeline Project for 15 Years

More as a basis of comparison than a realistic option, this option is the same as Option No. 2, except that the Fair Oaks Boulevard pipeline replacement project is postponed for 15 years. This option has the affect of removing a significant capital expenditure from the near-term plans. The project is primarily needed at this time to get ahead of the County's road widening and resurfacing project. While the pipeline replacement project also provides operational benefits, it could be deferred. Because of increased costs associated with construction in new County roads, any construction work or repair work required for the next several years could be more expensive than work done prior to the road project. Specific elements of this project include:

- Meter retrofit program completed in 10 years, requiring about 600 retrofit meter installations per year.

- Fair Oaks Boulevard pipeline replacement deferred until FY 15-16.

- General pipeline replacement projects as scheduled, but at a level of lower than required over the long-term (pipeline replacement expenditures would increase over time).

- Contribute $200,000 per year to the surface water storage reserve from FY 08-09 through FY 12-13.

- Other Master Plan projects, as scheduled.

To support the capital replacement program as presented in this option without additional long-term debt, as well as meet current and anticipated operating costs and debt obligations, the District would need to increase water rates an estimated 6% per year for the next six years. After this transition period, water rates would stabilize with annual water rate increases estimated in the 1% to 4% range for the remainder of the planning period.

Advantages and disadvantages of this option include:

Advantages

- Capital replacement program needs are fully met, except for Fair Oaks Boulevard pipeline replacement.
- Additional long-term debt, and associated financing costs, is avoided.
- Long-term rate stability, near or below the rate of inflation, is achieved after six years.

Disadvantages

- Six years of moderate rate increases are required.
- District must accept risk of pipe breaks or leaks requiring repair, or pipeline replacement in Fair Oaks Boulevard after the road has been resurfaced by the County.
- The meter retrofit program would require about 10 years to complete.

8.3.1.8 Rate Scenarios

The required revenue associated calculated and Table 8-1 summarizes the estimated annual water rate increases associated with each of the seven options considered.

8.3.2 Recommended Financial Business Plan Strategy

Based on evaluation of the seven financial strategies described above, as well as discussions during two public workshops, it was recommended that the District consider a financial strategy similar to that outlined in Options No. 5 and No. 6. As described previously, the difference in these two options is the relative timing of rate increases over the next two years. Basically, to fund the capital program and debt service as presented in these options, we estimate that the District will need to increase water rates by a total of about 20% over the next two years.

Subsequent budget workshops and evaluation resulted in adoption of a five-year rate resolution (Resolution Number 05192003-2) reflecting a modified capital improvement schedule in the initial years of the CIP presented in the May 2003 plan.

Table 8-1
Summary of Estimated Water Rate Increases for Each Financial Business Plan

Financial Business Plan Option	FY 03-04	FY 04-05	FY 05-06	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11	FY 11-12	FY 12-13
Option #1 -- Full CIP with 6-year metering program, no new debt	12%	36%	3%	3%	2%	2%	1%	1%	1%	1%
Option #2 -- 5-Year ramped CIP with 10-year metering program, no new debt	12%	12%	10%	10%	2%	2%	2%	1%	1%	1%
Option #3 -- 10-Year ramped CIP with 15-year metering program, no new debt	8%	8%	8%	5%	5%	3%	3%	3%	3%	3%
Option #4 -- 5-Year ramped CIP with 10-year metering program, $5.0 million debt for FOB pipeline replacement	6%	8%	6%	6%	6%	6%	8%	5%	3%	2%
Option #5 -- 5-year ramped CIP with 10-year metering program, $7.8 million debt for FOB pipe replacement and La Vista reservoir rehabilitation (1)	5%	15%	4%	4%	4%	4%	4%	4%	4%	3%
Option #6 -- 5-year ramped CIP with 10-year metering program, $7.8 million debt for FOB pipe replacement and La Vista reservoir rehabilitation (1)	12%	8%	4%	4%	4%	4%	4%	4%	4%	3%
Option #7 -- 5-year ramped CIP with 10-year metering program, no new debt, postpone FOB pipe replacement beyond 10 years	6%	6%	6%	6%	6%	6%	4%	4%	4%	2%

Notes:

(1) Options #5 and #6 are the same except for rate increases in the first 2 years.

The modified capital improvement schedule included the following changes:

9. Fair Oaks Boulevard Project Pipeline Replacement Project design and construction is delayed up to 10 years. Adopted rate provides for possible borrowing to complete the project should the County of Sacramento resolve alignment and configuration alternatives and obtain additional funding needed to proceed with the work.

10. La Vista Reservoir rehabilitation project deferred to fiscal year 08-09 and 09-10. Rehabilitation may include removal and replacement of steel tank verses reconstruction of existing tank due to deferred maintenance.

The recommendations in this Master Plan range from specific to general and are based on the apparent conditions at the time the plan was adopted in principle on May 19, 2003. The rate resolution adopted June 23rd, 2003 continues moving the Carmichael Water District to an on-going pay-as-you-go capital replacement program addressing the long-term sustainability of a safe and reliable water supply.

The rate options presented below reflect the options as presented in the May 19, 2003 Master Plan document.

While the District will benefit from attaining a level of water rates that will sustain the long-term capital replacement program, using debt to finance near-term projects provides a prudent means of attaining this financial goal with only moderate rate increases. The driving factor for debt financing is the scheduled Sacramento County Fair Oaks Boulevard Widening and Resurfacing Project. This is the type of situation where the long-term financing of capital projects is advantageous and allows for reduced rate escalation while continuing to meet District goals.

8.4 Special Financial Business Planning Issues

In addition to developing a long-term financial strategy for the District, a number of special issues were addressed during the financial business planning process. These included:

- Approach for completing the meter retrofit program, which will now focus on metering of single-family customers.
- Meter reading and the collection of water consumption data.
- The transition to metered water rates for single-family residential customers.
- Water system capital facility fees.
- Other special issues.

8.4.1 Meter Retrofit Program

In 1992, a new state law required water meters be installed on all new water service connections. Water meters have long been unpopular in the Sacramento region. However, regional water planning efforts beginning with the Water Forum process initiated discussions of

the need for water conservation and water use efficiency, including the installation of water meters. Then in 1998, the District's Water Rate Structure Committee (WRSC) unanimously recommended an aggressive meter retrofit program. The WRSC was not persuaded by the need for water conservation, but believed that water meters are essential for equitable billing of water service.

Beginning in 1999, the District has been working to install water meters on all existing service connections. The effort started with parks, schools, and commercial customers, and metered billing of these customers began in FY 00-01. Multi-family customers (apartment buildings) were the next targeted group, and by FY 01-02 metered billing began for multi-family customers. At present, the District is completing metering of duplexes, triplexes, and fourplexes, as well as metering of condominium complexes. These groups should be metered in the near future, and they too will be converted to metered billing.

The last, and largest, group of customers to meter will be single-family customers. Metering of these customers is expected to take about 10 years[2]. While this is a long time, it is faster than Water Forum requirements. Faster metering programs are possible, but add to the financial strain of implementing the complete capital replacement program.

District staff is working to install retrofit residential meters with the following goals:

- Complete metering with limited disruption to service and the community, and within financial mean.
- Remain responsive to special needs and voluntary metering requests.
- Provide all customers the opportunity for billing based on water use.
- Develop a water use database to facilitate conservation outreach and improved understanding.
- Continue to migrate to conservation pricing to encourage further water use reductions.

8.4.1.1 Metering of Condominium Complexes

The metering of condominium complexes poses some unique challenges for the District. First, each condominium unit is separately owned while water service connections serve multiple dwellings (as well as common areas such as laundry facilities, irrigation, etc.). Second, it is generally impractical to separate services and provide a meter for each condominium unit. Third, the District currently bills each condominium unit separately, with bills for common areas going to the homeowner association.

While there are a limited number of condominium complexes within the District's service area, it is likely that metering will be somewhat controversial due to both plumbing and billing issues. The District, and ultimately customers, will be best served by following general policies regarding the metering of condominium complexes, but also remaining flexible (within bounds) to the unique circumstances of each complex.

[2] Financial strategy options also considered 6-year and 15-year residential metering programs.

Based on an evaluation of this issue, and input provided during workshops with the Board of Directors, it is recommended that the District adhere to the following basic principals:

- Water meters will be installed on all water service connections into a condominium complex in accordance with District standards.

- The District will not be responsible for "private" water distribution systems (i.e., plumbing downstream of water meters).

- For each condominium complex, the District will measure total water use (aggregate water use from all meters), and calculate total water bills based on the number and size of meters, as well as water usage. Each condominium unit would be billed an equal amount determined by dividing the total bill for the complex (sum of all meter bills) by the total number of dwelling units within the complex.

- The District will consider alternative billing methods for condominium complexes subject to the following requirements:

    - The homeowners association of the condominium complex requests an alternative method, and acts as an intermediary between owners and the District;

    - An alternative method can be developed based on data available and physical constraints of the plumbing system with any cost of modifications being borne by condominium owners and/or homeowners association (not the District);

    - An alternative method is approved by a majority of the condominium owners, as determined by the homeowners association; and

    - The alternative method is reasonable, reflects the cost of service, encourages water conservation, and generally results in the same or similar level of revenue as the standard billing method.

    - Additional costs associated with any alternative billing method are incorporated into the charges and not borne by other customers.

8.4.1.2 Metering of Single-Family Residences

As a result of new development since 1992, as well as voluntary meter requests and meter installations occurring as part of service line or pipeline replacement projects, the District already has a portion of the residential meters installed. This, however, represents a small percentage of the total number of single-family connections. Approximately 6,000 residential meters remain to be installed.

In 1998, the Water Rate Structure Committee recommended that the District pursue an aggressive meter retrofit program. District staff and Board members appreciate the value of meters for water management and equitable billing, and would likely welcome having meters installed overnight, if that were possible. Installing meters, however, on all existing service connections is time consuming and costly, even with recent efforts by staff to speed the process and reduce costs.

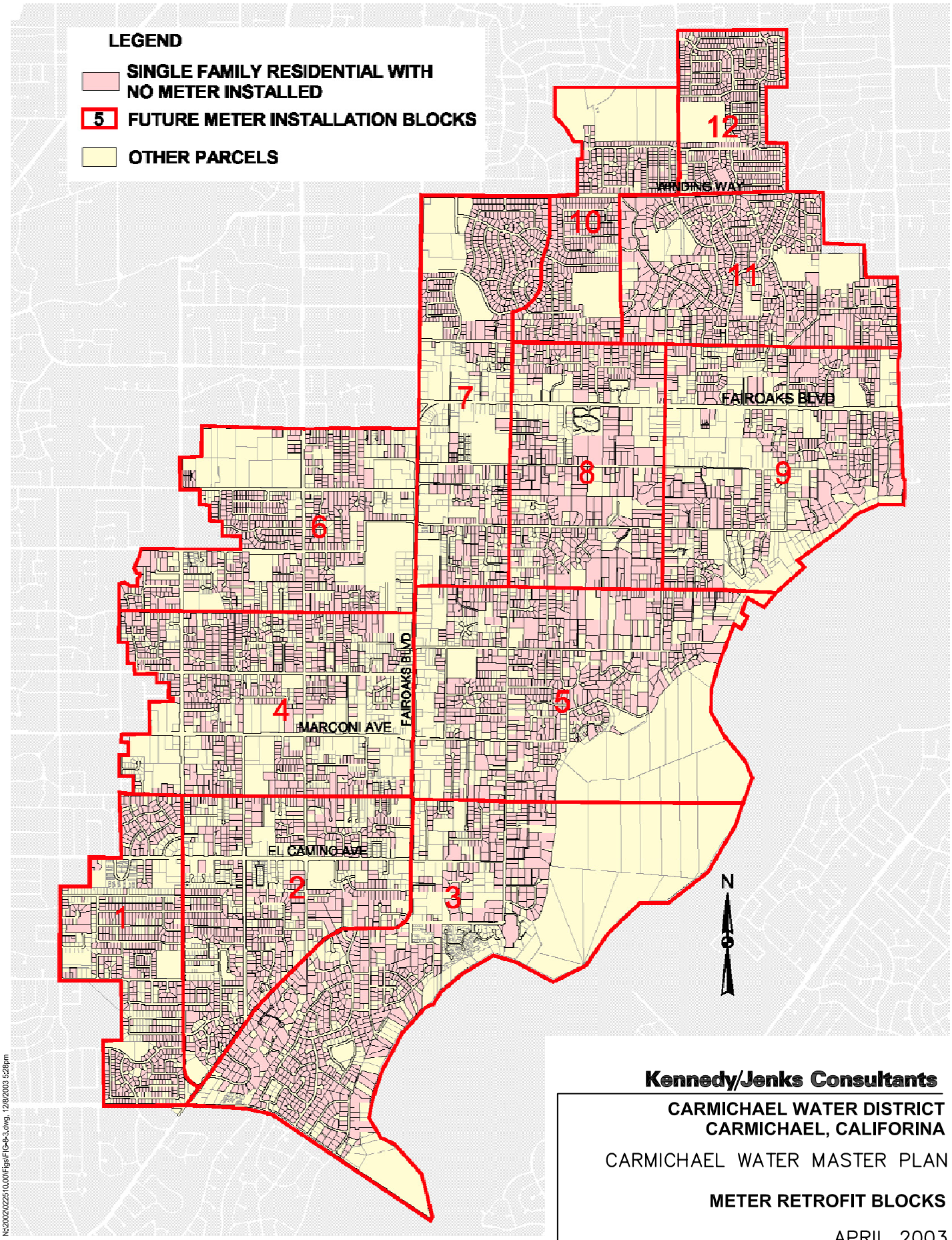
Many of the service lines in the District were constructed with plastic pipe, which has shown to be prone to leaks and premature failure. As a result, the District is replacing most service lines in conjunction with the meter retrofit program. While the cost of each meter and service line installation varies (due to site conditions, service size, access, and other factors), the average cost per retrofit is about $1,000.

Ideally, District staff would like to install about 1,000 meters per year. This level of effort would cost about $1 million per year and reflecting a combined effort by District Crews and contract services. This would be an aggressive metering effort by all measures. However, due to other capital replacement program needs and financial constraints, the recommended residential meter retrofit effort is recommended to be about 600 meters per year for 10 years. The estimated costs for this level of effort would be about $600,000 per year.

Figure 8-3 shows locations where residential meters remain to be installed and has the District broken into 12 sub-areas for prioritizing meter installations. The sub-areas include approximately 600 parcels each for meter retrofit and reflects a numbering system proceeding from the southwest to the northeast. This figure is a GIS product and may be used to track installations, readings and records as the meter retrofit program continues.

In order to efficiently and cost-effectively install retrofit meters, the District should do the following:

- Incorporate water meter installations as part of all pipeline replacement projects.
- Dedicate meter retrofit crews to a planned, orderly approach to metering each street and each neighborhood. The process and sequencing should be determined by staff, with the following priorities:
    - Complete infill pockets in areas that are already partially metered. This will facilitate more efficient meter reading and limit questions such as “Why do I have a meter and my neighbor does not?”
    - Prioritize areas with known service line problems.
    - Consider contracting for areas known or believed to have uniform conditions likely to be metered quickly and efficiently (e.g., subdivision built by a single developer).
    - Focus District crews on difficult area characterized by gradual infill development, non-uniform parcel size and shapes, well established landscapes, unknown site conditions, etc.
    - The last areas to be metered should be those with backyard water mains with limited access. The District may find, at that time, that radio read meters are warranted.
- Continue efforts to provide meters to customers who voluntarily request them.



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Kennedy/Jenks Consultants

CARMICHAEL WATER DISTRICT
CARMICHAEL, CALIFORINA

CARMICHAEL WATER MASTER PLAN

METER RETROFIT BLOCKS

APRIL 2003
FIGURE 8-3
K/J 022510.00

8.4.2 Meter Reading and Water Consumption Data

The District has been reading water meters on non-residential and multi-family customers for several years, as these customers are already subject to metered billing. District staff members have also read residential water meters, but on a sporadic basis due to time and resource limitations. Beginning in FY 03-04, the District plans to begin regular, bi-monthly reading of all meters. While non-residential and multi-family water use data will be used for billing purposes, residential water use data will primarily be used for information purposes at this time.

Residential customers can, and some have, request to be placed onto the metered water rate schedule. The District should continue to allow this voluntary conversion to metered rates. Many customers will likely benefit from the change, though until customers have water use data and are able to determine the potential impacts, voluntary conversions are likely to be limited.

Collecting water use data through bi-monthly meter reading will assist the District in better understanding residential water use characteristics, including variations among customers and across seasons. Water use data will also enable the District to identify some large water users, and to productively direct education or water conservation assistance efforts.

At this time, customers can call or visit the District to obtain a water use history for their individual accounts (to the extent that data exists). Staff is also able to provide an explanation of current flat rate billing and metered rate billing, and help determine how customer's individual water bill may change with metered billing.

As the metering efforts for the residential customer base approaches completion, the District should expand efforts to inform customers about water use characteristics and the potential implications of metered billing. This should begin with general information (e.g., articles in the newsletter) to explain average, typical, and low- and high-water use patterns, as well as tips on tracking water use, reading meters, and calculating bills with the metered rate structure.

We have found that one of the greatest obstacles associated with the transition from flat to metered rate billing is the fear of the unknown. When customers do not know what impact the new rate structure will have on them, they resist the change. The District should plan on providing at least a 12-month water consumption history (six bi-monthly meter reading cycles) to each customer prior to transitioning all customers to metered rates. This will go a long way toward alleviating customer fear.

Analysis of meter reading data over the next several years will also assist the District in understanding the revenue impact of the transition to metered billing, and enable the District to modify the rate structure, if necessary, to ensure equitable billing and proper revenue collections.

8.4.3 Transition to Metered Water Rates

Following the completion of water meter installation for each group of customers (i.e., non-residential and multi-family) metered rates have been implemented by the District with very little resistance or disruption. However, single-family customers may be different because

residential customers are more sensitive to the cost of water service, as well as issues of fairness.

Based on discussion of potential metered rate transition issues with the Board of Directors during a financial business planning workshop, we recommend that the District implement metered water rates for residential customers in a two-step process. First, during the period of retrofit metering, the District should allow any residential customer to voluntarily switch to metered billing, and all new water service connections should immediately be placed on the metered water rate. Second, at the completion of the meter retrofit program, customers should be provided with water use data and comparative billing (flat rate vs. metered rate) information covering a 12-month period prior to mandatory conversion to metered water rates.

While the voluntary metering program and the voluntary conversion to metered rates will be attractive to some customers, others are likely to resist metering efforts and will oppose metered rates as long as possible. Some customers may argue that being forced to the metered rates before other customers within the same customer class are metered is unfair. Therefore, some customers will (and already have) requested that metered billing not be required until all residential services are fully metered. This approach is being followed by most water agencies in the region that are also implementing metering programs. There are two known exceptions to this approach:

- The City of Roseville plans to convert residential customers to metered rates as each neighborhood is metered, following a 12-month period of water use data and comparative bill information being provided to each customer. This approach was agreed to when the City renegotiated its contract with the U.S. Bureau of Reclamation. About one-half of the City's residential customers are already metered (due largely to the amount of new construction since 1992). The City plans to begin providing water use and comparative bill information in the Spring of 2003, and begin metered billing of those customers a year later. Another group of customers will go through the conversion process each year as their meter retrofit program progresses.

- The Sacramento Suburban Water District has been converting groups of customers to metered rates annually, following installation of retrofit meters. This conversion process has caught the attention of some customers and may become an issue as the Sacramento Suburban Water District continues to resolve consolidation and legal issues associated with former district entities.

Postponing mandatory conversion to metered rate billing until all residential customers are metered and have been provided with water use and comparative bill information is probably the most reasonable and customer-friendly approach to the transition. This approach may delay some of the water conservation benefits that metered rates provide; however, customers who want to pay metered rates can do so.

While this approach will mean that most residential customers will not likely be converted to metered rate billing until about 2013, we recommend that metered rate billing immediately apply to all new water service connections, as well as those customers requesting the change. Finally, once customers opt for the metered billing they should not be allowed to return to the flat rates.

8.4.4 Metered Water Rate Structure Issues

One of the outcomes of the 1998 water rate study with the Rate Structure Advisory Committee was the development of a metered water rate structure. The District implemented metered water rates in FY 99-00, when it began billing non-residential customers based on actual water usage.

The metered water rate structure includes a fixed bi-monthly service charge, which varies with the size of the water meter, and a uniform commodity rate. The service charge is intended to recover a portion of fixed customer and capacity-related costs, while the commodity rate is intended to recover variable costs, plus the fixed costs not recovered through service charges. One might argue that fixed costs should be recovered through the fixed service charges, and variable costs recovered through the variable commodity charges. In the cost allocation and rate setting process, fixed customer costs (e.g., utility billing) are allocated equally to each customer, while fixed capacity costs (e.g., capital replacement program costs) are allocated based on potential demand as represented by the hydraulic capacity associated with each meter size. Other fixed costs are reasonably allocated based on water usage (e.g., water system maintenance costs). In addition, by recovering a greater share of costs through the commodity rate, there is an increased economic incentive for customers to conserve water, and a greater ability for customers to control their water bill.

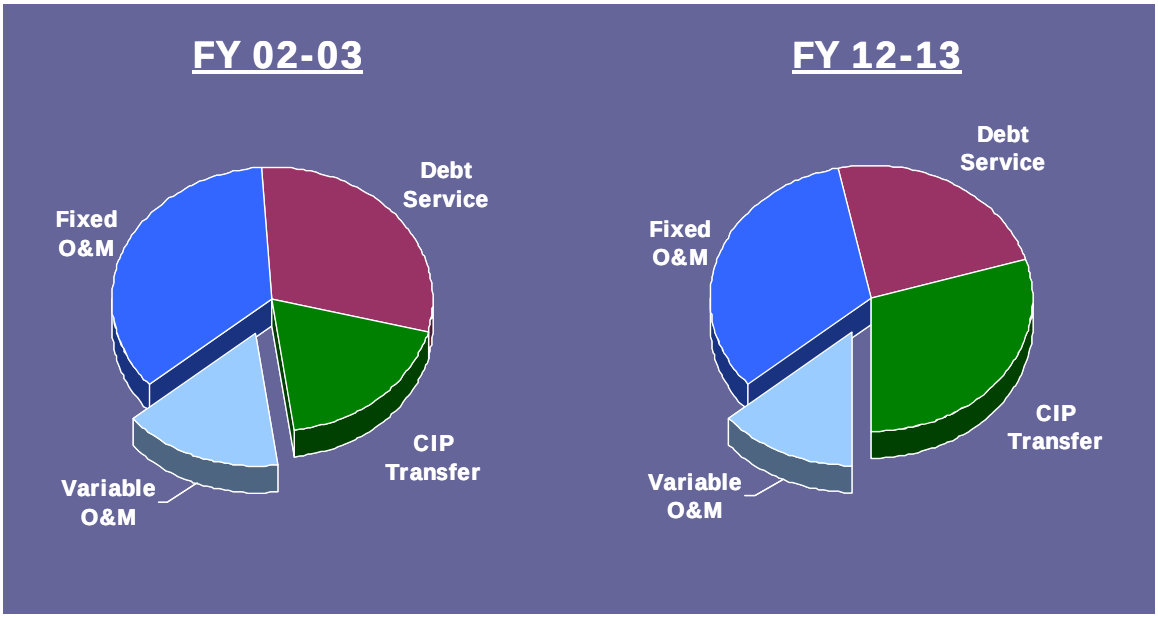
When originally adopted the metered water rate structure was designed such that, in aggregate, service charges would generate about 75% of water rate revenues and the uniform commodity rate would generate about 25% of the water rate revenues. Since that time, the District has modified the structure somewhat, such that at present the service charge would generate about 55% of rate revenues, while the commodity rate would generate about 45%.[3] The District made this change to increase the water conservation incentive embodied in the rate structure, and to provide customers with greater opportunity to control their water bills.

Board members have discussed the possibility of further emphasizing the commodity rate over the service charge in the rate schedule. However, as more revenue is collected from the commodity rate, the District's relative revenue and cost structures will become more sensitive to changes in water demands. That is, when water sales fall the reduction in water rate revenue could exceed the reduction in water system costs. This situation will be exacerbated, as flat rate customers become metered rate customers.

Figure 8-4 summarizes the relationship between fixed and variable costs, both for the current fiscal year and estimates for 10 years from now. At present, only about 16% of the District's annual costs are variable. In the future, only about 14% of costs will be variable, based on long-range financial plan analyses presented in this study.

[3] It should be noted that this does not mean that each customer's bill would comprise 55% of service charge and 45% commodity charge. Quite the contrary, actual bills may vary dramatically from this overall aggregate revenue split. For example, water bills of customers using very little water will have bills that approach 100% service charge, whereas for high volume users the commodity charge can be many times larger than the service charge.

Figure 8-4
Summary of Current and Future Fixed and Variable Costs



Based on discussions with the Board of Directors during a financial business planning workshop, we recommend that the District follow a two-step process with respect to metered water rates. First, the District should maintain the current rate structure (overall revenue split of 55% service charges and 45% commodity rates) for the duration of the meter retrofit program. This stability should minimize customer confusion regarding the implications of metered rates and facilitate continue orderly metering. This will also allow the District to gather more complete water use data and enable more accurate revenue volatility analyses with respect to various rate structures. In a second step, to occur once the District's residential customers are about 75% metered, the District should review rate structure issues with the benefit of more complete and comprehensive water use data. At that time, the District can also develop the details for implementing a revenue balancing reserve, as previously discussed in this section.

8.4.5 Capital Facility Fees

The term *connection fee* is generally used by the District, as well as other water utilities, to represent the fees charged to new development to cover the costs associated with providing water service to new customers. The District uses connection fees as a general term to reflect two specific fees that are normally charged to new customers. The first fee is a *tap fee*. The tap fee is charged to reimburse the District for the cost of tapping into the District's water main, constructing a service lateral to the customer's property, and installing a water meter. The second fee charged new customers is the *capital facilities fee*. This discussion focuses on this latter fee, which is intended to reflect the cost of providing capacity in the water system. The tap fee is periodically reviewed and updated by staff to reflect the average or typical costs associated with constructing service laterals.

The District is largely built-out. New development is occurring through infill and increased densification of previously developed property. In addition, the water system is largely in place. As presented in this Master Plan, the District's capital program needs are now primarily focused on replacement and rehabilitation of existing infrastructure of the water system. While some improvements provide additional water system capacity (e.g., upsizing pipelines), the intent is largely to provide a higher level of service, rather than provide more capacity for new development.

The District's current capacity facilities fee was implemented by Resolution No. 121790-01 in December 1990. The fee has not changed since that time, and was based on the cost of providing additional water supply capacity through the construction of additional wells. With the construction of the membrane water treatment plant and changes in the operations of the District's water system, the existing fee is outdated and no longer adequately reflects the cost of providing capacity to new customers. It is recommended that the District update the capacity facilities fee to reflect the current cost of water system capacity.

8.4.5.1 Legal Requirements and Calculation Methodology for Capital Facility Fees

The District has broad authority to charge users for capital facilities. The limitations of that authority are encompassed by the requirements that exactions on new development bear a *reasonable relationship* to the needs created by, and the benefits accruing to that development. California courts have long used the reasonableness standard or nexus test to evaluate the constitutionality of exactions, including capital facilities fees. Statutory requirements for water and wastewater capacity charges have been codified in Government Code Section 66013. Specifically, this code section states:

> Notwithstanding any other provision of law, when a local agency imposes fees for water connections or sewer connections, or imposes capacity charges, those fees or charges shall not exceed the estimated reasonable cost of providing service for which the fee or charge is imposed…

There are several methodologies for calculating capital facilities fees, and information on these has been presented in the District previously. The District is a good candidate for the system buy-in methodology. The methodology is appropriate for the following reasons:

- The District's capital program needs are primarily focused on replacement and rehabilitation needs of the water system, rather than expansion of the system to provide new capacity for development.

- The system buy-in methodology is well accepted and results in a relatively conservative estimate for the cost of capacity.

- The system buy-in fee does not require a detailed analysis of system capacity, capacity needs, and deficiencies that is required for other methods.

- Fee revenue is used to reimburse the District (or existing customers) for prior investment in the water system, and the revenue can then be used at the District's discretion, and is

not subject to detailed accounting and reporting requirements necessary for other methodologies.

We recommend that the District update the capital facilities fees using the system buy-in methodology.

8.4.5.2 Private Fire Services

At present, the District charges capital facilities fees for both water service and private fire service connections. We recommend that a capacity facilities fee not be charged for private fire service connections. The cost of providing fire flow capacity is included in the cost of water system facilities. All customers benefit from fire protection capacity and the system of public fire hydrants, and fire flow related costs are incorporated in the District's rates and capacity facility fee. To have a separate capital facilities fee for private fire service connections would require that fire flow related costs for public and private fire service connections be distinguishable and separable. This is impractical. Since the payment of capital facilities fees includes costs for public fire flow capacity, it could be redundant to charge for it again in instances when there is a private fire service connection.

A tap fee, or procedures that require new development to bear the cost of constructing private fire service laterals and appurtenances, as well as any extraordinary cost to upsize existing distribution pipelines to provide required fire flows, should continue to be imposed for these connections to the water system.