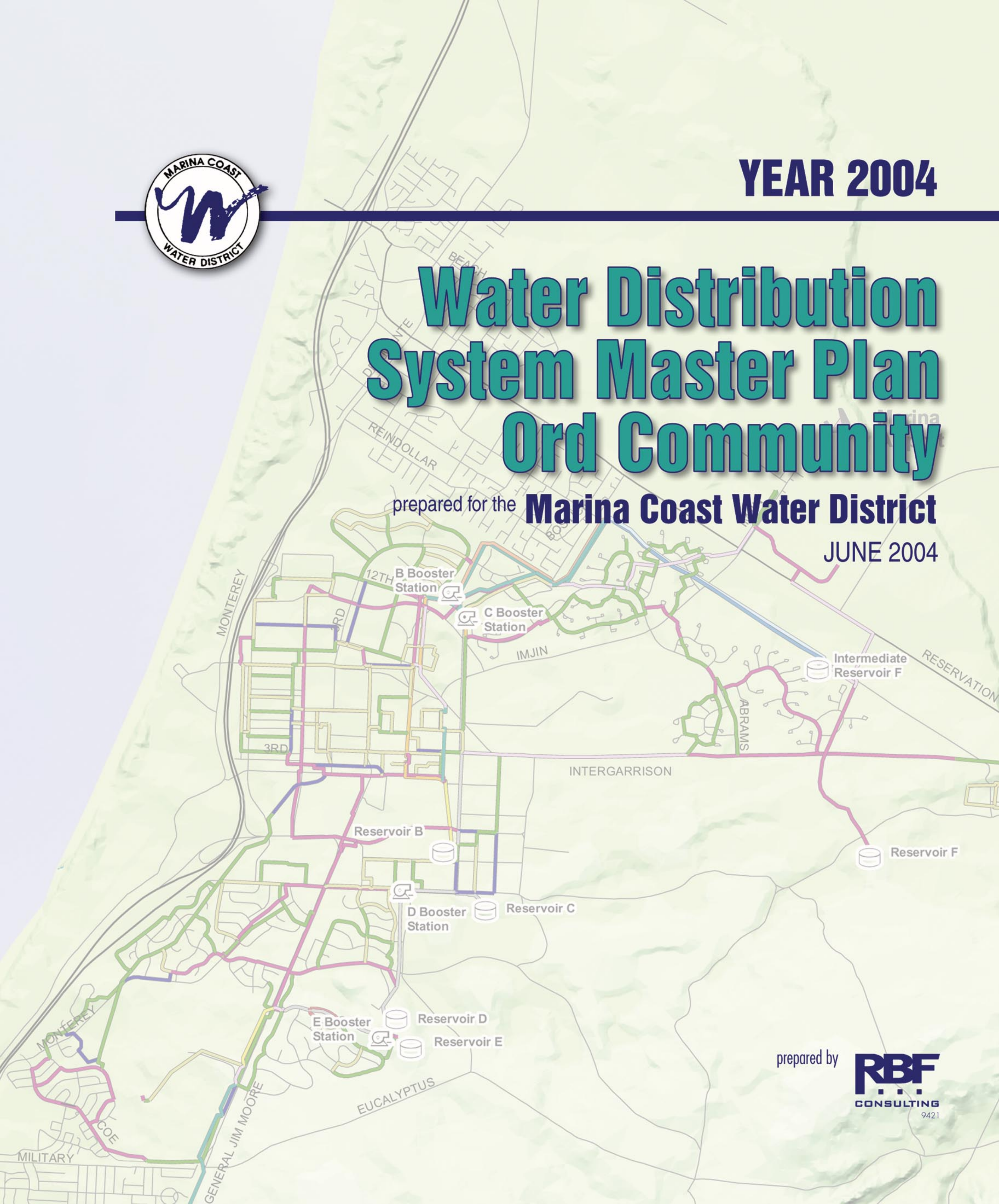
MARINA COAST WATER DISTRICT

YEAR 2004

Water Distribution System Master Plan Ord Community

prepared for the **Marina Coast Water District**

JUNE 2004



prepared by

RBF CONSULTING

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MARINA COAST WATER DISTRICT

WATER DISTRIBUTION SYSTEM MASTER PLAN

ORD COMMUNITY

FINAL PROJECT REPORT

JUNE, 2004

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ACP	Asbestos Cement Pipe
AFY	Acre-feet per year
BRAC	Army Base Realignment and Closure Program
CCP	Concrete Coated and Lined Reinforced Steel Cylinder Pipe
CIP	Capital Improvement Projects
CML&C	Cement Mortar Lined and Coated Steel Water Transmission Main
CRDRP	Carmel River Dam and Reservoir Project
CSIP	Castroville Seawater Intrusion Project
CTS	Cathodic Test Station
DU	Dwelling Unit
DRMP	Development and Resources Management Plan
FORA	Fort Ord Reuse Authority
FORIS	Fort Ord Reuse Infrastructure Study
FORP	Fort Ord Reuse Plan
fps	Feet per Second
FTE	Full Time Equivalent (student population)
FT	Foot
gpm	Gallons per minute
GIS	Geographic Information System
GPD	Gallons per Day
GPM	Gallons per Minute
HP	Horsepower
HRS	Hours
lf	Lineal Foot
MCL	Maximum Contaminant Level
MCWD	Marina Coast Water District
MG	Million Gallons
MPWMD	Monterey Peninsula Water Management District
MRWPCA	Monterey Regional Water Pollution Control Agency
mV	Millivolts
MWL	Mid Water Level
NSF	National Sanitation Foundation
PCB	polychlorinated biphenyls
PBC	Public Benefit Conveyance
POM	Presidio of Monterey
PRV	Pressure Reducing Valve
psi	Pounds per Square Inch
SRO's	Single Room Occupancy Units
SAP’s	Service Area Polygons
SVWP	Salinas Valley Water Project
SWRCB	State Water Resources Control Board

UWMP	Urban Water Management Plan
WDR	Waste Discharge Requirement
WRA	Water Resources Agency

1 EXECUTIVE SUMMARY

1.1 AUTHORIZATION

The Marina Coast Water District (MCWD or District) authorized RBF Consulting to complete a Water System Master Plan and Capital Improvement Program (CIP) for water infrastructure improvements on February 28, 2002.

1.2 BACKGROUND

The purpose of this Water System Master Plan is to provide a recommended schedule of facility improvements needed to meet the projected water demands in the Ord Community over the next 20 years. A proposed CIP has been developed, including engineering estimates of probable project cost for proposed water infrastructure improvements.

The Marina Coast Water District was formed as a County Water District in 1960. In 1996, MCWD was selected by the Fort Ord Reuse Agency (FORA) to take over conveyance of the water and wastewater systems throughout the former Fort Ord Army installation. MCWD is currently serving approximately 13,000 customers within the former Fort Ord (Ord Community). The Fort Ord Reuse Plan anticipates an ultimate population of 37,400 residents with a workforce of approximately 18,300 employees. To support the forecasted population, the Reuse Plan anticipates that 6,160 new residential units will be constructed throughout the Ord Community. This development is anticipated to place significant demand on the Ord Community water system which was designed, constructed and maintained for over 60 years by the U.S. Army to contribute to meeting our nations defense mission.

1.3 STUDY AREA

The study area for this Water Distribution System Master Plan is defined as the Ord Community as identified in the FORA *Fort Ord Reuse Plan*. The former army base consists of approximately 28,000 acres incorporating portions of the cities of Seaside, Sand City, Monterey, Del Rey Oaks, Marina and portions of unincorporated Monterey County. Land use, population growth and specific development areas were analyzed for this study to predict water demand, pursuant to adopted General Plans and Land Use Maps of the underlying jurisdictions and the constraints for development and water availability as managed by FORA.

1.4 POPULATION AND DEMAND PROJECTIONS

Population growth and land uses within the study area were evaluated to effectively plan for development within the Ord Community. Growth projections presented in the FORA *Reuse Plan EIR* and MCWD year 2001 Urban Water Management Plan (UWMP) were analyzed. The District provided planning information describing the anticipated increase in residential, commercial and industrial developments for each jurisdiction throughout the Ord Community. This information was used to project the future population of the Ord Community in 5-year increments over the next 20-year period.

An analysis was made of the underlying land use jurisdictions throughout the Ord Community and a Geographic Information System (GIS) was developed overlaying the land use map of each jurisdiction onto the service area base maps. Current and future water demands for the Ord Community were computed through interpretation of development potential pursuant to the land use maps and corresponding water use factors. MCWD water use rates that correspond to underlying land use designations (i.e. residential, commercial, office, etc.) were used to establish water demands. Using District planning information, land use maps and water use rates, the anticipated community-wide water demands were projected. The water demands were equated to average day, maximum day, and peak hour conditions for each of the 5-year planning periods.

1.5 WATER DISTRIBUTION SYSTEM MODEL

A computer hydraulic simulation model representing the Ord Community's existing water distribution system was developed. This model includes representations of the main distribution pipelines, reservoirs, booster stations, and zone valves within the Ord Community based on information provide by the District. The model was used to analyze various operating scenarios in order to predict future operating conditions.

The District's hydraulic operating criteria require a minimum system pressure of 40 psi for average day, maximum day and peak hour demand scenarios and a minimum residual pressure of 20 psi for maximum day plus fire flow conditions. These criteria were used as constraints in the hydraulic analysis of the water model. Modeling results were evaluated to determine severity, timing and location of future water distribution system deficiencies. Proposed water system improvements were modeled and analyzed for each planning period to mitigate anticipated system deficiencies. Various system improvements and design scenarios were studied in order to develop an efficient water system that meets the operational requirements.

1.6 INFRASTRUCTURE ANALYSIS

The existing Ord Community water system was evaluated to determine if sufficient storage and pumping capacity exists to meet current demands. Results of this analysis indicate that there exists sufficient hydraulic capacity to meet existing water demands throughout the Ord Community.

The hydraulic capacity of reservoirs and booster stations was evaluated for each of the planning 5-year periods. An inventory of the improvements and recommended capacities for construction during each of the planning periods is provided in Table 1.1, Incremental Storage and Pumping Improvements.

TABLE 1.1
INCREMENTAL STORAGE AND PUMPING IMPROVEMENTS

Facility	2004	2005	2010	2015	2020
Storage (MG)	4,500,000	5,300,000	7,600,000	2,400,000	-
Pumping (Hp)	252	742	380	380	-

1.7 FACILITY EVALUATION

A limited facility evaluation investigation was conducted of the existing concrete and steel reservoirs and one transmission main within the distribution system. The assessment concluded that the reservoirs do not conform to current water quality regulations and seismic design codes. Only through a substantial capital investment could these structures be brought into conformance. Recent soils reports indicate that area soils are relatively non-corrosive to buried metal and concrete. However, most of the galvanized pipelines within the study area have been found to be corroded and require replacement. The pipelines examined in the facility evaluation appeared to be serviceable for the long term with little maintenance. Additionally, system valves, fire hydrants, and service laterals may require replacement because they have reached or exceeded their service life or are damaged due to corrosion.

1.8 RECOMMENDATIONS

Improvements are required to meet water distribution system requirements within the Ord Community to meet District standards. General recommendations for the Ord Community water system are provided in this section. Specific infrastructure improvements are provided in the 20-year CIP. The general recommendations for improving the District's water system fall into the following categories:

- Water System Master Plan Updates
- Operational Improvements
- Capital Improvement Program

Each category is summarized below.

1.8.1 Water System Master Plan Updates

Over the next 10 years, significant redevelopment is planned to occur throughout the Ord Community. New residential, commercial and other developments will be constructed. To ensure the plans presented in this Water System Master Plan continue to provide effective guidance to the District, it is recommended that this Plan be revised and updated every two to three years. It is recommended that detailed energy consumption studies be prepared as a part of new pump station designs. These studies refine the master plan level of analysis of this study to incorporate results of base redevelopment and planned relocation of the main booster pump station.

1.8.2 Operational Improvements

Initial investigations of this study analyzed the existing water system configuration and developed a CIP based on that configuration. In February 2003, the District was provided a draft Ord Community Water System Master Plan for review and comment.

Completion of the draft plan was put on hold due to the progress of the Deep Aquifer Investigative Study and the Well No. 30 Rehabilitation/Replacement Study. The Well No. 30 Rehabilitation/Replacement study recommends moving Well No. 30 to the Well No. 32 site due to seawater intrusion in the upper aquifers. Monitoring wells surrounding Well No. 29 have experienced very small, but measurable, concentrations of groundwater contamination. Testing at Well No. 29 has not detected contamination. A study has not been performed to determine if the groundwater contamination will affect Well No. 29. The District's well field may migrate to the east in order to avoid groundwater contamination and seawater intrusion. This easterly migration increases the distance between the well field and the Main Booster Station.

A CIP was developed in 1998 when the District received conveyance of the Ord Community water distribution system. The CIP included priority rehabilitation of the Main Booster Station. The cost estimate to replace the pumps and electrical system and to provide standby power was $2.1 million in 1998. The rehabilitation cost is approximately $2.4 million in 2003 using Engineering News-Record (ENR) adjustments.

In early 2003, information regarding Marina Heights and East Garrison developments became available to the District. The Marina Heights Notice of Preparation for a Project Environmental Impact Report (EIR) showed the Main Booster Station parcel remaining unmodified at its present location. Thereafter, District staff and the Marina Heights developer engaged in discussions regarding the Main Booster Station. These discussions addressed existing facility rehabilitation requirements and alternatives for the Main Booster Station and the underlying parcel. Additionally, the East Garrison development published its Notice of Preparation for an EIR in August 2003. In conjunction with the East Garrison development, Monterey County is planning to construct a new roadway that connects Reservation Road with Inter-Garrison Road. Well No. 32 site is in close proximity to the intersection of the new Monterey County Road and Reservation Road. The roadway alignment could potentially contain a new trunk water pipeline.

Given the evidence of seawater intrusion and groundwater contamination at Well No. 29 and Well No. 30, the need to rehabilitate the Main Booster Station, and the opportunity to facilitate District goals while working with developers, the focus of the Ord Community Water System Master Plan was altered to identify those facilities required to move the Main Booster Station to the Well No. 32 site. The CIP presented in this Water System Master Plan corresponds to the anticipated changes to the water distribution system.

1.8.3 Capital Improvement Program

Based on the water system hydraulic analysis, population growth and associated water demands, District standards and discussions with District staff, a Capital Improvement Program has been developed to meet the long-term Ord Community Water System needs. This CIP provides an inventory of the projects recommended for construction in order to meet the project water system demand and pressure requirements. The CIP also provides a schedule of recommended improvements and corresponding cost estimates. The estimates of likely total project costs for each planning period are shown as Table 1.2, CIP Summary.

TABLE 1.2
CAPITAL IMPROVEMENT PROGRAM SUMMARY[1][2]

CIP #	Facility	2004	2005	2010	2015	2020
W-1	Water Supply Wells	$112,500	$1,537,500	$2,335,500	-	-
W-2	Not Used	-	-	-	-	-
W-3	Storage Reservoirs	$8,166,000	$7,767,000	$14,850,000	$3,600,000	-
W-4	Booster Stations	$636,000	$2,346,000	$1,590,000	$1,140,000	-
W-5	Transmission Pipelines	$605,453	$6,719,640	$1,262,340	$575,895	-
	TOTAL	$9,519,953	$18,370,140	$20,037,840	$5,315,895	-

[1] Costs reported in Year 2003 Dollars
[2] ENR October 2003 20-City Construction Cost Index value of 6770.96

2 INTRODUCTION

2.1 LOCATION/HISTORY

The Marina Coast Water District (MCWD or District) is located on the coast of Monterey Bay at the northwest end of the Salinas Valley, Monterey County, California (Figure 1). MCWD is approximately 120 miles south of the City of San Francisco.

MCWD is a County Water District formed and authorized by Division 12 of the California Water Code. MCWD was formed in 1960 and has consistently provided potable water and wastewater collection and treatment services to customers in its service area. The District has historically served approximately 18,000 customers in the City of Marina.

In 1996, MCWD was selected by the Fort Ord Reuse Authority (FORA) to take over conveyance of the water and wastewater systems at the former Fort Ord Army installation. The former army base consists of approximately 28,000 acres incorporating portions of the cities of Seaside, Monterey, Del Rey Oaks, Marina and portions of unincorporated Monterey County (Figure 2). For approximately five years, MCWD was under contract with the U.S. Army to operate and maintain the water and wastewater systems on the former Fort Ord while awaiting a Public Benefit Conveyance (PBC) of all water and wastewater facilities. In November of 2001, water and wastewater systems were conveyed to MCWD. The District is now permanently responsible for providing water and wastewater service throughout the former Fort Ord Army Installation. The former Fort Ord has become known and is referred to as the Ord Community. For purposes of this Master Plan, the terms former Fort Ord and Ord Community are used interchangeably.

2.2 WATER SUPPLIES

In 1997, the District constructed the region's first seawater desalination facility treating 300 Acre-Feet per Year (AFY) of new potable supplies. MCWD has ongoing investigations to evaluate the potential of constructing additional desalination facilities to feasibly provide an additional 2,400 AFY water augmentation supplies. At the time of the writing of this report, MWCD was investigating operational problems and improvement options to its existing seawater desalination plant. As a result, the desalination plan remains off-line; however, it is an active water supply in accordance with quarterly reports filed with the CA Department of Health Services.

To retard the advancement of seawater intrusion, the Monterey Regional Water Pollution Control Agency (MRWPCA) in partnership with the Monterey County Water Resources Agency (MCWRA) built two projects: (1) a water recycling facility at the Regional Treatment Plant and (2) a reclaimed water distribution system. These facilities are known locally as the Salinas Valley Reclamation Project (SVRP) and the Castroville Seawater Intrusion Project (CSIP) respectively. The projects were completed in 1997 and are known collectively as the Monterey County Recycled Water Project (MCRWP).

Two regional water management agencies have jurisdiction over lands that comprise the former Fort Ord. The Monterey County Water Resources Agency (MCWRA) is responsible for the regulation of water from the Salinas Valley Groundwater Basin and the Monterey Peninsula Water Management District (MPWMD) is responsible for regulation of water from the Seaside Groundwater Basin.

MCWD's potable water supply is the underlying Salinas Basin. The Seaside Basin provides approximately 400 AFY of non-potable water with the MCWD service area used for irrigation of the Blackhorse and Bayonet Golf Courses.

The U.S. Army, on behalf of the United States of America, entered into a memorandum of agreement for the annexation of Fort Ord into Special Benefit Zones 2 and 2A of the MCWRA. The agreement established a maximum withdrawal by MCWD of 6,600 AFY of groundwater from the Salinas Basin, provided that no more than 5,200 AFY are withdrawn from the 180-foot and the 400-foot aquifers. The remaining 1,400 AFY is to come from the 900-foot (deep) aquifer. As a part of the Base Reuse Plan an allocation of the 6,600 AFY was made for each of the jurisdictions, which now comprise the Ord Community. Table 2.1 presents the allocation of potable water supplies by jurisdiction.

TABLE 2.1*
ALLOCATION OF EXISTING WATER SUPPLY BY JURISDICTION**
(Based on FORA's April 12, 1996 Resolution)

JURISDICTION (AFY)	TOTAL WATER ALLOCATION [3]
City of Seaside	748
County/City of Del Rey Oaks	75
County/City of Monterey	65
City of Marina	1,175
Monterey County	560
ARMY	1,410
CSUMB	1,035
UC MBEST	230
County/State Parks and Recreation	45
County/Marina Sphere Polygon 8a	10
SUBTOTAL	**5,315 AFY**
Line Loss (10%)	530
FORA Strategic Reserve	
Encumbered Reserve:	
Army - 160 AFY1	
CSUMB - 125 AFY1	
Seaside - 230 AFY2	
Unemcumbered - 270 AFY	755
TOTAL	**6,600 AFY**

* Source: Fort Ord Reuse Plan, Table 3.11-2, page 198.

** Subject to subsequent action of the FORA Board.

Encumbrances to FORA's Strategic Reserve:

1- 160 AFY at the POM Annex and 125 AFY at CSUMB polygon 10 are available upon metering of existing dwelling units.

2 - 230 AFY loaned to the City of Seaside is available to Seaside for golf course irrigation until replacement water is provided.

3 - These water allocation numbers reflect changes to the original allocation resulting from Board Action on August 14, 1998. Original water allocation by jurisdiction before the changes include: City of Marina - 1,185 AFY; Monterey County - 545 AFY; UC MBEST - 165 AFY; and County/Marina Sphere Polygon - 50 AFY. This resulted in a subtotal of 5,284 AFY for jurisdictions and an encumbered reserve of 785 AFY.

The Salinas Valley Groundwater Basin has experienced seawater intrusion as a result of extensive use for agricultural irrigation and pumping near the coast. The regional long-term water supply strategy is based on the recognition of the need to find 2,400 AFY of additional water supplies to meet the redevelopment of the former Fort Ord as identified in the Base Reuse Plan. Development of non-potable water supplies, including recycled wastewater from the MRWPCA are ways that the District is investigating to meet water demands, thereby saving groundwater for potable uses. MCWD and MRWPCA have a long history of collaboration for the investigation on the best uses of recycled water throughout the service area.

The California-American Water Company (American Water Company) is the local water purveyor and distributor for the Monterey Peninsula, and the non-Fort Ord portions of the cities of Seaside, Sand City and Del Rey Oaks.

Regionally, water supplies are under close examination. On July 6, 1995, the State Water Resources Control Board (SWRCB) ruled that California-American Water Company was diverting up to 10,730 AFY of Carmel River water without legal right (SWRCB Decision 95-10). California-American Water Company and MPWMD have since been developing the Carmel River Dam and Reservoir Project (CRDRP) to secure additional water rights to divert Carmel River water to storage behind the proposed dam.

MPWMD's environmental document for the CRDRP has been successfully challenged in court, requiring MPWMD to perform additional environmental studies. A water supply contingency plan is needed to address Decision 95-10 and provide a reliable and implementable water supply for the MPWMD service area. The effort to identify alternate supplies has become known as Plan B.

The State has further mandated a 20% reduction in water use from the Carmel River with future possible reductions up to 76%. To achieve this, MPWMD and California-American Water Company have instated water conservation and water rationing plans.

2.3 CLIMATE

The area's Mediterranean-type climate is characterized by warm, dry summers and cool, rainy winters. The Pacific Ocean is the principal influence on the climate of the area. Ocean effects include fog and onshore westerly winds which moderate temperature extremes with morning fog as a common year-round occurrence. Daily ambient air temperatures typically range between 40 and 70 degrees Fahrenheit; however, temperatures extremes in the low 100's have been recorded in the inland areas.

Average annual precipitation is approximately 15 inches, the majority of which falls between November and April. Because the predominant soil is permeable sand, runoff is limited and stream flows only occur intermittently and within the very steep canyons in the eastern portion of the Ord Community. Summers are usually cool, with fog and low clouds forming overnight and dissipating during the day. Typically, winds blow onshore, although during the spring and summer it is not unusual for an offshore flow to develop, which produces a strong easterly breeze (California State Parks, 1996).

2.4 PHYSICAL CHARACTERISTICS

The portion of the MCWD service area analyzed in this Water System Master Plan is limited to the Ord Community, an area of approximately 28,000 acres. The water facilities on the former Fort Ord were constructed over a period of approximately 60 years by the United States Army to meet the needs of an active military base. Construction, expansion, operation and maintenance of these facilities were the responsibility of the U.S. Army. Therefore, facility construction and operation were subject to the Army's standards of design and construction guidelines. These guidelines are typically less stringent than the standards established by the State Department of Health Services, State Department of Water Resources, Monterey County Environmental Health Department and the American Water Works Association. However, construction and maintenance of all new water facilities will need to meet standards established in Title 22 of the

State Water Code as implemented by the California Department of Health Services. MCWD has adapted a set of procedural guidelines and design standards in effect throughout the service area, compliant with federal, state and local requirements

Approximately 110 miles of 4 to 36-inch diameter water pipelines exist throughout the Ord Community. The Ord Community is undergoing intense redevelopment from its former use as a military base. Redevelopment includes two university campuses, numerous residential subdivisions, commercial and institutional uses. In accordance with the District's In-Tract Policy for Water and Wastewater Systems, redevelopment includes abandoning and reconstruction of much of the small diameter potable water distribution system facilities that provided service from the trunk pipelines to individual end-uses.

Groundwater has always been the major source of supply to the service area. Groundwater wells are constructed in the 180 and 400-foot aquifers of the Salinas Basin. The District is currently investigating replacement of existing wells with new wells drilled into the 900-foot or "deep aquifer". All potable groundwater is delivered from the wells to the Intermediate F reservoir, and thereafter to the Sand Tank. From the Sand Tank, a series of booster stations pump water to each of the water system pressure zones and reservoirs. The former Fort Ord's water storage and distribution system includes 13 reservoir/tanks, with a combined capacity of 10.4 MG, and six pump stations.

2.5 GROWTH PROJECTIONS

2.5.1 Future Water Demand

Build-Out conditions for the Ord Community have been specified in the FORA Base Reuse Plan and accompanying EIR. The projected residential development for the Ord Community is presented in Table 2.2. General Plans of each of the jurisdictions throughout the former Fort Ord have developed the underlying land use designations to be consistent with the FORA's planning documents.

TABLE 2.2
PROJECTED RESIDENTIAL DEVELOPMENT THROUGH 2015
(Based on the 6,600 AFY of Potable Water)

CATEGORY	UNITS	OCCUPANCY	POPULATION
POM Annex	1,590	2.6/unit	4,134
CSUMB Housing	1,253	2.0/unit	2,506
New Housing[2]	6,160	2.6/unit	16,016
Existing Housing	1,813	2.6/unit	4,714
CSUMB on campus students[3]	NA	NA	10,000
TOTAL	**10,816**	**-**	**37,370**

Source: Taken From Table 3.11-3; FORA Fort Ord Reuse Plan

Notes:

1 Assumes that no students live in this housing. If students occupy this housing then the estimate for students living on campus would be reduced to avoid double counting.

2 Single Room Occupancy Units (SRO's) shall be counted as .38 units on a comparable water demand.

3 Assumes 80% of 2015 projections of 12,500 full time employees (FTE).

Increased water demand has been identified in the Base Reuse Plan EIR as the primary constraining factor to the reuse of the former Fort Ord. The annexation agreement with MCWRA assumes a potable water supply of 6,600 AFY to be assured from well water until a replacement is made available by the MCWRA (provided that such withdrawals do not accelerate the overdraft and seawater intrusion problems in the Salinas Valley Groundwater Basin). The 6,600 AFY of well water could support the first phase of development of the proposed project to the year 2015. Development to 2015 would result in a water demand of 6,469 AFY; this figure accounts for a 10% distribution loss due to leaks and does not include an additional demand of 1,952 AFY expected to be supplied by reclaimed water. However, given the existing condition of the groundwater aquifer, there is public concern over the ability of the existing wells to assure 6,600 AFY. Studies conducted on the deep (900-foot) aquifer raise additional concerns to the long-term sustainability of the 6,600 AFY.

Water supply to the former Fort Ord is a significant regional issue upon which future land development is intricately tied. Historic seawater intrusion has impacted the groundwater supply requiring abandonment of older water supply wells and construction of new wells on the eastern margins of the former base. The hydrogeologic investigation of the Salinas Valley Basin by Harding ESE identified contaminated of portions of the upper A Zone aquifer above the shallow 180-foot aquifer from TCE has made it currently unavailable for potable use. Remediation efforts of the A Zone are ongoing by the Army, however this does not represent a potential viable water supply.

From the early redevelopment planning phase, recycled water was identified as the source of supply for landscape irrigation and other non-potable uses to direct as much available potable water as possible to economic redevelopment. The District and the MRWPCA completed a Urban Regional Recycled Water Distribution Master Plan as a collaborative effort. That study identified the feasibility requirements for a new non-potable distribution system to provide reclaimed wastewater from the SVRP to non-potable demands throughout the Ord Community and potentially southerly to portions of the Monterey Peninsula. However, due to the uncertainty regarding the implementation of a regional recycled water distribution system, this water distribution system master plan assumed that all irrigation demands would be met with potable water.

3 MAPPING UPDATE

Included in the master plan scope of work was a task to make updates to the District's mapping reflective of minor changes in land use, new roadways and development. During project implementation MCWD identified 18 projects in various stages of construction, as presented in Table 3.1. Each of these projects was added to the District's Water System Base Maps.

TABLE 3.1
PROJECTS ADDED TO MCWD BASE MAPPING

Project	From	Source
12th Street Realignment 18"	MCWD	Bestor Engineering
CSUMB Master Plan	MCWD	Bestor Engineering
Landrum Court PRV	MCWD	FORA
12" California Street Extension	MCWD	FORA, SHJ
MCWD 18" Water Line	MCWD	MCWD
16" Marina Airport Water Pipeline	MCWD	C&D
12" Second Ave. Pipeline	MCWD	Bestor Engineering
UCMBEST	MCWD	FORA
12" 2nd Avenue Pipeline	MCWD	Bestor Engineering
Imjim Road	FORA	C+D
York Road Extension	FORA	
Upper Ragsdale	FORA	
North South Road realignment	FORA	
Pipeline to Lightfighter Road	FORA	
Pipeline to First Street	FORA	
Blanco Road Upgrade	FORA	FORA
Eighth Street Upgrades	S&W CIP Chart	
Crescent Street Extension	S&W CIP Chart	

RBF was provided an electronic copy of the water system base maps in AutoCAD format. RBF coordinated with the District, FORA, project applicants, and various consulting engineering firms to obtain details of proposed water facilities.

RBF provided updates to the water system base maps electronically including each of the identified projects. RBF delivered under separate cover to the District 60 sheets of updated maps and electronic copies of the updated AutoCAD files on CD format.

4 WATER DEMANDS

Estimation of anticipated future water demand projections is a necessary part of a water system master planning investigation. Analysis of the hydraulic capacity of the existing distribution system and the identification of future system deficiencies in this study require an assessment of likely water demands throughout the Ord Community. Analysis for this master plan required development of demand estimates at a sufficiently high enough resolution to anticipate hydraulic performance according to the potential land use developments within each of the five underlying jurisdictions that comprise the Ord Community.

4.1 LAND USE

Land use within the project service area is the responsibility of each of the underlying jurisdictions.

The Fort Ord Base Reuse Plan governs planning throughout the former Fort Ord that each jurisdiction must adhere to. The Cities of Del Rey Oaks, Seaside, Marina, and the County of Monterey have each developed their General Plans to be in conformity with the Base Reuse Plan. Pursuant to provision 3.11.5.4.(b) of the Fort Ord Base Reuse Plan, a Residential Development Plan has been put in place providing development limitations as follows:

> "***Residential Development Program.*** *To prevent using up scarce resource availability, overall residential development limitations must be put in place to save capacity for industrial/commercial land uses and to prevent residential development from outstripping the existing 6600 AFY of potable water supply at the former Fort Ord. The land use jurisdictions shall manage and determine the use for their full water allocation. The Residential Development Program limits total residential development that is served by the FORA existing potable water supply, based on the planning projections detailed in Table 3.11-3 (and reproduced here as Table 2.1):*"

4.1.1 Land Use Analysis

A land use Geographic Information System (GIS) was developed to analyze MCWD's service area water demand requirements throughout the Ord Community and to form the basis for the hydraulic loading of the distribution system model. The GIS was assembled by including the land use maps from portions of the Cities of Seaside, Marina, Del Rey Oaks, Monterey and Monterey County within the Ord Community. The map of the GIS identifying land uses within each jurisdiction is presented as Figure 3.

The land use GIS includes identification of allowable land uses pursuant to the General Plan for each of the underlying jurisdictions. Each jurisdiction's land use map use independently developed use designations and allowable developmental densities that while consistent with the FORA Reuse Plan differ from each other and with the District's Urban Water Management Plan (UWMP). Land use designations were associated with a representative customer type per the District's UWMP.

The results of the land use analysis are presented in Tables 4.1 through 4.4.

TABLE 4.1
CITY OF MARINA LAND USE ANALYSIS
FORMER FORT ORD PORTION

General Plan Designation	MCWD UWMP	Acres
Light Industrial/Science Center	Industrial	467
Multiple Use	Other Commercial	149
Office/Research	Office/R&D	95
Retail/Personal Services	Retail/Service	151
Visitor Serving	Hotel/Motel	126
Golf Course, Park & Recreation, Agriculture	Turf (ball fields, golf courses)	393
Habitat Reserve	Landscape	398
Education	Schools (K-12)	340
Other Public Facilities	Institutional	259
Multi-Family	Multi-Unit Residential	110
Single-Family, Village Homes	Single Family-Low Density, Single Family Residence, Single Family-High Density	238

TABLE 4.2
CITY OF SEASIDE LAND USE ANALYSIS
FORMER FORT ORD PORTION

General Plan Designation	MCWD UWMP	Acres
Business Park	Office/R&D	95
Community Commercial	Other Commercial, Retail/Service	53
Habitat Management	Landscape	1420
Public / Institutional	Institutional, Schools (K-12)	495
Parks and Open Space, Recreational Commercial	Turf (ball fields, golf courses)	610
Regional Commercial	Hotel/Motel	98
High Density Residential	Multi-Unit Residential	83
Low Density Single Family Residential	Single Family-Low Density, Single Family Residence, Single Family-High Density	781

TABLE 4.3
MONTEREY COUNTY/DEL REY OAKS
LAND USE ANALYSIS
FORMER FORT ORD PORTION

General Plan Designation	MCWD UWMP	Acres
Habitat Management	Landscape	14240
Business Park/Light Industrial	Industrial	277
Low Density Residential	Single Family Residence	888
Planned Development Mixed Use District	Office/R&D	1009
Open Space	Turf (ball fields, golf courses)	1888
Public Facility	Retail/Service	238
University Medium Density Residential	Single Family-High Density	415
Visitor Serving	Hotel/Motel	257

TABLE 4.4
UCMBEST/POM ANNEX/CSUMB
LAND USE ANALYSIS
FORMER FORT ORD PORTION

General Plan Designation	MWCD UWMP	Acres
UCMBEST		119
Education (P)		
POMA		
Military, Military Enclave		561
CSUMB		
School University		363

4.2 WATER SUPPLIES AND DEMANDS

The District has prepared a year 2001 Urban Water Management Plan (UWMP) that presents water demand estimates for the Ord Community in 5-year increments from year 2000 through year 2020. Estimates developed by the District are identified for each jurisdiction in the UWMP and form the basis for the 5-year incremental water demand estimates considered in this investigation.

The FORA Reuse Plan EIR established the year 2015 water demand of 6,600 AFY of potable water from the Salinas Basin and 400 AFY from the Seaside Basin. The Reuse Plan EIR identified a future potential need for an additional 2,400 AFY as a necessary Augmentation Water Supply. Adoption of the EIR included a constraint on development to the level that could be supported by existing water allocations. FORA manages allocations through a Development and Resources Management Plan (DRMP).

While the modeled demands are based on the anticipated demands by jurisdiction they do not exactly equal the 6,600 plus 2,400 AFY, water supply limits as defined in the FORA Reuse EIR. The anticipated demands and their associated timing provided by the District in the UWMP are estimates of anticipated development made by local jurisdictions using the District's unit water demand rates. These estimates are not entirely consistent with the availability of water supplies to the District and the resource constraints in place that limit development to available water supplies. Therefore, the 5-year incremental demand projections are to be used for planning purposes only. Development throughout the Ord Community cannot proceed beyond the water constraints outlined in the FORA Reuse Plan.

This water system master plan provides for the distribution of potable water to meet all irrigation demands on the former Fort Ord due of the uncertainty of the timing of the construction of a new non-potable distribution system. Additionally, MCWD's ongoing investigation for augmentation water is analyzing both potable and non-potable supply options. Much of the non-potable demand has been identified for proposed future development projects. The precise timing of the developments requiring non-potable water is unknown. Capital improvements recommended herein should be viewed in coordination with the future construction and use of the non-potable water distribution system.

Prior to the District's operation of the water distribution system, water use on the former Fort Ord had not been well documented and individual water services were generally not metered. Average year potable water usage within the former Fort Ord has been estimated to be approximately 2,600 AFY or 1,600 gpm, based on recorded well production from October 1993, when the Army left, through August 1995. A current maximum day demand of 3,200 gpm is estimated based on a maximum to average day ratio of 2.0. The peaking factor of 2.0 may change in the future if recycled water supplies become available to meet irrigation demands. Irrigation demands during dry periods can significantly increase maximum day demand factors. The District currently measures water service for the Ord Community at a few individual service connection meters, making a more accurate accounting of demand by land use impossible at this time.

Based on the land use analysis conducted as a part of this master plan, a maximum potential water demand was estimated. This maximum potential demand represents a demand that could result if the development constraints were removed by FORA and all of the identified land uses were fully developed. The potential future unconstrained water demand for the Ord Community is approximately 31,100 AFY and is based on the existing land use maps of each underlying jurisdiction in the Ord Community portion of MCWD's service area. Modeling of the unconstrained demand was not accomplished as a part of this project. The Fort Ord Reuse Environmental Impact Report (May, 1996) noted that at full build-out, 40 to 60 years in the future, water demands could be as much as 18,262 AFY.

Hydraulic simulation modeling for the development of the water system Capital Improvement Program (CIP) requires distribution of future year water demands throughout each jurisdiction of the service area. This distribution was accomplished using the GIS and the UWMP water demands estimates. The Service Area Polygons (SAP's), jurisdictional boundaries and service area boundary are shown in Figure 4.

The following is an overview of the process used to load the demands into the hydraulic model:

- Service Area Polygons (SAP's) were defined across the Ord Community to establish logical and representative water demands. SAP's were constructed in relationship to existing water distribution pipelines and sized to meet an initial criteria of a maximum day demand of no more than 800 gpm total for the year 2020. As necessary, SAP's were resized during the analysis to result in reasonably sized demand nodes.

- The District provided spreadsheets of the anticipated number of customers by land use in each jurisdiction for five-year increments from year 2000 through 2020.

- Land use designations were identified (by jurisdiction) underlying each SAP and the acreage within each was noted. Water demands were calculated for each SAP based on the interpretation of the land use and the acreage of each customer type per the UWMP. Estimates were made at five-year increments from 2000 through 2020 according to the Districts projections of customers by type in each jurisdiction.

- Demand nodes were developed relative to the SAP's, assigned a node number and entered into the hydraulic model. Where the District was able to identify specific developments they were removed from the District's Projected Customer Base spreadsheet and applied directly into the SAP as they were geographically known to occur.

- A Microsoft Excel Spreadsheet was used to manage development of acreages of each land use, customer type and unit water demand assumptions.

The purpose in making estimates of water demand by SAP was strictly for determining the anticipated Capital Improvement Program needed by the District to maintain water service through the projected future year 2020 demands. The analysis of future demands is not intended and should not be used for any other purposes.

Estimation of the conveyance requirements, hydraulic capacity and deficiencies of the water distribution system are based on a number of assumptions of likely future developments, their locations and adherence to a pattern of water usage, including average and peak instantaneous demands. Where available, information on the precise geographic location of water demands has been incorporated into the development of the model.

5 WATER SYSTEM EVALUATION

5.1 INTRODUCTION

As described in Section 1.8.2, there are many factors that have resulted in the recommendation to move the main booster station from its current location. These include the evidence of seawater intrusion and groundwater contamination at Well No. 29 and Well No. 30, previous estimates of the high cost of rehabilitating the Main Booster Station, and the opportunity to facilitate District goals for safe and efficient system operations while working with developers. The focus of the Ord Community Water System Master Plan was therefore modified to identify those facilities required to move the Main Booster Station to the Well No. 32 site. The CIP presented in this Water System Master Plan corresponds to the anticipated changes to the water distribution system.

5.2 HYDRAULIC MODEL

A hydraulic model was created as a representation of the physical water distribution facilities to simulate operation of the working system. The computer simulation software used in the analysis of the model was WaterCAD for Windows version 4.1 by Haestad Methods, Inc.

The basis for the development of the distribution system model was provided to RBF by the District and was originally developed by FORA for a previous assessment of capital improvements by the engineering consulting firm of Shaff & Wheeler. The previous hydraulic model included approximately 75 miles of distribution pipelines, from 4 to 36-inches in diameter. Updates were made to the model to reflect changes that have occurred including construction of new pipelines, pump station operations, and modifications to include operation of zone and pressure reducing valves. A map showing the locations of the water distribution facilities included in the model is provided as Figure 5.

A summary of the pipelines included in the new water system model is provided in Table 5.1. A total of 486,554 feet (approximately 92 miles) of pipelines 4 to 36-inches in diameter is included in the model.

TABLE 5.1
SUMMARY OF MODELED WATER PIPELINES

Diameter (Inches)	Length (Feet)	Diameter (Inches)	Length (Feet)
4.0	1,665	18.0	31,427
6.0	68,745	20.0	4,296
8.0	144,584	22.0	206
10.0	31,319	24.0	19,534
12.0	112,577	27.0	12,048
14.0	8,831	30.0	822
16.0	30,144	36.0	11,032
		42.0	8,737
TOTAL LENGTH MODELED			**486,554**

5.3 DESIGN CRITERIA

The Ord Community water system has been evaluated in numerous investigations throughout the years. Many of the references available to the project team were reviewed and the criteria previously used for system evaluations noted. Since the original development of the water system was not in accordance with current engineering practice for a California water district, it became necessary to develop a new set of criteria that could be used to evaluate system performance consistent with current design standards.

A series of hydraulic criteria were assembled and provided to the District for review and comment. Final criteria were issued in a memorandum titled MCWD Potable Water System Model Assumptions. The content of that memorandum is summarized in Table 5.2.

TABLE 5.2
MASTER PLAN DESIGN CRITERIA[1]

CRITERIA	EXPANSION
System water storage equals the volume of one maximum-day demand plus a fire demand within each pressure zone.	
Working pressure range during maximum-day demands equals 40 psi to 100 psi.	Where multi-level construction is known, an additional 5 psi for every floor above ground level is applied.
Hazen-Williams roughness coefficient of 120 for existing pipes and 130 for new pipes.	
Maximum allowable velocities under normal demand conditions equal to 6 fps.	Maximum allowable velocities during fire flow events equal to 15 fps.
Pumps sized to deliver maximum-day demand over a 16-hour period.	Allows system recovery from unscheduled pump outages during multi-day high demand periods and to maximize use of lower power rate structure by pumping during off-peak energy periods.
Estimated residential demands = 295 GPD/DU (Based on District unit demand value.	
Estimated irrigation demands per District Regional Urban Recycled Water Distribution Study.	
Estimated commercial demands of 3000 GPD/Acre.	
Estimated school demand of 20 GPD/Student.	
Maximum day demand to peak hour demand factor of 2.0.	

[1] District standards were adopted after the hydraulic analysis for this report was completed. The CIP reflects the criteria in this table used for system-wide master planning analysis.

Since the pumping criteria affect both capital and operational costs over the life of the pumping facilities a preliminary energy evaluation was performed to verify energy consumption criteria. The analysis was prepared to compare the estimated construction and energy costs for pump stations sized to deliver the maximum day demand in a 16-hour, an 18-hour and a 24-hour period. The analysis considered the following factors:

- Seasonal variations in water consumption.
- Annual energy costs based on the District's PG&E's year 2001 rate structure and associated energy cost ($/Kwh) including seasonal and daily peaking cost variations is shown in Table 5.4.

- Anticipated electrical energy costs calculated for the District's water distribution system for years 2004 through 2033.

- Maintenance costs for the pumping facilities were assumed to be equivalent for each pumping period and therefore were not included in this energy evaluation.

- Application of an inflation rate equal to 3.3% for the estimated operational lifetime of the facilities, pursuant to the California energy commission anticipated energy cost inflation.

TABLE 5.3
PG&E RATE SCHEDULE AND ENERGY COSTS

PG&E Rate Structure	**Energy Cost**	**Summer Period (May 1 - Oct 31)**		**Winter Period (Nov 1 - Apr 30)**		**Days Applicable**
	($/Kwh)	Time Frame	Hours	Time Frame	Hours	
Peak	0.19184	Noon–6:00pm	6	NA		Weekdays except holidays
Partial Peak	0.13671	8:30am-Noon	3.5	8:30am-9:30pm	13	Weekdays except holidays
		6:00pm-9:30pm	3.5			Weekdays except holidays
Off Peak	0.12671	9:30pm-8:30am	11	9:30pm-8:30am	11	Weekdays except holidays
		All Day	24	All Day	24	Weekends and holidays

Source: PG&E Energy Prices for Qualifying Facilities and MCWD 2001 rate structure

Altering the pumping rate design criteria from 16-hour period to 24-hour period affects the required pump station horsepower, pump station outlet pipeline diameter, and electrical energy consumption and therefore the capital costs of required CIP facilities. Reservoir sizes are unaffected by pumping rates because they are sized to store the volume of one maximum day demand plus a fire flow event within each pressure zone.

The estimated 30-year present worth value of the construction costs of pump stations and pipeline facilities sized for a 24-hour pumping period is less than those sized for 16-hour and 18-hour periods. However, the annual energy cost of the 24-hour pumping is greater than the 16 and 18-hour pumping periods. The 16 and 18-hour pumping periods take advantage of the off-peak energy cost savings and use less energy on a daily and annual basis than the 24-hour period as shown in Table 5.5. Results of this analysis indicate that the anticipated energy savings associated with an 18-hour pumping period exceeds the estimated increased construction costs. Details of the analysis are provided in Appendix C.

TABLE 5.4
DAILY ENERGY COST COMPARISON

Season	Days Applicable	16-Hour Period ($/Kw*day)	18-Hour Period ($/Kw*day)	24-Hour Period ($/Kw*day)
Summer	Weekdays	2.07736	2.35078	3.50182
	Weekends and Holidays	2.02736	2.28078	3.04104
Winter	Weekdays	2.07736	2.35078	3.17104
	Weekends and Holidays	2.02736	2.28078	3.04104

Pursuant to the master planning level of the analysis conducted in this investigation, it is recommended that the District plan for pumping facilities capable of delivering the maximum day demand in a 16-hour period. The 16-hour pumping period will provide the water distribution system with the capacity to recover from unscheduled pumping outages during extended high demand periods, during multiple fire flow events within the system or resulting from changes to future water demands and system operations unforeseen in this master plan level of investigation. It is recommended that site-specific energy analysis be prepared as a part of the design process to confirm facility sizing.

Previous investigations have used different criteria for minimum fire flow and duration requirements based on anticipated needs for military buildings (Boon, Cook & Assoc, 1985). Fire flows and durations used in this master plan are taken from the Uniform Fire Code Section 903.3 and as adopted for use by local jurisdictions including the City of Marina, Department of Public Safety. Local fire districts were contacted to obtain their criteria for use in this master plan, summarized in Table 5.5.

TABLE 5.5 MINIMUM FIRE FLOW REQUIRMENTS			
Land Use*	**Flow (gpm)**	**Residual Pressure (psi)**	**Flow Duration (Hrs.)**
Residential	1,500	20	2
Commercial	4,000	20	4

*Land use designation determined within each zone based on project GIS mapping.

5.4 EXISTING SYSTEM FACILITIES

Facilities on the former Fort Ord were designed, installed, maintained and operated by the U. S. Army to support the operations of the Fort Ord military installation. These facilities were therefore not constructed or maintained pursuant to the current requirements established by the State Department of Health Services, Federal EPA, State Department of Water Resources, Monterey County Environmental Health Department or guidance provided by the American Water Works Association. All new water facilities within the Ord Community will need to meet standards established in Title 22 of the State Water Code pursuant to the requirements of the California Department of Health Services.

The potable water distribution system is operated as a series of five pressure zones, designated A through E. Closed valves and pressure regulation valves define the pressure zone boundaries.

Water storage is provided by thirteen reservoirs located throughout the Ord Community, listed in Table 5.6. The computer simulation model included six reservoirs whose operation was identified as critical to the distribution system. Facility evaluation was performed on each of these reservoirs and the Fritzche Airfield (Airport) Reservoir the results of which are presented in the remaining sections of this report.

Four booster pump stations are operated to fill reservoirs and pressurize distribution system pipelines. Summary data for each pump station is provided in Table 5.7.

TABLE 5.6
POTABLE WATER STORAGE RESERVOIRS
ORD COMMUNITY

RESERVOIR	PRESSURE ZONE	MATERIAL	CAPACITY (GAL)	YEAR BUILT	COMMENT
RESERVOIRS INCLUDED IN MODEL					
Intermediate **F**	None	Steel	169,000	1984	Provides equalization
Reservoir **B**	B	Concrete	2,000,000	1942	
Reservoir **C1**	C	Concrete	2,000,000	1964	
Reservoir **D**	D	Concrete	2,000,000	1954	
Reservoir **E**	E	Concrete	250,000	1958	
Reservoir **C2**	C	Concrete	2,000,000	1990	
RSERVOIRS NOT MODELED					
Bayview	B	Steel	200,000	1951	Not Currently In Operation
Sand Tank	None	Concrete	1,000,000	1952	Equalization to Main Booster Station
East Garrison No. 1	East Garrison	Steel	200,000	1976	Not Currently In Operation
East Garrison No. 2	East Garrison	Concrete	200,000	1940	Not Currently In Operation
Huffman	D	Concrete	60,000	1961	Not Currently In Operation
Travel Camp		Steel	65,000	1982	Not Currently in Operation
Fritzsche Airfield (Airport reservoir)	C	Elevated Steel	300,000	1958	Not Currently In Operation

TABLE 5.7
SYSTEM MODEL PUMP DATA
ORD COMMUNITY

STATION	PUMP	HORSEPOWER (HP)	ELEVATION (FT)	CAPACITY (GPM)	NOTES
Main Booster Pump Station	B-1	125	110	2,800	Sand Tank to B Reservoir
	B-2	125	110	2,800	
	B-3	125	110	2,000	
	C-1	125	110	1,800	Sand Tank to C1 Reservoir
	C-2	125	110	1,800	
	C-3	125	110	1,800	
	C-4	125	110	1,800	
	C-5	125	110	2,400	
D	D-1	100	300	4,800	C Zone to D Reservoir
	D-2	50	300	2,000	
E	E-1	30	475	600	D Zone to E Reservoir
	E-2	30	475	600	
C2(1)	F-1	N/A	N/A	N/A	Intermediate F Tank to C2 Reservoir (Not Operational)
	F-2	N/A	N/A	N/A	

(1) C2 Booster Pumps were not included in the system hydraulic model.

5.5 EXISTING SYSTEM OPERATION

Water is supplied to the Ord Community from a series of wells located on Reservation Road (well numbers 29, 30 & 31). The overall system configuration is shown as a hydraulic profile as Figure 6.

Water is discharged from the wells into the Intermediate F Reservoir from where it flows by gravity to the Sand Tank through parallel 16 and 27-inch diameter pipelines. The C2 Booster Pump Station could potentially pump water to Reservoir C2, however it currently is not functional.

The Sand Tank serves as the forebay to the distribution system feeding water to the pumps in the main booster station from where it is distributed throughout the five pressure zones.

The B and C pumps lift water from the main booster pump station into Reservoirs B, C1 and C2, respectively. The zone A receives its water supply from the B pressure zone through 4 pressure reducing valves. Water in Reservoirs C1 and C2 float on the zone C. Water from the zone C cascades down to zone B through 2 pressure reducing valves.

The D booster pumps water from the zone C to the Reservoir D. Water from the Reservoir D flows into the zone D and through a pressure reducing valve into the zone B.

The E pump station, located next to the Reservoir E, fills the elevated Reservoir E. Water service is provided to the zone E from the Reservoir E. Recent modifications to the system have installed new SCADA controls to improve system operations.

5.6 RELOCATED MAIN BOOSTER STATION ALTERNATIVES

During the progress of this master plan project the District requested that a preliminary hydraulic evaluation be made to consider alternative locations and facilities for replacement of the Sand Tank and main booster pump station consistent with the anticipated needs of the distribution system.

Preliminary evaluation of three working alternatives was performed to identify potential new locations and facilities required for the relocation of the main booster station. In each of the three alternatives the pumping capacity of the main booster pump station was relocated to the Intermediated F reservoir site. Schematics of the following alternatives are provided as Figure 7, Figure 8, and Figure 9.

- <u>Alt 1- Intermediate F Booster + Reservoir F to Reservoir C Booster:</u> This alternative requires construction of a new booster pump station to transfer water from the F Reservoir to the C Reservoir. Additionally, the existing Intermediate F booster pump station would be strengthened to accommodate conveyance of all water from the Intermediate F Reservoir to the F Reservoir.

- Alt 2- Intermediate F Booster + Reservoir D to Reservoir E Booster: This alternative requires construction of a new booster pump station to transfer water from the F Reservoir to the D and E Reservoirs. Additionally, the existing Intermediate F booster pump station would be strengthened to accommodate conveyance of all water from the Intermediate F Tank to the F Reservoir. Existing D and E booster pump stations would be abandoned.

- Alt 3- Intermediate F Booster: This alternative considers a major increase in the capacity of the Intermediate F booster pump station to provide the energy necessary to fill Reservoirs F, E and D. Booster pump stations D & E would be abandoned.

The results of the preliminary investigation indicated that relocating the main booster pump station from its current location to the vicinity of the well field was feasible. At this time, the District identified the East Garrison vicinity as a potential location for a new booster pump station as shown in Figure 10.

5.7 CIP SYSTEM FACILITIES

Based on the conclusions of the analysis and discussions with the District the recommendation to relocate the main booster station to the Well #32 site was identified as the preferable long-term operating scenario. The new pumping and storage facilities required at the relocated the main booster station include a 1.3 MG reservoir and a pump station with an ultimate total horsepower of approximately 1,580 Hp. These facilities are referred to as the Well Field Reservoir and Well Field Booster Station. Approximately 7,500 LF of 42-inch diameter pipeline is required from the Well Field Booster Station to the Reservoir C2.

After coordination with the District's PRV replacement project, pressure zone boundaries were redefined and PRV operations were refined. Summary information of the pressure regulating valves supplying water to their associated pressure zones is presented as Table 5.8. A map showing each of the new pressure zone boundaries and the pressure regulating valves that separate the pressure zones is presented as Figure 11.

TABLE 5.8
PRV DATA

Pressure Zone	PRV	Elevation (FT)	Outlet Setting (FT)	Comments
A	PRV-21	110	268	Zone B to Zone A
	PRV-22	179	268	Zone B to Zone A
	PRV-24	120	290	Zone B to Zone A
B	PRV-10	200	312	Zone C to Zone B
	PRV-20	190	305.29	Zone C to Zone B
	PRV-25	175	255	Zone C to Zone B
	PRV-26	241	312	Zone C to Zone B
	PRV-30	230	267	Zone D to Zone B
C	PRV-27	310	360	Zone D to Zone C
D	N/A	N/A	N/A	
E	N/A	N/A	N/A	

5.8 CIP SYSTEM OPERATIONS

The water distribution system operations recommended to develop the CIP significantly differ from the existing operations due to the relocation of the main booster station and the PRV replacement project. The hydraulic profile for the anticipated future conditions is shown as Figure 12.

Water from the wells will be directed toward the new Well Field Reservoir. This reservoir will serve as a forebay to the new Well Field Booster Station. The Well Field Booster Station will supply the entire system demand through a dedicated force main to Reservoir C2. A new booster pump station and new pipeline will connect Reservoir C2 to Reservoir C1. The alignment of the connection pipeline shown in the CIP map may need to be altered based on the availability of design level topography along the alignment. Reservoirs C1 and C2 will float on Zone C.

Zone C will supply Reservoir B through four PRV stations and an altitude valve at Reservoir B. Zone A will receive its water supply from Reservoir B through three PRV stations.

The D Booster Station will pump water to Reservoir D/E. Reservoir D/E consolidates Zone D and Zone E storage into one facility. Zone D will provide water to Zone C and Zone B through two PRV stations. Zone E will be served from by a variable frequency drive pump station located adjacent to Reservoir D/E.

5.9 STORAGE ANALYSIS

Reservoir sizing criteria considers storage of a full maximum day water demand and accounts for flow through PRV stations that interconnect pressure zones. Critical fire flow volume is stored within each pressure zone. Comparison was made of the design criteria established in this master plan to that previously used by the Fort Ord Reuse Infrastructure Study (FORIS 1994).

The results of the comparison between storage criteria are presented in Table 5.9. The use of the FORIS storage criteria would ultimately underestimate the anticipated system-wide needs for the Ord Community, therefore the master plan criteria was used for this study.

TABLE 5.9
COMPARISION OF TOTAL SYSTEM
STORAGE REQUIREMENTS BY CRITERIA

YEAR	STORAGE REQUIRED MASTER PLAN CRITERIA (MG)	STORAGE REQUIRED FORIS STUDY CRITERIA (MG)
2000	7.67	6.95
2005	14.23	11.43
2010	19.06	15.47
2015	24.24	19.95
2020	24.35	20.00

Projection of the anticipated maximum day water demands was made for each of the five-year intervals from year 2000 through 2020 by pressure zone. The anticipated demand was compared to the availability of storage in each pressure zone and the results presented as Table 5.10. This table presents the results of the anticipated storage volume by pressure zone under the following two assumptions:

1. A + B Storage: Zone A lacks its own storage reservoir. Water is available to zone A from zone B through four pressure regulating valves. The analysis for water storage requirements continues to evaluate zone A storage in Reservoir B. Previous recommendations have identified a new Reservoir A to be located along 12th Street just north of Abrams Road. Analysis of the anticipated water demands yields a year 2020 zone A storage requirement of approximately 1.15 MG, or roughly 15% of the combined zone A/B storage volume. Additionally, the future Reservoir A site is located at approximately elevation 175 feet. At this elevation a future reservoir could only provide serviceable pressures to less than half of the zone A demands. Therefore, it is recommended that the zone A storage demands be included in Reservoir B storage facilities.

2. Well Field Reservoir: 1.13 MG of storage will be located at the new Well Field Reservoir. This volume is not counted as system storage due to its inability to provide service to the distribution system without the Well Field Booster Station in operation.

TABLE 5.10
ANTICIPATED STORAGE REQUIREMENTS
BY PRESSURE ZONE

Year	Pressure Zone	Max. Day Demand (MG)	Fire Flow Volume (MG)	PRV Supply from Zone C to Zone B (MG)	Total Zone Demand (MG)	System Storage (MG)	Additional Storage (MG)	Total Storage (MG)	Difference (MG)
2000	A + B	1.32	0.96	-0.95	1.33	2.0	-	2.0	0.67
	C	1.24	0.96	0.95	3.15	4.0	-	4.0	0.85
	D	1.34	0.96		2.30	2.0	-	2.0	- 0.30
	E	0.71	0.18		0.89	0.25	-	0.25	- 0.64
	TOTAL	**4.61**			**7.67**	**8.25**	**-**	**8.25**	**0.58**
2005	A + B	4.22	0.96	-2.87	2.31	2.0	-	2.0	-0.31
	C	3.66	0.96	2.87	7.49	4.0	4.0	8.0	0.51
	D	3.29	1.14		4.43	2.25	2.25	4.5	0.07
	TOTAL	**11.17**			**14.23**	**8.25**	**6.25**	**14.50**	**0.27**
2010	A + B	5.98	0.96	-3.95	2.99	2.0	1.6	3.6	0.61
	C	5.26	0.96	3.95	10.17	8.0	2.5	10.5	0.33
	D	4.76	1.14		5.90	4.5	3.5	8.0	2.10
	TOTAL	**16.00**			**19.06**	**14.50**	**7.60**	**22.10**	**3.04**
2015	A + B	7.49	0.96	-4.88	3.57	3.6	-	3.6	0.03
	C	6.88	0.96	4.88	12.72	10.5	2.4	12.9	0.18
	D	6.81	1.14		7.95	8.0	-	8.0	0.05
	TOTAL	**21.18**			**24.24**	**22.10**	**2.40**	**24.50**	**0.26**
2020	A + B	7.52	0.96	-4.93	3.55	3.6	-	3.6	0.05
	C	6.97	0.96	4.93	12.86	12.9	-	12.9	0.04
	D	6.81	1.14		7.95	8.0	-	8.0	0.05
	TOTAL	**21.29**			**24.35**	**24.50**	**-**	**24.50**	**0.15**

6 FACILITY EVALUATION

6.1 INTRODUCTION

A facility evaluation of the in-service concrete and steel reservoirs was conducted on the former Fort Ord from October 29 thru 31, 2002. A preliminary corrosion survey was completed on the existing 24-inch cement mortar lined and coated (CML&C) steel water transmission main in 6th Avenue.

Concrete reservoirs B, C1, D and C2, and steel reservoirs "Bayview", "Intermediate F", "Reservoir E", and the "Airport" were inspected.

Inspections were conducted of the exteriors of the reservoirs. Paint samples were taken from the steel tanks for laboratory chemical analysis to determine the presence of hazardous materials.

The District contracted separately with Aqua-Tech Company to conduct internal underwater inspections of the Fort Ord concrete reservoirs. Aqua-Tech conducted dive inspections consisting of collecting interior photographs and samples of interior joint caulking and floor sediments. These samples were analyzed for the presence of hazardous materials. Internal inspection reports were reviewed and our analysis included in the conclusions of reservoir conditions in this report for recommended repair work.

Photographs of the exteriors of the inspected reservoirs and the laboratory chemical analyses of the paint samples and interior joint caulking and floor sediment are provided in Appendix A.

6.2 RESERVOIR CONCLUSIONS

Review of interior inspection reports and external visual inspections conclude that the concrete reservoirs and elevated steel tanks do not conform to current water quality regulations or seismic design codes. It is only through considerable expense that these structures could be brought into conformance.

Table 6.1 presents recommendations for each reservoir.

TABLE 6.1
RESERVOIR INSPECTION - RECOMMENDED ACTIONS

Reservoir	Immediate Recommendation	Interior Insp.
Reservoir B	• Drain and clean tank • Inspect floor and floor joints • Remove float well or replace support brackets • Wash roof and seal	Yes
Reservoir C1	• Exterior wire wrap should be exposed to sound steel • Corroded wire should be repaired or replaced • Drain and clean tank	Yes
Reservoir D	• Drain and clean tank • Inspect floor and floor joints	Yes
Reservoir C2	• Drain and clean tank • Inspect floor and floor joints • Remove joint caulking and replace with approved material • Evaluate water quality conformance	Yes
Reservoir E	• Extensive repairs required • Overcoat or remove and dispose of lead paint	No
Intermediate Reservoir	• Repair ring wall • Repair Cathodic protection system • Overcoat or remove and dispose of lead paint • Drain and clean tank • Inspect floor and floor joints	No
Airport Reservoir	• Repair Cathodic protection system • Overcoat or remove and dispose of lead paint • Drain and clean tank • Inspect floor and floor joints	No

6.2.1 Reservoir B

Reservoir B is a 2 MG prestressed type concrete tank constructed in 1942. The tank is approximately 100 feet in diameter and 30 feet high and is partially buried with only the roof exposed above ground level. The roof is of a domed construction and the interior has no support columns.

The dive report shows several cracks in the walls. These cracks appear to be sealed by what appears to be calcareous deposits caused by the formation of calcium leached from the concrete. Water migrating through the tank wall at these cracks to the exterior may have caused the reinforcing steel to become corroded. This process occurs as the water migrates through the wall and chloride in the water is deposited on the reinforcing steel, causing the steel to corrode and form rust deposits. As rust forms, it expands and causes further cracking of the concrete and leads to eventual failure of the structure.

The tank contains a significant amount of sediment preventing a thorough floor inspection. The interior ladder has corroded away and the support brackets for the float well are severely corroded. The interior floor sediment tested positive for Lead, Zinc and Chromium. However, all values are well below the action limits set forth in the Federal maximum contaminant levels (MCL's).

The exterior inspection revealed several cracks in the roof needing repair. The roof vent is also in need of repair.

6.2.1.1 Reservoir B Recommendations

This tank is serviceable for the short term, approximately 5 to 6 more years. However, it is recommended, in order to realize any extended short term service, that the tank be drained and cleaned of all sediment and debris and a thorough inspection of the floor and any floor joints be conducted and any necessary repairs made. Additionally, the float well should be removed or the support brackets replaced. The exterior of the roof should be pressure washed and sealed with a polyurethane type coating.

6.2.2 Reservoir C1

Reservoir C1 is a 2 MG prestressed type concrete tank constructed on grade. This tank was constructed in 1964. The tank is approximately 130 feet in diameter and 22 feet high. The roof is of a domed construction and the interior has no support columns.

The dive report revealed that the tank was lined with what appeared to be a rubberized material. This lining material has disbonded from the walls and has accumulated on the floor and may lead to stopping of flow through the inlet/outlet pipe and/or the tank drain. The liner material was tested for hazardous constituents, particularly polychlorinated biphenyls (PCB's). The chemical analysis indicated that the liner contained no material deemed hazardous for contact with potable water. The interior ladder and overflow pipe appear to be serviceable. This tank contains a significant amount of sediment on the floor. The interior floor sediment tested positive for Lead, Zinc and Chromium. However, all values are well below the action limits set forth in the Federal MCL regulations.

The exterior inspection revealed several leaks at the wall/floor joint interface. Areas of exposed reinforcing steel wire wrap were discovered as shown in Appendix A. These were discovered at the base of the walls and the wire was broken in several places. Electropotential measurements indicated that the reinforcing wire is actively corroding.

6.2.2.1 Reservoir C1 Recommendations

This tank may be serviceable for the short term. It is recommended, in order to realize any extended short term service, that the corroded exterior reinforcing wire wrap be exposed to sound steel and the corroded wire over wrapped in order to prevent tank wall failure. The tank should be drained, cleaned of all sediment and the liner material removed in order to facilitate a thorough inspection of the floor and any floor joints. This will most likely reveal the source of the water leaks.

Due to the severity of the reinforcing wire corrosion, it is recommended that this structure be monitored closely especially immediately after any measurable seismic event.

6.2.3 Reservoir D

Reservoir D is a 2 MG prestressed type concrete tank constructed on grade. This tank was constructed in 1952. The tank is approximately 135 feet in diameter and 24 feet high. The tank has a flat roof with 35 interior support columns.

The exterior inspection revealed major cracking in the tank wall as shown in Appendix A. The white colored deposits on the wall, shown in the photos, indicate the locations of the cracking.

These deposits form when water migrates through the wall. As the water travels through the wall and past the reinforcing steel and nears the surface it evaporates and leaves chloride deposits on the steel. As the steel corrodes it forms rust, which expands and enlarges the cracks in the concrete wall. The white deposits tested positive for chloride and also contain significant amounts of iron oxide from the steel.

Leaks are estimated to be at the rate of 20 to 30 gallons per minute coming from under the tank when small holes were dug near the tank base as shown in Appendix A.

The dive report reveals significant corrosion on all submerged metallic appurtenances. Sediment conceals the floor surface. Samples were taken of exposed joint caulking. This material, which is in contact with the stored potable water, was tested for hazardous constituents, particularly polychlorinated biphenyls (PCB's). The chemical analysis indicated that the joint caulking material, both in the interior and exterior joints, contained extremely high levels of PCBs. PCBs are regulated by the Environmental Protection Agency from being in contact with potable water. The interior ladder and overflow pipe have significant corrosion damage. The interior floor sediment tested positive for Lead, Zinc and Chromium. However, all values are well below the action limits set forth in the Federal MCL regulations.

6.2.3.1 Reservoir D Recommendations

This tank may not be serviceable for the short term and should be scheduled for replacement as soon as possible. However, it may be advisable to drain the tank and clean it of all sediment in order to facilitate a thorough inspection of the floor and any floor joints, revealing the source of the existing water leaks.

Due to the anticipated severity of the reinforcing wire corrosion and the water leakage, it is recommended that this structure be monitored closely especially immediately after any measurable seismic event.

It is concluded that this tank could fail catastrophically in a significant seismic event.

6.2.4 Reservoir C2

Reservoir C2 is a 2 MG prestressed type concrete tank constructed in 1990. The tank is approximately 109 feet in diameter and 32 feet high. The tank has a flat roof with 20 interior support columns.

The dive report shows several cracks in the walls. These cracks appear to be sealed by what appears to calcareous deposits caused by the formation of calcium leached from the concrete. However, water migrating through the tank wall at these cracks to the exterior may have caused the reinforcing steel to corrod. Samples were taken of exposed joint caulking. This material, which is in contact with the stored potable water, was tested for hazardous constituents, particularly polychlorinated biphenyls (PCB’s). The chemical analysis indicated that the joint caulking material contained very high levels of PCB’s. Additionally; the tank contains a significant amount of sediment on the floor. The sediment prevents a thorough inspection of the floor. The interior floor sediment tested positive for Lead, Zinc and Chromium. However, all values are well below the action limits set forth in the Federal regulations. The interior ladder and overflow pipe are serviceable.

The exterior inspection revealed a sound structure with good surface coating and no visible signs of reinforcing steel corrosion.

6.2.4.1 Reservoir C2 Recommendations

This tank is in good condition and is serviceable for the long term provided it is regularly maintained. The roof vent needs to be replaced in order to conform to the requirements of current water quality regulations. It is anticipated that since this tank was constructed after 1968, it conforms to the then current standards for seismic design as set forth in AWWA D-100. However, it is recommended that the tank be drained and cleaned of all sediment and debris and a thorough inspection of the floor and any floor joints be conducted and any necessary repairs made. The joint caulking must be removed and replaced with a National Sanitation Foundation (NSF) approved material. The existing caulking will need to be disposed of as a hazardous waste. Additionally, the tank should be evaluated further for conformance with water quality regulations that may require additional mechanical upgrades to improve water circulation.

6.2.5 Reservoir E

Reservoir E is a decommissioned elevated steel tank adjacent to Reservoir D. Currently this structure is used as a tower for a cellular phone company and contains many cellular antennae.

It was reported by District staff that the vessel itself is corroded and that there exist penetrations of the shell. Visually we noted several structural support members of the tower were missing or disconnected from the structure at one end. An assessment of its seismic stability may be necessary and repairs made if the District plans on maintaining it for the cellular phone company. The access ladder is not safe to climb on. The existing cathodic protection system is not serviceable. Extensive and expensive repairs would be needed to return this structure to water storage service.

6.2.5.1 Reservoir E Recommendations

Exterior paint samples were taken and analyzed for hazardous materials. The analyses, as shown in the Appendix A, indicate that the paint is very high in Lead and Chromate. Under current State and Federal regulations this material cannot be left exposed to the environment. Therefore, it must be overcoated, if possible, or removed and disposed of as a hazardous waste. If the structure were to be demolished, the paint would have to be mitigated before the steel could be disposed. If the material is disposed of in a regulated hazardous waste landfill, the District will become responsible for the material forever. In order to relieve the District from this liability, the structure could be dismantled and sold on consignment to countries that have no hazardous material regulations.

6.2.6 Bayview Reservoir

Bayview Reservoir is a decommissioned on-grade steel tank located at the Bayonet and Black Horse public golf courses. The tank was inspected in order to determine if it could be put into use to supply additional fire flow to new developments adjacent to the golf course.

The tank wall and roof are severely corroded in various locations and penetrations exist both in the wall and the roof. The access ladder is not safe to climb on. The existing cathodic protection system is not serviceable.

Exterior paint samples were taken and analyzed for hazardous materials. The analyses indicate that the paint is also very high in Lead and Chromate and will need to be disposed of in conformance with all State and Federal regulations.

6.2.6.1 Bayview Reservoir Recommendations

It is estimated that the expense to repair this structure in order to return it to service, would far exceed its present worth.

6.2.7 Intermediate F Reservoir

The Intermediate F Reservoir has a capacity of 169,000 gallons and is an on-grade steel tank. The reservoir was constructed in 1984.

The tank appears to be sound and serviceable. The tank is equipped with seismic anchors tied into a concrete ring wall foundation. The ring wall is fractured at two locations, as shown in photographs in Appendix A, and could be attributed to flaws in the anchoring system. It appears that the width or thickness of the ring wall may be inadequate. The existing internal cathodic protection system is not operable or serviceable.

Exterior paint samples were taken and analyzed for hazardous materials. The analyses indicate that the paint is very high in Lead and will need to be overcoated or removed and disposed of in conformance with all regulations.

6.2.7.1 Intermediate Reservoir Recommendations

If this tank is to remain in service for the long term, it is recommended that it be drained and cleaned and that a thorough inspection of the interior coatings and the floor plates be conducted in order to assess the condition and to make recommendations for any needed repairs.

6.2.8 Airport Reservoir

The Airport Reservoir is an elevated steel tank adjacent to Fort Ord (Marina) airport. Currently this tank provides fire flows to the airport and is also used as an airplane navigational beacon.

Visually the structure appears to be sound and serviceable. The existing cathodic protection system is not serviceable.

Exterior paint samples were taken and analyzed for hazardous materials. The analyses indicate that the paint is very high in Lead and Chromate. Under current State and Federal regulations these materials cannot be left exposed to the environment.

6.2.8.1 Airport Reservoir Recommendations

If this tank is to remain in service for the long term, it is recommended that it be drained and cleaned and that a thorough inspection of the interior coatings and the shell plates be conducted in order to assess the condition and to make recommendations for any needed repairs.

An assessment of the tank seismic stability may be necessary and repairs made if the District plans on maintaining it for the long term.

The tank must be overcoated, if possible, or the existing paints removed and disposed of as a hazardous waste.

6.3 PIPELINE EVALUATION

In addition to assessing the reservoirs, RBF was requested to make a determination as to the condition and thus the life expectancy of the various water pipelines within the Fort Ord water distribution system. Per the hydraulic modeling conducted during this project, certain pipelines were identified as being key to the growth that is anticipated throughout the Ord Community. These pipelines are 1) 24-inch in 6th Avenue; 2) 18-inch in Inter-Garrison Road; 3) 12-inch in east side of North/South Road; and 4) 8-inch in west side of North/South Road. Evaluated pipelines are summarized in Table 6.2. The facility evaluation does not satisfy developer's requirements of meeting the District's In-Tract Water and Wastewater Collection System Infrastructure Policy.

TABLE 6.2
PIPELINES - RECOMMENDED ACTIONS

LOCATION	RECOMMENDATION	DIAMETER
6th Avenue	Install Cathodic test stations	24-inch
Inter-Garrison Road	None	18-inch
North/South Road	Install Cathodic test stations	12 & 8-inch

6.3.1 6th Avenue 24-inch Pipeline

This pipeline is located in the west side of 6th Avenue and runs from the main booster pump station at the Sand Tank to Reservoir C adjacent to Gigling Road. This pipeline is constructed of concrete coated and lined reinforced steel cylinder pipe (CCP).

The pipeline was accessed at valve vaults along 6th Avenue. Electrical connections to the pipeline were made on either side of the valves at the flanges. Using a meter registering millivolts (mV) and a $Cu/CuSO_4$ reference electrode a pipe-to-soil potential survey was conducted at intervals along the centerline of the pipe. This form of test indicates where anodic (corroding) and cathodic areas exist on the pipeline. The tests indicated a normal corroding potential for an unprotected pipe buried in soil.

However, some areas were identified where there exists significant current discharge from the pipe. This condition would be due to the pipeline picking up stray electrical currents from a foreign pipeline impressed current cathodic protection system. This current drain will eventually lead to pipe failure unless it can be mitigated. Further investigation found a Pacific Gas & Electric gas pipeline crossing the 24-inch water pipeline near the 8th Street cutoff. This gas pipeline is being protected with an impressed current system and is most likely the source for the stray current interference. It is anticipated that this problem can be mitigated easily by installing sacrificial anodes on the 24-inch water pipeline where the current discharge is evident.

Recent soils chemical and resistivity analyses, prepared by Haro, Kasunich and Associates, Inc., were reviewed to further assist pipeline assessment. This chemistry indicated that the area soils are relatively non-corrosive to buried metal and concrete. The resistivity test results showed that the soils are only mildly corrosive to buried metallic structures. This is good news for buried metallic pipelines having a concrete coating. In addition to this available information, District staff provided a coupon of the pipe removed during a recent hot tap operation for the new science building at the California State University at Monterey Bay (CSUMB). That sample, consisting of the concrete coating, the wire reinforcing wrap, the steel cylinder and the concrete lining, was observed to be in excellent condition. Thickness measurements conducted were made leading to the conclusion that there had been no measurable metal loss to either the wire or the cylinder.

6.3.1.1 6th Avenue 24-inch Pipeline Recommendations

The pipeline appears to be serviceable for the long term provided that the measured corrosion activity is mitigated in the near future. It recommended that initially the District have cathodic test stations (CTS) installed along the pipeline so a more definitive and comprehensible electropotential survey can be conducted over the entire length of the pipeline.

6.3.2 Inter-Garrison 18-inch Pipeline

The 18-inch pipeline in Inter-Garrison Road was also directly accessed at the valve structures. This pipeline is constructed of asbestos-cement pipe (ACP). Therefore, only a destructive type test would be of any benefit to assessment of its condition. However, with the knowledge that the area soils are rather benign and that the water is not aggressive, it is estimated that the ACP is in excellent condition and should be serviceable for the long term. There may exist corrosion activity at iron fittings such as elbows and tees, etc. However, if those appurtenances are wrapped or coated and even encased in concrete thrust blocks, little or no corrosion activity is anticipated. Internal corrosion of the fittings may be more of an issue.

In order to try and provide some assessment of the internal surfaces of iron fittings, etc., we inspected some of the removed and discarded water system components stored in the District Yard. These appurtenances showed significant corrosion byproduct in the water passage. Rust formations had almost completely blocked the water passages in most of the older piping. This type of corrosion attack is common for the interior of iron pipe and fittings especially after the thin cement lining becomes damaged from years of service.

6.3.2.1 Inter-Garrison 18-inch Pipeline Recommendations

It is anticipated that this pipeline will be serviceable for the long term with little maintenance.

6.3.3 North/South Road 12 & 8-inch Pipelines

Pipelines in North/South Road are made of ACP. Therefore it is anticipated that they will be as serviceable as the 18-inch water pipeline in Inter-Garrison Road.

6.3.3.1 North/South Road 12 & 8-inch Pipelines Recommendations

A 27-inch pipeline exists in Old County Road. Investigation revealed that no direct access to the pipe exists. Therefore, we could not determine the type of pipe material. It may be advantageous to excavate this pipeline in order to determine its material. If the pipeline is made of steel, then

CTS could be installed to provide a direct electrical connection to the pipe so that potential measurements can be recorded.

7 CAPITAL IMPROVEMENT PROGRAM

This section presents the recommended improvement projects resulting from the analysis of water system facilities and the facility evaluation. Recommendations for water facility improvement projects are summarized in Table 7.1 at the end of this section and presented graphically as Figure 13.

Engineering estimates of the likely construction cost for recommended water system improvements are developed based on several data sources. Pipeline construction costs are developed using engineer's estimates and construction bids for similar work at the District and experience of the project team. Pump station construction costs are estimated as a dollar per installed horsepower developed for the District based on the consultant's experience with similar facilities. Construction cost estimates for repairs and replacement of the water storage reservoirs are based on experience of the consultant team members with similar work and the facility evaluation. Capital cost estimates include a 25% contingency added to the construction cost to account for unexpected costs that may not be apparent at this master planning level of investigation. Soft cost budgets are developed as an appropriate percentage of the estimated capital cost for the following activities: 10% for engineering design; 10% for construction management and inspection; and, 5% for legal and administrative fees. Project costs are estimated by adding the soft cost budgets to the capital cost of each facility. The contingency and soft cost values are subject to future refinement as additional engineering efforts are conducted during further planning and the design engineering process of each project. Likely project cost estimates are reported in Table 7.1.

Estimates were made of the likely construction scheduling for the facility improvements. Scheduling of capital improvements are based on consideration of the following factors:

- Timing that individual facilities may become deficient, based on the modeled water demands.

- Local knowledge of the timing of individual planned developments anticipated in each of the jurisdictions throughout the Ord Community.

- Results of the facilities evaluation of the existing in-service reservoirs and overview assessment of the pipeline and appurtenant facilities.

- An attempt to schedule capital projects to result in a consistent level of effort for the District to accomplish the final planning, engineering design bidding, construction and inspection/testing of the recommended improvements.

- Consideration of the relationship between specific recommended projects and the timing of land development projects. The District should monitor these relationships to ensure that planned water system facilities are constructed at the proper time.

- Discussions with District operations staff regarding operational experiences with the existing system and review and investigation of stockpiled distribution system components (pipes and valves) removed from service.

Several facilities within the CIP are closely interdependent with other proposed projects and therefore require proper construction sequencing. These facilities have been identified in Table 7.1 and are grouped as follows:

- Group A Projects - It is recommend that the District begin development of Well #33 (CIP 1.04) before construction of other Group A capital facilities to ensure that anticipated supplies can be delivered. After the Well #33 capacity is confirmed, the Well Field Reservoir (CIP 3.08), Well Field Booster Station (CIP 4.01) and Main Booster Transmission Line (CIP 5.03) can be constructed concurrently. The Intermediate F Reservoir (CIP 3.06) may be demolished after the main booster station has been relocated. Group A facilities should be constructed before Group C facilities.

- Group B Projects - It is recommended that the new Reservoir D/E (CIP 3.03) and the E Booster Station (CIP 4.04) be constructed and brought into operation before the existing Reservoirs D and E (CIP 3.03) are demolished. Group B projects may be constructed concurrently with other facilities.

- Group C Projects - It is recommended that the C Transfer Booster Station (CIP 4.03) and the Reservoir C2 to Reservoir C1 Transmission Line (CIP 5.04) be constructed concurrently. It is necessary for both facilities to be operational in order to benefit the distribution system.

Projects included in Table 7.1 that do not have a "Group" designation may be constructed independently at a time convenient to the District and are not necessarily tied to other proposed projects.

7.1 RECOMMENDED WATER SUPPLY WELL PROJECTS

The District has conducted several studies regarding the groundwater supply wells including the Deep Aquifer Investigative Study and the Well No. 30 Rehabilitation/Replacement Study. Through these studies, the District has identified the need to rehabilitate or replace Well No. 29 and Well No. 31. Other projects recommended by these investigatins include a deep aquifer monitoring well and the construction of a new Well No. 33.

7.2 RECOMMENDED STORAGE PROJECTS

Table 5.8 presents a summary of the anticipated future storage requirements and recommended capital projects for new storage capacity by organized pressure zone.

The total year 2020 storage requirement is estimated to be 24.35 MG. The following recommendations are made from the facility evaluation of the existing reservoirs, are dependent upon potential availability of suitable reservoir sites and are further detailed in the analysis presented in Table 5.8:

1. Reservoir B Maintenance: Reservoir B should be drained, cleaned, inspected and the joint caulking removed and replaced with approved material. This maintenance work should be conducted in year 2004.

2. Zone A+B Additional Capacity: The anticipated storage requirement for Zone B is anticipated to be exceeded by the year 2010. An additional 1.6 MG of storage is estimated to be required in year 2010. Total storage volume required for Zone A+B is therefore 3.6 MG.

3. Reservoir C1 Tank Replacements: Based on the facility evaluation of the existing Reservoir C1, it is recommended that the reservoir be replaced by year 2010 with a new tank. The total storage requirement at this site is 4.5 MG.

4. Reservoir C2 Tank Maintenance: It is recommended that Reservoir C2 be drained, cleaned, inspected and the joint caulking be removed and replaced with approved material. This maintenance work should be conducted as soon as possible.

5. Zone C Additional Capacity: It is recommended that an additional 4.0 MG be constructed at the existing Reservoir C2 site in 2004. and 2.4 MG at the existing Reservoir C2 site in 2015. The total storage volume within Zone C would therefore be 12.9 MG.

6. Reservoir D and Reservoir E Modifications: The facility evaluation of Reservoir D and Reservoir E indicates both facilities are at significant levels of disrepair. While it is possible to provide service to the Zone E with the construction of a new elevated Reservoir E, it is recommended that this pressure zone be served by a combination of a new ground tank and booster pumping station. Tanks D and E would be

demolished and replaced in year 2004 with a new 4.5 MG D/E reservoir and pump station to Zone E.

7. Zone D Additional Capacity: Between year 2006 and year 2010 it is recommended that a new 3.5 MG reservoir be constructed at the Reservoir D/E site. The total storage volume within Zone D and Zone E would therefore be 8.0 MG

8. Additional Recommendations: Recommendations for additional storage projects are presented in Table 7.1 and include: Demolition of the Airport Elevated, Bayview, and Intermediate F Reservoirs.

7.3 RECOMMENDED BOOSTER STATION PROJECTS

Hydraulic analysis resulted in the following recommended booster station projects:

1. Well Field Booster Station: Construction of the Well Field Booster Station is scheduled for 2004. While it is recommended that the pump house be constructed for the ultimate pumping capacity, the pumping capacity can be constructed as necessary to meet anticipated demands. Approximately 212 Hp is required in 2004. Total horsepower at the Well Field Booster Station is estimated to be 1,578 Hp by Year 2020.

2. D Booster Station Rehabilitation: The existing pump station has sufficient capacity to deliver year 2020 demands. However, previous facility evaluations conducted by the District indicate that the D Booster Station should be replaced by year 2010.

3. Reservoir C2 to Reservoir C1 Booster Station: A booster station is required to transfer water between Reservoirs C1 and C2. This pump station would be necessary in year 2005.

4. E Booster Station: Zone E will become a closed system after the demolition of Reservoir E. The E Booster Station is recommended as a variable frequency drive pump station. This will allow the pump station to maintain pressure throughout Zone E. The District may wish to investigate other alternatives for maintaining pressure within Zone E.

7.4 RECOMMENDED PIPELINE PROJECTS

A total of twenty pipeline projects have been identified in Figure 13 and Table 7.1. Ten of the improvements are necessary because of anticipated future deficiencies in conveyance of the anticipated demands. The remaining ten pipelines are estimated to have sufficient capacity to deliver anticipated system demands but are inadequately sized to satisfy required fire flows. For purposes of the development of capital estimates, pipeline improvement projects have been identified as new parallel pipes. Alternatively, the District may choose to remove the existing pipelines and replace them with a single new pipeline that has a hydraulic capacity equivalent to the existing pipeline plus the new recommended pipeline. The decision to parallel or replace deficient pipeline segments should be evaluated on a case-by-case basis during the design phase of each project taking into consideration detailed field investigations of the condition of the existing pipeline materials and appurtenances. Pipeline construction projects require coordination with anticipated transportation improvements and land ownership easement requirements during final design to address site-specific alignment issues. The District should continue to coordinate with FORA and local jurisdictions within the Ord Community regarding planned roadway improvement projects.

TABLE 7.1
CAPITAL IMPROVEMENT PROGRAM

CIP Project #	Hydraulic Model Reference	Project Location/Description	Quantity	Diameter (in)	Year Required	CI Grou
W-1		**WATER SUPPLY WELLS**				
1.01	**Deep Aquifer**	**Recommended Actions** **TOTAL**				
		Deep Aquifer Monitoring Well			2004	
1.02	**Well 29**	**Recommended Actions** **TOTAL**				
		Rehabilitate/Replace Well 29			2007	
1.03	**Well 31**	**Recommended Actions** **TOTAL**				
		Rehabilitate/Replace Well 31			2010	
1.04	**Well 33**	**Recommended Actions** **TOTAL**				
		Construct Well 33			2004/2005	A
W-2		**NOT USED**				
W-3		**STORAGE RESERVOIRS**				
3.01	**Reservoir B1**	**Recommended Actions** **TOTAL**				
		Inspect interior	2,000,000 GAL		2004	
		Remove joint caulking and replace with approved material	2,000,000 GAL		2004	
		Wash roof and seal	2,000,000 GAL		2004	
		Construct new reservoir - 1.6 MG	1,600,000 GAL		2010	
3.02	**Reservoir C2**	**Recommended Actions** **TOTAL**				
		Inspect interior	2,000,000 GAL		2004	
		Remove joint caulking and replace with approved material	2,000,000 GAL		2004	
		Evaluate water quality conformance	2,000,000 GAL		2004	
		Construct new reservoir - 4.0 MG	4,000,000 GAL		2004	
3.03	**Reservoir D/E**	**Recommended Actions** **TOTAL**				
		Demolish existing Reservoir D	2,000,000 GAL		2005	B
		Demolish existing Reservoir E	250,000 GAL		2005	B
		Construct new Reservoir "D/E" - 4.5 MG	4,500,000 GAL		2005	B
		Construct new reservoir - 3.5 MG	3,500,000 GAL		2010	
3.04	**Reservoir C1**	**Recommended Actions** **TOTAL**				
		Demolish existing Reservoir C1	2,000,000 GAL		2010	
		Construct new Reservoir C1 - 4.5 MG	4,500,000 GAL		2010	
		Construct New Reservoir - 2.4 MG	2,400,000 GAL		2015	

TABLE 7.1
CAPITAL IMPROVEMENT PROGRAM

CIP Project #	Hydraulic Model Reference	Project Location/Description	Quantity	Diameter (in)	Year Required	CI Grou
3.07	**Airport Reservoir**	**Recommended Actions** **TOTAL**				
		Demolish Airport Reservoir	300,000 GAL		2005	
3.08	**Well Field Booster Reservoir**	**Recommended Actions** **TOTAL**				
		Construct new reservoir - 1.3 MG	1,300,000 GAL		2005	A
W-4		**BOOSTER STATIONS**				
4.01	**Well Field Booster Station**	**Recommended Actions** **TOTAL**				
		Construct new booster station	212 HP		2004	A
		Increase pumping capacity	606 HP		2005	
		Increase pumping capacity	380 HP		2010	
		Increase pumping capacity	380 HP		2015	
4.02	**Rehabilitate D Booster Station**	**Recommended Actions** **TOTAL**				
		Rehabilitate D Booster Station	150 HP		2010	
4.03	**Res C2 To Res C1 Booster Station**	**Recommended Actions** **TOTAL**				
		Construct new booster station	136 HP		2005	C
4.04	**E Booster Station**	**Recommended Actions** **TOTAL**				
		Construct new booster station	40 HP		2005	B
W-5		**TRANSMISSION PIPELINES**				
5.01	**P-9000 to P-9005**	**Ardennes Cir to North-South Road** **TOTAL**	**5,394 LF**	**16 to 20**		
	P-9000	North-South Rd	1,915 LF	20	2004	
	P-9001	North-South Rd	604 LF	18	2004	
	P-9002	North-South Rd	901 LF	16	2004	
	P-9003	North-South Rd	1,548 LF	16	2004	
	P-9004	Ardennes Cir	206 LF	18	2004	
	P-9005	Ardennes Cir	220 LF	18	2004	
5.02	**P-9006 to P-9009**	**Gigling Rd -"D" Booster Station to North-South Rd.** **TOTAL**	**2,088 LF**	**8**		
	P-9006	Gigling Rd	134 LF	8	2015	
	P-9007	Gigling Rd	634 LF	8	2015	
	P-9008	Gigling Rd	296 LF	8	2015	
	P-9009	Gigling Rd	1,024 LF	8	2015	
5.03	**P-9046**	**Main Booster Transmisson Line** **TOTAL**	**7,495 LF**	**42**		
	P-9046		7,495 LF	42	2005	A
	P-9047	**Reservoir C2 to Reservoir C1 Transmisson Line** **TOTAL**	**11,032 LF**	**36**		

TABLE 7.1
CAPITAL IMPROVEMENT PROGRAM

CIP Project #	Hydraulic Model Reference	Project Location/Description		Quantity	Diameter (in)	Year Required	CII Grou
5.06	**P-9040 to P-9041**	**Reservoir B Supply Pipeline**	**TOTAL**	**2,161 LF**	**14**		
	P-9040	Reservoir B to 12" Pipeline		728 LF	14	2015	
	P-9041	12" Pipeline to First St.		1,433 LF	14	2015	
5.07	**P-9045**	**Injim Rd.**	**TOTAL**	**2,056 LF**	**16**		
	P-9045	Existing 27" Pipeline to University Dr.		2,056 LF	16	2015	
5.08	**P-9035 to P-9037**	**Imjim Rd (Airport Area)**	**TOTAL**	**1,933 LF**	**8**		
	P-9035	Imjim Rd		1,061 LF	8	2015	
	P-9036	Imjim Rd		509 LF	8	2015	
	P-9037	Imjim Rd		363 LF	8	2015	
5.09	**P-3000 to P-3001**	**North-South Rd (Del Rey Oaks)**	**TOTAL**	**12,179 LF**	**10 to 16**		
	P-3000	North-South Rd		9,248 LF	16	2005	
	P-3001	North-South Rd		2,931 LF	10	2005	
5.10	**P-9024 to P-9028**	**Seventh Ave. and Gigling Rd.**	**TOTAL**	**3,775**	**8 to 12**		
	P-9024	Seventh Ave.		26	12	2005	
	P-9025	Seventh Ave.		1,671	8	2005	
	P-9026	Gigling Rd		567	8	2005	
	P-9027	Gigling Rd		582	8	2005	
	P-9028	Gigling Rd		929	8	2005	
5.11	**P-9010 to P-9016**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**6,126 LF**	**8 to 14**		
	P-9010	Eigth St.		1,139 LF	12	2010	
	P-9011	Eigth St.		170 LF	12	2010	
	P-9012	Eigth St.		1,994 LF	8	2010	
	P-9013	Nineth St.		535 LF	12	2010	
	P-9014	Nineth St.		484 LF	14	2010	
	P-9015	Fourth Ave.		613 LF	14	2010	
	P-9016	Nineth St.		1,191 LF	14	2010	
5.12	**P-9017 to P-9018**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**823 LF**	**8**		
	P-9017	Nineth St.		506 LF	8	2010	
	P-9018	Nineth St.		317	8	2010	
5.13	**P-9019 to P-9022**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**4,644 LF**	**8 to 10**		
	P-9019	First Ave.		1,279 LF	8	2010	
	P-9020	First Ave.		916 LF	8	2010	

TABLE 7.1
CAPITAL IMPROVEMENT PROGRAM

CIP Project #	Hydraulic Model Reference	Project Location/Description		Quantity	Diameter (in)	Year Required	CII Grou
5.14	**P-9023**	**Fire Flow Improvements - Residential Fire Flow**	**TOTAL**	**610 LF**	**8**		
	P-9023	Third Ave.		610 LF	8	2010	
5.15	**P-9029 to P-9030**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**1,434 LF**	**8**		
	P-9029	Eigth St.		1,252 LF	8	2010	
	P-9030	Eigth St.		182 LF	8	2010	
5.16	**P-9031 to P-9033**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**3,169 LF**	**8**		
	P-9031	Quartermaster Ave.		1,966 LF	8	2010	
	P-9032	First Ave.		585 LF	8	2010	
	P-9033	First Ave.		618 LF	8	2010	
5.17	**P-9034, P-9048 to P-9050**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**2,824 LF**	**8 to 10**		
	P-9034	Third Ave.		500 LF	8	2005	
	P-9048	Third Ave.		742 LF	10	2005	
	P-9049	Third St.		1,051 LF	10	2005	
	P-9050	Third St.		531 LF	8	2005	
5.18	**P-9051 to P-9053**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**2,249 LF**	**8**		
	P-9051	Between Fifth Ave. and Sixth Ave.		563 LF	8	2005	
	P-9052	Between Fifth Ave. and Sixth Ave.		1,160 LF	8	2005	
	P-9053	Between Fifth Ave. and Sixth Ave.		526 LF	8	2005	
5.19	**P-9054 to P-9062**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**3,955 LF**	**8**		
	P-9054	Third St.		554 LF	8	2005	
	P-9055	Fifth St.		82 LF	8	2005	
	P-9056	Fifth St.		239 LF	8	2005	
	P-9057	Fifth St.		380 LF	8	2005	
	P-9058	Fifth St.		990 LF	8	2005	
	P-9059	First Ave.		658 LF	8	2005	
	P-9060	First Ave.		312 LF	8	2005	
	P-9061	First Ave.		243 LF	8	2005	
	P-9062	First Ave.		497 LF	8	2005	
5.20	**P-9063 to P-9065**	**Fire Flow Improvements - Commerical Fire Flow**	**TOTAL**	**3,089 LF**	**8**		
	P-9063	Nineth St.		1,618 LF	8	2010	
	P-9064	First Ave.		1,081 LF	8	2010	
	P-9065	Quartermaster Ave.		390 LF	8	2010	

8 SOURCE INFORMATION

The following reports, documents and drawings were used in the development of this master plan investigation as sources of reference data:

- Marina Coast Water District (2001) Marina Coast Water District 2001 Urban Water Management Plan.
- Marina Coast Water District (2001) Customer Database: 2001 Water Meter Readings
- Marina Coast Water District (2001) AutoCAD & GIS facility files & aerial photographs
- Marina Coast Water District (1996) Utility Service Proposal for the Former Fort Ord Area
- Marina Coast Water District (2001) Fort Ord Water/Wastewater Systems: Proposed Operating Expenses, CIP and Charge Rates for FY 2001-2002, Marina, California.
- Marina Coast Water District (In Progress) Technical, Managerial and Financial Capacity Assessment for Change of Ownership of Community Public Works Systems, Marina,
- Marina Coast Water District (2001) Emergency Response Plan for the Former Ft. Ord, Marina, California.
- Bestor Engineers, Schaaf & Wheeler, Fugro West (1995) Preliminary Design Report: Infrastructure Improvements
- Fort Ord Reuse Authority (1997) Fort Ord Reuse Plan
- Fort Ord Reuse Authority (2001) Annual Report CY 200-2001. Marina, CA.
- Fort Ord Reuse Infrastructure Study (1994) Fort Ord Water Systems Library, kept by Schaaf and Wheeler

- FORA (2001) Capital Improvement Program (CIP) FY 2001 to 2021

- Boone, Cook and Assoc. (U) Department of the Army-Sacramento District Corps of Engineers- Final Report Water Distribution System Study. Fort Ord, California

- California-American Water Company (1998) Report on Presidio of Monterey (POM) Water Distribution System

- Westin (1997) Fort Ord Water SCADA System: Communications & Control System Block Diagram

- Schaaf & Wheeler (1999) MCWD Public Benefit Conveyance Application App C: Fort Ord Military Reservation Water Facilities Drawings

- Stone & Youngberg LLC (1997) Financial Feasibility Analysis for the Fort Ord Water System, San Francisco, California.

- California State University Monterey Bay (received 2002) CSUMB RFP Cad and GIS files.

- Lee & Associates (1993) Project No. By-00019-3J Fort Ord Water System Study-Fort Ord, California

- Bissell & Karn (1993) Forensic Engineering Study-Well D Replacement, Fort Ord, California

- Dean S. Kingman, Consulting Engineers (1964) Operation and Maintenance Manual Water Supply and Distribution System- Fort Ord, California

- US Department of the Army (1990) Water Permit No. 02-90-013: Serving Fort Ord and the Vicinity Monterey County

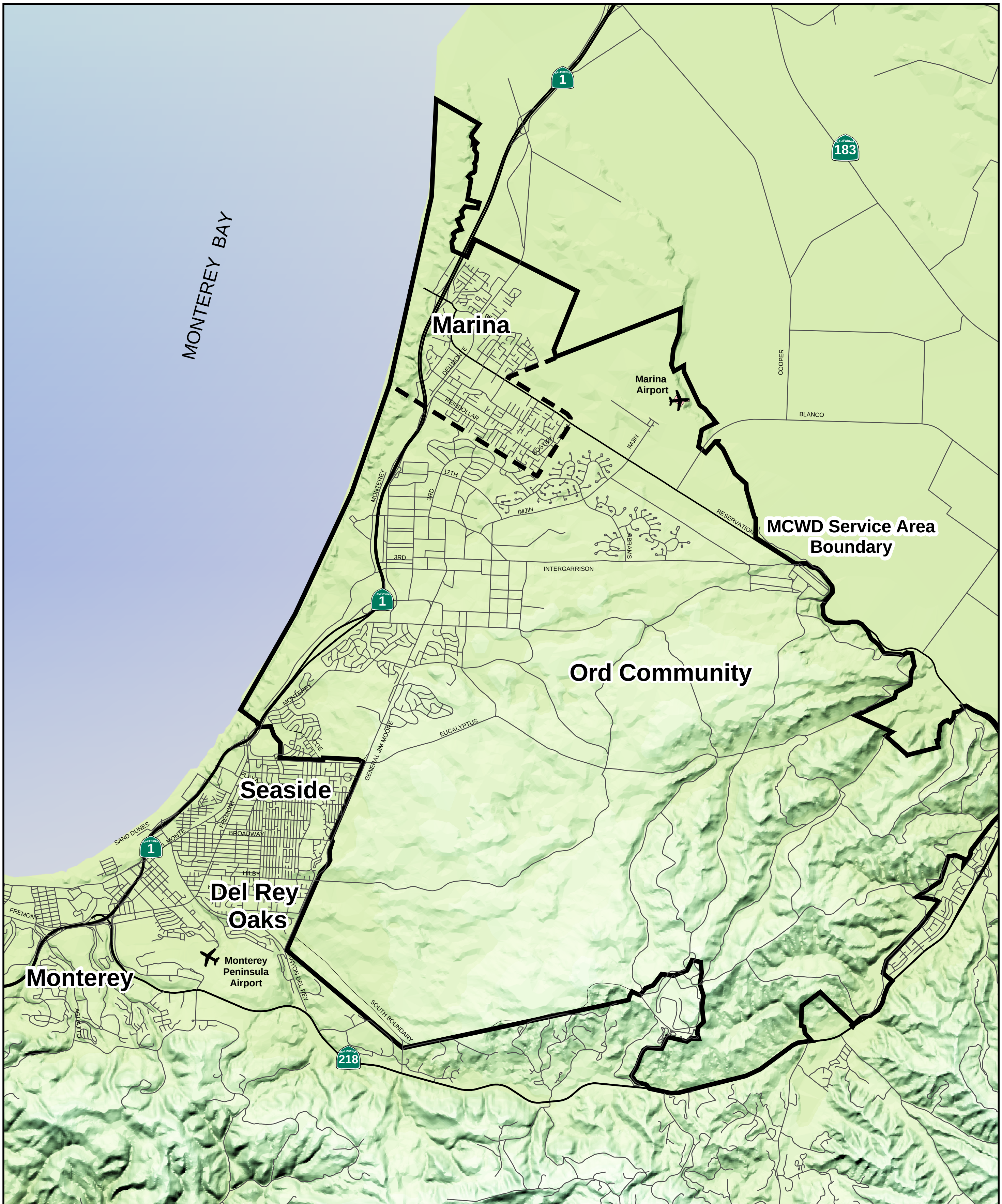
- Fort Ord Reuse Authority (1998) Water/Wastewater Facilities Agreement
- Water Resources Agency (1993) Agreement between MCWRA, and the USA for the annexation of Fort Ord into Zones 2,2A of the MCWRA
- City of Marina (2001) City of Marina General Plan: Draft Urban Growth Boundary Edition
- City of Monterey (1992) General Plan
- Monterey County Planning Commission (1982) Monterey County General Plan
- Marina Coast Water District Code

MCWD
Water Distribution System Master Plan

Project Location Map
Ord Community
Figure 1

June 2004

50 0 50 100 Miles



MCWD Water Distribution System Master Plan

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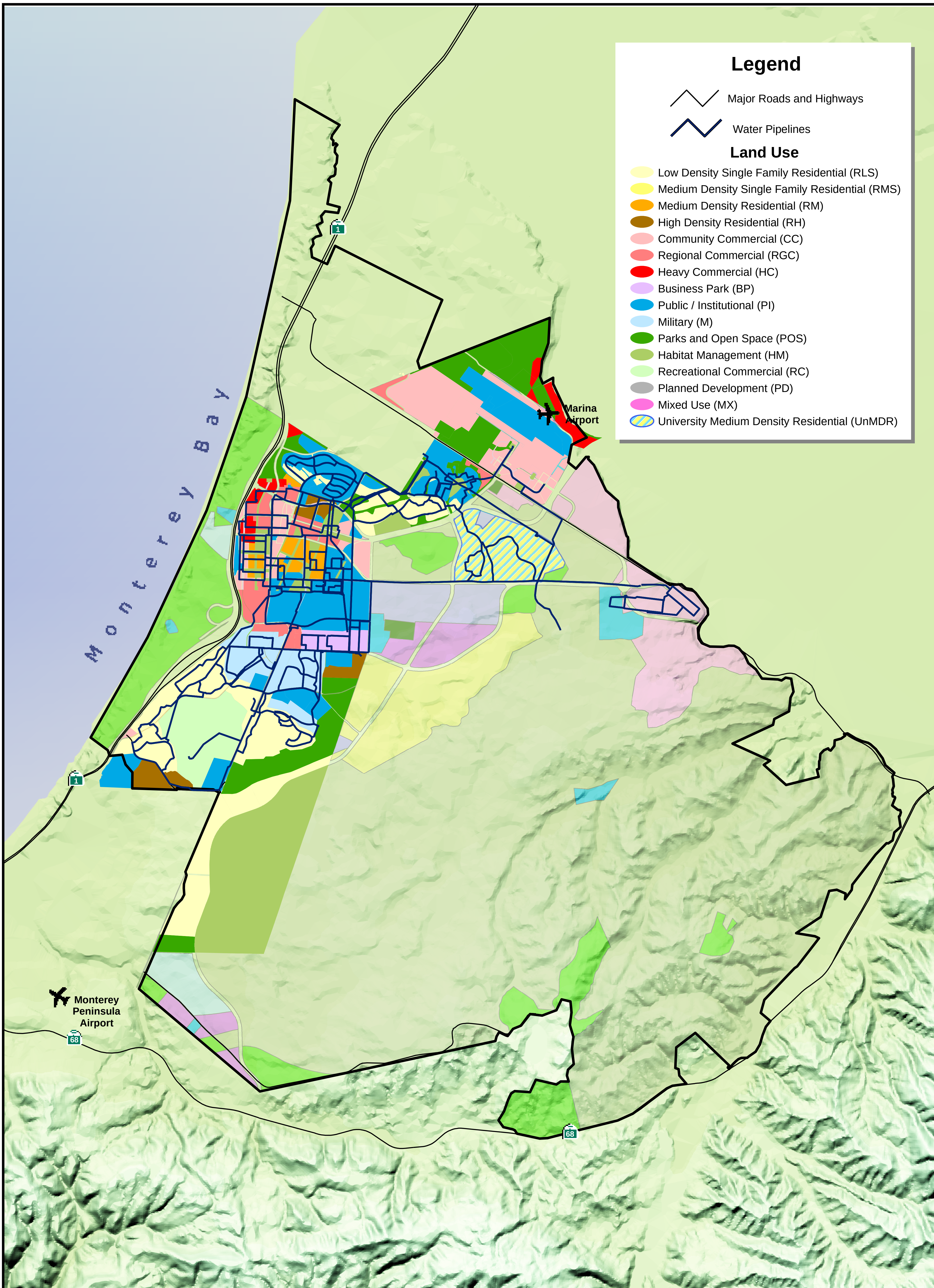
N S E W

0 2,375 4,750 9,500 14,250 19,000 Feet

Project Vicinity Map
Figure 2

June 2004

JN: 35100175 Vicinity Map.mdx



MCWD
Water Distribution System Master Plan

Land Use Map
Figure 3

June 2004

5,000 2,500 0 5,000
Feet

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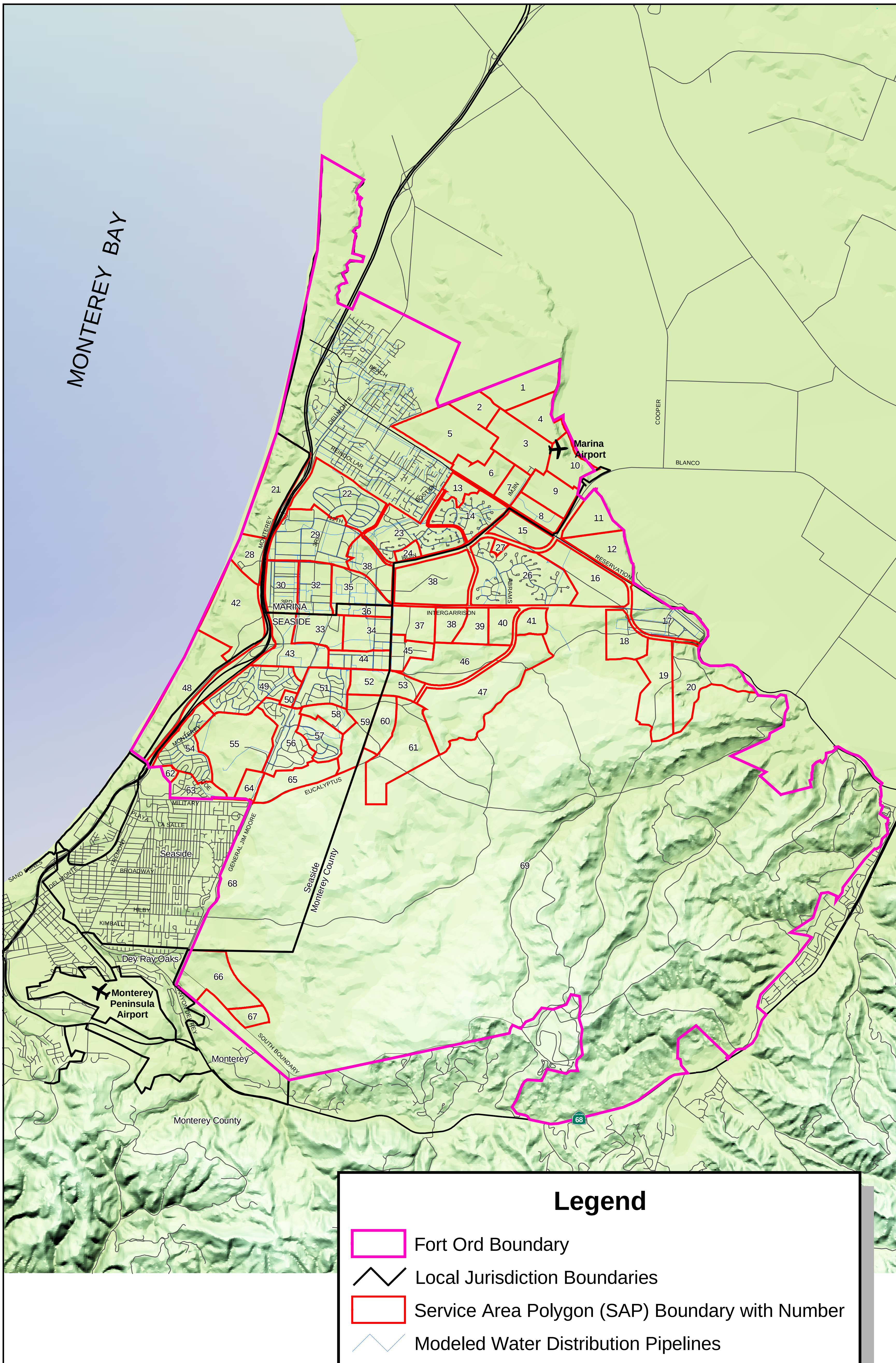
M:\Mdata\35100175\35100175\GIS\Fig3.mxd - JA/SPL 6/16/04



MARINA COAST WATER DISTRICT

MCWD Water Distribution System Master Plan

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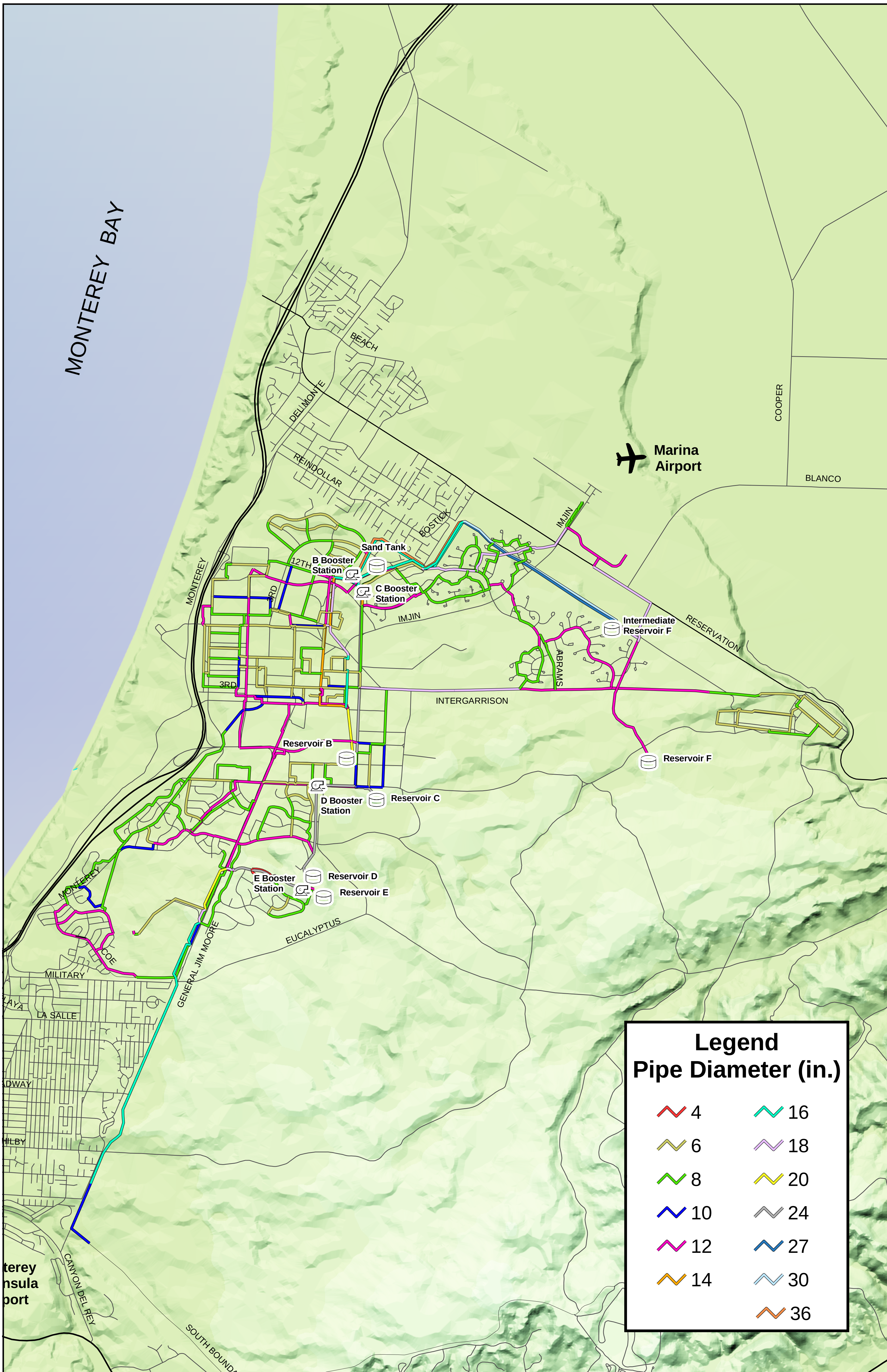
Service Area Polygon (SAP) Map
Figure 4
June 2004

JN: 35100175 Sap Map.mdx



MCWD Water Distribution System Master Plan

Modeled Water Facilities Map
Figure 5

June 2004

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Scale 1"=4,000'

JN: 35100175 Facilities Map.mdx

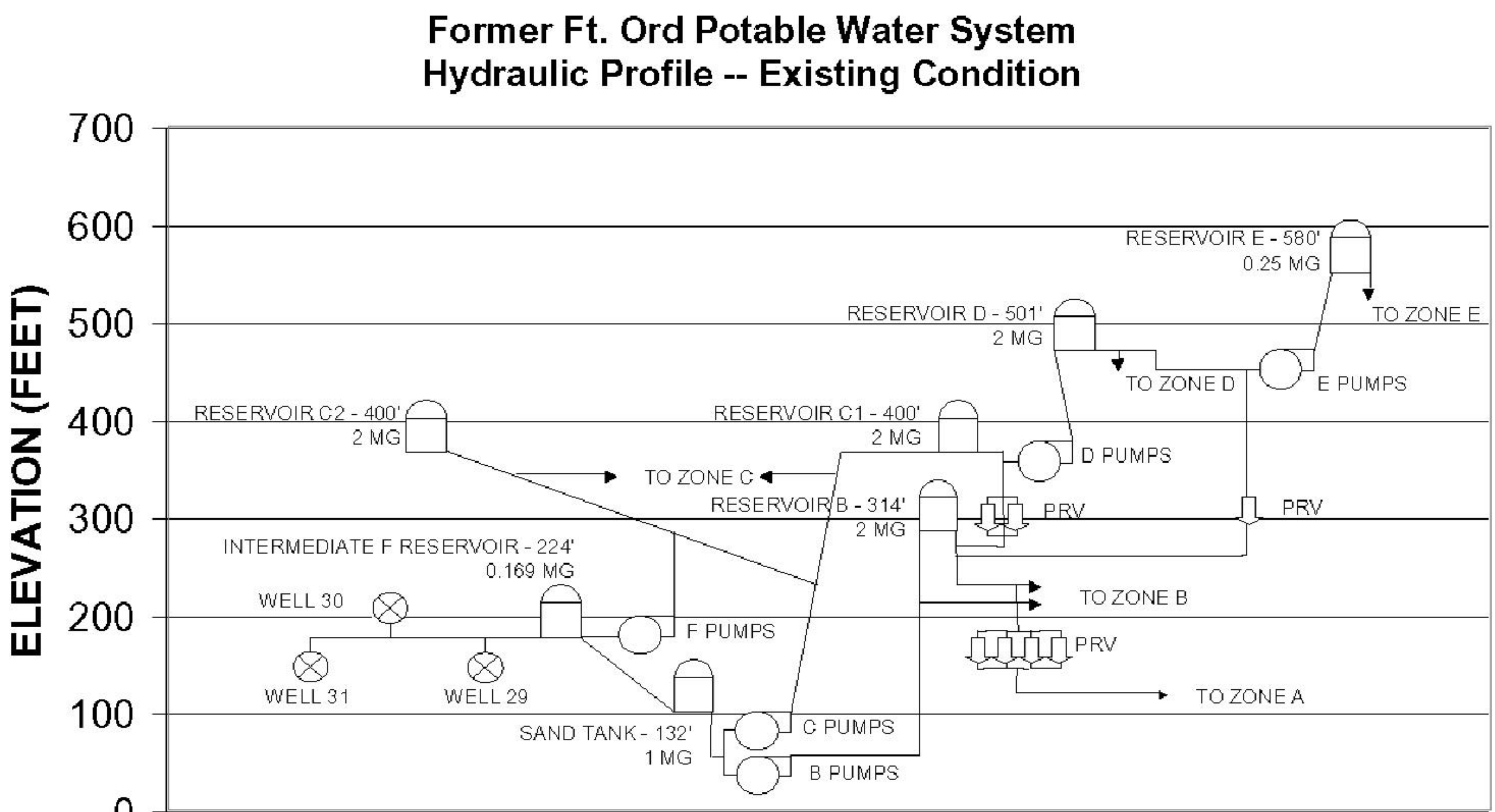

FIGURE 6

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MAIN BOOSTER RELOCATION PRELIMINARY ALTERNATIVE 1

ABANDON MAIN BOOSTER
STATION AND SAND TANK

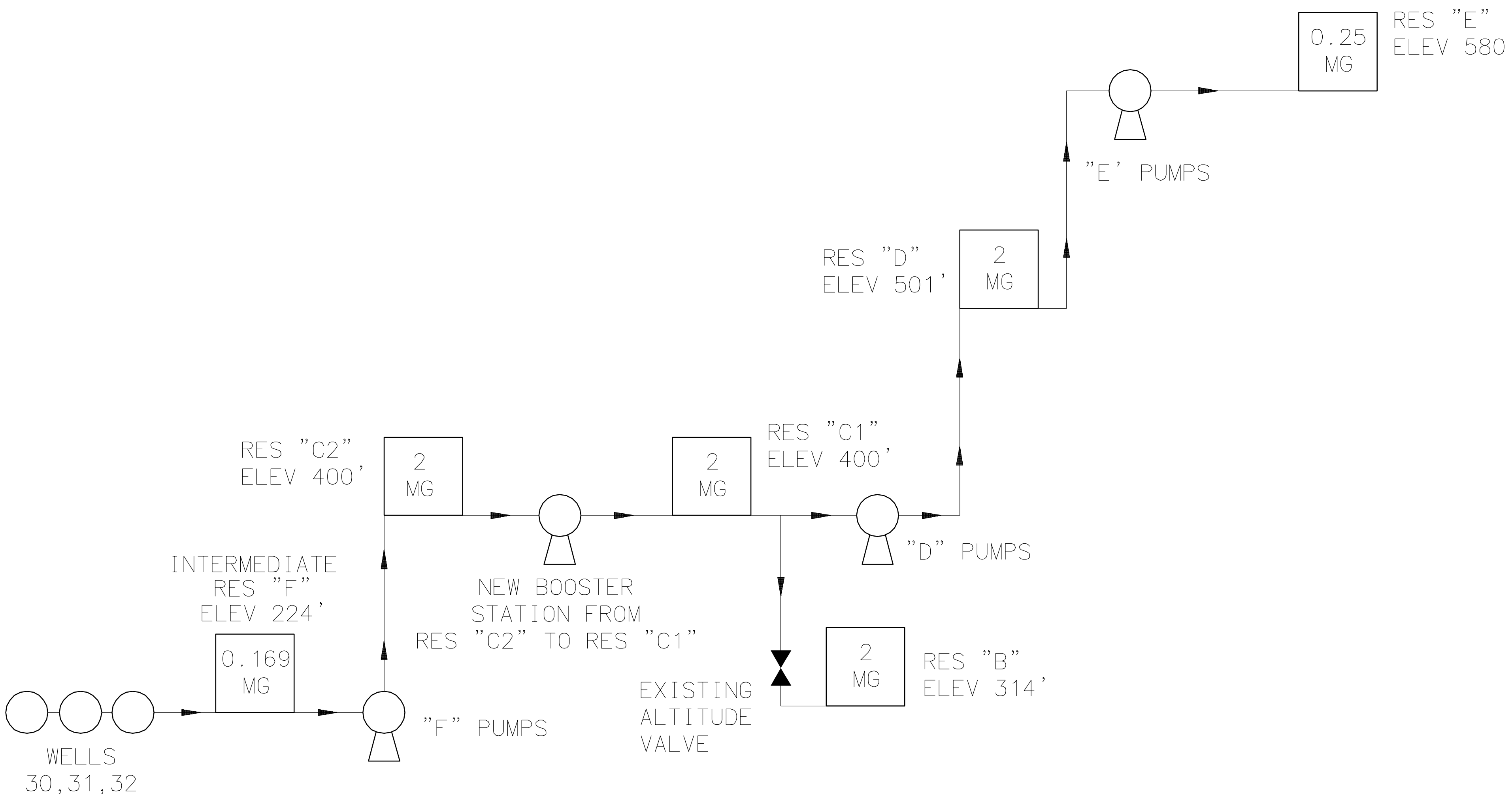

FIGURE 7

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MAIN BOOSTER RELOCATION PRELIMINARY ALTERNATIVE 2

ABANDON MAIN BOOSTER
STATION AND SAND TANK

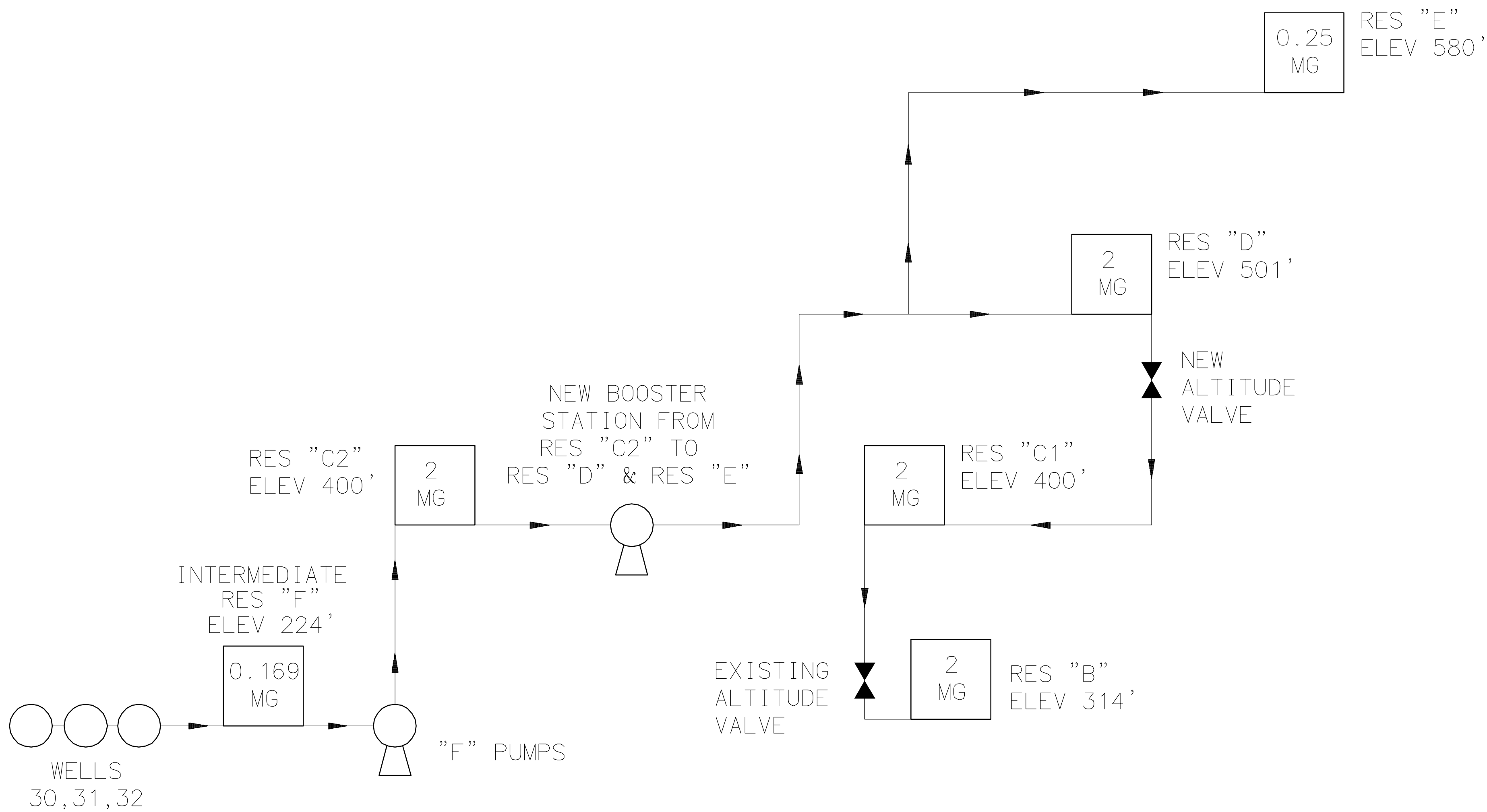

FIGURE 8

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MAIN BOOSTER RELOCATION PRELIMINARY ALTERNATIVE 3

ABANDON MAIN BOOSTER
STATION AND SAND TANK

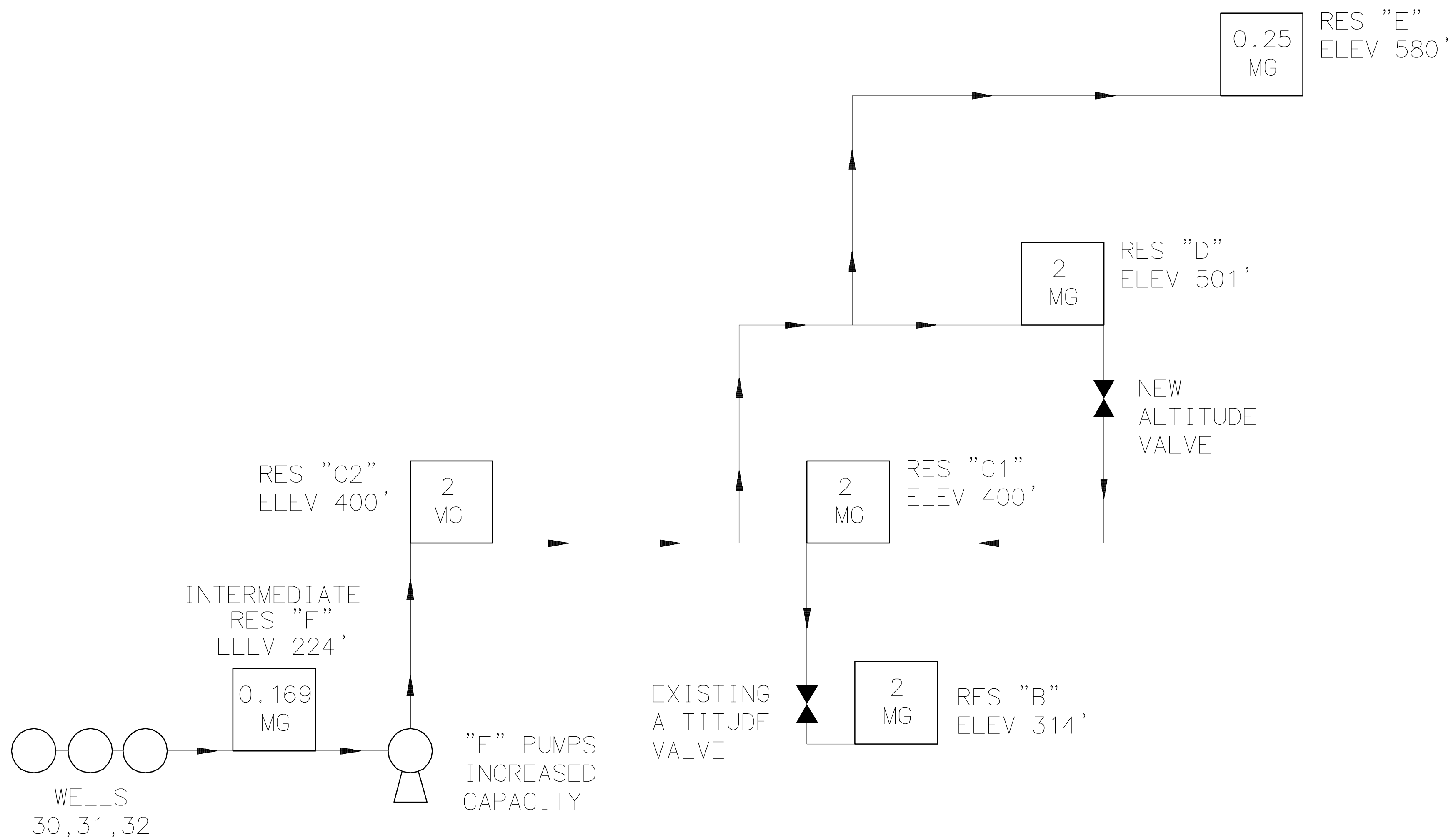

FIGURE 9

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MAIN BOOSTER RELOCATION PRELIMINARY ALTERNATIVE 4

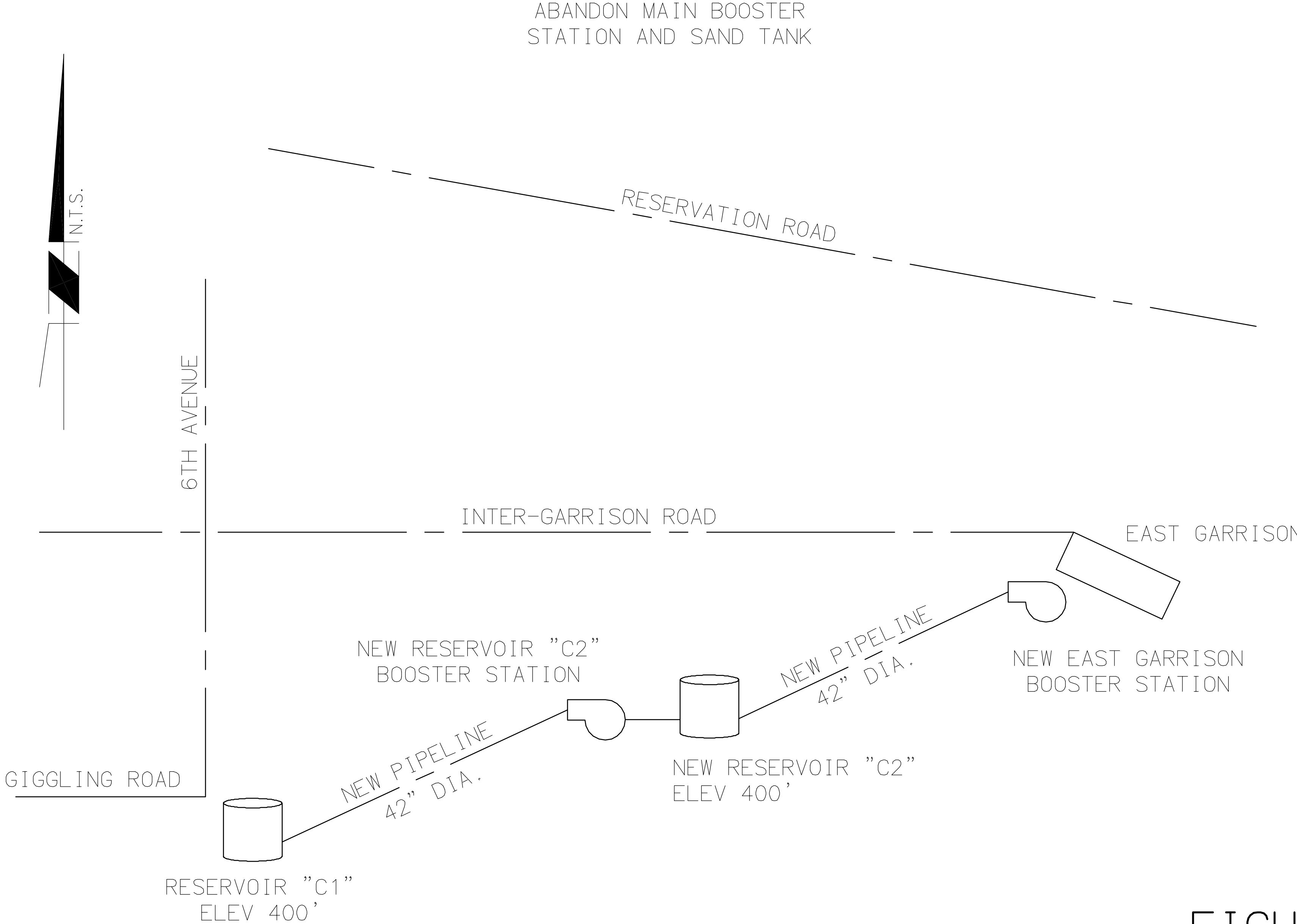

FIGURE 10

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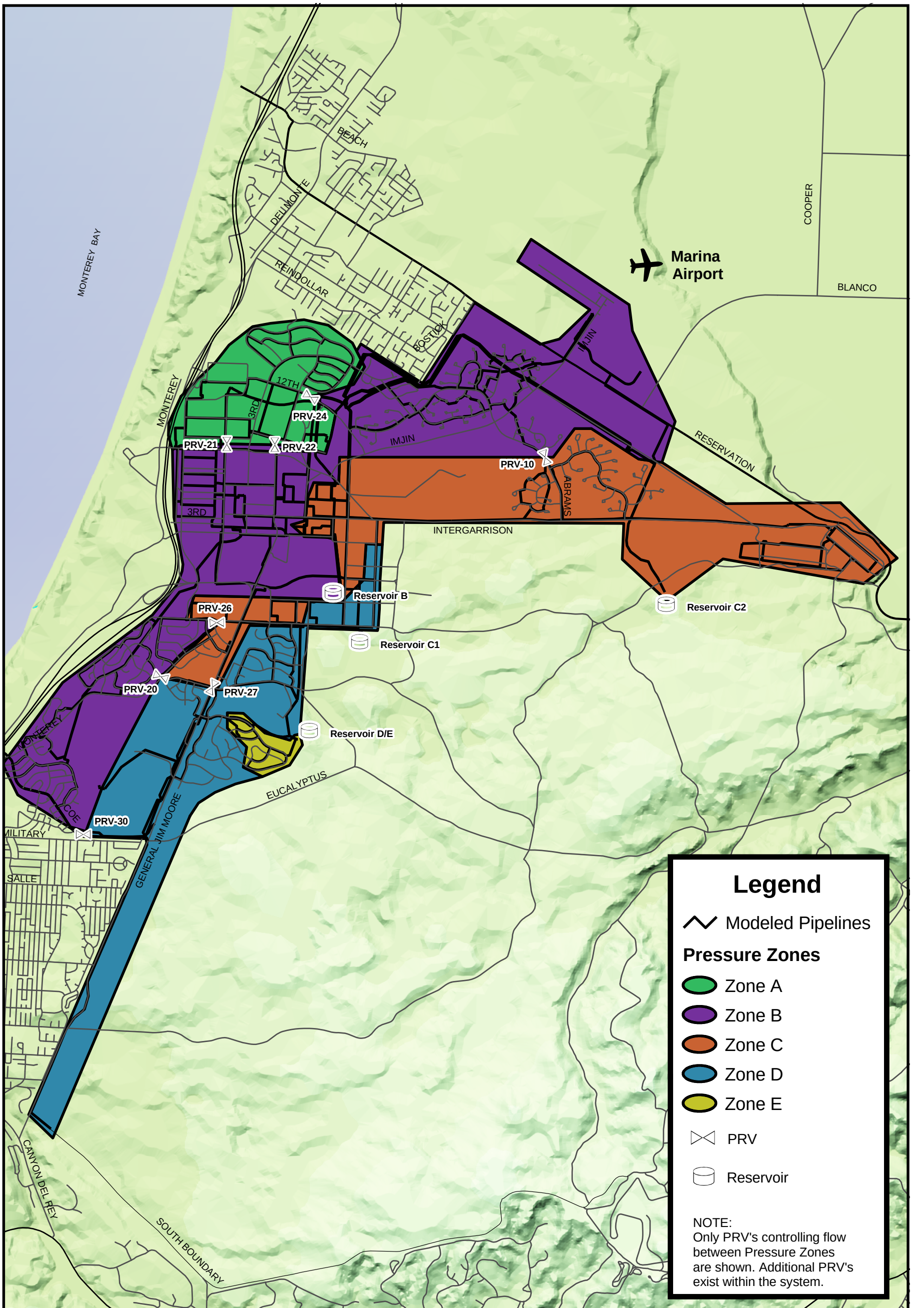

MCWD Water Distribution System Master Plan

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N
W E
S

Scale 1"=3,500

Pressure Zone Map
Figure 11

June 2004

JN: 35100175 Pressure Zone Map.mdx

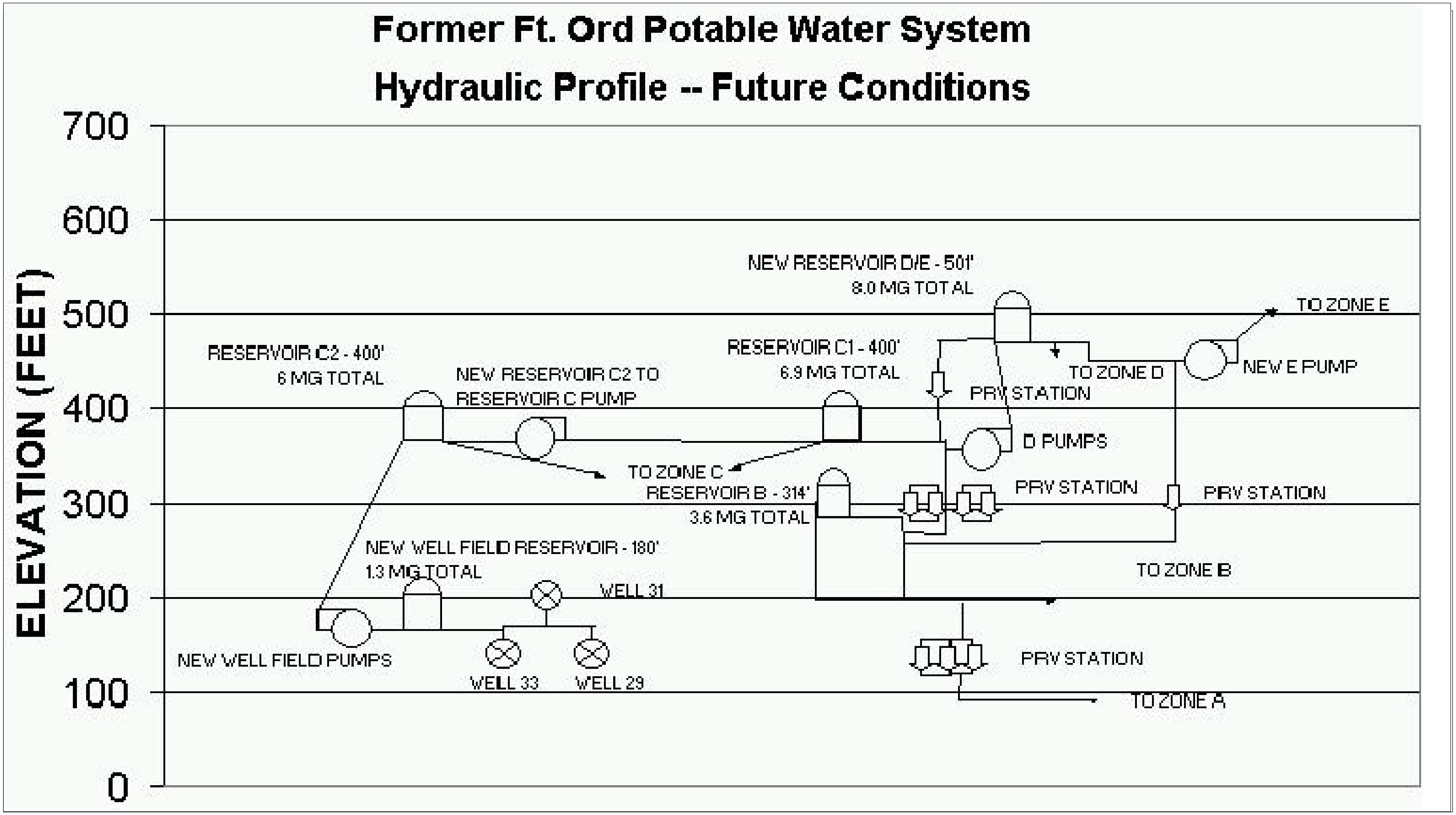

FIGURE 12

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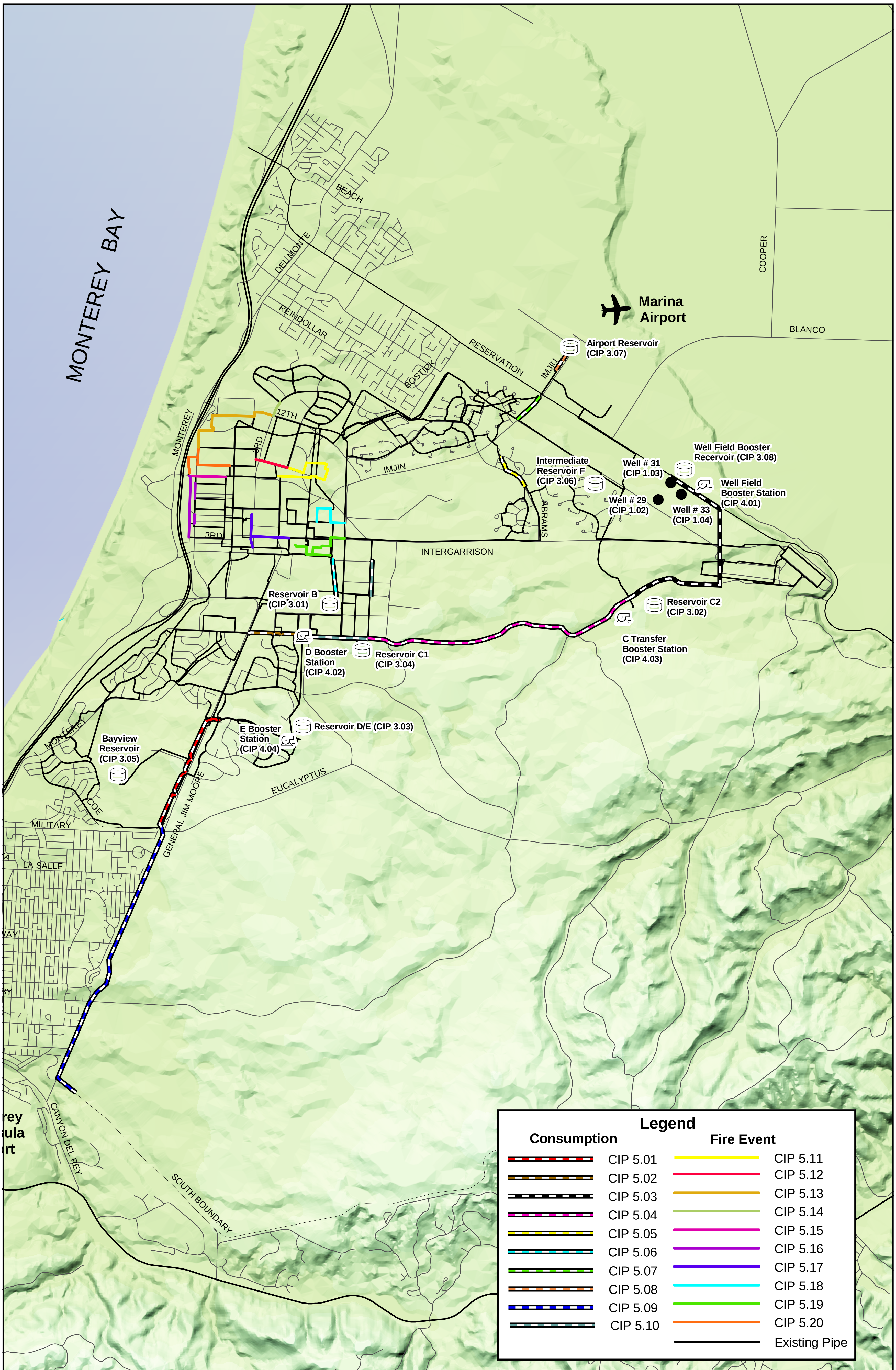

MARINA COAST WATER DISTRICT

MCWD Water Distribution System Master Plan

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N W E S

Scale 1"=4,000'

Capital Improvement Program (CIP) Map
Figure 13

June 2004

JN: 35100175 CIP Map.mdx

APPENDIX A
FACILITY EVALUATION PHOTOGRAPHS


Reservoir "B"


Reservoir "B"


Reservoir "B"


Reservoir "B"

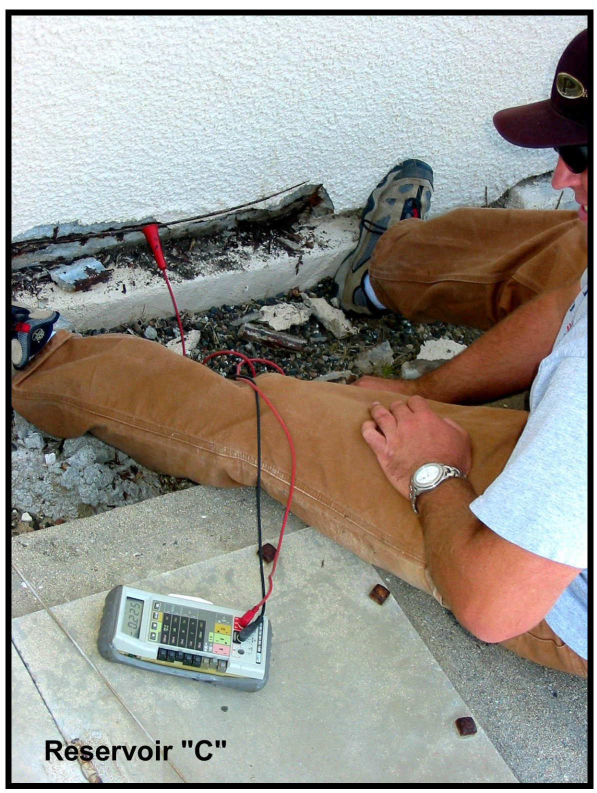

Reservoir "C"


Reservoir "C"


Reservoir "C"


Reservoir "C"


Reservoir "C"


Reservoir "C"


Reservoir "D"

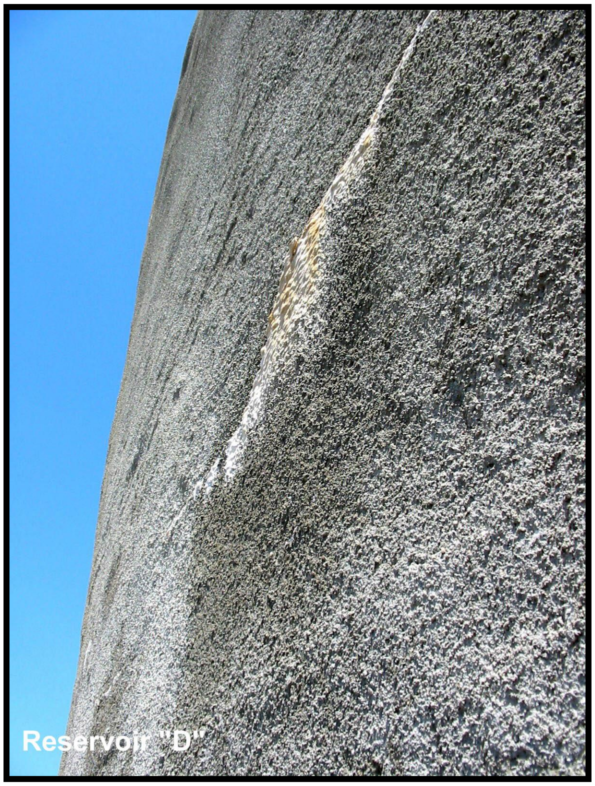

Reservoir "D"


Reservoir "D"


Reservoir "D"


Reservoir "D"


Reservoir "D"


Reservoir "D"


Reservoir "D"


Reservoir "D"


Reservoir "D"


Reservoir "F"


Reservoir "F"


Reservoir "E"

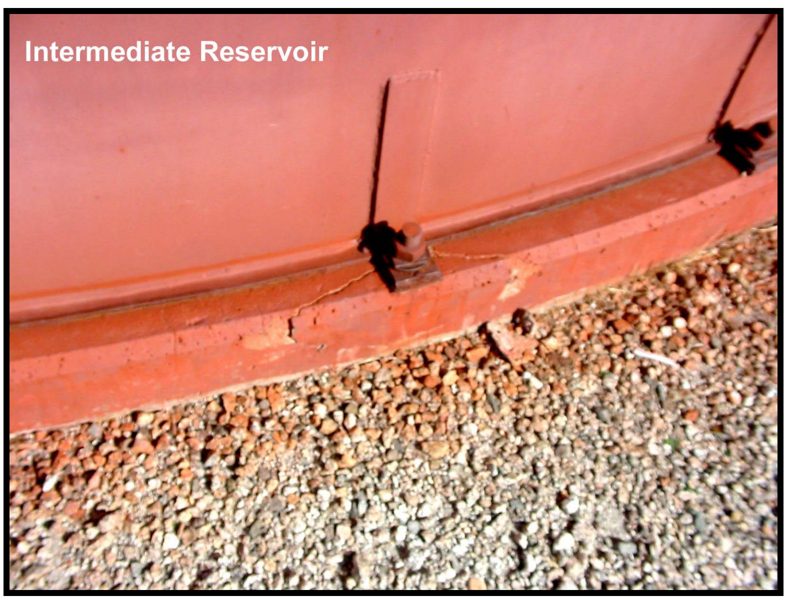

Reservoir "E"


Reservoir "E"


Bayview Reservoir

Bayview Reservoir


Intermediate Reservoir


Intermediate Reservoir


Airport Reservoir


Airport Reservoir

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9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
2520 E. Sunset Rd., Suite 3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

CHAIN OF CUSTODY FORM

Page ______ of ______

Client Name/Address: RBF – Temecula Office	Project/PO Number: FORA samples MCWD
Project Manager: John R. Barnes	Phone Number: (909) 676 8042
Sampler: Harry J. Kippos	Fax Number: (909) 676 7240

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	lead	chromium	zinc	chlorides	Fe (iron)	sulfates					Special Instructions
paint, Zone E elevated Tank	chips	bag		10/30	9	none											
Reservoir 2 Bayer Moore Tank				10/30	9:30												
Airfield Elevated Tank				10/30	10												
BayView Tank (golf course)				10/30	10:30												
Intermediate Tank				10/30	11:00												
Boyer Tank 1969				10/30	11:30												
Reservoir "C" external deposit	Scale	bag		10/29	2:30												

Relinquished By:	Date /Time:	Received by:	Date /Time:	Turnaround Time: (Check)
Harry J. Kippos	11/1 8:30AM			same day ______ 72 hours ______
Relinquished By:	Date /Time:	Received by:	Date /Time:	24 hours ______ 5 days ______ 48 hours ______ normal ✓
Relinquished By:	Date /Time:	Received in Lab by: Edith Aceves	Date /Time: 11/1/02 8:30	Sample Integrity: (Check) intact ✓ on ice RT

Note: By relinquishing samples to Del Mar Analytical, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

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LABORATORY REPORT

Prepared For: RBF & Associates-Temecula
27555 Ynez Road, Suite 400
Temecula, CA 92591
Attention: John Barnes

Project: FORA Samples MCWD

Sampled: 10/29/02-10/30/02
Received: 11/01/02
Issued: 11/13/02

CA ELAP Certificate #1197

AZ DHS License #AZ0428

SAMPLE CROSS REFERENCE

LABORATORY ID	CLIENT ID	MATRIX
ILK0029-01	Paint, Zone E elevated Tank	Solid
ILK0029-02	Paint, Reservoir Z Royce Moore Tank	Solid
ILK0029-03	Paint, Airfield Elevated Tank	Solid
ILK0029-04	Paint, Bayview Tank (Golf Course)	Solid
ILK0029-05	Paint, Intermediate Tank	Solid
ILK0029-06	Paint, Boyer Tank 1969	Solid
ILK0029-07	Reservoir "C" external deposit	Solid

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Rachel Parker
Project Manager

ILK0029 *<Page 1 of 7>*

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RBF & Associates-Temecula
27555 Ynez Road, Suite 400
Temecula, CA 92591
Attention: John Barnes

Project ID: FORA Samples MCWD

Report Number: ILK0029

Sampled: 10/29/02-10/30/02
Received: 11/01/02

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			mg/kg	mg/kg				
Sample ID: ILK0029-01 (Paint, Zone E elevated Tank - Solid)			**Sampled: 10/30/02**					
Chromium	EPA 6010B	I2K0759	20	**1400**	19.9	11/7/2002	11/8/2002	
Lead	EPA 6010B	I2K0759	40	**2000**	19.9	11/7/2002	11/8/2002	
Zinc	EPA 6010B	I2K0759	99	**1700**	19.9	11/7/2002	11/8/2002	
Sample ID: ILK0029-02 (Paint, Reservoir Z Royce Moore Tank - Solid)			**Sampled: 10/30/02**					
Chromium	EPA 6010B	I2K0759	14	**210**	14.3	11/7/2002	11/7/2002	
Lead	EPA 6010B	I2K0759	29	**2600**	14.3	11/7/2002	11/7/2002	
Zinc	EPA 6010B	I2K0759	71	ND	14.3	11/7/2002	11/7/2002	RL-4
Sample ID: ILK0029-03 (Paint, Airfield Elevated Tank - Solid)			**Sampled: 10/30/02**					
Chromium	EPA 6010B	I2K0759	39	**12000**	38.6	11/7/2002	11/7/2002	
Lead	EPA 6010B	I2K0759	1500	**490000**	772	11/7/2002	11/8/2002	
Zinc	EPA 6010B	I2K0759	190	ND	38.6	11/7/2002	11/7/2002	RL-4
Sample ID: ILK0029-04 (Paint, Bayview Tank (Golf Course) - Solid)			**Sampled: 10/30/02**					
Chromium	EPA 6010B	I2K0759	18	**950**	18.5	11/7/2002	11/7/2002	
Lead	EPA 6010B	I2K0759	37	**1100**	18.5	11/7/2002	11/7/2002	
Zinc	EPA 6010B	I2K0759	92	**1900**	18.5	11/7/2002	11/7/2002	
Sample ID: ILK0029-05 (Paint, Intermediate Tank - Solid)			**Sampled: 10/30/02**					
Chromium	EPA 6010B	I2K0759	32	ND	32.3	11/7/2002	11/7/2002	RL-4
Lead	EPA 6010B	I2K0759	65	**73**	32.3	11/7/2002	11/7/2002	
Zinc	EPA 6010B	I2K0759	160	ND	32.3	11/7/2002	11/7/2002	RL-4

Del Mar Analytical, Irvine
Rachel Parker
Project Manager

RBF CONSULTING

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9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
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RBF & Associates-Temecula
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Temecula, CA 92591
Attention: John Barnes

Project ID: FORA Samples MCWD

Report Number: ILK0029

Sampled: 10/29/02-10/30/02
Received: 11/01/02

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			mg/kg	mg/kg				
Sample ID: ILK0029-06 (Paint, Boyer Tank 1969 - Solid)			**Sampled: 10/30/02**					
Chromium	EPA 6010B	I2K0759	140	**3100**	141	11/7/2002	11/8/2002	
Lead	EPA 6010B	I2K0759	280	**750**	141	11/7/2002	11/8/2002	
Zinc	EPA 6010B	I2K0759	1400	**190000**	282	11/7/2002	11/8/2002	
Sample ID: ILK0029-07 (Reservoir "C" external deposit - Solid)			**Sampled: 10/29/02**					
Iron	EPA 6010B	I2K0759	25	**360**	5	11/7/2002	11/8/2002	

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Rachel Parker
Project Manager

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RBF & Associates-Temecula
27555 Ynez Road, Suite 400
Temecula, CA 92591
Attention: John Barnes

Project ID: FORA Samples MCWD

Report Number: ILK0029

Sampled: 10/29/02-10/30/02
Received: 11/01/02

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			%	%				
Sample ID: ILK0029-07 (Reservoir "C" external deposit - Solid)				**Sampled: 10/29/02**				
Soluble Sulfate	EPA 300.0	I2K0557	0.00050	**0.0031**	1	11/5/2002	11/5/2002	
			mg/kg	mg/kg				
Sample ID: ILK0029-07 (Reservoir "C" external deposit - Solid)				**Sampled: 10/29/02**				
Chloride	EPA 300.0	I2K0557	5.0	**150**	1	11/5/2002	11/5/2002	

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Sampled: 10/29/02-10/30/02
Received: 11/01/02

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I2K0759 Extracted: 11/07/02										
Blank Analyzed: 11/07/02 (I2K0759-BLK1)										
Chromium	ND	1.0	mg/kg							
Iron	ND	5.0	mg/kg							
Lead	ND	2.0	mg/kg							
Zinc	ND	5.0	mg/kg							
LCS Analyzed: 11/07/02 (I2K0759-BS1)										
Chromium	46.3	1.0	mg/kg	50.0		93	80-120			
Iron	47.4	5.0	mg/kg	50.0		95	80-120			
Lead	46.1	2.0	mg/kg	50.0		92	80-120			
Zinc	45.2	5.0	mg/kg	50.0		90	80-120			
Matrix Spike Analyzed: 11/07/02 (I2K0759-MS1)					**Source: ILK0054-06**					
Chromium	61.4	1.0	mg/kg	50.0	12	99	75-125			
Iron	12100	5.0	mg/kg	50.0	10000	4200	75-125			*M-HA*
Lead	49.8	2.0	mg/kg	50.0	3.2	93	75-125			
Zinc	74.1	5.0	mg/kg	50.0	31	86	75-125			
Matrix Spike Dup Analyzed: 11/07/02 (I2K0759-MSD1)					**Source: ILK0054-06**					
Chromium	59.8	1.0	mg/kg	50.0	12	96	75-125	3	20	
Iron	11700	5.0	mg/kg	50.0	10000	3400	75-125	3	20	*M-HA*
Lead	48.4	2.0	mg/kg	50.0	3.2	90	75-125	3	20	
Zinc	73.1	5.0	mg/kg	50.0	31	84	75-125	1	20	

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Project ID: FORA Samples MCWD

Report Number: ILK0029

Sampled: 10/29/02-10/30/02
Received: 11/01/02

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I2K0557 Extracted: 11/05/02										
Blank Analyzed: 11/05/02 (I2K0557-BLK1)										
Soluble Sulfate	ND	0.00050	%							
Chloride	ND	5.0	mg/kg							
LCS Analyzed: 11/05/02 (I2K0557-BS1)										
Soluble Sulfate	0.0103	0.00050	%	0.0100		103	90-110			
Chloride	49.1	5.0	mg/kg	50.0		98	90-110			
Matrix Spike Analyzed: 11/05/02 (I2K0557-MS1)					**Source: ILK0165-05**					
Soluble Sulfate	0.0112	0.00050	%	0.0100	0.0010	102	80-120			
Chloride	58.5	5.0	mg/kg	50.0	11	95	80-120			
Matrix Spike Dup Analyzed: 11/05/02 (I2K0557-MSD1)					**Source: ILK0165-05**					
Soluble Sulfate	0.0110	0.00050	%	0.0100	0.0010	100	80-120	2	20	
Chloride	57.5	5.0	mg/kg	50.0	11	93	80-120	2	20	

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Attention: John Barnes

Project ID: FORA Samples MCWD

Report Number: ILK0029

Sampled: 10/29/02-10/30/02
Received: 11/01/02

DATA QUALIFIERS AND DEFINITIONS

M-HA Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).

RL-4 Reporting limit raised due to insufficient sample volume.

ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.

RPD Relative Percent Difference

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APPENDIX B
HYDRAULIC MODEL INPUT AND OUTPUT DATA

APPENDIX C
ENERGY EVALUATION

PROJECT: Ord Community Water Distribution System Master Plan
SHEET NO: 1 of 7
DESCRIPTION: Energy Evaluation

PGE Rates	Summer Period (May 1 - Oct 31) $/Kwh	Time Frame	hrs	Winter Period (Nov 1 - Apr 30) $/Kwh	Time Frame	hrs	Days Applicable
Peak	0.11064	Noon - 6:00pm	6	0.11064	NA		Weekdays except holidays
Partial Peak	0.05551	8:30am-Noon 6:00pm-9:30pm	3.5 3.5	0.05551	8:30am-9:30pm	13	Weekdays except holidays Weekdays except holidays
Off Peak	0.04551	9:30pm-8:30am 12:00am-12:00a	11 24	0.04551	9:30pm-8:30am 12:00am-12:00am	11 24	Weekdays except holidays Weekends and holidays
Base Rate	0.0812	Added to all Time Frames					

24 hour

Summer Weekday	3.502	$/Kwday
Summer Weekend/Holiday	3.041	$/Kwday
Winter Weekday	3.171	$/Kwday
Winter Weekend/Holiday	3.041	$/Kwday

16 hour

Summer Weekday	2.077	$/Kwday
Summer Weekend/Holiday	2.027	$/Kwday
Winter Weekday	2.077	$/Kwday
Winter Weekend/Holiday	2.027	$/Kwday

18 hour

Summer Weekday	2.351	$/Kwday
Summer Weekend/Holiday	2.281	$/Kwday
Winter Weekday	2.351	$/Kwday
Winter Weekend/Holiday	2.281	$/Kwday

PROJECT: Ord Community Water Distribution System Master Plan
SHEET NO: 2 of 7
DESCRIPTION: Energy Evaluation

Period	Total Days	Weekday	Weekend/Holiday
Summer (June, July, Aug, Sept)	122	88	34
5 max day per week	87	63	24
2 avg day per week	35	25	10
Spring/Fall (May, Oct)[1]	62	42	20
3 max day per week	27	18	9
4 avg day per week	35	24	11
Spring/Fall (Mar, Apr, Nov)[2]	91	67	24
3 max day per week	39	29	10
4 avg day per week	52	38	14
Winter (Dec, Jan, Feb)	90	64	26
0 max day per week	0	0	0
7 avg day per week	90	64	26
Subtotal	**365**	**261**	**104**

[1] Corresponds to PG&E summer rate schedule
[2] Corresponds to PG&E winter rate schedule

PROJECT: Ord Community Water Distribution System Master Plan

SHEET NO: 3 of 7

DESCRIPTION: Energy Evaluation

$/yr = hrs/yr*$/Kwh*kw

1kw = 0.7457 hp

24 hr Period

Year	24hr Avg Day (gpm)	24hr Max Day (gpm)	Static Head (ft)	Pump Efficiency	24hr Avg Day (hp)	24hr Max Day (hp)	24hr Avg Day (kw)	24hr Max Day (kw)
2004	933	1,867	210	0.7	71	142	53	106
2005	3,600	7,200	210	0.7	273	546	204	407
2010	5,267	10,533	210	0.7	399	799	298	596
2015	6,933	13,867	210	0.7	526	1052	392	784

16 hr Period

Year	16hr Avg Day (gpm)	16hr Max Day (gpm)	Static Head (ft)	Pump Efficiency	16hr Avg Day (hp)	16hr Max Day (hp)	16hr Avg Day (kw)	16hr Max Day (kw)
2004	1,400	2800	210	0.7	106	212	79	158
2005	5,400	10800	210	0.7	410	819	305	611
2010	7,900	15800	210	0.7	599	1198	447	893
2015	10,400	20800	210	0.7	789	1577	588	1176

18 hr Period

Year	16hr Avg Day (gpm)	16hr Max Day (gpm)	Static Head (ft)	Pump Efficiency	16hr Avg Day (hp)	16hr Max Day (hp)	16hr Avg Day (kw)	16hr Max Day (kw)
2004	1,244	2489	210	0.7	94	189	70	141
2005	4,800	9600	210	0.7	364	728	271	543
2010	7,022	14044	210	0.7	533	1065	397	794
2015	9,244	18489	210	0.7	701	1402	523	1046

PROJECT: Ord Community Water Distribution System Master Plan
SHEET NO: 4 of 7
DESCRIPTION: Energy Evaluation

24 Period $/yr = day/yr*$/Kwd*Kw

Year 2004		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	3.50182	24	3.04104	106	$ 31,031
	Summer avg days	25	3.50182	10	3.04104	53	$ 6,206
	Spring/Fall[1] max days	18	3.50182	9	3.04104	106	$ 9,405
	Spring/Fall[1] avg days	24	3.50182	11	3.04104	53	$ 6,270
	Spring/Fall[2] max days	29	3.17104	10	3.04104	106	$ 12,913
	Spring/Fall[2] avg days	38	3.17104	14	3.04104	53	$ 8,609
	Winter max days	0	3.17104	0	3.04104	106	$ -
	Winter avg days	64	3.17104	26	3.04104	53	$ 14,885
	TOTAL	**261**		**104**			**$ 89,319**

Year 2005		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	3.50182	24	3.04104	407	$ 119,691
	Summer avg days	25	3.50182	10	3.04104	204	$ 23,938
	Spring/Fall[1] max days	18	3.50182	9	3.04104	407	$ 36,277
	Spring/Fall[1] avg days	24	3.50182	11	3.04104	204	$ 24,185
	Spring/Fall[2] max days	29	3.17104	10	3.04104	407	$ 49,809
	Spring/Fall[2] avg days	38	3.17104	14	3.04104	204	$ 33,206
	Winter max days	0	3.17104	0	3.04104	407	$ -
	Winter avg days	64	3.17104	26	3.04104	204	$ 57,412
	TOTAL	**261**		**104**			**$ 344,518**

Year 2010		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	3.50182	24	3.04104	596	$ 175,104
	Summer avg days	25	3.50182	10	3.04104	298	$ 35,021
	Spring/Fall[1] max days	18	3.50182	9	3.04104	596	$ 53,072
	Spring/Fall[1] avg days	24	3.50182	11	3.04104	298	$ 35,381
	Spring/Fall[2] max days	29	3.17104	10	3.04104	596	$ 72,869
	Spring/Fall[2] avg days	38	3.17104	14	3.04104	298	$ 48,579
	Winter max days	0	3.17104	0	3.04104	596	$ -
	Winter avg days	64	3.17104	26	3.04104	298	$ 83,991
	TOTAL	**261**		**104**			**$ 504,017**

Year 2015		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	3.50182	24	3.04104	784	$ 230,516
	Summer avg days	25	3.50182	10	3.04104	392	$ 46,103
	Spring/Fall[1] max days	18	3.50182	9	3.04104	784	$ 69,867
	Spring/Fall[1] avg days	24	3.50182	11	3.04104	392	$ 46,578
	Spring/Fall[2] max days	29	3.17104	10	3.04104	784	$ 95,928
	Spring/Fall[2] avg days	38	3.17104	14	3.04104	392	$ 63,952
	Winter max days	0	3.17104	0	3.04104	784	$ -
	Winter avg days	64	3.17104	26	3.04104	392	$ 110,571
	TOTAL	**261**		**104**			**$ 663,516**

[1] Corresponds to PG&E summer rate schedule
[2] Corresponds to PG&E winter rate schedule

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PROJECT: Ord Community Water Distribution System Master Plan
SHEET NO: 5 of 7
DESCRIPTION: Energy Evaluation

16hr Period $/yr = day/yr*$/Kwd*Kw

Year **2004**		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	2.07736	24	2.02736	158	$ 28,471
	Summer avg days	25	2.07736	10	2.02736	79	$ 5,694
	Spring/Fall[1] max days	18	2.07736	9	2.02736	158	$ 8,672
	Spring/Fall[1] avg days	24	2.07736	11	2.02736	79	$ 5,781
	Spring/Fall[2] max days	29	2.07736	10	2.02736	158	$ 12,747
	Spring/Fall[2] avg days	38	2.07736	14	2.02736	79	$ 8,498
	Winter max days	0	2.07736	0	2.02736	158	$ -
	Winter avg days	64	2.07736	26	2.02736	79	$ 14,699
	TOTAL	**261**		**104**			**$ 84,563**

Year **2005**		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	2.07736	24	2.02736	611	$ 109,818
	Summer avg days	25	2.07736	10	2.02736	305	$ 21,964
	Spring/Fall[1] max days	18	2.07736	9	2.02736	611	$ 33,450
	Spring/Fall[1] avg days	24	2.07736	11	2.02736	305	$ 22,300
	Spring/Fall[2] max days	29	2.07736	10	2.02736	611	$ 49,166
	Spring/Fall[2] avg days	38	2.07736	14	2.02736	305	$ 32,777
	Winter max days	0	2.07736	0	2.02736	611	$ -
	Winter avg days	64	2.07736	26	2.02736	305	$ 56,695
	TOTAL	**261**		**104**			**$ 326,170**

Year **2010**		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	2.07736	24	2.02736	893	$ 160,660
	Summer avg days	25	2.07736	10	2.02736	447	$ 32,132
	Spring/Fall[1] max days	18	2.07736	9	2.02736	893	$ 48,936
	Spring/Fall[1] avg days	24	2.07736	11	2.02736	447	$ 32,624
	Spring/Fall[2] max days	29	2.07736	10	2.02736	893	$ 71,928
	Spring/Fall[2] avg days	38	2.07736	14	2.02736	447	$ 47,952
	Winter max days	0	2.07736	0	2.02736	893	$ -
	Winter avg days	64	2.07736	26	2.02736	447	$ 82,943
	TOTAL	**261**		**104**			**$ 477,174**

Year **2015**		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	2.07736	24	2.02736	1176	$ 211,501
	Summer avg days	25	2.07736	10	2.02736	588	$ 42,300
	Spring/Fall[1] max days	18	2.07736	9	2.02736	1176	$ 64,422
	Spring/Fall[1] avg days	24	2.07736	11	2.02736	588	$ 42,948
	Spring/Fall[2] max days	29	2.07736	10	2.02736	1176	$ 94,690
	Spring/Fall[2] avg days	38	2.07736	14	2.02736	588	$ 63,127
	Winter max days	0	2.07736	0	2.02736	1176	$ -
	Winter avg days	64	2.07736	26	2.02736	588	$ 109,191
	TOTAL	**261**		**104**			**$ 628,179**

[1] Corresponds to PG&E summer rate schedule
[2] Corresponds to PG&E winter rate schedule

PROJECT: Ord Community Water Distribution System Master Plan
SHEET NO: 6 of 7
DESCRIPTION: Energy Evaluation

18hr Period $/yr = day/yr*$/Kwd*Kw

Year **2004**		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	2.35078	24	2.28078	141	$ 28,593
	Summer avg days	25	2.35078	10	2.28078	70	$ 5,719
	Spring/Fall[1] max days	18	2.35078	9	2.28078	141	$ 8,707
	Spring/Fall[1] avg days	24	2.35078	11	2.28078	70	$ 5,805
	Spring/Fall[2] max days	29	2.35078	10	2.28078	141	$ 12,802
	Spring/Fall[2] avg days	38	2.35078	14	2.28078	70	$ 8,535
	Winter max days	0	2.35078	0	2.28078	141	$ -
	Winter avg days	64	2.35078	26	2.28078	70	$ 14,761
	TOTAL	**261**		**104**			**$ 84,921**

Year **2005**		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	2.35078	24	2.28078	543	$ 110,287
	Summer avg days	25	2.35078	10	2.28078	271	$ 22,057
	Spring/Fall[1] max days	18	2.35078	9	2.28078	543	$ 33,584
	Spring/Fall[1] avg days	24	2.35078	11	2.28078	271	$ 22,389
	Spring/Fall[2] max days	29	2.35078	10	2.28078	543	$ 49,380
	Spring/Fall[2] avg days	38	2.35078	14	2.28078	271	$ 32,920
	Winter max days	0	2.35078	0	2.28078	543	$ -
	Winter avg days	64	2.35078	26	2.28078	271	$ 56,934
	TOTAL	**261**		**104**			**$ 327,553**

Year **2010**		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	2.35078	24	2.28078	794	$ 161,346
	Summer avg days	25	2.35078	10	2.28078	397	$ 32,269
	Spring/Fall[1] max days	18	2.35078	9	2.28078	794	$ 49,132
	Spring/Fall[1] avg days	24	2.35078	11	2.28078	397	$ 32,755
	Spring/Fall[2] max days	29	2.35078	10	2.28078	794	$ 72,241
	Spring/Fall[2] avg days	38	2.35078	14	2.28078	397	$ 48,161
	Winter max days	0	2.35078	0	2.28078	794	$ -
	Winter avg days	64	2.35078	26	2.28078	397	$ 83,293
	TOTAL	**261**		**104**			**$ 479,198**

Year **2015**		Weekday (Day)	PG&E Rate ($/Kwd)	Weekend/Holiday (Day)	PG&E Rate ($/Kwd)	Pump (Kw)	Cost $
	Summer max days	63	2.35078	24	2.28078	1046	$ 212,405
	Summer avg days	25	2.35078	10	2.28078	523	$ 42,481
	Spring/Fall[1] max days	18	2.35078	9	2.28078	1046	$ 64,681
	Spring/Fall[1] avg days	24	2.35078	11	2.28078	523	$ 43,120
	Spring/Fall[2] max days	29	2.35078	10	2.28078	1046	$ 95,103
	Spring/Fall[2] avg days	38	2.35078	14	2.28078	523	$ 63,402
	Winter max days	0	2.35078	0	2.28078	1046	$ -
	Winter avg days	64	2.35078	26	2.28078	523	$ 109,651
	TOTAL	**261**		**104**			**$ 630,842**

[1] Corresponds to PG&E summer rate schedule
[2] Corresponds to PG&E winter rate schedule

PROJECT: Ord Community Water Distribution System Master Plan
SHEET NO: 7 of 7
DESCRIPTION: Energy Evaluation

Inflation Rate 1.033

	24hr Period	16hr Period	18hr Period
Pump Cost	$ 312,468	$ 468,701	$ 416,623
2005	$ 922,610	$ 1,383,914	$ 1,230,146
2010	$ 679,678	$ 1,019,517	$ 906,238
2015	$ 801,140	$ 1,201,711	$ 1,068,187
Pipe Cost	$ 975,000	$ 1,499,000	$ 1,199,200
2004	$ 89,319	$ 84,563	$ 84,921
2005	$ 392,949	$ 372,021	$ 373,599
2006	$ 406,085	$ 384,458	$ 386,088
2007	$ 419,661	$ 397,311	$ 398,995
2008	$ 433,690	$ 410,593	$ 412,334
2009	$ 448,188	$ 424,319	$ 426,118
2010	$ 677,602	$ 641,515	$ 644,235
2011	$ 700,254	$ 662,960	$ 665,772
2012	$ 723,664	$ 685,123	$ 688,028
2013	$ 747,856	$ 708,027	$ 711,029
2014	$ 772,857	$ 731,696	$ 734,799
2015	$ 1,051,445	$ 995,447	$ 999,668
2016	$ 1,086,594	$ 1,028,725	$ 1,033,087
2017	$ 1,122,919	$ 1,063,115	$ 1,067,623
2018	$ 1,160,458	$ 1,098,655	$ 1,103,314
2019	$ 1,199,253	$ 1,135,383	$ 1,140,197
2020	$ 1,239,344	$ 1,173,339	$ 1,178,314
2021	$ 1,280,775	$ 1,212,564	$ 1,217,705
2022	$ 1,323,591	$ 1,253,100	$ 1,258,413
2023	$ 1,367,839	$ 1,294,991	$ 1,300,482
2024	$ 1,413,566	$ 1,338,282	$ 1,343,957
2025	$ 1,460,821	$ 1,383,021	$ 1,388,886
2026	$ 1,509,656	$ 1,429,255	$ 1,435,316
2027	$ 1,560,124	$ 1,477,035	$ 1,483,299
2028	$ 1,612,279	$ 1,526,413	$ 1,532,885
2029	$ 1,666,178	$ 1,577,441	$ 1,584,130
2030	$ 1,721,878	$ 1,630,175	$ 1,637,087
2031	$ 1,779,440	$ 1,684,671	$ 1,691,815
2032	$ 1,838,927	$ 1,740,990	$ 1,748,372
2033	$ 1,900,402	$ 1,799,191	$ 1,806,820
TOTAL	**$ 36,798,511**	**$ 36,917,221**	**$ 36,297,683**

APPENDIX D
DIVER'S REPORT

Aqua-Tech Company conducted the reservoir dive inspection under a separate contract with the District. The company's website and phone number are www.watertankdivers.com and 916-482-3703.