BAKER WATER TREATMENT PLANT

PERMITS MATRIX

25-Jan-13

IRWD PROJECT NAME	LOCATION	TYPE OF PERMIT	AGENCY	PURPOSE	PERMIT NO.	ISSUANCE DATE	STATUS
Emergency Overflow for Storm Drain	On-site at Baker WTP in City of Lake Forest	Regulatory	RWQCB (401)	Water Quality Certification for fill within waters of the U.S.	File #302011-07	07/05/11	
Emergency Overflow for Storm Drain	On-site at Baker WTP in City of Lake Forest	Regulatory	State Dept. of Fish and Game (1602)	For alteration to streambeds.	File #1600-2011-0060-R5	06/28/11	
Water Treatment Plant	On-site at Baker WTP in City of Lake Forest	Fire Master Plan	OCFA	Fire Access, FH locations, signing & striping	SR #176603	05/10/11	
Water Treatment Plant	On-site at Baker WTP in City of Lake Forest	Fire Master Plan	OCFA	Fire Access, FH locations, signing & striping	SR #174091	12/13/12	
Product Water Pipeline	On-site at Baker WTP in City of Lake Forest	Encroachment	City of Lake Forest	Potholing along Serrano Trail.	E2012-043	02/16/12	
Product Water Pipeline	On-site at Baker WTP in City of Lake Forest	Encroachment	OC Parks	Potholing along Serrano Trail.	P2012-00175	03/08/12	
Product Water Pipeline	On-site at Baker WTP in City of Lake Forest	Encroachment	OC Parks	Geotech. Investig. along Serrano Trail	P2012-00217	03/28/12	
Product Water Pipeline	On-site at Baker WTP in City of Lake Forest	UG Classification	CalOSHA	Jack & Bore	C068-059-13T	12/12/12	
OC-33 Modifica-tions	Irvine Regional Park	Encroachment	OC Parks	Encroachment into County Parks fee property for access	P2012-00085	03/06/12	
OC-33 Modifica-tions	Irvine Regional Park	Encroachment	OC Parks	Encroachment into County Parks fee property for access.	Rider #1 to P2012-00085	06/30/12	
OC-33 Modifica-tions	Irvine Regional Park	Encroachment	OC Parks	Encroachment into County Parks fee property for access.	Rider #2 to P2012-00085	12/20/12	
Emergency Overflow for Storm Drain	On-site at Baker WTP in City of Lake Forest	Encroachment	OC Parks	Encroachment for Serrano Creek open space (outlet) & Portion of Storm Drain that crosses Trail. Gate & paving improvements along access rd.			In process
Emergency Overflow for Storm Drain	On-site at Baker WTP in City of Lake Forest	Agreement	SCE	Encroachment for Overflow Storm Drain that crosses SCE Easement			In process
Emergency Overflow for Storm Drain	On-site at Baker WTP in City of Lake Forest	Encroachment	City of Lake Forest	Encroachment into Flood Plain			In process
Water Treatment Plant	On-site at Baker WTP in City of Lake Forest	Chemicals	OCFA	Chemical Classification	SR #178966		In process

BAKER WATER TREATMENT PLANT

PERMITS MATRIX

25-Jan-13

IRWD PROJECT NAME	LOCATION	TYPE OF PERMIT	AGENCY	PURPOSE	PERMIT NO.	ISSUANCE DATE	STATUS
Water Treatment Plant	On-site at Baker WTP in City of Lake Forest	Entry Permit	SAC	Install new connection to SAC line			In process
Water Treatment Plant	On- and off-site at Baker WTP in City of Lake Forest	Service Agreement	SCE	Establish electrical service at the facility			In process
Product Water Pipeline	On-site at Baker WTP in City of Lake Forest	Encroachment	OC Parks	Encroachment into landscaped slope from Serrano Trail to Forestwood.	Permit #2012-00281		In process
Product Water Pipeline	On-site at Baker WTP in City of Lake Forest	Approval	HOA	Remove/replace landscaping within slope from Serrano Trail to Forestwood, and landscaping adjacent to Trail.			In process
Product Water Pipeline	On-site at Baker WTP in City of Lake Forest	Encroachment	City of Lake Forest	Pipeline construction in Palmwood, Autumnwood & Forestwood; and electrical conduit in Palmwood.			In process
Storm Drain??	On-site at Baker WTP in City of Lake Forest	UG Classification	CalOSHA	Directional drill			In process
Raw Water Pump Station	Peters Canyon Regional Park in Uninc. OC	Encroachment	OC Parks	Encroachment into County Parks fee property for access and construction.			In process
Raw Water Pump Station	Peters Canyon Regional Park in Uninc. OC	Approval	SAC	Demo existing building, replace with new one.			In process

BAKER WATER TREATMENT PLANT

PERMITS MATRIX

25-Jan-13

IRWD PROJECT NAME	LOCATION	TYPE OF PERMIT	AGENCY	PURPOSE	PERMIT NO.	ISSUANCE DATE	STATUS
Raw Water Pump Station	Peters Canyon Regional Park in Uninc. OC	Entry Permit	SAC	Valve Replacement			In process
OC-33 Modifica-tions	Uninc. OC	Entry Permit	Boy Scouts	Replace existing meter, piping modifications to accommodate new meter. Added 3 Santiago Lateral air valves to permit request.		04/03/12	In process
Baker Pipeline Air Valve Modifications	Off-site, S. of Irvine Reg'l Park within City of Orange	Entry Permit	ICDC	B9 vault			In process
Baker Pipeline Air Valve Modifications	Off-site, within City of Irvine	Entry Permit	ICDC	B-35 can			In process
Baker Pipeline Air Valve Modifications	Off-site, within City of Irvine	Entry Permit	ICDC	B-47 Air Vac			In process
Baker Pipeline Air Valve Modifications	Off-site, within City of Lake Forest	Entry Permit	Pacific Commerctr.	B-88 can			In process
Baker Pipeline Air Valve Modifications	Off-site, within City of Lake Forest	Entry Permit	SAC	4 Air Vacs			In process
Baker Pipeline Dewatering	Irvine Regional Park in Uninc. OC	Encroachment	OC Parks	Dewater a portion of the Baker Pipeline			In process
Baker Pipeline Dewatering	Peters Canyon Regional Park in Uninc. OC	Encroachment	OC Parks	Dewater a portion of the Baker Pipeline			In process

BAKER WATER TREATMENT PLANT PROJECT

Final Environmental Impact Report
SCH#: 2010051055

Prepared for
Irvine Ranch Water District

April 2011

ESA

BAKER WATER TREATMENT PLANT PROJECT

Final Environmental Impact Report
SCH#: 2010051055

Prepared for
Irvine Ranch Water District

April 2011

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FILED APR 26 2011 TOM DALY, CLERK-RECORDER DEPUTY

Notice of Determination Appendix D

TO:

☐ Office of Planning and Research
For U.S. Mail: P.O. Box 3044, Sacramento, CA 95812-3044
Street Address: 1400 Tenth Street, Sacramento, CA 95814

☒ County Clerk
County of: Orange
Address: 12 Civic Center Plaza, Room 101
Santa Ana, CA 92701

FROM:

Public Agency: Irvine Ranch Water District (Applicant)
Address: 15600 Sand Canyon Avenue
Irvine, California 92618
Contact: Paul Weghorst
Phone: (949) 453-5300
Lead Agency (if different from above):
Address:
Contact:
Phone:

Subject: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

State Clearinghouse Number (if submitted to State Clearinghouse): 2010051055

Project Title: Baker Water Treatment Plant Project

Project Location (include county): Wisteria and Palmwood, Lake Forest, Orange County, 92630

Project Description:
The Project would provide increased water supply reliability in southern Orange County by creating redundancy of treatment system capacity for potable water. The Baker WTP would have a normal operating capacity of 28 mgd and would treat raw water from variable supply sources, including imported water and Irvine Lake water. The Baker WTP would provide treated water to IRWD and four partner water agencies in southern Orange County: El Toro Water District, Moulton Niguel Water District, Santa Margarita Water District, and Trabuco Canyon Water District.

This is to advise that the Irvine Ranch Water District (☒ *Lead Agency* or ☐ *Responsible Agency*) has approved the above described project on April 25, 2011 (*Date*) and has made the following determinations regarding the above described projects.

1. The project [☐ will ☒ will not] have a significant effect on the environment.
2. ☒ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☐ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [☒ were ☐ were not] made a condition of the approval of the project.
4. A mitigation reporting or monitoring plan [☒ was ☐ was not] adopted for this project.
5. A statement of Overriding Considerations [☐ was ☒ was not] adopted for this project.
6. Findings [☒ were ☐ were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval, or the Negative Declaration, is available to the General Public at:
http://www.irwd.com

Signature (Public Agency) Title: Principal Water Resources Manager

Date: 4/26/11 Date Received filing at OPR:

Recorded in Official Records, Orange County
Tom Daly, County Recorder
2839.25
201185000497 2:43 pm 04/26/11
194 11 Z02
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Authority cited: Section 21083, Public Resources Code.
Reference: Section 21000-21174, Public Resources Code.

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Acronyms Used in this Report

AASHTO	American Association of State Highway and Transportation Officials
AB	Assembly Bill
ADT	Average Daily Traffic
AEP	Association of Environmental Professionals
af	Acre Feet
AMP	Allen-McColloch Pipeline
amsl	Above Mean Sea Level
APCDs	Air Pollution Control Districts
AQMDs	Air Quality Management Districts
AQMP	Air Quality Management Plan
ASCE	American Society of Civil Engineers
ASTs	Aboveground Storage Tanks
B.P.	Before Present
Basin Plan	Santa Ana River Basin Water Quality Control Plan
BFP	Baker Filtration Plant
BMPs	Best Management Practices
CAA	Clean Air Act
Cal EPA	California Environmental Protection Agency
Cal OSHA	California Occupational Safety and Health Administration
CalARP	California Accidental Release Prevention
Caltrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CBC	California Building Code
CCAA	California Clean Air Act
CCR	California Code of Regulations
CDC	California Department of Conservation
CDFFP	California Department of Forestry and Fire Protection
CDFG	California Department of Fish and Game
CDTSC	California Department of Toxic Substances Control
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act

CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CGS	California Geological Survey
CH_4	Methane
CHL	California Historical Landmarks
CHRIS	California Historical Resources Information System
CMP	Congestion Management Plan
CMU	Concrete Masonry Unit
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society Electronic Inventory
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	CO_2 Equivalent
Corps	U.S. Army Corps of Engineers
CSS	Coastal Sage Scrub
CT	Chlorine Contact
CUPA	Certified Unified Program Agency
CWA	Clean Water Act
cy	Cubic yards
dB	Decibels
dBA	A-weighted Decibels
DFG Code	California Fish and Game Code
DNL (Ldn)	24-hour day and night A-weighted noise exposure level
DOGGR	State Department of Conservation Division of Oil, Gas, and Geothermal Resources
Draft EIR	Draft Environmental Impact Report
DTSC	Department of Toxic Substance Control
DWR	Department of Water Resources
EIR	Environmental Impact Report
EOCWD	East Orange County Water District
ERP	Emergency Response Plan
ETWD	El Toro Water District
FCAA	Federal Clean Air Act
FCAAA	Federal Clean Air Act Amendments

FCF	Flow Control Facility
Fe	Iron
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FHWA	Federal Highway Administration
FIP	Federal Implementation Plan
FIRMs	Flood Insurance Rate Maps
FMMP	Farmland Mapping and Monitoring Program
FTA	Federal Transit Administration
GHG	Greenhouse Gas
gpm	Gallons per Minute
GWP	Global Warming Potential
GWR	Groundwater Recharge
GWRS	Groundwater Replenishment System
H_2O	Water Vapor
HAPs	Hazardous Air Pollutants
HCP	Natural Community Conservation Plan/Habitat Conservation Plan
HFCs	Hydrofluorocarbons
HMBP	Hazardous Materials Business Plan
HOA	Homeowners Association
HRI	California State Historic Resources Inventory
HS	Highway System
HWCL	Hazardous Waste Control Law
Hz	Hertz
I-5	Interstate 5
IBC	International Building Code
IRWD	Irvine Ranch Water District
IWMD	Orange County Integrated Waste Management Department
kWH	Kilowatt Hours
LAWD	Los Alisos Water District
LAWRP	Los Alisos Water Recycling Plant
LCP	General Plan/Local Coastal Plan
LOS	Level of Service
LUST	Leaking Underground Storage Tank

M	Richter Magnitude
M&I	Municipal and Industrial
MBTA	Migratory Bird Treaty Act
MCAS	Marine Corps Air Station
MCL	Maximum Contaminant Level
MFS	Membrane Filtration System
MG	Million Gallons
mgd	Million Gallons per Day
Mmax	Maximum Moment Magnitude
Mn	Manganese
MNWD	Moulton Niguel Water District
MPAH	County of Orange Master Plan of Arterial Highways
MRZ	Mineral Resource Zones
MTBE	Methyl Tertiary-Butyl Ether
MUN	Municipal and Domestic Supply
MUTCD	Manual on Uniform Traffic Control Devices
Mw	Moment Magnitude
MWD	Metropolitan Water District of Southern California
MWDOC	Metropolitan Water District of Orange County
MWDOC	Municipal Water District of Orange County
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NCCP	Natural Community Conservation Plan
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NITM	North Irvine Transportation Mitigation
NOC	Notice of Completion
NOP	Notice of Preparation
NOx	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRCS	National Resources Conservation Service
NRW	Non-reclaimable Waste or Wastewater

OAL	Office of Administrative Law
OCC	Orange County Certified
OCFA	Orange County Fire Authority
OCTA	Orange County Transportation Authority
OCWD	Orange County Water District
OPR	Office of Planning and Research
OSHA	Occupational Safety and Health Administration
PD	Planned Development
PFCs	Perfluorocarbons
PGA	Peak Ground Acceleration
PHG	Public Health Goal
PHI	California Points of Historical Interest
PM	Particulate Matter
PM10	Respirable Particulate Matter
PM2.5	Fine Particulate Matter
PPV	Peak Particle Velocity
PRC	Public Resources Code
PWPS	Product Water Pump Station
RARE	Preservation of Rare and Endangered Species
RCPG	Regional Comprehensive Plan and Guide
RCRA	Resource Conservation and Recovery Act
REC 1	Water Contact Recreation
REC 2	Non-Contact Water Recreation
RMP	Risk Management Plan or Program
RMP	Risk Management Program
RMS	Root Mean Square
ROG	Reactive Organic Gases
RWQCB	Regional Water Quality Control Board
RWTP	Baker Regional Water Treatment Plant
SAA	Streambed Alteration Agreement
SAC	Santiago Aqueduct Commission
SARWQCB	Santa Ana Regional Water Quality Control Board
SB	Senate Bill
SCAB	South Coast Air Basin

SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCCIC	South Central Coastal Information Center
SCE	Southern California Edison
SCEDC	Southern California Earthquake Data Center
SCP	South County Pipeline
SDC	Seismic Design Category
SF_6	Sulfur Hexafluoride
SIP	State Implementation Plan
SLF	Sacred Lands File
SMBRP	Site Mitigation and Brownfields Reuse Program
SMWD	Santa Margarita Water District
SOCWA	South Orange County Water Agency
SONGS	San Onofre Nuclear Generating Station
SR-241	State Route 241
SR-261	State Route 261
STATSGO	State Soil Geographic
SVP	Society for Vertebrate Paleontology
SVUSD	Saddleback Valley Unified School District
SWLF	Solid Waste Landfill
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TACs	Toxic Air Contaminants
TCWD	Trabuco Canyon Water District
TDS	Total Dissolved Solids
TIA	Traffic Impact Analysis
TMDL	Total Maximum Daily Load
TSCA	Toxic Substances Control Act
USCB	United State Census Bureau
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

USTs	Underground Storage Tanks
Vdb	Decibel Notation
VMT	Vehicle Miles Traveled
VOCs	Volatile Organic Compounds
WARM	Warm Freshwater Habitat
WDRs	Waste Discharge Requirements
WILD	Wildlife Habitat
WSEL	Water Surface Elevation
WTP	Baker Water Treatment Plant

EXECUTIVE SUMMARY

ES.1 Introduction

The Irvine Ranch Water District (IRWD) has prepared this Environmental Impact Report (EIR) to provide the public, responsible and trustee agencies and IRWD decision-makers information about the potential adverse effects on the local and regional environment associated with construction and operation of the Baker Water Treatment Plant (WTP) Project (proposed project). This EIR has been prepared pursuant to the California Environmental Quality Act (CEQA).

The proposed Baker WTP would have a normal operating capacity of 43.5 cfs (28 mgd) and would treat raw water from variable supply sources. The proposed Baker WTP would provide redundant treatment capacity to Metropolitan Water District of Southern California's (MWD) Diemer Treatment Plant. The project would not increase the capacity of regional treated water distribution pipelines, but rather improve regional potable water system reliability and operational flexibility. As described in Chapter 1, the Baker WTP would provide treated water to IRWD and four partner water agencies in southern Orange County: El Toro Water District (ETWD), Moulton Niguel Water District (MNWD), Santa Margarita Water District (SMWD), and Trabuco Canyon Water District (TCWD). In addition to the Baker WTP, the proposed project also would include a new offsite pump station near Peters Canyon Reservoir; a meter exchange and pipeline replacement at OC-33; a new sewer pipeline to convey non-reclaimable wastewater (NRW) from the Baker WTP to IRWD's sanitary sewer system; and may include new pipelines to convey treated water from the Baker WTP to the South County Pipeline.

This Executive Summary provides an overview of the proposed project, its objectives, and a summary of the potential impacts anticipated as a result of project implementation. The summary table (**Table ES-1**) included at the end of this chapter identifies these impacts and lists the mitigation measures recommended to reduce significant adverse impacts. Alternatives to the proposed project are also briefly described.

For a full description of the proposed project, its impacts, and alternatives, please refer to Chapters 2, 3, 4, and 5 of this EIR.

ES.2 Background

IRWD was established in 1961 as a California Water District pursuant to the California Water District Law (California Water Code, Division 13). IRWD provides potable and recycled water, sewage collection and treatment, and urban runoff treatment to municipal and industrial (M&I) and agricultural customers within an 115,531-acre service area in Orange County, California. The IRWD service area includes all of the City of Irvine and portions of Tustin, Newport Beach,

Costa Mesa, Orange and Lake Forest. Currently, 75 to 80 percent of the water IRWD provides for its customers comes from local sources, including groundwater (produced from the groundwater basin managed by Orange County Water District), surface water, and recycled water (from IRWD's Michelson and Los Alisos Water Recycling Plants). Less than 25 percent of IRWD's water supply is imported by MWD and purchased by IRWD through the Municipal Water District of Orange County (MWDOC). MWD imports water through both the State Water Project (SWP) and the Colorado River Aqueduct systems.

In 2001, IRWD completed a consolidation with Los Alisos Water District (LAWD), which served portions of the City of Lake Forest. The existing Baker Filtration Plant (BFP), located on Wisteria in Lake Forest, was one of the facilities owned and operated by LAWD that is now owned by IRWD. The BFP was operational from 1971 to 1983, and was decommissioned when the Allen-McColloch Pipeline was constructed. All BFP facilities are currently non-operational although remain onsite, including reservoirs, a filter plant, pump stations, and storage/office building. IRWD has additional facilities in and around the BFP site that provide filtered water as a supplement to its recycled water system.

ES.3 Project Objectives

The proposed Baker WTP is a regional project that is intended to:

- Improve water reliability to areas of south Orange County by constructing local treatment capability for a variable supply source (imported water from MWD and local Irvine Lake water).
- Provide a reliable, local potable water supply in the event of emergency conditions or scheduled maintenance of MWD's delivery system.
- Increase operational flexibility by creating redundancy within the raw water supply system.

ES.4 Project Description

Raw Water Supply and Conveyance

The raw water sources for the proposed project include imported water supplied by MWD or local surface water from Irvine Lake. Both raw water sources would be conveyed using existing pipeline facilities, including the Lower Feeder, Santiago Lateral, Baker Pipeline, and Irvine Lake Pipeline. Imported raw water would enter the Santiago Lateral from the Lower Feeder upstream of the Diemer Filtration Plant. Then, raw water would enter the Baker Pipeline from the Santiago Lateral at the OC-33 turnout. The proposed project includes a meter exchange within the existing concrete vault at OC-33 and replacement of a short segment of pipeline at OC-33 as well.

Raw water from Irvine Lake would be used intermittently throughout the year and in the event of an outage of the Lower Feeder or Santiago Lateral. Irvine Lake is fed by Santiago Creek and water imported through the Santiago Lateral. The lake captures approximately 7,000 acre-feet of local runoff per year (RBF/Carollo, 2010). IRWD is a partial owner of the lake together with Serrano Water District. IRWD currently supplies untreated water from Irvine Lake to irrigation customers. To deliver water from Irvine Lake to the Baker Pipeline, a new pump station would be

constructed at the existing Baker/Irvine Lake Pipeline Intertie Facility near Peters Canyon Reservoir. The pump station would transfer water from the Irvine Lake Pipeline to the Baker Pipeline. The pump station would be aboveground and would be designed with a similar aesthetic and architecture as the existing neighboring buildings onsite.

Baker WTP

Raw water would be treated at the proposed Baker WTP, which would be located at the site of the existing BFP. The Baker WTP would have a normal operating capacity of about 43.5 cfs (28 mgd). Raw water treatment would consist of membrane filtration, ultraviolet light for disinfection, and chloramination for secondary or residual disinfection (RBF/Carollo, 2010).

The proposed project would require demolition of some existing aboveground facilities at the BFP. The following new facilities would be constructed at the proposed Baker WTP:

- **Raw Water Conveyance Facilities:** flow control facility, TCWD pump station, forebay, feed water strainers, feed water pump station; and about 1,000 feet of new 42-inch feed water pipeline.
- **Treatment Facilities:** treatment building to house membrane filters and UV facilities, disinfection facility, backwash water treatment facilities, chemical storage building, standby generator, electrical equipment.
- **Treated Water Facilities:** product water pump station, surge tanks, standby generator, electrical equipment, new 36-inch and 42-inch product water pipelines, meter vault.
- **Emergency Overflow Facilities:** 42-inch pipeline and discharge structure to convey overflow water from the forebay and disinfection facility to Serrano Creek.
- **Site Access Facilities:** access during construction via Biscayne Bay Drive and existing access road; access during plant operation via Palmwood/Wisteria, Biscayne Bay Drive, and/or Indian Ocean Avenue; Wisteria gate relocation and new security fencing.

The aboveground Baker WTP facilities would be designed to be compatible with existing buildings onsite at the BFP. The architectural theme would include concrete masonry unit (CMU) block walls, steel deck roofs, and aluminum frame doors and windows (RBF/Carollo, 2010). The building designs would attenuate the sound levels of mechanical equipment to be in compliance with City of Lake Forest noise ordinances at the Baker WTP property line. The proposed Baker WTP would require a computerized supervisory control and data acquisition (SCADA) system to allow for remote control and monitoring of equipment, in addition to local control and monitoring. The Baker WTP SCADA system would be integrated into IRWD's existing district-wide SCADA system, which is used to communicate with IRWD facilities and ensure coordination and proper operation of IRWD facilities and systems throughout the service area. Operation of the Baker WTP SCADA system may require minor alterations to the existing antennae tower, which currently is part of IRWD's existing district-wide SCADA system.

Approximately 0.6 mgd of NRW would be generated at the proposed Baker WTP and conveyed to the IRWD sanitary sewer system. A new sewer connection at the southeastern corner of the Baker site would be necessary, as well as a new sewer pipeline. Approximately 2,500 linear feet of new 15-inch sewer pipeline would be installed along the Serrano Creek Trail in the City of

Lake Forest to connect to an existing 15-inch sewer pipeline with adequate capacity. The proposed sewer pipeline alignment would be located within an existing 15-foot utility easement owned by IRWD. NRW would be conveyed to IRWD's Los Alisos Water Recycling Plant for treatment.

Treated Water Conveyance

Treated water from the Baker WTP would flow by gravity to IRWD customers through its existing distribution system. Treated water would be conveyed to ETWD, MNWD, SMWD, and TCWD through a new pipeline connection to either the AMP or South County Pipeline (SCP). The preferred method of delivering water to the partner agencies would be through an existing connection to the AMP on the Baker WTP property. IRWD is currently coordinating with MWD for use of the AMP. If the AMP alternative is unable to be implemented, then IRWD would construct a new pipeline connecting the Baker WTP to the SCP. IRWD is considering two pipeline alignments to connect to the SCP.

ES.5 Project Alternatives

CEQA requires that "*an EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project….*" (*CEQA Guidelines*, Section 15126.6 (a)). The discussion must focus on alternatives to the project or its location that are capable of lessening significant impacts, even if these alternatives would impede, to some degree, the attainment of project objectives, or if they would be more costly (Section 15126.6 (b)). The EIR is required to briefly describe the rationale for selecting the alternatives to be discussed and also identify any alternatives that were considered by the Lead Agency, but were rejected as infeasible during the scoping process.

The specific alternative of "No Project" shall be evaluated along with its impact. If the "No Project" alternative is determined to be the environmentally superior alternative, the EIR shall also identify an environmentally superior alternative among the other alternatives.

Two alternatives analyzed in this EIR are summarized below and are examined in greater detail in Chapter 6. The alternatives are analyzed even though the proposed project would not result in any significant effects.

No-Project Alternative

Under the No Project Alternative, IRWD would not implement the proposed project; there would be no construction of the proposed Raw Water Pump Station, Baker WTP, sewer pipeline, treated water conveyance pipeline, or OC-33 meter exchange. The Baker site would remain unchanged and the Baker/Irvine Lake Pipeline Intertie also would remain unchanged. The BFP would continue to provide filtered well water to supplement IRWD's recycled water system and the antennae tower would continue to operate as part of IRWD's existing district-wide SCADA system. The Diemer Filtration Plant would continue to provide treatment for imported water for IRWD and the partner agencies in south Orange County. Raw water in Irvine Lake would continue to be utilized for agricultural irrigation.

Under the No Project Alternative, none of the project objectives would be achieved. There would be no improvements to water supply reliability in south Orange County, no increase in local water treatment capability for variable supply sources, and no redundancy in raw water supply systems to provide operational flexibility. In addition, none of the environmental impacts identified in Chapters 3 and 4 of this Draft EIR that are associated with construction and operation of the proposed project would occur.

Alternative 1: Peters Canyon WTP Location

In 2007, the Santiago Aqueduct Commission (SAC) prepared the *Baker Pipeline Regional Treatment Facility Feasibility Study* (Malcolm Pirnie, 2007), which evaluated implementation of a regional WTP at two locations, the existing Baker site and the Peters Canyon WTP. Alternative 1 consists of development of the Peters Canyon WTP, which is owned by the East Orange County Water District (EOCWD) and is located in the County of Orange approximately 0.35 miles east of Peters Canyon Reservoir. The site is surrounded by open space in the foothills of the Santa Ana Mountains and is within the boundaries of the Loma Ridge portion of the Irvine Ranch Natural Landmark. Under Alternative 1, IRWD would form a Joint Powers Authority (JPA) or otherwise contract with EOCWD for use of the Peters Canyon WTP site and implement improvements similar to the proposed project, to produce 28 mgd of treated water using either imported water or Irvine Lake water as the raw water source. Alternative 1 would require a reconnection to the Baker pipeline and an extension of the Irvine Lake Pipeline under SR-261 to convey Irvine Lake water to the site.

Alternative 1 would meet all of the goals of the project but would result in greater or more severe impacts to the environment related to aesthetics, air quality, biological resources, land use compatibility, energy and greenhouse gas emissions. Alternative 1 would result in lesser impacts associated with hazardous materials and noise.

Alternative 2: Conventional Treatment Process

The 2007 Feasibility Study (Malcolm Pirnie, 2007) evaluated conventional treatment as an alternative to membrane filtration. Under Alternative 2, IRWD would construct a new treatment plant at the Baker site using a conventional treatment process instead of a membrane filtration process. A conventional treatment process typically would require facilities such as primary treatment facilities (flocculation and sedimentation basins), secondary filtration facilities, disinfection facilities (chlorine contactor, UV facility), an equalization basin, and solids handling facilities (thickener, belt filter presses, solids disposal). Conventional treatment requires a larger footprint than a membrane filtration process, requires more chemical use and has greater sludge disposal requirements, and is slightly more expensive to build, operate, and maintain.

Although Alternative 2 would meet all of the goals of the project, as compared to the proposed project, Alternative 2 would result in greater impacts to the environment related to aesthetics, air quality (construction impacts), odor, hazardous materials, and noise. As compared to the proposed project, Alternative 2 would result in fewer operational impacts to energy and greenhouse gas emissions.

Summary of Alternatives Analysis

The alternatives evaluated in Chapter 6 of this EIR present a tradeoff between achieving project objectives and impacting the environment. The No Project Alternative would avoid all the environmental impacts of the proposed project but would not meet any of the project objectives. Alternatives 1 and 2 would meet all of the project objectives but could result in additional impacts to the environment relative to the proposed project.

An EIR must identify the environmentally superior alternative. In addition, the *CEQA Guidelines* (Section 15126.6(e)(2)) require that, if the environmentally superior alternative is the No Project Alternative, the EIR shall also identify an environmentally superior alternative among the other alternatives.

The No Project Alternative would result in the least environmental impacts because there would be no physical changes to the environment as a result of the proposed project. All impacts associated with the proposed project would be avoided. As a result, the No Project Alternative could be considered the environmentally superior alternative, and therefore, in accordance with CEQA, an environmentally superior alternative shall be identified among the other alternatives.

Alternatives 1 and 2 would not likely result in significant and unavoidable impacts. However, both would increase the severity of impacts associated with some environmental resources while decreasing impacts associated with others. For Alternatives 1 and 2, the increase in potential environmental impacts outweighs the potential decrease in impacts when compared to the proposed project. Therefore, the proposed project is considered the Environmentally Superior Alternative.

ES.6 Summary of Impacts

Table ES-1, at the end of this chapter, presents a summary of the impacts and mitigation measures identified for the proposed project. The complete discussion of impacts is presented in Chapter 3, Environmental Setting, Impacts, and Mitigation Measures. The level of significance for each impact is determined using significance criteria (thresholds) developed for each category of impacts; these criteria are presented in the appropriate sections of Chapter 3. Significant impacts are those adverse environmental impacts that meet or exceed the significance thresholds; less than significant impacts would not exceed the thresholds. Table ES-1 indicates the measures that would be implemented to avoid, minimize, or otherwise reduce significant impacts to a less than significant level

ES.7 Areas of Known Controversy

Section 15123 (b)(2) of the *CEQA Guidelines* requires that an EIR summary identify areas of controversy known to the Lead Agency, including issues raised by other agencies and the public.

On May 18, 2010, a Notice of Preparation (NOP) for the proposed project was distributed by the IRWD to the State Clearinghouse, interested agencies, and the public. Responses to the NOP were received by the following agencies: the City of Lake Forest, the City of Orange, the Department of

Transportation, the Native American Heritage Commission, and the South Coast Air Quality Management District. Comments from the public also were received during a public scoping meeting held on May 26, 2010.

Key environmental concerns raised by these organizations and the public included: (1) potential adverse effects on Serrano Creek Trail; (2) the aesthetic impact to nearby residential land uses; (3) the traffic impacts on local residential streets; (4) operational noise; and (5) operational light and glare. This EIR addresses each of the aforementioned areas of concern or controversy in detail in Chapters 3 and 4.

ES.8 Organization of this EIR

This Draft EIR has been organized into the following chapters:

ES. Executive Summary. This chapter summarizes the contents of the EIR.

1. Introduction and Project Background. This section discusses the CEQA process, the purpose of the EIR, and provides background information about IRWD and the development of the proposed project.

2. Project Description. This section provides an overview of the proposed project, describes the need for and objectives of the proposed project, and provides detail on the characteristics of the proposed project.

3. Environmental Setting, Impacts and Mitigation Measures. This chapter describes the environmental setting and identifies impacts of the proposed project for each of the following environmental resource areas: Aesthetics; Agriculture and Forestry; Air Quality and Greenhouse Gas Emissions; Biological Resources; Cultural Resources; Geology, Soils, Seismicity and Mineral Resources; Hazards and Hazardous Materials, Hydrology and Water Quality, Land Use and Recreation; Noise and Vibration; Public Services and Utilities; and Transportation and Traffic. Measures to mitigate the impacts of the proposed project are presented for each resource area.

4. Cumulative Impacts. This chapter describes the potential impacts of the proposed project when considered together with other related projects in the project area.

5. Growth Inducement. This chapter describes the potential for the proposed project to induce growth.

6. Alternatives Analysis. This chapter presents an overview of the alternatives development process and describes the alternatives to the proposed project that were considered.

7. Report Preparers. This chapter identifies authors and consultants involved in preparing this EIR, including persons and organizations consulted.

8. Comment Letters.

9. Responses to Comments.

10. Corrections and Additions to the Draft EIR.

TABLE ES-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
3.1 Aesthetics							
Impact 3.1-1: Implementation of the proposed project could impact scenic vistas.	**AES-1:** IRWD shall prepare a landscape plan during project design that includes specifications for perimeter vegetation to screen the Baker WTP from neighboring streets. The landscape plan also shall include specifications to maintain or replace vegetation onsite to the extent feasible.	Less than significant			X		
Impact 3.1-2: Implementation of the proposed project could impact the visual character of project sites and surroundings.	**AES-2:** IRWD shall restore areas disturbed during construction of the treated water pipeline and sewer pipeline by reestablishing pre-existing conditions including topography, repaving roadways, replanting trees, and/or reseeding or restoring with native plants typical of the immediate surrounding area. IRWD shall be responsible for monitoring the replanted areas for up to three years, or less if the revegetation is determined to be successful and sufficient to avoid excessive erosion	Less than significant.				X	X
Impact 3.1-3: Implementation of the proposed project would create a new source of light or glare that could adversely affect day or nighttime views in the area.	**AES-3:** The exterior nighttime security lighting installed on and around the project facilities shall be of a minimum standard required to ensure safe visibility. Lighting shall be shielded and directed downward, away from the line of sight of neighboring properties, to minimize impacts of light and glare. External security lighting shall be turned off automatically at night to the extent feasible.	Less than significant.	X		X		
	Implement Mitigation Measure **NOISE-1.**		X	X	X	X	X
3.2 Agriculture and Forestry Resources							
No Agriculture and Forestry Resources impacts identified.							
3.3 Air Quality and Greenhouse Gas Emissions							
Impact 3.3-1: The proposed project could violate an air quality standard or contribute	None required.	Less than significant.					

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
substantially to an existing or projected air quality violation during its construction and operation.							
Impact 3.3-2: The proposed project could result in a cumulatively considerable net increase of any criteria pollutant under an applicable federal or state ambient air quality standard.	None required.	Less than significant.					
Impact 3.3-3: The proposed project could expose sensitive receptors to substantial pollutant concentrations.	Although not required, to minimize potential effects to sensitive receptors during construction, Mitigation Measures AQ-1 through AQ-4 would implement best management practices to further decrease construction emissions.	Less than significant.			X	X	X
	AQ-1: General contractors shall implement a fugitive dust control program pursuant to the provisions of SCAQMD Rule 403.						
	AQ-2: All construction equipment shall be properly tuned and maintained in accordance with manufacturer's specifications.				X	X	X
	AQ-3: General contractors shall maintain and operate construction equipment so as to minimize exhaust emissions. During construction, trucks and vehicles in loading and unloading queues would turn their engines off when not in use to reduce vehicle emissions. Construction emissions should be phased and scheduled to avoid emissions peaks and discontinued during second-stage smog alerts.				X	X	X
	AQ-4: All construction vehicles shall be prohibited from idling in excess of ten minutes, both on- and off-site				X	X	X
Impact 3.3-4: The proposed project could conflict with implementation of state goals for reducing greenhouse gas emissions and thereby have a negative effect on Global Climate Change.	None required.	Less than significant.					

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
3.4 Biological Resources							
Impact 3.4-1: Implementation of the proposed project could have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS.	**BIO-1:** If Option 1 of the treated water pipeline is implemented, to avoid potential impacts to terrestrial special-status species, the following measures shall apply: IRWD shall retain a qualified biologist with a CDFG Scientific Collection Permit and Memorandum of Understanding to conduct preconstruction surveys for the California Species of Special Concern that have the potential to occur within the project impact area. These wildlife species include orange throated whiptail, coast (San Diego) horned lizard, and coast patch-nose snake. All special-status wildlife species observed within the project site during preconstruction surveys shall be relocated, at the approval of CDFG, to an approved site with suitable habitat for these species. Surveys and relocation of wildlife may occur prior to construction; however, focused surveys must occur within 30 days prior to construction to ensure that no special-status wildlife is present within the project site during construction. Survey and relocation methods shall be approved by CDFG prior to commencement of grading.	Less than significant.					X
	BIO-2: For Option 1 of the treated water pipeline, exclusionary fencing (i.e., silt fencing) shall be installed around the perimeter of the construction area where native vegetation is present, or where suitable habitat for special-status (terrestrial) species is present, as determined by a qualified biologist. The exclusionary fencing shall be backfilled (or buried) at the base of the fence to exclude reptiles from entering the work area. Installation of exclusionary fencing shall be verified by a qualified biologist prior to the commencement of construction or ground disturbing activities.	Less than significant.					X

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	BIO-3: A preconstruction nest survey shall be conducted if construction and/or ground disturbing activities will commence between February 15 and August 15. To avoid impacts to native nesting birds, including coastal cactus wren, coastal California gnatcatcher, and least Bell's vireo, IRWD and/or its contractors shall retain a qualified biologist to conduct breeding bird surveys in potential nesting habitat within and adjacent to all project sites prior to construction or site preparation activities. Potential nesting habitat may include grassy and weedy areas, as well as shrubs and trees. Suitable nesting habitat in the vicinity of proposed disturbance areas shall be determined by the qualified biologist. The qualified biologist shall conduct a nest survey within five days of ground disturbance activities associated with construction, (such as site clearing, grading, or excavation) to determine if active nests of bird species protected by the Migratory Bird Treaty Act (MBTA) or the California Fish and Game Code are present in the construction zone or within a distance determined by CDFG or the qualified biologist. If ground disturbance activities are delayed, additional pre-construction surveys will be conducted such that no more than five days will have elapsed between the last survey and the commencement of ground disturbance activities. Surveys shall include examination of trees, shrubs, and the ground within grassland for nesting birds, as several bird species known to occur in the area are shrub or ground nesters.	Less than significant.	X	X	X	X	X
	BIO-4: If active nests are found during surveys conducted in accordance with Mitigation Measure BIO-3, then the qualified biologist shall determine whether construction activities have the potential to disturb the nest(s) and determine appropriate	Less than significant.	X	X	X	X	X

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	construction limitations, which may include but are not limited to erection of sound barriers, full-time monitoring by a qualified biologist, or establishment of no-construction buffers (usually 300 ft for nesting song birds and 500 ft for nesting raptors and special-status bird species). In addition, the qualified biologist shall serve as a construction monitor during those periods when construction activities will occur near active nest areas to ensure no inadvertent impacts to the nest occur. If necessary, limits of construction to avoid an active nest shall be established in the field with flagging, fencing, or other appropriate barriers; and construction personnel shall be instructed on the sensitivity of nest areas. The results of the survey, and any avoidance measures taken, shall be submitted to IRWD within 30 days of completion of the pre-construction surveys and construction monitoring to document compliance with applicable state and federal laws pertaining to the protection of native birds.						
Impact 3.4-2: Implementation of the proposed project could have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFG or USFWS.	**BIO-5:** If Option 1 of the treated water pipeline is implemented, then coastal sage scrub and coastal prickly pear succulent scrub communities that are disturbed by construction shall be restored at the same location where impacts occur on a 1:1 ratio following the completion of construction activities. If coastal sage scrub or coastal prickly pear succulent scrub would be removed for construction purposes, a restoration plan shall be completed that specifies, at a minimum, the following: (1) the location of replacement sites; (2) the quantity and species of plants to be planted; (3) a schedule and action plan to maintain and monitor the re-vegetation area; (4) a list of criteria and performance standards by which to measure success of the planting sites; (5) measures to exclude unauthorized entry into the re-	Less than significant.					**X**

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	vegetation/enhancement areas; and (6) contingency measures in the event that mitigation efforts are not successful. This restoration plan shall be completed prior to construction of the proposed project. Restoration activities, whether onsite or offsite, shall reuse vegetative material from the site of disturbance to the extent feasible.						
	BIO-6: IRWD shall require construction contractors to implement the following measures during construction of the Baker WTP and the sewer pipeline**:** • The construction contractor shall install temporary erosion control measures around drains to reduce localized impacts to Serrano Creek in the area of the project and protect onsite drainages from excess sedimentation, siltation, and erosion. These measures shall consist of the installation of silt fencing, coirs, berms, and dikes to protect storm drain inlets and drainages. • No changing of oil or other fluids, or discarding of any trash or other construction waste materials shall occur on the project site. Vehicles carrying supplies, such as concrete, shall not be allowed to empty, clean out, or otherwise place materials into natural areas on or immediately adjacent to the site. • Any equipment or vehicles driven and/or operated within or adjacent to onsite drains shall be checked and maintained daily, to prevent leaks of materials that if introduced to Serrano Creek could be deleterious to aquatic life. No equipment maintenance shall be conducted near onsite drains.	Less than significant.			**X**	**X**	**X**
	BIO-7: During construction of the emergency overflow facility and associated rip rap, the construction contractor shall take measures to				**X**		

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	avoid impacts to sensitive riparian habitat within and surrounding Serrano Creek where feasible, such as installing construction impact boundaries marked by flagging or temporary fencing. If avoidance is not feasible, negative impacts to sensitive riparian habitat shall be mitigated at ratios based on the quality of habitat affected. In general, sensitive riparian habitat, such as Southern Sycamore Alder Riparian Woodland, shall be restored or enhanced at a ratio as determined in consultation with CDFG.						
Impact 3.4-3: Implementation of the proposed project could conflict or have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other.	**BIO-8:** Construction activities within Serrano Creek shall be limited to dry season periods to avoid wet weather flow conditions in the creekbed.	Less than significant.			**X**		
	BIO-9: No activities shall occur within Serrano Creek until appropriate permits have been obtained from the US Army Corps of Engineers, Regional Water Quality Control Board, and/or California Department of Fish and Game.	Less than significant.			**X**		
Impact 3.4-4: Implementation of the proposed project could conflict with local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.	**BIO-10:** A Eucalyptus Tree Cutting Permit shall be obtained from the City of Lake Forest prior to cutting, pruning or removing any eucalyptus trees during the restricted period, April 1 through October 31. The transportation of or disposal of infected eucalyptus trees or logs shall occur only as permitted.	Less than significant.			**X**	**X**	**X**
3.5 Cultural Resources							
Impact 3.5-1: Project construction could affect an archaeological resource.	**CUL-1**: Prior to the start of any earth-moving activity, an archaeological monitor shall be retained by the IRWD to monitor ground-disturbing activities associated with the construction of the treated water pipelines and	Less than significant.				**X**	**X**

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	the Serrano Creek sewer pipeline, including but not limited to grading, excavation, brush clearance and grubbing. The monitor shall be, or shall work under the supervision of, a qualified archaeologist, defined as an archaeologist meeting the Secretary of the Interior's Standards for professional archaeology (Department of the Interior, 2010). The duration and timing of monitoring shall be determined by the qualified archaeologist in consultation with the IRWD and based on the grading plans. Initially, all ground-disturbing activities shall be monitored. However, the qualified archaeologist, based on observations of soil stratigraphy or other factors, and in consultation with IRWD, may reduce the level of monitoring as warranted. In the event that cultural resources are unearthed during ground-disturbing activities, the archaeological monitor shall be empowered to halt or redirect ground-disturbing activities away from the vicinity of the find so that the find can be evaluated. Due to the sensitivity of the project area for Native American resources, at least one Native American monitor may, if requested, also monitor ground-disturbing activities in the project area. The monitor(s) shall be selected from amongst the Native American groups identified by the Native American Heritage Commission as having affiliation with the project area.						
	CUL-2*:* Unanticipated Discovery. During construction of all project components, if a cultural resource is encountered, construction activities shall be redirected away from the immediate vicinity of the find until it can be evaluated by a qualified archaeologist. If the find is determined to be potentially significant, the archaeologist, in consultation with the IRWD and appropriate Native American group(s) (if the find	Less than significant.	**X**	**X**	**X**	**X**	**X**

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	is a prehistoric or Native American resource), shall develop a treatment plan. Construction activities shall be redirected to other work areas until the treatment plan has been implemented or the qualified archaeologists determines work can resume in the vicinity of the find.						
Impact 3.5-2: Implementation of the proposed project could adversely affect paleontological resources.	**CUL-3:** Paleontological Mitigation and Monitoring Plan. Prior to the start of any earth-moving activity, IRWD shall retain an Orange County Certified Paleontologist. The Paleontologist shall prepare a Paleontological Mitigation and Monitoring Plan that provides for the treatment of paleontological resources in accordance with the mitigation guidelines for areas of high potential outlined by the SVP. The mitigation and monitoring plan shall address pre-construction salvage and reporting; pre-construction contractor sensitivity training; procedures for paleontological resources monitoring; microscopic examination of samples where applicable; the evaluation, recovery, identification, and curation of fossils, and the preparation of a final mitigation report.	Less than significant.	X	X	X	X	X
	CUL-4: Paleontological Monitoring. All earth moving activities in the Oso Sand Member of the Capistrano Formation shall be monitored full time.unless the paleontologist determines that sediments are previously disturbed or there is no reason to continue monitoring in a particular area due to other depositional factors, which would make fossil preservation unlikely or deemed scientifically insignificant. If it becomes apparent to the paleontologist that bedrock will not be impacted in an area, monitoring may be suspended temporarily until bedrock is impacted again. Spot-checking by the paleontologist will be allowed to determine if bedrock is being impacted. If impacts to bedrock resume, full-time monitoring will resume. In the event fossils are exposed during earth moving, construction activities shall be redirected to other work areas	Less than significant.	X	X	X	X	X

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	until the procedures outlined in the Paleontological Mitigation and Monitoring Plan have been implemented or the paleontologist determines work can resume in the vicinity of the find.						
Impact 3.5-3: Implementation of the proposed project could result in the disturbance of human remains.	**CUL-5:** If human remains are encountered unexpectedly during construction excavation and grading activities, State Health and Safety Code Section 7050.5 requires that no further disturbance shall occur until the County Coroner has made the necessary findings as to origin and disposition pursuant to PRC Section 5097.98. If the remains are determined to be of Native American descent, the coroner has 24 hours to notify the NAHC. The NAHC will then identify a Most Likely Descendent (MLD), of the deceased Native American, who will provide recommendations as to the future disposition of the remains. Per Public Resources Code 5097.98, the landowner shall ensure that the immediate vicinity, according to generally accepted cultural or archaeological standards or practices and taking into account the possibility of multiple human remains, where the Native American human remains are located, is not damaged or disturbed by further development activity until the landowner has discussed and conferred with the MLD, as prescribed in this section (PRC 5097.98).	Less than significant.	X	X	X	X	X
3.6 Geology, Soils, and Mineral Resources							
Impact 3.6-1: Implementation of the proposed project could expose people and structures to strong seismic ground shaking, seismic related ground failure, and landslides.	None required.	Less than significant.					
Impact 3.6-2: Implementation of the proposed project could result in substantial soil erosion or loss of topsoil.	**GEO-1:** IRWD shall require the construction contractor to include best management practices (BMPs) in the Storm Water Pollution Prevention Plan for the project, to minimize soil erosion and	Less than significant.	X	X	X	X	X

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	sedimentation from the project sites, including but not limited to the following: use of sediment barriers and traps, silt basins, and silt fences.						
	Implement Mitigation Measure **AES-2.**			X		X	X
Impact 3.6-3: The proposed project may be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off- site landslide, lateral spreading, subsidence, liquefaction, or collapse	**GEO-2:** Prior to approval of construction plans for the proposed project, a design-level geotechnical investigation, including collection of site-specific subsurface data shall be completed by IRWD for all project components. The geotechnical investigation shall be conducted by a certified engineering geologist or registered geotechnical engineer. The geotechnical investigation shall identify appropriate engineering considerations, including density profiles, approximate maximum shallow groundwater level, vertical and lateral extent of the saturated sand/silt layers that could undergo liquefaction, and potential presence of expansive soils. The geotechnical investigation shall recommend site-specific design criteria to mitigate potential risks due to liquefaction, landslides, subsidence, and expansive soils. Recommended design criteria shall be in accordance with SP 117 where appropriate (e.g., sewer pipeline) and become part of the proposed project.	Less than significant.	X	X	X	X	X
Impact 3.6-4: The proposed project may be located on expansive soils.	Implement Mitigation Measure **GEO-2.**	Less than significant.	X	X	X	X	X
3.7 Hazards and Hazardous Materials							
Impact 3.7-1: The proposed project could create a significant hazard to the public or the environment through routine transport, use or disposal of hazardous materials that may result in accident conditions involving the release of hazardous materials into the environment.	**HAZ-1:** IRWD shall require the construction contractor to include the following BMPs in the SWPPP that would prevent the accidental release of hazardous materials. The plan shall include, but not be limited to, the following BMPS: • Follow manufacturers' recommendations and regulatory requirements for use, storage, and disposal of chemical products and hazardous	Less than significant.	X	X	X	X	X

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	materials used in construction. • During routine maintenance of construction equipment, properly contain and remove grease and oils. • Properly dispose of discarded containers of fuels and other chemicals. • In the event of a petroleum product spill, the contractor shall contain the spill and clean up the contaminated area in compliance with regulations with DTSC and RWQCB approval. Contaminated soils shall be removed and disposed of in accordance with applicable regulations.						
Impact 3.7-2: The proposed project could impair the implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan.	Implement Mitigation Measures **TR-1** and **TR-3.**	Less than significant.	**X**	**X**	**X**	**X**	**X**
Impact 3.7-3: The proposed project could expose people and structures to a significant risk or loss, injury or death to wildland fires.	**HAZ-2:** IRWD shall require the construction contractor to implement the following best management practices during construction of the Raw Water Pump Station and OC-33 Meter Exchange to prevent wildland fires. • During construction, all staging areas, welding areas, or areas slated for development using spark-producing equipment shall be cleared of dried vegetation or other flammable material. • Any construction equipment that includes a spark arrestor shall be equipped with a spark arrestor in good working order. • All vehicles and crews working at the project site shall have access to functional fire extinguishers at all times. • Construction crews shall have a spotter during welding activities to look out for potentially dangerous situations, including accidental sparks.	Less than significant.	**X**	**X**			

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
3.8 Hydrology and Water Quality							
Impact 3.8-1: Construction and operation of the proposed project could violate water quality standards or waste discharge requirements.	None required.	Less than significant.					
Impact 3.8-2: The proposed project could substantially alter the existing drainage pattern of a site or area through the alteration of the course of a stream or a river that would increase the rate or amount of surface runoff in a manner that would result in flooding, erosion, or siltation on or off site.	Implement Mitigation Measure **AES-2.**	Less than significant.				**X**	**X**
Impact 3.8-3: The proposed project could potentially contribute or create runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide sources of polluted runoff.	None required.	Less than significant.					
3.9 Land Use, Planning, and Recreation							
Impact 3.9-1: Implementation of the proposed project could conflict with applicable land use plans, policies, or regulations.	None required.	Less than significant.					
Impact 3.9-2: Construction of the proposed project could affect recreational facilities and have a significant effect on the environment.	**LU-1:** For installation of the sewer pipeline, IRWD shall require the construction contractor to prepare and implement a Trail Detour Plan prior to construction. The plan shall: • Identify hours of construction. • Include a work area delineation requiring trail detours. • Identify and establish detours around construction where room is available without affecting vegetation. Install detour signs as appropriate. • If detours are not possible identify signage	Less than significant.				**X**	

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	requirements noting temporary trail closure. • Post notices regarding upcoming trail detours and closures at trail heads and entry points at least 10 days in advance. Implement Mitigation Measure **AES-2.**					X	
3.10 Noise and Vibration							
Impact 3.10-1: Project construction and operation could expose persons to or generate noise levels in excess of the City of Orange and/or City of Lake Forest noise standards.	**NOISE-1:** To reduce daytime noise impacts due to construction activities, in addition to complying with the construction hours for standard construction activities, the project applicant shall require construction contractors to implement the following measures**:** • Construction shall be restricted to the hours between 7:00 a.m. and 8:00 p.m., excluding Sundays or federal holidays, except as otherwise permitted by the City of Lake Forest or City of Orange. • Equipment and trucks used for project construction shall use noise control techniques (e.g., mufflers, use of intake silencers, ducts, engine enclosures, and acoustically-attenuating shields or shrouds). • Adjacent land uses within 500 feet of the construction site shall be notified about the estimated duration and hours of construction activity at least 30 days before the start of construction. • A noise disturbance coordinator shall be established. The noise disturbance coordinator shall be responsible for responding to any local complaints about construction noise. The noise disturbance coordinator would determine the cause of the noise complaint (e.g., starting too early, bad mufflers, etc.) and would be required to resolve the noise complaints. All	Less than significant.	X	X	X	X	X

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
	notices sent to adjacent land uses within 500 feet of the construction site and all signs posted at the construction site shall list the telephone number and e-mail address for the noise disturbance coordinator.						
	NOISE-2: IRWD shall secure a noise variance from the relevant jurisdiction prior to nighttime construction activities that would generate noise in excess of noise standards.	Less than significant.	X	X	X	X	X
	NOISE-3: IRWD shall conduct a post-construction noise survey to ensure that operation of new equipment at the Baker WTP and Raw Water Pump Station is in compliance with the City of Lake Forest Noise Ordinance (11.16.040 Exterior Noise Standards) and City of Orange Noise Ordinance (8.24.050 Exterior Noise Standards) at the property boundary.	Less than significant.			X		
Impact 3.10-2: Project construction would generate groundborne vibration and noise.	None required.	Less than significant.					
Impact 3.10-3: Activities associated with operations of the project could increase noise levels at nearby land uses.	Implement Mitigation Measure **NOISE-3.**	Less than significant.			X		
3.11 Public Services and Utilities							
Impact 3.11-1: The proposed project could result in the expansion or construction of new storm water drainage facilities.	None required.	Less than significant.					
Impact 3.11-2: The proposed project could be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs.	None required.	Less than significant.					
Impact 3.11-3: The proposed project would comply with federal, state, and local statutes	None required.	Less than significant.					

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
and regulations related to solid waste.							
Impact 3.11-4: The proposed project could affect local and regional energy supplies such that additional electrical capacity is required.	None required.	Less than significant.					
3.12 Transportation and Traffic							
Impact 3.12-1: Construction and operational activity would affect traffic in the project area.	**TR-1:** For installation of Pipeline Option 1 and 2, the construction contractor shall prepare and implement a Traffic Control/Traffic Management Plan prior to construction. The plan shall: • Identify hours of construction and hours for deliveries; • Include a work area delineation requiring traffic control and flagging; • Identify all access and parking restrictions, pavement markings and signage requirements (e.g., speed limit, temporary loading zones); • Maintain access to residence and business driveways, public facilities, and recreational resources at all times to the extent feasible; Minimize access disruptions to businesses and residences; • Notify affected residents and businesses prior to the start of construction; • Include a plan to coordinate all construction activities with emergency service providers in the area at least one month in advance. Emergency service providers shall be notified of the timing, location, and duration of construction activities.	Less than significant.					**X**
Impact 3.12-2: Implementation of the proposed project could exceed a level of service standard established by the Orange County Transportation Authority.	None required.	Less than significant.					
Impact 3.12-3: The proposed project could substantially increase hazards due to a design	**TR-2:** IRWD shall obtain the necessary road encroachment permits or easements prior to	Less than significant.					**X**

TABLE ES-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE IRWD BAKER WATER TREATMENT PLANT PROJECT

			Proposed Project Facilities				
Impacts	**Mitigation Measures**	**Significance after Mitigation**	**Raw Water Pump Station**	**OC-33 Meter Exchange**	**Baker WTP**	**Sewer Pipeline**	**Treated Water Pipeline**
feature or incompatible use.	construction and would comply with the applicable conditions of approval.						
	Implement Mitigation Measure **TR-1.**						**X**
Impact 3.12-4: The proposed project could result in inadequate emergency access.	**TR-3:** During construction of the treated water pipeline, IRWD shall require that the construction contractor notify the responsible law enforcement agencies and fire department two weeks prior to the start of work as to when and where construction would begin and end, and shall coordinate their emergency access plans and procedures accordingly.	Less than significant.					**X**
	Implement Mitigation Measure **TR-1.**						**X**
4.0 Cumulative Impacts							
Impact 4-1: The proposed project, together with related projects, could create cumulative short-term construction impacts related to air quality, hydrology and water quality, noise and vibration, and traffic and transportation	**CUM-1:** IRWD shall communicate and coordinate project construction activities and the project's Traffic Control Plan with the City of Lake Forest. Phasing of project construction shall be coordinated to minimize cumulative impacts to traffic and circulation.	Less than significant.			**X**	**X**	**X**
Impact 4-2: Operation of the proposed project, together with related projects, could create cumulative impacts to aesthetics, air quality, storm water runoff and facilities, and traffic and transportation.	None required.	Less than significant.					

Baker Pipeline Regional Treatment Facility Feasibility Study

Prepared For:
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January 2007

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ACRONYMS

AF	Acre-feet
AFY	Acre-feet/year
AMP	Allan-McCoulough Pipeline
AST	Aboveground Storage Tank
BP	Baker Pipeline
BW	Backwash
CDHS	California Department of Health Services
CEQA	California Environmental Quality Act
CFE	Combined Filter Effluent
CFS	Cubic feet/second
Cl	Chlorine
ClO_2	Chorine Dioxide
CIP	Clean-in-Place
CRP	Colorado River Project
CRW	Colorado River Water
CT	Concentration/time
CWD	County Water District
D/DBPR	Disinfection/Disinfection Byproduct Rule
DBP	Disinfection Byproduct
DHS	Department of Health Services
E&I	Electrical and Instrumentation
EOCWD	East Orange County Water District
EPA	Environmental Protection Agency
FACA	Federal Advisory Committee
FS	Feasibility Study
FTE	Full-time Equivalents
GAC	Granual Activated Carbon
GE	General Electric
HAA5	Five Haloacetic Acids
HGL	Hydraulic Grade Line
I&C	Instrumentation and Control
IDSE	Initial Distribution System Evaluation
IESWTR	Interim Enhanced Surface Water Treatment Rule
IL	Irvine Lake
ILP	Irvine Lake Pipeline
ILW	Irvine Lake Water
IRWD	Irvine Ranch Water District
KW	Kilowatt
KWH	Kilowatt Hour
LAWD	Los Alisos Water District
LF	Lower Feeder
LRAA	Locational Running Annual Average
LT2	Long Term 2
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
M	Million
MCL	Maximum Contaminant Level

ACRONYMS

MF	Microfiltration
MG	Million Gallons
MGD	Million Gallons/day
MIEX	Magnetic Ion Exchange
MND	Mitigated Negative Declaration
MPN	Most Probable Number
MWD	Metropolitan Water District of Southern California
MWDOC	Municipal Water District of Orange County
NaCIO	Sodium Hypochlorite
NH4OH	Ammonium Hydroxide
NOI	Notice of Intent
NTU	Nephelometric Turbidity Units
O&M	Operation and Maintenance
OCFA	Orange County Fire Authority
OH&P	Overhead and Profit
OSHA	Occupational Health and Safety Association
PAC	Powdered Activated Carbon
ROM	Rough-Order-of-Magnitude
RWQCB	Regional Water Quality Control Board
SAC	Santiago Aqueduct Commission
SCAQMD	South Coast Air Quality Management District
SDCWA	San Diego County Water Authority
SDWA	Safe Drinking Water Act
SPCC	Spill Prevention Control and Countermeasure
SPW	State Water Project
SS	Sanitary Sewer
SWP	Storm Water Pollution
SWPPP	Site Specific Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCWD	Trabuco County Water District
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TTHM	Total Trihalomethanes
US	United States
UF	Ultrafiltration
UV	Ultraviolet
VOC	Volatile Organic Compound
WTP	Water Treatment Plant

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EXECUTIVE SUMMARY

A new Baker Regional Water Treatment Plant (WTP) is being contemplated to treat untreated water from the Santiago Lateral and/or Irvine Lake through the Baker Pipeline (BP). The Feasibility Study thoroughly addresses the critical issues that must be resolved to develop the Project. Previous studies have indicated that the unit costs of a Baker WTP would exceed Metropolitan's water treatment surcharges. This FS demonstrates that the Project is viable because the cost will be lower than imported water, and there are significant reliability improvement benefits from the Project. The Project consists of the following features:

- Effective treatment of both water sources.
- Plant siting that results in optimum utilization of existing facilities.
- A treatment process with lowest footprint and overall costs.
- Reliability features of project components.

Treating Irvine Lake water will provide backup during an emergency (e.g., Diemer Plant, Santiago Lateral, or Lower Feeder outage following an earthquake).

The ideal site for the WTP should provide for the largest footprint for new or expanded facilities. The original Baker plant site meets this need. The recommended microfiltration (MF) membrane process results in the following benefits: 1) Smaller footprint requirements than conventional treatment; 2) More reliable treatment and compliance with pending surface water treatment regulations; and 3) Facilitated project approval by the California Department of Health Services (CDHS). In order to optimize the MF recovery rate, backwash recycling and recovery is recommended to minimize reject disposal costs.

Conclusions and recommendations for implementing the Baker WTP Project are as follows:

1. The new WTP should be designed to treat either a blend of imported water or Irvine Lake (IL) water, and have a capacity of 25 mgd (39 cfs).
2. The most challenging water quality conditions for the Project are: a) 100% SPW water from the Lower Feeder; b) 100% IL water.
3. Membrane filtration is the preferred treatment process for the Baker WTP.
4. The existing Baker site is the preferred location for the Baker WTP.
5. The treatment process train should include:
    a. Pretreatment by chemical oxidation (IL supply);
    b. Pressurized microfiltration (MF) membrane treatment;
    c. Ultraviolet light for disinfection and taste/odor control;
    d. Liquid sodium hypochlorite and ammonia for chlorine residual;
    e. Backwash recycling using MF to reduce reject flows.

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6. Project integration facilities include: a) Additional feedwater and product water pipeline capacity, b) Product water pump station for conveying water to the AMP, c) IL pump station to match BP hydraulics under certain lake levels.
7. Hydropower is not viable as a Project component; however, BP hydraulics negate the need for feedwater pumping through the MF modules and other process train units.
8. Unit treatment capital costs are estimated at $1.34/gallon. Unit O&M costs are approximated at $0.15/1000 gallon. Overall capital costs for treatment and integration facilities are estimated at $46M at present cost levels.
9. Unit costs of treatment are projected to be less than the Metropolitan Water District's treatment surcharges by the year 2010. Project unit costs are projected to be less than MWD treated water costs by 2015, as shown on Figures ES-1, ES-2 and Table ES-1.
10. In addition to being cost-competitive, the Project would have additional benefits: a) High level of reliability; b) Provides a replacement water supply if the Diemer WTP, Santiago Lateral, or Lower Feeder is out of service; c) Excellent and consistent water quality; d) Ease of operations; e) High level of regulatory compliance and acceptance; f) Superior space utilization; g) Reactivates an idle facility.
11. There are no apparent environmental or permitting constraints to Project development.
12. The Project could be operational within 2 1/2 years.
13. Project implementation steps should continue as follows:
    a. Bench testing – chlorine dioxide dosing and MF fouling potential of manganese-laden Irvine Lake water (1 month);
    b. Pilot testing at two site locations (6 months), focused on:
        - Chlorine dioxide dosing for manganese oxidation;
        - MF flux optimization and performance of the latest state-of-the-art units;
        - Backwash recycling – second stage MF performance criteria.
    c. Refined economics analysis based on projected MWD rates and operational assumptions;
    d. Seismic load analysis to confirm structural integrity of the treatment building;
    e. Geotechnical investigation – chemical storage, UV reactor and pumping station areas;
    f. Preliminary design report;
    g. Final design.

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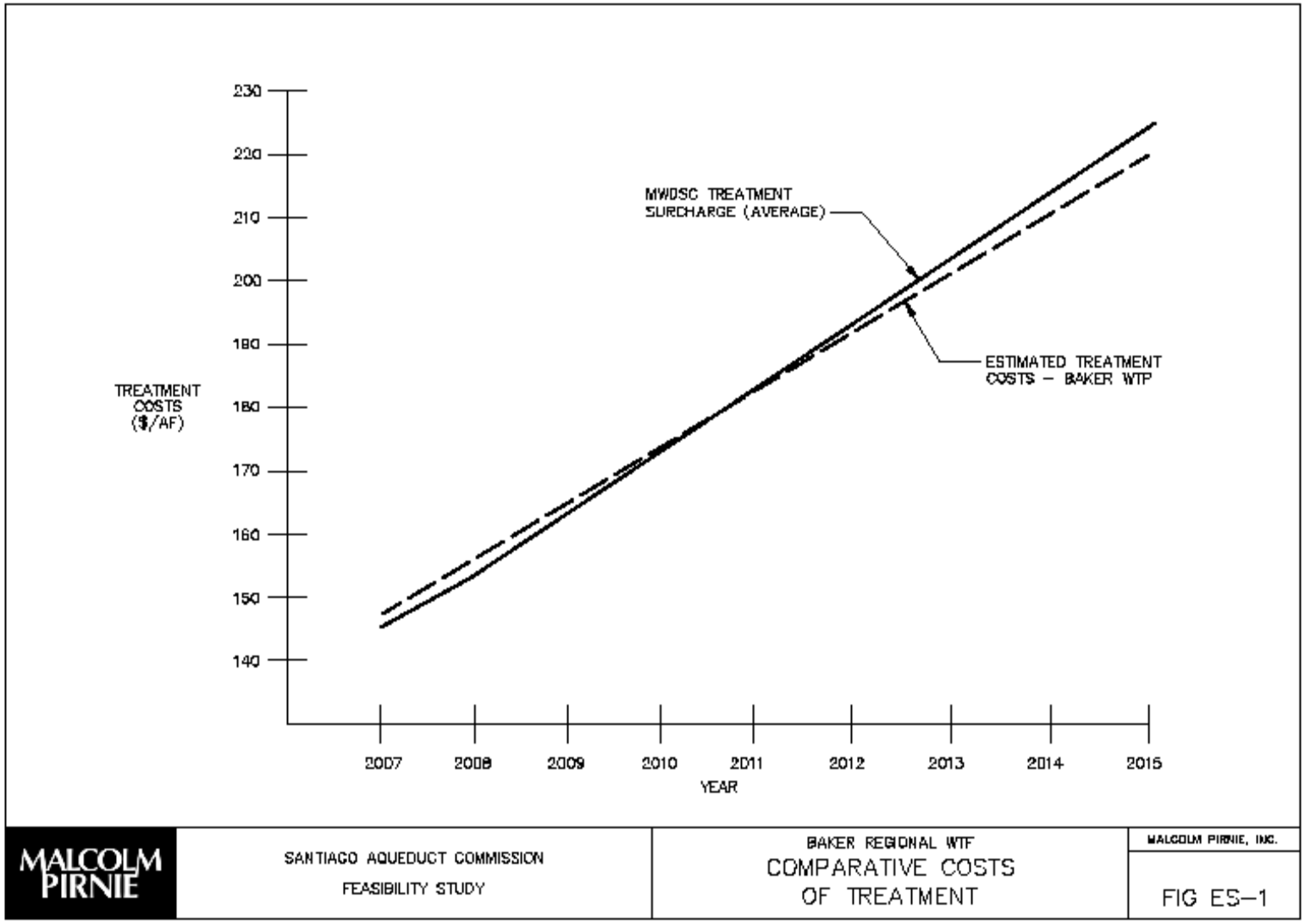
Figure ES-1. Comparative Costs of Treatment



EXECUTIVE SUMMARY

Figure ES-2. Project Economics

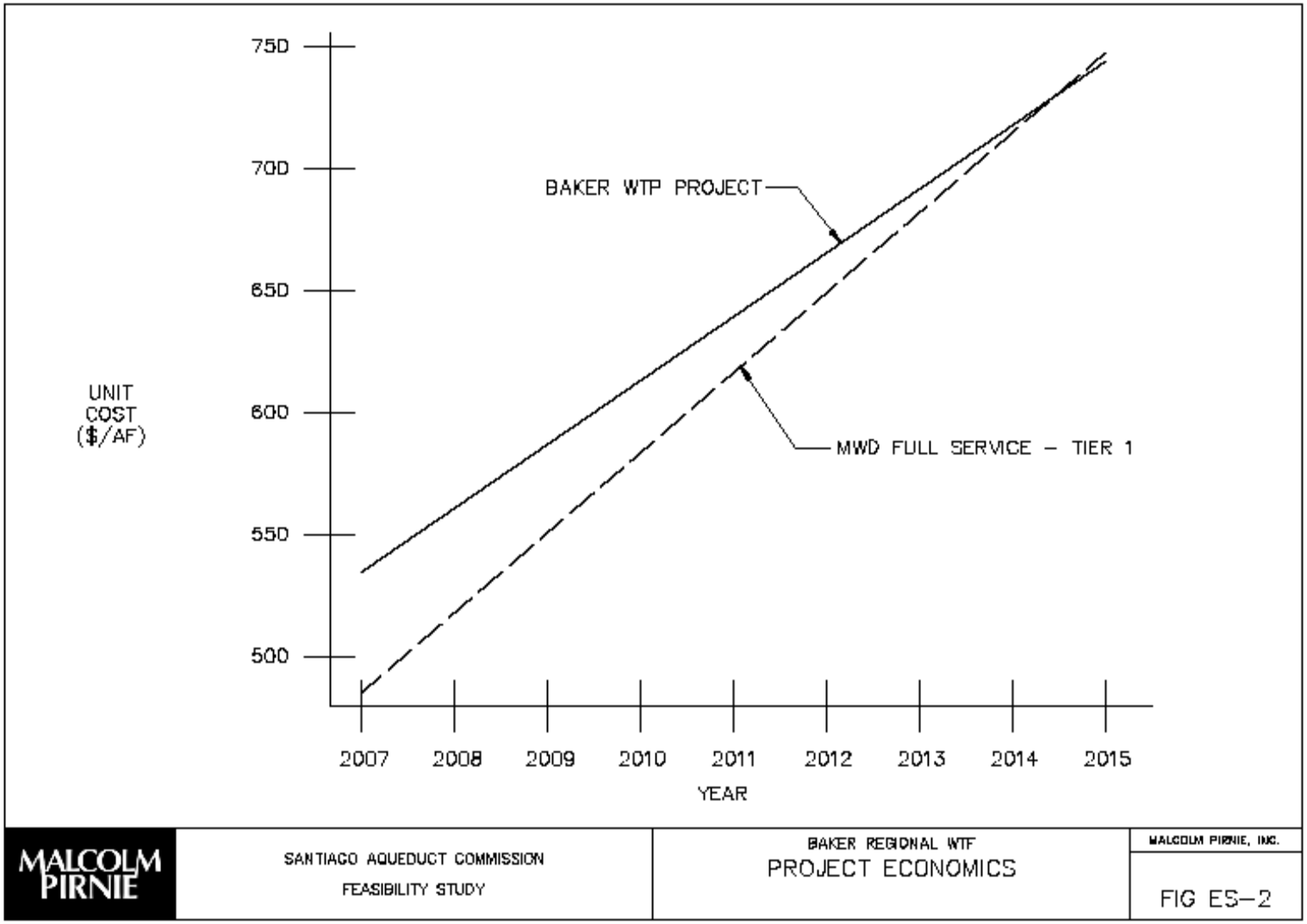


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Table ES-1. Unit Costs of Project and Metropolitan Costs

Year	Unit Cost ($/af)				
	Baker WTP Project				
	Capital Recovery (a)	O&M (b)	Water Purchases (c)	Total	Metropolitan Full Service Tier 1 (d)
2007	108	94	331	533	478
2008	108	98	361	567	527
2009	108	104	376	588	556
2010	108	110	391	609	590
2011	108	114	409	631	615
2012 (e)	108	120	430	658	646
2013 (e)	108	126	451	685	678
2014 (e)	108	132	474	714	712
2015 (e)	108	139	497	744	748

(a) Based on assumed financing of $41.4M @ 5% for 30 years

(b) Includes treatment, ancillary and integration costs

(c) Imported water full service Tier 1 rates less treatment surcharge; Metropolitan projections (10/12/06)

(d) Metropolitan projections (10/12/06)

(e) Inflated after 2010 at 5% / year

CHAPTER 1 PROJECT OVERVIEW

A new Baker Regional Water Treatment Plant (WTP) is being contemplated to treat untreated water from the Santiago Lateral and/or Irvine Lake (IL) through the Baker Pipeline. For the Project to become a reality, it will be necessary to demonstrate in the Feasibility Study (FS) that the Project is the most economical and reliable among various alternatives being considered for the area.

The FS thoroughly addresses the critical issues that must be resolved to develop the Project. Previous studies have indicated that the unit costs of a Baker WTP would exceed Metropolitan Water District's water treatment surcharges. For the Project to be viable, it will be necessary to: 1) Determine that the cost will be lower than other candidate projects, and 2) To document the reliability improvement benefits of the Project. Malcolm Pirnie's approach in preparing the FS is to identify and describe the most economical and reliable configuration of the WTP. Such a project would consist of the following elements:

- Effective treatment of both water sources.
- Plant siting that results in optimum utilization of existing facilities.
- A treatment process with lowest footprint and overall costs.
- Reliability features of project components.

Reduced treatability could result from prioritizing the utilization of a blend of imported water through the Santiago Lateral but not necessarily including IL water. The additional cost of treating the iron and manganese in IL water may slightly increase treatment costs, but also allow use of Irvine Lake water during an emergency (e.g. Diemer Plant, Santiago Lateral, or Lower Feeder outage following an earthquake).

The ideal site for the WTP should provide for the largest footprint for new or expanded facilities. The original Baker plant site may meet this need. A microfiltration (MF) membrane process train is one of several alternative processes that will be evaluated in the FS. MF may result in the following benefits: 1) Smaller footprint requirements than conventional treatment; 2) More reliable treatment and compliance with pending surface water treatment regulations; and 3) Facilitated project approval by the California Department of Health Services (CDHS). In order to optimize the MF recovery rate, backwash recycling and recovery will be considered to minimize reject dewatering or disposal requirements and costs.

Reliability features of the Project may include standby power generation to allow project operations during an emergency outage, treatment redundancy provisions, and structural seismic upgrading of existing treatment facilities, if required.

CHAPTER 2 ANALYSIS OF SUPPLY SOURCES

This chapter presents an overview of the alternative water supply sources for the Project, a water quality analysis of these alternatives, and a description of the Project feedwater characteristics.

2.1 Overview of Alternative Supply Sources

The following sources of untreated water are considered in this FS:

- Imported water – Colorado River Water (CRW)
- Imported water – State Project Water (SPW)
- Irvine Lake Water (ILW)

Untreated CRW is currently conveyed in the Metropolitan Water District of Southern California (Metropolitan) Lower Feeder (LF) from Lake Matthews to the Diemer Water Filtration Plant (Diemer). CRW can therefore be served through the Santiago Lateral (Turnout SL-0), and the Baker Pipeline (BP). Metropolitan staff have indicated that both CRW and SPW can be conveyed in the LF within the next few years, following completion of the Inland Feeder, and ozone treatment facilities at the Diemer and Weymouth water filtration plants. The ratio of CRW and SPW to be flowing in the LF is contingent on several factors, including: 1) mineral levels in CRW, 2) Total organic carbon (TOC) and bromide levels in SPW, 3) Metropolitan's program to balance these two water quality issues, 4) CRW/SPW supply conditions, and 5) Metropolitan's transmission system operational conditions. The long-term blend of CRW and SPW may approximate a 50:50 ratio. However, there may be times when the LF and Project feedwater could be 100% SPW. The treatment challenge under this condition is discussed further in the next section.

Irvine Lake Water (ILW) could also be utilized by the Project through the Irvine Lake Pipeline (ILP) and BP, either as a blend with imported water or separately. ILW could be a very reliable supply if imported water is not available (e.g. following a major earthquake). The major treatment challenge with ILW is iron and manganese concentrations, also discussed further in the next section.

2.2 Source Water Quality Analysis

The controlling water quality aspects of imported water from a regulatory and process selection standpoint are salinity and hardness for the CRW source and TOC and bromide for the SPW source. A full water quality characterization for both sources is shown in Appendix A. A summary table (Table 2-1) for critical source water quality parameters includes total dissolved solids (TDS), total organic carbon (TOC), and bromide (Br). Neither source has been found to be a significant source of pathogens, including *Cryptosporidium parvum*, which would be a concern under the newly promulgated Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

While the fundamental water quality of ILW will not change due to storage, several other phenomena in Irvine Lake may degrade water quality. First, Irvine Lake is an open reservoir. Additional pathogen loading in Irvine Lake from episodic watershed events may increase treatment requirements for the Baker WTP. However, recent watershed sanitary surveys prepared for CDHS indicate this is not significant.

Table 2-1. Summary Of Imported Source Water Quality

Parameter	TDS (mg/L)				Turbidity (NTU)		TOC (mg/L)		Br (mg/L)	
	Lake Mathews	Silverwood	Skinner Eff	Mills Eff	Skinner Eff	Mills Eff	Skinner Inf	Mills Inf	Skinner Inf	Mills Inf
Average	634	261	573	289	0.080	0.075	2.76	2.82	0.100	0.220
Std Dev	47.9	80.8	81.0	79.8	0.021	0.020	0.24	0.51	0.033	0.103
1 Std Dev (90th % confidence)	682	342	654	368	0.101	0.095	3.008	3.33	0.133	0.323
2 Std Dev (95th % confidence level)	730	422	735	448	0.121	0.115	3.251	3.83	0.166	0.425
Minimum	544	115	429	133	0.050	0.040	2.26	1.90	0.010	0.040
Maximum	727	428	719.5	577	0.190	0.120	3.335	4.65	0.205	0.460

Note: Data shown is for the Colorado River (Lake Matthews) and the State Water Project (Silverwood Reservoir). A typical blended water quality is represented by the Skinner WTP effluent (Skinner Eff), and a typical 100% SPW effluent is represented by the Mills WTP effluent (Mills Eff.).

IL is subject to seasonal limnological phenomena, including algae blooms which may produce additional fresh, biologically derived organic carbon, and may increase coagulant demand and reduce filtration rates. Algae blooms may also produce compounds that have a noxious taste and odor or are toxic and are difficult to remove during conventional filtration and disinfection. Finally, stratification may produce anoxic conditions that dissolve and release iron and manganese into the sourcewater. IL currently has traditional stratification management methods, which include aeration and a multi-level outlet tower. Additional outlet tower modifications are planned to minimize iron and manganese levels. Treatment requirements based on *Cryptosporidium parvum* and coliform bacteria occurrence are described in the LT2ESWTR and in CDHS guidance for additional disinfection, respectively.

A treatment plant could be designed to treat a supply that was 100% derived from either source. A 100% CRW source is not expected since Metropolitan's approach is to maintain a blend such that total TDS is near 500 mg/l. A 100% SPW source would require special attention to disinfection byproduct formation, as the peak TOC and bromide concentrations that may occur in this source present a significant challenge with respect to regulated organohalide disinfection byproduct formation (DBP, includes total trihalomethanes, TTHM, and the sum of five haloacetic acids, HAA5). Sourcewater from the SPW also presents a challenge for alternative disinfection using ozone for a new plant, due to forming bromate at concentrations near the maximum contaminant level (MCL) and the additional treatment measures that must be undertaken using this process. The current bromate control practice is to add acid to depress pH prior to ozonation, and then add caustic to raise pH to protect against corrosion in the distribution system. This practice is fairly expensive for a new plant.

The new Baker plant will have the flexibility to treat a blend of CRW, SPW, and ILW sourcewaters, thus simplifying the treatment process required. The following considerations guide the selection of an appropriate blend ratio for two sources.

Salinity. California drinking water regulations specify a secondary standard for total dissolved solids (TDS) of 500 mg/L. To meet this standard, the blend ratio should be approximately 50% from each supply. To meet a more conservative target TDS of 400 mg/L, the blend would be approximately 30% CRW and 70% SPW.

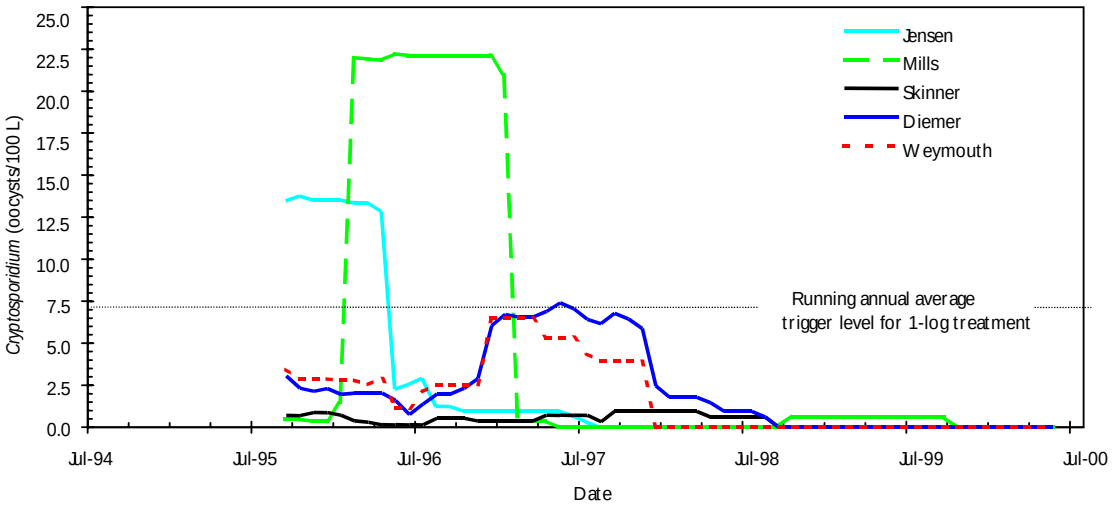
Total Organic Carbon. TOC is the primary precursor for regulated organohalide DBPs. The blended water TOC concentration using a 50%/50% blend of sourcewaters is approximately 3 mg/L, and a blended water TOC concentration using a 30%/70% (CRW/SPW) blend is approximately 3.5 mg/L. It is predicted that a TOC concentration of less than 1 mg/L would be required to allow the use of free chlorine as a residual disinfectant and still reliably comply with DBP regulations. Therefore, without the use of a costly TOC removal process (high pressure membranes, granular activated carbon, or MIEX resin), residual disinfection using chloramination must be practiced.

Bromide. Bromide is the inorganic halide precursor to bromate and is also incorporated in lieu of chloride into organohalide DBPs. Due to its larger molecular weight, bromide incorporation into regulated DBPs during disinfection results in higher mass concentrations of DBPs compared to waters that do not contain relatively high

concentrations of bromide. Bromide is also the key precursor to bromate formation when using ozone, and acid-base and chloramination chemistry are the basis of fundamental bromate control strategies.

Pathogens. Pathogen removal is specified by the LT2ESWTR and CDHS regulations, and through filtration (removal) and chemical disinfection (inactivation), is intended to provide adequate protection from exposure to viruses, bacteria, and cysts. Since 1996, Metropolitan has been monitoring source water *Cryptosporidium* concentrations at their treatment plant intakes and the historical *Cryptosporidium* oocysts levels are plotted in Figure 2-1. The Mills Plant, shown in green, receives East Branch SPW from Devils Canyon. The high levels indicated in 1996/1997 were associated with an unusual runoff event related to the construction of a new outlet tower at Lake Silverwood. Hopefully, such an event will not occur in the future, although the potential for such an event needs to be considered in future planning. Based on data since this event in 1996/1997, the Baker WTP would not be required to provide any additional *Cryptosporidium* treatment beyond the normal levels of treatment when treating 100% SPW.

Figure 2-1. Cryptosporidium Detection in Metropolitan Supplies



The impact of storing water in IL on LT2 compliance will be determined during a two-year sourcewater monitoring period required by the Rule that will begin this year. It is not expected that significant concentrations of *Cryptosporidium* will be found, and current total coliform monitoring has shown only one month where increased levels of disinfection would have been required.

CHAPTER 2 ANALYSIS OF SUPPLY SOURCES

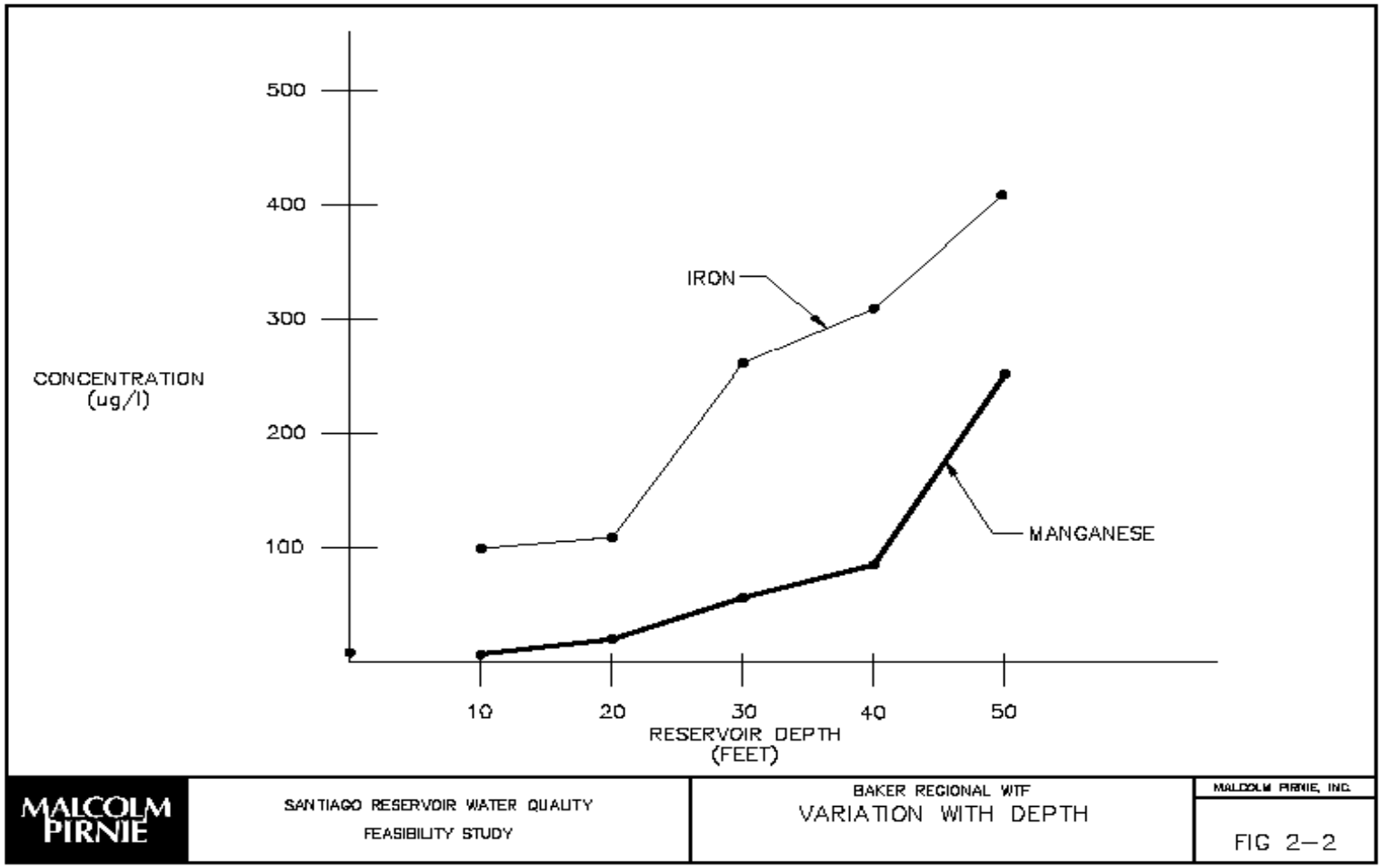
Iron and Manganese. In the past, iron and manganese levels in ILW has exceeded MCL levels, particularly during the summer months and / or when IL levels are low. A historic summary of maximum iron and manganese levels are shown in Table 2-2, and the data with variable depth is depicted in Figure 2-2 and Table 2-3.

Table 2-2. Iron and Manganese Water Quality – Santiago Reservoir (a)

Constituent	MCL (ug/l	Maximum Levels (ug/l)		
		2003	2004	2005
Iron (ppb)	300	250	560	870
Manganese (ppb)	50	59	67	246
Turbidity (NTU)	5	35	9	28

(a) Serrano Water District water quality reports provided by IRWD.

Figure 2-2. Santiago Reservoir Water Quality Variations with Depth



It is expected that IL outlet tower modifications to be undertaken by IRWD will result in concentrations near the MCL levels, and therefore still require some treatment.

Table 2-3. Iron and Manganese Concentration with Irvine Lake Water Levels

Elevation (ft)	Turbidity (NTU)	Iron (µg/l)	Manganese (µg/l)
760	3.11	99.53	14.83
750	3.56	110.67	24.44
740	7.04	249.40	47.01
730	7.71	295.70	52.61
720	9.36	375.21	243.83

Note: Normal operating elevation is 735.

2.3 Project Feedwater Characteristics

Feedwater flow projections for the Project are based on the hydraulic capacity of the lower reaches of the BP, and will vary whether or not Trabuco Canyon Water District (TCWD) will continue to treat raw water from the BP at it's current WTP. Flows under the IL operating scenario are based on IL water levels. These flows are summarized in Table 2-4.

Table 2-4. Estimated Project Feedwater Flows

Source Scenario	Feedwater Flow	
	(cfs)	mgd
Imported Water (a)		
- TCWD WTP Not Operating	39.5	25.5
- TCWD WTP Operating	33.0	21.3
Irvine Lake (b)	39.0	25.1

(a) Capacity of Reach 5U of Baker Pipeline

(b) Assumes the full reservoir capacity delivered over months (assumes maximum emergency period)

For purposes of the treatment process selection analysis in Chapter 3, the Project feedwater flow is assumed to be 25 mgd.

Feedwater quality projections are summarized in Table 2-5 for the following operating conditions:

- 100% imported water at 50:50 CRP/SPW blend

- 100% SPW
- 100% ILW

Table 2-5. Project Feedwater Quality Characteristics

Constituent	Average Imported Water		Maximum Imported Water		Irvine Lake Water	
	CRP/ SPW (a)	100% SPW (b)	CRP/ SPW (a)	100% SPW (b)	Average	Maximum
TDS (mg/l)	579	285	720	577	575	640
Turbidity (NTh)	0.080	0.075	0.190	0.120	6	35
TOC (mg/l)	2.76	2.82	3.34	4.65	3.2	4.57
Bromide (mg/l)	0.100	0.210	0.205	0.460	0.082	0.14
Total Iron (Fe)(µg/l)	ND	ND	ND	ND	189	300 (c)
Total Manganese (Mn) (µg/l)	ND	ND	ND	ND	35	50 (c)

(a) Based on Skinner WTP effluent

(b) Based on Mills WTP effluent

(c) Based on IL outlet tower improvements

ND = Non-Detectable

Historic coliform concentration data is documented in watershed sanitary surveys for CRW, SPW and ILW.

CHAPTER 3 TREATMENT PROCESS SELECTION

This chapter addresses the alternative treatment processes considered for the Project, the process evaluation, and selection of the preferred process train.

3.1 Overview of Alternative Treatment Processes

The following alternative treatment processes are considered for the Baker WTP:

1 Conventional treatment (aeration, mixing, coagulation, flocculation, clarification, granular media filtration, oxidation and disinfection).

2 Direct filtration (in-line coagulation, multi-media filtration, oxidation and disinfection).

3 Membrane filtration (microfiltration), backwash recycling and recovery, and disinfection).

4 Chemical oxidation of iron and manganese (Irvine Lake supply).

3.2 Regulatory Climate

The following current State and federal Rules will guide and inform the selection of a treatment process for the Baker WTP. The rules are part of the Microbial/DBP Rule Cluster, which is intended to balance risks associated with microbial and pathogen occurrence with DBP formation, with the specific intent of not sacrificing acute microbial protection to reduce health risks from chronic exposure to DBPs.

The current D/DBPR is the Stage 2 DBP Rule, which modified the method of compliance calculation from the Stage 1 D/DBP Rule to include locational running annual averages for regulated TTHM and HAA5. In addition, modifications to disinfection or DBP control strategies must be sure to maintain compliance with the companion microbial control rule, the Long Term 2 Enhanced Surface Water Treatment Rule.

3.3 Stage 2 D/DBPR

As part of the 1996 amendments to the SDWA, Congress established deadlines for the DBP rules, requiring the U.S. Environmental Protection Agency (EPA) to promulgate a Stage 2 DBPR by May 2002. As agreed to during Stage 1 negotiations, EPA convened a Federal Advisory Committee (FACA) to negotiate the Stage 2 Rule. The negotiations were completed in September 2000, culminating in an Agreement-In-Principle, which all negotiators have signed. The Stage 2 DBP Rule became effective in March 2006, and compliance with the Rule will begin in April 2012. Systems are required to perform an Initial Distribution System Evaluation (IDSE) to select new compliance monitoring sites that reflect high TTHM and HAA5 levels. These new sites will be used when Phase 2 becomes effective six years after promulgation. The studies will be based either on system specific monitoring or other system specific data that provides equivalent or better information on site selection. Systems will recommend new or revised monitoring sites to CDHS based on their IDSE study. The allowable TTHM and HAA5 levels in Phase 2, at the new samples sites, will be 0.080 mg/L and 0.060 mg/L, respectively. Compliance will be on an individual Locational Running Annual Average (LRAA) basis. Finally, systems will be required to perform “operational level” calculations to assess peak DBP formation and occurrence, and if exceeded, take steps to reduce peak DBP formation.

CHAPTER 3 TREATMENT PROCESS SELECTION

3.4 Long Term 2 Enhanced Surface Water Treatment Rule

The LT2ESWTR was negotiated along with the Stage 2 D/DBPR and will apply to all surface water systems. The two-part Agreement-In-Principle discussed in the Stage 2 D/DBP regulation also included the LT2ESWTR, and will also serve as the foundation for the LT2ESWTR. The LT2ESWTR became effective in March 2006.

The LT2ESWTR is designed to provide additional protection against *Cryptosporidium*. The amount of additional protection will be made on a system specific basis. The LT2ESWTR incorporates system specific treatment requirements based on a 'Microbial Framework' approach. This approach generally involves assignment of systems into different categories (or bins) based on the results of source water *Cryptosporidium* monitoring. Additional treatment requirements depend on the bin to which the system is assigned. Systems will choose technologies to comply with additional treatment requirements from a 'toolbox' of options.

For purposes of bin classification, all surface water systems will need to perform 24 months of source water *Cryptosporidium* monitoring. Systems are placed into bins as shown in Table 3-1 below based on the results of the initial assessment monitoring. The bins have been structured according to the total *Cryptosporidium* oocyst count.

Table 3-1 - Cryptosporidium Action Bins Requirement Table

Bin Number	Average *Cryptosporidium* Concentration	Additional Treatment Requirements for Systems with Conventional Treatment that are in Full Compliance with LT2ESWTR
1	*Cryptosporidium* < 0.075/L	No action
2	0.075/L ≤ *Cryptosporidium* < 1.0/OL	1-log treatment (systems may use any technology or combination of technologies from toolbox as long as total credit is at least a-log)
3	1.0/L ≤ *Cryptosporidium* < 3.0/L	2.0 log treatment (systems must achieve at least 1-log of the required 2-log treatment using ozone, chlorine dioxide, UV, membranes, bag/cartridge filters, or in-bank filtration)
4	*Cryptosporidium* ≥ 3.0/L	2.5 log treatment (systems must achieve at least 1-lot of the required 2.5 log treatment using ozone, chlorine dioxide, UV, membranes, bag/cartridge filters, or in-bank filtration)

The additional treatment requirements in the above table are based, in part, on the assumption that the conventional treatment plant is in compliance with the LT2ESWTR and achieves an average of 2 logs removal of *Cryptosporidium*. Thus, the total

CHAPTER 3 TREATMENT PROCESS SELECTION

Cryptosporidium removal requirements for the action bins 2, 3 and 4 correspond to total *Cryptosporidium* removals of 3.0, 4.0, and 4.5 log, respectively.

Systems will have three years following initial bin classification (due in March 2009) to meet the treatment requirements associated with the bin (due March 2012). An additional two-year extension may be granted by CDHS when capital investments are necessary. Meeting the log treatment requirements identified for each “Action Bin” may necessitate one or more actions from an array of strategies from a "toolbox" of options.

3.5 California Interim Enhanced Surface Water Treatment Rule (IESWTR)

CDHS believes, based on its own experiences and understanding of treatment plant performance, that some changes to the Federal IESWTR are prudent and would increase the level of protection from exposure to pathogens, especially *Cryptosporidium*.

The California IESWTR:

- Increases Combined Filter Effluent (CFE) turbidity continuous monitoring from every 4 hours to every 15 minutes.
- Requires reporting 50th, 90th, 95th, 98th and 99th percentile turbidity values instead of reporting the “number and percentage less than 0.3 NTU.” Operators have indicated that the DHS requires systems to report the number and percentage less than 0.2 NTU.
- Sets an “action level” at 0.3 NTU and applies it at all times after the filter has been in continuous operation for 60 minutes (federal language sets the level at 0.5 NTU after 4 hours of continuous operation).
- Annual filter media inspections are required.
- Requires continuous generation of disinfection profiles.
- Weekly verification of on-line turbidimeters (vs. manufacturers recommendations).
- Source water monitoring for fecal/total coliforms using density analyses.
- All systems using a disinfectant must have detectable residual in at least 95% of distribution system samples every month.
- Monitor and report sedimentation basin effluent turbidity (information only).
- Monitor turbidity and flow of recycled backwash water (information only).

Finally, CDHS has documented policy for requiring additional disinfection based on monthly source water total coliform concentrations. CDHS can require an additional 1-log inactivation of viruses and *Giardia* if total coliform concentrations exceed 1,000 Most Probable Number (MPN)/mL, and can require an additional 2-log inactivation if total coliform concentrations exceed 10,000 MPN/mL.

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3.6 Treatment Process Evaluation

Because the Baker WTP will supply water to south Orange county, where imported supplies from Metropolitan dominate and Metropolitan practices chloramination, the finished water will also be chloraminated to ensure water quality compatibility and stability. When designing cost-effective treatment, this fact then removes expensive precursor removal technologies from consideration. Moreover, there are two primary source water quality combinations to consider; 1) a typical and probable 50%/50% blend of CRW and SPW, and 2) a worst case of 100% SWP. What remains for critical process selection review includes:

- Filtration,
- Primary Disinfection,
- Taste and Odor Control.

Filtration. The filtration process is designed to remove turbidity and particulates, major subset of which are pathogens. Coagulants (primary and coagulant aids) are added to facilitate this process and improve filtration. Some source waters have such a high coagulant demand (including the SPW), that pretreatment solids removal processes may be necessary. Pretreatment may include chemical addition, mixing processes, pre-oxidation, flocculation, and sedimentation. Source waters with low coagulant demand may forgo the pretreatment process. There are three primary types of filtration that may be considered for the Baker WTP:

- Conventional filtration (mono, dual, or tri-media consisting of sand, anthracite, garnet, or deep-bed GAC) with full pretreatment,
- Direct filtration (media filtration without solids removal pretreatment),
- Low-pressure membrane filtration (microfiltration, MF, or ultrafiltration, UF).

Direct filtration is employed by Metropolitan at the Skinner WTP for a blend of CRW and SPW source waters. However, system configuration ensures that a blend will always be available at the Skinner WTP. Location of the Baker WTP does not allow for this flexibility. System configuration and potential reductions of CRW supplies suggest that 100% SPW is the most conservative and demanding treatment supply for the Baker WTP. A supply of 100% SPW does not allow for direct filtration to be used for the Baker WTP.

Conventional filtration is a proven, reliable, and low-cost filtration technology. Disadvantages of the process include the need for larger plant footprints for flocculation and sedimentation basins, and space and equipment for solids treatment and water recycling. Use of conventional filtration also typically requires the practice of enhanced coagulation per the disinfection byproduct rules, and this increases coagulant use and solid production and reduces filtration rate.

Low pressure membrane filtration is a recently developed and utilized technology that uses hollow plastic fibers with well-defined openings to achieve filtration. Two technologies are in use: 1) pressurized membrane filtration, where water flows under pressure from headers into the inside of the hollow membranes and is forced through to the outside, and 2) vacuum membrane filtration, where water is drawn from the outside of

the hollow fiber into the interior to achieve filtration. Each technology has its advantages and disadvantages based on water quality, plant size, and existing facilities. Pressurized membrane filtration typically produces higher filtration rates, but requires more equipment and may be less economical for new large plant sizes (larger than 30 mgd). Vacuum or submerged filtration produces lower filtration rates but requires less equipment and maintenance, and is more economical for larger plant sizes and smaller plants provided suitable basins are available (retrofit). Membrane filtration is a current favorite due to very reliable operation for producing low turbidity and meeting filtration regulations. Membrane filtration plants are also not required to practice enhanced coagulation, thus minimizing coagulation use and solids handling facilities.

A major consideration for filtration technology selection is the volume and nature of the backwash residual stream. Conventional filtration will generate that greatest volume and mass of residual solids from the coagulation, filtration, and backwash process. To recycle this water and increase utilization, a relatively large clarification or separation process is needed, as well as solids handling and dewatering facilities. Direct filtration has the same requirements, but to a lesser degree, since smaller coagulant concentrations are used and enhanced coagulation is avoided. Membrane filtration offers the greatest benefit here, because no coagulants are required under normal conditions, thus the backwash residuals stream is more easily treated and the remaining residuals stream after recycling can be sent directly to a sewer.

Primary Disinfection and Alternative Disinfection. The use of a chemical oxidant and disinfectant is required to protect public health from exposure to pathogens and provide a multi-barrier approach to pathogen removal. This task has traditionally been achieved using chlorine, until concern over the health effects of DBPs reduced the use of chlorine and promoted interest in other disinfectants. The other disinfectants that may currently be employed for primary disinfection include:

- Ozone,
- Chlorine dioxide, and
- Ultraviolet radiation (UV).

Ozone. Ozone is a powerful oxidant and chemical disinfectant that is widely used in the US and Europe. Ozone must be generated on-site, consuming significant amounts of electricity, and must be fed into a specially designed and monitored contactor. Ozone does not leave a long-lasting residual, and must be used in conjunction with chlorine or chloramines for residual disinfection. In the presence of bromide, ozone will form bromate, a regulated DBP. For the concentrations of bromide found in the SWP, using ozone represents a significant risk of forming bromate at concentrations near the MCL. Current techniques for minimizing bromate formation consist of adding acid to drive the formation of hypobromous acid, which is less likely to form bromate. Amounts of acid addition are increased in alkaline waters, which buffer pH changes. Acid addition also may require caustic addition to raise pH after treatment for corrosion control purposes. Both chemical addition steps may raise TDS. Ozone has additional benefits due to its ability to oxidize taste and odor problem compounds. Finally, the bromate MCL is currently set at a relatively high concentration due to the disinfection benefits of ozone,

however, this level may be revised downward in the future to levels where it is uncertain if current bromate control strategies may be effective. A promising technique of prechloramination for bromate control is relatively untested. Due to the risk of bromate formation and the relative costs of ozone treatment for new facilities, ozone is not recommended for the Baker WTP.

Chlorine Dioxide. Chlorine dioxide is another strong oxidant and chemical disinfectant, second only to ozone in terms of common water treatment chemicals. Chlorine dioxide is also generated on-site and delivered as liquid; the primary chemical feedstock is sodium chlorite. Reaction of chlorine dioxide produces chlorite, a regulated DBP, and chlorate, formation of which limits the doses and use of chlorine dioxide for primary disinfection, except for some relatively unusual techniques to chemically reduce chlorite and chlorate after formation. Small amounts of chlorine dioxide are highly effective for iron and manganese oxidation. However, chlorine dioxide is relatively ineffective for addressing taste and odor compounds.

UV. Ultraviolet radiation is a physical method of disinfecting microorganisms, which is achieved via damage of the pathogens genetic material. UV disinfection is achieved by passing water through relatively compact reactors containing UV lamps. The number of lamps and reactor size is governed by the type of UV lamp technology used; medium pressure lamps offer smaller footprint but use more electrical energy and operate at higher temperatures, while low pressure-high output lamps require more lamps and space but consume less energy. In all cases, the footprint for UV disinfection is competitive with ozone and chlorine contactors. UV disinfection also does not leave a lasting residual, and must be combined with chlorine or chloramine residual disinfection. Finally, UV disinfection may be combined with hydrogen peroxide addition and augmented with additional UV lamps to provide oxidation of taste and odor compounds and other organics through the generation of hydroxyl radicals, which are strong oxidants comparable with ozone.

Taste and Odor Control. In addition to the oxidative techniques for taste and odor control listed above (ozone and UV/peroxide), several adsorptive technologies are available to address this challenge. In the case where DBP precursor removal is not required and is not achieved using granular activated carbon (GAC), powdered activated carbon (PAC) may be intermittently fed prior to filtration to achieve adsorption and removal of taste and odor compounds. However, the use of PAC is abrasive and significantly increases the solids handling requirements of filter backwashing, clarification, and water recycling.

3.7 Comparison of Alternative Treatment Processes

Table 3-2 summarizes the relative merits of the available treatment technologies for the Baker WTP. It is assumed in this table that residual disinfection using chloramines will be used and that adsorptive precursor removal is not necessary.

CHAPTER 3 TREATMENT PROCESS SELECTION

Table 3-2. Summary of Alternative Treatment Process Effectiveness

Technology	Treatment Challenge					
	DBP Control		LT2	Taste and Odor Control	Fe & Mn Removal	Solids Handling
	50%/50% Blend	100% SWP				
Filtration						
Conventional	+	+	-	-	NA	-
Direct	+	×	×	×	NA	-
Membrane	+	+	+	NA	NA	+
Primary Disinfection						
Chlorine	+	-	-	×	-	-
Ozone	×	-	+	+	+	+
Chlorine Dioxide	×	×	×	×	+	-
UV/H2O2	+	+	+	+	×	+
Residual Disinfection						
Chlorine	×	×	NA	NA	NA	NA
Chloramines	+	+	NA	NA	NA	NA
Precursor/Organics Removal						
PAC	-	-	NA	+	NA	-

Key:

+ is an effective technology
- is an adequate technology
× is an inappropriate technology
NA = Not Applicable

3.8 Conceptual Costs of Viable Processes

The following two alternative processes are considered viable for the Baker WTP:

- Conventional Treatment
- Membrane Filtration

A process flow diagram for conventional treatment applied to the Baker WTP is shown on Figure 3-1. A comparable process flow diagram for membrane filtration treatment applied to the Baker WTP is shown on Figure 3-2.

Figure 3-1. Baker Regional Water Treatment Facility Conventional Process Flow Train

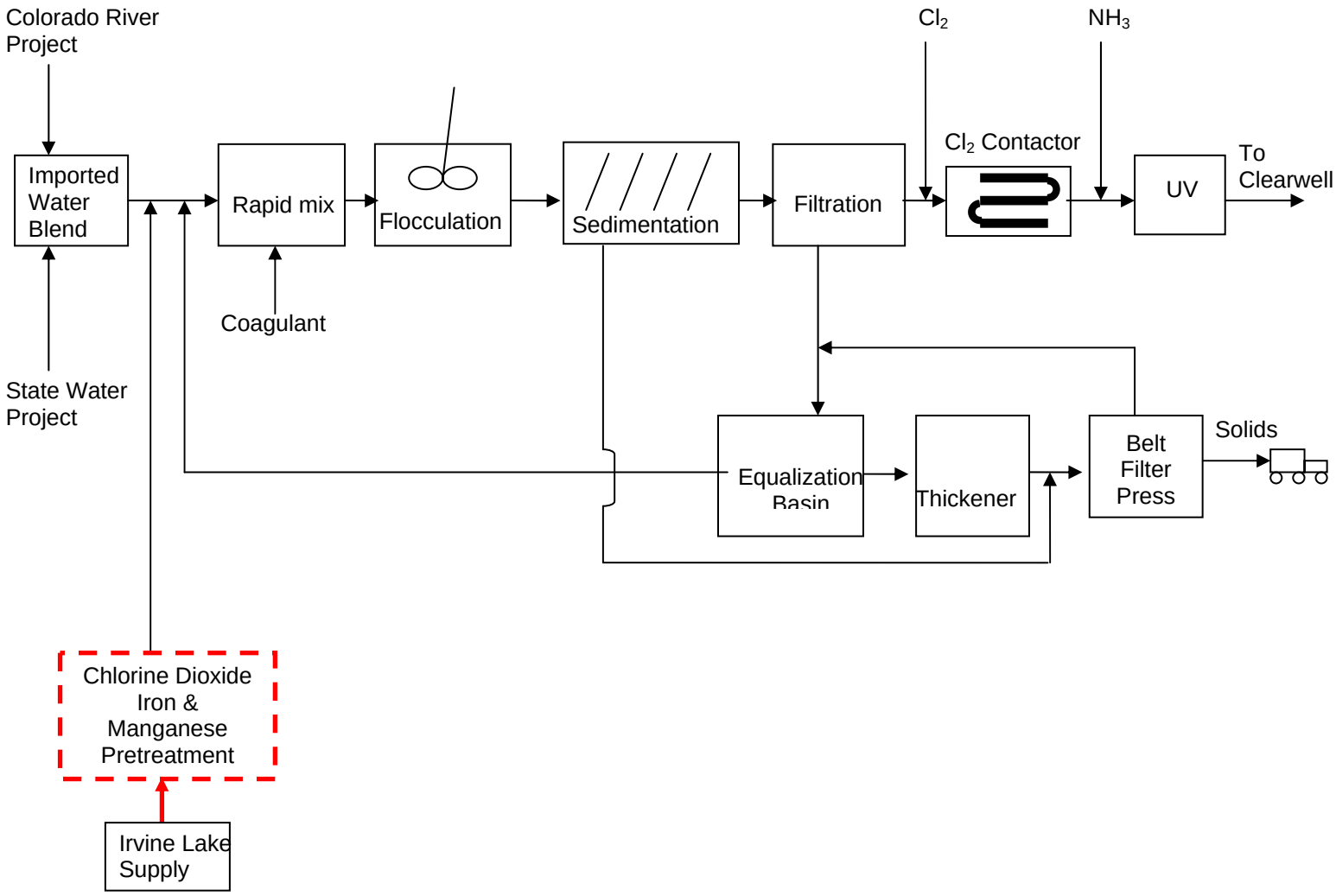
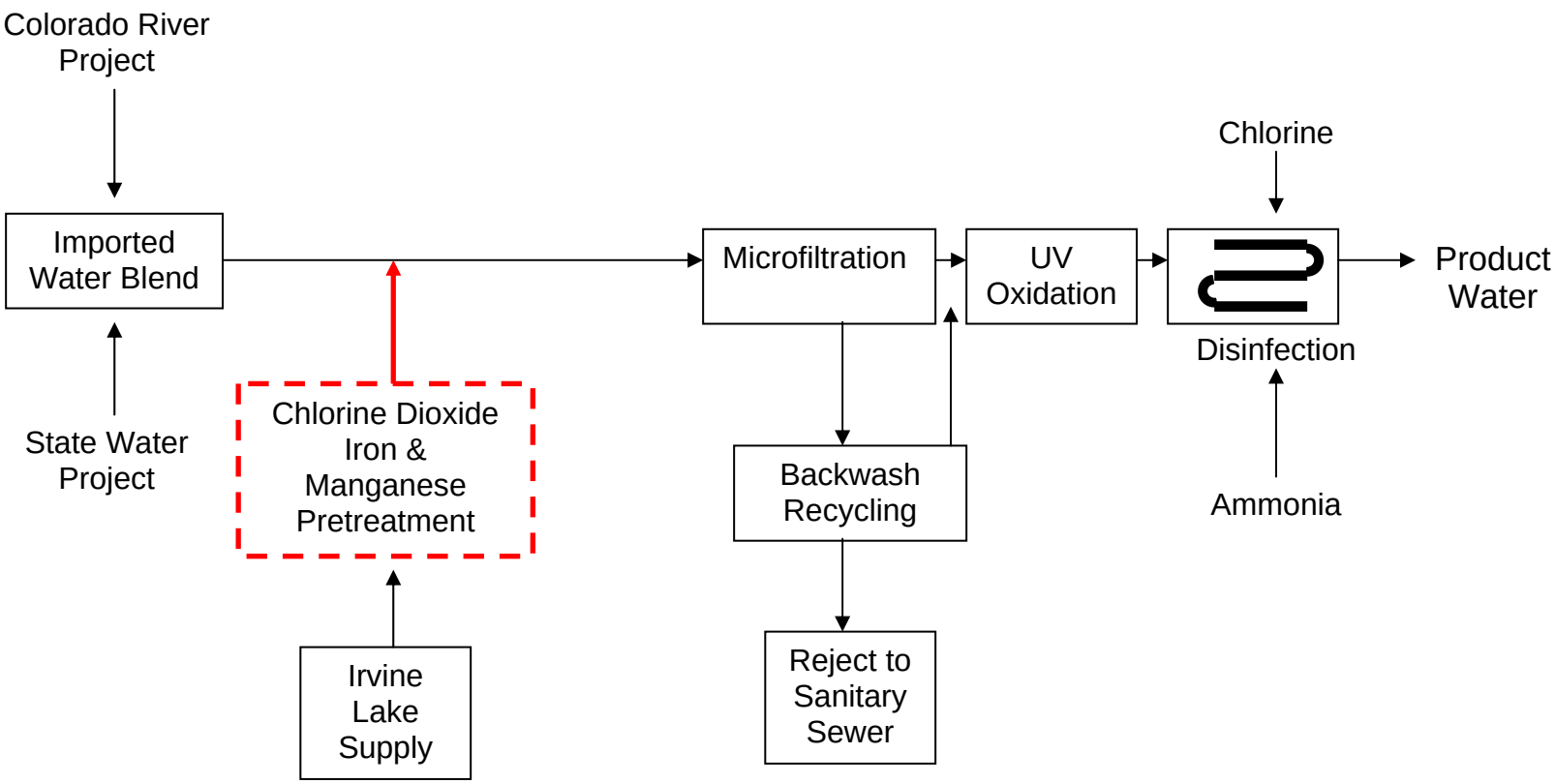


Figure 3-2. Baker Regional Water Treatment Facility Tentative Best Apparent Process Flow Train



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Costs were developed for a 25 mgd WTP configured with either a conventional process or a MF process. Direct filtration was not estimated due to the inability of this process to effectively treat 100% SPW. Maximum use of existing facilities was assumed, including retaining the use of existing buildings and reservoir facilities. Retrofit costs will be considered separately for the best apparent process.

Unit treatment equipment costs were developed using a variety of sources. First, Malcolm Pirnie recently completed a cost estimate for the SDCWA Twin Oaks plant (50 mgd option), and these costs were used where appropriate. The costs obtained in this fashion were compared to those developed using the Culp/Wesner/Culp computer W/W Costs Model 3.0, which allows price escalation based on ENR indices and allows user input for the local cost of chemicals and materials. This model was used for all comparable unit processes, other than microfiltration, and produced very similar results.

MF unit costs were obtained from the previous Twin Oaks cost estimate and from discussions with membrane manufacturers regarding recent bid costs and installations. MF membrane costs were based on using a pressurized MF system, which will be more appropriate for the existing sites. The size of the new Baker treatment plant is large enough where some economy of scale in costs is achieved, but not so large (50 – 100 mgd and larger) where larger economies are achieved.

The major process differences in the plants are the need for additional chemical addition and solids handling for the conventional plant (that will be required to perform coagulation), and the disposal of a liquid fraction to sewer from the backwashing process for the MF plant.

Costs are presented in terms of unit equipment costs and unit annual operational and maintenance (O&M) costs. From the O&M costs, an operational cost per volume treated is determined ($/1000 gallons). The total of the unit equipment costs are then used to determine an opinion of probable cost based on typical methods for including other installation costs, including associated electrical, instrumentation and control (I&C), site work and yard piping, design, administrative, and contractor overhead and profit costs. The total capital costs are then reduced to the cost per unit capacity of the plant ($ per installed gallon).

Finally, normalized, total annual production costs (capital, capital recovery, and annual O&M) were determined using a cost of money of 5%, a useful life of 30 years, and a plant utilization of 90%, to account for planned maintenance downtime. These costs are presented in terms of total annual cost per volume of water produced ($/AF). These costs will be further refined for the preferred process at the preferred site.

Costs for the conventional process are summarized on Tables 3-3 and 3-4. Membrane process costs are shown on Tables 3-5 and 3-6.

CHAPTER 3 TREATMENT PROCESS SELECTION

Table 3-3. 25 MGD Conventional WTP Capital Cost Estimate

Plant Capacity: 25 mgd	%	$
Equipment		$ 16,147,000
Electrical and Instrumentation (E&I)	12%	$ 1,938,000
Sitework and Piping	20%	$ 3,229,000
Mobilization, Insurance, Administration	8%	$ 1,292,000
Contractor Overhead and Profit (OH&P)	10%	$ 1,615,000
SUB-TOTAL Treatment Construction		$ 24,221,000
Design and Construction Engineering	12%	$ 2,907,000
Construction Contingencies and Adjustments	25%	$ 6,055,000
Legal and Administration	3%	$ 727,000
TOTAL Capital Cost - Treatment		$ 33,910,000

Table 3-4. 25 MGD Conventional WTP Equipment and O&M Costs

Unit Process	Equipment and Installation Costs ($)	Operation and Maintenance Costs ($/yr)
Rapid Mix	$ 125,000	$ 22,000
Raw Water Chemical Feed	$ 1,200,000	$ 373,000
Flocculation and Sedimentation	$ 3,500,000	$ 135,000
Media Filtration	$ 6,000,000	$ 150,000
Finished Water Chemical Feed	$ 1,350,000	$ 255,000
Chlorine Contact Basin	$ 410,000	$ -
UV Disinfection	$ 1,625,000	$ 280,000 (a)
Backwash Equalization Tank	$ 683,000	$ -
Residuals Handling	$ 1,254,000	$ 150,000
TOTAL	**$ 16,147,000**	**$ 1,365,000**

(a) Includes removal of occasional pathogen spikes from potential watershed events.

Table 3-5. 25 MGD Microfiltration WTP Capital Costs Estimate

Plant Capacity: 25 mgd	%	$
Equipment		$ 15,980,000
Electrical and Instrumentation (E&I)	12%	$ 1,918,000
Sitework and Piping	20%	$ 3,196,000
Mobilization, Insurance, Administration	8%	$ 1,278,000
Contractor Overhead and Profit (OH&P)	10%	$ 1,598,000
SUBTOTAL Treatment Construction		$ 23,970,000
Design and Construction Engineering	12%	$ 2,876,000
Construction Contingencies and Adjustments	25%	$ 5,992,000
Legal and Administrative	3%	$ 719,000
TOTAL Capital Cost - Treatment		$ 33,557,000

Table 3-6. 25 MGD Microfiltration WTP Equipment and O&M Costs

Unit Process	Equipment and Installation Costs ($)	Operation and Maintenance Costs ($/yr)
Microfiltration	$12,620,000	$ 731,000
Finished Water Chemical Feed	$ 1,350,000	$ 233,000
Chlorine Contact Basin	$ 410,000	$ -
UV Disinfection	$ 1,600,000	$ 256,000 (a)
TOTAL	**$15,980,000**	**$1,220,000**

(a) Includes removal of occasional pathogen spikes from potential watershed events.

Unit costs of the two viable alternative processes are summarized on Table 3-7.

Table 3-7. Summary of Alternative Process Costs

	Conventional Process	Microfiltration Process
Capital Costs ($M)	33.9	33.6
Unit Capital Cost ($/gallon)	1.36	1.34
O&M Costs ($M/yr)	1.36	1.22
Unit Production Cost ($/1000 gallon)	0.17	0.15
Capital Recovery ($M/yr) (a)	2.20	2.18
Total Annual Cost ($M/yr) (b)	3.56	3.40
Annual Production (AFY)(c)	24,950 (d)	24,950 (d)
Unit Annual Cost ($/AF) (c)	143	137

(a) 5% at 30 years (crf = 0.065)

(b) Capital recovery plus O&M

(c) Assumes 25 mgd feedwater flow, 99% conventional process recovery, 99% membrane process recovery (assuming backwash recycling), and 90% utilization factor (allowance for planned maintenance downtime)

(d) Rounded

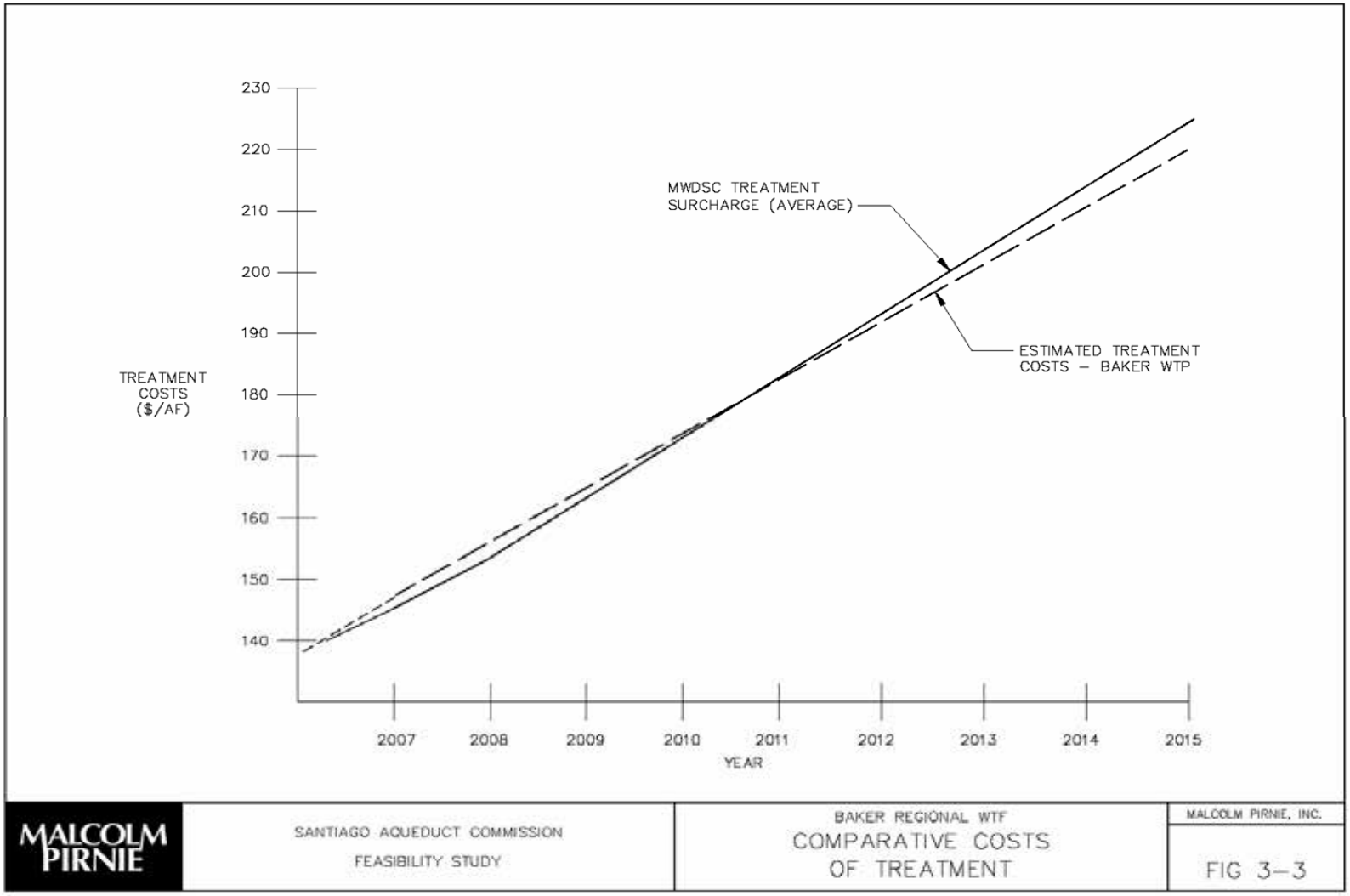
3.9 Preferred Treatment Process

As shown in the table, the MF process is slightly more economical than the conventional treatment process for the Baker WTP. The projected unit treatment cost, including O&M costs estimated at 5% per year, is also less than the Metropolitan treated water surcharge in year 2010, as shown on Figure 3-3. The Metropolitan treatment costs are increasing significantly because of ozone treatment facilities implementation. Full Project costs are analyzed in Chapter 7.

In addition to an economic edge, the MF process has the following advantages, compared to the conventional process:

- More reliable treatment and compliance with pending regulations;
- Ease of operations;
- Smaller footprint requirements;
- Ability to be installed in existing treatment buildings;
- Less chemical use and sludge disposal problems;
- Favored by the CA Department of Health Services.

Figure 3-3. Comparative Costs of Treatment



CHAPTER 3 TREATMENT PROCESS SELECTION

MF is the preferred process for filtration. The best apparent process flow train includes the following components:

- Microfiltration (MF);
- Chlorine dioxide for iron and manganese pre-treatment (when using Irvine Lake water);
- UV for primary disinfection and taste and odor control.

CHAPTER 4 TREATMENT FACILITY SITE ANALYSIS

In this chapter the following topics are discussed: 1) Overview of optional sites for the Baker WTP, 2) optional sites evaluation, 3) selection of the preferred site.

4.1 Overview of Optional Sites

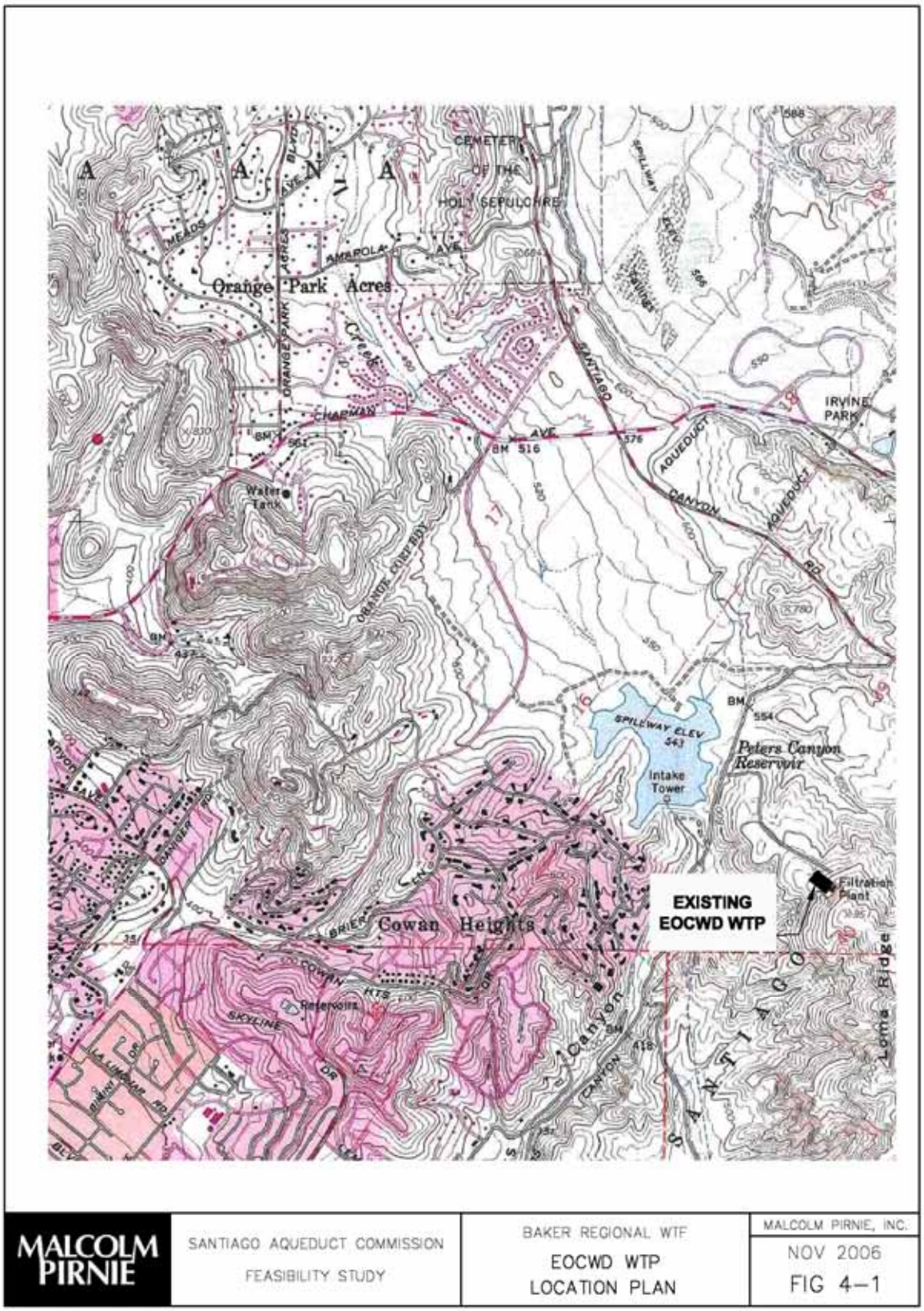
The following two sites are candidate sites for the Baker WTP:

- Peters Canyon WTP site
- Baker WTP site

The Peters Canyon WTP site is owned by the East Orange County Water District (EOCWD) and is located on Figure 4-1 and shown Figure 4-2. The Baker WTP is owned by Irvine Ranch Water District (IRWD) (formerly Los Alisos Water District [LAWD]), and is shown on Figure 4-3 and Figure 4-4.

CHAPTER 4 TREATMENT FACILITY SITE ANALYSIS

Figure 4-1. EOCWD WTP Location Plan



CHAPTER 4 TREATMENT FACILITY SITE ANALYSIS

Figure 4-2. EOCWD WTP Facilities

CHAPTER 4 TREATMENT FACILITY SITE ANALYSIS

Figure 4-3. Baker WTP Location

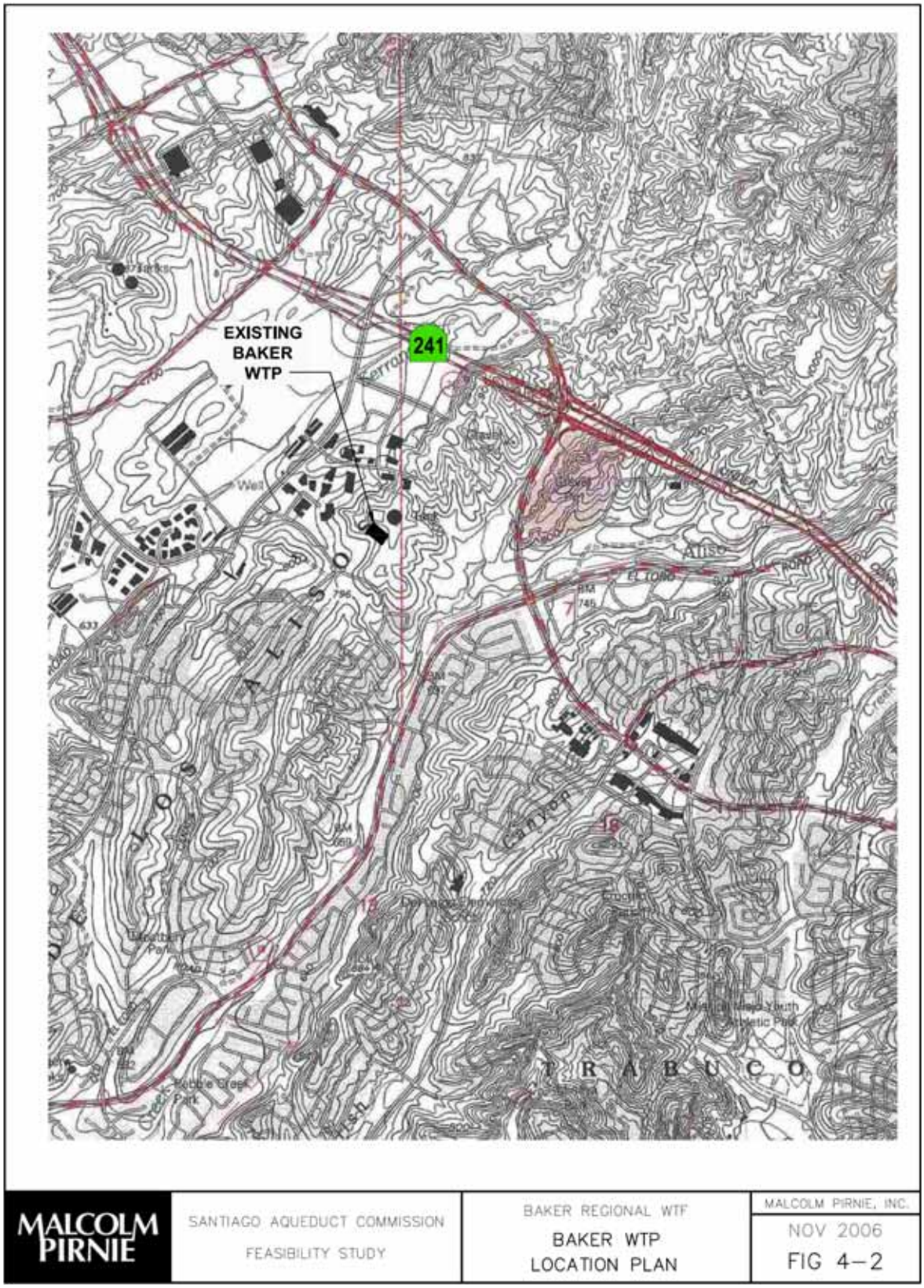


Figure 4-4. Baker WTP Facilities

Peters Canyon WTP Site. The Peters Canyon WTP was constructed in 1963 and has been decommissioned for some time. It has a rated capacity of 8.9 cfs. The site could possibly be utilized for the Project WTP; however, site expansion is constrained by several factors as seen in the photo. The land surrounding the WTP building would require extensive grading and fill to create sufficient space for a 30-39 cfs treatment footprint. The practical maximum capacity of the Project WTP within the existing building at this site may be limited to about 15 cfs (10 mgd).

Baker WTP Site. The original Baker WTP has only been partially utilized for some time, and had a rated capacity of 15 cfs. The site could be utilized for the Project WTP, but would require modifications and additional facilities to provide sufficient capacity.

Both WTP's at these two sites utilized a "Hardinge" filtration process, consisting of shallow single-media filters and a traveling bridge for automatic backwashing. The

CHAPTER 4 TREATMENT FACILITY SITE ANALYSIS

process was typical when installed, but now would require extensive enhancements and additional processes to meet current and pending water quality regulations. However, the concrete structures and building would be incorporated into a new facility using the MF process.

4.2 Alternative Site Evaluation

An evaluation of the two sites has been conducted to address advantages and disadvantages in terms of the following criteria:

- Proximity to system infrastructure;
- Site area requirements;
- Site evaluation;
- Utilities availability;
- Site vulnerability;
- Facilities condition / seismic upgrading;
- Site access;
- Compatibility with surrounding development;
- Environmental impacts;
- Permit requirements.

Results of the site evaluation are tabulated on the following pages:

1. PROXIMITY TO SYSTEM INFRASTRUCTURE

Baker Site	–	Immediately adjacent to the Baker Pipeline
	–	AMP connection onsite (needs enlargement)
	–	Downstream of TCWD turnout (facilitates continued use of TCWD WTP if desired and viable)
EOCWD Site	–	No longer connected to the Baker Pipeline – reconnection required
	–	Conversion of Baker Pipeline to treated water facility would not allow for continued use of TCWD WTP.

CHAPTER 4 TREATMENT FACILITY SITE ANALYSIS

2. SITE AREA REQUIREMENTS

Baker Site	– Space adjacent to existing WTP is available and originally planned for expansion – Within existing LAWD/IRWD system plant facilities (reservoirs, buildings) are well-buffered from surrounding residential neighborhoods (trees, natural noise barrier) – Adequate clearwell capacity is available for disinfection CT needs
EOCWD Site	– Existing topography limits extensive expansion of existing WTP – Extensive grading required for expansion beyond 10 mgd – Cell phone tower relocation possibly required – Greater expansion required than Baker Site, due to lower capacity of existing WTP – Irvine Ranch Environmental Reserve limits expansion at the site

3. SITE ELEVATION

Baker Site	– Full utilization of hydropower potential, if viable for project requirements – Aqueduct pressure sufficient to meet membrane pressure requirements
EOCWD Site	– No hydropower potential available – Influent pumping required at new WTP for pressurized membranes – Difficult to convey Irvine Lake water to the site

4. UTILITIES AVAILABILITY

Baker Site	– Power substation in adjacent neighborhood (assume excess capacity is available) – All other utilities at site
EOCWD Site	– Capacity of all utilities probably sufficient

CHAPTER 4 TREATMENT FACILITY SITE ANALYSIS

5. SITE VULNERABILITY (Flooding, Earthquake, Security)

Baker Site	–	No flooding risk (elevated site)
	–	Closest San Joaquin Hills Fault is active; magnitude 6.6 scenario could produce 0.4g acceleration
	–	Fenced site surrounded by residential neighborhood (low security risk)
EOCWD Site	–	No flooding risk (elevated site)
	–	Closest Peralta Hills Fault is active; magnitude 6.8 scenario could produce 0.3g acceleration
	–	Fenced site (low security risk)

6. FACILITIES CONDITION / SEISMIC UPGRADING

Baker Site	–	Limited corrosion and rehabilitation requirements
	–	Constructed before Loma Prieta/Northridge earthquakes and may need rehabilitation to meet new codes
EOCWD Site	–	Corrosion may require demolition and reconstruction
	–	Constructed before Loma Prieta/ Northridge/San Fernando earthquakes and may need rehabilitation to meet new codes; Portion of the onsite reservoir is located on fill

7. SITE ACCESS

Baker Site	–	Chemical deliveries and construction access available through commercial access from Bake Parkway/Commerce Center Drive (need to notify future adjacent residents)
	–	No need to traverse the current adjacent residential neighborhood
EOCWD Site	–	Convenient access off Jamboree Road for chemical deliveries and construction equipment

8. COMPATIBILITY WITH SURROUNDING DEVELOPMENT

Baker Site	–	Major utilities plant/corporation yard surrounded by residential neighborhoods, and buffered by dirt embankments and landscaping
	–	Continued good neighbor
EOCWD Site	–	No surrounding development; full visibility
	–	Construction in sensitive area (East Orange development)
	–	Irvine Ranch Environmental Reserve surrounds the WTP site

CHAPTER 4 TREATMENT FACILITY SITE ANALYSIS

9. ENVIRONMENTAL IMPACTS

Baker Site	–	Energy: Similar power use as regional treatment; potential hydropower credit
	–	Noise: Noise generators are inside buildings
	–	Aesthetics: Existing plant is well buffered
EOCWD Site	–	Energy: More power use than Baker site (no hydropower)
	–	Noise: No neighbors; noise generators are inside
	–	Aesthetics: Full ridge-line view from SR 241/Jamboree Road
	–	Air quality constraints: Site grading

Environmental issues will be further discussed in Chapter 8

10. PERMIT REQUIREMENTS

Baker Site	–	Lead agency will be exempt from City of Lake Forest building permits requirements: No constraints anticipated on other permits
EOCWD Site	–	Lead agency will be exempt from County of Orange building permits requirements: No constraints anticipated on other permits

Permit requirements will be further discussed in Chapter 8.

Based on the above evaluation, it is concluded that the Baker site is the preferred location for the project treatment facilities. This discussion was confirmed by the SAC representatives at the Progress Meeting No. 2 held on October 12, 2006. The Peters Canyon site could be utilized in future project phases, contingent on Baker Pipeline hydraulic improvements.

4.3 Options for Chlorine Dioxide Facilities Location

In Chapter 3, the need for chlorine dioxide chemical addition for iron and manganese reduction in Irvine Lake water was discussed. There are four optional locations for these facilities:

1. Irvine Lake – adjacent to Irvine Lake Pipeline (ILP)
2. Irvine Park – adjacent to ILP chlorination station
3. Peters Canyon WTP site
4. Baker WTP site

The Irvine Lake (IL) optional location is constrained by adjacent recreational facilities, and would require interaction with Serrano Water District and other stakeholders. The Irvine Park optional location is constrained by being too close to the recently completed chlorination facilities and the resulting chemical interactions. The Peters Canyon WTP would have available space, but would require a new pipeline to reconnect to the Baker Pipeline (BP). The Baker WTP site is viable, since a portion of the existing 2MG

clearwell could be modified to provide the required 20-minute contact time, assuming it is not dedicated to reclaimed water storage.

It is concluded that the chlorine dioxide facilities should be located at the Baker WTP.

CHAPTER 5 TREATMENT PLANT LAYOUT

This chapter addresses the overall facilities and treatment equipment requirements, and the treatment facilities layout at the Baker Site.

5.1 Facilities Requirements

The following facilities are necessary for construction of a membrane treatment plant at the Baker site:

1. Pretreatment for iron and manganese oxidation (Irvine Lake supply);
2. Microfiltration (MF) process equipment and appurtenances;
3. UV light disinfection / taste and odor control;
4. Chemical storage and feeding equipment;
5. Pipeline improvements (influent, product water);
6. Product water pumping station;
7. Irvine Lake pumping station (located at Peters Canyon Flow Control Facility);
8. Hydropower reverse pump turbine (potential);
9. Backwash water handling.

The treatment facilities layout is addressed below. Layout of the other system facilities is discussed in Chapter 6. The existing overall site is shown on Figure 5-1 and the existing treatment plant is depicted on Figure 5-2.

Figure 5-1. Existing Site Vicinity Plan

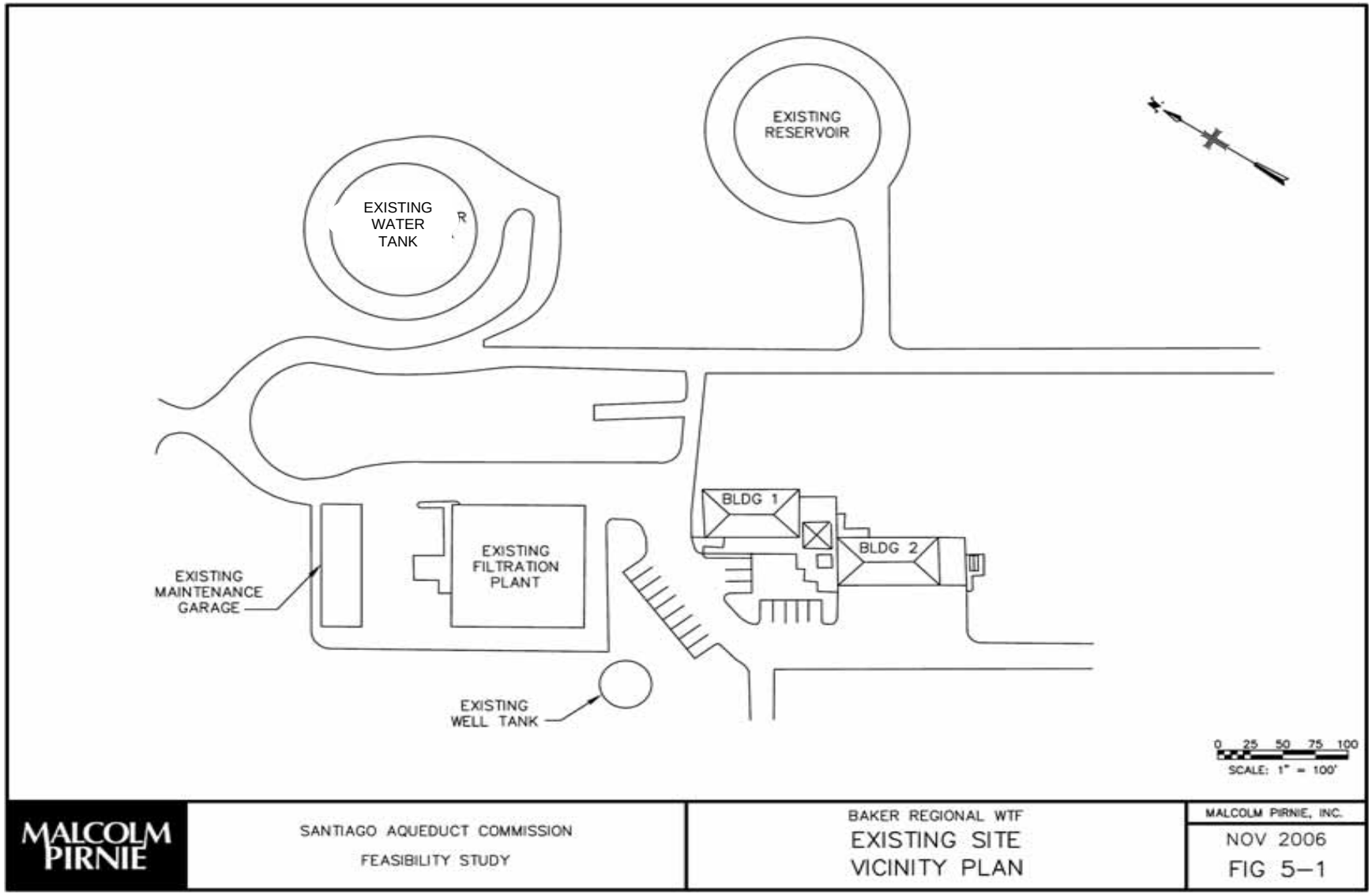
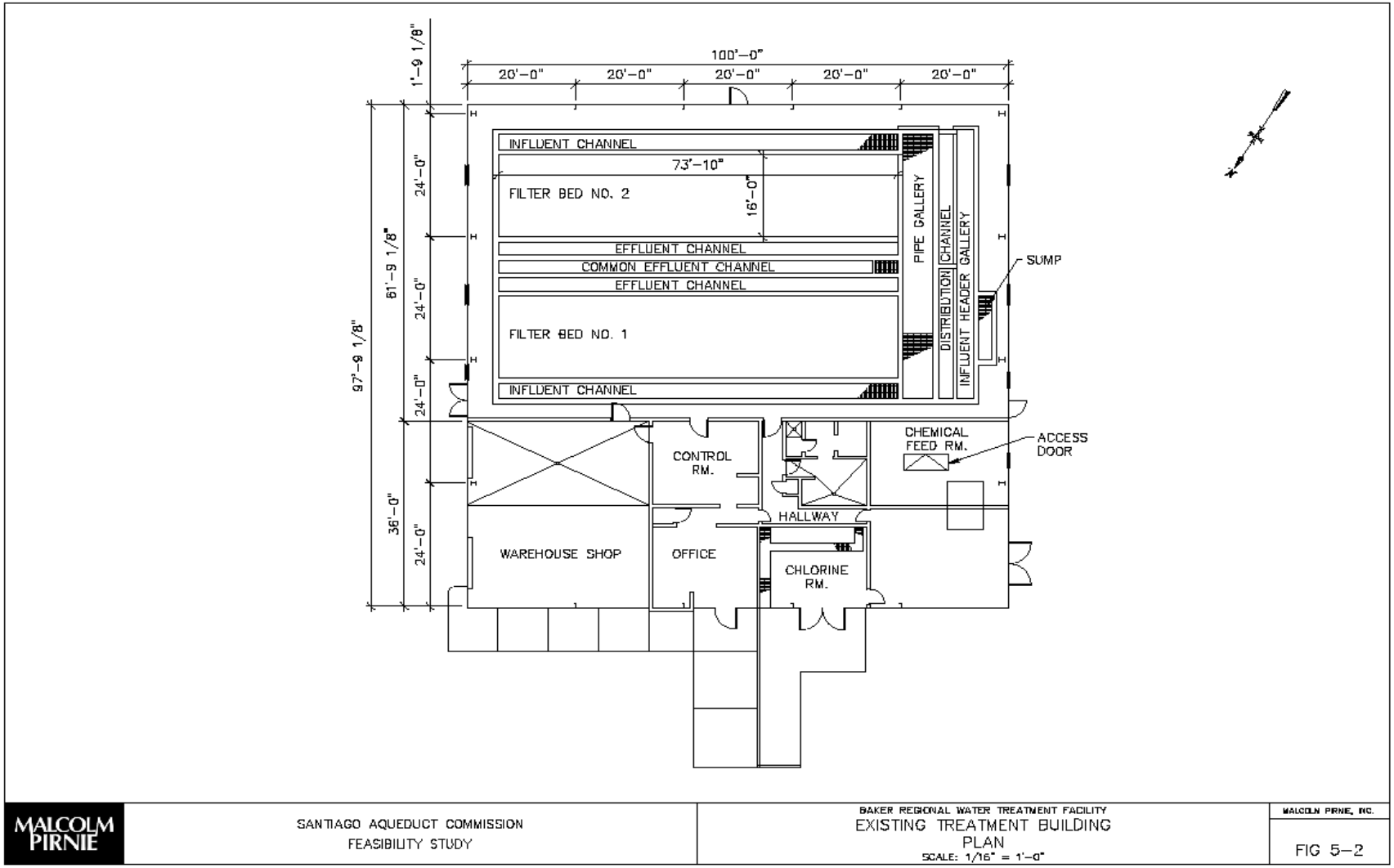


Figure 5-2. Existing Treatment Building Plan



5.2 Alternative Membrane Equipment

There are two types of MF equipment that could be used for renovating the Baker WTP – a pressurized system constructed at grade or a submerged vacuum system. The submerged system requires insertion into a fairly deep below-grade basin. The current filtration basins at the Baker plant are quite shallow (approximately four feet deep), which was typical of the "Hardinge" filter equipment, but insufficient for use of a submerged system. It could be possible to excavate new deep basins, but this would jeopardize the structural integrity of the basins and add significant cost to the project. The pressurized system is quite adaptable to placement inside the existing treatment building, and is the system of choice for the new Baker WTP.

There are two established equipment manufacturers that currently provide the pressurized systems:

- Siemens (formerly U.S. Filter) - Memcor CP System;
- Pall - Microsa System

Other suppliers such as Ionics (now GE) have provided pressurized MF systems in the past, but are not current industry leaders in this area.

5.3 Preferred Equipment Layout

This Section summarizes the conceptual layout for the treatment equipment at the Baker WTP.

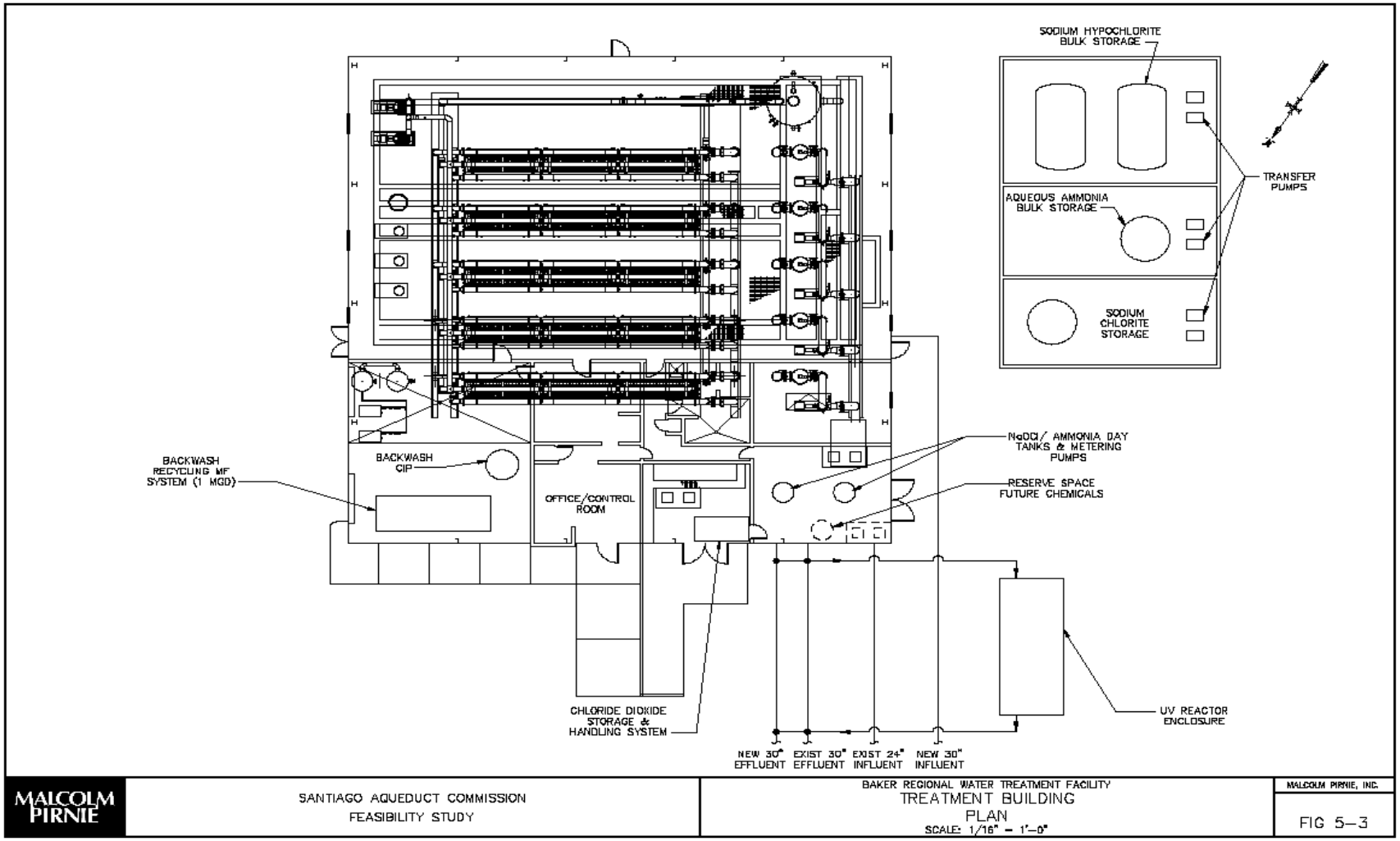
Figure 5-3, the Treatment Building Plan, identifies possible locations for the new 25-mgd treatment facilities in the existing filtration building. The new treatment equipment located inside the existing building includes:

- 25-mgd of MF treatment capacity – consisting of five (5) pressurized MF skids, each rated at 5 mgd based on a flux rate of 35 gallons/square foot/day (gfd). The MF system layout includes feedwater strainers, clean-in-place (CIP), and other appurtenant equipment;
- An additional 1-mgd MF system for treatment of the backwash water (including an additional CIP system for the backwash recycling MF system);
- Chlorine dioxide storage and handling system;
- Day tanks and metering pumps for sodium hypochlorite and ammonia systems; and
- Additional space reserved for office/control room and potential future chemical facilities.

Figure 5-3 also identifies a new 30-inch diameter influent and a new 30-inch diameter product water line connecting to the Water Treatment Plant.

CHAPTER 5 TREATMENT PLANT LAYOUT

Figure 5-3. Treatment Building Plan



CHAPTER 5 TREATMENT PLANT LAYOUT

New treatment equipment located outside the existing filtration building includes:

- Bulk storage and transfer pumping for sodium hypochlorite, ammonia and sodium chlorite.
- UV reactors (housed in an enclosure)
- Product water pump station (shown in Figure 6-3)
- Standby power generator (shown in Figure 6-3)

Figure 5-4 depicts a cross-section showing how the MF units would fit within the existing structure. Preliminary analysis shows that the existing structure is adequate for compliance with current seismic codes, primarily because the original design incorporated provisions to expand the structure for additional planned capacity. This needs to be confirmed with more detailed seismic load analyses which are beyond the scope of the FS.

The chemical feed and storage requirements are summarized in Table 5-1.

Table 5-1. Chemical Feed and Storage Requirements

Chemical	Stock Strength	Dose	30 Day Storage	Pump Size	Notes
	(%)	(mg/L)	(gal)	(gal/hr)	
NaOCl	12	3	19000	20	Target Residual 2.5 mg/L as Cl_2, system capable of 3 mg/L dose
NH4OH	19	1.75	7700	8	Dose as NH4OH, target 0.7 mg/L as N
NaClO	25	0.8	2000	2	Dose approximately 0.8 mg/L to produce residual of 0.6 mg/L ClO-

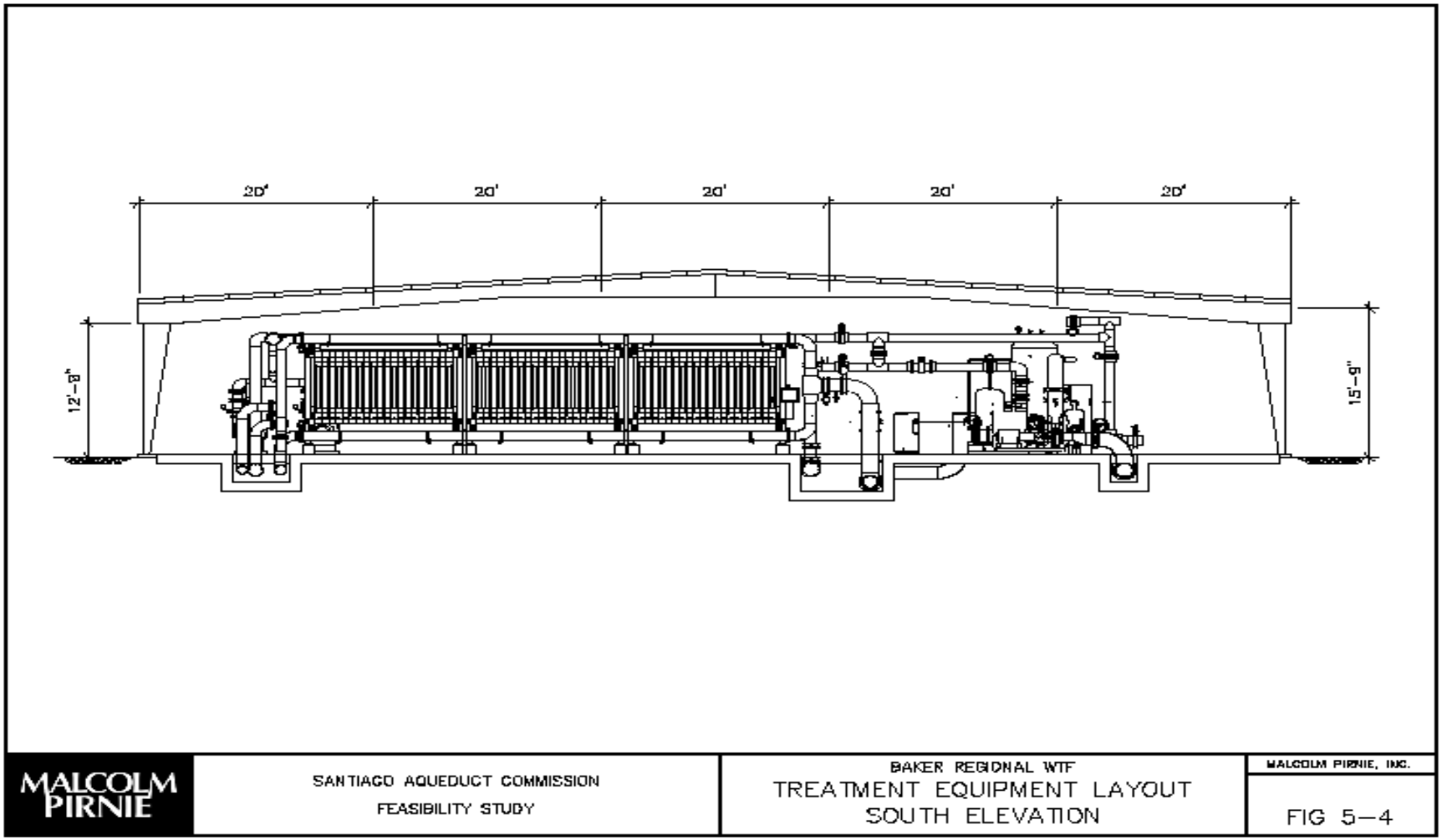
Notes: Sizes based on maximum flow and average dose used.

Acid, caustic, and citric acid for membrane CIP assumed to be part of membrane system layout.

5.4 Options for Backwash Handling

The MF equipment produces both product water and backwash generated during cleaning. The typical recovery (ratio of product to feedwater) is 97% by flow. The BP has a capacity of approximately 39 cfs (25 mgd) at the Baker turnout. If the plant is constructed at this flow capacity, approximately 24.25 mgd of product and 0.75 mgd of backwash (BW) water would be generated. There are various options for handling this BW:

Figure 5-4. Treatment Equipment Layout South Elevation



Discharge to sanitary sewer (SS);

1. Concentrate and recycle; smaller discharge to SS;
2. Dewatering; solids to landfill;
3. Equalization storage; off-peak discharge to SS.

Discharge to SS. The 0.75 mgd BW could be discharged to the SS serving the Baker site. However, downstream reaches are limited in capacity. It may be possible to increase SS capacity by implementing a pipe-bursting trenchless-technology project; however, the location of the perpendicular AMP makes this idea impractical. Sufficient SS capacity potentially exists further downstream.

Backwash Recycling. It may be possible to construct a separate MF module to further reduce the volume of the BW, provide additional product water, and significantly reduce water losses. Potential product water increase (and avoided water loss) is estimated at 0.63 mgd, assuming an 85% recovery for the second-stage MF unit. The SS discharge of concentrated reject would reduce to 0.11 mgd, and the overall MF project recovery would be 99%.

Dewatering. Dewatering of the BW utilizing a belt filter press is another potential BW handling option. Resulting solids would need to be disposed in a sanitary landfill, and liquid filtrate discharge to the SS.

Equalization Storage. Consideration has been given to isolating a portion of the existing 2MG clearwell at the Baker site for diurnal storage of BW, and discharge to the SS during off-peak periods when additional capacity is available. As discussed is Chapter 4, the balance of the clearwell volume would be used for contact time for iron and manganese oxidation using chlorine dioxide.

Cost of Options. The estimated costs of the four options for BW handling are summarized in Table 5-2 on the following page.

Table 5-2. Costs of Backwash Handling Options

Option	Capital Cost ($M)			O&M Costs ($M/yr)	Annual Costs ($M/yr)	Volume Recycled (afy)
	Discharge (a)	Facilities	Total			
SS Discharge	0.75	.050 (b)	0.80	-	0.05	0
BW Recycling	0.11	0.46	0.57	0.05	0.042(c)	700
Dewatering	0.11	0.52	0.63	0.25	0.290	0
Storage	0.38	0.23	0.61	-	0.040	0

(a) Based on $750,000/cfs total maximum cost

(b) Assumes pipe-bursting of 1000 feet-8-inch sewer

(c) Assuming minimum value of recycled water is $137/af (treatment cost), then net cost of recycling is zero; total value is significantly greater

CHAPTER 5 TREATMENT PLANT LAYOUT

The SS discharge options are problematic alternatives, and do not result in recycling any portion of the reject stream. The BW dewatering option has the highest overall annual cost does not result recycling, and adds a solids handling component to the project O&M activities. The recycling option has the lowest capital and annual cost, and results in recycling of about 700 afy of BW that would otherwise be wasted. If the value of this recycled BW is set at the treatment facilities cost of $137/af, then the net annual cost of the recycling option is reduced to zero. Considering the total imported water treatment and purchase costs avoided by recycling, costs are offset by an order of magnitude.

Based on the above analysis, recycling is the preferred BW handling option. The location of the additional MF facilities is shown on Figure 5-3. An alternative backup plan would be the construction of a dewatering belt filter press.

CHAPTER 6 SYSTEM FACILITIES LAYOUT

This chapter includes a delineation of the Project hydraulics requirements, a description of the system integration facilities, and the location and layout of those facilities.

6.1 Overview of Project Hydraulics

Hydraulic Profiles. Two hydraulic profiles for the project have been prepared, and are shown on Figures 6-1 and 6-2. The first profile is based on a project capacity of 40 cfs feedwater flows (approximately 25 mgd), and assumes that the Trabuco CWD (TCWD) would participate in the new project rather than continuing to operate the current TCWD WTP. The second profile assumes continued operation of the TCWD plant, and a project feedwater capacity of 33 cfs (approximately 21 mgd). Both profiles indicate that sufficient hydraulic grade at the Baker turnout (elevation 715) exists for meeting the pressurized flow requirements of the MF equipment without the need for feedwater pumping in the process train. A product water pumping station will be necessary to match the hydraulic grade of the AMP, so that all SAC agencies could utilize project water.

Hydraulic Potential. Consideration was made of potential hydropower that could be generated on the BP. The hydraulic grade line (HGL) differential between the upper and lower reaches of the BP is 100 feet (elevation 815 to elevation 715), under static conditions. Because of the power requirements of the Project (product water pumping station and potential MF feedwater pumps), an assessment was made of utilizing this hydropower potential to meet a portion of these needs (see Appendix B). The analysis indicated that if the 100 foot differential were available, hydropower could be cost-effectively developed using a turbine (reverse pump) to generate about 300 KW of power, which is approximately one-half of the projected power requirements of the product water pumping station (as discussed later). However, this potential is constrained by two factors: 1) Project reactivation will result in the 100-foot differential to be consumed by friction losses through BP water conveyance; 2) utilizing the remaining HGL below elevation 715 and down to the natural grade at the Baker site would require that the feedwater be repumped to meet the pressure requirements for the MF process. This would be counter-productive to the concept of hydropower generation to meet project needs. It is therefore concluded that hydropower generation is not feasible for the Project.

6.2 System Integration Facilities

In order to integrate the MF WTP into the proposed project, the following facilities are required:

1. Additional feedwater pipeline to convey up to a total of 25 mgd from the Baker turnout to the Baker WTP (approximately 500 feet of 30-inch pipeline) together with junction structures;
2. Additional product water pipeline to convey up to a total of 24.8 mgd from the rehabilitated Baker WTP to the existing AMP connection vault (approximately 1100 feet of 30-inch pipeline), together with junction structures and vault upgrading;

Figure 6-1. Preliminary Hydraulic Profile (40 cfs)

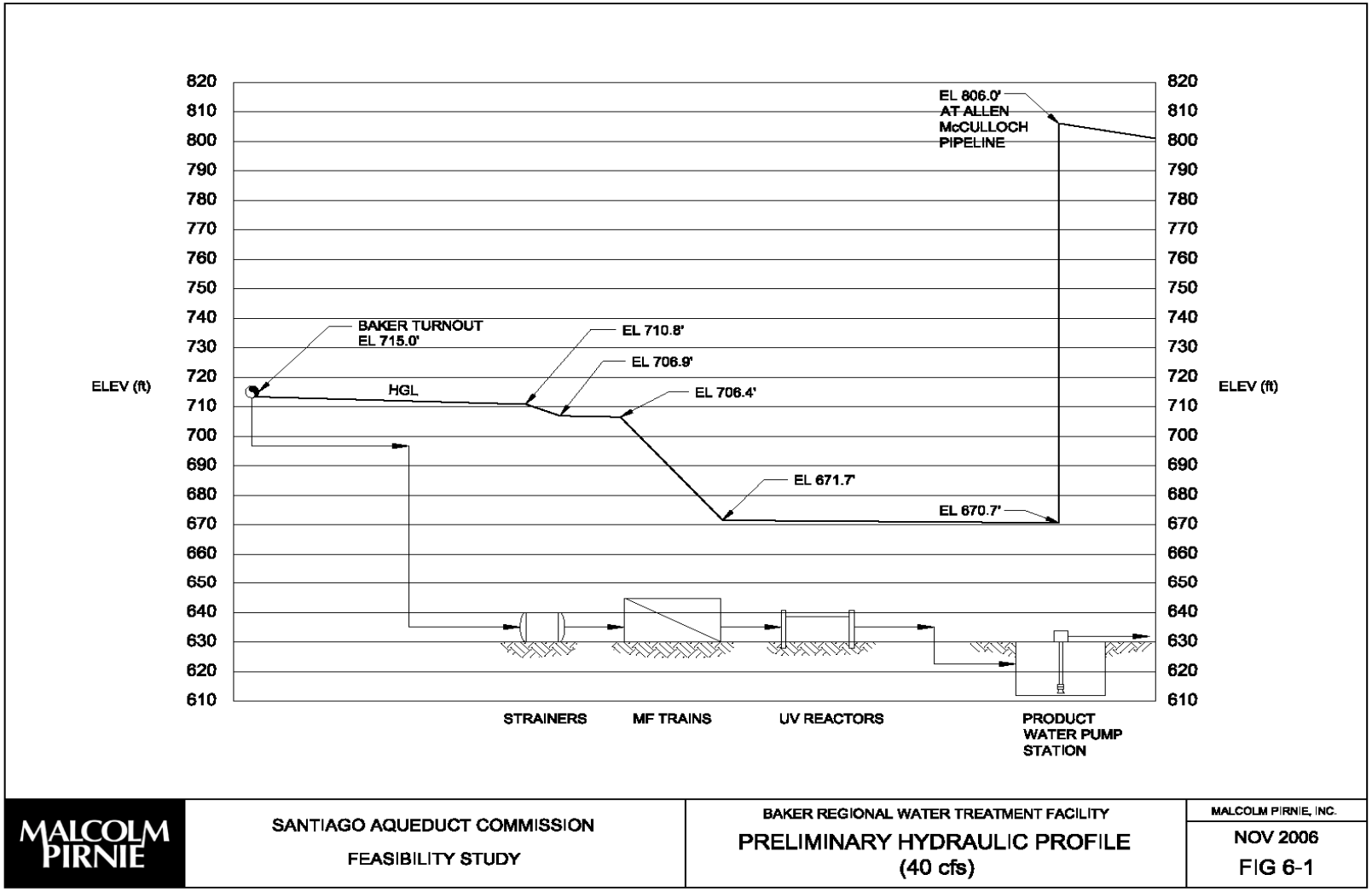
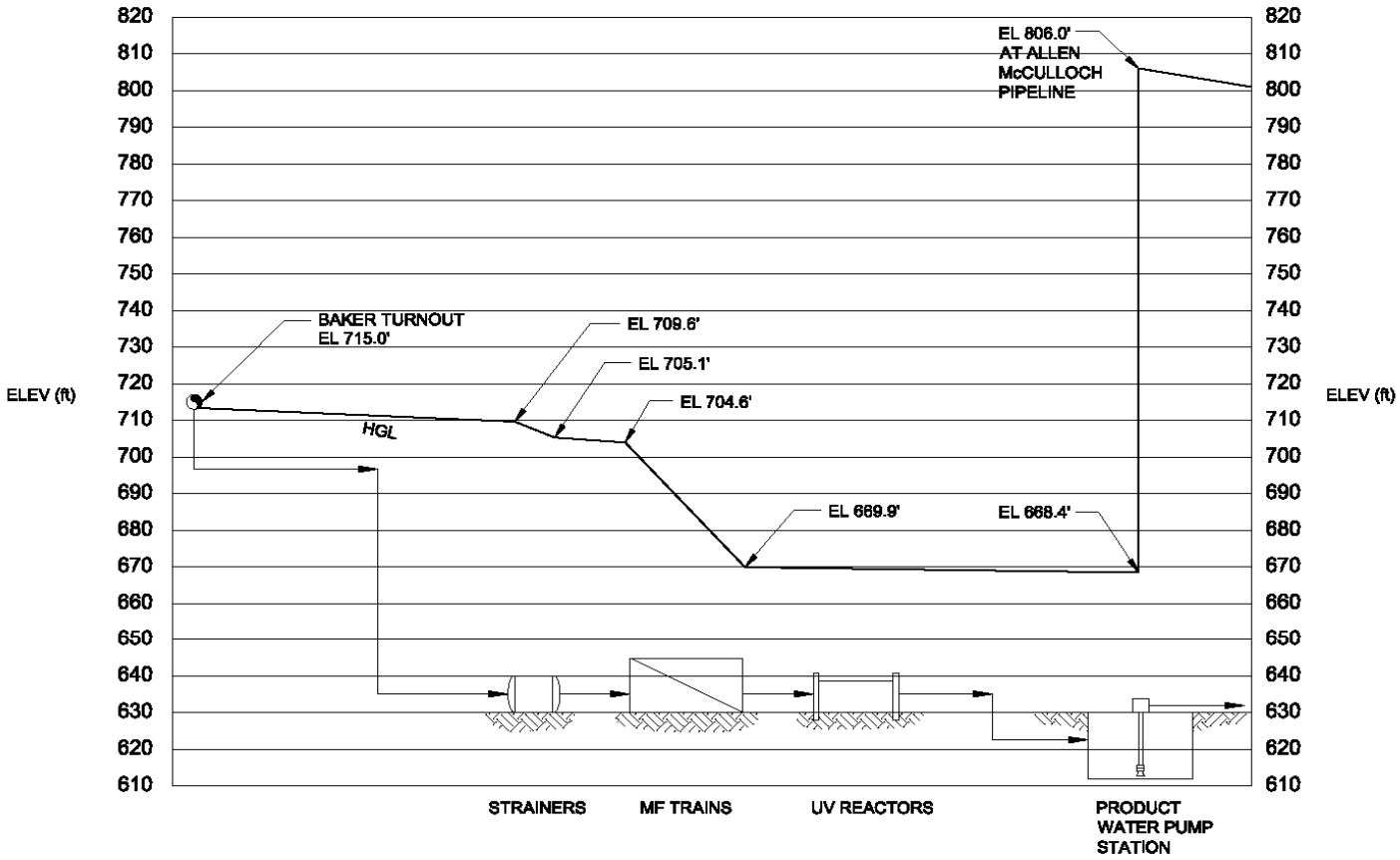


Figure 6-2. Preliminary Hydraulic Profile (33 cfs)



MALCOLM PIRNIE	SANTIAGO AQUEDUCT COMMISSION FEASIBILITY STUDY	BAKER REGIONAL WATER TREATMENT FACILITY PRELIMINARY HYDRAULIC PROFILE (33 cfs)	MALCOLM PIRNIE, INC. FIG 6-2

3. A new product water pumping station to meet the AMP HGL (elevation 805) (40 cfs at TDH of 152 feet), including surge control, variable speed drive pumps, integrated control systems, flow metering, and an AMP connection facility;
4. A new ILP pumping station to meet the BP HGL, to be located at the Peters Canyon Flow Control Facility (35 cfs at TDH of 80 feet).

The location of the above facilities (except the ILP pumping station) is shown on Figure 6-3. The ILP pumping station location is shown on Figure 6-4.

Figure 6-3. Treatment Facilities Site Vicinity Plan

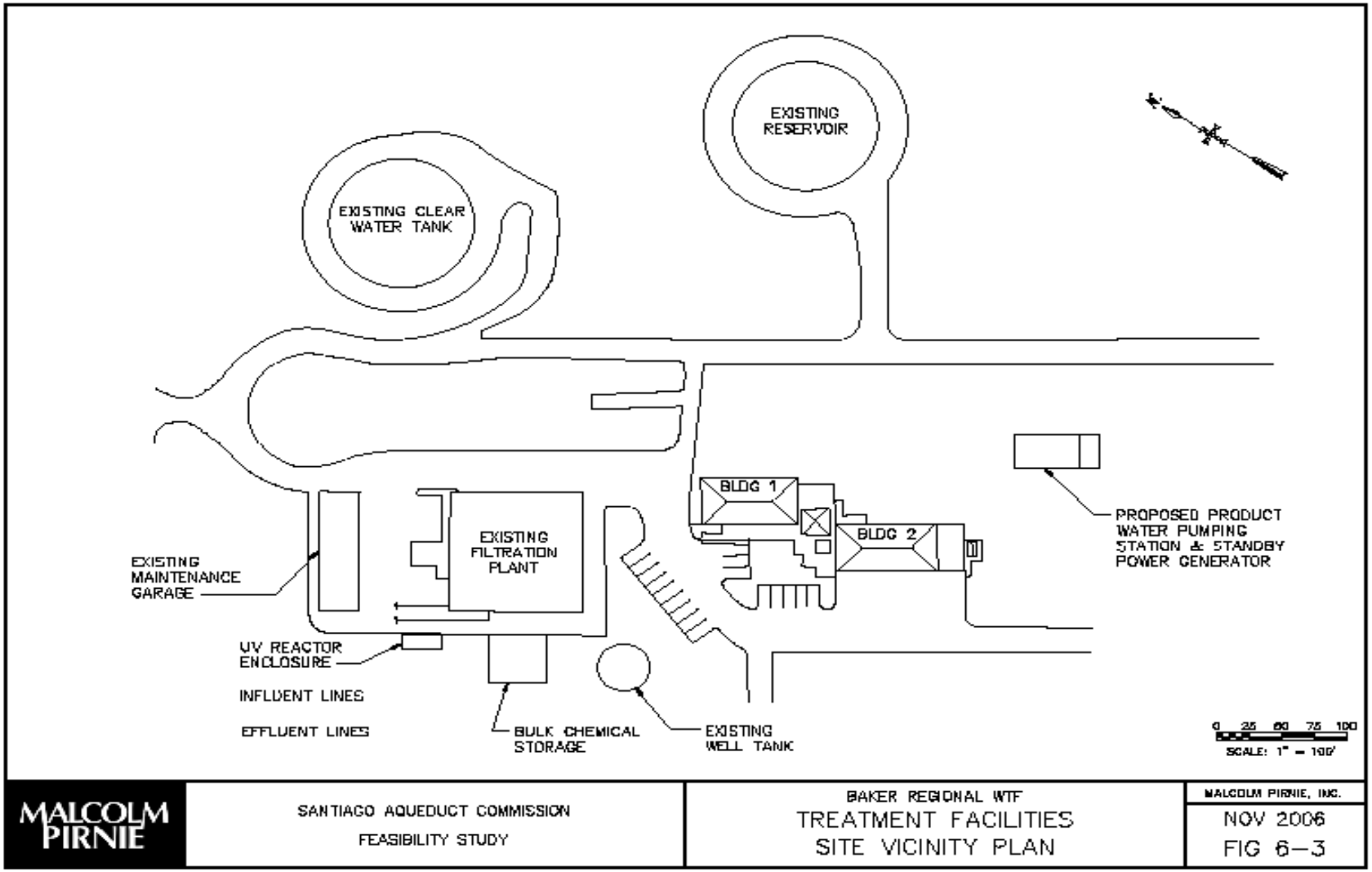
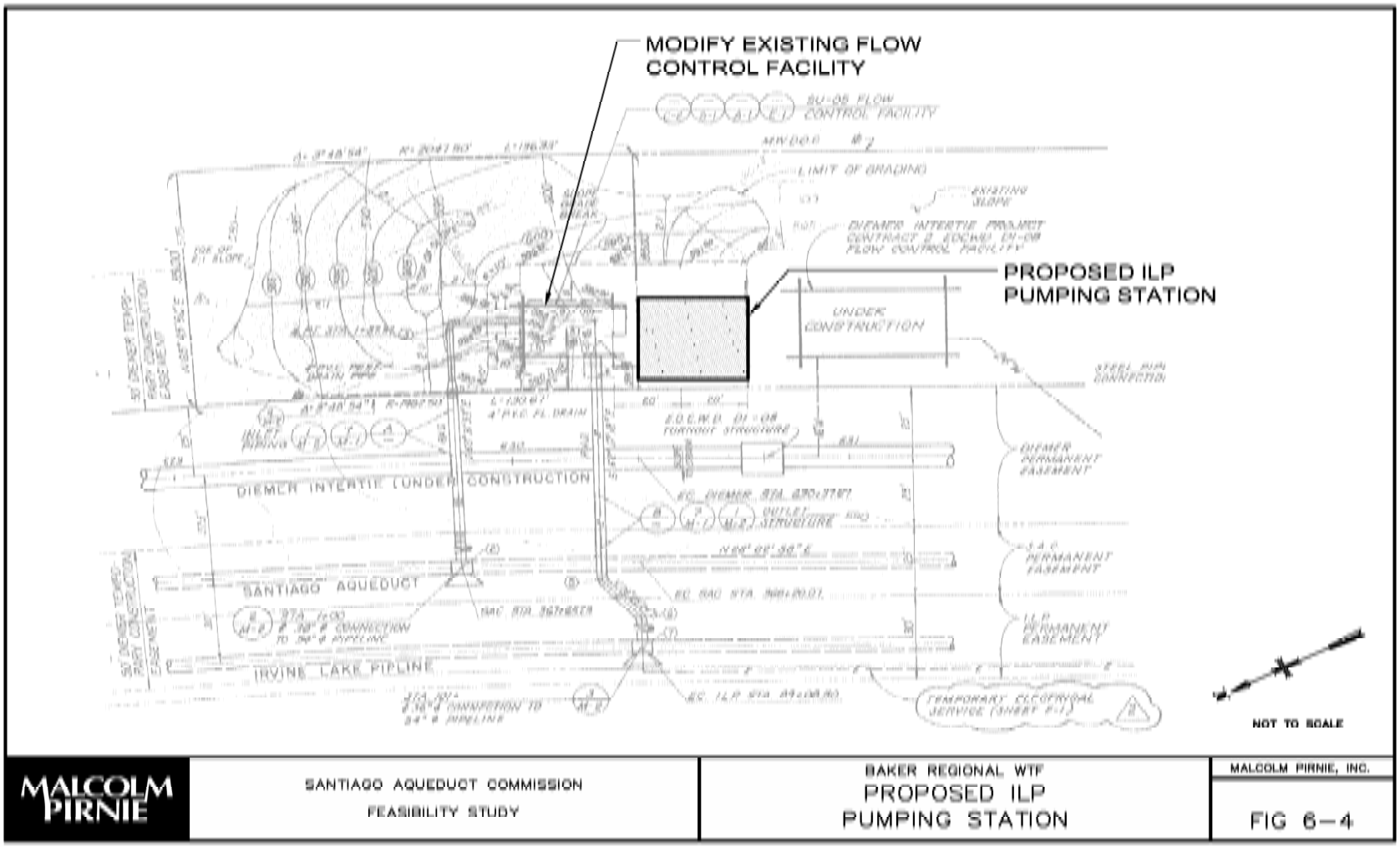


Figure 6-4. Proposed ILP Pumping Station



CHAPTER 7 ESTIMATED PROJECT COSTS

Estimated construction, capital, O&M and unit costs to implement the Baker Regional Treatment Facility Project are addressed in this chapter.

7.1 New Water Treatment Plant Construction

A further refined cost analysis for the Baker WTP has been conducted. The estimated construction costs for the new water treatment equipment at the Baker site are summarized on Table 7-1. As shown, the total estimate is $23,970,000.

Table 7-1. Construction Costs of New Microfiltration Water Treatment Equipment

Item	Cost ($)
1. MF Equipment – 25 mgd	12,250,000
2. MF Equipment – backwash recycling	370,000
3. Feedwater pumps (a)	0
4. UV Equipment	1,600,000
5. Product Water Chemical Feed System	1,350,000
6. Chlorine Contact Basin	410,000
Subtotal – New Installed Equipment	15,980,000
7. Electrical & Instrumentation @ 12%	1,918,000
8. Sitework & Piping @ 20%	3,196,000
9. Mobilization / Insurance / Management @ 8%	1,278,000
10. Contractor Overhead & Profit @10%	1,598,000
Subtotal – Construction Cost - New Equipment	23,970,000

(a) Not required due to pressurized feed from Baker Pipeline

7.2 Ancillary Construction at WTP

Additional construction activities at the Baker WTP are necessary to facilitate the project implementation. These costs are shown on Table 7-2, which total $1,530,000.

Table 7-2. Ancillary Construction Costs

Item	Cost ($)
1. Demolition (piping, mechanical, backwash bridge	200,000 (a)
2. Existing Building - Structural Rehabilitation - Fire Suppression Equipment - Corrosion remediation / protection	 250,000 (b) 50,000 100,000
3. Interior Upgrade (day room, lab counter, painting)	200,000
4. Concrete Fill – Existing WTP filter basins and channels	450,000 (c)
5. 2 MG Clearwell Modifications	100,000 (d)
6. 4.3 MG Reservoir Modifications	100,000 (e)
7. Hoist – MF maintenance	30,000
8. Sewer Capacity Charge – backwash reject	50,000
Ancillary Construction Total	$ 1,530,000 (f)

(a) Assumes 50% salvage value
(b) Budget only; preliminary analysis shows structure is adequate
(c) 560 cubic yards at $800/cy
(d) Compartments for chlorine contact and backwash storage
(e) Convert to product water clearwell
(f) Does not include salvage value of existing Baker site or facilities

7.3 Integration Facilities Construction Costs

Pumping and pipeline facilities are necessary to integrate the Baker WTP into the existing water transmission system. These costs, summarized in Table 7-3, amount to $7,610,000.

Table 7-3. Integration Facilities Construction Costs

Item	Cost ($)
1. Feedwater Pipeline – 500 ft – 30 in. @ $265/ft	135,000
2. Product Water Pipeline - 1100 ft. – 30 in. @ $265/ft	295,000
3. Product Water Pumping Station – (a) 40 cfs @ 152 ft TDH (900 HP)	4,700,000 (c)
4. Irvine Lake Pumping Station - (b) 35 cfs @ 80 ft TDH (500 HP)	2,300,000
5. Standby Power For Product Water P.S. – (675 KW)	180,000
6. OC-33 Metering Structure	300,000
Total – Integration	7,610,000 (d)

(a) Adjacent to AMP vault

(b) Peters Canyon location

(c) Includes surge control, variable speed drives, integrated controls systems, flow metering, and an AMP connection facility

(d) Does not include potential South County Pipeline integration costs

7.4 Capital Cost Summary

The total construction and capital costs for all Project components are summarized in Table 7-4. As shown, total construction costs are $33,110,000. Including design and construction contingencies, the total project cost is projected at $46,400,000.

CHAPTER 7 ESTIMATED PROJECT COSTS

Table 7-4. Capital Cost Summary

Item	Cost ($)
Construction Cost	
- New Installed Equipment	23,970,000
- Ancillary Construction	1,530,000
- Integration Facilities	7,610,000
Subtotal Construction	33,110,000
Construction Support	
- Design and Construction Engineering – 12%	3,970,000
- Construction Contingencies – 20% (a)	6,620,000
- Construction Cost Adjustment (materials shortages)– 5%	1,660,000
- Legal & Project Administration – 3%	990,000
Subtotal Support	13,240,000
Total Capital Cost (rounded)	46,400,000

(a) Includes budget for possible site power supply expansion and possible backwash dewatering belt filter press

Project O&M costs are shown on Table 7-5.

Table 7-5. Project O&M Costs

Cost Category	O & M Costs ($M/yr)		
	Treatment Plant (h)	Integration Facilities	Total
Labor	0.15 (a)	0.10	0.25
Equipment Replacement	0.50 (b)	0.10	0.60
Power (c)	0.20 (d)	0.82 (e)	1.02
Chemicals (f)	0.22	-	0.22
Other	0.15 (g)	0.10	0.25
TOTAL	**1.22**	**1.12**	**2.34**

(a) Two full-time equivalents (FTE) (operator, I&C technician, maintenance staff) @ $75,000/yr.
(b) Membranes and UV lamps
(c) At 13 cents / kwh
(d) Includes miscellaneous process pumping; feedwater pumping not required
(e) Product water pumping @ $.7M /yr, and Irvine Lake pumping @ $.125M/yr
(f) Includes chlorine, ammonia and chlorine dioxide
(g) Includes building maintenance and service
(h) Includes ancillary construction costs

CHAPTER 7 ESTIMATED PROJECT COSTS

As shown on Table 7-6, project costs, including untreated water purchases, are about $609/af in 2010. The Project costs are lower than the projected Metropolitan treated water costs around the year 2015. Projected unit costs for the Project and Metropolitan costs are shown in Table 7-7, Figure 7-1 and Appendix C.

Table 7-6. Project Water Economics

Cost Component	$
Capital Cost (a)	48,700,000
Capital Recovery (5% @ 30 years)	2,690,000 / yr
O&M Costs (b)	2,709,000 / yr
Subtotal Project Annual Cost	5,399,000 / yr
Water Purchases (c)	9,800,000 / yr
Total Annual Cost	15,199,000 / yr
Unit Annual Cost (d)	609 / af

(a) Escalated to 2008 @ 5% (estimated midpoint of construction)

(b) Escalated to 2010 @ 5% /yr (estimated startup)

(c) Imported water Tier 1 cost less treatment surcharge in 2010 ($391/af)

(d) Yield is 24,950 af/y

Table 7-7. Unit Costs of Project and Metropolitan Costs

Year	Unit Cost ($/af)				
	Baker WTP Project				
	Capital Recovery (a)	O&M (b)	Water Purchases (c)	Total	Metropolitan Full Service Tier 1 (d)
2007	108	94	331	533	478
2008	108	98	361	567	527
2009	108	104	376	588	556
2010	108	110	391	609	590
2011	108	114	409	631	615
2012 (e)	108	120	430	658	646
2013 (e)	108	126	451	685	678
2014 (e)	108	132	474	714	712
2015 (e)	108	139	497	744	748

(a) Based on assumed financing of $41.4M @ 5% for 30 years

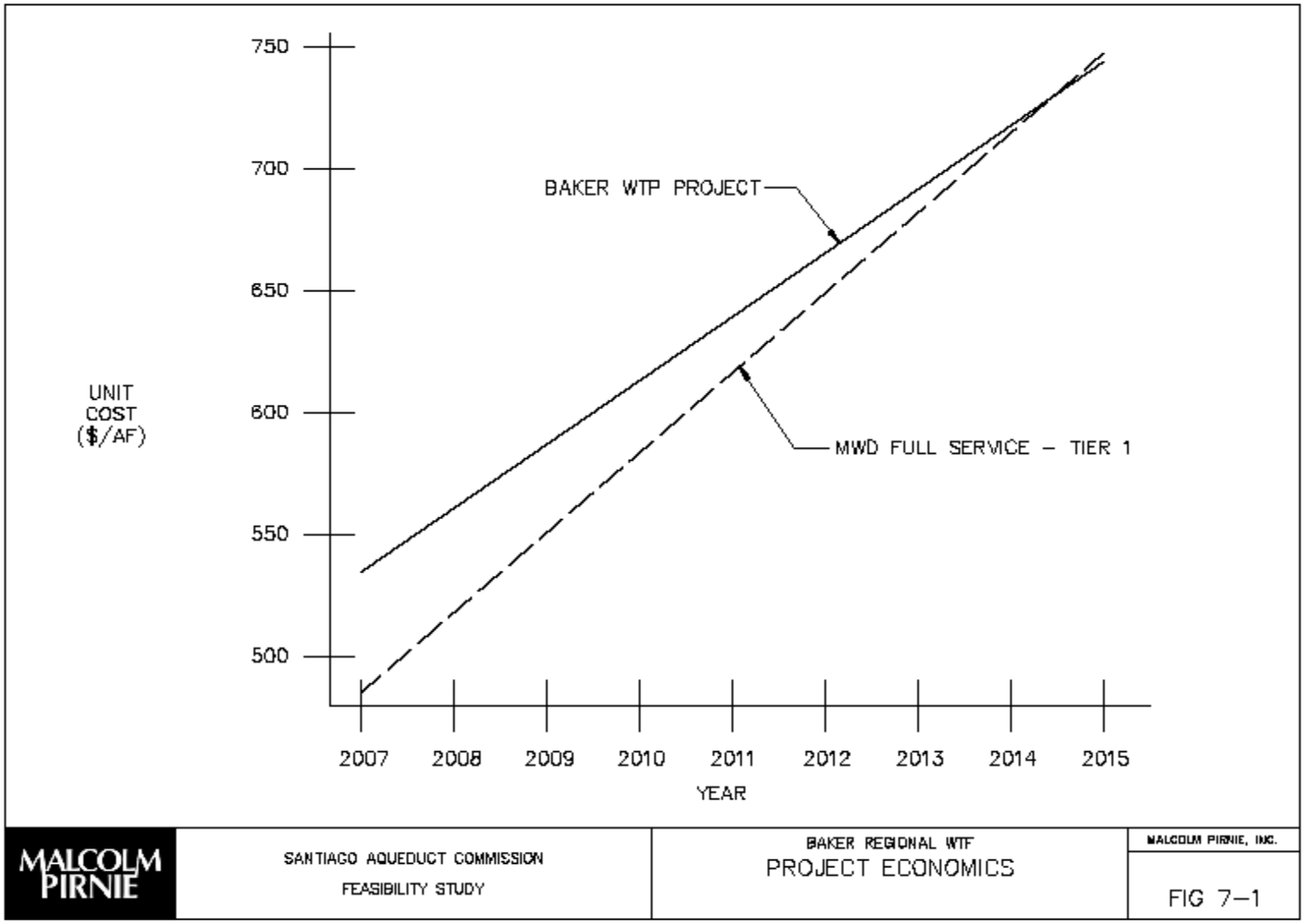
(b) Includes treatment, ancillary and integration costs

(c) Imported water full service Tier 1 rates less treatment surcharge; Metropolitan projections (10/12/06)

(d) Metropolitan projections (10/12/06)

(e) Inflated after 2010 at 5% / year

Figure 7-1. Project Economics



CHAPTER 8 PROJECT IMPLEMENTATION

This chapter summarizes Project environmental issues, permitting, operational issues, implementation scheduling, and steps for completion.

8.1 Environmental Issues

Preliminary analysis of the potential environmental issues related to construction and operation of the Project confirms that a Mitigated Negative Declaration (MND) will effectively comply with the CA Environmental Quality Act (CEQA) requirements. The MND will be prepared by SAC/IRWD staff, with support from Malcolm Pirnie.

At the outset of developing the FS, it was thought that compliance with new air quality emissions regulations (PM-10 for particulate matters) would be difficult, if extensive excavation and soils export were required. However, it is possible to meet the Project treatment requirements within the existing treatment building, or with new external facilities at grade. Minor excavation and export will be required for new pipelines. Similarly, there was concern that construction vehicle access and chemical deliveries during operation would need to be through an existing residential community. However, a secondary site access from the north through an existing commercial area can meet these needs.

Table 8-1 presents a summary of CEQA issues categories and particular project issues.

Table 8-1. CEQA Issues Summary

Category	Project Issue
1. Water Quality	Complies with existing and future regulations
2. Ecological Resources	Site already developed
3. Cultural Resources	No impacts
4. Seismic Risk	Mitigatable
5. Growth Inducement	Project increases supply reliability
6. Land Use	Current facilities compliance
7. Planning	Meets regional water planning needs
8. Aesthetics	Compatible with current development
9. Air Quality	Nominal excavation during construction; diesel truck emissions during construction; standby generator for operations emergency power.
10. Noise / Vibration	Noise generators are inside buildings
11. Population / Housing	No impacts
12. Traffic / Circulation	Chemical delivered through a commercial area
13. Public Services / Utilities	Possible offsite sewer upgrading required during Project development
14. Hazards / Hazardous Material	Typical storage for chemicals; secondary containment & handling mitigations

CHAPTER 8 PROJECT IMPLEMENTATION

At this time, it appears there are only three significant project issues which need to be mitigated:

1. Limited sanitary sewer capacity to convey MF backwash and off-spec. discharges (can be mitigated by including a backwash recycling component which minimizes Project waste flows to a level that can effectively be conveyed);
2. Construction of the Irvine Lake pumping station in the Peters Canyon area (can be mitigated by judicious site selection near existing flow control facilities);
3. Storage of conventional water treatment chemicals (can be mitigated by effective safety provisions, secondary containment, and chemical deliveries through non-residential areas.

8.2 Project Permitting

Several permits and project approval from various agencies will be necessary to implement the project. These are summarized on Table 8-2. It appears the most challenging approval will be from the Orange County Fire Authority (OCFA), with particular concerns for chemical storage and building fire suppression.

Table 8-2. Permitting Compliance Plan

Agency	Permit	Processing Time	Prerequisite Data	Items to be Submitted	Required Fees	Primary Responsibility	Critical Project Component
California State Water Resources Control Board (SWRCB)	• Notice of Intent (NOI) to comply with NPDES General Permit for Storm Water Discharges Associated with Construction Activity • Spill Prevention Control and Countermeas-ure (SPCC) • Aboveground Storage Tank (AST) Storage Statement	Submit 30 days prior to start of construction	Site Specific Storm Water Pollution Prevention Plan (SWPPP)	• Notice of Intent • Site Map	($200 + $20/acre) + 18.5% surcharge	Contractor	Site Construction, Chemical Storage
California Dept. of Industrial Relations Division of Occupational Health and Safety (CAL-OSHA)	• Excavation Permit • Pressure Vessel Permit	Over the counter	Contractor ready to begin work	• Permit application form • Copy of updated safety program •Application fee •Competent person letter	$50	Contractor	Pipeline Trench Safety
State Department of Health Services (DHS)	• Amended Waterworks Permit	6 months	Contractor will be requested to provide a variety of information throughout the process	• Treated water quality • Treatment plant operational information • Other information as required by DHS	Application Review Costs (approximately $90/hr)	Lead Agency	WTP Process and Water Quality
Regional Water Quality Control Board (RWQCB), Santa Ana Region	• NPDES General Permit-General Waste Discharge Requirements to Surface Waters Which Pose Insignificant (de Minimus) threat to Water Quality	Contractor will operate under lead agency's general waste discharge permit	Report water quality sampling results	• Construction Dewatering Plan • Notice of Intent to Dewater (all information required by permit at least 10 days prior to each discharge). Lead Agency will submit • Analytical and flow data required by permit	None	Lead Agency	Site Dewatering, if required
South Coast Air Quality Management District (SCAQMD)	• Permit to Construct/Operate (Form 400-A) • Form 400-CEQA •Supplemental forms, as needed	3 months	60%± design level	•Application • 60%± plans & specs • Emission Control Equipment List • Drawing or schematics of equipment •Description of process, process rate, emission source testing, manufacturer's catalog, VOCs, equipment location	Filing fee of $104.43 + Initial payment of $365.51 for plan evaluation + Plan evaluation fee of $104.43/hr	Contractor	Construction Grading (PM-10), if required
Irvine Ranch Water District (IRWD)	• Connection Permit • Discharge Permit	 6 months	Location of connection	• Annual flow, BOD, and suspended solids	Based on flows	Contractor Lead Agency	Possible Backwash Discharge
Orange County Fire Authority (OCFA)	• Requires approval of plans for fire safety provisions	1 month	80-90% design level + required chemical information	• Plans must include all fire sprinkler system information • Fire Master Plan • Chemical classification packet •Hazardous Materials Business Plan	$7,900	Contractor	Building Sprinklers; Chemical Storage
City of Lake Forest	• Lead agency exempt from building permits, but must submit plans to Lake Forest for transfer to OCFA	2 weeks	80-90% design level + required chemical information	Required drawings and information for the OCFA	None	Contractor	OCFA requirements
Utility Companies-USA coordination (gas, electric, phone, cable, water, sewer)	• No permit but contact for conflicts	60-90 days	60%± plans	•Improvement plans showing utility horizontal and vertical locations of existing utilities	None	Contractor	Site Construction
Adjacent Utilites Owner	•Encroachment Permit	Variable	Final Design	•Improvement plans showing utility horizontal and vertical locations of existing utilities	Variable	Lead Agency	Site Construction

8.3 Operational Issues

During preparation of the FS, the following operational issues have been uncovered:

1. Hydraulic surges in the BP
2. Air entrainment in the BP
3. Capacity constraints in the BP

Hydraulic surges in the BP have occurred during low flows and during extensive agricultural deliveries in the past. This has been a particular problem with operation of the TCWD WTP. With implementation of the Baker WTP project, it is felt that BP flows will be much more extensive and consistent, and that previous hydraulic surge problems will not continue. The product water pump station will include a robust surge control system.

Air entrainment has also been problematic for TCWD. This phenomenon has been reported to relate to Metropolitan Lower Feeder operations, and during filling of Irvine Lake. Although MF systems use an air scour step for membrane cleaning, air entrainment has been reported as one of the various factors leading to excessive fiber breakage in some MF plants. More analysis of this issue should be conducted during preliminary design of the Baker WTP. It may be possible to schedule project downtime for preventive maintenance activities during periods of Irvine Lake filling, if that problem persists, or to effectively schedule Irvine Lake fill/draw activities.

The capacity of the BP could possibly be increased by modifying the hydraulic conditions. MWDOC has conducted a preliminary hydraulic analysis of this matter (see Appendix D). The analysis shows that it may be possible to increase the BP capacity from 40 cfs to as much as 67 cfs. Evaluation of treatment and transmission facilities for this additional capacity is beyond the scope of this FS.

8.4 Implementation Schedule

The following time durations would be necessary to conduct the additional work required for Project development:

Activities	Duration (months)
• Bench Testing / Pilot Testing; Site Investigations and Preliminary Design; Permitting/CEQA Compliance	8
• Final Design	6
• Construction Bidding and Award	3
• Construction	12
• Startup and Initial Operations	1
TOTAL	**30**

Bench and/or pilot testing would focus on the chemical oxidation and MF pretreatment for IL water. Site investigations would address building structural integrity confirmation and geotechnical surveys.

8.5 Summary of Conclusions and Recommendations

The following conclusions and recommendations for implementing the Baker WTP Project are made:

1. The new WTP should be designed to treat either a blend of imported water or Irvine Lake water, and have a capacity of 25 mgd (39 cfs);
2. The most challenging water quality conditions for the project are: a) 100% SPW water from the Lower Feeder and BP; b) 100% Irvine Lake water (iron and manganese focus);
3. Membrane filtration is the preferred treatment process for the Baker WTP;
4. The existing Baker site is the preferred location for the Baker WTP;
5. The treatment process train should include:
    a. Pretreatment by chemical oxidation (IL supply);
    b. Pressurized microfiltration (MF) membrane treatment;
    c. Ultraviolet light for disinfection and taste / odor control;
    d. Liquid sodium hypochlorite and ammonia for chlorine residual;
    e. Backwash recycling using MF to reduce reject flows.
6. Project integration facilities should include: a) Additional feedwater and product water pipeline capacity, b) Product water pump station for conveying water to the AMP, c) Irvine Lake pump station to match BP hydraulics under certain lake levels;
7. Hydropower is not viable as a Project component; however, BP hydraulics negate the need for feedwater pumping through the MF modules and other process train units;
8. Unit treatment capital costs are estimated at $1.34/gallon. Unit O&M costs are approximated at $0.15/1000 gallon. Overall capital costs for treatment and integration facilities are estimated at $46M at present cost levels;
9. Unit costs of treatment are projected to be less than Metropolitan treatment surcharges by the year 2010. Project unit costs are projected to be less than Metropolitan treated water costs by 2015;
10. In addition to being cost-competitive, the Project would have additional benefits: a) High level of reliability; b) Provides a replacement water supply if the Diemer WTP, Santiago Lateral, AMP, EOCWD Feeder No. 2, or Lower Feeder are out of service; c) Excellent and consistent water quality ; d) Ease of operations; e) High level of regulatory compliance and acceptance; f) Superior space utilization; g) Reactivates an idle facility;

11. There are no apparent environmental or permitting constraints to Project development;
12. The project could be operational within 2 1/2 years;
13. Project implementation steps should continue as follows:
    a. Bench testing – chlorine dioxide dosing and MF fouling potential of manganese – laden Irvine Lake water (1 month);
    b. Pilot testing at two site locations (6 months), focused on:
        - Chlorine dioxide dosing for manganese oxidation;
        - MF flux optimization and performance of the latest state-of-the-art units;
        - Backwash recycling – second-stage MF performances criteria.
    c. Refined economic analysis based on projected MWD rates and operational assumptions;
    d. Seismic load analysis to confirm structural integrity of the treatment building (6 weeks);
    e. Geotechnical investigation – chemical storage, UV reactor and pumping station areas;
    f. Preliminary design report;
    g. Final design.

APPENDIX A

WATER QUALITY INFORMATION

Appendix A Water Quality Information

MWD Water Quality Characterization

	SiO2 mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	CO3 mg/L as CaCO3	HCO3 mg/L as CaCO3	SO4 mg/L	Cl mg/L	NO3 mg/L	F mg/L	B mg/L	TDS mg/L
Skinner	9.1	67	26	88	4.2	0.0	141	226	86	0.7	0.2	0.1	579
Mills	12.7	22	13	58	2.8	0.75	87	49	78	2.45	0.11	0.15	285
	TH mg/L as CaCO3	T. Alk mg/L as CaCO3	pH	EC uS/cm	Br mg/L	Cl mg/L	TOC mg/L	CHC13 ug/L	CHC12Br ug/L	CHCiBr2 ug/L	CHBr3 ug/L	TTHMs ug/L	%SPW %
Skinner	275	116	8.0	942	0.1	87	2.7	14	14	12	2	43	14
Mills	108	73	8.36	516	0.21	78	2.82	17	20	20	6	62	98

APPENDIX B

HYDROPOWER POTENTIAL

APPENDIX B HYDROPOWER POTENTIAL

1.1 Introduction/Background

The Santiago Aqueduct Commission is considering the reactivation of the Baker Water Treatment Plant. This would be a membrane facility and there is potentially 100 feet of head differential between the aqueduct hydraulic gradient and the water treatment plant. The scope-of-work includes a study of the feasibility of installing a hydroelectric facility to use this head differential to generate electrical power.

The following is a brief study to determine if such a facility is feasible, from a technical and economic standpoint.

1.2 Study Criteria

The following technical and economic criteria were used in this study:

- Flow rate- 39 CFS and relatively constant
- Head available- 100 Feet
- Load Factor (flow availability)- 90%
- Energy Value- $0.13 per KWH with no escalation
- Economic Study Term- 30 years
- Interest Rate- 5%
- Discount Rate- 2%

Based on the hydroelectric equipment available for this type of facility the following design criteria were used:

- Hydroelectric System efficiency- 80%
- Annual O&M costs- 5% of capital costs

1.3 Equipment Selection

Based on the size of this facility, about 300 kilowatts, the hydroelectric equipment used falls into the category of “large hydroelectric”. The types of equipment that would be suitable for this facility include a cross-flow turbine, a Francis turbine and a reverse pump.

A cross-flow turbine is suitable and has a relatively lower capital cost. Efficiencies are typically in the range of 75% and the turbine can handle a wide range of flows. However, this turbine must discharge to a free surface. Therefore it is not considered at this point.

A Francis turbine is also suitable. It has the highest efficiency at 83%, but also has the highest capital cost. This is also at the low end of the flow range for a Francis turbine. This equipment can discharge into a piping system and it also can handle varying flow rates.

A reverse pump has a low capital cost, similar to the cross-flow turbine, and an efficiency of about 80%. Like the Francis turbine, it can discharge into a piping system. However, a reverse pump must have relatively constant flow rates.

Based on the above information and the characteristics of the system, a reverse pump system is selected to use for this study. Based on what is known about the system, a constant flow rate can be provided for the reverse pump. In addition, the reverse pump is more economical than the Francis turbine. All three systems evaluated are not eliminated at this time and they can be evaluated further in subsequent studies. Based on manufacturer communications, the delivery time for a system is 8 to 12 months.

1.4 Facility Capital Cost

Based on the reverse pump system the following rough-order-of-magnitude (ROM) capital cost was generated. It must be understood that these costs are very preliminary and have been prepared without benefit of any site data. This ROM estimate should not be used for budgeting or any other purpose other than for this brief economic evaluation and actual costs could be significantly higher or lower than this:

Item	Cost
Site Work	$ 30,000
Building/Vault	$ 100,000
Hydroelectric Generator Equipment	$ 275,000
Piping	$ 75,000
Equipment and Pipe Installation	$ 250,000
Switchyard	$ 100,000
Subtotal	**$ 830,000**
Contingency @ 25%	$ 207,500
Engineering, CM and Admin @ 25%	$ 207,500
Total	**$ 1,245,000**

1.5 Economic Evaluation

The economic and technical criteria described above became the basis of an economic evaluation and generated the following intermediate results:

- Debt Service on the Investment- $80,900 per year
- O&M Costs- $62,200 per year
- Energy Generation- 2,080,000 KWH per year
- Value of Energy @ $ 0.13/KWH- $270,500 per year
- Cash Flow- $127,200 per year

The net present worth of this investment is $2,850,000. The annualized rate of return is about 16.5%. This would indicate that this project may be feasible from an economic standpoint. Please see the attached spreadsheet for detailed study calculations.

However, there are items that can significantly affect the outcome of this study and warrant further discussion and study. A partial list includes the following items:

- Confirm that the full 100 feet of head is available for energy generation. There may be system head losses and process head needs that could reduce this value.
- Confirm that the flow rate of 39 CFS is relatively constant and will be available 90% of the time. This can affect both equipment selection and the economic analysis.
- Confirm discharge conditions, i.e., free surface or pipe.
- Evaluate the value of the energy and any escalation of energy prices.

Capital Cost Estimate

Item	Cost	
Site Work	$	30,000.00
Building/Vault	$	100,000.00
Hydroelectric Generator Equipment	$	275,000.00
Piping	$	75,000.00
Equipment and Pipe Installation	$	250,000.00
Switchyard	$	100,000.00
Subtotal	**$**	**830,000.00**
Contingency @ 25%	$	207,500.00
Engineering, CM and Admin @ 25%	$	207,500.00
Grand Total	**$**	**1,245,000.00**

Turbine Type	Equipment Package Cost		Efficiency	Comments
Cross Flow Turbine	$	250,000.00	75%	Must discharge into open channel
Francis Turbine	$	400,000.00	83%	Can discharge into pipe and can take varying flow rates
Reverse Pump	$	275,000.00	80%	Can discharge into pipe, but needs constant flow rate

Delivery: 8 to 12 months

Source of Equipment Cost:

Canyon Industries, Inc.

Business type: manufacturer

Product types: large hydro energy systems (> 50 kW), small hydro energy systems (< 50 kW), large hydro turbines (> 50 kW), small hydro turbines (< 50 kW), large hydro energy system components (> 50 kW), small hydro energy system components (< 50 kW) .

Address: 5500 Blue Heron Lane, P.O. Box 36, Deming, Washington USA 98244
Telephone: (360) 592-5552
FAX: (360) 592-2235

Santiago Water Commission
Baker Water Treatment Plant
Hydroelectric Study

Study Criteria

No.	Criterion	Quantity	Units
1	Flow Rate	39	cfs
2	Head	100	feet
3	Hydroelectric Efficiency	80%	per cent
4	Load Factor	90%	per cent
5	Study Term	30	years
6	Energy Value	$ 0.13	kwh
7	Interest Rate	5%	per cent
8	Discount Rate	2%	per cent
9	Energy Escalation	0%	per cent/year
10	Facility Capital Cost	$ 1,245,000.00	dollars
11	O & M Cost	5%	per cent of capital cost
	Net Present Value	$2,849,209.24	
	Rate of Return	16.55%	

Economic Evaluation

Year	Debt Service	O&M Costs	Total Costs	KWH/Year	Value of Energy	Operating Margin	Yearly Cash Flow
1	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
2	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
3	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
4	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
5	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
6	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
7	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
8	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
9	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
10	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
11	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
12	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
13	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
14	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
15	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
16	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
17	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
18	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
19	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
20	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
21	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
22	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
23	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
24	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
25	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
26	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
27	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
28	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
29	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
30	$80,989.04	$ 62,250.00	$ 143,239.04	2,080,431	$ 270,456.01	$ 208,206.01	$ 127,216.97
Totals	$ 2,429,671.10	$ 1,867,500.00	$ 4,297,171.10	62,412,925	$ 8,113,680.23	$ 6,246,180.23	$ 3,816,509.13
Net Present Value							$2,849,209.24
Rate of Return							15.89%

APPENDIX C

MWD WATER RATE FORECASTS

APPENDIX C MWD WATER RATE FORECASTS

Met 5 Year Forecast From FY 06/07 Budget
Averages Calculated by MWDOC

AVERAGE OF LOW AND HIGH FORECAST (ROUNDED TO NEAREST DOLLAR)					
MET Rates and Charges	2007	2008	2009	2010	2011
Tier 1 Supply Rate ($/AF)	73	76	80	86	91
Tier 2 Supply Rate ($/AF)	169	169	169	169	169
System Access Rate ($/AF)	143	146	149	152	158
Water Stewardship Rate ($/AF)	25	26	26	33	40
System Power Rate ($/AF)	90	114	121	121	121
Treatment Surcharge ($/AF)	147	154	160	177	184
Readiness to Serve Charge ($M)	80	83	87	92	95
Capacity Charge ($/cfs)	6800	6800	6800	7300	7500
Full Service Tier 1 (Treated) ($/AF)	478	515	536	568	593
Full Service Tier 2 (Treated) ($/AF)	574	608	625	651	671
Interim Ag Untreated ($/AF)	241	271	286	301	319
Interim Ag Treated ($/AF)	364	401	422	454	479
Replenishment Untreated ($/AF)	238	268	283	298	316
Replenishment Treated ($/AF)	360	397	418	450	475

LOW FORECAST					
MET Rates and Charges	2007	2008	2009	2010	2011
Tier 1 Supply Rate ($/AF)	73	73	73	81	85
Tier 2 Supply Rate ($/AF)	169	169	169	169	169
System Access Rate ($/AF)	143	143	143	143	150
Water Stewardship Rate ($/AF)	25	25	25	31	38
System Power Rate ($/AF)	90	113	120	120	120
Treatment Surcharge ($/AF)	147	148	154	170	177
Readiness to Serve Charge ($M)	80	83	87	92	95
Capacity Charge ($/cfs)	6800	6800	6800	7300	7500
Full Service Tier 1 (Treated) ($/AF)	478	502	515	545	570
Full Service Tier 2 (Treated) ($/AF)	574	598	611	633	654
Interim Ag Untreated ($/AF)	241	264	271	285	303
Interim Ag Treated ($/AF)	364	388	401	431	456
Replenishment Untreated ($/AF)	238	261	268	282	300
Replenishment Treated ($/AF)	360	384	397	427	452

HIGH FORECAST					
MET Rates and Charges	2007	2008	2009	2010	2011
Tier 1 Supply Rate ($/AF)	73	78	86	90	96
Tier 2 Supply Rate ($/AF)	169	169	169	169	169
System Access Rate ($/AF)	143	149	155	160	165
Water Stewardship Rate ($/AF)	25	26	27	35	41
System Power Rate ($/AF)	90	115	122	122	122
Treatment Surcharge ($/AF)	147	159	166	183	191
Readiness to Serve Charge ($M)	80	83	87	92	95
Capacity Charge ($/cfs)	6800	6800	6800	7300	7500
Full Service Tier 1 (Treated) ($/AF)	478	527	556	590	615
Full Service Tier 2 (Treated) ($/AF)	574	618	639	669	688
Interim Ag Untreated ($/AF)	241	278	300	317	334
Interim Ag Treated ($/AF)	364	413	442	476	501
Replenishment Untreated ($/AF)	238	275	297	314	331
Replenishment Treated ($/AF)	360	409	438	472	497

Met High Low Forecast from Budget - October 2006 MWDOC 10/12/2006

APPENDIX D

SANTIAGO LATERAL/BAKER PIPELINE REFINED HYDRAULICS

APPENDIX D SANTIAGO LATERAL/BAKER PIPELINE REFINED HYDRAULICS

Baker Treatment Plant
Hydraulic Analysis of Raw Water Feed via Santiago Lateral and Baker Pipeline
Summary of Runs

		Flow (cfs) Taken by							
Case	Description of Case	Ana-heim at A-08	IRWD at OC-13	EOCWD & IRWD at Peters	IRWD & County at Borrego Wash	Treat-ment Plant	Baker Total	HGL at End	Notes
0	Baker Ownership (exist.)	23.3	0	59.40	6.00	39.5	104.90	716	
1	max to end w/ ownership amount at Peters	23.3	0	59.40	0.00	45.0	104.4	715	remove take at Borrego
2	10 cfs at Peters	23.3	0	10.00	0.00	50.2	60.2	715	EOCWD reserved ownership
3	max to end w/ 0 at Peters	23.3	0	0.00	0.00	58.5	58.5	715	
4	IRWD 100 cfs	23.3	100	0.00	0.00	41.6	41.6	715	IRWD typically takes 100 cfs in March
5	max to end with pumping at end	23.3	0	0.00	0.00	67.4	67.4	640	must pump into Treatment Plant

APPENDIX D SANTIAGO LATERAL/BAKER PIPELINE REFINED HYDRAULICS

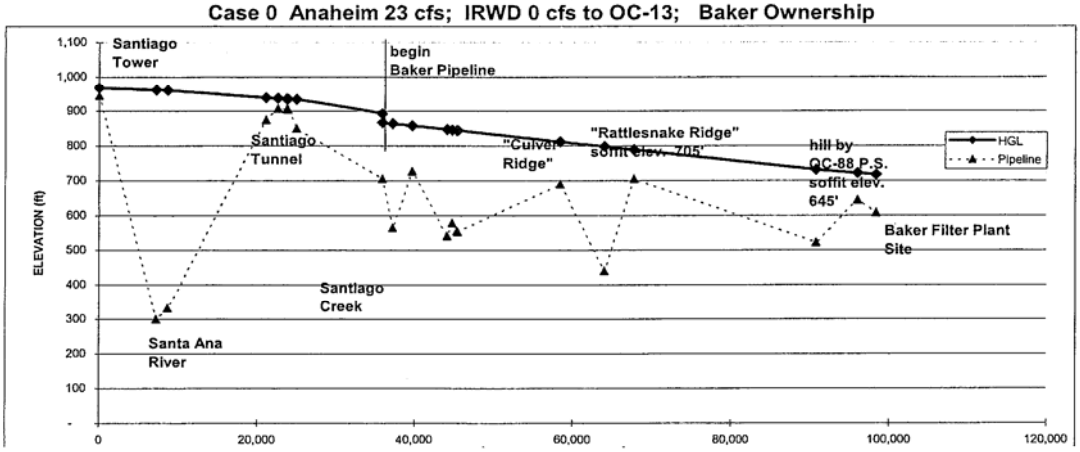
Table
Baker Pipeline
HYDRAULIC GRADE CALCULATION

Case 0 Anaheim 23 cfs; IRWD 0 cfs to OC-13; Baker Ownership

Node	Reach Designat	Reach Length (ft)	Inside Diam. (inch)	Friction Factor	Turnout Q (cfs)	Pipe Flow Q (cfs)	Veloc. V ft/sec	Friction Loss (ft)	Minor Losses Type	Minor Losses (ft)	HGL (ft)	Top Inside Pipe Elev. (ft)	Water Pressure (psi)
Santiago Control Tower						128					967.0	945.0	10
begin Santiago Lateral			72			128	4.5		entrance	0.2			
meter SL-0			34			128			venturi meter	0.9			
sectionalizing valve				"N"		128			valve	0.2			
sta. eq. 48+00 Ah = 45+66.81 Bk	SL upper	7,267	72	0.011		128	4.5	4.8					
Santa Ana River crossing											961.0	300.0	286
		1,450	72	0.011		128	4.5	1.0					
reducer & OC-12											960.1	332.0	272
ta. eq. 98+00 Ah = 109+68.42 Bk		12,391	60	0.011		128	6.5	21.5					
A-08 (Anaheim)					23.3						938.6	874.5	28
		1,467	60	0.011		105	5.3	1.7					
sectionalizing valve			42			105			valve	0.2	936.7	907.5	13
		20	60	0.011		105	5.3	0.0					
begin tunnel									exit	0.2	936.4	907.5	13
	Santiago Tu	1,120	60	0.011		105	5.3	1.3					
end tunnel									entrance	0.2	934.9	905.5	13
		120	60	0.011		105	5.3	0.1					
standpipe by west end of tunnel											934.7	905.0	13
		1,120	60	0.011		105	5.3	1.3					
reducer											933.4	850.0	36
		10,879	48	0.011		105	8.4	41.5					
OC-33 outlet; SL continues to OC-13					0.0						891.9	705.0	81
OC-33 Outlet and MET Valve			42			105	10.9		outlet & valve	1.8			
OC-33 meter		50	14			105			venturi meter	22.2			
begin Baker Pipeline			42	"C"		105	10.9		valve	0.9	867.0	705.0	70
	1U	1,343	54	120		105	6.6	3.2					
Santiago Ck. & emerg. intertie w/ILP											863.7	564.5	130
		2,447	54	120		105	6.6	5.9					
Loma Ridge high pt.											857.9	727.5	56
		4,447	54	120		105	6.6	10.7					
Handy Ck. blowoff											847.2	541.0	133
		631	54	120		105	6.6	1.5					
emerg. intertie w/ AMP											845.7	578.7	116
		625	54	120		105	6.6	1.5					
EOCWD Conn.					59.46						844.2	556.0	125
		102	54	120		45	2.9	0.1					
reducer and											844.1	553.5	126
begin 39" MWDOC line		12,944	39	120		45	5.5	32.2					
Culver ridge high point	2U/3U										811.9	690.3	53
		5,579	39	120		45	5.5	13.9					
end MWDOC line and											798.0	440.5	155
rejoin original Santiago Aqueduct		3,690	39	120		45	5.5	9.2					
"Rattlesnake ridge" high point	4U										788.8	705.4	36
		23,119	39	120		45	5.5	57.6					
Borrego Creek					6.0						731.2	522.6	90
		5,250	39	120		39	4.8	10.1					
hill by OC-88 P.S.											721.2	644.9	33
		2,305	39	120		39	4.8	4.4					
20" outlet & reducer					32.9						716.8	608.0	47
valves & Trabuco outlet	5U	20	24	120	6.55	7	2.1	0.0	valve	0.0			
emerg. intertie w/ AMP "South"			24								716.7	607.0	48
					128.2								
					23.3								
					104.9								

Baker Pipeline Generalized Profile and Hydraulic Grade Line

Case 0 Anaheim 23 cfs; IRWD 0 cfs to OC-13; Baker Ownership



Baker Hydraulics prepared by Municipal Water District of Orange County 12/11/2006

APPENDIX D SANTIAGO LATERAL/BAKER PIPELINE REFINED HYDRAULICS

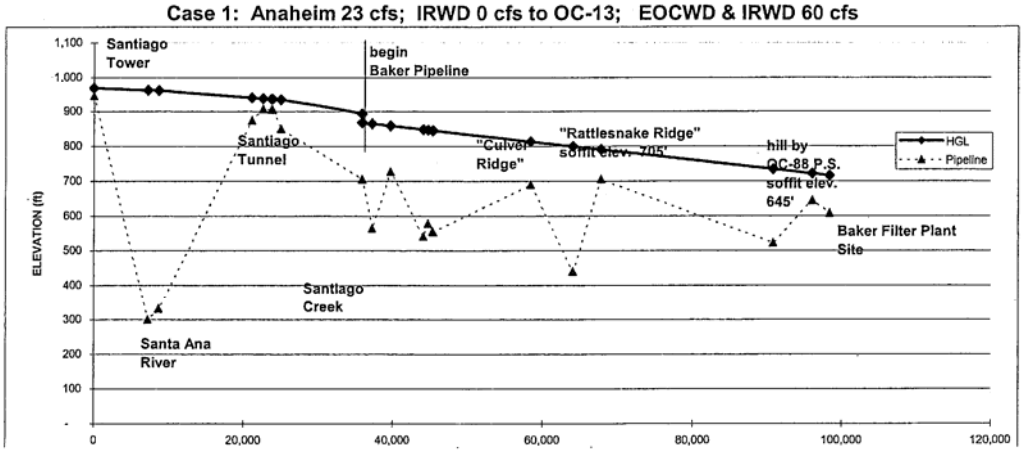
Table
Baker Pipeline
HYDRAULIC GRADE CALCULATION

Case 1: Anaheim 23 cfs; IRWD 0 cfs to OC-13; EOCWD & IRWD 60 cfs

Node	Reach Designat	Reach Length (ft)	Inside Diam. (inch)	Friction Factor	Turnout Q (cfs)	Pipe Flow Q (cfs)	Veloc. V ft/sec	Friction Loss (ft)	Minor Losses Type	Minor Losses (ft)	HGL (ft)	Top Inside Pipe Elev. (ft)	Water Pressure (psi)
Santiago Control Tower						128					**967.0**	945.0	10
begin Santiago Lateral			72			128	4.5		entrance	0.2			
meter SL-0			34			128			venturi meter	0.9			
sectionalizing valve				"N"		128			valve	0.2			
sta. eq. 48+00 Ah = 45+66.81 Bk	SL upper	7,267	72	0.011		128	4.5	4.7					
Santa Ana River crossing											961.0	300.0	286
		1,450	72	0.011		128	4.5	0.9					
reducer & OC-12											960.1	332.0	272
ta. eq. 98+00 Ah = 109+68.42 Bk		12,391	60	0.011		128	6.5	21.3					
A-08 (Anaheim)					23.3						938.8	874.5	28
		1,467	60	0.011		105	5.3	1.7					
sectionalizing valve			42			105			valve	0.2	936.8	907.5	13
		20	60	0.011		105	5.3	0.0					
begin tunnel									exit	0.2	936.6	907.5	13
	Santiago Tu	1,120	60	0.011		105	5.3	1.3					
end tunnel									entrance	0.2	935.1	905.5	13
		120	60	0.011		105	5.3	0.1					
standpipe by west end of tunnel											934.9	905.0	13
		1,120	60	0.011		105	5.3	1.3					
reducer											933.7	850.0	36
		10,879	48	0.011		105	8.3	41.2					
OC-33 outlet; SL continues to OC-13					0.0						892.4	705.0	81
OC-33 Outlet and MET Valve			42			105	10.9		outlet & valve	1.8			
OC-33 meter		50	14			105			venturi meter	22.0			
begin Baker Pipeline			42	"C"		105	10.9		valve	0.9	867.7	705.0	70
	1U	1,343	54	120		105	6.6	3.2					
Santiago Ck. & emerg. intertie w/ILP											864.5	564.5	130
		2,447	54	120		105	6.6	5.8					
Loma Ridge high pt.											858.7	727.5	57
		4,447	54	120		105	6.6	10.6					
Handy Ck. blowoff											848.1	541.0	133
		631	54	120		105	6.6	1.5					
emerg. intertie w/ AMP											846.6	578.7	116
		625	54	120		105	6.6	1.5					
EOCWD Conn.					59.5						845.1	556.0	125
		102	54	120		45	2.8	0.1					
reducer and											845.0	553.5	126
begin 39" MWDOC line		12,944	39	120		45	5.4	31.7					
Culver ridge high point	2U/3U										813.3	690.3	53
		5,579	39	120		45	5.4	13.7					
end MWDOC line and											799.6	440.5	156
rejoin original Santiago Aqueduct		3,690	39	120		45	5.4	9.0					
"Rattlesnake ridge" high point	4U										790.6	705.4	37
		23,119	39	120		45	5.4	56.6					
Borrego Creek					0.0						734.0	522.6	92
		5,250	39	120		45	5.4	12.9					
hill by OC-88 P.S.											721.1	644.9	33
		2,305	39	120		45	5.4	5.6					
20" outlet & reducer					38.50						715.4	608.0	47
valves & Trabuco outlet	5U	20	24	120	6.55	7	2.1	0.01	valve	0.0			
emerg. intertie w/ AMP "South"			24								715.4	607.0	47
					127.8								
					45.05								

Baker Pipeline Generalized Profile and Hydraulic Grade Line

Case 1: Anaheim 23 cfs; IRWD 0 cfs to OC-13; EOCWD & IRWD 60 cfs



Baker Hydraulics prepared by Municipal Water District of Orange County 12/11/2006

APPENDIX D SANTIAGO LATERAL/BAKER PIPELINE REFINED HYDRAULICS

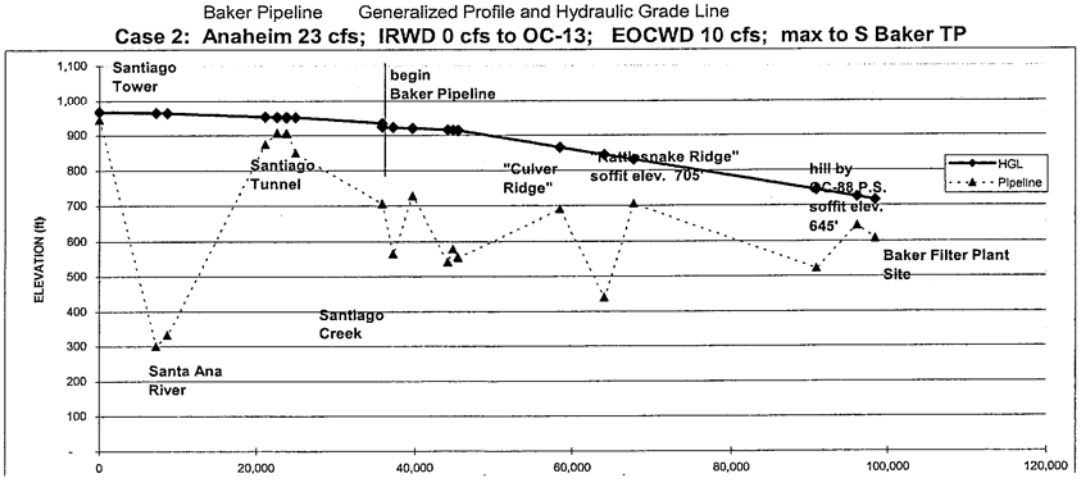
Table
Baker Pipeline
HYDRAULIC GRADE CALCULATION

Case 2: Anaheim 23 cfs; IRWD 0 cfs to OC-13; EOCWD 10 cfs; max to S Baker TP

Node	Reach Designat	Reach Length (ft)	Inside Diam. (inch)	Friction Factor	Turnout Q (cfs)	Pipe Flow Q (cfs)	Veloc. V ft/sec	Friction Loss (ft)	Minor Losses Type	Minor Losses (ft)	HGL (ft)	Top Inside Pipe Elev. (ft)	Water Pressure (psi)
Santiago Control Tower						90					**967.0**	945.0	10
begin Santiago Lateral			72			90	3.2		entrance	0.1			
meter SL-0			34			90			venturi meter	0.5			
sectionalizing valve				"N"		90			valve	0.1			
sta. eq. 48+00 Ah = 45+66.81 Bk	SL upper	7,267	72	0.011		90	3.2	2.3					
Santa Ana River crossing											964.0	300.0	288
		1,450	72	0.011		90	3.2	0.5					
reducer & OC-12											963.6	332.0	274
ta. eq. 98+00 Ah = 109+68.42 Bk		12,391	60	0.011		90	4.6	10.6					
A-08 (Anaheim)					23.3						953.0	874.5	34
		1,467	60	0.011		67	3.4	0.7					
sectionalizing valve			42			67			valve	0.1	952.2	907.5	19
		20	60	0.011		67	3.4	0.0					
begin tunnel									exit	0.1	952.1	907.5	19
	Santiago Tu	1,120	60	0.011		67	3.4	0.5					
end tunnel									entrance	0.1	951.5	905.5	20
		120	60	0.011		67	3.4	0.1					
standpipe by west end of tunnel											951.4	905.0	20
		1,120	60	0.011		67	3.4	0.5					
reducer											950.9	850.0	44
		10,879	48	0.011		67	5.3	16.8					
OC-33 outlet; SL continues to OC-13					0.0						934.1	705.0	99
OC-33 Outlet and MET Valve			42			67	6.9		outlet & valve	0.7			
OC-33 meter		50	14			67			venturi meter	9.0			
begin Baker Pipeline			42	"C"		67	6.9		valve	0.4	924.0	705.0	95
	1U	1,343	54	120		67	4.2	1.4					
Santiago Ck. & emerg. intertie w/iLP											922.6	564.5	155
		2,447	54	120		67	4.2	2.5					
Loma Ridge high pt.		-									920.1	727.5	83
		4,447	54	120		67	4.2	4.6					
Handy Ck. blowoff											915.4	541.0	162
		631	54	120		67	4.2	0.7					
emerg. intertie w/ AMP											914.8	578.7	146
		625	54	120		67	4.2	0.6					
EOCWD Conn.					10.0						914.1	556.0	155
		102	54	120		57	3.6	0.1					
reducer and											914.0	553.5	156
begin 39" MWDOC line		12,944	39	120		57	6.8	48.6					
Culver ridge high point	2U/3U										865.4	690.3	76
		5,579	39	120		57	6.8	21.0					
end MWDOC line and											844.5	440.5	175
rejoin original Santiago Aqueduct		3,690	39	120		57	6.8	13.9					
"Rattlesnake ridge" high point	4U										830.6	705.4	54
		23,119	39	120		57	6.8	86.8					
Borrego Creek					0.0						743.8	522.6	96
		5,250	39	120		57	6.8	19.7					
hill by OC-88 P.S.											724.1	644.9	34
		2,305	39	120		57	6.8	8.7					
20" outlet & reducer					50.2						715.4	608.0	47
valves & Trabuco outlet	5U	20	24	120	6.55	7	2.1	0.0	valve	0.0			
emerg. intertie w/ AMP "South"			24								715.4	607.0	47
					90.0								
					56.8								

Baker Pipeline Generalized Profile and Hydraulic Grade Line

Case 2: Anaheim 23 cfs; IRWD 0 cfs to OC-13; EOCWD 10 cfs; max to S Baker TP



Baker Hydraulics prepared by Municipal Water District of Orange County 12/11/2006

APPENDIX D SANTIAGO LATERAL/BAKER PIPELINE REFINED HYDRAULICS

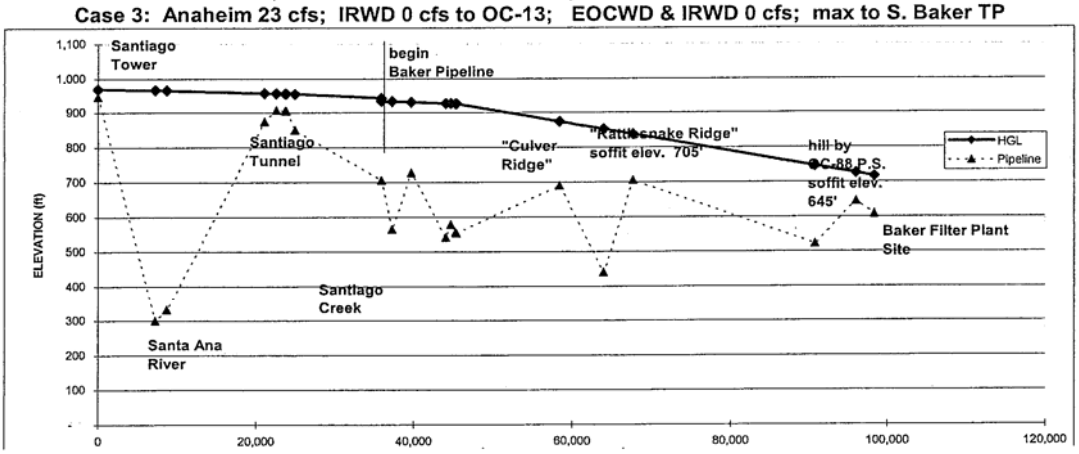
Table
Baker Pipeline
HYDRAULIC GRADE CALCULATION

Case 3: Anaheim 23 cfs; IRWD 0 cfs to OC-13; EOCWD & IRWD 0 cfs; max to S. Baker TP

Node	Reach Designat	Reach Length (ft)	Inside Diam. (inch)	Friction Factor	Turnout Q (cfs)	Pipe Flow Q (cfs)	Veloc. V ft/sec	Friction Loss (ft)	Minor Losses Type	Minor Losses (ft)	HGL (ft)	Top Inside Pipe Elev. (ft)	Water Pressure (psi)
Santiago Control Tower						82					**967.0**	945.0	10
begin Santiago Lateral			72			82	2.9		entrance	0.1			
meter SL-0			34			82			venturi meter	0.4			
sectionalizing valve				"N"		82			valve	0.1			
sta. eq. 48+00 Ah = 45+66.81 Bk	SL upper	7,267	72	0.011		82	2.9	1.9					
Santa Ana River crossing											964.6	300.0	288
		1,450	72	0.011		82	2.9	0.4					
reducer & OC-12											964.2	332.0	274
ta. eq. 98+00 Ah = 109+68.42 Bk		12,391	60	0.011		82	4.2	8.7					
A-08 (Anaheim)					23.3						955.4	874.5	35
		1,467	60	0.011		58	3.0	0.5					
sectionalizing valve			42			58			valve	0.1	954.9	907.5	21
		20	60	0.011		58	3.0	0.0					
begin tunnel									exit	0.1	954.8	907.5	20
	Santiago Tu	1,120	60	0.011		58	3.0	0.4					
end tunnel									entrance	0.1	954.3	905.5	21
		120	60	0.011		58	3.0	0.0					
standpipe by west end of tunnel											954.3	905.0	21
		1,120	60	0.011		58	3.0	0.4					
reducer											953.9	850.0	45
		10,879	48	0.011		58	4.7	12.9					
OC-33 outlet; SL continues to OC-13					0.0						941.0	705.0	102
OC-33 Outlet and MET Valve			42			58	6.1		outlet & valve	0.6			
OC-33 meter		50	14			58			venturi meter	6.9			
begin Baker Pipeline			42	"C"		58	6.1		valve	0.3	933.2	705.0	99
	1U	1,343	54	120		58	3.7	1.1					
Santiago Ck. & emerg. intertie w/ILP											932.1	564.5	159
		2,447	54	120		58	3.7	2.0					
Loma Ridge high pt.											930.1	727.5	88
		4,447	54	120		58	3.7	3.6					
Handy Ck. blowoff											926.5	541.0	167
		631	54	120		58	3.7	0.5					
emerg. intertie w/ AMP											926.0	578.7	151
		625	54	120		58	3.7	0.5					
EOCWD Conn.					0.0						925.5	556.0	160
		102	54	120		58	3.7	0.1					
reducer and											925.4	553.5	161
begin 39" MWDOC line		12,944	39	120		58	7.0	51.3					
Culver ridge high point	2U/3U										874.1	690.3	80
		5,579	39	120		58	7.0	22.1					
end MWDOC line and											852.0	440.5	178
rejoin original Santiago Aqueduct		3,690	39	120		58	7.0	14.6					
"Rattlesnake ridge" high point	4U										837.3	705.4	57
		23,119	39	120		58	7.0	91.7					
Borrego Creek					0.0						745.6	522.6	97
		5,250	39	120		58	7.0	20.8					
hill by OC-88 P.S.											724.8	644.9	35
		2,305	39	120		58	7.0	9.1					
20" outlet & reducer					51.9						715.7	608.0	47
valves & Trabuco outlet	5U	20	24	120	6.55	7	2.1	0.0	valve	0.0			
emerg. intertie w/ AMP "South"			24								715.6	607.0	47
					81.7								
					58.5								

Baker Pipeline Generalized Profile and Hydraulic Grade Line

Case 3: Anaheim 23 cfs; IRWD 0 cfs to OC-13; EOCWD & IRWD 0 cfs; max to S. Baker TP



Baker Hydraulics prepared by Municipal Water District of Orange County 12/11/2006

APPENDIX D SANTIAGO LATERAL/BAKER PIPELINE REFINED HYDRAULICS

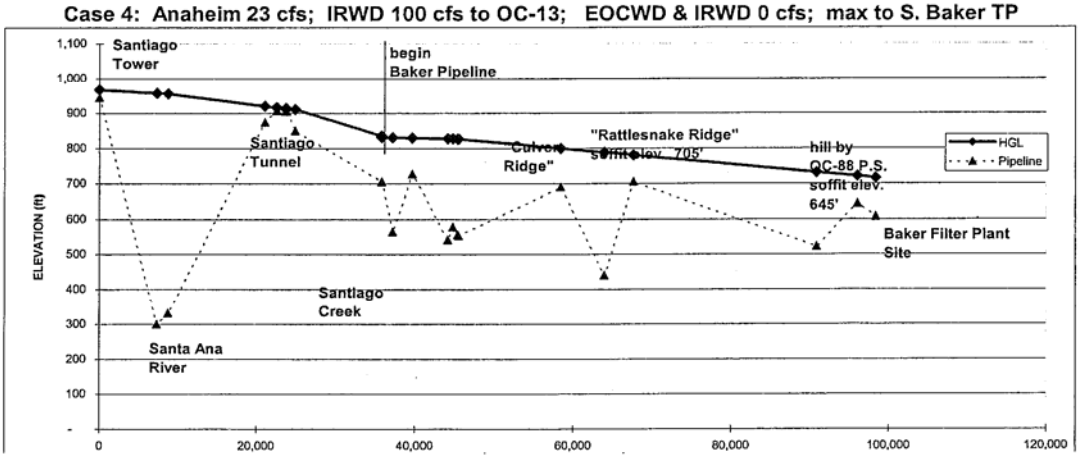
Table
Baker Pipeline
HYDRAULIC GRADE CALCULATION

Case 4: Anaheim 23 cfs; IRWD 100 cfs to OC-13; EOCWD & IRWD 0 cfs; max to S. Baker TP

Node	Reach Designat	Reach Length (ft)	Inside Diam. (inch)	Friction Factor	Turnout Q (cfs)	Pipe Flow Q (cfs)	Veloc. V ft/sec	Friction Loss (ft)	Minor Losses Type	Minor Losses (ft)	HGL (ft)	Top Inside Pipe Elev. (ft)	Water Pressure (psi)
Santiago Control Tower						165					**967.0**	945.0	10
begin Santiago Lateral			72			165	5.8		entrance	0.3			
meter SL-0			34			165			venturi meter	1.5			
sectionalizing valve				"N"		165			valve	0.3			
sta. eq. 48+00 Ah = 45+66.81 Bk	SL upper	7,267	72	0.011		165	5.8	7.9					
Santa Ana River crossing											957.1	300.0	285
		1,450	72	0.011		165	5.8	1.6					
reducer & OC-12											955.5	332.0	270
ta. eq. 98+00 Ah = 109+68.42 Bk		12,391	60	0.011		165	8.4	35.5					
A-08 (Anaheim)					23.3						920.0	874.5	20
		1,467	60	0.011		142	7.2	3.1					
sectionalizing valve			42			142			valve	0.4	916.5	907.5	4
		20	60	0.011		142	7.2	0.0					
begin tunnel									exit	0.4	916.0	907.5	4
	Santiago Tu	1,120	60	0.011		142	7.2	2.4					
end tunnel									entrance	0.4	913.3	905.5	3
		120	60	0.011		142	7.2	0.3					
standpipe by west end of tunnel											913.0	905.0	3
		1,120	60	0.011		142	7.2	2.4					
reducer											910.7	850.0	26
		10,879	48	0.011		142	11.3	75.6					
OC-33 outlet; SL continues to OC-13					100.0						835.0	705.0	56
OC-33 Outlet and MET Valve			42			42	4.3		outlet & valve	0.3			
OC-33 meter		50	14			42			venturi meter	3.5			
begin Baker Pipeline			42	"C"		42	4.3		valve	0.1	831.1	705.0	55
	1U	1,343	54	120		42	2.6	0.6					
Santiago Ck. & emerg. intertie w/ILP											830.5	564.5	115
		2,447	54	120		42	2.6	1.1					
Loma Ridge high pt.											829.5	727.5	44
		4,447	54	120		42	2.6	1.9					
Handy Ck. blowoff											827.6	541.0	124
		631	54	120		42	2.6	0.3					
emerg. intertie w/ AMP											827.3	578.7	108
		625	54	120		42	2.6	0.3					
EOCWD Conn.					0.0						827.0	556.0	117
		102	54	120		42	2.6	0.0					
reducer and											827.0	553.5	119
begin 39" MWDOC line		12,944	39	120		42	5.0	27.3					
Culver ridge high point	2U/3U										799.7	690.3	47
		5,579	39	120		42	5.0	11.8					
end MWDOC line and											787.9	440.5	151
rejoin original Santiago Aqueduct		3,690	39	120		42	5.0	7.8					
"Rattlesnake ridge" high point	4U										780.1	705.4	32
		23,119	39	120		42	5.0	48.8					
Borrego Creek					0.0						731.4	522.6	90
		5,250	39	120		42	5.0	11.1					
hill by OC-88 P.S.											720.3	644.9	33
		2,305	39	120		42	5.0	4.9					
20" outlet & reducer					35.0						715.4	608.0	47
valves & Trabuco outlet	5U	20	24	120	6.55	7	2.1	0.0	valve	0.0			
emerg. intertie w/ AMP "South"			24								715.4	607.0	47
					164.8								
					41.6								

Baker Pipeline Generalized Profile and Hydraulic Grade Line

Case 4: Anaheim 23 cfs; IRWD 100 cfs to OC-13; EOCWD & IRWD 0 cfs; max to S. Baker TP



Baker Hydraulics prepared by Municipal Water District of Orange County 12/11/2006

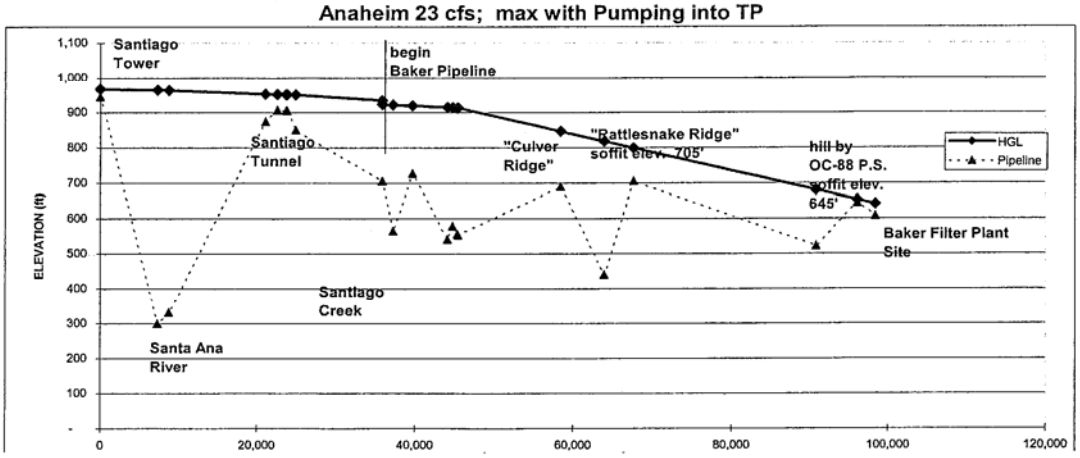
APPENDIX D SANTIAGO LATERAL/BAKER PIPELINE REFINED HYDRAULICS

Table
Baker Pipeline
HYDRAULIC GRADE CALCULATION
Anaheim 23 cfs; max with Pumping into TP

Node	Reach Designat	Reach Length (ft)	Inside Diam. (inch)	Friction Factor	Turnout Q (cfs)	Pipe Flow Q (cfs)	Veloc. V ft/sec	Friction Loss (ft)	Minor Losses Type	Minor Losses (ft)	HGL (ft)	Top inside Pipe Elev. (ft)	Water Pressure (psi)
Santiago Control Tower						91					**967.0**	945.0	10
begin Santiago Lateral			72			91	3.2		entrance	0.1			
meter SL-0			34			91			venturi meter	0.5			
sectionalizing valve				"N"		91			valve	0.1			
sta. eq. 48+00 Ah = 45+66.81 Bk	SL upper	7,267	72	0.011		91	3.2	2.4					
Santa Ana River crossing											964.0	300.0	288
		1,450	72	0.011		91	3.2	0.5					
reducer & OC-12											963.5	332.0	274
ta. eq. 98+00 Ah = 109+68.42 Bk		12,391	60	0.011		91	4.6	10.7					
A-08 (Anaheim)					23.3						952.8	874.5	34
		1,467	60	0.011		67	3.4	0.7					
sectionalizing valve			42			67			valve	0.1	952.0	907.5	19
		20	60	0.011		67	3.4	0.0					
begin tunnel									exit	0.1	951.9	907.5	19
	Santiago Tu	1,120	60	0.011		67	3.4	0.5					
end tunnel									entrance	0.1	951.3	905.5	20
		120	60	0.011		67	3.4	0.1					
standpipe by west end of tunnel											951.2	905.0	20
		1,120	60	0.011		67	3.4	0.5					
reducer											950.7	850.0	44
		10,879	48	0.011		67	5.4	17.1					
OC-33 outlet; SL continues to OC-13					0.0						933.6	705.0	99
OC-33 Outlet and MET Valve			42			67	7.0		outlet & valve	0.8			
OC-33 meter		50	14			67			venturi meter	9.1			
begin Baker Pipeline			42	"C"		67	7.0		valve	0.4	923.3	705.0	95
	1U	1,343	54	120		67	4.2	1.4					
Santiago Ck. & emerg. intertie w/ILP											921.9	564.5	155
		2,447	54	120		67	4.2	2.6					
Loma Ridge high pt.											919.3	727.5	83
		4,447	54	120		67	4.2	4.7					
Handy Ck. blowoff											914.6	541.0	162
		631	54	120		67	4.2	0.7					
emerg. intertie w/ AMP											913.9	578.7	145
		625	54	120		67	4.2	0.7					
EOCWD Conn.					0.00						913.2	556.0	155
		102	54	120		67	4.2	0.1					
reducer and											913.1	553.5	156
begin 39" MWDOC line		12,944	39	120		67	8.1	66.7					
Culver ridge high point	2U/3U										846.4	690.3	68
		5,579	39	120		67	8.1	28.8					
end MWDOC line and											817.6	440.5	163
rejoin original Santiago Aqueduct		3,690	39	120		67	8.1	19.0					
"Rattlesnake ridge" high point	4U										798.6	705.4	40
		23,119	39	120		67	8.1	119.2					
Borrego Creek					0.0						679.4	522.6	68
		5,250	39	120		67	8.1	27.1					
hill by OC-88 P.S.											652.4	644.9	3
		2,305	39	120		67	8.1	11.9					
20" outlet & reducer					60.8						640.5	608.0	14
valves & Trabuco outlet	5U	20	24	120	6.55	7	2.1	0.0	valve	0.0			
emerg. intertie w/ AMP "South"			24								640.4	607.0	14

Q at Santiago Tower 90.6
Q at end of Baker 67.4

Baker Pipeline Generalized Profile and Hydraulic Grade Line
Anaheim 23 cfs; max with Pumping into TP



Baker Hydraulics prepared by Municipal Water District of Orange County 12/13/2006

April 2010

Baker Water Treatment Plant
Preliminary Design Report

Prepared for:
Irvine Ranch Water District
PR 11218

Prepared by:
RBF CONSULTING
carollo

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EXECUTIVE SUMMARY

GENERAL

This report presents a summary description of the Baker Water Treatment Plant Project, including the raw water conveyance system, pre-treatment systems, membrane system, post-treatment systems, and product water delivery systems. The intent of this Preliminary Design Report (PDR) is to document the work that has been completed, including existing facilities investigations and testing, analysis of alternatives, economic analyses, and preliminary design, and to describe the project that is being recommended for final design, including project economics and implementation schedule.

INTRODUCTION AND BACKGROUND

The Baker Water Treatment Plant (Baker WTP) is a regional project that will treat up to 43.5 cfs (28 mgd) of raw water imported from the Metropolitan Water District (MWD) or supplied locally from Irvine Lake, to drinking water standards to supply water agencies in southern Orange County.

Irvine Ranch Water District (IRWD) is the lead agency for the Baker WTP project. The Project Stakeholders and their respective project capacity rights as currently defined are:

- El Toro Water District – 5.0 cfs
- Irvine Ranch Water District – 10.5 cfs
- Moulton Niguel Water District – 13.0 cfs
- Santa Margarita Water District – 13.0 cfs
- Trabuco Canyon Water District – 2.0 cfs
- Municipal Water District of Orange County – 0 cfs

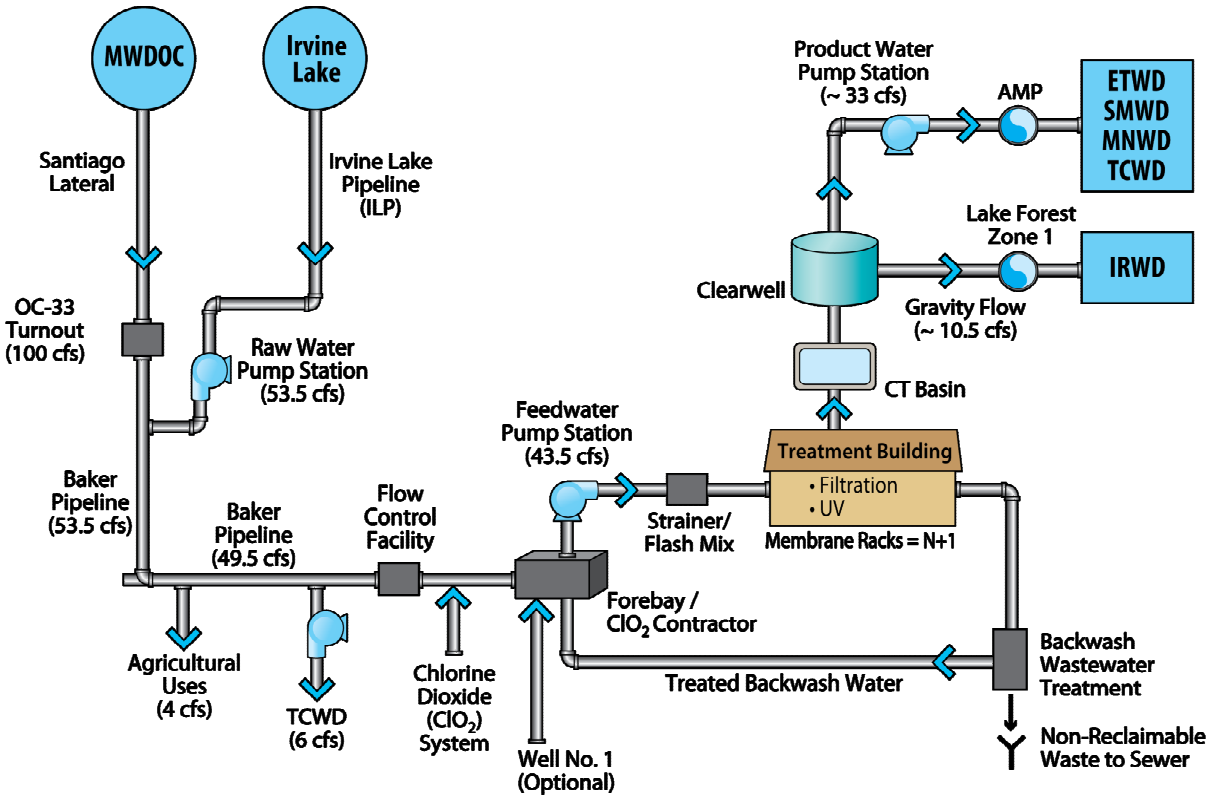
In December 1999, the Allen McColloch Pipeline (AMP) ruptured causing significant reduction in MWD supplies to south Orange County, and demonstrating south Orange County's dependence on AMP operation. The observed dependence on the AMP, led the Santiago Aqueduct Commission (SAC) to consider a new water treatment plant utilizing the Baker Pipeline for raw water transmission. In 2006, SAC and Project Stakeholders undertook a study to determine the feasibility of constructing a surface water treatment plant that could take advantage of already existing infrastructure, to develop a cost-effective local source of supply. This study concluded that such a project was feasible from both an engineering and cost perspective, and that existing infrastructure, primarily the SAC-owned Baker pipeline, Irvine Lake pipeline, and MWD owned AMP, could be used to convey raw water to the plant and deliver potable water to

local water agencies. The study also recommended that a new treatment plant using microfiltration membrane technology, pressure driven, be constructed at the former Los Alisos Water District (LAWD) Baker WTP site, located in the City of Lake Forest, near the terminus of the Baker pipeline and adjacent to the AMP. Subsequent engineering investigations have confirmed these recommendations, resulting in Project Stakeholders deciding to move forward with Project preliminary design.

PROJECT OVERVIEW

The Baker WTP Project has three primary components: raw water conveyance system, treatment system, and product water delivery system. Exhibit ES-1 schematically illustrates the proposed Baker WTP Project.

Exhibit ES-1 Baker WTP Project Illustration



The Baker WTP Project, starting at the OC-33 turnout, will use existing facilities or will construct new facilities that are located in the south Orange County cities of Orange, Irvine, and Lake Forest and unincorporated Orange County. The majority of new facilities, including all treatment processes, will be located at the former Los Alisos Water District Baker Plant site, located in the City of Lake Forest.

The following sub-sections briefly describe each of the Baker WTP Project primary components.

RAW WATER CONVEYANCE SYSTEM

The raw water delivery system is comprised primarily of existing facilities. New facilities include a raw water pump station, a pump station for TCWD, and flow control at the Baker WTP. Exhibit ES-2 shows an overview of the Baker WTP raw water delivery system.

For the majority of the year, the raw water source will be a blend of Colorado River Water (CRW) and State Project Water (SPW), delivered from MWD's Lower Feeder system to MWD's Santiago Lateral to SAC's Baker Pipeline, through the OC-33 turnout, and then to the Baker Plant.

During certain times of the year, and when MWD water is not available, the raw water source will be Irvine Lake, which stores a combination of MWD water (as described above) and surface runoff from the Irvine Lake watershed. Irvine Lake is jointly owned by IRWD and Serrano Water District. Irvine Lake water will be delivered to the plant via IRWD's Irvine Lake Pipeline (ILP), then to the Baker Pipeline and then to the Plant.

To deliver 43.5 cfs of Irvine Lake water to the Baker WTP at a required HGL of 690 ft, a raw water pump station is required. This raw water pump station is designed to pump water from the ILP into the Baker Pipeline. The raw water pump station is sized to deliver up to 43.5 cfs of Irvine Lake water to the Baker WTP, 6 cfs to TCWD, and 4 cfs for existing agricultural use, for a total capacity of 53.5 cfs. The proposed raw water pump station is located at the Peters Canyon site in the City of Orange. The pump station will be housed within a building.

Flow from the Baker pipeline will terminate at the Baker WTP at a new forebay. Flow control is required just upstream of the forebay to achieve an HGL sufficient to supply the forebay with the plant's raw water demand.

If IRWD's Well No. 1 (LAWD) is re-commissioned, it may provide a small additional source of raw water, and may be designed to deliver groundwater to the forebay. Therefore, it is assumed that water from Well No. 1 will undergo the same treatment process as the water delivered from the Baker Pipeline.

TREATMENT SYSTEM

Exhibit ES-3 illustrates the recommended treatment system. Selection of the treatment process for the Baker WTP was based on many factors, including raw water quality,

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carollo Engineers...Working Wonders With Water™

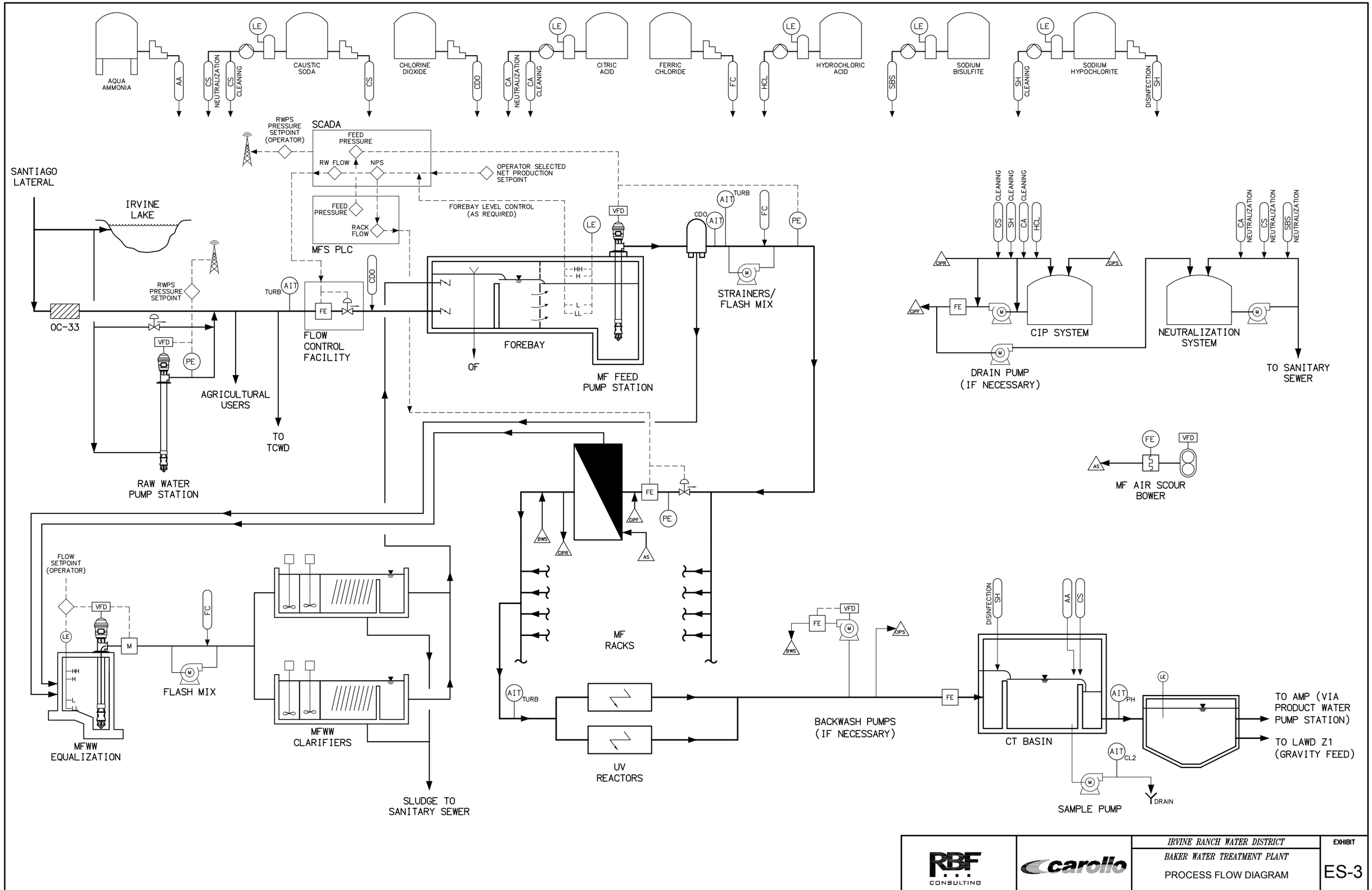
0 1 2 Miles

Baker Pipeline
Santiago Lateral
ILP (Future Recycled Water)
Irvine Lake Pipeline
Pump Station
Reservoir

Baker Water Treatment Plant

Raw Water System Overview

Exhibit ES-2


AQUA AMMONIA
AA
CS NEUTRALIZATION
CS CLEANING
LE
CAUSTIC SODA
CS
CHLORINE DIOXIDE
CDO
CA NEUTRALIZATION
CA CLEANING
CITRIC ACID
FERRIC CHLORIDE
FC
HCL
HYDROCHLORIC ACID
SBS
SODIUM BISULFITE
SH CLEANING
SODIUM HYPOCHLORITE
DISINFECTION SH
RWPS PRESSURE SETPOINT (OPERATOR)
SCADA
FEED PRESSURE
RW FLOW
NPS
OPERATOR SELECTED NET PRODUCTION SETPOINT
FEED PRESSURE
RACK FLOW
MFS PLC
FOREBAY LEVEL CONTROL (AS REQUIRED)
SANTIAGO LATERAL
IRVINE LAKE
OC-33
RWPS PRESSURE SETPOINT
TURB
AIT
FE
CDO
FLOW CONTROL FACILITY
VFD
PE
AGRICULTURAL USERS
TO TCWD
RAW WATER PUMP STATION
HH
H
L
LL
FOREBAY
OF
MF FEED PUMP STATION
STRAINERS/ FLASH MIX
CDO
AIT
TURB
FC
PE
CIPR
CIPS
CIPF
CS CLEANING
SH CLEANING
CA CLEANING
HCL
FE
CIP SYSTEM
DRAIN PUMP (IF NECESSARY)
CA NEUTRALIZATION
CS NEUTRALIZATION
SBS NEUTRALIZATION
NEUTRALIZATION SYSTEM
TO SANITARY SEWER
FE
VFD
AS
MF AIR SCOUR BOWER
FE
CIPF
PE
BWS
CIPR
AS
MF RACKS
AIT
TURB
UV REACTORS
FLOW SETPOINT (OPERATOR)
VFD
LE
M
FC
FLASH MIX
MFWW EQUALIZATION
MFWW CLARIFIERS
SLUDGE TO SANITARY SEWER
VFD
FE
BWS
CIPS
BACKWASH PUMPS (IF NECESSARY)
DISINFECTION SH
AA
CS
FE
CT BASIN
AIT
PH
LE
AIT
CL2
DRAIN
SAMPLE PUMP
TO AMP (VIA PRODUCT WATER PUMP STATION)
TO LAWD Z1 (GRAVITY FEED)
RBF CONSULTING
carollo
IRVINE RANCH WATER DISTRICT
BAKER WATER TREATMENT PLANT
PROCESS FLOW DIAGRAM
EXHIBIT
ES-3

drinking water quality regulations (current and future), ease of operation, and life-cycle cost. Considerable focus was placed on ensuring that overall project costs, variable raw water quality, taste and odor flexibility, ease and cost of operation and maintenance, and plant footprint size were all acceptable. With all alternatives and factors presented and considered, IRWD and the Project Stakeholders confirmed the selection of pressurized membrane filtration for Baker WTP.

The main components of the treatment system are all located at the Baker WTP site and are briefly described below:

CHLORINE DIOXIDE PRE-TREATMENT

Chlorine dioxide will be used for pretreatment of iron and manganese when Irvine Lake water is being supplied to the plant. Through bench testing, it was determined that chlorine dioxide is the most effective pretreatment oxidant for Irvine Lake water, and is essential for prevention of membrane fouling. Effective removal of iron and manganese also will mitigate potential aesthetic issues of the product water and will ensure compliance with USEPA secondary MCLs.

Chlorine dioxide will be dosed upstream of the forebay, downstream of the flow control valve.

Chlorine dioxide will be generated at the plant, due to its inability to be compressed or stored commercially as a gas because of its explosive properties. It was decided that a three chemical combination, using sodium chlorite, sodium hypochlorite, and hydrochloric acid, would be used to generate the chlorine dioxide to avoid the need for chlorine gas storage and use at the plant.

Chemicals will be stored in a fully enclosed chemical building located on site.

FOREBAY AND FEED WATER PUMP STATION

The forebay will control or enhance hydraulic operations and treatment processes and will provide four primary functions:

- storage needed to equalize flow from the Baker Pipeline to the membrane filtration system (MFS),
- protection of the MFS from pressure surges in the Baker Pipeline,

- contact time for the chlorine dioxide pre-treatment system required when Irvine Lake water is supplied to the plant,
- serves as a forebay for the membrane feed water pump station.

The forebay is sized at 785,000 gallons and will be a cast-in-place, partially buried structure, with a roof system that will accommodate a fully enclosed Feed Water Pump Station.

The Feed Water Pump Station will transfer water from the forebay through the membrane system. Flow to the membranes will continually vary based upon a number of factors, including cycle times for backwash, chemically enhanced backwash, clean-in-place operations, and membrane integrity testing. Water levels in the forebay will vary due to the variation in flow between the Baker Pipeline supply and the variable feed water rates. Anticipated maximum feed pressures to the membrane system are in the range of 25 psi to 40 psi. The feed water pump station will be equipped with VFD-driven vertical turbine pumps and will be housed in a fully enclosed structure located on top of the forebay roof.

STRAINER / FLASH MIX SYSTEM

Wedge wire type feed water strainers (250 μm) will be used to remove debris and large particles from the flow stream that can damage and/or plug membrane hollow fibers and pores.

Coagulant will be fed upstream of the MFS to reduce the rate of membrane fouling and reduce the formation of disinfection by products. Coagulant must be thoroughly mixed for effective coagulation. A pump diffusion flash mix system will be used for this purpose. The final decision on coagulant is pending jar testing of Irvine Lake water to determine effectiveness to reduce TTHM formation potential. Jar testing will be performed by Carollo at the start of final design. The two coagulants under consideration are Polyaluminum chlorides (PACl)/aluminum chlorohydrates (ACH) and ferric chloride.

PRESSURIZED MEMBRANE FILTRATION (PMF)

Pressurized Membrane Filtration (PMF) is the core filtration process selected for the Baker WTP. PMF will be used at the Baker WTP to meet California Department of Public Health (CDPH) treatment requirements for turbidity removal and to partially satisfy the disinfection requirement.

The membrane filtration system will be designed to net 28 mgd. Additional water will be produced by the system for cleaning sequences (chemical cleaning and backwash). Feed water recovery has been specified to be a minimum of 92%.

The membrane system will be PVdF (Polyvinylidene fluoride) hollow fiber based systems, filtering water from outside to inside. Individual modules with capacities of 15 to 20 gpm are assembled on individual racks with common piping with capacities of 2 mgd to 3 mgd, depending upon the system manufacturer. A total of not more than 14 racks is anticipated, which includes one fully redundant rack.

The PMF equipment will be housed within a fully enclosed treatment building. The treatment building will contain the membrane filtration system (racks, cleaning, backwash and air subsystems, and controls), UV system, electrical equipment, control room, laboratory (wet room), and HVAC equipment.

From September to December 2007 (Phase I), and then from February to April 2008 (Phase II), pressure membrane system pilot tests were performed on Irvine Lake water and SPW. Two manufacturers were selected for the pilot testing: Pall and Siemens. Each of these manufacturers has been requested to prepare a bid for supplying the Baker WTP membrane system [Pall Microza – Module designation USV 6203 (MF); Siemens CP-Module designation L2OV (UF)]. The bids will be competitive, evaluated bids, with the basis of selection being a present worth analysis of chemical, energy, and membrane replacement costs, plus bid price. Bids are expected to be received April 2010.

BACKWASH WASTE WATER SYSTEM

Treatment and recycling of the combined waste washwater (CWW) minimizes plant waste discharges and maximizes plant feed water recovery. The Baker WTP will collect and treat waste water produced within the plant, and recycle this treated waste water to the head of the plant. The total or CWW for the Baker WTP comes from two sources: the membrane feed water strainers waste washwater (SWW) and the membrane filtration system waste washwater (MFWW), excluding chemical cleaning solutions. The estimated flowrate for the CWW depends upon the membrane system selected and performance, but is estimated to range between 0.5 and 3.0 mgd.

Seven alternative backwash waste water systems were investigated and from this screening process two alternatives, second stage membranes and plate settlers, were advanced for further evaluation. The final screening analysis resulted in conventional treatment utilizing plate settlers being recommended due to their adequate performance for the intended application, lower capital cost, and lower annual operating costs.

Discharges to the sanitary sewer will be greatly reduced due to the backwash waste water system. Residual discharges to the sanitary sewer are estimated to be about 130,000 to 200,000 gpd (primarily dependent upon the type of membrane system selected), and the instantaneous maximum flow is anticipated at 0.5 cfs (or 220 gpm).

With the backwash waste water system, the overall feed water recovery for the plant is estimated to be 99.5%, based on an average raw water flow rate of 28.1 mgd.

UV DISINFECTION

UV disinfection will be provided at the Baker WTP following membrane treatment to meet regulatory disinfection requirements. CDPH establishes total treatment requirements with respect to *Giardia*, virus, and *Cryptosporidium* reduction, based upon federal requirements in the Interim Enhanced Surface Water Treatment Rule (IESWTR) and the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

With membrane filtration credits provided by the CDPH considered, the disinfection process requirements for the Baker WTP are 0.5-log *Giardia* inactivation and 4-log virus removal (see Table 2.3).

The primary goal of the UV disinfection is to achieve the 0.5-log *Giardia* inactivation. The virus removal requirement will be achieved by chemical disinfection.

The UV system can also be used for destruction of trace organic compounds through the use of higher UV doses alone and/or in combination with hydrogen peroxide as an advanced oxidation process (AOP). Use of UV for destruction of trace organics (including taste and odor causing compounds) assumes that granular activated carbon (GAC) contactors are installed downstream for removal of hydrogen peroxide and byproducts generated by this process. Treatment for taste and odor causing compounds at the Baker WTP is limited to space planning for a future GAC system, and expandability of the UV system for AOP.

The UV system design also considered CDPH notification level for N-nitrosodimethylamine, more commonly referred to as NDMA, to account for future expandability needed in the UV system to achieve high UV doses for photolysis of NDMA.

A low pressure high output (LPHO) UV system was selected for the Baker WTP, after evaluation with medium pressure systems. The evaluation primarily centered around capital cost, life cycle cost, space requirements, and operations and maintenance requirements.

CONTACT (CT) BASIN

Following UV disinfection, the treated water will flow into a partially-buried concrete contact (CT) basin to provide disinfection contact time per CDPH regulations. The basin will be sized to provide adequate contact time for free chlorine to meet the 4-log virus inactivation requirement. This criteria assumes that the membrane filtration system is provided zero credit for virus inactivation.

Alternate sodium hypochlorite injection points will be provided in the basin to allow for manual adjustment of dosing points, in order to minimize TTHM formation during periods of low plant flow or when contact time in the CT basin is increased.

Post-treatment chemicals to be injected at the CT basin include: sodium hypochlorite for disinfection, aqua ammonia for chloramine formation, and caustic soda for pH control. Metering pumps for post-treatment chemicals will be paced on a flow meter located immediately upstream of the CT basin and adjusted based on a chlorine residual analyzer.

From the contact basin, the treated water flows to IRWD's existing 16 MG clearwell.

PRODUCT WATER DELIVERY SYSTEM

The product water delivery system includes an existing 16 MG clearwell, a new product water pump station, and the existing Allen McColloch Pipeline (AMP). All product water from the plant will initially be stored in existing Zone 1 (LAWD) reservoir, which will be converted to the Baker WTP clearwell. For design purposes, the HGL variation in the reservoir was set to fluctuate between 600 and 621 feet amsl.

A Product Water Pump Station (PWPS) will be constructed at a capacity of 33 cfs, which is based upon the total plant production of 43.5 cfs, minus IRWD's capacity allocation of 10.5 cfs. IRWD's capacity allocation will be delivered directly to their Zone 1 (LAWD) system through an existing 24-inch diameter pipeline.

The discharge hydraulic conditions of the PWPS are based upon the hydraulic grade line of the AMP. The AMP HGL varies greatly between summer (high demand) and winter (low demand) conditions. The absolute minimum and maximum HGL in the AMP are understood to be a low of 630 ft and a high of 806 ft per MWD's drawing B-416427 (AMP Hydraulic Plan and Profile). MWDOC has analyzed the AMP pipeline under peak day (maximum day demands) up to the year 2035. Based on this analysis, the lowest (non-surge) stable HGL was determined for 2035 to be approximately 703 ft at OC-88 (South County Pump Station), and 701 ft at OC-74 (IRWD connection point on the Baker site), which are within the range provided by Flow Science.

Hydraulic analysis verified the HGL fluctuation in the AMP require variable speed drives to maintain discharge flow under variable conditions. Speed reduction down to 70-percent was considered in selecting the type and number of pumps. It is recommended that for low discharge head conditions (below 690 feet), the flow into the AMP should be managed by pressure reduction with a throttling valve.

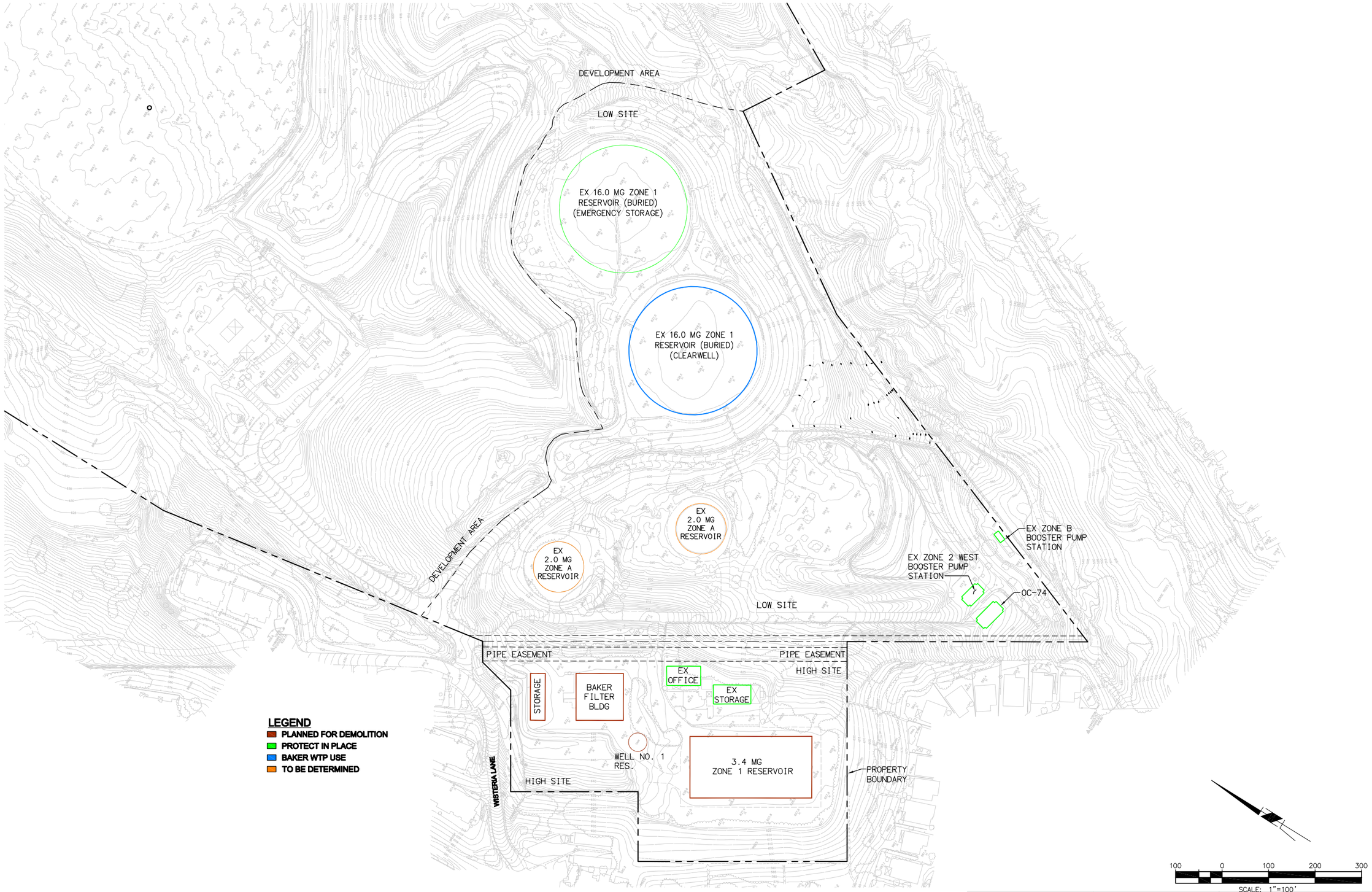
The design of the PWPS includes four (4) vertical turbine type duty pumps + one (1) stand-by pump configuration. The pump station will housed in a building, and will include an air conditioned electrical room with five variable frequency drive controllers. Equipment exterior to the building will include a surge tank, SCE transformer, switchboard, and power generator.

BAKER SITE

The Baker WTP will be located at the former Los Alisos Water District (LAWD) Baker Water Treatment Plant (WTP) site. Currently, there is existing operation of on-site facilities to provide supplemental water from the Baker Pipeline to the Zone A (LAWD) recycled water system, to supply demands to a nearby equestrian center and, at times provide make up water from local man made lakes. The original Baker Filter building will be demolished as part of this project, along with several other facilities, namely: storage building, 3.4 million gallon cast-in-place reservoir, Well No. 1 onsite storage and piping system. Prior to demolition IRWD will need to make provisions for an alternative supply of water to serve these demands.

The new Baker WTP will primarily be constructed at the “high” elevation area of the site. Several buildings will be protected-in-place in this area, namely the administration office and adjacent storage building. Exhibit ES-4 shows existing onsite facilities that will require demolition and those required to be protected-in-place.

The layout of the new Baker WTP is shown on Exhibit ES-5. The decision to construct the Baker WTP at the high elevation area was a result of cooperation between IRWD’s development group, which is planning to improve the Baker site’s low elevation area to include a future park and natural treatment system (NTS) basin, and IRWD’s engineering staff and consultant. There are several facilities that will be constructed at the low elevation site area. These facilities include a pipeline required to deliver water from the Baker WTP to the 16 MG clearwell, electrical service conduit, Trabuco Canyon Water District (TCWD) pump station, flow control facility, product water pump station and associated piping. These facilities have been sited to minimize potential for interference with proposed development plans.



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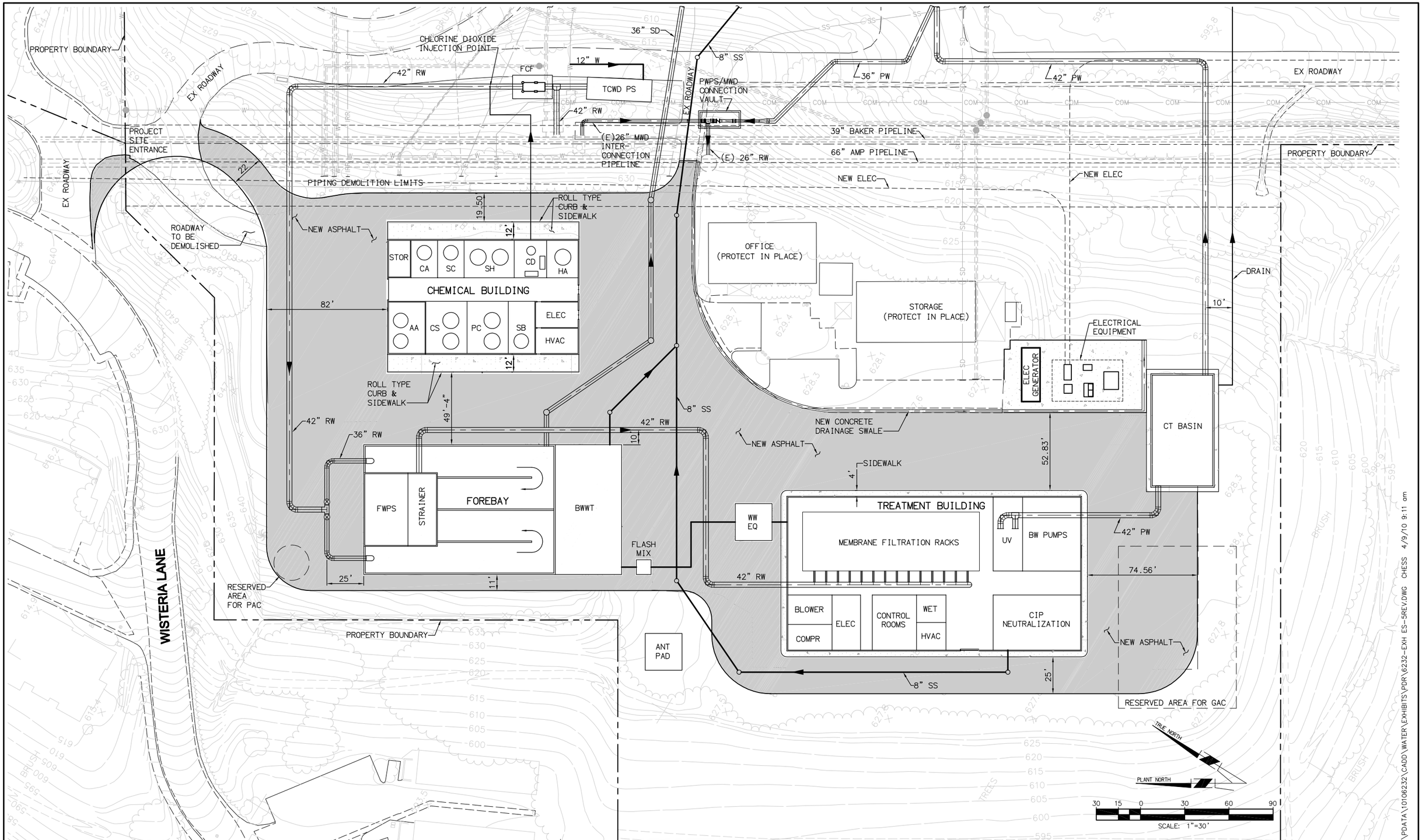
IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

BAKER SITE
EXISTING FACILITIES

EXHIBIT

ES-4



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IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

PROPOSED SITE LAYOUT

EXHIBIT

ES-5

ECONOMIC EVALUATION

For the Baker WTP Project, an economic evaluation was conducted. All costs are presented in April 2010 dollars (ENR Index = 8676). The capital costs approximate Class 3 budget estimates as defined by the Association for the Advancement of Cost Engineering (AACE). Estimates provided herein have an associated accuracy of -10 percent to +30 percent. Class 3 level estimates are intended for budget, authorization, or control.

CAPITAL COST

An updated estimate of construction cost has been prepared for the Baker WTP Project. Construction costs were converted to capital cost by including contingencies and non-construction project related costs to the estimate. A summary of these estimates are provided in Table ES-1. Cost estimates are included in Section 23 and Appendix Q of this report.

OPERATION AND MAINTENANCE COST

Operation and maintenance (O&M) costs have been developed from several data sources and engineering calculations. Table ES-2 contains a summary of the estimated annual O&M cost. A breakdown of the O&M costs is given in Section 23.

ANNUALIZED COST ESTIMATES

Annualized capital cost (with repayment over 30 years @ 4.5 percent) and annual O&M costs, were converted to $/acre-foot of water unit cost based on anticipated water volume production. The plant is assumed to have a 90 percent utilization throughout the year. Future projections, in $/acre-foot of water, to the year 2028 were developed based on inflation assumptions and anticipated escalation of fees as described in Section 23.

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Table ES-1 - Baker WTP Project - Summary of Estimated Capital Costs [1]

Baker Water Treatment Plant	Cost
Equipment and Buildings	
WTP Equipment, Sitework and Buildings	$31,869,000
Mobilization / Insurance / Management [2]	$2,550,000
Subtotal (Equipment and Buildings)	***$34,419,000***
Integration Facilities	
OC-33 Expansion	$240,000
Raw Water Pump Station	$2,908,000
Flow Control Facility, Forebay Reservoir, TCWD PS and Feed Water PS	$4,300,000
Product Water Pump Station	$3,504,000
Backup Power	$1,250,000
Mobilization / Insurance / Management [2]	$976,000
Subtotal (Integration Facilities)	***$13,178,000***
SUBTOTAL (Equip. and Bldgs + Int. Facs.)	***$47,597,000***
District Costs [3]	**$2,200,000**
Baker Site Land Use Cost [4]	**$440,000**
Environmental [5], Engineering[6]	**$4,607,000**
Contingency / Legal [7]	**$6,611,000**
TOTAL ESTIMATED CAPITAL COST	**$61,455,000**

[1] Capital cost are Class 3 Estimates as defined by AACEI with estimated -10% to +30% range of accuracy

[2] Mobilization / Insurance / Management Cost calculated at 8-percent of capital cost

[3] Cost provided by IRWD - includes project management, field support, construction administrative services, inspection and G&A.

[4] Cost for land use at Baker Site per Baker WTP Agreement Section 3.1. Area = 4 acres. Unit Cost = $110,000 /acre

[5] Environmental Documentation cost is based on EIR preparation cost provided to IRWD of $170,000.

[6] Based on approved design fee for Baker WTP plus authorized flow test budget, and design fee for forebay and feed water pump station.

[7] Contingency / Legal is based on 15-percent of Subtotal (Equipment and Buildings + Integration Facilities excluding cost for Moblization, Insurance and Management).

Table ES-2 Estimated Annual O & M Cost Summary

Baker Water Treatment Plant [1]	Value
1 Chemical Mixing	$3,800
2 MF System	$716,300
3 UV System	$21,200
4 Process Chemicals	$1,212,100
5 Energy Costs from Pumping	$1,516,300
6 Washwater Pumping	$15,900
7 Labor [2]	$379,600
8 Other System O&M Costs [3]	$75,000
Cost per Year ($) [4]	**$3,940,000**

[1] Energy, Chemical, and Consumables (Replacement) costs are escalated at an annual rate of 5-percent.
[2] Labor costs are based on weekly operator staffing of T5 (40 hrs) and T4 (30 hrs), with escalation of 3-percent annually.
[3] Other O&M costs are escalated at a annual rate of 3-percent.
[4] Based on 90% treatment plant utilization (evaluated at 330 days per year). Rounded to nearest $1,000.

ECONOMIC EVALUATION RESULTS

The estimated capital cost of the project (in April 2010 dollars), including construction, engineering, environmental, construction management and administration, is $61,455,000.

The estimated annual operation and maintenance costs (in 2010 dollars), including energy, chemical and replacement costs, labor, and other ongoing costs is $3,940,200.

The cost of Baker WTP water is estimated as $766 per acre-foot, assuming capital cost amortized over 30 years at 4.5-percent interest, and excluding the cost of wheeling water still be finalized with MWD. Based upon rate projections provided by MWD, it is anticipated that treated water from the Baker WTP will cost the same as imported water by the year 2017, approximately 5 years after project startup, and at lower cost thereafter.

SCHEDULE

Table ES-3 summarizes the proposed project schedule.

Table ES-3 Baker WTP Schedule Summary

Construction Contract/ Milestone	Start Date	Finish Date
Raw Water Pump Station / OC-33 Modf.		
Design	April 2010	March 2011
Bidding & Award	March 2011	May 2011
Construction	June 2011	June 2012
Baker Water Treatment Plant		
Design	April 2010	March 2011
Bidding & Award	March 2011	May 2011
Construction	June 2011	November 2012

SECTION 1 INTRODUCTION

1.1 PROJECT OBJECTIVES

The Baker Water Treatment Plant (Baker WTP or Project) is a regional project, intended to:

- Increase potable water supply to south Orange County,
- Improve water reliability to areas of south Orange County by providing a local treatment plant, capable of treating water from MWD as well as local Irvine Lake water.
- Deliver a local potable water supply that can be relied upon in the event of emergency conditions or scheduled maintenance of the Metropolitan Water District's delivery system
- Produce potable water at a competitive cost to MWDOC treated water rates.

1.2 PROJECT BACKGROUND

The Baker WTP project will augment potable water supplies to parts of south Orange County, California by locally treating and delivering Colorado River Water, State Project Water, and Irvine Lake Water. South Orange County currently receives the majority of its potable water from Municipal Water District of Orange County (MWDOC) via Metropolitan Water District's (MWD's) Diemer Filtration Plant and Allen McCulloch pipeline, and is lacking large-scale alternative local supplies. This Project will provide a reliable local supply to south Orange County and is a result of years of coordination by south Orange County water agencies.

Several years ago, the Santiago Aqueduct Commission (SAC) undertook a study to determine the feasibility of constructing a surface water treatment plant that could take advantage of already existing infrastructure, to develop a cost-effective local source of supply. This study concluded that such a project was feasible from both an engineering and cost perspective. Part of this cost effectiveness is due to the use of existing infrastructure, primarily the SAC-owned Baker pipeline and Irvine Lake pipeline, which could convey raw water to the plant and MWD owned Allen McCulloch pipeline (AMP), which could be used to deliver potable water to local water agencies. The study also concluded that the treatment plant location was best suited at the former Los Alisos Water District (LAWD) Baker WTP site, located in the City of Lake Forest, near the terminus of the Baker pipeline and adjacent to the AMP.

Following completion of the SAC study, participating water agencies, identified in this report as Project Stakeholders, solicited proposals from Consultants, and selected the RBF/Carollo team to execute preliminary and final design tasks necessary to solicit competitive bids for construction, and to provide engineering support through construction and commissioning.

1.3 PROJECT STAKEHOLDERS

The Baker WTP Project is being implemented by Project Stakeholders. The Stakeholders include five (5) south Orange County water retail agencies, and the area's MWD member. These agencies are:

- El Toro Water District (ETWD)
- Irvine Ranch Water District (IRWD)
- Moulton Niguel Water District (MNWD)
- Santa Margarita Water District (SMWD)
- Trabuco Canyon Water District (TCWD)
- Municipal Water District of Orange County (MWDOC) - MWD member

The retail agencies are jointly financing the project. Each agency's financial participation will be proportionate to their capacity rights' shares in the project. MWDOC's participation in the Project is to facilitate coordination between the retail agencies and MWD and assisting in the water billing function. IRWD is the lead agency for the Baker WTP project, responsible for managing design, overseeing construction, and will also be responsible for operating and maintaining the plant.

All five water retail agencies are expected to receive water from the Baker WTP, and are expected to hold capacity rights to the plant.

1.4 BAKER WTP CAPACITY ALLOCATIONS / EXISTING FACILITIES CAPACITY RIGHTS

Capacity allocations in the Baker WTP are defined in the *Agreement for Construction, Operation and Maintenance of Baker Water Treatment Plant,* which was revised in December 2009 to reflect the Baker WTP capacity as 43.5 cfs. The capacity allocation among the Stakeholders in the Baker WTP is anticipated to be according to Table 1.1.

Each of the Stakeholders has unique water rights in the Baker Pipeline (managed by the Santiago Aqueduct Commission) and Allen McColloch Pipeline

(managed by Metropolitan Water District of Orange County). See Table 1.1 for a summary of capacity in both pipelines and the Baker WTP.

Table 1.1 – Stakeholder Summary

Agency	Baker WTP Capacity (cfs)	Existing Water Rights in Baker Pipeline	Existing Water Rights in AMP (through MWDOC)
Irvine Ranch Water District (IRWD)	10.5	Y	Y
El Toro Water District (ETWD)	5	N	Y
Moulton Niguel Water District (MNWD)	13	N	Y
Santa Margarita Water District (SMWD)	13	Y	Y
Trabuco Canyon Water District (TCWD)	2	Y	N
Total	**43.5**	-	-

Exhibit 1.1 depicts a portion of the Santiago lateral, the Baker Pipeline, the Irvine Lake Pipeline, and the Baker site.

1.5 PROJECT CONCEPT DEVELOPMENT

The development of the Baker WTP project concept as described in this PDR has evolved through a number of steps, including:

1.5.1 Feasibility Study

In August 2006, the Santiago Aqueduct Commission commissioned a feasibility study to investigate the concept of a treatment plant serving supplemental treated water to agencies of Southern Orange County. With water supply reliability as a focal point of the study, water supply to the Baker Pipeline was considered from Metropolitan Water District (MWD) and Irvine Lake. MWD receives supplies of Colorado River Water (CRW) and State Project Water (SPW). Thus, three primary water source types exist for the Project.

The feasibility study was completed January 2007, and amended in June 2007 to include further financial analysis. Analysis covered operational capacities of 33 and 40 cfs. Potential treatment processes were analyzed based on cost, treatment plant layout, and the capability of each process to effectively treat each water source type. The study concluded with the recommendations for the Baker WTP to be:

1) located at the Baker Site in Lake Forest, and
2) a pressure membrane filtration plant with disinfection by UV / chlorination.

1.5.2 Pilot Testing

Following the feasibility study, pilot testing with two pressure membrane filtration systems (Pall and Memcor CP/Siemens) was performed on Irvine Lake and State Project water. The final bench test report was completed in June 2007. The pilot test report was completed in August 2008. The pilot report verified adequate treatment by both manufacturer system, and established maximum flux rates for each of:

- Pall = 50 gfd
- Memcor = 45 gfd

1.5.3 Technical Memorandum

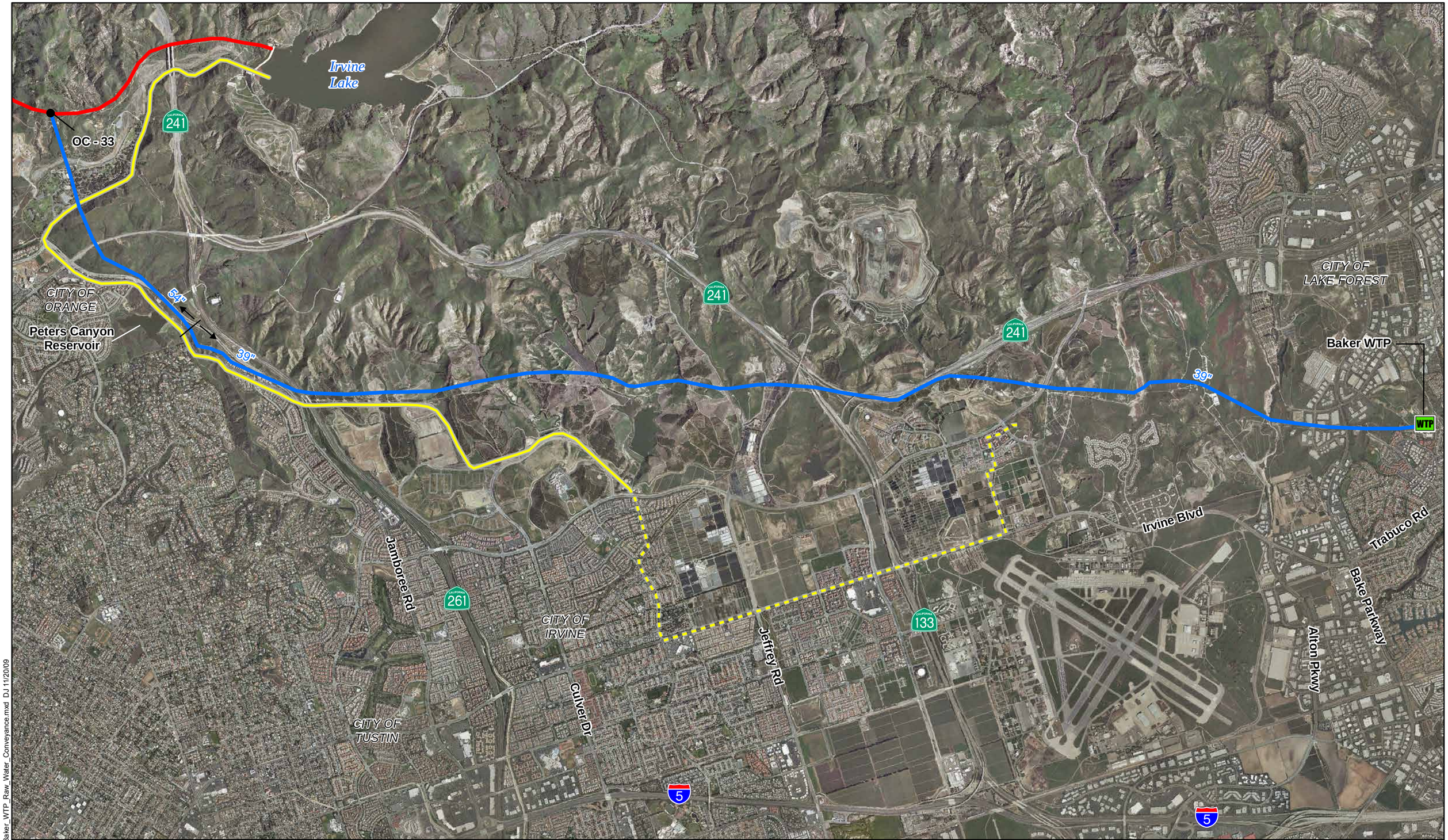
Following the award for design of Baker WTP, the RBF/Carollo engineering team completed a technical memorandum entitled *The Baker Regional Water Treatment Plant – Design Concept and Cost Update* in November 2008. The memorandum updated the preliminary design concept for Baker WTP at capacities of 40 and 60 cubic feet per second (cfs) in advance of a Baker Pipeline flow test, and estimated capital, operations and maintenance and product water costs, and compared these costs to the June 2007 financial analysis. Conclusions were that costs were generally comparable, assuming the same design configuration is implemented.

1.5.4 Baker Pipeline Flow Test

On April 21, 2009 a flow test of the Baker Pipeline was completed. The purpose of the flow test was to determine the current pipeline capacity based on the minimum hydraulic grade necessary to operate pressure membranes without pumping. Following the flow test, RBF Consulting prepared a preliminary design memorandum that summarized the results, and estimated the maximum capacity of the Baker Pipeline to be 40 cfs (based on a minimum required HGL of 720 ft at the Baker WTP site for pressurize membrane filtration at the high site elevation

1.5.5 Preliminary Design Memoranda

In May 2009, RBF/Carollo began submitting preliminary design memoranda (PDMs) to IRWD for the major project components. The purpose of the PDMs was to summarize the Project in greater detail, identify design-related issues associated with each major project component, identify alternatives, present evaluation of alternatives, make



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Baker Pipeline
Santiago Lateral
ILP (Future Recycled Water)
Irvine Lake Pipeline (ILP)

Baker Water Treatment Plant
Project Overview
Exhibit 1.1

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recommendations, identify design criteria, and receive client feedback on major issues and decisions, as required. Each PDM was delivered to IRWD and distributed to the Project Stakeholders. Collectively, fifteen PDMs were prepared, as listed.

1. Baker Pipeline Hydraulics
2. Iron and Manganese Management
3. Product Water Pump Station
4. Membrane Filtration
5. Raw Water Conveyance Facilities / Raw Water Pump Station
6. Baker Plant Site – Facility Layouts / Plant Hydraulics
7. Pre-Treatment
8. Backwash Wastewater Treatment and Recovery
9. Chemical Storage
10. Disinfection
11. Electrical – Site Infrastructures
12. Instrumentation and Controls
13. Pump Station – Surge Analysis
14. Cost Estimate
15. Back-up Power Generation

Internal meetings were held with IRWD to review client comments. All review comments received from the PDMs are incorporated in this Preliminary Design Report.

1.5.6 Historical Overview

The Baker WTP project entails construction of a new membrane filtration plant at the Baker site. The Baker site was owned by the Los Alisos Water District, and utilized as the agency's headquarters and location of the Baker Filter Plant. The Baker Filter Plant was constructed in 1970 and had a rated capacity of 15 cfs. As water quality regulations became more stringent it was not cost effective to upgrade the Baker Filter Plant, so the plant was decommissioned.

When residential development increased in Southern Orange County in the mid-1970s, the need for a larger transmission pipeline became evident. In 1977, the design of the Diemer Intertie or Allen McColloch Pipeline (AMP) began. The AMP was constructed to deliver treated

imported water to southern Orange County from the Diemer Plant located in the City of Yorba Linda. Demand increased in the AMP, leading to the need for a parallel pipeline. During construction of the AMP Parallel a reach of the 54-inch section of the Baker Pipeline was utilized. To replace the reach for the Baker Pipeline a new reach of 39-inch pipeline was constructed.

As residential development increased, reliance on raw water through the Baker Pipeline diminished. Eventually, Baker Pipeline operation was reduced to delivery of water for remaining agriculture use (approximately 4 cfs) and Trabuco Canyon Water District's Dimension Plant (maximum flow rate of 6 cfs).

In December 1999, the Allen McColloch Pipeline ruptured causing significant reduction in MWD supplies to southern Orange County, and demonstrating the dependence of this region on AMP operation. The observed dependence on the AMP, led the Santiago Aqueduct Commission to consider a new water treatment plant utilizing the Baker Pipeline for raw water transmission, and to begin seeking Project participants (Stakeholders).

1.6 SUMMARY OF PROJECT

The Baker WTP project consists of existing and proposed facilities for raw water conveyance, water treatment and product water delivery. A schematic diagram summarizing the Baker WTP project and ownership of facilities is provided as Exhibit 1.2.

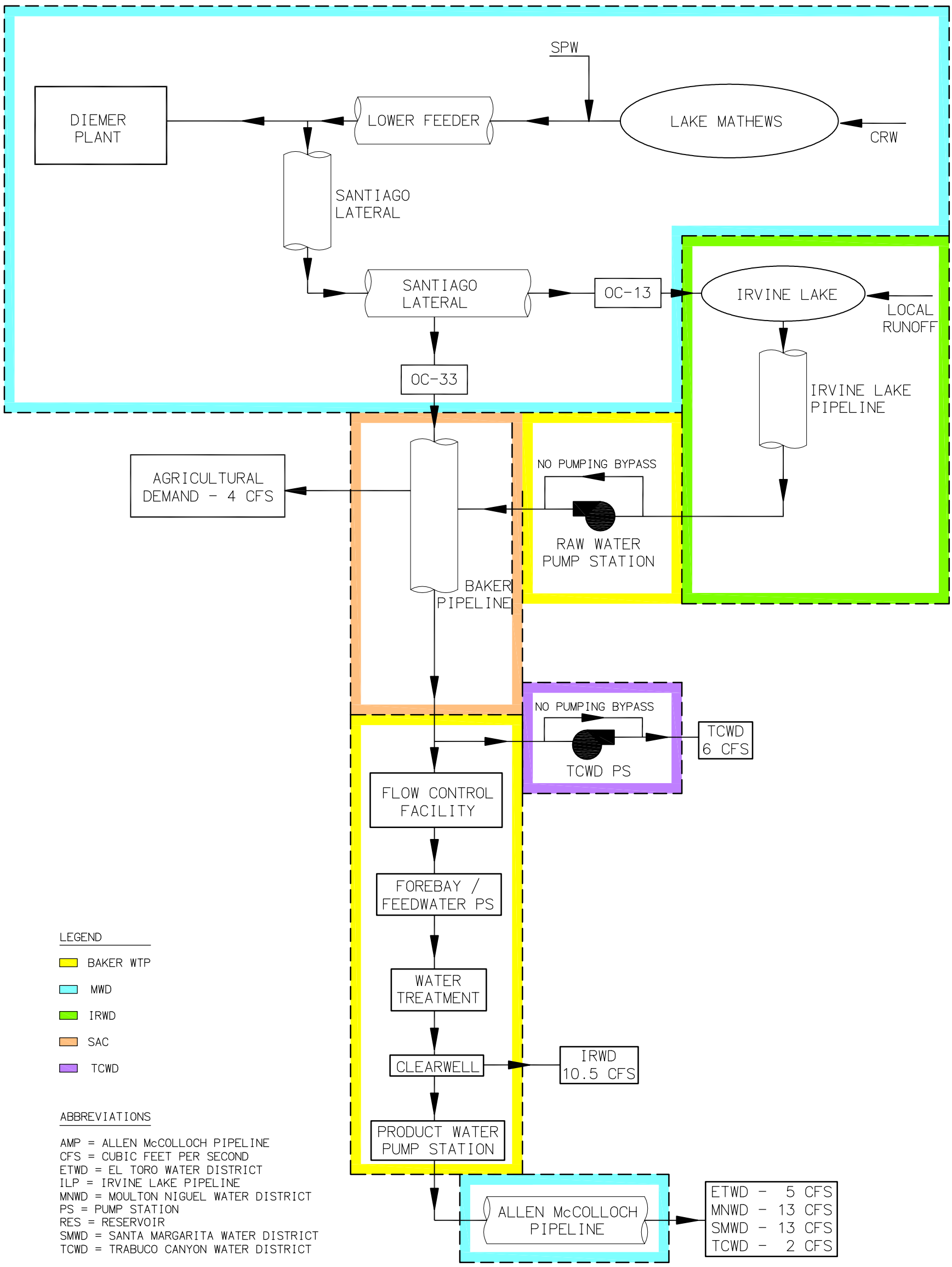
The following descriptions provide a brief summary of the overall project. Further details regarding each aspect of the overall Project are provided in the later sections of the Preliminary Design Report.

1.6.1 Raw Water

The sources, facilities and operation to ensure raw water supply include:

1.6.1.1 Sources

Raw water conveyed to the Baker WTP will be imported water from the Metropolitan Water District (MWD) system, or Irvine Lake water. The MWD system will supply Colorado River Water, State Project Water or a combination of both. Irvine Lake water will be used under two conditions:



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carollo

IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT
PROJECT SUMMARY SCHEMATIC

EXHIBIT 1.2

1) outage of Santiago Lateral or Diemer Filtration Plant (emergency conditions or scheduled maintenance)

2) as determined annually - based on rainfall conditions and Irvine Lake water level, not exceeding a three month period.

Small additional flow may be delivered to the Baker WTP from IRWD's Well No. 1, which is approximately 1 mile west of the Baker WTP.

1.6.1.2 Conveyance System

Primary operation of Baker Pipeline will consist of raw water supplied by gravity from the Santiago Lateral to the Baker WTP. Secondary operation will convey Irvine Lake water to the Baker WTP by pumping (Raw Water Pump Station) from the Irvine Lake Pipeline to the Baker Pipeline. Primary and secondary operation will supply up to 43.5 cfs (28 mgd) for treatment.

A forebay will be constructed at Baker WTP to manage variable treatment process flow rates and isolate the Baker WTP from the hydraulics of the Baker Pipeline. Flow and head conditions into the forebay will be controlled by a flow control facility, consisting of a motor operated sleeve valve. A pump station (Feedwater Pump Station) will be constructed to boost water from the forebay to pressure membrane filters. The pump station will boost raw water from the forebay to the hydraulic grade required for filtration through the membrane media.

1.6.2 Operation

Raw water delivery will be scheduled with Metropolitan Water District. All flows scheduled but not delivered through the OC-33 turnout will result in discharge to Irvine Lake. However, flow rejection should only occur during plant shutdown or transfer from Santiago Lateral to Irvine Lake supply.

Raw Water Conveyance System operation will require communication and analysis of flow rates at OC-33, Baker Raw Water Pump Station, the Flow Control Facility and

Feedwater Pump Station; hydraulic grades at the Baker Raw Water Pump Station and Feedwater Pump Station; and water surface level at Irvine Lake and the forebay for proper operation.

1.6.3 Treatment Process

Baker WTP will utilize pressure membrane filtration for treatment, and include pre-treatment and backwash waste water treatment / recovery for optimum plant production.

1.6.3.1 Pre-Treatment

Raw water pre-treatment will include the use of strainers and dosing of coagulant, upstream of the membrane filters. In addition, Irvine Lake water will introduce higher levels of iron and manganese in the raw water supply. As a result, chlorine dioxide will be dosed into Irvine Lake water upstream of forebay ensuring oxidation for removal by filtration.

1.6.3.2 Membrane Filtration

Pressure membrane filters will be installed in the treatment building for Baker WTP. The treatment process will be designed for a maximum raw water delivery of 43.5 cfs (28 mgd), and backwash waste water recovery.

1.6.3.3 UV Disinfection

UV disinfection will be located downstream of the pressure membrane filters to provide additional disinfecting primarily for Giardia inactivation, with all equipment contained within the treatment building.

1.6.3.4 Chloramination Disinfection

Secondary disinfection will be in the form of chloramination, with a CT Basin constructed adjacent to the treatment building.

1.6.3.5 Backwash Waste Water Treatment / Recovery

Backwash waste water will be collected from the feedwater strainer system and membrane filtration system for treatment and recovery. The recommended backwash treatment system is sedimentation with plate settlers constructed at an elevation

enabling water recovered from the sedimentation basin to flow to the raw water forebay by gravity.

1.6.4 Product Water Delivery

Treated or 'product' water from Baker WTP will flow by gravity from the CT basin to an existing on-site reservoir to serve as the clearwell. From the clearwell product water will be distributed by gravity or pumping. The clearwell and product water distribution system are describe further:

1.6.4.1 Clearwell

An existing 16 MG reservoir formerly operated by Los Alisos Water District as Zone 1 emergency storage will be modified for use as the Baker WTP clearwell.

1.6.4.2 Gravity Delivery

IRWD will be the only agency receiving product water by gravity. IRWD's capacity of up to 10.5 cfs (approximately 4,700 gpm) will be conveyed through the existing 24-inch outlet pipeline from the clearwell to the IRWD's Los Alisos Zone 1 system.

1.6.4.3 Product Water Pump Station

To deliver product water to all other Project stakeholders, a new pump station will be constructed to boost water from the clearwell to the Allen McColloch Pipeline. The pump station will have a design capacity of 33 cfs (approximately 14,800 gpm). The proposed capacity by agency is as follows:

- El Toro Water District – 5 cfs
- Moulton Niguel Water District – 13 cfs
- Santa Margarita Water District – 13 cfs
- Trabuco Canyon Water District – 2 cfs

1.6.4.4 Allen McColloch Pipeline

The Allen McColloch Pipeline (AMP) crosses the Baker site in parallel to the Baker Pipeline and immediately east of the new WTP. The pipeline will convey pumped flow from the clearwell to the Project Stakeholders.

Connection to the AMP will be made at the vault on the Baker site which was constructed during the Baker Pipeline / Allen McColloch Pipeline temporary inter-connection, when the AMP was being repaired.

1.7 PRELIMINARY DESIGN REPORT OBJECTIVES

The objectives of the Baker WTP Preliminary Design Report are:

- Definition of the overall Baker WTP concept
- Presentation of Preliminary Design analysis
- Economic evaluation, including capital and operation / maintenance costs, and product water cost comparison with imported water.

SECTION 2 SOURCE WATER, REGULATIONS AND TREATMENT OBJECTIVES

2.1 OVERVIEW

This section identifies the water sources for the Baker Water Treatment Plant Project, summarizes the quality of those sources, discusses the impact of existing and anticipated regulatory requirements, and details the product water quality goals.

2.2 RAW WATER SOURCES

Raw water sources for the Baker WTP include existing supplies and possible future sources. Existing sources of supply include imported water from Metropolitan Water District (MWD), Irvine Lake, and a possible future supplemental supply from IRWD's Lake Forest Well No. 1. Exhibit 2.1 shows the raw water sources.

2.2.1 Metropolitan Water District (Santiago Lateral)

MWD water will be the primary supply source for the Baker WTP. Imported water from MWD will be delivered through the Santiago Lateral to the Baker Pipeline at MWD's OC-33 turn-out. Imported water supply from MWD for Baker WTP will consist of a blend of Colorado River Water (CRW) and State Project Water (SPW).

The ratio of this blend has varied significantly in recent years, and can be anticipated to vary in the future. The composition of the blend from MWD depends upon the delivery of State Project Water, which can be limited based on drought conditions and environmental constraints. Each year the California Department of Water Resources sets a 'Table A Allotment' which determines the distribution of water through the State Project system. As a result of the recent drought and environmental constraints limiting SWP flow through the Bay Delta, the percentage of SPW was significantly reduced within the Lower Feeder and Santiago Lateral in 2008 and 2009. The reduction altered the percentage of SPW to CRW from, approximately 50% CRW:50% SPW in 2007, to 93% CRW:7% SPW in 2008.

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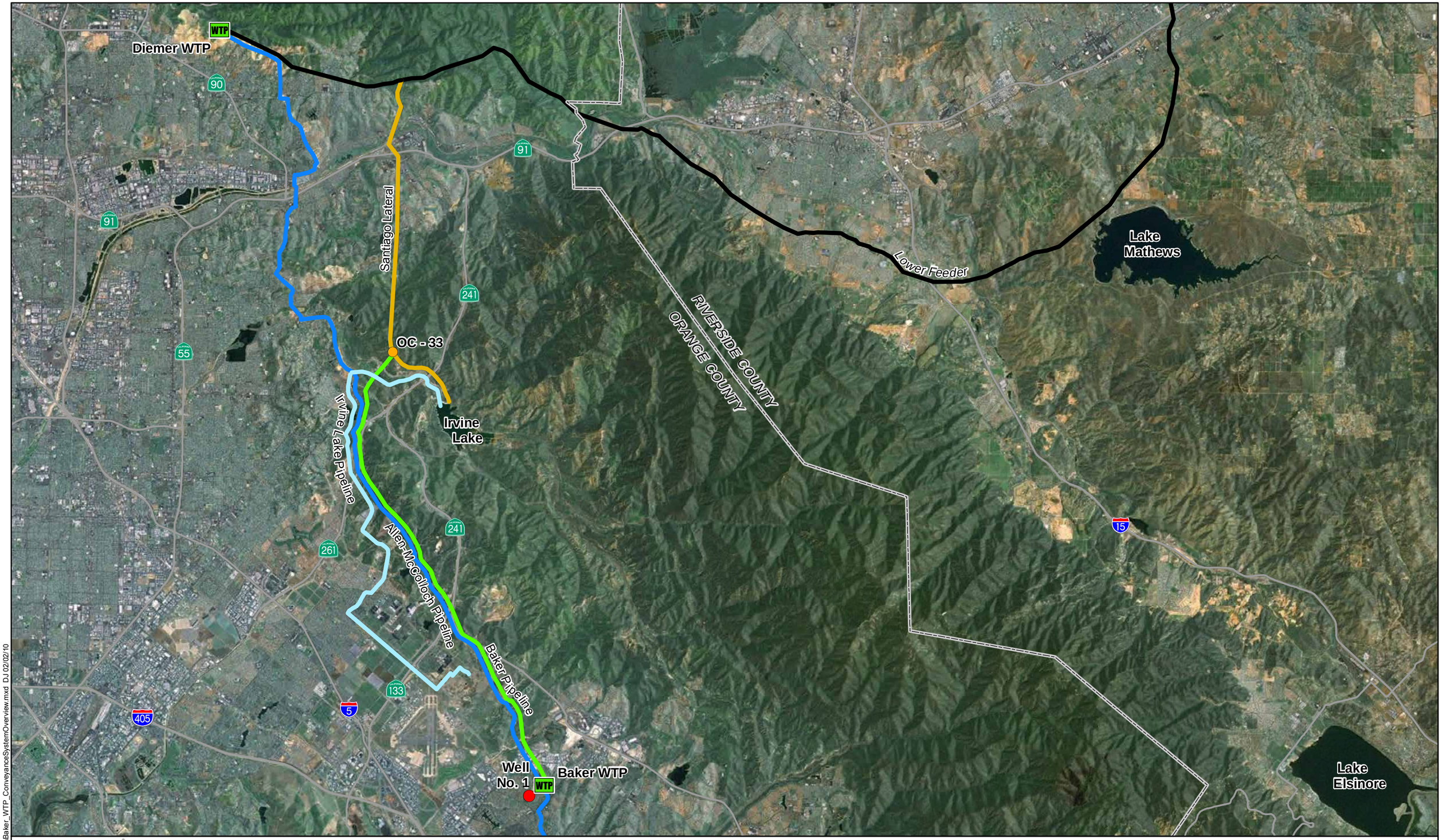

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Well No. 1
Allen-McColloch Pipeline
Baker Pipeline
Irvine Lake Pipeline
Lower Feeder
Santiago Lateral

Baker Water Treatment Plant Project

Raw Water Sources

Exhibit 2.1

In terms of treatment approach, SPW supply is a driver for a number of processes selected for the plant. Organic material in SPW is prone to chlorinated disinfection byproduct formation, specifically trihalomethanes (THM). Raw SPW and low CRW to SPW blends represent a worst case for meeting disinfection goals without exceeding applicable MCLs for THM, therefore for design purposes it is anticipated that imported water supply from MWD will be in the form of:

- 100% SPW, or
- 50% / 50% blend of CRW and SPW

2.2.2 Irvine Lake Water (ILW)

Water to Irvine Lake water is derived from two sources: MWD imported water via the Santiago Lateral, described above, and local run-off water captured from the Irvine Lake watershed.

Irvine Lake stores up to 28,000 AF and currently varies in depth from (EL.) 710 to 790 ft. Like any lake, Irvine Lake is subject to seasonal limnological phenomena. The phenomena include algae blooms which may produce additional fresh biologically derived organic carbon, and may increase coagulant demand while reducing filtration rates.

Algae blooms may also produce compounds that have a noxious taste and odor. These compounds may also be toxic and can be difficult to remove during conventional filtration and disinfection.

2.2.3 Lake Forest Well No. 1

Lake Forest Well No. 1 (owned and operated by IRWD) is a potential supplemental supply source for the Baker WTP. In the past, the well has been operated to supply to the Baker Filter Plant, local irrigation and make-up water for nearby community lakes. The current capacity of the well is estimated to be approximately 200 gpm (Boyle 2002).

A benefit/impact study was prepared by Carollo Engineers. The study recommended that, should water from Well No. 1 be used at the Baker WTP, it be added to the MF waste washwater equalization basin to allow for clarification and recirculation to the head of the plant. This approach also eliminates the need for constructing a well to waste system and utilizes the already planned facilities to handle solids with the sludge removal system. The study is provided as Appendix A.

Subsequent to this study, with the addition of the forebay, the recommendation has been revised to deliver Well No. 1 flows to the forebay. Accommodations will also be provided to deliver the flow to the CT basin, if accepted by California Department of Public Health.

2.3 ANTICIPATED RAW WATER QUALITY

An estimated range of raw water quality was prepared based on an understanding of the current and possible future raw water sources described above. The raw water quality estimate focused on parameters that will be critical to meet the anticipated product water quality.

The key raw water quality parameters for plant design and operation are:

- Total Dissolved Solids (TDS) - TDS levels in CRW can be as high as 700 mg/L, exceeding the secondary (recommended) maximum contaminant level (SMCL) of 500 mg/L. Though MWD had set a goal of 325 mg/L of TDS for delivery, there has not been adequate SPW available in recent years to blend CRW water below the SMCL of 500 mg/L. Product water TDS will be solely dependent on the blend provided by MWD.

- Total Organic Carbon (TOC) - TOC in SPW is known to have a strong tendency to form disinfection by-products (DBPs) when chlorine is used. The TOC level in ILW is comparable to the TOC level in SPW. To minimize DBPs, chloramines will be used as the residual disinfectant in the distribution system. Additional processes recommended to minimize DBP formation are in-line coagulation and UV disinfection.

- Temperature - Membrane system capacity decreases at low water temperatures due to higher water viscosity. The minimum water temperature used for design is 10° Celsius for the membrane system, since excursions below 10°C are uncommon. Historic low temperatures (4°C) will impact CT requirements for virus inactivation and have been taken into account in the CT basin design.

- Alkalinity – Alkalinity, including carbonate alkalinity, measures the highest in Irvine Lake Water.

- Hardness - The blending strategy to be implemented by MWD will dictate finished water hardness, since hardness removal is not a treatment goal for the Baker WTP. While hardness removal is not a treatment goal for the main

plant process, a softened carrier water system will be provided to avoid scaling caustic soda, sodium hypochlorite, and aqua ammonia diffusers.

- Turbidity - Raw water turbidity in CRW, SPW and ILW are low enough to accommodate direct filtration by membrane.
- Bromide - Bromide is primary to the formation of bromate and organohalide disinfection by-products. Chloramination will serve as the control strategy for bromate formation.
- Iron and Manganese - Neither is known to have detrimental health effects. However, they can be associated with unpleasant taste and odor, and staining of laundry and fixtures. Iron and manganese have a secondary MCL of 0.3 mg/L and 0.05 mg/L, respectively. Most significant to Baker WTP is the potential for dissolved forms to adversely impact membrane filtration (See Section 8 – Iron and Manganese Management). Chlorine dioxide will serve as the control strategy for iron and manganese oxidation.

A summary of raw water quality anticipated from the three primary source types is provided in Table 2.1.

Table 2.1 – Water Quality by Source[1]

Parameter	Unit	50% Colorado River Water (CRW) - 50% State Water Project (SPW)		100% State Water Project (SPW)		100% Irvine Lake (ILW)	
		Avg	Max	Avg	Max	Avg	Max
TDS	mg/L	470	565	248	430	575	640
TOC	mg/L	2.8	3.3	2.8	4.7	3.2	4.6
Temperature	°C	8 (min)	25	4 (min)	25	13 (min)	27
Hardness	mg/L as CaCO3	195	270	99	158	330[2]	--
Alkalinity	mg/L as CaCO3	100	115	72	98	160[2]	--
Turbidity	NTU	2.5	21	3.5	41	6	35
Bromide	mg/L	0.10	0.20	0.20	0.48	0.082	0.14
Total Iron	µg/L	ND[3]		ND		189	>300
Total Manganese	µg/L	ND		ND		35	>50

Notes:
1. Assumes the Baker WTP could receive 100% SPW to a blend of 50% SPW – 50% CRW or 100% ILW.
2. Two analyses only.
3. Non Detectable, typ.

2.4 CURRENT AND ANTICIPATED REGULATORY REQUIREMENTS

Baker WTP will provide water in adherence with current and pending rules and regulations regarding surface water treatment and disinfection by-products dictated by state and federal regulations.

2.4.1 California Department of Public Health (CDPH)

Current regulatory requirements for product water at the Baker WTP will be dictated by the CDPH, Division of Drinking Water and Environmental Management. The regulatory requirements are set forth in the California Code of Regulations, Title 22.

The CDPH drinking water standards are equivalent to or more stringent than national primary drinking water standards as established by the Environmental Protection Agency (EPA). Baker WTP will meet these standards as listed in Title 22 of the California Code of Regulations, and adhere to standards and best practices related to:

- Product water primary maximum contaminant levels (MCL)
- Product water secondary maximum contaminant level (SMCL)
- Public health goals (PHG)
- Water quality reporting
- Use of best available treatment technology

Title 22, Chapter 17 contains nine Articles pertaining directly to surface water treatment. Table 2.2 summarizes the pertinent Articles.

Table 2.2 – Title 22 Surface Water Treatment Articles

Article	Synopsis
1-General Requirements and Defintions	Establishes treatment techniques in lieu of maximum contaminant levels for turbidity and certain microbial contaminants. Provides definition of terms.
2-Treatment Requirements, Watershed Protection Requirements and Performance Standards	Provides multibarrier treatment requirements. Provides requirements for avoiding filtration. Provides requirements when filtration is necessary. Provides requirements for recycled flow. Provides disinfection requirements.
3-Monitoring Requirements	Provides monitoring requirements.
3.5-Enhanced Filtration and Disinfection	Provides enhanced requirements for systems serving at least 10,000 people.
4-Design Standards	Provides minimum design standards for surface water treatment processes.
5-Operation	Provides operator requirements.
6-Reporting	Provides reporting requirements to the SWRCB.
7-Watershed Sanitary Surveys	Provides requirements for sanitary surveys of the watershed, which must be completed every five years.
8-Public Notification	Provides requirements for notification of customers.

2.4.2 Long Term 2 Surface Water Treatment Rule

Baker WTP will treat surface water originating from MWD's lower feeder, a blend of CRW and SPW, or Irvine Lake. As a result, the Project will be subject to the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), a federal water treatment regulation established to define requirements for, and assess Crytosporidium removal.

In the case that source water is susceptible to Crytosporidium contamination, membrane filtration must meet three criteria for construction and operation.

1. The process must comply with the definition of membrane filtration as stipulated by the LT2ESWTR, and thus be a separation process with a maximum particulate size, physical barrier and demonstrated efficiency to the Environmental Protection Agency (EPA).

2. The removal efficiency of the membrane filtration process must be established through a product-specific challenge test and direct integrity testing. *Note: In California, third party challenge testing*

results need not be conducted at every site. Previous third party testing for the membrane filters under consideration for the Baker WTP will be used to meet this requirement.

3. The membrane filtration system must undergo periodic direct integrity testing and continuous indirect integrity monitoring during operation.

The total disinfection requirements for Giardia, virus, and Cryptosporidium are presented in Table 2.3. Dedicated disinfection processes must meet the balance of the disinfection requirements not met by membrane filtration (equivalent to 0.5-log Giardia inactivation and 4-log virus inactivation).

Table 2.3 – Summary of Regulatory Disinfection Requirements

	Required Log Reduction		
	Giardia	**Virus**	***Cryptosporidium***
Treatment Requirements			
Federal Treatment Requirements[1]	3.0	4.0	2.0[2]
Additional Requirements for Membrane Facilities[3]	1.0	0	2.0
Additional Disinfection Requirements[4]	0.5	0	0
Total Treatment Requirements	4.5	4.0	4.0
Membrane Filtration Credit	4.0	0.5-2.0[5]	4.0[6]
Disinfection Process Requirement	0.5	4.0[7]	0.0

Notes
1. Based on federal requirements in the Surface Water Treatment Rule, IESWTR and LT2ESWTR.
2. Based on results of *Cryptosporidium* source water monitoring program by the Serrano Water District on ILW (Bin 1).
3. Membrane facilities in California are currently required to be operated and maintained to achieve 4-log *Cryptosporidium* and *Giardia* removal.
4. California requires additional disinfection downstream of filters of 0.5 log *Giardia* or 4-log virus.
5. 0.5 for MF pressurized systems, 2.0 for UF ZW500d submerged system.
6. Based on full compliance with the IESWTR and LT2ESWTR.
7. Current membrane integrity testing methods cannot verify virus removal as required by the USEPA Membrane Filtration Guidance Manual. It is recommended that the District achieve virus inactivation though free chlorine disinfection.

2.4.3 Disinfection By-Products

Compliance with Stage 1 and 2 Disinfectants / Disinfection Byproducts Rule (D/DBPR), which establishes the maximum residual disinfectant goals for chlorine, chloramines, and chlorine dioxide, maximum contaminant level goals four trihalomenthanes (THM), two haloacetic

acids (HAA), bromate and chlorite according to the National Primary Drinking Water Regulations, and regulations for the State of California.

2.4.4 Potential (Future) Treatment Goals

The CDPH has established a notification level for three nitrosamines including N-nitrosodimethylamine (NDMA) at 0.01-µg/L. Other potential contaminants of concern including atrazine and 1,4 dioxane. These standards are not enforceable, and there is no data to suggest that these are specifically applicable to the sources water for the Baker WTP. Space has been reserved on site for construction of an advanced oxidation process (AOP) using medium pressure UV reactors and granular activated carbon. Section 15 provides a discussion of UV reactor selection and recommends low pressure high output system for this project.

2.4.5 Other Dedicated Treatment Requirements

In addition to the water quality and monitoring standards, CDPH Title 22, Chapter 17 mandates the treatment plant design and construction includes the following:

- Alarm devices to provide warnings of process failures
- Standby replacement equipment available to assure continuous operation and control of unit processes
- Continuous turbidity monitoring
- Multiple filter units which provide redundant capacity when filters are out of service for backwash or maintenance.

2.5 TREATMENT OBJECTIVES

The following requirements hold for treatment of surface water for Baker WTP:

- Daily effluent turbidity of <0.3 NTU in 95-percent of samples
- 4.5-log Giardia inactivation/removal
- 4.0-log Crytosporidium inactivation/removal
- 4.0-log virus inactivation/removal
- Iron and manganese removal

2.6 PRODUCT WATER QUALITY GOALS

Baker WTP will be designed with established minimum product water quality goals, based upon State of California Department of Public Health (DPH) standards, and additional project specific goals as described below.

2.6.1 Turbidity

Turbidity standards require that 95% of turbidity standards taken each month be less than 0.3 NTU, with a maximum of 1 NTU. Because membrane filtration will be used, performance requirements in the membrane procurement specification require filtered water turbidity to be less than 0.1 NTU 95% of the time with a maximum of 0.15 NTU.

2.6.2 Iron and Manganese

The three primary objectives of iron and manganese management are:

- Finished water with iron and manganese concentrations below their respective SMCL.
- Prevention of membrane fouling. Review of literature and troubleshooting of membrane plants suggests that an iron concentration as low as 0.05 mg/L and a manganese concentration as low as 0.02 mg/L is an appropriate target for these constituents in the membrane filtrate.
- Reasonable effort to minimize customer aesthetic complaints. Review of literature suggests that iron level as low as 0.1 mg/L and manganese level as low as 0.02 mg/L in the finished water could generate complaints.

Based on the above considerations, the following treatment goals were established

- Manganese level in MF feed water: 0.02 mg/L
- Iron level in MF feed water: 0.05 mg/L

2.6.3 Chlorine Dioxide

Chlorine dioxide used for iron and manganese control (see Section 8) must comply with the Maximum Residual Disinfectant Level (MRDL) of 0.8 mg/L in the finished water. However, a project specific limit of 0.2 mg/L will be met to prevent potting of the Pall membrane module.

2.6.4 Chlorite

Typically, the reaction of chlorine dioxide produces approximately 50 to 70 percent conversion of chlorine dioxide to chlorite (weight to weight basis). The MRDL for chlorite leaving the Baker WTP is 1.0 mg/L, resulting in the need to limit the chlorine dioxide dose to a maximum of 1.4 mg/L.

2.6.5 Disinfection Byproducts

Virus disinfection with free chlorine in source waters for the Baker WTP is anticipated to result in formation of Total Trihalomethane (TTHM) and Haloacetic Acids (HAA). In order to comply with related standards, goals of 64 μg/L for TTHM after free chlorine disinfection (80% of the MCL of 80 μg/L), and 48 μg/L of HHA (80% of the MCL of 60 μg/L) have been selected for the Baker WTP. This allows for additional formation of 10% to 15% in the distribution system following chloramination.

2.6.6 Total Chlorine

Chloramine concentration in the distribution system must be compatible with MWDSC's level, since the two sources will be blended in the AMP and could be blended in IRWD's system. Therefore, the minimum free chlorine residual at the end of the chlorine contact basin should be 2 mg/L.

Table 2.4 provides a summary of the project Product Water Quality Goals.

Table 2.4 – Product Water Quality Goals Summary

Constituent	Units	Goal
Turbidity	NTU	<0.3 NTU 95% of the time
Manganese	mg/L	<0.02 mg/L
Iron	mg/L	<0.05 mg/L
Chlorine Dioxide	mg/L	<0.2
Chlorite	mg/L	<1.0
TTHMs	μg/L	<64
HAA	μg/L	<48
Corrosivity		Non-corrosive
Total Chlorine	mg/L	2 mg/L

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SECTION 3 RAW AND PRODUCT WATER CONVEYANCE HYDRAULICS

3.1 OVERVIEW

This section describes the hydraulic conditions for the facilities that feed the Baker WTP and deliver product water to customers. The facilities that were subjected to hydraulic analyses include both existing and proposed systems:

Raw (Untreated) Water Facilities

- MWD facilities, including the Santiago Lateral and OC-33 turnout,
- Existing raw water facilities, including the Baker pipeline, Irvine Lake, and Irvine Lake Pipeline, and
- Proposed raw water facilities, including the Raw Water Pump Station, flow control facility, forebay, and Feed Water Pump Station.

Baker Water Treatment Plant

Product (Finished) Water Systems

- Clearwell,
- Product Water Pump Station, and
- The Allen McColloch pipeline.

Included are descriptions of existing and proposed facilities, system operation, and overall project hydraulics.

3.2 MWD SYSTEM

MWD delivers State Project and Colorado River Water through the Lower Feeder to the Santiago Lateral. The Santiago Lateral supplies the Baker Pipeline through the OC-33 turn-out located north of Irvine Regional Park. Exhibit 3.1 provides an overview of the pipelines that will influence hydraulics to the Baker WTP Project.

3.2.1 Santiago Lateral

The Santiago Lateral is a pipeline of approximately 8.7 miles in length, ranging in diameter from 72-inch at its upstream end, to 48-inch at its terminus in Irvine Lake. The pipeline receives State Project and Colorado River Waters from MWD's Lower Feeder. The Santiago Lateral was

constructed, by MWD, in 1956, to deliver raw water to the City of Anaheim and several water districts. Currently, the active service connections on the lateral are:

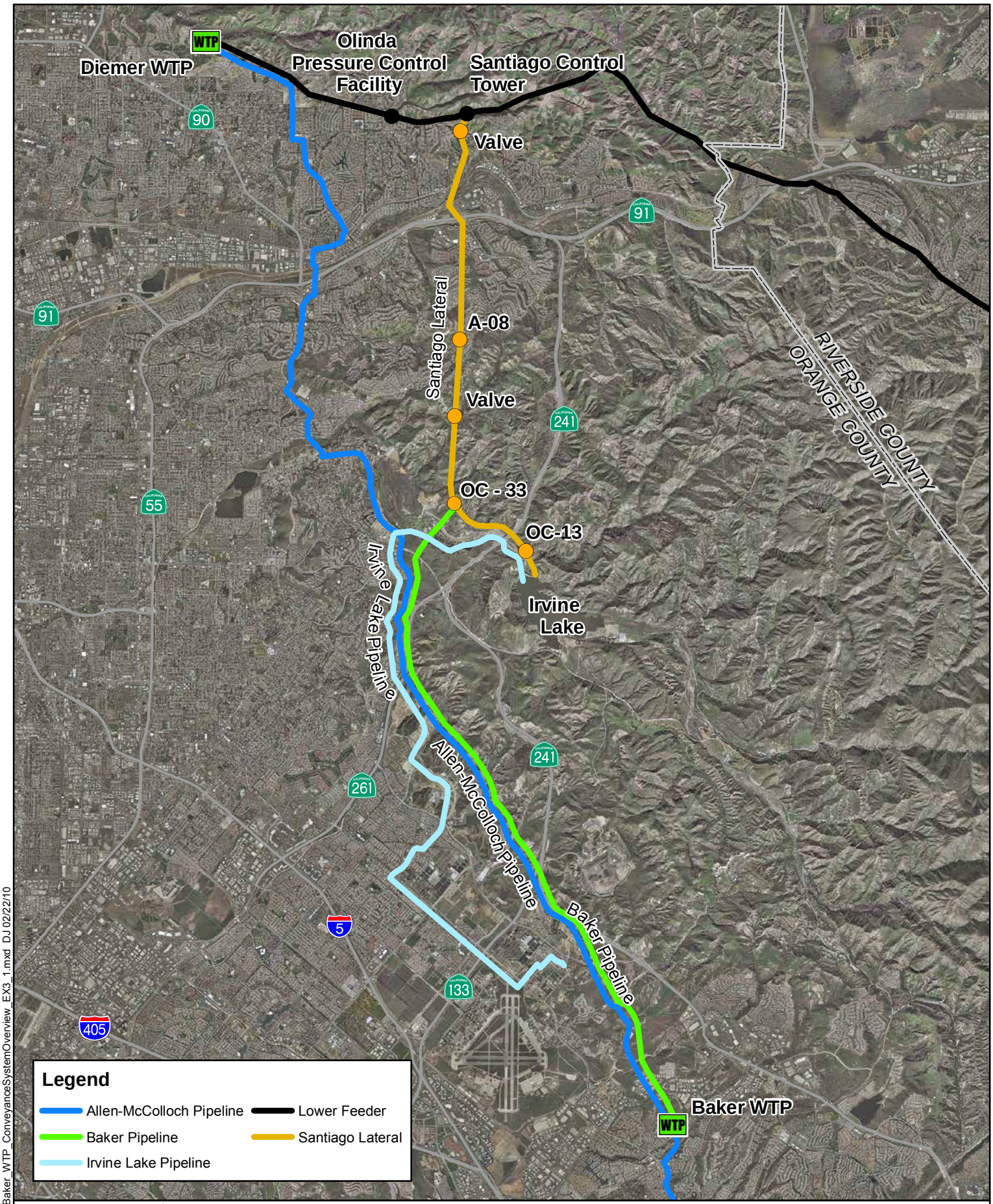
- A-08 serves 23 cfs to the City of Anaheim's Walnut Canyon Reservoir and Water Treatment Plant.
- OC-33 supplies a current capacity of 40 cfs to the Baker Pipeline.
- OC-13 is an in-line meter on the Santiago Lateral that conveys up to 100 cfs to Irvine Lake

The design capacity of the pipeline, at its headworks (Santiago Control Tower) on the Lower Feeder, is 150 cfs. The capacity is reduced to 100 cfs about halfway along its length, and continues at this capacity to Irvine Lake. In 2002, MWD performed a flow test for the Santiago Lateral and concluded that the flow through OC-13 should be limited to 100 cfs. During the test, flows at A-08 and OC-33 were 20 cfs and 19 cfs, respectively.

Releases into the Santiago Lateral originate at the Santiago Control Tower. The Santiago Control Tower communicates with the Olinda Pressure Control Facility located downstream of the control tower on the Lower Feeder. When the water surface level, in the control tower, moves outside of the preset range (962 feet to 966 feet) the Olinda facility either reduces or increases the flow in the Lower Feeder, as necessary, in order to maintain the preset range (HGL) in the tower.

There are two sectionalizing valves on the Santiago Lateral – one just downstream of the Venturi meter, near the tower, and another at the upstream end of the Santiago Tunnel. The former valve is not used to regulate flow, whereas the valve at the tunnel is sometimes throttled to control flow to OC-33 (described below) and OC-13 (turn-out to Irvine Lake). Downstream of the tunnel, flow in the pipeline is unregulated, and cascading flow occurs at several locations when the flow to the lake is insufficient to raise the HGL, in the lateral, above the pipeline's summits.

Exhibit 3.2 shows the pipe and hydraulic profiles of the Santiago Lateral.



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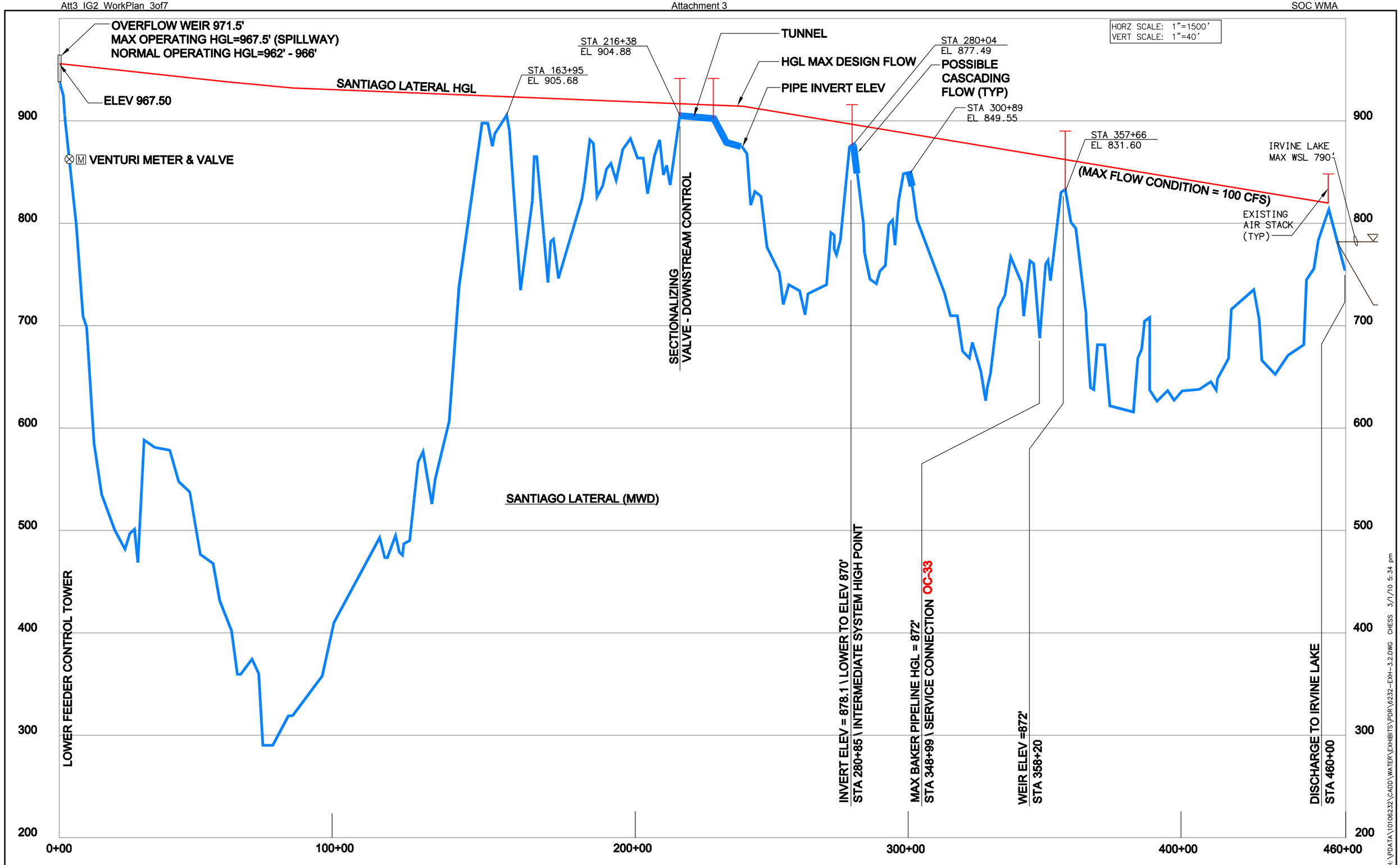
Baker Water Treatment Plant Project

Conveyance System Overview

Exhibit 3.1



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carollo

IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

SANTIAGO LATERAL PROFILE

EXHIBIT 3.2

3.2.2 OC-33

OC-33 is the turn-out from the Santiago Lateral to the Baker Pipeline. The turn-out currently has a flow meter rated up to 40 cfs. OC-33 was once equipped with a flow meter capable of measurement up to 100 cfs. When flow rates declined in the Baker Pipeline, the Santiago Aqueduct Commission elected to replace the meter with a smaller one to achieve increased accuracy. Increased flows through the turn-out, as a result of Baker WTP, may require modifications to the turn-out, as discussed in Section 4.

3.3 EXISTING RAW WATER CONVEYANCE FACILITIES

Existing raw water facilities downstream of the Santiago Lateral are illustrated on Exhibit 3.1 and include:

- Baker Pipeline
- Irvine Lake
- Irvine Lake Pipeline

3.3.1 Baker Pipeline

The Baker Pipeline, originally named the Santiago Aqueduct, was constructed in 1962 by the Santiago Aqueduct Commission to provide untreated Colorado River water to several water districts and agricultural interests in central Orange County. In recent years, MWD has delivered a blend of Colorado River Water and State Water Project Water to the Baker Pipeline.

3.3.1.1 Hydraulics

The Baker Pipeline was designed to operate with downstream control, and, structurally, to withstand a maximum HGL of 872 feet. An HGL of 872 feet can only be realized when the discharge to Irvine Lake, through the Santiago Lateral, is 100 cfs. The HGL in the Santiago Lateral at OC-33 is fixed at its maximum by the elevation of a high point in the Santiago Lateral immediately downstream of OC-33. It is impossible to develop a higher HGL (i.e., > 832 feet) at this point without discharging to Irvine Lake; thereby limiting the Baker Pipeline to a flow rate below its potential. The maximum HGL achievable at this point (i.e. 872 ft) occurs with maximum flow in the lateral (i.e., 100 cfs). When there is less flow, the HGL

diminishes until it reaches approximately 832 feet, at which point there is no discharge to Irvine Lake. A profile of Baker Pipeline and hydraulic profile is provided in Exhibit 3.3.

3.3.1.2 Flow Test

Irvine Ranch Water District and RBF Consulting completed a flow test of the Baker Pipeline on April 21, 2009 to evaluate its hydraulic performance. Flow in the Baker Pipeline was controlled during the test at the Baker site by a temporarily installed butterfly valve on the 20- / 24-inch pipeline that served the former Baker Filter Plant. At 15-minute intervals during the 4-hour test, flow readings were taken at OC-33 and the Baker site, and pressure readings were taken at the Irvine Lake Pipeline / Baker Pipeline turnout, Baker site, and selected high points (air valve locations) along the Baker Pipeline.

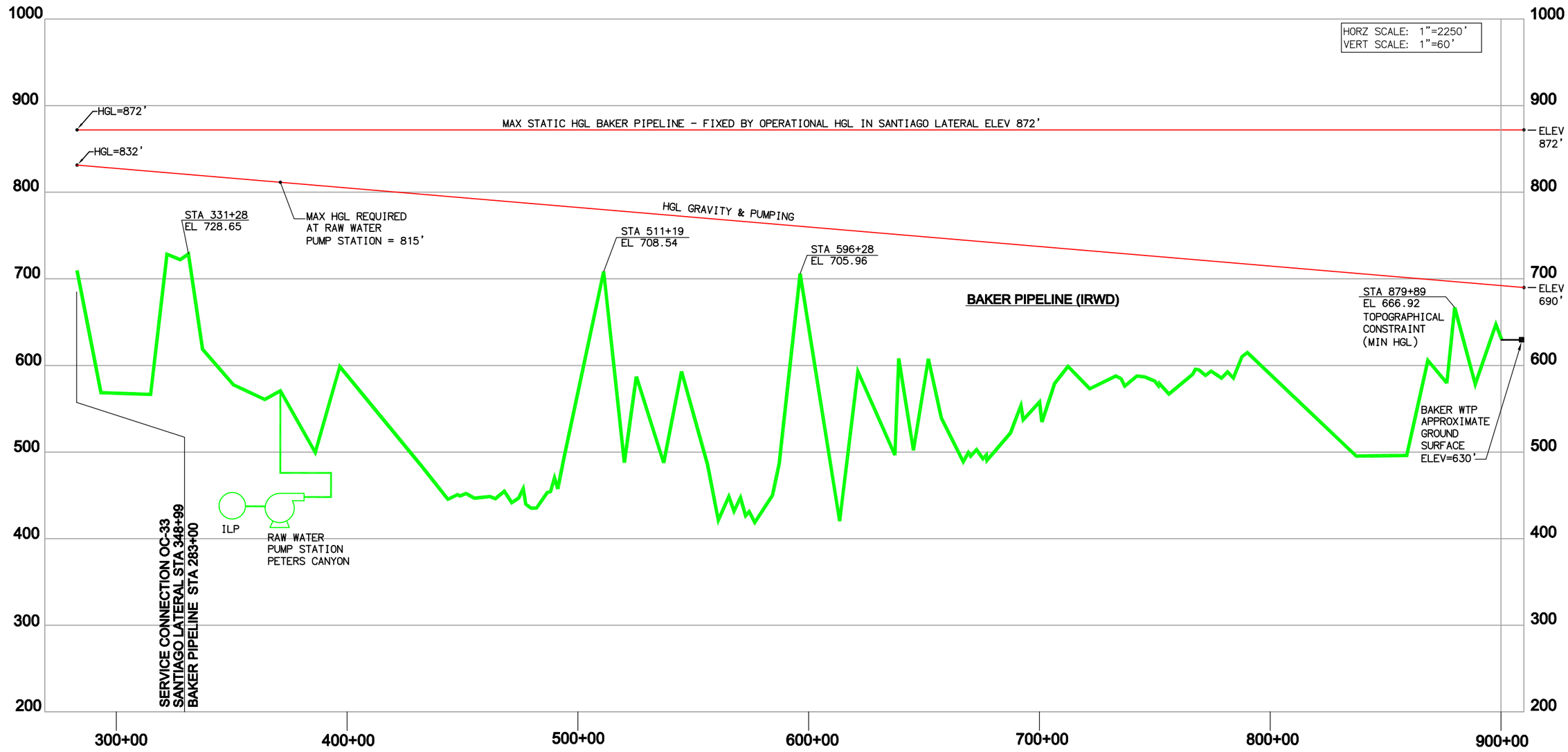
3.3.1.3 Flow Test Analysis

The flow test results were used to determine a representative Hazen Williams C Factor for the Baker Pipeline. It was observed that valve modulation (both opening and closing the 24-inch butterfly valve) significantly impacted pressure and flow values at the beginning and end of the flow test. As a result, focus in the calculations was placed on flow test results from 9:55 am to 10:55 am, as shown on Exhibit B1 of Appendix B.

Based on the flow test results, a Hazen Williams factor of 140 was selected to predict friction losses in the Baker Pipeline. Exhibit B2 in Appendix B depicts the results of the flow test against various values of the Hazen Williams factor.

3.3.1.4 Capacity Rights

The Baker Pipeline capacity is physically dependent on hydraulics, and institutionally limited by capacity rights allocated by agreement. In October 2009, Irvine Ranch Water District and RBF / Carollo completed efforts to determine the proposed reallocation of water rights through the Baker Pipeline. The efforts focused on pipeline hydraulics to



OPERATING CONDITION MAX DESIGN FLOW
BAKER WTP - 43.5 CFS TRABUCO WTP - 6 CFS AGRICULTURAL - 4 CFS

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IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

BAKER WATER TREATMENT PLANT
BAKER PIPELINE PROFILE

EXHIBIT 3.3

maximize plant flow and minimize the transfer of capacity rights in Reaches 1 through 5. Two alternative capacities of raw water supply to Baker WTP were recommended:

- 37 cfs – considering the use of available head for pressure membrane filtration, requiring an HGL of 720 feet at the Baker WTP
- 43.5 cfs – considering the use of a forebay reservoir and pump station, requiring an HGL of 690 feet

Cost analysis of each alternative was presented at the Project Stakeholder's meeting held on October 29, 2009. With Project Go-No-Go Decision 1 the Stakeholders selected the higher (43.5 cfs) flow alternative as the basis for treatment plant design.

3.3.2 Irvine Lake

Irvine Lake (also referred to as the Santiago Reservoir) was built in 1931 to serve nearby agricultural demands. The lake is currently supplied by State Project and Colorado River waters delivered by Metropolitan Water District through the Santiago Lateral and OC-13. The lake has a maximum capacity of approximately 28,000 acre-feet. From the 2007 Feasibility Study it is understood that the lake captures an average of approximately 7,000 acre-feet of local runoff per year. A summary of the water storage (capacity) and surface area is provided as Exhibit 3.4. Throughout the upper WSLs (750 – 790 ft) of Irvine Lake, approximately 5,000 AF is contained within each 10 ft band. This is the approximate quantity of water that is expected to be withdrawn from the lake over a 6 to 8 week period on an annual basis.

Delivery of Irvine Lake water to the Baker WTP will provide reliability, in the event of an emergency or maintenance caused outage along the Santiago Lateral or the Lower Feeder. In the event that it should become necessary to curtail or limit service to OC-33, Irvine Lake can be used as a raw water source for the Baker WTP, either replacing or supplementing the MWD supply.

Water is transferred from Irvine Lake into the Irvine Lake Pipeline through the Irvine Lake Outlet Tower. The tower is 8 ft in diameter and is controlled by using the upper gates (24-inch gates) at elevations of 720,

730, 740 and 750 ft. All lower gates (30-inch gates) are buried under lake sediments. To maintain long-term operation of the tower and improve water quality in the Irvine Lake Pipeline, an extension to the 720 gate was installed to raise the inlet elevation to 735 ft. Irvine Ranch Water District has also considered an extension to the 710 gate. However, the extension has been put on hold pending seismic evaluation of the tower as required by the Division of Safety of Dams.

Each of the gates is equipped with a Johnson screen with the following characteristics:

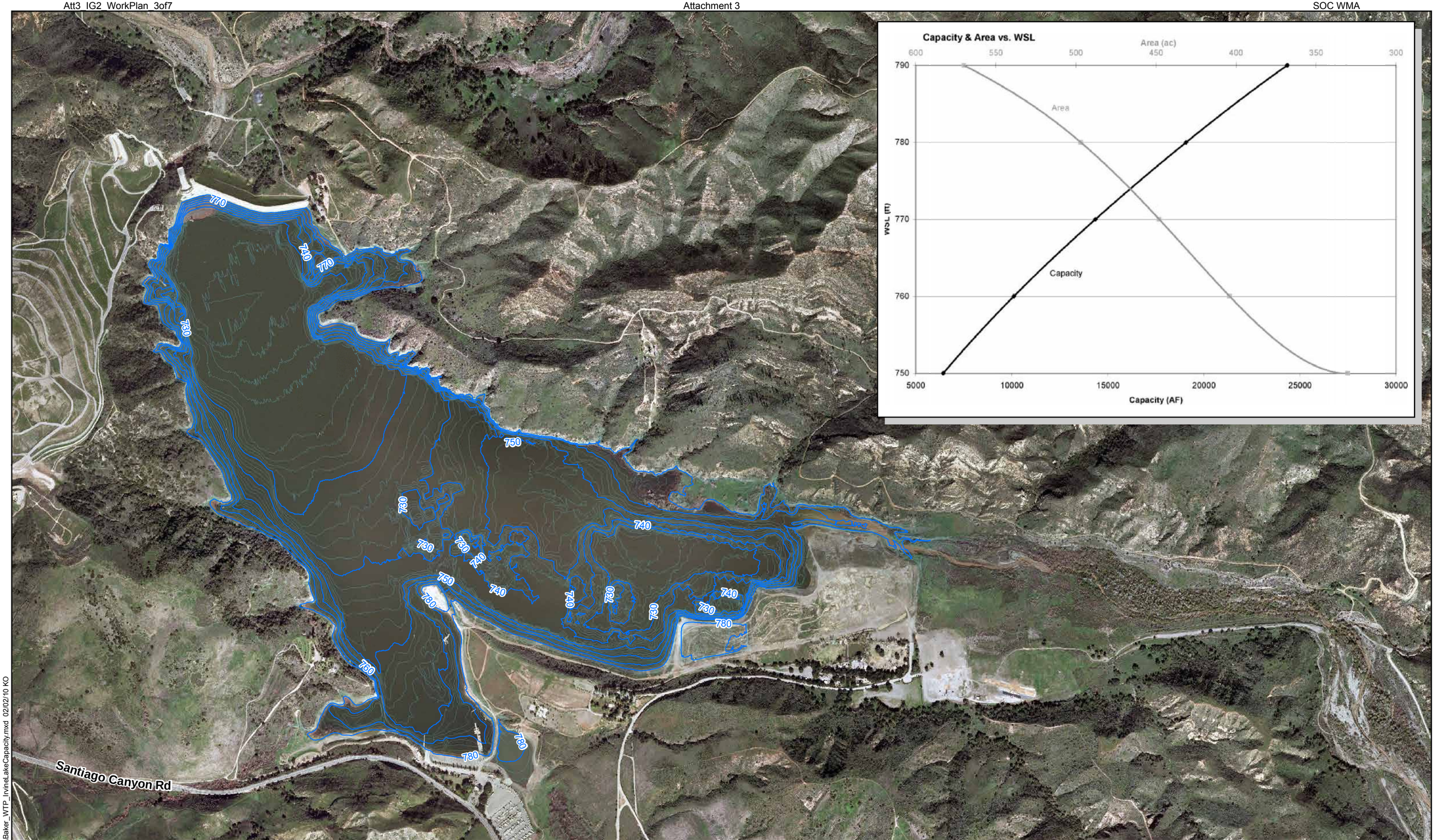
- "T" shape configuration
- 30-inch diameter
- 96-inch length
- Slot opening = 0.50"
- 79.6% open area
- Collapse strength = 10' of water
- Material – 304 SS

Johnson recommends that the maximum through-slot velocity of the screens be 0.5 fps which will produce a per-screen capacity of 11.25 cfs. However flows up to 22.5 cfs per screen can be achieved with a through-slot velocity of 1.0 fps although increased fouling will result. Therefore, at the lower flow rate, the outlet tower could release 45.0 cfs, and at the higher flow rate – a maximum of 90.0 cfs (if screens fully clean).

3.3.3 Irvine Lake Pipeline

The Irvine Lake Pipeline (ILP) originates at Irvine Lake and conveys water from the lake's outlet works through a pipeline of varying diameters over a total length of about 65,000 feet to its terminus near Lambert Reservoir north of the former El Toro Marine Corps Air Station. The pipeline was constructed to serve agriculture demands, through three reaches:

- The Irvine Lake Reach extends from Irvine Lake to Peters Canyon Reservoir.
- The Rattlesnake Reach extends through the Cities of Orange, Tustin and Irvine before terminating near the Rattlesnake Reservoir in the North Irvine area.



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Baker Water Treatment Plant

Irvine Lake and Capacity

Exhibit 3.4

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- The Lambert Reach is under evaluation to determine the date at which it will be separated and utilized as part of the Zone C recycled water system.

The capacity to be delivered through the Irvine Lake Pipeline during Baker WTP operation is under analysis by IRWD and RBF Consulting with consideration of:

- Outlet Tower capacity – when the screens are mostly clear of debris IRWD has measure flows between 60 and 70 cfs in the upper reach of the ILP,
- Current and future agriculture demands on the Irvine Lake Pipeline and Baker Pipeline,
- Supply to Serrano Water District and Trabuco Canyon Water District.

The above listed factors may cumulatively limit the raw water flow to the Baker WTP when supplied from Irvine Lake to less than 43.5 cfs. However, for the PDR the capacity of the Raw Water Pump Station is maintained as 53.5 cfs (43.5 cfs for Baker WTP, 4 cfs for Baker Pipeline served agriculture, 6 cfs for TCWD), as a conservative basis for Project costs. Additional evaluation is required to quantify these impacts.

3.4 PROPOSED RAW WATER CONVEYANCE FACILITIES

The proposed raw water conveyance facilities include all facilities to be constructed to enable delivery of untreated water from Santiago Lateral or Irvine Lake Pipeline to the Baker WTP.

3.4.1 Alternative Facilities Considered

The approach to delivering raw water to the treatment plant has been studied by weighing factors such as:

- Capital Cost
- Lowest Energy Use
- Surge Protection
    - Baker Pipeline
    - Treatment Plant
- Ease of Operation

- Land Acquisition

Several alternative facilities were considered in developing the proposed concept for the raw water conveyance system. Appendix C describes the facilities previously considered, including a hydraulic control structure, regulating reservoir and constant head tank.

3.4.2 Proposed Facilities

The facilities to be constructed to enable raw water delivery to the Baker WTP include:

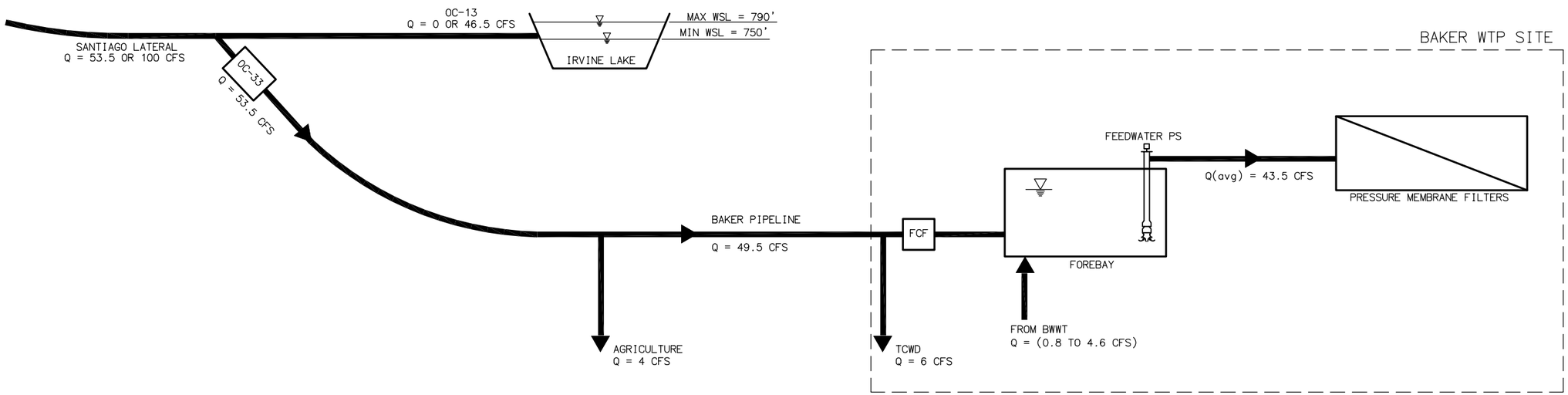
- Raw Water Pump Station - a pump station constructed to boost water from the Irvine Lake Pipeline to the Baker Pipeline, with a maximum design flow rate of 53.5 cfs (24,000 gpm).
- Flow Control Facility – at the terminus of the raw water pipeline, the flow control facility consists of a motor operated sleeve valve to control the flow into the forebay. A redundant sleeve valve is included in the cost estimate.
- Forebay - a 0.785 MG partially buried, cast-in-place concrete reservoir to isolate the hydraulics / surge of the Baker Pipeline and treatment plant systems, and to provide flow equalization between the constant flow rate of raw water delivery in the Baker Pipeline, and variable flow rate of the treatment plant due to operation (backwashing and integrity testing).
- Feedwater Pump Station - vertical turbine pumps to boost water from the forebay through the pressure membranes. Pumps will have variable speed drives to manage variable flow rates through the treatment process, and maximum and minimum discharge pressure based on the acceptable range of pressure upstream of the membrane filters.

3.5 RAW WATER SYSTEM OPERATION

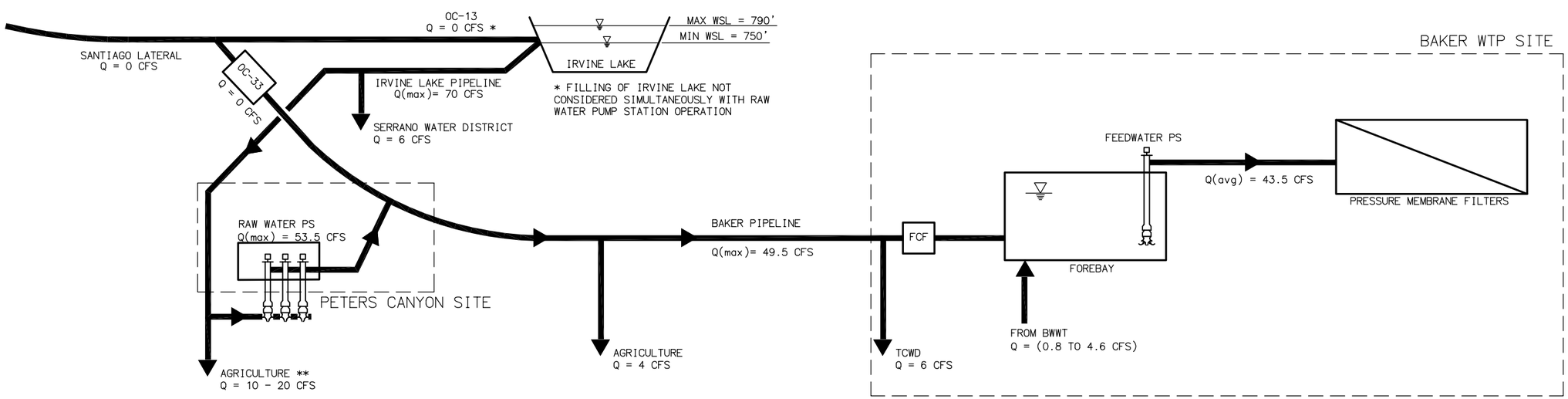
There are two methods (gravity and pumping) for the conveyance of raw water to the Baker WTP. These methods comprise a total of six operational schemes, which are summarized in Table 3.1. Exhibits 3.5 shows the overall system under gravity and pumping conditions. Exhibits 3.6 (gravity operation) and 3.7 (pumping operation) depict all methods of water conveyance as described and defined in Sections 3.5.1 and 3.5.2.

TABLE 3.1
BAKER WATER TREATMENT PLANT
RAW WATER CONVEYANCE OPERATIONAL SCHEMES

CONVEYANCE METHOD	OPERATIONAL SCHEME	Water Source	Santiago Lateral		Baker P/L Flow	ILP Flow	Comments
			Flow	Flow to Lake			
GRAVITY	Gravity - Normal Operation	Santiago Lateral	Yes	Possible - but not required	OC-33 to WTP	No	Flow to Irvine Lake may increase HGL at OC-33 to Max = 872'
	Gravity - Combined Baker P/L and ILP	Santiago Lateral & Irvine Lake	Yes	Possible - but not required	OC-33 to WTP	From Irvine Lake to RWPS and downstream	Requires high WSL in Irvine Lake & reduced flow through OC-33. Blending at RWPS.
	Gravity Transfer - Baker P/L to ILP	Santiago Lateral	Yes	May be required	OC-33 to RWPS to ILP	Downstream of RWPS	Flow to lake may be required in order to develop high HGL in Santiago Latral and full flow to WTP
	Gravity Transfer - ILP to Baker P/L	Irvine Lake	No	Unlikely	RWPS to WTP	From Irvine Lake to RWPS and downstream	No flow through OC-33
PUMPING	Pumping - Normal Operation	Irvine Lake	Unlikely		RWPS to WTP	From Irvine Lake to RWPS and downstream	No flow through OC-33. WSL in Irvine Lake greater than 740'
	Pumping - Combined Baker P/L (gravity) and ILP (RWPS feed)	Santiago Lateral & Irvine Lake	Yes	Unlikely	Gravity from OC-33 blending with ILP water pumped by RWPS to Baker P/L	Yes	Blended Irvine Lake and Santiago Lateral waters. WSL in Irvine Lake greater than 740'



GRAVITY- SANTIAGO LATERAL SUPPLY TO BAKER WTP



PUMPING - IRVINE LAKE WATER SUPPLY TO BAKER WTP

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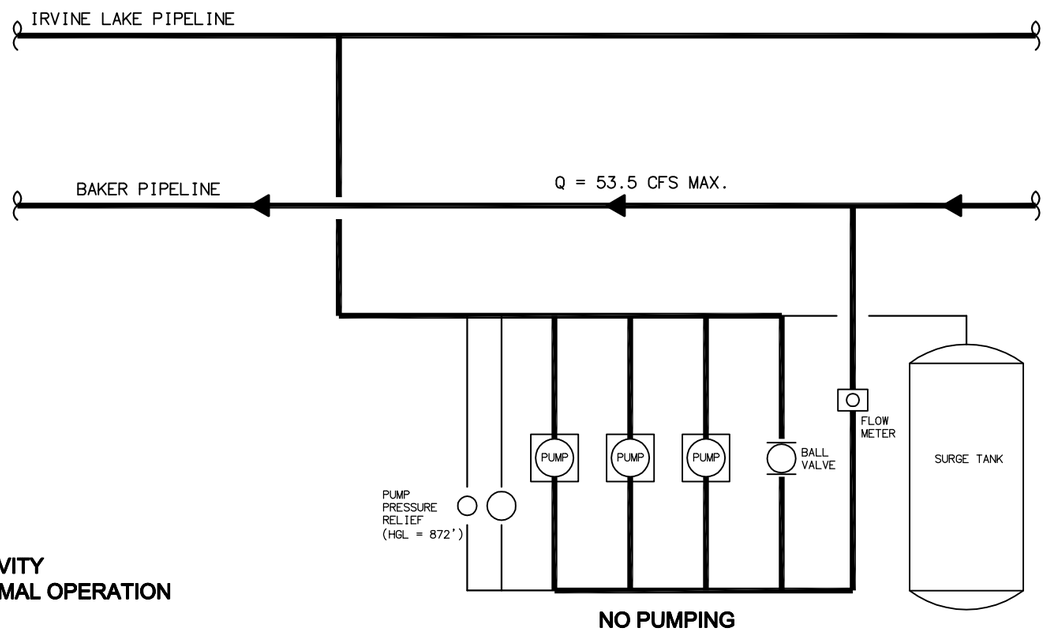
IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

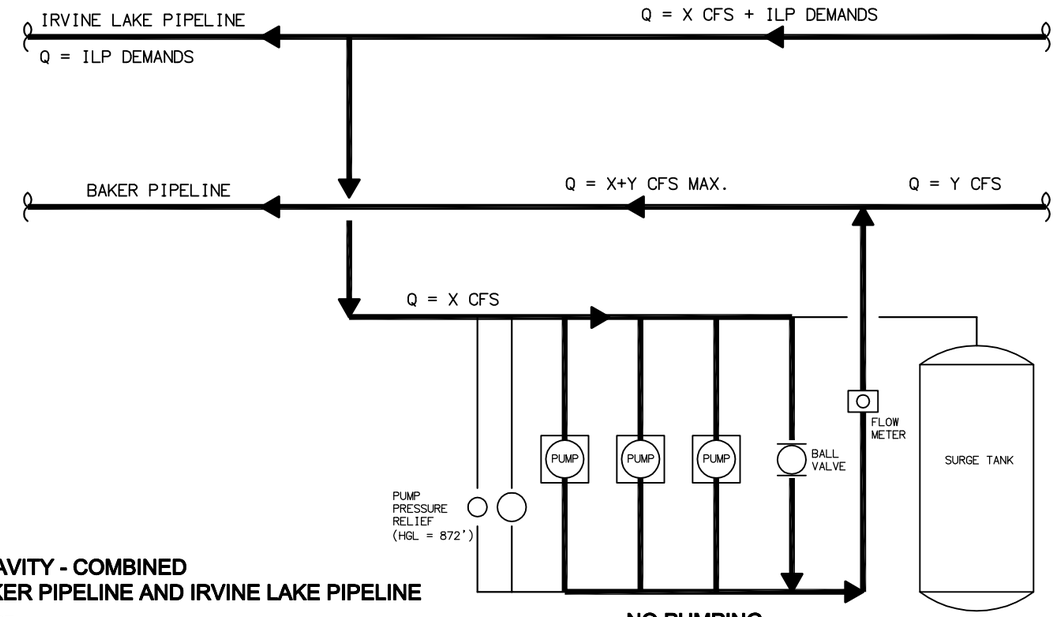
RAW WATER CONVEYANCE SYSTEM OPERATION SUMMARY

EXHIBIT 3.5



GRAVITY
NORMAL OPERATION

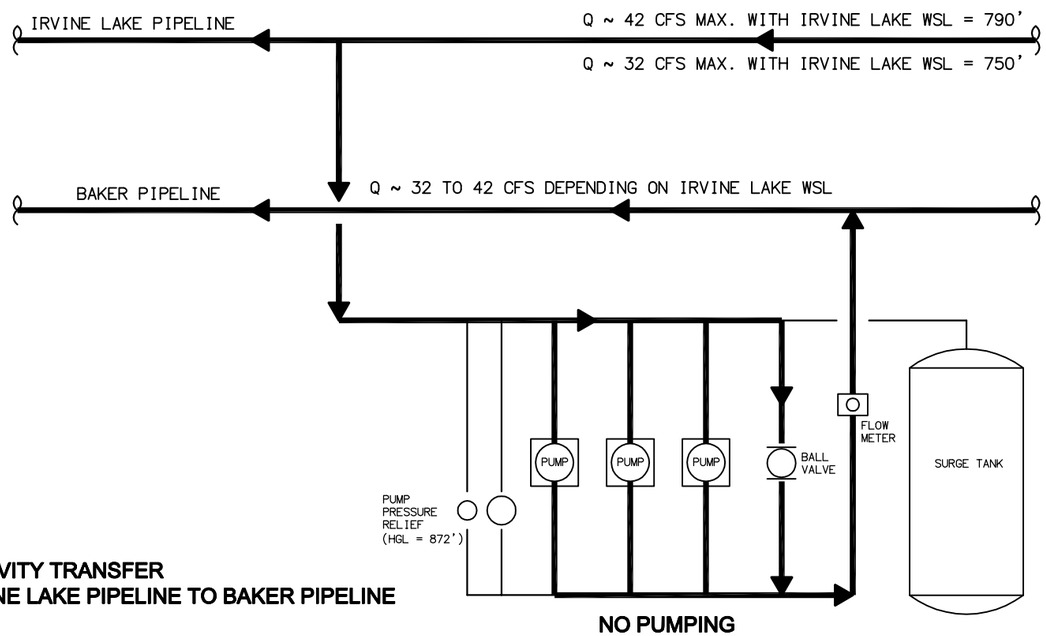
NO PUMPING



GRAVITY - COMBINED
BAKER PIPELINE AND IRVINE LAKE PIPELINE

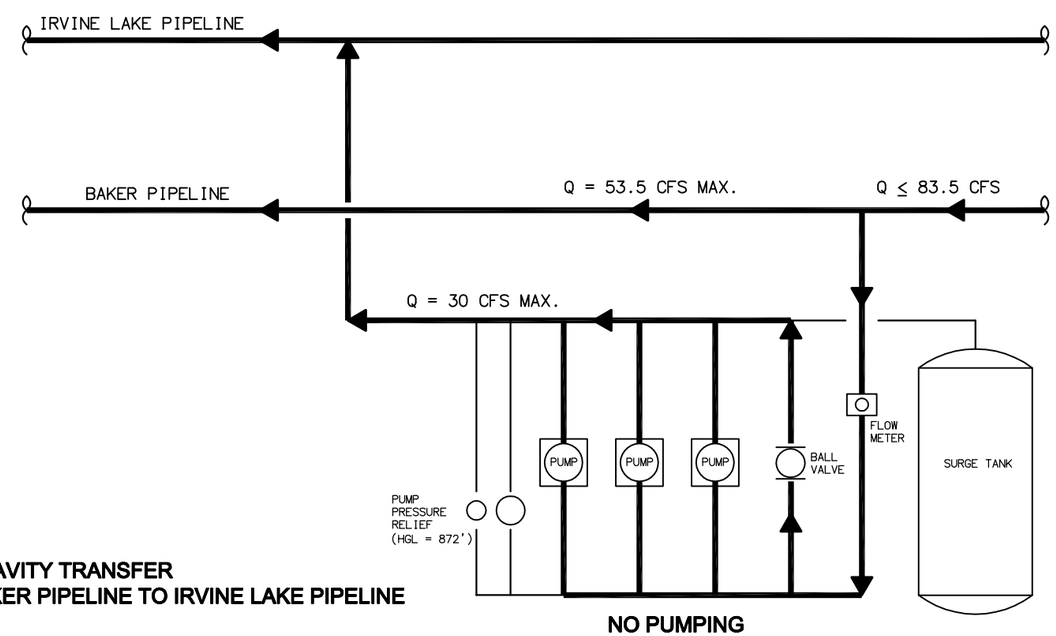
NO PUMPING

WHERE:
X CANNOT EXCEED 42.5 CFS
Y CANNOT EXCEED 53.5 CFS
X+Y CANNOT EXCEED 53.5 CFS



GRAVITY TRANSFER
IRVINE LAKE PIPELINE TO BAKER PIPELINE

NO PUMPING



GRAVITY TRANSFER
BAKER PIPELINE TO IRVINE LAKE PIPELINE

NO PUMPING

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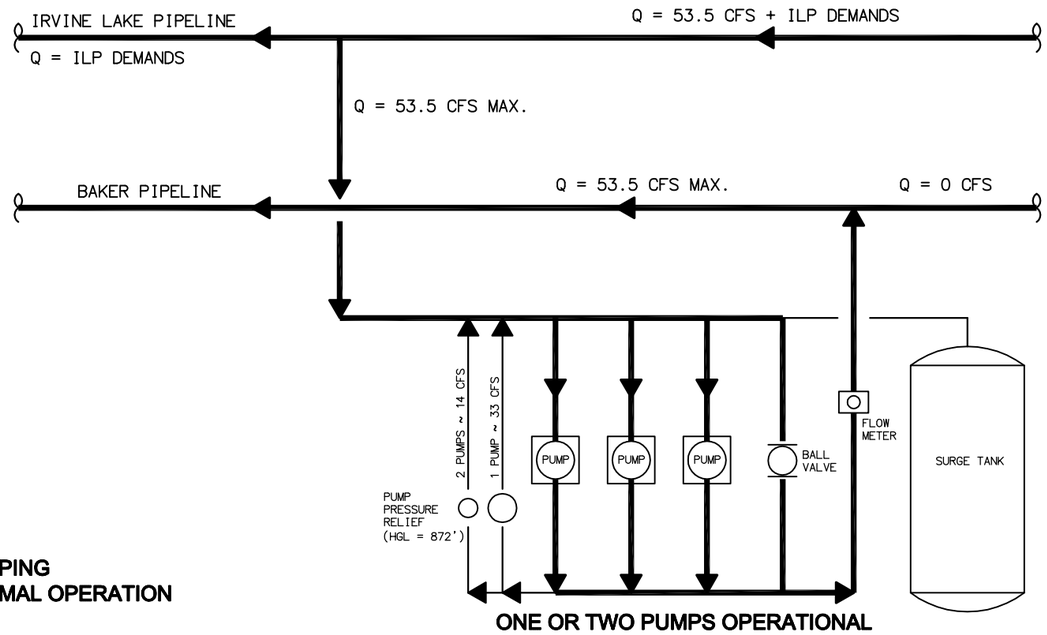
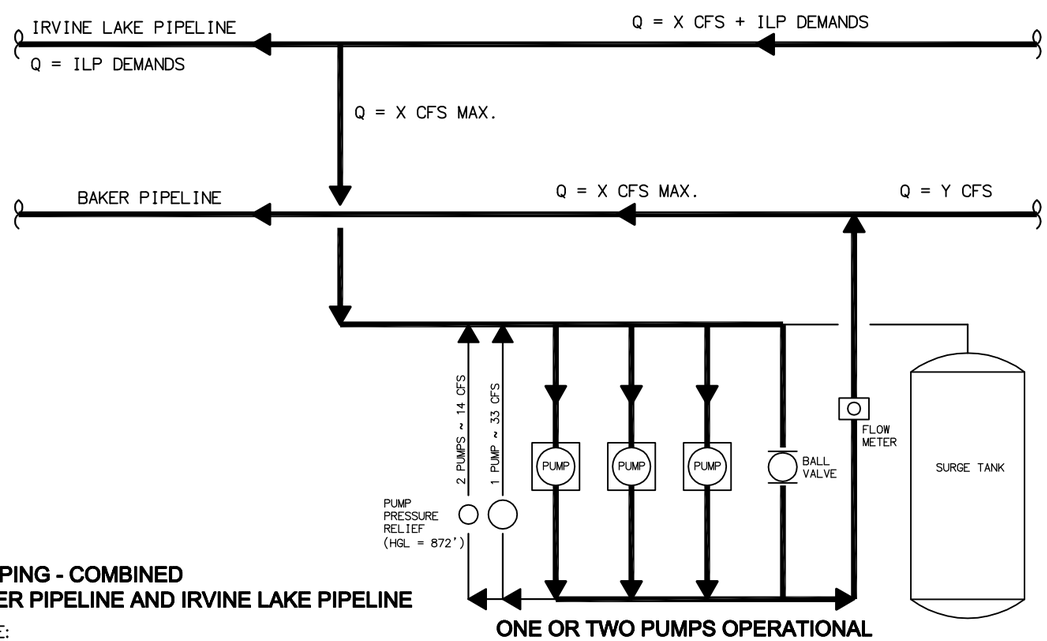
IRVINE RANCH WATER DISTRICT
BAKER WATER TREATMENT PLANT
RAW WATER PUMP STATION
GRAVITY OPERATION SCHEMATIC

EXHIBIT
3.6



PUMPING
NORMAL OPERATION



PUMPING - COMBINED
BAKER PIPELINE AND IRVINE LAKE PIPELINE

WHERE:
X CANNOT EXCEED 42.5 CFS
Y CANNOT EXCEED 53.5 CFS
X+Y CANNOT EXCEED 53.5 CFS

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IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

RAW WATER PUMP STATION PUMPING OPERATION SCHEMATIC

EXHIBIT **3.7**

3.5.1 Gravity Conveyance

The majority of the time (i.e. ten to eleven months annually) raw water will be conveyed to the Baker WTP, directly from the MWD system, by gravity, through the Baker Pipeline. No intermediate storage facility will be involved, between the MWD system and the forebay at the Baker WTP. Gravity conveyance includes four possible operational schemes as described below.

Gravity - Normal Operation

This will consist entirely of Santiago Lateral gravity supply, through OC-33, to the Baker WTP, agricultural users and TCWD, through the Baker Pipeline. No pumping.

The flow through OC-33 and the Baker Pipeline (Gravity-Normal Operation – See Table 3.1) will be controlled by:

- MWD releasing Lower Feeder water, into the Santiago Lateral, on a daily basis, at the flow rates requested by IRWD through MWDOC.
- Instantaneous control through operation of the 18-inch sleeve valve upstream of the Baker WTP forebay.

Under conditions when the plant's output is being maintained at a constant daily rate, any flow swings will be absorbed by the forebay, and there should be no discharge of water to the lake or overflows to the stormwater system, at the plant.

Since the water released by MWD is generally not variable, variation of Baker Pipeline flow and plant demand, ranging from daily to instantaneous, will be absorbed by one or a combination of the following:

- Flows, in Baker Pipeline, in excess of plant demand, will occur daily as a result of variable flow through the pressurized membranes due to backwashing or maintenance. Such flow variations are accounted for in the design capacity of the forebay,
- As a less desired alternative, excess water that cannot be handled in this manner will first result in modification of flow rate from the feedwater pump station, and if still unresolved thereafter, will lead to the reduction of flow to the plant by closing the sleeve valve at the flow control facility to divert excess raw water flow to Irvine Lake. See

Section 7 and 10 for further on the flow control facility and feedwater pump station, respectively.

- If flow cannot be controlled within the normal operating range of the forebay or operation of the flow control facility, thereby causing the high WSL in the forebay to be exceeded, then excess flow from the Baker Pipeline will overflow into the local drainage system of the Baker WTP, discussed in Section 17.

Gravity – Combined Baker Pipeline and Irvine Lake Pipeline

Under certain conditions it may be desirable to receive water from both OC-33 and Irvine Lake, by gravity alone. This mode of operation presents no difficulties since the water from Irvine Lake would be operated at a variable rate while the MWD supplied water would be the base flow. That is, minor variations in the Baker Pipeline demand would be made up from Irvine Lake. However, the aggregate flow rate that is possible is limited, because the water surface level in Irvine Lake is significantly lower than that possible at OC-33. As a result, the flow rate from OC-33 must be reduced in order to prevent back-flow to the lake.

Gravity Transfer – Baker Pipeline to Irvine Lake Pipeline

Water from the Santiago Lateral can be transferred directly to the Irvine Lake Pipeline from the Baker Pipeline under conditions when it is not desirable to convey lake water in the Lake Reach of the ILP. In such a case, Santiago Lateral water, through OC-33 and Reach 1 of the Baker Pipeline, can be passed around the Lake Reach of the ILP by opening the 18-inch ball valve, in the RWPS, and back-flowing through the pump station. The valving has been sized to accommodate a flow of 30 cfs. However, the operation of the ball valve will require a minimum downstream backpressure in order to keep the valve from cavitation. This downstream backpressure should be achievable since the minimum values of the downstream HGLs are less than the normal operating range of WSLs in Irvine Lake (750' to 790'). The following Table 3.2 shows the minimum HGLs in the ILP needed, at the Raw Water Pump Station, to preclude cavitation. These values are below the expected HGLs in the ILP which will be controlled by the WSL in Irvine Lake as well as downstream takeouts.

Table 3.2 Operational Scheme – Baker to Irvine Lake Pipeline

Operating Condition	HGL	
	Baker P/L	Minimum Req'd in ILP
Max HGL in Santiago Lateral (Filling Irvine Lake at Flow Rate = 100 cfs)	872	749
Normal Maximum Operating HGL in Baker (No Flow to Irvine Lake)	832	725
Normal Operating HGL in Baker (Max Flow in Baker - No Flow to Irvine Lake)	815	714

Gravity Transfer – Irvine Lake Pipeline to Baker Pipeline

Under conditions when the Baker WTP plant requires raw water deliveries from Irvine Lake, that are on the order of 39 cfs, or less, flow to the plant can be achieved without pumping. That is, when the lake is at its minimum operational WSL of 750', about 16 cfs can be delivered by opening the 18-inch ball valve in the pump station and allowing flow to bypass the pumps. Also at the high WSL of 790' in the lake, about 39 cfs can be delivered to the plant without pumping. The above flow rates are based upon the assumption that there are no agricultural or TCWD demands.

When raw water is released from Irvine Lake into the ILP, flow can be delivered to the Baker WTP via the Baker Pipeline either by gravity or by pumping. (See Exhibit 3.8). Pumping will be necessary whenever the Baker WTP is supplied near normal operating capacities (i.e. in the range of 40 cfs). The conditions associated with these schemes are laid out in Table 3.1. Additional constraints associated with the Gravity Transfer – ILP to Baker P/L are as follows:

- Total flow through the Irvine Lake Pipeline equal to or less than 39 cfs, and the Irvine Lake WSL is 790'. Flow to Baker WTP in this scheme will depend on the simultaneous agriculture demands, and supplies to Serrano Water District and Trabuco Canyon Water District,

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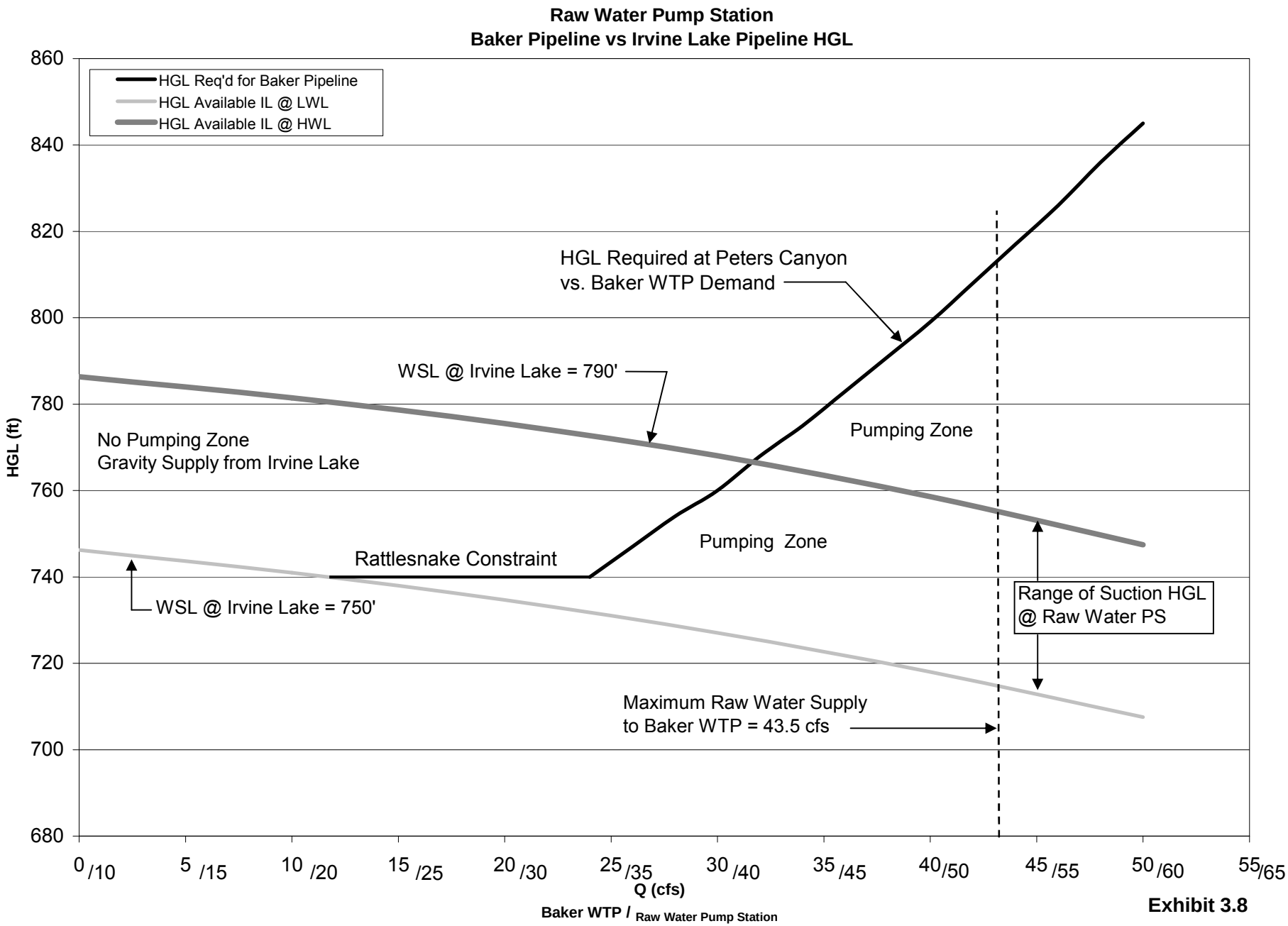

Raw Water Pump Station
Baker Pipeline vs Irvine Lake Pipeline HGL
HGL Req'd for Baker Pipeline
HGL Available IL @ LWL
HGL Available IL @ HWL
HGL (ft)
860
840
820
800
780
760
740
720
700
680
HGL Required at Peters Canyon
vs. Baker WTP Demand
WSL @ Irvine Lake = 790'
No Pumping Zone
Gravity Supply from Irvine Lake
Pumping Zone
Pumping Zone
Rattlesnake Constraint
WSL @ Irvine Lake = 750'
Range of Suction HGL
@ Raw Water PS
Maximum Raw Water Supply
to Baker WTP = 43.5 cfs
0 /10
5 /15
10 /20
15 /25
20 /30
25 /35
30 /40
35 /45
40 /50
45 /55
50 /60
55 /65
Q (cfs)
Baker WTP / Raw Water Pump Station

Exhibit 3.8

- Total flow through the Irvine Lake Pipeline between 33 cfs and 39 cfs, when the Irvine Lake WSL is between 750' and 790'. Again, flow to Baker WTP will be subject to the simultaneous demands of agriculture and other agencies.

- The Rattlesnake hill which is about one-third of the distance between the RWPS and the WTP will require a minimum HGL at the RWPS of 740 feet. This is referenced in Section 5 as the 'Rattlesnake Constraint'.

3.5.2 Pumping Conveyance

The Baker Raw Water Pump Station will pump Irvine Lake water, delivered to it through the ILP, through the Baker Pipeline to the Baker WTP, within the limits of the following constraints: Also, see Table 3.1.

- The Santiago Lateral is not being operated to fill Irvine Lake.
- WSL in the lake is greater than 740'.

The first constraint arises because the filling of Irvine Lake typically occurs at high flow rates. This results in an elevated HGL at OC-33 as well as an increase in the required discharge pressure at the Raw Water Pump Station, in the event that filling the lake and pumping from it should occur simultaneously. This is not a design condition for the RWPS since it will stretch the pumps beyond recommended operating limits.

The second constraint is based on the capacity limitations of the Irvine Lake Tower below the elevation of 740 ft, and because the release of Irvine Lake water with substantially heightened concentrations of manganese and iron occurring below this WSL, would be avoided.

General Baker P/L Operation

Since, under normal operating conditions, there are no institutional complications associated with withdrawals from Irvine Lake, the flow in the Baker Pipeline can be maintained or instantaneously modified as long as it is kept below the pipeline's maximum capacity. However, since the plant's instantaneous flow requirement may exceed the pipeline's capacity, the WSL in the forebay must be held within the band that defines its operational volume. In order to accomplish this, the flow control valve may be modulated based upon an assessment of the

forebay's high and low WSLs, and the flow measurement at the flow control facility.

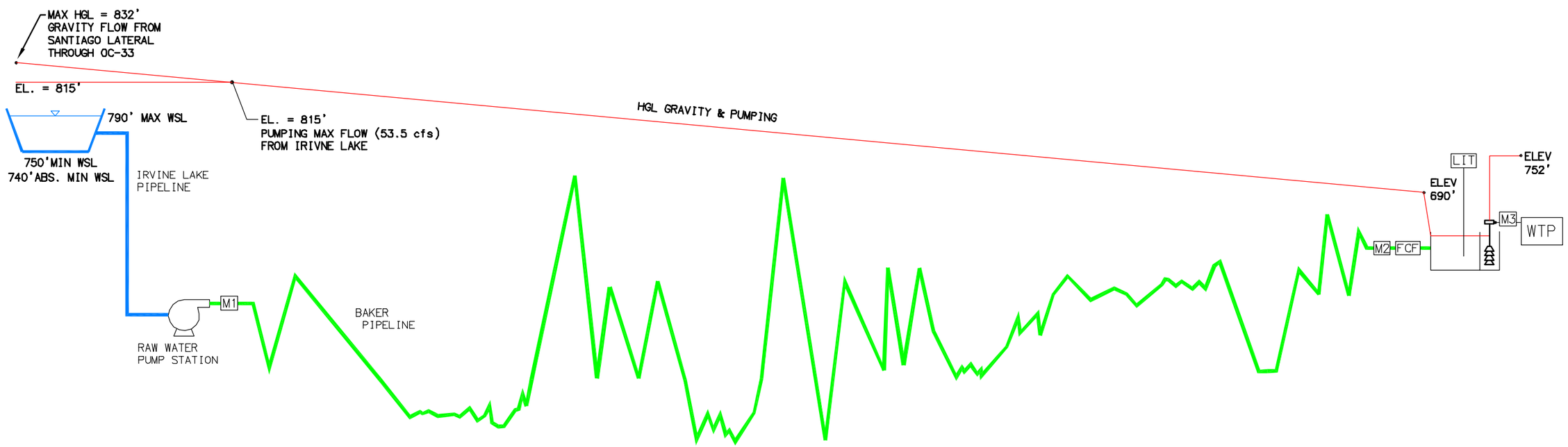
There are two operational schemes for the pumping of Irvine Lake water, which are described summarized in Table 3.1 and described below:

- Pumping - Normal Operation
- Pumping – Combined Baker P/L (gravity) and ILP (RWPS feed)

Pumping – Normal Operation

When pumping and delivering, only Irvine Lake water to the WTP, the Baker Raw Water Pump Station, will target a discharge HGL that will be a function of the system curve for the Baker P/L. Demands in the Baker P/L, downstream of the RWPS, for agriculture, Trabuco Canyon Water District and the WTP, will define the pump station's discharge. It is not envisioned that the pump station will be operated simultaneously with the filling of Irvine Lake, through Santiago Lateral and OC-13; this would raise the discharge HGL of the RWPS above the normal operational design point.

Calculation of the headloss through Irvine Lake Pipeline to the Raw Water Pump Station is provided in Table E1 of Appendix E.



SCHEMATIC OF RAW WATER CONVEYANCE SYSTEM

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Pumping – Combined Baker P/L (gravity) and ILP (RWPS feed)

It will be possible to combine flows from the Santiago Lateral, through OC-33 to the Baker Pipeline, with water from Irvine Lake. Under this operational scheme:

- there will be no flow to the lake (i.e. HGL at OC-33 </= 832')
- the flow from OC-33 will be constant
- variations in downstream demand will be met from Irvine Lake via the ILP and the RWPS

3.6 TREATMENT

Water will be conveyed through the treatment system by a combination of gravity flow and pumping. Exhibit 3.10 shows the hydraulic profile of the treatment plant.

3.7 PRODUCT WATER SYSTEM

The Product Water System includes the clearwell to store product water from Baker WTP, and the Product Water Pump Station to boost water into the Allen McColloch Pipeline.

3.7.1 Clearwell

The clearwell for the Baker WTP will be an existing 16 MG buried concrete reservoir, previously used as emergency storage for Zone 1 of the Los Alisos Water District system. A 42-inch pipeline will be constructed to deliver product water from the CT basin to the clearwell by gravity. The reservoir low and high water level elevations are 595 ft and 621 ft, respectively.

3.7.2 Product Water Pump Station

The Product Water Pump Station will be designed to pump a flow of 33 cfs from the clear well through a new 36-inch diameter pipeline to the Allen McColloch Pipeline.

3.7.3 Allen McColloch Pipeline

Product water delivery to El Toro Water District, Moulton Niguel Water District and Santa Margarita Water District will be through the AMP Pipeline. Trabuco Canyon Water District's plant capacity will be conveyed into the AMP. As TCWD does not currently own capacity in the AMP, a transfer of water with one of the other Project Stakeholders

will be established to provide TCWD its capacity. Product water will be delivered to the AMP at the connection constructed during the Baker Pipeline/AMP interconnect. Hydraulic grade in the AMP varies significantly by season, with a maximum HGL of 806 ft during periods low demand (wet season) to an absolute minimum HGL of 630 ft during periods of high demand (dry season).

3.8 PRODUCT WATER SYSTEM OPERATION

The product water system will deliver water by gravity or pumping as summarized:

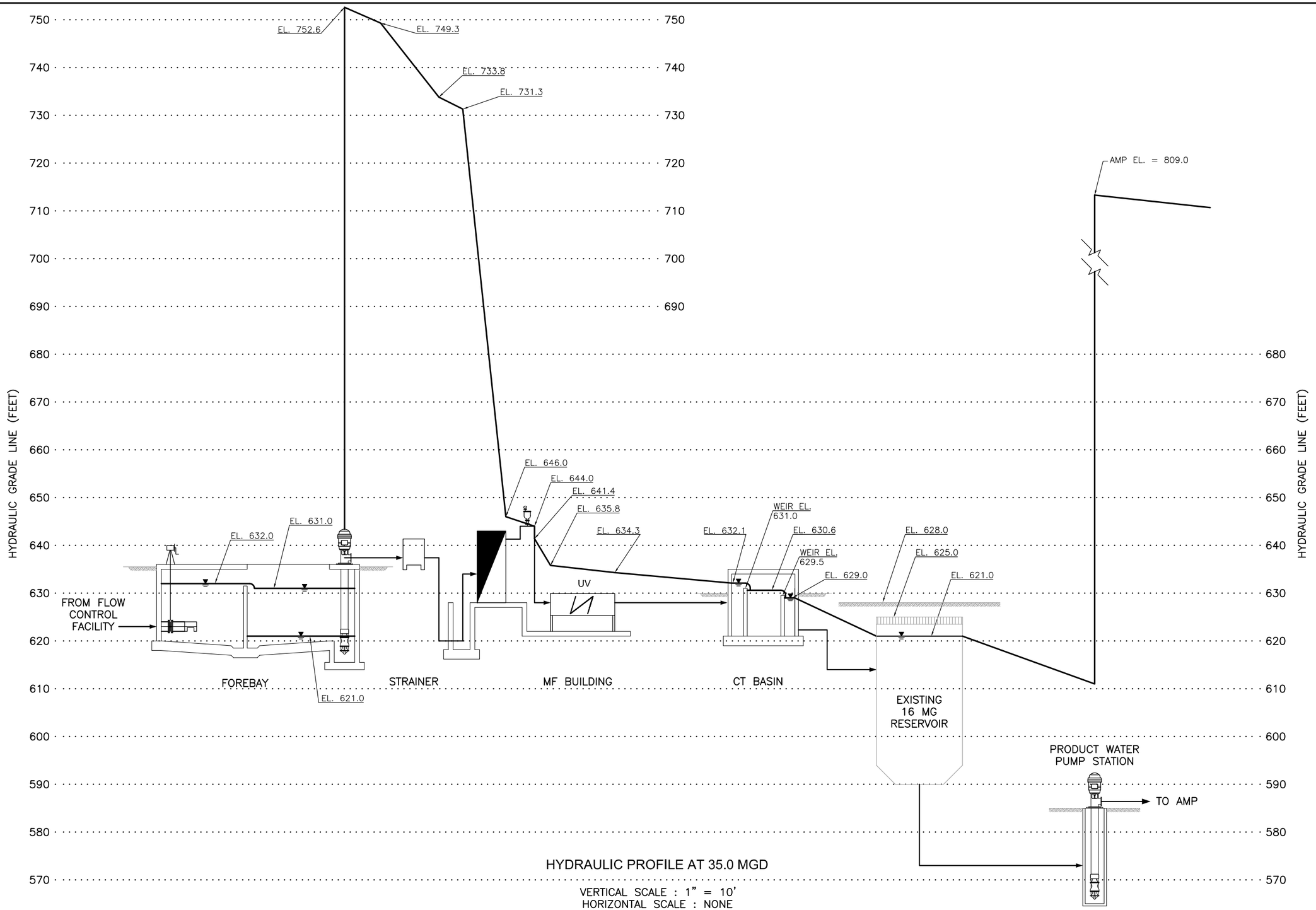
- Gravity Flow – from the clearwell to IRWD through the existing Zone 1 outlet pipeline to the reservoir.
- Pumped Flow – the pump station will be designed to pump from the clearwell to the AMP, accounting for the variable levels in the clearwell and HGL in the AMP.

3.9 HYDRAULICS

The overall Baker WTP project hydraulics are illustrated on Exhibit 3.11, noting the following:

Raw Water System

1. OC-33 turnout – HGL can range from 832 to 872 ft dependent on the flow in Santiago Lateral to Irvine Lake.
2. Raw Water Pump Station – discharge HGL of 815 ft, and design not based on pumping during the filling of Irvine Lake.
3. Topographic Constraint – the HGL in Baker Pipeline should be a minimum of 15 feet above the centerline elevation of the pipeline, and will be greater when Irvine Lake is being filled from the Santiago Lateral.
4. Flow Control Facility – this facility will control flow and break head of gravity flow from Baker Pipeline to the forebay. The estimated range of HGL on the upstream side of the facility is 690 to 730 ft. Downstream of the facility the HGL will be within a few feet of the water surface level in the forebay.
5. Feedwater Pump Station – this facility will boost water to an HGL determined by the membrane system manufacturer, currently estimated at 752 feet.



HYDRAULIC PROFILE AT 35.0 MGD

VERTICAL SCALE : 1" = 10'
HORIZONTAL SCALE : NONE

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IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

HYDRAULIC PROFILE MAIN PROCESS

EXHIBIT 3.10

6. Strainer – a strainer for protection of the membrane system will be located downstream of the feed water pump station, and will generate additional headloss anticipated to range from 0 to 16 ft, depending on feed water pump station discharge flow.

Treatment Plant

7. Membrane Filtration and UV – a total of 64 feet of headloss is accounted for across the filters and UV system.

8. CT Basin – this open basin was located such that adequate head is provided for gravity flow of product water to the clearwell.

Product Water System

9. Clearwell – the existing 16 MG reservoir operating range is considered to be 600 to 621 ft.

10. Product Water Pump Station – this pump station will boost water from the clearwell to the Allen McCulloch Pipeline, and account for headloss in the 36-inch diameter pipeline to the point of connection and valve / metering vault near the connection.

11. Allen McColloch Pipeline Connection – the HGL of the AMP is understood to vary from a minimum HGL of 630 ft, to a maximum of 806 ft.

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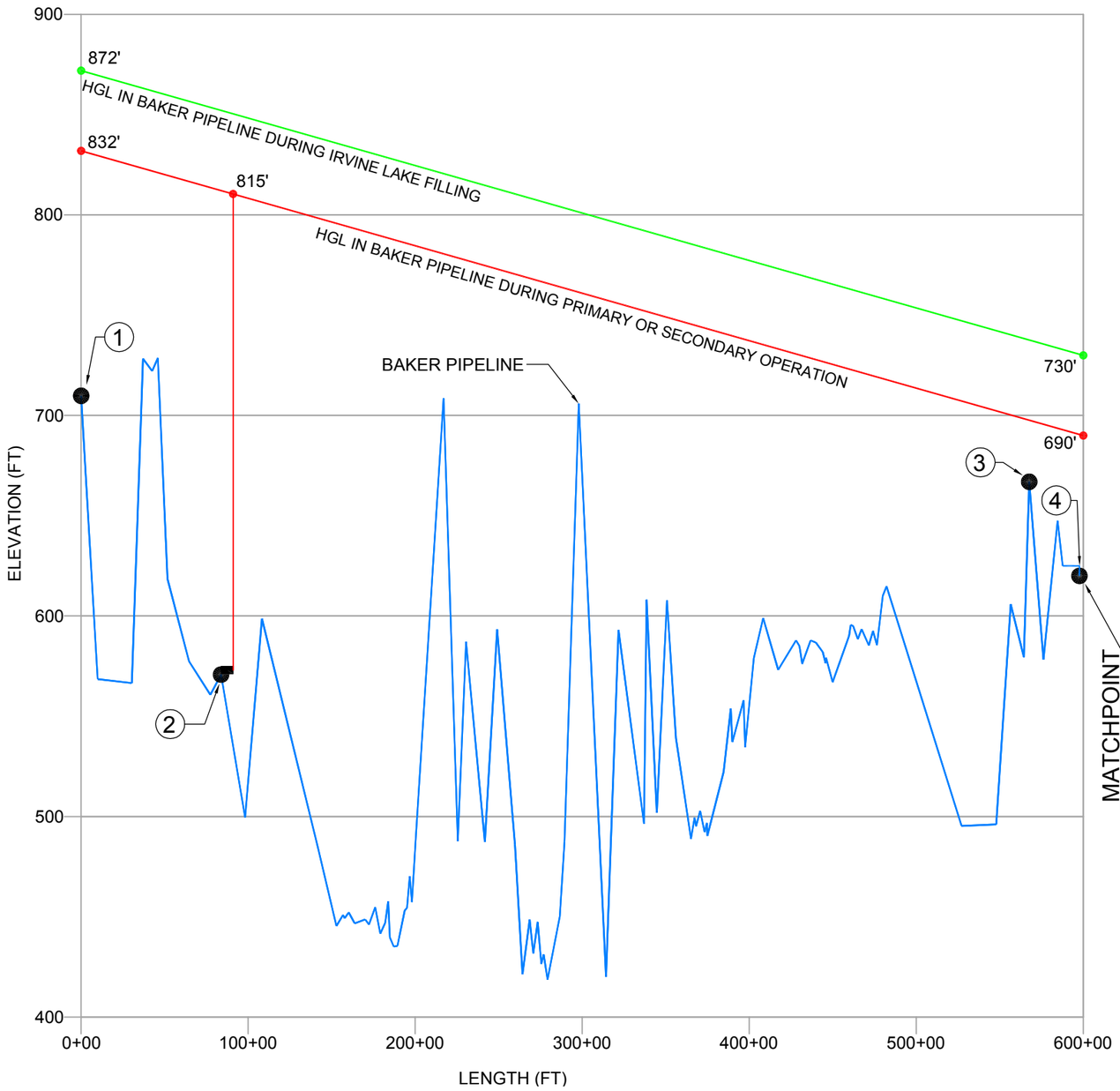

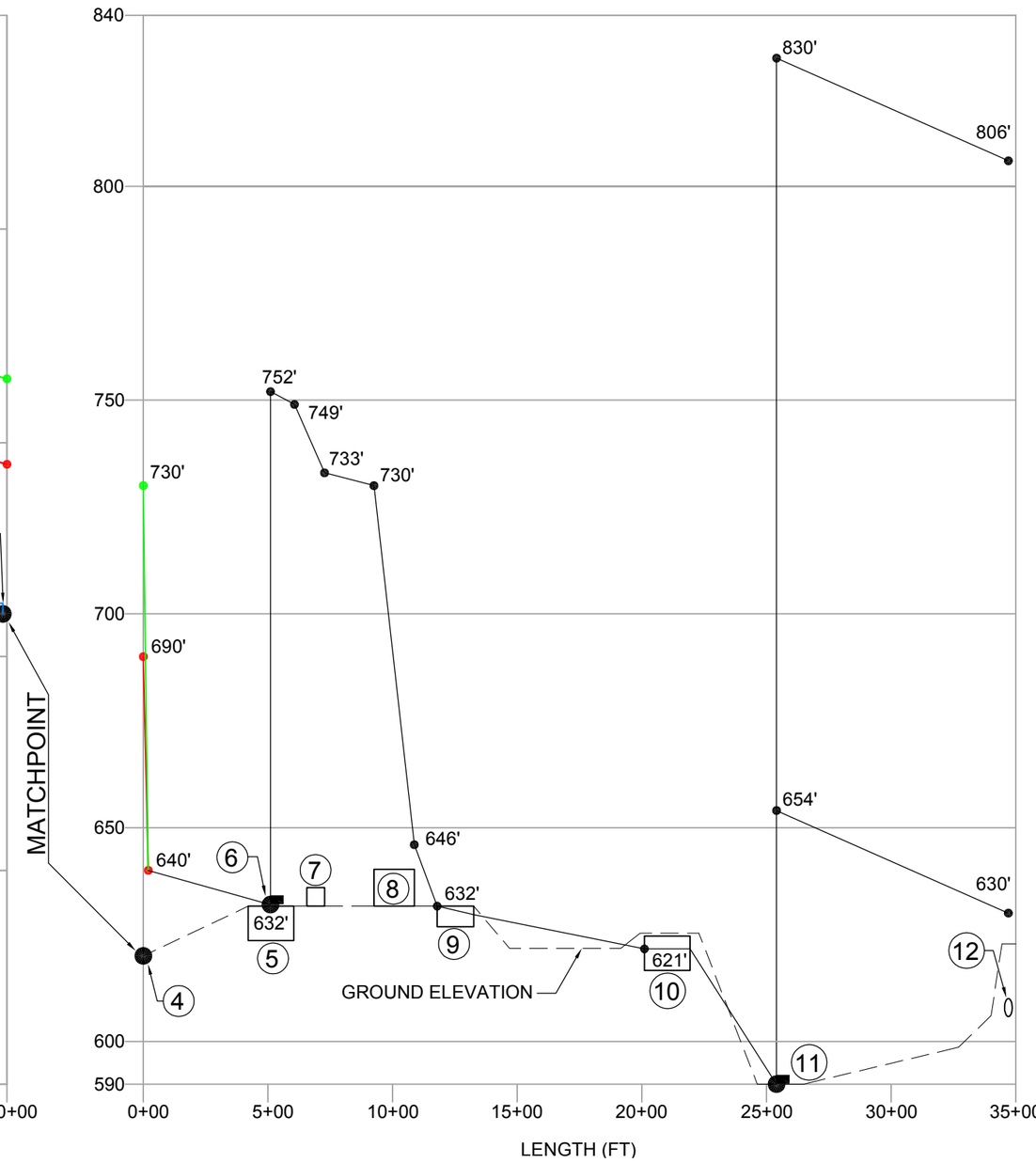

NO.	FACILITY	MAX. HGL (ft)	MIN. HGL (ft)	HGL GOVERNED BY
1	OC-33 TURN-OUT	872	832	SANTIAGO LATERAL TOWER
2	RAW WATER PUMP STA.	832	815	FLOW THRU OC-33
3	TOPO CONSTRAINT	737	697	BAKER P/L HGL
4	FLOW CONTROL FAC.	690 - 730	640	BAKER P/L HGL
5	FOREBAY	632	621	PLANT OPERATION
6	FEEDWATER PUMP STA.	752	-	HGL GOVERNED BY
7	STRAINER	749	733	FWPS HGL
8	MF / UV	731	646	PMF MANUF. DESIGN

NO.	FACILITY	MAX. HGL (ft)	MIN. HGL (ft)	HGL GOVERNED BY
9	CT BASIN	632	631	FIXED
10	CLEARWELL	621	600	PLANT OPERATION
11	PRODUCT WATER PS	830-654	-	AMP HGL
12	AMP CONNECTION	806	630	AMP DEMANDS

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IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

BAKER PROJECT
HYDRAULIC PROFILE

EXHIBIT 3.11

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SECTION 4 OC-33 Turnout

4.1 OVERVIEW

The OC-33 turnout is an existing in-line metering facility off of the Santiago Lateral. Its function is to measure flows that pass from the Santiago Lateral to the Baker Pipeline. Capacity of the turn-out is limited by the maximum flow measurement of the installed meter. This section addresses flow capacity and required modification of the OC-33 turn-out, prior to and after the start up of the Baker WTP.

4.2 CAPACITY

The OC-33 turn-out capacity under prior, current and future conditions is explained as:

4.2.1 Prior Capacity

The OC-33 turn-out was constructed with a flow meter (Venturi type) capable of measurement up to 100 cfs (for construction plans, refer to Appendix D). A combination of agricultural demand and supply to water treatment plants in southern Orange County dictated the range of flow measurement necessary.

4.2.2 Current Capacity

Raw water supply to Los Alisos Water District and El Toro Water District, through the Baker Pipeline, declined in the late 1970s and 1980s due to residential development and the decommissioning of the Baker Filter Plant. Eventually, the flow rate through OC-33 dropped to approximately 15-percent of maximum flow. In 1989, the flow meter was replaced with a new meter (Venturi type) capable of more accurately measuring lower flows and limited to 40 cfs.

4.2.3 Future Capacity

Operation of the Baker WTP will increase the normal flow through the OC-33 turn-out to Baker Pipeline. The allocated water rights per the current Baker Pipeline Agreement (held between Santiago Aqueduct Commission and each agency) total to 104.9 cfs in Reach 1.

The Project Stakeholders plan to reallocate the water rights in the Baker Pipeline with the Baker WTP Project. The water rights will be revised (per Table 4.1) to 99 cfs in Reach 1, and include capacity for:

- Baker Water Treatment Plant - held by IRWD, MNWD, SMWD, ETWD, TCWD.
- Agriculture Use - capacity for agriculture users in the area of Orchard Hills and North Irvine area.
- Trabuco Canyon Water District –Six (6) cfs capacity in Baker Pipeline for supply to the Dimension Plant.
- Irvine Ranch Water District –Thirty two (32) cfs capacity for transfer of water through Reach 1 of the Baker Pipeline to the Irvine Lake Pipeline when the Irvine Lake Reach (of the ILP) requires maintenance.
- Other Baker Pipeline Water Rights Holders – agencies or entities with water rights to Baker Pipeline that are not participating in the Baker WTP project (including the County of Orange, East Orange County Water District and The Irvine Company).

Table 4.1 Maximum OC-33 Flow Rate

Capacity Rights of	Flow (cfs)
Baker Water Treatment Plant	43.5
Agriculture Use	4.0
Trabuco Canyon Water District	6.0
Irvine Ranch Water District	32.0
Other Baker Pipeline Water Rights Holders	13.5
Total	99.0

4.3 MODIFICATION

The existing flow meter is limited to measurement of 40 cfs. Therefore, the existing meter will be removed and replaced with a Venturi or Mag type flow meter (at MWD's direction) capable of measuring up to 100 cfs. Coordination with MWD has been initiated, and regularly scheduled meetings are planned to continue discussion between MWD and IRWD through final design. Further discussion of MWD coordination is provided in Section 24.

SECTION 5 RAW WATER PUMP STATION

5.1 OVERVIEW

The Baker Raw Water Pump Station (RWPS) will enable supply of raw water from Irvine Lake to the Baker Water Treatment Plant. This section describes the basis for design and operation of the pump station, covering the following topics:

- Capacity – basis for the design capacity of the pump station
- Hydraulics – pump station specific hydraulic calculations and analysis
- Site Development – location of the pump station, site access, demolition, earthwork, drainage, easements and geotechnical conditions
- Design Criteria – summary of design parameters
    - Pump
    - Surge
    - Mechanical
    - Structural
    - Geotechnical
    - Operation

5.2 Capacity

The capacity of the pump station includes delivery of raw water for the Baker WTP, the Trabuco Canyon Water District filtration plant, and agriculture demands. These flows are shown in Table 5.1.

Table 5.1 RWPS Capacity

Demand Point	Flow (cfs)
Baker WTP	43.5
Trabuco Canyon Water District – Dimension WTP	6.0
Agricultural Use	4.0
TOTAL	**53.5**

Three agencies (East Orange County Water District, The Irvine Company and the County of Orange), which are not Baker WTP stakeholders, have capacity rights totaling 13.5 cfs in Reach 1 of the Baker Pipeline. It is assumed these agencies will continue with their allocated rights in the Baker Pipeline and may receive water from Reach 1, during operation of the Baker WTP. These flows are considered to be separate from water supplied to the Baker Pipeline through the Baker Raw Water Pump Station, and therefore are not included in the pump station capacity.

5.3 Hydraulics

Hydraulic calculations to estimate the range of suction and discharge pressures for the RWPS are provided in Table E1 of Appendix E. The range of suction pressures accounts for minor and frictional losses through the Irvine Lake Pipeline. The range of discharge pressures is based on the minimum discharge HGL necessary to maintain a minimum head of 15 feet over the high points in the Baker Pipeline.

A summary of the primary calculation values is provided as Table 5.2.

Table 5.2 RWPS Hydraulics

Description	Parameter
Hydraulics (Suction)	
Water Level in Irvine Lake	750 - 790 ft
Maximum Flow	70 cfs
Headloss thru IL outlet tower and Irvine Lake Pipeline	0 - 57 ft
Minimum HGL at Raw Water Pump Station	708 ft
Hydraulics (Discharge)	
Discharge HGL in Baker Pipeline	815 ft
Maximum Flow	53.5 cfs

The 100% and 70% speed curves, for a representative pump (Johnston 27 CC) and for lake levels of 750 ft and 790 ft, are shown in Exhibit 5.1. The curves represent two-pumps operating with one standby. The condition with one pump operating is not shown since the HGL at which water is delivered to the RWPS is generally above the system curve for lower flows, and gravity flow is possible.

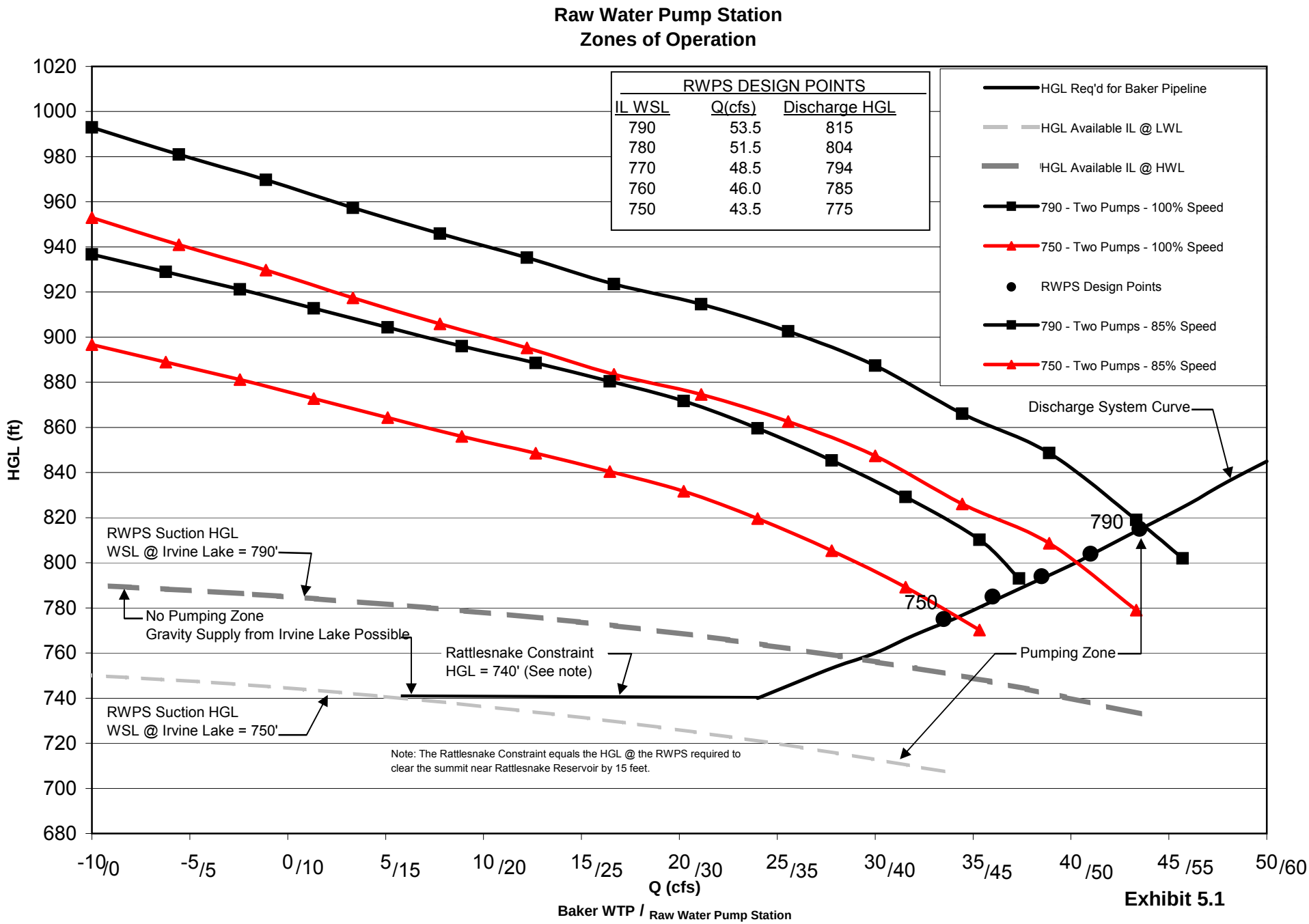
Raw Water Pump Station
Zones of Operation
RWPS DESIGN POINTS
IL WSL Q(cfs) Discharge HGL
790 53.5 815
780 51.5 804
770 48.5 794
760 46.0 785
750 43.5 775
HGL Req'd for Baker Pipeline
HGL Available IL @ LWL
HGL Available IL @ HWL
790 - Two Pumps - 100% Speed
750 - Two Pumps - 100% Speed
RWPS Design Points
790 - Two Pumps - 85% Speed
750 - Two Pumps - 85% Speed
Discharge System Curve
790
750
RWPS Suction HGL
WSL @ Irvine Lake = 790'
No Pumping Zone
Gravity Supply from Irvine Lake Possible
Rattlesnake Constraint
HGL = 740' (See note)
Pumping Zone
RWPS Suction HGL
WSL @ Irvine Lake = 750'
Note: The Rattlesnake Constraint equals the HGL @ the RWPS required to clear the summit near Rattlesnake Reservoir by 15 feet.
HGL (ft)
1020 1000 980 960 940 920 900 880 860 840 820 800 780 760 740 720 700 680
-10/0 -5/5 0/10 5/15 10/20 15/25 20/30 25/35 30/40 35/45 40/50 45/55 50/60
Q (cfs)
Baker WTP / Raw Water Pump Station

Exhibit 5.1

Separate design points were calculated for each ten feet of lake level from 790 ft to 750 ft. The development of these values is shown in Table E1 of Appendix E. They reflect a reduction in flow through the ILP and the Baker Pipeline as a function of declining water surface level in Irvine Lake. The reduction of flow was made in order to achieve pumping conditions, over the 40-foot range in Irvine Lake WSLs, which would parallel the system curve and thereby fix the power requirements required for the maximum outlet tower flow rate (70 cfs) at the highest lake level (790'). The horsepower required to pump from this lake level at 53.5 cfs is approximately the same as that required to pump from a WSL of 750 ft at 43.5 cfs. In order to maintain the same discharge rate over the entire range of declining lake levels the pump station horsepower would have to increase from 750 to 1,000 HP.

This approach to sizing the RWPS was taken since the possible range of flow through the ILP and the Baker Pipeline has not been finalized to the extent that discrete design points are available. Although it is believed that the demands underlying the pumping rates are reasonable, this is a matter that must be addressed further in final design, including coordination amongst the Project Stakeholders.

5.4 SITE DEVELOPMENT

The Baker Raw Water Pump Station will be constructed at the "Peters Canyon" site which is owned by the Santiago Aqueduct Commission (SAC). The site is located in the City of Orange, between the Peters Canyon Reservoir and Jamboree Road. The pump station will be constructed within the SAC parcel, but will require construction easements with the County of Orange and Metropolitan Water District (see **Drawing C3**). Currently, two buildings exist at the site:

- Irvine Lake Pipeline / Baker Pipeline Flow Control Facility – operated by IRWD
- Municipal Water District of Orange County and East Orange County Water District Flow Control Facility – operated by MWD

Crossing the site are the Irvine Lake Pipeline, Baker Pipeline and Allen McColloch Pipeline. The IRWD flow control facility is used for routine transfer of water from the Baker Pipeline to the Irvine Lake Pipeline.

5.4.1 Site Access

Site access consists of a unpaved roadway off of Jamboree Road. A swing gate is located along the roadway allowing access of authorized vehicles only. Asphalt pavement exists along a portion of the site access road closer to the buildings and in the area designated for parking.

5.4.2 Demolition

The Irvine Lake Pipeline / Baker Pipeline Flow Control Facility will be demolished in order to accommodate construction of the Baker Raw Water Pump Station.

5.4.2.1 Description

The pump station construction will occur on SAC, MWD and County of Orange owned land, requiring the demolition of the existing flow control facility and earthwork to prepare a level pad for the building. Site demolition will consist of demolition and removal of:

- ILP / Baker Flow Control Building
- Asphalt Pavement
- Electrical Meter / Switchboard
- Chainlink Fence
- Portions of pipeline connected to the Irvine Lake Pipeline and Baker Pipeline.

Exhibit 5.2 (Drawing D2) depicts the existing building, pipelines and area of demolition and land ownership at the site. The function of transferring water from the Baker Pipeline to the ILP will be temporarily discontinued with the demolition of the facility. Concurrent with the demolition work, two buried butterfly valves, at the connections to the Baker Pipeline and the ILP, will be refurbished, or removed and replaced.

5.4.2.2 Hazardous Materials

The possibility of hazardous materials (e.g. lead paint, asbestos) having been incorporated into the original construction will be investigated. If present, these materials will be removed by a specialty contractor prior to the general demolition.

5.4.3 Earthwork

The new pump station site may also need space reserved for a surge tank connected to the Irvine Lake Pipeline. The surge tank would be adjacent to the pump station building. Retaining walls would be constructed to extend the construction pad while minimizing the necessary earthwork prior to construction.

5.4.4 Drainage

Few changes to the existing drainage patterns will be required. The overall site is small in terms of stormwater development, thus there will be no major drainage control facilities incorporated into the construction.

Exhibit 5.3 (Drawing C3) shows the proposed site improvements associated with the construction of the Raw Water Pump Station.

5.5 Design Criteria

5.5.1 Pump

The pump design parameters are summarized in Table 5.3. The system curve and pump curves are depicted on Exhibit 5.1. Design is based on 70-percent speed as the lowest pump speed.

Table 5.3 RWPS - Pump Criteria

	Units	Value
Pump Station Design Capacity	CFS	53.5
Pumps Type: Vertical Turbine	-	-
No. of Pumps	NO.	3
No. of Redundant Pumps	NO.	1
Design Flow per Pump	GPM	12,000
TDH	FT of Water	105
Power	HP	450

5.5.2 Surge

Flow Science, Inc. prepared a surge analysis for the RWPS. The analysis considered surge conditions on the suction and discharge sides of the pump station.

No potentially damaging surge events, which would require the installation of a surge tank to protect the Baker Pipeline, are predicted for the discharge side of the pump station. However, the report recommends:

- the installation of vacuum relief valves at local high points Stations, 328+13, 164+85, 597+81, and 881+62 on the Baker Pipeline and,

- the construction of a constant-head-tank upstream of the WTP, in order to protect the plant from low pressures that could be produced as a result of a power failure at the RWPS (Note that the currently planned forebay will function as a constant-head-tank, with respect to the protection of the membranes).

The protection of the ILP, from transients caused by a power failure at the RWPS, will require one of the following:

- the construction of a 3,200 cu. ft. surge tank on the suction side of the Raw Water Pump Station or,

- the installation of an eight-inch diameter surge relief valve at ILP station 328+20.

During a complete power interruption, without one of these facilities, there would be an incursion into the ILP's safety margin for transient events. The surge tank would be more expensive to construct than the relief valve, although the latter would require the construction of approximately 1,500 feet of 8-inch diameter pipe. Alternatively the relief valve could be installed at Sta 214+00 where it would be able to discharge into an existing detention basin and require approximately 200 feet of 8-inch pipeline.

Analysis is on-going and will be continued into and through design to finalize the facilities necessary and in support of coordination with MWD. The conclusions provided herein are based on the Draft Report (November 2009), which has been provided to MWD for initial review.

5.5.3 Mechanical

The mechanical layout of the RWPS, illustrated on Exhibit 5.4 (Drawings M17 - Plan, M18 and M19 - Sections), encompasses the configuration of the pumps, valves, meter and surge tank associated with the design. The mechanical criteria associated with valving, meters and surge are summarized in Table 5.4.

Table 5.4 RWPS - Mechanical Criteria

Equipment	Count	Size	Description
Check Valves	3	30-inch	Silent Check
Butterfly Valves	3	30-inch	Manual – Gear Operator - Direct Burial
Butterfly Valves	3	30-inch	Manual – Gear Operator
Butterfly Valves	2	20-inch	Manual – Gear Operator
Butterfly Valves	2	12-inch	Manual – Gear Operator
Globe Valve	1	16-inch	Pressure Relief
Globe Valve	1	10-inch	Pressure Relief
Ball Valve	1	18-inch	Flow Control - MOV
Air Valves	3	6-inch	Combination Air Vac / Release
Air Valve	1	4-inch	Air Release
Air Valve	1	2-inch	Air Release
Meter	1	30-inch	Magnetic
Surge Tank	1	3500 cu. ft.	Hydropneumatic

5.5.4 Structural

The Raw Water Pump Station will be constructed as a masonry block building measuring approximately 30 ft by 60 ft. The new building will be constructed with slope retainment to the south to reduce the extent of grading into the existing slope. In addition, the planned area for the surge tank requires a retaining wall, as shown in Exhibit 5.3 (**Drawing C3**).

5.5.5 Geotechnical

A geotechnical investigation, including borings and soil data logging, will be completed with the design of the Raw Water Pump Station.

5.5.6 Operation

The RWPS will be operated to convey Irvine Lake water to the Baker WTP in the event of an interruption in supply from the Santiago Lateral. When flow is reduced or stopped through OC-33, Irvine Lake can be used as a raw water source for the Baker WTP, either replacing or supplementing the MWD supply.

The modifications made at the Peters Canyon site will not affect the ability of the Baker Pipeline to be utilized as bypass pipeline in the event of future maintenance of the Allen McColloch Pipeline.

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SECTION 6 TRABUCO CANYON WATER DISTRICT PUMP STATION

6.1 BACKGROUND

Trabuco Canyon Water District receives raw water through the Baker Pipeline, which it treats at its Dimension Plant. Raw water is currently delivered to TCWD from the Baker Pipeline by way of a 12- / 16-inch pipeline. IRWD and TCWD operate the connection based on a minimum HGL of 720 ft, to provide a flow of up to 6 cfs at the minimum required pressure for the Dimension Plant.

Under the proposed project, the Baker Pipeline will be operated to deliver raw water flow of 43.5 cfs to the Baker WTP. In the event that all water rights are conveyed through Reach 1 of the Baker Pipeline, the HGL at the Baker WTP is estimated to be 690 feet. As a result, a pump station will be required to continue raw water delivery to the TCWD Dimension Plant.

This section describes the preliminary design concept and criteria for the TCWD Pump Station.

6.2 PUMP STATION

The TCWD Pump Station will be constructed to receive water from the Baker Pipeline and boost water to a minimum HGL of 720 ft for supply to TCWD's Dimension Plant. As currently considered the pump station will draw water from the main raw water pipeline to the Baker WTP Project, upstream of the flow control facility. A bypass pipeline will be provided to transfer water by gravity, similar to current conditions, when sufficient head exists. The pump station will be constructed along the access road situated between the Baker Pipeline valve vaults and Zone A Reservoirs. Design of the pump station will consist of three (3) pumps, with two as duty pumps, and one stand-by. All pumps will be constructed above ground and inside a block wall enclosure with a chainlink cage over the top for security.

6.3 CAPACITY

The pump station capacity of 6 cfs (2,700 gpm) equals the water rights currently held by TCWD in the Baker Pipeline. It is understood that TCWD operation of the Dimension Plant includes periods of backwash where rapid decreases of flow to the plant ranging from 1 to 3 cfs can occur.

6.4 HYDRAULICS / OPERATION

The HGL upstream of the TCWD Pump Station will vary with the hydraulic conditions in the Baker Pipeline. During normal operation of the Baker WTP, the HGL is estimated to drop below 720 ft, due to the existing water rights for agricultural demands in the upstream reaches of Baker Pipeline. When Irvine Lake is being filled from the Santiago Lateral the HGL into the Baker Pipeline will rise by approximately 40 ft. In this case, the HGL in Baker Pipeline will rise above 720 ft, allowing for flow to bypass the TCWD Pump Station directly to the Dimension Plant.

The TCWD Pump Station design must also account for the rapid variation of flow during backwashing of the media filters at the Dimension Plant. Two potential solutions are under consideration:

1. Relief Valve – a valve to release flow during the short periods of reduced flow through the Dimension Plant media filters.

2. Flow Equalization – an equalization basin between the TCWD Pump Station and Dimension Plant.

6.5 DESIGN CRITERIA

The hydraulic design criteria for the TCWD Pump Station are summarized in Table 6.1.

Table 6.1 TCWD Pump Station Design Criteria

Type:	Unit	Value
Type of Pump: Horizontal Split Case or Vertical Pumps	-	-
No. of Pumps (Duty and Redundant)	NO.	3
No. of Redundant Pumps	NO.	1
Capacity per Pump	GPM	1,350
TDH (Maximum)	FT of Water	60
Size	HP	25
Mechanical	-	-
Upstream Pipeline Diameter	IN	12
Inlet Pipeline	IN	12
Discharge Pipeline	IN	12
Isolation Valves	IN	12
Downstream Pipeline Diameter	IN	16

SECTION 7 FLOW CONTROL FACILITY

7.1 OVERVIEW

The flow control facility at the Baker Water Treatment Plant will control flows originating either from the Santiago Lateral through OC-33 or from Irvine Lake via the Baker Raw Water Pump Station. In each case, the facility will handle flows up to the maximum capacity of the Baker Pipeline, less takeouts for agricultural interests and TCWD. These takeouts represent about twenty percent of the total pipeline capacity, but are withdrawn from the pipeline upstream of the facility.

7.2 HYDRAULICS AND OPERATION

The Baker Water Treatment Plant has been sized to treat a raw water flow of about 43.5 cfs (28 mgd). Exhibit 7.1 shows the upstream HGL at the facility, as a function of the flow rate delivered through the Baker Pipeline to the facility. The downstream HGL required to deliver the flow to the forebay is represented by the lower curve. The HGL at the entrance to the facility will be reduced, by the flow control valve, to an HGL sufficient to supply the forebay, with the WTP's raw water demand.

Both ball valves and sleeve valves were analyzed in order to determine their suitability as flow control valves. Butterfly and gate valves were summarily eliminated because of their inability to operate, without cavitating, where there is little outlet pressure. In this case, the only available pressure downstream of the flow control facility is that required to convey the raw water to the forebay, a vertical distance of less than 20 feet. Two ball valve configurations were considered:

- Parallel trains: 12-inch ball valves and static sleeve valves (Table 7.1)
- Single train:18-inch ball valve—16-inch static sleeve valve (Table 7.2)

Neither of these configurations proved to be workable over a sufficient range of flow conditions, tending to cavitate at low flows, while at higher flows the valves approached full-open and could not be expected to effectively modulate flows.

An 18-inch angle-pattern sleeve valves will be capable of operating over the full range of flows without cavitating (see Table 7.3). Exhibit 7.2 (see **Drawing M1**) depicts the proposed flow control facility with two sleeve valves for redundancy. Dependent on the potential for quagga mussel in the Irvine Lake Pipeline and Baker Pipeline, strainers upstream of the flow control facility may be necessary.

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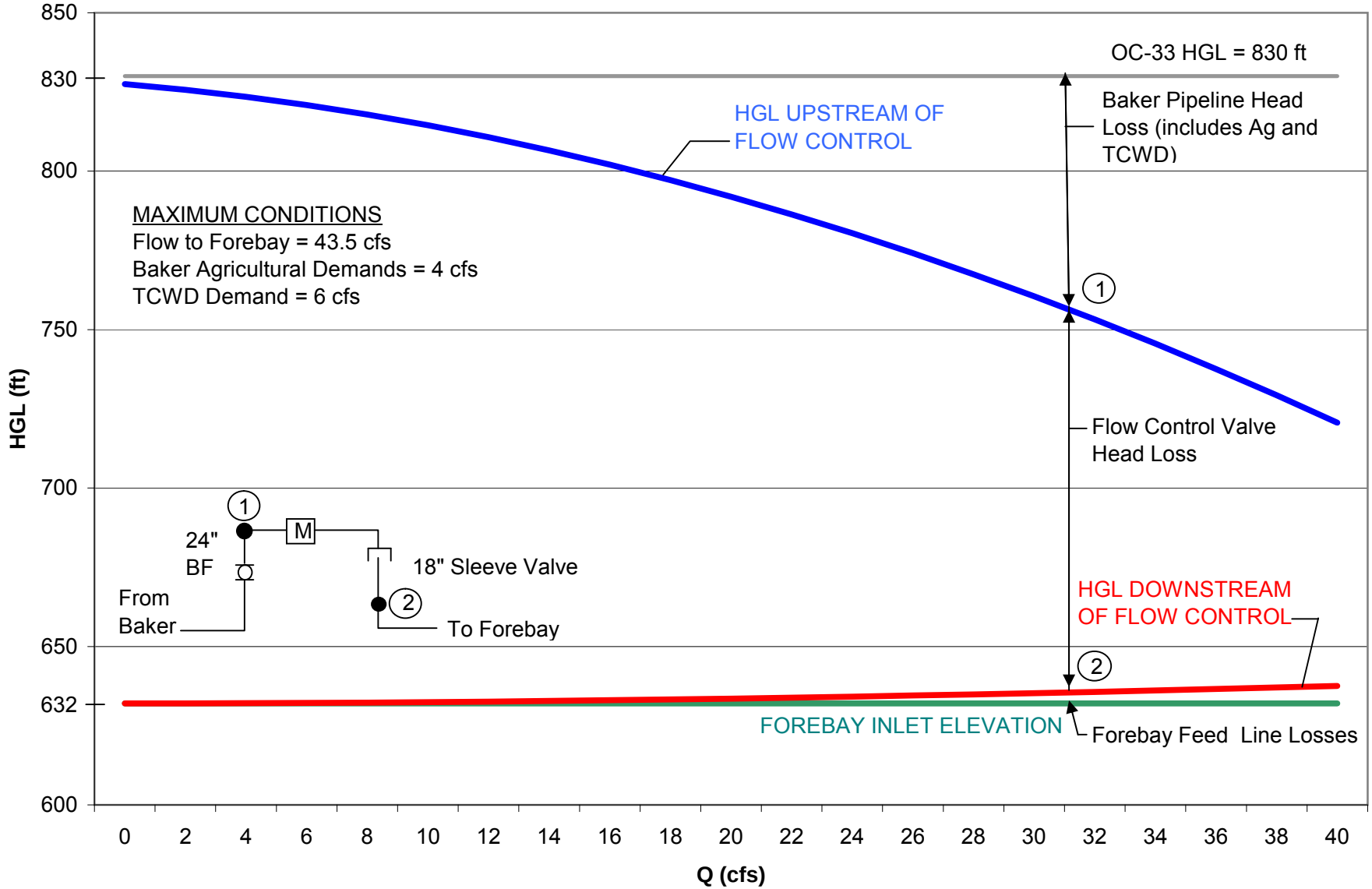
Exhibit 7.1
Flow Control Valve



Flow to WTP Forebay (43.5 cfs Max.)

TABLE 7.1
BAKER WATER TREATMENT PLANT
FLOW CONTROL FACILITY - CAVITATION ANALYSIS
Two Parallel 12-inch Ball Valves and Static Sleeve Valves

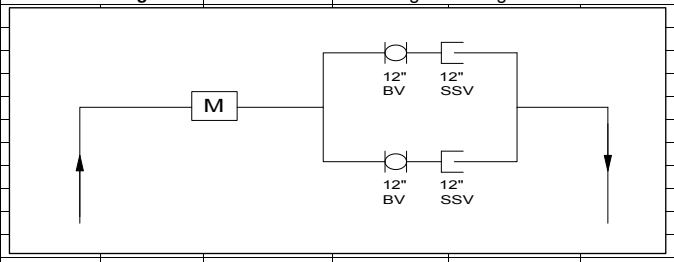
Raw Water Flow to WTP (CFS)	Flow Through Each Parallel Valve (CFS)	Valve Elevation (Feet)	HGL (Feet) --12-INCH BALL VALVE		HGL (Feet) --12-INCH STATIC SLEEVE VALVE		BALL VALVE									
							Head (Feet)			Ball Valve						
			Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Difference Across Valve	Cavitation Parameter	Valve Diameter (Inches)	Velocity (FPS)	C_v gpm/√psi	C_v cfs/√ft	% of Full Open C_v	Valve Angle (Degrees)
0	0.0	618	830	632	632	632	212	14	198	0.24	12	0.0	0	0.0	0.0	0
5	2.5	618	822	633	633	632	204	15	189	0.25	12	3.2	247	0.4	1.2	13
10	5.0	618	814	635	635	632	196	17	179	0.28	12	6.4	508	0.7	2.4	25
15	7.5	618	804	639	639	633	186	21	166	0.32	12	9.6	793	1.2	3.8	35
20	10.0	618	792	644	644	634	174	26	148	0.40	12	12.7	1119	1.6	5.3	42
25	12.5	618	777	651	651	634	159	33	126	0.52	12	15.9	1512	2.2	7.2	50
30	15.0	618	761	659	659	636	143	41	101	0.73	12	19.1	2027	3.0	9.7	57
35	17.5	618	742	669	669	637	124	51	73	1.16	12	22.3	2794	4.1	13.3	63
40	20.0	618	721	680	680	638	103	62	40	2.36	12	25.5	4284	6.3	20.4	72
45	22.5	618	698	693	693	640	80	75	5	23.88	12	28.7	14388	21.1	68.5	84

Valve Angle (Degrees)	% of Full Open C_v	Ball Valve Diameter (Inches)	C_v gpm/√psi	C_v cfs/√ft
5	0.2			
10	0.9	12	21003	30.8
15	1.4			
20	1.8			
25	2.4			
30	3.1			
35	3.7			
40	4.7			
45	5.9			
50	7.2			
55	9.0			
60	11.2			
65	14.1			
70	18.0			
75	24.5			
80	41.5			
85	73.0			
90	100.0			

Acceptable Design Limits

- Cavitation Parameter > 1.50
- Velocity - Ball Valve < 30 fps
- Velocity - Butterfly Valve < 16 fps
- Velocity - Pipe/CML < 20 fps
- Velocity - Pipe/Fusion Bonded Epoxy Lining < 30 fps
- Valve Angle - 15 degrees minimum
- Valve Angle - 75 degrees maximum

Schematic Diagram



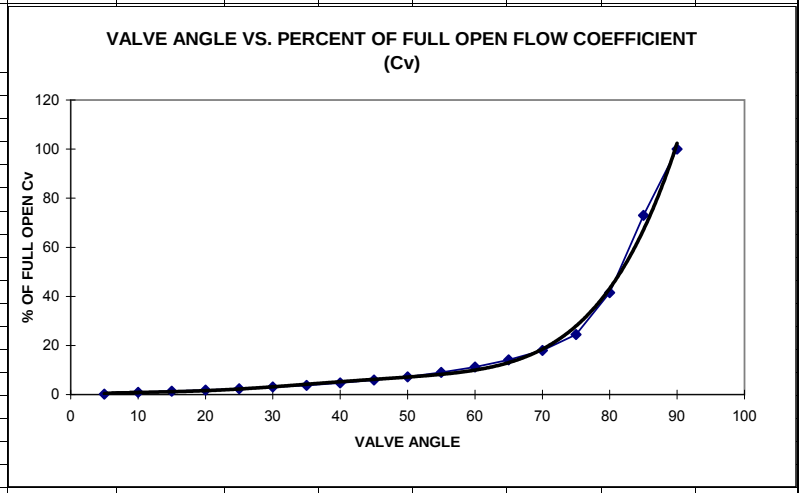
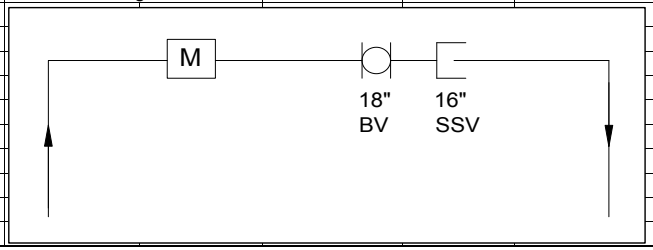


TABLE 7.2
BAKER WATER TREATMENT PLANT
FLOW CONTROL FACILITY - CAVITATION ANALYSIS
18-inch Ball Valve and 16-inch Static Sleeve Valve

Raw Water Flow to WTP (CFS)	Valve Elevation (Feet)	HGL (Feet) --18-INCH BALL VALVE		HGL (Feet) --16-INCH STATIC SLEEVE VALVE		BALL VALVE									
						Head (Feet)			Ball Valve						
		Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Difference Across Valve	Cavitation Parameter	Valve Diameter (Inches)	Velocity (FPS)	C_v gpm/√psi	C_v cfs/√ft	% of Full Open C_v	Valve Angle (Degrees)
0	618	830	632	632	632	212	14	198	0.24	18	0.0	0	0	0.0	0
5	618	822	633	633	632	204	15	190	0.25	18	2.8	247	0	0.5	7
10	618	814	635	635	632	196	17	180	0.28	18	5.7	507	1	1.1	12
15	618	804	638	638	633	186	20	166	0.32	18	8.5	791	1	1.7	19
20	618	792	643	643	634	174	25	149	0.39	18	11.3	1115	2	2.4	25
25	618	777	649	649	634	159	31	128	0.50	18	14.2	1502	2	3.2	31
30	618	761	657	657	636	143	39	104	0.69	18	17.0	2002	3	4.2	38
35	618	742	665	665	637	124	47	76	1.06	18	19.8	2728	4	5.8	45
40	618	721	676	676	638	103	58	45	2.02	18	22.6	4058	6	8.6	54
45	618	698	687	687	640	80	69	10	9.89	18	25.5	9517	14	20.1	72

Valve Angle (Degrees)	% of Full Open C_v	% of Full Open C_v	Valve Diameter (Inches)	C_v gpm/√psi	C_v cfs/√ft
5	0.2	0.2			
10	0.9	0.9	18	47256	69.3
15	1.4	1.4			
20	1.8	1.8	**Acceptable Design Limits**		
25	2.4	2.4	Cavitation Parameter > 1.50		
30	3.1	3.1	Velocity - Ball Valve < 30 fps		
35	3.7	3.7	Velocity - Butterfly Valve < 16 fps		
40	4.7	4.7	Velocity - Pipe/CML < 20 fps		
45	5.9	5.9	Velocity - Pipe/Fusion Bonded Epoxy Lining < 30 fps		
50	7.2	7.2	Valve Angle - 15 degrees minimum		
55	9.0	9.0	Valve Angle - 75 degrees maximum		
60	11.2	11.2			
65	14.1	14.1	Schematic Diagram		
70	18.0	18.0			
75	24.5	24.5			
80	41.5	41.5			
85	73.0	73.0			
90	100.0	100.0			



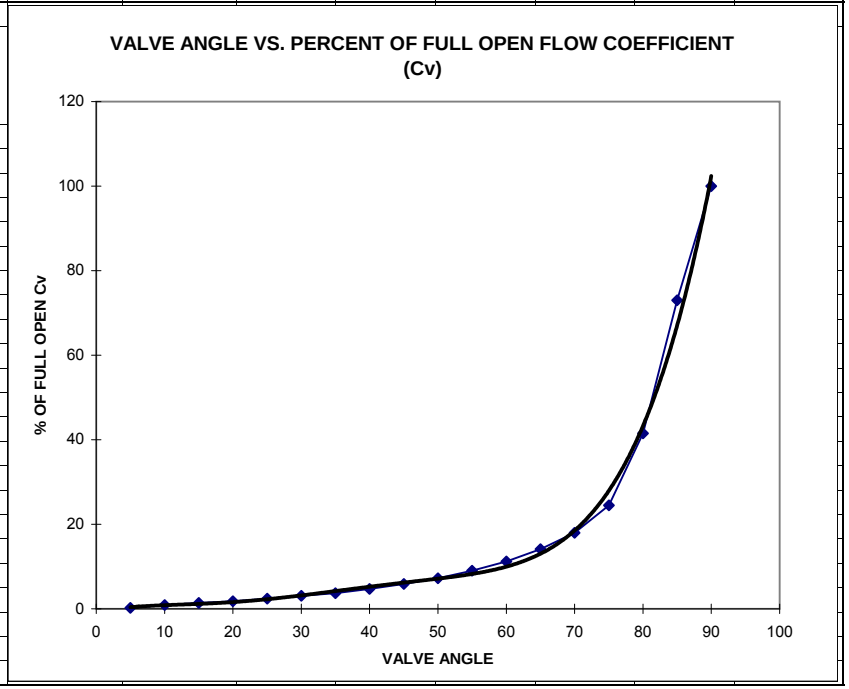


TABLE 7.3
BAKER WATER TREATMENT PLANT
FLOW CONTROL FACILITY - CAVITATION ANALYSIS
18-inch Angle Pattern Sleeve Valve

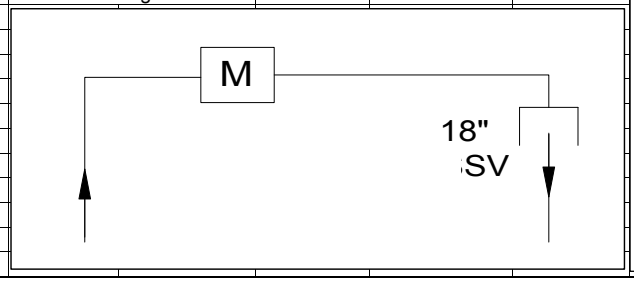
Raw Water Flow to WTP (CFS)	Valve Elevation (Feet)	HGL (Feet) --18-INCH SLEEVE VALVE		SLEEVE VALVE									
				Head (Feet)			Sleeve Valve						
		Upstream	Downstream	Upstream	Downstream	Difference Across Valve	Cavitation Parameter	Valve Diameter (Inches)	Velocity (FPS)	C_v gpm/√psi	C_v cfs/√ft	% of Full Open C_v	Stroke %
0	618	830	632	212	14	198	0.24	18	0.0	0	0.0	0.0	0
5	618	822	632	204	14	190	0.25	18	2.8	247	0.4	3.7	2
10	618	814	632	196	14	182	0.26	18	5.7	504	0.7	7.5	4
15	618	804	633	186	15	171	0.28	18	8.5	779	1.1	11.7	6
20	618	792	634	174	16	158	0.31	18	11.3	1081	1.6	16.2	8
25	618	777	634	159	16	143	0.35	18	14.2	1423	2.1	21.3	11
30	618	761	636	143	18	125	0.41	18	17.0	1826	2.7	27.3	15
35	618	742	637	124	19	105	0.50	18	19.8	2327	3.4	34.8	20
40	618	721	638	103	20	82	0.65	18	22.6	3000	4.4	44.9	27
45	618	698	640	80	22	58	0.96	18	25.5	4035	5.9	60.3	41

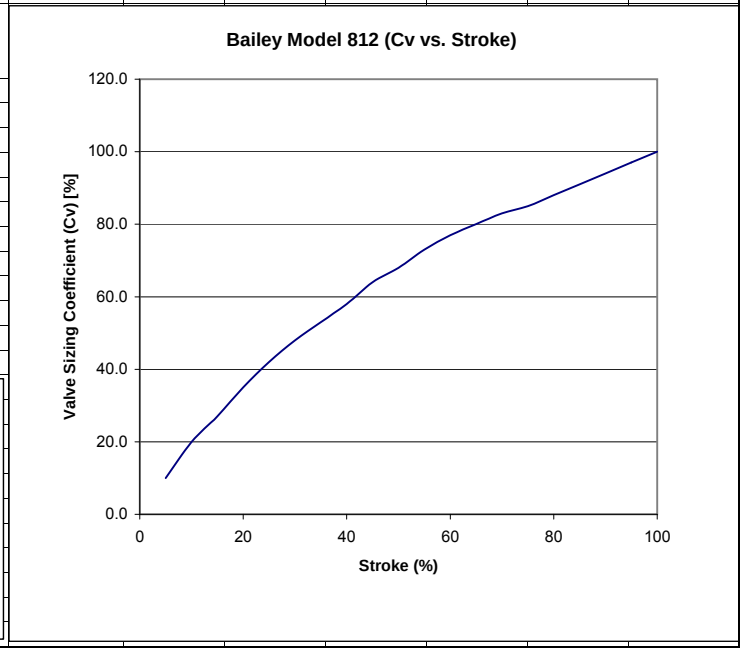
Stroke %	% of Full Open C_v	Valve Diameter (Inches)	C_v Bailey Model 812 gpm/√psi	C_v Bailey Model 812 cfs/√ft
5	10.0	18	6689	9.8
10	20.0			
15	27.0			
20	35.0			
25	42.0			
30	48.0			
35	53.0			
40	58.0			
45	64.0			
50	68.0			
55	73.0			
60	77.0			
65	80.0			
70	83.0			
75	85.0			
80	88.0			
85	91.0			
90	94.0			
95	97.0			
100	100.0			

Acceptable Design Limits

Cavitation Parameter - No minimum
Velocity - Sleeve Valve < 30 fps
Velocity - Butterfly Valve < 16 fps
Velocity - Pipe/CML < 20 fps
Velocity - Pipe/Fusion Bonded Epoxy Lining < 30 fps
Stroke - No Min - No Max

Schematic Diagram





7.3 SITE IMPROVEMENTS

Several factors influenced the location of the flow control facility.

- Lower elevation of the flow control valve allows greater back pressure on the valve and the less potential for cavitation.
- The lower elevation eliminates the need for a vault of about 15 feet of depth.
- An additional advantage of the location is that it provides for a longer raw water pipeline, which equates to greater chlorine dioxide contact time.

The flow control facility will be located along the access road to the Baker site, and northeast of the existing connection to the Baker Pipeline as shown on Exhibit 7.3. The flow control facility will be constructed into the existing slope, requiring a wall for retainment of 5 +/- feet on the back side of the facility. Along the access road, the facility will include extension of the wall or bollards to protect all mechanical equipment. An enclosure will be considered for sound attenuation.

Exhibit 7.3 Flow Control Facility Site

7.4 ACCEPTABLE DESIGN LIMITS

Acceptable design limits (per Table 7.4) were used for the design of the flow control facility:

Table 7.4 Acceptable Design Limits

Component	Maximum Velocity (cfs)	Minimum Cavitation Parameter	Valve Angle or Stroke	
			Minimum	Maximum
Pipe Lining				
Cement Mortar	20	NA	NA	NA
Fusion Bonded Epoxy	30	NA	NA	NA
Valves				
Butterfly	16	-	-	-
Ball	30	1.5	15 degrees	75 degrees
Sleeve	30	0.15	5-percent	None

The cavitation parameter is calculated by dividing the downstream absolute pressure by the pressure drop across the valve. The lower the number, the greater the cavitation potential. Therefore, for the same downstream conditions, a sleeve valve can break ten times the head that a ball valve can without cavitating.

7.5 DESIGN CRITERIA

The design criteria for the flow control facility are summarized in Table 7.5.

Table 7.5 Flow Control Facility Design Criteria

Description	Units	Value
Location: Parallel to the access road east of the valve vault.	-	-
Mechanical	-	-
Upstream (Raw Water) Pipeline Diameter	IN	24
Reduced Pipe Diameter	IN	18
Flow Control Valve Type: Motor Operated Sleeve Valve	-	-
Sleeve Valve Diameter	IN	18
Downstream (Raw Water) Pipeline Diameter	IN	48

SECTION 8 IRON AND MANGANESE MANAGEMENT

8.1 OVERVIEW

The Baker WTP will require pretreatment for the management of iron and manganese in the ILW raw water supply. Pretreatment is essential for prevention of membrane fouling. Pretreatment, in conjunction with membrane treatment, will mitigate potential aesthetic issues and ensure compliance with Secondary MCLs.

Membrane filtration requires periodic cleaning such as conventional backwash and chemically enhanced backwash (CEB). Membranes may also be cleaned in place (CIP) to maintain production.

Filtered water and sodium hypochlorite are typically used to prepare the cleaning solutions. Pilot test data indicate that chlorine concentration in the cleaning solutions for Baker WTP could vary from 400 mg/L for CEB to 1,000 mg/L for CIP solution. With such chlorine concentrations, dissolved iron and manganese present in the filtered water will be oxidized in the cleaning solutions and precipitate on the membranes. Every backwash will push the oxidized iron and manganese into the membrane pores instead of removing them creating a fouling condition that is difficult to reverse.

Iron and manganese concentrations reported in this work are below historical levels and existed primarily in oxidized (filterable) solids form before pre-treatment. However, there is a significant potential for manganese to be present in its dissolved form in ILW. This could result in rapid membrane fouling and elevated manganese concentrations in finished water if manganese is not adequately oxidized upstream of the membrane filtration process.

Iron and manganese may also generate aesthetic issues such as staining of laundry and fixtures. Iron and manganese could also be detrimental to various industrial processes. As a consequence, the USEPA has set the SMCL at 0.3 mg/L for iron and 0.05 mg/L for manganese.

Bench testing conducted for the Baker WTP showed that treating ILW with a chlorine dioxide preoxidation ahead of the membrane filtration process will minimize membrane fouling, while meeting finished water iron and manganese goals.

8.2 OBJECTIVES

The three primary objectives of iron and manganese management are:

- Production of finished water with iron concentration and manganese concentration below their respective SMCL
- Prevention of membrane fouling-Review of literature and troubleshooting of membrane plants suggests that an iron concentration as low as 0.05 mg/L and a manganese concentration as low as 0.02 mg/L is an appropriate target.
- Minimization of customer aesthetic complaints-Review of literature suggests that iron levels as low as 0.1 mg/L and manganese levels as low as 0.02 mg/L in the finished water could generate complaints.

The following treatment goals were established to achieve the objectives:

- Manganese level in MF feed water: 0.02 mg/L
- Iron level in MF feed water: 0.05 mg/L
- Monitor and control concentrations and dosing rates of oxidant chemicals for minimizing residual disinfectant level and ensure compliance with the Maximum Residual Disinfectant Level (MRDL).

8.3 OXIDATION

Oxidation is recommended for the pretreatment process. Oxidation of dissolved manganese requires either higher oxidant dosage or longer contact time than oxidation of dissolved iron. Therefore, selection of the oxidant chemical must be based on manganese oxidation. Oxidant chemicals considered for use at the Baker WTP, include:

- Potassium Permanganate
- Ozone
- Sodium Hypochlorite
- Chlorine Dioxide

Potassium permanganate was disregarded because of its operational challenges and the risk of pink water events in case of overdosing. Ozone was disregarded because of the risk of fatal damage to the membranes with any residual. It was

determined that bench testing must be conducted to distinguish between sodium hypochlorite and chlorine dioxide.

8.4 BENCH TESTING

A supplemental bench-testing program was conducted to support design criteria for oxidant selection, dose, and required contact time upstream of the membrane filtration system. Irvine Lake water samples were taken at a sampling station on the Irvine Lake Pipeline just upstream of the existing Irvine Lake Pipeline Disinfection Facility in Irvine Regional Park.

The bench-testing included analysis of sodium hypochlorite and chlorine dioxide for further evaluation of required dose and contact time. Sodium hypochlorite was abandoned because it could not achieve the required level of manganese oxidation in 20 minutes, which would have required a contact basin too large to fit on the plant site. Based upon the results of the bench-test program, the Baker WTP design should:

- Incorporate injection of chlorine dioxide downstream of the flow control facility based on the measure flow rate of raw water to the forebay.
- Achieve a minimum contact time of 5 minutes upstream of the membranes in order to oxidize dissolved manganese and achieve the treatment objectives defined in Section 8.2. The bench-test program confirmed that dissolved iron was undetectable after oxidation by chlorine dioxide.

8.5 OXIDANT GENERATION

Chlorine dioxide cannot be compressed or stored commercially as a gas because it is explosive under pressure. Therefore, it is manufactured on site and never shipped. In addition, strong aqueous solutions of chlorine dioxide will release gaseous chlorine dioxide into a closed atmosphere above the solution at levels that may exceed critical concentrations. For drinking water applications, chlorine dioxide aqueous solutions between 0.1 and 0.5 percent (e.g., 1,000 mg/L and 5,000 mg/L) are typically produced at the point of use from two alternative generation methods:

1. Two chemicals: sodium chlorite, and chlorine gas
2. Three chemicals: sodium chlorite, sodium hypochlorite, and hydrochloric acid

Comparison of chlorine dioxide generation methods is provided in Table 8.1.

Table 8.1 Pros and Cons of Chlorine Dioxide Generation Methods

Generation Method	Pros	Cons
Sodium Chlorite Chlorine Gas	- Most efficient production method (95% yield) - Lower O&M cost ($4.60 per pound of chlorine dioxide)	- Hazards associated with on-site storage and handling of chlorine gas (150 lb cylinders)
Sodium Chlorite Sodium Hypochlorite[1] Hydrochloric Acid	- Use of sodium hypochlorite is less hazardous than chlorine gas - Sodium hypochlorite already used for cleaning membranes	- Less efficient production method (90% yield) - Degradation of sodium hypochlorite solution - Potential low pH - Higher O&M cost ($5.45 per pound of chlorine dioxide)[2]

Notes
1. 12.5 percent solution is used. The use of 0.8 percent solution to produce chlorine dioxide is unproven. The same 12.5 percent solution will be used for membrane CEB and CIP
2. Cost for 28 mgd and a chlorine dioxide dose of 1 mg/L is estimated to be at $12.70 per acre-foot for the two chemical generation method and $15.00 per acre-foot for the three chemical generation method.

Despite the technical benefits and the lower O&M costs of the two-chemical generation method, IRWD selected the three-chemical generation method for operator safety and neighborhood acceptance.

8.6 OXIDANT PACING METHOD

Two pacing methods are available for each of the two generation methods described in the previous paragraph.

For the **automatic or direct method**, the concentration of the chlorine dioxide solution delivered by the generator is continuously adjusted to the WTP flow set point and the chlorine dioxide demand. Concentration of the chlorine dioxide solution is measured by means of an optical analyzer. When sodium hypochlorite is used in lieu of chlorine gas, a pH loop may be added, as the liquid phase reaction is best achieved at low pH. Automatic control valves and flow meters are used to ensure the correct ratio of chemicals is continuously combined together. The water flow rate through the generator is constant. The chlorine dioxide solution is directly injected into the process piping by the generator.

For the **batch method**, the concentration of the chlorine dioxide solution produced by the generator is set at a fixed rate. Water flow rate through the generator is also constant. A high concentration chlorine dioxide solution is stored in a batch tank. Storage time is limited to avoid significant degradation. Metering pumps are flow paced to achieve the required dosing turndown ratio.

Comparison of chlorine dioxide pacing methods is provided in Table 8.2.

Table 8.2 Pros and Cons of Chlorine Dioxide Pacing Methods

Pacing Method	Pros	Cons
Direct	Less equipment No chlorine dioxide solution tank No need for scrubber	Turndown ratio limited by the hydraulic requirements of the Venturi and the optimum reaction conditions Backpressure limited to 30 psi Generator continuous operation More maintenance Risk of forming chlorate at plant low flow
Batch	Infinite turndown ration with metering pump and mass flow meter Dosing concept similar to other chemicals with metering pump Generator operates at a constant set point. Turns on/off on batch tank level Less maintenance Inventory of chlorine dioxide solution allows for response time for routine maintenance Better consistency of the chlorine dioxide dose	Chlorine dioxide solution tank Floating cover or vapor eductor More expensive equipment Larger footprint

The batch pacing method is selected in order to provide a more robust and more reliable chlorine dioxide generation system.

8.7 OXIDANT RESIDUAL CONTROL

The use of chlorine dioxide for the Baker WTP Project beckons consideration of residual control in the product water.

Chlorine Dioxide

The MRDL for chlorine dioxide leaving the Baker WTP is 0.8 mg/L. Also, the maximum continuous level of chlorine dioxide acceptable to the potting of the Pall membrane module is 0.2 mg/L.

Chlorine dioxide in water does not hydrolyze to any appreciable extent but remains in solution as a dissolved gas. Therefore, chlorine dioxide dosage shall be adjusted based on iron and manganese levels in ILW. The adjustment will be indirectly achieved through the operation of an on-line chlorine dioxide analyzer on the MF feed water pipeline.

Chlorine dioxide residual can be destroyed by sunlight or other sources of ultraviolet (UV) light. Continuous operation of UV reactors for disinfection purpose should eliminate any traces of chlorine dioxide in the finished water at the Baker WTP.

Chlorite

Typically, the reaction of chlorine dioxide produces approximately 50 to 70 percent conversion of chlorine dioxide to chlorite (weight to weight basis). The bench-scale testing study confirmed the 50 percent conversion for initial chlorine dioxide doses of 1.0 mg/L and 1.5 mg/L. The MCL for chlorite leaving the Baker WTP is 1.0 mg/L. Therefore, a maximum dosage limit of 1.4 mg/L for chlorine dioxide should prevent the need for reducing chlorite level in the finished water.

The Office of Environmental Health Hazard Assessment has finalized a Public Health Goal (PHG) of 0.050 mg/L for chlorite. The PHG is set at a level at which no known or anticipated adverse effects on health occur with an adequate margin of safety. The PHG is not based on a risk/benefit analysis; it is not an MRDL, and compliance is not required. However, when a PHG is exceeded, it is commonly mentioned in the annual water quality report issued to the customers.

Two methods of compliance (if required in the future) are presented in the following paragraphs. The methods are the use of ferrous iron as an additional pretreatment step and the use of GAC contactors downstream of the membrane system.

- Ferrous iron has been proven to reduce both chlorine dioxide and chlorite to chloride without forming additional chlorate. However, ferrous iron could resolubilize manganese dioxide because manganese dioxide can act as an electron acceptor in a reducing environment. To minimize the risk of resolubilization of manganese dioxide, ferrous chloride or ferrous sulfate should be added 5 minutes after the addition of the coagulant. The practical implementation of the approach would require a clarification process upstream of the membrane feed pumps as the 5-minute lag time cannot be achieved in-line between the flash-mix system and the MF system. Footprint will be reserved on the proposed site layout.

- Granular Activated Carbon (GAC) contactors can remove chlorite by adsorption and chemical reduction. As the contactors are operated with no chlorine, the formation of chlorate is minimized. Further bench-testing would be required to assess the chlorite removal achieved with GAC.

Other Residuals

Generation of chlorine dioxide may also generate chlorate and chloride.

Chlorate is unregulated for now. However, California Department of Public Health requires that a notification be issued for levels of chlorate in the finished water at or above 0.8 mg/L. The bench-scale testing study indicated that less than 0.25 mg/L of chlorate should be produced when dosing chlorine dioxide at 1.4 mg/L. Also, the additional chlorate that could be formed by reaction of the residual chlorite with sodium hypochlorite should not lead to a chlorate concentration above the notification level. No known treatment exists for removing chlorate when formed. The practical approach for minimizing chlorate at the Baker WTP is to:

- Install a batch generator that will always produce high concentrations of chlorine dioxide and therefore promote low initial formation of chlorate
- Monitor and control the pH of the reaction that produce chlorine dioxide to prevent the generator from operating at high pH
- Monitor and control the chlorine dioxide residual at the treatment building

Chloride has a SMCL of 250 mg/L. The magnitude of chloride ions formed during the generation of chlorine dioxide and the dosing of chlorine dioxide at 1.4 mg/L will not measurably increase the chloride ion concentration in the raw water.

8.8 OXIDANT MONITORING

Analytical equipment will be required to monitor the performance of the chlorine dioxide generator and ensure compliance with the chlorine dioxide MRDL and the chlorite MCL. The analytical chemistry of chlorine dioxide is complicated by the chemical's volatility and sensitivity to light. Some analytical methods may be labor-intensive and require a high level of technical skill. The preliminary monitoring program includes:

- Quarterly checking of the generator performance
- Daily sampling for chlorine dioxide at the entrance to the distribution system
- Daily sampling for chlorite at the entrance to the distribution system

- Monthly three-sample set in the distribution system for chlorite
- Daily sampling for chlorate at the entrance to the distribution system

Amperometric titration methods will be used for compliance monitoring of the chlorine dioxide residual and chlorite concentrations in the distribution system as well as for determining the purity of the chlorine dioxide delivered by the generator. The amperometric titrator will be installed at the Baker WTP in the treatment building.

8.9 DESIGN CRITERIA

The design criteria for the iron and manganese management facilities are summarized in Table 8.3.

Table 8.3 Iron and Manganese Management Design Criteria

Description	Units	Value
Maximum Dissolved Manganese Concentration in MF Feed Water	MG/L	0.02
Maximum Dissolved Iron Concentration in MF Feed Water	MG/L	0.05
Generator Type: Batch; 3-chemicals	-	-
Generator Number: 1 (with space for future standby generator)	-	-
Maximum Chlorine Dioxide Dose	MG/L	1.4
Minimum Generator Capacity	Pound per day	350
Required Minimum Contact Time in the Forebay	MIN	5
Total Hydraulic Residence Time in the Forebay (per design)	MIN	10
Additional Contact Time in the Upstream Piping	MIN	7
Note: sodium chlorite, sodium hypochlorite, and hydrochloric acid storage facilities, as well as chlorine dioxide feed system are described in Section 13		

SECTION 9 FOREBAY

9.1 INTRODUCTION

A forebay will be constructed at the Baker WTP:

1. To provide an equalization volume upstream of the membrane filtration system (MFS). The equalization volume allows the Baker WTP to be fed at a constant flow and the MFS to be operated at a typical variable flow; therefore reducing the size of the MFS.

2. To provide a surge control volume large enough to close the plant raw water flow control valve in a time long enough to minimize pressure surges and protect the integrity of the pipeline upstream of the Baker WTP.

3. To provide a contact volume corresponding to the minimum contact time of 5 minutes identified in Section 8 for chlorine dioxide to oxidize dissolved manganese before filtration by the MFS.

4. To support the installation of the membrane feed water pump station. The six membrane feed pumps are each installed in a separate bay at the end of the equalization basin. The pump station and its operation are described in Section 10.

The Baker WTP is a base loaded plant. Therefore, the forebay must be designed to minimize the downtime associated with maintenance activities. As such, the design of the forebay accounts for two 50-percent capacity cells within the forebay. Each cell includes a 50-percent capacity contact basin, followed by a 50-percent capacity equalization basin. Each cell within the forebay is designed with a dedicated 48-inch diameter overflow.

9.1.1 Capacity

The total capacity of the forebay will be 785,000 gallons, made up of:

- The *equalization volume* of the forebay is 500,000 gallons, as agreed with the MFS suppliers and as specified in the Membrane Procurement Package. The volume is equally split between the two cells of the forebay. Appendix F includes a depiction of the variation in level in the forebay as a result of maintenance (backwash, CIP) and integrity testing of the membrane filtration system.

- The *total contact volume* of the forebay is 210,000 gallons. It corresponds to a hydraulic residence time of 10 minutes at plant full

capacity with a T_{10} (time that 10 percent of the water leaving the basin has a residence time equal to or less than) to T ratio of 0.5. Therefore, the contact volume achieves the minimum chlorine dioxide contact time of 5 minutes discussed in Section 8. The volume for contact is equally split between the two cells of the forebay.

- The *surge control volume* is 75,000 gallons based on a minimum flow control valve closure time of three minutes, as discussed in Section 7. The surge volume is added as freeboard on top of the equalization basins and contact basins.

Appendix F includes the calculation of total forebay capacity.

9.1.2 Hydraulics

Raw water will enter the two contact basins in parallel through 36-inch pipeline and 36-inch butterfly valves. Both contact basins will be operated at a constant water level (EL. 632.0) set by an outlet weir. The contact basins will be hydraulically connected through the raw water pipeline. Raw water will be forced below an under baffle wall before flowing over/through an above baffle/diffusion wall. This design will improve the efficiency of the contact basin (e.g., increase T_{10}/T as required) for the chlorine dioxide that does not hydrolyze and remains as a dissolved gas in water.

Beyond the contact basin raw water will flow into each of the two equalization basins. The equalization basins are operated at variable level, with a maximum operational water level of EL. 631.0. From the equalization basins, the water is pumped by the feedwater pump station to the MFS. The equalization basins are hydraulically connected through a normally open 48-inch by 48-inch flushed bottom slide gate. During maintenance of one half (or one cell) of the forebay, the slide gate will be closed to isolate each half.

9.2 FOREBAY CONSTRUCTION

The forebay will be constructed within the existing slope area behind the former Baker Filter Building. Exhibit 9.1 (Drawing M15) shows the forebay planned to have dimensions of 88 feet by 130 ft and depth varying from 16 feet to 23 feet. A pump-bay will be constructed to provide adequate suction head and flow distribution for the vertical turbine pumps planned for the Feedwater Pump Station. A section of the forebay is provided as Exhibit 9.2 (Drawing M16).

9.2.1 Covers

Top concrete slabs will be constructed over the contact basins to prevent destruction of the chlorine dioxide residual by sunlight. Additionally, because chlorine dioxide does not hydrolyze (remains as a dissolved gas in water), a slight negative pressure (e.g., 2-inch of water) will be maintained below the top slab of the contact basins by use of fans, to minimize leakage of chlorine dioxide above the water surface.

Strainers to protect the membrane hollow fibers will be installed downstream of the Feedwater Pump Station. As a result, the equalization basins were considered with an open top. However, algae may grow in the basins of the forebay if no roof is constructed. Algae growth would most substantially impact the Project by creating taste and odor events, and impairing the operation of the strainers. Therefore, structurally supported retractable fabric covers from Geomembrane Technology Inc. (GTI), or alternative covers preferred by the District will be specified over the top of the equalization basins.

9.2.2 Access

Access to each contact and equalization basin will be provided by two 36-inch by 36-inch hatches or removable covers, with a ladder at each and access safety equipment (Safe-T-Climb system or equivalent). A total of eight hatches for access will be provided.

9.2.3 Earthwork

The location of the forebay impacts the extent of grading and shoring necessary for construction. The proposed ground elevation at the forebay is (EL.) 635 ft +/-, and the top of bottom slab is anticipated to be (EL.) 613 ft +/-. Slopes exist to the north and west of the forebay. The slope to the north should be protected with the use of shoring. The inlet pipelines into the reservoir will penetrate the forebay in the upper third of the wall, which will minimize excavation out to the property line to the north. The manufactured slope to the west will also require shoring during construction.

9.2.4 Drainage

The forebay will be drained by opening the normally closed 24-inch by 24-inch flushed bottom slide gates and turning on one of the membrane feed pumps at low speed. The floor of the forebay slopes toward the drains.

When the low-low level alarm that protects the membrane feed pump is activated, the remaining water will be removed by a drain or sump pump. If a drain pipeline is not utilized, then hydraulic and electrical connections will be available at low point in the membrane feed pump wet wells for connection of a temporary sump pump.

The forebay will be constructed with an exterior drainage system to convey any water trapped in the soil surrounding the tank to drain. This will allow the forebay to be designed for a drained condition (i.e. no hydraulic lateral surcharge). The system will consist of perforated PVC pipeline installed around the perimeter of the structure.

9.3 MAINTENANCE

One-millimeter backwashable strainers will be installed upstream of the flow control facility in order to prevent blockage of the sleeve valve. These strainers will also minimize the accumulation of solids in the forebay. Nevertheless, solids will accumulate in the forebay over time. In order to facilitate solids removal, the bottom slabs are designed with a 2.5 percent slope directed towards the membrane feed pump wet wells. Accumulated solids can be hosed down to the wet wells for removal by the temporary sump pump.

9.4 DESIGN CRITERIA

The design criteria for the forebay are summarized in Table 9.1.

Table 9.1 Forebay Design Criteria

Description	Units	Value
Structural		
Type: unlined reinforced cast-in-place concrete	-	-
T_{10} / T = 0.5	-	-
Contact Volume (2 x 105,000 gallons)	GAL	210,000
Equalization Volume (2 x 250,000 gallons)	GAL	500,000
Surge Volume	GAL	75,000
Total Volume	**GAL**	**785,000**
Mechanical		
Piping Material: cement mortar lined steel	-	-
Slide Gate, Hatch, and Ladder Material: 316 stainless steel	-	-
Structurally Supported Retractable Cover: GTI or equal	-	-

SECTION 10 FEED WATER PUMP STATION

10.1 INTRODUCTION

The membrane filtration system (MFS) will be fed by the feed water pump station (FWPS) located in the forebay. The pumping requirements are MFS-specific, and detailed pump criteria will be developed once a MFS is selected. For purpose of estimating costs and developing a forebay layout (see Section 9), pumping requirements are presented in this section based on similar project experience and projections based on preliminary operating conditions provided by Pall and Siemens.

10.1.1 Capacity

Maximum FWPS capacity has been estimated at 35 mgd, based on an "instantaneous factor" (IF) of 1.25 and a net production of 28 mgd. The IF is defined as the ratio of the maximum instantaneous flow rate to the net production rate. This value has been selected based on preliminary information provided by Pall and Siemens. The IF is based on system and project specific factors that will be determined after a MFS supplier is selected.

The IF is derived by the membrane supplier to determine the flow rate each rack needs to produce while in filtration mode to make up for membrane cleaning down time and excess filtrate production needed for backwash and chemical cleaning cycles.

The MFS feed flow will be less than the 35 mgd when the following cleaning events occur:

- Backwash - Up to 2 racks out of service simultaneously for 2-4 minutes. An estimated 1000 individual backwashes occur per day at minimum anticipated backwash intervals (20 minutes).
- Chemically cleaning (enhanced backwash or clean-in-place) - One rack at a time for 1 hour to 7 hours. A maximum of 14 chemical cleaning events per day (one per rack) has been specified in the procurement documents.
- Direct Integrity testing – One rack at a time for approximately 30 minutes, not to coincide with a chemical cleaning. One integrity

test per day is required by regulation (a maximum of 14 racks is specified in the procurement documents).

The cycling of racks into and out of service results in rapid changes in FWPS flow. Exhibit 10.1 presents modeled feed flow rate variations for a membrane system operating at an IF of 1.25. Abrupt decreases in flow indicate a rack taken off line; abrupt increases in flow indicate a rack brought back on line.

10.1.2 Hydraulics

The hydraulic profile presented in Section 3 is based on a maximum instantaneous flow of 35 mgd and a maximum headloss through the membrane rack of 37 psi. These values are subject to change based on specific supplier requirements after membrane system selection.

Table 10.1 Feed Water Pump Station Hydraulics

Description	Parameter
Hydraulics (Suction)	
Water Level in Forebay[1]	621 - 631 ft
Maximum Flow[2]	54 cfs
Maximum static lift between forebay and membrane system	10 ft
Hydraulics (Discharge)	
Minor losses between feed pump discharge and membrane rack[2]	6 ft
Losses through strainer, associated isolation valves and manifolds[2]	16 ft
Losses through membrane system[3]	87 ft
HGL at filtrate manifold[4]	644 ft
HGL at Raw Water Pump Station[2,3]	753 ft

Notes:
1. Water level in forebay to vary under normal operation to cycling of membrane racks through cleaning cycles and integrity testing.
2. Loss estimated based on estimated maximum flow between the FWPS and the membrane racks. Actual value to be determined based on selected membrane system and supplier guaranteed maximum for the project.
3. Losses estimated based on previous project experience. Actual value to be determined based on selected membrane system and supplier guaranteed maximum for the project.
4. Filtrate manifold elevation to be fixed in order to keep membrane racks under the HGL.

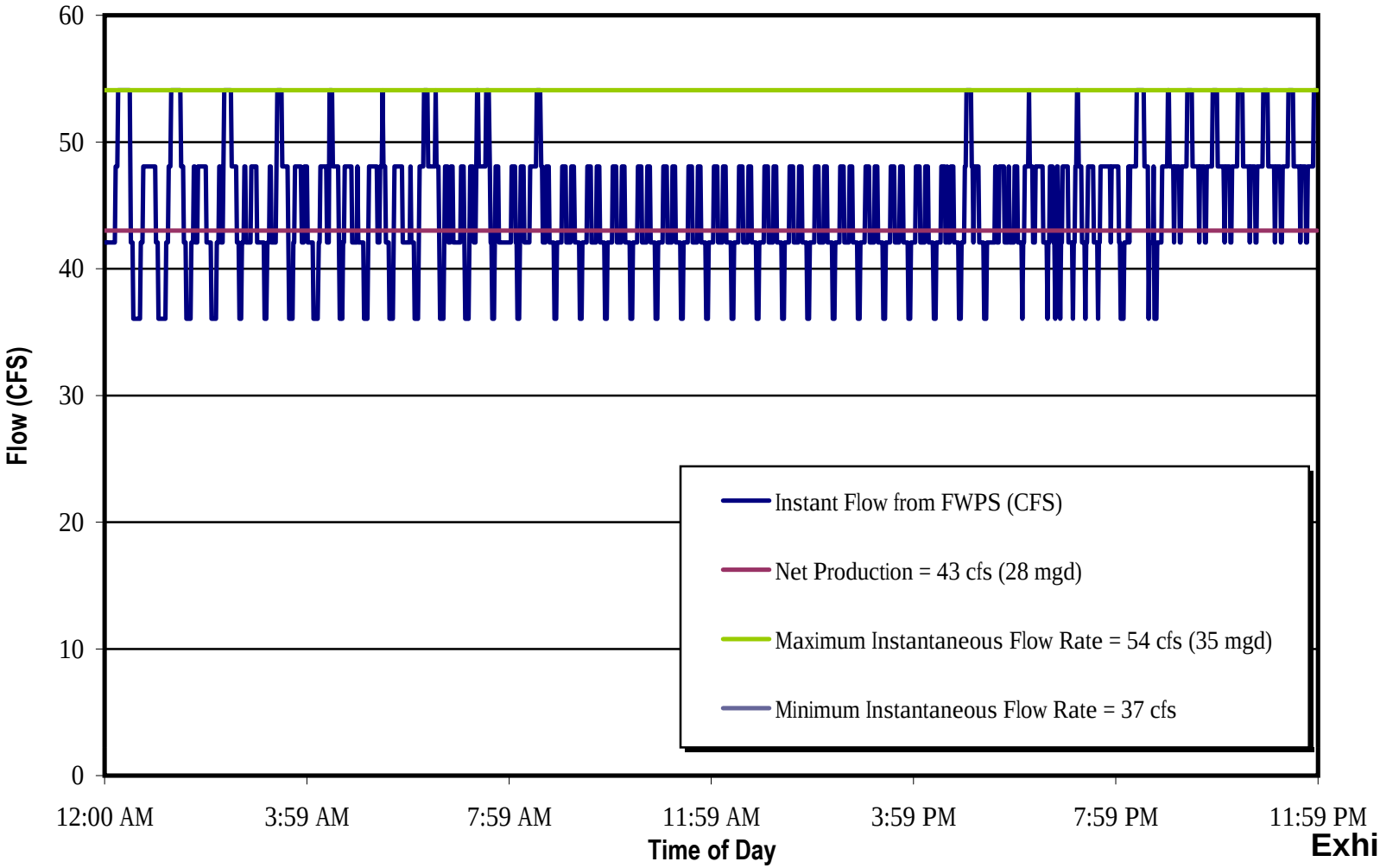

60
50
40
30
20
10
0
Flow (CFS)
12:00 AM
3:59 AM
7:59 AM
11:59 AM
3:59 PM
7:59 PM
11:59 PM
Time of Day
Instant Flow from FWPS (CFS)
Net Production = 43 cfs (28 mgd)
Maximum Instantaneous Flow Rate = 54 cfs (35 mgd)
Minimum Instantaneous Flow Rate = 37 cfs

Exhibit 10.1

Upstream hydraulics

- The forebay level will be allowed to vary between high and low levels according to instantaneous membrane flow demands.

Downstream hydraulics

- Control pressure is governed by the membrane rack feed water control valve.
- Position of (and headloss through) the control valve is governed by the pressure setpoint and the transmembrane pressure of the rack.
- Control pressure setpoint will be determined by the MFS PLC based on control valve position of the most fouled (highest TMP) membrane rack.

10.1.3 Operation

A preliminary control description is presented below.

Primary Pump Control

- Pumps will operate on pressure control from PIT XXX-XX, located in the treatment building.
- Pressure will be determined primarily within the MF system PLC, and sent to SCADA, which will control the pumps.
- One of the 6 feed pumps will serve as an installed redundant pump.
    - Redundant pump to be used to provide additional flow as required in Forebay Level Control (FLC) mode.
- A hardwired LOW-LOW level switch will shut down MF feed pumps
- LIT XXX-XX will initiate Forebay Level Control (FLC) mode as necessary to maintain the forebay between High and Low levels.

Secondary Pump Control

- FLC Mode will be accomplished through an automatic override of the operator selected production set point (up or down depending on the forebay level).
- The new setpoint is then signaled to the MPLC, which in turn adjusts the flow through the membrane racks.
-
- At LOW level, the SCADA will decrease the operator selected production

setpoint by 25%.

- Hold value for 10 minutes, recheck level. If level is above the LOW level, hold setpoint.
- If level is still below LOW level, readjust flow setpoint by the following formula:
- Flow in MGD = OPERATOR SETPOINT *
  - (Max Adjustment at LOW LOW LEVEL (%)+((Max Adjustment at LOW LOW LEVEL (%)-Initial Adjustment at LOW LEVEL(%)/(LOW LEVEL (FT)-LOW LOW LEVEL(FT)))*Measured Level (ft))
- Recheck level in 10 minute increments. LOW-LOW level shut off by level switch.
- Forebay level control mode will be maintained until the forebay level is 5 feet.

- At HIGH LEVEL, the SCADA will increase the operator selected production setpoint by 10%.
  - Hold value for 10 minutes, recheck level. If level is BELOW than HIGH LEVEL, hold setpoint.
  - If level is still ABOVE HIGH LEVEL, readjust flow setpoint by the following formula:
    - =1+((Max Adjustment at HIGH HIGH LEVEL(%)-Initial Adjustment at HIGH LEVEL(%))/(HIGH HIGH LEVEL(ft)-HIGH LEVEL(ft)))*(Measure Forebay Level (ft)-HIGH LEVEL (ft))+Initial Adjustment at HIGH LEVEL(%))
  - The maximum production rate will be capped at 10% greater than rated MF plant capacity.
  - SCADA will signal the flow control valve to begin closing if the water level in the forebay exceeds HIGH HIGH LEVEL.
  - Forebay level control mode will be maintained until the forebay level is 5 feet.

10.2 DESIGN CRITERIA

Vertical turbine pumps are recommended for the FWPS. Minimum footprint requirements and ability to pump from a buried forebay are the primary criteria for this recommendation.

10.2.1 Structural

- Pumps will be mounted on the top slab of the forebay.
- A concrete masonry block building will be constructed on top of the forebay, around the FWPS, strainer, and flash mix equipment. Building footprint will be 64' x 72'.

10.2.2 Pump

Table 10.2 Feed Water Pump Design Criteria

Feedwater Pump Station	Units	Values
Location: Above Forebay	-	-
Pump Station Design Capacity (Range)	CFS	27 to 54
Pump Type: Vertical Turbine with VFD	-	-
No. of Pumps	NO.	6
No. of Redundant Pumps	NO.	1
Design Flow Range per Pump	GPM	4,861
Mechanical	-	-
Discharge Pipeline Diameter	IN	18
Isolation Valve Size	IN	18
Flow Meter Size	IN	30
Discharge Header Pipeline Diameter	IN	42

10.2.3 Mechanical

A preliminary mechanical equipment layout sketch is provided in Exhibit 10.2.

10.2.3.1 Piping

Piping in the pump discharge manifold through the strainer will be mortar lined steel. Piping material between the strainer and the membrane filtration system will be selected to minimize risk of membrane damage due to corrosion byproducts from the pipe. Piping material must be coordinated with membrane system supplier in order to maintain membrane warranty. Candidate materials are 316 stainless steel and mortar lined steel.

10.2.3.2 Mechanical Design Criteria

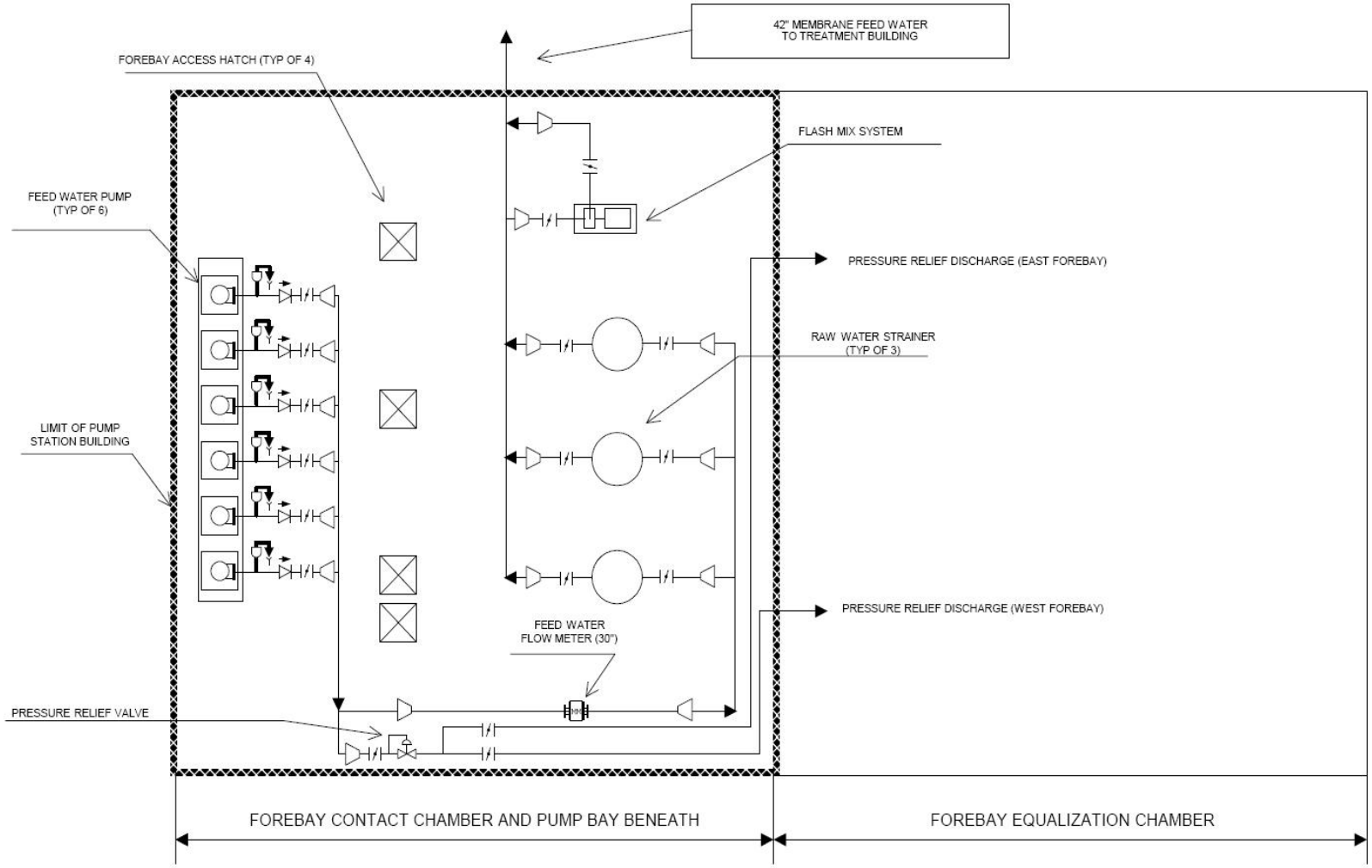
Valves used in the FWPS are shown schematically in Exhibit 10.2, and listed in Table 10.

Table 10.3 FWPS Mechanical Criteria

Equipment	Count	Size	Description
Check Valves	6	16-inch	Silent Check
Butterfly Valves	6	16-inch	Manual – Gear Operator (FW Pumps)
Butterfly Valves	3	16-inch	Manual – Gear Operator (Pressure Relief)
Butterfly Valves	6	24-inch	Manual – Gear Operator (Strainers)
Butterfly Valves	2	12-inch	Manual – Gear Operator (Flash Mix Pump)
Globe Valve	1	16-inch	Pressure Relief
Air Valves	6	4-inch	Combination Air Vac / Release (FW Pumps)
Air Valve	1	2-inch	Air Release
Meter	1	30-inch	Magnetic
Surge Tank	TBD	-	Hydropneumatic

10.2.3.3 Metering

Flow from the FWPS will be metered on the common discharge manifold by a 30” magnetic flow meter.



PLAN
NOT TO SCALE

Feedwater Pump Station Layout
Exhibit 10.2

SECTION 11 Strainer/Flash Mix System

11.1 OVERVIEW

Pretreatment will be required upstream of the microfiltration (MF) membrane system at Baker WTP to achieve:

- Large solids removal to assist in protecting membrane fibers from damage and irreversible fouling.
- Total organic carbon (TOC) removal to assist with disinfection byproducts (DBP) control.
- Iron and manganese removal (see Section 8).

11.2 FEEDWATER STRAINERS

Membrane feed water strainers are used to remove debris and large particles from feed water that can damage and/or plug membrane hollow fibers and pores. Damaged membrane fibers can result in non-compliance with required log removals, requiring downtime for fiber repair and loss of plant capacity. As such, MF system suppliers require straining as part of their membrane module warranty.

Self-cleaning strainers are the most common type of screen for membrane filtration pretreatment. Other types of equipment such as basket screens and cartridge filters are not practical in surface water applications due to frequency of screen change outs and manual cleaning.

Potential manufacturers of the feed water strainers with relevant membrane experience include: Amiad, Boll, and Fluid Engineering. Hellan Strainers may be considered pending additional evaluation.

The strainer size recommended for Baker WTP is 250 μm, considering:

- Membrane suppliers under consideration for the Baker WTP have recommended a range between 250 μm to 400 μm.
- Screen sizes less than 250 μm would require additional straining units
- Screen sizes less than 250 μm would generate higher volumes of waste washwater

A wedge wire type strainer is recommended over mesh strainers on the basis of:

- Greater mechanical strength.
- Lower headloss.
- Reduced potential for clogging by algae.

11.3 IN-LINE COAGULATION

A coagulant feed point upstream of the MF system is recommended to meet the following objectives:

- Reduce the rate of membrane fouling.
- Reduce the formation of disinfection by products.

Addition of coagulant to the feed water will reduce or, at some feed water doses, eliminate the need for a secondary feed at the waste washwater treatment clarifier. Lower membrane fouling rates also reduce cleaning frequency and associated downtime and chemical costs. Note that a separate coagulant feed point will be used for removal of suspended solids from the membrane filtration system backwash stream prior to recycling, as discussed in Section 14.

11.3.1 Coagulation Selection

There are several commonly used inorganic coagulants that could be considered for settling clarified solids and minimizing TTHM formation. However, not all of the commonly used coagulants are suitable for in line addition to membrane feed water. Candidate inorganic coagulants are listed below in order of preference for in-line coagulation applications:

- Polyaluminum chlorides (PACl)/aluminum chlorohydrates (ACH) are generally preferred from a membrane process perspective. They require the least amount of time to form filterable floc and reaction times are relatively unaffected by water temperature.
- Ferric chloride has been used successfully in in-line coagulation membrane applications. At the Hemet WFP the addition of low coagulant doses (2 mg/L - 5 mg/L) reduced the cleaning frequency from monthly to quarterly.

- Iron and aluminum sulfates (alum) have been shown to increase the rate of MF fouling in some applications and are generally not preferred by the MF system suppliers.

IRWD's membrane pilot study (MPI, 2008) demonstrated that the addition of ferric chloride to the membrane feed water resulted in lower rates of transmembrane pressure rise (fouling) compared to periods without coagulant addition.

Disinfection By-Product (DBP) Control

Coagulant selection will also consider effectiveness to reduce the formation of total trihalomethanes (TTHM).. Jar testing on coagulated ILW and SPW is recommended to generate data to assist in coagulant selection to meet applicable TTHM standards.

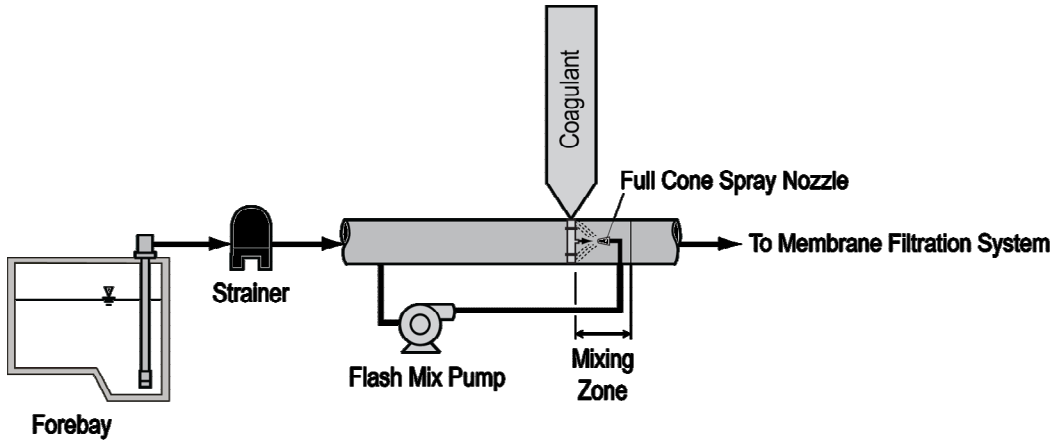
Testing will simulate coagulation, filtration, and chlorine disinfection processes at the Baker WTP, focusing on coagulants preferred for in-line coagulation/MF (ferric chloride and polyaluminum coagulants). Coagulant selection and dose will be based on a maximum TTHM concentration of 64 μg/L after free chlorine disinfection (80% of the limit of 80 μg/L), to account for additional TTHM formation of 10% to 15% in the distribution system following chloramination.

11.3.2 Flash Mixing

High intensity mixing is required for effective coagulation. Pump diffusion flash mix (see schematic on Exhibit 11.1) is recommended for the following reasons:

- Works at both high and low flow rate (high turndown) compared to static mixers.
- High (and adjustable) mixing energy delivered.
- Can be accomplished between the forebay and the membrane system without breaking head.

Exhibit 11.1 Flash Mix Schematic



11.4 DESIGN CRITERIA

11.4.1 Feedwater Strainer

Preliminary design criteria and equipment characteristics for three strainer manufacturers is provided in Table 11.1.

Table 11.1 Strainer Design Criteria

Manufacturer	Amiad	Boll	Fluid Engineering
Screen Size	250 µm	250 µm	250 µm
Proposed Configuration	3 x 50%	3 x 50%	3 x 50%
Screen Type	Wedge Wire	Wedge Wire	Wedge Wire
No. of Straining Elements	1	52	1
Strainer Body Diameter (in)	67	53	56
Inlet/Outlet Size (in)	24	24	24
Filtration while Backwashing?	Y	Y	Y
Backwash Mechanism	Brush/Radial Liquid Backwash	Radial and axial flow liquid backwash	Radial liquid backwash through suction scanner
Backwash Pressure Source	System pressure	System pressure	System pressure
Backwash Rate (gpm)	310	538	400-500
Backwash Volume (gallons)	155	225	1000
Backwash Duration (seconds)	30	25	120
Percent of Raw Water Wasted (Typical)	0.05	0.03	0.07
Strainer pad footprint (ft^2)	625	540	540

Note:
1. Includes costs for strainer supplier scope of supply only (strainer bodies, elements, and controls).

11.4.2 Flash Mix System

The key components of the pumped diffusion flash mix system are the booster pump and titanium mixing nozzle (required for corrosion characteristics). Table 11.2 summarizes the design criteria for the pumped diffusion flash mix systems in the feed water and waste washwater treatment systems.

Table 11.2 Flash Mix Design Criteria

Description	Units	MF Feed Water Criteria	BWWT Criteria
Flash Mix Type: Pumped Diffusion Flash Mix			
Pump type: End Suction Centrifugal			
No. of Pump	NO	1	1
Pump Motor	HP	15	5
Mixing Intensity (G)	S^{-1}	750	750
Mixing Energy (GxT)	-	1600	1600
Notes: 1. A standby perforated pipe diffuser will be provided at each coagulant injection point for redundancy.			

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SECTION 12 TREATMENT PROCESS

12.1 OVERVIEW

Treatment process selection for the Baker WTP Project is documented in the report entitled "Design Concept and Cost Update" (RBF and Carollo Engineers, November 2008), Appendix G includes schematics of the process alternatives considered. Exhibit 12.1 shows the comparison matrix. This section covers:

- a summary of the findings of the process selection study.
- additional information documenting refinements made to the process recommendation since that report was issued.

12.2 TREATMENT PROCESS ALTERNATIVES

As part of the preliminary design effort for the Baker WTP Project, Irvine Ranch Water District, Carollo Engineers, and RBF Consulting reviewed potential treatment process alternatives. A process selection matrix, provided as Exhibit 12.1, was developed by Carollo Engineers to compare seven possible alternatives. From the seven process alternatives, the focus was narrowed to one process (Baseline) for comparison to previous studies, and two primary alternatives as follows.

- Baseline - preoxidation with chlorine dioxide, pressurized membrane filtration, UV disinfection, virus inactivation with free chlorine and residual disinfection with chloramines.
- Alternative 1A - preoxidation with chlorine dioxide, pressurized membrane filtration, UV disinfection, granular activated carbon, virus inactivation with free chlorine and residual disinfection with chloramines.
- Alternative 1B - preoxidation with chlorine dioxide, powdered activated carbon, submerged membrane filtration, UV disinfection, virus inactivation with free chlorine and residual disinfection with chloramines.

12.3 PROCESS SELECTION

Selection of the treatment process for the Baker WTP Project was based on many factors, including raw water quality, drinking water quality regulations (current and future), ease of operation, and life-cycle cost. Considerable focus was placed on ensuring that overall project costs, variable raw water quality, taste and odor flexibility, ease and cost of operation and maintenance, and plant foot

print size were all acceptable. With all alternatives and factors presented and considered, IRWD and the Project Stakeholders confirmed the selection of the Baseline alternative (pressurized membrane filtration) for the Baker WTP Project.

12.4 PROCESS REFINEMENTS

12.4.1 Forebay

Two alternatives for providing feed pressure were presented for final selection of the pressurized membrane process configuration:

- Use of pressure in Baker Pipeline from MWD and Raw Water Pump Station for driving membrane filtration
- Break head at the Baker WTP and construct a forebay and Feed Water Pump Station

A forebay was selected for the following reasons:

- Chlorine Dioxide Contact Time: Potential remote locations for the chlorine dioxide system were determined to be undesirable, and the chlorine dioxide contact time requirement could therefore not be met in the pipeline. The forebay includes a dedicated contact time compartment to allow for oxidation of manganese when Irvine Lake is the water source.
- Hydraulic control for membrane system operation: Direct use of pressure in the Baker Pipeline would require active flow control on raw water from both MWD and the Raw Water Pump Station. The alternative was to design the membrane system to accept constant flow from the Baker Pipeline by adding additional membrane racks. Additional membrane racks would have increased the equipment and treatment building costs (see Section 23).

12.4.2 Taste and Odor Control

Granular activated carbon contactors have been removed from the project due to cost constraints. The site has been planned to allow for addition of GAC at a later date should GAC be determined to be necessary. There is space on the site for addition of powdered activated carbon at later date as a lower cost alternative for taste and odor control. See Exhibit 17.1 for the areas reserved at the Baker WTP site in case GAC and PAC systems are added in the future.

Exhibit 12.1 – Treatment Process Comparison Matrix

	Baseline ClO_2-PMF-UV-Cl_2	**Alt 1A** ClO_2-PMF-GAC-UV-Cl_2	**Alt 1B** ClO_2-SMF-PAC-UV-Cl_2	**Alt 2** O_3-BAF-SMF	**Alt 3** O_3-SED-GMF	**Alt 4** ClO_2-SED-GAC-UV-Cl_2
Layout Flexibility (Land Development)	1	2	2	3	4	4
Consistency with Diemer Aesthetics	4	2	3	1	1	2
Operational Effectiveness						
Filtration	1	1	1	1	2	2
T&O Events	4	2	2	1	1	2
DBPs	1	1	1	2	2	1
Capacity	1	1	2	1	1	1
Total	**12**	**9**	**11**	**9**	**11**	**12**

LEGEND:
1. Good *2: Moderate* *3: Poor* *4: Not Addressed*

12.5 PROCESS FLOW DIAGRAM

The Process Flow Diagram (PFD) developed for the project is presented as Exhibit 12.2 (also **Drawing G7** of the Preliminary Submittal). The PFD depicts major treatment processes, pump stations, chemical feed points, piping, control loops, ancillary equipment, and instrumentation.

12.5.1 Primary Treatment Process Flow

Key elements of the primary treatment process and their roles in meeting treatment objectives are summarized in Table 12.1 below.

Table 12.1 Key Processes and Their Roles in Meeting Treatment Objectives

Treatment Objective	Treatment Goal	Associated Processes and Structures
Manganese Removal[1]	<0.02 mg/L	Chlorine Dioxide/Membrane filtration
DBP Control[2]	<64 μg/L TTHM[3] <48 μg/L HAA5[3]	Coagulation/Flash Mix (Main Process) Chloramine as residual disinfectant through ammonia addition at CT Basin
Turbidity Removal	<0.1 NTU 95% of the time	Membrane Filtration Forebay
Disinfection - Cryptosporidium	4-log removal/inactivation[4]	Membrane Filtration
Disinfection - Giardia	4.5-log removal/inactivation[4]	Membrane Filtration – 4 log UV Disinfection – 0.5 log
Disinfection - Virus	4.0-log removal/inactivation[4]	Free chlorine addition at CT Bain
Corrosion Control	Non-corrosive finished water	Caustic soda feed at CT basin.

Notes:
1. Manganese removal required only when Irvine Lake used at supply for Baker WTP. SMCL for manganese is 0.05 mg/L. Lower goal established to minimize membrane fouling from manganese, and to prevent aesthetic issues in the distribution system.
2. DBP control strategy is to minimize free chlorine contact time in CT Basin. Coagulant addition removes Membranes and UV to provide Giardia disinfection upstream of the CT Basin. This reduces treatment requirement in CT Basin to virus only. Residual disinfection with chloramines minimized additional DBP formation in the distribution system.
3. DBP goals set to 80% of MCL to allow for additional formation of 10% to 15% in the distribution system.
4. Section 15 provides a discussion of disinfection goals established for the project.

12.5.2 Waste Washwater Recovery

The individual membrane racks that make up the membrane system (up to 14) backwash in discrete events. The backwash water or membrane filtration waste washwater (MFWW) is equalized in the MFWW equalization basin and pumped at a constant rate to the clarification process to avoid overloads and upsets.

The clarification process selected for the Baker WTP is lamella plate setters. This process can be hydraulically loaded 3 to 4 times higher than a conventional clarification process. As a result, the MFWW clarifiers can be sized for common wall construction with the forebay, reducing construction costs. Other high rate clarification processes are available, however they rely on polymer addition and may result in irreversible membrane fouling.

12.6 TREATMENT PROCESS

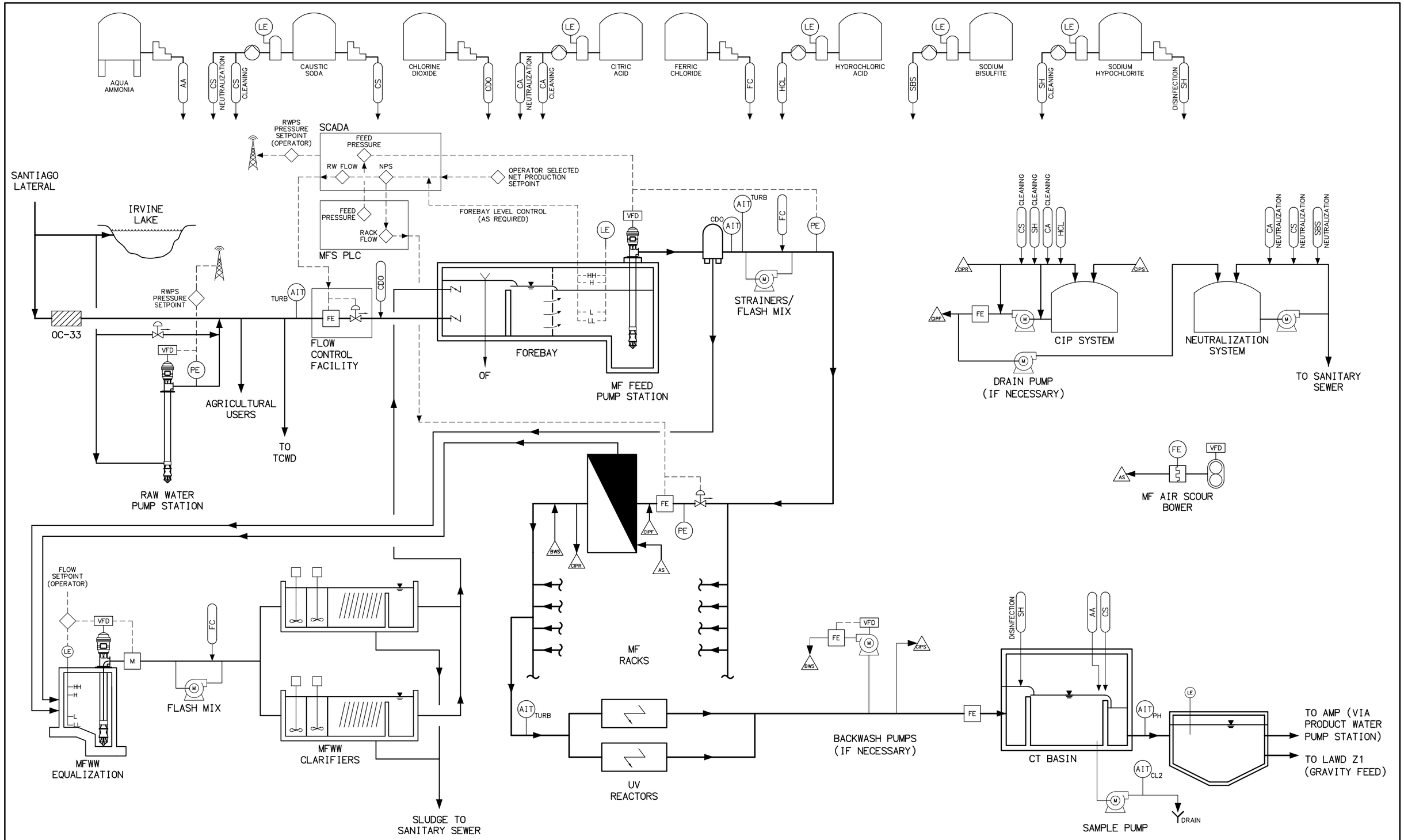
Pressurized membrane filtration (PMF) is the core filtration and disinfection process selected for the Baker WTP. Membrane filtration is a physical particle removal and disinfection process. Several manufacturers can supply systems approved by the California Department of Public Health for removal of turbidity, Giardia, cryptosporidium, and viruses.

12.6.1 Description

PMF will be used in the Baker WTP to meet treatment requirements for turbidity removal and to partially satisfy disinfection requirement. Complimentary processes will be utilized to meet additional treatment requirements. Membrane system design characteristics are discussed below.

- Membrane systems under consideration are PVdF (Polyvinylidene fluoride) hollow fiber based systems, filtering water from outside to inside. Individual modules with capacities of 15 to 20 gpm are assembled on individual racks with common piping with capacities of 2 mgd to 3 mgd. A maximum of 14 racks is specified in the procurement documents, including one fully redundant rack not required to meet nominal 28 mgd capacity.

- Automation – Membrane systems are highly automated and sophisticated processes that require PLC based controllers.



RBF CONSULTING | carollo

IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

PROCESS FLOW DIAGRAM

EXHIBIT 12.2

- Feed water pumping – Only pressure driven membrane systems are under consideration for this project. Feed pressure at the membrane racks will vary by supplier. Anticipated maximum feed pressures are in the range of 25 psi to 40 psi.

- Membrane System Capacity: The membrane filtration system will be designed to net 28 mgd. Additional water will be produced by the system for cleaning sequences (chemical cleaning and backwash). Feed water recovery has been specified in the procurement documents to be a minimum of 92%.

- Residuals Handling: With the exception of chemical cleaning residuals, washwater will be equalized, clarified and recycled to the forebay for reuse. Neutralized cleaning solutions will be discharged to the sewer. See Section 14.

- Cleaning Operations: Three primary cleaning operations are used in membrane filtration systems used to maintain capacity and minimize transmembrane pressure and energy use:

  - Backwash – In this process, a dedicated pump station pumps filtered water from the inside-out removing particles accumulated on the membrane surface. Backwash sequences also use air delivered concurrently with water through a compressed air (compressors or blowers, depending on the manufacturer). Backwashes occur every 15 to 30 minutes on each rack. Backwashes are initiated and function fully automatically, though additional backwashes can be manually initiated.

  - Chemically Enhanced Backwash (CEB) – CEB use commodity cleaning chemicals (sodium hypochlorite, caustic soda and citric acid and/or mineral acids) to remove materials from the membrane surface not removed by backwashing. Inorganic scale, coagulants, biological growth, and organic materials sorbed to the membrane surface are typically responsible for membrane fouling and are targeted by these chemicals. The CEB system uses chemical cleaning equipment consisting of pumps, tanks, recirculation loops and water heaters. CEB may occur up to once per day per rack, and take approximately one hour to complete.

CEB are fully automated and are typically initiated automatically though they can be manually initiated.

- Clean in Place (CIP) – This process uses the same subsystems as CEB, but uses higher doses of cleaning solutions with longer soak durations (up to 7 hours per rack). CIPs have been specified to occur no longer than once per month per rack. CIPs are manually initiated. Most sequences occur automatically, but operator input is required at steps required verification of chemical doses.

- Integrity Testing: The membrane systems have been specified to include two mean of integrity checks, direct (pressure decay testing) and indirect (turbidity monitoring).

  - Pressure decay testing (PDT) – In this test pressurized air is introduced into the membrane modules and displaces water. The rate of pressure loss is indicative of integrity breaches (fiber or module damage), and is used to calculate a log removal value (disinfection performance). PDT occurs automatically once per day are required by federal regulation. Failed tests will shut a rack down for retesting and/or membrane repair.

  - Indirect integrity testing – Laser turbidimeters have been specified for monitoring turbidity on each rack as an indicator of membrane integrity. Increases in turbidity may signal fiber damage and raw water bypass through the membrane fibers. Sustained turbidities over 0.1 NTU will cause a rack to shut down.

- Cleaning Solution Neutralization – Spent cleaning solutions will be neutralized and discharged to the sanitary sewer. Chlorinated solutions will be neutralized with sodium bisulfite and caustic soda, acidic cleaning solutions with caustic soda. Criteria for discharge is a chlorine residual of less than 1 mg/L of free chlorine, and pH between 6.5 and 8.5.

- Ancillary Equipment – Membrane systems utilize ancillary equipment to support cleaning procedures. Major ancillary equipment includes CIP, neutralization, and backwash pumps, air compressors (for valve operation and integrity testing), and backwash air blowers.

12.6.2 Manufacturers

Two manufacturers are listed in the procurement specification based on the District's previous pilot testing effort on Irvine Lake Water and State Project Water.

- Pall Microza - Module designation USV 6203 (MF)
- Siemens CP – Module designation L20V (UF)

Practical differentiation between MF and UF membranes in drinking water applications is ability of UF to remove virus to a greater degree than MF membranes. CDPH approved third-party testing of these two systems resulted in approval for Siemens for 1.5 log virus removal credits versus Pall's approval for 0.5 log virus removal credits. However, no distinction is made in the plant disinfection strategy between the two system for two reasons;

- Integrity testing procedures are not capable of verification of virus rejection due to high-pressure requirements for such testing.
- The minimal cost difference for disinfectant contact time required to meet overall virus disinfection goal of 4-log.

12.6.3 Procurement

Procurement will be completed through a competitive evaluated bid. The basis is present worth of chemical, energy, and membrane replacement costs plus bid price. Key elements of the membrane suppliers' scope of supply include:

- Membrane modules and racks
- Membrane system controls, PLC, programming, and instrumentation
- Chemical cleaning, neutralization, and backwash pumps
- Chemical cleaning and neutralization tanks
- Integrity monitoring systems
- Blowers and compressors
- Installation, start up, and testing services.

- 48 month 100% module replacement warranty plus a minimum of 6 additional years pro-rated module replacement warranty.
- 48-month labor and equipment fiber repair services
- 24 month process warranty and equipment

Key membrane system related equipment not provided by the membrane suppliers:

- Feed water pumps
- Feed water strainers
- Installation of racks and modules
- Interconnecting piping
- Cleaning chemical storage and feed systems
- Anchor bolts

12.7 MEMBRANE FILTRATION SYSTEM DESIGN CRITERIA

Design criteria for the membrane filtration system are provided in Table 12.2.

Table 12.2 Membrane Filtration System Design Criteria

Pressurized Membrane System		
Type: Polymeric Hollow Fiber Microfiltration Or Ultrafiltration		
Number Of Membrane Racks (Max)	NO.	14
Number Of Redundant Membrane Racks	NO.	1
Minimum Recovery	PERCENT	92
Backwash Interval (Min) Per Rack	MINUTES	TBD
Backwash Supply Flow Rate (Water)	GPM	TBD
Backwash Supply Flow Rate (Air)	SCFM	TBD
Chemical Backwash Interval (Min) Per Rack	DAYS	1
Clean-In-Place Interval (Min) Per Rack	DAYS	30

12.8 TREATMENT BUILDING

The Treatment Building will house the membrane filtration system (racks, cleaning, backwash and air subsystems, as well as dedicated membrane system controls) and the UV system. The building has been sized to allow space for the treatment building electrical equipment, control room, laboratory (wet room), and HVAC equipment.

The south end of the building will be located six feet below the membrane rack and control room level. This allows the CT basin inlet weir to be used as a means of keeping the UV reactors fully submerged (below the hydraulic grade line), and provides secondary containment for chemical cleaning and neutralization tanks.

Primary process lines (membrane feed and filtrate) will be located in the center of the building, located in a trench or concrete encased beneath the floor slab. All valves and instrumentation associated with these lines will be kept above grade for ease of access and maintenance.

A plan view of the treatment building is provided in Exhibit 12.3 (Drawing R1). In addition, renderings of the treatment building are provided as Drawings R2 to R9.

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SECTION 13 Chemical Storage and Feed Systems

13.1 OVERVIEW

The Baker WTP will require the use of various chemicals throughout the treatment processes. Some chemicals are necessary for meeting finished water quality goals, while others are utilized as part of the membrane cleaning process. The equipment and procedures for storing and delivering chemicals to treatment processes are described in this section.

Objectives include:

- Size the chemical systems at the Baker WTP.
- Define design criteria for each chemical system.
- Define the major components of each chemical system-Prepare schematics.
- Establish preliminary layout for the Chemical Building.
- Estimate requirements for chemical deliveries.

13.2 CHEMICAL REQUIREMENTS

There are nine chemicals planned for use at the Baker WTP:

Chlorine Dioxide – Used for oxidation of iron and manganese in raw water from Irvine Lake.

Primary Coagulant – Used to inhibit membrane fouling. Used to assist with disinfection by product (DBP) control.

Sodium Hypochlorite – Used for virus disinfection, membrane cleaning and on site generation of chlorine dioxide.

Aqua Ammonia – Will be combined with free chlorine to form chloramines, the residual disinfectant in the distribution system.

Sodium Hydroxide – Used for pH adjustment of finished water, membrane cleaning and neutralization of membrane cleaning wastewater.

Citric Acid – Used for membrane cleaning.

Hydrochloric Acid – Used for pH adjustment of membrane cleaning solution, neutralization of membrane cleaning wastewater and on site generation of chlorine dioxide

Sodium Bisulfite – Used for dechlorination of membrane cleaning wastewater.

Sodium Chlorite – Used for on site generation of chlorine dioxide.

13.3 CHEMICAL SYSTEM DESIGN CRITERIA

13.3.1 Chemical System Sizing Criteria

Each of the chemical systems is sized based on the following criteria

- Each chemical storage system shall be designed for a minimum of one full truck load of the chemical with 50% of that required volume in reserve.
- Chemical storage system shall have a minimum of two tanks for chemicals with continuous usage to allow for one tank to be taken off-line for maintenance and cleaning without affecting plant operations.
- One tank is acceptable for chemicals with intermittent usage.
- Each chemical storage system shall be designed for a minimum of 15 days of storage under average chemical dose applied to the full plant design capacity of 28 MGD.
- When optional chemicals are available such as for primary coagulant, the most corrosive alternate is assumed for material selection.
- For each chemical metering system, the type of metering pump is based on the following criteria:
    - Pump shall be suited for the chemical application intended.
    - For each established flow and discharge pressure, pump to be the reasonably largest one so it could be easily retrofited with another type in the future

  Based on these criteria, the design is developed around Milton Roy double diaphragm hydraulically actuated Milroyal G. Pulseafeeder will be listed as an alternative supplier.
- For each chemical transfer application an air-operated double-diaphragm air pump is specified. Supplier is Wilden or equal.
- Each chemical is conveyed neat – not diluted - to the point of use.
- Should dilution water be required to design and operate the diffuser, dilution water will be conveyed to the point of use.
- Softened water will be used as dilution water for sodium hypochlorite, aqua ammonia, and sodium hydroxide.
- A screw type air compressor system is provided to feed the air-operated pumps and the air-actuated valves.

13.3.2 Piping and Tank Materials

Table 13.1 lists the pipe and storage tank materials recommended for each chemical. Material selection for the chemical tanks and chemical piping is based on a meeting held with IRWD on May 20, 2009 as well as

Table 13.1 Pipe and Storage Tank Materials Summary

Chemical	In Containment Area (Chemical Building)						Outside Containment Area			Comment
	Tank Material	Tank Vent Material (5)	Tank OF Material	Tubing Material	Fittings Material	Valve Material Type	Tubing Material	Carrier Pipe Material	Valve Material	
Bulk Chemical										
Sodium Hypochlorite 12.5%	FRP	PVC SCH80	PVC SCH80	PVC SCH80	PVC SCH80	PVC 3-Piece True Union Ball Valve (1)	Teflon	PVC SCH80	PVC ChemFlare End (1)	
Aqua Ammonia 29%	Lined Steel	PVC SCH80	PVC SCH80	316	316 Swagelock-type	SS 3-Piece 60 Series Ball Valve	Teflon	PVC SCH80	PVC ChemFlare End	Pressurized tank (top and bottom dome + legs)
Caustic Soda 25%	Steel (2)	PVC SCH80	PVC SCH80	Black steel (3)	Black steel	Carbon Steel Flanged Lubricated Plug Valve	Teflon	PVC SCH80	PVC ChemFlare End	Flat bottom
Ferric Chloride 39%	FRP	PVC SCH80	PVC SCH80	PVC SCH80	PVC SCH80	PVC 3-Piece True Union Ball Valve	Teflon	PVC SCH80	PVC ChemFlare End	
Citric Acid 50%	FRP	PVC SCH80	PVC SCH80	316	316 Swagelock-type	SS 3-Piece 60 Series Ball Valve	Teflon	PVC SCH80	PVC ChemFlare End	
Sodium Bisulfite 38%	FRP	PVC SCH80	PVC SCH80	PVC SCH80	PVC SCH80	PVC 3-Piece True Union Ball Valve	Teflon	PVC SCH80	PVC ChemFlare End	
Chlorine Dioxide On Site Generation										
ClO2 Solution (2,500 mg/L) Batch Tank	FRP	PVC SCH80	PVC SCH80	PVC SCH80	PVC SCH80	PVC 3-Piece True Union Ball Valve	Teflon	PVC SCH80	PVC ChemFlare End	Black FRP tank
Sodium Chlorite 25% - 31%	FRP	PVC SCH80	PVC SCH80	PVC SCH80	PVC SCH80	PVC 3-Piece True Union Ball Valve	Teflon	PVC SCH80	PVC ChemFlare End	
Hydrochloric Acid 15%	FRP (Epoxy Vinyl Ester Only) (4)	PVC SCH80	PVC SCH80	PVC SCH80	PVC SCH80	PVC 3-Piece True Union Ball Valve	Teflon	PVC SCH80	PVC ChemFlare End	

NOTES
(1)Sodium Hypochlorite Application: Vented ball to relieve pressure build-up inside valve
(2) Caustic Soda Application: Unlined steel tank is appropriate. However, rust will be visible inside the tank
(3) Caustic Soda Application: No trace heat tracing because of use of 25% Caustic soda and indoor installation
(4) Hydrochloric Acid Application: Vinyl ester lined steel tank would be a good alternative. However, nozzles below 4" would be in titanium
(5) Material to transition to CPVC SCH80 before penetrating through the roof

SOC WMA
Attachment 3
Att3_IG2_WorkPlan_3of7

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coordination with design-build team for the Wells 21/22 Project.

13.4 DESIGN CRITERIA BY CHEMICAL

13.4.1 Primary Coagulant

The primary coagulant will be added at the primary process flash mix system and/or at the secondary flash mix system prior to the MF waste water clarifiers. Table 13.2 summarizes the design criteria for the primary coagulant system.

Table 13.2 Primary Coagulant Design Criteria

Description	Units	Criteria
Type: Ferric Chloride, 39% Solution (4.6 lb/gal)		
Feed Points: Flash Mix, Membrane Backwash		
Dosage:		
Flash Mix (equivalent raw water; Min-Ave-Max)	mg/L	2-10-20
Metering Pumps		
Type: Double diaphragm hydraulically actuated with gauge leak detection		
Number		
Duty	No.	2
Standby	No.	1
Design Capacity (Each)	gph	45
Model	Milton Roy	Milroyal G
Storage Tanks		
Type: Vertical FRP		
Number	No.	2
Volume		
Each	Gal.	8,000
Total	Gal.	16,000
Days of Storage (Average Dosage)	Days	29
Delivery Interval (Average Dose)	Days	7

Notes
1. Chemical system can accommodate ferric chloride, ferric sulfate, alum, and polyaluminum chloride
2. Dosage is based on doses actually used at the Serrano Water District WTP, the Eastern Municipal Water District Hemet Water Filtration Plant, and jar testing data for particulate removal at the Palmdale Water District WTP

13.4.2 Sodium Hydroxide

Sodium hydroxide (or caustic soda) is used to raise the pH of the solution or process flow that it is added to. At the Baker WTP, sodium hydroxide will be added to the effluent of the CT basin in order to raise the pH to an appropriate level prior to the water being sent to the distribution system. It will also be added to the membrane cleaning solution used to clean the membranes on a monthly basis and to the cleaning waste water after membrane cleaning has taken place in order to adjust the pH prior to disposal to the sanitary sewer. Table 13.3 summarizes the design criteria for the sodium hydroxide system.

Table 13.3 Sodium Hydroxide Design Criteria

Description	Units	Criteria
Type: Liquid, 25% solution (2.67 lb/gal as 25%)		
Feed Points: CT Basin Effluent, CIP Tank, CIP Neutralization Tank		
Dosage at CT Basin (Min-Ave-Max):	mg/L	1-4-7
Dosage at CIP & Neutralization Tanks	mg/L	10,000 & 16,400
Metering Pumps		
Type: Double diaphragm hydraulically actuated with gauge leak detection		
Number (CT Basin)		
Duty	No.	1
Standby	No.	1
Design Capacity (Each)	gph	30
Model	Milton Roy	Milroyal G
Transfer Pumps		
Type: Air-operated double diaphragm		
Number (CIP Tank, CIP Neutralization. Tank)		
Duty	No.	1
Standby	No.	1
Capacity (Each)	gpm	TBD
Model	Wilden	TBD
Storage Tanks		
Type: Vertical Welded, Bare Steel		
Number	No.	2
Volume		

Description	Units	Criteria
Each	Gal.	8,500
Total	Gal.	17,000
Days of Storage (Average Dosage)	Days	25
Delivery Interval (Average Dose)	Days	7

Sodium hydroxide is typically used in concentrations of 25% and 50% by weight. The 25% solution is typically used during the winter to avoid crystallization of the chemical during the colder months, while the 50% solution is typically used during the summer since it is less expensive per equivalent weight of sodium hydroxide. During the winter months, 25% solution may be purchased direct from the local suppliers or 50% solution may be purchased and diluted onsite. The freezing point for 25% sodium hydroxide is 5 degrees F, while the freezing point for 50% sodium hydroxide is 53 degrees F.

13.4.3 Citric Acid

Citric acid is used during monthly chemical cleaning of the membrane system and will be pumped to the membrane CIP tank at a dosage of 20,000 mg/L. Table 13.4 summarizes the design criteria for the citric acid system.

Table 13.4 Citric Acid Design Criteria

Description	Units	Criteria
Type: Liquid, 50% solution (5.2 lb/gal)		
Feed Points: CIP Tank		
Maximum Dosage:	mg/L	20,000
Transfer Pumps		
Type: Air-operated double diaphragm		
Duty	No.	1
Standby	No.	1
Design Capacity (Each)	gpm	TBD
Model	Wilden	TBD
Storage Tanks		
Type: Vertical FRP		
Number	No.	1

Description	Units	Criteria
Volume	Gal.	6,900
Days of Storage (Average Dose)	Days	46
Delivery Interval (Avearge Dose)	Days	31

13.4.4 Sodium Bisulfite

Sodium bisulfite will be applied to the chemical cleaning solution in the neutralization tank after chemical cleaning of the membrane units has taken place in order to remove chlorine from the sodium hypochlorite CIP solution.Table 13.5 summarizes the design criteria for the sodium bisulfite system.

Table 13.5 Sodium Bisulfite Design Criteria

Description	Units	Criteria
Type: Liquid, 38% solution (4.1 lb/gal)		
Feed Points: Neutralization Tank		
Dosage (CEB – CIP):	mg/L	410-1,030
Transfer Pumps		
Type: Air-operated double diaphragm		
Duty	No.	1
Standby	No.	1
Design Capacity	gpm	TBD
Model	LMI (Milton Roy)	Series B/C
Storage Tanks		
Type: Vertical FRP		
Number	No.	1
Volume	Gal.	6,300
Days of Storage (Average Dose)	Days	102
Delivery Interval (Average Dose)	Days	68

13.4.5 Sodium Hypochlorite

Sodium hypochlorite will be added to the inlet of the CT basin in order to provide the primary virus disinfection for the plant. It will also be added to the membrane CIP tank for chemical cleaning of the membrane units on a monthly basis and on a daily basis through the chemically enhanced backwashes. The chemical cleaning of the membranes is designed for the use of 400 mg/L of sodium hypochlorite for the CEB's and 1,000 mg/L for the monthly CIP's. Sodium hypochlorite will also be used to generate chlorine dioxide.

Table 13.6 summarizes the design criteria for the sodium hypochlorite system based upon the use of bulk sodium hypochlorite delivered at 12.5%. The concentration of sodium hypochlorite degrades over time and a final solution concentration of 10.5% was assumed for application to the processes for storage and feed calculation purposes.

Table 13.6 Sodium Hypochlorite Design Criteria

Description	Units	Criteria
Type: Liquid, 10.5% solution (1.0 lb/gal as hypochlorite or 0.95 lb/gal as chlorine)		
Feed Points: CT Basin Influent, CIP Tank		
Dosage at CT Basin Influent (Min-Ave-Max)	mg/L	2.5-3.0-4.0
Dosage at CIP Tank (CEB-CIP)	mg/L	400-1,000
Demand at Chlorine Dioxide Generator (Min-Ave-Max)	ppd	34-136-191
Metering Pumps		
Type: Double diaphragm hydraulically actuated with gauge leak detection		
Number (CT Basin Inlet)		
Duty	No.	1
Standby	No.	1
Design Capacity (Each)	gph	40
Model	Pulsafeeder	Pulsar Hypo
Transfer Pumps (CIP Tank)		
Number		
Duty	No.	1
Standby	No.	1

Description	Units	Criteria
Capacity	gpm	TBD
Model	Wilden	TBD
Storage Tanks		
Type: Vertical FRP		
Number	No.	2
Volume		
Each	Gal.	8,500
Total	Gal.	17,000
Days of Storage (Average Dosage)	Days	16
Delivery Interval (Average Dose)	Days	5

Two options are available for valves on the sodium hypochlorite storage and feed system, which are ball valves with drilled balls and diaphragm valves. Due to the fact that sodium hypochlorite produces a gas as it degrades over time, pressure can build up in locations where this gas can be trapped such as in the ball of a ball valve. If the ball does not have a way to release the pressure, it can explode and cause injury. Therefore, it is required that all ball valves used for sodium hypochlorite have a hole drilled in one side of the ball. While diaphragm valves do not trap liquid the way ball valves can, they are more expensive and operators at other sites have expressed a preference for ball valves. This preference is based on how quarter turn ball valves can be operated quicker, which is important when performing pump calibrations. Based upon this information, ball valves with drilled balls are the basis for design.

Delivery of 12.5 percent sodium hypochlorite solution is selected for consistency between District's different operations sites.

13.4.6 Aqua Ammonia

Aqua ammonia is added to the finished water to combine with the free chlorine provided by the sodium hypochlorite and form chloramines. Chloramines react minimally with organic carbon in the water and therefore minimize the formation of disinfection by-products. Table 13.8 summarizes the design criteria for the aqua ammonia system.

Table 13.7 Aqua Ammonia Design Criteria

Description	Units	Criteria
Type: Liquid, 29% solution (2.2 lb/gal)		
Feed Points: CT Basin Effluent		
Dosage (Min-Ave-Max)	mg/L	0.6-0.8-1.0
Metering Pumps		
Type: Double diaphragm hydraulically actuated with gauge leak detection		
Number		
Duty	No.	1
Standby	No.	1
Design Capacity (Each)	gph	5
Model	Pulsafeeder	Pulsar Hypo
Storage Tanks		
Type: Vertical, Pressurized, Lined Steel		
Number	No.	2
Volume		
Each	Gal.	5,000
Total	Gal.	10,000
Days of Storage (Average Dosage)	Days	92
Delivery Interval (Average Dose)	Days	59

13.4.7 Chlorine Dioxide

Chlorine dioxide will be added to the raw water received from Irvine Lake, at the plant site, in order to oxidize iron and manganese as described in Section 8. Table 13.9 summarizes the design criteria for the chlorine dioxide generation system. A detailed discussion regarding the different means for on-site generation of chlorine dioxide is provided in Section 8.

Table 13.8 Chlorine Dioxide Design Criteria

Description		Units	Criteria
Type: On-site Generation, Three-chemicals, Batch Tank			
Feed Point: At Baker WTP, upstream of forebay			
Dosage (Min-Ave-Max)		mg/L	0.5-1.0-1.4
Metering Pumps			
Type: Double diaphragm hydraulically actuated with gauge leak detection			
Number			
	Duty	No.	1
	Standby	No.	1
	Design Capacity (Each)	gph	660
	Model	Milton Roy	Milroyal C
Sodium Chlorite			
Type: Liquid, 25% solution, 2.6 Lbs/gal			
	Demand at ClO2 Generator (Min-Ave-Max)	ppd	83-331-463
	Storage Tank		
	Type: Vertical FRP		
	Number	No.	1
	Volume	Gal.	6,900
	Days of Storage (Average Dose)	Days	53
	Delivery Interval (Average Dose)	Days	36
Hydrochloric Acid			
Type: Liquid, 15% solution, 1.3 Lbs/gal			
	Demand at ClO2 Generator (Min-Ave-Max)	ppd	33-133-187
	Storage Tank		
	Type: Vertical FRP		
	Number	No.	1
	Volume	Gal.	8,000
	Days of Storage (Average Dose)	Days	80
	Delivery Interval (Average Dose)	Days	53
Sodium Hypochlorite	Gravity Fed. Type, Number, Volume. Refer to Table 13.6		

Supplemental calculations for the chemical storage and feed systems are provided in Appendix H

13.5 CHEMICAL STORAGE BUILDING

A preliminary layout for the chemical facility is provided in Exhibit 13.1 (Drawing M2). Highlights of the layout include the following:

- The chemical building is air-conditioned. The air handling unit is located in the HVAC room.
- The chemical building is equipped with a fire detection system and a fire protection system.
- Each chemical is stored in its dedicated containment area. Aqua ammonia is stored in a separate room. Chlorine dioxide is also stored in a separate room.
- Each containment area:
  - is constructed with above grade containment walls. Based on available space, access to the containment area will be through stairs or ladders.
  - has a volume based on the volume of the larger tank, plus 10 minutes of sprinkler system operation, plus freeboard.
  - is equipped with its own chemical delivery lock box to be designed per the requirements of the Orange County Fire Department.
  - includes a sump. Hydraulic connections and electrical connection are provided at each sump for installation of a temporary sump pump.
- Chemical storage tanks are installed on elevated concrete pads to ensure that metering and transfer pumps are provided with a flooded suction
- Metering pumps are accessible from outside of the containment area. Instrumentation displays can be read from outside of the containment area.
- The chemical building includes a storage room for storage of spare parts. The softening equipment is located in this room. The air compressor system is also located in the storage room.

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SECTION 14 BACKWASH WASTE WATER SYSTEM

14.1 OVERVIEW

The total or combined waste washwater (CWW) flow for the Baker WTP will be comprised of:

- Membrane feed water strainers waste washwater (SWW).
- Membrane filtration system waste washwater (MFWW), excluding chemical cleaning solutions.

Estimated range of CWW flows at the Baker WTP are 0.5 mgd to 3.0 mgd (primarily dependent on membrane system selection and performance). In most cases, this waste washwater is amenable to treatment and recycling back to the head of the plant. Treatment and recycling facilities minimize plant waste discharges and maximize plant feed water recovery.

14.1.1 Water Quality

Sources of waste washwater from the Baker WTP are depicted in Exhibit 14.1. A summary of CWW quantity and quality is presented in Table 14.1.

Exhibit 14.1 Sources of Waste Washwater

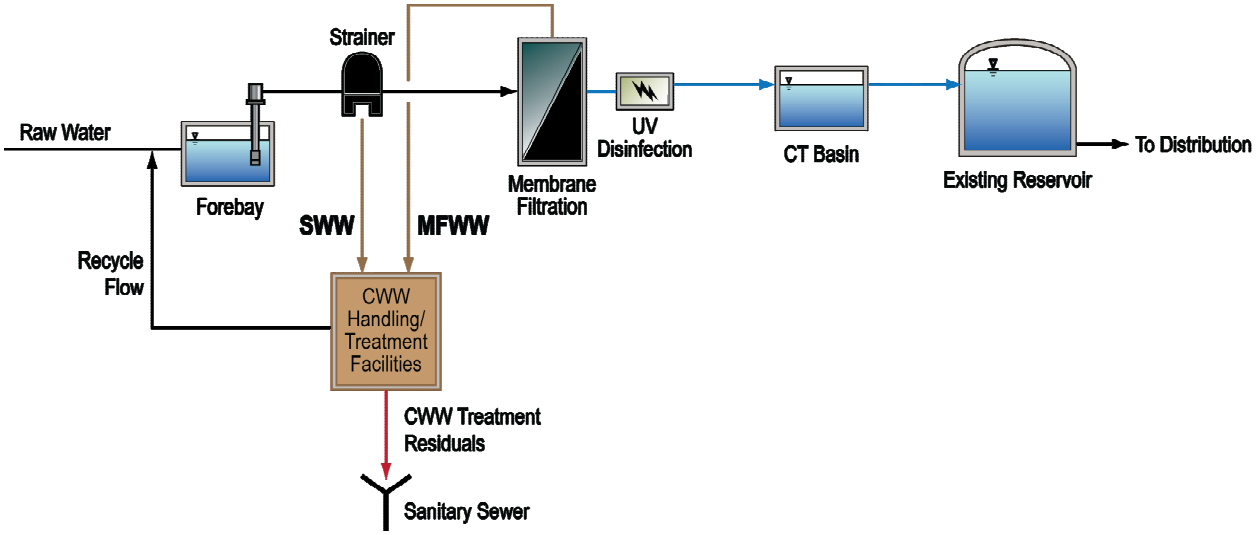

Table 14.1 Summary of Combined Waste Washwater Characteristics

	Units	CWW Flow Condition		
		Average	Minimum	Maximum
Assumed Operation and Raw Water Quality Data				
MF System Recovery	%	92	98	90
Raw Water Coagulant Dose[1]	mg/L	10	10	10
Raw Water Turbidity[2]	NTU	6	6	6
Raw Water Total Manganese[3]	mg/L	0.075	0.075	0.075
Estimated CWW Quantity and Quality				
Daily CWW Generation[4]	Million Gallons	2.2	0.5	3.0
CWW Turbidity	NTU	74	288	58
CWW TSS[1,3]	mg/L	194	751	151
CWW Total Manganese[3,6]	mg/L	1.7	7.4	1.4

Notes
1. Ferric sulfate is the assumed coagulant. A TSS to dose ratio of 0.79 is assumed.
2. Average Irvine Lake Water assumed for calculations in this table.
3. Manganese concentrations based on data presented in Malcolm Pirnie, 2008.
4. Based on total membrane system feed flow (raw water and recycle flows) at indicated recovery. Includes SWW flows.
5. A ratio of 1:1.3 (NTU:TSS) has been assumed for TSS calculations.
6. Assumes 50% removal in washwater treatment process, 80% removal in the primary MF process, and raw water manganese concentration of 0.075mg/L.

14.1.2 Treatment Alternatives

The following treatment alternatives screening is based on meeting key treatment goals for the CWW stream.

- Turbidity – An operational goal for turbidity in the recycle stream of less than 2 NTU, but no greater than average feed water turbidity.

Treatment processes used for treating combined washwater (CWW) flows at membrane facilities have a common treatment objective of liquid/solid clarification. These processes are varied in their suitability for specific applications. For the purpose of preliminary screening, candidate liquid/solid clarification processes used for treating CWW are grouped into broad categories in Table 14.2.

Appendix I includes supplemental calculations in support of the backwash wastewater treatment system preliminary design.

Table 14.2 Preliminary Screening of CWW Treatment Alternatives

	Fatal Flaw(s)	Other Considerations
Clarification		
Plate settlers	None	Proven solids removal technology
Lagoons	Required footprint; visual impact to planned future development	Eliminated
Actiflo®	Polymer carry over could permanently foul membranes	Eliminated
Dissolved Air Floatation (DAF)	Similar application of DAF to water using in-line coagulation have required the use of excess polymer to develop float.	Eliminated
Filtration		
Second stage membranes	None	Recycling permeate to head of plant required
Pressurized Media filtration	None	Provides reliable Mn removal Requires upstream clarification Waste washwater requires equalization and discharge to sewer
Disposal		
Discharge of all CWW flows to sanitary sewer	Wastes up to 3.0 million gallons per day of CWW	Minimal equipment requirements Largest volume of sanitary sewer discharge Requires additional sanitary sewer pipeline capacity to be constructed

From this preliminary screening two alternatives (CWW1 and CWW2) were carried forward for further consideration.

Alternative CWW1 - Second Stage Membranes

In this alternative, a dedicated membrane system would be installed to filter CWW flows prior to recycling to the head of the plant. No pretreatment (clarification) is required upstream. Equalization of CWW flows is required for proper membrane system operation. Phase 2 pilot testing (MPI, 2008) included verification of this approach on State Project supply at 80% recovery, providing the basis for the total waste flow estimates and Mn removal estimates.

Alternative CWW2 - Plate Settlers

This alternative consists of plate settlers for CWW clarification with space provided for future addition of pressurized media filters for enhanced Mn removal. Pressure filters would require an additional pump station. It is

recommended that pressure filters be used only as needed in the future for the following reasons:

- ILW, the source of manganese at the Baker WTP, will be used for a limited duration each year, limiting the possibility of manganese accumulation in the plant.
- Settled water will be returned to the forebay and where it will be contacted with water containing chlorine dioxide at the forebay inlet prior to transfer to the membrane system.
- The Baker WTP will be designed for blending ILW with MWDSC supplies to lower manganese concentrations. This strategy can be implemented should manganese levels exceed project goals.

14.1.3 Treatment Process Selection

A summary of final screening of alternatives CWW1 and CWW2 are presented in Table 14.3.

Table 14.3 Summary of Final Screening of Alternatives CWW1 and CWW2

Screening Criteria	Alternative	
	CWW1 Second Stage Membranes	CWW2 Plate Settlers
Direct Capital Cost ($)	3,510,000	1,640,000
Annual Operating Costs ($/year)	557,000[1,2] to be adjusted for new raw water costs.	317,000[1]
Average Plant Discharge to Sanitary Sewer at 28 mgd Production (mgd)	0.5	0.12
Projected Range of Finished Water Mn Concentrations, ILW Supply (mg/L)[3,4,5]	0.012 – 0.021	0.012 – 0.049
Projected Range of Finished Water Mn Concentrations, MWDSC Supply (mg/L)[6]	ND	ND

Note
1. Includes amortized capital costs at 4.5 percent over 30 years, purchase cost of raw water discharged to sewer, electrical, and chemical costs.
2. Includes cost components in Note 1 plus membrane replacement costs.
3. Based on operation with Irvine Lake Water at raw water Mn concentration of 0.075 mg/L. Low end of project based on residual manganese concentration measured in bench testing presented in Section 8, and 100% removal of oxidized manganese solids in the membrane system.
4. High range of estimates based on 50% removal of manganese solids in CWW clarifier (based on literature review) and 80% removal of manganese in across the membrane filtration system (based on pilot study results).
5. Irvine Lake supply to be used no more than 3 months per year; Alternative supplies (State Project Water and Colorado River) contain non-detectable concentrations of Mn.
6. MWDSC supplies have non-detectable levels of manganese.

14.1.4 Recovery

For alternative CWW2, estimated residual discharges to the sanitary sewer include:

- Neutralized chemical cleaning residuals – 10,000 gallons per day
- Sludge from the CEE clarifier – 120,000 gallons per day

The overall feed water recovery for the plant is estimated to be 99.5%, based on an average raw water flow of 28.1 mgd.

14.1.5 Sludge Disposal

It is assumed that sludge (as well as neutralized chemical cleaning residuals) will be disposed of in the sanitary sewer.

14.2 BACKWASH WATER DESIGN CRITERIA

14.2.1 Process

Criteria for key components of the CWW treatment system are included in Table 14.4, below.

14.2.2 Mechanical

14.2.2.1 Piping

Process piping for the MFWW equalization basin will be 14-inch mortar lined steel. Piping will be routed to allow for use of either one or both CWW clarifiers. Clarifier outlet piping will allow for return of settled water to either half of the forebay by gravity, and either the chlorine dioxide contact compartment or pumping equalization compartment.

14.2.2.2 Valves

Valving will include:

- Isolation valves (14-inch cast iron coated butterfly valves) for MFWW transfer pumps
- Check valves and combination air valves (cast iron bodies) for MFWW transfer pumps.
- MFWW inlet piping and each connection to the forebay will be equipped with isolation valves.

14.2.2.3 Metering

CWW will be metered at the discharge of the MFWW transfer pumps.

14.2.2.4 Coagulant / Chemical Mixing

As with the main process flash mix system, coagulant will be dosed to the CWW at the transfer pump discharge as needed to meet settled water quality goals. Dose in the CWW will depend on the dose delivered in the membrane feed water as required to maintain membrane performance and meet DBP goals. A metering pump sized for a maximum dose of 20 mg/L at 28 mgd in the main process flow will be dedicated to the CWW system. Coagulant mixing will be accomplished with a pumped diffusion flash mix system (constant speed end suction centrifugal). Estimated driver horsepower is 5 HP.

14.2.3 Structural and Layout

CWW clarifier has been sized to allow for common wall construction with the forebay.

The CWW Treatment/Handling facilities layout is further described in Exhibit 14.2 (Drawing M13 – Plan View) and Exhibit 14.3 (Drawing M14 – Section).

SECTION 15 ULTRAVIOLET DISINFECTION

15.1 OVERVIEW

The total disinfection requirements for Giardia, virus, and Cryptosporidium are established in Table 2.3 of Section 2, along with CDPH approved disinfection credits for membrane filtration, which will serve as the core of the treatment process at Baker WTP. Dedicated disinfection processes must meet the balance of the disinfection requirements not met by membrane filtration (i.e., 0.5-log Giardia inactivation and 4-log virus inactivation).

To achieve the required additional disinfection requirements, the recommendation made in the Baker Pipeline Regional Treatment Facility Feasibility Study (Malcolm Pirnie, Inc., 2007) consists of a combined ultraviolet (UV) for Giardia inactivation and free chlorine for virus inactivation.

This section discusses the use of UV, which will provide Baker WTP with a multi-barrier approach to disinfection as well as a strategy for complying with current and future regulatory requirements.

15.2 DISINFECTION GOALS

The primary goal of UV disinfection at Baker WTP is to achieve 0.5-log *Giardia* inactivation.

15.2.1 UV for Giardia Disinfection

UV systems can inactivate *Giardia* and *Cryptosporidium* at low UV doses. Therefore, UV disinfection system sizing is based on an assumption of worst-case additional *Cryptosporidium* inactivation requirement per LT2ESWTR for a compliant membrane filtration plant, i.e. 1.5-log (based on a maximum *Cryptosporidium* removal/inactivation requirement of 5.5 log and 4-log removal in the membrane system). This requirement would be triggered in the unlikely event that future *Cryptosporidium* sampling requires additional *Cryptosporidium* inactivation. The UV system will be sized to meet a UV dose of 3.9 mJ/cm^2 for 1.5-log Cryptosporidium inactiviation, and initially operated to meet a UV dose of 1.5 mJ/cm^2 for 0.5-log Giardia inactivation.

15.2.2 UV for Advanced Oxidation Processes (AOP)

UV can also be used for destruction of trace organic compounds through the use of higher UV doses alone and/or in combination with hydrogen peroxide as an advanced oxidation process (AOP). Use of UV for

destruction of trace organics (including taste and odor causing compounds) assumes that granular activated carbon (GAC) contactors are installed downstream for removal of hydrogen peroxide and byproducts generated by this process.

Given the 0.01-µg/L CDPH notification level for three nitrosamines including N-nitrosodimethylamine (NDMA), an analysis was conducted to develop a cost effective approach to account for future expandability of the Baker WTP UV system to high UV doses for photolysis of NDMA. The dose requirement for a 90% destruction of NDMA by photolysis is 700 mj/cm^2. The use of hydrogen peroxide in an AOP process would provide flexibility for partial destruction of other potential contaminants of concern including atrazine and 1,4 dioxane.

15.3 Equipment

15.3.1 Medium Pressure versus Low Pressure High Output UV Systems

UV systems for potable water applications fall into two basic categories:

- Systems with medium pressure (MP) lamps, and
- Systems with low-pressure high output (LPHO) lamps.

The LPHO lamps consume 100 to 500 watts of electricity per lamp and emit germicidal UV light at a single wavelength of 253.7 nm with electrical conversion efficiency between 30 and 40 percent. The MP lamps, on the other hand, consume 1 to 20 kW of electricity per lamp and emit germicidal UV light over a wide range of wavelengths from 200 to 300 nm with an electrical conversion efficiency of 10 to 15 percent.

The unique qualities and differences between LPHO and MP lamps have various impacts on UV system design and costs (capital and O&M) associated with the UV process. Table 15.2 summarizes the general comparison between LPHO and MP UV systems.

The decision to design around MP or LPHO is made on a case-by-case basis. The primary issues typically evaluated are capital cost, life cycle cost, space requirements, and operations and maintenance requirements. Since power cost is a major component of overall UV life cycle costs, this is frequently a key criterion for equipment selection.

Table 15.1 Generalized Comparison of MP and LPHO UV Systems

Parameter	MP System	LPHO System
Capital Cost	Lower	Higher
Space Required	Lower	Higher
Maintenance Requirements	Lower	Higher
Power Costs	Higher	Lower
Lamp Life	Lower	Higher
Fouling Rates	Higher	Lower
Headloss	Lower	Higher
Cleaning	Automatic Wipers	Offline acid rinse
Mercury Release Containment	More difficult	Less difficult
Expandability to high doses for oxidation and photolysis	More Feasible	Less Feasible

At this time, MP UV reactors are best suited for use in UV/AOP applications. Of the major conventional disinfection UV system manufacturers, two have AOP systems currently in use for destruction of organic chemicals at treatment plants utilizing H_2O_2; Trojan Technologies (London, Ontario) and Calgon Corporation (Pittsburgh, Pennsylvania). Each of these manufacturers can scale their reactors from disinfection to AOP doses by the addition of lamps and electrical equipment.

15.3.2 MP versus LPHO for Phasing in AOP at the Baker WTP

Two alternatives were evaluated for phasing in UV/AOP to meet future regulations for trace organic compounds and/or controlling taste and odor causing compounds.

- Alternative 1: Initial installation of a LPHO system for disinfection only. Replacement with a MP system for UV/AOP at year 10 (earliest anticipated timing for trace organics regulation).
- Alternative 2: Initial installation of a MP system for disinfection only. Upgrade of MP system for use as UV/AOP reactor at year 10.

15.3.3 Results Summary

Present worth including amortized capital cost and annual operations and maintenance costs for Alternative 1 are 38% less over the first 10 years than Alternative 2 when both are used for Giardia disinfection only. ($958,600 for LPHO versus $1,536,800 for MP).

Costs for years 11 through 30 were estimated as follows:

- Year 11 - Alternative 1: Remove LPHO (no salvage value), install MP UV/AOP reactors and upgrade electrical system.
- Year 11 - Alternative 2: Add additional MP lamps to existing reactors and upgrade electrical system.
- Years 11-30 - Operate both as UV/AOP reactors for 3 months of the year, and as disinfection only for 9 months of the year.

Total life cycle costs are estimated at $7.3M for Alternative 1 versus $7.1M for Alternative 2.

Alternative 1 (LPHO for initial installation and addition of MP if needed in the future) is recommended based on lower present worth of UV equipment when used for disinfection only. The detailed analysis is included in Appendix J.

15.4 DESIGN CRITERIA

Key preliminary design criteria for sizing the Baker WTP UV system are summarized in Table 15.3 below.

Table 15.2 UV System Design Criteria

Description	Units	LPHO System Criteria
Design Flow	mgd	28
Maximum Headloss[1]	inches	18
Design UVT[2]	%	80
Train Redundancy	No.	1
Treatment Requirement	Log	1.5-log *Cryptosporidum*
UV Dose	mJ/cm^2	3.9
Process Location	-	Post-MF, upstream of future GAC and CT basin
Dose Monitoring Strategy	-	UVDGM compliant MS2 or T1 phage calculated dose algorithm
Manufacturer	-	Wedeco (No other LPHO manufacturer in the USA)

Notes
1. Headloss through UV system (reactor + associated piping and components) at design flow and redundancy.

SECTION 16 CONTACT (CT) BASIN DISINFECTION

16.1 OVERVIEW

A CT Basin will be constructed to provide disinfection contact time, in accordance with regulations outlined in:

- California Surface Water Treatment Rule
- California Regulations Related to Drinking Water

The CT Basin will be a partially-buried concrete reservoir sized to provide adequate disinfection contact time for free chlorine to meet 4-log virus inactivation requirements. Sizing Calculations for the CT basin are provided in Appendix K.

16.2 DISINFECTION GOALS

The total disinfection requirements for Giardia, virus, and Cryptosporidium are established in Table 2.2 of Section 2, along with CDPH approved disinfection credits for membrane filtration, which will serve as the core of the treatment process at Baker WTP. Dedicated disinfection processes must meet the balance of the disinfection requirements not met by membrane filtration (i.e., 0.5-log Giardia inactivation and 4-log virus inactivation). Ultraviolet disinfection will be used to meet the 0.5-log giardia inactivation requirement, as discussed in Section 15. The CT Basin will be sized to meet the 4-log virus inactivation requirements.

Some of the candidate membrane filtration systems have been granted virus log removal credit by CDPH. However, it should be recognized that none of the integrity tests utilized by these systems are sensitive enough to detect a breach of the size of a virus (e.g., less than 0.5 µm). Therefore, post-membrane disinfection facilities should be designed for total virus inactivation or 4-log.

16.3 DISINFECTION BY-PRODUCTS

Provisions will be made to minimize formation of total trihalomethanes within the basin, particularly during periods of low plant flow when contact time in the CT basin is increased. In order to minimize potential for TTHM formation:

- an alternate chlorine injection point and fixed weir will be provided at an intermediate distance between the inlet and outlet of the basin.
- at low flows, the chlorine injection point can be manually changed by valving.

16.4 POST TREATMENT CHEMICAL INJECTION

Post-treatment chemicals to be injected at the CT basin include:

- Sodium hypochlorite for disinfection.
- Aqua ammonia for chloramine formation.
- Caustic soda for pH control.

Metering pumps for post treatment chemicals will be paced on a flow meter located immediately upstream of the CT basin.

16.4.1 Sodium Hypochlorite

Sodium hypochlorite will be dosed via a perforated pipe diffuser located underneath the nape of the inlet and intermediate fixed weirs. This will minimize off-gassing. Metering pump will be controlled based on the measured flow and an operator input dose setpoint. The target chlorine residual will be met by trimming the sodium hypochlorite flow to measured residual chlorine immediately upstream of the CT basin outlet weir.

16.4.2 Aqua Ammonia

Aqua ammonia for chloramine formation will be dosed via a perforated pipe diffuser located underneath the nape of the fixed outlet weir. This will minimize off-gassing. Metering pump will be based on a set ratio with the sodium hypochlorite pumps, with ammonia to chlorine ratio of between 4 and 5 to 1.

16.4.3 Corrosion Inhibitor

Corrosion inhibitor (if necessary) will be dosed at the outlet weir.

16.4.4 Caustic Soda

Caustic soda will be dosed via a perforated pipe diffuser located at the outlet weir. Metering pump will be controlled based on measure CT basin inlet flow and an operator selected dose setpoint. The metering pump flow will be trimmed based on a target pH.

16.5 DESIGN CRITERIA SUMMARY

Design criteria for the CT Basin are summarized in Table 16.1.

Table 16.1 Basin Design Criteria

Disinfection (CT) Basin		
Type: Partially Buried Concrete, Serpentine Channels	-	-
Virus Inactivation (pH=6-9, Min. Temperature = 4° C)	**LOG**	**4.0**
Concentration x Time (CT) Requirement	MG.MIN/L	12.4
Number of Trains	NO.	2
Disinfection Capacity, Total	MGD	35
T_{10} / T	PERCENT	60
L/W Ratio	-	34
Water Depth	FT	10.5
Total Volume	GAL	200,000
Overall Basin Dimensions (L x W)	FT x FT	44 x 80
Free Chlorine Average Dose	mg/L	3.0
Free Chlorine Average Residual	mg/L	2.0
Ammonia Average Dose	mg/L	0.5

Exhibit 16.1 (**Drawing M11** – Plan) and Exhibit 16.2 (**Drawing M12** – Section) summarize the preliminary design of the CT basin.

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SECTION 17 TREATMENT PLANT SITE

17.1 OVERVIEW

The treatment plant of the Baker WTP project will be constructed at the Baker site, comprising the following (see Exhibit 17.1).

- Treatment Plant (or High) site – primary area of new construction,
- Pipeline Easements – for the Baker and Allen McColloch Pipelines,
- Low site – located to the east of the pipeline easement,
- Development Area – area to the northeast of the treatment plant, planned for development.

This section describes the existing and future facilities for Baker WTP at the Baker site and covers the following topics:

- Existing Facilities – description of current and future conditions,
- New Facilities – description of the size and height of each,
- Site Access – means of access for the site, with focus on chemical delivery,
- Plant Layout – a summary of layout of the plant with supporting rationale,
- Civil Site Design – preliminary grading and drainage, and
- Utilities – describing utility abandonments, replacements, new installations and pipeline materials.

17.2 EXISTING FACILITIES

Existing facilities at the Baker site include reservoirs, filter plant, pump stations and storage/office buildings. Exhibit 17.1 delineates the four areas of the Baker site, shows the location of each of the existing facilities, and categorizes each as:

a) planned for demolition,

b) protected in-place or,

c) future use under analysis by IRWD.

17.2.1 Baker WTP Use

- 16 MG Pre-Stressed Concrete Reservoir (nearest to Baker WTP) – the fully buried reservoir was used for emergency storage by Los Alisos Water District. With Baker WTP the reservoir will be converted to the clearwell for storage of product water prior to distribution.

17.2.2 Future Use Under Analysis

- 16 MG Buried Pre-Stressed Concrete (furthest from Baker WTP) – used for emergency storage by LAWD, diameter of approximately 300 ft and depth of 30 ft. The second reservoir is being analyzed as part of the Lake Forest Sub Area Master Plan. The analysis will determine whether the reservoir will continue to provide emergency storage for the LAWD Zone 1 system, or be used as recycled water storage tank long-term.

- Zone A Reservoirs - two 2.0 MG recycled water reservoirs exist on the Baker site. The reservoirs were constructed as above ground steel tanks, and currently serve the LAWD Zone A system.

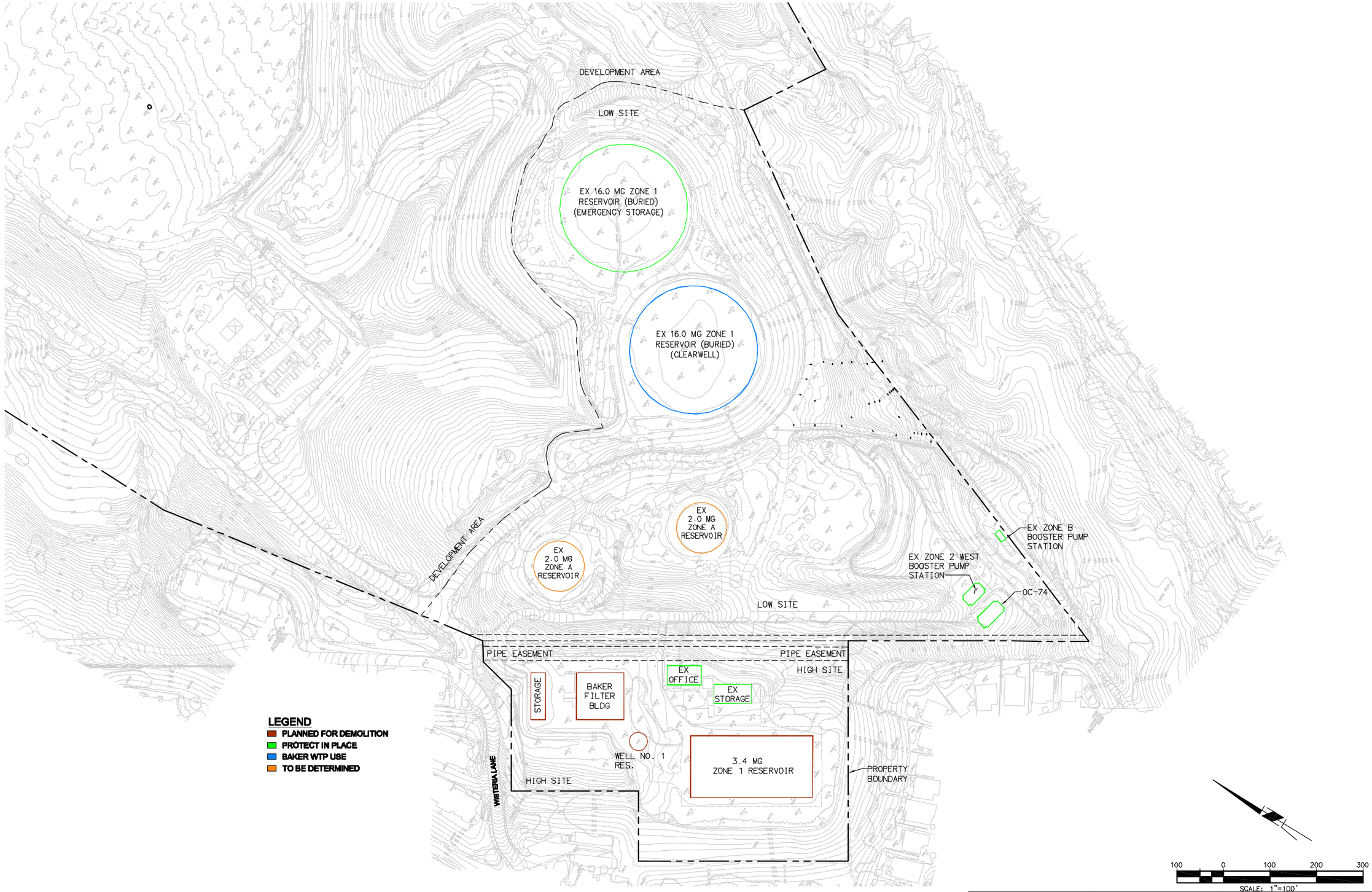
17.2.3 Planned for Demolition

- Filter Building - the filter building of the former Baker Filter Plant is a metal building measuring approximately 100 ft x 100 ft - not large enough to house the membrane filters for Baker WTP. The building will be inspected for hazardous materials prior to demolition.

- Storage Building (north of existing Baker Filter Building) – this storage building is too small to be used for chemical storage. The building will be inspected for hazardous materials prior to demolition.

- Zone 1 3.4 MG Reservoir – formerly used as the clearwell for Baker Filter Plant, this buried concrete reservoir is no longer in service and will be demolished.

- Well No. 1 System - constructed to supply water to the LAWD Zone 1 domestic water system. Constructed with a design capacity of approximately 1,000 gpm, which declined to an approximate maximum of 200 gpm. The well is no longer in operation. Prior to being taken out of service the well had provided water for:



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RBF CONSULTING

carollo

IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

BAKER SITE
EXISTING FACILITIES

EXHIBIT

17.1

- supplemental water to the filter in the basins of the former Baker Filter Plant before its addition to the Zone A non-potable system in the LAWD system
- distribution for small areas of irrigation, and
- make-up water for manmade lakes within residential communities of Lake Forest, west of the Baker WTP site.

Now, these demands are met by water from the Baker Pipeline. IRWD is in the process of developing a plan for converted service to each of the users of the former Well No. 1 system, including recycled water or continued Baker Pipeline supply. The new system will be installed prior to site demolition and construction at Baker WTP. Thereafter, any on-site pipeline to the system will need to be protected in place, and the existing above ground steel tank can be demolished.

17.2.4 Protect In Place

- Zone 2 West Pump Station – located in the southern corner of the Baker site, supplying water from Zone 1 to 2 of the LAWD system.
- OC-74 Turn-out Building – located beside the Zone 2 West Pump Station, enabling supply of treated water from the AMP to the LAWD Zone 1 system, as necessary.
- Zone B Pump Station - near Serrano Creek, boosting water from the Zone A system (two reservoirs at the Baker site).
- Office and Storage Building (south of the existing Baker Filter Building) – both buildings will be protected in-place. Access to each facility will be impacted during construction.

17.3 NEW FACILITIES

Construction at the treatment plant will include the new facilities for:

- Raw Water – to collect, control and convey raw water for treatment
- Treatment – all facilities associated with the main treatment process
- Chemicals – to store and deliver
- Backwash Wastewater – for treatment and recovery

- Disinfection – bringing product water to drinking water standards
- Product Water – to deliver product water
- Non-reclaimable wastewater disposal

The new facilities for Baker WTP are summarized in Table 17.1.

Table 17.1 New Facilities Summary

Facility	Size	Construction
Raw Water System		
Flow Control Facility	T.B.D.	Slab on grade with surrounding wall.
TCWD Pump Station	T.B.D.	Slab on grade with surrounding wall.
Forebay	785,000 gal (71' x 135')	Cast-in-place concrete reservoir.
Feedwater Building - Pump Station - Strainer	64' x 72'	Building housing pump and flah mix / strainer.
Treatment System Treatment Building - Office / Control Center - UV Disinfection System	105' x 200'	Single story building (slab on grade).
Chemical System Chemical Building	80' x 132'	Single story building (slab on grade).
Backwash Waste Water System MFWW Equalization and Pumps	30,000 gal (20' x 25')	Buried pre-cast concrete tank w/ submersible pumps.
Sedimentation Basin	44' x 71'	Concrete basin with top just above grade.
Disinfection System Contact Basin	200,000 gal 44' x 80'	Concrete basin with top just above grade.

17.4 TREATMENT PLANT ACCESS

The future treatment plant site can be accessed from:

1. Wisteria Lane – access originating at Trabuco Road, and passing through the residential communities along Peachwood Drive, Palmwood Drive, and Wisteria Lane. Wisteria Lane has limited turning radius off of Palmwood Dr. and into the Baker site, and will require parking restriction enforcement on the south side of the street if chemical deliveries are made through this access.

2. Commercentre Drive – access is also possible from Commercentre Drive to the existing Baker site via Biscayne Bay or Indian Ocean Drive and dirt roads across the future development area. Access provided from Commercentre Drive will require the future development to accommodate turning radius requirements of the chemical delivery trucks to the Baker WTP, both during and after construction.

As site access must account for increased delivery frequency and larger chemical delivery trucks it is recommended that access via Commercentre Drive be pursued. Dependent on the final development planning, access from Indian Ocean Drive may provide the least extent of improvements, while also reducing the impact to existing or future residential communities.

If site access cannot be made through the future development, then:

- the access gate to the plant from Wisteria will need to be expanded, including some re-grading of the joint homeowner / Baker site slope, west of the existing gate,
- the City of Lake Forest will need to change to and enforce parking restriction on the southside of the Wisteria Lane,

17.5 TREATMENT PLANT LAYOUT

Alternative layouts of the treatment plant site were developed. Each alternative was based on consideration of:

- On-Site Access – based on a turning radius of 55 ft (chemical delivery truck), maintaining chemical delivery to both the east and west side of the chemical building, and providing maintenance access to all other facilities (treatment building, SCE switchboard and transfer, CT basin, forebay, feedwater pump station and backwash wastewater treatment.
- Visual and Noise Impacts – the nearby residential community to the Baker site was considered in layout alternatives. New above ground facilities were set back from the property boundary and facilities known to create noise during normal operation (i.e. Feedwater Pump Station and strainer) are planned in buildings.
- Yard Piping – the length of pipeline and number of utility crossings was considered in each alternative.

- Adjacent Facilities – the location of facilities at times was dictated by certain advantages in siting of facilities near each other.

Three alternatives were presented to the IRWD in workshop form, and to the Project Stakeholders in report form.

Alternative 1 – with the treatment building where the Zone 1 reservoir currently exists, and the chemical building where the filter building exists.

Alternative 2 – with the treatment building where the Zone 1 reservoir currently exists , and the chemical building in the center of the site.

Alternative 3 – with the treatment building where the filter building exists, and the chemical building where the Zone 1 reservoir exists.

Alternative 1, shown as Exhibit 17.2 (Drawing C1 and Exhibit ES-4), was selected for the Baker WTP based on its major advantages in addressing the considerations previously listed, and as summarized in Table 17.2.

Table 17.2 Layout Advantages

Consideration	Advantage
On-Site Access	- Ease of access to both sides of the chemical building for deliveries.
Visual and Noise Impacts	- Minimal impact with the feedwater pump station and strainers in a building, and the chemical and treatment buildings located where facilities currently exist.
Yard Piping / Adjacent Facilities	- Siting of the CT basin near the chemical building reduces pipe construction. - Siting the backwash wastewater treatment and forebay next to each other eliminates the construction water pipeline in recirculating treated backwash water.

17.6 CIVIL SITE DESIGN

Preliminary design of the grading and drainage for the plant layout is provided as Exhibit 17.3 (Drawing C2). The grading and drainage concept was based on:

- Maintaining a similar approach to site drainage as existing, including areas of sheet flow, on-site storm drains and v-gutters.

- Grading down the existing slope behind the filter building for construction of the forebay, feedwater pump station and backwash wastewater treatment facilities.

17.7 Utilities

The major utilities and construction related to utilities are covered in this section.

17.7.1 Baker Pipeline Connection

Raw water will be delivered to the Baker WTP through the Baker Pipeline. The existing connection and valve vault off of the Baker Pipeline will be used. There are currently three connections to Baker Pipeline through the vault.

- 20-inch former feedwater pipeline to the Baker Filter Plant with an existing ball valve
- 12-inch former by-pass pipeline to the Baker Filter Plant with an existing gate valve
- 12-inch pipeline to Trabuco Canyon Water District with an existing gate valve.

The 12- and 20-inch pipelines to the former filter plant combine beyond the vault into the 24-inch main feedwater pipeline. Trabuco Canyon Water District's pipeline increases to a 16-inch pipeline beyond the vault.

For Baker WTP each of the existing connections to the Baker Pipeline will be utilized as follows:

- IRWD connection (12-inch and 20-inch pipeline and valves) – the existing 12- and 20-inch connections to the Baker Pipeline will be maintained. Each of the existing isolation valves will be replaced with new ball valves. After each valve pipeline diameter increasers will be added to upsize the 20-inch pipeline to 24-inch and 12-inch to 16-inch. The new 16- and 24-inch pipelines will join beyond the valve vault into a single 36-inch.
- TCWD connection (12-inch valve and 16-inch pipeline) - will be maintained and continue to serve the Dimension Plant. The existing pipeline will serve as the majority of the suction and discharge pipe to the TCWD Pump Station.

17.7.2 Flow Control Facility and Solids

The flow control facility will be constructed with a sleeve valve having openings of approximately 3/8" to 1/2" size. Small solids may pass

through the sleeve valve and into the forebay. As a result, the construction of raw water strainers upstream of the flow control facility has recently been considered. If added to the Project, the flow control facility would be moved to the north along the access road to provide room for the strainers to be immediately downstream of the connection to the Baker Pipeline.

17.7.3 Raw Water Pipelines

Raw water pipeline will be constructed to deliver water from the Baker Pipeline to the forebay. All raw water pipelines will be cement mortar and lined steel pipe. As shown on Exhibit 17.2, reaches of 36-inch and 42-inch pipeline will be constructed between the flow control facility and forebay. Thereafter, 42-inch pipeline will be constructed from the feed water pump station to the treatment building.

17.7.4 Product Water Pipelines

Product water pipelines for Baker WTP are summarized in Table 17.3.

Table 17.3 Product Water Pipelines

From	To	(E)xisting or (N)ew	Size (in)
Treatment Building	CT Basin	N	42
CT Basin	Clearwell	N	42
Clearwell	IRWD Zone 1	E	24
Clearwell	Product Water Pump Station	N	36
Product Water PS	AMP	N	36

New 42-inch pipeline will be constructed from the treatment building to the CT basin, and the CT basin to the clearwell. At the clearwell a new connection will be required. The connection will include a valve vault adjacent to the existing reservoir, and wall (toward the top of the tank) or roof penetration and include inlet piping within the reservoir so that water discharge within the tank occurs 4 to 6 feet from the tank invert. Product water will be conveyed from the clearwell through an existing 24-inch Lake Forest Zone 1 pipeline to IRWD, and in a new 36-inch pipeline to the Product Water Pump Station and Allen McColloch Pipeline.

17.7.5 Chemical Distribution

Chemical distribution pipelines are summarized in Table 17.4, and also discussed in Section 13.

Table 17.4 Chemical Distribution Pipelines

Type	From	To	Tube Material / Carrier Pipe
Aqua Ammonia	Chemical Building	CT Basin	Teflon / 316 SS
Chlorine Dioxide	Chemical Building	Raw Water Pipeline	Teflon / PVC Sch 80
Citric Acid	Chemical Building	Treatment Building	Teflon / 316 SS
Ferric Chloride	Chemical Building	Treatment Building	Teflon / PVC Sch 80
Hydrochloric Acid	Chemical Building	Chemical Building	Teflon / PVC Sch 80
Sodium Bisulfite	Chemical Building	Treatment Building	Teflon / PVC Sch 80
Sodium Hydroxide	Chemical Building	Treatment Building	Teflon / Black Steel
Sodium Hypochlorite	Chemical Building	CT Basin	Teflon / PVC Sch 80

17.7.6 Drainage

Ultimate drainage design for the Baker WTP will need to incorporate emergency overflow conditions, as well flow from the 100 year storm. One option still to be investigated is using the proposed detention basin planned as part of the adjacent development. This detention basin is planed to be located at the low area of the Baker site. It is understood that the detention basin may be located where the two 2.0 MG Zone A reservoirs are located. If so, worst-case storm drain/overflow conditions could be handled by transferring flow from the high site to the low site by either sheet flow, construction of a new drainage pipeline, or a combination of both.

17.7.7 Water Discharge

The Baker WTP may need to convey raw or treated water for discharge to Serrano Creek in case of emergency operating conditions. Conditions upon which discharge may be required include:

- Overflow of the Forebay (raw water) – occurring only if the level in the forebay cannot be maintained and the flow control valve does not modulate appropriately to reduce or shut-off flow.

- Overflow or Discharge from the Contact Basin (treated water) – occurring only if the flow to the contact basin exceeds discharge, and the water cannot be delivered to the clearwell or the forebay.

If flow to Serrano Creek is required, there are two likely discharge points. These are:

- East of the 16 MG Reservoirs – the overflow pipeline for the two 16 MG reservoirs consists of 18-, 36- and 48-inch pipeline. The discharge point is on the Baker site, east of the reservoirs and north just north of the property boundary / off-site trail. At the discharge point is existing rip-rap and a 72-inch pipeline to carry the flow under the existing trail to Serrano Creek. The existing pipeline was constructed as storm drain line 'B' of the Zone 1 emergency storage reservoirs.
- East of the Zone 2 West Pump Station – a storm drain was also constructed near the Zone 2 West Pump Station with the Zone 1 emergency reservoirs. The line is referenced as storm drain line 'D'. The discharge of this pipeline does not appear to have rip rap, and would be anticipated to have greater impact to Serrano Creek if utilized.

Further evaluation of water discharge options and locations will be provided during final design.

17.7.8 Sewer

Concurrently with the design of Baker WTP, the Lake Forest Sub Area Master Plan is being prepared by Dudek. The report includes an evaluation of the sewerage of the Baker Site (Baker WTP and future development). Therefore, a definitive plan for the disposal of the plant's non-reclaimable wastewater (NRW) will be developed as the master plan progresses. At present, two possible approaches to the disposal of wastes have been considered, both of which require a crossing of Serrano Creek with new pipeline:

- Construction of a gravity sewer from the sedimentation basin, that will be constructed as part of this Project to the southern corner of the project site, where a sewer siphon would be constructed to cross Serrano Creek and connect with the 15-inch VCP pipeline on the other side or,

- Construction a pump station and forcemain along the same alignment, and to the same terminus.

IRWD and RBF have also begun consideration of the following:

- Construction of a shallow gravity sewer along the foot path that parallels Serrano Creek on its north side. The discharge location would be about 600 feet north of Trabuco Road to an existing 15-inch VCP sewer.

Each of these options appear feasible. However, the shallow sewer option may be preferred because it does not require a crossing of Serrano Creek. However, the final recommendation depends on the results of the master planning efforts. Further evaluation of the sewer

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SECTION 18 PRODUCT WATER PUMP STATION

18.1 INTRODUCTION

A Product Water Pump Station (PWPS) will be constructed to pump product water from the clearwell to the Allen McColloch Pipeline for delivery to each Project Stakeholder, except Irvine Ranch Water District. Irvine Ranch Water District will receive water from the clearwell by gravity, into the Lake Forest Zone 1 system.

This section covers the preliminary design of the Product Water Pump Station, addressing:

- Capacity
- Hydraulics
- Site Development
- Design Criteria
- Surge System

18.1.1 Capacity

The capacity for the Product Water Pump Station will be 33 cfs, based on the total capacity for Baker WTP, minus IRWD's capacity. Table 18.1 summarizes capacity in the pump station by agency.

Table 18.1 Product Water Pump Station Capacity

Agency	Capacity (cfs)
El Toro Water District (ETWD)	5
Moulton Niguel Water District (MNWD)	13
Santa Margarita Water District (SMWD)	13
Trabuco Canyon Water District (TCWD)	2
TOTAL	**33**

18.1.2 Hydraulics

Hydraulic calculations were completed for the suction and discharge of the Product Water Pump Station. A summary of each is provided.

Suction side hydraulics - were based on the low and high water operating levels of the Baker WTP clearwell. The proposed clearwell for the Baker WTP is the southern most 16.0 MG reservoir at the Baker Site. The tank was constructed with a low water level of 595 ft and high water level of 621 ft above mean sea level (amsl). For the basis of preliminary design of the PWPS the design minimum HGL at the pumps was evaluated as 585 ft amsl calculated to be 10 feet of headloss from the clearwell to the pump station.

Discharge side hydraulics - were based on the hydraulic grade line of the Allen McColloch Pipeline. The hydraulic grade line of the Allen McColloch Pipeline varies significantly between summer (high demand) and winter (lower demand) conditions. The absolute minimum and maximum HGL in the AMP are understood to be a low of 630 ft, and high HGL of 806 ft per coordination with Flow Science. Metropolitan Water District has performed analysis of the AMP pipeline under peak day (maximum day demands) up to the year 2035. Based on that analysis, the lowest (non-surge) stable HGL was determined for 2035 to be approximately, 703 ft at OC-88 (South County Pump Station), and 701 ft at OC-74 (IRWD connect on the Baker site).

Table 18.2 PWPS Capacity and HGL Requirements

Description	Parameter
Hydraulics (Suction)	
Water Level in Clearwell	595 - 621 ft
Maximum Flow w/ one standby pump (4 pumps)	33 cfs
Maximum Flow w/ no standby pump (all 5 pumps)	40 cfs
Headloss thru Suction Piping (Maximum)	24 ft
Minimum HGL at Product Water Pump Station (per headloss calculation)	585 ft
Hydraulics (Discharge)	
Discharge HGL in Allen McColloch Pipeline	630 – 806 ft
Maximum Flow	33 cfs

A summary of delivery capacity and HGL requirement is provided as Table 18.3.

Table 18.3 PWPS Capacity and HGL Requirements

Agency	Capacity (cfs)	Distributed By	HGL Required (ft)
Irvine Ranch Water District	10.5	IRWD System	595 – 621 ft
El Toro Water District	5	AMP	630 ft (min) to 806 ft (max)
Moulton Niguel Water District	13		
Santa Margarita Water District	13		
Trabuco Canyon Water District	2		

Hydraulics calculations for the Product Water Pump Station were completed to determine the total dynamic head, type and number of pumps, develop system curves and plot preliminary pump curves utilizing variable speed drives to address the fluctuations in discharge head. Table 18.3 summarizes the capacity and HGL requirements. Table L1 of Appendix L also depicts the HGL conditions from the clearwell to the AMP.

Hydraulic analysis verified the HGL fluctuation in the AMP require variable speed drives to maintain discharge flow. Speed reduction down to 70-percent was considered in selecting the type and number of pumps.

The design of the pump station includes four (4) duty pumps + one (1) stand-by pump configuration. It was determined through coordination with pump manufacturers and hydraulic calculations that the infrequent low HGL range below 690 ft should be separated from the pump design operating band, and managed by pressure reduction with a throttling valve. If a baseload for the Product Water Pump Station is established, it may be possible to change the pump station design to include single speed pumps. This issue will be further investigated in final design.

Exhibit 18.1 depicts the operating range of the pump station, and depicts the operation conditions where pressure reduction will be needed to provide flow during low head conditions in the Allen McColloch Pipeline.

See Table L2 of Appendix L for the design criteria of the pumps.

18.1.3 Operation

The Product Water Pump Station will be operated to deliver up to 33 cfs of flow to the Allen McColloch Pipeline. Pressure information will be received from the AMP to determine the correct operating range of the pumps and the throttling valve.

18.2 SITE DEVELOPMENT

The Product Water Pump Station site layout is shown in Exhibit 18.2 (Drawing C4).

To the south of the pump station is a 24-inch pipeline that was used to fill the existing 16 MG reservoirs with treated water through the OC-74 turn-out off of the Allen McColloch Pipeline.

The extent of grading, and reserved space for a surge tank, SCE transformer, switchboard, and power generator. An access road around the pump station will be constructed for ease of access for maintenance / equipment trucks. The proposed pump station building will require 2 – 3 ft of soil retainment along the north wall which will have to be accounted for in the structural design. However, this minimizes the grading implications and prevents disturbance of soil over the top of the northern most 24-inch IRWD / LAWD Zone 1 pipeline.

18.3 MECHANICAL

The mechanical layout of the PWPS is based on four vertical turbine type pumps, with a fifth pump as stand-by, a high-to-low pressure bypass, and a throttling valve. Suction and discharge header pipelines will be 36-inch based on the full design capacity of the pump station (33 cfs or 14,800 gpm). Pipelines to and from each pump will be 20-inch (8.25 cfs or 3,700 gpm). All isolation valves shall be butterfly type. In addition, a throttling valve, motor operated ball valve type will be installed to reduce head when the AMP has a low HGL. The ball valve will be located within the PWPS pump room and above the finished floor with a minimum of 3 ft height to centerline. The mechanical design for the pump station will include HVAC for air conditioning the electrical room planned to have five variable frequency drive controllers.

Exhibit 18.3 (Drawings M20 and M21) shows the mechanical layout of the Product Water Pump Station.

Pump Curve
4 Pump Configuration - Product Water Pump Station

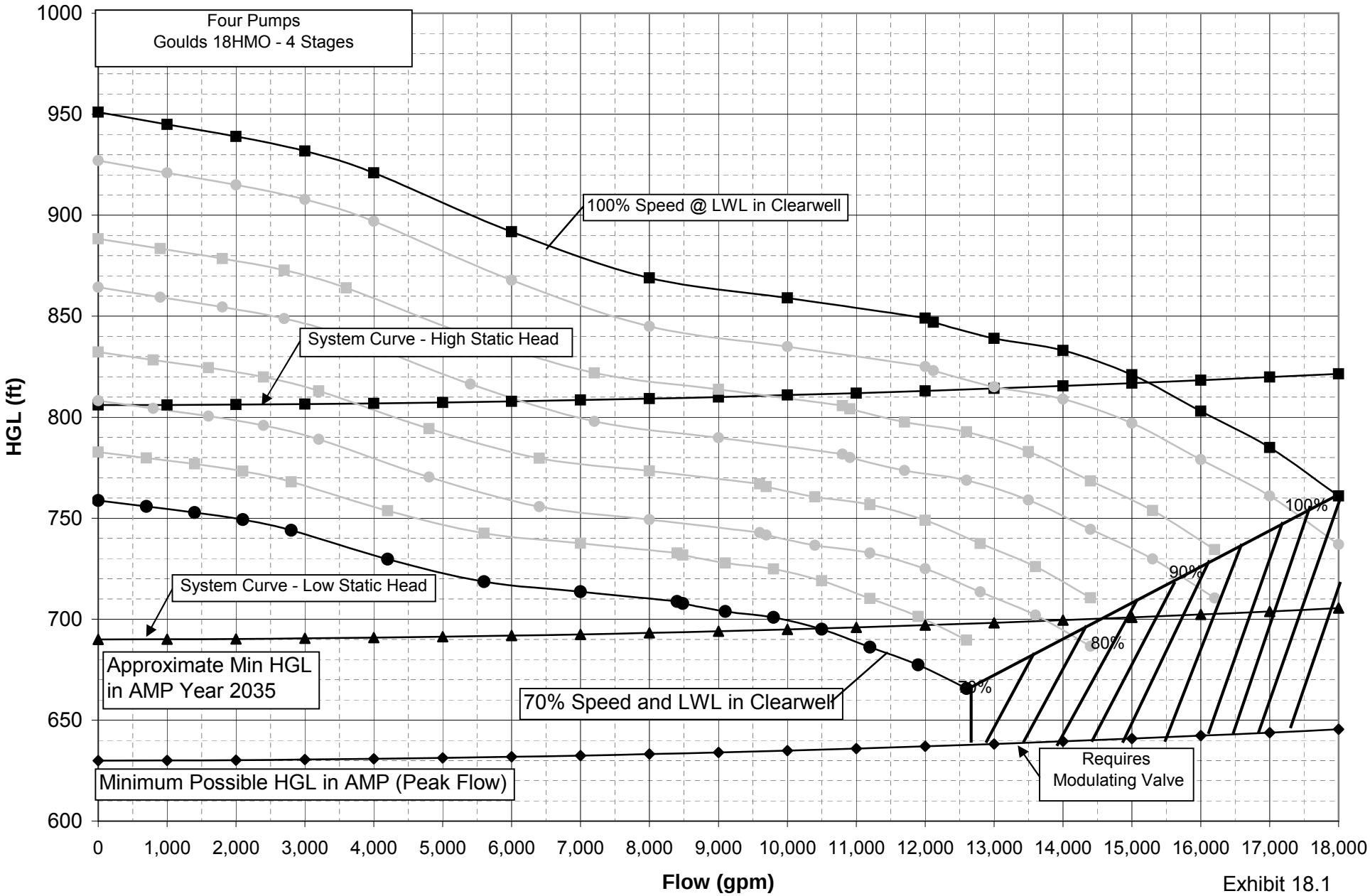


Exhibit 18.1

The discharge pipeline from the PWPS will be 36-inch diameter. The pipeline will connect to the AMP at design Station 353+35 (Record 353+37.20). This is the current location of an air-valve as well as the emergency inter-connection vault for the AMP to the Baker Pipeline. It is anticipated that the connection facility will involve the following:

- Utilization of the existing air-valve structure at Station 353+37.20 as the connection point.
- Construction of one or two new vaults for the installation of a magnetic meter, check valve, new isolation valve for the existing AMP/Baker cross-connection, and a removable spool to render the cross-connection inoperable when flow from the AMP to the Baker is not required.

The new vault(s) will be reinforced concrete, approximately ten feet deep and will be situated adjacent to the existing access road. The length and width of the vaults cannot be determined until the design criteria are established by MWD.

Exhibit 18.1 (Drawing M22) shows the proposed metering vault for the pump-in connection to the Allen McColloch Pipeline. The drawing has been provided to MWD for review.

18.4 DESIGN CRITERIA

The design criteria for the Product Water Pump Station are provided as Table 18.4.

Table 18.4 Product Water Pump Station Design Criteria

Description	Units	Value
Type: Vertical Turbine	-	-
No. of Pumps	NO.	5
No. of Redundant Pumps	NO.	1
Capacity per Pump	GPM	3,700
TDH (Maximum)	FT of Water	235
Size	HP	300
Mechanical	-	-
Upstream Pipeline Diameter	IN	36
Inlet Pipeline	IN	20
Discharge Pipeline	IN	20
Isolation Valves	IN	20
Throttling Valve	IN	24
Downstream Pipeline Diameter	IN	36

18.4.1 SURGE

Preliminary surge analysis for the Product Water Pump Station has been completed. The analysis analyzed power failure to the Product Water Pump Station under three steady state flow conditions.

1. Full AMP winter demands without OC-88 and OC-88a pump stations or surge protection at the pump stations.

2. Full AMP summer demands with OC-88 pump station and its associated surge protection in operation.

3. Full AMP winter demands with OC-88a pump station and its associated surge protection in operation.

The results of the surge analysis show that loss of power to the Product Water Pump Station will cause a pressure drop wave in the AMP. When reflected the wave would cause an upsurge wave along the AMP exceeding the 830 ft HGL level. In order to prevent the excessive HGL (greater than 830 ft) it is recommended that a pressurized surge tank of 1,810 cu. ft. be installed downstream of the flow control ball valve. Additionally, it was found that a surge relief valve downstream of the flow control ball valve will be necessary. The combination of the surge tank and pressure relief valve will serve to prevent the HGL in the AMP from exceeding 830 ft under all three operating conditions.

Analysis is on-going and will be continued into and through design to finalize the facilities necessary and in support of coordination with MWD. The conclusions provided herein are based on the Draft Report, which has yet to be reviewed by MWD.

18.4.2 GEOTECHNICAL

A geotechnical investigation, including borings and soil data logging will be completed during the design of the Product Water Pump Station.

SECTION 19 ELECTRICAL SITE INFRASTRUCTURE

19.1 OVERVIEW

This section describes the electrical distribution systems for the Raw Water Pump Station, Baker Water Treatment Plant and Product Water Pump Station.

19.2 RAW WATER PUMP STATION

SCE will provide a 480 volt, 3 phase, electrical service to accommodate the loads of the Raw Water Pump Station. The single line diagram for the pump station is included in Exhibit 19.1 (Drawing E11).

The new metered switchboard is located on the pump station site as shown on Exhibit 19.2 (Drawing E10). The service to the pump station will be provided from an upsized SCE transformer also shown on Exhibit 19.2. The existing transformer serves three facilities; 1) EOCWD flow control facility, 2) MWDOC-Gerald price facility and 3) IRWD Santiago aqueduct flow control facility. The IRWD flow control facility will be demolished. The new SCE transformer will be sized to serve the EOCWD facility, MWDOC facility and the new pump station. The pump station contractor will install a new concrete pad with slab box for the upgraded transformer and conduits from the transformer to the switchboard. SCE will install the new transformer, wiring from the transformer to the switchboard and set the meter in the switchboard. Electrical service to the existing facilities will be unavailable during the transformer replacement. IRWD will advise EOCWD and MWDOC of the planned upgrades to the electrical service and required outages.

The motor control center, VFDs and control panel are located as shown on Exhibit 19.2 (Drawing E10). The motor control center includes feeder circuit breakers for the VFDs, circuit breaker feeder for air conditioning, a 480 -120/208 Volt stepdown transformer and 120/208 Volt distribution panel to accommodate auxiliary loads such as lighting and receptacles. The control panel houses the PLC, radio, UPS and associated control components. Radio communication will be used between the pump station and the treatment facility. The antenna will be mounted on the roof of the pump station building at a height specified by IRWD. The radio communication and system integration is further described in Section 20.

19.3 GENERAL POWER SERVICE AND DISTRIBUTION – BAKER WATER TREATMENT PLANT SITE

19.3.1 Existing Conditions

Four electrical metered services are currently installed at the Baker site. These metered services are listed below and shown on Exhibit 19.3:

Treatment Building - 480 Volt, 3 phase

Treatment Building - 208 Volt, 3 phase

Zone B Booster Pump Station - 480 Volt, 3 phase

Zone 2 West Booster Pump Station – 480 Volt, 3 Phase

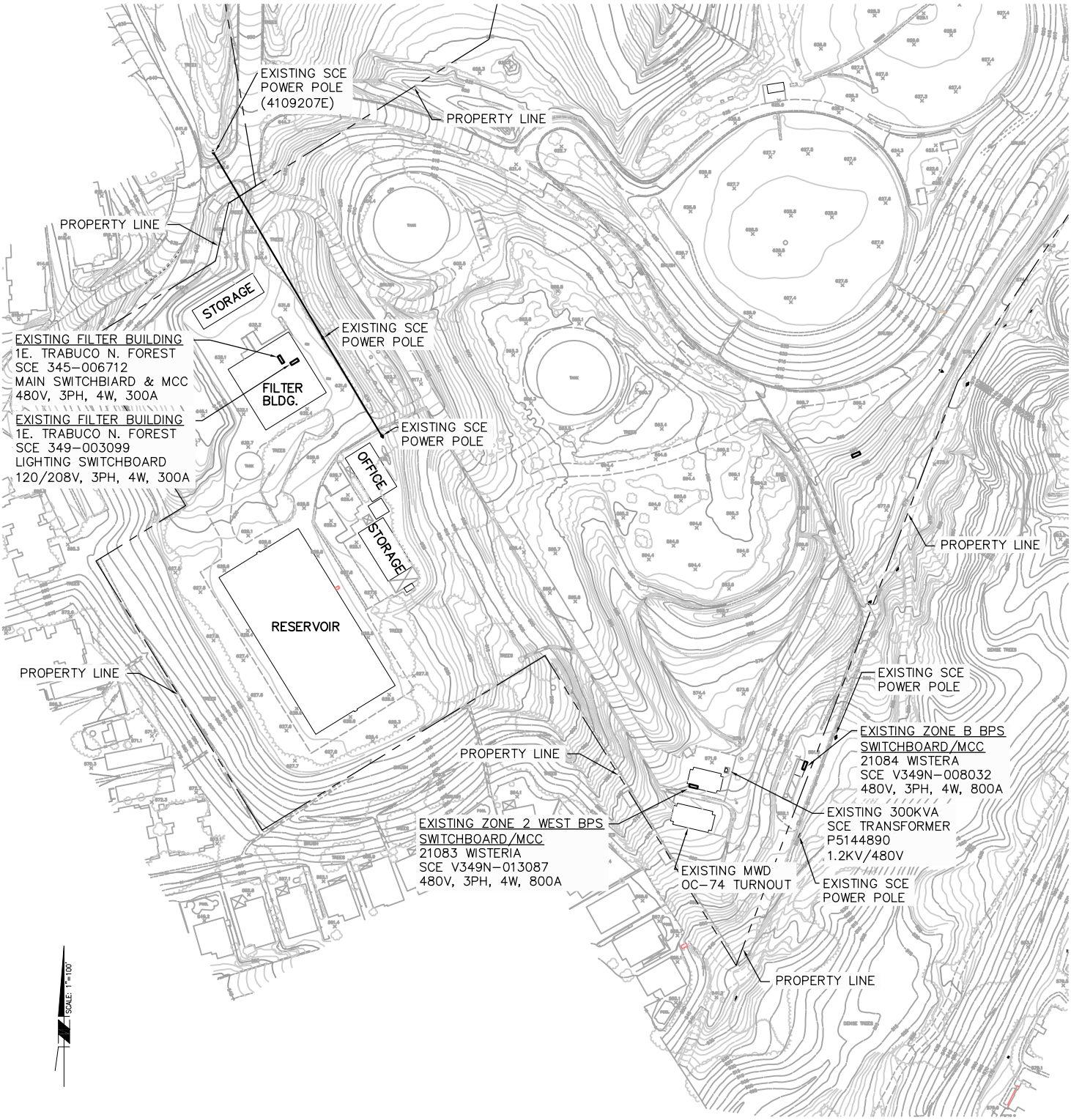
The proposed water treatment plant requires a 480 Volt, 3 phase electrical service to accommodate the approximate connected load of 3,776 Amperes. The existing Treatment Building 480 Volt and 208 Volt services (noted as Items 1 and 2 above) will be demolished. The proposed product water pump station requires a 480 Volt, 3 phase electrical service to accommodate the approximate load of 1,913 Amperes. The existing Zone B Booster Pump Station and Zone 2 West Booster Pump Stations are currently served at 480 Volts, 3 phase, and have connected loads of 751 and 700 Amperes, respectively.

SCE requires that the existing metered services and all new services required at the site be combined and served from one SCE point of connection. The services for the proposed water treatment plant and product water pump station will be provided from the overhead distribution line located adjacent to the existing water treatment facility. The new service plan also incorporates the existing Zone B Booster Pump Station and Zone 2 West Booster Pump Station.

Exhibit 19.4 depicts the proposed single line diagram and includes a summary of the loads for the existing facilities. Exhibit 19.5 (Drawing E2) depicts the proposed locations for the new electrical components.

19.3.2 Overall Site Electrical Distribution

The new electrical service for the water treatment plant site will be metered at 12.5 kV. SCE will install and maintain the 12.5 kV metering structure, medium voltage wiring, transformers and low voltage wiring



EXISTING SCE ELECTRICAL SERVICES

1"=100'-0"

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carollo

IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

EXISTING ELECTRICAL SERVICES

EXHIBIT 19.3

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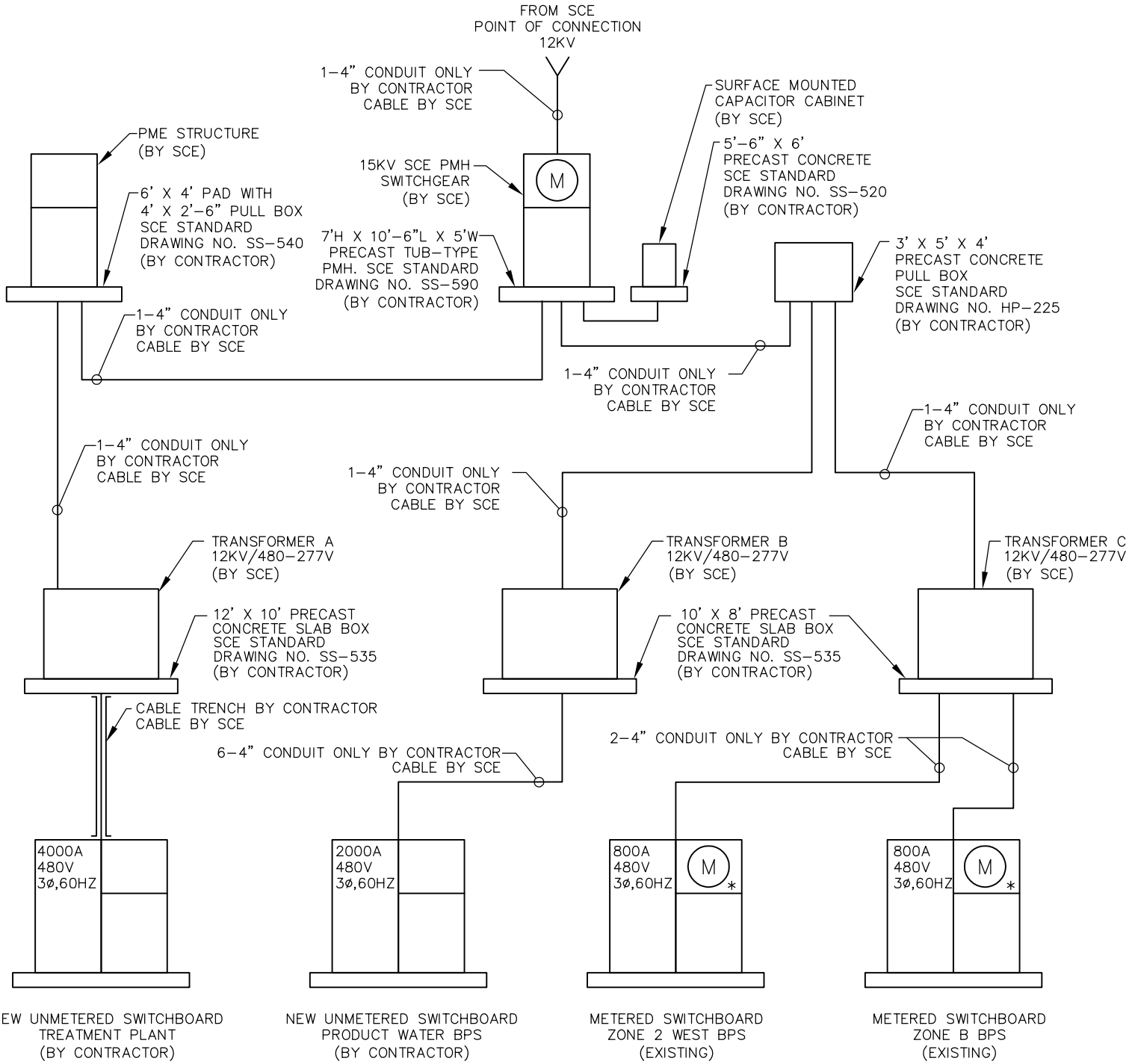

* SCE TO REMOVE EXISTING METER

ZONE 2 WEST BPS

LOAD SCHEDULE		
EQUIPMENT	HP	AMPS
PUMP 1	50	65
PUMP 2	100	124
PUMP 3	200	240
PUMP 4	200	240
15KVA XFMR	–	31
TOTAL		700

ZONE B BPS

LOAD SCHEDULE		
EQUIPMENT	HP	AMPS
PUMP 1	200	240
PUMP 2	200	240
PUMP 3	200	240
15KVA XFMR	–	31
TOTAL		751

RBF CONSULTING

carollo

IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

OVERALL POWER SERVICE BLOCK DIAGRAM

EXHIBIT 19.4

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from the transformers to the unmetered switchboards. The electrical contractor will install the conduit systems, concrete slab boxes for the transformers and other structures as required by the approved SCE service plan. SCE requires these facilities be inspected and approved by SCE field inspectors prior to SCE installing the wiring in conduits or setting transformers on the concrete pads. The Electrical Contractor will coordinate these inspections with the SCE field inspector. These requirements will be included in the project specifications prepared for the project.

The existing metered switchboards for the Zone B Booster Pump Station and Zone 2 West Booster Pump Stations will remain. SCE will provide the electrical service from the new SCE transformer "C" to each switchboard and will remove the existing meters at each switchboard.

New unmetered switchboards will be installed by the electrical contractor for the proposed product water pump station and the water treatment facility. SCE will install the wiring from the new SCE transformers to the unmetered switchboards. If the electrical usage at the proposed booster pump station is required to be individually metered for rate purposes, a power meter will be included in the electrical design for the proposed pump station. This power meter will be owned and maintained by IRWD.

19.3.3 Location of Electrical Facilities

The 12.5 kV metering and transformers for the water treatment plant will be located near the water treatment plant. SCE will serve these facilities from the existing SCE pole located at the entrance to the facility. Serving the facility from this pole allows the removal of the existing SCE poles adjacent to the water treatment facility. The existing SCE pole is located outside the IRWD property line requiring an easement from the adjacent property owner for the new underground service installation. SCE requires an easement with a width of six (6) feet extending from the existing SCE pole to the IRWD property line as depicted on Exhibit 19.5 (Drawing E2). SCE will obtain required easements from adjacent property owners. However, SCE will not pay a property owner for an easement and any charges for the easement would be paid by IRWD.

SCE transformer "A" to feed the proposed water treatment facility will be located near the new 12.5 kV metering structure. SCE transformer "B" will serve the new product water pump station and will be located near the

new product water pump station. SCE transformer "C" will serve the existing pump stations and will be located in the vicinity of the existing pump stations.

19.3.4 Construction Requirements

The electrical contractor for the water treatment facility will install the infrastructure for the SCE facilities including the concrete pads, pullboxes and conduit systems. SCE requires that clearances be maintained around SCE electrical equipment as depicted on Exhibit 19.6. The SCE facilities must be installed on non-sloped areas with appropriate access for SCE service vehicles.

SCE requires an easement from IRWD for the capacitor bank and PMH structure for the 12.5 kV primary metering equipment located as shown on Exhibit 19.6.

19.3.5 SCE Contractual Requirements

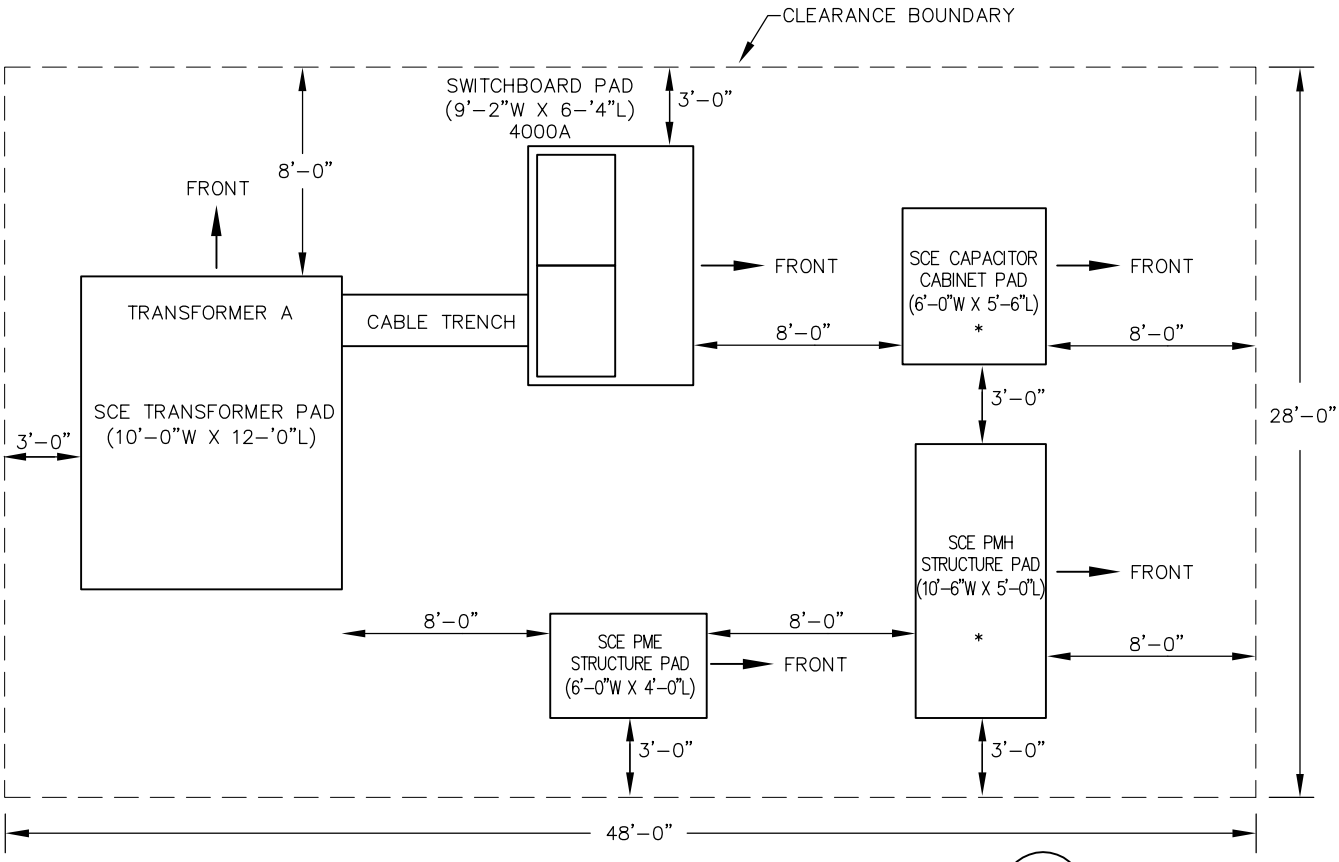
SCE will bill on a monthly basis for the installation and maintenance of the installed SCE facilities. Energy usage and demand charges will also be included on the monthly bill from SCE. The monthly charges will be determined by SCE after loads for the facility are finalized. These charges will be determined in a similar manner to those established at the Los Alisos Water Reclamation Plant where SCE owns and maintains the 12.5 kV system and the service is metered at 12.5 kV under Time of Use rate schedule TOU-8.

19.3.6 Treatment Plant

The 480 Volt, three phase electrical service is provided to the Treatment Plant per Section 19.3 and as shown on Exhibit 19.5 (Drawing E2).

The single line diagrams for the facilities at the treatment plant are included as Exhibit 19.7A to 19.7F (Drawings E3, E5 to E9). Power to each of four motor control centers will be provided from Switchboard MSB-2. Four motor control centers provide power distribution for the loads of the treatment plant area as follows:

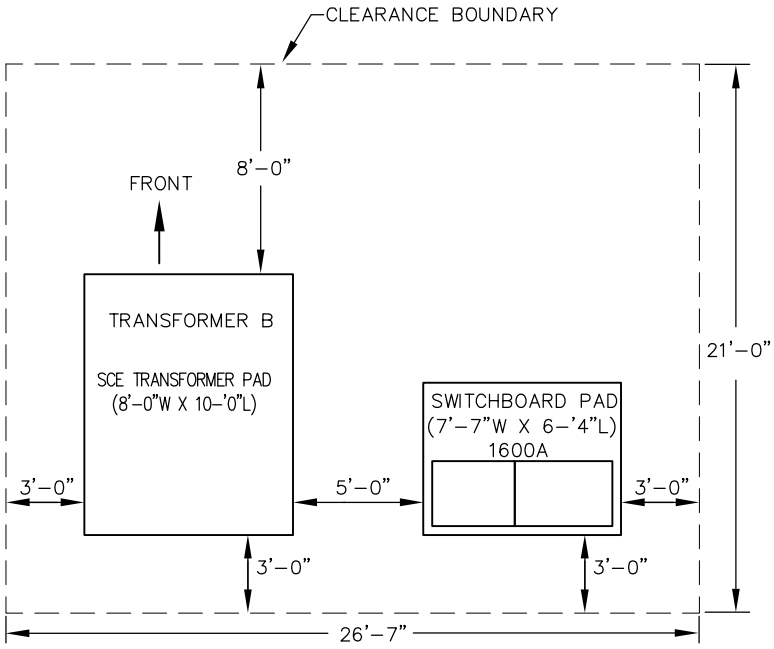
1. MCC – WTP feeds RO Treatment Plant loads
2. MCC – FWPS feeds Feedwater Pump Station Loads
3. MCC – CHEM feeds chemical system loads



WATER TREATMENT PLANT ELECTRICAL SERVICE EQUIPMENT CLEARANCE (A / 19.8)

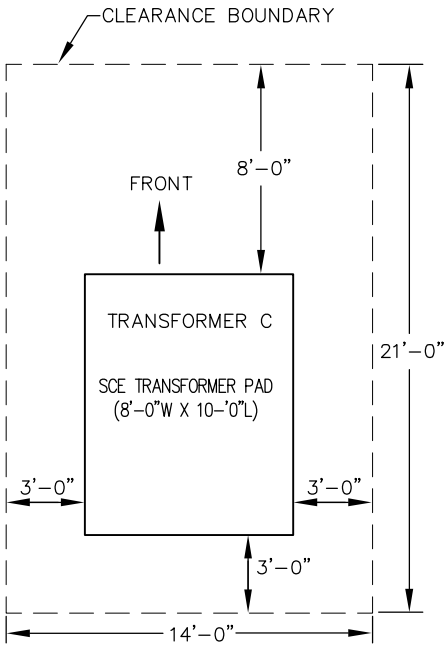
NTS

* SCE REQUIRES EASEMENT FROM IRWD
FOR CAPACITOR & PMH STRUCTURE PADS



PRODUCT WATER BPS ELECTRICAL SERVICE EQUIPMENT CLEARANCE (B / 19.10)

NTS



TRANSFORMER C CLEARANCE (C / 19.5)

NTS

RBF CONSULTING

carollo

IRVINE RANCH WATER DISTRICT

BAKER WATER TREATMENT PLANT

ELECTRICAL SERVICE EQUIPMENT CLEARANCE

EXHIBIT 19.6

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4. MCC – TCWD feeds Trabuco Canyon Water District pump station loads

The SCE transformer and unmetered switchboard to serve the treatment plant are located as shown on Exhibit 19.8 (Drawing E4). The Motor Control Centers will be located in dedicated rooms within the treatment plant, feedwater pump station and chemical buildings. The MCC for the Trabuco Canyon Pump Station will be located adjacent to the pump station in a weatherproof NEMA 3R airconditioned enclosure.

19.3.7 Product Water Pump Station

The 480 Volt, three phase electrical service is provided to the Product Water Pump Station as described in Section 19.3. The single line diagram for the pump station is included in Exhibit 19.9 (Drawing E13).

The SCE transformer and unmetered switchboard are located on the pump station site as shown on Exhibit 19.10 (Drawing E12). The automatic transfer switch and motor control center are located in the pump station electrical room. The motor control center includes five 300 horsepower variable frequency drives, feeder circuit breaker for air conditioning, a 480 -120/208 Volt stepdown transformer and 120/208 Volt distribution panel to accommodate auxiliary loads such as lighting and receptacles. The control panel is also located in the electrical room and houses the PLC and associated control components. The control panel and control functionality is further described in Section 20.

19.4 Backup Power

19.4.1 Baker Site Generators

A description of backup power is provided for the treatment plant and product water pump station.

19.4.1.1 Treatment Plant

A 2,000 kW diesel emergency generator will provide 480 Volt, 3 phase, power to the Water Treatment Plant in the event that SCE power is unavailable. Under emergency conditions, the loads selected to run on emergency power will be selected by

PLC programming. The generator is sized to accommodate selected loads of the plant as summarized in Table 19.1.

Table 19.1 Water Treatment Plant Generator Sizing Criteria

Load	kW
Membrane Process	230
Chemical	165
Flash Mix Strainer	6
BWWWT	135
Feedwater Pump Station	1125
Trabuco Canyon Water District Pump	40
Total	**1701**

The emergency generator is equipped with an integral fuel tank sized to operate the generator at full load for 24 hours. The location for the emergency generator is shown on Exhibit 19.8 (Drawing E4).

19.4.1.2 Product Water Pump Station

A 1,100 kW diesel emergency generator will provide 480 Volt, 3 phase, power to the Product Water Pump Station in the event that SCE power is unavailable. The generator is rated to accommodate selected loads at the pump station as indicated in Table 19.2.

Table 19.2 Product Water Pump Station Generator Sizing Criteria

Load	HP/kW	Backup Generation Required
Pump 1	300 HP	Yes
Pump 2	300 HP	Yes
Pump 3	300 HP	Yes
Pump 4	300 HP	Yes
Pump 5 (Standby)	300 HP	No
Air Conditioning	60 kW	Yes
Lighting/Receptacles	10 kW	Yes

The emergency generator is equipped with an integral fuel tank sized to operate the generator at full load for 24 hours. The pump station generator is located as shown on Exhibit 19.10 (Drawing E12).

19.4.1.3 Raw Water Pump Station

An emergency generator or a connection for a portable emergency generator is not required for the Raw Water Pump Station. This decision is based upon the following:

1. The SCE power supply in the area of the pump station is reliable.
2. SCE generally restores power in a short time following an outage.
3. Alternatives exist for Baker WTP operation without the Baker Raw Water Pump Station:
4. Changing back to supply from Santiago Lateral
5. Irvine Lake water supplied by gravity at a reduced capacity
6. The period of usage of Irvine Lake Water is expected to be limited to about six to eight weeks annually. This short period of time minimizes the probability of a power failure during the annual window of operation of the pump station. The ability to deliver water from the lake by gravity, at about fifty percent of maximum, will mitigate the effect of a power loss by allowing the WTP to continue operating, albeit at a production rate less than maximum.

19.5 ELECTRICAL DESIGN CRITERIA

The major electrical equipment will be specified as indicated Table 19.3:

Table 19.3 Electrical Equipment Summary

Equipment	Manufacturer/Model Number	Sole Source (Yes/No)
Motor Control Center	Allen-Bradley, no equal	Yes
Motor Management Relays	Multilin 369, Model HIRMOE, no equal	Yes
Switchboards	GE, Square D, or equal	No
Power Monitor	Multilin PQM-T20-C-A, no equal	Yes
Transformer, Dry Type	Square D electromagnetically shielded type, or equal	No
Automatic Transfer Switch	ASCO 7000 Series, GE Zenith ZTS, no equal.	No
Generator	Onan, Caterpillar	No
Variable Frequency Drive	Allen Bradley Power Flex 18-pulse, no equal	Yes

SECTION 20 INSTRUMENTATION AND CONTROL

20.1 OVERVIEW

This section summarizes the proposed approach for the following components of instrumentation and control system design:

- Equipment/instrument tagging
- Modes of equipment control
- Control system network
- IRWD preferred control system equipment manufacturers
- SCADA and PLC programming

20.2 EQUIPMENT / INSTRUMENT TAGGING

Equipment and instruments will be tagged in accordance with the IRWD Process Equipment & Instrument Tag Guideline, which is included as Appendix M.

20.3 MODES OF EQUIPMENT CONTROL

With the exception of equipment provided as part of the Membrane System, including blowers, compressors, backwash pumps, and pumps related to the membrane cleaning system, there will be two primary modes of control for every piece of equipment in the facility: Local and Remote. In the Local mode, the equipment will be controlled via control devices (pushbuttons and/or selector switches) located in the field either directly adjacent to the equipment or in a field control panel located near the equipment. In the Remote mode, the equipment will be controlled remotely either by a PLC or by control functions invoked through the facility SCADA system.

20.3.1 Local Control – Gates and Valves

Each gate and valve will be equipped with a LOCAL-OFF-REMOTE (LOR) selector switch and OPEN/CLOSE pushbuttons.

- LOCAL position - the OPEN/CLOSE pushbuttons will be enabled, thus allowing the equipment to be controlled locally.
- OFF position - the local OPEN/CLOSE pushbuttons will be disabled and all modes of control will be inhibited. The gate/valve will remain in the position that it was in when the LOR switch was placed in OFF.

- REMOTE position - the local OPEN/CLOSE pushbuttons will be disabled, and the equipment will be controlled remotely.

In addition to the position status of the gate/valve, the position of the LOR switch will be monitored via discrete inputs to the PLC that controls/monitors the equipment, and will be displayed in SCADA.

20.3.2 Local Control – Process Equipment (pumps, fans, etc.)

Each piece of process equipment will be equipped with a HAND-OFF-AUTO (HOA) selector switch.

- HAND position - the equipment will start.
- OFF position - the equipment will stop and all modes of control will be inhibited.
- AUTO position - the equipment will be controlled remotely.

In addition to the status of the equipment (running, failed, etc.), the position of the HOA switch will be monitored via discrete inputs to the PLC that controls/monitors the equipment, and will be displayed in SCADA.

20.3.3 Remote Control – Gates and Valves

Each gate and valve will have a software AUTO/MANUAL (A/M) selector switch in SCADA, which will be enabled when the LOR switch in the field is placed in the REMOTE position. In addition to the A/M switch, each gate and valve will have software OPEN/CLOSE pushbuttons in SCADA.

- MANUAL position - the gate/valve will be controlled with the software OPEN/CLOSE pushbuttons in SCADA.
- AUTO position - the gate/valve will be controlled by the PLC.

In general, the facility will be designed such that gates and valves operate in the AUTO mode of control under normal conditions.

20.3.4 Remote Control - Process Equipment (pumps, fans, etc.)

Each piece of process equipment will have a software AUTO/MANUAL (A/M) selector switch in SCADA, which will be enabled when the HOA switch in the field is placed in the AUTO position. In addition to the A/M

switch, each piece of equipment will have software START/STOP pushbuttons in SCADA.

- MANUAL position - the equipment will be controlled with the software START/STOP pushbuttons in SCADA.
- AUTO position - the equipment will be controlled by the PLC.

In general, the facility will be designed such that process equipment operates in the AUTO mode of control under normal conditions.

20.4 CONTROL SYSTEM NETWORK

A preliminary SCADA Block Diagram showing the major control system network components is provided as Exhibit 20.1 (Drawing I011).

As shown on the SCADA Block Diagram, the facility control system will be comprised of a network of distributed PLC's and a SCADA network. The quantity and location of PLC's will be established primarily by geography where the PLC closest to the unit process will be the point of connection for that unit process to the control system. The following is a summary of the PLC locations and the major unit processes that will be connected to each.

PLC Location	Major Unit Processes
Raw Water Pump Station	Raw Water Pump Station
Forebay	Feed Water Pump Station Raw Water Strainer & Flash Mix Backwash Water Treatment
Treatment Building	Membrane System Ultraviolet Disinfection Membrane Filtration Waste Washwater CT Basin
Chemical Building	All chemical storage and feed systems Flow Control Facility
Product Water Pump Station	Product Water Pump Station

In addition to a PLC, each control panel will include the following major components: fiber patch panel, managed network switch, and an operator interface terminal (HMI) comprised of a PC, keyboard, and a touch screen monitor mounted on the control panel door.

With the exception of the Raw Water Pump Station, the facility control system network will be comprised of a self-healing, fiber ring employing rapid spanning-tree network protocol via connections to the managed network switches installed in the individual control panels. The self-healing, fiber ring will be used to implement PLC-to-PLC, PLC-to-SCADA, and SCADA-to-PLC monitoring and control functions by linking all of the control system components (PLC's, HMI's, Servers, etc.). The Raw Water Pump Station control panel will communicate with the facility control system via wireless radio link.

Operator access to the SCADA system for process control and monitoring will be provided at each process control panel, as well as at workstations located in the Control Room. In addition to the SCADA workstations in the Control Room, the design will also include one computer to be used as a development station. The SCADA Block Diagram shows various other network devices, such as servers and network attached storage devices, however the necessity and selection of these devices will be coordinated and finalized with the District during final design.

To enhance reliability of the control system network, redundant fiber optic cables comprising the fiber ring will be specified. Wherever possible, the redundant fiber optic cables will be installed in separate conduits to decrease the likelihood of a simultaneous failure of both cables. Furthermore, where the fiber optic ring connects to the control room network equipment, the two sides of the fiber optic ring will be installed separate conduits, decreasing the likelihood of isolating the control room network equipment from the unit process control panels. Given the self-healing nature of the network architecture, if one side of the fiber ring is broken, the communication paths will be automatically re-routed thus allowing the control system to remain functional.

20.5 CONTROL SYSTEM EQUIPMENT MANUFACTURERS

In conversations with District Staff, and through the process of reviewing the District's standard specifications, the following preferred control system equipment manufacturers have been identified:

Equipment	District-Preferred Manufacturer
Programmable Logic Controllers	Modicon Quantum with Unit Processors
PLC Programming Software	Modicon Unity
SCADA Software	Wonderware Archestra
HMI Monitors	Allen-Bradley 17" Industrial Touch Screen
SCADA Servers	Dell
Managed Ethernet Switches	Hirschmann
Ethernet Radios	MDS
Uninterruptible Power Supplies (UPS)	Powerware
Control Panel Enclosures	Hoffman

20.6 SCADA AND PLC PROGRAMMING

Services for SCADA and PLC programming will be procured under a stand-alone contract that will be assigned to the General Contractor selected for construction of the Baker WTP. Carollo/RBF will develop the Request for Proposals (RFP) for the SCADA and PLC programming services based on the District's standard programming agreement, and the specific software requirements for the Baker WTP control system design.

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SECTION 21 ARCHITECTURAL

21.1 OVERVIEW

The architectural theme of the District's new Baker Water Treatment Plant (Baker WTP) is critical to the overall success of the project. The 5.25-acre site is located on top of a hill south-east of Wisteria Lane in Lake Forest, CA. The site is surrounded by residential neighborhoods and a future 3-acre public park. This section presents the summary of the effort by the PDR team to develop the appropriate architectural theme.

21.2 ARCHITECTURAL CRITERIA

The initial step in developing the architectural theme was to identify criteria determined to be important to all the stakeholders. Three categories of criteria were considered: neighborhood and developer concerns; District and stakeholders issues; and process criteria. Detailed issues are outlined below.

21.3 NEIGHBORHOOD AND DEVELOPER CONCERNS

- Provide space/landscaping to mitigate view from properties on the west side.
- Minimize structure height so not to obstruct neighbor's view
- Buildings should have a community building appearance, and the site should not resemble an industrial park with outdoor machinery and chemical storage tanks visible from the east side future park, residential development, and surrounding residents
- Mechanical equipment sound level should be attenuated in building

21.4 DISTRICT AND STAKEHOLDER ISSUES

- Buildings and facilities positioned on site "campus style"
- Build-out capacity achieved as part of the project to be 28 mgd
- Facilitate access for chemical delivery trucks
- No administration building
- Small lab or wet room included in the treatment building
- Reserve footprint for potential future GAC contactors and PAC dosing system

21.5 PROCESS DESIGN CRITERIA

- Plant building useful life to be 50 years
- Corrosive chemicals to be stored in chemical building, and to be used in the forebay (chlorine dioxide), treatment building (membrane cleanings), CT basin (disinfection) and backwash treatment facilities (coagulation).

21.6 ARCHITECTURAL THEME

Based on the above criteria listed in paragraph 21.2, the architectural theme was developed around:

- Walls: concrete masonry unit (CMU) blocks
- Roof: steel deck
- Doors (office part of treatment building): aluminum frame
- Doors (other locations): hollow metal framed doors
- Windows: aluminum frame

The following paragraphs illustrate the architectural concept for different buildings and treatment processes to be built at the Baker WTP.

21.7 MEMBRANE FEED WATER PUMP STATION

21.8 TREATMENT BUILDING

21.9 CHEMICAL BUILDING

21.10 CT BASIN

21.11 PRODUCT WATER PUMP STATION

SECTION 22 SITE SECURITY

22.1 OVERVIEW

This section discusses the security measures envisioned at each of the facilities of the Baker Water Treatment Plant Project.

22.2 RAW WATER PUMP STATION

The Raw Water Pump Station will be located at the Peters Canyon site, which already has security measures consisting of an access gate and chainlink fence. Both measures will be maintained at the site. Portions of the chainlink fence will be removed and replaced during construction.

22.3 TREATMENT PLANT

A chainlink fence will be constructed along the access road east of the Baker Pipeline easement for security of the Baker WTP site. The existing access gate from Wisteria Lane will be maintained. A new access gate will be constructed for vehicle access from the low site area. Surveillance cameras will be installed at the treatment plant as part of site security. The number and locations of cameras will be determined during design. The manufacturer and model is shown in Table 22.1.

Table 22.1 Security Camera Manufacturer Data

Manufacturer	Model Number
Industrial Video and Control	PTZ-3330-01

22.4 FLOW CONTROL FACILITY AND TCWD PUMP STATION

The flow control facility and TCWD Pump Station will be constructed within a block wall enclosure with chainlink roof.

22.5 PRODUCT WATER PUMP STATION

A chainlink fence will be constructed around the Product Water Pump Station. The site is already bounded to the south by an existing fence separating the Baker site from Serrano Creek. The new fence will run along each access road, along the top of slope to the north of the pump station and tie into the existing fence.

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SECTION 23 ECONOMIC EVALUATION

23.1 OVERVIEW

The purpose of this section is to discuss capital and O&M cost factors and assumptions used to develop the Baker WTP Project cost estimates. Opinion of costs for both capital and O&M are also included, and were based upon the project components and features general described in Sections 4 to 22 of this report. All costs presented herein are described in February 2010 dollars (ENR index = 8660).

The capital cost estimates herein approximate Class 3 budget estimates as defined by the Association for the Advancement of Cost Engineering (AACE), with associated accuracy of -10 to +30 percent. Class 3 level estimates are intended for budget, authorization of contract purposes. These estimates are based on the Engineer's perception of current conditions in the project area and are subject to change as variances in cost of labor, materials, equipment, services provided by others, or economic conditions occur.

Estimates previously prepared for the project include:

- The Baker Pipeline Regional Treatment Facility Feasibility Study, prepared by Malcolm Pirnie in January 2007, which included an addendum in June 2007 to estimate the cost of treated water from Baker WTP Project for comparison with the projected cost of treated water from Metropolitan Water District.

- The Baker Regional Water Treatment Plant – Design Concept and Cost Update with concept level costs, prepared following the award for design by RBF Consulting and Corollo Engineers in November 2008.

- Updated project cost estimate in June 2009, by RBF / Carollo, to take into consideration (i) preliminary design concepts (including the potential of pumping raw water supplied from the Santiago Lateral through the Baker Pipeline) and (ii) alternative treatment plant capacities.

- Preliminary Design Memorandum No. 14 – Cost Estimate, dated November 2009, issued to the Project Stakeholders including costs under three Project alternatives, and comparison of Baker WTP Project treated water cost with water purchased through Municipal Water District of Orange County.

23.2 OBJECTIVES

The objectives of the economic evaluation of the Baker WTP Project are to:

- Identify the basis of the probable capital costs
- Provide a detailed breakdown of probable construction costs
- Estimate capital costs
- Determine the amortized value over a 30-year period
- Estimate O&M costs
- Escalate O&M costs based on expected rates
- Estimate the cost of water produced by Baker WTP Project and compare it to the projected cost of treated imported water.

23.3 BACKGROUND

Preliminary Design Memorandum No. 14 presented the cost for the BAKER WTP PROJECT under three alternative Project definitions. The three alternatives are summarized in Table 23.1.

Table 23.1 BAKER WTP PROJECT Alternatives Summary

Baker Water Treatment Plant		Alternative 1	Alternative 2	Alternative 3
1	Raw Water Delivered	37 cfs 23.9 MGD	37 cfs 23.9 MGD	43.5 cfs 28.1 MGD
2	Product Water Produced	36.5 cfs 23.6 MGD 23,782 AFY[2]	36.5 cfs 23.6 MGD 23,782 AFY[2]	43.0 cfs 27.8 MGD 28,018 AFY[2]
3	Membrane Filtration Capacity [1]	25.7 MG	35.1 MG	30.2 MG
4	Membrane Rack Configuration	N+1	N+4	N+1
5	Number of Membrane Racks	10	13	12
6	OC-33 Modification	60 cfs	60 cfs	60 cfs
7	Regulating Reservoir	1.0 MG	n/a	n/a
8	Constant Head / Balancing Tank	0.5 MG	0.3 MG	n/a
9	Forebay	n/a	n/a	1.0 MG
10	Raw Water Pump Station (Design Capacity)	47 cfs	47 cfs	53.5 cfs
11	Product Water Pump Station (Design Capacity [3])	29 cfs	29 cfs	33 cfs

[1] MF Capacity is based on flow rates for Raw Water and Membrane Filtration Washwater, and defined as volumetric (MG).
[2] Annual Production in AFY is based on a 90-percent utilization rate.
[3] Product Water Pump Station (Design Capacity) is rounded to the nearest cubic foot per second.

Each alternative was fully analyzed to generate cost values for capital and operation and maintenance, and quantify the overall product water cost. Table 23.2 summarizes the product water cost by alternative as presented in Preliminary Design Memorandum No. 14.

Table 23.2 Cost Summary by Alternative

Alt	Description	Raw Water (cfs)	Product Water (cfs)	Product Water Cost ($/AF)
1	Regulating Reservoir, Constant Head Tank, N+1 Membrane Configuration	37 cfs	36.5 cfs	$765
2	Constant Head Tank, N+4 Membrane Configuration	37 cfs	36.5 cfs	$771
3	Forebay Reservoir and Feedwater Pump Station, N+1 Membrane Configuration	43.5 cfs	43.0 cfs	$766

At the Project Stakeholder meeting held in November 2009, Alternative 3 was selected. The primary factors influencing the decision included:

- Land Acquistion – not required for Alternative 3.
- Schedule Impact – without land acquisition, no impact to schedule.
- Comparable cost – product water cost for each alternative was within $5 per acre-foot (< 1% cost variation between alternatives).

23.4 ECONOMIC EVALUATION

The remainder of this section provides an updated economic evaluation consistent with the current design concept for the Project as described in Sections 4 to 22. While the current definition of the Project stems from the selection of Alternative 3 there have been some modifications to the Project since the issuance of PDM No. 14, including:

- OC-33 Modification = 100 cfs
- Forebay – Capacity = 0.785 MG

- Number of Membrane Racks (dependent on manufacturer) = 14 (max)

Table 23.3 summarizes the Project as currently defined.

Table 23.3 Project Summary

Baker Water Treatment Plant		Value
1	Raw Water Delivered	43.5 cfs 28.1 MGD
2	Product Water Produced	43.0 cfs 27.8 MGD 28,018 [2] AFY
3	Membrane Filtration Capacity [1]	30.2 MG
4	Membrane Rack Configuration	N+1
5	Number of Membrane Racks (Max.)	14
6	OC-33 Modification	100 cfs
7	Forebay	0.785 MG
8	Raw Water Pump Station (Design Capacity)	53.5 cfs
9	Product Water Pump Station (Design Capacity)	33 cfs

[1] MF Capacity is based on flow rates for Raw Water and Membrane Filtration Washwater, and defined as volumetric (MG).

[2] Annual Production in AFY is based on a 90-percent utilization rate (evaluated at 330 days per year).

23.5 Capital Costs

The estimates of capital costs in this section provide: 1) a more detailed break down of the Baker WTP Project and associated "integration facilities", and 2) refined unit costs for general, sitework, mechanical, and electrical components of the Project. Unit costs were derived from recent RBF/ Carollo projects.

23.5.1 Construction

Construction costs are estimated based on the following:

- Capital cost are Class 3 Estimates as defined by AACEI with a -10% to +30% range of accuracy.
- Mobilization and demobilization, insurance and management are based on 8-percent of total construction costs.
- Pressurized Membrane Filtration (PMF) Equipment costs are based on an average cost developed from the budget estimates provided by Pall and Siemens on October 23, 2009.

- Electrical capital costs are assumed at 12.5-percent of total corresponding facility cost.

The total capital cost estimate is summarized in Table 23.4, and shown in further detail in Table Q1 of the Appendix Q.

23.5.2 Other Capital Costs

Engineering

The cost of engineering (design) of the Baker WTP Project is based on the authorized budget, plus an the cost for the design of the forebay and feedwater pump station.

Environmental

The cost of preparing the environmental documentation for Baker WTP Project is based on the preparation of an Environmental Impact Report (EIR). IRWD has received a fee estimate of $170,000 from their environmental consultant for the preparation of the report.

Construction Management / District Costs

IRWD will perform construction management and inspection activities during the construction of the proposed project. These costs are allocated under “District Costs”. IRWD staff has provided an estimate of District Costs to the Project stakeholders. The estimate covered costs for project management, field support, construction administration services and inspections, and totaled to $2,200,000.

Baker Site Land Use Cost

The Baker Water Treatment Plant Agreement (Agreement) defines cost to the project for the use of land at the Baker Site in Lake Forest, California. A cost of $110,000 / acre was defined in the Agreement based on an appraisal of land value. The high site of the Baker Site is the reserved area for construction of Baker WTP Project. The high site has an approximate area of 4.0 acre. Thus, land use cost is shown as a one-time cost of $440,000.

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Table 23.4 - Baker WTP Project - Summary of Estimated Capital Costs [1]

Baker Water Treatment Plant	Cost
Equipment and Buildings	
WTP Equipment, Sitework and Buildings	$31,869,000
Mobilization / Insurance / Management [2]	$2,550,000
Subtotal (Equipment and Buildings)	***$34,419,000***
Integration Facilities	
OC-33 Expansion	$240,000
Raw Water Pump Station	$2,908,000
Flow Control Facility, Forebay Reservoir, TCWD PS and Feedwater PS	$4,300,000
Product Water Pump Station	$3,504,000
Backup Power	$1,250,000
Mobilization / Insurance / Management [2]	$976,000
Subtotal (Integration Facilities)	***$13,178,000***
SUBTOTAL (Equip. and Bldgs + Int. Facs.)	***$47,597,000***
District Costs [3]	**$2,200,000**
Baker Site Land Use Cost [4]	**$440,000**
Environmental [5], Engineering[6]	**$4,607,000**
Contingency / Legal [7]	**$6,611,000**
TOTAL ESTIMATED CAPITAL COST	**$61,455,000**

[1] Capital cost are Class 3 Estimates as defined by AACEI with estimated -10% to +30% range of accuracy

[2] Mobilization / Insurance / Management Cost calculated at 8-percent of capital cost

[3] Cost provided by IRWD - includes project management, field support, construction administrative services, inspection and GandA.

[4] Cost for land use at Baker Site per Baker WTP Agreement Section 3.1. Area = 4 acres. Unit Cost = $110,000 /acre

[5] Environmental Documentation cost is based on EIR preparation cost provided to IRWD.

[6] Based on approved design fee for Baker WTP plus authorized flow test budget, and design fee for forebay and feed water pump station.

[7] Contingency / Legal is based on 15-percent of Subtotal (Equipment and Buildings + Integration Facilities excluding cost for Moblization, Insurance and Management).

23.6 Operation and Maintenance Costs

O&M costs have been developed based on previous projects and engineering calculations. A summary of total O&M costs is provided in Table 23.5. All costs are discussed below and further information is provided in Appendix Q.

23.6.1 Energy Costs

Energy costs are estimated based on a unit cost of $0.13 per kilowatt-hour (KWh). Tables Q2 through Q8 in Appendix Q estimate the annual energy costs, in February 2010 dollars. An escalation rate of 5-percent was used to estimate future energy costs.

23.6.2 Chemical and Replacement Costs

A breakdown of the chemical costs for the treatment facility is provided in Tables Q9 and Q10 in Appendix Q. Membrane replacement costs are summarized in Table Q11 in Appendix Q. An escalation rate of 5-percent is used to estimate future chemical and replacement costs.

Table 23.5 Estimated Annual O&M Cost Summary

Baker Water Treatment Plant [1]		Value
1	Chemical Mixing	$3,800
2	MF System	$716,300
3	UV System	$21,200
4	Process Chemicals	$1,212,100
5	Energy Costs from Pumping	$1,516,300
6	Washwater Pumping	$15,900
7	Labor [2]	$379,600
8	Other System O&M Costs [3]	$75,000
Cost per Year ($) [4]		**$3,940,000**

[1] Energy, Chemical, and Consumables (Replacement) costs are esclated at a annual rate of 5-percent.

[2] Labor costs are esclated at a annual rate of 3-percent.

[3] Other O&M costs are esclated at a annual rate of 3-percent.

[4] Based on 90% treatment plant utilization (evaluated at 330 days per year). Rounded to nearest $1,000.

23.6.3 Labor Costs

The labor costs are estimated for the Project in Table Q12 in Appendix Q. The labor cost includes time for two full time operators at the treatment plant. This value may change depending on the final classification of Baker WTP Project by the California Department of Public Health. An escalation rate of 3-percent is used to estimate future labor costs.

23.6.4 Other O&M Costs

This evaluation takes into consideration additional O&M costs associated with the overall Project system, including the integration facilities. This cost is assumed at 2-percent of the amortized cost annual capital costs, and are escalated at an annual rate of 3-percent to estimate future costs.

23.7 Baker WTP Water Cost

Based upon the capital and O&M costs developed herein, an economic evaluation was performed for the Project calculating the cost of water available via the Baker WTP Project project, and comparing this cost with projected MWDOC treated water costs. Cost of Baker WTP Project water is estimated in Table 23.6based on the following estimates and assumptions:

- Costs defined in February 2010 Dollars for direct comparison with prior analysis (ENR index = 8660).
- A capital cost amortized over 30 years at 4.5-percent interest (per Feasibility Study).
- Energy, chemicals, and replacement costs assumed to escalate at a rate of 5-percent annually.
- Labor costs assumed to escalate at a rate of 3-percent annually.
- Other O&M costs assumed to escalate at a rate of 3-percent annually.
- Untreated Tier 1 and Tier 2 water costs from MWDOC assumed to escalate at a rate of 21.5-percent and 14.3-percent, respectively, in year 2011, and a rate of 5-percent thereafter .

23.8 Water Cost Comparison

When comparing the cost of water for Baker WTP Project with cost of treated water imported by MWDOC, it is anticipated that treated water from the Baker WTP Project will cost the same as imported water by the year 2017,

Table 23.6 - Summary of Annual Treated Water Cost (2010 Dollars)

Baker Water Treatment Plant	COST
Total Capital Cost	$61,455,000
Capital Cost	**$61,455,000**
1. Annual Capital Cost [2]	$3,749,000
2. Annual Project O & M Costs [3]	
2.1 Energy, Chemicals, and Consumables	$3,485,600
2.2 Labor	$379,600
2.3 Other O & M Costs [4]	$75,000
Subtotal Annual Capital/O&M Cost	**$7,689,200**
($/AF)	**$274**
3. Cost of Untreated Water from MWDOC [5] ($/AF)	**$492**
Water Production[6] = 28,018 AFY	
Baker WTP Treated Water Unit Cost ($/AF)	**$766**

Abbreviations: AFY = Acre-Feet per Year, FWPS = Feedwater Pump Station, PW = Product Water, Reg = Regulating, Res = Reservoir RW = Raw Water

[1] Unit Cost of Water is for 2009 cost assumptions

[2] Based on 30 year period at 4.5%

[3] See Table 14.3 for Estimated Annual O&M Cost by alternative.

[4] Based on 2% of annual capital cost

[5] Based on estimates shown in Table Q14 of Appendix Q (per 9/1/2009 MWD rate change). This cost represents an increase of $68 / AF to Tier 1 and 2 melded untreated water rate since last estimate prepared June 2009.

[6] Based on 90% treatment plant utilization (evaluated at 330 days per year).

Annual Payment Calculation

Annual Capital Costs	
Interest (Annual) =	4.5%
Rate (Monthy) =	0.00375
Years =	30
Months =	360
Loan Amount =	$61,455,000
Monthly Payment =	$312,417
Annual Payment [7] =	**$3,749,000**

[7] Based on CRF value of 0.061

approximately 5 years after project startup. Thereafter, the Baker WTP Project is anticipated to produce water at lower cost than as purchased through MWDOC. This is based on the following methodology:

- A meld of Tier 1 and Tier 2 rates has been developed for this evaluation (90% of Tier 1 rate, and 10% of Tier 2 rate). The cost of the Tier 1 and 2 melded rate per the water rates 'Effective 1/1/2009' was $424 per acre-ft.

- On September 1, 2009 the Metropolitan Water District of Southern California adjusted the cost of treated and untreated water. The cost of the untreated water melded water rates 'Effective 9/1/2009' was recalculated to be $492 / AF.

- The melded cost for treated and untreated water, based on water rate projections provided by Municipal Water District of Orange County and Irvine Ranch Water District, are provided in Table Q13 in Appendix Q.

- Annual capital recovery and O&M costs were converted to $/acre-foot ($/AF/yr) values using the anticipated production volume of 28,018 AFY. As indicated in the cost summary tables shown above, projected costs are determined based on a plant utilization rate of 90-percent.

- A detailed breakdown of estimated future water costs is provided in Table Q14 in Appendix Q. Table Q15 in Appendix Q provides a summary of the estimated water costs over the next 20 years based upon projections of untreated water costs from MWDOC and water treatment costs for Baker WTP Project.

- Exhibit 23.1 presents a graphical representation of the escalated costs for Baker WTP Project and MWD treated water over the next 20 years. Table Q16 in Appendix Q summarizes the cost difference by year for treated water from Baker WTP Project and MWD.

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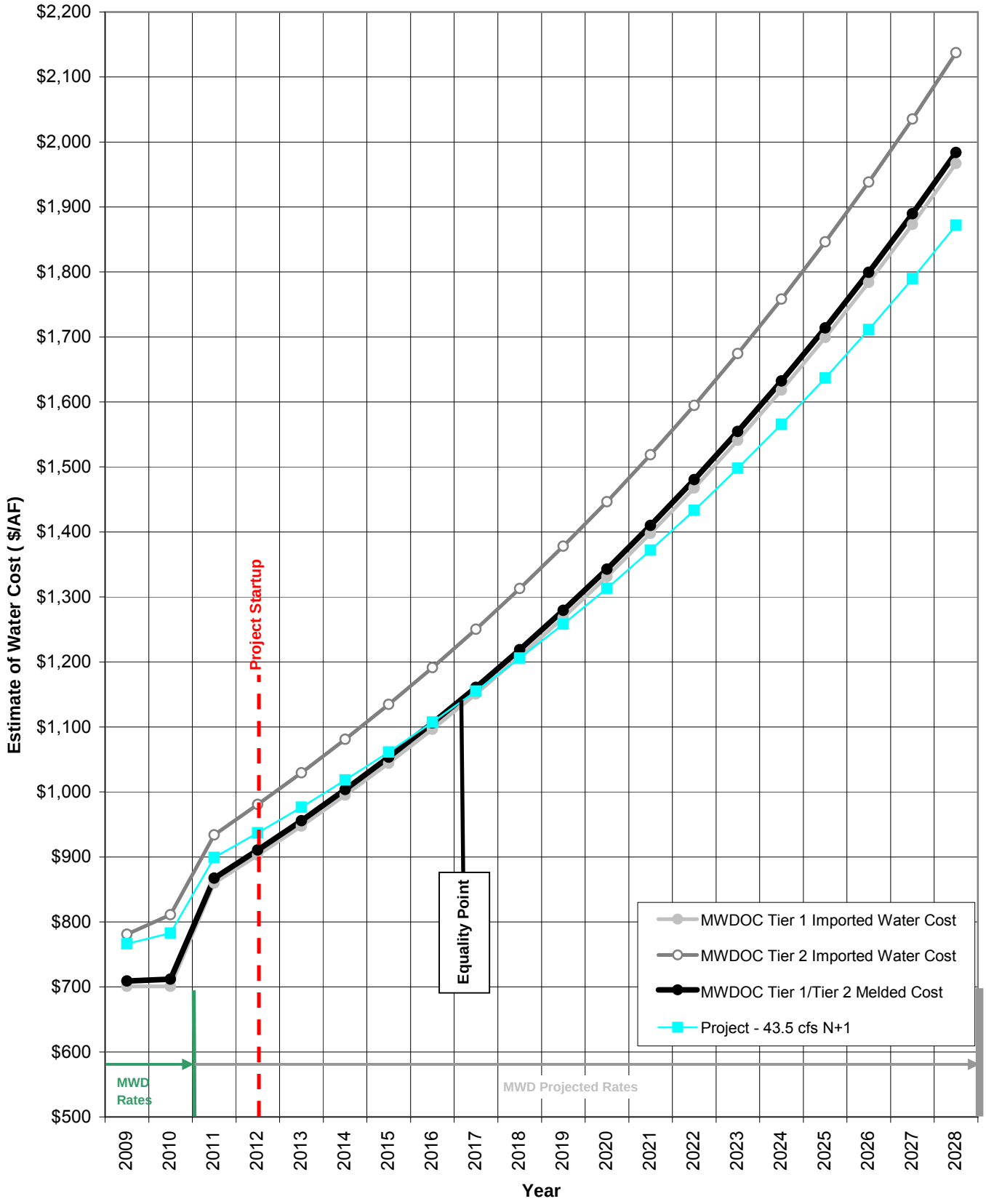
Exhibit 23.1 - Cost of Water Comparison
Imported Water (MWDOC)
vs.
Baker WTP



SECTION 24 INSTITUTIONAL FACTORS

24.1 BACKGROUND

Institutional factors that must be considered in the design, and prior to construction of the Baker WTP, include:

- MWD Coordination.
- Regional Water Quality Control Board Coordination.
- Other Permitting and Coordination.

24.2 MWD COORDINATION

Several issues remain to be resolved with MWD prior to the final design of the Baker Water Treatment Plant project. These include:

- Capacity of OC-33
- Flow through OC-33
- MWD acceptance of Baker surge analysis recommendations
- Product Water Pump Station discharge location and connection design
- MWD acceptance of AMP surge analysis recommendations
- Raw water delivery protocol
- Encroachment permits into AMP pipeline easement

24.2.1 Capacity of OC-33

Since the original construction of the Baker Pipeline, the capacity of OC-33 has been changed on at least two occasions: from an initial capacity of 40 cfs, up to 100 cfs, and then back to its current capacity of 40 cfs. With the construction of the Baker WTP Project, a turnout metering capacity of 100 cfs is recommended (see Section 4). As a result, the existing meter may have to be replaced or the nameplate capacity revised.

24.2.2 Flow through OC-33

When raw water is being directly supplied to Baker WTP through the Santiago Lateral, occasional discharges past OC-33 will occur when there is a temporary rejection of the Baker Pipeline flow by the flow control facility at Baker WTP. Generally, these flows can be expected to be

lower than 10 cfs, which is less than ten percent of the proposed meter capacity of 100 cfs. (The MWD Administrative Code provides that flows through a turnout that are less than ten percent of the rated meter capacity will be billed at the full 10 percent of the meter's capacity.) Unless some arrangement or variance is worked out with MWD, the project could be paying for more water than it receives.

Additionally, when water is supplied from Irvine Lake to the Raw Water Pump Station, there may be occasions when a reverse flow occurs through OC-33, which would be picked up by OC-13.

24.2.3 Baker Surge Analysis

The Baker Pipeline surge analysis completed for this project, predicts slight transient increases in the operating HGL of the Santiago Lateral, following a power failure at the Baker Raw Water Pump Station. These increases are minor (5 feet max) but are in excess of the design HGL for the Santiago Lateral. Coordination with MWD has been initiated and will continue through final design.

24.2.4 Product Water Pump Station Discharge to AMP

The connection point of the Product Water Pump Station discharge line to the AMP, has been tentatively placed at a location just downstream of the existing Baker/AMP emergency connection. Neither the location of the connection point nor the design details of the connection have been reviewed with MWD. MWD's Administrative Code (paragraphs 4700 and 4800) covers the design elements required for a connection that receives water from its system, but not that introduces water into its system. Coordination with MWD has been initiated and will continue through final design.

24.2.5 AMP Surge Analysis

A surge analysis of the AMP will be required to analyze the impacts of the Baker WTP. When complete, the recommendations of the AMP study will be reviewed and accepted by MWD.

24.2.6 Raw Water Delivery Protocol

Raw water deliveries through the MWD system are critical to the operation of the Baker WTP. The MWD Administrative Code defines and limits the advance notice requirements for variations in the deliveries through its service connections.

The MWD Administrative Code requires that the receiving agency stipulate a continuous demand rate. The Baker WTP system will be unable to comply this with this requirement under certain conditions. These conditions will be mitigated, to some extent, by allowing discharges to Irvine Lake and by absorbing small flow variations in the plant's forebay.

This matter must be coordinated with MWD to ensure a mutual understanding of the technical capabilities, as well as the institutional constraints, of the Baker WTP are fully understood.

24.3 REGIONAL WATER QUALITY CONTROL BOARD

The membrane filtration system will be operated to isolate any racks requiring maintenance, allowing water produced during maintenance / testing to be re-circulated to the forebay for treatment.

However, as discussed in Section 17, Baker WTP will be constructed to discharge water to Serrano Creek in the event of the following failed operation / emergency conditions of:

- Overflow of the forebay (which is only possible if the flow control valve fails open) - Water discharged from the forebay would be a combination of raw water and recirculated treated backwash water.
- Product Water to Waste (if off-specification water from the contact basin could not be returned to the forebay) - Water discharge from the contact basin would be water treated through the membrane filtration that cannot be brought to specification due to a failure of the finished water chemical system. Such water would require dechlorination if discharged to Serrano Creek.

Coordination with the Santa Ana Regional Water Quality Control Board will be necessary to gain approval for discharges to Serrano Creek. Coordination may lead to the requirement of the filing of a *Limited Threat Discharge to Surface Water – Notice of Intent* to be processed with the Santa Ana RWQCB.

24.4 SANTIAGO AQUEDUCT COMMISSION COORDINATION

The Santiago Aqueduct Commission has the governing authority over the Baker Pipeline and owns the property where the Raw Water Pump Station is planned for construction. With the Baker WTP Project each Stakeholder will hold capacity rights in the Baker Pipeline equivalent to their water rights in the Baker WTP.

The only agencies holding capacity rights in the Baker Pipeline initially were Santa Margarita Water District, Trabuco Canyon Water District and Irvine Ranch Water District. As a result, IRWD and RBF Consulting evaluated the total capacity rights in the Baker Pipeline, and developed an approach to reallocating the water rights per the Baker Pipeline Agreement, allowing for each agency to retain or obtain rights equivalent to capacity in the WTP. The reallocation accounted for present worth and maintained overall total value by modifying the capacity to all entities owning capacity rights in the pipeline.

All five (5) reaches of the Baker Pipeline were modified. The revised capacity per reach is:

- Reach 1 = 99.00 cfs
- Reach 2 = 54.78 cfs
- Reach 3 = 50.68 cfs
- Reach 4 = 50.68 cfs
- Reach 5 = 49.50 cfs

IRWD presented the revision to water rights to the Santiago Aqueduct Commission. The Baker Pipeline Agreement is being modified accordingly, including the compensation (for buying or selling capacity) between each of the agencies.

24.5 PERMITTING AND COORDINATION

Table 24.1 provides a summary of permitting and coordination anticipated for the Baker WTP.

Baker WTP
Permit Compliance Plan

Table 24.1

Agency	Permit / Submittal / Request	Processing Time	Prerequisite Data	Items to be Sent	Responsible Party	Critical Project Component
California State Water Resources Control Board (SWRCB)	• Notice of Intent (NOI) - NPDES General Permit for Construction Activity • Spill Prevention Control and Countermeasure (SPCC)	Submit 30 days prior to start of construction	Site Specific Storm Water Pollution Prevention Plan (SWPPP)	• Notice of Intent • Site Map	RBF / Carollo	Site Construction Chemical Storage
California Dept. of Industrial Relations Division of Occupational Health and Safety (CAL-OSHA)	• Excavation Permit • Pressure Vessel Permit	Over the counter.	Contractor ready to begin work.	• Permit Application Form • Copy of updated safety program • Application Fee • Competent Person Letter	Contractor	Construction Safety: Pipeline Trench Confined Space(s)
City of Lake Forest	• Plan Submittal for City review (building permit no required) and transfer to OCFA	2 to 4 weeks	90% Design Plans + Chemical Data	• Required drawings and information for OCFA	RBF / Carollo	OCFA Requirements
East Orange County Water District (EOCWD)	• Encroachment Permit for Raw Water Pump Station	2 to 4 weeks	90% Raw Water Pump Station Design Plans	• Required drawings	RBF / Carollo	Raw Water Pump Station Construction
Irvine Ranch Water District (IRWD)	• Connection Permit	1 month	Location of connection to Serrano Creek sewer pipeline.	• Location of pipeline connection	RBF / Carollo	Backwash waste water system design.
	• Discharge Permit	6 months	Flow rate and water quality data for non-reclaimable waste water.	• Annual flow, BOD, and suspended solids	RBF / Carollo	Non-reclaimable waste water disposal.
Metropolitan Water District (MWD)	• Approval of plans for connection to AMP and Product Water PS surge design. • Encroachment Permit for Raw Water Pump Station	3 months	60% Design Plans for Raw Water and Product Water Pump Station	• Required drawings	Agency	Raw and Product Water Pump Station Construction
Orange County Fire Authority (OCFA)	• Approval of plans by OCFA regarding fire safety provisions	1 month	60% Design Plans + Chemical Data	• Plans must identify fire sprinkler information • Fire Master Plan • Chemical Classifications • Hazardous Materials Plan	RBF / Carollo	Fire Protection Systems: Fire Sprinkler Systems Fire Hydrant Chemical Storage
South Coast Air Quality Management District (SCAQMD)	• Permit to Construct / Operate Form 400-A • Form 400-CEQA • Other Forms (as needed)	3 months	60% +/- Design Plans	• Application • Design Drawings • Emission Control Equipment List • Drawings / Schematics of Equipment • Process Description with rate, emission sources, manuf data, VOCs, equipment location	RBF / Carollo	Grading
State of California Department of Public Health (CDPH)	• Amended Waterworks Permit	6 months	60% +/- Design Plans	• Treated water quality • Treatment Plant operation description • Other information as requested	Agency	WTP Process and Water Quality
Utility Coordination	• Contact for utility information to avoid conflicts.	60 to 90 days	60% +/- Design Plans	• Required drawings showing utilities (horizontal and vertical).	RBF / Carollo	Underground Construction
Utility Owners (Others)	• Encroachment Permits (as applicable).	1 to 2 months	60% +/- Design Plans	• Required drawings showing utilities (horizontal and vertical).	RBF / Carollo	Underground Construction

SECTION 25 SCHEDULE

25.1 OVERVIEW

Construction of the Baker Water Treatment project will be divided into two construction contracts, with a bid package for each.

- Construction Bid Package No. 1 – Raw Water Pump Station and OC-33 Modification
- Construction Bid Package No. 2 – Baker Water Treatment Plant covering all facilities at the Baker site:
  - Flow Control Facility
  - TCWD Pump Station
  - Forebay and Feedwater Pump Station
  - Treatment Building, UV and CT Basin
  - Backwash Wastewater Treatment
  - Yard Piping (w/ connections to Baker Pipeline, 16 MG Res. and AMP)
  - Product Water Pump Station

Table 25.1 provides a summary of the anticipated start and completion dates for the design, bidding, and construction milestones to both construction contracts.

Table 25.1 Baker WTP Project Schedule Summary

Construction Contract/ Milestone	Start Date	Finish Date
Raw Water Pump Station / OC-33 Modf.		
Design	April 2010	March 2011
Bidding & Award	March 2011	May 2011
Construction	June 2011	June 2012
Baker Water Treatment Plant		
Design	April 2010	March 2011
Bidding & Award	March 2011	May 2011
Construction	June 2011	November 2012

25.2 SCHEDULE

The detailed design and construction schedule for Baker WTP is provided as Exhibit 25.1, and construction schedule for the Raw Water Pump Station as Exhibit 25.2.

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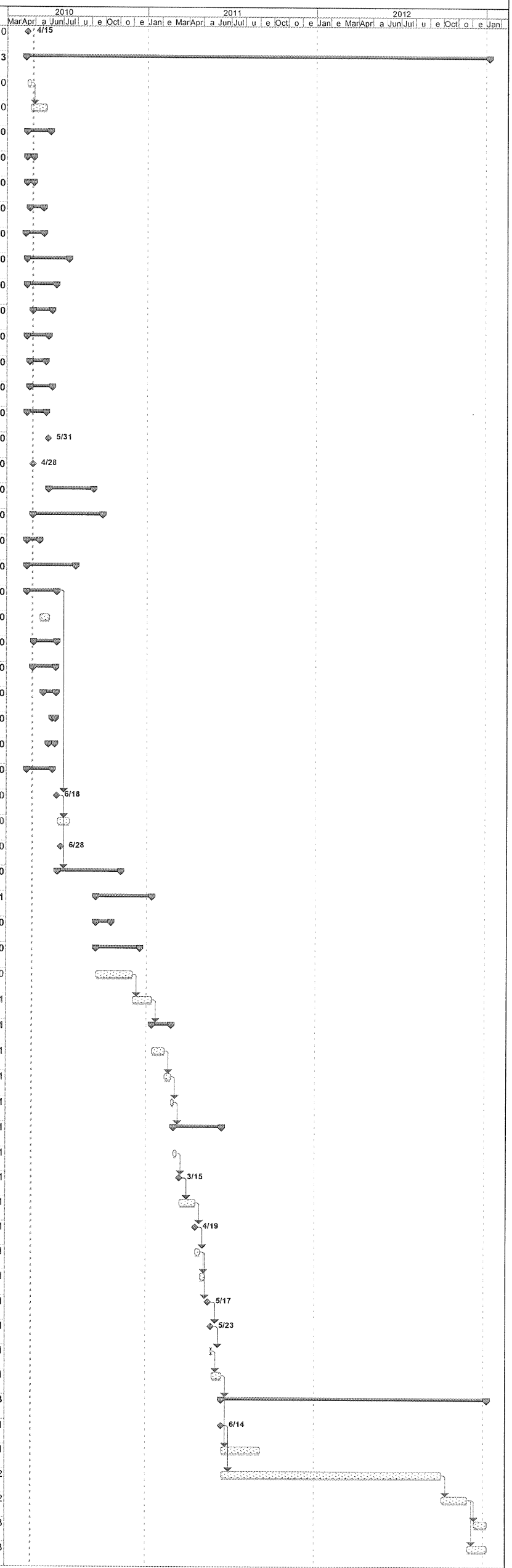
BAKER WATER TREATMENT PLANT PROJECT
FINAL DESIGN, BIDDING, AND CONSTRUCTION SCHEDULE
ONSITE BAKER WATER TREATMENT PLANT FACILITIES

Updated April 14, 2010

ID	Task Name	Duration	Start	Finish
1	BAKER FINAL DESIGN KICKOFF	0 days	Thu 4/15/10	Thu 4/15/10
2	Onsite Facilities (Baker WTP and Product Water PS)	717 days	Mon 4/12/10	Tue 1/8/13
3	Prepare Draft Detailed Equipment Lists	5 days	Thu 4/15/10	Wed 4/21/10
4	Review / Finalize Lists with IRWD (Anticipated 3 - 4 Coordination Mtgs)	5 wks	Thu 4/22/10	Wed 5/26/10
5	Geotechnical Investigation	37 days	Thu 4/15/10	Fri 6/4/10
10	Determine NRW Point of Discharge	11 days	Thu 4/15/10	Fri 4/30/10
18	Determine Method for Surface Discharge Disposal	11 days	Thu 4/15/10	Fri 4/30/10
23	Determine Use of Existing Admin Building	22 days	Wed 4/21/10	Thu 5/20/10
30	Site Access	30 days	Mon 4/12/10	Fri 5/21/10
36	Building Architecture	65 days	Thu 4/15/10	Wed 7/14/10
44	Membrane Building Layout (i.e. Space Planning)	46 days	Thu 4/15/10	Thu 6/17/10
51	Chemical Building Layout	30 days	Wed 4/28/10	Tue 6/8/10
57	Flow Control Valve(s) / TCWD Pump Station / Upstream Strainers Design	33 days	Thu 4/15/10	Mon 5/31/10
63	Forebay / ClO2 Contact Basin	25 days	Wed 4/21/10	Tue 5/25/10
69	16 MG Clearwell Modifications	35 days	Wed 4/21/10	Tue 6/8/10
75	Product Water Pump Station	30 days	Thu 4/15/10	Wed 5/26/10
81	MWD Milestones that Impact Onsite Facilities	0 days	Mon 5/31/10	Mon 5/31/10
84	Site Development	0 days	Wed 4/28/10	Wed 4/28/10
87	MF System Design	70 days	Tue 6/1/10	Tue 9/7/10
92	System Integrator Selection	108 days	Wed 4/28/10	Mon 9/27/10
106	Demolition	20 days	Thu 4/15/10	Wed 5/12/10
108	SCE Coordination	76 days	Thu 4/15/10	Fri 7/30/10
111	Interim Drawing Submittal Preparation	47 days	Thu 4/15/10	Fri 6/18/10
112	Demolition Plan	3 wks	Thu 5/13/10	Wed 6/2/10
113	Site Civil	36 days	Fri 4/30/10	Fri 6/18/10
120	Mechanical Plans and Sections	36 days	Wed 4/28/10	Wed 6/16/10
129	Architectural Plans	20 days	Fri 5/21/10	Thu 6/17/10
135	Structural Plans	5 days	Wed 6/9/10	Tue 6/15/10
137	Electrical	10 days	Tue 6/1/10	Mon 6/14/10
140	Instrumentation	40 days	Thu 4/15/10	Wed 6/9/10
142	Interim Drawings Submittal	0 days	Fri 6/18/10	Fri 6/18/10
143	IRWD Review	20 days	Mon 6/21/10	Fri 7/16/10
144	Workshop for RBF/Carollo to Present Design to IRWD and Stakeholders	0 days	Mon 6/28/10	Mon 6/28/10
145	60% Design	100 days	Mon 6/21/10	Fri 11/5/10
229	90% Design	88 days	Mon 9/13/10	Wed 1/12/11
230	Landscape Design	25 days	Mon 9/13/10	Fri 10/15/10
233	Permit Packages Preparation / Assistance	70 days	Mon 9/13/10	Fri 12/17/10
240	90% PS&E Preparation	11.6 wks	Mon 9/13/10	Wed 12/1/10
241	IRWD Review	30 days	Thu 12/2/10	Wed 1/12/11
242	100% Design (Incorporate IRWD Comments)	30 days	Thu 1/13/11	Wed 2/23/11
243	100% PS&E Preparation	20 days	Thu 1/13/11	Wed 2/9/11
244	Final Review (Back-Check) by IRWD	10 days	Thu 2/10/11	Wed 2/23/11
245	Final Design Submittal	4 days	Thu 2/24/11	Tue 3/1/11
246	Bid Phase	75 days	Wed 3/2/11	Tue 6/14/11
247	Bid Packages Assembled and Distribution to Bidders	1 wk	Wed 3/2/11	Tue 3/8/11
248	Pre-Bid Meeting	0 days	Tue 3/15/11	Tue 3/15/11
249	Bid Preparation	5 wks	Tue 3/15/11	Mon 4/18/11
250	Bid Opening	0 days	Tue 4/19/11	Tue 4/19/11
251	Bid Evaluation / Recommendation for Award	8 days	Tue 4/19/11	Thu 4/28/11
252	Stakeholders' GO / NO GO DECISION	7 days	Fri 4/29/11	Mon 5/9/11
253	E&O Committee Meeting	0 days	Tue 5/17/11	Tue 5/17/11
254	Board Meeting	0 days	Mon 5/23/11	Mon 5/23/11
255	IRWD Issues Notice of Award	2 days	Mon 5/23/11	Tue 5/24/11
256	IRWD Issues Notice to Proceed	3 wks	Wed 5/25/11	Tue 6/14/11
257	Construction Phase	410 days	Tue 6/14/11	Tue 1/8/13
258	Pre-Construction Meeting	0 days	Tue 6/14/11	Tue 6/14/11
259	Submittals	60 days	Wed 6/15/11	Tue 9/6/11
260	Construction	17 mons	Wed 6/15/11	Tue 10/2/12
261	Start-up and Testing	2 mons	Wed 10/3/12	Tue 11/27/12
262	Record Drawings	1 mon	Wed 12/12/12	Tue 1/8/13
263	Project Closeout	6 wks	Wed 11/28/12	Tue 1/8/13



Project: Baker Final Design Schedule_
Date: Mon 4/26/10

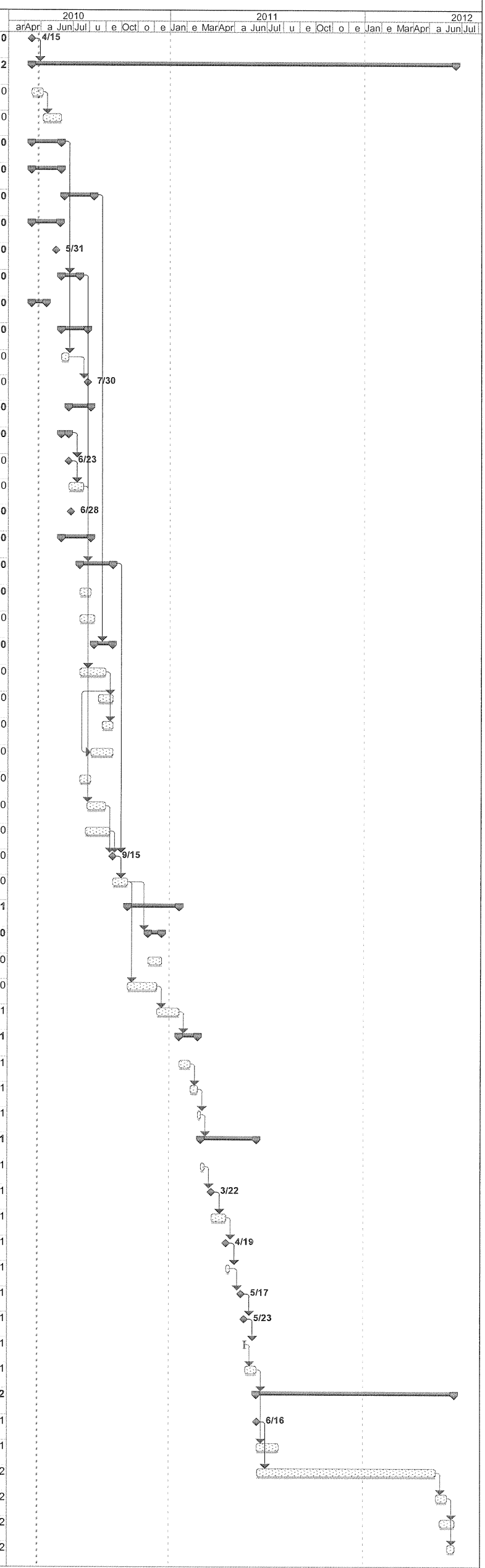
Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External MileTask | Split

EXHIBIT 25.1

BAKER WATER TREATMENT PLANT PROJECT
FINAL DESIGN, BIDDING, AND CONSTRUCTION SCHEDULE
RAW WATER DELIVERY SYSTEM (OC-33 AND RAW WATER PUMP STATION)

Updated April 14, 2010

ID	Task Name	Duration	Start	Finish
1	**BAKER FINAL DESIGN KICKOFF**	**0 days**	**Thu 4/15/10**	**Thu 4/15/10**
2	**Raw Water Delivery System (OC-33, Raw Water Pump Station)**	**570 days**	**Thu 4/15/10**	**Wed 6/20/12**
3	Prepare Draft Detailed Equipment Lists	15 days	Thu 4/15/10	Wed 5/5/10
4	Review / Finalize Lists with IRWD (Anticipated 2 Coordination Mtgs)	5 wks	Thu 5/6/10	Wed 6/9/10
5	**Verify Raw Water Pump Station Capacity at 53.5 cfs**	**40 days**	**Thu 4/15/10**	**Wed 6/9/10**
6	**Determine Available Capacity in Irvine Lake Pipeline (ILP)**	**40 days**	**Thu 4/15/10**	**Wed 6/9/10**
17	**Coordinate with County of Orange and MWD for Easement Requirements**	**40 days**	**Wed 6/16/10**	**Tue 8/10/10**
21	**Geotechnical Investigation**	**38 days**	**Thu 4/15/10**	**Mon 6/7/10**
26	**MWD Coordination**	**0 days**	**Mon 5/31/10**	**Mon 5/31/10**
28	**Surge Analysis**	**25 days**	**Thu 6/10/10**	**Wed 7/14/10**
30	**Demolition**	**20 days**	**Thu 4/15/10**	**Wed 5/12/10**
32	**SCE Coordination**	**36 days**	**Thu 6/10/10**	**Fri 7/30/10**
33	Finalize Electrical Loads / Provide to SCE	2 wks	Thu 6/10/10	Wed 6/23/10
34	SCE Provides Design Criteria	0 days	Fri 7/30/10	Fri 7/30/10
35	**Pump Station Building Architecture**	**30 days**	**Thu 6/24/10**	**Wed 8/4/10**
41	**Interim Drawing Submittal Preparation**	**10 days**	**Thu 6/10/10**	**Wed 6/23/10**
52	Interim Drawings Submittal	0 days	Wed 6/23/10	Wed 6/23/10
53	IRWD Review	20 days	Thu 6/24/10	Wed 7/21/10
54	**Workshop for RBF/Carollo to Present Design to IRWD and Stakeholders**	**0 days**	**Mon 6/28/10**	**Mon 6/28/10**
55	**Develop Technical Specification Sections and Project Manual**	**40 days**	**Thu 6/10/10**	**Wed 8/4/10**
61	**Plans Preparation - 60% Submittal**	**45 days**	**Thu 7/15/10**	**Wed 9/15/10**
62	**General Sheets**	**3 wks**	**Thu 7/15/10**	**Wed 8/4/10**
63	**Typical Details**	4 wks	Thu 7/15/10	Wed 8/11/10
64	**Civil**	**25 days**	**Wed 8/11/10**	**Tue 9/14/10**
71	**Mechanical Plans, Sections, and Details**	7 wks	Thu 7/15/10	Wed 9/1/10
72	**Architectural Floor Plan, Elevations, Roof Plan, Details and Schedules**	4 wks	Thu 8/19/10	Wed 9/15/10
73	**Structural Details**	3 wks	Thu 8/26/10	Wed 9/15/10
74	**Electrical**	6 wks	Thu 8/5/10	Wed 9/15/10
75	**Instrumentation**	3 wks	Thu 7/15/10	Wed 8/4/10
76	IRWD Project Manual Preparation	5 wks	Thu 7/29/10	Wed 9/1/10
77	Construction Cost Estimate Update	7 wks	Mon 7/26/10	Fri 9/10/10
78	60% Submittal	0 days	Wed 9/15/10	Wed 9/15/10
79	IRWD Review	20 days	Thu 9/16/10	Wed 10/13/10
80	**90% Design**	**70 days**	**Thu 10/14/10**	**Wed 1/19/11**
81	**Permit Packages Preparation / Assistance**	**20 days**	**Mon 11/22/10**	**Fri 12/17/10**
82	OCFA	1 mon	Mon 11/22/10	Fri 12/17/10
83	90% PS&E Preparation	8 wks	Thu 10/14/10	Wed 12/8/10
84	IRWD Review	30 days	Thu 12/9/10	Wed 1/19/11
85	**100% Design (Incorporate IRWD Comments)**	**25 days**	**Thu 1/20/11**	**Wed 2/23/11**
86	100% PS&E Preparation	15 days	Thu 1/20/11	Wed 2/9/11
87	Final Review (Back-Check) by IRWD	10 days	Thu 2/10/11	Wed 2/23/11
88	Final Design Submittal	4 days	Thu 2/24/11	Tue 3/1/11
89	**Bid Phase**	**75 days**	**Wed 3/2/11**	**Tue 6/14/11**
90	Bid Packages Assembled and Distribution to Bidders	1 wk	Wed 3/2/11	Tue 3/8/11
91	Pre-Bid Meeting	0 days	Tue 3/22/11	Tue 3/22/11
92	Bid Preparation	4 wks	Tue 3/22/11	Mon 4/18/11
93	Bid Opening	0 days	Tue 4/19/11	Tue 4/19/11
94	Bid Evaluation / Recommendation for Award	5 days	Tue 4/19/11	Mon 4/25/11
95	E&O Committee Meeting	0 days	Tue 5/17/11	Tue 5/17/11
96	Board Meeting	0 days	Mon 5/23/11	Mon 5/23/11
97	IRWD Issues Notice of Award	2 days	Mon 5/23/11	Tue 5/24/11
98	IRWD Issues Notice to Proceed	3 wks	Wed 5/25/11	Tue 6/14/11
99	**Construction Phase**	**266 days**	**Wed 6/15/11**	**Wed 6/20/12**
100	Pre-Construction Meeting	0 days	Thu 6/16/11	Thu 6/16/11
101	Submittals	6 wks	Wed 6/15/11	Tue 7/26/11
102	Construction	12 mons	Thu 6/16/11	Wed 5/16/12
103	Start-up and Testing	3 wks	Thu 5/17/12	Wed 6/6/12
104	Record Drawings	1 mon	Thu 5/24/12	Wed 6/20/12
105	Project Closeout	2 wks	Thu 6/7/12	Wed 6/20/12



Project: Exhibit 25.2.mpp
Date: Mon 4/26/10

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External MileTask | Split

EXHIBIT 25.2

APPENDIX A

Well No. 1 Memorandum

Project Coordination

To: Irvine Ranch Water District - Engineering **JN:** 10-106232

From: Cindy Miller - RBF; Jim Meyerhofer, Vincent Roquebert, Dan Hugaboom - Carollo

Date: September 3, 2009

Re: Baker Water Treatment Plant – Well No. 1

PURPOSE

The purpose of this memorandum is to provide the IRWD alternatives and a recommendation for utilizing water produced from Well No. 1 in the proposed water process for the Baker WTP. Well No. 1 is located adjacent to the Baker WTP and is currently piped to discharge into a well tank located on the Baker WTP site.

REFERENCES

Information for this memorandum was obtained from the following sources:

- Groundwater Supply Evaluation for the Los Alisos System (Boyle Engineering Corporation, December 2002)
- Baker WTP Preliminary Design Memorandums (RBF/Carollo, 2009)

BACKGROUND

IRWD owns a well adjacent to the Baker WTP site. Based on the available information this well is operated at approximately 200 gallons per minute (gpm) or 322 acre.ft/year. If included in the treatment process this well would increase plant output by 1.1%.

The Boyle report indicates that a pump pedestal and waste line need to be added to Well No. 1 in order to comply with criteria for a potable water well. Assuming the appropriate upgrades are made to make the well suitable for potable water use, the primary issue with its use at the Baker WTP is water quality. Well water quality most relevant to the purpose of this memorandum is summarized in Table 1 below.

Well No.1 exceeds potable water standards (at times) for iron, manganese, arsenic, TDS, and turbidity. Alternatives for managing these constituents involve blending with process flows at the Baker WTP. At minimum plant flows (assumed to be 10 mgd of raw water), Well No. 1 is diluted at a ratio of 35:1. At peak plant flows dilution is increased to 87:1. Dilution eliminates water quality concerns for all of these constituents without additional treatment, with the exception of turbidity. Treatment requirements would be limited to virus disinfection, which can be accomplished in the CT basin proposed for the main treatment process.

The Boyle report indicates that rehabilitation activities were performed on Well No. 1 to eliminate silting. It is unclear from the report if and by how much well water turbidity has decreased. However, it is assumed in this memorandum that well water turbidity has been reduced to a more typical value 0.5 NTU.

Table 1 Well No. 1 Water Quality[1]

Constituent	Potable Water Standard	Range (mg/L)	Average (mg/L)
Total Hardness	None	189 - 500	390
Total Alkalinity	None	225 - 268	240
pH	SMCL = 6.5 to 8.5	6.7 - 7.6	7.3
Total Dissolved Solids (TDS)	SMCL = 500 mg/L	600 - 950	710
Turbidity	<0.3 NTU 95% of the time	1.1 - 7.5	4.6
Arsenic	MCL = 0.010 mg/L	ND - 0.012	0.007
Iron	SMCL = 0.3 mg/L	ND - 2.96	0.6
Manganese[2]	SMCL = 0.050 mg/L	ND - 0.07	0.044

Note:
1. Based on annual water quality data presented in Boyle (December 2002) from 1989 to 2001.

ALTERNATIVES FOR INCLUSION OF WELL NO. 1

The following treatment alternatives have been developed to manage turbidity from Well No. 1. Other constituents of interest in Well No.1 will be managed through dilution into the main process stream. Alternatives are summarized in Table 2.

Blending into the Membrane Waste Washwater (MFWW) Equalization Basin

In this alternative, well water is pumped into the membrane waste washwater (MFWW) equalization basin, transferred to the clarification process, and ultimately introduced into the raw water pipeline. This eliminates any concerns about silt (turbidity) in Well No. 1 impacting finished water quality or membrane performance. In addition, turbidity peaks associated with well cycling could be handled in the clarification process, eliminating the need for a dedicated well to waste system. Blending in this manner will not impact the treatment process selection, equipment, or pipeline sizing for the Baker WTP. Finished water quality is not impacted.

This alternative would require construction of a pipeline from nearby the existing well tank on the Baker WTP site to the MFWW equalization basin, associated valving and controls. These improvements are depicted in Figure 1.

Blending with Finished Water at the CT Basin

In this alternative, well water is pumped into the CT basin and blended with membrane permeate from the Baker WTP prior to disinfection. This would allow the water to be disinfected in the CT basin proposed for the main process stream. In order to for this alternative to be viable, it must be confirmed that Well No. 1

rehabilitation activities have lowered turbidity to more typical well turbidity levels (less than 0.5 NTU). Assuming a well water turbidity of 0.5 NTU, finished water turbidity would be expected to increase by 33% to 100% (up to 0.020 NTU to 0.030 NTU) depending on the Baker WTP flow rates. This alternative eliminates any risk of MF system fouling from well water manganese or iron.

This alternative would include construction of a pipeline from nearby the existing well tank on the Baker WTP to the CT basin, a well to waste pipeline to the proposed MFWW equalization basin, associated valving and controls. The well to waste pipeline would be used to mitigate any turbidity peaks associated with pump start up. These improvements are depicted in Figure 2.

Table 2 Alternatives for Using Well No. 1 Water at the Baker WTP

Alternative	Pros	Cons
Blend into MFWW Equalization Basin	• No measurable impact to finished water quality • No impact to process selection/sizing • Turbidity removal with minimal additional capital cost (pipeline only) • No new residuals stream • No well to waste line required	• Risk (minimal) of impacting MF performance from additional iron and manganese load.
Blend Directly into CT Basin Inlet	• Eliminates possible impacts to membrane system performance • No new residuals stream	• Increases finished water turbidity from 0.015 NTU to 0.020 NTU to 0.030 NTU at low Baker WTP flows

CONCLUSIONS

- Well No. 1 is suitable for blending into the CT basin at the Baker WTP without violating any primary or secondary MCLs.
- At assumed well turbidity of 0.5 NTU and minimum Baker WTP flows, direct blending of Well No. 1 into the CT basin is expected to increase finished water turbidity from 0.015 NTU to 0.020 NTU. At minimum plant flows, blended turbidity could reach 0.03 NTU. This approach would require construction of both a blend line and a well to waste line.
- Well No. 1 could be blended into the MFWW equalization basin to utilize clarification and filtration facilities proposed for the Baker WTP to manage turbidity from Well No 1. This approach eliminates impacts to plant finished water quality from Well No. 1 and requires only one pipeline to be constructed.

RECOMMENDATIONS

It is recommended that Well No. 1 be blended into the MFWW equalization basin if it is to be used as a supply source for the Baker WTP.

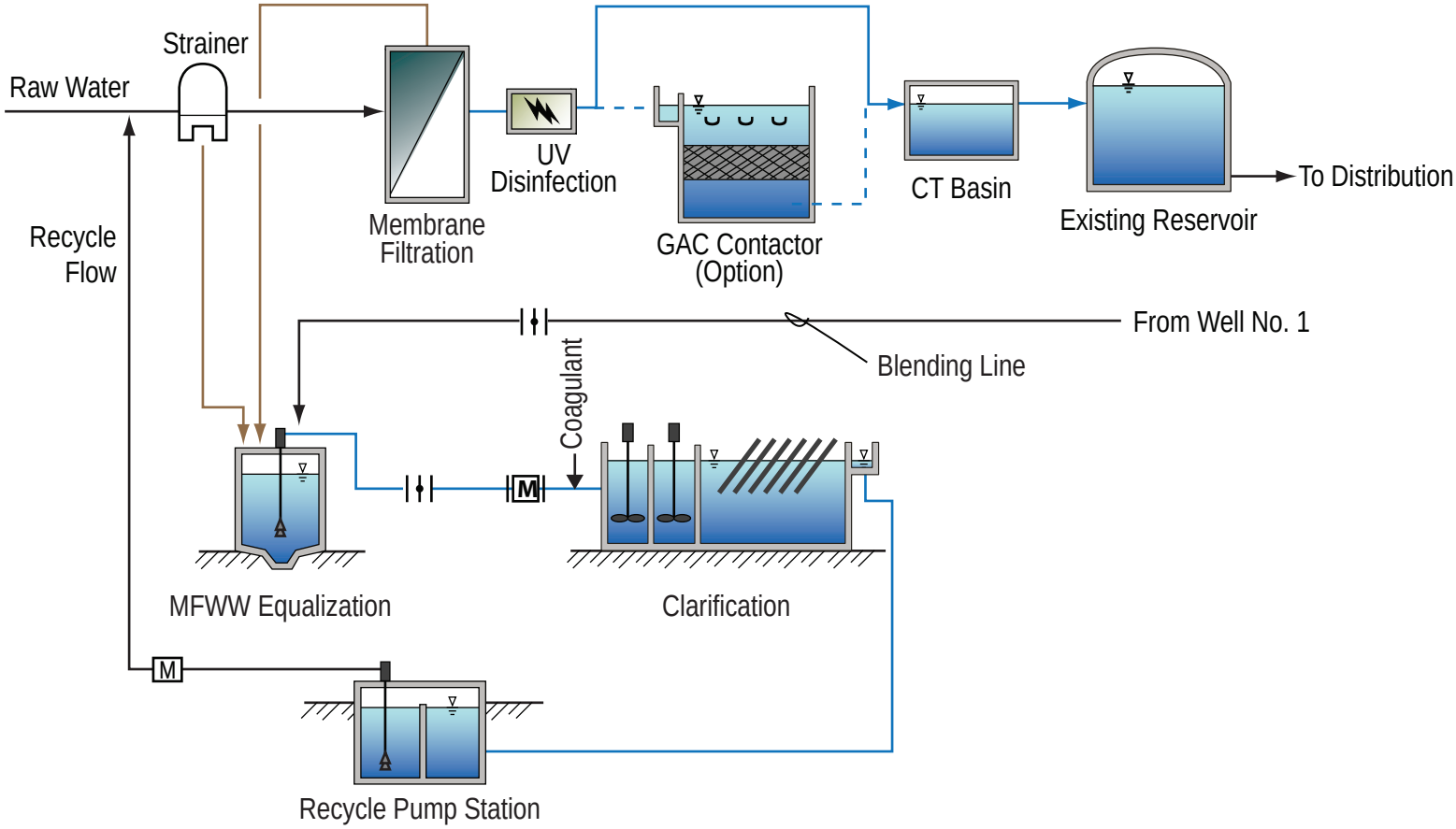


Figure 1
Well No. 1 MFWW Equalization Basin Blending Alternative
IRWD

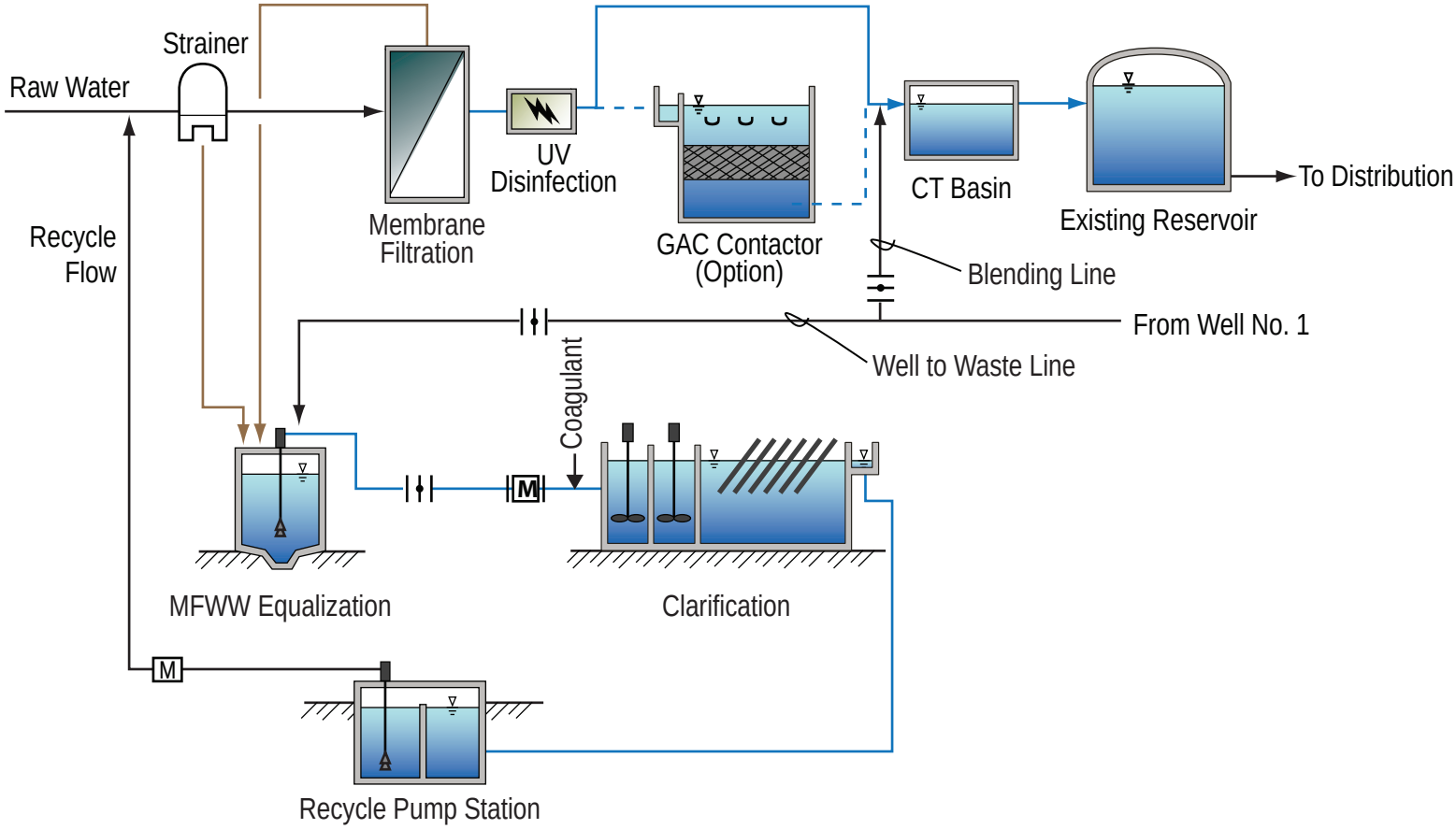


Figure 2
Well No. 1 CT Basin Blending Alternative
IRWD

APPENDIX B

Baker Pipeline Flow Test – Results / Calculations

TABLE B1
BAKER PIPELINE FLOW TEST
FLOW TEST SUMMARY

DATA LOGGING LOCATION	Parameter	STEP																																	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
		TIME OF TEST (Minutes)																																	
		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145 [1]	150	155	160
		9:00 AM	9:05 AM	9:10 AM	9:15 AM	9:20 AM	9:25 AM	9:30 AM	9:35 AM	9:40 AM	9:45 AM	9:50 AM	9:55 AM	10:00 AM	10:05 AM	10:10 AM	10:15 AM	10:20 AM	10:25 AM	10:30 AM	10:35 AM	10:40 AM	10:45 AM	10:50 AM	10:55 AM	11:00 AM	11:05 AM	11:10 AM	11:15 AM	11:20 AM	11:25 AM	11:30 AM	11:35 AM	11:40 AM
SANTIAGO LATERAL																																			
OC-33 IRWD Flow Reading	**Flow (cfs)**	4.29	3.75	4.08	4.56	4.02	9.62	9.28	15.94	16.01	24.6	23.8	23.8	29.66	35.28	37.42	37.61	39.23	39.4	39.83	39.83	39.83	39.83	39.82	39.82	39.82	39.82	30.29	17.81	14.16	*10*	7.63	3.94	
OC-33 MWD Flow Reading	**Flow (cfs)**	3.17	4.06	-	3.96	-	9.50	9.40	15.42	15.72	-	30.13	-	30.71	35.20	37.42	-	39.46	39.26	40.00	40.00	40.00	40.00	40.00	40.00	40.00	38.10	28.87	15.05	11.25	6.09	5.21	4.06	
B01 Pressure Reading	**Pressure (psi)**	48	48	51	51	51	50	50	50	49.5	49.5	49	49	48.5	48	48	48	48	48	48	47.5	47.5	47.5	47.5	47.5	47.5	48	49	50	50	*51*	51	51	
Centerline Elev = 717'	**HGL (ft)**	830.9	830.9	837.8	837.8	837.8	835.5	835.5	835.5	834.3	834.3	833.2	833.2	832.0	830.9	830.9	830.9	830.9	830.9	830.9	829.7	829.7	829.7	829.7	829.7	829.7	830.9	833.2	835.5	835.5	*837.8*	837.8	837.8	
BAKER PIPELINE																																			
EOCWD FCF @ Sta 370+00	**Pressure (psi)**	104	104	105	105	105	103	100	102	102	101	100	100	100	100	99	99	99	99	99	99	99	99	99	99	99	99	100	100	101	102	103		
Gage Elev = 600'	**HGL (ft)**	840.2	840.2	842.6	842.6	842.6	837.9	831.0	835.6	835.6	833.3	831.0	831.0	831.0	831.0	828.7	828.7	828.7	828.7	828.7	828.7	828.7	828.7	828.7	828.7	828.7	828.7	831.0	831.0	833.3	835.6	837.9		
B47 4"AVAR @ Sta 597+81	**Pressure (psi)**	50	52	52	51	52	50	50	48	48	45	45	42	41	38	38	37	37	36	34	34	34	33	32	32	32	36	41	47	50	50	52	52	
Gage Elev = 715'	**HGL (ft)**	830.5	835.1	835.1	832.8	835.1	830.5	830.5	825.9	825.9	819.0	819.0	812.0	809.7	802.8	802.8	800.5	800.5	798.2	793.5	793.5	793.5	791.2	788.9	788.9	788.9	798.2	809.7	823.6	830.5	830.5	835.1	835.1	
B90 3" AV @ Sta 900+62	**Pressure (psi)**	83	83	83	83	80	80	77	77	70	70	64	64	57	57	54	54	52	52	50	50	47	47	46	46	50	58	63	76	78	78	78	78	83
Gage Elev = 655'	**HGL (ft)**	846.7	846.7	846.7	846.7	839.8	839.8	832.9	832.9	816.7	816.7	802.8	802.8	786.7	786.7	779.7	779.7	775.1	775.1	770.5	770.5	763.6	763.6	761.3	761.3	770.5	789.0	800.5	830.6	835.2	835.2	835.2	835.2	846.7
TCWD - Pressure Readings	**Pressure (psi)**					74		72	67			62		57				47		46			42	40		39								
Gage Elev = 665.5'	**HGL (ft)**					836.4		831.8	820.3			808.7		797.2				774.1		771.8			762.5	757.9		755.6								
Baker WTP (Exist Contr Panel)	**Pressure (psi)**	90.93	88.58	89.3	89.16	89.06	85.3	85.8	79.3	81.4	72.9	72.6	62.5	62.61	52.71	52.62	48.5	48.4	44.78	45.17	41.84	42.04	38.9	39	36.25	36.25	46.05	65.84	62.31	86.62	89.95	89.36		
Gage Elev = 636'	**HGL (ft)**	846.0	840.6	842.3	842.0	841.7	833.0	834.2	819.2	824.0	804.4	803.7	780.4	780.6	757.8	757.6	748.0	747.8	739.4	740.3	732.7	733.1	725.9	726.1	719.7	719.7	742.4	788.1	779.9	836.1	843.8	842.4		
24-inch Lateral @ 18-inch conn.	**Pressure (psi)**	107	107	107	106	98	103	103	98	98	90	78	78	68	68	64	64	58	58	56	56	52	52	50	50	58	58	62	78	94	102	108		
Gage Elev = 597'	**HGL (ft)**	844.2	844.2	844.2	841.9	823.4	834.9	834.9	823.4	823.4	804.9	777.2	777.2	754.1	754.1	744.8	744.8	731.0	731.0	726.4	726.4	717.1	717.1	712.5	712.5	731.0	731.0	740.2	777.2	814.1	832.6	846.5		
18-inch Line to 2.0 MG Clearwell	**Flow (cfs)**	0	0	0	0	4.5	5.8	6.6	10.7	15.2	17.9	22.2	23.5	27.3	28.8	30	31.5	32.2	33.4	34.0	34.9	35.6	36.0	36.9	35.0	33.3	25.5	24.3	8.8	6.2	2.3	0.0		
2.0 MG Reservoir (East)	**Pressure (psi)**	0	0	0	0	0	0	0	1	1	3	7	8	8	13	15	15	17	17	18	18	20	20	22	22	22	14	14	6	5	5	4		
Gage Elev = 599'	**HGL (ft)**	602.2	602.4	602.6	602.8	602.9	603.5	603.8	604.4	605.8	606.8	608.2	609.0	609.4	609.2	608.7	611.9	611.5	614.2	611.2	612.0	612.2	614.8	619.1	622.0	624.8	629.1	629.9	630.5	629.9	629.4	627.9	627.0	624.9
	WSL(ft)	1.39	1.47	1.56	1.63	1.68	1.95	2.07	2.33	2.95	3.39	3.97	4.35	4.49	4.4	4.18	5.58	5.41	6.58	5.26	5.64	5.7	6.82	8.69	9.97	11.19	13.04	13.38	13.62	13.38	13.17	12.49	12.13	11.2
2.0 MG Reservoir (West)	**HGL (ft)**	603.6	603.6	603.6	603.7	603.6	603.7	603.7	603.8	603.9	604.0	604.2	604.2	604.4	604.5	604.8	605.0	605.3	605.5	605.6	606.0	606.4	607.1	607.6	608.0	608.4	609.7	610.1	610.6	611.6	612.1	613.9	613.5	614.6
	WSL(ft)	2.01	2.01	2.01	2.03	2.01	2.05	2.05	2.06	2.12	2.17	2.23	2.25	2.32	2.39	2.49	2.59	2.73	2.8	2.85	3.04	3.19	3.51	3.74	3.89	4.06	4.64	4.79	5.02	5.46	5.68	6.43	6.28	6.77

[1] OC-33 flow reading was not available. Interpolation was used to determine flow and pressure for use in subsequent figures and analysis.

Exhibit B1
Baker Flow Test (HGL per Time)

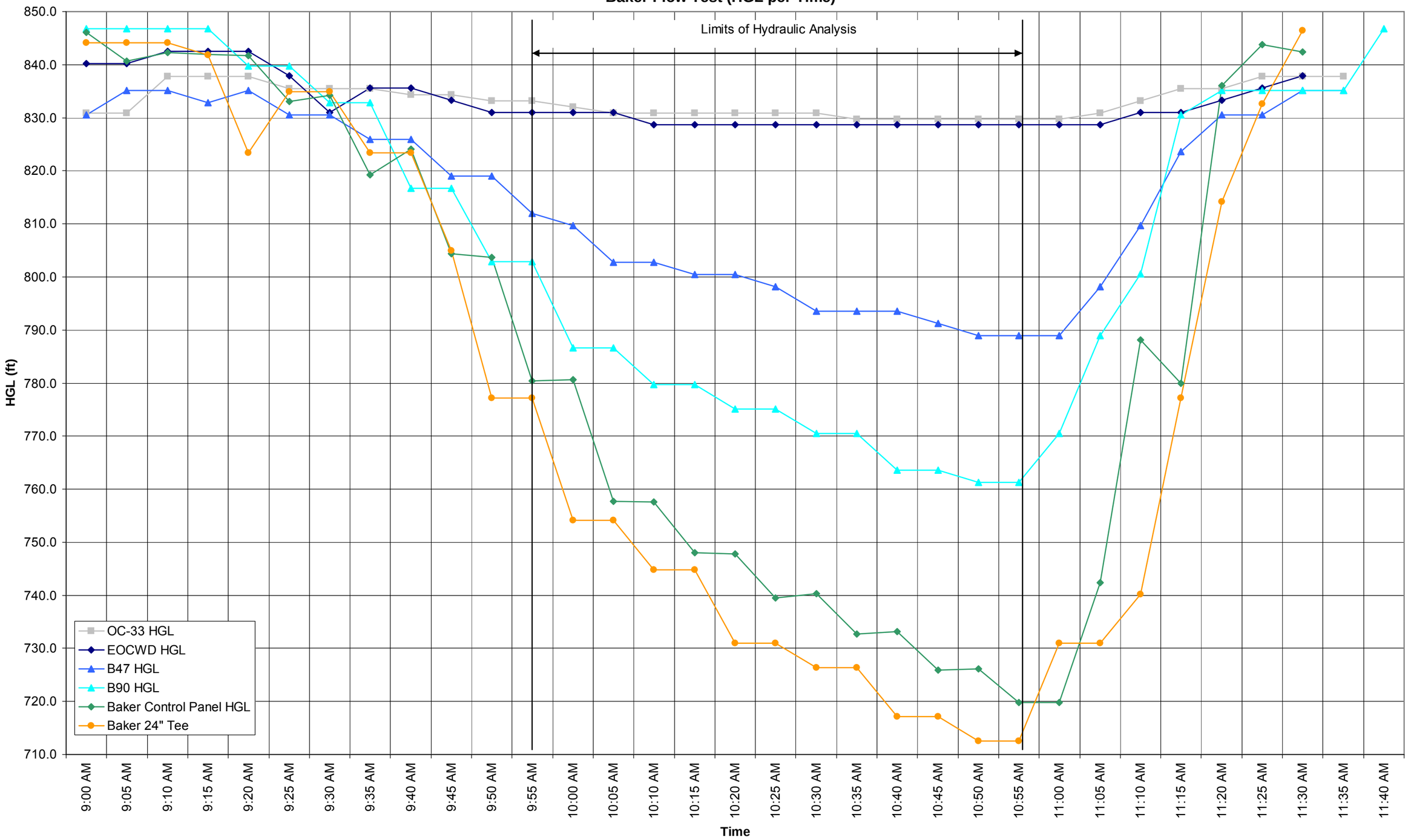
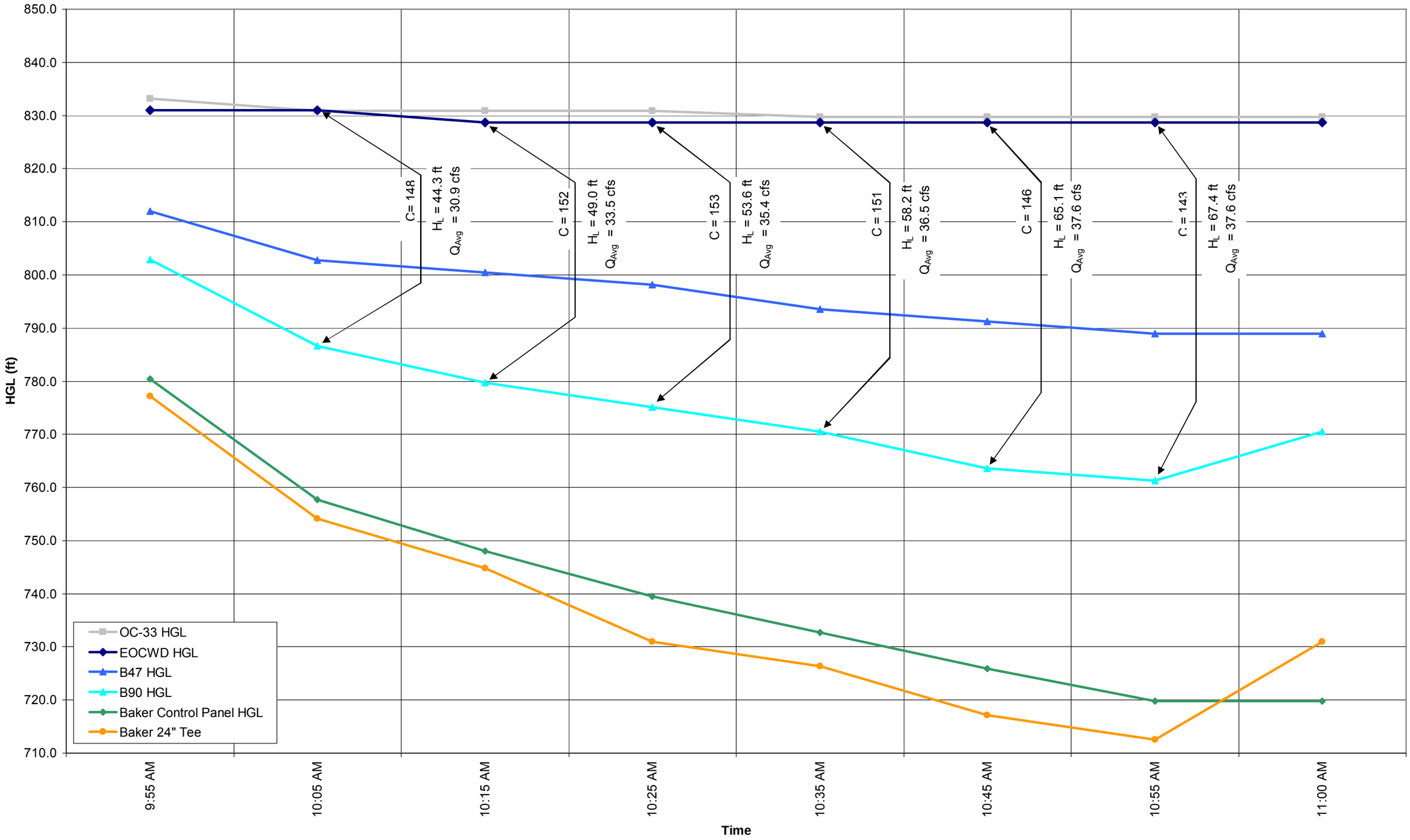


Exhibit B2
Hazen Williams 'C' Value Determination from Results



APPENDIX C

Raw Water Conveyance Facilities Previously Considered

FACILITIES CONSIDERED PREVIOUSLY

Hydraulic Control Structure

The Santiago Lateral and the Baker Pipeline have a combined length of approximately nineteen miles, beginning at the Lower Feeder and terminating at the Baker Water Treatment Plant. The Baker Pipeline, itself, traverses twelve miles of undulating terrain from its connection to the Santiago Lateral to the Baker WTP. These existing facilities provide the system backbone that make the steady-state delivery of water to the WTP possible. However, it is the long lengths of these facilities, particularly the Baker Pipeline, that could make the control of flow to the plant a challenge.

Slight variations in demand, at the treatment plant, will produce swings in the hydraulic grade line along the length of the Baker pipeline. These variations in demand will then become translated into rejection, to Irvine Lake, of a portion of the water delivered by MWD, through the Santiago Lateral, to OC-33. Any instantaneous reduction in demand at the plant raises the HGL at OC-33 and when the HGL exceeds 832' water is spilled to Irvine Lake. This condition arises because of the profile of the Santiago Lateral. Immediately downstream of OC-33 is a high point in the pipeline that limits the HGL at OC-33 to about 832', except when water is discharged to the lake, a maximum HGL elevation of 872' can be realized at OC-33. In order to counter this effect, as well as to provide for a greater HGL at OC-33 that would allow the development of greater capacity, in the pipeline and the WTP, IRWD proposed to MWD, the construction of a hydraulic control structure, at the high point in the Santiago Lateral downstream of OC-33.

This facility would:

- reduce variations in the HGL at OC-33
- dampen variations of flow in the Baker Pipeline
- eliminate unintended flows to Irvine Lake

To date, MWD staff has held an opposed stance toward the proposal.

Regulating Reservoir

Without free-water-surface storage, at the head of the Baker pipeline, alternative means of regulating the flow and mitigating operational spikes in the HGL, at OC-33, in the Santiago Lateral, as well as along the Baker Pipeline, have been considered. Unfortunately, a regulating tank on the Baker pipeline near OC-33 is impossible to site, because of topographical constraints (no locations with sufficient elevation) in the vicinity of the turnout. However, between OC-33 and the plant, there are two locations that have been considered for a regulating tank:

- near Peters Canyon reservoir in the vicinity of the raw water pump station
- near Orchard Hills development

At both of the locations the regulating tanks would have to intercept the HGL approximately at their mid-height. The approximate ranges in the HGL at these locations are:

- Peters Canyon – 872' to 818' +/-
- Orchard Hills – 872' to 750+/-

In order to be effective over the possible ranges in the water surface levels, in the tanks, their heights would be about 54' and 112', respectively. As a practical matter, the tanks would be sized to operate over a band width of water surface levels of about 30', thereby allowing equal volumes of storage above (15') and below (15') the most likely HGL at normal operating downstream demand. The capacity of the tank, at either location, would be on the order of two million gallons. When pumping, from Irvine Lake, this volume would provide about one hour of storage, for plant operation, during a power failure at the pump station. During gravity flow condition, from the Santiago Lateral, this volume would allow about one hour of continued delivery of water through OC-33, in the event of a treatment plant shutdown, without discharging to Irvine Lake.

Balancing and Constant-Head Tanks

For the purposes of this report, these terms are defined as follows:

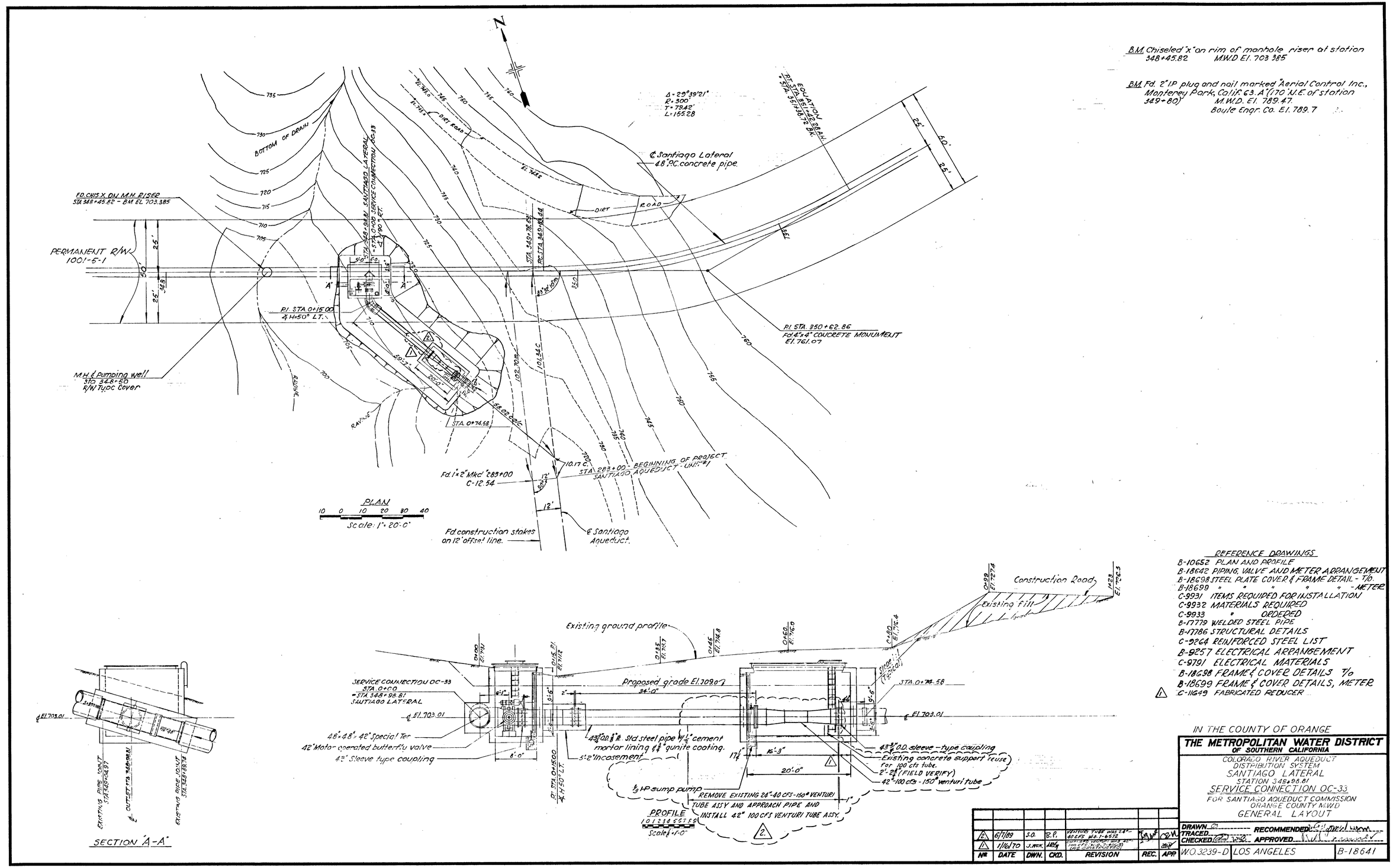
- Constant Head Tank – Storage that includes no volume for plant flow variation
- Balancing Tank – Storage that has sufficient volume to accommodate all variations in plant flow

In addition to dealing with major flow adjustments, due to the unforeseen shutdown of either the pump station or the water treatment plant, instantaneous flow variations of short duration can be part of the normal plant operation. Depending on the number of filter racks, and the frequency of backwash and cleanings, these variations in flow may run from 25 to 45 cfs, for a few minutes at a time, several times per day, as well as fluctuations, of lesser magnitude, several times per hour. Since the capacity of the pipeline is below the possible upper flow demand of the plant, operational storage, near the plant, is required in order to provide a mechanism for supplying supplemental water, during peaking, and for storing water during low plant demand.

APPENDIX D

OC-33 Construction Plans

SPECIFICATIONS No. SHEET No.



B.M. Chiseled "x" on rim of manhole riser at station 348+45.82 M.W.D El. 703.385

B.M. Fd. 2" IP plug and nail marked "Aerial Control Inc., Monterey Park, Calif. 63. A" (170' N.E. of station 349+80) M.W.D. El. 789.47. Boyle Engr. Co. El. 789.7

REFERENCE DRAWINGS

B-10652 PLAN AND PROFILE
B-18648 PIPING, VALVE AND METER ARRANGEMENT
B-18698 STEEL PLATE COVER & FRAME DETAIL - T/O.
B-18699 " " " " " -METER
C-9931 ITEMS REQUIRED FOR INSTALLATION
C-9932 MATERIALS REQUIRED
C-9933 " ORDERED
B-17779 WELDED STEEL PIPE
B-17786 STRUCTURAL DETAILS
C-9264 REINFORCED STEEL LIST
B-9257 ELECTRICAL ARRANGEMENT
C-9791 ELECTRICAL MATERIALS
B-18698 FRAME & COVER DETAILS T/O
B-18699 FRAME & COVER DETAILS, METER
△ C-11649 FABRICATED REDUCER

IN THE COUNTY OF ORANGE

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

COLORADO RIVER AQUEDUCT
DISTRIBUTION SYSTEM
SANTIAGO LATERAL
STATION 348+98.81
SERVICE CONNECTION OC-33
FOR SANTIAGO AQUEDUCT COMMISSION
ORANGE COUNTY M.W.D
GENERAL LAYOUT

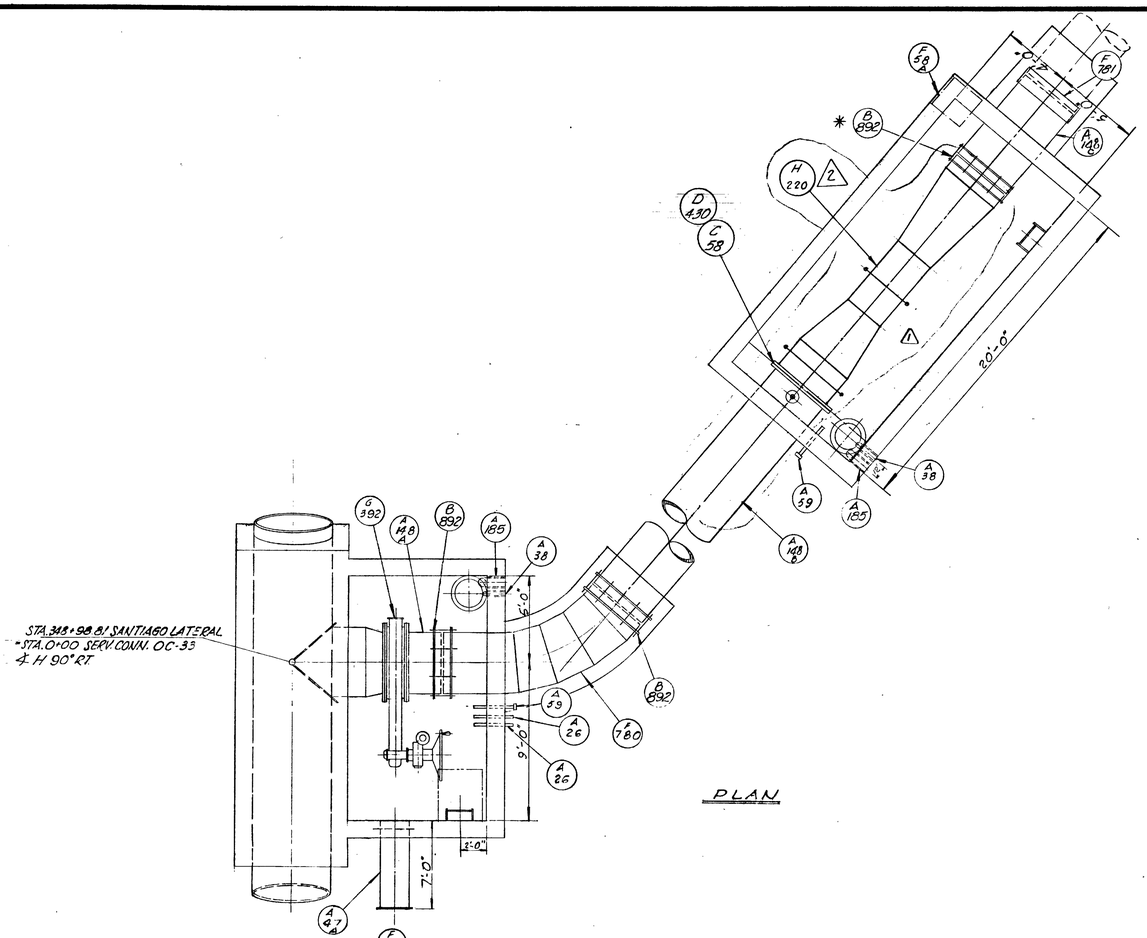
DRAWN ---- RECOMMENDED ----
TRACED ---- APPROVED ----
CHECKED ----

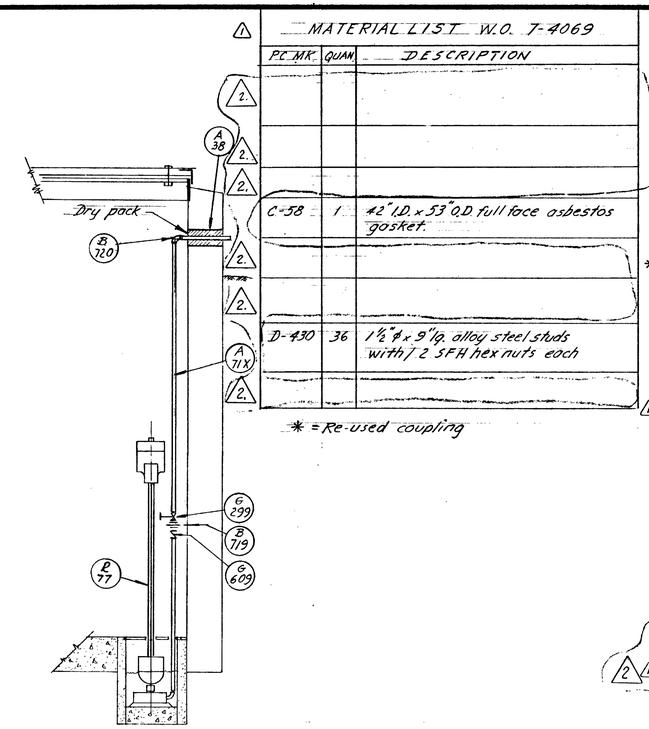
No.	DATE	DWN.	CKD.	REVISION	REC.	APP.
2	6/7/89	S.O.	B.P.	VENTURI TUBE WAS 24"-40 CFS No. T-6572		
1	11/16/70	J.MCK.	RDG	CONTROL VALVE WAS 42" 100 CFS Sta. 0+00 (Sta. 348+98.81)		

W.O. 3239-D LOS ANGELES B-18641

NON-PORT PAPER-CLOTH 1068
FEB 5 1970
MAR 27 1980
OCT 14 1993

FORM NO. 861-M-1-80 P.O. 92276
Attachment 3
SOC WMA





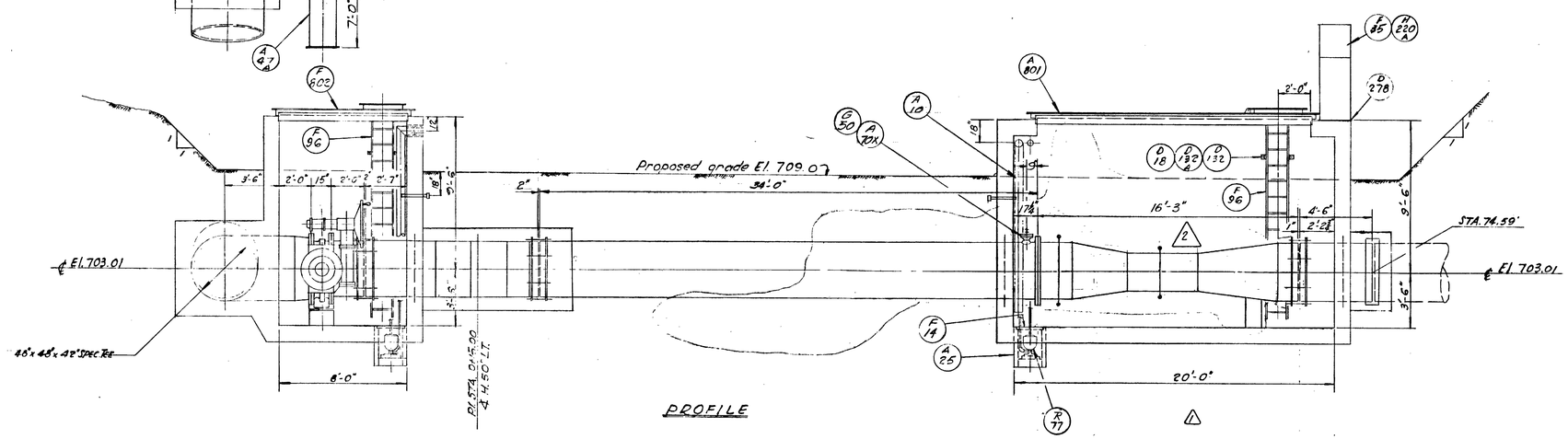
MATERIAL LIST W.O. T-4069

PC. MK.	QUAN.	DESCRIPTION
C-58	1	42" I.D. x 53" O.D. full face asbestos gasket.
D-430	36	1½" ø x 9" lg. alloy steel studs with 12 SFH hex nuts each

✱ = Re-used coupling

MATERIAL LIST

Pc Mk.	Quan.	Description
A-10	40	LF. 6" O.D. STD STEEL CASING
A-25	2	18" I.D. PCP 2'-6" SUMP
A-185	2	4" I.D. STD. PIPE SLEEVE 14" LG
A-40	2	6" I.D. STD. PIPE SLEEVE 14" LG.
A-71X	40	LF. 1½" EX. HVY. RED. BRASS PIPE T&C.
A-70X	1	1" x 2" LG. EX. HVY. RED. BRASS NIPPLE
A-148A	1	42" I.D. PIPE NIPPLE FOR SPEC. M-2343
A-148B	1	42" I.D. METER APPROACH PIPE FOR SPEC. M-2343
A-148C	1	42" I.D. PIPE SPOOL P.E. SPEC. M-2343
A-47A	1	20" VALVE SHAFT EXTERIOR HOUSING
A-26	1	½" COUP. NIPPLE 18" LG.
A-59	2	¾" " " 18" LG.
A-60	1	1" " " 18" LG.
✱ B-892	3	43⅜" SLEEVE TYPE COUPLING SPEC-2343
B-1342	2	1⅛" x .125" B. BRASS COUPLINGS
C-58	3	42" I.D. x 53" O.D. x ⅛" THK. FF ASBESTOS GASKETS W/36-1⅝" DIA. HOLES ON 49¾" BC.
B-720	4	1⅛"-90°-125# BRASS ELBOW
B-719	2	1⅛"-125# BRASS SCREWED GROUND JOINT UNIONS
D-18	20	¾" x 3½" LG HEX. HD. MACH. BOLT W/1 SF. HVY. HEX. NUTS EA.
D-89	72	1½" x 8¾" LG. ALLOY STEEL STUDS W/2 SFH HEX NUTS EA.
D-132	20	¾" 2 UNIT. TYPE 1A, PLAN CLICH ANCHOR
D-132A	20	EXTRA LEADS
D-278	4	⅝" x 1¾" HEX. HD CAP SCREWS.
F-780	1	42" I.D. 50° MITERED ELBOW, P.E. M-2343
F-781	1	2 PIECE BUTT STRAP FOR 43¾" O.D. PIPE.
F-14	2	18" METAL SUMP COVERS
F-35	1	BUILDERS TYPE "M" INSTRUMENT HOUSING
F-58A	1	BUILDERS TYPE "M" INSTRUMENT MOUNTING BASE
F-96	2	STD. STEEL LADDERS W/ 4'& 2'0" BRACKETS
F-801	1	STEEL PLATE COVER ASSEMBLY
F-802	1	" " " "
G-299	2	1⅛"-125# BRZ. GATE VALVE - CRANE #440
G-50	1	1"-250# BRONZ COCK VALVE
G-392	1	42" MOTOR OPERATED BUTTERFLY VALVE
G-609	2	1⅛" 125# BRZ. VERT. LIFT CHECK VALVE CRANE #29
H-220	1	42"-100 CFS VENTURI TUBE ASSEMBLY
H-220A	1	100 cfs BUILDERS TYPE M FLOW METER W/CTM TRANSMITTER & CRA-TYP REMOTE INSTRUMT.
R-77	2	⅓ HP. SUMP PUMP (PENBERTHY)
	1	51" O.D. x 51" O.D. x 43" I.D. x ⅜" THK. R. FAB. D WELD STEEL CROTCH-PLATE REINF-TEE WITH ONE END BELLED FOR STANDARD LOCK JOINT ONE END PLAIN AND SIDE OUTLET FLANGED. SPEC. M-2342.
	1	51" O.D. x ⅜" THK. R. FAB STL. SPOOL WITH ONE END PLAIN & ONE SPIGOT RING FOR STD. LOCK JOINT M-2342
	1	51" I.D. x 14" WIDE x ⅜" THK. R. FAB STL. COMPLETE BUTT STRAP TO BE FURNISHED IN TWO IDENTICAL PIECES TOGETHER WITH ONE PIECE 1" x ¼" STL. BAR 15" LG. & 8" STL. PIPE PLUGS. SPEC. M-2342.
	2	RUBBER GASKETS FOR 51" DESIGN DIAM. LOCK JOINT BY 2⅝" CROSS SECTION SPEC M-2342



REFERENCE DRAWINGS

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B-18641 GENERAL LAYOUT
B-18698 STEEL PLATE COVER & FRAME DETAIL - T/O
B-18699 " " " " " METER
C-9931 ITEMS REQUIRED FOR INSTALLATION
C-9932 MATERIALS REQUIRED
C-9933 " ORDERED
B-17779 WELDED STEEL PIPE
B-17786 STRUCTURAL DETAILS
C-9264 REINFORCED STEEL LIST
B-9257 ELECTRICAL ARRANGEMENT
B-9791 ELECTRICAL MATERIALS
B-18698 FRAME & COVER DETAILS T/O
B-18699 FRAME & COVER DETAILS, METER

№	DATE	DWN.	CKD.	REVISION	REC.	APP.
2	6-8-89	S.O.	B.P.	VENTURI TUBE WAS 54" AND CRS. METER WAS C-1488 MAT'LS		
1	1/16/70	L.W.		CHANGED VENTURI TUBE WAS 7-1048 (NOT CONSTRUCTED)		

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

COLORADO RIVER AQUEDUCT
DISTRIBUTION SYSTEM
SANTIAGO LATERAL
STATION 348+98.81
SERVICE CONNECTION OC-33
FOR SANTIAGO AQUEDUCT COMMISSION

PIPING, VALVE AND METER ARRANGEMENT

DRAWN ..... RECOMMENDED .....
TRACED .....
CHECKED ..... APPROVED .....

W.O. 3239-D | LOS ANGELES | B-18642

MICROFILMED
AUG 24 1966
SEP 22 1966
FEB 5 1978
MAR 27 1980
OCT 1 1995
OCT 14 1997
DIETERICH-POST PAPER CLOTH 1085

APPENDIX E

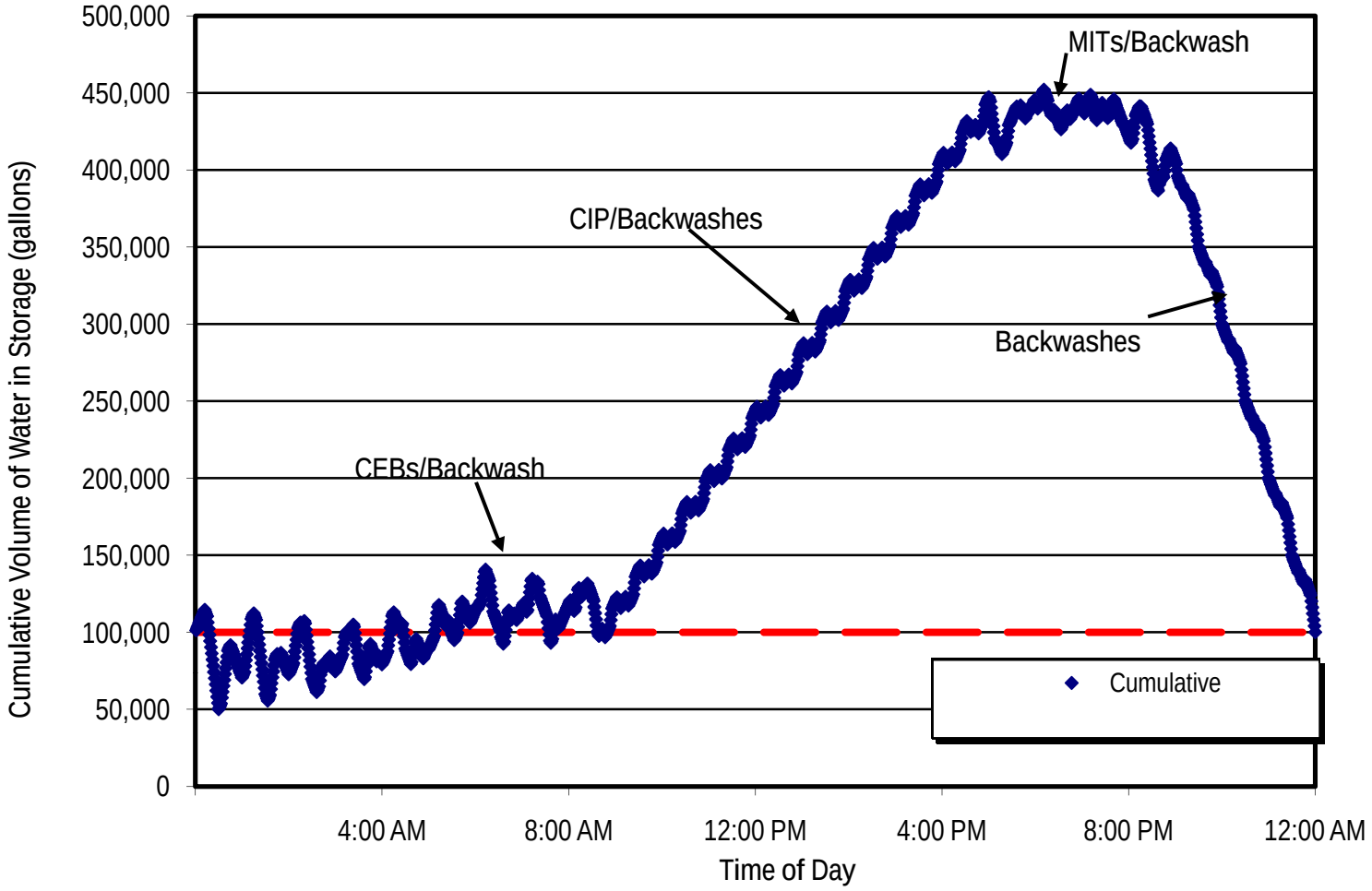
Raw Water Pump Station Calculations

TABLE E1
BAKER WATER TREATMENT PLANT PROJECT
RAW WATER CONVEYANCE FACILITIES
IRVINE LAKE PIPELINE / BAKER HYDRAULICS FOR RAW WATER PUMP STATION

Irvine Lake WSL (ft)	Maximum Design Q at Outlet Tower (cfs)	Maximum Gravity Flow in ILP (cfs)	Q (cfs)	Tower Intake Loss (ft)	Tower Outlet Loss (ft) (30-inch)	Pipeline Length (ft) and Diameter (in)	Pipeline Loss to Serrano T/O (ft)	Q Serrano T/O to RWPS (cfs)	Pipeline Loss Serrano T/O to RWPS (ft)	Total Pipeline Loss (ft)	Suction HGL at Peters Canyon (ft)	Suction Head	Discharge Static Lift to 815'	System HGL	Discharge Static Lift to System Curve'	RWPS Discharge (cfs)	TDH to 815'	TDH to System Curve	HP Lift to 815'	HP Lift to System Curve
790	70	42.5	70.0	10.0	2.3	11,000' - 39" 2,800' - 33" and 42" parallel 5,000' - 54"	39.7	64.0	4.9	44.6	733	143	82	815	82	53.5	92	92	744	744
			60.0	7.3	1.7		29.9	54.9	3.7	33.5	747	157	68	784	37	45.9	75	44	520	304
			50.0	6.9	1.2		21.3	39.2	2.0	23.3	759	169	56	757	0	38.2	62	0	356	0
			40.0	6.4	0.7		14.1	22.4	0.7	14.8	768	178	47	734	0	30.6	50	0	232	0
			30.0	5.6	0.4		8.3	9.6	0.1	8.4	776	186	39	716	0	22.9	41	0	143	0
			20.0	4.4	0.2		3.9	2.7	0.0	3.9	781	191	34	702	0	15.3	34	0	79	0
			10.0	2.5	0.0		1.1	0.4	0.0	1.1	786	196	29	693	0	7.6	29	0	33	0
			0.0	0.0	0.0		0.0	0.0	0.0	0	790	200	25	690	0	0.0	25	0	0	0
780	67.5	40	67.5	9.3	2.1		37.2	61.5	4.5	41.7	727	137	88	804	77	51.0	97	87	750	668
			60.0	7.3	1.7		29.9	54.7	3.6	33.5	737	147	78	782	45	45.3	85	52	581	355
			50.0	5.5	1.2		21.3	45.6	2.6	23.9	749	159	66	756	6	37.8	71	11	403	64
			40.0	4.4	0.7		14.1	36.4	1.7	15.8	759	169	56	733	0	30.2	59	0	271	0
			30.0	3.6	0.4		8.3	27.3	1.0	9.3	767	177	48	716	0	22.7	50	0	172	0
			20.0	2.5	0.2		3.9	18.2	0.5	4.4	773	183	42	702	0	15.1	43	0	98	0
			10.0	1.1	0.0		1.1	9.1	0.1	1.2	778	188	37	693	0	7.6	38	0	43	0
			0.0	0.0	0.0		0.0	0.0	0.0	0	780	190	35	690	0	0.0	35	0	0	0
770	65	37.5	65.0	8.6	2.0		34.6	59.0	4.2	38.8	721	131	94	794	74	48.5	103	82	753	601
			60.0	7.3	1.7		29.9	54.5	3.6	33.5	727	137	88	780	52	44.8	95	59	640	402
			50.0	6.9	1.2		21.3	45.4	2.6	23.9	738	148	77	754	16	37.3	82	21	462	119
			40.0	6.4	0.7		14.1	36.3	1.7	15.8	747	157	68	732	0	29.8	71	0	321	0
			30.0	5.6	0.4		8.3	27.2	1.0	9.3	755	165	60	715	0	22.4	62	0	210	0
			20.0	4.4	0.2		3.9	18.2	0.5	4.4	761	171	54	702	0	14.9	55	0	124	0
			10.0	2.5	0.0		1.1	9.1	0.1	1.2	766	176	49	693	0	7.5	49	0	55	0
			0.0	0.0	0.0		0.0	0.0	0.0	0	770	180	45	690	0	0.0	45	0	0	0
760	62.5	35	62.5	8.0	1.8		32.2	56.5	3.9	36.1	714	124	101	785	70	46.0	108	78	754	541
			60.0	7.3	1.7		29.9	54.2	3.6	33.5	718	128	97	761	44	39.4	103	49	614	292
			50.0	6.4	1.2		21.3	45.2	2.6	23.9	729	139	86	741	12	32.9	90	16	448	79
			40.0	4.4	0.7		14.1	36.2	1.7	15.8	739	149	76	724	0	26.3	78	0	312	0
			30.0	3.6	0.4		8.3	27.1	1.0	9.3	747	157	68	710	0	19.7	70	0	208	0
			20.0	2.5	0.2		3.9	18.1	0.5	4.4	753	163	62	699	0	13.1	63	0	125	0
			10.0	1.1	0.0		1.1	9.0	0.1	1.2	758	168	57	693	0	6.6	58	0	57	0
			0.0	0.0	0.0		0.0	0.0	0.0	0	760	170	55	690	0	0.0	55	0	0	0
750	60	32.5	60.0	7.3	1.7		29.9	54.0	3.6	33.4	708	118	107	775	68	43.5	114	74	751	489
			50.0	6.9	1.2		21.3	45.0	2.5	23.9	718	128	97	751	33	36.3	102	37	557	205
			40.0	6.4	0.7		14.1	36.0	1.7	15.8	727	137	88	730	3	29.0	91	0	399	0
			30.0	5.6	0.4		8.3	27.0	1.0	9.3	735	145	80	714	0	21.8	82	0	270	0
			20.0	4.4	0.2		3.9	18.0	0.5	4.4	741	151	74	701	0	14.5	75	0	164	0
			10.0	2.5	0.0		1.1	9.0	0.1	1.2	746	156	69	693	0	7.3	69	0	76	0
			0.0	0.0	0.0		0.0	0.0	0.0	0	750	160	65	690	0	0.0	65	0	0	0

APPENDIX F

Forebay Calculations


500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Cumulative Volume of Water in Storage (gallons)
MITs/Backwash
CIP/Backwashes
Backwashes
CEBs/Backwash
Cumulative
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
Time of Day

Forebay Sizing Calculations
Baker WTP
IRWD

CHLORINE DIOXIDE CONTACT CHAMBER

Raw Water Flow=	43.5	cfs	
Maximum Return Water Flows=	3.81	cfs	(2.46 mgd see MFWW Calcs)
Contact Chamber Max Flow=	47.3	cfs	
Contact Time for Mn Oxidation=	10	min	
	600	seconds	
Required Contact Chamber Volume=	28386	ft^3	
Average Chamber Depth=	13.5		
First 20 feet	19	ft	
Next 44 feet	11	ft min	
Chamber Width =	16.5	ft	
Chamber Length=	64	ft	
Calculated East Chamber Volume=	14256	ft^3	
Calculated West Chamber Volume=	14256	ft^3	
Total Volume (exclude between slab and low water level)=	28512	ft^3	
	213,270	gallons	
Time Provided=	603	seconds	
	10.0	minutes	

EQUALIZATION CHAMBER

Volume Required for MF Equalization=	500,000	gallons	
	66,845	ft^3	
Maximum depth=	10.5	feet between LL and HH (El 620.5 and EL 631)	
Channel Width=	16.5	feet	
Required Channel Length=	386	feet	
East Channel Length=	64	feet from outlweir to south end	
	128	feet from south end to end of pump bay	
West Channel=	same as East channel		
Total Length=	384	feet	
Actual Volume Provided=	497,629	gallons	
Additional Volume for Surge Equalization =	75,000	gallons	
	10,027	ft^3	
Provided Surge Volume Above High Equlization level			
Equalization Area =	12732	ft^2	
	7937	gallons per inch	
Inches above equlization elevation to provide surge equalization=	9.45	inches	

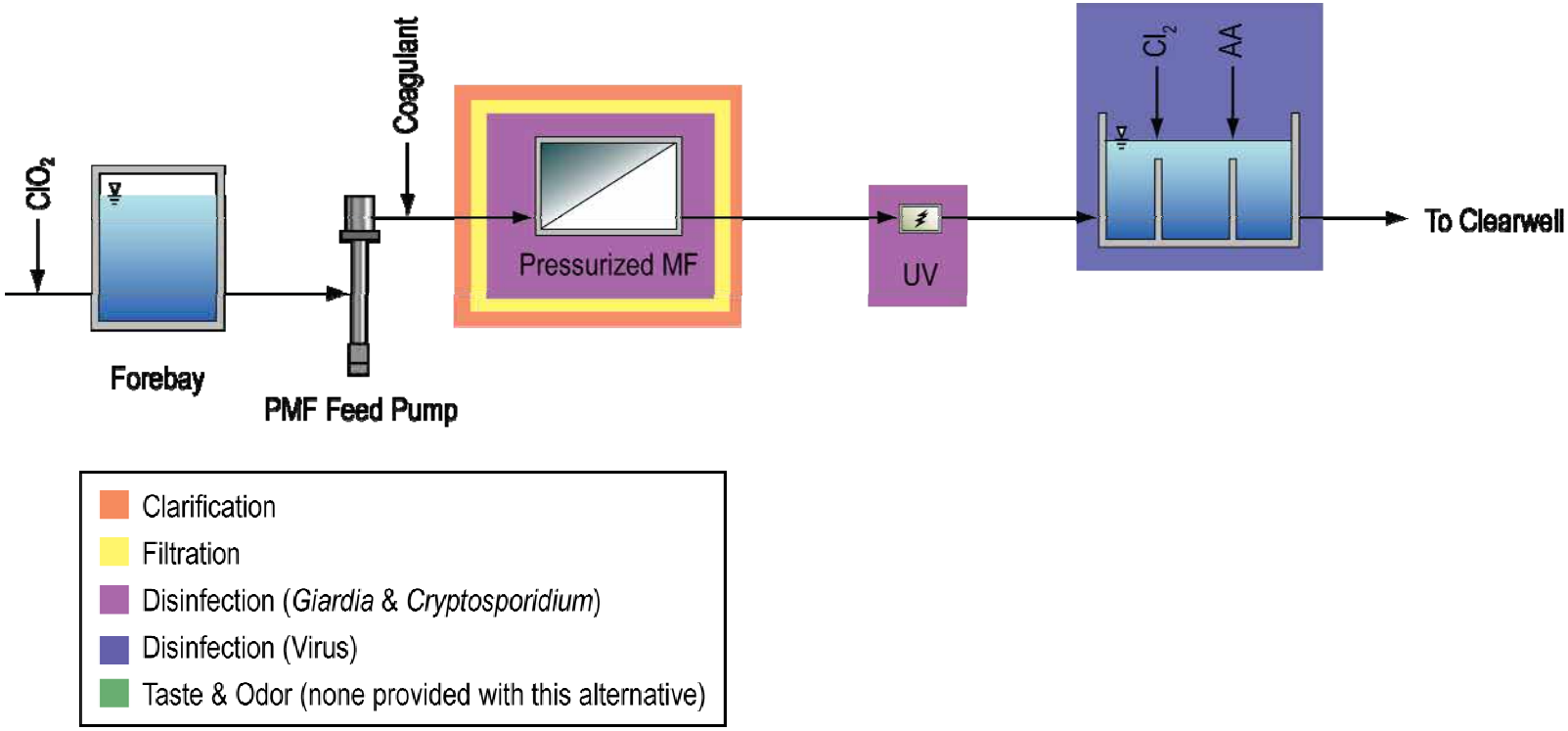
-Therefore, Oulet weir submerged
Overflow to be minimum elevation of 10" above contact zone levation of 632 or minimum 632.83'

TOTAL EQUALIZATION VOLUME	**785,899**	**gallons**
Chlorine Dioxide Contact Chamber	213,270	gallons
Equalization Chamber	497,629	gallons
Surge Volume	75,000	gallons

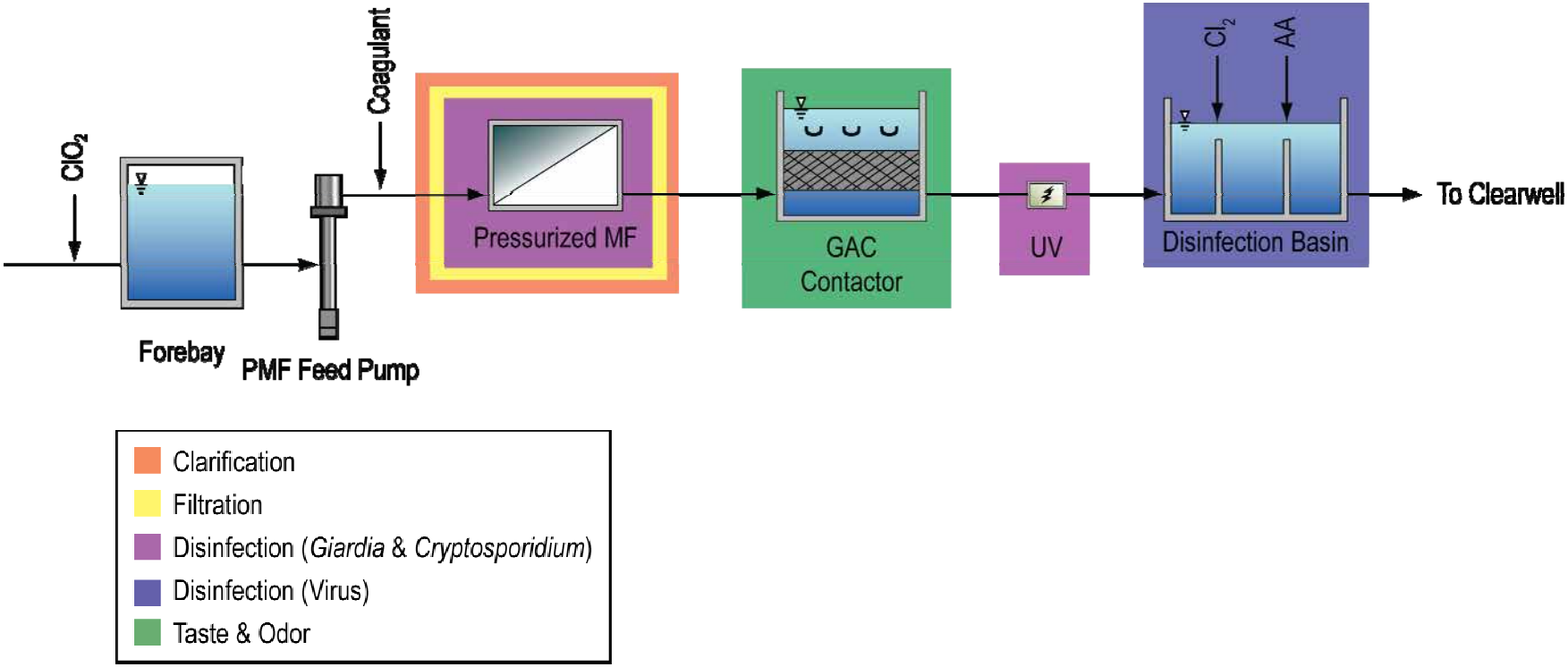
APPENDIX G

Process Schematics

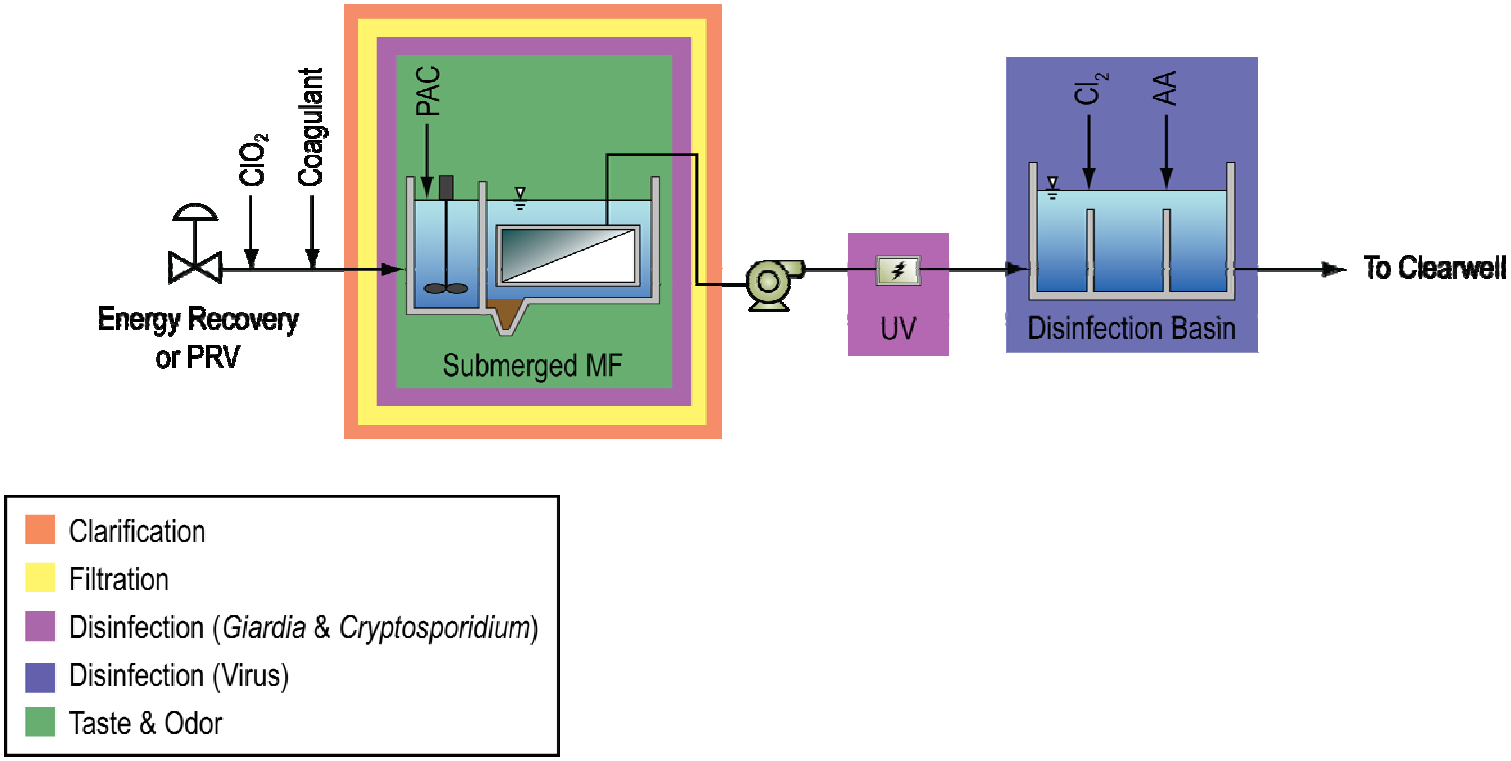
Preoxidation/Membrane Filtration/ UV+Chlorine Disinfection/Chloramination



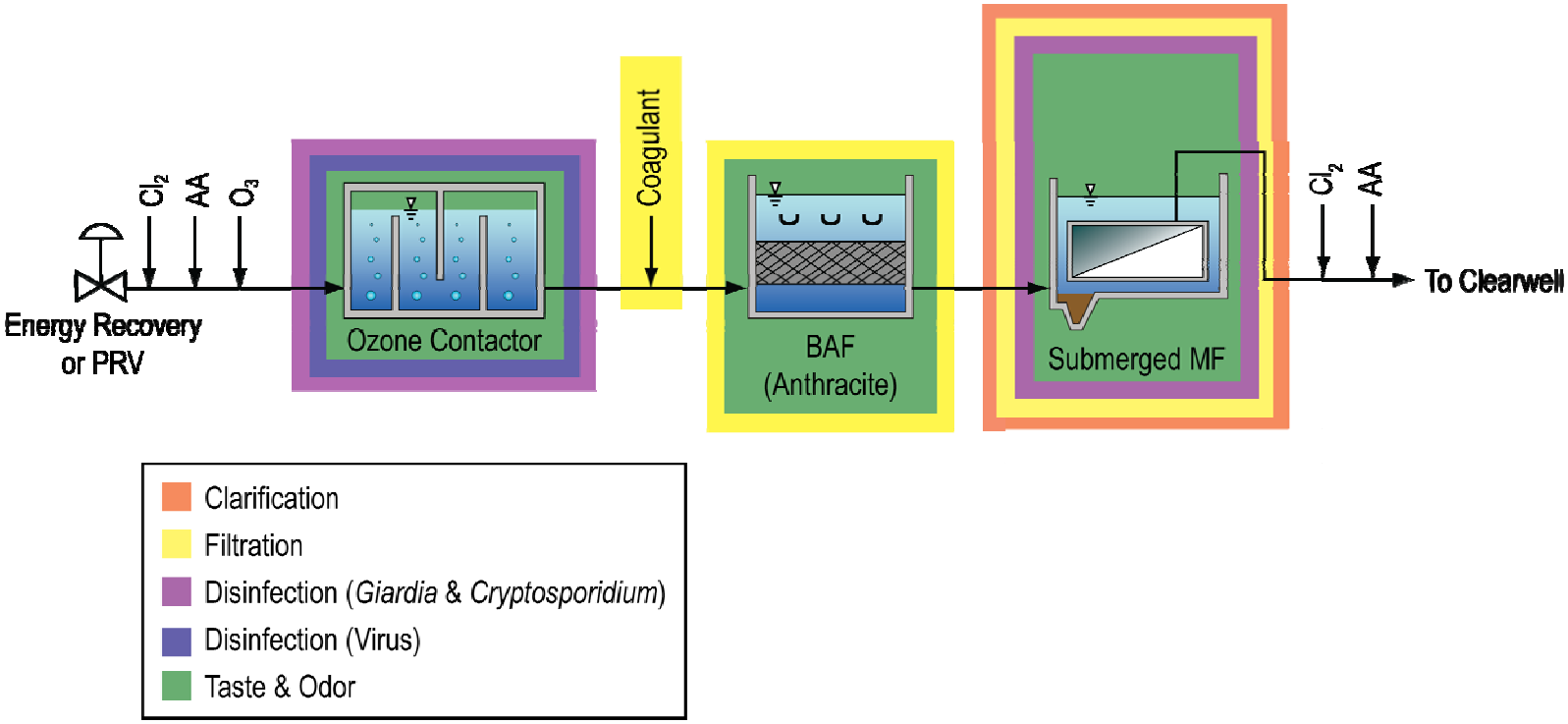
Preoxidation/Membrane Filtration/GAC Contactors/UV/Chlorine Disinfection/Chloramination



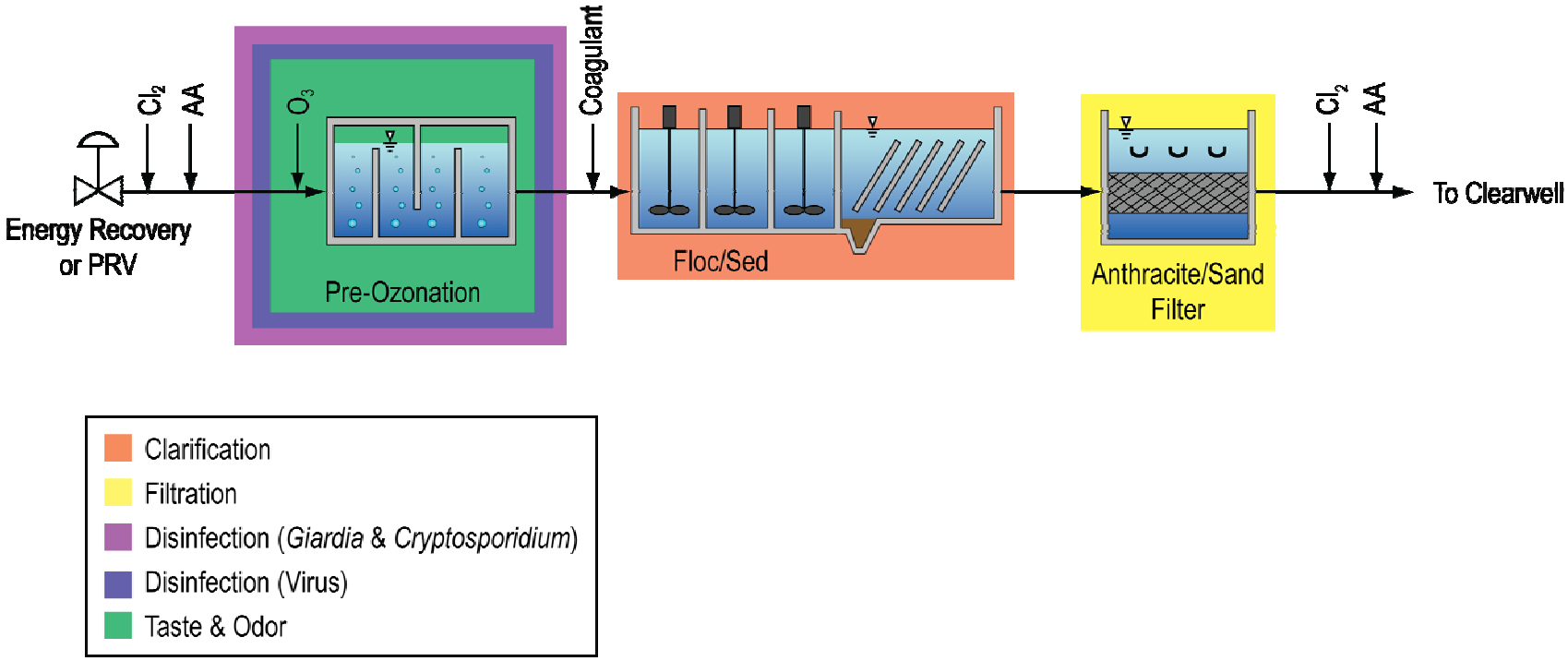
Preoxidation/PAC/Membrane Filtration/ UV/Chlorine Disinfection/Chloramination



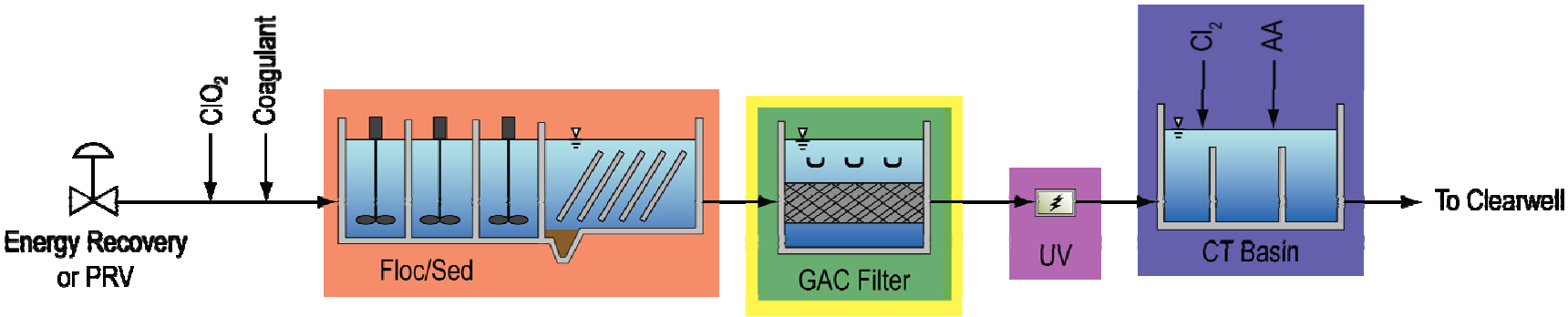
Ozone/BAF/Membrane Filtration/Chloramination



Ozone/Media Filtration/ Chloramination



Preoxidation/GAC Media Filtration/ Chlorine Disinfection/Chloramination



- Clarification
- Filtration
- Disinfection (*Giardia* & *Cryptosporidium*)
- Disinfection (Virus)
- Taste & Odor

APPENDIX H

Chemical System Calculations

Primary Coagulant (PC) SYSTEM CRITERIA
Baker WTP
Irvine Ranch Water District

Description		Units	Min	Avg	Max
Ferric Chloride PROPERTIES					
Concentration	39 %				
Specific Gravity	1.42				
Solution Strength	4.6 lb/gal				
DESIGN CRITERIA					
Process Flow Rate		mgd	14.1	28.1	28.1
Chemical Dosage		mg/l	2.0	10.0	20.0
Chemical Usage		ppd	234	2344	4687
Chemical Feed Rate		gph	2.1	21.2	42.4
Chemical Feed Rate		gpm	0.04	0.35	0.71
Chemical Feed Rate (Pre-Membrane)		gpd	51	508	1017
BULK STORAGE TANKS					
Bulk Storage Tanks		No.		2	
Storage Capacity (each tank)		gal		8,000	
Storage Capacity (total)		gal		16,000	
Storage Time (total)		days	268	31	20
Delivery Truck Full Load		gal		4,000	
Time Between Delivery (average)		days	67	7	5
No. of Truck Deliveries in Storage		#		4	
METERING PUMPS					
Pump Type				Hydraulic Diaphragm	
Pump Model Number, or equal				TBD	
Connection Size		mm		TBD	
Motor Speed Turndown Ratio		ratio		TBD	
Stroke Turndown Ratio		ratio		TBD	
Required Pump Capacity (maximum)		gph		42	
Required Pump Capacity (minimum)		gph		2.1	
Required Minimum Turndown		ratio		20:1	
Process Flow Rate		mgd	14.1	28.1	28.1
Number of Metering Pumps in Service		No.	1	1	1
Chemical Feed Rate (Total)		gph	2	21	42
Metering Pump Capacity (Per Pump)		gph	TBD	TBD	TBD
Pump Speed		%	TBD	TBD	TBD

Notes:
1. Motor speed under PLC control to maintain pH set point. Stroke length manually adjusted, as required, to modify metering pump range.

Primary Coagulant (PC) SYSTEM CRITERIA
Baker WTP
Irvine Ranch Water District

Description		Units	Min	Avg	Max
Ferric Chloride PROPERTIES					
Concentration	39 %				
Specific Gravity	1.42				
Solution Strength	4.6 lb/gal				
DESIGN CRITERIA					
Process Flow Rate		mgd	14.1	28.1	28.1
Chemical Dosage		mg/l	2.0	10.0	20.0
Chemical Usage		ppd	234	2344	4687
Chemical Feed Rate		gph	2.1	21.2	42.4
Chemical Feed Rate		gpm	0.04	0.35	0.71
Chemical Feed Rate (Pre-Membrane)		gpd	51	508	1017
BULK STORAGE TANKS					
Bulk Storage Tanks		No.		2	
Storage Capacity (each tank)		gal		8,000	
Storage Capacity (total)		gal		16,000	
Storage Time (total)		days	268	31	20
Delivery Truck Full Load		gal		4,000	
Time Between Delivery (average)		days	67	7	5
No. of Truck Deliveries in Storage		#		4	
METERING PUMPS					
Pump Type				Hydraulic Diaphragm	
Pump Model Number, or equal				TBD	
Connection Size		mm		TBD	
Motor Speed Turndown Ratio		ratio		TBD	
Stroke Turndown Ratio		ratio		TBD	
Required Pump Capacity (maximum)		gph		42	
Required Pump Capacity (minimum)		gph		2.1	
Required Minimum Turndown		ratio		20:1	
Process Flow Rate		mgd	14.1	28.1	28.1
Number of Metering Pumps in Service		No.	1	1	1
Chemical Feed Rate (Total)		gph	2	21	42
Metering Pump Capacity (Per Pump)		gph	TBD	TBD	TBD
Pump Speed		%	TBD	TBD	TBD

Notes:
1. Motor speed under PLC control to maintain pH set point. Stroke length manually adjusted, as required, to modify metering pump range.

CAUSTIC SODA (CS) SYSTEM CRITERIA FOR
CLEANING SOLUTION MAKEUP AND NEUTRALIZATION
Baker WTP (BASIS - Pall MF)
Irvine Ranch Water District

Description			
CAUSTIC SODA PROPERTIES			
Concentration	25 %		
Specific Gravity	1.27		
Solution Strength	2.6 lb/gal		
For citric neutralization	0.82 lbs NaOH/lb citric acid		
DESIGN CRITERIA (CS/SH CIP AND CEB SOLUTIONS)			
Volume Solution per CEB/CIP		gallons	5000
Chemical Dosage CIP		mg/l	12000
Chemical Dosage CEB		mg/l	0
USAGE FOR CIP CLEANING SOLUTIONS			
Pounds/CIP		lbs.	501
Volume Chemical per CIP		gallons	189
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
USAGE FOR CEB CLEANING SOLUTIONS			
Pounds/CEB		lbs.	0
Volume Chemical per CEB		gallons	0
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
TOTAL USAGE PER RACK			
CIP Frequency		per month	1
CEB Frequency		per month	30
Monthly Usage per Rack		gallons	189
NO. OF RACKS		**ea**	10
TOTAL MONTHLY USAGE FOR MEMBRANE CLEANING		**gallons**	1894
DESIGN CRITERIA (NEUTRALIZATION OF ACID CIP AND CEB SOLUTIONS)			
Volume Solution per CEB/CIP		gallons	5000
Chemical Dosage TO NEUTRALIZE ACID CIP		mg/l	16400
Chemical Dosage TO NEUTRALIZE ACID CEB		mg/l	16400
USAGE FOR NEUTRALIZING CIP ACID CLEANING SOLUTIONS			
Pounds/CIP		lbs.	684
Volume Chemical per CIP		gallons	259
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
USAGE FOR NEUTRALIZING CEB ACID CLEANING SOLUTIONS			
Pounds/CEB		lbs.	684
Volume Chemical per CEB		gallons	259
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
TOTAL USAGE PER RACK			
CIP Frequency		per month	1.00
CEB Frequency		per month	1.00
Monthly Usage per Rack		gallons	518
NO. OF RACKS		**ea**	10
TOTAL MONTHLY USAGE FOR MEMBRANE CLEANING		**gallons**	5177
BULK STORAGE TANKS	SEE "CAUSTIC SODA FOR CORROSION CONTROL"		
TRANSFER PUMPS FOR CIP SOLUTION MAKEUP			
Pump Type			AIR ACTUATED DIAPHRAGM
Pump Model Number, or equal			TBD
Connection Size		inches	TBD
Speed Turndown Ratio		ratio	TBD
Total Turndown Ratio (w/ changing hose)		ratio	TBD
Required Pump Capacity (maximum)		gpm	TBD
Required Pump Capacity (minimum)		gpm	TBD
Total Turndown		ratio	TBD
Number of Transfer Pumps in Service		No.	1
Chemical Feed Rate (Total)		gpm	TBD
Chemical Feed Rate (Per Pump)		gpm	TBD
Pump Speed		%	TBD
TRANSFER PUMPS			
Pump Type			AIR ACTUATED DIAPHRAGM
Pump Model Number, or equal			TBD
Connection Size		inches	TBD
Speed Turndown Ratio		ratio	TBD
Total Turndown Ratio (w/ changing hose)		ratio	TBD
Required Pump Capacity (maximum)		gpm	TBD
Required Pump Capacity (minimum)		gpm	TBD
Total Turndown		ratio	TBD
Number of Transfer Pumps in Service		No.	1
Chemical Feed Rate (Total)		gpm	TBD
Transfer Pump Capacity (Per Pump)		gpm	TBD
Pump Speed		%	TBD

Notes:
1. Transfer pumps will be calibrated on site to deliver required flow and operated at constant speed.

Caustic Soda (CS) SYSTEM CRITERIA for Corrosion Control
Baker WTP
Irvine Ranch Water District

Description		Units	Min	Avg	Max
CAUSTIC SODA PROPERTIES					
Concentration	25 %				
Specific Gravity	1.27				
Solution Strength	2.6 lb/gal				
DESIGN CRITERIA					
Process Flow Rate		mgd	14.1	28.1	28.1
Chemical Dosage		mg/l	1	4	7
Chemical Usage		ppd	117	937	1640
Chemical Feed Rate		gph	1.8	14.8	25.9
Chemical Feed Rate		gpm	0.03	0.25	0.43
Chemical Feed Rate		gpd	44	355	621
Monthly Usage for Corrosion Control		gallons	1330	10638	18617
Membrane Cleaning Monthly Usage		gallons	7071	7071	7071
BULK STORAGE TANKS					
Bulk Storage Tanks		No.		2	
Storage Capacity (each tank)		gal		8,500	
Storage Capacity (total)		gal		17,000	
Storage Time (total incl. membrane cleaning)		days	61	29	20
Delivery Truck Full Load		gal		4,500	
Time Between Delivery (average)		days	16	8	5
				4	
METERING PUMPS (for Corrosion Control)					
Pump Type				Hydraulic Diaphragm	
Pump Model Number, or equal				TBD	
Connection Size		mm		TBD	
Motor Speed Turndown Ratio		ratio		TBD	
Stroke Turndown Ratio		ratio		TBD	
Required Pump Capacity (maximum)		gph		26	
Required Pump Capacity (minimum)		gph		1.8	
Required Minimum Turndown		ratio		14:1	
Process Flow Rate		mgd	14.1	28.1	28.1
Number of Metering Pumps in Service		No.	1	1	1
Chemical Feed Rate (Total)		gph	2	15	26
Metering Pump Capacity (Per Pump)		gph	TBD	TBD	TBD
Pump Speed		%	TBD	TBD	TBD

Notes:
1. Motor speed under PLC control to maintain pH set point. Stroke length manually adjusted, as required, to modify metering pump range.

HYDROCHLORIC ACID (HCL) SYSTEM CRITERIA
Baker WTP (BASIS - Siemens MF)
Irvine Ranch Water District

Description		Units	Avg
CITRIC ACID PROPERTIES			
Concentration	15.0 %		
Specific Gravity	1.07		
Solution Strength	1.34 lb/gal		
DESIGN CRITERIA (Acid CIP)			
Volume Solution per CEB/CIP		gallons	5000
Chemical Dosage for CIP		mg/l	400
Chemical Dosage for CEB		mg/l	400
USAGE FOR CIP			
Pounds/CIP		lbs.	17
Volume Chemical per CIP		gallons	12
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
USAGE FOR CEB			
Pounds/CEB		lbs.	17
Volume Chemical per CEB		gallons	12
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
TOTAL USAGE PER RACK			
CIP Frequency		per month	1
CEB Frequency		per month	1
Monthly Usage per Rack		gallons	25
NO. OF RACKS		**ea**	10
TOTAL MONTHLY USAGE FOR MEMBRANE CLEANING		**gallons**	100
BULK STORAGE TANKS	SEE "CHLORINE DIOXIDE (CDO) THREE CHEMICAL SYSTEM CRITERIA"		
TRANSFER PUMPS			
Pump Type			AIR ACTUATED DIAPHRAGM
Pump Model Number, or equal			TBD
Connection Size		inches	TBD
Speed Turndown Ratio		ratio	TBD
Total Turndown Ratio (w/ changing hose)		ratio	TBD
Pump Capacity (maximum)		gpm	TBD
Pump Capacity (minimum)		gpm	TBD
Total Turndown		ratio	TBD
Number of Metering Pumps in Service		No.	1
Chemical Feed Rate (Total)		gpm	TBD
Chemical Feed Rate (Per Pump)		gpm	TBD
Pump Speed		%	TBD

Notes:
1. Transfer pumps will be calibrated on site to deliver required flow and operated at constant speed.

SODIUM BISULFITE (SBS) SYSTEM CRITERIA
Baker WTP (BASIS - Pall MF)
Irvine Ranch Water District

Description		Units	Plant Capacity 28 mgd
SODIUM BISULFITE PROPERTIES			
Concentration	38 %		
Specific Gravity	1.34		
Solution Strength	4.2 lb/gal		
For SH neutralization	1.47 lbs SBS/lb CL2		
DESIGN CRITERIA (Sodium Hypochlorite CEB/CIP)			
DESIGN CRITERIA (NEUTRALIZATION OF SH EFM/CIP)			
SEE "SODIUM HYPOCHLORITE (SH) MEMBRANE CLEANING SYSTEM CRITERIA" FOR SH CLEANING DOSES			
Volume Solution per CEB/CIP		gallons	5000
Chemical Dosage CIP		mg/l	1470
Chemical Dosage CEB		mg/l	588
USAGE FOR CIP			
Pounds/CIP		lbs.	61.3
Volume Chemical per CIP		gallons	14
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
USAGE FOR CEB			
Pounds/CEB		lbs.	25
Volume Chemical per CEB		gallons	5.8
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
TOTAL USAGE PER RACK			
CIP Frequency		per month	1
CEB Frequency		per month	30
Monthly Usage per Rack		gallons	188
NO. OF RACKS		**ea**	10
TOTAL MONTHLY USAGE FOR MEMBRANE CLEANING		**gallons**	**1881**
BULK STORAGE TANKS			
Storage Tanks		No.	1
Selected Volume per Tank		gal	6,300
Storage Capacity (total)		gal	6,300
Storage Time (total)		days	100
Delivery Truck Full Load		gal	4,200
Time Between Delivery (average)		days	67
No. of Truck Deliveries in Storage		#	1.5
TRANSFER PUMPS			
Pump Type			AIR ACTUATED DIAPHRAGM
Pump Model Number, or equal			TBD
Connection Size		inches	TBD
Speed Turndown Ratio		ratio	TBD
Total Turndown Ratio (w/ changing hose)		ratio	TBD
Required Pump Capacity (maximum)		gpm	TBD
Required Pump Capacity (minimum)		gpm	TBD
Total Turndown		ratio	TBD
Number of Transfer Pumps in Service		No.	1
Chemical Feed Rate (Total)		gpm	TBD
Transfer Pump Capacity (Per Pump)		gpm	TBD
Pump Speed		%	TBD

Notes:
1. Transfer pumps will be calibrated on site to deliver required flow and operated at constant speed.

SODIUM HYPOCHLORITE (SH) MEMBRANE CLEANING SYSTEM CRITERIA
Baker WTP (BASIS - Pall MF)
Irvine Ranch Water District

Description		Units	Avg
SODIUM HYPOCHLORITE PROPERTIES			
Concentration	10.80 % as NaOCl		
Specific Gravity	1.17		
Solution Strength	1.050 lb SH/gal		
Solution Strength	1.000 lb Cl/gal		
DESIGN CRITERIA (SH EFM/CIP)			
Volume Solution per EFM/CIP		gallons	5000
Chemical Dosage CIP		mg/l	1000
Chemical Dosage CEB		mg/l	400
USAGE FOR CIP			
Pounds/CIP		lbs.	41.7
Volume Chemical per CIP		gallons	42
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
USAGE FOR CIP			
Pounds/CEB		lbs.	16.69
Volume Chemical per CEB		gallons	16.7
Time for Chem Transfer		minutes	TBD
Required Minimum Transfer Pump Flowrate		gpm	TBD
TOTAL USAGE PER RACK			
CIP Frequency		per month	1
CEB Frequency		per month	30
Monthly Usage per Rack		gallons	542
NO. OF RACKS		**ea**	**10**
TOTAL MONTHLY USAGE FOR MEMBRANE CLEANING		**gallons**	**5423**
BULK STORAGE TANKS	SEE "SODIUM HYPOCHLORITE (SH) SYSTEM CRITERIA"		
TRANSFER PUMPS			
Pump Type			AIR ACTUATED DIAPHRAGM
Pump Model Number, or equal			TBD
Connection Size		inches	TBD
Speed Turndown Ratio		ratio	TBD
Total Turndown Ratio (w/ changing hose)		ratio	TBD
Required Pump Capacity (maximum)		gpm	TBD
Required Pump Capacity (minimum)		gpm	TBD
Total Turndown		ratio	TBD
Number of Transfer Pumps in Service		No.	1
Chemical Feed Rate (Total)		gpm	TBD
Transfer Pump Capacity (Per Pump)		gpm	TBD
Pump Speed		%	TBD

Notes:
1. Transfer pumps will be calibrated on site to deliver required flow and operated at constant speed.

SODIUM HYPOCHLORITE (SH) DISINFECTION SYSTEM CRITERIA
Baker WTP
Irvine Ranch Water District

Description		Units	Min	Avg	Max
SODIUM HYPOCHLORITE PROPERTIES					
Concentration	10.8 %	as NaOCl			
Specific Gravity	1.17				
Solution Strength	1.050 lb SH/gal				
Solution Strength	1.000 lb Cl/gal				
DESIGN CRITERIA					
Process Flow Rate		mgd	14.1	28.1	28.1
Chemical Dosage for Disinfection (mg/L of Chlorine)		mg/l	2.5	3	4
Chemical Feed Rate		gph	12.2	29.3	39.0
Chemical Feed Rate		gpm	0.20	0.49	0.65
Chemical Feed Rate		ml/min	770	1,847	2,463
Daily Usage		ppd	293	703	937
Monthly Usage for Disinfection		gallons	8,786	21,086	28,115
Monthly Usage for MF Cleaning		gallons	5,423	5,423	5,423
Monthly Usage for ClO2 Generation		gallons	1,024	4,098	5,737
Total Monthly Usage at 28 mgd		**gallons**	**15,233**	**30,607**	**39,275**
BULK STORAGE TANKS					
Bulk Storage Tanks		No.		2	
Storage Capacity (each tank)		gal		8,500	
Storage Capacity (total)		gal		17,000	
Storage Time (total)		days	33	17	13
Delivery Truck Full Load		gal		4,900	
Time Between Delivery (average)		days	10	5	4
No. of Fuill trucks i					
DISINFECTION SYSTEM METERING PUMPS					
Pump Type				Hydraulic Diaphragm	
Pump Model Number, or equal				TBD	
Connection Size		mm		TBD	
Speed Turndown Ratio		ratio		TBD	
Total Turndown Ratio		ratio		TBD	
Required Pump Capacity (maximum)		gph		40	
Required Pump Capacity (minimum)		gph		10	
Required Minimum Turndown		ratio		4:1	
Process Flow Rate		mgd	14.1	28.1	28.1
Number of Metering Pumps in Service		No.	1	1	1
Chemical Feed Rate (Total)		gph	12	29	39
Metering Pump Capacity (Per Pump)		gph	TBD	TBD	TBD
Pump Speed		%	TBD	TBD	TBD

Notes:
1. Motor speed under PLC control to maintain chlorine residual set point. Stroke length manually adjusted, as required, to modify metering pump range.

APPENDIX I

Backwash Wastewater Calculations

Meurer Research, Inc.
6270 Joyce Dr. Golden, CO 80403
Phone 303-279-8373 Fax 303-279-8429

Plate Settler Design Sheet

Project Name: Irvine Ranch Water District

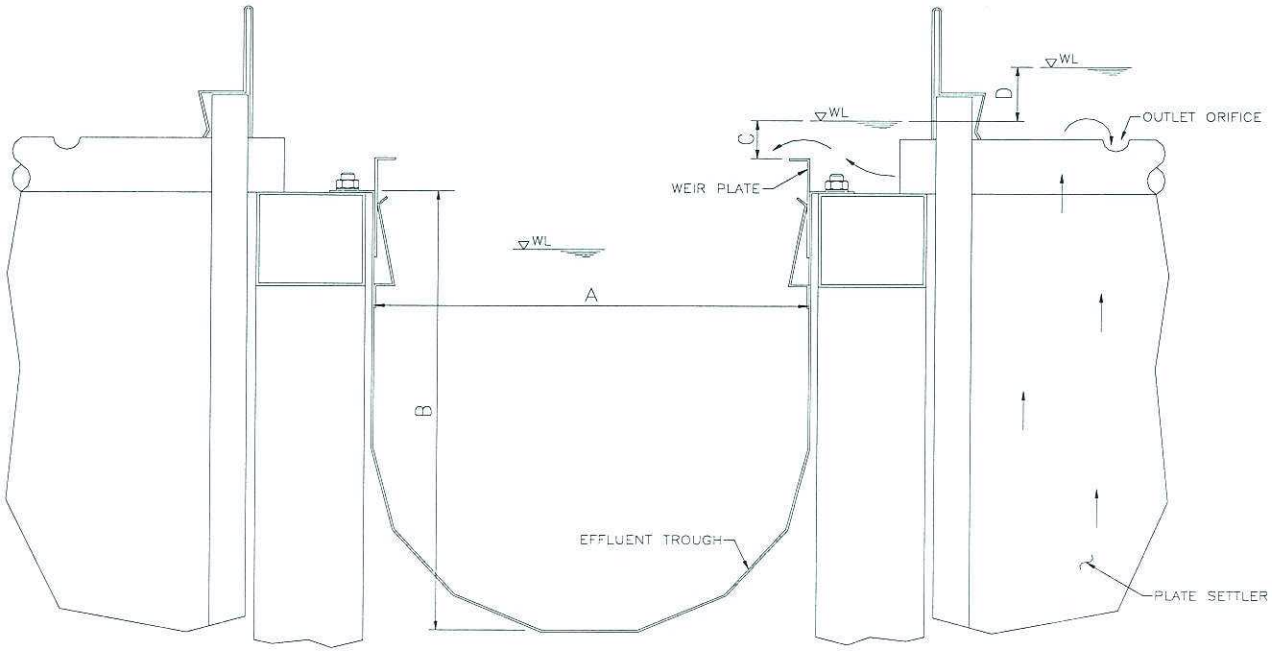
Date: 4/23/2009

Total Design Flow:	3.00 mgd	2084 gpm	Number of Basins:	1
Design Flow per Basin:	3.00 mgd	2084 gpm	Length of Basin:	40 ft
Hydraulic Flow per Basin (max.):	3.00 mgd	2084 gpm	Width of Basin:	20 ft
			Depth of Basin (SWD):	16 ft

Design Loading Rate:	0.4 gpm/ft^2	Effective Settling Area:	5209 ft^2
Efficiency Factor:	90 %	Projected Settling Area:	5788 ft^2
Angle of Plate Inclination:	55 degrees	Actual Settling Area:	10090 ft^2

Width of plate:	4.5	Plate Settler Area:	45.0 ft^2
Length of plate:	10	Total Plates per Basin:	224
No. of Rows per Basin:	3	No. of Plate Cartridges per Row:	1
Flow per Plate:	9.29 gpm	No. of Plate Settlers per Cartridge:	75
Outlet Orifices per Plate:	4	Weight of Cartridge:	4498 lbs
Diameter of Orifices:	3/4 inches	Length of Plate Settler Equipment:	20.0 ft
Head loss through orifices (D):	1.38 inches	Width of Plate Settler Equipment:	18.3 ft

Number of Troughs:	3 (2 + 2 half troughs)	Width of Trough (A):	12 inches
Flow per Trough:	695 gpm	Depth of Trough (B):	12 inches
Trough Capacity:	717 gpm	Head loss over weir (C):	0.77 inches



Floc/Sed

Assumption: Coagulant used in the primary process stream; coagulation here is supplemental

		MAX	AVG	MIN	
Flow	mgd	3.0	1.4	0.3	
Flash mix type:			Pump Diffusion		
Coagulant:		PACl	PACl	PACl	
Dose:	mg/L	20	10	5	
Flocculator Type:		Vertical	Vertical	Vertical	
Flocculation time	min	25	25	25	per Susumu pg. 376
Total Flocculation basin volume	gallons	52080	52080	52080	
No. of Stages	ea	2	2	2	
Flocculation volume each stage	gallons	26040	26040	26040	
	ft3	3481	3481	3481	
L,W,H	ft	15	15	15	
G					
Stage 1		60	60	60	
Stage 2		30	30	30	
Power Stage 1	Hp	0.8	0.8	0.8	
Power Stage 2	Hp	0.2	0.2	0.2	
Total Power	Hp	1.0	1.0	1.0	

APPENDIX J

Ultraviolet Light Disinfection Calculations

Baker Water Treatment Plant
Irvine Ranch Water District

UV System Design Approach

09/03/2009

DESCRIPTION		UV FOR DISINFECTION ONLY		REFERENCE
		LPHO LAMP ALTERNATIVE	MP LAMP ALTERNATIVE	
Approach				
Year 1		Install UV reactors for disinfection only (LPHO lamps, 50 KVA)	Install UV reactors for disinfection only (MP lamps, 230 KVA)	
Unit Costs				
UV Disinfection Equipment		$487,000	$437,000	Vendor Quote
Equipment Installation	33%	$162,333	$145,667	Tracy, CA
Mobilization/Insurance/Management	10%	$64,933	$58,267	
Annual O&M Cost		$15,000	$55,000	UVCAT
Present Worth Analysis (i=4.5%)				
P		$714,267	$640,933	
P/A (30 years)	16.2889	$244,333	$895,889	
TOTAL		$958,600	$1,536,822	

Notes:
1) UV reactor is sized to minimize headloss and maximize head available to the membrane system. Therefore, buiding size and process mechanical are the same for LPHO reactors and MP reactors
2) Annual O&M cost for base loaded WTP at 25 MGD. Water UV transmittance at 85%. 1.5-log Crypto/Giardia inactivation. Power at $0.13/kWhr. Replacement lamps included
3) UVCAT is Carollo Engineers proprietary simulation software

Baker Water Treatment Plant
Irvine Ranch Water District

UV System Design Approach

09/03/2009

DESCRIPTION		UV FOR DISINFECTION INITIALLY. UV/AOP AFTER 10 YEARS		REFERENCE
		LPHO/MP ALTERNATIVE	MP ALTERNATIVE	
Approach				
Year 1		Install UV reactors for disinfection only (LPHO lamps, 50 KVA)	Install UV reactors for UV/AOP. Install UV MP lamps for disinfection only. Install electrical for disinfection only (230 KVA)	
Year 1		Size plant switchboard, treatment building switchboard or MCC, and conductors in between to accommodate future installation and power UV/AOP (900 KVA).		
Year 11		Remove LPHO UV disinfection reactors. Install UV/AOP reactors. Upgrade electrical switchboards	Add MP lamps to UV reactors for UV/AOP. Upgrade electrical switchboards	
Unit Costs				
UV Disinfection Equipment		$487,000	$437,000	Vendor Quote
Installation	33%	$162,333	$145,667	Tracy, CA
Mobilization/Insurance/Management	10%	$64,933	$58,267	
Annual O&M Cost (Years 1 to 10)		$15,000	$55,000	UVCAT
Salvage Value (Year 11)		$0	N.A.	
UV/AOP Equipment (Year 11)		$1,036,000	$599,000	Vendor Quote
Installation (Year 11)	33%	$341,880	$197,670	Tracy, CA
Mobilization/Insurance/Management (Y 11)	10%	$137,788	$79,667	
Annual O&M Cost (Years 11 to 30)		$425,000	$425,000	UVCAT
Present Worth Analysis (i=4.5%)				
P		$714,267	$640,933	
P/A (10 years)	7.9127	$118,691	$435,199	
P/F (11 years)	0.6162	$933,953	$539,998	
P/A (years 11 to 30)	13.0079	$5,528,373	$5,528,373	
TOTAL		$7,295,283	$7,144,504	

Notes:
1) UV reactor is sized to minimize headloss and maximize head available to the membrane system. Therefore, buiding size and process mechanical are the same for LPHO reactors and MP reactors
2) Annual O&M cost for base loaded WTP at 25 MGD. Water UV transmittance at 85%. 1.5-log Crypto/Giardia inactivation (disinfection). 1-log MIB removal (AOP). AOP used 3 months per year. Power at $0.13/kWhr. Replacement lamps included
3) UVCAT is Carollo Engineers proprietary simulation software

APPENDIX K

Contact Basin Disinfection Calculations

BAKER REGIONAL WATER TREATMENT PLANT
4-LOG VIRUS INACTIVATION WITH FREE CHLORINE

	Max	Min.	CT (mg/L*min)					Ratio
	Flow[a]	Temp	Required	Actual				of
Month	(mgd)	(^{o} C)		Pipe 1	Pipe 2	CT	Total	CT_a/CT_r
Jan	35.0	4	9.2	0.0	0.0	9.9	9.9	1.08
Feb	35.0	10	5.9	0.0	0.0	9.9	9.9	1.7
Mar	35.0	10	5.9	0.0	0.0	9.9	9.9	1.7
Apr	35.0	11	5.4	0.0	0.0	9.9	9.9	1.8
May	35.0	11	5.4	0.0	0.0	9.9	9.9	1.8
Jun	35.0	15	3.9	0.0	0.0	9.9	9.9	2.5
Jul	35.0	27	2.2	0.0	0.0	9.9	9.9	4.5
Aug	35.0	25	2.2	0.0	0.0	9.9	9.9	4.6
Sep	35.0	15	3.9	0.0	0.0	9.9	9.9	2.5
Oct	35.0	12	5.0	0.0	0.0	9.9	9.9	2.0
Nov	35.0	10	5.9	0.0	0.0	9.9	9.9	1.7
Dec	35.0	10	5.9	0.0	0.0	9.9	9.9	1.7

Water Quality

pH = 6 - 9
Chlorine Residual (mg/L) = 2.00

CT Volume

Filtrate Pipe from Filtration Building to Basin [Pipe 1]

Dia =	42	inches
Length =	0	feet
Volume =	0	gallons
T_{10}/T =	80%	

FW Pipe from Basin to 16 MGD Reservoir [Pipe 2]

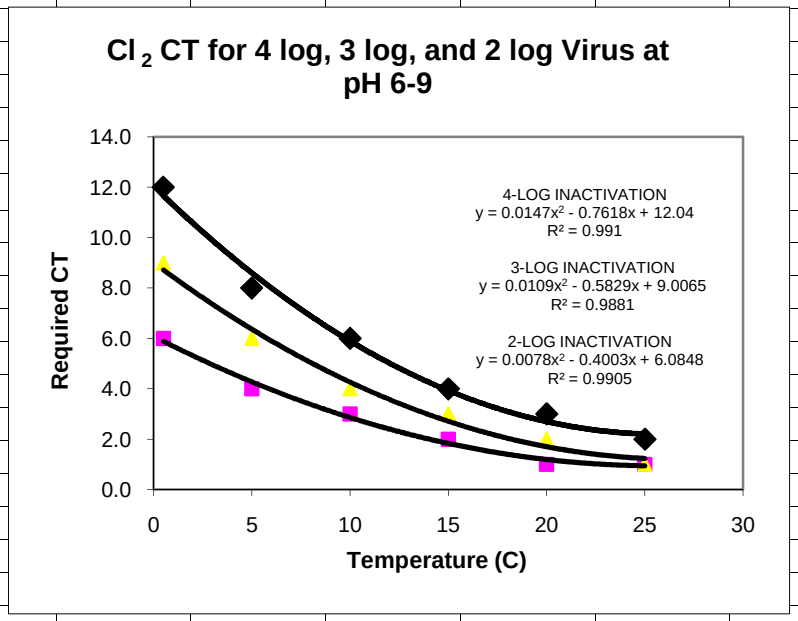
Dia =	42	inches
Length =	0	feet
Volume =	0	gallons
T_{10}/T =	80%	

CT Basin

Channel Width	6.2	ft
Channel Length	208	ft
L/W	34	
Area =	2,559	sq ft
Minimum Depth =	**10.5**	ft
Total Volume =	201,024	gallons
AWWARF T_{10}/T =	**60%**	
Design T_{10}/T =	60%	
Safety Factor =	1.0	

Ref. AWWARF Improving Clearwell Design for CT Compliance; Figure 7.7

CL2 LOG Virus Formula



Source: EPA SWTR Guidance Manual
Table E-7

x	y	y	y
Temp	Required	Required	Required
(^{o} C)	4 -LOG CT	3 -LOG CT	2 -LOG CT
[t]	**[CT]**	**[CT]**	**[CT]**
0.5	12.0	9.0	6.0
5	8.0	6.0	4.0
10	6.0	4.0	3.0
15	4.0	3.0	2.0
20	3.0	2.0	1.0
25	2.0	1.0	1.0

APPENDIX L

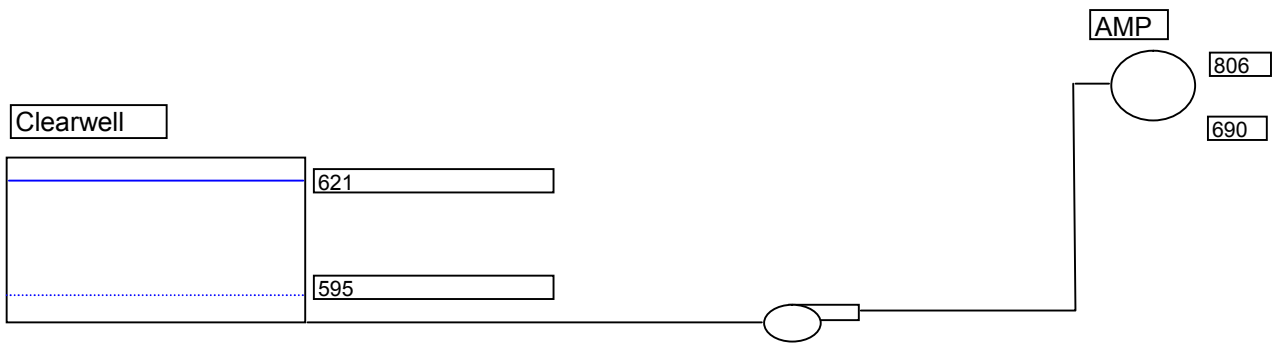
Product Water Pump Station Calculations

JN 10-106232

Baker WTP
Product Water Pump Station
Hydraulic Calculations
TABLE L1 - Static Head Calculation

Static Head Condition				Comment
Clearwell Reservoir Minimum	595	(ft)	(Elev.)	Conservative, Min = 2 ft
Clearwell Reservoir Maximum	621	(ft)	(Elev.)	HWL
Maximum HGL of AMP =	806	(ft)	(Elev.)	
Minimum (Design) HGL of AMP =	690	(ft)	(Elev.)	

Static Head, **Low Head** Condition:	**69**	**(ft)**	AMP = Low HGL 690 to 630 ft handled by
Static Head, **High Head** Condition:	**211**	**(ft)**	pressure reduction.



JN 10-106232

Baker WTP
Product Water Pump Station
Hydraulic Calculations
TABLE L2 - Pump Design Summary

Pump Requirements	Q =	14,800	gpm	=	33.0	cfs
Static Head	Low Static Head =	69	ft			
	High Static Head =	211	ft			
Suction Piping	Suction Losses =	10	ft @ Design Flow			
Discharge Piping	Friction Losses =	5	ft @ Design Flow			
	Minor Losses =	8	ft @ Design Flow			
Total Dynamic Head	TDH =	235	ft @ Design Flow (High Head Condition)			
Pump Efficiency	Efficiency =	82	% (Up to 86% depending on operation point)			
Pump Horsepower	hp =	300	per pump (4 duty - 1 back-up)			
Net Positive Suction Head	NPSHA =	39.5	ft			
	NPSHR [1] =	18.0	ft			

[1] Based on ITT Industries / Goulds Pump Model No. 18HMO.

APPENDIX M

IRWD – Process Equipment & Instrument Tag Guidelines

SEPTEMBER 2009

IRWD

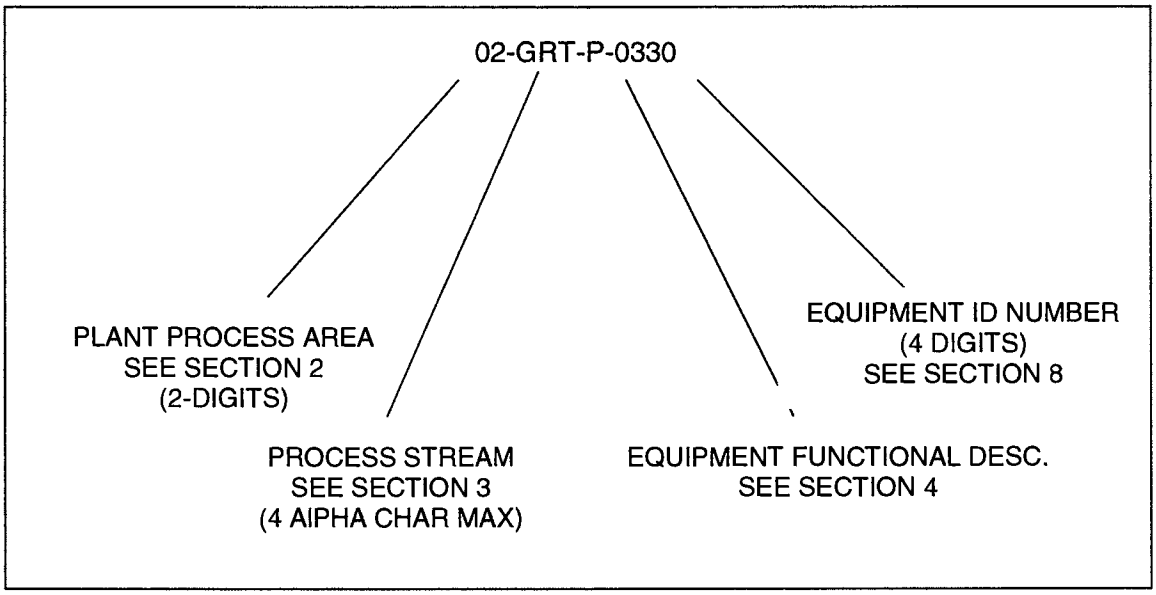
PROCESS EQUIPMENT & INSTRUMENT TAG GUIDELINE

TABLE OF CONTENTS

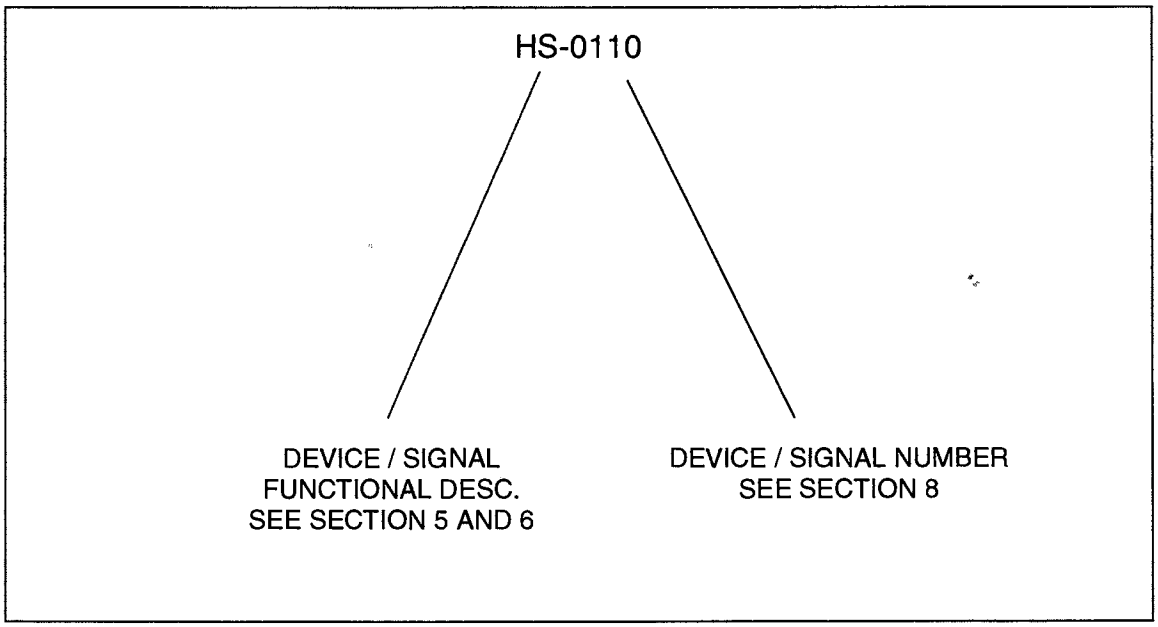
Section Title

1. EQUIPMENT AND INSTRUMENT TAG FORMAT

EQUIPMENT



INSTRUMENTATION DEVICE AND SIGNALS



2. PLANT PROCESS AREAS

(The Plant Process Area does not denote a physical area, it identifies an entire plant process)

AREA NUM	EQUIPMENT DESCRIPTION
00	INFLUENT/RAW/PRETREATMENT
01	
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	
14	
15	ELECTRICAL AND COMMUNICTATIONS
16	OFF-SITE (RTU) COMMUNICATIONS SIGNALS
17	MISCELLANEOUS AREAS
18	
19	

- 1 PROCESS AREA FOR CWEM

3. PLANT PROCESS STREAMS

ABBREVIATION	EQUIPMENT DESCRIPTION
AA	AQUA AMMONIA
BWS	BACKWASH SUPPLY
CA	COMPRESSED AIR
CF	RO CLEANING FEED
CLW	RO CLEANING WASTE
CR	RO CLEANING RETURN
CW	CLARIFIED WATER
D	DRAIN
FPW	FINAL PRODUCT WATER
FW	FILTERED WATER
OF	OVERFLOW
NRW	NON RECLAIMABLE WASTE
PCR	PERMEATE CLEANING RETURN
REC	RO CIP RECIRC
ROC	RO CONCENTRATE
ROF	RO FEED
ROP	RO PERMEATE
RW	RAW WATER
S	SEWER
SA	SULFURIC ACID
SD	STORM DRAIN
SH	SODIUM HYDOXIDE
SHC	SODIUM HYPOCHLORITE
SPD	SUMP PUMPED DRAIN
TI	THRESHOLD INHIBITOR
WT	POTABLE WATER
WBW	WASTE BACKWASH

4. EQUIPMENT FUNCTIONAL DESCRIPTIONS

ABBREVIATION	EQUIPMENT DESCRIPTION
AC	AIR CONDITIONING PACKAGE UNIT
AHU	AIR HANDLER
ATS	AUTOMATIC TRANSFER SWITCH
AV	AIR VAC
BAT	BATTERY BANK
BCH	BATTERY CHARGER
BCP	BRANCH CIRCUIT PANEL
BFV	BUTTERFLY VALVE
BKR	BREAKER (POWER)
BLV	BALANCING VALVE
BOL	BOILER
BPV	BACK PRESSURE VALVE
BSR	BARSCREEN, RAKE
BV	BALL VALVE
BWR	BLOWER
CEN	CENTRIFUGE
CF	CARTRIDGE FILTER
CHL	CHLORINATOR
CHR	CHILLER
CLF	CLARIFIER
CLR	COLLECTOR, SLUDGE OR SCUM
CMP	COMPRESSOR
CND	CONDENSOR
CON	CONTROLLER, MOTOR, ELECTRONIC
CRN	CRANE
CT	CURRENT TRANSFORMER
CTW	COOLING TOWER
CUB	CUBICLE
CV	CHECK VALVE
CVY	CONVEYOR
DG	DEGASSIFIER
DLN	DRIVE LINE
DP	DISTRIBUTION PANEL 480V OR 240V
DPR	RELAY, MACHINE DIFFERENTIAL
DRY	DRYER
EF	EXHAUST FAN
ELV	ELEVATOR
ENG	ENGINE
EVP	EVAPORATOR
EW	EYE WASH (SAFETY SHOWER)

ABBREVIATION	EQUIPMENT DESCRIPTION
EXR	EXCHANGER
F	FAN
FBK	FEEDER BREAKER
FIX	FIXTURE, LIGHTING
FLA	FLAME ARRESTOR
FLR	FLARE
FLT	FILTER
FLV	FLAPPER VALVE
FP	FEED PUMP
FRM	FRAME
FRQ	RELAY, FREQUENCY
FRX	FIRE EXTINGUISHER
GAT	GATE
GBK	GENERATOR BREAKER
GBX	GEARBOX
GDR	GRINDER
GEN	GENERATOR
GEX	GENERATOR EXCITER
GLV	GLOBE VALVE
GOP	GATE OPERATOR
GV	GATE VALVE
HTR	HEATER
IOC	RELAY, INSTANTANEOUS OVERCURRENT
IRC	IRRIGATION CONTROLLER
ITC	RELAY, INST/TIME OVERCURRENT
LER	RELAY, LOSS OF EXCITATION
LP	LIGHTING PANEL/LOW VOLTAGE PANEL
M	MECHANICAL EQUIPMENT
MBK	MAIN BREAKER
MCC	MOTOR CONTROL CENTER
MDRV	MAGNETIC DRIVE
MOV	MOTORIZED VALVE OPERATOR
MP	METERING PUMP
MS	MOTOR STARTER
MSB	MAIN SWITCH BOARD
MTG	METERING SECTION
MTR	MOTOR
MXR	MIXER
NSO	RELAY, NEGATIVE SEQUENCE OVERCURRENT
NV	NEEDLE VALVE
OPS	OPERATOR
CP	PANEL (CONTROL, FIELD)
P	PUMP
PD	PULSATION DAMPENER

ABBREVIATION	EQUIPMENT DESCRIPTION
PIPE	PIPING
PIV	PINCH VALVE
PM	POWER MONITOR
PRD	PRESSURE REDUCING VALVE
PRG	PRESSURE REGULATING VALVE
PRV	PRESSURE RELIEF VALVE
PRVB	PRESSURE RELIEF/VACUUM BREAKER
PTEQ	PORTABLE EQUIPMENT
PTS	POTENTIAL TRANSFORMER
PUR	PURIFIER
PV	PLUG VALVE
PVD	RELAY, DIFFERENTIAL VOLTAGE
PWR	RELAY, PILOT WIRE DIFFERENTIAL
PWS	RELAY, PILOT WIRE SENDING
REF	REFRIGERATOR, STORAGE
REG	REGULATOR
RLY	RELAY
RPD	REDUCED PRINCIPLE DEVICE
RPR	RELAY, POWER DIFFERENTIAL
SBD	RELAY, STATIC DIFFERENTIAL
SBK	STANDBY POWER BREAKER
SBR	SCRUBBER
SCPR	SERVICE CONNECTION PRESSURE REGULATOR
SF	SUPPLY FAN
SFR	RELAY, STATIC FREQUENCY
SOF	SOFTENER
SPR	SEPARATOR
STR	STRAINER
STRC	STRUCTURE
SV	SOLENOID VALVE
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SWI	SWITCH
SWP	SWEEP ARM ASSEMBLY
SYN	RELAY, SYNC CHECK
TBC	TURBOCHARGER
TBK	TIE BREAKER
TCV	TROTTLE CONTROL VALVE
TK	TANK
TOC	RELAY, TIME OVERCURRENT
TOU	RELAY, TIME OVER/UNDER VOLTAGE
TRP	TRAP
TSV	TELESCOPING VALVE
TUR	TURBINE
TUV	RELAY, TIME VOLTAGE

ABBREVIATION	EQUIPMENT DESCRIPTION
TWR	TOWER (SURGE)
UPS	UNINTERRUPTABLE POWER SUPPLY
UVS	RELAY, UNDER VOLTAGE AND PHASE SEQUENCE
VB	VACUUM BREAKER (WATER)
VBR	RELAY, VOLTAGE BALANCE
VDC	DOUBLE CHECK VALVE (FIRE SYSTEM)
VEHL	VEHICLE
VFD	VARIABLE FREQUENCY DRIVE
VKG	KNIFE GATE VALVE
VNTV	VENT VALVE
VRD	RELAY, RESTRAINED DIRECTIONAL OVERCURRENT
XFMR	TRANSFORMER

5. DEVICE / SIGNAL FUNCTIONAL DESCRIPTION

Following is a table of abbreviations for signal functional identification. The table is a comprehensive list of many types of signals and devices.

Following the comprehensive table section in Section 6 is a list of commonly used abbreviations. These are shown in the sample P & IDs that are also provided in this document.

	Controllers				Readout Devices		Switches and Alarm Devices										Transmitter								
Initiating or Measured Variable	Recording	Indicating	Blind	Self Actuated Control Valves	Recording	Indicating	Alarm High	Alarm High/High	Switch High	Switch High/High	Alarm Low	Alarm Low/Low	Switch Low	Switch Low/Low	Alarm Comb	Switch Comb	Recording	Indicating	Blind	Solenoids, Relays,	Primary Elements	Test Point	Well or Probe	Viewing Device or Glass	Safety Device
Analysis	ARC	AIC	AC		AR	AI	AAH	AAHH	ASH	ASHH	AAL	AALL	ASL	ASLL	AAHL	ASHL	ART	AIT	AT	AY	AE	AP	AW		
Burner/ Combustion	BRC	BIC	BC		BR	BI	BAH	BAHH	BSH	BSHH	BAL	BALL	BSL	BSLL	BAHL	BSHL	BRT	BIT	BT	BY	BE		BW	BG	
Density	DRC	DIC	DC	DCV	DR	DI	DAH	DAHH	DSH	DSHH	DAL	DALL	DSL	DSLL	DAHL	DSHL	DRT	DIT	DT	DY	DE	DP			
Voltage	ERC	EIC	EC		ER	EI	EAH	EAHH	ESH	ESHH	EAL	EALL	ESL	ESLL	EAHL	ESHL	ERT	EIT	ET	EY	EE				
Flow Rate	FRC	FIC	FC	FCV, FICV	FR	FI	FAH	FAHH	FSH	FSHH	FAL	FALL	FSL	FSLL	FAHL	FSHL	FRT	FIT	FT	FY	FE	FP		FG	
Flow Quantity	FQRC	FQIC			FQR	FQI	FQAH	FQAH	FQSH	FQSH	FQAL	FQAL	FQSL	FQSL	FQHL			FQIT	FQT	FQY	FQE				
Flow Ratio	FFRC	FFIC	FFC		FFR	FFI	FFAH	FFAH	FFSH	FFSH	FFAL	FFAL	FFSL	FFSL	FFHL										
Hand		HIC	HC						HSH	HSH			HSL	HSLL											
Current	IRC	IIC			IR	II	IAH	IAHH	ISH	ISHH	IAL	IALL	ISL	ISLL	IAHL	ISHL	IRT	IIT	IT	IY	IE				
Power	JRC	JIC			JR	JI	JAH	JAHH	JSH	JSHH	JAL	JALL	JSL	JSLL	JAHL	JSHL	JRT	JIT	JT	JY	JE				
Time	KRC	KIC	KC	KCV	KR	KI	KAH	KAHH	KSH	KSHH	KAL	KALL	KSL	KSLL	KAHL	KSHL	KRT	KIT	KT	KY	KE				
Level	LRC	LIC	LC	LCV	LR	LI	LAH	LAHH	LSH	LSHH	LAL	LAL	LSL	LSL	LAHL	LSHL	LRT	LIT	LT	LY	LE		LW	LG	
Moisture	MRC	MIC	MC		MR	MI	MAH	MAHH	MSH	MSHH	MAL	MALL	MSL	MSLL	MAHL	MSHL	MRT	MIT	MT	MY	ME	MP	MW		
Pressure	PRC	PIC	PC	PCV	PR	PI	PAH	PAHH	PSH	PSHH	PAL	PALL	PSL	PSLL	PAHL	PSHL	PRT	PIT	PT	PY	PE	PP			PSV, PSE
Pressure Differential	PDRC	PDIC	PDC	PDCV	PDR	PDI	PDAH	PDAH	PDSH	PDSH	PDAL	PDAL	PDSL	PDSL			PDRT	PDIT	PDT	PDY	PE	PP			
Quantity	QRC	QIC			QR	QI	QAH	QAHH	QSH	QSHH	QAL	QALL	QSL	QSLL	QAHL	QSHL	QRT	QIT	QT	QY	QE				
Radiation	RRC	RIC	RC		RR	RI	RAH	RAHH	RSH	RSHH	RAL	RALL	RSL	RSLL	RAHL	RSHL	RRT	RIT	RT	RY	RE		RW		
Speed	SRC	SIC	SC	SCV	SR	SI	SAH	SAHH	SSH	SSHH	SAL	SALL	SSL	SSLL	SAHL	SSHL	SRT	SIT	ST	SY	SE				
Temperature	TRC	TIC	TC	TCV	TR	TI	TAH	TAHH	TSH	TSHH	TAL	TALL	TSL	TSLL	TAHL	TSHL	TRT	TIT	TT	TY	TE	TP	TW		TSE

	Controllers				Readout Devices		Switches and Alarm Devices										Transmitter								
Initiating or Measured Variable	Recording	Indicating	Blind	Self Actuated Control Valves	Recording	Indicating	Alarm High	Alarm High/High	Switch High	Switch High/High	Alarm Low	Alarm Low/Low	Switch Low	Switch Low/Low	Alarm Comb	Switch Comb	Recording	Indicating	Blind	Solenoids, Relays,	Primary Elements	Test Point	Well or Probe	Viewing Device or Glass	Safety Device
Temperature Differential	TDRC	TDIC	TDC	TDCV	TDR	TDI	TDAH	TDAH	TDSH	TDSH	TDAL	TDAL	TDSL	TDSL			TDRT	TDIT	TDT	TDY	TE	TP	TW		
PLC/MMI																				UY					
Vibration/Machinery Analysis	VRC	VIC	VC		VR	VI	VAH	VAHH	VSH	VSHH	VAL	VALL	VSL	VSLL	VAHL	VSHL	VRT	VIT	VT	VY	VE				
Weight/Force	WRC	WIC	WC		WR	WI	WAH	WAHH	WSH	WSHH	WAL	WALL	WSL	WSLL	WAHL	WSHL	WRT	WIT	WT	WY	WE				
Weight/Force Differential	WDRC	WDIC	WDC		WDR	WDI	WDAH	WDAH	WDSH	WDSH	WDAL	WDAL	WDSL	WDSL			WDRT	WDIT	WDT	WDY	WE				
Event/State/ Presence	YRC	YIC	YC		YR	YI	YAH	YAHH	YSH	YSHH	YAL	YAL	YSL	YSL	YAHL	YSHL			YT	YY	YE				
Posistion/Dimension	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZAH	ZAHH	ZSH	ZSHH	ZAL	ZAL	ZSL	ZSL	ZAHL	ZSHL	ZRT	ZIT	ZT	ZY	ZE				
Gauging/Deviation	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDAH	ZDAH	ZDSH	ZDSH	ZDAL	ZDAL	ZDSL	ZDSL			ZDRT	ZDIT	ZDT	ZDY	ZDE				

6. COMMONLY USED DEVICE AND SIGNAL FUNCTIONAL IDENTIFICATION

Following is a table of abbreviations for signal functional identification. The table is a comprehensive list of many types of signals and devices.

Following the comprehensive table section in Section 6 is a list of commonly used abbreviations. These are shown in the sample P & IDs that are also provided in this document.

TAG	DESCRIPTION
	DISCRETE DEVICES:
HI	SELECTOR SWITCH STATUS (REMOTE-LOACL)
HK	OUTPUT TO EQUIPMENT (e.g. PUMP CALL, VALVE OPEN/CLOSE COMMAND)
HS	HAND SWITCH – FIELD DEVICE
YI	STATUS INDICATION (MOTOR RUN STATUS)
YN	DATA LINK (MODBUS, MODBUS PLUS)
ZI	POSITION FEEDBACK SIGNAL
ASH	ANALYZER VALUE - HIGH
ASL	ANALYZER VALUE - LOW
FSH	FLOW HIGH SWITCH
FSL	FLOW LOW SWITCH
HKC	OUTPUT TO A VALVE TO CLOSE
HKO	OUTPUT TO A VALVE TO OPEN
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
ZSC	CLOSED POSITION SWITCH
ZSO	OPEN POSITION SWITCH
UA	DEVICE FAIL (MOTOR OVERLOAD, COMMON FAIL OR ALARM)
YI	RUNNING STATUS (MOTOR)
	ALARMS:
LA	LEVEL ALARM
PA	PRESSURE ALARM
TA	TEMPERATURE ALARM
EA	POWER FAIL ALARM
UA	EQUIPMENT FAIL OR ALARM
LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW

TAG	DESCRIPTION
	CONTROL SIGNALS:
SC	SPEED CONTRL (ANALOG SIGNAL TO VFD)
FC	FLOW CONTROL (ANALOG SIGNAL TO FCV)
ZC	POSITION CONTROL (ANALOG SIGNAL TO VALVE)
FSP	FLOW SETPOINT
RSP	REMOTE SETPOINT
	INSTRUMENTATION:
FI	FLOW RATE INDICATING TRANSMITTER (ANALOG SIGNAL)
PI	PRESSURE (ANALOG SIGNAL)
SI	SPEED (ANALOG SIGNAL)
ZI	POSITION (ANALOG SIGNAL)
AE	ANALYTICAL INSTRUMENTATION DEVICE
	SOFTWARE CALCULATED VALUES:
FQI	FLOW TOTAL
KQI	MOTOR RUN TIME TOTAL
KQR	MOTOR NUMBER OF STARTS
	DATA NETWORK CONNECTIONS:
YN	DATA LINK (MODBUS, MODBUS PLUS, ETHERNET, SERIAL DATA)
	SWITCH DEVICES
HA	HAND-AUTO
HOA	HAND-OFF-AUTO
HSC	HAND SWITCH COMPUTER
LOR	LOCAL-OFF-REMOTE
OAC	OPEN-AUTO-CLOSE
OO	ON-OFF
OOA	ON-OFF-AUTO
OOR	ON-OFF-REMOTE
OSC	OPEN-STOP-CLOSE
OSCA	OPEN-STOP-CLOSE-AUTO
	OTHER DEVICES/EQUIPMENT
PLC	PROGRAMMABLE LOGIC CONTROLLER
RTU	REMOTE TERMINAL UNIT
SCS	SUPERVISORY CONTROL STATION
TSP	TWISTED SHIELDED PAIR
TTR	TONE TELEMETRY RECEIVER
TTT	TONE TELEMETRY TRANSMITTER

7. STANDARD DEVICE AND SIGNAL PLC I/O IDENTIFICATION

Following is a table of abbreviations for typical signal identification for the PLC I/O for typical equipment.

The I/O shown in the table matches the typical equipment schematics and PLC programming templates for the equipment.

PUMP (CONSTANT SPEED)			
	HI-001	DI	Station Pump 1 In Remote
	YI-001	DI	Station Pump 1 Run Status
	UA-001	DI	Station Pump 1 Fail
	HI-001A	DI	Station Pump 1 TOU Key Switch Status
	YI-001A	DI	Station Pump 1 TOU Relay Status
	PAHL-001	DI	Station Pump 1 Hi/Lo Disch. Pressure Alarm
	PAL-001	DI	Station Pump 1 Low Suction Pressure Alarm
	UA-001A	DI	Station Pump 1 Alarm
	HK-001	DO	Station Pump 1 Run Command
	HK-001A	DO	Station Pump 1 TOU Lockout Command
PUMP (VARIABLE SPEED)			
	HI-001	DI	Station Pump 1 In Remote
	YI-001	DI	Station Pump 1 Run Status
	UA-001	DI	Station Pump 1 Fail
	HI-001A	DI	Station Pump 1 TOU Key Switch Status
	YI-001A	DI	Station Pump 1 TOU Relay Status
	PAHL-001	DI	Station Pump 1 Hi/Lo Disch. Pressure Alarm
	PAL-001	DI	Station Pump 1 Low Suction Pressure Alarm
	UA-001A	DI	Station Pump 1 Alarm
	HK-001	DO	Station Pump 1 Run Command
	HK-001A	DO	Station Pump 1 TOU Lockout Command
	SI-001	AI	Station Pump 1 Speed
	SC-001	AO	Station Pump 1 Speed Command
VALVE (OPEN/CLOSED)			
	HI-001	DI	Valve In Remote
	ZSO-110	DI	Valve Open Position
	ZSC-110	DI	Valve Closed Position
	HKO-110	DO	Valve Open Command
	HKC-110	DO	Valve Closed Command

VALVE (MODULATING)			
	HI-110	DI	Valve In Remote
	ZI-110	AI	Valve Position
	FC-110	AO	Valve Position Command (flow control)
other control	LC-110	AO	Valve Position Command (level control)
commands:	PC-110	AO	Valve Position Command (pressure control)
	ZC-110	AO	Valve Position Command (position control)
PRESSURE REDUCING VALVE VAULT			
	ZSC-10	DI	Zone x-y PRV Large Valve Closed Position
	ZSC-20	DI	Zone x-y PRV Small Valve Closed Position
	PT-20	AI	Zone x-y PRV Upstream Pressure
	PT-10	AI	Zone x-y PRV Downstream Pressure
SURGE TANK			
	LSHH-209	DI	Suction Surge Tank Level High Alarm
	LSLL-209	DI	Suction Surge Tank Level Low Alarm
	UA-209	DI	Suction Surge Tank Control Panel Alarm
AIR COMPRESSOR			
	YI-303	DI	Air Compressor Run Status
	PSLL-301	DI	Compressed Air Low Pressure
UNINTERRUPTIBLE POWER SUPPLY			
LOOP - 08	EA-725	DI	UPS System Fail
	YI-725	DI	UPS System On Batteries
STATION POWER			
LOOP - 09	EA-731	DI	Station Power Phase Loss
MCC POWER LOSS			
LOOP - 09	EA-731	DI	Station Power Phase Loss
INTRUSION DETECTION			
LOOP - 10	ZSC-712	DI	Station Intrusion Door Status -
	HI-713	DI	Station Intrusion Override Switch -

8. PANEL IDENTIFICATION

TAG	DESCRIPTION
CP	CONTROL PANEL
LCP	LOCAL CONTROL PANEL
FOP	FIBER OPTIC PANEL
MCP	MASTER CONTROL PANEL (MWRP)
TDB	TUBE DISTRIBUTION BOX

Use numbering for panels which correspond to the general plant process area location of the equipment.

Example:

9. MCC IDENTIFICATION

Use numbering for MCC which correspond to the general plant process area location of the equipment.

Example:

10. MANHOLE AND PULL BOX IDENTIFICATION

TAG	DESCRIPTION
MH	MANHOLE
PB	PULL BOX
JB	JUNCTION BOX

Use numbering for manholes and boxes which correspond to the to the general plant process area location of the equipment.

Example:

11. EQUIPMENT, DEVICE & INSTRUMENT NUMBER

1 Process Plants:

Typically use 4 digits for process plant:

- MWRP
- LAWRP
- DATS
- PTP
- Baker Plant

Refer to P & ID sheets attached for examples of process plant equipment numbering sequences.

2 Water Distribution and Collections Facilities:

Typically use 3 digits for water distribution, collections, and similar facilities:

A. Booster Pump Station:

001-004	Typically used for pumps in the station (pump 1, 2, 3, 4 – not 101, 102 or 100, 200, etc.)
100-199	Low pressure (suction/downstream) side of the station
200-299	High pressure (discharge/upstream) side of the station
300-399	Process equipment not directly in the main process (air compressor for example)
700-799	Facility equipment (power, doors, lighting, UPS)

B. Reservoir:

10	Inlet valve equipment
20	Outlet valve equipment
100-199	Reservoir process (level transmitter, level floats, overflow float, etc.)

700-799 Facility equipment (hatches, power, etc.)

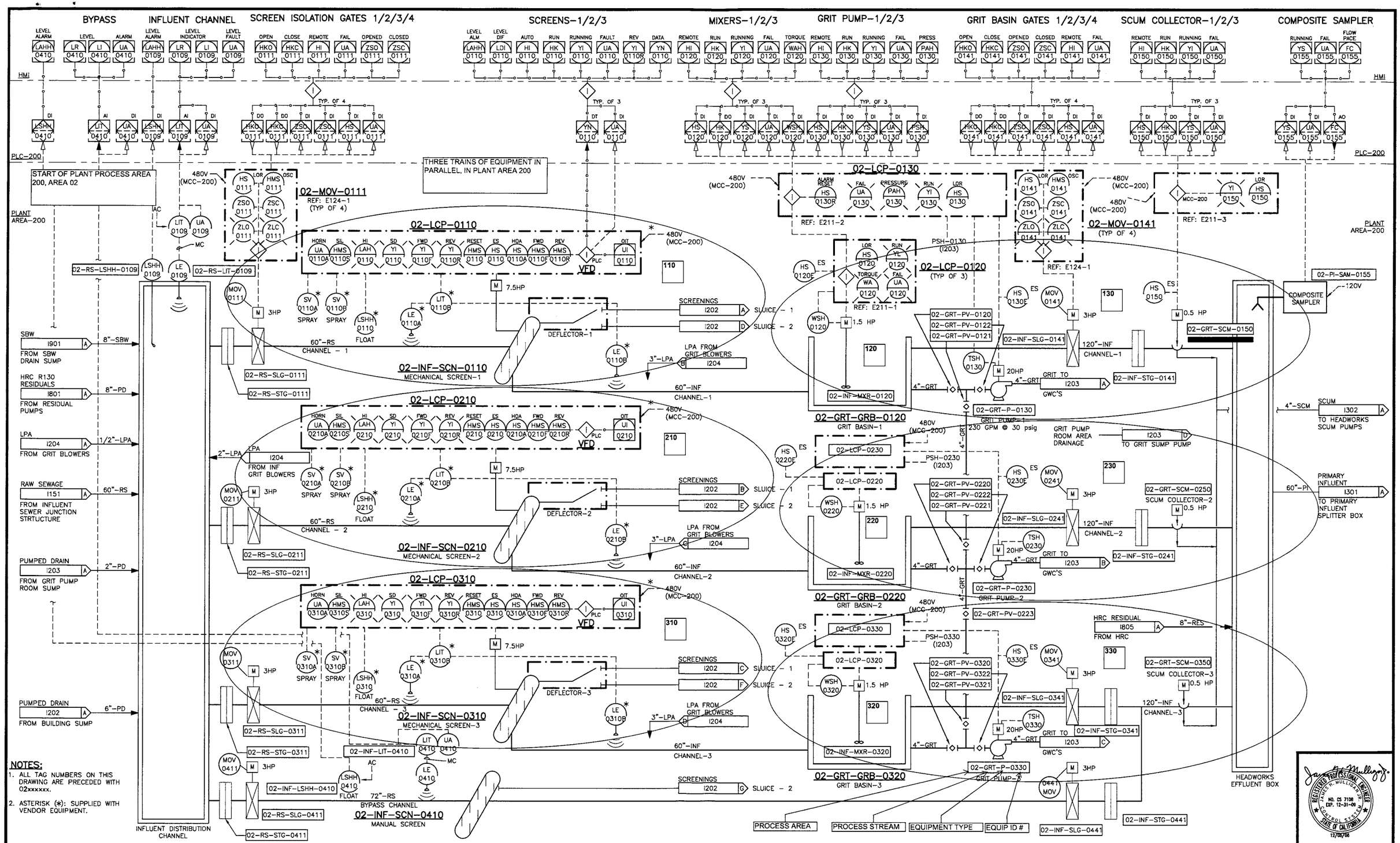
C. PRV:

10-19 Small Valve or downstream process

20-29 Large Valve equipment of upstream process

3 P & ID PROCESS AND EQUIPMENT NUMBERING EXAMPLES

(SEE ATTACHED P&ID SHEETS)



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STEVEN L. MALLOY — IRWD PRINCIPAL ENGINEER RCE 31926 — DATE 12/17/08

IRVINE RANCH WATER DISTRICT

IRVINE RANCH WATER DISTRICT
MWRP PHASE 2 EXPANSION
PROJECT NUMBERS 20214 & 30214

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
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P&ID HEADWORKS
SCREENS AND GRIT BASINS

DRAWING 1201
SHEET 569 OF 628

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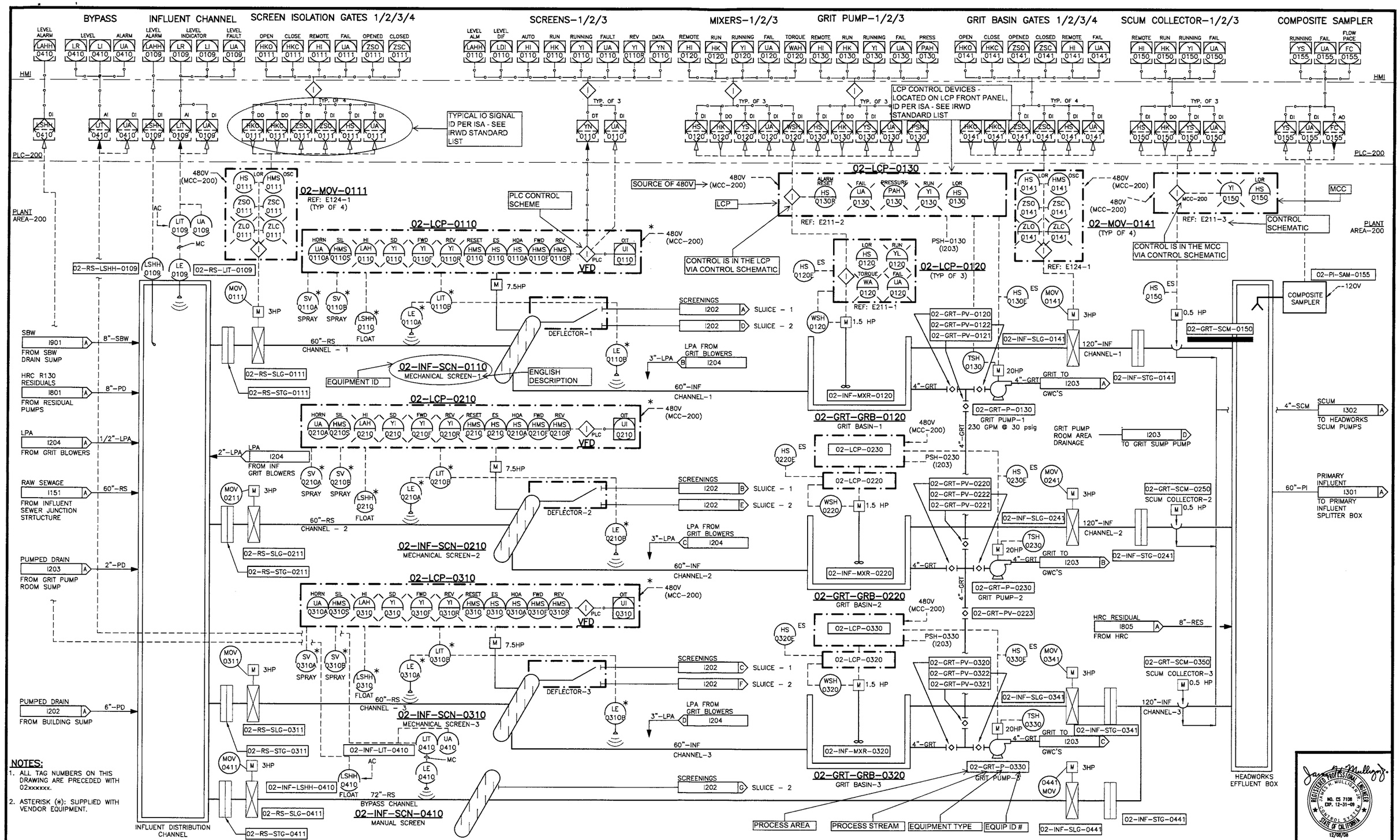

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IRVINE RANCH WATER DISTRICT

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P&ID HEADWORKS
SCREENS AND GRIT BASINS

DRAWING 1201
SHEET 569 OF 628

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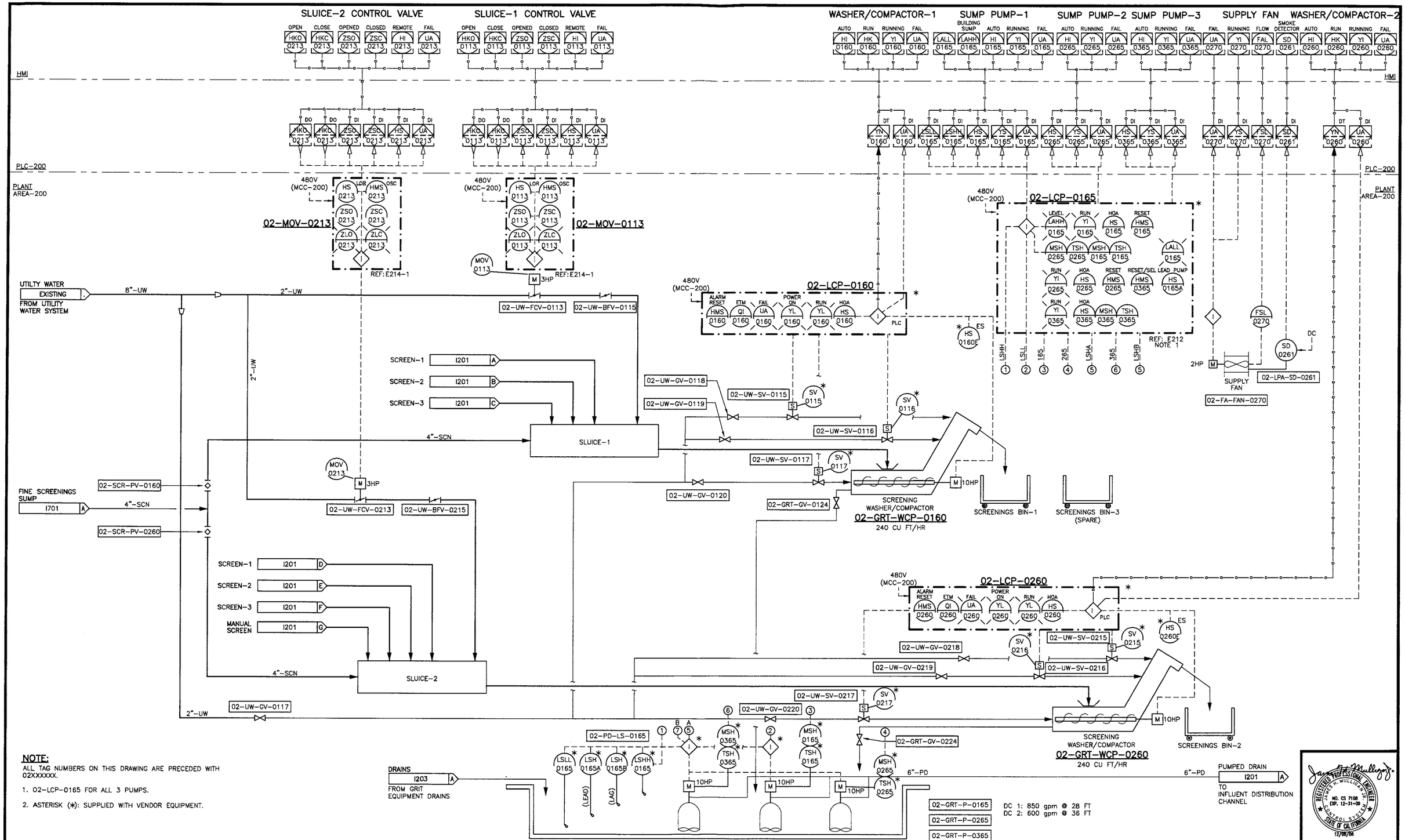

NOTE:

ALL TAG NUMBERS ON THIS DRAWING ARE PRECEDED WITH 02XXXXXX.

1. 02-LCP-0165 FOR ALL 3 PUMPS.
2. ASTERISK (*): SUPPLIED WITH VENDOR EQUIPMENT.

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IRVINE RANCH WATER DISTRICT

IRVINE RANCH WATER DISTRICT MWRP PHASE 2 EXPANSION

PROJECT NUMBERS 20214 & 30214

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P&ID HEADWORKS SCREENINGS PROCESSING

DRAWING 1202
SHEET 570 OF 628

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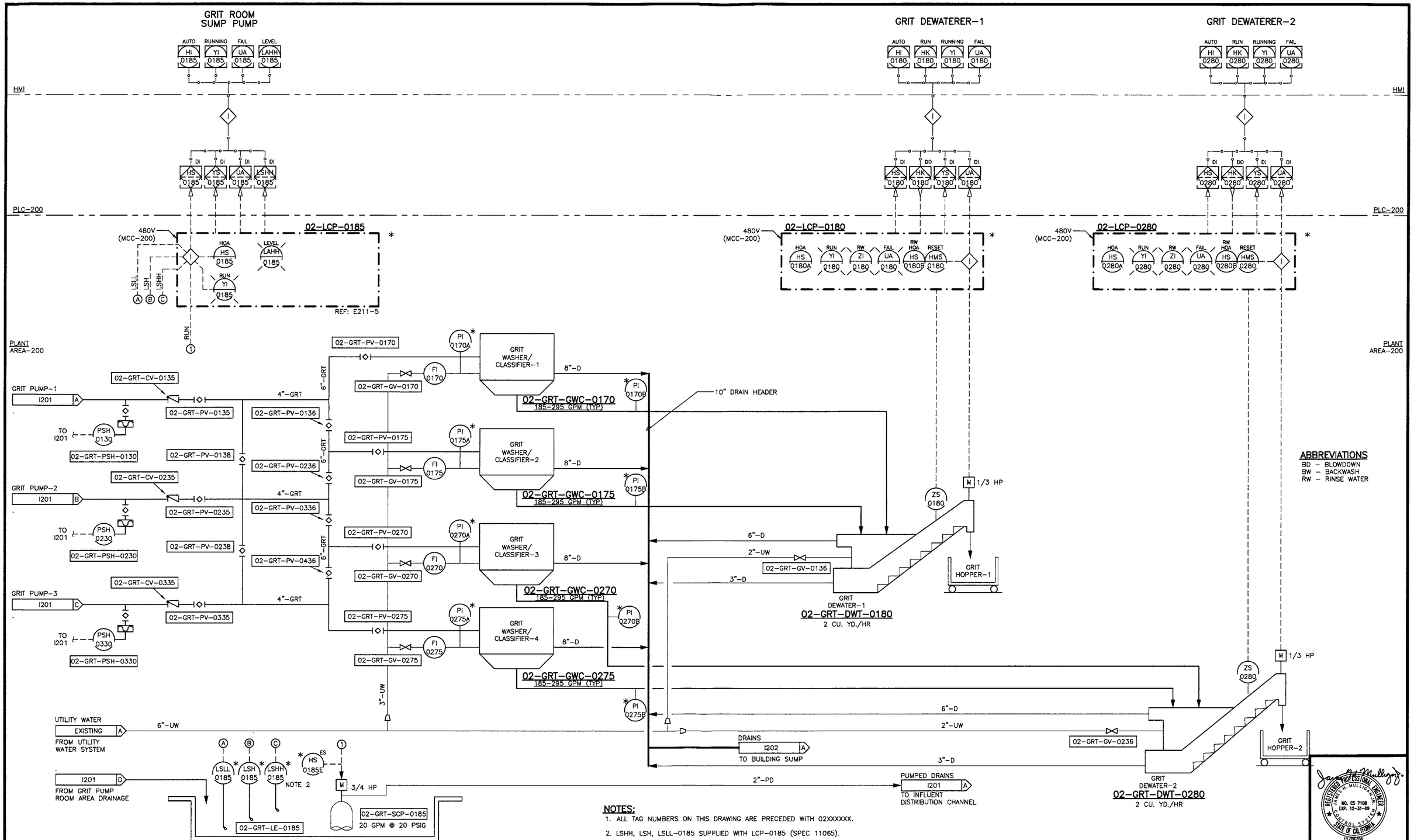

NOTES:

1. ALL TAG NUMBERS ON THIS DRAWING ARE PRECEDED WITH 02XXXXXX.
2. LSHH, LSH, LSLL-0185 SUPPLIED WITH LCP-0185 (SPEC 11065).
3. ASTERISK (*): SUPPLIED WITH VENDOR EQUIPMENT.

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IRVINE RANCH WATER DISTRICT

IRVINE RANCH WATER DISTRICT
MWRP PHASE 2 EXPANSION
PROJECT NUMBERS 20214 & 30214

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P&ID HEADWORKS
GRIT PROCESSING

DRAWING 1203
SHEET 571 OF 628

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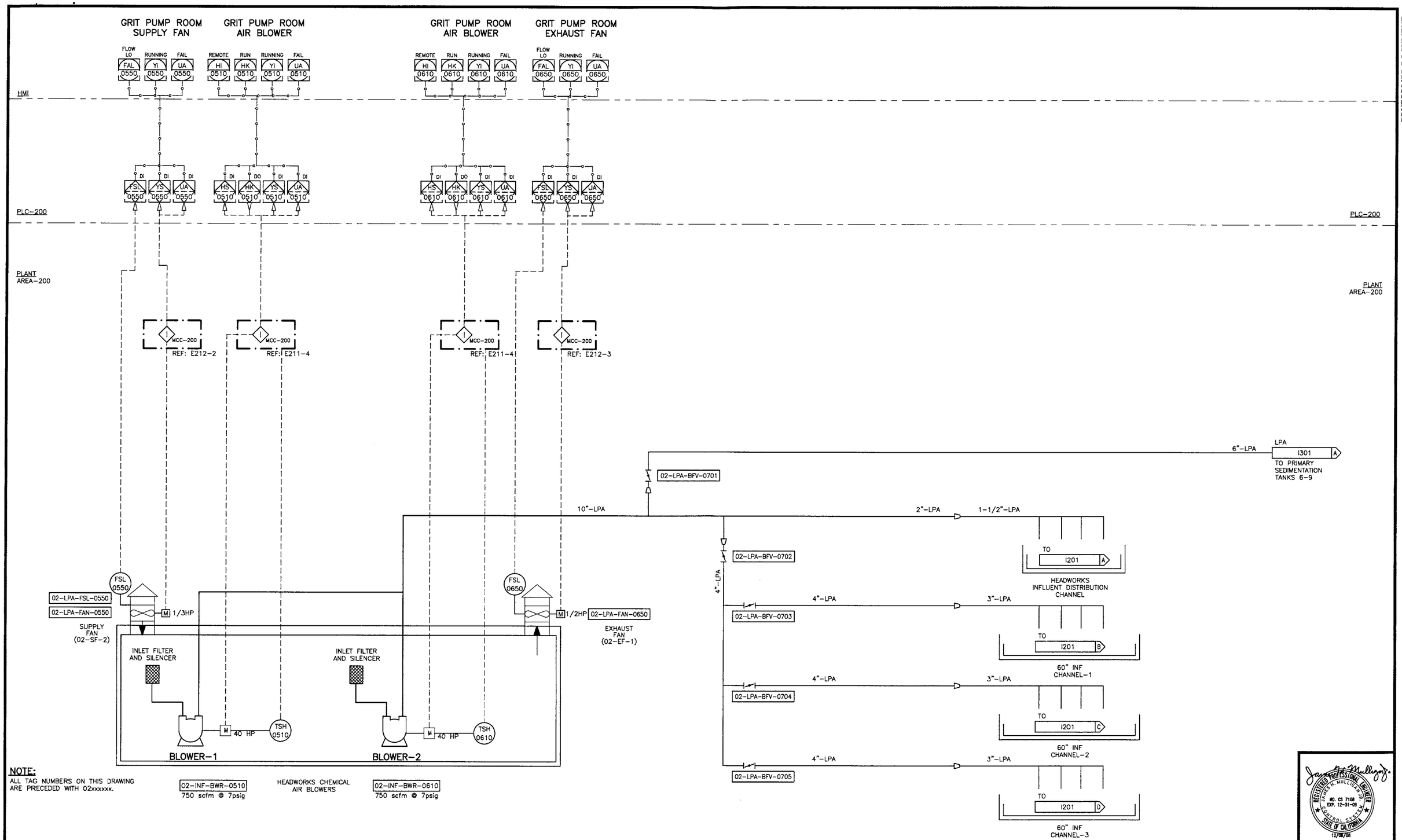

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IRVINE RANCH WATER DISTRICT

IRVINE RANCH WATER DISTRICT
MWRP PHASE 2 EXPANSION
PROJECT NUMBERS 20214 & 30214

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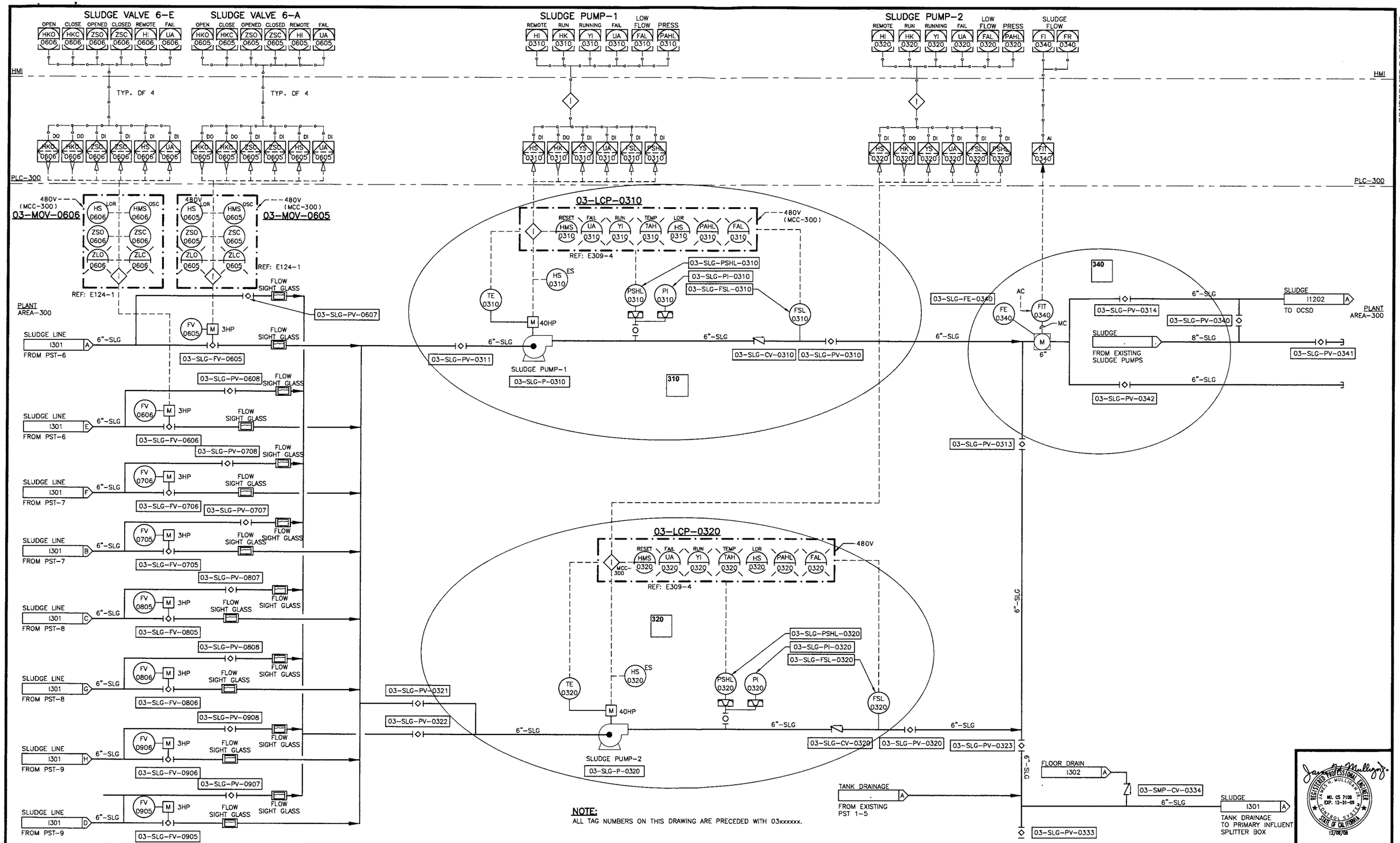
P&ID HEADWORKS
SCREENS AND GRITS
LOW PRESSURE AIR SYSTEM

DRAWING 1204
SHEET 572 OF 628



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IRVINE RANCH WATER DISTRICT

IRVINE RANCH WATER DISTRICT
MWRP PHASE 2 EXPANSION
PROJECT NUMBERS 20214 & 30214

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P&ID PRIMARY SEDIMENTATION TANKS
PRIMARY SLUDGE PUMPS

DRAWING 1303
SHEET 575 OF 628

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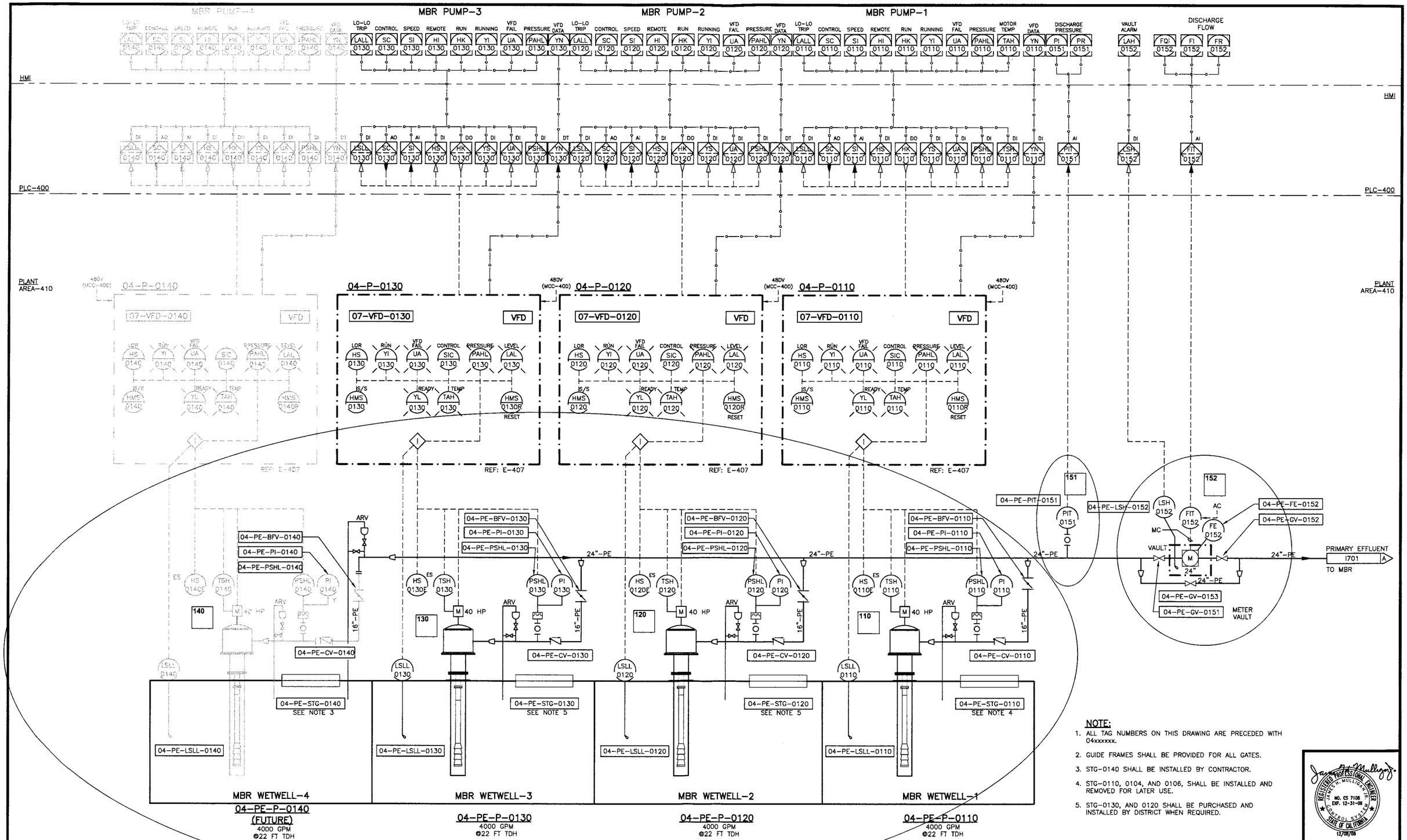

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1. ALL TAG NUMBERS ON THIS DRAWING ARE PRECEDED WITH 04xxxxxx.
2. GUIDE FRAMES SHALL BE PROVIDED FOR ALL GATES.
3. STG-0140 SHALL BE INSTALLED BY CONTRACTOR.
4. STG-0110, 0104, AND 0106, SHALL BE INSTALLED AND REMOVED FOR LATER USE.
5. STG-0130, AND 0120 SHALL BE PURCHASED AND INSTALLED BY DISTRICT WHEN REQUIRED.

REGISTERED PROFESSIONAL ENGINEER JAMES R. MULLIGAN, JR. NO. CS 7108 EXP. 12-31-08 CONTROL SYSTEMS STATE OF CALIFORNIA 12/08/08

No.	DATE	REVISIONS	APP'D
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IRVINE RANCH WATER DISTRICT

IRVINE RANCH WATER DISTRICT
MWRP PHASE 2 EXPANSION
PROJECT NUMBERS 20214 & 30214

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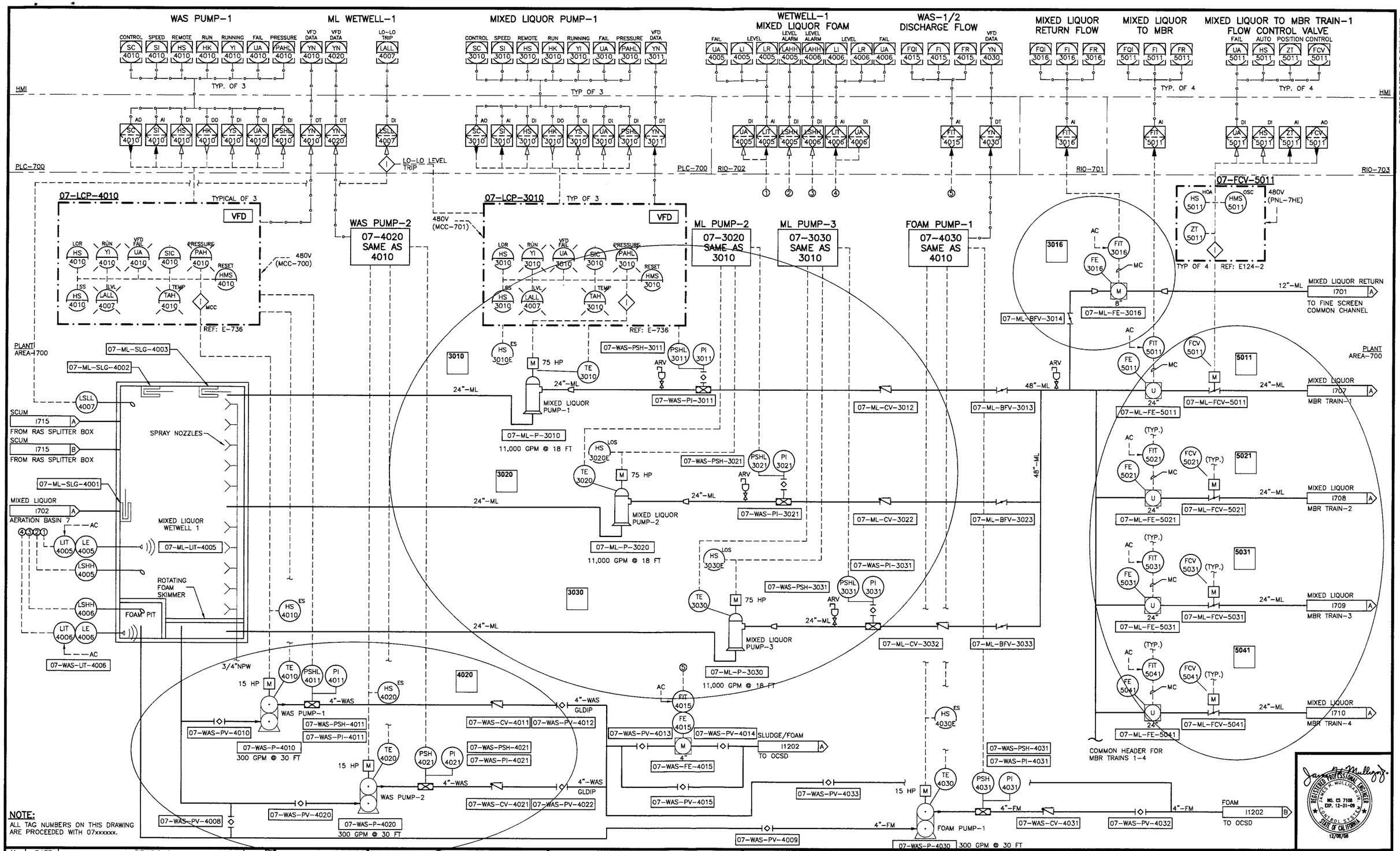
P&ID PEPS-1
MEMBRANE BIOREACTOR FEED

DRAWING 1402
SHEET 577 OF 628



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IRVINE RANCH WATER DISTRICT

IRVINE RANCH WATER DISTRICT
MWRP PHASE 2 EXPANSION
PROJECT NUMBERS 20214 & 30214

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P&ID MEMBRANE BIOREACTOR
MIXED LIQUOR PUMPS 1-3

DRAWING 1704
SHEET 584 OF 628

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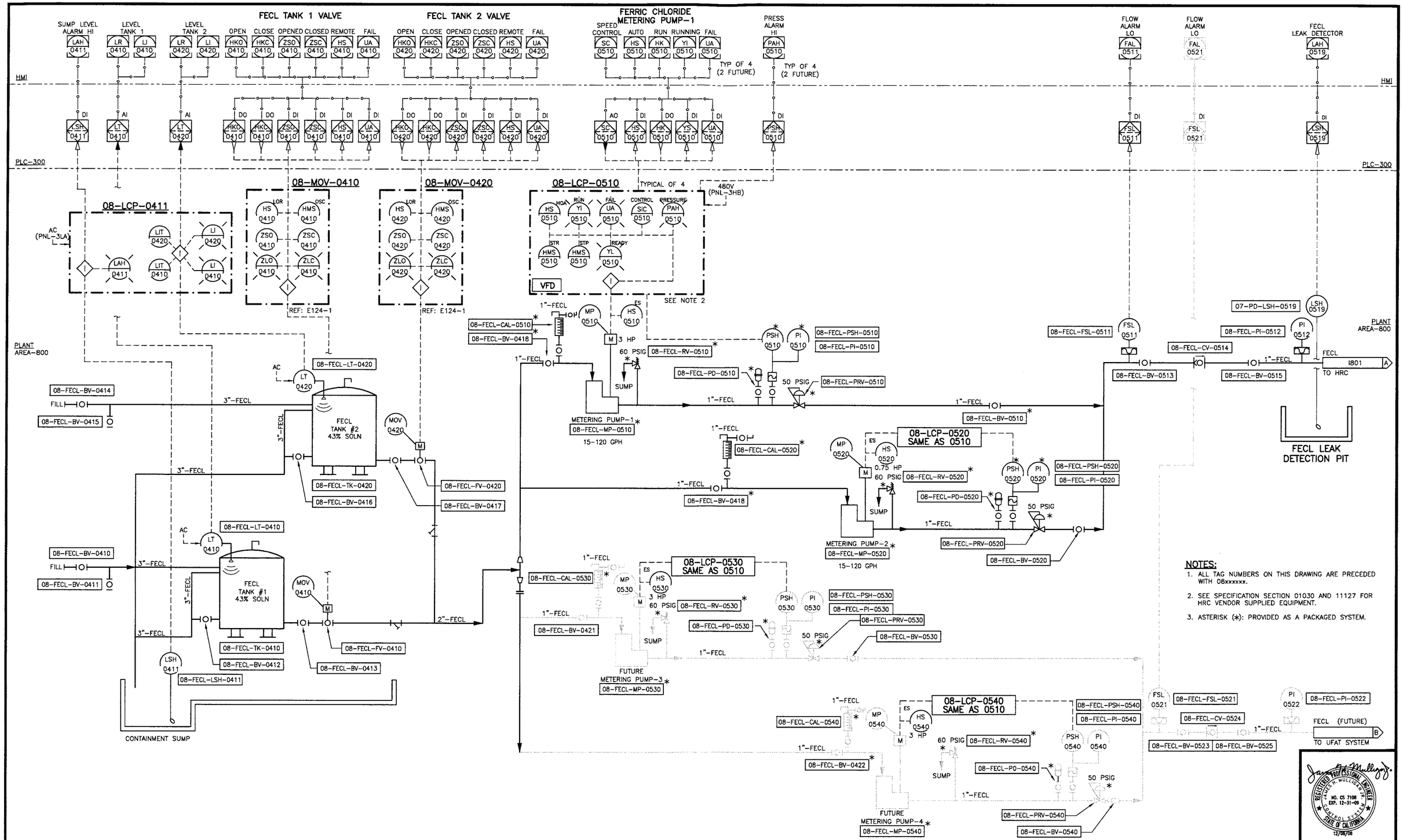

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IRVINE RANCH WATER DISTRICT

IRVINE RANCH WATER DISTRICT
MWRP PHASE 2 EXPANSION
PROJECT NUMBERS 20214 & 30214

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P&ID HIGH RATE CLARIFIER
FECL SYSTEM

DRAWING 1804
SHEET 611 OF 628

APPENDIX Q

Economic Evaluation Calculations

TABLE Q1
BAKER WATER TREATMENT PLANT
DRAFT PRELIMINARY DESIGN REPORT
ESTIMATE OF CAPITAL COSTS

Item No.	Item Description	Quantity	Unit	Unit Price[1]	Total Price [1]
	Baker Water Treatment Plant Equipment and Buildings				
1	***Membrane Filtration/ UV System***				***$15,527,000***
1.1	Pressurized Membrane Building	21,000	SF	$160	$3,360,000
1.2	PMF Equipment [10]	30,161,000	GAL	$0.34	$10,255,000
1.3	UV System	27,791,000	GAL	$0.04	$1,112,000
1.4	Process Mechanical	1	LS	$800,000	$800,000
2	***Washwater Equalization and Treatment***				***$1,960,000***
2.1	Membrane Filtration Washwater Equalization	55,000	GAL	$3	$165,000
2.2	Membrane Filtration Washwater Transfer Pumps	60	HP	$3,000	$180,000
2.3	Washwater Treatment	5,000,000	GAL	$0.20	$1,000,000
2.4	Recycle Pump Station	55,000	GAL	$3	$165,000
2.5	Recycle Pumps	150	HP	$3,000	$450,000
3	***Chemical Building / Chlorine Dioxide System***				***$4,724,000***
3.1	Mechanical / Building / Site Work	27,791,000	GAL	$0.14	$3,891,000
3.2	Chlorine Dioxide Chemical / Mechanical Equipment	1	LS	$750,000	$750,000
3.3	Flash Mix Equipment	1	LS	$82,500	$82,500
4	***Contact Basin***				***$860,000***
4.1	Contact Basin	215,000	GAL	$4	$860,000
5	***Electrical and Instrumentation***				***$3,721,000***
5.1	*Water Treatment Plant Site*	1	LS	$551,000	$551,000
5.2	Electrical (Membrane Filtration / UV System) [3]	1	LS	$2,215,000	$2,215,000
5.3	Electrical (Washwater Equalization and Treatment) [3]	1	LS	$280,000	$280,000
5.4	Electrical (Chemical Building) [3]	1	LS	$675,000	$675,000
6	***HVAC***				***$1,550,000***
6.1	HVAC	1	LS	$1,550,000	$1,550,000
7	***Site Work and Piping***				***$3,527,000***
7.1	Sitework	1	LS	$850,500	$850,500
7.2	Site Mechanical	1	LS	$2,676,000	$2,676,000
8	***Mobilization / Insurance / Management***				***$2,550,000***
8.1	Mobilization / Insurance / Management	1	LS	$2,550,000	$2,550,000
				Subtotal - Equipment and Buildings	**$34,419,000**
	Integration Facilities				
9	***OC-33 Expansion***				***$240,000***
9.1	OC-33 Expansion Mechanical / Site Work	1	LS	$240,000	$240,000
10	***Raw Water Pump Station***				***$2,908,000***
10.1	Site Work	1	LS	$181,000	$181,000
10.2	Yard Piping	1	LS	$246,000	$246,000
10.3	Mechanical	1	LS	$1,019,000	$1,019,000
10.4	Building	1	LS	$254,000	$254,000
10.5	Electrical & Instrumentation	1	LS	$808,000	$808,000
10.6	Surge Design / Facilities	1	LS	$400,000	$400,000
11	***Forebay System (Reservoir /Feedwater Pump Station / TCWD PS)***				***$4,300,000***
11.1	Forebay Reservoir (0.8 MG)	1	LS	$1,300,000	$1,300,000
11.2	Forebay Earthwork (Cut / Fill)	1	LS	$80,000	$80,000
11.3	Flow Control Facility Mechanical (w/ enclosure)	1	LS	$250,000	$250,000
11.4	Feedwater Pump Station (w/ building)	1	LS	$1,700,000	$1,700,000
11.5	TCWD Pump Station (w/ building)	1	LS	$370,000	$370,000
11.6	Electrical & Instrumentation	1	LS	$600,000	$600,000

TABLE Q1
BAKER WATER TREATMENT PLANT
DRAFT PRELIMINARY DESIGN REPORT
ESTIMATE OF CAPITAL COSTS

Item No.	Item Description	Quantity	Unit	Unit Price[1]	Total Price [1]
12	***Product Water Pump Station / AMP Connection***				***$3,504,000***
12.1	Site Work	1	LS	$52,000	$52,000
12.2	Yard Piping	1	LS	$391,000	$391,000
12.3	Mechanical	1	LS	$1,228,000	$1,228,000
12.4	Building	1	LS	$273,000	$273,000
12.5	Electrical & Instrumentation	1	LS	$938,000	$938,000
12.6	Surge Design / Facilities	1	LS	$300,000	$300,000
12.7	AMP Metering Vault / Connection	1	LS	$322,250	$322,250
13	***Backup Power***				***$1,250,000***
13.1	Backup Power at Treatment Plant Site	1	LS	$740,000	$740,000
13.2	Backup Power for Product Water Pump Station Site	1	LS	$510,000	$510,000
14	***Mobilization / Insurance / Management***				***$976,000***
14.1	Mobilization / Insurance / Management [4]	1	LS	$976,000	$976,000
				Subtotal - Integration Facilities	**$13,178,000**
				SUBTOTAL (Equipment and Buildings + Integration Facilities)	**$47,597,000**
				District Costs [5]	**$2,200,000**
				Baker Site Land Use Cost [6]	**$440,000**
				Environmental Documentation [7]	$170,000
				Engineering [8]	$4,437,000
				Contingency / Legal [9]	$6,611,000
				Contingency / Engineering / Environmental / Legal / Administration	**$11,218,000**
				TOTAL ESTIMATE OF CAPITAL COST	**$61,455,000**

Notes:

[1] Capital cost are Class 4 Estimates as defined by AACEI with estimated -15% to +30 range of accuracy

[2] Final cost to be determined by Southern California Edison.

[3] Electrical calcualted 12.5% of total corresponding facility cost.

[4] Mobilization / Insurance / Management Cost calculated at 8-percent of capital cost.

[5] Estimate provided by IRWD - includes cost for project management, field support, construction administrative services and inspection.

[6] Cost for land use at Baker Site per Baker WTP Agreement Section 3.1. Area = 4 acres. Unit Cost = $110,000 /acre.

[7] Environmental Documentation cost is based on EIR preparation cost provided to IRWD.

[8] Based on approved design fee for BWTPP, plus authorized flow test budget, and forebay / feedwater pump station design.

[9] Contingency / Legal is based on 15-percent of Subtotal (Equip. and Buildings + Int. Facilities excluding cost for Moblization, Insurance and Management).

[10] Based on calculation using average of budget estimates provided by Pall and Siemens on 10/23/09.

Table Q2: Flash Mix Energy Costs

Item	Unit	Values
Power	hp	5
Days/ year [1]	-	329
Energy	kWh/year	29,395
Unit Cost	$/kWh	$0.13
Total	**$/Year**	**$3,821**

[1] Based on 90-percent plant utilization

Table Q3: Membrane Filtration Energy Costs

Item	Unit	Values [3]
Upstream Elevation	feet	70
Downstream Elevation	feet	0
Product Water	MGD	27.5
Minimum Recovery	%	92%
Gross Production (including recycle flows)	MGD	29.4
Maximum Instantaneous Flux	gfd	45
On-Line Factor	%	86%
Net Flux	gfd	36
Membrane Area per Module	s.f.	538
Min. Number of Modules	No.	1537
No. of Duty Units	No.	11
No. of Rotating (Standby) Units	No.	0
No. of Units Out of Service	No.	1
Total Number of Units	No.	12
No.of Modules per Unit	No.	140
Total Number of Modules	No.	1676
Backwash Flow per Module	gpm	8
Maximum Backwash Flow	gpm	1117
Average BW Interval	min	30
% Time Backwash Pump is in Operation	%	73%
Power	hp	28
Days/ year [1]	-	329
Energy	kWh/year	121,853
Unit Cost	$/kWh	$0.13
MF Backwash Pumping Energy Cost	$/Year	$15,841
Air Compressors	$/Year	$12,150
EFM/ CIP Pumps	$/Year	$1,200
Total	**$/Year**	**$29,191**

[1] Based on 90-percent plant utilization

[2] Pall MF system was selected for cost estimates as O&M costs are anticipated to be higher than those for Siemens.

[3] Forebay Pump Station pumping costs are presented in Table 14.13. Annual cost is estimated at $511,979.

Table Q4: UV System Energy Costs

Item	Unit	Values
Energy Use	kWh/day	365
Days/ year [1]	-	329
Energy	kWh/year	120,034
Unit Cost	$/kWh	$0.13
Total	**$/Year**	**$15,604**

[1] Based on 90-percent plant utilization

Table Q5: Raw Water Pump Station Energy Costs

Item	Unit	Values
Power	hp	1200
Days/ year [1]	-	55
Energy	kWh/year	1,175,820
Unit Cost	$/kWh	$0.13
Total	$/Year	$152,857

[1] Based on 15-percent utilization rate for the RWPS

Table Q6: Product Water Pump Station Energy Costs

Item	Unit	Values
Upstream Elevation	feet	615
Downstream Elevation	feet	820
Capacity - Flow	cfs	32.5
	gpm	14,587
	mgd	21.0
Power	hp	1080
Days/ year [1]	-	329
Energy	kWh/year	6,349,408
Unit Cost	$/kWh	$0.13
Total	$/Year	$825,423

[1] Based on 90-percent plant utilization

Table Q7: MFWW Transfer Pumping Energy Costs

Item	Unit	Values
Flow	gpm	1,646
TDH	ft	35
Power	hp	21
Days/ year [1]	-	329
Energy	kWh/year	122,324
Unit Cost	$/kWh	$0.13
Total	$/Year	$15,902

[1] Based on 90-percent plant utilization

Table Q8: Feedwater Pump Station / TCWD Pump Station Energy Cost

Item	Unit	Feedwater Pump Station	TCWD PS
Upstream Elevation	feet	630	690
Downstream Elevation	feet	725	725
Capacity - Flow	cfs	43.5	6
	gpm	19,524	2,693
	mgd	28.1	3.9
Power	hp	670	34
Days/ year [1]	-	329	329
Energy	kWh/year	3,938,301	200,131
Unit Cost	$/kWh	$0.13	$0.13
Total	$/Year	$511,979	$26,017

[1] Based on 90-percent plant utilization

Table Q9: Cost of Cleaning Chemicals for Membrane System

Baker Water Treatment Plant	Project Total ($/year)
MF CIP Chemicals	
Citric Acid 50% (Cleaning)	$180,079
Citric Acid 50%(Neutralization)	$0
NaOCl 12.5%	$5,823
NaSHSO3 38%	$4,200
NaOH 25% (Cleaning)	$36,616
NaOH 25% (Neutralization)	$60,050
MF EFM Chemicals	**$286,769**
NaOCl 12.5%	$64,048
NaSHSO3 38%	$46,202
Total	**$397,019**

[1] Based on 90-percent plant utilization

Table Q10: Cost of Process Chemicals

Baker Water Treatment Plant	Project (43.5 cfs) Total ($/year)
Ferric Chloride, 42%	$577,124
NaOCl	$208,163
NaOH 25%	$108,527
AA 29%	$106,764
Chlorine Doxide	$211,535
Total	**$1,212,113**

[1] Based on 90-percent plant utilization

Table Q11: Cost of Replacing Consumables

Baker Water Treatment Plant	365 days	90% Plant Utilization [1]
	Project [2] (43.5 cfs)	Project (43.5 cfs)
Spare Parts [3]	$102,549	$102,549
Module Replacment	$187,540	$187,540
UV Lamp Replacement	$6,018	$5,567
Total	**$296,108**	**$295,656**

[1] Module and Spare Parts Costs are not impacted by plant utilization rate.

[2] Module Replacement determined by the number of modules required.

[3] Spare Parts cost is based on 1-percent of membrane cost. Cost fully incurred after second year (post warranty).

Table Q12: Labor Costs

Baker Water Treatment Plant	Unit	Values
No. of Operators	No.	2
Weeks per Year	week	52
Hours per Week (T4)	hr	40
Unit Cost (T4) [1]	$/h	$100
Subtotal (T4) Labor Cost	$/Year	$208,000
Hours per Week (T5)	hr	30
Unit Cost (T5) [1]	$/h	$110
Subtotal (T5) Labor Cost	$/Year	$171,600
Total	**$/Year**	**$379,600**

[1] Includes G and per the Baker Agreement of 78.6-percent

Table Q13: Estimation of Untreated Water Cost from MWDOC

Baker Water Treatment Plant	MWDOC Rates for Treated Water [1]					Assumed MWDSC Rates for Untreated Water[2][3]				MWDOC Surcharge Rate		Assumed MWDOC Rates for Untreated Water [4]		
	Tier 1		Tier 2		Mix [5]	Tier 1		Tier 2		Tier 1	Tier 2	Tier 1 [6]	Tier 2 [6]	Mix [5]
	Rate	% Increase	Rate	% Increase	Rate	Rate	% Increase	Rate	% Increase	Rate	Rate	Rate	Rate	Rate
2009	$701		$781		$709	$484		$564		n/a	n/a	$484	$564	$492
2010	$701	-	$811	-	$712	$484	0.0%	$594	-	$6.5	$6.5	$491	$601	$502
2011	$860	22.6%	$934	15.2%	$867	$594	22.6%	$684	15.2%	$8.0	$8.0	$602	$692	$611
2012	$903	5.0%	$981	5.0%	$911	$623	5.0%	$718	5.0%	$8.5	$8.5	$632	$727	$641
2013	$948	5.0%	$1,029	5.0%	$956	$654	5.0%	$754	5.0%	$8.5	$8.5	$663	$762	$673
2014	$995	5.0%	$1,081	5.0%	$1,004	$687	5.0%	$792	5.0%	$9.0	$9.0	$696	$801	$706
2015	$1,044	5.0%	$1,135	5.0%	$1,053	$721	5.0%	$831	5.0%	$9.0	$9.0	$730	$840	$741
2016	$1,097	5.0%	$1,191	5.0%	$1,106	$757	5.0%	$873	5.0%	$9.5	$9.5	$767	$882	$778
2017	$1,151	5.0%	$1,250	5.0%	$1,161	$795	5.0%	$916	5.0%	$9.5	$9.5	$804	$925	$816
2018	$1,208	5.0%	$1,313	5.0%	$1,219	$834	5.0%	$962	5.0%	$10.0	$10.0	$844	$972	$857
2019	$1,268	5.0%	$1,378	5.0%	$1,279	$876	5.0%	$1,009	5.0%	$10.0	$10.0	$886	$1,019	$899
2020	$1,331	5.0%	$1,447	5.0%	$1,343	$919	5.0%	$1,059	5.0%	$10.0	$10.0	$929	$1,069	$943
2021	$1,398	5.0%	$1,519	5.0%	$1,410	$965	5.0%	$1,112	5.0%	n/a	n/a	$976	$1,123	$990
2022	$1,468	5.0%	$1,595	5.0%	$1,480	$1,013	5.0%	$1,168	5.0%	n/a	n/a	$1,024	$1,179	$1,040
2023	$1,541	5.0%	$1,675	5.0%	$1,554	$1,064	5.0%	$1,226	5.0%	n/a	n/a	$1,076	$1,238	$1,092
2024	$1,618	5.0%	$1,758	5.0%	$1,632	$1,117	5.0%	$1,288	5.0%	n/a	n/a	$1,129	$1,300	$1,146
2025	$1,699	5.0%	$1,846	5.0%	$1,714	$1,173	5.0%	$1,352	5.0%	n/a	n/a	$1,186	$1,365	$1,204
2026	$1,784	5.0%	$1,938	5.0%	$1,799	$1,232	5.0%	$1,420	5.0%	n/a	n/a	$1,245	$1,433	$1,264
2027	$1,873	5.0%	$2,035	5.0%	$1,889	$1,293	5.0%	$1,491	5.0%	n/a	n/a	$1,307	$1,505	$1,327
2028	$1,967	5.0%	$2,137	5.0%	$1,984	$1,358	5.0%	$1,565	5.0%	n/a	n/a	$1,373	$1,580	$1,394

[1] Based on June 2009 water rate projections provided to IRWD by MWDOC, and updated after 9/1/2009 to account for MWDSC water rate change.

[2] 2009 and 2010 rates for full service untreated and treated MWDSC water is based on estimates posted on MWDSC's website November 2009.

[3] Future cost of untreated MWDSC water is estimated based on escalation rates similar to the treated water costs

[4] The sum of MWDSC untreated water cost and MWDOC surcharge rates

[5] Assumes 90-percent of Tier 1 and 10-percent of Tier 2

[6] Assume rates to annualy escalate at a rate of 5-percent beyond year 2020

Table Q14: Projected Cost of Water for Baker WTP

Baker Water Treatment Plant - 43.5 cfs Forebay, Feedwater PS, N+1

Year	Energy, Chemical, & Consumables Costs (5% Escalation)	Labor Costs (3% Escalation)	Non-Reclaimable Water Treatment (3% Escalation)	Other O&M System Costs (3% Escalation)	Total Escalated O&M Costs ($/AF/yr)	Annual Capital Cost ($/AF/yr)	Cost of Untreated Water from MWDOC ($/AF/yr)	Total Project Costs Alternative 1 ($/AF/yr)
2009	$3,485,600	$379,600	$0	$75,000	$141	$134	$492	$766
2010	$3,659,900	$391,000	$2,300	$77,300	$147	$134	$502	$783
2011	$3,842,900	$402,700	$4,600	$79,600	$155	$134	$611	$899
2012	$4,035,000	$414,800	$7,000	$82,000	$162	$134	$641	$937
2013	$4,236,700	$427,200	$9,400	$84,400	$170	$134	$673	$976
2014	$4,448,600	$440,100	$11,900	$86,900	$178	$134	$706	$1,018
2015	$4,671,000	$453,300	$14,600	$89,600	$187	$134	$741	$1,061
2016	$4,904,600	$466,900	$17,200	$92,200	$196	$134	$778	$1,108
2017	$5,149,800	$480,900	$20,000	$95,000	$205	$134	$816	$1,155
2018	$5,407,300	$495,300	$22,900	$97,900	$215	$134	$857	$1,206
2019	$5,677,600	$510,200	$25,800	$100,800	$225	$134	$899	$1,258
2020	$5,961,500	$525,500	$28,800	$103,800	$236	$134	$943	$1,313
2021	$6,259,600	$541,200	$31,900	$106,900	$248	$134	$990	$1,372
2022	$6,572,600	$557,500	$35,100	$110,100	$260	$134	$1,040	$1,433
2023	$6,901,200	$574,200	$38,400	$113,400	$272	$134	$1,092	$1,498
2024	$7,246,300	$591,400	$41,800	$116,800	$285	$134	$1,146	$1,566
2025	$7,608,600	$609,100	$45,400	$120,400	$299	$134	$1,204	$1,637
2026	$7,989,000	$627,400	$49,000	$124,000	$314	$134	$1,264	$1,712
2027	$8,388,500	$646,200	$52,700	$127,700	$329	$134	$1,327	$1,790
2028	$8,807,900	$665,600	$56,500	$131,500	$345	$134	$1,394	$1,872

Annualized Capital Cost = $3,749,000

Annual Production (AF)= 28,018

Annualized Capital Cost Per AF= $134

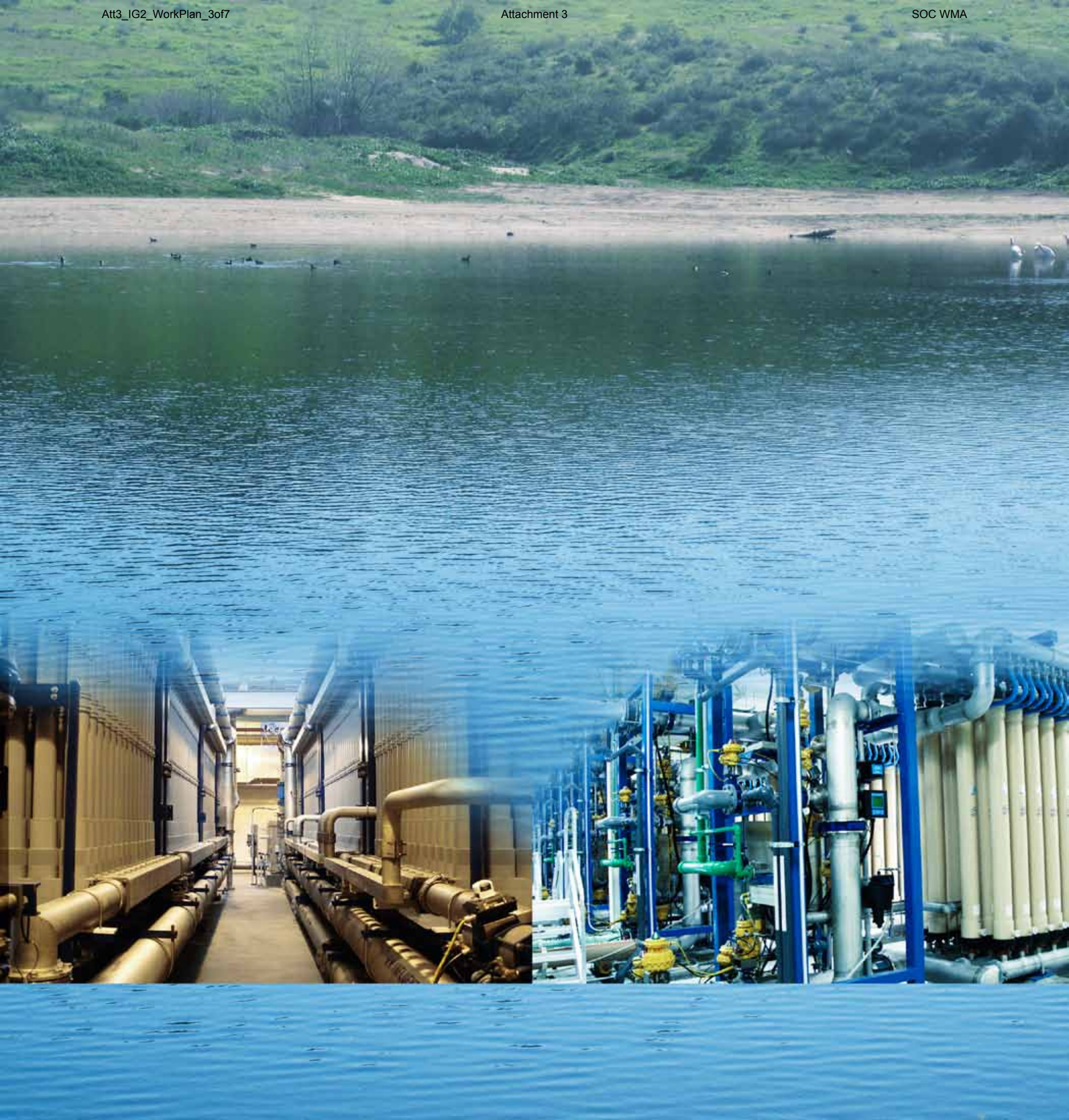
Table Q15: Projected Cost of Baker WTP Product Water

Baker Water Treatment Plant	Cost ($)
2009	$766
2010	$783
2011	$899
2012	$937
2013	$976
2014	$1,018
2015	$1,061
2016	$1,108
2017	$1,155
2018	$1,206
2019	$1,258
2020	$1,313
2021	$1,372
2022	$1,433
2023	$1,498
2024	$1,566
2025	$1,637
2026	$1,712
2027	$1,790
2028	$1,872

Table Q16: Baker WTP Water Costs vs. MWDOC Import Water Cost

Baker Water Treatment Plant	$/AFY Cost Difference (Baker WTP Water Cost minus MWDOC Tier 1/Tier 2 Meld) [1] ($)
Present - 2009	$57
Project Startup - 2012	$27
2014 (year 2 of operation)	$15
2015 (year 3 of operation)	$8
2016 (year 4 of operation)	$2
2017 (year 5 of operation)	($6)
2018 (year 6 of operation)	($13)
2020 (year 8 of operation)	($30)
2024 (year 12 of operation)	($67)
2028 (year 16 of operation)	($112)

[1] Melded rate at ratio of 90-percent Tier 1 and 10-percent Tier 2.



Addendum No. 1 to the

BAKER WATER TREATMENT PLANT PROJECT

Environmental Impact Report (State Clearinghouse No.2010051055)

Prepared for:
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

February 2012

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ADDENDUM NO. 1 TO THE BAKER WATER TREATMENT PLANT PROJECT ENVIRONMENTAL IMPACT REPORT

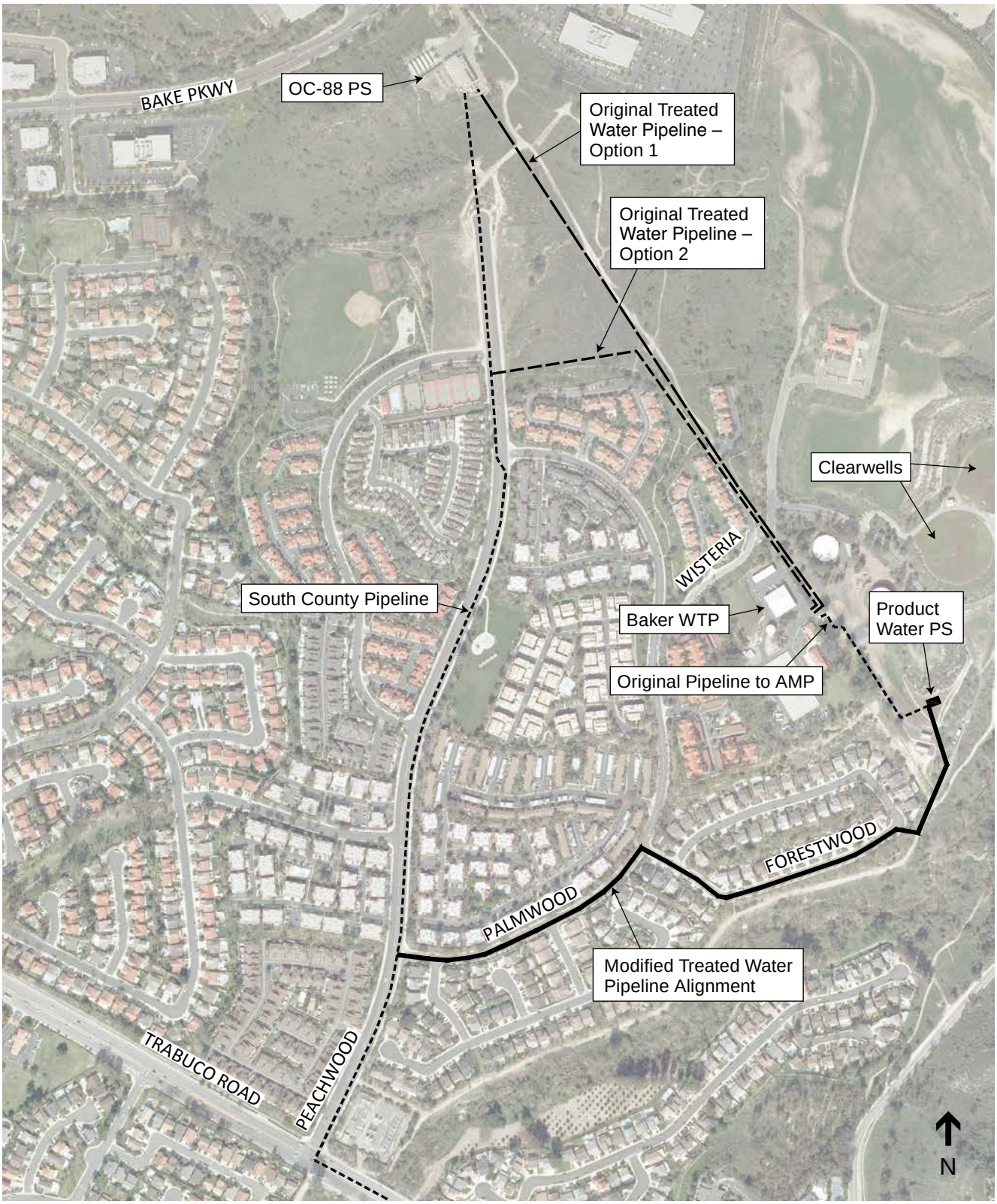
1.0 Introduction

The Irvine Ranch Water District (IRWD) proposes modifications to the Baker Water Treatment Plant (WTP) Project. The proposed modifications include changes to the alignment of the treated water pipeline (Figure 1) and changes to the mechanical design of the product water pump station (PWPS). The potential environmental effects of the proposed modifications to the Project are addressed in this Addendum No. 1 to the Baker WTP Project Final Environmental Impact Report (EIR). All other planned Baker WTP facilities and project objectives outlined in the Final EIR remained unchanged.

IRWD has prepared this Addendum pursuant to the California Environmental Quality Act (CEQA) Guidelines Section 15164, to describe the modifications to the Project and to evaluate whether the modifications present any new significant impacts not identified in the previously certified Final EIR that would require preparation of a subsequent or supplemental EIR. As documented in the analysis presented below, the proposed modifications would not result in substantial changes that warrant preparation of a subsequent or supplemental EIR pursuant to Section 15162 of the CEQA Guidelines.

1.1 Project Background

In April of 2011, the IRWD's Board of Directors certified the Baker WTP Project Final EIR. The Final EIR evaluated the environmental effects of constructing and operating a new potable water treatment facility in the City of Lake Forest that will enhance water supply reliability in southern Orange County. The Baker WTP Project will provide redundant treatment capacity to Metropolitan Water District of Southern California's (MWD) Diemer Treatment Plant by treating raw water at a normal operating capacity of 43.5 cubic feet per second (28 million gallons per day). The Project will not increase the capacity of regional treated water distribution pipelines, but rather improve regional potable water system reliability and operational flexibility. The Project also will provide treated water to four partnering water agencies in southern Orange County: El Toro Water District (ETWD), Moulton Niguel Water District (MNWD), Santa Margarita Water District (SMWD), and Trabuco Canyon Water District (TCWD).



SOURCE: RBF Consulting, 2012.

Baker Water Treatment Plant Project Addendum No. 1 . 209247.07

Figure 1
Treated Water Pipeline Alignment

1.2 Purpose of Addendum

Under CEQA, the lead agency or a responsible agency shall prepare an addendum to a previously-certified EIR if some changes or additions are necessary to the prior EIR, but none of the conditions calling for preparation of a subsequent or supplemental EIR have occurred (CEQA Guidelines §§ 15162, 15164). Once an EIR has been certified, a subsequent EIR is only required when the lead agency or responsible agency determines that one of the following conditions has been met:

(1) Substantial changes are proposed in the project, or substantial changes occur with respect to the circumstances under which the project is undertaken, which require major revisions of the previous EIR due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects (CEQA Guidelines §15162(a)(1), (2));

(2) New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete, shows any of the following:

   a. The project will have one or more significant effects not discussed in the previous EIR;

   b. Significant effects previously examined will be substantially more severe than shown in the previous EIR;

   c. Mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or

   d. Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative (CEQA Guidelines §15162(a)(3)).

If one or more of the conditions described above for a subsequent EIR exist, but only minor additions or changes would be necessary to make the previous EIR adequately apply to the project in the changed situation, then the lead agency may prepare a supplement to an EIR, rather than a subsequent EIR *(*CEQA Guidelines §15163(a)).

CEQA recommends that a brief explanation of the decision to prepare an addendum rather than a subsequent or supplemental EIR be included in the record (CEQA Guidelines §15164(e)). IRWD has evaluated the potential environmental impacts of the proposed modifications as set forth below in Section 1.3 of this Addendum No. 1. IRWD acting as the Lead Agency, has determined that none of the above CEQA conditions apply and that Addendum No. 1 to the adopted Final EIR is the appropriate environmental documentation for the proposed modifications and fully complies with CEQA, as described in the CEQA Guidelines.

An addendum does not need to be circulated for public review, but rather can be attached to the Final EIR (CEQA Guidelines §15164(c)). Prior to initiating the modified Project, the IRWD

Board of Directors will consider this Addendum No. 1 together with the adopted Final EIR and make a decision regarding the modified Project (CEQA Guidelines §15164(d)).

1.3 Modification Description

The Baker WTP Project Final EIR identified that the preferred method of delivering treated water to the partner agencies would be through an existing connection to the Allen McColloch Pipeline (AMP) onsite at the Baker WTP. The AMP is a major potable water transmission pipeline owned by MWD that bisects the Baker WTP Project site (Baker site). During review of the AMP connection with MWD, this point-of-delivery location was determined to be infeasible. Therefore, as described in the Final EIR, the treated water would be delivered to partner agencies via the South County Pipeline, which is located southwest of the Baker WTP in the Peachwood right-of-way (ROW) (see Figure 1). The Final EIR described and evaluated two potential alignments for a treated water pipeline to connect the Baker WTP to the South County Pipeline (see Treated Water Pipeline Option 1 and Option 2 in Figure 1). However, due to constraints on land acquisitions and easement acquisitions associated with these alignments, IRWD has since identified a new alignment that would maximize use of existing ROWs, eliminate the need for land acquisition, and avoid impacts to future development (see Modified Treated Water Pipeline Alignment in Figure 1). The modified treated water pipeline alignment would result in minor design changes to the PWPS located onsite at the Baker WTP. These modifications are described in more detail below.

Treated Water Pipeline Alignment

The proposed treated water pipeline alignment is shown in Figure 1. The modified alignment would run offsite from the south corner of the Baker site, crossing under the AMP and IRWD's Lake Forest Zone 1 and Zone 2 pipelines, and running parallel to the Project's sewer pipeline alignment for approximately 320 feet along the Serrano Creek Trail. Then the pipeline would run up the slope embankment, adjacent to IRWD's existing easement for two other potable water lines, and cross into the ROW of Forestwood. From Forestwood, the pipeline would continue west within the ROWs of Autumnwood, Palmwood Drive, and Peachwood where a connection to the South County Pipeline would be constructed near the Peachwood–Palmwood intersection. The total pipeline length would be approximately 3,200 linear feet (LF), with a diameter of 36 inches. An underground vault would be constructed near the intersection of Palmwood Drive and Sprucewood to house an isolation valve that will be installed on the treated water pipeline at the connection point to the South County Pipeline.

New easements would be required to accommodate the modified treated water pipeline alignment. IRWD would need to secure an easement from the County of Orange to expand its existing pipeline easements between the Baker site and Forestwood. IRWD also may need to secure an easement from the Serrano Highland Master Homeowner's Association that owns a parcel of land located between the Baker site and Valewood.

Product Water Pump Station

As described in the Final EIR, the PWPS would pump treated water from the Baker WTP storage reservoirs to the South County Pipeline for delivery to the Project's partner water agencies. Due to the change in the pipeline alignment and point of delivery along the South County Pipeline, modifications to the mechanical design of the PWPS are required to accommodate an increased discharge pressure in the treated water pipeline. The footprint and design of the PWPS building would not change from that described in the Final EIR (page 2-12). The PWPS would continue to house five pumps (four duty and one standby) and have a capacity of 33 cfs; however, the size of each pump would increase to 450 HP from 300 HP. There would be no measurable environmental impacts associated with this modification, and as such the PWPS is not addressed further in this Addendum No. 1.

1.4 Construction Methods

The treated water pipeline would be installed primarily using trench installation construction techniques as described in the Final EIR (pages 2-14 and 2-15). For installation of the pipeline where it crosses under the AMP and IRWD's Zone 1 and Zone 2 pipelines and runs along the Serrano Creek Trail, jack-and-bore construction methods may be used. Construction of this segment would require a temporary construction easement from the County of Orange (already identified in the Final EIR on page 2-17). To install the pipeline from the Serrano Creek Trail to city streets and within city streets, open trench methods would be utilized. Depth of excavation would be approximately six to eight feet to accommodate the 36-inch pipe with an engineered bed and cover. Once installed, the pipeline alignment would be returned to its previous condition along the entire length of the alignment.

1.5 Project Phasing and Schedule

The treated water pipeline would be constructed at the same time as the Baker WTP. Construction duration would not change from that described in the Final EIR, taking approximately six months to complete, moving on average at a rate of 50 to 100 feet per day.

2.0 Incorporation by Reference

Consistent with Section 15150 of the CEQA Guidelines, the following documents were used in the preparation of this Addendum and are incorporated herein by reference:

- Baker Water Treatment Plant Project Draft Environmental Impact Report, January 2011 (State Clearinghouse No. 2010051055).
- Baker Water Treatment Plant Project Final Environmental Impact Report, April 2011 (State Clearinghouse No. 2010051055).
- Technical Memorandum for Baker Water Treatment Plant – Product Water Delivery to South County Pipeline, RBF Consulting, December 1, 2011.

These documents are available for review during regular business hours at IRWD located at 15600 Sand Canyon Avenue, Irvine, California 92618-3102.

3.0 Analysis of Potential Environmental Impacts Associated with the Proposed Modification

The proposed modification would not change the regulatory framework, impact discussion, mitigation measures, or significant conclusions for the following resource areas as currently described in the adopted Final EIR: Agricultural Resources, Air Quality and Greenhouse Gases; Hazards and Hazardous Materials; Hydrology and Water Quality; Public Services and Utilities.

3.1 Aesthetics

The Final EIR concluded that potential impacts to the aesthetics of the Project area would be less than significant after mitigation. This section provides an analysis of the potential aesthetics impacts associated with the modification of the treated water pipeline alignment.

3.1.1 Setting

The corridor for the treated water pipeline would run onsite at the Baker WTP for 360 feet south, then through an open space area of Serrano Creek Trail for approximately 320 feet, where it would then turn northwest into Forestwood and continue within city streets. Surrounding land uses primarily consist of low density residential, public facility, community park/open space, and light industrial. Existing natural features in the vicinity of the Baker site include Serrano Creek and Serrano Creek Trail. The City of Lake Forest has not designated any scenic roadways or scenic vistas/viewpoints in the area surrounding the Project.

3.1.2 Summary of Potential Impact

As already analyzed Chapter 3.1 of the Final EIR (page 3.1-9), during pipeline construction, equipment would be visible from surrounding streets, including hilltop residential units located east of the Baker site. However, there are no City-designated scenic vistas in the vicinity of the Baker WTP and construction activities would be temporary. Upon completion of construction, the treated water pipeline would be located underground within Serrano Creek Trail and city streets and no longer visible. The modified pipeline would not impact scenic vistas.

The Final EIR analyzed the potential for Project pipelines to affect the visual character of the Project sites, including open space areas around Serrano Creek and adjacent to residential land uses (Final EIR page 3.1-10). A portion of the modified treated water pipeline would be constructed in this open space area, parallel to the Project sewer pipeline. As documented in the Final EIR, construction would affect the visual character of the pipeline corridor; however, once constructed the pipelines would be underground and would not alter permanently the visual character of the sites or their surroundings. Implementation of Mitigation Measure AES-2, as included in the Final EIR, would ensure that construction of the modified treated water pipeline would not substantially degrade the visual character of the pipeline alignment by requiring post-

construction site restoration, including restoring topography, vegetation, and repaving roadways. Impacts would be less than significant with mitigation.

3.1.3 Conclusion

The Project would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the Mitigation Monitoring and Reporting Program (MMRP). Impacts to aesthetics would be less than significant with mitigation.

3.2 Biological Resources

The Final EIR assessed potential impacts to biological resources and concluded that construction of the Project would have a less than significant impact with the incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

3.2.1 Setting

The modified treated water pipeline alignment would cross the drainage channel at the south corner of the Baker WTP that is tributary to Serrano Creek. The crossing would be accomplished with jack and bore methods to avoid impacts to the drainage and creek. The modified pipeline would be located beneath the Serrano Creek Trail for approximately 320 feet, and then within the public ROW until it connects to the South County Pipeline in Peachwood. The portion of the alignment beneath the Serrano Creek Trail would be located within Non-Reserve Lands in the Central Subarea of the Orange County Natural Communities Conservation Program (NCCP).

3.2.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of Project implementation on sensitive species, riparian habitat, natural communities, wetlands, and compliance with local biological resource policies. The Final EIR concluded that with implementation of mitigation the Project would have less than significant impacts to biological resources. A portion of the new treated water pipeline alignment would parallel the previously-approved sewer pipeline alignment along Serrano Creek Trail adjacent to Serrano Creek. Impacts associated with installation of the new treated water pipeline in this open space area would be identical to those identified for the sewer pipeline. Because the previous Final EIR analyzed the impacts of a pipeline installation along the Serrano Creek Trail, there would be no new impacts associated with development of the modified treated water pipeline. With implementation of Mitigation Measures BIO-3, BIO-4, BIO-6 and BIO-10 identified in the Final EIR, the potential impacts to biological resources would be mitigated to less than significant levels.

3.2.3 Conclusion

The Project would not result in a new significant impact not previously identified in the Final EIR, nor would it substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to biological resources would be less than significant with mitigation.

3.3 Cultural Resources

The Final EIR assessed potential impacts to cultural resources and concluded that construction of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

3.3.1 Setting

An archaeological survey of the sewer pipeline alignment along Serrano Creek was conducted by an ESA archaeologist on June 25, 2010. A portion of the modified treated water pipeline would run parallel to the sewer pipeline alignment before crossing into paved city streets. Undeveloped land was systematically surveyed in transects of 20 meters or less and the ground surface subject to careful inspection for cultural resources. The surveys found no cultural resources within the pipeline alignments but concluded that due to the number of prehistoric archaeological sites in close proximity to the Project area, previously-unknown resources may be uncovered during excavation activities.

3.3.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of Project implementation on cultural and paleontological resources and determined that with implementation of mitigation the modified Project would have less than significant impacts to these resources. The area has been previously disturbed by the construction of the existing Baker Facility, existing pipelines, the adjacent housing development, and the Serrano Creek Trail. The Final EIR determined that due to the large number of prehistoric archaeological sites in close proximity to the Project area and its location along a reliable water source, the Project area has some archaeological sensitivity, particularly for prehistoric archaeological resources. With implementation of Mitigation Measures CUL-1, CUL-2, CUL-3 and CUL-4, the potential construction impacts to cultural resources and paleontological resources would be mitigated to less than significant. Because the Final EIR analyzed the portions of the modified treated water pipeline alignment that would be located on undeveloped, unpaved lands, no new impacts associated with development of the modified Project would occur. Therefore, with implementation of mitigation measures identified in the Final EIR, the potential construction impacts to cultural resources would be mitigated to less than significant levels.

3.3.3 Conclusion

The Project would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to cultural resources would be less than significant with mitigation.

3.4 Geology, Soils and Mineral Resources

The Final EIR assessed potential impacts associated with geologic events and concluded that construction and operation of the proposed Project would have a less than significant impact with

incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

3.4.1 Setting

The Project area lies within a region of California referred to as the Peninsular Ranges geomorphic province. The Peninsular Ranges consist of a series of ranges that are separated by northwest trending valleys, subparallel to faults branching off of the San Andreas Fault. The trend of topography is similar to the Coast Ranges, but the geology is more like the Sierra Nevada, with granite rock intruding the older metamorphic rocks. The province extends into lower California and is bound on the east by the Colorado Desert Province (Final EIR, 2011).

3.4.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of Project implementation associated with geologic hazards and seismic events, including seismic ground shaking, landslides and liquefaction, subsidence, expansive soils, and erosion. With the implementation of Mitigation Measures GEO-1 and GEO-2, impacts associated with these hazards would be reduced to less than significant levels. The modified pipeline alignment would be located within the Project area analyzed in the Final EIR. Similar to the sewer pipeline, a portion of the treated water pipeline would be located within an area of potential liquefaction around Serrano Creek. Implementation of Mitigation Measure GEO-2 would apply to the modified pipeline alignment and would mitigate potential impacts associated with liquefaction and other hazards such as expansive soils to less than significant levels. In addition, implementation of the best management practices recommended in Mitigation Measure GEO-1 would minimize impacts associated with erosion and sedimentation during construction of the pipeline to less than significant levels.

3.4.3 Conclusion

The Project would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to geology, soils and mineral resources would be less than significant with mitigation.

3.5 Land Use, Planning and Recreation

The Final EIR assessed potential impacts to land use and recreation and concluded that construction and operation of the approved Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

3.5.1 Setting

The modified Project is located in the City of Lake Forest. The modified treated water pipeline alignment would require expansion of an easement for the portion of the pipeline alignment between the Baker WTP and Forestwood, in the vicinity of Serrano Creek Trail. A new easement from the Serrano Highland Homeowners Association also would be required for the portion of the

pipeline that runs between Serrano Creek Trail and Forestwood. The current land use designation for the modified pipeline alignment is Regional Park/Open Space and Low-Medium Density Residential, (Final EIR, 2011).

3.5.2 Summary of Potential Impact

Water and wastewater transmission facilities are not subject to city building or zoning ordinances, per Government Code 53091, and therefore a site development permit would not be required for the modified treated water pipeline. A portion of the modified treated water pipeline alignment would be located in a similar location as the sewer pipeline, along the Serrano Creek Trail. To avoid impacts to public use of the trail during construction and installation of the pipeline, implementation of a trail detour plan as described in Mitigation Measure LU-1 in the Final EIR would reduce impacts to recreational facilities to less than significant levels. Once the pipeline is installed, the trail would be restored to pre-construction conditions as required by Mitigation Measure AES-2, also as described in the Final EIR, such that there would be no long-term permanent impacts to recreational facilities. Installing the pipeline within existing public ROWs would not conflict with current zoning and land use designations. Therefore, with implementation of mitigation measures identified in the Final EIR, the potential construction impacts associated with land use conflicts would be mitigated to less than significant.

3.5.3 Conclusion

The modified Project would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to land use and recreation would be less than significant with mitigation.

3.6 Noise and Vibration

The Final EIR assessed potential impacts to sensitive receptors due to Project noise and vibration and concluded that construction and operation of the approved Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

3.6.1 Setting

The modified treated water pipeline alignment would be located in an area consisting of open space and residential land uses. The nearby residences qualify as noise sensitive land uses and would potentially be exposed to noise generated from Project activities. The distance from the modified pipeline construction activities to the closest residences would be approximately 30 feet.

3.6.3 Summary of Potential Impact

Construction activities would create a temporary increase in ambient noise levels in the immediate vicinity of the construction zone. The nearest sensitive receptor to pipeline construction activities would be approximately 30 feet from the modified treated water pipeline alignment. The Final EIR found the greatest noise levels associated with excavation and finishing

and would be 89 dBA at a distance of 50 feet and evaluated the impact of the sewer pipeline installation 30 feet from residential land uses. Installation of the modified treated water pipeline would result in construction noise impacts similar to those analyzed for the sewer pipeline. An average of 50 to 100 feet of pipeline would be installed per day; therefore sensitive receptors would be exposed to pipeline construction noise only for up to two weeks. The modified Project would parallel the previously-analyzed sewer pipeline alignment for the first segment and then run within the existing public ROW, 30 feet from the nearest sensitive receptors. With implementation of Mitigation Measures NOISE-1 and NOISE-2 identified in the Final EIR, potential construction noise impacts on sensitive receptors would be mitigated to less than significant levels. Once constructed and operational, the modified pipeline would be underground and would have no impacts due to noise or vibration.

3.6.3 Conclusion

The modified Project would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to sensitive receptors associated noise and vibration are less than significant with mitigation.

3.7 Transportation and Traffic

The Final EIR assessed potential impacts to traffic and concluded that construction and operation of the approved Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

3.7.1 Setting

The majority of the modified treated water pipeline would be installed within city streets. Forestwood, Autumnwood, and Palmwood Drive are local feeder streets that serve a residential area. Peachwood conveys local traffic to arterial roadways within the City of Lake Forest.

3.7.2 Summary of Potential Impact

The modified treated water pipeline would be installed within city street ROWs and would temporarily slow traffic serving the local residential community. The two optional treated water pipeline alignments analyzed in the Final EIR affected different streets in the neighborhood adjacent to the Baker site. However, impacts associated with construction would be similar to those described in the Final EIR (pages 3.12-9 and 3.12-10). Mitigation Measure TR-1 would require a Traffic Control/Traffic Management Plan to be implemented during pipeline construction. At least one lane of traffic would be maintained within the streets at all times. Access to each driveway within the city streets would be maintained during installation. As a result, the temporary impacts to traffic would be less than significant with mitigation.

3.7.3 Conclusion

The modified Project would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the

existing commitments contained within the MMRP. Impacts to traffic and circulation are less than significant with mitigation.

4.0 Summary of Environmental Effects

As discussed above in this Addendum, the proposed modifications would not change the conclusions of the certified Final EIR. The construction and operation of the proposed modified treated water pipeline would meet the same objectives of improving water reliability to areas of south Orange County, providing a reliable local water supply in the event of emergency conditions or scheduled maintenance of the MWD delivery system; increased operational flexibility by creating redundancy within the raw water supply system.

No new potentially significant impacts would occur, and the Project would not increase the severity of previously identified significant impacts. The proposed modifications to the previously-approved Project do not meet any of the conditions that would require the preparation of a subsequent EIR or negative declaration set forth in Section 15162 of the CEQA Guidelines or any of the conditions set forth in Section 15163 of the CEQA Guidelines.

5.0 Determination

Section 15164(a) of the CEQA Guidelines states the following:

> "The lead agency or responsible agency shall prepare an addendum to a previously certified EIR if some changes or additions are necessary but none of the conditions described in Section 15162 calling for the preparation of subsequent EIR have occurred."

The proposed modifications to the original Project would not result in new significant environmental effects or a substantial increase in the severity of previously identified significant effects. Furthermore, new information associated with the proposed modifications do not indicate that the Project will have one or more significant effects not discussed in the adopted Final EIR; that significant effects previously examined will be substantially more severe than shown in the adopted Final EIR; that mitigation measures or alternatives previously found not to be feasible would in fact be feasible; or that mitigation measures or alternatives which are considerably different from those analyzed in the adopted Final EIR would substantially reduce one or more significant effects on the environment, but the Project proponents decline to adopt the mitigation measures or alternative. Accordingly, an addendum has been prepared as opposed to a supplemental or subsequent EIR. IRWD is adopting this Addendum No. 1 in accordance with the CEQA Guidelines (§15164).

Irvine Ranch Water District

_____	_____
Signature	Date
Christian Kessler	Assistant Engineer/Planner
Printed Name	Title

Addendum No. 2

BAKER WATER TREATMENT PLANT PROJECT

Environmental Impact Report
(State Clearinghouse No.2010051055)

Prepared for
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

March 2013

ESA

Addendum No. 2

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BAKER WATER TREATMENT PLANT PROJECT

Final Environmental Impact Report Addendum No. 2

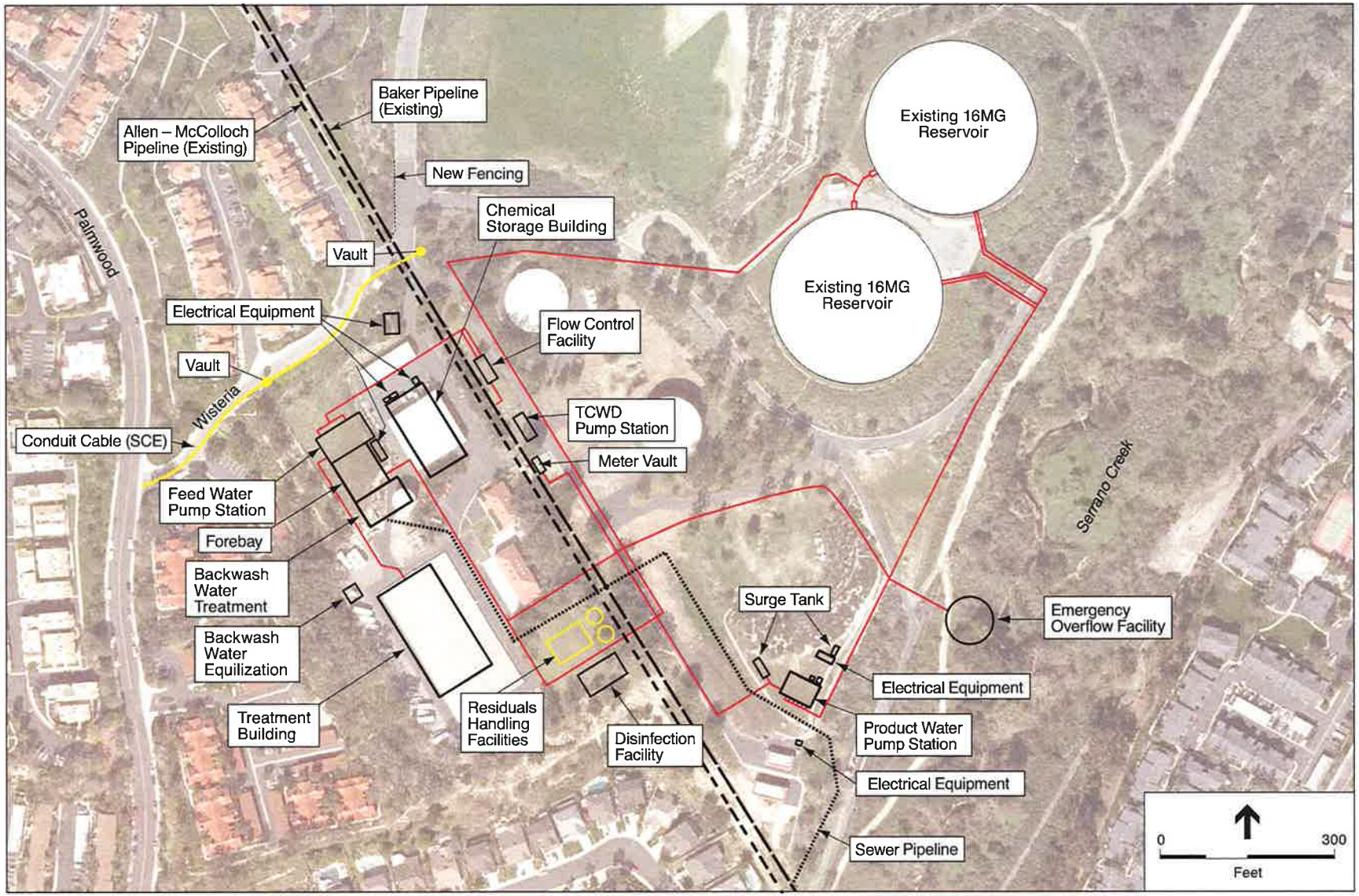
1.0 Introduction

The Irvine Ranch Water District (IRWD) proposes to modify the Baker Water Treatment Plant (WTP) Project. The proposed modifications include an addition to the treatment process at the Baker WTP and two new electrical conduit alignments necessary for Southern California Edison (SCE) to service the Project. The treatment process at the Baker WTP would be modified to include new residuals handling facilities that would allow residuals processing to occur onsite at the Baker WTP rather than at Los Alisos Water Recycling Plant (LAWRP) as previously planned. **Figure 1** shows the approximate location of the new residuals handling facilities at the Baker site. Figure 1 also shows the approximate location of the first proposed SCE conduit alignment. **Figure 2** shows the approximate location of the second proposed SCE conduit alignment south of the Raw Water Pump Station. The potential environmental effects of the proposed modifications to the Project are addressed in this Addendum No. 2 to the Baker WTP Project Final Environmental Impact Report (EIR) (SCH # 2010051055). All other planned Baker WTP facilities and Project objectives outlined in the Final EIR and Addendum No. 1 remain unchanged. The proposed modifications do not affect the changes to the Project that were analyzed in Addendum No. 1.

IRWD has prepared this Addendum pursuant to the California Environmental Quality Act (CEQA) Guidelines Section 15164, to describe the modifications to the Project and to evaluate whether the modifications present any new significant impacts not identified in the previously certified Final EIR and Addendum No.1 that would require preparation of a subsequent or supplemental EIR. As documented in the analysis presented below, the proposed modifications would not result in substantial changes that warrant preparation of a subsequent or supplemental EIR pursuant to Sections 15162 and 15163 of the CEQA Guidelines.

2.0 Project Background

In April of 2011, the IRWD Board of Directors certified the Baker WTP Project Final EIR. The Final EIR evaluated the environmental effects of constructing and operating a new potable water treatment facility in the City of Lake Forest at the location of the former Baker Filtration Plant (BFP). The Project included other requisite offsite components, such as the Raw Water Pump Station located in the City of Orange. The Baker WTP Project will enhance water supply reliability in southern Orange County and provide redundant treatment capacity to Metropolitan Water District of Southern California's (MWD) Diemer Treatment Plant by treating raw water at



SOURCE: RBF Consulting; Carollo; ESA, 2013.

IRWD Baker WTP EIR Addendum No. 2 . 211448.01

Figure 1
Baker Water Treatment Plant
Proposed Modifications

SOURCE: RBF Consulting; ESA, 2013.

IRWD Baker WTP EIR Addendum No. 2 . 211448.01

Figure 2
Raw Water Pump Station
Proposed Modifications

a normal operating capacity of 43.5 cubic feet per second (28 million gallons per day). The Project will not increase the capacity of regional treated water distribution pipelines, but rather improve regional potable water system reliability and operational flexibility. The Project also will provide treated water to four partnering water agencies in southern Orange County: El Toro Water District (ETWD), Moulton Niguel Water District (MNWD), Santa Margarita Water District (SMWD), and Trabuco Canyon Water District (TCWD).

In March of 2012, the IRWD Board of Directors certified Addendum No. 1 to the Baker WTP Project Final EIR. Addendum No. 1 evaluated the environmental effects of modifying the alignment of the treated water pipeline that will connect the Baker WTP to the South County Pipeline and changes to the mechanical design of the product water pump station.

3.0 Purpose of Addendum

Under CEQA, the lead agency or a responsible agency shall prepare an addendum to a previously-certified Final EIR if some changes or additions are necessary to the prior EIR, but none of the conditions calling for preparation of a subsequent or supplemental EIR have occurred (CEQA Guidelines §§ 15162, 15164). Once an EIR has been certified, a subsequent EIR is only required when the lead agency or responsible agency determines that one of the following conditions has been met:

(1) Substantial changes are proposed in the project, or substantial changes occur with respect to the circumstances under which the project is undertaken, which require major revisions of the previous EIR due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects (CEQA Guidelines §15162(a)(1), (2));

(2) New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete, shows any of the following:

   a. The project will have one or more significant effects not discussed in the previous EIR;

   b. Significant effects previously examined will be substantially more severe than shown in the previous EIR;

   c. Mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or

   d. Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative (CEQA Guidelines §15162(a)(3)).

If one or more of the conditions described above for a subsequent EIR exist, but only minor additions or changes would be necessary to make the previous EIR adequately apply to the

project in the changed situation, then the lead agency may prepare a supplement to an EIR, rather than a subsequent EIR (CEQA Guidelines §15163(a)).

CEQA recommends that a brief explanation of the decision to prepare an addendum rather than a subsequent or supplemental EIR be included in the record (CEQA Guidelines §15164(e)). IRWD has evaluated the potential environmental impacts of the proposed modifications as set forth below in Section 6 of this Addendum No. 2. IRWD acting as the Lead Agency, has determined that none of the above CEQA conditions apply and that Addendum No. 2 to the adopted Final EIR is the appropriate environmental documentation for the proposed modifications and fully complies with CEQA, as described in the CEQA Guidelines.

An addendum does not need to be circulated for public review, but rather can be attached to the Final EIR (CEQA Guidelines §15164(c)). Prior to initiating the modified Project, the IRWD Board of Directors will consider this Addendum No. 2 together with the adopted Final EIR and Addendum No. 1 and make a decision regarding the modified Project (CEQA Guidelines §15164(d)).

4.0 Proposed Modifications

4.1 Baker Water Treatment Plant

The Baker WTP Project Final EIR identified a new 15-inch sewer pipeline that would be constructed to convey residual non-reclaimable waste (NRW) from the Baker WTP to IRWD's Los Alisos Water Recycling Plant (LAWRP) for treatment. At the LAWRP, the NRW would be dewatered and the solids hauled offsite to a composting facility. Subsequent to completion of the Final EIR, IRWD identified new concerns associated with this residuals management approach due to planned changes with the manner in which LAWRP solids will be handled.

As part of the proposed modification, the waste stream from the treatment process at the Baker WTP would be pumped via a new onsite underground pipeline to proposed residuals handling facilities. The waste stream would be a dilute sludge comprised mostly of silt and inorganic materials. The sludge would be thickened, dewatered, temporarily stored, and hauled offsite to a landfill. The liquid from the dewatering process will be piped to the LAWRP via an existing sewer pipeline connection. The NRW pipeline originally proposed in the Final EIR may not need to be built because the capacity of the existing sewer pipeline is sufficient for dewatering discharges from the proposed residuals handling facilities. However, the NRW pipeline could be constructed in the future.

The following proposed facilities associated with this modification would be built at the Baker site, within the boundaries of the existing BFP as delineated in Figure 2-2 of the Final EIR:

- **Thickeners**: two partially-buried concrete open-air basins, approximately seven feet above ground surface (12-ft water depth) and 22 feet in diameter.

- **Dewatering Building**: one 2,400 square foot (sf) building with a height of approximately 25 feet would contain thickened sludge feed pumps, dewatering centrifuges, a polymer storage and feed system, dewatered sludge conveyor system, and electrical equipment.
- **Load Out**: new facilities adjacent to the dewatering building would facilitate short-term storage and offsite disposal of dewatered sludge.
- **Equalization Storage**: one approximately 25,000-gallon partially buried and enclosed concrete basin would provide equalization for flows entering the sewer pipeline.
- Other ancillary facilities such as new onsite pipelines and up to three pumps or pump stations in subsurface vaults (approximately 10 to 20 HP each).

Polymer would be used in the thickening process. Polymer is not classified as a hazardous material. No additional hazardous materials to those described in the Final EIR (page 2-15) would be required. Polymer would be delivered to the Baker WTP approximately one to two times per month. In addition, disposal of the sludge would require approximately two to seven round-trip truck trips per week between the Baker WTP and the landfill. As described in the Final EIR (page 2-12), delivery vehicles would access the Baker site either via Commercentre Drive/Biscayne Bay Drive; or via Palmwood and Wisteria; or via Commercentre Drive/Indian Ocean Drive if and when planned future development on the vacant land north of the Baker site is completed. These access routes are shown in Figure 2-6 of the Final EIR.

As described in the Final EIR (page 2-8), the above ground portions of the Project, which would include the proposed residuals handling facilities, would be designed to be compatible with existing buildings onsite, with an architectural theme that would include concrete masonry unit block walls, steel deck roofs, and aluminum frame doors and windows. The facility designs would attenuate the sound levels of mechanical equipment such that noise levels at the property boundary are in compliance with City of Lake Forest noise ordinances.

In addition to the proposed residuals handling facilities, IRWD has determined that the required size of the emergency overflow pipeline would need to be modified up to 54 inches, instead of 42 inches as previously described on pages 2-8 and 2-12 of the Final EIR. The estimated flow rate of 54 cubic feet per second (cfs) from the discharge structure would remain unchanged.

The energy required to operate the Baker WTP would still be approximately 24.5 million kilowatt hours per year (Final EIR, page 2-16) even with implementation of the proposed modification. However, the existing underground power service provided by SCE would need to be upgraded to provide adequate capacity to feed the loads at the new dewatering building. New underground conduit and wiring would be required. As shown in Figure 1, two new vaults would be installed, one on IRWD property near the Baker site entrance off of Wisteria, and one along Wisteria within the right-of-way (ROW). IRWD would install two 6-inch conduits along Wisteria within the ROW, connecting the two vaults and continuing on to existing SCE facilities at the intersection of Wisteria and Palmwood. SCE would install the cable wiring within the conduits, connecting the Baker site to the existing electrical switch at Wisteria and Palmwood. The total length of conduit and cable wiring would be approximately 650 feet.

4.2 Raw Water Pump Station

The Baker WTP Final EIR included construction of a Raw Water Pump Station (RWPS) located within the Peters Canyon Regional Park in the City of Orange at the site of the existing Baker/Irvine Lake Pipeline Intertie facilities. The RWPS would boost water from the Irvine Lake Pipeline into the Baker Pipeline to convey flow through both pipelines (Final EIR, page 2-4).

SCE currently operates a conduit that supplies electricity to the existing Baker/Irvine Lake Pipeline Intertie facilities. The existing conduit consists of a Cable in Conduit (CIC) assemblage that cannot fully accommodate the proposed RWPS as described in the Baker WTP Final EIR. In order to upgrade the existing CIC system to support pump station activities, approximately 1,100 linear feet of 5-inch PVC conduit and electrical cable would be installed parallel to the existing CIC conduit. The existing CIC conduit would be remain in place. The new conduit would convey electricity to the proposed RWPS from an existing SCE connection at Jamboree Road (see Figure 2).

The proposed conduit alignment would run through coastal sage scrub (CSS) vegetation south of the RWPS, as identified in the Baker WTP Final EIR and in the 2010 Biological Resource Assessment (Final EIR, Appendix C, page 4). The proposed alignment would be bordered by Jamboree Road to the east, Peters Canyon Road to the west, and the RWPS to the north. The proposed alignment would be located on land owned by the County of Orange. This proposed project modification may require SCE to secure an easement from the County of Orange.

4. 3 Construction Methods

The construction equipment that is expected to be present onsite for the duration of construction is described on page 2-14 of the Final EIR, along with the expected number of construction workers. No additional construction equipment or workers would be required due to the proposed modifications. Construction methods also would be similar to that described in the Final EIR, including site clearing, excavation, grading, treatment plant construction, paving, and site restoration.

IRWD would use trench installation construction techniques to install both SCE conduits. Such construction techniques were described in the Final EIR on pages 2-14 and 2-15. Trenching would utilize a conventional cut and cover construction technique which would include trench excavation, conduit installation, electrical cable installation, backfill operations, and re-surfacing to the original condition. All work would be buried, including any vault structures and boxes. Once installed, the disturbed areas would be returned to pre-construction conditions along the entire length of the alignments.

4. 4 Project Phasing and Schedule

Construction of the proposed modifications would proceed simultaneously with construction of all other Baker WTP facilities as described in the Final EIR. The Baker WTP construction phases

would not change due to inclusion of these new Project components. The duration of construction still would be approximately 18 to 24 months.

5.0 Incorporation by Reference

Consistent with Section 15150 of the CEQA Guidelines, the following documents were used in the preparation of this Addendum and are incorporated herein by reference:

- Baker Water Treatment Plant Project Draft Environmental Impact Report, January 2011 (State Clearinghouse No. 2010051055).
- Baker Water Treatment Plant Project Final Environmental Impact Report, April 2011 (State Clearinghouse No. 2010051055).
- Baker Water Treatment Plant Project Final Environmental Impact Report Addendum No. 1, February 2012 (State Clearinghouse No. 2010051055).
- Residuals Handling Alternatives for the Baker Water Treatment Plant, April 2012, Prepared by Carollo Engineers for Irvine Ranch Water District.

These documents are available for review during regular business hours at IRWD located at 15600 Sand Canyon Avenue, Irvine, California 92618-3102.

6.0 Analysis of Potential Environmental Impacts Associated with the Proposed Modifications

The proposed modifications would not change the regulatory framework, impact discussion, mitigation measures, or significance conclusions for the following resource areas as currently described in the adopted Final EIR: Agricultural and Forestry Resources, Air Quality and Greenhouse Gases; Hazards and Hazardous Materials; Hydrology and Water Quality; Public Services and Utilities.

In addition, the proposed modification to the size of the emergency overflow pipeline would not alter any impact discussions, mitigation measures, or significance conclusion as currently described in the adopted Final EIR. Impacts associated with construction of the pipeline, or the physical presence of the pipeline underground, remain unchanged. The proposed discharge rate of 54 cfs into Serrano Creek has not been modified. Therefore, impacts to the creek remain unchanged. As such, this proposed modification is not addressed further in the analyses below.

6.1 Aesthetics

The Final EIR (Chapter 3.1) concluded that potential impacts to aesthetics in the vicinity of the Baker site and the Raw Water Pump Station site would be less than significant after mitigation. This section provides an analysis of the potential aesthetics impacts associated with the proposed residuals handling facilities and conduit installations. There would be no permanent, long-term impacts associated with the proposed conduit alignments as they would be located underground.

6.1.1 Setting

The proposed residuals handling facilities would be located at the Baker site within the boundaries of the existing BFP. The preliminary locations of the facilities are shown in Figure 1. The proposed conduit alignment within the Wisteria ROW is also shown in Figure 1. The Baker site is characterized by the existing treatment facilities associated with the BFP. Surrounding land uses primarily consist of low density residential, public facility, and community park/open space. Existing natural features in the vicinity of the Baker site include Serrano Creek and Serrano Creek Trail. The City of Lake Forest has not designated any scenic roadways or scenic vistas/viewpoints in the area surrounding the Baker site.

The proposed conduit alignment south of the RWPS would be located within Peters Canyon Regional Park, a 354-acre County regional park in the City of Orange (Figure 2). In the vicinity of the RWPS, several City of Orange roadways have scenic qualities and are designated as viewscape corridors. Viewscape corridors are defined as routes that traverse a corridor within which unique or unusual scenic resources and aesthetic values are found. Viewscape corridors include portions of Jamboree Road, Santiago Canyon Road, and Newport Boulevard (City of Orange General Plan, 2009). The proposed conduit alignment would only be visible during construction activities from Jamboree Road and distantly from Santiago Canyon Road. Construction activities would not be visible from Newport Boulevard.

6.1.2 Summary of Potential Impact

As already analyzed in the Final EIR, the Project would introduce new treatment facilities onsite at the BFP that would be visible from surrounding streets, including hilltop residential units located east of the Baker site. There are no scenic highway corridors or City-designated scenic vistas in the vicinity of the Baker site. The proposed Baker WTP would replace existing water treatment facilities within the same general footprint of the existing BFP. The aboveground Baker WTP facilities would be designed to be similar to and compatible with existing buildings onsite. In addition, implementation of Mitigation Measure AES-1 would ensure that a landscape plan is implemented to screen Project facilities from neighboring streets and that landscape vegetation is maintained onsite to the extent feasible to screen Project facilities from scenic views from hilltop residences. Thus the Project would not introduce a new contrasting feature that would affect scenic vistas or alter the visual character of the site.

The proposed modification would add residuals handling facilities at the Baker site and a conduit alignment within the Wisteria ROW. The residual handling facilities would be designed to be compatible with other Project buildings and would not alter the visual character of the site. Mitigation Measure AES-1 as included in the Final EIR also would apply to the proposed residuals handling facilities. As a result, the proposed aboveground structures would be screened by vegetation to the fullest extent possible to preserve scenic views from surrounding and hilltop residences. Impacts would be less than significant with mitigation.

Construction activities associated with installation of the Wisteria conduit alignment would temporarily introduce construction equipment into the roadway. However, similar to the impacts associated with the treated water pipeline and sewer pipeline analyzed in the Final EIR, the

proposed conduit alignment would be below ground and would not impact a scenic vista (Final EIR, page 3.1-9).

The proposed SCE conduit and cable alignment south of the RWPS similarly would be constructed entirely below ground and would not alter the permanent visual character of the site or surroundings. There would be no new permanent above ground structures that would compromise scenic views or viewscape corridors. Mitigation Measures AES-2 as included in the Final EIR would apply to the proposed RWPS conduit alignment, requiring restoration of the area disturbed during construction to reestablish pre-existing conditions including native plantings. Impacts to scenic viewscape corridors would be less than significant with mitigation.

The Final EIR also analyzed potential light and glare impacts resulting from permanent security lighting at the proposed Baker WTP. Implementation of Mitigation Measure AES-3 included in the Final EIR would ensure lighting would be shielded and directed downward away from neighboring properties and land uses. The proposed modification also would require nighttime security lighting on the residuals handling facilities and would be subject to Mitigation Measure AES-3. Impacts would be less than significant with mitigation.

6.1.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the Mitigation Monitoring and Reporting Program (MMRP). Impacts to aesthetics would be less than significant with mitigation.

6.2 Biological Resources

The Final EIR (Chapter 3.4) assessed potential impacts to biological resources and concluded that construction of the Project would have a less than significant impact with the incorporation of mitigation. The following discussion addresses potential impacts of the modified Project.

6.2.1 Setting

The proposed residuals handling facilities would occur within already disturbed areas of the Baker site, which consists of water treatment structures, pavement, and ornamental landscaping. The proposed Wisteria conduit alignment would be installed primarily within the ROW of Wisteria adjacent to the Baker site, with a small portion installed on the Baker site. The Baker site is surrounded by urban development with the exception of Serrano Creek, which borders the site to the east. Common wildlife includes species adapted to urban environments. The Baker site is not considered a wildlife movement corridor and is designated as Non-Reserve Lands in the Orange County Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP).

The proposed RWPS conduit alignment would traverse CSS habitat previously evaluated in the 2010 Biological Resource Assessment as native habitat with varying degrees of disturbance (2010 Biological Resource Assessment, page 5). The RWPS site and surroundings are not considered a

wildlife movement corridor; however, the site is designated as Reserve Lands in the Orange County NCCP/HCP (Final EIR, page 3.4-8).

6.2.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of the Project to biological resources in and around the Baker site. Mitigation measures were adopted that would ensure construction and operation of the Baker WTP does not adversely affect special-status bird species (BIO-3 and BIO-4), neighboring riparian habitat in Serrano Creek and sensitive natural communities (BIO-6 and BIO-7), or jurisdictional wetlands in Serrano Creek (BIO-8 and BIO-9), or conflict with local biological resource policies such as the City of Lake Forest tree preservation policies (BIO-10).

The proposed modification would add residuals handling facilities to the Baker WTP within the boundaries of the existing Baker site. The proposed component would be constructed simultaneously with the other components of the Baker WTP. Potential impacts associated with this proposed modification would be similar to those already described in the Final EIR at the Baker site. With implementation of Mitigation Measures BIO-3, BIO-4, BIO-6, BIO-8, BIO-9, and BIO-10, impacts associated with the proposed residuals handling facilities would be less than significant.

Installation of the Wisteria conduit alignment would occur using trench installation construction techniques as described in the Final EIR (pages 2-14 and 2-15). Trenching would utilize a conventional cut and cover technique that would include trench excavation, conduit installation, backfill operations, and re-surfacing to the original condition. The proposed conduit installation would occur primarily within the already-disturbed Wisteria ROW, with a small portion installed on a portion of the Baker site characterized by ornamental landscaping (Final EIR, Figure 3.4-1). Implementation of the conduit alignment within the paved Wisteria ROW would not result in additional impacts to biological resources. Potential impacts at the Baker site associated with the proposed conduit installation would be similar to those already described in the Final EIR. With implementation of Mitigation Measures BIO-3, BIO-4, BIO-6, BIO-8, BIO-9, and BIO-10, impacts would be less than significant.

The Final EIR assessed the potential impacts of the Project to biological resources in and around the RWPS site. Mitigation measures were adopted to ensure construction and operation of the RWPS would not adversely affect special-status bird species (BIO-3 and BIO-4). Installation of the proposed SCE conduit would occur within and near vegetation with the potential to host nesting song birds (Final EIR, page 3.4-20). Mitigation Measures BIO-3 and BIO-4 would reduce potential impacts to breeding and nesting birds to a level of less than significance.

In addition, installation of the conduit would have direct temporary impacts to CSS habitat during construction, similar to those already evaluated for other Project pipelines in the Final EIR. The Final EIR identified potential temporary impacts to sensitive natural communities, particularly CSS, associated with installation of treated water pipelines near the Baker site. Mitigation Measure BIO-5 would apply to the RWPS conduit installation, requiring restoration of disturbed CSS habitat at a 1:1 ratio. As a result, impacts to sensitive natural communities would be less than significant with mitigation.

The proposed RWPS conduit alignment also is located on lands designated as Reserve Lands in the Orange County NCCP/HCP (Final EIR, page 3.4-8). Thus, temporary impacts to CSS habitat within Reserve Lands would occur during construction of the RWPS conduit alignment. IRWD, the County of Orange, and SCE are all Participating Landowners in the NCCP/HCP. Participating Landowners provide land and/or funding to support creation of the Reserve System and/or implementation of the Adaptive Management Program (County of Orange, 1996: NCCP/HCP, page II-162). The NCCP/HCP authorizes incidental take of CSS habitat by Participating Landowners for covered activities such as public utilities, regardless of the number of species, if any, occupying the area (County of Orange, 1996: NCCP/HCP EIR/EIS, pages 6-11 to 6-13). For Participating Landowners, impacts within Reserve Lands are considered to be fully mitigated due to the creation of the permanent habitat Reserve System and implementation of the Adaptive Management Program. The proposed RWPS conduit alignment would not conflict with the NCCP/HCP or require any additional mitigation for temporary impacts to CSS habitat or associated special-status species.

6.2.3 Conclusion

The proposed modifications would not result in a new significant impact not previously identified in the Final EIR, nor would it substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to biological resources would be less than significant with mitigation.

6.3 Cultural Resources

The Final EIR (Chapter 3.5) assessed potential impacts to cultural resources and concluded that construction of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.3.1 Setting

The Project area is located in an area between an elevated coastal terrace and the Santa Ana Mountains. The majority of the Project area has been previously developed and is disturbed. The Baker site has been associated with prehistoric and historic settings as documented in the Final EIR (p. 3.5-2 through 3.5-5). Archaeological and paleontological surveys of the Baker site and the RWPS site were conducted in 2009. The surveys noted that much of the sites were highly disturbed. No cultural or paleontological resources were observed during the course of the field surveys.

6.3.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of ground disturbance due to construction of the Project, including the Baker WTP and the RWPS, and determined that, with implementation of mitigation, impacts to cultural resources, including archaeological, paleontological, and historic resources would be less than significant. Construction activities could unearth, expose, or disturb subsurface archaeological or paleontological resources. The Final EIR determined that due to the large number of prehistoric archaeological sites in close proximity to the Baker site and RWPS site, and the Baker site's location along a reliable water source, the areas have some

archaeological sensitivity. With implementation of Mitigation Measures CUL-1, CUL-2, CUL-3 and CUL-4, the potential impacts to cultural resources would be mitigated to less than significant levels.

The proposed modifications would add residuals handling facilities to the Baker WTP within the boundary of the area of potential effect already surveyed and analyzed in the Final EIR. The proposed modifications also would include a new conduit alignment within the Wisteria ROW and a small portion of the Baker site. The proposed components would be constructed simultaneously with the other components of the Baker WTP. Impacts similar to those already evaluated for the Project have potential to occur due to construction of these proposed components. Mitigation Measures CUL-2, CUL-3 and CUL-4 would apply to the proposed residuals handling facilities and Wisteria conduit alignment and would reduce impacts to cultural resources to less than significant levels.

Installation of the RWPS conduit alignment would occur parallel to an existing CIC route. Construction activities would unearth soils that already have been excavated, reducing the likelihood of cultural resource exposure or disturbance. Impacts similar to those already evaluated for the Project have potential to occur due to construction of this proposed component. Mitigation Measures CUL-1, CUL-2, CUL-3 and CUL-4 would apply to the RWPS conduit alignment, reducing impacts to cultural resources to less than significant levels.

6.3.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to cultural resources would be less than significant with mitigation.

6.4 Geology, Soils and Mineral Resources

The Final EIR (Chapter 3.6) assessed potential impacts associated with geologic events and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.4.1 Setting

The Baker site is located generally in a seismically active area, but there are no known Alquist-Priolo fault zones in the vicinity of the Project. The closest faults to the Baker site are the Newport-Inglewood and Elsinore faults. The Baker site is also not in an area considered susceptible to landslides or liquefaction. There are no Mineral Resources Zones in the vicinity of the Baker site.

The RWPS site is located near one active fault, the Elsinore fault, and two potentially active faults, the Peralta Hills fault and the El Modena fault. With no recent record of activity, neither is anticipated to be capable of generating significant earthquakes. The RWPS site is also not in an

area considered susceptible to landslides or liquefaction. There are no Mineral Resources Zones in the vicinity of the RWPS site.

6.4.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of Project implementation associated with geologic hazards and seismic events, including seismic ground shaking, landslides and liquefaction, subsidence, expansive soils, and erosion. None of the Project components would be located in an area considered susceptible to landslides. Construction of all Project components would involve grading, trenching, and excavation activities that may reduce soil cohesion. Implementation of Mitigation Measure GEO-1 would ensure best management practices for soil erosion and sediment control, and would reduce potential impacts to a less than significant level. Resurfacing disturbed areas with asphalt also would minimize erosion at the Baker site during treatment plant operation to less than significant levels. The upper area of the Baker site has a gradual slope of approximately 60 feet to the south and west, with the toe of the slope bordering residential properties. The Baker WTP facilities would be built in accordance with the required California Building Code slope setback requirements to eliminate the risk for slope failure. In addition, Mitigation Measure GEO-2 requires a geotechnical investigation for all Project components to identify site-specific design criteria to mitigate potential geologic hazards, such as slope failure, liquefaction, subsidence, and expansive soils. With the implementation of Mitigation Measures GEO-1 and GEO-2, Project impacts would be reduced to less than significant levels.

The proposed modifications would add residuals handling facilities to the Baker WTP within the existing boundaries of the Baker site. The proposed component would be constructed simultaneously with the other components of the Baker WTP. Construction of the Wisteria conduit alignment would occur primarily within the already-disturbed Wisteria ROW and a small portion of the Baker site. Once installed, the disturbed area of the ROW would be returned to its previous condition along the entire length of the alignment. Installation of the RWPS conduit alignment would occur parallel to an existing conduit in soils that have been previously disturbed. Similarly, once constructed, the disturbed area would be restored to pre-construction conditions. Construction-related impacts to erosion and sedimentation associated with the residuals handling facilities and both SCE conduit alignments would be similar to those already evaluated for the other Baker WTP components. Impacts associated with liquefaction, landslides, subsidence, and expansive soils also would be similar to those already evaluated in the Final EIR. No new operational impacts would occur. Implementation of GEO-1 and GEO-2 would reduce impacts associated with the proposed modifications to less than significant levels.

6.4.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to geology, soils and mineral resources would be less than significant with mitigation.

6.5 Land Use, Planning and Recreation

The Final EIR (Chapter 3.9) assessed potential impacts to land use and recreational resources and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.5.1 Setting

The proposed residuals handling facilities would be located at the Baker site in the City of Lake Forest. As described in the Final EIR, the land use designation at the Baker site is Public Facility, and the zoning designation is General Agriculture. The proposed Wisteria conduit alignment would start at the Baker site and run within the Wisteria ROW.

The proposed RWPS conduit alignment would be located within Peters Canyon Regional Park on land designated as Open Space Park by the City of Orange, similar to the RWPS site as described in the Final EIR. The associated zoning designation is Recreation Open Space. Although the proposed conduit and cable would be installed parallel to an existing CIC, there currently is no utility easement associated with these facilities. Thus, installation of the RWPS conduit alignment may require SCE to acquire an easement from the landowner, which is the County of Orange.

6.5.2 Summary of Potential Impact

The Final EIR determined that development of the Baker WTP at the Baker site would not conflict with applicable land use plans, policies, or regulations. Development of the Baker WTP would be consistent with the Public Facilities land use designation, which allows public utility land uses. Water facilities are not subject to city building or zoning ordinances, per Government Code 53091. Therefore, a site development permit would not be required for development of the Baker WTP in the General Agriculture zone (Final EIR, page 3.9-7). As part of the Baker WTP, the proposed residuals handling facilities also would be consistent with land use and zoning designations. Impacts would be less than significant.

The proposed Wisteria conduit alignment would be installed primarily within the roadway ROW. Wisteria is a private road; however, IRWD has a utility and access easement within the Wisteria ROW. There would be no conflict with applicable land use plans, policies, or regulations, and there would be no effect to recreational facilities.

The proposed RWPS conduit alignment may require acquisition of an easement from the County of Orange prior to installation. Once installed, the conduit would be underground and would not conflict with the Open Space Park land use, which allows for passive and active recreation. There would be no long-term effect to the surrounding recreational facility or recreational uses. The Recreation Open Space zone allows public/private utility buildings and structures as a conditional use. The proposed conduit thus would be consistent with such zoning designations, which may require a conditional use permit, if applicable to SCE. Impacts would be less than significant.

6.5.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to land use and recreation due to Project modifications are less than significant.

6.6 Noise

The Final EIR (Chapter 3.10) assessed potential impacts to sensitive receptors due to Project noise and vibration and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.6.1 Setting

As described in the Final EIR, the Baker site is adjacent to residential land uses. The nearby residences qualify as noise sensitive receptors and would potentially be exposed to noise generated from Project activities. Construction activities at the Baker site would get as close as 100 feet to residential units located on Wisteria and Forestwood. The Wisteria conduit alignment could be as close as 30 feet to neighboring residential units (Figure 1).

As described in the Final EIR, the proposed RWPS would be located near Peters Canyon Reservoir, approximately 1,190 feet south of the nearest sensitive receptor. The RWPS conduit alignment would be even further from such receptors, as the conduit would be installed south of the pump station site (Figure 2).

6.6.2 Summary of Potential Impact

Construction activities would create a temporary increase in ambient noise levels in the immediate vicinity of the construction zone. Noise-related construction impacts at the Baker site, the RWPS site, and within adjacent neighborhoods are described in the Final EIR. Table 3.10-1 shows that the greatest noise levels are associated with excavation and finishing and would be 89 dBA at a distance of 50 feet. Accordingly, attenuated at 100 feet, the closest residences to the Baker site would experience noise levels up to 83 dBA Leq during finishing and excavation, the loudest construction activities that would occur. The Final EIR evaluated the effects of construction noise on sensitive receptors approximately 30 feet from offsite pipeline installations. With implementation of Mitigation Measures NOISE-1 and NOISE-2, potential construction noise impacts on sensitive receptors would be mitigated to less than significant levels. Mitigation to be implemented includes restrictions on days and times for construction activities in accordance with the City of Lake Forest Noise Ordinance and use of noise control techniques.

The Final EIR also assessed noise resulting from construction of the RWPS. The nearest sensitive receptor to the facility is located approximately 1,190 feet to the north. Accordingly, attenuated at 1,190 feet, these residences would experience noise levels of up to 61 dBA Leq during finishing and excavation, the loudest of construction activities that would occur. The Final EIR determined

that construction of the RWPS would be inaudible to the nearest sensitive receptors (Final EIR, page 3.10-10). Noise impacts would be less than significant without mitigation.

The proposed modifications would add residuals handling facilities to the Baker WTP at the Baker site. The proposed component would be constructed simultaneously with the other components of the Baker WTP. Construction noise impacts would be similar to those already described in the Final EIR. Construction of the residuals handling facilities would not require additional or different equipment or methods. Implementation of Mitigation Measures NOISE-1 and NOISE-2 would reduce construction noise impacts to less than significant levels.

The proposed Wisteria conduit alignment also would result in construction noise impacts similar to those analyzed in the Final EIR for the offsite sewer pipeline. Similar to the pipelines, an average of 50 to 100 feet of conduit would be installed per day; therefore sensitive receptors would be exposed to conduit construction noise only for up to two weeks. With implementation of Mitigation Measures NOISE-1 and NOISE-2 identified in the Final EIR, potential construction noise impacts on sensitive receptors would be mitigated to less than significant levels.

Construction of the RWPS conduit alignment would occur south of the pump station site, further away from the nearest sensitive receptors. As such, noise impacts due to construction of the conduit would be less than those already described in the Final EIR. Construction-related noise would be inaudible to sensitive receptors. Impacts would be less than significant without mitigation.

For operational noise, the Project would be designed to attenuate sound levels of mechanical equipment such that noise levels at the Baker site boundary are in compliance with the City of Lake Forest Noise Ordinance (11.16.040 Exterior Noise Standards), and noise levels at the RWPS site are in compliance with the City of Orange Noise Ordinance (8.24.050 Exterior Noise Standards). At the boundary with adjacent residential properties, noise levels would not exceed 55 dBA between the hours of 7:00 a.m. and 10:00 p.m. or 50 dBA between the hours of 10:00 p.m. and 7:00 a.m. Implementation of Mitigation Measure NOISE-3 would ensure that Project operation does not exceed noise standards by requiring post-construction noise monitoring to confirm compliance with standards at the property boundary. Impacts would be reduced to less than significant levels with mitigation.

Operation of the proposed residuals handling facilities would generate noise that would contribute to the cumulative noise level associated with operation of the entire Baker WTP. The proposed modified Project would be designed to attenuate the sound levels of all mechanical equipment such that noise levels at the property boundary are in compliance with the City's noise ordinances. Implementation of Mitigation Measure NOISE-3 would ensure such compliance is attained. Impacts associated with the proposed modification would be less than significant with mitigation. Once constructed and operational, there would be no noise impacts associated with either the Wisteria or RWPS conduit alignments since they would be underground. No mitigation is required.

6.6.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to sensitive receptors associated noise and vibration are less than significant with mitigation.

6.7 Transportation and Traffic

The Final EIR (Chapter 3.12) assessed potential impacts to transportation and traffic and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.7.1 Setting

The Baker site is located in southern Orange County in the City of Lake Forest. The RWPS site is located in the City of Orange. The regional and local transportation system is comprised of an interconnected network of roadways, local transit systems, and pedestrian and bicycle facilities. Construction and operational vehicles would access the Baker site either via Commercentre Drive/Biscayne Bay Drive; or via Palmwood and Wisteria; or via Commercentre Drive/Indian Ocean Drive if and when planned future development on the vacant land north of the Baker site is completed. Construction and operational vehicles would access the RWPS site from Jamboree Road.

6.7.2 Summary of Potential Impact

As described in the Final EIR (p. 2-12), construction and operational vehicles would access the Baker site from surrounding roadways. The access routes are shown in Figure 2-6 of the Final EIR. Hauling and delivery of materials would require approximately 500 truck trips over the 18- to 24-month construction period. Up to 60 workers per day would be required onsite. Construction vehicles could result in short-term, intermittent lessening of roadway capacities due to slower moving vehicles and the larger turning radii of certain trucks as compared to passenger vehicles. Construction vehicles would access the Baker site via Commercentre Drive and Biscayne Bay Drive to the north on a paved road that currently traverses the undeveloped site. Construction traffic would not affect circulation in residential areas along Wisteria. Construction staging and parking would be located onsite at the Baker site and would not affect traffic on surrounding roadways or affect emergency access. Impacts to traffic due to construction would be less than significant.

Once constructed, access to the Baker WTP would be from Biscayne Bay Drive to the north and Wisteria to the south. If and when the planned future development north of the Baker site is completed, the northern access point to the Baker WTP would be Indian Ocean Avenue instead of Biscayne Bay Drive (see Final EIR, Figure 2-5). On average, operational traffic would include up to three worker entries per day and up to 20 deliveries per month. Access from Wisteria requires a 90-degree turn onto the Baker WTP property. This access point is feasible for some delivery trucks and IRWD staff vehicles; the entry point for large delivery trucks would be from the north.

Due to the limited number of trips associated with operations of the plant, traffic and circulation on Biscayne Bay Drive and Palmwood/Wisteria would not be significantly impaired.

The proposed modifications would add residuals handling facilities to the Baker WTP at the Baker site. The proposed facilities would be constructed simultaneously with the other components of the Baker WTP and would not require additional workers or result in a substantial increase in the number of hauling and delivery trucks over the 18- to 24-month construction period. Construction-related impacts to traffic and circulation would be similar to those already described for the Baker WTP in the Final EIR. Impacts would be less than significant without mitigation.

The proposed modifications also would include a SCE conduit alignment within the ROW of Wisteria. Potential traffic impacts related to the construction of the SCE conduit alignment would be similar to construction impacts described in the Final EIR (p. 3.12-9). The treated water pipeline alignments analyzed in the Final EIR would affect Wisteria and other private streets adjacent to the Baker site. The conduit alignment would be installed in the Wisteria ROW and would temporarily slow traffic serving the local residential community. Mitigation Measure TR-1 would require a Traffic Control/Traffic Management Plan to be implemented during construction. The Plan would require at least one lane of traffic and access to driveways to be maintained within the street at all times. As a result, the temporary impacts to traffic would be less than significant with mitigation.

Once constructed, disposal of the sludge produced from the residuals handling facilities would require approximately two to seven round-trip truck trips per week between the Baker WTP and the landfill. Polymer would be delivered approximately one to two times per month. No additional staff would be required to operate the Baker WTP due to the addition of the residuals handling facilities. Operational vehicles would access the Baker WTP site by means of the aforementioned site entry points. Once constructed, operation of the Wisteria conduit alignment would be underground and would not affect traffic or circulation in the project vicinity. The vehicle trips associated with the proposed modification would not have a significant impact on local and regional traffic or circulation. No additional traffic impacts would occur. Impacts would be less than significant without mitigation.

As discussed in the Final EIR, construction vehicles would access the RWPS site without affecting local roadways or causing lane closures (Final EIR, page 3.12-10). Traffic impacts associated with construction of the RWPS conduit alignment would be to those already described in the Final EIR. Construction of the proposed RWPS conduit alignment would not affect local roadway circulation; all construction staging and parking would occur onsite. Operation of the RWPS conduit and cable also would not adversely affect local traffic and circulation. Impacts would be less than significant.

6.7.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the

existing commitments contained within the MMRP. Impacts to transportation and traffic are less than significant with mitigation.

7.0 Summary of Environmental Effects

As discussed in this Addendum No. 2, the proposed modifications would not change the conclusions of the certified Final EIR and Addendum No. 1. The construction and operation of the proposed residuals handling facilities would meet the same objectives of improving water reliability to areas of south Orange County, providing a reliable local water supply in the event of emergency conditions or scheduled maintenance of the MWD delivery system; and increased operational flexibility by creating redundancy within the raw water supply system.

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. The proposed modifications to the previously-approved Project do not meet any of the conditions that would require the preparation of a subsequent or supplemental EIR as set forth in Sections 15162 and 15163 of the CEQA Guidelines.

8.0 Determination

Section 15164(a) of the CEQA Guidelines states the following:

> The lead agency or responsible agency shall prepare an addendum to a previously certified EIR if some changes or additions are necessary but none of the conditions described in Section 15162 calling for the preparation of subsequent EIR have occurred.

The proposed modifications to the original Project would not result in new significant environmental effects or a substantial increase in the severity of previously identified significant effects. Furthermore, new information associated with the proposed modifications does not indicate that: the Project will have one or more significant effects not discussed in the adopted Final EIR; significant effects previously examined will be substantially more severe than shown in the adopted Final EIR; mitigation measures or alternatives previously found not to be feasible would in fact be feasible; or mitigation measures or alternatives which are considerably different from those analyzed in the adopted Final EIR would substantially reduce one or more significant effects on the environment, but the Project proponents decline to adopt the mitigation measures or alternative. Accordingly, an addendum has been prepared as opposed to a supplemental or subsequent EIR. IRWD is adopting this Addendum No. 2 in accordance with the CEQA Guidelines Section 15164.

Irvine Ranch Water District

Signature	3/11/13 Date
Jo Ann Corey Printed Name	Engineering Technician III Title

Easements

Doc. No. E1958

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Ray Thatcher, District R/W Agent
Irvine Ranch Water District
15600 Sand Canyon Avenue
P. O. Box 57000
Irvine, California 92619-7000
IRWD Doc. E 1958

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GRANT OF EASEMENT
TO
IRVINE RANCH WATER DISTRICT
BY
SERRANO HIGHLANDS MASTER ASSOCIATION

FOR VALUABLE CONSIDERATION, receipt of which is hereby acknowledged, SERRANO HIGHLANDS MASTER ASSOCIATION, a California non-profit mutual benefit corporation ("Owner" herein), hereby grants and conveys to IRVINE RANCH WATER DISTRICT, a California Water District organized under and existing pursuant to Section 34000 et seq. of the California Water Code, ("Grantee" herein), a perpetual, non-exclusive easement and right-of-way for water pipeline and access purposes. This easement shall include, but not by way of limitation, the right to construct, reconstruct, remove and replace, renew, inspect, maintain, repair, improve, and otherwise use the hereinafter described property for these purposes, together with incidental appurtenances and connections, in, over, under, upon, along, through and across the real property located in the City of Lake Forest, County of Orange, State of California, as described in Exhibit "A" and depicted in Exhibit "B", which exhibits are attached hereto and made a part hereof (the "Easement Area"), as necessary in connection with the use, operation and maintenance of the facilities lying within the Easement Area. This easement shall also include the right to construct, reconstruct, remove and replace, renew, inspect, maintain, repair, improve and otherwise use parallel or any other facilities or appurtenances of the same general type and purpose as the originally installed facilities (collectively, the originally installed facilities and any such parallel or other facilities, and any replacements, renewals, repairs and improvements of any of the foregoing are collectively referred to as the "Facilities").

Subject to: Covenants, conditions, restrictions, easements, rights, rights-of-way and encumbrances of record.

A. Rights of Owner to Use Easement Area:

1. Rights of Use. Subject to the provisions of Paragraph A-2 below, it is understood and agreed that the easements and rights-of-way acquired herein are also acquired subject to the rights of the Owner to use the Easement Area for any purpose whatsoever to the extent that such use does not interfere with the Grantee's use of its easement. The Owner retains the rights which are not inconsistent with the easement. Such use by the Owner shall include, but not be limited to, the compatible use for streets, roadways, pipelines, fences or block walls, cuts, fills or other structures or other compatible improvements under, upon, over, and across the Easement Area.

Project	Lot C, Tract 11279
Title Company	none
Title Report No.	Vesting deed Inst. No. 84-200866
Project Engineer	RBF Consulting

2. Concurrence of Grantee. Such use by the Owner of the Easement Area for landscaping purposes which do not involve the erection of structures or other improvements upon the Easement Area and which are consistent with the Grantee's use of the easement may be made without notification to or concurrence of Grantee except that no trees shall be planted in said Easement Area without the prior written consent of Grantee. Further, such use by the Owner of the Easement Area for roadway improvements, which do not result in cuts closer than three (3) feet above the top of Grantee's Facilities or fills greater than two (2) feet above the existing ground may be made without notification to or concurrence of Grantee. It is agreed, however, that no such use for any other purposes shall be made until plans for such proposed use by Owner have been reviewed with or submitted to Grantee, and Grantee has concurred that such proposed use will be consistent with Grantee's use of the Facilities. If Grantee fails to provide objection in writing to any such proposed use by the Owner within ten (10) days after plans for the proposed use have been submitted to Grantee, such proposed use shall be deemed concurred in by Grantee. Grantee agrees that it shall not unreasonably withhold its concurrence.

B. Successors and Assigns:

This Grant of Easement shall be binding upon and inure to the benefit of the successors and assigns of Owner and Grantee.

C. Acceptance and Recordation:

Grantee agrees, by acceptance and recordation of this Grant of Easement from Owner, that the terms and conditions herein set forth shall be binding upon and inure to the benefit of Grantee.

IN WITNESS WHEREOF this Grant of Easement has been executed this 20 day of September, 2012

"Owner"

SERRANO HIGHLANDS MASTER ASSOCIATION,
a California non-profit mutual benefit corporation

By _____
Title: PRESIDENT

By _____
Title: PRESIDENT

Project	Lot C, Tract 11279
Title Company	none
Title Report No.	Vesting deed Inst. No. 84-200866
Project Engineer	RBF Consulting

FORM SF (5-2003)
Wesmt-SerranoHOA.docx

NOTARY ACKNOWLEDGEMENT

STATE OF CA)
)
COUNTY OF ORANGE)

On Sept 20, 2012, before me, Sharyl Marie Ratkovic, Notary Public
a Notary Public in and for said State, personally appeared Lee Tracy
_____,

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

SHARYL MARIE RATKOVIC
Commission # 1951656
Notary Public - California
Orange County
My Comm. Expires Sep 11, 2015

Notary Public in and for said State

(SEAL)

Project	Lot C, Tract 11279
Title Company	none
Title Report No.	Vesting deed Inst. No. 84-200866
Project Engineer	RBF Consulting

FORM SF (5-2003)
Wesmt-SerranoHOA.docx

GOVERNMENT CODE 27361.7

I certify under penalty of perjury that the notary seal on the document to which this statement is attached read as follows:

NAME OF THE NOTARY: SHARYL MARIE RATKOVIC

DATE COMMISSION EXPIRES: SEP. 11, 2015

COUNTY WHERE BOND IS FILED: ORANGE

COMMISSION NUMBER: 1951856

MANUFACTURER/VENDER NUMBER: NNA1

PLACE OF EXECUTION : ~~LAGUNA~~ HILLS **DATE:** 10/10/12

SIGNATURE: [signature]

I certify under penalty of perjury and the laws of the State of California that the illegible portion of this document to which this statement is attached reads as follows:

Place of Execution _____ **Date** _____

Signature _____

IRVINE RANCH WATER DISTRICT

CERTIFICATE OF ACCEPTANCE

This is to certify that the interest in real property conveyed by deed or grant dated September 20, 2012 from SERRANO HIGHLANDS MASTER ASSOCIATION, a California non-profit mutual benefit corporation to IRVINE RANCH WATER DISTRICT, a California Water District, is hereby accepted by the undersigned officer on behalf of the Board of Directors pursuant to authority conferred by Resolution 1965-36 of the Board of Directors, adopted on October 6, 1965, and the grantee consents to recordation thereof by its duly authorized officer.

Date: 9/27/12

IRVINE RANCH WATER DISTRICT

By: Leslie Bonkowski
Leslie Bonkowski
Secretary to Board of Directors

IRVINE RANCH WATER DISTRICT
FORMED
JAN. 23, 1961
CALIFORNIA

Project	Lot C, Tract 11279
Title Company	none
Title Report No.	Vesting deed Inst. No. 84-200866
Project Engineer	RBF Consulting

FORM SF (5-2003)
Wesmt-SerranoHOA.docx

EXHIBIT "A"

WATER PIPELINE EASEMENT TO IRVINE RANCH WATER DISTRICT FROM SERRANO HIGHLANDS MASTER ASSOCIATION (APN 610-182-22)

LEGAL DESCRIPTION

That certain parcel of land situated in the City of Lake Forest, County of Orange, State of California being that portion of Lot C of Tract No. 11279 as shown on a map thereof filed in Book 493, Pages 14 through 21 of Miscellaneous Maps in the Office of the County Recorder of said County described as follows:

BEGINNING at the most southerly corner of said Lot C; thence along southwesterly line of said lot North 31°44'53" West 4.59 feet; thence North 20°43'59" East 53.58 feet to the northeasterly line of said lot; thence along said northeasterly line South 31°44'53" East 25.21 feet to the northwesterly line of Parcel B as described in Grant of Easement to Los Alisos Water District recorded December 15, 1975 in Book 11595, Page 213 of Official Records in said Office of the County Recorder; thence along said northwesterly line South 20°43'59" West 19.72 feet to the southeasterly line of said Lot C; thence along said southeasterly line South 58°15'07" West 26.86 feet to the **POINT OF BEGINNING**;.

CONTAINING: 795 square feet, more or less.

SUBECT TO: Covenants, conditions, reservations, restrictions, rights-of-way, and easements of record, if any.

EXHIBIT "B" attached hereto and by this reference made a part hereof.

Prepared by me or under my direction:

Dated: August 21, 2012

Gregory P. Heiertz, R.C.E. 33084
License expires June 30, 2014

REGISTERED PROFESSIONAL ENGINEER
GREGORY P. HEIERTZ
NO. C33084
EXP. 6-30-14
CIVIL
STATE OF CALIFORNIA

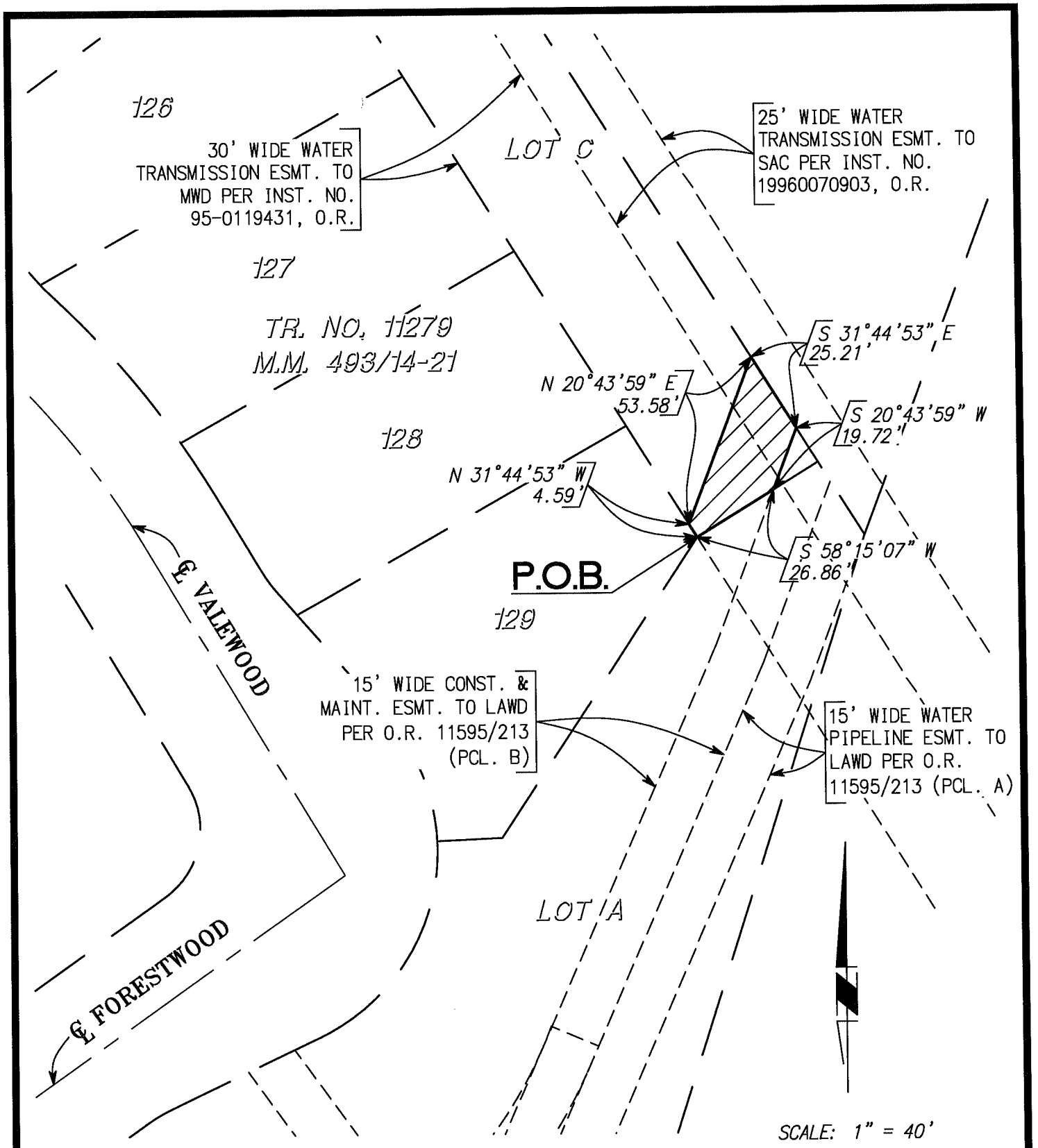

EXHIBIT "B"

SKETCH TO ACCOMPANY A LEGAL DESCRIPTION FOR

EASEMENT AREA = 795 S.F.±

SHEET 1 OF 1 SHEET

WATER PIPELINE EASEMENT TO IRVINE RANCH WATER DISTRICT FROM SERRANO HIGHLANDS MASTER ASSOCIATION

(APN 610-182-22)

IRVINE RANCH WATER DISTRICT

15600 SAND CANYON AVENUE, IRVINE, CA 92619

AUGUST 21, 2012

PROJECT 11218 (1417)

EXBPLAT.DWG

Addendum No. 2

BAKER WATER TREATMENT PLANT PROJECT

Environmental Impact Report
(State Clearinghouse No.2010051055)

Prepared for
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

March 2013

ESA

Addendum No. 2

BAKER WATER TREATMENT PLANT PROJECT

Environmental Impact Report
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Prepared for
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

March 2013

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Oakland

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Portland

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Santa Cruz

Seattle

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Woodland Hills

211448.01

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BAKER WATER TREATMENT PLANT PROJECT

Final Environmental Impact Report Addendum No. 2

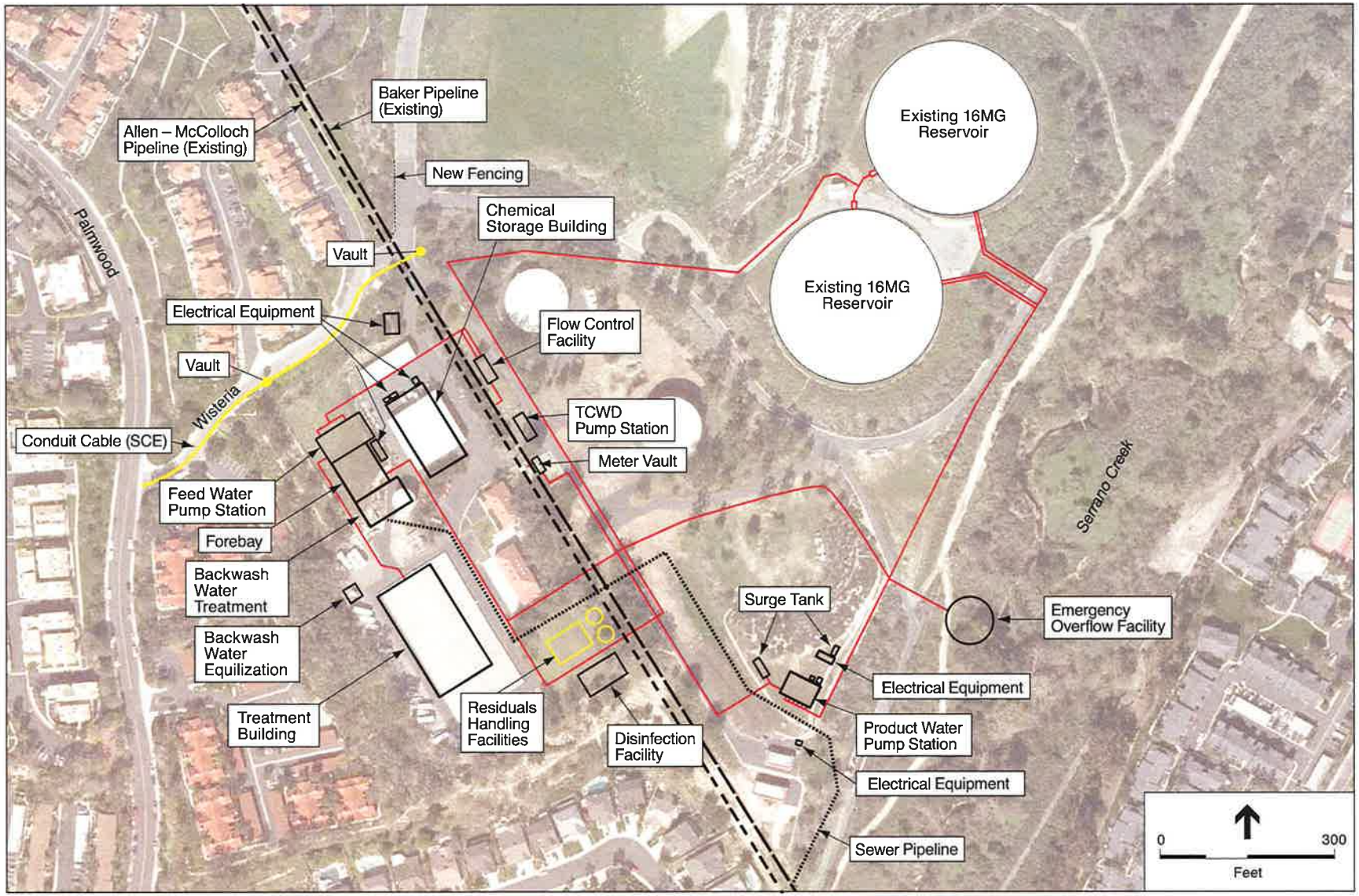
1.0 Introduction

The Irvine Ranch Water District (IRWD) proposes to modify the Baker Water Treatment Plant (WTP) Project. The proposed modifications include an addition to the treatment process at the Baker WTP and two new electrical conduit alignments necessary for Southern California Edison (SCE) to service the Project. The treatment process at the Baker WTP would be modified to include new residuals handling facilities that would allow residuals processing to occur onsite at the Baker WTP rather than at Los Alisos Water Recycling Plant (LAWRP) as previously planned. **Figure 1** shows the approximate location of the new residuals handling facilities at the Baker site. Figure 1 also shows the approximate location of the first proposed SCE conduit alignment. **Figure 2** shows the approximate location of the second proposed SCE conduit alignment south of the Raw Water Pump Station. The potential environmental effects of the proposed modifications to the Project are addressed in this Addendum No. 2 to the Baker WTP Project Final Environmental Impact Report (EIR) (SCH # 2010051055). All other planned Baker WTP facilities and Project objectives outlined in the Final EIR and Addendum No. 1 remain unchanged. The proposed modifications do not affect the changes to the Project that were analyzed in Addendum No. 1.

IRWD has prepared this Addendum pursuant to the California Environmental Quality Act (CEQA) Guidelines Section 15164, to describe the modifications to the Project and to evaluate whether the modifications present any new significant impacts not identified in the previously certified Final EIR and Addendum No.1 that would require preparation of a subsequent or supplemental EIR. As documented in the analysis presented below, the proposed modifications would not result in substantial changes that warrant preparation of a subsequent or supplemental EIR pursuant to Sections 15162 and 15163 of the CEQA Guidelines.

2.0 Project Background

In April of 2011, the IRWD Board of Directors certified the Baker WTP Project Final EIR. The Final EIR evaluated the environmental effects of constructing and operating a new potable water treatment facility in the City of Lake Forest at the location of the former Baker Filtration Plant (BFP). The Project included other requisite offsite components, such as the Raw Water Pump Station located in the City of Orange. The Baker WTP Project will enhance water supply reliability in southern Orange County and provide redundant treatment capacity to Metropolitan Water District of Southern California's (MWD) Diemer Treatment Plant by treating raw water at



SOURCE: RBF Consulting; Carollo; ESA, 2013.

IRWD Baker WTP EIR Addendum No. 2 . 211448.01

Figure 1
Baker Water Treatment Plant
Proposed Modifications

SOURCE: RBF Consulting; ESA, 2013.

IRWD Baker WTP EIR Addendum No. 2 . 211448.01

Figure 2
Raw Water Pump Station
Proposed Modifications

a normal operating capacity of 43.5 cubic feet per second (28 million gallons per day). The Project will not increase the capacity of regional treated water distribution pipelines, but rather improve regional potable water system reliability and operational flexibility. The Project also will provide treated water to four partnering water agencies in southern Orange County: El Toro Water District (ETWD), Moulton Niguel Water District (MNWD), Santa Margarita Water District (SMWD), and Trabuco Canyon Water District (TCWD).

In March of 2012, the IRWD Board of Directors certified Addendum No. 1 to the Baker WTP Project Final EIR. Addendum No. 1 evaluated the environmental effects of modifying the alignment of the treated water pipeline that will connect the Baker WTP to the South County Pipeline and changes to the mechanical design of the product water pump station.

3.0 Purpose of Addendum

Under CEQA, the lead agency or a responsible agency shall prepare an addendum to a previously-certified Final EIR if some changes or additions are necessary to the prior EIR, but none of the conditions calling for preparation of a subsequent or supplemental EIR have occurred (CEQA Guidelines §§ 15162, 15164). Once an EIR has been certified, a subsequent EIR is only required when the lead agency or responsible agency determines that one of the following conditions has been met:

(1) Substantial changes are proposed in the project, or substantial changes occur with respect to the circumstances under which the project is undertaken, which require major revisions of the previous EIR due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects (CEQA Guidelines §15162(a)(1), (2));

(2) New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete, shows any of the following:

   a. The project will have one or more significant effects not discussed in the previous EIR;

   b. Significant effects previously examined will be substantially more severe than shown in the previous EIR;

   c. Mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or

   d. Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative (CEQA Guidelines §15162(a)(3)).

If one or more of the conditions described above for a subsequent EIR exist, but only minor additions or changes would be necessary to make the previous EIR adequately apply to the

project in the changed situation, then the lead agency may prepare a supplement to an EIR, rather than a subsequent EIR (CEQA Guidelines §15163(a)).

CEQA recommends that a brief explanation of the decision to prepare an addendum rather than a subsequent or supplemental EIR be included in the record (CEQA Guidelines §15164(e)). IRWD has evaluated the potential environmental impacts of the proposed modifications as set forth below in Section 6 of this Addendum No. 2. IRWD acting as the Lead Agency, has determined that none of the above CEQA conditions apply and that Addendum No. 2 to the adopted Final EIR is the appropriate environmental documentation for the proposed modifications and fully complies with CEQA, as described in the CEQA Guidelines.

An addendum does not need to be circulated for public review, but rather can be attached to the Final EIR (CEQA Guidelines §15164(c)). Prior to initiating the modified Project, the IRWD Board of Directors will consider this Addendum No. 2 together with the adopted Final EIR and Addendum No. 1 and make a decision regarding the modified Project (CEQA Guidelines §15164(d)).

4.0 Proposed Modifications

4.1 Baker Water Treatment Plant

The Baker WTP Project Final EIR identified a new 15-inch sewer pipeline that would be constructed to convey residual non-reclaimable waste (NRW) from the Baker WTP to IRWD's Los Alisos Water Recycling Plant (LAWRP) for treatment. At the LAWRP, the NRW would be dewatered and the solids hauled offsite to a composting facility. Subsequent to completion of the Final EIR, IRWD identified new concerns associated with this residuals management approach due to planned changes with the manner in which LAWRP solids will be handled.

As part of the proposed modification, the waste stream from the treatment process at the Baker WTP would be pumped via a new onsite underground pipeline to proposed residuals handling facilities. The waste stream would be a dilute sludge comprised mostly of silt and inorganic materials. The sludge would be thickened, dewatered, temporarily stored, and hauled offsite to a landfill. The liquid from the dewatering process will be piped to the LAWRP via an existing sewer pipeline connection. The NRW pipeline originally proposed in the Final EIR may not need to be built because the capacity of the existing sewer pipeline is sufficient for dewatering discharges from the proposed residuals handling facilities. However, the NRW pipeline could be constructed in the future.

The following proposed facilities associated with this modification would be built at the Baker site, within the boundaries of the existing BFP as delineated in Figure 2-2 of the Final EIR:

- **Thickeners**: two partially-buried concrete open-air basins, approximately seven feet above ground surface (12-ft water depth) and 22 feet in diameter.

- **Dewatering Building**: one 2,400 square foot (sf) building with a height of approximately 25 feet would contain thickened sludge feed pumps, dewatering centrifuges, a polymer storage and feed system, dewatered sludge conveyor system, and electrical equipment.
- **Load Out**: new facilities adjacent to the dewatering building would facilitate short-term storage and offsite disposal of dewatered sludge.
- **Equalization Storage**: one approximately 25,000-gallon partially buried and enclosed concrete basin would provide equalization for flows entering the sewer pipeline.
- Other ancillary facilities such as new onsite pipelines and up to three pumps or pump stations in subsurface vaults (approximately 10 to 20 HP each).

Polymer would be used in the thickening process. Polymer is not classified as a hazardous material. No additional hazardous materials to those described in the Final EIR (page 2-15) would be required. Polymer would be delivered to the Baker WTP approximately one to two times per month. In addition, disposal of the sludge would require approximately two to seven round-trip truck trips per week between the Baker WTP and the landfill. As described in the Final EIR (page 2-12), delivery vehicles would access the Baker site either via Commercentre Drive/Biscayne Bay Drive; or via Palmwood and Wisteria; or via Commercentre Drive/Indian Ocean Drive if and when planned future development on the vacant land north of the Baker site is completed. These access routes are shown in Figure 2-6 of the Final EIR.

As described in the Final EIR (page 2-8), the above ground portions of the Project, which would include the proposed residuals handling facilities, would be designed to be compatible with existing buildings onsite, with an architectural theme that would include concrete masonry unit block walls, steel deck roofs, and aluminum frame doors and windows. The facility designs would attenuate the sound levels of mechanical equipment such that noise levels at the property boundary are in compliance with City of Lake Forest noise ordinances.

In addition to the proposed residuals handling facilities, IRWD has determined that the required size of the emergency overflow pipeline would need to be modified up to 54 inches, instead of 42 inches as previously described on pages 2-8 and 2-12 of the Final EIR. The estimated flow rate of 54 cubic feet per second (cfs) from the discharge structure would remain unchanged.

The energy required to operate the Baker WTP would still be approximately 24.5 million kilowatt hours per year (Final EIR, page 2-16) even with implementation of the proposed modification. However, the existing underground power service provided by SCE would need to be upgraded to provide adequate capacity to feed the loads at the new dewatering building. New underground conduit and wiring would be required. As shown in Figure 1, two new vaults would be installed, one on IRWD property near the Baker site entrance off of Wisteria, and one along Wisteria within the right-of-way (ROW). IRWD would install two 6-inch conduits along Wisteria within the ROW, connecting the two vaults and continuing on to existing SCE facilities at the intersection of Wisteria and Palmwood. SCE would install the cable wiring within the conduits, connecting the Baker site to the existing electrical switch at Wisteria and Palmwood. The total length of conduit and cable wiring would be approximately 650 feet.

4.2 Raw Water Pump Station

The Baker WTP Final EIR included construction of a Raw Water Pump Station (RWPS) located within the Peters Canyon Regional Park in the City of Orange at the site of the existing Baker/Irvine Lake Pipeline Intertie facilities. The RWPS would boost water from the Irvine Lake Pipeline into the Baker Pipeline to convey flow through both pipelines (Final EIR, page 2-4).

SCE currently operates a conduit that supplies electricity to the existing Baker/Irvine Lake Pipeline Intertie facilities. The existing conduit consists of a Cable in Conduit (CIC) assemblage that cannot fully accommodate the proposed RWPS as described in the Baker WTP Final EIR. In order to upgrade the existing CIC system to support pump station activities, approximately 1,100 linear feet of 5-inch PVC conduit and electrical cable would be installed parallel to the existing CIC conduit. The existing CIC conduit would be remain in place. The new conduit would convey electricity to the proposed RWPS from an existing SCE connection at Jamboree Road (see Figure 2).

The proposed conduit alignment would run through coastal sage scrub (CSS) vegetation south of the RWPS, as identified in the Baker WTP Final EIR and in the 2010 Biological Resource Assessment (Final EIR, Appendix C, page 4). The proposed alignment would be bordered by Jamboree Road to the east, Peters Canyon Road to the west, and the RWPS to the north. The proposed alignment would be located on land owned by the County of Orange. This proposed project modification may require SCE to secure an easement from the County of Orange.

4. 3 Construction Methods

The construction equipment that is expected to be present onsite for the duration of construction is described on page 2-14 of the Final EIR, along with the expected number of construction workers. No additional construction equipment or workers would be required due to the proposed modifications. Construction methods also would be similar to that described in the Final EIR, including site clearing, excavation, grading, treatment plant construction, paving, and site restoration.

IRWD would use trench installation construction techniques to install both SCE conduits. Such construction techniques were described in the Final EIR on pages 2-14 and 2-15. Trenching would utilize a conventional cut and cover construction technique which would include trench excavation, conduit installation, electrical cable installation, backfill operations, and re-surfacing to the original condition. All work would be buried, including any vault structures and boxes. Once installed, the disturbed areas would be returned to pre-construction conditions along the entire length of the alignments.

4. 4 Project Phasing and Schedule

Construction of the proposed modifications would proceed simultaneously with construction of all other Baker WTP facilities as described in the Final EIR. The Baker WTP construction phases

would not change due to inclusion of these new Project components. The duration of construction still would be approximately 18 to 24 months.

5.0 Incorporation by Reference

Consistent with Section 15150 of the CEQA Guidelines, the following documents were used in the preparation of this Addendum and are incorporated herein by reference:

- Baker Water Treatment Plant Project Draft Environmental Impact Report, January 2011 (State Clearinghouse No. 2010051055).
- Baker Water Treatment Plant Project Final Environmental Impact Report, April 2011 (State Clearinghouse No. 2010051055).
- Baker Water Treatment Plant Project Final Environmental Impact Report Addendum No. 1, February 2012 (State Clearinghouse No. 2010051055).
- Residuals Handling Alternatives for the Baker Water Treatment Plant, April 2012, Prepared by Carollo Engineers for Irvine Ranch Water District.

These documents are available for review during regular business hours at IRWD located at 15600 Sand Canyon Avenue, Irvine, California 92618-3102.

6.0 Analysis of Potential Environmental Impacts Associated with the Proposed Modifications

The proposed modifications would not change the regulatory framework, impact discussion, mitigation measures, or significance conclusions for the following resource areas as currently described in the adopted Final EIR: Agricultural and Forestry Resources, Air Quality and Greenhouse Gases; Hazards and Hazardous Materials; Hydrology and Water Quality; Public Services and Utilities.

In addition, the proposed modification to the size of the emergency overflow pipeline would not alter any impact discussions, mitigation measures, or significance conclusion as currently described in the adopted Final EIR. Impacts associated with construction of the pipeline, or the physical presence of the pipeline underground, remain unchanged. The proposed discharge rate of 54 cfs into Serrano Creek has not been modified. Therefore, impacts to the creek remain unchanged. As such, this proposed modification is not addressed further in the analyses below.

6.1 Aesthetics

The Final EIR (Chapter 3.1) concluded that potential impacts to aesthetics in the vicinity of the Baker site and the Raw Water Pump Station site would be less than significant after mitigation. This section provides an analysis of the potential aesthetics impacts associated with the proposed residuals handling facilities and conduit installations. There would be no permanent, long-term impacts associated with the proposed conduit alignments as they would be located underground.

6.1.1 Setting

The proposed residuals handling facilities would be located at the Baker site within the boundaries of the existing BFP. The preliminary locations of the facilities are shown in Figure 1. The proposed conduit alignment within the Wisteria ROW is also shown in Figure 1. The Baker site is characterized by the existing treatment facilities associated with the BFP. Surrounding land uses primarily consist of low density residential, public facility, and community park/open space. Existing natural features in the vicinity of the Baker site include Serrano Creek and Serrano Creek Trail. The City of Lake Forest has not designated any scenic roadways or scenic vistas/viewpoints in the area surrounding the Baker site.

The proposed conduit alignment south of the RWPS would be located within Peters Canyon Regional Park, a 354-acre County regional park in the City of Orange (Figure 2). In the vicinity of the RWPS, several City of Orange roadways have scenic qualities and are designated as viewscape corridors. Viewscape corridors are defined as routes that traverse a corridor within which unique or unusual scenic resources and aesthetic values are found. Viewscape corridors include portions of Jamboree Road, Santiago Canyon Road, and Newport Boulevard (City of Orange General Plan, 2009). The proposed conduit alignment would only be visible during construction activities from Jamboree Road and distantly from Santiago Canyon Road. Construction activities would not be visible from Newport Boulevard.

6.1.2 Summary of Potential Impact

As already analyzed in the Final EIR, the Project would introduce new treatment facilities onsite at the BFP that would be visible from surrounding streets, including hilltop residential units located east of the Baker site. There are no scenic highway corridors or City-designated scenic vistas in the vicinity of the Baker site. The proposed Baker WTP would replace existing water treatment facilities within the same general footprint of the existing BFP. The aboveground Baker WTP facilities would be designed to be similar to and compatible with existing buildings onsite. In addition, implementation of Mitigation Measure AES-1 would ensure that a landscape plan is implemented to screen Project facilities from neighboring streets and that landscape vegetation is maintained onsite to the extent feasible to screen Project facilities from scenic views from hilltop residences. Thus the Project would not introduce a new contrasting feature that would affect scenic vistas or alter the visual character of the site.

The proposed modification would add residuals handling facilities at the Baker site and a conduit alignment within the Wisteria ROW. The residual handling facilities would be designed to be compatible with other Project buildings and would not alter the visual character of the site. Mitigation Measure AES-1 as included in the Final EIR also would apply to the proposed residuals handling facilities. As a result, the proposed aboveground structures would be screened by vegetation to the fullest extent possible to preserve scenic views from surrounding and hilltop residences. Impacts would be less than significant with mitigation.

Construction activities associated with installation of the Wisteria conduit alignment would temporarily introduce construction equipment into the roadway. However, similar to the impacts associated with the treated water pipeline and sewer pipeline analyzed in the Final EIR, the

proposed conduit alignment would be below ground and would not impact a scenic vista (Final EIR, page 3.1-9).

The proposed SCE conduit and cable alignment south of the RWPS similarly would be constructed entirely below ground and would not alter the permanent visual character of the site or surroundings. There would be no new permanent above ground structures that would compromise scenic views or viewscape corridors. Mitigation Measures AES-2 as included in the Final EIR would apply to the proposed RWPS conduit alignment, requiring restoration of the area disturbed during construction to reestablish pre-existing conditions including native plantings. Impacts to scenic viewscape corridors would be less than significant with mitigation.

The Final EIR also analyzed potential light and glare impacts resulting from permanent security lighting at the proposed Baker WTP. Implementation of Mitigation Measure AES-3 included in the Final EIR would ensure lighting would be shielded and directed downward away from neighboring properties and land uses. The proposed modification also would require nighttime security lighting on the residuals handling facilities and would be subject to Mitigation Measure AES-3. Impacts would be less than significant with mitigation.

6.1.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the Mitigation Monitoring and Reporting Program (MMRP). Impacts to aesthetics would be less than significant with mitigation.

6.2 Biological Resources

The Final EIR (Chapter 3.4) assessed potential impacts to biological resources and concluded that construction of the Project would have a less than significant impact with the incorporation of mitigation. The following discussion addresses potential impacts of the modified Project.

6.2.1 Setting

The proposed residuals handling facilities would occur within already disturbed areas of the Baker site, which consists of water treatment structures, pavement, and ornamental landscaping. The proposed Wisteria conduit alignment would be installed primarily within the ROW of Wisteria adjacent to the Baker site, with a small portion installed on the Baker site. The Baker site is surrounded by urban development with the exception of Serrano Creek, which borders the site to the east. Common wildlife includes species adapted to urban environments. The Baker site is not considered a wildlife movement corridor and is designated as Non-Reserve Lands in the Orange County Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP).

The proposed RWPS conduit alignment would traverse CSS habitat previously evaluated in the 2010 Biological Resource Assessment as native habitat with varying degrees of disturbance (2010 Biological Resource Assessment, page 5). The RWPS site and surroundings are not considered a

wildlife movement corridor; however, the site is designated as Reserve Lands in the Orange County NCCP/HCP (Final EIR, page 3.4-8).

6.2.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of the Project to biological resources in and around the Baker site. Mitigation measures were adopted that would ensure construction and operation of the Baker WTP does not adversely affect special-status bird species (BIO-3 and BIO-4), neighboring riparian habitat in Serrano Creek and sensitive natural communities (BIO-6 and BIO-7), or jurisdictional wetlands in Serrano Creek (BIO-8 and BIO-9), or conflict with local biological resource policies such as the City of Lake Forest tree preservation policies (BIO-10).

The proposed modification would add residuals handling facilities to the Baker WTP within the boundaries of the existing Baker site. The proposed component would be constructed simultaneously with the other components of the Baker WTP. Potential impacts associated with this proposed modification would be similar to those already described in the Final EIR at the Baker site. With implementation of Mitigation Measures BIO-3, BIO-4, BIO-6, BIO-8, BIO-9, and BIO-10, impacts associated with the proposed residuals handling facilities would be less than significant.

Installation of the Wisteria conduit alignment would occur using trench installation construction techniques as described in the Final EIR (pages 2-14 and 2-15). Trenching would utilize a conventional cut and cover technique that would include trench excavation, conduit installation, backfill operations, and re-surfacing to the original condition. The proposed conduit installation would occur primarily within the already-disturbed Wisteria ROW, with a small portion installed on a portion of the Baker site characterized by ornamental landscaping (Final EIR, Figure 3.4-1). Implementation of the conduit alignment within the paved Wisteria ROW would not result in additional impacts to biological resources. Potential impacts at the Baker site associated with the proposed conduit installation would be similar to those already described in the Final EIR. With implementation of Mitigation Measures BIO-3, BIO-4, BIO-6, BIO-8, BIO-9, and BIO-10, impacts would be less than significant.

The Final EIR assessed the potential impacts of the Project to biological resources in and around the RWPS site. Mitigation measures were adopted to ensure construction and operation of the RWPS would not adversely affect special-status bird species (BIO-3 and BIO-4). Installation of the proposed SCE conduit would occur within and near vegetation with the potential to host nesting song birds (Final EIR, page 3.4-20). Mitigation Measures BIO-3 and BIO-4 would reduce potential impacts to breeding and nesting birds to a level of less than significance.

In addition, installation of the conduit would have direct temporary impacts to CSS habitat during construction, similar to those already evaluated for other Project pipelines in the Final EIR. The Final EIR identified potential temporary impacts to sensitive natural communities, particularly CSS, associated with installation of treated water pipelines near the Baker site. Mitigation Measure BIO-5 would apply to the RWPS conduit installation, requiring restoration of disturbed CSS habitat at a 1:1 ratio. As a result, impacts to sensitive natural communities would be less than significant with mitigation.

The proposed RWPS conduit alignment also is located on lands designated as Reserve Lands in the Orange County NCCP/HCP (Final EIR, page 3.4-8). Thus, temporary impacts to CSS habitat within Reserve Lands would occur during construction of the RWPS conduit alignment. IRWD, the County of Orange, and SCE are all Participating Landowners in the NCCP/HCP. Participating Landowners provide land and/or funding to support creation of the Reserve System and/or implementation of the Adaptive Management Program (County of Orange, 1996: NCCP/HCP, page II-162). The NCCP/HCP authorizes incidental take of CSS habitat by Participating Landowners for covered activities such as public utilities, regardless of the number of species, if any, occupying the area (County of Orange, 1996: NCCP/HCP EIR/EIS, pages 6-11 to 6-13). For Participating Landowners, impacts within Reserve Lands are considered to be fully mitigated due to the creation of the permanent habitat Reserve System and implementation of the Adaptive Management Program. The proposed RWPS conduit alignment would not conflict with the NCCP/HCP or require any additional mitigation for temporary impacts to CSS habitat or associated special-status species.

6.2.3 Conclusion

The proposed modifications would not result in a new significant impact not previously identified in the Final EIR, nor would it substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to biological resources would be less than significant with mitigation.

6.3 Cultural Resources

The Final EIR (Chapter 3.5) assessed potential impacts to cultural resources and concluded that construction of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.3.1 Setting

The Project area is located in an area between an elevated coastal terrace and the Santa Ana Mountains. The majority of the Project area has been previously developed and is disturbed. The Baker site has been associated with prehistoric and historic settings as documented in the Final EIR (p. 3.5-2 through 3.5-5). Archaeological and paleontological surveys of the Baker site and the RWPS site were conducted in 2009. The surveys noted that much of the sites were highly disturbed. No cultural or paleontological resources were observed during the course of the field surveys.

6.3.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of ground disturbance due to construction of the Project, including the Baker WTP and the RWPS, and determined that, with implementation of mitigation, impacts to cultural resources, including archaeological, paleontological, and historic resources would be less than significant. Construction activities could unearth, expose, or disturb subsurface archaeological or paleontological resources. The Final EIR determined that due to the large number of prehistoric archaeological sites in close proximity to the Baker site and RWPS site, and the Baker site's location along a reliable water source, the areas have some

archaeological sensitivity. With implementation of Mitigation Measures CUL-1, CUL-2, CUL-3 and CUL-4, the potential impacts to cultural resources would be mitigated to less than significant levels.

The proposed modifications would add residuals handling facilities to the Baker WTP within the boundary of the area of potential effect already surveyed and analyzed in the Final EIR. The proposed modifications also would include a new conduit alignment within the Wisteria ROW and a small portion of the Baker site. The proposed components would be constructed simultaneously with the other components of the Baker WTP. Impacts similar to those already evaluated for the Project have potential to occur due to construction of these proposed components. Mitigation Measures CUL-2, CUL-3 and CUL-4 would apply to the proposed residuals handling facilities and Wisteria conduit alignment and would reduce impacts to cultural resources to less than significant levels.

Installation of the RWPS conduit alignment would occur parallel to an existing CIC route. Construction activities would unearth soils that already have been excavated, reducing the likelihood of cultural resource exposure or disturbance. Impacts similar to those already evaluated for the Project have potential to occur due to construction of this proposed component. Mitigation Measures CUL-1, CUL-2, CUL-3 and CUL-4 would apply to the RWPS conduit alignment, reducing impacts to cultural resources to less than significant levels.

6.3.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to cultural resources would be less than significant with mitigation.

6.4 Geology, Soils and Mineral Resources

The Final EIR (Chapter 3.6) assessed potential impacts associated with geologic events and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.4.1 Setting

The Baker site is located generally in a seismically active area, but there are no known Alquist-Priolo fault zones in the vicinity of the Project. The closest faults to the Baker site are the Newport-Inglewood and Elsinore faults. The Baker site is also not in an area considered susceptible to landslides or liquefaction. There are no Mineral Resources Zones in the vicinity of the Baker site.

The RWPS site is located near one active fault, the Elsinore fault, and two potentially active faults, the Peralta Hills fault and the El Modena fault. With no recent record of activity, neither is anticipated to be capable of generating significant earthquakes. The RWPS site is also not in an

area considered susceptible to landslides or liquefaction. There are no Mineral Resources Zones in the vicinity of the RWPS site.

6.4.2 Summary of Potential Impact

The Final EIR assessed the potential impacts of Project implementation associated with geologic hazards and seismic events, including seismic ground shaking, landslides and liquefaction, subsidence, expansive soils, and erosion. None of the Project components would be located in an area considered susceptible to landslides. Construction of all Project components would involve grading, trenching, and excavation activities that may reduce soil cohesion. Implementation of Mitigation Measure GEO-1 would ensure best management practices for soil erosion and sediment control, and would reduce potential impacts to a less than significant level. Resurfacing disturbed areas with asphalt also would minimize erosion at the Baker site during treatment plant operation to less than significant levels. The upper area of the Baker site has a gradual slope of approximately 60 feet to the south and west, with the toe of the slope bordering residential properties. The Baker WTP facilities would be built in accordance with the required California Building Code slope setback requirements to eliminate the risk for slope failure. In addition, Mitigation Measure GEO-2 requires a geotechnical investigation for all Project components to identify site-specific design criteria to mitigate potential geologic hazards, such as slope failure, liquefaction, subsidence, and expansive soils. With the implementation of Mitigation Measures GEO-1 and GEO-2, Project impacts would be reduced to less than significant levels.

The proposed modifications would add residuals handling facilities to the Baker WTP within the existing boundaries of the Baker site. The proposed component would be constructed simultaneously with the other components of the Baker WTP. Construction of the Wisteria conduit alignment would occur primarily within the already-disturbed Wisteria ROW and a small portion of the Baker site. Once installed, the disturbed area of the ROW would be returned to its previous condition along the entire length of the alignment. Installation of the RWPS conduit alignment would occur parallel to an existing conduit in soils that have been previously disturbed. Similarly, once constructed, the disturbed area would be restored to pre-construction conditions. Construction-related impacts to erosion and sedimentation associated with the residuals handling facilities and both SCE conduit alignments would be similar to those already evaluated for the other Baker WTP components. Impacts associated with liquefaction, landslides, subsidence, and expansive soils also would be similar to those already evaluated in the Final EIR. No new operational impacts would occur. Implementation of GEO-1 and GEO-2 would reduce impacts associated with the proposed modifications to less than significant levels.

6.4.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of an impact identified in the Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to geology, soils and mineral resources would be less than significant with mitigation.

6.5 Land Use, Planning and Recreation

The Final EIR (Chapter 3.9) assessed potential impacts to land use and recreational resources and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.5.1 Setting

The proposed residuals handling facilities would be located at the Baker site in the City of Lake Forest. As described in the Final EIR, the land use designation at the Baker site is Public Facility, and the zoning designation is General Agriculture. The proposed Wisteria conduit alignment would start at the Baker site and run within the Wisteria ROW.

The proposed RWPS conduit alignment would be located within Peters Canyon Regional Park on land designated as Open Space Park by the City of Orange, similar to the RWPS site as described in the Final EIR. The associated zoning designation is Recreation Open Space. Although the proposed conduit and cable would be installed parallel to an existing CIC, there currently is no utility easement associated with these facilities. Thus, installation of the RWPS conduit alignment may require SCE to acquire an easement from the landowner, which is the County of Orange.

6.5.2 Summary of Potential Impact

The Final EIR determined that development of the Baker WTP at the Baker site would not conflict with applicable land use plans, policies, or regulations. Development of the Baker WTP would be consistent with the Public Facilities land use designation, which allows public utility land uses. Water facilities are not subject to city building or zoning ordinances, per Government Code 53091. Therefore, a site development permit would not be required for development of the Baker WTP in the General Agriculture zone (Final EIR, page 3.9-7). As part of the Baker WTP, the proposed residuals handling facilities also would be consistent with land use and zoning designations. Impacts would be less than significant.

The proposed Wisteria conduit alignment would be installed primarily within the roadway ROW. Wisteria is a private road; however, IRWD has a utility and access easement within the Wisteria ROW. There would be no conflict with applicable land use plans, policies, or regulations, and there would be no effect to recreational facilities.

The proposed RWPS conduit alignment may require acquisition of an easement from the County of Orange prior to installation. Once installed, the conduit would be underground and would not conflict with the Open Space Park land use, which allows for passive and active recreation. There would be no long-term effect to the surrounding recreational facility or recreational uses. The Recreation Open Space zone allows public/private utility buildings and structures as a conditional use. The proposed conduit thus would be consistent with such zoning designations, which may require a conditional use permit, if applicable to SCE. Impacts would be less than significant.

6.5.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to land use and recreation due to Project modifications are less than significant.

6.6 Noise

The Final EIR (Chapter 3.10) assessed potential impacts to sensitive receptors due to Project noise and vibration and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.6.1 Setting

As described in the Final EIR, the Baker site is adjacent to residential land uses. The nearby residences qualify as noise sensitive receptors and would potentially be exposed to noise generated from Project activities. Construction activities at the Baker site would get as close as 100 feet to residential units located on Wisteria and Forestwood. The Wisteria conduit alignment could be as close as 30 feet to neighboring residential units (Figure 1).

As described in the Final EIR, the proposed RWPS would be located near Peters Canyon Reservoir, approximately 1,190 feet south of the nearest sensitive receptor. The RWPS conduit alignment would be even further from such receptors, as the conduit would be installed south of the pump station site (Figure 2).

6.6.2 Summary of Potential Impact

Construction activities would create a temporary increase in ambient noise levels in the immediate vicinity of the construction zone. Noise-related construction impacts at the Baker site, the RWPS site, and within adjacent neighborhoods are described in the Final EIR. Table 3.10-1 shows that the greatest noise levels are associated with excavation and finishing and would be 89 dBA at a distance of 50 feet. Accordingly, attenuated at 100 feet, the closest residences to the Baker site would experience noise levels up to 83 dBA Leq during finishing and excavation, the loudest construction activities that would occur. The Final EIR evaluated the effects of construction noise on sensitive receptors approximately 30 feet from offsite pipeline installations. With implementation of Mitigation Measures NOISE-1 and NOISE-2, potential construction noise impacts on sensitive receptors would be mitigated to less than significant levels. Mitigation to be implemented includes restrictions on days and times for construction activities in accordance with the City of Lake Forest Noise Ordinance and use of noise control techniques.

The Final EIR also assessed noise resulting from construction of the RWPS. The nearest sensitive receptor to the facility is located approximately 1,190 feet to the north. Accordingly, attenuated at 1,190 feet, these residences would experience noise levels of up to 61 dBA Leq during finishing and excavation, the loudest of construction activities that would occur. The Final EIR determined

that construction of the RWPS would be inaudible to the nearest sensitive receptors (Final EIR, page 3.10-10). Noise impacts would be less than significant without mitigation.

The proposed modifications would add residuals handling facilities to the Baker WTP at the Baker site. The proposed component would be constructed simultaneously with the other components of the Baker WTP. Construction noise impacts would be similar to those already described in the Final EIR. Construction of the residuals handling facilities would not require additional or different equipment or methods. Implementation of Mitigation Measures NOISE-1 and NOISE-2 would reduce construction noise impacts to less than significant levels.

The proposed Wisteria conduit alignment also would result in construction noise impacts similar to those analyzed in the Final EIR for the offsite sewer pipeline. Similar to the pipelines, an average of 50 to 100 feet of conduit would be installed per day; therefore sensitive receptors would be exposed to conduit construction noise only for up to two weeks. With implementation of Mitigation Measures NOISE-1 and NOISE-2 identified in the Final EIR, potential construction noise impacts on sensitive receptors would be mitigated to less than significant levels.

Construction of the RWPS conduit alignment would occur south of the pump station site, further away from the nearest sensitive receptors. As such, noise impacts due to construction of the conduit would be less than those already described in the Final EIR. Construction-related noise would be inaudible to sensitive receptors. Impacts would be less than significant without mitigation.

For operational noise, the Project would be designed to attenuate sound levels of mechanical equipment such that noise levels at the Baker site boundary are in compliance with the City of Lake Forest Noise Ordinance (11.16.040 Exterior Noise Standards), and noise levels at the RWPS site are in compliance with the City of Orange Noise Ordinance (8.24.050 Exterior Noise Standards). At the boundary with adjacent residential properties, noise levels would not exceed 55 dBA between the hours of 7:00 a.m. and 10:00 p.m. or 50 dBA between the hours of 10:00 p.m. and 7:00 a.m. Implementation of Mitigation Measure NOISE-3 would ensure that Project operation does not exceed noise standards by requiring post-construction noise monitoring to confirm compliance with standards at the property boundary. Impacts would be reduced to less than significant levels with mitigation.

Operation of the proposed residuals handling facilities would generate noise that would contribute to the cumulative noise level associated with operation of the entire Baker WTP. The proposed modified Project would be designed to attenuate the sound levels of all mechanical equipment such that noise levels at the property boundary are in compliance with the City's noise ordinances. Implementation of Mitigation Measure NOISE-3 would ensure such compliance is attained. Impacts associated with the proposed modification would be less than significant with mitigation. Once constructed and operational, there would be no noise impacts associated with either the Wisteria or RWPS conduit alignments since they would be underground. No mitigation is required.

6.6.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to sensitive receptors associated noise and vibration are less than significant with mitigation.

6.7 Transportation and Traffic

The Final EIR (Chapter 3.12) assessed potential impacts to transportation and traffic and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the modified Project.

6.7.1 Setting

The Baker site is located in southern Orange County in the City of Lake Forest. The RWPS site is located in the City of Orange. The regional and local transportation system is comprised of an interconnected network of roadways, local transit systems, and pedestrian and bicycle facilities. Construction and operational vehicles would access the Baker site either via Commercentre Drive/Biscayne Bay Drive; or via Palmwood and Wisteria; or via Commercentre Drive/Indian Ocean Drive if and when planned future development on the vacant land north of the Baker site is completed. Construction and operational vehicles would access the RWPS site from Jamboree Road.

6.7.2 Summary of Potential Impact

As described in the Final EIR (p. 2-12), construction and operational vehicles would access the Baker site from surrounding roadways. The access routes are shown in Figure 2-6 of the Final EIR. Hauling and delivery of materials would require approximately 500 truck trips over the 18- to 24-month construction period. Up to 60 workers per day would be required onsite. Construction vehicles could result in short-term, intermittent lessening of roadway capacities due to slower moving vehicles and the larger turning radii of certain trucks as compared to passenger vehicles. Construction vehicles would access the Baker site via Commercentre Drive and Biscayne Bay Drive to the north on a paved road that currently traverses the undeveloped site. Construction traffic would not affect circulation in residential areas along Wisteria. Construction staging and parking would be located onsite at the Baker site and would not affect traffic on surrounding roadways or affect emergency access. Impacts to traffic due to construction would be less than significant.

Once constructed, access to the Baker WTP would be from Biscayne Bay Drive to the north and Wisteria to the south. If and when the planned future development north of the Baker site is completed, the northern access point to the Baker WTP would be Indian Ocean Avenue instead of Biscayne Bay Drive (see Final EIR, Figure 2-5). On average, operational traffic would include up to three worker entries per day and up to 20 deliveries per month. Access from Wisteria requires a 90-degree turn onto the Baker WTP property. This access point is feasible for some delivery trucks and IRWD staff vehicles; the entry point for large delivery trucks would be from the north.

Due to the limited number of trips associated with operations of the plant, traffic and circulation on Biscayne Bay Drive and Palmwood/Wisteria would not be significantly impaired.

The proposed modifications would add residuals handling facilities to the Baker WTP at the Baker site. The proposed facilities would be constructed simultaneously with the other components of the Baker WTP and would not require additional workers or result in a substantial increase in the number of hauling and delivery trucks over the 18- to 24-month construction period. Construction-related impacts to traffic and circulation would be similar to those already described for the Baker WTP in the Final EIR. Impacts would be less than significant without mitigation.

The proposed modifications also would include a SCE conduit alignment within the ROW of Wisteria. Potential traffic impacts related to the construction of the SCE conduit alignment would be similar to construction impacts described in the Final EIR (p. 3.12-9). The treated water pipeline alignments analyzed in the Final EIR would affect Wisteria and other private streets adjacent to the Baker site. The conduit alignment would be installed in the Wisteria ROW and would temporarily slow traffic serving the local residential community. Mitigation Measure TR-1 would require a Traffic Control/Traffic Management Plan to be implemented during construction. The Plan would require at least one lane of traffic and access to driveways to be maintained within the street at all times. As a result, the temporary impacts to traffic would be less than significant with mitigation.

Once constructed, disposal of the sludge produced from the residuals handling facilities would require approximately two to seven round-trip truck trips per week between the Baker WTP and the landfill. Polymer would be delivered approximately one to two times per month. No additional staff would be required to operate the Baker WTP due to the addition of the residuals handling facilities. Operational vehicles would access the Baker WTP site by means of the aforementioned site entry points. Once constructed, operation of the Wisteria conduit alignment would be underground and would not affect traffic or circulation in the project vicinity. The vehicle trips associated with the proposed modification would not have a significant impact on local and regional traffic or circulation. No additional traffic impacts would occur. Impacts would be less than significant without mitigation.

As discussed in the Final EIR, construction vehicles would access the RWPS site without affecting local roadways or causing lane closures (Final EIR, page 3.12-10). Traffic impacts associated with construction of the RWPS conduit alignment would be to those already described in the Final EIR. Construction of the proposed RWPS conduit alignment would not affect local roadway circulation; all construction staging and parking would occur onsite. Operation of the RWPS conduit and cable also would not adversely affect local traffic and circulation. Impacts would be less than significant.

6.7.3 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the

existing commitments contained within the MMRP. Impacts to transportation and traffic are less than significant with mitigation.

7.0 Summary of Environmental Effects

As discussed in this Addendum No. 2, the proposed modifications would not change the conclusions of the certified Final EIR and Addendum No. 1. The construction and operation of the proposed residuals handling facilities would meet the same objectives of improving water reliability to areas of south Orange County, providing a reliable local water supply in the event of emergency conditions or scheduled maintenance of the MWD delivery system; and increased operational flexibility by creating redundancy within the raw water supply system.

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. The proposed modifications to the previously-approved Project do not meet any of the conditions that would require the preparation of a subsequent or supplemental EIR as set forth in Sections 15162 and 15163 of the CEQA Guidelines.

8.0 Determination

Section 15164(a) of the CEQA Guidelines states the following:

> The lead agency or responsible agency shall prepare an addendum to a previously certified EIR if some changes or additions are necessary but none of the conditions described in Section 15162 calling for the preparation of subsequent EIR have occurred.

The proposed modifications to the original Project would not result in new significant environmental effects or a substantial increase in the severity of previously identified significant effects. Furthermore, new information associated with the proposed modifications does not indicate that: the Project will have one or more significant effects not discussed in the adopted Final EIR; significant effects previously examined will be substantially more severe than shown in the adopted Final EIR; mitigation measures or alternatives previously found not to be feasible would in fact be feasible; or mitigation measures or alternatives which are considerably different from those analyzed in the adopted Final EIR would substantially reduce one or more significant effects on the environment, but the Project proponents decline to adopt the mitigation measures or alternative. Accordingly, an addendum has been prepared as opposed to a supplemental or subsequent EIR. IRWD is adopting this Addendum No. 2 in accordance with the CEQA Guidelines Section 15164.

Irvine Ranch Water District

Signature	3/11/13 Date
Jo Ann Corey Printed Name	Engineering Technician III Title