Appendix H
Engineer's Title 22 Report

ENGINEERING REPORT
for the

DELTA DIABLO SANITATION DISTRICT RECYCLED WATER FACILITY

June 24, 1999

Prepared for:

Delta Diablo Sanitation District

2500 Pittsburg-Antioch Highway Antioch, California 94509

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Consulting Engineers/Project Managers

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Section 1 - Introduction

Description of Project

Delta Diablo Sanitation District (DDSD) proposes to build recycled water facilities that would provide recycled wastewater for cooling tower make-up to two power plants in the Pittsburg area. Furthermore, DDSD seeks general approval to implement landscape irrigation projects in the service area.

DDSD owns and operates its Water Pollution Control Facilities (WPCF) located at 2500 Pittsburg-Antioch Highway in Antioch, California. DDSD currently treats wastewater collected from its collection system in the City of Antioch, City of Pittsburgh and incorporated community of Bay Point to secondary effluent standards in accordance with its NPDES Permit No. CA0038547. Disinfected and dechlorinated final effluent is discharged into New York Slough through the DDSD outfall. DDSD is proposing construction of recycled water production facilities at its WPCF. The recycled water facilities would treat secondary effluent diverted from the existing junction box upstream of the chlorine contact basin by the conventional filtration process. The filtered effluent would be chlorinated using sodium hypochlorite and then conveyed to the recycled water customers (Users).

The proposed facilities will serve recycled water to Enron's proposed Pittsburg District Energy Facility (PDEF) merchant power plant and to Calpine/Bechtel's proposed Delta Energy Center (DEC) for use in cooling tower and other industrial processes. Additional recycled water will be provided to other industries and local landscape irrigation customers in the future.

The PDEF is currently in the application phase with the California Energy Commission (CEC), with final certification expected in August 1999. The DEC merchant power plant is also in the application phase, with approval from the CEC expected in late 1999 or early 2000. Purpose of Report

This report serves as the Engineering Report in accordance with California Code of Regulations (CCR) Title 22. The report has been prepared in accordance with the Department of Health Services' "Guidelines for the Preparation of an Engineering Report for the Production, Distribution, and Use of Recycled Water," dated September 1997. This report has been prepared for DDSD and is intended for submittal to the San Francisco Bay Area Regional Water Quality Control Board (RWQCB) and the State of California Department of Health Services (DHS) as part of the project permitting process. The proposed project described in this report includes the facilities initially required to serve recycled water to the PDEF and DEC facilities. Service of recycled water to future irrigation customers will be documented at a later date.

Report Organization

This report is organized in accordance with DHS guidelines for similar recycled water production and distribution projects. The following sections are included in this report"

- Section 2 – Recycled Water Production Facilities
- Section 3 – Recycled Water Transmission and Distribution Facilities
- Section 4 – Recycled Water Use Areas

Section 2 - Recycled Water Production Facilities

This section includes the following:

- Definition of the entity responsible for the production and distribution to users of recycled water;
- Description of the DDSD WPCF secondary effluent that will be diverted to the recycled water production facilities;
- Description of the recycled water quality requirements;
- Descriptions of the proposed recycled water production facilities;
- Proposed reliability features associated with the facilities;
- Proposed contingency plans to prevent distribution of water not meeting minimum quality requirements; and
- Proposed monitoring and reporting program for operation of the recycled water production facilities.

Recycled Water Producer and Distributor

DDSD is the proposed Producer of recycled water and the City of Pittsburg or DDSD will be the Distributor of recycled water for this project, as defined in RWQCB Order 96-011, "General Water Reuse Requirements for Municipal Wastewater and Water Agencies." DDSD will carry out the responsibilities of Producer described in Order 96-011. The City of Pittsburg or DDSD will carry out the responsibilities of Distributor, also described in Order 96-011.

Source Water Quality

The supply to the recycled water production facilities is secondary effluent from the DDSD WPCF. Appendix B is a compilation of water quality data from 1998 that was submitted by DDSD as a part of its annual report to the RWQCB. Table 2-1 is a summary of the data.

The DDSD collection system currently serves residential, commercial, and industrial users in the cities of Antioch and Pittsburg and the unincorporated community of Bay Point. The collection system area encompasses 42 square miles, with 338 miles of sanitary sewer lines tributary to the WPCF. The wastewater influent to the WPCF is primarily domestic, with approximately eight percent of the flow contributed by industrial and commercial sources.

The existing WPCF provides secondary wastewater treatment for up to 16.5 million gallons per day (mgd) average dry weather flow. In 1998, the average daily flow and average dry weather flow were 14.1 mgd and 13.2 mgd, respectively. The wastewater secondary treatment, chlorination and dechlorination prior to discharge to New York Slough in the Delta. Biosolids generated at the WPCF are applied to agricultural land in various counties, including Solano and San Joaquin County , California, as approved by the Central Valley RWQCB.

Table 2-1
Summary Water Quality Data

Characteristic	Maximum	Minimum	Mean	Median	95th Percentile
Flow (mgd)	27.36	11.67	13.77	13.34	16.87
BOD (mg/l)	470.00	100.00	218.45	220.00	260.00
TSS (mg/l)	450.00	99.00	219.19	217.00	261.95
Ag (µg/l)	0.00	0.00	0.00	0.00	0.00
As (µg/l)	36.70	0.00	6.56	4.40	22.48
Cd (µg/l)	0.00	0.00	0.00	0.00	0.00
Cr (µg/l)	6.00	0.00	0.50	0.00	2.70
Cu (µg/l)	98.00	0.00	45.41	45.00	79.10
Hg (µg/l)	4.25	0.00	0.49	0.00	3.20
Ni (µg/l)	30.60	0.00	6.48	0.00	27.52
Pb (µg/l)	6.50	0.00	2.28	0.00	6.12
Se (µg/l)	6.30	0.00	2.60	2.50	5.28
Zn (µg/l)	140.00	41.00	101.21	106.00	131.55

Note: Data from DDSD WPCF Annual Report for 1998.

DDSD currently has an EPA-approved Pretreatment Program, as described in its District Code, Chapter 2.28. The Industrial Waste Pretreatment Program consists of 21 industrial dischargers (eight categorical and 13 non-categorical). All Significant Industrial User (SIU) facilities were inspected and sampled at least once in 1998, in accordance with 40 CFR 403 regulations.

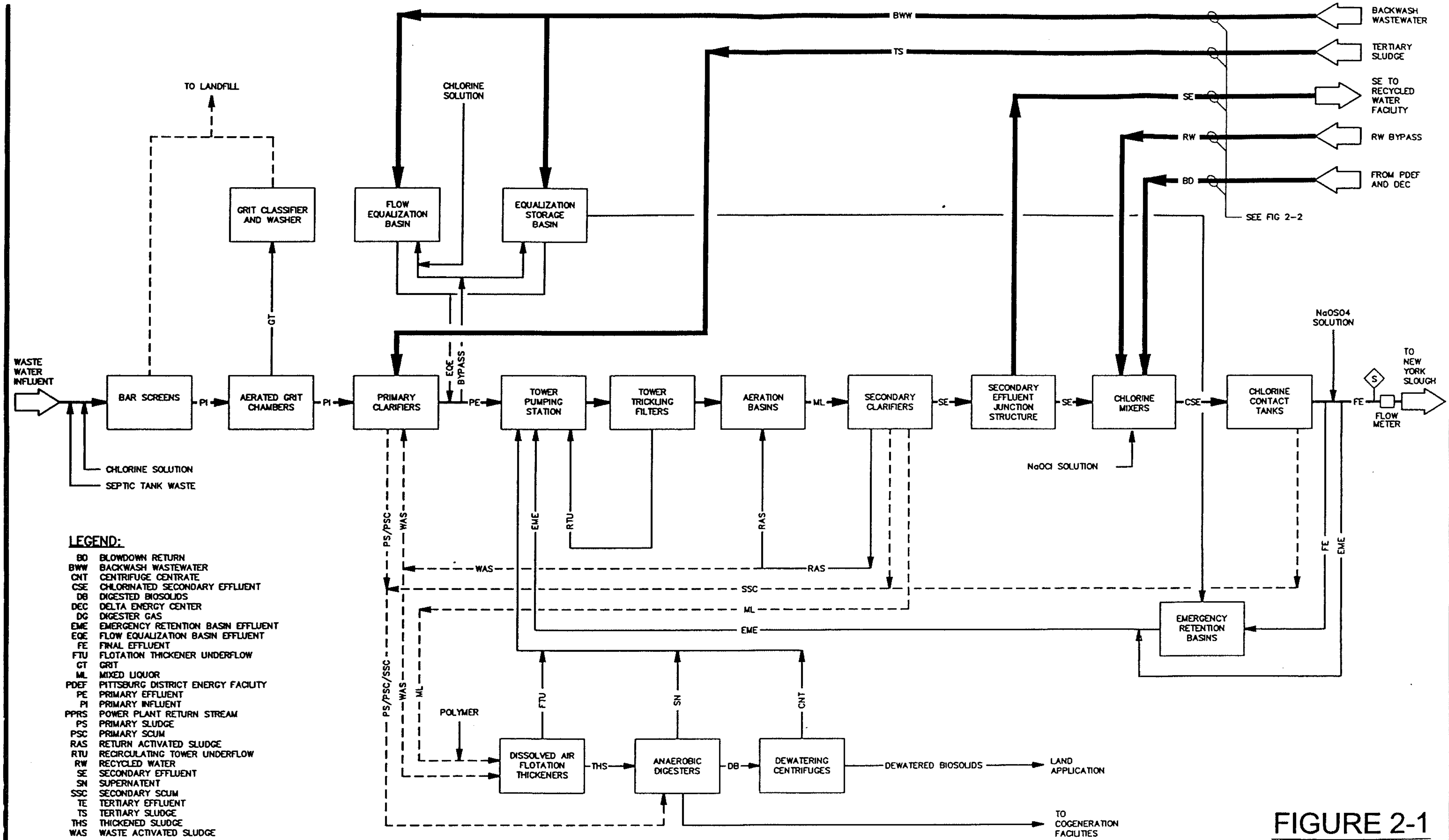
The pretreatment program is managed under the DDSD Laboratory Director and includes industrial monitoring inspection staff.

Recycled Water Quality Requirements

Recycled water produced at the proposed recycled water facilities will meet the water quality requirements stated in the most current draft CCR Title 22 for disinfected tertiary recycled water. Table 2-2 is a summary of these recycled water quality requirements.

DDSD WPCF Treatment Processes

The existing DDSD WPCF treatment process schematic is depicted in Figure 2-1. An aerial view of the WPCF is depicted on Figure 2-2. The treatment processes include screening and grit removal, primary clarification, tower trickling filters, aeration, secondary clarification, and disinfection/dechlorination. Biosolids processing is accomplished with dissolved air flotation,



LEGEND:

BD	BLOWDOWN RETURN
BWW	BACKWASH WASTEWATER
CNT	CENTRIFUGE CENTRATE
CSE	CHLORINATED SECONDARY EFFLUENT
DB	DIGESTED BIOSOLIDS
DEC	DELTA ENERGY CENTER
DG	DIGESTER GAS
EME	EMERGENCY RETENTION BASIN EFFLUENT
EQE	FLOW EQUALIZATION BASIN EFFLUENT
FE	FINAL EFFLUENT
FTU	FLOTATION THICKENER UNDERFLOW
GT	GRIT
ML	MIXED LIQUOR
PDEF	PITTSBURG DISTRICT ENERGY FACILITY
PE	PRIMARY EFFLUENT
PI	PRIMARY INFLUENT
PPRS	POWER PLANT RETURN STREAM
PS	PRIMARY SLUDGE
PSC	PRIMARY SCUM
RAS	RETURN ACTIVATED SLUDGE
RTU	RECIRCULATING TOWER UNDERFLOW
RW	RECYCLED WATER
SE	SECONDARY EFFLUENT
SN	SUPERNATENT
SSC	SECONDARY SCUM
TE	TERTIARY EFFLUENT
TS	TERTIARY SLUDGE
THS	THICKENED SLUDGE
WAS	WASTE ACTIVATED SLUDGE
(S)	SAMPLE POINT – EFFLUENT DISCHARGE COMPLIANCE MONITORING (NPDES)

PRELIMINARY

FIGURE 2-1

0" — VERIFY SCALES — 1" BAR IS ONE INCH LONG ON FULL SIZE DRAWING. IF NOT ONE INCH LONG ON THIS DRAWING, ADJUST SCALES ACCORDINGLY

REV	DATE	BY	APVD	DESCRIPTION

DESIGNED	X
DRAWN	X
CHECKED	X
APPROVED	X

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DELTA DIABLO SANITATION DISTRICT

RECYCLED WATER FACILITY

WASTEWATER TREATMENT PLANT PROCESS FLOW DIAGRAM

DWG NO	
SHEET NO	X OF X
PROJ NO	013.0010
DATE	JUNE 1999

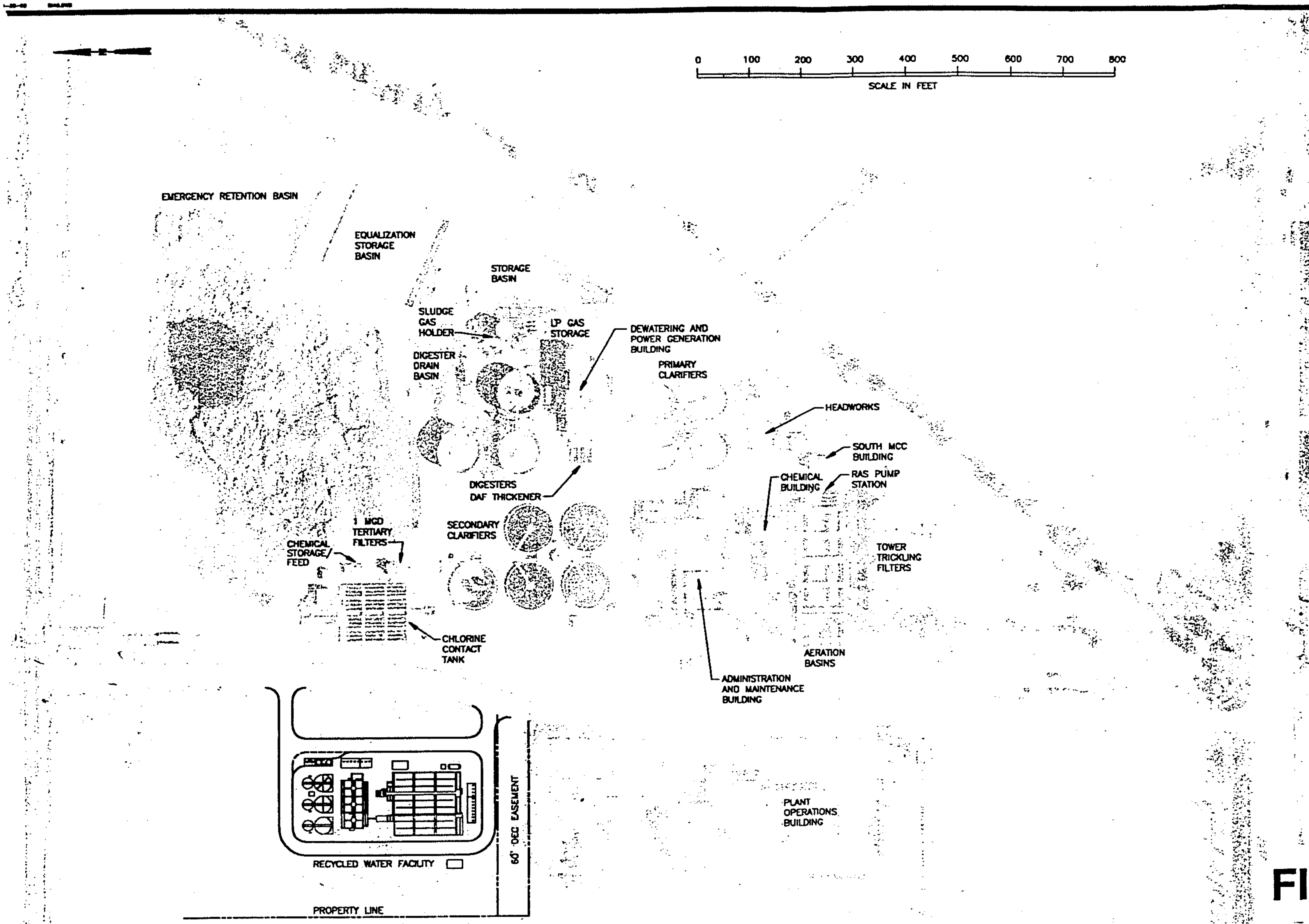

FIGURE 2-2

PRELIMINARY

0 1" — VERIFY SCALES — BAR IS ONE INCH LONG ON FULL SIZE DRAWING. IF NOT ONE INCH LONG ON THIS DRAWING, ADJUST SCALES ACCORDINGLY

REV	DATE	BY	APVD	DESCRIPTION

DESIGNED	X
DRAWN	X
CHECKED	X
APPROVED	X

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DELTA DIABLO SANITATION DISTRICT

RECYCLED WATER FACILITY

WASTEWATER TREATMENT PLANT SITE PLAN

DWG NO	X
SHEET NO	X OF X
PROJ NO	013.0010
DATE	JUNE 1999

Table 2-2
Summary of Recycled Water Quality Requirements

Parameter	Requirement
Filter Loading Rate	5 gpm/ft^2 maximum
Turbidity	• 2 NTU, daily average • 5 NTU no more than 5% of any 24 hour period • 10 NTU at any time
(Chlorine Residual) times (Modal Contact Time)	450 mg-minutes/l, minimum
Chlorination Modal Contact Time	90 minutes, minimum
Total Coliform Bacteria	• Median concentration MPN less than 2.2 MPN per 100 ml, maximum, from 7 day period • MPN of 23 per 100 ml, maximum, in more than one sample in 30-day period • MPN of 240 per 100 ml, maximum, in any sample in 30-day period

Note: Recycled water quality requirements taken from draft Water Recycling Criteria, September 1998 version.

anaerobic digestion, and centrifuge dewatering. Table 2-3 is a summary of the WPCF process design criteria and loading rates.

Proposed Recycled Water Treatment Process

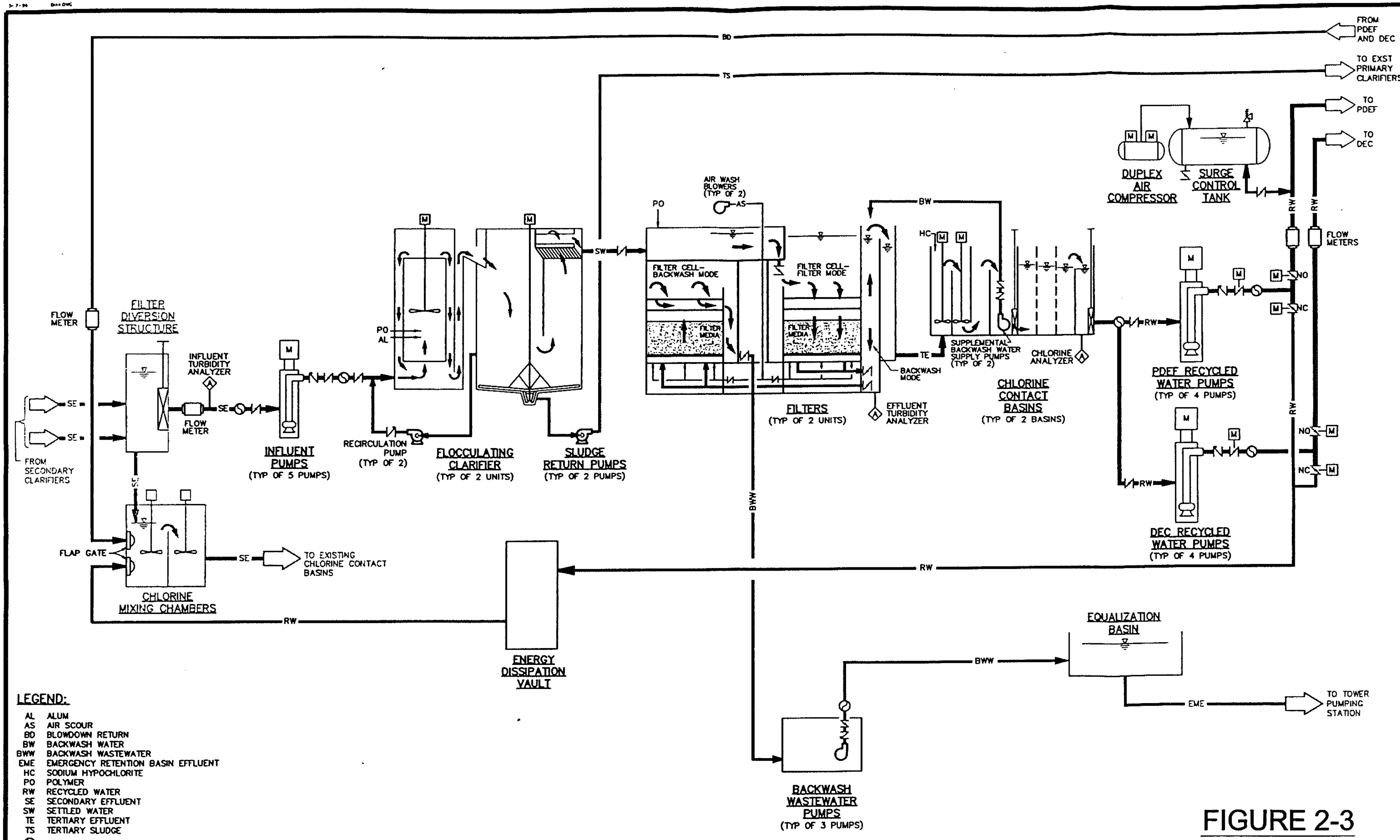
The proposed recycled water treatment process is a conventional filtration configuration that includes the following processes:

- Coagulation and Sedimentation;
- Filtration; and
- Disinfection.

The process flow diagram is shown in Figure 2-3. The initial production capacity will be 12.2 mgd for a facility serving PDEF and DEC. The treatment process modules will be based on a 6.1 mgd nominal capacity. A future third process module train could be constructed to serve additional industrial and irrigation customers, bringing the ultimate Recycled Water Facility capacity to 18.3 mgd.

Each of the individual processes is describe in the following paragraphs. Reliability/redundancy features are discussed in the subsequent section, including proposed minimum process monitoring and alarming, which are indicated in Figure 2-4.

A preliminary site layout for the Recycled Water Facility is shown on Figure 2-5.



LEGEND:

AL ALUM
AS AIR SCOUR
BD BLOWDOWN RETURN
BW BACKWASH WATER
BWW BACKWASH WASTEWATER
EME EMERGENCY RETENTION BASIN EFFLUENT
HC SODIUM HYPOCHLORITE
PO POLYMER
RW RECYCLED WATER
SE SECONDARY EFFLUENT
SW SETTLED WATER
TE TERTIARY EFFLUENT
TS TERTIARY SLUDGE
Ⓢ HEADER OR CONNECTING CHANNEL
[M] ELECTRIC MOTOR

PRELIMINARY

FIGURE 2-3

DESIGNED	X
DRAWN	X
CHECKED	X
APPROVED	X

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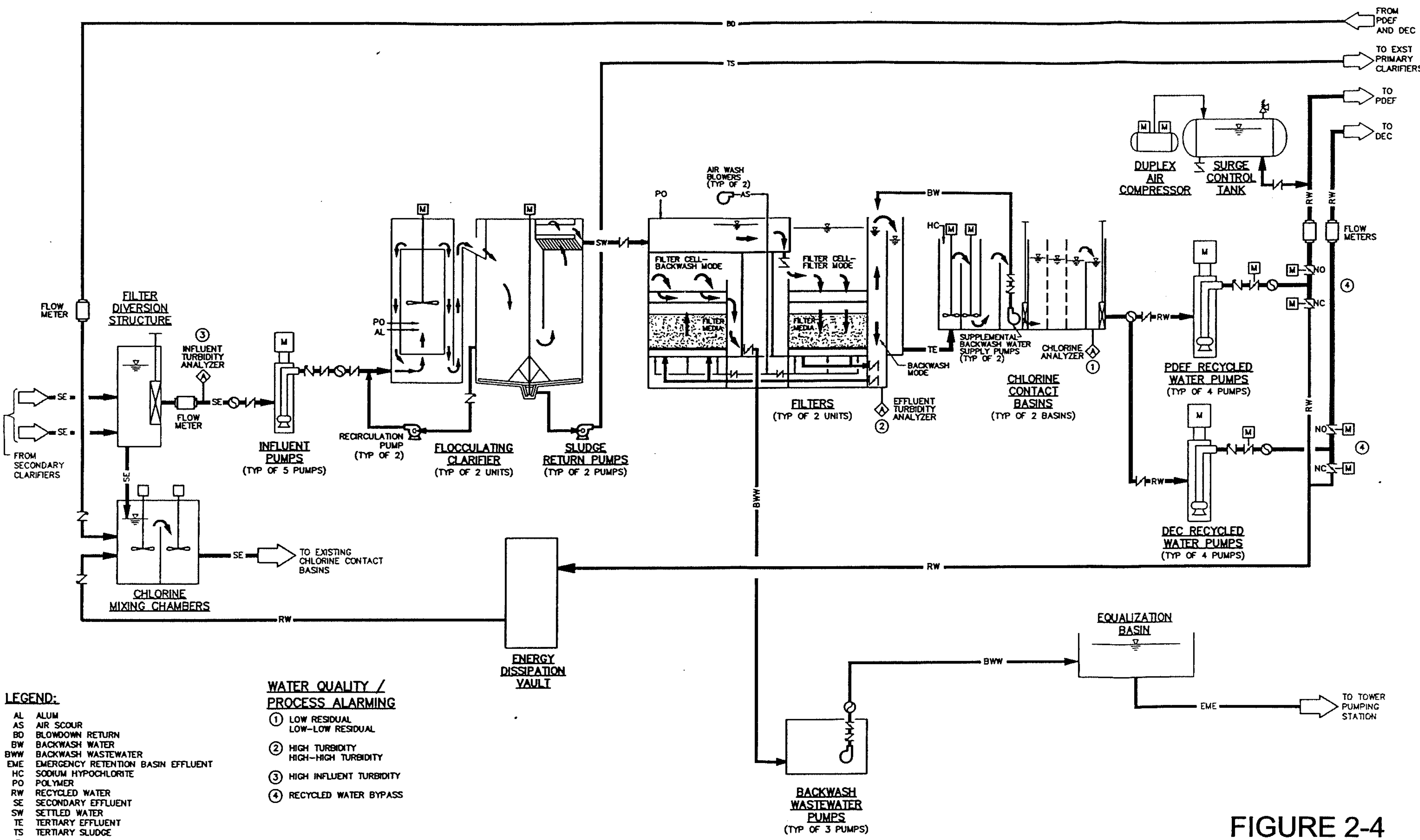
DELTA DIABLO SANITATION DISTRICT

RECYCLED WATER FACILITY

RECYCLED WATER PROCESS FLOW DIAGRAM

DWG NO	
SHEET NO	X OF X
PROJ NO	013.0010
DATE	JUNE 1999



LEGEND:

AL ALUM
AS AIR SCOUR
BD BLOWDOWN RETURN
BW BACKWASH WATER
BWW BACKWASH WASTEWATER
EME EMERGENCY RETENTION BASIN EFFLUENT
HC SODIUM HYPOCHLORITE
PO POLYMER
RW RECYCLED WATER
SE SECONDARY EFFLUENT
SW SETTLED WATER
TE TERTIARY EFFLUENT
TS TERTIARY SLUDGE
⊘ HEADER OR CONNECTING CHANNEL
[M] ELECTRIC MOTOR

WATER QUALITY / PROCESS ALARMING

1. LOW RESIDUAL
   LOW-LOW RESIDUAL
2. HIGH TURBIDITY
   HIGH-HIGH TURBIDITY
3. HIGH INFLUENT TURBIDITY
4. RECYCLED WATER BYPASS

FIGURE 2-4

PRELIMINARY

DESIGNED	X
DRAWN	X
CHECKED	X
APPROVED	X

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DELTA DIABLO SANITATION DISTRICT

RECYCLED WATER FACILITY
RECYCLED WATER
PROCESS FLOW DIAGRAM – ALARMS

DWG NO	
SHEET NO	X OF X
PROJ NO	013.0010
DATE	JUNE 1999

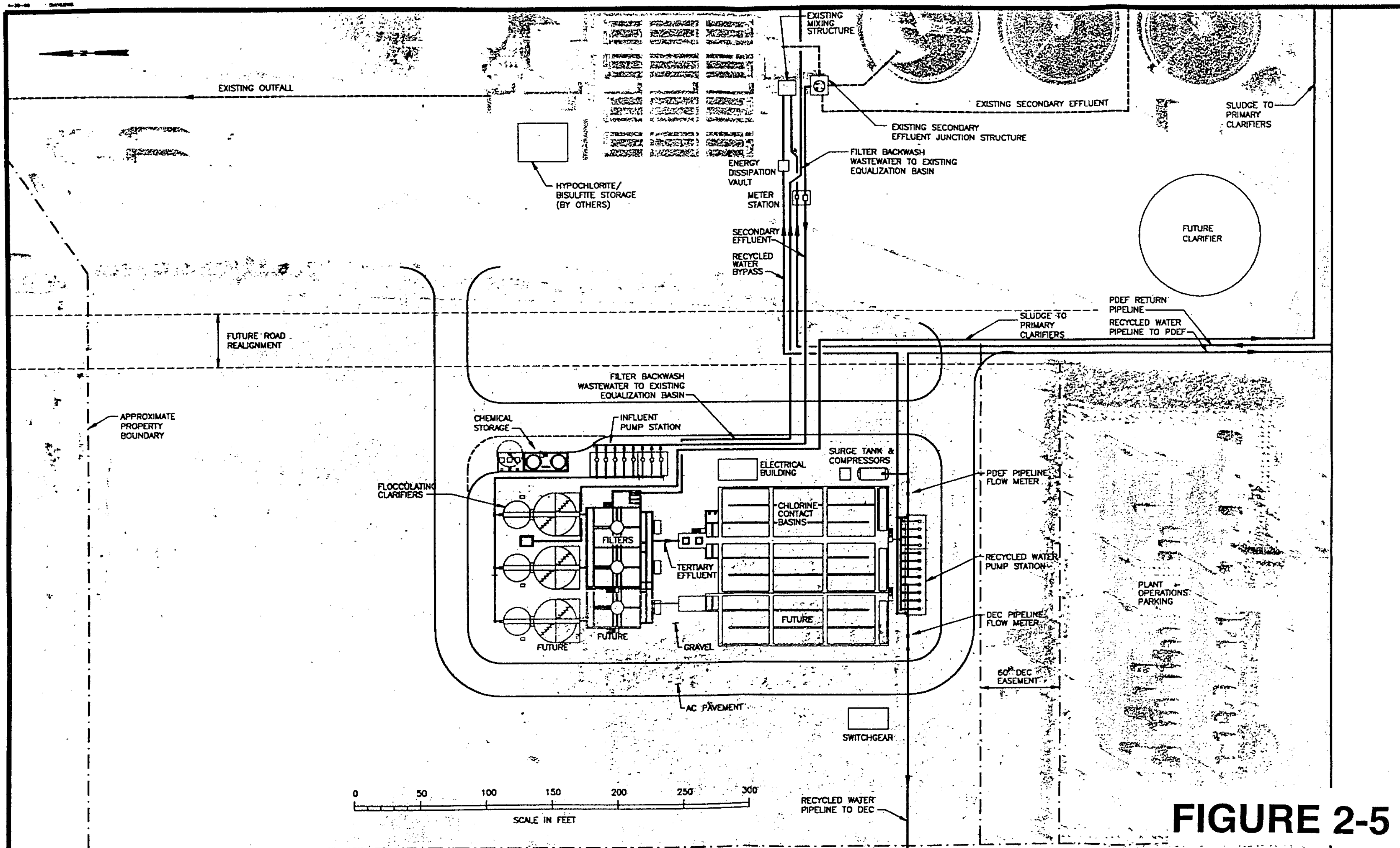

FIGURE 2-5

PRELIMINARY

VERIFY SCALES — BAR IS ONE INCH LONG ON FULL SIZE DRAWING. IF NOT ONE INCH LONG ON THIS DRAWING, ADJUST SCALES ACCORDINGLY

REV	DATE	BY	APVD	DESCRIPTION

DESIGNED	X
DRAWN	X
CHECKED	X
APPROVED	X

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DELTA DIABLO SANITATION DISTRICT

RECYCLED WATER FACILITY

RECYCLED WATER FACILITY
SITE PLAN

DWG NO	X
SHEET NO	X OF X
PROJ NO	013.0010
DATE	JUNE 1999

Table 2-3
Delta Diablo Sanitation District Water Pollution Control Facilities
Treatment Plant Design Criteria

Description	Criteria
FLOW, MGD	
PWWWF, unequalized	38.1
ADPMF	19.1
ADDWF	16.5
SUSPENDED SOLIDS, PPD	
@ ADPM	36,300
BIOCHEMICAL OXYGEN DEMAND, PPD	
@ ADPM	32,300
INFLUENT BAR SCREENS	
NUMBER – (MECHANICAL)	3
WIDTH, FT. (EACH UNIT)	4.5
CLEAR OPENINGS, IN.	0.63
SCREEN VELOCITY @ PHWWF.	
(2 UNITS), FPS	3.6
INFLUENT METERING	
PARSHALL FLUME CAPACITY, MGD	32.5
MAG METER CAPACITY, MGD	44.5
AERATED GRIT CHAMBERS	
NUMBER	2
LENGTH, FT.	20
WIDTH, FT.	20
SIDE WATER DEPTH, FT.	12
DETENTION TIME, MINUTES	
@ PMWWF	2.7
@ ADPMF	5.4
@ ADDWF	6.2
GRIT PUMPS	
NUMBER	4
CAPACITY, GPM (EACH UNIT)	165
GRIT REMOVAL AIR BLOWERS	
NUMBER	2
CAPACITY, CFM (EACH UNIT)	280
PRESSURE, PSIG	6.5
PRIMARY CLARIFIERS	
NUMBER	4
DIAMETER, FT.	70
SIDE WATER DEPTH, FT.	10
OVERFLOW RATE, GPD/SF	
@ ADPMF	1,240
@ ADDWF	1,070
DETENTION TIME, HOURS	
@ ADPMF	1.4
@ ADDWF	1.7
WEIR LOADING RATE, GPD/LIN. FT.	
@ ADPMF	21,750
@ ADDWF	18,750

Description	Criteria
AERATION BASINS	
NUMBER	5
LENGTH, FT.	84
WIDTH, FT.	42
SIDE WATER DEPTH, FT.	14.5
TOTAL VOLUME, 1,000 CF	255
BOD LOADING, PPD. (PPD/1,000 CF)	
@ ADPM	17,500 (68)
DETENTION TIME, HRS.	
@ ADPMF	2.5
MECHANICAL AERATORS	
NUMBER	10
HORSEPOWER @ HIGH SPEED (LOW SPEED)	40(20)
EFFICIENCY, LB. 0_2/HP-HR	2.0
TOTAL 0_2 TRANSFER, PPD	19,200
SECONDARY CLARIFIERS	
NUMBER	5
DIAMETER, FT.	90
SIDE WATER DEPTH, FT.	14
OVERFLOW RATE, GPD/SF	
@ ADPMF	600
@ ADDWF	520
SOLID LOADING, PPS/SF	
@ ADPMF	20.0
@ ADDWF	17.3
RETURN ACTIVATED SLUDGE PUMPS	
NUMBER	3
CAPACITY, GPM EACH	5,000
HYPOCHLORITE DISINFECTANT FEED SYSTEM	
STORAGE TANKS, NUMBER @ GAL	2 @ 9,200
FEED PUMP, NUMBER @ CAPACITY	3 @ 180 GPH
CHLORINE CONTACT TANKS	
NUMBER	4
LENGTH, FT.	120
WIDTH, FT.	21
AVERAGE WATER DEPTH, FT.	10
CONTACT TIME, MINUTES	
@ ADPMF	57
@ ADDWF	66
EMERGENCY RETENTION BASINS	
NUMBER	1
CAPACITY, MG	15
EMERGENCY RETENTION BASIN PUMPS	
NUMBER	3
CAPACITY, GPM (EACH UNIT)	2,700

Table 2-3 (continued)
Delta Diablo Sanitation District Water Pollution Control Facilities
Treatment Plant Design Criteria

Description	Criteria	Description	Criteria
EQUALIZATION STORAGE BASIN		DISSOLVED AIR FLOTATION THICKENERS	
NUMBER:	1	NUMBER	3
CAPACITY, MG	1.0	LENGTH, FT.	36
		WIDTH, FT.	12
EQUALIZATION STORAGE RETURN PUMPS		SIDE WATER DEPTH, FT.	9
NUMBER	2	ADPM SOLIDS LOADING, PPD. (PPH/SF)	23,300 (0.75)
CAPACITY, GPM (EACH UNIT)	1,000	ADPM HYDRAULIC LOADING, GPM/SF	.75
		PRESSURIZATION AIR PRESSURE, PSIG	65
TOWER TRICKLING FILTERS		PRESSURIZATION AIR QUANTITY, SCFM	7.5
NUMBER	4		
DIAMETER, FT.	50	ANAEROBIC DIGESTERS	
MEDIA DEPTH, FT.	21.5	NUMBER	3
TOTAL MEDIA SURFACE AREA, SF	9,100	DIAMETER, FT.	80
TOTAL VOLUME OF MEDIA, 1,000 CF	202	SIDE WATER DEPTH, FT.	29.5
BOD LOAD, PFD (PFD/1,000 CF)		TOTAL VOLUME, 1,000 CF	444
@ ADPM	25,700 (127)	AVERAGE VSS LOADING, TOTAL, PFD (PFD/CF)	37,100 (.08)
HYDRAULIC LOADING, GPM/ST		AVERAGE HYDRAULIC DETENTION TIME, DAYS	27
(W/O RECIRCULATION)			
@ ADPMF	1.5	DEWATERING CENTRIFUGES	
@ ADDWF	1.2	NUMBER	2
		MAXIMUM HYDRAULIC CPACITY, GPM	180
TOWER FEED PUMPS		MAXIMUM G-FORCE	1,000
NUMBER	6		
CAPACITY, GPM (EACH UNIT)		POWER GENERATION	
@ 64' TDH	5,000	NUMBER	3
		TYPE	RECIP.
		ENGINE DATA	
		KW PER UNIT	800
		SPEED, RPM	1,200
		ALERNATOR DATA	
		KVA	675
		VOLTAGE	480
		FREQUENCY, HZ.	60

Coagulation and Sedimentation

Coagulation and sedimentation are required to optimize the filterability of the secondary effluent by settling larger solids and reducing the turbidity. Coagulant and flocculent chemical aids are injected into the secondary effluent in a reactor chamber, where they are mixed with the flow using mechanical mixers. The coagulated flow then moves to the separate clarification/thickening vessel. The settled water is decanted-off and conveyed to the filter influent channel. Settled solids collect at the bottom of the settling basin. A solids scraper in the settling basin moves the solids to the hopper bottom and into the sludge line. Sludge pumps convey the solids to the WPCF primary clarifiers for further treatment..

The coagulation and sedimentation will occur in flocculating clarifier units. These pre-engineered and manufactured steel units consist of an influent reactor vessel where chemical injection and mixing is accomplished, a flume, a thickener/clarifier vessel, lamellar tube settlers, and effluent launders. A sludge recirculation pump station and piping provides sludge recirculation capability back to the reactor vessel.

Chemical injection into the reactor vessel will be controlled through an automated chemical pacing system. Algorithms for chemical dosing will be programmed into the control system based on filter influent turbidity and recycled water production flow rate. Secondary effluent flow rate and turbidity into the flocculating clarifiers will be monitored continuously upstream of the influent pump station.

Preliminary chemical selection and dosage for normal operations were investigated in a jar test program conducted on the WPCF secondary effluent. The chemical dosages were then further tested through a full-scale, 400 gpm filter pilot test. The methodology and results of the pilot testing are summarized in Appendix A. The chemical dosage ranges proposed for the coagulation/flocculation process are summarized in Table 2-4. The estimated dosage range using the conventional treatment (coagulation/settling/filtration/disinfection) process is based on the flocculating clarifiers achieving an effluent turbidity of less than 5 NTU.

Table 2-4
Proposed Chemical Dosages for Coagulation/Flocculation

Chemical	Dosage Range (mg/l)	
	Direct Filtration	Conventional Treatment (Estimated)
Polyaluminum Chloride	55 to 80	30 to 60
Anionic Polymer	6 to 9	6 to 9

Coagulant/Flocculent Chemical Feed Systems

The chemical feed system will consist of chemical storage containers, metering pumps, piping, and injection diffusers at locations of chemical addition. The primary chemicals that will be used are alum or polyaluminum chloride (coagulant) and anionic polymer (flocculent).

Additional or alternative chemicals may be used as operations staff optimizes chemical addition for the Recycled Water Facility.

Chemical Storage: Chemical storage will consist of two 5,000 gallon tanks for coagulant storage and two 400 gallon polymer storage tote bins. Each alum tank will contain storage for approximately 13 days of Recycled Water Facility average production. Each flocculent tote bin will contain storage for approximately 6 days of Recycled Water Facility average production. The tanks and tote bins will be installed in a chemical storage pad that will include containment storage volume of at least 15,000 gallons (150 percent of largest tank volume).

Chemical Fill Station: Filling of the tanks will be accomplished from a fill station located adjacent to the chemical storage area and alongside the access roadway. Chemical delivery trucks will park alongside the fill station, connect its hoses to the quick-connect couplings at the fill station, open fill valves, and fill the storage containers. Spills at the fill area will be collected in a sump and drained into the chemical storage pad containment. The spill area will be sloped to provide containment of an area large enough to encircle the chemical delivery truck.

Chemical Feed Equipment: The chemical feed equipment for coagulant will consist of three metering pumps (two duty and one standby). One metering pump will be dedicated to each flocculating clarifier unit, with the chemical feed piping manifolded together to allow each metering pump to feed either flocculating clarifier. Similarly, three polymer blending units will be provided for preparation and delivery of polymer to the flocculating clarifiers. The metering pumps will be installed at the chemical storage area at an elevation that will allow gravity feed from the bottom of the storage containers to the pump.

Chemical Piping System: The chemical feed piping will be routed from the storage containers to the chemical feed pumps and from the pumps to the points of injection. The coagulant and flocculent chemical injection locations will include:

- Discharge pipeline from the influent pump station, upstream of the bifurcation to the two flocculating clarifier units; and
- Filter influent channel to each filter unit.

The chemical piping will be configured and valved to allow flow from either of two storage containers to any of the three feed pumps, then to any of the three injection locations. This will provide the maximum operational flexibility.

Chemical Diffusers: Two chemical diffusers will be provided at each injection location. The diffusers will allow pressurized delivery of the chemicals into the process flow stream. The diffusers will be designed to maximize dispersion and initial mixing of the chemical into the main process flow stream. Additional mixing is provided by the turbulence inherent in the flow stream.

Filtration

A filter pilot test was performed at the DDSD WPCF using an existing 1 mgd CenTROL filter unit similar in configuration to the proposed full-scale filter units. The results of the pilot test have been used to establish the need for coagulation and sedimentation ahead of the filters, as well as design criteria for coagulant/flocculent dosage, filter loading rates, filter run times, and backwash rates. The proposed full-scale filtration process will consist of passing settled water from the flocculating clarifiers through a bed of filter media that will remove the floc and other filterable suspended matter. The proposed filter system is based on U.S. Filter Company's AWT Multiwash CenTROL filter unit, which is a declining-rate type filter. Each filter unit consists of four filter bed cells, each with separate inlet control valves, effluent piping and valves, air wash and backwash piping and valves, and backwash troughs.

Backwashing of the filters will be accomplished using air and filtered effluent in a sequence that allows one filter cell to backwash at any one time. An air blower unit will provide the air wash supply, which will be conveyed to the bottom of the filters. The air travels through the air wash piping in the filter underdrain and enters the filter bed from the bottom. Filtered effluent is also conveyed through the filter effluent piping in reverse direction from the filter effluent channel, then up through the underdrain system into the filter bed. The combined air and water backwash will effectively scour and remove the solids entrapped in the filter bed, then discharge them with the backwash wastewater through the wash water troughs. The backwashing sequence is controlled by a programmable logic control unit, which will open and close valves on the filter unit to accomplish normal sequential backwashing of the filter cells.

Backwash water will normally be provided from the filter effluent channel. Supplemental backwash supply will be provided for low flow operations by pumping chlorinated filter effluent water from the chlorine contact basin.

Basic design criteria for and projected performance of the filter system are described below.

Filter Loading Rate: Based on results from the filter pilot testing and Title 22 requirements, the maximum loading on the filter beds shall be 5 gallons per minute per square foot (gpm/ft^2) of filter bed surface. The filter beds will be sized such that the maximum loading rate applies with one filter cell out of service (in backwash cycle) at the maximum recycled water production flow rate. Table 2-5 summarizes the filter bed sizing to meet the maximum loading rate requirement.

Filter Backwash Rate: The proposed maximum filter backwash rate is 12 gpm/ft^2 of filter bed surface.

Filter Backwash Frequency: Based on filter pilot tests, adjusted for the addition of the flocculating clarifiers (full conventional treatment), the filter run before backwash is a minimum of 12 hours per cell.

Filter Media and Depth: The proposed filter media is 48 inches of 1.4 mm to 1.6 mm anthracite coal.

Table 2-5
Filter Unit Surface Area Sizing

Filter System Capacity: 12.2 mgd nominal plus 5% for backwash = 12.8 mgd
Number of Filter Units: 2 each
Number of Filter Cell per Filter Unit: 4 (total of 8 cells in two filter units)
Maximum Filter Loading Rate: 5 gallons/minute/ft^2 of filter surface area
Minimum Filter Surface Area:

Convert Flow from mgd to gpm: 12.8×10^6 gallons/day / 24 hours/day / 60 minutes/hour
= 8,889 gallons/min

Minimum Surface Area = Flow / Maximum Loading Rate = 8,889 gallons/min / 5 gallons/min/ft^2
= 1,778 ft^2

Assume this area is for 7 of 8 filter cells (one cell in backwash mode):

Minimum Filter Cell Area = Minimum Surface Area / (Total Number of Cells less one Cell in Backwash) =
1,778 ft^2 / (8-1)
= 254 ft^2
Filter Cell Dimension (assume square shape):
L = W = (Minimum Surface Area) $^{0.5}$
= 15.9 ft
>>>Use 16 ft cell dimension

Total Filter Area = Cell Area x Number of Cells = 16 ft^2 x 8
= 2,048 ft^2.

Actual maximum loading rate is:

Maximum Loading Rate = Maximum Flow Rate / Filter Cell Area / Number of Cells less one cell in backwash

@ maximum production rate using both filter units (serving max. demand to PDEF and DEC)
= 8,889 gallons/min / (16 ft x 16 ft x 7 cells)
= 4.96 gallons/min/ft^2 of filter surface area

Filter Chemical Addition: Chemical injection of additional filter aids into the filter influent channel will be accommodated. A chemical diffuser pipe will be installed in the filter influent channel to accomplish chemical addition immediately ahead of the filter beds. This chemical injection point could be used to optimize chemical addition as the recycled water facility begins operation.

Provisions for backwashing with chlorinated tertiary effluent (disinfected tertiary recycled water) will be included to provide a biocide to the filters. This will be accomplished, as described above, by pumping recycled water from the chlorine contact basin to the filter backwash piping.

Expected Filter Performance: Based on the filter pilot testing program described in Appendix A, filter performance will meet Title 22 requirements using the direct filtration treatment process. A full conventional treatment process is proposed to extend filter run times. With a conventional treatment process, filter performance will be improved from that reported in

Appendix A, including potentially reduced chemical usage, longer filter run times, and improved solids handling.

Disinfection

Disinfection of the filter effluent will be accomplished by injecting sodium hypochlorite and providing retention time for the flow stream in a chlorine contact basin. The contact basin will have baffling that will create serpentine flow, preventing short-circuiting, and providing at least 90 minutes of modal contact time within the basin at the maximum recycled water production rate. Hypochlorite injection into the flow stream will be in a mixing box upstream of the contact basin. Mechanical mixers will thoroughly mix the hypochlorite solution with the filtered effluent flow stream prior to discharging into the chlorine contact basin.

Basic design criteria for and projected performance of the disinfection system are described below.

Basin Sizing: The chlorine contact facilities are sized to provide at least 90 minutes of contact time within the basin prior to discharge to the Recycled Water Pump Station. Two basins will be provided, each sized for a flow of 6.1 mgd. Minimum volume within the basins needed to meet the contact time requirements will be maintained with an effluent weir. The minimum basin dimensions and calculations demonstrating conformance with the contact time requirement are summarized in Table 2-6.

Hypochlorite Feed System: Sodium hypochlorite will be injected into the filtered effluent to achieve a total CT (chlorine concentration times modal contact time) of at least 450 mg-min/l. Hypochlorite will be fed to the mixing box from the WPCF hypochlorite system, which will begin operation in the summer of 1999. The hypochlorite system includes two 9,200 gallon storage tanks, providing seven days of storage at the WPCF design average day dry weather flow capacity of 16.5 mgd. Hypochlorite feed will be accomplished using three identical positive displacement diaphragm-type hypochlorite metering pumps, each capable of delivering between 4.5 and 180 gallons per hour. One pump will feed the secondary effluent disinfection needs at the WPCF. Another pump will feed the headworks pre-chlorination and RAS sludge bulking feed points. The third pump will be a standby pump. The pump serving the disinfection demand will be used to serve the disinfection needs of the Recycled Water Facility, as well as the remaining WPCF flow. This pump will have sufficient capacity to serve both feed points because the recycled water flow is taken from the WPCF flow stream, with a net reduction in the final effluent from the WPCF equal to the Recycled Water Facility flow.

The control system for the hypochlorite feed will include provision of a Hand-Off-Automatic (HOA) selector switch on the metering pumps. The automatic stroke length controller on each pump will be configured to accept standard 4 to 20 milli-Amp (mA) signals from the Recycled Water Pump Station flow meters and the chlorine residual analyzers at the chlorine contact basin effluent channel.

Table 2-6
Chlorine Contact Basin Sizing

Dimension	Basis
No. of Basins:	2
Maximum Basin Capacity:	6.1 mgd
No of Channels in Basin:	3
Wetted Channel Cross-SectionGeometry:	Square
Length:	Assume the length is 120 feet to approximately match the existing WPCF contact basin length.
Average Side Water Depth:	Assume 12 ft
Width:	Assuming minimum 90 minute contact time at maximum 6.1 mgd flow rate, the total width required is: Min. Total Volume Req'd = $6.1\text{x}10^6$ gallons/day x 0.1337 ft^3/gallons x 1.5 hr / 24 hr/day = 50,973 ft^3 Width = Total Volume / Length x Depth = 50,973 ft^3 / 120 ft x 12 ft = 35.4 ft Call width 36 ft. consisting of 3 channels @ 12 ft x 12 ft wetted dimension
Actual Contact Time	For Contact Basin dimensions of 120 ft x 36 ft x 12 ft: Contact Time = Basin Volume / Maximum Flow Rate = 120 ft x 12 ft x 36 ft / ($6.1\text{x}10^6$ gallons/day x 0.1337 ft^3/gallon / 24 hour/day) = 1.53 hours **= 91.5 minutes.**

Compound loop capability in the control system will allow automatic adjustment of hypochlorite dosage paced off the flow meters and chlorine residual analyzers.

The required dosage of hypochlorite will be controlled automatically based on recycled water chlorine residual and recycled water production flow rate. The recycled water will have a target chlorine residual concentration of 5 mg/l. The initial dosage at the mixing box will be approximately 11 mg/l. The dosage will be automatically adjusted via algorithms programmed into the Recycled Water Facility control system to maintain a chlorine residual of 5 mg/l at the chlorine effluent channel.

Chlorine residual will be monitored continuously using a chlorine residual analyzer at the chlorine contact basin effluent channel. Flow will also be monitored downstream of the contact basin. Redundant chlorine residual analyzers will be provided. Single flow meters will be provided on the DEC and PDEF recycled water pump station discharge headers, although flow can also be calculated indirectly from the secondary effluent flow meter and the backwash pump flow meter signals.

Recycled Water Facility Reliability Features

Reliability features will be provided with the recycled water production facilities to meet and exceed the requirements of CCR Title 22. These features will include:

- Alarms to indicate problems with the Recycled Water Facility process units;
- Standby power for critical facilities;
- Emergency diversion and disposal method for recycled water not meeting minimum water quality requirements;
- Redundant and standby equipment and instruments on each treatment process; and
- System controls that automate chemical addition and control the treatment processes.

The proposed project will supply only disinfected tertiary recycled water. These tertiary treatment facilities will be provided with appropriate reliability features. No additional reliability features for the WPCF will be included as a part of this project. The specific reliability features proposed for the project are described in the following paragraphs.

Alarms: Alarms will be used to annunciate conditions such as:

- Loss of power;
- Failure of recycled water treatment processes/equipment;
- Failure of DDSD WPCF treatment processes/equipment;
- Turbidity and chlorine residual of recycled water exceeding Title 22 requirements; and
- Problem conditions at the PDEF and DEC power plants.

The alarms will be integrated into the overall Recycled Water Facility control system, which will include a central control panel at the WPCF control room. This control room is manned 24 hours a day. In some cases, alarms will annunciate to indicate a problem condition only and in other cases, alarms will be accompanied by automated system responses such as emergency shutdown of recycled water pumps and diversion of the process flow stream when recycled water quality fails to meet minimum specifications. The use and response to alarm conditions are described later in this report.

Power Supply: Reliability features associated with the power supply will include a new separate service from the local electric utility, Pacific Gas and Electric Co. (PG&E). If available and cost effective, a second service connection will be provided from a separate circuit. The effect of having redundant power services from separate circuits would be to increase the reliability of the power supply to the DDSD Recycled Water Facility.

Standby power will also be provided for the Recycled Water Facility to operate the control systems and to actuate valves and gates that will allow emergency diversion of flow. The standby power will be provided from a diesel or gas-fired engine generator set. Alternatively, individual valve actuators with backup power systems (pneumatic or hydraulic actuators with accumulator tanks) and uninterruptible power supply (UPS) units for the control systems may be provided.

Emergency Diversion and Disposal: Provisions for emergency diversion and disposal of flow involves shutting down recycled water pumps and activating the recycled water waste bypassing system to the WPCF. Upon detection of water that does not meet the minimum quality requirements (turbidity of 10 NTU or more or chlorine residual less than 5 mg/l), the control system will initiate an emergency shutdown of the influent pump station and the PDEF and DEC recycled water pump stations. This will effectively isolate the Recycled Water Facility. The bypass valves to return water to the WPCF will automatically open and the isolation valves on the recycled water discharge headers will automatically close. Operators would then correct any process or equipment problems and reset the system. As the Recycled Water Facility is brought back online, water would be bypassed from the PDEF and DEC recycled water pump stations to the WPCF chlorine mixing box. This would be accomplished by starting up the influent pump station and PDEF and DEC recycled water pump stations, along with the chemical feed systems, commencing flow through the Recycled Water Facility. Water would be pumped from the recycled water pump station through the bypass to the WPCF, where it would be wasted to the disinfection process. Water quality within the Recycled Water Facility would be monitored closely by operators until water quality requirements were being met consistently, at which time the transmission pipeline isolation valves would be opened and the bypass valves closed, resuming delivery of recycled water to the customers. Water diverted through the bypass system will be disinfected and dechlorinated in existing WPCF process units and discharged in accordance with the DDSD NPDES permit.

Flow bypassing at the Recycled Water Facility will not overload the existing WPCF processes because the recycled water flow stream originally derives from the WPCF flow stream. The WPCF has sufficient capacity to treat incoming raw wastewater without diversion of a side stream to the recycled water facilities.

Further discussion of emergency diversion procedures is included later in this report.

Existing WPCF Reliability Features: All existing DDSD WPCF process units include multiple treatment units capable of treating peak permitted plant flows with one unit out of service. These include screening and grit removal, primary sedimentation, trickling tower filtration, aeration, secondary clarification, disinfection and dechlorination, activated sludge, and solids handling processes.

Recycled Water Facility Process Train Configuration: Each Recycled Water Facility process train will be sized for 50 percent of the maximum recycled water demand from the PDEF and DEC, including an allowance for backwash water. This allows for one unit to be taken out of service without completely interrupting recycled water production. Manifolding the process units together so that flow can bypass a particular unit process that is out of service provides some degree of redundancy. Additional redundancy features include:

- Eight filter cells to provide sized to provide full production capacity with one cell out of service;
- Redundant chlorine mixers at the chlorine contact basin; and
- Valving to allow isolation of process units.

Influent Pump Station: The influent pump station will include a standby pump capable of pumping 25 percent of the maximum plant flow to the flocculating clarifiers.

Flocculating Clarifiers: Reliability features associated with the flocculating clarifier process units include the ability to increase the loading rate from the design loading rate. This would allow additional flow to be routed through a single unit, making up for some of the capacity that would be lost if one unit were out of service. The effect on the overall process would be a slow degradation in settled water quality (increase in filter influent turbidity), which would result in shorter filter runs. Over a short duration of several days, this condition would not significantly affect overall recycled water quality. Additional chemical injection points at the filter influent channel will allow operators to compensate for changing water quality of the filter influent flow.

The solids handling facilities associated with the flocculating clarifiers will also be provided with reliability features in the form of standby pumping equipment.

Chemical Feed Systems: The coagulant and flocculent chemical systems, including the chemical storage, chemical feed pumps, chemical piping, chemical injection diffusers, and related appurtenances for coagulant and flocculent chemicals, will include reliability features to ensure proper operation.

Multiple chemical storage tanksfor alum and tote bins for polymer will be provided so that in the event that a tank is damaged or must otherwise be taken out of service, the second bin can brought on-line manually by opening a valve. This configuration will provide storage volume adequate for in excess of 13 days and 6 days of operation for alum and polymer, respectively, at average recycled water production. The chemical storage area will also include containment volume equal to 150 percent of the largest storage tank to prevent spillage of chemical in the event of a rupture.

Multiple chemical feed pumps will also be provided, consisting of one duty and one standby unit of equal capacity. Each feed pump will be capable of pumping the maximum chemical demand, with a turndown adequate to meet the minimum demand requirement. These feed pumps will not be provided with standby power.

Chemical piping systems will include chemical lines sized for maximum chemical feed rate. One spare chemical line will also be provided to each feed point in case of damage to the primary chemical lines. The chemical piping will be provided with a secondary containment, either as double wall pipe or by routing the piping in a containment conduit.

Filters: The basic configuration of the proposed filter units provides a significant reliability feature. Each filter unit consists of four separate cells, each capable of producing up to one-third of the total recycled water production capacity through that filter unit. If even three cells are out of production, the filter unit can still produce recycled water at a rate of 33 percent of the total filter unit capacity.

Additional filter system reliability features are associated with the backwash system. The backwash supply normally comes from the filter effluent channel, which provides the water and head to reverse flow through the effluent piping and back into a drawn-down cell's underdrain, up through the media, and overflowing into the wash water troughs. Flow from each of the cells in production is used for backwashing, resulting in a dip in recycled water production during backwashing. At low production rates, there will be a deficiency in filtered effluent available for backwash. To make up for this deficiency, supplemental backwash supply pumps will be installed at the chlorine contact basin mixing box so that chlorinated tertiary effluent water can be conveyed to the filter effluent channel to maintain water levels and supplement the available backwash supply. Use of this chlorinated supply will also provide a biocide should the filters experience bio-growth.

Two supplemental backwash supply pumps will be provided, each with a capacity of 1.1 mgd. This represents a total supplemental supply of 2.2 mgd, or 50 percent of the required backwash flow capacity.

The backwash wastewater system will include reliability features in the form of standby pumping capacity from the filters to the WPCF equalization basin. Three backwash wastewater pumps, including two duty and one standby pump of equal capacity will be installed in a sump that will provide volume of approximately 50 percent of the required backwash volume for equalization.

Chlorine Contact Basin: The reliability features provided with the disinfection system include effluent weirs that will maintain the minimum volume required for meeting CT requirements. Two chlorine mixers will also be provided to ensure reliable mixing of hypochlorite into the flow stream.

Hypochlorite Feed System: The hypochlorite system being installed at the WPCF by DDSD will be on-line in mid-1999. The hypochlorite system includes reliability features, including a standby feed pump that can provide up to 100% of the maximum hypochlorite demand, two storage tanks with a storage volume equivalent to 7 days of continuous feed at the WPCF design ADDWF flow rate.

Recycled Water Pump Station: The PDEF and DEC recycled water pump station will consist of four dedicated pumps (three duty and one standby) of the same capacity for service to each power plant. This represents standby pumping capacity of 33 percent of the maximum power plant demands.

Metering Facilities: Metering of Recycled Water Facility process stream flows will include the secondary effluent flow from the WPCF, recycled water flow to PDEF, recycled water flow to DEC, and bypass flow from the recycled water pump station to the WPCF. This will allow direct and indirect measurement of the critical flow streams, which is required for pacing of the chemical feed systems. This allows the control system to verify meter accuracy by comparing direct meter measurements with indirect flow calculations. Also, if a meter is not operating, the Recycled Water Facility will still be operable using the other operating meters.

Instrumentation: Redundant instrumentation will be provided for monitoring secondary effluent turbidity, filter effluent turbidity, and chlorine contact basin effluent chlorine residual. Two analyzers (one duty and one backup) will be provided at each location. Where sample pumps are required, the configuration will be the same.

Control Systems: Reliability features included in the Recycled Water Facility control system will include a staged alarm system, hard-wired interlocks for automatic flow stoppage (pump station shutdown) under certain alarm conditions, backup power supply, and programmed logic that will automate emergency diversions when water quality requirements are not being met.

The staged alarm system will consist of multiple levels of alarm conditions for certain critical parameters. The initial alarm level will be used to indicate potential problems with Recycled Water Facility operations, such as effluent turbidity exceeding 2 NTU, to alert operators of potential problems within the Recycled Water Facility that could result in a drop or stoppage of recycled water deliveries. This would give operators time to correct problems and maintain production. The next level of alarm would result in the reduction or stoppage of flow through the various unit processes. The last level of alarm would result in automatic shutdown of the influent pump station and the PDEF and DEC recycled water pump stations upon detection of inadequate recycled water quality.

Automated shutdown of the pumping facilities to isolate the Recycled Water Facility will be accomplished through hard-wired interlocks that would trip pumping units under certain alarm conditions. The hard-wired interlocks are needed in lieu of programmed interlocks to prevent inadvertent reprogramming that could bypass the interlocks.

Backup power to the control system would be provided by integral uninterruptible power supply (UPS) systems provided with the control hardware. The emergency generator would also supply power to the control system in the event of a prolonged power outage.

Control logic will be developed to implement the operational schemes for the Recycled Water Facility, including emergency shutdown. The logic will include set-point adjustments for operator controlled parameters such as number of pumps operating, filter cell backwash order, and alarm set-points. The logic will also require that process or equipment trouble/fail alarms be reset locally at the process unit or equipment to assure that an operator has reviewed the situation. This will prevent inadvertent operation of equipment that requires repair or other attention from operations staff.

All equipment will include provisions for remote and local manual override in the event of automated system failure or problems. This feature will also be used for startup of the Recycled Water Facility, allowing close operator oversight of the process units and equipment.

Supplemental Water Supply

No supplemental water supply will be provided by DDSD as a part of the Recycled Water Facility project. When the Recycled Water Facility is not operating or is not producing recycled water meeting the minimum quality requirements, the PDEF and DEC power plants will activate their own backup water supply.

The PDEF proposes to construct a 600,000 gallon on-site recycled water reservoir that will serve as a backup supply to the DDSD recycled water facilities during production outages or downturns. At full power plant production, the 600,000 gallon reservoir could provide recycled water for cooling towers and other industrial uses for almost 4 hours. In addition, the PDEF will have a connection to the City of Pittsburg water system.[1]

The DEC will have connections to both the City of Pittsburg potable water system and the Contra Costa Water District's Contra Costa Canal raw water supply.[2]

Monitoring and Reporting

Monitoring and reporting will be performed by DDSD, as the Producer, in compliance with the requirements set forth in the RWQCB's "Self-Monitoring Program for Order 96-011" and "Standard Provisions and Reporting Requirements for Water Reuse Orders," which are attached as Appendix B and Appendix C, respectively.

Recycled water effluent quality monitoring will occur at the recycled water chlorine contact basin effluent channel, upstream of the recycled water pump station.

Monitoring points at the user sites will be established and documented in the Recycled Water Use Permit between the City of Pittsburg or DDSD (as Distributor) and each User.

Contingency Plan

The proposed contingency plan for emergency shutdown of the recycled water facility flow stream consists of tripping pumps at the influent pump station and the recycled water pump station. This will effectively isolate the Recycled Water Facility from the recycled water distribution system and prevent release of water not meeting minimum quality requirements. Along with the automatic tripping of pump motors, filter effluent valves will automatically close to prevent overflows at the chlorine contact basin. The valves will be able to close in one to two minutes. The chlorine contact basin has adequate freeboard to absorb any flow from the filters until the effluent valves close. Should a spill occur, the spilled water would be collected in the Recycled Water Facility storm drainage system, which is connected to the existing WPCF drainage system. This system discharges to the emergency retention basin, which is then pumped to the WPCF primary clarifier process units.

[1] From Application for Certification for Pittsburg District Energy Facility, prepared by Pittsburg District Energy Facility, L.L.C., dated June 1998.
[2] From Application for Certification for Delta Energy Center, prepared by Calpine Corporation/Bechtel Enterprises, Inc., dated December 1998.

The following paragraphs describe the contingency procedures that will be followed if an emergency shutdown is required.

Emergency Shutdown: Given the configuration of the proposed DDSD Recycled Water Facility, an emergency diversion would not have to occur. Rather, an emergency shutdown and isolation of the Recycled Water Facility would be initiated. Conditions under which emergency shutdown of the Recycled Water Facility include:

- Turbidity at the filter effluent basin above Title 22 maximum requirement;
- Chlorine residual at the contact basin effluent channel falls outside the acceptable operating range;
- Loss of power to recycled water treatment facilities; and
- Filter loading rates above 5 gpm/ft^2.

Emergency Diversion Procedures: When an alarm condition or emergency diversion condition arises that requires emergency shutdown of the Recycled Water Facility, the control system will automatically trip, through hard-wired interlocks, the influent pump station and the PDEF and DEC recycled water pump station pumps. The bypass system isolation valves will also automatically open as the isolation valves on the recycled water pump station discharge manifolds close. This will effectively isolate out-of-spec recycled water within the Recycled Water Facility and prevent conveyance into the recycled water distribution system.

Restart of Recycled Water Facilities: After an emergency shutdown of the Recycled Water Facility, plant operators must follow a specific procedure before resuming deliveries of recycled water. The initial step is to reset all equipment and processes after clearing the cause of the shutdown. Resetting of equipment must be done locally at the equipment to ensure the operators have addressed any equipment problems. Once the equipment has been reset and is in "ready" mode, the recycled water facilities will be restarted by sequentially starting up the influent and recycled water pumps. From a zero flow condition, pumps will have a hard-wired start-enable interlock that requires the bypass valving to be open and the recycled water pipeline isolation valves to be closed. This will ensure that from a start-up condition, water is wasted to the WPCF chlorine mixing structure until such time that water quality parameters are being met. At such time, the bypass can be closed and the recycled water isolation valves opened for delivery of recycled water to customers. The wasted recycled water will be disinfected, dechlorinated, and disposed through the WPCF facilities in accordance with the DDSD NPDES permit.

Notification of Treatment Failures: Notification of emergency shutdowns at the Recycled Water Facility will be done according to a procedures documented in the Recycled Water Facility Operations and Maintenance Manual. This will include alarm annunciation at the DDSD WPCF and appropriate follow-up investigation and reporting of the cause of the failure and corrective actions taken by DDSD operations staff. Notification will be made to the City of Pittsburg or DDSD (Distributor), recycled water users, and RWQCB and DOHS staff.

<u>Notification to Users:</u> The PDEF and DEC will be notified by alarm annunciation via a SCADA link between the DDSD Recycled Water Facilities and the DEC and PDEF. DDSD operators

will also contact the PDEF operators by telephone promptly upon an outage or production downturn.

Notification of City of Pittsburg or DDSD (Distributor): The City of Pittsburg or DDSD, as Distributor, shall be notified of Recycled Water Facility failures by telephone within 4 hours of a shutdown.

Notification of RWQCB and DOHS Staff: Notification of a Recycled Water Facility shutdown or treatment failure shall be done in accordance with the provisions of RWQCB Order 96-011, and the Self-Monitoring Program for Order 96-011, as documented in the Recycled Water Facility Operations and Maintenance Manual.

Section 3 - Recycled Water Transmission and Distribution Facilities

This section includes a description of the recycled water transmission and distribution facilities associated with the DDSD Recycled Water Facility project. These facilities consist of the PDEF and DEC recycled water Pump station, a 16-inch transmission pipeline from the Recycled Water Facility to the PDEF site, and a 18-inch transmission pipeline from the Recycled Water Facility to the DEC site.

Recycled Water Pump Station

The recycled water pump station will boost recycled water for transmission to the PDEF and DEC power plants. The facility will consist of barrel pumping units, suction and discharge piping and valving, and appurtenant facilities located at the Recycled Water Facility. Figure 3-1 is an illustration of the pump station. A waste bypass will be included on both the PDEF and DEC recycled water pump station discharge headers for wasting water produced at startup of the recycled water facilities until water quality requirements are met.

Three duty pumps and one standby pump will be provided to serve the PDEF. A similar configuration will serve the DEC. This configuration will ensure reliable flow to the PDEF and allow for a reasonable turndown in delivered recycled water flow from the pump station. A surge tank and duplex compressor will be included for the PDEF recycled water pump station, because of the pipeline length, to mitigate potential surge events caused by pump station trips, sudden valve closures, and other events that could cause transients in the transmission pipeline. The pump station will be controlled based on flow requests from PDEF and DEC and recycled water facility operations. Storage and/or supplemental water sources will be provided at the PDEF and DEC sites to make up for Recycled Water Facility shutdowns or production downturns and to provide hydraulic control for the transmission system.

The recycled water pump station will be designed to provide identification of the facility as a recycled water facility, including placards and signage on recycled water-containing piping and equipment. Exposed piping and equipment containing recycled water will be painted Pantone 522 purple. Signage and painting will be in accordance with the California-Nevada Section AWWA publication "The Guidelines for Distribution of Non-potable Water."

Recycled Water Transmission Pipelines

Dedicated recycled water transmission pipelines will convey recycled water from the recycled water production facilities to the PDEF and DEC. The PDEF recycled water

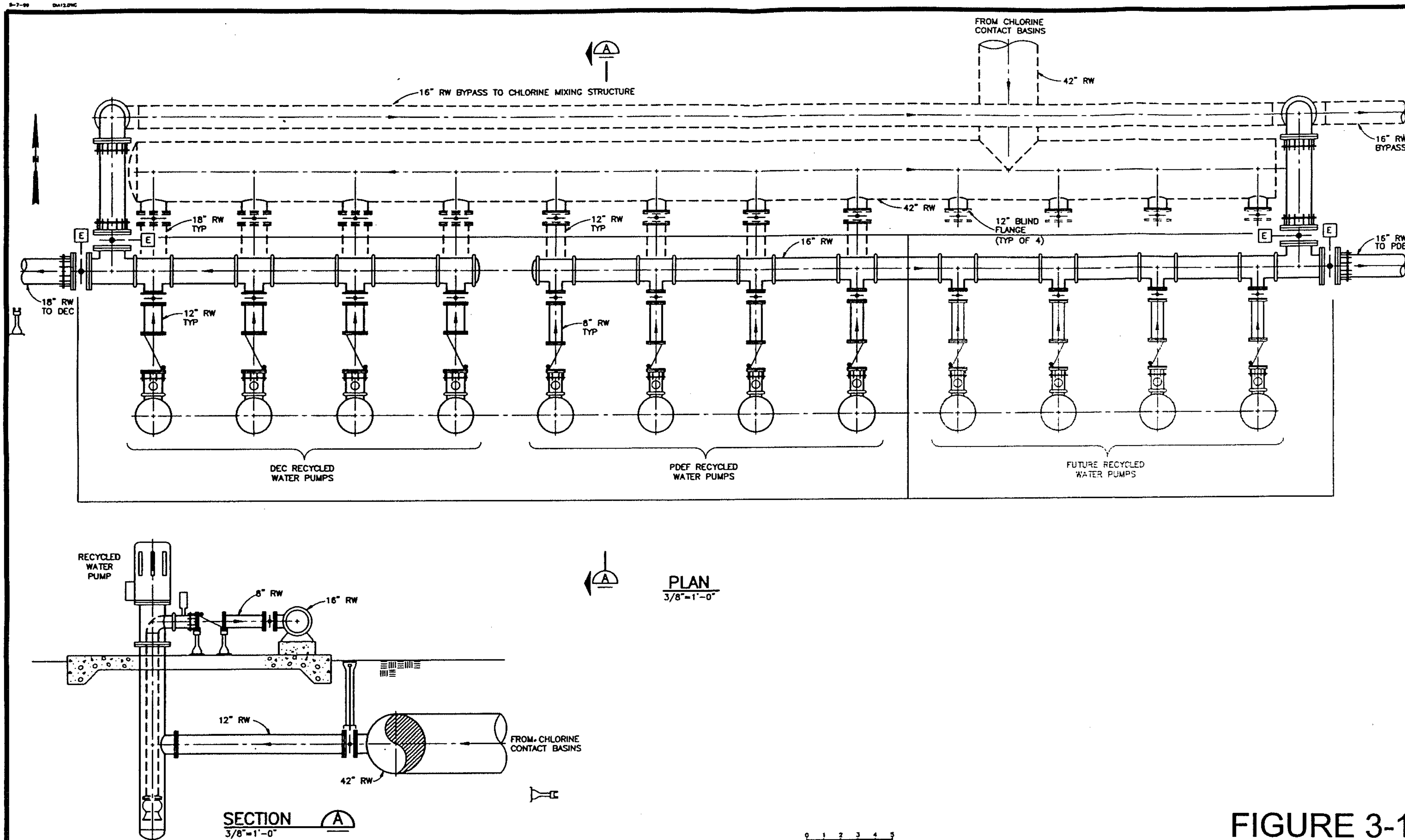


FIGURE 3-1

0 1 2 3 4 5
SCALE IN FEET

PRELIMINARY

0" — 1"
VERIFY SCALES — BAR IS ONE INCH LONG ON FULL SIZE DRAWING. IF NOT ONE INCH LONG ON THIS DRAWING, ADJUST SCALES ACCORDINGLY

REV	DATE	BY	APVD	DESCRIPTION

DESIGNED	X
DRAWN	X
CHECKED	X
APPROVED	X

RMC
Raines, Melton, & Carella, Inc.
Consulting Engineers/Project Managers

DELTA DIABLO SANITATION DISTRICT

RECYCLED WATER FACILITY

RECYCLED WATER PUMP STATION
PLAN AND SECTION

DWG NO	FIG-__
SHEET NO	X OF X
PROJ NO	013.0010
DATE	JUNE 1999

transmission pipeline is approximately 18,000 feet long. The DEC recycled water transmission pipeline is approximately 300 feet long.

PDEF Recycled Water Pipeline: The PDEF recycled water pipeline is a 16-inch line that will serve the PDEF. In the future, additional landscape irrigation and industrial users will be connected to this pipeline, but initially, only PDEF will be served from it. The pipeline will discharge to a closed recycled water piping system at the PDEF.

The proposed PDEF recycled water pipeline alignment is shown on Figure 3-2. The route begins at the DDSD WPCF site, heading south along the main WPCF access road, then west along the Pittsburg-Antioch Highway. The alignment then turns north along a new PDEF truck access road parallel to and east of Columbia Street, then to the power plant site along the northward extension of Columbia road, then west to the PDEF site along the south side of West 3rd Street. An existing 18-inch potable water line runs along a portion of Pittsburg-Antioch Highway.

DEC Recycled Water Pipeline: The DEC recycled water pipeline begins at the DEC recycled water pump station and heads west to the DDSD property line. The DEC power plant site lies adjacent to the west side of the DDSD property. The pipeline will be 18-inch and is dedicated for serving DEC.

Pipeline Design Criteria: The recycled water pipelines will be designed to deliver the flows required for PDEF and DEC operations. These criteria are summarized in Table 3-1. The pipeline and its appurtenant facilities will also be designed considering guidelines and regulations pertaining to the distribution of recycled water, including the following:

- Guidelines for the Distribution of Non-potable Water from the California-Nevada Section – AWWA;
- California Waterworks Standards from CCR Title 22;
- Regulations Relating to Cross-Connections from Title 17, Chapter 5, Group 4;
- Manual of Cross-Connection Control/Procedures and Practices from DHS; and
- Disinfected Tertiary Recycled Water Guidelines: On-Site Facility Retrofitting from California-Nevada Section – AWWA.

The pipeline alignments will be developed to maintain minimum separation with potable water lines in accordance with Section 6430 of Title 22, including 10-foot minimum separation with parallel potable water lines and minimum 1-foot separation where recycled water lines must cross under potable lines. Where these criteria cannot be met, special design features such as continuous welding of pipe joints will be provided in the recycled water pipeline design.

Recycled water pipe will be identified with integral Pantone 522 purple coloring and/or recycled water utility warning tape approximately 1-foot above the pipe. Pipeline appurtenances such as air valves, isolation valves, blowoffs, and other related appurtenant facilities will be similarly identified. All surface elements such as valve covers will be

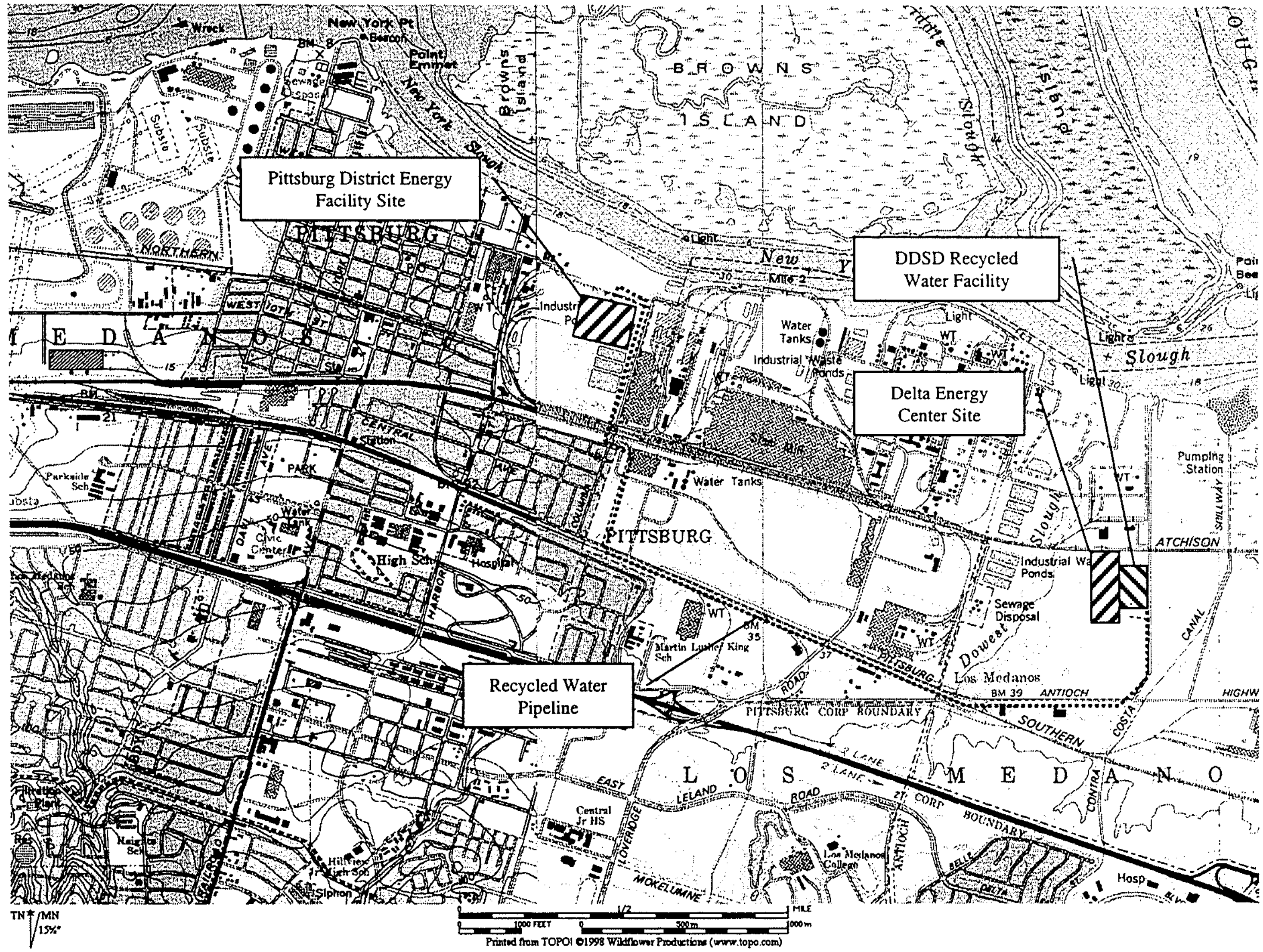


Figure 3-2
Delta Diablo Sanitation District
Recycled Water Facility Project

Recycled Water Pipeline Alignments

Table 3-1
Recycled Water Pipeline Design Criteria

Description	Criteria
PDEF Recycled Water Pipeline	
Maximum PDEF Demand	3.7 mgd
Pipeline Size (determined by PDEF)	16-inch
Delivery Pressure at PDEF	100 psi
Additional Available Capacity in Pipeline	1.5 mgd
DEC Recycled Water Pipeline	
Maximum DEC Demand	8.5 mgd
Pipeline Size (determined by DEC)	18-inch
Delivery Pressure at DEC	100 psi
Additional Available Capacity in Pipeline	Zero

distinguishable from the potable water system using Pantone 522 purple coloring and different shaped and sized valve cans and enclosures. The appurtenances and pipelines will be identified in accordance with the California-Nevada Section AWWA publication "Guidelines for the Distribution of Non-potable Water."

Cross-Connection Control: Cross-connection control and monitoring will be conducted by the City of Pittsburg under their existing cross-connection control program. Initially, no connections other than to PDEF and DEC will be included on recycled water transmission and distribution pipelines. Monitoring will center on observation of the pipeline alignment to detect any illegal connections. Comparing meter records at the power plants with the meters at the Recycled Water Facility will also be used to detect mass imbalances, which could be an indication of a leak or illegal connection. Cross-connection monitoring will be summarized in reports prepared by DDSD or the City of Pittsburg, as Distributor.

Section 4 - Recycled Water Use Areas

The initial use of recycled water will be for industrial cooling water for the PDEF and DEC merchant power plants. Additional uses in the future may include irrigation uses and other industrial uses. These future uses will be described in supplemental Engineering Reports as those uses are defined and implemented. The two industrial users are described in the section.

PDEF and DEC Power Plants

The following paragraphs are a description of the PDEF and DEC recycled water use areas and includes general information about the two facilities. Neither facility has been designed yet. Preliminary engineering work is currently being done to provide support for the California Energy Commission (CEC) permitting process. A decision from the CEC is expected in August 1999 and late 1999 for the PDEF and DEC plants, respectively.

Given the preliminary nature of the designs, the discussion that follows related to recycled water system design and operation is necessarily general in nature. The information contained herein will serve as criteria in the development of the recycled water systems for the PDEF and DEC.

PDEF Site General Information: The PDEF site is located along the south side of East 3rd Street between Harbor Street and the USS-POSCO steel plant. The property is currently zoned for general industrial use (IG) within the City of Pittsburg. The site is currently vacant and undeveloped. The property is owned by USS-POSCO.

DEC Site General Information: The DEC site is located along the west side the DDSD WPCF property. The property is currently zoned for general industrial use (IG) within the City of Pittsburg. The site is currently vacant and undeveloped.

Agency Jurisdiction: Agencies with jurisdiction over the development and operations at the PDEF and DEC are summarized in Table 4-1.

User Responsibilities: The Users will be responsible, under a Recycled Water Use Permit with the City of Pittsburg or DDSD, for regulating and monitoring the distribution of recycled water at the power plants. The regulations, procedures, monitoring requirements, and reporting requirements will be defined in the Recycled Water Use Permit.

PDEF and DEC will identify a User Supervisor who will be knowledgeable of the entire water treatment and distribution system, both potable and non-potable. The User Supervisor will be responsible for installation, operation, and maintenance of all in-plant recycled water facilities and cross-connection equipment. The User Supervisor will also

Table 4-1
Agencies with Jurisdiction over PDEF and DEC Development and Operations

Area of Jurisdiction	Agency
Power Generation Application for Certification	• California Energy Commission (CEC) (AFC No. 98-AFC-1)
Land Use	• US Army Corps of Engineers San Francisco District (USACOE) • CEC • California Department of Transportation (Caltrans) • City of Pittsburg • City of Antioch
Levies Against Development Projects (near school districts)	• Pittsburg Unified School District • Antioch Unified School District
Air Quality	• Bay Area Air Quality Management District (BAAQMD) (Application No. 18595)
Noise	• Federal Energy Regulatory Commission (FERC) • Federal Transportation Agency • Federal Highway Administration • Housing and Urban Development • Federal Aviation Authority • California Occupational Safety and Health Agency (CalOSHA) • Department of Health Services (DOHS) • City of Pittsburg • City of Antioch
Traffic and Transportation	• Caltrans • Contra Costa County • City of Pittsburg • City of Antioch
NPDES Storm Water	• Regional Quality Control Board (RWQCB) San Francisco Bay-Region
Fire Protection	• City of Pittsburg Fire Department • City of Pittsburg (for use of reclaimed water for fire protection)
Worker and Public Health and Safety	• Federal Occupational Safety and Health Administration (OSHA) • DOHS • California Offices of Emergency Services (OES)
Hazardous Materials Inventory and Reporting, Emergency Planning, and Public Right to Know Act	• OSHA • DOHS
Hazardous and AHMs	• OES • Contra Costa County

Table 4-1 (continued)
Agencies with Jurisdiction over PDEF and DEC Development and Operations

Hazardous Materials and Waste Management	• EPA Region IX • National Response Center • CalOSHA • Caltrans • California Highway Patrol • RWQCB San Francisco Bay Region • Contra Costa County Health Department • City of Pittsburg Fire Department • City of Pittsburg
Storage of Ammonia and IIPP	• CalOSHA
Power Transmission Lines	• FAA • CEC • California Public Utilities Commission (CPUC)
Water Supply and Quality	• RWQCB San Francisco Bay Region • EPA Region IX • State Water Resources Control Board • CEC • City of Pittsburg
Soil Conservation	• RWQCB San Francisco Bay Region • CEC • City of Pittsburg • City of Antioch
Biological Resources	• US Fish and Wildlife Service • USACOE • California Department of Fish and Game • CEC • City of Pittsburg • City of Antioch
Cultural and Paleontological Resources	• State Historic Preservation Office • USACOE • CEC • Contra Costa County
Aesthetic/Visual Resources	• City of Pittsburg • City of Antioch

be responsible for performing inspections at the PDEF and DEC, monitoring the recycled water use areas, and reporting to DDSD and the City of Pittsburg, as required by RWQCB Order 96-011 and its associated Self-Monitoring Program for Order 96-011 document.

Recycled Water Uses: PDEF and DEC intend to use recycled water for the some or all of the following industrial processes:

- Cooling tower make-up water;
- Heat recovery steam generator (HRSG) make-up water (after additional treatment)
- Auxiliary boiler feed water (after additional treatment) ; and
- Other miscellaneous equipment uses.

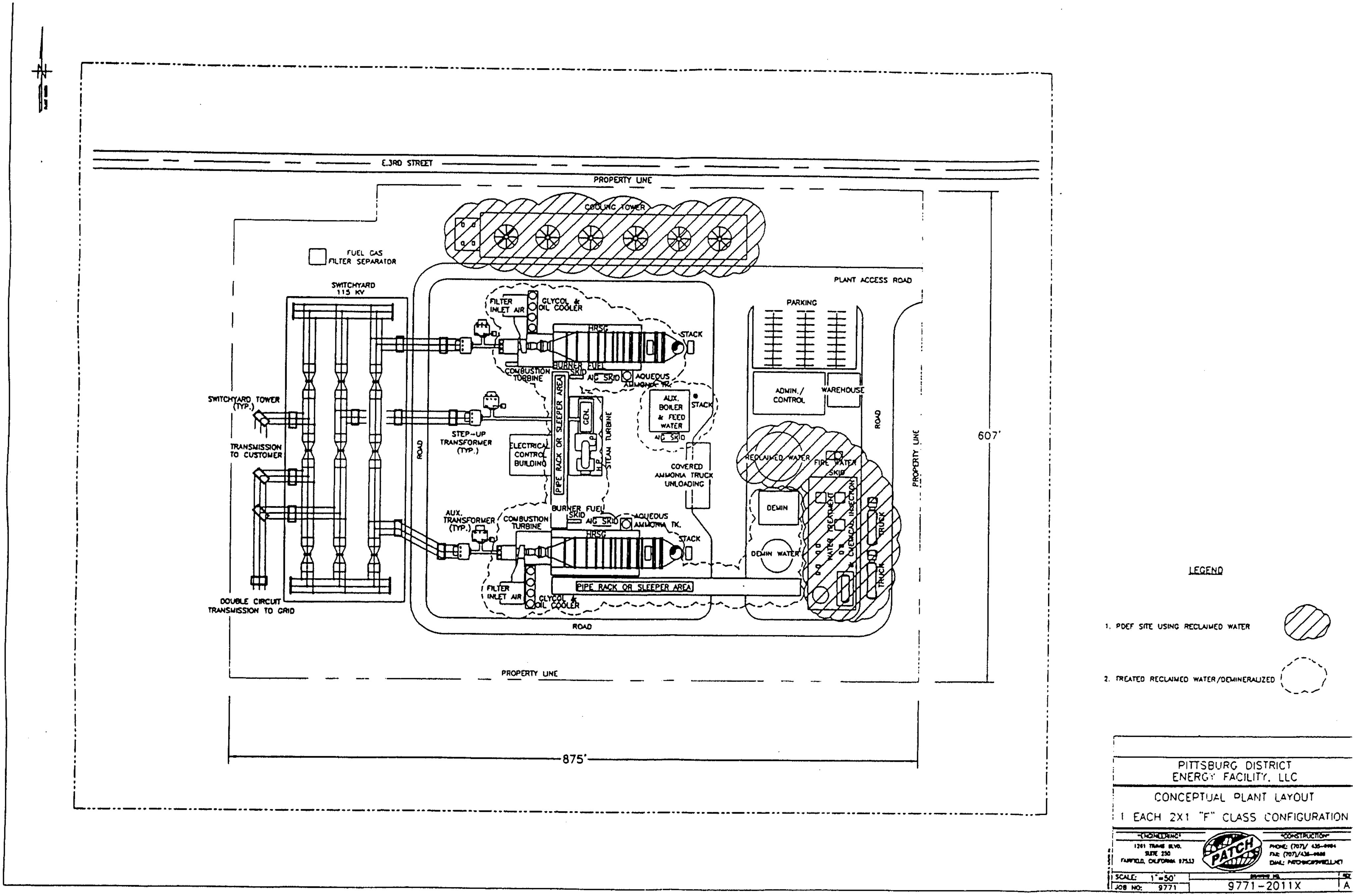
The PDEF site and its recycled water use areas are illustrated on Figure 4-1. Figure 4-2 is a schematic diagram of the PDEF recycled water system. Similar figures for the DEC are shown in Figures 4-3 and 4-4. The following paragraphs describe the industrial processes that will utilize recycled water.

<u>Cooling Tower Make-Up Water:</u> Steam turbines and auxiliary heat exchangers, which are used to remove heat from other miscellaneous plant equipment, are sources of steam or hot water that require cooling. The circulating water within the cooling towers will condense the steam-turbine exhaust and provide cooling to heat exchangers.

The circulating water make-up will be supplied from the pressurized recycled water supply line or an on-site storage tank. PDEF will have a 600,000-gallon recycled water storage tank. DEC will also have some storage, although the configuration of that storage is not yet known. The make-up flow will be metered by a turbine meter or ultrasonic flow meter and monitored in a distributive control system (DCS). DDSD will be in communication with PDEF and DEC via an integrated communication system. That system will be used to monitor and control flow from DDSD to the power plant sites.

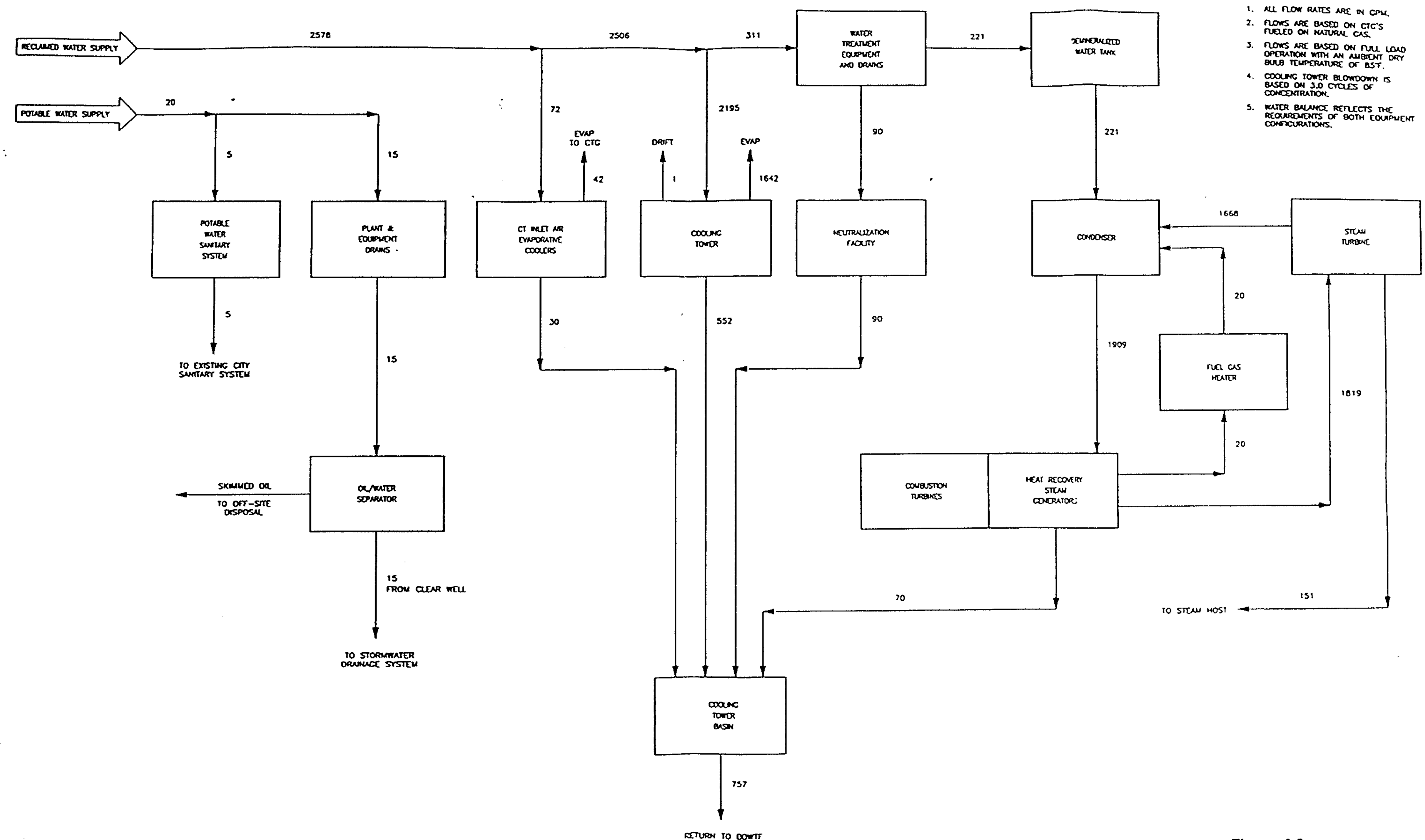
The recycled water will be supplied to cooling water towers so that a constant level is held in the cooling tower basins. This flow is the sum of combined blowdown flows, and the combined cycle steam turbine load evaporation rate.

Cooling tower system recycled water will be circulated for approximately 3 cycles of concentration between the cooling towers and the cooling tower basin. A conductivity analyzer will regulate cooling tower blowdown. The blowdown flow from PDEF will be returned to DDSD for disposal under DDSD's NPDES Permit. It will be metered and displayed on the DCS. DEC will dispose of its blowdown and other waste streams through a separate NPDES permit to be obtained by DEC. A portion of the circulating water, taken upstream of the condenser, will flow to the auxiliary heat exchangers and return to circulating water return piping downstream of the condenser. The cooling tower basin is the collection point for the majority of the wastewater generated in by the PDEF and DEC plants.



Source: PDEF AFC Drawing No. 9771-1002, Rev. A

Figure 4-1
PDEF Recycled Water Use Areas

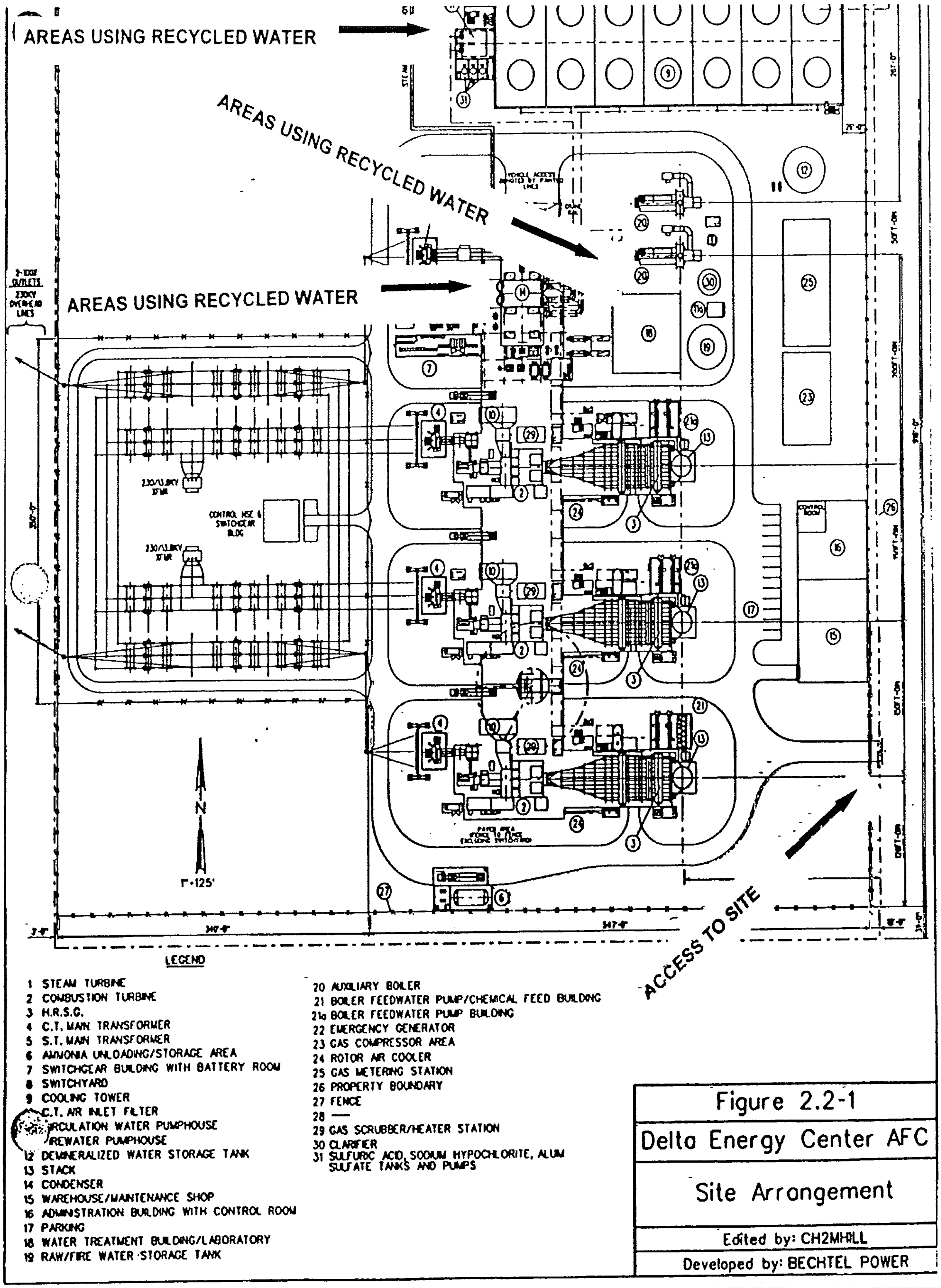


NOTES:

1. ALL FLOW RATES ARE IN GPM.
2. FLOWS ARE BASED ON CTG'S FUELED ON NATURAL GAS.
3. FLOWS ARE BASED ON FULL LOAD OPERATION WITH AN AMBIENT DRY BULB TEMPERATURE OF 85°F.
4. COOLING TOWER BLOWDOWN IS BASED ON 3.0 CYCLES OF CONCENTRATION.
5. WATER BALANCE REFLECTS THE REQUIREMENTS OF BOTH EQUIPMENT CONFIGURATIONS.

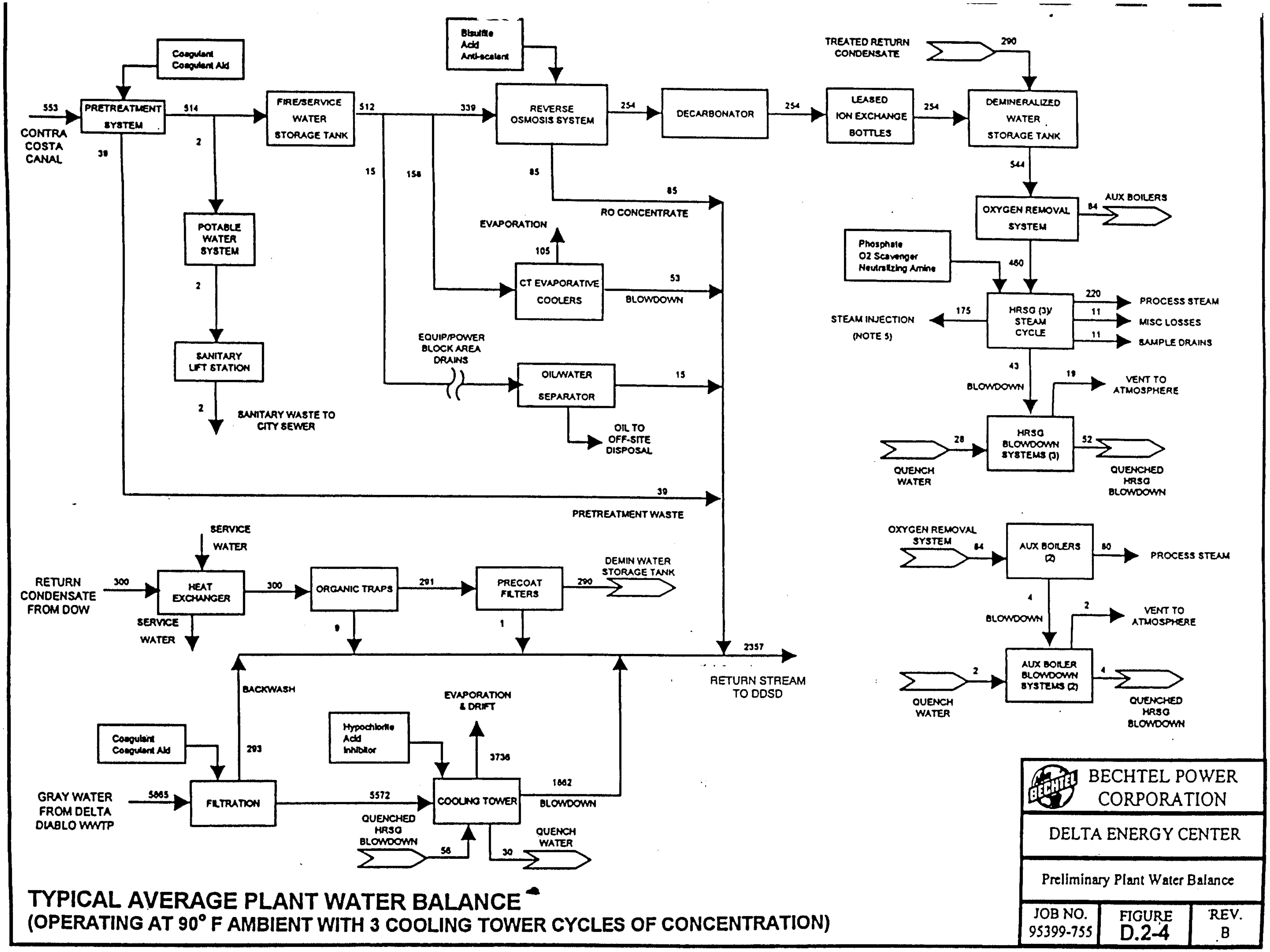
Figure 4-2
PDEF Water Balance Diagram

Source: PDEF AFC Drawing No. 9771-2011X, Rev. A



Source: Figure 2.2-1 from DEC AFC

Figure 4-3
DEC Site
Recycled Water Use Areas



Source: DEC AFC Figure D.2-4, Rev. B

Figure 4-4
DEC Water Balance Diagram

A chemical feed system will supply water-conditioning chemicals to the cooling water to minimize corrosion and to control the formation of mineral scale and biofouling. Chemical treatment will include addition of sulfuric acid to reduce scaling, and sodium hypochlorite, a chlorine substitute, to minimize biofouling. Sodium hypochlorite will be shock fed into the system. The chemical feed equipment will consist of several storage drums and two full capacity chemical metering pumps. In addition, an organic phosphate, corrosion-inhibitor solution will be fed into the cooling tower system. The corrosion inhibitor feed equipment will consist of several chemical storage drums and two full capacity metering pumps. The chemical feed system will be designed for continuous monitoring of control parameters and specified quantities for optimum operations.

The cooling process within a cooling tower creates airborne droplets that can exit the cooling tower as "drift." The cooling tower's make-up water total dissolved solids (TDS), that are included in these drift emissions and comprise the particulate emissions from the cooling tower to which the public can be exposed, concentrates in the tower's circulating water. The PDEF and DEC cooling towers will be equipped with multi-pass cellular mist eliminators to reduce these potential drift emissions.

Mist eliminators are solid matrices typically made from fiberglass, plastic or metal that remove airborne droplets in air streams exiting a cooling tower by inertial separation caused by directional changes through herringbone, wave or cellular (i.e., honeycomb) shapes. Airborne droplets impact on these surfaces and return to the cooling tower water. The design may include features such as corrugations and water removal channels to enhance the drift removal.

<u>Heat recovery steam generator (HRSG) make-up water:</u> Makeup water for the HRSGs is taken from the recycled water storage tank, but additional treatment of the water will be performed prior to use in the HSRGs, including filtration and demineralization, to reduce suspended and dissolved solids. Recycled water from the storage tank will be treated by reverse osmosis equipment, followed by polishing with demineralizer ion exchange resins to remove dissolved minerals. Demineralized water at the PDEF will be stored in a 250,000-gallon storage tank, which provides 14 hours of capacity in the event the demineralizer treatment process is interrupted. The DEC will also have demineralized water storage of an undefined volume.

At the PDEF, as an option to using recycled water in the demineralizer system, a potable water line may be connected directly to the demineralizer. Recycled water from the 600,000-gallon storage tank would serve as a backup supply. The potable water line will have a reduced pressure backflow preventer to meet cross-connection control requirements, and the backup recycled water will be connected via a swivel-ell connection for use in emergencies when potable water is not available. A system for emergency connection to the recycled water line will be developed to include specific controls on the connection process to avoid backflow of reclaimed water into the potable water system. These will be documented in the PDEF Operations and Maintenance Manual.

Additional chemical conditioning of the water will occur in the HRSG/steam turbine cycle to minimize corrosion and scale formation. The system will feed an oxygen scavenger to the feed water for pH control. The design will provide for automatic feed of the oxygen scavenger in proportion to condensate flow, and the amine in proportion to condensate flow with a pH bias. The system will include an oxygen scavenger solution feed tank and two full capacity chemical feed pumps, and an amine solution feed tank and two full capacity chemical feed pumps.

The chemical feed system will also feed sodium phosphate to the HRSG boiler water to control pH and minimize scale formation. The system will be designed for operation of the HRSGs using the low solids, congruent phosphate method of boiler water treatment. The design will provide for feeding sodium phosphates to the HRSG water to react with any hardness present. For congruent phosphate treatment, a dilute solution of a disodium phosphate and trisodium phosphate mixture will be manually prepared in a phosphate solution tank dedicated to each HRSG steam drum pressure level. Feed of phosphate to each HRSG steam drum will be manually initiated based on boiler water phosphate residual and pH. One full capacity phosphate feed pump will be provided for each HRSG steam drum with one common spare pump serving each drum pressure level.

<u>Auxiliary Boiler Feed Water:</u> The PDEF plant will include a backup auxiliary boiler that will be equipped with a low NOx, natural-gas-fired burner. The auxiliary boiler will provide a backup steam source to ensure continuous steam supply. Demineralized recycled water will be used to feed the auxiliary boiler.

<u>Miscellaneous Equipment Uses:</u> Auxiliary cooling water (recycled water) is supplied to the auxiliary cooling water heat exchangers from the circulating water system. This is part of a closed-loop cooling water system. The primary systems consist of:

- closed-loop cooling water pumps;
- heat exchangers;
- closed-loop water ("head") tank;
- chemical shock feeder tank.

The auxiliary cooling water will be provided to steam and gas turbine lube oil coolers, boiler feed water pump bearings, sampling coolers and generator hydrogen coolers. The system will use corrosion-inhibited reclaimed water with ethylene glycol for cooling.

<u>Non-Industrial Recycled Water Uses:</u> Recycled water will be used as an emergency source of fire-fighting water only in the event of an emergency when the potable water supply is insufficient. A service water tank sized for 2-hour capacity of a worst-case fire event will store potable water fire-fighting water. From the service tank, a jockey pump will distribute the water to the fire-distribution loop. The recycled water will not be used

to fill the tank, but will connect to the fire-distribution loop on the suction side of the jockey pump.

The proposed fire-protection system will include backflow prevention to prevent cross connection between potable and recycled water supplies. Redundant backflow devices will be installed, including an air gap on the potable water supply connection to the service tank. Also, the recycled water supply line from the 600,000 gallon storage tank will be connected on the suction side of the jockey through a reduced pressure backflow preventer or by using a "swivel ell" connection between the fire water storage tank and the jockey pump.

Recycled Water Systems Design Requirements: The PDEF and DEC recycled water systems will be designed to comply with various recycled water design guidelines and to meet the requirements of the Recycled Water Use Permit. The following features will be included in the design:

- Containment berms and structures will be provided at each place of reuse for collection of recycled water spills or leaks. The collected leakage and spillage will be conveyed by gravity to the evaporative cooling tower basin, which will then flow to a return waste stream pipeline. The PDEF waste stream pipeline will return back to the DDSD WPCF. The return waste stream will be discharged into the WPCF chlorine mixing box for disinfection and subsequent dechlorination and disposal through the DDSD outfall. DDSD is currently preparing an application to revise its NPDES permit to include the return waste stream from PDEF. The DEC return waste stream pipeline will discharge directly to the DDSD outfall under a new NPDES permit being obtained by DEC.
- Recycled water storage tanks will include a potable water emergency supply connection. The discharge to the storage tank will be at the top of the tank through a gooseneck connection with an air gap between the gooseneck and the tank. The air gap connection will be designed in full compliance with cross-connection control requirements. Also, the potable water supply pipeline to the tank will be an above-ground pipe from the City of Pittsburg revenue meter to the recycled water tank, which will be marked to readily identify it as a potable pipeline.
- Backflow prevention devices will be provided at locations where potable and recycled water supplies could be cross-connected. These locations are the recycled water storage tank, the fire-fighting system, and possibly the demineralizer system. Backflow prevention devices will be designed in accordance with the applicable State and local laws, rules, and regulations and will be subject to approval by the Department of Health Services (DOHS).
- Public access to the PDEF and DEC will be strictly controlled. A chain link fence will surround the site and a controlled access gate will be installed at the main plant entrances. The public will have minimal ability to access the PDEF and DEC, although employees will be able to access areas of recycled water use. The recycled water use areas will be identified with appropriate signage and all accessible recycled water piping, storage tanks, process equipment, and appurtenant facilities will be painted Pantone 512 purple and will carry a permanently attached placard with

"CAUTION: NON-POTABLE WATER – DO NOT DRINK" printed or embossed on it. Signage will comply with the provisions stated in the California-Nevada Section AWWA publication "The Guidelines for the On-Site Retrofit of Facilities Using Disinfected Tertiary Recycled Water." Also, leak detection and monitoring within recycled water use areas will be used to minimize potential exposure to recycled water. Finally, PDEF and DEC employee protection measures will include regular training.

Use Area Inspections and Monitoring

Potential exposure hazards at the PDEF and DEC could occur at the following locations and events:

- Cooling tower system;
- Recycled water and demineralized recycled water storage tanks;
- Overflow of the recycled water storage tanks;
- Recycled water treatment and chemical injection building;
- Maintenance and repair of tanks, pipes, and other recycled water basins; and
- Fire protection events where recycled water is used.

An overfill event at the recycled water storage tank could potentially occur discharging recycled water onto the ground within work areas, possibly exposing employees to recycled water. To prevent this occurrence, the recycled water tank will have high-level indicator controls that will shut off the flow from the pipeline. In addition, high-level alarms, both at the tank and in the control room, will sound. Telemetry between the PDEF and DEC plants and DDSD will allow shutdown of recycled water flow during an overfill event. An overflow pipe on the recycled water storage tank will be routed to the cooling tower basin.

Chemical dosing operations for the recycled water system will be located in the recycled water treatment and chemical injection areas. The chemicals will be added to the system via small dosing pumps. The pumps will be fed directly from chemical containers and will not be diluted with recycled water, therefore worker contact with the recycled water will be minimal. Engineering controls will monitor for leaks in the recycled water pipelines. Visual inspections will also be done to monitor any reclaimed water leaks.

The administrative building will be separate from all recycled water use areas. The administration building plumbing will be fully supplied by the potable water system.

User/Water Supplier Supervisors: The PDEF and DEC User Supervisors will be responsible for installation, operation and maintenance of all in-plant recycled water facilities and cross correction equipment and for performing inspections and conducting routine monitoring of the PDEF recycled water use areas. The DDSD User Site Inspector will conduct inspections of the PDEF and DEC sites in accordance with RWQCB Order 96-011 and the Recycled Water User Permits.

Proposed Inspection and Reporting: The DDSD Site Supervisor will have the right to enter PDEF and DEC during reasonable hours for inspecting the recycled water operations. The PDEF and DEC User Supervisors will perform the following inspections and reporting:

- Inspection of potential cross-connections with the potable water system to ensure that recycled water facilities comply with the regulatory requirements.
- Inspection of signage and controls to prevent direct human consumption of non-potable water and control and limit run-off.
- Notification of updates or proposed changes, modifications, or additions to on-site recycled water facilities. All changes would be approved by the City of Pittsburg and DDSD as a requirement in the Recycled Water Use Permit.
- Reporting of all failures in recycled water to regulatory agencies.
- Inspections and reporting required in the RWQCB's Order 96-011 and Self-Monitoring Program for Order No. 96-011.

Employee Training

At least one PDEF and DEC User Supervisor will be trained to meet the certification requirements set forth by the California Water Code, and the AWWA California-Nevada Section's "Guidelines for the On-Site Retrofit of Facilities Using Disinfected Tertiary Recycled Water," and the California-Nevada Section's recommended cross-connection (shutdown) testing procedures.

PDEF and DEC will participate in DDSD training courses in the use of recycled water. Training will be conducted pursuant to the California Water Code (amended January 1998). The training will be conducted over a period such that all workers receive the training as a requirement to begin working in specific recycled water use areas.

In conjunction with the signage and labeling of areas and equipment using reclaimed water, an integrated program on the practices, precautions, and procedures for recycled water use will be implemented plant-wide involving all levels of administrative and process workers. Specific training programs for workers in areas of recycled water use will be conducted to provide those workers an intimate level of knowledge in the operations and maintenance of the processes in the recycled water use areas.

The PDEF and DEC User Supervisors will also conduct periodic on-site training for recycled water treatment personnel, and other employees working in and around recycled water use areas. The Water Distribution Operator Training Handbook (AWWA 1976) will be the main resource for the training of the User Supervisors and other employees responsible for specific use areas. Where practices and procedures have been updated or modified for distribution and use of recycled water, the appropriate regulatory guidance documents will be provided in the training.

The training will include the relevant topics from the Water Distribution Operator Training Handbook, modified specifically for use of recycled water at PDEF and DEC and as applicable. Potential topics could include the following:

- Sources of Water and Their Characteristics;
- Water Production, Storage and Distribution;
- Public Health;
- Operational Mathematics;
- Applied Hydraulics;
- Reservoirs;
- Pipe, Types, Uses and Protection;
- Pipe Installation and Maintenance;
- Pipeline Appurtenances;
- Meters and Services;
- Pumps and Motors;
- Electricity, Instrumentation and Control;
- Safety;
- Chlorine Handling and Safety (chlorine dosing not anticipated at PDEF);
- Maps, Drawings and Records;
- Public Relations; and
- System Operation.

The following are the user responsibilities also to be covered in the training program:

- Informing the public of the use of recycled water;
- Using reclaimed water in a manner consistent with reclaimed water use criteria;
- Exercising a high degree of responsibility for the maintenance of the use area; and
- Assigning and maintaining a site supervisor position.

Other specific topics to be covered in the training will include:

- Procedures used when working with recycled water;
- Regulatory rules and regulations associated with recycled water use; and
- Basic cross-connections and backflow principles and procedures.

The training programs will include visual and written materials, as well as hands-on activities.

Rules and Regulations

DDSD will develop a formal Rules and Regulations on the Use of Recycled Water manual that will become a part of the Recycled Water User Permits with the Users by reference. The manual will codify procedures, restrictions, and other requirements that DDSD will place on recycled water users. Table 2.1 – Agency/User Responsibilities for Recycled Water Use (California) of the California-Nevada Section AWWA's

"Guidelines for the On-site Retrofit of Facilities Using Disinfected Tertiary Recycled" lists a responsibility matrix. The section on "Use Areas" lists the major items that will be included in the manual and that PDEF and DEC will be required to implement:

- Conduct backflow device testing on potable water service, where applicable;
- Cross-connection inspections;
- Cross-connection shutdown tests;
- Monitoring of on-site recycled water use for compliance with the Rules and Regulations;
- Notification of involved agency/users of non-compliance;
- Installation and maintenance of signs indicating recycled water and recycled water use at the facility

In addition, the Rules and Regulations manual will include the forms required to prepare notifications and to document the testing and inspection activities.

The Rules and Regulations manual for working with recycled water at the PDEF and DEC will also incorporate the relevant sections (where applicable) of the following documents:

1. Guidelines for Distribution of Non-Potable Water (California-Nevada Section AWWA)
2. Guidelines for On-Site Retrofit of Facilities using Disinfected Tertiary Recycled Water (California Nevada Section AWWA)
3. Manual of Cross-Connection Control/Procedures and Practices (Department of Health Services)
4. California Department of Health Services Environmental Management Branch: "Guidelines for Use of Reclaimed Water"
5. Memorandum of Agreement Between the Department of Health Services and the State Water Resources Control Board on Use of Reclaimed Water".
6. California Code of Regulations, Title 17; "Drinking Water Supplies – Backflow Prevention".

Appendix A

Technical Memorandum: DDSD Jar Testing and Filter Pilot Testing Program

Date: May 13, 1999

Prepared by: Bill Slenter, RMC
Reviewed by: Marilyn Bailey, RMC

Introduction

Tertiary filtration pilot testing was performed on DDSD secondary effluent during April 1999 as part of the DDSD Recycled Water Facility project. The purpose of this testing was to evaluate the feasibility of treating DDSD secondary effluent to meet California Department of Health Services (DHS) Draft Title 22 requirements for disinfected tertiary recycled water. The treatment process evaluated was monomedia gravity filtration with coagulant and flocculant chemical addition.

Data obtained from this pilot testing includes filter influent and effluent turbidities, coagulant and flocculant dosages, filter water levels, filter run lengths, and filter loading rates. The data obtained from the pilot testing was used to evaluate:

- Success of consistently meeting Title 22 requirements using direct filtration;
- Chemical dosages required to obtain Title 22 effluent quality; and
- Filter run times and backwash volumes under high DDSD secondary effluent turbidity conditions.

The primary goal of this testing was to determine if DDSD effluent could meet Title 22 requirements using direct filtration. The initial evaluation of operational and cost feasibility were secondary goals at this facility evaluation stage of the project.

Pilot Test Methodology

Facilities Description

Although bench-scale filter systems are typically used for pilot testing, this pilot test took advantage of an existing 1 million gallon per day (mgd) full-scale monomedia tertiary filter facility at the DDSD treatment plant. This system, consisting of a 4 cell monomedia gravity filter, chemical feed equipment, and pumps, was installed several years ago to recycle a small portion of DDSD's effluent for filling non-potable water tanker trucks. Because this existing filter system was essentially the same design as that being considered for the Recycled Water Facility project, it was ideal for use in the pilot test and was expected to provide more reliable results than bench-scale facilities.

The design criteria of the existing filter system are provided in Table A-1. A plan view filter schematic is provided in Figure A-1. A process diagram of this system is given in Figure A-2. Note that two cells are shown in the schematic, whereas the actual filters have four cells.

The General Filter CenTROL design operates like a typical gravity filter, except for a few unique hydraulic features. As shown in Figure A-2, filter influent first enters the splitter box at the top of the filter and is split to the four filter cells via weirs. The influent water moves from the splitter box through inlet pipes and inlet valves into the cell wash troughs. The wash troughs are normally submerged, which minimizes the turbulence of the incoming flow.

To initiate a cell backwash, the cell inlet valve is closed and the cell is allowed to drain down. Then the backwash valve is opened and the remaining water above the filter bed is allowed to drain out of the filter through the wash trough. When the water level in the cell drops to the top of the wash trough, air scour is automatically initiated, and at about the same time the water level in the operating filters and the effluent weir tank begins to push clarified water upwards through the backwashing filter bed and out of the wash trough, removing accumulated solids in the process. At the end of the backwash cycle, air scour is deactivated and backwash water is allowed to continue passing through the bed for a short time to remove entrained air. Then the backwash

Table A-1: Filter System Design Criteria

<u>Filters</u>	
Manufacturer and model	General Filter CenTROL
Capacity (total)	1 mgd (700 gpm)
Number of cells	4
Diameter, each cell	7.5 ft
Height, each cell	18.5 ft
Media type	Monomedia Anthracite[a]
Media size	1.4 – 1.6 mm
Media depth	4 ft
Filter bed surface area, each cell	44.2 ft^2
Feed pumps (located in secondary effluent junction box)	2 @ 350 gpm each (1 pump @ 400 gpm used in test)
Max cell loading rate	5 gpm/ft^2
Backwash rate	12 gpm/ft^2 recommended 9 gpm/ft^2 actual[b]
<u>Chemical Feed System</u>	
Coagulant pump	Single metering pump, 8 gph max.
Flocculant dilution system	Stranco PolyBlend Model PB50-N
Dilution system capacity (neat)	1 gph
Coagulant and Flocculant Storage	Liquid chemical tote bins, 200 gal. each
<u>Instrumentation</u>	
Influent Turbidimeter	Hach Surface Scatter 6 w/ Honeywell chart recorder
Effluent Turbidimeter	Hach 1720C w/ Honeywell chart recorder

[a]Cell 3 contains a dual-media bed and was not used in this pilot test.
[b]Due to equipment limitations, the filters were operated at a reduced backwash rate. See text for further explanation.

valve is then closed and the water level is allowed to slowly rise to cover the filter bed (via continued upwards water flow through the bed). Finally the cell inlet valve is reopened to bring the cell back into production.

Pilot Test Objectives

The primary objective of the pilot test was to determine if DDSD secondary effluent can be treated using direct filtration with chemical addition to meet draft Title 22 requirements for disinfected tertiary recycled water. The applicable Title 22 requirements are provided in Table A-2.

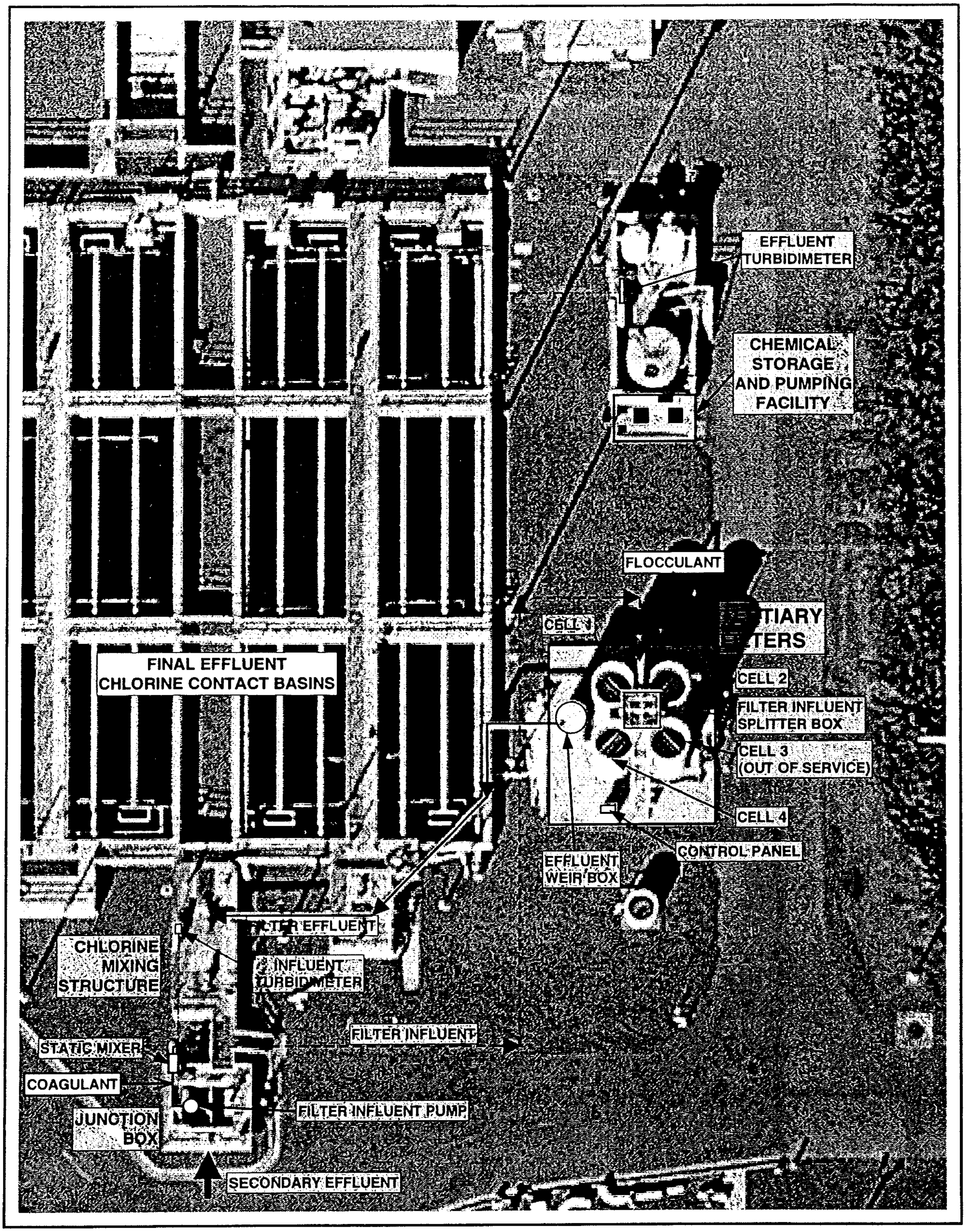
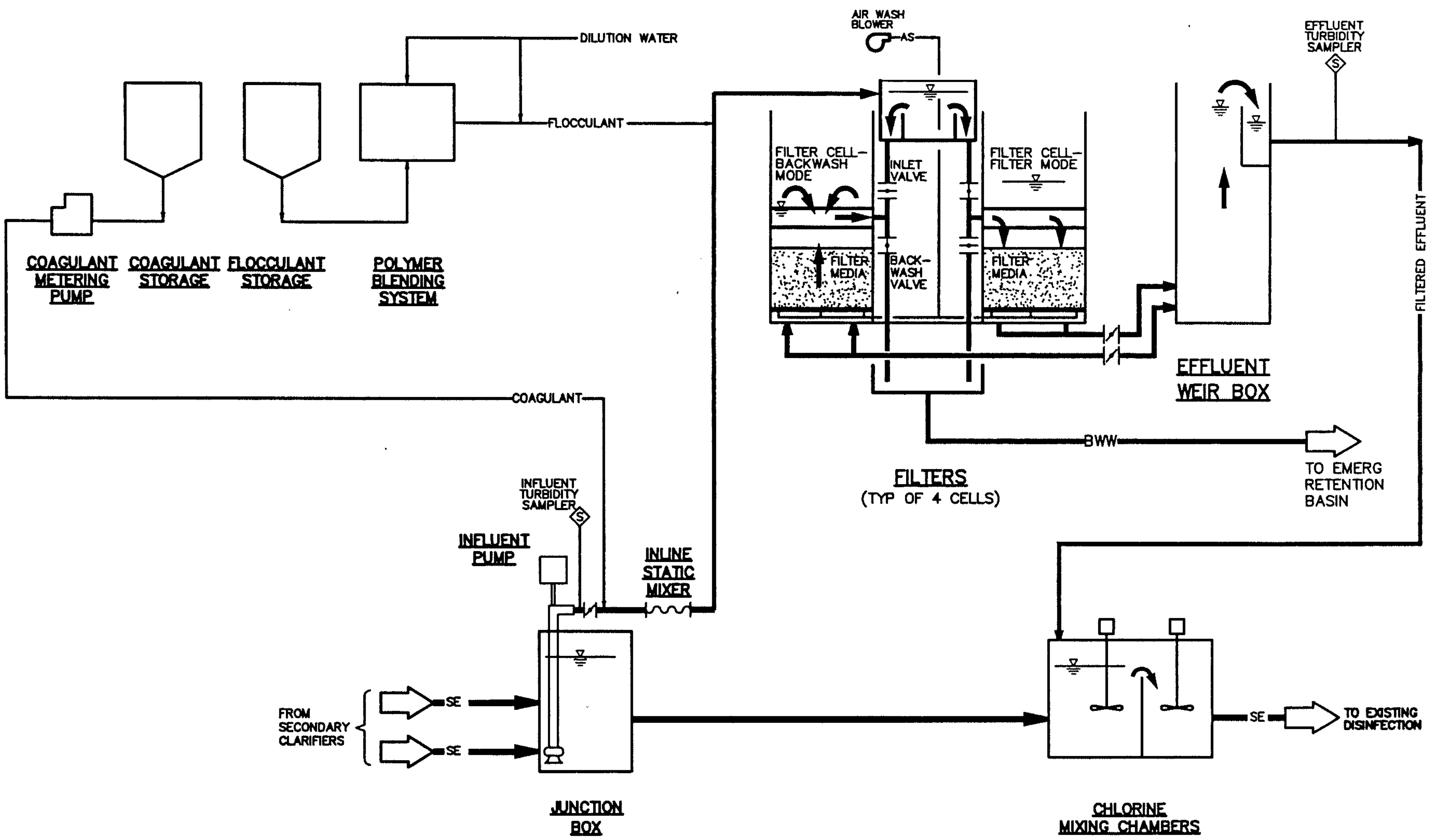


Figure A-1
Recycled Water Pilot Test Facility



LEGEND:

BWW BACKWASH WASTE WATER
SE SECONDARY EFFLUENT
AS AIR SCOUR

FIGURE A–2

PILOT FILTER PROCESS DIAGRAM

Table A-2: Title 22 Filtration Requirements

Parameter	Requirement
Filter Loading Rate	5 gpm/ft^2, maximum
Turbidity	<2 NTU, daily average
	≥5 NTU no more than 5% of any 24 hour period
	≥10 NTU at any time prohibited

The initial evaluation of operational and cost feasibility (which involves chemical dosage and filter run lengths) were secondary objectives at this facility evaluation stage of the project.

Testing Methodology

The filter system was operated through a range of chemical dosages, influent turbidity loadings, and filter hydraulic loading rates during the pilot testing. Chemical dosage was adjusted for each run based on the filter influent turbidity in order to ensure an effluent turbidity less than 2 NTU. Filter influent turbidity was entirely dependent on DDSD wastewater plant operation, and during the test period it varied from about 6.5 to 11.5 NTU. DDSD does not normally monitor final effluent turbidity because it is not a discharge permit requirement. However periodic grab samples taken by DDSD staff over the last few years show that the normal range of final effluent turbidity for the treatment plant is about 6 to 12 NTU.

Table A-3 summarizes the pilot test run scenarios and the corresponding operating parameters for each run.

Table A-4 summarizes the measurement parameters and frequencies used during the pilot testing.

Table A-3: Pilot Test Parameters

Start Date	Run No.	Test Type	Test Duration (hrs)	Filter Loading Rate (gpm/ft^2)	Average Influent Turbidity (NTU)
4/9/99	1	Normal operation	4	3.2 – 4.9[a]	10.2
4/22/99	2	Normal operation	22	3.2 – 4.9[a]	8.2
4/23/99	3	Normal operation	5	3.2 – 4.9[a]	8.0
4/26/99	4	Max. loading rate	3½	5.0 – 5.4[b]	7.0
4/27/99	5	Max. loading rate	2½	5.0 – 5.4[b]	8.0

[a]Loading rate was normally 3.2 gpm/ft^2, and increased to 4.9 gpm/ft^2 when one cell was in backwash mode.
[b]The loading rate objective for these tests was 5.0 gpm/ft^2. The actual loading rate reached 5.4 gpm/ft^2 at times due to the method of filter flow control (pump throttling via a manual valve).

Filter Runs 1 through 3 covered the normal filter operation. Filter Runs 4 and 5 covered the worst case filter hydraulic loading condition, which is defined as the maximum hydraulic loading rate of 5 gpm/ft^2 allowed by Title 22. During Runs 4 and 5, a loading rate of at least 5 gpm/ft^2 was maintained throughout the test, while during Runs 1 through 3 this maximum rate was reached during a cell backwash only.

Table A-4: Pilot Test Measurements and Frequencies

Parameter	*Source*	*Frequency*	*Method*
Flow Rate	Filter Influent	Once per test (Normal ops) Once per hour (Max flowrate)	Strap-on Doppler flowmeter
Backwash Rate	Approximated from filter influent flow rate		
Cell Water Level	Each filter cell	Approx every 2 hrs	Local level indicator
Chemical Feed Rate	Chem feed system	Twice per test	Metering pump calibration columns
Turbidity (continuous)	Filter Influent & Effluent	Continuous	Inline turbidimeters and chart recorders
Turbidity (grab)	Filter Influent & Effluent	As needed to verify inline unit calibration –twice per test, minimum	Hand grabs, bench turbidimeter

During Filter Runs 1 through 3, three filter cells were operated with a single influent pump discharging at it's rated capacity of 400 gpm. The second influent pump originally installed at this facility was not in service. Filter Cell 3 was not operated at all during the pilot testing, because it contained a different media than the other three cells. The influent and effluent valves on this cell were closed throughout all pilot testing to fully isolate it from the system.

Because the pilot filter design depends on the effluent of operating cells to supply the filtered backwash water to a cell in backwash, the unavailability of the second influent pump and Cell 3 created a reduction in the available backwash flow from the filter manufacturer's recommended rate of 12 gpm/ft^2. The actual backwash rate during the pilot test was approximately to 9 gpm/ft^2. To compensate, the backwash duration was prolonged to ensure that the total backwash volume was adequate to remove the accumulated solids from the filter. It is important to note that any deficiency in backwash volume and rate would subsequently result in shortened filter run times and increased backwash frequencies due to solids build-up in the filter beds. This could render the overall test results less favorable and thus result in more conservative filter and chemical design criteria.

During Filter Runs 4 and 5, one filter cell was operated with the influent pump operating at a reduced flow rate. This arrangement was necessary because the single pump could not attain the flow rate necessary to deliver 5 gpm/ft^2 to more than one cell at a time. Because of the reduced flowrate of these runs, backwashes were performed before the other cells were isolated and the pump throttled back. Each test was run until a backwash was required, at which point the test was ended and the other cells brought back online so that a backwash could be performed.

The same coagulant and flocculant filter aid chemicals were used during all five pilot test runs. These chemicals were selected from an initial group of about 13 chemicals based on a jar test comparison of floc quality and filterability. The coagulant used in this test was NALCO Ultrion 7157 polyaluminum chloride. The flocculant used in this test was NALCO 7744 anionic polymer. The coagulant was fed directly into the filter influent stream as far upstream of the filters as possible (near the influent pump discharge), and was mixed using an inline static mixer. The flocculant was diluted to approximately 0.5 percent using a Stranco Polyblend polymer dilution system, and then fed directly to the filter influent just upstream of the filter influent splitter box with additional dilution water to enhance mixing.

As part of the test procedure, filter influent and effluent grab samples were taken frequently and analyzed for turbidity using a Hach 2100N laboratory bench turbidimeter. This turbidimeter was calibrated by DDSD's EPA-certified laboratory per Standard Methods Procedure No. 2130 and the Hach 2100N User Manual, and the calibration was checked daily using Gelex secondary standards. Inline turbidimeter readings were recorded at the time the grab samples were taken for comparison with the lab turbidimeter data. The results are shown in Table A-5.

As shown by the data, both inline turbidimeters provided data that was reasonably close to the bench turbidimeter results with some amount of offset. The influent inline turbidimeter consistently read higher than the bench unit, while the effluent inline turbidimeter consistently read lower than the bench unit. Although some amount of variability is expected due to the inherent lack of precision of turbidity measurements, the offsets were relatively consistent. Therefore, the influent and effluent inline turbidimeter chart recorder data were adjusted by –8% and +12%, respectively. All turbidity data provided in this report reflects that adjustment.

Table A-5: Turbidimeter Verification Data

Filter Influent Turbidity (NTU)			*Filter Effluent Turbidity (NTU)*		
Inline	*Lab*	*Difference*	*Inline*	*Lab*	*Difference*
8.9	8.3	8%	1.7	2.0	-14%
9.1	8.2	10%	1.7	1.9	-9%
10.5	9.9	6%	1.7	1.8	-9%
8.7	8.2	6%	1.3	1.5	-16%
7.9	7.9	1%	1.1	1.4	-17%
7.3	6.8	7%	1.1	1.2	-15%
7.5	7.3	3%	1.0	1.2	-19%
7.9	7.5	5%	1.0	1.1	-13%
7.7	7.1	8%	1.7	2.0	-15%
8.0	7.3	9%	1.7	1.9	-12%
8.1	7.2	11%	1.6	1.8	-8%
8.1	6.8	19%	1.6	1.7	-9%
7.9	6.5	20%	1.3	1.3	-3%
10.0	10.0	0%	2.9	3.3	-12%
9.0	7.9	14%	2.4	2.4	0%
9.2	8.7	6%	1.2	1.5	-20%
	Avg	8%		Avg	-12%
	Min	0%		Min	-20%
	Max	20%		Max	0%

Results

Pilot test results are summarized in Table A-6. As shown, the average effluent turbidity in each of the tests never exceeded the Title 22 limit of 2 NTU. There were no effluent turbidity excursions above the 5 NTU or 10 NTU Title 22 limits.

Table A-6: Summary of Pilot Test Results

Filter Run No.	*Coagulant Dosage (mg/L)*	*Flocculant Dosage (mg/L)*	*Average Influent Turbidity (NTU)[a]*	*Average Effluent Turbidity (NTU)[a]*	*Maximum Effluent Turbidity (NTU)[a]*
1	58.1	8.9	10.2	1.5	1.6
2	58.1	6.4	8.2	1.3	1.9
3	40.3	6.4	8.0	1.8	2.0
4	70.7	8.0	7.0	1.9	2.6
5	75.7	8.1	8.0	1.5	2.2

[a]Influent and effluent inline turbidimeter readings were corrected based on grab samples tested in a laboratory bench turbidimeter. Refer to the text for further explanation.

In Filter Runs 3, 4, and 5, there were brief periods at the beginning of each test where effluent turbidity did meet or exceed 2 NTU. In all three cases the excursions occurred immediately following a backwash, and ended within the first hour of operation after sufficient solids had accumulated to "ripen" the media. Filter Runs 4 and 5 had the most significant excursions above 2 NTU (up to 2.6 NTU). These excursions are considered unrepresentative of normal filter operation because a single cell would not normally be operated alone. Instead, during normal operation there would be multiple cells operating and the issue of media "ripening" would have a lesser impact on the filter effluent due to dilution from the effluent of other cells. In any case, the excursions experienced in this test do not constitute violations of Title 22.

Detailed graphs of filter performance data (levels and turbidities) for each filter run included at the end of this Appendix as Attachment A-1. The pilot test log sheets are also attached.

Conclusions

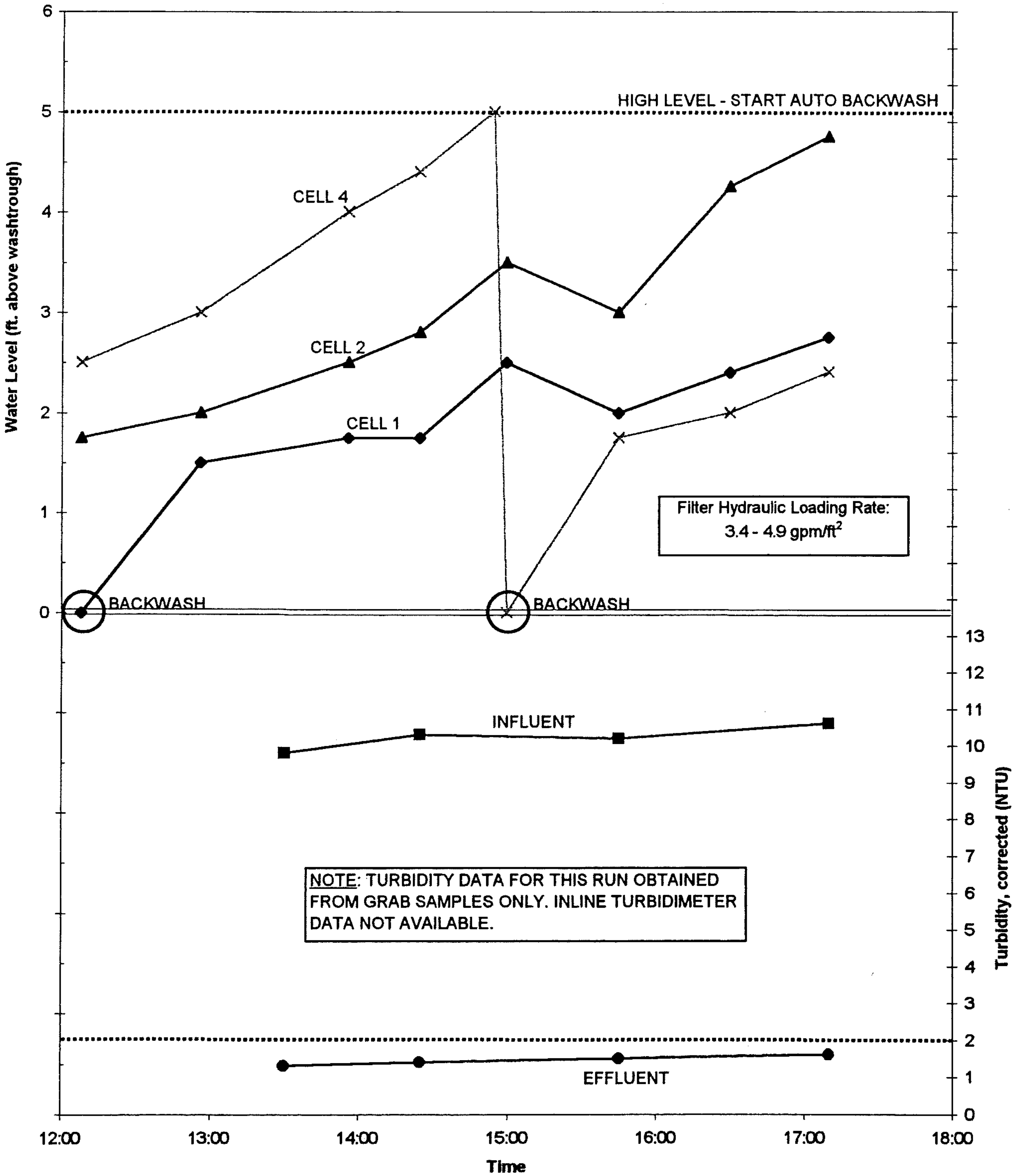
The data from this pilot test indicate that DDSD secondary effluent can be adequately treated to Title 22 turbidity standards for disinfected tertiary recycled water using direct filtration with up to about 75 mg/l of polyaluminum chloride coagulant and about 9 mg/l of anionic polymer flocculant. However, due to the high chemical dosage requirements and short filter run lengths required to treat DDSD effluent to Title 22 standards, it is recommended that conventional filtration be selected as the treatment process for this project.

Attachment A-1:

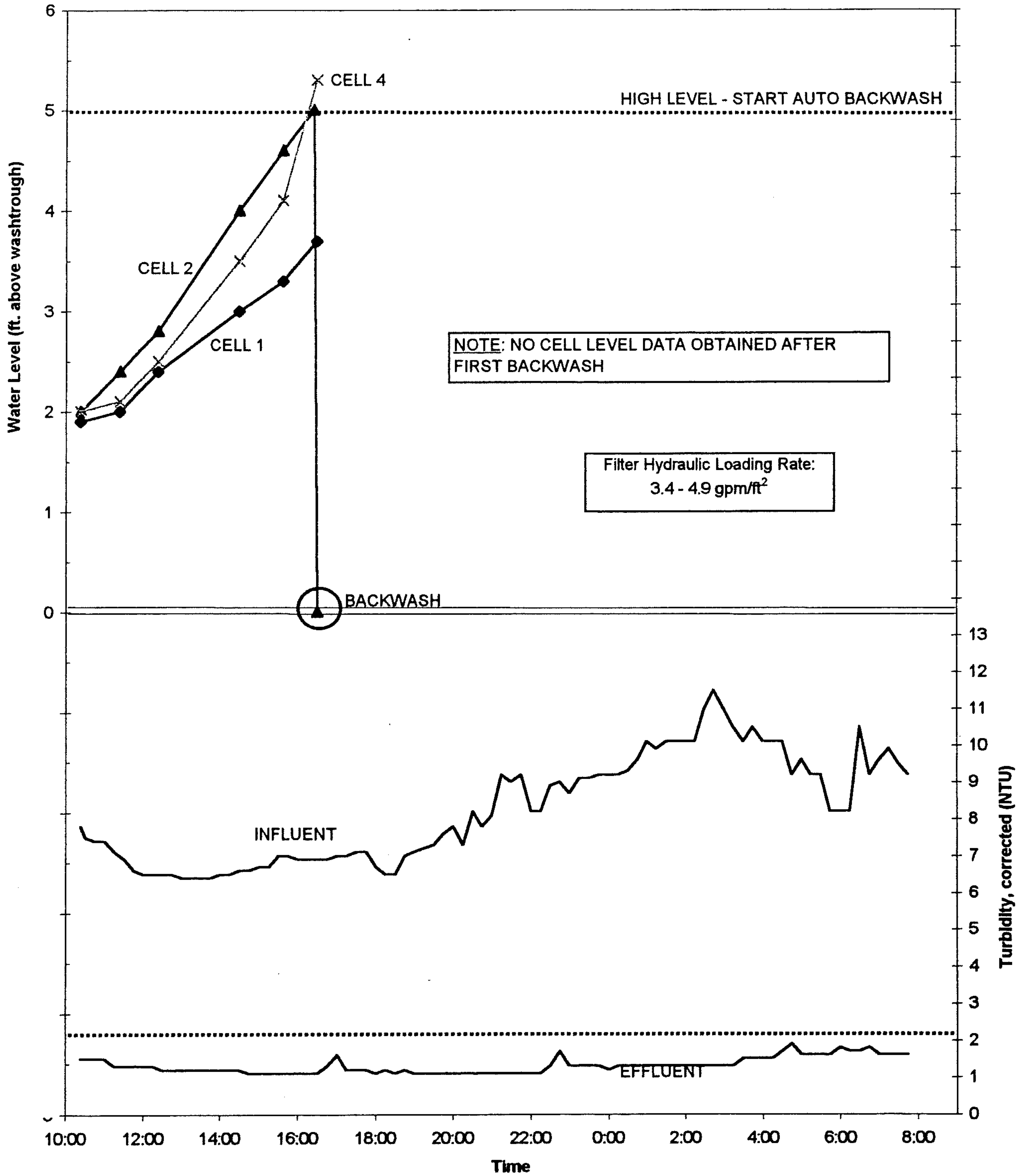
Detailed Filter Performance Charts

Filter Pilot Test Log Sheet

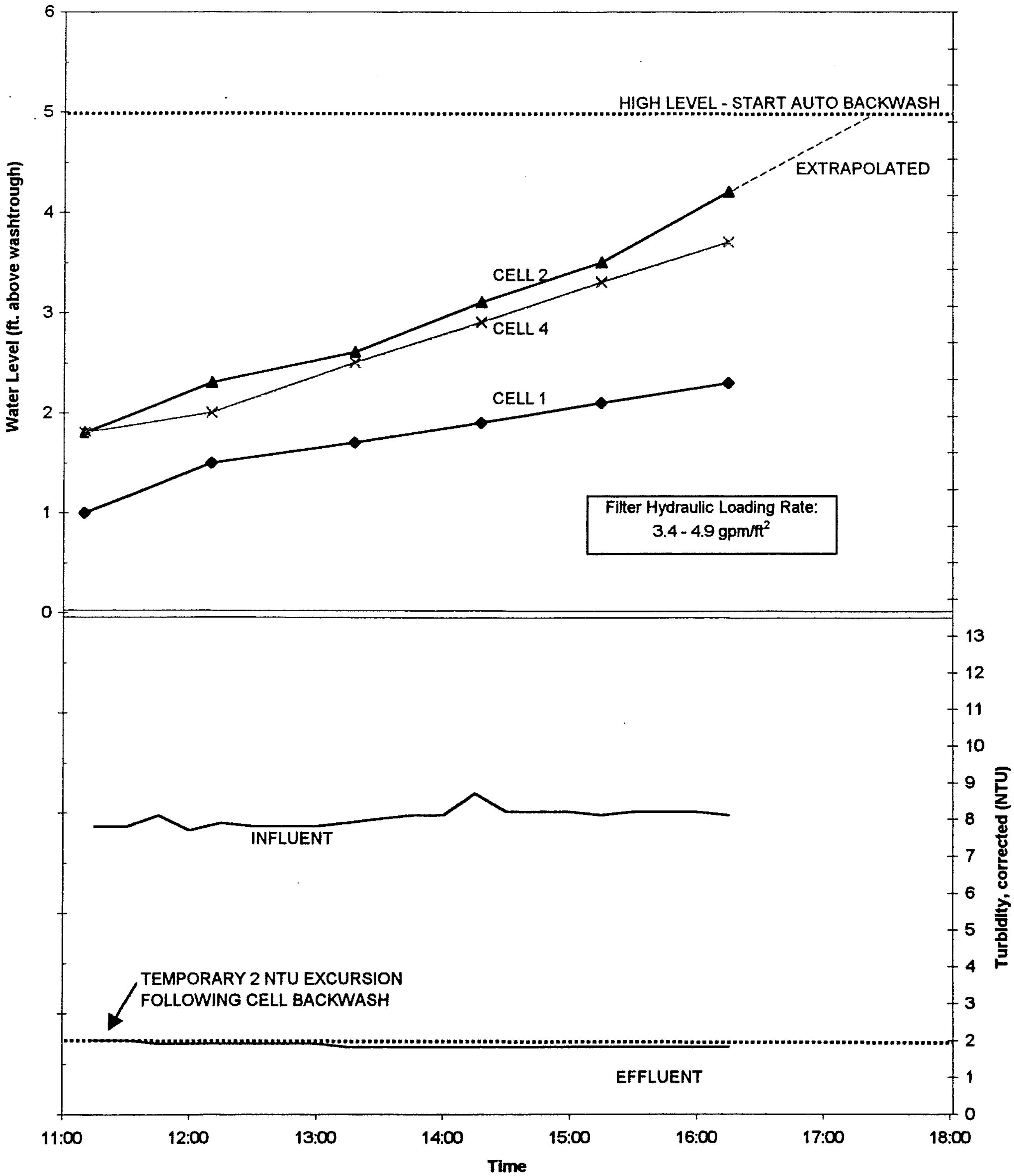
Filter Run Results
Run #1
9-April-1999

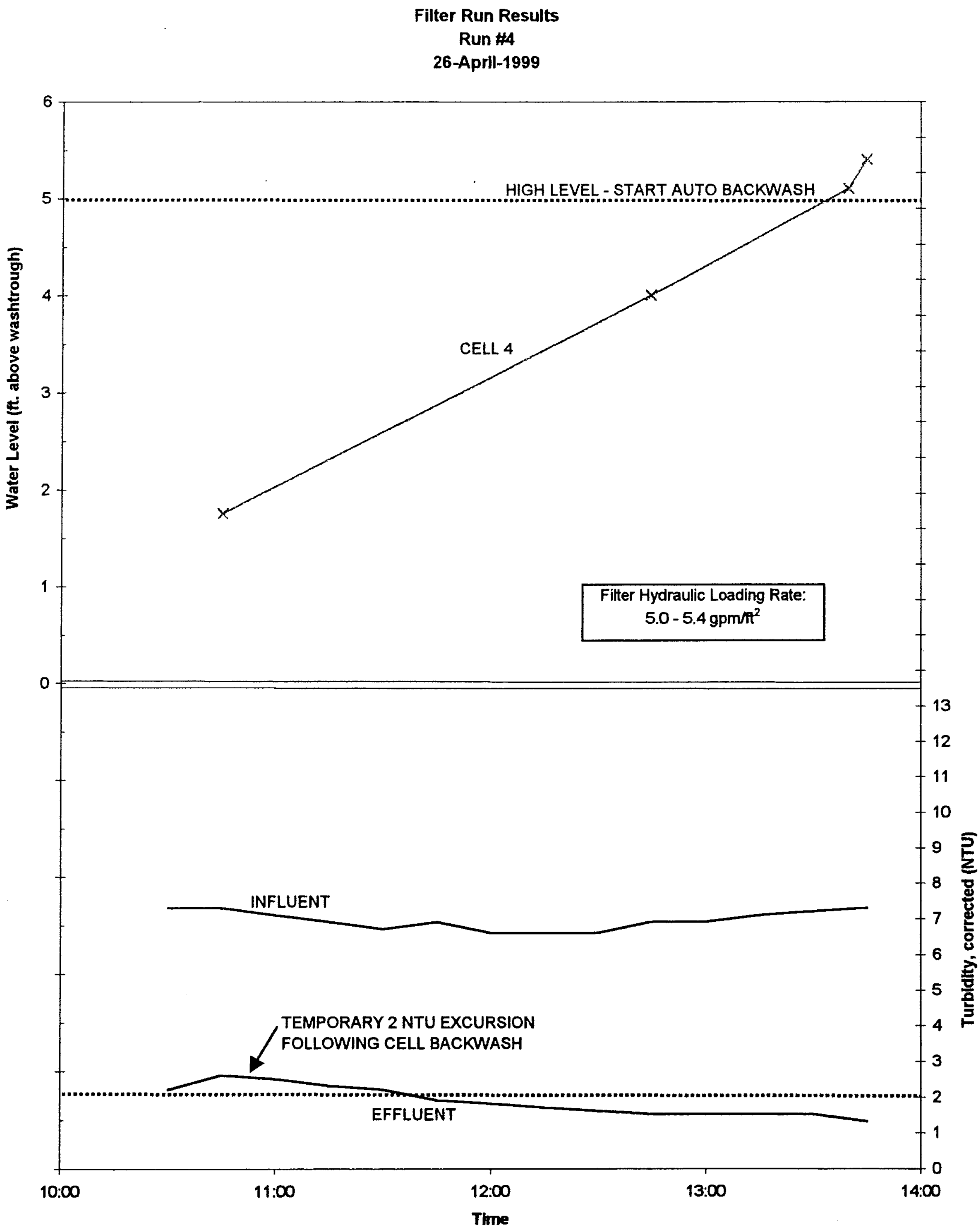


Filter Run Results
Run #2
22-April-1999 to 23-April-1999

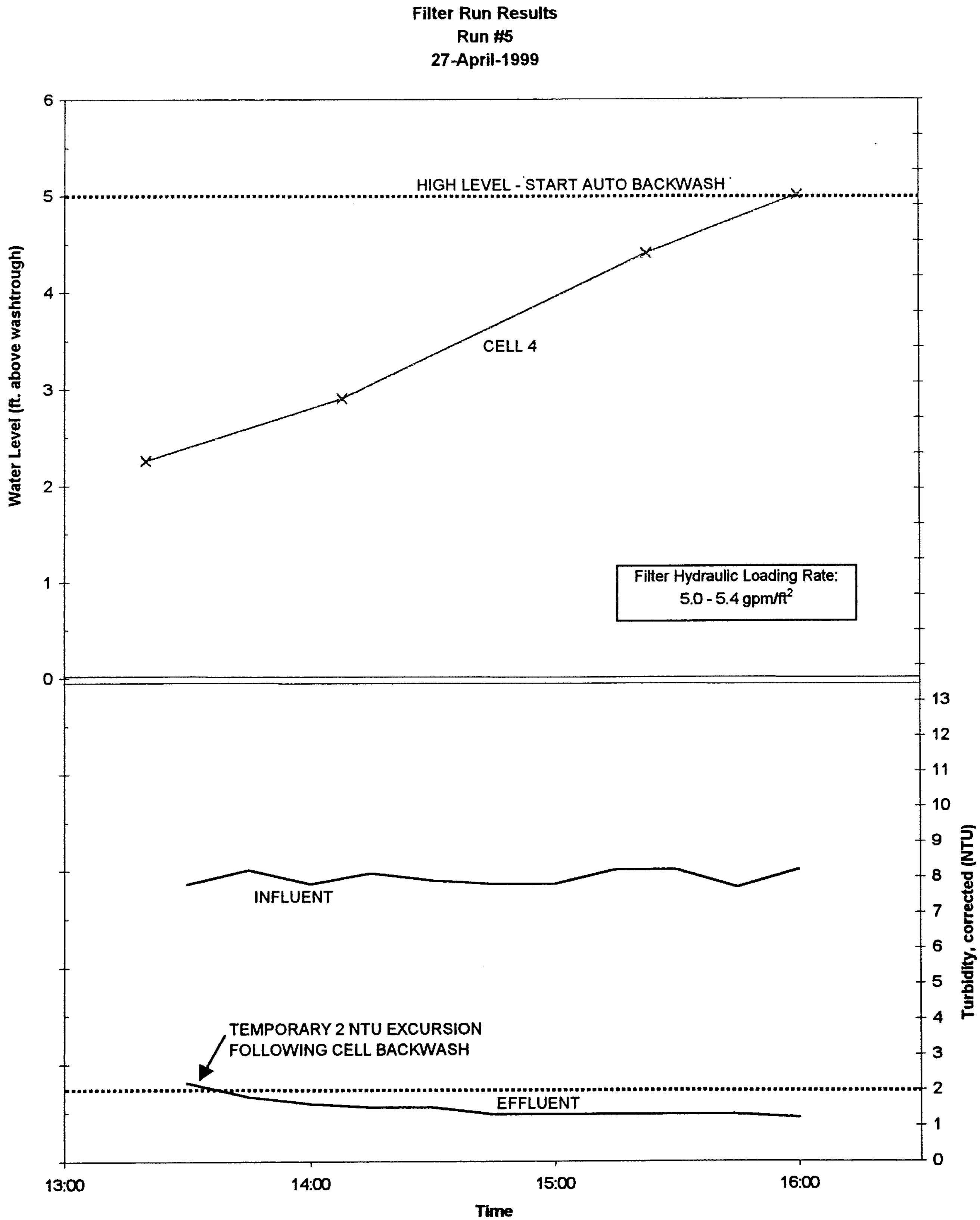


Filter Run Results
Run #3
23-April-1999





Filter Run Results
Run #4
26-April-1999
HIGH LEVEL - START AUTO BACKWASH
CELL 4
Filter Hydraulic Loading Rate:
5.0 - 5.4 gpm/ft²
Water Level (ft. above washtrough)
INFLUENT
TEMPORARY 2 NTU EXCURSION
FOLLOWING CELL BACKWASH
EFFLUENT
Turbidity, corrected (NTU)
10:00
11:00
12:00
13:00
14:00
Time



Filter Run Results
Run #5
27-April-1999
Water Level (ft. above washtrough)
HIGH LEVEL - START AUTO BACKWASH
CELL 4
Filter Hydraulic Loading Rate:
5.0 - 5.4 gpm/ft2
INFLUENT
TEMPORARY 2 NTU EXCURSION
FOLLOWING CELL BACKWASH
EFFLUENT
Turbidity, corrected (NTU)
13:00
14:00
15:00
16:00
Time
0
1
2
3
4
5
6
7
8
9
10
11
12
13

DDSD Recycled Water Facility Evaluation
FILTER PILOT TESTING
Testing Performed By: Bill Slenter / Amanda Wong
Coagulant: NALCO Ultrion 7157
Flocculant: NALCO 7744 Anionic Polymer

Note: Complete inline turbidimeter chart recorder data not provided on this log sheet.

Date	Time	Influent Velocity (fps)*	Influent Flow (gpm)	Number of Cells Operating	Loading Rate (gpm/ft²)	Loading Rate (1 cell in BW) (gpm/ft²)	Coagulation Rate (ml/min)	Flocculation Rate (ml/min)	Coagulation Rate (ppm)	Flocculation Rate (ppm)	Water Level (ft) Cell 1	Water Level (ft) Cell 2	Water Level (ft) Cell 4	INLINE Turbidity (NTU) Filter Influent	INLINE Turbidity (NTU) Filter Effluent	GRAB Turbidity (NTU) Filter Influent	GRAB Turbidity (NTU) Filter Effluent	Comments
4/9/99	11:30	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9								Started system, initiated backwash on Cell 2
4/9/99	12:08	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9	BW	1.75	2.50					Cell 2 done backwashing. Start backwash Cell 1
4/9/99	12:42	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9								Cell 1 done backwashing.
4/9/99	12:56	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9	1.50	2.00	3.00					
4/9/99	13:30	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9						9.8	1.3	
4/9/99	13:56	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9	1.75	2.50	4.00					
4/9/99	14:25	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9	1.75	2.80	4.40			10.3	1.4	
4/9/99	15:00	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9	2.50	3.50	BW					
4/9/99	15:45	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9	2.00	3.00	1.75			10.2	1.5	
4/9/99	16:30	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9	2.40	4.25	2.00					
4/9/99	17:10	2.50	430	3	3.2	4.9	75.0	14.0	58.1	8.9	2.75	4.75	2.40			10.6	1.6	Cell 2 very close to backwash
								FILTERS SHUT DOWN										
4/22/99	10:09	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4				8.7	1.3	8.2	1.5	
4/22/99	10:23	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4	1.90	2.00	2.00					Pilot test start
4/22/99	11:23	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4	2.00	2.40	2.10					
4/22/99	11:30	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4				7.9	1.1	7.9	1.4	
4/22/99	12:23	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4	2.40	2.80	2.50					
4/22/99	12:30	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4				7.3	1.1	6.8	1.2	
4/22/99	13:38	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4				7.4	1.0			
4/22/99	14:29	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4	3.00	4.00	3.50					
4/22/99	14:34	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4				7.5	1.0	7.3	1.2	
4/22/99	15:38	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4	3.30	4.60	4.10					
4/22/99	15:43	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4				7.9	1.0	7.5	1.1	
4/22/99	16:28	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4	3.70	BW	5.30	7.6	1.2			
4/23/99	7:38	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4	1.80	3.40	2.60					
4/23/99	7:53	2.50	430	3	3.2	4.9	75.0	10.0	58.1	6.4				8.6	1.3			
4/23/99	11:10	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4	1.00	1.80	1.80					Pilot test start
4/23/99	11:14	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4				7.7	1.7	7.1	2.0	
4/23/99	12:10	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4	1.50	2.30	2.00					
4/23/99	12:13	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4				8.0	1.7	7.3	1.9	
4/23/99	13:18	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4	1.70	2.60	2.50					
4/23/99	13:21	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4				8.1	1.6	7.2	1.8	
4/23/99	14:18	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4	1.90	3.10	2.90					
4/23/99	14:23	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4				8.1	1.6			
4/23/99	15:13	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4	2.10	3.50	3.30					
4/23/99	15:16	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4				8.1	1.6	6.8	1.7	
4/23/99	16:13	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4	2.30	4.20	3.70					
4/23/99	16:15	2.50	430	3	3.2	4.9	52.0	10.0	40.3	6.4				7.9	1.5			
4/26/99	10:30	1.27	220	1	5.0	NA	51.0	7.0	77.2	8.7								Pilot Test Start - Cell #4 at 5 gpm/sf
4/26/99	10:43	1.41	240	1	5.4	NA	51.0	7.0	70.7	8.0			1.75					
4/26/99	11:45	1.41	240	1	5.4	NA	51.0	7.0	70.7	8.0			3.00		1.6			
4/26/99	12:45	1.41	240	1	5.4	NA	51.0	7.0	70.7	8.0			4.00	7.9	1.3	6.5	1.3	
4/26/99	13:40	1.32	230	1	5.2	NA	51.0	7.0	73.8	8.4			5.10	8.1	1.2			
4/26/99	13:50	1.38	240	1	5.4	NA	51.0	7.0	70.7	8.0			5.40					Pilot Test End

Date	Time	Influent Velocity (fps)*	Influent Flow (gpm)	Number of Cells Operating	Loading Rate (gpm/ft^2)	Loading Rate (1 cell in BW) (gpm/ft^2)	Coagulation Rate (ml/min)	Floculation Rate (ml/min)	Coagulation Rate (ppm)	Floculation Rate (ppm)	Cell 1	Cell 2	Cell 4	Filter Influent	Filter Effluent	Filter Influent	Filter Effluent	Comments
4/27/99	13:20	1.30	220	1	5.0	NA	50.0	6.5	75.7	8.1			2.25					New run. Increase coagulation to 60 mg/l, try to get below 2 NTU
4/27/99	14:08	1.40	240	1	5.4	NA	50.0	6.5	69.4	7.4			2.90					
4/27/99	14:16	1.40	240	1	5.4	NA	50.0	6.5	69.4	7.4			3.40	9.2	1.2	8.7	1.5	
4/27/99	15:23	1.30	220	1	5.0	NA	50.0	6.5	75.7	8.1			4.40					
4/27/99	16:02	1.30	220	1	5.0	NA	50.0	6.5	75.7	8.1			5.00					shut down, slightly before backwash (@ 5.5')
							FILTERS SHUT DOWN											

Notes

*Indicates that the value was extrapolated from the previous reading and not read directly from the meter.

Appendix B

Delta Diablo Sanitation District
Water Pollution Control Facility 1998 Annual Report
Water Quality Data

DELTA DIABLO SANITATION DISTRICT

TABLE 1
REQUIREMENT COMPLIANCE SUMMARY
1998

	WASTE EFFLUENT														RECEIVING WATER					
PARAMETER	BOD			SUSPENDED SOLIDS			TOTAL COLIFORM BACTERIA		pH	EFFLUENT ACUTE TOXICITY 90th Percentile = 70% survival		CHLORINE RESIDUAL	SETTLEABLE MATTER		DISSOLVED OXYGEN	pH	FLOATING SOLIDS OR FOAM	FLOATING OIL	TURBIDITY AND/OR DISCOLORATION	ATMOSPHERIC ODOR OF WASTE ORIGIN
LIMIT	Average <30 mg/L 30 Consecutive Days	Average <45 mg/L 7 Consecutive Days	Percent removal - 85% 30 Consecutive Days	Average <30 mg/L 30 Consecutive Days	Average <45 mg/L 7 Consecutive Days	Percent removal - 85% 30 Consecutive Days	Any One Sample 500 MPN Per 100 mL	Median <23 MPN/100 5 Consecutive Days	6.0 - 9.0	Sticklebacks	Fathead Minnows	Residual 0.00	Instantaneous Max = 0.2 mL/L	Average <0.1 mL/L 30 Consecutive Days	Minimum of 5.0 mg/L	Variation from Natural Ambient < 0.2 pH				
Jan	0/1	0/4	0/1	0/1	0/4	0/1	0/13	0/13	0/31	0/1	0/1	0/31	0/10	0/1	0/0	0/0	0/0	0/0	0/0	0/0
Feb	0/1	0/4	0/1	0/1	0/4	0/1	0/12	0/12	0/28	0/1	0/1	0/28	0/13	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Mar	0/1	0/5	0/1	0/1	0/5	0/1	0/13	0/13	0/31	0/1	0/1	0/31	0/13	0/1	0/0	0/0	0/0	0/0	0/0	0/0
Apr	0/1	0/5	0/1	0/1	0/5	0/1	0/14	0/14	0/30	0/1	0/1	0/30	0/14	0/1	0/0	0/0	0/0	0/0	0/0	0/0
May	0/1	0/4	0/1	0/1	0/5	0/1	0/13	3/13	0/31	0/1	0/1	0/31	0/13	0/1	0/0	0/0	0/0	0/0	0/0	0/0
Jun	0/1	0/5	0/1	0/1	0/5	0/1	0/14	1/14	0/30	0/1	0/1	0/30	0/13	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Jul	0/1	0/4	0/1	0/1	0/5	0/1	0/14	0/14	0/31	0/1	0/1	0/31	0/15	0/1	0/0	0/0	0/0	0/0	0/0	0/0
Aug	0/1	0/4	0/1	0/1	0/5	0/1	0/12	0/12	0/31	0/1	0/1	1/31	0/12	0/1	0/0	0/0	0/0	0/0	0/0	0/0
Sep	0/1	0/5	0/1	0/1	0/5	0/1	0/14	0/14	0/30	0/1	0/1	0/30	0/14	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Oct	0/1	0/4	0/1	0/1	0/5	0/1	0/13	0/13	0/31	0/1	0/1	0/31	0/13	0/1	0/0	0/0	0/0	0/0	0/0	0/0
Nov	0/1	0/4	0/1	0/1	0/4	0/1	0/12	0/12	0/30	0/1	0/1	0/30	0/12	0/1	0/0	0/0	0/0	0/0	0/0	0/0
Dec	0/1	0/5	0/1	0/1	0/5	0/1	0/15	0/15	0/31	0/1	0/1	0/31	0/15	0/1	0/1	0/1	0/1	0/1	0/1	0/1

TABLE 2
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

BOD										
Month	CONCENTRATION (mg/L)			No.SAMPLES		LOADING (kg/day)			No.SAMPLES	
	Max	Min	Avg	W/Viol.	Ana.	Max	Min	Avg	W/Viol.	Ana
January	9.7	6.9	8.3	0	9	543	344	450	0	9
February	9.4	5.1	8.1	0	8	906	391	570	0	8
March	16.3	5.6	11.3	0	9	832	285	588	0	9
April	18.2	9.3	12.9	0	9	922	461	651	0	9
May	12.5	7.0	9.3	0	8	641	336	476	0	8
June	12.0	7.4	9.5	0	9	571	363	467	0	9
July	15.9	8.1	11.0	0	8	752	388	535	0	8
August	17.0	10.0	13.4	0	9	894	564	706	0	9
September	21.0	10.0	13.8	0	11	1078	486	720	0	11
October	14.0	9.1	11.9	0	8	666	446	578	0	8
November	17.0	6.4	10.3	0	8	985	367	533	0	8
December	15.0	8.2	11.1	0	10	796	411	550	0	10
Annual Maximum	21					1078				
Annual Minimum		5.1					285			
Annual Average			10.9					569		
Total				0	106				0	106

TABLE 3
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

TOTAL SUSPENDED SOLIDS

Month	CONCENTRATION (mg/L)			No. SAMPLES		LOADING (kg/day)			No.SAMPLES	
	Max	Min	Avg	W/Viol.	Ana.	Max	Min	Avg	W/Viol.	Ana
January	10.8	6.0	7.4	0	20	574	294	405	0	20
February	10.0	5.8	7.9	0	18	871	405	578	0	18
March	15.0	6.2	9.5	0	22	782	334	511	0	22
April	14.0	6.0	10.3	0	21	716	298	529	0	21
May	12.6	6.7	8.5	0	20	640	318	432	0	20
June	20.0	5.6	10.0	0	20	1100	282	504	0	20
July	24.4	5.4	10.9	0	21	1211	252	539	0	21
August	21.8	9.6	14.2	0	21	1133	449	737	0	21
September	20.0	10.4	14.2	0	21	1052	516	736	0	21
October	17.6	9.2	13.5	0	20	885	451	689	0	20
November	22.2	9.0	13.4	0	19	1249	447	718	0	19
December	23.2	10.2	14.4	0	19	1176	491	736	0	19
Annual Maximum	24.4					1249				
Annual Minimum		5.4					252			
Annual Average			11.2					593		
Total				0	242				0	242

TABLE 4
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

COLIFORM ORGANISMS-MPN/100mL

Month	SINGLE SAMPLES		No. SAMPLES		5-DAY MOVING MEDIAN		No.SAMPLES	
	Max	Min	W/Viol.	Ana.	Max	Min	W/Viol.	Ana
January	50	4	0	13	22	10	0	13
February	23	2	0	12	21	8	0	12
March	23	4	0	13	11	6	0	13
April	30	4	0	14	17	11	0	14
May	110	4	0	13	26	9	3	13
June	54	4	0	14	26	11	1	14
July	70	4	0	14	22	7	0	14
August	70	7	0	12	22	11	0	12
September	50	4	0	14	23	13	0	14
October	30	2	0	13	13	7	0	13
November	50	2	0	12	17	4	0	12
December	81	3	0	15	17	8	0	15
Annual Maximum	110				26			
Annual Minimum		2				4		
Total			0	159			4	159

	Single Sampl Max	Single Sampl Min	5-Day Movir Max	5-Day Moving Median Min
January	50	4	22	10
February	23	2	21	8
March	23	4	11	6
April	30	4	17	11
May	110	4	26	9
June	54	4	26	11
July	70	4	22	7
August	70	7	22	11
September	50	4	23	13
October	30	2	13	7
November	50	2	17	4
December	81	3	17	8

TABLE 5
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

CHLORINE RESIDUAL					
Month	CONCENTRATION (mg/L)			No. OF SAMPLES	
	Maximum	Minimum	Average	With Violation	No. Analyzed
January	0.0	0.0	0.0	0	continuous
February	0.0	0.0	0.0	0	continuous
March	0.0	0.0	0.0	0	continuous
April	0.0	0.0	0.0	0	continuous
May	0.0	0.0	0.0	0	continuous
June	0.0	0.0	0.0	0	continuous
July	0.0	0.0	0.0	0	continuous
August	5.8	0.0	0.0	1	continuous
September	0.0	0.0	0.0	0	continuous
October	0.0	0.0	0.0	0	continuous
November	0.0	0.0	0.0	0	continuous
December	0.0	0.0	0.0	0	continuous
Annual Maximum	5.8				
Annual Minimum		0.0			
Annual Average			0.0		
Total				1	continuous

*8/10/98: 68 minute violation. 5.8 mg/L was the last tested pre SO2 Chlorine Residual prior to the violation.

TABLE 6
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

pH				
Month	pH		No. OF SAMPLES	
	Maximum	Minimum	With Violation	No. Analyzed
January	7.1	6.9	0	31
February	7.2	6.6	0	28
March	7.2	6.5	0	31
April	7.3	6.8	0	30
May	7.1	6.8	0	31
June	7.3	6.7	0	30
July	7.3	6.8	0	31
August	7.3	6.7	0	31
September	7.2	6.8	0	30
October	7.3	6.9	0	31
November	7.3	6.9	0	30
December	7.4	6.4	0	31
Annual Maximum	7.4			
Annual Minimum		6.4		
Annual Average				
Total			0	365

TABLE 7
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

OIL AND GREASE

Month	Concentration mg/L			No. SAMPLES		Loading (lb/day)			No. SAMPLES	
	Max	Min	Avg	W/Viol.	Ana.	Max	Min	Avg	W/Viol.	Ana.
January	0.0	0.0	0.0	0	1	0	0	0	0	1
February	0.0	0.0	0.0	0	1	0	0	0	0	1
March	0.0	0.0	0.0	0	1	0	0	0	0	1
April	0.0	0.0	0.0	0	1	0	0	0	0	1
May	0.0	0.0	0.0	0	1	0	0	0	0	1
June	0.0	0.0	0.0	0	1	0	0	0	0	1
July	0.0	0.0	0.0	0	1	0	0	0	0	1
August	0.0	0.0	0.0	0	1	0	0	0	0	1
September	0.0	0.0	0.0	0	1	0	0	0	0	1
October	0.0	0.0	0.0	0	1	0	0	0	0	1
November	0.0	0.0	0.0	0	1	0	0	0	0	1
December	0.0	0.0	0.0	0	1	0	0	0	0	1
Annual Maximum	0.0					0				
Annual Minimum		0.0					0			
Annual Average			0.0					0		
Total				0	12				0	12

NOTE: 0 = Below Reporting Limit of 5 ppm

TABLE 8
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

SETTLEABLE MATTER					
Month	CONCENTRATION (mL/L)			No. OF SAMPLES	
	Maximum	Minimum	Average	With Violation	No. Analyzed
January	0	0	0	0	12
February	0	0	0	0	13
March	0	0	0	0	13
April	0	0	0	0	14
May	0	0	0	0	13
June	0	0	0	0	13
July	0	0	0	0	15
August	0	0	0	0	12
September	0	0	0	0	14
October	0	0	0	0	13
November	0	0	0	0	12
December	0	0	0	0	15
Annual Maximum	0				
Annual Minimum		0			
Annual Average			0		
Total				0	159

NOTE: 0 = Below Reporting Limit of 0.1 mg/L/hr

TABLE 9
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

FLOW-THRU FISH BIOASSAY-SURVIVAL 100% EFFLUENT										
Month	3-SPINE STICKLEBACKS					FATHEAD MINNOWS				
				No. SAMPLES					No. SAMPLES	
	Max	Min	Avg	W/Viol.	Ana.	Max	Min	Avg	W/Viol.	Ana.
January	100	100	100	0	1	100	100	100	0	1
February	100	100	100	0	1	95	95	95	0	1
March	100	100	100	0	1	100	100	100	0	1
April	100	100	100	0	1	100	100	100	0	1
May	55	55	55	0	1	100	100	100	0	1
June	100	100	100	0	1	90	90	90	0	1
July	100	100	100	0	1	100	100	100	0	1
August	100	100	100	0	1	100	100	100	0	1
September	100	100	100	0	1	100	100	100	0	1
October	100	100	100	0	1	100	100	100	0	1
November	100	100	100	0	1	100	100	100	0	1
December	100	100	100	0	1	100	100	100	0	1
Annual Maximum	100					100				
Annual Minimum		55					90			
Annual Average			96					99		
Total				0	12				0	12

TABLE 10
WEEKLY AVERAGE
DELTA DIABLO SANITATION DISTRICT
BOD mg/L
1998

Month	Influent					Effluent				
	1st week	2nd week	3rd week	4th week	5th week	1st week	2nd week	3rd week	4th week	5th week
January	220	200	210	215		7.5	8.3	7.5	9.6	
February	130	135	260	180		7.3	8.4	8.2	8.6	
March	205	210	228	210	210	10.8	16.1	11.6	9.8	5.6
April	210	190	220	240	230	10.2	10.8	14.6	13.3	13.9
May	205	195	225	190		11.8	9.9	7.3	8.3	
June	185	195	335	205	220	9.5	11.2	7.9	9.3	9.8
July	210	223	215	225		8.1	10.5	14.0	10.2	
August	215	190	200	220		13.5	13.7	11.5	15.0	
September	220	225	230	227	260	19.5	14.5	12.0	11.7	12.5
October	230	260	250	235		13.0	10.4	13.0	12.5	
November	220	210	235	245		7.4	10.1	9.1	14.5	
December	230	235	230	265	215	11.6	9.3	9.1	12.5	13.0
1st week average	207					10.8				
2nd week average		206					11.1			
3rd week average			237					10.5		
4th week average				221					11.3	
5th week average					227					11.0

TABLE 11
FLOW SUMMARIES
DELTA DIABLO SANITATION DISTRICT
1998

Month	INFLUENT FLOW (MGD)				FINAL EFFLUENT (MGD)			
	Total	Maximum	Minimum	Average	Total	Maximum	Minimum	Average
January	449	19.7	12.7	14.5	447	18.8	12.7	14.4
February	516	27.4	15.3	18.4	531	27.4	14.8	18.9
March	442	16.1	12.7	14.3	440	15.1	12.8	14.2
April	408	14.7	11.7	13.6	405	14.7	11.8	13.5
May	421	15.1	12.8	13.6	414	14.3	12.5	13.3
June	388	13.8	12.3	12.9	397	14.5	12.4	13.2
July	395	14.0	11.7	12.7	405	14.4	12.0	13.1
August	404	14.0	12.0	13.0	425	15.4	12.3	13.7
September	391	14.4	12.1	13.0	407	15.1	12.4	13.6
October	406	14.5	12.2	13.1	412	15.4	12.2	13.3
November	399	15.7	12.1	13.3	409	16.3	12.1	13.6
December	404	14.4	11.9	13.0	412	15.1	12.3	13.3
Annual Total	5025				5103			
Annual Maximum		27.4				27.4		
Annual Minimum			11.7				11.8	
Annual Average				13.8				14.0

TABLE 12
ANNUAL WASTE CHARACTERISTIC AND LOADING SUMMARY
DELTA DIABLO SANITATION DISTRICT
1998

BOD/TSS INFLUENT

Month	BOD (mg/L)			TSS (mg/L)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
January	240	180	210	360	170	216
February	300	100	176	310	99	188
March	246	180	213	300	140	205
April	240	190	218	320	192	227
May	250	180	204	310	190	236
June	470	160	229	450	190	239
July	230	210	220	240	150	210
August	230	160	205	230	130	199
September	280	220	232	310	190	221
October	270	230	248	350	116	223
November	250	200	228	280	200	224
December	270	180	235	310	200	236
Annual Maximum	470			450		
Annual Minimum		100			99	
Annual Average			218			219

TABLE 13
WEEKLY AVERAGE
DELTA DIABLO SANITATION DISTRICT
TSS mg/L
1998

Month	Influent					Effluent				
	1st week	2nd week	3rd week	4th week	5th week	1st week	2nd week	3rd week	4th week	5th week
January	206	230	212	226		8.5	7.1	6.6	7.2	
February	204	184	175	180		8.6	7.5	7.3	8.0	
March	198	178	235	220	193	10.5	13.1	8.3	6.9	8.0
April	212	210	240	258	215	8.5	11.3	10.8	11.7	7.6
May	248	236	226	230	250	9.1	8.5	8.6	7.8	7.8
June	213	233	310	208	200	8.9	12.7	9.0	10.7	7.8
July	208	208	218	218	185	6.2	9.5	15.6	10.8	12.0
August	206	183	202	194	205	11.2	12.3	15.8	16.4	15.8
September	205	216	226	218	260	17.1	12.7	12.7	14.3	15.8
October	184	273	218	222	210	15.4	11.8	13.6	13.2	10.8
November	216	220	220	230	255	11.0	12.2	12.2	16.1	21.2
December	213	218	232	280	240	15.4	11.3	13.3	18.0	16.5
1st week average	209					10.9				
2nd week average		216					10.8			
3rd week average			226					11.2		
4th week average				224					11.8	
5th week average					221					12.3

DELTA DIABLO SANITATION DISTRICT
HEAVY METALS (ug/L)
1998

		Ag		As		Cd		Cr		Cu		Hg		Ni		Pb		Se		Zn	
Month	Day	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff
Jan	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35	0.0	0.00	0.00	25.0	0.0	4.0	0.0	3.7	3.9	120	0.0
	21									45	0.0	0.32	0.00								
Feb	11	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	30	0.0	0.00	0.00	0.0	0.0	0.0	0.0	2.5	0.0	41	0.0
	24									98	0.0	0.53	0.00								
Mar	5									46	0.0	0.00	0.00								
	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49	0.0	0.00	0.00	0.0	0.0	0.0	0.0	2.7	0.0	108	0.0
Apr	1	0.0	0.0	36.7	5.3	0.0	0.0	0.0	0.0	39	0.0	0.00	0.00	0.0	0.0	0.0	0.0	3.7	2.4	94	0.0
	12									49	16.7	3.60	5.40								
	20			8.0	5.8					68	0.0							4.6	2.9		
	28											0.71	2.20								
May	4	0.0	0.0	8.0	5.6	0.0	0.0	0.0	0.0	70	0.0	0.00	0.00	0.0	0.0	0.0	0.0	2.3	1.3	127	0.0
	12											0.00	0.00								
	18									57	0.0	2.00	3.20								
Jun	2	0.0	0.0	8.6	6.8	0.0	0.0	0.0	0.0	64	0.0	0.46	0.00	30.6	0.0	6.5	0.0	2.6	1.4	126	0.0
	16									49	0.0	0.22	0.00								
Jul	1									52	0.0										
	8	0.0	0.0	6.6	4.4	0.0	0.0	0.0	0.0	45	0.0	0.00	0.00	0.0	0.0	0.0	0.0	1.9	0.0	110	0.0
	21									55	16.9	4.25	0.22								
Aug	4	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	35	4.1	0.00	0.00	0.0	0.0	5.7	0.0	0.0	0.0	90	11.0
	20									37	0.0	0.00	0.00								
Sep	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	110	17.0
	16									0	12.7	0.00	0.00								
	29									64	14.0	0.00	0.00								
Oct	13	0.0	0.0	4.4	6.6	0.0	0.0	0.0	0.0	15	4.1	0.30	0.00	9.2	8.4	5.4	0.0	6.3	7.0	140	16.0
	28									83	9.9	0.00	0.00								
Nov	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00	0.00	5.6	0.0	5.8	0.0	1.9	0.0	77	0.0
	16									24	0.0									72	0.0
Dec	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41	0.0	0.00	0.00	7.4	7.5	0.0	0.0	1.6	1.0	98	21.0
	14									38	0.0	0.26	0.00							104	0.0
Average		0.0	0.0	6.6	2.7	0.0	0.0	0.5	0.0	45	2.9	0.49	0.42	6.5	1.3	2.3	0.0	2.6	1.5	101	4.6
Maximum		0.0	0.0	36.7	6.8	0.0	0.0	6.0	0.0	98	16.9	4.25	5.40	30.6	8.4	6.5	0.0	6.3	7.0	140	21.0
Minimum		0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	41	0.0
Discharge Limit		23		200		10.7		110		78		1		71		23		50		1055	