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To: Board of Directors
From: General Manager
Date: January 25th, 2007

Subject: **CO_2 Emissions and Imported State Project Water to Ventura County**

For the past decade, much attention has been given to so-called greenhouse gases and their role in altering the earth's climate. Greenhouse gases include water vapor, nitrous oxide, methane, tropospheric ozone and carbon dioxide (CO_2).

In 2006, Governor Schwarzenegger called for a reduction in anthropogenic contributions to greenhouse gases, with a focus on CO_2. Because of the sizable power requirements to convey State Project water to Southern California, the potable community began to assess its own "carbon footprint", and ask just how much CO_2 is produced for every acre foot of water conveyed. What are the comparisons with locally produced potable water? This memorandum summarizes the author's approach to answer those questions.

Power Requirements

Pumping plant design information for the State Water Project (SWP) system is well documented [1]. Pumping plants utilized in moving water to Ventura County, and the power requirements needed in calendar year 2004 are listed below in Table 1. [2]

Table 1: CY 2004 SWP MWH AND AF BY PUMPING PLANT

PLANT	MWh	AF	kWh/AF	Normal Static Head (feet)
Banks	892,609	3,104,770	287	236 – 252
Dos Amigos	397,117	2,861,029	139	107 - 125
Buena Vista	516,766	2,147,650	241	205
Wheeler Ridge	563,529	2,158,235	261	233
Wind Gap	1,249,417	2,056,919	607	518
Edmonston	4,580,994	2,032,080	2254	1926
Oso	231,378	877,066	264	231

Additionally, imported water is treated at Metropolitan's Joseph Jensen Filtration Plant. Ozonation is used as a primary disinfectant, and is power intensive.

Sources of Power

The State's major sources of electricity are shown below in Table 2. Electricity utilized to convey water to Southern California is seen to emanate from three different sub-regions, namely CAL, PNW and DSW. Almost 80% of California's electricity is generated within the state (CAL) [3]. That number includes two coal plants which are considered in-state, since they are in California specific control areas. The other 20% is imported from energy grids cited as the Pacific Northwest (PNW) and the Desert Southwest (DSW).

Table 2. California's Major Sources of Electricity (2005)

In-State	**78.33%**
Natural Gas	37.71%
Nuclear	14.47%
Large Hydro	17.03%
Coal*	20.07%
Renewable	10.73%
Imports	**21.67%**
PNW	7.04%
DSW	14.63%

**Intermountain and Mohave coal plants are considered in-state, since they are in California control areas.*

Typically, each sub-region has the ability to generate electricity utilizing different sources. This discussion will focus on those sources which produce significant carbon dioxide emissions, namely, natural gas and coal.

Approach

Estimates of CO_2 emissions per acre foot of water conveyed were made two different ways. The most straightforward approach was to utilize published emission rate data [4]. The California Climate Action Registry (the Registry) has published data in pounds emitted per megawatt hour generated (lbs/MWh) for each sub region (e Grid). Data available for year 2000 are shown below in Table 3. The data represent an annual average, and account for electrical transmission and distribution losses.

Table 3
eGRID Subregion Annual Average CO_2 Output-Based Emission Rates
(Year 2000 – Total Energy)

eGRID Subregion Name	eGRID Subregion Acronym	Percent of Total	CO_2 Output Emission Rate (lbs/MWh)
WECC California	CAL	0.7833	804.54
WECC Pacific Northwest	PNW	0.0704	671.04
WECC Southwest	DSW	0.1463	1,423.95

All of Calleguas' supply is treated at Jensen. Power data for Jensen is shown below in Table 4. [5] The data show an increase in power requirements when ozone disinfection came on-line in June, 2005.

Table 4
2005 Power Requirements at Jensen

Month	kWH	Bill	AF
January	700,000	$57,888.92	42,131
February	428,000	$45,280.43	25,037
March	428,000	$45,280.43	24,567
April	428,000	$45,280.43	32,841
May	428,000	$45,280.43	14,601
June	1,165,000	$100,393.17	36,168
July	1,330,000	$113,355.17	41,685
August	1,636,000	$132,770.12	43,196
September	1,596,000	$128,510.56	37,193
October	1,660,000	$133,792.33	41,361
November	1,362,000	$110,339.87	38,201
December	1,434,000	$114,398.19	38,933

Since the numbers in Table 1 are from actual data, the inherent pump and motor inefficiencies will have already been accounted for. Summing the energy requirements, we arrive at 4.053 MWh/AF for the State Water Project. Including energy requirements at the Jensen Filtration Plant with ozone disinfection of 0.037 MWh/AF, a total of 4.090 MWh of energy are required for every acre foot of water delivered to Ventura County.

The calculated weighted average of carbon dioxide emissions shown in Table 3 is 0.443 tons of CO_2 emitted per megawatt hour. Thus, we see that 1.81 tons of CO_2 are produced for every acre foot of water delivered to the Calleguas service area. In a typical year of 120,000 acre feet or more of imported water demand, approximately 217,000 tons of carbon dioxide will have been produced.

Alternative Calculation

Let's start the calculation over, but this time we will start with the ideal power equation, or

$$P = \gamma Q h$$

where: $\gamma =$ the specific weight of water *[W/L^3]*
$Q =$ the volumetric flow rate *[L^3/time]*
$h =$ total static head lift *[L]*

Summing the last column of Table 1, we see that $h =$ 3,473 feet. From the above equation, we get an ideal power requirement of 3,555 KWh/AF. We can compute actual power requirements by dividing by the pump and motor efficiency η_p and electrical transmission and distribution efficiency η_D, which is equal to $1-\eta_{losses}$. In the United States, losses have been referenced on the order of 7%. [6]

$$P_{actual} = \frac{P_{ideal}}{\eta_p \eta_D}$$

Relying on data provided in Table 1, compared to the ideal power requirement, we compute the pump and motor efficiency to be 0.88. That is,

$$\eta_P = \frac{3555}{4053} = 0.88$$

This is a reasonable number. Assuming T&D losses of 7%, and still including power requirements for Jensen, we get an actual energy requirement of 4.344 MWh/AF.

Now we must focus our attention on the electrical grids, and utilize other independent sources of data with respect to CO_2 emissions per Mwh. The California Energy Commission reports [7] that the In-State CO_2 emission rate is 0.4 tons/MWh, while the Out-of-State emission rate is 0.55 tons/MWh. Taking a weighted average based on the proportion of electricity which comes from within or out of the State, (Table 3), yields 0.43 tons/MWh. Multiplying this result by our calculated energy requirement of 4.344 MWh/AF, yields a result of 1.87 tons of carbon dioxide produced for every acre foot of water delivered. This compares favorably with our first calculation (within 5%).

Carbon Footprint for Local Groundwater Pumping and Desalting Facilities

Power requirements for a low pressure membrane, reverse osmosis groundwater pumping and treatment facility are on the order of 1.64 MWh/AF, including pump, motor and transmission losses [8]. CO_2 production was calculated to be 0.70 tons/AF of water produced. Feedwater TDS was assumed to be 2000 mg/liter. Groundwater pumping lift was assumed to be 200 feet, with $\eta_P = 0.88$, and $\eta_D = 0.93$. A comparison is shown below in Table 5.

Table 5. Ventura County Potable Water Carbon Footprint

	MWh/AF	CO_2 (tons/AF)
Imported	4.09	1.84
GW Pumping and Desal	1.64	0.70

Conclusions

Importing water to Ventura County is clearly an energy intensive operation, which is almost three times higher than local supply development. It is interesting to see how the carbon footprint for water compares with that of a standard automobile. A typical car emits 22 pounds of CO_2 per gallon of gas consumed. On average, Americans travel 240 miles per week in their car, getting 22.40 miles per gallon [9], [10], [11]. This translates to 5.4 tons of CO_2 generated per year on average for every car. This number does not include additional generation due to the transportation of crude oil to a refinery, or the processing of gasoline itself. Assuming that an average family of four uses about 1 acre foot per year we can make a brief comparison on a per capita basis shown in Table 6.

Table 6. Carbon Footprint on per Capita Basis

Source	CO_2 (tons/yr/capita)
Imported Water	0.460
Local Desalinated Groundwater	0.175
Automobile	2.7 – 5.4
1997 Kyoto (Carbon Allowance)	5.4

References:

1. Department of Water Resources, Division of Operations and Maintenance, “Data Handbook, State Water Project”, 1992.

2. Data provided by Metropolitan Water District of Southern California.

3. California Energy Commission, Website, www.energy.ca.gov, 2005.

4. California Climate Action Registry, Appendix to the General Reporting Protocol, Power/Utility Reporting Protocol, April 2005.

5. Data provided by Metropolitan Water District.

6. U.S. Climate Change Technology Program, Technology Options for the Near and Long Term, page 34, November, 2003.

7. California Energy Commission, “A Preliminary Environmental Profile of California’s Imported Electricity”, CEC-700-2005-017, June 2005.

8. American Water Works Association, Manual of Water Supply Practices, “Reverse Osmosis and Nanofiltration”, Denver, Colorado, 1999.

9. Earth Institute, www.vtearthinstitute.org

10. Yes Magazine, Winter 1999-2000, American Forests, www.americanforests.org

11. Acterra, 3 Phases Energy, Sierra Club, www.cool-it.us

Don Kendall

California Electrical Energy Generation

California Electrical Energy Generation, 1997 to 2011*
Total Production, by Resource Type
(Gigawatt Hours)

	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997
California Generation plus Net Imports:	284,953	290,519	298,827	307,183	304,517	298,096	289,086	289,979	279,774	274,290	266,582	246,876	243,077	244,576	230,243
Hydroelectric	42,727	34,308	29,196	24,446	27,094	48,535	40,240	34,448	36,327	31,318	24,909	42,053	41,627	48,757	41,400
Nuclear	36,666	32,214	31,509	32,482	35,698	32,036	36,155	30,241	35,594	34,353	33,294	43,533	40,419	41,715	37,267
In-State Coal	3,120	3,406	3,735	3,977	4,217	4,190	4,283	4,086	4,269	4,275	4,041	3,183	3,602	2,701	2,276
Oil	36	52	67	92	103	134	148	127	103	81	379	449	55	123	143
Natural Gas	90,751	109,752	117,208	122,906	120,265	109,141	97,103	105,183	94,522	92,658	115,695	106,878	84,703	82,052	74,341
Geothermal	12,685	12,740	12,907	12,907	13,029	13,093	13,292	13,494	13,329	13,396	13,525	13,456	13,251	12,554	11,950
Biomass	5,777	5,798	5,968	5,819	5,658	5,716	6,027	6,074	6,060	6,192	5,701	6,086	5,663	5,266	5,701
Wind	7,594	6,172	6,249	5,724	5,570	4,902	4,084	4,258	3,316	3,546	3,242	3,604	3,433	2,776	2,739
Solar	1,058	908	850	733	668	616	660	741	759	851	836	860	838	839	810
Other	0	0	7	25	0	19	12	39	95	25	26	0	0	230	896
Direct Coal Imports**	13,032	13,119	13,556	14,463	14,417	14,452	24,114	24,504	23,148	23,653	23,699	23,877	22,802	22,570	22,411
Other Imports***	71,508	72,050	77,575	83,608	77,799	65,263	62,967	66,785	62,253	63,941	41,235	2,897	26,685	24,993	30,310
Governmental and Utility-Owned In-State Generation:	93,912	86,355	81,877	79,354	83,015	91,756	83,252	71,210	76,391	70,455	67,045	99,733	97,688	121,955	119,961

Hydroelectric	34,427	28,256	24,345	20,666	23,194	39,969	33,200	28,956	29,970	26,366	21,432	41,001	40,593	47,326	40,122
Nuclear	36,666	32,214	31,509	32,482	35,698	32,036	36,155	30,241	35,594	34,353	33,294	43,533	40,419	41,715	37,267
In-State Coal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil	30	35	45	53	53	51	58	51	41	43	123	157	55	123	143
Natural Gas	21,848	24,954	25,052	25,175	23,092	18,727	12,837	10,814	9,591	8,537	11,198	13,747	14,995	27,699	37,048
Geothermal	858	846	903	947	975	970	997	1,140	1,190	1,150	996	1,252	1,543	5,009	5,302
Biomass	37	38	18	28	-	-	2	6	4	4	-	34	73	80	71
Wind	-	-	-	-	-	-	-	-	-	-	-	7	7	3	6
Solar	45	10	5	3	2	2	2	2	2	2	3	3	3	2	2
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial In-State Generation:	106,503	118,996	125,819	129,758	129,286	126,626	118,754	127,480	117,982	116,240	134,603	120,369	95,903	75,058	57,561
Hydroelectric	8,300	6,052	4,851	3,780	3,899	8,566	7,040	5,492	6,357	4,952	3,477	1,052	1,035	1,430	1,277
Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
In-State Coal	3,120	3,406	3,735	3,977	4,217	4,190	4,283	4,086	4,269	4,275	4,041	3,183	3,602	2,701	2,276
Oil	6	17	22	39	51	83	90	76	62	38	256	293	-	-	-
Natural Gas	68,903	84,798	92,157	97,731	97,172	90,415	84,266	94,368	84,931	84,121	104,497	93,130	69,708	54,354	37,292
Geothermal	11,826	11,894	12,004	11,960	12,054	12,123	12,295	12,354	12,139	12,246	12,528	12,204	11,708	7,546	6,648
Biomass	5,740	5,760	5,950	5,792	5,658	5,716	6,025	6,068	6,057	6,188	5,701	6,052	5,590	5,186	5,630
Wind	7,594	6,172	6,249	5,724	5,570	4,902	4,084	4,258	3,316	3,546	3,242	3,597	3,426	2,773	2,733
Solar	1,013	898	845	730	666	614	658	739	757	848	834	857	835	837	808
Other	0	0	7	25	-	19	12	39	95	25	26	-	-	230	896
Energy Exports:	5,146	5,054	4,629	5,064	5,586	5,056	5,685	4,825	6,026	6,534	14,854	N/A	N/A	N/A	N/A
Pacific Northwest	1,133	1,809	1,871	2,242	2,620	2,518	2,061	1,532	1,471	1,020	5,846	N/A	N/A	N/A	N/A
Pacific Southwest	4,013	3,245	2,759	2,822	2,966	2,539	3,623	3,292	4,555	5,514	9,007	N/A	N/A	N/A	N/A
Energy Imports:	89,686	90,223	95,760	103,136	97,802	84,771	92,766	96,113	91,427	94,128	79,787	N/A	N/A	N/A	N/A
Pacific Northwest	28,851	26,486	21,800	26,201	27,289	22,321	22,347	22,363	23,775	28,206	12,672	N/A	N/A	N/A	N/A

Pacific Southwest	60,835	63,737	73,960	76,935	70,514	62,450	70,419	73,750	67,652	65,921	67,114	N/A	N/A	N/A	N/A
Net Energy Imports (Imports less Exports):	84,539	85,169	91,131	98,072	92,217	79,714	87,081	91,289	85,401	87,594	64,933	26,774	49,487	47,563	52,720
Pacific Northwest	27,718	24,677	19,929	23,959	24,669	19,803	20,286	20,831	22,303	27,186	6,826	18,777	26,051	19,428	25,204
Pacific Southwest	56,821	60,492	71,201	74,113	67,547	59,911	66,795	70,458	63,097	60,408	58,107	7,997	23,436	28,135	27,517

*** Note:** The data in this table is based on corrections and updates as of August 1, 2012.

**** Note:** The "Direct Coal Imports" category is based on reported ownership shares and contractual arrangements for power purchases by California utilities. Due to legislative changes required by Assembly Bill 162 (2009) and to simplify the characterization of coal power generation, only Utah's Intermountain Power Project and Nevada's Mohave Generation Station (closed as of 2006) are included in the reported "Direct Coal Imports" for 1997 through 2011 on this table. A more detailed analysis of the role of coal-based power generation within California is outside the scope of this table. The California Air Resources Board is currently undertaking the task of identifying the fuel source of all imported power into California. When comparing coal and other power imports over time, the best approach is to compare the combined value of both "Direct Coal Imports" and "Other Imports."

***** Note:** In this tabulation, generation located physically out-of-state is included in the energy imports category. The energy imports and exports include all electricity flows in and out of the state as reported by four California Balancing Authorities: California Indendent System Operator, Los Angeles Department of Water and Power, Imperial Irrigation District, and Sacramento Municipal Utility District plus generation at five out-of-state power plants that are within one or more of these Balancing Authorities' control areas but are physically located outside California. These plants include Intermountain Power Plant in Utah, Mohave Generation Station in Nevada (now closed), Caithness Dixie Valley Valley Plant in Nevada, Termoelectrica de Mexicali Plant and InterGen's La Rosita Plant both of which are in Mexico. Power generated by these plants are not typically reported on Balancing Authorities control area imports and exports categories, hence their inclusion in this methodology.

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WEST SIMI VALLEY WATER RECYCLING PROJECT

ENGINEERING REPORT

BY THE

VENTURA COUNTY WATERWORKS DISTRICT NO. 8

DECEMBER 30, 2011

WEST SIMI WATER RECYCLING PROJECT

ENGINEERING REPORT

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APPENDIX A – Waste Discharge Requirements (Order No. R4-2003-0081)

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VENTURA COUNTY WATERWORKS DISTRICT NO. 8 / CITY OF SIMI VALLEY

WEST SIMI VALLEY WATER RECYCLING PROJECT

ENGINEERING REPORT

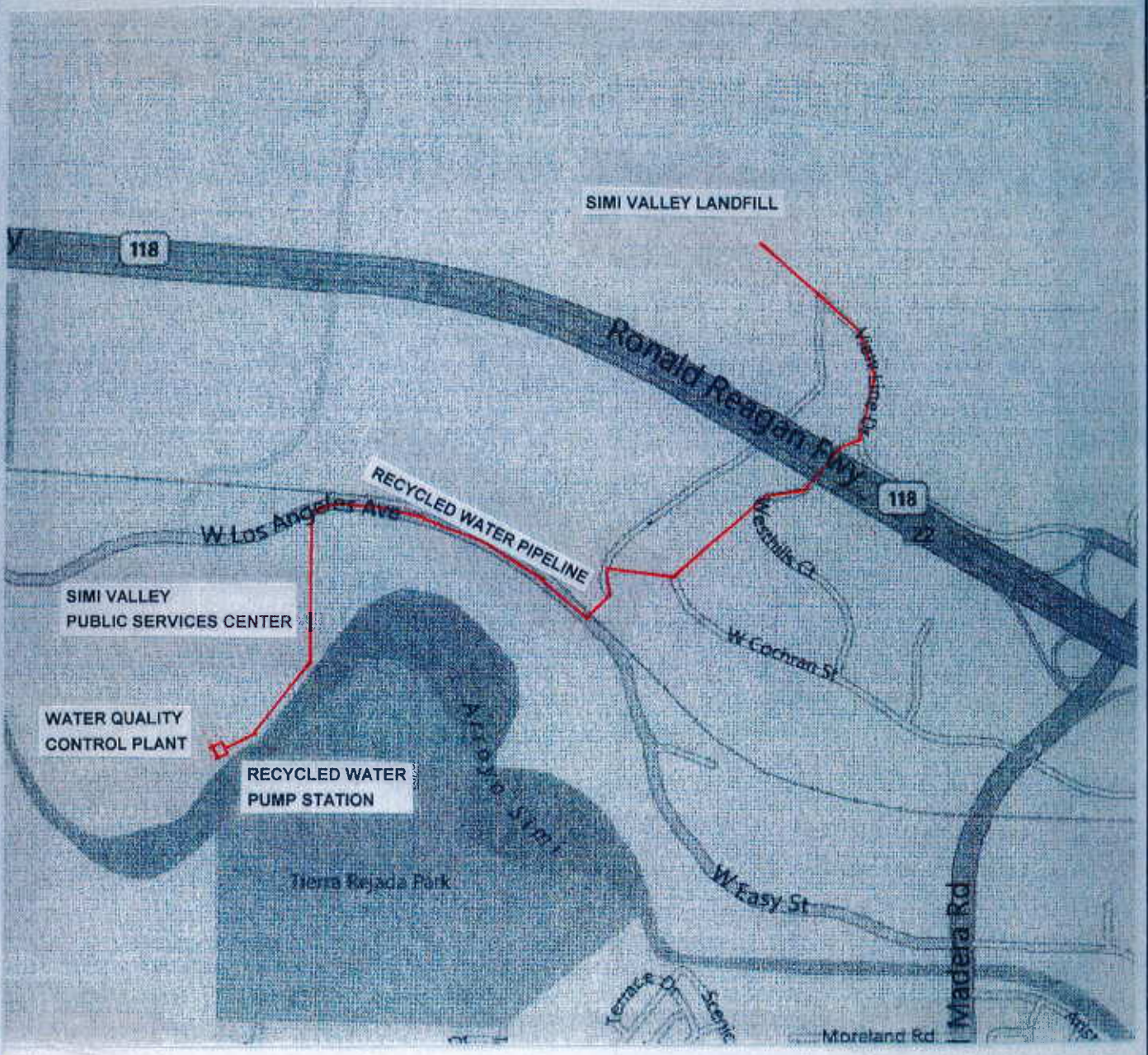
1.0 INTRODUCTION

The Ventura County Waterworks District No. 8 (District) / City of Simi Valley (City) proposes the West Simi Valley Water Recycling Project (WSVWRP) to extend the existing recycled water distribution system to serve an additional 28 or more customers with large irrigation and other non-potable uses.

The existing recycled water distribution system currently serves recycled water, a tertiary-treated wastewater from the Simi Valley Water Quality Control Plant (SVWQCP), to the Simi Valley Landfill and Simi Valley Public Services Center. The SVWQCP is located at 600 West Los Angeles Avenue in Simi Valley, California. **Figure 1** shows the locations of the SVWQCP, the recycled water distribution pipeline, and the two current users, the Simi Valley Landfill and the Simi Valley Public Services Center. The existing recycled water distribution system operates under Water Reclamation Requirements Order No. 87-46 issued to the City of Simi Valley by the California Regional Water Quality Control Board, Los Angeles Region (RWQCB). The amount of recycled water served to the Simi Valley Landfill for dust control and to the Public Services Center for irrigation averages approximately 50 acre-feet per year (AFY).

The proposed WSVWRP will increase the delivery of recycled water by an average of 1,170 AFY to new users, including the Sinaloa, Wood Ranch, and Sunset Hills Golf Courses as shown in **Figure 2**.

This engineering report provides the necessary information for the California Department of Public Health (CDPH) and the RWQCB to demonstrate that the WSVWRP will comply with the Water Recycling Criteria in accordance with Sections 60301 through 60355, inclusive, of the California Code of Regulations, Title 22.

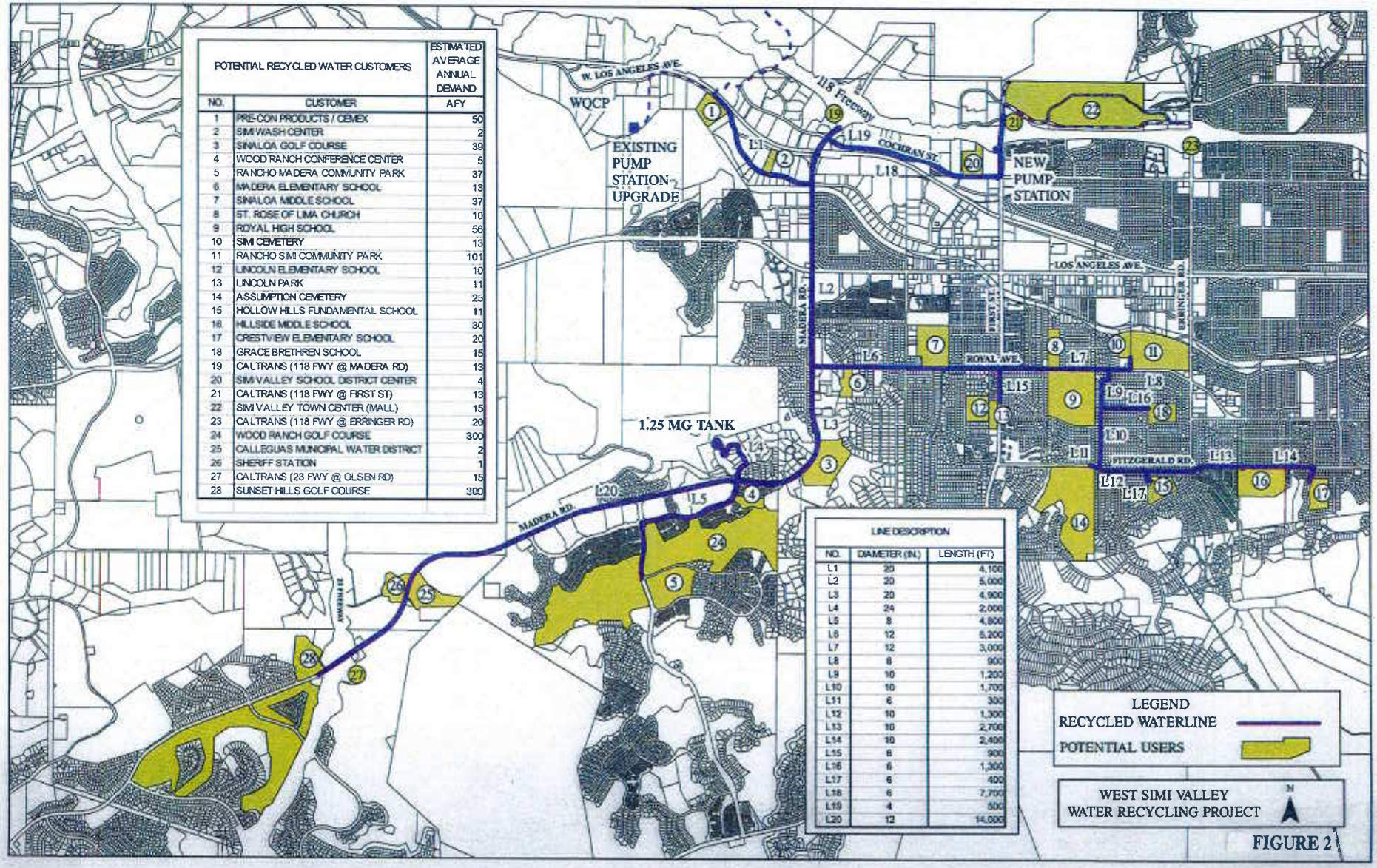


NO SCALE

EXISTING RECYCLED WATER FACILITIES AND CUSTOMERS

WEST SIMI VALLEY WATER RECYCLING PROJECT

FIGURE 1



POTENTIAL RECYCLED WATER CUSTOMERS		ESTIMATED AVERAGE ANNUAL DEMAND
NO.	CUSTOMER	AFY
1	PRE-CON PRODUCTS / CEMEX	50
2	SIMI WASH CENTER	2
3	SINALOA GOLF COURSE	39
4	WOOD RANCH CONFERENCE CENTER	5
5	RANCHO MADERA COMMUNITY PARK	37
6	MADERA ELEMENTARY SCHOOL	13
7	SINALOA MIDDLE SCHOOL	37
8	ST. ROSE OF LIMA CHURCH	10
9	ROYAL HIGH SCHOOL	56
10	SIMI CEMETERY	13
11	RANCHO SIMI COMMUNITY PARK	101
12	LINCOLN ELEMENTARY SCHOOL	10
13	LINCOLN PARK	11
14	ASSUMPTION CEMETERY	25
15	HOLLOW HILLS FUNDAMENTAL SCHOOL	11
16	HILLSIDE MIDDLE SCHOOL	30
17	CRESTVIEW ELEMENTARY SCHOOL	20
18	GRACE BRETHREN SCHOOL	15
19	CALTRANS (118 FWY @ MADERA RD)	13
20	SIMI VALLEY SCHOOL DISTRICT CENTER	4
21	CALTRANS (118 FWY @ FIRST ST)	13
22	SIMI VALLEY TOWN CENTER (MALL)	15
23	CALTRANS (118 FWY @ ERRINGER RD)	20
24	WOOD RANCH GOLF COURSE	300
25	CALLEGUAS MUNICIPAL WATER DISTRICT	2
26	SHERIFF STATION	1
27	CALTRANS (23 FWY @ OLSEN RD)	15
28	SUNSET HILLS GOLF COURSE	300

LINE DESCRIPTION		
NO.	DIAMETER (IN.)	LENGTH (FT)
L1	20	4,100
L2	20	5,000
L3	20	4,900
L4	24	2,000
L5	8	4,800
L6	12	5,200
L7	12	3,000
L8	6	900
L9	10	1,200
L10	10	1,700
L11	6	300
L12	10	1,300
L13	10	2,700
L14	10	2,400
L15	6	900
L16	6	1,300
L17	6	400
L18	6	7,700
L19	4	500
L20	12	14,000

FIGURE 2

2.0 RECYCLED WATER PROJECT

2.1 GENERAL

- City of Simi Valley, Sanitation Division operates and maintains the SVWQCP, the source of the tertiary-treated recycled water.
- Ventura County Waterworks District No. 8 will plan, design, construct, operate and maintain the recycled water distribution system and provide training for the site managers of the various potential customers regarding the use of recycled water.
- County of Ventura will inspect customer's on-site recycled water facilities to ensure proper separation from potable water facilities and backflow prevention.
- City of Thousand Oaks (TO) will be asked to enter into an agreement to allow the District to serve recycled water to Sunset Hills Golf Course and other TO customers.
- Calleguas Municipal Water District (Calleguas) will be asked to amend an agreement to address their ownership of the existing recycled water distribution system.
- Recycled water customers will enter into user agreements that require the trained site managers to be responsible for their proper operation and maintenance of on-site recycled water facilities.

2.2 RULES AND REQUIREMENTS

- Producer/Distributor
  - California Code of Regulations, Title 22, Sections 60301 through 60355, and Title 17 relating to cross-connections
  - "Guidelines for Use of Reclaimed Water", State of California Department of Health Services, Environmental Management Branch
  - Waste Discharge Requirements by RWQCB (Order No. R4-2003-0081, NPDES No. CA0055221) [see **Appendix A**]
  - Water Reclamation Requirements by RWQCB (Order No. 87-46) [see **Appendix B**]

- Users
  - District's "Recycled Water Design and Construction Standards"
  - User Agreements

2.3 PRODUCER – DISTRIBUTOR – USER

2.3.1 Recycled Water

The City of Simi Valley, Sanitation Division is the producer operating the SVWQCP, the source of the tertiary-treated recycled water, which meets the requirements for irrigation of parks, playgrounds, street and highway landscaping, and golf courses, as established in Title 22 of the California Administrative Code.

The current average daily SVWQCP flow is approximately 9 million gallons per day (mgd). Wastewater flows from the SVWQCP's service area at build-out are estimated to be approximately 14.5 mgd. Historical annual average SVWQCP flows are as follows:

Year	Average Flow (mgd)	Peak Flow (mgd)
2005	9.54	19.14
2006	8.80	17.50
2007	9.62	18.87
2008	9.76	19.59
2009	x.xx	x.xx
2010	x.xx	x.xx

The quality of the effluent from the SVWQCP is monitored and reported to the RWQCB as required by the Water Reclamation Requirements for under Order No. 87-46 and Waste Discharge Requirements under Order No. R4-2003-0081, NPDES No. CA0055221. A summary of the effluent quality analyses for the years 2006 to 2010, inclusive, is shown in **Table 1**.

2.3.2 Distributor

The Ventura County Waterworks District No. 8 is the distributor operating the proposed expansion of the existing recycled water distribution system. The proposed expansion, shown in **Figure 2**, will consist of an upgraded pump station at the SVWQCP, a proposed storage tank, and proposed pipeline to deliver recycled water supply to the various potential users for irrigation and other non-potable use.

2.3.3 Users

Potential users to be served by WSVWRP include, but are not limited to, the following as shown in **Figure 2**:

1 CEMEX USA/Pre-Con Products (aggregate processing/irrigation)
2 Simi Wash Center (car washing/irrigation)
3 Sinaloa Golf Course, Rancho Simi Park District (irrigation)
4 Wood Ranch Conference Center (irrigation)
5 Rancho Madera Community Park (irrigation)
6 Madera Elementary School (irrigation)
7 Sinaloa Middle School (irrigation)
8 St. Rose of Lima Church (irrigation)
9 Royal High School (irrigation)
10 Simi Cemetery (irrigation)
11 Rancho Simi Community Park (irrigation)
12 Lincoln Elementary School (irrigation)

13 Lincoln Park (irrigation)
14 Assumption Cemetery (irrigation)
15 Hollow Hills Fundamental School (irrigation)
16 Hillside Middle School (irrigation)
17 Crestview Elementary School (irrigation)
18 Grace Brethren School (irrigation)
19 CalTrans (118 Freeway @ Madera Road) (irrigation)
20 Simi Valley School District Center (irrigation)
21 CalTrans (118 Freeway @ First Street) (irrigation)
22 Simi Valley Town Center (irrigation)
23 CalTrans (118 Freeway @ Erringer Road) (irrigation)
24 Wood Ranch Golf Course, American Golf Corporation (irrigation)
25 Calleguas Municipal Water District in Thousand Oaks (irrigation)
26 Ventura County Sheriff Department in Thousand Oaks (irrigation)
27 CalTrans (23 Freeway @ Olsen Road) (irrigation)
28 Sunset Hills Golf Course in Thousand Oaks, American Golf Corporation (irrigation)

2.4 RAW WASTEWATER

The SVWQCP treats wastewater from the following sources:

- Residential
- Commercial
- Industrial
- Institutional

The average biological oxygen demand (BOD) and total suspended solids (TSS) in the influent wastewater are shown as follows:

Year	BOD (mg/L)	TSS (mg/L)
2005	2.0	2.0
2006	2.4	2.0
2007	2.6	2.0
2008	2.0	1.8
2009	x.x	x.x
2010	x.x	x.x

Effluent BOD averages 99 percent removal. Average BOD is 2.0 mg/L and the limit is 20 mg/L. Effluent TSS averages 99 percent removal. Average TSS is 1.8 mg/L and the limit is 15 mg/L.

The average TDS and chloride levels in the influent wastewater for 2010 were approximately 736 mg/L and 152 mg/L, respectively.

TABLE 1
EFFLUENT QUALITY AND WATER RECLAMATION REQUIREMENTS FOR THE SIMI VALLEY WATER QUALITY CONTROL PLANT

CONSTITUENT	UNITS	ANNUAL EFFLUENT DATA						DISCHARGE LIMITATIONS
		2005	2006	2007	2008	2009	2010	
pH	Min-Max	7.1 - 7.4	7.1 - 7.4	7.0 - 7.4	7.1 - 7.5	7.0 - 7.4	7.0 - 7.4	6.0-9.0
Turbidity	NTU	1	1	0.4	0.4	0.4	0.5	2
Total Coliform	MPN/100mL	1.3	<2.0	<2.0	<2.0	<2.0	<2.0	2.2
Temperature	*F	74	74	74	75	75	74	<100
Suspended Solids	mg/L	2	2.0	2.0	1.8	1.6	1.9	15
Settleable Solids	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Total Dissolved Solids	mg/L	819	747	689	730	724	747	850
Total BOD	mg/L	1	2.4	2.6	2.0	1.9	2.3	20
Ammonia Nitrogen	mg/L	ND	<1.0	<0.1	1.61	1.49	1.34	2.35
Organic Nitrogen	mg/L	1	1	1.1	1.3	1.2	1.5	NS
Chlorine Residual	mg/L	ND	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Total Nitrogen	mg/L	9.7	11.3	11.1	10.0	9.9	9.2	NS
Acute Bioassay	% Survival	97	98	100	100	99	100	90
Chronic Toxicity	Survival Tuc	1.0	1.00	1.00	1.00	1.00	1.00	1.00
Orthophosphate-P	mg/L	2.3	2.6	3.4	3.1	3.3	3.0	NS
Algal Biomass	ug/L	0.7	2.0	<2.0	2.0	<2.0	<2.0	NS
MBAS	mg/L	ND	0.13	0.11	0.07	0.11	0.08	0.5
CTAS	mg/L	ND	<0.20	<0.20	0.21	<0.20	<0.20	NS
TKN	mg/L	1.5	1.4	1.3	2.5	2.9	3.0	NS
Gamma-BHC	ug/L	ND	ND	<0.050	<0.050	<0.020	<0.020	0.2
4,4-DDE	ug/L	ND	ND	<0.050	<0.050	*<0.005	*<0.005	* 0.00059
Nitrate + Nitrite	mg/L	7.5	9.2	9.1	7.7	7.3	6.7	9.0
Phosphate	mg/L	0.3	NA	NA	NA	NA	NA	NL
Fluoride	mg/L	0.4	0.4	0.3	0.8	0.9	0.8	1.6
Cyanide	mg/L	2.1	<5.0	<5.0	<5.0	**<5.0	**<5.0	**3.9
Chloride	mg/L	131	124	134	150	152	141	190
Sulfate	mg/L	259	210	178	194	188	205	250
Total Hardness	mg/L	302	261	225	243	241	259	NS
Antimony	ug/L	ND	<1.0	<0.5	0.68	<2.0	<2.0	NS
Arsenic	ug/L	ND	<4.7	1.4	1.9	<1.9	2.6	50
Barium	ug/L	12.8	13.00	12.5	16	18	20.5	1,000
Boron	mg/L	0.6	0.6	0.5	0.6	0.6	0.5	1.0
Cadmium	ug/L	ND	ND	<0.1	<0.10	<0.10	1.0	5
Total Chromium	ug/L	4		0.28	0.31	0.49	<2.0	50
Copper	ug/L	0.005	ND	6.4	6.5	12.8	6.2	1,000
Iron	ug/L	73	62.0	55	44	<40	<40	300
Lead	ug/L	0.7	ND	<0.2	<0.20	<5.0	1.00	50
Mercury	ug/L	0.05	ND	<0.48	<0.05	<.20	<0.20	2.00
Nickel	ug/L	1.5	ND	2.4	2.3	<10.0	3.0	100
Selenium	ug/L	1.7	2.0	1.4	1.3	1.6	2.3	1.6
Silver	ug/L	ND	ND	<0.2	0.2	<10	1.6	50
Thallium	ug/L	ND	ND	<0.2	<0.20	<1.0	<1.0	2
Zinc	ug/L	57	60	38	45	50	48	5,000
Oil and Grease	mg/L	ND	<4.8	<3.1	<5.0	<4.8	< 4.7	10

* Contract Laboratory's reporting limit is <0.005 ug/L

** Contract Laboratory's reporting limit is <5.0 ug/l

Currently, there are two significant industrial users that supply an average unit flow rate of approximately 4,500 gallons per day (gpd). Currently, industrial water users contribute approximately 0.05 percent by volume of the total wastewater treated by the SVWQCP.

2.5 TREATMENT PROCESSES

2.5.1 Treatment Train Schematic

Figure 3 shows the schematic of the treatment train and processes for the SVWQCP.

2.5.2 Description of Treatment Processes

The SVWQCP produces an effluent that has been oxidized, coagulated, clarified, filtered and disinfected. The basic plant liquid processes include the following:

- Pretreatment
- Primary sedimentation
- Flow equalization
- Nitrification-Denitrification
- Secondary sedimentation
- Coagulation
- Tertiary filtration
- Chlorination and dechlorination

Sludge treatment consists of thickening (dissolved air floatation), anaerobic digestion, and dewatering (chemical conditioning, sludge screening, filter presses), and off-site disposal at the local landfill.

The final treated wastewater is discharged to the Arroyo Simi, which forms the southern boundary of the SVWQCP site.

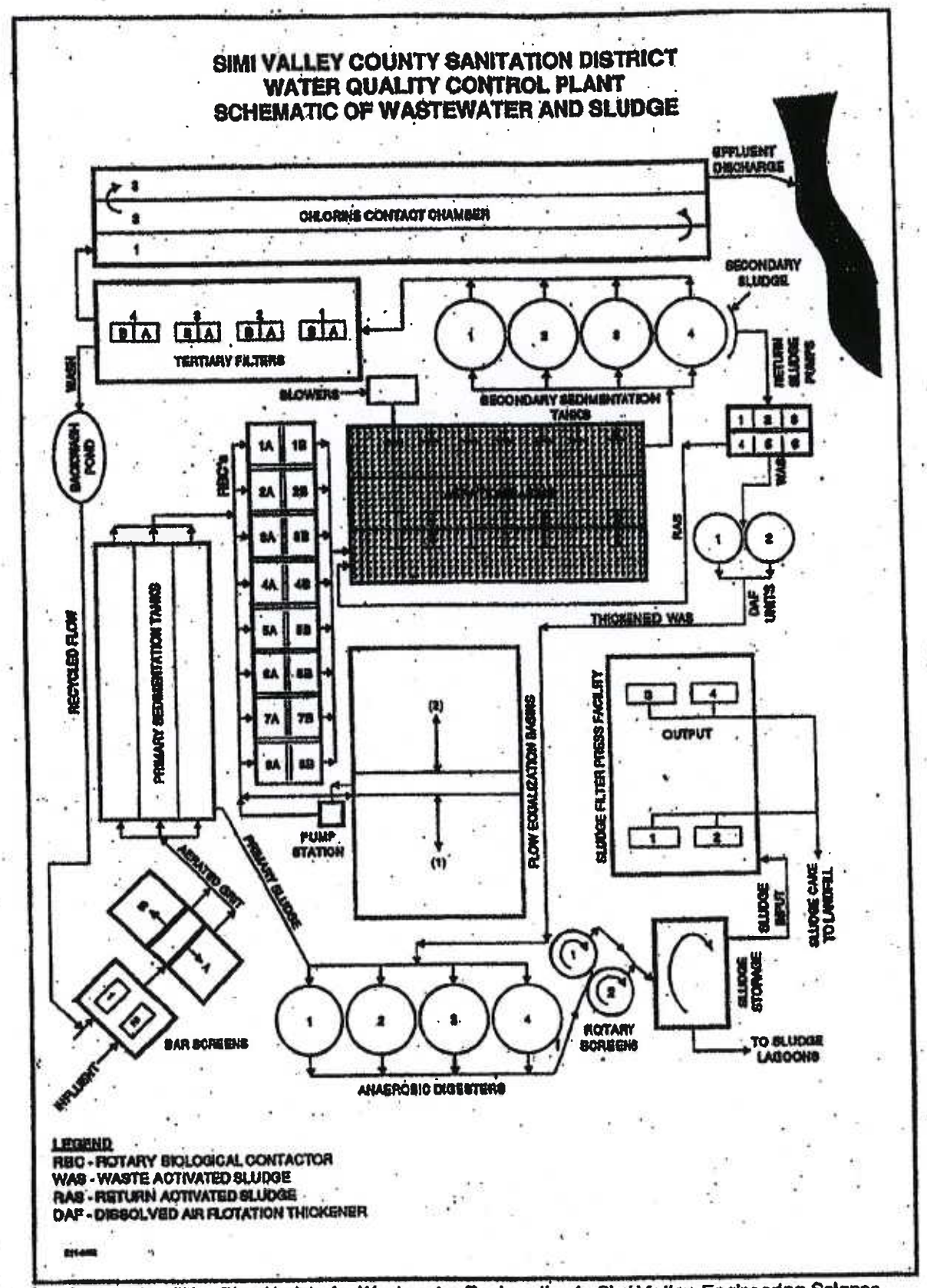
The treatment processes are described in detail as follows.

2.5.2.1 Pretreatment Facilities

The pretreatment facilities at the SVWQCP consist of a bar screen building followed by aerated grit chambers. The mechanically cleaned bar screens are backed up with a manually cleaned bar screen. The bar screens remove the large pieces of debris present in the influent wastewater. Debris that has been trapped by this method is conveyed to a screenings conveyor and is hauled by trucks to a sanitary landfill.

The aerated grit chambers remove heavy particulates of grit and condition grease for removal in the primary sedimentation process. Air applied in this

FIGURE 3



Source: *Facilities Plan Update for Wastewater Reclamation in Simi Valley*, Engineering Science

process aerates the wastewater and keeps lighter organic matter in suspension. Grit is collected at the bottom of the chambers and transported to grit cyclones. The cyclones use centrifugal force to draw heavier particles out of suspension so that they may be conveyed to a vehicle for disposal at a sanitary landfill.

2.5.2.2 Primary Sedimentation

There are three primary sedimentation tanks designed to remove floatables such as grease and settleable solids from the wastewater. Floatables and scum are skimmed by mechanical means. Sediment is scraped into a trough that runs across the inlet end of the tank. The resulting primary sludge and skimmings are pumped to anaerobic digesters.

2.5.2.3 Flow Equalization Basins

The wastewater effluent from the primary clarifiers may be directed to and from the equalization basins when flows are above or below the average daily flow. Flow equalization is controlled by deviation controllers, which monitor and divert all flows over the average daily setpoint by gravity. The flow equalization basins are equipped with a separate pump station that delivers stored wastewater back to the biological nitrogen removal (BNR) treatment area for further treatment during off-peak hours.

2.5.2.4 Biological Nitrogen Removal

A Modified Ludzack-Ettinger process is used to achieve ammonia and nitrate removal. This process begins with an un-aerated anoxic zone (used to de-nitrify by converting nitrate to nitrogen gas) and is followed by an aeration basin (used to nitrify by converting ammonia to nitrate). At the end of the aeration basin, mixed liquor (MLSS) is recycled back to the anoxic zone at a rate between 200% and 400% of the average flow, taking the nitrate and converting it into nitrogen gas, which is 80% of the earth's atmosphere.

2.5.2.5 Activated Sludge

Activated sludge process is when primary clarifier effluent enters an aerated tank where previously developed biological floc particles are brought into contact with organic matter of the incoming wastewater. The organic matter, a carbon and energy source for cell growth, are converted into cell tissue and oxidized end products (mainly carbon dioxide). The biological mass, referred to as mixed liquor suspended solids (MLSS), consists mostly of microorganisms, inert suspended matter, and non-biodegradable suspended matter.

2.5.2.6 Secondary Sedimentation

The purpose of the four secondary sedimentation tanks is to separate the mixed liquor suspended solids from the treated wastewater and to thicken the RAS. These settled solids are pumped from the collection hoppers at the bottom of the tanks to the inlet side of the aeration basins. A certain amount of these solids, along with scum skimmed from the tanks, is wasted out of the system to the dissolved air flotation units for further processing. The clear liquid portion of the secondary effluent flows to the effluent diversion structure where it is channeled to the applied water pumping station ahead of the tertiary filters.

2.5.2.7 Inline Coagulation

Facilities are included ahead of the tertiary filters for the addition of either alum or polymers for inline coagulation. Chemical addition assists in improving the filtration efficiency and in meeting the discharge and reuse requirements.

2.5.2.8 Tertiary Filtration

The low lift water pumping station ahead of the tertiary filtration facilities provides the hydraulic head necessary for wastewater to pass through the filters to the chlorination facilities. The filtration facilities consist of four multi-media filters, each divided in two cells to permit separate backwashing of each cell. Two low-pressure blowers for air scour, three backwash pumps, waste backwash water holding pond, and three backwash pond pumps are provided for this process.

The filters can either operate automatically or manually. Flow equalization equipment prevents surges on the filters and limits maximum flow. Wastewater from the backwash water holding tank is conveyed to the plant ahead of the bar screen facility for reprocessing through the treatment plant.

Specifications for filter media are listed as follows.

Filter Gravel

- Physical Characteristics

  Filter gravel shall be uncrushed and shall consist of hard, rounded stones with an average specific gravity of not less than 2.60. Not more than one percent, by weight, of gravel shall have a specific gravity of 2.25 or less. The gravel shall contain not more than two percent, by weight, of the pieces in which the largest dimension exceeds three times the smallest dimension. Filter gravel shall be visually free of shale, mica, sand, silt, clay, dirt, and organic impurities.

- Acid Solubility

  Acid solubility shall not exceed five percent for size smaller than 3/8-inch and not exceed ten percent for 3/8-inch and larger sizes. Tests for acid solubility shall be conducted in accordance with American Waterworks Standards (AWWA) B100, Section 5.3, Standard for Filtering Material.

- Gravel Size

  The filter gravel shall be placed in one layer with a passing screen size of ¼-inch, retaining screen size of 1/8-inch, and a layer depth of eight inches. The porosity of the gravel shall be not less than 35 percent or greater than 45 percent. Filter gravel shall be screened through square mesh screens conforming to American Society of Testing and Materials, Section E-11, Standard Specifications for Wire-Cloth Sieves for Testing Purposes. Filter gravel that is finer or coarser than the designated size limits shall be limited to no more than seven percent, by weight, of each gravel size.

Filter Sand

- Physical Characteristics

  Filter sand shall be composed of hard, durable grains of siliceous material free from clay, loam, dirt, micaceous and organic matter. Filter sand shall contain no more than five percent, by weight, of flat particles and shall have a minimum specific gravity of 2.60.

- Acid Solubility

  Acid solubility for filter sand shall not exceed five percent when tested in accordance with AWWA B100, Section 5.3.

- Sand Size

  Filter sand shall be the size and bed depth after backwashing and skimming as follows:

  - Effective Size 0.90 mm
  - Maximum Uniformity Coefficient 1.40
  - Sand Depth 18 inches

Anthracite Coal

- Physical Characteristics

  Filter anthracite shall be composed of hard, durable anthracite coal particles and shall be free of iron sulfides, clay, shale, and extraneous foreign matter. The average specific gravity shall be within the range of 1.50 to 1.58. Average hardness shall be 3.0 to 4.0 on the Moh scale.

- Acid Solubility

  Acid solubility of the anthracite shall not exceed one percent. Tests for acid solubility shall be conducted in accordance with AWWA B100, Section 5.3.

- Anthracite Size

  Filter anthracite shall be of the size and bed depth after backwashing and skimming as follows:

  - Particle Size Range 2.4 to 2.8 mm
  - Uniformity Coefficient 1.40
  - Depth 48 inches

  The ratio of the 90 percent finer anthracite size to the 10 percent finer sand size shall be within the range of 2.5 to 3.5.

Backwash rates for the filters are as follows:

- Backwash Water Flow

  - Maximum Rate 35 gpm/sf
  - Minimum Rate 5 gpm/sf
  - Maximum Rate per Nozzle 0.33 gpm
  - Maximum Head Loss (at max flow) 28 in. W.C.
  - Maximum Head Loss (at 20 gpm/sf) 10 in. W.C.

- Backwash Air

  - Maximum Pressure 7.0 psig
  - Minimum Pressure 6.5 psig
  - Flow Rate 1,400 scfm
  - Flow Rate per Nozzle 1.33 scfm

Filter Effectiveness

- Turbidities of Filter Influent 0.94 NTU
- Turbidities of Filter Effluent (after filter and Chemical) 0.40 NTU

2.5.2.9 Chlorination and Dechlorination

After tertiary filtration, the effluent flows to the ammonia addition and chlorination facilities.
Chlorine, in the form of sodium hypochlorite, can be applied at two places in the treatment process, including the chlorine contact tank for disinfection and the diversion structure upstream of the tertiary filters.

The chlorine contact tank is equipped with an inlet flash mixer. Plug flow in the contact tank is ensured by the serpentine nine-channel configuration in two bays, which prevents short-circuiting. Prior to chlorine addition, ammonia is injected to control the formation of trihalomethanes.

Effluent from the chlorine contact tank passes through a mixing chamber, where sodium bisulfate is added to dechlorinate the effluent. The mixing chamber includes a sodium bisulfate spray bar diffuser and a weir, which produces flash mixing. Dechlorinated effluent flows over a control weir and through a Parshall flume metering facility prior to discharge into the Arroyo Simi.

2.5.3 Chemicals Used in Treating Wastewater at the SVWQCP

Chemical	Storage	Mixture Method	Dosage
Ferric Chloride	2,400 gal, liquid	Direct injection	220 ml/min
Alum	6,540 gal, liquid	Direct injection	7-10 ml/min
Aqueous Ammonia	2,400 gal, liquid	Mixed, direct injection	1.8 mg/L
Sodium Hypochlorite	10,600 gal, liquid	Mixed, direct injection	8.0 mg/L
Sodium Bisulfate	12,900 gal, liquid	Mixed, direct injection	3.0 mg/L

2.6 PLANT RELIABILITY FEATURES

The SVWQCP is staffed daily from 7:00 am to 5:00 pm with an additional evening Plant check from 9:00 pm to 11:00 pm. In the event of an alarm, the appropriate personnel will be notified by an automated telephone dialer. While the stated response time is 30 minutes, plant personnel have demonstrated that they can respond to an alarm within 10 to 15 minutes.

Features are described as follows:

- Back-up Power Source

  A 1,500 kw generator is used for a 100 percent backup power source in the event of an outage of the primary electrical power supply.

- Alarms and Contingency Plans

  Each process and its parameters are monitored on 24-hour, 7 days per week using a using a SCADA system and Wonderware Software together with a second remote alarm dialing monitor system. All process irregularities or failures produce an alarm that is sent to the operator. Operators are responsible for notifications to customers as described in Section 2.9.5.

- Microbial Analysis (Coliform)

  The recycled water distribution system will receive disinfected tertiary effluent from the chlorine contact tank prior to dechlorination. The turbidity of the recycled water is constantly monitored. Furthermore, the design of the recycled water system incorporates additional safety measures to significantly increase the security level for eliminating coliform and potentially unsafe contamination in the recycled water transmission system. These safety measures are described as follows:

  - Immediate recycled water pump station shut-down upon instrument detection of a high turbidity or low chlorine residual.
  - Entrapment on the pump station discharge of a volume of recycled water equaling five minutes of discharge at the pump station's ultimate design pumping rate.
  - Full line-draining of all entrapped water to the SVWQCP Lagoon No. 2 for retreatment in the Plant.
  - Double valve isolation at the connection between the recycled water line and the chlorine tank.

2.7 SUPPLEMENTAL WATER SUPPLY

- Users to be served by the WSVWRP will be served potable water from Calleguas through the WSVWRP system to provide reliability for their non-potable water needs.
- Potable water from Calleguas will be delivered from the District's 1035 Pressure Zone to the WSVWRP storage tank via an inlet pipeline that will discharge water above the tank overflow weir to ensure a positive air-gap separation is maintained.
- Potable water from Calleguas is imported supply from the State Water Project that is delivered by the Metropolitan Water District and meets all State drinking water standards.

- Approximately 3,000 gallons per minute of the potable water supply can be delivered to the WSVWRP storage tank.

2.8 MONITORING AND REPORTING

The RWQCB established monitoring and reporting requirements for SVWQCP discharge to the Arroyo Simi under Order No. RA-2003-0081, NPDES No. CA0055221 and for wastewater reclamation under Order No. 87-46. Monthly and annual reports containing all required data as stipulated by Orders No. R4-2003-0081 and No. 87-46 are prepared and submitted to the RWQCB with explanations provided listing any exceptions to the discharge or reclamation requirements.

The information contained herein on Laboratories, Analytical Quality Assurance Program, Records, Sampling Procedures, Measurements and Analyses, and Instruments and Equipment contains excerpts from the "NPDES No. CA0055221 2008 Annual Report" and a description of the standard procedures and methods of analysis used by the laboratory.

2.8.1 Laboratories

The City of Simi Valley, Water Quality Control Laboratory (WQCL) is certified by the California Department of Public Health (CDPH) under the California Environmental Laboratory Accreditation Program (ELAP). The ELAP annually certifies the City to perform the following fields of testing:

Field of Testing 101 – Microbiology of Drinking Water

Total and fecal coliform and E. Coli by multiple tube fermentation, Total coliform and E. coli by Colilert techniques, heterotrophic bacteria by Pour Plate and Sim Plate.

Field of Testing 102 – Inorganic Chemistry of Drinking Water

Alkalinity, chloride, fluoride, hardness, nitrate, nitrite, sulfate, total filterable residue, conductivity, phosphate, total and combined chlorine, and cyanide.

Field of Testing 107 – Microbiology of Wastewater

Total and fecal coliform by multiple tube fermentation, fecal coliform by A-1 media, heterotrophic bacteria by Pour Plate.

Field of Testing 108 – Wastewater Inorganic Chemistry

Alkalinity, ammonia, biochemical oxygen demand, boron, calcium, chemical oxygen demand, chloride, chlorine residual, cyanide, fluoride, hardness, Kjeldahl nitrogen, magnesium, nitrate, nitrite, oil and grease, dissolved oxygen, pH, phenols, orthophosphate, total phosphorus, total residue, filterable residue, non-filterable

residue, settable residue, volatile residue, specific conductance, sulfate, sulfide, surfactants, and turbididty.

Field of Testing 109 – Toxic Chemical Elements of Wastewater

Aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium total, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, thallium, tin-vanadium, and zinc.

Field of Testing 126 – Microbiology of Recreational Wastewater

Total and fecal coliform by multiple tube fermentation, and fecal coliform and E. Coli by multiple tube fermentation, total coliform and E. Coli by Colilert 18, enterococci by Enterolert.

All other analyses are performed by outside ELAP-certified laboratories approved for such analyses by CDPH and in accordance with current guidelines by the Environmental Protection Agency (EPA). Currently, the City has contract agreements with the following ELAP-certified laboratories:

- WECK Laboratories, Inc., City of Industry, CA
- Test America, Inc., Irvine, CA
- FGL Environmental, Inc., Stockton, CA
- Pat-Chem Laboratories, Moorpark, CA

2.8.2 Analytical Quality Assurance Program

The Quality Assurance Program is a continuing program to ensure the reliability, precision, and accuracy of data produced by the WQCL. It emphasizes prevention, early detection, and correction of factors that could result in questionable data, validating the generated data. It discusses the basic factors of water and wastewater measurements that determine the value of analytical results, and it provides recommendations for the control of these factors to ensure that analytical results are accurate. These recommendations are basic to the City's Quality Assurance Program and increases confidence in the reliability of reported analytical results.

2.8.3 Records

2.8.3.1 Data Accessibility

All relevant data including data sheets, monthly reports, annual reports, log books, and other data books are kept in the lab for a period of five years.

2.8.3.2 Sample Logbooks and Worksheets

Logbooks are kept for entering the date, time, sample type, sample origin, sample collector, analyst, and type of analysis required. A specific laboratory identification number is assigned to each sample that is received by the lab.

2.8.3.3 Data Work Books

All data generated by the WQCL is written in ink and is kept either in a bound notebook and/or on data worksheets. The data reported on a monthly basis to the State for NPDES Discharge Requirements is recorded in a bound master data notebook. All monthly analyses, municipal data, and Arroyo Simi data are also recorded in bound data books.

2.8.3.4 Graphs and Charts

Standard curves have been established for each analysis involving photometric determination. These curves are verified each time an analysis is performed by including at least two different standard concentrations in each run. All standard curves (new and old) are kept in the lab in a spiral notebook.

2.8.3.5 Records for Media Preparation

Records for media preparation, as well as the other Quality Assurance Data, are kept in the Quality Assurance notebook. Entries include date, analyst, type and strength of media prepared, dry weight of media, lot, control number, sterility check (5 percent media incubated at 35$\pm$ degrees Centigrade for two days and checked for growth), and positive-negative check.

2.8.3.6 Inventory Control

An adequate supply of chemicals and laboratory supplies is maintained at all times to ensure the uninterrupted work of the lab. The chemicals and laboratory supplies are inventoried once a year and kept on index cards (with all pertinent information) in a file box.

2.8.4 Sampling Procedures

All samples are collected, handled, and preserved in accordance with "Standard Methods for the Examination of Water and Wastewater", 19th , 20th., and 21st. edition, APHA, Washington, D.C., (1975)[1980 and "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Washington, D.C. (1979)].

All samples are obtained to meet the requirements of the Sampling program and are handled in such a way that it does not deteriorate or become contaminated before it reaches the WQCL. The samples are analyzed immediately upon receipt in the WQCL

(when possible), since the shorter the time that elapses between collection of a sample and its analysis, the more reliable will be the analytical results. In the event analysis cannot be started immediately, the EPA developed methods to preserve the sample will be used.

The samples (influent, effluent) collected for tests required by the SVWQCP's NPDES Discharge Requirements on a daily or monthly basis are time or flow composited by a 24-hour automatic sampler (with a refrigerated compartment). All other samples taken for discharge requirements, process control, and industrial wastes are generally grab samples, which are taken at specific times from predetermined sampling points and/or sample schedules posted in the WQCL.

2.8.5 Measurements and Analyses

Standard procedures used in the WQCL for the analysis of water and wastewater are in accordance with current EPA, Federal Register Guideline procedures, or as specified in the monitoring program. Standard references most often used include the following:

- "Standard Methods for the Examination of Water and Wastewater", APHA, WEF, AWWA, WPCF, 19th, 20th, and 21st Editions.
- "Methods for Chemical Analysis of Water and Wastes", EPA, 1983 Test Methods for Evaluations Solid Waste Physical/Chemical Methods EPA 1982.
- "Annual Book of Standards", Part 31, ASTM, 1979.

Other references used are available in the WQCL's main library. A working set of methods abstracted from the above references is also kept in the main library.

As a minimum, all reagents used in the WQCL will be at least analytical reagent grade. Reagents of lesser purity than specified for the method are not used. Upon delivery of any chemical, it is checked immediately to see that it meets quality assurance requirements. The container is marked (in ink) with the date of receipt and initialed by the checker.

Reagents and standards are prepared and standardized with the utmost of care and technique. Only distilled or deionized water is used in their preparation. Only small amounts of reagents that have a short shelf life are prepared one at a time. They are re-standardized or prepared fresh as often as required by their stability. Stock and working standard solutions are checked frequently for signs of deterioration, such as discoloration or precipitation. All solutions prepared in the lab are accurately labeled as to composition, concentration, date of preparation, and preparer. Commercially prepared reagents and standard solutions are used as long as they are checked for accuracy.

Primary standards are obtained from the National Bureau of Standards (NBS) whenever possible. Only reputable chemical supply houses are used as sources for supplies.

All other reagents, standards, and media are prepared in accordance with Standard Methods or the EPA Laboratory Manual. As reagents, standards, and media are prepared, they are recorded with all pertinent information in their respective sections of the Quality Assurance Book.

2.8.6 Instruments and Equipment

All instruments are standardized, calibrated, and maintained in accordance with EPA guideline procedures for Quality Control and the instrument's manufacturer manuals. These manuals are kept on file and are made accessible to all WQCL personnel. In the event of instrument malfunction or breakdown, where WQCL personnel cannot find the source of the problem, the instrument is sent to the manufacturer or a reputable service company for repair.

2.8.6.1 Personnel Training

Only WQCL personnel specifically trained to operate the instruments are authorized to do so.

2.8.6.2 Maintenance Records

Records of calibration, maintenance, and servicing are kept in the Maintenance and Service Book. A supply of bulbs, batteries, fuses, and other essential replacement parts are kept on hand when possible.

2.8.6.3 Thermometer Calibration

The WQCL thermometers used in the ovens and incubators are periodically checked against an NBS-certified thermometer. Calibrations corrections (difference between the two thermometers) are marked on each thermometer that is examined and are recorded in the Quality Assurance Book.

2.8.6.4 Instrument Servicing, Calibration, Standardization, and Readings Taken

- The **Analytical Balance** (Sartorius) is checked daily with known standard weights (mg and g) and is calibrated and serviced annually by a certified balance technician. Weights are recorded daily in the Quality Assurance Book. Service information is logged in the Instrument Maintenance Book.
- The **Triple Beam** (Ohaus) and **Toploading** (Sartorius) balances are kept clean and are periodically checked for accuracy.
- The **Specific Ion Analyzer** (Orion 901) is standardized daily with two buffers of different concentration (7 and 10). The buffers are changed every week or as needed. Electrodes are kept clean and in good working order.

Temperature and standardization information are recorded daily in the Quality Assurance Book.

- The **Nephelometer Turbidimeter** (Digital Turner Designs) is standardized daily with supplied turbidity standard. The standard is replaced annually or as needed. Standardization information is recorded daily in the Quality Assurance Book.
- The **Spectrophotometer** (B&L Spec 21) is periodically checked with a spectro-checked set, which checks for stray light, calibration maximum absorbence and linearity. Blanks and Standards are run along with each analysis. Spectro-check information is recorded in the Instrument Maintenance Book.
- The **Conductivity Meters** (Hach & Myron) are periodically standardized against a known standard sodium chloride solution. The conductivity of laboratory water is recorded daily in the Quality Assurance Book.
- The **D.O. Meter** (Orion 501 Ionalyzer) and **oxygen electrode** (Orion) are calibrated daily before use, in accordance with manufacturer's instructions. Membranes and batteries are replaced as indicated by instrument performance. Calibration information is recorded daily in the Quality Assurance Book.
- The **Microscope** (Microstar) and **Light Source** (American Optical) are serviced and cleaned as needed by a certified technician. Service information is logged in the Quality Assurance Book.
- The **American Waterbaths** (VWR Scientific Model 1240 T) are cleaned and refilled with distilled or deionized water as needed. The various temperatures that correspond with different tests are noted and logged in the Quality Assurance Book.
- The **Autoclave** (Market Forge Sterilmatic) is kept clean and is checked periodically for proper function. Three types of indicators are used to ensure adequate sterilization conditions. Including time, temperature, and pressure: Diack Control, Sterilometer strips, and Kilit ampoules. Autoclave checks are recorded in the Quality Assurance Book with each use.
- The **Dishwasher** (Labconco) is checked on a regular basis to ensure proper cleaning is taking place.
- The **Drying Oven** (Precision Scientific, Model 26) is periodically cleaned and kept at a constant temperature of 180 degrees $\pm$ 2 degrees Centigrade. Temperature is recorded in the Quality Assurance Book when the oven is used.
- The **Drying Oven** (Blue M – Stable-Therm) is periodically cleaned and kept at constant temperature of 103 to 105 degrees Centigrade. Temperature is recorded twice daily (morning and evening) in the Quality Assurance Book.
- The **Muffle Furnace** (Thermolyne 30400 Furnace) is periodically cleaned and is kept at a constant temperature of 550 degrees $\pm$ 50 degrees Centigrade. Temperature is recorded in the Quality Assurance Book when the furnace is used.

- The **BOD Incubator** (Thermo) with **Incutrol/2** (Hach) is periodically cleaned and kept at a constant temperature of 20 degrees $\pm$ 1 degree Centigrade. Temperature is recorded twice daily in the Quality Assurance Book.
- The **Bacteria Incubators** (VWR, Model 2 and 4) are periodically cleaned and kept at a constant temperature of 35 degrees $\pm$ 0.5 degrees Centigrade. Occasionally Model 2 is used at other temperatures. Temperatures are recorded twice daily in the Quality Assurance Book.
- The **Refrigerators** (Fischer Scientific) and **Labline** (explosive proof) are periodically cleaned and are kept at a constant temperature of 4 to 5 degrees Centigrade. Temperatures are recorded twice daily in the Quality Assurance Book.
- The **Quebec Colony Counter** (American Optical) is used for testing and counting bacterial populations.
- The **Bacti-Cinerator II** (S/P) is used for sterilizing transfer loops for bacterial analysis.
- The **COD Reactor** (Hach) is used for the COD test.
- **Equipment Calculator** (Hewlett Packard, Casio, and Texas Instruments)
- The **Distillation Apparatus** is used for various applications.
- The **Ammonia Distillation Apparatus** (Lab Con Co) is used for ammonia test.
- The **Equipment Samplers** are used for sample collecting.
- **Commercial Blender** (Waring)
- **Ultrasonic Cleaner** (L&R Co. T-21B)
- **Electrophotometer II** (Fischer)
- **HACH DR/2000 Spectrophotometer**
- **HACH DR/3000 Spectrophotometer**
- **HACH DR/4000 Spectrophotometer**

2.8.6.5. Equipment – Containers and Glassware

All equipment, containers, and glassware are checked periodically for chipped or broken edges or deformities and are discarded if deemed unsafe or unrepairable.

Glassware used for laboratory purposes is generally of borosilicate glass. For special purposes, other materials may be used such as stainless steel, porcelain, nickel, plastic, etc. Stoppers, caps, and plugs are chosen for their resistance to the attack of material contained in the vessel. Teflon stopcocks are used exclusively in burettes and separatory funnels.

Polyethylene and polypropylene containers are used for sampling to reduce breakage. All volumetric glassware (burettes, volumetric flasks, pipettes) are "Class A" quality.

2.9 CONTINGENCY PLAN

In the event the recycled water produced by the SVWQCP does not meet the Water Reclamation Requirements (Order No.87-46), the Plant will discontinue supplying recycled water to customers.

2.9.1 Diversion Conditions

Recycled water will be diverted from the recycled water distribution system in the event of instrument detection of high turbidity (2.0 or more), low chlorine residual, or loss of tertiary treatment.

2.9.2 Diversion Procedures

- Immediate recycled water pump station shut-down upon instrument detection of high turbidity, low chlorine residual, or failure of coagulation or tertiary filtration processes.
- Entrapment on the recycled water pump station discharge of a volume of recycled water equaling five (5) minutes of discharge at the pump station's ultimate design pumping rate.
- Full line-draining of all entrapped recycled water to the SVWQCP Lagoon No. 2 for retreatment in the Plant.
- Double valve isolation at the connection between the recycled water line and the chlorine basin.

2.9.3 Diversion Area

All entrapped recycled water in the recycled water pump station suction piping will be diverted to the SVWQCP's Lagoon No. 2.

2.9.4 Disposal of Inadequately Treated Effluent

Inadequately treated effluent will be routed from Lagoon No. 2 back through the Plant for retreatment.

2.9.5 Notification Plan

In the event that the SVWQCP is unable to supply acceptably treated recycled water, all recycled water customers will be notified by telephone that they will be supplied domestic water supply to replace the recycled water supply.

3.0 TRANSMISSION AND DISTRIBUTION SYSTEMS

The WSVWRP consists of the following improvements as shown in **Figure 2**:

- Upgrade of the existing recycled water pump station located at the SVWQCP by adding 3 pump units, each with a capacity of 3.5 cubic feet per second
- Construction of a 1.25-million gallon tank for recycled water storage at the District-owned Lower McCoy Tank site
- Construction of approximately 64,320 feet of recycled water pipeline in West Los Angeles Avenue, West Easy Street, Madera Road, Cochran Street, Royal Avenue, Fitzgerald Road, Olsen Road, Country Club Drive, Westranch Lane, and other public streets

The upgraded pump station at the SVWQCP will be operated to deliver tertiary-treated recycled water to maintain a water level elevation range in the 1-million gallon storage tank between 1,020 feet and 1,035 feet and to provide recycled water supply for irrigation and other non-potable use to the users identified in Section 2.3.3 and **Figure 2**.

4.0 USE AREAS

With exception of CEMEX USA / Pre-Con Products and Simi Wash Center, all other users identified in Section 2.3.3 will use recycled water for irrigation.

4.1 Irrigation

- Irrigation customers identified in Section 2.3.3 will use recycled water for general landscape irrigation.
- Irrigation will utilize primarily sprinkler systems.

4.2 Other Industrial Uses

- CEMEX USA / PreCon Products will use recycled water for manufacturing of concrete products, related processing, dust control and minor landscape irrigation.
- Simi Valley Wash Center will use recycled water for washing automotive vehicles and minor landscape irrigation.

4.3 Use Area Design

On-site user recycled water facility design, construction, testing, and operations will be in accordance with the following:

- "Recycled Water Design and Construction Standards, Ventura County Waterworks District No. 8", dated December 10, 2003 [see **Appendix C**]
- "Guidelines for the Use of Reclaimed Water" State of California Department of Health Services, under Order No. 87-46, Water Reclamation Requirements for the Simi Valley County Sanitation District (Water Quality Control Plant) by the State of California, California Regional Water Quality Control Board - Los Angeles Region, dated April 10, 1987 [see **Appendix B**]

In general, areas where recycled water will be used for irrigation or other industrial uses will be subject to the following precautions:

- Recycled water for irrigation use will be applied at a rate that does not exceed the infiltration rate of the soil.
- Irrigation sprayers and sprinklers will be carefully adjusted to ensure that recycled water is not oversprayed onto roadways, buildings or other public areas not normally irrigated.
- Areas subject to irrigation and that may drain onto roadways or other non-irrigation areas will be regraded to prevent ponding of recycled water on those areas.
- Areas where recycled water will be used for industrial use will have suitable measures to minimize recycled water leaving such areas.

In the event that overspray or runoff occurs, corrective measures and possible required modifications or corrections will be taken including the following:

- If runoff or ponding occurs before the landscape's water requirement is met, the automatic irrigation controls will be reprogrammed with additional watering cycles to meet the water requirements and prevent runoff.
- If overspray occurs, the sprinkler heads will be adjusted or replaced as necessary to ensure that all irrigation spray is directed only to areas meant to receive recycled water.

In order to prevent the possibility of cross-connection between potable and recycled water supply systems, the following precautions will be taken:

- All recycled water valves, outlets, quick couplers, and sprinkler heads will be of a type, or secured in a manner, that only permits operation by personnel authorized and trained to use recycled water.
- Hose bibs will not be used in the recycled water system where available to public access.
- Where possible, a minimum 10-foot horizontal and 1-foot vertical separation will be maintained between potable and recycled water pipelines with the potable water pipeline to be above the recycled water pipeline. Special construction requirements for the recycled water pipeline will be provided if the desired minimum separation cannot be achieved.
- An air-gap separation or reduced pressure backflow prevention device at any domestic water service connections will be required for recycled water use areas.
- No connections between the potable and recycled water system piping is permitted, and supplemental water supply will be provided by the District's proposed recycled water storage tank that will be supplied potable water from the domestic system via an inlet pipeline discharging above the tank overflow weir to ensure a positive air-gap separation is maintained.

4.4 Use Area Inspections and Monitoring

The areas where problems such as ponding, runoff, or overspray of recycled water for irrigation are most likely to occur include paved roadways and parking lots. In order to effectively monitor recycled water irrigation systems, each customer will designate a "User Supervisor." The District will be notified of the User Supervisor's name, address, and telephone number at which the person can receive phone calls or messages after normal working hours.

The User Supervisor will be aware of the entire on-site reclaimed water system and of all conditions of reclaimed water use. The User Supervisor will be responsible for the installation, operation, and maintenance of pipelines and cross-connection equipment. The User Supervisor's responsibilities will include the following:

- Ensuring that all operations personnel are trained in and familiarized with the use of recycled water.
- Furnishing operations personnel with maintenance instructions, controller charts, and record drawings to ensure proper operation of the recycled water system.
- Preparing and submitting record drawings of the on-site recycled water system to the District.
- Notifying the District of all updates or proposed changes, modifications, or additions to the on-site recycled water facilities. Changes should be approved by the District and designed and constructed in accordance with all applicable requirements, standards, and guidelines.
- Operating and controlling the on-site recycled water system to prevent direct human consumption of recycled water and to control and limit runoff and overspray.
- Reporting all failures in the on-site recycled water system that cause an unauthorized discharge of recycled water.
- Complying with all applicable Federal, State, and local statutes, ordinances, regulations, contracts, and requirements prescribed by the District.
- Installing and maintaining signs at all on-site recycled water facilities.

The User Supervisor is responsible for notifying the District of all failures in the on-site recycled water system whether or not, in the opinion of the User Supervisor, the failures resulted in violations of any requirement or regulation. The User Supervisor is also responsible for notifying the District of all violations that occur as a result of the user's action, the action of operations personnel, or any use of the recycled water service. If the User Supervisor is unsure whether a violation has occurred, the User Supervisor shall notify the District so that a determination can be made.

Notification of failures and violations will be made as soon as possible or, in any event, no later than noon on the next regular working day following the occurrence. Such notifications will be made by telephone to the District's designated representative.

If the District designated representative determines that a violation has occurred, the User Supervisor will be responsible for initiating corrective action. If corrective action is required, the User Supervisor will submit to the District for approval a written statement describing the violation(s), summarizing corrective actions to be taken, and providing a timetable for completing the corrections. Corrective actions may involve modifications of operational procedures, personnel training, and physical alterations to on-site recycled water facilities. Until corrective actions are completed and approved by the District, recycled water use should continue only to the extent permitted by the District and regulatory agencies.

The User Supervisor will maintain a written log of all system failures, violations, and corrective actions taken, the District will periodically review the log.

On behalf of the District, the City of Simi Valley, Sanitation Division, will submit its quarterly permit report that includes the following to the RWQCB and the CDPH:

- The quality and quantity of the recycled water
- The use of recycled water (the method of irrigation and the areas irrigated)
- The reason for noncompliance with standards, if appropriate, and the corrective action taken

In the event that the recycled water treated by the SVWQCP does not meet the specified Water Reclamation Requirements, distribution of the inadequately treated recycled water will be discontinued and replaced with potable water by the District via its recycled water storage tank that will be supplied from the domestic water system through an inlet pipeline discharging above the tank overflow weir to ensure a positive air-gap separation is maintained. The District will notify its recycled water customers of this type of an occurrence.

4.5 Employee Training

Customer User Supervisors and operations personnel will be trained in the use of recycled water to ensure compliance with the Water Reclamation Requirements, Guidelines for Use of Reclaimed Water, and California-Nevada Section – American Waterworks Association Guidelines for Distribution of Non-potable Water. User Supervisors will be responsible for maintaining records of employee training.

The District will provide information and guidelines to customer User Supervisors and operations personnel, and copies of applicable guidelines and regulations will be kept on-site and available for operations personnel. User Supervisors will be responsible for training new employees and providing retraining for all operations personnel on a periodic basis.

APPENDIX A

WASTE DISCHARGE PERMIT

BY THE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

ORDER NO. R4-2003-0081

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. R4-2003-0081

NPDES PERMIT NO. CA0055221

CITY OF SIMI VALLEY
SIMI VALLEY WATER QUALITY CONTROL PLANT

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State of California
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. R4-2003-0081

NPDES NO. CA0055221

WASTE DISCHARGE REQUIREMENTS FOR CITY OF SIMI VALLEY (Simi Valley Water Quality Control Plant)

The California Regional Water Quality Control Board, Los Angeles Region (hereafter Regional Board), finds:

PURPOSE OF ORDER

1. City of Simi Valley (hereinafter the City or Discharger) discharges tertiary-treated wastewater, from its Simi Valley Water Quality Control Plant (Simi Valley WQCP) located in Simi Valley, to Arroyo Simi, a water of the United States. The discharge is regulated under waste discharge requirements contained in Order No. 96-043, adopted by this Regional Board on June 10, 1996. Order No. 96-043 also serves as a permit under the National Pollutant Discharge Elimination System (NPDES No. CA0055221).

2. On September 29, 1997, the Regional Board adopted Order No. 97-122, which revised the NPDES permit to incorporate provisions from Resolution No. 97-10, *Support for Watershed Management in the Calleguas Creek Watershed*, into the permit and modify Simi Valley WQCP's Monitoring and Reporting Program No. CI-3021. Aside from the revision, the Expiration Date, and all other Limitations, Requirements, and Provisions of Order No. 96-043 were unchanged and remained in full force and effect. The modifications to the permit under Order 97-122 included: adding a footnote to the nitrogen effluent limitation and to the ammonia receiving water objective, and adding a finding regarding the Calleguas Creek Characterization Study.

3. Order No. 96-043 has an expiration date of May 10, 2001. Section 122.6 of Title 40, Code of Federal Regulations (40 CFR) and section 2235.4 of Title 23, California Code of Regulations, state that an expired permit continues in force until the effective date of a new permit provided the permittee has timely submitted a complete application for a new permit. On November 13, 2000, the City filed a Report of Waste Discharge (ROWD) and applied to the Regional Board for reissuance of waste discharge requirements (WDRs) and NPDES permit to continue to discharge tertiary-treated wastewater. Therefore, the Discharger's permit has been administratively extended until the Regional Board acts on the new WDR and permit.

4. This Order is the reissuance of waste discharge requirements that serves as an NPDES

permit for the Simi Valley WQCP.

FACILITY AND TREATMENT PROCESS DESCRIPTION

5. The City owns and operates the Simi Valley WQCP, a tertiary wastewater treatment plant located at 600 West Los Angeles Avenue, Simi Valley, California. Figure 1 shows the location of the plant. The Simi Valley WQCP currently receives wastewater from the City of Simi Valley and unincorporated sections of Ventura County. The wastewater is a mixture of domestic and industrial wastewater. The latter is pretreated pursuant to 40 CFR, Part 403 prior to discharge to the sewers.

6. The City reported in its ROWD that the Simi Valley WQCP has a design capacity of 12.5 million gallons per day (mgd) and serves approximately 112,000 people. On August 19, 1985, the City of Simi Valley approved the "Sewerage Master Plan Upgrade and Preliminary Design and Engineering Expansion of the Simi Valley Water Quality Control Plant". This four stage upgrade and expansion program would increase the plant capacity to 17.5 MGD by the year 2012. However, due to a slow growth initiative, the City does not plan to increase the existing design capacity.

7. The United States Environmental Protection Agency (USEPA) and the Regional Board have classified Simi Valley WQCP as a major discharger. It has a Threat to Water Quality and Complexity Rating of 1-A, pursuant to CCR Section 2200.

8. Treatment at the Simi Valley WQCP consists of aerated grit removal, primary sedimentation, flow equalization, activated sludge biological treatment, secondary sedimentation, dual media filtration, chlorination and dechlorination. Primary sludge is anaerobically digested and waste activated sludge is thickened and aerobically digested. Sewage solids separated from the wastewater are disposed of at the Simi Valley Landfill or to Buttonwillow Land and Cattle Company in California. Bar screen debris is disposed of at a landfill. The City began modifying the treatment process at the Simi Valley WQCP; ultimately, new aeration basins will be used for nitrification and denitrification. Figure 2 illustrates the schematic of wastewater flow.

9. **Water Recycling.** The Simi Valley WQCP currently recycles approximately 10% (0.9 million gallons per year) of the total treated effluent and plans to continue doing so. The production, distribution, and reuse of recycled water are presently regulated under Water Reclamation Requirements (WRR) contained in Order No. 87-46, adopted by this Board on May 5, 1987.

   Recycled water is used for landscape irrigation at the Simi Valley WQCP and for dust control at a landfill.

10. ***Storm Water Management.*** The City contains and treats storm water runoff at the Simi Valley WQCP, including stormwater infiltration and inflows in the sewer and stormwater that traverses the treatment tanks. It has developed a Storm Water Pollution Prevention Plan (SWPPP) for storm water flows at the facility that do not enter the treatment system.

DISCHARGE OUTFALL AND RECEIVING WATER DESCRIPTION

11. The Simi Valley WQCP discharges tertiary-treated wastewater to Arroyo Simi, a water of the United States, above the estuary, within the Calleguas Creek Watershed Management Area, at the following discharge point:

    Discharge Serial No. 001: Discharges tertiary treated municipal and industrial wastewater into Arroyo Simi (approximate coordinates: Latitude 34° 16' 56" North, Longitude 118° 48' 44" West);

    During dry weather (May 1 – October 31), the primary sources of water flow in the receiving waters, downstream of the discharge point, is the Simi Valley WQCP effluent and other NPDES-permitted discharges, including urban runoff conveyed through the municipal separate storm sewer systems (MS4). Storm water and dry weather urban runoff from MS4 are regulated under an NPDES permit, *Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the Ventura County Flood Control District, County of Ventura, and the Cities of Ventura County* (Ventura Municipal Permit), NPDES Permit No. CAS004002.

12. The Ventura County Flood Control District channelized portions of Calleguas Creek to convey and control floodwater, and to prevent damage to homes located adjacent to the Creek. Calleguas Creek is a water of the United States that conveys floodwater and urban runoff, along with treated waste water. Arroyo Simi is unlined near the point of discharge. Groundwater recharge occurs incidentally in these unlined areas of Arroyo Simi, Arroyo Las Posas, and Calleguas Creek, where the underlying sediments are highly transmissive to water as well as pollutants.

    Notwithstanding that segments located further downstream of the discharge are concrete-lined, the watershed supports a diversity of wildlife. Threatened and endangered species such as the peregrine falcon, least tern, light-footed clapper rail, and the brown pelican are found in Calleguas Creek and Mugu Lagoon.

DISCHARGE QUALITY

13. From 1997 to 2001, the Discharger's discharge monitoring reports showed the following:

    - treated wastewater average annual flow rate of 9.1 mgd.
    - average annual removal rate of 91% and 94%, of BOD and total suspended solids, respectively.
    - 7-day median and daily maximum coliform values as <2 MPN/ 100 ml in the treated wastewater for ten of the twelve months of the year.

14. The characteristics of the wastewater discharged, based on data submitted in the 2001 annual summary discharge monitoring report, are as follows. Only the priority pollutants that were detected are shown below. Nondetected toxic priority pollutants and the detection limits are given in the factsheet. (Note: The "<" symbol indicates that the pollutant was not detected (ND) at that concentration level.)

Table 1
Effluent Characteristics

CTR#	Constituent	Unit	Ave. or Range	Maximum	Minimum
	Flow	mgd	9.3	10.1	8.7
	pH	pH units	7.1	7.3	6.9
	Temperature (Nov. – April) (May – Oct.)	°F	69.8 winter 76.2 summer	75 78	67 72
	BOD_5 20°C	mg/L	8	10.7	4.9
	Suspended solids	mg/L	2	2.4	1.5
	Settleable solids	ml/L	<0.1	<0.1	<0.1
	Total dissolved solids	mg/L	713	803	614
	Chloride	mg/L	139	149	124
	Sulfate	mg/L	180	297	120
	Boron	mg/L	0.6	0.8	0.5
	Turbidity	NTU	1	2	1
	Oil and grease	mg/L	<5	<5	<5
	Fluoride	mg/L	0.3	0.6	0.2
	Ammonia-N	mg/L	24.2	31	14.6
	Organic-N	mg/L	2	2.5	1.5
	Nitrate-N + Nitrite-N	mg/L	2.3	3.4	1.3
	Total Nitrogen	mg/L	29	35.9	24.3
6	Copper	µg /L	9.4	12	6.8
	Iron	µg /L	125	140	110
9	Nickel	µg /L	<10 – 5.9	5.9	<10
10	Selenium	µg /L	<5 - 12	12	<5
11	Silver	µg /L	<10 – 3.1	3.1	<10
13	Zinc	µg /L	35.5	41	30
26	Chloroform	µg /L	<5 - 3.7	3.7	<5
27	Dichlorobromomethane	µg /L	<5 – 0.8	0.8	<5
36	Methylene chloride	µg /L	<5 – 0.5	0.5	<5
	MTBE	µg /L	0.9	0.9	--

APPLICABLE LAWS, PLANS, POLICIES AND REGULATIONS

15. ***Federal Clean Water Act***. The federal Clean Water Act (CWA) provides that no person may discharge pollutants from a point source into a water of the United States, except in conformance with an NPDES permit. NPDES permits establish effluent limitations that incorporate various requirements of the CWA designed to protect and enhance water quality.

16. ***Basin Plan***. The Board adopted a revised *Water Quality Control Plan, Los Angeles Region: Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan) on June 13, 1994, amended on January 27, 1997, by Regional Board Resolution No. 97-02. This updated and consolidated plan represents the Board's master water quality control planning document and regulations. The revised Basin Plan

was approved by the State Board and the State of California Office of Administrative Law (OAL) on November 17, 1994, and February 23, 1995, respectively. The Basin Plan (i) designates beneficial uses for surface and groundwaters, (ii) sets narrative and numeric objectives that must be attained or maintained to protect the designated (existing and potential) beneficial uses and conform to the state and federal antidegradation policies, and (iii) includes implementation provisions, programs, and policies to protect all waters in the Region. In addition, the Basin Plan incorporates (by reference) all applicable State and Regional Board plans and policies and other state pertinent water quality policies and regulations. The 1994 Basin Plan was prepared to be consistent with all applicable State and Regional Board plans and policies adopted from 1994 and earlier. This Order implements the plans, policies and provisions of the Board's Basin Plan.

17. ***Sources of Drinking Water Policy***. On May 19, 1988, the State Board adopted Resolution No. 88-63, *Sources of Drinking Water (SODW) Policy*, which established a policy that all surface and ground waters, with limited exemptions, are suitable or potentially suitable for municipal and domestic supply. To be consistent with State Board's SODW policy, on March 27, 1989, the Regional Board adopted Resolution No. 89-03, *Incorporation of Sources of Drinking Water Policy into the Water Quality Control Plans (Basin Plans) – Santa Clara River Basin (4A)/ Los Angeles River Basin (4B).*

18. Consistent with Regional Board Resolution No. 89-03 and State Board Resolution No. 88-63, in 1994 the Regional Board conditionally designated all inland surface waters in Table 2-1 of the 1994 Basin Plan as existing, intermittent, or potential for Municipal and Domestic Supply (MUN). However, the conditional designation in the 1994 Basin Plan included the following implementation provision: "no new effluent limitations will be placed in Waste Discharge Requirements as a result of these [potential MUN designations made pursuant to the SODW policy and the Regional Board's enabling resolution] until the Regional Board adopts [a special Basin Plan Amendment that incorporates a detailed review of the waters in the Region that should be exempted from the potential MUN designations arising from SODW policy and the Regional Board's enabling resolution]." On February 15, 2002, the USEPA clarified its partial approval (May 26, 2000) of the 1994 Basin Plan amendments and acknowledged that the conditional designations do not currently have a legal effect, do not reflect new water quality standards subject to USEPA review, and do not support new effluent limitations based on the conditional designations stemming from the SODW Policy until a subsequent review by the Regional Board finalizes the designations for these waters. This permit is designed to be consistent with the existing Basin Plan.

19. ***Beneficial Uses***. The designated beneficial uses in the Basin Plan for Arroyo Simi, Arroyo Las Posas, Calleguas Creek, and Mugu Lagoon:

A. For surface water:

<u>Arroyo Simi</u> - Hydro Unit 403.62

Existing: wildlife habitat, and preservation of rare, threatened or endangered species;

Intermittent: industrial process supply, ground water recharge, freshwater replenishment, contact and non-contact water recreation, and warm freshwater habitat;

Potential: municipal and domestic supply;

The potential MUN beneficial use for the water body is consistent with Regional Board Resolution 89-03; however the Regional Board has only conditionally designated the MUN beneficial uses and at this time cannot establish effluent limitations designed to protect the conditional designation.

Arroyo Las Posas - Hydro Unit 403.62

Existing: ground water recharge, freshwater replenishment, contact and non-contact water recreation, warm freshwater habitat, and wildlife habitat;

Potential: municipal and domestic supply, industrial process supply, industrial service supply, agricultural supply, cold freshwater habitat;

The potential MUN beneficial use for the water body is consistent with Regional Board Resolution 89-03; however the Regional Board has only conditionally designated the MUN beneficial uses and at this time cannot establish effluent limitations designed to protect the conditional designation.

Arroyo Las Posas - Hydro Unit 403.12

Existing: ground water recharge, contact and non-contact water recreation, warm freshwater habitat, and wildlife habitat;

Potential: municipal and domestic supply, industrial process supply, industrial service supply, agricultural supply, cold freshwater habitat;

The potential MUN beneficial use for the water body is consistent with Regional Board Resolution 89-03; however the Regional Board has only conditionally designated the MUN beneficial uses and at this time cannot establish effluent limitations designed to protect the conditional designation.

Calleguas Creek - Hydro Unit 403.12

Existing: industrial service supply, industrial process supply, agricultural supply, ground water recharge, contact and non-contact water recreation, warm freshwater habitat, and wildlife habitat;

Potential: municipal and domestic supply;

The potential MUN beneficial use for the water body is consistent with Regional Board Resolution 89-03; however the Regional Board has only conditionally designated the MUN beneficial uses and at this time cannot establish effluent limitations designed to protect the conditional designation.

Calleguas Creek - Hydro Unit 403.11

Existing: agricultural supply, groundwater recharge, freshwater replenishment, contact and non-contact water recreation, warm freshwater habitat, cold freshwater habitat, wildlife habitat, rare, threatened or endangered species, and wetland habitat;

Potential: municipal and domestic supply;

The potential MUN beneficial use for the water body is consistent with Regional Board Resolution 89-03; however the Regional Board has only conditionally designated the MUN beneficial uses and at this time cannot establish effluent limitations designed to protect the conditional designation.

Calleguas Creek Estuary - Hydro Unit 403.11

Existing: non-contact water recreation, commercial and sport fishing, estuarine habitat, wildlife habitat, rare, threatened or endangered species, migration of aquatic organisms, spawning, reproduction, and/or early development, and wetland habitat;

Potential: navigation, water contact recreation;

Mugu Lagoon - Hydro Unit 403.11

Existing: navigation, non-contact water recreation, commercial and sport fishing, estuarine habitat, marine habitat, wildlife habitat, preservation of biological habitats, rare, threatened or endangered species, migration of aquatic organisms, spawning, reproduction, and/or early development, shellfish harvesting, and wetland habitat.

Potential: water contact recreation;

B. The beneficial uses of the receiving ground waters are:

Simi Valley Basin – DWR Basin No. 4-9

Confined aquifer:	Existing-	municipal and domestic supply, industrial service supply; industrial process supply; and, agricultural supply.
Unconfined aquifer:	Existing-	municipal and domestic supply, industrial service supply; industrial process supply; and, agricultural supply.

Las Posas Valley – DWR Basin No. 4-8

South Basin:	Existing-	municipal and domestic supply, industrial service supply; industrial process supply; and, agricultural supply.
North Basin:	Existing-	municipal and domestic supply, industrial service supply; industrial process supply; and, agricultural supply.

Pleasant Valley (Ventura Central Basin) – DWR Basin No. 4-6

Confined aquifers:	Existing-	municipal and domestic supply, industrial service supply; industrial process supply; and, agricultural supply.
Unconfined aquifers:	Existing-	industrial service supply; industrial process supply; and, agricultural supply;
	Potential-	municipal and domestic supply.

Oxnard Plain (Ventura Central Basin) - DWR Basin No. 4-4

Confined aquifers:	Existing-	municipal and domestic supply, industrial service supply; industrial process supply; and, agricultural supply.
Unconfined aquifers:	Existing-	municipal and domestic supply; and, agricultural supply;
	Potential-	industrial service supply.
Oxnard Forebay:	Existing-	municipal and domestic supply, industrial service supply; industrial process supply; and, agricultural supply.

20. ***Title 22 of the California Code of Regulations***. The California Department of Health Services established primary and secondary maximum contaminant levels (MCLs) for a number of chemical and radioactive contaminants in drinking water. These MCLs are codified in Title 22, CCR (Title 22). Chapter 3 of the Basin Plan incorporates Title 22 by reference. Title 22 MCLs have been incorporated into NPDES permits and Non-Chapter 15 WDRs to protect the municipal and domestic supply (MUN) and groundwater recharge (GWR) beneficial uses.

    Groundwater Recharge. Arroyo Simi, near the Simi Valley WQCP discharge is designated for GWR. Surface water from Arroyo Simi enters the Simi Valley, South Las Posas, North Las Posas, Pleasant Valley, and the Oxnard Plain Groundwater Basins. Since ground water from these basins is used to provide drinking water to people in Ventura, Title 22-based limits are needed to protect that drinking water supply. By limiting the contaminants in the Simi Valley WQCP discharges, the amount of pollutants entering the surface waters and groundwater basins are correspondingly reduced. Once groundwater basins are contaminated, it may take years to clean up, depending on the pollutant. Compared to surface water pollution, investigations and remediation of groundwater are often more difficult, costly, and extremely slow. For these reasons Title 22-based limits will remain in the NPDES permit to protect the GWR use and the MUN use in the ultimate receiving water.

21. ***Antidegradation Policy***. On October 28, 1968, the State Board adopted Resolution No. 68-16, *Maintaining High Quality Water*, which established an antidegradation policy for State and Regional Boards. Similarly, the CWA (section 304(d)(4)(B)) and USEPA regulations (40 CFR section 131.12) require all NPDES permitting actions to be consistent with the federal antidegradation policy.

22. ***California Toxics Rule (CTR)***. The USEPA promulgated the CTR criteria that became effective on May 18, 2000 (codified as 40 CFR section 131.38). The CTR established water quality criteria for priority toxic pollutants in California's inland surface waterways. The CTR also provides for schedules of compliance not to exceed 5 years from the date of permit renewal for an existing discharger if the demonstrates that it is infeasible to promptly comply with the CTR criteria. The human health criteria for carcinogens in the CTR is based on an incremental cancer risk level of one in a million (10^{-6}). USEPA recognizes that adoption of criteria at a different risk factor is outside of the scope of the CTR. However, States have the discretion to adopt water quality criteria that result in a higher risk level, if the chosen risk level has been demonstrated to adequately protect the most highly exposed subpopulation, and all necessary public outreach participation has been conducted. This demonstration has not been conducted in California. Further, information that is available on highly exposed subpopulations in California supports the need to protect the general population at the 10^{-6} level. The discharger may undertake a study, in accordance with the procedures set forth in Chapter 3 of USEPA's Water Quality Standards Handbook: Second Edition (EPA-823-B-005a, August 1994) to demonstrate that a different risk level is more appropriate for discharges subject to this Order. Upon completion of the study, the State Board and Regional Board will review the results and determine if the risk level proposed is more appropriate. In the mean time, the State will continue using a 10^{-6} risk level, as it has

done historically, to protect the population against carcinogenic pollutants.

23. ***State Implementation Plan (SIP).*** Anticipating USEPA's promulgation of the CTR, the State Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (also known as the State Implementation Plan or SIP) on March 2, 2000. The SIP was amended by Resolution No. 2000-30, adopted on April 26, 2000, and the Office of Administrative Law approved the SIP on April 28, 2000. The SIP applies to discharges of toxic pollutants to inland surface waters, enclosed bays and estuaries of California which are subject to regulation under the State's Porter-Cologne Water Quality Control Act (Division 7 of the Water Code) and the Clean Water Act. The policy provides for the following:

    a. implementation procedures for the priority pollutant criteria promulgated by USEPA through the CTR and for the priority pollutant objectives established by Regional Water Quality Control Boards (RWQCBs) in their water quality control plans (Basin Plans);
    b. monitoring requirements for priority pollutants with insufficient data to determine reasonable potential;
    c. monitoring requirements for 2,3,7,8–TCDD equivalents; and,
    d. chronic toxicity control.

24. ***Watershed Approach.*** This Regional Board has been implementing a Watershed Management Approach (WMA), to address water quality protection in the Los Angeles Region, as detailed in the Watershed Management Initiative (WMI). The WMI is designed to integrate various surface and ground water regulatory programs while promoting cooperative, collaborative efforts within a watershed. It is also designed to focus limited resources on key issues and use sound science. Information about the Calleguas Creek Watershed and other watersheds in the region can be obtained from the Regional Board's web site at *http://www.swrcb.ca.gov/rwqcb4/* and clicking on the word "Watersheds".

25. ***CWA 303(d) Listed Pollutants.*** On May 12, 1999, USEPA approved the State's 1998 list of impaired waterbodies prepared pursuant to CWA 303(d). The list (hereinafter referred to as the 303(d) list) identifies waterbodies where water quality standards are not expected to be met after the implementation of technology-based effluent limitations on point sources (water quality-limited waterbodies).

    Arroyo Simi, Arroyo Las Posas, Calleguas Creek, Mugu Lagoon, and its tributaries are on the 303(d) List for the following pollutants/stressors, from point and non-point sources:

    Arroyo Simi Reach 2 (Above Brea Canyon) – Hydrologic Unit 403.67

    - Boron, sulfate, total dissolved solids.

Arroyo Simi Reach 1 (Moorpark Freeway(23) to Brea Canyon) – Hydrologic Unit 403.62

- Ammonia, boron, chloride, chromium (in fish tissue), nickel (in fish tissue), selenium (in fish tissue), silver (in fish tissue), sulfates, total dissolved solids (TDS), and zinc (in fish tissue).

Arroyo Las Posas Reach 2 (Fox Barranca to Moorpark Freeway (23)) – Hydrologic Unit 403.62

- Ammonia, chloride, DDT (in sediment), nitrate and nitrite, sulfates, and TDS.

Arroyo Las Posas Reach 1 (Lewis Somis Road to Fox Barranca) – Hydrologic Unit 403.12

- Ammonia, chloride, DDT (in sediment), nitrate and nitrite, sulfates, and TDS.

Calleguas Creek Reach 3 (Potrero Road to Somis Road) -- Hydrologic Unit 403.12

- Chloride, TDS, Nitrate and nitrite.

Calleguas Creek Reach 2 (0.5 miles South of Broome Road to Potrero Road) -- Hydrologic Unit 403.12

- Ammonia, Nitrogen, Toxicity, Sediment Toxicity, Chem A[1] pesticides (in fish tissue), Chlordane (in fish tissue), Dacthal (in fish tissue), DDT (in fish tissue and sediment), Endosulfan (in fish tissue), PCBs (in fish tissue), and Toxaphene (in fish tissue and sediment).

Calleguas Creek Reach 1 (Estuary to 0.5 miles South of Broome Road) – Hydrologic Unit 403.11

- Ammonia, Nitrogen, Toxicity, Sediment Toxicity, Chem A pesticides (in fish tissue), Chlordane (in fish tissue), DDT (in fish tissue and sediment), Endosulfan (in fish tissue), PCBs (in fish tissue), and Toxaphene (in fish tissue and sediment).

Mugu Lagoon -- Hydrologic unit 403.11

- Copper, Mercury, Nickel, Nitrogen, Zinc, Chlordane (in fish tissue), Dacthal (in fish tissue), DDT (in fish tissue and sediment), Endosulfdan (in fish tissue), PCBs (in fish tissue), Sediment toxicity, and Sedimentation/Siltation.

1 Chem A refers to the sum of the chemicals aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, HCH (including lindane), endosulfan, and toxaphene.

26. ***Total Maximum Daily Loads.*** A Total Maximum Daily Load (TMDL) is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, with a margin of safety, that may be discharged to a water quality-limited water body. The regulatory requirements for TMDL are codified in 40 CFR section 130.7. Section 303(d) of the CWA requires that TMDLs must be developed for the pollutants of concern which impact the water quality of water bodies on the 303(d) list. Under the March 23, 1999, amended consent decree between the USEPA and Heal the Bay, et al., (Case No. C 98-4825 SBA, *Heal the Bay, Santa Monica Bay Keeper, et al. v. Browner, et.al.),* TMDLs for chloride in Calleguas Creek must be completed by March 2002; nutrients by March 2002; pesticides, historic pesticides, and PCBs by March 2005; and metals by 2006. The remaining TMDLs, such as sulfates are tentatively scheduled for completion by the year 2006.

Chloride TMDL and Chloride Limits. On March 22, 2002, the consent decree deadline for the establishment of a chloride TMDL, USEPA Region 9, established the Calleguas Creek Total Maximum Daily Load for chloride. Subsequently, on October 17, 2002, The State Board adopted Order WQO 2002-0017, in the matter of the petition of the City of Simi Valley, City of Simi Valley, Camarillo Sanitary District, Camrosa Water District, and Ventura County Waterworks District No. 1, which provided a stay, maintaining the 190 mg/L chloride interim effluent limitation of prior Regional Board resolutions and contained in the existing NPDES permits for the aforementioned POTWs. Consistent with the State Board's stay, upon expiration of the stay, the accompanying Order or its successors will be reopened and modified to include appropriate final effluent limits for chloride.

Nutrient TMDL. On October 24, 2002, the Regional Board adopted Resolution No. 2002-017, Amendment to the Basin Plan for the Los Angeles Region to Include a TMDL for Nitrogen Compounds and Related Effects in Calleguas Creek. Subsequent to the effective date of the nutrient TMDL, this Order or its successors will be reopened and modified to include final effluent limits that will be consistent with the waste load allocations in the nutrient TMDL.

27. Pursuant to this Regional Board's watershed initiative framework, the Calleguas Creek Watershed Management Area was the targeted watershed for fiscal year 2001-2002. However, the NPDES permit renewals were re-scheduled so that provisions of the CTR and SIP could be incorporated into the permits.

In January 1996, the Regional Board published the *Calleguas Creek Preliminary Report: Water Quality* (State of the Watershed Report). This document contains a summary of water quality problems and issues in the Calleguas Creek Watershed, describes Calleguas Creek and its tributaries, presents an overview of the existing monitoring data, and suggests that further monitoring is required. In December 2001, the Regional Board published the *Watershed Management Initiative.*

As described in the State of the Watershed Report and in Chapter 2.10 of the *Watershed Management Initiative*, the Calleguas Creek Watershed drains a 343 square mile area of southern Ventura County and a small portion of western Los Angeles County. The northern boundary of the watershed is formed by the Santa Susana

Mountains, South Mountain, and Oak Ridge. The southern boundary is formed by the Simi Hills and Santa Monica Mountains. Urban development is largely restricted to the City limits of Simi Valley, Moorpark, Thousand Oaks, and Camarillo. Although some residential development has occurred along the slopes of the watershed, most upland areas are still open space. Agricultural activities, primarily the cultivation of orchards and row crops, are spread out along the valleys and on the Oxnard Plain. Mugu Lagoon, located at the mouth of the watershed, is one of the few remaining significant saltwater wetland habitats in southern California. Groundwater supplies are critical to agricultural operations and to the sand and gravel mining industry in the watershed.

28. ***Performance Goals***. In Order No. 96-043, the Regional Board implemented the Water Quality Task Force[2] recommendations on the use of performance goals, rather than performance-based limits, when appropriate. In the absence of an Inland Surface Water Plan and Enclosed Bays and Estuaries Plan, performance goals were intended to minimize pollutant loadings (primarily toxics) and, at the same time, maintain the incentive for future voluntary improvement of water quality whenever feasible, without the imposition of more stringent limits based on improved performance. Effluent performance goals were not enforceable limitations or standards. This Order does not contain performance goals, but rather implements controls as referenced below to reflect technology-based effluent limits and water quality-based effluent limits (WQBELs).

REGULATORY BASIS FOR EFFLUENT LIMITS AND DISCHARGE REQUIREMENTS

29. ***Water Quality Objectives and Effluent Limits***. Water Quality Objectives (WQOs) and effluent limitations in this permit are based on:
    - The plans, policies and water quality standards (beneficial uses + objectives + antidegradation policy) contained in the 1994 *Water Quality Control Plan, Los Angeles Region: Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*, as amended, including chemical constituent limitations established by incorporating the California Code of Regulations, Title 22, maximum contaminant levels designed to protect the existing drinking water use of the receiving groundwaters;
    - California Toxics Rule (40 CFR 131.38);
    - The State Board's "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California" (the State Implementation Plan or SIP);
    - USEPA Regions 9 & 10 Guidance for Implementing Whole Effluent Toxicity Programs Final May 31, 1996;
    - USEPA Whole Effluent Toxicity (WET) Control Policy July 1994;
    - Applicable Federal Laws and Regulations
      - Federal Clean Water Act, and
      - 40 CFR sections 122 125, and 131, among others; and,
    - Best professional judgment (pursuant to 40 CFR section 122.44).

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2 *Working Together for an Affordable Clean Water Environment.* A final report presented to the California Regional Water Quality Control Board, Los Angeles Region by Water Quality Advisory Task Force, September 1993.

30. Where numeric water quality objectives have not been established in the Basin Plan, 40 CFR section 122.44(d) specifies that water quality based effluent limits may be set based on USEPA criteria and supplemented where necessary by other relevant information to attain and maintain narrative water quality criteria to fully protect designated beneficial uses.

31. U.S. EPA regulations, policy, and guidance documents upon which Best Professional Judgment (BPJ) was developed include, in part:

- Inspectors Guide for Evaluation of Municipal Wastewater Treatment Plants, April 1979 (EPA/430/9-79-010);
- Fate of Priority Pollutants in Publicly Owned Treatment Works Pilot Study October 1979 (EPA-440/1-79-300);
- Technical Support Document for Water Quality Based Toxics Control March 1991 (EPA-505/ 2-90-001); and,
- USEPA NPDES Permit Writers' Manual, December 1996 (EPA-833-B-96-003).

32. ***Mass and Concentration Limits.*** 40 CFR section 122.45(f)(1) requires that except under certain conditions, all permit limits, standards, or prohibitions be expressed in terms of mass units. 40 CFR section 122.45(f)(2) allows the permit writer, at its discretion, to express limits in additional units (e.g., concentration units). The regulations mandate that, where limits are expressed in more than one unit, the permittee must comply with both.

Generally, mass-based limits ensure that proper treatment, and not dilution, is employed to comply with the final effluent concentration limits. Concentration-based effluent limits, on the other hand, discourage the reduction in treatment efficiency during low-flow periods and require proper operation of the treatment units at all times. In the absence of concentration-based effluent limits, a permittee would be able to increase its effluent concentration (i.e., reduce its level of treatment) during low-flow periods and still meet its mass-based limits. To account for this, this permit includes mass and concentration limits for some constituents; however, the mass-based limits are inappropriate during wet weather flows when plant flows may exceed design capacity. Therefore, during storm events when flows exceed design capacity, only concentration-based limits are applicable.

33. **Maximum Daily Effluent Limitations.** Pursuant to 40 CFR section 122.45(d)(2), for a POTW's continuous discharges, all permit effluent limitations, standards, and prohibitions, including those necessary to achieve water quality standards, shall, unless impracticable, be stated as average weekly and average monthly discharge limitations. It is impracticable to only include average weekly and average monthly effluent limitations for certain pollutants in the permit, because a single daily discharge of certain pollutants, in excess amounts, can cause violations of water quality objectives. The effects of certain pollutants on aquatic organisms are often rapid. For many pollutants, an average weekly or average monthly effluent limitation alone is not sufficiently protective of beneficial uses. As a result, maximum daily effluent limitations, as

referenced in 40 CFR section 122.45(d)(1), are included in the permit for certain constituents as discussed in the Fact Sheet accompanying this Order.

34. ***Pretreatment.*** Pursuant to 40 CFR Part 403, the City developed and has implemented an approved industrial wastewater Pretreatment Program. This Order requires implementation of the approved Pretreatment Program.

35. ***Sewage Sludge.*** To implement CWA section 405(d), on February 19, 1993, USEPA promulgated 40 CFR Part 503 to regulate the use and disposal of municipal sewage sludge. This Order implements the regulations and it is the responsibility of the Discharger to comply with said regulations, which are enforceable by USEPA.

36. ***Storm Water.*** CWA section 402(p), as amended by the Water Quality Act of 1987, requires NPDES permits for storm water discharges. Pursuant to this requirement, in 1990, USEPA promulgated 40 CFR section 122.26 that established requirements for storm water discharges under an NPDES program. To facilitate compliance with federal regulations, on November 1991, the State Board issued a statewide general permit, General NPDES Permit No. CAS000001 and Waste Discharge Requirements for Discharges of Storm Water Associated with Industrial Activities. This permit was amended in September 1992 and reissued on April 17, 1997 in State Board Order No. 97-03-DWQ.

    General NPDES permit No. CAS000001 is applicable to storm water discharges from the Simi Valley WQCP's premises. On March 11, 1992, the City filed a Notice of Intent to comply with the requirements of the general permit. The City developed and currently implements a Storm Water Pollution Prevention Plan (SWPPP), to comply with the State Board's Order No. 97-03-DWQ. As City contains and treat the storm water they are exempt from the requirements.

37. ***Clean Water Act Effluent Limitations.*** Numeric and narrative effluent limitations are established pursuant to Section 301 (Effluent Limitations), Section 302 (Water Quality-Related Effluent Limitations), Section 303 (Water Quality Standards and Implementation Plans), Section 304 (Information and Guidelines [Effluent]), Section 305 (Water Quality Inventory), Section 307 (Toxic and Pretreatment Effluent Standards), and Section 402 (NPDES) of the CWA. The CWA and amendments thereto are applicable to the discharges herein.

38. ***Antibacksliding.*** Antibacksliding provisions are contained in Sections 303(d)(4) and 402(o) of the CWA and in 40 CFR section 122.44(l). Those provisions require a reissued permit to be as stringent as the previous permit with some exceptions. Section 402(o)(2) outlines six exceptions where effluent limitations may be relaxed.

39. ***Applicable Water Quality Objectives.*** 40 CFR section 122.44(d)(vi)(A) requires the establishment of numeric effluent limitations to attain and maintain applicable narrative water quality criteria to protect the designated beneficial use.

    The Basin Plan includes narrative and numeric Water Quality Objectives (WQOs). The CTR promulgates numeric aquatic life criteria for 23 toxic pollutants and numeric human

health criteria for 57 toxic pollutants. A compliance schedule provision in the CTR and the SIP authorizes the State to issue schedules of compliance for new or revised NPDES permit limits based on the federal CTR criteria when certain conditions are met. Where numeric water quality objectives have not been established in the Basin Plan, 40 CFR section 122.44(d) specifies that WQBELs may be set based on USEPA criteria and supplemented, where necessary, by other relevant information to attain and maintain narrative water quality criteria to fully protect designated beneficial uses.

40. ***Types of Pollutants***. For CWA regulatory purposes, pollutants are grouped into three general categories under the NPDES program: conventional, toxic, and non-conventional. By definition, there are five conventional pollutants (listed in 40 CFR section 401.16): 5-day biochemical oxygen demand, total suspended solids, fecal coliform, pH, and oil and grease. Toxic or "priority" pollutants are those defined in Section 307(a)(1) of the CWA (and listed in 40 CFR section 401.12 and 40 CFR Part 423, Appendix A) and include metals and organic compounds. Non-conventional pollutants are those which do not fall under either of the two previously described categories and include such parameters as ammonia, phosphorous, chemical oxygen demand, whole effluent toxicity, etc.

41. ***Technology-Based Limits for Municipal Facilities (POTWs).*** Technology-based effluent limits require a minimum level of treatment for industrial/municipal point sources based on currently available treatment technologies while allowing the discharger to use any available control techniques to meet the effluent limits. The 1972 CWA required POTWs to meet performance requirements based on available wastewater treatment technology. Section 301 of the CWA established a required performance level--referred to as "secondary treatment"--that all POTWs were required to meet by July 1, 1977. More specifically, Section 301(b)(1)(B) of the CWA required that EPA develop secondary treatment standards for POTWs as defined in Section 304(d)(1). Based on this statutory requirement, EPA developed national secondary treatment regulations which are specified in 40 CFR Part 133. These technology-based regulations apply to all POTWs and identify the minimum level of effluent quality to be attained by secondary treatment in terms of five-day biochemical oxygen demand, total suspended solids, and pH.

42. ***Water Quality Based Effluent Limits (WQBELs)***. Water quality-based effluent limits are designed to protect the quality of the receiving water by ensuring that State water quality standards are met by discharges from an industrial/municipal point source. If, after technology-based effluent limits are applied, a point source discharge will cause, have the reasonable potential to cause, or contribute to an exceedance of an applicable water quality criterion, then 40 CFR section 122.44(d)(1) requires that the permit contain a WQBEL. Although the CWA establishes explicit technology-based requirements for POTWs, Congress did not exempt POTWs from additional regulation to protect water quality standards. As a result, POTWs are also subject to WQBELs. Applicable water quality standards for Arroyo Simi, Arroyo Las Posas, Calleguas Creek, and Mugu Lagoon are contained in the Basin Plan and CTR, as described in previous findings.

43. ***Water Quality Based Effluent Limitations for Toxic Pollutants.*** Toxic substances are regulated in this permit by WQBELs derived from the 1994 Basin Plan, the CTR, and/or best professional judgment (BPJ) pursuant to 40 CFR section 122.44. If a discharge

causes, has a reasonable potential to cause, or contribute to a receiving water excursion above a narrative or numeric objective within a State water quality standard, federal law and regulations, as specified in 40 CFR section 122.44(d)(1)(i), and in part, the SIP, require the establishment of WQBELs that will protect water quality. As documented in Table R and the fact sheet, pollutants exhibiting reasonable potential in the discharge, authorized in this Order, are identified in the Reasonable Potential Analysis (RPA) section and have final effluent limits. The discharger is required to gather the appropriate data and the Regional Board will determine if final effluent limits are needed. If final limits are needed, the permit will be reopened and limits will be included in the permit.

44. ***Basis for Effluent Limits for 303(d) Listed Pollutants.*** For 303(d) listed pollutants, the Regional Board plans to develop and adopt total maximum daily loads (TMDLs) which will specify wasteload allocations (WLAs) for point sources and load allocations (LA) for non-point sources, as appropriate. Following the adoption of TMDLs by the Regional Board, NPDES permits will be issued, and where appropriate, reopened to include effluent limits consistent with the assumptions of the TMDL, based on applicable WLAs. In the absence of a TMDL, the permits will include water quality-based effluent limitations derived as provided in the CTR and SIP (if applicable). These effluent limits are based on criteria applied end-of-pipe as explained in part IX.A.5 of the accompanying fact sheet.

45. ***Mixing Zones and Dilution Credits.*** Mixing zones and dilution credits are not allowed in this Order. Allowance of a mixing zone is in the Regional Board's discretion under Section 1.4.2 of the SIP and under the Basin Plan (Basin Plan Chapter 4, page 30). If the discharger subsequently conducts appropriate mixing zone and dilution credit studies, the Regional Board can evaluate the propriety of granting a mixing zone or establishing dilution credits. The Regional Board has concluded mixing zones and dilution credits would be inappropriate to grant in light of the following factors:

- The Simi Valley WQCP discharge contributes the largest flow into Arroyo Simi in the vicinity of the discharge point and it overwhelms the receiving water providing limited mixing and dilution;
- Even in the absence of the Simi Valley WQCP discharge, the receiving water primarily consists of nuisance flows and other effluents, limiting its ability to assimilate additional waste;
- Several reaches of Arroyo Simi, Arroyo Las Posas, Conejo Creek, Calleguas Creek, and Mugu Lagoon [including those subject to this Order] are 303(d) listed (i.e, impaired) for certain constituents;
- Impaired waters do not have the capacity to assimilate pollutants of concern at concentrations greater than the applicable objective;
- For the protection of the beneficial uses, such as rare, threatened, or endangered species.
- For the protection of warm freshwater habitat;
- For the protection of the beneficial uses, such as estuarine habitat; marine habitat; wildlife habitat;
- Because a mixing zone study has not been conducted; and
- Because a hydrologic model of the discharge and the receiving water has not been conducted.

46. Specific effluent limitations for each constituent contained in this order were developed in accordance with the foregoing laws, regulations, plans, policies, and guidance. The specific methodology and example calculations are documented in the fact sheet prepared by Regional Board staff that accompanies this Order.

REASONABLE POTENTIAL ANALYSIS

47. As specified in 40 CFR section 122.44(d)(1)(i), permits are required to include limits for all pollutants "which the Director (defined as the Regional Administrator, State Director, or authorized representative in 40 CFR section 122.2) determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State water quality standard." Using the method described in the SIP, the Regional Board has conducted Reasonable Potential Analyses (RPA) using the discharger's effluent data contained in Table D. The RPA compares the effluent data with water quality objectives in the Basin Plan and CTR.

A. Using the method described in the TSD, the Regional Board has conducted Reasonable Potential Analysis (RPA) for Chronic toxicity (Table C2 of the accompanying Fact Sheet) using the discharger's effluent data from their annual self monitoring reports. Chronic toxicity effluent data is summarized in Table C1 of the accompanying Fact Sheet. The RPA compares the effluent data with USEPA's 1 TUc water quality criteria. The Discharger's effluent demonstrated chronic toxicity during the last permit cycle. Based on this information, the Regional Board has determined that there is a reasonable potential that the discharge will cause toxicity in the receiving water and, consistent with SIP section 4, the Order contains a numeric effluent limitation for chronic toxicity. The circumstances warranting a numeric chronic toxicity effluent limitation are presently under review by the State Water Resources Control Board (State Board) in SWRCB/OCC Files A-1496 & A-1496(a) [Los Coyotes/Long Beach Petitions]. The State Board's decision is expected in July 2003. In the event the State Board removes the numeric chronic toxicity effluent limitation from the Los Coyotes/Long Beach permits or replaces the limit with a narrative chronic toxicity effluent limitation, this Order contains a reopener to allow the Regional Board to modify this permit, if necessary, consistent with the State Board order on the Los Coyotes/Long Beach Petitions.

B. Using the method described in the SIP, the Regional Board has conducted Reasonable Potential Analysis (RPA) using the discharger's effluent data. The RPA compares the effluent data with water quality objectives in the Basin Plan and CTR.

a. ***Reasonable Potential Determination.*** The RPA (per the SIP) involves identifying the observed maximum pollutant concentration in the effluent (MEC) for each constituent based on the effluent concentration data. There are three tiers to determining reasonable potential. If any of the following three tiers is triggered, then reasonable potential exists:

1. For the first tier, the MEC is compared with the lowest applicable Water Quality Objective (WQO), which has been adjusted for pH, hardness and translator data, if appropriate. If the MEC is greater than the (adjusted) WQO, then there is reasonable potential for the constituent to cause or contribute to an excursion above the WQO and a WQBEL is required. However, if the pollutant was not detected in any of the effluent samples and all of the reported detection limits are greater than or equal to the WQO, proceed with Tier 2. The Regional Board exercised its discretion in identifying all available, valid, relevant, representative data and information in accordance with SIP Section 1.2 (page 8).

2. For the second tier, if the MEC is less than the adjusted WQO, then the observed maximum ambient background concentration (B) for the pollutant is compared with the adjusted WQO. If B is greater than the adjusted WQO, then a WQBEL is required. If B is less than the WQO, then a limit is only required under certain circumstances to protect beneficial uses. If a constituent was not detected in any of the effluent samples and all of the detection limits are greater than or equal to the adjusted WQO, then the ambient background water quality concentration is compared with the adjusted WQO. The Regional Board exercised its discretion in identifying all available, applicable ambient background data in accordance with SIP Section 1.4.3 (page 16).

3. For the third tier, other information is used to determine RPA, such as the current CWA 303(d) List. Section 1.3 of the SIP describes the type of information that can be considered in Tier 3.

For all parameters that have reasonable potential to cause or contribute to an exceedance of a WQO/criteria, numeric WQBELs are required. Section 1.4, Step 5 of the SIP (page 8) states that maximum daily effluent limitations (MDELs) shall be used for POTWs in place of average weekly limitations. WQBELs are based on CTR, USEPA water quality criteria, and Basin Plan objectives.

If the data are unavailable or insufficient to conduct an RPA for a pollutant, or if all reported detection limits of the pollutant in the effluent are greater than or equal to the WQO, the Regional Board will establish interim requirements, in accordance with Section 2.2.2 of the SIP, that require additional monitoring for the pollutant in place of a WQBEL. Upon completion of the required monitoring, the Regional Board shall use the gathered data to conduct a RPA and determine if a WQBEL is required. However, if Tier 1 or Tier 3 triggered reasonable potential for a pollutant, then the lack of receiving water data for Tier 2 evaluation would not inhibit the establishing WQBELs in the permit.

A numeric limit has not been prescribed for a toxic constituent if it has been determined that it has no reasonable potential to cause or contribute to excursions of water quality standards. However, if the constituent had a limit in the previous permit derived from Quality Criteria for Water 1986 [EPA 440/5-86-

001, May 1, 1986 (Gold Book)], from other EPA guidance documents, and from California Code of Regulations (Title 22) maximum contaminant levels, and if none of the Antibacksliding exceptions apply, then the limit will be retained. In accordance with SIP section 1.2, Regional Board staff used its discretion to conclude that two data points for 2,3,7,8-TCDD (Dioxin) was insufficient information to prescribe a CTR-based effluent limitation. The Discharger will be required to increase the frequency of monitoring from semiannually to quarterly, to gather more information on 2,3,7,8-TCDD (Dioxin). A narrative limit to comply with all water quality objectives is provided in *Standard Provisions* for the priority pollutants which have no available numeric criteria.

b. ***RPA Data***. The RPA was based on effluent monitoring data for February 1996 through December 2002, interim monitoring results from August 2001 to December 2002, and monitoring results at Station A (Simi Valley WQCP) of the Calleguas Creek Characterization Study – Surface Water Element (September 2000), conducted by Larry Walker and Associates. Table R (Table R1) of the fact sheet summarizes the RPA, lists the constituents, and where available, the lowest, adjusted WQO, the MEC, the "Reasonable Potential" result, and the limits from the previous permit.

Metals Water Quality Objective. For metals, the lowest applicable Water Quality Objective (WQO) was expressed as total recoverable, and where applicable, adjusted for hardness. A spreadsheet was used to calculate the total recoverable CTR criteria (Table R2). Hardness values from samples collected in the receiving water upstream of the discharge point were averaged and used to determine the appropriate CTR WQO for those hardness-dependent metals. Individual hardness values were capped at 400 mg/L to obtain the resulting average hardness of 400 mg/L.

Interim Monitoring Requirements. In accordance with the SIP, the Regional Board may impose interim monitoring requirements upon the Discharger, so that the Discharger obtains adequate ambient, background water data for priority pollutants upstream of the discharge point as well as suitable effluent data. The Executive Officer directed the Discharger to begin an interim monitoring program to collect eighteen data points. The Discharger collected the eighteen required samples and reported the results quarterly to the Regional Board. After additional information is gathered, Regional Board staff will conduct RPA once again, to determine if additional numeric limitations are necessary. Section 1.3, Step 8, of the SIP authorizes the Regional Board to use the gathered data to conduct RPA, as outlined in Steps 1 through 7, and determine if a water quality-based effluent limitation is required.

A reopener provision is included in this Order that allows the permit to be reopened to allow the inclusion of new numeric limitations for any constituent that exhibits reasonable potential to cause or contribute to exceedance of applicable water quality objectives.

For some priority pollutants, the applicable water quality objectives are below the levels that current technology can measure. Section 2.4.5 of the SIP discusses how compliance will be determined in those cases. The Discharger should work with the laboratory to lower detection levels to meet applicable and reliable detection limits; follow procedures set forth in 40 CFR Part 136; and, report the status of their findings in the annual report. During the term of the permit, if and when monitoring with lowered detection limits shows any of the priority pollutants at levels exceeding the applicable WQOs, the discharger will be required to initiate source identification and control for the particular pollutant. Appendix 4 of the SIP lists the minimum levels and laboratory techniques for each constituent.

The numeric limitations contained in this Order are intended to protect and maintain existing, intermittent, and potential beneficial uses of the receiving waters. Environmental benefits provided by these limitations are reasonable and necessary.

48. The Order is consistent with State and Federal antidegradation policies in that it does not authorize a change in the quantity of wastewater discharged by the facility, nor does it authorize a change or relaxation in the manner of treatment. As a result, both the quantity and quality of the discharge are expected to remain the same consistent with antidegradation policies. The accompanying monitoring and reporting program requires continued data collection and if monitoring data show a reasonable potential for a constituent to cause or contribute to an exceedance of water quality standards, the permit will be reopened to incorporate appropriate WQBELs. Such an approach ensures that the discharge will adequately protect water quality standards for potential and existing uses and conforms with antidegradation policies and antibacksliding provisions.

49. ***Pollutant Minimization Program.*** This Order provides for the use of a Pollutant Minimization Program, developed in conformance with Section 2.4.5.1 of the SIP, when there is evidence that a priority pollutant is present in the Discharger's effluent above an effluent limitation.

INTERIM REQUIREMENTS

50. **Nitrogen Compounds & Related Effects.** The Nitrogen Compounds and Related Effects TMDL adopted by the Regional Board on October 24, 2002, includes waste load allocations for ammonia (NH_3), nitrite as nitrogen (NO_2–N), nitrate as nitrogen (NO_3–N), and total nitrogen (NO_2–N + NO_3–N). The TMDL authorizes interim limits (expressed as interim waste allocations) for total nitrogen (NO_3-N + NO_2-N). The interim waste load allocation applies until four years after the effective date of the TMDL. In addition, the Nutrient TMDL authorized, at the discretion of the Regional Board, interim limits for ammonia extending until no later than October 24, 2004, for POTWs that are not able to achieve immediate compliance with the ammonia waste load allocation.

Once the TMDL is effective, the TMDL's interim waste load allocations may be used, consistent with Section 303(d)(4)(A) and other applicable federal laws and regulations, to develop an interim effluent limitation in the NPDES. Until that approval, however, appropriate limits cannot be specified in the NPDES permit. As a result, a separate time schedule order proscribes the appropriate nutrient limits initially. Because the Regional

Board knows the interim waste load allocations and the ammonia waste load allocation, the Order includes alternate nitrogen compounds and related effects limits trigger on the effective date of the TMDLs. When approved by U.S. EPA, the TMDL will be effective and the interim waste load allocation for total nitrogen and the waste load allocation for ammonia will apply to the discharge, along with an interim limit for ammonia. The Executive Officer will notify the discharger when the U.S. EPA approves the Nutrient TMDL, but the notice will not effect the application of the interim limits.

Ammonia. The 1994 Basin Plan provides that to protect aquatic life, the total ammonia concentrations in receiving waters shall not exceed the objectives for the corresponding in-stream conditions given in Tables 3-1 to 3-4 of the Basin Plan. The objectives for total ammonia take into account the effect of un-ionized ammonia on aquatic habitat. Compliance with this requirement was required by June 14, 2002. The City has worked with the Calleguas Creek Watershed Management Plan Committee to develop a watershed-wide solution to the ammonia nitrogen water quality problem. The City will upgrade its Simi Valley WQCP so that it nitrifies and denitrifies, thereby meeting the waste load allocations in the *Nitrogen Compounds and Related Effects TMDL* for Calleguas Creek Watershed. Additionally, the Dischargers will participate in a water effects ratio (WER) study to develop a site specific objective for ammonia. This WER study must be completed within three years of the effective date of the TMDL.

The City will not be able to immediately comply with the ammonia as nitrogen effluent limitation and needs time to come into compliance with the ammonia as nitrogen effluent limitation. The accompanying Time Schedule Order requires the City to comply with the ammonia as nitrogen limitation before October 24, 2004. However, the Regional Board's Nitrogen Compounds and Related Effects TMDL includes explicit authority to incorporate interim ammonia effluent limitations into this permit. If approved by U.S. EPA, the TMDL would allow the limits specified in the accompanying Time Schedule Order to be incorporated into the NPDES permit as interim limits expiring on October 24, 2004. The decision to include interim limits in the permit is at the discretion of the Regional Board. The Regional Board has determined that the City will not be able to immediately comply with the ammonia limits and waste load allocation, and believes it is appropriate to allow a compliance schedule for ammonia. In the interest of efficiency, this order provides interim limits for ammonia that become applicable if the Nitrogen Compounds and Related Effects TMDL is approved by U.S. EPA.

51. Because there is reasonable potential, the ammonia objective, which was a receiving water quality objective in the previous permit, is a WQBEL. The numeric limits for total ammonia applicable to the Simi Valley WQCP discharge are contained in Basin Plan Tables 3-2 and 3-4 (Attachment H of this Order).

This Order does not contain a statistically derived water quality based effluent limitation (WQBEL) for ammonia. Instead, the ammonia limit was taken directly from the Basin Plan Tables. This was done to prevent backsliding issues that might arise from the Ammonia Basin Plan Amendment (Resolution No. R02-011), adopted by the Regional Board on April 25, 2002. The Amendment updates the existing ammonia objectives in the 1994 Basin Plan with the 1999 USEPA criteria. The existing criteria for ammonia in the Basin Plan Tables are more stringent than the recently adopted ammonia criteria. Once the Ammonia

Basin Plan Amendment has been approved by the Office of Administrative Law, and after it becomes effective, then the Regional Board will reopen the NPDES permit to update the ammonia effluent limits. At that time, WQBELs will be developed for ammonia.

52. ***Selenium, Cyanide and 4,4-DDE.*** Data submitted in previous self-monitoring reports indicated that these constituents have been detected in the effluent or in the receiving water, at least once, at a concentration greater than the limits prescribed in this Order. The Simi Valley WQCP, therefore, may not be able to achieve consistent compliance with the CTR-based final effluent limit for these constituents. The City has the option of conducting studies to obtain the necessary data to develop site-specific objectives for selenium, cyanide and 4,4-DDE, for the protection of human health from the consumption of fish and shellfish taken from the receiving waters and for the protection of aquatic life in the receiving water. However, the City should prepare and submit a draft workplan to the Regional Board for review and approval, prior to implementing the study.

53. 40 CFR section 131.38(e) provides conditions under which interim effluent limits and compliance schedules may be issued, but the current Basin Plan does not allow inclusion of interim limits and compliance schedules in NPDES permits for effluent limits. The CTR and SIP allow inclusion of interim limits in NPDES permits for CTR-based priority pollutants. The CTR provides for a five-year maximum compliance schedule, while the SIP allows for longer, TMDL-based compliance schedule. However, the USEPA has yet to approve the longer compliance schedules. Therefore, this Order includes interim limits and compliance schedules for CTR-based priority pollutants limits for a maximum of five years, when the Discharger has been determined to have problems in meeting the new limits. This Order also includes a reopener to allow the Regional Board to grant TMDL-based compliance schedules if the USEPA approves the longer compliance schedule provisions of the SIP. For new non-CTR-based limits (ammonia as nitrogen) prescribed in this Order based on Basin Plan's WQO, for which the Discharger will not be able to meet immediately, interim limits and compliance dates are provided in the accompanying Time Schedule Order.

54. In conformance with the CTR and the relevant provisions of SIP Section 2.1, the Discharger has submitted documentation from their source control department that demonstrate efforts have been made to quantify pollutant levels in the discharge and the sources of the pollutants entering the POTW. In addition, the Discharger already has in place a source control and pollutant minimization approach through its existing pollutant minimization strategies and through the pretreatment program. The duration of interim requirements established in this Order was developed in coordination with Regional Board staff and the Discharger, and the proposed schedule is as short as practicable. The five-year compliance schedule is based on the maximum allowable compliance schedule.

PUBLIC NOTIFICATION AND CEQA COMPLIANCE

55. The Regional Board has notified the Discharger and interested agencies and persons of its intent to renew waste discharge requirements for this discharge and has provided them with an opportunity to submit their written views and recommendations.

56. The Regional Board, in a public hearing, heard and considered all comments pertaining to the discharge and to the tentative requirements.

57. This Order shall serve as a National Pollutant Discharge Elimination System permit pursuant to Section 402 of the Federal Clean Water Act or amendments thereto, and is effective 50 days from the date of adoption because of significant public comment, in accordance with federal law, provided the Regional Administrator, USEPA, has no objections.

58. Pursuant to California Water Code Section 13320, any aggrieved party may seek review of this Order by filing a petition with the State Board. A petition must be sent to the State Water Resources Control Board, P.O. Box 100, Sacramento, California, 95812, within 30 days of adoption of the Order.

59. The issuance of waste discharge requirements that serve as an NPDES Permit for this discharge is exempt from the provisions of Chapter 3 (commencing with Section 21100) of Division 13 (California Environmental Quality Act) of the Public Resources Code in accordance with California Water Code Section 13389.

IT IS HEREBY ORDERED that the City of Simi Valley, as operator of the Simi Valley Water Quality Control Plant, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, and the provisions of the Federal Clean Water Act and regulations and guidelines adopted thereunder, shall comply with the following:

I. DISCHARGE REQUIREMENTS

A. Effluent Limitations

1. Wastes discharged shall be limited to treated municipal wastewater and stormwater, only, as proposed in the ROWD.

2. The discharge of an effluent with constituents in excess of the following limits is prohibited:

(a) Conventional and nonconventional pollutants for Discharge Serial No. 001:

Constituent	Units	Discharge Limitations		
		Daily Maximum[1]	7-Day Average[2]	Monthly Average
BOD_5 20°C	mg/L	45	30	20
	lbs/day[3]	4,690	3,130	2,080
Suspended solids	mg/L	45	40	15
	lbs/day[3]	4,690	4,170	1,560
Settleable solids	ml/L	0.3	--	0.1
Oil and grease	mg/L	15	--	10

Constituent	Units	Discharge Limitations		
		Daily Maximum[1]	7-Day Average[2]	Monthly Average
	lbs/day[3]	1,560	--	1,040
Total residual chlorine	mg/L	0.1[4]	--	--
Total dissolved solids	mg/L	--	--	850
	lbs/day[3]	--	--	88,580
MBAS[5]	mg/L	--	--	0.5
	lbs/day[3]	--	--	50
Chloride	lbs/day[3]	10,100 [6]	--	--
	lbs/day[3]	9,200 [6]*	--	--
Sulfate	mg/L	--	--	250
	lbs/day[3]	--	--	26,100
Boron	mg/L	--	--	1.0
	lbs/day[3]	--	--	104
Fluoride	mg/L	--	--	1.6
	lbs/day[3]	--	--	167
Total inorganic nitrogen	mg/L	--	--	10 [7]
(Nitrate + nitrite as nitrogen)	mg/L	--	--	9 [8]
	mg/L	32.17 [9]	--	31.60 [9]
	lbs/day[3]	3354 [9]	--	1,040
Nitrite-N (as N)	mg/L	--	--	0.9 [8]
Total ammonia	mg/L	[10]	--	[10]
	mg/L	--	--	2.35 [8]
	lbs/day	[3]	--	[3]
	mg/L		--	30 [11]

[1] The daily maximum effluent concentration limit shall apply to both flow weighted 24-hour composite samples and grab samples, as specified in the Monitoring and Reporting Program (Attachment T).

[2] As defined in Standard Provisions, Attachment N.

[3] The mass emission rates are based on the plant design flow rate of 12.5 mgd. During wet-weather storm events in which the flow exceeds the design capacity, the mass discharge rate limitations shall not apply, and concentration limitations will provide the only applicable effluent limitations.

[4] Based on results of continuous monitoring, total residual chlorine concentration of up to 0.3 mg/L, at the point in the treatment train immediately following dechlorination, shall not be considered violations of this requirement provided the total duration of such excursions do not exceed 15 minutes during any 24-hour period. Peaks in excess of 0.3 mg/L lasting less than 3 minute shall not be considered a violation of this requirement.

[5] Unlined reaches of Arroyo Simi downstream of the discharge points are designated with the beneficial use of groundwater recharge (GWR) in the Basin Plan. In order to protect the underlying drinking water basins, this Title 22-based limit is prescribed.

[6] The USEPA's March 22, 2002, chloride TMDL included mass-based waste load allocations for Chloride loading; however, the Regional Board cannot implement the WLA until after the stay granted by the State Board is dissolved. When the stay is dissolved, any subsequent chloride effluent limitations established in

the permit will need to be consistent with the assumptions of the waste load allocations established in a chloride TMDL for the Calleguas watershed. Unless there is a subsequent TMDL action, the waste load allocations are 10,100 lb/day in routine conditions and 9,200* lb/day in drought conditions for Discharge Serial No. 001.

[7] This is the water quality objective for nitrate plus nitrite as nitrogen in the current Basin Plan. This effluent limitation applies immediately and will stay in effect until the Nutrient TMDL for Calleguas Creek, Resolution 2002-017, *Amendment to the Water Quality Control Plan for the Los Angeles Region to Include a TMDL for Nitrogen Compounds and Related Effects in Calleguas Creek*, is approved by USEPA (i.e., the effective date of the TMDL). At that time, the interim effluent limitation accompanying table footnote [9] will be effective. If U.S. EPA does not approve the *Nitrogen Compounds and Related Effects TMDL*, this effluent limitation will remain in effect until revised by the Regional Board.

[8] This is the waste load allocation, according to the *Nitrogen Compounds and Related Effects TMDL* adopted by the Regional Board on October 24, 2002. The waste load allocation will ultimately serve as the effluent limitation for the discharge. This limit becomes effective four years after the USEPA approves the *Nitrogen Compounds and Related Effects TMDL*, and will supercede any previously applicable effluent limitations for Total Inorganic Nitrogen. If U.S. EPA does not approve the *Nitrogen Compounds and Related Effects TMDL*, this effluent limitation will not apply.

[9] This is the interim limit for nitrate plus nitrite as nitrogen, according to the *Nitrogen Compounds and Related Effects* TMDL adopted by the Regional Board on October 24, 2002. This interim limit becomes effective when the USEPA approves the *Nitrogen Compounds and Related Effects* TMDL for Calleguas Creek Watershed and ends four years from the effective date of the *Nitrogen Compounds and Related Effects* TMDL. This interim limit will supercede the effluent limitation specified accompanying table footnote [8] and will remain in effect until superceded by the effluent limitation specified accompanying table footnote [9]. If U.S. EPA does not approve the *Nitrogen Compounds and Related Effects TMDL*, this effluent limitation will not apply.

[10] The City must meet the total ammonia limitations contained in Attachment H, Basin Plan Tables 3-2 and 3-4, for the protection of freshwater aquatic habitat, by June 14, 2002. At a future date, these Ammonia Tables will be replaced with the 1999 USEPA Ammonia Update criteria for ammonia, according to the Ammonia Basin Plan Amendment, Resolution No. 2002-011 (adopted by the Los Angeles Regional Board on April 25, 2002). Following State Board, Office of Administrative Law, and USEPA approval of the Ammonia Basin Plan Amendment, the Regional Board will reopen this NPDES permit to revise the ammonia effluent limits using the new criteria. However, following State Board, Office of Administrative Law, and USEPA approval of the *Nitrogen Compounds and Related Effects* TMDL, the waste load allocation limit for ammonia will replace other ammonia limits in the NPDES permit.

Table 3-2. One-hour Average Concentration for Ammonia for waters designated as WARM (Salmonids or other sensitive coldwater species absent) :

	Temperature °C				
pH	**0**	**5**	**10**	**15**	**20**
Un-ionized ammonia (mg/liter NH_3)					
6.5	0.0091	0.0129	0.0182	0.026	0.036
6.75	0.0149	0.021	0.030	0.042	0.059
7.0	0.023	0.033	0.046	0.066	0.093
7.25	0.034	0.048	0.068	0.095	0.135
7.5	0.045	0.064	0.091	0.128	0.181
7.75	0.056	0.080	0.113	0.159	0.22
8.0	0.065	0.092	0.130	0.184	0.26
8.25	0.065	0.092	0.130	0.184	0.26
8.5	0.065	0.092	0.130	0.184	0.26
8.75	0.065	0.092	0.130	0.184	0.26
9.0	0.065	0.092	0.130	0.184	0.26
Total ammonia (mg/liter NH_3)					

pH	Temperature °C				
	0	5	10	15	20
6.5	35	33	31	30	29
6.75	32	30	28	27	27
7.0	28	26	25	24	23
7.25	23	22	20	19.7	19.2
7.5	17.4	16.3	15.5	14.9	14.6
7.75	12.2	11.4	10.9	10.5	10.3
8.0	8	7.5	7.1	6.9	6.8
8.25	4.5	4.2	4.1	4.0	3.9
8.5	2.6	2.4	2.3	2.3	2.3
8.75	1.47	1.4	1.37	1.38	1.42
9.0	0.86	0.83	0.83	0.86	0.91

Table 3-4. Four-day Average Concentration for Ammonia for waters designated as WARM (Salmonids or other sensitive coldwater species absent) :

pH	Temperature, °C						
	0	5	10	15	20	25	30
Un-ionized ammonia (mg/liter NH_3)							
6.5	0.0008	0.0011	0.0016	0.0022	0.0031	0.0031	0.0031
6.75	0.0014	0.0020	0.0028	0.0039	0.0055	0.0055	0.0055
7.0	0.0025	0.0035	0.0049	0.0070	0.0099	0.0099	0.0099
7.25	0.0044	0.0062	0.0088	0.0124	0.0175	0.0175	0.0175
7.5	0.0078	0.0111	0.0156	0.022	0.031	0.031	0.031
7.75	0.0129	0.0182	0.026	0.036	0.051	0.051	0.051
8.0	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.25	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.5	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
8.75	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
9.0	0.0149	0.021	0.030	0.042	0.059	0.059	0.059
Total ammonia (mg/liter NH_3)							
6.5	3.0	2.8	2.7	2.5	2.5	1.73	1.23
6.75	3.0	2.8	2.7	2.6	2.5	1.74	1.23
7.0	3.0	2.8	2.7	2.6	2.5	1.74	1.23
7.25	3.0	2.8	2.7	2.6	2.5	1.75	1.24
7.5	3.0	2.8	2.7	2.6	2.5	1.76	1.25
7.75	2.8	2.6	2.5	2.4	2.3	1.65	1.18
8.0	1.82	1.7	1.62	1.57	1.55	1.10	0.79
8.25	1.03	0.97	0.93	0.90	0.90	0.64	0.47
8.5	0.58	0.55	0.53	0.53	0.53	0.39	0.29
8.75	0.34	0.32	0.31	0.31	0.32	0.24	0.190
9.0	0.195	0.189	0.189	0.195	0.21	0.163	0.133

[11] Under the authority of the *Nitrogen Compounds and Related Effects TMDL* this interim limit will supercede the effluent limitation specified accompanying table footnote [9] upon the effective date of the *Nitrogen Compounds and Related Effects TMDL* and will remain in effect until superceded by the effluent limitation specified accompanying table footnote [10]. If U.S. EPA does not approve the *Nitrogen Compounds and Related Effects TMDL*, then this effluent limitation will not apply.

(b) Toxic pollutants for Discharge Serial No. 001:

CTR # [1]	Constituent	Units	Discharge Limitations	
			Monthly Average[2]	Daily Maximum
1	Antimony	µg/L	6	--
		lbs/day[4]	0.6	--
2	Arsenic[3]	µg/L	50	--
		lbs/day[4]	5	--
4	Cadmium[3]	µg/L	5	--
		lbs/day[4]	0.5	--
5b	Chromium VI[3]	µg/L	50	--
		lbs/day[4]	5	--
6	Copper[3]	µg/L	1,000	--
		lbs/day[4]	100	--
7	Lead[3]	µg/L	50	--
		lbs/day[4]	5	--
8	Mercury	µg/L	2	--
		lbs/day[4]	0.2	--
9	Nickel [3]	µg/L	100	--
		lbs/day[4]	10	--
10	Selenium [3], [5], [6]	µg/L	1.6	8.2
		lbs/day[4]	0.17	0.85
11	Silver [3]	µg/L	50	--
		lbs/day[4]	5	--
12	Thallium[3]	µg/L	2	--
		lbs/day[4]	0.21	--
13	Zinc [3]	µg/L	5000	--
		lbs/day[4]	500	--
14	Cyanide [5], [6]	µg/L	3.9	9.4
		lbs/day[4]	0.40	0.98
38	Tetrachloroethylene	µg/L	5	--
		lbs/day[4]	0.5	--
77	1,4-Dichlorobenzene	µg/L	5	--
	(p-Dichlorobenzene)	lbs/day[4]	0.5	--
105	Lindane (gamma-BHC) [5], [6]	µg/L	0.2	
		lbs/day[4]	0.02	
109	4,4-DDE [5], [6]	µg/L	0.00059	0.0012
		lbs/day[4]	0.000062	0.00013
115	Endrin	µg/L	2	--
		lbs/day[4]	0.2	--
126	Toxaphene	µg/L	3	--
		lbs/day[4]	0.3	--
	Barium	µg/L	1,000	--
		lbs/day[4]	100	--
	Iron	µg/L	300	--
		lbs/day[4]	30	--
	Methoxychlor	µg/L	40	--

CTR # [1]	Constituent	Units	Discharge Limitations	
			Monthly Average[2]	Daily Maximum
		lbs/day[4]	4	--
	2,4-D	µg/L	70	--
		lbs/day[4]	7	--
	2,4,5-TP (Silvex)	µg/L	10	--
		lbs/day[4]	1	--
	Halomethanes [7]	µg/L	80	--
		lbs/day[4]	8	--

[1] This number corresponds to the compound number found in Table 1 of CTR. It is simply the order in which the 126 priority pollutants were listed in 40 CFR section 131.38 (b)(1).

[2] Compliance may be determined from a single analysis or from the average of the initial analysis and three additional analyses within the month taken one week apart after the results of the initial analysis are obtained.

[3] Concentration expressed as total recoverable.

[4] The mass emission rates are based on the plant design flow rate of 12.5 mgd. During wet-weather storm events in which the flow exceeds the design capacity, the mass discharge rate limitations shall not apply, and concentration limitations will provide the only applicable effluent limitations.

[5] For priority pollutants, Section 2.4.5 of CTR *Compliance Determination*, reads, "Dischargers shall be deemed out of compliance with an effluent limitation if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reported ML."

[6] This effluent limitation will not be in effect until April 10, 2008, and until that time the Discharger shall comply with the interim limits established in I.B.(7) below.

[7] Halomethanes shall mean the sum of bromoform, bromodichloromethane, chloroform, and dibromochloromethane.

B. Other Effluent Limitations

1. The pH of wastes discharged shall at all times be within the range of 6.5 to 8.5.

2. The temperature of wastes discharged shall not exceed 100°F.

3. Pursuant to 40 CFR sections 133.102(a)(3) and 133.102(b)(3), the 30-day average percent removal by weight for BOD and total suspended solids shall not be less than 85 percent. Percent removal is defined as a percentage expression of the removal efficiency across a treatment plant for a given pollutant parameter, as determined from the 30-day average values of the raw wastewater influent pollutant concentrations to the facility and the 30-day average values of the effluent pollutant concentrations.

4. Radioactivity of the wastes discharged shall not exceed the limits specified in Title 22, Chapter 15, Article 5, Section 64443, of the CCR, or subsequent revisions.

5. The wastes discharged to water courses shall at all times be adequately disinfected. For the purpose of this requirement, the wastes shall be considered adequately disinfected if the median number of coliform organisms at some point in the treatment process does not exceed 2.2 per 100 milliliters, and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last seven (7) days for which an analysis has been completed. The samples shall be collected at a time when wastewater flow and characteristics are most demanding on treatment facilities and disinfection processes.

6. For the protection of the water contact recreation beneficial use, the turbidity of the filtered wastewater (a) shall not exceed a daily average of 2 Nephelometric turbidity units (NTUs), and (b) shall not exceed 5 NTU's more than 5 percent of the time (72 minutes) during any 24 hour period.

7. <u>Interim Effluent Limitations</u>

a. The Discharger shall comply immediately with the following interim effluent limit until April 10, 2008. Thereafter, the Discharger shall comply with the limitations specified in Section I.A.2.b. of this Order:

Constituent	Units	Monthly Average **
Selenium	µg/L	9.1
Cyanide	µg/L	5.2
4,4-DDE	µg/L	0.05

** Interim effluent limits are typically derived statistically at 95% confidence level for monthly averages and at the 99% confidence level for the daily maximum interim limits. Effluent performance data and the *Plimit*™ program, which is based on Appendix E of the TSD, are then used to calculate the interim limits. Where, effluent values (x_i) are assumed to be lognormally distributed for data sets containing all detects, and delta log-normally distributed for data sets containing detects and non-detects. However, In the case of cyanide the monthly average interim limit was set as the limit in the existing permit (Order No. 96-043), in accordance with SIP section 2.2.1 which reads, Numeric interim limitations for the pollutant must be based on current treatment facility performance or on existing permit limitations, whichever is more stringent. In the case of 4,4-DDE, the interim limit was set equal to the method detection limit, because there were not enough detected values to calculate an interim limit statistically.

b. The Discharger shall submit quarterly progress reports (January 15, April 15, July 15 and October 15) to describe the progress of studies and/or actions undertaken to reduce these compounds in the effluent, and to achieve compliance with the limits in this Order by the above-mentioned deadline. The first progress report

shall be received at the Regional Board by October 15, 2003.

8. To protect underlying ground water basins, pollutants shall not be present in the wastes discharged at levels that pose a threat to ground water quality.

C. Toxicity Requirements

1. Effluent Acute Toxicity Limitation and Requirements:

a. The acute toxicity of the effluent shall be such that: (i) the average survival in the undiluted effluent for any three (3) consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, and (ii) no single test producing less than 70% survival.

b. If either of the above requirements (1.a.i or 1.a.ii) is not met, the Discharger shall conduct six additional tests over a six-week period. The Discharger shall ensure that results of a failing acute toxicity test are received by the Discharger within 24 hours of completion of the test and the additional tests shall begin within 3 business days of receipt of the result. If the additional tests indicate compliance with acute toxicity limitation, the Discharger may resume regular testing. However, if the results of any two of the six accelerated tests are less than 90% survival, then the Discharger shall begin a Toxicity Identification Evaluation (TIE). The TIE shall include all reasonable steps to identify the sources of toxicity. Once the sources are identified, the Discharger shall take all reasonable steps to reduce toxicity to meet the objective.

c. If the initial test and any of the additional six acute toxicity bioassay tests results are less than 70% survival, the Discharger shall immediately implement Initial Investigation Toxicity Reduction Evaluation (TRE) Workplan.

d. The Discharger shall conduct acute toxicity monitoring as specified in Monitoring and Reporting Program No. 3021 (Attachment T).

2. Effluent Chronic Toxicity Limitation and Requirements:

a. The chronic toxicity of the effluent shall be expressed and reported in toxic units, where:

$$TU_c = \frac{100}{NOEC}$$

The No Observable Effect Concentration (NOEC) is expressed as

the maximum percent effluent concentration that causes no observable effect on test organisms, as determined by the results of a critical life stage toxicity test.

b. Chronic toxicity of 100% effluent shall not exceed a monthly median of 1.0 TU_c or a daily maximum of 2.0 TU_c in a critical life stage test.

c. If the chronic toxicity of the effluent exceeds the monthly median of 1.0 TU_c, the Discharger shall immediately implement accelerated chronic toxicity testing according to MRP No. 3021, Section IV.D.2.e. If any three out of the initial test and the six accelerated tests results exceed 1.0 TU_c, the Discharger shall initiate a TIE and implement the Initial Investigation TRE Workplan, as specified in Section C.4, below.

d. The Discharger shall conduct chronic toxicity monitoring as specified in MRP No. 3021.

e. City is constructing nitrification and denitrification (NDN) process units to remove nitrogen species from their effluent. Per the Discharger's request, City has been granted permission to extract ammonia from their effluent samples for chronic toxicity testing until the construction is completed. The removal of ammonia prior to acute toxicity testing may be performed with Executive Officer approval.

3. Receiving Water Chronic Toxicity Limitation and Requirements:

a. There shall be not chronic toxicity in ambient waters as a result of wastes discharged.

b. Receiving water and effluent toxicity sampling and testing shall be performed on the same day.

c. If the chronic toxicity in the receiving water, immediately downstream of the discharge, exceeds the monthly median of 1.0 TU_c in a critical life stage test and the toxicity is a result of waste discharge, then the Discharger shall immediately implement accelerated chronic toxicity testing according to monitoring and Reporting Program 3021, Section IV.D.2.e. If two of the six tests exceed 1.0 TU_c, the Discharger shall initiate a TIE and implement the Initial Investigation TRE Workplan, as specified in Section C.4, below.

d. If the results of the chronic toxicity testing at an upstream receiving water station is greater than the results of the testing downstream, and the result of the effluent chronic toxicity test is

less than or equal to 1 TUc, then accelerated monitoring does not need to be implemented.

4. Preparation of an Initial Investigation TRE Workplan

The Discharger shall prepare and submit a copy of the Discharger's initial investigation Toxicity Reduction Evaluation (TRE) workplan to the Executive Officer of the Regional Board for approval within 90 days of the effective date of this permit. If the Regional Board Executive Officer does not disapprove the workplan within 60 days, the workplan shall become effective. The Discharger shall use USEPA manuals EPA/600/2-88/070 (industrial) or EPA/833B-99/002 (municipal) as guidance. This workplan shall describe the steps the Discharger intends to follow if toxicity is detected, and should include, at a minimum:

i. A description of the investigation and evaluation techniques that will be used to identify potential causes and sources of toxicity, effluent variability, and treatment system efficiency;

ii. A description of the facility's methods of maximizing in-house treatment efficiency and good housekeeping practices, and a list of all chemicals used in the operation of the facility; and,

iii. If a toxicity identification evaluation (TIE) is necessary, an indication of the person who would conduct the TIEs (i.e., an in-house expert or an outside contractor). See MRP Section VI.D.3.c.iii for guidance manuals.

D. Receiving Water Limitations

1. For waters designated with a warm freshwater habitat (WARM) beneficial use, the temperature of the receiving water at any time or place and within any given 24-hour period shall not be altered by more than 5°F above the natural temperature (or above 70°F if the ambient receiving water temperature is less than 60 °F) due to the discharge of effluent at the receiving water station located downstream of the discharge. Natural conditions shall be determined on a case-by-case basis.

2. The pH of inland surface waters shall not be depressed below 6.5 or raised above 8.5 as a result of wastes discharged. Ambient pH levels shall not be changed more than 0.5 units from natural conditions as a result of wastes discharged. Natural conditions shall be determined on a case-by-case basis.

3. The dissolved oxygen in the receiving water shall not be depressed below 5 mg/L as a result of the wastes discharged.

4. The fecal coliform concentration in the receiving water shall not exceed a

log mean of 200/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10% of total samples during any 30-day period exceed 400/100 ml as a result of the wastes discharged.

5. Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in natural turbidity attributable to controllable water quality factors shall not exceed the following limits, as a result of wastes discharged:

   a. Where natural turbidity is between 0 and 50 NTU, increases shall not exceed 20%, and

   b. Where natural turbidity is greater than 50 NTU, increases shall not exceed 10%.

6. The wastes discharged shall not produce concentrations of toxic substances in the receiving water that are toxic to or cause detrimental physiological responses in human, animal, or aquatic life.

7. The wastes discharged shall not contain radionuclides in concentrations that are deleterious to human, plant, animal, or aquatic life, or that result in accumulation of radionuclides in the food web to an extent that present a hazard to human, plant, animal, or aquatic life.

8. The concentrations of toxic pollutants in the water column, sediments, or biota shall not adversely affect beneficial uses as a result of the wastes discharged.

9. The wastes discharged shall not contain substances that result in increases in BOD which adversely affect the beneficial uses of the receiving waters.

10. Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.

11. The wastes discharged shall not cause the receiving waters to contain any substance in concentrations that adversely affect any designated beneficial use.

12. The wastes discharged shall not alter the natural taste, odor, and color of fish, shellfish, or other surface water resources used for human consumption.

13. The wastes discharged shall not result in problems due to breeding of mosquitoes, gnats, black flies, midges, or other pests.

14. The wastes discharged shall not result in visible floating particulates, foams, and oil and grease in the receiving waters.

15. The wastes discharged shall not alter the color of the receiving waters; create a visual contrast with the natural appearance of the water; nor cause aesthetically undesirable discoloration of the receiving waters.

16. The wastes discharged shall not contain any individual pesticide or combination of pesticides in concentrations that adversely affect beneficial uses of the receiving waters. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life as a result of the wastes discharged.

II. SLUDGE REQUIREMENTS

To implement CWA Section 405(d), on February 19, 1993, USEPA promulgated 40 CFR Part 503 to regulate the use and disposal of municipal sewage sludge. This regulation was amended on September 3, 1999. The regulation requires that producers of sewage sludge meet certain reporting, handling, and disposal requirements. Since the State of California, hence the Regional Board, has not been delegated the authority to implement the sludge program, enforcement of the sludge requirements contained in this Order and permit shall be the sole responsibility of USEPA. However, any reports submitted to USEPA shall also be furnished to the Regional Board. The City is also responsible for compliance with waste discharge requirements for the generation, transport, and application of biosolids issued by the State Board or other Regional boards to which jurisdiction of the City's biosolids are transported and applied.

III. PRETREATMENT REQUIREMENTS

A. This Order includes the Discharger's Pretreatment Program as previously submitted to this Regional Board. Any change to the program shall be reported to the Regional board and to USEPA in writing and shall not become effective until approved by the Executive Officer and the USEPA Regional Administrator in accordance with procedures established in 40 CFR 403.18.

B. The Discharger shall implement and enforce its approved pretreatment program. The Discharger shall be responsible and liable for the performance of all pretreatment requirements contained in Federal Regulations 40 CFR Part 403, including subsequent regulatory revisions thereof. Where Part 403 or subsequent revision places mandatory actions upon the Discharger as Control Authority but does not specify a timetable for completion of the actions, the Discharger shall complete the required actions within six months from the effective date of this Order or the effective date of the Part 403 revisions, whichever comes later. For violations of pretreatment requirements, the Discharger shall be subject to enforcement actions, penalties, fines, and other remedies by the Regional Board, USEPA, or other appropriate parties, as provided in the Federal Clean Water Act. The Regional Board or USEPA may initiate enforcement action against an

industrial user for non-compliance with acceptable standards and requirements as provided in the Federal Clean Water Act and/or the California Water Code.

C. The Discharger shall update its pretreatment local limits to meet the requirements of this Order. Within 60 days of the effective date of this Order, the Discharger shall submit the plan and schedule for updating the local limits for approval of the Executive Officer.

D. The Discharger shall enforce the requirements promulgated under Sections 307(b), 307(c), 307(d), and 402(b) of the Clean Water Act with timely, appropriate, and effective enforcement actions. The Discharger shall require industrial users to comply with Federal Categorical Standards and shall initiate enforcement actions against those users that do not comply with the standards. The Discharger shall require industrial users subject to Federal Categorical Standards to achieve compliance no later than the date specified in those requirements or, in the case of a new industrial user, upon commencement of the discharge.

E. The Discharger shall perform the pretreatment functions as required in 40 CFR Part 403 including, but not be limited to:

(1) Implement the necessary legal authorities as provided in 40 CFR 403.8 (f) (1);

(2) Enforce the pretreatment requirements under 40 CFR 403.5 and 403.6;

(3) Implement the programmatic functions as provided in 40 CFR 403.8 (f) (2); and

(4) Provide the requisite funding of personnel to implement the pretreatment program as provided in 40 CFR 403.8 (f) (3).

F. The Discharger shall submit annual reports to the Regional Board, the State Board, and the USEPA Region 9, describing the Discharger's pretreatment activities over the period. If the Discharger is not in compliance with any conditions or requirements of this Order, the Discharger shall include the reasons for noncompliance and state how and when the Discharger will comply with such conditions and requirements. The annual and quarterly reports shall contain, but not be limited to, the information required in the attached *Pretreatment Reporting Requirements* (Attachment P), or approved revised version thereof.

IV. PROVISIONS

A. Discharge of wastes to any point other than specifically described in this Order and permit is prohibited and constitutes a violation thereof.

B. The Discharger shall comply with all applicable effluent limitations, national standards of performance, toxic, and pretreatment effluent standards, and all federal regulations established pursuant to Sections 208(b), 301, 302, 303(d),

304, 306, 307, 316, 403, and 405 of the Federal Clean Water Act and amendments thereto.

C. This Order includes the attached *Monitoring and Reporting Program* (Attachment T). If there is any conflict between provisions stated in Monitoring and Reporting Program and the Standard Provisions, those provisions stated in the former prevail.

D. This Order includes the attached *Standard Provisions and General Monitoring and Reporting Requirements* (*Standard Provisions*) (Attachment N). If there is any conflict between provisions stated herein and the Standard Provisions, those provisions stated herein prevail.

E. Compliance Determination

1. Compliance with single constituent effluent limitations – If the concentration of the pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reported Minimum Level (See reporting requirement III.A. of MRP), then the Discharger is out of compliance.

2. Compliance with monthly average limitations – In determining compliance with monthly average limitations, the following provisions shall apply to all constituents:

   a. If the analytical result of a single sample, monitored monthly, quarterly, semiannually, or annually, does not exceed the monthly average limit for that constituent, the Discharger will have demonstrated compliance with the monthly average limit for that month.

   b. If the analytical result of a single sample, monitored monthly, quarterly, semiannually, or annually, exceeds the monthly average limit for that constituent, the Discharger shall collect four additional samples at approximately equal intervals during the month. All five analytical results shall be reported in the monitoring report for that month, or 45 days after the sample was obtained, whichever is later.

      When all sample results are greater than or equal to the reported minimum Level (see Reporting Requirement III.A. of MRP), the numeric average of the analytical results of these four samples will be used for compliance determination.

      When one or more sample results are reported as "Non-Detected (ND)" or "Detected, but not Quantified (DNQ)" (see Reporting Requirement III.D. of MRP), the median value of these four samples will be used for compliance determination. If one or both

of the median values is ND or DNQ, the median will be the lower of the two middle values.

c. In the event of noncompliance with a monthly average effluent limitation, the sampling frequency for that constituent shall be increased to weekly and shall continue at this level until compliance with the monthly average limitation has been demonstrated.

d. If only one sample was obtained for the month or for a monthly period and the result exceeded the monthly average, then the Discharger is in violation of the monthly average limit.

3. Compliance with effluent limitations expressed as a sum of several constituents – If the sum of the individual pollutant concentrations is greater than the effluent limitation, then the Discharger is out of compliance. In calculating the sum of the concentrations of a group of pollutants, consider constituents reported as ND or DNQ to have concentrations equal to zero.

F. In calculating mass emission rates and the monthly average concentrations, use one half of the method detection limit for "Not Detected" (ND) and the estimated concentration for "Detected but Not Quantified" (DNQ).

G. <u>Pollutant Minimization Program (PMP)</u>

1. The goal of the PMP is to reduce all potential sources of a pollutant through minimization (control) strategies, including pollution prevention measures, in order to maintain the effluent concentration at or below the effluent limitation.

   Pollution prevention measures may be particularly appropriate for persistent bioaccumulative priority pollutants where there is evidence that beneficial uses are being impacted. The completion and implementation of a Pollution Prevention Plan, required in accordance with California Water Code Section 13263.3(d) shall fulfill the PMP requirement in this section.

2. The Discharger shall develop a PMP, in accordance with Section 2.4.5.1., of the SIP, if all of the following conditions are true, and shall submit the PMP to the Regional Board within 120 days of determining the conditions are true:

   a. The calculated effluent limitation is less than the reported minimum level (ML);
   b. The concentration of the pollutant is reported as detected but not quantified (DNQ); and,
   c. There is evidence showing that the pollutant is present in the

effluent above the calculated effluent limitation.

3. The Discharger shall develop a PMP, in accordance with Section 2.4.5.1., of the SIP, if all of the following conditions are true, and shall submit the PMP to the Regional Board within 120 days of determining the conditions are true:

   a. the calculated effluent limitation is less than the method detection limit (MDL);
   b. The concentration of the pollutant is reported as "Non-Detected", ND;
   c. There is evidence that the pollutant is present in the effluent above the calculated effluent limitation.

4. The Discharger shall consider the following in determining whether the pollutant is present in the effluent at levels above the calculated effluent limitation:

   a. health advisories for fish consumption;

   b. presence of whole effluent toxicity;

   c. results of benthic or aquatic organism tissue sampling;

   d. sample results from analytical methods more sensitive than methods included in the permit; and,

   e. the concentration of the pollutant is reported as DNQ and the effluent limitation is less than the method detection limit.

5. Elements of a PMP. The PMP shall include actions and submittals acceptable to the Regional board including, but not limited to, the following:

   a. An annual review and semiannual monitoring of potential sources of the reportable pollutant, which may include fish tissue monitoring and other bio-uptake sampling;

   b. Quarterly monitoring for the reportable pollutant in the influent to the wastewater treatment system;

   c. Submittal of a control strategy designed to proceed toward the goal of maintaining concentrations of the reportable pollutant in the effluent at or below the calculated effluent limitation;

   d. Implementation of appropriate cost-effective control measures for the pollutant, consistent with the control strategy; and,

e. An annual status report that shall be sent to the Regional Board including:
   - All PMP monitoring results for the previous year;
   - A list of potential sources of the reportable pollutant;
   - A summary of all action taken in accordance with control strategy; and,
   - A description of actions to be taken in the following year.

H. The Discharger shall provide standby or emergency power facilities and/or storage capacity or other means so that in the event of a plant upset or outage due to power failure or other causes, the discharge of raw or inadequately treated sewage does not occur.

I. The Discharger may conduct studies to obtain data in support of developing site-specific objectives for selenium, cyanide and 4,4-DDE for the protection of human health from consumption of organisms. In such event, the Discharger shall submit to the Regional Board a detailed workplan for these studies within 180 days after the effective date of this Order (by January 25, 2004). The workplan shall provide a schedule consistent with Effluent limitation A.7.a. for the development and adoption of site specific objectives for selenium, cyanide and 4,4-DDE.

J. The Discharger shall comply with all applicable water quality objectives for receiving waters, including the toxic criteria in 40 CFR Part 131.36, as specified in this permit.

VI. REOPENERS AND MODIFICATIONS

A. This Order may be reopened and modified, in accordance with SIP Section 2.2.2.A, to incorporate new limits based on future reasonable potential analysis to be conducted, upon completion of the collection of additional data by the Discharger. Not withstanding the foregoing, in the event that reasonable potential analyses indicate that a pollutant has reasonable potential, the Regional Board staff shall bring an appropriate modification to the Regional Board, at the next practicable Board meeting.

B. This Order may be reopened and modified to incorporate, in accordance with the provisions set forth in 40 CFR Parts 122 and 124, the proposed watershed monitoring program.

C. This Order may be modified, in accordance with the provisions set forth in 40 CFR sections 122 and 124, to include new MLs.

D. This Order may be reopened and modified, to revise effluent limitations as a result of future Basin Plan Amendments, such as an update of the Ammonia objective, or the adoption of a TMDL for Calleguas Creek Watershed.

E. This Order may be reopened and modified to include TMDL-based compliance schedules, upon a proper demonstration by the Discharger and developed in accordance with section 2.1 of the SIP, if and when the USEPA approves the TMDL-based compliance schedules provision of the SIP.

F. This Order may be reopened and modified, to revise the toxicity language once that language becomes standardized.

G. This Order may also be reopened and modified, revoked, and reissued or terminated in accordance with the provisions of 40 CFR sections 122.44, 122.62 to 122.64, 125.62, and 125.64. Causes for taking such actions include, but are not limited to, failure to comply with any condition of this order and permit, endangerment to human health or the environment resulting from the permitted activity.

VII. EXPIRATION DATE

This Order expires on June 5, 2008.

The Discharger must file a Report of Waste Discharge in accordance with Title 23, California Code of Regulations, not later than 180 days in advance of such date as application for issuance of new waste discharge requirements.

VIII. RESCISSION

Order Nos. 96-043 and 97-122, adopted by this Regional Board on June 10, 1996, and September 29, 1997, respectively, are hereby rescinded, except for enforcement purposes.

I, Dennis A. Dickerson, Executive Officer, do hereby certify that the foregoing is a full, true and correct copy of an order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on June 5, 2003.

Dennis A. Dickerson
Executive Officer

FIGURE 1
MAP

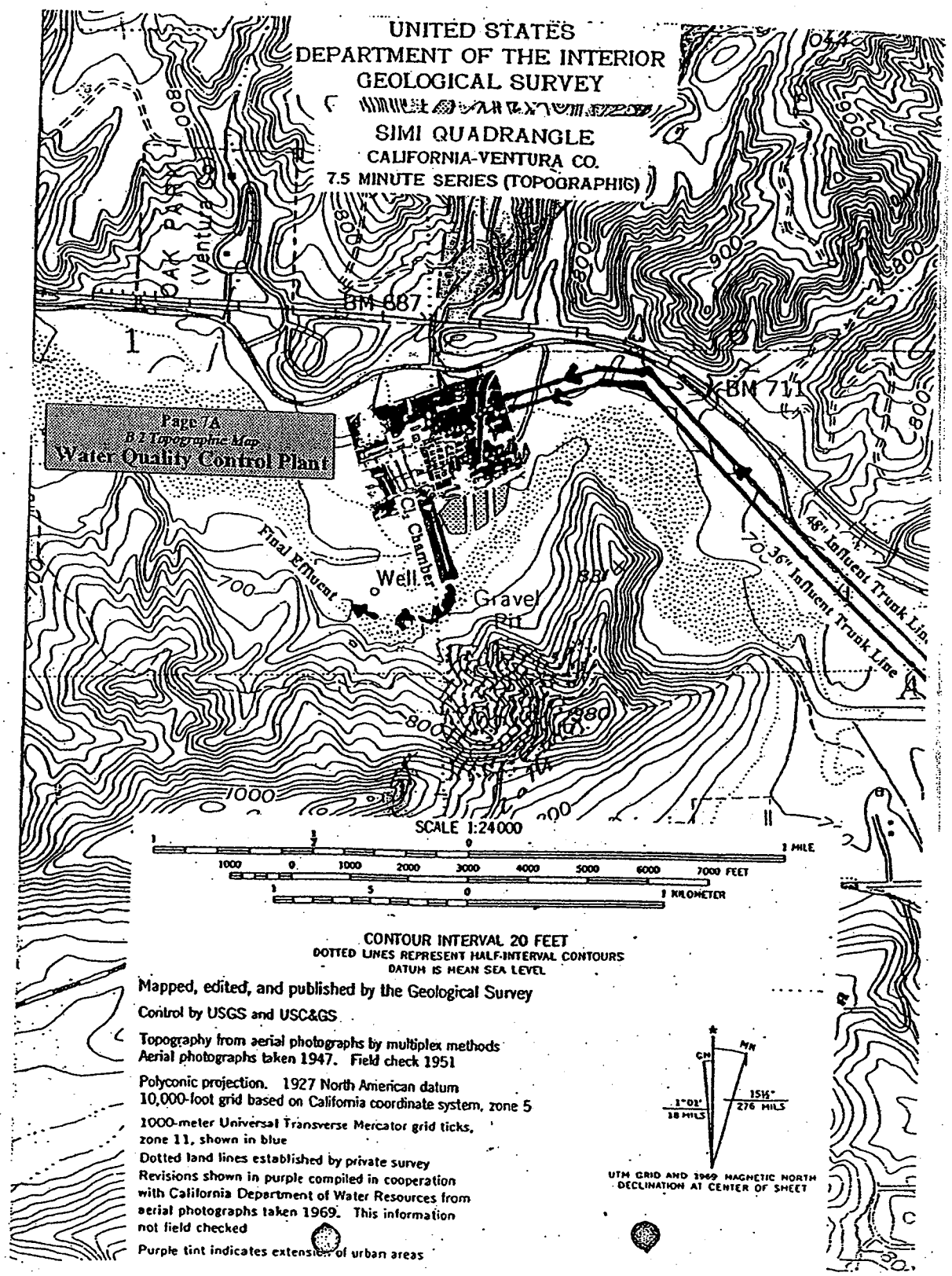
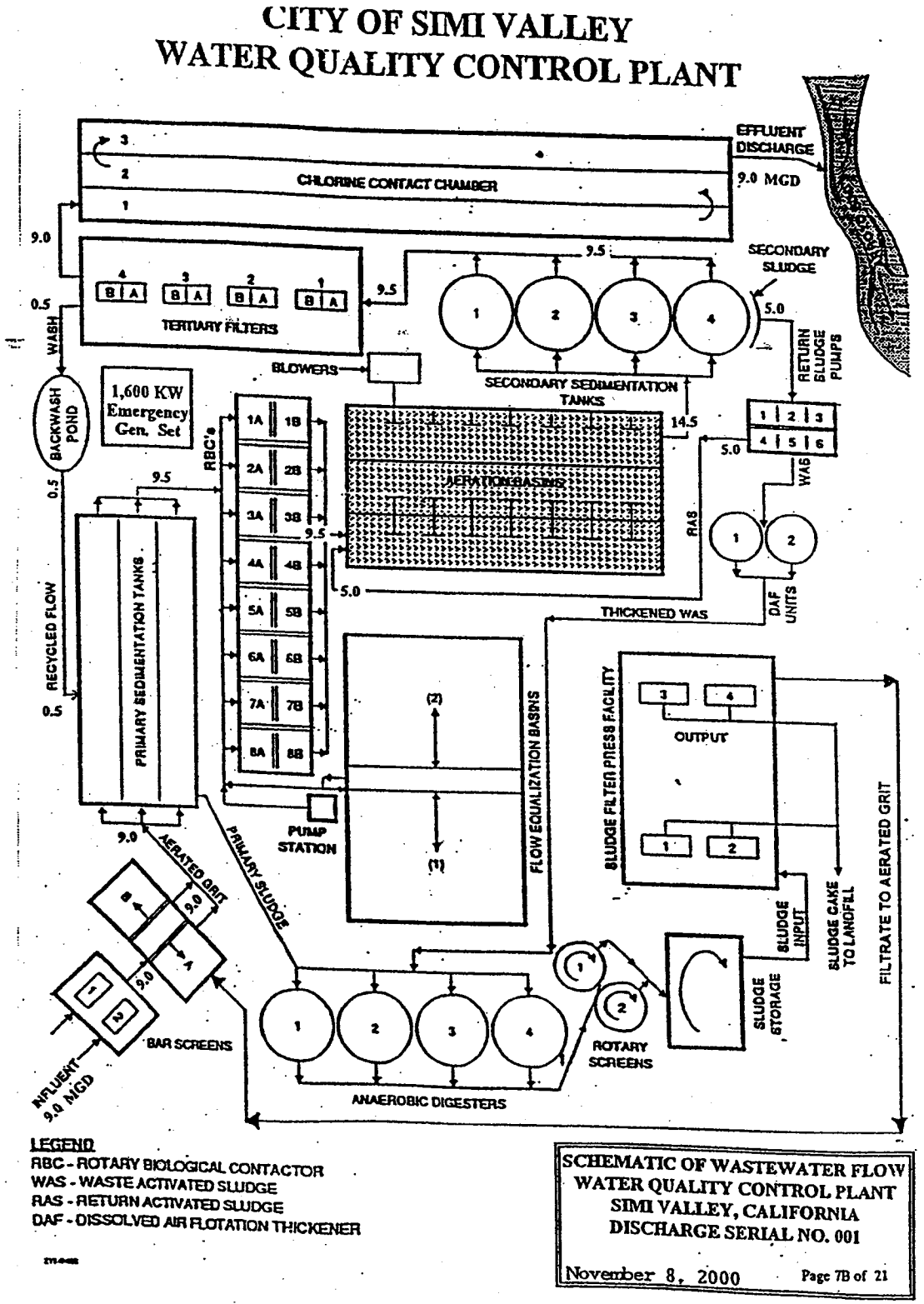

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
SIMI QUADRANGLE
CALIFORNIA-VENTURA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
Page 7A
B.1 Topographic Map
Water Quality Control Plant
BM 887
BM 711
Cl. Chamber
Well
Gravel Pit
Final Effluent
48" Influent Trunk Line
36" Influent Trunk Line
SCALE 1:24000
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography from aerial photographs by multiplex methods
Aerial photographs taken 1947. Field check 1951
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 5
1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue
Dotted land lines established by private survey
Revisions shown in purple compiled in cooperation with California Department of Water Resources from aerial photographs taken 1969. This information not field checked
Purple tint indicates extension of urban areas
UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

FIGURE 2
WASTEWATER PROCESS DIAGRAM



APPENDIX B

WATER RECLAMATION REQUIREMENTS

BY THE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

ORDER NO. 87-46

State of California
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, LOS ANGELES REGION

ORDER NO. 87-46

WATER RECLAMATION REQUIREMENTS
FOR

SIMI VALLEY COUNTY SANITATION DISTRICT
(Water Quality Control Plant)
(File No. 61-60)

The California Regional Water Quality Control Board, Los Angeles Region, finds:

1. Simi Valley County Sanitation District (hereinafter referred to as "Reclaimer") operates the Water Quality Control Plant, at 600 West Los Angeles Avenue, Simi Valley, California, with a design flow capacity of 9.1 million gallons per day (mgd). The plant discharges part or all of its treated effluent to adjacent District leased properties to be utilized for irrigation. In addition, the District proposes to dispose of anaerobically digested sludge and separated supernatant by spreading it in areas approved by this Board for soil amendment purposes. Currently the District is not reclaiming any of its wastewater and sludge is recycled back to the plant.

2. The Reclaimer discharges to surface waters in accordance with a National Pollution Discharge Elimination System permit (NPDES No. CA0055221) adopted by this Board.

3. The wastewater treatment consists of primary and secondary sedimentation, activated sludge, chlorination and filtration.

4. A review of the current requirements has been conducted by Board staff in accordance with California Administration Code, Title 23, Chapter 3, Subchapter 9, Article 2, Section 2232.2.

5. The areas of irrigation and impoundment reuse and the sludge disposal site are located in Section 6, T2N, R18W, and Section 1, T2N, R19W, S.B.B. & M, within East Las Posas Hydrologic Subarea.

6. The Board adopted a Revised Water Quality Control Plan for Santa Clara River Basin on March 27, 1978. The Plan contains water quality objectives for ground water in East Las Posas Hydrologic Subarea. The requirements contained in

March 23, 1987
Revised April 10, 1987

this Order, as they are met, will be in conformance with the goals of the Water Quality Control Plan.

7. Ground water in East Las Posas Hydrologic Subarea is beneficially used for municipal and domestic supply, industrial service and process supply, and agricultural supply.

8. Section 13523 of the California Water Code provides that a Regional Board, after consulting with and receiving the recommendations of the State Department of Health Services and after any necessary hearing, shall, if it determines such action to be necessary to protect the public health, safety, or welfare, prescribe water reclamation requirements for water which is used or proposed to be used as reclaimed water. Section 13523 further provides that such requirements shall include, or be in conformance with, the statewide reclamation criteria.

9. The use of reclaimed water for impoundments or for irrigation could affect the public health, safety, or welfare; requirements for such use are therefore necessary in accordance with Section 13523 of the Water Code.

10. This project involves an existing facility and as such is exempt from the provisions of the California Environmental Quality Act in accordance with California Administrative Code, Title 14, Chapter 3, Section 15301.

The Board has notified the Reclaimer and interested agencies and persons of its intent to prescribe water reclamation requirements for this facility and has provided them with an opportunity to submit their written views and recommendations.

The Board in a public meeting heard and considered all comments pertaining to the direct beneficial use and to the tentative water reclamation requirements.

IT IS HEREBY ORDERED, that Simi Valley County Sanitation District, shall comply with the following:

A. Reclaimed Water Limitations

1. Reclaimed water shall be limited to treated municipal wastewater only, as proposed.

2. Reclaimed water shall not contain constituents in excess of the following limits:

Constituent	Unit	Maximum Limitations
Total dissolved solids	mg/l	1500
Chloride	mg/l	250
Sulfate	mg/l	700
Boron	mg/l	1.0

3. The pH of reclaimed water shall at all times be within the range 6.0 to 9.0.

4. Reclaimed water shall not contain trace constituents or other substances in concentrations exceeding the limits contained in the current edition of the California Department of Health Services Drinking Water Standards.

5. Radioactivity shall not exceed the limits specified in Title 22, Chapter 15, Article 5, Sections 64441 and 64443, California Administrative Code, or subsequent revisions.

6. Reclaimed water shall not cause the nitrogen content in the receiving ground water to exceed the objectives in the Water Quality Control Plan.

7. Reclaimed water used as agricultural supply shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use.

B. Specifications for Use of Reclaimed Water

1. Reclaimed water used for the irrigation of golf courses, cemeteries, freeway landscapes, and landscapes in other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized wastewater.

   The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 240 per 100 milliliters in any two consecutive samples.

Oxidized wastewater means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

Disinfected wastewater means wastewater in which the pathogenic organisms have been destroyed by chemical, physical or biological means.

2. Reclaimed water used for the irrigation of parks, playgrounds, schoolyard, and other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater or a wastewater treated by a sequence of unit processes that will assure an equivalent degree of treatment and reliability.

The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 23 per 100 milliliters in any sample.

A coagulated wastewater means an oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable floc-forming chemicals or by an equally effective method.

A filtered wastewater means an oxidized, coagulated, clarified wastewater which has been passed through natural undisturbed soils or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5 percent of the time during any 24-hour period.

3. Reclaimed water used as a source of supply in a nonrestricted recreational impoundment shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater.

The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of

coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

4. Reclaimed water used as a source of supply in a restricted recreational impoundment shall be at all times an adequately disinfected, oxidized wastewater.

   The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

5. Reclaimed water used as a source of supply in a landscape impoundment shall be at all times an adequately disinfected, oxidized wastewater.

   The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

6. Reclaimed water shall not be directly used for uses other than those enumerated above until requirements for these uses have been established by this Board in accordance with Section 13523 of the California Water Code, unless the Board waives such requirements or finds that the above cited standards are applicable to these uses.

7. Reclaimed water uses shall meet the requirements specified in the "Guidelines for Use of Reclaimed Water" issued by the State Department of Health Services.

8. Reclaimed water used for irrigation shall be retained on the areas of use and shall not be allowed to escape as surface flow except as provided for in a National Pollutant Discharge Elimination System Permit.

   For the purpose of this requirement, however, minor amounts of irrigation return water from peripheral areas shall not be considered a violation of this Order

provided the discharge meets the requirements contained in a National Pollutant Discharge Elimination System Permit issued to the Simi Valley County Sanitation District (Water Quality Control Plant).

9. Reclaimed water shall be applied at such a rate and volume as not to exceed vegetative demand and soil moisture conditions. Special precautions must be taken to prevent clogging of spray nozzles, to prevent overwatering and to exclude the production of runoff. Pipelines shall be maintained so as to prevent leaks.

10. Reclaimed water used for irrigation shall not be allowed to run off into recreational lakes unless it meets the criteria for such lakes.

C. Requirements for Use of Sewage Sludge

1. Sewage sludge discharged to land shall be limited to digested sewage sludge only.

2. Sewage sludge applied to the land surface shall not be permitted to pond on the property or be placed in ponded water.

3. Erosion of the sludge application site by surface flow shall be prevented.

4. Sewage sludge shall be discharged at the proposed site and on land owned or controlled by the Reclaimer, or at a site approved in writing by the Executive Officer.

5. No sludge spreading area shall be closer than 100 feet to any water well or a stream channel or watercourse.

6. Sewage sludge applied to the land surface shall be incorporated into the soil within 48 hours after application.

7. There shall be no public access to the sludge application site.

8. The Reclaimer shall remove any wastes which are discharged at this site in violation of these requirements.

9. Sludge shall not be applied onto lands within 100 feet of any low pressure water line from which domestic water is derived.

10. The pH of any sewage sludge and soil mixture at the site shall be 6.5 or greater.

11. Sewage sludge applied to the land surface shall not contain trace contaminants in excess of the following concentration limits:

Trace Contaminant	Dry Weight Concentration
Lead	500 mg/kg
Cadmium	25 mg/kg
Polychlorinated Biphenyls	5 mg/kg

12. The cumulative application of trace contaminants from sewage sludge shall not exceed the appropriate levels in the following table:

	Maximum cumulative addition of metal, mg/kg		
Metal	Soil Cation Exchange Capacity, meq/100g		
	0-5	5-15	>15
Zinc	250	500	1,000
Copper	125	250	500
Nickel	50	100	200
Lead	400	800	800
Cadmium	5	10	20

13. The annual application of cadmium from sewage sludge shall not exceed 0.5 kilograms per hectare (kg/ha).

14. The application of sewage sludge shall not exceed agronomic rates in accordance with the State Department of Health Services' "Manual of Good Practice for Landspreading of Sewage Sludge".

15. Sewage sludge shall not be applied directly to any crop.

16. In accordance with regulations contained in 40 CFR, Part 257.3-6(b)(1), sewage sludge applied to the land surface shall be treated by a "Process to Significantly

Reduce Pathogens"[1] prior to application and incorporation.

17. There shall be no animal grazing at the sewage sludge application site.

18. Storm runoff, except rain falling naturally on the site, shall be diverted around the sewage sludge application site.

19. Water used for irrigation shall not be allowed to escape from the sludge spreading areas as surface runoff and shall be applied in quantities to meet the irrigation needs of the crops only.

20. Odors of waste origin shall not be perceptible beyond the boundaries of the property.

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[1]Processes to Significantly Reduce Pathogens:

Aerobic digestion: The process is conducted by agitating sludge with air or oxygen to maintain aerobic conditions at residence times ranging from 60 days at 15°C to 40 days at 20°C. with a volatile solids reduction of at least 39 percent.

Air drying: Liquid sludge is allowed to drain and/or dry on under-drained sand beds, or paved or unpaved basins in which the sludge is at a depth of nine inches. A minimum of three months is needed, two months of which temperatures average on a daily basis above 0°C.

Anaerobic digestion: The process is conducted in the absence of air at residence times ranging from 60 days at 20°C to 15 days at 35° to 55°C, with a volatile solids reduction of at least 38 percent.

Composting: Using the within-vessel, static aerated pile or windrow composting methods, the solid waste is maintained at minimum operating conditions of 40°C for 5 days. For four hours during this period the temperature exceeds 55°C.

Lime stabilization: Sufficient lime is added to produce a pH of 12 after 2 hours of contact.

Other methods: Other methods or operating conditions may be acceptable if pathogens and vector attraction of the waste (volatile solids) are reduced to an extent equivalent to the reduction achieved by any of the above methods.

21. Breeding of flies, mosquitoes, or other vectors of public health or nuisance significant insofar as it relates to this sludge application shall be controlled by the Reclaimer.

22. Neither the sludge application nor any treatment or handling of wastes shall cause a pollution or nuisance.

23. Storm diversion facilities and other safeguards, including ground water monitoring systems, shall be constructed prior to sludge application activities.

24. The distance from the sewage sludge application site to domestic supply wells and private residences shall be at least 500 feet.

D. General Requirements

1. The discharge or use of raw or inadequately treated sewage at any time is prohibited.

2. Reclaimed water shall not be used for irrigation during periods of extended rainfall and/or runoff.

3. Standby or emergency power facilities and/or sufficient capacity shall be provided for reclaimed water storage during rainfall or in the event of plant upsets or outages, and at times when spray irrigation cannot be practiced.

4. Reclaimed water use or disposal shall not result in earth movement in geologically unstable areas.

5. Adequate facilities shall be provided to protect the sewage treatment and reclamation facilities from damage by storm flows and runoff.

6. Adequate freeboard shall be maintained in reclaimed water storage pond to ensure that direct rainfall will not cause overtopping.

7. Neither treatment of waste nor any reclaimed water use or disposal shall cause pollution or nuisance.

8. Water reclamation and reuse or disposal shall not result in problems due to breeding of mosquitoes, gnats, midges, or other pests.

9. Reclaimed water use or disposal shall not impart tastes, odors, color, foaming, or other objectionable characteristics to receiving ground waters.

10. Reclaimed water use or disposal which could affect receiving ground waters shall not contain any substance in concentrations toxic to human, animal, or plant life.

11. Odors of sewage origin shall not cause a nuisance.

E. Provisions

1. A copy of these requirements shall be maintained at the reclamation facility so as to be available at all times to operating personnel.

2. In the event of any change in name, ownership, or control of these waste treatment and reclamation facilities, the Reclaimer shall notify this Board of such change and shall notify the succeeding owner or operator of the existence of this Order by letter, copy of which shall be forwarded to the Board.

3. In accordance with Section 13522.5 of the Water Code, the Reclaimer shall file a report of any material change or proposed change in character, location or volume of the reclaimed water or its uses.

4. The Reclaimer shall file with the Board technical reports on self monitoring work performed according to the detailed specifications contained in the Monitoring and Reporting Programs, as directed by the Executive Officer.

5. The Reclaimer shall notify this Board by telephone within 24 hours of any violations of reclaimed water use conditions or any adverse conditions as a result of the use of reclaimed water from this facility; written confirmation shall follow within one week.

6. The Reclaimer shall notify Board staff by telephone immediately of any confirmed coliform counts that could cause a violation of the 7-day median limit, including the date(s) thereof. This information shall be confirmed in the next monitoring report; in addition, for any actual coliform limit violations that occurred, the report shall also include the reasons for the high coliform results, the steps being taken to correct the

problem (including dates thereof), and the steps being taken to prevent a recurrence.

7. These requirements do not exempt the Reclaimer from compliance with any other laws, regulations, or ordinances which may be applicable; they do not legalize this reclamation facility, and they leave unaffected any further restraint on the use of reclaimed water at this site which may be contained on other statutes or required by other agencies.

8. The Reclaimer shall be responsible to insure that all users of reclaimed water comply with the specifications and requirements for such use.

9. This Order does not alleviate the responsibility of the Reclaimer to obtain other necessary local, state, and federal permits to construct facilities necessary for compliance with this Order; nor does this Order prevent imposition of additional standards, requirements, or conditions by any other regulatory agency. Expansion of this facility from its current capacity shall be contingent upon issuance of all necessary permits, including a conditional use permit.

10. Supervisors and operators of this publicly owned wastewater treatment plant shall possess a certificate of appropriate grade as specified in California Administrative Code, Title 23, Chapter 3, Subchapter 14, Section 2455 and 2460.

11. The Reclaimer shall provide to each user of reclaimed water from the Water Quality Control Plant a copy of these requirements, to be maintained at the user's facility as to be available at all times to operating personnel.

12. For any extension of the reclaimed water system, the Reclaimer shall submit a report detailing the extension for the approval of the Executive Officer. Following construction, as built drawings shall be submitted to the Executive Officer for approval prior to use of reclaimed water.

13. The Reclaimer shall submit to the Board within 60 days of the adoption of this Order, a fail-safe procedure for approval by the Executive Officer.

14. Prior to initiation of any sewage sludge application operations, the Reclaimer shall submit a report which describes all runoff control facilities and ground water monitoring wells, including their locations and well completion information, to this Board for the Executive Officer's review and approval.

15. Order No. 80-47 adopted by this Board on August 25, 1980, is hereby rescinded.

I, Robert P. Ghirelli, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on April 27, 1987.

Robert P. Ghirelli

ROBERT P. GHIRELLI, D.Env.
Executive Officer

GK/

State of California
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, LOS ANGELES REGION

MONITORING AND REPORTING PROGRAM NO. 6408
FOR

SIMI VALLEY COUNTY SANITATION DISTRICT
(Water Quality Control Plant)
(File No. 61-60)

The Reclaimer shall implement this monitoring program on the effective date of this Order.

Monitoring reports shall be submitted by the dates in the following schedule:

Reporting period	Report Due
January - March	May 15
April - June	August 15
July - September	November 15
October - December	February 15

The first monitoring report under this program shall be submitted by August 15, 1987.

By March 1 of each year, the Reclaimer shall submit an annual report to the board. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the Reclaimer shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the Requirements.

Values obtained for the NPDES monitoring report during periods of discharge to surface waters may be reported here in lieu of duplicate testing, if representative. However, non-NPDES self-monitoring reports shall be submitted separately from the NPDES monitoring reports.

Reclaimed Water Monitoring

A sampling station shall be established where representative samples of reclaimed water can be obtained. Reclaimed water samples may be obtained at a single station provided that station is representative of the quality at all discharge points. Each

sampling station shall be identified. The following shall constitute the reclaimed water monitoring program:

Constituent	Units	Type of Sample	Minimum Frequency of Analysis
Turbidity[1]	NTU	continuous	-----
Total flow[2]	gallon	continuous	-----
Coliform group[3]	MPN/100ml	grab	daily
pH	pH units	grab	daily
Total dissolved solids	mg/l	24-hr composite	monthly
Chloride	mg/l	24-hr composite	monthly
Boron	mg/l	24-hr composite	monthly
Sulfate	mg/l	24-hr composite	monthly
Arsenic	mg/l	24-hr composite	quarterly
Barium	mg/l	24-hr composite	quarterly
Cadmium	mg/l	24-hr composite	quarterly
Chromium	mg/l	24-hr composite	quarterly
Lead	mg/l	24-hr composite	quarterly
Mercury	mg/l	24-hr composite	quarterly
Selenium	mg/l	24-hr composite	quarterly
Silver	mg/l	24-hr composite	quarterly

[1]Required only for applications having a turbidity limit. The average value recorded each day and amount of time that 5 NTU was exceeded each day shall be reported. Turbidity samples may be obtained anywhere in the treatment process subsequent to the filtration procedure.

[2]Shall report the daily volume of reclaimed water and the monthly volume used at each site.

[3]Samples shall be obtained at some point in the treatment process at a time when wastewater flow and characteristics are most demanding on the treatment facility and disinfection procedures. The location(s) of the sampling point(s) and any changes thereto must be approved by the Executive Officer, and proposed changes shall not be made until such approval has been granted. If reclaimed water is used for irrigation of golf courses, cemeteries, freeway landscapes, parks, playgrounds, schoolyards, or other areas where the public has similar access or exposure, samples shall be obtained subsequent to the chlorination procedure. Coliform values obtained must meet the strictest requirement specified for all uses during periods of multiple use, unless separate coliform analyses are obtained at each particular point of use.

Sewage Sludge Monitoring

Composite sewage sludge samples shall be collected and analyzed for the following parameters:

Parameter	Unit	Frequency
Total solid content	%	quarterly
pH	pH units	quarterly
Ammonia nitrogen	mg/kg, dry weight	quarterly
Total nitrogen	mg/kg, dry weight	quarterly
Cadmium	mg/kg, dry weight	quarterly
Lead	mg/kg, dry weight	quarterly
Zinc	mg/kg, dry weight	quarterly
Copper	mg/kg, dry weight	quarterly
Nickel	mg/kg, dry weight	quarterly
Total chromium	mg/kg, dry weight	quarterly
Polychlorinated biphenyls	mg/kg, dry weight	quarterly

Soil Monitoring

A soil sampling grid shall be established for the sludge application site and the sampling points shall be located where representative soil samples can be obtained. The soil sampling grid shall be approved by the Executive Officer. Composite soil samples shall be collected from active plots and analyzed annually for the following parameters:

Parameter	Unit	Frequency
pH	pH units	annually
Cation exchange capacity	meq/100g	annually
Cadmium	mg/kg, dry weight	annually
Lead	mg/kg, dry weight	annually
Zinc	mg/kg, dry weight	annually
Copper	mg/kg, dry weight	annually
Nickel	mg/kg, dry weight	annually
Total chromium	mg/kg, dry weight	annually
Total nitrogen	mg/kg, dry weight	annually

Crop Analysis

The plant uptake of cadmium, zinc, and copper for each crop shall be determined after crop harvesting.

Site Observation

Sewage sludge application areas shall be inspected on a weekly basis for observation of sludge runoff or ponding. The results of these observations shall be submitted to the Board along with each quarterly monitoring report.

Sludge Disposal Reporting

Each report shall contain the following information with respect to the reporting period:

1. Total volume of sludge disposed of during the reporting period.

2. Sewage sludge application rate during the reporting period in tons per hectare.

3 A map or description of the areas of the site where sludge was applied during the reporting period, including the quantity (gallons per acre per day) applied per each area, if there are no changes from the previous monitoring report, a statement to that effect shall suffice.

4. The analytical results of various sampling programs, as required.

5. The results of the site observations.

6. A certification that all wastes deposited were in compliance with the Board's requirements and that no wastes were deposited outside of the boundaries of the site, as specified in the Board's requirements.

General Provisions for Sampling and Analysis

All sampling, sample preservation, and analyses shall be performed in accordance with the latest edition of "Guidelines Establishing Test Procedures for Analysis of Pollutants", promulgated by the United States Environmental Protection Agency.

All chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by the State Water Resources Control Board or approved by the Executive Officer.

General Provisions for Reporting

For every item where the requirements are not met, the Reclaimer shall submit a statement of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time and submit a timetable for correction.

The Reclaimer shall maintain all sampling and analytical results, including strip charts; date, exact place, and time of sampling; dates analyses were performed; analyst's name; analytical techniques used; and results of all analyses. Such records shall be retained for a minimum of three years. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge or when requested by the Board.

In reporting the monitoring data, the Reclaimer shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized to demonstrate compliance with Water Reclamation Requirements and, where applicable, shall include results of receiving water observations.

The Reclaimer shall file a report with this Board describing the purposes for which reclaimed water from this facility is used, estimating quantities used for each type of use, depicting on a map or drawing the area(s) of use, and stating the name and address of each user of reclaimed water if other than the Reclaimer. This report shall be updated at least annually, and shall be included with the annual report due March 1st each year.

Each quarterly report shall include a statement that all reclaimed water was used only as specified in the requirements during the quarter.

If no water was delivered for reuse during the quarter, the report shall so state.

Monitoring reports shall be signed by:

a. In the case of corporations, by a principal executive officer at least of the level of vice-president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which discharge originates;

b. In the case of a partnership, by a general partner;

c. In the case of a sole proprietorship, by the proprietor;

d. In the case of municipal, state or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

Each report shall contain the following completed declaration:

"I declare under penalty of perjury that the foregoing is true and correct.

Executed on the _____ day of _____ at _____.

_____(Signature)

_____(Title)"

Ordered by Robert P. Ghirelli
Executive Officer

April 27, 1987
Date

GK/

State of California
Department of Health Services

GUIDELINES FOR USE OF RECLAIMED WATER

I. General

A. Reclaimed water shall meet the Regional Water Quality Control Board (RWQCB) requirements and the requirements specified in the "Wastewater Reclamation Criteria." (Title 22, Div. 4, Section 60301 through 60355). These guidelines apply to those reclaimed water use areas supplied water from sewage treatment plants having reliability features and operational histories meeting the Regional Water Quality Control Board and "Wastewater Reclamation Criteria" requirements. Additional precautions may be required where these conditions are not met.

B. Reclaimed water should be confined to the authorized use area.

1. Direct or windblown spray should be confined to the area designated and approved for reclamation.

2. Precautions should be taken to assure that reclaimed water will not be sprayed on any facility or area not designated for reclamation such as passing vehicles, buildings, domestic water facilities or food handling facilities.

C. Notification should be provided to inform the public that reclaimed wastewater is being used. The notification should include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read.

D. Public contact with reclaimed water should be minimized except where specifically approved by the health agencies and the Regional Water Quality Control Board.

E. The reclaimed water distribution and transmission system piping should comply with the design requirements contained in the California-Nevada Section AWWA publication "Guidelines for Distribution of Nonpotable Water."

1. All piping, valves and outlets should be marked to differentiate reclaimed water from domestic or other water.

2. All reclaimed water controllers, valves, etc., should be affixed with reclaimed water warning signs.

F. All reclaimed water valves, outlets, quick couplers, and sprinkler heads should be of a type or secured in a manner that only permits operation by personnel authorized by the user.

G. Use or installation of hose bibbs on any irrigation system presently operating or designated to operate with reclaimed water, regardless of the hose bibb construction or identification, should not be permitted.

H. There should be at least a 10-foot horizontal and 1-foot vertical separation (with the domestic water above the reclaimed water pipeline) between all pipelines transporting reclaimed water and those transporting domestic water.

I. Plans and specifications for the reclaimed and domestic water systems should be submitted to the Sanitary Engineering Branch of the State Department of Health Services and the local health department for review and approval before construction of new reclamation facilities or system conversion.

J. An air-gap separation or reduced pressure principle device shall be provided at all domestic water service connections to reclaimed water use areas. (Title 17, Chapter 5, Section 7604).

K. There shall be no connection between the potable water supply and piping containing reclaimed water. Supplementing reclaimed water with water used for domestic supply shall not be allowed except through an air-gap separation. (Title 17, Chapter 5, Section 7604).

L. Supplementing reclaimed water with water from irrigation or industrial wells should not be allowed except through an air gap or reduced pressure principle device.

M. Drinking water facilities should be protected from direct or windblown reclaimed water spray.

N. Tank trucks and other equipment which are used to distribute reclaimed water should be clearly identified with warning signs.

O. There should be no irrigation or impoundment of reclaimed water within 500 feet of any well used for domestic supply or 100 feet of any irrigation well unless it can be demonstrated that special circumstances justify lesser distances to be acceptable.

P. Adequate measures should be taken to prevent the breeding of insects and other vectors of health significance, and the creation of odors, slimes or unsightly deposits.

Q. A user supervisor should be appointed by the user. The user supervisor should be responsible for installation, operation and maintenance of the reclamation system, prevention of potential hazards, implementing these Guidelines, and coordination with the cross-connection control program of the water purveyor or the local health department.

R. The user should maintain as-built plans of the use area showing all buildings, domestic and reclaimed water facilities, the sewage collection system, etc. Plans should be updated as modifications are made.

S. A contingency plan including notification of the RWQCB and health agencies should be developed outlining the action to be taken in the event effluent quality fails to meet required standards.

T. Inspection, supervision and employee training should be provided by the user to assure proper operation of the reclaimed water system. Records of inspection and training should be maintained by the user.

U. The producer and/or user should submit a monthly report to the State Department of Health Services and the local health agencies containing:

1. The quality and quantity of water reclaimed.

2. The use (the method of irrigation and the crop(s) and area(s) irrigated).

3. The reason for noncompliance with standards, if appropriate and the corrective action taken.

II. Landscape Irrigation

A. At parks, playgrounds, schoolyards, other areas (e.g. golf courses with contiguous residential development) where the public has similar access or exposure, and other areas irrigated with oxidized, coagulated, clarified, filtered, disinfected wastewater having a 7- day median number of coliform organisms not exceeding 2.2/100 ml, and a maximum concentration of coliform organism not exceeding 23/100 ml in any sample:

(The reclaimed water treatment and quality stated above also applies at use areas having adjacent property where the public may be subject to direct or indirect contact with reclaimed water spray for example; golf courses with contiguous residential development).

1. Adequate signs should be posted indicating that reclaimed wastewater is used for irrigation and is not safe for drinking (e.g. ATTENTION: RECLAIMED WASTEWATER - DO NOT DRINK).

B. At golf courses not included in A. above irrigated with oxidized, disinfected wastewater having a 7-day median number of coliform organisms not exceeding 23/100 ml or any two consecutive coliform samples not exceeding 240/100 ml:

2. Adequate signs should be posted indicating that reclaimed wastewater is used for irrigation and it is not safe for drinking or contact (e.g. ATTENTION: RECLAIMED WASTEWATER AVOID CONTACT - DO NOT DRINK).

3. Score cards should indicate that reclaimed wastewater is used.

4. Irrigation with reclaimed water should not occur in areas where food is handled or consumed.

5. Irrigation should be controlled to prevent ponding and runoff of reclaimed water unless acceptable to the Regulatory Agency.

C. At cemeteries irrigated with oxidized, disinfected wastewater having a 7-day median number of coliform organisms not exceeding 23/100 ml or any two consecutive coliform samples not exceeding 240/100 ml:

1. Irrigation should be scheduled for times the public is not present.

2. Adequate signs should be posted indicating that reclaimed wastewater is used for irrigation and it is not safe for drinking or contact (e.g. ATTENTION: RECLAIMED WASTEWATER AVOID CONTACT - DO NOT DRINK).

3. Potable water should be supplied for flower containers.

4. Irrigation should be controlled to prevent ponding and runoff of reclaimed water unless acceptable to the Regulatory Agency.

D. Highway landscape and other landscaped areas irrigated with oxidized, disinfected wastewater having a 7-day median number of coliform organisms not exceeding 23/100 ml or any two consecutive coliform samples not exceeding 240/100 ml:

1. Signs should be posted along the perimeter at points of access to the use area indicating that reclaimed wastewater is used for irrigation and it is not safe for drinking or contact (e.g. ATTENTION: RECLAIMED WASTEWATER AVOID CONTACT - DO NOT DRINK).

2. Irrigation should be controlled to prevent ponding and runoff of reclaimed water unless acceptable to the Regulatory Agency.

III. Impoundments

A. Nonrestricted recreational impoundments containing oxidized, coagulated, clarified filtered, disinfected wastewater having a 7-day median number of coliform organisms not exceeding 2.2/100 ml and a maximum concentration of coliform organisms not exceeding 23/100 ml in

1. Impoundments should have perimeter signs indicating that the wastewater stored is not safe for drinking (e.g. ATTENTION: RECLAIMED WASTEWATER - DO NOT DRINK).

2. Runoff should be prevented from entering the pond unless the impoundment is sized to accept the runoff without discharge or an NPDES permit has been issued for the discharge.

3. There should be no discharge of reclaimed water to any pond with less than one foot of freeboard unless discharge from the pond is allowed by NPDES permit.

B. Restricted recreational impoundments containing oxidized, disinfected wastewater having a 7-day median number of coliform organisms not exceeding 2.2/100 ml:

1. Impoundments should have perimeter signs indicating that the wastewater stored is not safe for drinking or body contact (e.g. ATTENTION: RECLAIMED WASTEWATER AVOID CONTACT - DO NOT DRINK).

2. Runoff should be prevented from entering the pond unless the impoundment is sized to accept the runoff without discharge or an NPDES permit has been issued for the discharge.

3. There should be no discharge of reclaimed water to any pond with less than one foot of freeboard unless discharge from the pond is allowed by NPDES permit.

C. Landscape impoundments containing oxidized, disinfected wastewater having a 7-day median number of coliform organisms not exceeding 23/100 ml:

1. Impoundments should have perimeter signs indicating that the wastewater stored is not safe for drinking or body contact(e.g. ATTENTION: RECLAIMED WASTEWATER AVOID CONTACT - DO NOT DRINK).

2. Runoff should be prevented from entering the pond unless the impoundment is sized to accept the runoff without discharge or an NPDES permit has been issued for the discharge.

3. There should be no discharge of reclaimed water to any pond with less than one foot of freeboard unless discharge from the pond is allowed by NPDES permit.

IV. Agricultural Reuse Area Guidelines

A. At areas irrigated with undisinfected primary or undisinfected seconday effluent:

1. Warning signs reading "SEWAGE DISPOSAL AREA - KEEP OUT" should be posted at least every 500 feet with a minimum of one sign at each corner and one at each access road.

2. Fencing or other barriers should be installed where needed to restrict public access.

3. The perimeter of the disposal area should be graded to prevent ponding along public roads or other public areas.

4. Setbacks

   a. Surface Irrigation - setbacks should be established where needed to restrict public contact.

   b. Spray Irrigation - there should be no irrigation within 500 feet of the authorized spray boundary. A setback of less than 500 feet may be approved if warranted by the use area design. Some of the use area characteristics to be taken into account are: wind velocity and direction, topography, sprinkler characteristics and controls.

B. At areas irrigated with oxidized, disinfected, wastewater having a 7-day median number of coliform organisms not exceeding 23/100 ml:

1. Perimeter warning signs indicating that the reclaimed wastewater is not safe for drinking or contact (e.g. WARNING: RECLAIMED WASTEWATER AVOID CONTACT - DO NOT DRINK) should be posted at least every 500 feet with a minimum of one sign at each corner and one at each access road.

2. Fencing should be installed where needed to restrict public access.

3. The perimeter of the disposal area should be graded to prevent ponding along public roads or other public areas.

4. Setbacks

   a. Surface Irrigation - Setbacks should be established where needed to restrict public contact.

   b. Spray Irrigation - The amount of setback is to be determined by the use of the adjoining property.

C. At areas irrigated with oxidized, disinfected wastewater having a 7-day median number of coliform organisms not exceeding 2.2/100 ml:

1. Warning signs indicating that the reclaimed wastewater is not safe for drinking or contact (e.g. WARNING: RECLAIMED WASTEWATER AVOID CONTACT - DO NOT DRINK) should be posted with a minimum of one sign at each corner and one at each access road.

2. Fencing or other barriers should be installed where needed to restrict public access.

3. The perimeter of the disposal area should be graded to prevent ponding along public roads or other public areas.

4. Setbacks

   a. Surface Irrigation - Setbacks should be established where needed to restrict public contact.

   b. Spray Irrigation - The amount of setback is to be determined by the use of the adjoining property.

D. At areas irrigated with oxidized, disinfected, coagulated, clarified, filtered, disinfected wastewater having a 7-day median number of coliform organisms not exceeding 2.2/100 ml:

   a. Warning signs indicating that the reclaimed wastewater is unsafe to drink (e.g. WARNING: RECLAIMED WASTEWATER - DO NOT DRINK) should be posted every 500 feet with a minimum of one sign at each corner and one at each access road.

E. The following table indicates the minimum degree of treatment for the specific types of crops and methods of application:

TREATMENT GUIDELINES FOR AGRICULTURAL USE OF RECLAIMED WATER

MINIMUM DEGREE OF TREATMENT FOR TYPE OF CROP AND METHOD OF APPLICATION

TYPE OF CROP	PRIMARY EFFLUENT	OXIDIZED, DISINFECTED TO 23 mpn/100 ml	OXIDIZED, DISINFECTED TO 2.2 mpn/100 ml	OXIDIZED, COAGULATE CLARIFIED, FILTERE DISINFECTED TO 2.2 mpn/100 ml
GENERAL				
Crops	*	*	Surface(1)	Surface or Spray
essed Food (2)	*	Surface or Spray	Surface or Spray	Surface or Spray
ards and Vineyards	Surface(3)	Surface(3)	Surface(3)	Surface or Spray
er, Fiber and (4) Crops	Surface or Spray	Surface or Spray	Surface or Spray	Surface or Spray
for Animals	*	Surface or Spray	Surface or Spray	Surface or Spray
SPECIFIC				
ice eral (Lettuce, rrots, etc.)	*	*	*	Surface or Spray
atoes - nprocessed)	*	*	Surface (3)	Surface or Spray
atoes(2) rocessed - No leaning)	*	Surface or Spray	Surface or Spray	Surface or Spray
uberries	*	*	*	Surface or Spray
ichokes	*	*	Surface (3)	Surface or Spray
rcress	*	*	*	Surface or Spray
ets	*	Surface or Spray	Surface or Spray	Surface or Spray
for human mption	*	*	Surface (3)	Surface or Spray

No effluent allowed in irrigation water because of mosquito propagation problems.

YPE OF CROP	PRIMARY EFFLUENT	OXIDIZED, DISINFECTED TO 23 mpn/100 ml	OXIDIZED, DISINFECTED TO 2.2 mpn/100 ml	OXIDIZED, COAGULATE CLARIFIED, FILTERE DISINFECTED TO 2.2 mpn/100 ml
and Vines - st Protection	Surface	Surface or Spray (5)	Surface or Spray (5)	Surface or Spray
achio or Walnut	*	*	*	Surface or Spray
nd	*	*	*	Surface or Spray
rus	Surface (3)	Surface (3)	Surface (3)	Surface or Spray
ado	Surface (3)	Surface (3)	Surface (3)	Surface or Spray
re	Surface (3)	Surface (3)	Surface or Spray	Surface or Spray
Crops				
	*	*	Surface or Spray	Surface or Spray
cal Nursery k	*	*	Surface or Spray	Surface or Spray
mas Trees	*	Surface or Spray	Surface or Spray	Surface or Spray
od omer Cut	*	Surface or Spray	Surface or Spray	Surface or Spray
od Customer Cut	Surface or Spray	Surface or Spray	Surface or Spray	Surface or Spray

t Allowed

t acceptable for root crops or crops where edible parts touch the ground.

ocessed food crops must undergo extensive commercial, physical or chemical processing fficient to destroy pathogenic agents. Processing does not include washing, pickling, rmenting, or milling.

ible portion of plant does not contact the ground.

for human ingestion.

praying within 30 days of fruit formation.

V. Guidelines for Worker Protection

A. Workers should be informed of the potential health hazards involved with contact or ingestion of reclaimed water, and should be educated regarding proper hygienic procedures to protect themselves and their families.

B. Precautionary measures should be taken to minimize worker contact with reclaimed water.

1. Workers should not be subjected to reclaimed water sprays.

2. Workers should be provided with protective clothing when there will be more than casual contact with the reclaimed water.

3. Where oxidized, coagulated, clarified, filtered, disinfected wastewater is used, less stringent precautions may be allowed.

C. Safe drinking water should be supplied for workers. Where bottled water is provided, the water should be in contamination-proof containers and protected from reclaimed water and dust.

D. Handwashing facilities should be provided.

E. Precautions should be taken to avoid contamination of food taken into reclaimed water use areas. Food should not be taken into areas still wet with reclaimed water.

F. Workers should be notified that reclaimed water is in use. Notification should include the posting of conspicuous warning signs with proper wording of sufficient size to be clearly read.

In those locations where English is not the primary language of the workers, the signs should be in the appropriate language as well as English.

G. An adequate first aid kit should be available on location.

GUIDELINE FOR THE PREPARATION OF AN ENGINEERING REPORT ON THE PRODUCTION, DISTRIBUTION, AND USE OF RECLAIMED WATER

1.0 INTRODUCTION

The Wastewater Reclamation Criteria require the submission of an engineering report to the Regional Water Quality Control Board and the Department of Health Services before wastewater reclamation projects are implemented. The report shall be amended prior to any modification to the project. The report shall describe the manner by which the projects will comply with the Wastewater Reclamation Criteria and conform to the Guidelines for Use of Reclaimed Water. The Wastewater Reclamation Criteria are contained in Sections 60301 to 60355, inclusive, of the California Administrative Code, Title 22, and prescribe:

+ Reclaimed water quality and wastewater treatment requirements for the various forms of use of reclaimed water, and
+ Reliability features required for the treatment facilities to ensure safe performance.

Section 60323 of the Wastewater Reclamation Criteria specifies that the report be prepared by a properly qualified engineer, registered in California and experienced in the field of wastewater treatment.

Reclamation projects vary in complexity. Therefore, reports will vary in content, and the detail presented will depend on the scope of the proposed project and the number and nature of the agencies involved in the production, distribution, and use of the reclaimed water. The report must contain sufficient information to assure the regulatory agencies that the degree of treatment and reliability is commensurate with the proposed use, and that the distribution and use of the reclaimed water will not create a health hazard or

2.0 PRODUCER

The producer is the public or private entity that will treat the wastewater used in the project. Where more than one agency is involved in the treatment, the responsibilities of each agency must be described.

2.1 Reclaimed Water

State the treatment processes and quality of water that are required and will be provided for each use.

2.2 Raw Wastewater

2.21 State the chemical quality.

2.22 State the proportion and type of industrial waste.

2.3 Treatment Processes

2.31 Provide a schematic of the treatment train.

2.32 Describe the treatment processes and the loading rates and/or contact times.

All filtration design criteria must be provided (filtration and backwash rates, filter depth and media specifications). The expected turbidities of the filter influent (prior to the addition of chemicals) and the filter effluent must be stated.

2.33 State the chemicals that will be used, the method of mixing, the point of application, and the dosages.

2.4 Plant Reliability Features

The plant reliability features proposed to comply with Sections 60333 - 60355 of the Wastewater Reclamation Criteria must be described in detail. The discussion of each reliability feature must state under what conditions it will be actuated. When alarms are used to indicate system failure, the report must state where the alarm will be received, how the location is manned, and who will be notified. The report must state the hours the plant will be manned.

2.5 Supplemental Water Supply

The report must describe all supplemental water supplies. The description must include:

+ Source

+ Quality

+ Quantity available

2.6 Monitoring

The report must describe a monitoring program than complies with the Wastewater Reclamation Criteria, and includes the frequency and location of sampling. Where continuous analyses and recording equipment is used, the method and frequency of calibration must be stated. All analyses shall be performed by a laboratory approved by the State Department of Health Services.

2.7 Contingency Plan

Section 60323 (c) of the Wastewater Reclamation Criteria requires that the engineering report contain a contingency plan designed to prevent inadequately treated wastewater from being delivered to the user. The "Contingency Plan" must include:

+ A list of conditions which would require an immediate diversion to take place;

+ A description of the diversion procedures;

+ Designation of the diversion area;

+ A plan for the disposal or treatment of any inadequately treated effluent;

+ A plan for notifying the reclaimed water user, the regional board, the state and local health departments, and other agencies as appropriate of any treatment failures that could result in the delivery of inadequately treated wastewater to the use area.

3.0 TRANSMISSION AND DISTRIBUTION SYSTEMS

Maps showing the location of the transmission facilities and the distribution system layout must be provided. The plans must include the location of all water and sewer lines. The report must describe how the transmission and distribution systems will comply with the following documents:

+ Guidelines for the Distribution of Non-potable Water, California-Nevada Section AWWA
+ Guidelines for Use of Reclaimed Water (DOHS)
+ Regulations Relating to Cross-Connections (Title 17, Chapter 5, Subchapter 1)
+ Manual of Cross-Connection Control / Procedures and Practices (DOHS)

Any deviation from the above, and the necessity therefore, must be discussed in the report.

4.0 USE AREAS

4.1 Use Area Description

The description of each use area must include:

+ The land use;
+ The type of reuse proposed;
+ The party responsible for the distribution and use of the reclaimed water at the site;
+ A map showing:
  - Specific areas of use
  - Areas of public access
  - Surrounding land use
  - The location of wells in or near the use area

+ Other Industrial Uses

  - The appropriate information shall be determined on a case by case basis

4.2 Use Area Design

The report must discuss how the facilities will be designed to minimize the chance of reclaimed water leaving the designated use area. The design must be in conformance with the Guidelines for Use of Reclaimed Water. Any proposed deviation from the Guidelines, and the necessity therefore, must be discussed in the report. Any domestic water distribution system shall be protected from the reclaimed water in accordance with the Regulations Relating to Cross-Connections.

4.3 Use Area Inspections and Monitoring

Identify the locations at the use area where problems are most likely to occur (e.g. ponding, runoff, overspray) and propose a program of inspection and reporting.

4.4 Contingency Plan

The report must identify the actions and precautions to be taken to protect the public health in the event inadequately treated water is delivered. The plan must include notification of the appropriate regulatory agencies and the exposed public. The plan must discuss the provisions for a backup water supply.

4.5 Employee Training

The report must describe the training the use area employees will receive to ensure compliance with the Wastewater Reclamation Criteria and Guidelines for Use of Reclaimed Water. The report must identify the entity that will provide the training and the frequency of training.

4.6 Rules and Regulations

The procedures, restrictions, and other requirements that are to be followed by the distributor and/or user must be described. The requirements and restrictions should be codified into a set of rules and regulations. The "Rules and Regulations" should be developed in accordance with "Guidelines for Use of Reclaimed Water". The Rules and Regulations should include measures to be used to protect the public health and prevent cross-connections. Describe in the report the feasibility of the adoption of enforceable Regulations to cover all the distribution systems and use areas, and identify the agency or agencies that would adopt them.

In addition to the general information, the following must be provided for these specific proposed uses:

+ Irrigation
  - Type of irrigation (e.g. landscape, specific food crop)
  - Method of irrigation (e.g. spray, flood, drip)
  - The location of domestic water supply facilities in or adjacent to the use area
  - The depth to groundwater underlying the use area and a description of the quality
  - The direction of drainage and a description of the area to which the drainage will flow
  - For spray irrigation a wind rose or the best available wind data are needed
  - The proposed irrigation schedule

+ Impoundments
  - The type of recreational activity to be allowed on the impoundment
  - The conditions under which the impoundment can be expected to overflow and the expected frequency
  - The direction of drainage and a description of the area to which the drainage will flow
  - The depth to groundwater underlying the use area and a description of the quality and use of the groundwater
  - A description of the soil profile underlying the use area

+ Cooling
  - Type of cooling system
  - A wind rose or the best available wind data

+ Groundwater Recharge
  - The appropriate information shall be determined on a case by case basis

APPENDIX C

RECYCLED WATER DESIGN AND CONSTRUCTION STANDARDS

BY THE

VENTURA COUNTY WATERWORKS DISTRICT NO. 8

CITY OF SIMI VALLEY

Recycled Water Design and Construction Standards

Ventura County
Waterworks District No. 8

Final

VENTURA COUNTY WATERWORKS
DISTRICT NO. 8
DESIGN AND CONSTRUCTION STANDARDS
RULES & REGULATIONS
FOR
RECYCLED WATER USE
SERVING THE CITY OF SIMI VALLEY

December 10, 2003

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1.0 INTRODUCTION AND GENERAL POLICIES

1.1 INTRODUCTION

Ventura County Water Works District No. 8 ("District") ("DISTRICT #8") is in the process of expanding its current recycled water service. The District falls within the jurisdiction of the Los Angeles Regional Water Quality Control Board (LARWQCB), whose goal and mission statement is to promote the beneficial use of treated wastewater through reclamation. LARWQCB's mission is to preserve and enhance the quality of California's water resources for the benefit of present and future generations. In an effort to pursue this goal, the District has chosen to offer recycled water to future customers to protect, preserve, and conserve ground and surface water resources in Ventura County as well as surrounding counties, helping conserve California's water supply.

1.2 PURPOSE

The purpose of these "Design and Construction Standards, Rules and Regulations for Recycled Water Use" (Recycled Water Standards and/or Rules and Regulations) is to establish standard procedures, specifications, and limitations for the safe and orderly development and operation of recycled water facilities and systems in the District's jurisdictional area. These Standards/Regulations cover the administrative, design, construction, operation and maintenance requirements, for obtaining recycled water service and the use of recycled water in onsite facilities, and aspects of the relationship between customers and the District. Reference "Rules and Regulations" for recycled water use of LARWQCB and DHS for other coverage.

1.3 SCOPE

These regulations are adopted to:

1.3.1 Promote Conservation

Achieve conservation of potable water supplies by using recycled water to the maximum extent possible for current and future demands. Recycled water uses shall be for the maximum public benefit and may include:

- agricultural irrigation
- commercial uses (including flushing toilets and urinals)
- construction use
- groundwater recharge
- industrial processes
- landscape irrigation
- landscape and/or recreational impoundments
- wildlife habitat

and others as may be approved by the District, LARWQCB, and State and County Departments of Health Services.

1.3.2 Prevent Human Consumption

Prevent direct human consumption of recycled water through:

- adherence to all applicable rules and regulations in accordance with Title 22
- posting of identification signs by the customer in accordance with Title 22
- cross-connection/backflow prevention and testing programs in accordance with Title 17
- tagging and color coding recycled water equipment in accordance with Title 22

1.3.3 Provide Control and Enforcement

Provide control over the use of the recycled water system to minimize the possibility of a nuisance or pollution as defined in the California Water Code, and provide provisions for enforcement.

1.3.4 Supplement Standard Specifications

Supplement the District's **Water Design and Construction Standards for Domestic Water.**

1.4 DEFINITIONS AND TERMS

Whenever in these specifications or in any documents or instruments where these specification govern, the following terms, abbreviations or definitions are used, the intent and meaning shall be interpreted as follows:

Abbreviations

AASHTO	–	American Association of State Highway and Transportation Officials
ACI	–	American Concrete Institute
ANSI	–	American National Standards Institute
API	–	American Petroleum Institute
ASCE	–	American Society of Civil Engineers
ASTM	–	American Society for Testing and Materials
AWWA	–	American Water Works Association
DHS	–	The Department of Health Services
UBC	–	Uniform Building Code
UPC	–	Uniform Plumbing Code
VCFPD	–	Ventura County Fire Protection District

Definitions

"Aerosol"	(see Windblown Spray).
"Air-Gap Separation"	A physical break between a supply pipe and a receiving vessel. The air-gap shall be at least double the diameter of the supply pipe, measured vertically above the flood rim of the vessel, and in no case less than one inch. The design shall be to the satisfaction of the City of Simi Valley.
"American Water Works Association (AWWA)"	The American Water Works Association California-Nevada Section.
"Applicant"	An owner, developer, builder, engineer, or authorized representative, firm, corporation, association, or agency who applies for recycled water service under the terms of these regulations. A successful applicant becomes a customer.
"Application Rate"	The rate at which water is applied to an irrigation or construction area, expressed in inches per day or gallons per minute per acre.
"Approved Backflow Prevention Assembly"	A device installed to protect the potable water supply from contamination by recycled water, such as treated wastewater. This device shall be approved by the DOHS and the District in conformance with Title 17.
"Approved Check Valve"	A watertight semiautomatic device which seats readily and completely and is designed to permit flow in only one direction, as approved by California State Health Services Department and the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, School of Engineering (USC).
"Approved Use"	An application of recycled water in a manner, and for a purpose, designated in a Use Permit issued by the District and in compliance with any and all applicable regulatory agency requirements.
"Approved Use Area"	A site with well-defined boundaries, designated in a Use Permit to receive recycled water for an approved use and acknowledged by the District and any and all applicable regulatory agencies.
"ASTM"	American Standard Testing and Materials.
"AWWA Guidelines"	American Water Works Association **Guidelines for Distribution of Nonpotable Water,** California-Nevada Section, latest edition.
"AWWA Standards"	American Water Works Association **Standards for Construction Materials,** latest edition.
"Board"	The Board of Directors of the Ventura County Waterworks District No. 8.
"City"	City of Simi Valley.

"Commercial Use"	Water used for toilets, urinals, decorative fountains, cooling towers, and other related uses.
"Construction Use"	An approved use of recycled water to support construction activities such as soil compaction and dust control during grading.
"Contractor"	The person(s), firm, or corporation entering into a contract with the District, owner, or user for the performance of work on all or any portion of facilities subject to these regulations.
"County"	The County of Ventura, State of California; more particularly for these standards, the Environmental Health Division of the Resource Management Agency.
"Cross Connection"	Any unprotected actual or potential connection between a potable water system and any source or system containing unapproved water or a substance that is not or cannot be approved safe, wholesome, and potable. By-pass arrangements, jumper connections, removable sections, swivel or change-over devices, and other devices through which backflow could occur, shall be considered to be cross-connections.
"Customer"	Any person, firm, corporation, association, or agency who holds a valid user permit issued by the City for use of its recycled water facilities. (User)
"Design Area"	A site, with well-defined boundaries, proposed to receive recycled water for an approved use, as delineated in an Application for Recycled Water Service.
"Design Consultant"	Any person or firm registered with the State of California providing site layout, landscaping, or irrigation system design services.
"Department of Health Services"	The Department of Health Services (DHS) of the State of California, Drinking Water Field Operations Branch in Carpinteria, California.
"DHS"	The Department of Health Services (DHS) of the State of California, Drinking Water Field Operations Branch in Carpinteria, California.
"Direct Beneficial Use"	The use of recycled water which has been transported from the point of production to the point of use without an intervening discharge to waters of the State.
"Direct Overspray"	Any discharge of water directly or indirectly onto areas other than that for which the application of recycled water is approved.
"Director"	The Director of Public Works of the City of Simi Valley, and shall include deputies and representatives as may be assigned to perform the duties of the District.
"Discharge"	Any release or distribution of recycled water to a use area or disposal (outfall, live stream). All discharges of recycled water must be approved by the regulatory agencies.

"Discharge Permit"	A permit issued by the LARWQCB for the discharge of recycled water.
"District"	The Ventura County Waterworks District No. 8.
"District Approval"	Approval of the District Engineer or supervising District Engineering staff.
"District Engineer"	The Director of Public Works of the City, or other registered civil engineer designated to oversee the interests and functions of the District.
"District Manager"	The City Manager acting in the capacity of Manager of the District.
"Effluent"	Treated wastewater discharged from a water reclamation plant.
"Engineer"	A professional engineer or firm of professional engineers appointed by and acting for the District Engineer on a District sponsored capital project. For a private development project, the term refers to the engineer hired by the developer and may also be referred to as the "developer's engineer" or "engineer of record".
"FEMA"	Federal Emergency Management Agency
"Fire Department"	Ventura County Fire Protection District.
"Fire Service Line"	A line whose sole function is to service a particular building or property with fire protection.
"General Public"	Any person(s) at large who may come in contact with facilities and/or areas where recycled water is approved for use.
"GPH"	The rate of water delivery in gallons per hour.
"GPM"	The rate of water delivery in gallons per minute.
"Gray Water"	Untreated wastewater other than toilet and/or urinal wastes.
"Greenbelt Areas"	Parcels of recreational or unoccupied public or private lands within the service area, including but not limited to, golf courses, cemeteries, parks and landscaping of common areas.
"HCF"	The unit of water quantity measurement delivered to the customer in hundreds of cubic feet.
"House Plumbing"	Plumbing fixtures, devices, and piping within a building or structure including pipes on the property from the meter. (Onsite Facilities)
"Improvement District (ID)"	Subarea of the District formed to set up assessments to pay for bonds sold to construct water and sewer facilities benefiting landowners in that subarea.

"Industrial Use"	Water used for industrial processes such as cooling, flushing, or construction, and other related uses.
"Infiltration Rate"	The rate at which soil will accept water without overland flow, expressed in inches per hour.
"Inspector"	An employee or agent of the District engaged to observe and record field compliance with design criteria, plans, construction standards.
"Installer"	A person(s) or firm performing work necessary to construct or install equipment or facilities subject to these Regulations.
"Landscape Impoundment"	A body of water which is used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.
"Landscape Irrigation"	Water used for the propagation and maintenance of trees, shrubs, groundcover and turf.
"LARWQCB"	California Regional Water Quality Control Board, Los Angeles.
"MGD"	The rate of water delivery in million gallons per day.
"Nonpotable Water"	Water that is not intended for human consumption.
"Offsite Facilities"	Existing or proposed facilities under the control of the District, from the source of supply to the point of connection with the customer's onsite facilities, up to and including the District's meter and meter box.
"Offsite" or "Off-Tract Water Line"	A water line beyond tract boundaries connecting the water lines with the District's system.
"Onsite Facilities"	Existing or proposed facilities within property under the control of the customer or owner, normally downstream of the District's meter tailpiece. (House Plumbing)
"Onsite Supervisor"	A qualified person designated by a recycled water customer and approved by the District to be responsible for the safe and efficient operation of the customer's recycled water system. This person shall be knowledgeable in the construction and operation of recycled water and irrigation systems and in the application of Federal, State and local guidelines, criteria, standards and regulations governing the use of recycled water. This person shall be trained in cross-connection control to the satisfaction of the District.
"Operator"	Any person(s) or firm, who by entering into an agreement with a user is responsible for operating onsite facilities.
"Operator's Personnel"	Any employee of the user, owner, or customer, whether permanent or temporary, or any contracted worker whose regular or assigned work involves the supervision, operation, or maintenance of equipment, facilities, or a system using recycled water.

"Owner"	Any holder of legal title, contract purchaser, or lessee under a lease with an unexpired term of more than one (1) year, of property for which recycled water service has been requested or established.
"Peak Moisture Demand"	The demand during the highest period of combined evapotranspiration (ET_0) and crop coefficient (K_c) for a specific site and plant material being irrigated on that site.
"Permit"	See Use Permit
"Permitted Capacity of Recycled Water"	The amount of recycled water that the customer is entitled to have for the area and use specified in the recycled water user permit.
"Permittee"	The permittee or customer operating under a Use Permit for recycled water or the installation or construction of recycled water facilities.
"Person"	Any public or private individual, partnership, corporation, agency, or association, including a homeowners' association.
"Planning Department"	The Planning Department of the City of Simi Valley.
"Plans"	Drawings for the installation of water pipelines, reservoirs, pump stations, wells, valves and details.
"Plate No."	Where not specified to the contrary, this refers to plates attached to these standards.
"POC"	The point of connection of the onsite facilities to the offsite facilities of the recycled water distribution system.
"Ponding"	The retention of recycled water on the surface of the ground or man-made surfaces, other than the designated use area, for a period of time following the cessation of an approved recycled water use activity such that a hazard or potential hazard to public health results.
"Potable Water"	Water that is pure, wholesome and suitable for human consumption, and which conforms to the latest edition of the United States Public Health Service Drinking Water Standards, the California Safe Drinking Water Act, and any other applicable standards.
"Pressure Zone"	The zone of operational pressure range within the District system as defined by elevation, i.e., Zone II, el. 1,090; same as service zone.
"Producer"	An agency which produces recycled water.
"Public Works Department"	The department established by the City to administer the public infrastructure systems, including those of the District.
"Record Drawings"	Drawings which show the constructed facilities, including all revisions to the original plans. (As-Built Plans)

"Recreational Impoundment"	A body of water used for recreational activities including, but not limited to, fishing, boating, and/or swimming. Allowable uses with recycled water depend on treatment level.
"Recycled Water"	Recycled water shall have the definition set forth in Title 22, Division 4 of the California Code of Regulations and shall mean water which, as a result of treatment of wastewater, is suitable for a direct beneficial use or a controlled use that otherwise would not occur. Specifically excluded from this definition is gray water.
"Recycled Water Facilities"	Systems, structures, etc., used in the treatment, storage, pumping, transmission and distribution of recycled water.
"Recycled Water Service Connection"	The point of connection (POC) of the customer's recycled water line with the recycled water service line of the District, which shall normally be the downstream end of the recycled water meter tailpiece.
"Recycled Water Service Line"	The District's pipeline between its recycled water distribution system and the recycled water service connection. Abbreviated as "RWSL".
"Recycled Water System"	District facilities that produce, convey, supply, store and intercept recycled water.
"Reduced Pressure Principle Backflow Prevention Assembly"	A backflow prevention device incorporating not less than two check valves, an automatically-operated differential relief valve located between the two check valves, and a completely closing shut-off valve on each side of the check valve assembly, equipped with test cocks for testing.
"Regulations"	These "Design and Construction Standards, Rules and Regulations for Recycled Water Use" prepared pursuant to the Discharge Permit and all rules and regulations of any other local or State agency or other regulations referred to and incorporated herein.
"Regulatory Agencies"	Those public agencies legally constituted to protect the public health and water quality and having regulatory authority over the District, such as the Reclamation Authority, the California Department of Health Services, the California Regional Water Quality Control Board, Ventura County Environmental Health, and others as may be appropriate.
"Required"	Unless specifically otherwise indicated, this shall mean a requirement of the District.
"Required Fire Flow"	A requirement established for each project as determined by the VCFPD using Insurance Services Office guidelines.
"Runoff"	Flow of water along the surface of the ground or other natural or man-made surface, including but not limited to, pedestrian walkways, streets, playground surfaces and grassy slopes.

"RWQCB"	The Regional Water Quality Control Board of the State of California, Los Angeles Region.
"Schedule of Rates"	A schedule containing fees, charges, and deposits determined and issued by the City for the uses and services of recycled water.
"Separation"	The horizontal and/or vertical distance between a recycled water pipeline and a parallel potable water pipeline, sewer pipeline, or a sludge force main. The separation shall be the clear out-to-out distance between the pipelines in question.
"Service"	The furnishing of recycled water to a customer through a metered or unmetered connection to onsite facilities.
"Service Area"	All areas identified for potential or actual recycled water use in the Water Reclamation and Reuse Conceptual Master Plan, and the Recycled Water Distribution Master Plan, including all subsequent revisions and updates for use of recycled water within Ventura County.
"Service Lateral"	The facility between the onsite facilities and the offsite facilities to the POC.
"Spray Irrigation"	Application of water to land to maintain vegetation or support growth of vegetation by spraying it from sprinklers or orifices in piping.
"SSPWC"	The latest edition of the Standard Specifications for Public Works Construction, including the Regional Supplement Amendments of the County of Ventura, commonly known as the "Green Book".
"Standard Specifications"	Specifications adopted by the District for construction of water and recycled water facilities.
"Surface Irrigation"	Application of water to land to maintain vegetation by means other than spraying.
"Tenant"	Any person, group, firm, partnership, corporation, association, or agency who pays rent to occupy and use land or a building.
"Terms"	All opinion or judgment, such as approvals, requirements, directions, or acceptances of the District.
"Tertiary Effluent"	Secondary effluent which as been disinfected and filtered consistent with provisions of California Code of Regulations Title 22.
"Transfer"	The conveyance or movement of water from one agency to another agency. Transfer includes the conveyance of control or responsibility of a volume of water stored in a storage facility commonly owned or controlled by more than one agency.
"Treated Wastewater"	Wastewater treated in accordance with the requirements of "Wastewater Reclamation Criteria," of the California Code of Regulations Title 22.

"UL"	Underwriter's Laboratory.
"Unauthorized Discharge"	Any release of recycled water that violates these Rules and Regulations or any applicable Federal, State, or local statues, regulations, ordinances, contracts, or other requirements.
"UPC"	Uniform Plumbing Code.
"Use Area"	The specific area designated to be served with recycled water through onsite facilities.
"Use Permit"	A permit issued by the District to a recycled water service applicant after the satisfactory completion of the service application procedures set forth in these regulations. The permit constitutes a service agreement that legally binds the customer to all conditions in these Rules and Regulations and to any and all applicable regulatory agency requirements.
"User"	Any person, group, firm, partnership, corporation, association, or agency approved to use recycled water by having been issued a user permit by the District. (Customer)
"VCEHD"	Ventura County Environmental Health Division (of the Resource Management Agency).
"Violation"	Noncompliance with any condition or conditions of these regulations and/or a Use Permit by any person, action or occurrence, whether willfully or by accident.
"Water Reclamation"	The planned renovation of wastewater to produce an effluent that is approved for specific beneficial uses by the appropriate regulatory agency.
"Windblown Spray"	Dispersed, airborne irrigation water or recycled water capable of being transmitted through the air by natural or manmade wind to locations other than that for which the direct application of irrigation water or recycled water is approved.
"Work"	The entire improvement proposed to be constructed pursuant to a permit or legal agreement and consistent with these Rules and Regulations.

1.5 APPLICABLE CODES AND POLICY

A. Ordinances, requirements, and applicable standards of governmental agencies having jurisdiction within the District's service area shall be observed in the design, construction, and operation of water systems. Such requirements include, but are not limited to current revisions of the following:

1. The American Water Works Association Standards.

2. The Uniform Plumbing Code as amended by the City of Simi Valley Building and Safety Division.

3. Road encroachment regulations of the City of Simi Valley or the County of Ventura, as applicable.

4. Standard Specifications – State of California Business and Transportation Agency, Department of Transportation Standard Specifications, current edition (CALTRANS), or Building News, Inc. (BNI) publication entitled "Standard Specifications for Public Works Construction", (commonly known as the "Greenbook") current edition and supplements.

5. Ventura County Environmental Health Standards and Codes.

6. State Department of Health Services Standards and Codes.

1.6 DISTRICT JURISDICTION

The District provides approval of plans and inspection of all public water and recycled water lines and service lines within public rights-of-way and easements of the District's water service area. For potable water, the Building and Safety Division, City of Simi Valley, has jurisdiction for all onsite facilities beyond the water meter. Outside of the City limits, the Ventura County Building and Safety Department has jurisdiction. However, due to the nature of recycled water use requirements, including identification and periodic onsite inspections, the District will provide onsite recycled water permitting and inspection.

Inspection above the pipe zone (trench and pavement) in public street areas is provided by the Public Works Department, either City or County, as appropriate.

Where repairs or replacement of a service line on the District's side of the meter is required subsequent to initial construction, it is the responsibility of the District, unless it is an upgrade situation. In such case, the owner or customer may either be permitted by the District to perform the work or may be required to post a cash deposit for the actual costs to be incurred by the District for the work. Conversely, repairs or replacement on the customer side of the meter are the responsibility of the property owner.

1.7 FIRE PROTECTION

Within the District and surrounding Ventura County areas, fire protection is provided by the Ventura County Fire Protection District (VCFPD) although water systems are owned by the water purveyors. The District reserves the right to assess the suitability of recycled water use for fire protection purposes on a case-by-case basis; however, this use is not anticipated in the foreseeable future.

1.8 WATER PURVEYORS WITHIN CITY

Within the City there are two water purveyors:

- Ventura County Water Works District No. 8
- Southern California Water Company

These standards address Ventura County Waterworks District No. 8 requirements.

1.9 DEVELOPER'S ENGINEER'S RESPONSIBILITY

These standards establish uniform policies and procedures for the design and construction of the District recycled water system. They are not intended to be a substitute for engineering knowledge, judgment, or experience. The procedures shall be reviewed by the developer's engineer and applied as necessary to a project. Proposed deviations from these standards shall be submitted for approval, in writing, prior to tentative map and/or development project approval.

It is the developer's engineer's responsibility to be aware of the District's Water System Master Plan and/or any applicable specific plan for water system improvements and to indicate any necessary main line relocations, extensions or oversizing on the tentative tract map exhibit. This responsibility shall include investigating any changes from the Master Plan necessitated by development subsequent to the Master Plan, but shall not relieve the developer of the responsibility to provide an approved system consistent with District requirements. Verification of the adequacy of the surrounding water system rests jointly with the District Engineer and the developer.

All plans, specifications, reports, or documents shall be prepared by a registered civil engineer licensed by the State of California, Department of Consumer Affairs, or by a subordinate employee under the civil engineer's direct supervision, and shall be signed and stamped with the civil engineer's seal to indicate responsibility for each plan, specification, report, or document.

A "Review" and/or "Accepted" signature of the District Engineer on the plans does not in any way relieve the developer's engineer of responsibility to meet all of the District's requirements. The plans may be revised by change order. However, plans that are signed as being authorized for construction generally will not require revisions based upon subsequent revisions to these standards, unless in the District's opinion, a change is necessary due to a significant change in the standards, or unless a developer does not proceed to construction within a reasonable time.

1.10 REFERENCED SPECIFICATIONS

References to standards such as AWWA or ASTM shall refer to the latest edition or revision of such standards unless otherwise specified.

1.11 BOARD OF DIRECTORS ACCEPTANCE

The District will not recommend that a recycled water system be accepted until all applicable requirements of these standards and of the appropriate Public Works Department have been met. Acceptance by the Board of Directors/City Council shall be done in total with all other improvements of a development project.

1.12 SEVERABILITY

If any section, subsection, sentence, clause, phrase, part, or portion of these Design and Construction Standards, and Rules and Regulations is for any reason held to be invalid or unconstitutional, such invalidity shall not affect any of the remaining portions. These Standards, and Rules and Regulations shall be interpreted so as to comply with applicable Federal and State laws and regulations.

1.13 RECYCLED WATER SERVICE REQUIREMENTS

1.13.1 General

The District shall provide recycled water service in accordance with these Rules and Regulations to all areas identified in the District Master Plan and subsequent updates, additions, revisions, or amendments for the use of recycled water, as and when such recycled water becomes available. Notwithstanding this, the District shall not be compelled to effect the availability of recycled water for any project or for any time frame.

1.13.2 Service Conditions

The District shall control and schedule recycled water distribution to customers. The provision of recycled water service and the use of recycled water by any customer shall be subject to all the terms and conditions of these Rules and Regulations.

1.13.3 Application Procedure

1.13.3.1 *Filing Application for Recycled Water Service*

An applicant meeting the requirements for recycled water service shall file an application for recycled water with the Customer Services Division of the City Department of Administrative Services on a standard form designated by the District.

The application form shall contain detailed information concerning the applicant as follows:

a. The applicant's relationship to the property for which recycled water service is requested. In cases where the applicant is not the legal owner of the property, the legal owner shall consent to the application on a supplemental notarized form.

b. The address and legal description of the property covered by the application may be required.

c. The purpose for which the property will be used.

d. The proposed use of recycled water within a specifically defined designated use area on the property.

e. The estimated service requirements for recycled water.

f. The designation of a proposed User's Recycled Water Supervisor.

g. Any special condition for service pursuant to these Rules and Regulations.

An example of the necessary forms is presented in the Appendices section. The Checklist/Action Request Form for Obtaining Recycled Water Service is shown as Appendix 1. The Application for Recycled Water Service is Appendix 2. The Certification Form for Recycled Water Service is in Appendix 3. The onsite maintenance and rating form is in Appendix 4. The final release checklist is in Appendix 5.

The application form, signed by the owner, shall be accompanied by plans and specifications per Section 4 delineating the proposed recycled water designated use area, the proposed location, size,

and type of all recycled water service connections and onsite facilities, and any areas in which recycled water must be specifically excluded.

1.13.3.2 *Compliance of Application with Regulatory Requirements*

The applicant for recycled water shall agree to comply with the requirements of these Rules and Regulations and any and all applicable Federal, State and local statutes, ordinances, regulations and other requirements.

1.13.3.3 *Application Fees and Other Charges*

Application fees, deposits, and capacity charges shall be paid in accordance with the City Schedule of Service Charges and the schedule of rates of the District and shall be subject to all terms and conditions of these Rules and Regulations.

1.13.3.4 *Review of Application by the District*

Upon receipt of an application for recycled water service, the District shall review the application and conduct any necessary investigation in order to determine whether the District shall provide recycled water service. The District may prescribe requirements in writing to the applicant as to the facilities necessary to be constructed including design, manner of construction, method of operation, and conditions of service.

1.13.4 Offsite Facilities/Agreements

1.13.4.1 *Extension of Distribution Mains*

Unless otherwise provided by written agreement between the customer and the District, the customer shall pay for all onsite facilities, including their installation, as well as for recycled water service lines and extension of recycled water transmission and distribution mains in order to provide recycled water service to the customer.

1.13.4.2 *Reimbursement Agreement:*

In cases where a customer/developer requests recycled water services in areas where the District does not have existing transmission and distribution mains, the customer's request for recycled water service shall be subject to the following:

Where the District determines that oversized or additional facilities are needed to accommodate future development, the project may be conditioned upon the applicant financing and developing such extra work. In this event, the District and applicant shall enter into an agreement for cost reimbursement whereby subsequent developers of benefited property will reimburse the original developer for proportional shares of the improvements. Any such reimbursement agreement with a development project shall be a condition of approval, otherwise reimbursement shall not be permitted.

1.13.4.3 *Participation Agreement:*

In cases, where the District has planned capital improvement projects which are scheduled for undertaking and completion on a planned timetable, and where the customer/developer finds the District's plan of implementation and completion too long to wait for, and where the customer chooses to undertake and complete a specific planned capital improvement project of the District with

the customer's own financial resources, then a participation agreement shall be concluded with the customer and the District agreeing on equitable sharing of the financial outlay of the project, and the project shall be completed in accordance with the design and specifications of the District.

1.13.5 Size and Location of Service Connections

The District reserves the right to determine the size and location of recycled water service lines, the service connections, and the meters and shall also have the right to determine the kind and size of backflow prevention devices and any and all other appurtenances to the service.

The District reserves the right to supply recycled water to contiguous areas of a single ownership through a single recycled water service connection.

Common areas owned or operated by homeowners' associations or similar cooperatives should have only one recycled water service connection whenever it is practical.

The recycled water service line shall be extended to a curb line, or property line of the customer's property, abutting upon a public street, highway, road, or District easement in which a recycled water distribution main is installed.

1.13.6 Permits

Following acceptance of the improvement plans, the applicant shall obtain an encroachment permit from the Department of Public Works for the installation of recycled water facilities, both offsite and onsite. This permit shall constitute a District encroachment permit. A recycled water use permit shall also be required.

1.13.7 Establishing Service

Installation of a meter by the District shall constitute approval of service. The use of recycled water shall constitute acknowledgment to comply with all the provisions of these Rules and Regulations, and any additional requirements prescribed by the District, to protect public health and welfare.

The meter shall be installed only after all construction of recycled water facilities has been completed, tested, inspected, and found acceptable by the District, and after all outstanding fees for recycled water service have been paid.

Service shall be effective indefinitely and shall not require renewal, except that the District reserves the right to suspend or terminate service, or to modify its terms and conditions, if any of the following occurs:

a. A change of the owner or customer of the property served by recycled water.

b. A change in the use of the property served by recycled water.

c. A change in the qualitative characteristics of recycled water.

d. A violation of these Rules and Regulations and other applicable regulations.

e. A change in regulations.

1.13.8 Conditions for Recycled Water Service

Recycled water service and any connections for service made under these Rules and Regulations, shall be subject to the following conditions:

1.13.8.1 *Control of Facilities (Liability)*

a. The District shall have control of and shall maintain and repair offsite facilities, recycled water service lines, and meters. The customer shall repair and maintain in good working condition the recycled water service connections and onsite facilities downstream from the meter. The District shall be entitled to inspect and test all connections and onsite facilities in the manner specified in Section 11.

   A customer may request that the meter through which the recycled water is being furnished be examined and tested by the District for the purpose of ascertaining whether or not it is correctly registering the amount of recycled water being delivered through it. In such an event, the customer shall make a request to the Customer Services Division for a Meter Controversy Test.

b. The District/City and its agents shall be indemnified and held harmless by the customer from and against all claims, damages, losses or expenses arising from the use of recycled water or from the use of facilities by which recycled water is conveyed.

1.13.8.2 *Hours of Operation:*

Irrigation with recycled water is restricted to the hours of 9:00 p.m. to 6:00 a.m. unless otherwise stated in the permit, or directed by the District.

1.13.8.3 *Prohibition of Changes:*

The customer shall not make any changes in, or additions to, the recycled water system without the written approval of the District. Any changes or damage to existing onsite facilities, whether the result of intention or unintended, shall be reported immediately to the District.

A recycled water service connection and water meter shall not be used to supply property not covered by the application requesting service.

1.13.8.4 *Subdividing an Approved Service Area*

a. When a property provided with a recycled water service connection and meter is subdivided, such connection and meter shall be considered as serving the lot or parcel of land on which the meter is located. Additional recycled water distribution mains and/or service lines will be required for all subdivided areas in accordance with these Rules and Regulations, unless, with the express written approval of the District, the subdivider provides covenants, conditions, and restrictions (CC&Rs) properly recorded with the County's Recorder for the operation of onsite recycled water facilities serving more than one lot, and also provides easements for recycled water distribution mains and/or service lines or shows easement locations in the CC&Rs.

b. All recycled water used on any premise where a recycled water meter is installed must pass through the meter. Customers shall be charged for all recycled water passing through the meters.

c. Every recycled water service connection and meter assembly shall include an angle ball meter stop, as approved by the District, on the inlet side of the meter, which shall be used exclusively by the District for controlling the recycled water supply through the recycled water service line. If the angle ball meter stop is damaged by the customer's use, repair and/or replacement by the District shall be at the customer's expense.

d. Each customer shall restrict the use of recycled water to those uses set forth in the application for recycled water services approved by the District.

1.13.8.5 *Discontinuation of Recycled Water Service*

By reason of circumstances beyond the control of the District, or in order to protect the facilities of the District, or for the protection of public health, safety, and welfare of the residents or property owners within the District, recycled water service may be reduced or terminated on a temporary or permanent basis under the conditions set forth below:

a. In the event that recycled water is not available for any reason, including, but not limited to, reduced plant production, increased demand, or repairs to facilities.

b. At any time the recycled water does not meet the requirements of the regulatory agencies, including but not limited to those prescribed by the California Code of Regulations, Title 22, Division 4. Recycled water service would, in such case, be renewed at such time that recycled water would again meet the requirements of the regulatory agencies, or at such time that the District would supplement the recycled water system from the potable water system.

c. When the District determines that a water shortage exists, or is threatened, which prevents further recycled water service.

d. At any time that the customer fails to maintain or operate the onsite system as required by these Rules and Regulations or other regulatory standards.

1.13.9 Illegal Connections

No person shall make any connection to recycled water facilities within the District without a use permit. The District reserves the right to terminate service at any time based upon the violations listed in Section 14 of these Rules and Regulations.

1.13.10 Cross-Connection Prevention

1.13.10.1 *Purpose*

The primary purpose of this Article is to protect the District's potable water supply from possible contamination by prohibiting and preventing cross-connections between the potable water distribution system and the recycled water distribution system, in accordance with Title 17, Chapter 5 of the California Code of Regulations. The secondary purpose is to protect the recycled water system from other contaminants.

These provisions are in addition to, and not in lieu of, the controls and requirements of other regulatory agencies, such as the Department of Health Services.

Cross-connection prevention is further discussed in Section 10.

1.13.10.2 *Backflow Prevention*

Regulations governing backflow prevention devices are intended to protect the District's potable water supplies and are not intended to protect customers from potential hazards of cross-connections in the customer's onsite facilities.

a. Approved backflow prevention for the District's recycled water supply shall be provided by the customer in accordance with the specifications and as required by the District and Ventura County Environmental Health.

b. The backflow prevention devices required shall be in accordance with the requirements specified by the District.

c. Provision, installation, maintenance and inspection of backflow prevention devices shall be the sole responsibility and duty of the customer, and at customer's expense. Inspection of backflow prevention devices shall be done at least once a year, or more often in those instances where successive inspections indicate repeated failures. These devices shall be inspected, repaired, overhauled, or replaced at the expense of the customer whenever they are found to be defective. Records of such tests, repairs and overhauls shall be provided to the District, and such records shall be made available to any concerned regulatory agency on request.

The installation and inspection of backflow prevention devices shall be done by a certified inspector at the expense of the customer. The customer shall submit to the District original inspection certificates as proof of compliance. All inspection and testing shall be done to the satisfaction of the District and the regulatory agencies concerned.

1.13.10.3 *Type of Protection*

The level of protection required is related to the degree of hazard that the District determines may potentially exist on the premises served. Minimally a Reduced Pressure Principle Backflow Prevention Device (RPPD) shall be required and Air Gap Separation (AG) shall be required for higher levels of concern (See Plate RW31 and 41, respectively). Requirements relative to various situations, are listed below. Situations not listed shall be evaluated on a case-by-case basis and the appropriate level of protection required shall be determined by the District in consultation with Ventura County Environmental Health and the State Health Department.

1.13.10.3.1 Degree of Hazard:

Sewage and Hazardous Substances:

a. On premises where the District's potable water system is used to supplement the recycled water supply, an air gap separation shall be provided.

b. On premises where recycled water is used and there is no interconnection with the potable water system, an RPPD separation may be used instead of an air gap if approved by the District, County and State.

c. On premises where hazardous materials and toxic substances are stored, handled, or produced in any manner in which the substances may enter either the potable water or the recycled water system, an air gap separation to both systems shall be provided

to avoid contamination of the potable water as well as degradation of the recycled water system. An RPPD may be provided in lieu of an air gap if approved by the District, County, and State.

d. On premises where entry is restricted so that cross-connection inspections cannot be made with sufficient frequency or at sufficiently short notice to assure that cross-connections do not exist, an air gap separation shall be used.

e. On premises where there is a repeated history of cross-connections being established or re-established, an air gap separation shall be used.

1.13.10.3.2 Color-Coding Recycled Water Systems:

Where any property subject to recycled water service utilizes existing facilities for the purpose or contains existing dual or multiple water systems and piping, the exposed portions of recycled water pipelines, valves, and other fittings shall be painted Pantone Purple 512, banded, or marked to distinguish clearly that they are used for recycled water. In addition, all new recycled water facilities, both exposed and unexposed, installed on any such property shall be similarly painted purple, banded, or marked. All recycled water outlets shall be posted with the wording "CAUTION: RECYCLED WATER - DO NOT DRINK". Main shut-off valves shall be clearly identified to distinguish between recycled water and potable water systems.

See Section 3 for specifications and Standard Plates RW73 through 77.

1.13.10.4 Customer's Designated Recycled Water Supervisor

The customer's designated recycled water supervisor, whose qualifications and responsibilities are discussed in Article 5.2.2, shall be responsible for the prevention of any cross-connections on the property, and in the event of a cross-connection to the potable water system, the customer shall immediately shutoff the main recycled water supply valve and depressurize the recycled water system to prevent further mixing with the potable supply, and shall also immediately advise the District of the occurrence of the cross-connection so that appropriate measures may be taken to control any contamination or pollution. The District shall immediately advise local and State health officers.

The customer shall assume all responsibilities for the prevention of cross-connections between the onsite facilities and any potable water supply, and shall indemnify and hold the District/City harmless from and against any claim of damage or loss which is caused or is alleged to have been caused, in whole or in part, by cross-connections of onsite facilities. Notwithstanding this covenant, the customer shall be subject to the rules pertaining to the use of recycled water as otherwise provided herein, including but not limited to those allowing the District, or County Environmental Health to inspect and approve all onsite recycled water facilities as provided in Section 11.

1.13.11 Conversion to or from Recycled Water Service

1.13.11.1 Conversion to Recycled Water Service (See procedure in Appendix 6)

When a customer proposes the conversion of any existing potable water irrigation system to a recycled water irrigation system, a comprehensive investigation of the proposed recycled water system shall be performed for the District at the expense of the customer. On a case-by-case basis, the District, and Ventura County Environmental Health, shall review the as-built drawings and investigation reports to insure the adequacy of measures to be undertaken to bring the existing system

into full compliance with these Rules and Regulations. The District or County Environmental Health may deny issuance of a recycled water use permit if either determines that the proposed conversion cannot be safely made.

1.13.11.2 Conversion from Recycled Water Service

If, due to onsite failure of the recycled water system, or use violations, the District determines it necessary to convert the onsite facilities from recycled water supply to a potable water system, or other water supply, it shall be the responsibility of the customer to pay all costs for such conversion, unless determined otherwise by the District. Conversion costs shall include the following:

1.13.11.2.1 Isolation of the Recycled Water Supply:

Service shall be removed and plugged by the District at the recycled water main, or abandoned in a manner approved by the District.

1.13.11.2.2 Installation of Backflow Prevention Device:

The customer shall install approved backflow devices on all water meter connections.

1.13.11.2.3 Removal of Existing Fittings:

The customer shall be responsible for replacement of all fittings with approved potable water fittings.

1.13.11.2.4 Hydraulic Testing and Disinfection:

The customer shall be responsible for hydraulic testing and disinfection of the converted pipeline, in accordance with Chapter 9 of the District potable water standards.

1.13.11.2.5 Notification:

The customer shall notify all personnel involved with the operation of the abandoned recycled water service.

1.13.11.2.6 Warning Signs/Labels/Color Coding:

The customer shall be responsible for the removal of all warning signs, labels, and color coding.

1.13.11.2.7 Installation of Potable Water System:

Installation of all potable water lines and facilities and any capacity fees due, as provided for in these Rules and Regulations shall be the responsibility of the customer.

1.13.12 Authorized Uses of Recycled Water

The uses of recycled water may include, but are not limited to, landscape irrigation, agricultural irrigation, construction water, industrial process water, commercial use, groundwater recharge, enhancement of wildlife habitat, and recreational impoundment. Each such use must be considered for approval by the District on a case-by-case basis. Determinations as to specific uses to be allowed shall be in accordance with the standards set forth in Title 22, Division 4 of the California Code of Regulations. The District may, at its discretion, set forth specific requirements as conditions to providing such services and/or require specific approval from the appropriate regulatory agencies.

The use of recycled water in swimming pools is not permitted.

1.13.13 Scheduling Recycled Water

The District will control and schedule the delivery of recycled water if, in the opinion of the District, scheduling is necessary for purposes including, but not limited to, the maintenance of an acceptable working pressure in the recycled water system and the provision for reasonable safeguards in relation to public health.

1.13.14 Temporary/Emergency Connections to the Potable Water System

If, in the opinion of the District an emergency exists, or is threatened to occur, whereby all or a portion of the water in the recycled water system is not available, the District may approve a temporary connection to the potable water system. The decision to allow temporary service to the potable water system shall be at the sole discretion of the District as stipulated in Chapter 3.4.3 of the Potable rules and Regulations of the District, and the City shall maintain and operate all connections.

Before such temporary connection is made, the portion where potable water is to be supplied shall be isolated by an air gap separation from the remainder of the recycled water system. This isolation shall occur at either individual services or on the offsite system, as determined by the District. An approved backflow prevention device shall be installed on the potable water lines in accordance with Section 3 of these Rules and Regulations and all applicable regulations of the governing agencies. The emergency connection shall be removed before connection is re-established to the recycled water system. Re-establishment of recycled water service must be inspected and approved by a District inspector prior to resuming delivery of recycled water.

On a case-by-case basis, the District and all related regulatory agencies may approve a temporary potable water connection for a customer's recycled water system for irrigation or other uses, without an air gap. The temporary connection shall be designed to allow only one water source to serve the customer's system at any given time. An approved backflow device and meter shall be installed on the potable water service and the recycled water service prior to the customer's connection, in accordance with Section 3. At no time shall the potable water system be connected to a system simultaneously served by a non-potable source.

The District, at its own discretion, may provide potable water or disinfected raw water in lieu of recycled water.

1.13.15 Additional Restrictions on the Uses of Recycled Water

1.13.15.1 Runoff and Ponding

a. The onsite facilities shall be designed to meet the peak moisture demand of all plant materials used within the design area and to apply irrigation water in a manner compatible with the infiltration rates of the soil types within the approved use area.

   Conditions that directly or indirectly cause runoff of recycled water outside of the approved recycled water use area, cause unintended ponding of recycled water, or permit windblown spray to pass outside of the approved use area shall be eliminated or controlled to the greatest extent possible with the use of the best practicable technology or methodology. Where such control, in the opinion of the District, is not adequate, whether due to technology or otherwise, recycled water service may be terminated.

b. The use of recycled water shall be limited to those uses permitted by Federal and State law, and to those uses approved by the District for the recycled water service area.

1.13.15.2 *Protection of Drinking Fountains and Public Facilities*

Any and all drinking fountains located within an approved recycled water use area shall be protected by re-siting or isolating them with a protective structure from contact with recycled water, whether by windblown spray or by direct application through irrigation or other approved uses.

Recycled water irrigation systems shall not be installed near food establishments or public facilities such as picnic tables. Design of systems near such facilities shall require County Environmental Health approval.

1.13.15.3 *Hose Bibbs and Quick Couplers*

No customer shall use or install any hose bibbs on a recycled water system regardless of style, construction or identifications. The use of quick couplers is at the sole discretion of the District. Their intended use shall require a separate plan review from the District. Only quick couplers with the approved color and identification will be allowed. (See Plate RW34)

1.13.15.4 *Fire Hydrants*

No customer or other party shall use or install fire hydrants or other connections for fire services on any onsite system that presently operates or is designed to operate with recycled water, regardless of the construction and identification of the fire hydrant or other connection for fire services. Although such use is not anticipated in the foreseeable future, the District does have full discretion to evaluate the need for recycled water use to meet fire service requirements, on a case-by-case basis.

2.0 DESIGN CRITERIA

2.1 DISTRICT WATER SYSTEM

The District is one of two water purveyors within the City of Simi Valley. The other is the Southern California Water Company. The District's service area generally includes the City of Simi Valley's Sphere of Influence. The service area consists of five operating sub-systems: 1) Western; 2) Eastern; 3) Knolls; 4) Box Canyon; and 5) Wood Ranch.

The District purchases most of its potable water from the Calleguas Municipal Water District who, in turn, purchases water from the Metropolitan Water District (MWD). The remainder of the potable water is pumped from groundwater wells located in the vicinity of Tapo Canyon.

The Simi Valley Water Treatment Plant is rated to treat 12.5 million gallons of wastewater per day, with peak flows up to 18 million gallons. The treatment plant is currently permitted to treat 4 mgd to full secondary treatment. Presently, the plant pumps approximately 60,000 gallons per day to the Simi Valley Landfill. Additional amounts are used for irrigation purposes at the treatment plant.

A detailed description of the District water system is contained in the District's Water Master Plan.

2.2 GENERAL

All potential uses of recycled water, including, but not limited to, uses for landscape irrigation systems, agricultural irrigation systems, systems used for industrial process or construction purposes, or recreational impoundment systems, or flushing toilets and urinals in non-residential buildings shall be reviewed by the District. If recycled water is to be used, the facilities shall be constructed in accordance with the procedures and requirements set forth below.

The District's recycled water program is subject to the regulations of the California Department of Health Services and the Ventura County Environmental Health Division. As set forth in the District's "Rules and Regulations for Water", the District shall determine whether a given service will be furnished with recycled water or potable water. The determination shall be in accordance with the standards of treatment and water quality requirements set forth in Title 22, Chapter 4 of the California Code of Regulations, with the intent of the District to work in conjunction with the health agencies to protect the public health, and with the availability and/or feasibility of making available recycled water facilities. All on-site facilities using recycled water will have an annual cross-connection test unless otherwise approved by the State and County health agencies. Details of specific cross-connection tests can be found in Appendix 7. Verification of inspections and any cross-connection found are reportable to both State and County health agencies.

2.3 DESIGN AND CONSTRUCTION CRITERIA

The design criteria for recycled water facilities is separated into two categories. Offsite recycled water facilities typically consist of those recycled water facilities which are, or will be, owned, operated, and maintained by the District, such as transmission or distribution mains in public rights-of-way. Typically, these are facilities on the upstream side of the water meter. Onsite recycled water facilities typically consist of facilities which will be operated and maintained by the customer, and are downstream of the water meter.

2.4 ONSITE SYSTEMS

2.4.1 Design Responsibility

The design of an onsite system that will use recycled water, including the preparation of plans, construction specifications, and record (As-Built) documents shall be under the responsibility of a civil engineer registered with the State of California, or such other design consultant as may be specifically authorized by the State for the use. Offsite facilities shall be designed by a State registered civil engineer unless otherwise specifically authorized by the District.

2.4.2 Provisions for Recycled Water

In those areas where recycled water is not immediately available for use when the area is ready for construction, an approved backflow prevention assembly shall be required for any potable water use. This assembly shall be provided, installed and tested at least annually by the customer. All maintenance of the onsite backflow prevention assembly shall be the responsibility of the customer. In those cases where the District uses a master backflow prevention assembly at the intertie between the recycled water distribution system and the potable water system, District may waive the requirement for the customer to install an onsite approved backflow prevention assembly.

Only the District, or the customer in accordance with District's requirements and under the inspection of the District, shall remove the backflow prevention assembly and make the connection to the recycled water distribution system when recycled water becomes available. At such time, if the District removes the assembly, District shall return the assembly to the customer. All points of connection to District's offsite facilities shall be determined by the District.

Backflow prevention assemblies required by the District on recycled water systems shall be clearly identified and/or installed in protective enclosures. The customer shall test these recycled water backflow prevention assemblies with the appropriate equipment, used only for recycled water backflow prevention assemblies.

Notification of all action taken with backflow prevention assemblies shall be made by the District to County Environmental Health.

2.4.3 Service Line

District reserves the right to specify the size and location and/or type of all offsite facilities. The recycled water service lines shall be extended to a location in compliance with District's standard drawings or the right-of-way line at the customer's property abutting upon a public street, highway, road or utility easement in which recycled water mains are installed.

2.4.4 Service Pressure

Static service pressure shall be as provided by the District. The design consultant must prepare and submit a hydraulic worksheet indicating hydraulic constraints.

When a reasonable service pressure would not be available to onsite facilities previously served from the potable water system, correcting this situation upon conversion to the recycled system shall be handled as follows:

- If a booster pump or pressure regulation was required for onsite facilities when service was provided from the potable system, then any booster pump or pressure regulation required for recycled water service shall be provided and maintained by the customer.

- If reasonable service pressure was available for the onsite facilities when service was provided from the potable system, then any action needed to provide recycled water service will be considered on a case-by-case basis in conjunction with the use permit application review.

2.4.5 Design Capacity

The onsite recycled water system shall be designed to meet the peak-demand requirements for all uses within the design area. Peak demand for plant materials must be determined utilizing performance evapotranspiration rates (ET_o), crop coefficients (K_c), distribution of uniformity (D.U.), irrigation efficiency (I.E.), and a 9-hour irrigation period per day.

2.4.6 Design Application Rates for Irrigation

An onsite irrigation system shall be designed to apply irrigation water in a manner compatible with the infiltration rates of the soil types within the approved use area. Evidence that infiltration rates have been assessed shall be included with the design. Where varying soil types are present to the extent that they cannot be adequately addressed by separate zones (hydrozone), the design of the irrigation system shall be compatible with the lowest infiltration rate present.

Average and maximum application rates. Irrigation systems must not exceed the following application rates:

Flat area:	Average Application Rate	15 gpm/acre
	Maximum Application Rate	20 gpm/acre
Slope area:	Average Application Rate	10 gpm/acre
	Maximum Application	15 gpm/acre

2.4.7 System Layout

- The recycled water system shall be designed based on peak-application rate requirements to prevent discharge onto areas that are not approved for use. Adjustable arc, adjustable radius sprinklers with anti-drain/check valves shall be used adjacent to roadways, boundary lines, and hardscape to confine the discharge from the system to the design area. No recycled water shall leave the intended areas, whether by direct overspray, ponding, runoff, or sprinkler break. A drainage device under control of the owner shall be installed at the toe of any slope receiving recycled water and draining to single-family residential lots.

- The onsite recycled water system shall be required to automatically shut off in the event of a line break.

- The recycled water system design shall avoid spray patterns that include obstructions that tend to concentrate recycled water to produce ponding and/or runoff, such as direct or indirect spraying against structures.

- The District reserves the right to limit the area of land under one ownership or homeowners association to be supplied by one recycled water service connection and corresponding meter.

- A recycled water service connection and its corresponding meter shall not be used to supply adjoining property of a different owner.

- Irrigation systems where landscaping around homes and in common areas served with one meter and maintained by the same customer, e.g. a homeowners association, may be allowed to cross roads, streets, or other public rights-of-way. When a property provided with a recycled water connection and corresponding meter is subdivided and no longer to be maintained by a single operator, such connection and meter shall be considered as serving the lot or parcel of land on which the meter is located. In such event, additional recycled water mains and/or recycled water service lines will be required for all subdivided areas in accordance with these regulations.

- For properties of the same customer, irrigation systems shall be allowed to cross roads, streets, or other public rights-of-way to serve medians and slopes along streets.

- All recycled water used on any property must pass through the meter. Customers shall be held responsible and charged for all recycled water passing through their meters.

2.4.8 System Control Devices

Every recycled water service line shall be equipped with an angle stop on the inlet side of the meter and ball valve on the discharge side of the meter. The angle stop is to be used only by District personnel to control the recycled water supply through the water service line. If the angle stop is damaged by the customer or his use of recycled water to an extent requiring replacement, then the customer shall bear full financial responsibility.

The onsite irrigation system shall be required to automatically shut off in the event of a line break. A master valve connected to a flow sensor should be used to provide automatic system shut down in the event of a pipeline break.

2.5 CONSTRUCTION WATER FACILITIES

2.5.1 Service Connections

Service connections for the construction use of recycled water may be provided by the District at locations as convenient as practicable to the customer, but at the discretion of the District. The service shall include a valved connection to a recycled water distribution main and water meter whose capacity shall be determined by the District from information supplied by the customer in his use permit application. The customer shall make the connection to the main in accordance with the District's requirements or contract with the District to do so. The meter shall be supplied by the District and installed by the customer in accordance with District requirements.

2.5.2 Onsite Minimum Cover Requirements

Transmission lines for conveying recycled water from the metered service connection to a storage container or water distribution vehicle shall be of adequate size and structural integrity to ensure that leaks or ruptures will not occur in the course of normal construction activity. These lines shall be provided by the customer. Lines crossing construction roadways or other areas receiving regular vehicular traffic must be buried to a depth of at least 18 inches for pipes less than 2 inch diameter or greater than 24 inches deep if pipe diameter is 2 inches or greater. Rigid pipe able to withstand the planned vehicular loads shall be employed for such installations.

2.5.3 Storage Facilities

Recycled water storage tanks and distribution vehicles shall be of adequate design and structural integrity to ensure that leaks or ruptures will not occur in the course of normal use. These tanks or ponds shall be provided by the customer. All storage ponds and any storage tanks not supported more than six feet above ground-level shall be contained within a fence or other enclosure that will restrict access by the general public to these facilities at all times when operations personnel are not present. Outlet control with positive shut-off shall be provided at each storage facility.

All recycled water storage facilities owned and/or operated by the customer shall be protected against erosion, overland runoff, and other impacts resulting from a 100-year frequency 24-hour storm as defined by FEMA.

2.5.4 Distribution Vehicles

Vehicles used for distributing recycled water for soil compaction and dust control shall be provided with adequate tanks and plumbing systems to ensure that leaks and ruptures will not occur in the course of normal use. Control valves shall be provided such that the recycled water can be applied in a controlled fashion on the approved use area and completely retained during transit in all other areas. Spray heads or nozzles shall be provided and configured such that the discharge is uniformly distributed and runoff, ponding or windblown overspray conditions are prevented.

2.6 PROTECTIVE MEASURES

The following provisions are intended to protect the potable water supply against actual, undiscovered, unauthorized, or potential cross-connection to the customer's recycled water system. These provisions are in addition to, not in lieu of, the controls and requirements of other regulatory agencies and are in accordance with Title 17 (Public Health) of the California Code of Regulations. They are not intended to provide regulatory measures for protection of customers from the hazards of cross-connections within their own property.

Approved backflow prevention methods on the potable water services to the property, as required in these provisions, shall be provided, installed, tested, and maintained by the customer at customer expense. These methods shall be located on the property served immediately downstream of the meter and shall not be on District facilities. All devices used shall be readily accessible for testing and maintenance and no device shall be submerged or exposed to recycled water direct overspray or runoff at any time.

When recycled water service is requested, the applicant must provide sufficient information, including plumbing and building plans, to enable the District to determine the level of backflow protection required. The proper backflow protection, as determined by the District and approved by DHS and other appropriate regulatory agencies, shall then be installed, inspected, and tested before recycled water service is provided.

The customer shall notify the District not less than 30 days prior to a change of use, user, onsite supervisor, owner, tenant, or operator. District will then reassess the level of protection required. Any and all proposed alterations to existing onsite facilities must be reported to and approved by the District prior to the proposed change.

At their discretion, representatives of the District, the City, or any regulatory agency having jurisdiction may conduct surveys of property where recycled water service is provided by the District to determine if any actual or potential cross-connection exists. Cross-connection protection in accordance with Title 17 is addressed in Section 1.13.10.

Water meters used for recycled water service shall not be interchanged or used for potable water service after repairs and/or meter testing have been performed.

It is each owner's responsibility to inspect and test, at least annually, each site using recycled water for compliance with all District, State and County regulations regarding the use of recycled water; and the District reserves the right to verify compliance at each site at any time. The testing and inspections shall include, but not be limited to the following:

- Operational test
- Cross-connection tests on all onsite systems
- Review of recycled, potable, potable fire protection, and potable water used for irrigation systems
- Identification tags and labels
- Painted surfaces
- Covers, caps, signs
- Other items that indicate recycled water is being used
- Irrigation controller time schedule
- Backflow protection
- All recycled and potable water related appurtenances

2.7 OFFSITE RECYCLED WATER FACILITIES INSTALLATION

Offsite recycled water facilities not subject to special assessments or made a condition to a private development permit shall be provided by the District. Where extension or replacement of recycled water distribution mains is required or approved by the District, the cost shall be borne by the benefited property owners or the District as provided in Section 5 of these Rules and Regulations.

2.8 OFFSITE RECYCLED WATER FACILITIES

2.8.1 Minimum Size

The minimum size distribution main shall be a 4-inch looped line. Smaller diameter mains may be individually approved by the District on dead-end mains. These mains shall be sized so that sufficient water is regularly drawn to prevent stagnation. Service lines shall be 1-inch or 2-inch copper, or ductile iron pipe (DIP) for larger sizes.

Required developer facilities shall be designed by the developer and mains shall be transferred to the District upon satisfactory completion of the project. Capital facilities are those provided by the District, generally 6-inch diameter and larger.

2.8.2 Approved Pipe Materials

C-900 PVC pipe either Class 150 or 200 may be used for offsite water mains up to 10-inches in diameter. The pipe shall be purple in color, and exposed facilities shall be marked in accordance with District standards to warn that there is recycled water in the pipe. DIP is required for District mains in easements other than public roadways, and shall be properly marked with purple marking tape.

2.8.3 Minimum Cover Requirements

(A) The top of distribution mains, 4-inch and smaller, shall be a minimum of 42 inches below the finished street grade unless indicated otherwise on job plans or directed otherwise by the District Inspector because of unusual field conditions.

(B) The top of transmission mains, 6-inch and larger, shall be a minimum of 48 inches below the finished street grade unless indicated otherwise on job plans or directed otherwise by the District Inspector because of unusual field conditions.

2.8.4 Standard Location

Offsite recycled water facilities shall typically be located either four (4) feet, or eight (8) feet from the curb face on the opposite side of the street from the potable water mains.

2.8.5 Easements

Easement widths provided for transmission mains shall be based on the existing conditions and are subject to approval by the District. The minimum easement width for a transmission main is 20 feet. The normal location of the transmission main shall be in the center of the easement.

2.9 DESIGN FOR PROPER FLUSHING

Proper flushing of water mains and the prevention of sediment buildup are important aspects of the District's maintenance program. Therefore, the following criteria apply:

A. Low points in the lines shall be eliminated wherever possible to prevent sediment accumulation.

B. Piping systems shall be looped wherever possible. Dead-end pipelines may be approved by the District on a case-by-case basis.

2.10 HORIZONTAL AND VERTICAL CURVES

A. General: The horizontal alignment of water pipelines in curved streets shall follow the street curvature or radius. Pipeline alignments shall not cross nor meander about the street centerline. Allowable joint deflections shall be as set forth in Table 2-1 or the manufacturer's recommendations, whichever criteria is more stringent. Vertical grade breaks in excess of the allowable joint deflections shall not be permitted. Fittings shall be required in such cases.

Table 2-1

Normal Pipe Size Inches	Minimum Radius Of Curvature
6"	175' (53 m)
8"	225' (69 m)
10"	275' (84 m)
12"	325' (99 m)

2.11 SEPARATIONS *(See Plate RW5)*

2.11.1 Horizontal

A 10-foot separation of the recycled water pipeline is required from a parallel potable water pipeline, a parallel storm drain, and/or a parallel sanitary sewer pipeline. If a 10-foot separation is not possible, approval for special construction requirements shall be obtained from the City and the Ventura County Environmental Health Division prior to commencement of construction. In any event, a horizontal separation less than 4 feet shall not be allowed. Common trench construction shall not be permitted.

2.11.2 Vertical

On new systems, potable water, recycled water, storm drain, and sewer lines should be located from the ground surface in order of descending quality. Potable water shall be above recycled water, which should be above storm drains and sewers. Minimum vertical separation should be one foot between top and bottom surfaces of crossing pipes. Exceptions to this general rule are as follows:

a. On irrigation systems where intermittently pressurized recycled water lines (laterals) serve sprinkler heads, crossing potable water line(s) may be placed under the recycled water laterals. No special construction requirements are necessary provided that one foot vertical separation is maintained.

b. On sites using pressurized irrigation laterals with valve-in-head sprinklers, crossing potable water line(s) may be placed under the recycled water laterals if additional protection is provided for the potable line. Common practices include sleeving or automatic flow control/shut off devices installed and functioning properly on each lateral that crosses a potable line.

   No additional special construction requirements are necessary provided that one foot vertical separation is maintained.

2.12 SERVICES *(See Plates RW13 through 17)*

A. One separate service shall be installed to each lot and a "RW" shall be stamped/incised on the curb face at the lateral location.

B. Minimum size shall be 1-inch copper.

C. No service shall be installed in a driveway.

D. Where site improvements or building pad orientation for a lot are not known at the time of street construction, a service lateral shall be installed to the back of the curb for a meter connection. Location of the service lateral should be located 5 feet off the side lot line to preclude conflict with future driveways.

E. Minimum separation between water and recycled laterals shall be 10 feet, unless otherwise approved by the District.

F. Unless otherwise approved, all services shall be perpendicular to the main.

2.13 VALVES

A. Maximum valve spacing on Distribution Mains

1. 1000 feet for pipelines 8 inches or less in diameter.

2. 750 feet for pipelines 10 inches and larger in diameter.

B. Valve Locations: As required by the District.

C. Butterfly valves shall normally be used for mains 12 inches and larger if operation pressures do not exceed 250 psi. Valve types for pressures over 250 psi need special approval by the District.

D. All dead ends shall be equipped with 2-inch blow-off assembly (Per Plate RW29).

E. All tee intersections and cross intersections shall have a valve at each branch.

F. Valve locations shall be designed so that no more than three valves have to be operated to shut down a line.

G. Valve box and covers shall conform to Plate RW19.

2.13.1 Blow-Offs and Air and Vacuum Valves

Blow-off or drain assembly shall be either an in-line type or end-of-line type and should be installed for removing water and sediment from the pipe. The line tap for the assembly should be no closer than 18 inches to a valve, coupling, joint or fitting unless it is at the end of the line. If there are restrictions on discharge or runoff, the regulatory agencies should be consulted for compliance.

Air/vacuum relief valve assemblies shall be installed at high points in the transmission main at locations approved by the District.

2.14 STRAINERS AT METER/POINT OF CONNECTION

Depending on the quality of the recycled water and type of storage utilized, strainers may be required at the consumer's meter. Strainers of the following types are generally satisfactory:

A. WYE Strainers: Not recommended for below ground (in vaults) installations.

B. Basket Strainers: Suitable for above or below ground (in vaults) installations.

C. Filter Strainers: Normally used above ground on drip irrigation systems.

Strainers are normally the same size as the line and should generally be installed after the meter.

A. Before Meter: Installation before the meter should only be used where protection of the meter as well as the onsite system is necessary, as determined by the District.

B. After Meter: Installation may be provided after the meter to benefit the onsite system, and maintenance in this case is not the responsibility of the District. However, it should be determined in advance whether there is a potential for debris in the water that would plug the meter.

Strainers can range in mesh size from 20 to 325. A mesh 80 is the minimum allowable. An analysis of potential debris will aid in prescribing the optimum size. In order to reduce maintenance, material that will not plug onsite irrigation nozzles should normally be allowed to pass. See Section 3 "Materials" and Plate RW44 for further information.

3.1 GENERAL REQUIREMENTS

This section discusses the materials involved in recycled water pipeline systems and associated construction activities. The materials selected have been chosen for their strength, durability and ease of maintenance. All materials, unless specifically approved otherwise by the District, shall be new and unused.

Colors and materials used for identification of all recycled water pipe; appurtenances, equipment, storage facilities and approved use areas shall be in accordance with the latest edition of the American Water Works Association (AWWA) guidelines, and it shall be the responsibility of the developer/engineer/contractor to be familiar with those standards to insure compliance. Titles corresponding to the specific numbers are given in the reference section of these standards. Identification requirement are shown on Plate RW47.

In some instances, and in order to establish some degree of parts standardization, particular manufacturers and product names are listed, for guidance, as being approved. Other products may also meet the requirements, but first must be certified in writing by the product/material manufacturer as being equal and shall be approved in writing by the District for use.

The District reserves the right to discontinue or disallow the use of any specific product or material. The District Engineer has the authority to make such changes based upon engineering judgment, product performance, or maintenance criteria at no cost to the District.

3.2 TESTING AND FINAL ACCEPTABILITY OF MATERIAL

The District shall require such tests and certifications as deemed necessary to show that the specified materials have been employed. Notwithstanding prior factory or yard inspections, the District shall have the right to reject any damaged or defective materials found on the job which may affect the durability or performance of the installation and order its removal from the site.

3.3 MAINLINE PIPE MATERIALS

Main pipeline materials for nominal pipe diameters 6-inch through 18-inch shall be either polyvinyl chloride (PVC), high density polyethelene (HDPE), or ductile iron pipe (DIP) as described in this section or as otherwise directed by the District. Main pipeline materials for nominal pipe diameters larger than 18-inches shall be either steel or ductile iron pipe (DIP) as described in this section or as otherwise direct by the District.

A. <u>PVC Pipe</u>

1. PVC pipe shall conform to the requirements of AWWA C900, which covers PVC (polyvinyl chloride) pipe in sizes 4-12 inches, or AWWA C905, which covers PVC pipe in sizes 14 inches and larger. Each length of pipe shall be clearly marked with the following:

   - Nominal size and O.D. base (e.g., 8" cast iron pipe size);
   - Material code (e.g., "PVC 1120");

- Dimensional ratio (e.g., DR 25 where DR is equal to outside diameter "divided by" thickness);
- AWWA pressure class (e.g., PC 150)
- AWWA designation "AWWA C900" or "AWWA C905"
- Manufacturer's trade name and production record code.
- Seal (mark) of testing agency

The standard laying length shall be 20 feet (plus/minus 1 inch) in all classes and sizes. A maximum of 15 percent may be furnished in random lengths of not less than 10 feet each.

One gasket shall be furnished with each length of elastomeric-gasket bell-end pipe and two gaskets shall be furnished with each coupling where couplings are used.

Pipe surfaces shall be free from nicks, scratches and other blemishes. The joining surfaces of pipe spigots and of integral bell and sleeve reinforced bell sockets shall be free from gouges or other imperfections that might cause leakage.

2. Joint Mechanisms: The joints shall be either of the following:

   - Integral wall - Thickened bell end (bell and spigot with rubber gasket).
   - Integral sleeve reinforced bell end
   - Elastomeric gasket couplings

   PVC solvent cement joints shall <u>not</u> be used at any time on distribution pipelines or fittings.

3. Couplings and Fittings: Where couplings are used, they shall meet the requirements of AWWA C900 for PVC pipe less than 14 inches in diameter or AWWA C905 for PVC pipe 14 inches in diameter or larger. Couplings shall be as furnished by the manufacturer. Couplings shall be marked with the same information as the pipe.

   Ductile iron fittings shall be used with PVC pipe and these are discussed in Section 3.4 (Mainline Fittings).

4. Physical Test Requirements: Inspection and testing by the manufacturer shall be in accordance with AWWA C900 for PVC pipe less than 14 inches in diameter or AWWA C905 for PVC pipe 14 inches in diameter or larger. All testing shall be done by a certified testing laboratory with such testing available for inspection by the District. If requested by the District, the manufacturer shall supply a letter of certification attesting to their pipe meeting these specifications.

B. <u>Ductile Iron Pipe (DIP)</u>

1. Pipe - The pipe shall conform to AWWA C151 for both quality and strength. Each pipe shall include the letters "DI" or word "DUCTILE" to indicate the pipe material.

2. Joints - These shall be of the rubber gasket push-on joint type conforming to the requirements of AWWA C111 and being of the "tyton" type.

3. Fittings - All fittings shall conform to AWWA C110.

4. Lining and Coating - Unless otherwise approved, the internal surfaces shall be lined with a uniform thickness of cement mortar and then sealed with a bituminous coating in accordance with AWWA C104. With the approval of the District, ductile iron fittings can be coated with fusion-bonded epoxy in accordance with AWWA C116.

   The outside surface shall be protected with a polyethylene encasement furnished and installed in accordance with AWWA C105.

C. Steel Pipe

1. Steel pipe shall conform to the requirements of ASTM Standard A120 which covers steel pipe less than 4 inches in diameter. Unless otherwise designated, it shall be of the wall thickness known as Schedule 40.

   Steel pipe 4 inches to 10 inches in diameter shall conform to the requirements of ASTM Standard A53. All dimensions and thicknesses shall comply with ANSI Standard B36.10.

   Steel pipe 12 inches and larger shall conform to the requirements of ASTM A53 or AWWA C200.

   Pipe and fittings shall be mortar-lined and coated except where otherwise indicated and shall be in accordance with AWWA Standards C205 and Section D3.

2. Joints: Steel pipe joint shall be welded bell and spigot joints, butt-strap, or full penetration butt-welded.

3. Fittings: Where fittings are used, they shall meet the requirements of AWWA C208 for steel fittings. Thickness of the steel fitting shall not be less than ¼ inch.

4. Lining and Coating: Steel pipe shall be supplied with a Type II cement mortar lining, shop-applied, conforming to AWWA C205. Steel pipe shall be supplied with an exterior protective coating in accordance with AWWA C203 or AWWA C214.

D. HDPE

1. HDPE pipe shall conform to the requirements of AWWA C901, which covers HDPE pipe ½ inch to 3 inches in diameter.

   HDPE pipe 4 inches to 54 inches in diameter shall conform to the requirements of AWWA C906.

2. Joints: Refer to DIP joints.

3. Fittings: Where fittings are used, they shall meet the requirements of AWWA C906 for HDPE fittings. In addition ASTM D2683, ASTM D3261, and ASTM D3350 shall all be referenced for HDPE fittings when using Socket-Type, Butt Heat Fusion, and Standard Specifications.

3.4 MAINLINE FITTINGS

Typical materials for mainline fittings are included below.

A. Ductile Iron Fittings - These fittings shall meet the requirements of AWWA C110. All fittings shall be rated for 250 psi. This standard covers, but is not limited to, fittings with combinations of ends, including mechanical joint, plain end, flange, and push joint. The fitting types are as follows:

90° bend, 45° bend, 22-1/2° bend, 11-1/4° bend.

Tees, reducers, caps & plugs, connecting pieces, flanged bends, flanged tees, flanged reducers.

B. Flanges, Bolts & Gaskets - These shall be flat-faced and meet the requirements of AWWA C207 and should be AWWA standard steel hub flanges, Class E (275 psi) (these flanges meet ANSI B-16.5). The flanges shall be marked with the size, name or trademark of manufacturer, and with the AWWA class, i.e., "E". Bolts and nuts shall be stainless steel type 316. Gaskets shall be of the drop-in gasket type, 1/8" thick. All bolts shall be coated with a nickel base anti-seize designed for use with stainless steel bolts, prior to installation.

Table 3-5

Pipe Size (Inches)	Bolt Hole Diameter (Inches)	Bolt Diameter x Length (Inches)	Number of Bolts
6	7/8	¾ x 3½	8
8	7/8	¾ x 3½	8
10	1	7/8 x 4	12
12	1	7/8 x 4	12
14	1-1/8	1 x 4½	12
16	1-1/8	1 x 4 1/2	16
18	1-1/4	1 1/8 x 5	16

The inherent problem with flanges is that they are rigid and do not provide flexibility. Two keys to their installation are (1) uniform tightening of the bolts, and (2) prevention of bending or torsional strains. Proper anchorage is important to meet the latter objective.

C. Mechanical Joint Fittings - This is a bolted joint of the stuffing box type. Each joint has a bell provided with an exterior flange having bolt holes or slots, and a socket with gaskets to receive the plain end of the pipe or fitting. The joint also has a sealing gasket, follower gland with bolt holes and tee head bolts with hexagonal nuts. Mechanical joint ends shall not be connected to flanged joint ends.

The mechanical joints shall meet AWWA C111. That standard covers the joint as well as gaskets and bolts.

Table 3-6

Pipe Size (Inches)	Number of Bolts	Bolt Diameter x Length (Inches)
6	6	¾ x 3½
8	6	¾ x 4
10	8	¾ x 4
12	8	¾ x 4
14	10	¾ x 4½
16	12	¾ x 4½
18	12	¾ x 4½

D. Flexible Couplings - These are designed to connect plain end pipes with a mechanical compression joint to provide a stress relieving, flexible, leak proof joint. They can be ordered in steel or cast iron pipe sizes (note: C900 PVC pipe has same O.D. as cast iron). The couplings shall either be Dresser Style 38, Romac 501, or Smith-Blair Series 411. The center barrel length for pipe diameters greater than 8-inches shall be a minimum of 14-inches. All flexible couplings shall be fusion-bonded epoxy lined and coated in accordance with AWWA C213. Fasteners, nuts, and bolts shall be Type 316 stainless steel.

E. Transition Couplings - These are used to connect pipes of the same nominal size, but different materials. Approved are Dresser Style 162, Romac 501, or Smith-Blair Series 413 transition couplings. The center barrel length shall be a minimum of 10-inches for pipe diameters 8-inches or less, a minimum of 14-inches for pipe diameters greater than 8-inches. All transition couplings shall be fusion-bonded epoxy lined and coated in accordance with AWWA C213. Fasteners, nuts, and bolts shall be Type 316 stainless steel.

F. Flanged Coupling Adapters - These are used to connect plain end pipe to flanged valves, pumps, meters, etc. They eliminate the need for both a flanged spool and coupling. Generally, they are available in sizes through 12 inches. Approved are Dresser style 127 cast iron, Romac style FCA501 (for cast iron and steel pipe sizes up to 16-inch) and Smith-Blair series 912 cast iron or 913 steel flanged coupling adapters. All flanged coupling adapters shall be fusion-bonded epoxy lined and coated in accordance with AWWA C213. Fasteners, nuts, and bolts shall be Type 316 stainless steel.

G. Insulating Couplings - These are used to stop the flow of electric current across the joint by means of an insulating boot. Approved are Smith-Blair Series 438, Romac IC501, and Dresser Style 39 insulating couplings. All insulated couplings shall be fusion-bonded epoxy lined and coated in accordance with AWWA C213. Fasteners, nuts, and bolts shall be Type 316 stainless steel.

H. Expansion Joints - Expansion joints shall be manufactured of ductile iron conforming to AWWA C153. All expansion joints shall have a capability to expand and contract a minimum of 4 inches or as otherwise indicated on the approved plans. All expansion joints shall have restrained joints at each point of connection to the distribution piping, and be self-restrained at full expansion. Approved are EBBA Iron "Ex-Tend" 200 style or U.S. Pipe "TR-Flex" style expansion joints. All expansion joints shall be lined with 15-mil fusion bonded epoxy in accordance with AWWA C213.

I. Flexible Ball Joints - Flexible ball joints shall be manufactured of ductile iron conforming to AWWA C153. All flexible ball joints shall consist of a ball and socket type of joint capable of at least 15 degrees minimum deflection. All flexible ball joints shall have restrained joints at each point of connection to the distribution piping. Approved are EBBA Iron FLEX 900 flexible ball joints. All flexible ball joints shall be lined with a minimum of 15 mils of fusion bonded epoxy in accordance with AWWA C213.

J. Flexible Expansion Joints - Flexible expansion joints shall be manufactured of ductile iron in accordance with AWWA C153. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint. Each integrated ball shall have a minimum of 15 degrees of deflection per ball and each integral expansion joint shall have a minimum of 4 inches of expansion (or as otherwise indicated on the approved plans). Flexible expansion joints shall be the double ball configuration. Single ball models may only be used with the prior written permission of the District Engineer. All flexible expansion joints shall have restrained joints at each point of connection to the distribution piping, and be self-restrained at full expansion. Approved for cast iron pipe sizes are EBBA Iron "Flex-Tend" style double ball flexible expansion joints. All flexible expansion joints shall be lined with 15-mil fusion bonded epoxy in accordance with AWWA C213.

K. Special Steel Pipe Fittings - AWWA C208 covers special fittings such as elbows, tees, crosses, reducers, etc., and should be consulted for a specific application.

3.5 SERVICE LINE MATERIALS AND FITTINGS

The materials covered in this section include the service line copper pipe, corporation (corp) stop, and saddles as well as the valves inside the meter box. Unless stated otherwise in this section, Service Line materials and fittings shall comply with the provisions of AWWA Standard C800. Also, see Plate Nos. RW13 through RW17 of these standards for design and construction considerations. The minimum service line size is 1".

A. Pipe - Type K soft copper tubing, continuous from corporation stop to curb stop, is approved with solder fittings for 1-inch and 1 ½-inch service lines. 2-inch service lines shall be type K rigid copper pipe with all joints silver soldered. All copper pipe shall be encased in an 8-mil Poly Sleeve. Solder fittings shall be lead-free. Solder shall be of the type certified for use in potable water applications as specified in AWWA Standard C800 Paragraph 4.4.1. 4-inch and larger service lines shall be ductile iron pipe (DIP).

B. Service Saddles - Service saddles shall be either the doublewide strap type made of bronze with bronze nuts, or the stainless double steel strap type. The thread shall be female iron pipe. Service saddles for 1" through 2" service lines connecting to C-900, PVC pipe shall be James Jones J-969, Mueller BR2S, or Ford 202B. Service saddles for 1" through 2" service lines connecting to AC or DI pipe shall be James Jones J-979, Mueller BR2B, or Ford 202BS.

C. Corporation Stops - These shall be bronze with a male iron pipe thread on the inlet side. One-inch and 2" corp stops shall be of the ball valve type. The outlet for the pipes shown below shall be as follows:

Table 3-7

Service Pipe	Corp Stop Outlet	Corp Stop
1" copper	Compression	Ford - FB1100-4-Q James Jones – J-1935SG Mueller – B-25028
2" copper	Compression or Copper tubing	Ford- FB1100-7-Q James Jones – J-1957SG Mueller - B-25028-00 (Tee-Head)

D. Angle Meter Ball Valve Stop - These shall be bronze and in the 1- inch size they shall be a standard angle meter ball valve. In a 2-inch size they shall be a flanged angle meter ball valve. Refer to the table below.

Table 3-8

Service Line	Angle Meter Stop	Inlet	Outlet	Type
1" copper	Standard*	Compression	Meter coupling nut	Mueller - B-24258 (1"x1") Ford - BA43-444WQ (1"x 1") Ford - BA43-342WQ (1"x 3/4") James Jones – J-1963WSG (1"x 3/4")
1½"*** or 2" copper	Flanged Angle**	Compression	Flanged, Slotted for 1½" meters	Ford BFA 43-777WQ (1½" to 2") James Jones – J-1975WSG

* For a 3/4" meter use a 1 x 3/4" angle meter stop and for a 1" meter use a 1" angle meter stop.
** For a 2" service and 1½" meter, a 2" meter stop slotted for 1½" is used.
*** Use of 1½" service lines by special permission only.

E. Customer Hand Valve - These are to be full-flow bronze ball valves with a customer handle. The outlets are always female iron pipe threads. Refer to the table below.

Table 3-9

Meter Size	Inlet	Outlet Size (Customer Side)	Type
3/4"	3/4" meter coupling nut	1"	Ford - B13-342WHB34S James Jones – J-1908 Mueller-B-24351 w/B-20298 Handle
1"	1" meter coupling nut	1"	Ford - B13-444WHB34S James Jones – J-1908
1½"	Flanged	1½"	James Jones – J-1913W Ford- BF13-676WHB67S Mueller - B-24337 w/B-20298 Handle
2"	Flanged	2"	James Jones - J-1913W Ford - BF13-676WHB67S

3.6 METER BOXES

All meter boxes shall have provisions for a touch/radio read receptacle. The meter boxes for 3/4", 1", 1 ½" and 2" meters shall be polymer concrete with polymer concrete cover and drop-in read lid painted Pantone Purple imprinted with "RW".

Table 3-10

Meter Size	Box Inside Dimensions	Model Numbers
3/4" or 1"	12" x 20"	Brooks Products 37 or Eisel Enterprises No. 437
1½" or 2"	17" x 30"	Brooks Products 66 or Eisel Enterprises No. 666

Traffic lids are not generally approved since the meter boxes are to be placed outside the traveled right-of-way, including driveways. Where the District Engineer concurs that no other alternative is available and permits the meter box to be in the traveled right-of-way or in a driveway, a steel traffic lid shall be used. Again, it must be emphasized that the engineer is required to design the location of meter boxes so that they are outside of driveways.

3.7 WATER METERS

Water meters, types and manufacturers, shall be selected and provided by the District. The District shall install the meter after purchase by the customer. A temporary jumper supplied by the District shall be installed pending installation of the meter.

3.8 MAINLINE VALVES

All mainline valves shall include a valve extension if top of operating nut is 5 feet deep or greater. All valve extensions shall be pinned to the operating nut.

A. Butterfly Valves

1. General - All butterfly valves shall be of the tight-closing, rubber-seat type conforming to AWWA C504 latest revision, except where noted herein. Valves shall be bubble-tight at the rated pressure in either direction and shall be suitable for throttling service and/or operation after long periods of inactivity. Manufacturer shall be ISO 9001 Certified or have similar certification up and above AWWA. Valve disc shall rotate 90° from fully open to tightly closed position.

2. Valve body - Shall be cast iron ASTM A126, Class B with integrally cast mechanical joints, ends for the pipe or flanged ends. All flanged ends shall be ANSI B16.1 flange drilling.

3. Disc - Discs for valve size 10" – 24" shall be of the concentric design. Valve discs shall be constructed of ductile iron ASTM A536, Grade 65-45-12 with a 316 stainless steel edge.

4. Shaft - Valves 10"- 24" shall have a one-piece through shaft of 18-8 stainless steel, corresponding to the requirements of AWWA C504, latest revision. The shafts shall fasten to the disc by means of a threaded disc pin or through pin providing a positive leak-proof connection of the shaft to the disc.

5. Valve Seats - Seats for valves 10" – 24" shall be peroxide-cured EPDM (ethylene-propylene-diene monomer) bonded to the body of the valve. All interior surfaces in contact with water, excluding stainless steel and disc, shall be rubber lined or epoxy coated. Valves with the seat located on the valve disc will not be permitted. Seats shall be designed so that no adjustments or maintenance is required.

6. Bearings - All shaft bearings shall be of the self-lubricating, corrosion-resistant, sleeve type. Bearings shall be designed for horizontal and/or vertical shaft loading.

7. Packing - Shaft packing shall be self-adjusting and suitable for pressure or vacuum service. Packing for valves 30" and larger shall incorporate an adjustable packing gland and the packing shall be adjustable and/or replaceable without removing the valve actuator.

8. Valve Operators - Shall be of the manual traveling nut type and conform to AWWA C504. Operators shall be equipped with a 2" AWWA square operating nut. They shall be sealed and gasketed and lubricated for underground service. The operator shall be capable of withstanding an input torque of 450 ft-lbs at extreme operator position without damage. All valve operators are to be installed and tested at the factory by the valve manufacturer. Bonnet and packing bolts shall be 316 stainless steel.

9. Painting and Coating - All valves shall be epoxy coated overall in accordance with Section 3.16 (MATERIALS-PAINTING). The valve disc shall be Fusion Bonded Epoxy Coated with an AWWA NSF-61 coating system or liquid epoxy on wetted interior surfaces 16 mils, holiday free. Exterior coating shall have 16 mils of liquid epoxy.

10. Testing - All valves shall be hydrostatic and leak tested in accordance with ANSI/AWWA C504, latest revision with the following modification: Buried service valves shall be tested and rated to 200 psi to facilitate field system hydro-test.

11. Proof of Design - Contractor shall provide to the District and shall obtain from the Manufacturer furnishing the valves an Affidavit of Compliance certifying that all required tests have been performed. This Affidavit of Compliance shall serve as proof of compliance with ANSI/AWWA C504, latest revision.

12. Marking - The manufacturer shall show on the valve the valve size, manufacturer, class, and year of manufacture.

13. Approved Valves – Valves shall be either Pratt Groundhog, K-FLO 500 Series, or Mueller Lineseal.

14. Number of Turns - The number of turns to open or close is as follows:

Table 3-11

Valve Size	Pratt Groundhog No. Turns	Mueller Lineseal No. Turns	K-FLO 500 Series No. Turns
6"	32	32	29
8"	32	32	29
10" & 12"	32	32	29
14" & 16"	30	30	42
18" & 20"	40	40	42

15. End types Available. Information of typical cases is as follows:

Table 3-12
Ends Available by Valve Size

Type	Pratt Groundhog	Mueller Line Seal	K-FLO 500 Series
Flange x Flange	6" - 24"	6" - 24"	6" - 24"
Flange x P.J.	6" - 12"	6" - 16", 24"	NA
P.J. x P.J.	6" - 16"	6" - 16", 24"	NA
M.J. x M.J.	6" – 24"	6" - 24"	6" - 20"

B. Resilient-Seated Gate Valves

1. General - This specification pertains to resilient-seated gate valves for underground services 3 inches to 10 inches in size, where design working pressures are less than 200 psig. Resilient-seated gate valves shall meet the requirements of AWWA standard specification C509 or latest revision thereof, and shall be of the same size as the main in which they are installed. All such valves shall be of the non-rising stem type, with 0-ring seal, equipped with 2 inch square operating nut which shall turn to the left in a counter-clockwise direction to open the valve. Valve seats shall be EPDM (ethylene-propylene-diene monomer) peroxide cured when available, otherwise sulfide cured. All bonnet, seal plate, and packing plate nuts and bolts shall be high strength type 316 stainless steel. Valve bodies and gates shall be manufactured of ductile iron with internal working parts machined from the grades of bronze specified as follows:

Part	Grade of Bronze*
Stem	E
Stem Nut	A

* Based on Table I, AWWA C509

Currently approved valves are manufactured by the Clow Corporation, the Mueller Company, and American Water Company.

See Section 3.16 (MATERIALS-PAINTING) for painting and coating requirements.

C. Plug Valves

1. General - Plug valves are to be used where the water main pressures are expected to exceed 150 psi or where required by the District. They shall be pressure lubricated, concentric venturi pattern type with flanged ends.

2. Valve Operators - When located below ground, they shall be spur gear operated with water tight gear housings, lubricant pipe, and road box. When located above ground or in vaults, they shall be worm-gear operated. Outside locations shall include watertight gear housings.

3. Painting. See Section 3.16 (MATERIALS-PAINTING).

D. Gate Valves

1. General - Whenever "Gate Valves" are specified, resilient-seated gate valves shall be understood. Gate valves may only be used with special permission and approval of the District Engineer. When allowed, gate valves shall meet the requirements of AWWA C-500 and shall be the same size as the main or service in which they are installed. This specification shall pertain to valves 10 inches and smaller for which the design working pressure is 200 psi. All gate valves shall be counter-clockwise opening. Buried gate valves shall be equipped with 2 inch square cast iron operating nuts. Exposed gate valves shall have hand-wheels.

2. Gate Valves - 2 inches or smaller are not allowed. Ball valves as described in section 3.8 paragraph E below shall be used instead.

3. Gate Valves - 3 inches through 10 inches. Gate valves shall have a non-rising stem, iron body, solid bronze internal working parts, parallel faced, with EPDM bottom wedging double discs and O-ring stuffing box. Bronze for all internal working parts, except stems, shall be ASTM B-62-70 (85-5-5-5).

   Currently approved, when allowed, are:
   Mueller A2380
   Clow 5062, 65, 68, 70, 80

4. Painting - The painting requirements are identical to those for butterfly valves. See Section 3.16 (MATERIALS - PAINTING).

5. Marking - The manufacturer shall show the manufacturer's name or mark, the year of manufacturer, valve size, and the designation of working pressure.

E. Mainline Ball Valves

1. General - Ball valves used in the main pipelines and/or service runs shall be the same size as the pipeline. The valve shall be non-rising stem type, fluorocoated ball valves, in sizes through 2–inches, installed where full-open, full-closed, 360-degree tee-head rotation, non-throttling control is required. The valve shall be manufactured of bronze alloys meeting the requirements of AWWA Specifications C800, latest revision.

2. The valve body shall be generously proportioned heavy-duty type, with iron pipe thread end connections.

3. The valve body shall be rated at 300 psi WSP, 200 psi WOG rated, and appropriately identified on the valve body.

4. The stem shall be manufactured of copper-silicon-bronze alloys meeting the requirements of ASTM Specifications B371, or ASTM Specifications B62, and contain less than 15% zinc.

5. All ball valves installed in distribution pipelines shall be equipped with a 2" gate valve operation nut for operation with standard gate valve wrenches. All other ball valves used in meter service or air-vac installations shall be equipped with tee-heads as described in the specific section.

6. The packing shall be Teflon (non-asbestos containing) material approved for potable water service.

7. Approved manufacturers and models are James Jones 1900 or Ford B11-777 with required features as described above.

F. Tapping Sleeves and Valves

1. Tapping Sleeves - Tapping sleeves shall be of high tensile ductile iron or stainless steel construction specifically designed to withstand the strains and vibrations of the tapping machine and shall include a stainless steel tapping saddle.

   The tapping sleeve shall have gaskets at each end of the sleeve. Sleeves with only an O-ring around the tapped hole are not approved.

   Approved tapping sleeves are as follows:

Sleeve	Use
Romac SST III;	AC pipe, Class 150-200, Sizes 6-12 inches PVC pipe, C-900, Sizes 6-12 inches DI pipe, Class 50 and up, Sizes 6-12 inches
Ford FTSS	AC pipe, Class 150-200, Sizes 6-12 inches PVC pipe, C-900, Sizes 6-12 inches DI pipe, Class 50 and up, Sizes 6-12 inches

   Note: Larger sizes require special approval.

   In selecting the class of the tapping sleeve, a Class 200 should be used wherever the mainline is Class 200, or if the operating pressure exceeds 125 psi.

2. Tapping Valve - Tapping valves shall meet all of the requirements for resilient-seated gate valves as described in Section 3.8 B. The tapping valve shall have a clear unobstructed waterway. The seat rings shall be of a large diameter to allow entry of the full diameter tapping machine cutter.

3. Painting - See Section 3.16 (MATERIALS-PAINTING).

G. Valve Stacks and Covers - The valve stack shall be Schedule 40 PVC pipe 8 inches in diameter (see Plate No. RW19).

The valve box cap shall be of the heavy duty, long body type. Approved is: Christy G-4 or approved equal, with "RW" "VCWWD No. 8" imprinted on top.

3.9 COMBINATION AIR RELEASE ASSEMBLIES (PLATE NOS. RW26 - 28)

A. Mechanical Assembly - The combination air release assembly has the features of an air release valve and a vacuum valve. Both units shall be housed in a cast iron body and all internal parts such as the float, bushings, level pins, seat, and baffle shall be either stainless steel or brass as furnished by the manufacturer. All assemblies shall be rated at 300 psi maximum operating pressure.

Approved assemblies are as follows:

Size	APCO Valve No.	Clow Model Design	Val-Matic Model Design	Crispen Model Design
1"	143C	A	201C	U10
2"	145C	B	202C	U20
3"	147C	C	203C	U30
4"	149C	D	204C	U40

The inlet threads shall be iron pipe threads of the same size as the valve.

B. Metal Housing or "Can" - Shall be per Plate Nos. RW26 through 28.

C. Service Lines - Type K soft copper per Section 3.5 (SERVICE LINE MATERIALS AND FITTINGS). There shall be a corp stop at the main per Section 3.5.

D. Ball Valves - James Jones 1900 or Ford B11-777 with a female iron pipe thread on each end and tee head.

E. Guard Posts - See Section 3.28 (MARKER AND GUARD POSTS).

3.10 BLOW-OFF ASSEMBLIES (PLATE NOS. RW29 & RW30)

A. 2 Inch Blow-Off. Refer to Plate No. RW29. Material shall be as follows:

1. Service Line - Type K copper Section 3.5 (SERVICE LINE MATERIALS AND FITTINGS), with a corp stop and saddle at main per Section 3.5.

2. 2" Ball Valve - James Jones 1900 or Ford B11-777 with female iron pipe thread on each end and tee head.

3. Vault - The same as for a meter installation up to 1". See Section 3.6 (METER BOXES).

4. Plastic Plug - This shall protect top of ball valve.

5. Corporation Stop - James Jones 1957SG or Ford FB 1100-7-Q-TA.

B. 2 Inch and 4 Inch Blow-Off – Refer to Plate Nos. RW29 and 30. Material shall be as follows:

1. Service Line - 2"copper per Section 3.5 or 4" PVC per Section 3.3. There shall be a bottom outlet tee on the main per Section 3.4.

2. 2" or 4" Valve - Resilient-seated gate valve per Section 3.8.

3. Flanged Spool - Made of ductile iron per Section 3.4

4. 2" or 4" Brass Nipple.

5. 2" Ball Valve. James Jones 1900 or Ford B11-777 with female iron pipe thread on each end and tee head.

6. Vault - Concrete box with one-piece concrete cover with reading lid. Approved are Brooks 66-S or Quikset W30 which are 24"x36".

7. Guard Posts - Required where an above ground blow-off is located in undeveloped areas. See Section 3.28 (MARKER AND GUARD POSTS).

3.11 FIRE HYDRANT ASSEMBLIES

The use of recycled water for fire protection is not contemplated for the foreseeable future. At such time as a system is in place which can provide the necessary quantity, flow, and reliability, the District and State DHS may consider it on a case-by-case basis.

3.12 PIPE TRENCH MATERIALS

Refer to Plate No. RW5 for trench cross section terminology.

A. Within Pipe Zone - The pipe zone extends from the bottom of the trench to 12 inches above the top of the pipe. The material within this zone shall be a clean, well graded imported sand with sizes within the following ranges:

Sieve Size	Percent Passing
No. 4	100
No. 8	80-95
No. 200	0-10

Gravel bedding may be approved where warranted by high groundwater or washout potential.

B. Above Pipe Zone - Materials shall conform to the requirements of the City's Public Works Department. Native material compacted to 90% or two-sack cement slurry is permitted.

3.13 ROADWAY MATERIALS

Pavement materials (asphalt and aggregate base) for resurfacing of trenches cut into existing pavement shall comply with the requirements of the City's Public Works Department, or Ventura County Public Works Department if in the unincorporated area. Typically AC replacement thichness is one inch greater than existing. New pavement requires geotechnical recommendation and approval.

3.14 CONCRETE MATERIAL

Approved concrete material shall be based on the 28 day compressive design strength and shall be chosen according to the following chart showing its intended use:

Class	Application	28 Day Strength (Min.)	Max. Aggregate Size	Slump Min.	Slump Max.
A	Walls, structures and reinforced structural encasement	3,500 psi	1 1/2"	3"	6"
B	Trust blocks, non-reinforced pipe encasement, non-structural use	2,000 psi	1 1/2"	2"	6"
C	Pump mix for abandoning lines	2,000 psi	3/8"	Adequate for Pumping	Adequate for Pumping

3.15 REINFORCING STEEL

A. Bar Reinforcement - Shall be Grade 40 minimum deformed bars conforming to ASTM A615, accurately placed securely in position. Where bars are spliced they shall be lapped at least twenty (20) diameters or butt welded, except where otherwise shown on the plans.

B. Mesh Reinforcement - Mesh reinforcement shall conform to the requirements of ASTM A185; wire gauge and mesh dimensions will be as shown on the plans.

3.16 PAINTING

A. General - This section will only cover the paint materials. "Painting" as it relates to construction is discussed in Section 7.20 (CONSTRUCTION-PAINTING).

All paint used for color coding shall be Pantone Purple or as otherwise specified by the District. Paints shall be delivered to the job site in original, unopened cans or packages bearing the brand name and manufacturer's name; and the contractor shall submit color samples to the District for approval.

Paints specified shall be used unless specific written approval is obtained in advance to use other products.

B. Specific Material Requirements

1. Combination Air Release Cans - These shall be painted as follows: Use Carboline's Rust Bond SG-epoxy (1 coat), Carboline's Shop primer (1 coat), Pantone Purple, color coding (2 coats) in such pattern as directed by the District, and with background color of Bayberry by De Voe, or approved alternate, (2 coats).

2. Cast Iron Valves, Fittings and Miscellaneous Metal (except bronze) - Exterior surface to receive 2 coats of Carboline's Bitumastic No. 50 (15 mil each).

   In addition to the bitumastic coating, encapsulate all exterior surfaces including nuts and bolts with a 10 mil layer of plastic film wrap described in "C" (Plastic film wrap) below.

The interior of valves with the exception of bronze and working parts (see exceptions below) shall be coated with 100 percent solids, catalytically setting epoxy which is manufactured for use in the interior of potable water systems. The fusion method of coating 100 percent solid epoxy is acceptable. The two components shall be of different colors to aid in complete mixing. The epoxy lining shall be factory applied and field applications will not be allowed.

Exceptions to the above policy for interior coating require written District approval in advance of delivery to the job site.

Fittings shall all be cement mortar lined or epoxy lined.

3. Detector Checks/RP Devices – These shall be printed as specified for combination air release cans.

4. Steel Surfaces - Use one shop coat of rust penetrating Carboline's Multi-Bond 150 and one field coat of Carboline's Shop primer 1. Finish coats for inside locations to be 2 coats of Carboline's 890 (epoxy mastic). Finish coats for outside locations to be 2 coats of Carboline's 139 Alkyd Polyurethane (alkyd) color coded as directed by the District.

   Cast iron and other bitumen coated metals located above ground and/or in vaults shall receive two coats of Carboline's Multi-Bond 120 (synthetic resin with 48 hours drying time between coats). Finish coats in pressure regulating station vaults and other inside locations except meter vaults shall be two coats of Carboline's 890 (epoxy mastic). Finish coats for outside locations shall be two coats of Carboline's 139 Alkyd Polyurethane (alkyd) color coded as directed by the District.

5. Concrete and Masonry - Exterior surfaces shall receive one coat of Carboline's Flexxide Masonry Block Sealer, or Dutch Boy Block Coat No. 30W01; one coat of Dutch Boy Nalprep No. 019; and two coats Carboline's Flexxide HB Elastamameric or 3359.

   Exterior surfaces below ground shall receive two coats of Carboline's Bitumastic Super Service Black, 12 mils/coat, or approved equivalent.

   Interior above ground surfaces shall receive one coat of Dutch Boy Masonry Vinyl Speed Primer No. 30W10 or Sentry's 500 resurfacer, and one coat of Dutch Boy Masonry Vinyl No. 32W11, or Koppers 601 Interior.

   Interior below ground surfaces, such as in pressure reducing stations and lift stations, shall receive a cementitious seal coat of Sentry Semcrete 610. After at least three days, two coats of Carboline's flexxide HB Elastomeric or 3359 shall be applied.

6. Wood - Exterior locations shall receive one primer coat and two finish coats. Primer shall be one coat Carboline's 139 Alkyd Polyurethane (alkyd) thinned 20%. Finish shall be two coats of Carboline's 139 Alkyd Polyurethane (alkyd). Interior wood surfaces shall receive one primer coat and two finish coats. Primer shall be one coat of Carboline's Multi-Bond 120. Finish coat shall be two coats of Carboline's 139 Alkyd Polyurethane(Alkyd). Color shall be as directed by the District.

C. Plastic Film Wrap - This wrap shall be used around all buried valves, bolted flanges and other fittings. The polyethylene film shall be of virgin polyethylene as produced by DuPont as

Alathon resin and shall meet the requirements of ASTM Designation D 1248 for Type 1, Class A, Grade E-1, and shall have a flow rate or nominal melt index of 0.4 g/min. maximum.

The polyethylene film shall be 8 mils in thickness. The length shall be sufficient to firmly attach the film to the pipe on either side of the valve, flange or fitting. The following minimum flat sheet widths shall be used for the specified valve sizes:

Nominal Valve Size	Minimum Flat Sheet Width
4"	24"
6"	24"
8"	24"
10"	30"
12"	36"
16"	48"
18"	48"

At the contractor's option, tubular material may be purchased and cut with one side to fold out to the required width.

Tape for securing the polyethylene wrap shall be two (2) inch wide adhesive tape such as Polyken No. 900 (Polyethylene), Scotchrap No. 5 (Polyvinyl), or approved equal. The tape shall be such that the adhesive will bond securely to both metal surfaces and polyethylene film.

3.17 QUICK COUPLING VALVE

Quick coupling valves shall be permitted for use only during the initial landscape germination period and shall be removed at the end of that period unless approved by the District. Quick coupling valves shall conform to the following:

Rating – Quick coupling valves shall be ¾-inch or one-inch nominal size with brass construction, Acme thread body and key, and a normal working pressure of 150 psi. All quick coupler valves used for recycled water shall be of a design that prevents the quick coupler key (spike) from being used in potable water quick couplers. Only Acme threaded couplings with approved color identification will be allowed.

Cover – The cover shall be permanently attached to the quick coupling valve. It shall be Pantone Purple 512 in color and made of rubber or vinyl with the following information stamped or molded on the cover:

1. "Recycled Water";
2. "Do Not Drink"; or
3. The international "Do Not Drink" symbol: A glass of water in a circle with a slash through it;
4. Locking cover.

3.18 WYE STRAINER/BASKET STRAINER

Strainers shall have cast bronze body. Screen shall be 80 mesh minimum, stainless steel screens. Automatic flushing is prohibited. It is the developer's obligation to analyze conditions to obtain the most suitable mesh size.

3.19 IRRIGATION HEADS

Recycled water irrigation heads and snap-on recycled water identification caps shall be used whenever possible. All onsite irrigation (sprinkler) heads shall conform to the following:

Rating – Sprinkler heads shall be the types and sizes with the radius of throw, pressure, discharge and any other designations, as indicated on the plans. The irrigation heads shall have internal check valves.

Manufacture – Unless otherwise specified and approved by the District, all heads shall be Rainbird 1800 with Rainbird 1800 purple recycled water caps.

Adjustable-arc, adjustable-radius heads/nozzles – To be used at site perimeters, walks, play areas, along non-vegetated areas and near picnic tables and drinking fountains.

Risers – All sprinkler risers shall be as shown on the plans. All risers shall be considered an aboveground new pipe. This includes existing risers on systems to be converted to recycled water use.

Substitutions – Any substitutions by the contractor for items specified on the plans must be submitted to the user and District for approval.

3.20 SPRINKLER HEAD STABILIZER

Sprinkler heads shall be securely installed to minimize breakage.

3.21 EXTERNAL CHECK VALVES

Install external check valves at all heads or bubblers that exceed manufacturer's internal check valve requirements.

3.22 SYSTEM CONTROL DEVICES

All onsite irrigation controllers and appurtenances shall conform to the following:

Type – Automatic controllers shall be UL listed of the type and manufacture shown on the plans or approved equal. Each controller shall be capable of eight repeats daily with 16-day variable cycles minimum. The controller shall have a water budget feature. It shall have remote start capability. It must be compatible with the master valve and flow sensor. It must have power outage time keeping capability.

3.23 INLINE PRESSURE REGULATOR

Recycled water inline pressure regulators smaller than 3 inches shall have a cast bronze body. The screens shall be stainless steel.

3.24 MASTER VALVE

Recycled water master valve shall be a pressure regulating (manually and electrically), normally-closed position valve.

3.25 FLOW SENSOR

The recycled water flow sensor must be compatible with the controller and master valve. The flow sensor must have high flow shut-off capability.

3.26 REMOTE CONTROL VALVES

Recycled water remote control valves shall have purple plastic bodies or painted purple brass bodies and bonnets. They shall be contamination proof, self-flushing/cleaning style, pressure regulating (manually and electrically), normally-closed positioned valves.

3.27 BOOSTER PUMPS

Booster pumps may be approved by the District on a case-by-case basis.

3.28 MARKER AND GUARD POSTS

In easements or where required on the plans, marker or guard posts shall be installed per the requirements of the District. Marker or guard posts shall be constructed of 4" diameter, schedule 40 steel pipe, 5'-6" in length. The posts shall be filled with concrete and set 2'-6" into the ground, centered in a concrete base of not less than 18" in diameter with a minimum of 3" of end cover and cambered to shed water.

Marker and guard posts shall be painted as steel surfaces per Section 3.16 (MATERIALS-PAINTING). Color shall be Syn-Lux 876 C (International Yellow) or Rustoleum Enamel "School Bus Yellow" #7448, or as otherwise directed by the District.

4.1 GENERAL

The District has established procedures for the preparation of plans. Deviation from these requirements, unless specifically authorized, will be cause for rejection. Plans shall be prepared by a civil engineer registered in California, and familiar with all aspects of these Standards. The engineer shall sign the plans at the time of initial submittal to attest to their accuracy and completeness, and shall follow the progress of the work, submit change orders, and provide "as-built" certification and information on the record drawings.

The responsibility for accuracy and completeness of the drawings rests with the developer's engineer. By signing the drawings, the District Engineer attests to the fact that they have been reviewed and are sufficient for permit issuance.

4.2 SHEET CHARACTERISTICS

Work shall be in ink on 4-mil double-mat Mylar sheets with overall dimensions of 24" x 36". Margins shall be two inches on the left, all others ½ inch. Minimum lettering size is 0.08". North shall be oriented to the top or left. The engineer's signature and seal shall be placed on each sheet.

4.3 SIGNATURE BLOCK

All sheets shall have an approved signature block (see Plate No. RW1). Changes to the plans after approval shall require change order approval by the District, unless changes are specifically authorized to be made without a change order and shown on the record drawings.

4.4 COVER SHEET

This shall be the first recycled water plan sheet in the set and shall contain:

A. An Index Map with an overall plan at a scale of 1" = 300 ft. showing general layout of water lines, sizes, valve locations, named streets, tract boundaries, lot boundaries and numbers, a sheet index, and other pertinent information. The cover sheet shall include a note as to the pressure zone by number and elevation. Care must be exercised to make sure scale and orientation are correct since these index maps are used to produce a water atlas. Incorrectly drawn maps will have to be redrawn. (Use of a secondary, key map, sheet may be approved).

B. A Vicinity Map with a scale of 1" = 1,000 ft. showing tract boundary, streets, adjacent tracts, major streets outside of tract boundaries, and the location of the benchmark.

C. All Benchmarks used in the project shall be graphically shown on this sheet and the elevations, descriptions, location, etc., spelled out as illustrated below:

BM No. _____ Elev. _____ F.B. _____ Page. _____

Type of Marker _____

Location _____

Elevations used in the preparation of plans shall be based on either National Geodetic Vertical Datum of 1929 (NGVD 29) or the North American Vertical Datum of 1988 (NAVD 88).

D. The general notes shall be shown on the cover sheet (see Section 4.11).

E. A Certification block shall be placed on the cover or key map sheet worded as follows:

CERTIFICATION

I hereby certify that the recycled water system as shown on City Drawing Number(s) _____ through _____ has been designed in conformance with District Standards and Regulations.

Registered Civil Engineer	RCE No.	Date

F. A record drawing (as-built) Material List shall be placed on the cover or key sheet as follows:

Material List

Item	Supplier and/or Manufacturer	Model/Type No.	No. Each
Pipe			
Services			
Valves			
Brass Products			

The information shall be completed by the developer's engineer prior to submittal of record drawings.

G. A Record Drawing Certificate shall be placed on the cover sheet as follows:

RECORD DRAWINGS CERTIFICATE

I hereby certify that the work shown on City Drawing Number(s) _____ through _____ inclusive, marked "Record Drawing" has been constructed in conformance with said plans and referenced specifications.

Registered Civil Engineer	RCE No.	Date

4.5 PLAN OF RECYCLED WATER SYSTEM

Plan drawings shall show the location of recycled water mains, service lines, and other structures in relation to survey lines and stations. Included shall be blow-offs, combination air release valves, main line valves, thrust blocks, etc. The plans shall provide all data for horizontal deflections or curves and indicate limits of any easements. Any known pad locations which are adjacent to an easement should be shown, as well as fences, walls, trees, etc., which are within or directly adjacent to the easement. The size and ownership of all existing and/or proposed underground utilities that cross or parallel the recycled water line, including facilities of other water purveyors, shall be included on the plans.

4.6 PROFILE OF RECYCLED WATER SYSTEM

Profiles shall show the grade, including any vertical curve data, size and type of pipe, and the overall segment length of each pipe type or size. Any special encasement required to carry loads on the pipe shall also be shown. Items such as valves and the other structures or appurtenant features listed on the plan shall be shown on the profile. Any pipeline two inches (2") or more in diameter which crosses the recycled water line, including water, wastewater, gas, telephone, power, storm drain, television, and oil lines, shall be shown and labeled on the profile. The grade of parallel lines within 5 feet of the water line shall also be shown.

The District is not responsible for the accuracy of the location of underground facilities, and approval of recycled water plans by the District does not constitute a representation as to the accuracy of the location of, or the existence or nonexistence of, any underground utility, pipe, or structure within the limits of the project. The contractor shall be responsible for locating such lines prior to or during excavation or boring.

4.7 GRAPHIC SCALES AND NORTH ARROW

Each plan and profile sheets shall contain:

A. A graphic scale, horizontal as well as vertical, illustrated such that a true representation is produced when the plans are reduced in size. The scales shall be as follows:

   Horizontal 1" = 40 feet (25mm = 7.6m)
   Vertical 1" = 4 feet (25mm = 1.2m)

   Double vertical scale drawings (i.e., 1" – 8 feet) may be submitted where the predominant slope of the existing ground surface on any sheet exceeds 15 percent. In such cases, the works "Double Scale" shall be boldly shown.

B. A north arrow oriented toward the top or to the left.

4.8 PROCEDURE FOR APPROVAL

Approval for improvement plans consists of two phases. Each phase consists of a series of requirements which must be met before final acceptance.

A. Requirements for authorization of construction (see Section 5 of these Standards).

B. Requirements for final acceptance (see Section 11 of these Standards).

4.9 PLAN CHECKING LIST

The following list is intended as a guideline to assist the preparer; it is not represented to be a complete list of requirements:

CHECK LIST FOR PLAN CHECKING AND PROJECT REQUIREMENTS

COVER SHEET

Standard size, title block, signature block
Revision and engineer's block
Index and vicinity map, including lot numbers and lot lines
Sheet index (with multiple sheets)
Key map (with multiple sheets)
Pressure zone(s) and elevation
Adjacent tracts and street layout
Benchmark
Design and record drawing certificates
Pressure requirement
General notes
Underground Service Alert note
Engineer's signature
Engineer's stamp and expiration date

GENERAL DESIGN

Recycled water need (area to be served, peak demand, annual use)
Conformity to master plans
Oversizing requirements
Pressure analysis
Selection of pipe type(s)
Instructions relative to sequencing, timing, and thrust blocks for tie-ins to the existing system

PLAN AND PROFILE SHEETS

Graphic scales
North arrows
Water line stationing left to right
Elevations at top of pipe
Cover
Curve data
Pipe size(s) and type(s)
Street dimensions, street names
Lot boundaries
Easements, including line bearings
Angle points, with deflection or fitting angle
Valves, combination air release, and blow-offs
Meter box detail where not in sidewalk
Size of meters
Lot numbers and pad elevations
Topography (including drainage paths, floodplain boundary, wells)
Location of storm drains, water lines, and sanitary sewers
Cross connection separation
Thrust blocks

ADMINISTRATIVE COMPLIANCE BEFORE CONSTRUCTION

Plan Check fee
Cost estimate
Agreement for construction and bonds
Insurance
Inspection fees
Connection fees
Encroachment permit
Preconstruction conference

ADMINISTRATIVE COMPLIANCE DURING OR AFTER CONSTRUCTION

Change Order Requests and Fees
Meter installation requests
Certifications
Record Drawings
Punch List

4.10 DEDICATION OF EASEMENTS AND FACILITIES TO THE DISTRICT

Dedications of easements, and in some cases of fee title, are to be provided on the face of subdivision maps; and the completed facilities are dedicated by language of the subdivision agreement. Where a subdivision is not involved, an offer of dedication or grant deed shall be recorded. The following language is intended as an example of standard language for the dedication of easements and facilities to the District. It shall be modified if necessary to fit a particular set of circumstances.

A. Easement. An easement to install, repair, maintain, renew, and replace recycled water mains and appurtenances with the rights of access, in, over, under, and across the following described real property in the County of Ventura, State of California:

B. Facilities. All rights, title, and interests in and to the recycled water system and appurtenances shown on City Drawing Nos._____through _____.

Additional language may be added by the District as required, such as an acknowledgement that the District shall not be responsible for the replacement of decorative pavement.

4.11 GENERAL NOTES

The General Notes shown on Plate RW49 shall be included on the Recycled Water Plan cover sheet. These notes are subject to modification as deemed necessary by the District.

5.0 FEES, CHARGES, AND REQUIREMENTS FOR AUTHORIZATION AND CONSTRUCTION

5.1 GENERAL

Specific fee/charge amounts are adopted annually by either Board resolution or ordinance following public hearings as required by law. Water service charges for metered accounts, unmetered construction purposes, interconnection between existing and new systems, and capital improvement are addressed in the District Charges, Rates and Fees. Water service fees for installation, relocation, or replacement of services, meters, and meter boxes are included in the City Schedule of Service Charges.

5.2 PLAN CHECK FEE

When recycled water plans are first submitted, a plan check fee shall be paid to the District by the developer. This fee is established by the City Schedule of Service Charges and is collected with City plan check fees. It shall be based upon an estimate of the cost of the improvements, provided by the developer's engineer utilizing the City's unit costs, with verification by the District. The fee may be increased if actual or subsequently estimated costs exceed that used for the initial fee calculation, if consultant services are required, or if extraordinary plan check time is incurred.

5.3 SUBMITTAL OF PRINTS (PLAN CHECK)

Recycled water plans shall be submitted as part of the complete improvement plan submittal for development projects. In stand-alone recycled water projects, two sets of prints of the proposed recycled water improvements and the engineer's estimate shall be submitted with the plan check fee for the first plan check.

5.4 SPECIAL PROVISIONS

If there is an unusual condition which may affect the feasibility of the project or which may require special consideration, it should be identified in writing prior to tentative map and/or development project approval.

5.5 INSPECTION FEE

At the time of encroachment permit application, the developer shall pay an inspection fee based upon the approved cost estimate, as established by the City Schedule of Service Charges. Overtime, weekend, and holiday time are subject to availability of inspection and to additional fees as established by the City Schedule.

5.6 EASEMENTS

Required easements shall be shown on the subdivision map, if applicable, or otherwise provided in offer/deed form for checking at the time of first submittal. Also, see Section 4.10.

5.7 AGREEMENTS, BONDS, AND INSURANCE CERTIFICATES

Prior to issuance of a permit for construction, the developer shall submit the following on City forms:

A. Agreement for construction of subdivision improvements (in triplicate with notarized signatures), modified as necessary if no subdivision is involved.

B. Insurance policy certificate on City endorsement form with limits as stated in the Agreement. The insurance certificate shall include general liability, auto liability and workers' compensation insurance in amounts as required by the City/District. The District, its officers, employees and agents, shall be named as additional insureds. The notice of cancellation period must be no less than 30 days. Any reference in the cancellation clause to "endeavor to" or "but failure to mail such notice shall impose no obligation or liability of any kind upon the company" must be deleted. Also, the words "This certificate is issued as a matter of information only and confers no rights on the certificate holder" must be deleted. If disclaimers cannot be deleted, then a signed warranty letter must be attached to the certificate.

C. A faithful performance bond (in triplicate and notarized) equivalent to 100 percent of the estimated cost, including contingencies, of construction. A certificate of deposit or letter of credit, in form acceptable to the City, may be substituted.

D. A labor and materials bond (in triplicate and notarized) equivalent to 100 percent of the estimated cost. A certificate of deposit or letter of credit, in form acceptable to the City, may be substituted.

E. A copy of a "release" from the Calleguas Municipal Water District acknowledging satisfaction of their requirements of fees for capital projects (Not a City Form).

5.8 "WILL-SERVE" LETTER

Prior to issuance of a permit to construct facilities, the developer shall obtain a recycled water "Will-Serve" letter indicating that the subject property lies within the District's service area and that the District will provide recycled water service subject to the terms, conditions, and limitations outlined by these standards.

5.9 APPROVAL FOR CONSTRUCTION

Upon review and acceptance of all improvement plans for a project and of all documents, bonds, and fees, staff shall notify the developer's engineer that the plans are signed and available for reproduction. The developer's engineer shall then provide the District with two sets of prints and return the original drawings to the District until they are "as-built". Once signed as accepted, the originals become District property.

No construction shall occur before the plans are signed and authorization is given for construction, generally an encroachment permit. A pre-construction meeting of all interested parties should be arranged by the developer, and may be required by the District.

This process should be conducted as part of the overall development process for a project.

5.10 CAPITAL IMPROVEMENT CHARGE

A capital improvement charge shall be paid, as a but-in to the existing system, when any person, firm, corporation, or other entity requests a new recycled water connection or in any way causes an increase in the recycled water usage. Unless approved by the Director, no will-serve letter shall be issued until the capital improvement charge has been paid. The capital improvement charge is based upon meter size and acreage as provided in the District Charges, Rates and Fees.

5.11 SERVICE LINE OR METER INSTALLATION

Normally, a developer will install the required service lines as part of the development project. The District will then install the meter.

Single service line connections to existing District owned pipelines may be done by the District along with the installation of the meter when no other work is needed.

All work by the District shall be paid by the owner or developer. The charge for installation of a service connection shall be based upon prevailing costs of materials and labor plus fringe benefits and an allowance for overhead. Deposit amounts shall be required prior to installation of the meter or service. After installation, the actual cost will be determined and adjustments made, either in the form of a refund of part of the deposit amount or additional payment by the owner/developer.

5.12 MAINLINE EXTENSION AND OVERSIZING AGREEMENTS

If any developer desires to enter into a reimbursement agreement with the District, such arrangements shall be made a condition of approval of the project. Thereafter, no such agreement shall be made. Reimbursement agreements for main line extensions involve future payments to the developer installing the improvement if and when the District receives funds from other benefiting properties within the term of the agreement. As a condition of approval of such benefiting property, a pro-rated share of the total cost of the improvement shall be required based on the proportionate use of the improvement as determined by the District. This shall be in addition to other fees, deposits, and charges. In the case of a District contribution for oversizing a line, no District contribution can be considered unless the line is 10" or greater in diameter. The District contribution will generally be the incremental difference of the pipeline cost. For tanks and pump stations, a proportional contribution will generally be considered.

5.13 TESTING OF BACKFLOW DEVICES

See Section 10 (CROSS CONNECTION AND BACKFLOW PREVENTION).

5.14 CUSTOMER'S GUARANTEE DEPOSIT

The District requires all applicants for recycled water service to post a guarantee deposit. An exception to this requirement is applicants who have at least one other active water service account with the District and who have no record of delinquent payments with respect to their water account(s). The deposit required herein shall be equal to the estimated amount payable by the applicant for one month of recycled water service but, shall in no event be less than the sum stipulated in the schedule of rates.

Guarantee deposits may be refunded upon application by the customer after a twelve (12) month period from the date of receipt in which a satisfactory payment record has been established. The District reserves the right to disallow or withhold the refund of any deposit after the twelve (12) month period if settlement of service bills becomes irregular or is delayed for any reason. Where service has been discontinued for non-payment of service bills, for whatever reason, and subsequently where the recycled water service is permanently revoked or terminated, the outstanding amount as well as the separation costs shall be settled against the deposit account and the balance of the deposit returned to the customer, provided nothing is owed to the District by the customer for recycled water services at other addresses. The service contract is then closed.

Any request for re-establishment of a recycled water service subsequent to permanent revocation or termination of the permit shall be handled per Article 11.4 of these Rules and Regulations.

5.15 RECYCLED WATER SERVICE RATES

5.15.1 Establishment of Rates

Recycled water service rates within the District shall be established by a resolution of the Board of Directors.

5.15.2 Change of Rates

The District reserves the right to change its rates for recycled water service. However, prior to considering any change in said recycled water service rates, a notice of the proposed change shall be posted by the District Secretary at least ten (10) days prior to consideration of such a resolution by the Board of Directors.

5.15.3 Capacity Charge

A capacity charge may be established by resolution of the Board of Directors to provide for system improvements. Said charge shall be paid as a component of the recycled water rates.

5.15.4 Recycled Water Meter

5.15.4.1 Meter Reading Period

Recycled water meters are read at the same time as the potable water meter.

If a recycled water meter fails to register during any period or is known to register inaccurately, the customer shall be charged for that period pursuant to an average daily consumption rate based upon a reading of the meter when in use and registering accurately during the same season or as close to the same season as is reasonably possible. Any customer may request that the meter through which the recycled water is being furnished be examined and tested.

6.0 CONSTRUCTION STAKING

6.1 GENERAL REQUIREMENTS

Construction staking on development projects is the responsibility of the developer's engineer or contractor. The term encompasses markings which may not involve any staking, such as markings on pavement. Stakes or marks should be set parallel to the pipeline alignment at an offset distance generally not more than 10 feet. Stakes or marks should be set at no greater interval than 50 feet on straight alignments when the pipeline slope is 0.6 percent or more. For horizontally curved pipelines at less than 0.6 percent slope, the stake or mark interval should be 10 feet. For horizontally curved pipelines above 0.6 percent slope and for straight pipe lines below 0.6 percent slope, the stake or mark interval should be 25 feet. It is recommended that cut sheets indicating station, offset, and cut be provided to the District Inspector.

6.2 PRESERVATION OF STAKES

Construction stakes or construction markings shall be carefully preserved by the contractor until after the installation has been inspected. If two or more consecutive stakes are knocked out during construction, new stakes should be set at the contractor's expense.

6.3 SERVICE LINES

For each service line, a stake shall be placed near the property line, to show its location if the meter box is not installed. The stake shall be a minimum 2" x 4" redwood post 2 feet in length with 18 inches buried.

6.4 RECORD DRAWINGS

The stationing for each service line is required on the record drawings.

7.1 GENERAL REQUIREMENTS

This section describes the use of materials and workmanship to be employed in construction of the water system. The developer/engineer shall prepare such general and special specifications as are necessary to define the nature and location of the work, contractual arrangements, payment for work and any other matters discussed within the standards presented here.

A. Use of This Section: The construction section is intended to highlight the features of construction, which are deemed to be most significant. In any construction activity, the recommendations of the manufacturer of a product, especially where more stringent, should apply. Also, the omission from this section of a particular practice which is considered to be a good construction technique common to the construction industry, should not be construed to mean that it is not required.

Specific standards incorporated into this section by reference include:

- AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches through 12 inches".
- AWWA Manual M11 "Steel Pipe – Design and Installation".
- AWWA Manual M23 "PVC Pipe – Design and Installation".
- AWWA Manual M41 "Ductile – Iron Pipe and Fittings".
- AWWA C901 "Polyethylene (PE) Pressure Pipe and Tubing, ½ in. through 3 in. for Water Service".
- AWWA C906 "Polyethylene (PE) Pressure Pipe and Fittings, 4 in. through 63 in. for Water Distribution".
- Standard Specifications for Public Works Construction.

The developer/contractor should refer to Section 3 (MATERIALS), along with this section and the respective plates, and Section 11 (TESTING AND INSPECTION).

B. Protection/Operation of Existing Recycled Water System: No developer or contractor will be allowed to operate any existing water valves or to cause a shutdown of any portion of the District's recycled water system without prior approval from the District's representative. That representative may be either the District Engineer, Superintendent, or the construction inspector with approval from the Superintendent. In general, any operation of valves in a planned shutdown will be done by District personnel. When shutdowns are required in a part of the District system, the District will expect evaluation of whether the shutdown should be done during the day or during the night. Contractor/developer economies shall be weighed less heavily in the decision than the interruption and inconvenience to existing customers. Any shutdown shall involve a thorough notification plan for existing customers.

C. Quality of Materials: Materials and equipment to be incorporated into the work shall be new and unused unless otherwise approved. In case a reference is not clear as to which of several available grades is desired, the highest quality material shall be used. When construction bids are received directly by the District, such bids shall show the proposed pipe material and the manufacture's name, if more than one type is allowed.

The contractor shall have at the job site or be able to supply upon request, certified copies of factory or laboratory test reports showing the strength characteristics of any materials used in the work. For reinforced concrete work, the contractor shall furnish, in advance of pouring, the mix design and rated strength as prepared by the concrete supplier.

D. Substitutions: Where articles or materials are specified by trade name, alternate materials or articles equal to those specified may be approved, provided the request for approval is in writing accompanied by supporting data in ample time to permit investigations without delaying the work. Unless substitutions have received prior approval, no deviation from the Standards will be allowed.

E. Quality of Workmanship: Work should be done by persons experienced in the specific work, under competent supervision, and to the District's complete satisfaction. When work is being done directly for the District, the contractor shall name each subcontractor in the proposal; and no substitutions shall be made without prior approval.

F. Defective Work: Any defective material or workmanship which becomes evident within one year of acceptance shall be replaced or repaired, at the District's discretion, without cost to the District. Refusal of the contractor to correct defective work shall be just cause for exclusion from performing future work. Such exclusion shall not limit the District's right to bring legal action to correct deficiencies and/or to withhold exoneration of warranty bonds.

G. District Inspection, Field Acceptance, and Warranty Period: The District has the primary responsibility for inspection of all excavation, materials, pipelaying (including appurtenant structures), trench backfill within the pipe zone, and testing. The City has the primary responsibility for trench backfill above the pipe zone and for roadway construction/restoration. Work shall be available for inspection at all times. The contractor shall provide notice to the District at least two work days prior to the start or resumption of any work. Initial notification should allow for scheduling a preconstruction meeting between interested parties. Failure to provide proper notification may delay the start of work. In addition, the District may refuse to accept any work for which inspection has not been arranged.

Inspection hours are 7:30 a.m. through 3:00 p.m., Monday through Friday, unless otherwise approved in writing by the District Engineer. All requests for after-hours, holiday, or weekend inspection are subject to the availability of inspection and shall be submitted in advance by the developer such that the District Engineer can approve and issue written authorization. All such work is subject to overtime charges as provided in the City Schedule of Service Charges.

Field acceptance is made by the inspector for the purpose of allowing the work to proceed. It shall not be considered acceptance of the work. The one-year warranty period for all project work shall begin as of Board acceptance. As mentioned in Section 7.1F (Defective Work), any defective work discovered during this period shall be repaired or replaced; and a new one-year period will begin for that corrected work. Unauthorized material shall not be subject to warranty period limits, and shall be replaced whenever discovered.

H. Public Relations: The contractor shall conduct affairs in a manner which will minimize disturbance of residents in the vicinity of the work. The job site shall be maintained in a condition which will bring no discredit to the District or its personnel. Pedestrian and vehicular travel shall be maintained unless detours or closures are specifically authorized by

the City; and all affected private improvements shall be restored to original condition or better, unless other arrangements are made with the property owner(s).

7.2 PERMITS

The developer or the developer's contractor shall obtain the following permits as applicable:

Encroachment: Within City of Simi Valley, an encroachment permit is required for all recycled water installation. The permit is secured from the Public Works Department. Within the County areas, or Caltrans jurisdiction, a similar permit is required. Particular attention is called to Section 7.15 (BACKFILL AND COMPACTION) and the appropriate Plate RW6.

7.3 SHIPMENT AND DELIVERY

All pipe shall be braced and stulled to prevent damage during shipment. Any damaged pipe or fittings delivered and unloaded at trench side shall be removed by the contractor from the work site. Handling of CMCL pipe, including off-loading and placement in the trench, shall be done using nylon (or other approved) rigging straps so as not to damage the pipe coatings. Rigging straps shall be properly rated for the weight category of the lift. Chains shall not be allowed to come into contact with the pipe.

7.4 CLEARING AND GRUBBING

A. General: Clearing and grubbing, which consists of removal of objectionable material from the work area, shall be done with caution such that existing underground improvements, adjacent property, and trees and shrubbery that are not to be removed are protected from damage. Clearing and grubbing for a development project requires an encroachment permit or a grading permit.

Within water easements or rights-of-way, trees, shrubs, fences, and all other improvements that have to be removed to permit construction, and which are intended for replacement, shall be replaced in kind or size (excluding native trees under 2-inch diameter or native brush) or with approved substitutes, unless permission to exclude such replacement is obtained from the owner/agency or granted by the District.

B. Removal and Disposal of Material: The contractor shall be responsible for leaving the site in a neat and finished appearance, free from debris or inflammable material. Disposal of removed material shall be in legally approved location(s).

C. Protected Trees: Work under or within the dripline of a protected tree may be subject to special requirements. The developer and/or contractor shall contact the City Planning Department if trimming, removing, or construction around protected trees is required. Protected trees include all native oaks, any tree designated historic, and mature trees (with 72 inches of cross-sectional trunk area).

7.5 UTILITIES, EXISTING FACILITIES, AND CONCRETE REMOVAL

A. Abandonment: Refer to Section 8 (ABANDONMENT) regarding abandonment of existing water lines and/or structures.

B. Utilities and Existing Facilities: Existing utilities and/or facilities shall be protected from damage during excavation and backfilling of trenches; and, if damaged, shall be repaired by and/or at the contractor's expense. This requirement shall not preclude the contractor from pursuing compensation for any existing utility or facility not shown on the drawings or the location of which is not shown to the contractor in sufficient time to avoid damage.

Whether expressly indicated on the drawings or not, contractors shall call the Underground Service Alert and allow time for surface marking prior to any excavation.

The District will mark the location of existing services upon request and with satisfactory notification in advance.

In case it is necessary to remove any such utilities, facilities, or any portions thereof, the contractor shall notify the District and the owner. The contractor shall not interfere with the utility and/or facility until notice to relocate or remove has been given to the owner and appropriate action has been taken or acknowledged by the owner.

The fact that any underground utility and/or facility is not shown on plans or marked in the field shall not relieve the contractor of responsibility to exercise a standard of care to ascertain prior to commencing work the existence of any underground utilities or facilities which may be subject to damage.

Concrete and Masonry Removal: Removals of existing concrete pavement, curbs, gutters, sidewalks, foundations, and other structures as noted on the plans or where otherwise necessary shall be disposed of by the contractor and shall be performed without damage to any portion of the existing work that is to remain in place. If damage occurs, the contractor shall repair any such damage at his own expense, to the satisfaction of the District. Repair/replacement of public sidewalks, curbs, gutters, storm drains, and/or roadway pavement shall be to the satisfaction of the City Public Works Department. Where existing reinforcement is to be incorporated in new work, such reinforcement shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in new concrete.

7.6 EXCAVATION AND TRENCHING

A. General: Trench excavation shall consist of all excavation involved in the installation of the recycled water lines. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. The material piles shall also not obstruct existing sidewalks or driveways unless approved by the City. All excess excavated material or material unsuitable for backfill shall be removed per Section 7.4B (Removal and Disposal of Materials). Provisions shall be made as necessary to prevent surface water from flowing into trenches or other excavations, and any water from any source accumulating therein shall be removed by pumping or by other approved methods and disposed of as permitted by Regional Board regulations. Sheeting and shoring shall be provided as required by OSHA for the protection of the work and for the safety of personnel.

Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the District, the pipe or duct can be safely and properly installed and backfill compaction can be properly achieved in such tunnel sections.

B. Excavation: Excavation for recycled waterlines shall be made only after pipe and other necessary materials are delivered to the work site. After delivery, trench excavation shall proceed, the pipe shall be installed, and the trench backfilled without undue delay.

Where rock excavation is required, the rock shall be excavated to a minimum overdepth of 6 inches below the trench depth indicated on the drawings, or as specified. Overdepth in the rock excavation and unauthorized overdepths shall be backfilled with the same material as the bedding zone. Whenever wet or otherwise unstable soil incapable of properly supporting and restraining the pipe is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the top of the pipe zone with an appropriate material of course sand or crushed rock to provide stable support.

C. Shoring: All shoring for open excavations shall conform to the State of California, Department of Industrial Relations, Division of Industrial Safety "Construction Safety Orders."

The contractor shall be responsible for adequately shored and braced excavations so that the earth will not slide, move, or settle, and so that existing improvements will be protected from damage.

No shoring once installed shall be removed until the trench has been approved for backfill operations. Removal of shoring shall only be accomplished during backfill operations and in such a manner as to prevent any movement of the ground or damage to the pipe or other structures.

The contractor shall obtain and pay all permits for any excavations over five (5) feet in depth into which a person is required to descend or any excavation less than five (5) feet in depth in soils where hazardous ground movement may be expected and into which a person is required to descend.

D. Trench Width and Grade: The width of the trench within the pipe zone shall be such that the clear space between the barrel of the pipe and trench wall shall not exceed the amount detailed in the standard plates. In general, the following shall be adhered to:

Table 7-1

Nominal Pipe Diameter	Trench Width	
	Minimum	Maximum
6"-12"	O.D.+12"	O.D.+18"
14"-18"	O.D.+18"	O.D.+24"

E. Pipe Subgrade: The trench bottom shall have a flat or semi-circular cross section. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of each joint except for required "bell holes" at joints. A coupling hole shall be excavated as necessary with sufficient length, width and depth to permit assembly and provide a minimum clearance of 3 inches below the coupling for a length of 6 inches beyond the coupling.

7.7 PIPE BEDDING AND LAYING

A. General: This portion of the work includes the furnishing of all materials and their proper assembly so as to result in a first class waterline installation true to line and grade and free from leaks, cracks, and obstructions.

Where choices are allowed, the contractor shall select such materials and construction methods as will result in a completed project in full accordance with these Standards. In that regard, refer to Section 3 (MATERIALS) and the Plates for additional details.

The approved recycled water pipeline design is based upon a proper combination of pipe strength and pipe support. No acceptance will be given unless the work of trenching, bedding, laying, backfilling, and compaction is conscientiously done in accordance with the procedures outlined in these Standards.

Except as otherwise approved or included in the permit, the maximum length of open trench at any one time shall nominally be 600 feet, but shall not exceed the distance necessary to accommodate the amount of pipe installed in a single day.

Grades should be transferred from ground surface to the bottom of the trench by experienced workmen, using not less than three consecutive grade points in common, so that variations from a straight grade may be readily detected. Each length of pipe shall be laid on firm, approved bedding material as specified and shall have full bearing for its entire length between bell holes excavated in said bedding material to allow for unobstructed assembly of all joints. Adjustments of pipe to line and grade shall be made by scraping away or filling in and tamping approved material under body of the pipe. No wedging or blocking with wood or soil to support the pipe will be permitted. Under no circumstances will a contractor be allowed to dump backfill materials on top of a pipe which is not continuously supported in its final grade position.

Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe, following the manufacturer's instructions for the specific jointing method being used. Pipe shall not be laid when the engineer or inspector determines that the condition of the trench or weather is unstable. As the work progresses, the interior of the waterline shall be cleared of all dirt and superfluous materials of every description. If the maximum width of the trench at the top of the pipe zone is exceeded, the contractor shall install such concrete cradling, pipe encasement or other bedding as may be required to support the added load of the backfill. Trenches shall be kept free from water until sufficient backfill has been applied to keep the pipe in place. At times when work is not in progress, open ends of pipe and fittings shall be securely closed to the satisfaction of the inspector so that no trench water, earth, or other substance will enter the pipe or fittings. Pipe or fittings damaged during assembly shall be removed and replaced.

B. Pipe Laid on Bedding vs. Earth Mounds: The key elements to the pipe bedding are that the pipe ultimately be continuously supported and that the full 4 inches of bedding material (imported sand or better) be placed under the pipe. Where pipe is to be laid where considerable amounts of rock or cobblestone or groundwater are present, the continuous bedding method shall be used. Earth mounds may be used, if specifically approved by the inspector, in areas exhibiting ideal pipe laying conditions where there is clear demonstration that the 4" bedding material can be placed after the pipe is laid in the trench.

For the continuous bedding method, the trench bottom shall be overexcavated a minimum of 4 inches and brought back to grade with imported bedding material. See Section 7.6B (Excavation and Trenching) for excavation in rock. Prior to lowering pipe into the trench, coupling holes shall be excavated in the bedding with sufficient length, width and depth to permit assembly and provide a minimum of 2 inches below the coupling.

For the earth mound method, the mounds shall be compacted firmly and of a size adequate to suspend the pipe 4 inches above the trench bottom while maintaining the pipe true to grade. Each length of pipe shall be laid on two mounds with the center of each placed at approximately one-fifth the distance from each end. Coupling holes shall provide a minimum clearance of 2 inches. After assembly, the bedding zone shall be properly backfilled with imported bedding material. The bedding material shall then be compacted utilizing appropriate methods to provide a firm and uniform bedding throughout the entire length of pipe.

C. Pipe Laying for Ductile Iron Pipe: Where approved for use, ductile iron pipe shall be laid in accordance with manufacturer instructions and in general compliance with the applicable procedures as listed for ductile iron pipe. Where specified, the District may request a specification for such installation practices. Specific attention shall be given to the placement of the polyethylene encasement wrap and any tapping of the pipeline for services and/or other main connections.

D. HDPE: Where approved for use, HDPE shall be laid in accordance with manufacturer instructions and in general compliance with the applicable procedures as listed for HDPE. Where specified, the District may request a specification for such installation practices.

7.8 THRUST BLOCKS, SUPPORTING OF VALVES, ETC.

A. Supporting of Valves: Valves and fittings shall be supported by the trench bottom, not the pipe. The concrete should be under and around the fitting and not the joint.

B. Thrust Blocks: These shall be placed as shown on the plans or as required by Plates RW36 through 38. The concrete shall meet the requirements of Section 3.14 (Concrete Material). Care shall be taken to insure that the concrete is poured against undisturbed ground and the fitting to be anchored.

7.9 HOT TAPPING

Hot tapping shall only be done in the presence of the District representative. Section 3.8F discusses the tapping sleeve and valve requirements. The tapping mechanism shall be of the self purging type so that cutting chips are removed from the tapping machine and do not enter the pipeline.

7.10 SERVICE CONNECTIONS AND SERVICE LINES

Service connections at the main shall not be placed directly opposite one another. There shall be a minimum of 1 foot of longitudinal separation between them. On PVC pipe, the taps shall be staggered vertically to prevent a split in the pipe.

With service saddles, the surface of the pipe shall be cleaned as necessary to remove all loose material before placing the saddle on the pipe.

In all metal to metal threaded connections, either teflon tape or sealing compound approved for use in potable water shall be used.

Refer to Plates RW13 and 14 for services to 2 inches, to Plates RW15 through 17 for larger meters.

7.11 INSTALLATION OF VALVES AND FITTINGS

Valves and fittings shall be installed at the locations shown on the plans, per the following check list:

- The weight of the valves or fittings is to be taken by firm ground or blocking and not the pipe.
- All materials are covered in Section 3 (MAINLINE FITTINGS), (MAINLINE VALVES), and (MATERIALS-PAINTING).
- Valves and all bolted connections shall receive a plastic film wrap (see Section 3 – MATERIALS-PAINTING) installed as follows: The valves shall be wrapped by passing the flat sheet of film under the valve bottom and bringing the ends up around the body to the stem and securing it in place with 2 inch strips of the plastic adhesive tape. The polyethylene shall be secured around the valve stem in such a manner as to leave the stem free to operate. The film shall be brought completely around the flanges and secured to the pipe with a plastic adhesive tape on either side of the valve, flange or fitting.
- All bolted connections shall be performed in an even manner by a series of tightening steps so that no portion of the bolted connection is overstressed.

7.12 INSTALLATION OF AIR RELEASE AND BLOWOFF ASSSEMBLIES

Combination air release and blowoff assemblies shall be installed as shown on Plate No's. RW26 through 30. The developer/contractor shall locate the combination air release cans and blowoff vaults in a suitable location with respect to the adjacent properties. This shall include locating them closer to property lines rather than in the middle of a property where there could be future objections from the property owner. The service line to the assembly shall have a positive grade to prevent accumulations of air.

Refer to Section 3 for copper tubing connections. The service line shall be one continuous length without fittings between the corp stop to the air release valve riser. The corp shall be stacked at the main with 8-inch PVC and valve box if 2 inches or larger.

Dielectric connections with PVC tape wrap shall be provided at all connections between steel, brass, or bronze.

7.13 INSTALLATION OF FIRE HYDRANT ASSEMBLIES

Recycled water fire hydrants are prohibited unless both the District and DOHS provide approval.

7.14 INSTALLATION OF METER BOXES, PRESSURE REGULATORS

A. General: Specific installation details are shown on the following plates:

Plate No.	Type
RW13	¾" and 1" meter
RW14	2" turbo meter
RW15	3" and larger compound meter

In all cases, the District will select the meter type and install the meter after proper arrangements have been made. (see Section 5 – FEES, CHARGES AND REQUIREMENTS FOR AUTHORIZATION OF CONSTRUCTION)

B. Meter Boxes: These shall be set with the longitudinal axis perpendicular with the street and located as shown in Plate No. RW22 with respect to the curb. In instances where meter boxes cannot be avoided within the traveled right-of-way, special written approval is required and the cover must be a steel traffic lid. All lids shall have provisions for touch and read meters.

With the exception of irrigation meters, spacers (or jumpers) will be placed within the meter box until the District installs the meter. The contractor may utilize spacers provided by the District on an "as available" basis. Care must be taken to avoid placing a strain on the spacer through misalignment of the house or service line.

Spacers (or jumpers) can be placed with irrigation meter boxes, however, the jumpers shall be locked off until payment of fees. Once fee payment has been confirmed, District crews will set the irrigation meters. Irrigation meters shall be set prior to the construction of any irrigation plumbing.

C. Jurisdiction: In general, pipes on the customer side of a meter box are under the jurisdiction of the City of Simi Valley, Building and Safety Division, if the property is within the City. If it is within the County, the Ventura County Building and Safety Department has jurisdiction. However, due to State requirements for the installation and monitoring of recycled water use, the District will permit, inspect, and monitor onsite recycled water facilities.

D. Pressure Regulators: The recycled water system is not anticipated to have high operating pressures. However, this does not relieve the developer/contractor of responsibility to verify pressure compatibility with the onsite system. If necessary, the types of regulators and their installation are as required for potable water by the respective Building and Safety agency.

7.15 BACKFILL AND COMPACTION

A. General: There are distinct zones to be considered in the backfilling procedure as follows (refer to Plate No. RW3 and 6):

- Pipe Zone (Bedding) – This area is from the trench bottom to 12 inches above the pipe. This zone is to be backfilled under the strict jurisdiction of the District.
- Above Pipe Zone – Backfill and compaction in existing streets and in the area above the pipe zone shall be in full accordance with the City or County encroachment permit issued for the specific work. The filling of trenches shall be subject to approval by the City or County Public Works inspector who shall have full authority to order compaction tests to demonstrate the actual backfill density.

Section 3.12 (PIPE TRENCH MATERIAL) of these Standards contains the material designations for both the pipe zone and above pipe zone regions.

B. Backfilling Pipe Zone: Sand as specified in Section 3.12 (PIPE TRENCH MATERIAL) must be used and shall be placed in the pipe zone with particular attention to getting material to the underside of the pipe and fittings to provide firm support along the full length of the pipe. Care shall be exercised in backfilling to prevent damage to the pipe or coating, as

applicable. Backfill in the pipe zone may be either compacted by hand tamping methods or jetted into place without hand working. In no case shall sufficient water be applied to float the pipe. See further discussion of jetting below in Section E. Acceptability of compaction in the pipe zone will be determined primarily by visual inspection and probing by the District's inspector to determine that no voids exist in the backfill. The backfill within the pipe zone shall meet the requirements of 90 percent relative compaction.

C. Backfilling Above Pipe Zone: The sequence of backfilling and compaction above the pipe zone in public rights-of-way, i.e., streets, shall be as directed by the District or County Public Works inspector; but in the absence of such instructions, the following procedure shall govern: Testing for pipe and joint leakage shall be done after consolidation of the backfill to the top of the aggregate base and after service lines have been installed to the property lines.

Backfill, compaction, and resurfacing shall be scheduled so that existing public streets are opened to normal traffic at the end of each day's work, unless otherwise authorized, and so that the backfill operations closely follow the pipe laying, avoiding open trenches overnight.

The trenches or excavations shall not be backfilled without prior inspection by the District's inspector. Such inspection does not relieve the contractor of compliance with the testing of the waterline. The contractor shall assume the cost of removal and replacement of backfill and base necessary for correction of defective conditions revealed by testing.

The backfill zone between the top of the pipe zone and the bottom of the roadway structural section or ground surface may be filled with approved native material. It shall be placed in lifts and compacted to 90 percent relative density. AC surfacing and aggregate base shall be placed as provided in the permit.

If the work is not subject to roadway requirements, the work shall be finished to match original conditions as further described in Section 12 (WATER SYSTEM AND WORK AREA CLEAN-UP).

In traffic areas within public rights-of-way where pavement is to be replaced, the City allows a two-sack cement sand slurry mixture to be used for trench backfill. This requirement will generally apply to trenches which are 2 feet or less in width. For trenches wider than 2 feet, slurry may be approved by the Public Works Department. It must be emphasized that the specific requirements above the pipe zone are within the jurisdiction of the Public Works Department, and developers/contractors shall have a responsibility to investigate and comply with all applicable requirements.

Plate No. RW6 presents the District's trench repair requirements within paved rights-of-way.

D. Backfill by Tampering Method: Backfill material shall be placed in uniform layers of not more than 12 inches. The moisture content of the backfill material shall be near or at the optimum required for compaction, and each layer shall be tamped until compacted to the required minimum relative compaction. Heavy duty compacting equipment having an overall weight in excess of 125 pounds shall not be used until backfill has been completed to a depth of 2 feet over the top of the pipe.

If a hydro-hammer is used for compaction, at least 4 feet of backfill must be placed over the top of the pipe prior to its use, to insure that the pipe is not damaged.

E. Jetting: Jetting with water to saturate the shading within the pipe zone is acceptable. Jet holes shall be a maximum of 10 feet apart and sufficient water should be applied to consolidate the bedding materials. Also, care must be taken not to push the jetting pipe below the spring line of the pipe, causing disturbance to the pipe grade; and the material should be jetted from the bottom upwards.

F. Compaction Tests: These tests shall be taken as determined and at locations selected by the inspector.

7.16 RESURFACING AND RESTORATION

Work in streets which are not yet paved shall be left in a suitable condition for finish grading, placement of base material, and paving by others.

If the work is within existing City or County streets, any required surfacing shall be in accordance with the City or County encroachment permit.

If the work has disturbed or damaged existing private streets, driveways, or other improved surfaces, the damaged portions shall be removed and restored to the limits designated by the inspector.

Substructures removed or damaged on public or private property shall be restored or replaced unless such structures are designated on plans "to be abandoned". Such structures include, but are not limited to trees, bushes, planting, groundcover, mail boxes, fences, and sprinkler systems.

Any temporary paving, barricades, or special provisions required by public agencies shall be furnished by the contractor as required.

7.17 BORING AND JACKING OPERATIONS

A. General: Placement of pipe by boring or jacking methods shall be indicated on the plans or permit application. As a general guideline, the following shall pertain:

1. Except for the use of air or water, the methods and equipment used in boring and jacking operations shall be optional to the contractor.

2. The placement of pipe shall be to the lines and grades shown on the plans.

3. Voids remaining outside the pipe (or carrier pipe if applicable) shall be backfilled with slurry.

4. Where a casing pipe is used, the recycled water pipe shall be supported with approved skids, shims, or wedges to the lines and grades shown on the plans.

5. The annular space within the casing shall be backfilled with washed concrete sand blown or rammed into place until the entire cavity if filled. Concrete bulkheads shall be placed at each end of the cased section to retain the backfill material.

B. Bores: The boring machine shall cut a true circular bore to the required line and grade. The boring shall be no more than 2 inches larger in diameter than the maximum outside diameter of the casing or water pipe to be installed.

C. Jacked Steel Casings: In addition to applicable portions above, the following shall pertain:

1. Where casings are used, the size and wall thickness of the casing shall be at the contractor's option except that the minimum casing thickness shall be not less than 3/8 inch.

2. Field joints of steel casings shall be welded with a continuous circumferential weld.

7.18 CONCRETE AND MORTAR WORK

A. Concrete

1. Material. Concrete used for encasements, filling, blocking, piers, and other typical water construction applications shall be transit-mixed concrete from a supervised batch plant which issues certified delivery tickets with each load, showing the mix proportions, mixing time, truck departure time and water added. Such certified tickets should be handed to the inspector at the time of delivery. Ready-mixed concrete shall be batched and handled in accordance with ASTM C94. Job mixed concrete shall be limited to that needed for patching and minor non-structural uses. In these cases, the materials and workmanship shall be the same as if transit-mixed concrete had been used. The 28-day compressive strength of concrete shall be chosen according to its intended use as outlined in Section 3.14 (CONCRETE MATERIAL) of these standards.

2. Placement. Concrete shall be placed in clean forms before its initial set begins, using the minimum amount of mixing water required for good workability. Concrete shall be worked into forms by rodding or vibrating to secure a dense homogeneous mass free from voids and rock pockets. All concrete shall be vibrated unless the inspector approves solely rodding to avoid having the concrete run out of the forms or trench.

3. Finish. Concrete surfaces where required shall be steel troweled to a smooth hard surface free from ridges, holes and surface roughness. Exposed walls shall be left with a surface finish comparable to that obtained with new plywood forms. Slabs and walkways shall be finished with a wood float unless otherwise specified. Corners and edges shall be neatly beveled. Surface defects shall be repaired to match the surrounding concrete.

B. Mortar: Mortar for general work (exclusive of ML & C steel pipe) shall consist of one part Type II Portland cement and two parts of sand, by volume, thoroughly mixed in a dry state before adding sufficient water to give the mortar a proper troweling consistency.

7.19 CONSTRUCTION WATER

The developer/contractor shall not take unmetered recycled water or unmetered potable water from the District's water systems. The developer/contractor can only utilize recycled water for construction if the procedures in RW41 are followed and use is approved by the District. Refer to Section 5 (FEES, CHARGES AND REQUIREMENTS FOR AUTHORIZATION AND CONSTRUCTION) for charges for construction water.

7.20 PAINTING

Section 3.16 (MATERIALS-PAINTING) discusses painting materials. These materials shall be opened and mixed at the job site. Workmanship shall be to the best standards of the painting industry. All work should be done by skilled and experienced painters. Surfaces to be painted shall first be thoroughly cleaned to remove dirt, loose scale, rust, oil, grease, and/or other foreign matter immediately prior to painting. Cleaning shall be done with abrasives, scrapers, wire brushes, and/or other approved means. Each coat shall be applied in such a manner as to assure an even, smooth, uniform adhering coat free from dirt, runs, brush marks, and laps, and shall be applied as recommended by the manufacturer. Painting will not be permitted when freshly painted surfaces may become damaged by rain, fog, or condensation or when inclement weather can be anticipated. Fresh paint damaged by the elements shall be replaced by the contractor at his expense. Drop cloths shall be used to protect floors, equipment, piping, and other exposed surfaces from spattering and spillage. Paint shall be allowed to dry thoroughly between application of successive coats. The manufacturer's recommended time between coats should be used as a guide as to when the next coat of paint may be applied.

The contractor shall notify the District after surface preparation and after the application of each successive coat of paint. Spray painting will not be permitted unless specifically authorized by the District.

7.21 SAFETY

Wherever the contractor observes or otherwise becomes aware of any unsafe activity, condition, practice, or operation, the contractor shall immediately discontinue said unsafe activity, condition, practice, or operation, including any and all unsafe acts of subcontractors. If the inspector notifies the contractor of same, it shall be the contractor's responsibility to comply. In such instances, the advice shall not be construed as implying any District or City liability.

Essential to proper safety is adherence to all Public Works Department traffic control requirements.

For District contracts, the contractor shall submit a copy of their annual CAL OSHA permit and the letter notifying CAL OSHA of the work.

8.0 ABANDONMENT

8.1 GENERAL

Any existing waterlines or structures which are to be abandoned shall be indicated on the drawings by the developer's engineer.

Abandonment procedures shall be approved by the District prior to commencement.

8.2 WATERLINES

Waterlines to be abandoned in place shall be entirely filled with pumped concrete. The pump mix shall be a mixture sufficiently workable for the purposes intended and shall have a minimum mix strength of 2,000 psi. The engineer shall show on the drawings the approximate number of cubic yards of concrete required for any particular reach.

8.3 STRUCTURES

Structures associated with lines to be abandoned shall be removed by the contractor/developer and given to the District if salvageable. All structures to be discarded shall be so identified on the project plans and approved for disposal by the District's representative prior to disposal. The developer shall make arrangements for the proper disposal of all discarded materials and/or equipment, including any materials identified as hazardous waste. All costs associated with the disposal of discarded materials and/or equipment, including any materials identified as hazardous waste, shall be solely at the developer's expense.

8.4 SERVICE LINE

Service lines shall be abandoned and plugged at the main under the direction of the District Inspector. This includes complete removal of existing corporation stops or other valves at the main and insertion of a properly sized brass or stainless steel plug depending on material of the main or saddle. No dissimilar metal plugs shall be allowed.

9.0 RESERVOIRS

9.1 GENERAL

Recycled water storage consists of a single component - maximum-day demand. All other parameters are those of the potable water standards.

10.0 CROSS CONNECTION AND BACKFLOW PREVENTION

10.1 GENERAL

According to the AWWA definition, "cross-connection means any connection or structural arrangement between a public or a consumer's potable water system and any non-potable source or system through which backflow can occur. Bypass arrangements, jumper connections, removable sections, swivel or change-over devices, and other temporary or permanent devices through which, or because of which, backflow can occur are considered cross-connections".

Cross-connections may be regarded as direct or indirect. A direct connection is an arrangement whereby a safe water system is physically joined to a system containing unsafe water, wastewater or other waste. An indirect connection is an arrangement whereby unsafe water in a system may be blown, pulled by vacuum, or otherwise diverted into a safe water system.

To understand cross-connection and backflow prevention, several other terms need definition. "Backflow" is generally defined as the flow of any foreign liquids, gasses, or other substances into the distribution pipelines of a potable supply of water from any other source or sources other than the intended one. For backflow to occur, two conditions must be present: (1) a link must exist between the potable and the non-potable system; (2) the resultant flow produced by the differential pressure must be toward the potable system. If both systems are at pressures greater than atmospheric (positive pressure), backflow due to "back-pressure" occurs. A pump, elevated tank, or boiler can create a back-pressure that is greater than the pressure in the potable system.

If the potable system is at a pressure less than atmospheric (negative pressure), the atmospheric pressure on the foreign liquid will force it toward the partial vacuum and "back-siphonage" occurs. A more explicit term for backflow when subatmospheric pressure exists is back-siphonage. Back-siphonage is the backing up, or siphoning, of a foreign liquid into a potable water system.

While protection of the potable water system is the primary focus of cross connection prevention, protection of the recycled water system from cross connection with sanitary sewer systems, industrial fluid, or other foreign sources is a concern.

10.2 JURISDICTION, AUTHORITY, REFERENCES

The District's requirements for backflow prevention are those of the Ventura County Environmental Health Division.

The "Cross-Connection Control Officer" for the District is the County of Ventura Environmental Health Division. They are responsible for ensuring that the devices are properly installed, maintained and tested. The various protective devices are to be installed, maintained and tested by and at the expense of the property owner.

A source of general information is a booklet titled "Cross-connections and Backflow Prevention" as published by AWWA.

10.3 TYPES OF BACKFLOW PREVENTION

As described below, there are several different types of protection devices. The "Reduced Pressure Principle Device" and "Double Check Valve" are used to prevent backflow and the former also prevents back-siphonage. The "Air Gap" and "Pressure or Atmospheric Vacuum Breakers" are used for prevention of back-siphonage. Descriptions of each device is as follows:

A. Reduced Pressure Principle Device: Commonly referred to as an RP or RPP, this device consists of two independently acting check valves, together with an automatically operating pressure differential relief valve located between the two check valves. The first check valve reduces the supply pressure at a predetermined amount so that during normal flow, and at cessation of normal flow, the pressure between the two check valves shall be lower than the supply pressure. If either check valve leaks, the relief valve will discharge to atmosphere. This will maintain the pressure in the zone between the two check valves lower than the supply pressure. The unit also has two shutoff valves (one upstream and one downstream of the checks) and properly located test cocks for field testing. (See Plate RW31.)

B. Double Check Valve: The double check valve assembly is composed of two single, independently acting check valves. The unit also has two tightly closing shutoff valves located at each end of the device and four test cocks for the testing of the check valves.

C. Air Gap: An air gap is a physical separation between the free flowing discharge end of a pipeline and an open or non-pressure receiving vessel. To have an acceptable air gap, the end of the discharge pipe has to be at least twice the diameter of the pipe above the topmost rim of the receiving vessel, but in no case can this distance be less than one inch.

   This is the simplest, most effective, and least expensive type of protection. However, the chance for inadvertent cross-connection and the cost of additional pumping to pressurize the system often makes this an undesirable or expensive protection system. (See Plate RW41.)

D. Pressure Vacuum Breaker: The PVB is a device that contains a single loaded check valve and a loaded air opening valve to admit air whenever the pressure within the body of the device approaches atmospheric. The body of the device has two tight closing shutoff valves and it is fitted with test cocks. (See Plates RW26 through 28.)

E. Atmospheric Vacuum Breaker: An atmospheric vacuum breaker has a moving element inside which during flow prevents water from spilling from the device and during cessation of flow drops down to provide a vent opening. This device should not remain under pressure for long durations and it cannot have any shutoff valve downstream from it.

10.4 REQUIREMENTS

Refer to the Ventura County Environmental Health Division for acceptable devices to be installed. In addition, the following is provided:

A. Reduced Pressure Principle Device (RP): Use where cross-connections are known or probably will exist which cannot be eliminated and where the degree of severity is judged by the Cross-Connection Control Officer to warrant more than a double check valve. (See Plate RW31.)

Specific Examples:

1. Recycled water service to industrial or commercial facilities where chemicals are used within the premises, which could potentially be harmful to the District system.

2. Irrigation systems such as median or park strips along streets, or landscape areas within projects.

B. Double Check Valve: Use where the recycled water system serves property which also has a potable water service. Also, use where a cross-connection possibly exists where the substances would be objectionable, but not necessarily harmful to the District system.

Specific Examples:

1. Recycled water service connections for irrigation which is also furnished water from wells.

2. Recycled water service to industrial or commercial facilities where cross connection might impart an objectionable taste, odor, or color, but would not be hazardous.

C. Air Gap: Use where there is a connection to any premise using a dangerous or toxic substance in toxic concentrations. The air gap shall be located as close as practicable to the service cock and all piping between the service cock and receiving tank shall be entirely visible. (See Plate RW41.)

Specific Example:

1. An agricultural installation where liquid fertilizer is injected.

D. Pressure Vacuum Breaker (PVB): This unit can only be used where there can be no back-pressure - only where there can be back-siphonage. The unit can have shutoff valves downstream of the device. The PVP must be installed at least 12" above the highest outlet or tank. (See Plates RW26 through 28.)

Specific Example:

1. Lawn irrigation system where outlets are situated well below the device and where there may be a shutoff valve downstream (or past) the device such as a hose bib.

E. Atmospheric Vacuum Breaker: As with the pressure type, there should be no possibility of back-pressure. This device cannot have any shutoff valves downstream of the device. It must be installed at least 6" above the highest outlet or tank.

Specific Example:

1. Typical irrigation zone.

10.5 INSTALLATION

Service protection is a backflow device installed on the customer side of the meter. These devices are specifically intended to protect the District water system regardless of other protective devices on the premises.

Internal protection devices may be desired where recycled water is used within a facility. These are intended to protect onsite facilities, and fall under the jurisdiction of the Building and Safety Division.

10.6 APPROVED DEVICES

Refer to the latest "List of Approved Backflow Prevention Assemblies", as issued by Ventura County Environmental Health Division.

10.7 TESTING AND MAINTENANCE

All backflow prevention devices shall be tested annually by a certified tester, with repairs or maintenance as needed. A form must be completed by the tester and returned to the District. Owners of devices that are on record with the District will be notified yearly of this responsibility.

11.1 MONITORING AND INSPECTION

The District, the City, the Ventura County Environmental Health Division, and/or the Los Angeles Regional Water Quality Control Board, or authorized representatives of any of these agencies shall have authority to monitor and inspect the entire recycled water system including both onsite and offsite facilities. The District or City shall conduct monitoring programs, as deemed necessary, to ensure that the customer's recycled water facilities are being operated in accordance with these Rules and Regulations, including the provision that cross-connections between potable water facilities and the recycled water facilities do not exist. In carrying out these functions, the District, the City, the Ventura County Environmental Health Division, and/or the Regional Water Quality Control Board, or authorized representatives of any of these agencies shall have the right to enter any customer's premises during reasonable hours upon presentation of proper credentials. Reasonable hours shall include hours when irrigation is being performed to ascertain whether the user is complying with the District's Rules and Regulations for Recycled Water. The customer shall provide full cooperation to facilitate these surveys, and shall indemnify and hold the District and City harmless for any damage, loss, or injury alleged to have been caused by District or City personnel while inspecting onsite facilities, except where sole negligence is duly established.

Each time there is a change of either owner or customer on any commercial or industrial premises, the owner or customer shall notify the District immediately, so that the District can reassess the level of protection required. Also, any alteration to existing onsite facilities that may affect required protection levels must be reported immediately to the District.

In situations where potable water lines are on the same property and located in the same area as recycled water lines, an annual cross-connection control site inspection will be required. The annual cross-connection inspection will be performed by the District, the City, the Ventura County Environmental Health Division, or an authorized and certified cross-connection specialist. At the discretion of the District, cross-connection inspections may occur more frequently, especially on potable irrigation systems which have been converted to a recycled water irrigation system. A copy of the inspection report will be forwarded to the non-inspecting agency.

11.2 CONSTRUCTION INSPECTION

The inspection of the work shall not relieve the contractor or owner of any obligation to complete the work as prescribed by the plans and applicable specifications. Defective work shall be made good, and unsuitable materials may be rejected notwithstanding the fact that such defective work and unsuitable materials have been previously overlooked by the inspector. The installation and inspection of work with unsuitable materials shall not be construed as acceptance of such materials, and modification to these specifications shall only be made by the District in writing.

11.2.1 District Facilities

11.2.1.1 *Construction Schedule*

The District may require that the contractor submit a schedule outlining the proposed construction operation. The contractor shall conform to the Rules and Regulations of the District regarding prior notification for inspection and deviations from the approved schedule.

11.2.1.2 *Notification and Approvals*

All work shall be subject to inspection by the District, as required by the District and/or these Rules and Regulations. The contractor shall give due notice to the District inspector in advance of backfilling, and installations shall be left open and uncovered until inspected. Unless the District expressly states otherwise, 48 hours notice shall be given, whether for materials or construction work. The contractor shall also notify Building and Safety, Ventura County Environmental Health, and all other regulating agencies of pending work for onsite irrigation systems involving conversions, and arrange for any required inspections by these agencies.

11.2.1.3 *Inspection Intervals*

The contractor shall not proceed with any subsequent phase of work until the previous phase has been inspected by the District Inspector. The following items shall be included in the inspection process:

1. Plans (approved and signed, including other regulatory agencies as required)
2. Materials
3. Trenching
4. Mainlines (including sleeving where applicable)
5. Service laterals
6. Identification tape
7. Meter and box setting
8. Backflow protection (not a District facility; certification required)

11.2.1.4 *Final Inspection*

Following the completion of all construction work and the submittal of record drawings and certification documents, the contractor shall request final inspection of the work. This request shall include the scheduling of the operational testing.

11.2.2 Construction Water Facilities

11.2.2.1 *Application and Construction Schedule*

The operator shall apply for a recycled water use permit for construction water and shall give the District a construction schedule prior to initiation of construction work.

11.2.2.2 *Notification and Approvals*

Unless the District expressly states otherwise, 48 hours notice shall be given by the operator in advance of any and all inspection requirements, whether for materials, installation, or initial use of recycled water.

11.2.2.3 *Inspection Prior to Use*

The operator shall request inspection of the installation. Prior to use of recycled water, District approval shall be obtained. Signage, labels, and air gap on the truck tank shall be installed. The Use Permit must be on site.

11.3 REVIEW AND TESTING

11.3.1 District Facilities

11.3.1.1 *Materials*

The contractor shall furnish the District with such information as it may desire regarding the character and quality of materials used. When requested by District, the contractor shall submit a certification that the product meets the requirements of these specifications.

All pipe and accessories shall be carefully inspected by the District and contractor for damage in transit. Any damaged pipe or fittings delivered and unloaded at trench-site shall be rejected and removed by the contractor from the site of the work.

11.3.1.2 *Installed Piping Systems*

New piping shall be subjected to a 4-hour hydrostatic pressure test at 120 percent of maximum rated operating pressure of the pipe or 150 psi, whichever is greater. The testing shall be conducted by the contractor in the presence of a District representative. The District may require the tests by a State-certified testing company. The water necessary to maintain this pressure shall be measured through a meter or other means satisfactory to the inspector. The leakage shall be considered as the amount of water entering the pipe during the test, less the measured leakage through valves and bulkheads. Any noticeable leaks shall be stopped and any defective pipe shall be replaced with new sections.

The test shall be made prior to connecting the new piping with existing systems or a service connection. Valves shall be open during the test period.

All concrete thrust blocks shall be allowed to cure to develop design strength prior to testing. All labor, materials, tools, and equipment for the testing shall be furnished by the contractor.

12.0 WATER SYSTEM AND WORK AREA CLEAN-UP

12.1 FINAL PROJECT CLEAN-UP

The project shall be left in a final condition which brings no discredit to the District. All valves shall be accessible with valve stacks clean. All structures shall be properly painted, where required, and free from dirt, concrete or other spattered materials. The work site shall be cleaned of all construction debris and excess materials. All pre-existing public and private improvements, structures, and/or facilities damaged during construction shall be restored to the pre-existing condition of said improvements, including but not limited to trees, shrubs, curbs, gutters, sidewalks, fences, grass, etc., unless other approvals have been given. Filled excavations shall be neatly finished in a manner to facilitate natural drainage and eliminate hazards to persons or property. Also, all requirements of the City and/or County Public Works Department, as appropriate, shall have been met.

All clean-up and restoration work shall be performed by the contractor, applicant, or developer at their cost. All work shall be subject to the approval of the District representative.

13.0 REQUIREMENTS FOR FINAL ACCEPTANCE

13.1 GENERAL

"Acceptance" of a project is a City Council/District Board action. With a development project, such action is taken only as overall acceptance of all public improvements required of a project.

13.1.1 Partial System Clearance

Partial system clearance may be given for connection to a recycled water system within a development project where the entire recycled water system is not complete or where full formal project acceptance is not requested. Such clearance does not imply that the District has accepted the facilities or waived any right to insist on repairs or corrections of punch list items subsequently identified in a final inspection of the entire recycled water system.

13.2 RECORD DRAWING ORIGINALS

At the time of a request for partial system clearance or for formal acceptance, the original plans shall be updated as record drawings and, along with two sets of prints, shall be submitted to District Engineering. The record drawings shall reflect the actual improvements made and give the accurate location of all new or relocated facilities. The record drawing certificate, as defined in Section 4.0, paragraph F, shall be signed and shall appear on the cover sheet of the recycled water plans.

Certification of the work and the responsibility for accurate record drawings must involve active participation by the developer's engineer during the project. All changes, whether done through the formal change order process or as a field adjustment shall be reflected on the record drawings.

13.3 ACCEPTANCE AND EXHONERATION OF SURETY

When all project requirements (field and administrative) have been met, staff will prepare a resolution recommending City Council/Board of Directors acceptance of the improvements and exoneration of the performance bonds, thereby initiating the warranty period.

Whereas, the normal warranty period is one year and the bond retention is 10% of the performance bond amount; both of these may be increased, if in the opinion of the District the normal period and amount are not sufficient.

13.4 STATUS DURING WARRANTY PERIOD

The developer/contractor is responsible during the warranty period for the proper performance and maintenance of the improvements. Should District crews have to perform any work on the public portion of the recycled water system improvements, the costs may be invoiced to the developer/contractor.

14.0 USER VIOLATIONS

14.1 SPECIFIC PROHIBITIONS

14.1.1 Runoff Conditions

Conditions that directly or indirectly cause runoff of recycled water outside of the approved use area, whether by design, construction practice, or system operation, are prohibited.

14.1.2 Ponding Conditions

Conditions that directly or indirectly cause ponding of recycled water within the approved use area are prohibited, unless expressly permitted. Temporary ponding caused by draining of the system is allowed with prior District approval.

14.1.3 Direct Overspray Conditions

Any discharge of water directly onto areas other than that within the approved use area is prohibited.

14.1.4 Windblown Overspray Conditions

Conditions that directly or indirectly permit windblown spray to pass outside of the approved use area, are prohibited.

14.1.5 Unapproved Uses

Use of recycled water for any purpose other than those explicitly approved in the currently effective Use Permit issued by the District and without the prior knowledge and approval of the District is prohibited.

14.1.6 Disposal in Unapproved Areas

Disposal of recycled water for any purpose, including approved uses, in areas other than those explicitly approved in the currently effective Use Permit issued by the District and without the prior knowledge and approval of the District, is strictly prohibited. Discharge of water from flushing or draining of the recycled system shall be done either at the approved use site and in a manner that does not create ponding or runoff conditions, or to a sanitary sewer manhole, with the approval of the agency responsible for operation of the sanitary sewer. In no case shall the discharge of recycled water to a sanitary sewer cause the sewer to overflow or otherwise create a public health hazard or nuisance.

14.1.7 Cross-Connections

Cross-connection, as defined by the California Code of Regulations Title 17, resulting from the use of recycled water or from the physical presence of a recycled water service, whether by design, construction practice, or system operation, is strictly prohibited.

14.1.8 Unprotected Drinking Fountains

Any and all drinking fountains located within the approved use area designated by the Use Permit shall be protected by siting and/or structure from contact with recycled water, whether windblown overspray or by direct application through irrigation or other approved use. Lack of such protection, whether by design, construction practice, or system operation, is strictly prohibited.

14.1.9 Unprotected Public Facilities

Facilities that may be used by the general public, including but not limited to eating areas, eating surfaces, pools, spas, hardscape, and playground equipment, and located within the approved use area designated by the Use Permit, shall be protected by siting and/or a structure from contact with recycled water, whether by windblown overspray or by direct application through irrigation or other approved use. Lack of such protection is prohibited unless expressly permitted by the District, VCEHD, and the City.

14.1.10 Hose Bibbs

Permanent installation of hose bibbs on any system that operates or is designed to operate with recycled water, is subject to specific prior approval by the District on a case-by-case basis.

14.1.11 Fire Hydrants

Use or installation of fire hydrants on any system that operates or is designed to operate with recycled water, regardless of the fire hydrant construction or identification, is subject to specific prior approval by the District on a case-by-case basis.

14.1.12 Hours of Operation

Irrigation with recycled water is prohibited other than between the hours of 9:00 p.m. and 6:00 a.m., unless expressly permitted or otherwise directed by the District.

14.1.13 Hose and Hose Appurtenances

Under no circumstances shall hoses or hose appurtenances that have used recycled water be connected to a potable water system or be used in any way for potable water purposes.

June 30, 2004

Progress Report on Efforts to Address Salts on the Calleguas Creek Watershed

Submitted to:
Calleguas Creek Watershed Management Plan

LARRY WALKER ASSOCIATES

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List of Acronyms

CCMS Calleguas Creek Modeling System
CCW Calleguas Creek Watershed
CMWD Calleguas Municipal Water District
CWA Clean Water Act
LA Load Allocation
POTW Publicly Owned Treatment Works
SSO Site-Specific Objective
TMDL Total Maximum Daily Load
USEPA United States Environmental Protection Agency
WLA Wasteload Allocation
WQCP Water Quality Control Plant
WQO Water Quality Objective
WRP Water Reclamation Plant
WTP Wastewater Treatment Plant

Executive Summary

The purpose of this document is to summarize work performed under the *Calleguas Creek Watershed Salts TMDL Work Plan* (Work Plan). Water quality objectives and beneficial uses are discussed, and an implementation plan for salts in the Calleguas Creek Watershed (CCW) is proposed. Regulatory issues related to surface water concentrations of salts (objectives, beneficial uses, and 303(d) listings) and broader salt management issues in the watershed are addressed. Additionally, the report provides an update on the analysis of options to address salts in the CCW.

Salts management problems in the CCW can be placed in two issue categories: regulatory issues related to 303(d) listings, and issues related to a salts imbalance. Although linked, these issues require different approaches in order to be satisfactorily addressed. Consequently, watershed sources were identified and water quality objectives and beneficial uses were reviewed. An assessment of identified projects was conducted to determine their ability to meet water quality objectives, improve the salts balance in the watershed, and increase local water resources.

Watershed Loadings

Six possible sources of salts to the watershed exist: water supply (water imported from the State Water Project or Freeman Diversion and deep aquifer groundwater pumping), water softeners, Publicly Owned Treatment Wks (POTW) treatment chemicals, atmospheric deposition, pesticides and fertilizers, and indoor water use (chemicals, cleansers, food, etc.). The use of pesticides and fertilizers may add some salts to the watershed, but the loads were not evaluated because there is insufficient information to determine the quantities added. These salts are then transported through POTW discharges and dry weather runoff to three possible endpoints: surface water, shallow groundwater, and/or stranded on the watershed in the soils. The salts stranded in the soils are eventually transported to surface water when precipitation mobilizes them and carries them to the creek system. Groundwater pumping and exfiltration moves salts from groundwater to surface water and surface water infiltration transports salts from the surface water to groundwater. Additionally, groundwater saturation of historic marine sediments can mobilize existing background salts from previously dry soil and transport them to the groundwater. However, none of these transport mechanisms add salts, they just move salts from one endpoint to another. Salts transported in the surface water to the ocean are currently the only salts that are exported from the watershed.

In the source analysis, the sources of salts to the watershed were quantified (Table ES-1). Then, the transport mechanisms were utilized to quantify the portion of salts transported to surface waters during typical dry weather conditions (Table ES-2). The salts that are not transported to surface waters are stranded in the watershed in soils and shallow, unconfined groundwater areas. These salts can be transported to the surface waters during large precipitation events, but are not mobilized during typical dry weather conditions. Consequently, the dry weather source analysis does not quantify the amount of salts that are mobilized and transported to surface waters during precipitation events.

Table ES-1. Summary of Salts Loads to Watershed

Source	Chloride (lbs/day)	TDS (lbs/day)	Sulfate (lbs/day)	Boron (lbs/day)
Water Supply [1]	75445	578182	192504	319
Residential, Industrial, Commercial Uses	11638	77911	14405	
Water Softeners	8855	14148		
Treatment Chemicals	700	700		
Atmospheric Deposition	40	340	91	0.13
Total	96678	671281	206999	319

1 Water supply includes imported State Water Project water, water imported through the Freeman Diversion from the Santa Clara River, and deep aquifer groundwater that is pumped for use in irrigation and municipal supply.

The primary source of salts to the watershed is the water supply. Water imported into the watershed from the State Water Project comes from the Sacramento/San Joaquin Delta. Consequently, chloride and TDS can vary significantly as a result of Northern California hydrology. During the drought, chloride concentrations neared 120 mg/L, but fell to 45 mg/L after El Nino. Therefore, the amount of salts entering the watershed from imported SWP water is strongly linked to hydrology in Northern California and the volume of water imported into the watershed and can vary significantly over time.

Table ES-2. Summary of Loadings to Surface Waters

Source	Chloride Load (lb/day)	% Total Chloride Load	TDS Load (lb/day)	% Total TDS Load	Sulfate Load (lb/day)	% Total Sulfate Load	Boron Load (lb/day)	% of Total Boron Load
POTWs	28,660	44%	140,259	26%	32,986	23%	126	59%
Groundwater pumping	2,750	4%	29,592	5%	22,974	16%	16.9	8%
Groundwater exfiltration	3,492	5%	14,456	3%	12,415	9%	4.43	2%
Urban Dry Weather	9,492	14%	89,675	16%	2,625	2%	9.19	4%
Agriculture Dry Weather	11,237	17%	166,634	30%	53,332	37%	47.7	22%
Total	55,632	100%	440,617	100%	124,332	100%	205	100%

Based on the information presented above, approximately 60% of the total watershed salts loads are transported to the surface waters on a daily basis. Because some of the surface water is diverted for irrigation in the lower watershed through the Conejo Creek Diversion Project, and all of the surface water in the upper watershed enters the ground water, only about 10% of the watershed salts load is exported out of the watershed to the ocean during dry weather. The remaining salts are left “stranded” in the soils or shallow groundwater basins in the watershed until large amounts of precipitation mobilize the salts and transport them off the watershed. The following table summarizes the ultimate fate of the imported salts during dry weather.

Table ES-3. Fate of Salts in Calleguas Creek Watershed during Dry Weather

Constituent	Salts Load To Watershed (lb/day)	Exported to Ocean (lb/day)	"Stranded" in Watershed (lb/day)
Chloride	96,700	10,400	86,300
TDS	671,200	49,500	621,700
Sulfate	207,000	13,600	193,400

Assessment of Water Quality Objectives and Beneficial Uses

In order to assess the need for and basis of site-specific objectives (SSOs) for the CCW, a review of the existing water quality objectives and beneficial uses was conducted. Agriculture and groundwater recharge are the beneficial uses potentially impacted by the development of SSOs and were the primary uses examined. The analysis of these beneficial uses resulted in the following conclusions that will be used to guide the development of SSOs:

1. Instantaneous objectives as contained in the Basin Plan are not necessary to protect beneficial uses.

2. Agriculture and groundwater recharge beneficial uses are not present in all areas of the watershed.

3. Water quality improvements in the surface water do not necessarily translate into protection of agriculture and groundwater recharge beneficial uses. Agriculture uses groundwater as its primary irrigation source and groundwater does not appear to be adversely impacted by surface water quality (Bachman, 2002).

Based on these conclusions, adjustments to the water quality objectives are recommended. For some reaches, the development of averaging periods for the numeric values found in the *Water Quality Control Plan:* Los Angeles Region (Basin Plan) will likely be the only recommended change to the objectives. For these reaches, it is proposed that the appropriate averaging period be determined based on additional analysis and the performance of the projects on the watershed. For other reaches, SSOs that include an adjustment to the numeric Basin Plan value may be recommended. These reaches include areas where agriculture and groundwater recharge beneficial uses are not present or not impacted by surface water salt concentrations (Reaches 11, 12, 13, 7, 8, 3, 4 and 5) and where natural background conditions make the achievement of the Basin Plan objectives not feasible and not necessary to protect beneficial uses (Reaches 6 and 7).

Analysis of Proposed Projects

Projects to address water resources and salts impairments in the upper and lower watershed have been developed. In the lower watershed, the projects involve removing Hill Canyon Wastewater Treatment Plant (WTP) and Camarillo Sanitary District Water Reclamation Plant (Camarillo WRP) effluent from the stream for reuse and the introduction of higher quality water into the upper reaches of the watershed to protect in stream beneficial uses. In the upper watershed, a groundwater desalter will be installed to treat poor quality groundwater and reduce the groundwater levels in the South Las Posas Basin. This will create storage for natural recharge from storm events, thus improving groundwater quality. Additionally, source control programs will be instituted to reduce water softener contributions of salts to the Simi Valley Water

Quality Control Plant (WQCP). Discharge from groundwater dewatering wells to surface water may be discontinued.

Models were used to assess the impacts of these projects on surface water salts concentrations, the watershed salts balance, improvement of local water resources, and the ability to comply with the EPA Chloride TMDL. Impacts of the proposed projects were also compared to the impacts of installing reverse osmosis treatment at the three wastewater treatment plants that discharge to the stream (Simi Valley WQCP, Hill Canyon WTP, and Camarillo WRP) at the levels necessary to comply with the EPA Chloride TMDL waste load allocations.

Model output was compared to the current, instantaneous Basin Plan objectives, 12 month rolling average objectives, and flow-weighted annual average objectives. For chloride, the results were also compared to the aquatic life criteria. The following tables summarize the locations in the watershed where model output predicts that the objectives would be exceeded less than one time in three years.

Table ES-4. Objective Status at Locations in the CCW for Current Conditions.[1]

Location	TMDL Reach	Chloride[2]				Sulfate[3]			TDS[4]			Boron[5]		
		D	12	W	C	D	12	W	D	12	W	D	12	W
Upper Watershed														
Arroyo Simi at Madera Rd.	Upper 7	×	×	✓	✓	×	×	×	×	×	×	×	✓	✓
Arroyo Simi below Highway 118	Mid 7	×	×	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Hitch Blvd.	Border 6/7	×	×	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Somis	Mid 6	×	×	✓	✓	×	×	✓	×	×	×	✓	✓	✓
Arroyo Las Posas at Seminary Rd.	Lower 6	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Lower Watershed														
South Fork Arroyo Conejo	13	×	×	✓	×	×	×	✓	×	×	×	✓	✓	✓
Conejo Creek Below Hill Canyon	10	×	×	×	✓	×	✓	✓	✓	✓	✓	✓	✓	✓
Arroyo Santa Rosa	11	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Conejo Creek @ Diversion	9B	×	×	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Conejo Creek at Howard Rd.	9A	×	×	×	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Calleguas Creek above Potrero Rd	3	×	×	✓	✓	×	×	×	×	×	✓	✓	✓	✓
Oxnard Plain														
Revolon Slough	4	×	×	✓	✓	×	×	×	×	×	×	×	×	×

1 Check indicates reaches meeting the objective, and "x" indicates reaches failing to meet objective.
2 D = daily concentrations < 150 mg/L, 12 = 12 month rolling average < 150 mg/L, W = 12 month flow weighted average concentrations < 150 mg/L, and C = CCC concentration < 230 mg/L.
3 D = daily concentrations < 250 mg/L, 12 = 12 month rolling average < 250 mg/L, and W = 12 month flow weighted average concentrations < 250 mg/L.
4 D = daily concentrations < 850 mg/L, 12 = 12 month rolling average < 850 mg/L, and W = 12 month flow weighted average concentrations < 850 mg/L.
5 D = daily concentrations < 1.0 mg/L, 12 = 12 month rolling average < 1.0 mg/L, and W = 12 month flow weighted average concentrations < 1.0 mg/L.

Under current conditions, the entire watershed meets the flow-weighted annual average objectives for boron and the Arroyo Simi/Las Posas meets the flow-weighted annual average objective for chloride. None

of the reaches meets the instantaneous maximum objectives for chloride and sulfate and only one reach meets the instantaneous maximum objective for TDS.

Table ES-5. Objective Status at Locations in the CCW after Banning Future Self-Regenerating Water Softeners and Providing Incentives/Disincentives to Reduce Water Softener Use. [1]

Upper Watershed Location	TMDL Reach	Chloride[2]				Sulfate[3]			TDS[4]			Boron[5]		
		D	12	W	C	D	12	W	D	12	W	D	12	W
Arroyo Simi at Madera Rd.	Upper 7	×	×	✓	✓	×	×	×	×	×	×	×	✓	✓
Arroyo Simi below Highway 118	Mid 7	×	✓	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Hitch Blvd.	Border 6/7	×	✓	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Somis	Mid 6	×	✓	✓	✓	×	×	✓	×	×	✓	✓	✓	✓
Arroyo Las Posas at Seminary Rd.	Lower 6	×	×	✓	✓	×	×	✓	×	×	✓	×	✓	✓

1 Check indicates reaches meeting the objective, and "x" indicates reaches failing to meet objective.
2 D = daily concentrations < 150 mg/L, 12 = 12 month rolling average < 150 mg/L, W = 12 month flow weighted average concentrations < 150 mg/L, and C = CCC concentration < 230 mg/L.
3 D = daily concentrations < 250 mg/L, 12 = 12 month rolling average < 250 mg/L, and W = 12 month flow weighted average concentrations < 250 mg/L.
4 D = daily concentrations < 850 mg/L, 12 = 12 month rolling average < 850 mg/L, and W = 12 month flow weighted average concentrations < 850 mg/L.
5 D = daily concentrations < 1.0 mg/L, 12 = 12 month rolling average < 1.0 mg/L, and W = 12 month flow weighted average concentrations < 1.0 mg/L.

Table ES-6. Objective Status at Locations in the CCW for Phase 3 (removal of Hill Canyon WTP and Camarillo WRP effluent) with 4 cfs CMWD Imported Water Released to the North Fork and 3 cfs Released to the South Fork of the Arroyo Conejo. [1]

Lower Watershed Location	TMDL Reach	Chloride[2]				Sulfate[3]			TDS[4]			Boron[5]		
		D	12	W	C	D	12	W	D	12	W	D	12	W
South Fork Arroyo Conejo	13	×	×	✓	✓	×	×	✓	×	×	✓	✓	✓	✓
Conejo Creek Below Hill Canyon	10	×	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓
Arroyo Santa Rosa	11	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Conejo Creek @ Diversion	9B	×	✓	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Conejo Creek at Howard Rd.	9A	×	✓	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Calleguas Creek above Potrero Rd	3	×	×	✓	✓	×	×	×	×	×	✓	✓	×	✓

1 Check indicates reaches meeting the objective, and "x" indicates reaches failing to meet objective.
2 D = daily concentrations < 150 mg/L, 12 = 12 month rolling average < 150 mg/L, W = 12 month flow weighted average concentrations < 150 mg/L, and C = CCC concentration < 230 mg/L.
3 D = daily concentrations < 250 mg/L, 12 = 12 month rolling average < 250 mg/L, and W = 12 month flow weighted average concentrations < 250 mg/L.
4 D = daily concentrations < 850 mg/L, 12 = 12 month rolling average < 850 mg/L, and W = 12 month flow weighted average concentrations < 850 mg/L.
5 D = daily concentrations < 1.0 mg/L, 12 = 12 month rolling average < 1.0 mg/L, and W = 12 month flow weighted average concentrations < 1.0 mg/L.

Table ES-7. Objective Status at Locations in the CCW Based on Reverse Osmosis Treatment Plan[1]

Location	TMDL Reach	Chloride[2]				Sulfate[3]			TDS[4]			Boron[5]		
		D	12	W	C	D	12	W	D	12	W	D	12	W
Upper Watershed														
Arroyo Simi at Madera Rd.	Upper 7	×	×	✓	✓	×	×	×	×	×	×	×	✓	✓
Arroyo Simi below Highway 118	Mid 7	✓	✓	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Hitch Blvd.	Border 6/7	✓	✓	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Somis	Mid 6	×	✓	✓	✓	×	×	✓	×	×	×	✓	✓	✓
Arroyo Las Posas at Seminary Rd.	Lower 6	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Lower Watershed														
South Fork Arroyo Conejo	13	×	×	✓	×	×	×	✓	×	×	×	✓	✓	✓
Conejo Creek Below Hill Canyon	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Arroyo Santa Rosa	11	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Conejo Creek @ Diversion	9B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Conejo Creek at Howard Rd.	9A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Calleguas Creek above Potrero Rd	3	×	×	✓	✓	×	×	×	✓	✓	✓	×	✓	✓
Oxnard Plain														
Revolon Slough	4	×	×	✓	✓	×	×	×	×	×	×	×	×	×

[1] Check indicates reaches meeting the objective, and "x" indicates reaches failing to meet objective.
[2] D = daily concentrations < 150 mg/L, 12 = 12 month rolling average < 150 mg/L, W = 12 month flow weighted average concentrations < 150 mg/L, and C = CCC concentration < 230 mg/L.
[3] D = daily concentrations < 250 mg/L, 12 = 12 month rolling average < 250 mg/L, and W = 12 month flow weighted average concentrations < 250 mg/L.
[4] D = daily concentrations < 850 mg/L, 12 = 12 month rolling average < 850 mg/L, and W = 12 month flow weighted average concentrations < 850 mg/L.
[5] D = daily concentrations < 1.0 mg/L, 12 = 12 month rolling average < 1.0 mg/L, and W = 12 month flow weighted average concentrations < 1.0 mg/L.

As shown in the tables, very few reaches consistently meet the current Basin Plan objectives with these proposed projects or reverse osmosis treatment. However for these proposed projects, the 12 month rolling average is more consistently met for chloride in most reaches, and sulfate and TDS in some reaches. The reverse osmosis treatment plan generally results in similar compliance with chloride objectives as these proposed projects downstream of the POTWs. However, the reverse osmosis plan results in more compliance with TDS and sulfate objectives downstream of the POTWs. Upstream of the Hill Canyon WTP, these projects result in improved water quality whereas the reverse osmosis treatment plan does not impact water quality in the reaches upstream of POTWs. Arroyo Santa Rosa and Revolon Slough consistently do not meet any of the possible objectives because the projects and reverse osmosis treatment do not address those reaches. However, the discontinuation of the Olsen Rd. WTP discharge to the Arroyo Santa Rosa has resulted in minimal if any flows in the reach, and may have resolved the salts impairment for the Arroyo Santa Rosa.

Although reverse osmosis treatment of wastewater effluent provides some water quality improvements, it will not result in compliance with all salts objectives, does not provide the additional benefits of these

proposed projects (such as improvements in local supply), and does not address all of the impacts of salts on beneficial uses. Additionally, reverse osmosis results in significantly less salt removal from the watershed, and requires significant energy resource consumption. The following table compares these additional impacts for these projects and reverse osmosis treatment.

Table ES-8. Summary of Impacts of Proposed Projects as Compared to Reverse Osmosis Treatment

Impact	Proposed Projects	Reverse Osmosis Treatment
Additional Local Water Resources	30 mgd	None
Pounds of Salt Removed from Watershed (Salt Balance)	370,000 lbs/day	55,000 lbs/day
Ability to Protect Beneficial Uses	Targets the beneficial use impacts	May not address all of the impacts on beneficial uses
Ability to Meet Current Water Quality Objectives in Stream	Will not meet the current objectives in all reaches	Will not meet the current objectives in all reaches
Other Impacts	Requires SSOs	SSOs may be required; Requires large amounts of energy

In conclusion, implementation of the proposed projects in combination with the recommended revisions to the water quality objectives listed above are likely to resolve the salts impairments in the watershed and provide significant water resource benefits to the CCW.

1. Introduction

The purpose of this document is to summarize work performed under the *Calleguas Creek Watershed Salts TMDL Work Plan* (Work Plan). Water quality objectives and beneficial uses are discussed, and an implementation plan for salts in the Calleguas Creek Watershed (CCW) is proposed. Regulatory issues related to surface water concentrations of salts (objectives, beneficial uses, and 303(d) listings) and broader salt management issues in the watershed are addressed. Additionally, the report provides an update on the analysis of options to address salts in the CCW. This document is not intended to be a Total Maximum Daily Load (TMDL) nor provide all technical information necessary for developing a TMDL.

The report is organized into six major sections. The introductory section of the report (Section 1) describes the watershed. Then, the problem statement (Section 2) lays out both the regulatory and water resource issues with salts. Watershed sources, fate, and transport of salts are included to help understand the approach being taken to address salts (Section 3). Water quality objectives and beneficial uses are reviewed to examine the need for developing site-specific objectives (SSOs) (Section 4). Proposed projects are analyzed and compared to reverse osmosis treatment, as recommended by the EPA Chloride TMDL, to determine the impacts on water quality, water supply, the watershed salt balance and beneficial uses (Sections 5, 6, and 7). Finally, the document identifies the next steps to be taken in the process (Sections 8 and 9).s

1.1. Environmental Setting

Calleguas Creek and its tributaries are located in southeast Ventura County and a small portion of western Los Angeles County. Calleguas Creek drains an area of approximately 343 square miles from the Santa Susana Pass in the east to Mugu Lagoon in the southwest. The main surface water system drains from the mountains in the northeast part of the watershed toward the southwest where it flows through the Oxnard Plain before emptying into the Pacific Ocean through Mugu Lagoon. The watershed, which is elongated along an east-west axis, is about thirty miles long and fourteen miles wide. The Santa Susana Mountains, South Mountain, and Oak Ridge form the northern boundary of the watershed; the southern boundary is formed by the Simi Hills and Santa Monica Mountains.

Land uses in the CCW include agriculture, high and low density residential, commercial, industrial, open space and a Naval Air Base located adjacent to Mugu Lagoon. The watershed includes the cities of Simi Valley, Moorpark, Thousand Oaks, and Camarillo. Most of the agriculture is located in the middle and lower watershed with the major urban areas (Thousand Oaks and Simi Valley) located in the upper watershed. The current land use in the watershed is approximately 26% agriculture, 24% urban, and 50% open space. Patches of high quality riparian habitat are present along the length of Calleguas Creek and its tributaries.

The watershed is characterized by three major sub watersheds: the Arroyo Simi/Las Posas in the north, Conejo Creek in the south and Revolon Slough in the west. Additionally, the lower watershed is also drained by several minor agricultural drains in the Oxnard plain. The following sections describe the sub watersheds in more detail. Figure 1 depicts Calleguas Creek with reach names and designations used in this report.

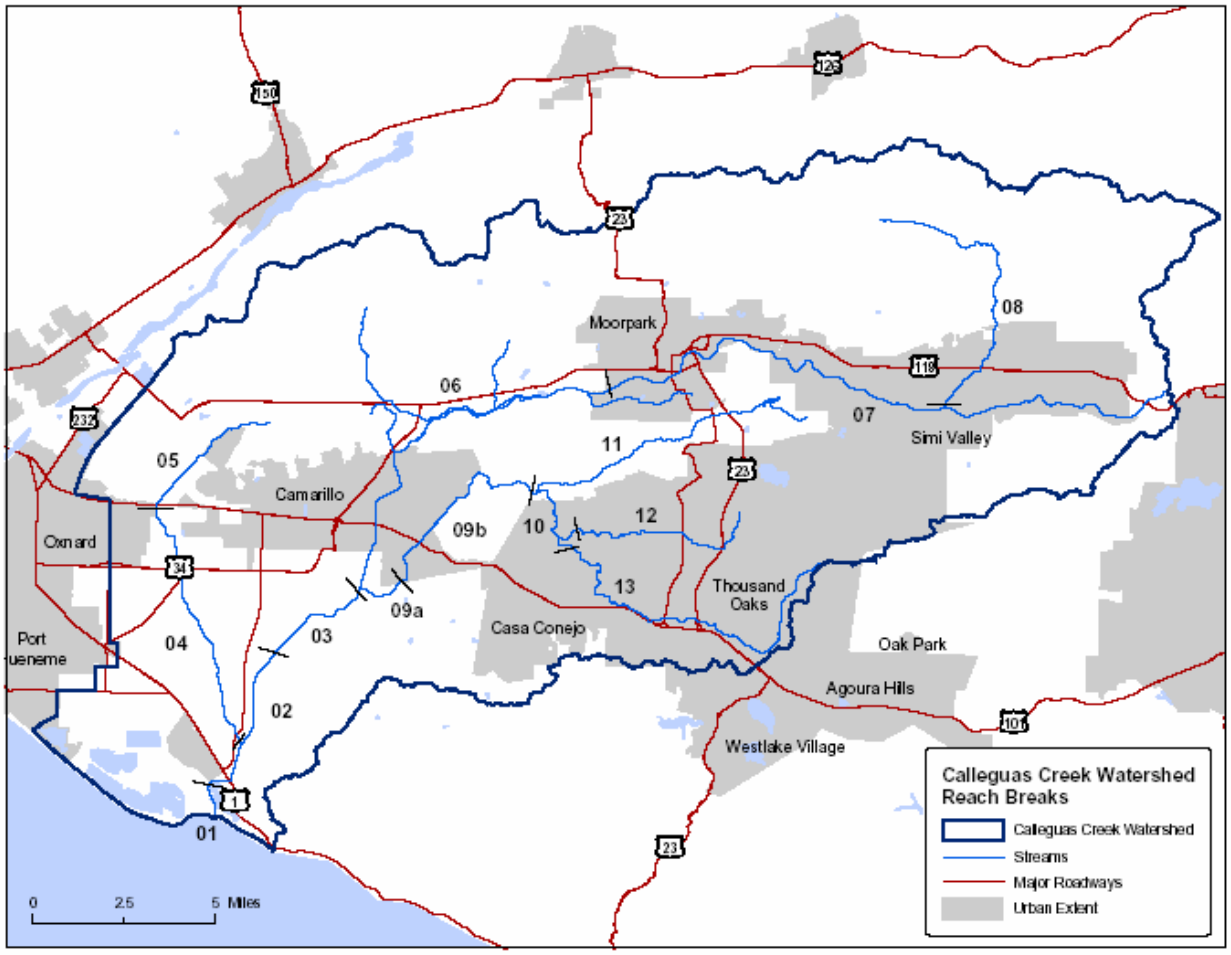

Figure 1. Calleguas Creek Watershed Reaches

1.1.1. Arroyo Simi/Las Posas

The upper portion of the watershed is drained by the Arroyo Las Posas and the Arroyo Simi, which is tributary to the Arroyo Las Posas. The upper part of the watershed system originates in the Simi Valley and surrounding foothills. The surface flow comes from the headwaters of the Arroyo Simi at Santa Susanna pass (upper parts of Reach 7) and Tapo Canyon (Reach 8). Arroyo Simi and Arroyo Las Posas flow through the cities of Simi Valley and Moorpark and join with Calleguas Creek near Camarillo.

Upstream of Simi Valley, the creek is unlined and passes through open space and recreational areas. Through the city of Simi Valley, the Arroyo Simi flows through concrete lined or rip-rapped channels. Between Simi Valley and Moorpark, a distance of approximately 7 miles, the creek is unlined and without rip-rap. From the edge of Moorpark to Hitch Boulevard, the creek is once again rip-rapped on the sides with a soft bottom throughout most of the channel, but in some areas, such as under bridges, the bottom is covered with concrete and rip rap.

The Arroyo Simi flows into the Arroyo Las Posas at Hitch Blvd. Downstream of Hitch Boulevard, Arroyo Las Posas passes through agricultural fields and orchards in a primarily natural channel. Although the Arroyo Las Posas channel joins with Calleguas Creek near Camarillo, surface flow is typically not present in this portion of the channel due to evaporation and groundwater recharge upstream of Seminary Road.

Two POTWs are located in this sub watershed. The Simi Valley Water Quality Control Plant (WQCP) discharges to the Arroyo Simi on the western edge of the City of Simi Valley. The Moorpark Wastewater Treatment Plant (WTP) discharges primarily to percolation ponds near the Arroyo Las Posas downstream of Hitch Boulevard. Direct discharges to the Arroyo Las Posas from the Moorpark WTP only occur during extremely wet periods.

1.1.2. Arroyo Conejo/Conejo Creek

Conejo Creek and its tributaries (Arroyo Conejo and Arroyo Santa Rosa) drain the lower portion of the watershed. Flow in the lower portion of the watershed originates in the City of Thousand Oaks and flows through the City of Camarillo before joining Calleguas Creek upstream of the California State University Channel Islands. This area supports significant residential and agricultural land uses. The following sections describe Conejo Creek and its tributaries.

1.1.2.1. Arroyo Conejo

The Arroyo Conejo runs through Thousand Oaks and has three branches, the main fork, the north fork, and the south fork. The main fork of the Arroyo Conejo runs underground for most of its length. The portions that are above ground are concrete lined until the creek enters Hill Canyon on the western side of the city and converges with the south fork. The south fork runs through the southern and western portions of Thousand Oaks. For most of its length, the south fork flows underground or through concrete lined channels. The Hill Canyon Wastewater Treatment Plant (WTP) discharges to the north fork of the Arroyo Conejo on the western edge of the City of Thousand Oaks. The north fork runs through Thousand Oaks upstream of the Hill Canyon WTP. The channel is concrete lined for the portion that runs through the city, but becomes unlined when it nears the treatment plant. The main fork and the south fork join together about a mile upstream of the treatment plant. The joined flow (usually called the south fork at this point) and the north fork converges approximately 0.4 miles downstream of the Hill Canyon WTP. The Arroyo Conejo then flows in a natural channel through a primarily open space area until it merges with the Arroyo Santa Rosa to form Conejo Creek at the base of the canyon.

Arroyo Santa Rosa

Arroyo Santa Rosa runs on the northern edge of the City of Thousand Oaks and through agricultural land in the Santa Rosa Valley. Arroyo Santa Rosa is a natural channel for most of its length with portions of riprap and concrete lining along the sides and bottom of the channel in the vicinity of homes (such as near Las Posas Road). Prior to 1999, a wastewater treatment plant (Olsen Rd.) discharged to Arroyo Santa Rosa and maintained a constant surface flow in the reach. Since 1999, the POTW has not discharged and much of the channel is dry during non-storm events.

1.1.2.2. Conejo and Calleguas Creek

Arroyo Conejo and Arroyo Santa Rosa converge at the base of Hill Canyon to form Conejo Creek. Conejo Creek flows downstream approximately 7.5 miles, through the City of Camarillo, to its confluence with

Calleguas Creek. Just downstream of the city, the Camarillo WRP discharges to Conejo Creek. Because the Arroyo Las Posas does not generally provide surface flow to Calleguas Creek during dry periods, Conejo Creek provides the majority of the flow in Calleguas Creek. For most of the length of the Conejo and Calleguas Creeks, the sides of the channel are rip rapped and the bottom is unlined.

1.1.3. Revolon Slough

Revolon Slough drains the agricultural land in the western portion of the watershed (Oxnard Plain). The slough does not pass through any urban areas, but does receive drainage from tributaries that drain urban areas. Revolon Slough starts as Beardsley Wash in the hills north of the City of Camarillo. The wash is a rip rapped channel for most of its length and combines with Revolon Slough at Central Avenue in Camarillo. The slough is concrete lined just upstream of Central Avenue and remains lined for approximately 4 miles to Wood Road. From there, the slough is soft bottomed with rip-rapped sides. The lower mile and a half or so of the slough to above Las Posas Road appears to be tidally influenced by inflows from Mugu Lagoon. Revolon Slough flows into Mugu Lagoon in a channel that runs parallel to Calleguas Creek. The flows from Revolon Slough and Calleguas Creek only converge in the lagoon.

In addition to Revolon Slough, a number of agricultural drains (Oxnard Drain, Mugu Drain, and Duck Pond Drain) serve as conveyances for agricultural and industrial drainage water to the Calleguas Creek estuary and Mugu Lagoon.

1.1.4. Mugu Lagoon

Mugu Lagoon, an estuary at the mouth of Calleguas Creek, supports a diverse wildlife population including migratory birds and endangered species. This area is affected by military land uses of the Point Mugu Naval Air Weapons Station and substantial agricultural activities in the Oxnard Plain. The lagoon consists of approximately 287 acres of open water, 128 acres of tidal flats, 40 acres of tidal creeks, 944 acres of tidal marsh and 77 acres of salt pan (California Resources Agency, 1997). It is comprised of a central basin into which flows from Revolon Slough and Calleguas Creek enter and two arms (eastern and western) that receives some drainage from agricultural and industrial drains. The salinity in the lagoon is generally between 31 and 33 parts per thousand (ppt) (Granade, 2001). The central basin of the lagoon has a maximum tidal range of approximately -1.1 to 7 feet (as compared to mean sea level) with smaller ranges in the two arms. The western arm of the lagoon receives less tidal volume because of a bridge culvert that restricts the flows in that area. The velocity of water traveling through the mouth of the lagoon is approximately 5-6 knots, which is a high velocity for a lagoon (Grigorian, 2001). The mouth of the lagoon never closes, apparently as a result of a large canyon present at the mouth of Calleguas Creek. The canyon prevents ocean sand from building up to a high enough level to close the mouth and likely accounts for the high velocities in the lagoon (Grigorian, 2001).

1.1.5. Climate and Hydrology

The climate in the watershed is typical of the southern California coastal region. Summers are relatively warm and dry and winters are mild and wet. Eighty-five percent of the rainfall occurs between November and March with most of the precipitation occurring during just a few major storms. Annual rainfall in Ventura County averages 15 inches and varies from 13 inches on the Oxnard Plain to a maximum of 20 inches in the higher elevations (USDA, 1995). About 15 to 20 discrete storm events occur per year concentrated in the wet-weather months, producing runoff of duration from one-half day to several days (USGS, 2000).

Discharge during runoff from storm events is commonly 10 to 100 times greater than at other times. Storm events and the resulting high stream flows are highly seasonal, grouped heavily in the months of November through February, with an occasional major storm as early as September and as late as April. Rainfall is rare in other months, and major storm flows historically have not been observed outside the wet-weather season.

1.1.6. Surface Waters

Dry weather surface water flow in the Calleguas Creek watershed is primarily composed of groundwater (pumped and exfiltration), municipal wastewater, urban non-storm water discharges, and agricultural runoff. In the upper reaches of the watershed, upstream of any wastewater discharges, groundwater discharge from shallow surface aquifers provides a constant base flow. Additionally, urban non-storm water runoff and groundwater extraction for construction dewatering or remediation of contaminated aquifers contribute to the base flow. Stream flow in the upper portion of the watershed is minimal, except during and immediately after rainfall. Flow in Calleguas Creek is described as storm peaking and is typical of smaller watersheds in coastal southern California.

In the Arroyo Simi/Las Posas sub watershed, additional flow is contributed by groundwater pumped for dewatering and discharged under permit to the Arroyo Simi upstream of Madera Road. The Simi Valley WQCP discharges downstream of the City of Simi Valley and provides much of the flow in the Arroyo Simi during dry weather. During most of the year, at the point where the channel reaches Seminary Road, the surface water flow has been lost to groundwater percolation and evaporation. During and immediately following significant rains, surface flows in the Arroyo Las Posas discharge to Calleguas Creek. In the Conejo Creek sub watershed, the Hill Canyon WTP provides the majority of the surface water flow. Additionally, the Camarillo WRP provides some flow in the lower portion of Conejo Creek. Revolon Slough receives all of its flow from agricultural discharges, groundwater exfiltration, and some urban non-storm water flow.

1.1.7. Groundwater

Groundwater features of the watershed are dominated by the Fox Canyon Aquifer System, which is linked to the neighboring Santa Clara River Watershed. The Fox Canyon Aquifer System is a series of deep, confined aquifers. These aquifers today receive little or no recharge from the watershed. The water quality in these aquifers is very high. However, because there is little recharge to these aquifers they suffer from overdraft. Major groundwater basins within the watershed include the Simi Basin, East Las Posas, West Las Posas, South Las Posas, Pleasant Valley, and Arroyo Santa Rosa Basins. Significant aquifers within the watershed include the Epworth Gravels, the Fox Canyon aquifer, and the Grimes Canyon aquifer in order from shallowest to deepest. In addition, the top 350 feet of sediments within the Pleasant Valley (PV) Basin are often referred to as the "Upper Zone", and are thought by some to be equivalent to the Hueneme aquifer zone that is a more well-defined and recognized layer to the west of the PV Basin.

Shallower, unconfined aquifers are located in the valleys of the watershed. In the upper sub-watersheds of Simi Valley and Conejo Valley, groundwater collects in the lower areas and overflows into the down-gradient valleys. The Tierra Rejada, Santa Rosa and South Las Posas valley basins are larger than the upper valley basins and are the most significant unconfined basins on the watershed. Areas of perched and unconfined groundwater are also present along the base of the Santa Monica Mountains, and overlying areas of the southeastern Oxnard Plain in the Pleasant Valley.

Water rights have not been adjudicated in many of these basins, and groundwater production is not comprehensively controlled or maintained. However, groundwater extractions are regulated in the Oxnard Plain, Pleasant Valley Basin and the Las Posas Basin by the Fox Canyon Groundwater Management Agency. In some basins, groundwater is being over-drafted and as a result Pleasant Valley has experienced subsidence. In other basins, such as the South Las Posas Basin, groundwater levels have increased significantly in the last several decades.

1.1.8. Anthropogenic Alterations

Historically, the Oxnard Plain served as the flood plain for Calleguas Creek. Starting in the 1850's, agriculture began to be practiced extensively in the watershed. By 1889, a straight channel from the area near the present day location of Highway 101 to the Conejo Creek confluence had been created for Calleguas Creek. In the 1920's, levees were built to channelize flow directly into Mugu Lagoon (USDA, 1995). Increased agricultural and urban land uses in the watershed resulted in continued channelization of the creek to the current channel system. Historically, Calleguas Creek was an ephemeral creek flowing only during the wet season. The cities of Simi Valley, Moorpark, Camarillo, and Thousand Oaks experienced rapid residential and commercial development beginning in the 1960s. In the early 70's, State Water Project supplies began being delivered to the watershed. In 1957, the Camarillo WRP came online, followed by the Hill Canyon WTP in Thousand Oaks in 1961. Increasing volumes of discharges from these POTWs eventually caused the Conejo/Calleguas system to become a perennial stream by 1972 (SWRCB, 1997). When the Simi Valley WQCP began discharging in the early 1970's, the Arroyo Simi/Arroyo Las Posas became a perennial stream that gradually flowed further downstream and currently reaches Seminary Road in Camarillo.

1.1.9. Flow Diversion Project

The Conejo Creek Diversion project in the Calleguas Creek watershed diverts the majority of flow in Conejo Creek to agricultural uses in the Pleasant Valley area. The diversion project is located approximately 7 miles downstream from the Hill Canyon WTP. The water rights application allows the diversion of an amount equal to the Hill Canyon WTP's effluent minus 4 cfs for in stream uses and channel losses. An additional amount of water equal to the flow contributed by use of imported water in the region (estimated at 4 cfs) may be diverted when at least 6 cfs of water will remain in the stream downstream of the diversion point (SWRCB, 1997). As a result of this project, flows in the lower reach of Conejo Creek have been reduced to less than half of the previous creek flows.

1.1.10. Reach Designations

Table 1 summarizes the reach descriptions of Calleguas Creek used in this TMDL and the correlation between these reaches and the 303(d) and consent decree listed reaches. These reach designations provide greater detail than the designations in the current *Water Quality Control Plan: Los Angeles Regional Water Quality Control Plan* (Basin Plan). The reach revisions may provide an appropriate analytical tool for future analyses in the watershed. At this time, though, the reach revisions are not regulatory and do not alter water quality objectives for the reaches in the existing Basin Plan.

Table 1. Description of Calleguas Creek Reaches

Assigned Reach No.	Reach Name Reach as Listed in 303(d) List and Consent Decree	Geographic Description
1 Mugu Lagoon	Mugu Lagoon	Lagoon fed by Calleguas Creek
2 Calleguas Creek South	Calleguas Creek Reach 1 and Reach 2 (Estuary to Potrero Rd.)	Downstream (south) of Potrero Rd
3 Calleguas Creek North	Calleguas Creek Reach 3 (Potrero to Somis Rd.)	Potrero Rd. upstream to confluence Conejo Creek
4 Revolon Slough	Revolon Slough Main Branch	Revolon Slough from Mugu Lagoon to Central Ave
5 Beardsley Channel	Beardsley Channel	Revolon Slough upstream of Central Ave.
6 Arroyo Las Posas	Arroyo Las Posas Reach 1 and part of Reach 2 (Lewis Somis Rd. to Moorpark Fwy (23))	Confluence with Calleguas Creek to Hitch Road
7 Arroyo Simi	Arroyo Simi Reach 1 and Reach 2 (Moorpark Fwy (23) to Headwaters) part of Arroyo Las Posas Reach 2	End of Arroyo Las Posas (Hitch Rd) to headwaters in Simi Valley.
8 Tapo Canyon	Tapo Canyon Reach 1 and Reach 2	Confluence w/ Arroyo Simi up Tapo Cyn to headwaters
9A Conejo Creek Diversion	Conejo Creek Reach 1 (Conflict with Calleguas Creek to Santa Rosa Rd.)	Extends from Camrosa Diversion to confluence with Calleguas Creek.
9B Conejo Creek Main Stem	Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	Extends from the confluence with Arroyo Santa Rosa downstream to the Camrosa Diversion
10 Hill Canyon reach of Conejo Creek	Part of Conejo Creek Reach 2 and Reach 3 (Santa Rosa Rd. to Lynn Rd.)	Confluence w/ Arroyo Santa Rosa to confluence w/ N. Fork; and N. Fork to just above Hill Canyon WTP
11 Arroyo Santa Rosa	Arroyo Santa Rosa	Confluence w/ Conejo Creek to headwaters
12 North Fork Conejo Creek	North Fork Conejo Creek	N. Fork just above Hill Canyon WTP to headwaters
13 Arroyo Conejo (South Fork Conejo Creek)	Conejo Creek Reach 4 (Above Lynn Rd.)	Confluence w/ N. Fork to headwaters —two channels

2. Problem Statement

Since 1999, ongoing discussions about the best mechanisms for managing chlorides in the CCW have clearly demonstrated that two distinct problems exist related to salts. The first is the regulatory defined problems based on the 303(d) list. This problem definition relies solely on the ability of the surface waters to meet Basin Plan water quality objectives to protect beneficial uses. However, the issues with salts are much broader than just surface water concentrations. Therefore, two problem statements were developed. The first deals with the regulatory requirements resulting from the 303(d) listings of salts in the CCW. The second deals with the broader impacts from salts in the CCW. The projects described in this report focus on addressing both components of the problem statement.

2.1. Regulatory Problem Statement

2.1.1. Regulatory Background

Section 303(d) of the Clean Water Act (CWA) requires that "Each State shall identify those waters within its boundaries for which the effluent limitations are not stringent enough to implement any water quality standard applicable to such waters." The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and establish TMDLs for such waters.

The Los Angeles Regional Water Quality Control Board (Regional Board) identified over 700 water body-pollutant combinations in the Los Angeles Region where TMDLs are required (SWRCB, 1999). A schedule for development of TMDLs in the Los Angeles Region was established in a consent decree (Heal the Bay Inc., et al. v. Browner C 98-4825 SBA) approved on March 22, 1999. The consent decree combined water body pollutant combinations in the Los Angeles Region into 92 TMDL analytical units. Based on the consent decree schedule, a TMDL for chloride was adopted by USEPA in March 2002. According to the consent decree, the remaining salts (TDS, sulfate, and boron) TMDLs must be approved or established by United States Environmental Protection Agency (USEPA) by March 2012.

In addition to the 303(d) listings for salts, a number of other regulatory activities have been ongoing in the watershed to address chloride surface water concentrations and objectives. The following section summarizes the other regulatory activities related to chloride that are relevant to the development of this report.

2.1.1.1. Chloride Regulatory History

During the drought that began in the 1980s and continued through the early 1990s, many dischargers in the Los Angeles Region had difficulty meeting the chloride discharge limits based on the Basin Plan objectives. Although, chloride levels were expected to subside after the drought, many water bodies continued to exceed the chloride objective.

In 1997, the Regional Board adopted Resolution 97-02 (the Chloride Policy) that revised the chloride water quality objectives (WQOs) upward to 190 mg/L for specified reaches of the Los Angeles River and 180 mg/L in the San Gabriel River. However, the chloride objectives were not revised in the Calleguas Creek and Santa Clara River watersheds due to concerns for agricultural beneficial uses, which are sensitive to chloride levels. Rather, the Regional Board extended the interim limits in these watersheds and directed staff to carefully determine the chloride WQO that would fully support the agricultural beneficial use (See Table 2). The Regional Board determined that the interim limits expired on March 29, 2002.

Table 2. Interim Chloride Limits for Specified Stream Segments

Calleguas Creek watershed segments for which existing dischargers are subject to Interim Chloride Limits	Interim Chloride Limit
Arroyo Simi and tributaries-upstream of Madera Road	160 mg/L
Arroyo Simi- downstream of Madera Road, Arroyo Las Posas, and tributaries	190 mg/L
Calleguas Creek and tributaries-between Potrero Road and Arroyo Las Posas (including Conejo Creek, Arroyo Conejo, and Arroyo Santa Rosa)	190 mg/L

After the expiration of the interim limits on March 29, 2002, the dischargers in the watershed worked with the State Water Resources Control Board (State Board) to develop a stay that would extend the interim limits for up to three years to allow them to pursue "a watershed planning effort to support determinations of beneficial uses, water quality objectives, and development of total maximum daily loads as necessary" (WQO 2002-0017). The State Board approved the stay in October 2002. The stay requires that a work plan be developed to "re-evaluate water quality objectives for chloride in the Calleguas Creek watershed and/or the beneficial uses currently associated with chloride objectives in the Calleguas Creek watershed (Work Plan)." The Regional Board must then ensure that the work plan provides "an adequate approach to determining appropriate water quality standards and implementation with respect to chloride in the Calleguas Creek watershed."

The Calleguas Creek Watershed Management Plan submitted a work plan to meet the requirements of the stay agreement in January 2003 (*Calleguas Creek Watershed Salts TMDL Work Plan*). The work plan was approved by the Regional Board in July 2003, thereby fulfilling the requirements of the stay agreement.

Concurrently with the activity surrounding the Chloride Policy, a chloride TMDL was being developed. In December 2001, the Regional Board developed a draft chloride TMDL (Draft Chloride TMDL) for the CCW. Although the proposed TMDL was never adopted by the Regional Board, the USEPA used it as a basis for developing a chloride TMDL for the CCW to meet the consent decree requirements. The USEPA developed chloride TMDL (EPA Chloride TMDL) was adopted by USEPA on March 2, 2002.

When the discharge permits for three of the POTWs in the watershed were renewed in 2003, the interim limits were placed in the NPDES discharge permits in accordance with the stay agreement. The USEPA objected to the draft orders that were consistent with the stay. USEPA contended that the final orders must include effluent limitations for chloride consistent with waste load allocations (WLA) contained in the EPA Chloride TMDL. As a result, the Regional Board adopted the orders with new chloride effluent limitations and accompanying time schedule orders based upon the EPA Chloride TMDL.

In response, the dischargers appealed their permits to the State Board. Another stay agreement was adopted in October 2003 to address the concerns outlined in the appeal. This agreement stayed the final chloride effluent limitations and time schedule orders associated with the limitations for all of the appealed permits. The stay acknowledged that a work plan has been approved by the Regional Board and activities related to the work plan were in progress. In December 2003, the Regional Board adopted orders for the remaining two POTWs that included effluent limitations for chloride consistent with WLAs contained in the EPA Chloride TMDL. These permits were also appealed to the State Board and a similar stay of the final chloride effluent limitations is pending. This document is a summary of work conducted under the approved work plan.

2.1.1.2. Water Quality Standards

Federal water quality standards consist of the following elements: 1) designated beneficial uses and 2) narrative and/or numeric water quality criteria. State water quality objectives, which parallel, federal criteria, are numeric values or narrative statements which are intended to provide reasonable protection of designated beneficial uses. For inland surface waters in the Los Angeles Region, beneficial uses, numeric and narrative objectives are identified in the Basin Plan. The State water quality objectives and Federal criteria applicable to salts are addressed in this section.

2.1.1.2.1. Beneficial Uses

Salts primarily impact two beneficial uses: agriculture irrigation and groundwater recharge. In addition, chloride has the potential to impact aquatic life, there are secondary drinking water standards for some salts, and industrial processing can be impacted by high salts concentrations. The following table summarizes the locations of these beneficial uses as listed in the Basin Plan.

Table 3. Beneficial Uses Potentially Impacted by Salts in Calleguas Watershed

Reach	Reach No.	Hydro Unit	WARM	MUN	IND	PROC	AGR	GWR
Mugu Lagoon	1	403.11						
Calleguas Creek Estuary	2	403.11						
Calleguas Creek	2, 3	403.11	E	P*			E	E
Calleguas Creek	3, 9A	403.12	E	P*	E	E	E	E
Revolon Slough	4	403.11	E	P*	P		E	E
Beardsley Wash	5	403.61	E	P*				
Conejo Creek	3, 9A	403.12	E	P*	E	E	E	E
Conejo Creek	9B	403.63	I	P*				I
Arroyo Conejo	9A, 9B,10	403.64	I	P*				I
Arroyo Conejo	13	403.68	I	P*				I
Arroyo Santa Rosa	11	403.63	I	P*				I
Arroyo Santa Rosa	11	403.65	I	P*				I
North Fork Arroyo Conejo	12	403.64	E	P*			E	E
Arroyo Las Posas	6	403.12	E	P*	P	P	P	E
Arroyo Las Posas	6	403.62	E	P*	P	P	P	E
Arroyo Simi	7	403.62	I	P*	I			I
Arroyo Simi	7	403.67	I	I*	I			I
Tapo Canyon Creek	8	403.66	I	I*		P	P	I
Tapo Canyon Creek	8	403.67	I	I*		P	P	I
Gillibrand Canyon Creek		403.66	I	P*				I
Gillibrand Canyon Creek		403.67	I	P*				I
Lake Bard		403.67	E	E	E	E	E	P

E-Existing Beneficial Use, P-Potential Beneficial Use, I-Intermittent Beneficial Use

* Asterixed MUN designations are not to be put into effect until a study has been done to confirm the presence of the beneficial use.

2.1.1.2.2. Water Quality Objectives

2.1.1.2.2.1. Surface Water Objectives

The Basin Plan contains water body specific numeric water quality objectives for salts in Table 4-2. The objectives for the CCW are applicable upstream of Potrero Road and are shown in Table 4. The objectives are currently applied as instantaneous maximum concentrations.

Table 4. Basin Plan Objectives for Salts

Constituent	Objective Upstream Potrero Road (mg/L)
TDS	850
Chloride	150
Sulfate	250
Boron	1.0
SAR	Not enough data

The objectives in Table 4 are water body specific and only apply upstream of Potrero Road. It is unclear based on the reach definitions in Table 3-8 of the Basin Plan whether or not the water body specific values apply to Revolon Slough and Beardsley Wash. Because Revolon Slough enters Calleguas Creek downstream of Potrero Road, it does not appear that the objectives apply to these reaches. However, in the 2002 listing process, USEPA determined that an interpretation of the narrative standards in the Basin Plan results in the application of the objectives to Revolon Slough.

In addition to the existing Basin Plan objectives, Federal advisory criteria are numeric for the protection of aquatic life and municipal drinking water exist for several salts as shown in Table 5.

Table 5. Federal Advisory Criteria for Salts

	MUN (mg/L)	AQ Life Chronic 4 day average (mg/L)	AQ Life Acute 1 hour average (mg/L)
TDS	500 (USEPA secondary MCL)		
Chloride	250 (USEPA secondary MCL)	230	860
Sulfate	400-500 (USEPA proposed MCL)		

Finally, California has secondary Maximum Contaminant Level (MCL) ranges for TDS, chloride and sulfate in drinking water.

Table 6. California Secondary Maximum Contaminant Levels - Ranges

Constituent, Units	Recommended	Upper	Short Term
Total Dissolved Solids, mg/L	500	1,000	1,500
Chloride, mg/L	250	500	600
Sulfate, mg/L	250		

2.1.1.2.2.2. Groundwater Objectives

The Basin Plan also includes objectives for groundwater basins as shown in Table 7.

Table 7. Groundwater Objectives in Calleguas Creek Watershed

	GWR Arroyo Simi/Simi Valley Basin	GWR Arroyo Simi/ South Las Posas	GWR Arroyo Las Posas/ South Las Posas	GWR Arroyo Las Posas/ North Las Posas	GWR Arroyo Santa Rosa and Conejo/ Arroyo Santa Rosa Basin	GWR Arroyo Santa Rosa/ Tierra Rejada Basin	GWR Arroyo Conejo/ Thousand Oaks area	GWR Arroyo Conejo/ Conejo Valley	GWR Conejo and Calleguas/ Pleasant Valley
TDS	1200	2500	1500	500	900	700	1400	800	700
Chloride	150	400	250	150	150	100	150	150	150
Sulfate	600	1200	700	250	300	250	700	250	300
Boron	1.0	3.0	1.0	1.0	1.0	0.5	1.0	1.0	1.0

2.1.1.2.2.3. Antidegradation

"State Board Resolution 68-16, Statement of Policy with Respect to Maintaining High Quality Water in California, known as the "Antidegradation Policy," protects surface and ground waters from degradation. According to the Antidegradation Policy, any actions that can adversely affect water quality in all surface and ground waters must be consistent with the maximum benefit of the people of the state, must not unreasonably affect present and anticipated beneficial use of such water, and must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Antidegradation Policy (40 CFR 131.12)." (LARWQCB, 2002b)

2.1.1.3. Other Relevant Policies

In addition to the Federal and State regulations described above, the Regional Board enacted Resolution No. 97-10, *Support for Watershed Management in the Calleguas Creek Watershed* on April 7, 1997. Resolution 97-10 recognized watershed management as an innovative, cost-effective strategy for the protection of water quality. Resolution 97-10 also recognized that the Calleguas Creek Municipal Water District and the POTWs in the Calleguas Creek watershed had worked cooperatively with the Regional Board to develop an integrated watershed-wide monitoring program. The Calleguas Watershed Management Plan has been active since 1996 in the development of a watershed management plan for the Calleguas Creek watershed and has proactively worked with the Regional Board and EPA to develop TMDLs in the watershed.

Another important component of addressing salts impacts and the watershed salt balance is water reclamation. Several portions of the California Water Code establish goals and guidelines supporting water reclamation that should be considered as part of the analysis of projects to address salts. The Legislature has established a goal of recycling 1 million acre feet of water by 2010. (Water Code §13577.) The Legislature has declared that the people of the State have a "primary interest" in the development of recycled water facilities, and that the State should "take all possible steps" to encourage the development of such facilities in order to meet the State's water needs. (Water Code §§13510, 13512.) The Water Code defines recycled water not as a waste but as "water, which, as a result of treatment, is suitable for a

direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource." (Water Code §13050(n).)

2.1.2. 303(d) Listings

As discussed previously, the CWA requires that water bodies that do not meet water quality standards be listed on the 303(d) list. The Basin Plan water quality objectives listed above were used to assess the surface water bodies in Calleguas Creek for listing on the 303(d) list. Ten out of fourteen reaches in the CCW are identified on the 2002 Clean Water Act Section 303(d) list of water-quality limited segments as impaired due to elevated levels of salts (Table 8).

Table 8. 2002 303(d) Listings

Reach No.	Reach Name	Boron	Chloride	Sulfates	TDS
7	Arroyo Simi	X	X	X	X
6	Arroyo Las Posas		X	X	X
8	Tribs to Arroyo Simi	X	X	X	X
13	South Fork Conejo Creek		X	X	X
12	North Fork Conejo Creek			X	X
10	Conejo Creek Hill Canyon		X	X	X
11	Arroyo Santa Rosa			X	X
9B	Conejo Creek Main Stem		X	X	X
9A	Camrosa Diversion			X	X
3	Calleguas Creek Upper Main Stem		X		X
2	Calleguas Creek Lower Main Stem				
4	Revolon Slough	X		X	X
5	Beardsley Wash				
1	Mugu Lagoon				

Blank cells indicate no listings for that constituent in the reach.

2.1.3. Basis of 303(d) listings

This section presents the data used for comparison to the water quality objectives that resulted in the 303(d) listings for salts. Regional Board staff conducted water quality assessments in 1996, 1998 and 2002, with the majority of salts listings first appearing on the 1998 303(d) list. This section discusses the data reviewed for the Water Quality Assessments and the application of the data that resulted in the 1998 303(d) listings. In 2002, changes were made to the 303(d) list based on the changes to the reach designations. Additionally, USEPA added listings on Revolon Slough for TDS, sulfate and boron. The available information on the basis for the 1998 listings is summarized in Table 9. The information used for the 2002 listings is not included in the table.

Table 9. Basis of 1998 303(d) Listings

Reach No.	2002 Reach Name	1998 Reach Name	TDS			Chloride			Sulfate			Boron		
			Max	Avg.	% Exceed	Max	Avg.	% Exceed	Max	Avg.	% Exceed	Max	Avg.	% Exceed
8	Tapo Canyon	Tapo Canyon	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
7	Arroyo Simi	Arroyo Simi R2	2380	1654	86	180	130	57	1040	800	86	1.5	0.9	57
		Arroyo Simi R1	2600	1751	100	1190	277	90	1000	842	86	1.4	1.1	60
6	Arroyo Las Posas	Arroyo Las Posas R2	1280	1194	100	190	171	75	500	438	100	0.91	0.84	0
11	Arroyo Santa Rosa	Arroyo Santa Rosa	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
12	North Fork Conejo Creek	Arroyo Conejo North Fork	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
13	South Fork Conejo Creek	Conejo R4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
10	Conejo Creek Hill Canyon	Conejo R3	1240	888	52	242	172	80	571	286	63	0.5	0.46	0
9B	Conejo Creek Main Stem	Conejo R2	1210	819	35	230	173	84	386	264	56	0.5	0.38	0
9A	Camrosa Diversion	Conejo R1	1210	625	33	236	181	87	414	261	52	0.5	0.38	0
3	Calleguas Creek Upper Main Stem	Calleguas R3	1340	860	54	264	185	92	550	372	59	0.6	0.42	0
2	Calleguas Creek Lower Main Stem	Calleguas R2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Calleguas R1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	Beardsley Wash	Beardsley	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	Revolon Slough	Revolon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	Mugu Lagoon	Mugu	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N.D. indicates that no data were available for the constituent for the reach.
N/A indicates that objectives were not considered applicable to the reach so no listings were made.

As shown in the table above, surface water concentrations of salts exceed the Basin Plan water quality objectives for most reaches in the CCW.

2.2. Water Resources Problem Statement

The regulatory problem statement summarizes the necessary information for the development of a TMDL to address surface water concentrations of salts. However, salts impacts are broader and not completely addressed through the 303(d) listing process. Therefore, this additional problem statement was developed to highlight the additional issues surrounding salts management in the CCW.

Large volumes of salts are imported into the watershed to support development in the semi-arid climate of the watershed. The salts are imported from State Water Project imported water, Santa Clara River through the Freeman Diversion, and the pumping of deep aquifers, not directly recharged by surface water or irrigation, within the watershed. Additionally, the watershed contains naturally occurring or background concentrations of salts due to the fact that many of the soils are marine sediments. The watershed's stream systems do not have the capacity to effectively transport these salts off of the watershed and existing transportation processes do not effectively transport the salts to the surface waters on a daily basis. Consequently, salts are stranded on the watershed and build-up over time. The result is a general salt imbalance on the watershed that manifests itself in higher surface water and groundwater concentrations of salts. The concentrations can increase significantly for prolonged periods following extreme wet periods on the watershed as years of stranded salts that have built-up on the watershed are flushed into the surface waters.

As will be discussed in this report, the impacts on beneficial uses from the salt imbalance and watershed flushing have been minimal to date. However, there is concern that if the salt imbalance continues unmanaged, there could be impacts to groundwater and general soil conditions. Therefore, alternative mechanisms for addressing the salt imbalance and potential beneficial use impacts need to be developed.

3. Source Assessment

In this section, estimated dry weather loadings from sources of salts to the watershed are examined and the fate and transport of the salts in the watershed are discussed.

3.1. Conceptual Model

A conceptual model is designed to show how the pollutant and water flow through the watershed system. A conceptual model of salts sources and transport is presented diagrammatically in Figure 2. This diagram is meant to provide a generalized conceptual overview of the salts sources and related processes occurring throughout the watershed. Figure 2 is not spatially specific, in that some of the sources and processes may predominate in certain areas of the watershed and be absent from other areas. The squares represent sources of salts to the watershed, the arrows represent the transport of salts, and the diamonds represent the ultimate fate of salts in the CCW.

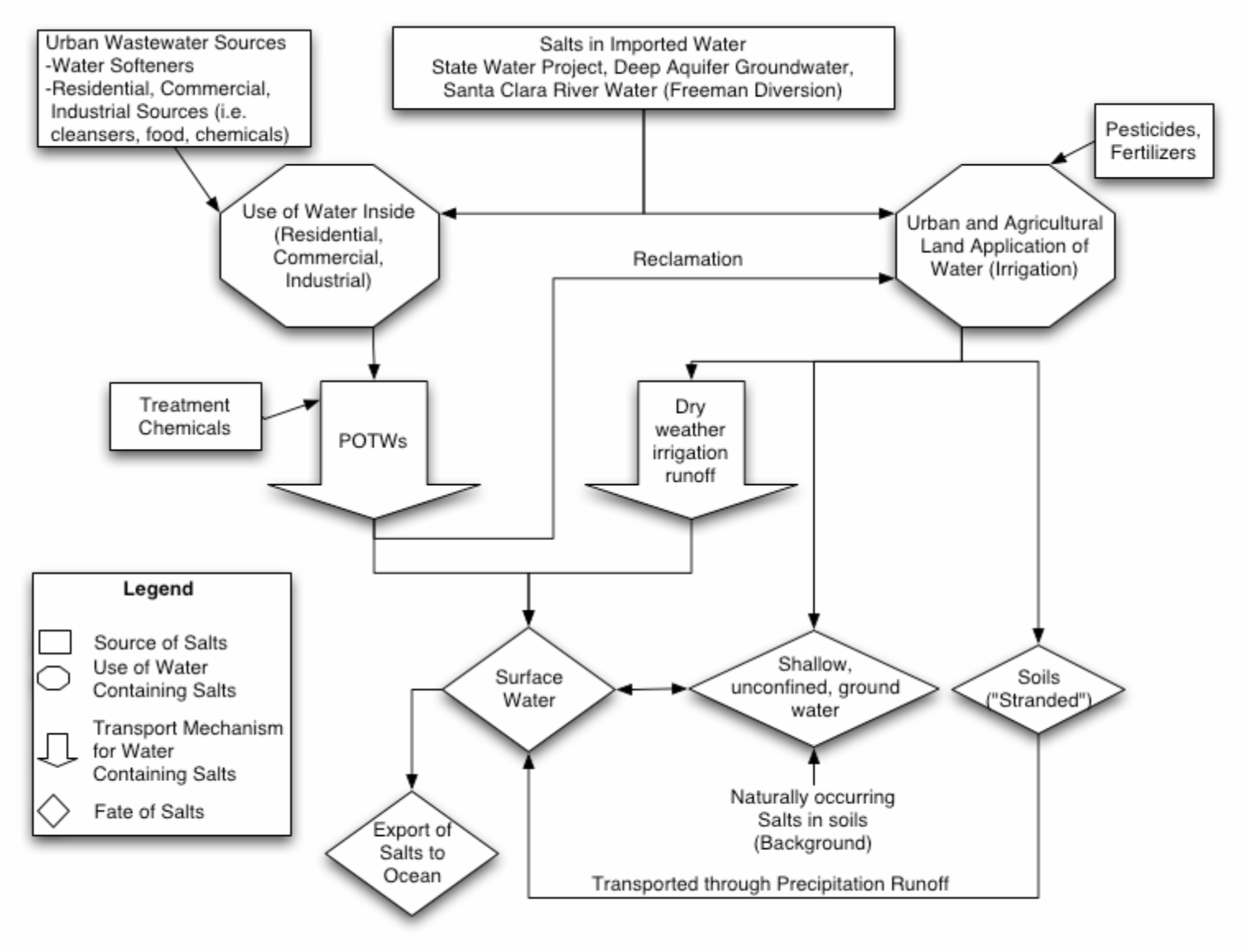

Figure 2: A Generalized Conceptual Model of salts flow for the Calleguas Creek Watershed.

3.2. Source Analysis

As shown in the conceptual model, six possible sources of salts to the watershed exist: water supply (water imported from the State Water Project or Freeman Diversion and deep aquifer groundwater pumping), water softeners, POTW treatment chemicals, atmospheric deposition, pesticides and fertilizers, and indoor water use (chemicals, cleansers, food, etc.). The use of pesticides and fertilizers may add some salts to the watershed, but the loads were not evaluated because there is insufficient information to determine the quantities added. These salts are then transported through POTW discharges and dry weather runoff to three possible endpoints: surface water, shallow groundwater, and/or stranded on the watershed in the soils. The salts stranded in the soils are eventually transported to surface water when precipitation mobilizes them and carries them to the creek system. Groundwater pumping and exfiltration moves salts from groundwater to surface water and surface water infiltration transports salts from the surface water to groundwater. Additionally, groundwater saturation of historic marine sediments can mobilize existing background salts from previously dry soil and transport them to the groundwater. However, none of these transport mechanisms add salts, they just move salts from one endpoint to another. Salts transported in the surface water to the ocean are currently the only salts that are exported from the watershed.

In the source analysis, the sources of salts to the watershed were quantified. Then, the transport mechanisms were utilized to quantify the portion of salts transported to surface waters during typical dry weather conditions. The salts that are not transported to surface waters are stranded in the watershed in soils and shallow, unconfined groundwater areas. These salts can be transported to the surface waters during large precipitation events, but are not mobilized during typical dry weather conditions. Consequently, the dry weather source analysis does not quantify the amount of salts that are mobilized and transported to surface waters during precipitation events.

3.2.1. Sources of Salts to Watershed

3.2.1.1. Water Supply

A major source of salts to the watershed is the load associated with introduced water sources. For the purposes of this report, introduced water includes water imported from the State Water Project, water produced from the watershed's deep confined aquifer system (Las Posas and Pleasant Valley groundwater basins), and Santa Clara River water (Freeman Diversion). While the concentration of salts in the introduced water is low relative to Basin Plan Objectives, the quantity of water brought into the watershed is sufficient to rate introduced water as the number one source of salts to the watershed.

Water supply for all cities except Thousand Oaks is composed of a combination of local groundwater and imported water. Thousand Oaks is supplied exclusively by State Water Project (SWP). Agricultural supply is primarily composed of local groundwater or reclaimed water that is supplemented with imported water from the SWP and Santa Clara River.

The introduced water supply load is estimated based on 1993 to 2003 water quality data and 2003 introduced water quantities. All local groundwater pumping was assumed to be from deep aquifers; essentially resulting in salts added to the system. Although some shallow groundwater pumping occurs that could be salts that entered the groundwater from introduced water, the assumption that all groundwater pumping is from deep aquifers results in a higher estimated load and is conservative. Reclaimed water used for irrigation purposes is not considered as part of the water supply load.

Table 10. Average Introduced Water Volumes and Quality Used for Loadings[1]

Water Source	Volume (MGD)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Boron (mg/L)
State Water Project	70	64	332	86	0.27
Santa Clara River (Freeman Diversion)	10	56	1080	490	0.70
Groundwater from Las Posas Basin	20	56	631	219	0.12
Groundwater from Pleasant Valley Basin	25	119	910	312	0.40

1 Concentrations are average values from available data from 1993 to 2003. Volumes are from Hajas, 2004.

The following table summarizes the total water supply loads to the watershed for each of the constituents based on the concentrations and volumes in Table 10.

Table 11. Total Water Supply Loads

Constituent	Load (lb/day)
Chloride	75,450
TDS	578,200
Sulfate	192,500
Boron	320
Volume (MGD)	125

The primary source of salts to the watershed is the water supply. Water introduced into the watershed from the State Water Project comes from the Sacramento/San Joaquin Delta. Consequently, chloride and TDS can vary significantly as a result of Northern California hydrology. During the drought, chloride concentrations neared 120 mg/L, but fell to 45 mg/L after El Nino (See Figure 3). Therefore, the amount of salts entering the watershed from imported SWP water is strongly linked to hydrology in Northern California and the volume of water imported into the watershed and can vary significantly over time.

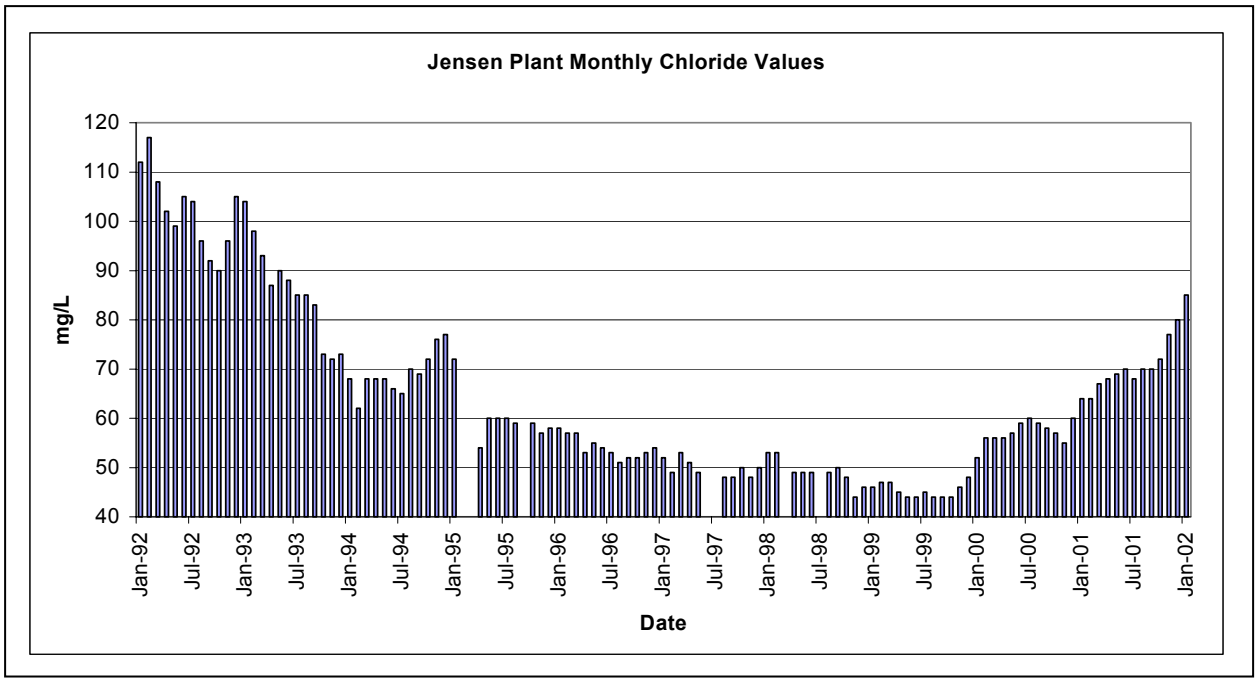

Figure 3. Imported Water Chloride History

3.2.1.2. Urban Wastewater Sources

Water supply and treatment plant effluent were compared to assess the overall amount of salts contributed to the watershed through industrial, commercial and residential activities and water softeners. Estimated loadings to the watershed were developed based on information for the urban areas served by wastewater treatment facilities.

Detailed source analyses were developed for TDS, chloride, and sulfate based on information from Simi Valley, Thousand Oaks, and Camarillo. This analysis was extrapolated to account for loadings from urban sources in Moorpark. Unsewered areas were assumed to be all residential sources with the same contribution of salts due to normal use as sewered areas and with the same percentage of water softener use. Population estimates for unsewered areas were estimated based on census data for unincorporated Ventura County in the CCW. Sufficient data were not available to allow an assessment of boron loadings from urban wastewater sources.

3.2.1.2.1. Residential, Commercial, and Industrial Activities

A planning level analysis of sources of salts from residential, commercial, and industrial activities was conducted for TDS, chloride, and sulfate. Insufficient data were available to conduct a similar analysis for boron. For TDS, chloride, and sulfate, data on industrial, commercial and residential activities were available. Industrial chloride and TDS data were available for Simi Valley, Thousand Oaks, and Camarillo. In addition, Simi Valley had conducted some chloride and TDS monitoring for commercial businesses. Simi Valley has also conducted some commercial and industrial sampling for sulfate, but data are not available for Camarillo and Thousand Oaks for sulfate. Commercial chloride sampling has also been conducted by the Sanitation Districts of Los

Angeles County (LACSD) and the City of Burbank. Simi Valley's commercial data was used to estimate their commercial loadings. For Camarillo and Thousand Oaks, commercial data from the other communities was corrected for water supply, averaged together where applicable, and adjusted for the number of businesses or business flow in Camarillo and Thousand Oaks. These adjusted values were used to estimate commercial loadings. Other community data were used because the Simi Valley commercial data included information that was very specific to the City of Simi Valley and the other community data were more appropriate for extrapolation to other areas. Loadings from normal residential use were based on literature values. The details of the values used and the calculations are included in Appendix B.

The source analysis presented below was developed for planning and informational purposes and should not be considered an exact quantification and determination of sources

3.2.1.2.2. Water Softeners

Information on contributions from water softeners was available based on work conducted in other nearby communities. LACSD has recently completed a survey in the Santa Clarita Valley to evaluate self-regenerating water softener usage (LACSD, 2002). The percentage of water softener use in this study was used as the basis for determining water softener contributions in the CCW. The contributions from water softeners were estimated based on the water supply hardness for each area of the watershed (See Appendix B for example calculation).

3.2.1.2.3. Summary of Urban Wastewater Loads

The following table summarizes the loads to the watershed from water softeners, residential, commercial and industrial activities.

Table 12. Summary of Urban Wastewater Loads to CCW

Source	Chloride Load (lb/day)	TDS Load (lb/day)	Sulfate Load (lb/day)
Water Softeners	8,855	14,148	N/A
Residential Use	7,480	54,109	4809
Commercial Use	3,109	18,913	5379
Industrial Use	1,048	4,889	4217
Total	20,493	92,059	14405

Details of the loading calculations for each of the three major wastewater treatment plants (Hill Canyon WTP, Simi Valley WQCP, and Camarillo WRP) and the assumptions used to estimate loadings for Moorpark, Camrosa, and unsewered areas are presented in Appendix B.

3.2.1.3. Treatment Chemicals

Another source of salts to treatment plant discharges is chemicals used in treatment plant operations. The most likely sources of salts are sodium hypochlorite that is used for disinfection and ferric chloride and aluminum sulfate (alum) that are used as coagulants. Camarillo estimated that approximately 2.5 mg/L of chloride are added to the effluent as a result of disinfection. Simi Valley estimates that approximately 553 lb/day of sodium hypochlorite are added per day for treatment plant disinfection or approximately 261 lb/day of chlorine. Based on these values,

approximately 700 lbs/day of chloride and TDS are added to the watershed as a result of treatment chemicals. No information is readily available on the impact of ferric chloride or alum used in the treatment plants on salt levels in the effluent.

3.2.1.4. Atmospheric Deposition

Salts may be deposited onto the earth's surface under either dry or wet (precipitation) conditions. Dry deposition occurs as particles settle out of the atmosphere and as gaseous pollutants adsorb onto the earth's surface. Wet deposition occurs when rain falls through contaminated air, scavenging pollutants by impaction and interception of particulate matter and by dissolving gaseous pollutants. Wet and dry deposition occurs directly onto receiving waters, or indirectly by depositing onto the watershed surface and subsequently transported to the surface water in runoff. To quantify the deposition contribution of pollutants to the Calleguas Watershed, available precipitation and deposition monitoring data were used to estimate loadings.

Data from national and local air quality monitoring networks were evaluated to estimate the salts loading to the watershed from atmospheric deposition. For wet deposition, data from the National Atmospheric Deposition Program (NADP) sites were used to determine the typical range of salts concentrations present in precipitation. Dry deposition was estimated from the Clean Air Status and Trends Network (CAST NET) and the Air Resources Board. A detailed discussion of the calculations is included in Appendix A.

Average chloride concentrations in precipitation along the California coastline are below 1 mg/L. Results for other constituents are similar. Because of the low average concentration and annual precipitation, the average annual wet deposition loading of chloride is approximately 3 kg/ha. Given that the watershed is some 88,800 ha (343 square miles), wet deposition accounts for approximately 1,610 lbs/day for the entire watershed.

Average depositional velocity for particulate matter (PM) in the Southern California area is 0.175 cm/sec. The average particulate chloride concentration measured in Simi Valley is 0.135ug/m^3. Multiplying the deposition rate by the concentration and watershed area, and using the proper unit conversions, leads to calculation of an average 40 lb/day dry deposition over the entire watershed.

Wet and dry deposition of chloride is representative of other salts and the magnitude of loads is similar. Dry deposition of TDS is estimated to be 340 lbs/day, and the sulfate load is approximately 90 lbs/day.

3.2.1.5. Total Estimated Salts Loads to the CCW

The total estimated salts loading to the CCW from water supply; residential, commercial, and industrial activities; water softeners; treatment chemicals; and atmospheric deposition are summarized in Figures 4 through 6.

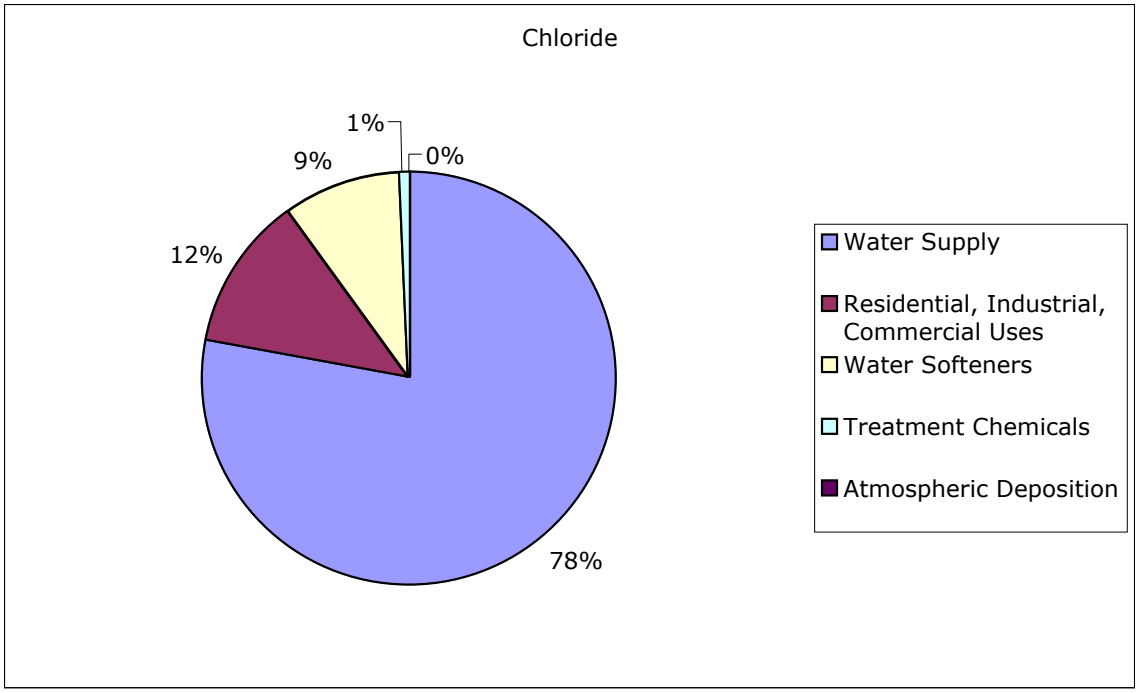

Figure 4. Sources of Total Chloride Load to Watershed of 97,000 lbs/day

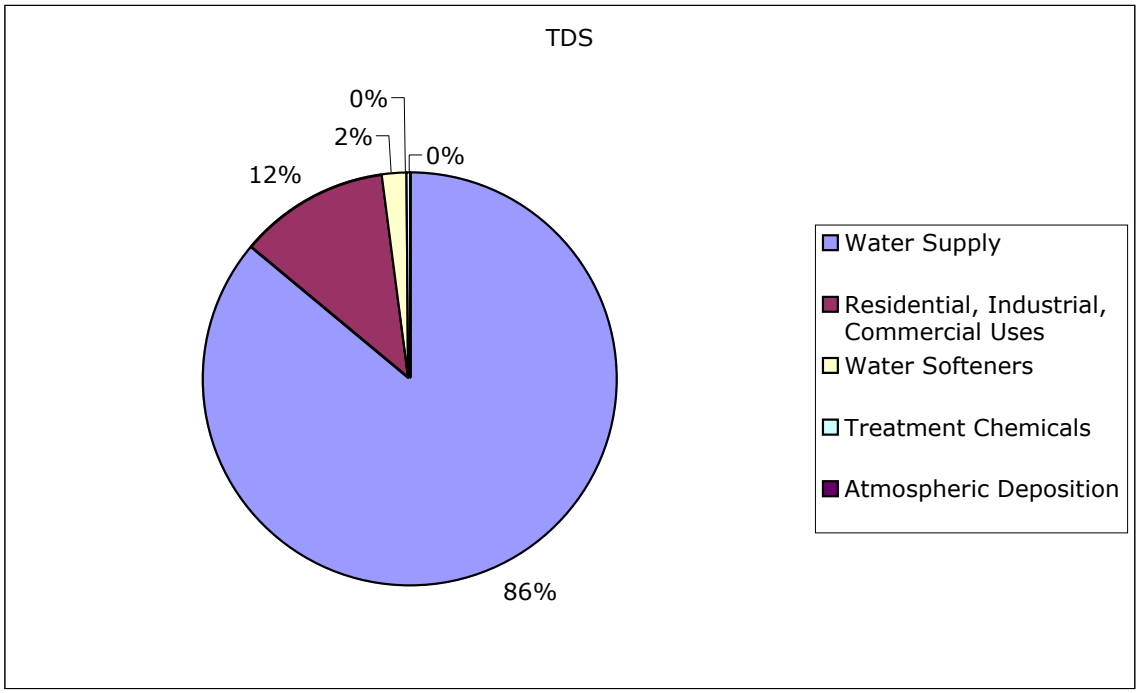

Figure 5. Sources of Total TDS Load to Watershed of 670,000 lbs/day

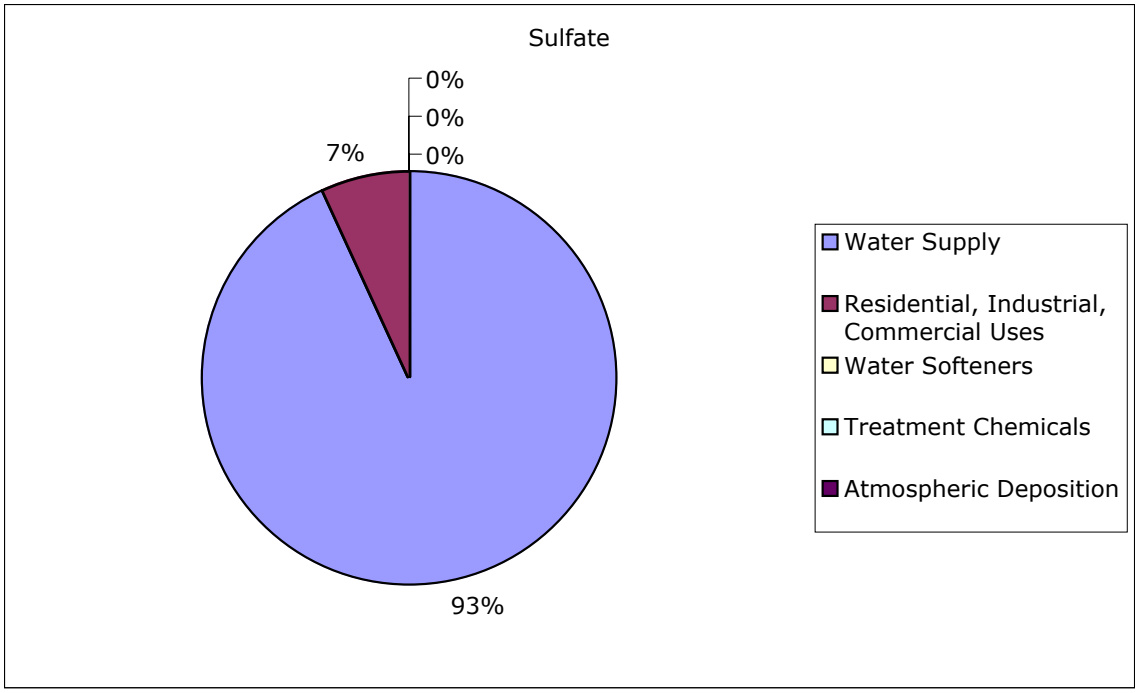

Figure 6. Sources of Total Sulfate Load to Watershed of 207,000 lbs/day

As shown in the figures above, the introduced water supply is the single largest source of salts to the watershed. Depending on the constituent, the introduced water supply is at least 78% of the overall salt load to the watershed.

3.2.2. Transportation of Salts to Surface Waters

Once the salts have been imported with and added to the water used in the watershed, they are transported through the watershed to one of three endpoints: surface water, groundwater, or the land surface/soils. The salts can also be transferred between these three endpoints when water flows mobilize the salts (i.e. precipitation events mobilize salts in the soils and transport them to the surface water). This section identifies the mechanisms that transport salts to the surface water from the original use of the water (i.e. POTWs) or between the endpoints (i.e. groundwater exfiltration). The quantities of salts transported during dry weather to the surface water are quantified for the following mechanisms.

- Groundwater Pumping
- Groundwater Exfiltration
- POTWs
- Dry weather urban and agricultural runoff

3.2.2.1. Groundwater Pumping

In the upper Arroyo Simi and the City of Thousand Oaks, groundwater is pumped and directly discharged to the creek system. High groundwater levels in Simi Valley require dewatering to prevent seepage into developed areas. Dewatering flows are typically discharged to the Arroyo Simi via the City's drainage system. In the City of Thousand Oaks, a number of treatment operations pump groundwater, treat it, and discharge it to the Arroyo Conejo under NPDES discharge permits. The following table summarizes the estimated loads from the groundwater pumping.

Table 13. Estimated Salts Loads from Groundwater Pumping

Source	Flow (cfs)	Chloride (mg/L)	Chloride Load (lb/day)	TDS (mg/L)	TDS Load (lb/day)	Sulfate (mg/L)	Sulfate Load (lb/day)	Boron (mg/L)	Boron Load (lb/day)
Simi Dewatering Wells	3.1	133	2224	1637	27,379	1302	21,774	0.98	16
Permitted Groundwater Discharge (Thousand Oaks)	0.5	195	526	820	2212	445	1200	0.2	0.54

3.2.2.2. Groundwater Exfiltration

Groundwater is a major source of salts to the surface water upstream of the upper POTWs (Simi Valley WQCP and Hill Canyon WTP). Groundwater exfiltration results in a continuous baseflow upstream of both POTWs. The flow rate of the baseflow depends on dry- or wet-year conditions. While the quantity and quality of the pumped groundwater has been measured, it is difficult to accurately measure groundwater baseflow in the stream because it is mixed with other discharges. The methods used to estimate the baseflow quantity and concentration are as follows:

1. Calculate the mean summer flows at the gaging stations in the watershed.
2. Subtract the known POTW discharges and estimates for urban and agricultural discharges.
3. Develop a relationship for baseflow quantities based on the precipitation during the previous winter.
4. Examine the salts concentrations from groundwater wells in the vicinity of the surface waters.
5. Compare the average well concentrations to estimates of concentrations based on surface water measurements.
6. Calculate an average baseflow concentration for chloride, sulfate and TDS.

Based on this procedure, average baseflow concentrations for salts were calculated and equations were developed to estimate baseflow quantities based on the previous winter's precipitation. A detailed discussion of the analysis is included in Appendix A. The average loadings estimated based on the analysis of concentrations for groundwater base flow were based on the analysis conducted for the development of the CCMS model and are shown in Table 14. Flow estimates were based on the critical condition precipitation year defined in the EPA chloride TMDL (12.2 inches annual precipitation).

Table 14. Average Loadings by Reach from Groundwater Exfiltration

Reach	Flow (cfs)	Chloride (mg/L)	Chloride Load (lb/day)	TDS (mg/L)	TDS Load (lb/day)	Sulfate (mg/L)	Sulfate Load (lb/day)	Boron (mg/L)	Boron Load (lb/day)
3	2.37	227	2907	907	11,614	801	10,256	0.2	2.56
7	0.098	199	105	1197	633	1232	651	1.4	0.74
8	0.098	199	105	1197	633	1232	651	1.4	0.74
10	0.010	195	11	820	45	445	25	0.2	0.01
11	0.090	195	94	820	397	445	215	0.2	0.10
12	0.092	195	97	820	408	445	221	0.2	0.10
13	0.16	195	173	820	727	445	395	0.2	0.18

Reaches not shown in the table do not receive significant loads from groundwater exfiltration..

3.2.2.3. POTWs

For the three POTWs that discharge to surface waters, estimates of the chloride, TDS, sulfate, and boron loadings to surface waters were estimated. The total loads from each of the POTWs are shown in Table 15. The loadings were estimated based on the concentration and flow analysis conducted for the development of the CCMS model (See Appendix A).

Table 15. POTW Salts Loads

POTW	Flow (cfs)	Chloride (mg/L)	Chloride Load (lb/day)	TDS (mg/L)	TDS Load (lb/day)	Sulfate (mg/L)	Sulfate Load (lb/day)	Boron (mg/L)	Boron Load (lb/day)
Simi Valley WQCP	14.3	139	10752	713	55151	139	10752	0.6	46
Camarillo WRP (1)	6.1	169	5604	863	28619	183	6069	0.65	22
Hill Canyon WTP	16.6	137	12304	629	56489	180	16165	0.65	58

(1) The loadings for Camarillo represent the total loadings from the POTW. However, some of the water is reclaimed for irrigation purposes during dry weather so the entire load may not be discharged to the surface water.

3.2.2.4. Land Use Runoff

Estimates of dry weather runoff from urban, agricultural, and open space lands were estimated using information developed for the Calleguas Creek Modeling System (CCMS) model. A

discussion of the model is discussed in the Linkage Analysis section and the details of the calculations are included in Appendix A. The loadings presented below represent average daily loadings to the reach from land use runoff. In reality, these loads would occur intermittently and in different locations at different times. However, information is not currently available to accurately account for the intermittent nature of these discharges.

3.2.2.4.1. Urban Runoff

Salts are applied to urban areas through irrigation water and fertilizers and pesticides. Runoff to surface waters occurs during dry weather as a result of over irrigation or applying irrigation water to impervious surfaces. During wet weather, precipitation transports salts that are stranded in the soils from previous irrigation water, fertilizer, and pesticide applications to the surface water. Irrigation water and precipitation have the potential to transport salts into shallow groundwater as well.

The following table summarizes the estimated urban runoff loads in each reach.

Table 16. Estimated Dry Weather Urban Loads

Reach	Flow (cfs)	Chloride (mg/L)	Chloride Load (lb/day)	TDS (mg/L)	TDS Load (lb/day)	Sulfate (mg/L)	Sulfate Load (lb/day)	Boron (mg/L)	Boron Load (lb/day)
1	0.275	217	322	2050	3045	60	89	0.21	0.31
2	0.000	217	0	2050	0	60	0	0.21	0.00
3	0.259	217	303	2050	2861	60	84	0.21	0.29
4	1.050	217	1230	2050	11,617	60	340	0.21	1.19
5	0.326	217	381	2050	3603	60	105	0.21	0.37
6	0.278	217	325	2050	3070	60	90	0.21	0.31
7	2.576	217	3016	2050	28,488	60	834	0.21	2.92
8	0.416	217	487	2050	4599	60	135	0.21	0.47
9A	0.126	217	147	2050	1393	60	41	0.21	0.14
9B	0.375	217	439	2050	4144	60	121	0.21	0.42
10	0.000	217	0	2050	0	60	0	0.21	0.00
11	0.171	217	200	2050	1894	60	55	0.21	0.19
12	0.582	217	681	2050	6432	60	188	0.21	0.66
13	1.675	217	1961	2050	18,529	60	542	0.21	1.90

3.2.2.4.2. Agricultural Runoff

Irrigation water, fertilizers and pesticides are also sources of salts to agricultural areas. The volume of runoff to surface waters from agricultural areas depends on the crop type being irrigated and the irrigation practices. Runoff from agricultural fields has been observed in varying quantities during all times of the year. During wet weather, precipitation transports salts that are stranded in the soils from previous irrigation water, fertilizer, and pesticide applications to the surface water. Irrigation water and precipitation have the potential to transport salts into shallow groundwater as well.

The following table summarizes the estimated dry weather agricultural runoff loads in each reach.

Table 17. Estimated Dry Weather Agricultural Loads

Reach	Flow (cfs)	Chloride (mg/L)	Chloride Load (lb/day)	TDS (mg/L)	TDS Load (lb/day)	Sulfate (mg/L)	Sulfate Load (lb/day)	Boron (mg/L)	Boron Load (lb/day)
1	0.768	193	800	2862	11,859	916	3796	0.82	3.40
2	2.177	193	2267	2862	33,619	916	10,760	0.82	9.63
3	0.304	193	317	2862	4698	916	1504	0.82	1.35
4	2.205	193	2297	2862	34,055	916	10,899	0.82	9.76
5	1.675	193	1744	2862	25,869	916	8279	0.82	7.41
6	2.176	193	2265	2862	33,593	916	10,752	0.82	9.62
7	0.630	193	656	2862	9723	916	3112	0.82	2.79
8	0.029	193	30	2862	441	916	141	0.82	0.13
9A	0.061	193	63	2862	935	916	299	0.82	0.27
9B	0.478	193	498	2862	7382	916	2363	0.82	2.11
10	0.011	193	12	2862	173	916	55	0.82	0.05
11	0.131	193	136	2862	2016	916	645	0.82	0.58
12	0.000	193	0	2862	0	916	0	0.82	0.00
13	0.147	193	153	2862	2271	916	727	0.82	0.65

3.2.2.5. Surface Water Loading Summary

The following table summarizes the dry weather loads to surface water from all of the sources listed above for each of the constituents.

Table 18. Summary of Loadings to Surface Waters

Source	Chloride Load (lb/day)	% Total Chloride Load	TDS Load (lb/day)	% Total TDS Load	Sulfate Load (lb/day)	% Total Sulfate Load	Boron Load (lb/day)	% of Total Boron Load
POTWs	28,660	44%	140,259	26%	32,986	23%	126.3	59%
Groundwater pumping	2750	4%	29,592	5%	22,974	16%	16.9	8%
Groundwater exfiltration	3492	5%	14,456	3%	12,415	9%	4.43	2%
Urban Dry Weather	9492	14%	89,675	16%	2625	2%	9.19	4%
Agriculture Dry Weather	11,237	17%	166,634	30%	53,332	37%	47.7	22%
Total	55,632	100%	440,617	100%	124,332	100%	205	100%

Wet weather loadings from each of these sources has the potential to be significant, but tend to be lower in concentration and do not occur during the critical conditions for salts. Wet weather loads are significant from the perspective of transporting stranded salts off the watershed and have been included in the modeling and linkage analysis.

3.3. Fate and Transport of Salts

Based on the information presented above, approximately 60% of the total watershed salts loads are transported to the surface waters on a daily basis. Because some of the surface water is diverted for irrigation in the lower watershed through the Conejo Creek Diversion Project, and all of

the surface water in the upper watershed enters the ground water, only about 10% of the watershed salts load is exported out of the watershed to the ocean during dry weather. The remaining salts are left "stranded" in the soils or shallow groundwater basins in the watershed until large amounts of precipitation mobilize the salts and transport them off the watershed. The following table summarizes the ultimate fate of the imported salts during dry weather.

Table 19. Fate of Salts in Calleguas Creek Watershed during Dry Weather

Constituent	Salts Load To Watershed (lb/day)	Exported to Ocean (lb/day)	"Stranded" in Watershed (lb/day)
Chloride	96,700	10,400	86,300
TDS	671,200	49,500	621,700
Sulfate	207,000	13,600	193,400

Dry season stranded salts are a temporary condition that is remedied by cyclical patterns of wet weather, which washes stranded salts out to the ocean. The cyclical patterns of drought followed by extreme periods of heavy rainfall produce high stream flows on the watershed. These infrequent yet routine wet periods create high stream flows that extend well into the summer and fall seasons carrying large volumes of salts off the watershed. It is this feature of the watershed that has prevented the daily importation of chlorides and other salts to the watershed from accumulating in ever increasing concentrations (Hajas, 2004). Salts accumulate even with average and slightly above average rain years and extreme wet years are needed to flush the stranded salts from the watershed.

4. Review of Water Quality Standards and Uses

As discussed above, the Basin Plan includes water quality standards for salts for the CCW. This section provides a review of the beneficial uses and water quality objectives and recommendations for objective changes based on the review.

4.1. Beneficial Uses

In order to assess the need for and basis of site-specific objectives (SSOs) for the CCW, a review of the existing water quality objectives and beneficial uses was conducted. Agriculture, aquatic life, and groundwater recharge are the beneficial uses potentially impacted by the development of SSOs and were the primary uses examined. Unless required under the SSO development process, use attainability analyses (UAAs) will not be pursued based on this work.

4.1.1. Aquatic Life

Chloride is the only constituent for which an aquatic life criterion exists. Chloride can be toxic to freshwater aquatic organisms by impacting the ionic balance in the water necessary to support freshwater aquatic life (USEPA, 1988). According to the USEPA criteria document, the most chloride sensitive organisms are fathead minnows and daphnids. Because these are common species, they are likely to be present throughout the CCW. Therefore, the aquatic life impacts from chloride could occur throughout the watershed.

Based on the objectives and a review of the USEPA criteria document, it is clear that aquatic life is not the most sensitive beneficial use in the watershed. However, it is the only beneficial use that is an in stream use. Therefore, there are not any alternative mechanisms for protecting the aquatic life beneficial use.

4.1.2. Agriculture

Agriculture is the most salt sensitive beneficial use in the CCW. This section discusses the most salt sensitive crops, the locations of the crops in the watershed, and the options for protecting this beneficial use from the impact of salts.

4.1.2.1. Crops Grown in the Calleguas Creek Watershed

Crops are grown in several areas of the watershed including the Oxnard Plain, the Pleasant Valley Plain, the Las Posas Valley (East and West) and the Santa Rosa Valley. Specific crops grown in the areas are shown in Figure 7. Of the crops shown in the figure, avocado, berry, citrus, strawberry, and, to some extent, nurseries are the most adversely impacted by high salinity and high chloride irrigation water. In general, avocados and citrus are grown in the northern part of the watershed, specifically the Las Posas Valley. Strawberries and row crops are grown in the Oxnard and Pleasant Valley Plains. Some avocado and citrus are grown in the lower portion of the Pleasant Valley Plain. In the Santa Rosa Valley, crops are avocados, row crops and citrus.

Agriculture is limited or not existent in the upper portions of the watershed because urban land uses have replaced agricultural fields in those areas. Agriculture is not likely to return to those areas.

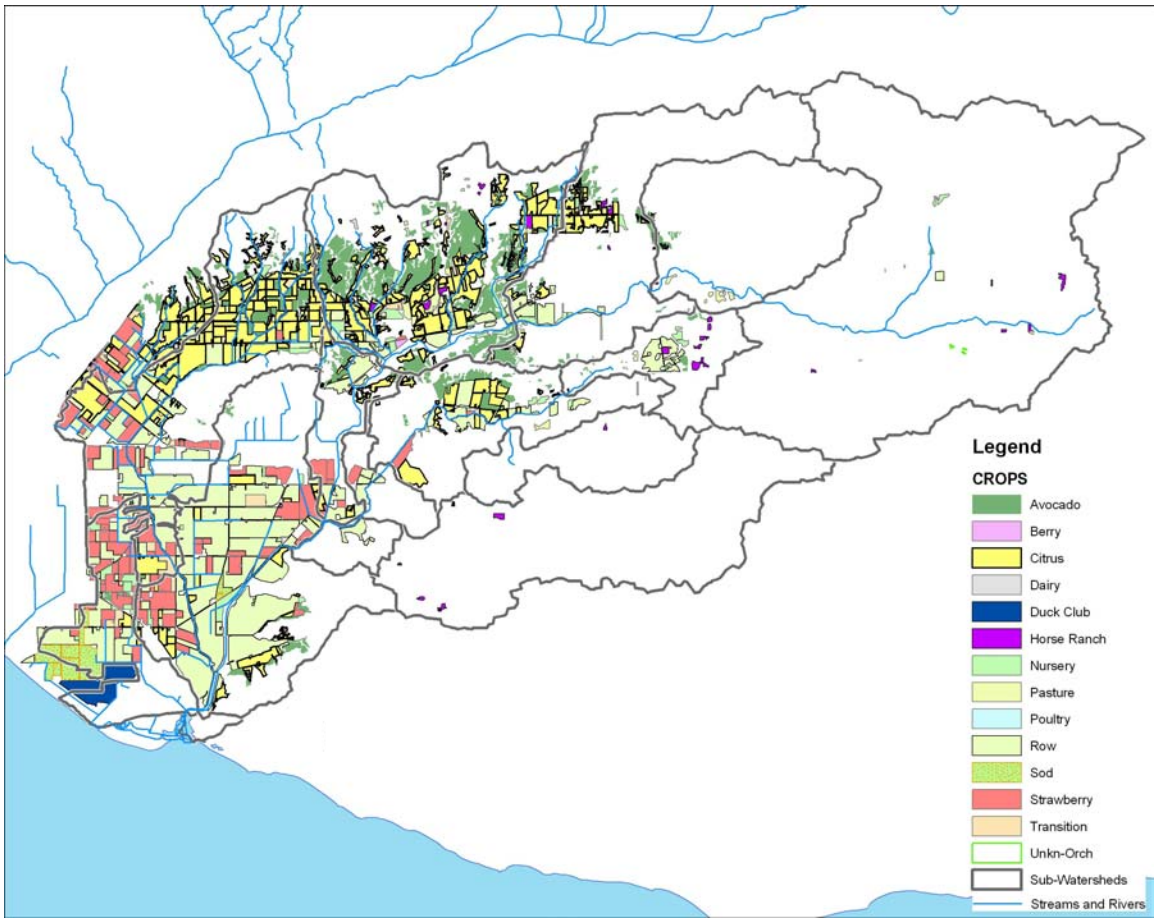

Figure 7. Crops Grown in Calleguas Creek Watershed

4.1.2.2. Impacts of High Salts on Crops

Determining the impact of salts on crops is difficult because of all of the factors that can influence the growth and yield of crops. The salinity of the irrigation water is only one factor in the equation. Numerous studies have been done to try to assess the impact of salinity and chloride in particular on crops and have come up with varying results depending on the conditions during the testing (Oster and Arpaia, 2002). An in-depth analysis of the impact of chloride on avocados would take a multi-year study using several acres of trees.

Rather than conduct this type of analysis to try to determine an independent quality objective for irrigation water, an assessment of the influences that impact the salinity sensitivities of crops was developed and the situations in which the quality of the irrigation water limits the ability to grow crops in the CCW was determined.

All crops have some sensitivity to salinity in irrigation water. The sensitivity is dependent on a number of factors including the type of crop, the precipitation received during the year, the irrigation practices, the type of soils, the amount of irrigation water applied, and the quality of the irrigation water. All of these factors need to be taken into account when considering the impacts of salts on

crop growth and yield. For example, providing extremely high quality water would potentially not result in a higher yield if sufficient water is not applied. Whereas, larger quantities of poorer quality water may result in better growth and yields (Oster and Arpaia, 2002).

No matter how pure the irrigation water, salts build up in the soils in the root zone over time. Typical irrigation practices are to flush (or leach) the salts from the root zone on a regular basis. The quality of the irrigation water impacts the frequency and quantity of water needed to flush the salts from the field. At some point, the salinity will be too high to allow the growth of salt sensitive crops (Oster and Arpaia, 2002). Therefore, the quality of the irrigation water needs to be high enough to allow the growth of salt sensitive crops and allow cost effective flushing of the root zone (i.e. allows sufficient time between flushings).

The importance of the quality of the irrigation water is also impacted by the quantity of water available. The ultimate limitation on crop production is the cost. Irrigation water accounts for approximately 10% of the total cost to produce avocados in Ventura County. So growers try to balance the quantity of water used to provide sufficient water for optimal growth without having too much runoff.

Additionally, the impacts on agriculture are not instantaneous. The total quality of the water over the course of the growing season impacts the growth and production of the crop. As shown in Figure 8, precipitation appears to be significantly correlated to production, at least for avocados. Total annual precipitation influences both the cumulative quantity and quality of water crops are exposed to. Irrigation is essentially designed to create artificial precipitation. Precipitation is an extremely low salt form of irrigation for the crops. Therefore, the higher the quantity of precipitation, the larger the quantity of effective irrigation water applied for the year. Additionally, the overall quality of the irrigation water applied for the year is higher. The strong correlation between total annual precipitation and production clearly demonstrates that the impacts of salts are not instantaneous.

Of the crops mentioned earlier as being salt-sensitive, avocados are the primary concern in the watershed. High chloride irrigation water is reported to cause leaf burn in avocados as an initial symptom with reduction in tree growth and fruit size the ultimate concern. The adverse effects may take up to three years of poor quality water before appearing. Growers in the South Las Posas Basin report that after El Nino (1998) productivity increased for a few years. However, they report that using irrigation water in the range of 150 mg/L – 180 mg/L over a three year period since then has resulted in greater than 50% reduction in tree growth and fruit size (Macintyre, 2004). Figure 8 shows an initial drop in productivity in 1999 with productivity increasing over the next two years along with increasing annual rainfall.

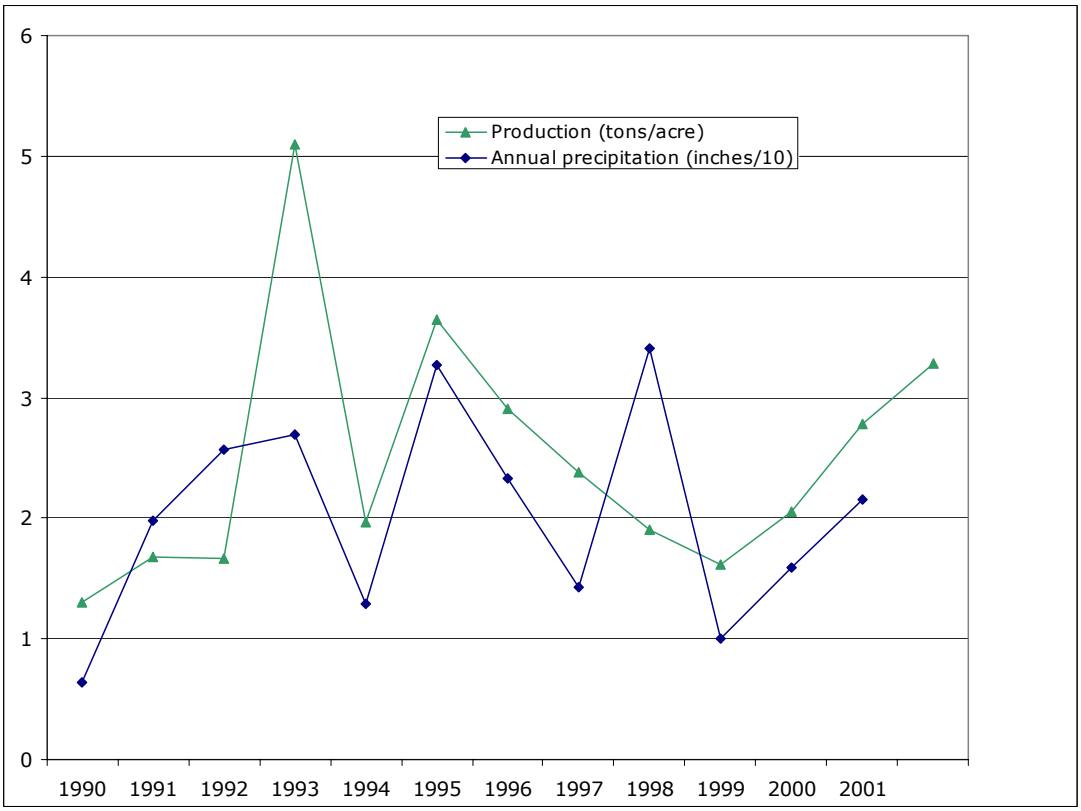

Figure 8. Ventura County Avocado Production and Annual Precipitation

The two key points demonstrated from the information and figures above is that precipitation (and potentially other factors) appears to have a significant impact on production and the impacts on agriculture from salts occur over long periods of time, not instantaneously.

4.1.2.3. Current Sources of Water for Crops

Most growers in the Calleguas Creek Watershed rely on groundwater delivered through local mutual water companies as their primary water supply. Growers in the Arroyo Simi/Las Posas and Conejo Valleys also utilize imported water supplied by Calleguas Municipal Water District through a variety of purveyors including Ventura Water Works District and Camrosa Water District or. United Water supplies growers in the Oxnard and Pleasant Valley Plains through the Pleasant Valley Water District (PVWD) or the Pumping Trough Pipeline (PTP). United water is a combination of local groundwater and water imported from the Santa Clara River at the Freeman Diversion. Growers in this area also receive water from the Conejo Creek Diversion Project. Growers in the Santa Rosa Valley receive water from Camrosa Water District. Water sources include local groundwater, Conejo Creek water and imported water from Calleguas Municipal Water District. These water supplies are blended to provide a consistent water quality to meet the grower's needs. In the Las Posas Valley, water sources include imported water or groundwater supplied through Ventura Waterworks Districts #1 and #19 and local groundwater supplied by Arroyo Las Posas

Mutual Water Company, Zone Mutual Water Company and Beryl wood Heights Mutual Water Company. Many growers also have private wells on their property.

Surface water is not diverted for use on salt sensitive crops in the watershed except for the Conejo Creek Diversion Project in Camrosa. In the Conejo and Calleguas Creeks, water right appropriations prevent the diversion of water in the stream for uses other than the Conejo Creek Diversion Project.

The quality of groundwater used as irrigation supply in the Calleguas Creek Watershed is shown in Figure 9 (chloride) and Figure 10 (TDS). In the figures, wells are only shown if data are available for the constituent. In addition, water quality for both groundwater and imported water is summarized in Table 20. In general, the water quality data is from between 1990 and 2003. In some cases, very little data were available during that time frame, so data collected from 1970 were also used.

Table 20. Calleguas Creek Watershed Water Quality

Water source	Average Chloride (mg/L)	Average TDS (mg/L)	Average Sulfate (mg/L)	Average Boron (mg/L)	Time Frame	Number of Samples
Oxnard, Pleasant Valley						
UWCD(Freeman Diversion - Imported Water)	57	880	495	0.71	1990-2003	433
CMWD(Jensen plant- Imported Water)	64	332	86	0.27	1993-2003	130
Pumping Trough Pipeline groundwater (Oxnard)	44	871	306	0.42	1990-2003	60
Pleasant Valley Water Conservation District groundwater	119	910	312	0.40	1990-2002	49
Camrosa Water District Conejo Creek Project	159	822*	n/a	n/a	0.27	86
Las Posas Valley (North)						
CMWD(Jensen plant- Imported Water)	64	870	86	0.27	1993-2003	130
Ventura County Waterworks District #19	48	589	193	0.08	1990-2002	16
Ventura County Waterworks District #1	25	452	129	0.13	1990-2002	27
North Las Posas basin (miscellaneous wells)	56	631	219	0.12	1990-2003	50
South Las Posas Basin						
CMWD(Jensen plant- Imported Water)	64	870	86	0.27	1993-2003	130
Ventura County Waterworks District #19	48	589	193	0.08	1990-2002	16
Beryl wood MWC	23	420	n/a	n/a	1993-2003	1
Zone MWC Location 1	14	535	89	0.06	1990-1999	4
Zone MWC Location 2	200	1544	649	0.64	1971-2000	19
Arroyo Las Posas MWC	345	1950	890	1.1	1991	2
Miscellaneous wells	213	1600	581	0.58	1975-1999	10
Santa Rosa Valley						
CMWD(Jensen plant- Imported Water)	64	870	86	0.27	1993-2003	130
Camrosa Water District Well #3	135	918	229	0.41	1991-2000	108
Camrosa Water District Wood creek Well	119	753	162	0.25	1993-2001	6
Camrosa Water District Conejo Creek Project	159	822*	n/a	n/a	1996-2003	90

* TDS average for Conejo Creek based on 12 data points in 2003

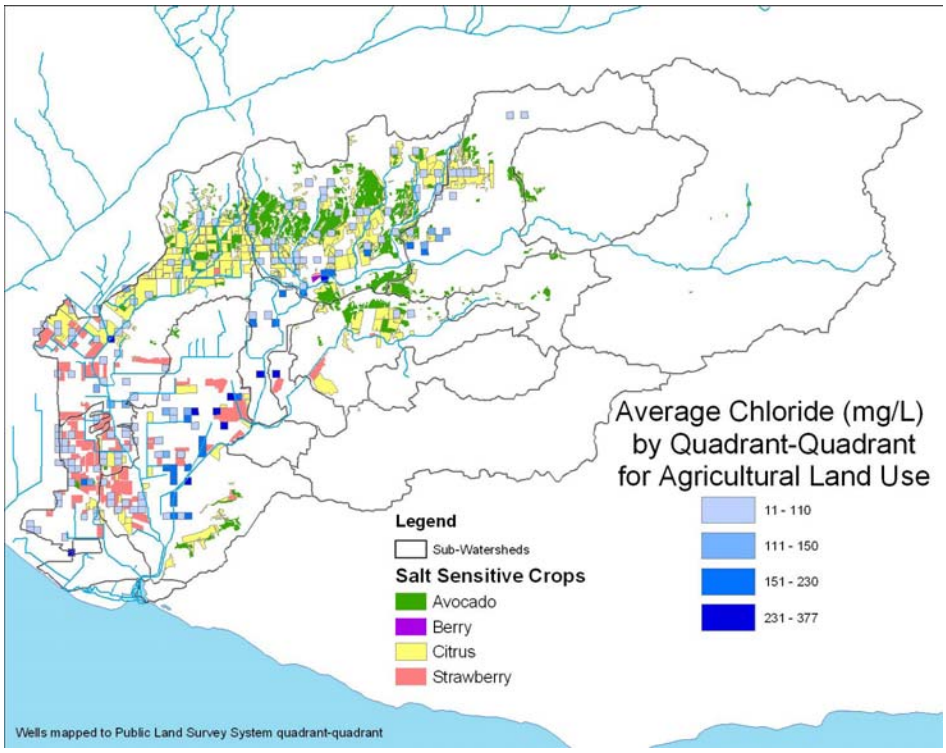

Figure 9. Average groundwater chloride levels in Calleguas Creek Watershed

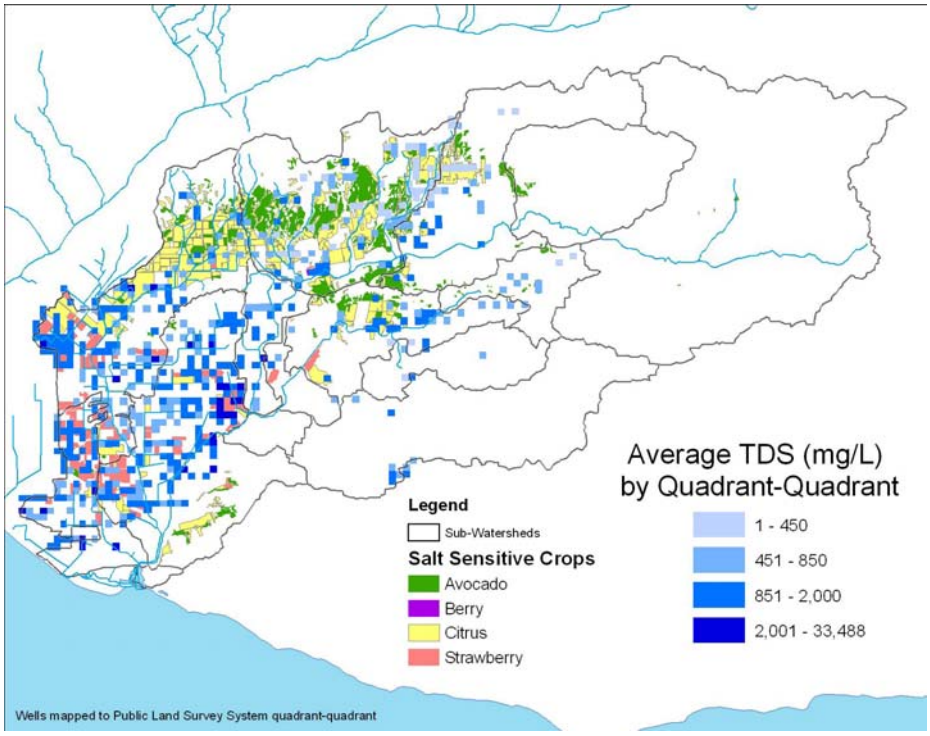

Figure 10.Average groundwater TDS levels in Calleguas Creek Watershed

The information presented above demonstrates that irrigation water supplies are well below surface water and groundwater objectives in most areas.

4.1.2.4. Assessment of Agricultural Beneficial Use Protection

Because surface water is not used as a primary irrigation source for any sensitive crops in the CCW, the quality of surface water is not critical to the protection of the agricultural beneficial use. In the Conejo Creek, water rights prevent anyone other than the Camrosa Water District from taking water out of the stream. Therefore, the only mechanism through which surface water could impact agriculture is through impacts due to groundwater recharge of basins used for agricultural supply. Consequently, regulating surface water quality to directly protect agriculture is not necessary.

For most of the watershed, chloride and TDS levels in the water supplied to agriculture is within the acceptable range even for salt sensitive crops. Two areas that may be impacted by high salt concentrations with respect to growing salt sensitive crops are the Santa Rosa Valley and the South Las Posas Basin. However, it is possible to supply these areas with alternative sources. Camrosa Water District manages the water made available to growers in the Santa Rosa Valley to deliver water with chloride levels of 110 mg/L. This is accomplished by blending imported water from CMWD with the groundwater from Well #3 and/or Conejo Creek water via the diversion facilities. Growers in the South Las Posas Basin receive ground water from Zone MWC, Arroyo Las Posas and Beryl wood Heights MWC. Average chloride concentrations in groundwater from the South Las Posas Basin are reported to be approximately 180 mg/L. As shown in Table 3, this is consistent with the values reported for groundwater wells in the basin. Growers report that irrigation water is alternated between Zone or Beryl wood Heights and Ventura Waterworks District #19 to achieve an acceptable level of chloride. Additionally, imported water from CMWD is available to growers in this area for blending or leaching.

Although two areas may have higher salts concentrations in groundwater, the link between surface water concentrations and groundwater concentrations is unclear (see Groundwater Recharge section 4.13). Therefore, the best mechanism for protecting agriculture is by managing the salts in the water supplied to the growers. In non-drought years, adequate quantities of source water is available to meet all the growers needs in the watershed, and alternative water supplies are available for growing salt sensitive crops if local irrigation supplies are not acceptable.

One of the concerns is the protection of future agricultural beneficial uses based on changing conditions in the watershed. As discussed previously, irrigation water is available to most of the watershed with salt levels that are acceptable for salt sensitive crops. In areas where higher salts concentrations exist, alternative water supplies are available should a grower choose to use them. The decision as to which crops to grow in the future are made based on a number of factors: soil conditions, irrigation water quality, market conditions, etc. As long as high quality irrigation water is available, a grower can choose the crops to grow on the land based on the factors and economics that make the most sense for the farming operation.

4.1.3. Groundwater Recharge

As discussed above, groundwater is the primary water supply for agriculture in the CCW. Additionally, groundwater is used as a municipal supply in several areas of the watershed. Finally,

the Calleguas Municipal Water District (CMWD) stores imported water in the North Las Posas groundwater basin. To prevent these uses from being impacted by poor quality groundwater, the groundwater recharge beneficial use needs to be protected.

Impacts on groundwater occur through infiltration of surface water and potentially through irrigation in the watershed. The beneficial use of groundwater recharge only addresses the surface water infiltration component of the impacts of salts on groundwater. As a result, this is the only impact discussed here.

4.1.3.1. Locations of Groundwater Recharge

Groundwater infiltration primarily occurs in the South Las Posas and Santa Rosa Basin. Although most reaches of the watershed have the GWR beneficial use, the only areas where significant recharge occurs are these two reaches and upper Revolon Slough/lower Beardsley Wash. This is clearly demonstrated by the fact that groundwater exfiltration occurs in most other reaches in the watershed.

The amount of recharge is predicated on the depth and width of the underlying stream channel deposits, the nature of the geologic materials comprising the stream channel deposits, the depth and nature of the geologic materials underlying the stream channel deposits, the depth to groundwater and the quantity and timing of water flowing into the streams.

Recharge to the shallowest aquifers occurs by subsurface infiltration through streambed deposits. Soil surveys conducted by the USDA / NRCS show permeability of streambed deposits within the Watershed to be greater than 20 inches/hour. Based on this number, water can easily percolate through the streambed deposits and recharge the shallow aquifers.

In some areas of the Watershed (Pleasant Valley and the Oxnard Plain), recharge beneath streams is limited due to a shallow perching layer. The perching layer is of low permeability and severely limits the amount of recharge passing through it. As a result, the shallow soils above the perching layer become saturated, thus preventing more water from percolating through them. Drainage in the southern portion of the Watershed is a large enough problem that local farmers have been forced to install drains to prevent problems such as root rot and to keep salts from accumulating in the groundwater.

4.1.3.2. Impacts from Surface Water Recharge of Groundwater

The impacts of surface water quality recharge on groundwater basins occur over time and are not instantaneous. Although localized impacts can occur over a few months to years, widespread impacts on groundwater basins take many years to occur. Groundwater mixing occurs very slowly as groundwater gradually moves through the basins.

The impacts of surface water recharge on groundwater basins were clearly demonstrated with the beginning of importation of State Water Project water into the basin. Salts concentrations in groundwater were impacted by the importation of water and development of the watershed beginning in the 1970's. However, since the beginning of importation of State Water Project water, the groundwater salt concentrations have remained relatively stable in most areas of the watershed (Hajas, 2004). The most notable exception is the South Las Posas Basin, where salts

concentrations have been increasing over time. It is also noteworthy, however, that long-term decreases in chloride concentrations have been observed in a few Santa Rosa Basin wells along Lower Conejo Creek.

Because all water discharged to the Arroyo Simi during dry weather infiltrates into the South Las Posas groundwater basin, this basin is the most significantly impacted by surface water recharge. A number of studies have been conducted to examine the quality of the groundwater and the impacts of surface water recharge on this basin. A significant amount of the analysis is presented in *Water Quality in the East and South Las Posas Basin: Problems and Solutions* (Bachman, 2002).

As described in this report, the South Las Posas Basin is completely full as a result of constant discharges to the Arroyo Simi/Las Posas. This "topping off" of the shallow aquifer occurred during the 1980's along the Arroyo Simi, and during the 1990's along the Arroyo Las Posas. The fact that the basin is full prevents recharge of higher quality storm water flows. Additionally, the higher water levels appear to be impacting the quality of water in the basin. The increase in water levels is strongly correlated with an increase in salts concentrations in many of the wells near the Arroyo Las Posas. The salts concentrations in those wells are higher than the concentrations in the surface water. Therefore, mechanisms other than changes in surface water quality appear to be contributing to the increasing salts levels in the groundwater.

Salts on the watershed have a number of geological origins. The watershed has remnants of significant volcanic activity, large multi-layered sediment deposits and evidence of ancient marine influence. All of these geologic characteristics indicate the presence of salts that dissolve into solution following rain events and remain dissolved in the watershed's groundwater and surface waters. It is widely believed that these salts have been a natural part of the watershed for thousands of years (Hajas, 2004). Increases in groundwater levels may cause saturation of soil previously above the water table, allowing additional salts to dissolve into the groundwater.

The combination of increased groundwater levels that leach background salts from the soils and surface water concentrations is the likely cause of the increased groundwater salts concentrations in the South Las Posas Basin. Consequently, protection of the groundwater recharge beneficial use is linked to both the quality and quantity of the water in the stream and natural background conditions.

In contrast to the South Las Posas Basin, groundwater quality in the Santa Rosa Basin has remained stable or improved over the past 15 years. Figure 11 shows groundwater quality data from 1 well near Hill Canyon WTP, 2 wells along Lower Conejo Creek, and 1 well along Lower Calleguas Creek. The data show a gradually decreasing trend in groundwater chloride concentrations at all 4 wells. While the TDS concentrations near the wells are subject to greater variability, they appear to remain relatively constant or only slightly increase. Screening levels for the wells are currently not available. However, if it is determined that the data in the figure represent the quality of the shallow Santa Rosa basin, then the analysis will suggest surface water recharge at the existing water quality is not adversely impacting the groundwater basins and may be improving the basins for some constituents.

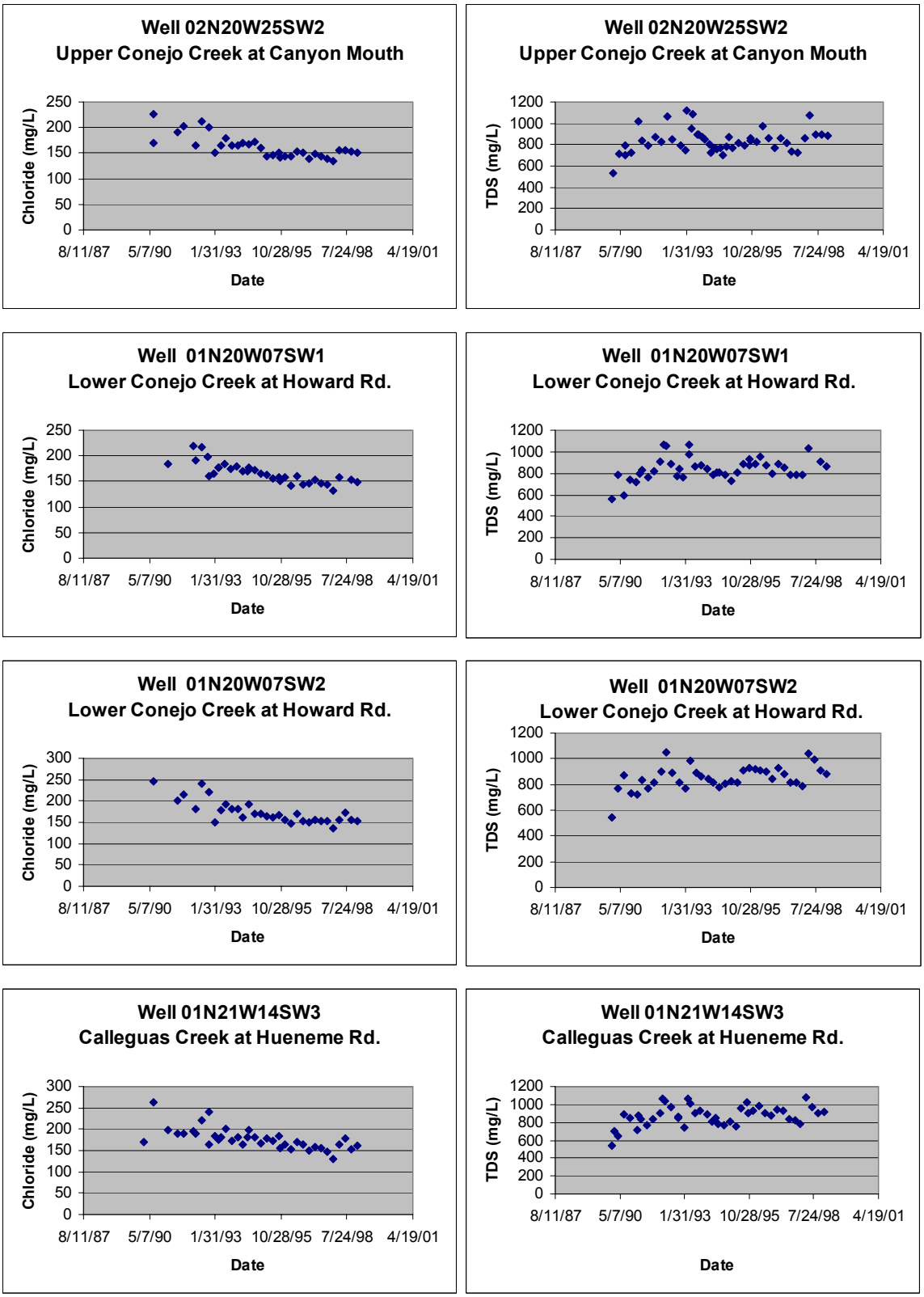

Figure 11. Groundwater quality data from wells near Conejo Creek and Lower Calleguas Creek

Another key aspect of the protection of the groundwater recharge beneficial use is that the protection of the groundwater itself is not inherently necessary. Instead, groundwater recharge must be protected to allow use of the water for agricultural and municipal purposes. No crops are grown in the groundwater basins and no aquatic life is present in the basins that are impacted by salts. Instead, impacts occur once groundwater is pumped for use. Therefore, the protection of the groundwater recharge beneficial use does not need to occur in basin. Alternative mechanisms for protecting the beneficial use could be implemented (such as point of use treatment) and may be necessary to address naturally occurring sources of salts.

4.2. Water Quality Objectives

As discussed in the problem statement section and throughout this report, surface water concentrations of salt are only one element of the salt impairment in the watershed. Therefore, the water quality objectives need to be designed to facilitate the protection of beneficial uses and the correction of the salts impairment in the watershed. To determine the best mechanism for protecting beneficial uses and mitigating salt impacts, a number of objective alternatives were considered.

- Current Basin Plan Objectives (Instantaneous Maximums)
- Numeric Values of Basin Plan Objectives with an averaging period applied instead of instantaneous maximums
- Aquatic life objectives
- Site-specific objectives
- Mass balance objectives

The criteria used to evaluate the alternatives included:

- consistency with State and federal water quality initiatives policies;
- level of beneficial use protection;
- consistency with the current science regarding water quality necessary to reasonably protect the beneficial uses; and
- applicability to existing condition of Calleguas Creek.

To help in the assessment of the water quality objectives and determine the potential for developing site-specific objectives (SSOs), the information gathered about the uses was compiled. This information was used to help determine the feasibility of developing SSOs that adequately protect the existing beneficial uses in the watershed. Following are the key points from the analysis to help in the development of SSOs.

1. Impacts to agriculture do not occur on an instantaneous basis. As discussed in the agricultural beneficial use section, impacts can take years to occur.

2. Annual precipitation plays a significant role in the yield of salt sensitive crops in the watershed.

3. Sensitive crops are only grown in certain areas of the watershed and the ability to grow sensitive crops is limited in other areas.

4. Irrigation water quality is only one of the factors that impacts crop yield and growth.

5. Irrigation water quality is only one of the factors that impact the choice of crops to grow in a particular area.

6. Impacts on groundwater basins are not instantaneous.

7. Impacts from surface waters on groundwater basins appear to be linked more to the quantity of water rather than the quality of the water in the creeks. In the lower watershed, salts concentrations in groundwater basins do not appear to have changed significantly and may have decreased for some constituents since equilibrium was reached after importation of State Water Project water began. In the upper watershed, higher groundwater levels appear to be leaching salts out of marine sediments in the upper watershed, thereby adding more salts to the groundwater.

8. Groundwater recharge only occurs in certain areas of the watershed.

9. Significant rain years flush salts stranded in soils and groundwater basins and result in higher surface water concentrations of salts for months to years after the high precipitation year. However, the flushing of the salts is critical for helping to maintain a salt balance in the watershed and results in lower surface water and groundwater concentrations after the flushing has been completed.

10. Control of surface water concentrations does not necessarily link to beneficial use protection. The primary source of irrigation water is groundwater and surface water quality does not appear to have a significant impact on groundwater quality.

Based on this information, a number of factors for assessing the appropriate water quality objectives are clear.

- Instantaneous objectives as contained in the Basin Plan are not necessary to protect beneficial uses.

- Agriculture and groundwater recharge beneficial uses are not present in all areas of the watershed.

- Water quality improvements in the surface water do not necessarily translate into protection of agriculture and groundwater recharge beneficial uses.

These factors were used to help assess the water quality objective options for the watershed.

4.2.1. Current Basin Plan Objectives (Instantaneous Maximums)

The current Basin Plan objectives for salts (Table 4) are instantaneous maximums. These objectives are applied equally throughout the watershed. The issues with these objectives are:

- Agriculture and groundwater recharge are not impacted instantaneously.
- The objectives are applied to all areas of the watershed even those that do not contain the sensitive beneficial uses.
- The administrative record for the development of these objectives is unclear as to the link between the numeric values and the protection of agriculture and groundwater recharge beneficial uses.

The positive aspects of these objectives are as follows:

- Because they are instantaneous maximums, they provide a very conservative approach to protecting beneficial uses in the watershed.
- Because the Basin Plan objectives are already on the books, Regional Board resources do not have to be expended on amending the Basin Plan.

4.2.2. Averaging Periods

Because the beneficial uses are not impacted instantaneously by salts concentrations, defining appropriate averaging periods for the objectives would be a possible mechanism for addressing one of the issues with the current Basin Plan objectives and protecting beneficial uses. The issues with this approach are:

- The development of the appropriate averaging period is challenging.
- The use of existing basin plan numeric values may not be protective of beneficial uses because the link between the numeric values and beneficial use protection is unclear.

The benefits of this approach are:

- An averaging period can more directly address the time frames over which beneficial use impacts occur.
- An averaging period would allow for more flexibility in managing salts and water resources in the watershed.
- The averaging period could take into account the benefits of watershed flushing of salts after wet years.

4.2.3. Aquatic Life Criteria

Aquatic life criteria are only available for chloride. Although these criteria are the most directly applicable to the stream system, they are not necessarily protective of all of the beneficial uses in the water body. Additionally, criteria have not been established for TDS, sulfate or boron so the impacts from these pollutants would not be addressed by using these criteria.

The EPA criteria are based on tests with common test species (fathead minnow and daphnids) that are likely to be present in the CCW. The criteria were developed in 1988 and only included three chronic test species. The chronic criterion was based on acute-to-chronic ratios rather than a calculation based on a calculation using a sufficient number of chronic tests. Therefore, it is possible that a site-specific objective could be developed for chloride. However, short of conducting studies with a sufficient number of species to replace the acute to chronic ratio approach in the criteria document, a SSO would likely not be successful. Therefore, the aquatic life beneficial use is likely to be best protected using the EPA criteria.

The aquatic life criteria represent the upper bound of chloride levels that can be present in the stream for shorter periods of time than needed to protect the other beneficial uses. Therefore, the aquatic life criteria for chloride are proposed as the upper limits as shown below:

> The four-day average does not exceed 230 mg/L more than once every three years on the average and the one-hour average concentration does not exceed 860 mg/L more than once every three years on the average.

4.2.4. Mass Balance Based Objectives

As discussed in the water resources problem statement, a salt imbalance exists in the watershed. Under the assumption that improving the salt imbalance in the watershed will improve water quality, objectives that are linked to the mass entering and leaving the watershed could be developed. This approach addresses the fundamental problem with salts and prevents an accumulation of salts in the watershed. However, the link between the mass removal and protection of water resources and beneficial uses would have to be demonstrated on a regular basis to ensure that beneficial uses were being protected. Additionally, the use of mass balance objectives would potentially involve the need to regulate areas other than surface water quality.

4.2.5. Site-Specific Objectives

This approach involves a careful evaluation of the location of beneficial uses impacted by salts in the watershed and identification of appropriate objectives to protect those beneficial uses. It also includes an analysis of areas in the watershed for which Basin Plan objectives cannot be achieved as a result of natural background conditions. The benefit of this approach is the direct link between beneficial uses and objectives. The challenge is selecting the appropriate objectives to protect the beneficial uses.

Certain areas of the watershed clearly do not have any of the sensitive beneficial uses and alternative objectives may be considered for these areas. These areas include the North and South Fork of the Arroyo Conejo (Reaches 12 and 13), the upper portion of the Arroyo Simi (Reach 7), Tapo Canyon (Reach 8), and the lower portion of Calleguas Creek above Potrero Road (Reach

3). Reaches 12, 13, 8 and the upper portion of 7 are all located in urban areas in which no agricultural areas exist or likely will exist in the future. Additionally, all of these areas are places where groundwater exfiltration occurs. Consequently, groundwater recharge would not be impacted in these reaches.

Reach 3 is the farthest downstream reach to which objectives apply. Concentrations in this reach tend to be higher because salts are transported out of the watershed through this reach. Sensitive beneficial uses do not exist in this reach and the transport of salts out of the watershed through this reach is a critical component of maintaining a salts balance in the watershed.

Although Reach 6 (Arroyo Las Posas) and the lower Reach 7 (Arroyo Simi) have the potential to contain beneficial uses impact salts, SSOs may be required as a result of the natural background conditions in those reaches. The natural background concentrations of salts in groundwater infiltration into the stream may result in the current Basin Plan objectives (even with an averaging period applied) being exceeded. Since the agricultural and groundwater recharge beneficial uses can be protected through other mechanisms than controlling surface water concentrations and surface water concentrations may not be directly linked to protection of the beneficial uses, site-specific objectives resulting from the natural background conditions may be appropriate and necessary for managing salts for these reaches.

Finally, site-specific objectives need to be considered for Revolon Slough/Beardsley Wash. As discussed in the problem statement, the numeric Basin Plan objectives do not apply to Revolon Slough/Beardsley Wash. However, USEPA used the numeric values in the Basin Plan as an interpretation of the narrative standards that do apply to Revolon Slough. Appropriate numeric objectives need to be developed for Revolon Slough/Beardsley Wash to protect beneficial uses in those reaches.

4.2.6. Recommended Objective Changes

The use of an averaging period is essential to protecting the beneficial uses. An averaging period more accurately reflects the impacts of salts on the beneficial uses and allows for management of the watershed to provide protection of the agricultural beneficial use. Therefore, a revision to the Basin Plan objectives to include an averaging period is recommended.

Site-specific objectives may be necessary for some reaches in the watershed where sensitive beneficial uses are not impacted and/or natural back ground conditions make SSOs necessary.

In conclusion, for some reaches, the development of averaging periods for the numeric values found in the Basin Plan will likely be the only recommended change to the objectives. For these reaches, it is proposed that the appropriate averaging period be determined based on additional analysis and the performance of the projects on the watershed. For other reaches, SSOs that include an adjustment to the numeric Basin Plan value may be recommended. These reaches include areas where agriculture and groundwater recharge beneficial uses are not present or not impacted by surface water salt concentrations (Reaches 11, 12, 13, 7, 8, 3, 4 and 5) and where natural background conditions make the achievement of the Basin Plan objectives not feasible and not necessary to protect beneficial uses (Reaches 6 and 7).

5. Linkage Analysis

The linkage analysis for salts focuses on the surface water concentrations of salts. However, as discussed previously, surface water concentrations are only one component of the watershed salt issue. Because it is difficult SP model other aspects of the salt problem (i.e. surface water and groundwater interactions, stranded salts), two simplified approaches have been used to demonstrate that salts will be removed from the watershed and that should have a correspondingly positive impact on surface water and groundwater salts concentrations. First, two surface water models were used to demonstrate the impact of projects on receiving water quality in the watershed. Secondly, a salt balance was developed to quantify the removal of salts from the watershed with the goal of achieving a salt balance. Achieving a salt balance in the watershed will prevent additional build-up of salts in any medium in the watershed and protect water supplies from increasing in salt concentrations.

For the surface water modeling, two different approaches were taken. The first is described in detail in Appendix A. The second is a modification to the chloride model developed by the Regional Board and modified by USEPA for the EPA Chloride TMDL. To estimate the salts balance in the watershed, a simple chloride mass balance was developed by the Camrosa Water District (Hajas, 2003a) and modified to address the other salts. The following section describes the various models and their uses.

5.1. Model Descriptions

5.1.1. Calleguas Creek Modeling System (CCMS)

The framework for the salts modeling effort is a numerical mass balance water quality model originally developed for use in the Calleguas Creek nutrient TMDL effort. The spreadsheet-based mass balance model was accepted by State and Federal regulatory authorities for use in the Nutrient TMDL process for the Calleguas Creek Watershed (CCW).

The water quality simulation component of the CCMS is built on a spreadsheet mass-balance model. To model the CCW, the entire watershed is divided into 15 sub watersheds based on drainages to sampling locations and significant tributaries. A computational element is assigned to each sub watershed for calculating the changes in stream flow and water quality due to processes present along stream reaches circumscribed by the sub-watersheds. The model was expanded to accommodate stochastic input, which allows calculation of the likely distribution of in-stream salts concentrations.

5.2. Computational Element

Each computational element balances the inflow and outflow of water and mass with conservation equations to calculate changes in in-stream flow and concentration across a sub watershed. Over each time step, the stream reach within any sub watershed is assumed to behave as a steady-state complete-mix reactor. Because of the relatively short reach length, stream geometry, and daily time step; flows can be considered in equilibrium on a daily basis, so long as the routing of peak flows is not of critical importance. Assuming that each sub watershed behaves as a complete-mix reactor implies that the in-stream concentration is constant at all locations within a

sub watershed (Tchobanoglous and Schroeder, 1985). Because the concentration is modeled as constant for the entire reach, all withdrawals from the reach, including the discharge to the downstream reach will have the same concentration by definition. A schematic of the computational element is displayed in Figure 12. Each input and output considered in the CCMS is represented in Figure 12 with an arrow pointing into the reach for additions, and pointing out from the reach to represent withdrawals. In Figure 12, flows from upstream reaches enter from the right and flow to downstream reaches exit to the left.

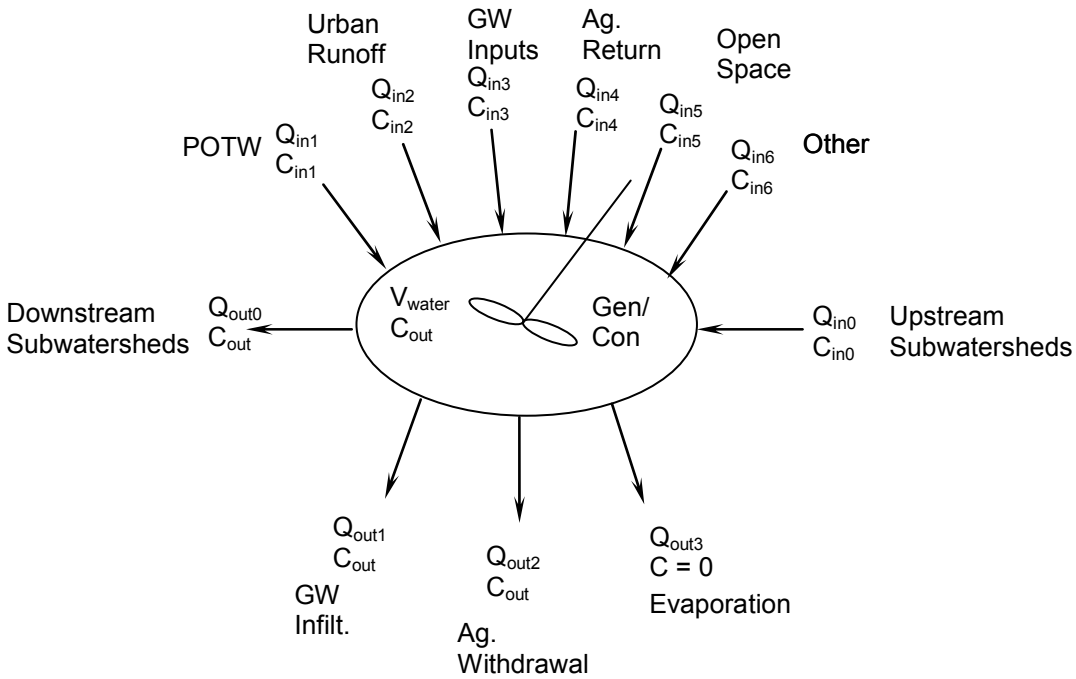

Figure 12: Schematic of Inputs and Outputs for a General Computational Element used in the CCMS Mass Balance Model to Estimate Water Flow and Quality within Surface Water Reaches.

5.2.1. Mass Balance Calculations

To calculate the stream discharge flow and in-stream concentration for a computational element, all inflow rates and concentrations must be specified along with all of the outflow rates (Tchobanoglous and Schroeder, 1985). Normally, the outflow to the downstream reach will be calculated with the conservation of flow equation. If all inflow rates and concentrations, and outflow rates are known, the in-stream concentration may be calculated. Because of the complete-mix assumption, the concentration in the outflows will equal the in-stream concentration, except in the case of evaporation (Tchobanoglous and Schroeder, 1985), where only water is assumed to be removed from the system by evaporation implying that the concentration of salts in evaporated water is equal to zero. The general conservation law is captured in Equation (1).

$$\text{accumulation} = \text{in} - \text{out} + \text{generation} \tag{1}$$

Each of the daily time steps is assumed to be in steady-state. By making the steady-state assumption the ability to model peak flood routing is lost; however because of the relatively small size of the CCW, a smaller time step than one day would be required to capture a flood wave moving through the watershed. The steady assumption specifies no accumulation of flow or mass in the surface water within a sub watershed, simplifying the mass balance equation by setting the left hand side of Equation (1) to zero, in effect requiring the sum of the inputs to equal the sum of the outputs plus and generation within the sub watersheds (Tchobanoglous and Schroeder, 1985). However, for the case of salts, the assumption is made that no generation or consumption occurs in any of the sub watersheds, further simplifying (1) to Equation (2).

$$\text{in} = \text{out} \tag{2}$$

5.2.2. Upstream Sub watersheds

Inflow and mass loading from the upstream sub watershed are added as inputs to the computational element. If the sub-watershed is located at the top of a stream's drainage, there will be no upstream sub watershed and the CCMS will assign a 0.0 for the flow and mass loading. If multiple upstream sub watersheds contribute to the computational element, the sum of the upstream outflows and sum of the mass loadings are inserted in Q_{in0} and $C_{in0}Q_{in0}$.

5.2.3. Sub watershed Inflows

Possible inflows include: publicly owned treatment works (POTWs), urban runoff, groundwater exfiltration, agriculture returns, open space runoff, and any other flows. Each computational element includes provisions to include a generation component, which would be necessary if the constituents were being generated chemio-physio-biologically in the reach. In the case of salts, the generation component is set to zero as no reactions producing salts are assumed to occur in the CCW surface waters.

5.2.4. Sub watershed Outflows

Possible withdrawals or outflows from the CCW reaches include groundwater infiltration, diversions, agricultural use, and evaporation. No processes are included in the model that consumes salts. Because of the complete-mix assumption, the concentration in each of the outflows is equal to the concentration calculated in the reach that is discharged to downstream sub watersheds.

5.2.5. Chloride TMDL Model

For the development of the Draft Chloride TMDL, the Regional Board developed a mass balance model for chloride in the CCW. When the USEPA prepared the TMDL that was adopted for the CCW, they used this model as the starting point and made some modifications based on additional information about the watershed. For the purposes of this analysis, the RWQCB model (which was the only one available in electronic format) was updated to match the USEPA model used for development of the EPA Chloride TMDL. The model was then modified to provide results for TDS, sulfate, and boron as well as chloride. Additionally, the chloride concentrations used as inputs to the model were updated based on the source analysis presented above.

The Chloride TMDL Model described four different conditions in the CCW and identified two of the conditions as critical conditions for the TMDL. For this analysis, only the two critical conditions (non-storm maximum flow and post-drought) were updated and used for the linkage analysis.

5.2.5.1. Input Concentrations

In the original model, input concentrations for POTWs were based on one year of monitoring data and assumptions were made to estimate the concentrations from POTWs during different conditions (i.e. drought and post—drought). For this analysis, the POTW concentrations were calculated as an average value of available data for years meeting the definition of the critical conditions. The groundwater exfiltration concentrations were calculated based on the analysis presented above and in Appendix A. Flow rates were not changed for any of the inputs or outputs and no changes were made to the number or types of inputs and outputs. The model is included as Appendix C.

The model with the updated concentrations did a relatively good job of predicting in stream water quality for chloride. However, for TDS, sulfate and boron, the model did not do as well at predicting the in-stream water quality. As shown in the loads above, agricultural loads of TDS and sulfate make up a higher proportion of the load to the watershed than for chloride. Since agricultural loads are not included in the chloride TMDL model, this may be one reason for the discrepancy between the model and real world conditions.

5.2.6. Salts Balance Model

Camrosa Water District developed a simple mass balance model that calculates the chloride loading to the watershed from introduced water and water use. Chloride outputs in dry weather surface water flow are compared to the chloride inputs and an estimate of the pounds of salt "stranded' in the watershed is determined. The details of the model are discussed in the technical memorandum "Salts Loading in the Calleguas Creek Watershed" (Hajas, 2003a).

This model was updated to include inputs and outputs of TDS and sulfate based on the loading information presented in the Source Assessment section.

All of the models discussed above were used to assess the impacts of the proposed projects on water quality and the watersheds salts balance and compare the benefits to alternative methods for addressing salts, such as reverse osmosis treatment.

6. Project Descriptions

To manage salts in the CCW, a number of projects have been developed to address all components of the salts problem in the watershed. These projects were developed as alternatives to treating the inputs to the stream system (through reverse osmosis) to protect beneficial uses. As discussed in the previous sections, salts management is more complex than just the concentrations of salts in the surface water. Focusing on surface water concentrations may not result in significant reductions of the overall salt load to the watershed or in the protection of all beneficial uses. Therefore, the following projects were developed to manage salts in the watershed and provide additional water resources to reduce the major source of salts to the watershed, the introduced water supply.

6.1. Regional Salinity Management Conveyance (Brine line)

The project consists of a pipeline system to collect treated wastewater and brine concentrations from treatment facilities and industrial operations in the CCW and convey the effluent to other areas for direct use or to an existing ocean outfall. The brine line forms the backbone of all the proposed projects by providing a mechanism for discharging salts to the ocean other than through the surface water system.

Calleguas Municipal Water District is working with other public water and wastewater agencies to construct the Calleguas Regional Salinity Management Project, which is designed to help manage high salinity water use and disposal. The project consists of a pipeline system that would collect treated wastewater and brine concentrates from wastewater treatment plants, groundwater wells (both municipal and agricultural), and industrial operations located within the Calleguas Creek watershed, and convey the effluent to other areas for direct use or to an existing ocean outfall.

The project is divided into two distinct phases. Phase I is comprised of the pipeline from the Camrosa Water District Wastewater Treatment Plant to an existing ocean outfall in the City of Oxnard. The remaining portions of the pipeline system extend north and east from the Camrosa plant to the City of Simi Valley. Phase II segments would provide for connections to other municipal wastewater and groundwater treatment facilities in the watershed.

Construction of the $64 million project began in 2003 and is expected to continue over a seven year period. A program environmental impact report was certified by Calleguas MWD in September 2002. Design specifications for the first segment of Phase I have been approved, and construction began in February 2003. Phase II components will be designed and constructed incrementally in coordination with POTWs and other potential dischargers.

The need to permit the ocean discharge is a critical component of the development of the project. Because the discharge from the project incorporates both brines and the disposal of poor quality groundwater and/or excess tertiary treated effluent, it is possible to manage the project to meet the permit limits assigned to the discharge to meet Ocean Plan requirements. In the future as different discharges are added to the project, it may become necessary to look at alternative outfall options. These options include modifying the existing outfall with a diffuser, extending the outfall deeper into the ocean, and/or building a new outfall for the discharge. The implementation of the Calleguas Salinity Management Project is essential to any solutions for addressing salts in the Calleguas Creek watershed. Consequently, alternative options will be evaluated in the future if necessary. However, in the short term, existing ocean outfalls will need to be used and managed to meet permit limits in order to facilitate the implementation of projects to address salts in the watershed in the near term.

6.2. Renewable Water Resource Management Program (RWRMP) for the Southern Reaches of the Calleguas Creek Watershed (SCCW)

For the lower reaches of the CCW (Conejo Creek and lower Calleguas Creek), the proposed project contains four phases as discussed below. The following discussion is taken from the Notice of Preparation for a Draft EIR for the project and describes the current information available

on the project. For the portions of the project after Phase 1, some information will need to be determined as more information is gathered through implementation of earlier phases (i.e. what facilities will be needed to discharge imported water supplies). The CEQA process will be used as the mechanism for obtaining input on the project. The information is presented here for clarity in the analysis of the projects. However, the CEQA documentation represents the official project description and the mechanism for commenting on the details of the projects.

The overall goal of the project is to provide an adaptive management plan and the facilities to improve the reliability of local water resources and reduce dependence on imported water. Objectives of the project include:

- Recycle and reuse wastewater to the greatest extent possible;
- Reclaim abandoned unconfined groundwater resources;
- Provide a reliable, high-quality, water supply to support the existing environmental value of the riparian corridor;
- Increase agricultural water quality options to promote agricultural sustainability
- Achieve a salts balance within each sub-watershed;
- Reduce the salt load to surface waters; and
- Manage recycled and reclamation projects in a manner that achieves and maintains a salt balance.

6.2.1. Project Components

The proposed project is an integrated set of facilities to reduce reliance on imported water supplies while improving water quality through the managed transport of salts out of the watershed. There are three major elements to the project: water resource reclamation, salts management, and adaptive management. While either water resource reclamation or salts management could be optimized without reference to the other, this project seeks to increase water resources while moving toward a net daily salts balance.

6.2.1.1. Water Resource Reclamation

The project reduces reliance on imported water and over drafted confined groundwater aquifers by expanding water recycling and reclaiming poor quality, unconfined groundwater supplies. The project facilities also improve the quality of water supporting the riparian environment and groundwater recharge. The project facilities increase the water quality options for agricultural users.

The general plan for water resource reclamation includes direct recycling of tertiary-treated wastewater that is currently discharged to the creek by the Camarillo WRP and, in later phases, by the Hill Canyon WTP. This recycled water would be delivered through a common transmission pipeline system operated by Camrosa Water District for beneficial reuse in the Camrosa, Pleasant Valley County Water District and portions of the City of Camarillo. Existing recycled water distribution systems would be expanded in the Santa Rosa Valley, along Conejo and Calleguas

Creeks below Highway 101, and east of Calleguas Creek below Potrero Road. When recycled water supplies exceed available demands and storage, the recycled water would be discharged either to a proposed new discharge point on Calleguas Creek below the Potrero Road bridge, or into the Calleguas Regional Salinity Management Project brine pipeline for ocean discharge.

Unconfined groundwater, high in salts, in the Santa Rosa Basin and the perched zone of the eastern Pleasant Valley Basin would be blended and/or treated for use. Existing wells in the Santa Rosa Basin would be used to increase the transport of groundwater down gradient through existing facilities and blending operations. Santa Rosa Basin water would also be treated by a new reverse osmosis (RO) treatment facility. A pipeline from the new RO plant would be connected to Calleguas MWD brine line for waste disposal. Existing wells in the perched zone of the eastern Pleasant Valley basin would be renovated or new wells constructed. RO treatment would also be applied to this water.

The management plan would result in improved surface water quality and improved water quality for consumptive beneficial uses. The management plan would result in the removal of treated wastewaters from the stream system, which would significantly reduce the average daily salt load to the surface waters. In turn replenishment water (imported water or other sources of high quality water) would be released to the stream system as necessary to preserve in stream environmental values and functions, including recharge of groundwater in the Santa Rosa Basin.

The plan would continue the current practice of providing water with lower concentrations of chloride to the avocado growers in the Santa Rosa Valley through a controlled blending operation. Blending operations at the existing Camrosa storage ponds and other locations on the watershed would be developed as needed to improve overall irrigation water quality. Reverse osmosis treatment of groundwater would improve drinking water quality, reduce hardness and result in improved recycled water quality in the Camrosa recycled water.

6.2.1.2. Salts Management

More salts enter the watershed on a daily basis through introduced water than are transported out in surface water flowing to the ocean. From time to time, this salt imbalance is expressed in surface water concentrations that exceed water quality standards, but the problem is larger than surface water quality. Unless salts are actively managed, stranded salts will continue to accumulate and periodically impair surface waters. They also have the potential to further degrade groundwater sources. Since the watershed is already impaired for salts, any project to reduce reliance on introduced water sources must address how it will affect watershed water quality and the current salt imbalance.

The proposed project seeks to manage salts through a systems approach. To the extent possible, the proposed project proposes to address the salt imbalance by reducing salts introduced into the watershed system, removing salts currently disposed into the creek system, distributing water so as to move salts down-gradient and off of the watershed, introducing high quality water into the creek system to increase its capacity to carry salts that cannot otherwise be intercepted, and finally capturing and disposing of concentrated salts that would not otherwise move off the watershed.

Reducing the introduction of salts would be accomplished by new programs and enhancements to existing programs for water conservation in both urban landscape and agricultural irrigation. The programs would target reductions in imported water and groundwater pumping from the Fox Canyon system to reduce salt loading to the watershed. A minimum goal of a 2 percent reduction in outdoor water would help meet the projected salt balance requirements. Programs would also be implemented providing incentives and/or disincentives to reduce the use of self-regenerative water softeners in the watershed with a goal of reducing the overall load to the sewer system by 10 percent.

The proposed facilities to capture and distribute recycled water will assist in the managed transport of salts down and out of the watershed. By transporting unconfined groundwater down gradient for beneficial uses and/or transporting brine streams from the treatment of this groundwater off of the watershed, salt loads to each sub-watershed would be controlled. Shallow groundwater with very high salts would be pumped directly to the brine line for disposal if necessary to achieve a salt balance in the lower sub-watershed. This active management of shallow, unconfined groundwater will also enhance recharge by higher quality replenishment water or from rain events.

6.2.1.3. Adaptive Management

The watershed's hydrology is complex and dynamic. In order to evaluate the project's ongoing effect on sub-watershed salt balances, the project includes a monitoring and adaptive management element. The initial phase includes the establishment of automated monitoring points on the creek to measure flow and salt concentrations. By collecting data on an ongoing basis, the agencies can track and evaluate how best to move additional salts down the watershed. Collected data would be analyzed regularly for comparison to water quality objectives and project-specific improvement criteria. Data, analysis results and conclusions would be shared with watershed stakeholders through the Calleguas Creek Watershed planning process. A continuous inventory of the inputs and outputs of salts to each sub-watershed would be maintained to document the relative success in transporting salts out of the watershed. The overall project is designed to be implemented incrementally so that water quality impacts and future actions can be evaluated at each phase.

The project phasing and specific facilities are described in more detail in the following sections.

6.2.2. Project Facilities and Phasing

The proposed project includes four phases, with a focus on Phase 1 as it is critical to address the immediate water quality problems of the lower Calleguas Creek watershed. Phase 1 would be implemented over a one- to three-year period following completion of environmental compliance. Other phases would be implemented later and may require additional CEQA review.

6.2.2.1. Phase 1

This phase focuses on increasing recycled/reclaimed water use, reducing salt inputs to surface waters and construction of facilities to transport salts out of the watershed. Components of Phase 1 include:

Expansion of Recycled Water Transmission and Distribution System. A pipeline and pumping facility would be constructed to deliver recycled water from the Camarillo WRP into the existing

Camrosa recycled water system approximately 1.2 miles west of the treatment plant. A replacement pipeline (36 inches in diameter) would be constructed from the Camrosa water storage ponds to a point south of the Potrero Road Bridge and with an inter-connection to the Calleguas MWD brine disposal system (approximately 2.8 miles). The pipeline alignment would follow the existing pipe corridor. Additional small diameter pipelines would be installed to distribute recycled and non-potable water to western Santa Rosa Valley, eastern portion of the City of Camarillo (immediately west of Calleguas Creek and south of U.S. 101), and in the eastern and southwestern portions of Pleasant Valley. These pipelines would be primarily located along agricultural access roads.

Groundwater Reclamation. A portion of the water produced from the southern Pleasant Valley Basin unconfined aquifer system would be treated for salt removal to produce potable water to supplement the Camrosa's potable water deliveries. The treatment plant would be located at the existing well facility near California State University Channel Islands and treat approximately one to two million gallons per day. The treatment process would employ either reverse osmosis or electro dialysis reversal technology. The brine waste streams from well treatment would be discharged to the Calleguas MWD brine disposal system for ocean disposal. A 0.4 mile-long small diameter pipeline would be constructed to transport the brine to the southwest to connect with the Calleguas MWD brine disposal system.

Water Conservation and Source Control. Incentives/disincentives to reduce salt-based water softener use would be implemented within the Camrosa, Camarillo and Thousand Oaks service areas. An outdoor water conservation program would be developed and implemented throughout the lower watershed.

Water Blending Facilities. Existing blending facilities and new facilities would be used to meet the water quality needs for salt concentrations of various users. The existing facilities in the Santa Rosa Valley would be expanded and new facilities in the eastern portion of the Pleasant Valley and at the Wood creek well in Camarillo would be added. Major new components would include:

- Expansion of the existing blending capacity for the agricultural irrigation system in the Santa Rosa Basin;
- New blending facility at the Wood creek Well Facility; and
- New blending facility at Camrosa's water storage ponds.

Relocation of Wastewater Discharge Point. Surplus treated wastewater from the Camarillo WRP, Camrosa WRF, and in a later phase the Hill Canyon WTP; would no longer be discharged at their current discharge locations. The combined wastewaters would be discharged to a point downstream of the Potrero Road Bridge on the Calleguas Creek when there is surplus wastewater in the water recycling system. This discharge location would also be used when the Calleguas MWD brine disposal system may be unable to receive such waters because of temporary operational interruptions. New major facilities would include a discharge structure with a capacity of 25 million gallons per day located downstream of the Potrero Road Bridge for release to the Calleguas Creek.

Monitoring. The program would include three new or upgraded automated flow measuring and sample collection stations at three points on the stream system to record flow and various water quality parameters. Preliminary monitoring locations include Arroyo Conejo in Hill Canyon, Conejo Creek at Baron Brothers Nursery and Calleguas Creek at University Drive.

6.2.2.2. Phase 2

Phase 2 would expand groundwater treatment, expand recycled water distribution facilities and initiate water releases to the Arroyo Conejo creek system in anticipation of termination of discharge of the Hill Canyon WTP to North Fork Arroyo Conejo (Phase 3). Phase 2 components would include:

Groundwater Reclamation. A portion of the water produced from the Santa Rosa Basin would be treated for salt removal to produce potable water to supplement the Camrosa's potable water deliveries. A treatment plant would be constructed at the Camrosa Water District headquarters to treat Santa Rosa Basin water (5.0 million gallons per day). The treatment process would employ either reverse osmosis or electro dialysis reversal technology. The brine waste streams from the treatment plant would be discharged to the Calleguas MWD brine disposal system for ocean disposal. A 2.7 mile-long small diameter brine disposal pipeline would be installed along Upland Road to connect to the Calleguas MWD brine disposal system near Arroyo Las Posas.

Initiate Replenishment Water Releases. Small amounts of imported water would be discharged to Arroyo Conejo from the Calleguas MWD distribution system. Water would be released in the City of Thousand Oaks from about 3 to 5 discharge locations. These water releases would be experimental to determine the feasibility to maintain in stream beneficial uses following the termination of discharge of Hill Canyon WTP effluent (see Phase 3). The facilities and permits necessary to release the water will be determined during the planning for the initiation of Phase 2. It is likely that dechlorination facilities will be necessary and an NPDES permit will need to be obtained for the releases.

Monitoring. Additional monitoring (beyond Phase 1) may be implemented to determine the effects of replenishment water releases.

6.2.2.3. Phase 3

This Phase focuses on terminating discharge of effluent from the Hill Canyon WTP into Arroyo Conejo and introducing it directly into the Camrosa recycled/non-potable water distribution system for agricultural irrigation purposes. Phase 3 components include:

Thousand Oaks – Camrosa Recycled Water Interconnect. A new 3.6 mile-long pipeline (30-36 inches in diameter) would be constructed to transport tertiary-treated wastewater from the Hill Canyon WTP to Interconnect with Camrosa's recycled water distribution system near Camrosa's Reservoir 1-A. The pipeline alignment would be located along Hill Canyon Road immediately west of the roadway pavement. The pipeline would likely be placed above-ground and covered with fill. In the Santa Rosa Valley, the pipeline would be located within agricultural fields. A new pump station at the City of Thousand Oaks Hill Canyon WTP would lift the water to Camrosa Reservoir 1-A.

Monitoring. Continued monitoring would be necessary to adjust the replenishment water to meet water quality and in-stream objectives. Based on this monitoring, the staging of the final project phase would be evaluated.

6.2.2.4. Phase 4

This Phase focuses on pumping brackish groundwater to transport salts. Components of Phase 4 include:

Conejo Groundwater Basin. Wells would be installed to pump groundwater from the Conejo Valley Basin and discharge into the stream system in coordination with replenishment releases to assure compliance with surface water quality standards. Major new components would include several shallow groundwater wells (3-5) located near the South Fork of the Arroyo Conejo with metering facilities and diffusers for release into the creek. Well locations have not been identified to date, but would likely be within the northern and western portion of Thousand Oaks.

Lower Watershed. In the lower areas of the watershed where salts may accumulate, shallow dewatering wells would be constructed and operated to 1) Blend with other waters for irrigation uses, 2) discharged to the Calleguas MWD brine disposal system, or 3) treated for use and the brine stream discharged to the Calleguas MWD brine disposal system. Disposal of these waters on an as-needed-basis would prevent continued salt accumulation and excess salt loading to the surface water system. Major components would include new shallow wells (number and location to be determined) and pipelines to pump and transport water to the Calleguas MWD brine disposal system, or for blending with the Camrosa recycled system.

Monitoring Ongoing monitoring would focus on long-term patterns and management of salt transport.

6.3. Upper Calleguas Creek Watershed Plan

The Upper Calleguas Creek Watershed Plan consists of a phased approach to determine the best mechanisms for protecting beneficial uses. Phase 1 will be implemented over the short term and consists of source control at the Simi Valley WQCP, the provision of alternative water supplies to the growers in the South Las Posas Basin, and monitoring. Phase 2 will be the evaluation of a groundwater recovery and recharge program and the development of site-specific objectives.

6.3.1. Source Control Program

A source control program, focused on incentives/disincentives to reduce the use of self-regenerative water softeners, will be implemented. The first phase will be a ban of future water softeners to the extent allowed under the law. The implementation of additional incentives/disincentives to reduce water softener use will be evaluated in the second phase.

6.3.2. Provision of Lower Salinity Water to Agricultural Users

The Calleguas Municipal Water District is working with Zone Mutual to provide imported State Project Water to agricultural users so that they can blend the lower salt concentration water with poorer quality groundwater from the shallow South Las Posas Basin aquifer to obtain water of sufficient quality for agricultural use. In return, Zone Mutual will pump higher volumes of water from the South Las Posas to remove the poorer quality water and allow recharge by higher quality surface water into the basin. The resulting project will reduce demands on the lower Las Posas Basin, which has higher quality water, and improve the quality of the water in the shallow portions of the South Las Posas Basin.

6.3.3. Monitoring Program

A monitoring program will be implemented to measure the groundwater and surface water concentrations in the upper watershed, the volume of brine discharged to the brine line from the desalter and the amount of potable water produced from the treatment.

6.3.4. Groundwater Recovery and Recharge

The Calleguas Municipal Water District, Ventura County Water Works District #19 and other interested parties are evaluating the construction of a groundwater desalter facility near Moorpark to pump and treat poor quality groundwater. The pumping of poor quality groundwater will supplement imported water supplies and reduce the groundwater levels in the shallow groundwater. By lowering groundwater levels, higher quality storm water flows can recharge the groundwater basin and improve the quality in the basin.

In addition, following the completion of the construction of the proposed brine line in Simi Valley, the dewatering wells that currently discharge to the upper Arroyo Simi maybe reclaimed and the water may no longer be discharged to the stream.

6.3.5. Site Specific Objectives

As discussed previously, natural background conditions in the Arroyo Simi may make the Basin Plan objectives unachievable. Should that be the case, the development of site-specific objectives will be pursued for the Arroyo Simi/Las Posas in addition to the recommended averaging period changes.

6.4. Other Alternatives

An alternative approach to water quality regulation is to treat the inputs to the surface water in order to achieve surface water quality objectives. An example of this approach is the use of reverse osmosis to treat POTW effluent as discussed in the EPA Chloride TMDL. For the purposes of this analysis, the effluent from the three POTWs that currently discharge to the stream was treated with reverse osmosis at the levels required to meet the drought WLAs in the EPA Chloride TMDL. The percent reductions used in the model were based on an analysis of the maximum dry weather chloride loads from each of the dischargers and the reductions required for the maximum discharge loads to be equal to or less than the WLAs. All of that water was then discharged to the stream. Although this approach may meet water quality objectives, in this case it

does not provide the best mechanism for protecting the beneficial uses. For this reason, the projects listed above were developed to provide protection of beneficial uses, improvements in surface water quality, and supplementation of potable water supplies. The alternative approach (Reverse Osmosis Treatment) is presented in the comparison to evaluate the ability of the plan to meet water quality objectives and protect beneficial uses and to demonstrate the added benefits of the proposed projects.

Additionally, the removal and reclamation of the effluent from the Simi Valley WQCP was evaluated as a potential alternative to the proposed upper watershed project. Only the impacts on water quality were assessed for this alternative.

7. Evaluation of Projects

To assess the impact of the proposed projects and the alternative projects, four criteria were addressed: impacts on water supply, impacts on the watershed salt balance, impacts on surface water quality, and the ability to meet the EPA chloride TMDL waste load and load allocations. The following sections discuss how each of these impacts were evaluated.

7.1. Water Supply Impacts

The lower watershed project (RWRMP) will significantly increase the local water supply and reduce imported water demand. The net impact of the RWRMP on the watershed would be to reduce the use of imported or pumped deep aquifer water by up to 22.5 million gallons per day.

The upper watershed project will also significantly increase the local water supply and reduce imported water demand. Additionally, the project will help protect the imported water stored in the North Las Posas Basin. When implemented, the project would reduce imported water and groundwater pumping demand by up to 9 million gallons per day.

The reverse osmosis treatment approach would not provide any increase in the local water supply. The treated water would need to be discharged back to the stream in order to meet the water quality objectives.

7.2. Watershed Salt Balance Impacts

Both of the projects and the reverse osmosis treatment plan improve the salt balance in the watershed. As discussed above, the watershed was divided into five sub watersheds and a salts balance was developed for each of them.

The lower watershed project will result in an approximate salts balance under average conditions once Phase 4 has been implemented. In the lower watershed, up to 300,000 lbs/day of salts (TDS) will be removed as a result of the projects. The upper watershed project will result in approximately 70,000 pounds/day of salts being removed from the upper watershed. Of the 70,000 lbs/day removed, approximately 55,000 lbs/day are stranded salts and 15,000 lbs/day are salts prevented from entering the watershed from water softeners. The Reverse Osmosis Treatment plan would result in approximately 70,000 lbs/day of salts removed from the watershed.

Therefore, the proposed projects will remove five times more salt mass from the watershed than the reverse osmosis treatment plan.

7.3. Surface Water Quality Impacts

The CCMS and the Chloride TMDL model were used to project the water quality resulting from the projects. The resulting water quality was then compared to current conditions and water quality objectives.

7.3.1. CCMS Evaluation

As discussed previously, the CCMS model has the capability to predict water quality on a daily basis or with any chosen averaging period. Because the impacts on agriculture and groundwater recharge occur over longer periods of time than a day and the variability in daily concentrations is significant because of rain events, the 12 month rolling average was used to assess the impacts of the projects.

Time series graphs and probability plots were developed for the upper watershed project and the phases of the lower watershed based on the project descriptions. Because a number of the elements proposed in the projects involve elements that do not have direct impacts on surface water quality, not all of the elements presented above were analyzed in the surface water modeling. Elements such as groundwater pumping and treatment are likely to have a positive impact on surface water quality, but it is difficult to estimate the impacts at this time. Consequently, the modeled results provide a conservative estimate of the impacts on surface water quality from the proposed projects. The elements of the projects that were included in the modeling and the changes to the model used to describe these project elements are listed in Table 21.

Table 21: Modeled Scenarios for Salts Control in the Calleguas Creek Watershed.

Name	Description	Model Input Changes
Entire Watershed		
Current Conditions	Current Watershed Conditions, Conejo Creek Diversion Operated According to Records [1].	None
Upper Watershed [6]		
Ban Future SRW and Provide Incentives/Disincentives to Discontinue SRW use	A 25% reduction in the chloride and TDS concentrations from Simi Valley WQCP due to banning future SRW installations and providing incentives for discontinuing SRW use.	Chloride and TDS set to 75% of the current value in Simi Valley WQCP effluent.
Lower Watershed [6]		
Phase 1	Expansion of the Recycled Water Transmission and Distribution System to allow reclamation of all Camarillo WRP effluent.	Camarillo WRP effluent flow rate set to zero. Conejo Creek Diversion operated to allow 6 cfs bypass and capture of balance.
Phase 2, 1.5 cfs CMWD to both NF and SF Conejo	As above, with the Initiation of Replenishment Water Releases. 1.5 cfs imported water from the CMWD discharged to both the NF and SF of the Arroyo Conejo were the volumes assumed for the releases.	As in Phase 1. 1.5 cfs flow rate added to NF and SF Arroyo Conejo with modeled concentrations of CMWD water.
Phase 3, 3 cfs CMWD to both NF and SF Conejo	As in Phase 1 with the Thousand Oaks-Camrosa Recycled Water Interconnect and continuation of replenishment water releases. Hill Canyon WTP effluent fully reclaimed after the connection and 3 cfs imported water from the CMWD discharged to both the NF and SF of the Arroyo Conejo as the assumed volumes for the releases.	As in Phase 1. Hill Canyon WTP effluent flow rate set to zero. 3 cfs flow rate added to NF and SF Arroyo Conejo with modeled concentrations of CMWD water.
Phase 3, 4 cfs CMWD to NF and 2 cfs to SF Conejo	As above with alterations to the amount of replenishment water releases to assess the impacts of different volumes and different release locations. As in Phase 1 with Hill Canyon WTP effluent fully reclaimed and 4 cfs imported water from the CMWD discharged to NF and 2 cfs discharged to the SF of the Arroyo Conejo as the assumed discharge volumes.	As in Phase 1. Hill Canyon WTP effluent flow rate set to zero. 4 cfs flow rate added to NF and 2 cfs added to SF Arroyo Conejo with modeled concentrations of CMWD water.
Phase 3, 2 cfs CMWD to NF and 4 cfs to SF Conejo	As above with alterations to the amount of replenishment water releases to assess the impacts of different volumes and different release locations. As in Phase 1 with Hill Canyon WTP effluent fully reclaimed and 2 cfs imported water from the CMWD discharged to NF and 4 cfs discharged to the SF of	As in Phase 1. Hill Canyon WTP effluent flow rate set to zero. 2 cfs flow rate added to NF and 4 cfs added to SF Arroyo Conejo with modeled concentrations of CMWD water.

Name	Description	Model Input Changes
	the Arroyo Conejo as the assumed discharge volumes.	
Phase 3, 4 cfs CMWD to NF and 3 cfs to SF Conejo	As above with alterations to the amount of replenishment water releases to assess the impacts of different volumes and different release locations. As in Phase 1 with Hill Canyon WTP effluent fully reclaimed and 4 cfs imported water from the CMWD discharged to NF and 3 cfs discharged to the SF of the Arroyo Conejo as the assumed discharge volumes.	As in Phase 1. Hill Canyon WTP effluent flow rate set to zero. 4 cfs flow rate added to NF and 3 cfs added to SF Arroyo Conejo with modeled concentrations of CMWD water.
Phase 3, 4 cfs CMWD to both NF and SF Conejo	As above with alterations to the amount of replenishment water releases to assess the impacts of different volumes and different release locations. As in Phase 1 with Hill Canyon WTP effluent fully reclaimed and 4 cfs imported water from the CMWD discharged to both the NF and SF of the Arroyo Conejo as the assumed discharge volumes.	As in Phase 1. Hill Canyon WTP effluent flow rate set to zero. 4 cfs flow rate added to NF and SF Arroyo Conejo with modeled concentrations of CMWD water.
Reverse Osmosis Treatment Plan	Implementation of Reverse Osmosis Treatment at Hill Canyon WTP, Simi Valley WQCP, and Camarillo WRP to meet the drought WLAs in EPA Chloride TMDL. Percent reductions were estimated using the maximum dry weather (June to September) chloride loads from each facility as predicted by the conditions in the model.	Chloride, sulfate, TDS, and boron (Salts) concentrations set to 68% of the current value of Simi Valley WQCP effluent and flow rate reduced to 93.2% of current flow. Salts concentrations set to 57.3% of the current value of Hill Canyon WTP effluent and flow rate reduced to 91% of current flow. Salts concentrations set to 40.1% of the current value of Camarillo WRP effluent and flow rate reduced to 87.4% of current flow.

[1] See Appendix A for Details
[2] Groundwater
[3] Self regenerating water softener
[4] Reverse osmosis or other desalination treatment.
[5] Assuming 80% of water desalinated and 20% discharged to brine line.
[6] Improvements to dry-weather runoff and POTW effluent quality due to higher quality source water from desalinating groundwater unaccounted for in current model runs.

For six key points in the watershed, time series graphs and probability plots were developed for each of the scenarios to demonstrate how the water quality changes through implementation of the project. The following figures show the comparison between current conditions prior to implementation of the projects and the final scenarios in the table above that demonstrate the best water quality achievable through the projects. Appendix D contains the figures showing the impacts of the other scenarios modeled. For all scenarios, the solid line in the figures is the Basin Plan objective.

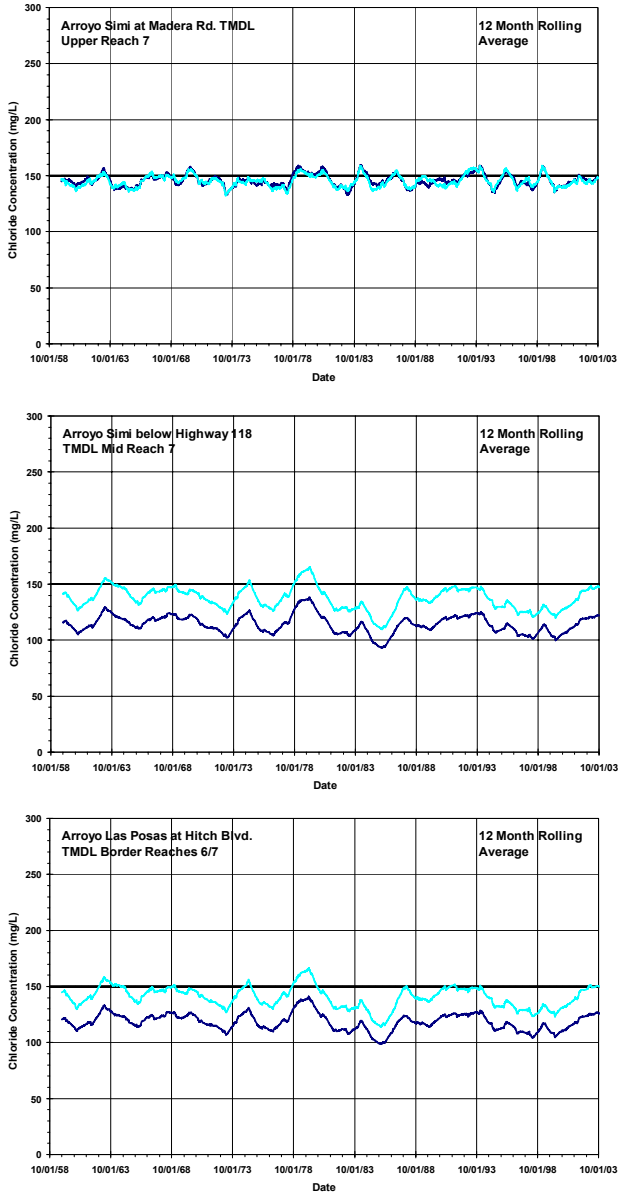

Figure 13: Current (light line) and Estimated (dark line) Chloride 12-month Rolling Average Concentrations in Arroyo Simi/Las Posas With No Future SRW and Incentives/Disincentives to Reduce SRW Use.

After implementation of the upper watershed projects, the chloride concentrations consistently meet the 12 month rolling average downstream of the Simi Valley WQCP, but not upstream. Concentrations in the surface water upstream of the Simi Valley WQCP are not addressed by these projects.

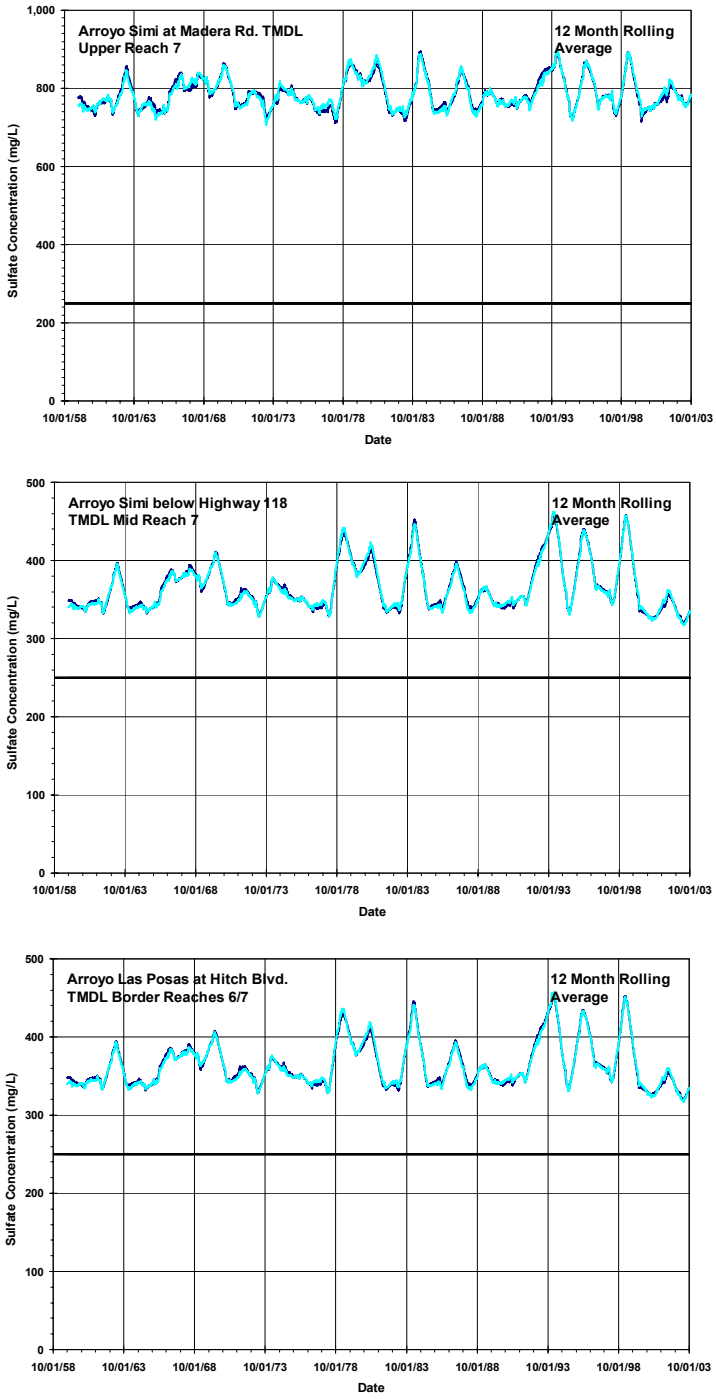

Figure 14: Current (light line) and Estimated (dark line) Sulfate 12-month Rolling Average Concentrations in Arroyo Simi/Las Posas With No Future SRW and Incentives/Disincentives to Reduce SRW Use.

Sulfate concentrations are not impacted by the modeled components of the project. It is possible that the groundwater desalting in the South Las Posas basin will have an impact on surface water sulfate concentrations, but the impacts cannot be determined at this time.

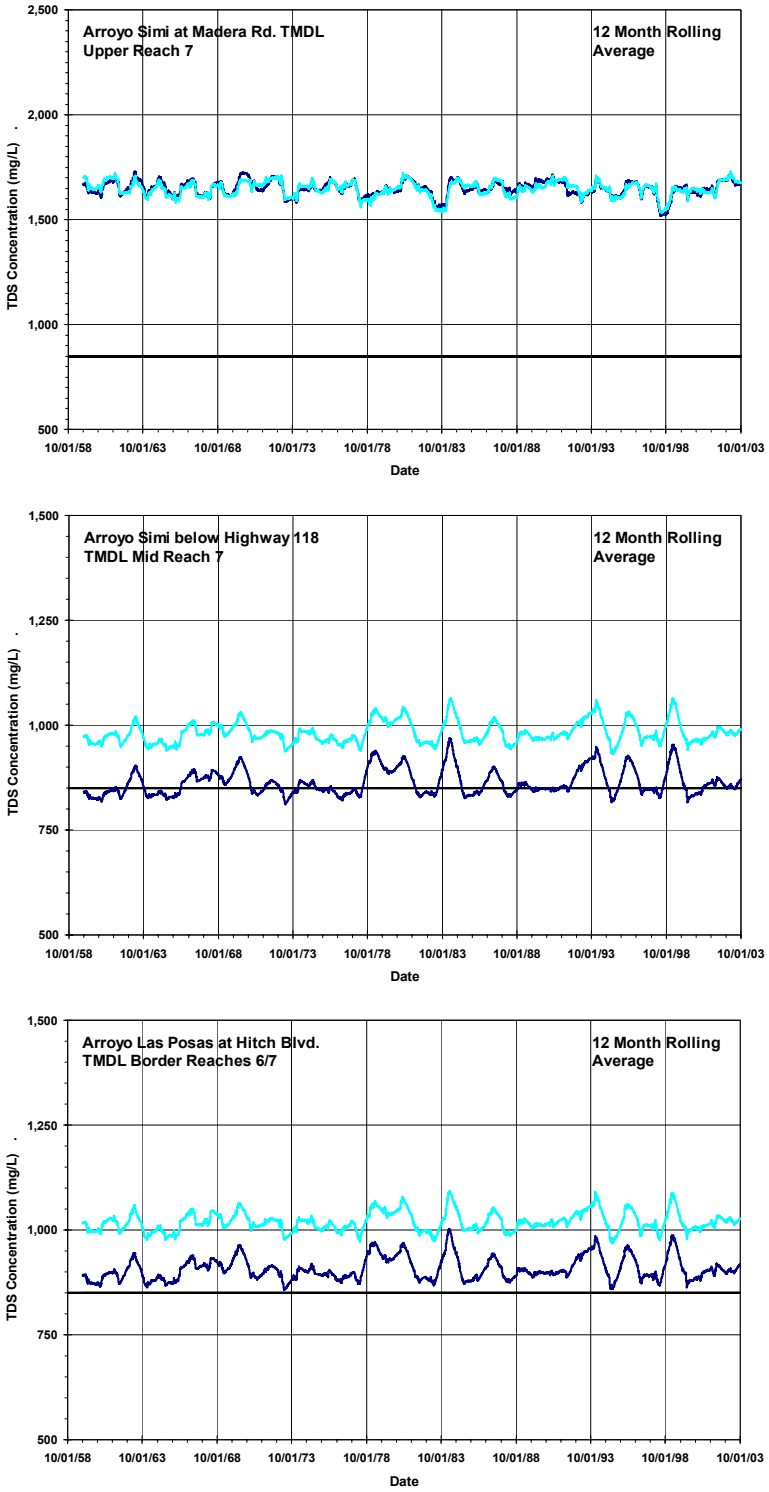

Figure 15: Current (light line) and Estimated (dark line) TDS 12-month Rolling Average Concentrations in Arroyo Simi/Las Posas With No Future SRW, and Incentives/Disincentives to Reduce SRW Use.

The projects result in a significant decrease in TDS concentrations (approximately 100 mg/L) and result in the surface water concentrations falling below the objectives under certain conditions. However, the 12 month rolling average would not consistently meet objectives.

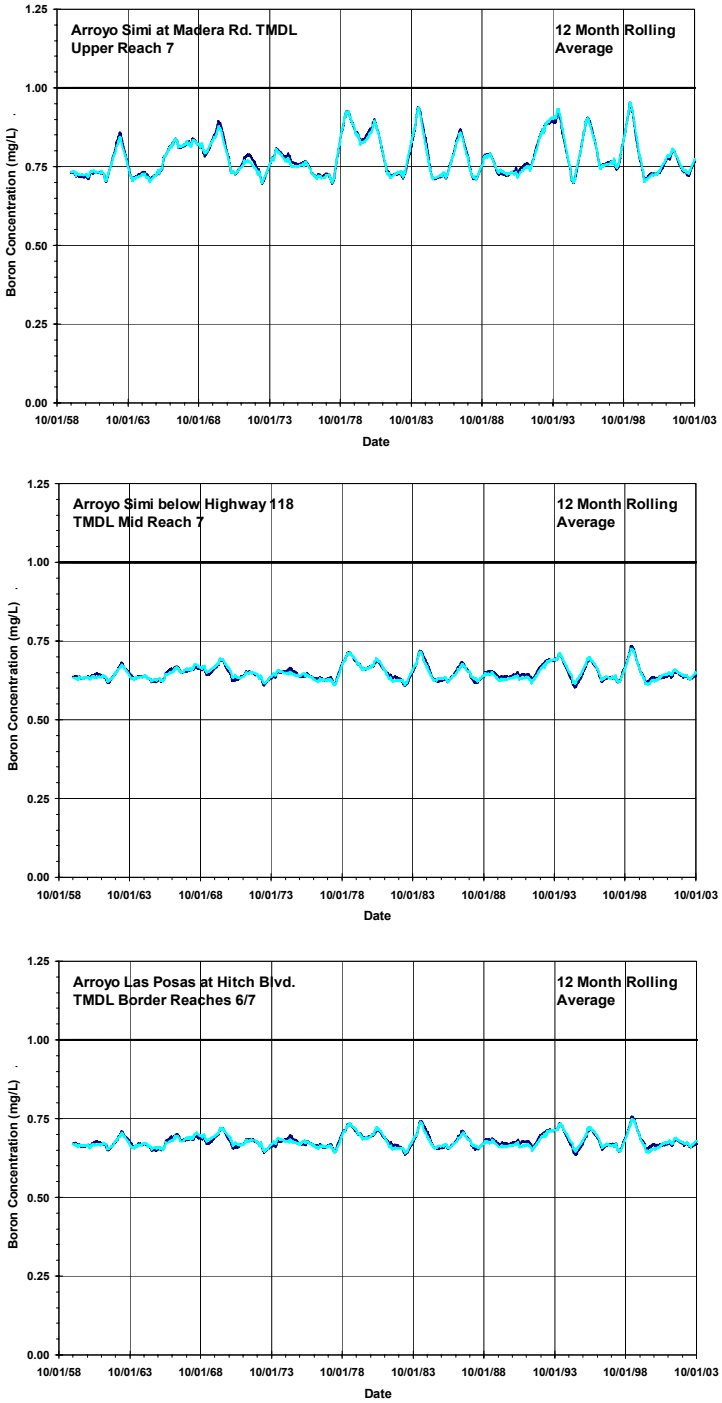

Figure 16: Current (light line) and Estimated (dark line) Boron 12-month Rolling Average Concentrations in Arroyo Simi/Las Posas With No Future SRW, and Incentives/Disincentives to Reduce SRW Use.

Boron consistently meets the 12 month rolling average objective even without implementation of the projects. The projects have no significant impact on boron concentrations.

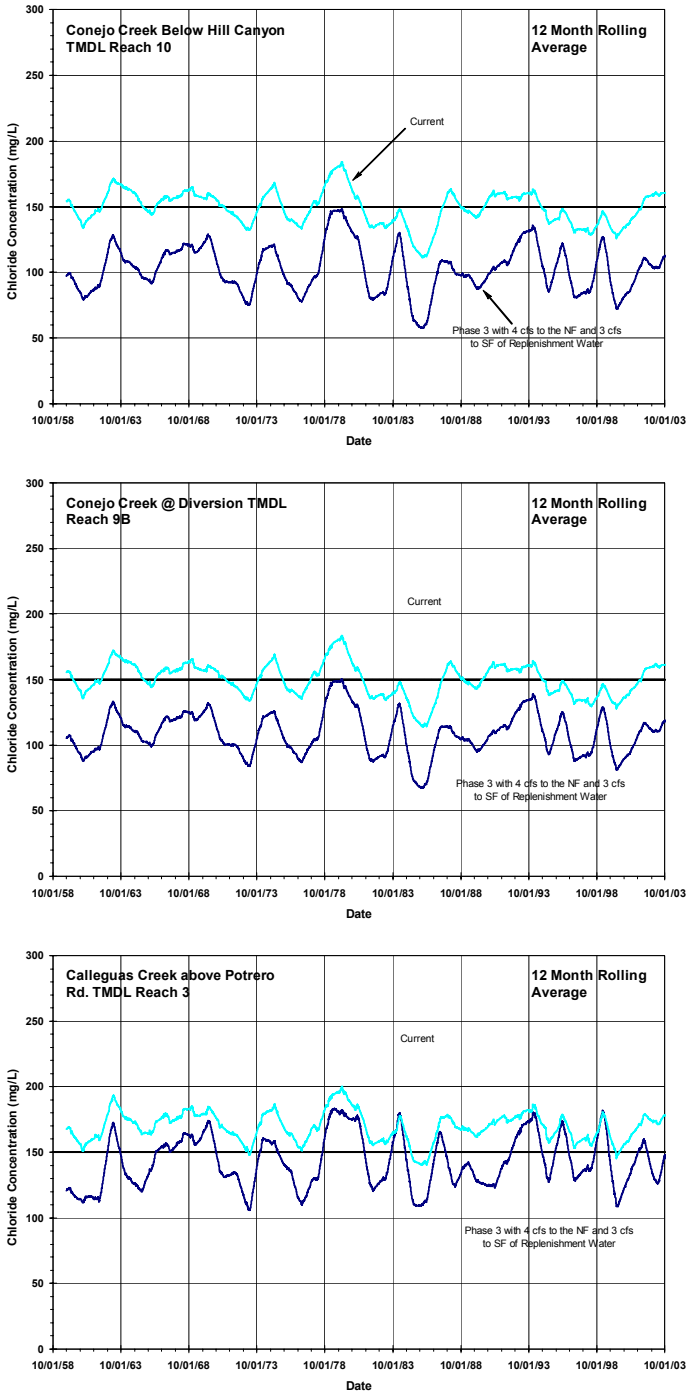

Figure 17: Current and Estimated Chloride 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP and supplying 4 cfs to the NF and 3 cfs to the SF Arroyo Conejo of Replenishment Water.

Concentrations of chloride decrease significantly after implementation of the lower watershed projects. In Conejo, concentrations are reduced by approximately 50 mg/L and the surface water would meet the 12 month rolling average objectives the majority of the time. Calleguas Creek would not consistently meet the 12 month rolling average objectives, but chloride concentrations are reduced through implementation of the projects.

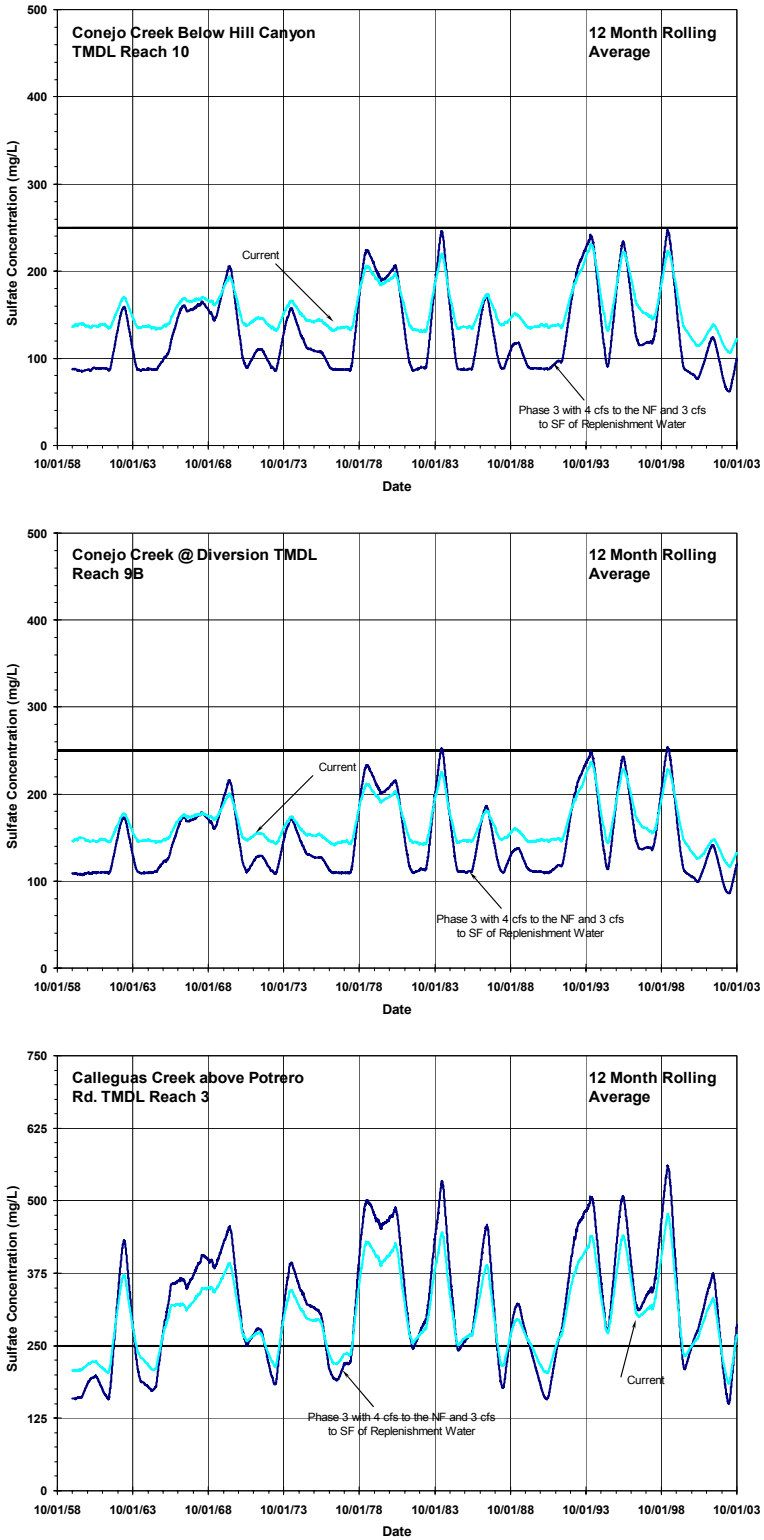

Figure 18: Current and Estimated Sulfate 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP and supplying 4 cfs to the NF and 3 cfs to the SF Arroyo Conejo of Replenishment Water.

Modeled sulfate concentrations are more variable than other constituents because there are fewer data available for this constituent and the available data are more variable. Consequently, the equations used to represent conditions in the watershed include more variability. Concentrations increase at Potrero Rd. because groundwater exfiltration containing high sulfate concentrations occurs in this reach. The projects reduce the amount of flow in the reach available to dilute the groundwater concentrations. However, the implementation of Phase 4 of the lower watershed project includes pumping of groundwater in this reach that should reduce the exfiltration. This should reduce sulfate concentrations in the surface water, but the impacts cannot be modeled until the project has been implemented.

The increase in sulfate concentrations at Potrero Road is not a problematic situation because it will not have an impact on beneficial uses. The reach is at the lower end of a reach of rising groundwater so no groundwater recharge occurs in this area. Additionally, the water rights are fully appropriated in this reach so no diversions for agriculture are permitted. Finally, the lower reach is the conduit by which salts are exported from the watershed. Higher concentrations in this reach are inevitable if additional salts are being exported from the upper reaches of the watershed to protect the beneficial uses present in those areas.

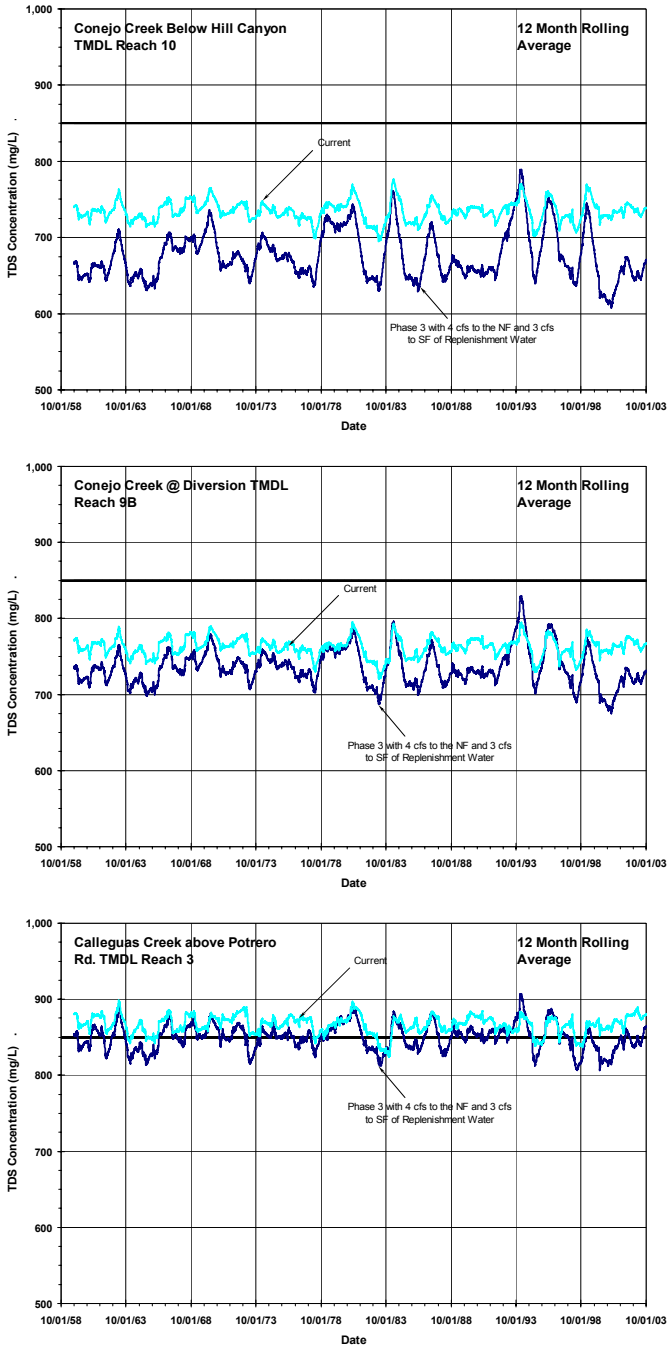

Figure 19: Current and Estimated TDS 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP and supplying 4 cfs to the NF and 3 cfs to the SF Arroyo Conejo of Replenishment Water.

TDS concentrations are reduced by approximately 50 mg/l in Conejo Creek, but remain approximately the same in Calleguas Creek. The TDS concentrations in the groundwater base flow are very high. Once the effluent is removed from the stream, the base flow makes up a much larger portion of the flow in the stream. Dilution is provided by the replenishment water releases, but it is not of the magnitude that was provided by the effluent. Like sulfate, any groundwater pumping and treatment that is implemented as part of the projects will likely reduce the surface water concentrations of TDS as well. However, the impacts could not be assessed at this time.

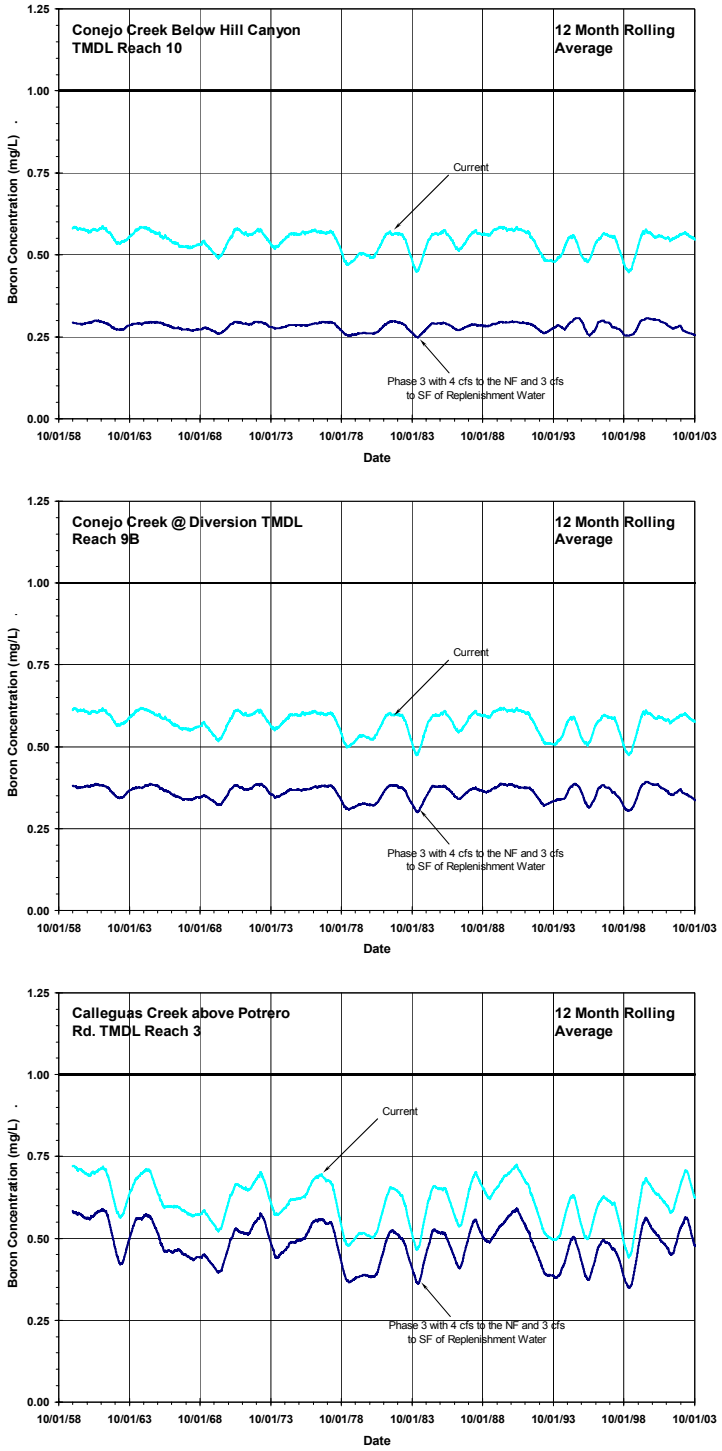

Figure 20: Current and Estimated Boron 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP and supplying 4 cfs to the NF and 3 cfs to the SF Arroyo Conejo of Replenishment Water.

Boron is not on the 303(d) list for these reaches. The current conditions shown in the graphs clearly demonstrate that boron concentrations are below the objective of 1.0 mg/L at all times.

The following series of plots show the probability of a given concentration occurring on any given day at the designated location in the watershed. The current conditions and the conditions present after implementation of the projects are presented in the plots.

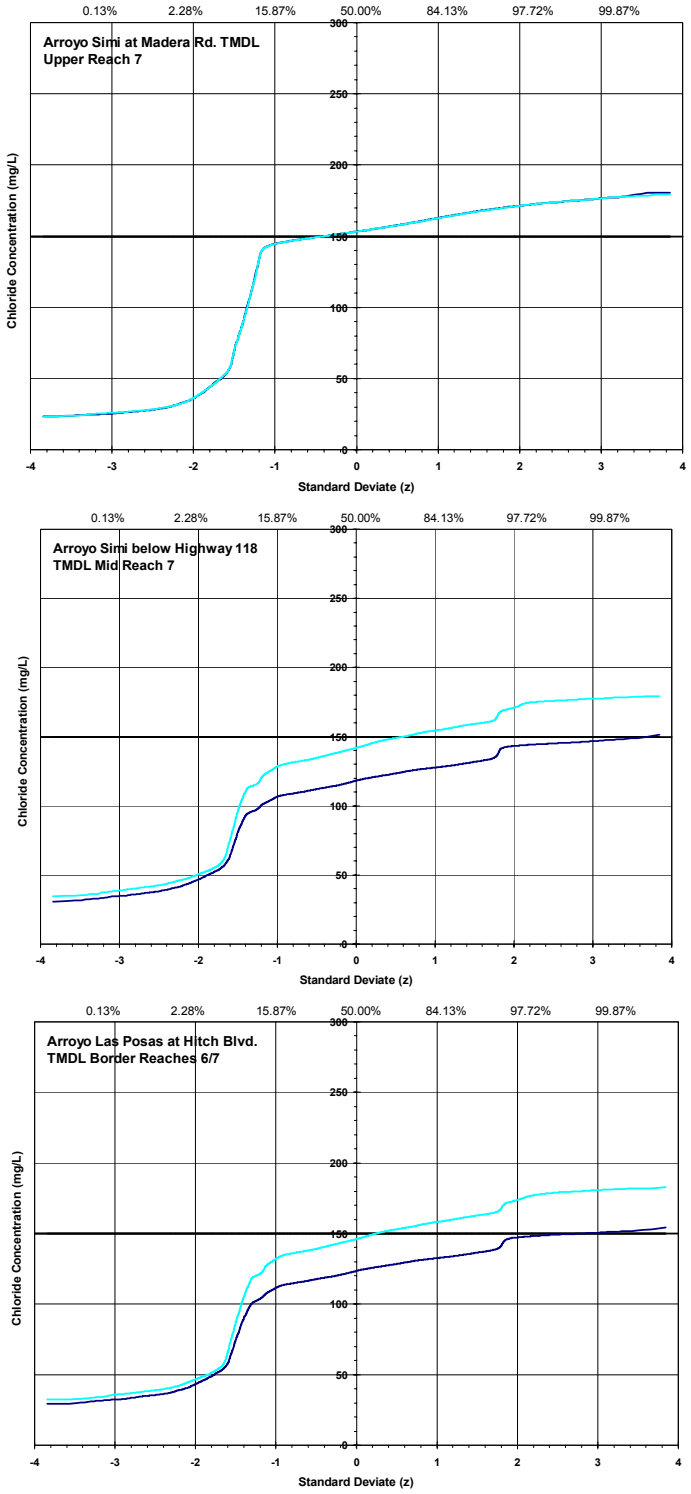

Figure 21: Current (light line) and Estimated (dark line) Probability Distributions of Daily Average Chloride Concentrations in Arroyo Simi/Las Posas with No Future SRW, and Incentives/Disincentives to Reduce SRW Use.

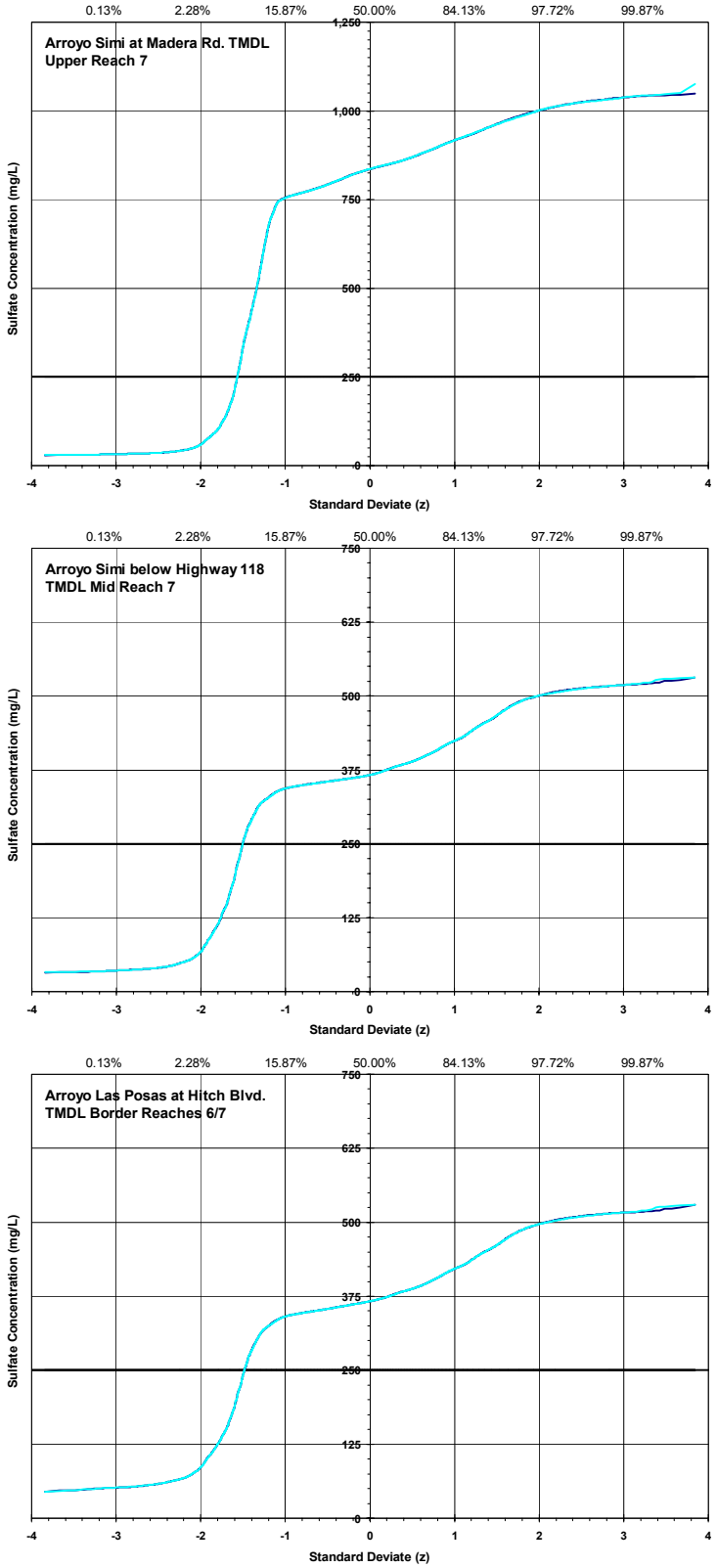

Figure 22: Current (light line) and Estimated (dark line) Probability Distributions of Daily Average Sulfate Concentrations in Arroyo Simi/Las Posas with No Future SRW and Incentives/Disincentives to Reduce SRW Use.

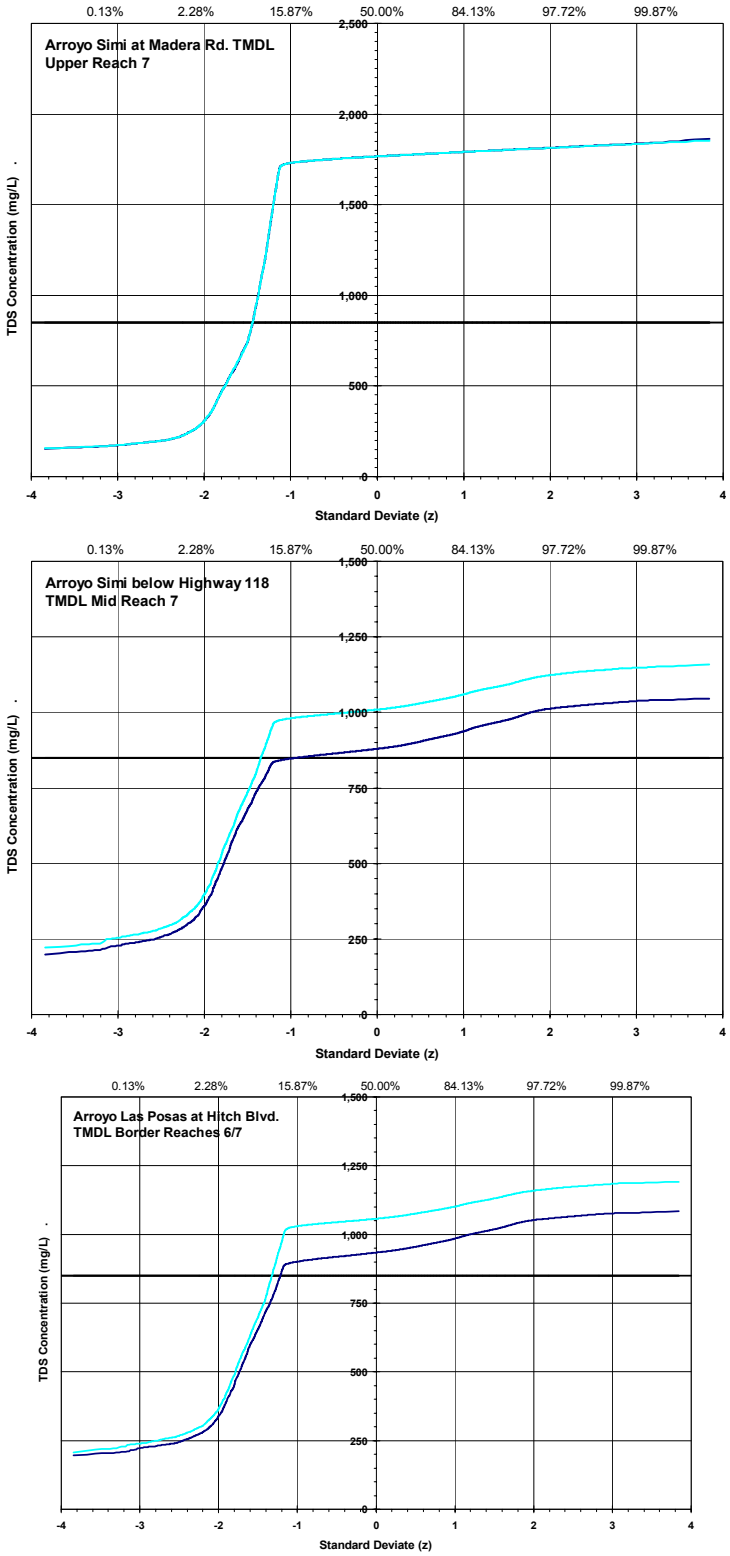

Figure 23: Current (light line) and Estimated (dark line) Probability Distributions of Daily Average TDS Concentrations in Arroyo Simi/Las Posas with No Future SRW and Incentives/Disincentives to Reduce SRW Use.

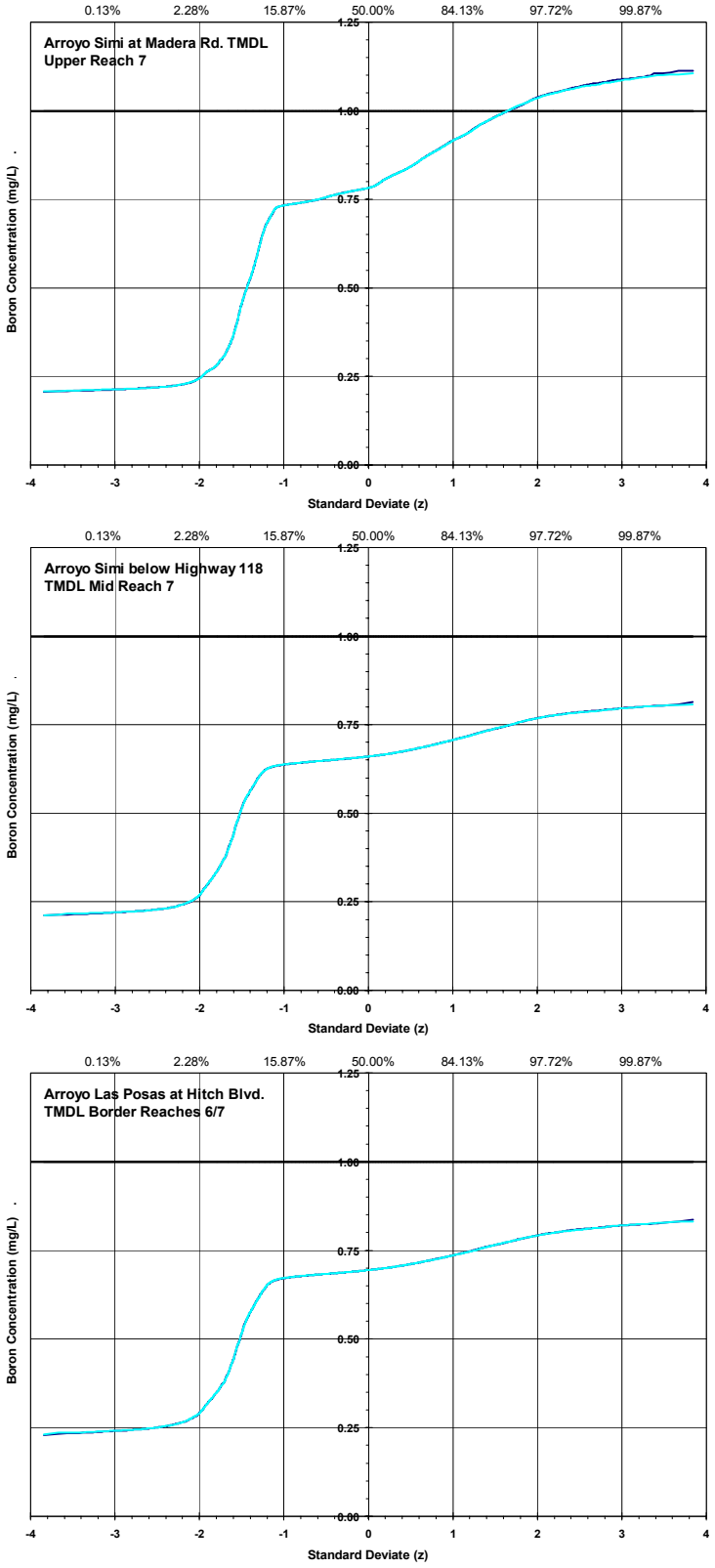

Figure 24: Current (light line) and Estimated (dark line) Probability Distributions of Daily Average Boron Concentrations in Arroyo Simi/Las Posas with No Future SRW and Incentives/Disincentives to Reduce SRW Use.

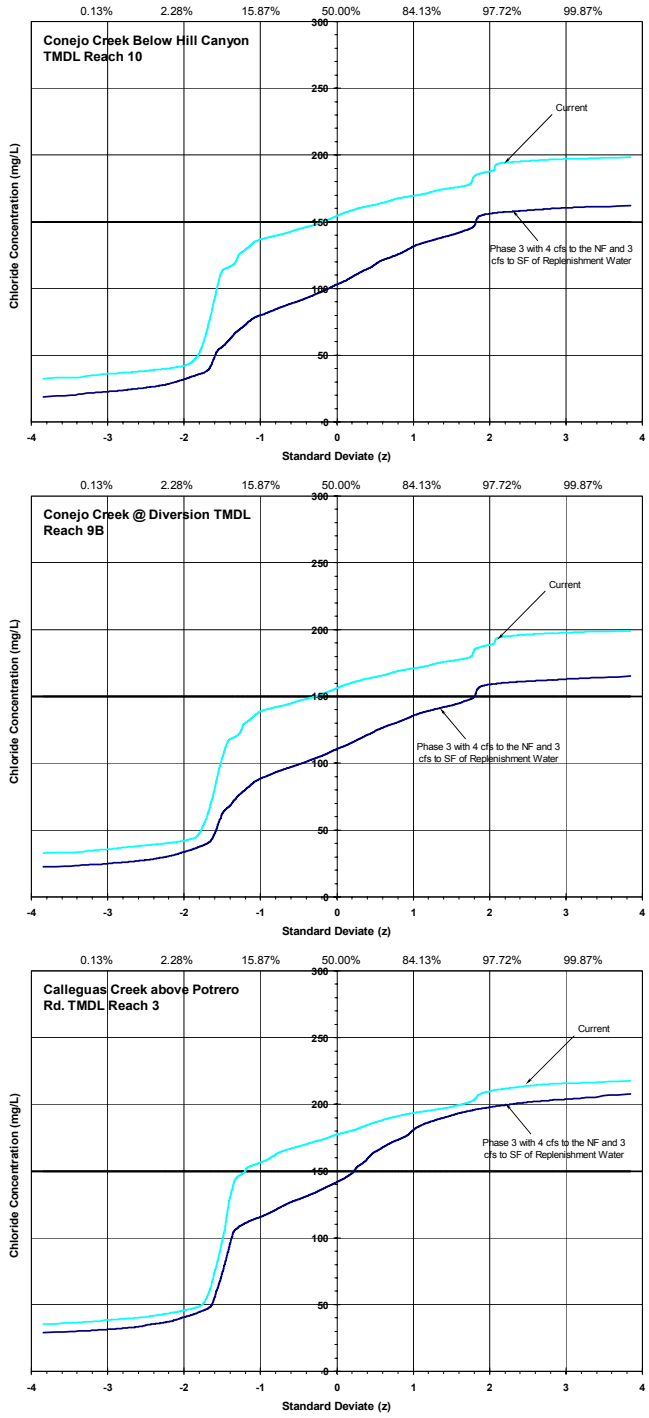

Figure 25: Current and Estimated Chloride Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP and supplying 4 cfs to the NF and 3 cfs to the SF Arroyo Conejo of Replenishment Water.

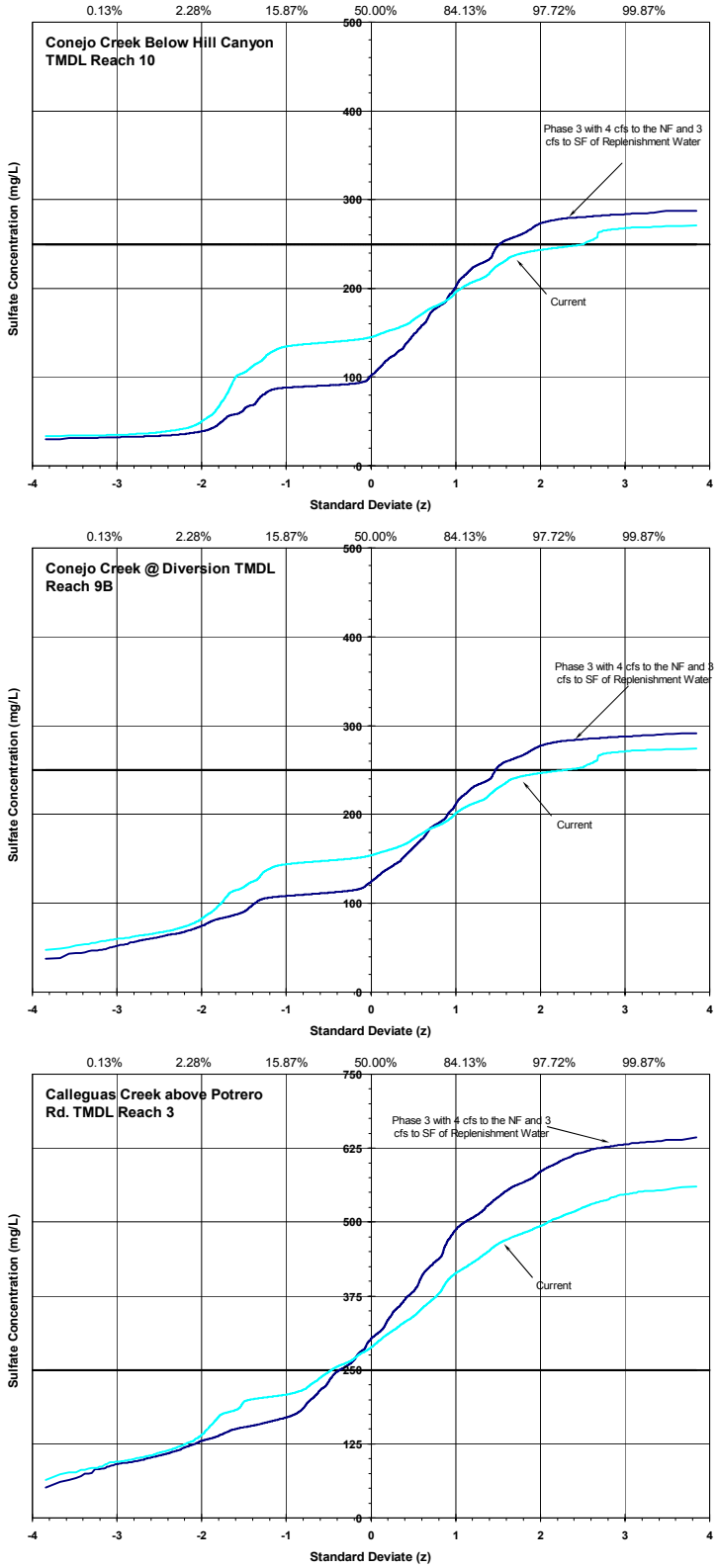

Figure 26: Current and Estimated Sulfate Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP and supplying 4 cfs to the NF and 3 cfs to the SF Arroyo Conejo of Replenishment Water.

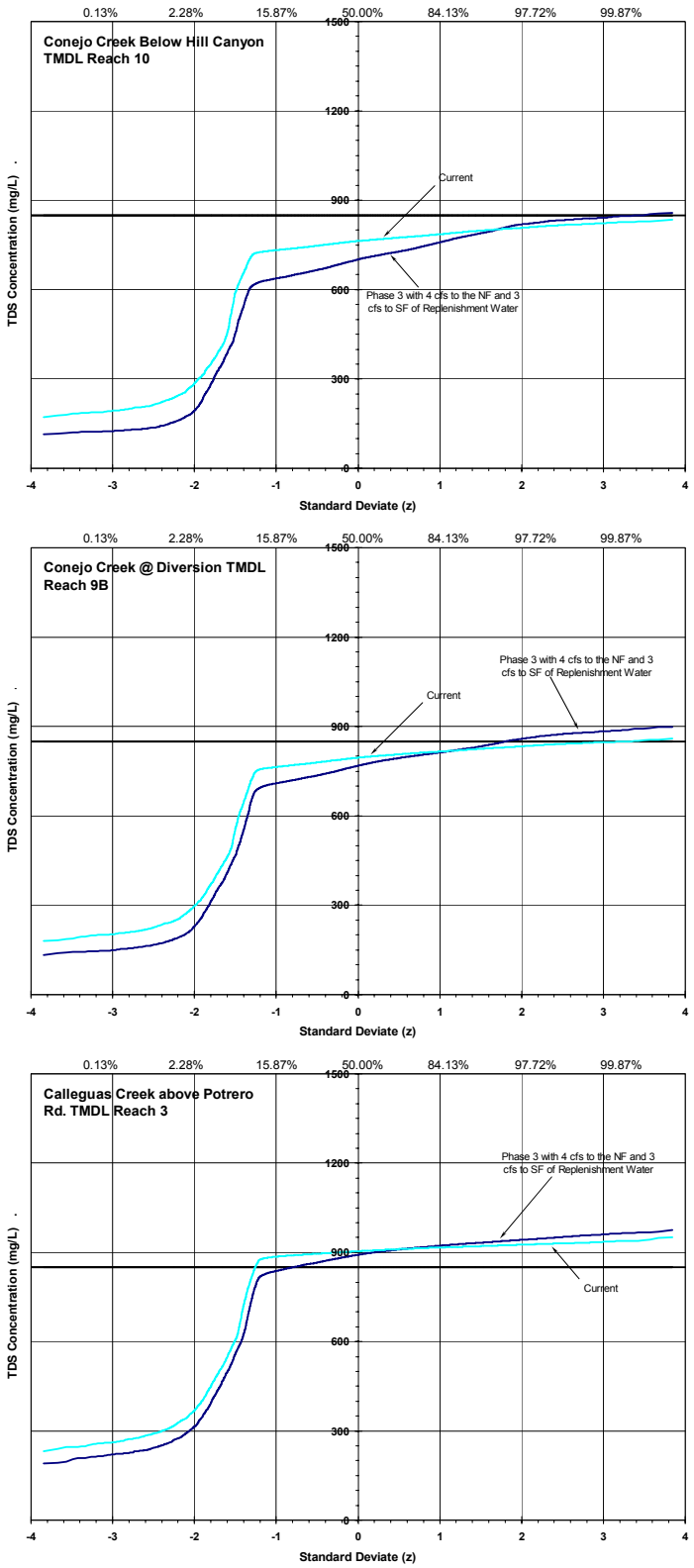

Figure 27: Current and Estimated TDS Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP and supplying 4 cfs to the NF and 3 cfs to the SF Arroyo Conejo of Replenishment Water.

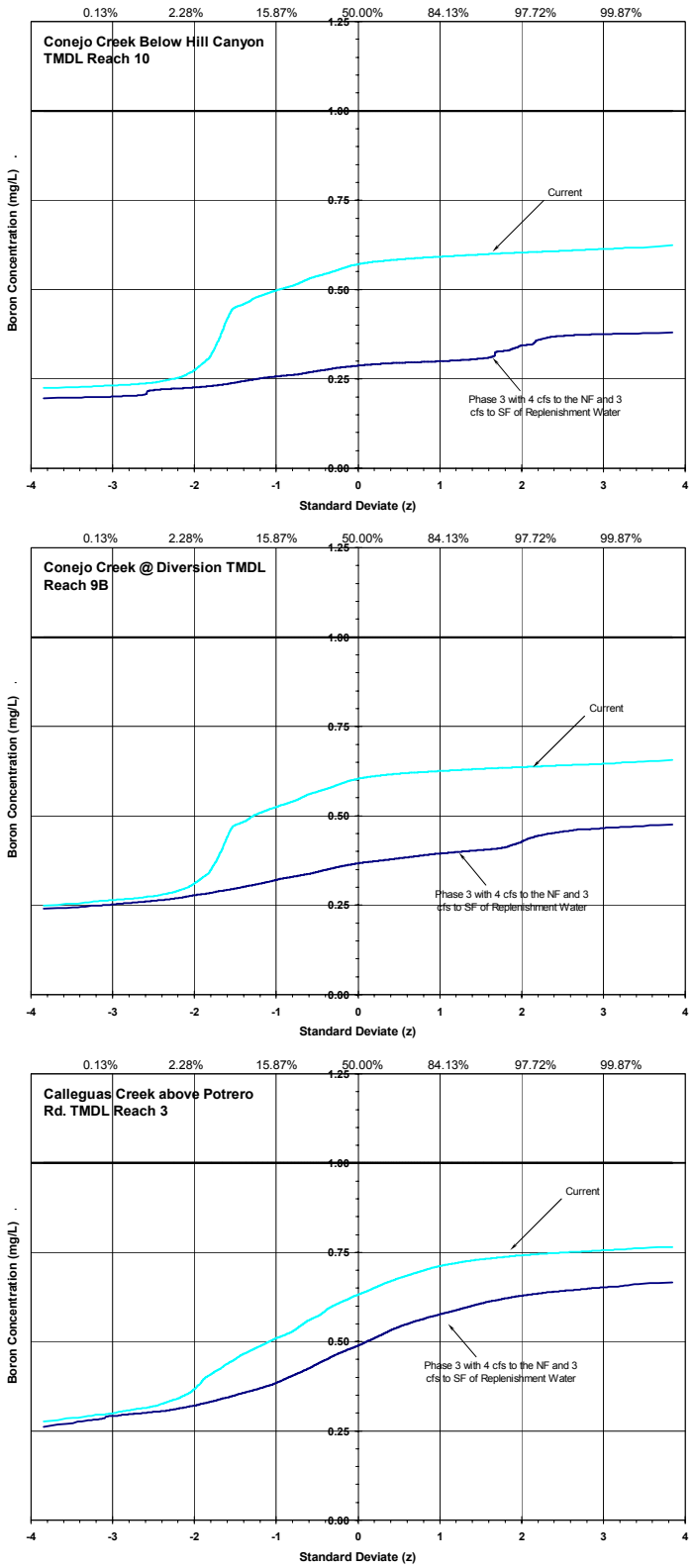

Figure 28: Current and Estimated Boron Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP and supplying 4 cfs to the NF and 3 cfs to the SF Arroyo Conejo of Replenishment Water.

For most areas of the watershed, the projects result in compliance with the objectives at least 95% of the time. However, the five percent of the time that the objectives are exceeded tend to be for extended periods of time as a result of drought or large precipitation events rather than spread evenly over time. The exceptions are TDS and sulfate in Arroyo Simi/Las Posas and TDS, chloride, and sulfate above Potrero Rd.

The same analysis was conducted for the Reverse Osmosis Treatment Plan to provide a comparison with the proposed projects. Additionally, the impact of removing the Simi Valley WQCP effluent from the stream was evaluated.

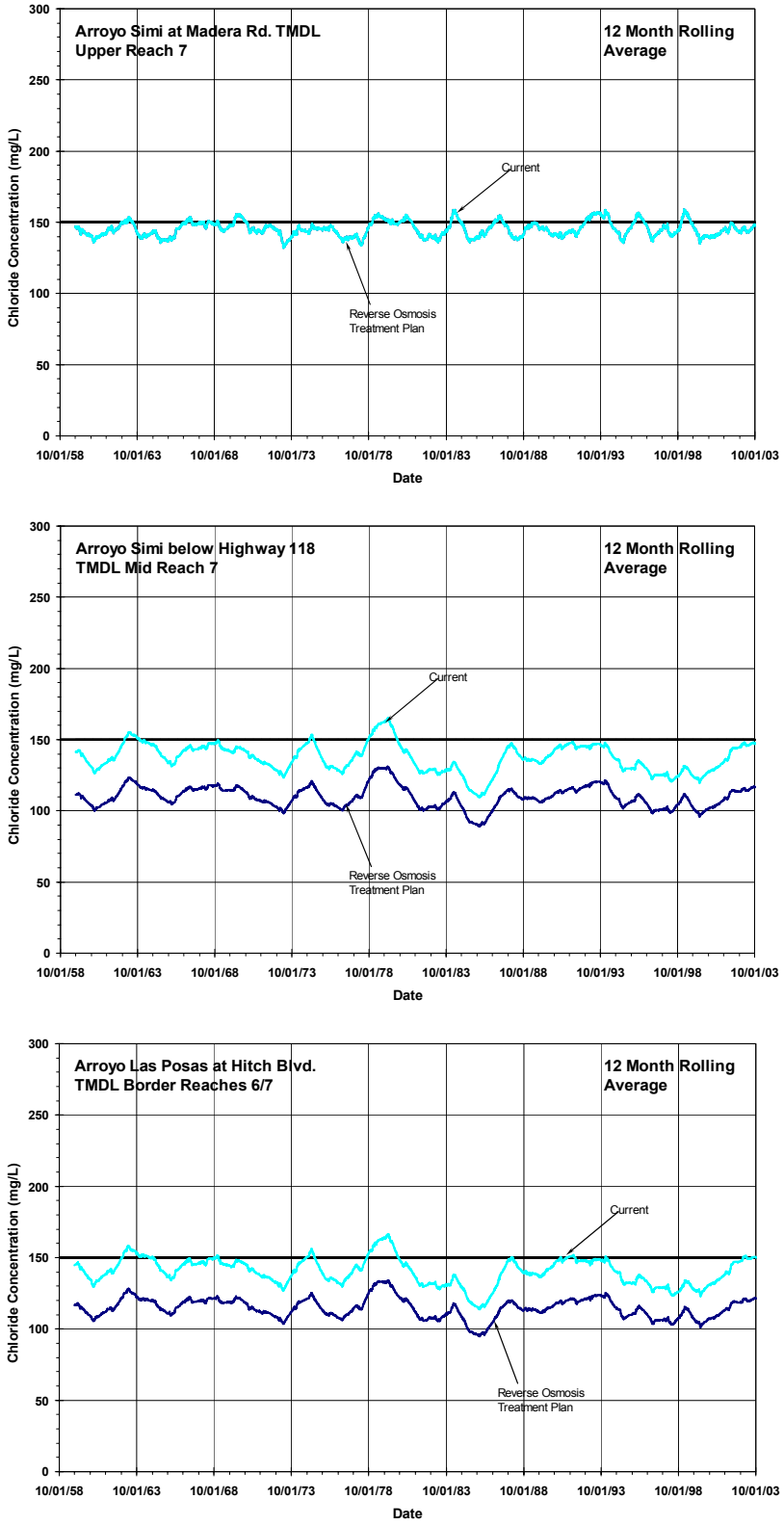

Figure 29: Current and Estimated 12-month Rolling Average Chloride Concentrations in Arroyo Simi for the Reverse Osmosis Treatment Plan.

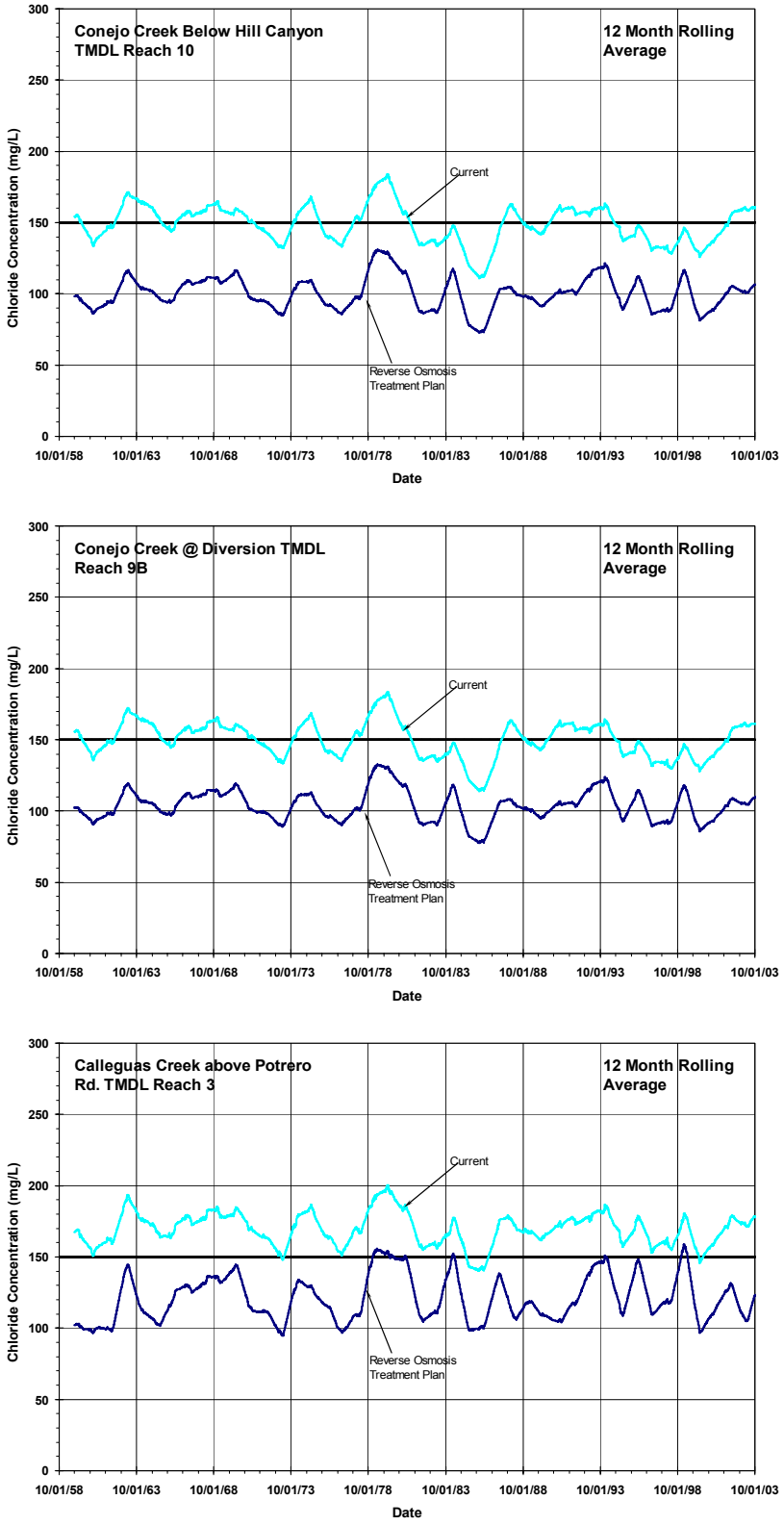

Figure 30: Current and Estimated 12-month Rolling Average Chloride Concentrations in the Lower CCW Reaches for the Reverse Osmosis Treatment Plan.

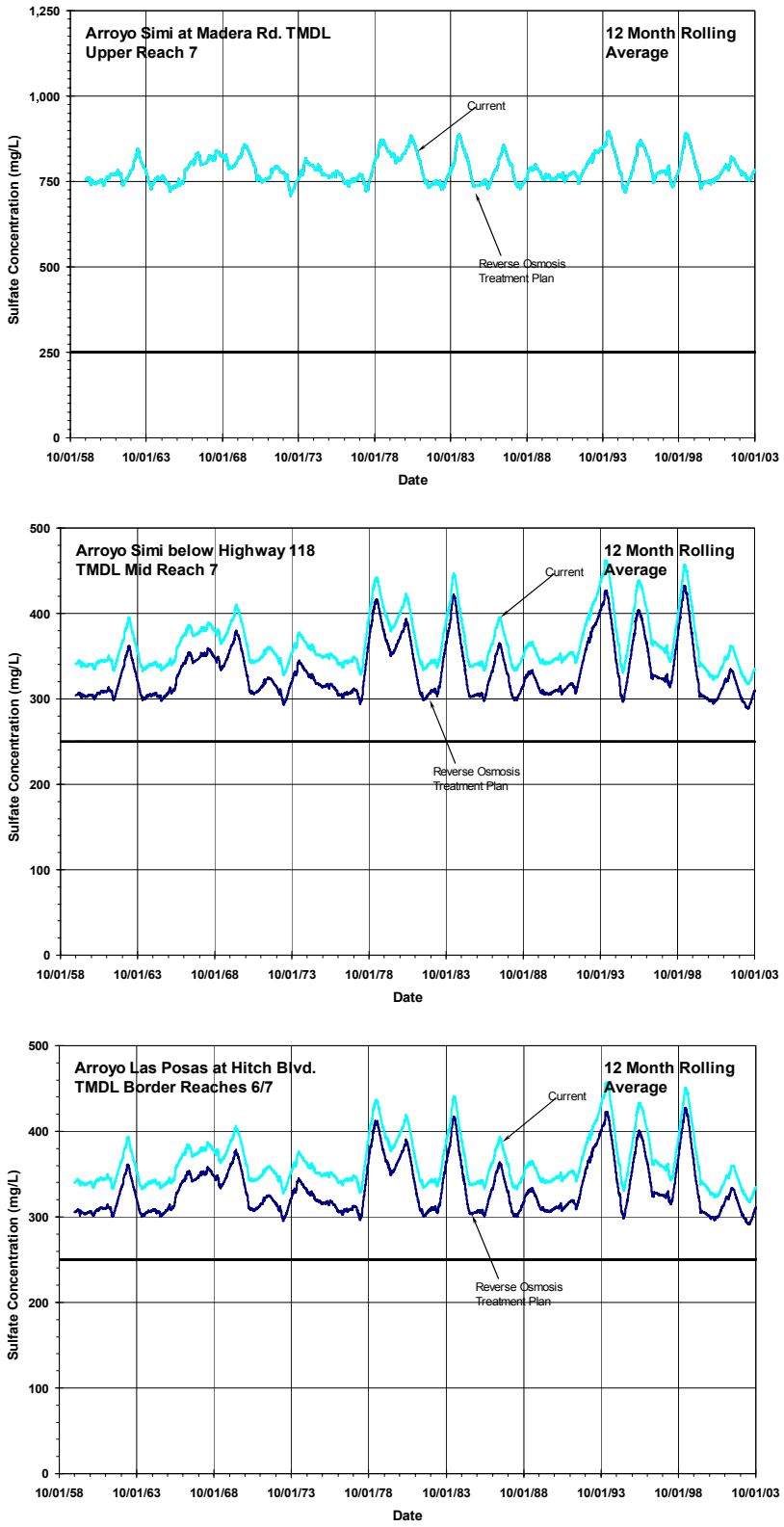

Figure 31: Current and Estimated 12-month Rolling Average Sulfate Concentrations in Arroyo Simi for the Reverse Osmosis Treatment Plan.

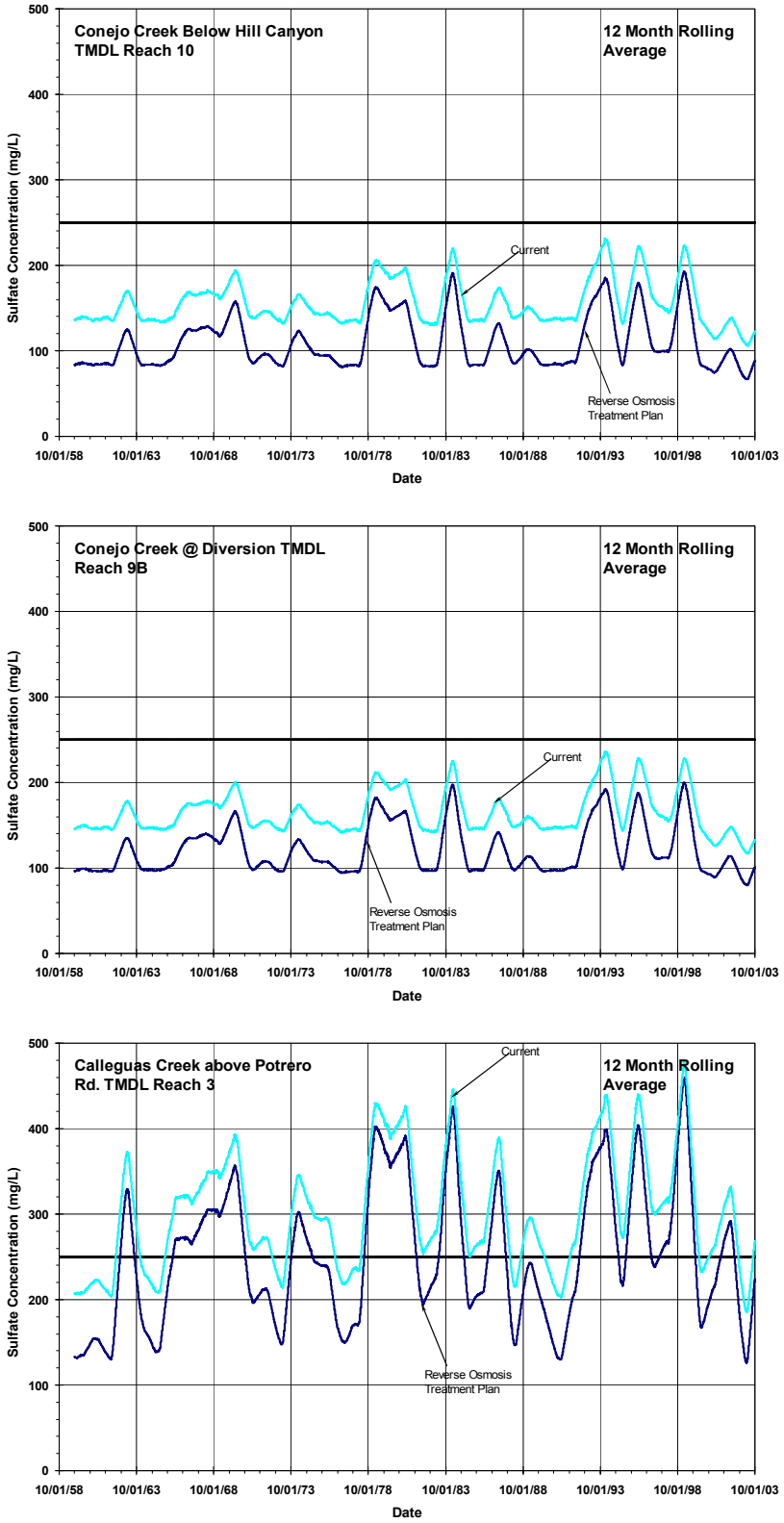

Figure 32: Current and Estimated 12-month Rolling Average Sulfate Concentrations in the Lower CCW Reaches for the Reverse Osmosis Treatment Plan.

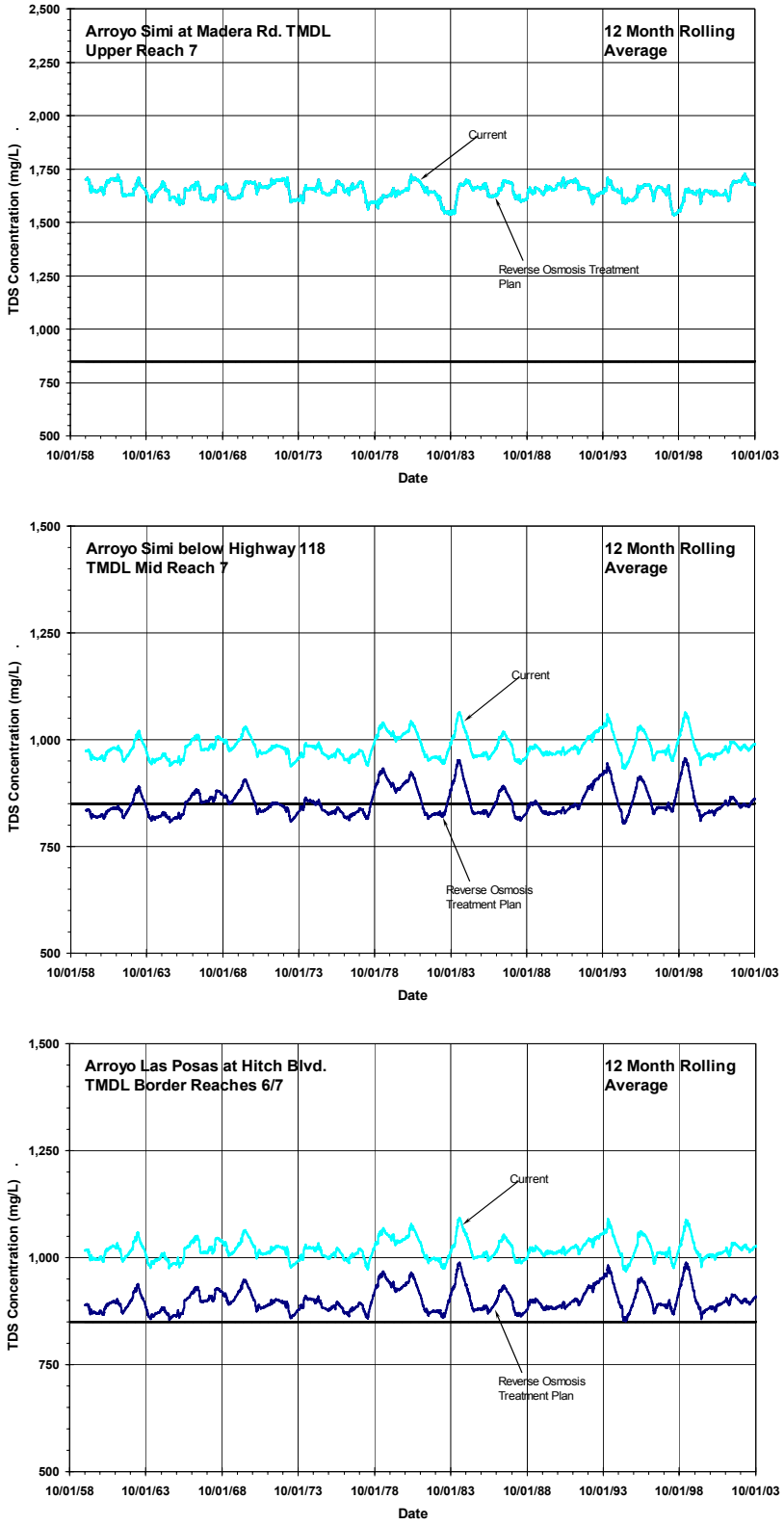

Figure 33: Current and Estimated 12-month Rolling Average TDS Concentrations in Arroyo Simi for the Reverse Osmosis Treatment Plan.

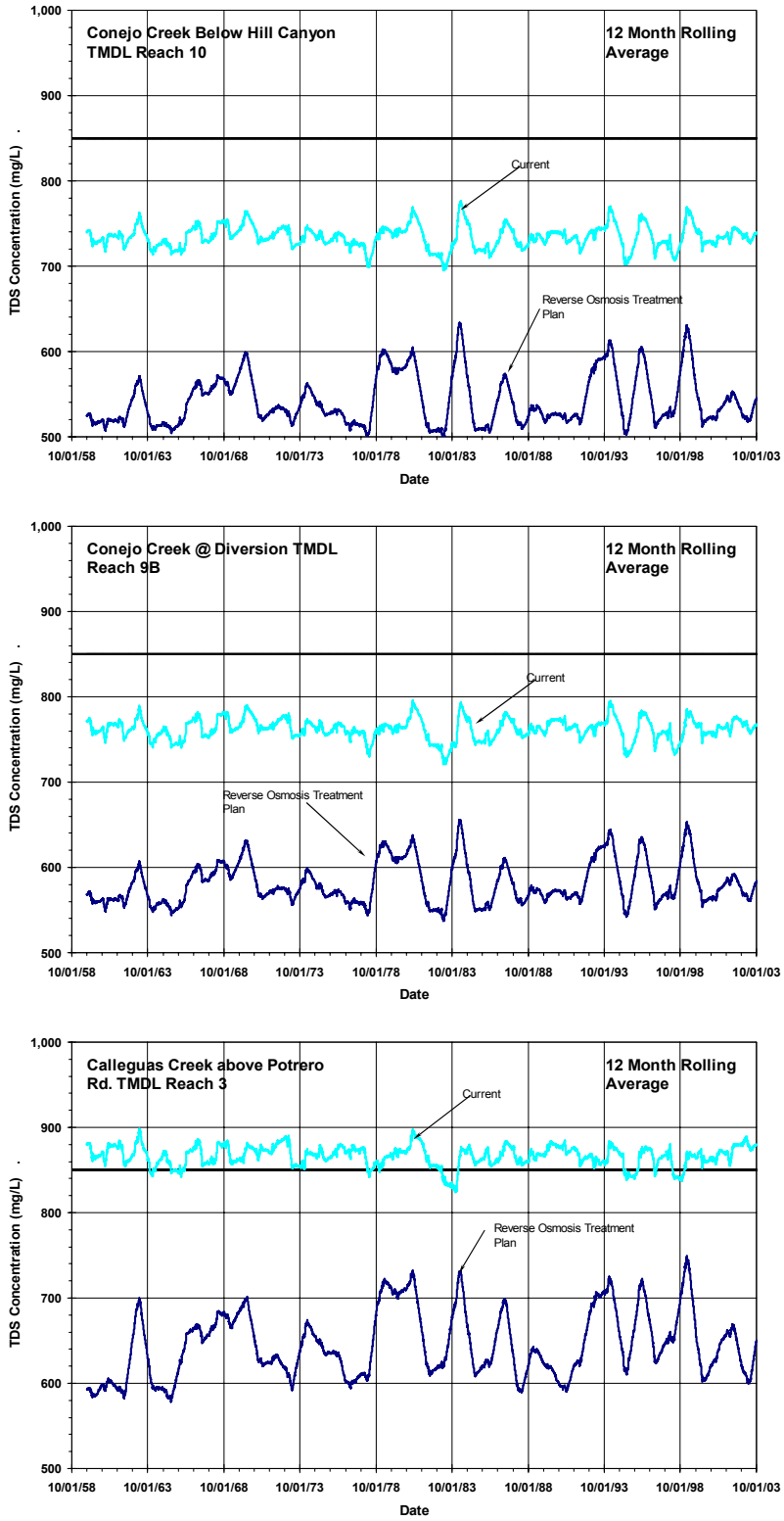

Figure 34: Current and Estimated 12-month Rolling Average TDS Concentrations in the Lower CCW Reaches for the Reverse Osmosis Treatment Plan.

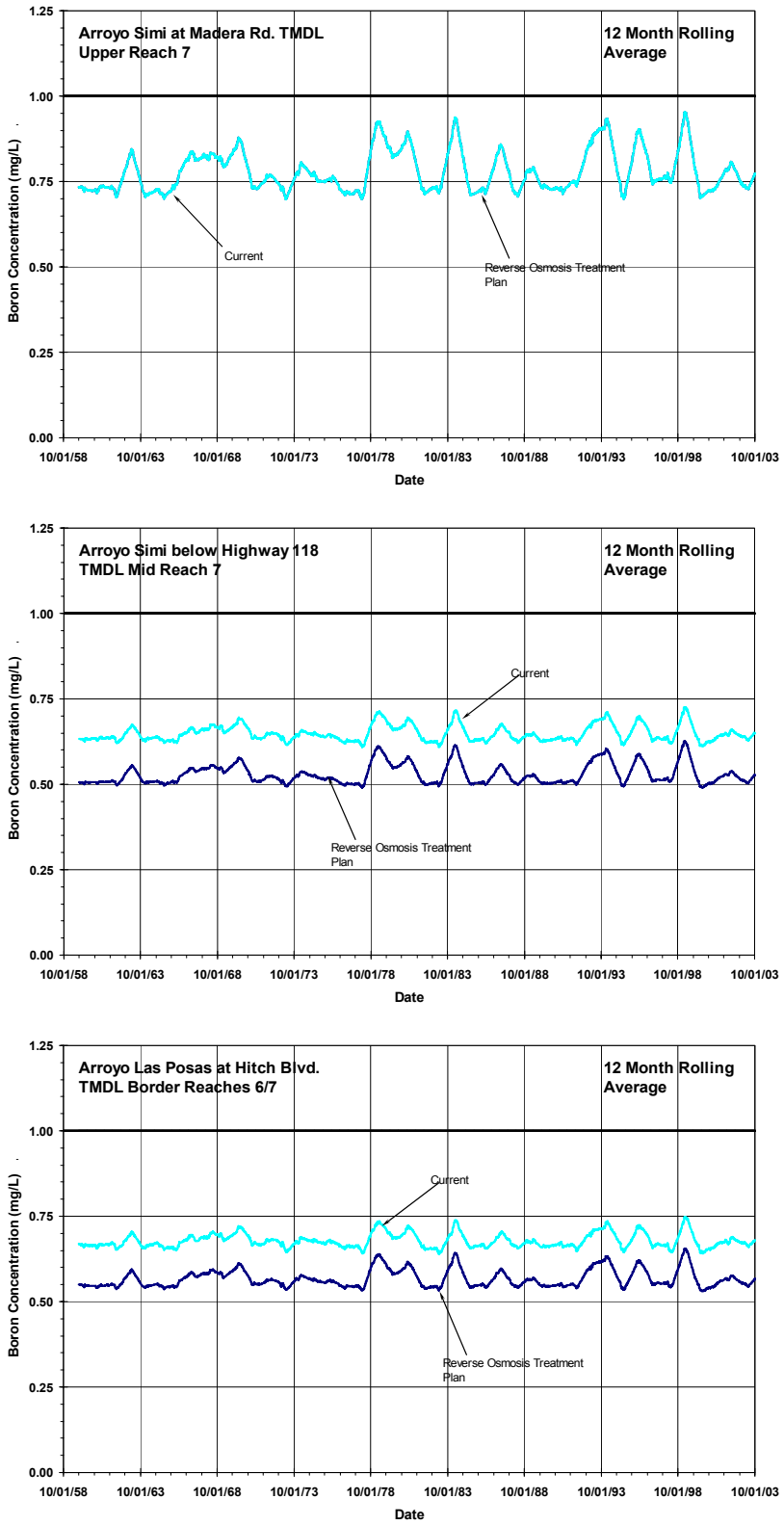

Figure 35: Current and Estimated 12-month Rolling Average Boron Concentrations in Arroyo Simi for the Reverse Osmosis Treatment Plan.

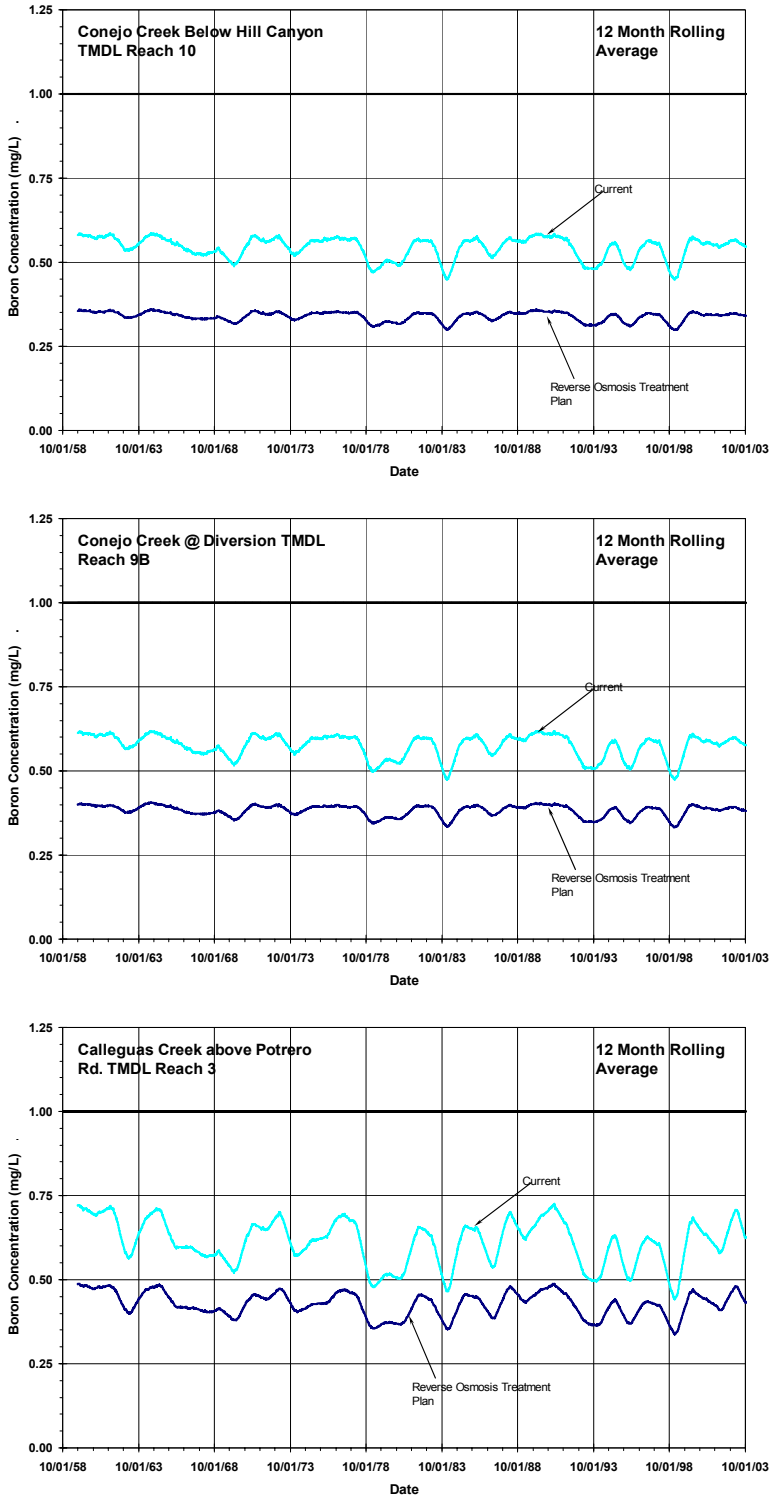

Figure 36: Current and Estimated 12-month Rolling Average Boron Concentrations in the Lower CCW Reaches for the Reverse Osmosis Treatment Plan.

The Reverse Osmosis Treatment Plan reduces surface water concentrations of salts. However, the plan does not result in compliance with the 12 month rolling average under all conditions for all reaches.

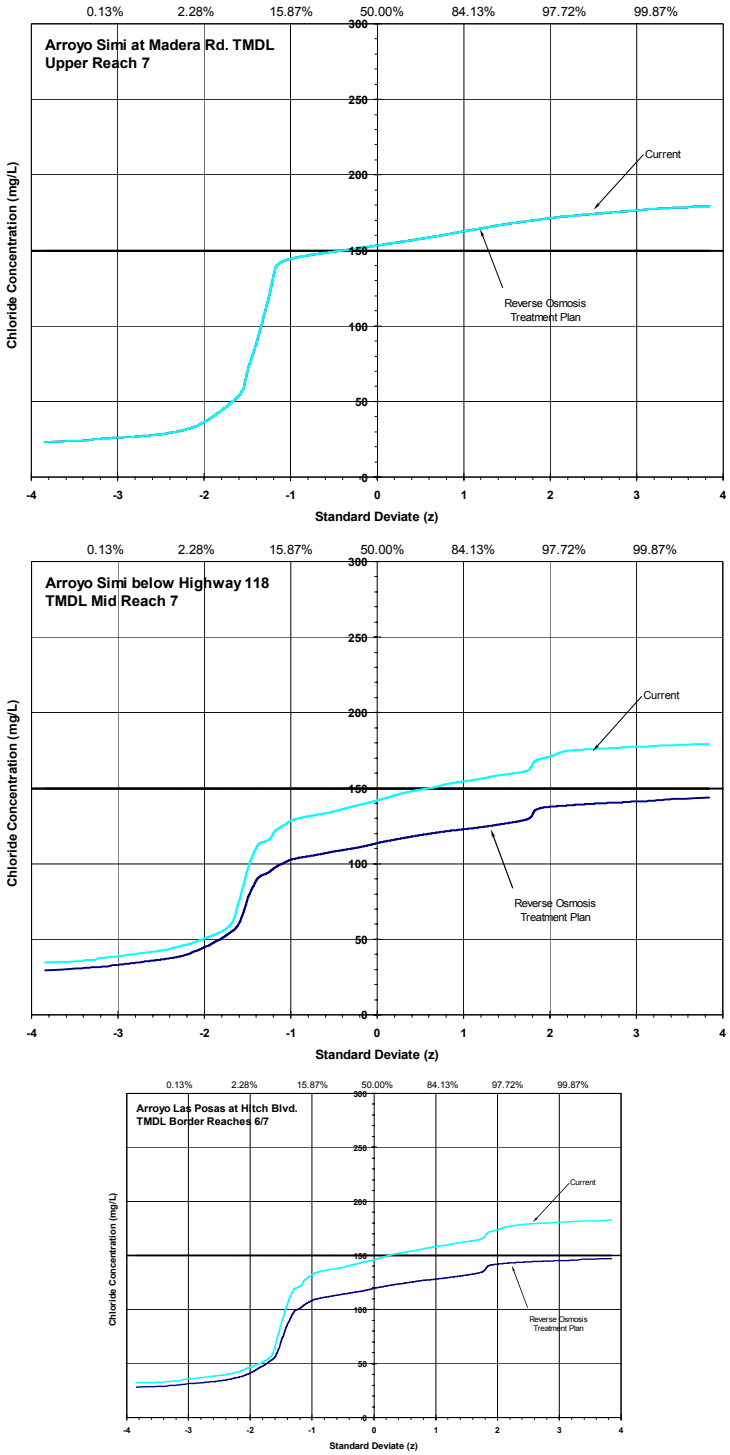

Figure 37: Current and Estimated Probability Distributions of Average Daily Chloride Concentrations in Arroyo Simi for the Reverse Osmosis Treatment Plan.

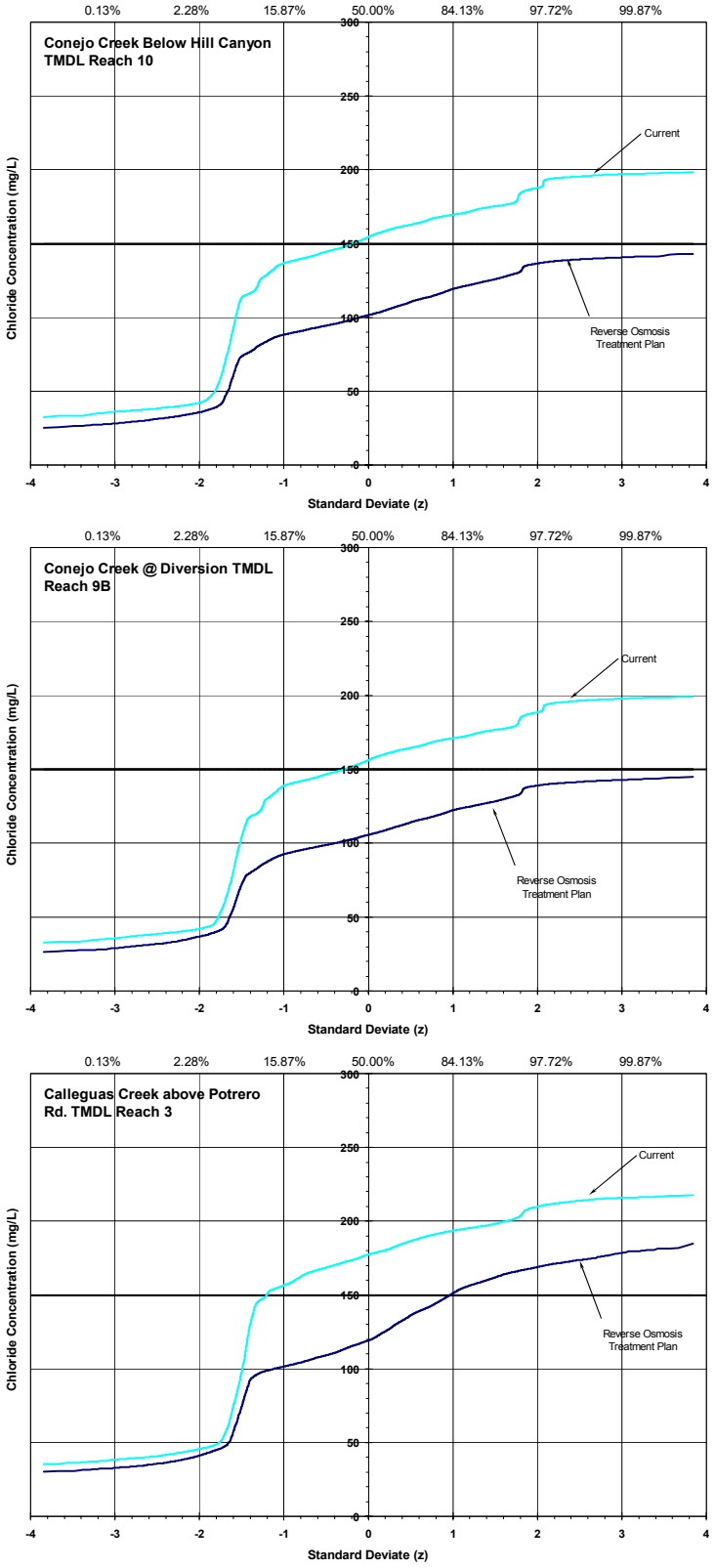

Figure 38: Current and Estimated Probability Distributions of Average Daily Chloride Concentrations in the Lower CCW Reaches for the Reverse Osmosis Treatment Plan.

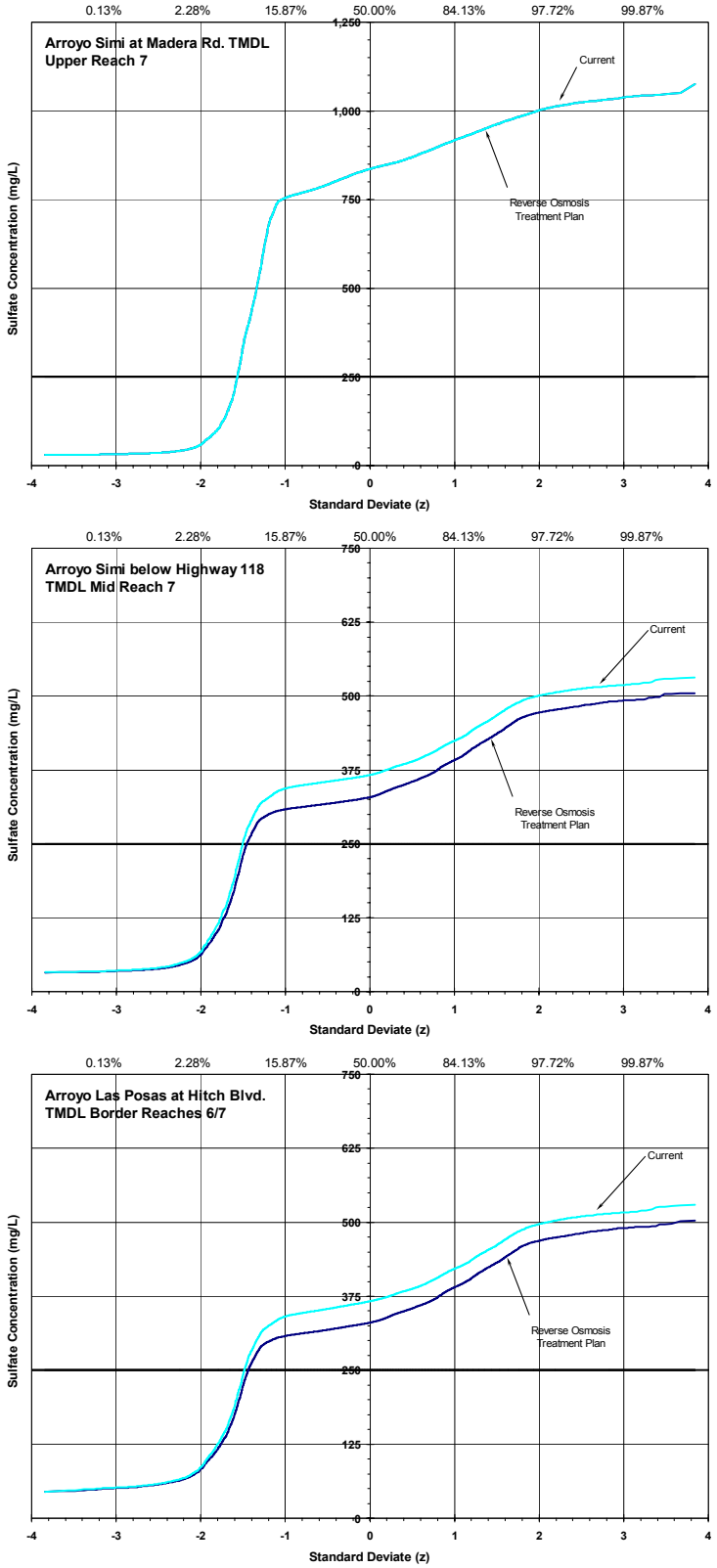

Figure 39: Current and Estimated Probability Distributions of Average Daily Sulfate Concentrations in Arroyo Simi for the Reverse Osmosis Treatment Plan.

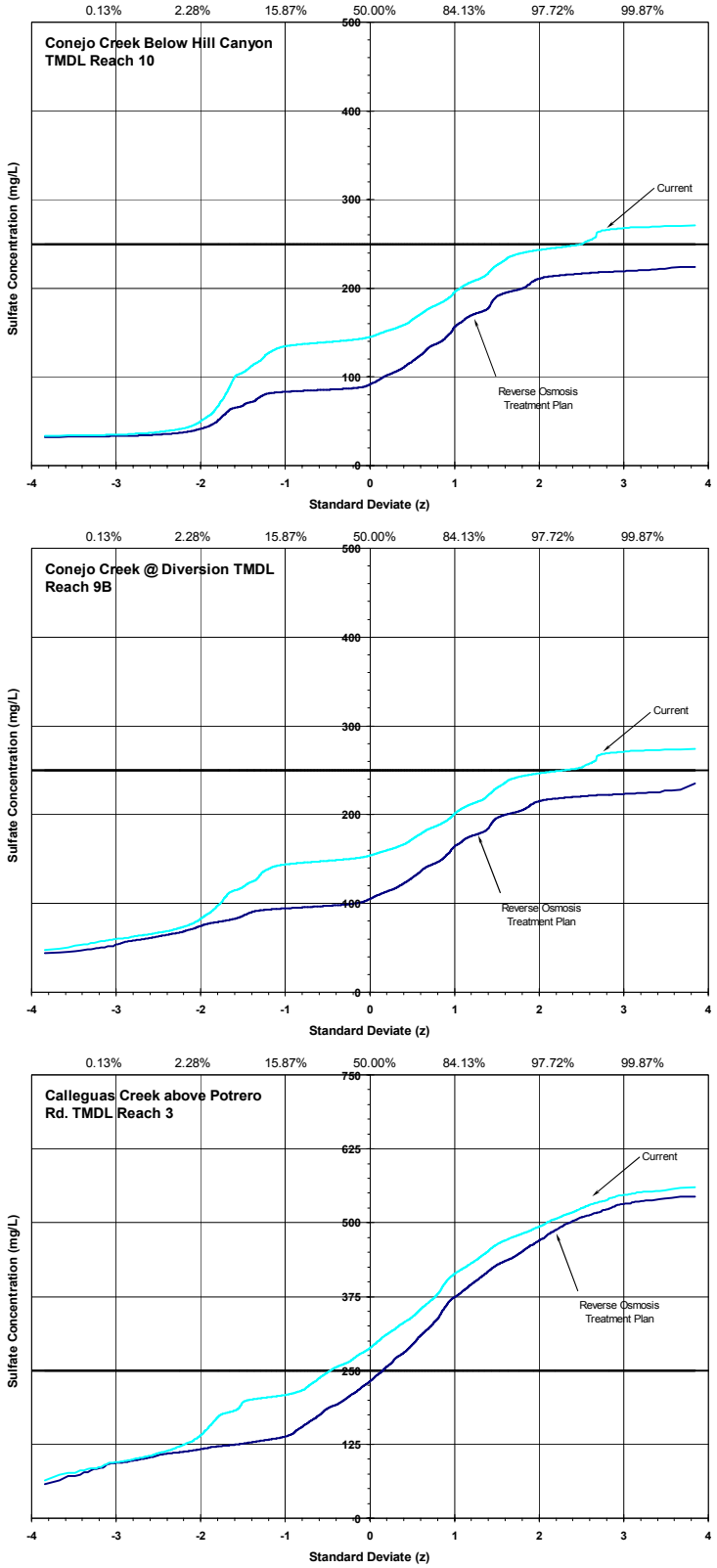

Figure 40: Current and Estimated Probability Distributions of Average Daily Sulfate Concentrations in the Lower CCW Reaches for the Reverse Osmosis Treatment Plan.

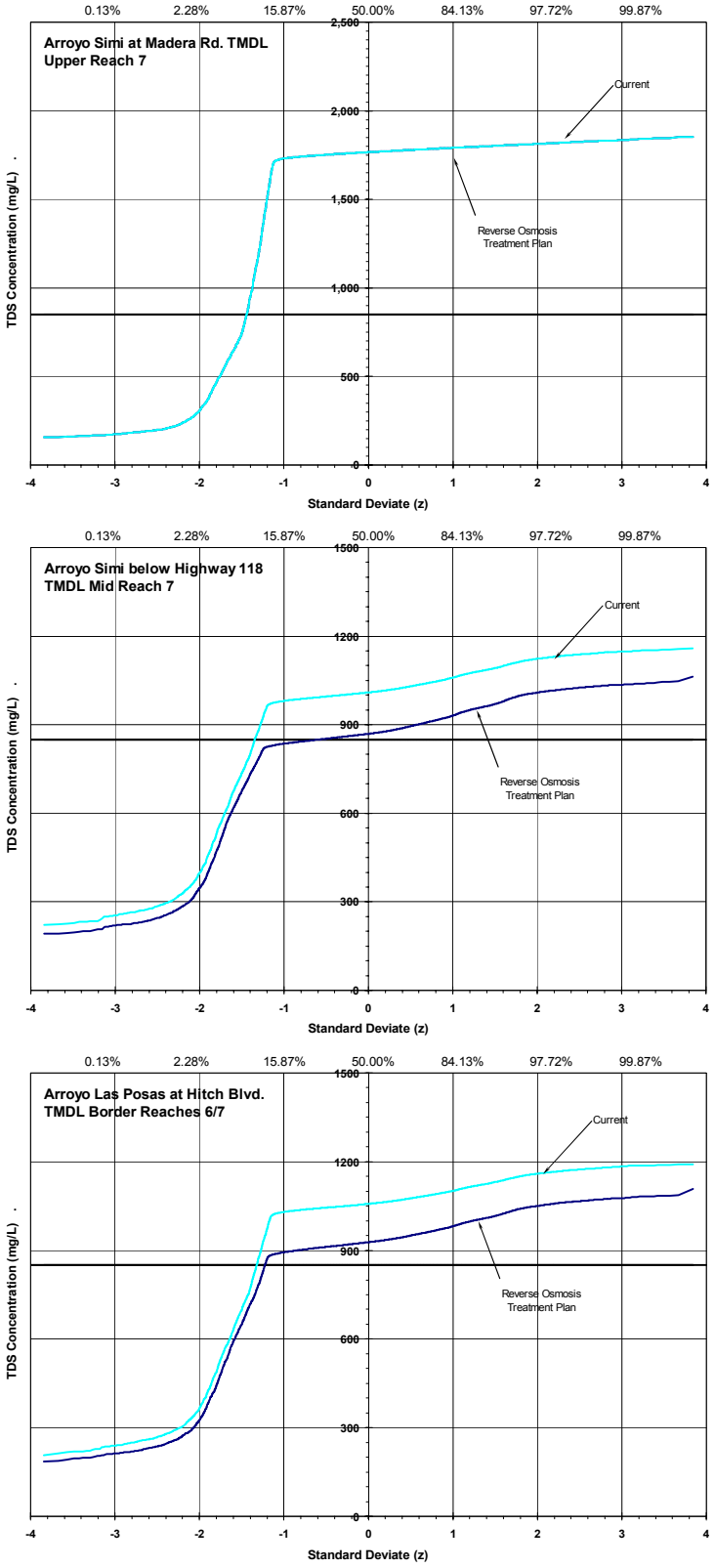

Figure 41: Current and Estimated Probability Distributions of Average Daily TDS Concentrations in Arroyo Simi for the Reverse Osmosis Treatment Plan.

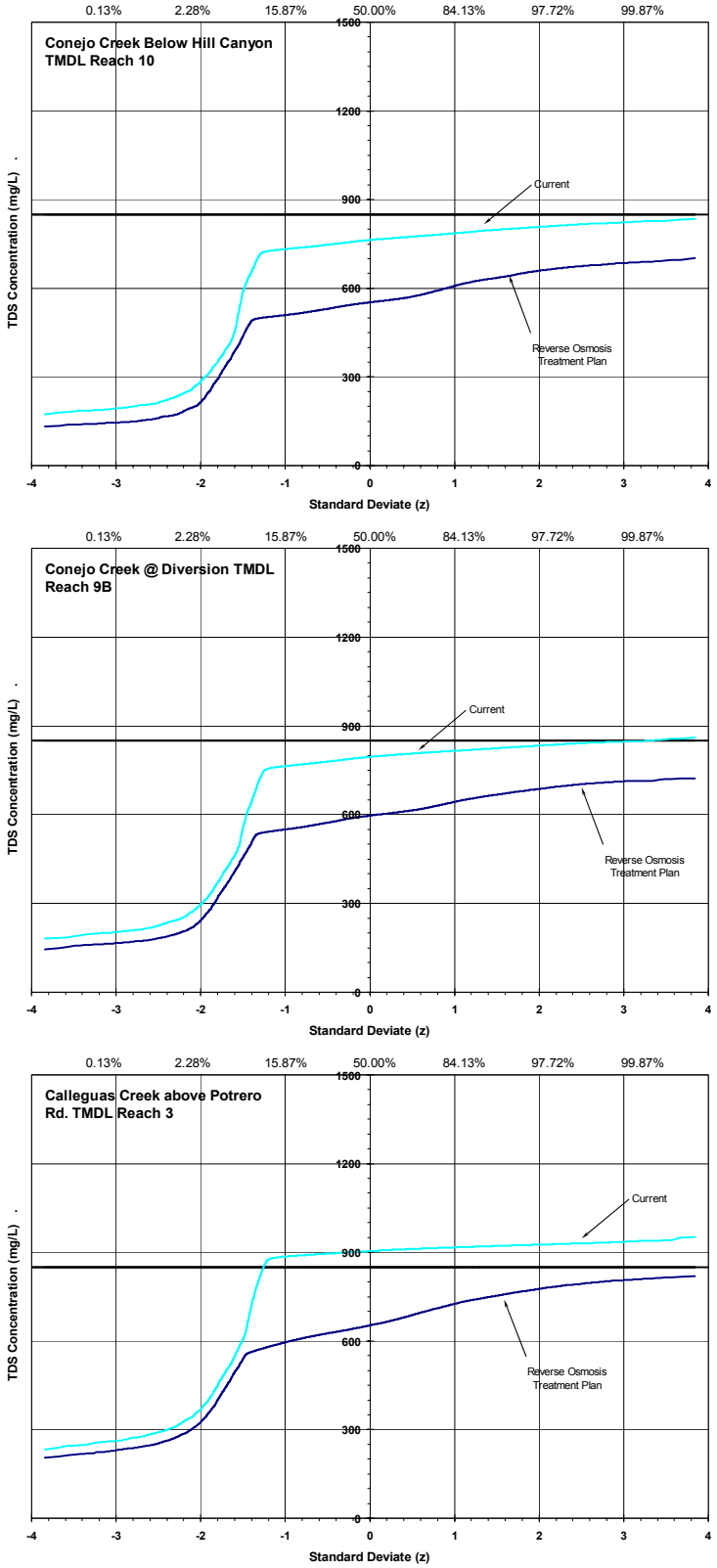

Figure 42: Current and Estimated Probability Distributions of Average Daily TDS Concentrations in the Lower CCW Reaches for the Reverse Osmosis Treatment Plan.

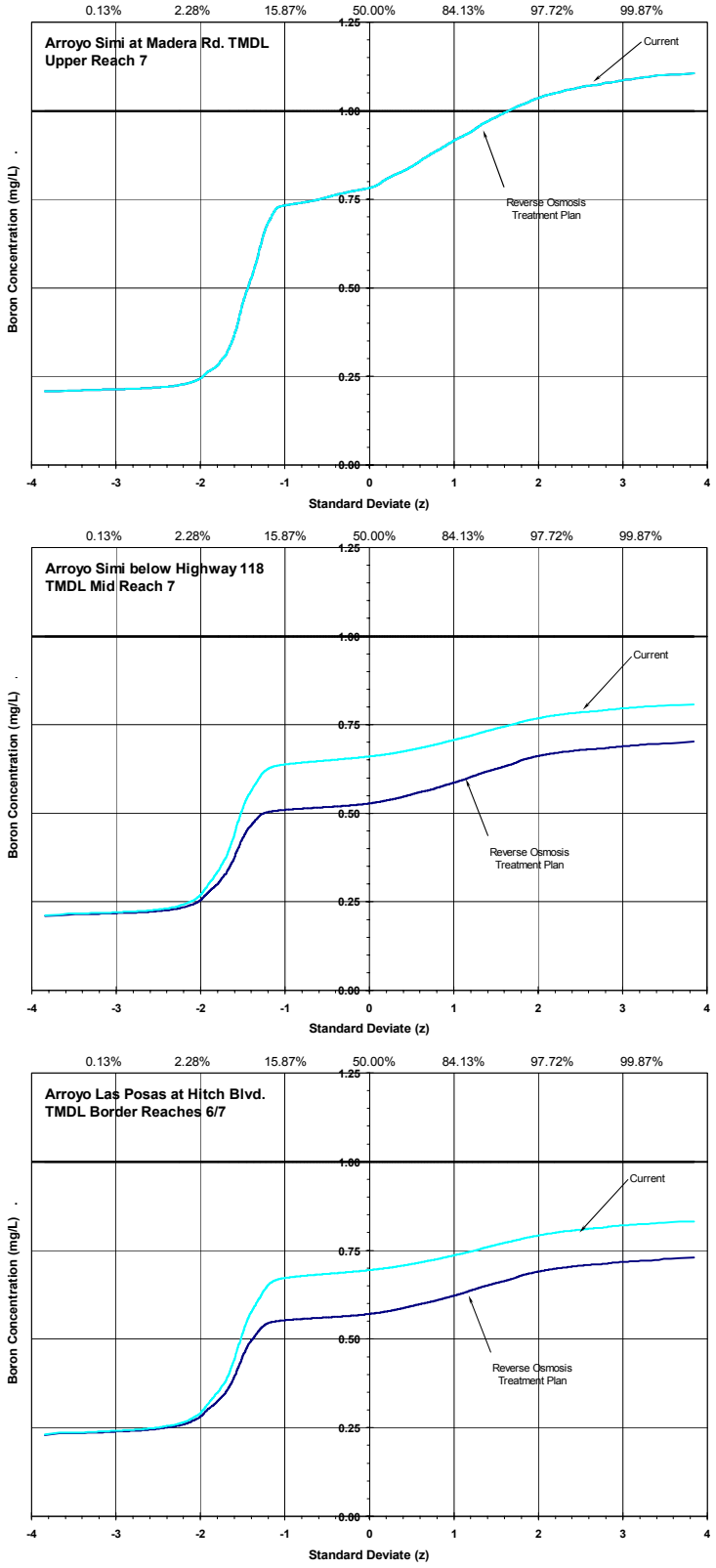

Figure 43: Current and Estimated Probability Distributions of Average Daily Boron Concentrations in Arroyo Simi for the Reverse Osmosis Treatment Plan.

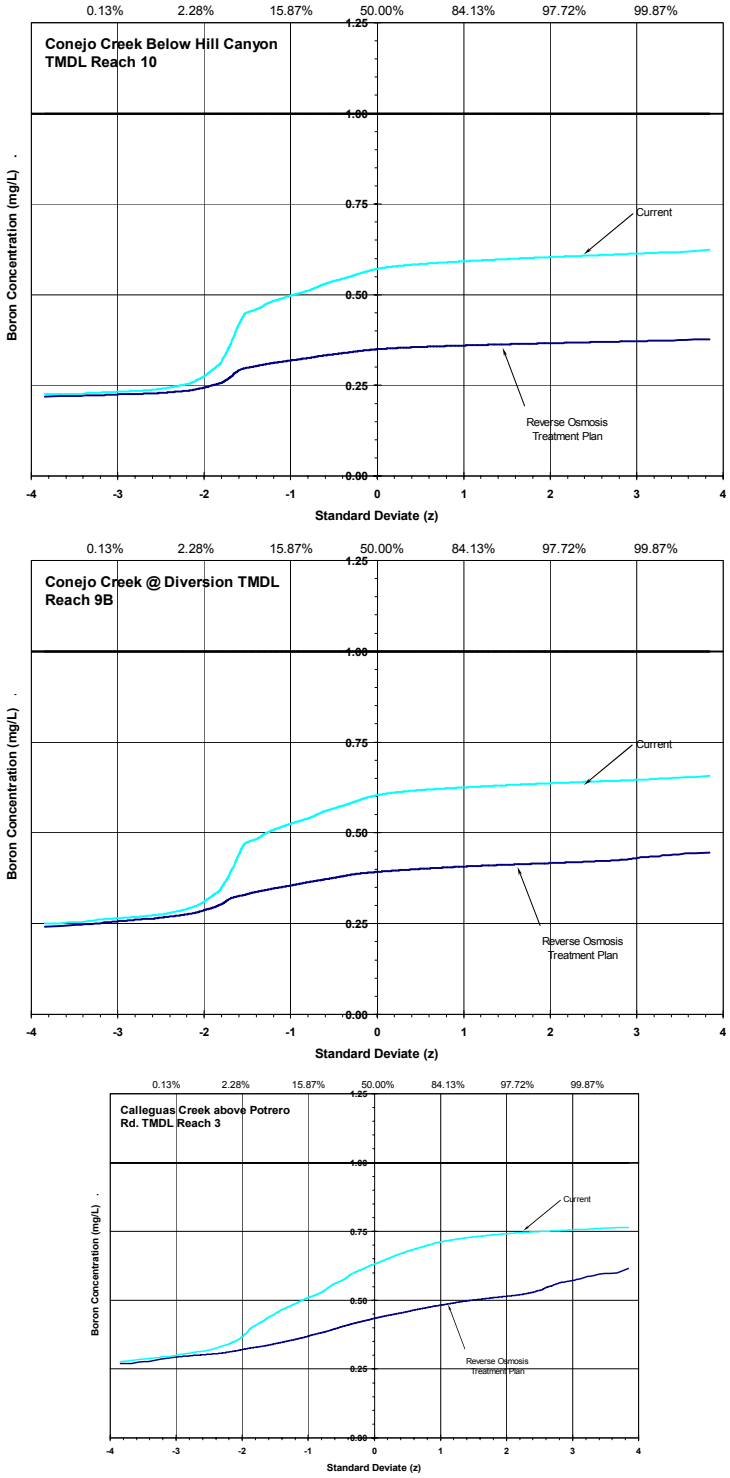

Figure 44: Current and Estimated Probability Distributions of Average Daily Boron Concentrations in the Lower CCW Reaches for the Reverse Osmosis Treatment Plan.

The probability distributions demonstrate that the Reverse Osmosis Treatment Plan will result in compliance with the objectives over 90% of the time for most reaches. However, like the projects, sulfate and TDS will not be in compliance in the Arroyo Simi/Las Posas and chloride, TDS, and sulfate meet objectives much less frequently above Potrero Rd.

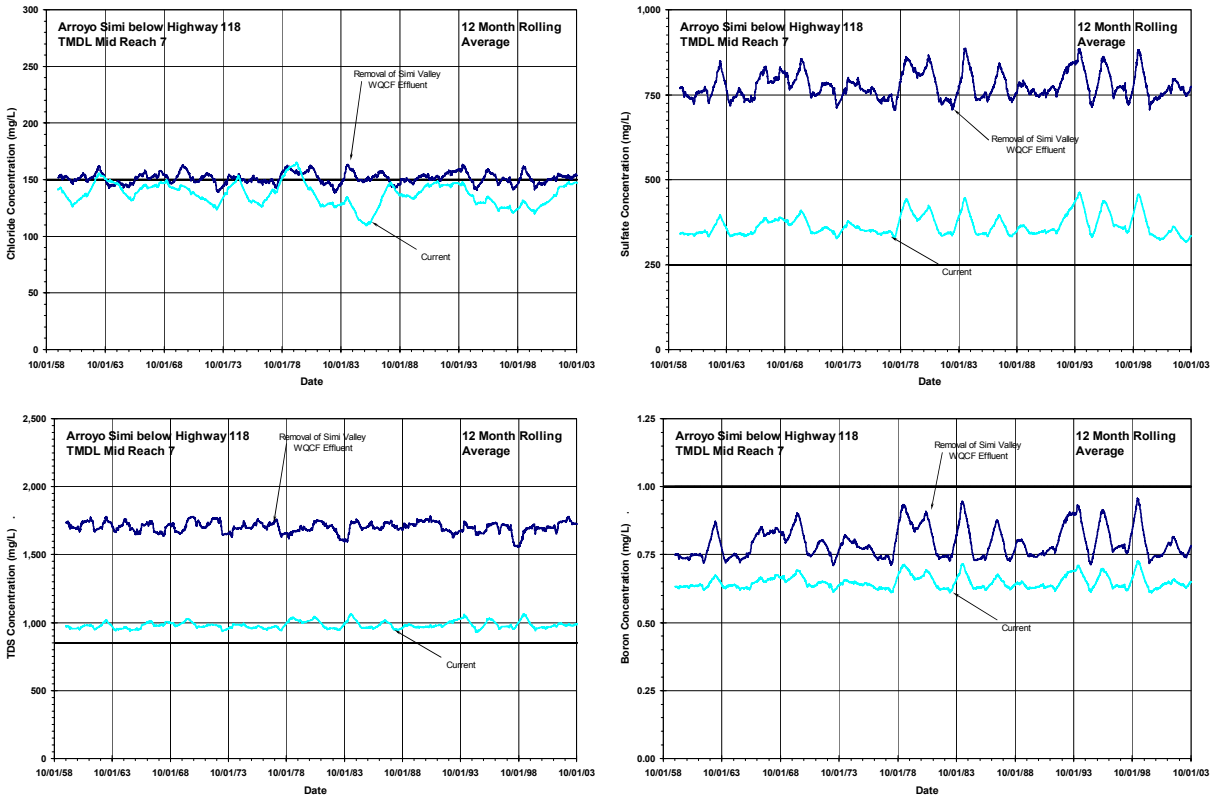

Figure 45. Salts Concentrations in Arroyo Simi at Hwy 118 after Removal of Simi Valley WQCP effluent

The removal of Simi's effluent results in significantly higher concentrations of all salts in the stream downstream of the discharge point. For this reason, this alternative will not be considered in any further analysis of alternatives.

Based on the results of the model, summary tables were developed to show where in the watershed the key objective options are met and exceeded in the watershed after implementation of the projects and the reverse osmosis treatment plan.

Table 22: Objective Status at Locations in the CCW for Current Conditions. [1]

Location	TMDL Reach	Chloride[2]				Sulfate[3]			TDS[4]			Boron[5]		
		D	12	W	C	D	12	W	D	12	W	D	12	W
Upper Watershed														
Arroyo Simi at Madera Rd.	Upper 7	×	×	✓	✓	×	×	×	×	×	×	×	✓	✓
Arroyo Simi below Highway 118	Mid 7	×	×	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Hitch Blvd.	Border 6/7	×	×	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Somis	Mid 6	×	×	✓	✓	×	×	✓	×	×	×	✓	✓	✓
Arroyo Las Posas at Seminary Rd.	Lower 6	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Lower Watershed														
South Fork Arroyo Conejo	13	×	×	✓	×	×	×	✓	×	×	×	✓	✓	✓
Conejo Creek Below Hill Canyon	10	×	×	×	✓	×	✓	✓	✓	✓	✓	✓	✓	✓
Arroyo Santa Rosa	11	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Conejo Creek @ Diversion	9B	×	×	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Conejo Creek at Howard Rd.	9A	×	×	×	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Calleguas Creek above Potrero Rd	3	×	×	✓	✓	×	×	×	×	×	✓	✓	✓	✓
Oxnard Plain														
Revolon Slough	4	×	×	✓	✓	×	×	×	×	×	×	×	×	×

[1] Check indicates reaches meeting the objective, and "x" indicates reaches failing to meet objective.

[2] D = daily concentrations < 150 mg/L, 12 = 12 month rolling average < 150 mg/L, W = 12 month flow weighted average concentrations < 150 mg/L, and C = CCC concentration < 230 mg/L.

[3] D = daily concentrations < 250 mg/L, 12 = 12 month rolling average < 250 mg/L, and W = 12 month flow weighted average concentrations < 250 mg/L.

[4] D = daily concentrations < 850 mg/L, 12 = 12 month rolling average < 850 mg/L, and W = 12 month flow weighted average concentrations < 850 mg/L.

[5] D = daily concentrations < 1.0 mg/L, 12 = 12 month rolling average < 1.0 mg/L, and W = 12 month flow weighted average concentrations < 1.0 mg/L.

Table 23: Objective Status at Locations in the CCW for Banning Future Self-Regenerating Water Softeners and Providing Incentives/Disincentives to Reduce Use of Self-Regenerating Water Softeners. [1]

Upper Watershed Location	TMDL Reach	Chloride[2]				Sulfate[3]			TDS[4]			Boron[5]		
		D	12	W	C	D	12	W	D	12	W	D	12	W
Arroyo Simi at Madera Rd.	Upper 7	×	×	✓	✓	×	×	×	×	×	×	×	✓	✓
Arroyo Simi below Highway 118	Mid 7	×	✓	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Hitch Blvd.	Border 6/7	×	✓	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Somis	Mid 6	×	✓	✓	✓	×	×	✓	×	×	✓	✓	✓	✓
Arroyo Las Posas at Seminary Rd.	Lower 6	×	×	✓	✓	×	×	✓	×	×	✓	×	✓	✓

1 Check indicates reaches meeting the objective, and "x" indicates reaches failing to meet objective.
2 D = daily concentrations < 150 mg/L, 12 = 12 month rolling average < 150 mg/L, W = 12 month flow weighted average concentrations < 150 mg/L, and C = CCC concentration < 230 mg/L.
3 D = daily concentrations < 250 mg/L, 12 = 12 month rolling average < 250 mg/L, and W = 12 month flow weighted average concentrations < 250 mg/L.
4 D = daily concentrations < 850 mg/L, 12 = 12 month rolling average < 850 mg/L, and W = 12 month flow weighted average concentrations < 850 mg/L.
5 D = daily concentrations < 1.0 mg/L, 12 = 12 month rolling average < 1.0 mg/L, and W = 12 month flow weighted average concentrations < 1.0 mg/L.

Table 24: Objective Status at Locations in the CCW for Phase 3 with 4 cfs CMWD Imported Water Released to the North Fork and 3 cfs Released to the South Fork of the Arroyo Conejo. [1]

Lower Watershed Location	TMDL Reach	Chloride[2]				Sulfate[3]			TDS[4]			Boron[5]		
		D	12	W	C	D	12	W	D	12	W	D	12	W
South Fork Arroyo Conejo	13	×	×	✓	✓	×	×	✓	×	×	✓	✓	✓	✓
Conejo Creek Below Hill Canyon	10	×	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓
Arroyo Santa Rosa	11	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Conejo Creek @ Diversion	9B	×	✓	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Conejo Creek at Howard Rd.	9A	×	✓	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓
Calleguas Creek above Potrero Rd	3	×	×	✓	✓	×	×	×	×	×	✓	✓	×	✓

1 Check indicates reaches meeting the objective, and "x" indicates reaches failing to meet objective.
2 D = daily concentrations < 150 mg/L, 12 = 12 month rolling average < 150 mg/L, W = 12 month flow weighted average concentrations < 150 mg/L, and C = CCC concentration < 230 mg/L.
3 D = daily concentrations < 250 mg/L, 12 = 12 month rolling average < 250 mg/L, and W = 12 month flow weighted average concentrations < 250 mg/L.
4 D = daily concentrations < 850 mg/L, 12 = 12 month rolling average < 850 mg/L, and W = 12 month flow weighted average concentrations < 850 mg/L.
5 D = daily concentrations < 1.0 mg/L, 12 = 12 month rolling average < 1.0 mg/L, and W = 12 month flow weighted average concentrations < 1.0 mg/L.

Table 25: Objective Status at Locations in the CCW for the Reverse Osmosis Treatment Plan. [1]

Location	TMDL Reach	Chloride[2]				Sulfate[3]			TDS[4]			Boron[5]		
		D	12	W	C	D	12	W	D	12	W	D	12	W
Upper Watershed														
Arroyo Simi at Madera Rd.	Upper 7	×	×	✓	✓	×	×	×	×	×	×	×	✓	✓
Arroyo Simi below Highway 118	Mid 7	✓	✓	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Hitch Blvd.	Border 6/7	✓	✓	✓	✓	×	×	×	×	×	×	✓	✓	✓
Arroyo Las Posas at Somis	Mid 6	×	✓	✓	✓	×	×	✓	×	×	×	✓	✓	✓
Arroyo Las Posas at Seminary Rd.	Lower 6	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Lower Watershed														
South Fork Arroyo Conejo	13	×	×	✓	×	×	×	✓	×	×	×	✓	✓	✓
Conejo Creek Below Hill Canyon	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Arroyo Santa Rosa	11	×	×	✓	✓	×	×	✓	×	×	×	×	×	✓
Conejo Creek @ Diversion	9B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Conejo Creek at Howard Rd.	9A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Calleguas Creek above Potrero Rd	3	×	×	✓	✓	×	×	×	✓	✓	✓	×	✓	✓
Oxnard Plain														
Revolon Slough	4	×	×	✓	✓	×	×	×	×	×	×	×	×	×

[1] Check indicates reaches meeting the objective, and "x" indicates reaches failing to meet objective.
[2] D = daily concentrations < 150 mg/L, 12 = 12 month rolling average < 150 mg/L, W = 12 month flow weighted average concentrations < 150 mg/L, and C = CCC concentration < 230 mg/L.
[3] D = daily concentrations < 250 mg/L, 12 = 12 month rolling average < 250 mg/L, and W = 12 month flow weighted average concentrations < 250 mg/L.
[4] D = daily concentrations < 850 mg/L, 12 = 12 month rolling average < 850 mg/L, and W = 12 month flow weighted average concentrations < 850 mg/L.
[5] D = daily concentrations < 1.0 mg/L, 12 = 12 month rolling average < 1.0 mg/L, and W = 12 month flow weighted average concentrations < 1.0 mg/L.

As shown in the tables, very few reaches consistently meet the current Basin Plan objectives with these proposed projects or reverse osmosis treatment. However for these proposed projects, the 12 month rolling average is more consistently met for chloride in most reaches, and sulfate and TDS in some reaches. The reverse osmosis treatment plan generally results in similar compliance with chloride objectives as these proposed projects downstream of the POTWs. However, the reverse osmosis plan results in more compliance with TDS and sulfate objectives downstream of the POTWs. Upstream of the Hill Canyon WTP, these projects result in improved water quality whereas the reverse osmosis treatment plan does not impact water quality in the reaches upstream of POTWs. Arroyo Santa Rosa and Revolon Slough consistently do not meet any of the possible objectives because the projects and reverse osmosis treatment do not address those reaches. However, the discontinuation of the Olsen Rd. WTP discharge to the Arroyo Santa Rosa has resulted in minimal if any flows in the reach, and may have resolved the salts impairment for the Arroyo Santa Rosa.

7.3.1.1. Chloride TMDL Model

The Chloride TMDL Model was also used to assess the scenarios shown in Table 21. The following tables summarize the locations in the stream where water quality is modeled and where the instantaneous objectives are met. Because the model is static, 12 month rolling averages and flow-weighted averages cannot be calculated.

Table 26. Reaches Meeting Basin Plan Objective Based on Chloride TMDL Model After Implementation of Final Phase of Projects

	Routine Critical				Long Term Critical			
	Chloride	TDS	Sulfate	Boron	Chloride	TDS	Sulfate	Boron
Conditions, USGS gauge Arroyo Simi	×	×	×	✓	×	×	×	✓
Conditions, outflow to Reach 6	✓	×	×	✓	✓	✓	×	✓
Conditions, USGS gauge Conejo Ck.	✓	✓	✓	✓	✓	✓	✓	✓
Conditions at proposed diversion	✓	✓	✓	✓	✓	✓	✓	✓
Conditions, outflow to Reach 3	✓	✓	✓	✓	✓	✓	✓	✓
Conditions, USGS gauge Potrero Rd.	×	×	×	✓	×	×	×	✓

Table 27. Reaches Meeting Basin Plan Objective Based on Chloride TMDL Model After Implementation of Reverse Osmosis Treatment Plan

	Routine Critical				Long Term Critical			
	Chloride	TDS	Sulfate	Boron	Chloride	TDS	Sulfate	Boron
Conditions, USGS gauge Arroyo Simi	×	×	×	✓	×	×	×	✓
Conditions, outflow to Reach 6	✓	✓	×	✓	✓	✓	×	✓
Conditions, USGS gauge Conejo Ck.	✓	✓	✓	✓	✓	✓	✓	✓
Conditions at proposed diversion	✓	✓	✓	✓	✓	✓	✓	✓
Conditions, outflow to Reach 3	✓	✓	✓	✓	✓	✓	✓	✓
Conditions, USGS gauge Potrero Rd.	×	×	×	✓	×	×	×	✓

Based on the tables above, neither the proposed projects nor the reverse osmosis treatment plan would result in all reaches meeting the Basin Plan objectives under the two defined critical conditions. The proposed projects result in more reaches meeting the chloride and sulfate objectives and fewer reaches meeting the TDS objectives under all conditions. The purpose of using the TMDL Model was to evaluate the results of the CCMS as compared to the model that had been used to adopt the EPA Chloride TMDL. As shown above, the CCMS allows a more detailed analysis of watershed conditions. The CCMS provides information on how often different types of objectives are exceeded in the watershed and how long exceedances last. Also, different averaging periods for the objectives and receiving water concentrations can be examined.

The CCMS model appears to be more conservative than the TMDL model. The TMDL model predicted more reaches would meet the Basin Plan objectives than the CCMS model.

7.3.1.2. Protection of Beneficial Uses

The projects contain provisions for providing alternative water supplies to sensitive agricultural uses as necessary. Additionally, the majority of agriculture uses groundwater as the primary irrigation source. Both projects will be improving the quality of the groundwater basins through pumping and treating poorer quality groundwater and creating room for higher quality storm water flows to recharge the basins.

The Reverse Osmosis Treatment plan protects agriculture that uses irrigation water directly from the stream system. However, it does not address agriculture that uses groundwater as an irrigation source and does not have provisions for providing alternative water supplies. Although groundwater recharge from surface waters would be of higher quality, because the basins are currently full, the recharge would have little impact on the groundwater basins.

7.3.1.3. Ability to Meet EPA Chloride TMDL WLAs

The final analysis of the proposed projects was the ability of the projects to meet the proposed waste load (WLA) and load allocations (LA). For the purpose of this analysis, the only WLA and LAs examined were those that required a reduction in loadings in the TMDL. The WLAs and LAs examined (for drought conditions) are included in the following table along with a summary of those met by the proposed projects.

Table 28. Summary of Project's Ability to Meet the EPA Chloride TMDL WLAs and LAs

Discharge	WLA or LA (lb/day)	Project Meet WLA/LA?	Notes
Simi Dewatering Wells	1200	Yes	The groundwater may be removed from the stream so the WLA would be met if that occurs.
Simi Valley WQCP	9200	Possibly	The estimated reductions in loads from water softener controls have the possibility to result in compliance with the WLAs if they are completely successful.
Moorpark WRP	1600	Yes	Moorpark does not regularly discharge to the stream so the WLA would be met.
Conejo pumped gw	330	No	The projects do not address this source so it is unlikely the WLAs would be met.
Hill Canyon WTP	9700	Yes	Hill Canyon WTP's effluent will be removed from the stream so the WLA will be met.
Camarillo WRP	2200	Yes	Camarillo WRP's effluent will be removed from the stream so the WLA will be met.
Groundwater discharge near Conejo	1000	Unknown	Groundwater in this area will be pumped and treated. If this pumping reduces discharge of groundwater to the stream, then the LA may be met.
Agricultural discharge	1300	No	The projects may improve the quality and reduce the quantity of the water supplied to agriculture in this area, but it is unlikely this will reduce the discharges sufficiently to meet the proposed reductions.
Camrosa WRP	1500	Yes	Camrosa will not discharge to the stream so the WLA will be met.
Groundwater discharge near Camrosa	1500	Unknown	Groundwater in this area will be pumped and treated. If this pumping reduces discharge of groundwater to the stream, then the LA may be met.

7.4. Summary of Project Analysis

Based on the two models examined, the proposed projects will result in an improvement in water quality over current conditions for all reaches influenced by the projects. Upstream of the introduction of higher quality water to the stream in Arroyo Conejo and the Simi Valley WQCP, improvements in water quality will not likely be seen. Additionally, the projects will not significantly impact water quality in Revolon Slough or Arroyo Santa Rosa.

The modeling demonstrates that the projects will not result in compliance with the Basin Plan objectives at all times, but may result in compliance with a 12 month rolling average objective, except for TDS and sulfate in Arroyo Simi and on Calleguas Creek at Potrero Rd. Additionally, the projects will result in significant improvements in local water resources and will improve the salt balance in the watershed.

Although reverse osmosis treatment of wastewater effluent provides some water quality improvements, it will not result in compliance with all salts objectives, does not provide the additional benefits of these proposed projects (such as improvements in local supply), and does not address all of the impacts of salts on beneficial uses. Additionally, reverse osmosis results in significantly less salt removal from the watershed, and requires significant energy resource consumption. The following table compares these additional impacts for these projects and reverse osmosis treatment.

Table 29. Summary of Impacts of Proposed Projects as Compared to Reverse Osmosis Treatment

Impact	Proposed Projects	Reverse Osmosis Treatment
Additional Local Water Resources	30 mgd	None
Pounds of Salt Removed from Watershed (Salt Balance)	370,000 lbs/day	55,000 lbs/day
Ability to Protect Beneficial Uses	Targets the beneficial use impacts	May not address all of the impacts on beneficial uses
Ability to Meet Current Water Quality Objectives in Stream	Will not meet the current objectives in all reaches	Will not meet the current objectives in all reaches
Other Impacts	Requires SSOs	SSOs may be required; Requires large amounts of energy

8. Conclusions

Based on the analysis presented above, the following conclusions and recommendations are made for the water quality objectives, beneficial uses, and implementation projects.

1. The current instantaneous maximum objectives in the Basin Plan are not appropriate for protection of the beneficial uses. It is recommended that analysis be conducted to determine an appropriate averaging period for the Basin Plan objectives.

2. The most sensitive aspects of the beneficial uses (i.e. avocado agriculture) do not occur in all areas of the watershed. It is recommended that the objectives take into account the varying sensitivities of the beneficial uses and naturally occurring conditions in the watershed and site-specific objectives be defined for some reaches in the watershed (specifically Reaches 3,4,5,6, 7, 8,12, and 13 and the upper portions of Reach 7).

3. The proposed projects provide water quality improvement, water resource benefits, and a flexible management approach to allow protection of beneficial uses. Implementation of the proposed projects in combination with the revisions to the water quality objectives listed above are likely to resolve the salts impairments in the watershed.

4. The proposed projects have significant benefits over Reverse Osmosis Treatment including increased local water supplies, higher watershed salt load removal, and more effective mechanisms for protecting beneficial uses.

5. The management plan is consistent with the EPA's chloride implementation plan criteria.

6. The monitoring plan data and the modeling tools that have been developed for the watershed will aid in developing recommendations for site-specific WQ standards where necessary and the criteria for any recommended averaging periods for the concentrations of various salts.

9. Next Steps

Following are the proposed next steps:

1. The CEQA process to implement the management plan for the lower reaches of the CCW has begun and is scheduled for completion early next year.
2. Necessary permit applications will be submitted following completion of CEQA.
3. Implementation of Phase 1 of the lower CCW plan is anticipated to be complete within 3 years.
4. Much of the monitoring portion of Phase1 of the lower CCW plan will be implemented within one year.
5. A SSO Work plan will be developed and submitted to the Regional Board for review and approval. Following approval, work will begin on the development of SSOs for the CCW.
6. The plan anticipates that as phases are implemented and data gathered, it may not be a necessary to develop TMDLs for TDS, sulfates, and boron. However, sufficient data should be available to develop TMDLs if necessary in a timely manner.
7. A second progress report will be provided to the EPA and the LARWQCB in June 2005 that will include the following:
    - Results of additional data gathering and modeling on all salts of concern
    - Detailed schedule for implementation of Phase1 of the lower CCW plan
    - Schedule of tasks related to implementation of Phases 2 and 3 of the lower CCW plan
    - A working watershed salts balance model for the lower reaches to be used as the key salt management tool on the lower watershed.
    - Summary of progress towards developing SSOs
    - Summary of outstanding issues, new developments and recommendations for additional actions.

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Appendix A

Description of CCMS

Technical Memorandum

LARRY WALKER ASSOCIATES

DATE: February 25, 2004

TO: File

CC:

SUBJECT: CCMS Computational Element

DRAFT

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Introduction

The framework for the salts modeling effort is a numerical mass balance water quality model originally developed for use in the Calleguas Creek nutrient TMDL effort. The spreadsheet-based mass balance model was accepted by State and Federal regulatory authorities for use in the nutrient TMDL process for the Calleguas Creek Watershed (CCW). Recently, the model has been linked to a water quality database and to extensive GIS-based information via a graphical user interface (GUI). The resulting decision support system is called the *Calleguas Creek Modeling System* (CCMS). The GUI permits access to the model, database, and GIS information via on-screen menu selection or mouse clicks on map features, allowing interactive model manipulation, querying of water quality data, and display of numerous layers of geo-referenced data. The GUI allows the user to interactively modify model parameters, evaluate pollution control scenarios, and display results in tabular and graphical form. Data queried from the database may be displayed in tabular or graphical form, or exported to a spreadsheet for manipulation and analysis.

The water quality simulation component of the CCMS is built on a spreadsheet mass balance model. To model the CCW, the entire watershed is divided into 15 subwatersheds based on drainages to sampling locations and significant tributaries. A computational element is assigned to each subwatershed for calculating the changes in stream flow and water quality due to processes present along stream reaches circumscribed by the sub-watersheds. To further facilitate the decision support capabilities of the CCMS, the model is being expanded to accommodate stochastic input, which will allow calculation of the likely distribution of in-stream salts concentrations and allow the CCMS to function in a dynamic modeling capacity. For the remainder of the discussion, dynamic modeling is used in the sense of continuous simulation/Monte Carlo modeling as discussed in the *Technical Support Document for Water Quality-based Toxic Control* commonly referred to as the TSD (EPA, 1991). Calculation procedures used in the dynamic modeling aspect of the CCMS are the focus of the following discussion. Specifically, the CCMS is being

expanded to allow statistical calculation of salts through out the CCW. Salts of interest include: chloride, total dissolved solids (TDS), sulfate, and boron. Hardness is included in the static CCMS, however the limited hardness data available preclude performing dynamic calculations for hardness. The details of both calculation procedures for modeling water flows and salts concentrations as used in both the original static and newly extended dynamic versions of the CCMS are discussed below.

Water Sources and Salts Loading to the Watershed

Precipitation, deep aquifer transfers, and imported water are all major sources of water to the watershed. Because precipitation carries negligible salts (LWA, 2003), deep aquifer and imported water are the major source of salts loading to the watershed (LWA, 2004a). Deep aquifer transfer and use in the CCW are currently addressed in the model as part of the urban and agriculture runoff. Incorporation of precipitation and imported water within the CCMS is discussed below.

Precipitation

Historical records for precipitation are used as input to the CCMS that serve to drive the continuous simulation. Precipitation stations located in the CCW are displayed in Figure 46. General statistics for the stations are listed in Table 30. Polygons are included in Figure 46 representing the area of influence for each station. The CCMS subwatersheds are overlaid on the Figure and the fractions of the total subwatershed area covered by each precipitation station are listed in Table 31. The arithmetic-mean method is used in the model for determining the areal precipitation for each subwatershed (Chow et al., 1988). Areal precipitation values for a subwatershed are calculated by using the percent of subwatershed area listed in Table 31 to form a weighted average of the precipitation measurements recorded at the local gages. As an example, the calculation to determine precipitation for subwatershed 8, corresponding to the Arroyo Santa Rosa, is calculated as Equation (3).

$$\text{precip. subwatershed } 8 = \text{gage}_{141} \cdot 0.0419 + \text{gage}_{192} \cdot 0.6262 + \text{gage}_{227} \cdot 0.2749 + \text{gage}_{49} \cdot 0.0568 \qquad (3)$$

Precipitation driven flows are calculated in the CCMS by the rational method (Chow et al., 1988). Combining the calculated precipitation with the runoff coefficient listed in Table 36, the estimated wet weather runoff from the various land use types in a watershed may be calculated. The fraction of the total subwatershed area comprising the various land use types listed in Table 40 are used to form a weighted average precipitation driven runoff. Runoff from urban, agricultural, and open space land-use areas are calculated separately. Details of the calculations for each land-use type are presented in subsequent sections corresponding to each considered land-use.

For each daily time step, the daily precipitation is calculated and stored using the above procedure for each of the CCMS subwatersheds based on the historic rainfall records. Summaries of available data for each precipitation station are presented in Table 30. The number of consecutive rain days and number of antecedent dry days are calculated and stored for each subwatershed depending on whether there was or was not rain during the previous time step, respectively. Calculation of the consecutive days of rain and antecedent dry days allow for modification of runoff parameters. Details of runoff calculations are provided in the subsequent sections.

Table 30: Precipitation Station General Statistics. See Figure 46 for Station Location within the CCW.

Station ID	Start Date	End Date	Average Annual (in) [a]	Max Daily Precip (in)
128	1/21/1943	2/26/2004	15.20	5.74
141	10/18/1948	3/2/2004	14.58	5.54
154	10/11/1947	3/2/2004	14.71	4.88
169	12/5/1956	3/2/2004	16.24	5.52
177	1/5/1957	3/2/2004	12.71	5.02
187	1/27/1956	2/26/2004	33.20	6.05
188	1/21/1956	3/2/2004	14.97	6.58
189	1/21/1956	2/3/2004	16.01	5.14
190	11/14/1955	2/3/2004	15.31	5.02
191	11/14/1955	2/3/2004	17.47	5.25
192	11/14/1955	2/4/2004	14.04	5.07
193	12/4/1980	2/4/2004	29.26	4.9
194	11/14/1955	2/3/2004	12.93	5.27
196	11/6/1977	2/4/2004	20.23	5.1
206	11/4/1960	2/6/2004	17.23	4.31
219	10/28/1964	2/26/2004	14.43	4.2
223	10/13/1946	1/28/2004	12.07	4.77
227	9/19/1966	2/4/2004	28.49	4.75
234	10/4/1968	2/4/2004	30.50	4.7
238	11/5/1970	2/3/2004	20.85	8.7
239	12/4/1972	9/29/2002	16.46	4.98
242	10/25/1971	2/3/2004	43.16	5.61
250	10/20/1976	2/3/2004	19.68	4.76
259	10/1/1981	1/3/2004	14.07	4.46
263	10/17/1984	2/3/2004	11.87	3.77
3	10/21/1902	7/12/1992	13.22	4.6
49	1/16/1929	1/28/2004	13.68	4.7

[a] Average based on annual precipitation for period of record for individual precipitation stations.

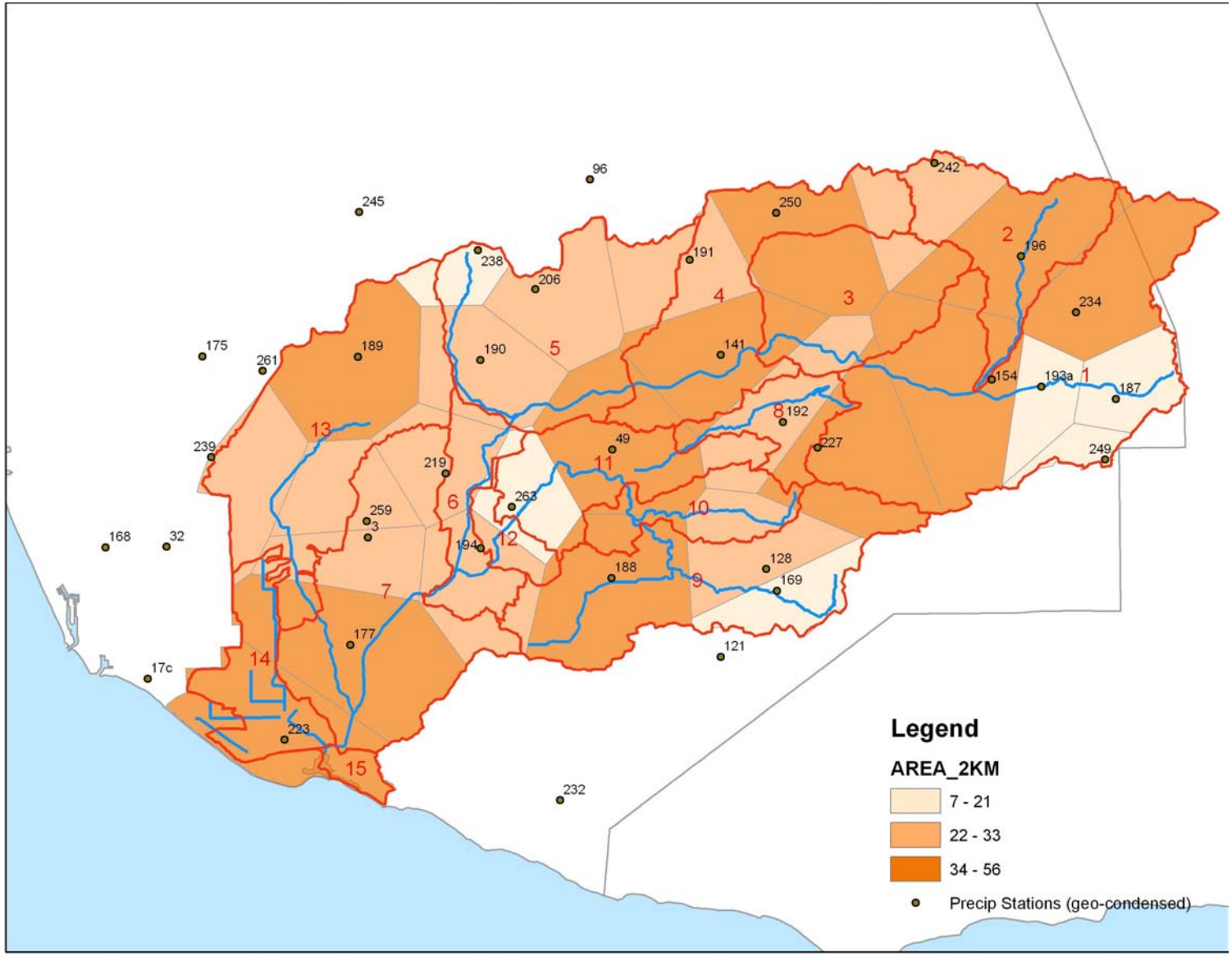

Figure 46: Precipitation Stations in the CCW with Area of Influence Superimposed on CCMS Subwatershed Boundaries.

Table 31: Precipitation Coverage of the CCW Subwatersheds.

Subwatershed [a]	Annual Average Precipitation (in)		Station ID [a]	Percent of Subwatershed
	1984 – 2002	1992 – 2002		
1	16.7	18.4	154	22.23
			187	10.99
			192	0.060
			193a	9.63
			196	18.00
			227	13.08
			234	19.05
			242	6.85
3	17.7	20.0	141	12.5
			154	12.02
			191	0.44
			192	14.71
			196	10.75
			227	1.5
			242	9.12
			250	38.96
4	17.0	19.3	141	38.67
			191	18.22
			192	2.03
			242	10.4
			250	22.9
			49	7.74
5	17.1	19.1	141	1.25
			190	27.01
			191	15.74
			206	33.34
			238	9.82
			263	0.18
			49	12.62
6	13.9	15.6	190	7.98
			194	49.05
			219	37.27
			263	5.69
7	13.7	15.6	177	45.81
			194	11.43
			219	11.45
			223	6.34
			259	24.88 [b]
			3	

continued

Table 31 continued

Subwatershed [a]	Annual Average Precipitation (in)		Station ID [a]	Percent of Subwatershed
	1984 – 2002	1992 – 2002		
8	15.1	16.8	141	4.19
			192	62.62
			227	27.49
			49	5.68
9	15.3	17.2	128	21.38
			169	19.93
			188	42.48
			194	4.05
			227	11.87
10	15.2	16.9	128	39.05
			188	22.06
			192	12.5
			227	7.13
			49	19.26
11	14.1	15.7	188	3.02
			192	11.85
			263	32.34
			49	52.78
12	13.2	14.6	188	8.08
			194	48.22
			219	1.74
			263	41.96
13	15.5	17.7	177	4.29
			189	39.15
			190	6.99
			219	2.98
			238	3.13
			239	23.13
			259	20.31 [b]
			3	
14	13.5	15.5	177	23.38
			223	69.69
			239	2.31
			259	4.61 [b]
			3	
15	13.4	15.3	223	99.72

[a] Subwatershed boundaries and precipitation stations displayed in Figure 46.
[b] Station 3 data used for dates prior to Sept. 30, 1992 and station 259 data used for all latter dates.

As is evidenced by the start dates for the precipitation stations in Table 30, several gages have limited historical records. To facilitate use of all stations in displayed in Figure 46, regressions for precipitation

amounts for stations with limited records based on adjacent stations with richer data sets are used to estimate the unknown precipitations. Developed regressions for each affected station are listed in Table 32. Using the regressions in Table 32 allows simulation of precipitation in the watershed from January 5th, 1957 to January 3rd, 2004. If all gages in one of the regressions report zero precipitation, regression not evaluated, and zero precipitation is used for the estimate.

Table 32: Regressions Estimating Precipitation at Locations Prior to Historical Data. (1)

Station ID	Historical Data Start Date	r^2	Regression(2)
193	Dec. 4, 1980	0.956	$0.6229*gage_{154} + 0.3338*gage_{187} + 0.1664*GausDev$
196	Nov. 6, 1977	0.918	$0.6959*gage_{154} – 0.0049*gage_{187} + 0.7912gage_{191} + 0.2641*GausDev$
206	Nov. 4, 1960	0.972	$0.3191*gage_{189} + 0.3709*gage_{190} + 0.3550*gage_{191} + 0.142*GausDev$
219	Oct. 28, 1964	0.937	$0.3103*gage_{190} + 0.5434*gage_{194} + 0.1357*gage_{3} + 0.176*GausDev$
227	Sep. 19, 1966	0.920	$0.4070*gage_{128} + 0.1223*gage_{169} + 0.4142*gage_{192} + 0.120*GausDev$
234	Oct. 4, 1968	0.943	$0.5325*gage_{154} + 0.3916*gage_{187} +0.1861*GausDev$
238	Nov. 5, 1970	0.874	$0.5508*gage_{189} + 0.3166*gage_{190} + 0.3735*gage_{191} + 0.364*GausDev$
239(3)	Dec. 4, 1972	0.936	$0.5294*gage_{189} + 0.2136*gage_{190} + 0.2621* gage_{3} + 0.195*GausDev$
242	Oct. 25, 1971	0.916	$0.1306*gage_{154} + 0.2758*gage_{187} + 0.7912*gage_{191} + 0.292*GausDev$
250	Oct. 20, 1976	0.965	$0.1733*gage_{141} + 0.9116*gage_{191} + 0.175*GausDev$
263	Oct. 17, 1984	0.935	$0.7422*gage_{194} + 0.1166*gage_{49} + 0.146*GausDev$

(1) Listed regressions valid from January 5, 1957 to date listed in "Historical Data Start Date".
(2) Calculation performed only if at least one station in regression listed greater than zero precipitation.
(3) Regression also used post September 29, 2002.

Imported Water Supplies

Imported water from the State Water Project and Freeman Diversion are accountable for essentially all the imported surface water. Deep groundwater wells drawing water from the lower confined aquifer underlying the CCW are producing water from the Fox Canyon Aquifer which is replenished with water from outside the watershed. Currently, only State Water Project water delivered from the Calleguas Municipal Water District is considered explicitly in the dynamic CCMS.

Water delivery rates to the subwatersheds in the CCW should influence the dry-weather urban and agricultural runoff rates. Typically, in the summer months, water deliveries far exceed the winter month deliveries. The seasonal variations will be included in future versions of the CCMS.

Water quality of the source water directly influences the water quality of POTW effluents, which are major inputs to the surface waters in the CCW. Where possible, regression relations are used in the dynamic CCMS to estimate POTW effluent salts concentrations based on Jensen Road water plant salts water quality. Direct use of historical source water quality from the Jensen Road water plant is used in the dynamic model when data are available. Monthly monitoring data for chloride, sulfate, and TDS are used as constant water quality for each month where data are available. Quarterly monitoring of boron is used as constant water quality of each quarter where data are available. Chloride and sulfate concentrations measured at the Jensen Plant are presented in Figure 47. All salts data for the Jensen Plant are displayed in Figure 48. Regressions between source water quality and POTW effluent quality for chloride and sulfate

were statistically sound and included in the dynamic CCMS. The equations used to relate imported water quality to POTW effluent are detailed in the POTW section below.

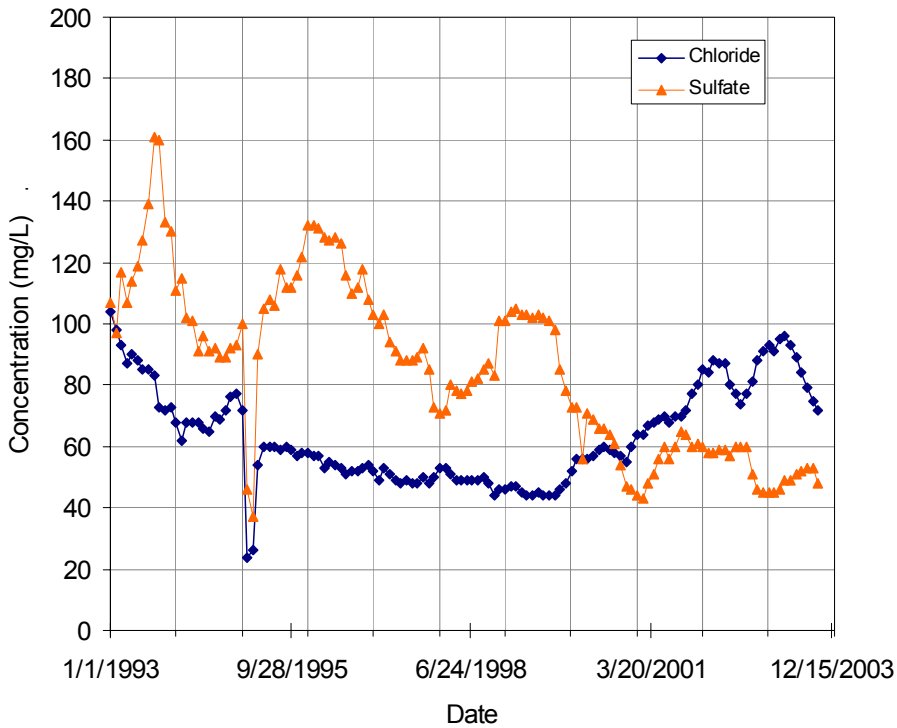

Figure 47: Chloride and Sulfate Concentrations Measured at the CMWD Jensen Plant.

Because the State Water Project water originates in the Sacramento Delta, regressions of water quality with the precipitation levels in Sacramento were investigated. Only the annual average concentration of chlorides exhibited reasonably strong correlation with Sacramento precipitation. For modeling dates prior to the range of available measured water quality, distributions are used to estimate TDS, sulfate, and Boron, Equations (4) - (6), respectively. The developed regression used to estimate chloride concentration based on the average of the second and third previous annual precipitation measurements in Sacramento, CA is presented as Equation (7).

$$\mathrm{TDS}_{\mathrm{supply}} = 328.65 \cdot exp\{0.142 \cdot \mathrm{GausDev}\} \tag{4}$$

$$\mathrm{SO}_4^{2-}{}_{\mathrm{supply}} = 81.02 \cdot exp\{0.348 \cdot \mathrm{GausDev}\} \tag{5}$$

$$\mathrm{B}^{-}_{\mathrm{supply}} = 0.263 \cdot exp\{0.246 \cdot \mathrm{GausDev}\} \tag{6}$$

$$\mathrm{Cl}^{-}_{\mathrm{supply}} = 277.92 - 71.11 \cdot ln\left(\frac{\mathrm{precip}_{\mathrm{Sac-2}} + \mathrm{precip}_{\mathrm{Sac-3}}}{2.0}\right) + 9.70 \cdot \mathrm{GausDev} \tag{7}$$

The "GausDev" is a standard normal random number used to account for the uncertainty in the regression. The relationship for chloride concentration in the State Import Water is plotted in Figure 49 for years 1950

to 2003. Determination of POTW effluent quality from the Jensen Plant water quality is discussed below in the POTW subsection. The relationships in Equations (4) - (7) are plotted in Figure 50.

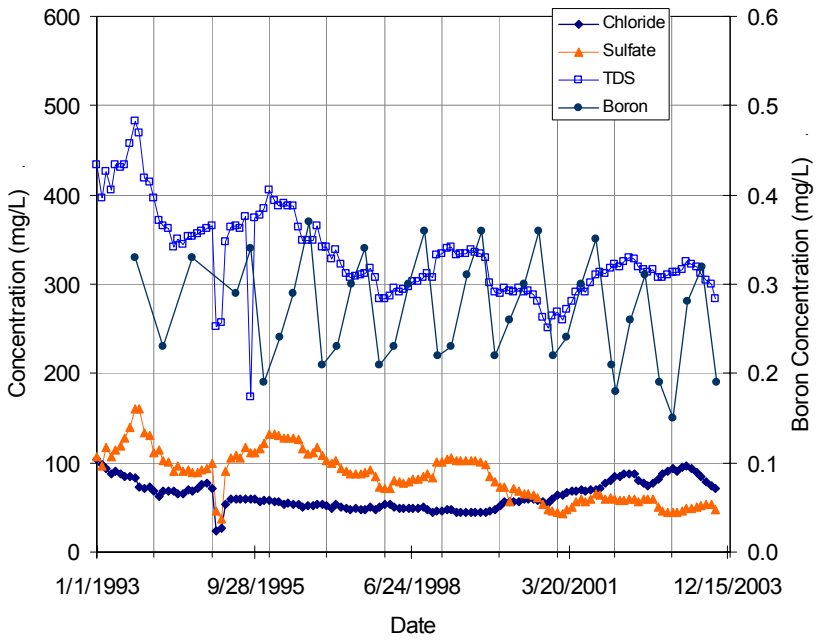

Figure 48: Concentrations of All Salts Species as Measured at the Jensen Plant.

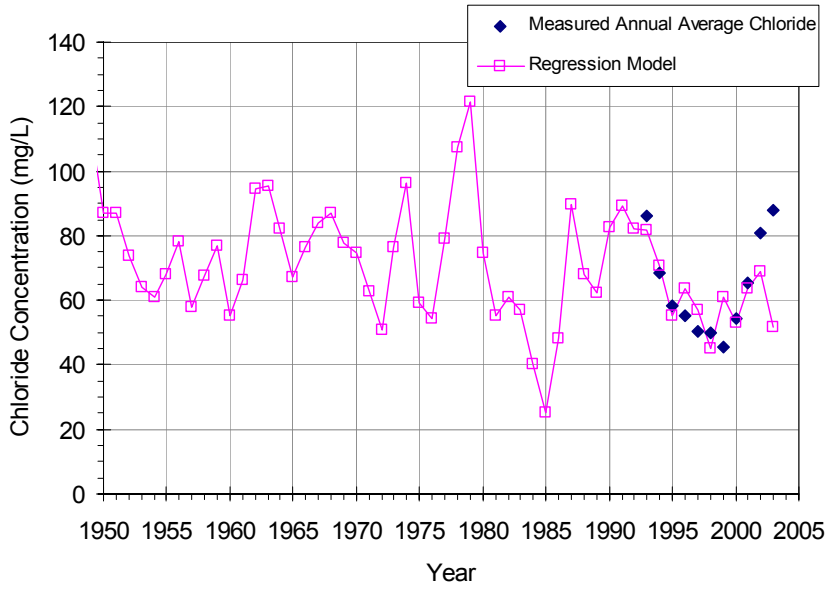

Figure 49: State Import Water Chloride Concentration Regression Based on Annual Precipitation in Sacramento, CA.

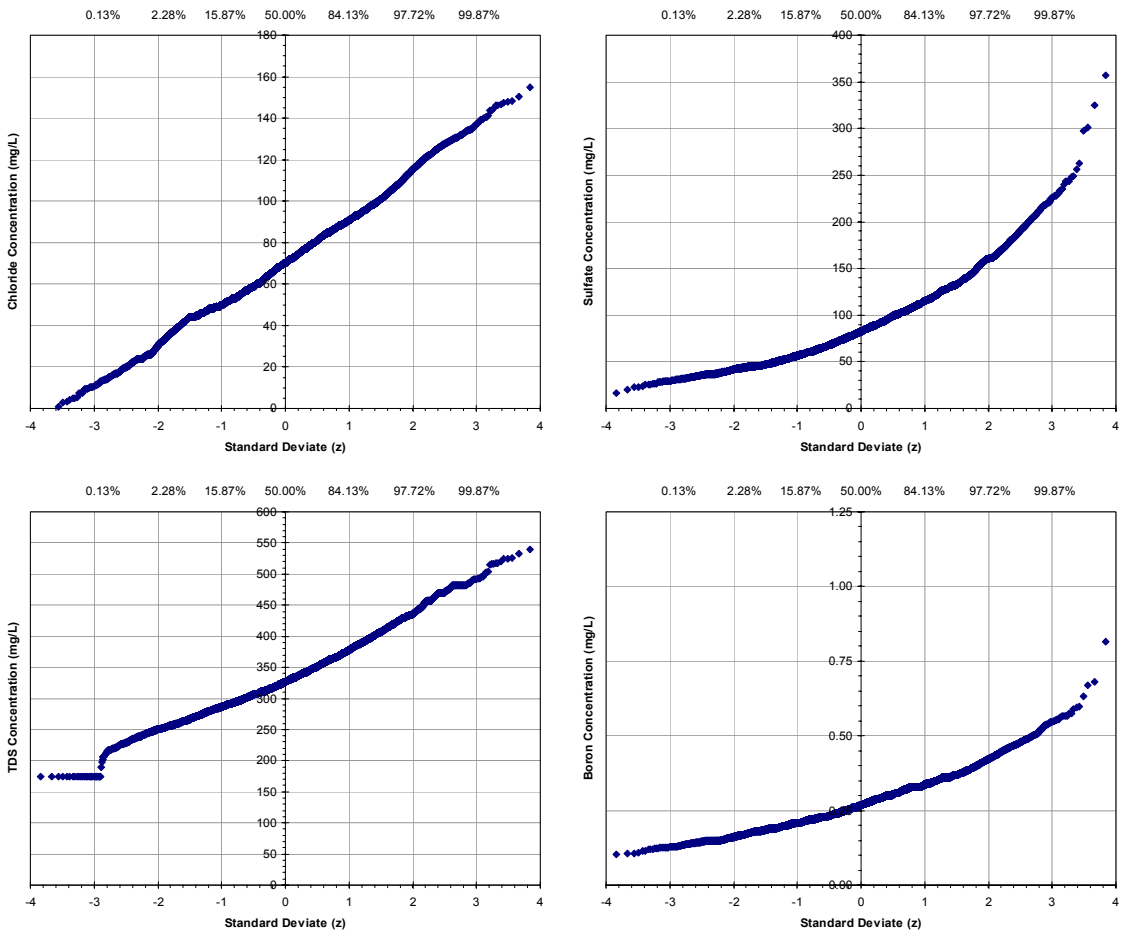

Figure 50: Probability distributions for State Import Water quality as used in the Dynamic CCMS.

Computational Element

Each computational element balances the inflow and outflow of water and mass with conservation equations to calculate changes in in-stream flow and concentration across a subwatershed. The computational elements used by the CCMS to model conditions in the CCW are displayed in Figure 46. Over each time step, the stream reach within any subwatershed is assumed to behave as a steady-state complete-mix reactor. Because of the relatively short reach length, stream geometry, and daily time step; flows can be considered in equilibrium on a daily basis, so long as the routing of peak flows is not of critical importance. Assuming that each subwatershed behaves as a complete-mix reactor implies that the in-stream concentration is constant at all locations within a subwatershed (Tchobanoglous and Schroeder, 1985). Because the concentration is modeled as constant for the entire reach, all withdrawals from the reach, including the discharge to the downstream reach will have the same concentration by definition. A schematic of the computational element is displayed in Figure 12. Each input and output considered in the CCMS is represented in Figure 12 with an arrow pointing into the reach for additions, and pointing out from the reach to represent withdrawals. In Figure 12, flows from upstream reaches enter from the right and flow to downstream reaches exit to the left. Details of the flows are discussed in subsequent subsections.

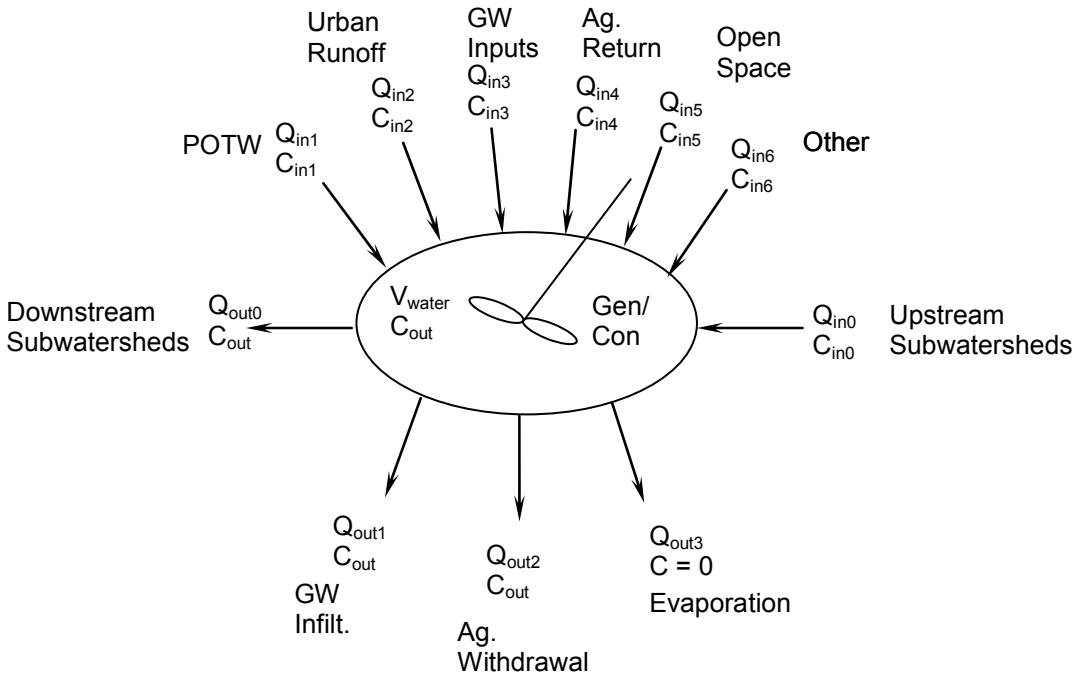

Figure 51: Schematic of Inputs and Outputs for a General Computational Element used in the CCMS Mass Balance Model to Estimate Water Flow and Quality within Surface Water Reaches.

Mass Balance Calculations

To calculate the stream discharge flow and in-stream concentration for a computational element, all inflow rates and concentrations must be specified along with all other of the outflow rates. Normally, the outflow to the downstream reach will be calculated with the conservation of flow equation. If all inflow rates and concentrations, and outflow rates are known, the in-stream concentration may be calculated. Because of the complete-mix assumption, the concentration in the outflows will equal the in-stream concentration, except in the case of evaporation (Tchobanoglous and Schroeder, 1985), where only water is assumed to be removed from the system by evaporation implying that the concentration of salts in evaporated water is equal to zero. The general conservation law is captured in Equation (1).

$$\text{accumulation} = \text{in} - \text{out} + \text{generation} \tag{8}$$

Each of the daily time steps is assumed to be in steady-state. By making the steady-state assumption the ability to model peak flood routing is lost; however because of the relatively small size of the CCW, a smaller time step than one day would be required to capture a flood wave moving through the watershed. The steady assumption specifies no accumulation of flow or mass in the surface water within a subwatershed, simplifying the mass balance equation by setting the left hand side of Equation (1) to zero, in effect requiring the sum of the inputs to equal the sum of the outputs plus and generation within the

subwatersheds (Tchobanoglous and Schroeder, 1985). However, for the case of salts, the assumption is made that no generation or consumption occurs in any of the subwatersheds, further simplifying (1) to Equation (2).

$$\text{in} = \text{out} \tag{9}$$

Referencing Figure 12, and setting the sum of all inflows equal to the sum of all outflows the flow balance for each subwatershed may be defined by Equation (10). Flows discharged downstream from the computational element may be calculated using algebra to solve Equation (10) for the flowrate leaving the subwatershed, Q_{out0}., yielding Equation (11).

$$Q_{in0} + Q_{in1} + Q_{in2} + Q_{in3} + Q_{in4} + Q_{in5} + Q_{in6} = Q_{out0} + Q_{out1} + Q_{out2} + Q_{out3} \tag{10}$$

$$Q_{out0} = Q_{in0} + Q_{in1} + Q_{in2} + Q_{in3} + Q_{in4} + Q_{in5} + Q_{in6} - Q_{out1} - Q_{out2} - Q_{out3} \tag{11}$$

The salt concentration within the subwatershed may be calculated by inserting the mass loadings indicated in Figure 12 into the conservation of mass equation, Equation (2), while recalling that the concentrations are equal for all outflows, except evaporation which by definition equals zero. The conservation of mass equation for a computational element is given by Equation (12). Rearranging Equation (12) for the outflow concentration yields Equation (13).

$$\begin{aligned} &C_{in0}Q_{in0} + C_{in1}Q_{in1} + C_{in2}Q_{in2} + C_{in3}Q_{in3} + C_{in4}Q_{in4} + C_{in5}Q_{in5} + C_{in6}Q_{in6} \\ &= C_{out}Q_{out0} + C_{out}Q_{out1} + C_{out}Q_{out2} + (0)Q_{out3} \end{aligned} \tag{12}$$

$$C_{out} = \frac{C_{in0}Q_{in0} + C_{in1}Q_{in1} + C_{in2}Q_{in2} + C_{in3}Q_{in3} + C_{in4}Q_{in4} + C_{in5}Q_{in5} + C_{in6}Q_{in6}}{Q_{out0} + Q_{out1} + Q_{out2}} \tag{13}$$

In general, the derived equations listed above will hold for each of the subwatersheds in the CCW, but not all flows will be present for each reach and if not present would be set to zero. Derivations of the individual flows are presented in the following sections.

Upstream Subwatersheds

Inflow and mass loading from the upstream subwatershed are added as inputs to the computational element. If the sub-watershed is located at the top of a stream's drainage, there will be no upstream subwatershed and the CCMS will assign a 0.0 for the flow and mass loading. If multiple upstream subwatersheds contribute to the computational element, the sum of the upstream outflows and sum of the mass loadings are inserted in Q_{in0} and $C_{in0}Q_{in0}$. A definition sketch of the case where multiple upstream reaches contribute to the computational element is displayed in Figure 52. The inflow to the computational element is a simple sum of the flowrates from the upstream reaches, as indicated in Equation (14).

$$Q_{in0} = Q_{out0\,A} + Q_{out0\,B} \tag{14}$$

The inflow of mass and concentration of the inflow are calculated in Equation (15), which may be rearranged into Equation (16) for calculating the concentration in the inflow.

$$C_{in0}Q_{in0} = C_A Q_{out0\,A} + C_B\, Q_{out0\,B} \tag{15}$$

$$C_{in0} = \frac{C_A Q_{out0\,A} + C_B\, Q_{out0\,B}}{Q_{in0}} \tag{16}$$

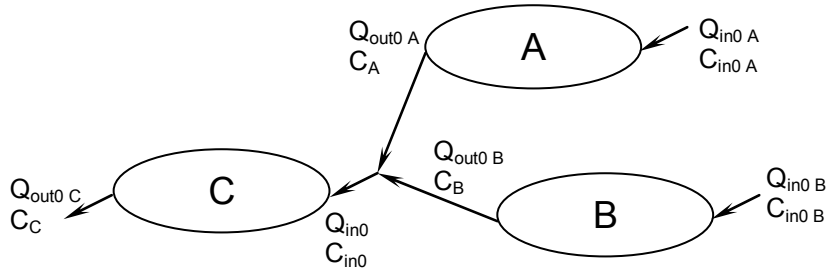

Figure 52: Schematic of Case where Two Upstream Subwatersheds, A and B, Contribute to the Inflow of a Computational Element, C.

Subwatershed Inflows

Possible inflows include: publicly owned treatment works (POTWs), urban runoff, groundwater exfiltration, agriculture returns, open space runoff, and any other flows. Each computational element includes provisions to include a generation component, which would be necessary if the constituents were being generated chemio-physio-biologically in the reach. In the case of salts, the generation component is set to zero as no reactions producing salts are assumed to occur in the CCW surface waters.

POTW Inflows to Computational Elements

Only the subwatersheds containing wastewater treatment plants that discharge to surface waters will have non-zero Q_{in1} and C_{in1}. Typical dry-weather effluent flowrate and salts concentrations for the treatment plants in the watershed used for the static CCMS are listed in Table 33. Steady dry-weather flows may be used as a check against the dynamic model calculations to verify expected behavior.

For the dynamic model, effluent monitoring data from the treatment plants are used to develop statistical descriptions of the effluent flowrate and salts concentrations. On review and analysis of flow data from the Simi Valley, Hill Canyon, and Camarillo POTWs there was an observed pattern of monthly variations in flowrates. Because the variations in flowrate could not be conclusively linked to external variables, separate distributions for flowrates from each POTW were calculated from the available data for each month of the year. Each distribution representing the expected effluent flowrate for each month are listed in Table 34 for each of the major POTWs in the CCW. Flowrates from POTWs are generally higher after precipitation. A relationship representing an incremental increase in flow due to precipitation is included in the dynamic CCMS calculations for Simi Valley, Hill Canyon, and Camarillo POTWs and each is listed in Table 34. To develop the flowrate equations all non-precipitation, daily effluent measurements for each month were grouped and analyzed separately. Each equation for the dry weather days is presented as the median flowrate of grouped data plus the standard deviation of grouped data times a normal random

number. Insufficient data from the Moorpark POTW precluded performing a similar analysis for that treatment plant. Each flowrate may be modified by a reduction factor to represent modifications due to an implementation strategy.

The full suite of calculations used to determine the effluent salts concentrations for each treatment plant is presented in Table 35. Concentrations of TDS and boron in effluents from all POTWs are calculated from distributions for each time step. Chloride and sulfate concentrations in the Simi Valley, Hill Canyon, and Camarillo POTW effluents are calculated from regression relations based on the drinking water quality from the Jensen Plant. Distributions are used to estimate the effluent quality from the Moorpark POTW for all constituents of concern. Each salt constituent for each POTW may be modified by a reduction factor to represent salt removals.

Table 33: POTW Parameters for the CCW Used in the Static CCMS.

POTW	Sub-watershed	Effluent Flow, Q_{in1} (cfs)	Salts Species Concentration, C_{in1} (mg/L)				
			Chloride	TDS	Sulfate	Boron	Hardness
Simi Valley	3	14	116	708	220	0.59	260
Moorpark	5	2	128	716	238	0.51	160
Hill Canyon	10	14	119	587	166	0.50	209
Camarillo	12	3.2	158	874	232	0.50	250

Table 34: POTW Effluent Flowrate Monthly Distributions and Increase due to Precipitation as used in the Dynamic CCMS.

Parameter	Effluent Flowrates (cfs) [a]		
	Simi Valley	Hill Canyon	Camarillo
Jan	14.27+0.481*GausDev	16.64+0.517*GausDev	4.863+0.83*GausDev
Feb	14.76+1.617*GausDev	17.22+1.839*GausDev	4.957+1.07*GausDev
Mar	14.43+1.079*GausDev	16.84+1.600*GausDev	4.365+1.17*GausDev
Apr	14.03+0.837*GausDev	16.73+0.906*GausDev	4.322+0.68*GausDev
May	13.81+0.866*GausDev	16.72+0.815*GausDev	4.598+0.83*GausDev
Jun	14.08+0.534*GausDev	16.56+1.004*GausDev	3.768+0.67*GausDev
Jul	13.85+0.424*GausDev	16.12+1.059*GausDev	3.418+0.60*GausDev
Aug	13.76+0.559*GausDev	15.99+0.967*GausDev	3.676+0.94*GausDev
Sep	13.70+0.568*GausDev	16.25+0.712*GausDev	4.614+0.70*GausDev
Oct	13.72+0.690*GausDev	16.38+0.817*GausDev	3.608+1.20*GausDev
Nov	14.21+0.687*GausDev	17.08+1.224*GausDev	4.853+1.24*GausDev
Dec	14.39+0.884*GausDev	16.91+1.407*GausDev	5.033+1.24*GausDev
Precip Days	Q_{day-1} + 1.151*$precip_{day}$	Q_{day-1} + 2.122*$precip_{day}$	Q_{day-1} + 1.025*$precip_{day}$

[a] Values rounded for display. Each monthly equation is presented in the form m+σ*GausDev, where m is the median of available data, σ is the standard deviation, and GausDev is a standard normal random number.

Urban Runoff to Computational Elements

Urban runoff is calculated in CCMS as a mix of runoff from residential, commercial, and industrial land uses. The typical percentage of imperviousness for each land use is used to estimate the runoff coefficient. Each runoff coefficient is multiplied by a water use per acre to determine a runoff rate per land use type. Watershed-wide parameters used for runoff calculations are listed in Table 36. Land use areas in each subwatershed are determined from GIS tools. To calculate the runoff by land use for each subwatershed, the total subwatershed area is multiplied by the fractional land use area. A list including subwatersheds, the total areas of each subwatershed, and the fractional areas by land use for each subwatershed is provided in Table 40.

Using the information listed in Table 36 and Table 40, the dry weather urban runoff is calculated using Equation (17).

$$Q_{in2} = \text{Total Area} \cdot \left(f_{res} \cdot runoff_{res} + f_{com} \cdot runoff_{com} + f_{ind} \cdot runoff_{ind} \right) \cdot \text{reductions}_{urban} \quad (17)$$

Where Total Area of the subwatershed in Equation (17) is from Table 40, reductions are any reductions in flows expected sue to implementation of BMPs, f_{res} represents the fractional area of the subwatershed that is residential as listed in Table 40, and $runoff_{res}$ represents the residential runoff value from Table 36. The terms corresponding to commercial and industrial areas are found in a similar fashion. Concentrations of salts in urban runoff, i.e. C_{in2}, used in the static CCMS are listed in Table 37.

Dry weather runoff is currently calculated in the dynamic model in the same manner as in the static model with the exception of allowing the runoff coefficients to vary uniformly between ±50% of the values listed in Table 36. Relating the dry weather runoff flow to the water delivery rates for each subwatershed would

allow the dynamic model to estimate seasonal and spatial changes in dry-weather runoff flows. The last runoff calculation is multiplied by an exponential decay factor to simulate tailing of stormwater runoff. The calculation is presented as Equation (18).

Wet weather runoff is calculated in the dynamic CCMS similarly to the dry-weather urban runoff, except the precipitation over the subwatershed multiplied by the runoff coefficient is used to determine the runoff flowrate and provisions are included in the model to mimic tailing of the runoff. Runoff will only occur if the precipitation is greater than a threshold value set by the user as listed in Equation (19). Wet-weather runoff flows currently do vary seasonally and spatially over the CCW in response to precipitation patterns.

$$\begin{aligned} Q_{in2} &= \text{Total Area} \cdot \left(f_{res} \cdot runoff_{res} + f_{com} \cdot runoff_{com} + f_{ind} \cdot runoff_{ind} \right) \cdot \text{reductions}_{urban} \\ &\quad + \text{Storm runoff}_{last} \cdot exp\{-(\#\text{ antecedent dry days}) \cdot \text{lag}\} \end{aligned} \tag{18}$$

$$\begin{aligned} \text{Storm runoff}_{day} &= \text{Total Area} \cdot \left(f_{res} \cdot C + f_{com} \cdot C_{com} + f_{ind} \cdot C_{ind} \right) \\ &\quad \cdot \left(\text{precip}_{day} - \text{threshold}_{urban} \right) \cdot \text{conversion} + \text{Storm runoff}_{day-1} \cdot exp\{-\text{lag}\} \end{aligned} \tag{19}$$

Table 35: Calculations for Determining Salts Concentrations in POTW Effluents used in the Dynamic CCMS.

POTW	Calculation (1)
Simi Valley	
Chloride	$0.827*Cl^-_{supply} + 78.71 + 6.81*GausDev$
Sulfate	$0.926*SO_4^{2-}{}_{supply} + 126.04 + 33.09*GausDev$
TDS	706.25*exp{0.3901*GausDev}
Boron	0.60663 + 0.10971*GausDev
Hill Canyon	
Chloride	$0.911*Cl^-_{supply} + 73.11 + 8.19*GausDev$
Sulfate	$0.962*SO_4^{2-}{}_{supply} + 60.78 + 15.04*GausDev$
TDS	620.11 + 42.52*GausDev
Boron	0.61169 + 0.096495*GausDev
Camarillo	
Chloride	$0.815*Cl^-_{supply} + 121.7 + 10.30*GausDev$
Sulfate	$0.801*SO_4^{2-}{}_{supply} + 161.8 + 26.87*GausDev$
TDS	899.56+70.274*GausDev
Boron	0.62833+0.065944*GausDev
Moorpark	
Chloride	131.2*exp{0.163*GausDev}
Sulfate	200.75+54.703*GausDev
TDS	658.17*exp{0.11964*GausDev}
Boron	0.52875+0.049545*GausDev

(1) Cl^-_{supply} and $SO_4^{2-}{}_{supply}$ are concentrations of chloride and sulfate in imported water supply as measured at the CMWD Jensen Plant.

Distributions are used to estimate concentrations of all salts at each time step for both dry- and wet-weather runoff in the dynamic CCMS. Calculations used to estimate dry-weather runoff salts concentrations are listed in Table 38. Because sufficient data to develop distributions for sulfate and boron concentrations in dry-weather runoff, the static model estimates are included in the dynamic model and uniformly varied plus and minus 50% of the estimate. Distributions for wet-weather runoff salts concentrations used in the dynamic CCMS are listed in Table 39. As for dry-weather concentrations, any constituent with insufficient data to develop distributions was estimated with available data or static CCMS values and uniformly varied plus and minus 50%. Dry- and stormwater runoff rates are used in a mass balance calculation to blend the water quality from both sources. Data for developing dry- and wet-weather runoff concentrations for sulfate and boron are lacking. Use of estimates of the distributions for sulfate and boron concentrations in the CCMS would yield better estimates of the variability of the in-stream concentrations for the two species.

Table 36: Table of Parameters used in Runoff Calculations.

Land Use	Percent Impervious	Runoff Coefficient	Dry Weather Runoff (cfs/acre)
Residential	30.0%	0.425	0.00014468
Industrial	70.0%	0.725	0.00024681
Commercial	50.0%	0.575	0.00019575
Agriculture	7.5%	0.256	0.00016580
Undeveloped/Open	0.0%	0.200	0.00006809

Table 37: Static Species Concentrations for Composite Urban Runoff, C_{in2}.

	Salts Species Concentration (mg/L)				
Season	Chloride	TDS	Sulfate	Boron	Hardness
Dry	176.25	1,900	60	0.21	897
Wet	24.2	174.6	15	0.21	59.7

Table 38: Dry-weather Urban Runoff Salts Concentrations as Calculated in the Dynamic CCMS.

Species	Dry-weather Urban Runoff Concentrations (mg/L)
Chloride	156.9*exp{0.62537*GausDev}
Sulfate	60.0±50%
TDS	1,869.2*exp{0.28519*GausDev}
Boron	0.21±50%

Table 39: Wet-weather Runoff Salts Concentrations as Calculated in the Dynamic CCMS.

	Wet-weather Urban Runoff Concentrations (mg/L)		
Species	Residential	Commercial	Industrial
Chloride	18.11*exp{0.9454*GausDev}	3.0±50%	17.92*exp{1.006*GausDev}
Sulfate	15.0±50%	15.0±50%	15.0±50%
TDS	81.60*exp{0.7625*GausDev}	57.71*exp{0.4766*GausDev}	90.96*exp{0.7636*GausDev}
Boron	0.21±50%	0.21±50%	0.21±50%

Table 40: Land Use Fractional Areas by Subwatershed.

Sub-water-shed	Description	Total Area (acres)	Fractional Land Use Area					
			Residential	Industrial	Commercial	Agricultural	Open Space	Open/Water
1	Upper Arroyo Simi	50,707	0.168	0.028	0.050	0.017	0.744	0.004
3	Arroyo Simi/Arroyo Las Posas	13,944	0.026	0.028	0.052	0.028	0.879	0.000
4	Arroyo Las Posas	18,239	0.110	0.026	0.060	0.149	0.667	0.000
5	Upper Calleguas Creek	21,113	0.040	0.020	0.007	0.585	0.359	0.002
EALP	End of Arroyo Las Posas	1,055	0.050	0.026	0.038	0.730	0.156	0.000
8	Arroyo Santa Rosa	5,467	0.138	0.046	0.000	0.144	0.675	0.005
9	Upper Arroyo Conejo	22,176	0.328	0.021	0.117	0.040	0.545	0.002
10	Lower Arroyo Conejo	6,746	0.367	0.012	0.154	0.010	0.459	0.000
11	Upper Conejo Creek	11,132	0.190	0.002	0.029	0.259	0.533	0.000
12	Lower Conejo Creek	2,590	0.135	0.018	0.126	0.141	0.585	0.004
6	Central Calleguas Creek	5,578	0.112	0.077	0.057	0.329	0.432	0.007
13	Revolon Slough	25,097	0.055	0.011	0.056	0.671	0.220	0.000
7	Lower Calleguas Creek	23,702	0.118	0.009	0.081	0.554	0.248	0.001
14	Agricultural Drain	7,798	0.007	0.006	0.165	0.594	0.237	0.005
15	Mugu Lagoon	1,344	0.000	0.000	0.015	0.000	0.869	0.078

Groundwater Inputs to Computational Elements

Groundwater exfiltration and groundwater dewatering discharges are included under the general heading of groundwater inputs to computational elements. Currently, the only dewatering wells included in the model are located in the Simi Valley area of the watershed.

Concentrations utilized for the exfiltrating groundwater in the Simi and Thousand Oaks basins are listed in Table 42. Groundwater exfiltration flowrates and concentrations are constant values in the static CCMS. The exfiltration flowrates, where they exist, in the CCW are listed in Table 41. The groundwater flows in the Simi Valley are largely due to continuous pumping to lower the groundwater table. From a modeling perspective, the dewatering well discharges affect the CCW system in an equivalent manner to the natural exfiltration of groundwater providing baseflow to the stream.

Table 41: Groundwater Inputs (Q_{in3}) and Infiltration (Q_{out1}) by Subwatershed. Reach Dimensions and Evaporation (Q_{out3}) Included for Each Subwatershed.

Sub-watershed	Description	Groundwater [a]		Reach Length (mile)	Average Width (feet)	Evaporation (cfs)
		Exfiltration (cfs)	Infiltration (cfs)			

1	Upper Arroyo Simi	2.30 [e]	---	10.06	25.7	0.22
3	Arroyo Simi/Arroyo Las Posas	---	5.84 [b]	5.31	38.1	0.17
4	Arroyo Las Posas	---	3.16 [b]	2.87	93.8	0.23
5	Upper Calleguas Creek	---	5.61 [b]	5.10	29.7	0.13
EALP	End of Arroyo Las Posas	---	0.25 [b]	0.54	29.7	0.01
8	Arroyo Santa Rosa	0.90	---	6.90	6.7	0.04
9	Upper Arroyo Conejo	1.54	---	10.98	15.5	0.14
10	Lower Arroyo Conejo	0.96	---	0.63	37.1	0.02
11	Upper Conejo Creek	---	11.85 [c,d]	6.16	29.1	0.15
12	Lower Conejo Creek	---	0.57 [c]	1.89	25.0	0.04
6	Central Calleguas Creek	---	---	2.40	75.0	0.15
13	Revolon Slough	---	---	16.80	50.0	0.70
7	Lower Calleguas Creek	---	---	5.30	133.4	0.59
14	Agricultural Drain	---	---	6.50	24.2	0.13
15	Mugu Lagoon	---	---	0.78	316.0	0.21

[a] For any reach, there will either be exfiltration adding water to the reach or infiltration removing water from the reach. The flowrate may be modified with a reduction coefficient to account for implementation strategies.
[b] Corresponds to 1.1 cfs/reach mile infiltration rate.
[c] Corresponds to 0.3 cfs/reach mile infiltration rate.
[d] Includes 10 cfs Conejo Creek diversion.
[e] Average discharge flowrate from groundwater dewatering wells.

Table 42: Static Species Concentrations for Exfiltrating Groundwater, C_{in3}.

	Salts Species Concentration (mg/L)				
Season	Chloride	TDS	Sulfate	Boron	Hardness
Dry	134.4	1,639	1,500	0.80	1,230
Wet	134.4	708	739	0.20	509

Analysis of available data revealed that dry-season groundwater exfiltration rates are related to the previous wet-season total precipitation. A relationship between annual precipitation and groundwater exfiltration has been developed for the Upper Arroyo Simi, Conejo Creek, and Calleguas Creek sections of the CCW (LWA 2004b). The relationships developed in LWA (2004b) for exfiltration contribution to in-stream flowrates are listed in Table 43. For dates between April 1st and September 30th for a given water year, the cumulative precipitation for the water year is used to calculate groundwater exfiltration using the developed relationships. For dates between October 1st and March 31st, a weighted average between the total precipitation in the previous water year and the cumulative precipitation for the current water year are used in the calculations. The static model estimates of groundwater exfiltration from the Conejo system are used to apportion the calculated flow contribution to the reaches tributary to Conejo Creek.

Groundwater well water quality data were reviewed to develop updated estimates of exfiltration water quality (LWA, 2004b). Salts concentration values used in the dynamic CCMS to represent groundwater exfiltration water quality are listed in Table 44. Separate relationships are used in the dynamic CCMS to determine the

quality of exfiltrating groundwater and dewatering discharge. Estimates for groundwater exfiltration quality from LWA (2004b) are based on water quality measurements of supply wells in close proximity of the waterways in conjunction with in-stream quality measurements. Dewatering well discharge water quality measurements are used to estimate the discharge quality.

Table 43: Groundwater Exfiltration Based on Annual Precipitation.

Region	Sub-watershed	*f* (1)	Groundwater Exfiltration (2) (cfs)
Simi Valley	1	---	0.145*ann precip – 1.671 + 3.1 (3)
Conejo Creek	8 (4)	0.0	0.404*ann precip – 4.63
	9	1.54/2.5	
	10	0.96/2.5	
Calleguas Creek	6	1.0	0.406*ann precip – 2.58
	7	1.0	

(1) Fraction used to apportion calculated groundwater exfiltration to various reaches in system.
(2) Annual precipitation based calculation. Precipitation for current water year for simulation dates between April 1st and September 30th. Weighted average of previous and current water year precipitation for all other simulation dates.
(3) Simi Valley dewatering wells set to 3.1 cfs
(4) No groundwater exfiltration is assumed to exist in Arroyo Santa Rosa. Included here for comparison with Table 41.

Table 44: Calculations for Determining Salts Concentrations in Groundwater Exfiltration as used in the Dynamic CCMS.

Groundwater	Salts Calculation [a] (mg/L)	Dewatering Well Discharge [b] (mg/L)
Arroyo Simi		
Chloride	199±30%	130.91 + 2.8524*GausDev
Sulfate	1,232±30%	1,158.*exp{0.1373*GausDev}
TDS	1,197±30%	1,634 + 31.232*GausDev
Boron	1.4±50%	0.954 + 0.05888*GausDev
Conejo Creek		
Chloride	195±30%	---
Sulfate	445±30%	---
TDS	820±30%	---
Boron	0.2±50%	---
Calleguas Creek		
Chloride	227±30%	---
Sulfate	801±30%	---
TDS	907±30%	---
Boron	0.2±50%	---

[a] Chloride, Sulfate, and TDS concentrations estimated to within ±30% in LWA (2004b).
[b] Concentration distributions developed from water quality measurements from dewatering well discharge.

Agriculture Returns to Computational Elements

The runoff from agricultural returns is calculated in a manner similar to urban runoff with the appropriate values from Table 36 and Table 40 using Equation (20).

$$Q_{in4} = \text{Total Area} \cdot \left(f_{ag} \cdot runoff_{ag}\right) \cdot \text{reductions}_{ag} \tag{20}$$

Concentrations of salts in agricultural returns, i.e. C_{in4} in Figure 12, are listed in Table 45.

Table 45: Static Species Concentrations for Agricultural Runoff, C_{in4}.

	Salts Species Concentration (mg/L)				
Season	Chloride	TDS	Sulfate	Boron	Hardness
Dry	239.3	2,449	916	0.82	954
Wet	174	1,362	707	0.69	424

Wet-weather runoff flows are calculated in a similar manner to the urban runoff. Currently, the runoff threshold is set to 0.15 in of rain, and the runoff lag is set to 6.0 days. Salts concentration estimates used in the dynamic CCMS for dry- and wet-weather agricultural runoff are listed in Table 46.

Table 46: Agricultural Return Water Quality as used in the Dynamic CCMS.

Species	Runoff Quality (mg/L)	
	Dry-weather	Wet-Weather
Chloride	156.22*exp{0.391*GausDev}	23.6*exp{0.844*GausDev}
Sulfate	416±50%	407±50%
TDS	958.4*exp{0.439*GausDev}	268.4*exp{0.724*GausDev}
Boron	1.7±50%	0.69±50%

Vacant (Open Space) Runoff to Computational Elements

The runoff from vacant areas of open space is calculated in a manner similar to urban runoff with the appropriate values from Table 36 and Table 40 using Equation (21).

$$Q_{in5} = \text{Total Area} \cdot \left(f_{\text{open}} \cdot runoff_{\text{open}}\right) \cdot \text{reductions}_{\text{open}} \tag{21}$$

Concentrations of salts in agricultural runoff, i.e. C_{in5} in Figure 12, are listed in Table 47.

Table 47: Static Species Concentrations for Open Space Vacant Runoff, C_{in5}.

Season	Salts Species Concentration (mg/L)				
	Chloride	TDS	Sulfate	Boron	Hardness
Dry	170.0	1,975	500	0.178	562
Wet	59.75	481.25	17	0.178	79.25

Wet-weather runoff flows are calculated similarly to the urban runoff. Currently, the runoff threshold is set to 0.50 in of rain, and the runoff lag is set to 6.0 days. Salts concentration estimates used in the dynamic CCMS for dry- and wet-weather open space runoff are listed in Table 48.

Table 48: Open Space Runoff Water Quality as used in the Dynamic CCMS.

Salt Constituent	Runoff Quality (mg/L)	
	Dry-weather	Wet-Weather
Chloride	153.4*exp{0.513*GausDev}	76.2*exp{0.737*GausDev}
Sulfate	500±50%	17±50%
TDS	1,744*exp{0.652*GausDev}	1,427*exp{0.537*GausDev}
Boron	0.18±50%	0.18±50%

Other Inflows to Computational Elements

Other processes possibly included in the future will account for management practices and diversions resulting from the implementation of control strategies.

Other inflows are reserved for the implementation of potential control strategies.

In-stream Generation within Computational Elements

While it is possible that salts generation may exist by dissolving minerals from historic marine sediments, currently the assumption is made that surface waters have dissolved all salts easily dissolvable and the process is negligible for all reaches in the watershed. Generation is set to zero for each subwatershed in the CCW.

Subwatershed Outflows

Possible withdrawals or outflows from the CCW reaches include groundwater infiltration and diversions, agricultural use, and evaporation. No processes are included in the model that consume salts. Because of the complete-mix assumption, the concentration in each of the outflows is equal to the concentration calculated in the reach that is discharged to downstream subwatersheds.

Groundwater Infiltration from Computational Elements

Groundwater infiltration rates by subwatershed for the steady-state CCMS are listed in Table 41. In general, the infiltration rate in the Northern CCW is 1.1 cfs/reach mile, and in the Conejo Creek region the rate is 0.3 cfs/reach mile. The 10 cfs Conejo Creek Diversion is included in as a groundwater outflow in Table 41. The infiltration rate is checked internally to ensure negative flowrates are not produced if the streambed becomes dry.

The infiltration rate calculations in the dynamic CCMS are similar to the calculations in the static CCMS. However, monthly measured diverted flowrates from the Conejo Creek Diversion are used to estimate the removal flowrate in the dynamic CCMS. Groundwater infiltration rates are increased in the lower sections of the Arroyo Las Posas to calibrate the dynamic CCMS calculated flowrates to the measured flowrates at Gage 806(a).

Riparian Vegetation Demand from Computational Elements

Natural stream draw-down for riparian habitat support and agricultural withdrawals are accounted for in the Riparian Vegetation Demand. The calculated rates of riparian uptake, agricultural withdrawals, and supporting information are listed in Table 49. In the dynamic CCMS calculations, the rate of riparian vegetation consumption is modified by the ratio of the daily evaporation to the annual average evaporation, as in Equation (22).

$$\text{Riparian ET} = \text{Riparian ET}_{\text{steady}} \frac{\text{daily evap (in/d)}}{0.164\ \text{(in/d)}} \tag{22}$$

The calculated lost flow is checked against the available flow to ensure that a negative flowrate for the subwatershed does not result from including the riparian consumptive loss. Water is drawn from the streams to satisfy the evapotranspiration demand of riparian vegetation. Because the water is drawn from the stream before evaporating, salts are carried from the stream to the root-zone. Salts not may accumulate in the root zone and would be subject to leaching back into the stream with baseflow.

Evaporation from Computational Elements

Evaporation from the reaches is calculated from the evaporation rate data multiplied by the estimated water surface area, and so is strictly the evaporative loss from the stream surface. Rates of evaporation from each of the reaches in the CCW are listed in Table 41. No salts are removed from the system via evaporation. The steady version of the CCMS uses a constant evaporation rate of 60 in/yr (0.164 in/d) multiplied by the stream surface area and length. In both the steady and dynamic versions of CCMS, the calculated lost flow from evaporation is checked against the available flow in the subwatershed to ensure that a negative flowrate does not result from including the evaporation loss.

Daily evapotranspiration values for coastal and inland areas of the CCW were developed in LWA 2004c. The variability within each month of the year of available daily evaporation is used to perturb the daily evaporation values calculated in LWA 2004c. Regression of historic evaporation against daily maximum temperatures in Camarillo or Oxnard would provide a mechanism for forming a daily estimate based on daily watershed conditions rather than rely on a constant value.

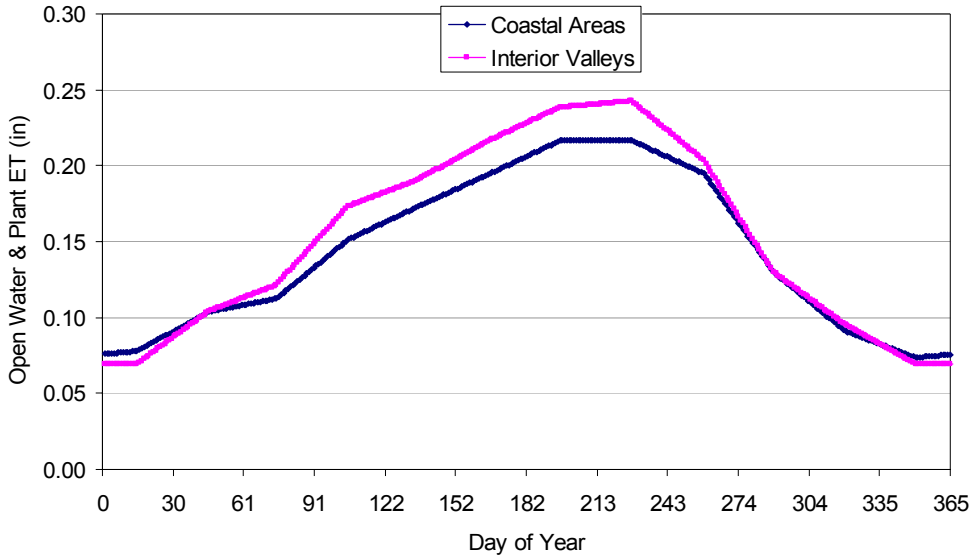

Figure 53: Base evapotranspiration from coastal and inland areas of the CCW.

Table 49: Riparian Uptake Rate (Q_{out2}) for Each Subwatershed.

Sub-watershed	Riparian Demand (cfs)	Stream-side Acreage (acres)	Riparian Vegetation Area Fraction (---)	Reach Length (miles)
1	0.00	12,877	0.017	10.06
3	0.00	6,797	0.028	5.31
4	1.89 [a]	3,674	0.149	2.87
5	11.68 [a]	6,528	0.585	5.10
EALP	0.00 [b]	691	0.730	0.54
8	0.76 [c]	2,175	0.144	6.90
9	0.00	14,054	0.040	10.98
10	0.00	806	0.010	0.63
11	7.05 [a]	7,885	0.259	6.16
12	1.18 [a]	2,419	0.141	1.89
6	3.48 [a]	3,072	0.329	2.40
13	---	21,504	0.671	16.80
7	1.38 [d]	6,784	0.554	5.30
14	---	8,320	0.594	6.50
15	0.00	998	0.000	0.78

[a] Calculated by 2.5 ft/year * Stream-side area * $f_{agriculture}$ * unit conversion.
[b] Calculated by 1.5 ft/year * (Stream-side area – 640) * $f_{agriculture}$ * unit conversion.
[c] Calculated by 2.5 ft/year * (Stream-side area – 640) * $f_{agriculture}$ * unit conversion.
[d] 0.26 cfs/reach mile * reach length.

In-stream Consumption within Computational Elements

No in-stream processes are included in the current version of the model that consumes salts from the water column. Consumption is set to zero for each subwatershed for each salt constituent.

Downstream Subwatersheds

The calculated outflow and mass load are used as input to the next most downstream computational element. As above, the reach discharge to downstream subwatersheds and outflow concentrations are calculated by Equations (23), and (24), respectively:

$$Q_{out0} = Q_{in0} + Q_{in1} + Q_{in2} + Q_{in3} + Q_{in4} + Q_{in5} + Q_{in6} - Q_{out1} - Q_{out2} - Q_{out3} \tag{23}$$

$$C = \frac{C_{in0}Q_{in0} + C_{in1}Q_{in1} + C_{in2}Q_{in2} + C_{in3}Q_{in3} + C_{in4}Q_{in4} + C_{in5}Q_{in5} + C_{in6}Q_{in6}}{Q_{out0} + Q_{out1} + Q_{out2}} \tag{24}$$

Improvements Remaining

- Obtain and analyze any additional water supply (State Import Water, Freeman Diversion, etc.) ideally including drought periods.

- Develop and implement a relationship between water delivery rates to each model subwatershed and influence on urban and agricultural dry-weather runoff.

- Determine the influence of the Freeman Diversion and deep groundwater well import water on flowrates and water quality within the CCW. Analysis of the water distribution and use throughout the watershed would be required to facilitate inclusion of the additional water sources. Reading and using the historical data from the two sources also would have to be implemented in the computer code of the CCMS.

- Determine the operational rules for the Simi Valley dewatering wells. Obtain flow data from Simi Valley. Currently, a constant pumping rate is set in the model. Variations in pumping rate could dramatically affect the local in-stream flowrate. Fluctuations in the quality of the dewatering well effluent would be beneficial to include in the dynamic model.

- Check locations and routing of urban runoff contributing to surface waters.

- Determine the quantity of groundwater dewatering in Thousand Oaks. If appreciable, include well flow and quality in a similar manner to Simi Valley dewatering wells.

- Determine estimates of distributions representing the concentrations of sulfate and boron in the various runoff streams in the CCW. Representing the sulfate and boron concentrations as uniform distributions ranging between likely maximum and minimum concentrations will provide a more robust calculation over using a simple constant value. However, estimates of the true distributions are more desirable.

- Determine relation between daily evaporation rate and daily maximum, minimum, or average temperature at an appropriate location within the watershed. Need daily temperatures at Camarillo for time period spanning April 1, 1991 to November 30, 2003.

- Use information provided from HSPF modeling to formulate better estimates of CCMS dynamic flowrate parameters.

- Align all TMDL reach end-points with CCMS subwatershed boundaries. However, results from the HSPF model would greatly facilitate the calibration of the new subwatersheds. Completing the expansion before HSPF results are available would be difficult, and should be postponed until results are available.

- Analyze HSPF output to develop estimates of groundwater infiltration rates based on in-stream flowrates. Presumably, as the flowrate in the stream increases, there will be more surface area for infiltration and the rate should increase.

- Use historical data and regressions to determine water delivery and quality to subwatersheds relating flow and quality of runoff to supplied water. Imported water, groundwater, and Freeman Diversion sources should be included in the analysis.

- Determine relationship between groundwater dewatering rates and groundwater exfiltration (baseflow) contributions to the surface waters to account for presumed reduction in exfiltration flows due to implementation of desalination of groundwater resources to augment water supply.

- Determine estimates of variability in groundwater exfiltration (baseflow) and include in as a perturbation of the baseflow calculations.

Conclusions

Conservation of mass is the basis of the CCMS water quality model. By assuming that each reach is steady for any given time step, reach outflow and concentration may be calculated from algebraic equations. The effect of using a daily time step and the steady-state assumption is to generate a series of daily average snapshots of the conditions likely to exist in the CCW. The CCMS is built on the principles of mass conservation forming a simple, robust, and defensible method of modeling constituent flows through the CCW.

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Conversions

Area

$$0.004047 \frac{km^2}{acre}$$

Volume

$$7.481 \frac{gal}{ft^3}$$

Flow

$$1.008 \frac{acre \cdot in/hr}{cfs}$$

$$0.0013813 \frac{cfs}{acre \cdot ft/yr}$$

$$0.5042 \frac{cfs}{acre \cdot ft/d}$$

$$1.547 \frac{cfs}{MGD}$$

Mass Loading

$$5.394 \frac{lb/d}{cfs \cdot mg/L}$$

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Technical Memorandum

DATE: April 21, 2004

TO: Calleguas Creek TAC and Interested Parties

CC: Salts TMDL Workgroup
TMDL Tools Workgroup

FROM: *Dustin Bambic*

SUBJECT: Surface-Groundwater Interaction

DRAFT

OVERVIEW

To develop a successful TMDL decision-support model, the interaction between ground and surface water must be quantified. However, within the Calleguas Creek watershed, many factors obscure the relationship. These factors include extreme seasonal variations in precipitation, complex hydrogeology, anthropogenic processes, and the lack of sufficient water quality data. The seasonal differences in precipitation often make it necessary to develop dry- and wet-weather regimen of water quality and quantity. However, such development can be difficult, because adequate data for each regime are not always available. The complex hydrogeology underlying the watershed further complicates the analysis due to the interaction of multiple groundwater sub-basins, which each contain a shallow unconfined aquifer, multiple levels of confined aquifer, and regional fault systems. Consequently, complicated flow paths result. Many reaches of Calleguas Creek receive groundwater inflow and are perennial, while others are ephemeral and infiltrate water into the ground at rates that often exceed the flow rate. The quality of the interacting groundwater also exhibits great seasonal and spatial variation. However, the available data on groundwater quality are of poor spatial and temporal resolution. This absence of data makes it problematic to predict changes in groundwater chemistry (based on season, precipitation, groundwater level, etc.) and the subsequent effect on surface water. Finally, anthropogenic processes further complicate the analysis by altering natural seasonal variations in hydrology. These alterations include the distribution of imported surface water, diversion of surface water to Pleasant Valley County Water District, wastewater treatment facility effluent discharges, groundwater pumping for irrigation, pumping to control high groundwater levels within the Simi Valley, and urban runoff.

Baseflow, water that is discharged to surface water from groundwater storage, is the fundamental link through which groundwater influences surface water quality. For Calleguas Creek, like many other watersheds throughout the country, the most reliable long-term data are daily precipitation and surface water discharge. Also the POTW-effluent discharges, pumped-groundwater discharges, and diversions from the Calleguas Creek system are rather constant and well-characterized. Therefore, by examining the summer flow record (when precipitation runoff is negligible), it is possible to reliably estimate the quantity of historic annual baseflow. More importantly, a relationship between that baseflow and the preceding-winter precipitation for each major segment of Calleguas Creek (Conejo Creek, Arroyo Simi/Las Posas, and Lower Calleguas Creek) was found. This correlation will allow the surface water model to predict dry-season baseflows as a function of preceding-winter precipitation. Then, using the available surface and groundwater quality data, average chloride, TDS, and sulfate concentrations will be applied to the predicted baseflow in each segment. This cycle of estimating baseflow quality and quantity defines the surface-groundwater interaction, and links the surface water model to subsurface processes.

METHODS

Baseflow Quantification and Prediction

To quantify baseflow within each major segment of Calleguas Creek, the historic daily discharge records for VCWPD flow gages 800, 803, and 805 (Figure 1) were used to calculate mean summer (June – August) flows for 1981-2000 (Figure 2). Intuitively, the long-term precipitation and discharge records suggest there is a correlation between mean summer discharge and precipitation the previous winter. Such correlations were determined for the three gages (800, 803, and 805), and results are shown graphically in Figure 3. The relationships are based on the assumption that all the precipitation for the water year (Oct. 1 – Sept. 30) fell before June. In fact, on average, 97.3% of the annual rainfall in the Calleguas Creek watershed occurs Oct 1-May 30. The observed increase in mean summer flows after wet winters is likely due to increased groundwater inputs (baseflow) to the stream system.

Because precipitation runoff during the dry-weather season of June through August is negligible, the only significant inputs to the stream are POTW effluent, urban runoff, agricultural tailwaters, and groundwater pumping from Simi Valley. Thus, by adding/subtracting the above components from the mean summer streamflow, an estimate of baseflow for each year can be calculated. The POTW effluents and Simi Valley groundwater pumping are the most significant and (fortunately) best characterized discharges. Estimates for dry-weather urban and agricultural runoff to each stream segment are also available. Finally, withdrawals from Conejo Creek for irrigation applications were included in the calculation. Knowledge of the above inputs and withdrawals makes it possible to use the mean summer discharge to derive a relationship for baseflow vs. previous-year annual precipitation (Figure 4).

In arid environments like the Calleguas Creek watershed, high precipitation winters are known to have a significant effect on water quality and quantity during the subsequent dry season. Without a specified relationship between the preceding-winter precipitation and following-year baseflow, the applied empirical model would exhibit no “memory” of high-precipitation winters. The derived regression equations in Figure 4 will be used in the mass balance model to predict higher surface water flows after wet winters, even after the precipitation-runoff has left the watershed. Consequently, the model will more accurately mimic the hydrology of the Calleguas Creek watershed, and provide more reliable results to be used during TMDL development. The baseflow

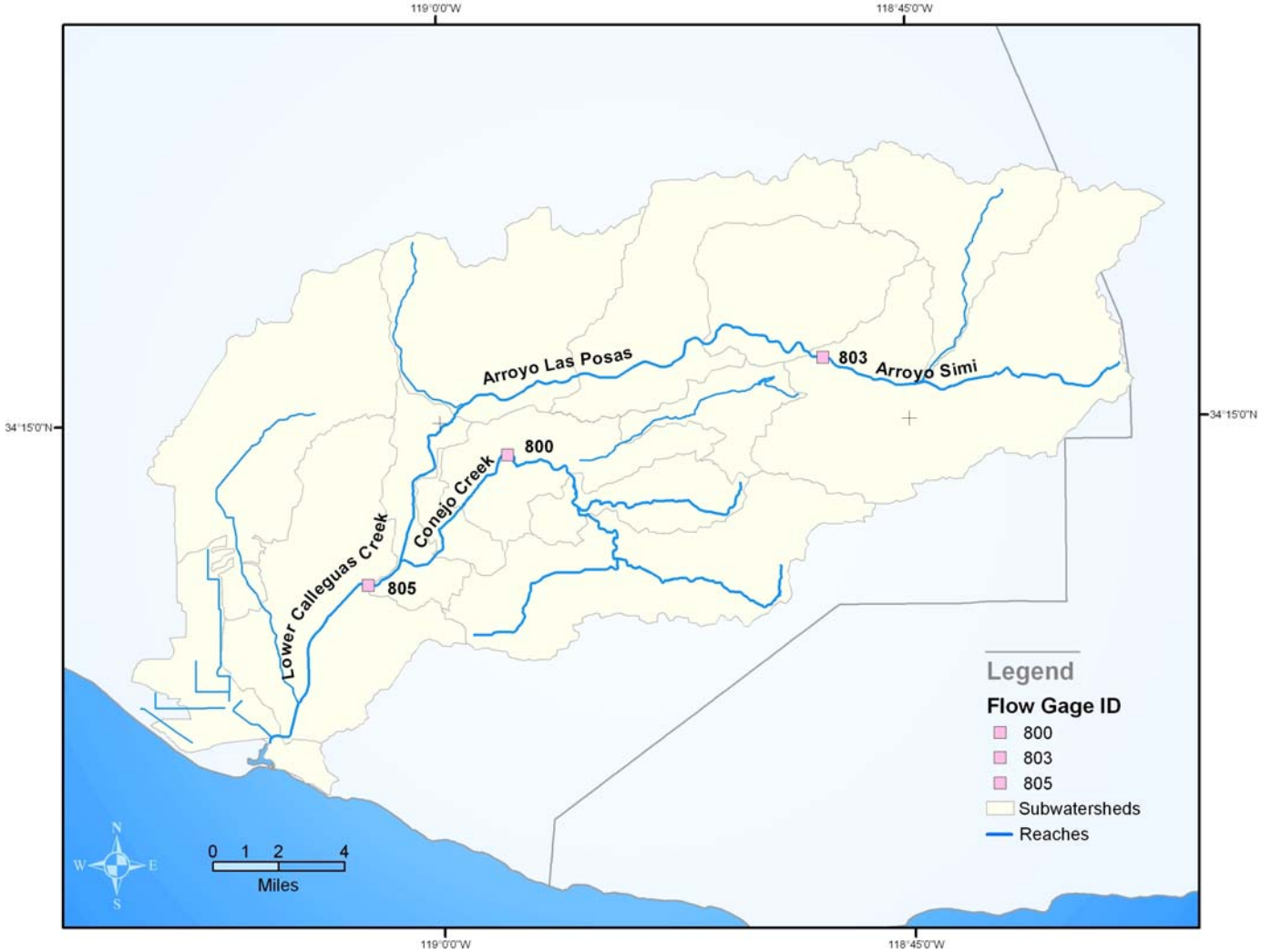

Figure 1. Calleguas Creek VCWPD Flow Gage Locations

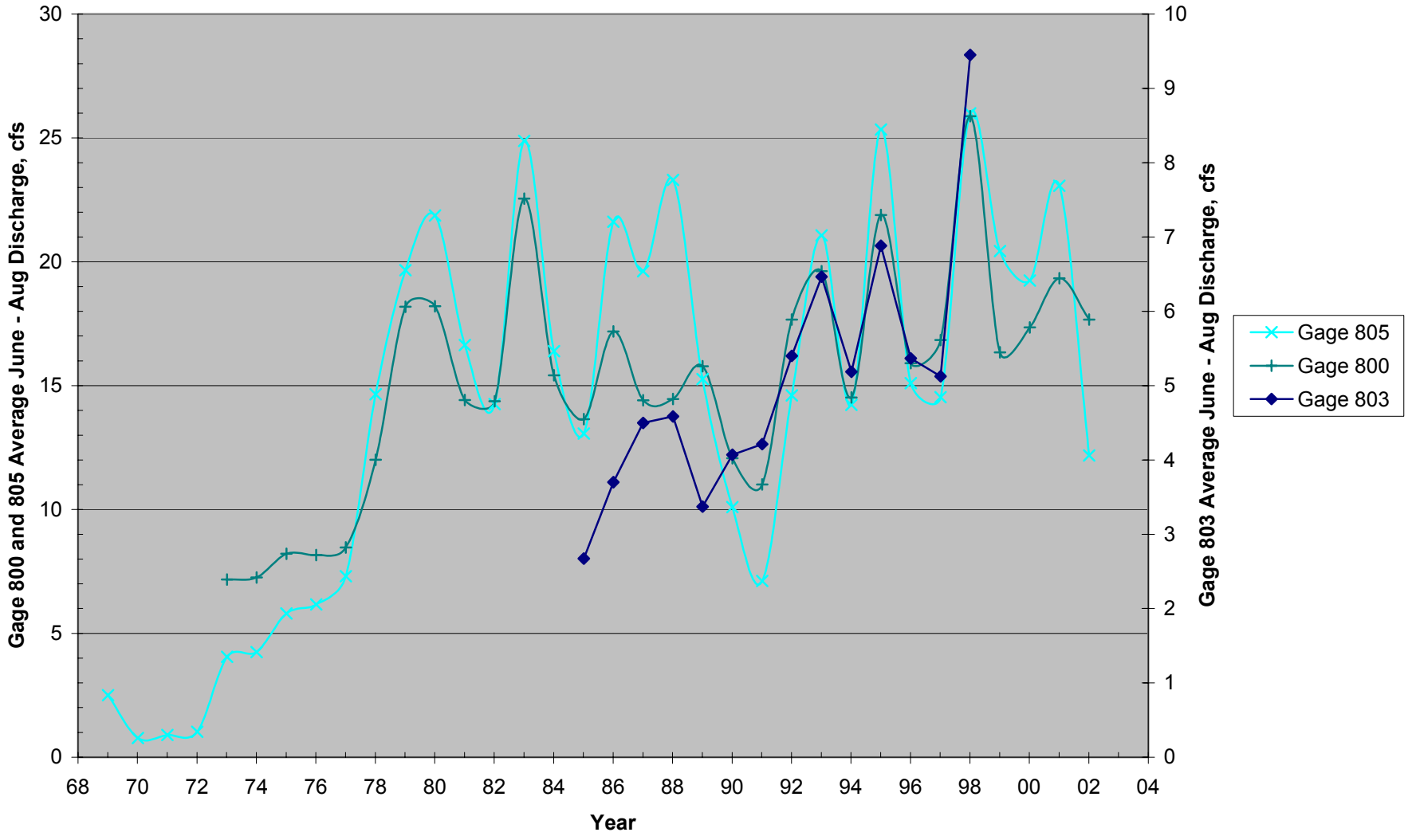

Figure 2. 1981 - 2002 Calleguas Creek Watershed Mean Summer (6/1 - 8/31) Flows

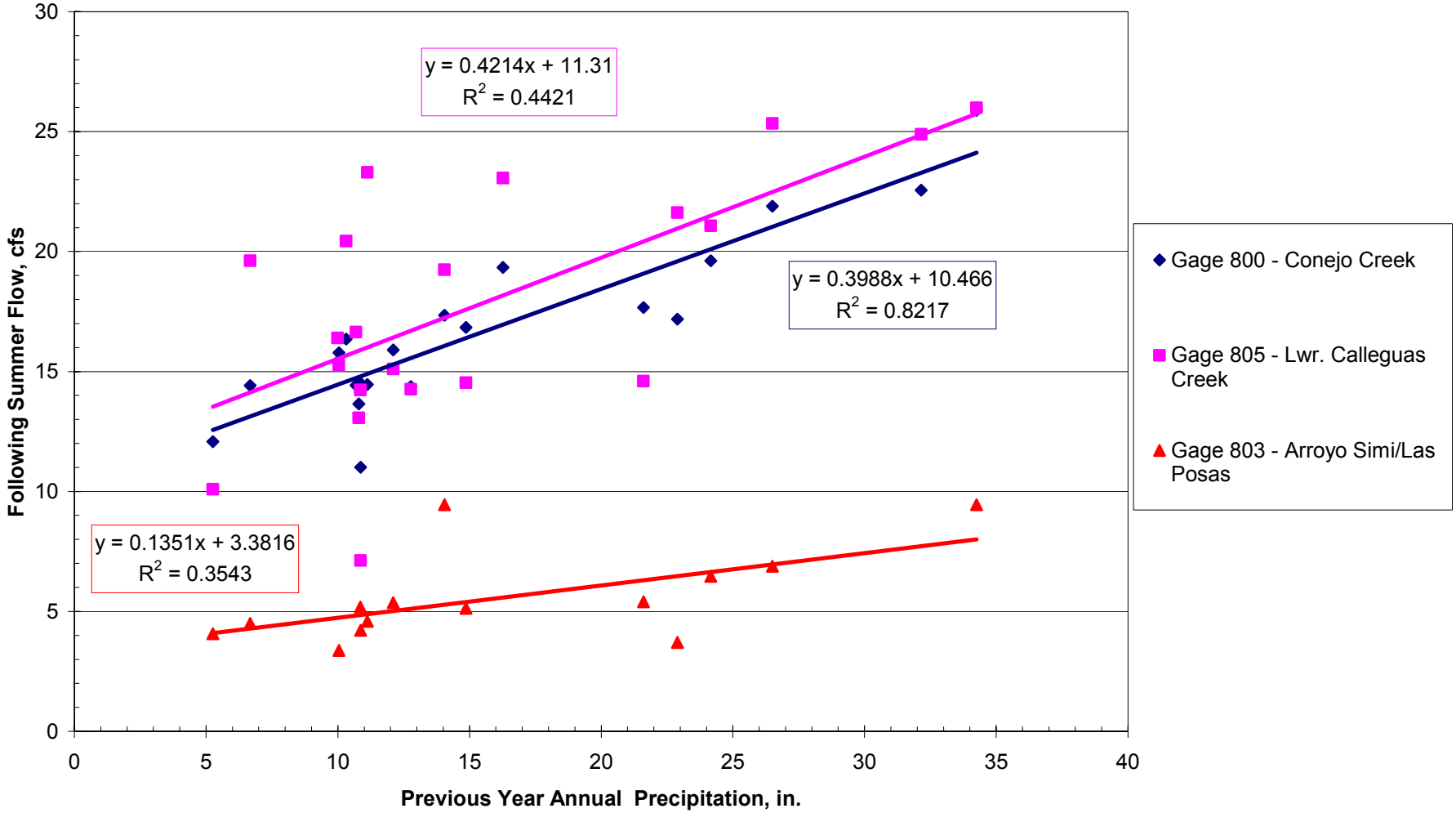

Figure 3. Calleguas Creek 1981 - 2001 Mean Summer Discharge vs. Previous-Year Annual Precipitation

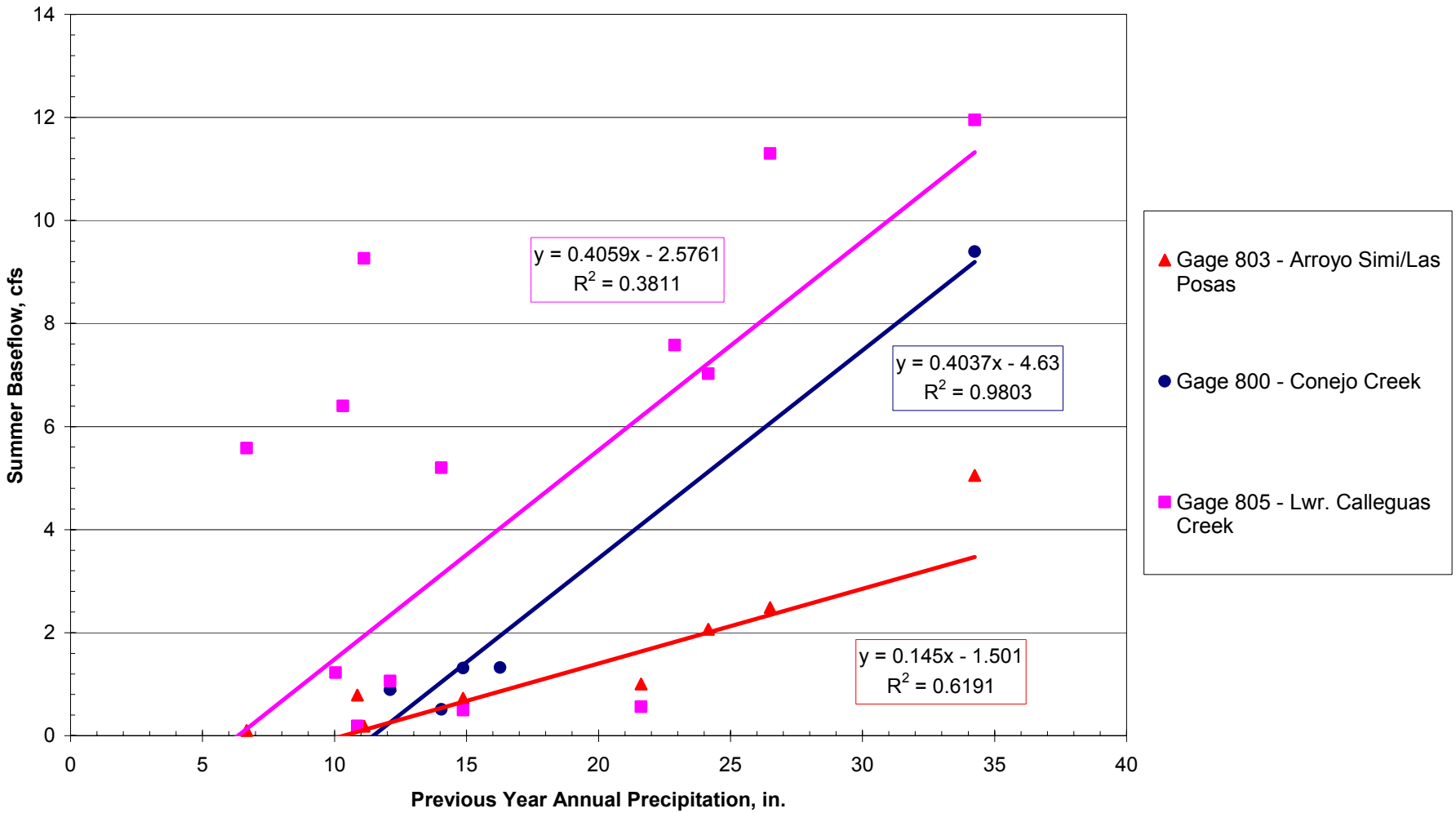

Figure 4. Calleguas Mean Summer Baseflow vs. Previous Year Annual Precipitation

calculations for the major segments (Conejo Creek, Lower Calleguas Creek, and Arroyo Simi/Las Posas) of the Calleguas Creek watershed are described in the next sub-sections.

Conejo Creek

Baseflows for the Conejo Creek segment (Gage 800) were calculated for the years 1996 through 2001 according to the following equation:

$$Q_{baseConejo} = Q_{summerConejo} – Q_{HillCanyon} – Q_{urban} - Q_{ag}$$

where:
$Q_{baseConejo}$ = 1996-2001 baseflows for the Conejo Creek segment
$Q_{summerConejo}$ = 1996-2001 mean summer discharge at Gage 800 (15.9 to 25.9 cfs)
$Q_{HillCanyon}$ = 1996-2001 Hill Canyon effluent mean summer discharge rates (13.6 to 15.4 cfs)
Q_{urban} = estimated Thousand Oaks dry-weather urban runoff (1.25 cfs)
Q_{ag} = estimated dry-weather agricultural runoff (0.16 cfs)

The baseflow calculation for Conejo Creek was limited to the years 1996-2001 because this is the period for which both discharge data from Hill Canyon (a large proportion of the flow at Gage 800) and precipitation data were available. Also, using the yearly data (as opposed to an overall average) resulted in a high r-squared value (0.98). Calculated baseflows are plotted vs. previous-year annual precipitation in Figure 4 along with the resulting regression line (blue) and corresponding regression equation. The equation will be used by the model to predict the discharge due to baseflow in all of Conejo Creek (Reaches 9A, 9B, and 10) through following winter.

Lower Calleguas

Baseflows for the Lower Calleguas Creek segment (Gage 805) were calculated for the years 1986 through 2001 according the following equation:

$$Q_{baseCall} = Q_{summerCall} – Q_{HillCanyon} – Q_{Cam} – Q_{urban} - Q_{ag} + Q_{diversion}$$

where:
$Q_{baseCall}$ = 1986-2001 baseflows for the Lower Calleguas Creek segment
$Q_{summerCall}$ = 1986-2001 summer flow at Gage 805 (7.1 to 26.0 cfs)
$Q_{HillCanyon}$ = 1996-2001 Hill Canyon effluent mean summer discharge rates (15.1 cfs)
Q_{Cam} = 1995-2003 Camarillo effluent mean summer discharge rate (3.4 cfs)
Q_{urban} = estimated Thousand Oaks and E. Camarillo dry-weather urban runoff (2.75 cfs)
Q_{ag} = estimated dry-weather agricultural runoff (0.69 cfs)
$Q_{diversion}$ = estimated lower Conejo Creek diversion rate (7.9 cfs)

The data window for Lower Calleguas Creek baseflow was chosen to be 1986 through 2000 because these years were considered to be representative of current conditions, and precipitation data was only available through 2000. Also, the effluent from the Hill Canyon and Camarillo WWTP's were not a large enough proportion of the flow at Gage 805 to limit the calculation to years for which effluent discharge data was available (like in Conejo Creek).

No direct measurement of lower Conejo Creek (below Gage 800) withdrawal rates were available for the summers of 1986 – 2001. The maximum withdrawal capacity along all of Conejo Creek during that period was

estimated to be 7.9 cfs (SWRCB, 1997). During the summer months, when irrigation rates are highest, it is likely that the maximum withdrawal rates were applied. Furthermore, nearly all agricultural/irrigated land lies downstream of Gage 800. Thus the entire Conejo Creek withdrawal capacity of 7.9 cfs was used for the Lower Calleguas Creek baseflow calculation.

Calculated baseflows are plotted vs. previous-year annual precipitation in Figure 4 along with the resulting regression line (pink) and corresponding regression equation. The equation will be used by the model to predict the discharge due to baseflow in Lower Calleguas Creek (Reaches 1, 2, and 3) through the following winter.

Arroyo Simi/Las Posas

Baseflows for the Arroyo Simi segment (Gage 803) were calculated for years 1986-1998 according to following equation:

$$Q_{baseSimi} = Q_{summerSimi} - Q_{dewatering} - Q_{urban}$$

where:
$Q_{baseSimi}$ = baseflows for the Arroyo Simi/Los Posas segment
$Q_{summerSimi}$ = 1986-1998 summer flow at Gage 803 (3.4 to 9.4 cfs)
$Q_{dewatering}$ = estimated Simi Valley groundwater dewatering rate (2.3 cfs)
Q_{urban} = estimated Simi Valley dry-weather urban runoff (2.1 cfs)

Note that no significant agricultural runoff drains to Gage 803. The data window for Arroyo Simi calculation was chosen to be 1986 through 1998 because these years were considered to be representative of current conditions, and Gage 803 data was only available through 1998. Calculated baseflows are plotted vs. previous-year annual precipitation in Figure 4 along with the resulting regression line (red) and corresponding regression equation. The equation will be used by the model to predict the discharge due to baseflow in Arroyo Simi and Arroyo Las Posas from the confluence of Tapo Canyon to the confluence of Conejo Creek (Reaches 6 and 7) through following winter.

Baseflow Chloride, TDS, and Sulfate Concentrations

Direct measurement of baseflow quality in developed watersheds is not usually feasible, because baseflow is often mixed with precipitation, effluent, agricultural runoff, and/or urban runoff. One approach to estimating baseflow quality is to investigate the water quality of wells near the surface water, because nearby wells are likely to be connected to groundwater that influences the surface water quality (i.e. groundwater that contributes to baseflow). Occasionally, however, surface water discharge and constituent concentration data are available for a site which is dominated by baseflow (i.e. an upstream location during dry-weather). In this case, the constituent concentration and discharge of the associated baseflow can be estimated by subtracting estimated discharges and concentrations of non-groundwater inputs. Such surface water quality data were available for the Conejo Creek segment.

Ideally, the surface water model would account for variations in baseflow concentration. Such a dynamic approach would require knowledge of the historical time-dependence of chloride, sulfate, and TDS concentrations in nearby groundwater. However data analysis showed that even wells that are nearby each other often display unique temporal trends, making it impossible to derive correlations between groundwater (or baseflow) concentration and precipitation, season, or groundwater level. This non-uniformity may be due to the heterogeneity of organic matter in the subsurface. The presence/absence of organic matter

enables/prevents different species of bacteria to control the oxidation-reduction state, and thus the precipitation-dissolution reaction rates (T.R. Ginn, personal communication, March 8, 2004)

Due to the "random" temporal variability of groundwater quality, the concentrations applied to baseflow will be constant. By using long-term groundwater quality data from wells that are nearby the major segments of Calleguas Creek (Arroyo Simi/Las Posas, Conejo Creek, and Lower Calleguas Creek), average concentrations of chloride, TDS, and sulfate were calculated and applied to the baseflow. Fortunately, the use of groundwater data was supported by Conejo Creek surface water data, as described in the Conejo Creek section below. In fact, the two methods resulted in identical average TDS concentrations. Furthermore, because groundwater chemistry is typically steady due to the fact that groundwater moves slowly with little mixing, exfilitrating groundwater concentrations may not vary greatly from season to season. Thus, applying a constant concentration to baseflow may be a reasonable assumption. More importantly, even though the concentration of chloride, sulfate, and TDS will be constant in the modeled baseflow, the quantity of baseflow varies with winter precipitation, allowing the groundwater to dynamically influence the surface water chemistry. Consequently, the model will predict higher surface water chloride after wet years and lower surface water chloride during storm events. Such predictions are consistent with observations by agricultural users in the watershed that yields are affected after particularly wet years due to higher surface water chloride concentrations (Hajas, personal communication), presumably as a result of higher groundwater inflows.

Conejo Creek

For Conejo Creek, both surface and groundwater quality data were used to estimate the chloride, sulfate, and TDS concentrations of the derived baseflow. Analysis of data from 30 wells in township-range sections that contain Conejo Creek resulted in the average chloride, sulfate, and TDS concentrations of 183, 239, and 820 mg/L, respectively. These averages and the associated summary statistics are listed in Table 1.

In addition, a historic record of dry-weather chloride, sulfate, and TDS concentration in Lower Calleguas and Conejo Creek are available. The chloride data are shown in Figure 5. The most upstream monitoring site was 50 ft. above the Hill Canyon WWTP discharge site. During the summer, the flow above Hill Canyon is dominated by baseflow, as seen by the much higher chloride concentrations at the site above Hill Canyon in Figure 5. Chloride concentrations are highest above Hill Canyon because baseflow concentrations are higher than downstream inputs in the Calleguas Creek watershed, as discussed in the Chloride vs. Precipitation section below.

The chloride, sulfate, and TDS data (Figure 6) for the site above Hill Canyon were used as a comparison for Conejo Creek well data displayed in Table 1. As discussed in the Baseflow Quantification and Prediction section above, one can determine average baseflow (Q_b) values in Conejo Creek. Then, applying estimates of agricultural (Q_{ag}) and urban runoff (Q_{urban}) discharge and constituent concentration (C_{ag} and C_{urban}, respectively), the baseflow constituent concentration (C_b) can be calculated using the following equation:

$$Q_tC_t = Q_bC_b + Q_{ag}C_{ag} + Q_{urban}C_{urban}, \quad \text{or}$$

$$C_b = (Q_tC_t - Q_{ag}C_{ag} - Q_{urban}C_{urban})/Q_b,$$

where:
Q_t = estimated discharge above Hill Canyon
C_t = measured constituent concentration above Hill Canyon.

The discharge at the site above Hill Canyon (Q_t) was assumed to be the average 1996-2002 discharge at Gage 800 (18.7 cfs), minus the average 1996-2002 Hill Canyon effluent discharge rate (15.1 cfs). The constituent concentrations used were the average 1987-1998 concentrations from Figure 6. The discharge and concentration values used for the calculation and the resulting calculated values for baseflow concentrations are summarized in Table 2. Solving for C_b resulted in baseflow concentrations of 248, 445, and 820 mg/L for chloride, sulfate, and TDS, respectively.

A comparison of the chloride, sulfate, and TDS concentrations derived from Conejo Creek surface and groundwater data suggests that using nearby well data for baseflow constituent determination is appropriate. In fact, the two methods derived the same value for TDS (820 mg/L) in Conejo Creek baseflow. Furthermore, the chloride values derived from the two methods (183 and 248 mg/L) were within approximately 30% of each other. The average result of the two methods (216 mg/L) will be used as the assigned chloride concentration of the baseflow in Conejo Creek. Similarly, the average sulfate concentration of 342 mg/L will be assigned to baseflow in Conejo Creek. The values that will be assigned to Conejo Creek baseflow are listed in Table 2.

Lower Calleguas

For the Arroyo Simi/Las Posas and Lower Calleguas reaches, there are insufficient surface water quality data to use for baseflow constituent estimation. Therefore, only data from wells that are the most likely to be connected to groundwater that influences surface water quality were used to estimate constituent concentrations in the groundwater inflow. Analysis of data from 34 wells in township-range sections that contain Lower Calleguas Creek resulted in the average constituent concentrations reported in Table 1. The average concentrations will be applied to the baseflow in all reaches of Lower Calleguas Creek (Reaches 1, 2, and 3). Summary statistics of well data are also presented in Table 1.

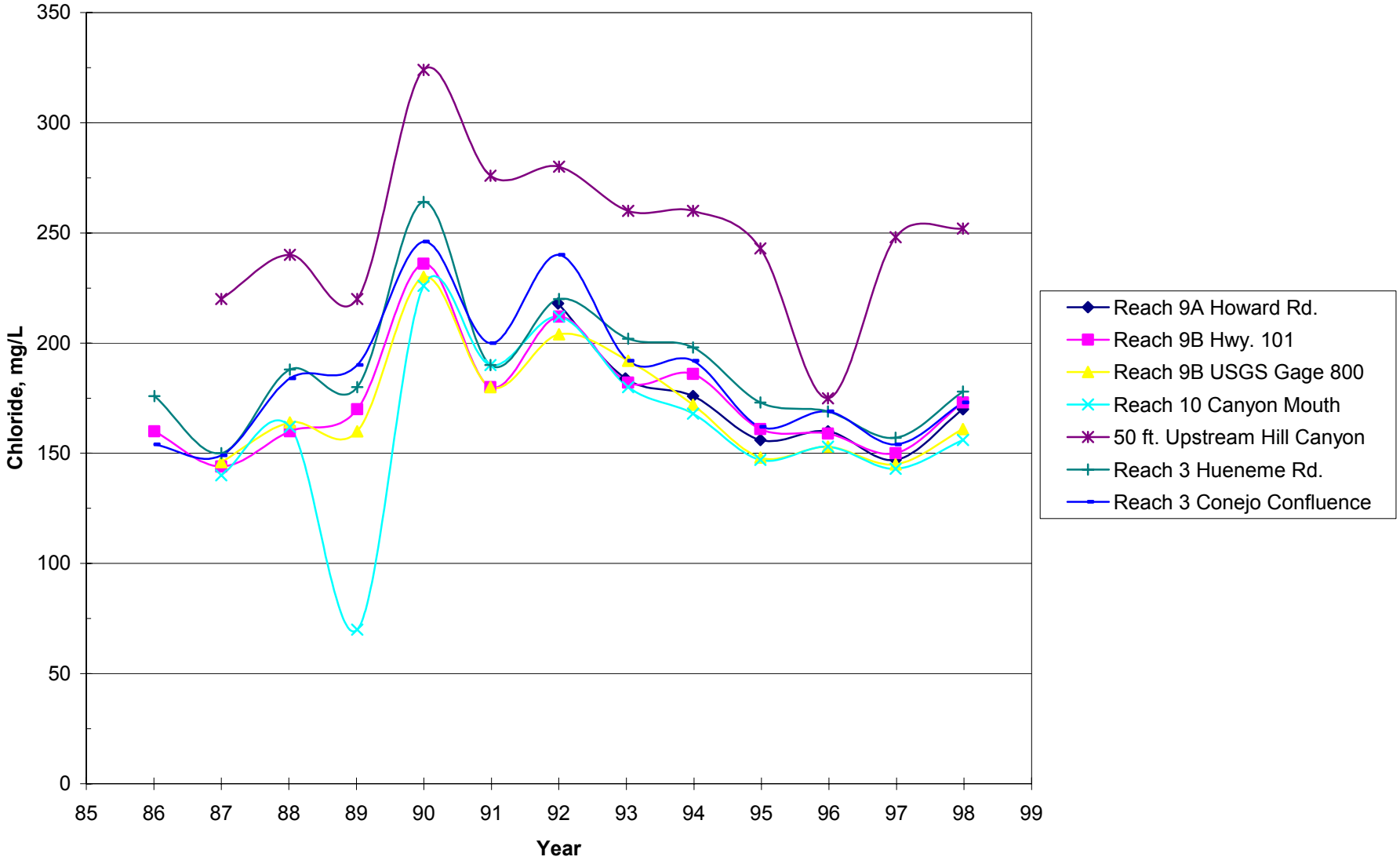

Figure 5. Calleguas and Conejo Creek Summer Recieving Water Chloride

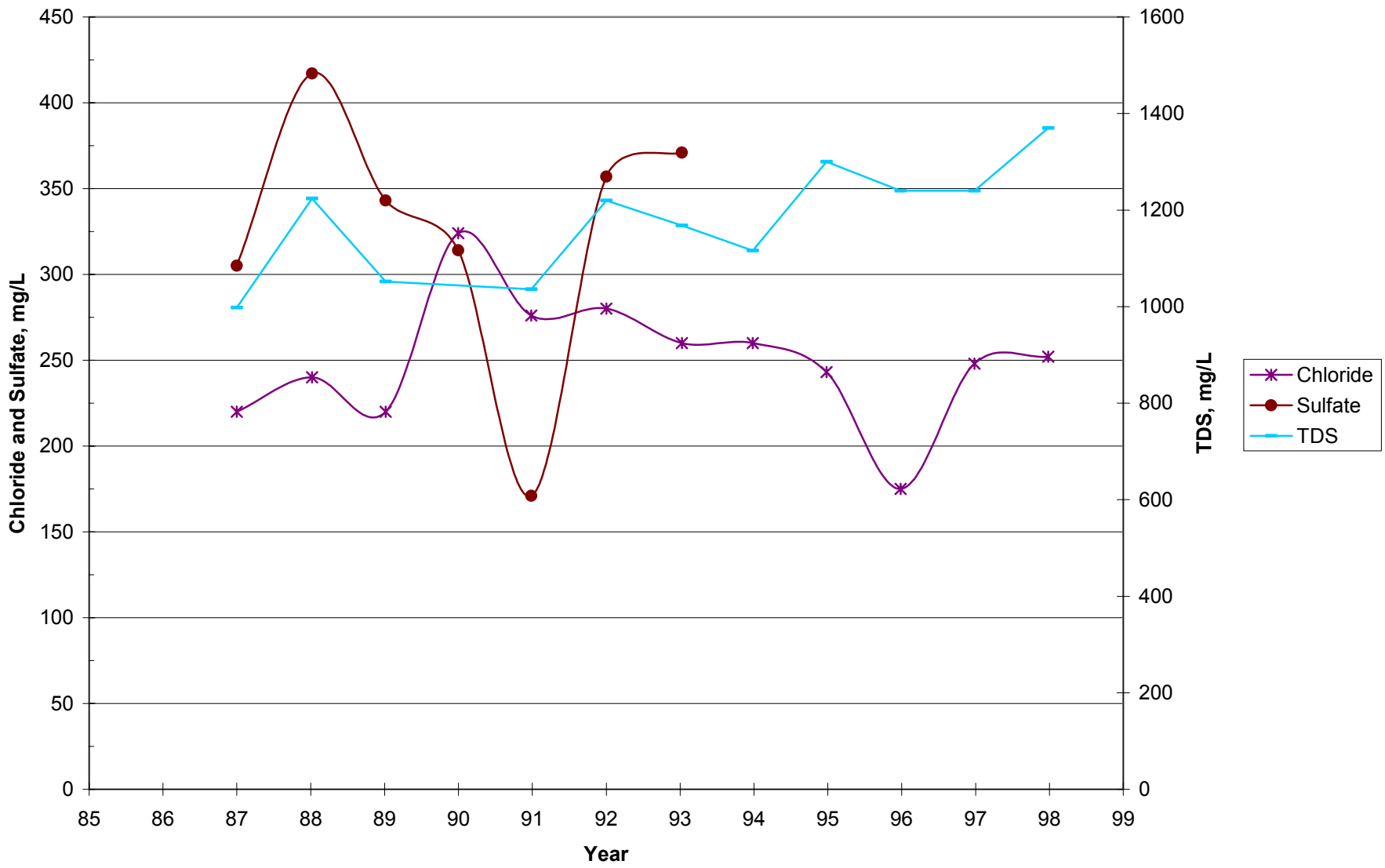

Figure 6. Conejo Creek Above Hill Canyon Summer Chloride, Sulfate, and TDS

Arroyo Simi/Las Posas

For the Arroyo Simi/Las Posas section, groundwater typically discharges from the Arroyo Simi and recharges along the Arroyo Las Posas. Therefore, Simi Valley dewatering wells near Arroyo Simi were used to estimate baseflow concentrations. Analysis of data from 5 wells resulted in the average constituent concentrations reported in Table 1. The average concentrations will be applied to the baseflow in Arroyo Simi and Arroyo Las Posas from the confluence of Tapo Canyon to the confluence of Conejo Creek (Reaches 6 and 7). Summary statistics of the well data are also presented in Table 1.

Chloride Concentration vs. Precipitation

Data compiled by the California Water Resources Board (1953) suggests that Calleguas Creek precipitation runoff exhibits chloride concentrations far below that of baseflow, resulting in low chloride concentrations during high discharge events (Figure 7). The horizontal axis of Figure 7 represents relative streamflow, with the mean annual streamflow assigned a value of one. Other Calleguas Creek surface water models have used these data exclusively for calibration (Durbin, 2002). Figure 7 shows concentrations of chloride in low relative-streamflows that are consistent with the calculated baseflow chloride concentrations in Table 1. Data from the Calleguas Creek Characterization Study also support the hypothesis of rainfall-runoff diluting baseflow chloride, as seen during the high discharge events sampled on 12/2/98 and 4/7/99 (Figure 8).

Conclusions

By calculating the quality and quantity of baseflow in the major segments of Calleguas Creek, the interaction between ground and surface water has been quantified. The correlations that define the interaction will be used in the surface water model to link surface and subsurface processes. The predicted groundwater inputs will vary spatially and temporally; a great improvement upon previous static versions of the surface water model. The quantity of groundwater inputs will be dependent on precipitation; higher after wet winters and vice-versa. The concentration of chloride, sulfate, and TDS in the baseflow will be reach-dependent to account for the spatial variation of groundwater sources within the watershed. Most significantly, the results presented here will enable the surface water model to provide more reliable estimates during the TMDL decision-making process, another step towards improving the Calleguas Creek watershed.

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State Water Resources Control Board. Proposed Decision Regarding Application 29408 and Wastewater Change Petition No. 6 for the City of Thousand Oaks and Availability of Unappropriated Water for Applications 29816, 29819, 29581, 29959, 30317, 30092, 30194 – Arroyo Conejo, Conejo Creek, and Calleguas Creek in Ventura County. Sacramento, CA. 1997.

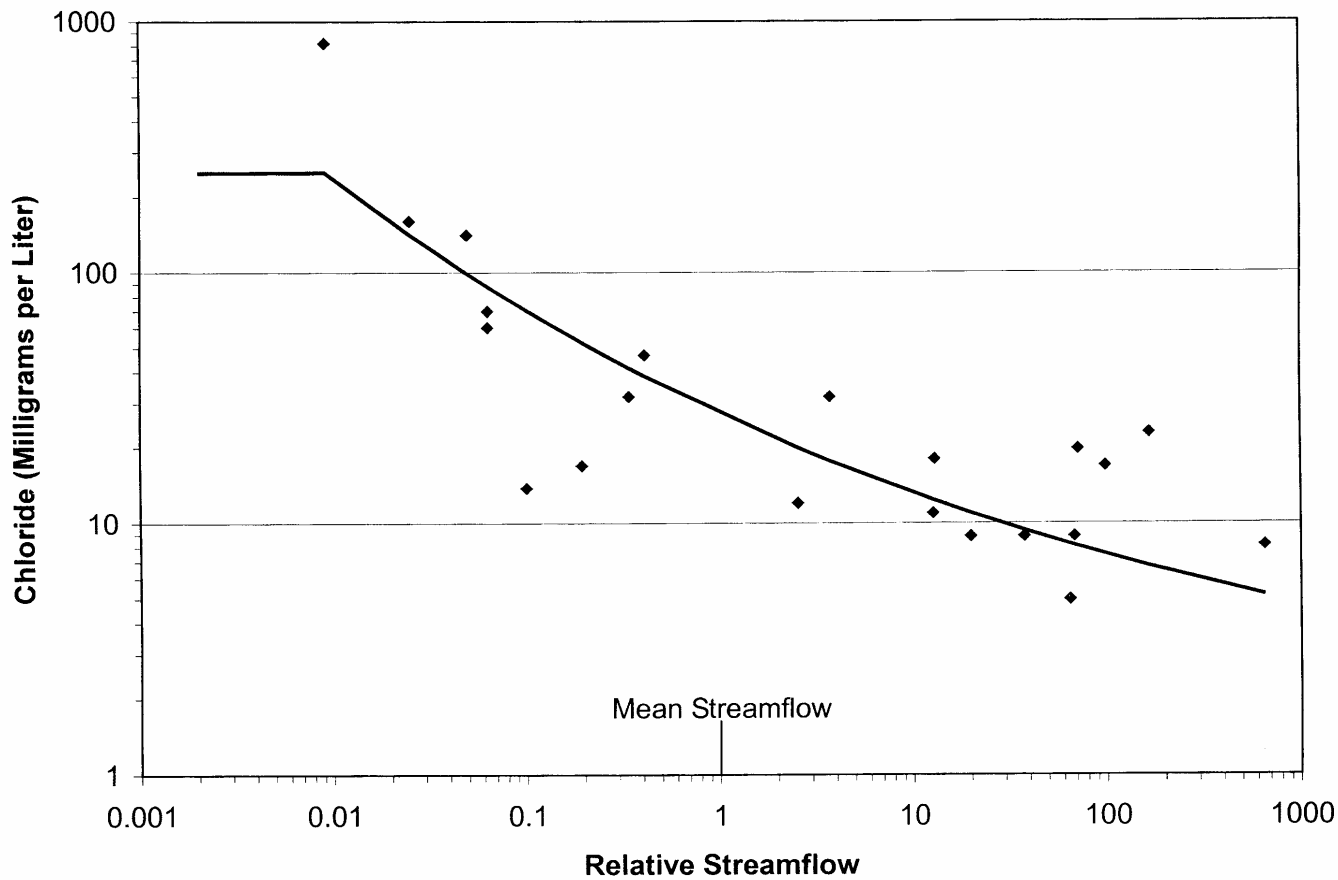


Figure 7. CC Surface Water Chloride Concentration vs. Relative Streamflow (from Durbin, 2002)

Table 1. Statistical Summary of GW Data Applied to Lower Calleguas and Arroyo Simi / Las Posas Baseflow

Parameter	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)
Conejo Creek			
# Samples	99	189	228
Average Concentration	**239**	**183**	**820**
Standard deviation	374	225	337
Maximum	1550	1650	1450
Minimum	0	1	0
Lower Calleguas			
# Samples	24	132	139
Average Concentration	**801**	**227**	**907**
Standard deviation	1285	332	337
Maximum	5600	2990	2770
Minimum	0	8	21
Arroyo Simi/Las Posas			
# Samples	28	28	33
Average Concentration	791	138	1741
Standard deviation	113	16	141
Maximum	1070	170	2067
Minimum	630	110	1560

Table 2. Surface Water Values Used for Conejo Creek Baseflow Estimation

Parameter	Average Flow (cfs)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)
Site above Hill Canyon 1987-1998 Summer Average	3.6	325	250	1283
Estimated Dry-Weather Urban Runoff	1.2	60	185	1937
Estimated Dry-Weather Agricultural Runoff	0.1	916	163	2662
Calculated Baseflow for Conejo Creek	2.3	**445**	**248**	**820**
Average of GW and Surface Water Methods (Value assigned to Conejo Creek baseflow)	-------	**342**	**216**	**820**

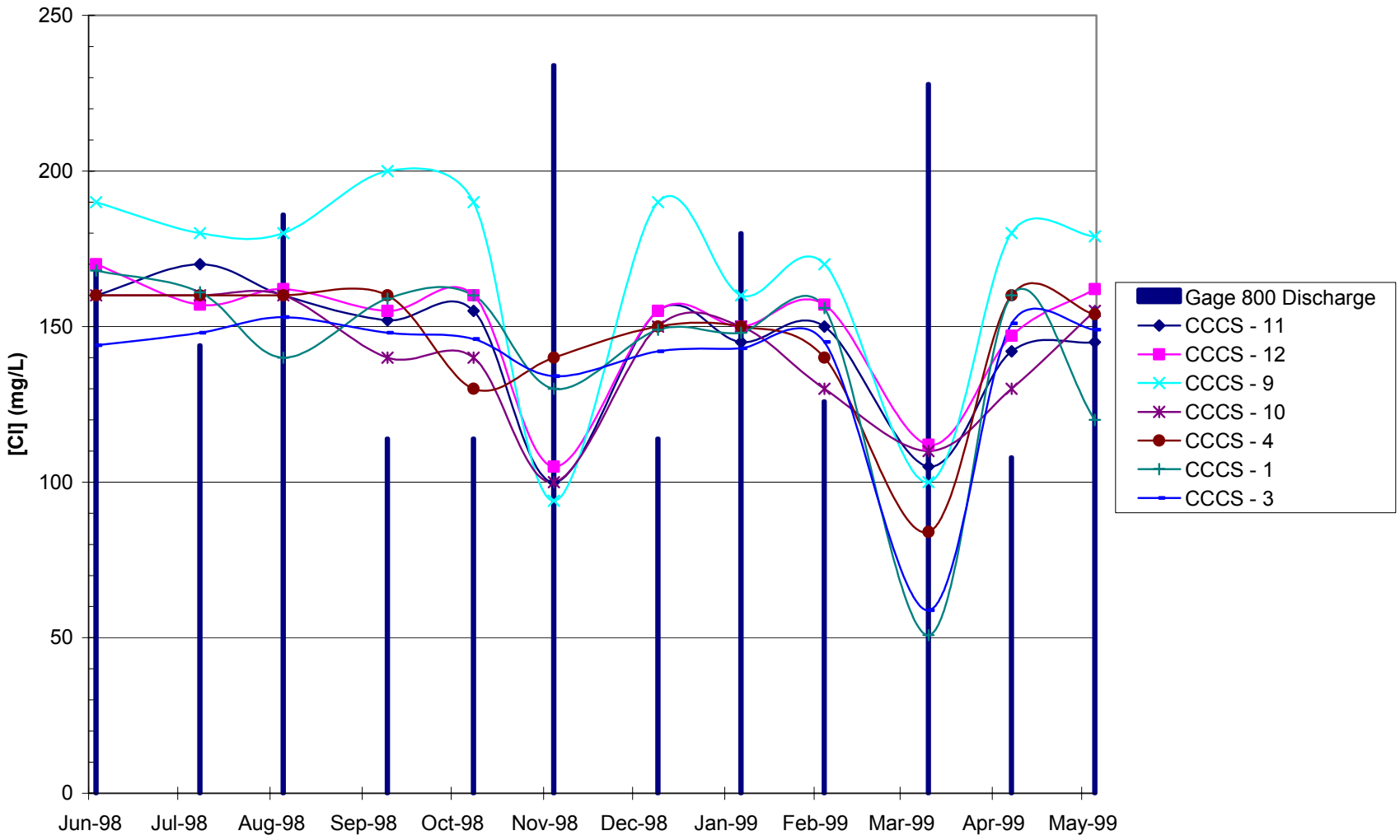


Figure 8. CCCS Receiving Water Chloride and Corresponding Gage 800 Discharge

Technical Memorandum
on
Stochastic Descriptions of Water Quality and Flows in the Calleguas Creek Watershed to Support the Calleguas Creek Dynamic Modeling System

Data Categories and Sources

Data categories analyzed to support the Calleguas Creek Dynamic Modeling System (CCDMS) included flow and quality of water inputs to the Calleguas Creek watershed and receiving waters within the watershed. Quality data considered were limited to the salt constituents, chloride, total dissolved solids (TDS), sulfate, and boron. The data categories considered in the analysis are summarized in Table 1 along with the sources from which the data were obtained.

Table 1. Summary of Data Categories Analyzed and Sources of Data

Data Category	Data Source
Flow	
POTW Effluent	
Camarillo WRP	Camarillo Wastewater Reclamation Plant
Hill Canyon WWTP	Hill Canyon Wastewater Treatment Plant
Simi Valley WQCP	Simi Valley Water Quality Control Plant
Receiving Water Gauge Stations	Ventura County Watershed Protection District
Quality	
POTW Effluent	
Camarillo WRP	Camarillo Wastewater Reclamation Plant
Hill Canyon WWTP	Hill Canyon Wastewater Treatment Plant
Simi Valley WQCP	Simi Valley Water Quality Control Plant
Imported Water	
Jensen Plant	Calleguas Municipal Water District
Freeman Diversion	United Water Conservation District
Stormwater Runoff	Ventura County Watershed Protection District; 205(j) Non-point Source Study; Calleguas Creek Characterization Study
Ag	
Open Space	

Data Category	Data Source
Industrial	
Commercial	
Residential	
Mixed Use	
Non-stormwater Runoff	Ventura County Watershed Protection District; 205(j) Non-point Source Study; Calleguas Creek Characterization Study
Ag	
Open Space	
Groundwater Discharge	Simi Valley Water Quality Control Plant; Calleguas Creek Characterization Study

Table 1. (continued)

Data Category	Data Source
Receiving water	Ventura County Watershed Protection District; 205(j) Non-point Source Study; Calleguas Creek Characterization Study; Camarillo WRP; Hill Canyon WWTP; Simi Valley WQCP
Precipitation	
Calleguas Rainfall Gauge Stations	Ventura County Watershed Protection District
Sacramento Precipitation Data	Western Regional Climatic Center
Evapotranspiration	(California SWRCB, 1984)

Data Analysis Procedures and Results

Data were analyzed for the purpose of describing the distributional characteristics of the various watershed flow and water quality parameters and, to the extent allowed by the nature of the data, to develop relationships between watershed input parameters and external variables used in the CCDMS. Such relationships, where found to be significant, are in the form of simple linear regressions. The resulting stochastic descriptions and predictive relationships are used within the CCDMS to produce internal variable values. In addition, distributional characteristics determined for watershed receiving water quality can serve as a model validation tool.

Most input parameter values were first plotted as functions of time to determine any apparent trends with time over years. In cases where time trends were apparent, selected portions of data sets were used in the analyses as necessary to best represent current conditions. Parameter values were also plotted as functions of month of the year to determine any apparent regular seasonal variability. In cases exhibiting significant seasonal variability, data were sorted and analyzed by month.

Specific analyses performed and the results obtained are presented below for the various data categories.

POTW Effluent Flow vs. Time

Effluent flow from the three POTWs that regularly discharge into the watershed, Camarillo, WRP, Hill Canyon WWTP, and Simi Valley WQCP, are plotted vs. time in Figure 1 through Figure 3, respectively. In the cases of Hill Canyon WWTP and Simi Valley WQCP, flow is tending to increase with time, most likely as a result of gradually increasing population contributing to the plants. Corresponding regression equations are displayed on each plot. The discharge pattern for Camarillo is more variable due to the variation in use of reclaimed water from the plant. To minimize the influence of time on the flow data values it was determined that subsequent stochastic descriptions of the data in all cases should be limited to the most recent 24 months of available data (October 2001 through September 2003). This time period is consistent with that used to describe effluent quality as discussed below.

POTW Effluent Flow vs. Month

Effluent flow data for Camarillo WRP, Hill Canyon WWTP, and Simi Valley WQCP were sorted by month and plotted in Figure 4 through Figure 6, respectively. Some differences in the distributions of data from month to month are apparent. Consequently, it was determined that separate frequency distributions for each month would provide a more accurate description of the flows from the various plants.

POTW Effluent Flow Frequency Distribution by Month

Monthly frequency distributions were determined for effluent flow data for non-precipitation days from each month for Camarillo WRP, Hill Canyon WWTP, and Simi Valley WQCP for the time period October 2001 through September 2003. Results are plotted for Camarillo in Figure 7 through Figure 18, for Hill Canyon in Figure 19 through Figure 30, and Simi Valley in Figure 31 through Figure 42. Each plot also displays a regression equation that describes the distributions. Regression equations are summarized in Table 2.

Table 2. Summary of Regression Equations and Statistics for POTW Effluent Flow Monthly Frequency Distributions and Δ Flow vs. Precipitation

Month	Camarillo WRP	Hill Canyon WWTP	Simi Valley WQCP
Jan	y = 4.863 + 0.82619norm(x) R= 0.97852	y = 16.642 + 0.51733norm(x) R= 0.92463	y = 14.269 + 0.48142norm(x) R= 0.98636
Feb	y = 4.9566 + 1.07norm(x) R= 0.94946	y = 17.218 + 1.8389norm(x) R= 0.88357	y = 14.764 + 1.6169norm(x) R= 0.85084
Mar	y = 4.3654 + 1.17norm(x) R= 0.97725	y = 16.842 + 1.5995norm(x) R= 0.91549	y = 14.43 + 1.0787norm(x) R= 0.91072
Apr	y = 4.3218 + 0.6838norm(x) R= 0.91311	y = 16.732 + 0.90588norm(x) R= 0.89113	y = 14.033 + 0.83749norm(x) R= 0.98076
May	y = 4.5976 + 0.8268norm(x) R= 0.95085	y = 16.724 + 0.8148norm(x) R= 0.96247	y = 13.812 + 0.86556norm(x) R= 0.93068
Jun	y = 3.7678 + 0.6655norm(x) R= 0.91555	y = 16.562 + 1.0042norm(x) R= 0.94187	y = 14.075 + 0.53396norm(x) R= 0.9697
Jul	y = 3.4175 + 0.6058norm(x) R= 0.97015	y = 16.118 + 1.0593norm(x) R= 0.92061	y = 13.847 + 0.42457norm(x) R= 0.98193
Aug	y = 3.6763 + 0.9436norm(x) R= 0.95871	y = 15.987 + 0.96662norm(x) R= 0.93561	y = 13.758 + 0.55879norm(x) R= 0.80508
Sep	y = 4.6145 + 0.6689norm(x) R= 0.96164	y = 16.253 + 0.71232norm(x) R= 0.96377	y = 13.699 + 0.56851norm(x) R= 0.98058
Oct	y = 3.6082 + 1.202norm(x) R= 0.96289	y = 16.38 + 0.81703norm(x) R= 0.85697	y = 13.723 + 0.68987norm(x) R= 0.99265
Nov	y = 4.8527 + 1.24norm(x)	y = 17.081 + 1.2237norm(x)	y = 14.212 + 0.68729norm(x)

	R= 0.98525	R= 0.88066	R= 0.98861
Dec	y = 5.0332 + 1.2383norm(x) R= 0.92881	y = 16.912 + 1.4069norm(x) R= 0.77868	y = 14.392 + 0.88446norm(x) R= 0.97912
Δ Flow vs. P	y = 0.97439x R= 0.25887	y = 2.1757x R= 0.57666	y = 1.1841x R= 0.4072

POTW Δ Effluent Flow vs. Precipitation

To quantify the effect of precipitation on effluent flow, the increases (Δ) in flows observed for days with precipitation following days without precipitation for the periods of record were plotted vs. average precipitation depths, which were determined by averaging rain gauge data from stations tributary to the POTW collection areas. Plots of Δ Effluent Flow vs. Precipitation Depth and the corresponding regression equations are presented for Camarillo WRP, Hill Canyon WWTP, and Simi Valley WQCP in Figures 43, 44, and 45, respectively. Regression equations are summarized in Table 2.

Receiving Water Flow vs. Precipitation

Receiving water flows at gauge stations 776, 800, 803, 805, 806, and 841 were plotted vs. area-weighted average precipitation depths determined from precipitation gauges tributary to the respective flow gauge stations. Plots and corresponding regression equations for gauge stations 776, 800, 803, 805, 806, and 841 are presented in Figures 46, 47, 48, 49, 50, and 51, respectively. Regression equations are summarized in Table 3.

Table 3. Summary of Regression Equations and Statistics for Gauge Flow vs. Precipitation

Gauge Station	Gauge Flow vs. Precipitation
776	y = 9.1422 + 228.02x; R= 0.62022
800	y = 17.125 + 385.92x; R= 0.68295
803	y = 7.3099 + 184.36x; R= 0.6352
805	y = 12.504 + 926.78x; R= 0.6983
806	y = 398.53x; R= 0.547
841	y = 17.445 + 396.73x; R= 0.63895

POTW Effluent Quality vs. Time

POTW effluent quality in terms of the salt constituents, chloride, total dissolve solids (TDS), sulfate, and boron, were plotted vs. time for the periods of record for the three principal treatment plants that discharge to the watershed. Results for Camarillo WRP are plotted in Figure 52 through 55 for chloride, TDS, sulfate, and boron, respectively. Chloride and TDS both clearly exhibit increasing trends over the period of record from 1998 through 2003, while sulfate and boron exhibit weak or no trends with time. The increasing trend in chloride is more dramatically illustrated in Figure 56, a plot of the 12-month running average effluent chloride vs. time. Plots for effluent quality vs. time for Hill Canyon and Simi Valley are presented in Figure 57 through Figure 60 and Figure 61 through Figure 64, respectively. Trends in chloride with time similar to those observed for Camarillo are noted for Hill Canyon and Simi Valley, although no apparent trends are exhibited with TDS, sulfate, or boron.

POTW Effluent Quality vs. Month

Effluent quality data for each salt constituent for Camarillo WRP, Hill Canyon WWTP, and Simi Valley WQCP were sorted by month and plotted in Figure 65 through Figure 68, Figure 69 through Figure 72, and Figure 73 through Figure 76, respectively. No clear differences in the distributions of data from month to month are apparent.

POTW Effluent Quality Frequency Distributions

Based on the observed relationships between effluent quality and time, and effluent quality and month of the year as described above, it was determined that frequency distributions of effluent quality in terms of the four salt constituents should be limited to the 2-year time period from October 2001 through September 2003 and that all data within the time period should be used in the analysis as opposed to separating the data by month. Resulting frequency distributions and corresponding regression equations for Camarillo WRP are plotted in Figure 77 through Figure 80, for Hill Canyon WWTP in Figure 81 through Figure 84, and for Simi Valley WQCP in Figure 85 through Figure 88. Similar plots were also prepared for the minor POTW discharges from the Camrosa and Moorpark treatment plants; results are presented in Figure 89 through Figure 92 and Figure 93 through Figure 96, respectively. Regression equations are summarized in Table 4.

Imported Water Quality vs. Time

The quality of the domestic water supply in terms of the four salt constituents of interests strongly influences the quality of POTW effluents. Imported water constitutes the major source of domestic water supply in the watershed. The principal source of imported water is State Water Project water distributed through the Jensen Water Treatment Plant (Jensen Plant). A smaller volume of water is diverted from the Santa Clara River trough the Freeman Diversion. Imported water quality data in terms of the four salt constituents of interests were analyzed with respect to variation with time. Results for the Jensen Plant are plotted in Figure 97 through Figure 100. Each of the salt constituents exhibits both short-term cyclic and long-term trends with time. The increasing trend in chloride is more dramatically illustrated in Figure 101, a plot of the 12-month running average chloride vs. time. These trends support the decision to limit POTW effluent analysis to data from the most current 2-year period.

Results for Freeman Diversion water are plotted in Figure 102 through Figure 105. No apparent time trends are exhibited in these plots.

Imported Water Quality Frequency Distributions

Frequency distributions of imported water quality in terms of the four salt constituents were determined for both the Jensen Plant and the Freeman Diversion. Plots of the distributions along with associated regression equations for the distributions are presented in Figure 106 through Figure 109 for the Jensen Plant and in Figure 110 though Figure 113 for the Freeman Diversion. Regression equations and statistics are summarized in Table 4.

Imported Water (Jensen Plant) Chloride vs. Precipitation

It was speculated that Jensen Plant chloride quality could be correlated with an external variable, such as precipitation in Northern California. To determine if such correlation exists, the Jensen Plant 12-month average chloride concentration data were plotted together with the annual precipitation depth for Sacramento vs. time. The 12-month average chloride was also plotted as a function of Sacramento Annual Precipitation. Results are presented in Figure 114 and 115, respectively. Based on the limited data set there is a weak negative correlation between Jensen Plant chloride and Sacramento Annual Precipitation, indicating that wet years in Northern California can be expected to produce lower chloride concentrations in imported water from the Jensen Plant.

POTW Effluent Quality vs. Jensen Plant Quality

In terms of direct correlation between POTW effluent salt quality and Jensen Plant quality, only chloride and sulfate exhibited significant correlations for the three principal POTWs. Plots of POTW effluent chloride and sulfate concentrations vs. Jensen Plant concentrations are presented in Figures 116 and 117, respectively for Camarillo WRP, in Figures 118 and 119 for Hill Canyon WWTP, and Figure 120 and 121 for Simi Valley WQCP. Corresponding regression equations and statistics are summarized in Table 5.

Table 4. Summary of Regression Equations and Statistics for Frequency Distributions of Quality Data from Watershed Inputs

Input Source	TDS	Chloride	Sulfate	Boron
Effluent				
Camarillo	y = 955.11 + 45.167norm(x) R= 0.97628	y = 187.85 + 9.2194norm(x) R= 0.86777	y = 216.37 + 19.632norm(x) R= 0.9759	y = 0.62741 + 0.02689norm(x) R= 0.97091
Hill Canyon	y = 640.75 + 36.932norm(x) R= 0.98374	y = 150.04 + 9.9102norm(x) R= 0.98443	y = 106.96 + 11.653norm(x) R= 0.97979	y = 0.60958 + 0.06363norm(x) R= 0.96829
Simi Valley	y = 696.56 + 55.412norm(x) R= 0.99159	y = 145.07 + 10.91norm(x) R= 0.98152	y = 170.63 + 24.261norm(x) R= 0.95165	y = 0.52963 + 0.05538norm(x) R= 0.82344
Camrosa	y = 716.55 + 146.13norm(x) R= 0.9298	y = 155.05 + 33.397norm(x) R= 0.94341	y = 133.27 + 12.608norm(x) R= 0.97092	y = 0.34338 + 0.17026norm(x) R= 0.98303
Moorpark	y = 573.67 + 8.2889norm(x) R= 0.99741	y = 140.67 + 13.469norm(x) R= 0.95492	y = 138.67 + 10.879norm(x) R= 0.90594	y = 0.55667 + 0.03108norm(x) R= 0.93326
Storm Runoff				
Ag	y = 568.37 * e^(0.72369norm(x)) R= 0.94632	y = 33.597 * e^(0.8436norm(x)) R= 0.95608	No Data	No Data
Open Space	y = 1427.3 * e^(0.53738norm(x)) R= 0.97977	y = 76.178 * e^(0.7366norm(x)) R= 0.98636	No Data	No Data
Industrial	y = 90.96 * e^(0.75636norm(x)) R= 0.96689	y = 24.25 + 16.895norm(x) R= 0.99846	No Data	No Data
Commercial	y = 57.711 * e^(0.47663norm(x)) R= 0.78019	y = 3 + 2.4605e-16norm(x) R= 0	No Data	No Data
Residential	y = 81.604 * e^(0.76254norm(x)) R= 0.97319	y = 18.11 * e^(0.94535norm(x)) R= 0.95108	No Data	No Data
Mixed Use	y = 525.25 * e^(0.90253norm(x)) R= 0.91777	y = 39.716 * e^(1.2859norm(x)) R= 0.90594	No Data	No Data

Non-storm Runoff				
Ag	y = 2662.5 + 989.56norm(x) R= 0.98538	y = 167.29 + 62.514norm(x) R= 0.95026	No Data	No Data
Open Space	y = 2078.7 + 994.16norm(x) R= 0.95134	y = 171.4 + 86.512norm(x) R= 0.9408	No Data	No Data
Mixed Use	y = 1937.5 + 502.33norm(x) R= 0.96524	y = 185.88 + 110.73norm(x) R= 0.94561	No Data	No Data
GW Discharge	y = 1633.7 + 31.232norm(x) R= 0.96421	y = 130.91 + 2.8524norm(x) R= 0.99112	y = 758.49 * e^(0.1373norm(x)) R= 0.91897	y = 0.80455 + 0.058875norm(x) R= 0.9406

Table 4. (continued)

Input Source	TDS	Chloride	Sulfate	Boron
Imported Water				
Jensen Plant	y = 328.65 * e^(0.14238norm(x)) R= 0.98771	y = 61.653 * e^(0.25203norm(x)) R= 0.97984	y = 85.731 + 27.61norm(x) R= 0.98197	y = 0.26974 + 0.059617norm(x) R= 0.97792
Freeman Diversion	y = 1105.8 + 253.35norm(x) R= 0.99483	y = 53.753 * e^(0.45105norm(x)) R= 0.98805	y = 507.08 + 139.97norm(x) R= 0.99791	y = 0.74741 + 0.19699norm(x) R= 0.983

Table 5. Summary of Regression Equations and Statistics for POTW Effluent Quality vs. Jensen Plant Quality

Salt	Camarillo WRP	Hill Canyon WWTP	Simi Valley WQCP
Chloride	y = 121.66 + 0.81487x R= 0.76842; RMS = 10.296	Y = 73.106 + 0.911x; R = 0.864; RMS = 8.189	y = 78.706 + 0.827x; R= 0.882; RMS = 6.808
Sulfate	y = 161.795 + 0.801x; R= 0.410; RMS = 26.867	Y = 60.779 + 0.962x; R = 0.695; RMS = 15.042	Y = 126.037 + 0.926x; R = 0.484; RMS = 33.092

Stormwater Runoff Quality Frequency Distributions

Only chloride and TDS data are available for stormwater runoff from different land uses. Insufficient data are available to establish relationships between stormwater runoff quality from different land uses and hydrological parameter external variables such as event rainfall amount, antecedent dry period and cumulative seasonal precipitation. Consequently, frequency distributions of chloride and TDS were developed to describe stormwater runoff quality for the following types of land use: agricultural, open space, industrial, commercial, residential, and mixed-use. Frequency distribution plots and corresponding regression equations and statistics for chloride and TDS are shown in Figures 122 and 123 for agricultural, Figures 124 and 125 for open space, Figures 126 and 127 for industrial, Figures 128 and 129 for commercial, Figures 130 and 131 for residential, and Figures 132 and 133 for mixed-use. Regression equations and statistics are summarized in Table 4.

Non-stormwater Runoff Quality Frequency Distribution

Non-stormwater (dry season) runoff data are only available for chloride and TDS from agricultural, open space and mixed-use land uses. Frequency distribution plots and corresponding regression equations and statistics are shown in Figures 134 and 135 for agricultural, Figures 136 and 137 for open space, and Figures 138 and 139 for mixed-use. Regression equations and statistics are summarized in Table 4.

Groundwater Discharge Quality Frequency Distribution

Groundwater is continuously pumped and discharged to the watershed in the Simi Valley area to control the level of the groundwater table. Frequency distributions for chloride, TDS, sulfate, and boron concentrations in pumped groundwater discharge are plotted in Figure 140 through Figure 143, respectively. Regression equations and statistics are summarized in Table 4.

Receiving Water Quality vs. Time

Concentrations of the four salt constituents observed in the various reaches of the Calleguas Creek watershed were plotted as functions of time. Plots for the various reaches are presented in the Figures listed below:

Reach	Figure No.			
	Chloride	TDS	Sulfate	Boron
2	144	145	146	147
3	148	149	150	–
4	151	152	153	154
5	155	156	–	–
6	157	158	159	160
7	161	162	163	164
9A	165	166	167	168
9B	169	170	171	172
10	173	174	175	176
11	177	178	179	180
13	181	182	183	184

In general, no consistent correlations with time were observed for any of the four salt constituents in any of the reaches.

Receiving Water Quality Frequency Distributions

Frequency distributions of salt quality data for the various reaches were prepared and are presented in the Figures listed below:

Reach	Figure No.			
	Chloride	TDS	Sulfate	Boron
2	185	186	187	188
3	189	190	191	192
4	193	194	195	–
5	196	197	198	199
6	200	201	–	–

7	202	203	204	205
9A	206	207	208	209
9B	210	211	212	213
10	214	215	216	217
11	218	219	220	221
13	222	223	224	225

These descriptions of receiving water quality may be useful during the model validation process. Regression equations and statistics associated with the frequency distributions are summarized in Table 6.

Receiving Water Gauge Flow vs. Quality

In an effort to describe receiving water salt quality as a function of stream flow, receiving water quality data were plotted vs. flow for selected stream gauges in the watershed. Not all flow gauges or constituents were analyzed in this manner, because it was discovered that quality data were only available for a small range of low flows. Consequently, any relationships developed would be valid only over a limited range of flows. Flows at Gauge 800 are plotted vs. chloride concentration in Figure 226. Flows at Gauge 803 are plotted vs. chloride, TDS, sulfate, and boron concentrations in Figures 227, 228, 229, and 230, respectively. Flows at Gauge 841 are plotted vs. chloride, TDS, and sulfate concentrations in Figures 231, 232, and 233, respectively. Regression equations and statistics are summarized in Table 7.

Daily Evapotranspiration vs. Day of Year

To develop daily values for evapotranspiration (ET) associated with water bodies and riparian vegetation that can be used as external variables in the CCDMS, monthly values of potential ET were obtain for coastal and inland areas within the Calleguas Creek watershed from a reference document (SWRCB, 1984) and daily values were calculated by interpolation between monthly values. ET for water surface and riparian vegetation were estimated by increasing the potential ET values by a factor of 1.10. Separate ET values were determined for coastal and inland areas. A plot of estimated ET versus day of year is presented in Figure 234.

references

California State Water Resource Control Board (1984), “Irrigation with Recycled Municipal Wastewater – A Guidance Manual", Report No. 84-1 wr. California. SWRCB, Sacramento, CA, July 1984.

Table 6. Summary of Regression Equations and Statistics for Frequency Distributions of Quality Data from Receiving Waters

Reach	TDS	Chloride	Sulfate	Boron
Reach 2	y = 1519.6 * e^(0.80032norm(x))	y = 378.18 * e^(1.1167norm(x))	y = 474.1 * e^(0.71844norm(x))	y = 1.5364 + 0.60691norm(x)
	R= 0.94871	R= 0.96222	R= 0.96143	R= 0.98441
Reach 3	y = 788.2 + 166.5norm(x)	y = 163.28 + 38.891norm(x)	y = 254.44 + 78.084norm(x)	No Data
	R= 0.92298	R= 0.91275	R= 0.99097	
Reach 4	y = 2200.3 + 1351.4norm(x)	y = 89.661 * e^(0.79697norm(x))	y = 1606.2 + 517.82norm(x)	y = 1.43 + 0.52767norm(x)
	R= 0.91519	R= 0.92875	R= 0.85207	R= 0.91711
Reach 5	y = 293.85 * e^(0.40701norm(x))	y = 17.549 * e^(0.52709norm(x))	No Data	No Data
	R= 0.96816	R= 0.95237		
Reach 6	y = 1187.7 + 131.07norm(x)	y = 150.45 + 18.4norm(x)	y = 459.97 + 81.622norm(x)	y = 0.73667 + 0.21298norm(x)
	R= 0.81652	R= 0.85704	R= 0.92966	R= 0.78161
Reach 7	y = 1221.6 + 674.56norm(x)	y = 142.4 + 18.917norm(x)	y = 729.92 + 243.59norm(x)	y = 1.0478 + 0.25025norm(x)
	R= 0.91798	R= 0.86582	R= 0.96237	R= 0.9643
Reach 9A	y = 832.75 + 111.4norm(x)	y = 159.95 + 19.65norm(x)	y = 248.58 + 32.006norm(x)	y = 0.37583 + 0.043026norm(x)
	R= 0.98686	R= 0.96879	R= 0.94475	R= 0.94542
Reach 9B	y = 777.52 + 143.07norm(x)	y = 159.65 * e^(0.16593norm(x))	y = 248.28 + 75.275norm(x)	y = 0.35417 + 0.052488norm(x)
	R= 0.95185	R= 0.98218	R= 0.99407	R= 0.96729
Reach 10	y = 953.73 + 232.74norm(x)	y = 168.09 * e^(0.24824norm(x))	y = 261.17 + 91.975norm(x)	y = 0.52425 + 0.1141norm(x)
	R= 0.98529	R= 0.97937	R= 0.98283	R= 0.97042

Reach 11	y = 668.33 + 94.652norm(x) R= 0.92968	y = 105.42 + 17.442norm(x) R= 0.97181	y = 150.5 + 25.916norm(x) R= 0.95627	y = 0.1875 + 0.042437norm(x) R= 0.90579
Reach 13	y = 1188.3 + 184.17norm(x) R= 0.84327	y = 167.75 + 29.957norm(x) R= 0.85555	y = 396.58 + 74.347norm(x) R= 0.89159	y = 0.17583 + 0.042261norm(x) R= 0.95017

Table 7. Summary of Regression Equations and Statistics for Gauge Flow vs. Receiving Water Quality

Gauge	TDS	Chloride	Sulfate	Boron
800		y = 163.91 – 0.1012x; R= 0.06749		
803	y = 2006.8 – 21.075x R= 0.5285	y = 164.81 – 1.7241x R= 0.6296	y = 1083.1 – 18.248x R= 0.8296	y = 1.2908 – 0.018211x R= 0.63212
841	y = 1291.2 – 4.3917x R= 0.29114	y = 170.9 – 0.88759x R= 0.43531	y = 498.05 – 1.8929x R= 0.30749	

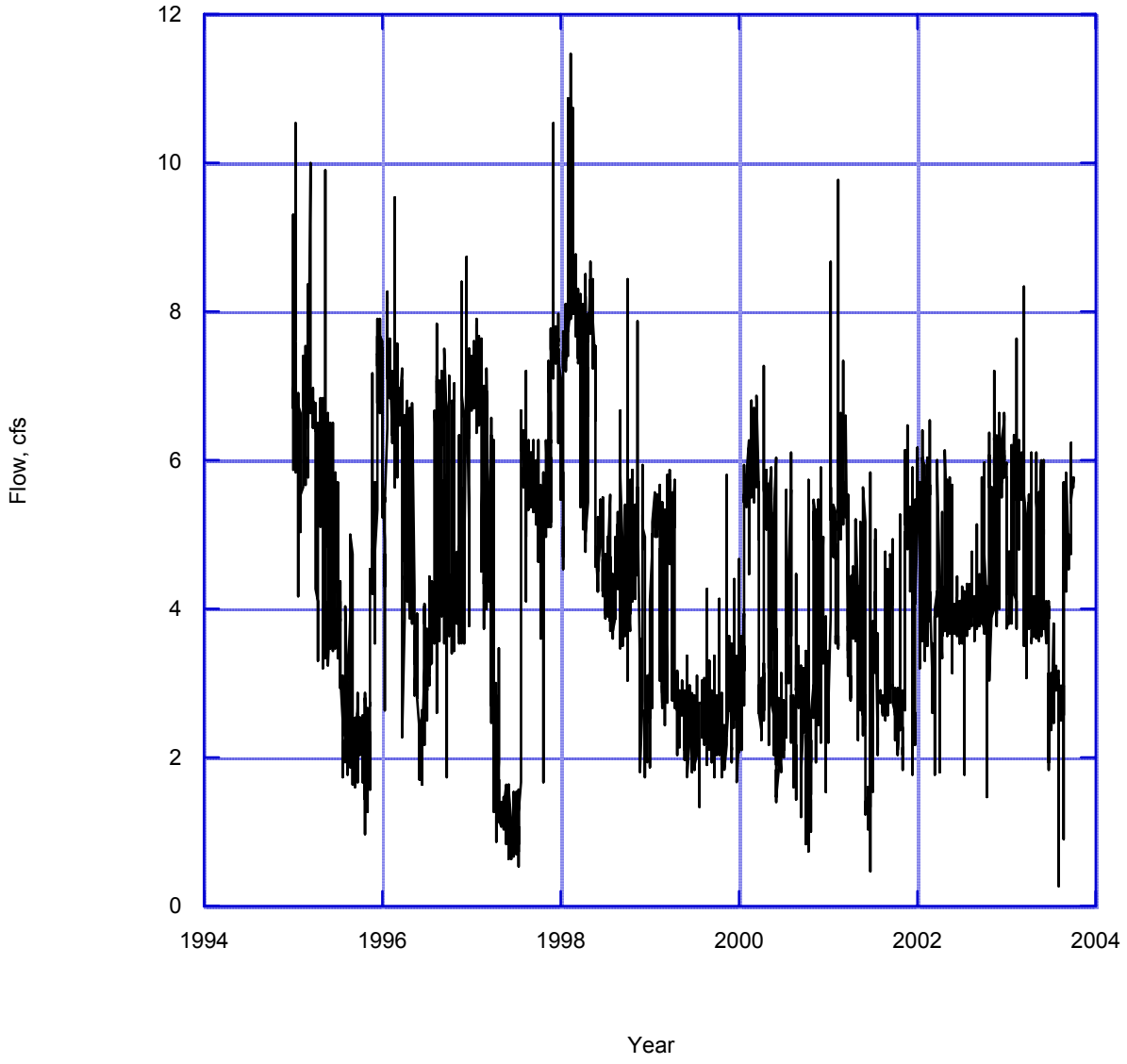


Figure 1. Camarillo Effluent Flow vs. Time

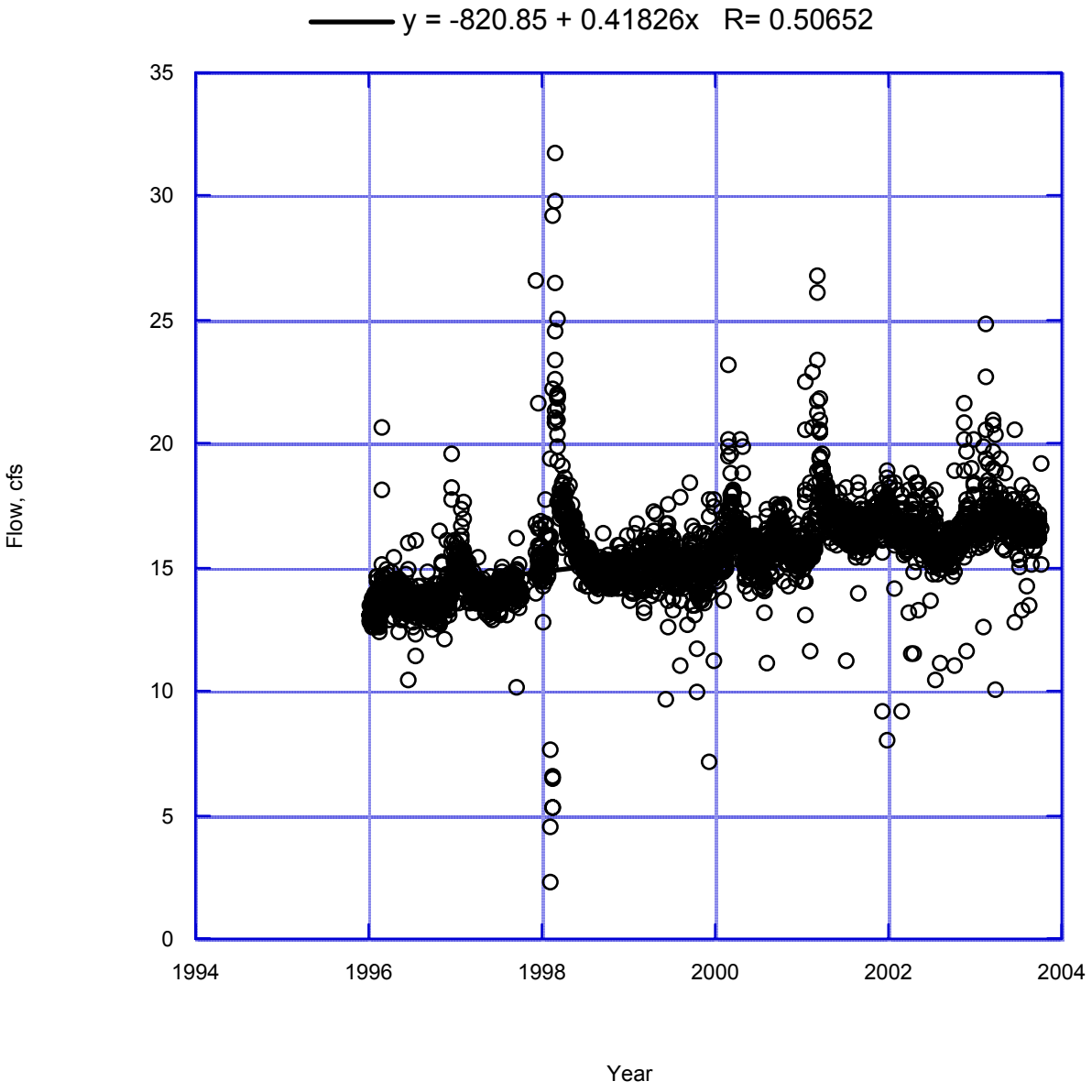


Figure 2. Hill Canyon Effluent Flow vs. Time

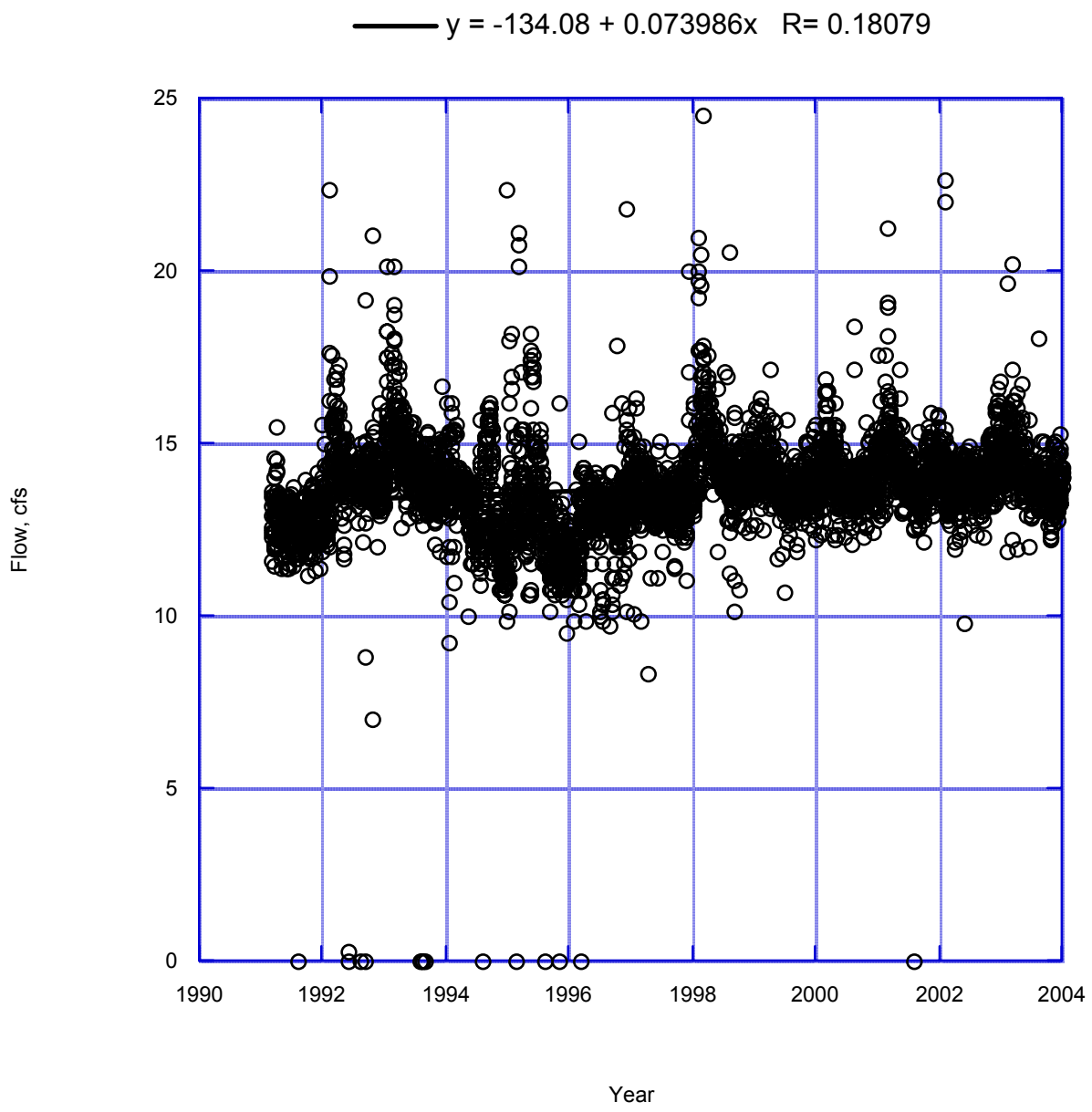


Figure 3. Simi Valley Effluent Flow vs. Time

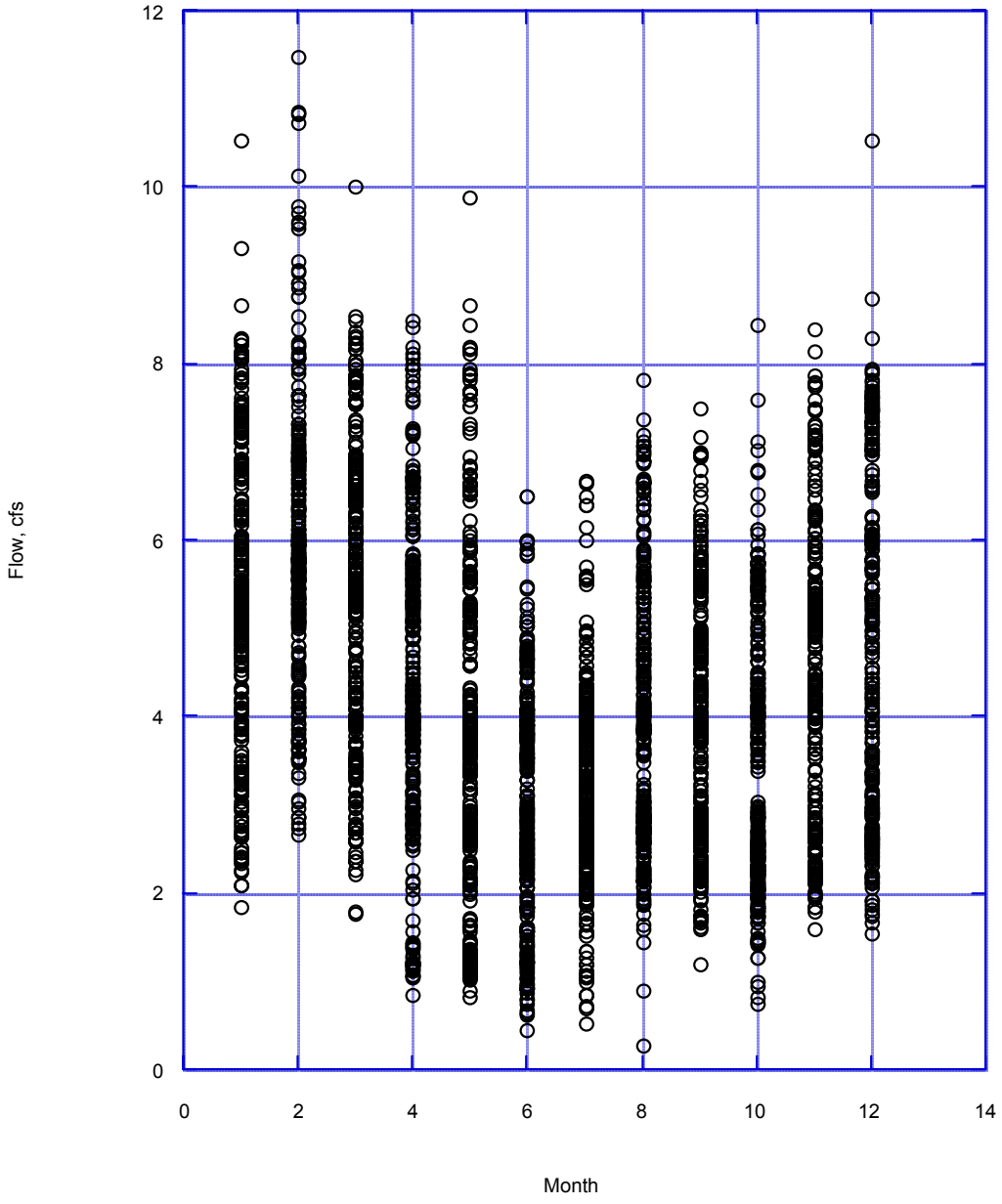


Figure 4. Camarillo Effluent Flow vs. Month

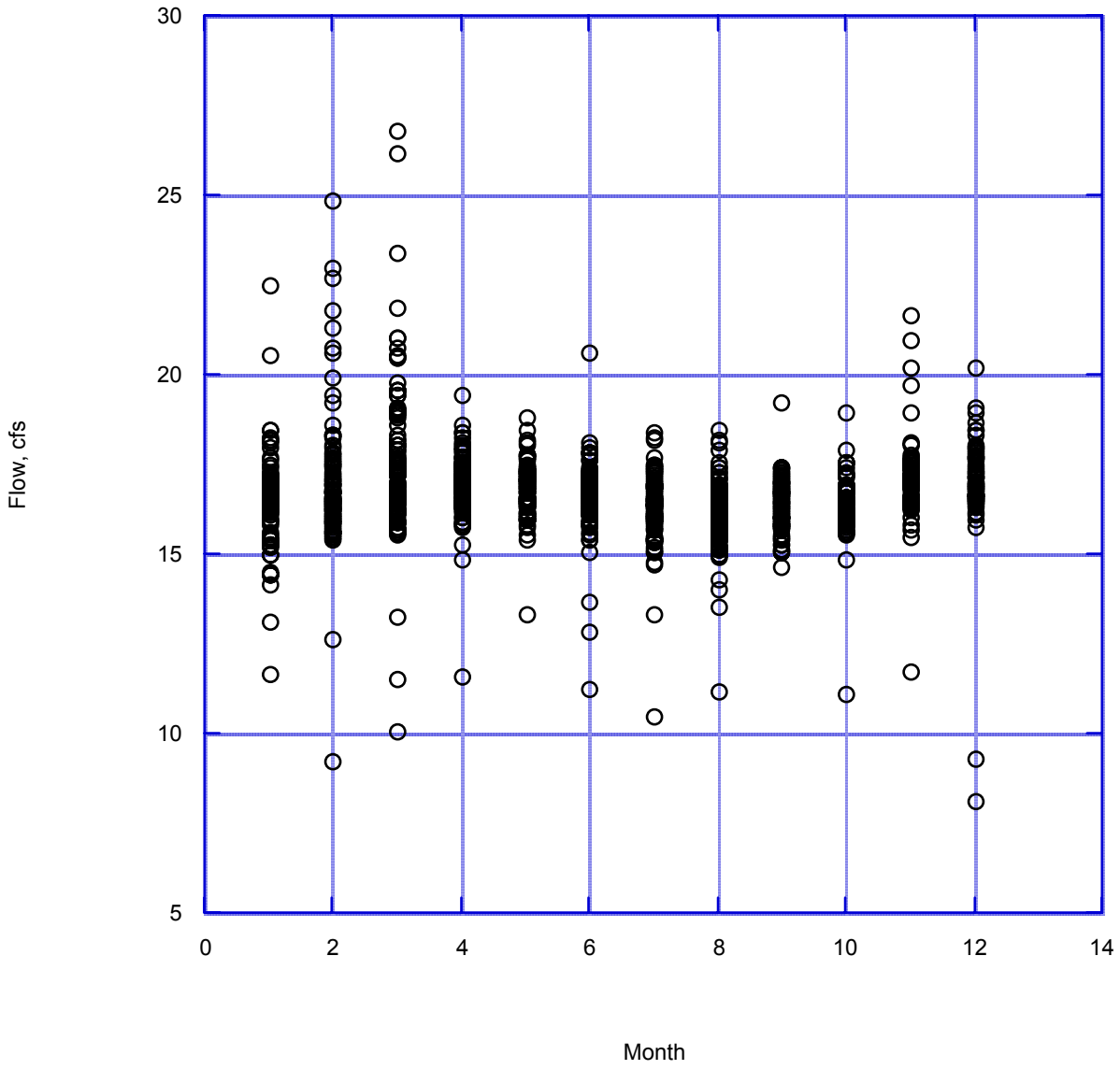


Figure 5. Hill Canyon Effluent Flow vs. Month (2001-2003)

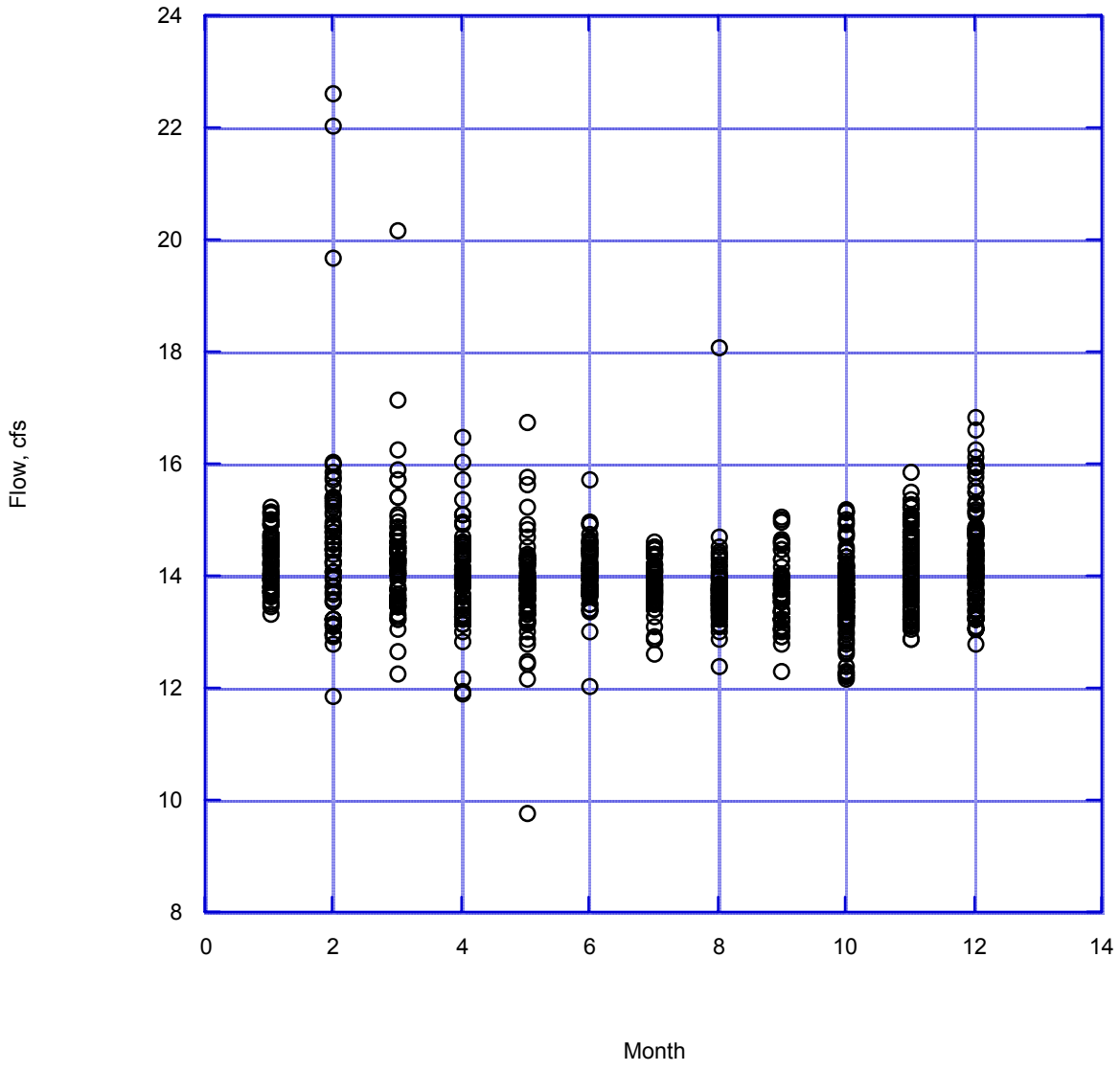


Figure 6. Simi Valley Effluent Flow vs. Month (2001-2003)

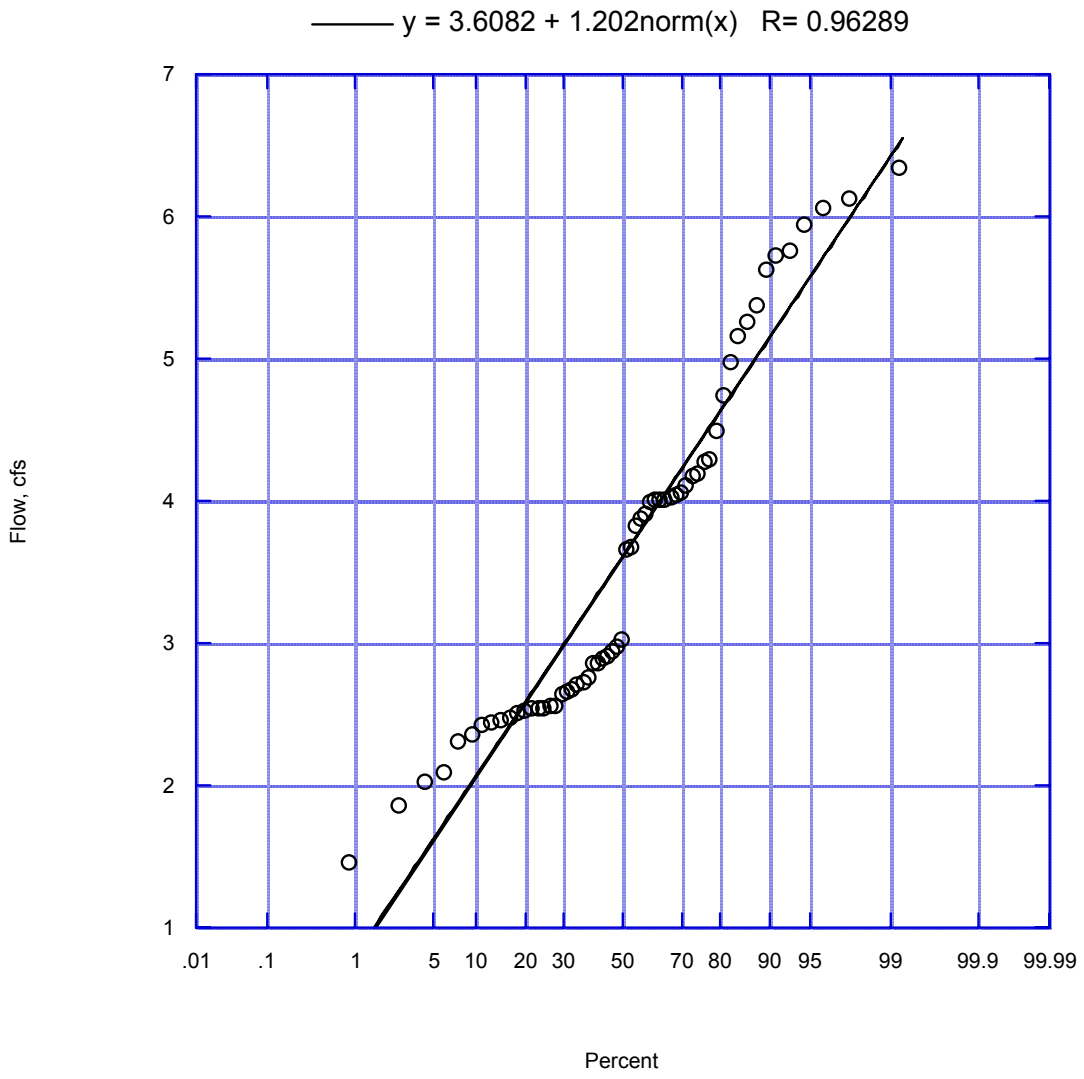


Figure 7. Camarillo Effluent Flow Frequency Distribution – Oct (01-02)

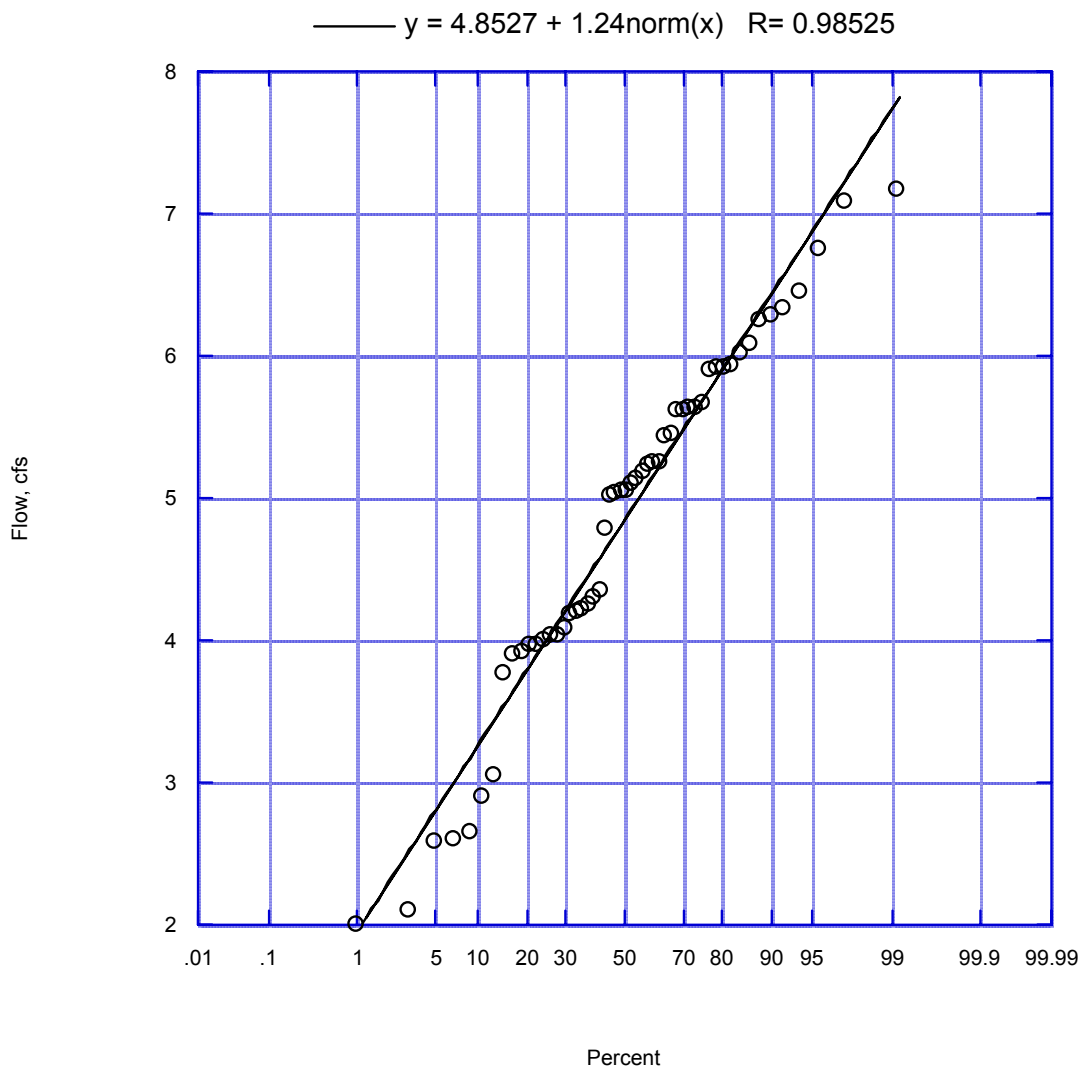


Figure 8. Camarillo Effluent Flow Frequency Distribution - Nov (01-02)

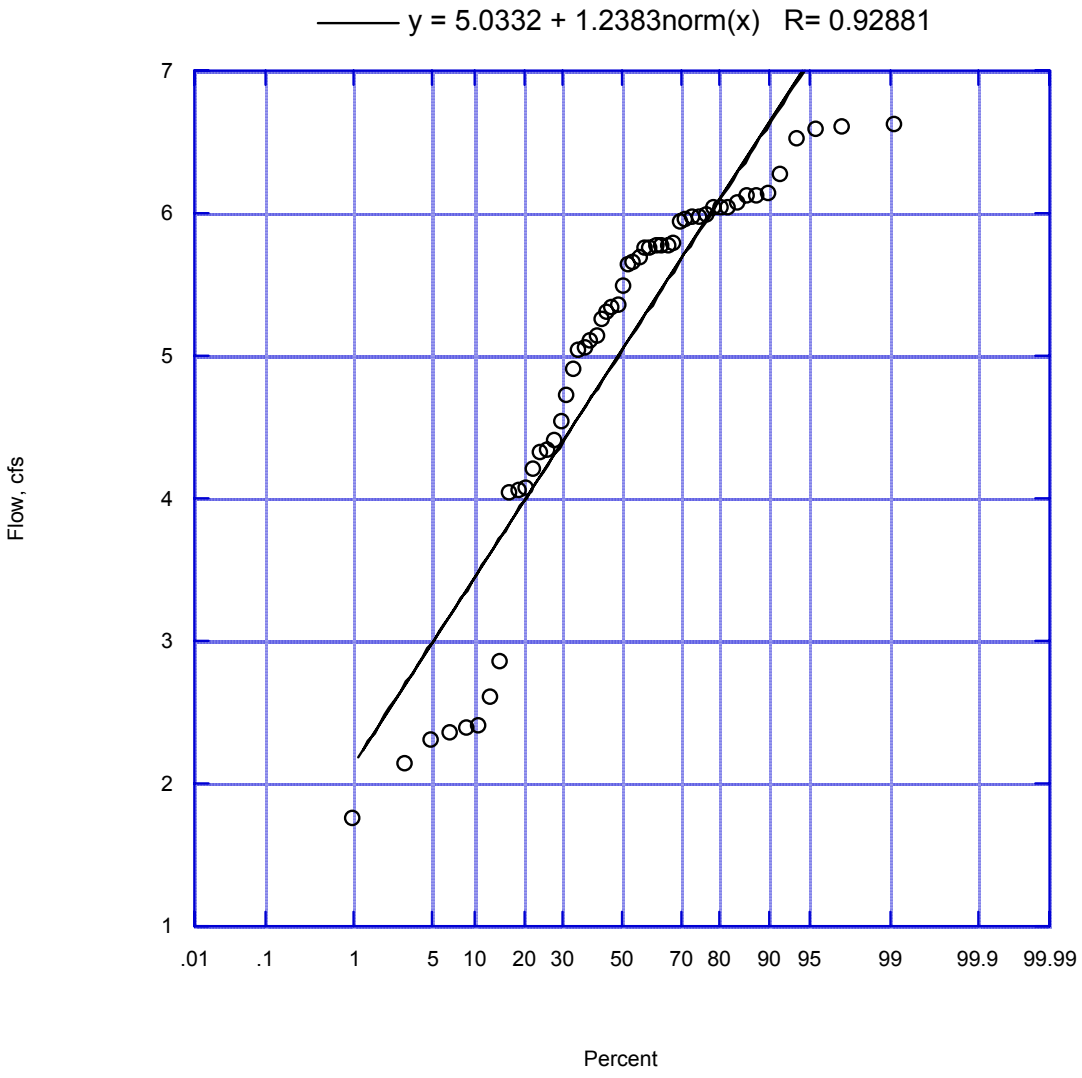


Figure 9. Camarillo Effluent Flow Frequency Distribution - Dec (01-02)

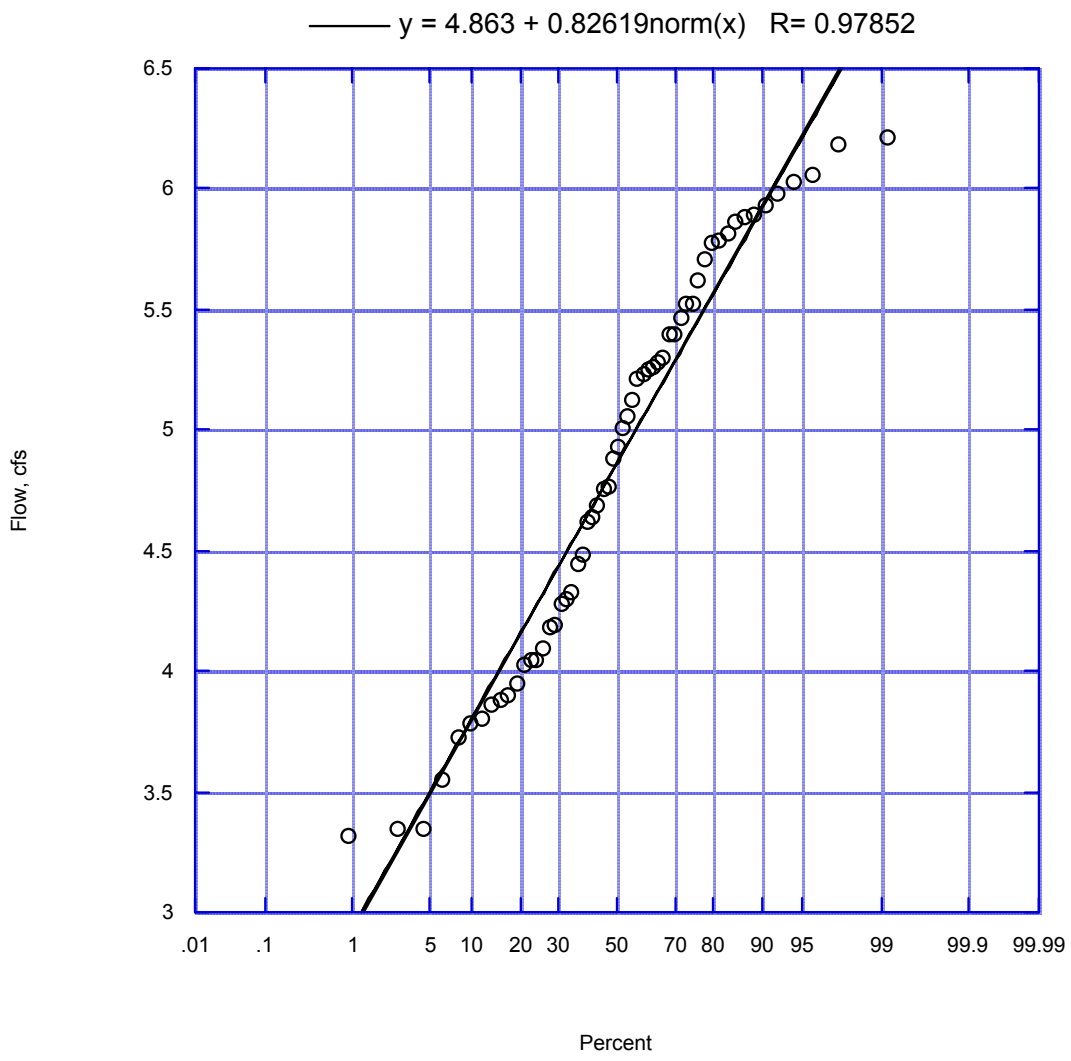


Figure 10. Camarillo Effluent Flow Frequency Distribution - Jan (02-03)

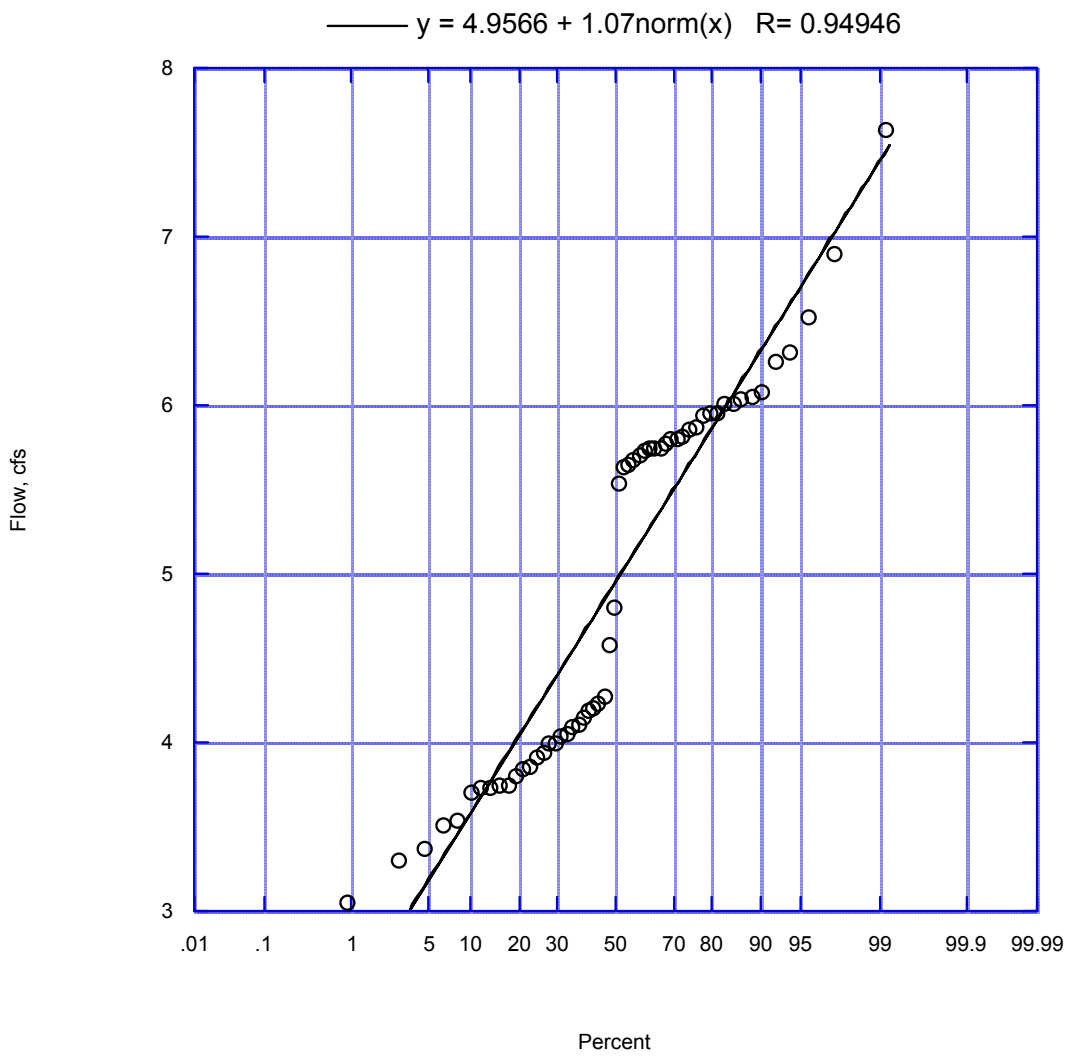


Figure 11. Camarillo Effluent Flow Frequency Distribution - Feb (02-03)

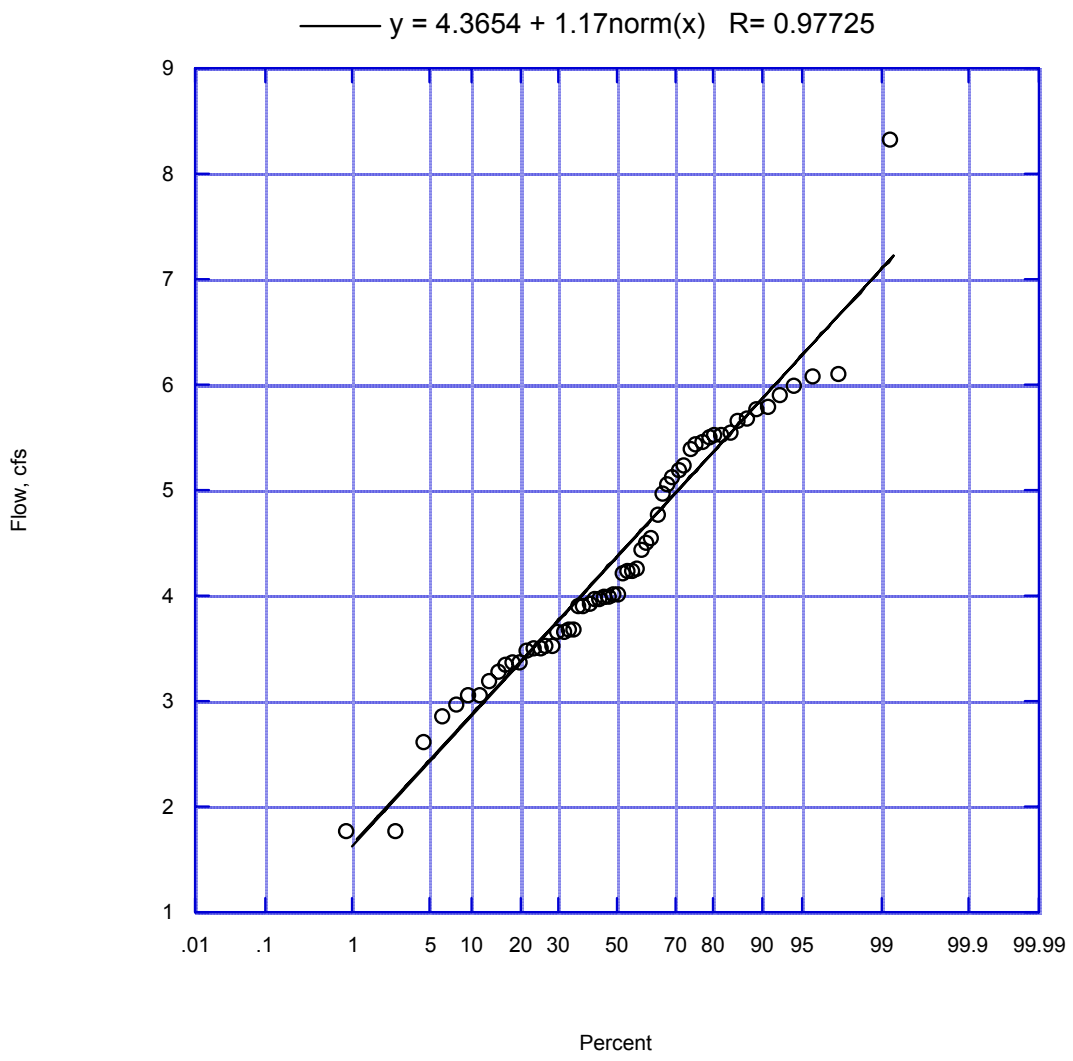


Figure 12. Camarillo Effluent Flow Frequency Distribution - Mar (02-03)

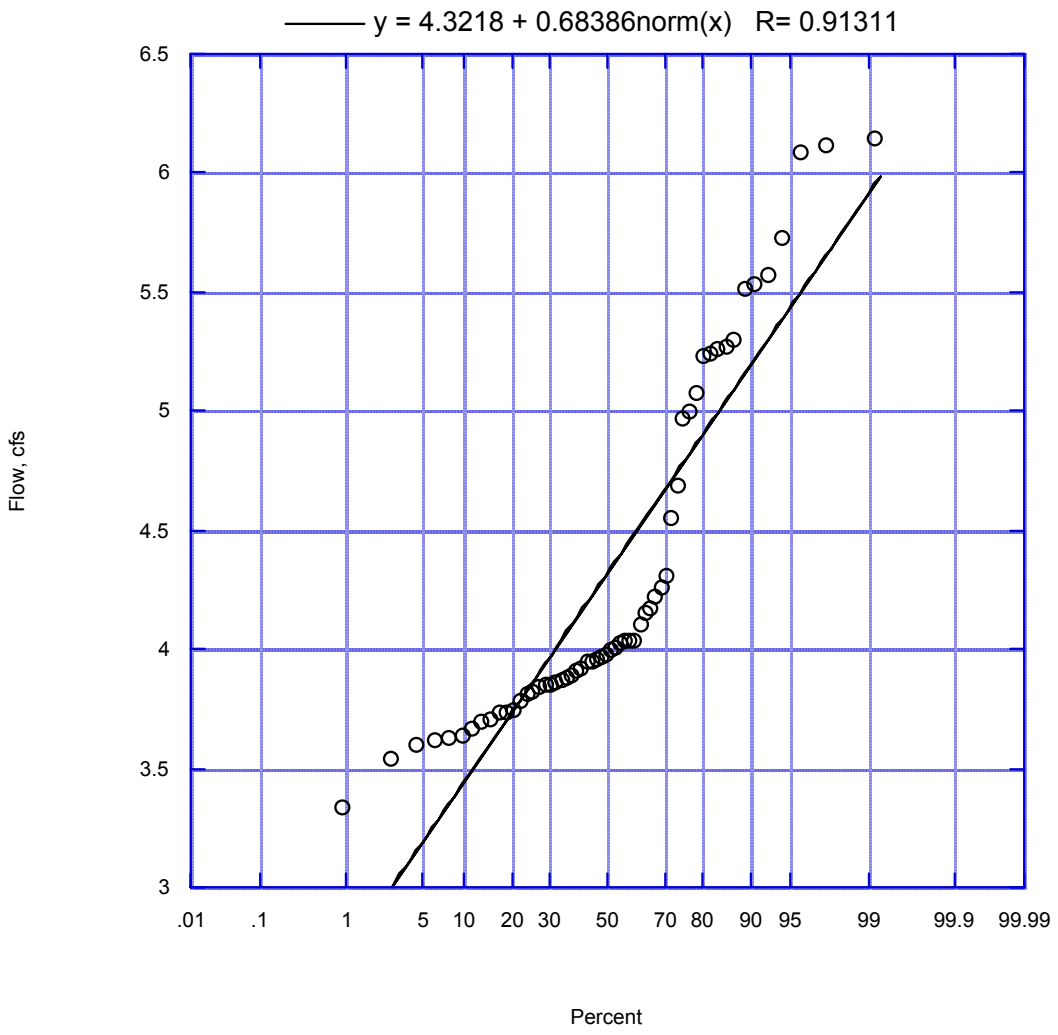


Figure 13. Camarillo Effluent Flow Frequency Distribution - April (02-03)

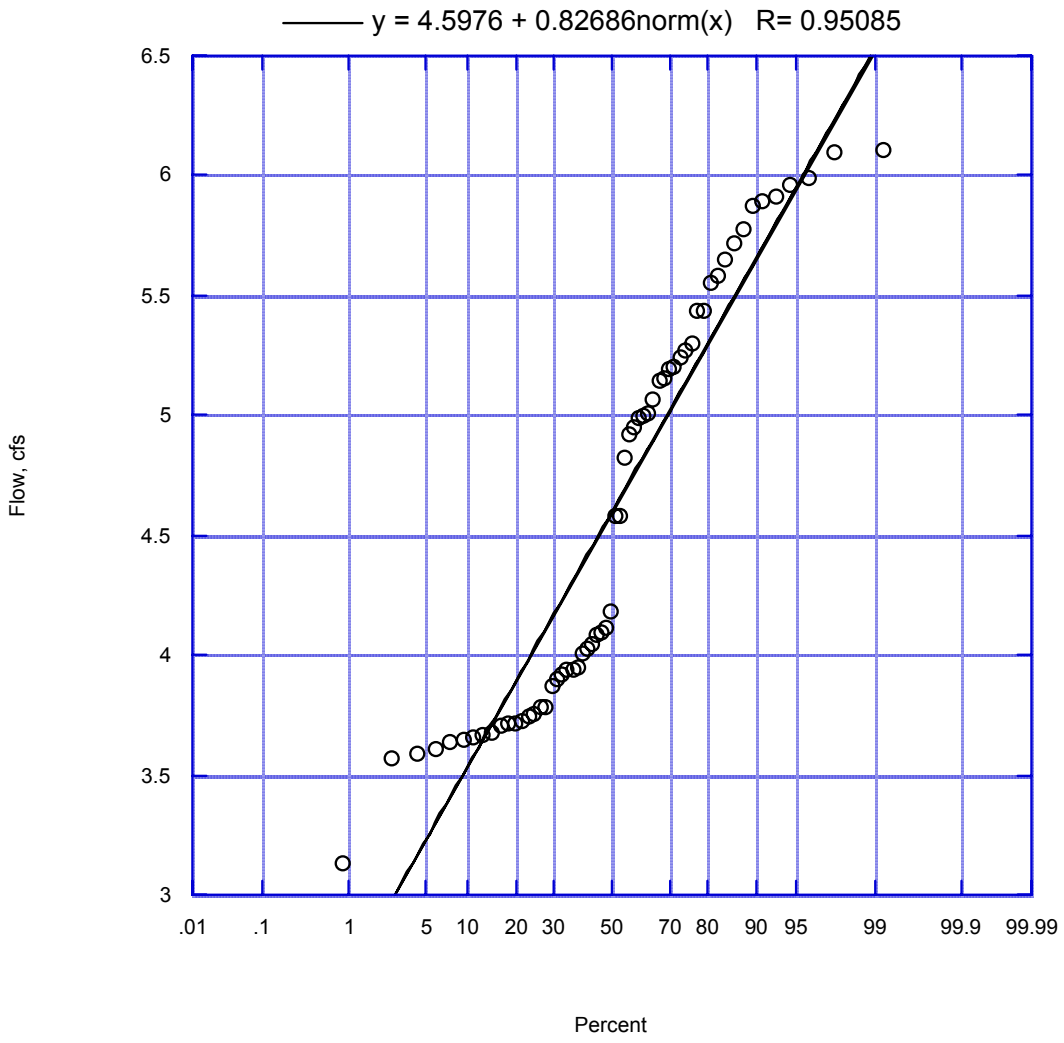


Figure 14. Camarillo Effluent Flow Frequency Distribution - May (02-03)

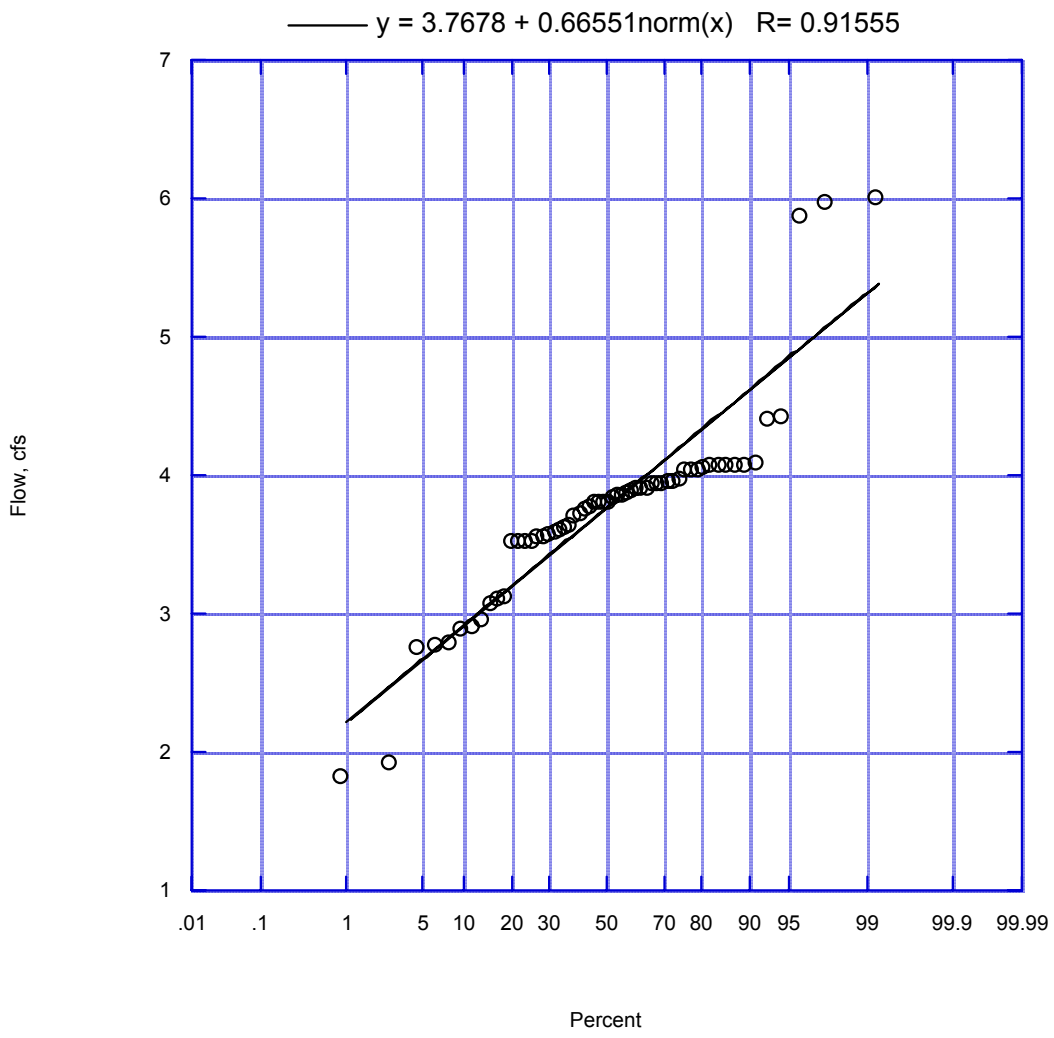


Figure 15. Camarillo Effluent Flow Frequency Distribution - June (02-03)

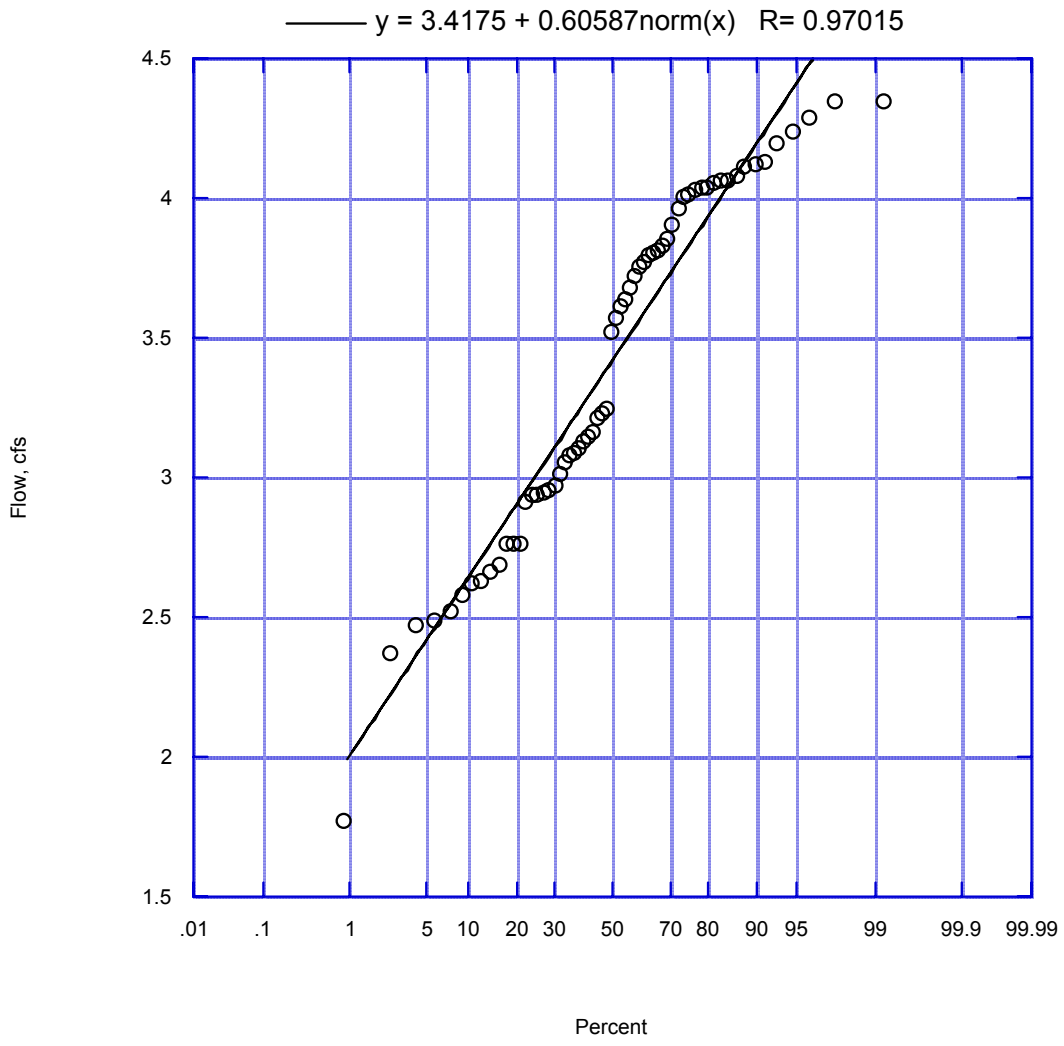


Figure 16. Camarillo Effluent Flow Frequency Distribution - July (02-03)

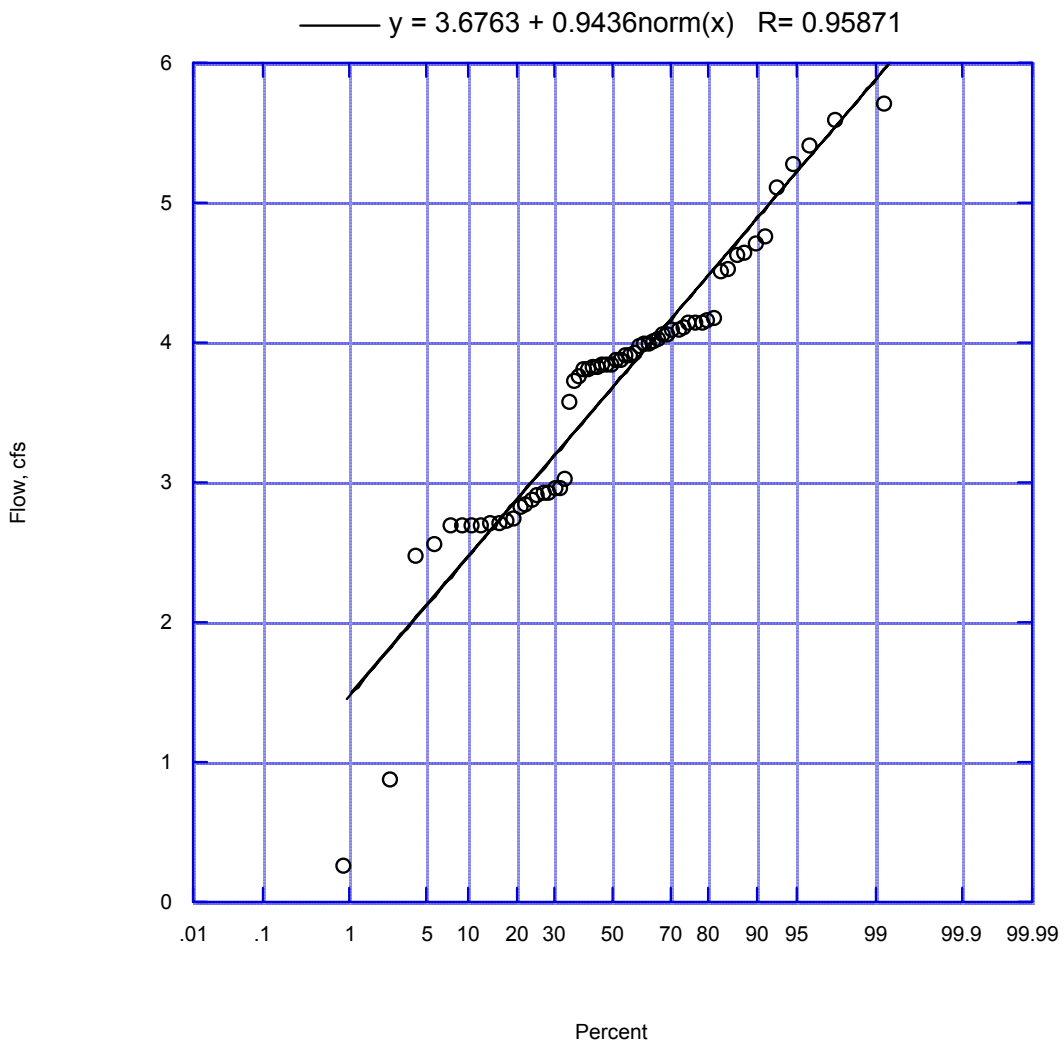


Figure 17. Camarillo Effluent Flow Frequency Distribution - Aug (02-03)

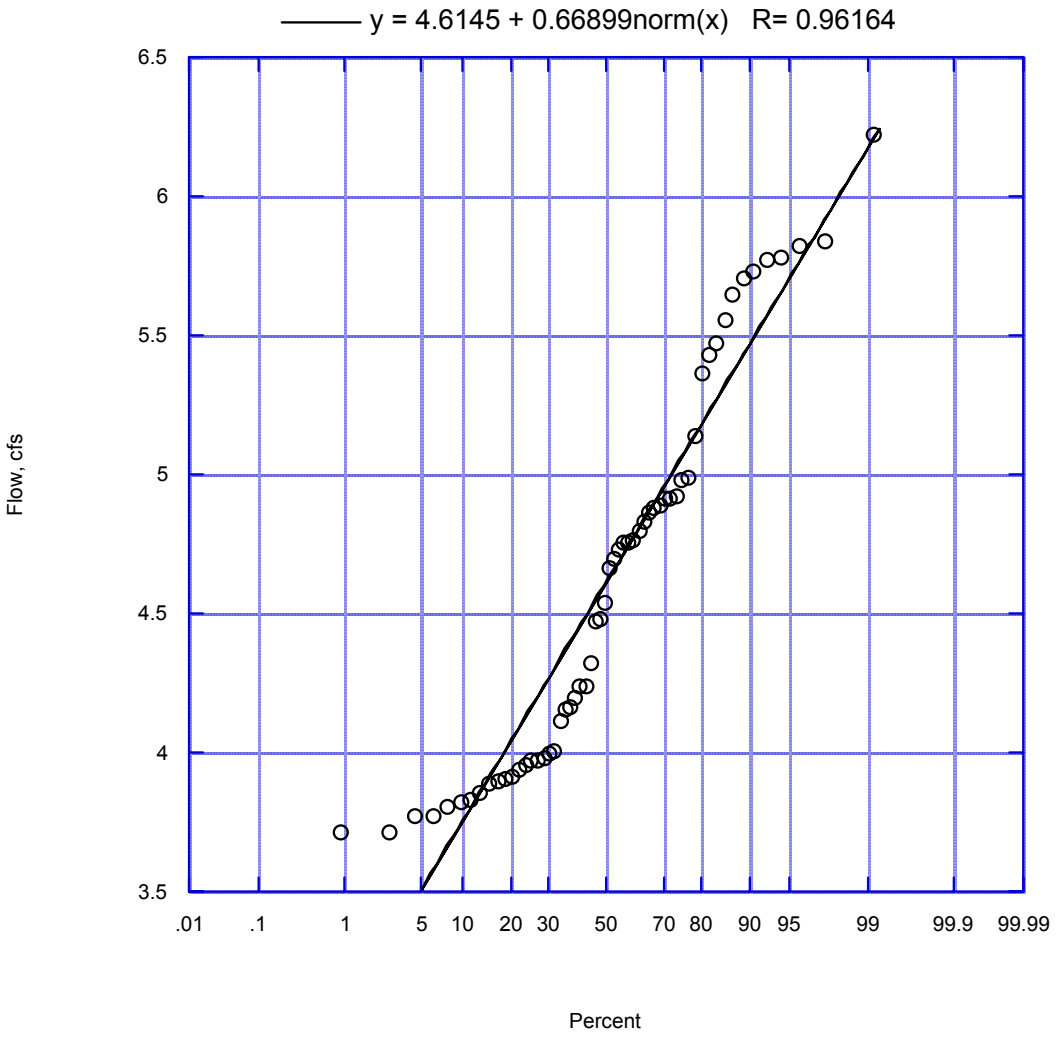


Figure 18. Camarillo Effluent Flow Frequency Distribution - Sept (02-03)

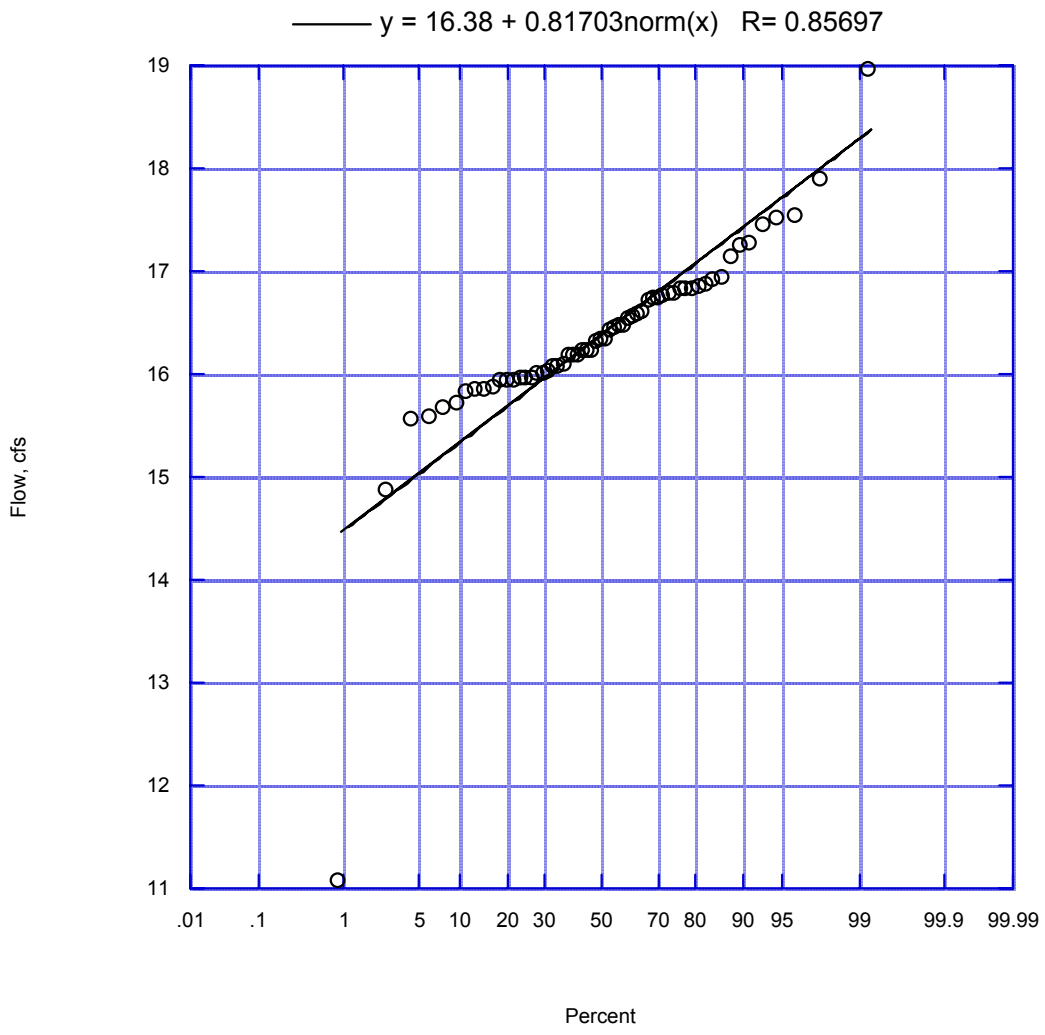


Figure 19. Hill Canyon Effluent Flow Frequency Distribution - Oct (01-02)

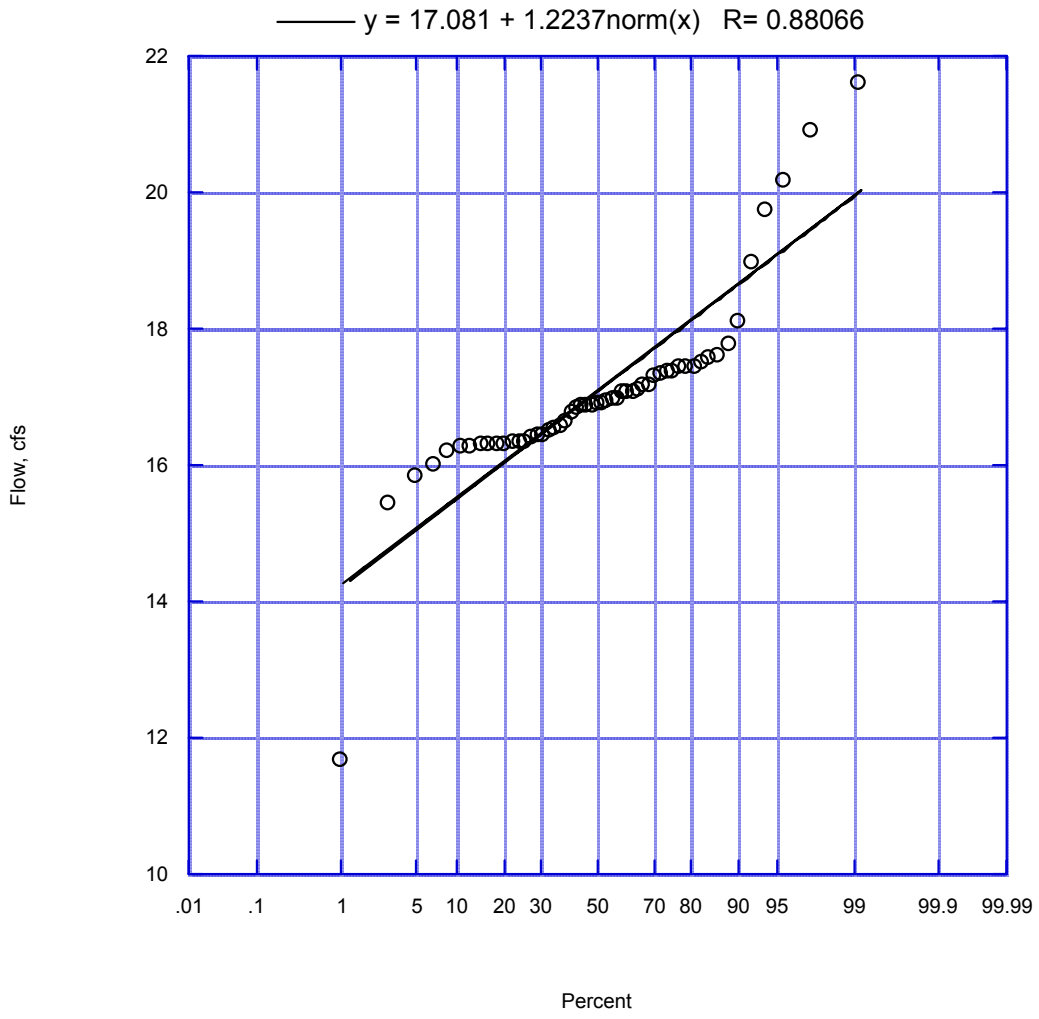


Figure 20. Hill Canyon Effluent Flow Frequency Distribution - Nov (01-02)

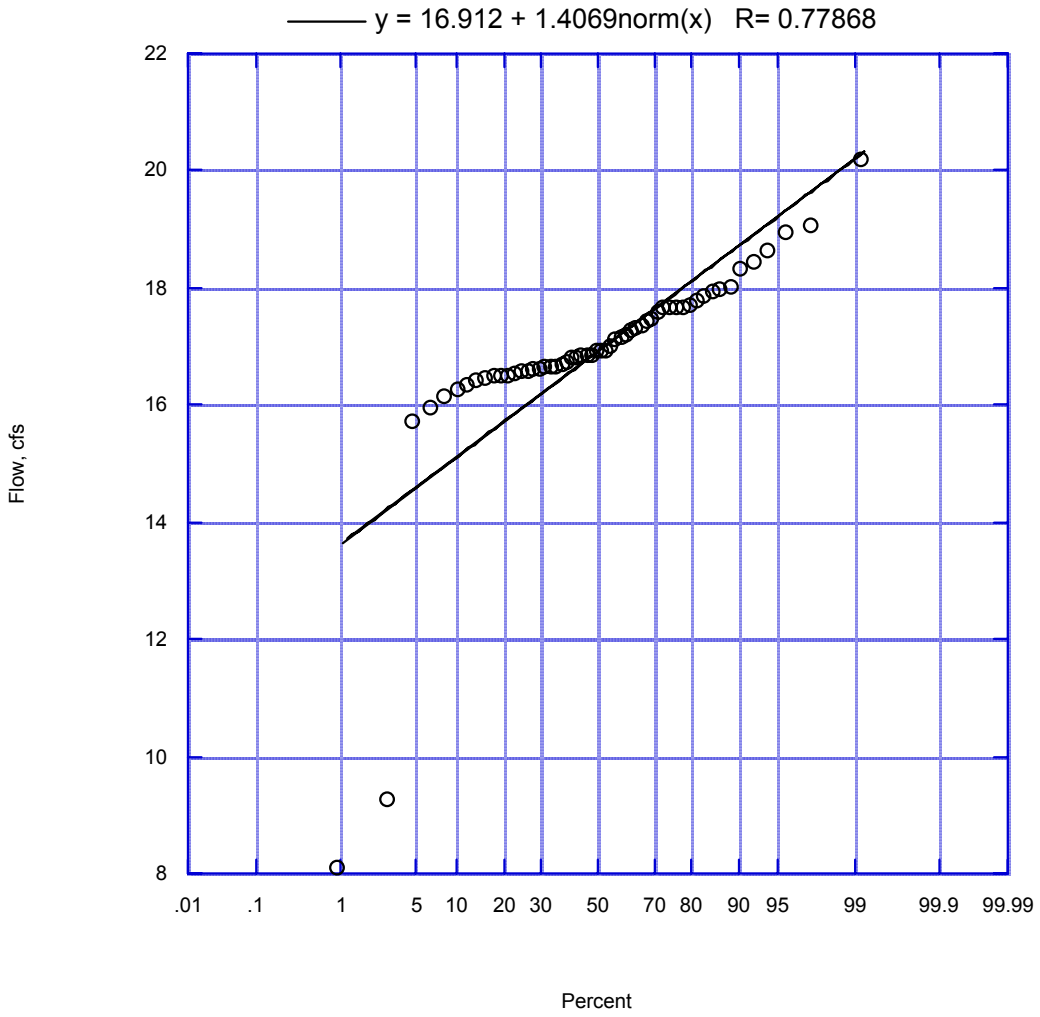


Figure 21. Hill Canyon Effluent Flow Frequency Distribution - Dec (01-02)

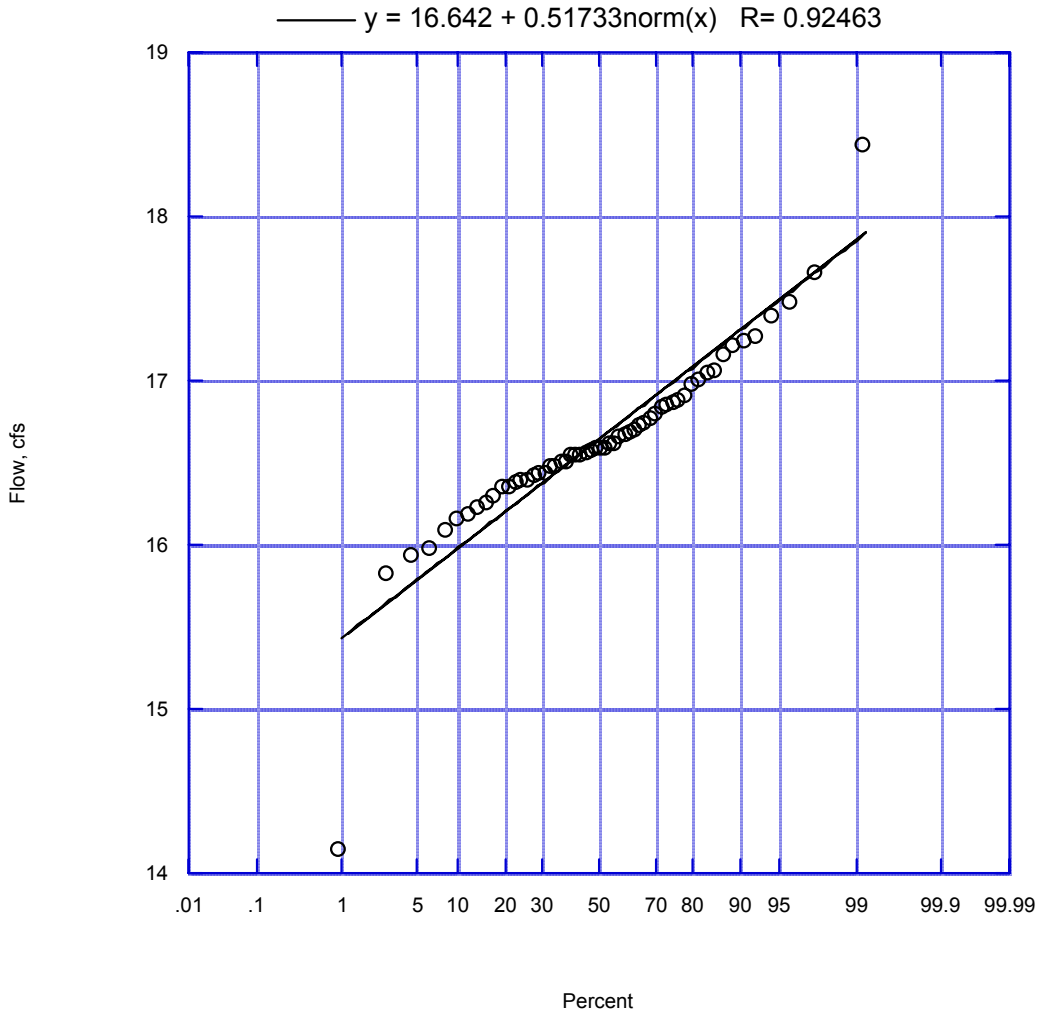


Figure 22. Hill Canyon Effluent Flow Frequency Distribution - Jan (02-03)

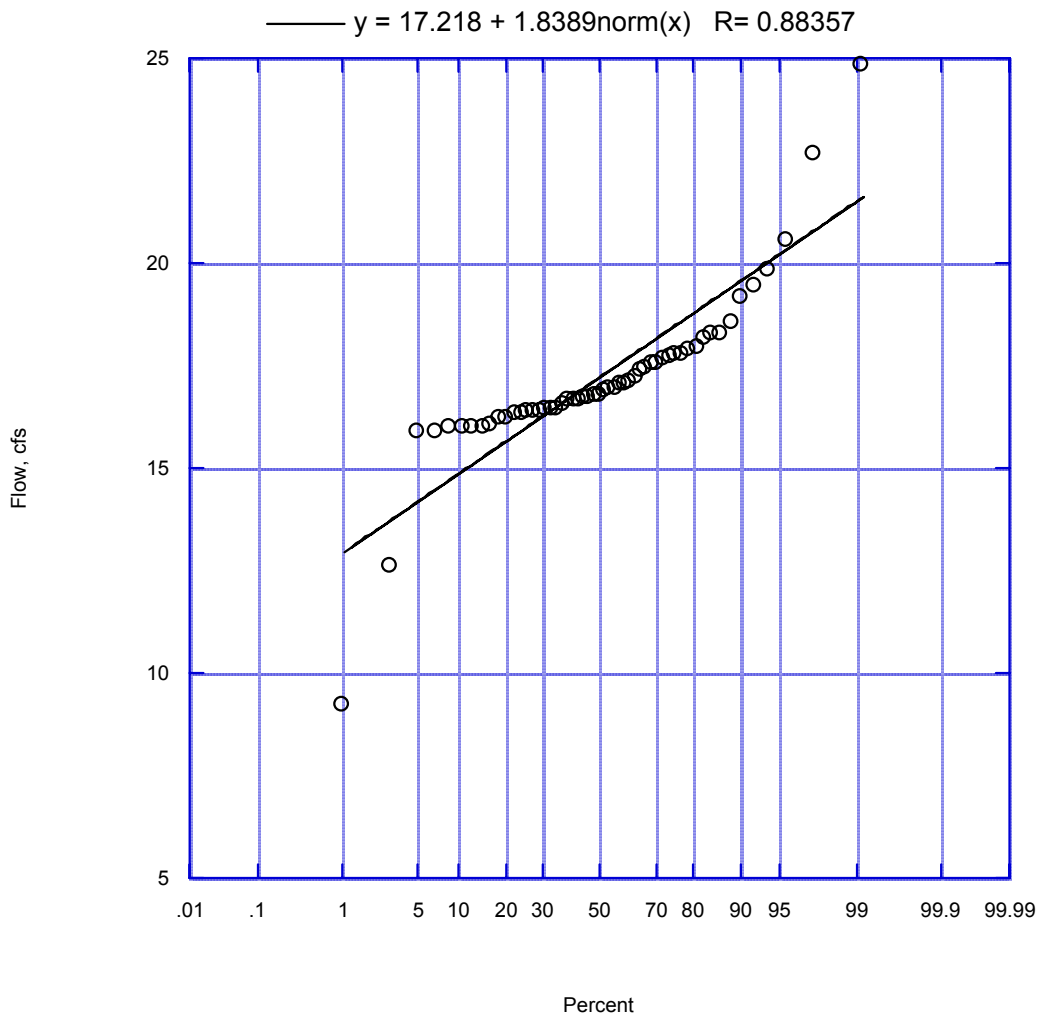


Figure 23. Hill Canyon Effluent Flow Frequency Distribution - Feb (02-03)

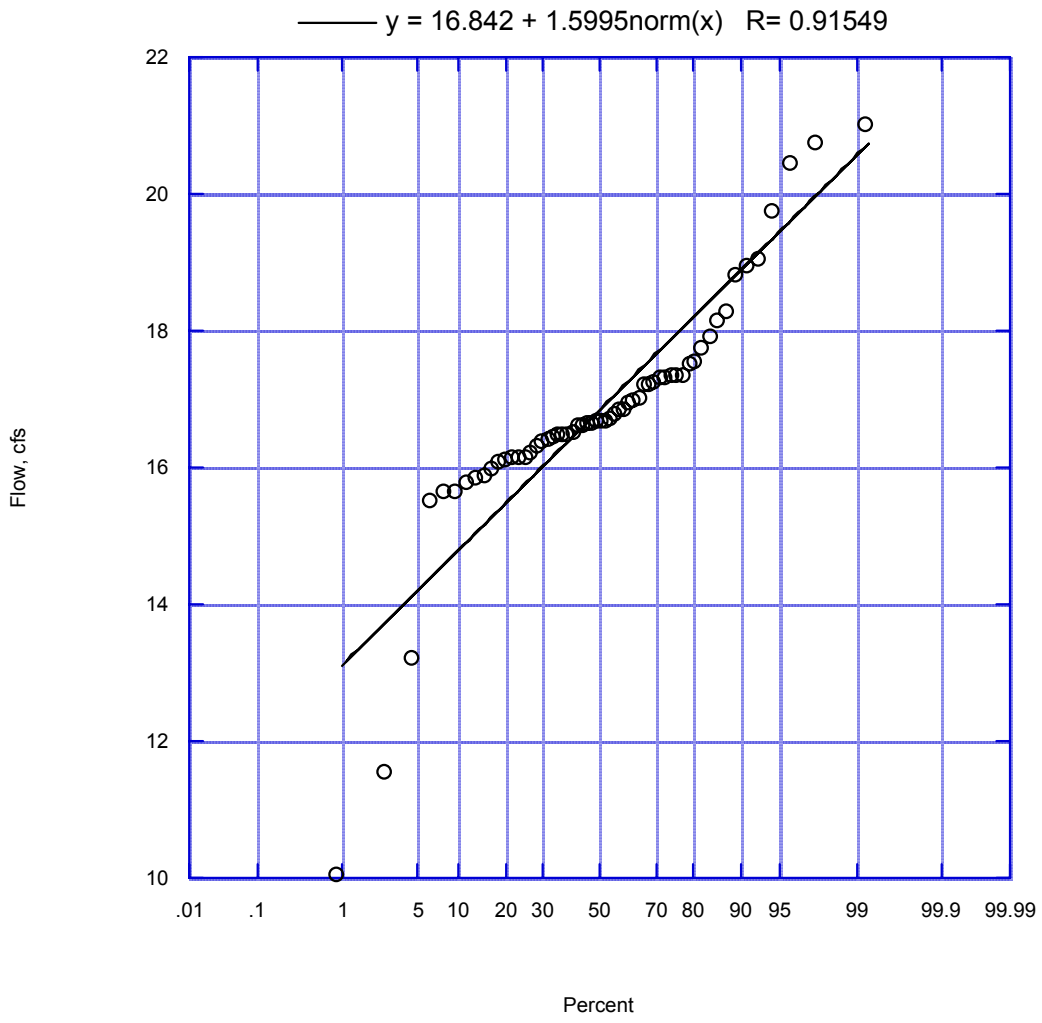


Figure 24. Hill Canyon Effluent Flow Frequency Distribution - Mar (02-03)

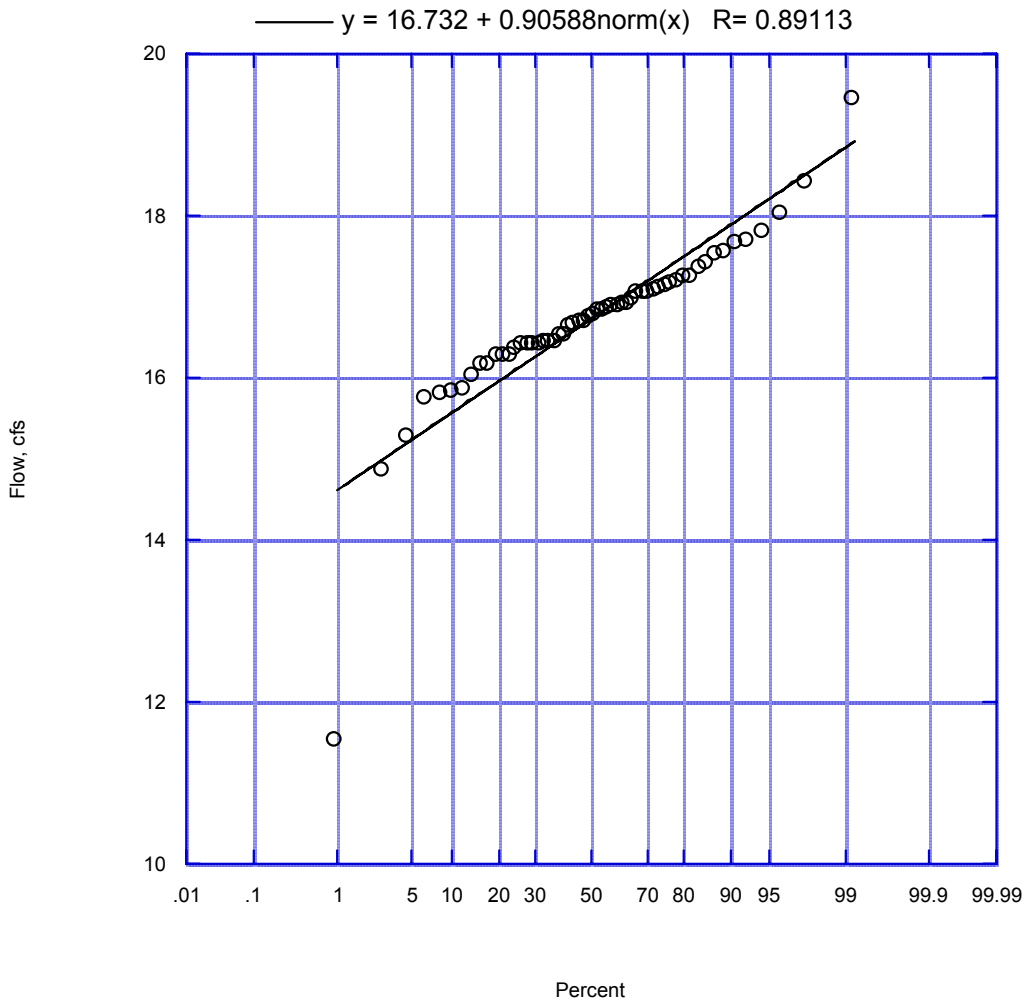


Figure 25. Hill Canyon Effluent Flow Frequency Distribution - April (02-03)

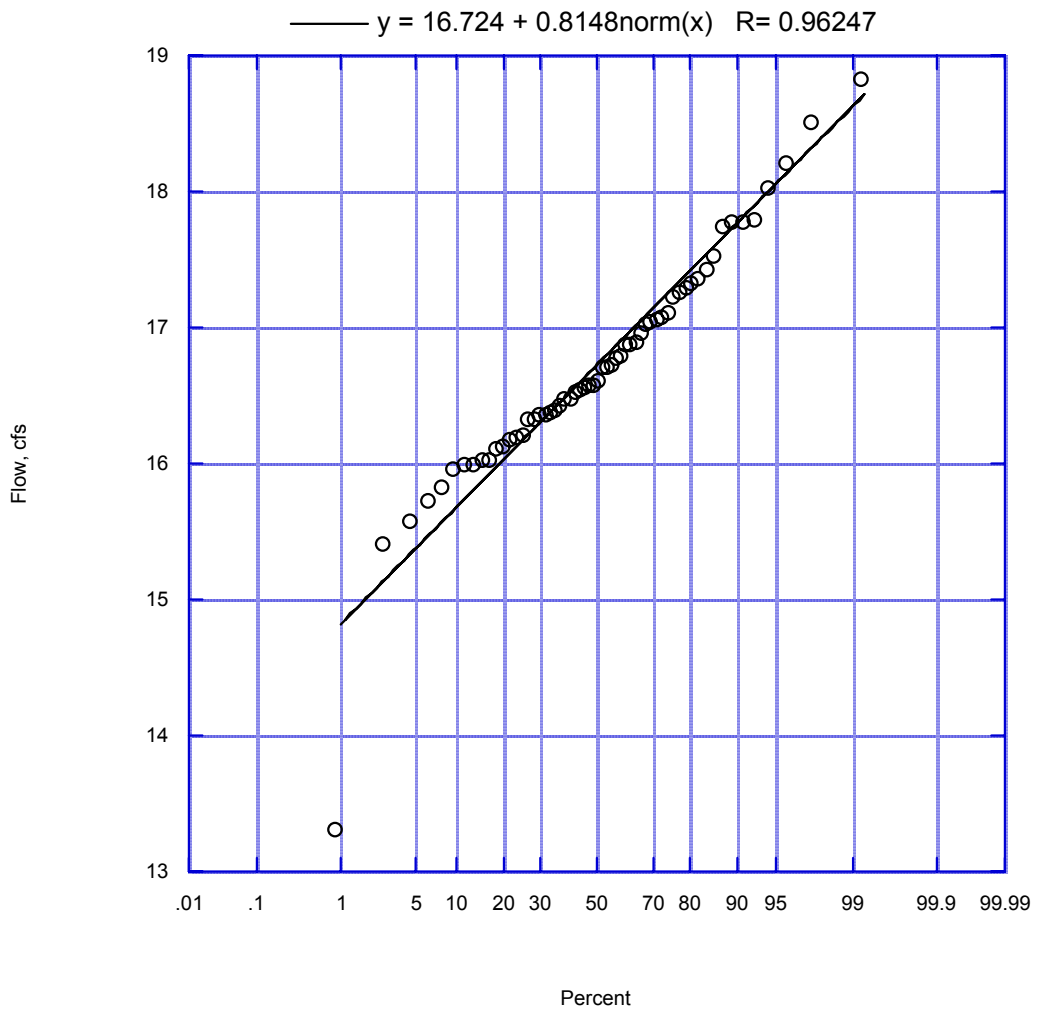


Figure 26. Hill Canyon Effluent Flow Frequency Distribution - May (02-03)

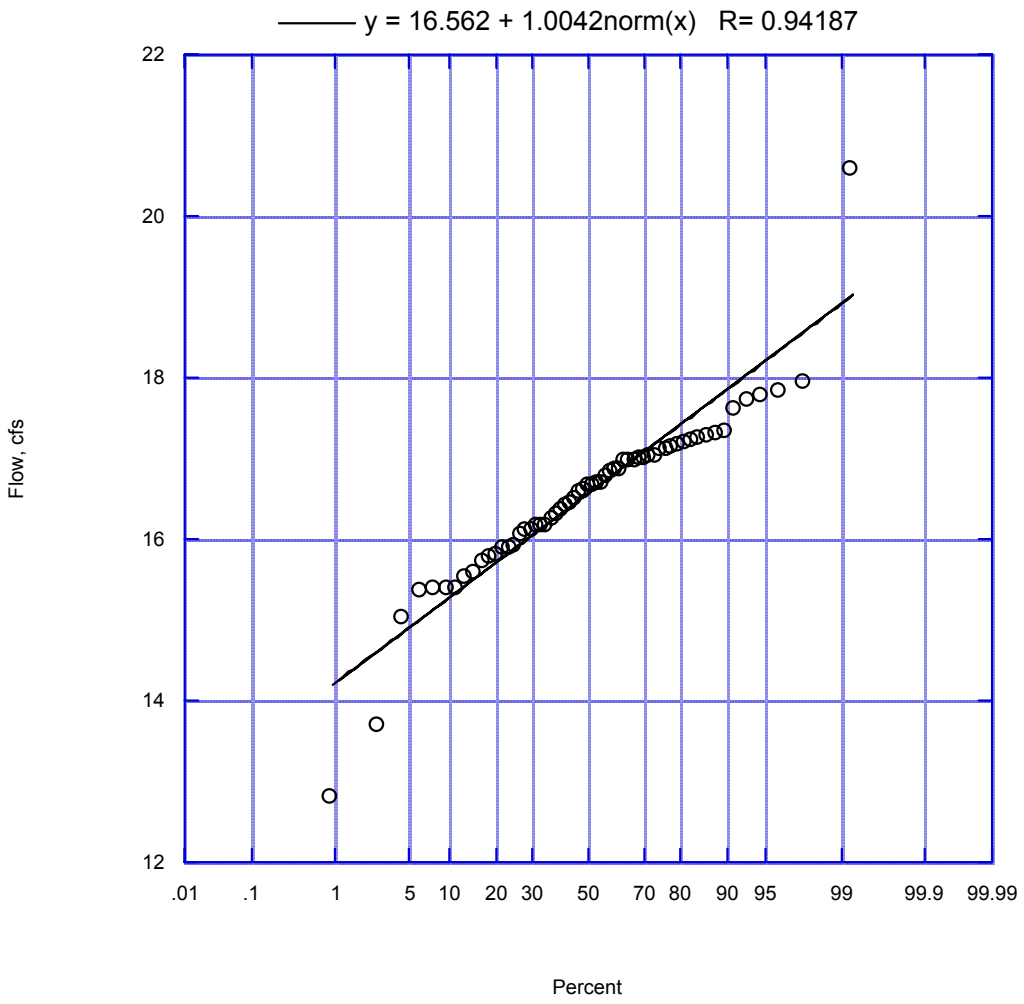


Figure 27. Hill Canyon Effluent Flow Frequency Distribution - June (02-03)

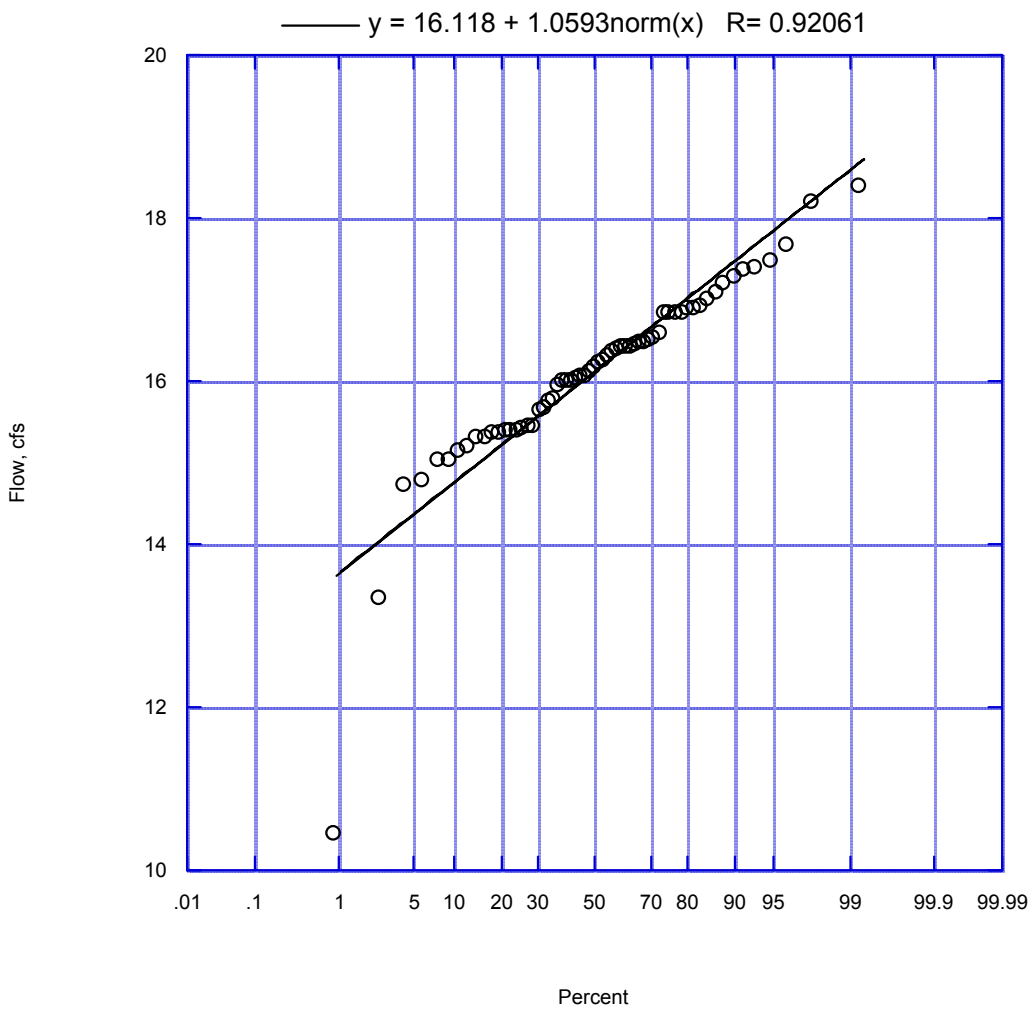


Figure 28. Hill Canyon Effluent Flow Frequency Distribution - July (02-03)

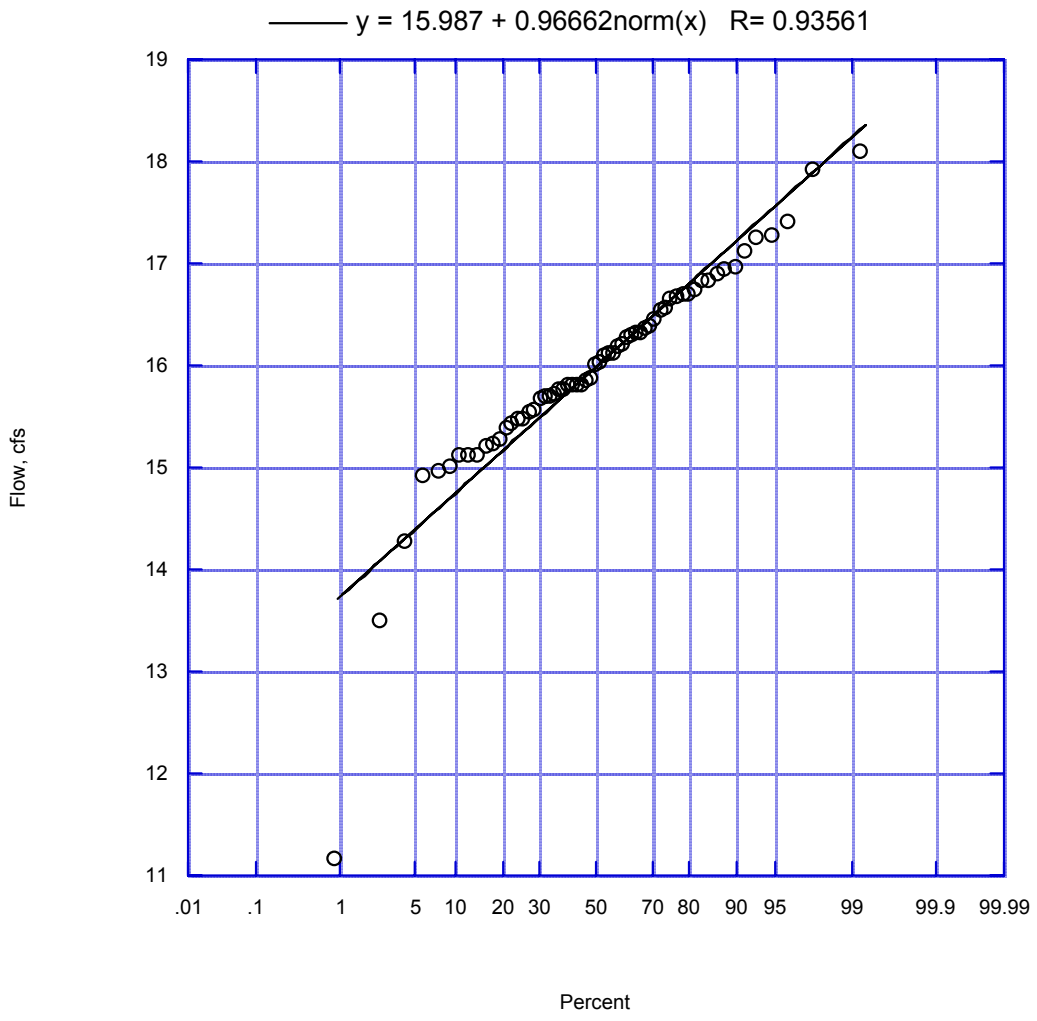


Figure 29. Hill Canyon Effluent Flow Frequency Distribution - Aug (02-03)

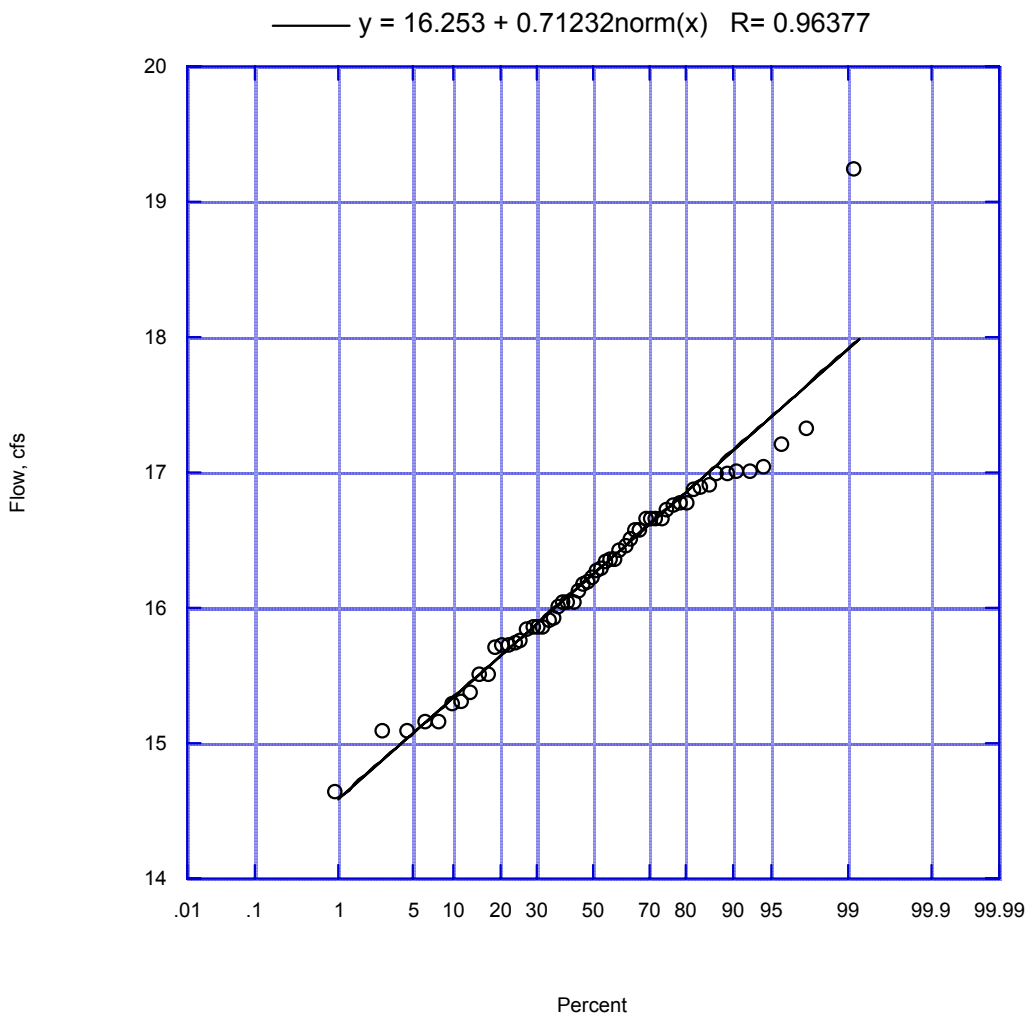


Figure 30. Hill Canyon Effluent Flow Frequency Distribution - Sept (02-03)

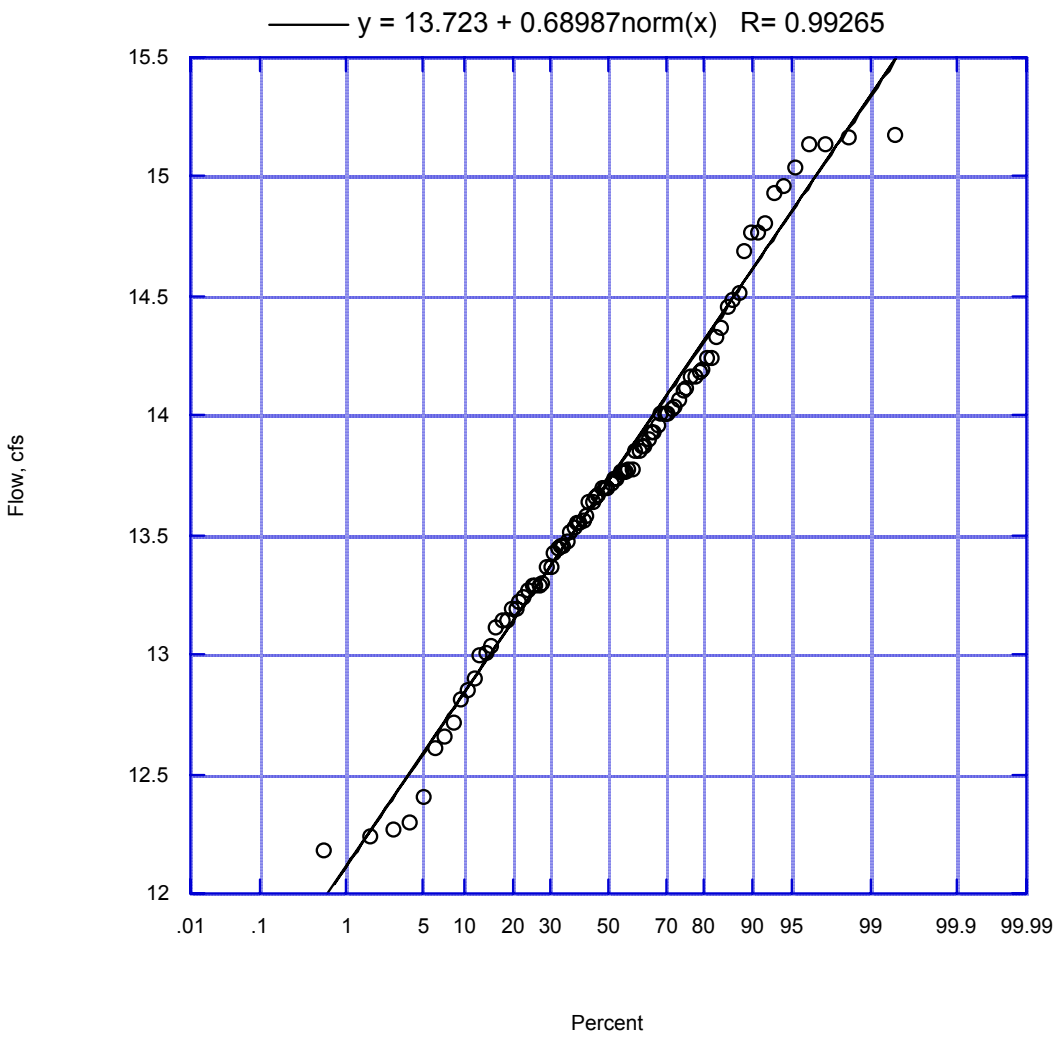


Figure 31. Simi Valley Effluent Flow Frequency Distribution - Oct (01-02)

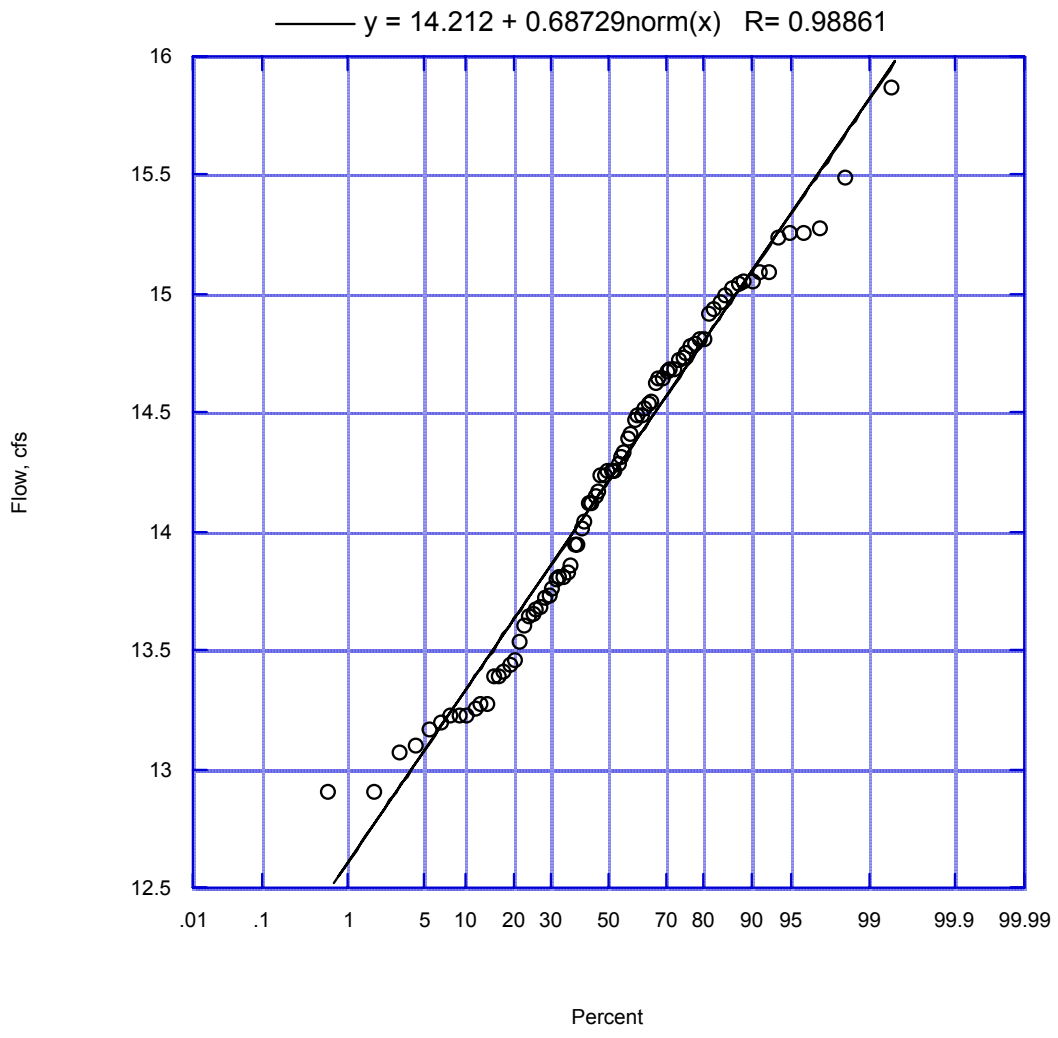


Figure 32. Simi Valley Effluent Flow Frequency Distribution - Nov (01-02)

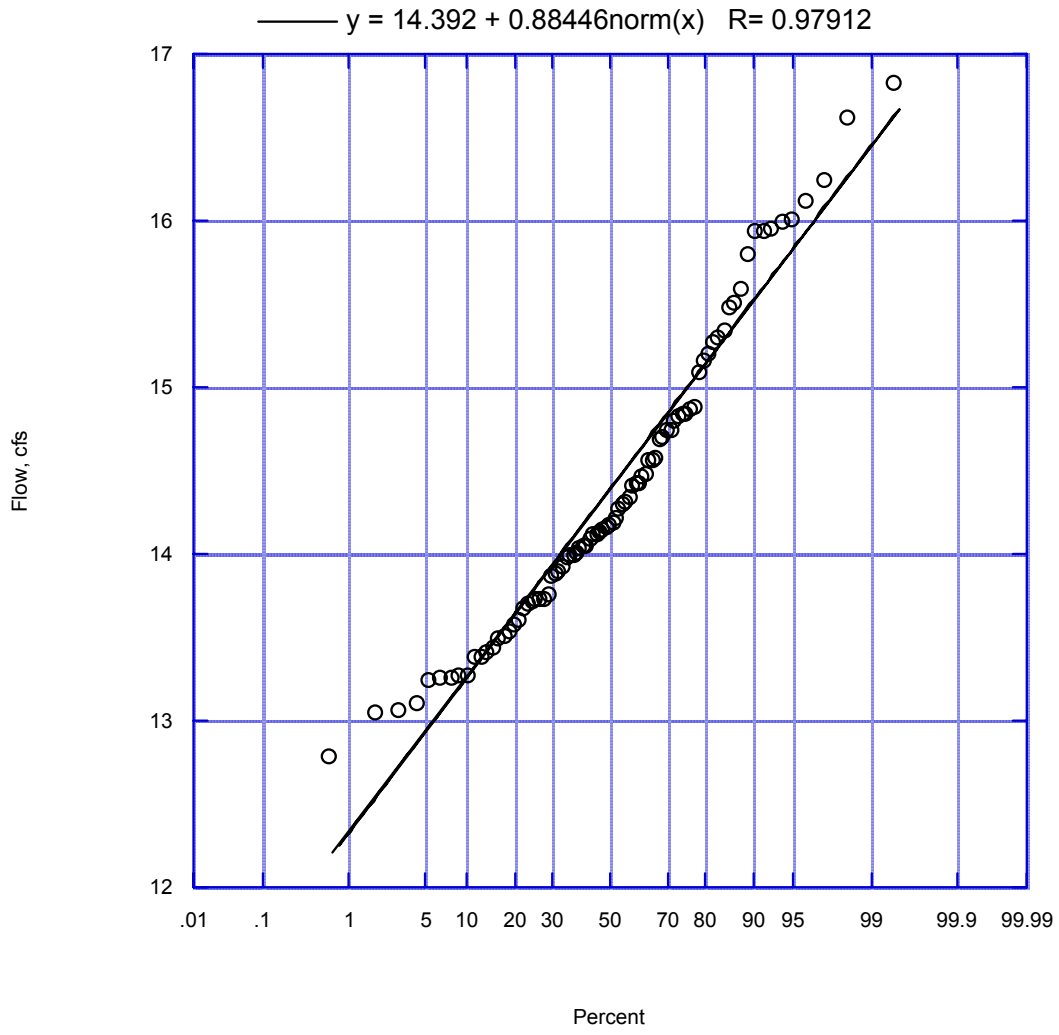


Figure 33. Simi Valley Effluent Flow Frequency Distribution - Dec (01-02)

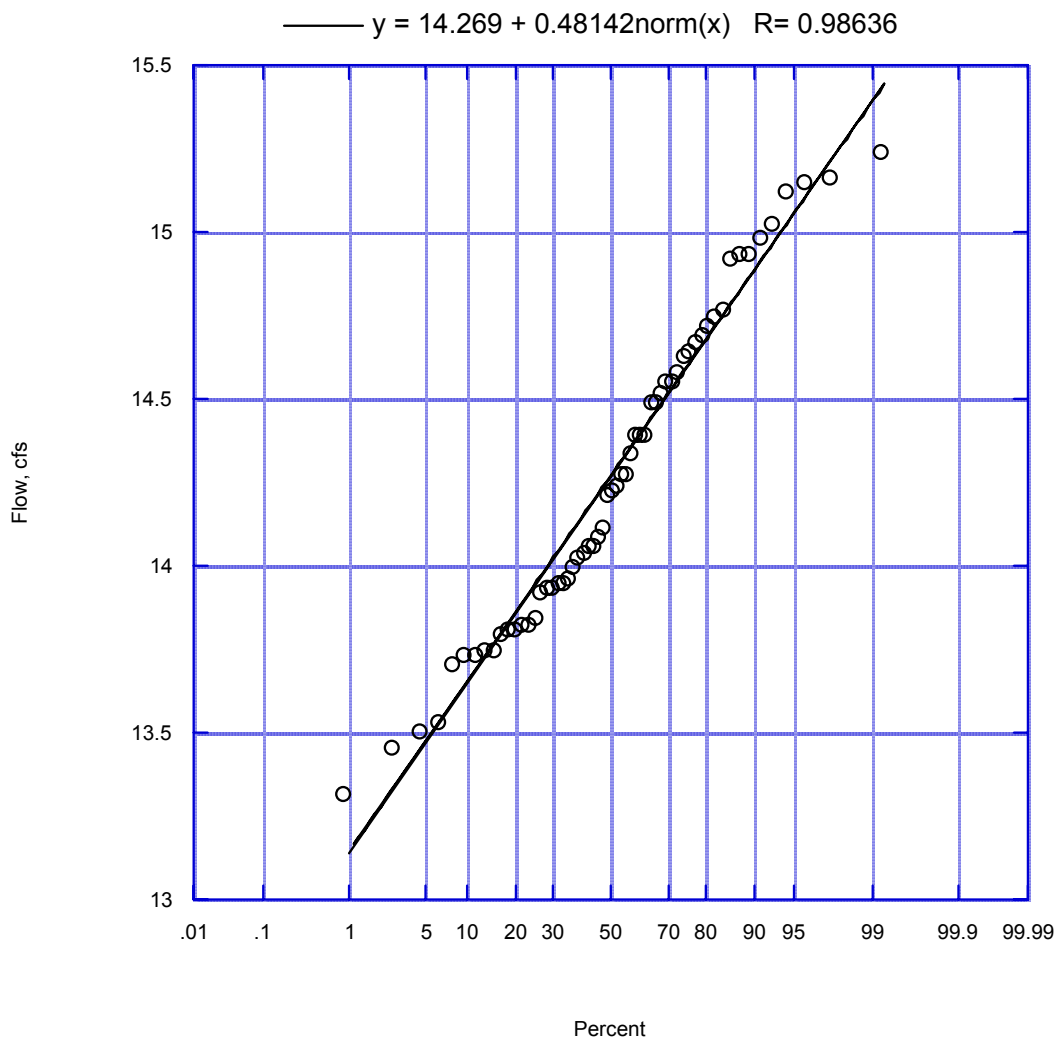


Figure 34. Simi Valley Effluent Flow Frequency Distribution - Jan (02-03)

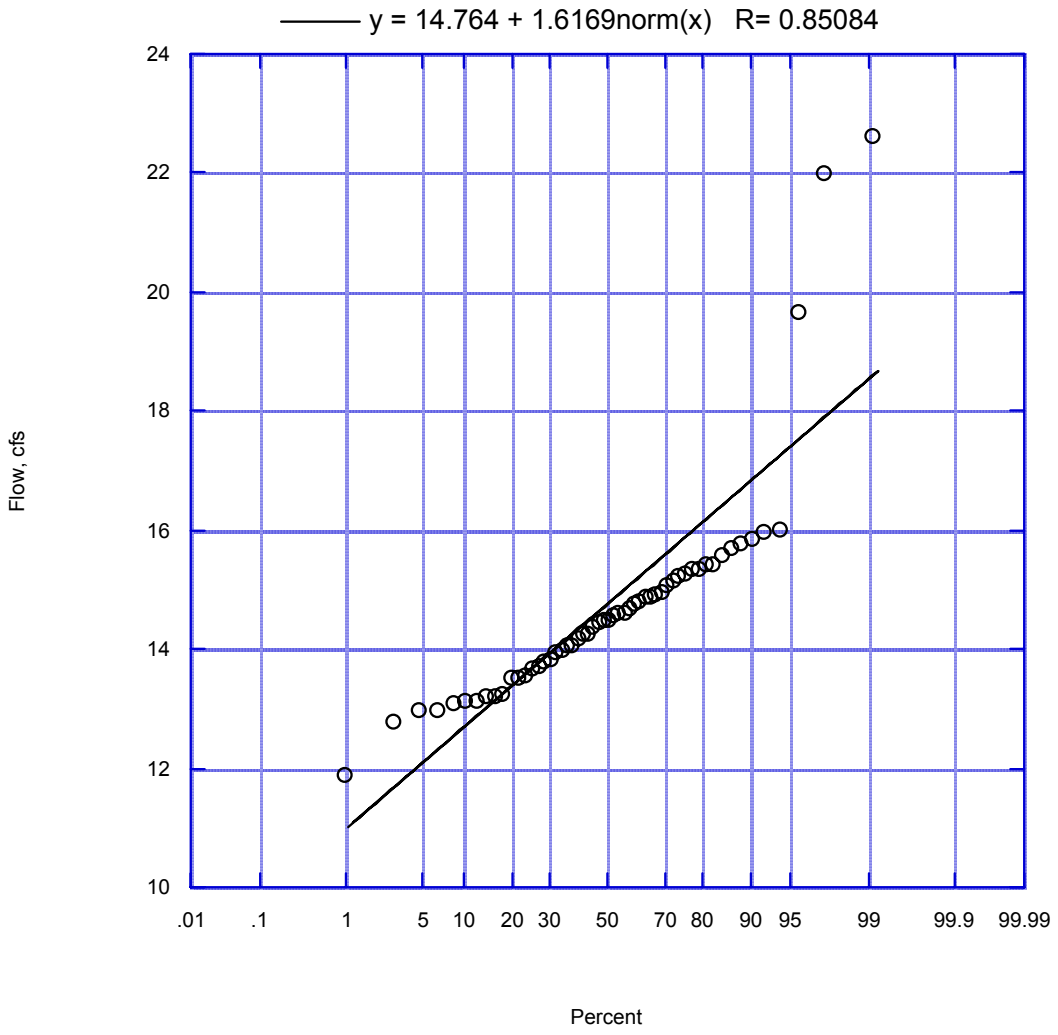


Figure 35. Simi Valley Effluent Flow Frequency Distribution - Feb (02-03)

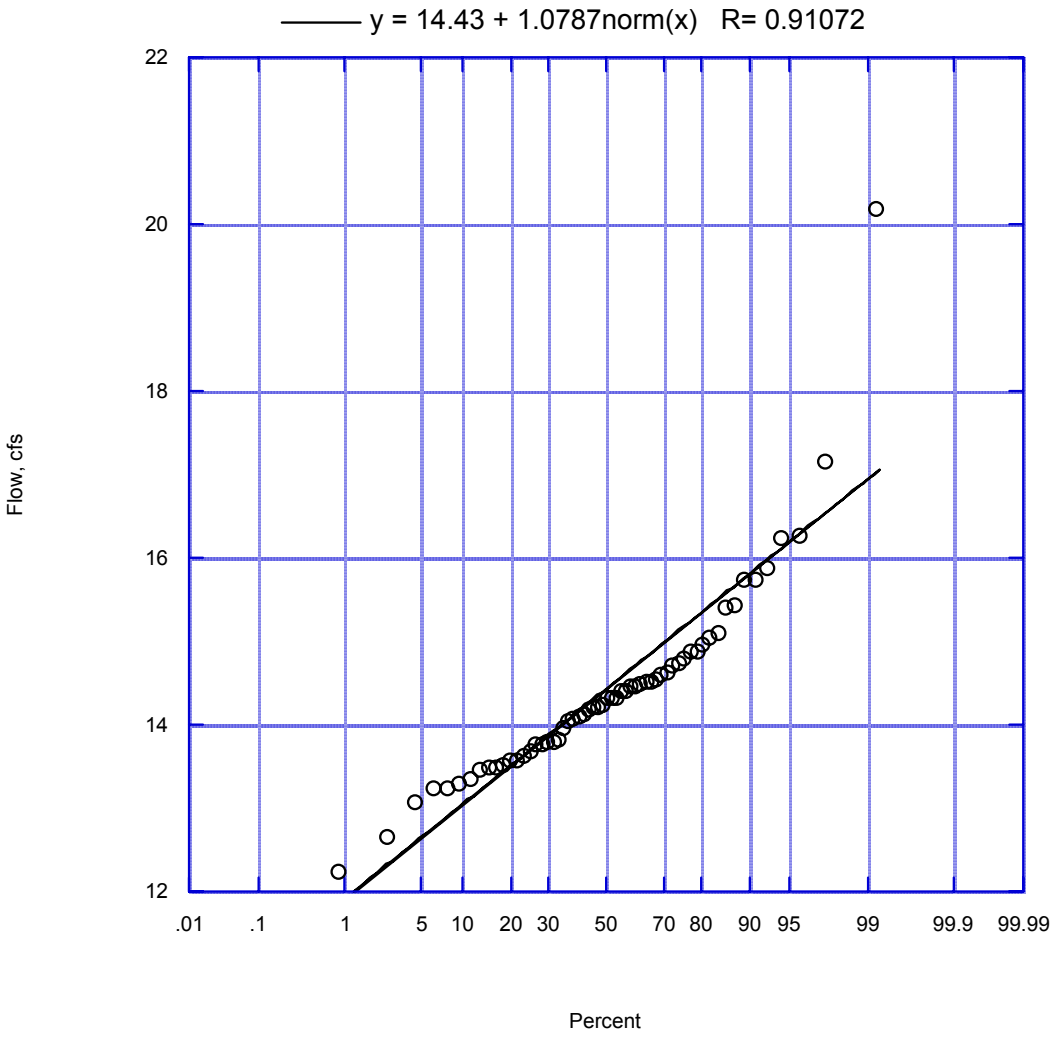


Figure 36. Simi Valley Effluent Flow Frequency Distribution - Mar (02-03)

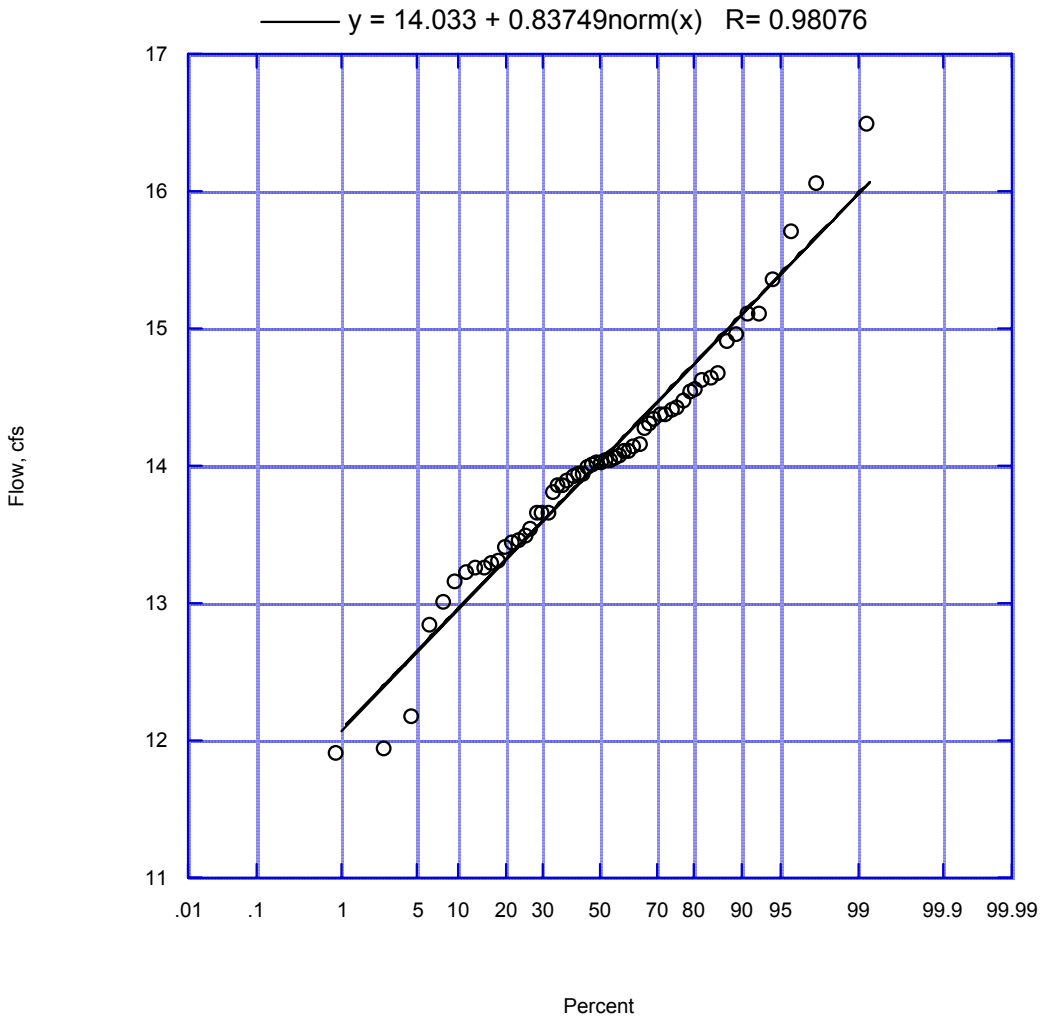


Figure 37. Simi Valley Effluent Flow Frequency Distribution - April (02-03)

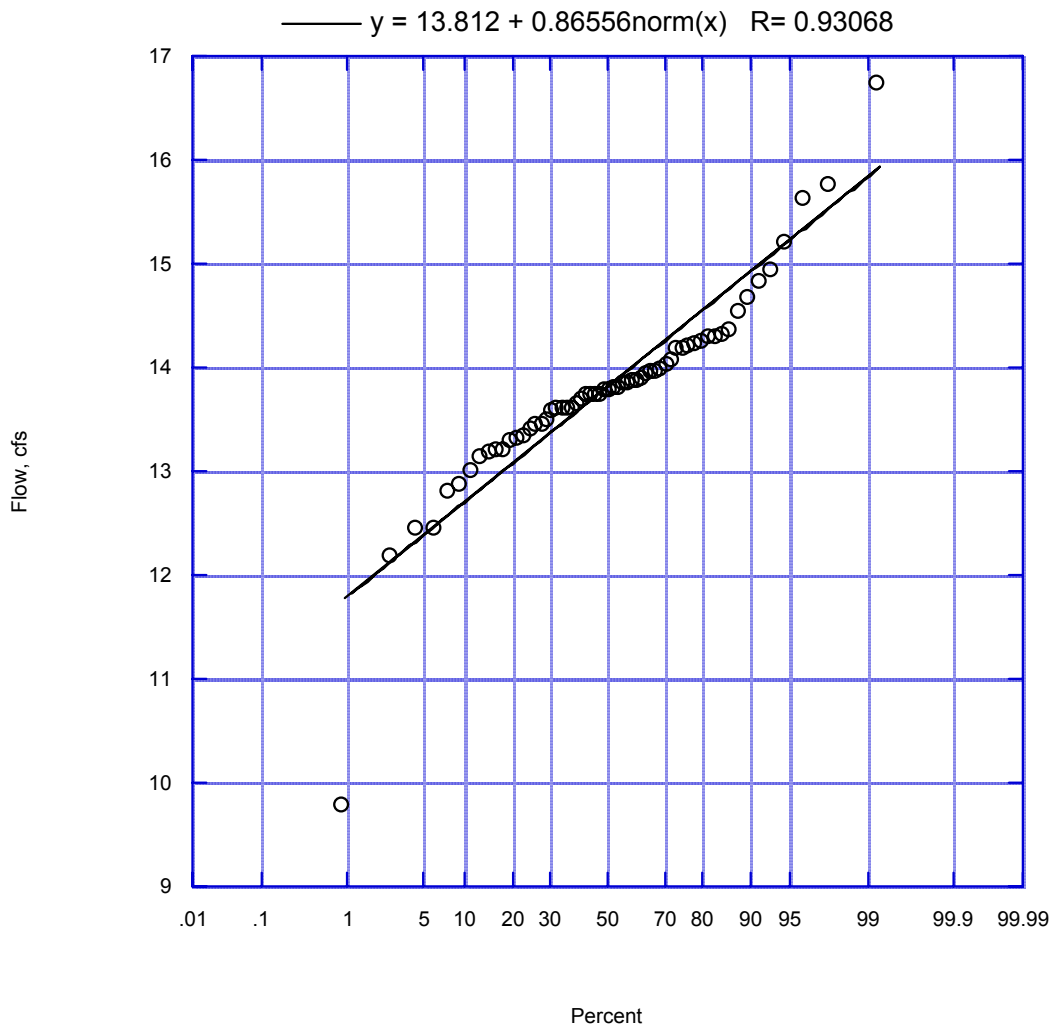


Figure 38. Simi Valley Effluent Flow Frequency Distribution - May (02-03)

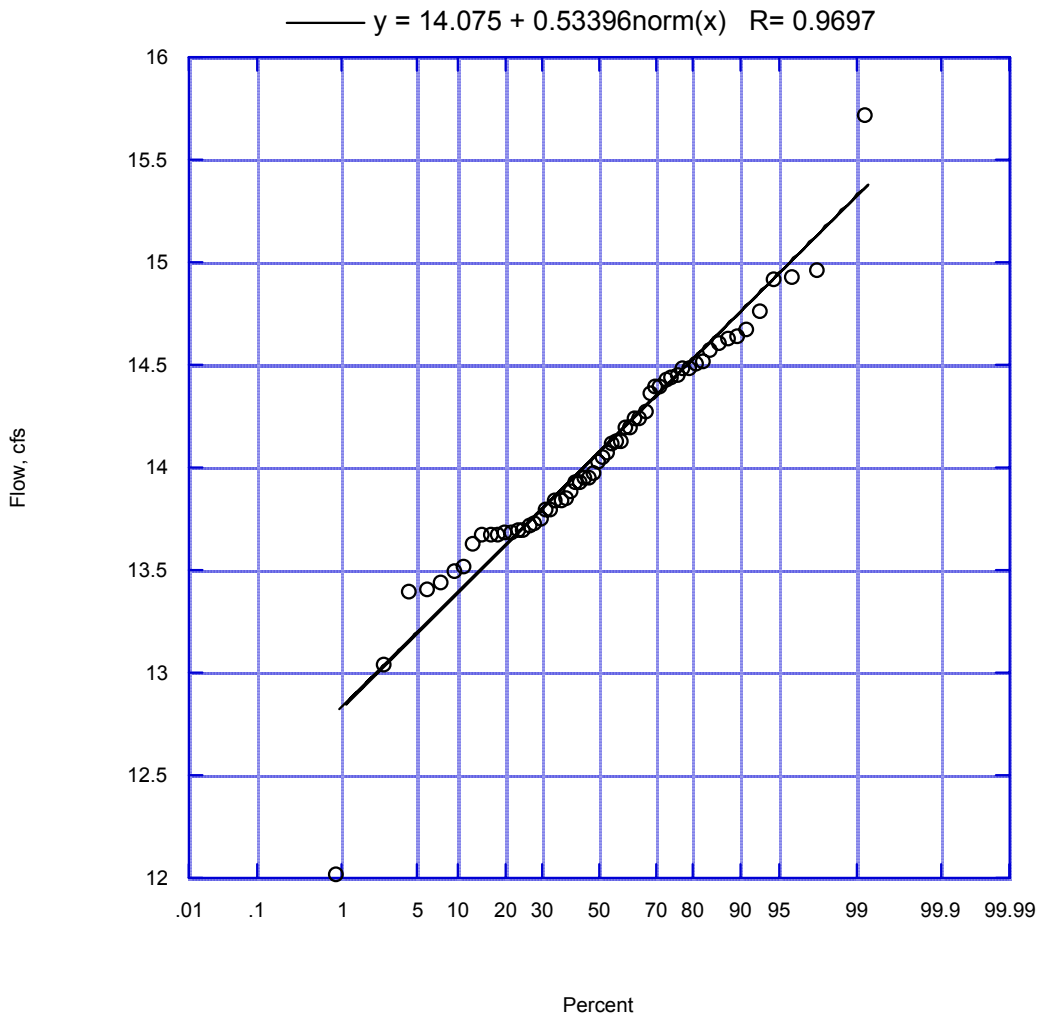


Figure 39. Simi Valley Effluent Flow Frequency Distribution - June (02-03)

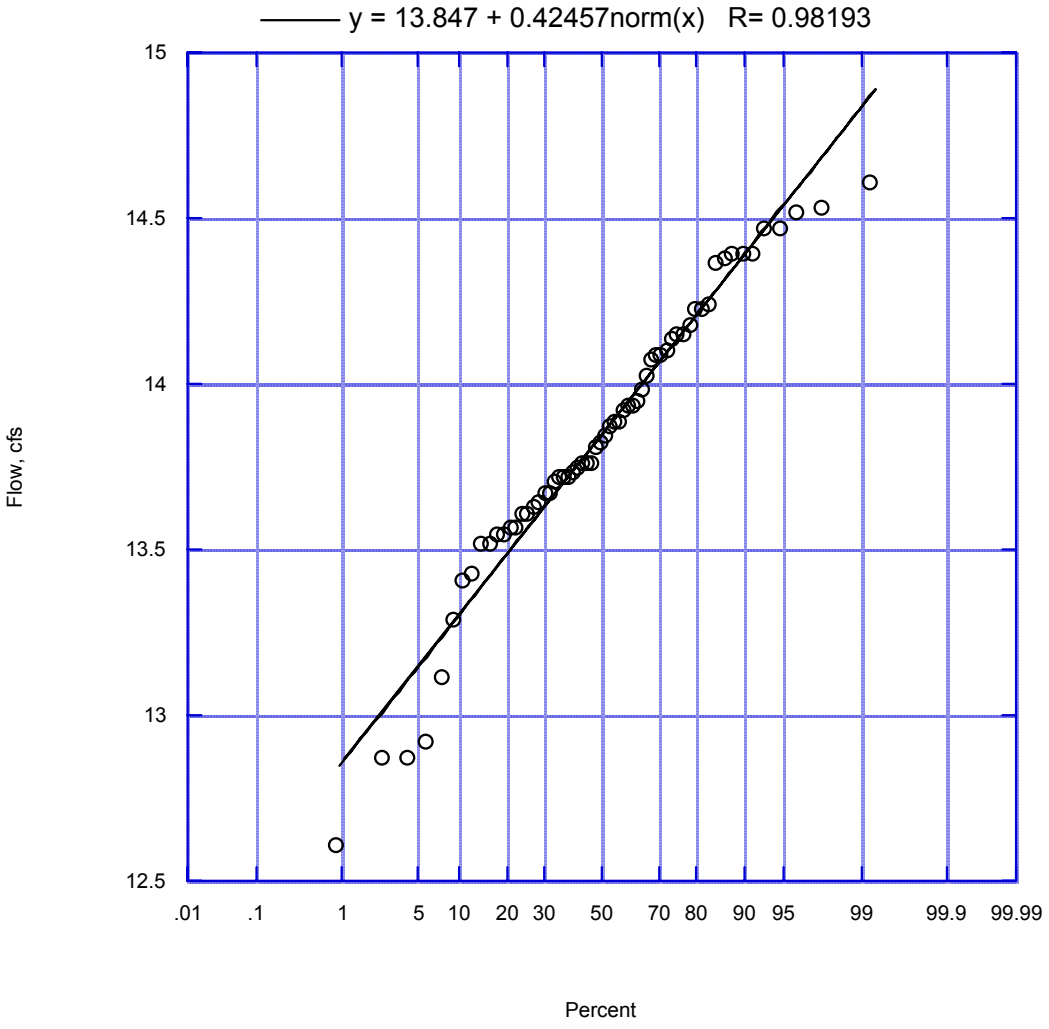


Figure 40. Simi Valley Effluent Flow Frequency Distribution - July (02-03)

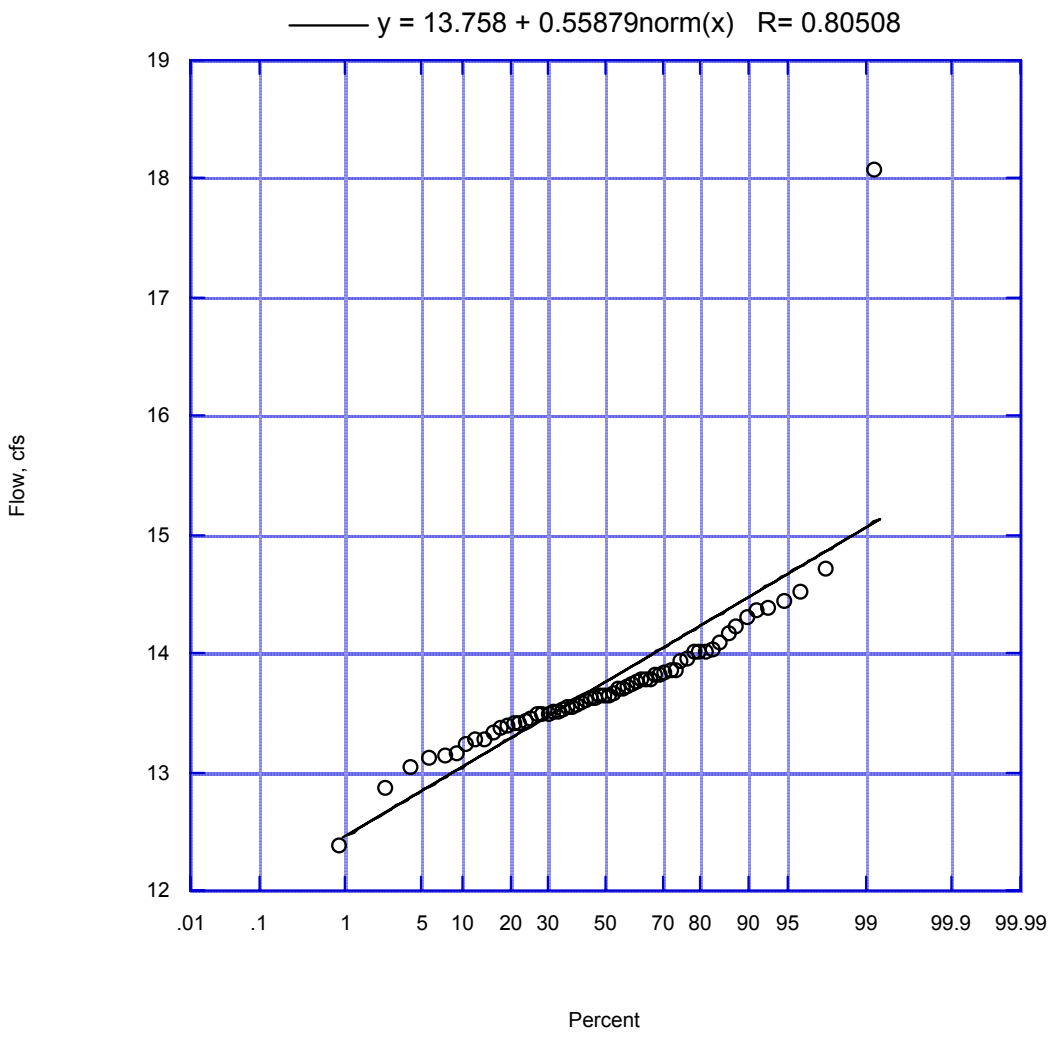


Figure 41. Simi Valley Effluent Flow Frequency Distribution - Aug (02-03)

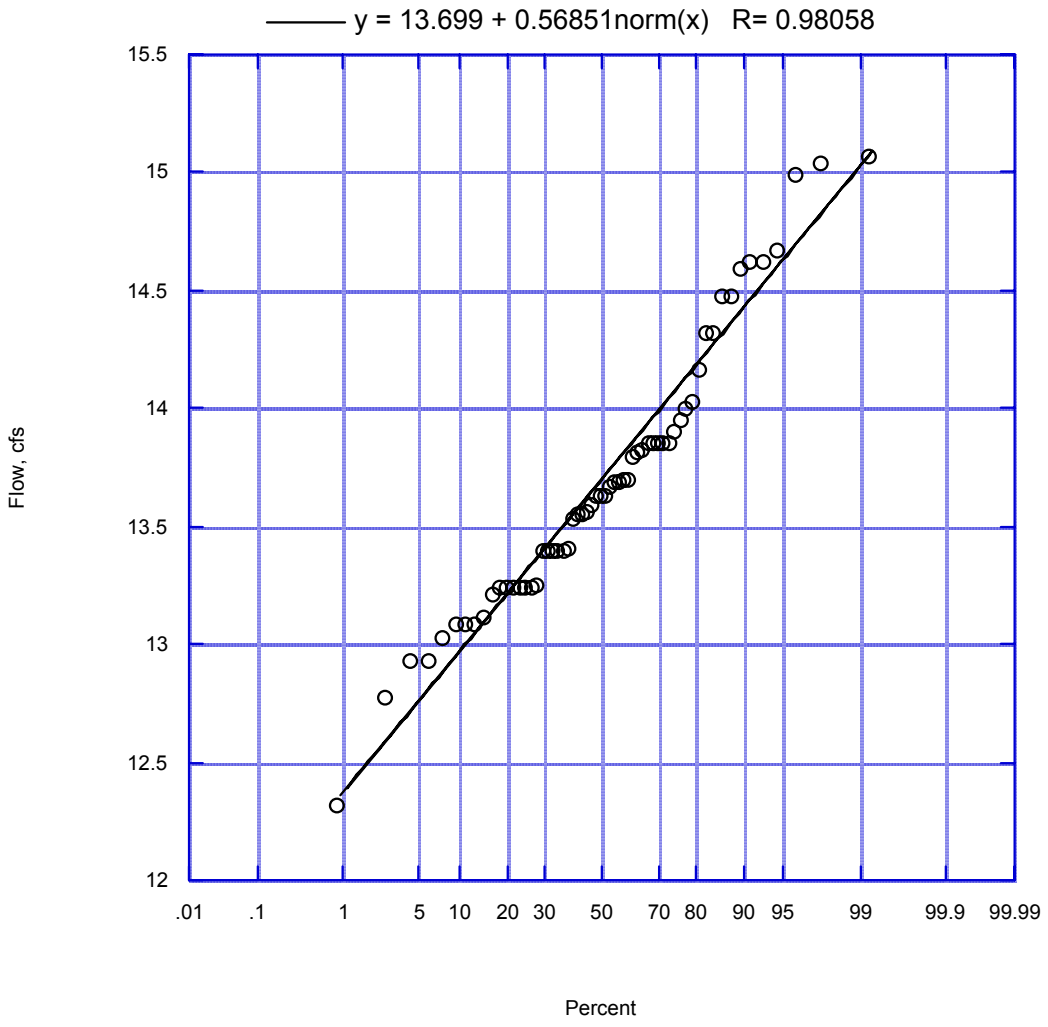


Figure 42. Simi Valley Effluent Flow Frequency Distribution - Sept (02-03)

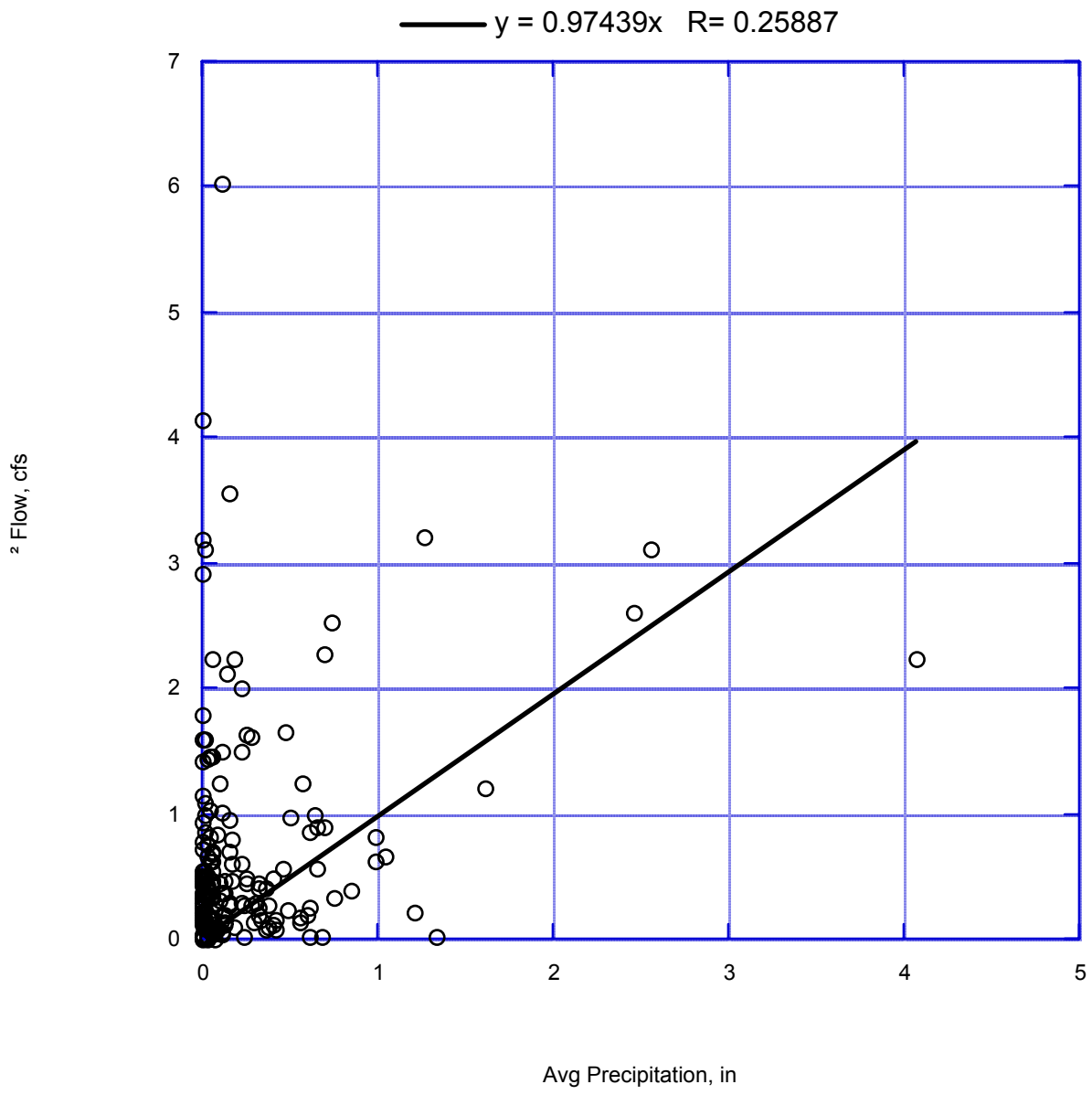


Figure 43. Camarillo ² Effluent Flow vs. Precipitation

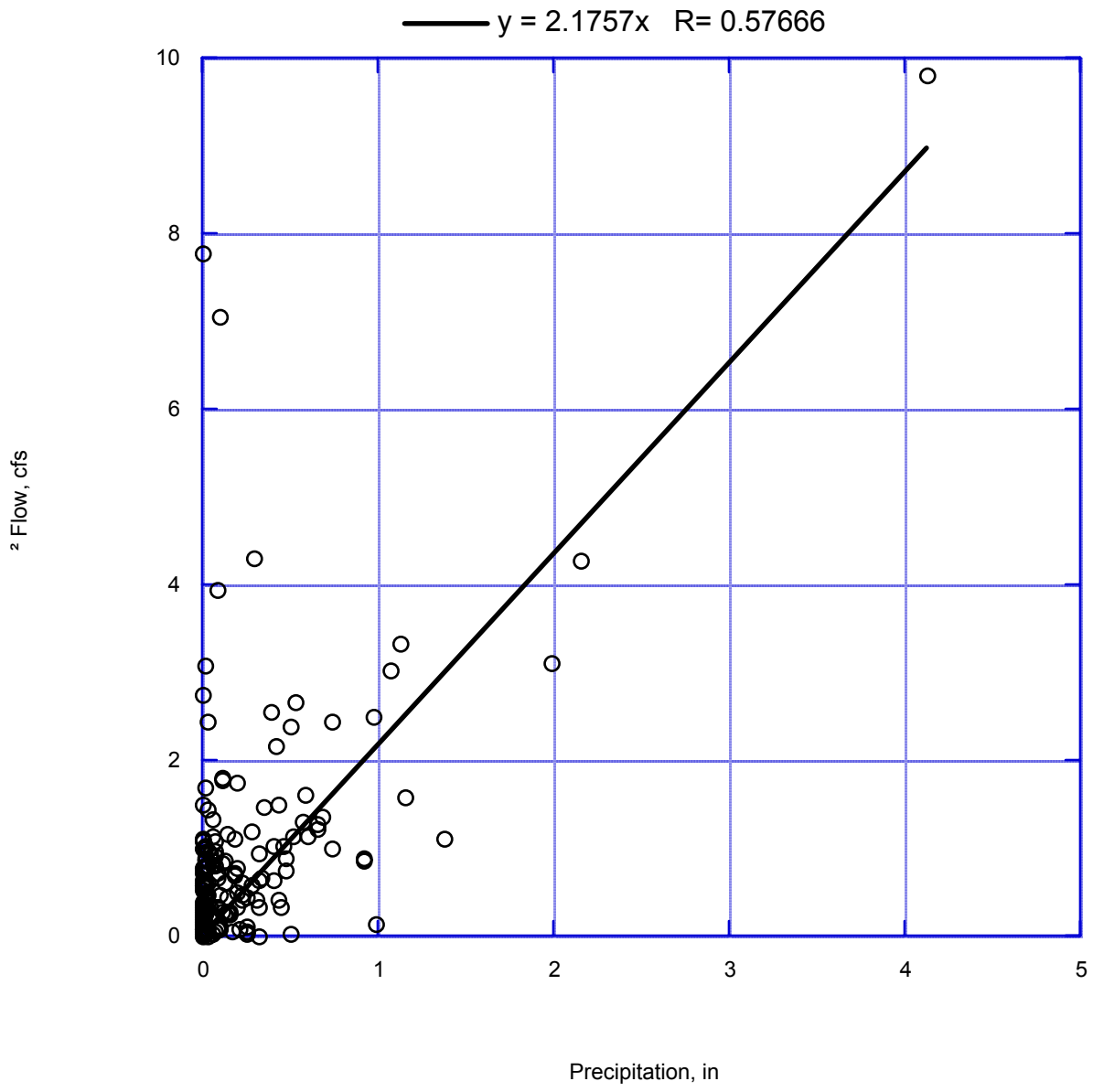


Figure 44. Hill Canyon ² Effluent Flow vs. Precipitation

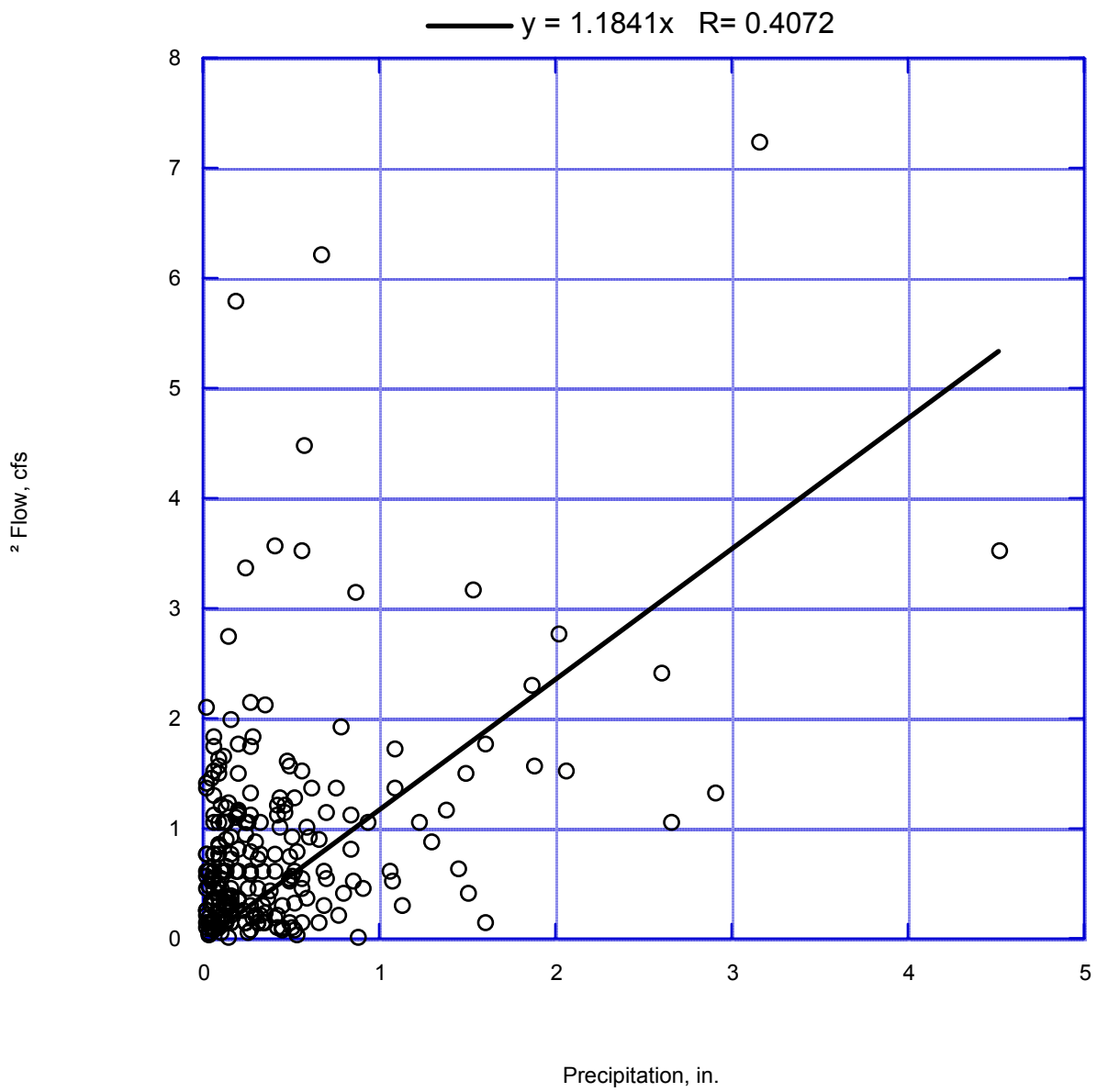


Figure 45. Simi Valley ² Effluent Flow vs. Precipitation

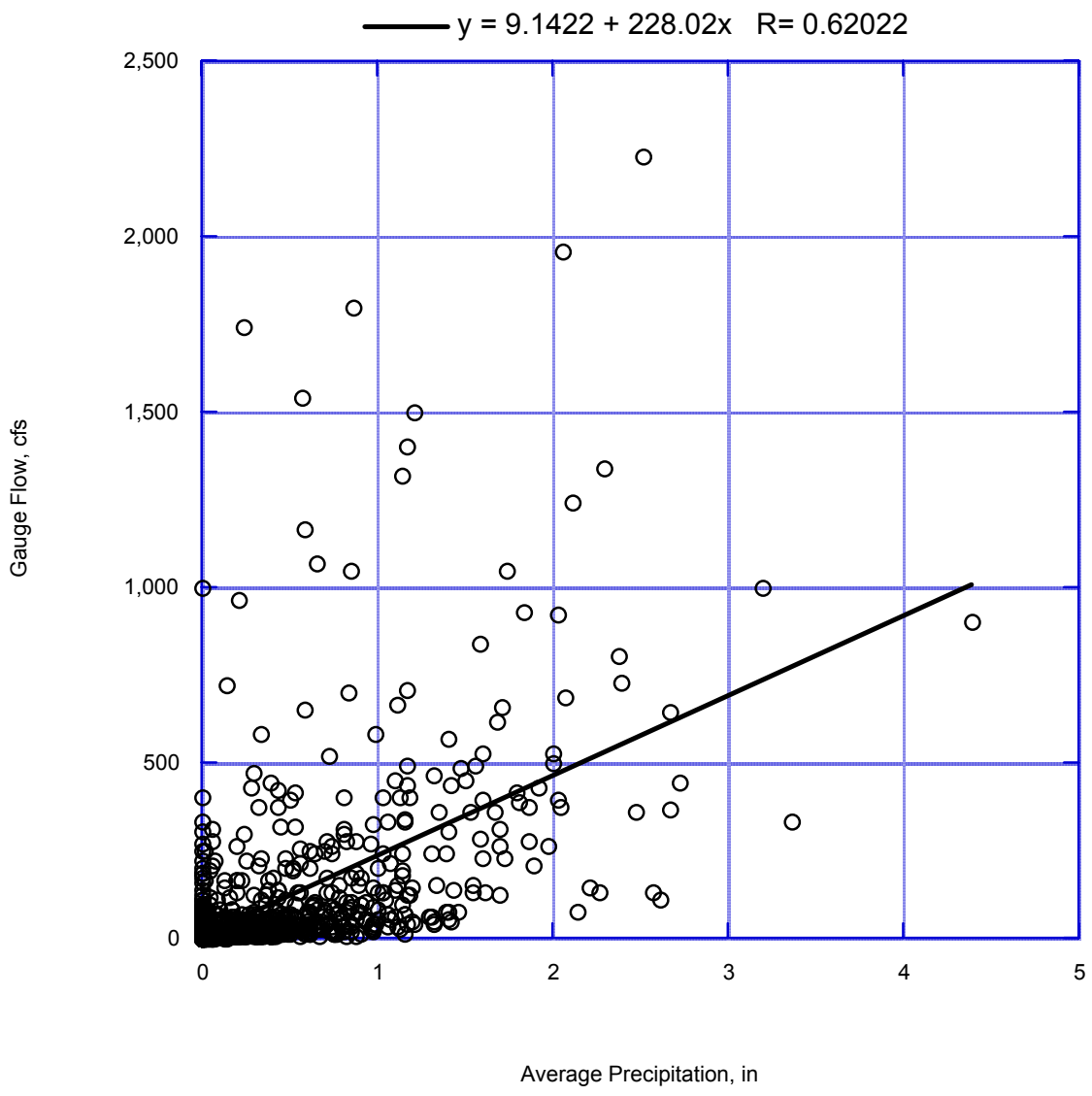


Figure 46. Gauge 776 Flow vs. Average Watershed Precipitation

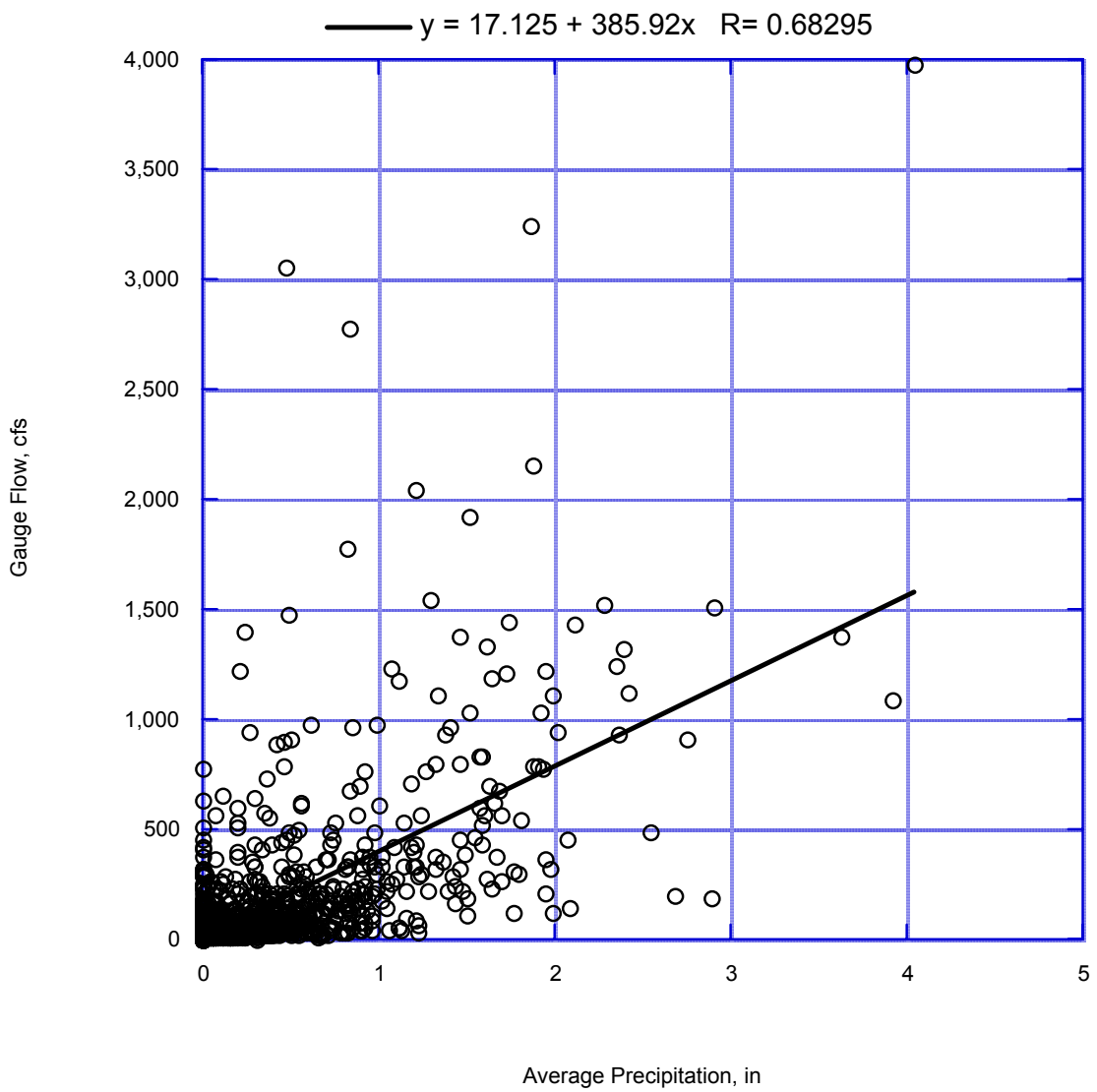


Figure 47. Gauge 800 Flow vs. Average Watershed Precipitation

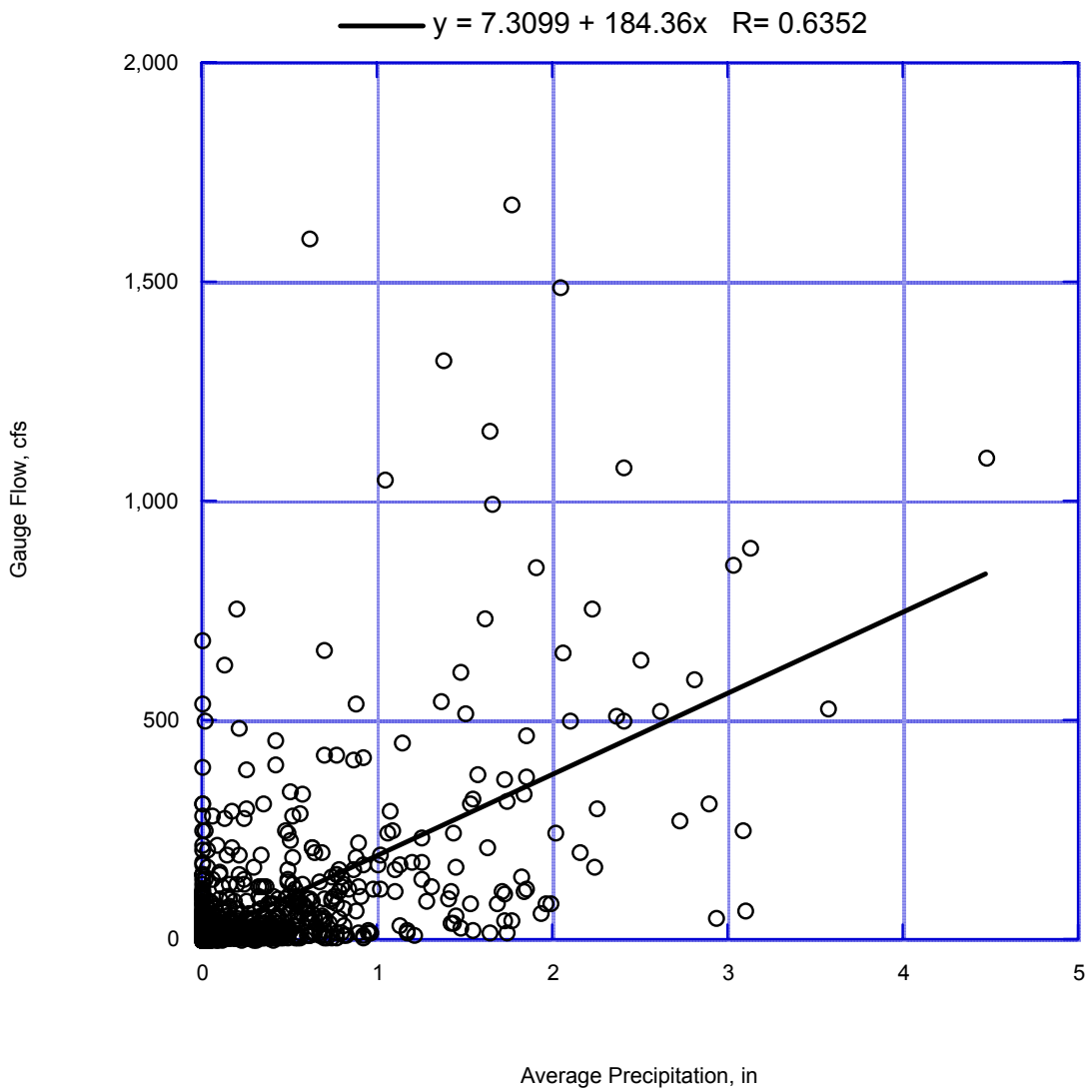


Figure 48. Gauge 803 Flow vs. Average Watershed Precipitation

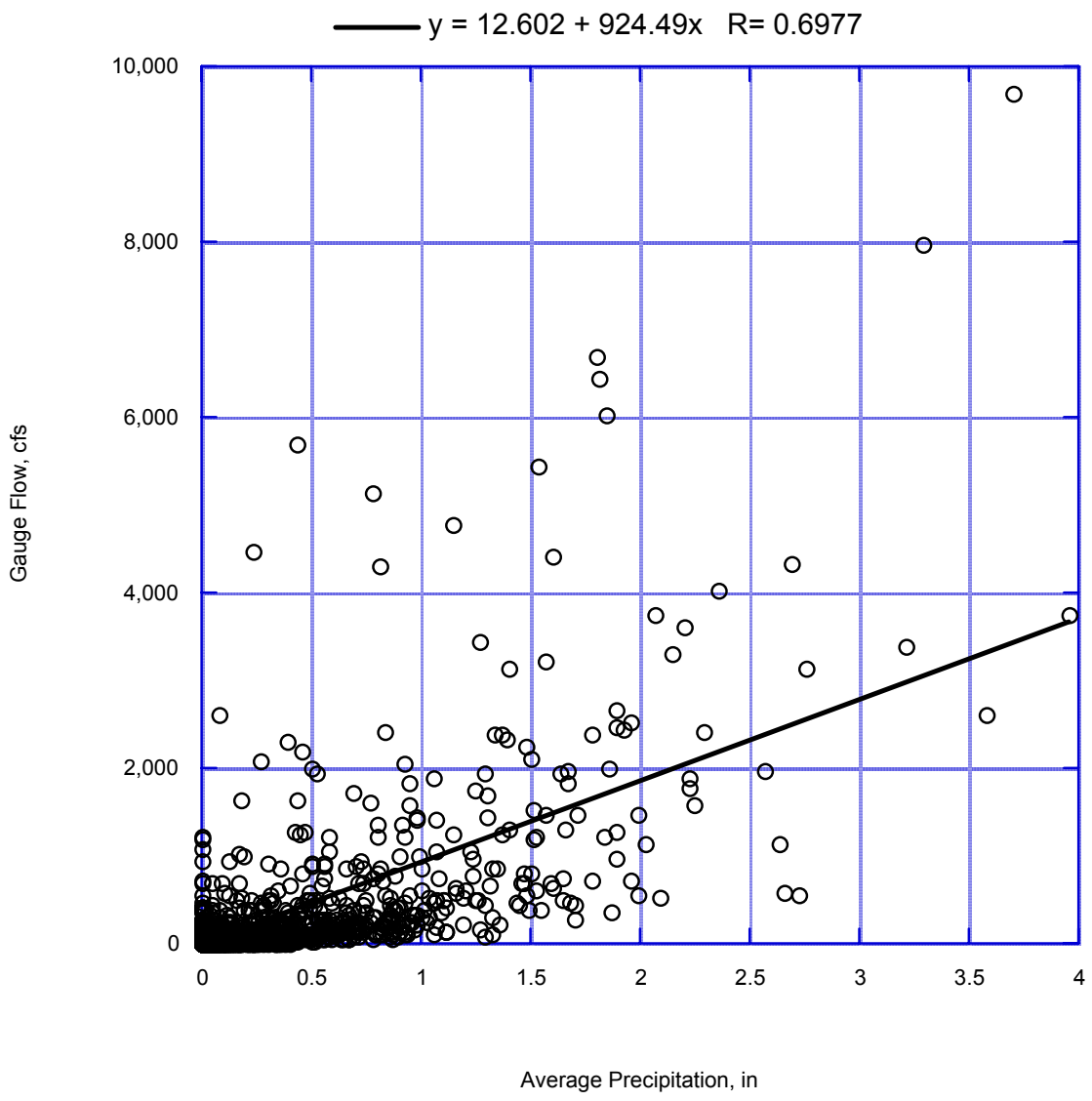


Figure 49. Gauge 805 Flow vs. Average Watershed Precipitation

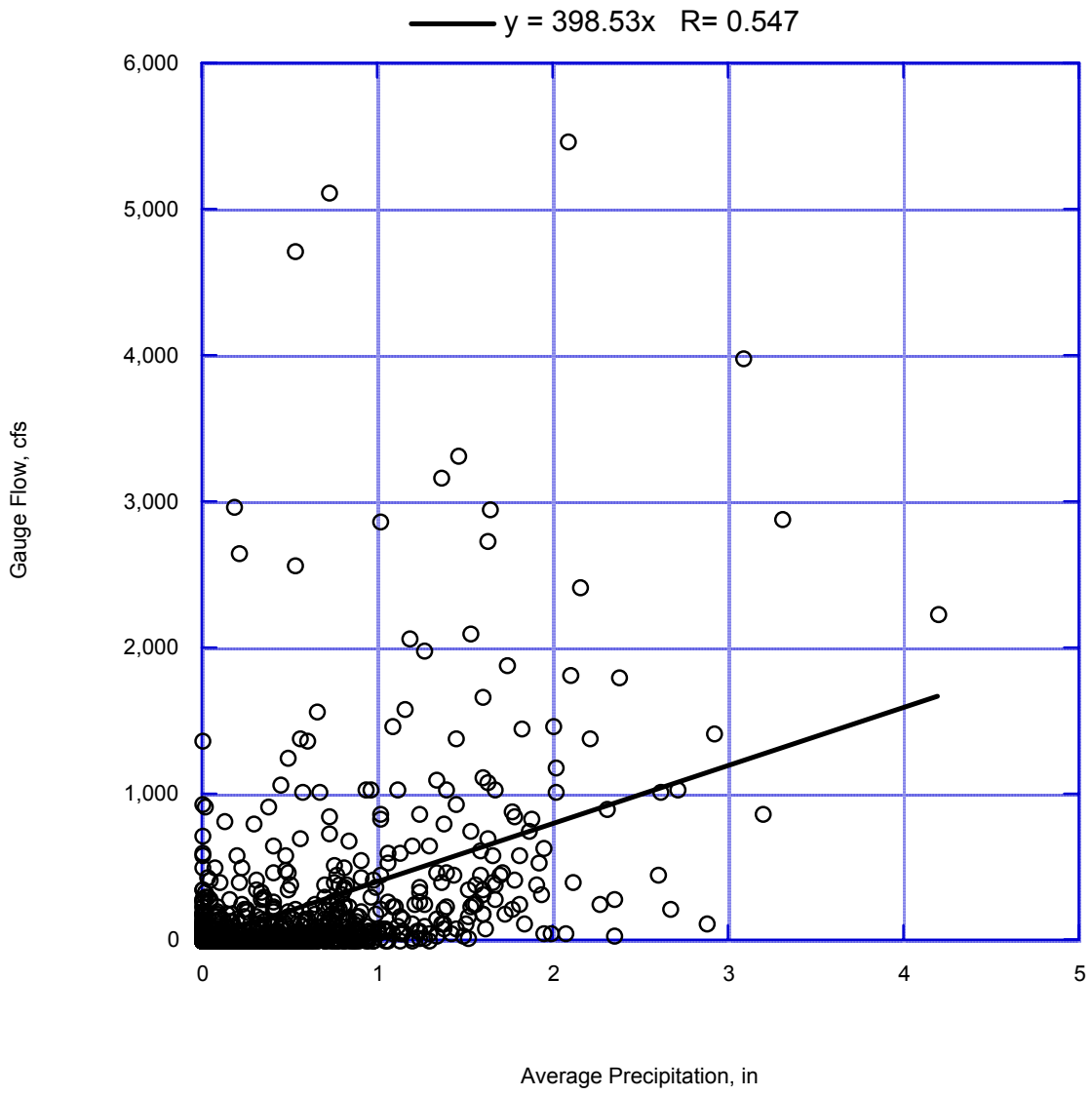


Figure 50. Gauge 806 Flow vs. Average Watershed Precipitation

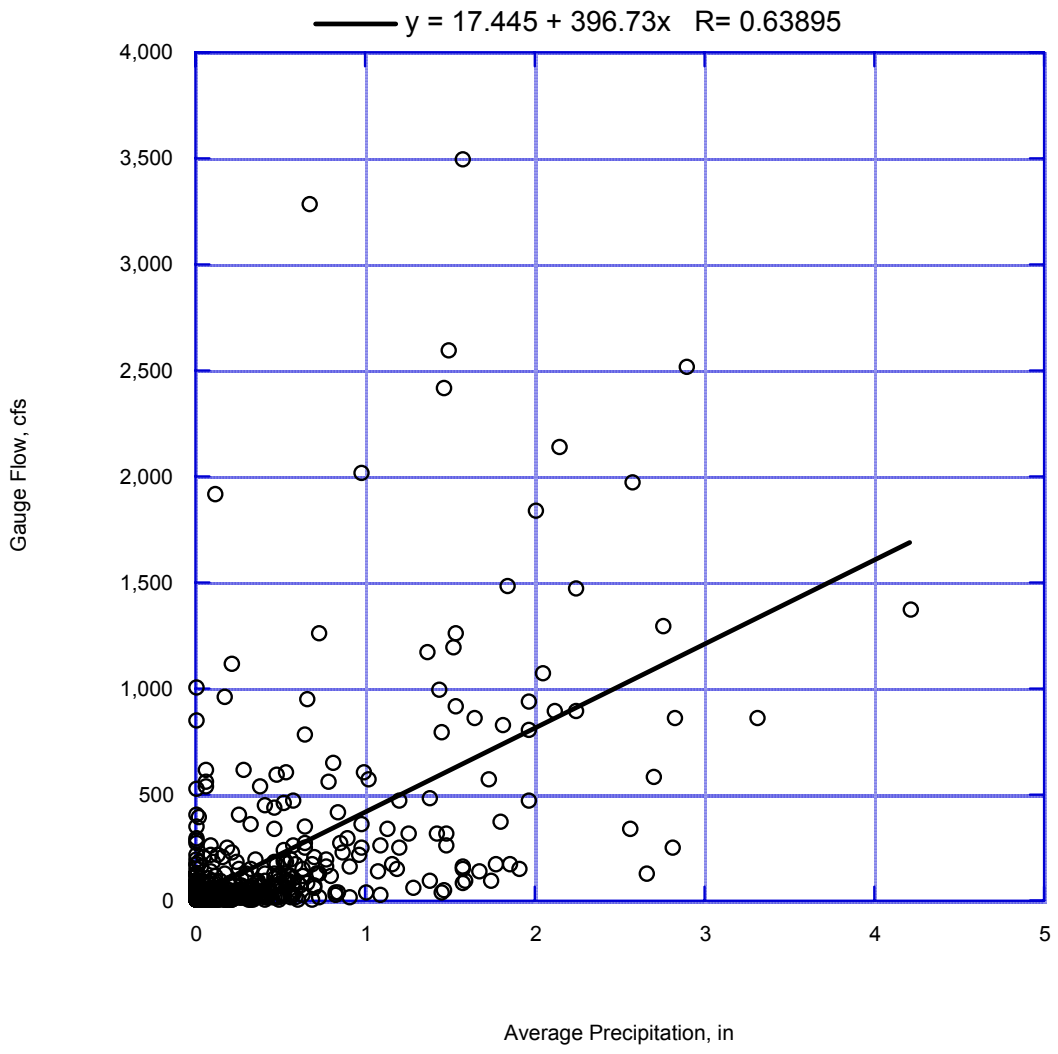


Figure 51. Gauge 841 Gauge Flow vs. Average Watershed Precipitation

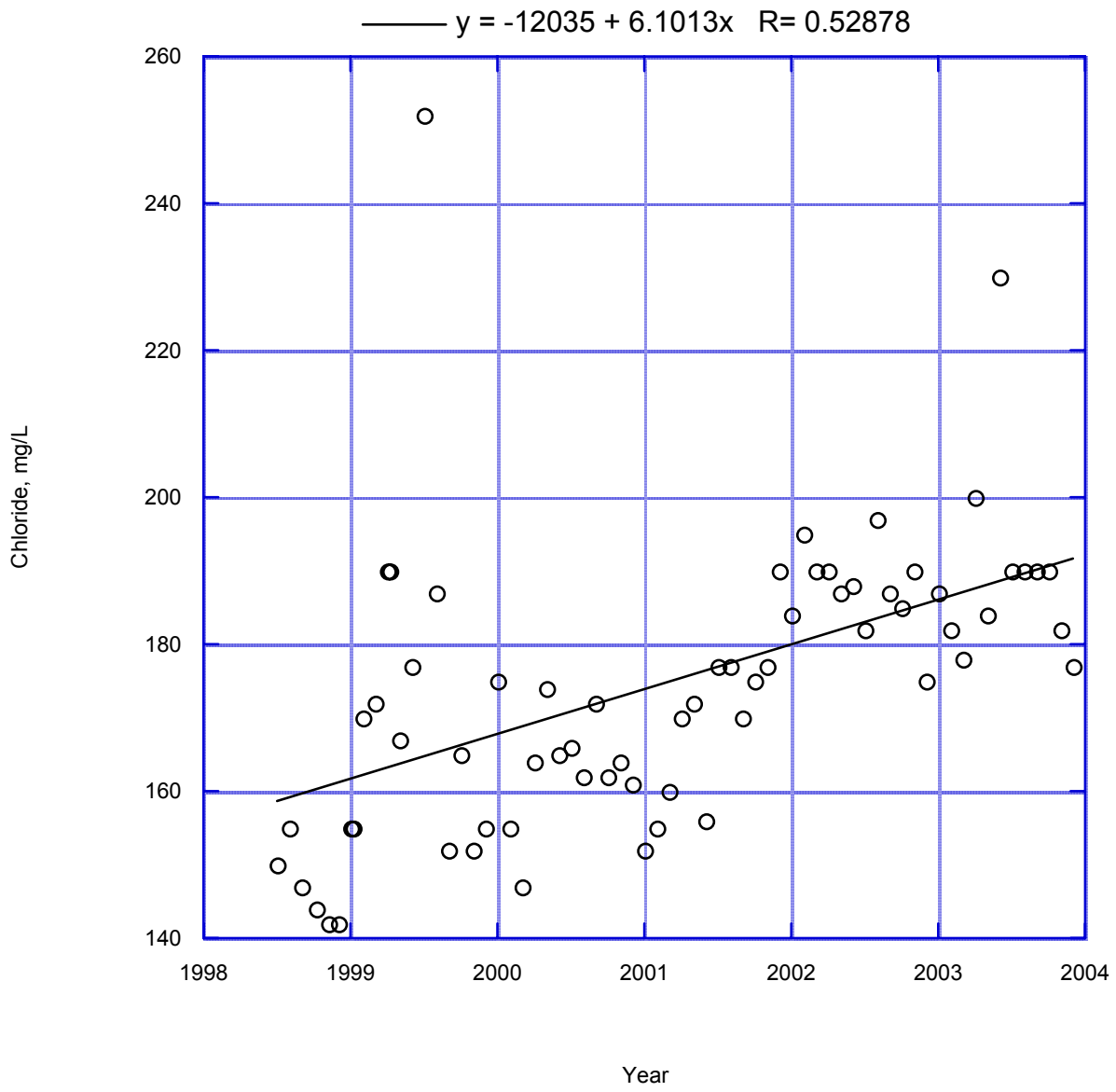


Figure 52. Camarillo Effluent Chloride vs. Time

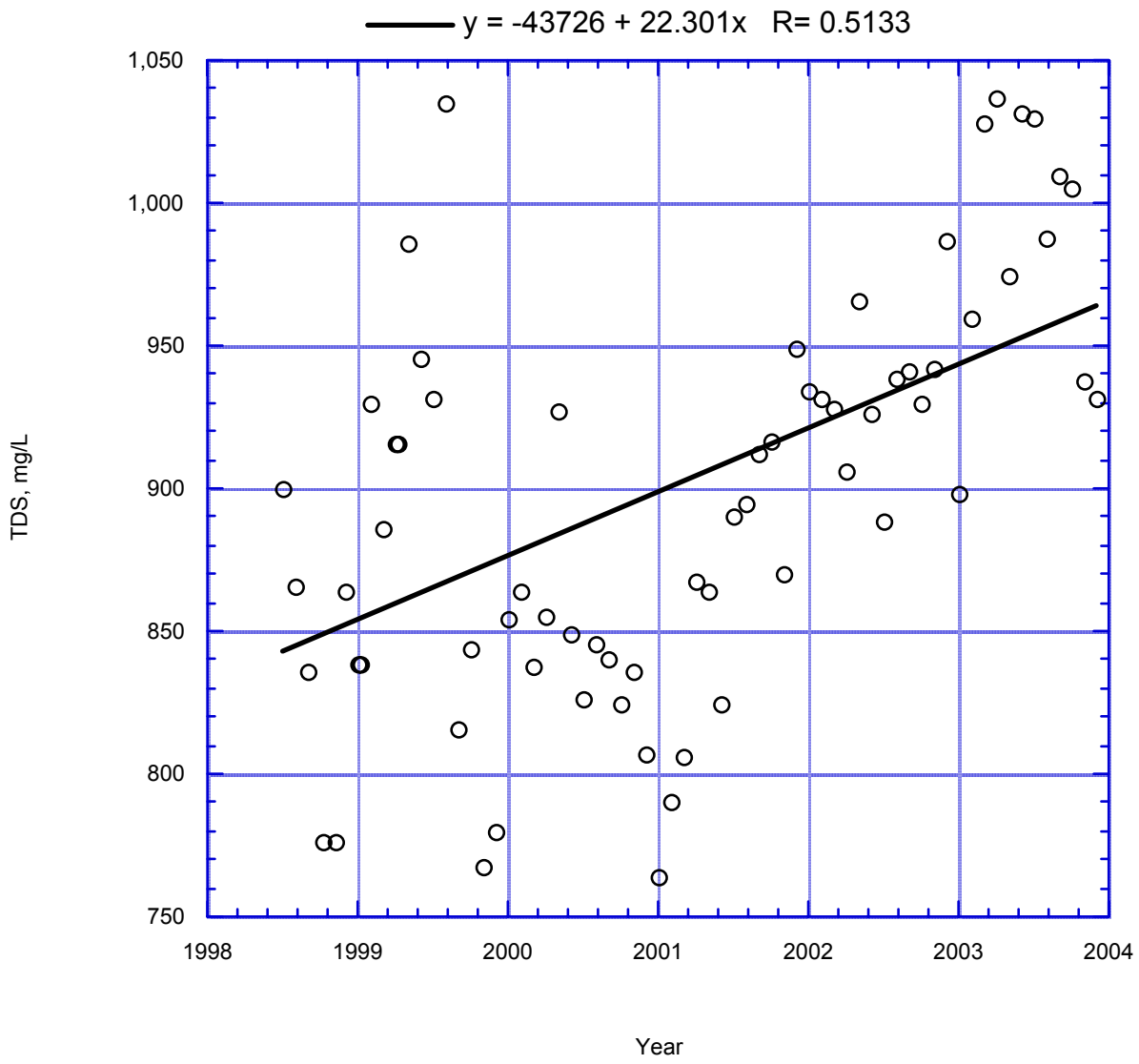


Figure 53. Camarillo Effluent TDS vs. Time

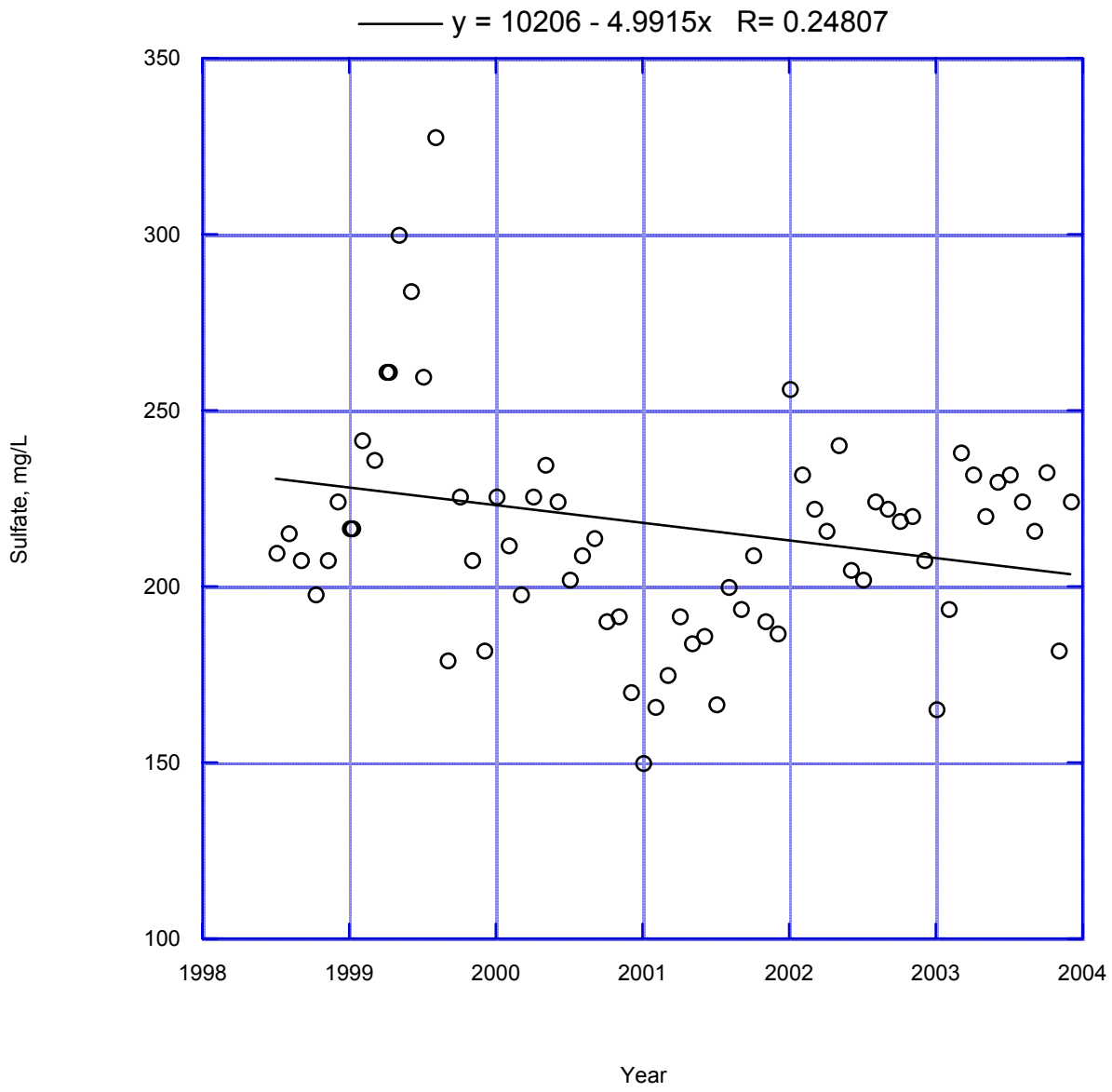


Figure 54. Camarillo Effluent Sulfate vs. Time

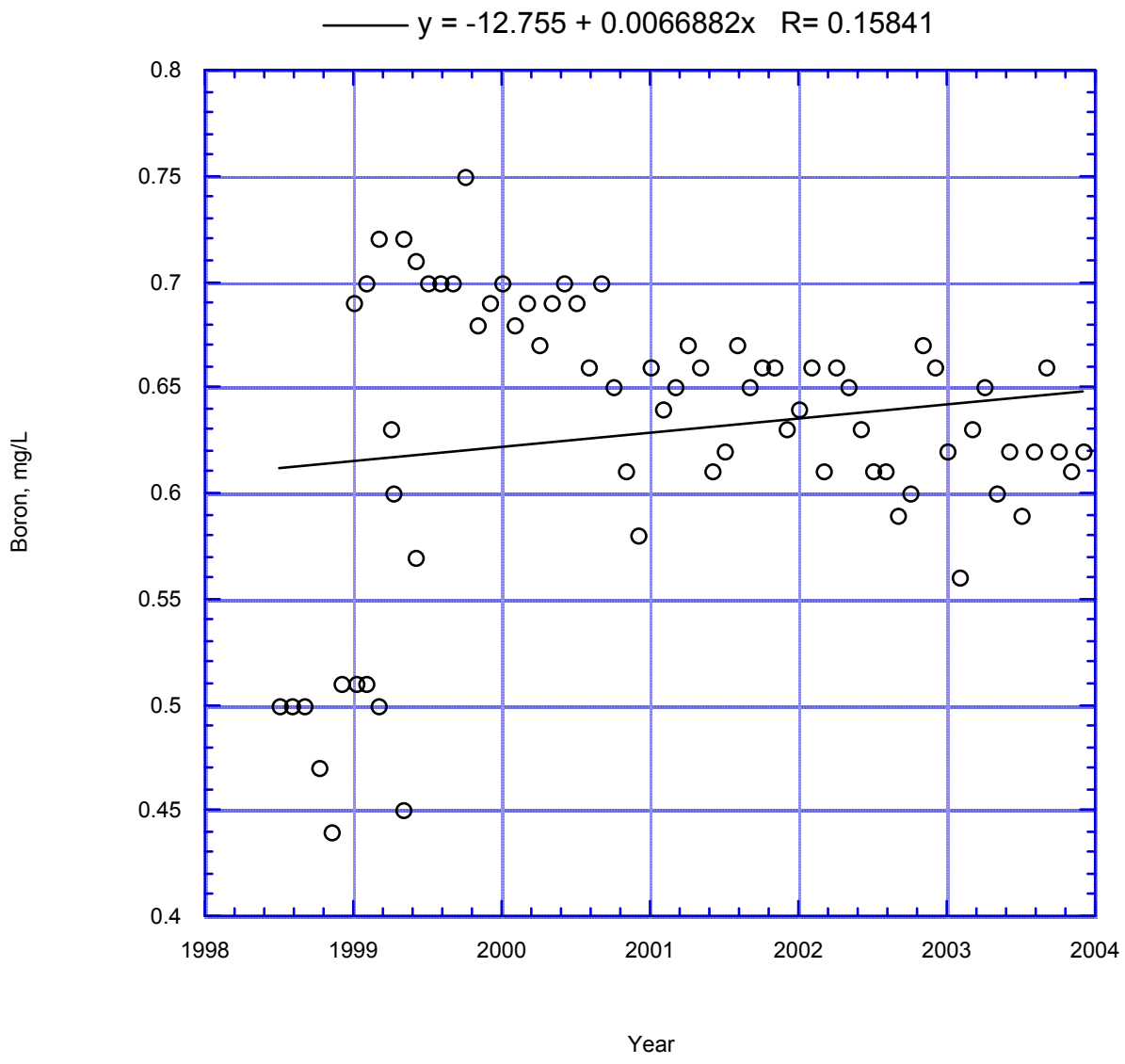


Figure 55. Camarillo Effluent Boron vs. Time

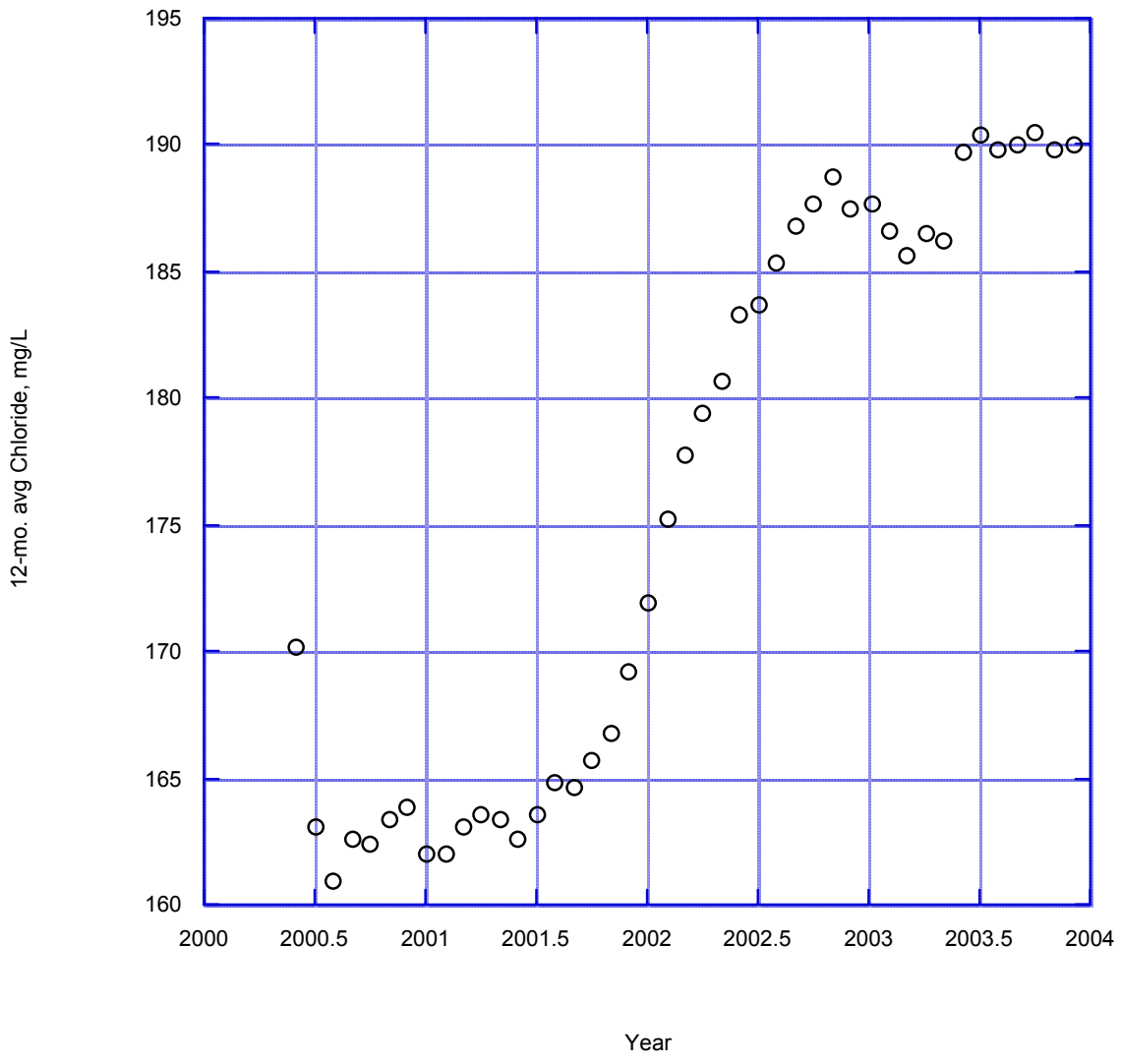


Figure 56. Camarillo Effluent 12-mo. Average Chloride vs. Time

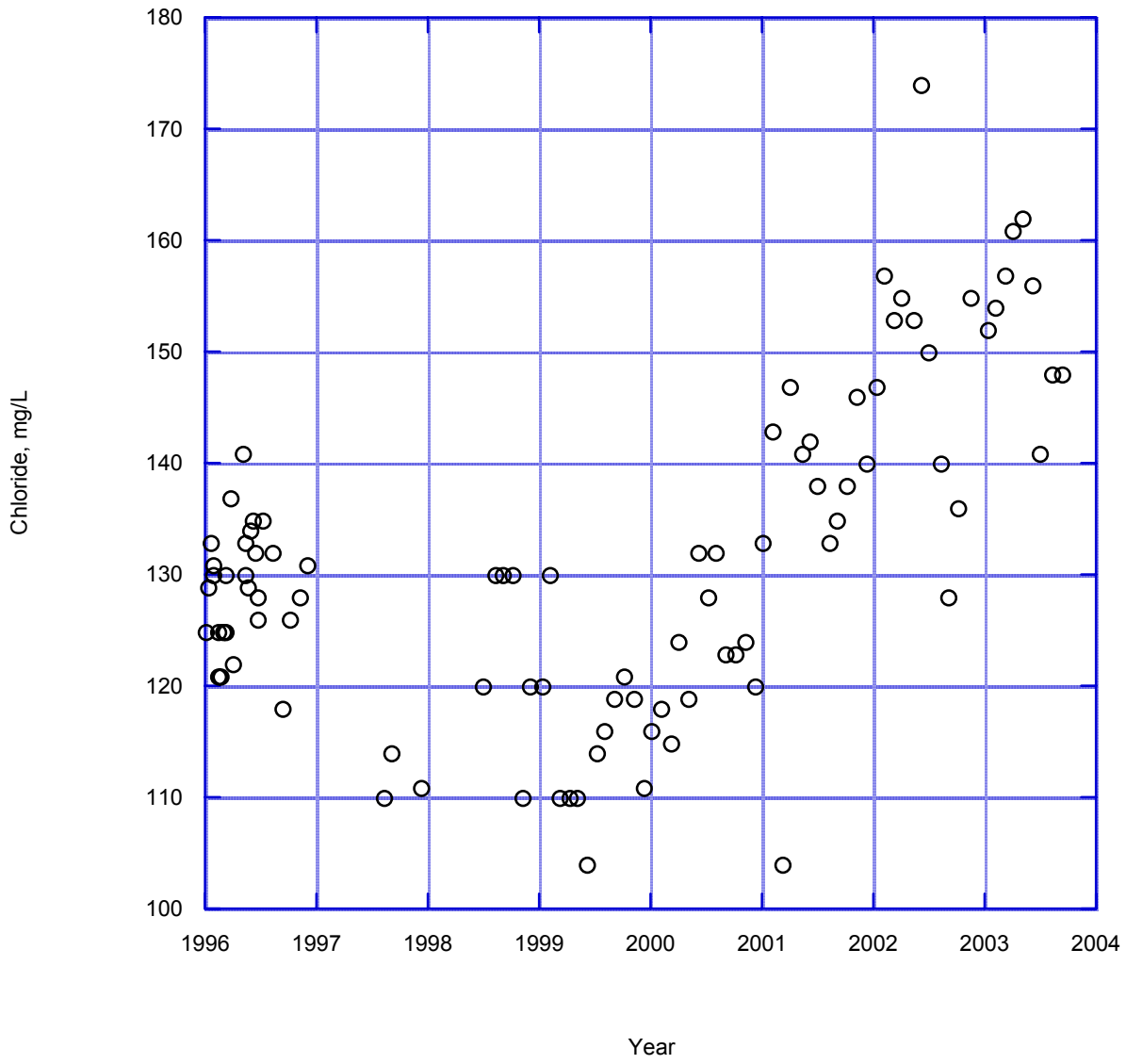


Figure 57. Hill Canyon Effluent Chloride vs. Time

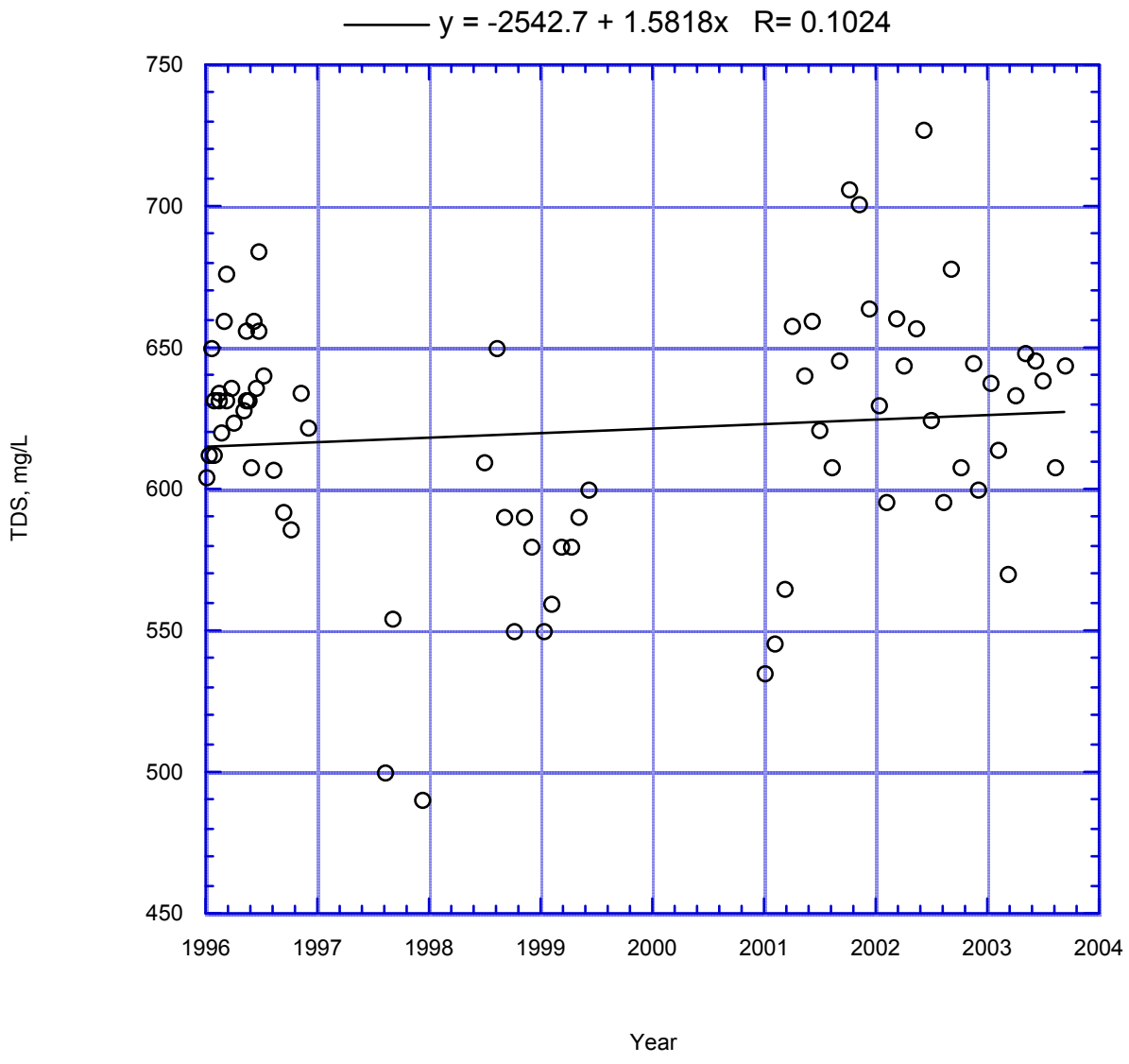


Figure 58. Hill Canyon Effluent TDS vs. Time

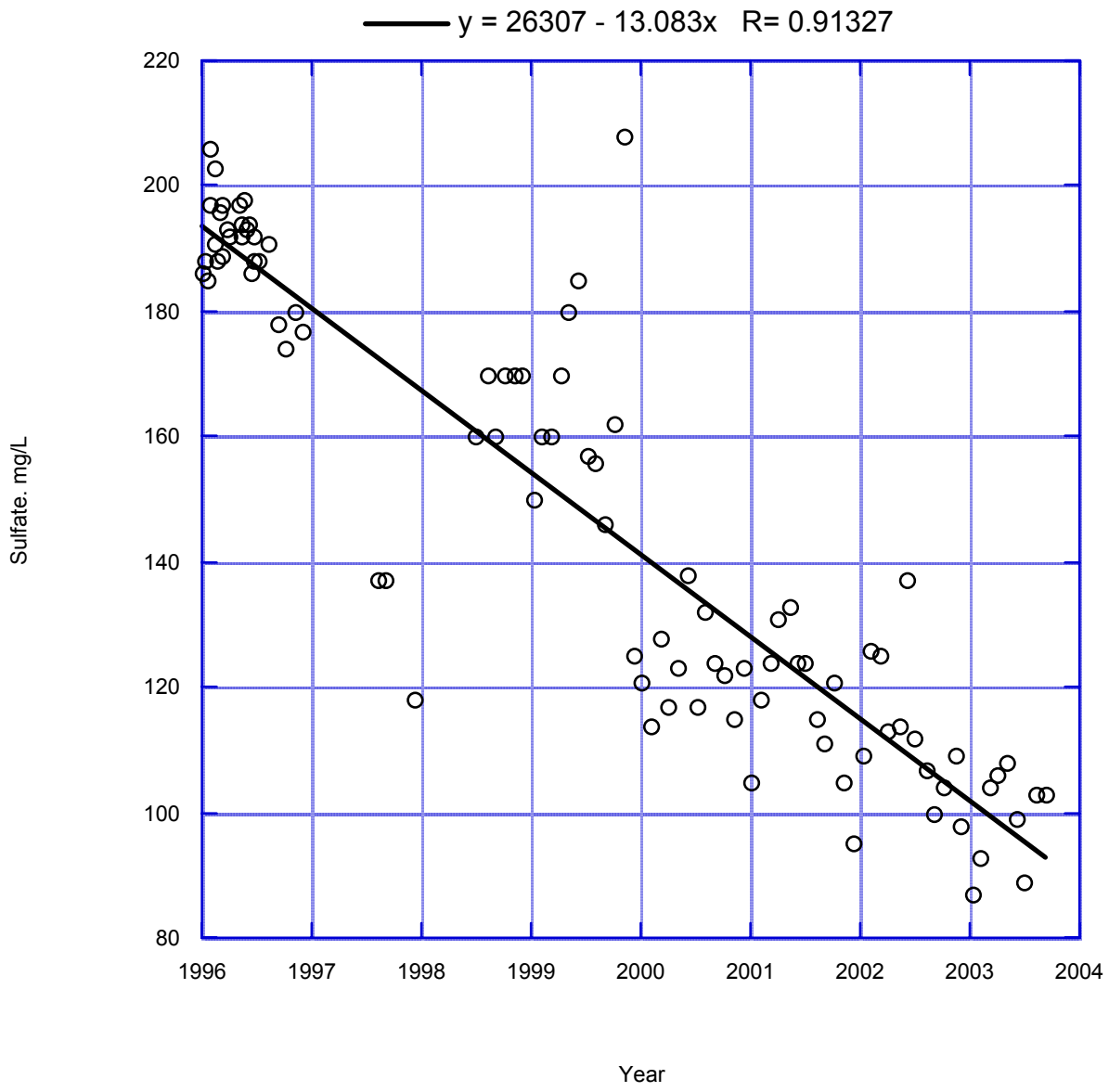


Figure 59. Hill Canyon Effluent Sulfate vs. Time

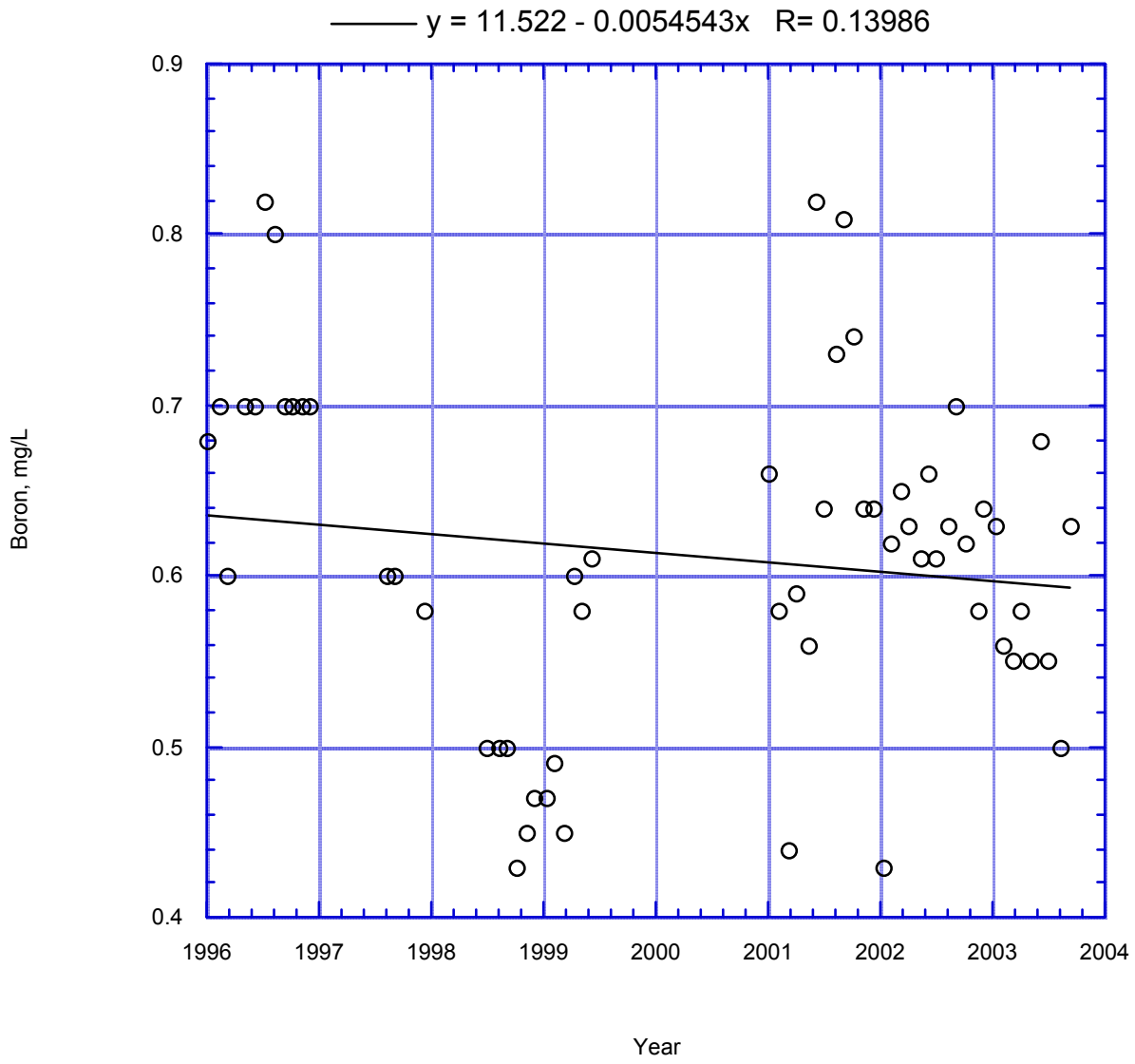


Figure 60. Hill Canyon Effluent – Boron vs. Time

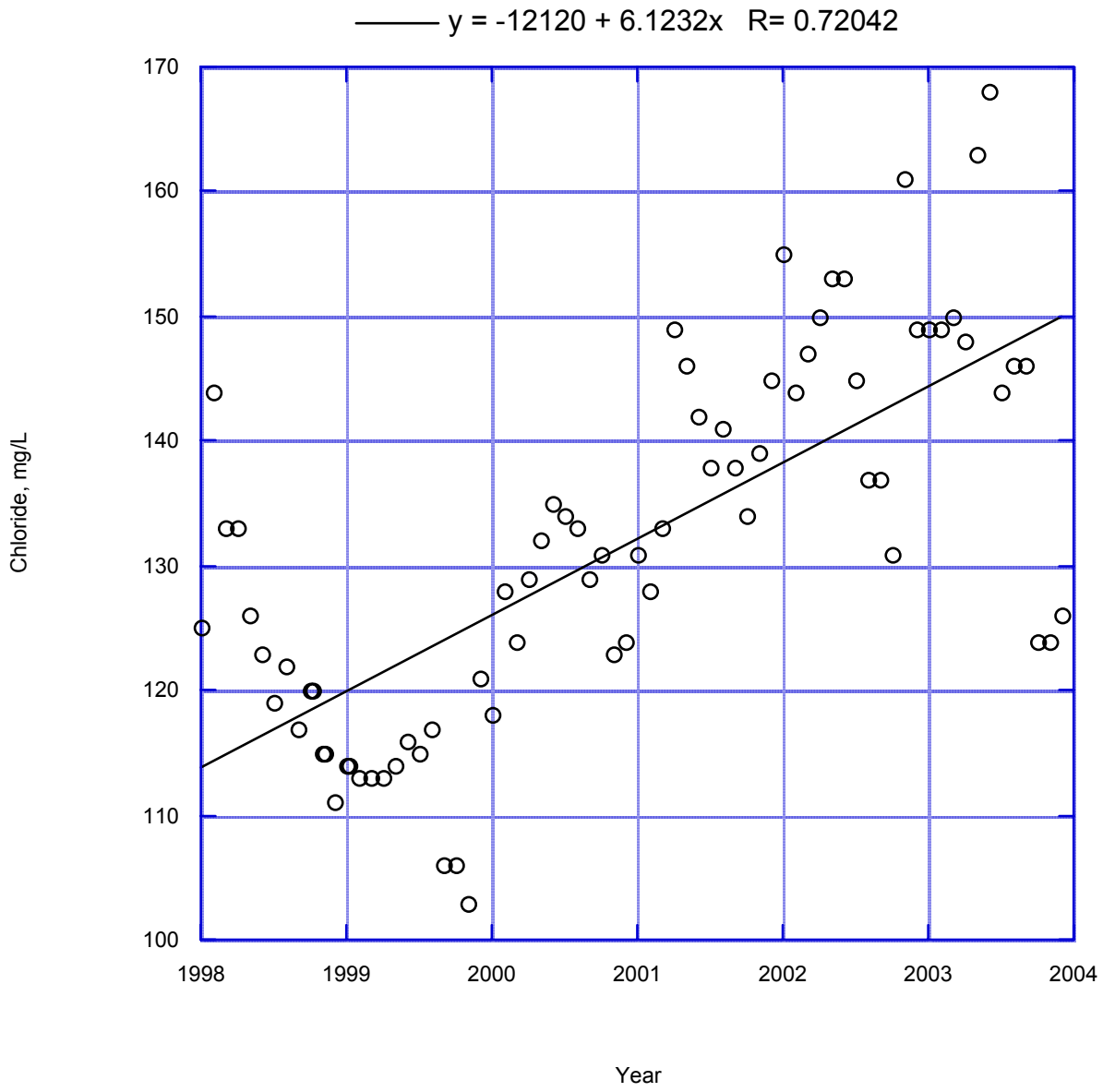


Figure 61. Simi Valley Effluent Chloride vs. Time

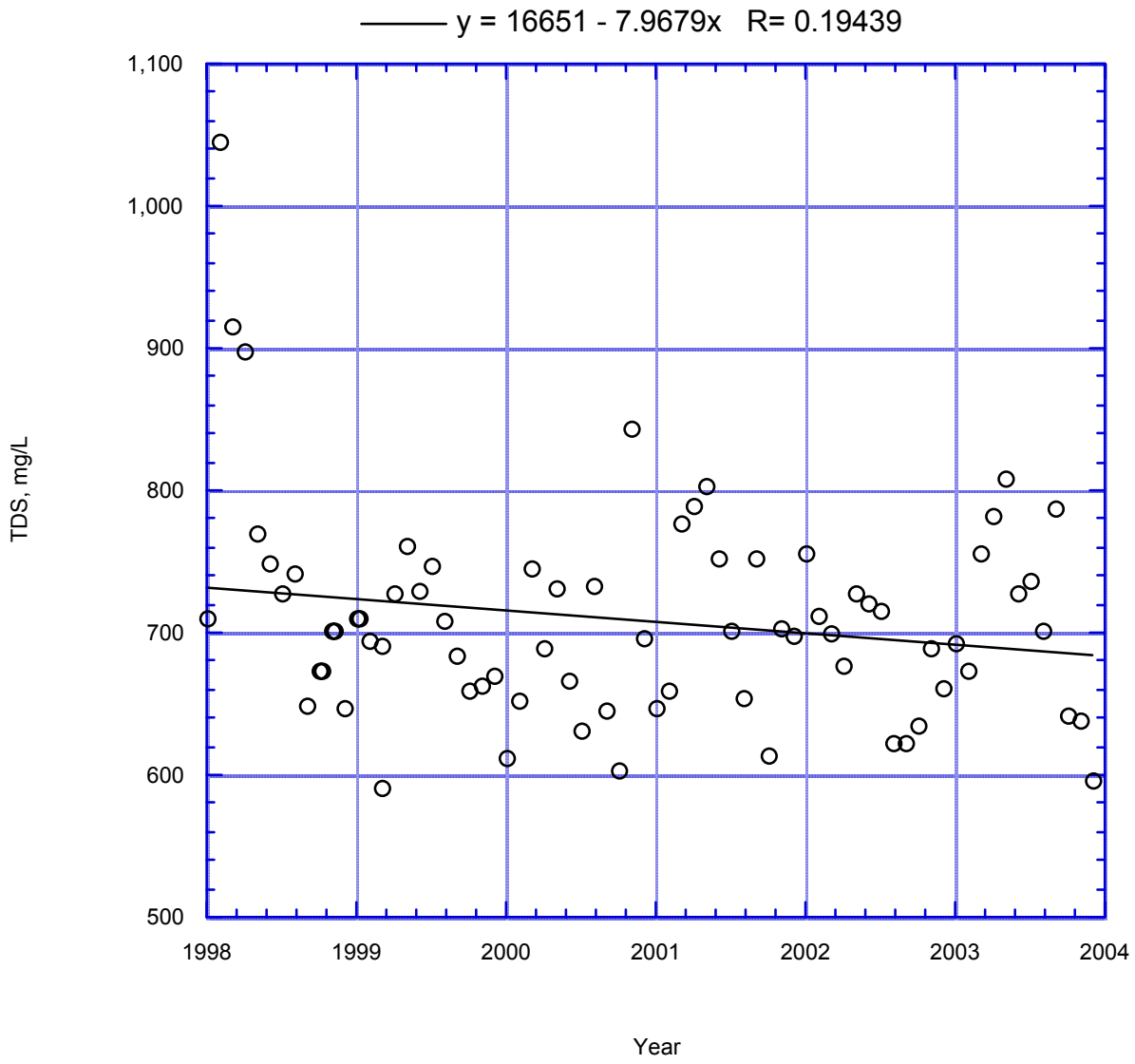


Figure 62. Simi Valley Effluent TDS vs. Time

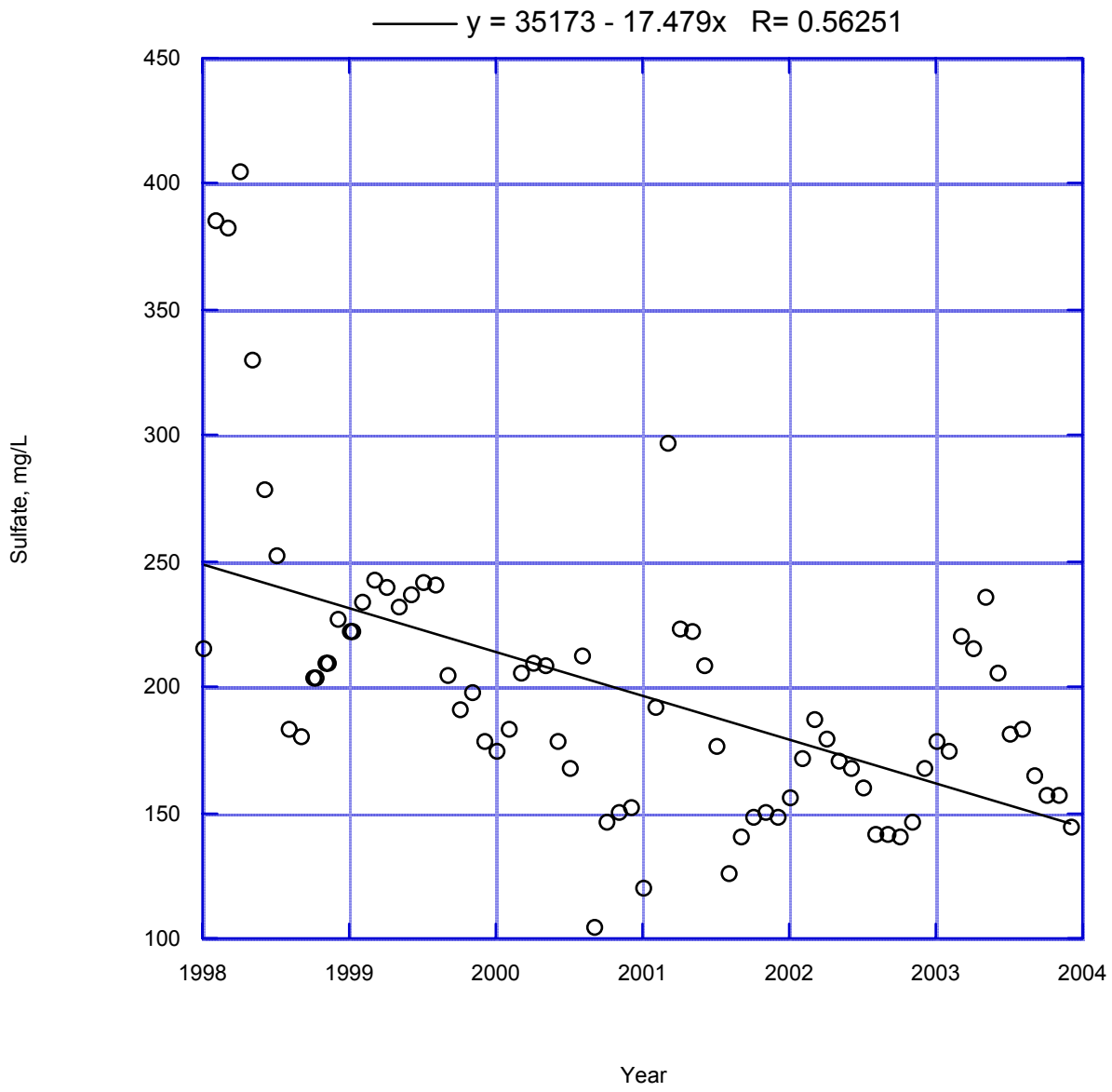


Figure 63. Simi Valley Effluent Sulfate vs. Time

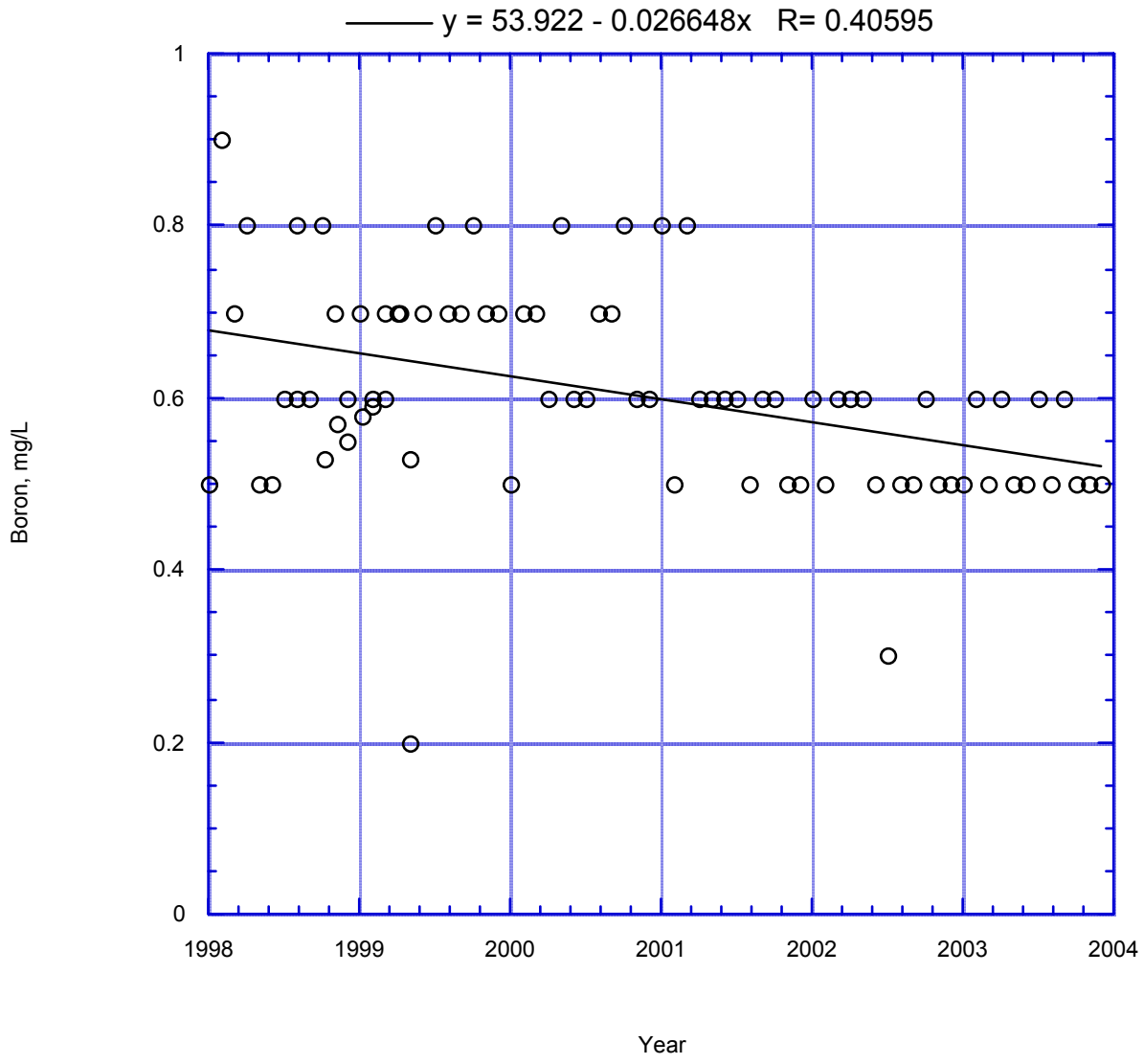


Figure 64. Simi Valley Effluent Boron vs. Time

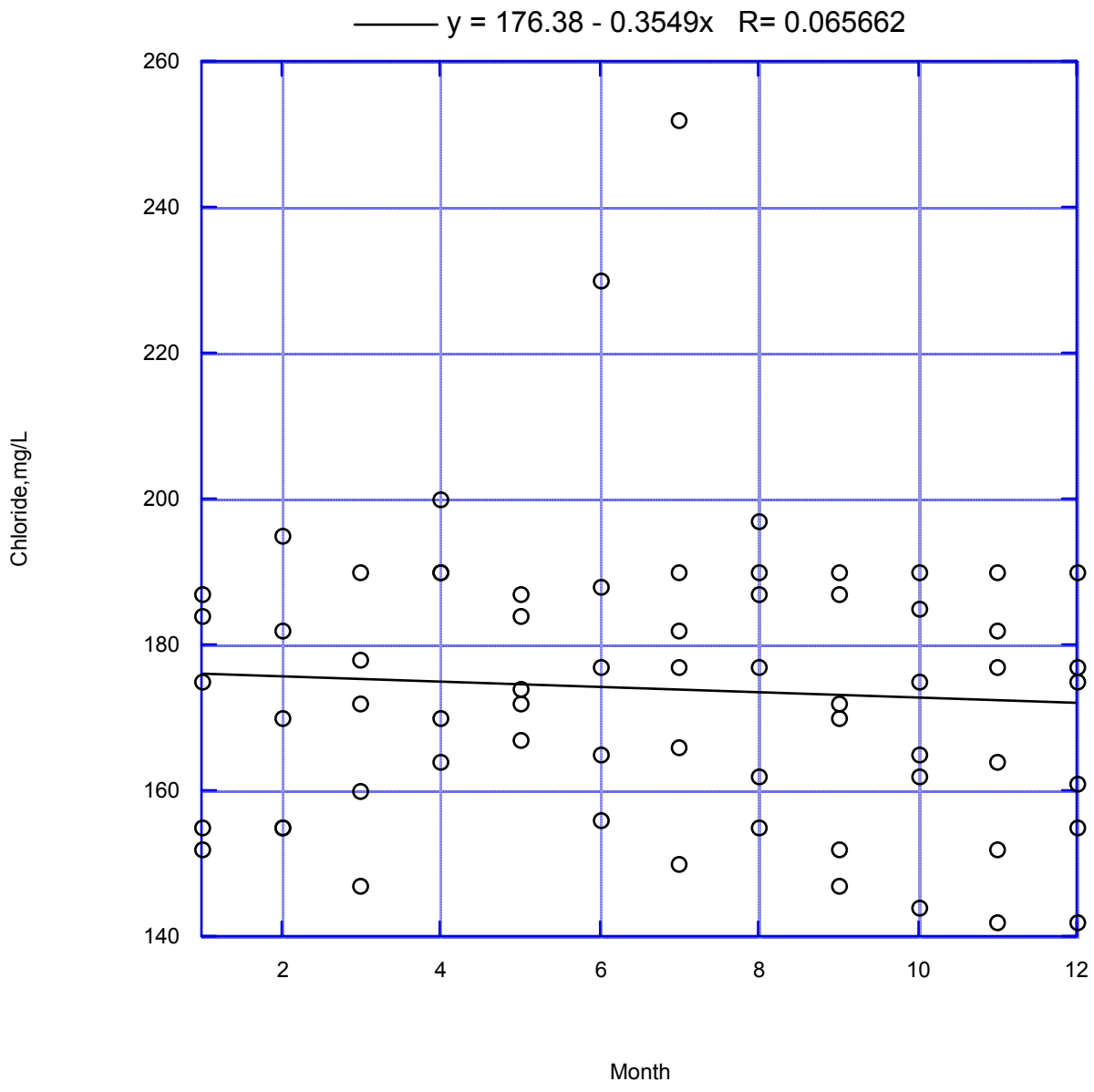


Figure 65. Camarillo Effluent Chloride v. Month

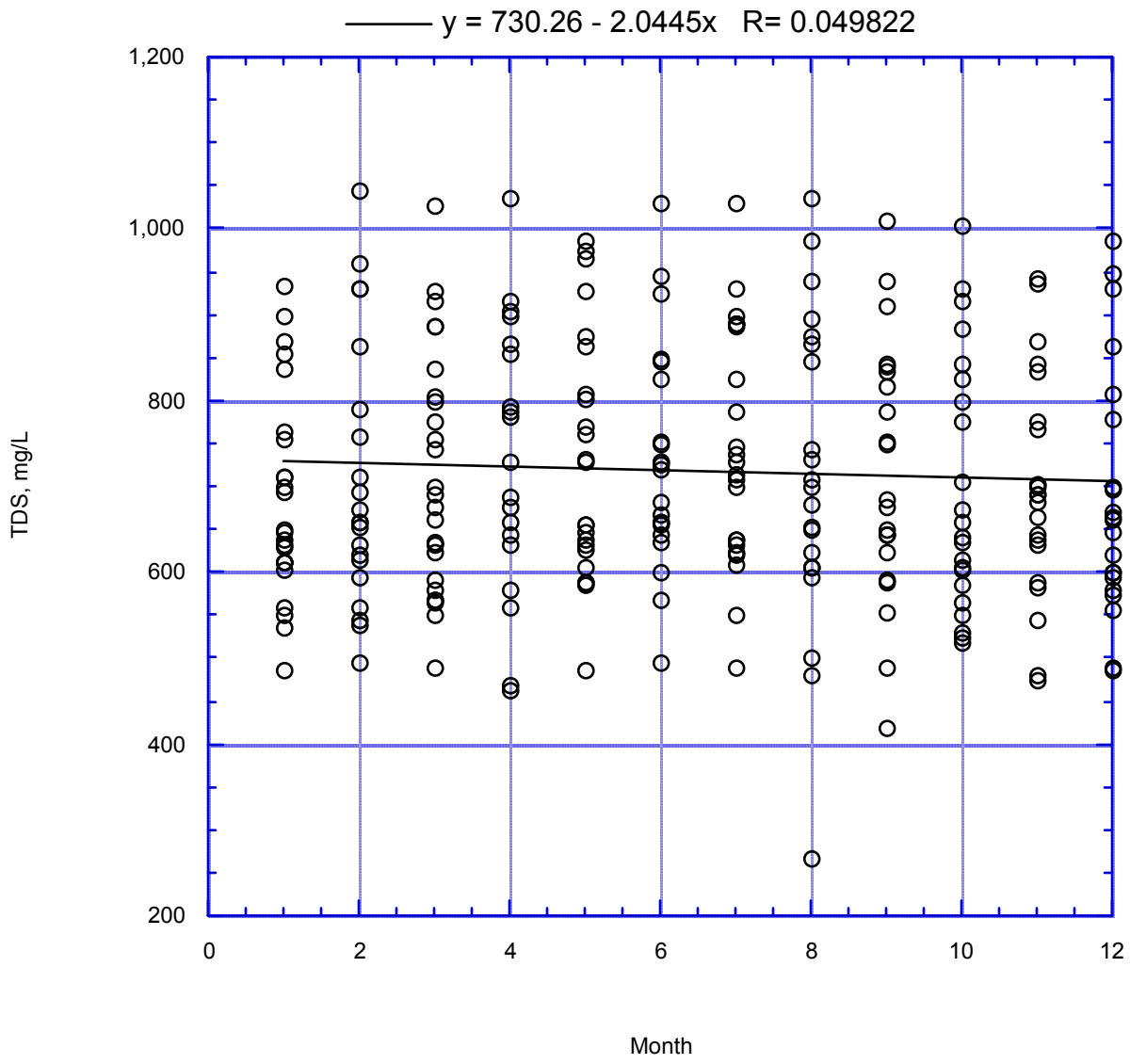


Figure 66. Camarillo Effluent TDS vs. Month

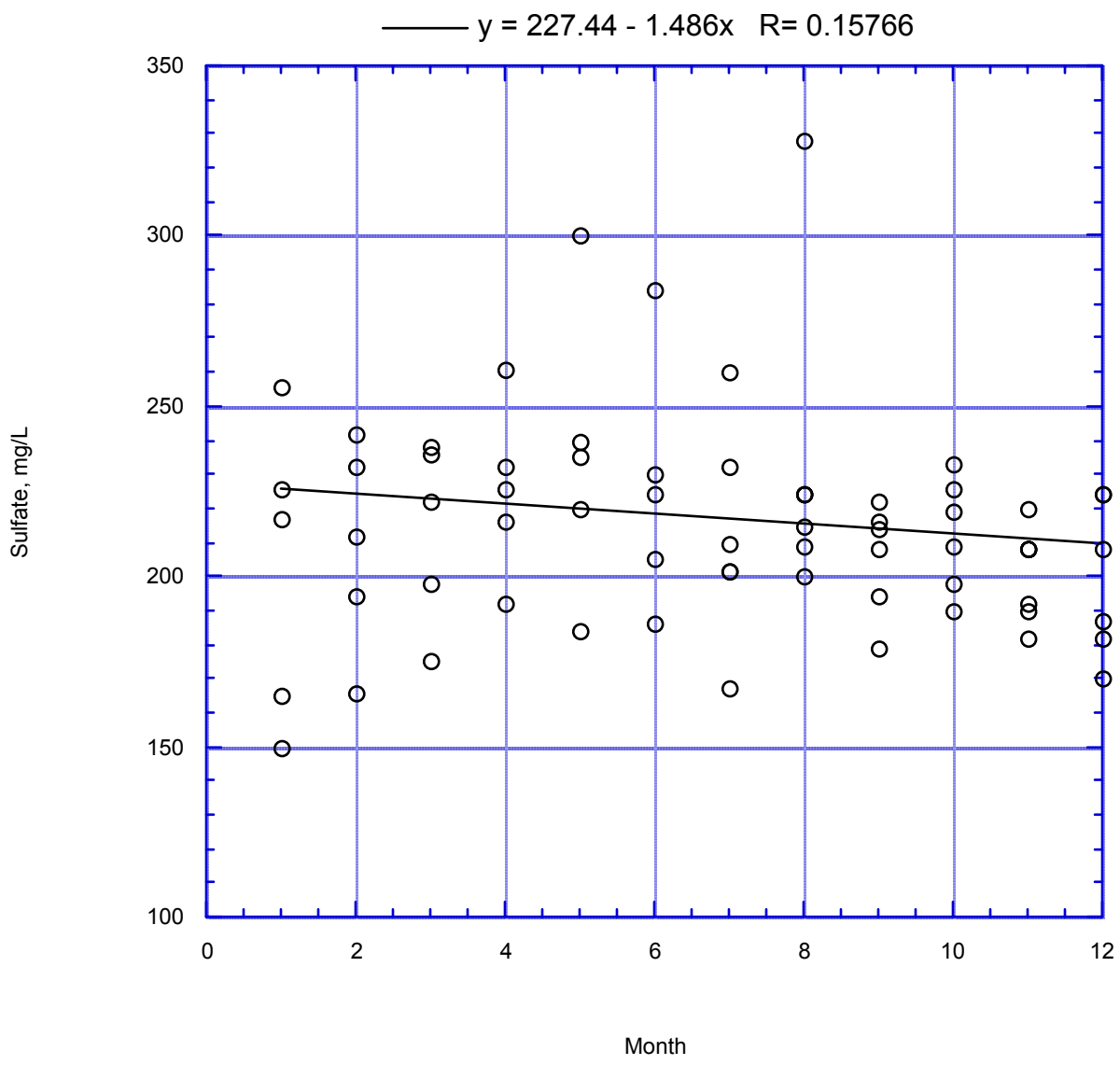


Figure 67. Camarillo Effluent Sulfate vs. Month

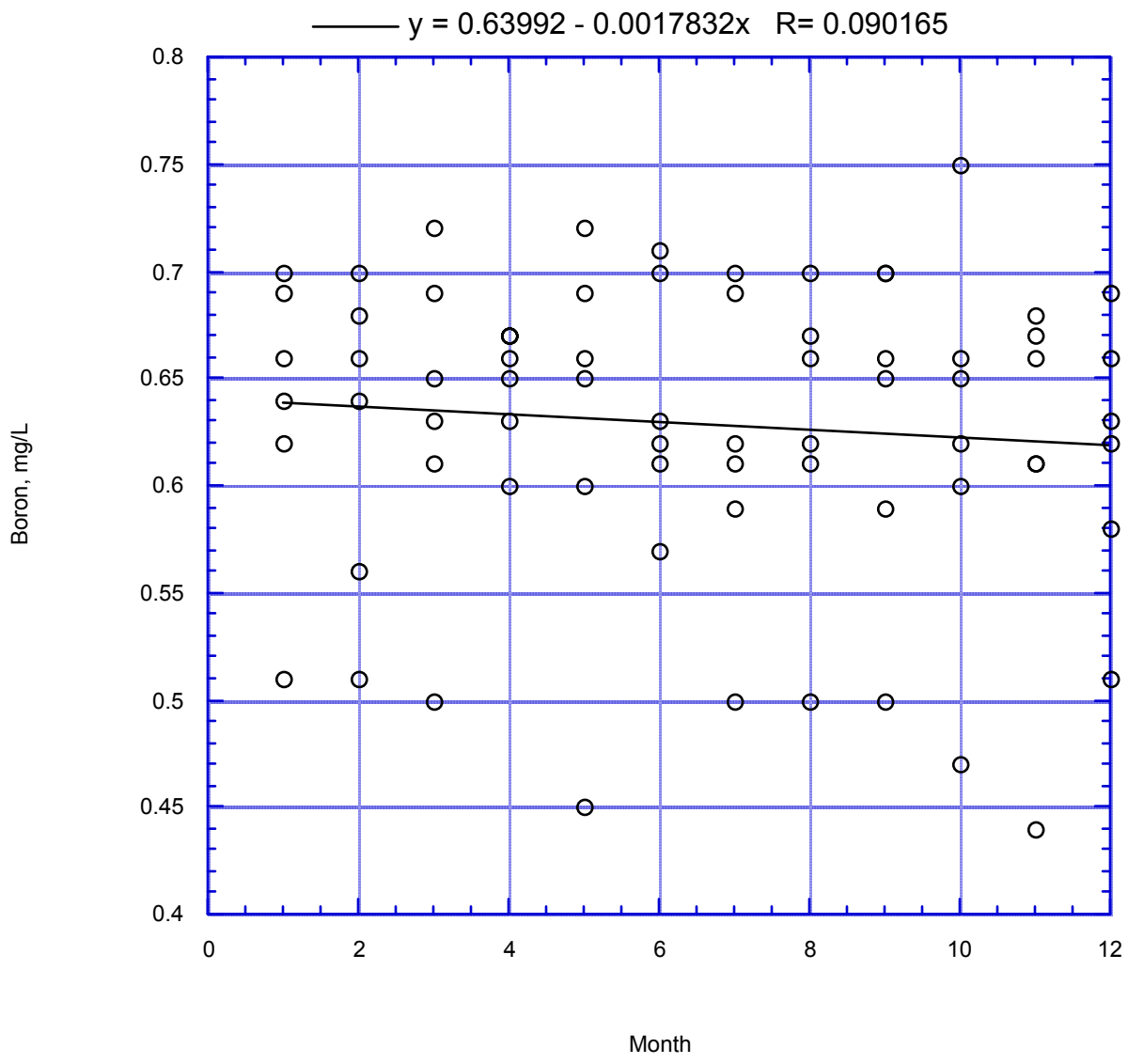


Figure 68. Camarillo Effluent Boron vs. Month

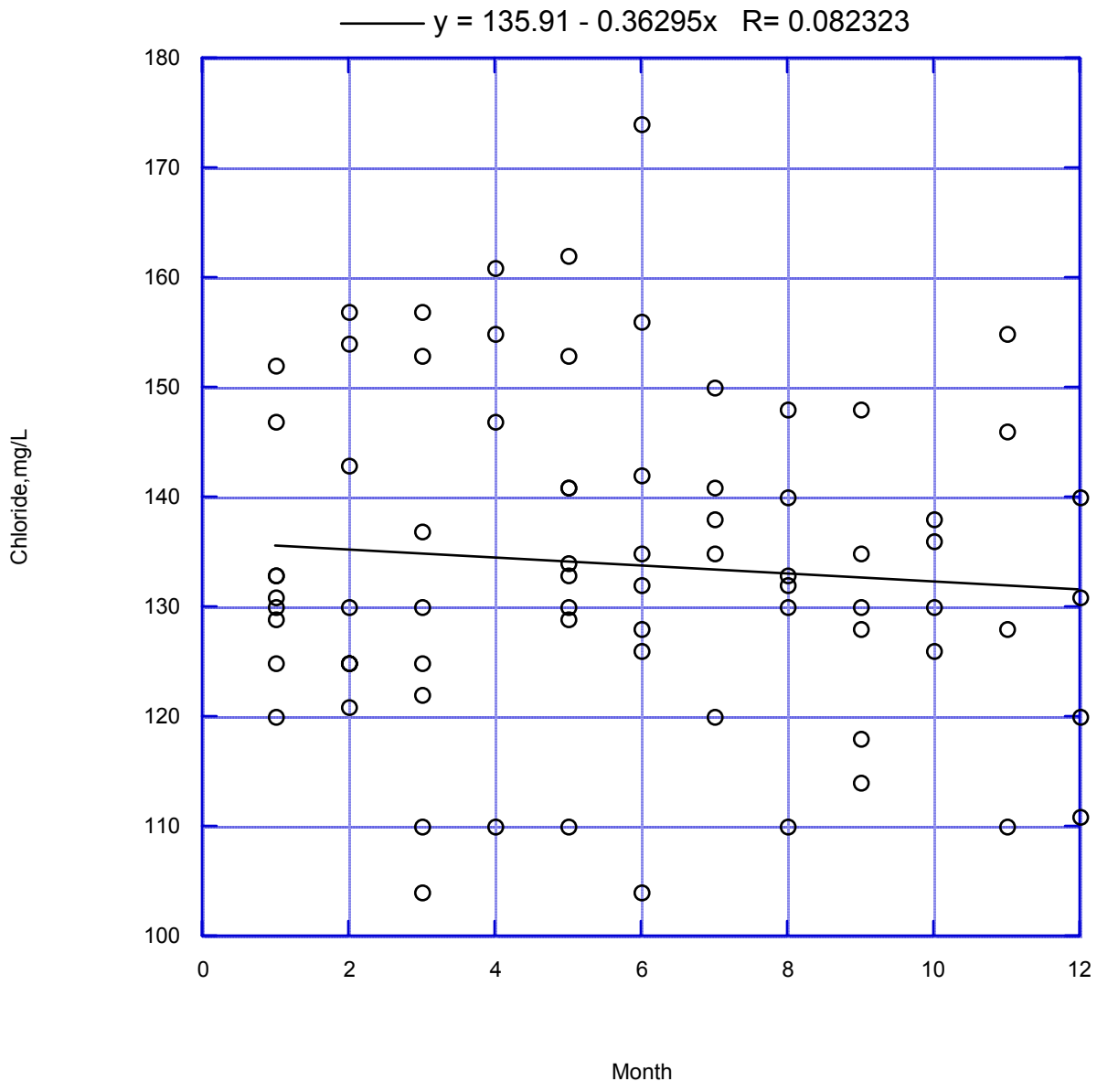


Figure 69. Hill Canyon Effluent Chloride vs. Month

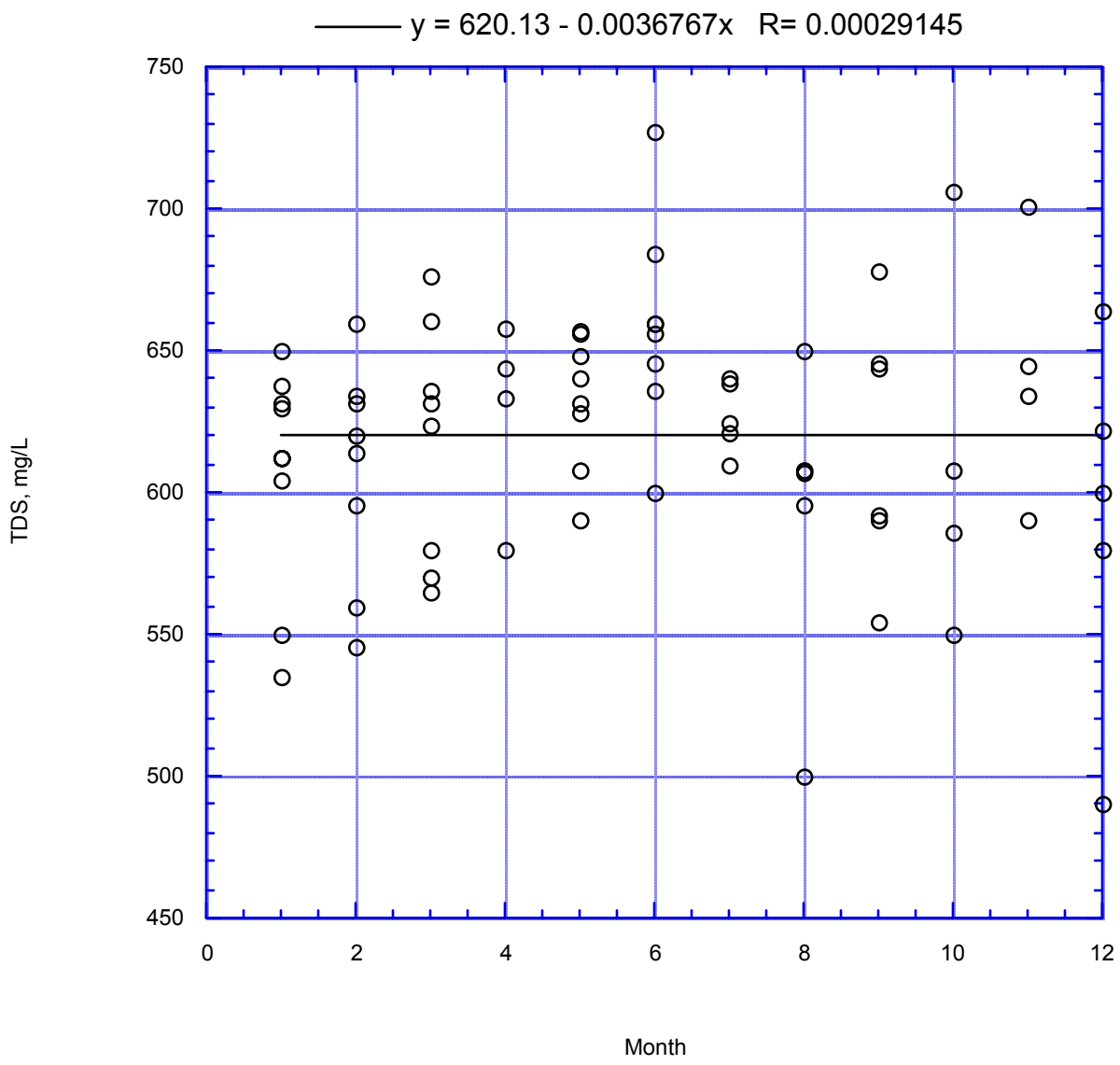


Figure 70. Hill Canyon Effluent TDS vs. Month

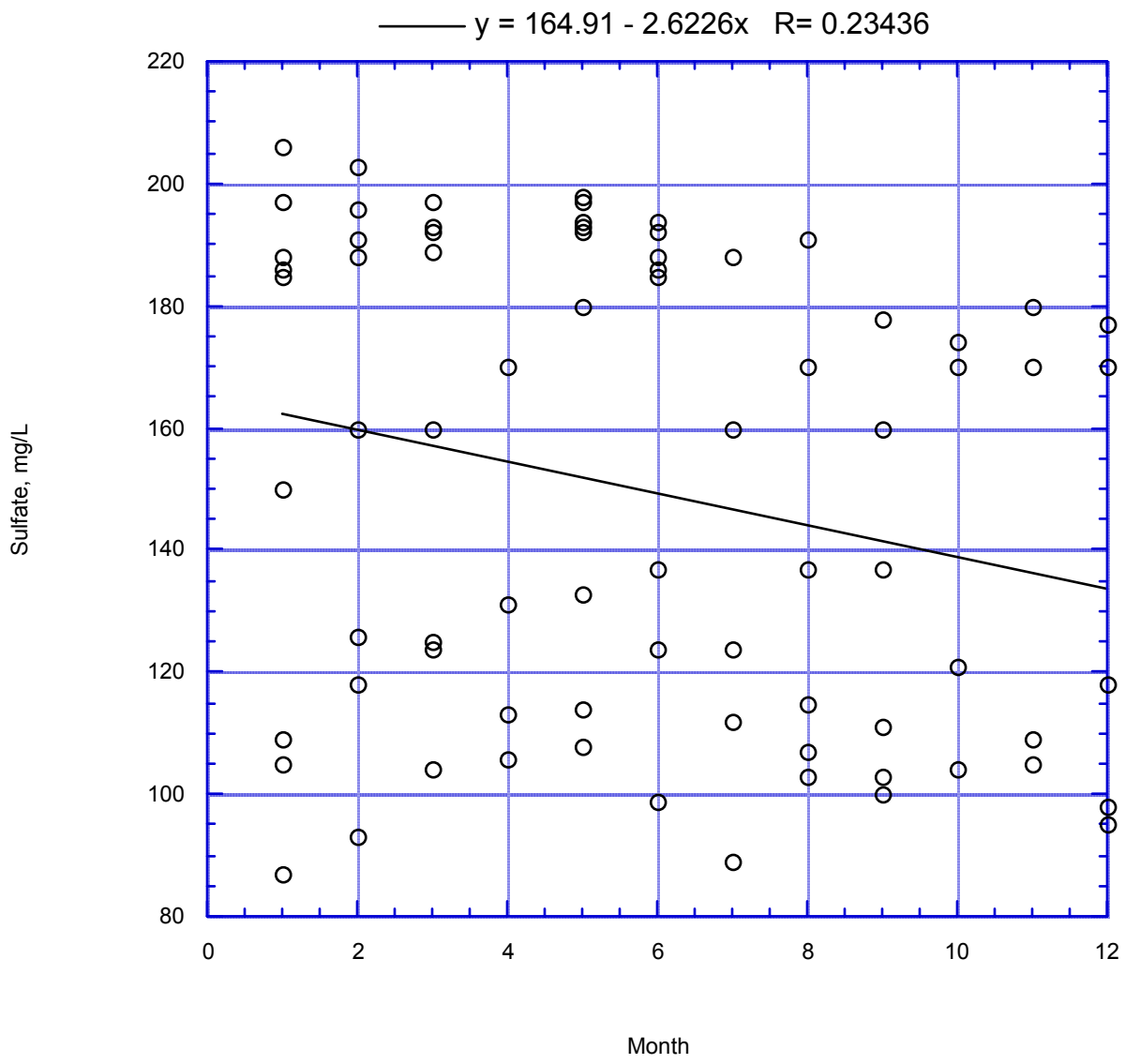


Figure 71. Hill Canyon Effluent Sulfate vs. Month

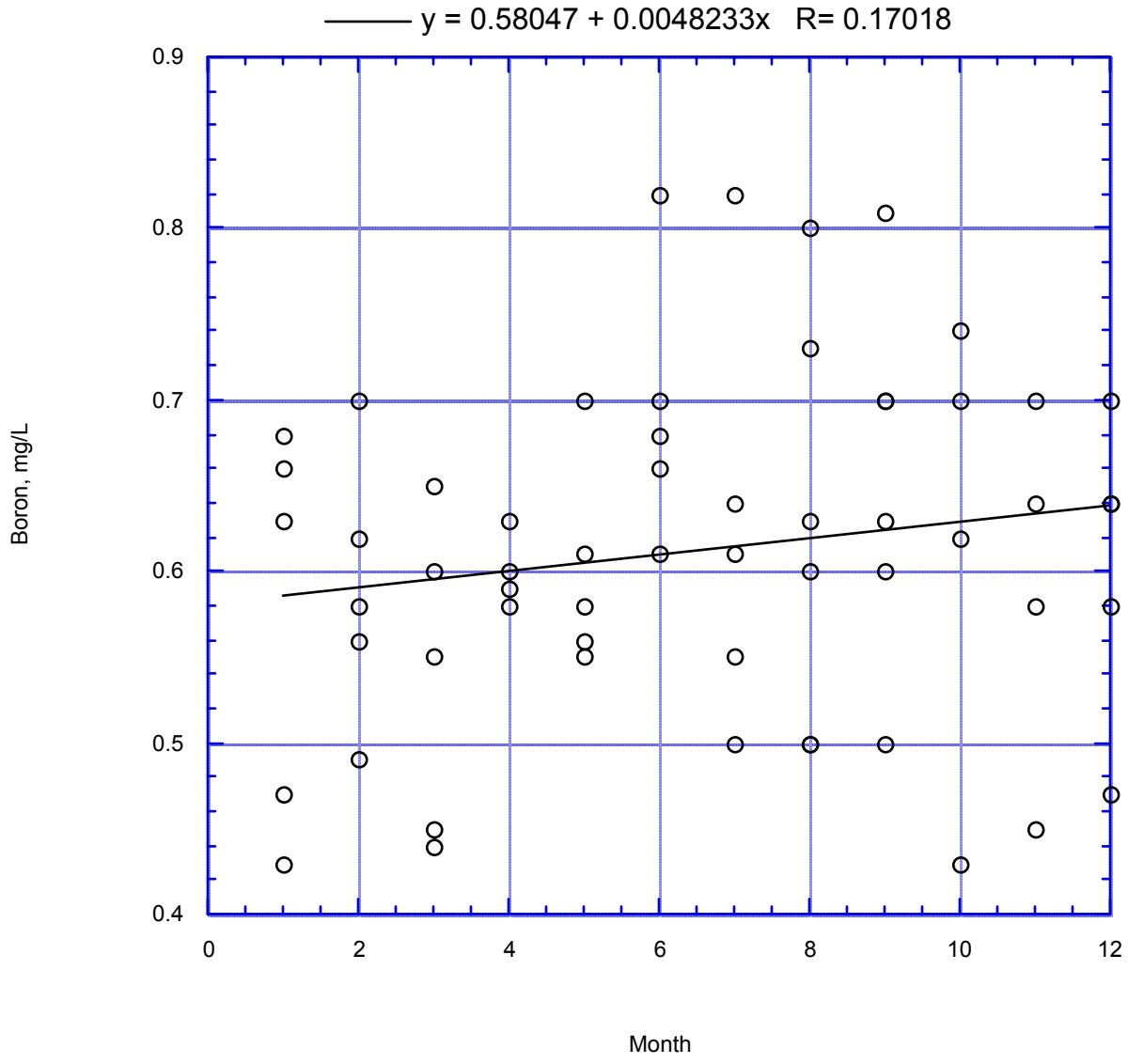


Figure 72. Hill Canyon Effluent Boron vs. Month

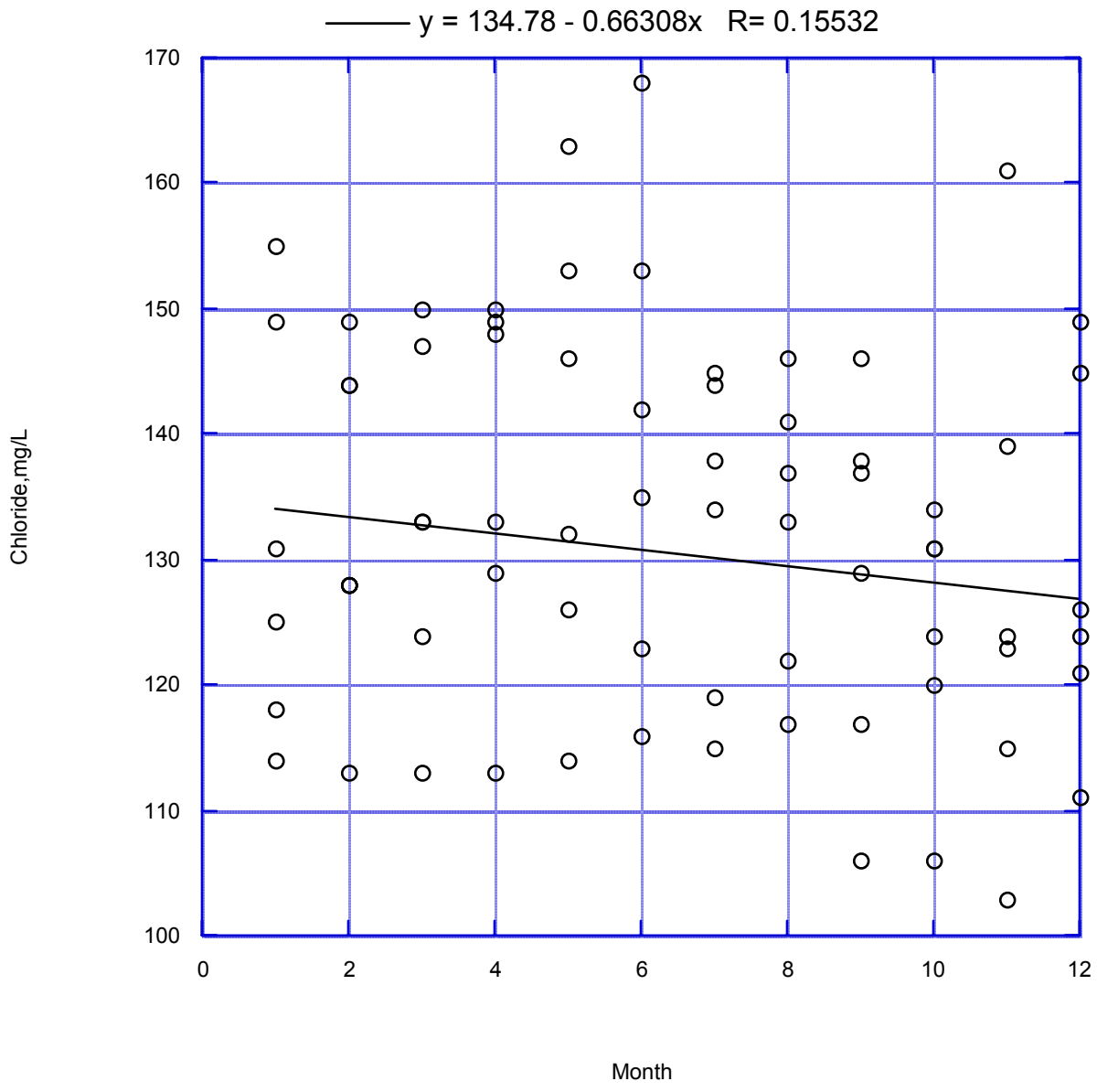


Figure 73. Simi Valley Effluent Chloride vs. Month

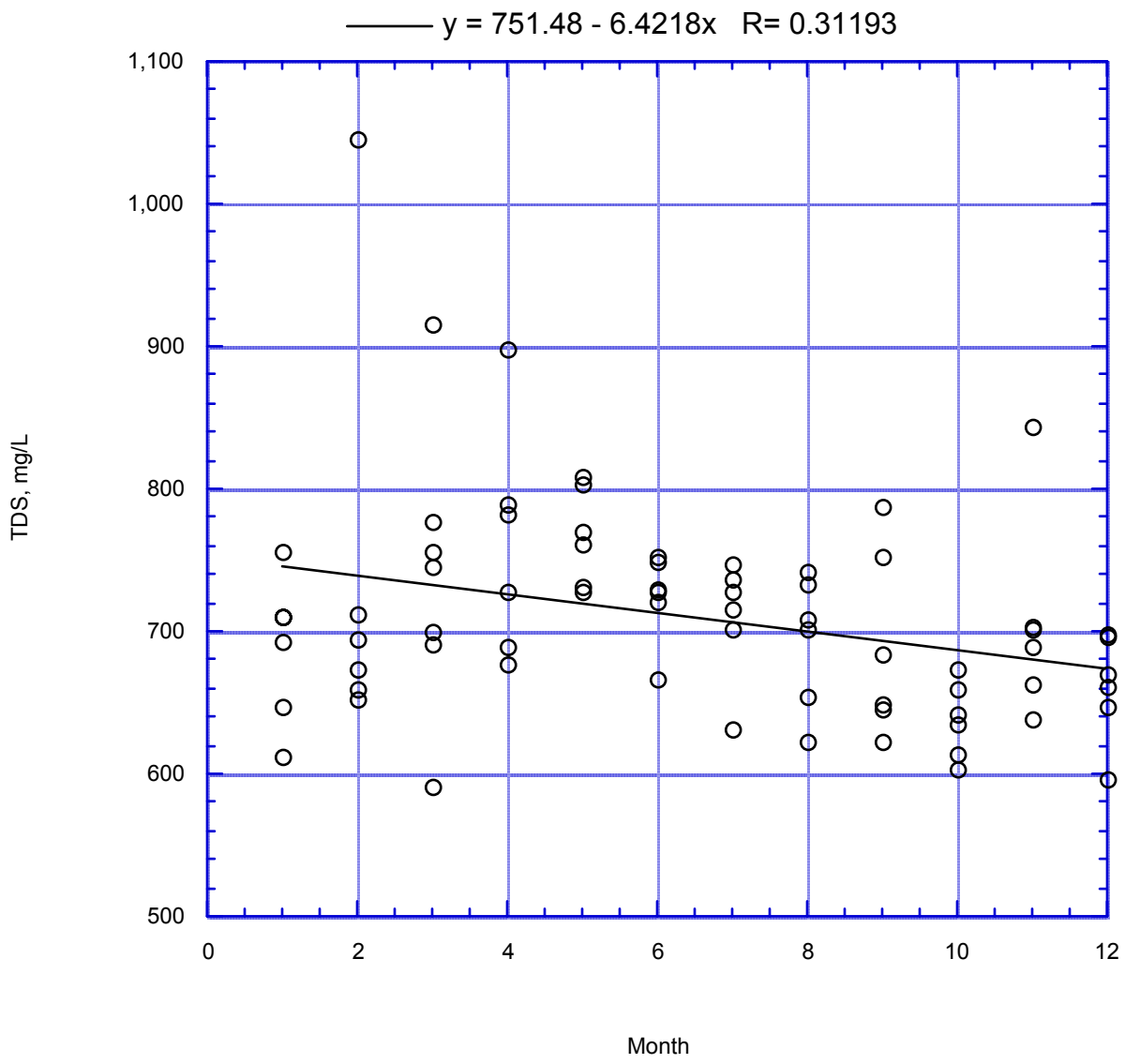


Figure 74. Simi Valley Effluent TDS vs. Month

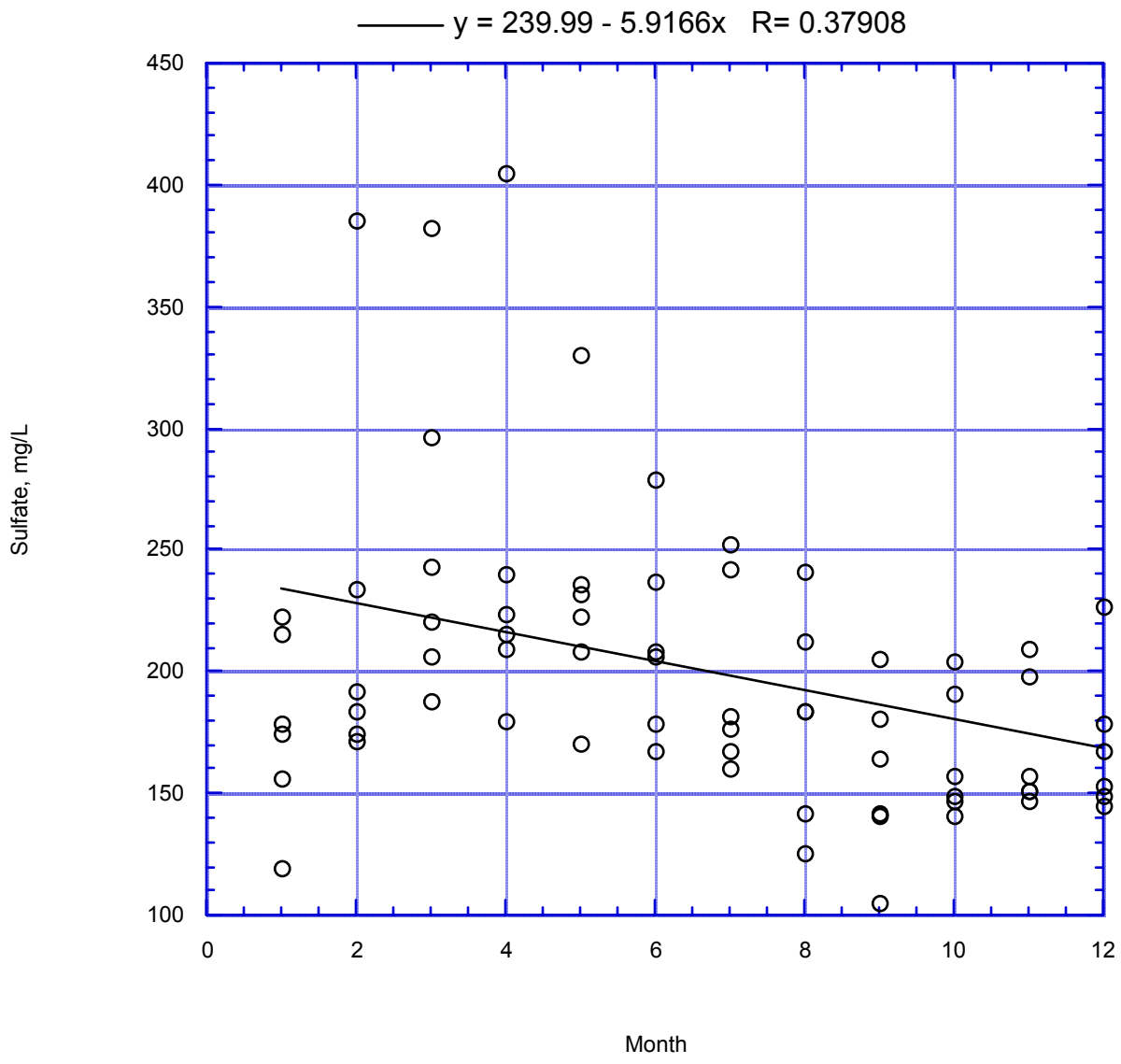


Figure 75. Simi Valley Effluent Sulfate vs. Month

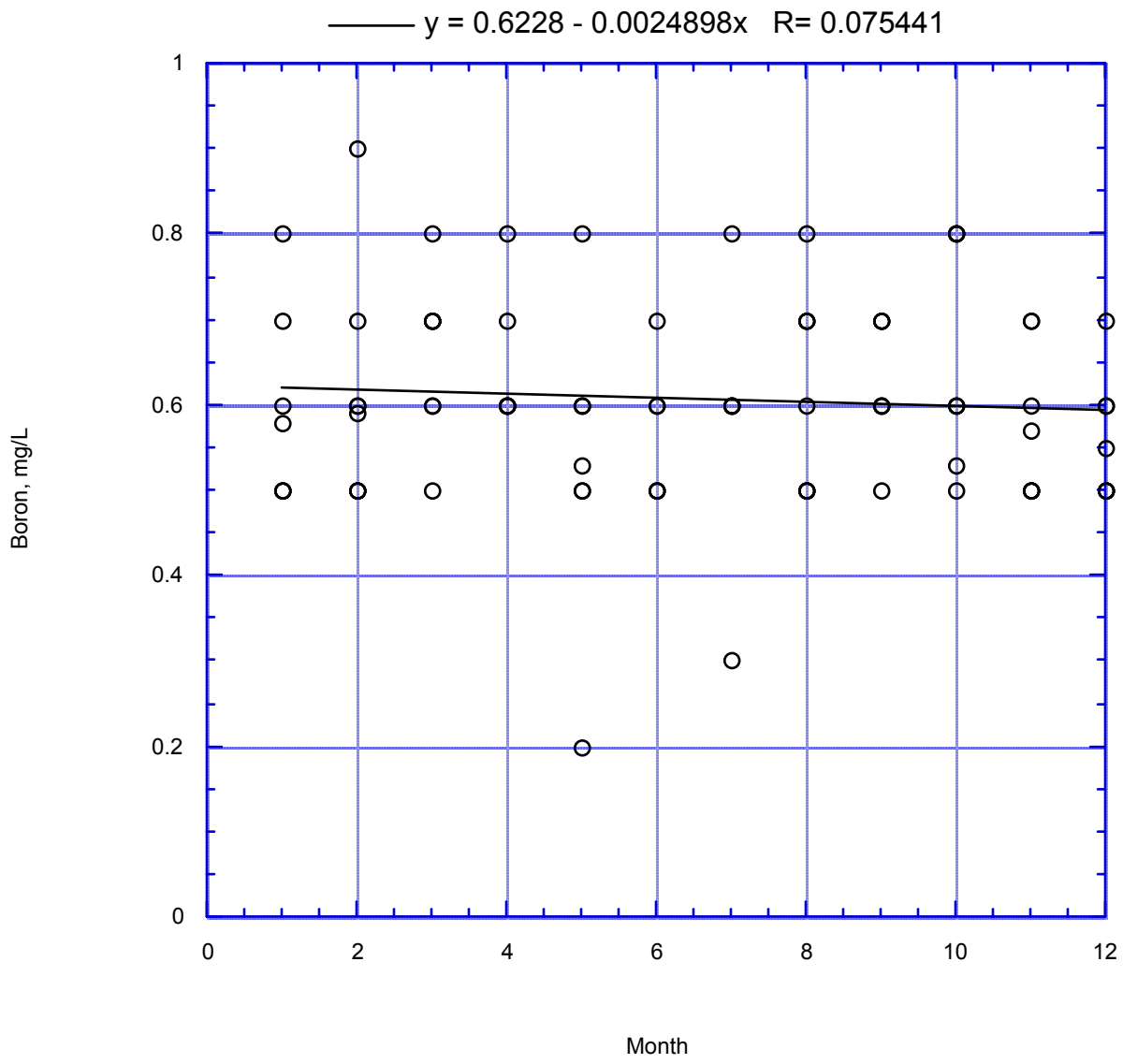


Figure 76. Simi Valley Effluent Boron vs. Month

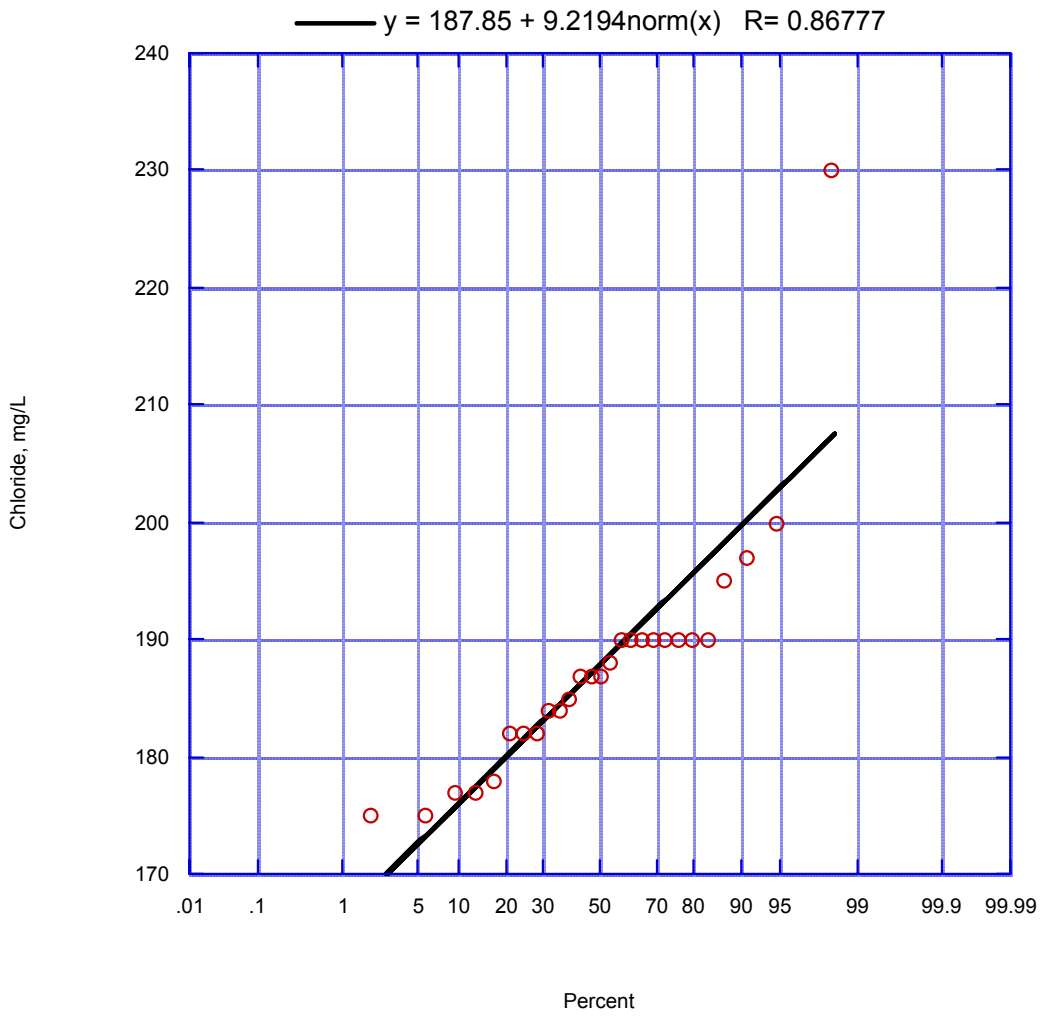


Figure 77. Camarillo Effluent Chloride Frequency Distribution (10/01-9/03)

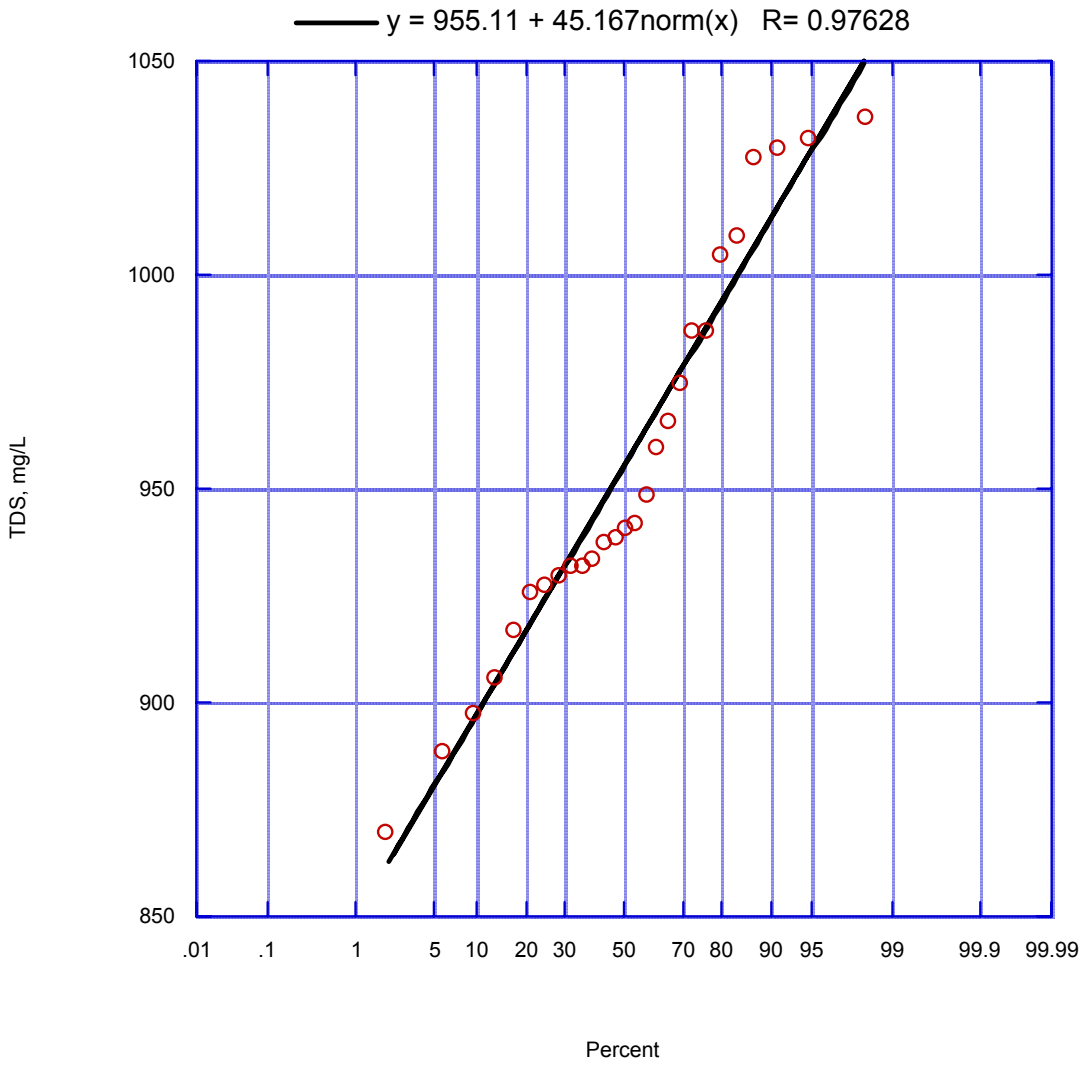


Figure 78. Camarillo Effluent TDS Frequency Distribution (10/01-12/03)

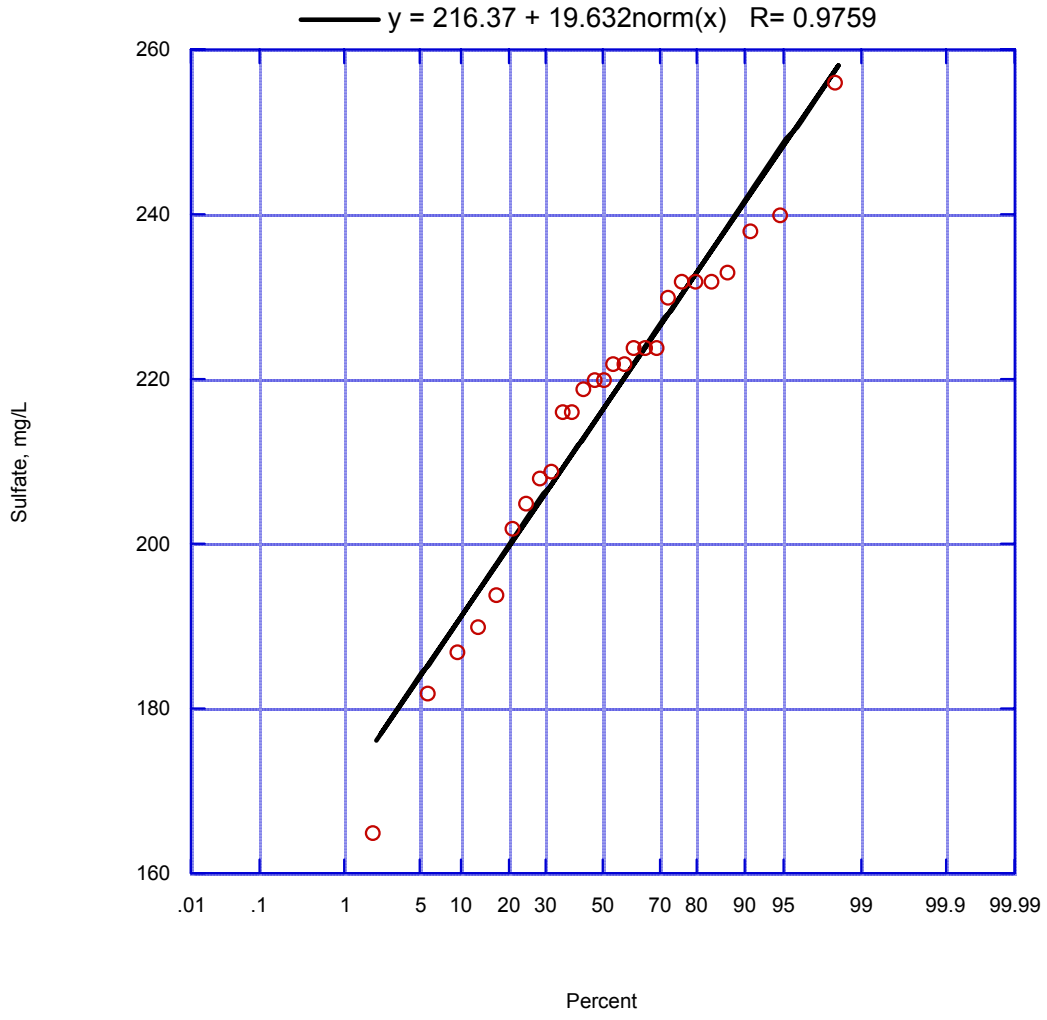


Figure 79. Camarillo Effluent Sulfate Frequency Distribution (10/01-12/03)

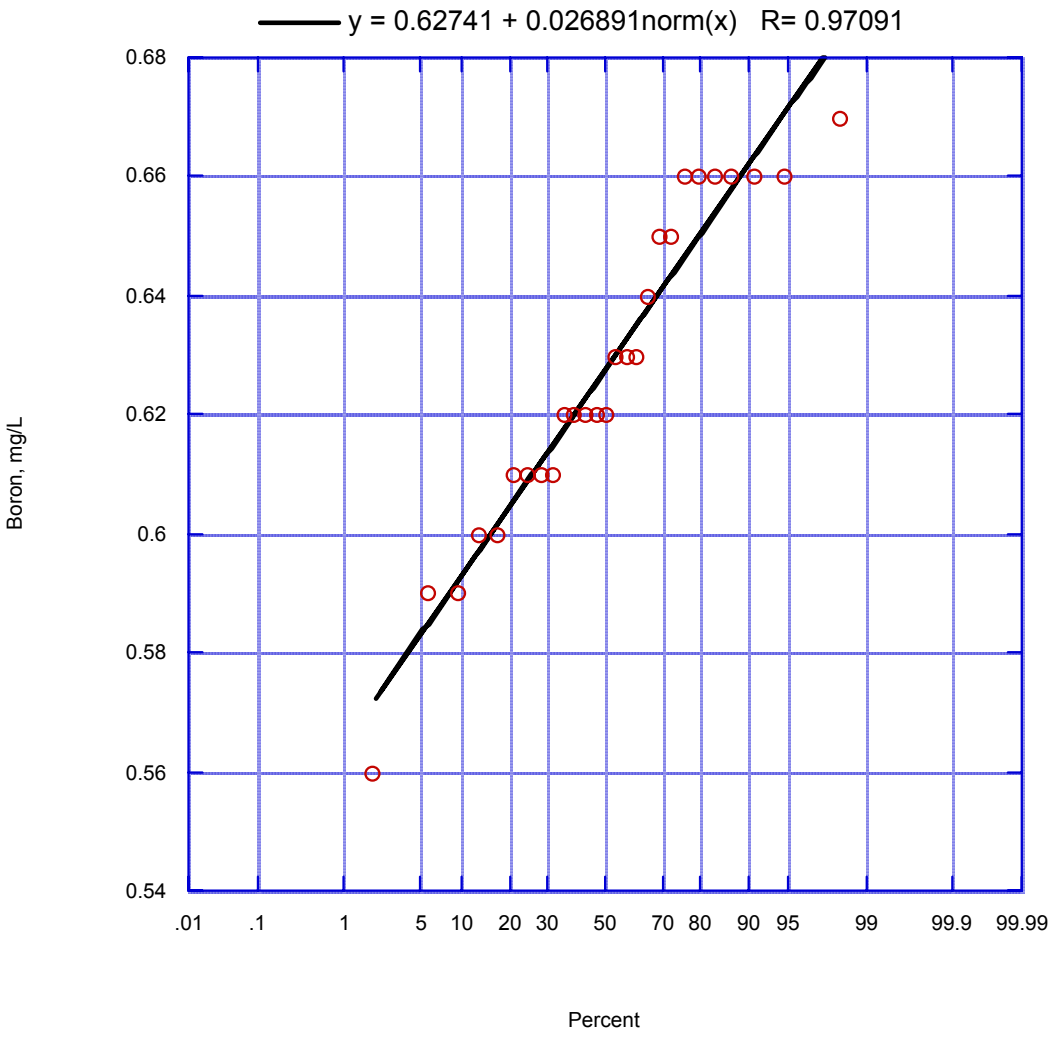


Figure 80. Camarillo Effluent Boron Frequency Distribution (10/01-12/03)

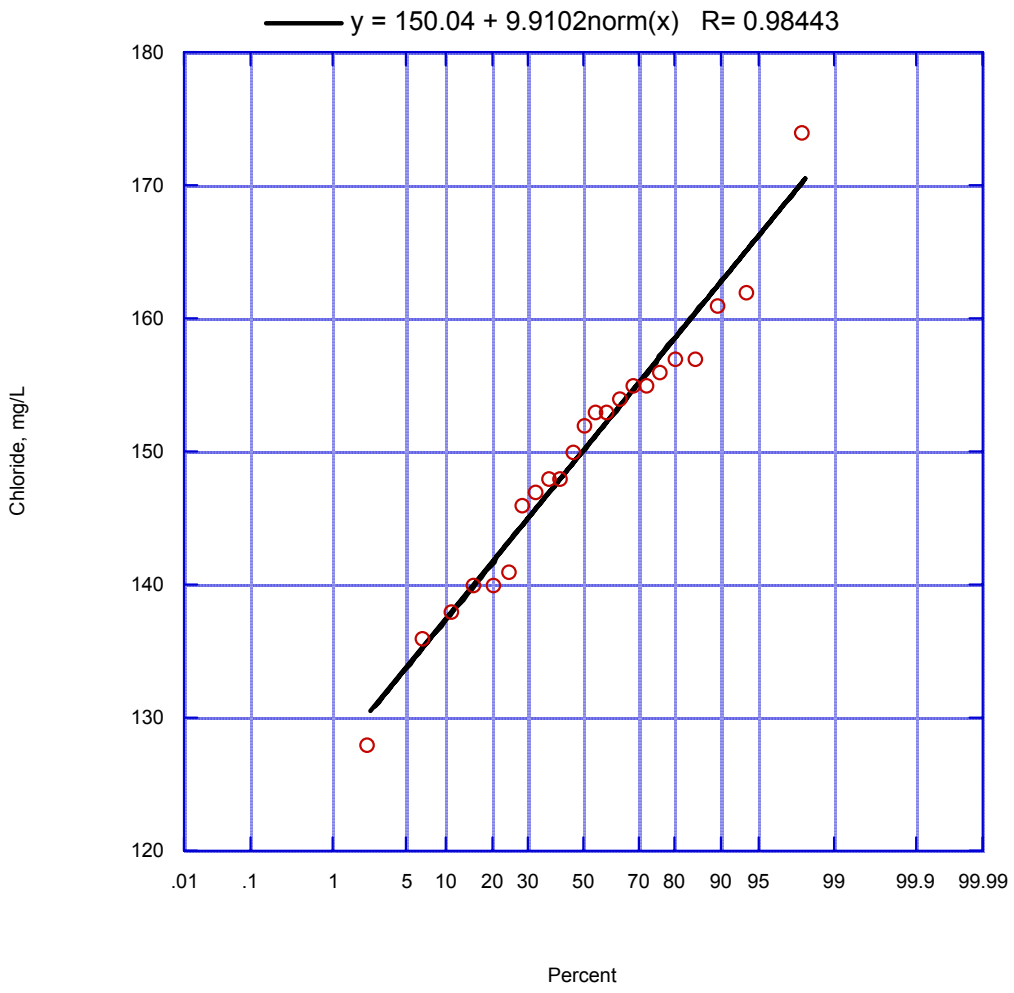


Figure 81. Hill Canyon Effluent Chloride Frequency Distribution (10/01-9/03)

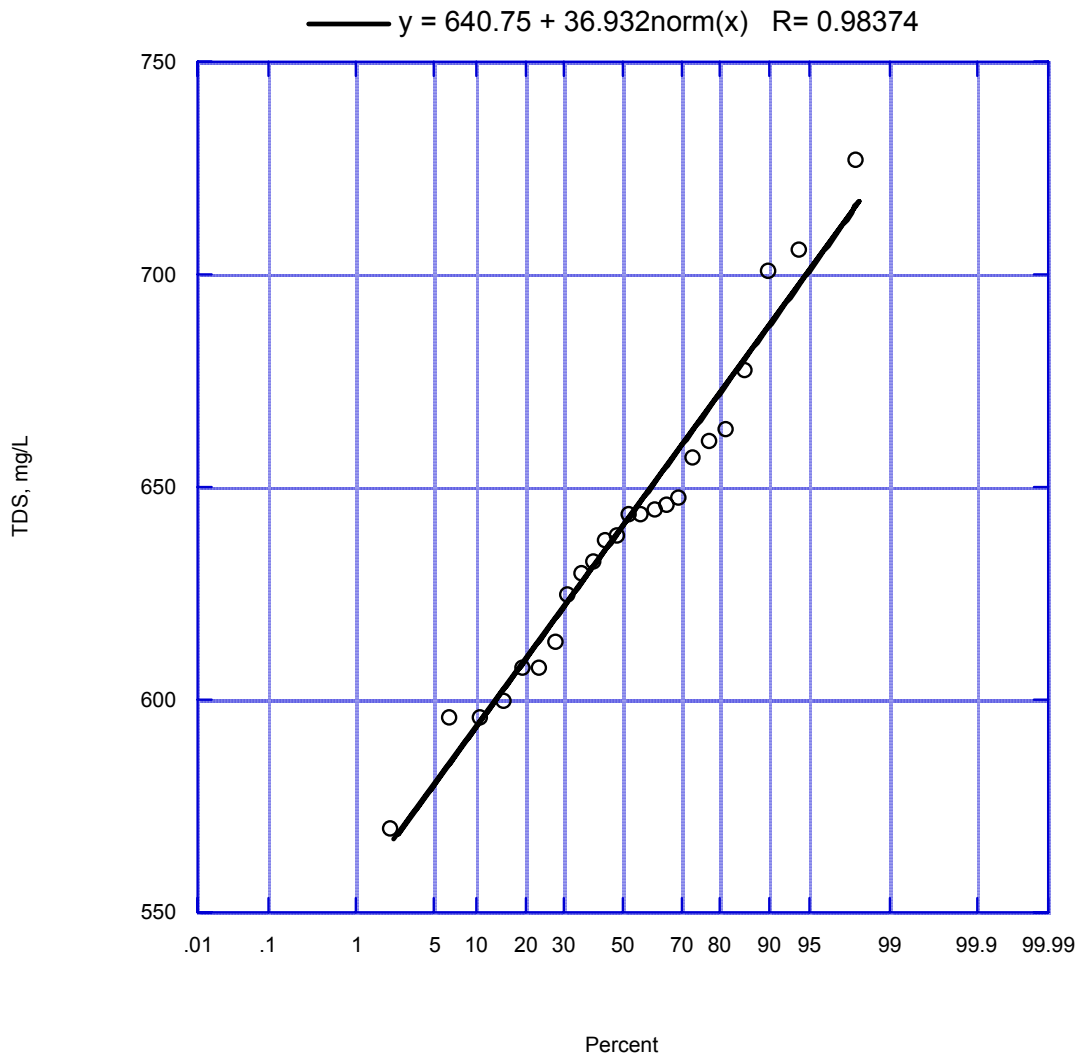


Figure 82. Hill Canyon Effluent TDS Frequency Distribution(10/01-9/03)

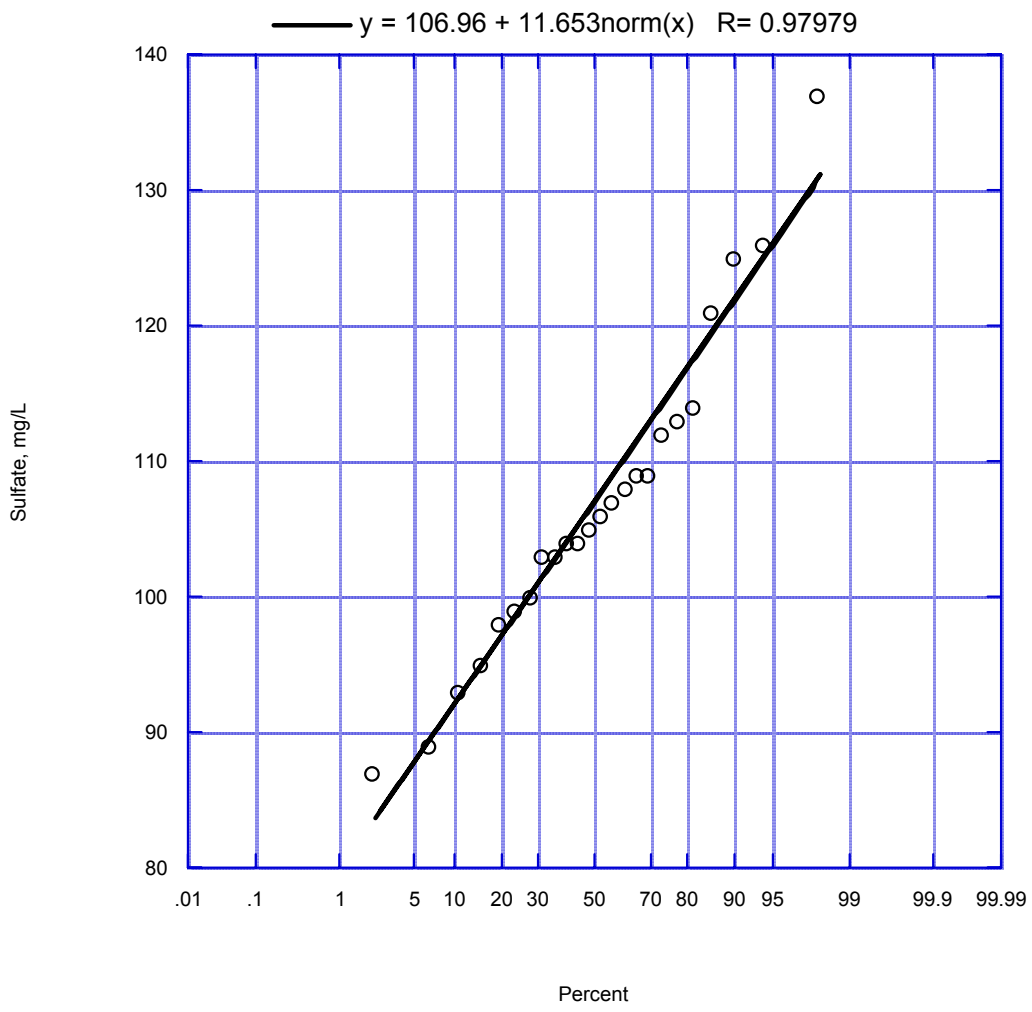


Figure 83. Hill Canyon Effluent Sulfate Frequency Distribution (10/01-9/03)

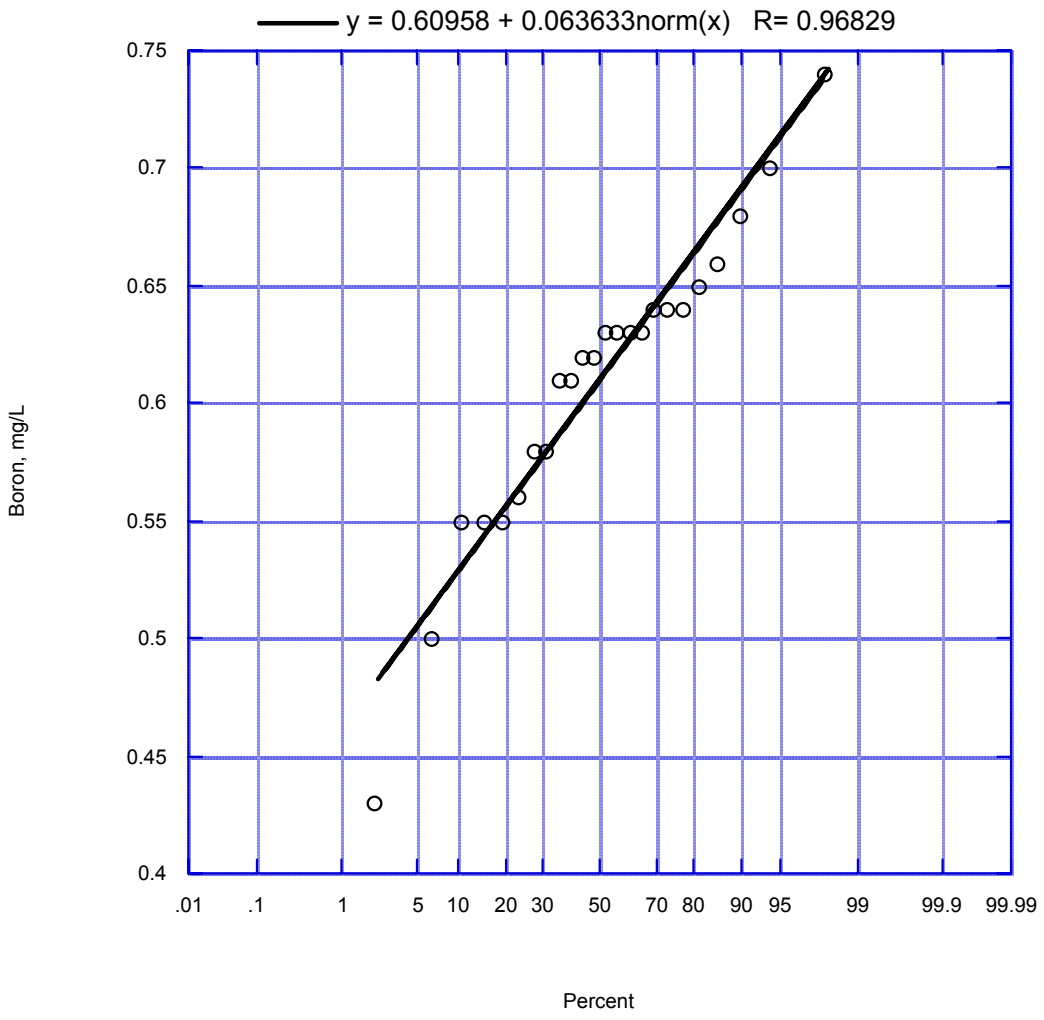


Figure 84. Hill Canyon Effluent Boron Frequency Distribution (10/01-9/03)

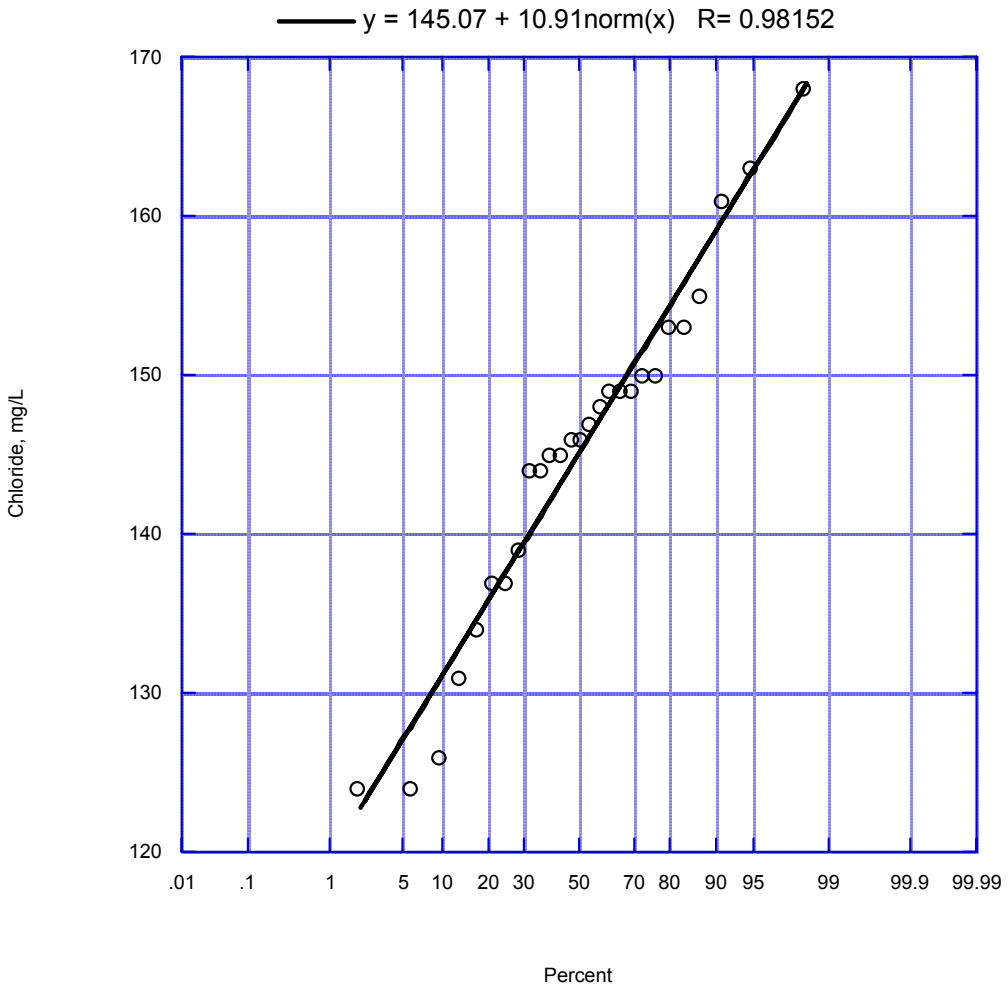


Figure 85. Simi Valley Effluent Chloride Frequency Distribution (10/01-12/03)

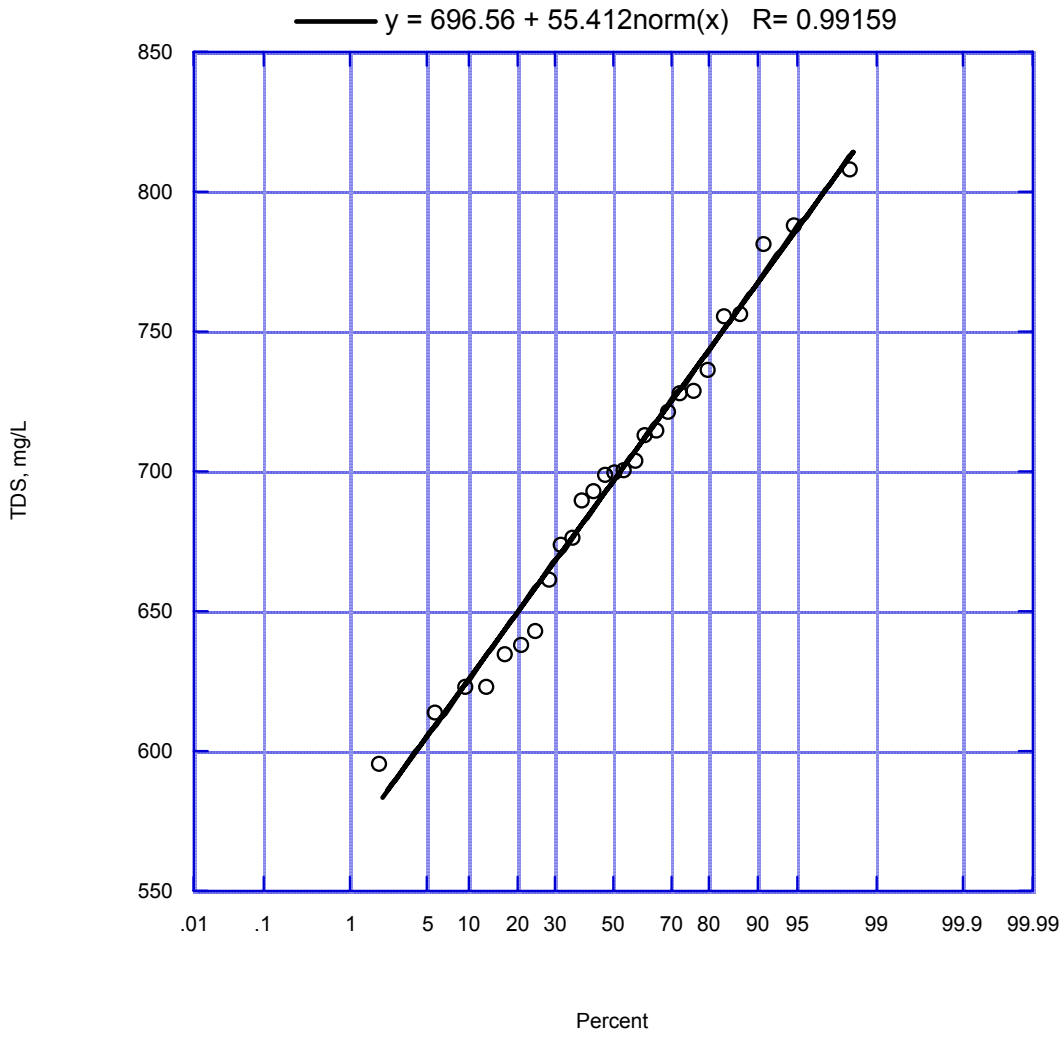


Figure 86. Simi Valley Effluent TDS Frequency Distribution (10/01-12/03)

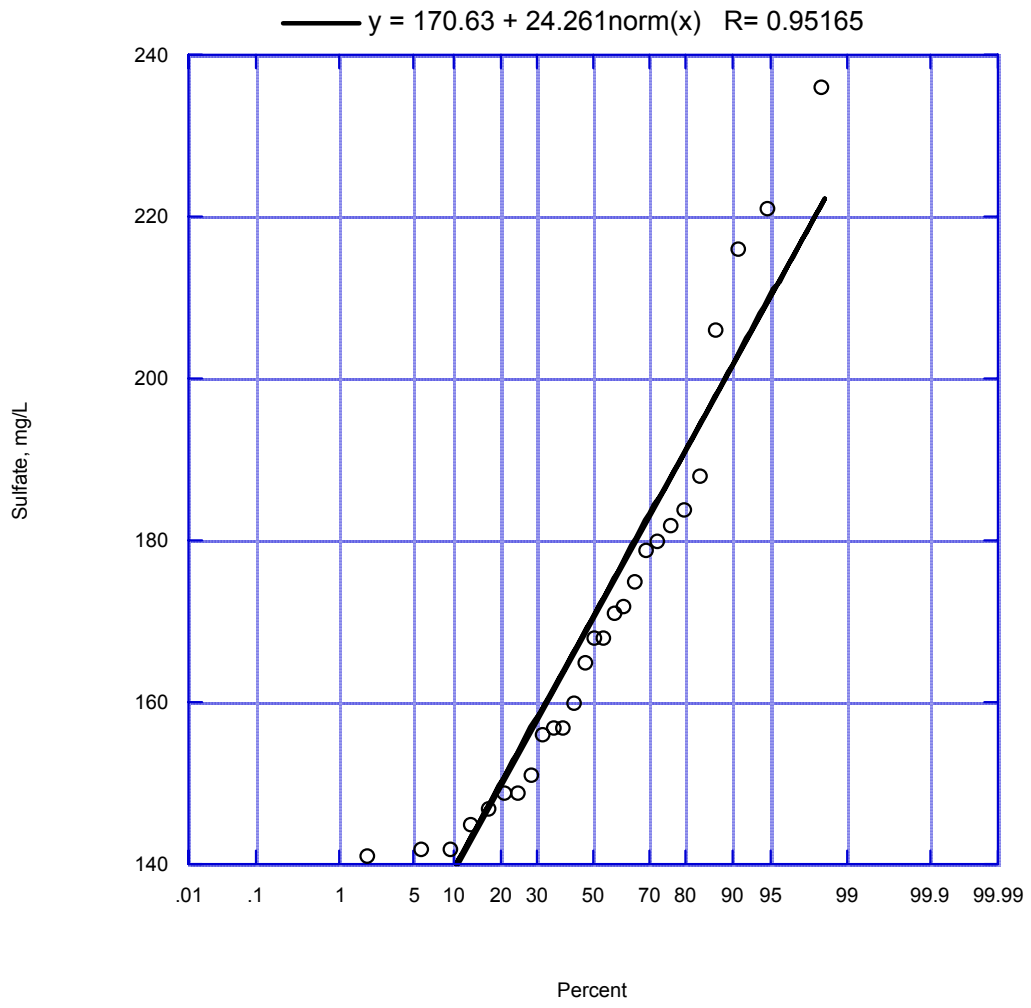


Figure 87. Simi Valley Effluent Sulfate Frequency Distribution (10/01-12/03)

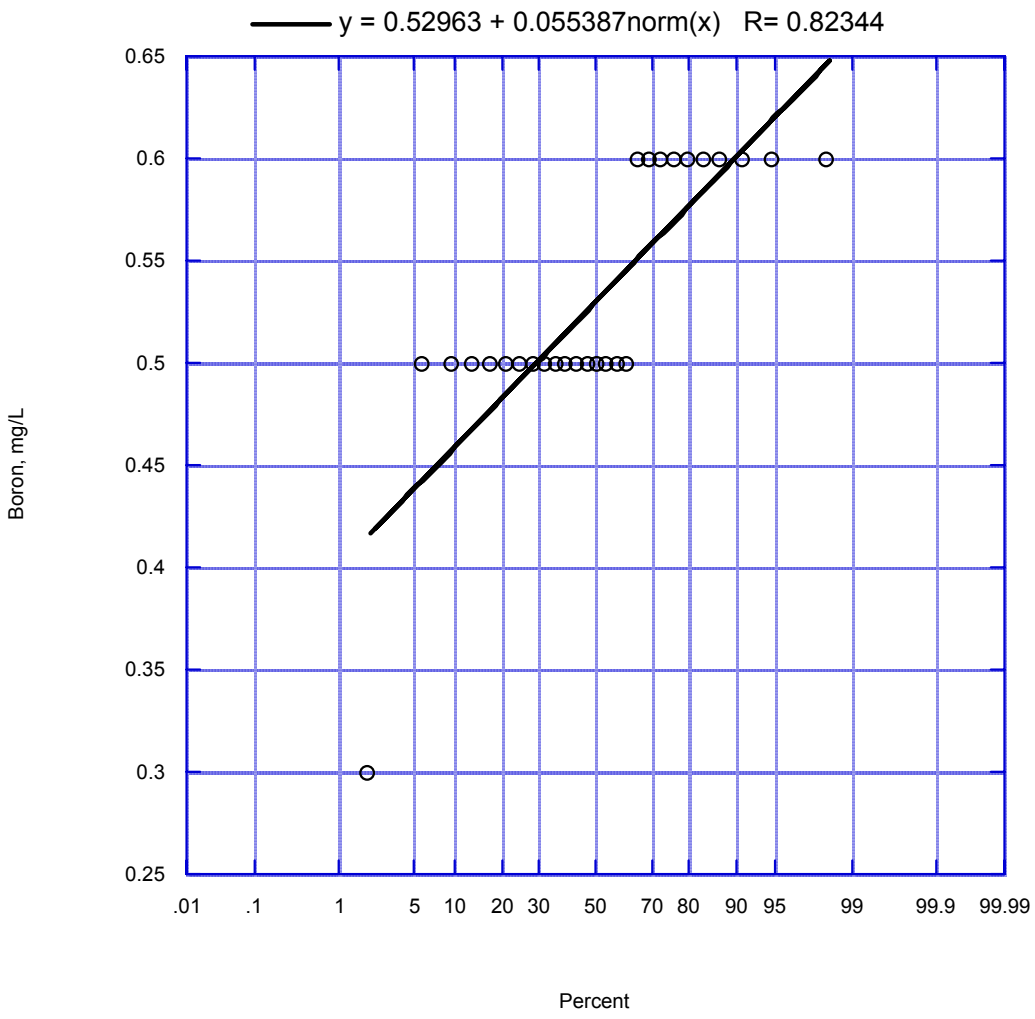


Figure 88. Simi Valley Effluent Boron Frequency Distribution (10/01-12/03)

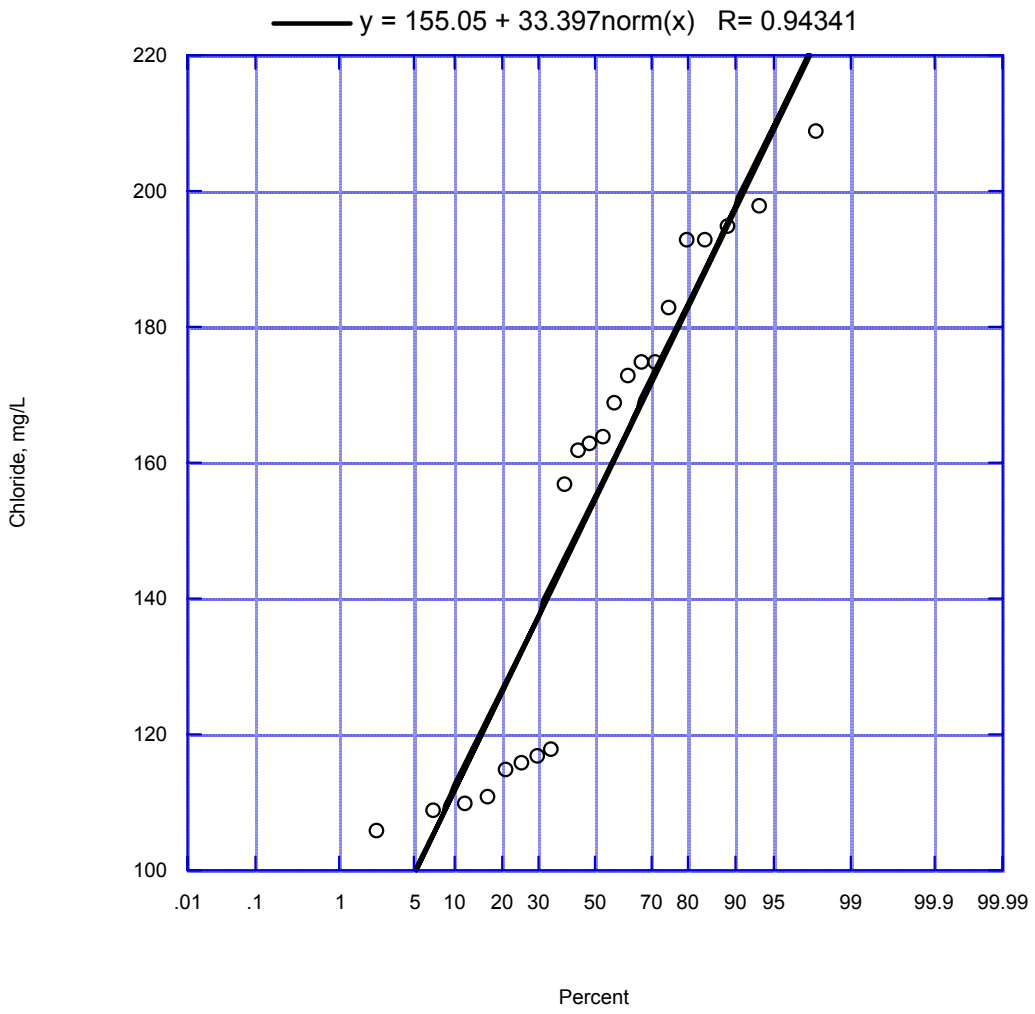


Figure 89. Camrosa Effluent Chloride Frequency Distribution (10/01-10/03)

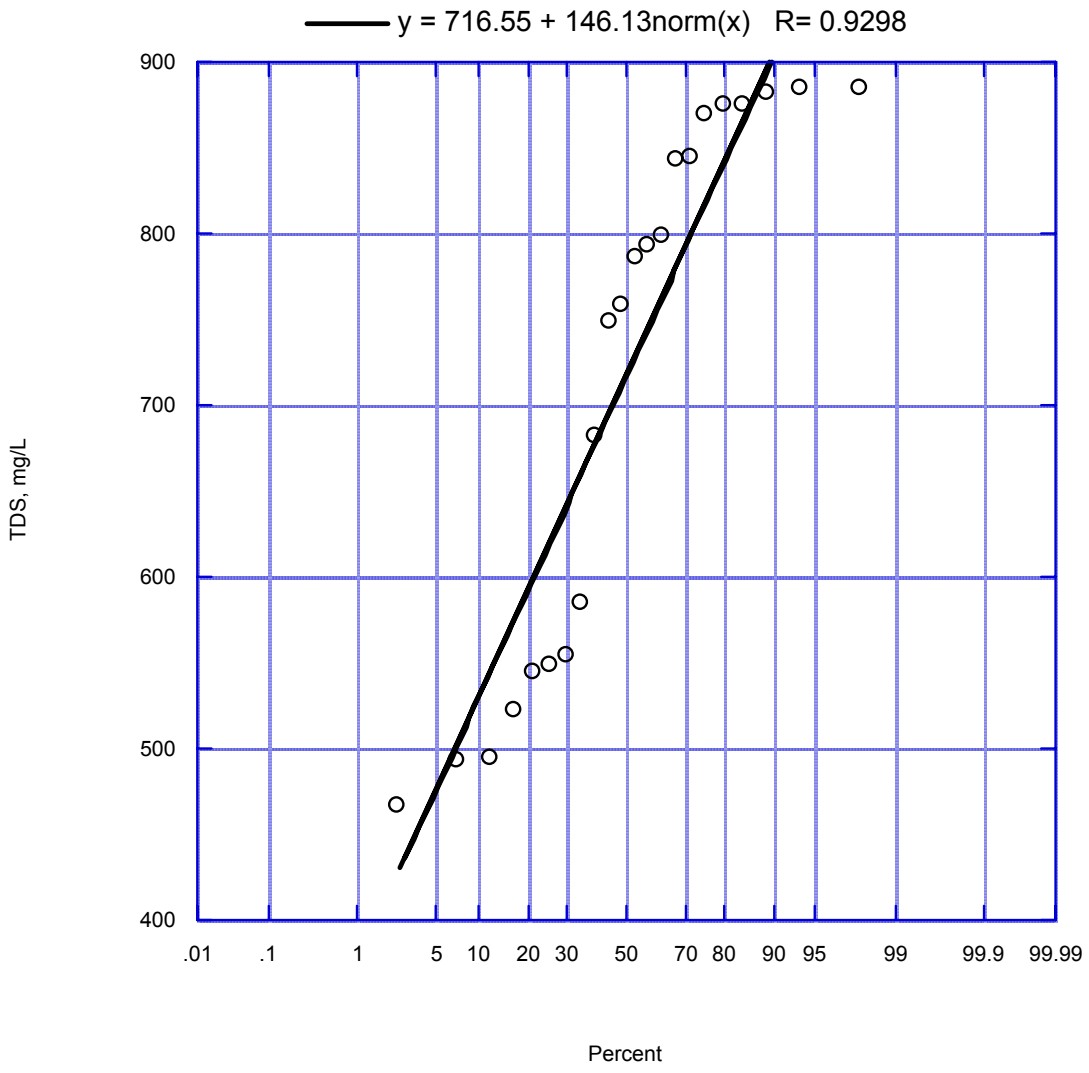


Figure 90. Camrosa Effluent TDS Frequency Distribution (10/01-10/03)

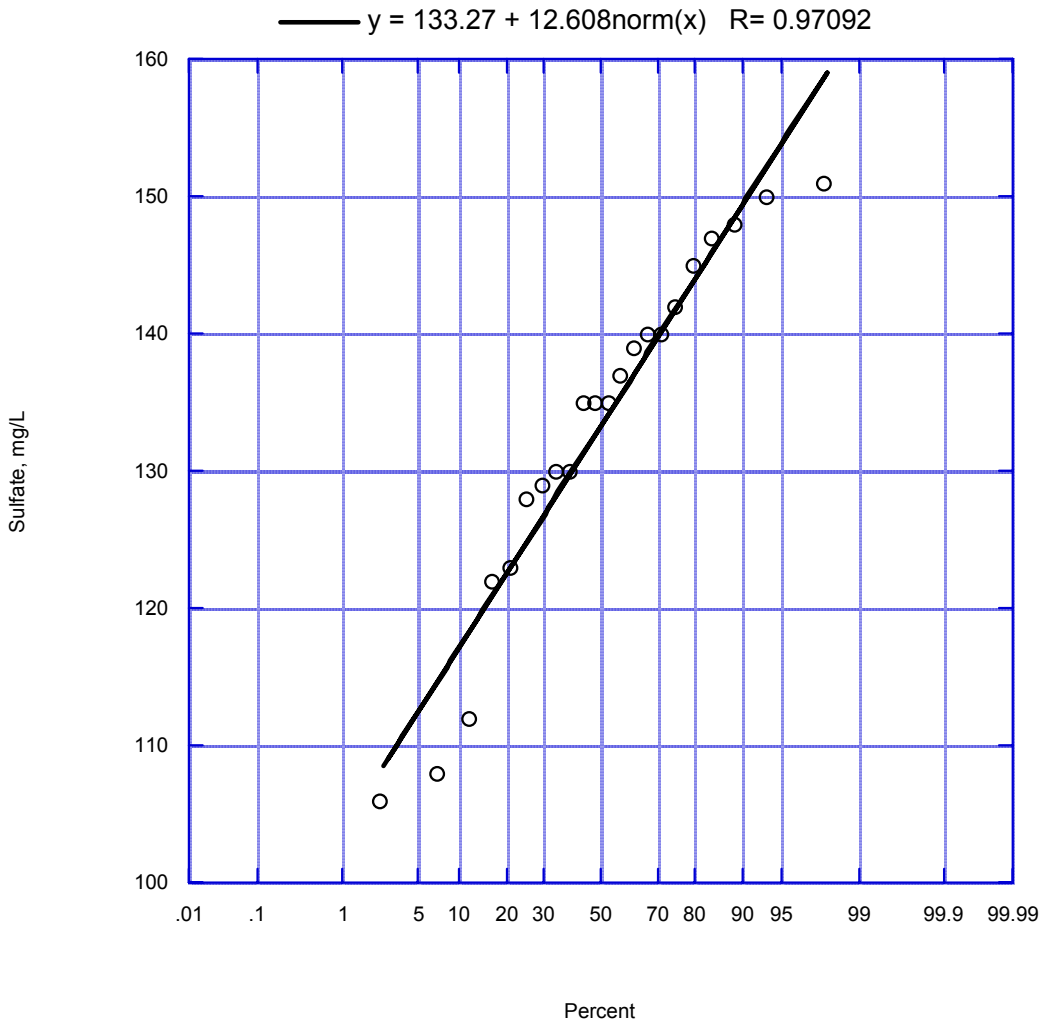


Figure 91. Camrosa Effluent Sulfate Frequency Distribution (10/01-10/03)

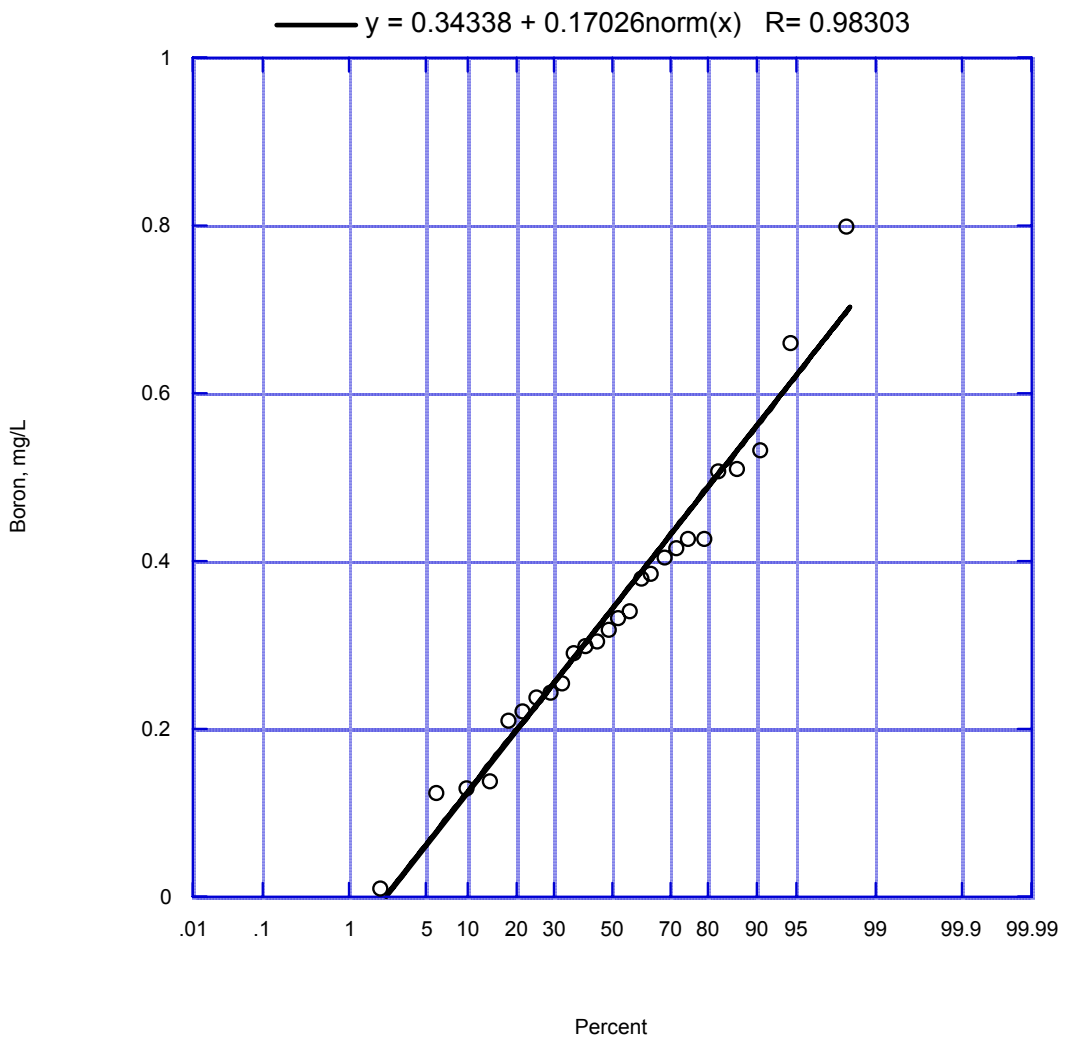


Figure 92. Camrosa Effluent Boron Frequency Distribution (10/01-11/03)

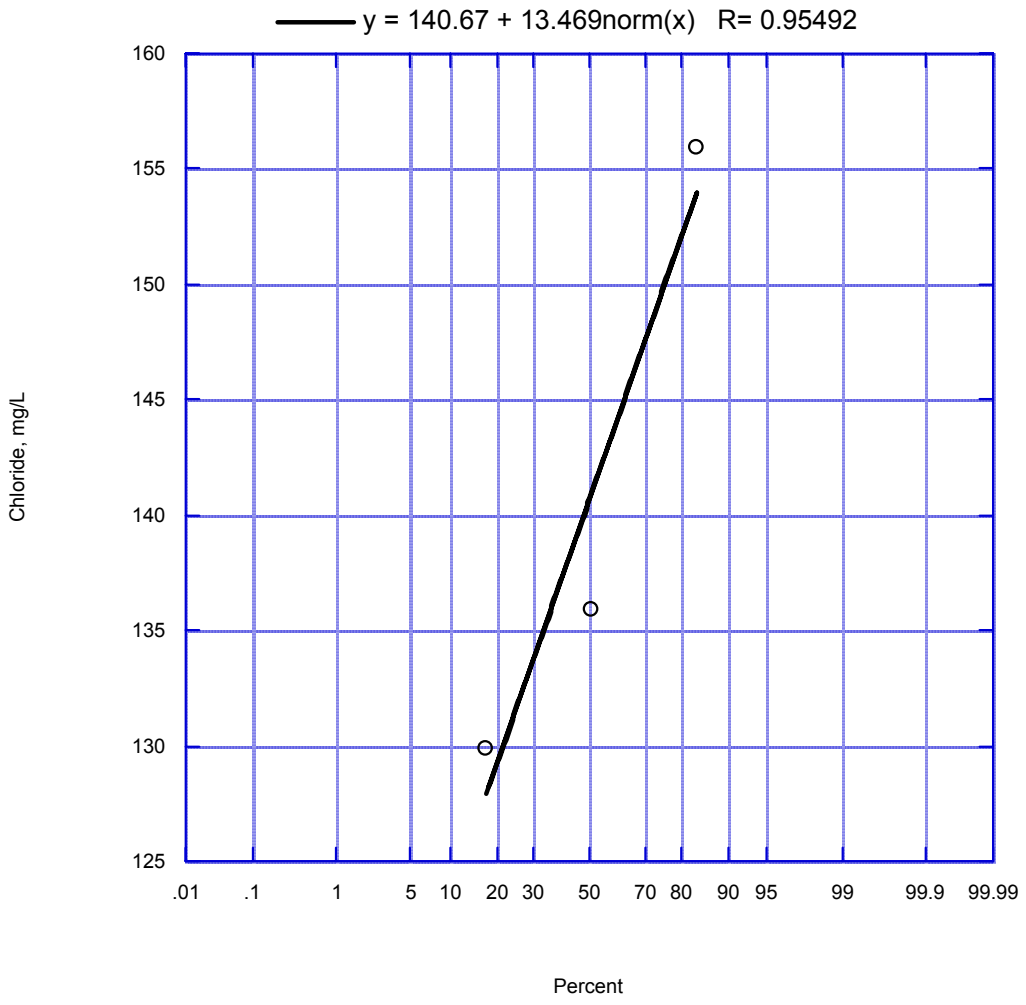


Figure 93. Moorpark Effluent Chloride Frequecny Distribution (10/01-12/01)

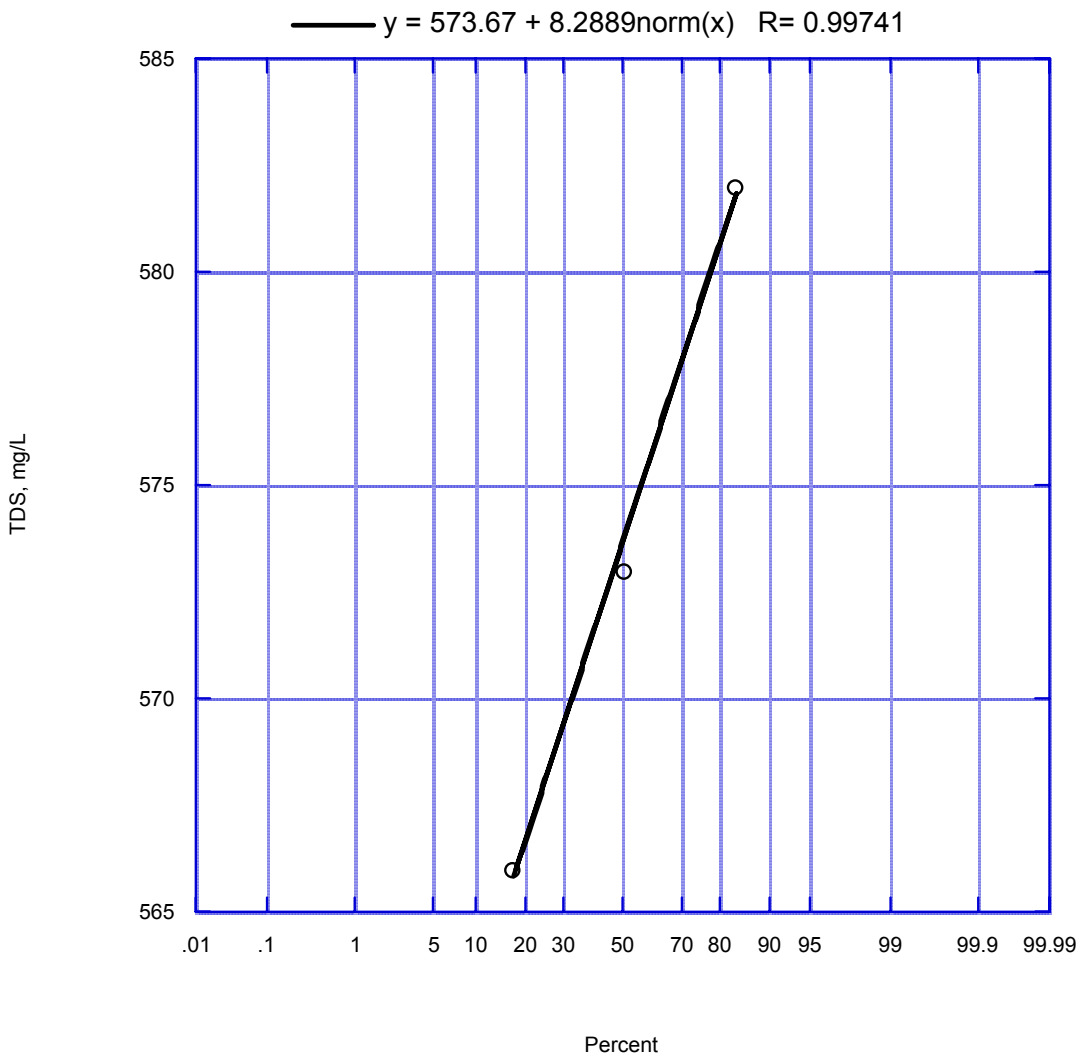


Figure 94. Moorpark Effluent TDS Frequency Distribution (10/01-12/01)

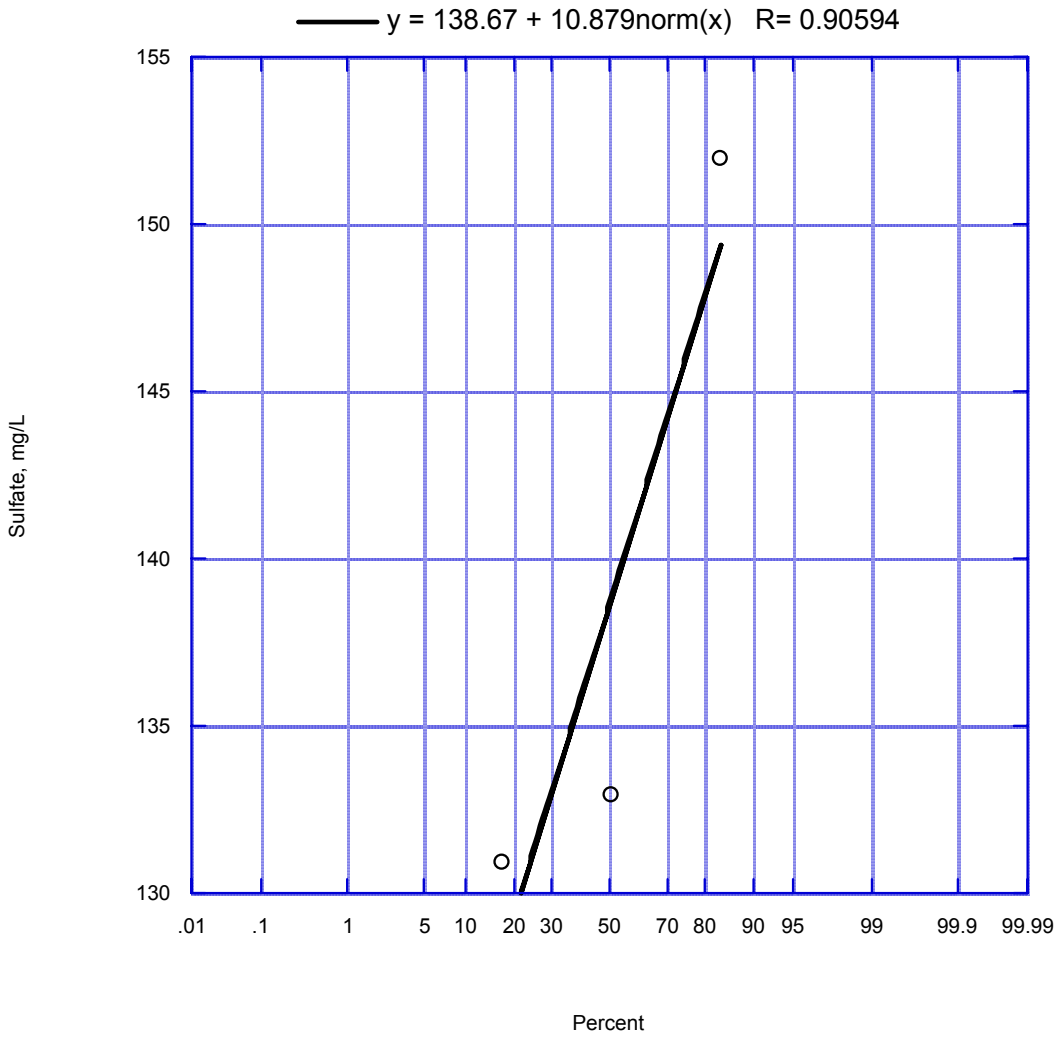


Figure 95. Moorpark Effluent Sulfate Freuency Distribution (10/01-12/01)

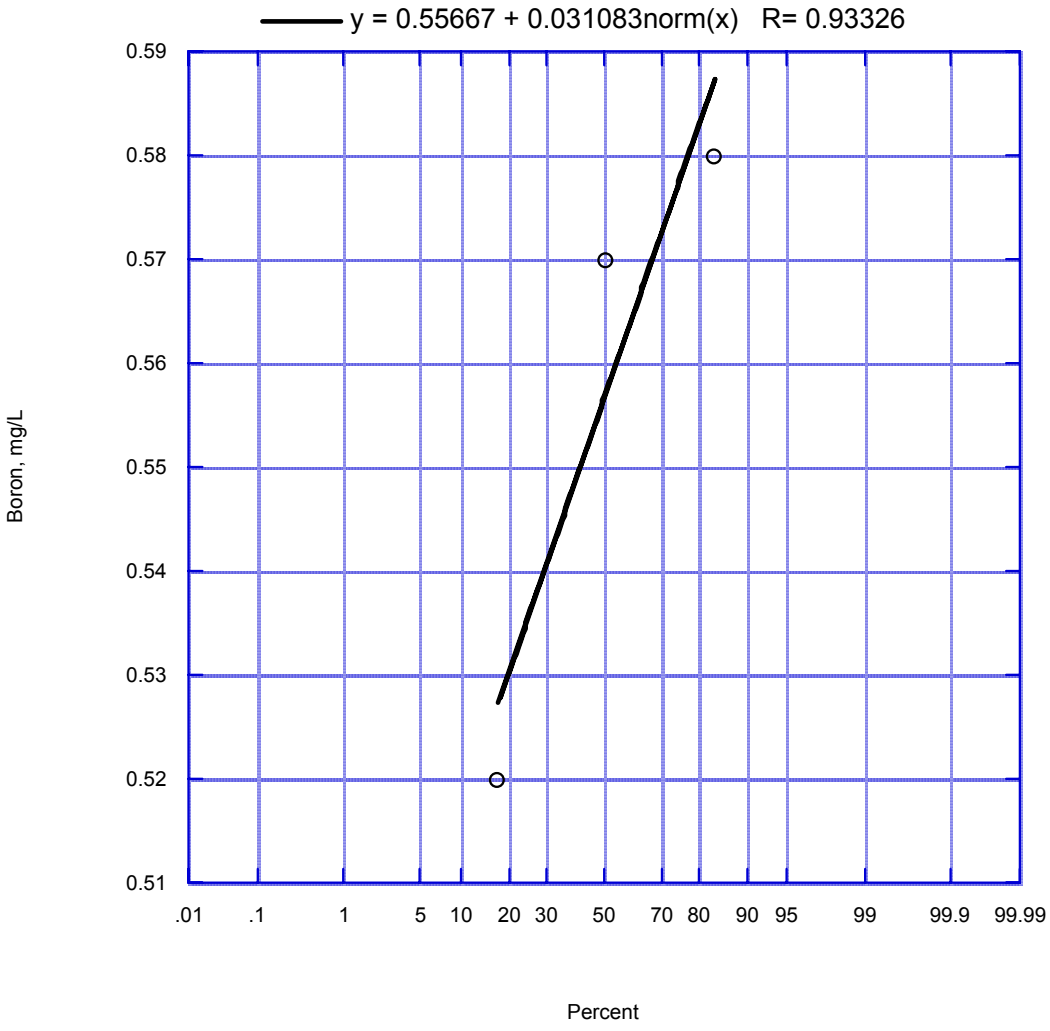


Figure 96. Moorpark Effluent Boron Frequency Distribution (10/01-12/01)

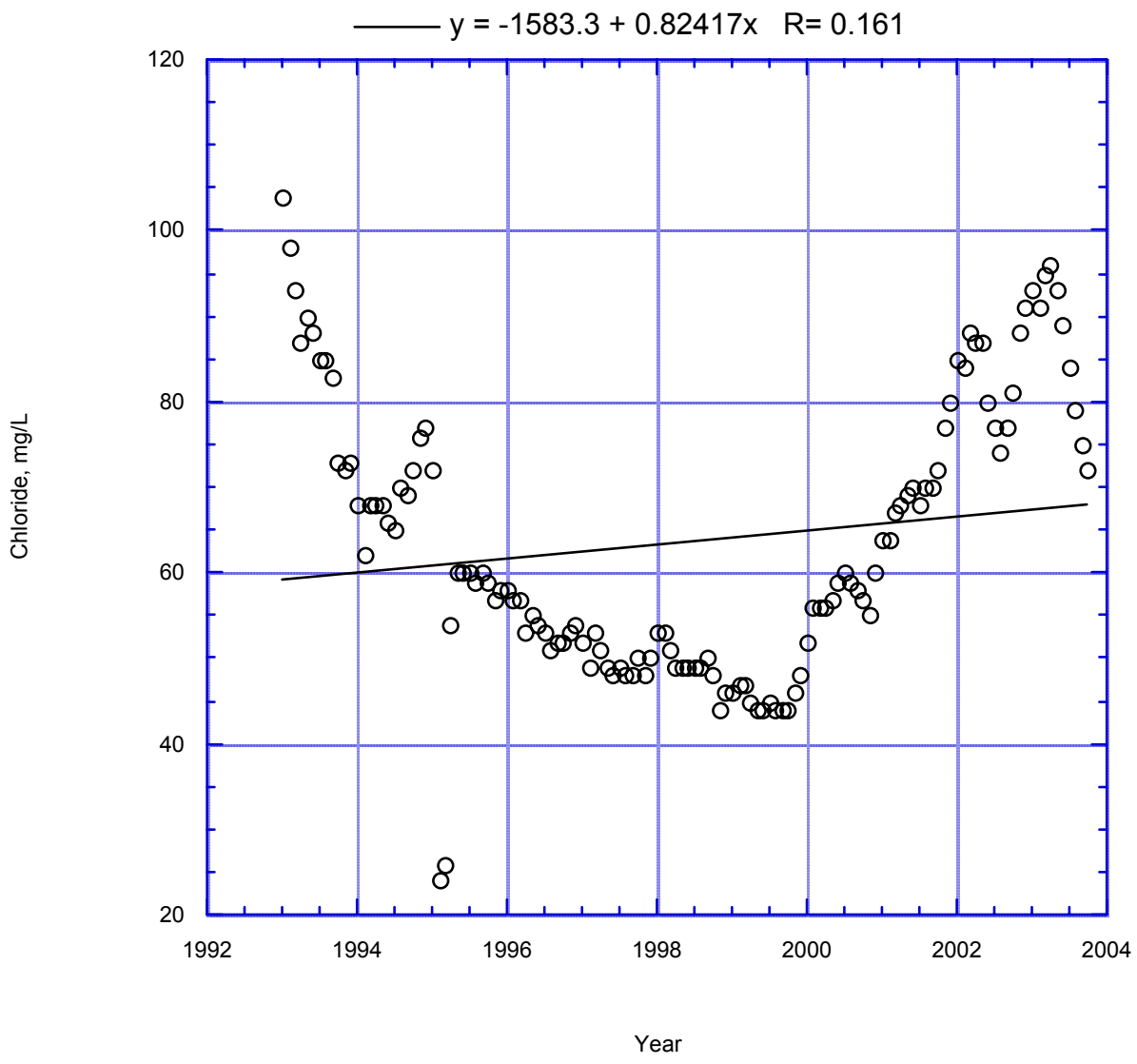


Figure 97. Jensen Plant Chloride vs. Time

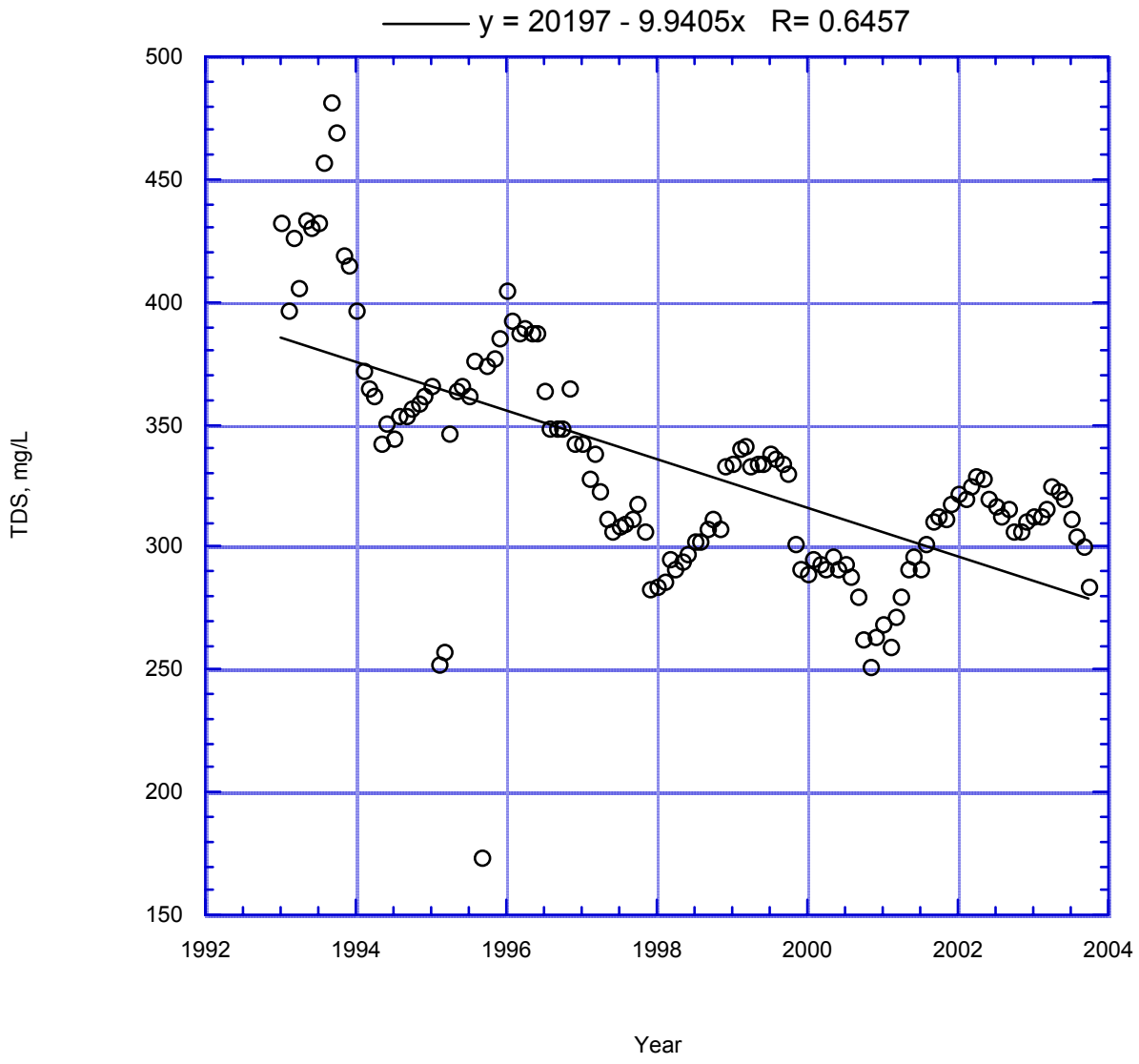


Figure 98. Jensen Plant TDS vs. Time

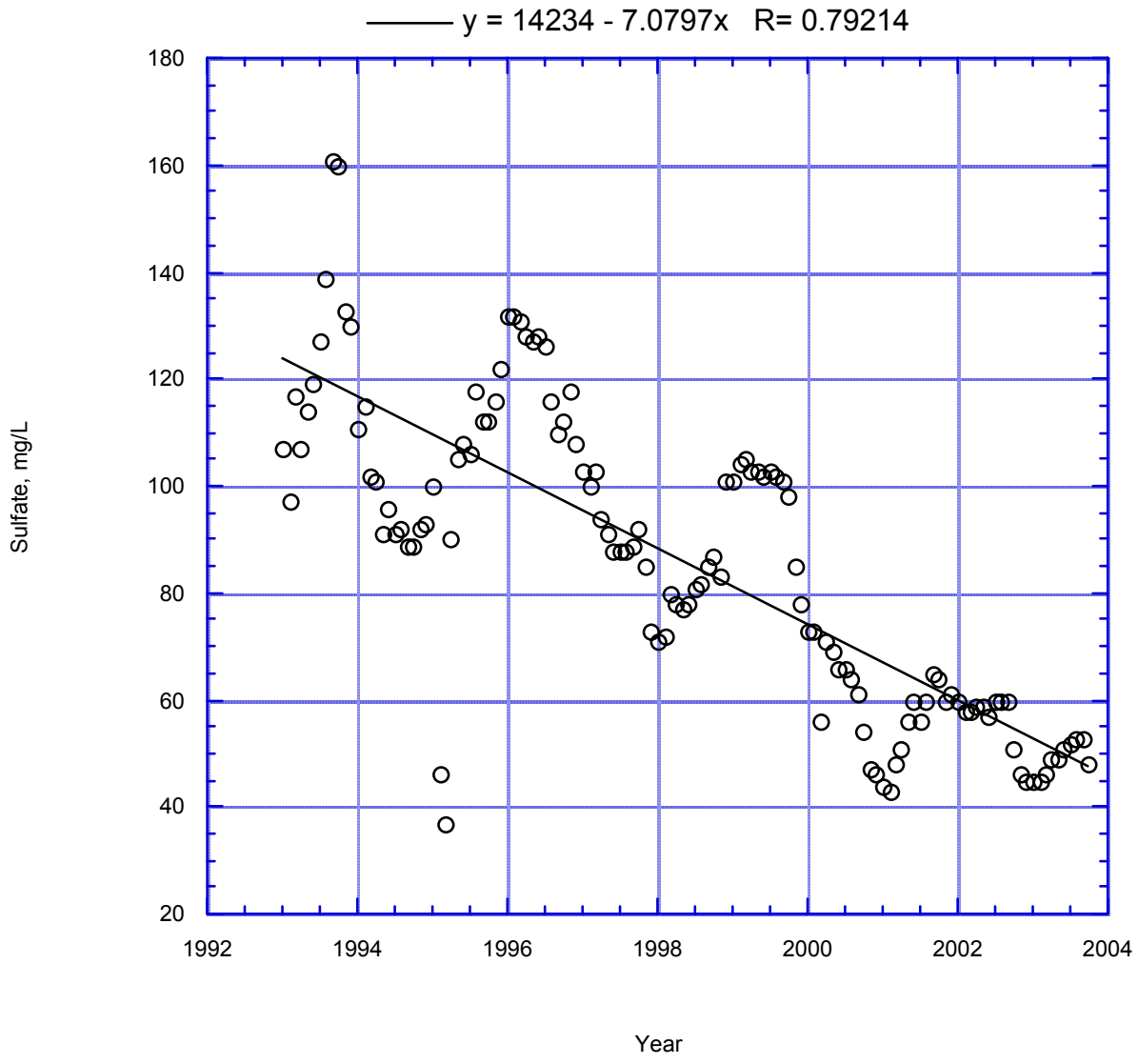


Figure 99. Jensen Plant Sulfate vs. Time

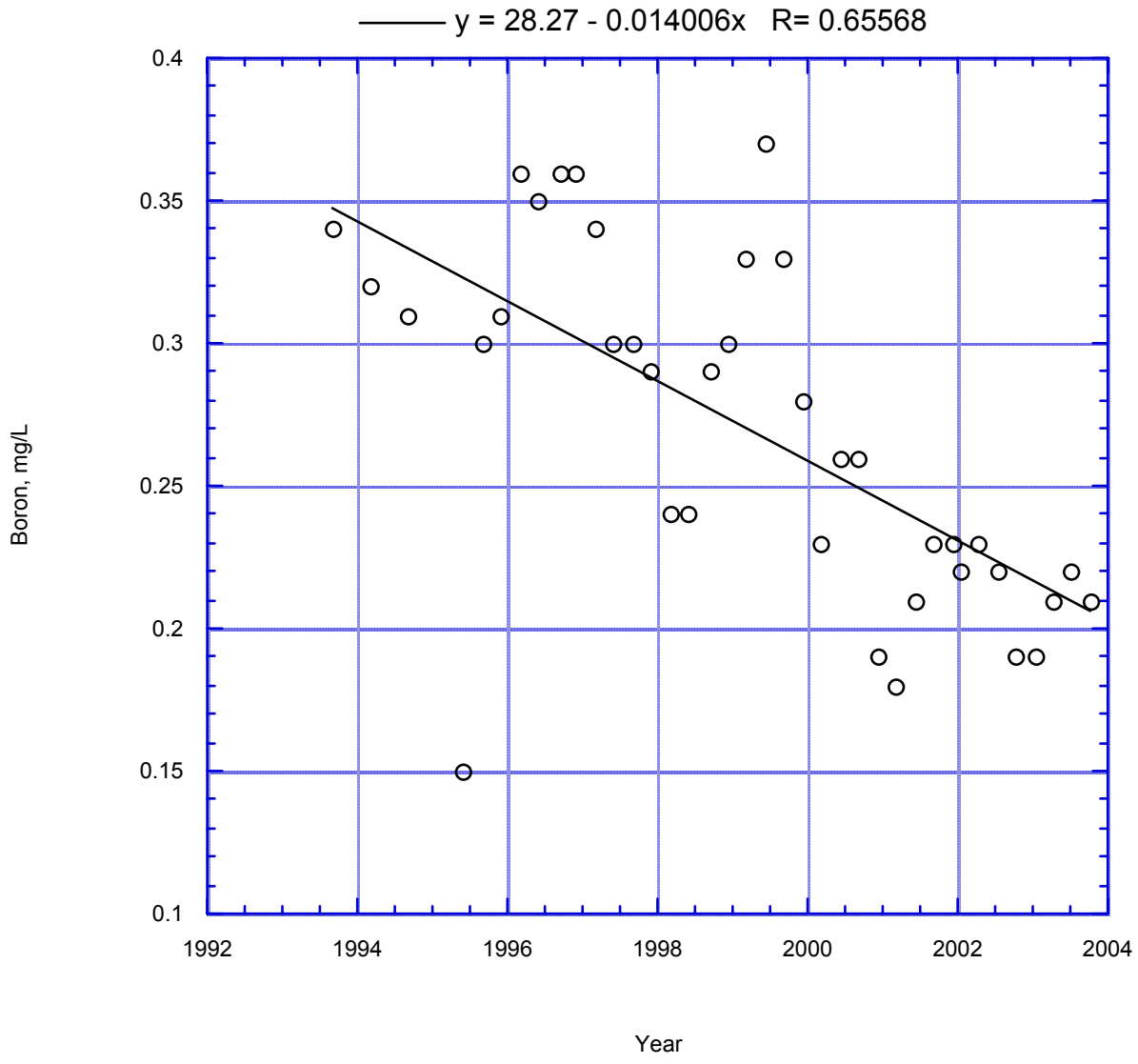


Figure 100. Jensen Plant Boron vs. Time

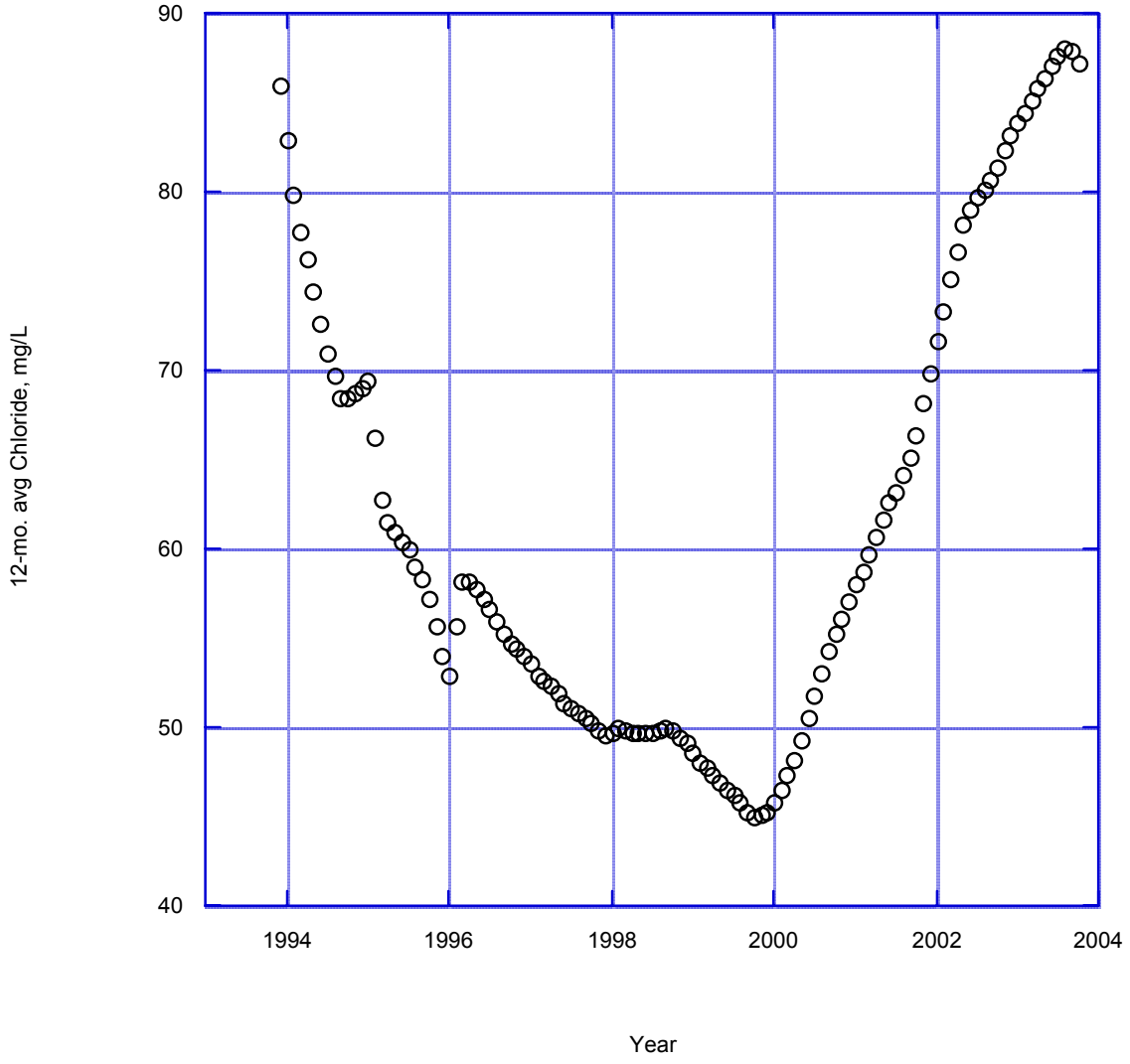


Figure 101. Jensen Plant 12-month Average Chloride vs. Time

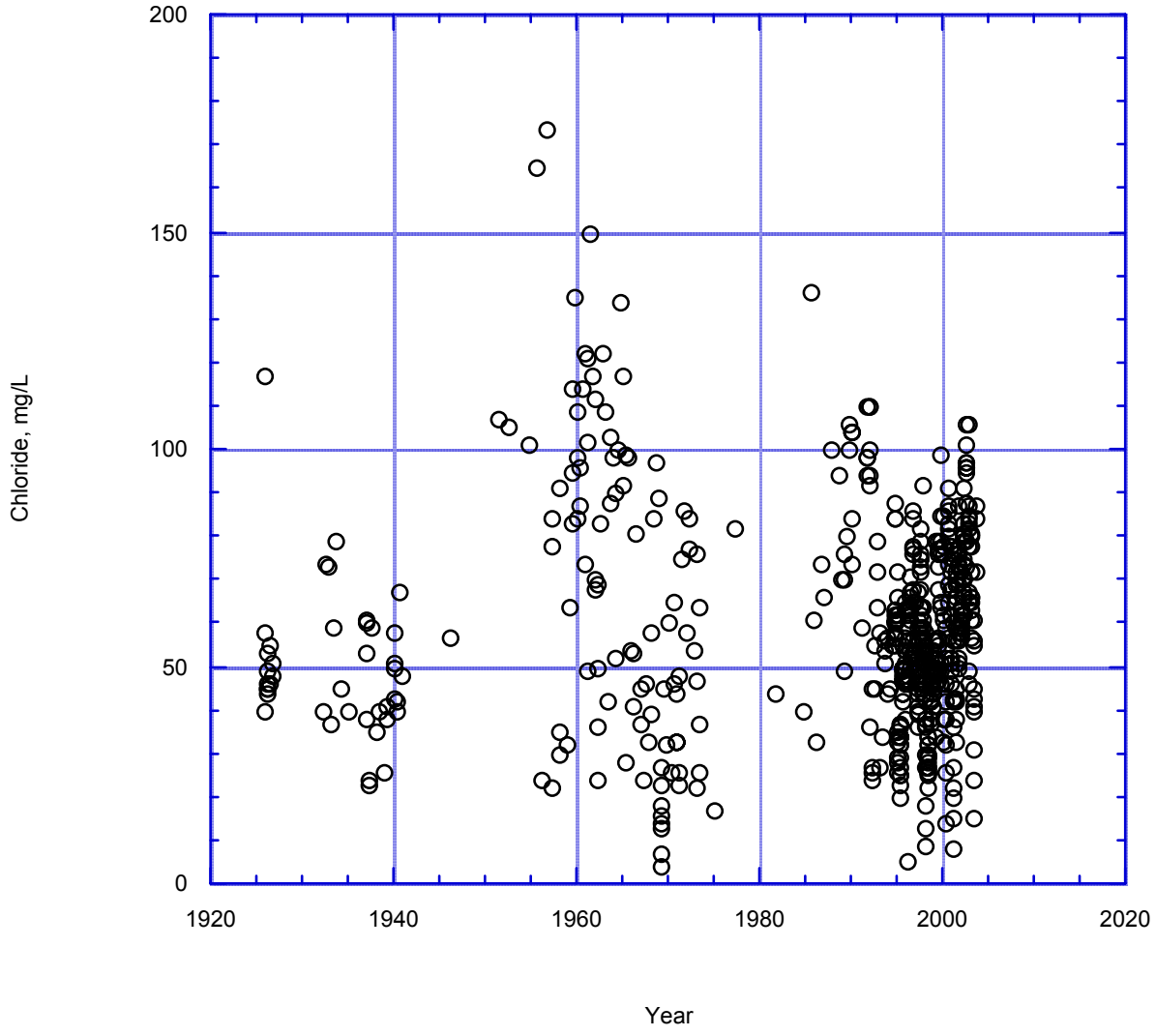


Figure 102. Freeman Diversion Chloride vs. Time

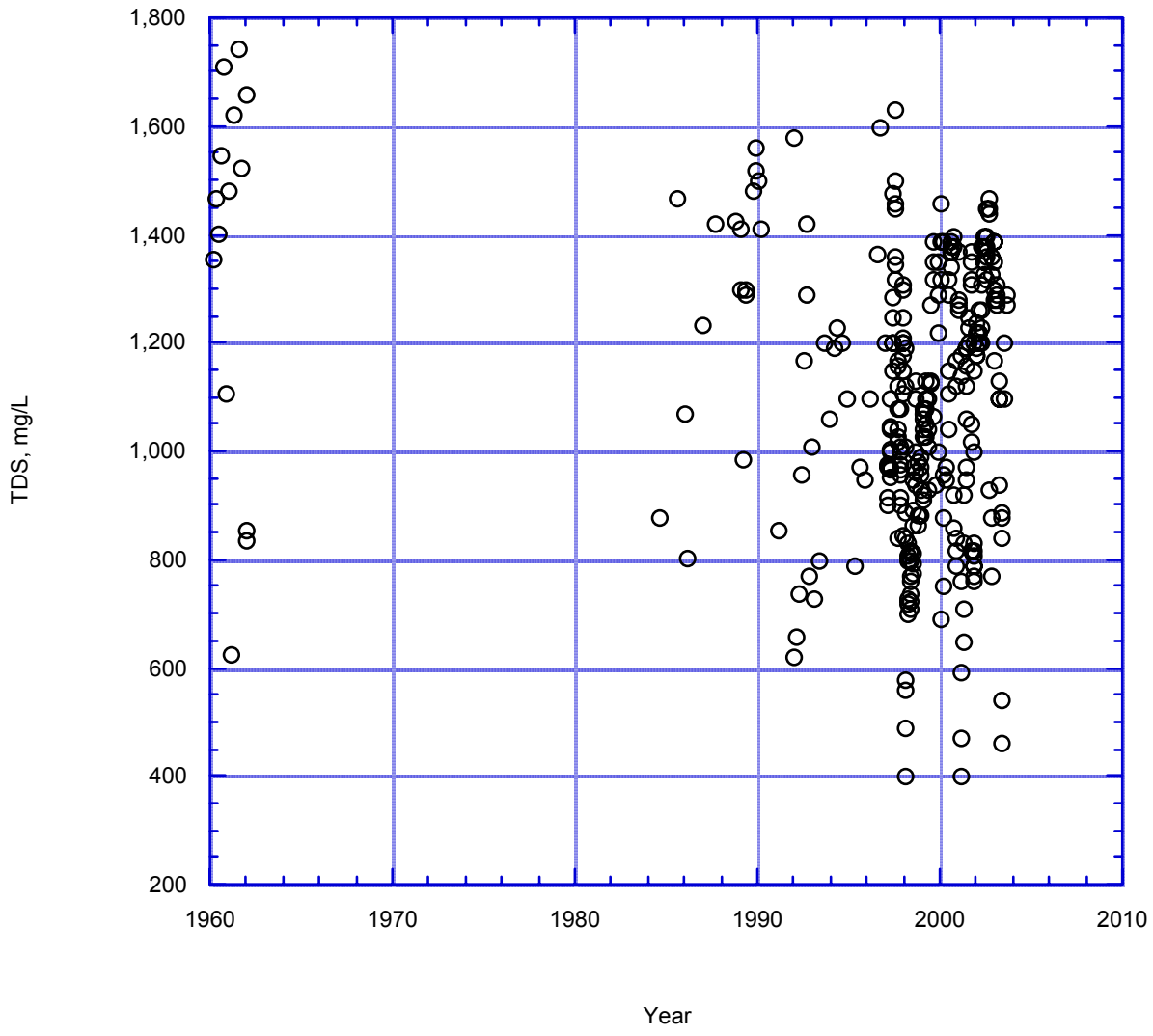


Figure 103. Freeman Diversion TDS vs. Time

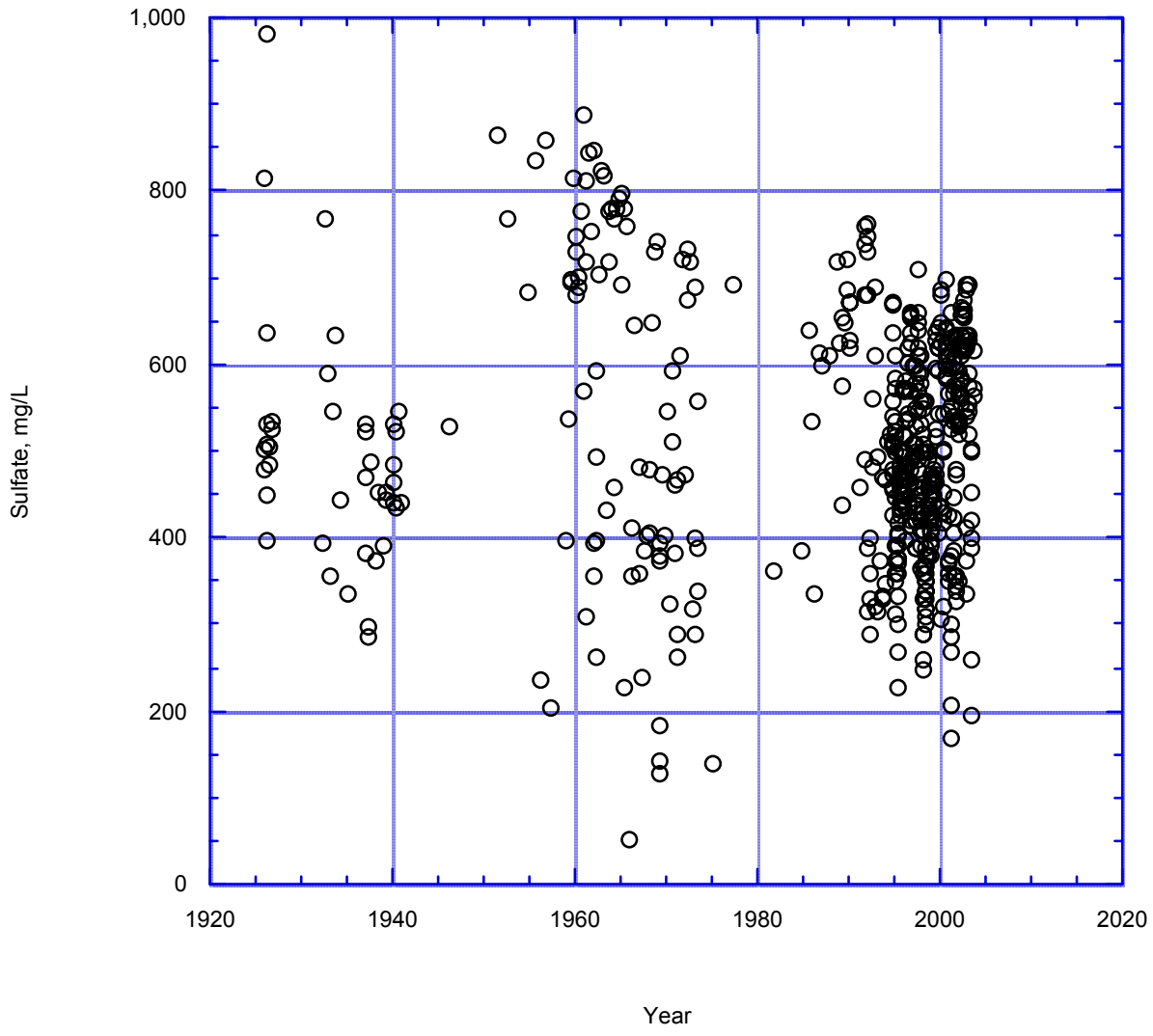


Figure 104. Freeman Diversion Sulfate vs. Time

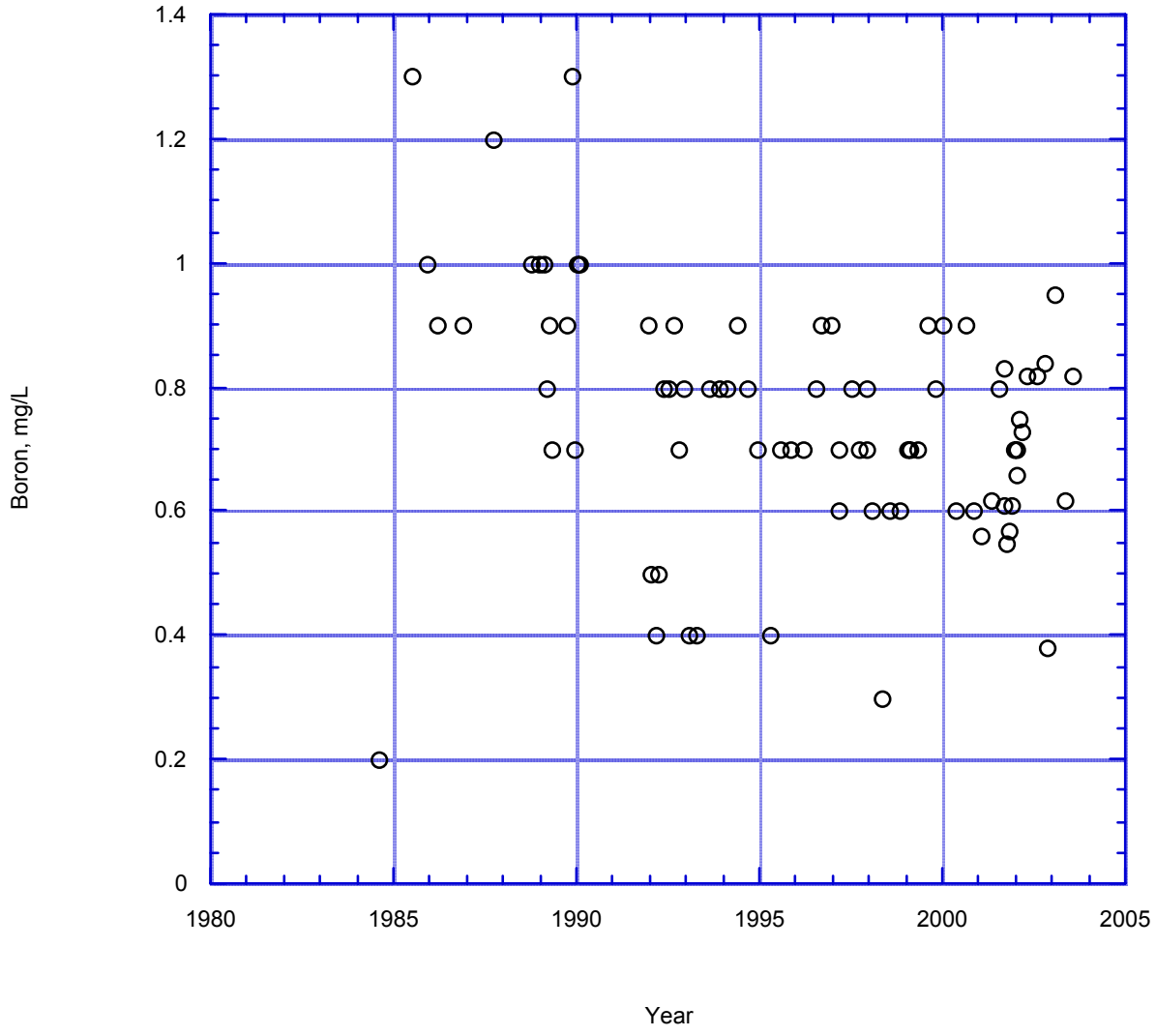


Figure 105. Freeman Diversion Boron vs. Time

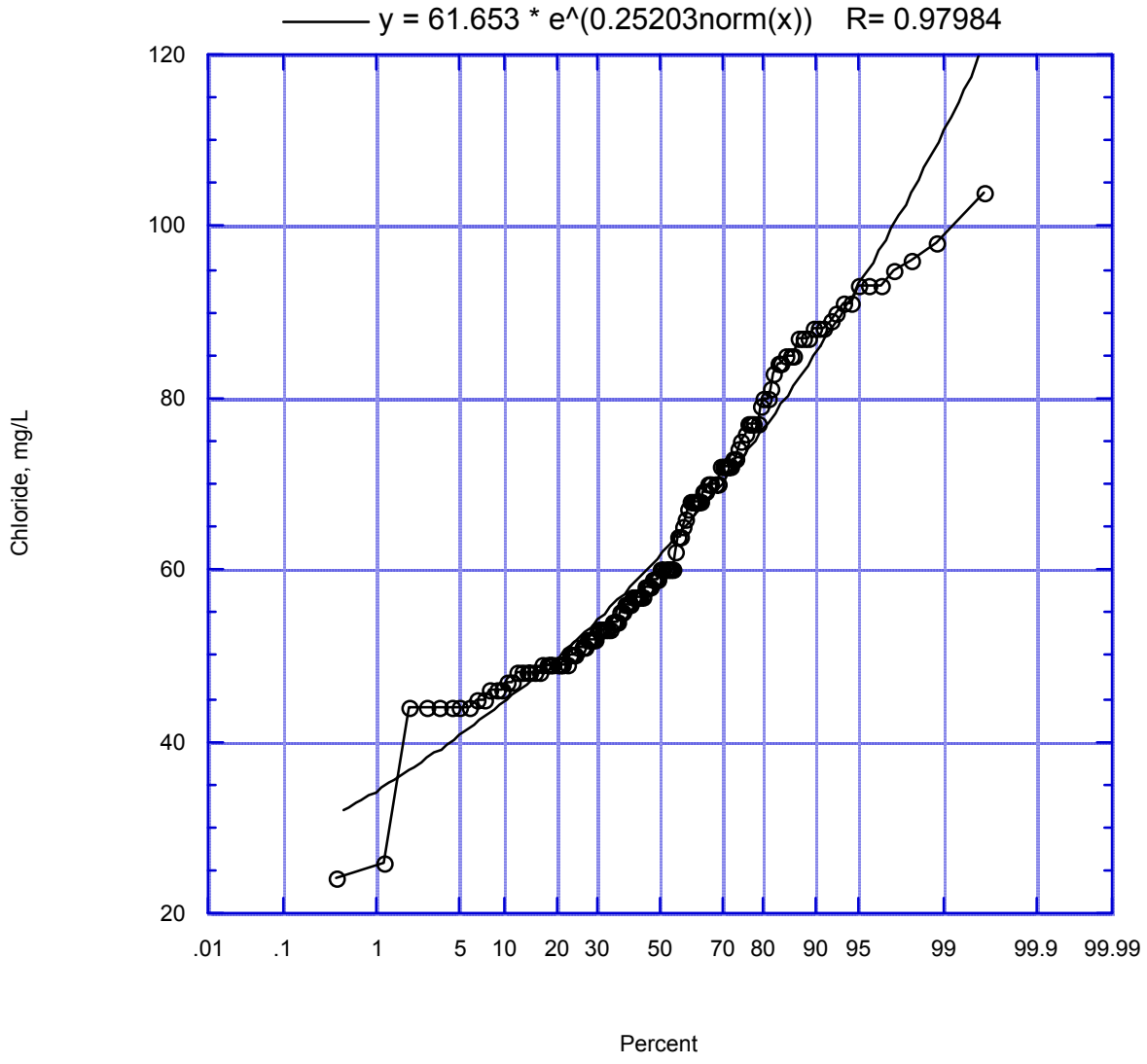


Figure 106. Jensen Plant Chloride Frequency Distribution

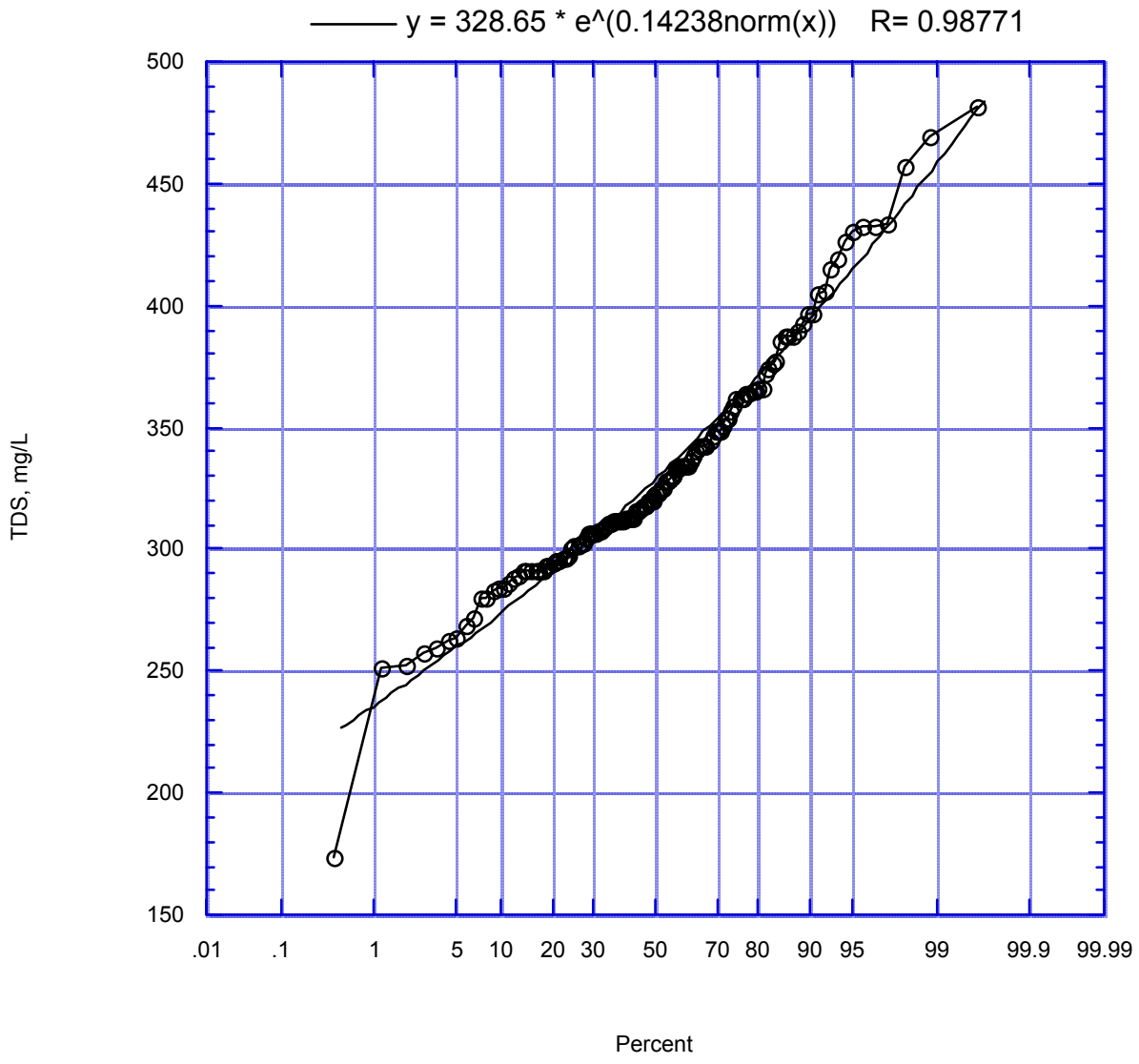


Figure 107. Jensen Plant TDS Frequency Distribution

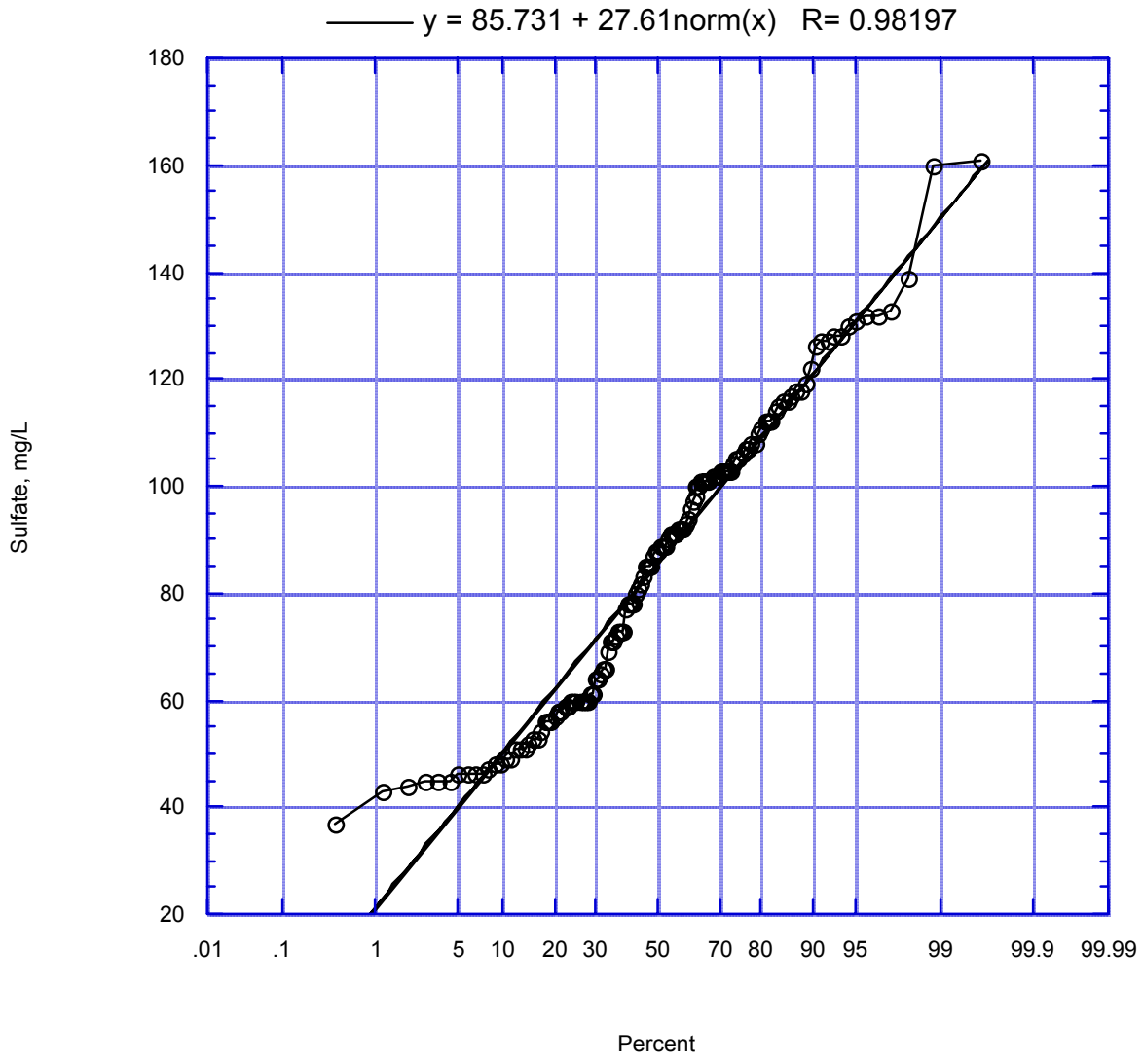


Figure 108. Jensen Plant Sulfate Frequency Distribution

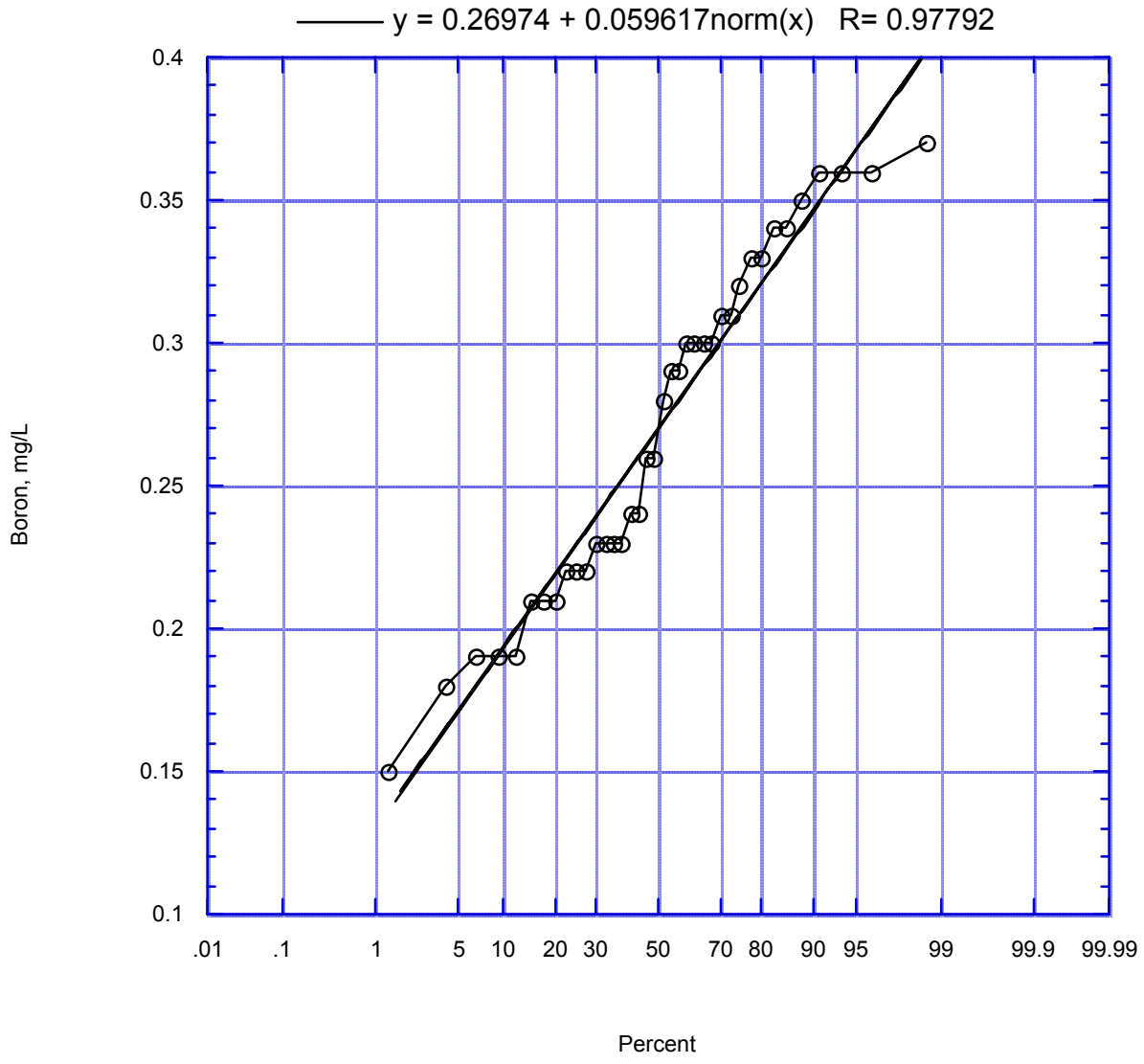


Figure 109. Jensen Plant Boron Frequency Distribution

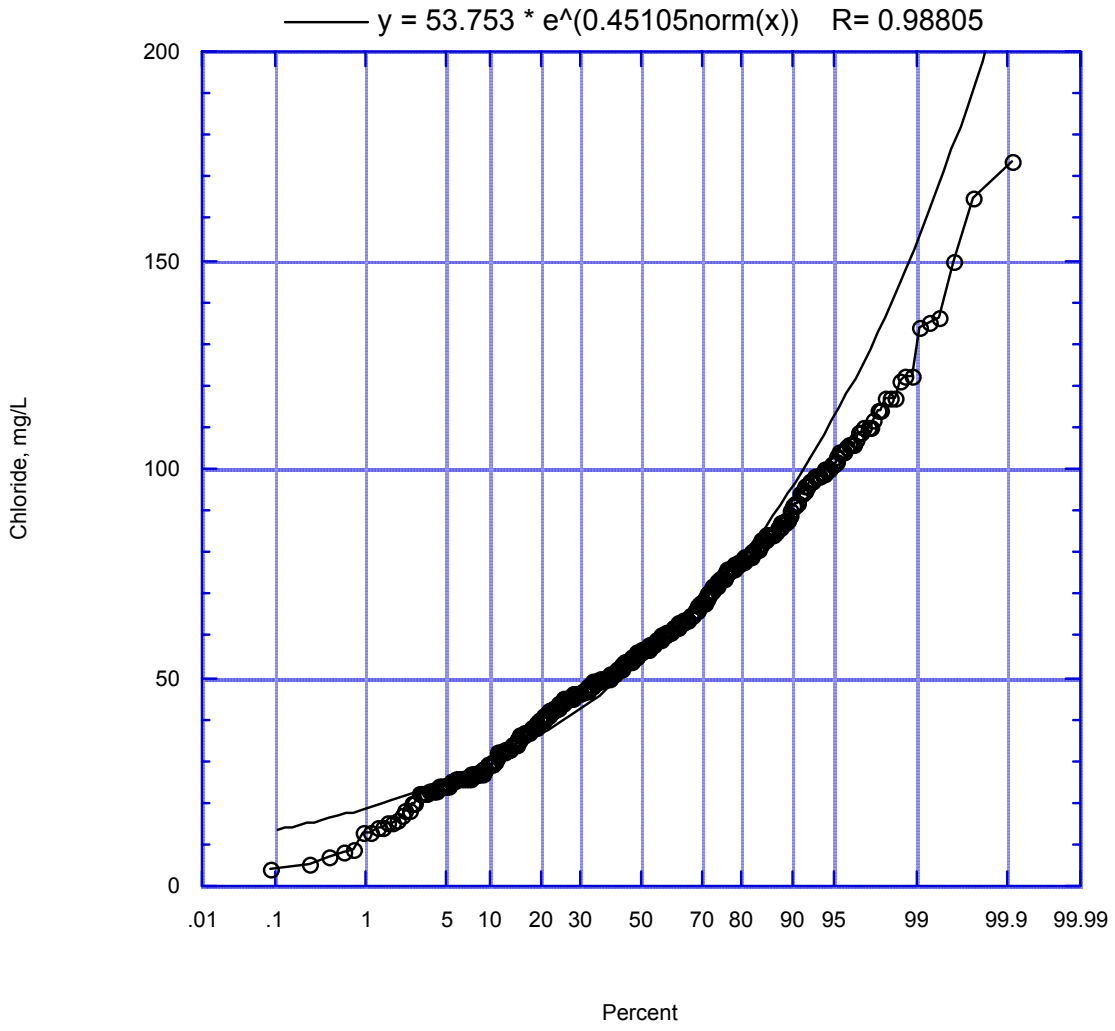


Figure 110. Freeman Diversion Chloride Frequency Distribution

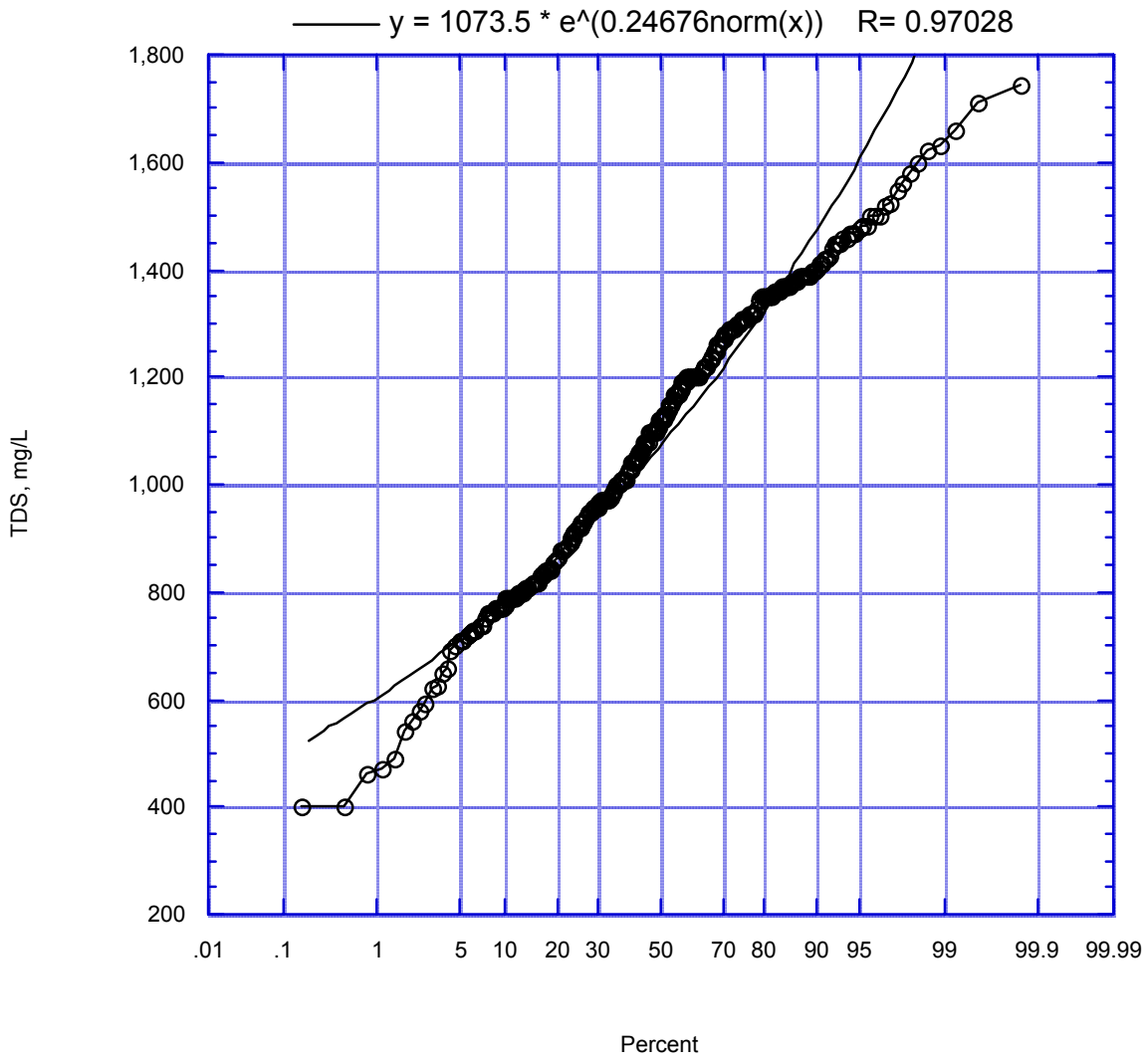


Figure 111. Freeman Diversion TDS Frequency Distribution

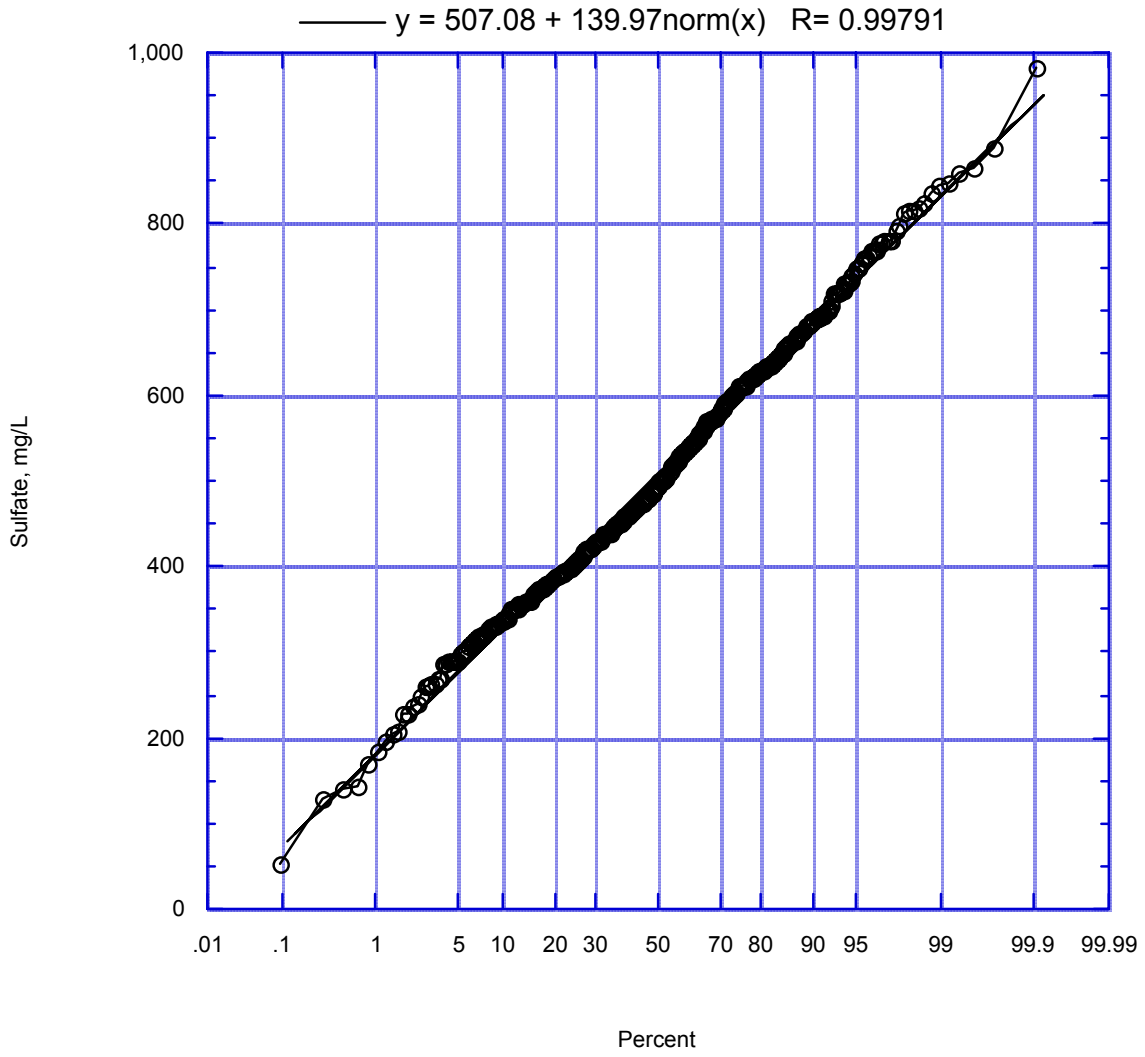


Figure 112. Freeman Diversion Sulfate Frequency Distribution

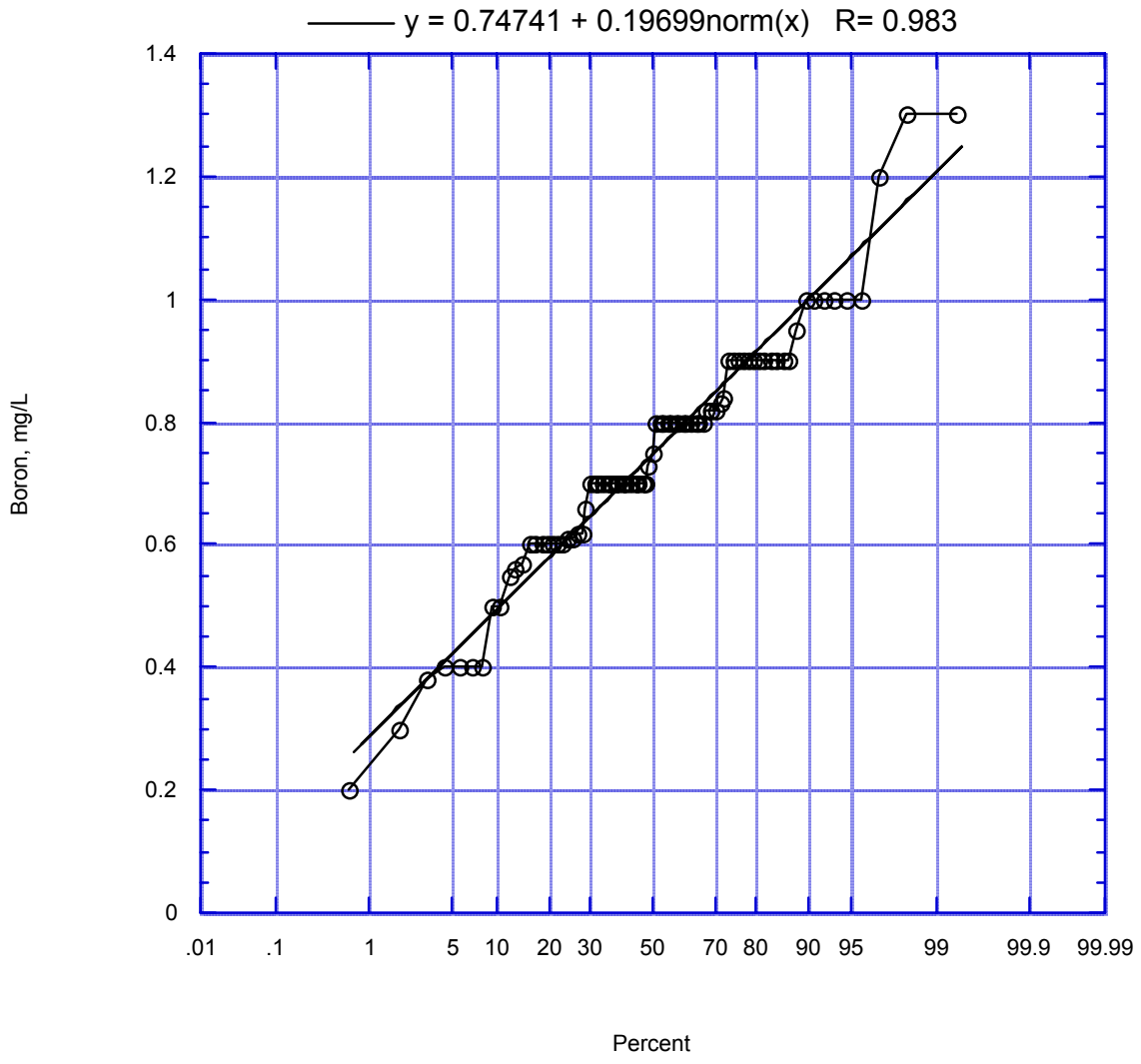


Figure 113. Freeman Diversion Boron Frequency Distribution

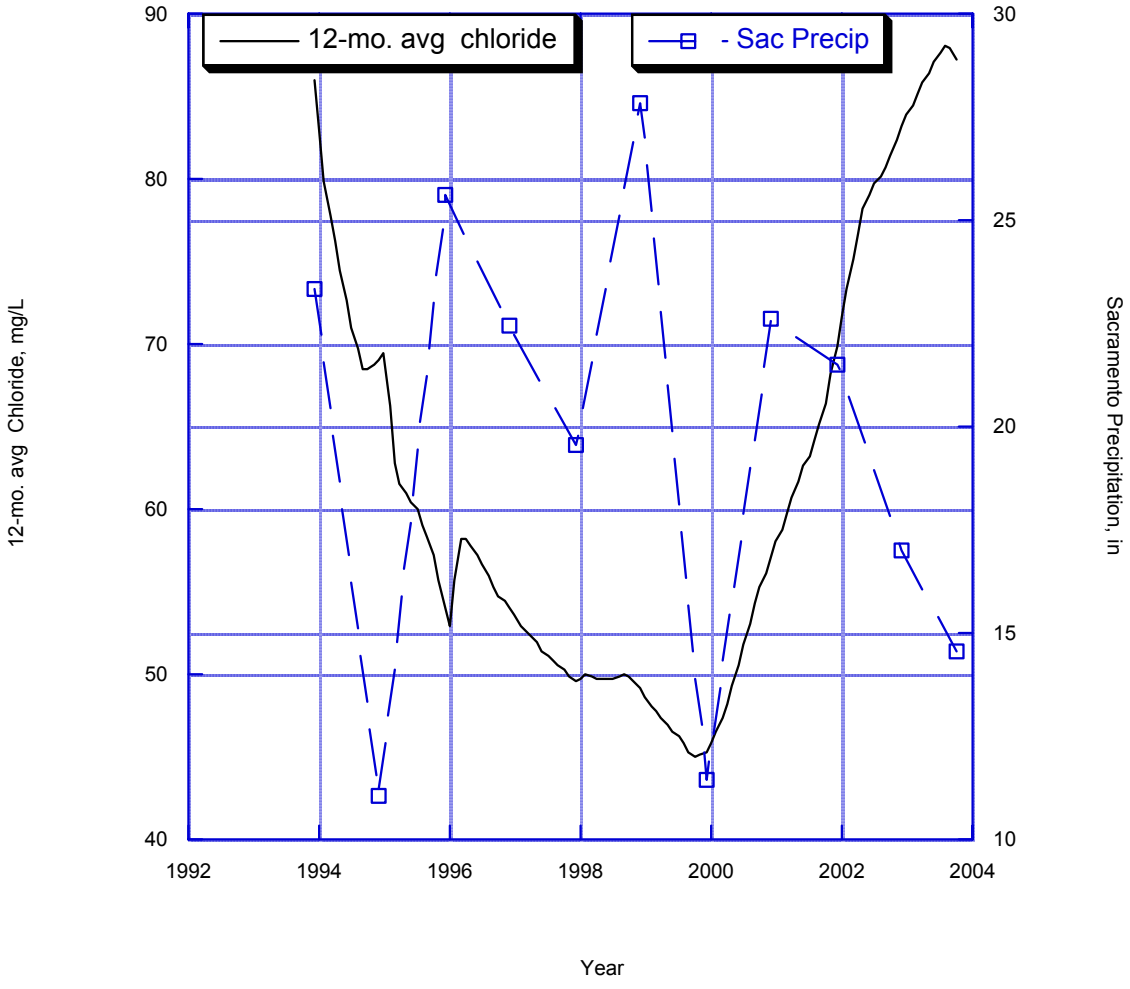


Figure 114. Jensen Plant Chloride and Sacramento Precipitation vs. Time

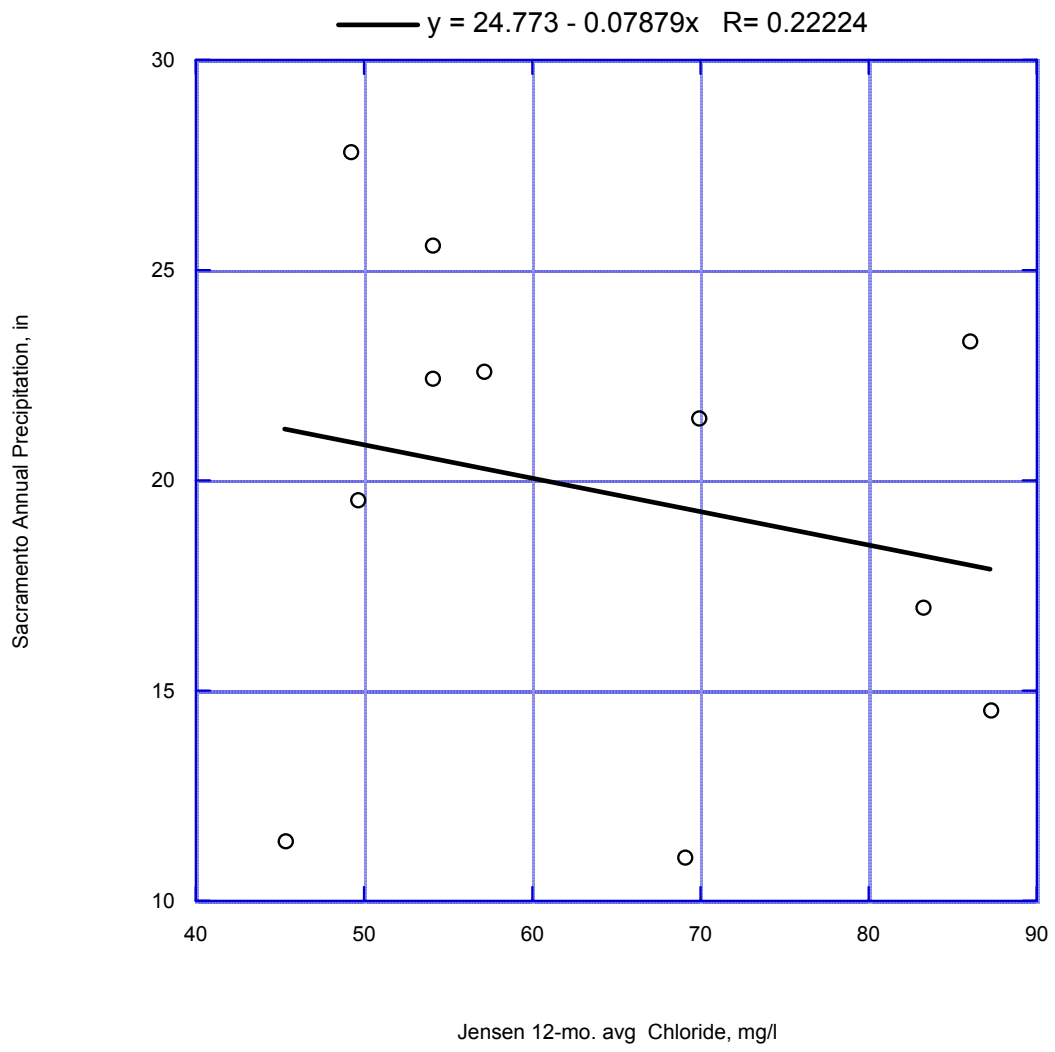


Fig 115. Jensen Plant 12-mo. avg Chloride vs. Sacramento Precipitation

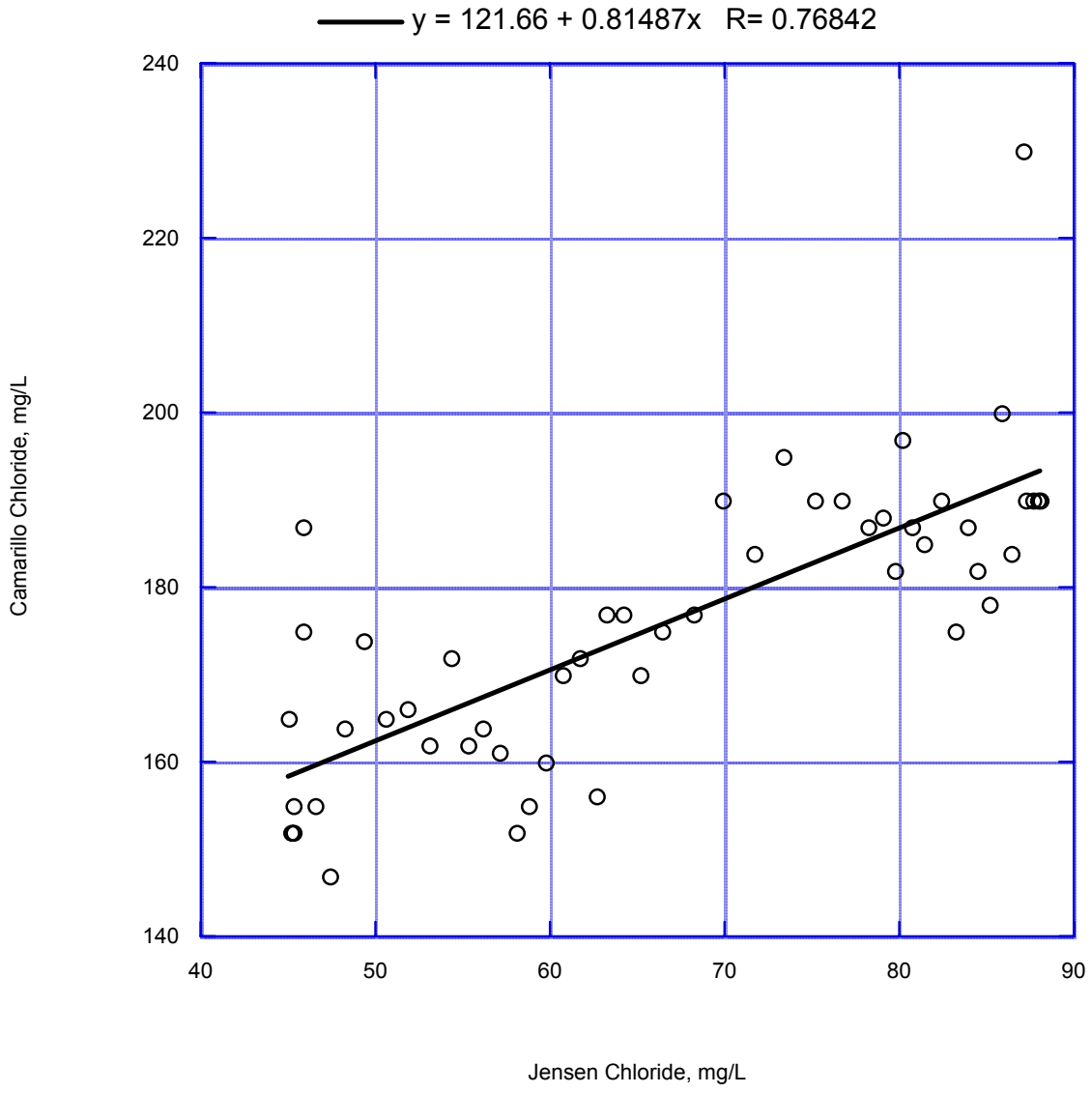


Figure 116. Camarillo Effluent Chloride vs. Jensen Plant Chloride

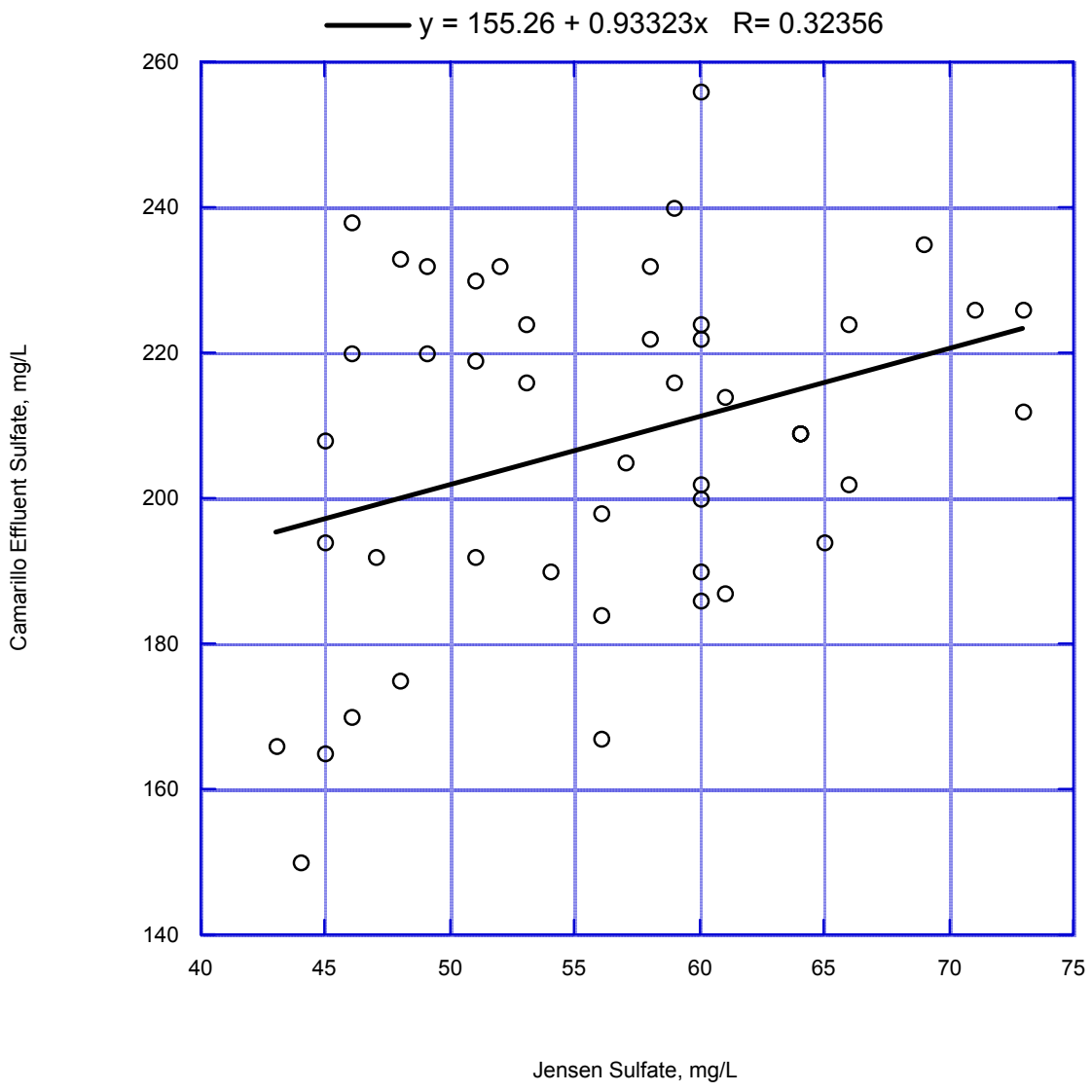


Figure 117. Camarillo Effluent Sulfate vs. Jensen Plant Sulfate

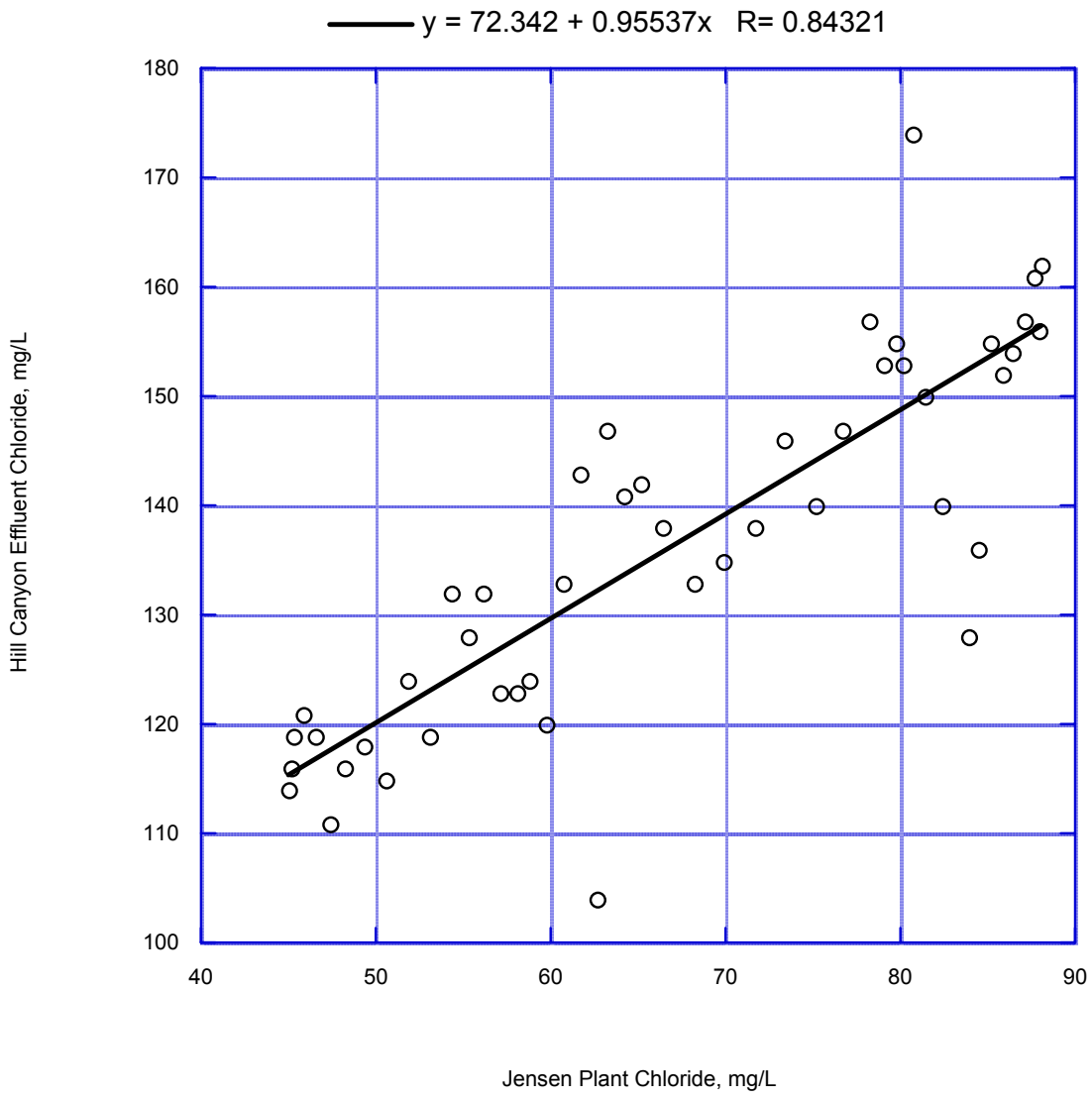


Figure 118. Hill Canyon Effluent Chloride vs. Jensen Plant Chloride

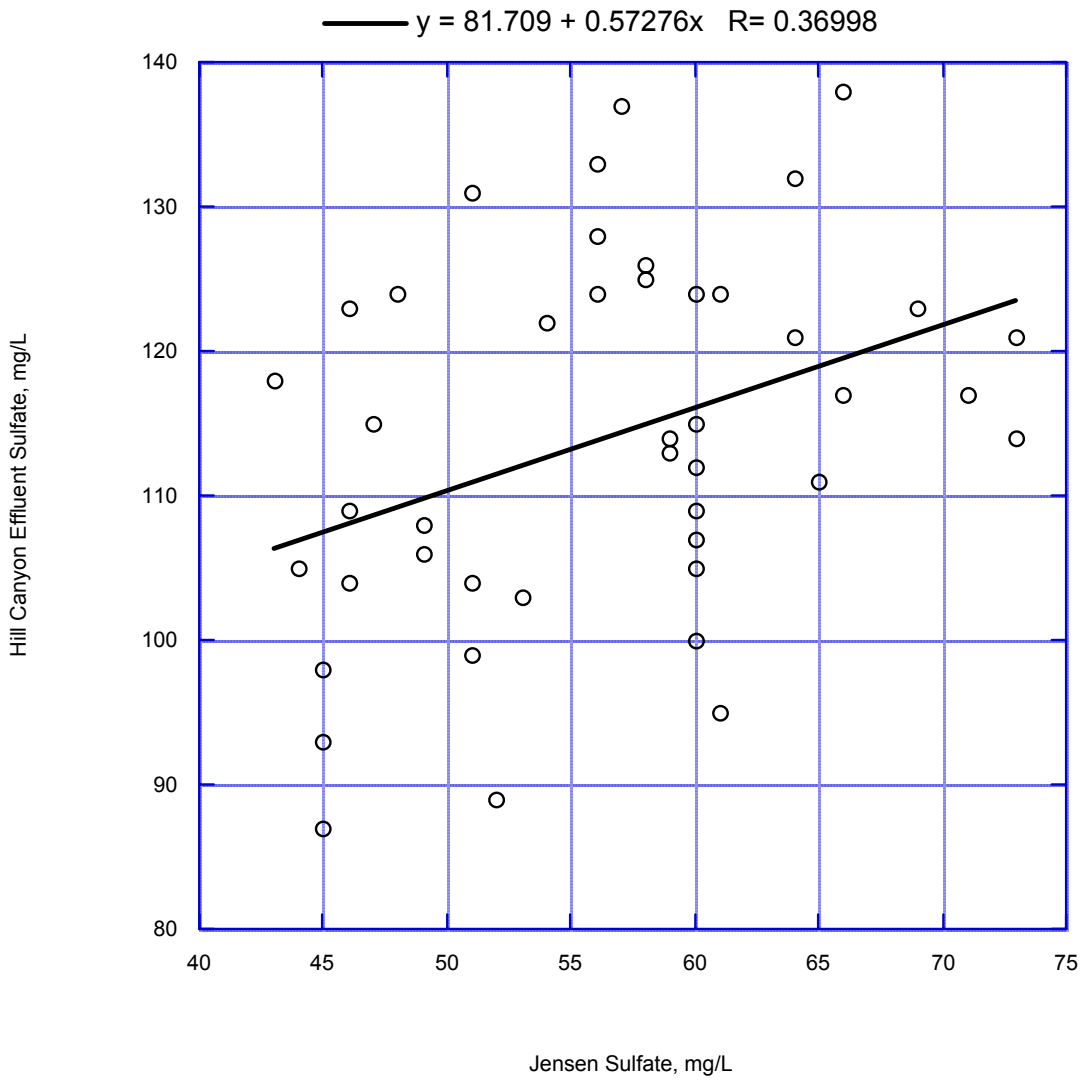


Figure 119. Hill Canyon Effluent Sulfate vs. Jensen Plant Sulfate

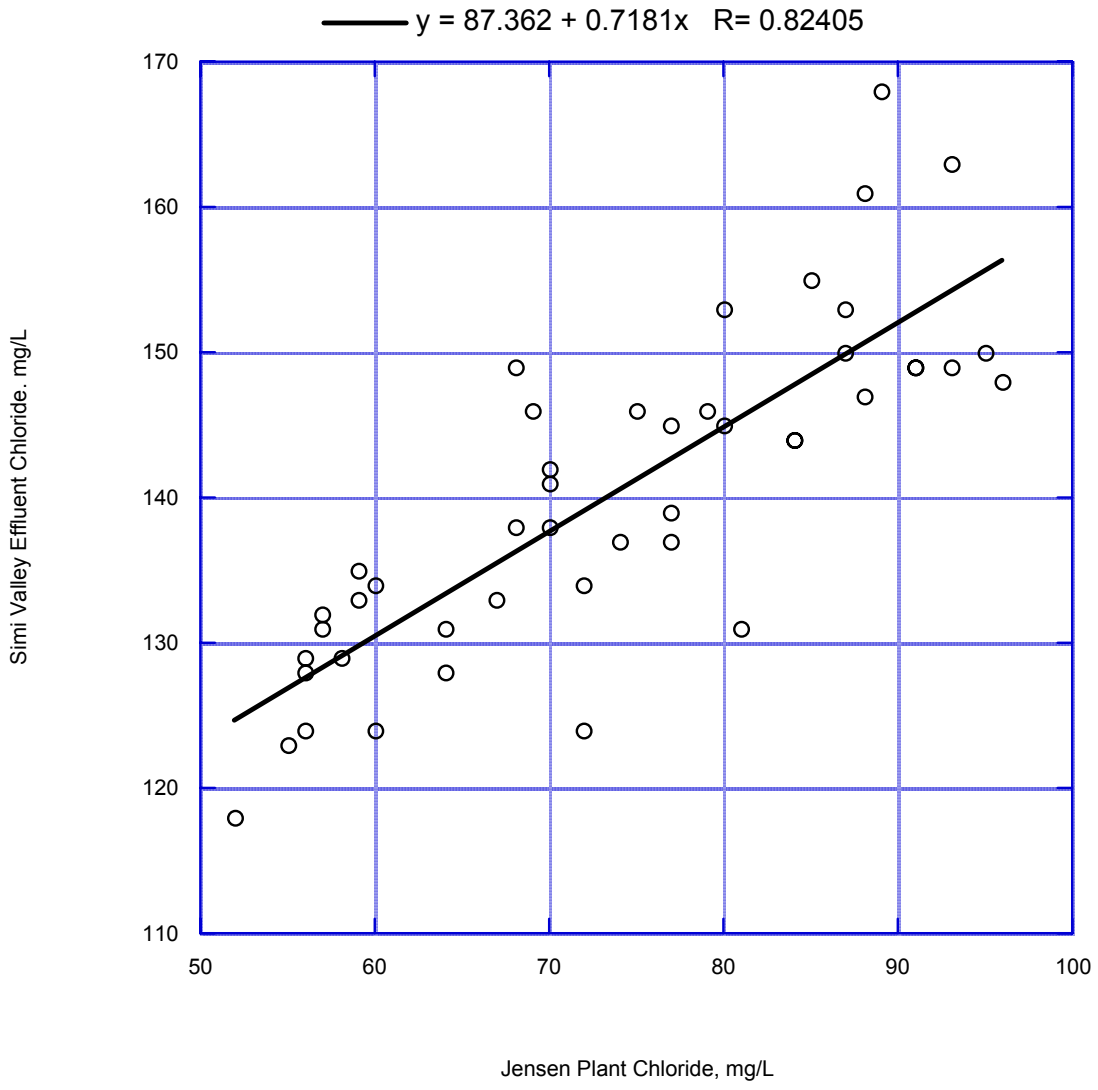


Figure 120. Simi Valley Effluent Chloride vs. Jensen Plant Chloride

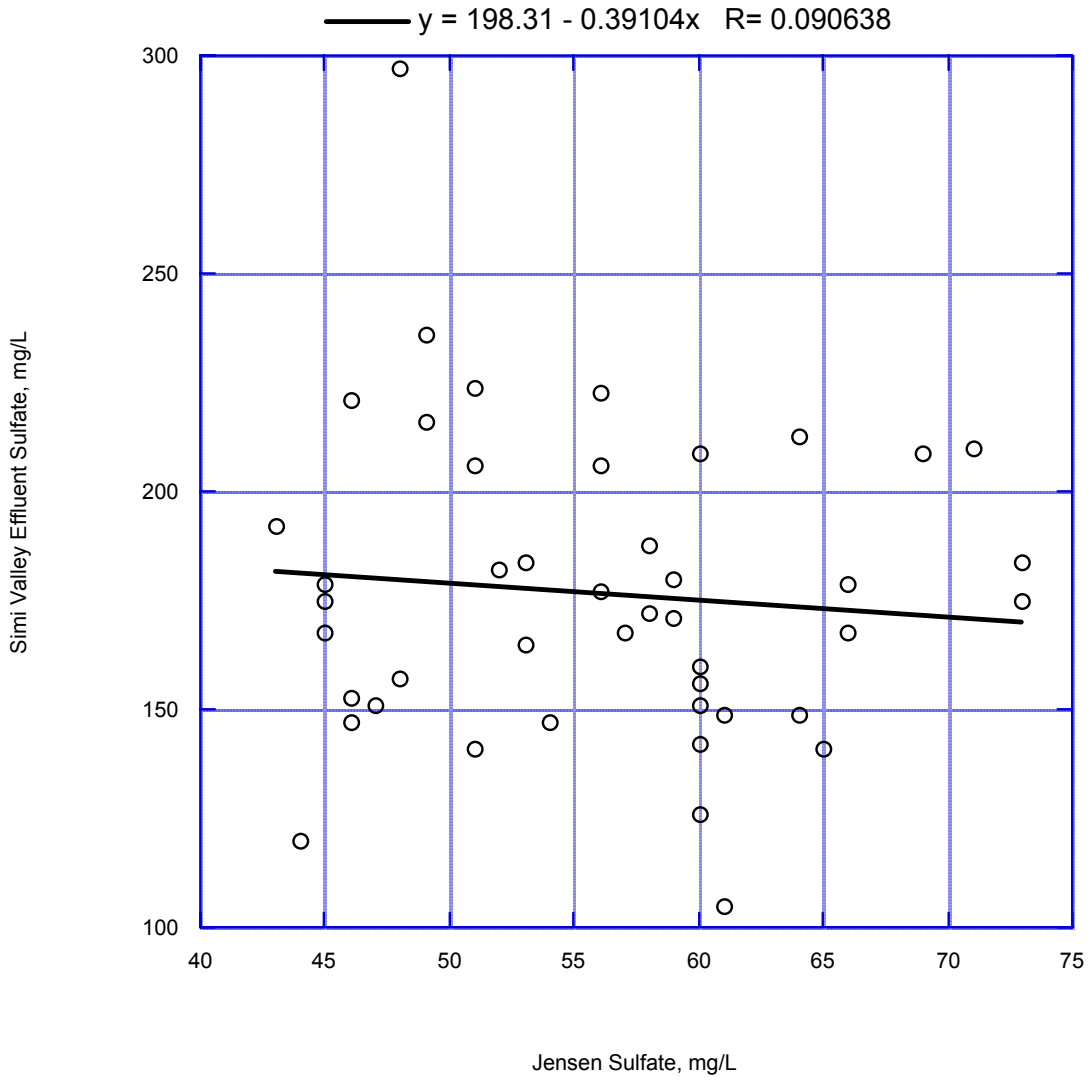


Figure 121. Simi Valley Effluent Sulfate vs. Jensen Plant Sulfate

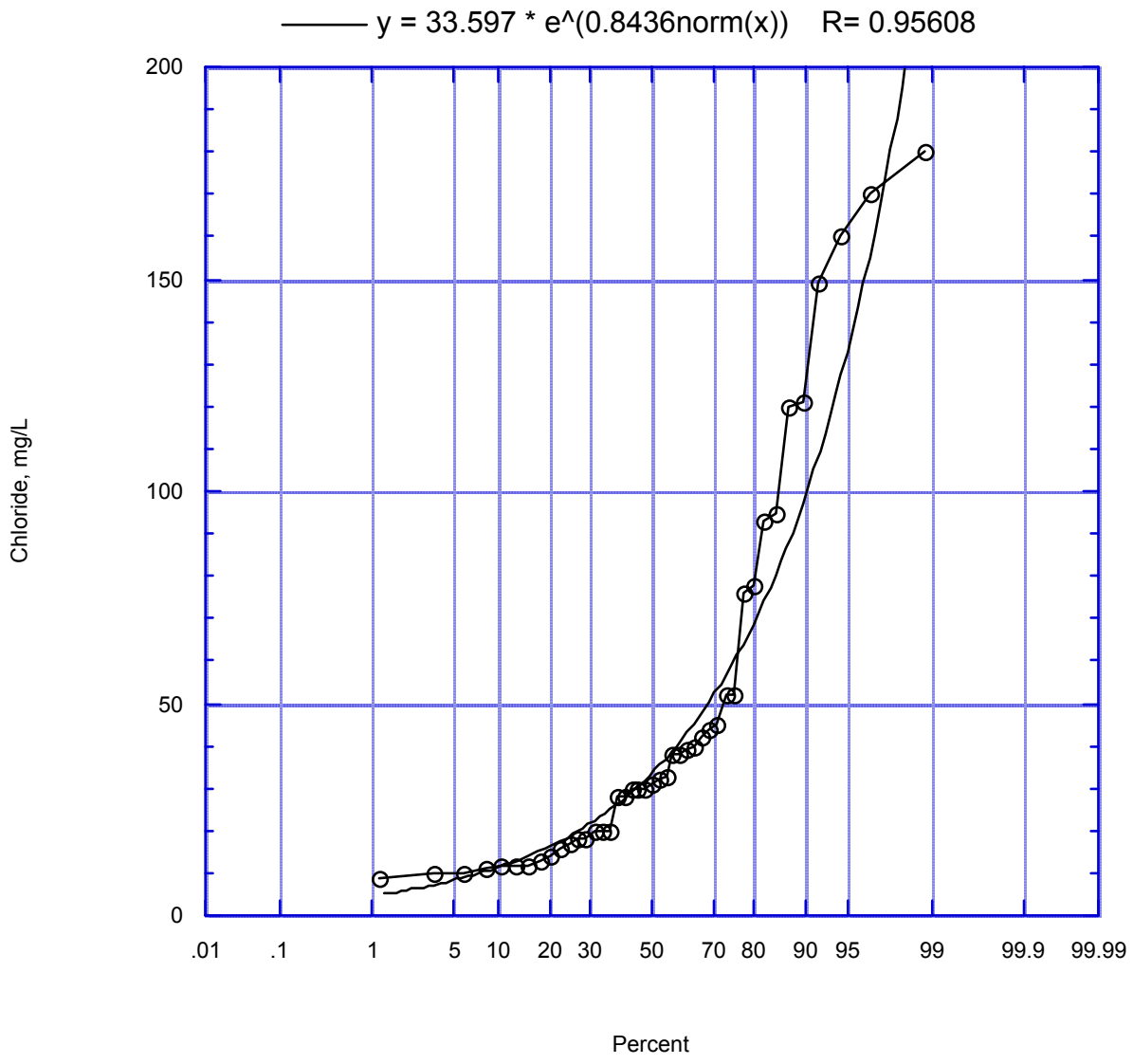


Figure 122. Frequency Distribution of Chloride in Stormwater Runoff form Agricutural Land Use

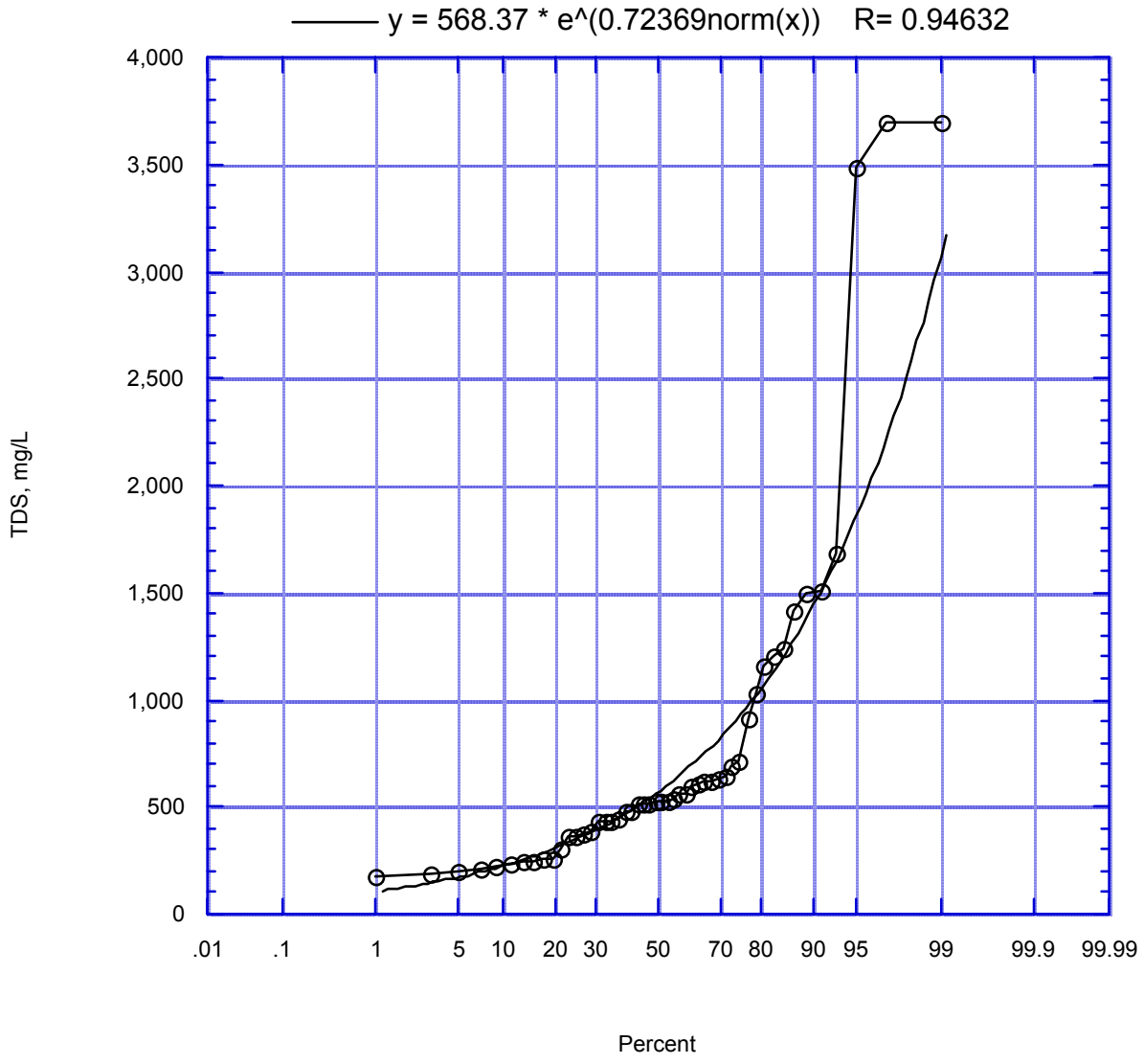


Figure 123. Frequency Distribution of TDS in Stormwater Runoff form Agricutural Land Use

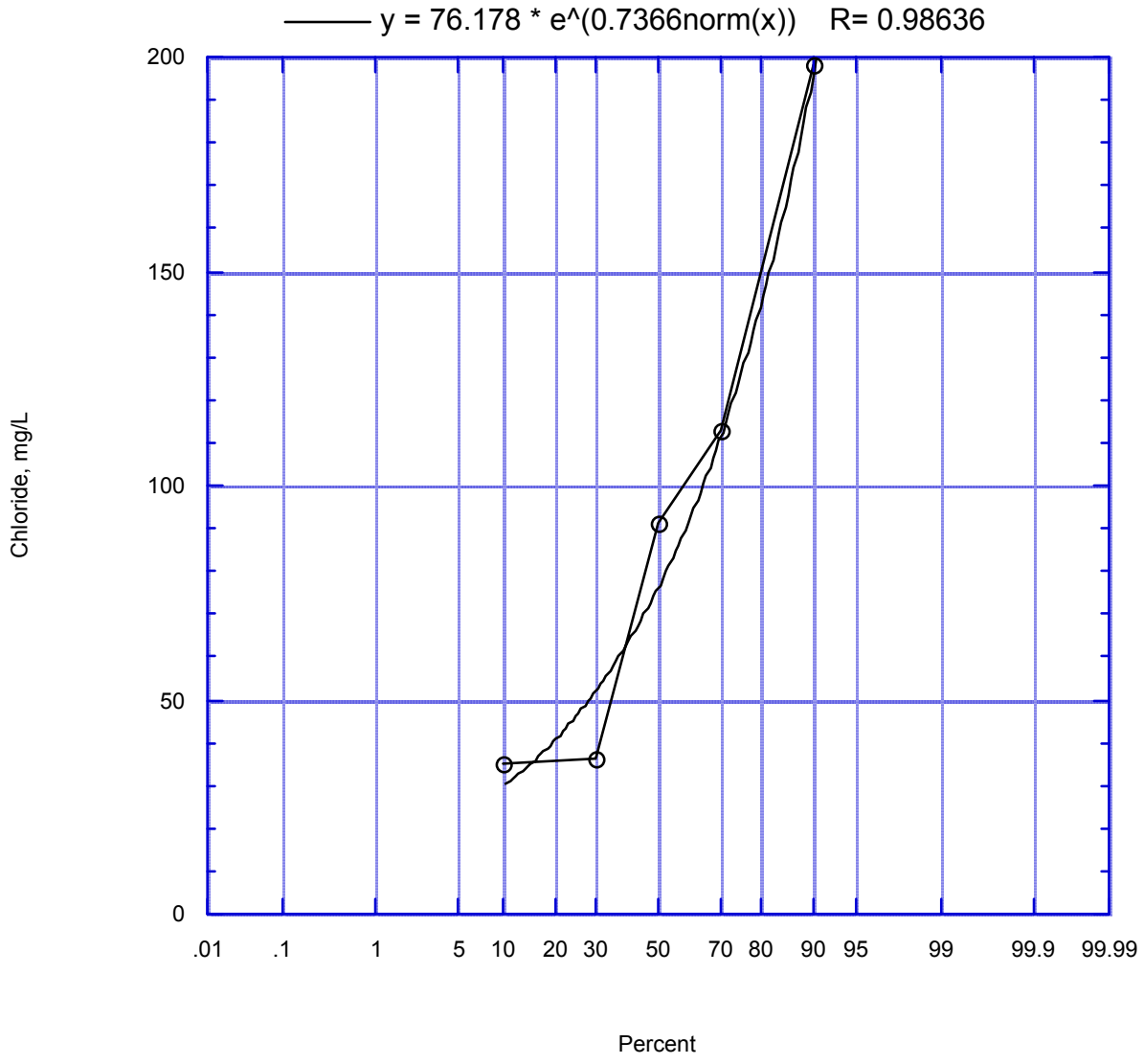


Figure 124. Frequency Distribution of Chloride in Stormwater Runoff form Open Space Land Use

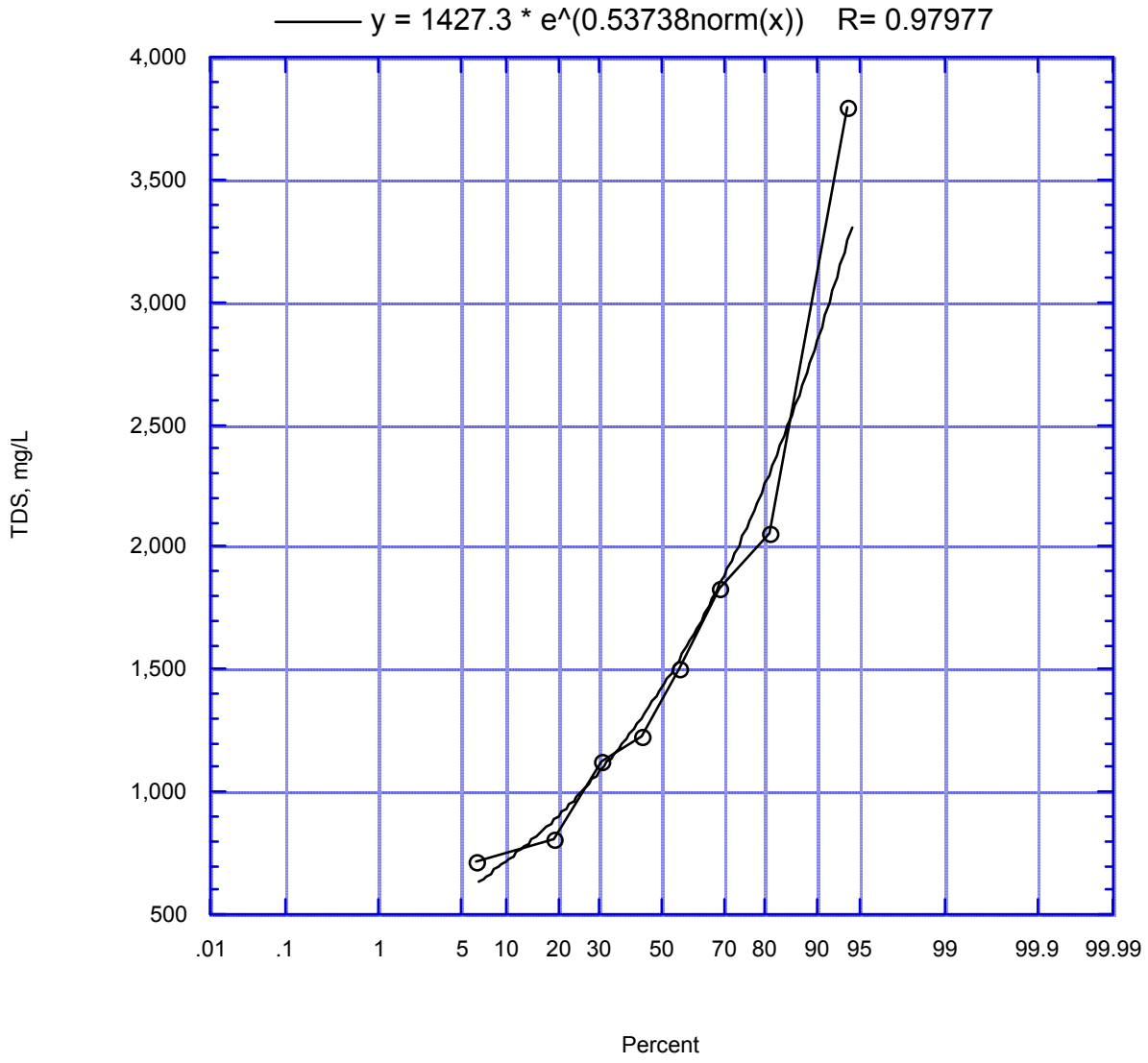


Figure 125. Frequency Distribution of TDS in Stormwater Runoff form Open Space Land Use

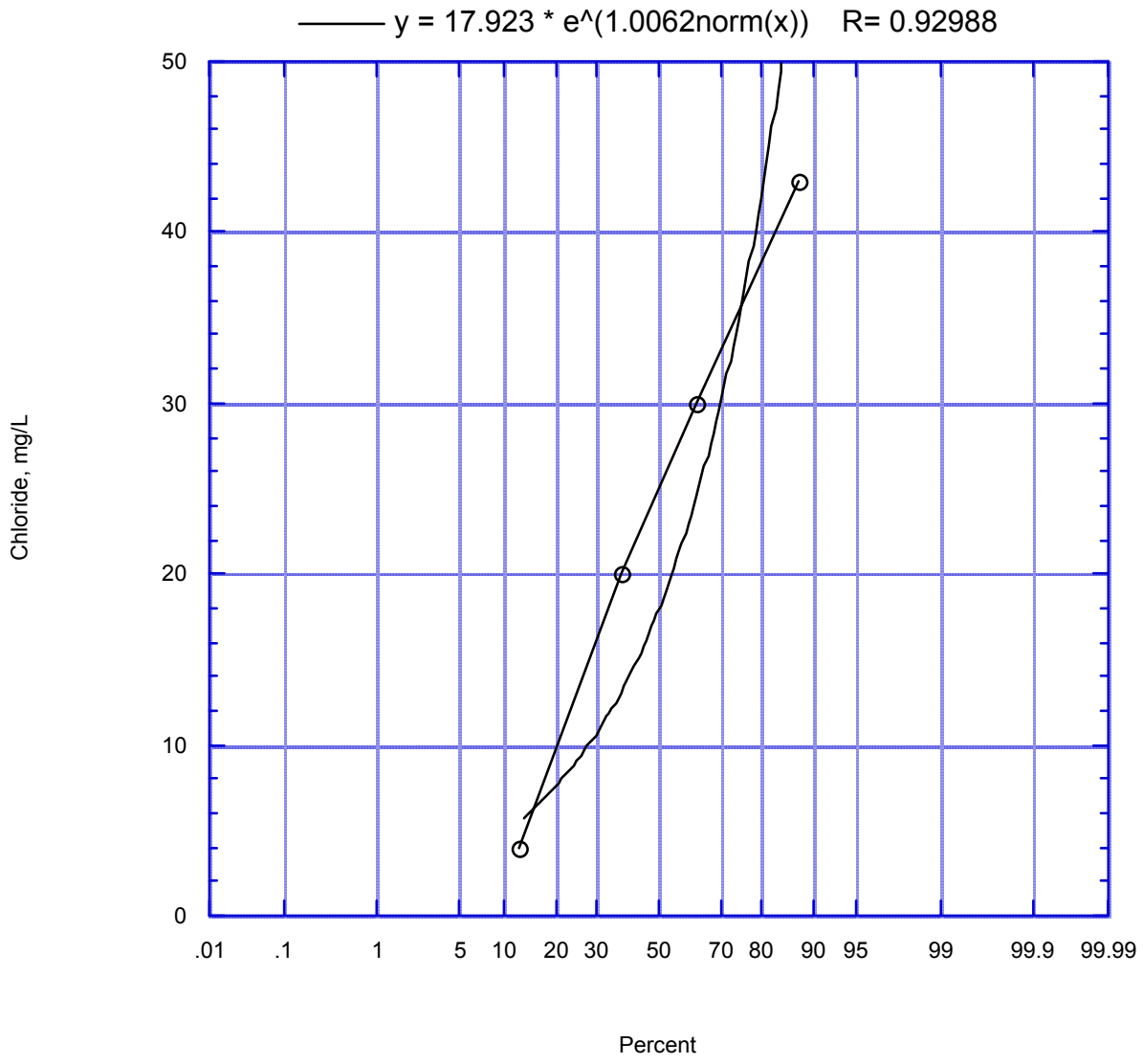


Figure 126. Frequency Distribution of Chloride in Stormwater Runoff form Industrial Land Use

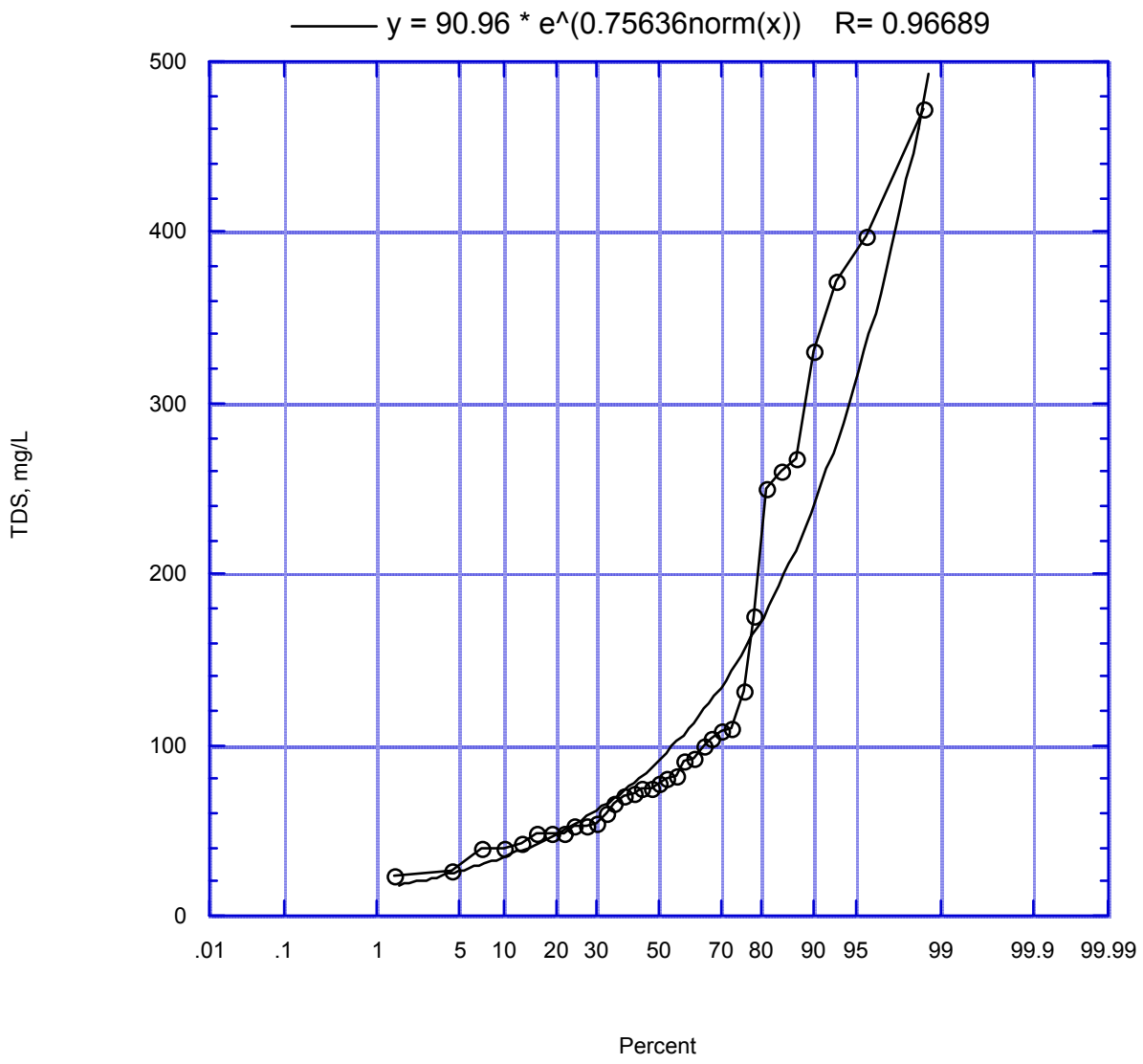


Figure 127. Frequency Distribution of TDS in Stormwater Runoff form Industrial Land Use

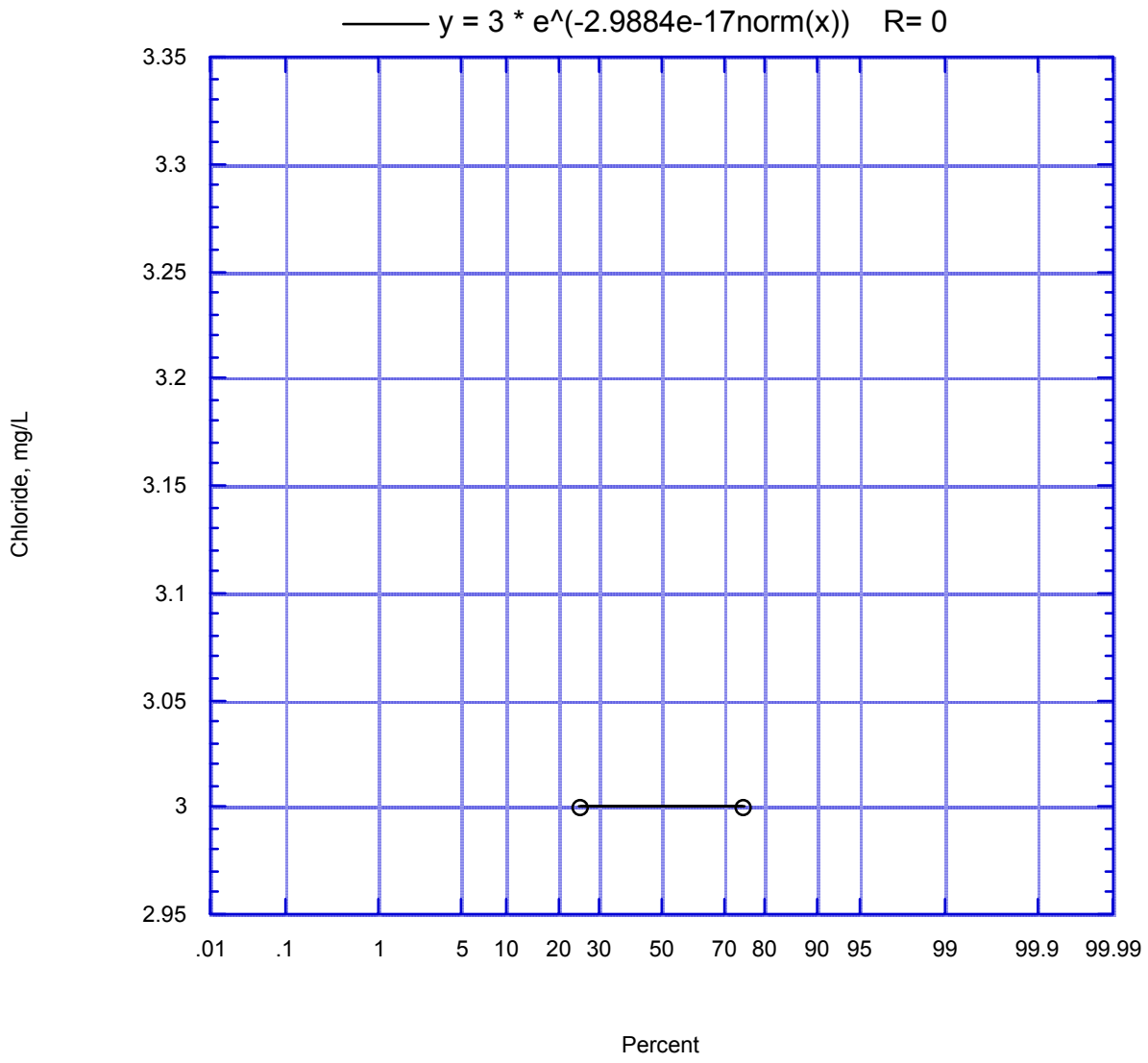


Figure 128. Frequency Distribution of Chloride in Stormwater Runoff form Commercial Land Use

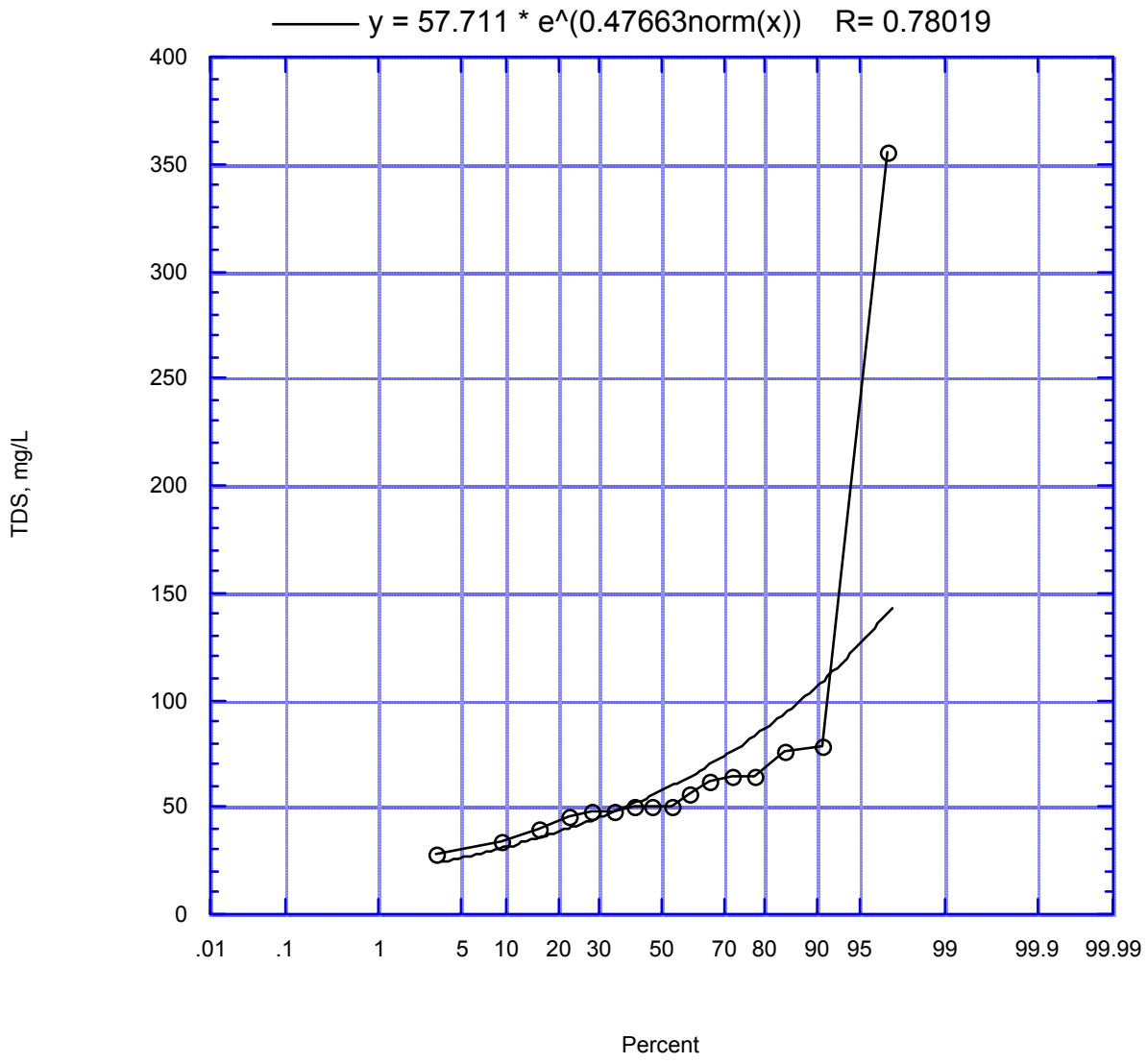


Figure 129. Frequency Distribution of TDS in Stormwater Runoff form Commercial Land Use

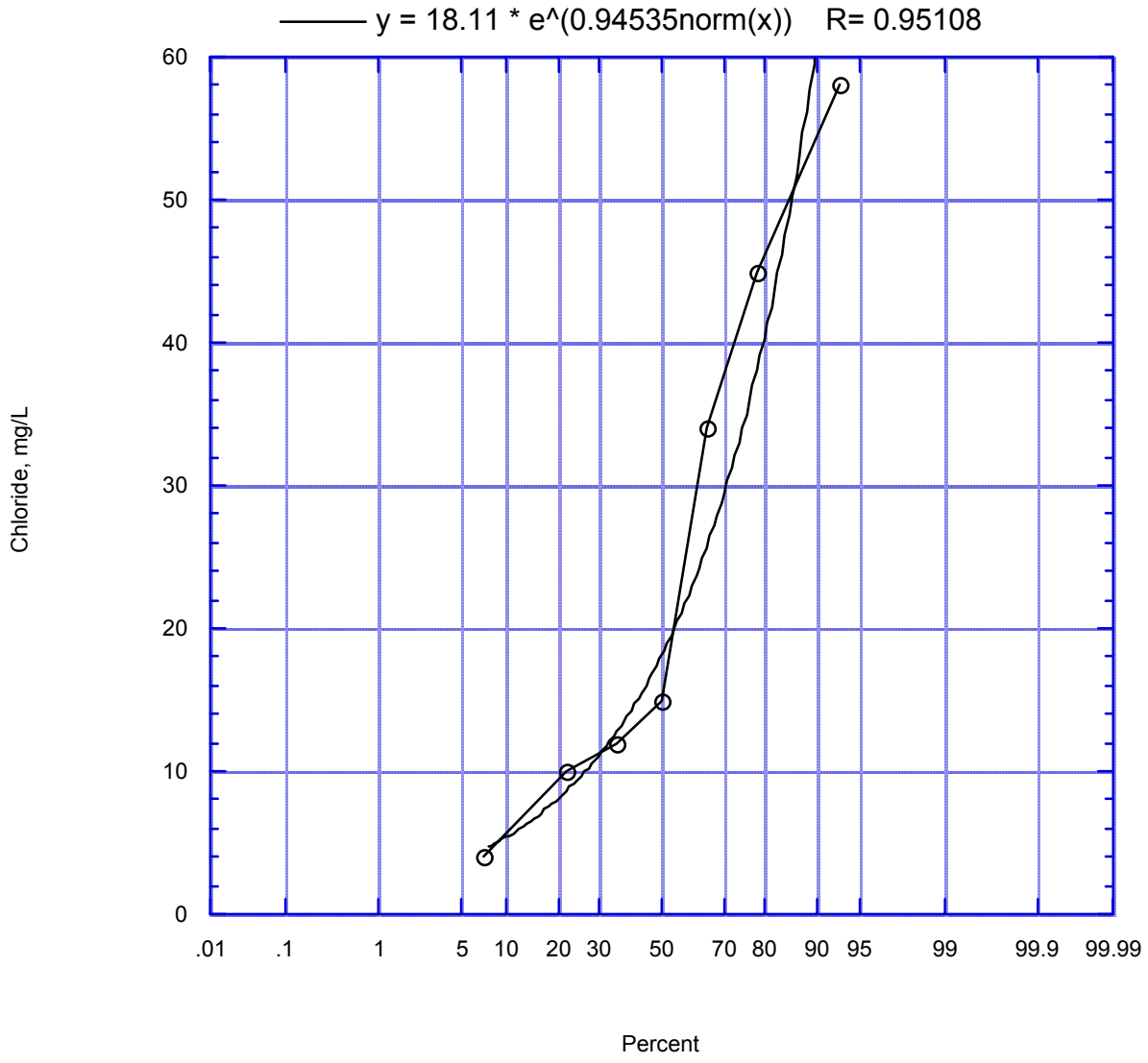


Figure 130. Frequency Distribution of Chloride in Stormwater Runoff form Residential Land Use

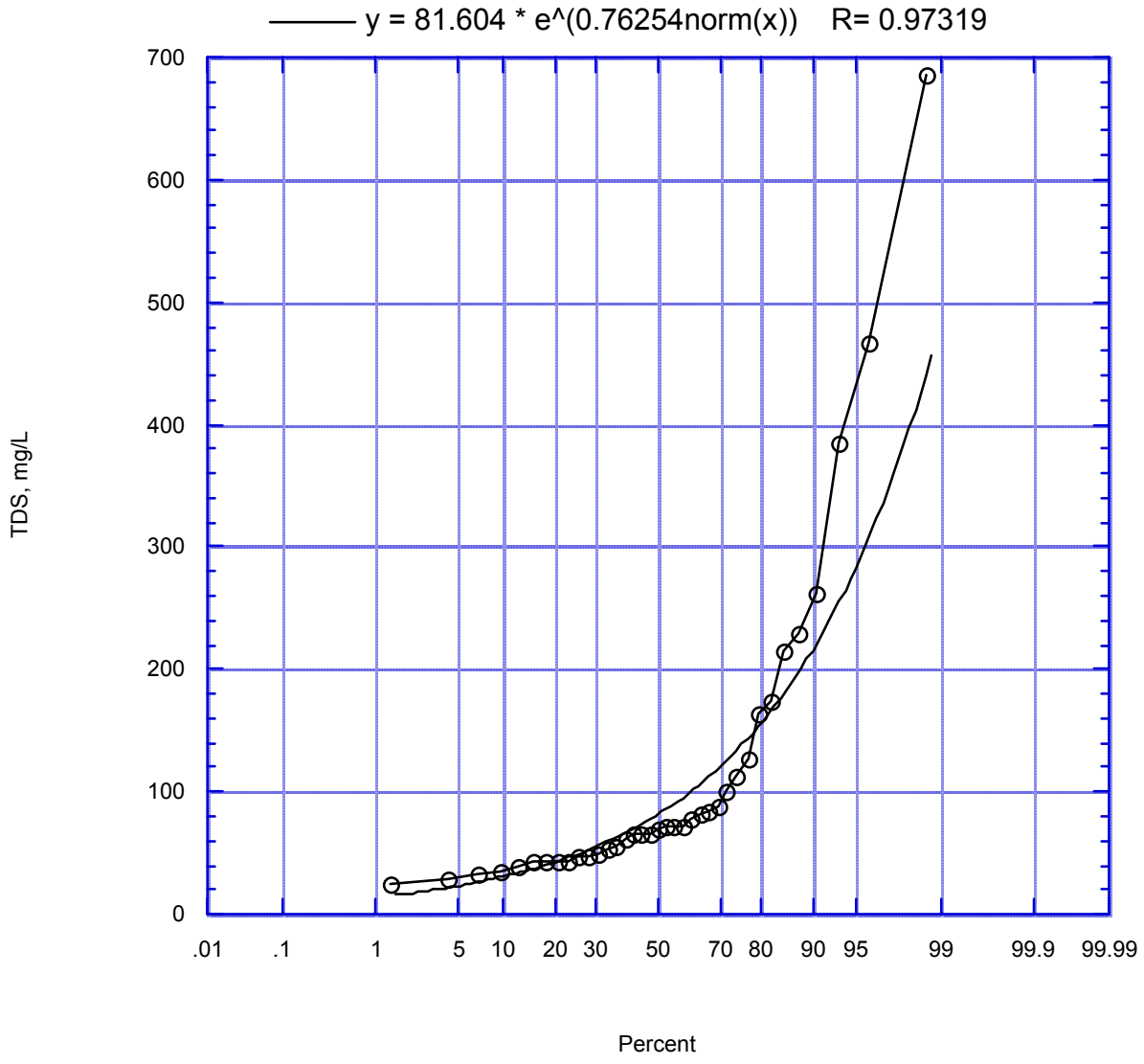


Figure 131. Frequency Distribution of TDS in Stormwater Runoff form Residential Land Use

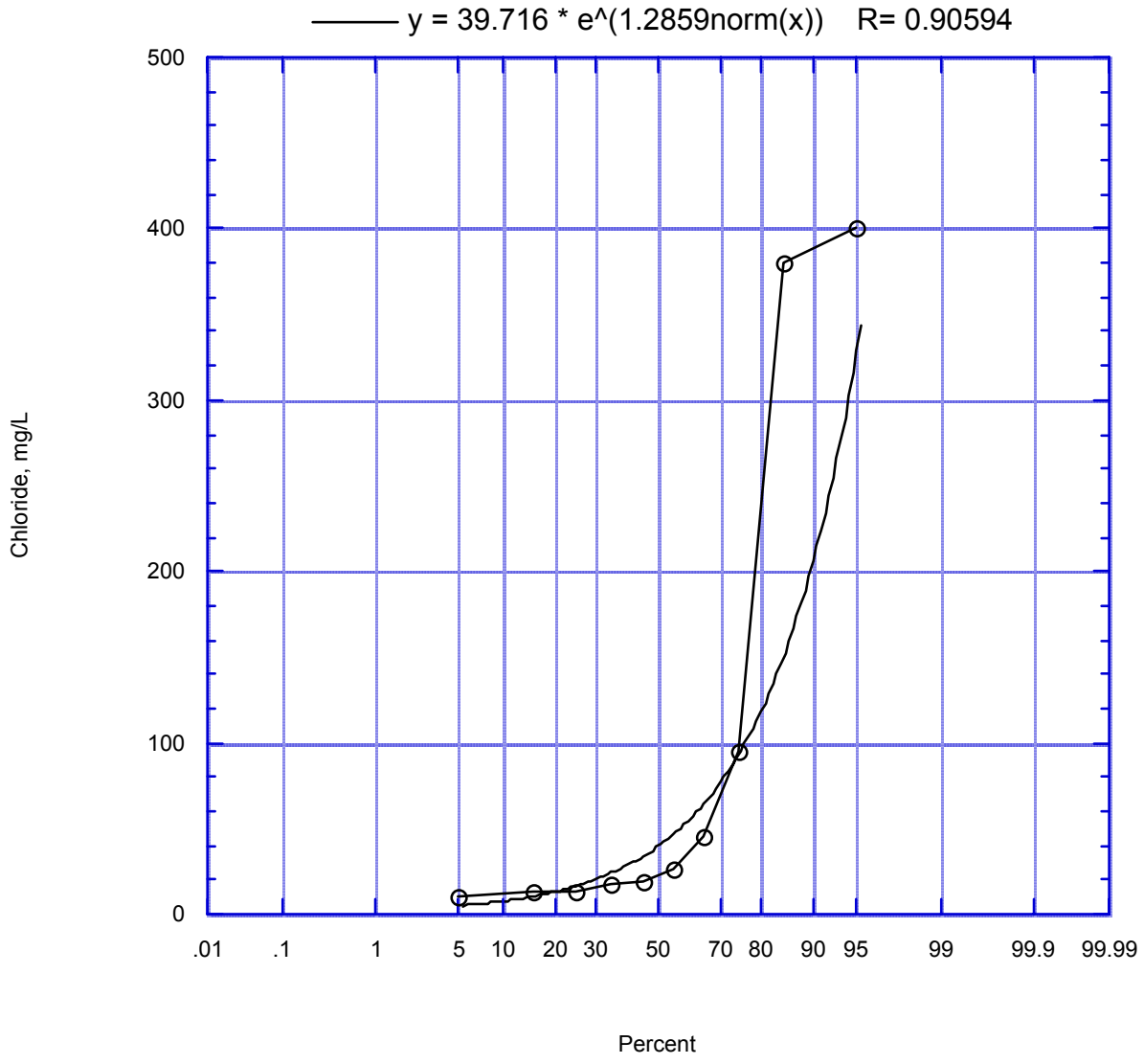


Figure 132. Frequency Distribution of Chloride in Stormwater Runoff form Mixed-use Land Use

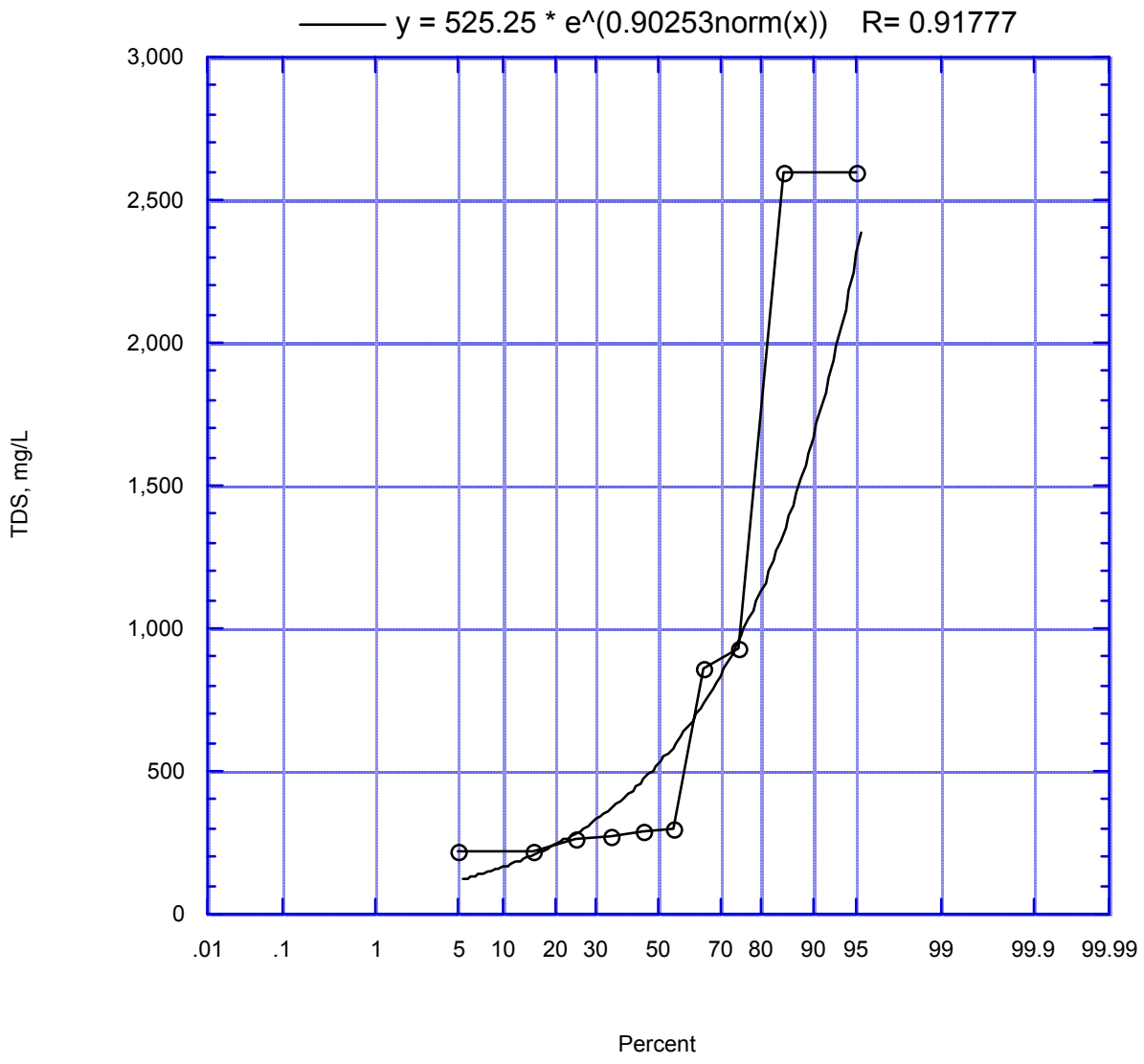


Figure 133. Frequency Distribution of TDS in Stormwater Runoff form Mixed-use Land Use

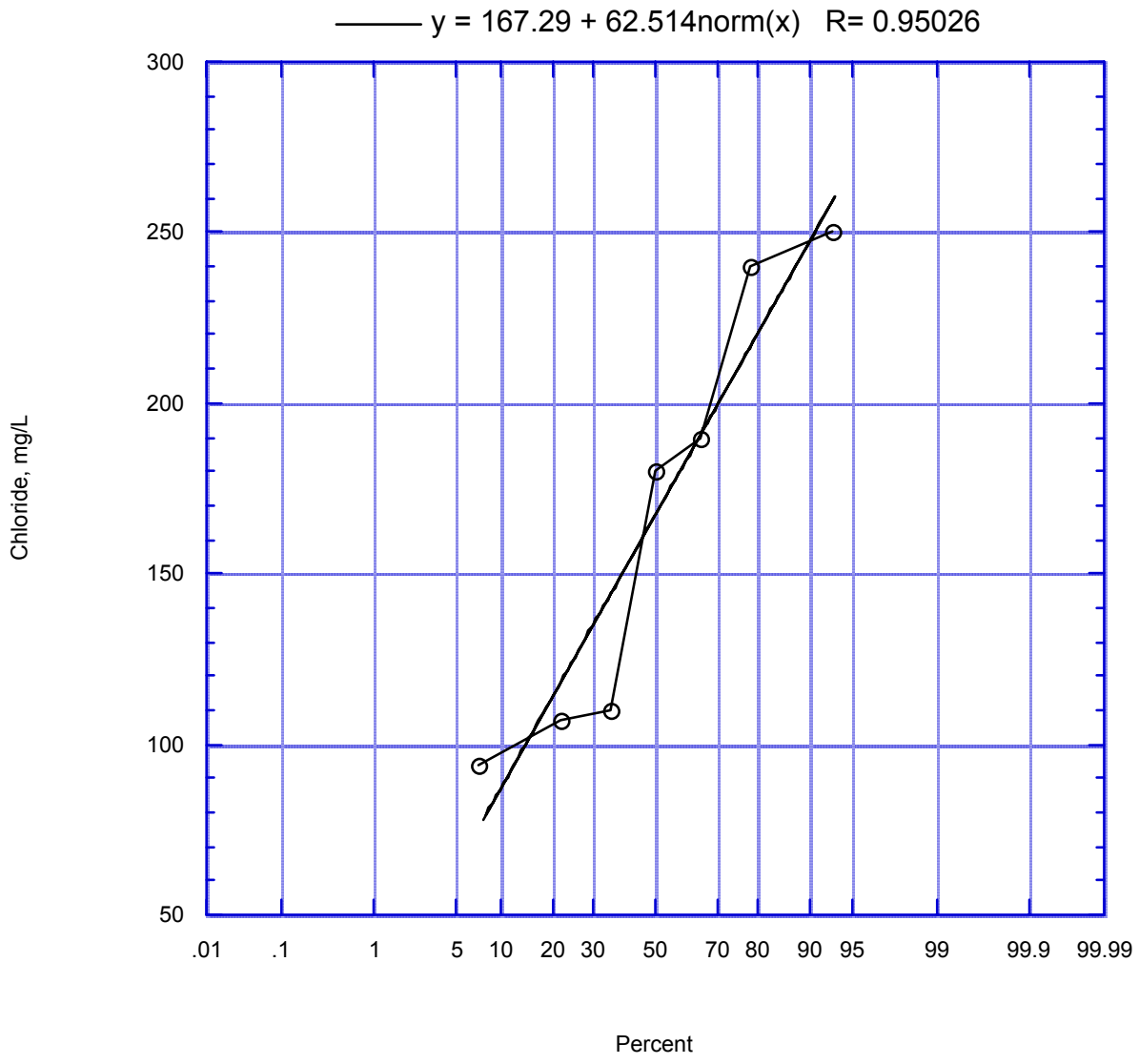


Figure 134. Frequency Distribution of Chloride in Non-stormwater Runoff form Agricutural Land Use

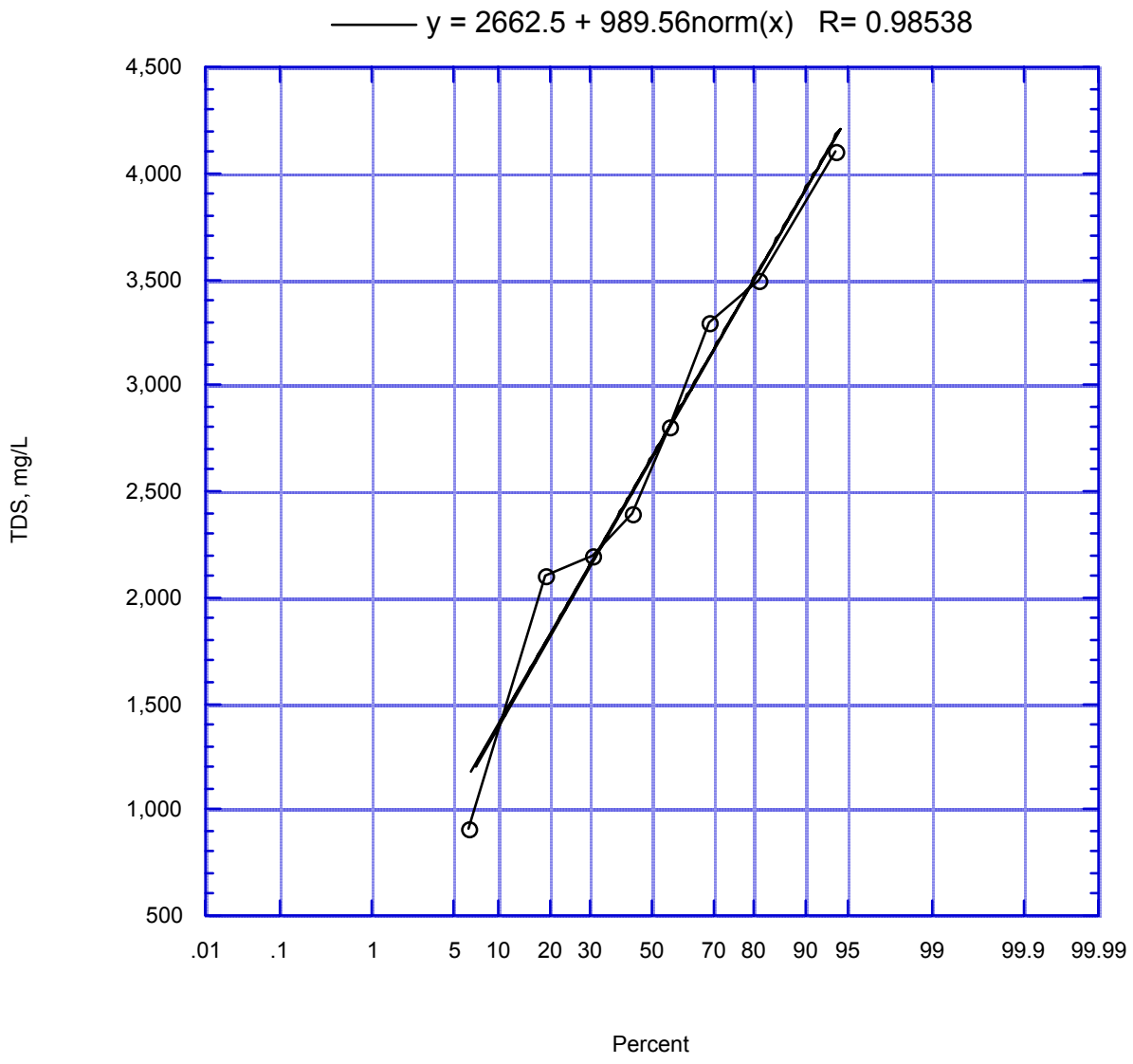


Figure 135. Frequency Distribution of TDS in Non-stormwater Runoff form Agricutural Land Use

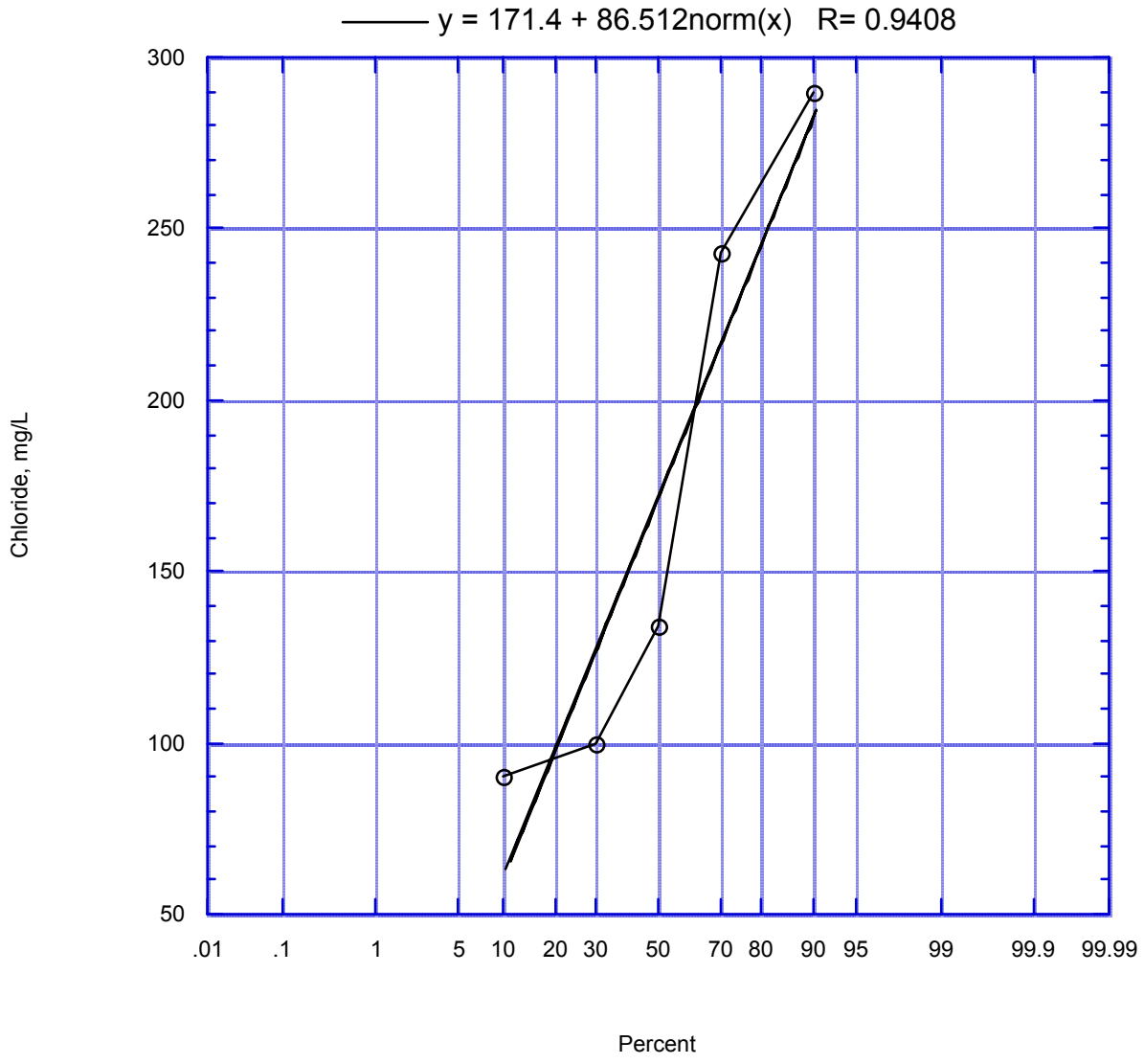


Figure 136. Frequency Distribution of Chloride in Non-stormwater Runoff form Open Space Use

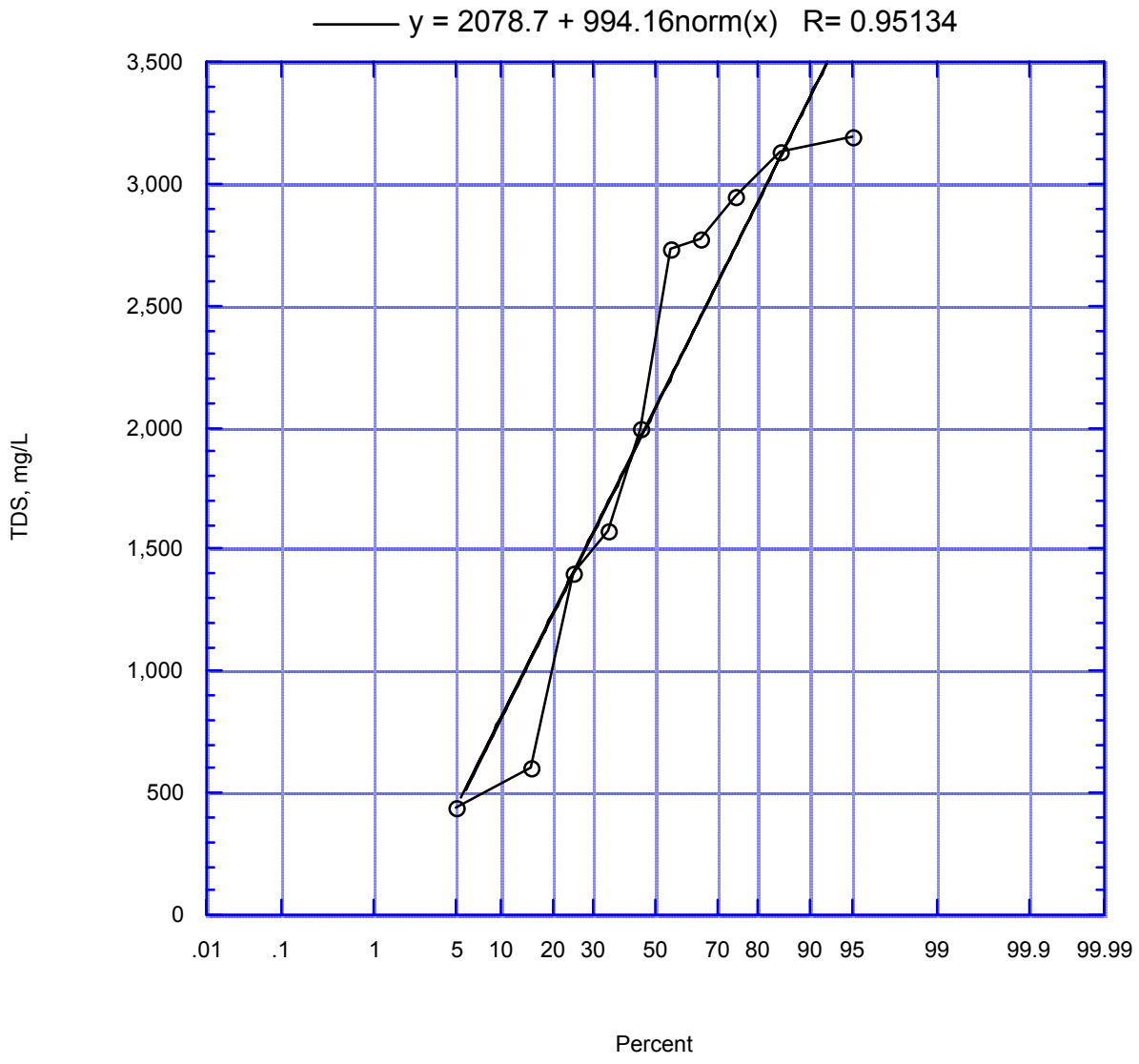


Figure 137. Frequency Distribution of TDS in Non-stormwater Runoff form Open Space Use

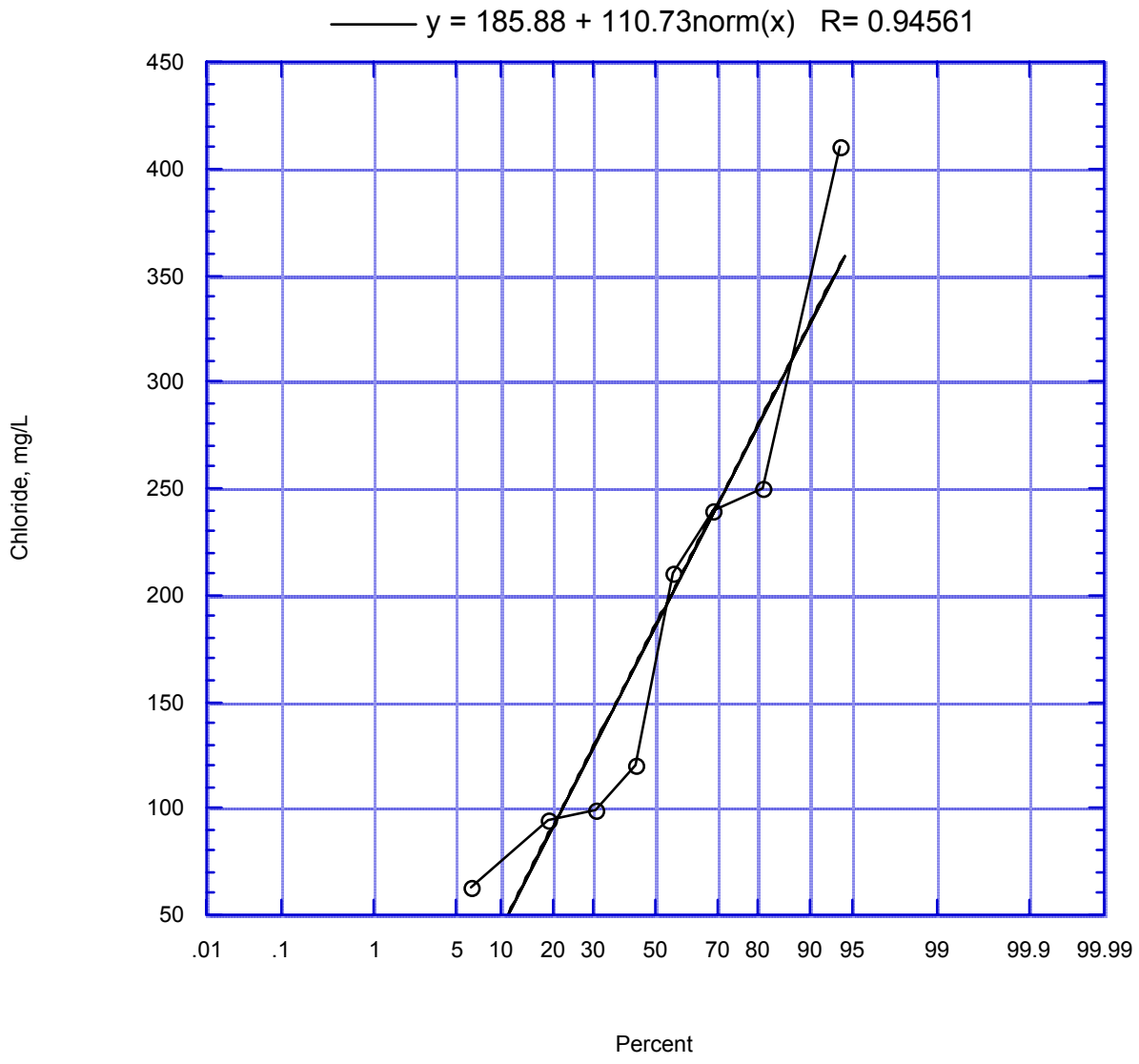


Figure 138. Frequency Distribution of Chloride in Non-stormwater Runoff form Mixed-use Use

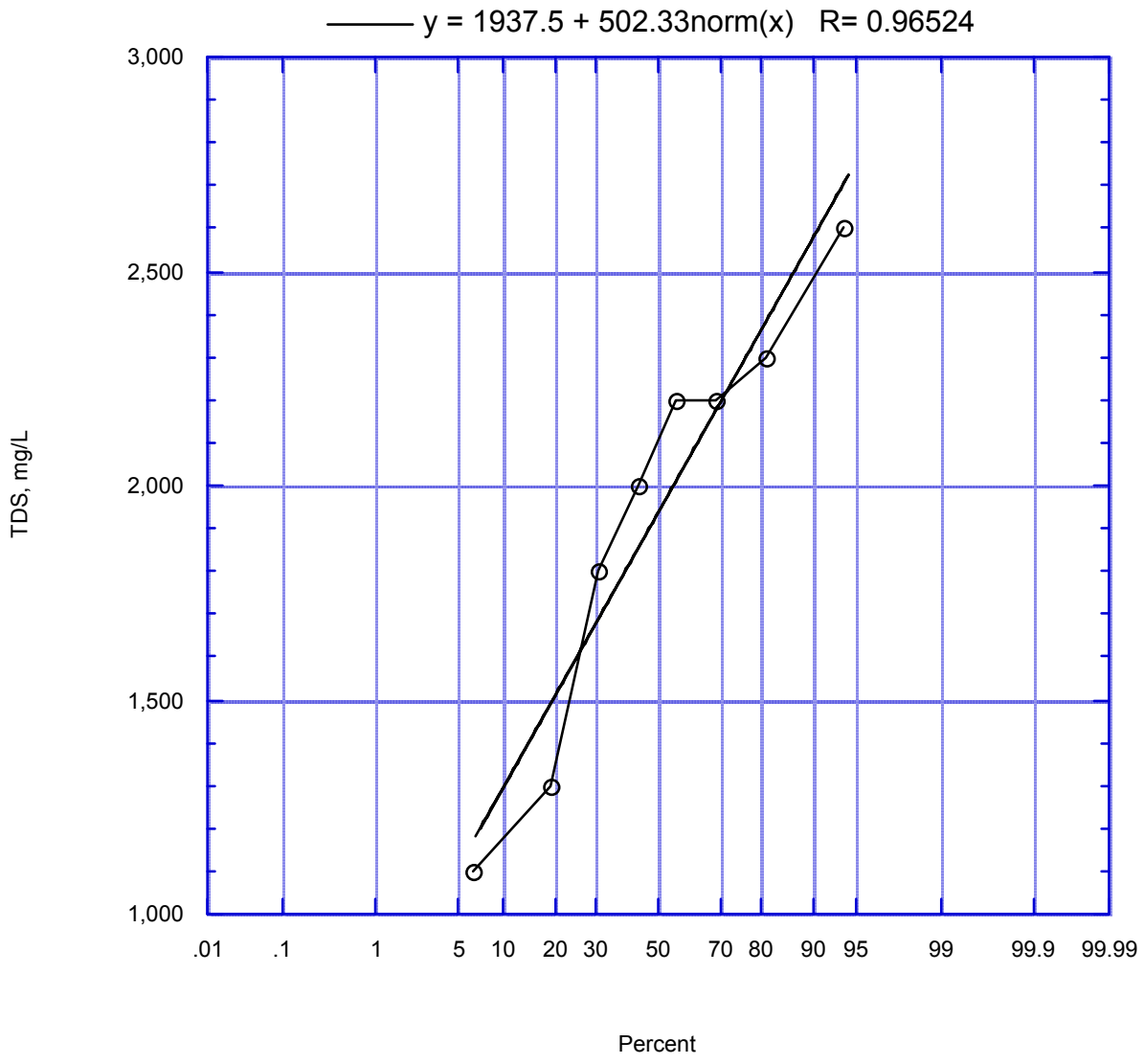


Figure 139. Frequency Distribution of TDS in Non-stormwater Runoff form Mixed-use Use

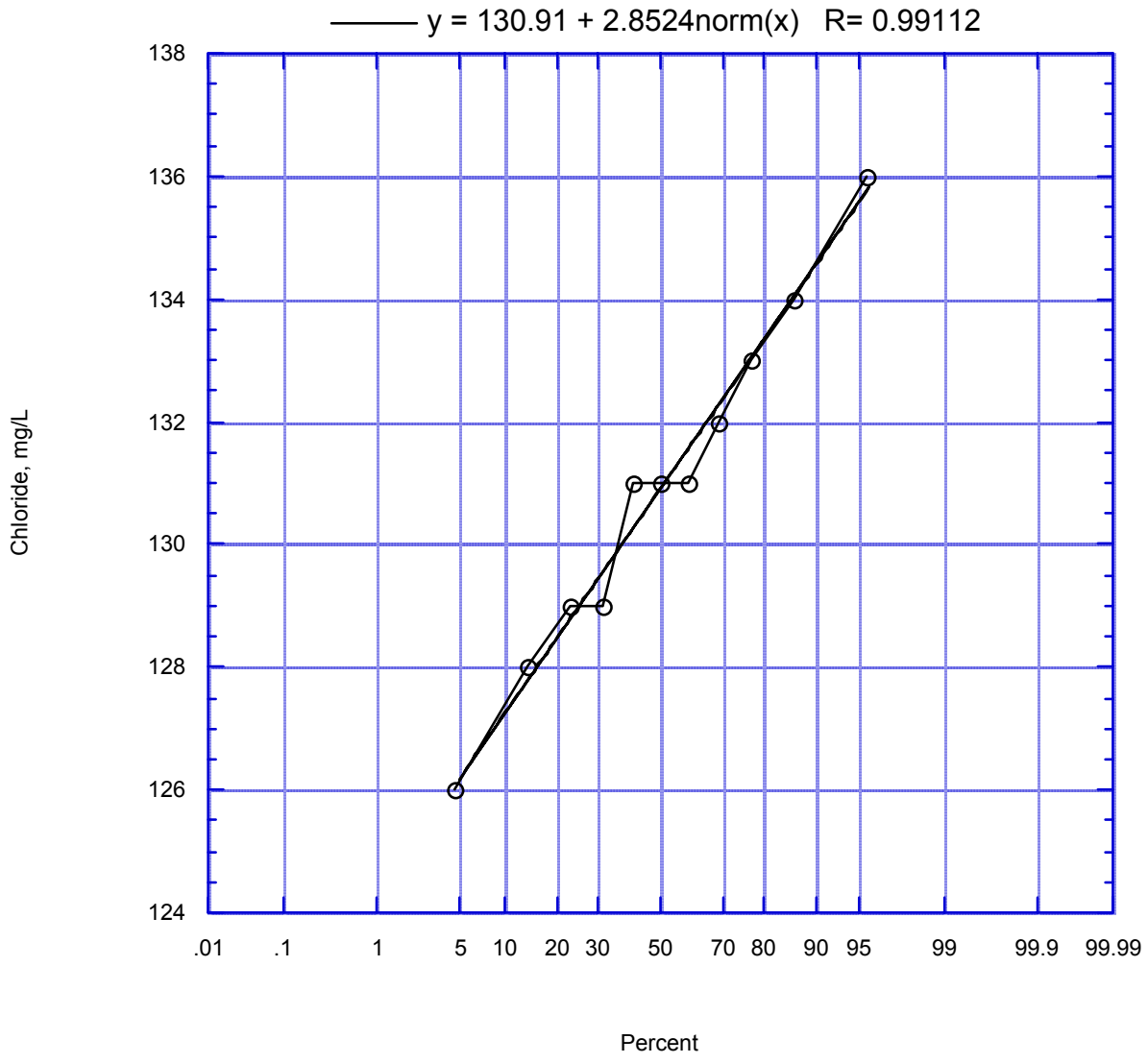


Figure 140. Frequency Distribution of Chloride in Pumped Groundwater Discharge

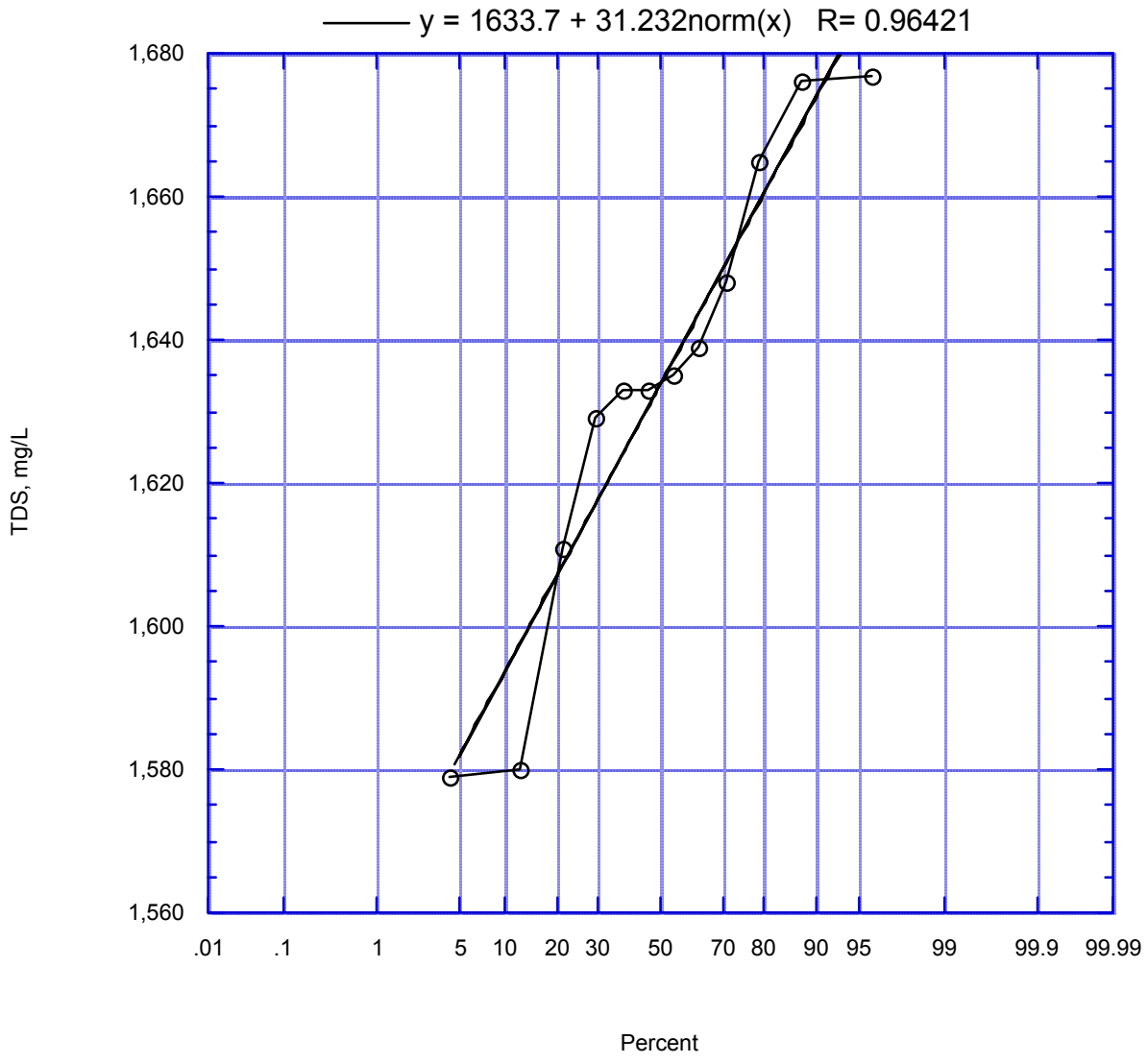


Figure 141. Frequency Distribution of TDS in Pumped Groundwater Discharge

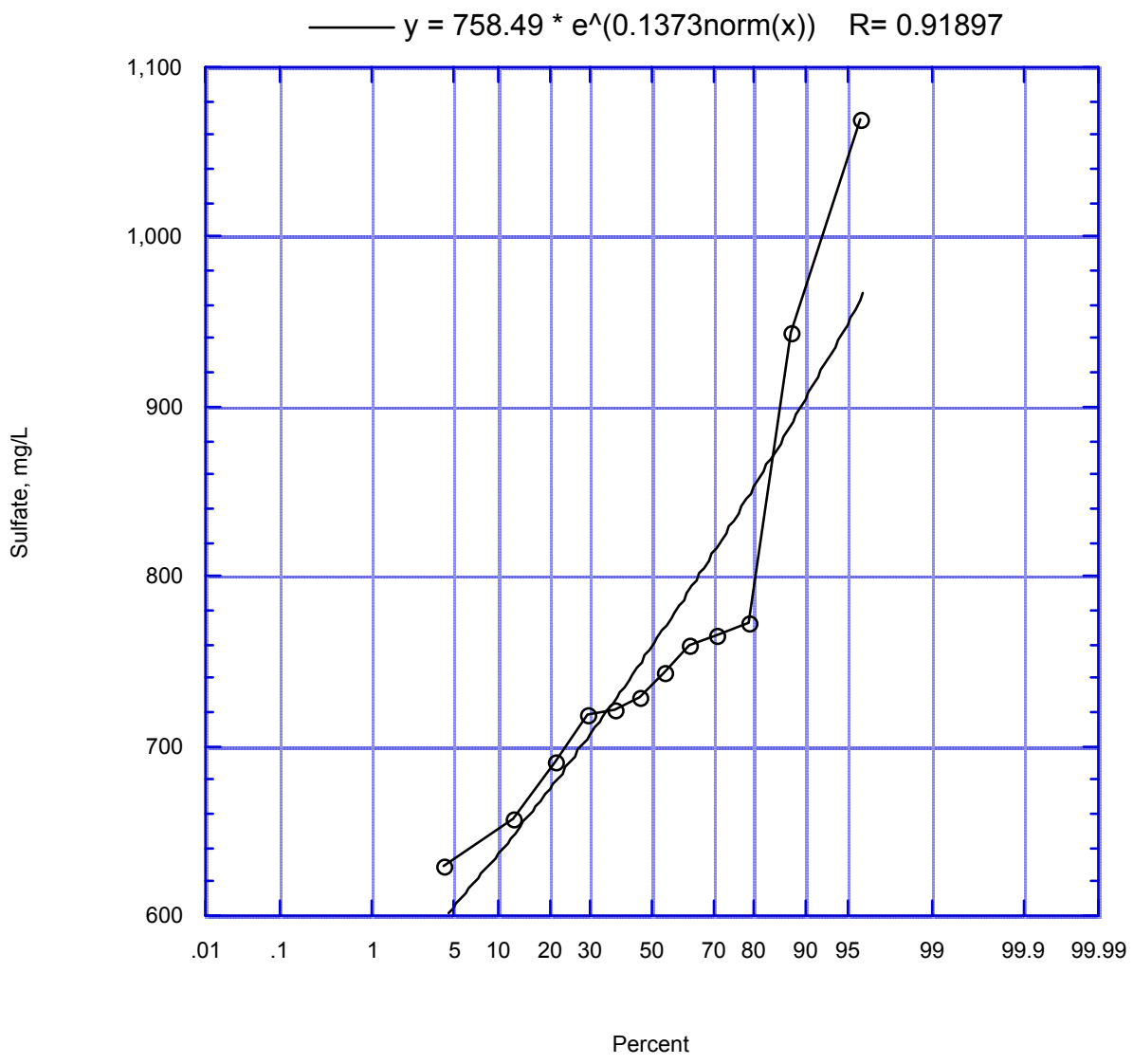


Figure 142. Frequency Distribution of Sulfate in Pumped Groundwater Discharge

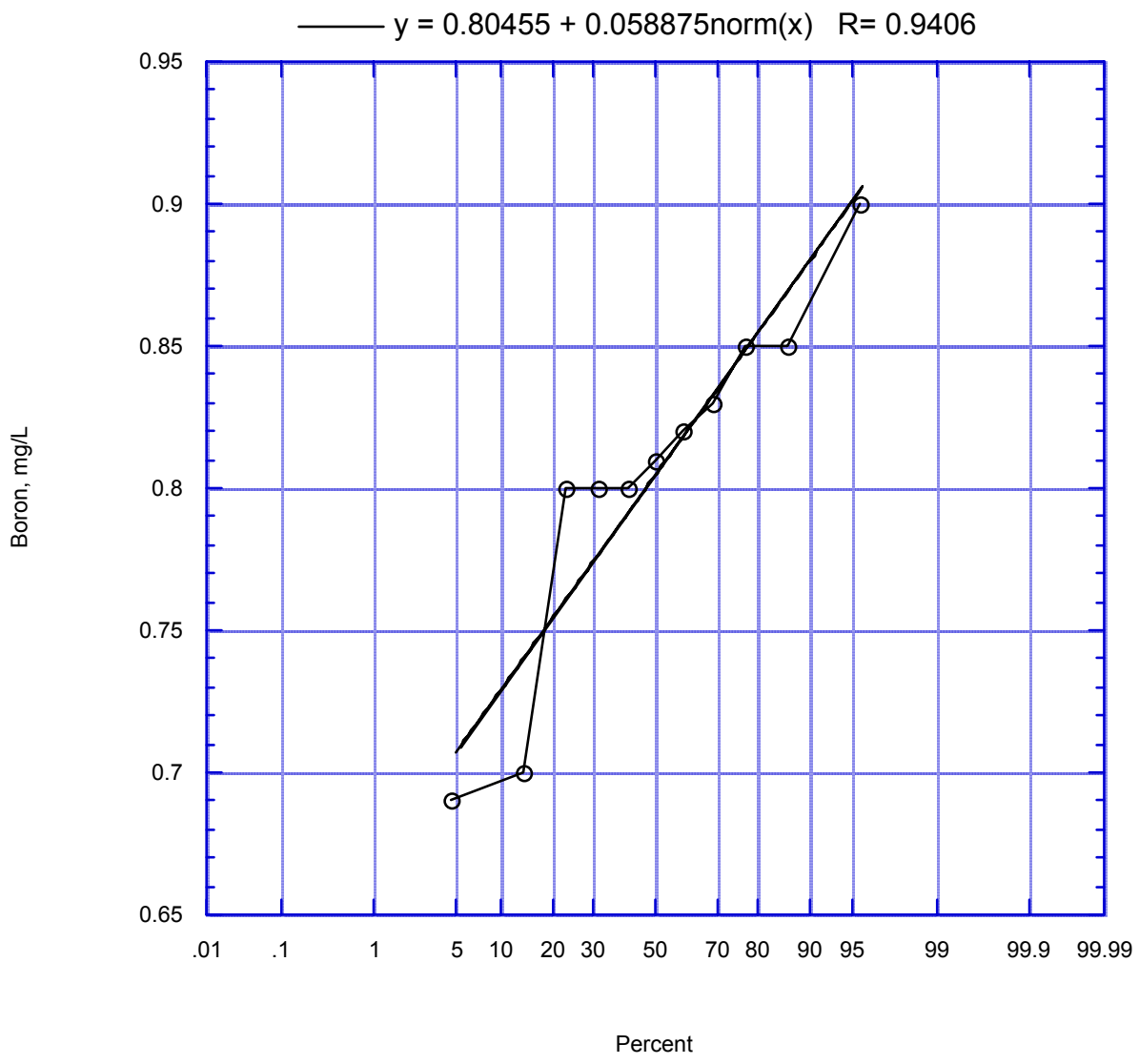


Figure 143. Frequency Distribution of Boron in Pumped Groundwater Discharge

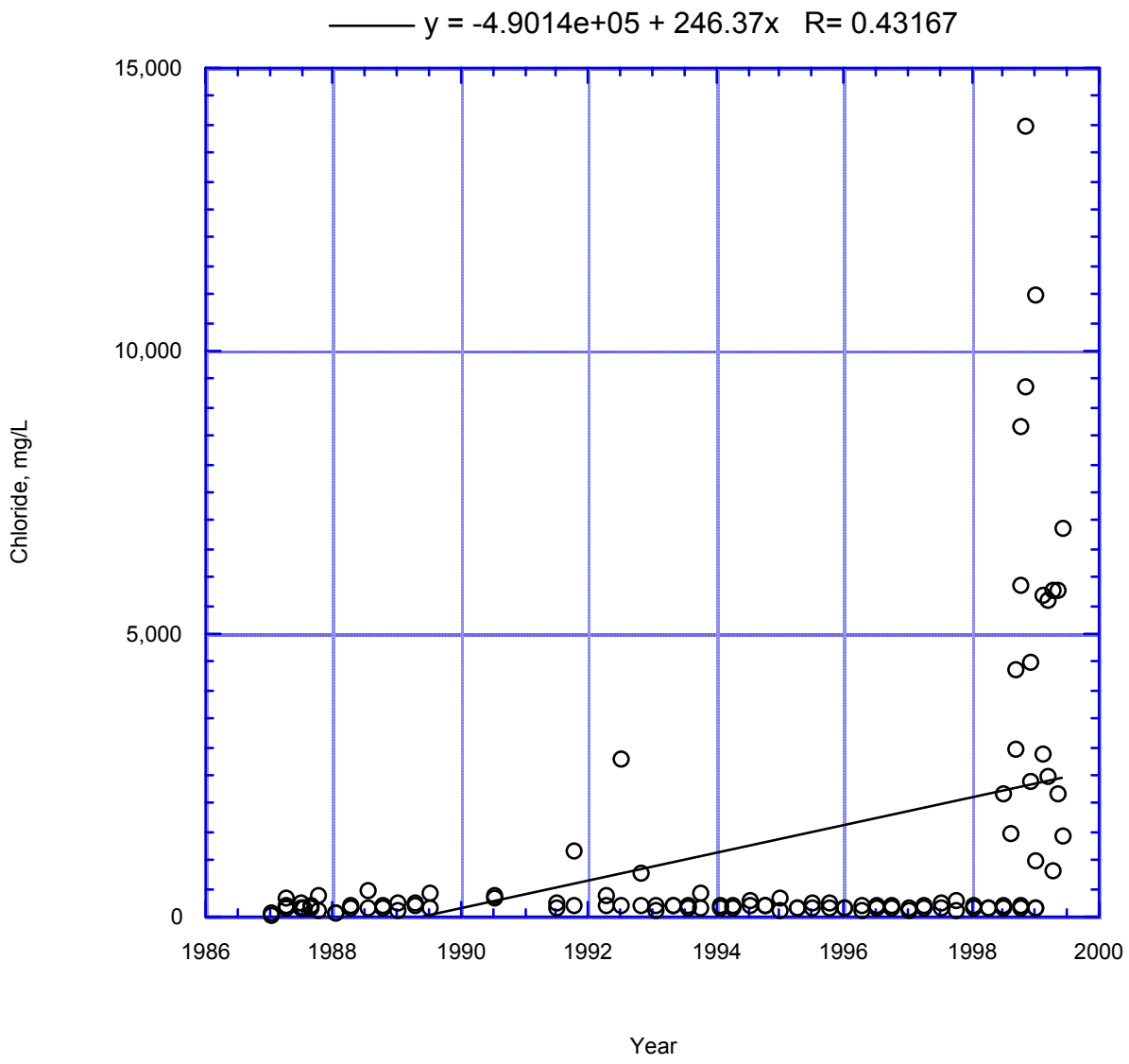


Figure 144. Reach 2 Chloride vs. Time

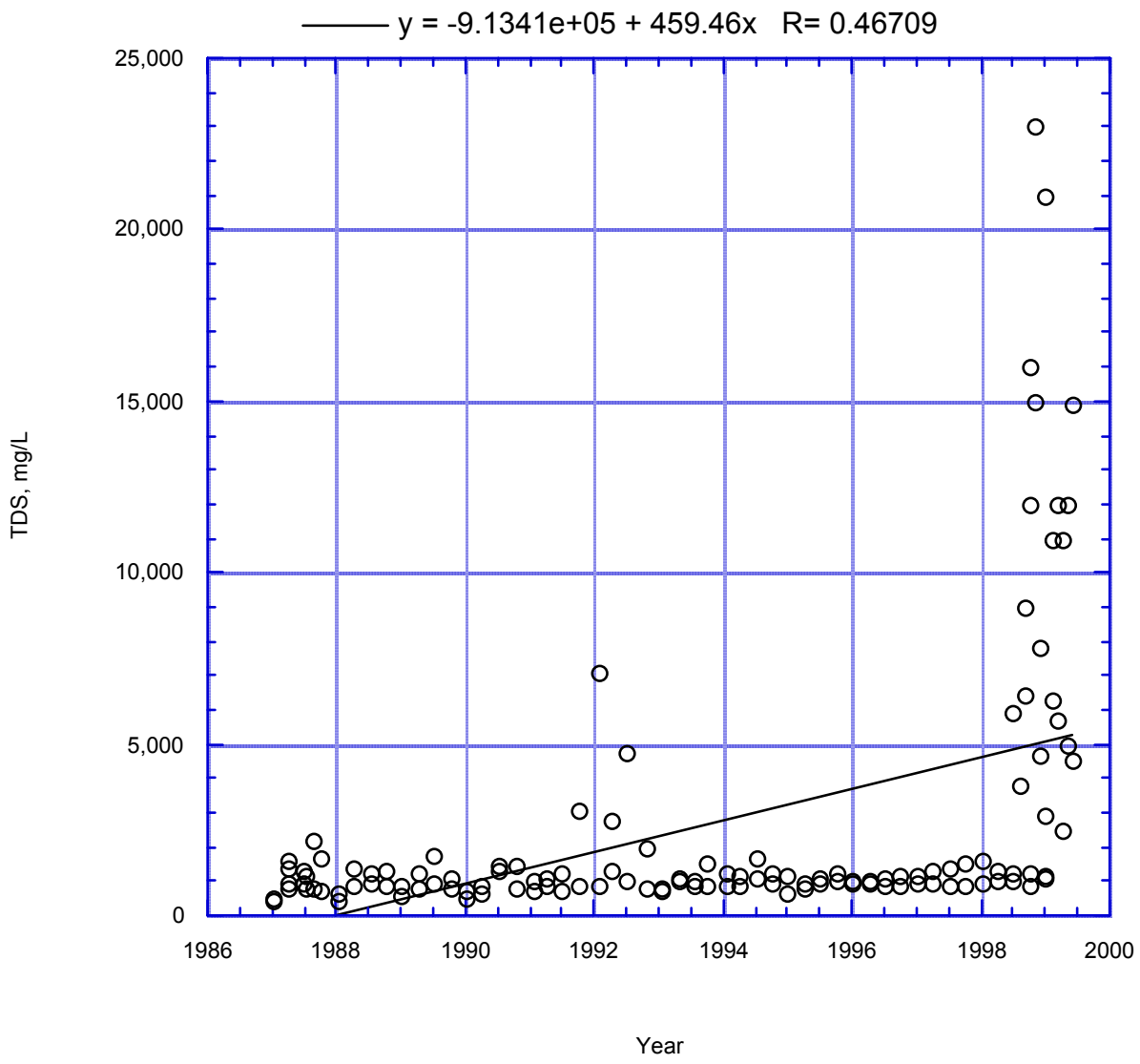


Figure 145. Reach 2 TDS vs. Time

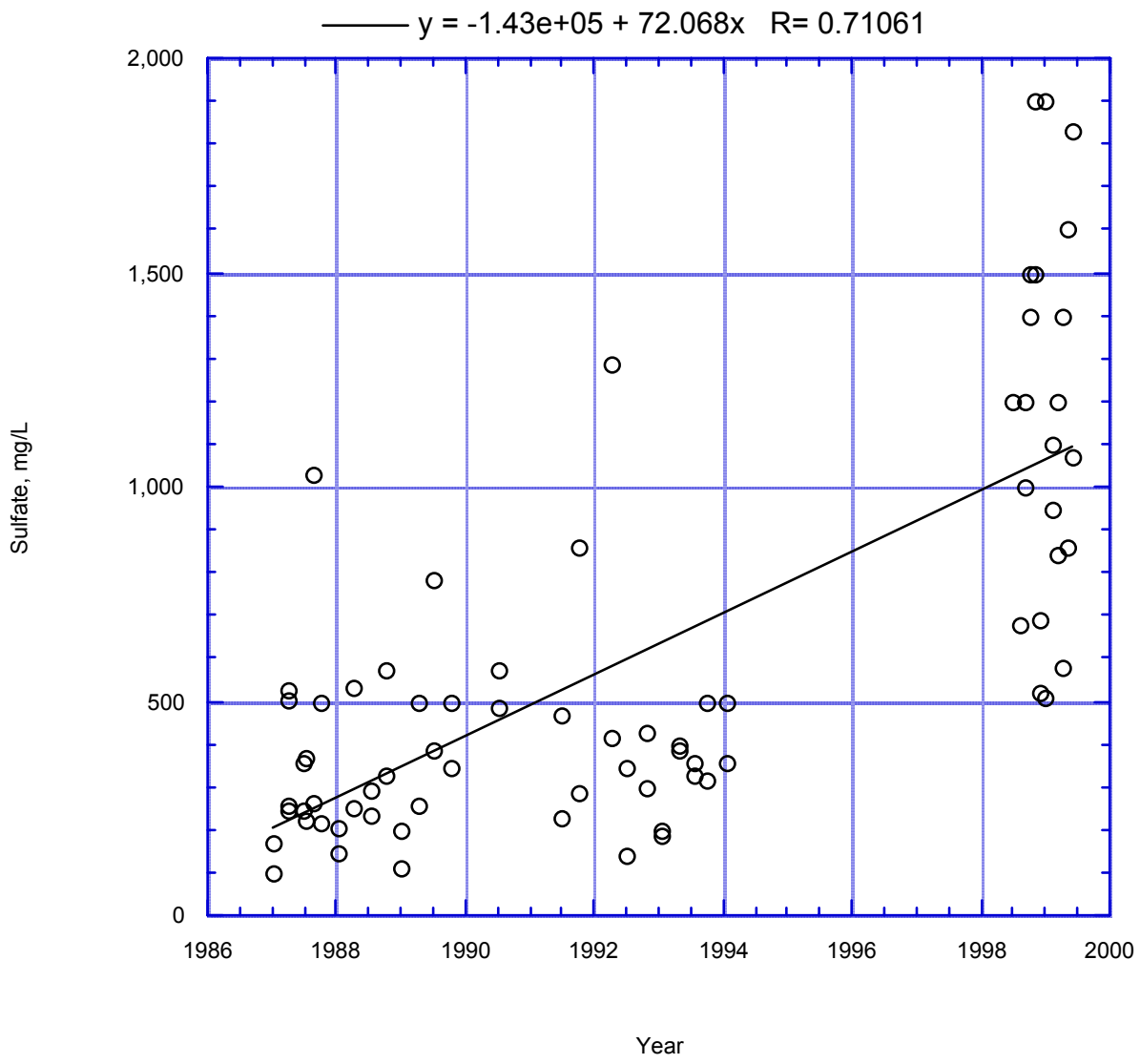


Figure 146. Reach 2 Sulfate vs. Time

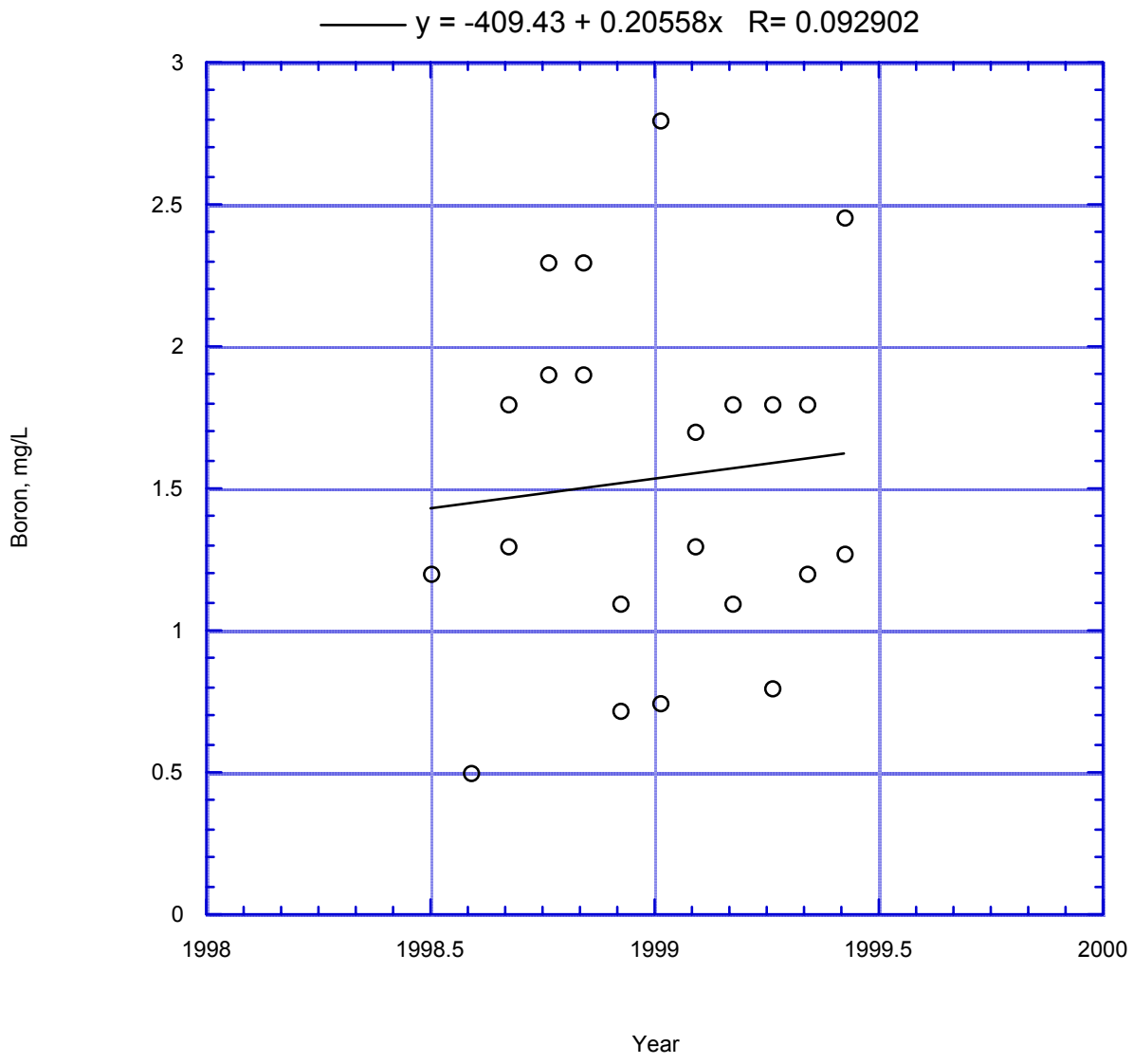


Figure 147. Reach 2 Boron vs. Time

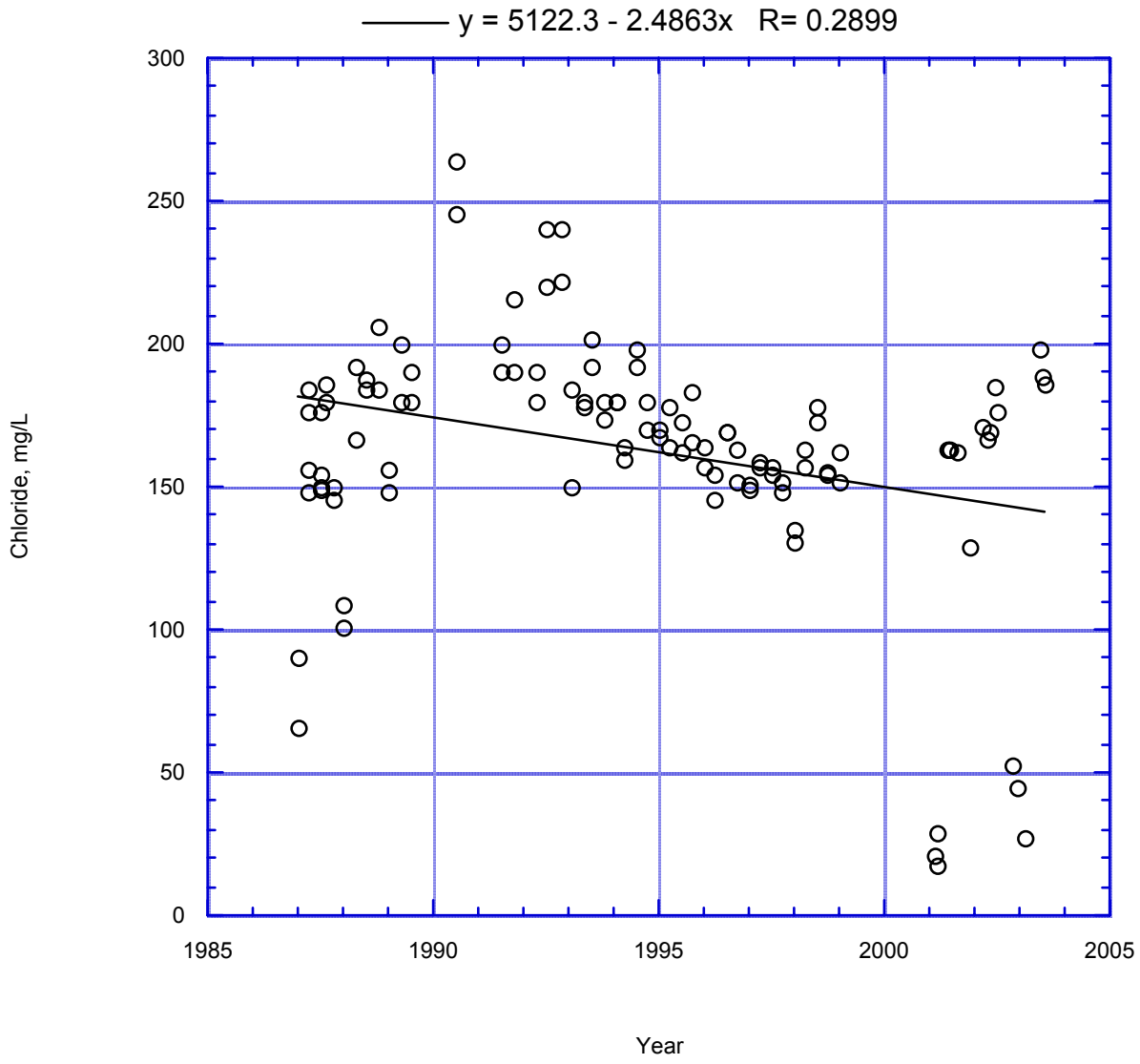


Figure 148. Reach 3 Chloride vs. Time

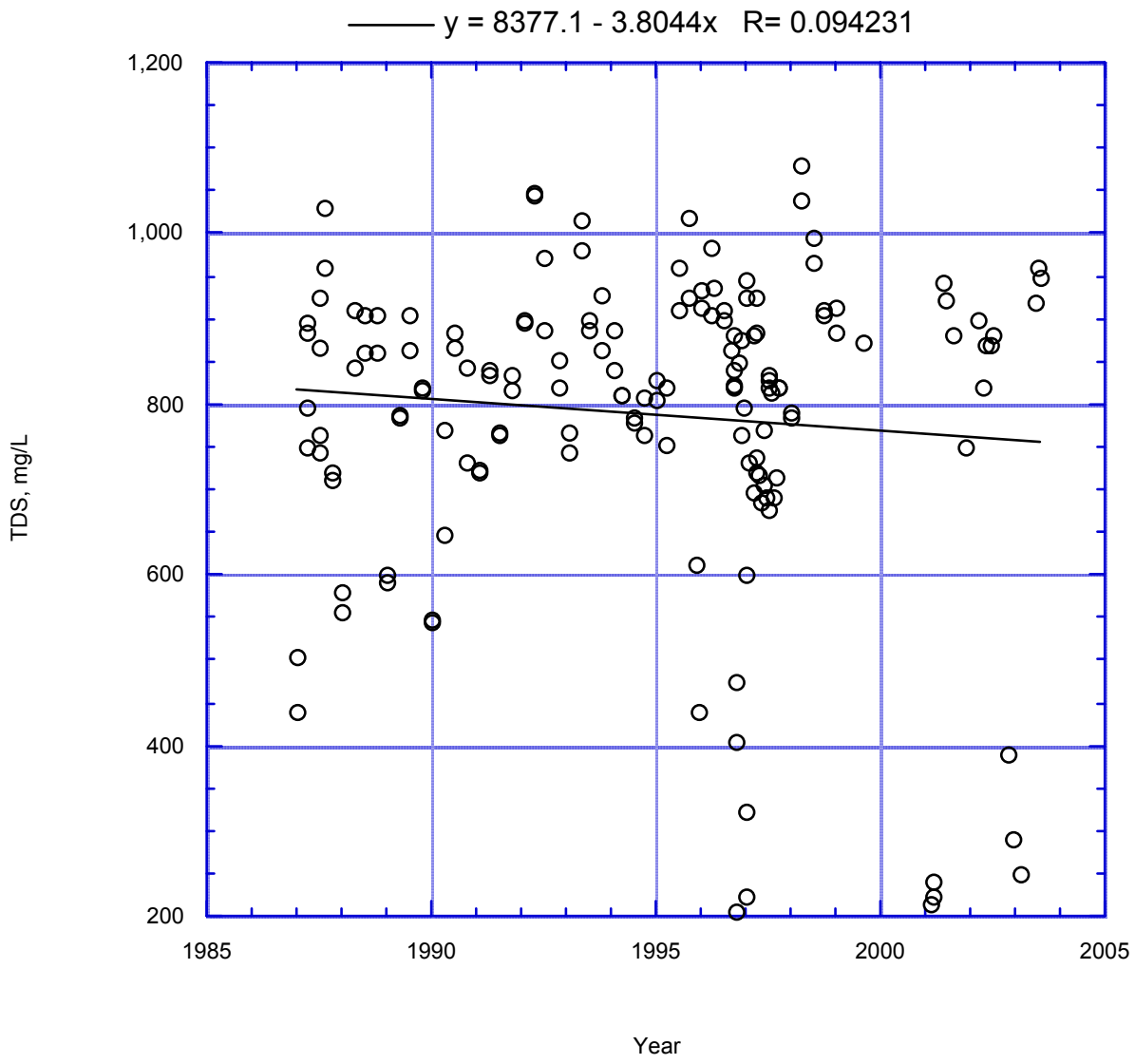


Figure 149. Reach 3 TDS vs. Time

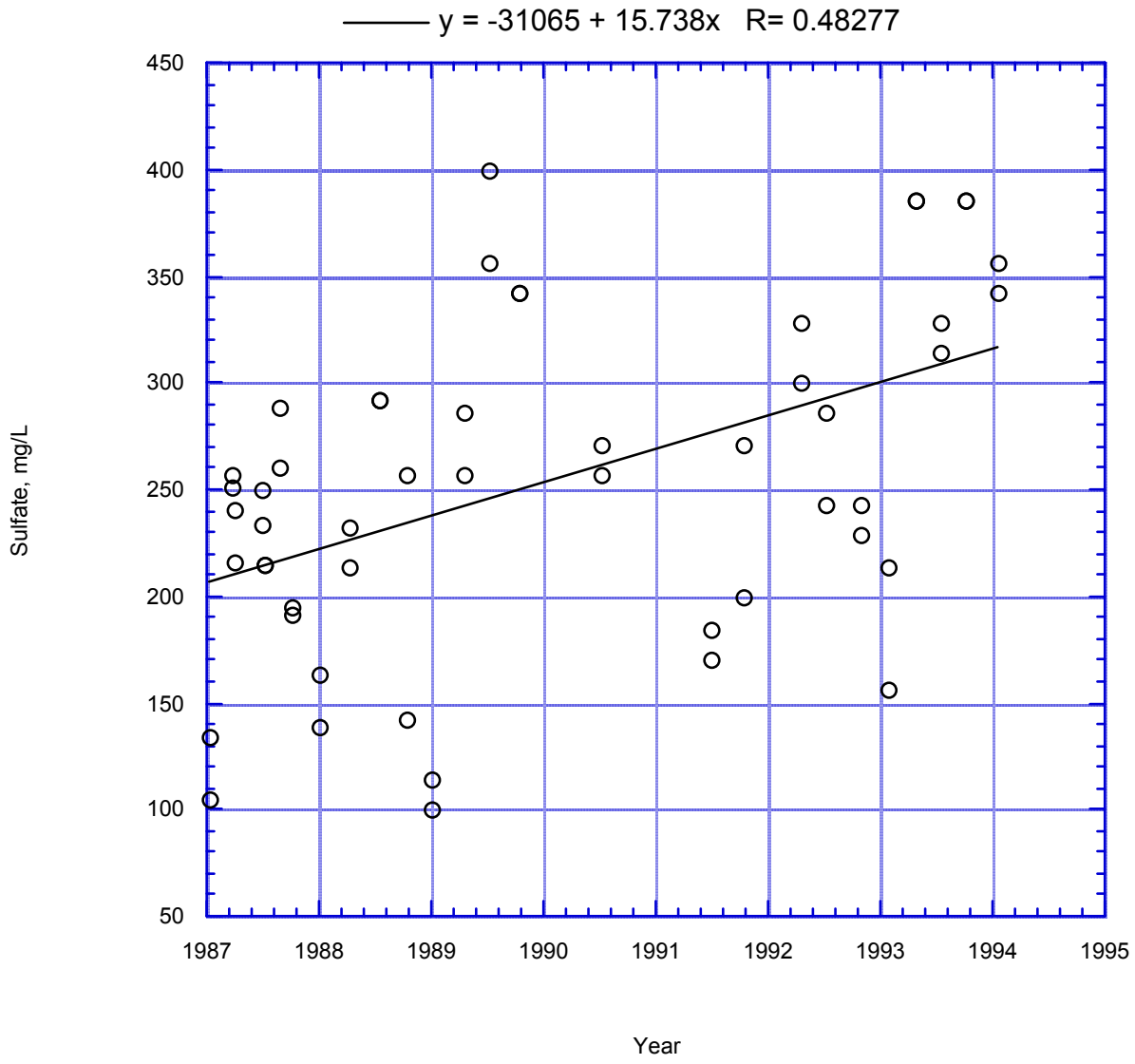


Figure 150. Reach 3 Sulfate vs. Time

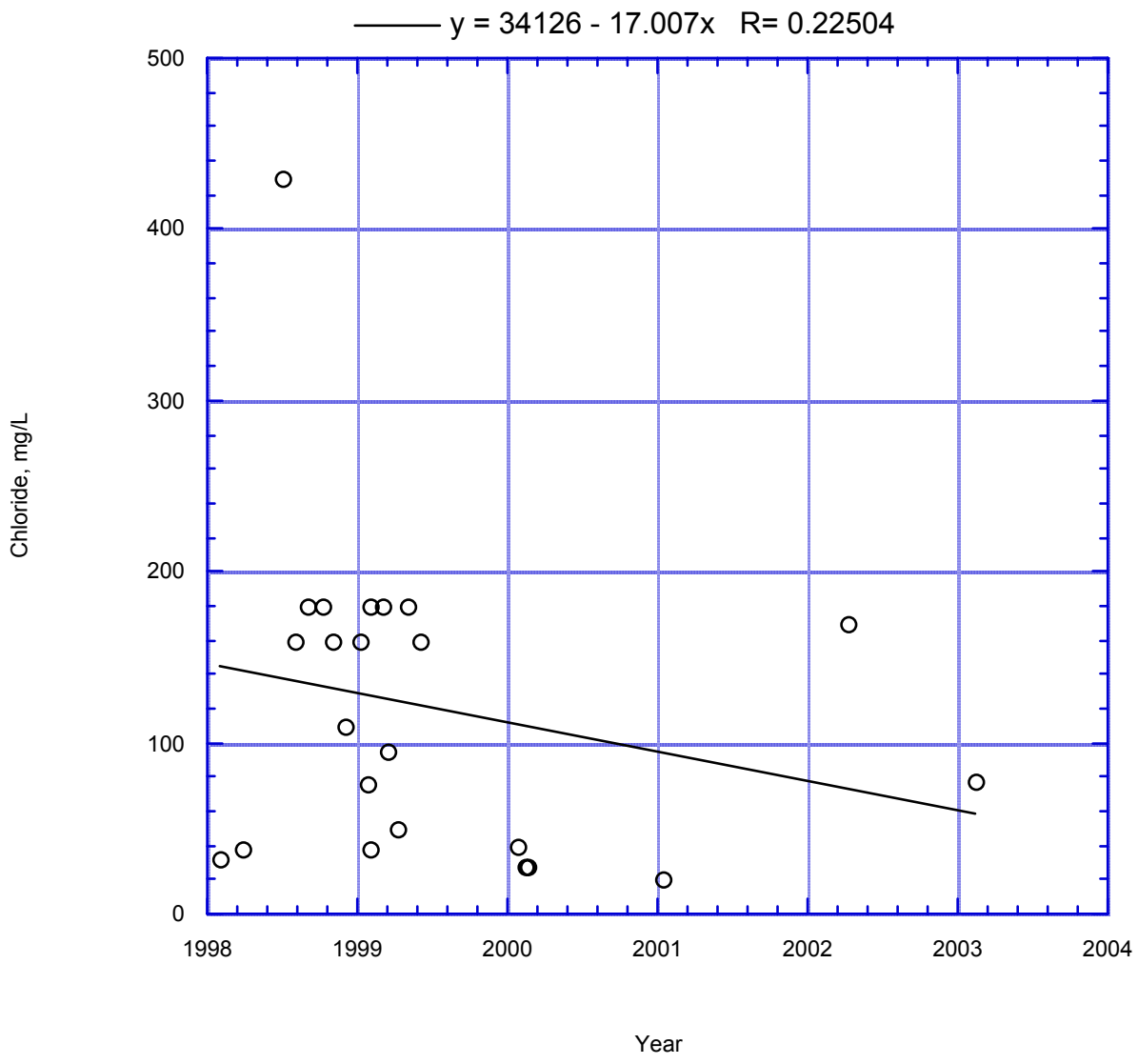


Figure 151. Reach 4 Chloride vs. Time

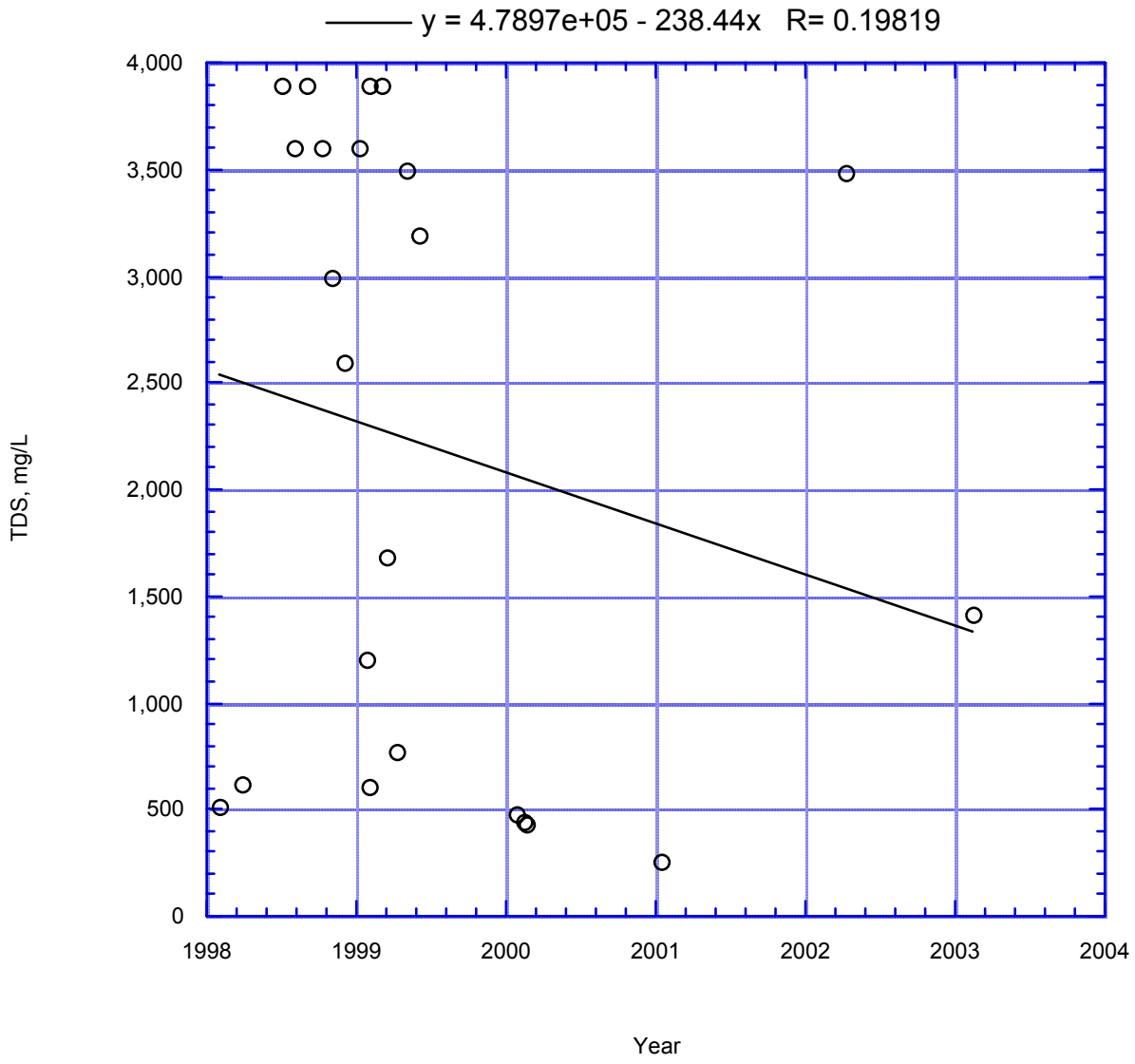


Figure 152. Reach 4 TDS vs. Time

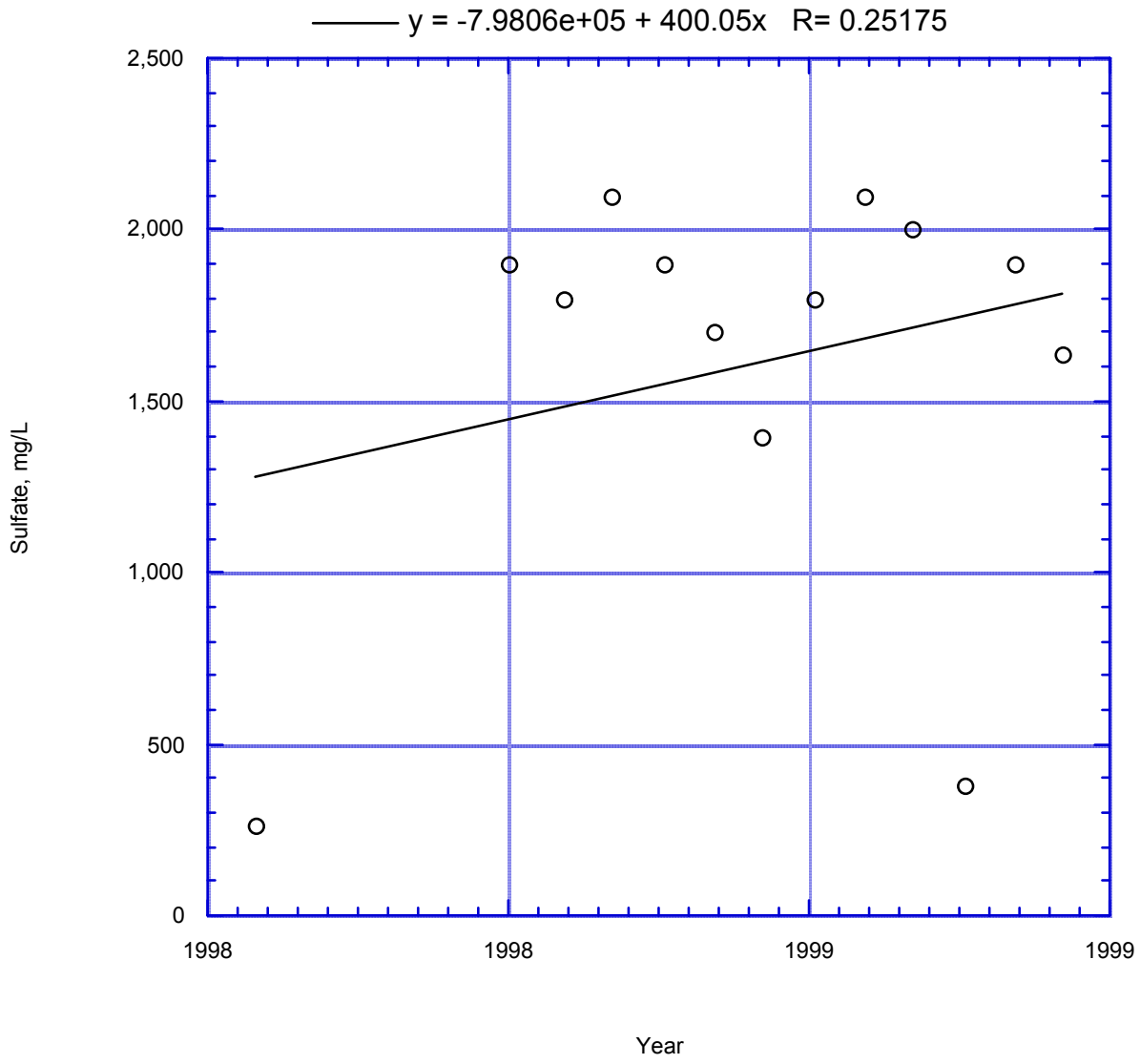


Figure 153. Reach 4 Sulfate vs. Time

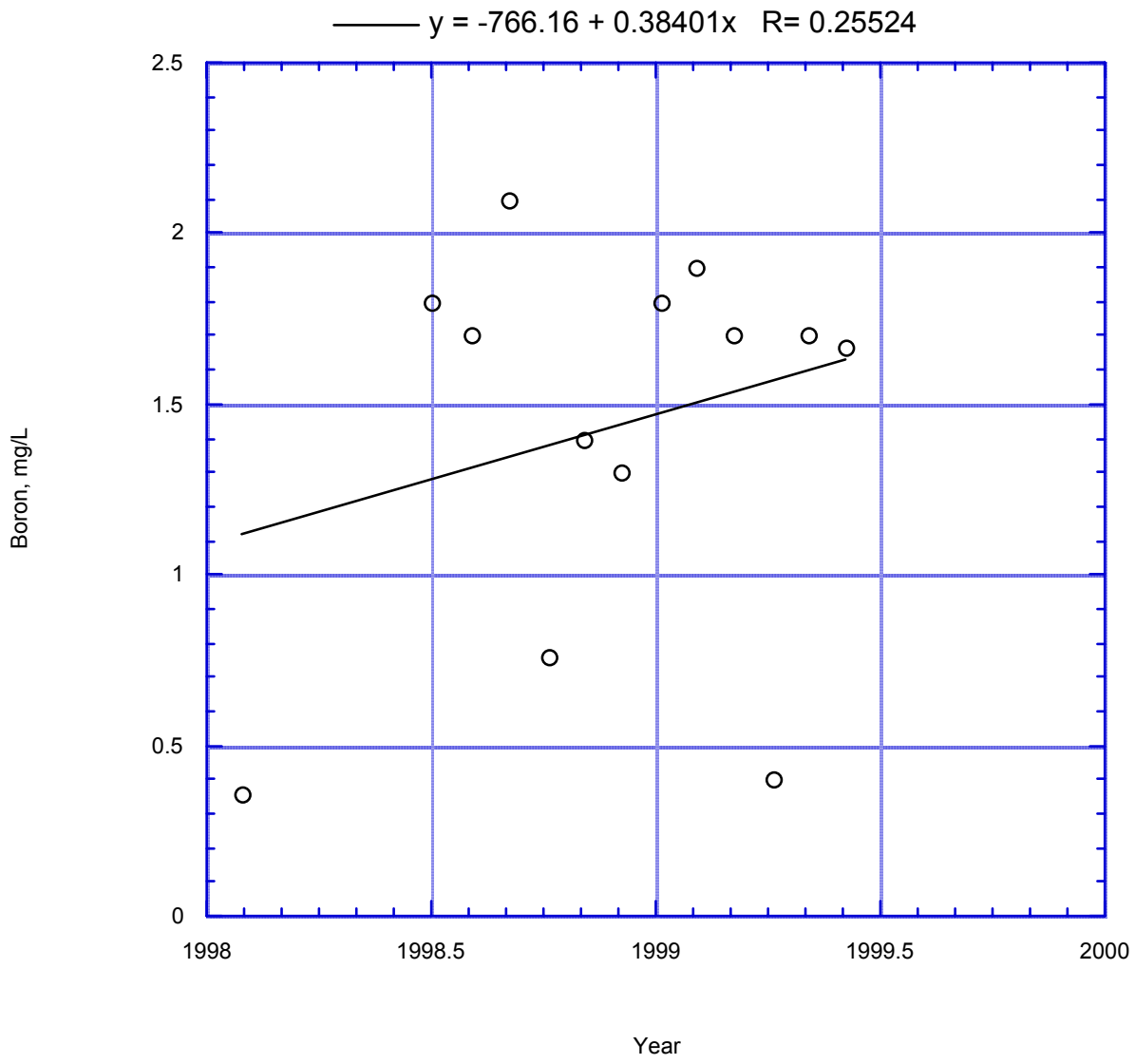


Figure 154. Reach 4 Boron vs. Time

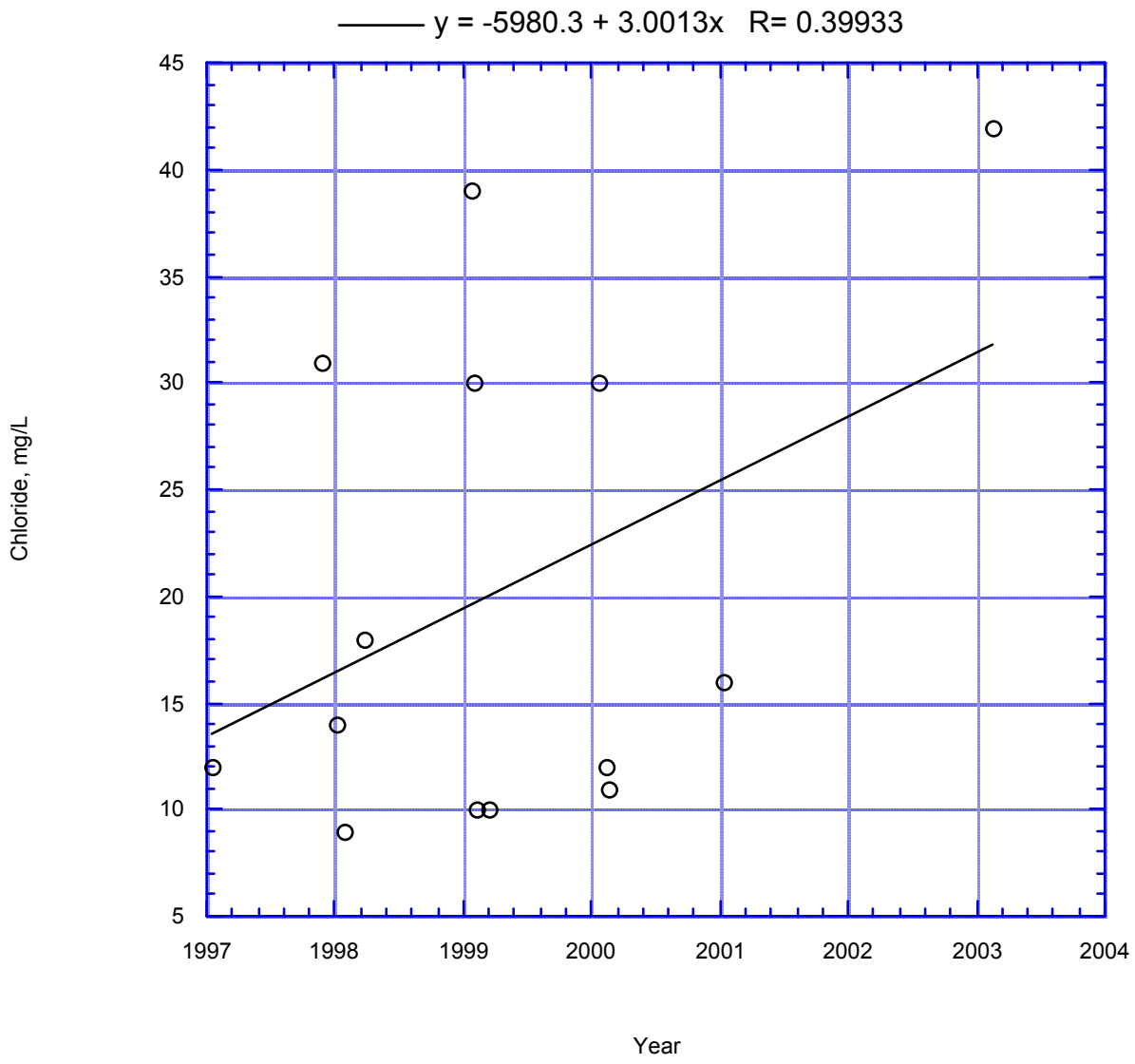


Figure 155. Reach 5 Chloride vs. Time

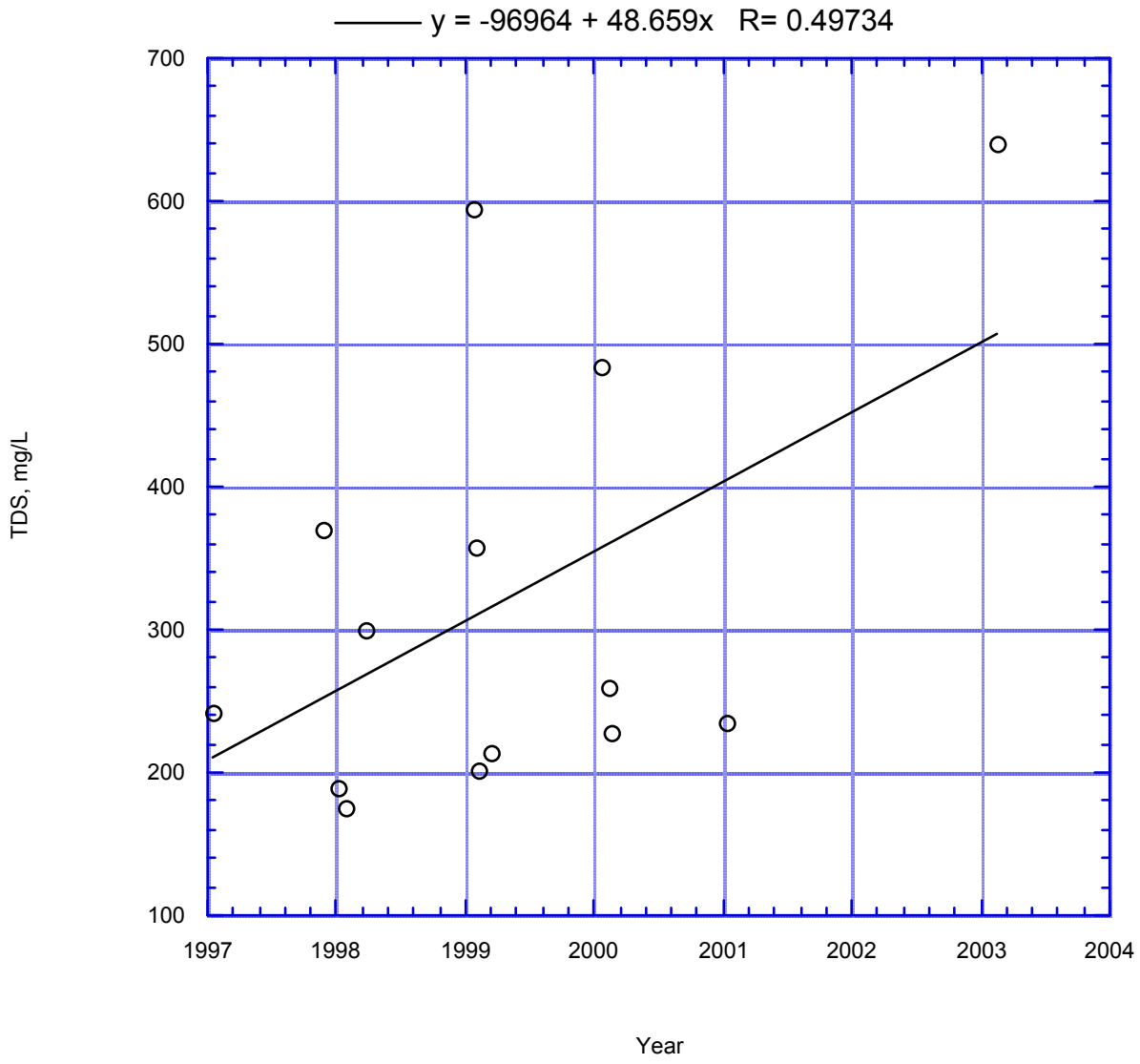


Figure 156. Reach 5 TDS vs. Time

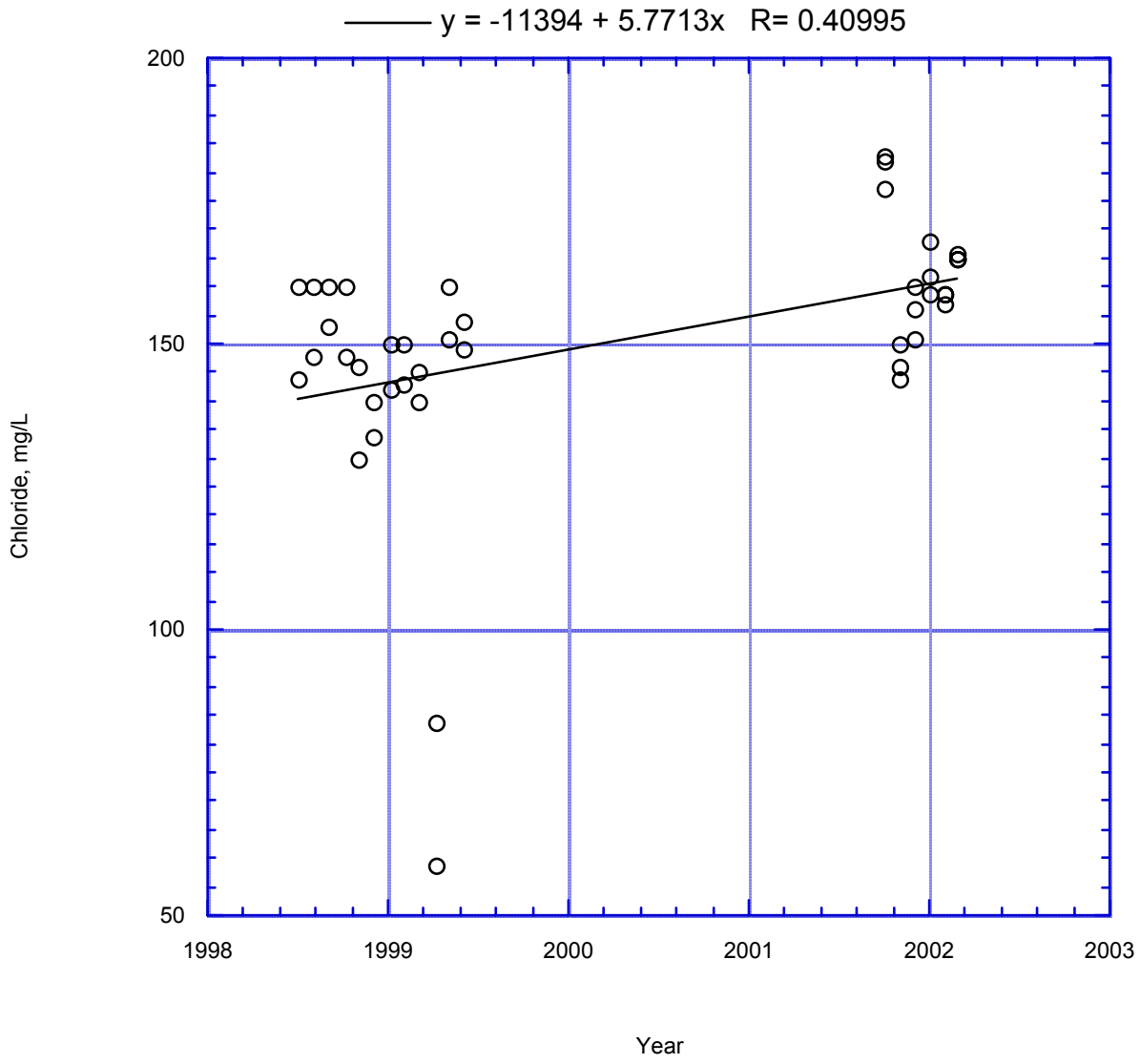


Figure 157. Reach 6 Chloride vs. Time

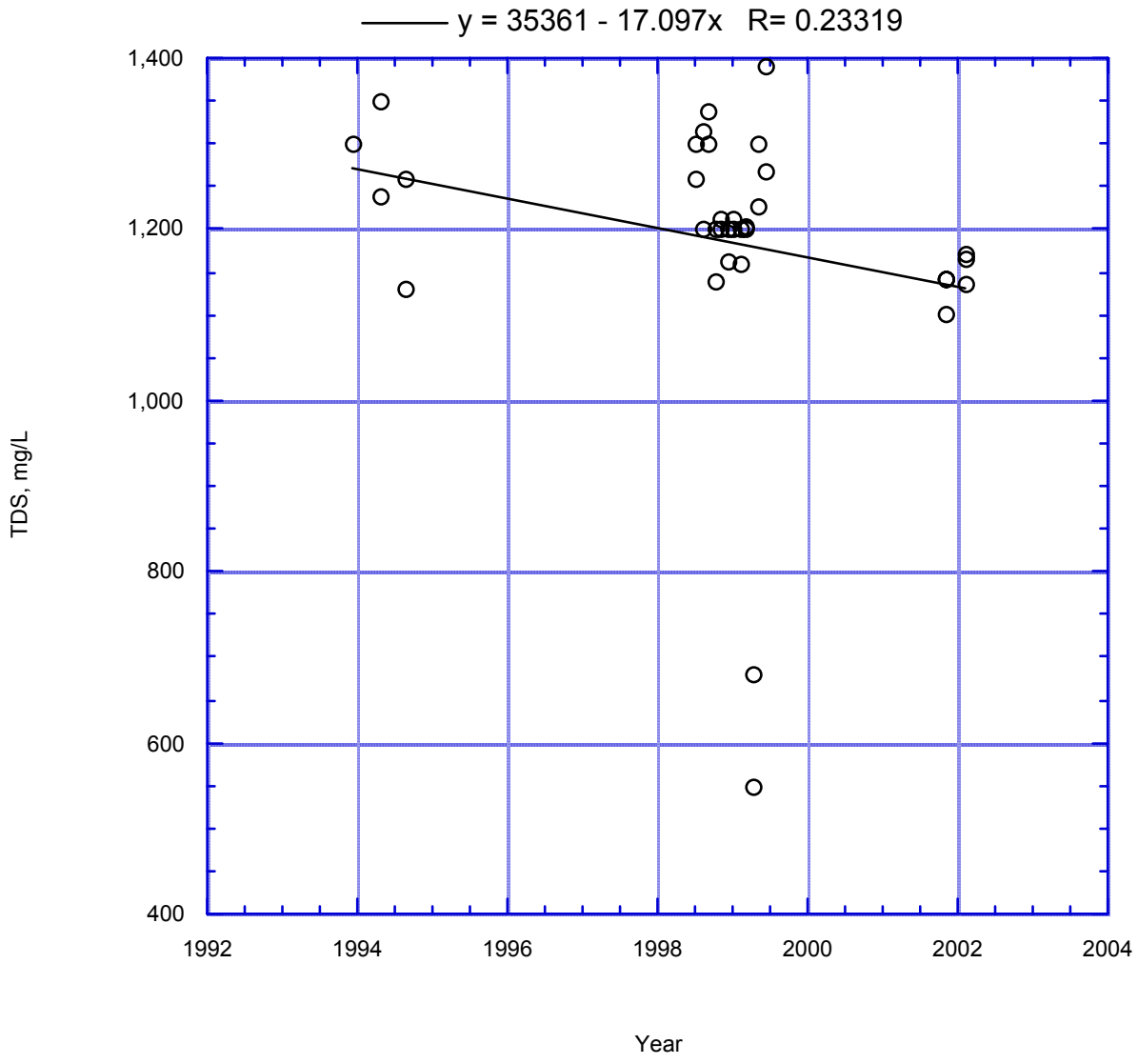


Figure 158. Reach 6 TDS vs. Time

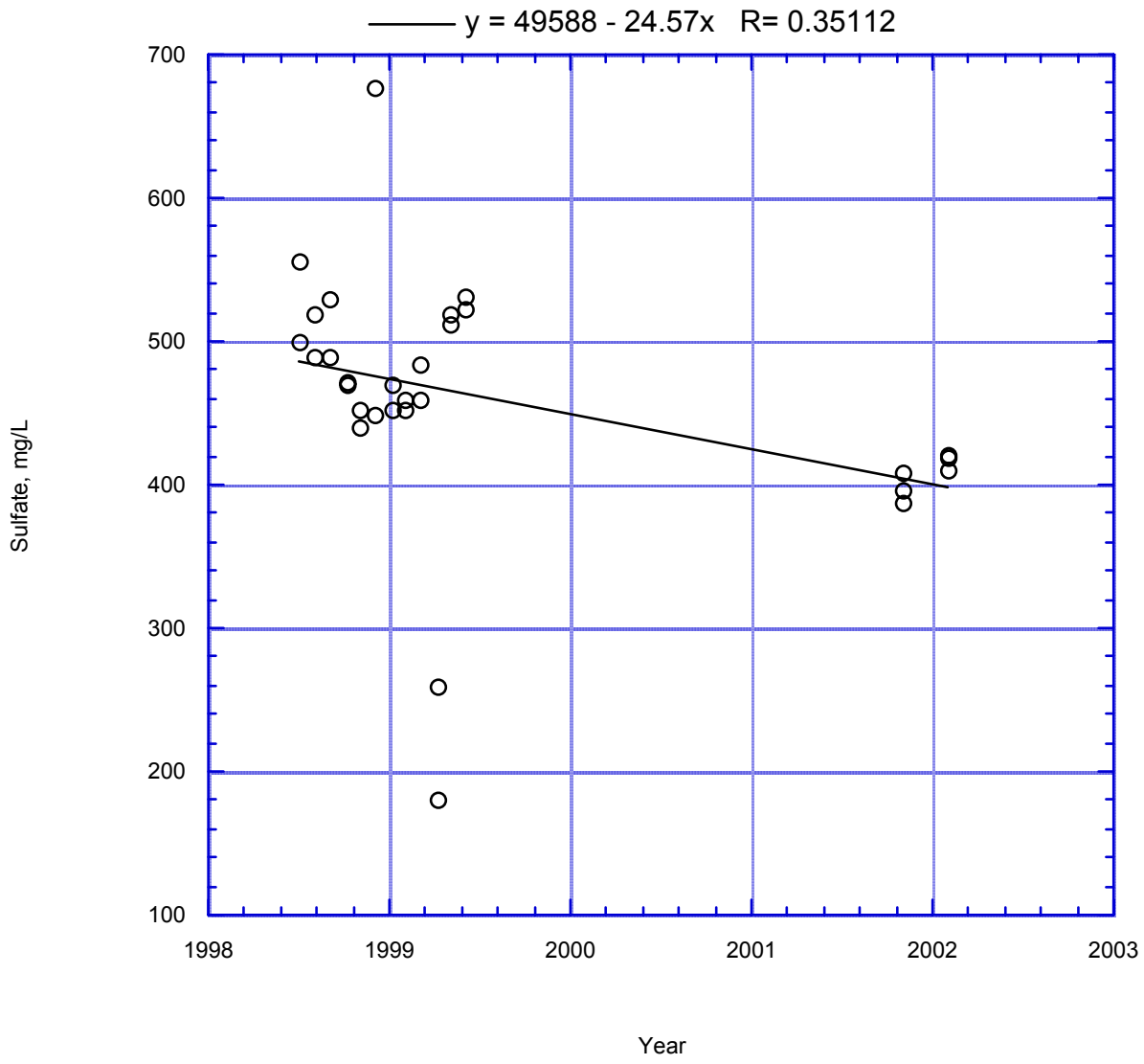


Figure 159. Reach 6 Sulfate vs. Time

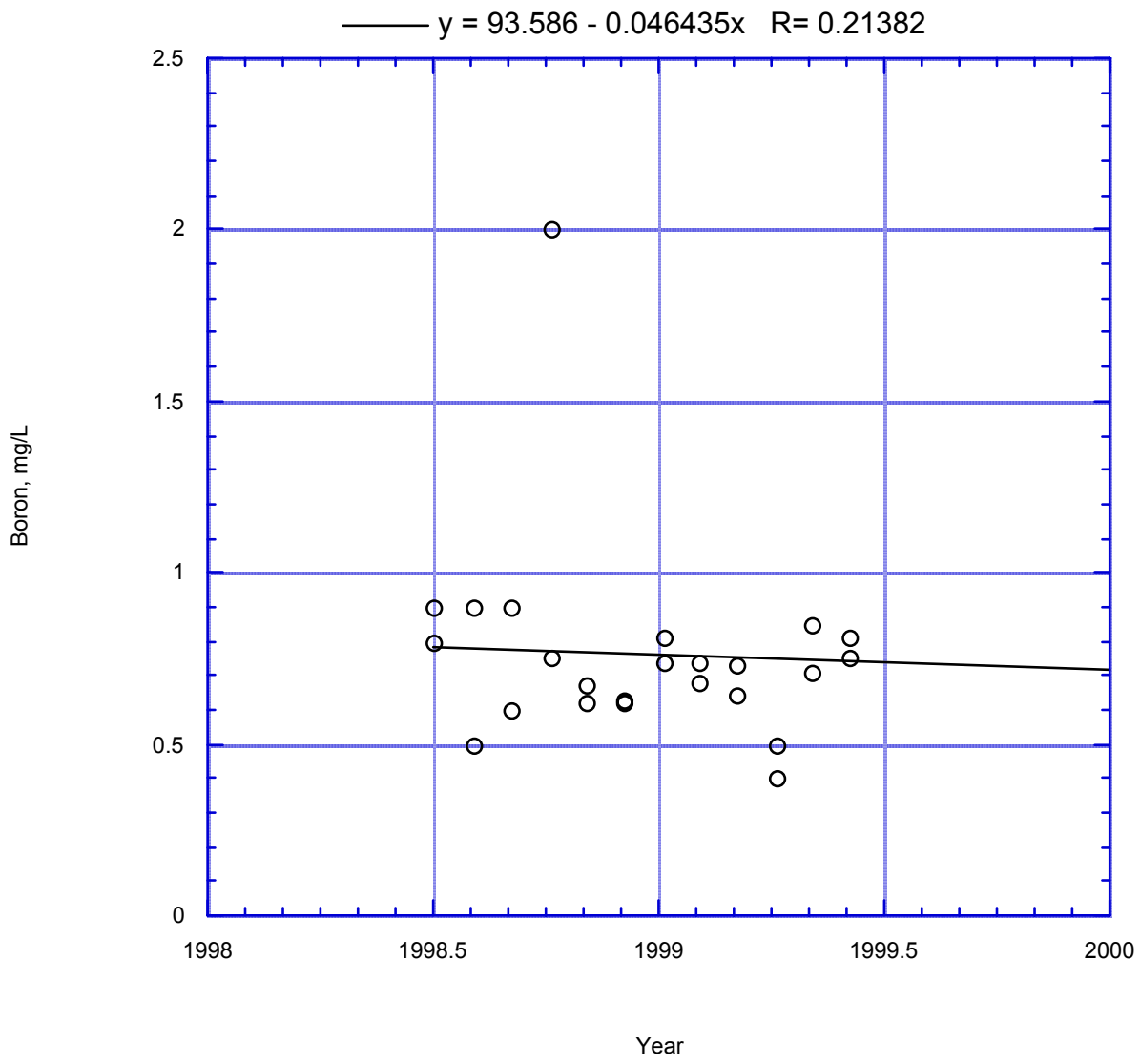


Figure 160. Reach 6 Boron vs. Time

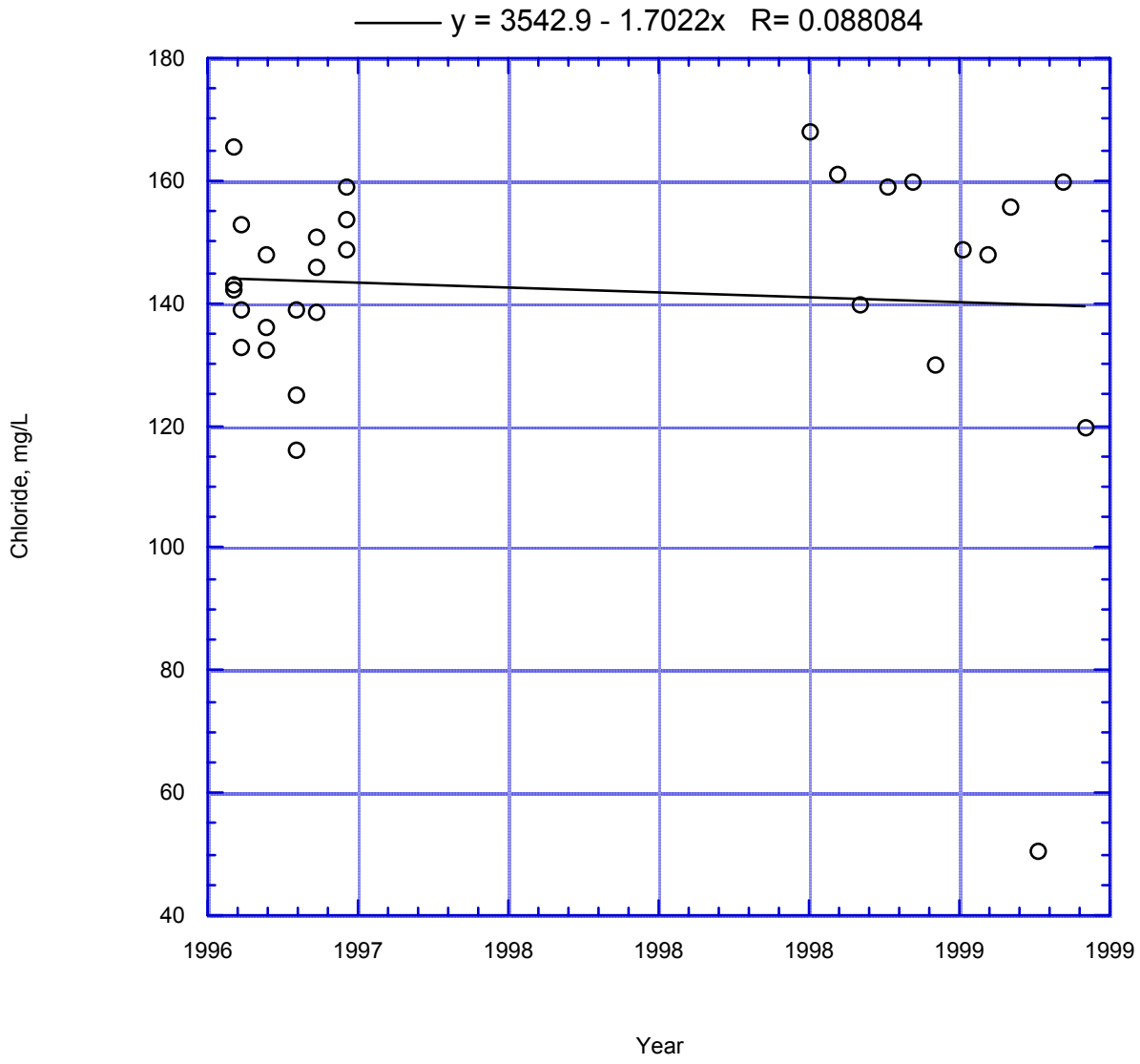


Figure 161. Reach 7 Chloride vs. Time

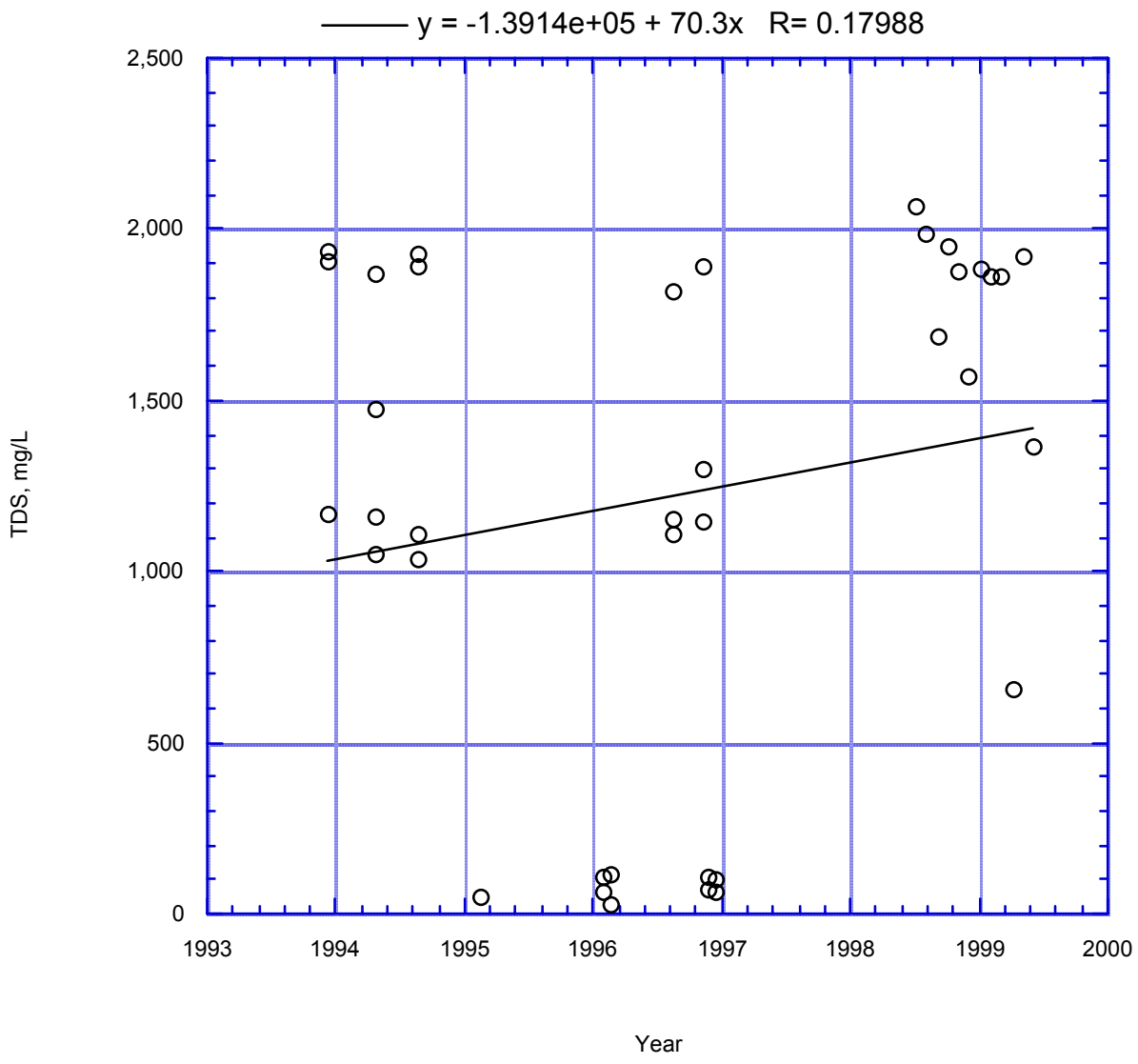


Figure 162. Reach 7 TDS vs. Time

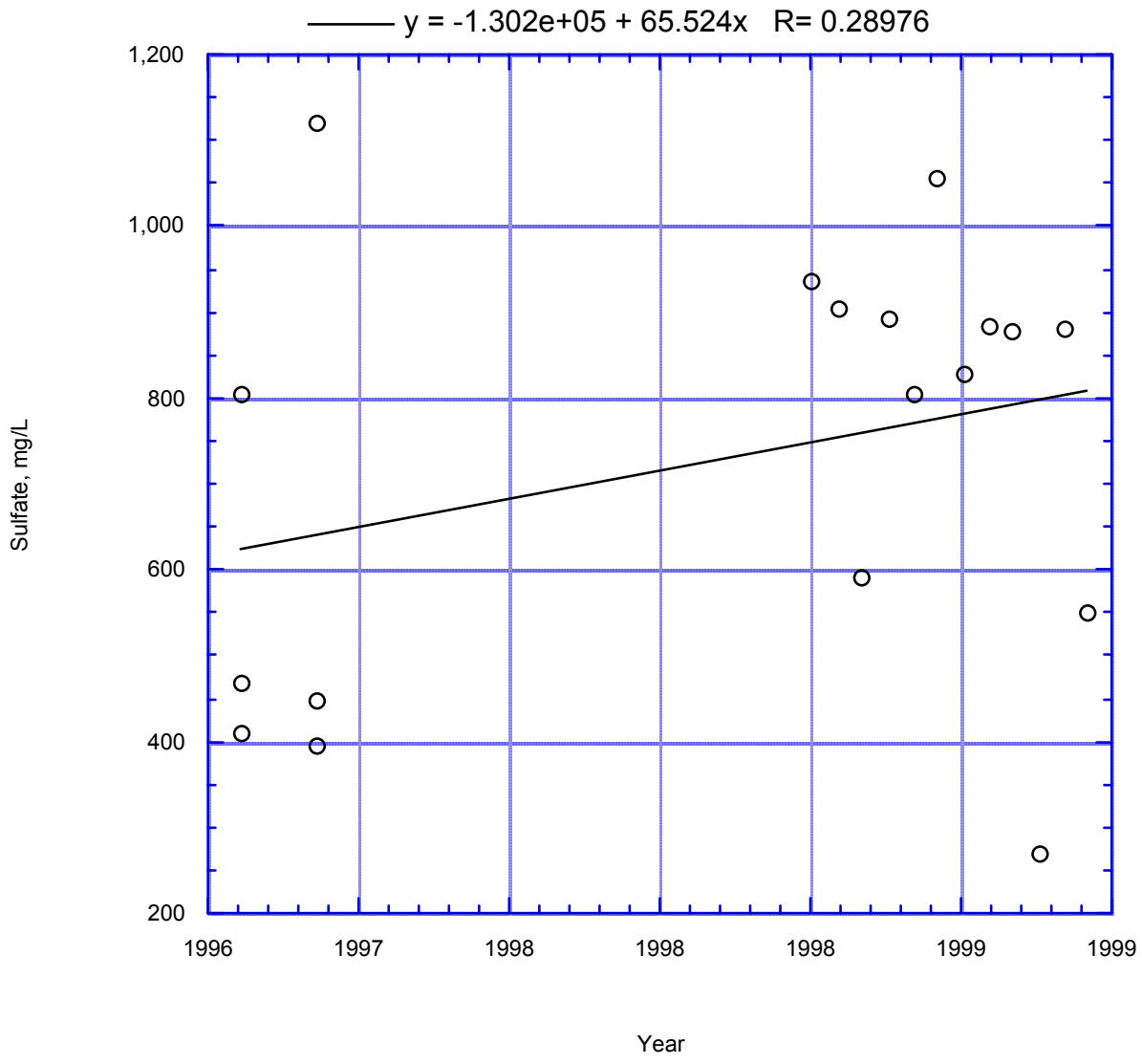


Figure 163. Reach 7 Sulfate vs. Time

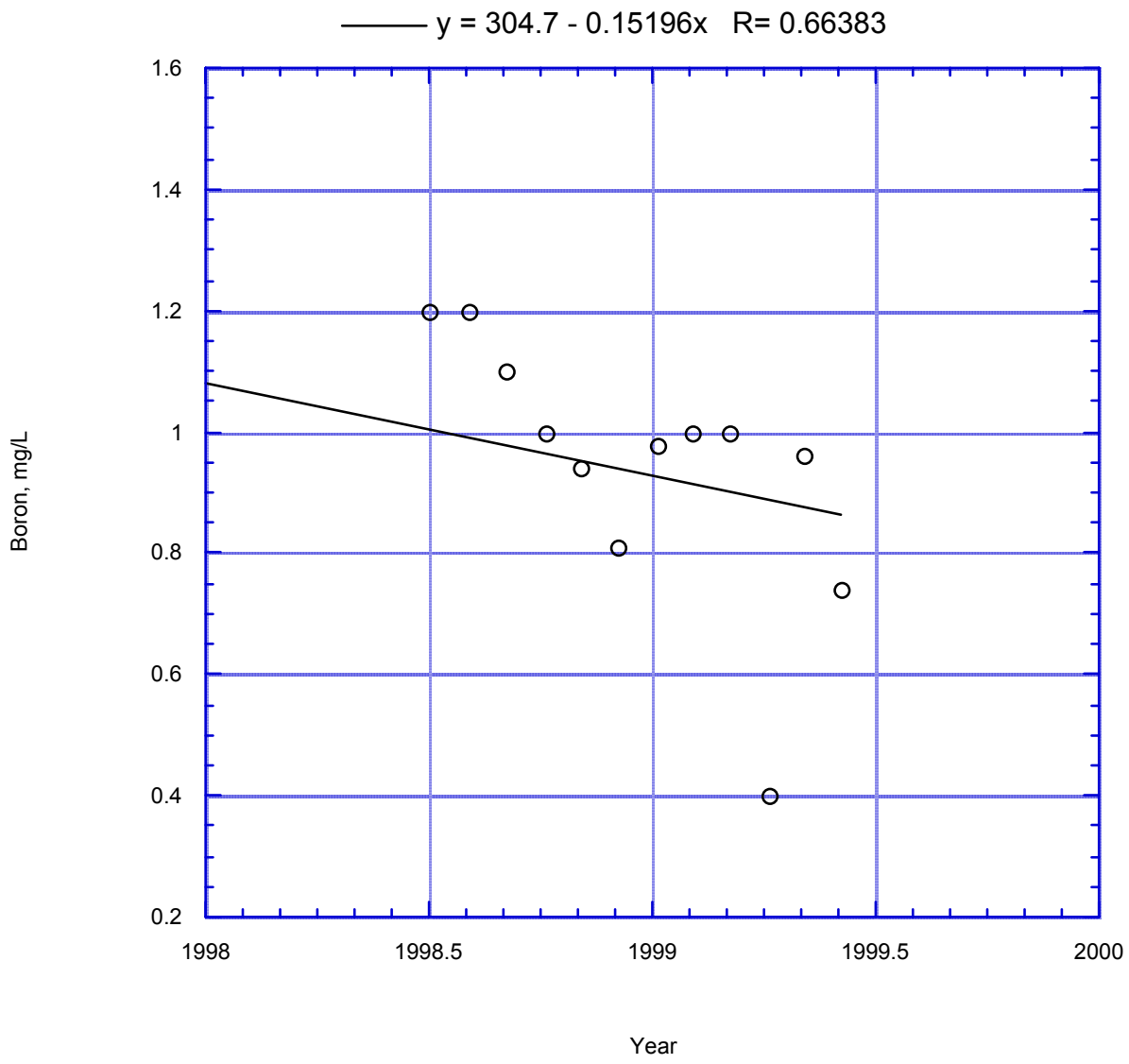


Figure 164. Reach 7 Boron vs. Time

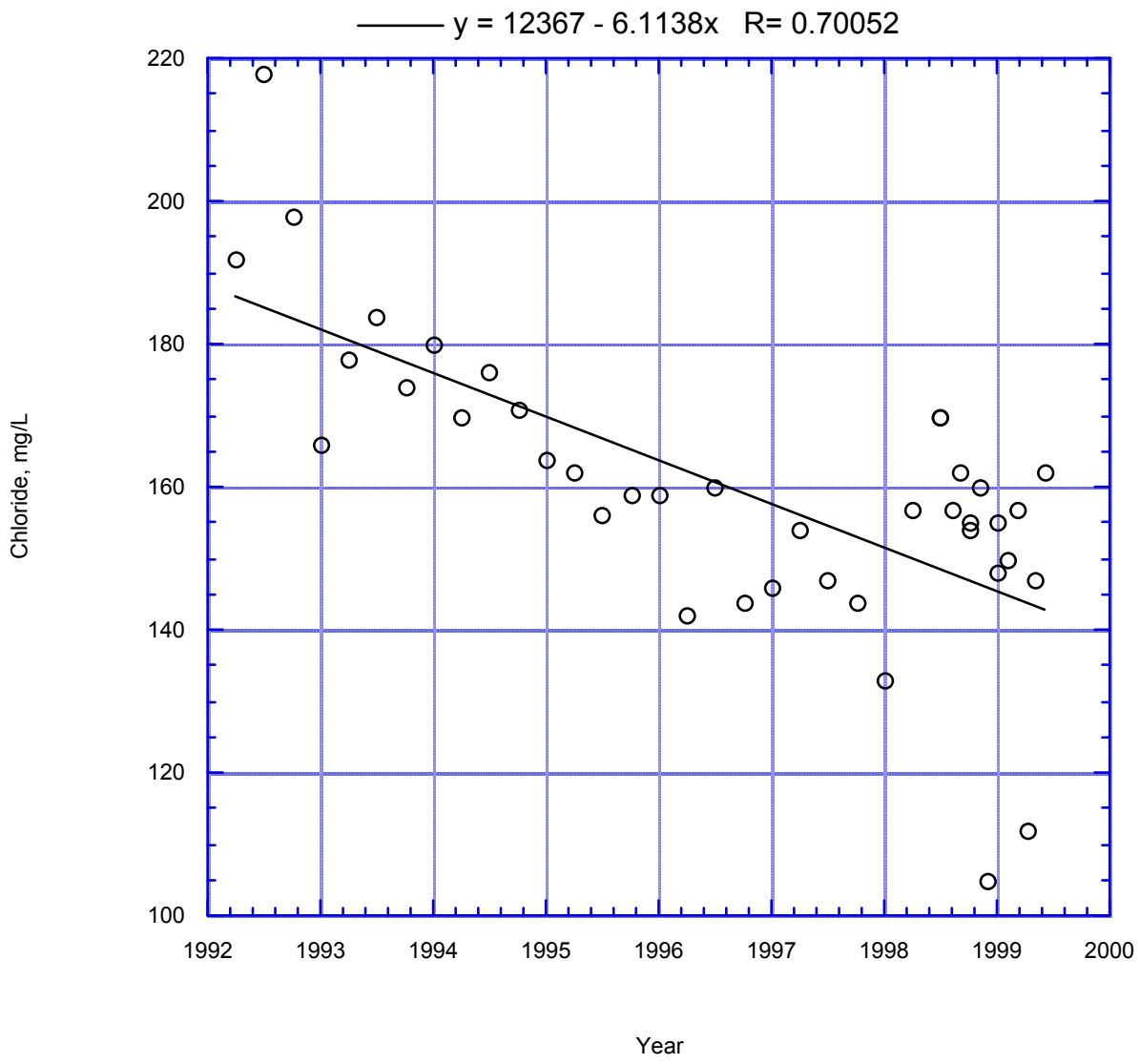


Figure 165. Reach 9A Chloride vs. Time

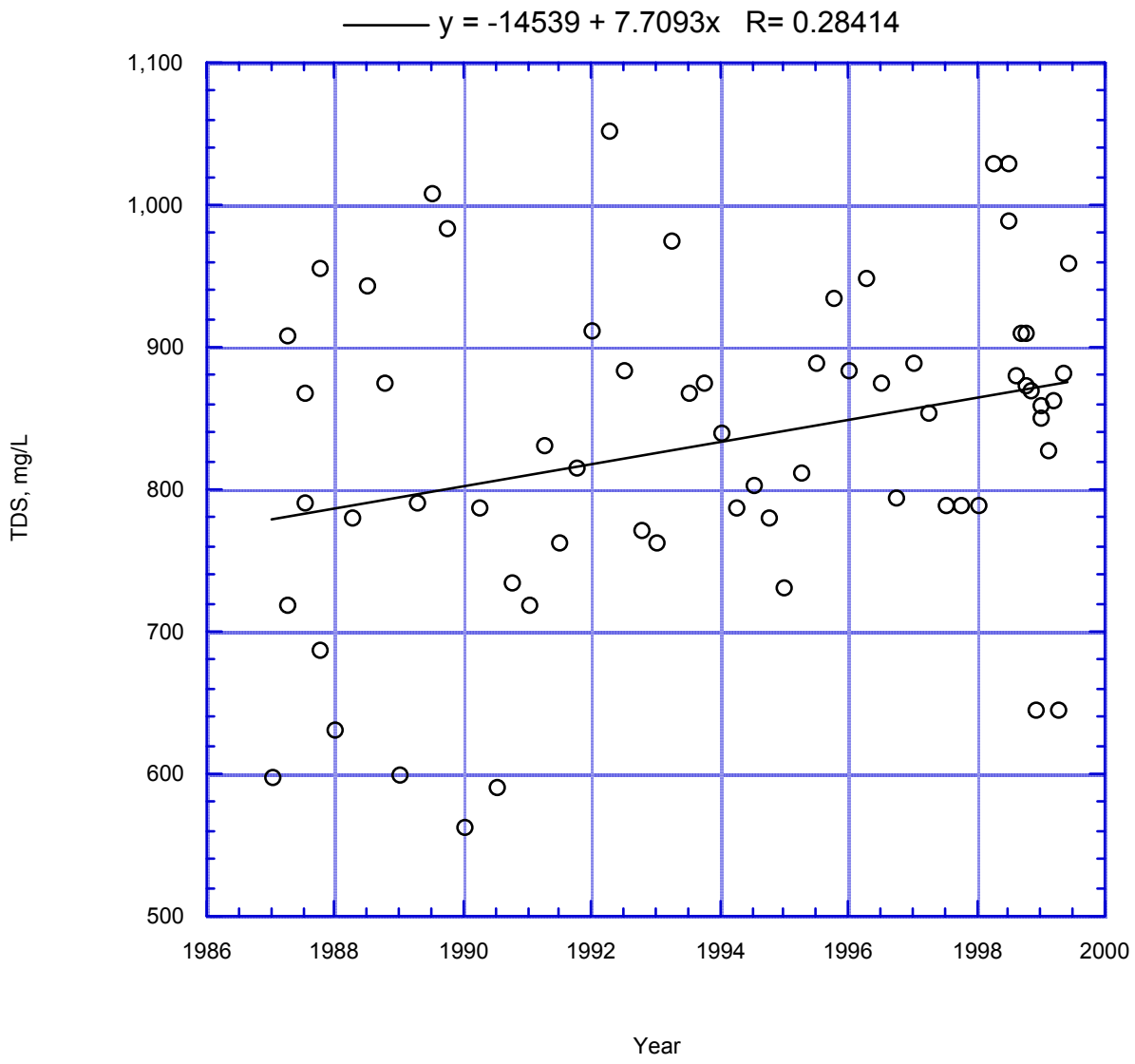


Figure 166. Reach 9A TDS vs. Time

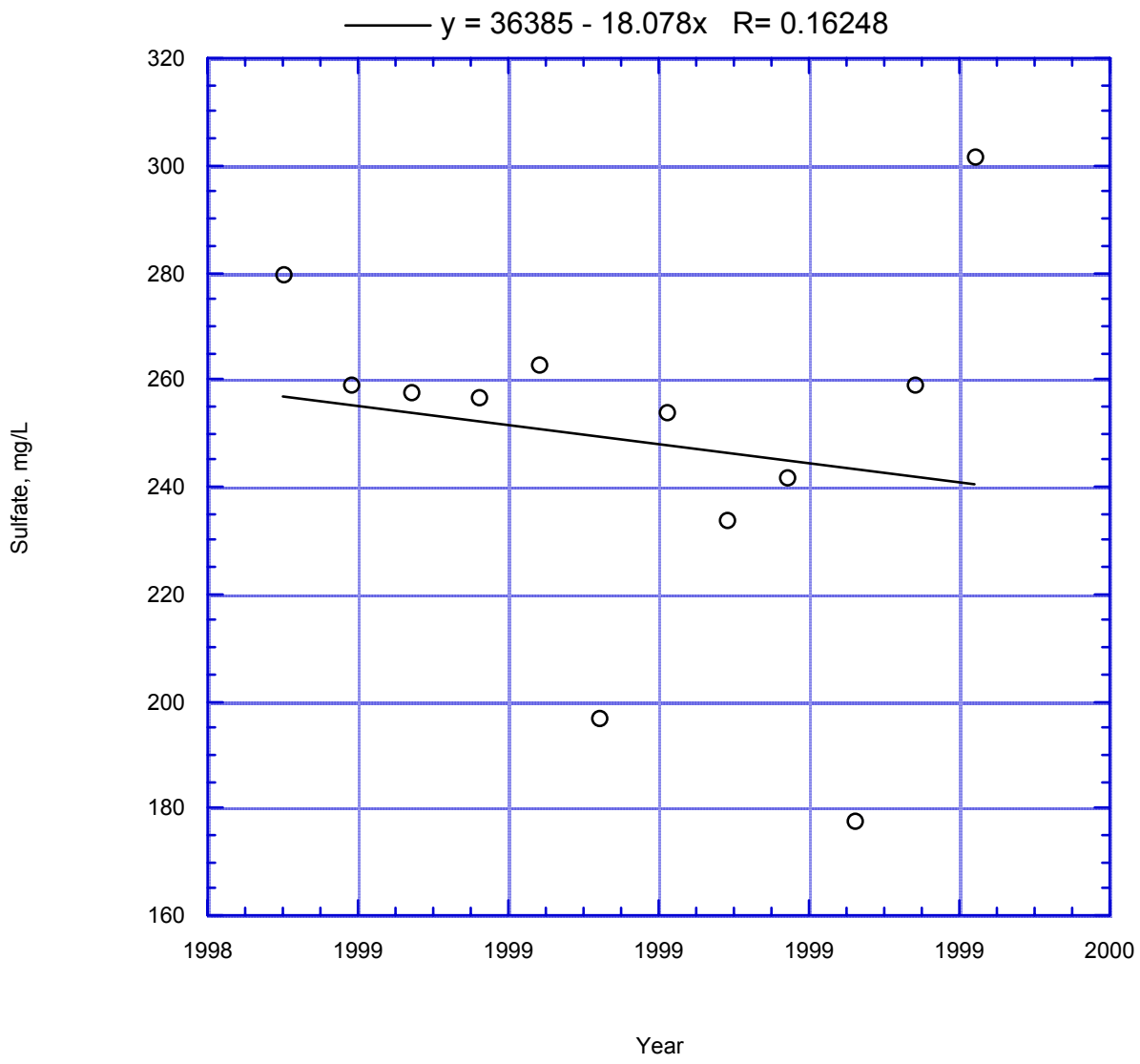


Figure 167. Reach 9A Sulfate vs. Time

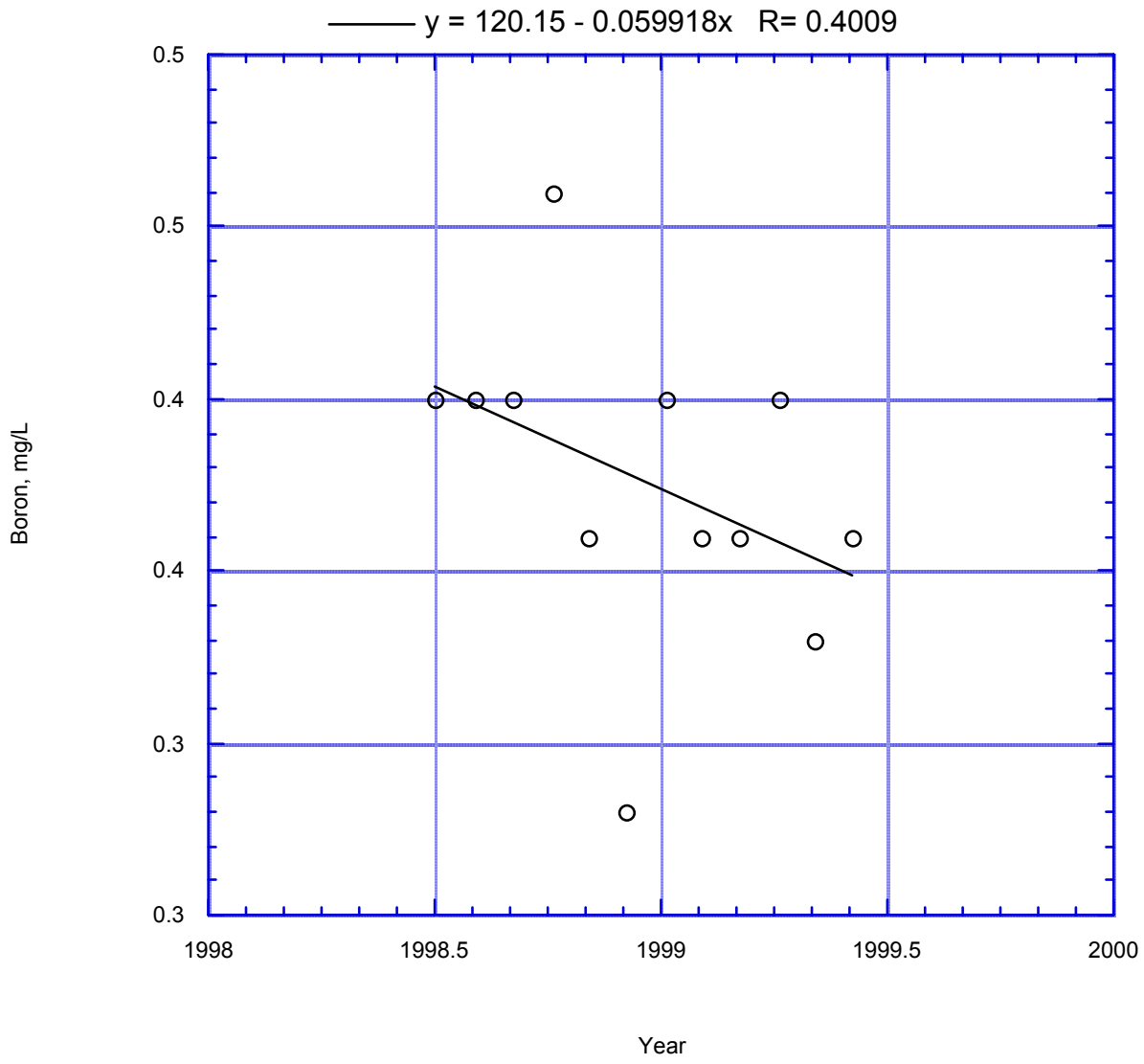


Figure 168. Reach 9A Boron vs. Time

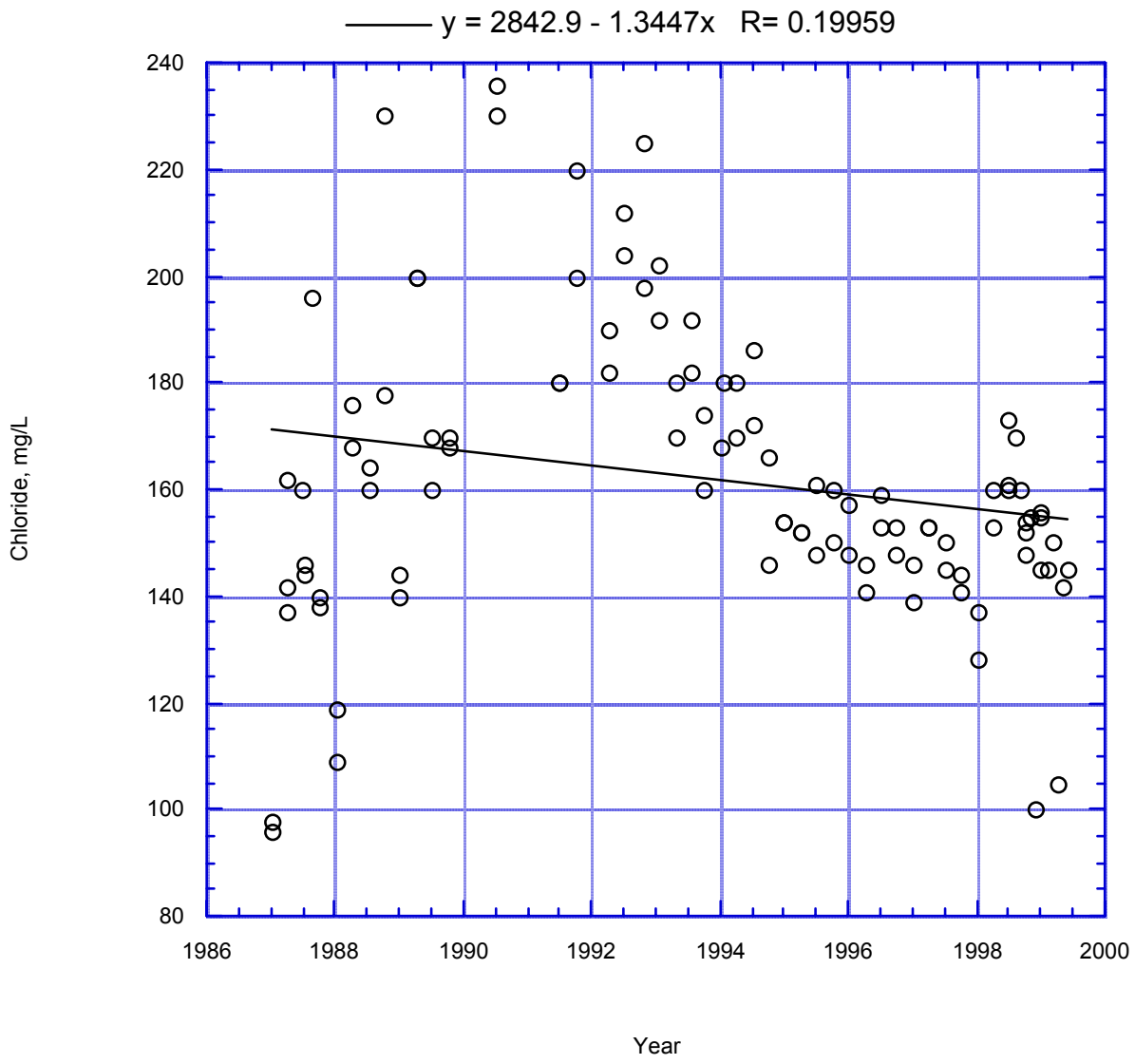


Figure 169. Reach 9B Chloride vs. Time

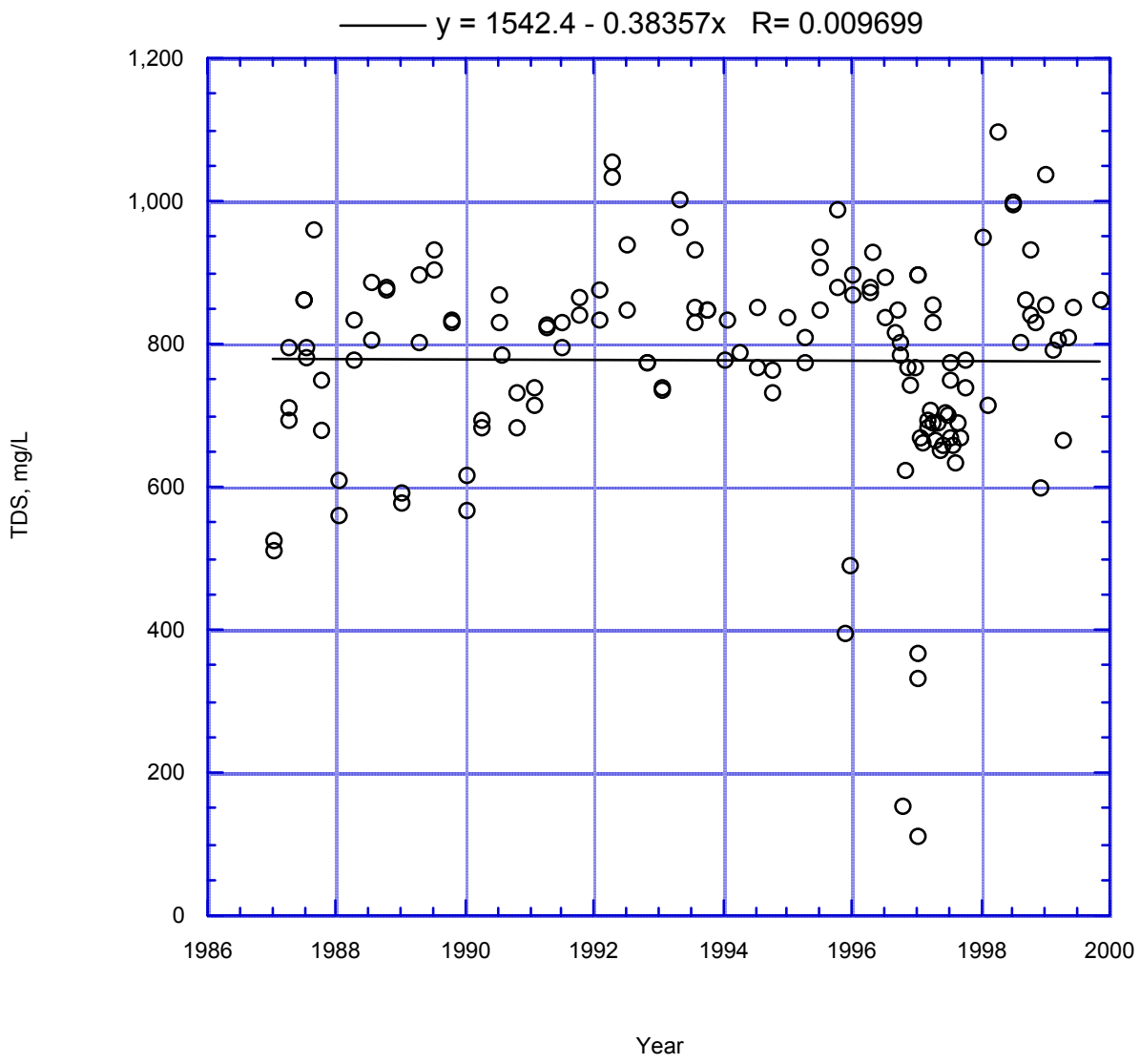


Figure 170. Reach 9B TDS vs. Time

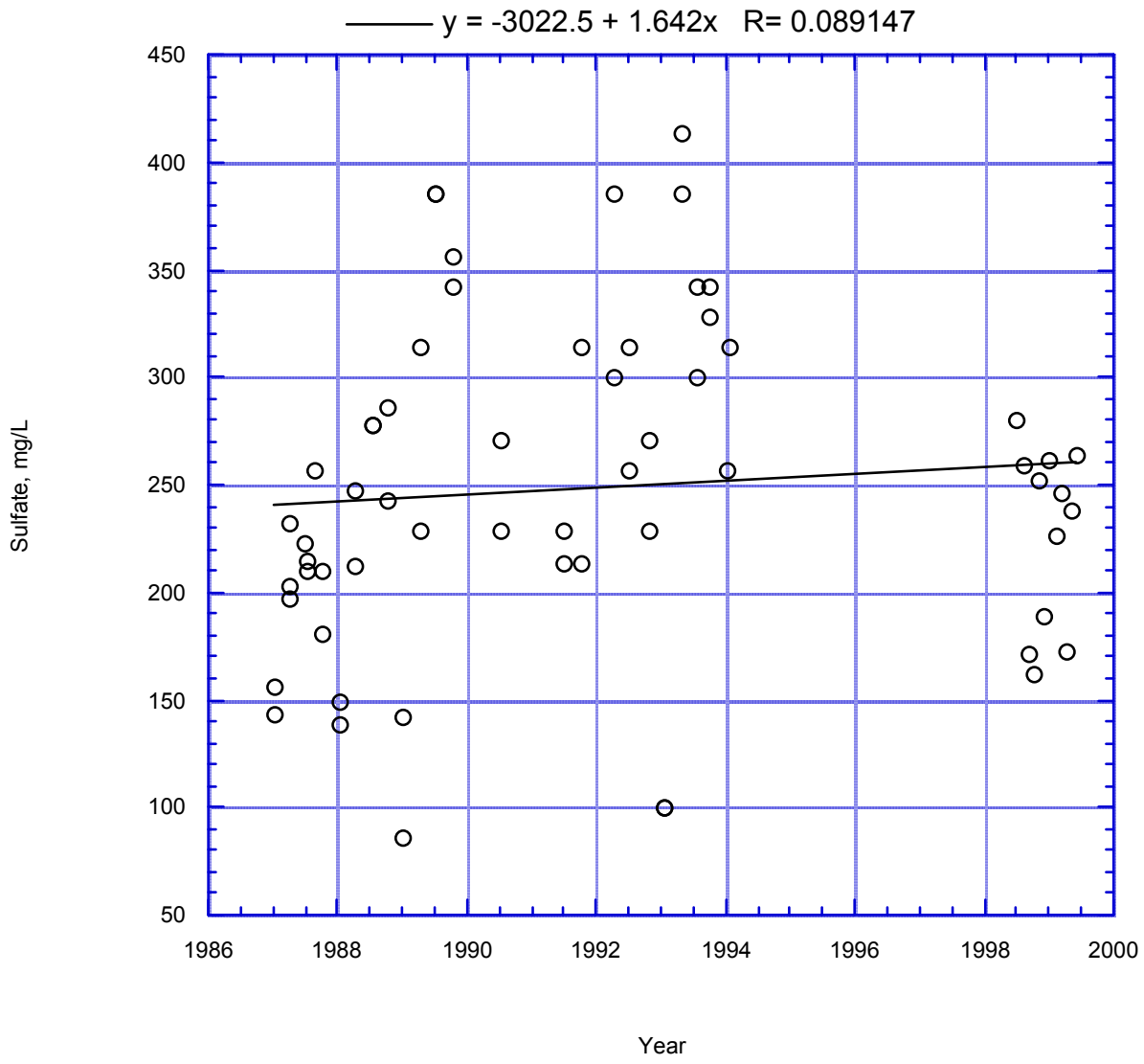


Figure 171. Reach 9B Sulfate vs. Time

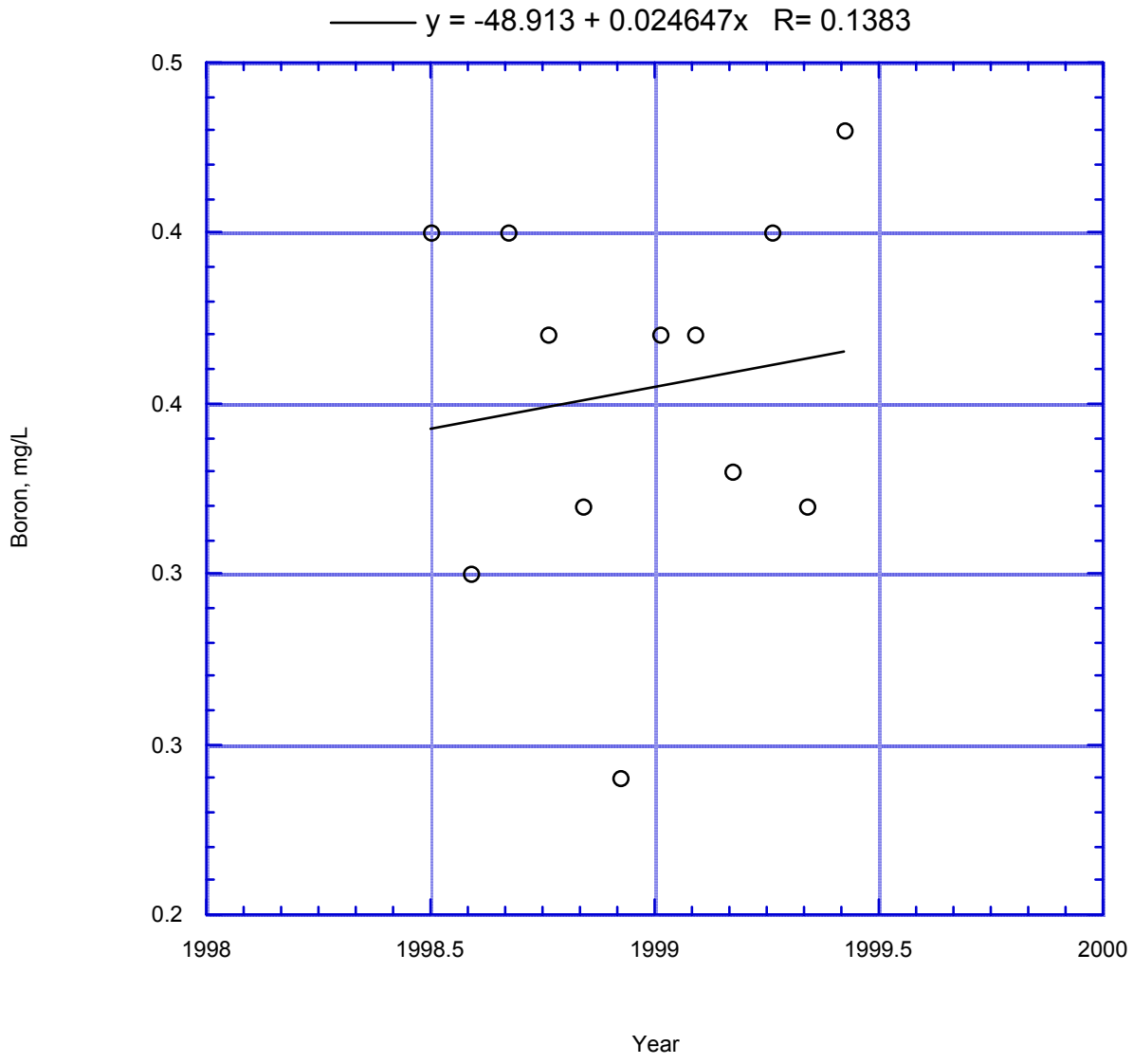


Figure 172. Reach 9B Boron vs. Time

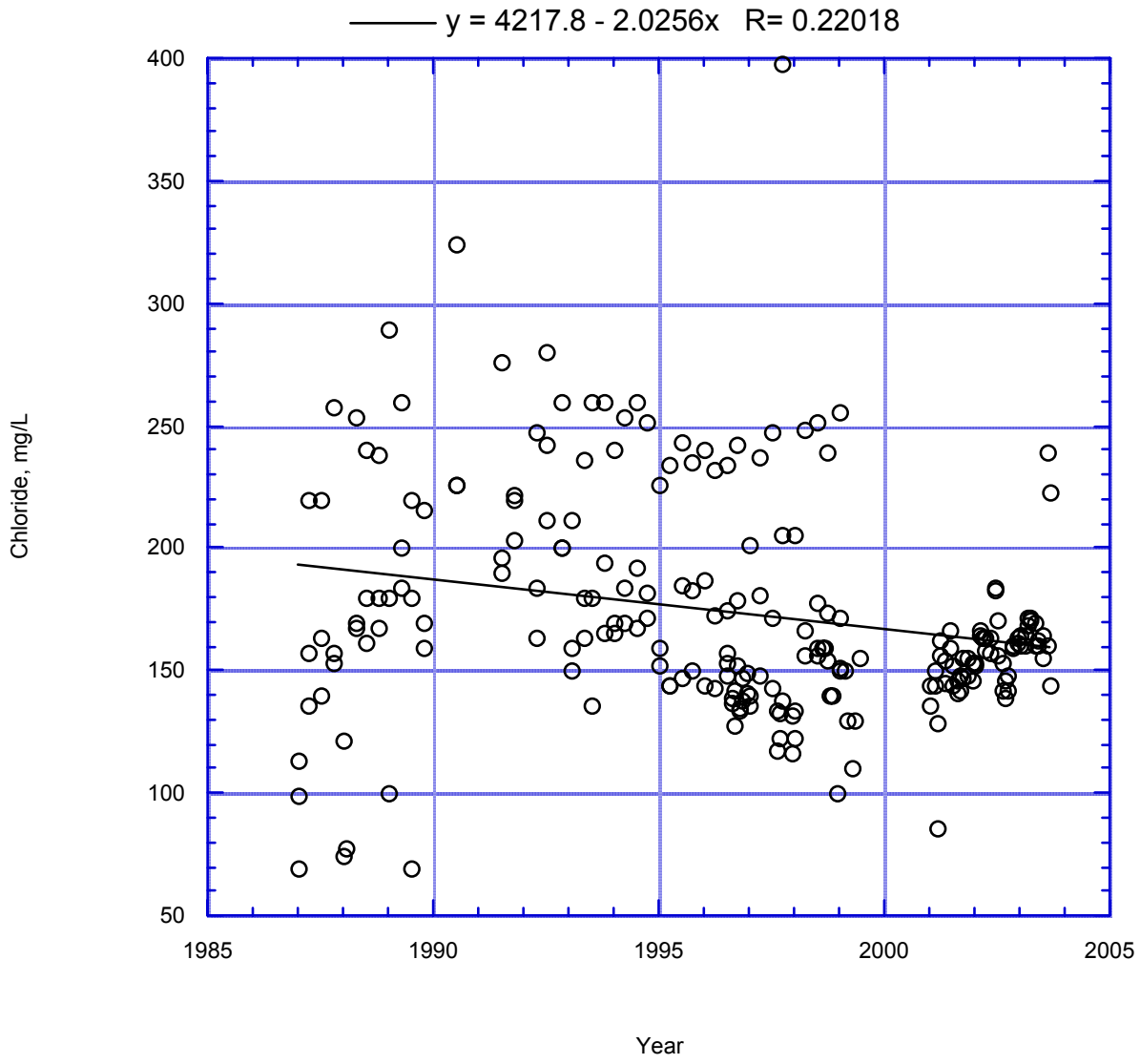


Figure 173. Reach 10 Chloride vs. Time

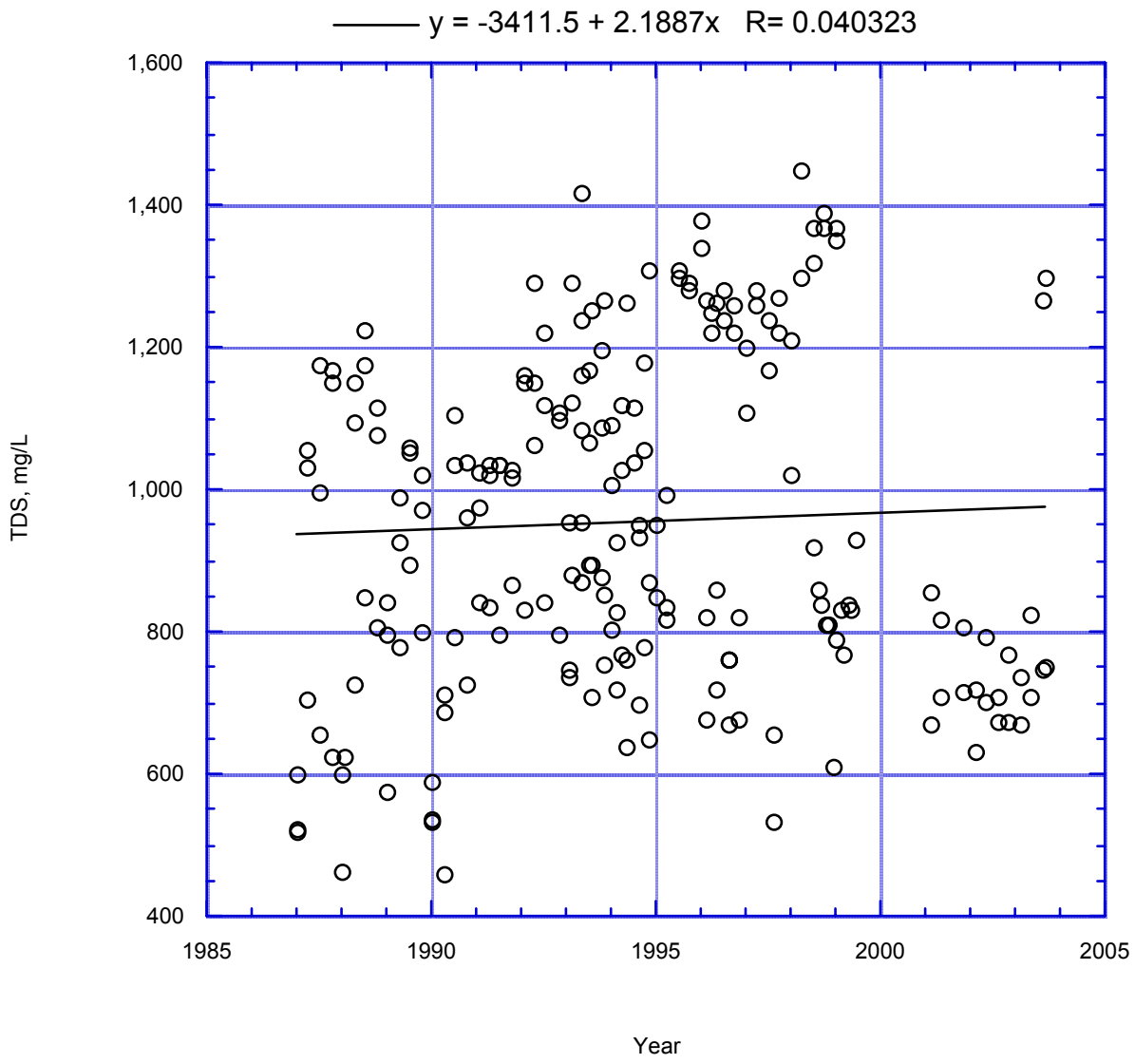


Figure 174. Reach 10 TDS vs. Time

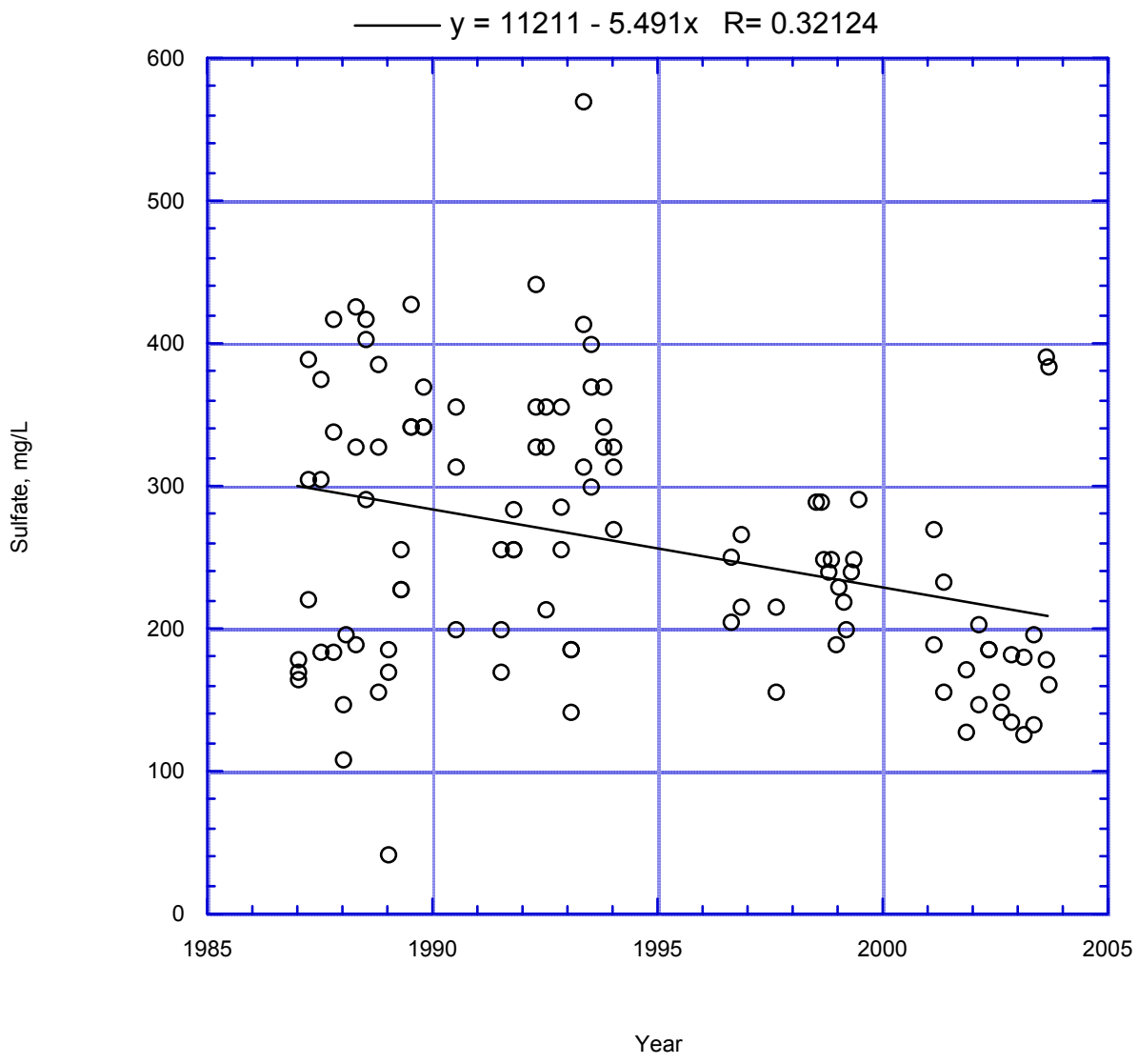


Figure 175. Reach 10 Sulfate vs. Time

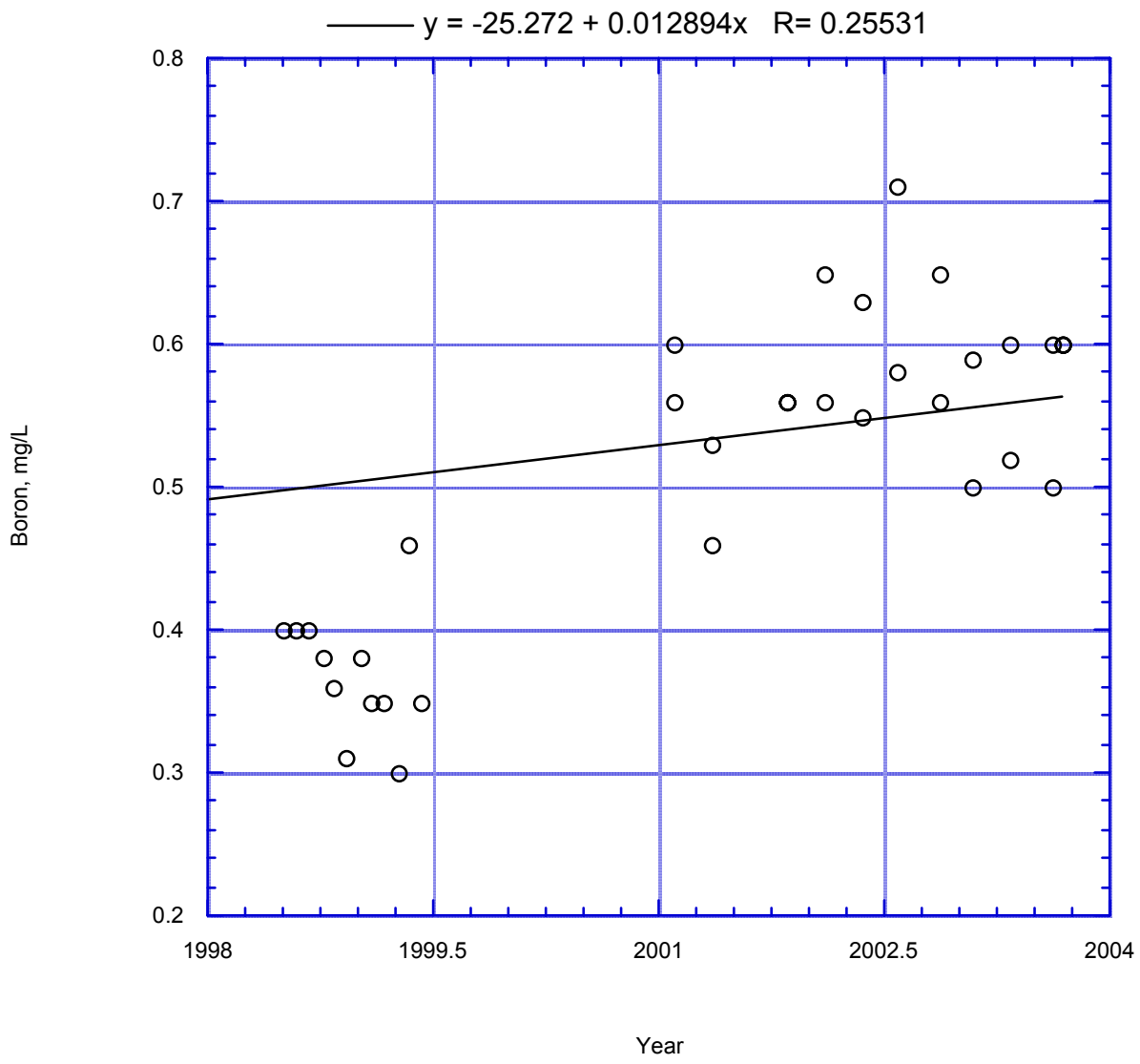


Figure 176. Reach 10 Boron vs. Time

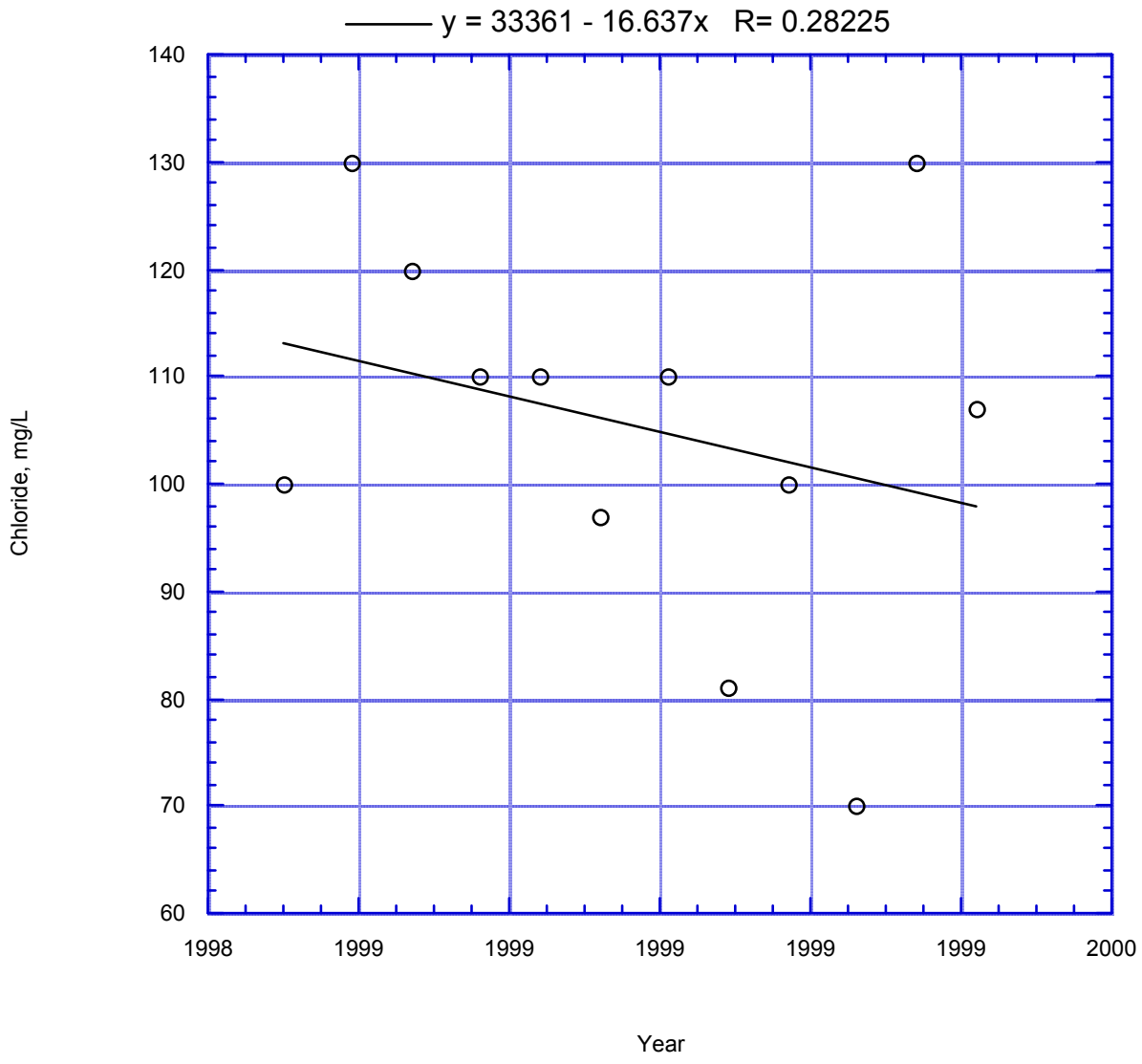


Figure 177. Reach 11 Chloride vs. Time

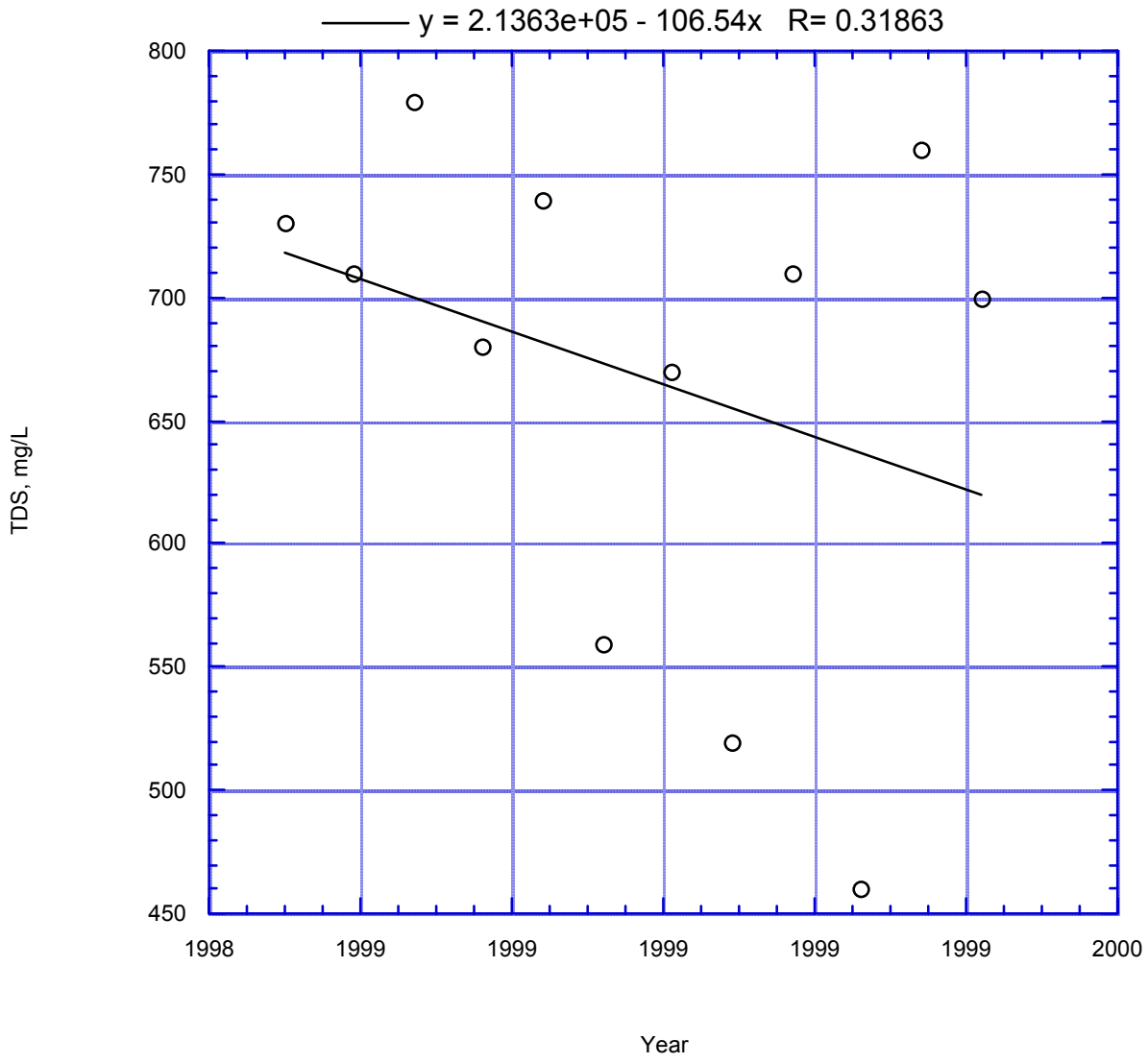


Figure 178. Reach 11 TDS vs. Time

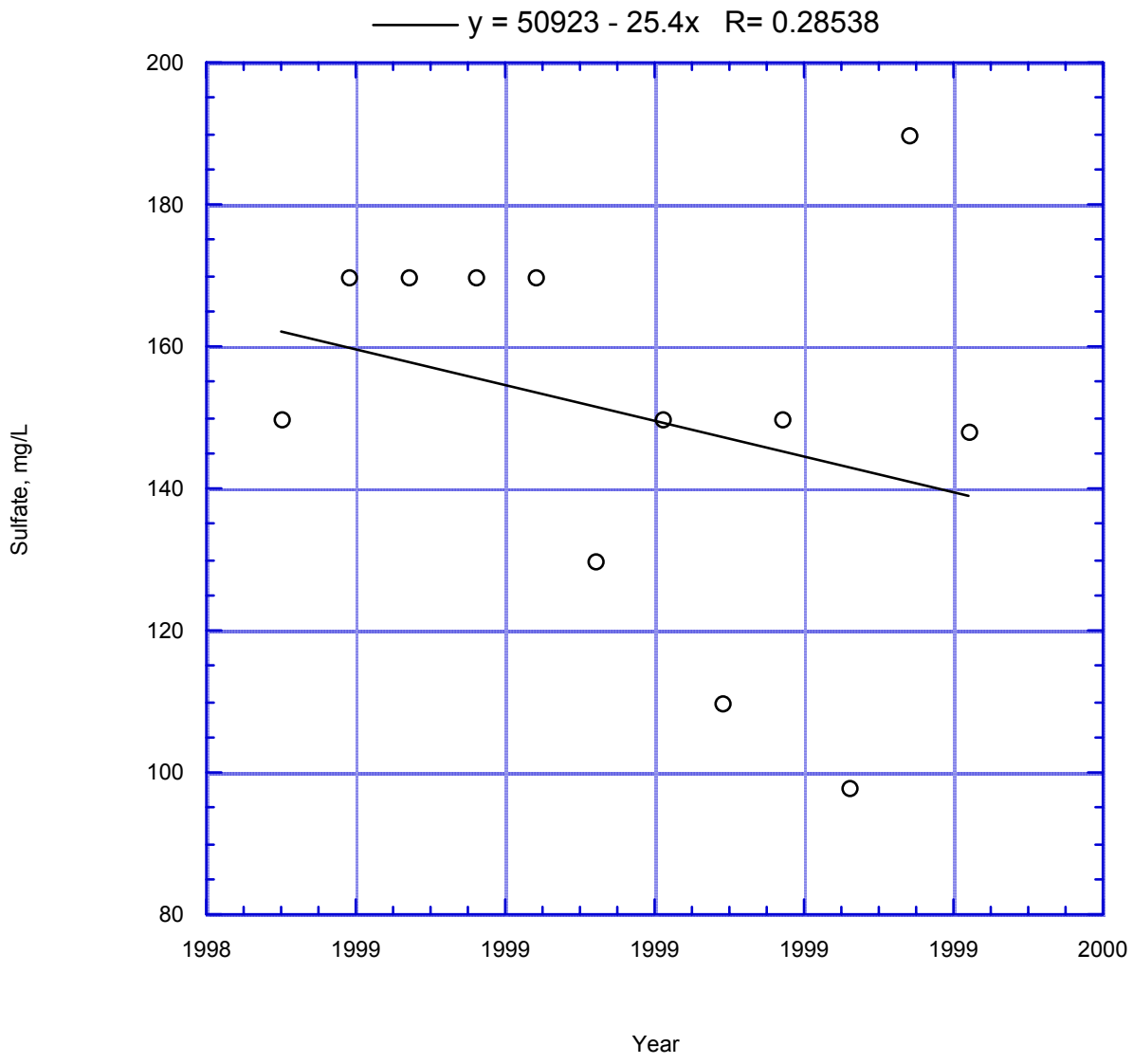


Figure 179. Reach 11 Sulfate vs. Time

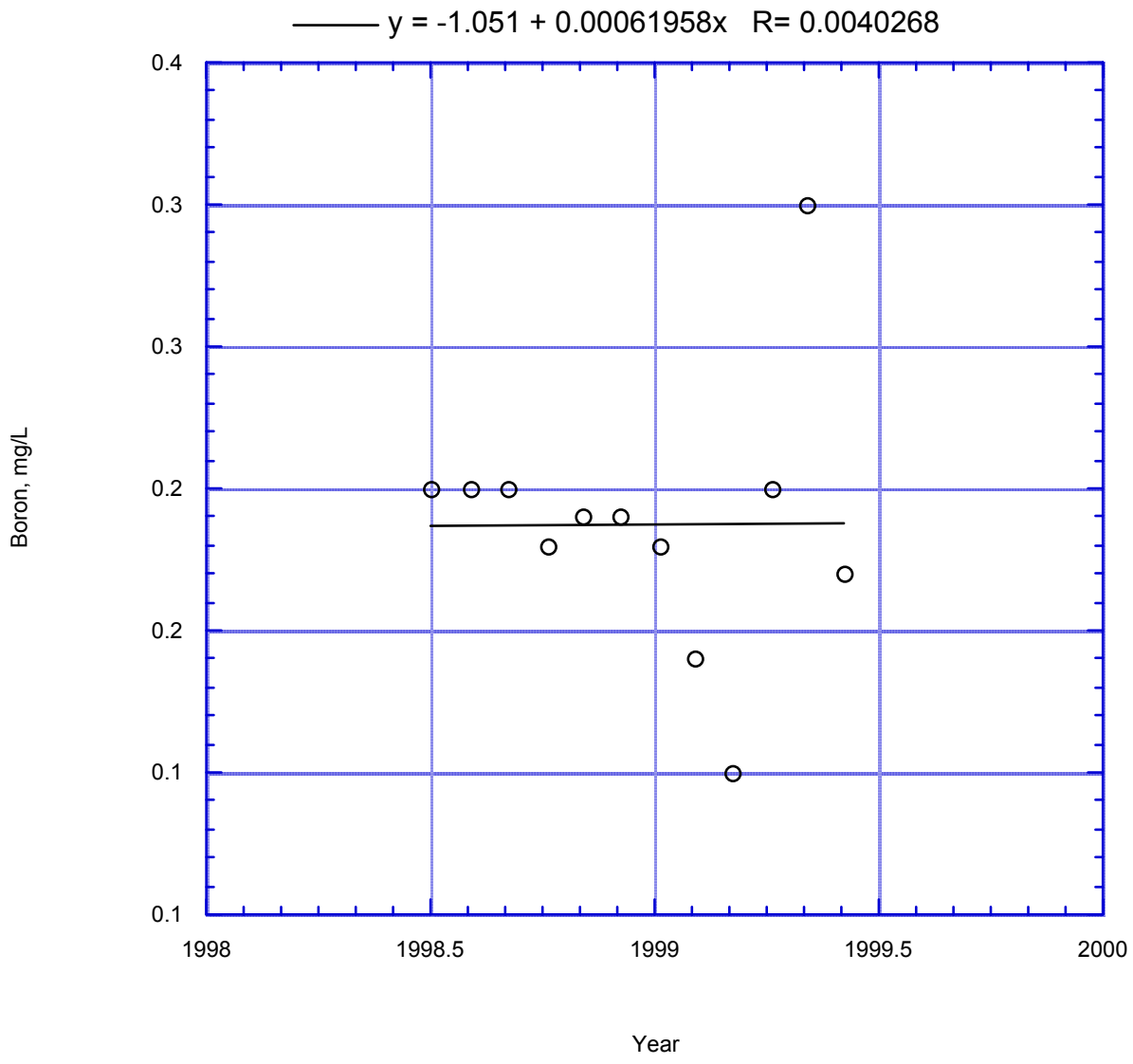


Figure 180. Reach 11 Boron vs. Time

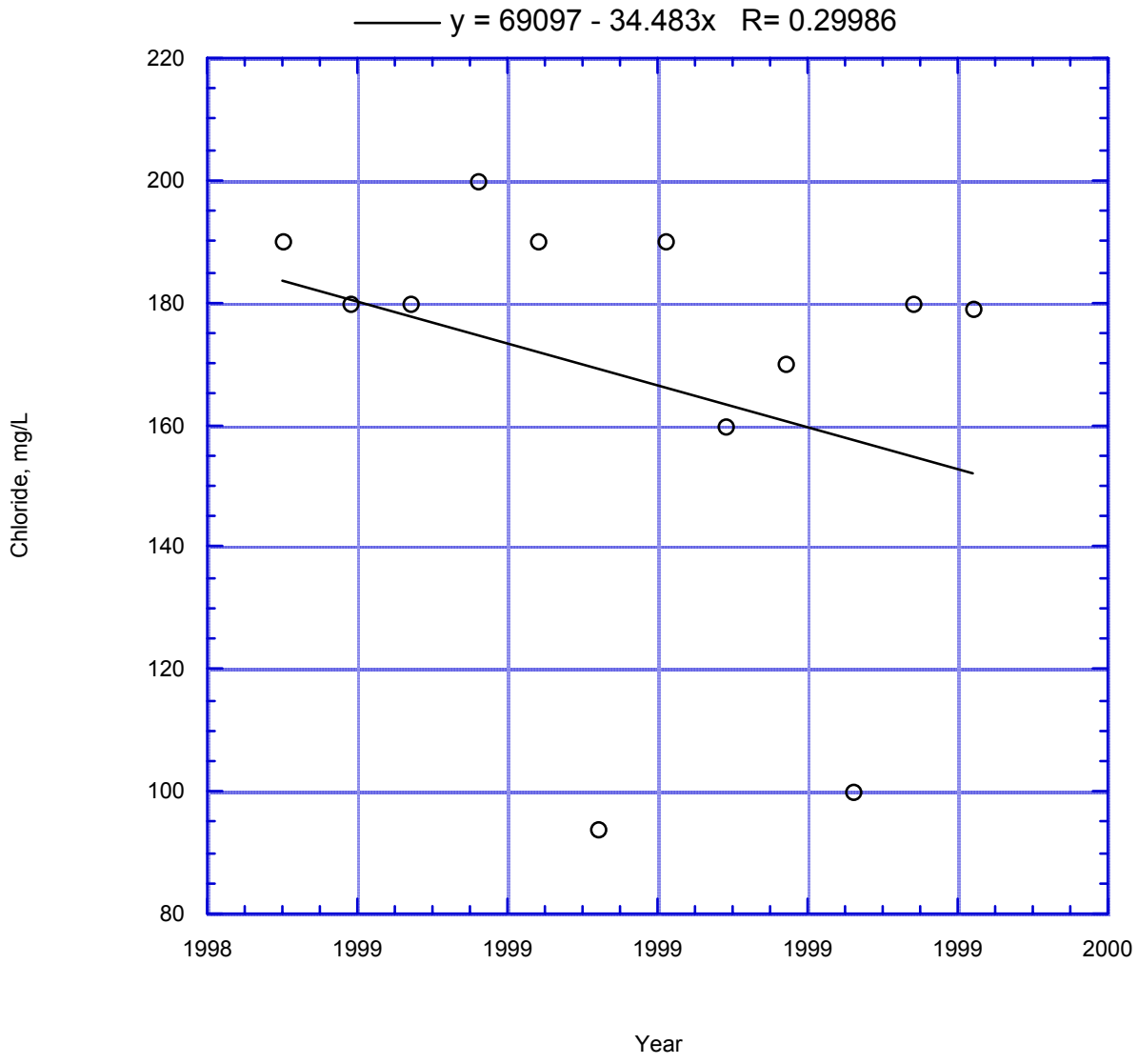


Figure 181. Reach 13 Chloride vs. Time

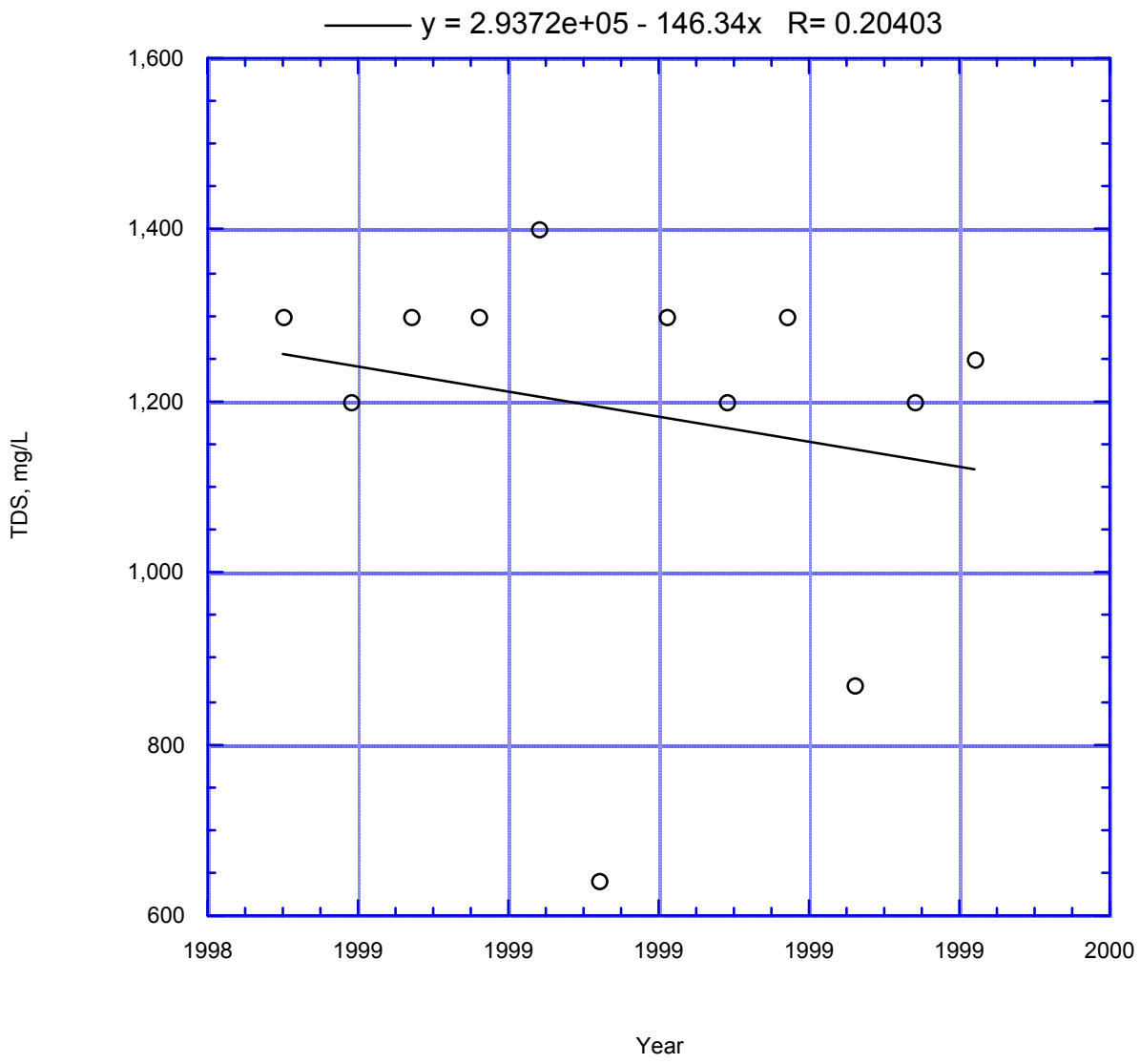


Figure 182. Reach 13 TDS vs. Time

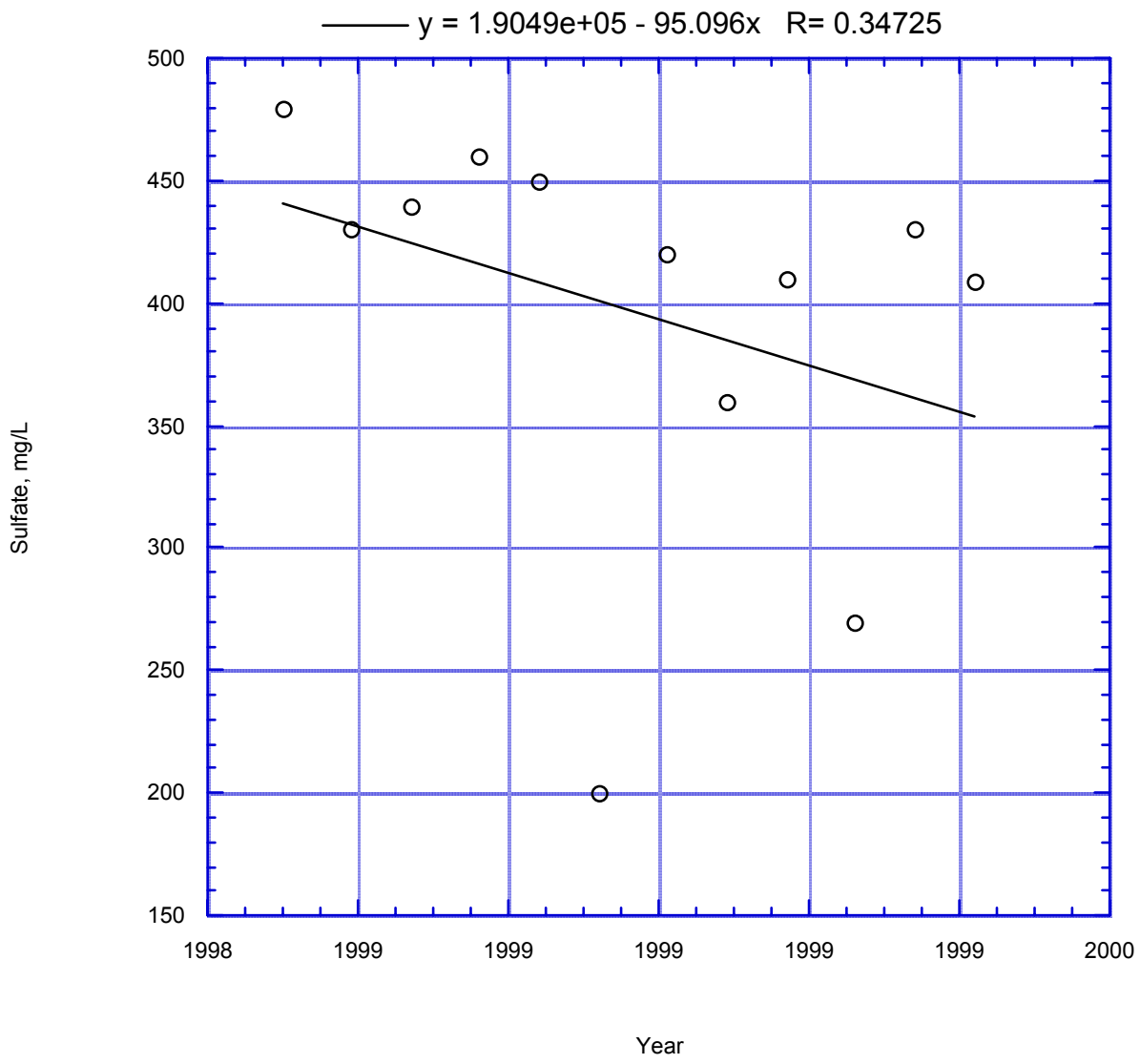


Figure 183. Reach 13 Sulfate vs. Time

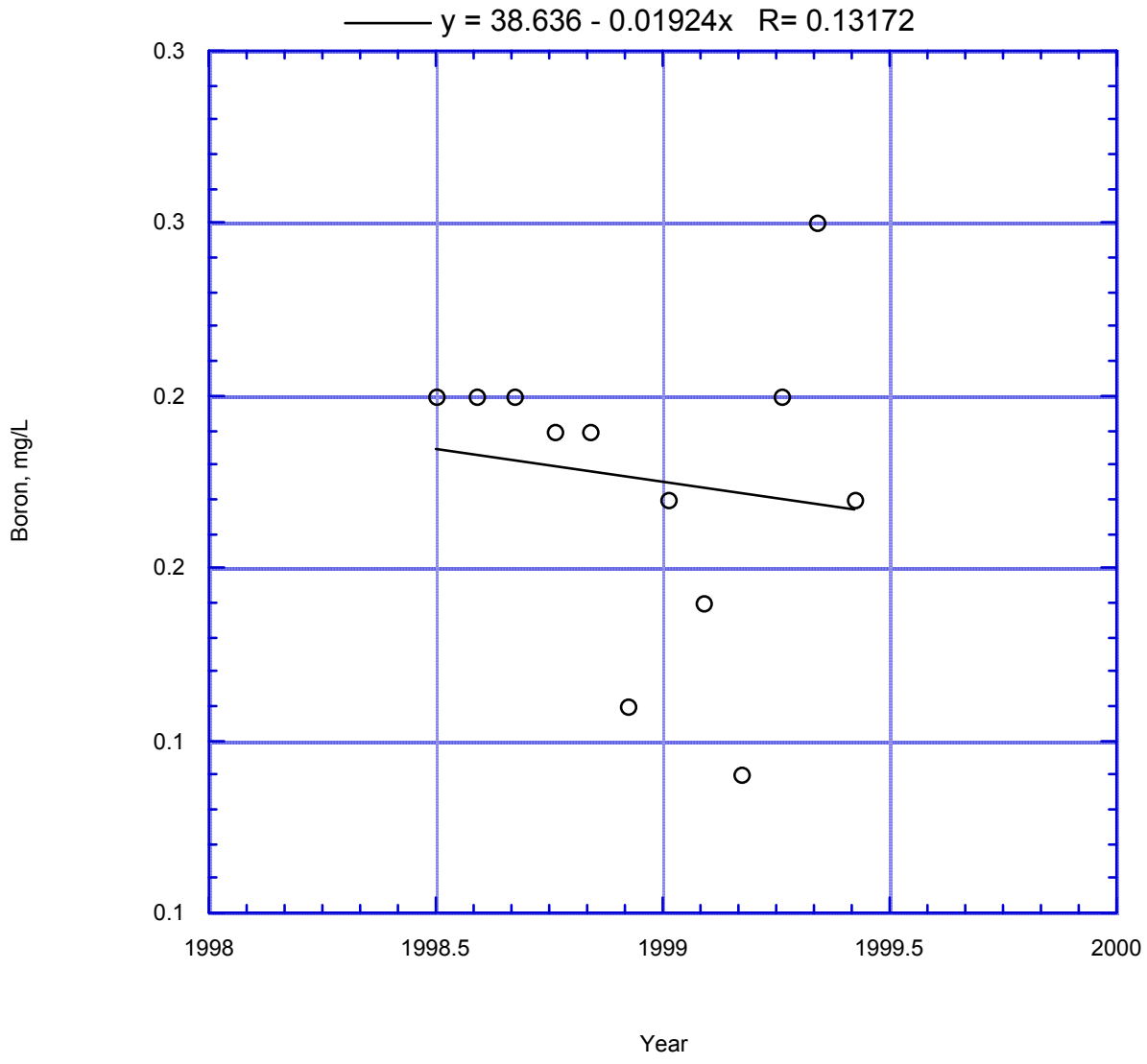


Figure 184. Reach 13 Boron vs. Time

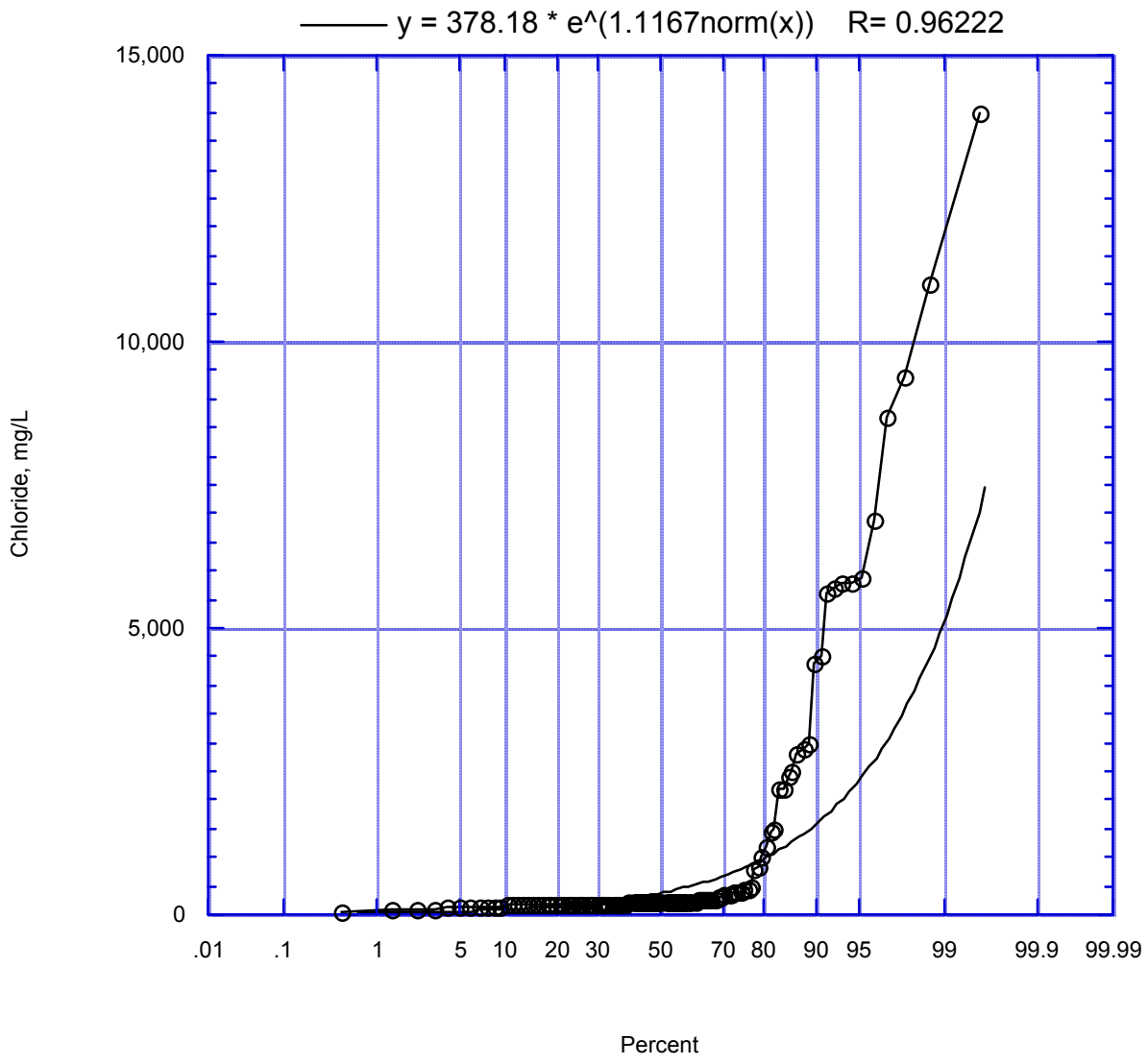


Figure 185. Reach 2 Chloride Frequency Distribution

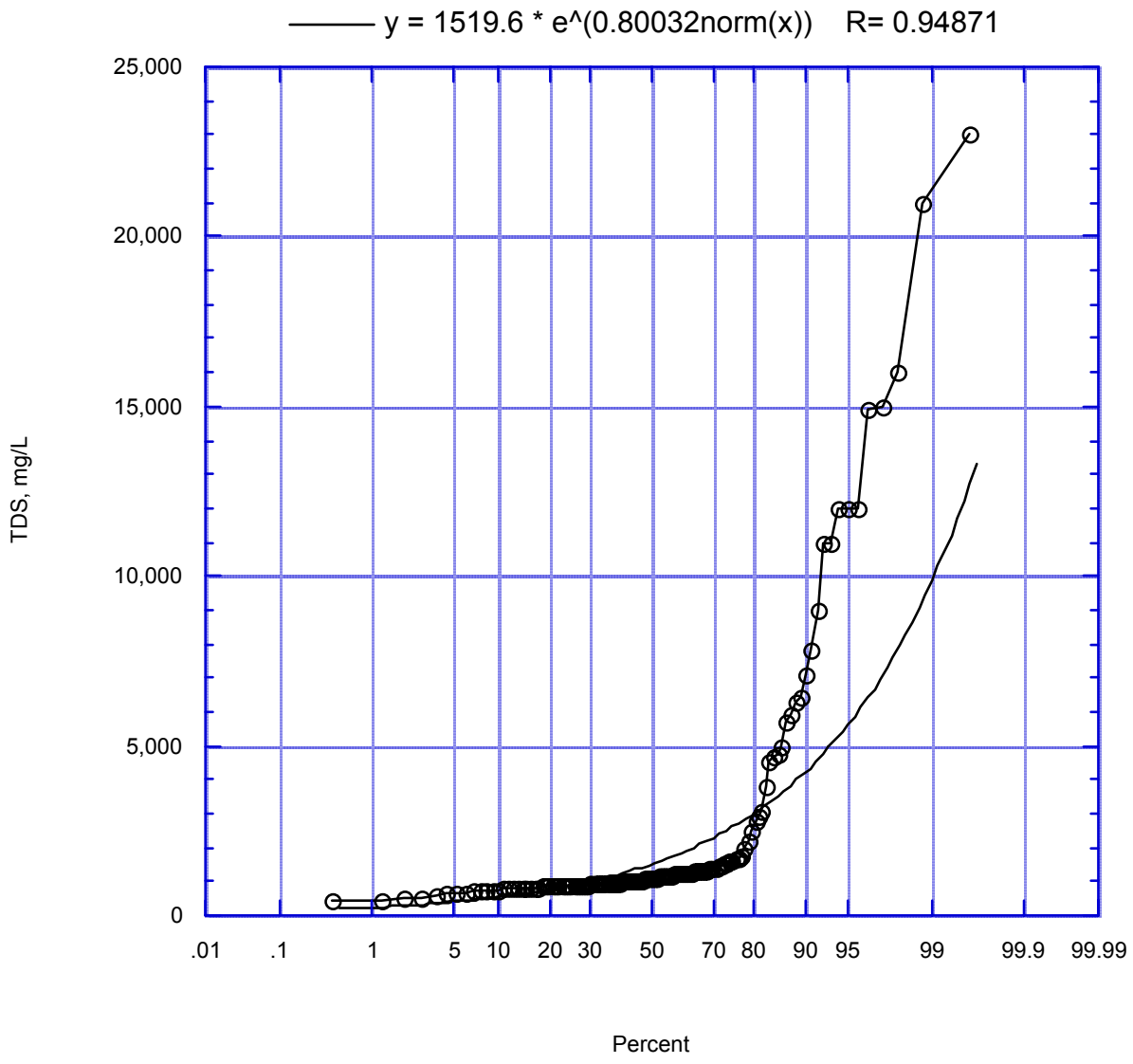


Figure 186. Reach 2 TDS Frequency Distribution

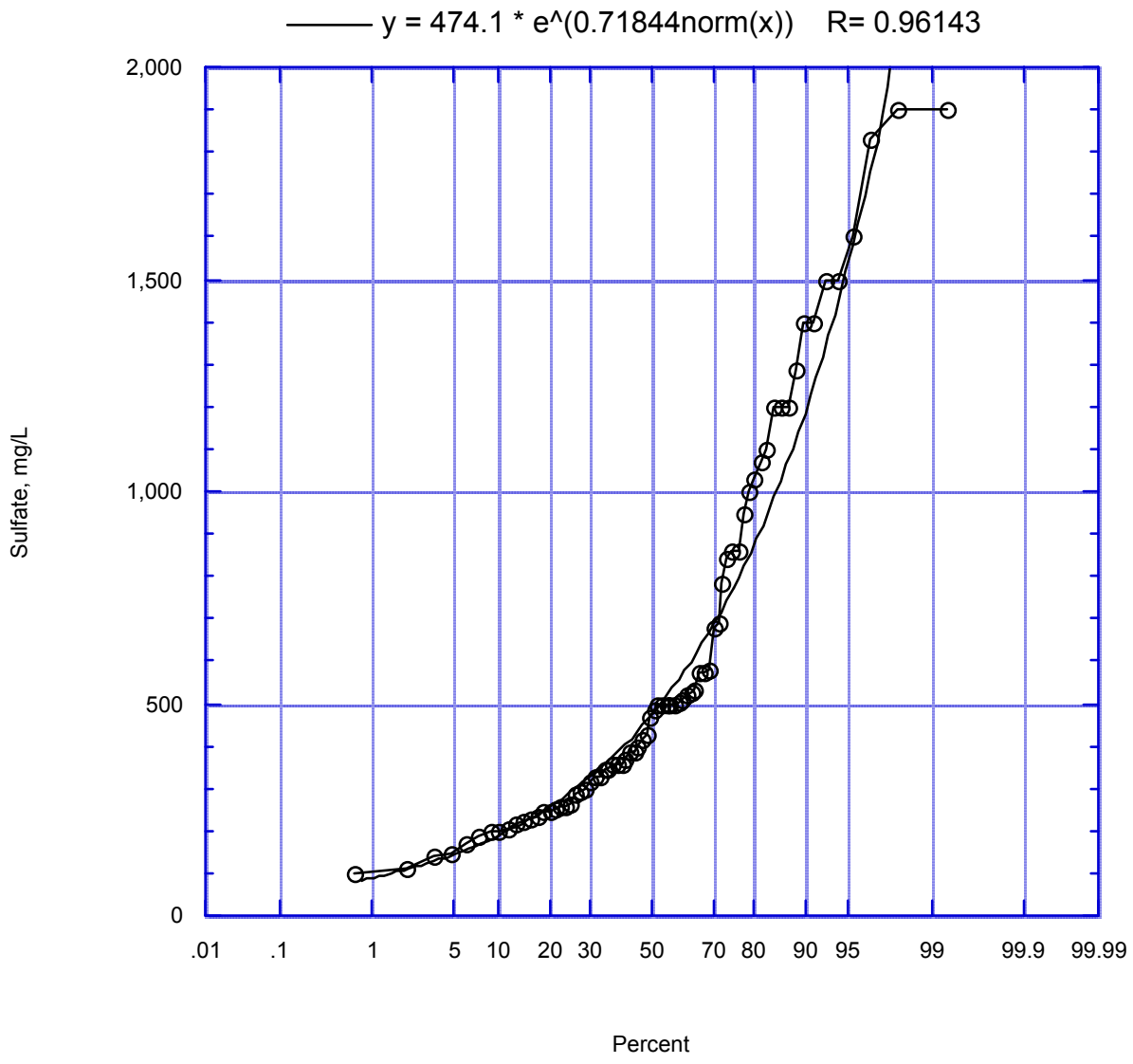


Figure 187. Reach 2 Sulfate Frequency Distribution

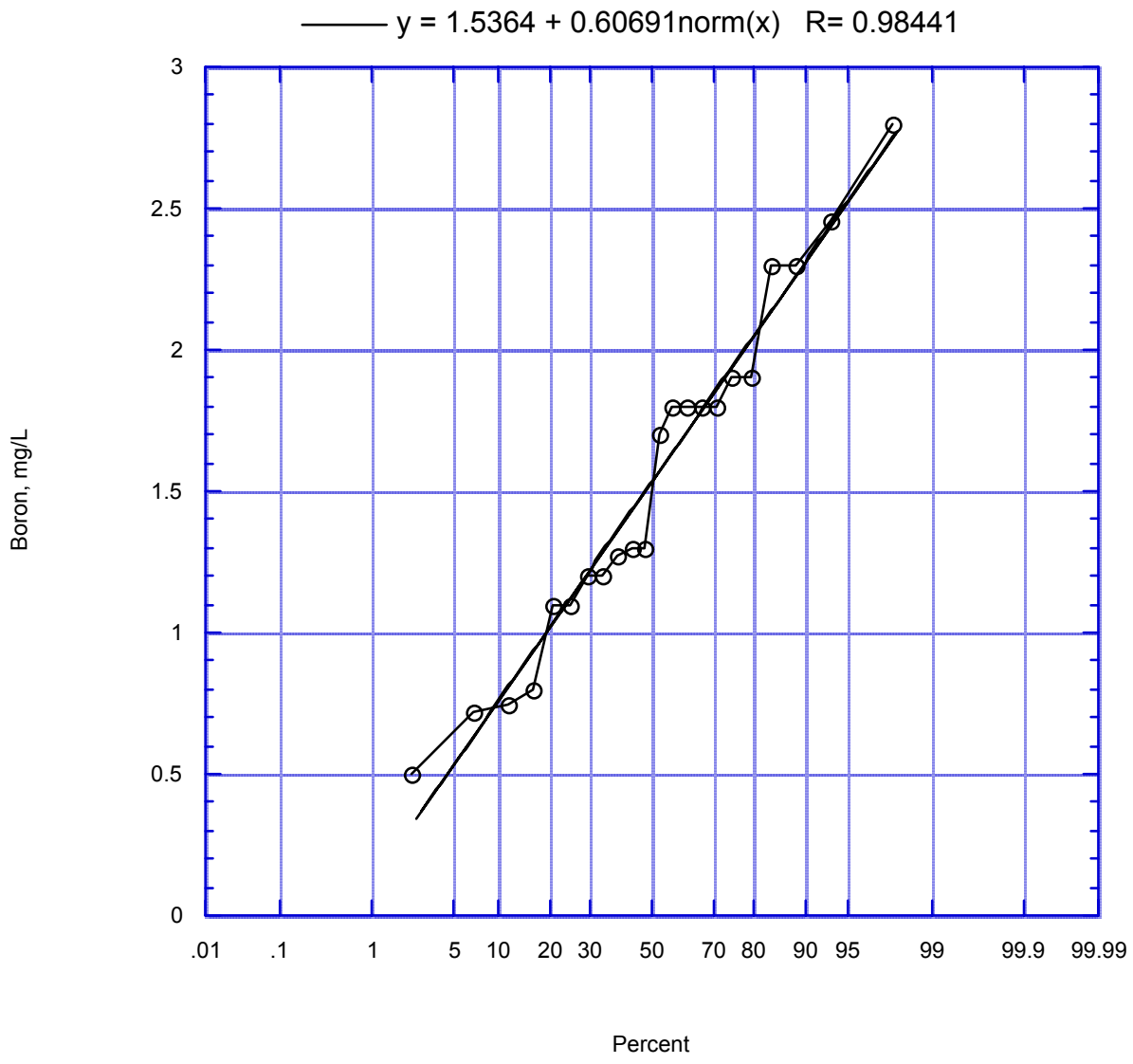


Figure 188. Reach 2 Boron Frequency Distribution

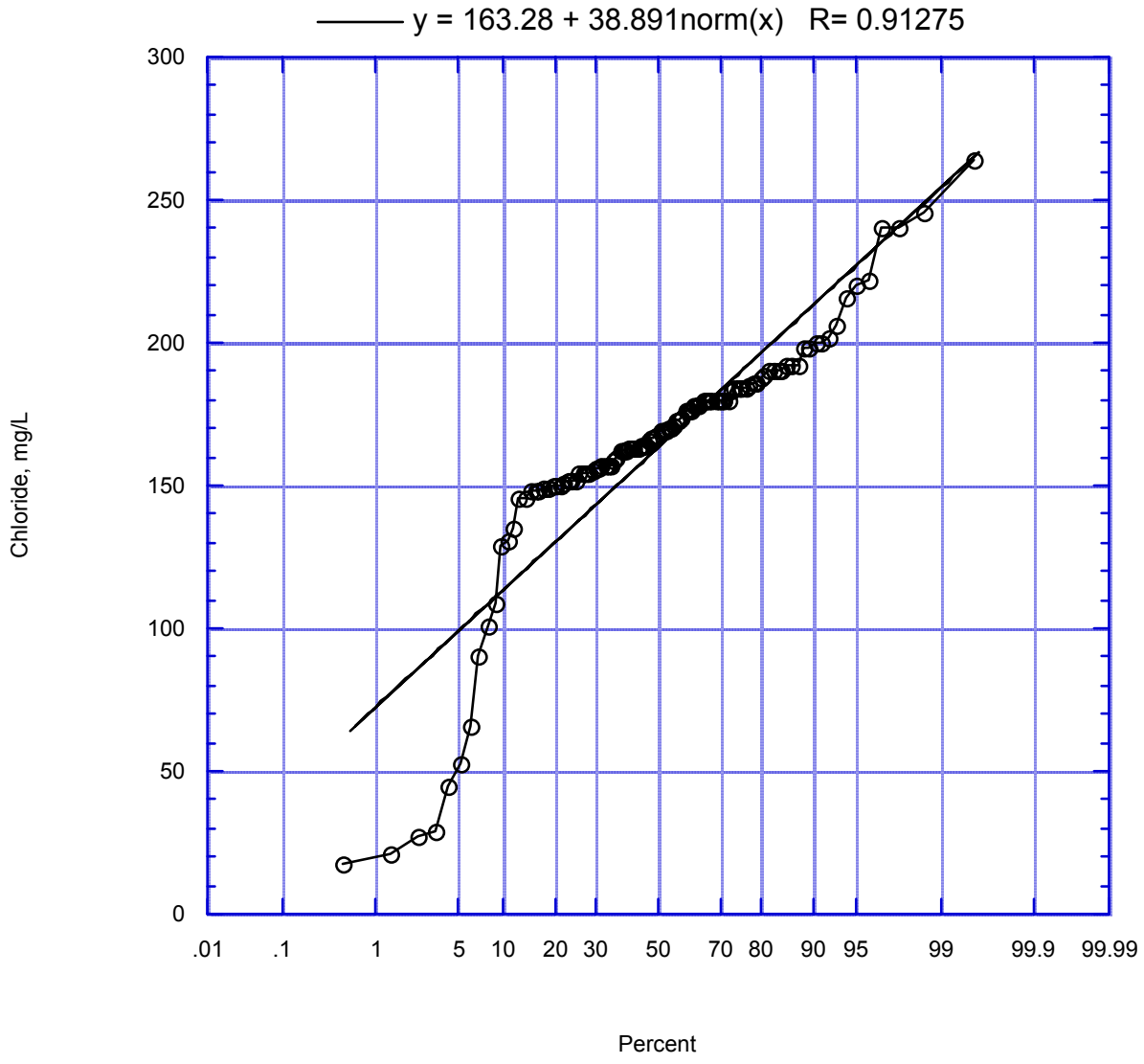


Figure 189. Reach 3 Chloride Frequency Distribution

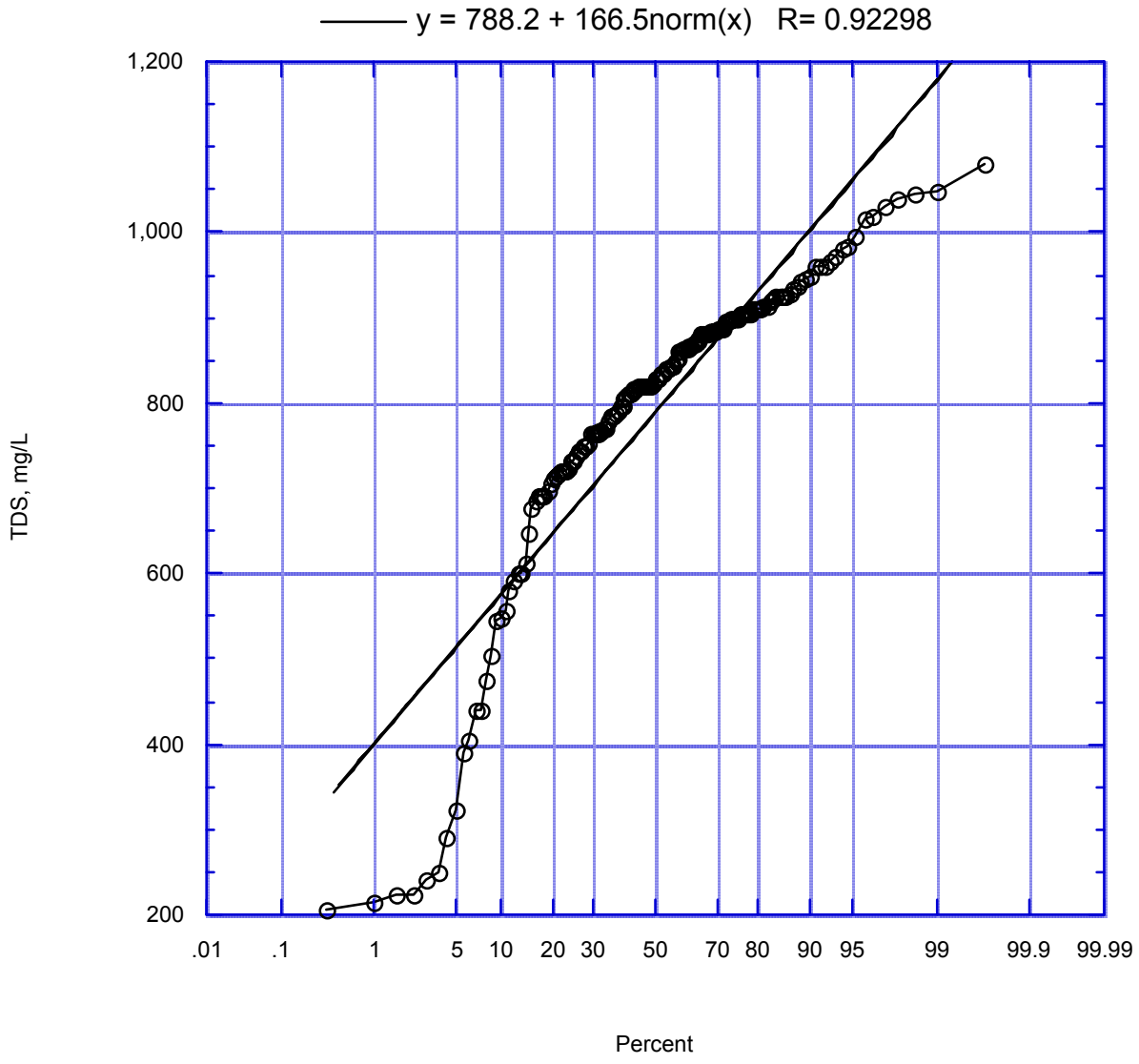


Figure 190. Reach 3 TDS Frequency Distribution

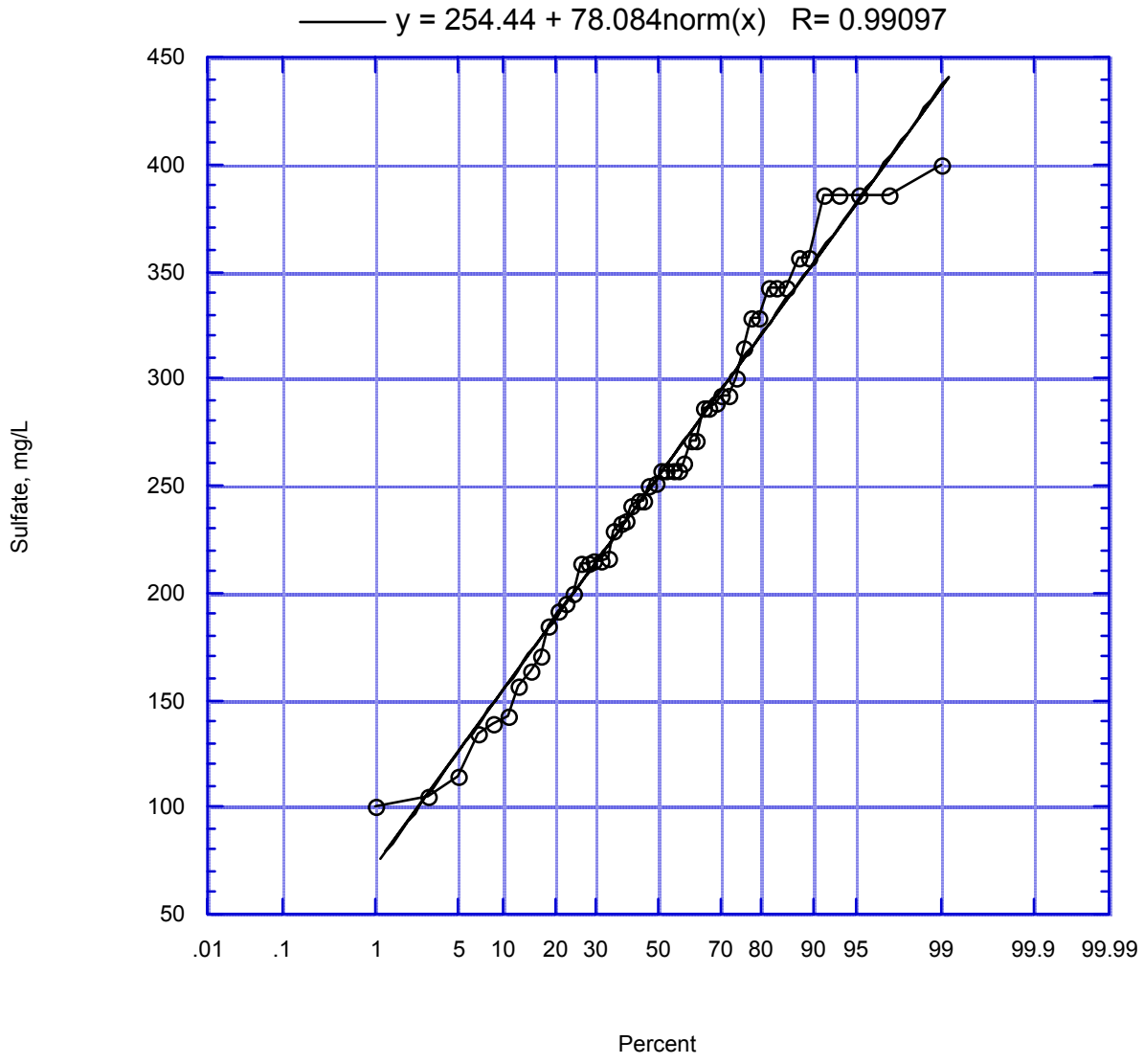


Figure 191. Reach 3 Sulfate Frequency Distribution

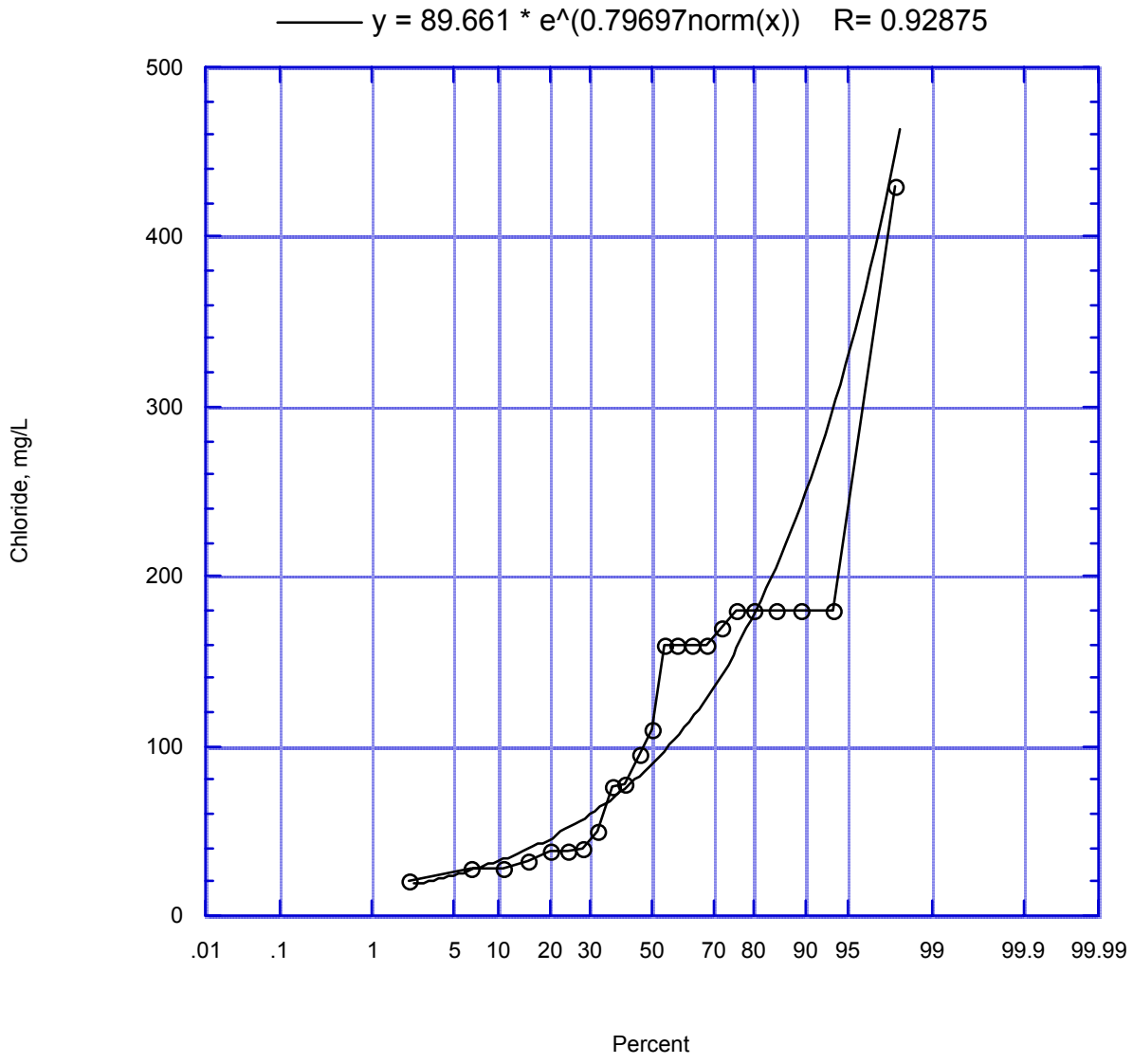


Figure 192. Reach 4 Chloride Frequency Distribution

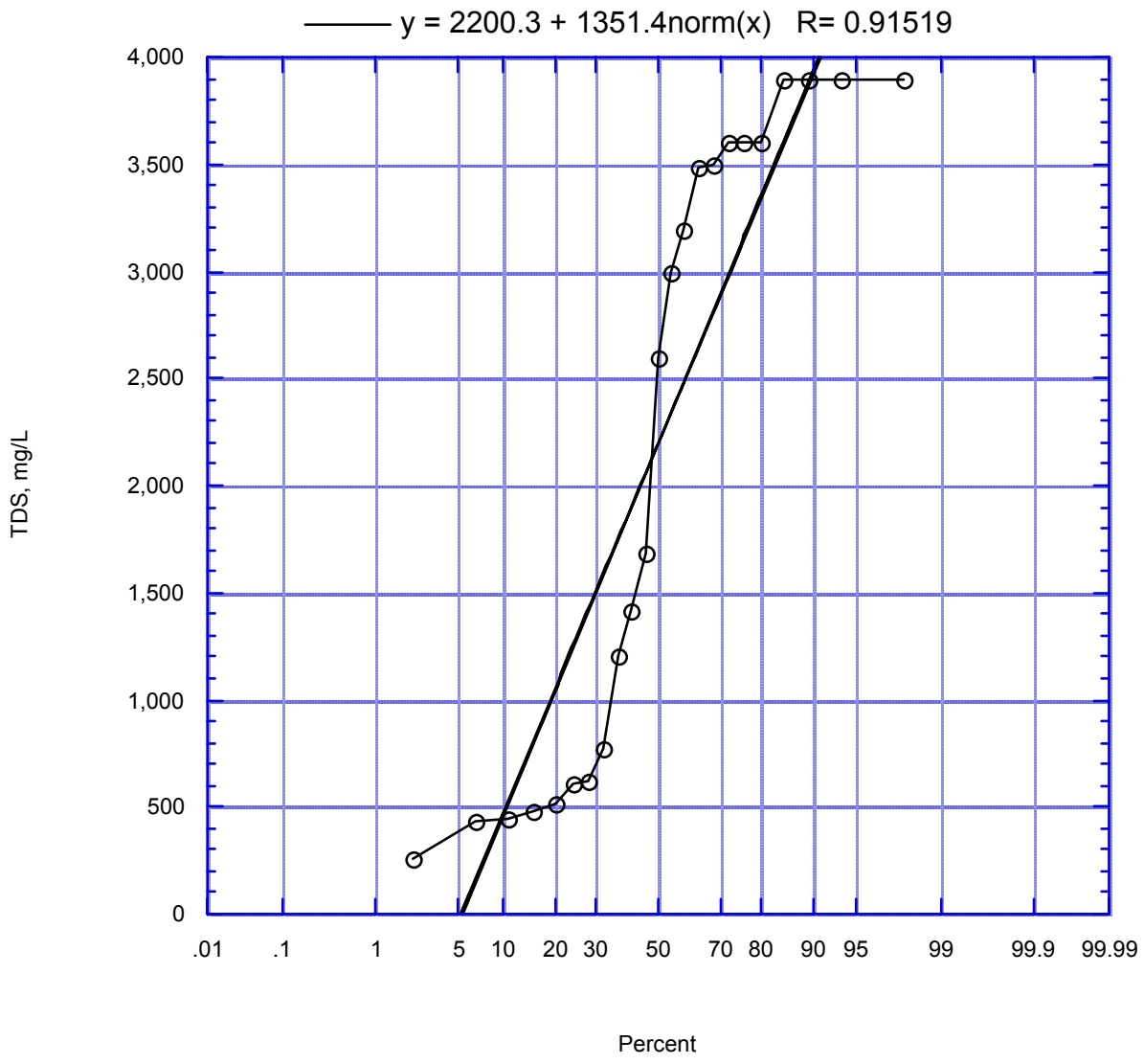


Figure 193. Reach 4 TDS Frequency Distribution

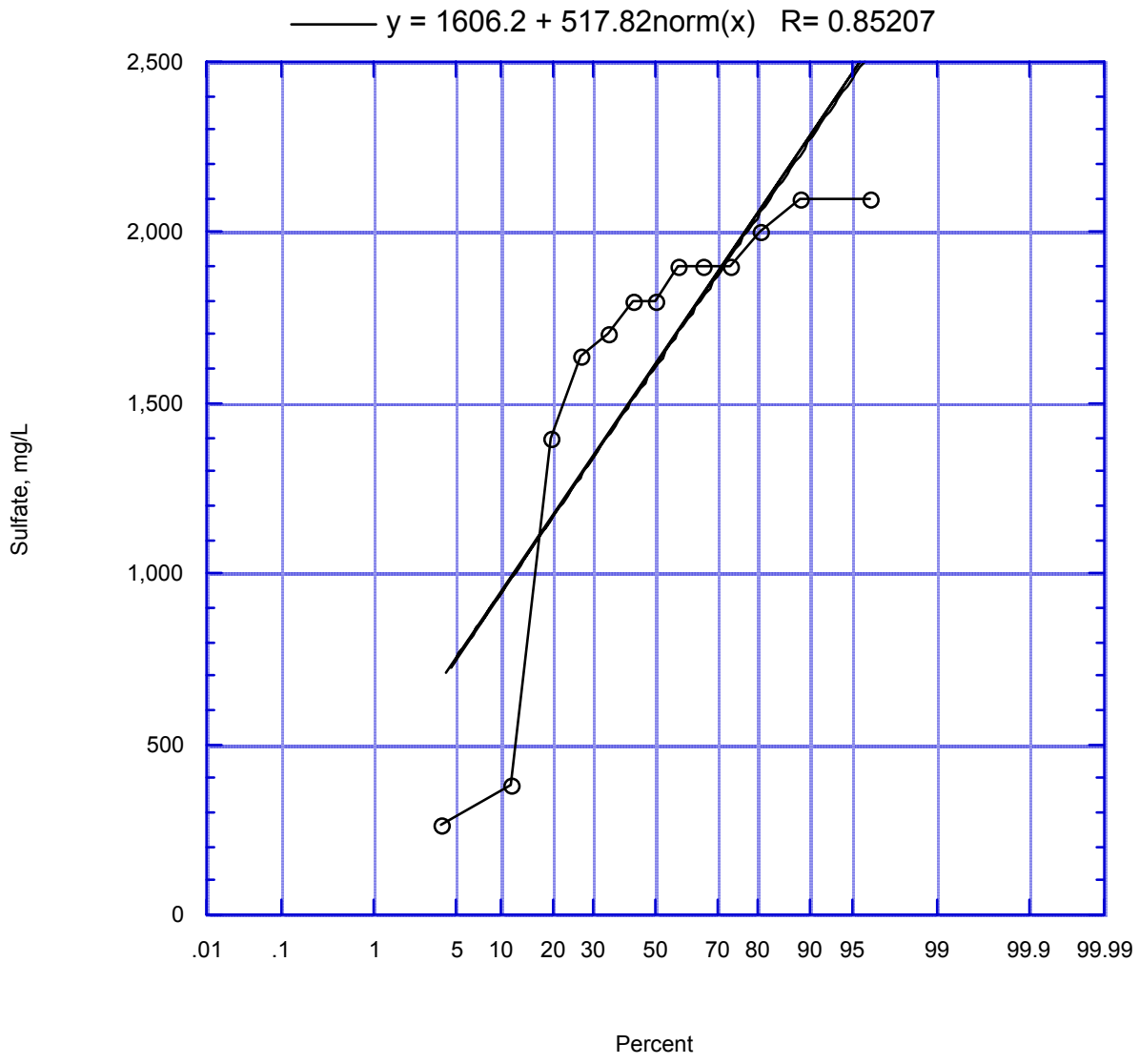


Figure 194. Reach 4 Sulfate Frequency Distribution

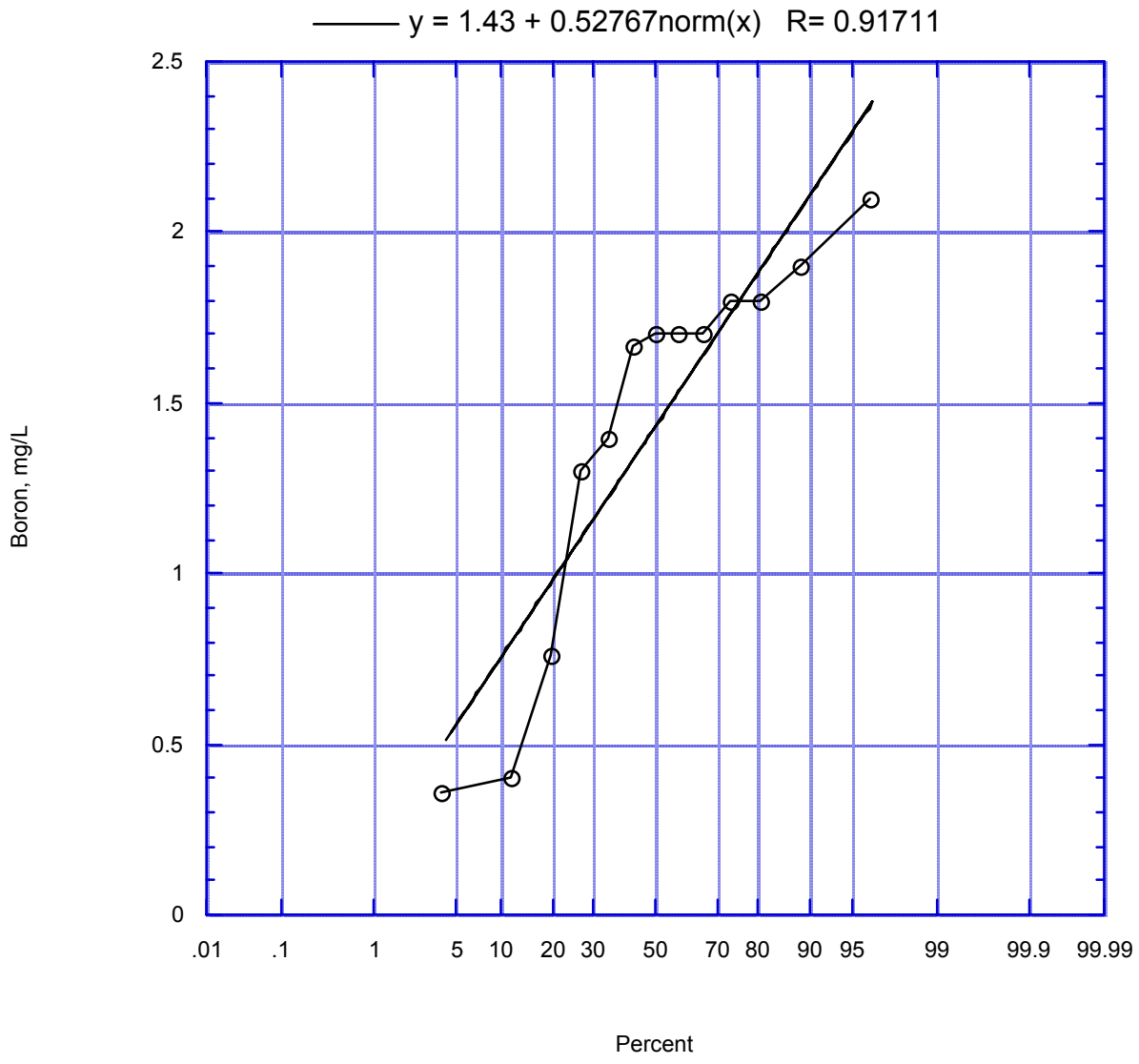


Figure 195. Reach 4 Boron Frequency Distribution

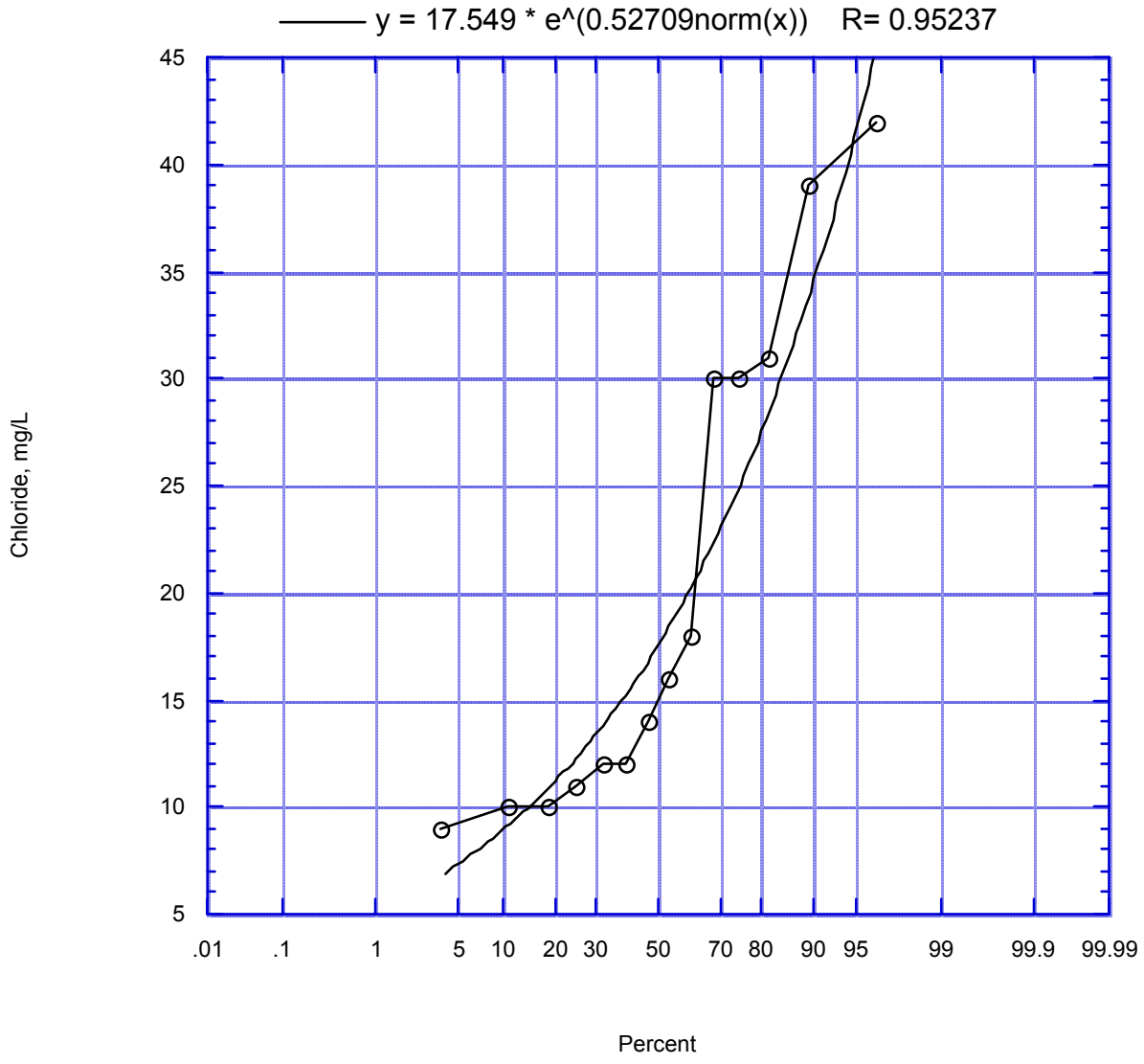


Figure 196. Reach 5 Chloride Frequency Distribution

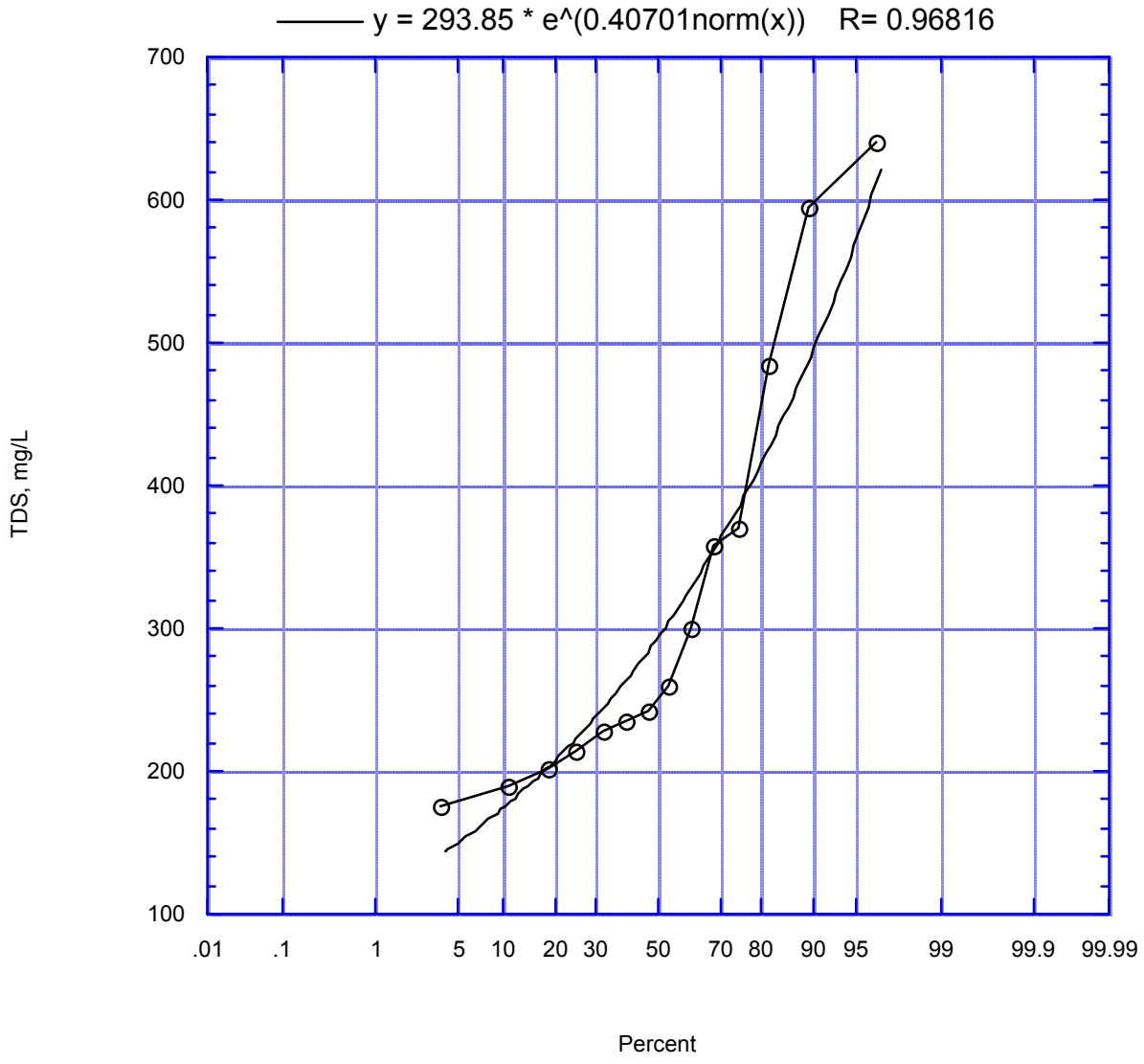


Figure 197. Reach 5 TDS Frequency Distribution

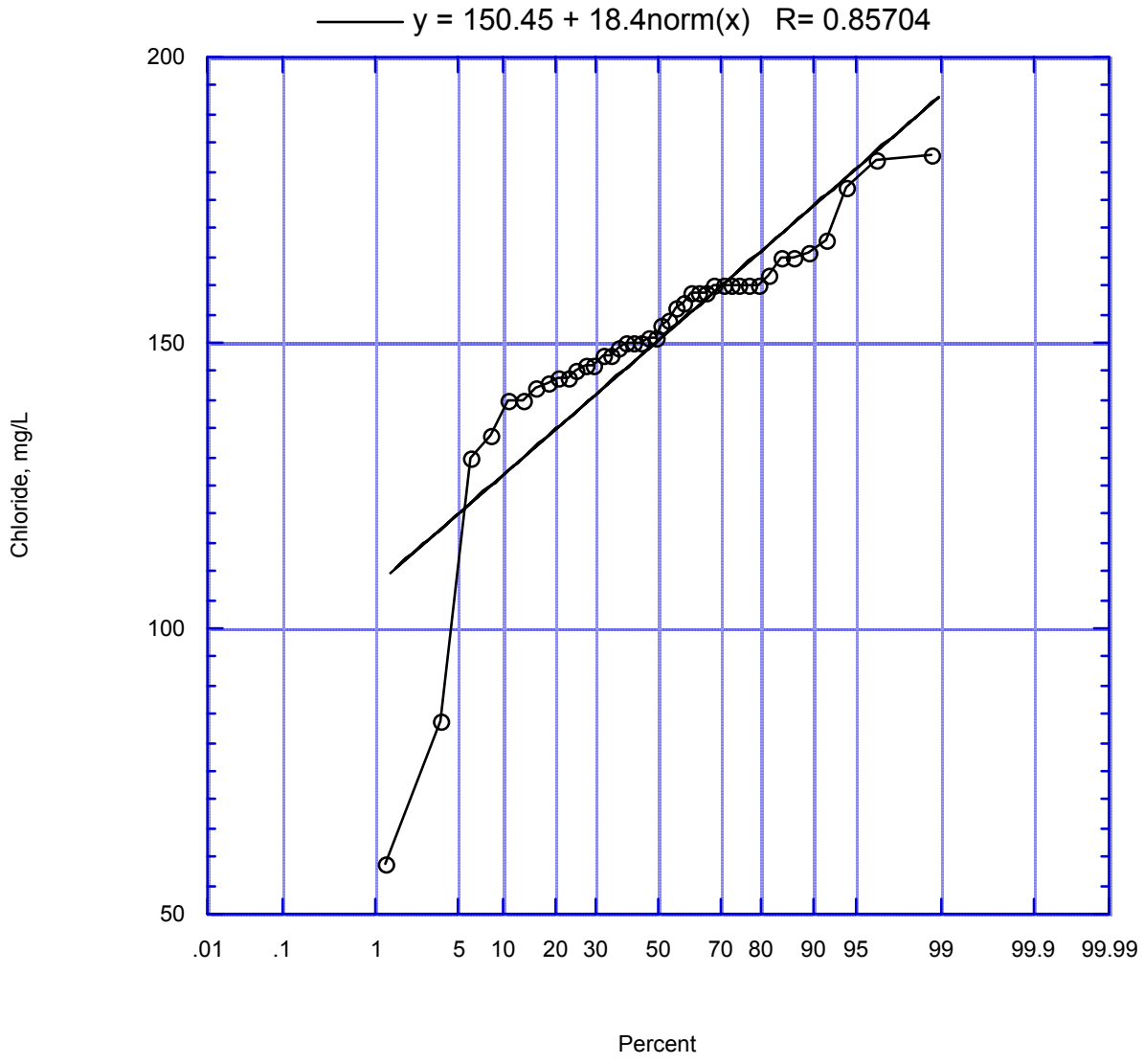


Figure 198. Reach 6 Chloride Frequency Distribution

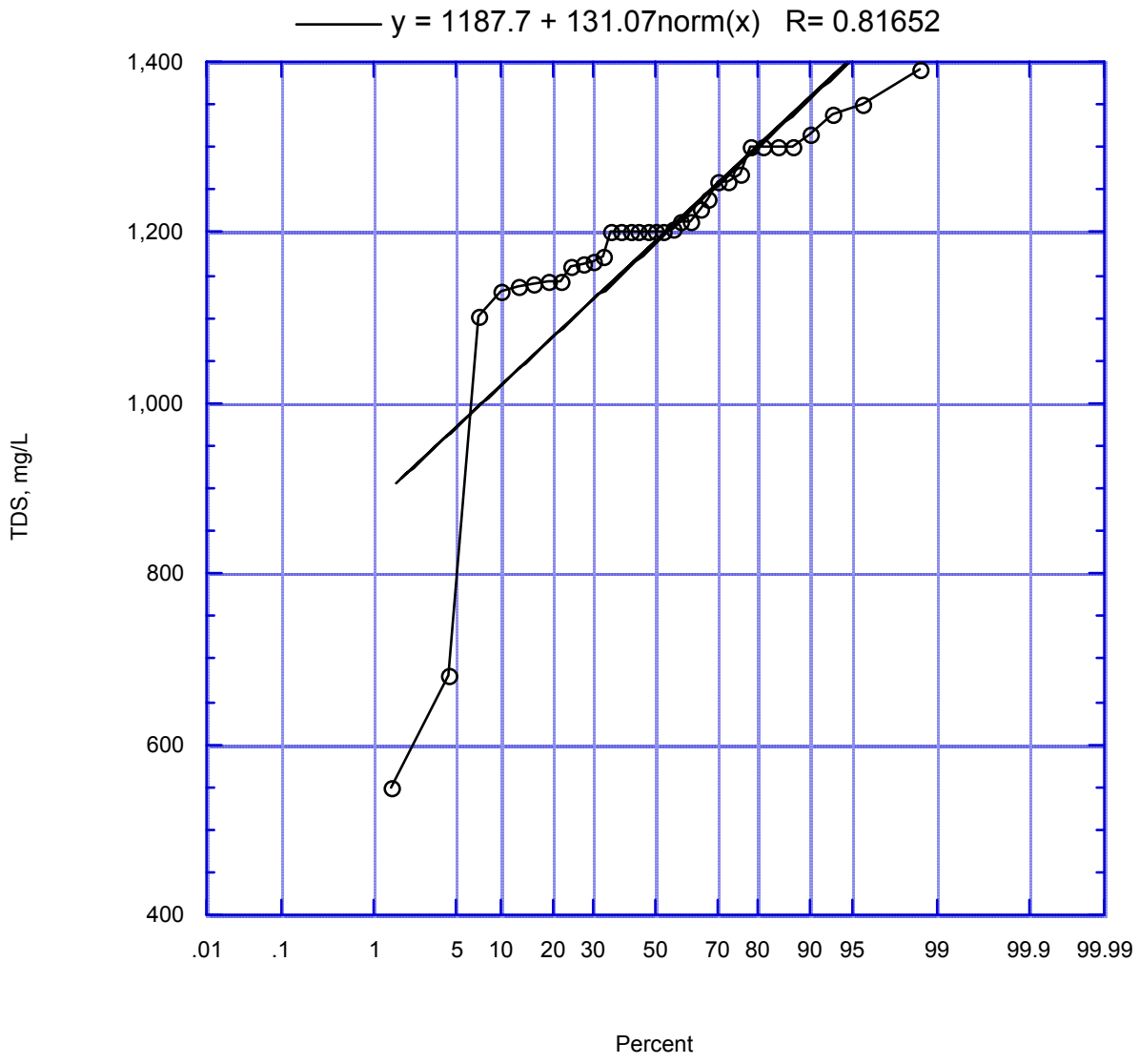


Figure 199. Reach 6 TDS Frequency Distribution

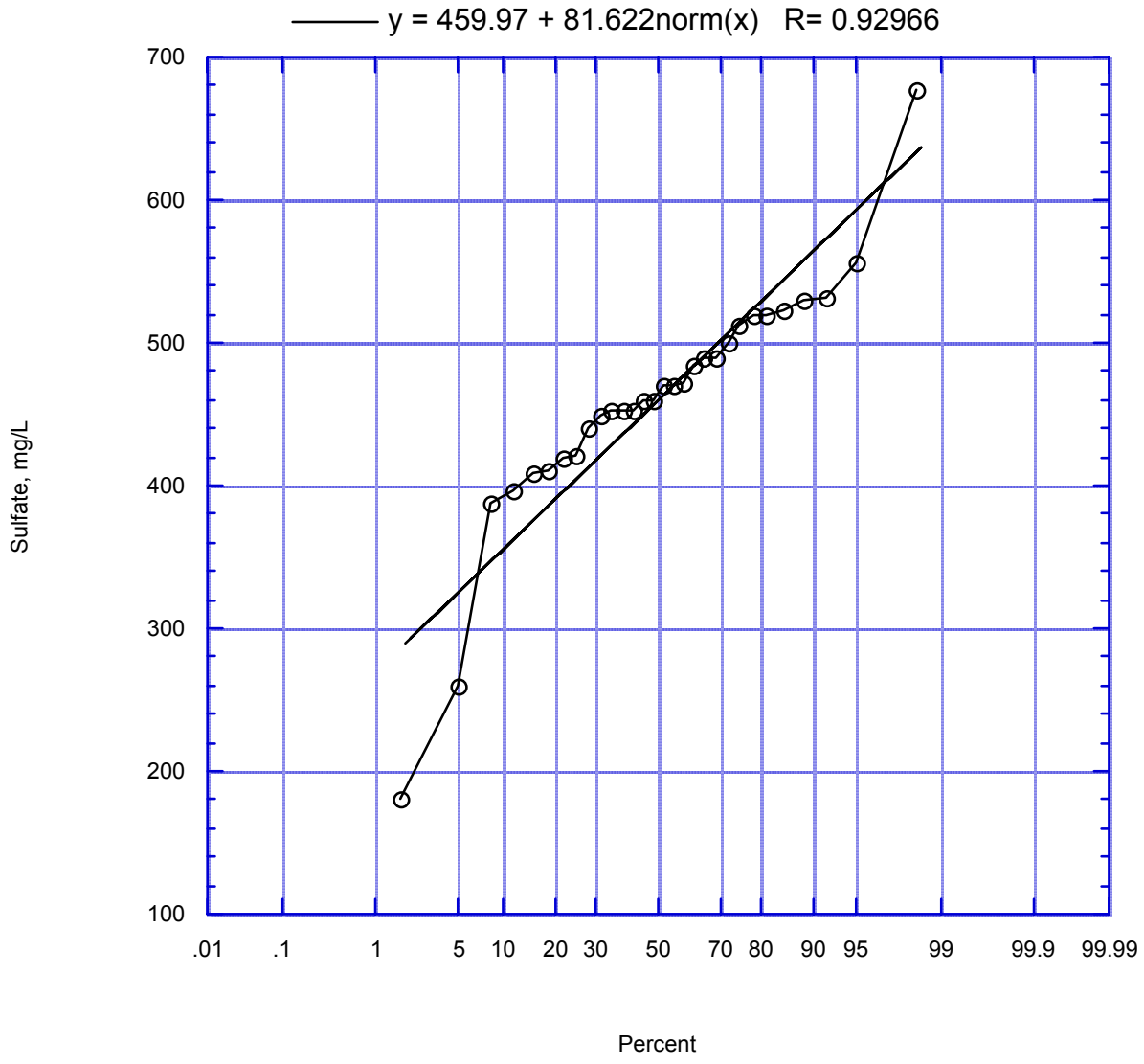


Figure 200. Reach 6 Sulfate Frequency Distribution

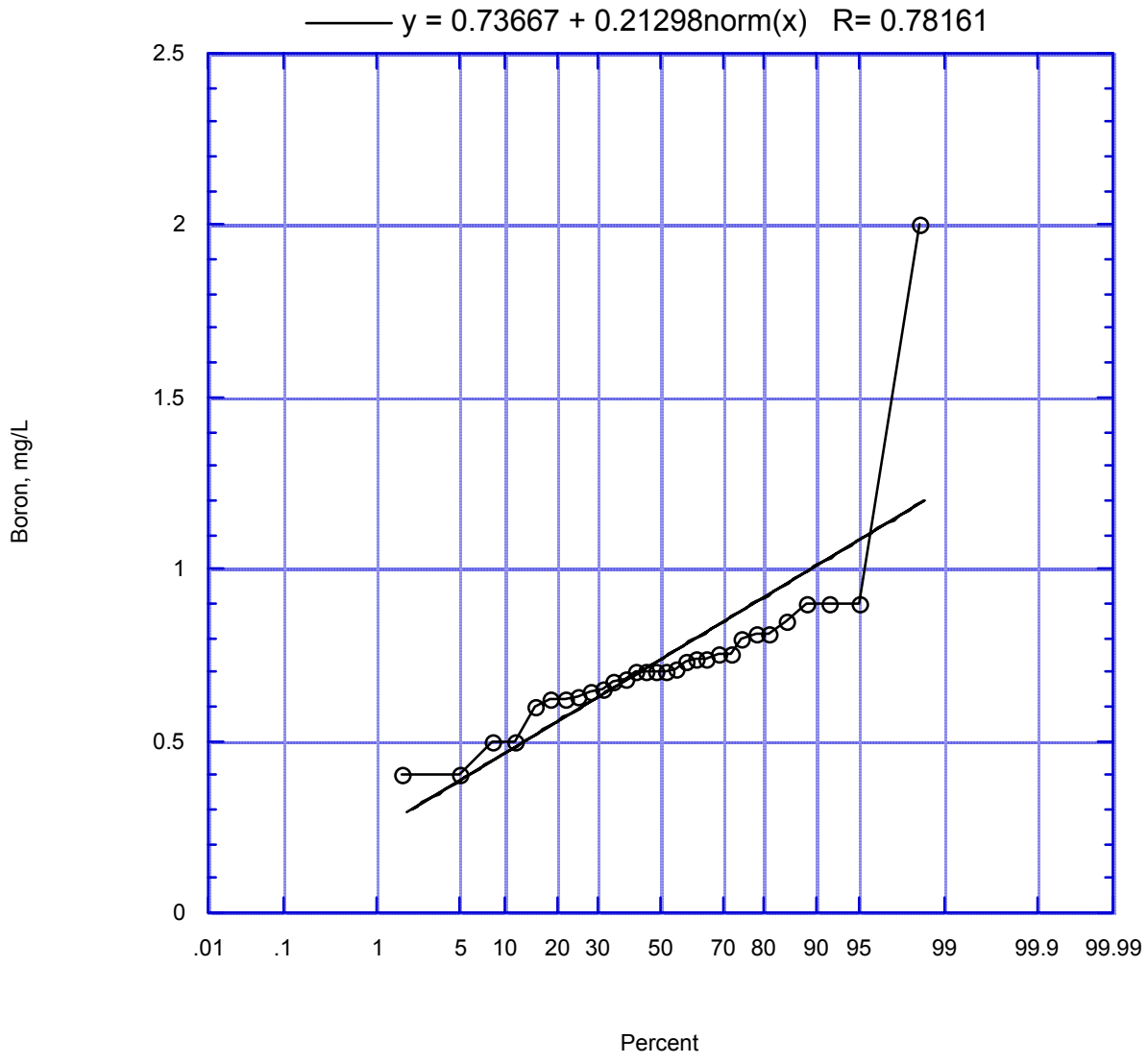


Figure 201. Reach 6 Boron Frequency Distribution

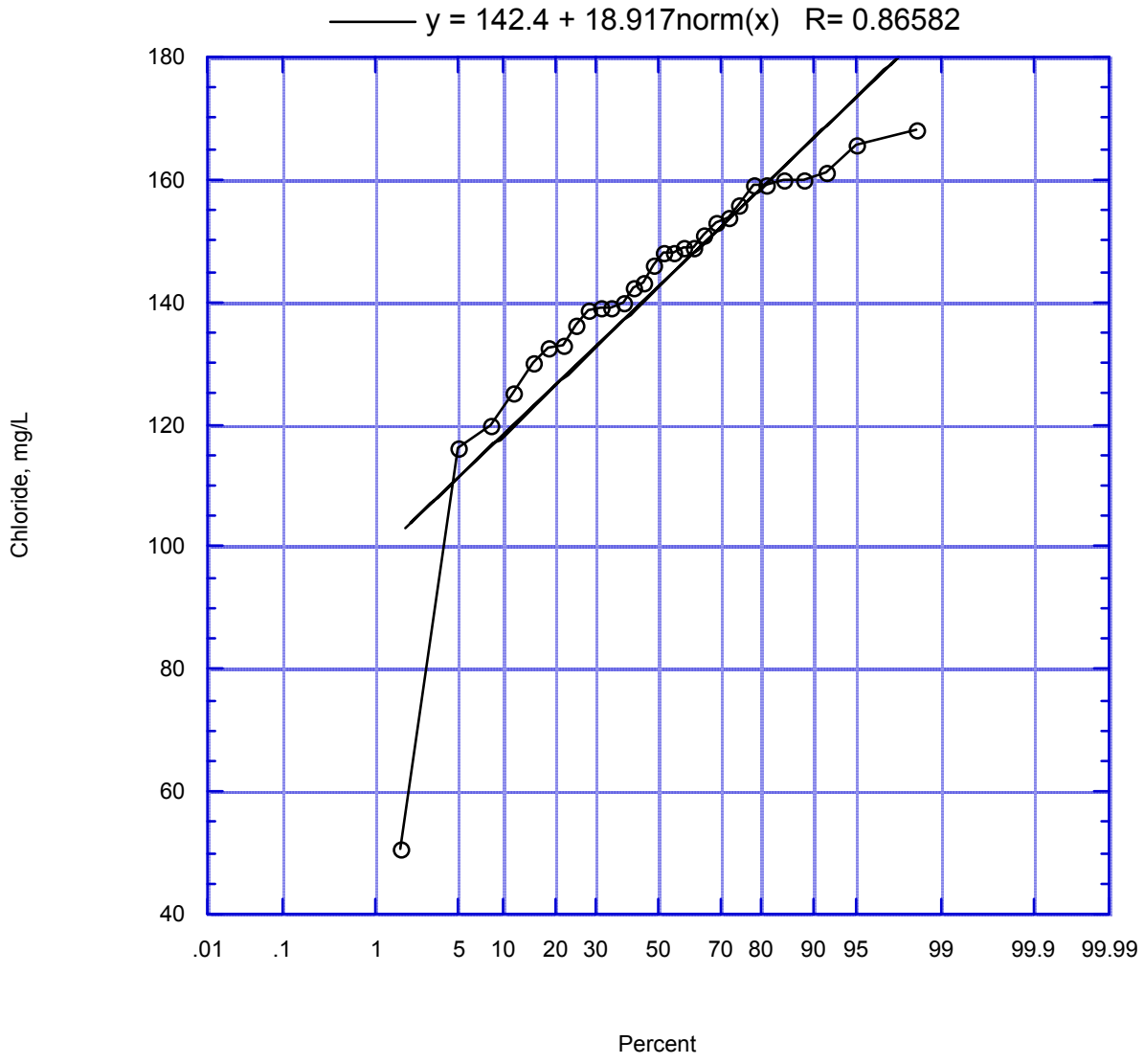


Figure 202. Reach 7 Chloride Frequency Distribution

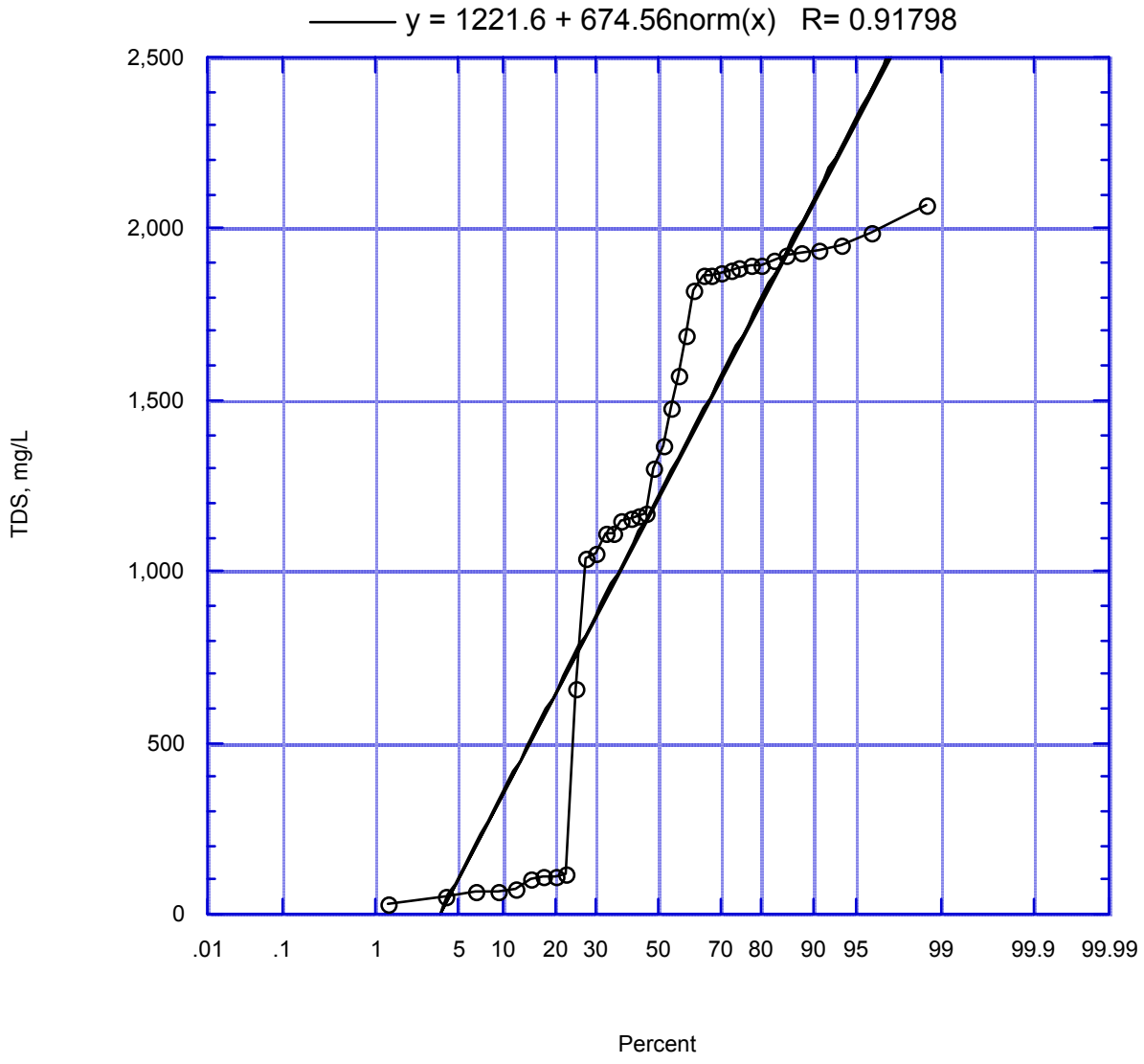


Figure 203. Reach 7 TDS Frequency Distribution

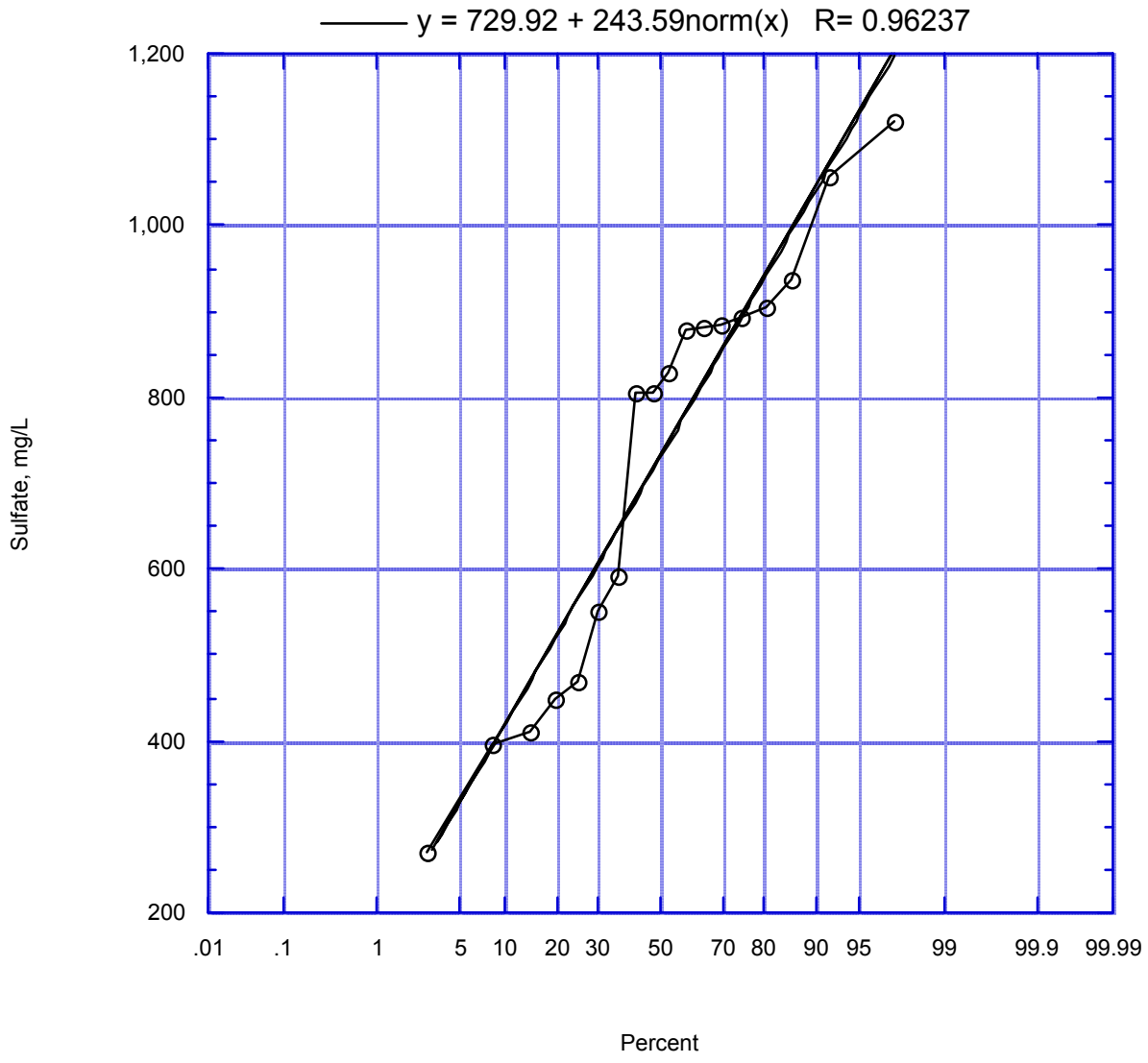


Figure 204. Reach 7 Sulfate Frequency Distribution

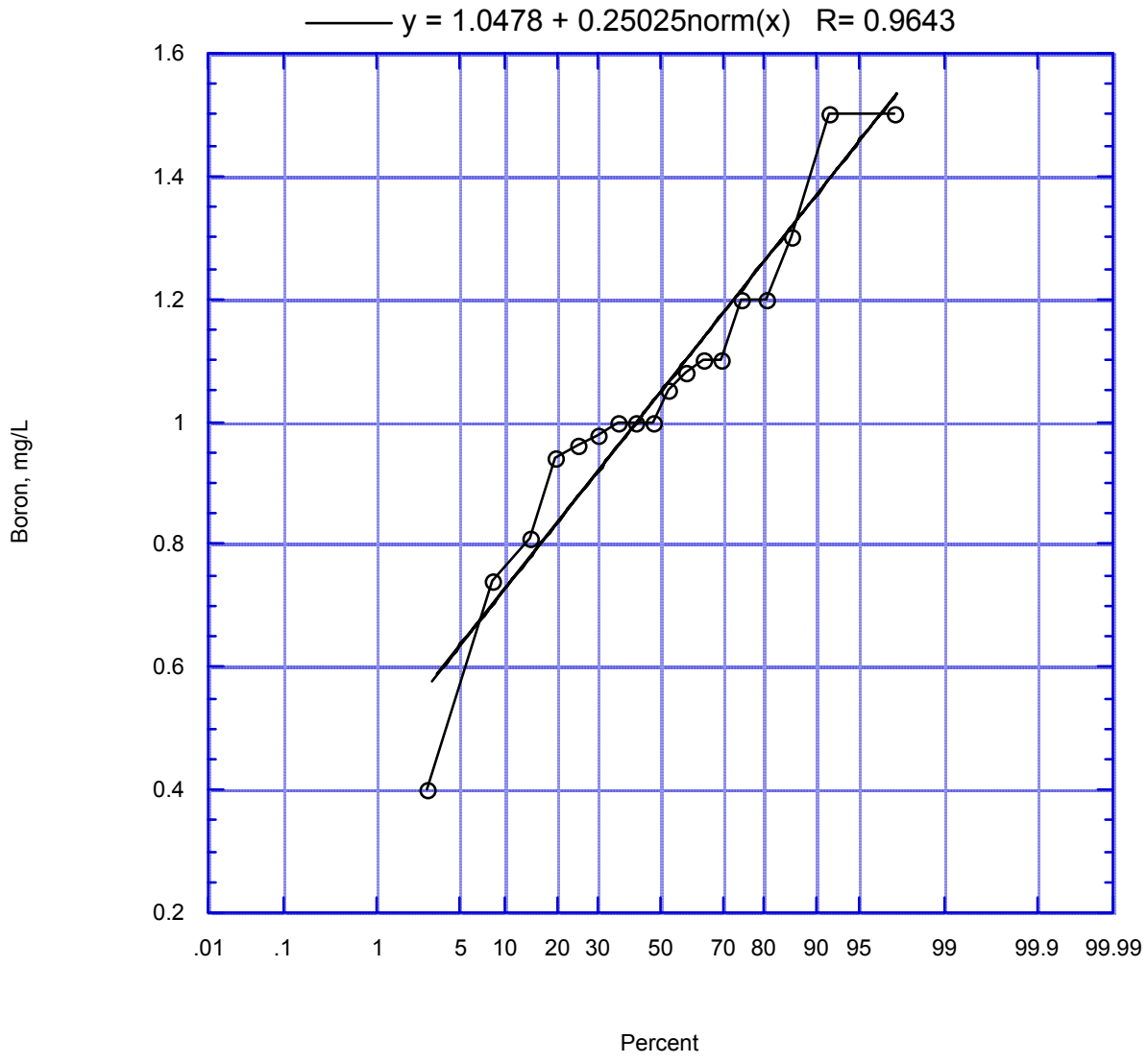


Figure 205. Reach 7 Boron Frequency Distribution

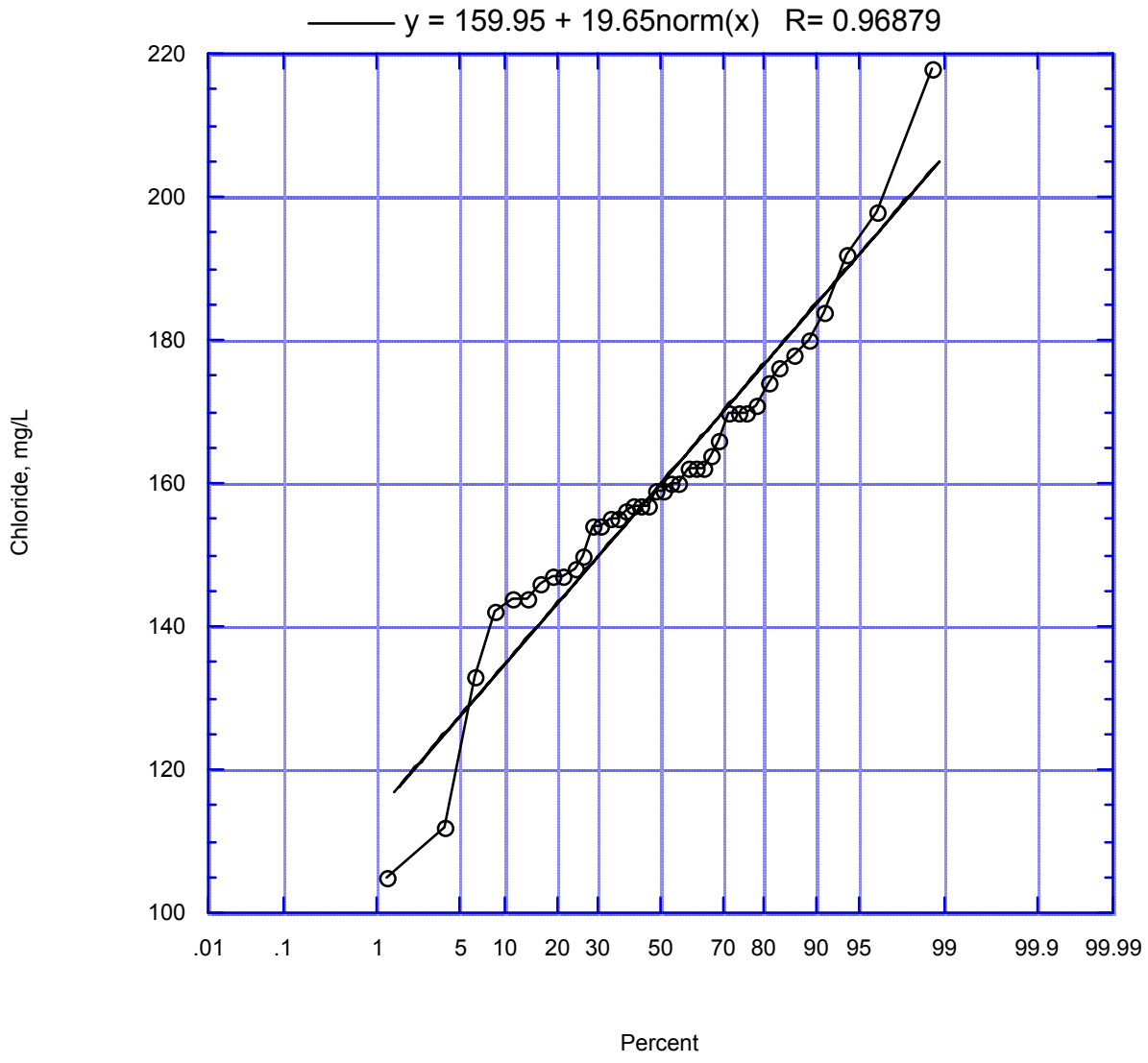


Figure 206. Reach 9A Chloride Frequency Distribution

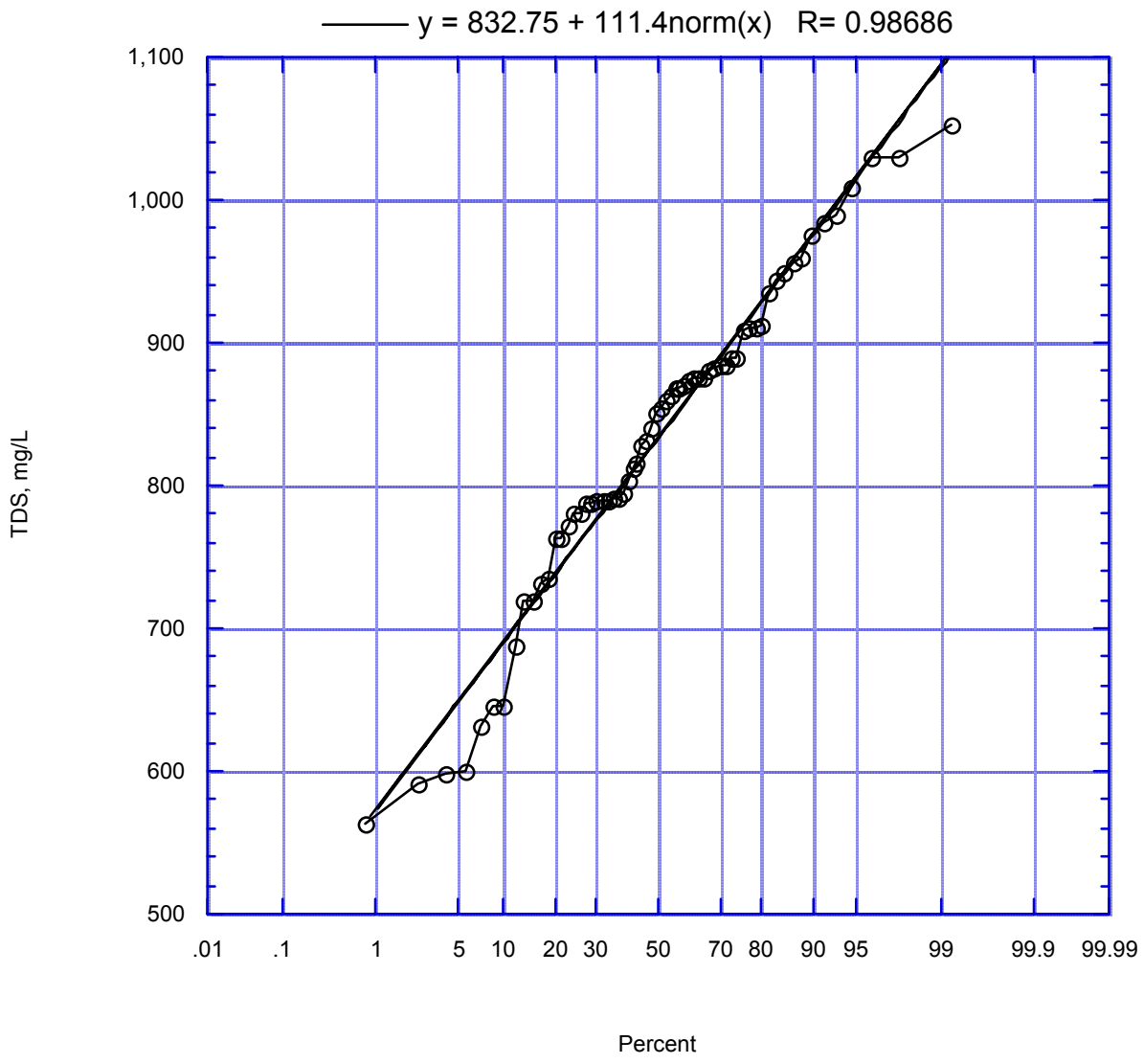


Figure 207. Reach 9A TDS Frequency Distribution

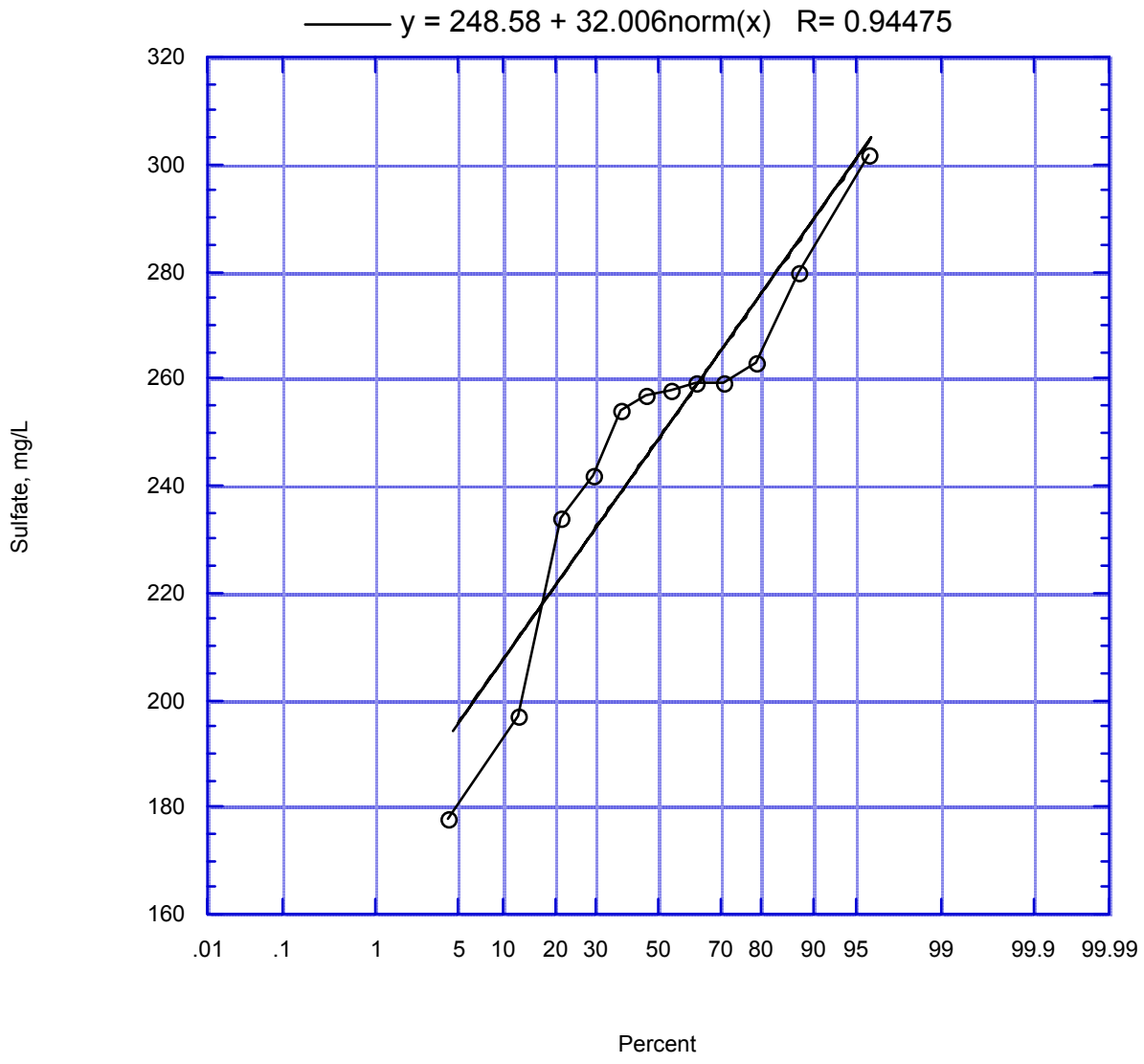


Figure 208. Reach 9A Sulfate Frequency Distribution

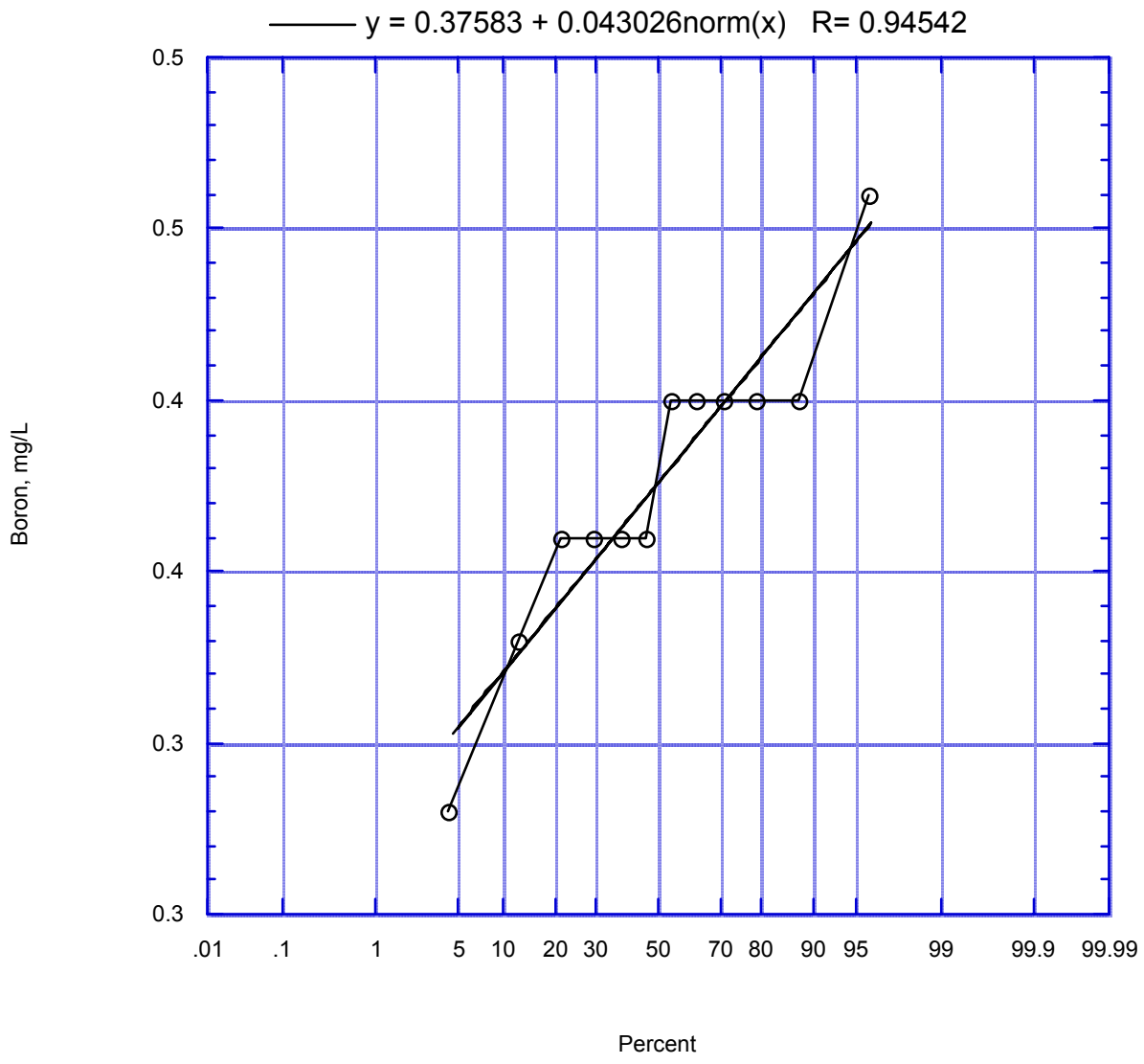


Figure 209. Reach 9A Boron Frequency Distribution

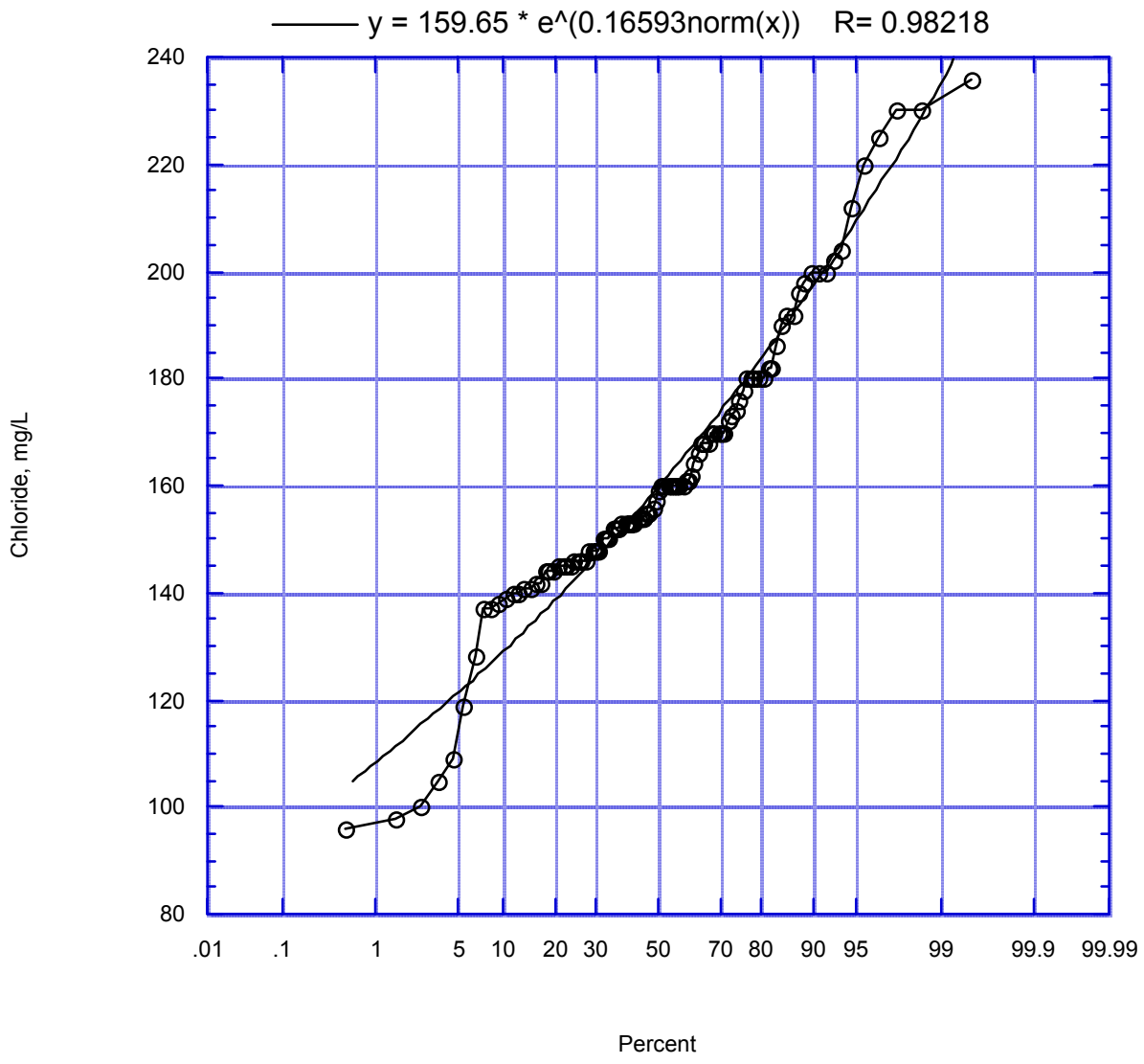


Figure 210. Reach 9B Chloride Frequency Distribution

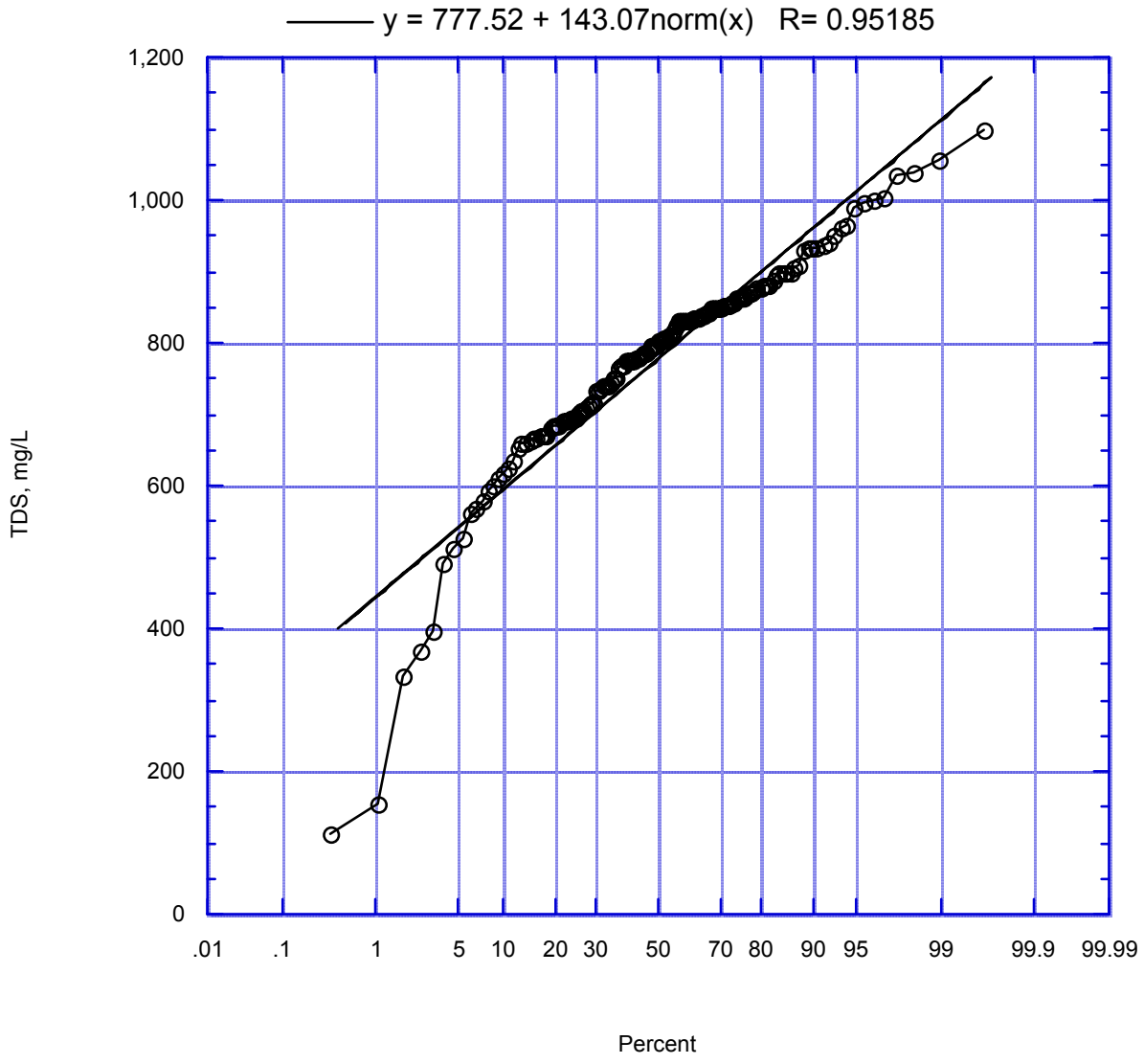


Figure 211. Reach 9B TDS Frequency Distribution

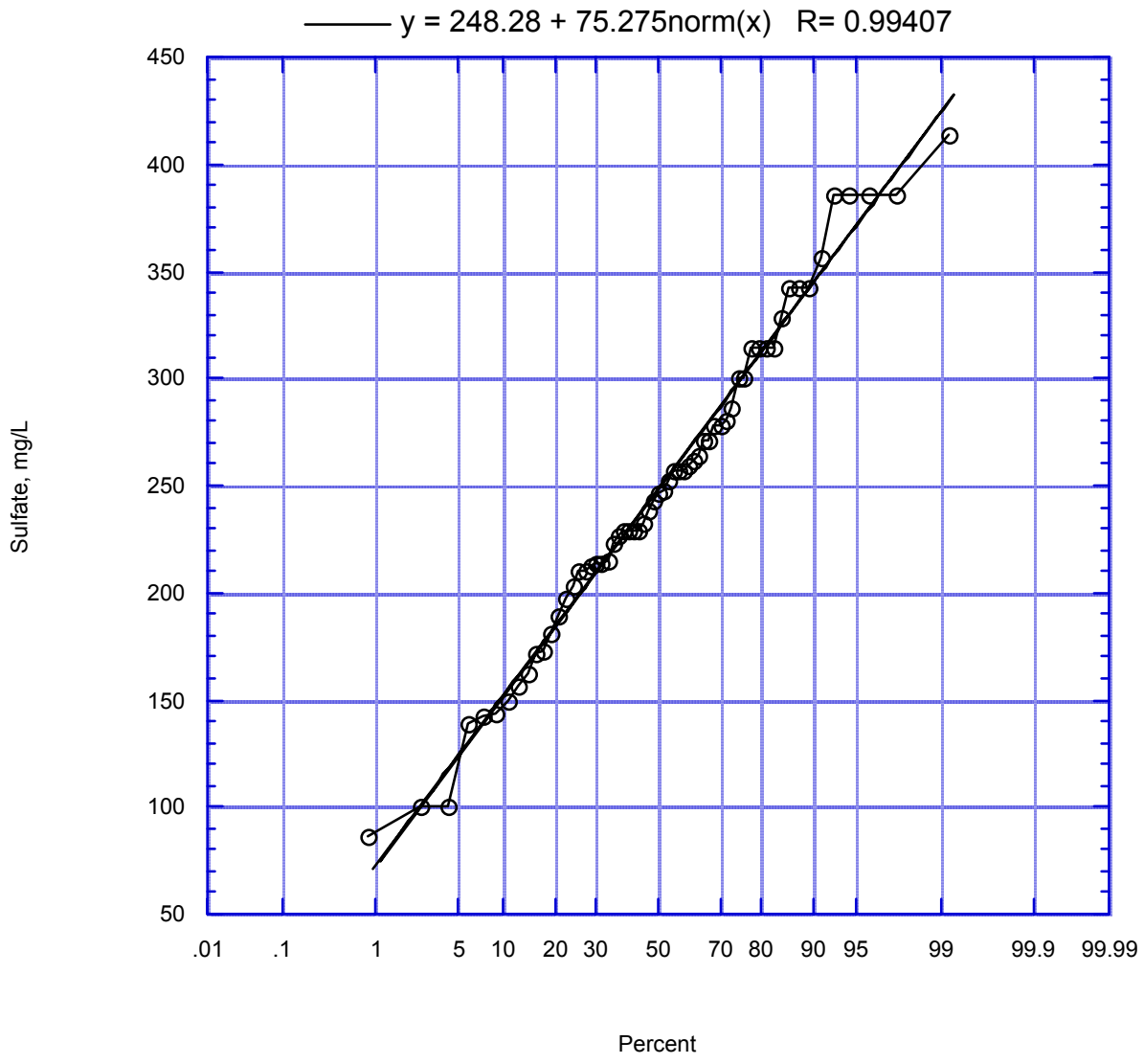


Figure 212. Reach 9B Sulfate Frequency Distribution

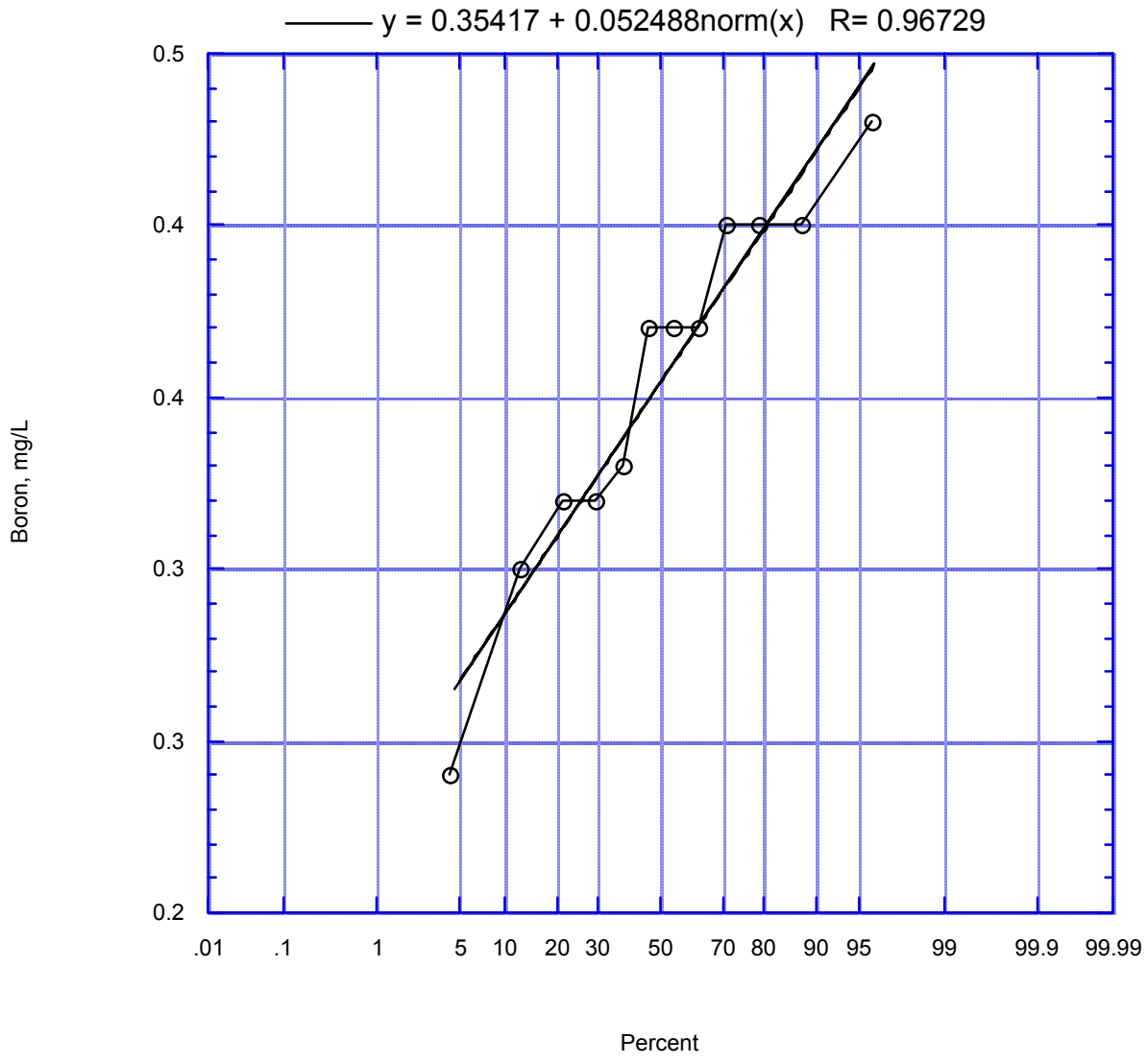


Figure 213. Reach 9B Boron Frequency Distribution

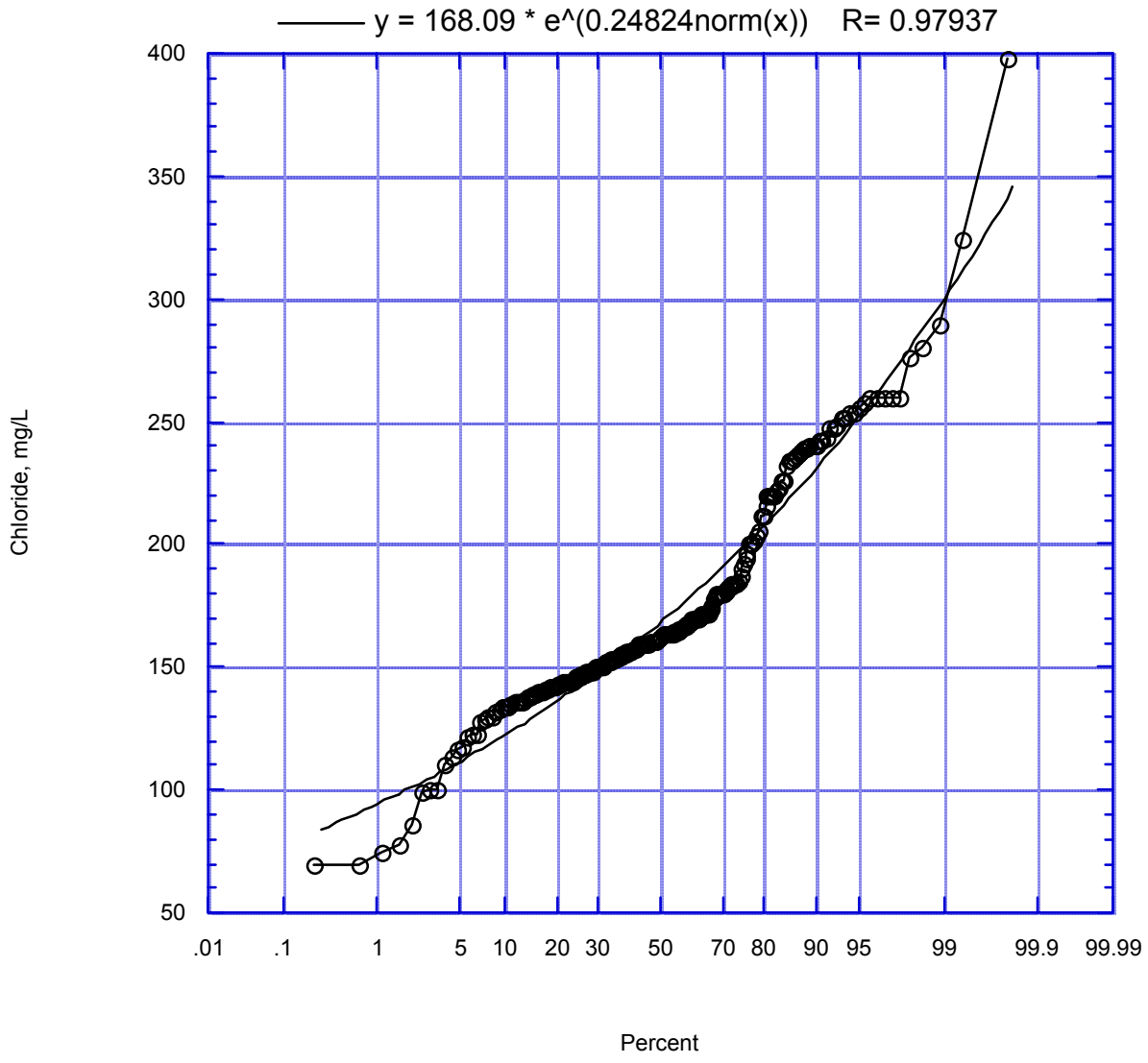
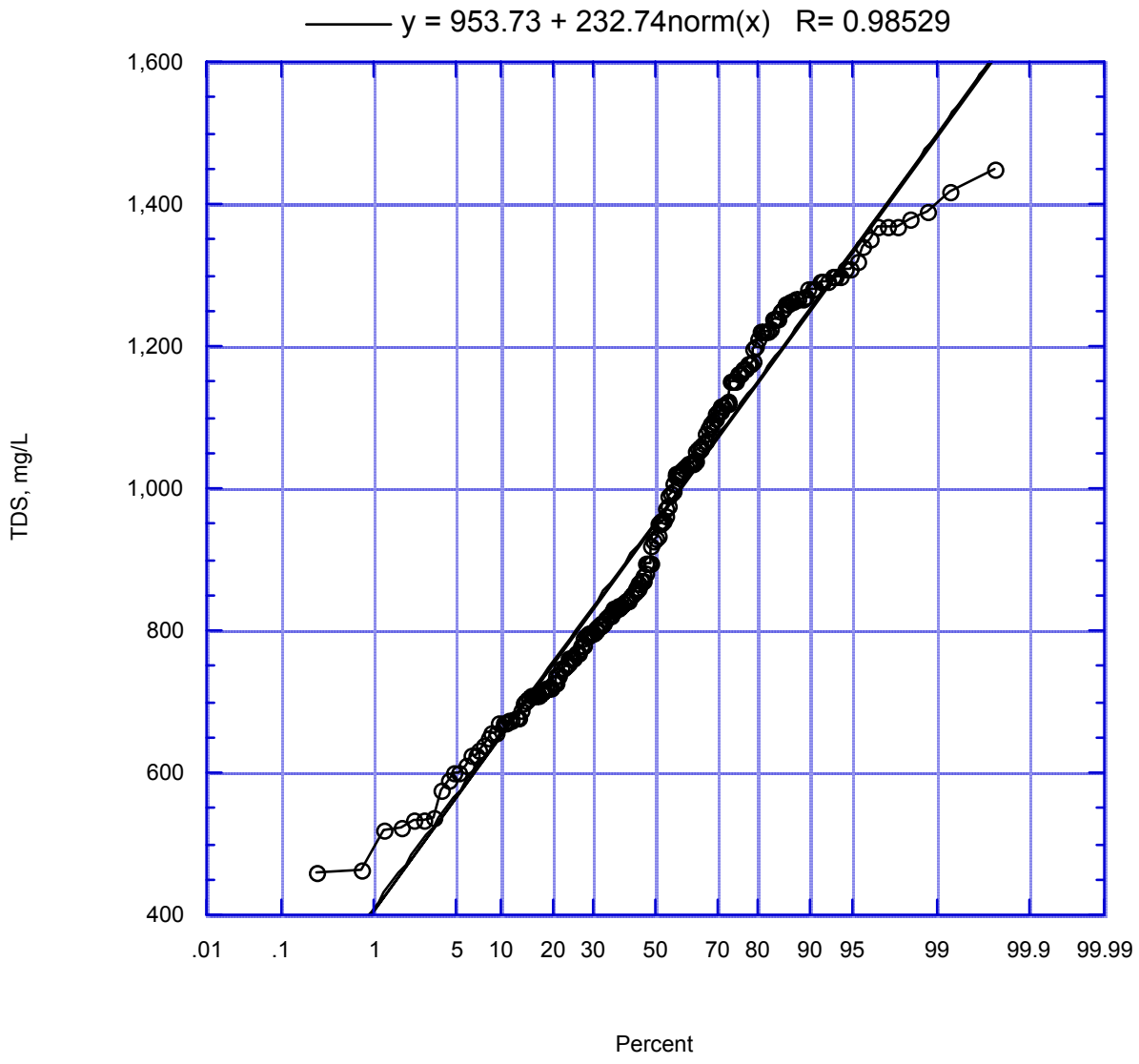
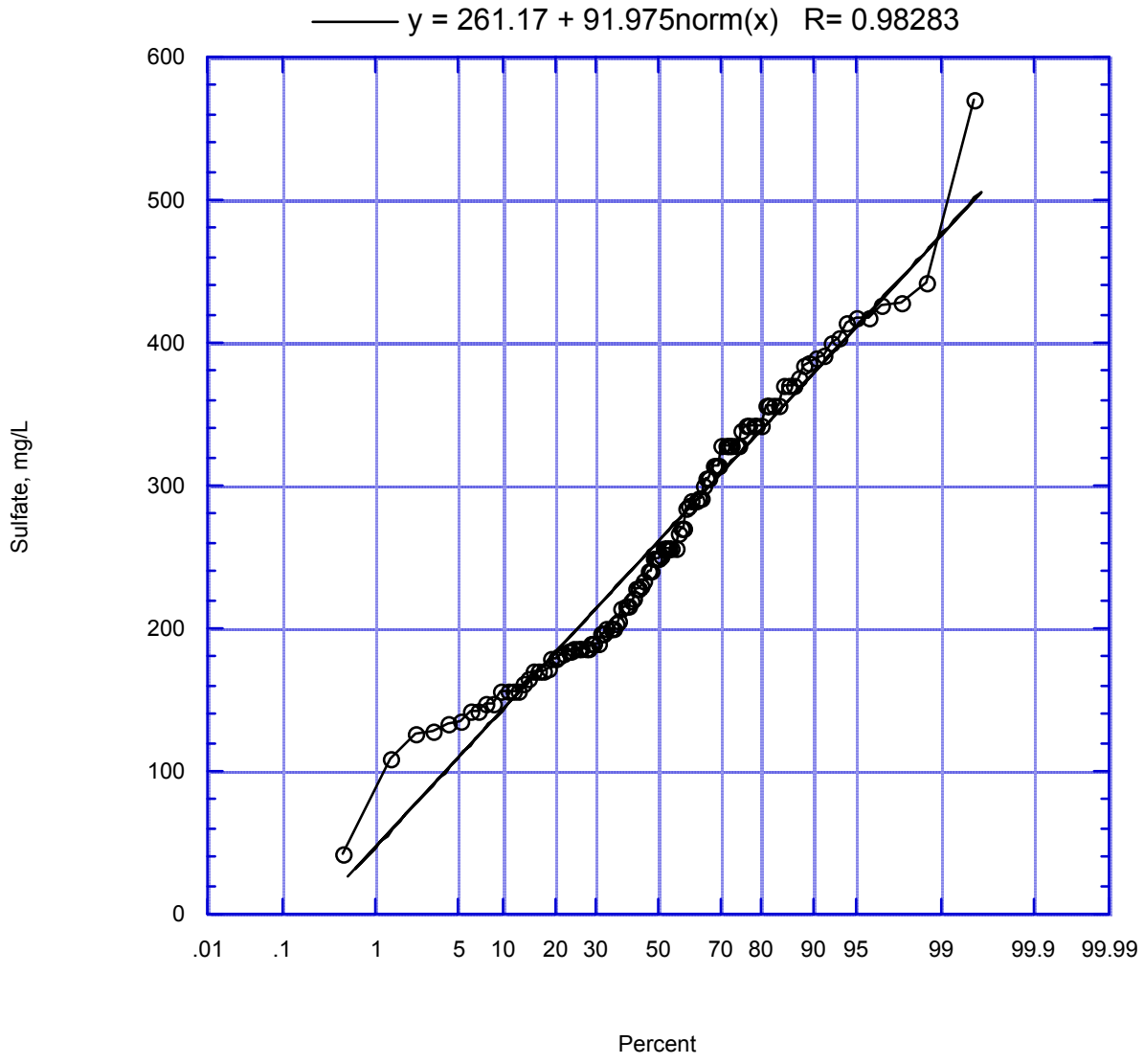


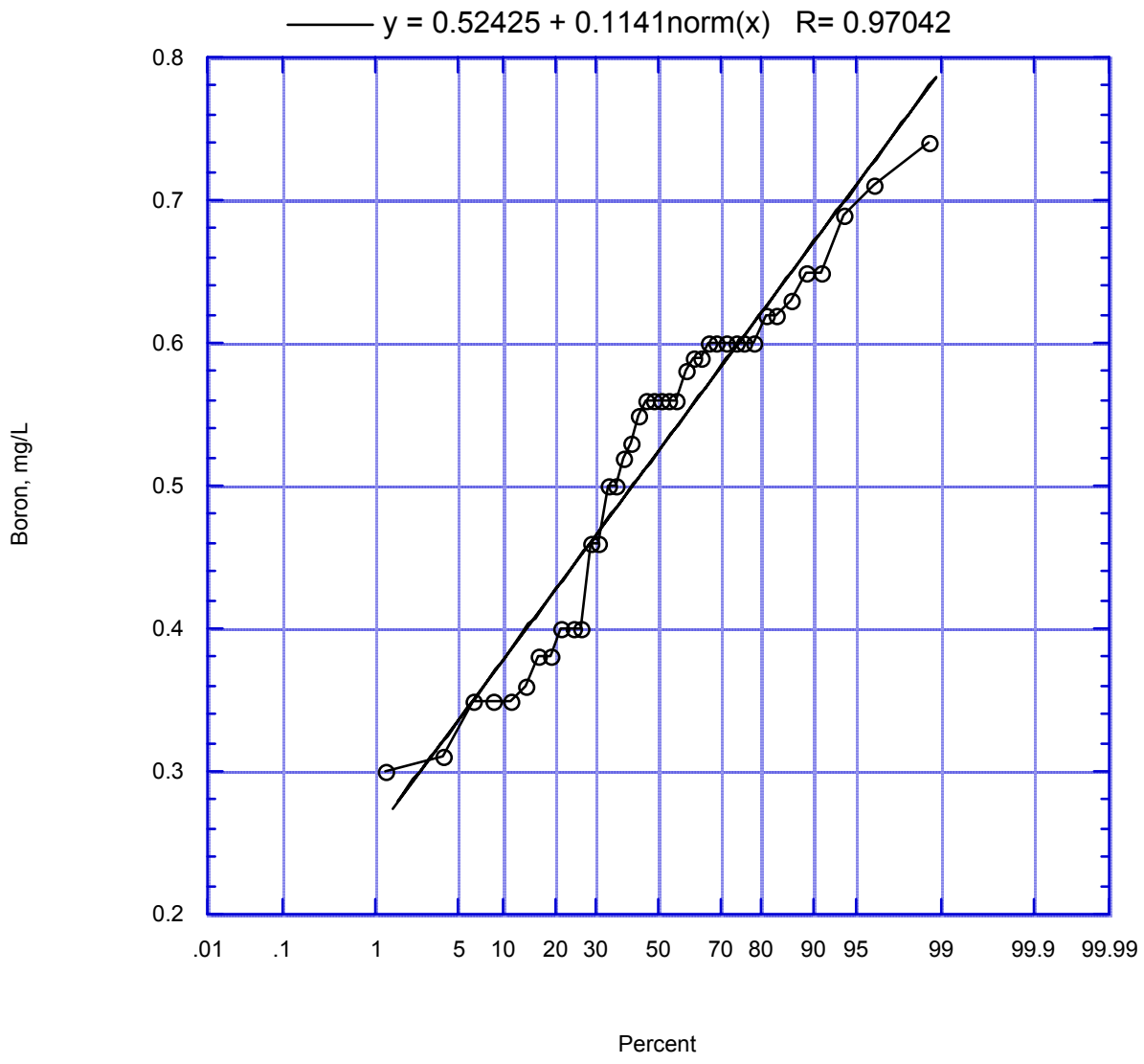
Figure 214. Reach 10 Chloride Frequency Distribution



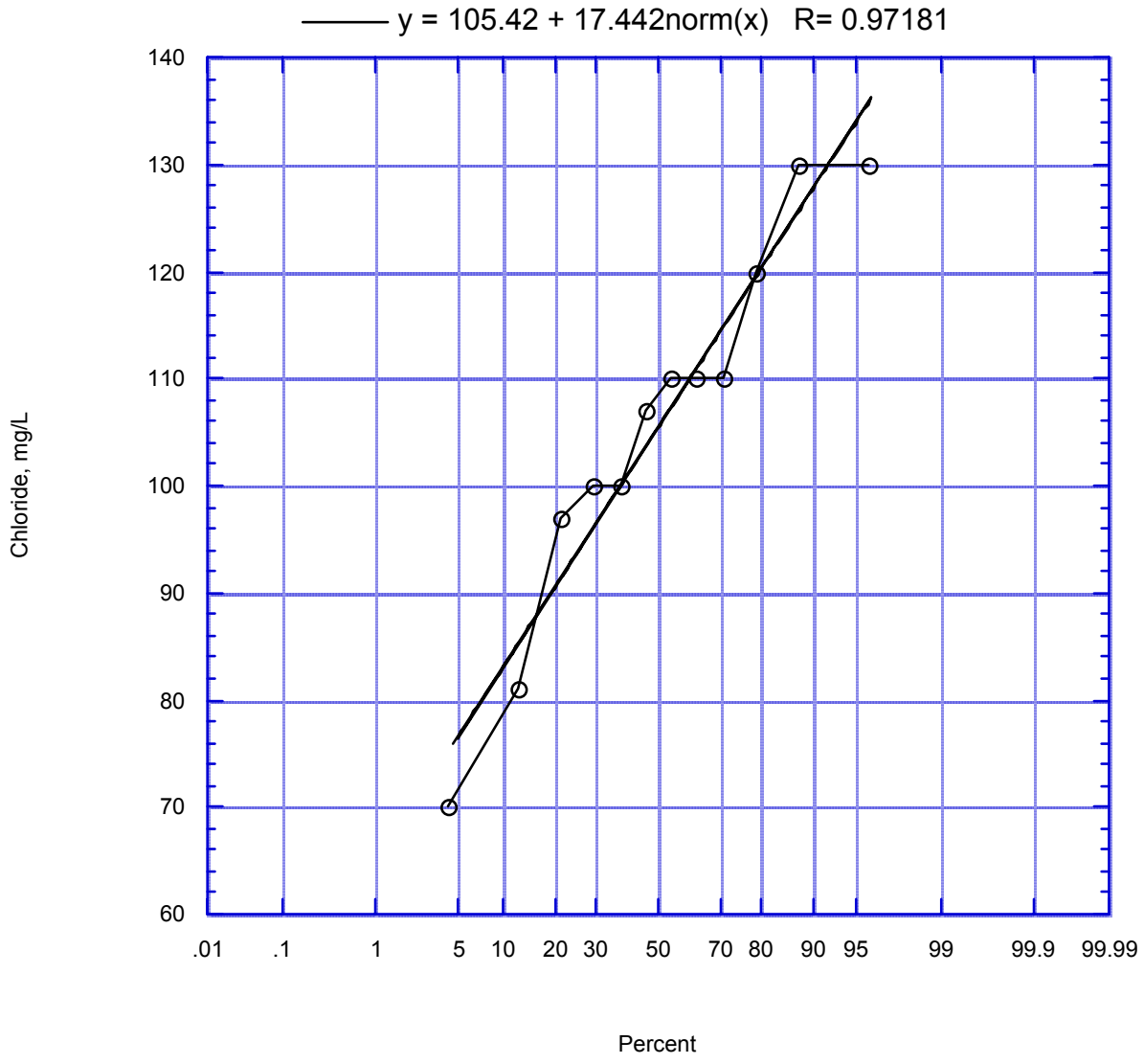
Fgure 215. Reach 10 TDS Frequency Distribution



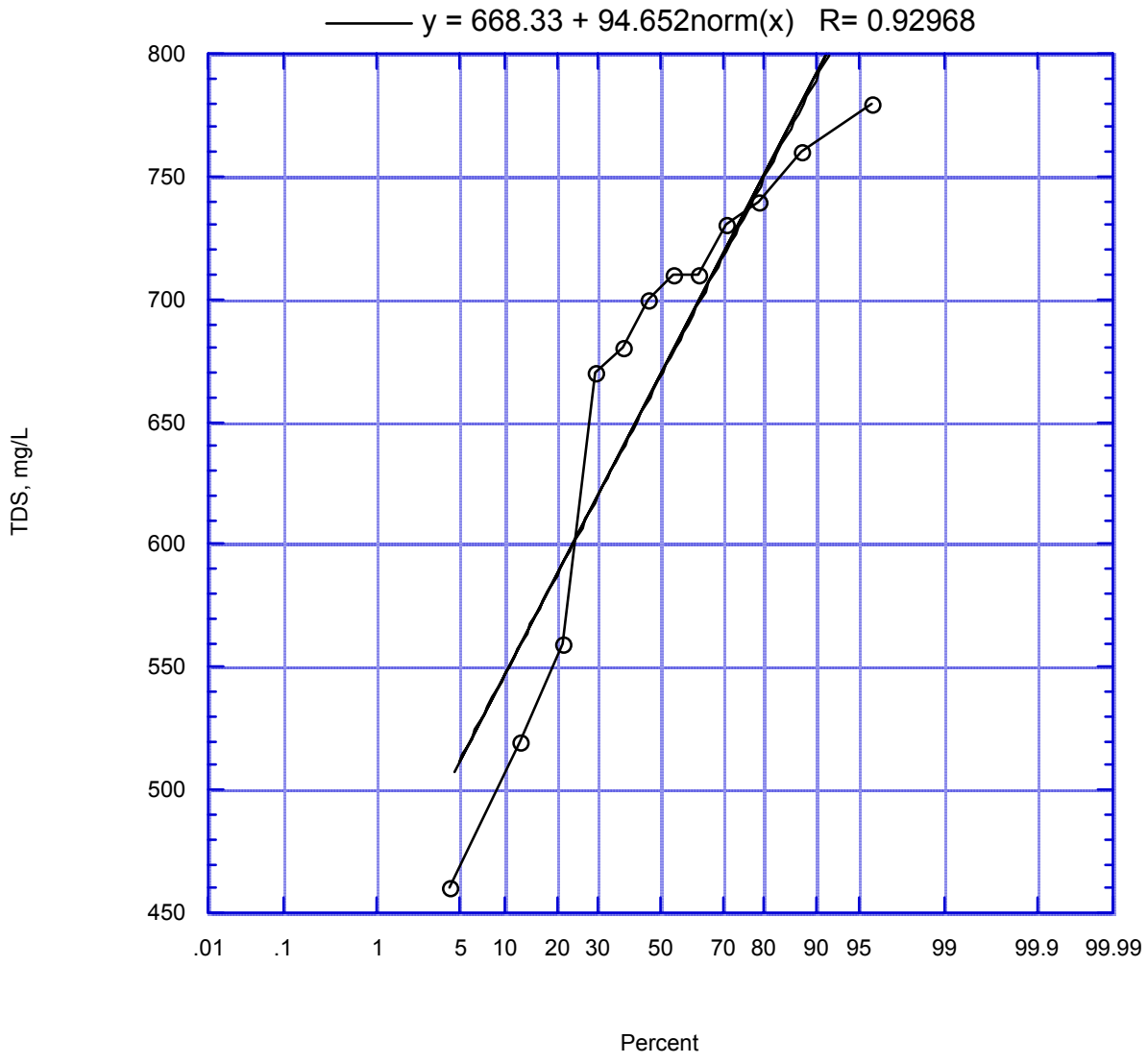
Fgure 216. Reach 10 Sulfate Frequency Distribution



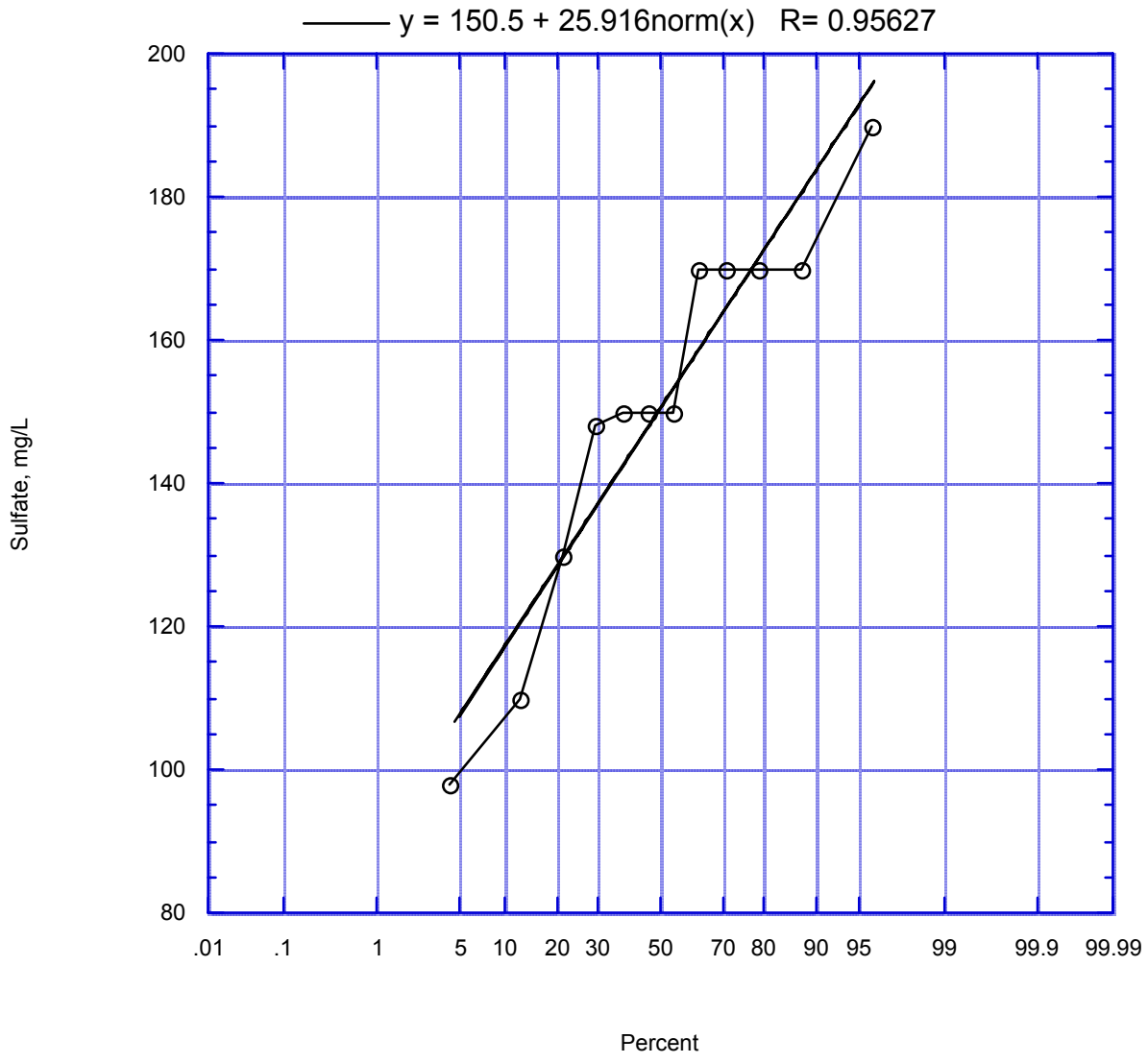
Fgure 217. Reach 10 Boron Frequency Distribution



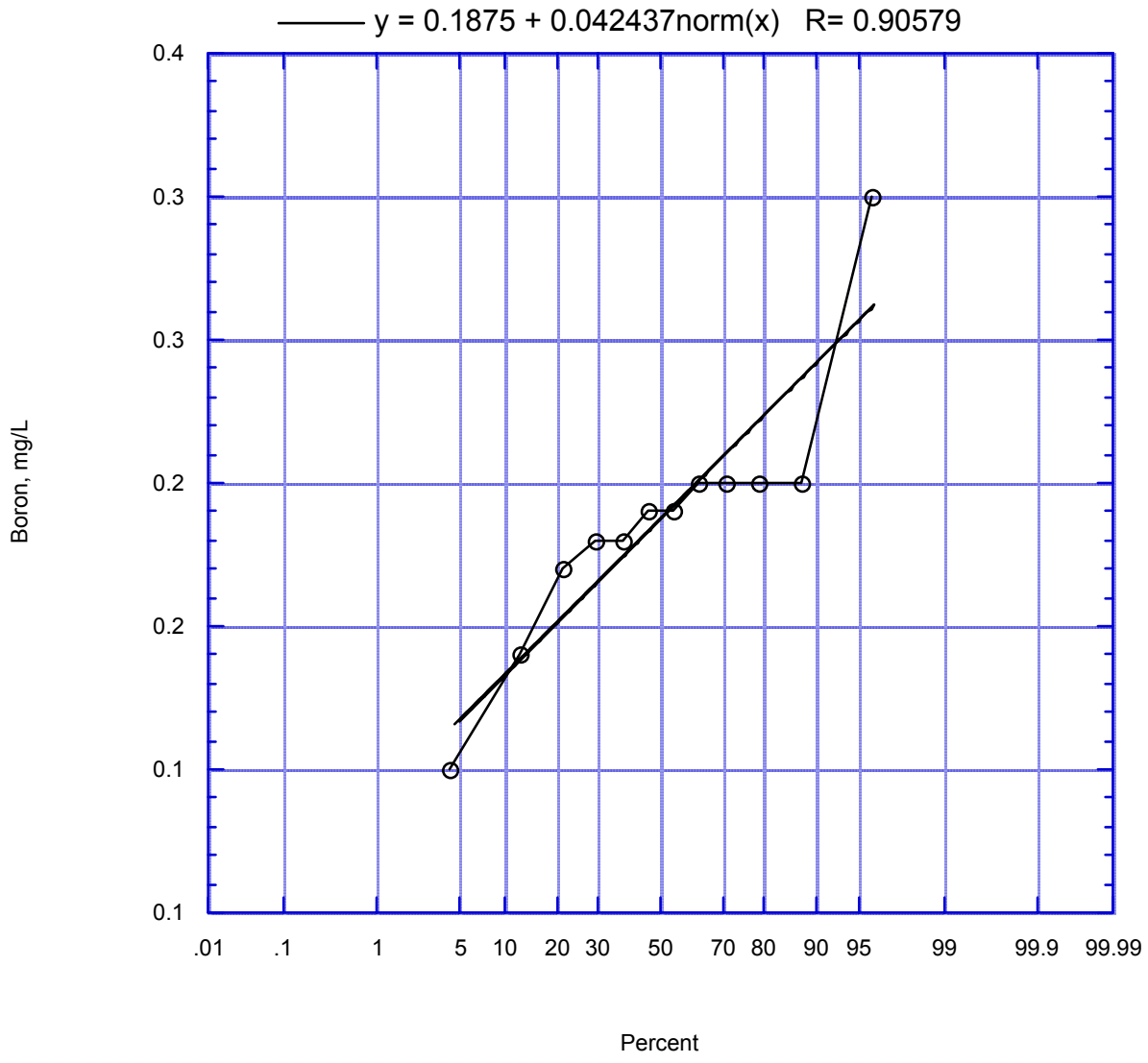
Fgure 218. Reach 11 Chloride Frequency Distribution



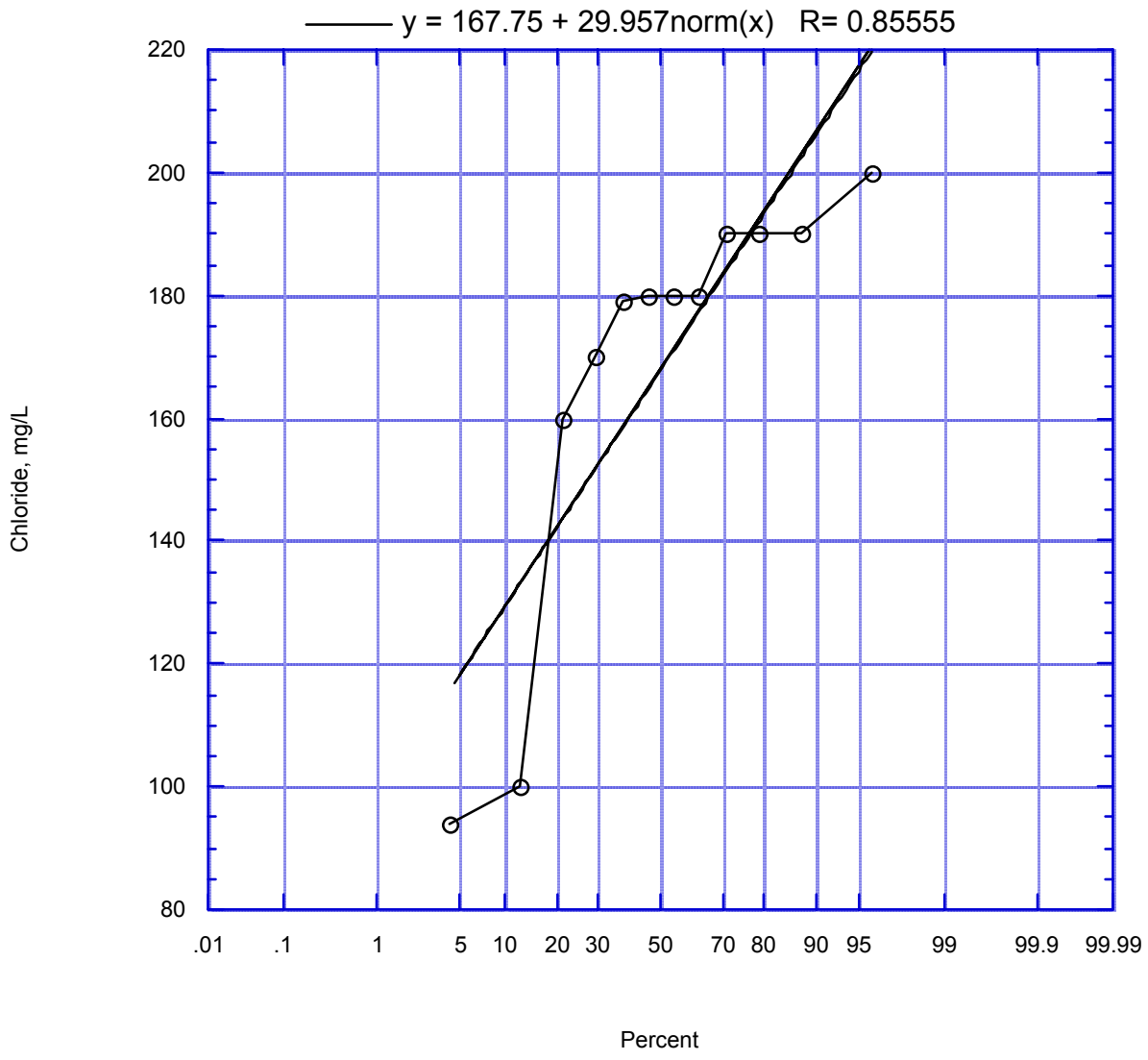
Fgure 219. Reach 11 TDS Frequency Distribution



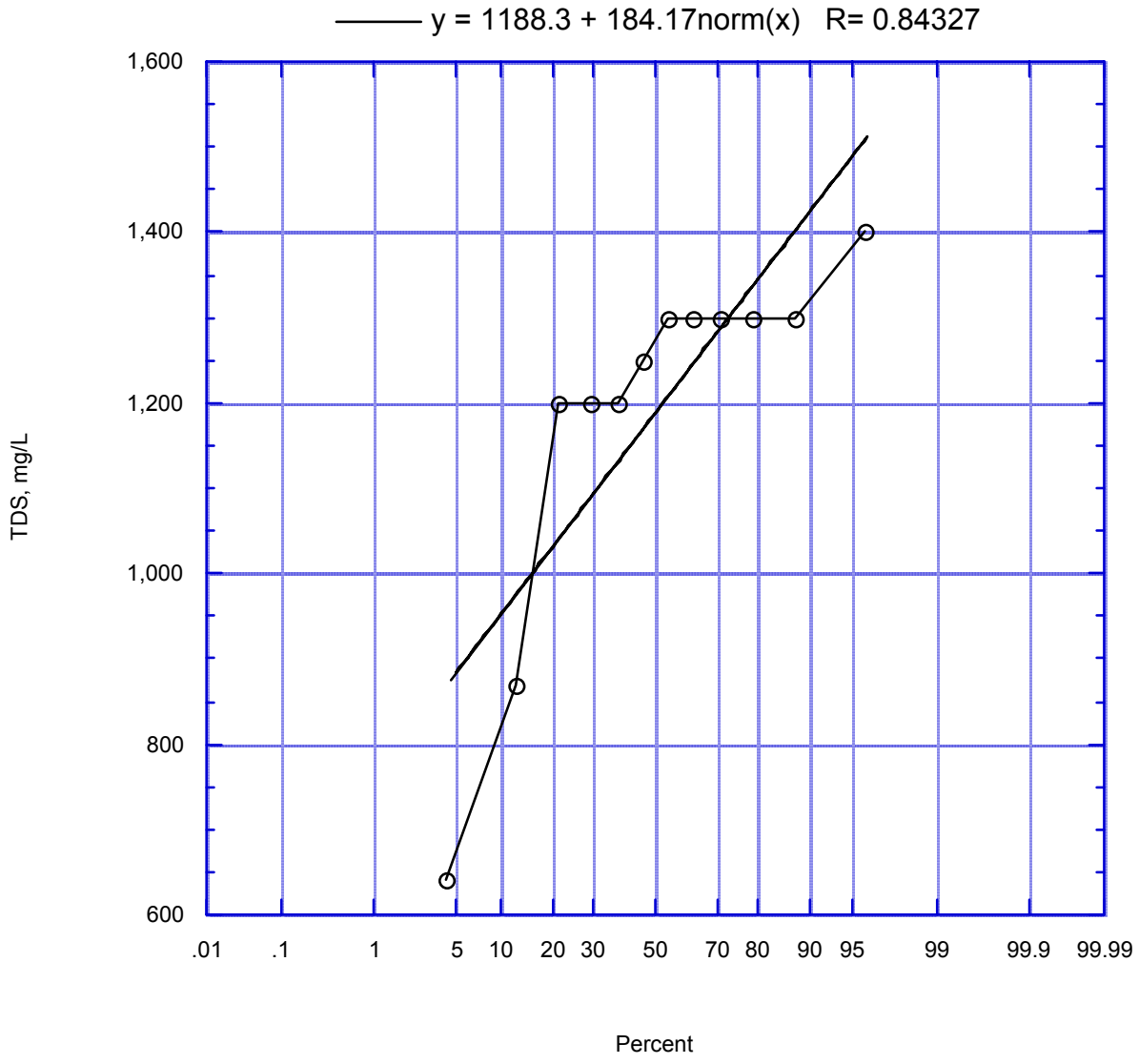
Fgure 220. Reach 11 Sulfate Frequency Distribution



Fgure 221. Reach 11 Boron Frequency Distribution



Fgure 222. Reach 13 Chloride Frequency Distribution



Fgure 223. Reach 13 TDS Frequency Distribution

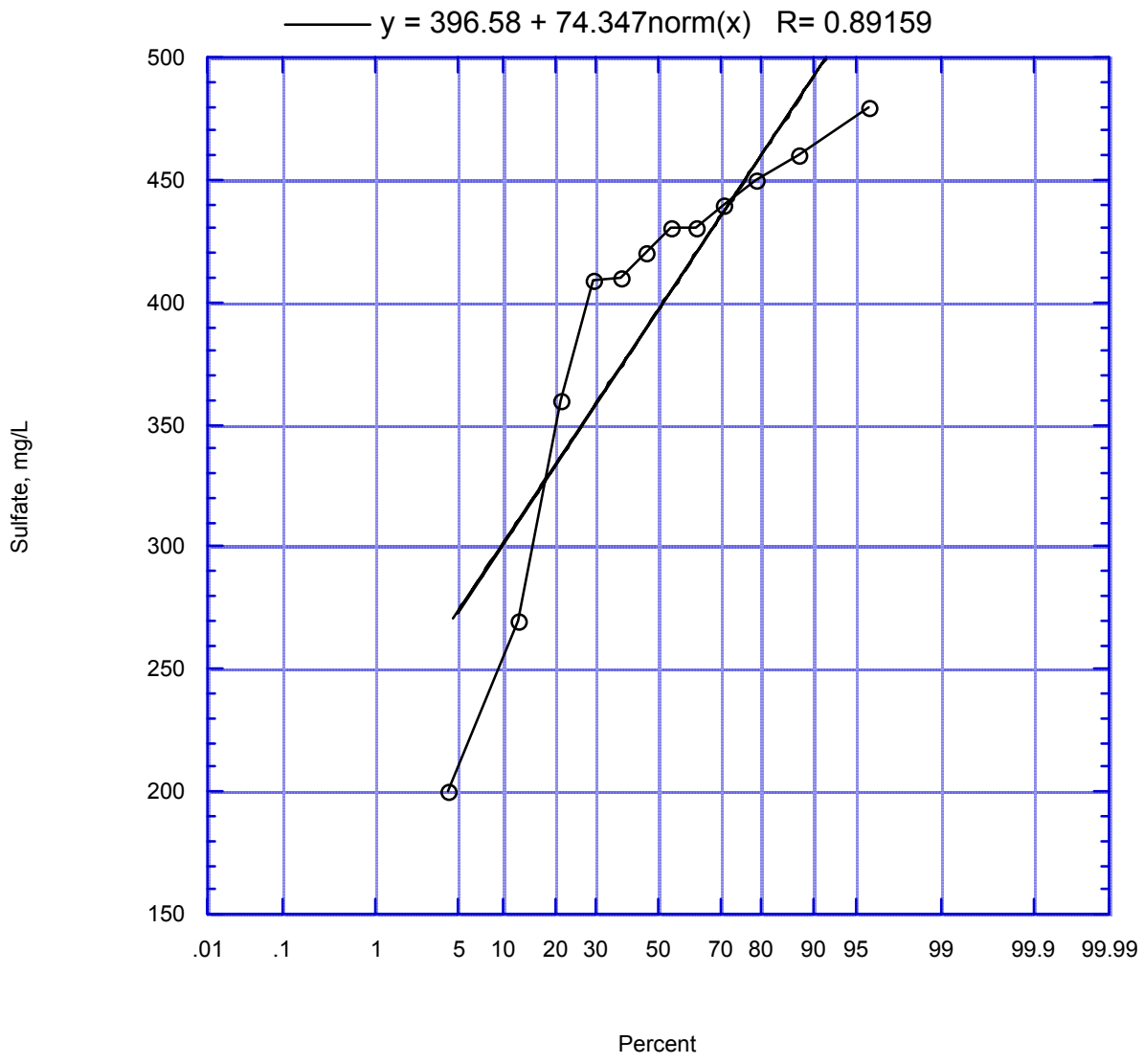


Figure 224. Reach 13 Sulfate Frequency Distribution

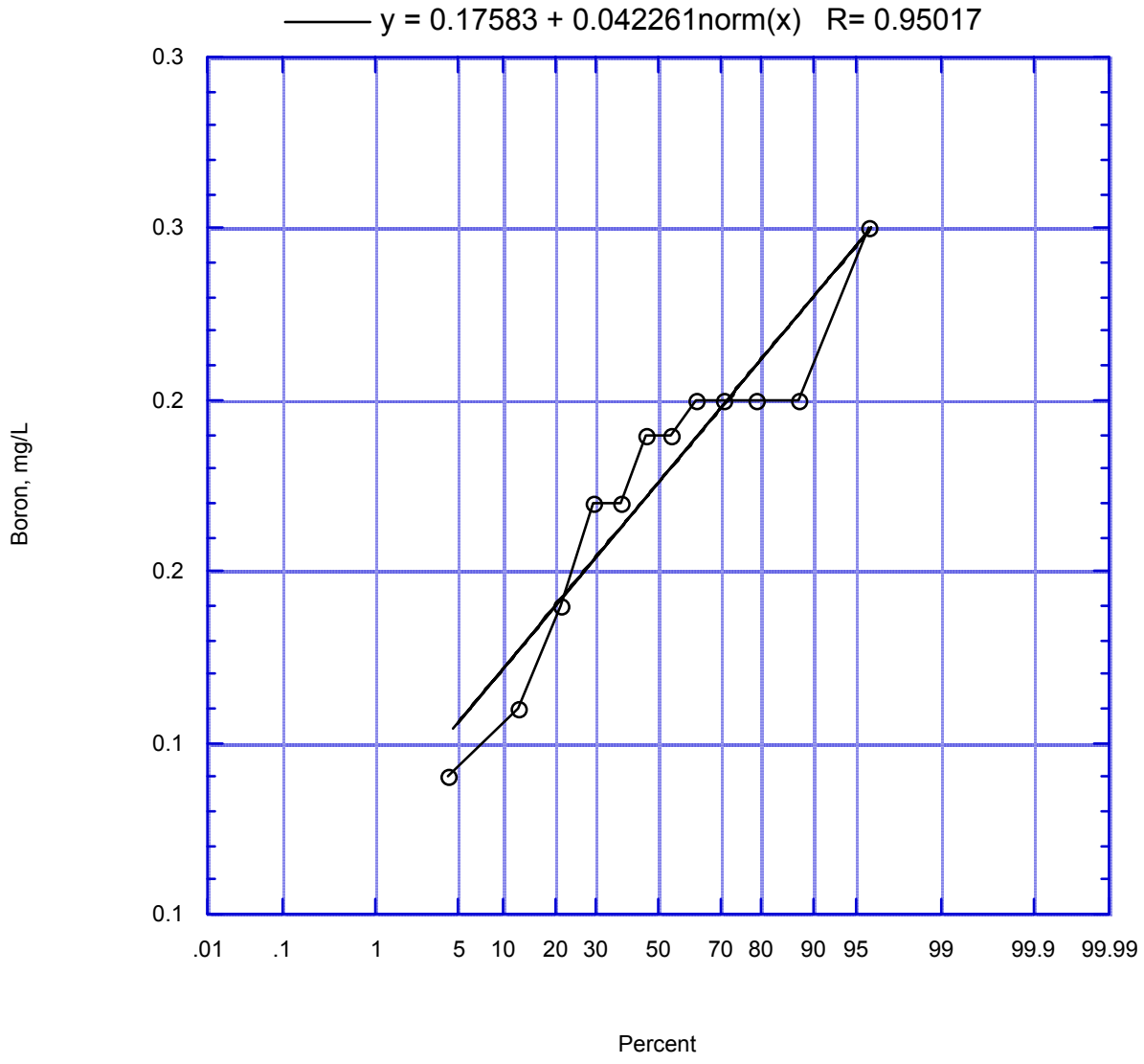


Figure 225. Reach 13 Boron Frequency Distribution

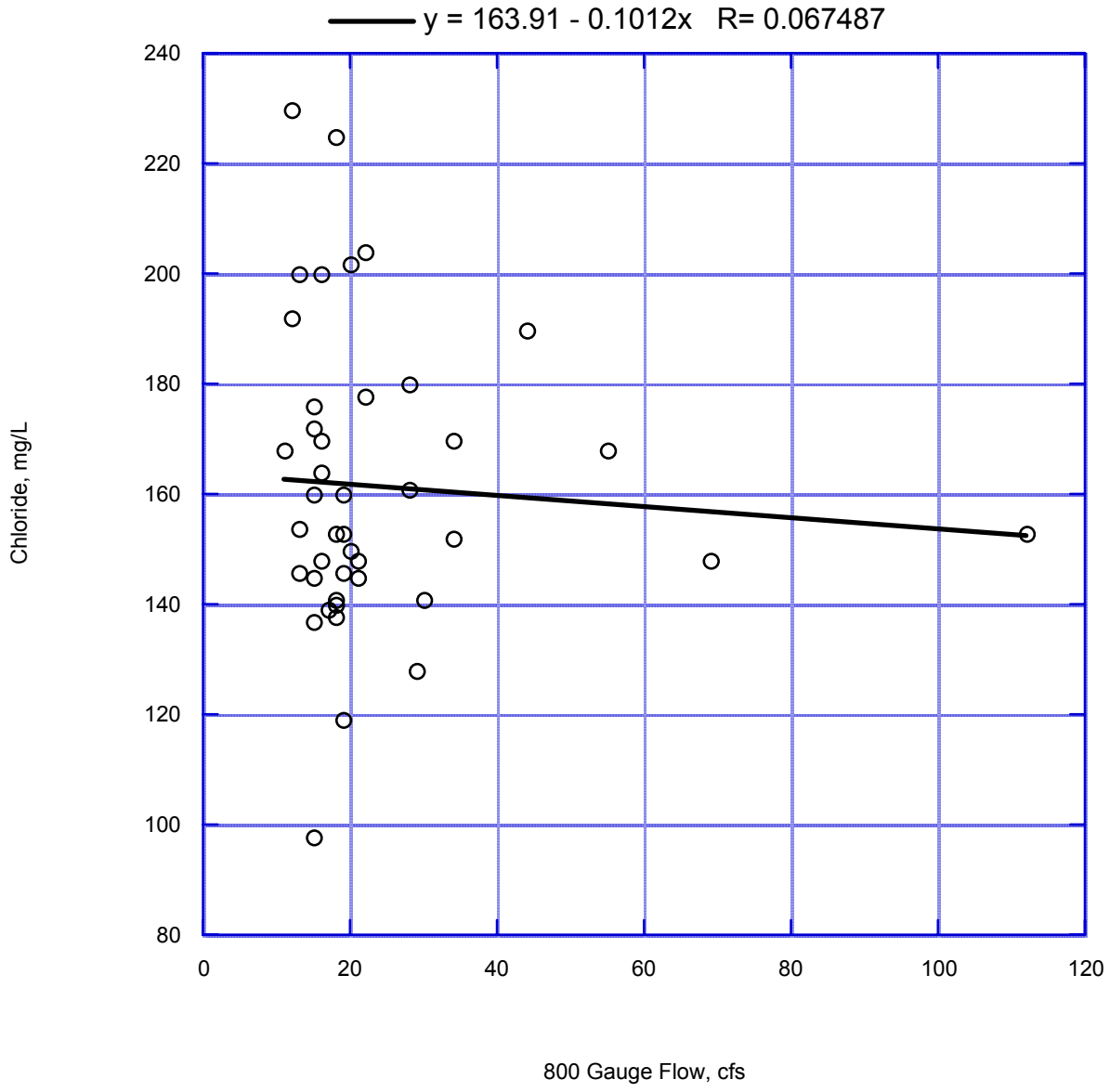


Figure 226. Chloride vs. Stream Flow at Gauge 800

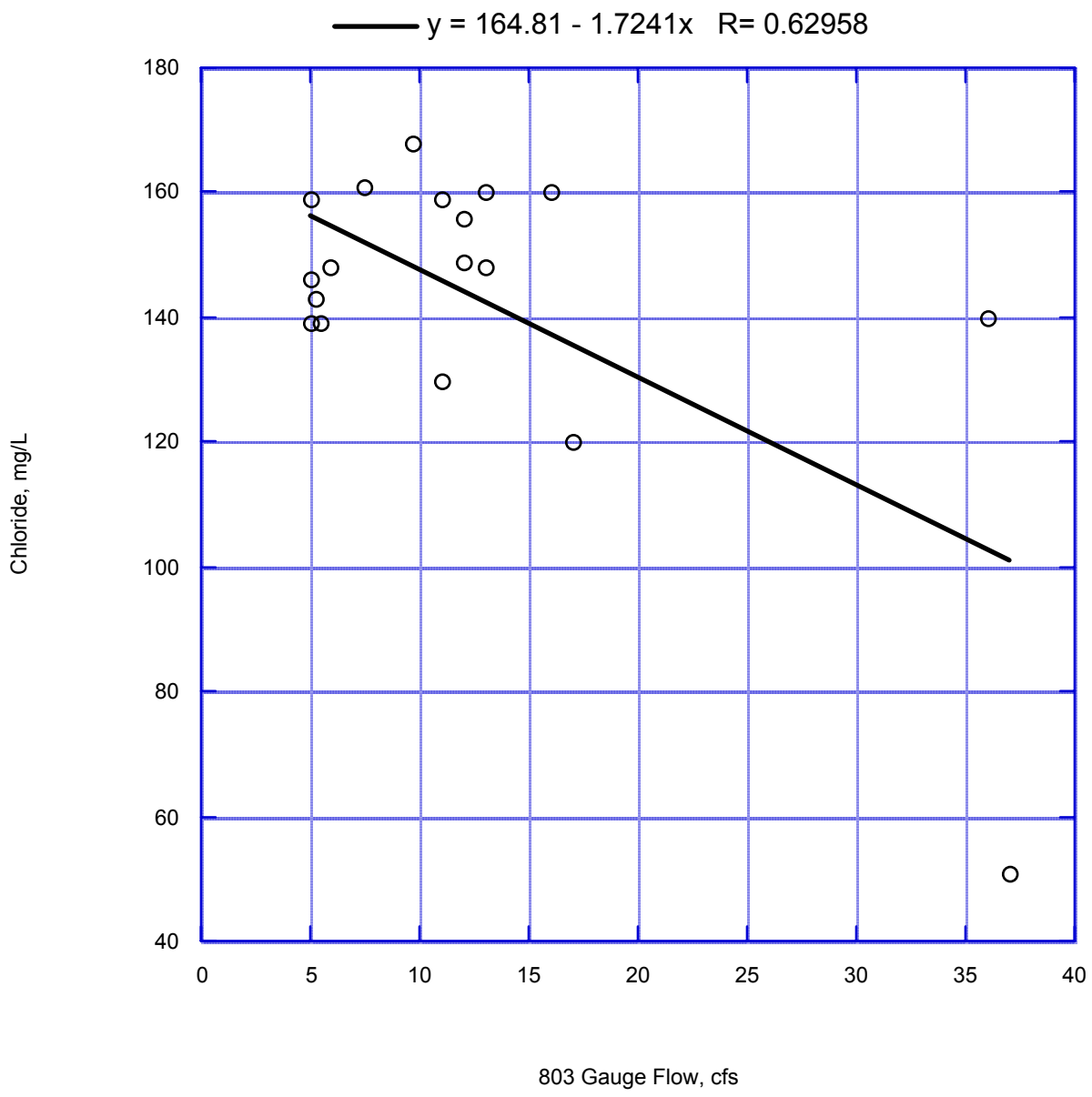


Figure 227. Chloride vs. Stream Flow at Gauge 803

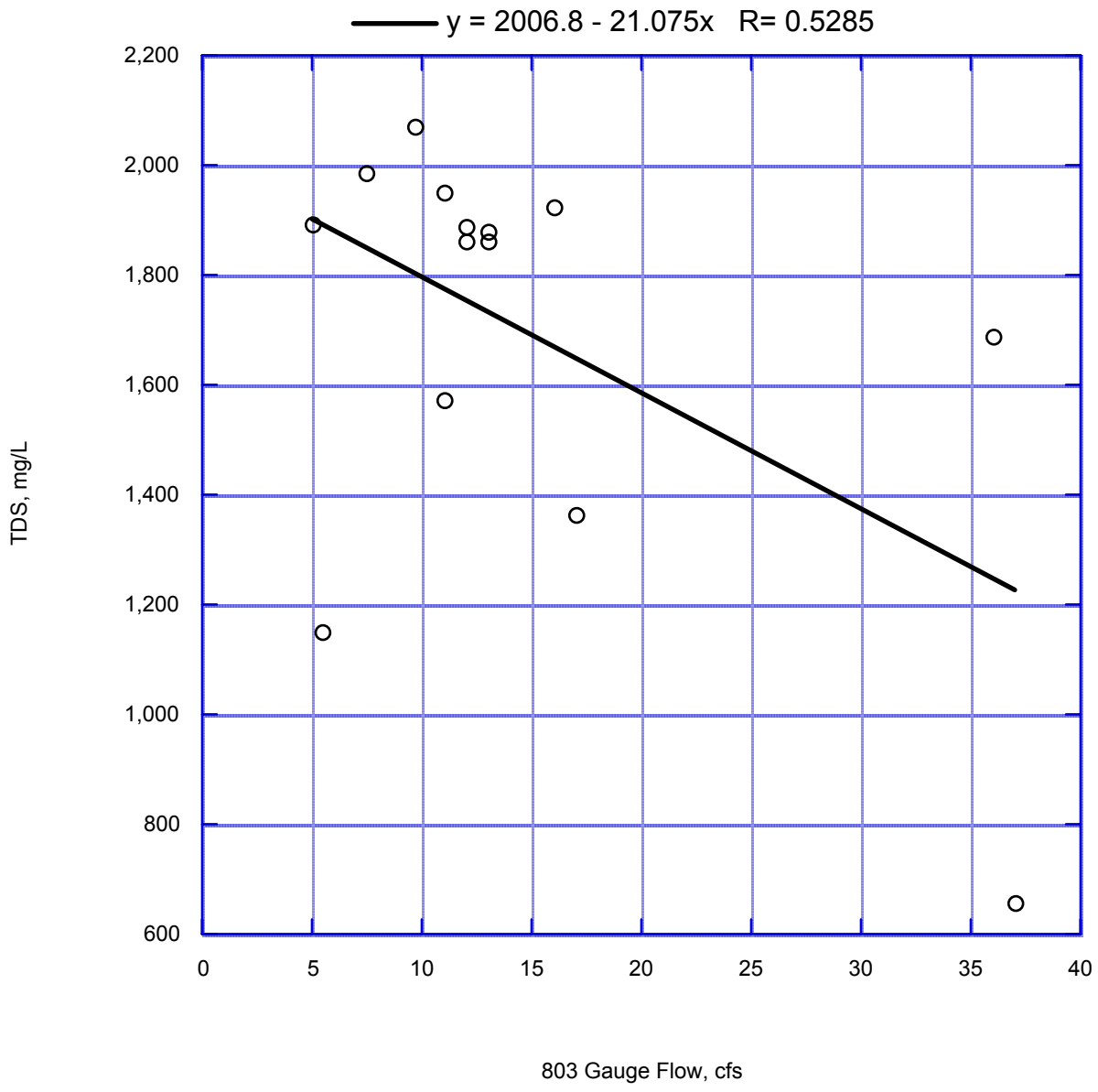


Figure 228. TDS vs. Stream Flow at Gauge 803

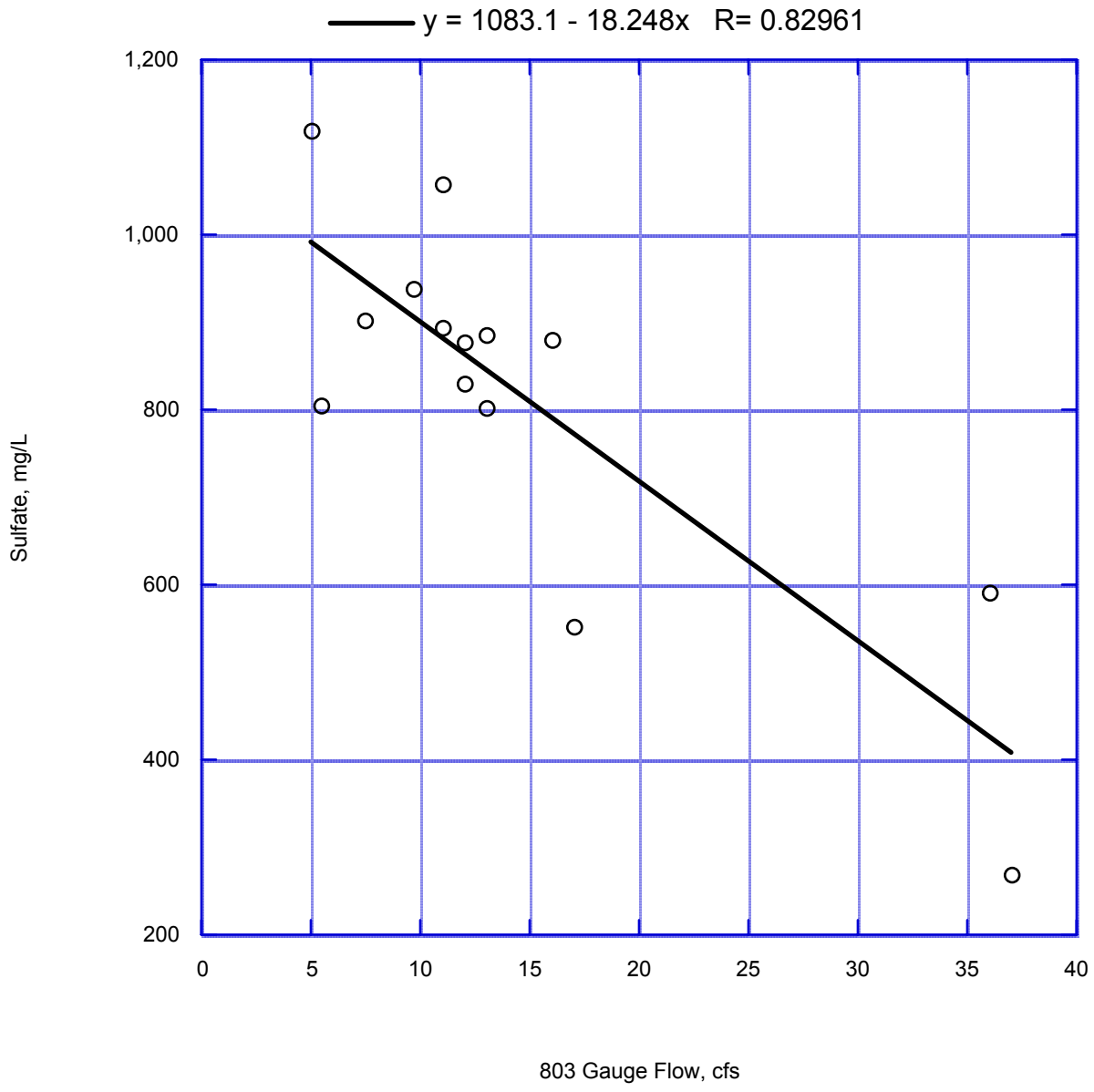


Figure 229. Sulfate vs. Stream Flow at Gauge 803

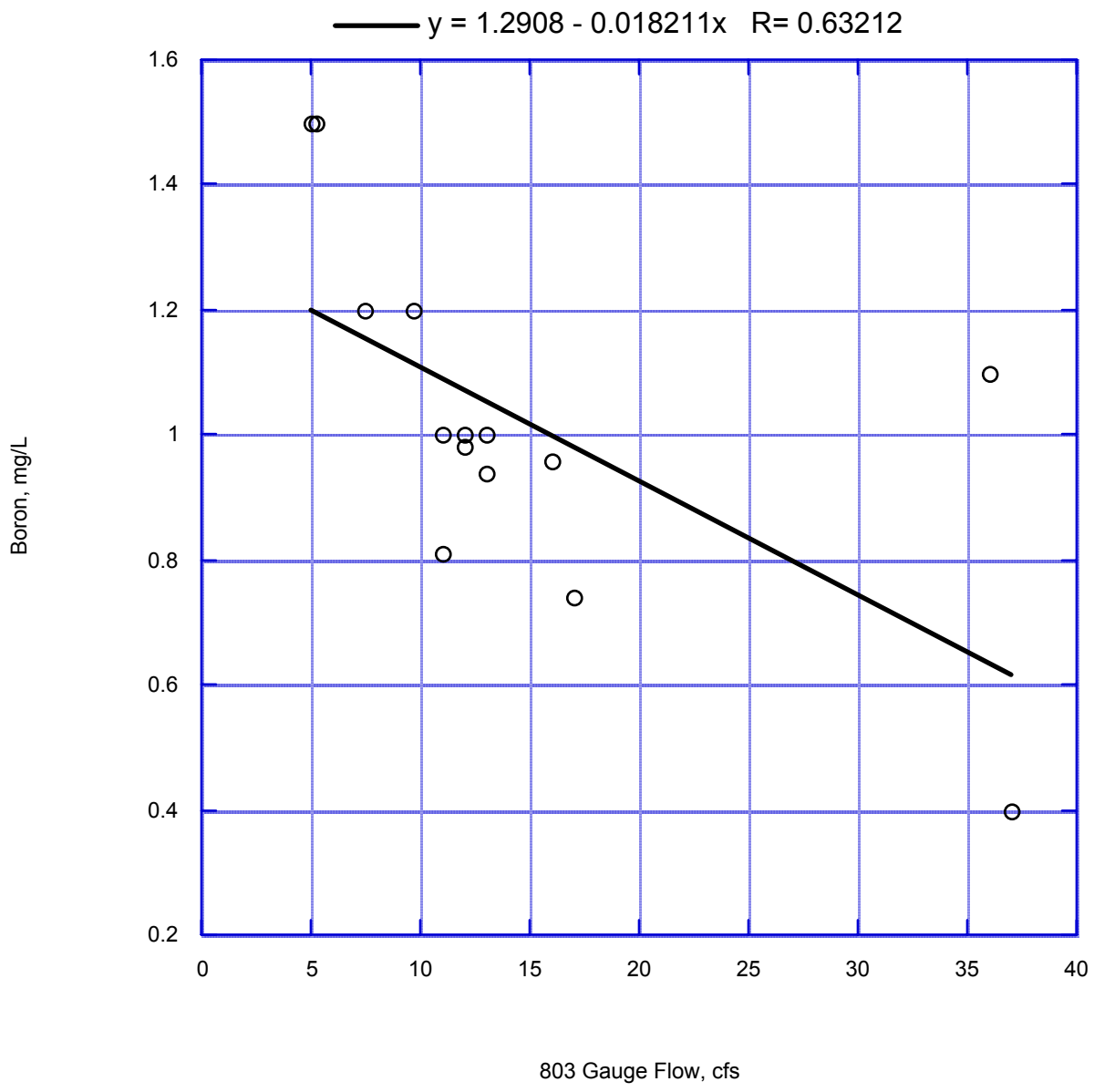


Figure 230. Boron vs. Stream Flow at Gauge 803

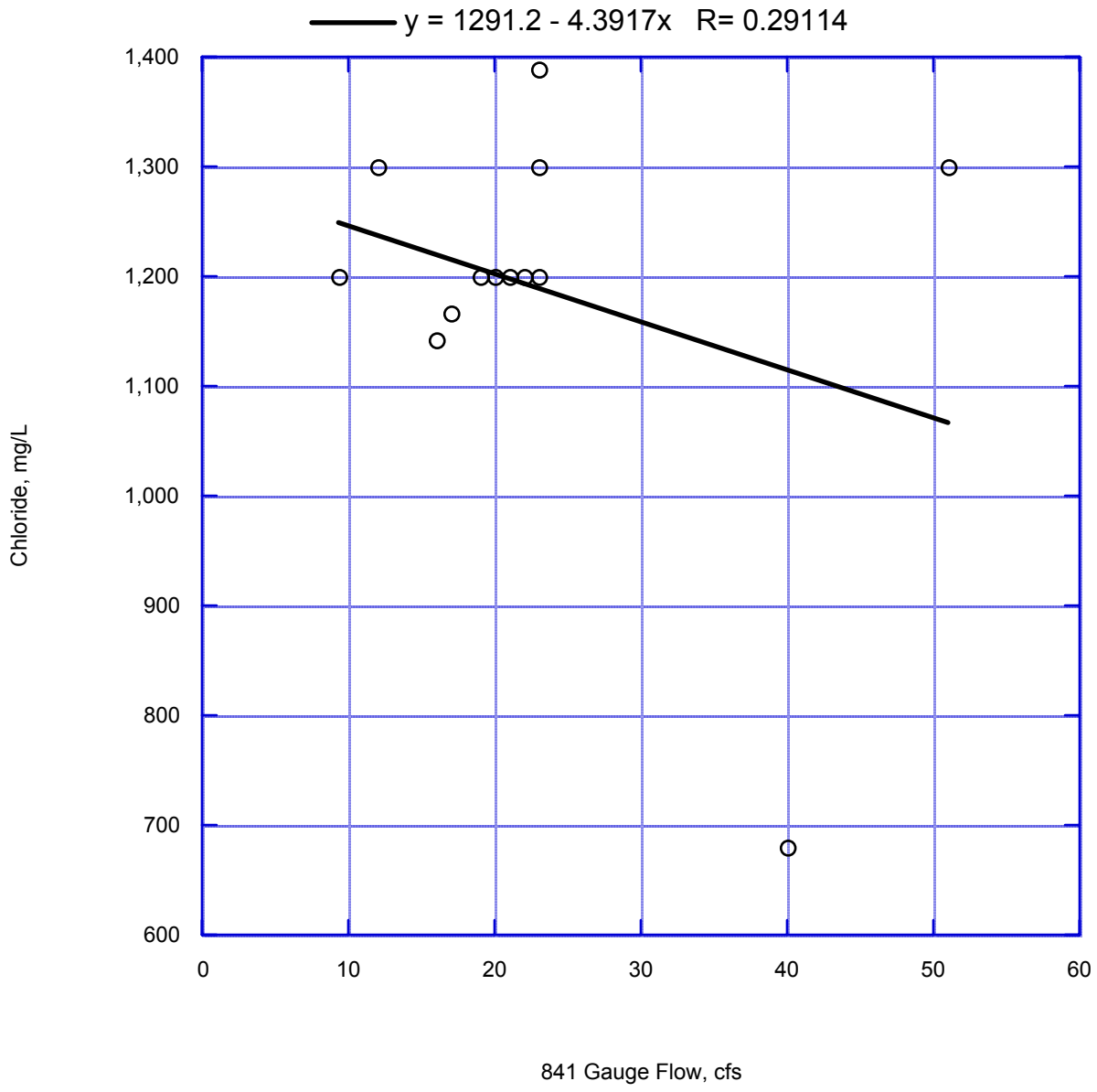


Figure 231. Chloride vs. Stream Flow at Gauge 841

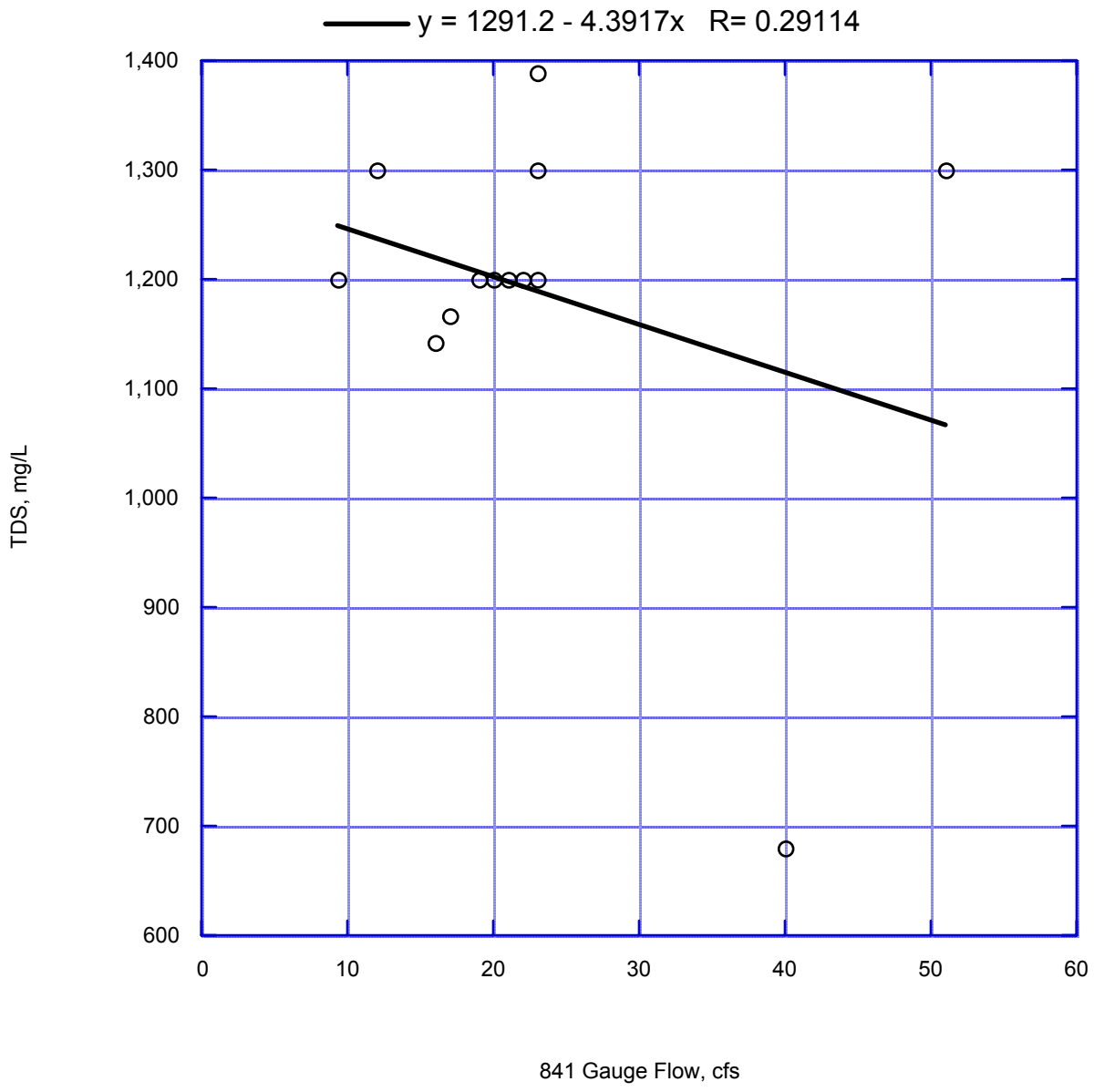


Figure 232. TDS vs. Stream Flow at Gauge 841

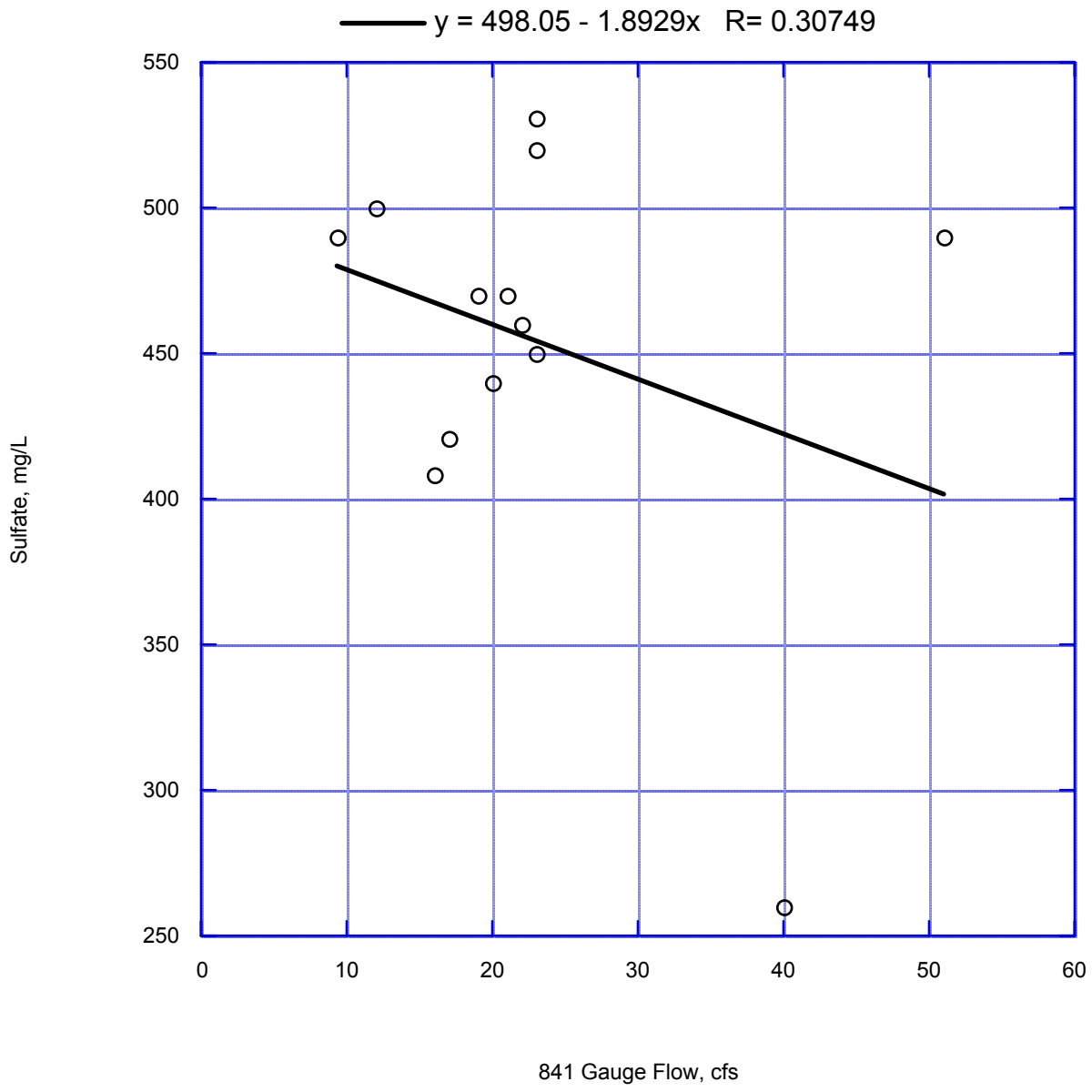


Figure 233. Sulfate vs. Stream Flow at Gauge 841

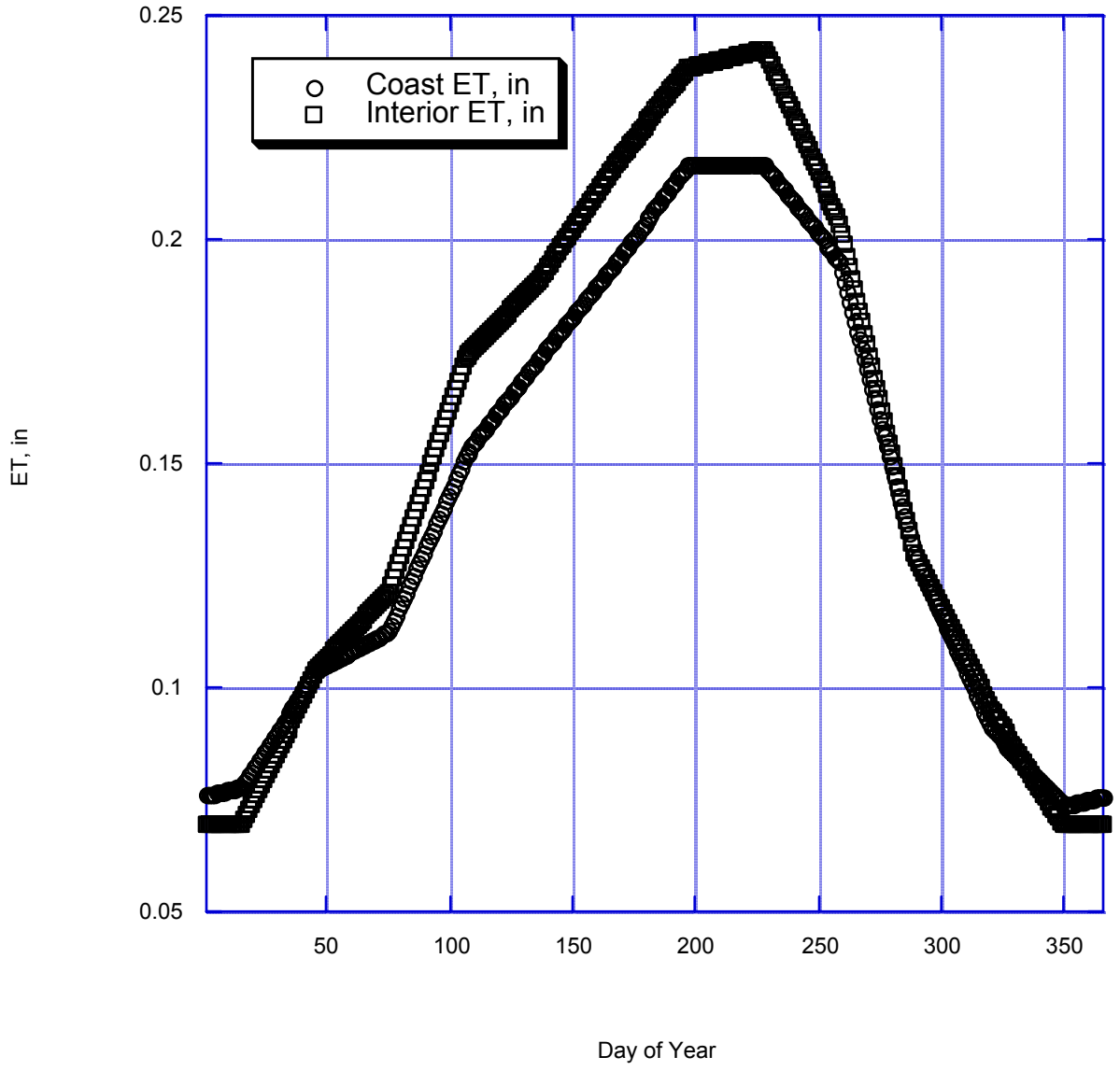


Figure 234. Water Surface and Mixed-plant ET vs. Time

Appendix B

POTW Source Analysis

Appendix B is included as an associated electronic file entitled App B-Urban Wastewater 6-30.xls.

Appendix C

EPA Chloride TMDL Model

Appendix C is included as an associated electronic file entitled Appendix C EPA Model 6-30.xls.

Appendix D

Plots of Modeled Scenarios

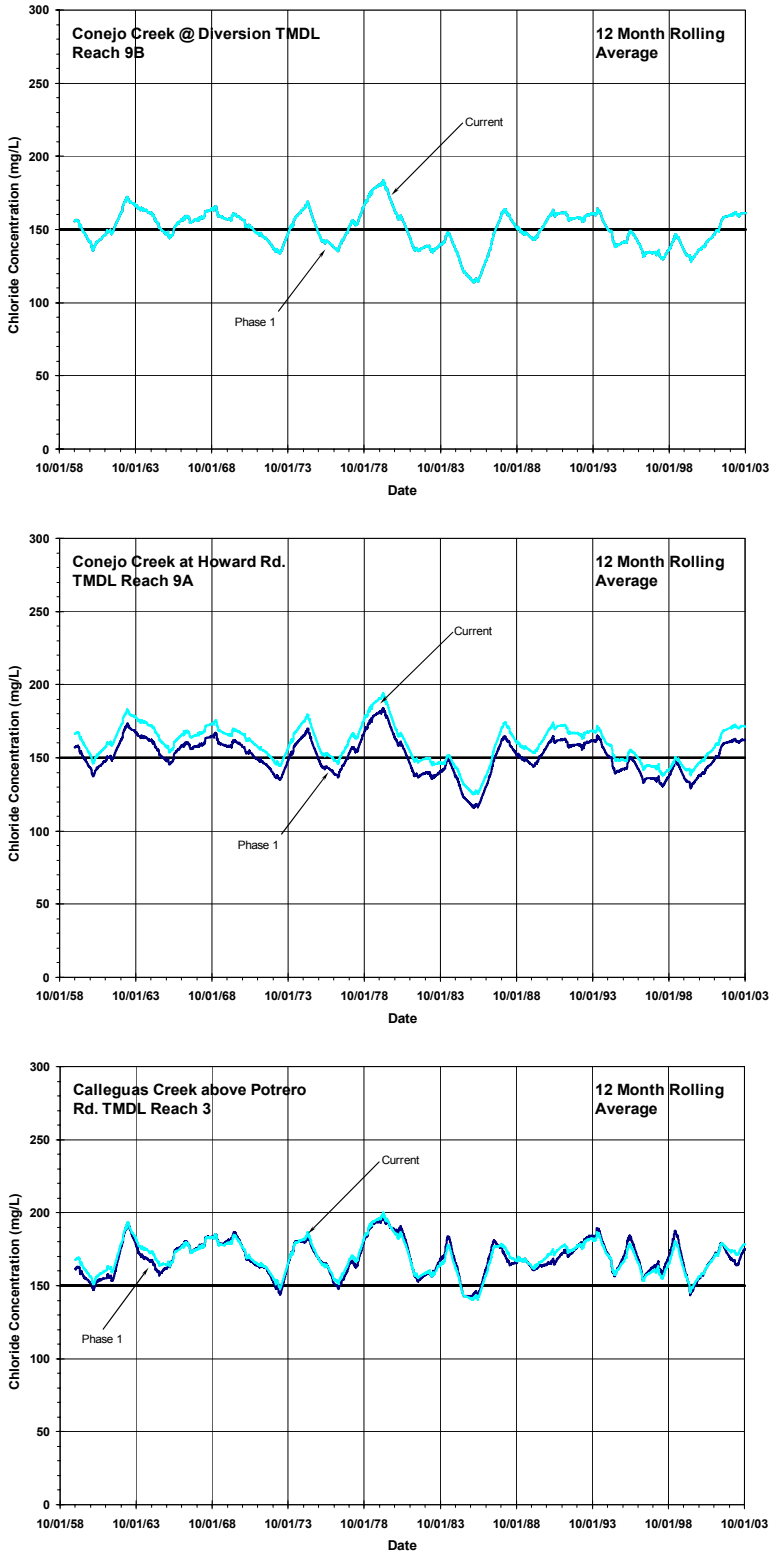


Figure 54: Current and Estimated Chloride 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 1 of the RWRMP.

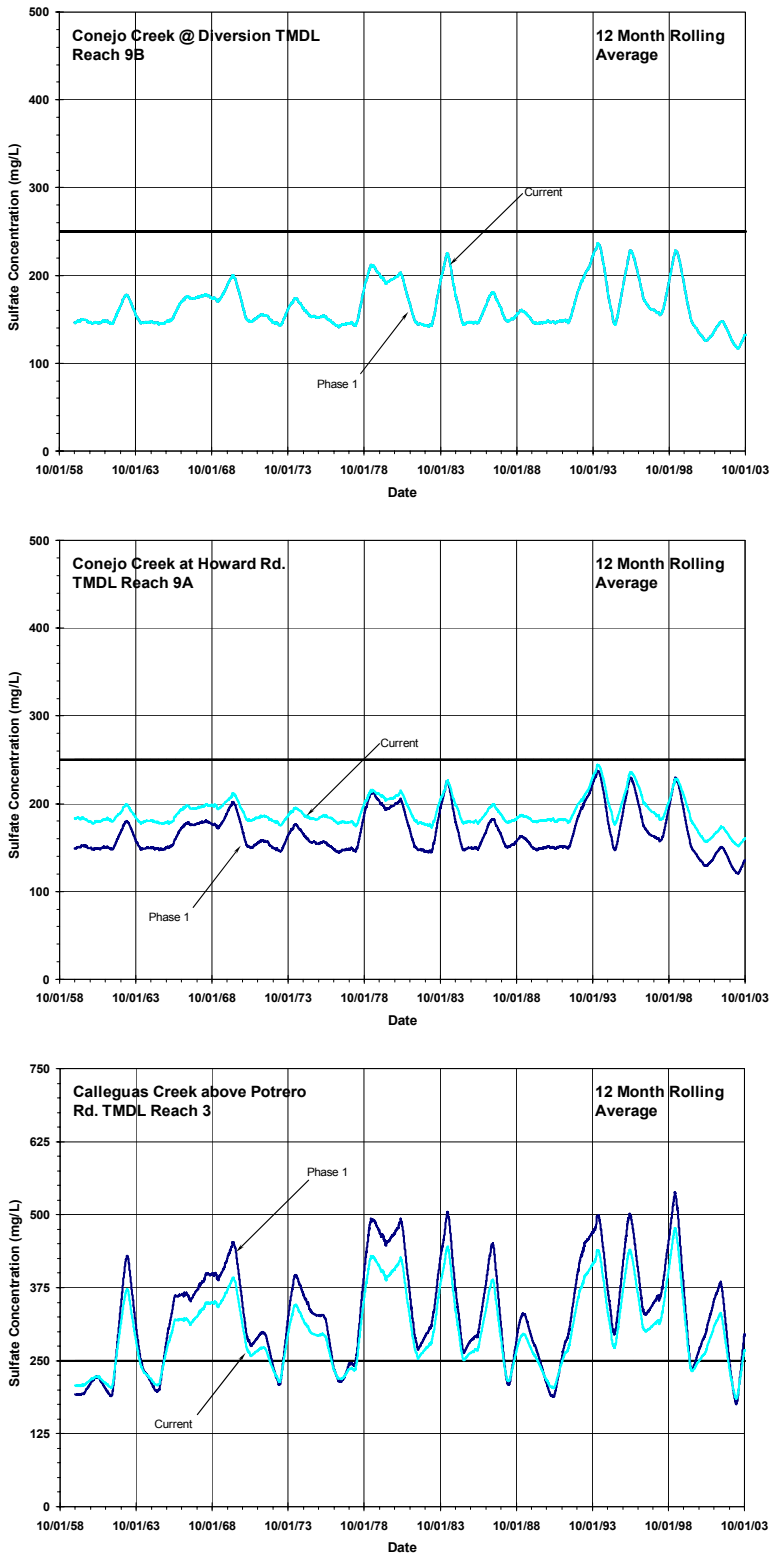


Figure 55: Current and Estimated Sulfate 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 1 of the RWRMP.

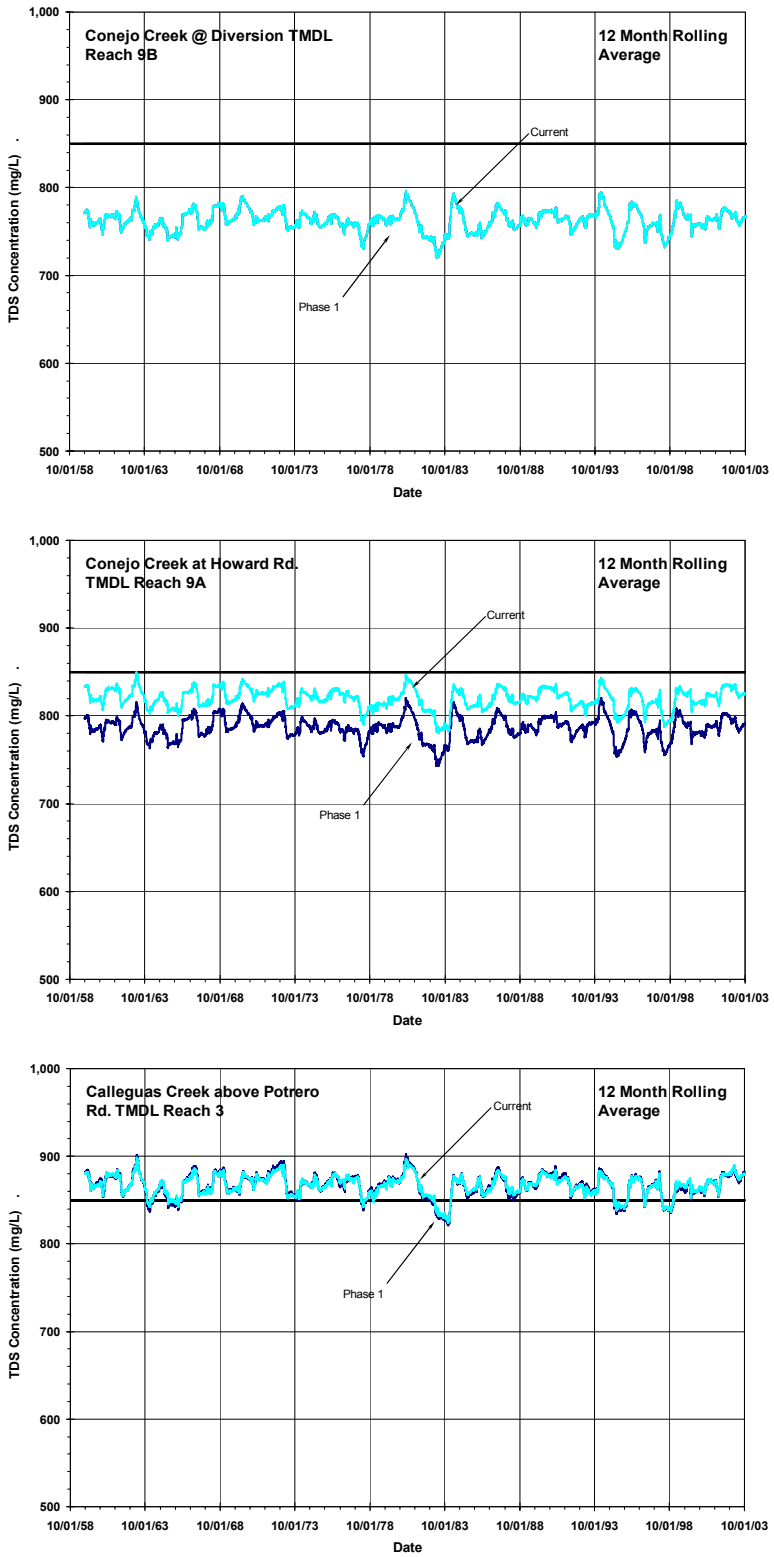


Figure 56: Current and Estimated TDS 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 1 of the RWRMP.

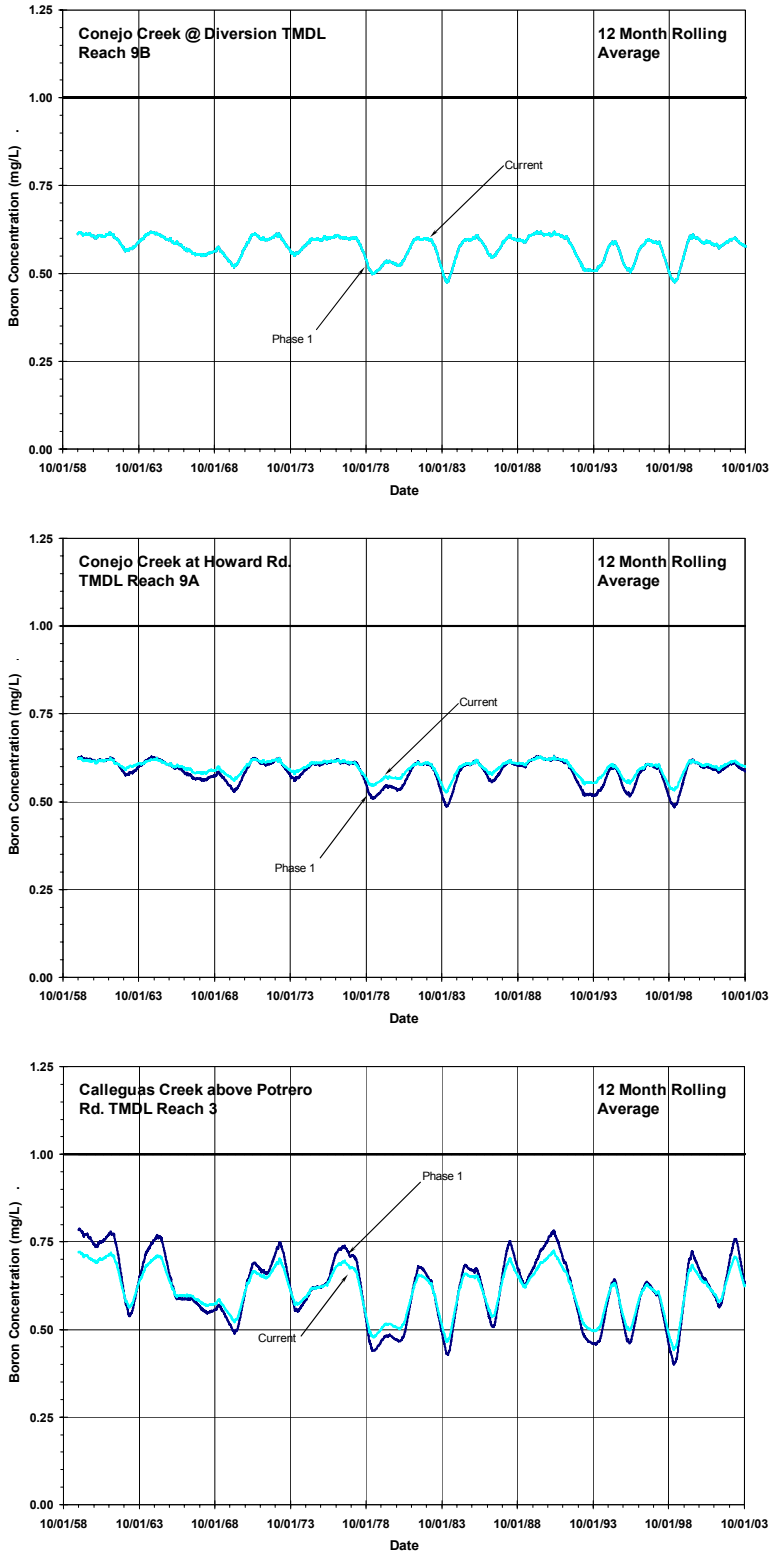


Figure 57: Current and Estimated Boron 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 1 of the RWRMP.

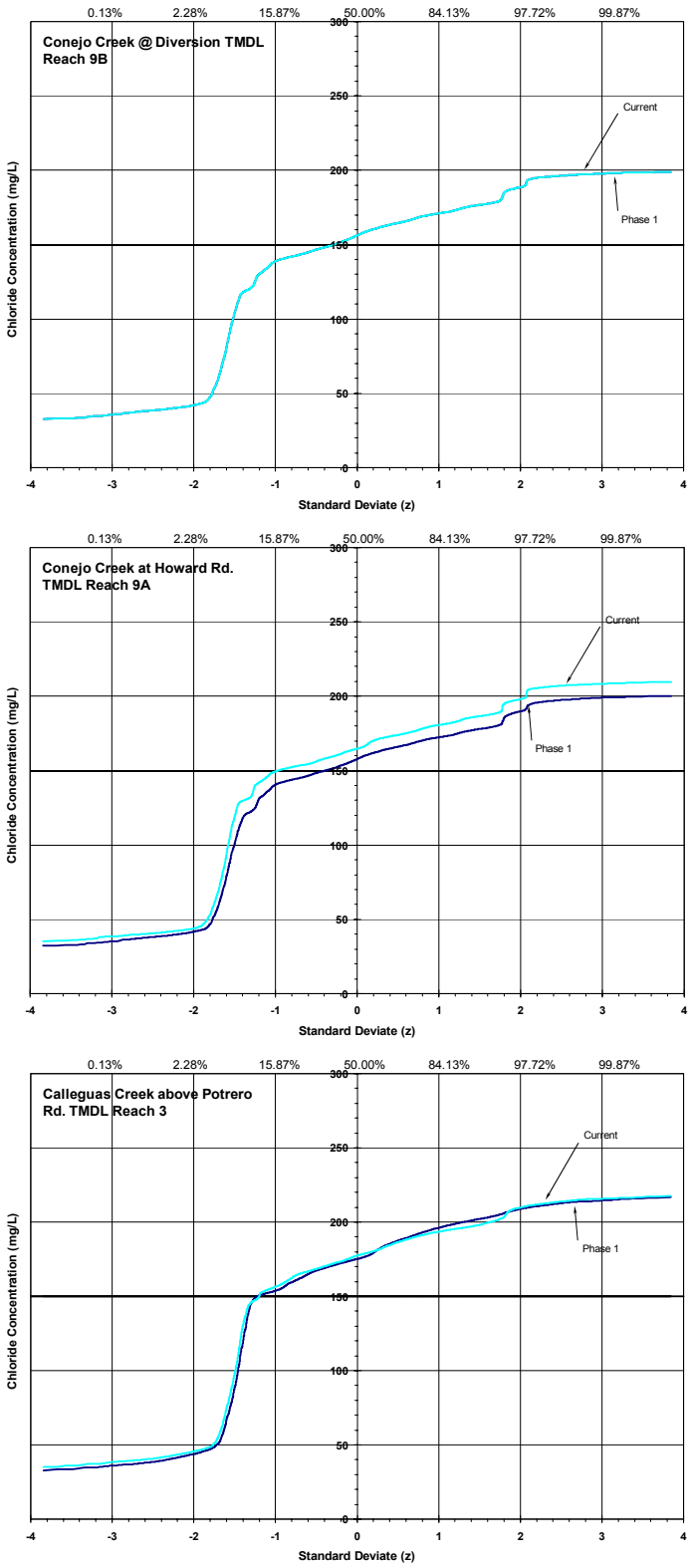


Figure 58: Current and Estimated Chloride Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 1 of the RWRMP.

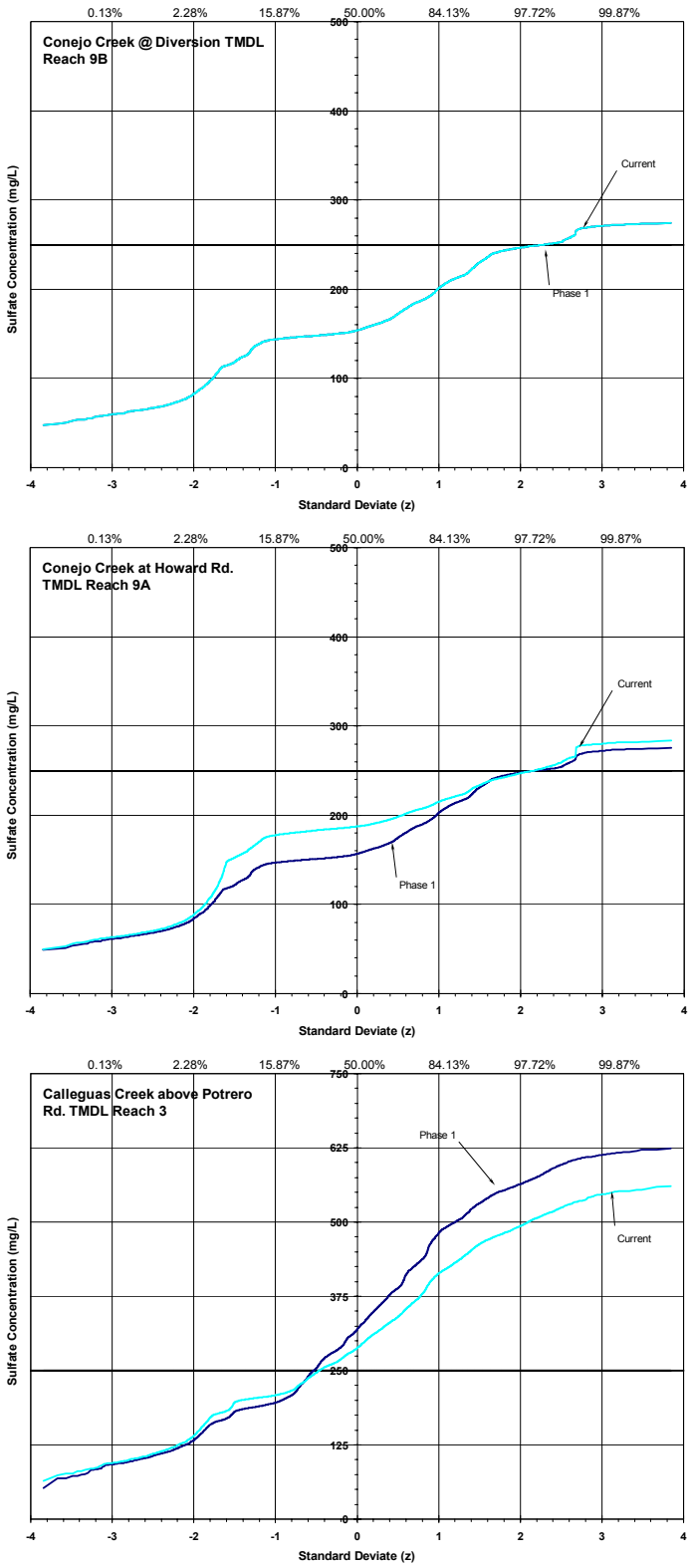


Figure 59: Current and Estimated Sulfate Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 1 of the RWRMP.

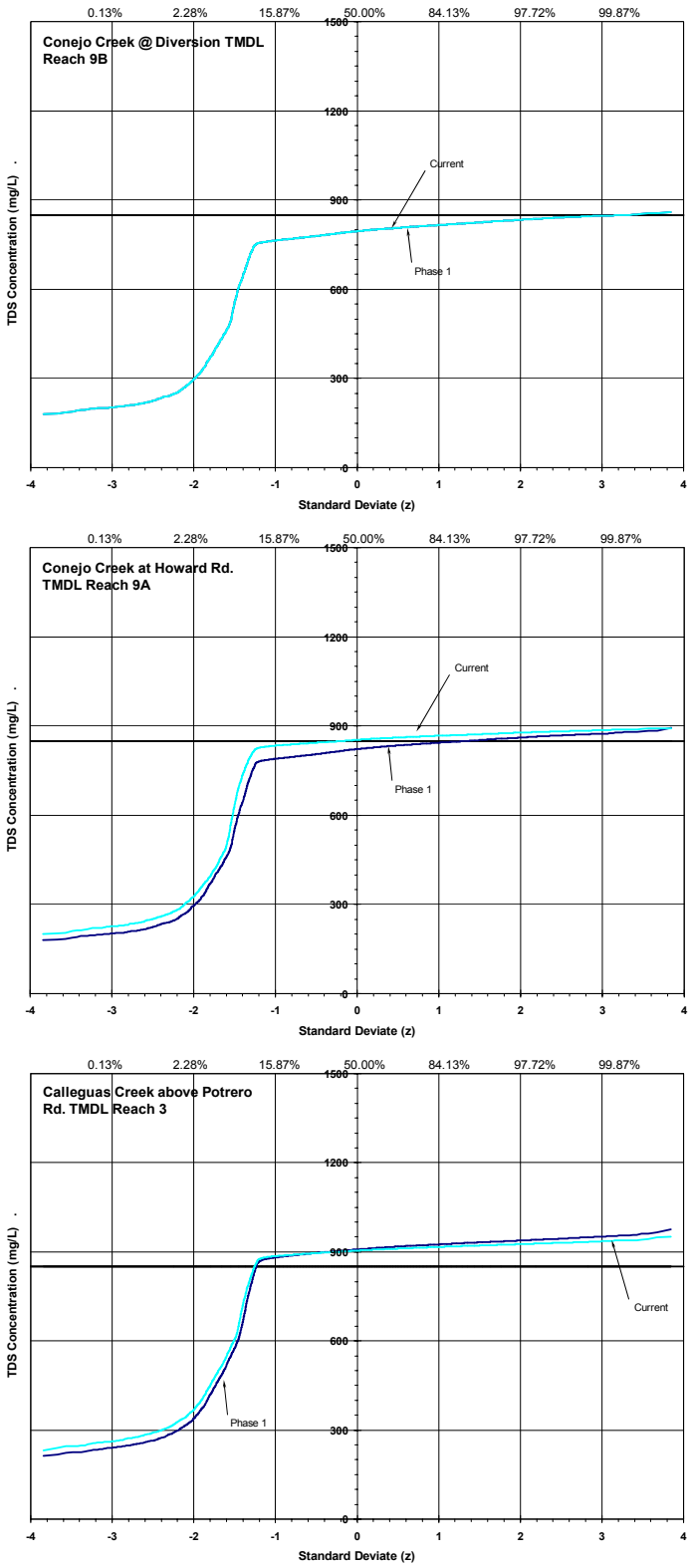


Figure 60: Current and Estimated TDS Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 1 of the RWRMP.

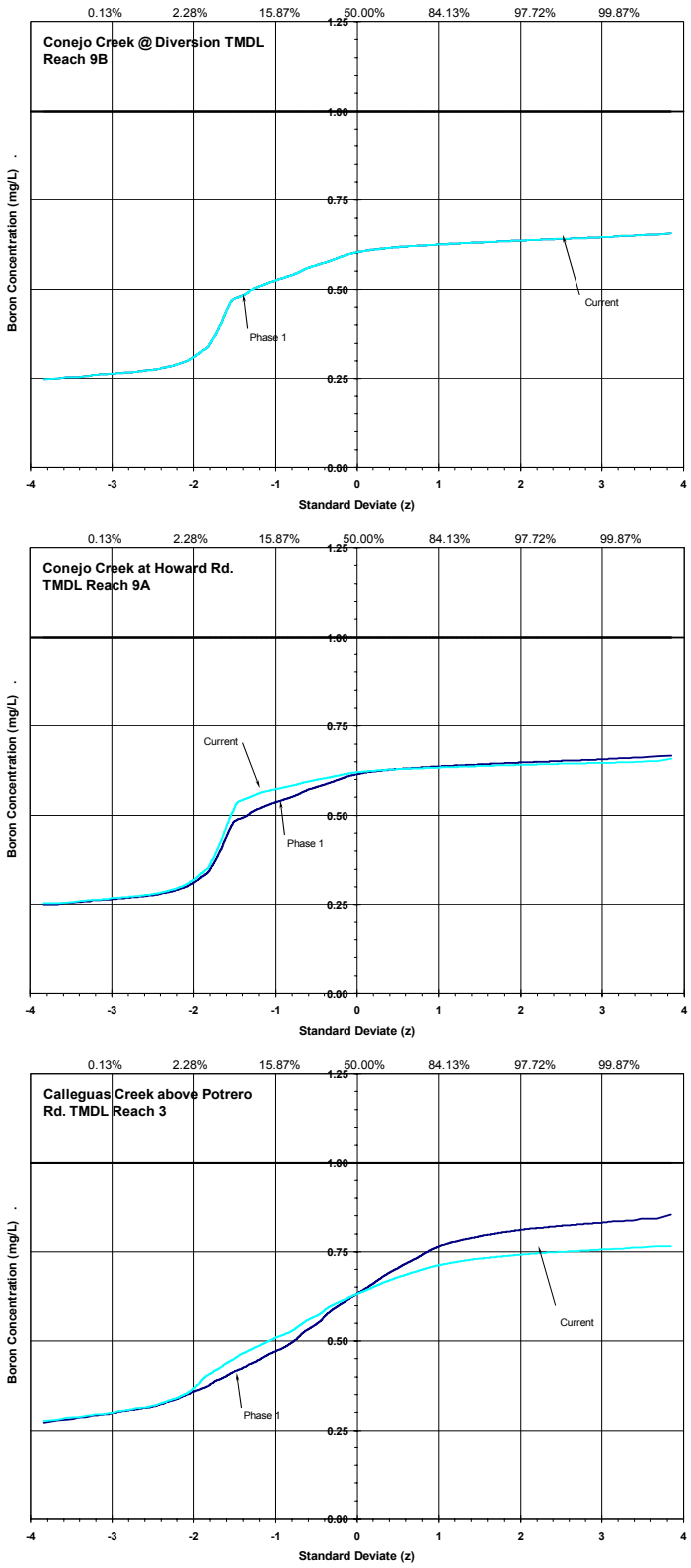


Figure 61: Current and Estimated Boron Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 1 of the RWRMP.

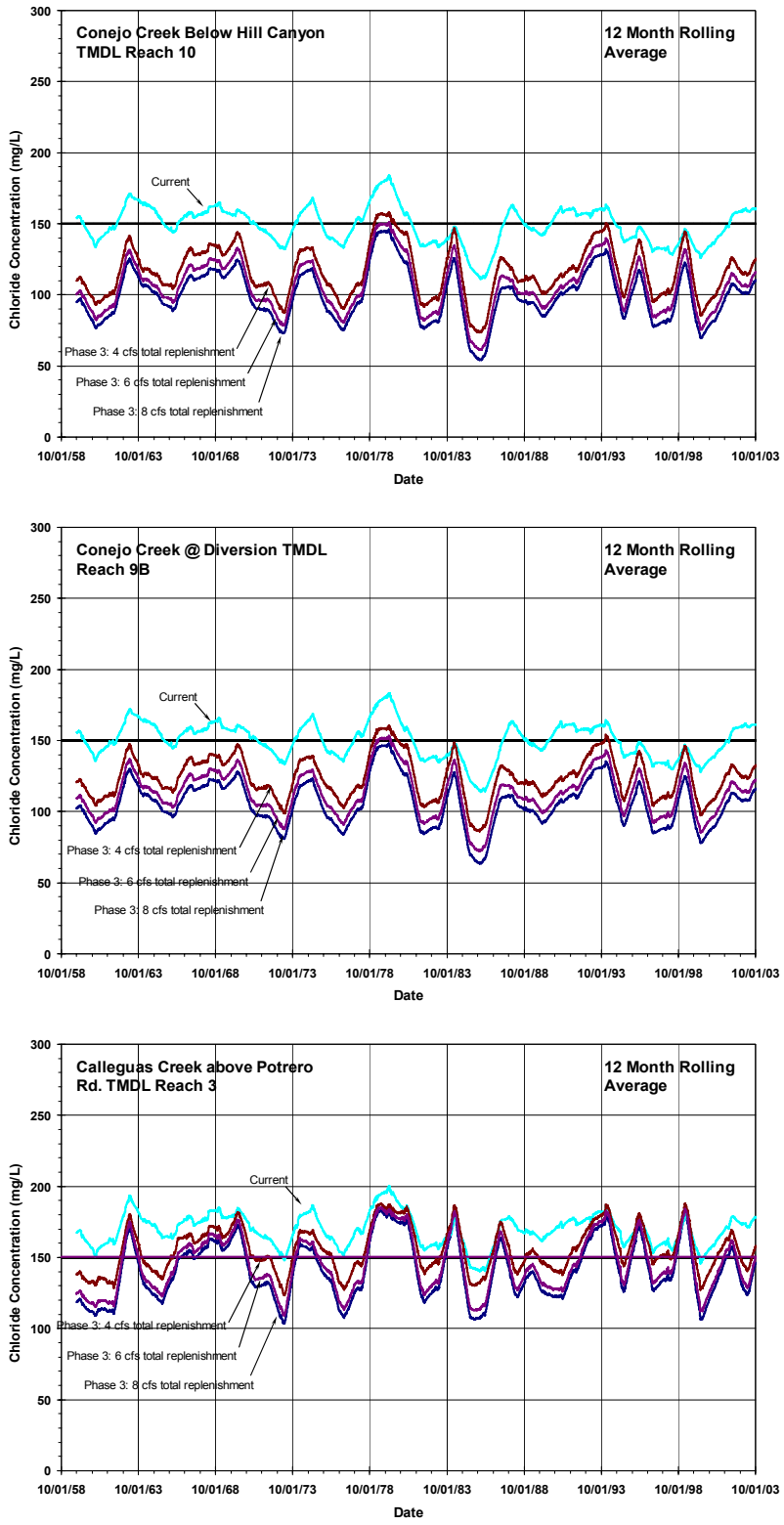


Figure 62: Current and Estimated Chloride 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP with Various Total Replenishment Flowrates Equally Divided between the North and South Forks of Arroyo Conejo.

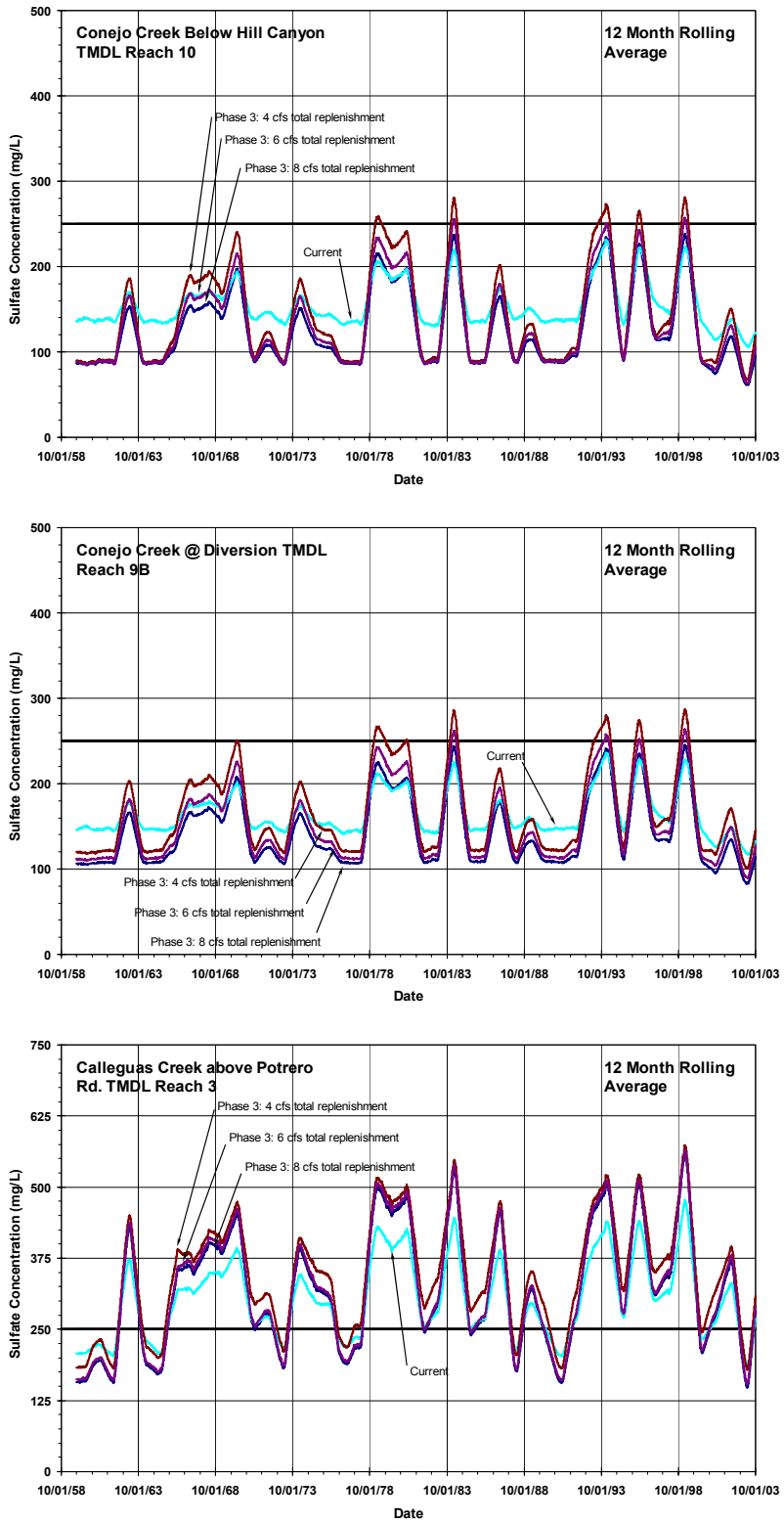


Figure 63: Current and Estimated Sulfate 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP with Various Total Replenishment Flowrates Equally Divided between the North and South Forks of Arroyo Conejo.

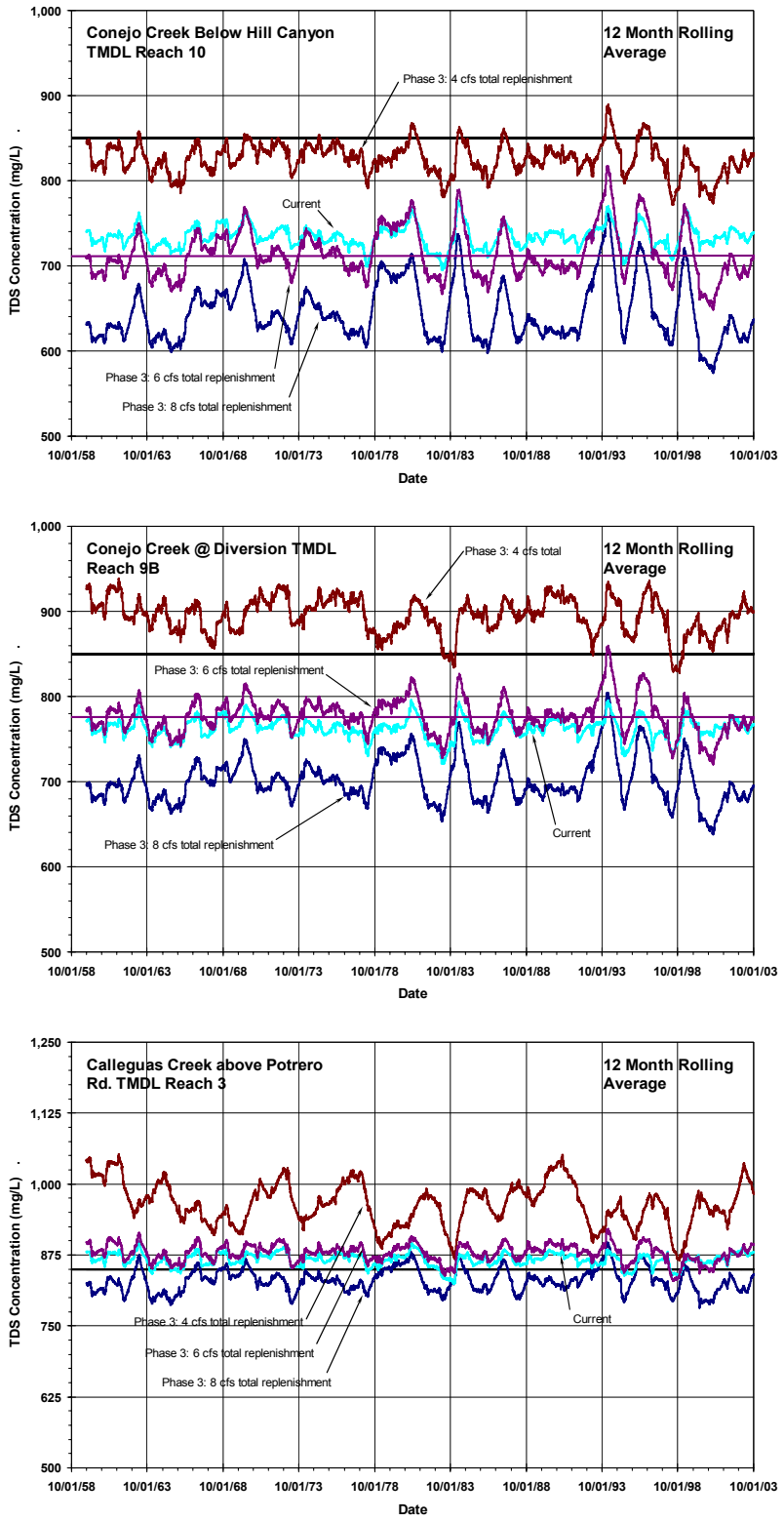


Figure 64: Current and Estimated TDS 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP with Various Total Replenishment Flowrates Equally Divided between the North and South Forks of Arroyo Conejo.

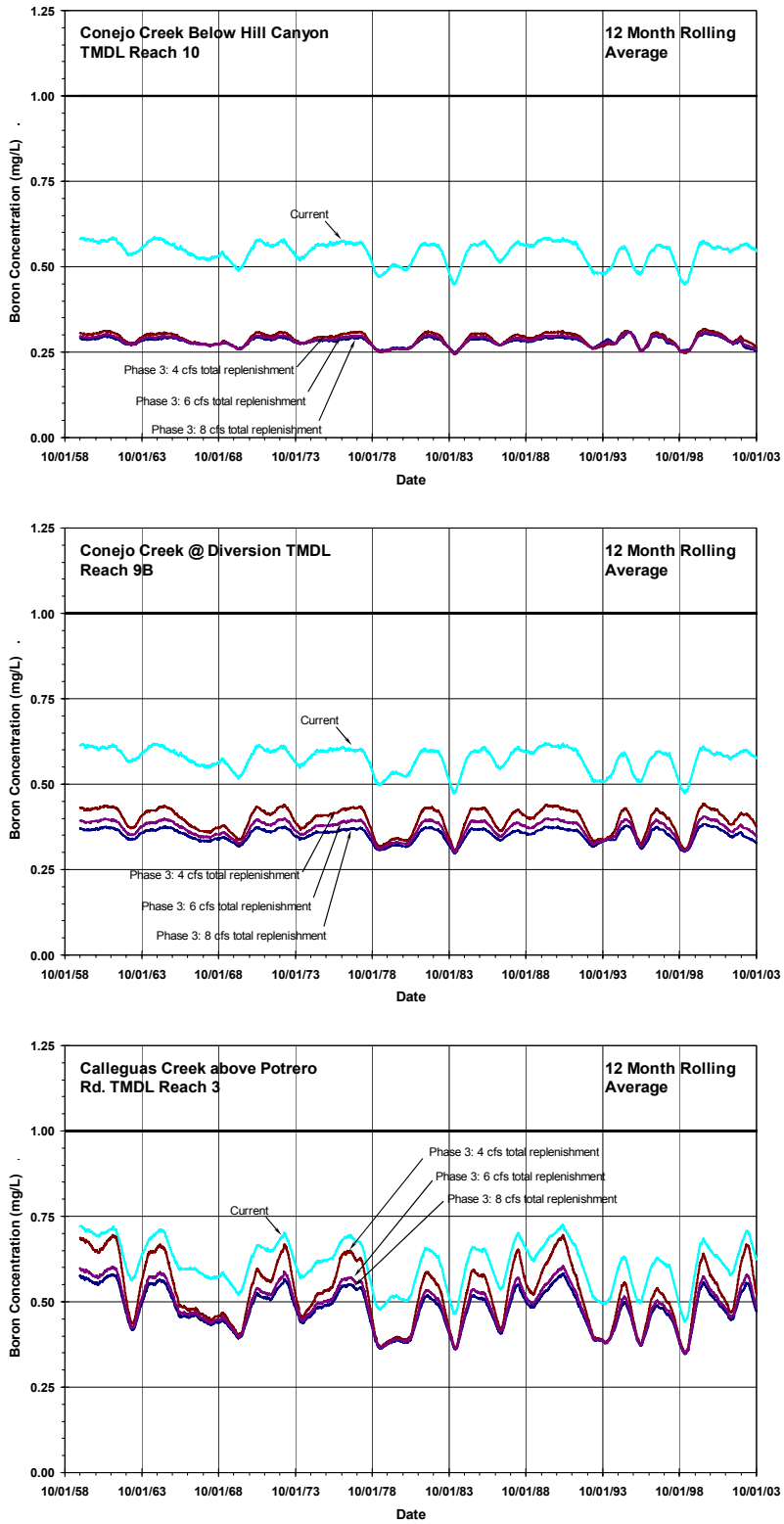


Figure 65: Current and Estimated Boron 12-month Rolling Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP with Various Total Replenishment Flowrates Equally Divided between the North and South Forks of Arroyo Conejo.

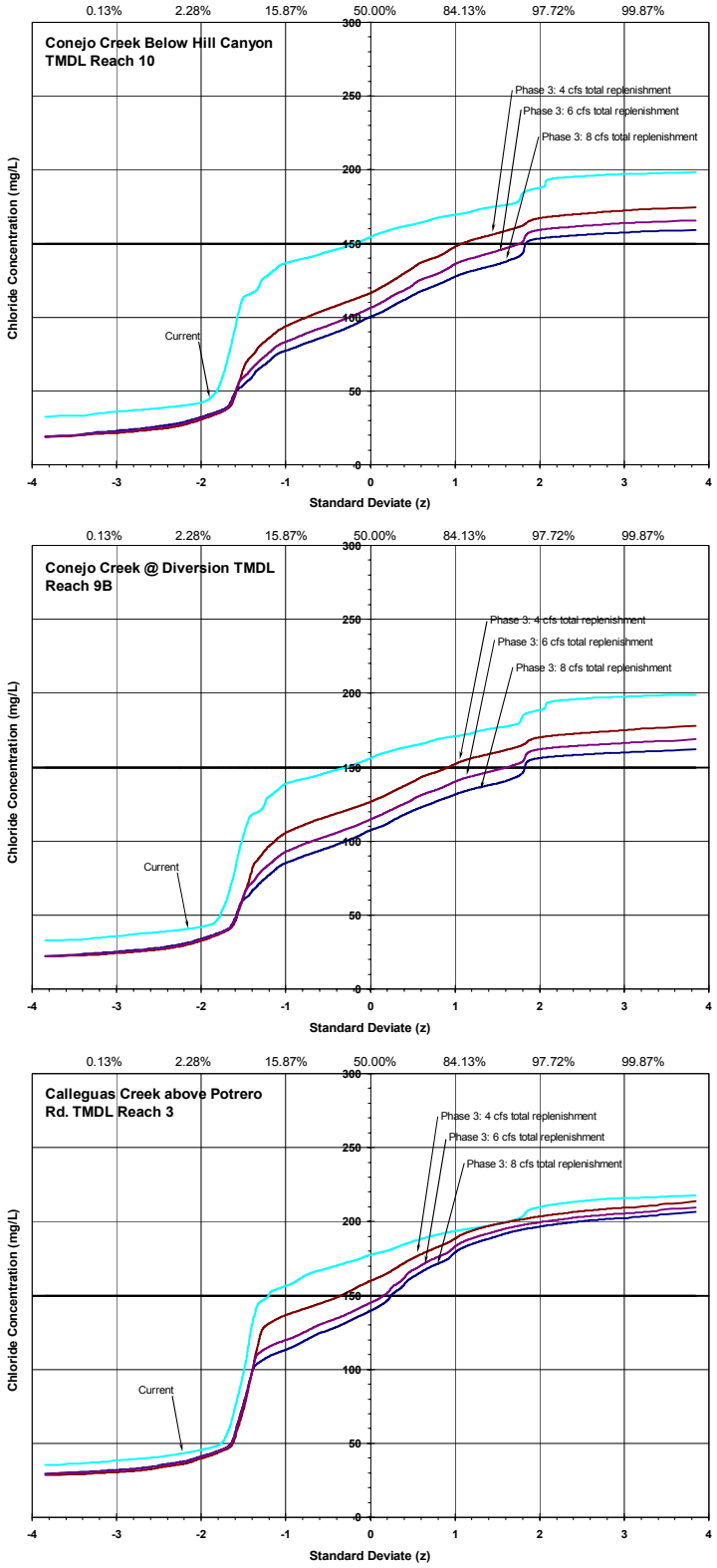


Figure 66: Current and Estimated Chloride Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP with Various Total Replenishment Flowrates Equally Divided between the North and South Forks of Arroyo Conejo.

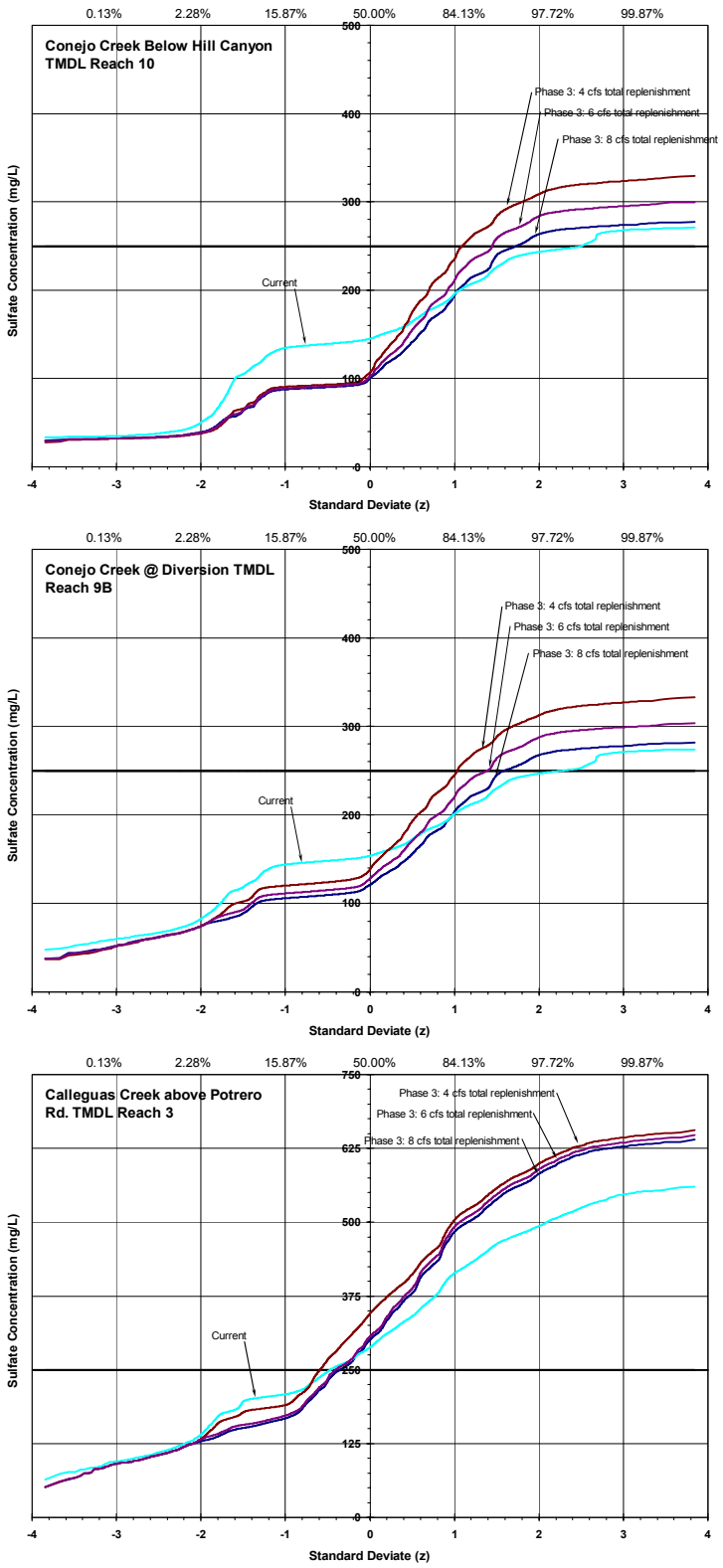


Figure 67: Current and Estimated Sulfate Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP with Various Total Replenishment Flowrates Equally Divided between the North and South Forks of Arroyo Conejo.

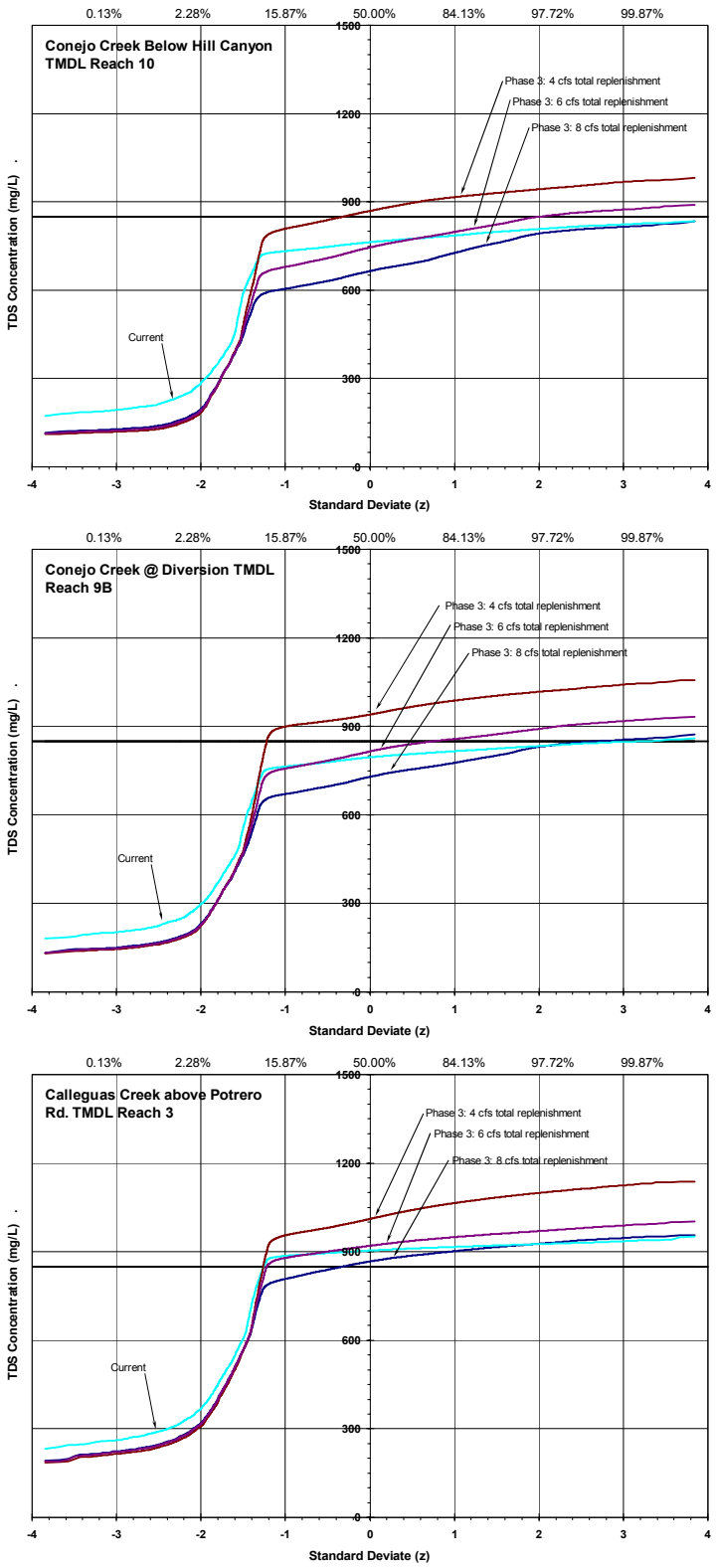


Figure 68: Current and Estimated TDS Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP with Various Total Replenishment Flowrates Equally Divided between the North and South Forks of Arroyo Conejo.

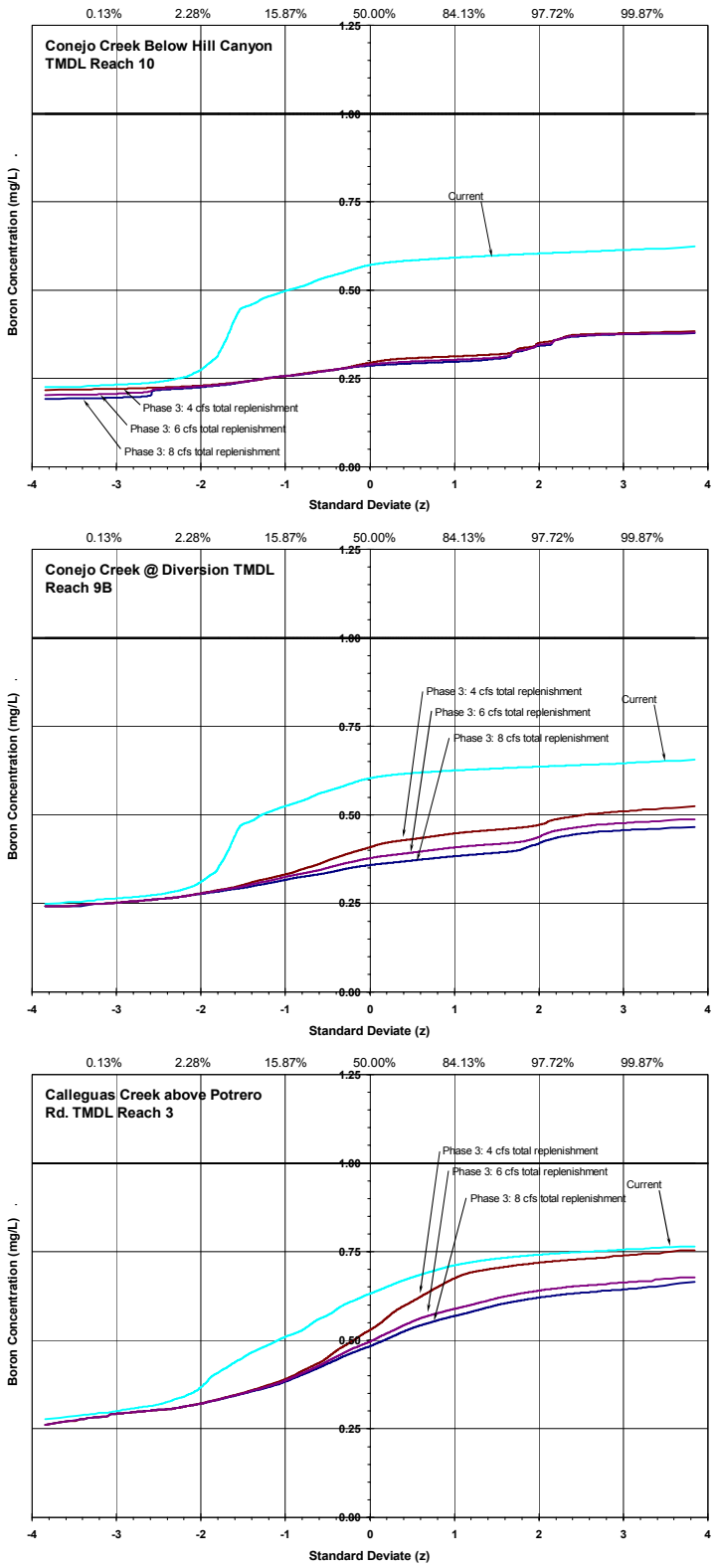


Figure 69: Current and Estimated Boron Probability Distribution of Daily Average Concentrations in Lower Watershed After Implementing Phase 3 of the RWRMP with Various Total Replenishment Flowrates Equally Divided between the North and South Forks of Arroyo Conejo.

Attachment A to Resolution No. R4-2007-016

Proposed Amendment to the Water Quality Control Plan – Los Angeles Region

to Incorporate the

Total Maximum Daily Load for Boron, Chloride, Sulfate, and TDS (Salts) in the Calleguas Creek Watershed

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on October 4, 2007

Amendments

Table of Contents
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs)

7- 22 Calleguas Creek Watershed Salts TMDL

List of Figures, Tables, and Inserts
Add:

Chapter 7. Total Maximum Daily Loads (TMDLs)
Tables

7-22 Calleguas Creek Watershed Salts TMDL
7-22.1. Calleguas Creek Watershed Salts TMDL: Elements
7-22.2. Calleguas Creek Watershed Salts TMDL: Implementation Schedule

Chapter 7. Total Maximum Daily Loads (TMDLs)
Calleguas Creek Watershed Salts TMDL

This TMDL was adopted by:

The Regional Water Quality Control Board on October 4, 2007.

This TMDL was approved by:

The State Water Resources Control Board on May 20, 2008.
The Office of Administrative Law on November 6, 2008.
The U.S. Environmental Protection Agency on December 2, 2008.

This TMDL is effective on December 2, 2008.

The elements of the TMDL are presented in Table 7-22.1 and the Implementation Plan in Table 7-22.2

Table 7-22.1. Calleguas Creek Watershed Salts TMDL: Elements

<table>
<tr><th>TMDL Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td>Problem Statement</td><td>Eleven of fourteen reaches in the Calleguas Creek Watershed (CCW) are identified on the 2002 Clean Water Act Section 303(d) list of water-quality limited segments as impaired due to elevated levels of boron, chloride, sulfate, or total dissolved solids (TDS) (these constitutions are commonly referred to as salts). Salts primarily impact two beneficial uses: agricultural supply and groundwater recharge. Below is 2002 303(d) list of water quality limited segments of the Calleguas Creek watershed:
<table>
<tr><th>Reach Name</th><th>Pollutant/Stressor</th></tr>
<tr><td>▪ Calleguas Creek Reach 3</td><td>Chloride, TDS</td></tr>
<tr><td>▪ Calleguas Creek Reach 6</td><td>Chloride, Sulfate, TDS</td></tr>
<tr><td>▪ Calleguas Creek Reach 7</td><td>Boron, Chloride, Sulfate, TDS</td></tr>
<tr><td>▪ Calleguas Creek Reach 8</td><td>Boron, Chloride, Sulfate, TDS</td></tr>
<tr><td>▪ Calleguas creek Reach 9A</td><td>Sulfate, TDS</td></tr>
<tr><td>▪ Calleguas Creek Reach 9B</td><td>Chloride, Sulfate, TDS</td></tr>
<tr><td>▪ Calleguas Creek Reach 10</td><td>Chloride, Sulfate, TDS</td></tr>
<tr><td>▪ Calleguas Creek Reach 11</td><td>Sulfate, TDS</td></tr>
<tr><td>▪ Calleguas Creek Reach 12</td><td>Sulfate, TDS</td></tr>
<tr><td>▪ Calleguas Creek Reach 13</td><td>Chloride, Sulfate, TDS</td></tr>
</table>
The list of impaired segments of the Calleguas Creek watershed in the 2002 303(d) list was maintained in the 2006 303(d) list.

The segment of Reach 4 below Laguna Road is tidally influenced and therefore not impaired for chloride, boron, sulfate, and TDS. Consequently, the waste load and load allocations developed for Reach 4 in this TMDL do not apply below Laguna Road.

The goal of this TMDL is to protect and restore the water quality in the Calleguas Creek watershed by controlling the loading and accumulation of salts.</td></tr>
<tr><td>Numeric Targets</td><td>Numeric targets are based on the site-specific numeric water quality objectives (WQOs) provided in the Basin Plan.

1. <u>Surface Water Quality Objectives</u>

Site-specific surface water quality objectives for the Calleguas Creek watershed are applicable upstream of Potrero Road. Site specific objectives have not been determined for Calleguas Creek below Potrero Road because the reach is tidally influenced. Below are WQOs for Calleguas Creek upstream of Potrero Road.</td></tr>
</table>

TMDL Element	Key Findings and Regulatory Provisions

Constituent	Water Quality Objective Upstream Potrero Road (mg/L)
Boron	1
Chloride	150
Sulfate	250
TDS	850

2. Groundwater Quality Objectives

Groundwater Basin[1]			Boron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)
DWR Basin No.	Groundwater Basin as Listed in the 1994 Basin Plan	Implementation Areas for Salts TMDL				
4-6	Pleasant Valley	Conejo and Calleguas/Pleasant Valley	1.0	150	300	700
4-7	Arroyo Santa Rosa	Arroyo Santa Rosa and Conejo/Arroyo Santa Rosa	1.0	150	300	900
4-8	Las Posas Valley – East of Grimes Canyon and Hitch Blvd	Arroyo Simi/South Las Posas	3.0	400	1200	2500
4-8	Las Posas Valley – South of LA Ave between Somis Rd & Hitch Blvd	Arroyo Las Posas/South Las Posas	1.0	250	700	1500
4-8	Las Posas Valley – North Las Posas Area	Arroyo Las Posas/North Las Posas	1.0	150	250	500
4-9	Simi Valley	Arroyo Simi/Simi Valley	1.0	150	600	1200
4-10	Conejo Valley	Arroyo Conejo/Conejo Valley	1.0	150	250	800
4-15	Tierra Rejada	Arroyo Santa Rosa/Tierra Rejada	0.5	100	250	700
4-19	Thousand Oaks	Arroyo Conejo/Thousand Oaks	1.0	150	700	1400

[1] The groundwater quality objectives specified in this table are equivalent to the groundwater quality objectives in the 1994 Basin Plan. Groundwater basins are numbered in the first column according to Bulletin 118-80 (Department of Water Resources, 1980). Designated groundwater basins in the 1994 Basin Plan are specified in the second column and groundwater basin descriptions of Calleguas Creek used in this TMDL are listed in the third column of the table.

Source Analysis

Sources of salts in the watershed include water supply (water imported from the State Water Project or Freeman Diversion and deep aquifer groundwater pumping), water softeners that discharge to publicly owned treatment works (POTWs), POTW treatment chemicals, atmospheric deposition, pesticides and fertilizers, and indoor water use (chemicals, cleansers, food, etc.). These salts are then transported through POTW discharges and runoff to surface water, shallow groundwater, and/or stranded on the watershed in the soils. Salts transported in the surface water to the ocean are currently the only salts

TMDL Element	Key Findings and Regulatory Provisions
	that are exported from the watershed. While the concentration of salts in the introduced water is usually below the Basin Plan Objectives, the quantity of water brought into the watershed is sufficient to rank introduced water as the greatest source of salts to the watershed. Salts that are transported during dry weather to the surface water are quantified via the following mechanisms: groundwater pumping, groundwater exfiltration, POTWs, dry weather urban and agricultural runoff. Wet weather loadings from each of these sources have the potential to be significant, but tend to be lower in concentration and do not occur during the critical conditions for salts. Wet weather loads are significant from the perspective of transporting stranded salts off the watershed.
Linkage Analysis	The linkage analysis for salts focuses on the surface water concentrations of salts. However, surface water concentrations are only one component of the watershed salts issue. Because it is difficult to model other aspects of the salt problem (i.e. surface water and groundwater interactions, stranded salts), two simplified approaches have been used to demonstrate that salts will be removed from the watershed, which should have a correspondingly positive impact on surface water and groundwater salts concentrations. First, a surface water model was developed to provide a linkage between sources and surface water quality and to demonstrate the impact of projects on receiving water quality in the watershed. Second, a salt balance was developed to quantify the removal of salts from the watershed with the goal of achieving a mass balance in which the mass of boron, sulfate, TDS and chloride imported into Calleguas Creek subwatersheds is no more than the mass of boron, sulfate, TDS and chloride exported from the Calleguas Creek subwatershed. Achieving a salt balance in the watershed will prevent additional build-up of salts in any medium in the watershed and protect ground water supplies from increasing in salt concentrations. The Calleguas Creek Modeling System is a mass balance based model that was developed for the surface water to provide a linkage between sources and surface water quality. To estimate the salts balance in the watershed, a simple chloride mass balance was developed by the Camrosa Water District (Hajas, 2003a) and modified to address the other salts.

TMDL Element	Key Findings and Regulatory Provisions
Waste Load Allocations	**<u>A. POTWs</u>** The TMDL includes waste load allocations (WLAs) for five POTWs in the Calleguas Creek watershed: Simi Valley Water Quality Control Plant (WQCP), Hill Canyon Wastewater Treatment Plan (WWTP), Moorpark WWTP, Camarillo Water Reclamation Plant (WRP), and Camrosa Water Reclamation Facility (WRF). At the end of the implementation period, only Simi Valley WQCP and the Hill Canyon WWTP are expected to discharge to surface waters. Moorpark WWTP and Camrosa WRF currently discharge directly to ponds under dry weather conditions. As part of the TMDL implementation, the Renewable Water Resources Management Program (RWRMP) will introduce treated wastewater from the Camarillo WRP into the Camrosa recycled water storage and distribution system. Surplus treated wastewater from Camarillo WRP and Camrosa WRF will be discharged at a point downstream of Potrero Road Bridge to Calleguas Creek. Dry weather WLAs are included for the case when Camarillo WRP, Camrosa WRF, and Moorpark WWTP need to discharge to the stream (for example, if there is insufficient recycled water demand during the wet season). Including WLAs for these POTWs ensures that water quality objectives are not exceeded as a result of their discharge. POTW mass-based WLAs are calculated as the POTW effluent flow rate multiplied by the water quality objective and include a mass-based adjustment factor (AF) that is subtracted from the product of the flow-rate and the water quality objective. The adjustment factor is used to link POTW allocations to the required reductions in background loads. The adjustment factors are implemented through mechanisms that export salts out of the subwatershed, such as groundwater pumping, to meet the salt balance requirements. To ensure that the loading capacity is achieved in surface water and the reductions in background loads are achieved, minimum salt exports shown below are required for POTWs and are included in WLAs as a component of the adjustment factors. If the background load reductions are not achieved, POTWs shall be responsible for providing additional load reductions to achieve water quality standards. The AF is set equal to the difference between the minimum salts export requirement to attain a salt balance in the subject reaches and the actual salts export. If the calculated annual dry weather salt exports from the subwatershed to which the POTW discharges are less than the minimum required exports for the previous year and the annual average receiving water concentration at the base of the subwatershed to which the POTW discharges exceeds water quality objectives for the previous year, the POTW allocations will be reduced using the adjustment factor.

TMDL Element	Key Findings and Regulatory Provisions
	The adjustment factors are also used to address unusual conditions in which the inputs to the POTWs from the water supply may challenge the POTWs ability to meet the assigned WLAs. The adjustment factor allows for the additional POTW loading only when the water quality objectives are met in the receiving waters. POTW allocations can be adjusted upwards when imported water supply chloride concentrations exceed 80 mg/L and discharges from the POTW exceed the WLA. In order to apply the AF to the assigned WLAs, the POTW is required to submit documentation of the water supply chloride concentrations, receiving water chloride concentration, the effluent mass, and evidence of increased salt exports to offset the increased discharges from the POTW to the RWQCB for approval. WLAs shown in table below apply to POTWS during dry weather when the flows in the receiving water are below the 86th percentile flow. During wet weather, the loading capacity of the stream is significantly increased by stormwater flows with very low salt concentrations. Any discharges from the POTWs during wet weather would be assimilated by these large storm flows and would not cause exceedances of water quality objectives. Boron is only listed in the Simi and Pleasant Valley (Revolon) subwatersheds and exceedances of boron do not occur in other portions of the watershed. Therefore, boron allocations are only included for the Simi Valley WQCP. Interim limits are included to allow time for dischargers to put in place implementation measures necessary to achieve final waste load allocations. The monthly average interim limits are set equal to the 95th percentile of available discharge data. **1. Minimum Salt Export Requirements for Adjustment Factor [a]** POTW: Minimum Chloride Export (lb/day); Minimum TDS Export (lb/day); Minimum Sulfate Export (lb/day); Minimum Boron Export (lb/day) Simi Valley WQCP: 460; 3220; 9120; 3.3 Moorpark WWTP: 460; 3220; 9120; 3.3 Hill Canyon WWTP: 1060; 7920; 4610; 0 Camrosa WRF: 1060; 7920; 4610; 0 Camarillo WRP: 1060; 7920; 4610; 0 [a] Minimum export requirements include a 10% Margin of Safety.

TMDL Element	Key Findings and Regulatory Provisions

2. Interim Monthly Average WLAs for POTWs

POTW	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Boron (mg/L)
Simi Valley WQCP	183	955	298	N/A
Hill Canyon WWTP	189	N/A	N/A	N/A
Moorpark WWTP	171	N/A	267	N/A
Camarillo WRP	216	1012	283	N/A
Camrosa WRF*	N/A	N/A	N/A	N/A

* Camrosa WRF has not discharged to surface water during the period under which interim limits were calculated. When effluent data are available, the Regional Board may adopt interim WLAs for Camrosa WRF.
N/A: The 95th percentile concentration is below the Basin Plan objective so interim limits are not necessary.

3. Final WLAs for POTWs[a,d]

POTW	Chloride (lb/day) [c]	TDS (lb/day) [c]	Sulfate (lb/day) [c]	Boron (lb/day) [c]
Simi Valley WQCP	150*Q-AF	850*Q-AF	250*Q-AF	1.0*Q-AF
Hill Canyon WWTP	150*Q-AF	850*Q-AF	250*Q-AF	N/A
Moorpark WWTP[b]	150*Q-AF	850*Q-AF	250*Q-AF	N/A
Camarillo WRP[b]	150*Q-AF	850*Q-AF	250*Q-AF	N/A
Camrosa WRF[b]	150*Q-AF	850*Q-AF	250*Q-AF	N/A

a. The allocations shown only apply during dry weather (as defined in this TMDL). During wet weather discharges from the POTWs do not cause exceedances of water quality objectives.
b. These POTWs are not expected to discharge after the end of the implementation period.
c. AF is the adjustment factor and equals the difference between the minimum salts export requirement and the actual salts export.
d. Q represents the POTW flow at the time the water quality measurement is collected and a conversion factor to lb/day based on the units of measurement for the flow.

N/A Boron is not listed in the reaches to which the POTW discharges. No WLA is required.

B. Urban Runoff

Permitted stormwater dischargers that are responsible parties to this TMDL include the Municipal Stormwater Dischargers (MS4s) of the Cities of Camarillo, Moorpark, Thousand Oaks, County of Ventura, Ventura County Watershed Protection District, and general industrial and construction permittees. Permitted stormwater dischargers are assigned a dry weather wasteload allocation equal to the average dry weather critical condition flow rate multiplied by the numeric target for each constituent. Waste load allocations apply in the receiving water at the base of each subwatershed. Because wet weather flows transport a large mass of salts at low concentrations, these dischargers meet water

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quality objectives during wet weather. Dry weather allocations apply when instream flow rates are below the 86th percentile flow and there has been no measurable precipitation in the previous 24 hours.

Interim limits are assigned for dry weather discharges from areas covered by NPDES stormwater permits to allow time to implement appropriate actions. The interim limits are assigned as concentration based receiving water limits set to the 95th percentile of the discharger data as a monthly average limit except for chloride. The 95th percentile for chloride was 267 mg/L which is higher than the recommended criteria set forth in the Basin Plan for protection of sensitive beneficial uses including aquatic life. Therefore, the interim limit for chloride for Permitted Stormwater Dischargers is set equal to 230 mg/L to ensure protection of sensitive beneficial uses in the Calleguas Creek watershed.

1. Interim Dry Weather WLAs for Permitted Stormwater Dischargers

Constituent	Interim Limit (mg/L)
Boron Total	1.3
Chloride Total	230
Sulfate Total	1289
TDS Total	1720

2. Final Dry Weather WLAs for Permitted Stormwater Dischargers

Subwatershed	Critical Condition Flow Rate (mgd)	Chloride Allocation (lb/day)	TDS Allocation (lb/day)	Sulfate Allocation (lb/day)	Boron Allocation (lb/day)
Simi	1.39	1,738	9,849	2,897	12
Las Posas	0.13	157	887	261	N/A
Conejo	1.26	1,576	8,931	2,627	N/A
Camarillo	0.06	72	406	119	N/A
Pleasant Valley (Calleguas)	0.12	150	850	250	N/A
Pleasant Valley (Revolon)	0.25	314	1,778	523	2

<table>
<tr><th>TMDL Element</th><th>Key Findings and Regulatory Provisions</th></tr>
<tr><td></td><td>

C. Final WLAs for Other NPDES Dischargers

Concentration-based WLAs are assigned at the Basin Plan objectives for other NPDES dischargers.

<table>
<tr><th>Constituent</th><th>Allocation (mg/L)</th></tr>
<tr><td>Chloride</td><td>150</td></tr>
<tr><td>TDS</td><td>850</td></tr>
<tr><td>Sulfate</td><td>250</td></tr>
<tr><td>Boron[a]</td><td>1.0</td></tr>
</table>

Other NPDES dischargers include, but are not limited to, permitted groundwater cleanup projects that could have significant salt concentrations as a result of the stranded salts in the shallow groundwater basins being treated. To facilitate the cleanup of the basins prior to alternative discharge methods (such as the brine line) being available, interim limits for other NPDES dischargers will be developed on a case-by-case basis and calculated as a monthly average using the 95th percentile of available discharge data.

</td></tr>
<tr><td>**Load Allocations**</td><td>

Dry weather load allocations are assigned as a group allocation to irrigated agricultural discharges. The load allocation (LA) is equal to the average dry weather critical condition flow rate multiplied by the numeric target for each constituent. Load allocations apply in the receiving water at the base of each subwatershed. Because wet weather flows transport a large mass of salts at a typically low concentration, these dischargers should meet water quality objectives during wet weather. Dry weather allocations apply when instream flow rates are below the 86th percentile flow and there has been no measurable precipitation in the previous 24 hours.

Interim limits are assigned for dry weather discharges from irrigated agricultural areas to allow time to implement appropriate actions. The interim limits are assigned as concentration based receiving water limits set to the 95th percentile of the discharger data as a monthly average limit except for chloride. The 95th percentile for chloride was 499 mg/L which is higher than the recommended criteria set forth in the Basin Plan for protection of sensitive beneficial uses including aquatic life. Therefore, the interim limit for chloride for Irrigated Agricultural Dischargers is set equal to 230 mg/L to ensure protection of sensitive beneficial uses in the Calleguas Creek watershed.

</td></tr>
</table>

TMDL Element	Key Findings and Regulatory Provisions

I. Interims Load Allocations for Irrigated Agricultural Dischargers

Constituent	Interim Limit (mg/L)
Boron Total	1.8
Chloride Total	230
Sulfate Total	1962
TDS Total	3995

II. Final Load Allocations for Irrigated Agricultural Dischargers

Subwatershed	Chloride Allocation (lb/day)	TDS Allocation (lb/day)	Sulfate Allocation (lb/day)	Boron Allocation (lb/day)
Simi	641	3,631	1,068	4
Las Posas	2,109	11,952	3,515	N/A
Conejo	743	4,212	1,239	N/A
Camarillo	59	336	99	N/A
Pleasant Valley	305	1,730	509	N/A
Revolon	7,238	41,015	12,063	48

Margin of Safety

A margin of safety (MOS) for the TMDL is designed to address uncertainties in the analysis that could result in targets not being achieved in the waterbodies. The primary uncertainties associated with this TMDL include the impact of implementing a salt balance on receiving water quality. The effect of the salt balance is estimated by the mass-balance and subject to the following uncertainties: 1) the flow rates used to determine the loading capacity may change due to TMDL implementation, 2) the use of a daily load for determining allocations and an annual mass balance to attain water quality objectives, and 3) the sources of salts may not be completely known. Both implicit and explicit MOS are included for this TMDL. The implicit MOS stems from the use of conservative assumptions made during development of the TMDL. The mass of salts transported out of the watershed during wet weather is on average over 15% of the annual mass of salts introduced to the watershed for all constituents. The salt export during wet weather ranges from 7% to 41% for TDS, 9% to 48% for chloride, and 13% to 89% for sulfate of the export required to meet a salt balance in the watershed. This mass is not used to determine compliance with the salt balance and represents a significant implicit margin of safety. The model also contains a component that serves to model the impact of "stranded" salts in the watershed. The component assumes low irrigation efficiencies and the ability of all salts applied as irrigation water anywhere in the watershed to be discharged to receiving water in

TMDL Element	Key Findings and Regulatory Provisions
	critical years. This likely overestimates the impact of "stranded" salts and results in a higher concentration of salts due to irrigation in the receiving water. An explicit MOS of 10% is applied to the adjustment factors for the POTWs to account for the uncertainties in the TMDL analysis. By applying the margin of safety to the adjustment factor, more salts are required to be exported than are necessary to offset the background loads in the watershed. This additional salt export provides a margin of safety on the salt balance to address uncertainties that the salt balance will result in compliance with water quality objectives. The 10% explicit MOS is determined sufficient to address the uncertainties associated with the estimated impact of the salt balance on receiving water loadings.
Future Growth	Ventura County accounts for slightly more than 2% of the state's residents with a population of 753,197 (US Census Bureau, 2000). GIS analysis of the 2000 census data yields a population estimate of 334,000 for the CCW, which equals about 44% of the county population. According to the Southern California Association of Governments (SCAG), growth in Ventura County averaged about 51% per decade from 1900-2000; with growth exceeding 70% in the 1920s, 1950s, and 1960s. Significant population growth is expected to occur within and near present city limits until at least 2020. Increased growth requires additional water. Therefore, future growth could result in increased loads of salts being imported into the watershed. However, the TMDL implementation plan is designed to maintain a salts balance in the watershed. If additional salts are imported into the watershed, a larger volume of salts will also be exported out of the watershed to maintain the balance. Consequently, increased imports from future growth are not expected to result in higher concentrations in receiving waters.
Seasonal Variations and Critical Conditions	The critical condition for salts is during dry weather periods. During wet weather, stormwater flows dilute the salt discharges and receiving water concentrations are significantly lower than water quality objectives. Dry weather, defined as days with flows lower than the 86th percentile flow and no measurable precipitation, is a critical condition regardless of the dry weather flows in the stream. The driving conditions for exceedances of water quality objectives are the concentrations in the water supply (which is driven by surface water concentrations in Northern California) and the previous year's annual precipitation and corresponding flows. Elevated salts concentrations during dry weather occur when stranded salts are discharged into the surface water after higher than average rainfall years. The elevated concentrations occur during years when the previous annual flow is

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	greater than the 75th percentile of the annual flows for the watershed (critical year). The higher concentrations occur during the dry periods of critical years regardless of whether the annual flow for the critical year is an average flow year, higher than average year, or lower than average year. The key parameter determining a critical year is the total annual flow volume for the previous year. Based on model results, four critical years were defined based on modeled results that resulted in receiving water concentrations greater than the 99th percentile concentration during at least 10% of the dry period. The critical years identified from the model occur with conditions similar to what occurred in 1978, 1979, 1983 and 1998.
Special Studies and Monitoring Plan	**<u>Special Studies</u>** Several special studies are planned to improve understanding of key aspects related to achievement of WLAs and LAs for the Salts TMDL. ***1. Special Study #1 (Optional) – Develop Averaging Periods and Compliance Points*** The TMDL technical report has provided information that shows instantaneous salts objectives may not be required to protect groundwater recharge and agricultural beneficial uses. It is possible that the beneficial uses will be protected and a salt balance achieved without achieving instantaneous water quality objectives in all reaches of the watershed. This optional special study is included to allow an investigation of averaging periods for the salts objectives in the CCW. Additionally, this study will investigate the locations of beneficial uses and the possibility of identifying compliance points for the salts objectives at the point of beneficial use impacts. The use of compliance points would alleviate the need to develop site-specific objectives for the reaches of the watershed upstream of the POTW discharges (described in Special Study #3) while still ensuring the protection of beneficial uses. Sensitive beneficial uses are not present in the upper reaches and POTW discharges dilute the salts from the upper reaches and may allow compliance with the objectives at the point of groundwater recharge downstream. This is an optional special study to be conducted if desired by the stakeholders or determined necessary or appropriate by the Executive Officer. ***2. Special Study #2 (Optional) – Develop Natural Background Exclusion*** Discharges of groundwater from upstream of the Simi Valley WQCP (Reaches 7 and 8) and Hill Canyon WWTP (Reaches 12 and 13) and

TMDL Element	Key Findings and Regulatory Provisions
	downstream of the Camrosa WRF (Reach 3) contain high salts concentrations. Natural marine sediments may contribute to the high concentrations in those discharges. This special study would evaluate whether or not the groundwater discharges in these areas would qualify for a natural sources exclusion. The special study could follow a 'reference system/anti-degradation approach' and/or a 'natural sources exclusion approach' for any allocations included in this TMDL that are proven unattainable due to the magnitude of natural sources. The purpose of a 'reference system/anti-degradation approach' is to ensure water quality is at least as good as an appropriate reference site and no degradation of existing water quality occurs where existing water quality is better than that of a reference site. The intention of a 'natural sources exclusion approach' is to ensure that all anthropogenic sources of salts are controlled such that they do not cause exceedances of water quality objectives. These approaches are consistent with state and federal anti-degradation policies (State Board Resolution No. 68-16 and 40 C.F.R. 131.12). This is an optional special study to be conducted if desired by the stakeholders or determined necessary for establishing a natural sources exclusion by the Executive Officer. ***3. Special Study #3 (Optional) – Develop Site-Specific Objectives*** The TMDL implementation plan provides for actions to protect the agricultural and groundwater recharge beneficial uses in the CCW. As shown in the linkage analysis, some downstream reaches may not achieve the water quality objectives through implementation of this TMDL because of the transport of salts out of the watershed through those reaches. Consequently, an optional special study is included to allow the CCW stakeholders to pursue development of site-specific objectives for salts for reaches upstream of the Hill Canyon WWTP and Simi Valley WQCP (Reaches 7, 8, 12, and 13), Calleguas Creek Reach 3, Revolon Slough (Reach 4) and Beardsley Wash (Reach 5). These alternative numeric water quality objectives would be developed based on the beneficial uses to be protected in a reach and the attainability of the current water quality objectives. This is an optional special study to be conducted if desired by the stakeholders or determined necessary or appropriate by the Executive Officer. ***4. Special Study #4 (Optional) – Develop Site-Specific Objectives for Drought Conditions*** During drought conditions, the load of salts into the watershed increases as a result of increasing concentrations in imported water. Stakeholders in the CCW cannot control the increased mass entering the watershed from the water supply. However, the stakeholders do have the ability to

TMDL Element	Key Findings and Regulatory Provisions
	manage the salts within the watershed to protect beneficial uses and export the additional mass of salts out of the watershed. If necessary, site-specific objectives may be developed to address situations that result in higher imported water salt concentrations to allow management of the salts and protection of beneficial uses. This special study may be combined with Special Study #3 if desired. This is an optional special study to be conducted if desired by the stakeholders or determined necessary or appropriate by the Executive Officer of the Regional Board. ***5. Special Study #5 (Optional) – Develop Site-Specific Objectives for Sulfate*** Sulfate is a necessary nutrient for plant growth and sulfate containing products are often applied to agriculture as fertilizers and pesticides. Therefore, site-specific objectives may be investigated and developed for sulfate that more accurately protects agricultural supply beneficial uses. Additionally, this study could evaluate whether or not a sulfate balance is necessary to maintain in the watershed. This special study may be combined with Special Study #3 and/or #4 if desired. This is an optional special study to be conducted if desired by the stakeholders or determined necessary or appropriate by the Executive Officer of the Regional Board. **<u>Monitoring Plan</u>** To ensure that the goal of a salts balance in the watershed is being achieved and water quality objectives are being met, a comprehensive method of tracking inputs and outputs to the watershed will be developed. A monitoring plan will be submitted to the RWQCB for Executive Officer approval within six months of the effective date of the CCW Salts TMDL. Monitoring will begin one year after Executive Officer approval of the monitoring plan to allow time for the installation of automated monitoring equipment. ***1. Input Tracking*** Inputs to the watershed are tracked through four mechanisms:1) Information on the import of State Water Project water is readily available and provides information on the mass of salts brought into the watershed; 2) Groundwater pumping records provide information on the mass of salts imported into the watershed from deep aquifer pumping; 3) Import records of water supply form the Santa Clara River can be obtained to determine the mass of salts imported through this source; 4) Monitoring data on imported water quality can be compared to

TMDL Element	Key Findings and Regulatory Provisions
	monitoring of effluent quality to estimate the amount of salts added through human use of the water. ***2. Output Tracking and Determining Compliance with Water Quality Objectives*** Outputs from the watershed will be tracked through surface water monitoring at key locations in the watershed and monitoring of discharges to the brine line. Monitoring will include both flow and quality. Compliance with water quality objectives will be determined at key locations where beneficial uses occur in the watershed. The stations used for output tracking will also be used to determine compliance with water quality objectives. The monitoring program will determine if the TMDL compliance points are protective of the beneficial uses for the subwatershed. If the monitoring determines that the compliance points are not protective of beneficial uses, an alternative compliance point will be selected. The Executive Officer may revise the TMDL compliance point based on the result of the monitoring. Additionally, if other places in the watershed are identified where sensitive beneficial uses occur, water quality monitoring stations can be added to determine compliance with water quality objectives. For the RWRMP, three new or upgraded automated flow measuring and sample collection stations will be installed at three points on the stream system to continuously record flow and various water quality parameters during dry weather. Preliminary monitoring locations include Arroyo Conejo in Hill Canyon, Conejo Creek at Baron Brothers Nursery and Calleguas Creek at University Drive. For the NRRWMP, one new or upgraded automated flow measuring and sample collection station will be added downstream of Simi Valley at the point at which groundwater recharge begins. A preliminary monitoring location is at Hitch Blvd. where an existing flow gauging station exists. However, the amount of groundwater recharge upstream of this site will need to be evaluated to determine the exact monitoring location. For Revolon Slough, the existing monitoring station at Wood Road. will be used to monitor quality and flow on Revolon Slough to determine the outputs from the Revolon portion of the Pleasant Valley subwatershed. Additional land use monitoring will be conducted concurrently at representative agricultural and urban runoff discharge sites as well as at POTWs in each of the subwatersheds and analyzed for chloride, TDS, sulfate, and boron. The location of the land use stations will be determined before initiation of the Calleguas Creek Watershed TMDL Monitoring Program (CCWTMP). All efforts will be made to include at least two wet weather sampling events during the wet season (October through April) during a targeted storm event.

TMDL Element	Key Findings and Regulatory Provisions
	3. Reporting and Modification of the Calleguas Creek Watershed TMDL Monitoring Program A monitoring report will be prepared annually within six months after completion of the final event of the sampling year. An adaptive management approach to the CCWTMP will be adopted as it may be necessary to modify aspects of the CCWTMP. Results of sampling carried out through the CCWTMP and other programs within the CCW may be used to modify this plan, as appropriate. These modifications will be summarized in the annual report. Possible modifications could include, but are not limited to the, following: ▪ The inclusion of additional land use stations to accurately characterize loadings; ▪ The removal of land use stations if it is determined they are duplicative (*i.e.,* a land use site in one subwatershed accurately characterize the land use in other subwatersheds); ▪ The inclusion of additional in-stream sampling stations; and ▪ The elimination of analysis for constituents no longer identified in land use and/or instream samples. If a coordinated and comprehensive monitoring plan is developed and meets the goals of this monitoring plan that plan should be considered as a replacement for the CCWTMP. ***4. Other Monitoring*** Other surface water and groundwater monitoring will be implemented as necessary to assess the impacts of the implementation actions and adjust the activities as necessary to protect beneficial uses and achieve the salts balance. Examples of additional monitoring that may be conducted include: ▪ Monitoring under Phase 2 and 3 of the RWRMP to evaluate the effects of replenishment water releases and groundwater treatment and releases. ▪ Monitoring to assess the impacts of management of the Simi Basin groundwater dewatering wells under Phase 1 of the NRRWMP.
Implementation Plan	The identified implementation actions provided in this TMDL will result in a salt balance in the stream and are expected to result in compliance with the allocations. The implementation plan is comprised of actions that directly impact discharges to the receiving water and actions that will indirectly impact discharges to receiving water. Responsible agencies and jurisdictions shall consider minimum flow

TMDL Element	Key Findings and Regulatory Provisions
	requirements that may be imposed by federal or state regulatory agencies when implementing actions to comply with this TMDL. Should the proposed implementation actions not result in compliance with objectives and site-specific objective are not adopted, additional implementation actions may be required to achieve the water quality objectives. Any plans or programs for implementation of the TMDL for the Southern Reaches of the CCW upstream of the Conejo Creek Diversion and the Northern Reaches of the CCW, that would result in significant reduction in instream flow, including but not limited to, an application for Water Reclamation Requirements (WRRs) shall include an analysis of potential impacts to instream beneficial uses that could result from the reclamation of wastewater or extracted groundwater. For Phase 1 of the Southern Reaches of the CCW Renewable Water Resource Management Program (RWRMP), Water Rights Decision 1638 from SWRCB satisfies these requirements and establishes the minimum flow requirements for Conejo and Calleguas Creek downstream of the Conejo Creek Diversion Project. Any WRRs shall require that timely written notice be given to the Regional Board, and to any regulatory agency whose instream flow is at issue, if diversion or reclamation of waste water or extraction of groundwater results or threatens to result in (or contributes to) insufficient flows to maintain beneficial uses. The Executive Officer shall issue an order pursuant to Water Code section 13267, which requires responsible agencies and jurisdictions to file a technical report if reclamation of waste water or extraction of groundwater results or threatens to result in (or contributes to) insufficient flows to maintain beneficial uses. The order shall require that the technical report identify the causes of the impairments or threatened impairments, and identifies options to abate the conditions. The Regional Board shall reconsider this TMDL if adequate flows to protect instream beneficial uses are not maintained. The implementation actions described in the TMDL represent a range of activities that could be conducted to achieve a salts balance in the watershed. Future considerations may result in other actions being implemented rather than the options presented. However, any proposed actions will be reviewed using the salt balance model to ensure the action does not adversely impact other implementation actions in the watershed or the salt balance of a downstream subwatershed. Currently, the implementation plan is presented in phases with a tentative schedule for each phase. The implementation of projects may occur earlier than planned or begin during an earlier phase. Additionally, many of the implementation actions require the use of the Regional Salinity Management Conveyance (RSMC or brine line). As such, the implementation schedule for those actions will be linked the

TMDL Element	Key Findings and Regulatory Provisions
	construction schedule for the RSMC. The implementation plan for the Salts TMDL includes regional and subwatershed specific implementation actions. There are four key structural elements to the regional implementation: Regional Salinity Management Conveyance (RSMC), Water Conservation, Water Softeners, and Best Management Practices for Irrigated Agriculture. Subwatershed implementation includes Renewable Water Resource Management Program (RWRMP) for the Southern Reaches and Northern Reach Renewable Water Management Plan (NRRWMP). Detailed discussion for each implementation element including description of the action, status and schedule for implementing the action, and a summary of the expected contribution to achievement of the salts balance are provided in the Staff Report and Technical Report for this TMDL. Proposed implementation actions in the watershed, responsible agencies, and the estimated completion date based on the effective date of the TMDL are summarized below.

Summary of Proposed Implementation Actions

Action	Responsible Agency/ies	Schedule for Completion
Water Conservation	POTWs, Permitted Stormwater Dischargers, and Other NPDES Permittees	3 years
Water Softeners	POTWs and Permitted Stormwater Dischargers	10 years
Best Management Practice for Agricultural Dischargers	Agricultural Dischargers	2 years
RMSC Phase 1	Calleguas Municipal Water District	2 year
RMSC Phase 2	Calleguas Municipal Water District	5 year
RMSC Phase 3	Calleguas Municipal Water District	10 years
RWRMP Phase 1	CamrosaWater District, Camarillo Sanitation District	3 years
RWRMP Phase 2	Camrosa Water District, City of Thousand Oaks	6 years
RWRMP Phase 3	Camrosa Water District, City of Thousand Oaks	10 years
RWRMP Phase 4	To Be Determined	15 years
NRRWMP Phase 1	Calleguas Municipal Water District, City of Simi Valley, Ventura County Water Work-District No.1	3 years
NRRWMP Phase 2	Calleguas Municipal Water District, Ventura County Water Work-District No.1, City of Camarillo	7 years
NRRWMP Phase 3	City of Camarillo, City of Simi Valley	10 years
NRRWMP Phase 4	To Be Determined	15 years
Final Completion Date		15 years

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	The sections below provide discussion of the application of the final WLAs for POTWs, specific permitted stormwater discharges, other NPDES dischargers, and agricultural dischargers. **I. POTWs, permitted stormwater discharges, and other NPDES discharges** The final WLAs will be included for permitted stormwater discharges, POTWs, and other NPDES discharges in accordance with the compliance schedules provided in Table 7-22.2. The Regional Board may revise these WLAs based on additional information developed through special studies and/or monitoring conducted as part of this TMDL. ▪ **POTWs** WLAs established for the POTWs in this TMDL will be implemented through NPDES permit limits. Compliance will be determined through monitoring of final effluent discharge as defined in the NPDES permit. The proposed permit limits will be applied as end-of-pipe mass-based monthly average effluent limits. Daily maximum effluent limit is not required because chloride is not expected to have an immediate or acute effect on the beneficial uses. Compliance with the minimum salt export requirements for POTWs will be based on the salt export from the subwatershed to which they discharge. The mechanisms for meeting the minimum salt export requirements and for monitoring progress towards meeting those requirements will be included in the monitoring program work plan and approved by the Executive Officer. At the end of each year, the amount of salt exported will be compared to the minimum required salt export. POTW allocations will be reduced using the adjustment factor if both of the following conditions occur: • The annual dry weather salt exports from the subwatershed to which the POTW discharges are below the minimum required exports for the previous year; and • The water quality objectives were exceeded in the receiving water at the base of the subwatershed The POTW allocations will be reduced for the following year by

TMDL Element	Key Findings and Regulatory Provisions
	the difference between the minimum required salt export and the actual amount exported. The discharger shall be notified by the Regional Board that the assigned WLAs are reduced and the reduced effluent limits shall be applied for the next year. If the POTW allocations are reduced, the POTW will need to increase the amount of salt export or reduce the mass of salts discharged from the POTW before the end of the following year when the adjustment will be evaluated again. POTWs can only request to adjust the assigned WLAs upwards using the adjustment factor under limited conditions provided below: • Water quality objectives are met in the receiving waters; • Imported water supply chloride concentrations exceed 80 mg/L; and • Discharges from the POTW exceed the allocation. When imported water supply chloride concentrations exceed 80 mg/L, the POTW will monitor the effluent to determine if the wasteload allocation is exceeded. If the wasteload allocation is exceeded and the POTW desires an adjustment to the allocation, the POTW will submit documentation of the water supply chloride concentrations, the receiving water chloride concentration, the effluent mass, and the evidence of increased salt exports to offset the increased discharges from the POTW to the Regional Board for approval. The adjustment factor will apply for three months and the POTW must submit the evidence outlined above every three months to keep the adjustment factor active. As long as the required information is submitted, the adjustment factor will be in effect upon notification in writing from the RWQCB. ▪ **Urban Stormwater Discharger** A group mass-based dry weather WLA has been developed for all permitted stormwater discharges, including municipal separate storm sewer systems (MS4s), and general industrial and construction stormwater permits. USEPA regulation allows allocations for NPDES-regulated stormwater discharges from multiple point sources to be expressed as a single categorical WLA when the data and information are insufficient to assign each source or outfall individual WLAs (40 CFR 130). The grouped allocation will apply to all NPDES-regulated municipal stormwater discharges in the CCW. MS4 WLAs will be incorporated into the NPDES

TMDL Element	Key Findings and Regulatory Provisions
	permit as receiving water limits measured in-stream at the base of each subwatershed. ▪ **Other NPDES Dischargers** WLAs established for other NPDES permitted dischargers in this TMDL, including minor non-stormwater permittees (other than Camrosa WRP) and general non-stormwater permittees, will be implemented through NPDES permit limits. The proposed permit limits will be applied as end-of-pipe concentration-based effluent limits, and compliance determined through monitoring of final effluent discharge as defined in the NPDES permit. **II. Agriculture** Load allocations for salts will be implemented through Conditional Waiver of Discharges from Irrigated Lands (Conditional Waiver Program) adopted by the LARWQCB on November 3, 2005. Compliance with LAs will be measured in-stream at the base of the subwatersheds and will be achieved through the implementation of Best Management Practices (BMPs) consistent with the Conditional Waiver Program. The Conditional Waiver Program requires the development of an agricultural water quality management plan (AWQMP) to address pollutants that are exceeding receiving water quality objectives as a result of agricultural discharges. Therefore, implementation of the load allocations will be through the development of an agricultural management plan for salts. Implementation of the load allocations will also include the coordination of BMPs being implemented under other required programs to ensure salts discharges are considered in the implementation. Additionally, agricultural dischargers will participate in educational seminars on the implementation of BMPs as required under the Conditional Program. Studies are currently being conducted to assess the extent of BMP implementation and provide information on the effectiveness of BMPs for agriculture. This information will be integrated into the AWQMP that will guide the implementation of agricultural BMPs in the Calleguas Creek watershed. After implementation of these actions, compliance with the allocations and TMDL will be evaluated and the allocations reconsidered if necessary based on the special studies and monitoring plan section of the implementation plan. As shown in Table 7-22.2, implementation of LAs will be conducted over a period of time to allow for implementation of the BMPs, as well as coordination with special studies and

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	implementation actions resulting from other TMDL Implementation Plans (Nutrient, Historic Pesticides and PCBs, Sediment, Metals, Bacteria, etc.).

Table 7-22.2 Calleguas Creek Watershed Salts TMDL: Implementation Schedule

Item	Implementation Action	Responsible Party	Completion Date
1	Effective date of interim Salts TMDL waste load allocations (WLAs)	POTWs, Permitted Stormwater Dischargers[1] (PSD), and Other NPDES Permittees	Effective date of the amendment
2	Effective date of interim Salts TMDL load allocations (LAs)	Agricultural Dischargers	Effective date of the amendment
3	Responsible jurisdictions and agencies shall submit compliance monitoring plan to the Los Angeles Regional Board for Executive Officer approval.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	6 months after effective date of the TMDL
4	Responsible jurisdictions and agencies shall begin monitoring as outlined in the approved monitoring plan.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	1 year after monitoring plan approval by Executive Officer
5	Responsible jurisdictions and agencies shall submit workplans for the optional special studies.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	Within 10 years of effective date of the TMDL
6	Responsible jurisdictions and agencies shall submit results of the special studies.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	2 years after workplan approval by Executive Officer
7	Re-evaluation of the interim WLAs and interim LAs for boron, chloride, sulfate, and TDS based on new data. Responsible jurisdictions and agencies shall demonstrate that implementation actions have reduced the boron, sulfate, TDS, and chloride imbalance by 20%.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	3 years after effective date of the TMDL
8	Re-evaluation of the interim WLAs and interim LAs for boron, chloride, sulfate, and TDS based on new data. Responsible jurisdictions and agencies shall demonstrate that implementation actions have reduced the boron, sulfate, TDS and chloride imbalance by 40%.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	7 years after effective date of the TMDL
9	Re-evaluation of the interim WLAs and interim LAs for boron, chloride, sulfate, and TDS based on new data. Responsible jurisdictions and agencies shall demonstrate that implementation actions have reduced the boron, sulfate, TDS, and chloride imbalance by 70%.	POTWs, Permitted Stormwater Dischargers (PSD), Other NPDES Permittees, and Agricultural Dischargers	10 years after effective date of the TMDL
10	The Los Angeles Regional Board shall reconsider this TMDL to re-evaluate numeric targets, WLAs, LAs and the implementation schedule based on the results of the special studies and/or compliance monitoring.	The Regional Board	12 years after effective date of the TMDL
11	Responsible jurisdictions and agencies shall demonstrate that the watershed has achieved an annual boron, sulfate, TDS, and chloride balance.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	15 years after effective date of the TMDL
12	The POTWs and non-storm water NPDES permits shall achieve WLAs, which shall be expressed as NPDES mass-based effluent limitation specified in accordance with federal regulations and state policy on water quality control.	POTWs and Other NPDES Permittees	15 years after effective date of the TMDL

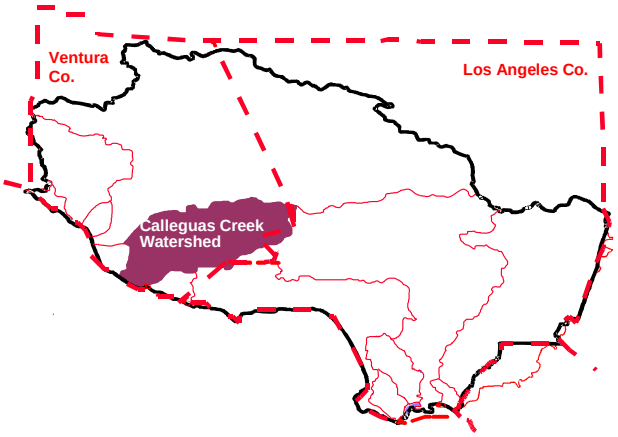
[1] Permitted stormwater dischargers that are responsible parties to this TMDL include the Municipal Stormwater Dischargers (MS4s) of the Cities of Camarillo, Moorpark, Thousand Oaks, County of Ventura, Ventura County Watershed Protection District, and general industrial and construction permittees.

Item	Implementation Action	Responsible Party	Completion Date
13	Irrigated agriculture shall achieve LAs, which will be implemented through the Conditional Waiver for Irrigated Lands as mass-based receiving water limits.	Agricultural Dischargers	15 years after effective date of the TMDL
14	The permitted stormwater dischargers shall achieve WLAs, which shall be expressed as NPDES mass-based limits specified in accordance with federal regulations and state policy on water quality control.	Permitted Stormwater Dischargers	15 years after effective date of the TMDL
15	Water quality objectives will be achieved at the base of the subwatersheds designated in the TMDL.	POTWs, PSD, Other NPDES Permittees, and Agricultural Dischargers	15 years after effective date of the TMDL

2.10 CALLEGUAS CREEK WATERSHED

This watershed will be targeted in FY2011/2012.

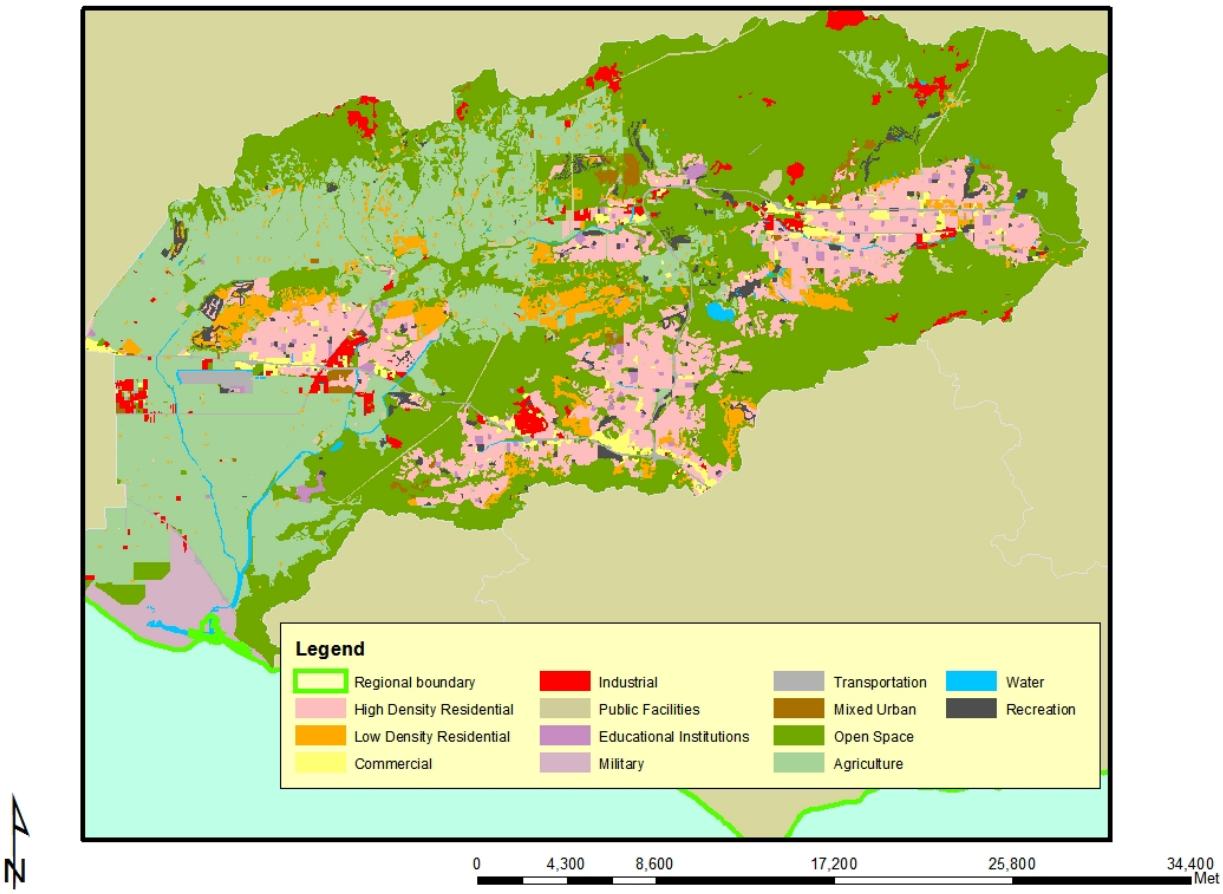
Overview of Watershed



Calleguas Creek and its major tributaries, Revolon Slough, Conejo Creek, Arroyo Conejo, Arroyo Santa Rosa, and Arroyo Simi drain an area of 343 square miles in southern Ventura County and a small portion of western Los Angeles County. This watershed, which is elongated along an east-west axis, is about 30 miles long and 14 miles wide. The northern boundary of the watershed is formed by the Santa Susana Mountains, South Mountain, and Oak Ridge; the southern boundary is formed by the Simi Hills and Santa Monica Mountains.

Land uses vary throughout the watershed. Urban developments are generally restricted to the city limits of Simi Valley, Moorpark, Thousand Oaks, and Camarillo. Although some residential development has occurred along the slopes of the watershed, most upland areas are still open space; however, golf courses are becoming increasingly popular to locate in these open areas. Agricultural activities, primarily cultivation of orchards and row crops, are spread out along valleys and on the Oxnard Plain as shown in the figure below.

Land Use in the Calleguas Creek Watershed



Mugu Lagoon, located at the mouth of the watershed, is one of the few remaining significant saltwater wetland habitats in southern California. The Point Mugu Naval Air Base is located in the immediate area and the surrounding Oxnard Plain supports a large variety of agricultural crops. These fields drain into ditches which either enter the lagoon directly or through Calleguas Creek and its tributaries. Other fields drain into tile drain systems which discharge to drains or creeks. Also in the area of the base are freshwater wetlands created on a seasonal basis to support duck hunting clubs. The lagoon borders on an Area of Special Biological Significance (ASBS) and supports a great diversity of wildlife including several endangered birds and one endangered plant species. Except for the military base, the lagoon area is relatively undeveloped.

Beneficial Uses in watershed:

Estuary	*Above Estuary*
Wildlife habitat	Wildlife habitat
Contact & noncontact water recreation	Contact & noncontact water recreation
Estuarine habitat	Industrial service supply
Marine habitat	Industrial process supply
Preservation of rare & endangered species	Preservation of rare & endangered species
Navigation	Agricultural supply
Preservation of biological habitats	Groundwater recharge
Wetlands habitat	Wetlands habitat
Migratory & spawning habitat	Freshwater replenishment
Shellfish harvesting	Warmwater habitat

Supplies of ground water are critical to agricultural operations and industry (sand and gravel mining) in this watershed. Moreover, much of the population in the watershed relies upon ground water for drinking.

Water Quality Problems and Issues

Aquatic life in both Mugu Lagoon and the inland streams of this watershed has been impacted by pollutants from nonpoint sources. DDT, PCBs, other pesticides, and some metals have been detected in both sediment and biota collected from surface waterbodies of this watershed. Additionally, ambient toxicity has been revealed in several studies from periodic toxicity testing in the watershed (ammonia from POTWs and pesticides such as diazinon and chlorpyrifos are implicated). Fish collected from Calleguas Creek and Revolon Slough exhibit skin lesions and have been found to have other histopathologic abnormalities. High levels of minerals and nitrates are common in the water column as well as in the groundwater. Sediment toxicity is also elevated in some parts of the lagoon. Reproduction is impaired in the resident endangered species, the light-footed clapper rail due to elevated levels of DDT and PCBs. Overall, this is a very impaired watershed. It appears that the sources of many of these pollutants are agricultural activities (mostly through continued disturbance and erosion of historically contaminated soils), which cover approximately 25% of the watershed along the inland valleys and coastal plain, although the nearby naval facility has also been a contributor. Other nonpoint sources include residential and urban activities, which are present over approximately 25% of the watershed. The remaining 50% of the watershed is still open space although there is a severe lack of benthic and riparian habitat.

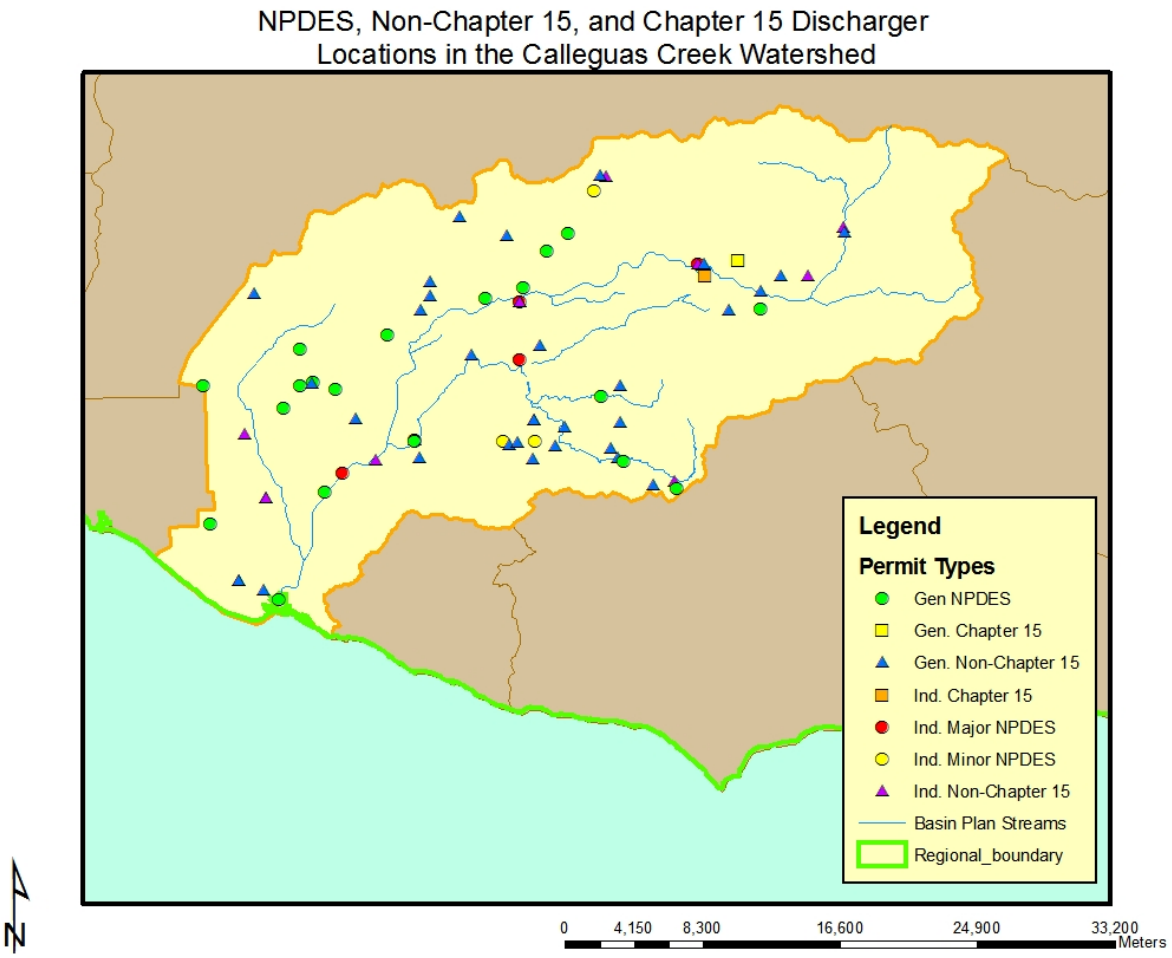
Permitted discharges:

- 26 NPDES discharges; five major discharges (POTWs); three minor discharges; eighteen discharges covered by general permits
- 73 dischargers covered under the industrial storm water permit
- 292 dischargers covered under the construction storm water permit
- Municipal storm water permit

Mugu Lagoon as well as the Calleguas Creek Estuary is considered a toxic hot spot under the Bay Protection and Toxic Cleanup Program (BPTCP) due to reproductive impairment (the endangered clapper rail), exceedance of the state Office of Environmental and Health Hazard Assessment (OEHHA) advisory level for mercury in fish, and exceedance of the NAS guideline level for DDT in fish, sediment concentrations of DDT, PCB, chlordane, chlorpyrifos, sediment toxicity and degraded benthic infaunal community.

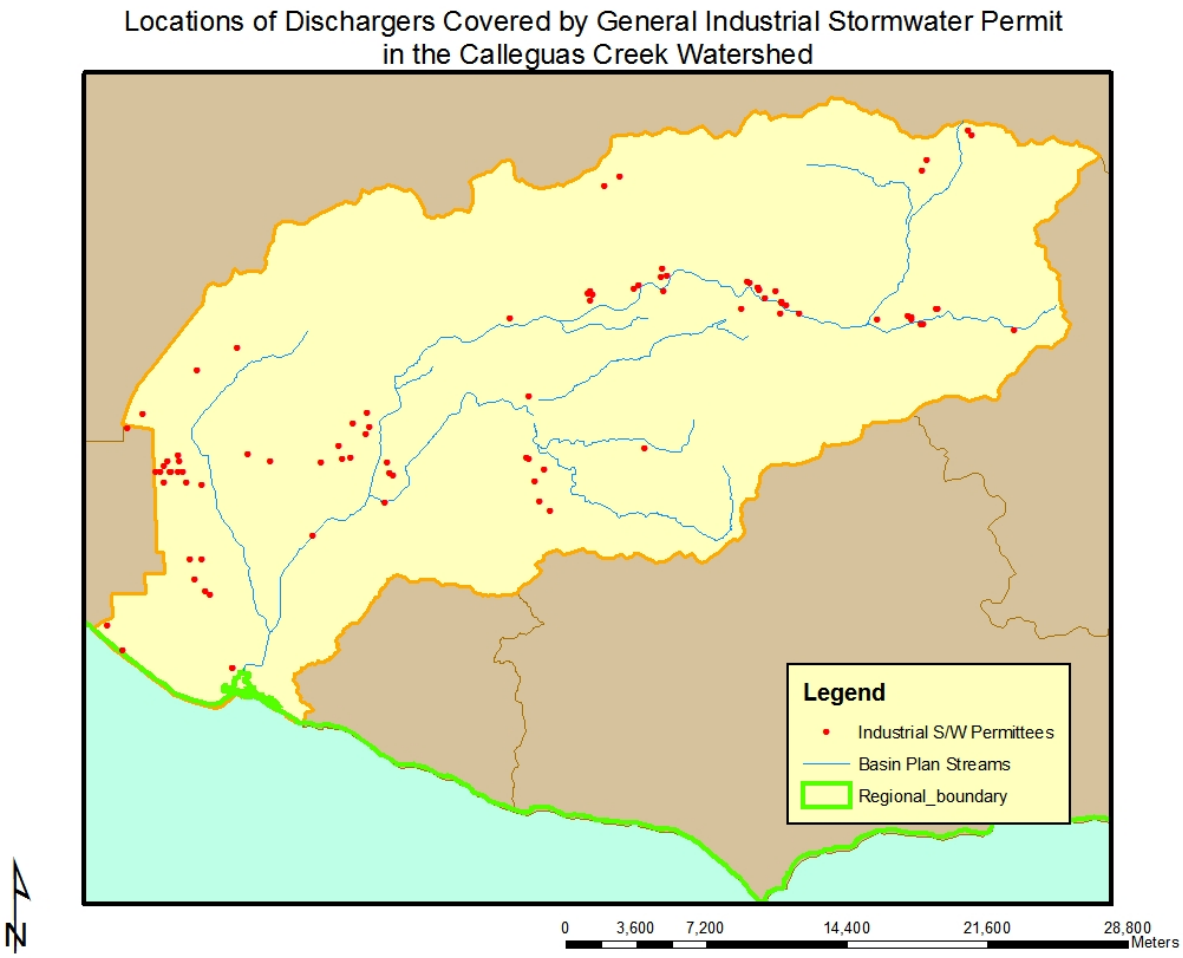
Primary issues related to POTW discharges include ammonia toxicity and high mineral content (i.e., salinity), the latter, in part, due to imported water supplies.

The locations of facilities with discharges to surface water or to the ground (other than those covered by general industrial or construction stormwater permits) are shown in the following figure. Major NPDES discharges are from either POTWs with a yearly average flow of over 0.5 MGD, from an industrial source with a yearly average flow of over 0.1 MGD, or are those discharges with lesser flows but with potential acute or adverse environmental impacts to surface waters. Minor NPDES discharges are all other discharges to surface waters that are not categorized as a Major. Minor discharges may be covered by general NPDES permits, which are issued administratively, for those that meet the conditions specified by the particular general permit. Non-Chapter 15 discharges are those to land or groundwater such as commercial septic systems or percolation ponds that are covered by Waste Discharge Requirements, a State permitting activity. Chapter 15 discharges generally relate to land disposal (landfills) under Chapter 15 of the California Code of Regulations, again an exclusively State permitting activity.



Discharges are fairly evenly spread around the watershed; four of the 26 NPDES discharges go to the Arroyo Conejo, while six discharge to Revolon Slough and twelve discharge to the Creek's various reaches.

Of the 90 dischargers enrolled under the general industrial storm water permit in the watershed, the largest numbers are located in the cities of Simi Valley and Camarillo. There is a diverse mix of industries represented including electric, gas and sanitary services; local and interurban passenger transit; electric and electronic equipment; and stone, clay and glass products based on their Standard Industrial Classification (SIC) codes. The locations of facilities with discharges covered by the general industrial stormwater permit are shown in the following figure.



There are 292 construction sites enrolled under the general construction storm water permit. About one-half of the sites are residential and about one-half are five acres or larger in size; one site is about 1,000 acres. Most of the sites are located in Camarillo, Simi Valley, and Thousand Oaks.

The table below gives the impairments for the watershed from the 2006 303(d) list:

Water Quality Limited Segment Name	Pollutant
Calleguas Creek Reach 1 (was Mugu Lagoon on 1998 303(d) list)	Chlordane (tissue)[1] Copper[2] DDT (tissue & sediment)[1] Endosulfan (tissue)[1] Mercury[2] Nickel[2] Nitrogen[3] PCBs (tissue)[1] Sediment Toxicity[1]

	Sedimentation/Siltation[1]
Calleguas Creek Reach 2 (estuary to Potrero Rd- was Calleguas Creek Reaches 1 and 2 on 1998 303d list)	Ammonia[3] ChemA (tissue)[1*] Chlordane (tissue)[1] Copper, Dissolved[2] DDT (tissue & sediment)[1] DDT[1] Endosulfan (tissue)[1] Fecal Coliform Nitrogen[3] PCBs (tissue)[1] Sediment Toxicity[1] Sedimentation/Siltation[1] Toxaphene (tissue & sediment)[1]
Calleguas Creek Reach 3 (Potrero Road upstream to confluence with Conejo Creek on 1998 303d list)	Chlordane Chloride DDT[1] Dieldrin[1] Nitrate and Nitrite[3] Sedimentation/Siltation[1] Total Dissolved Solids Toxaphene[1]
Calleguas Creek Reach 4 (was Revolon Slough Main Branch: Mugu Lagoon to Central Avenue on 1998 303d list)	Boron ChemA (tissue)[1*] Chlordane (tissue & sediment)[1] Chlorpyrifos (tissue)[1] DDT (tissue & sediment)[1] Dieldrin (tissue)[1] Endosulfan (tissue & sediment)[1] Fecal Coliform Nitrate as Nitrate (NO3)[3] Nitrogen[3] PCBs (tissue)[1] Sedimentation/Siltation[1] Selenium[2] Sulfates Total Dissolved Solids

	Toxaphene (tissue & sediment)[1] Toxicity[4] Trash
Calleguas Creek Reach 5 (was Beardsley Channel on 1998 303d list)	ChemA (tissue)[1*] Chlordane (tissue & sediment) Chlorpyrifos (tissue)[1] Dacthal (sediment)[1] DDT (tissue & sediment)[1] Dieldrin (tissue)[1] Endosulfan (tissue & sediment)[1] Nitrogen[3] PCBs (tissue)[1] Sedimentation/Siltation[1] Toxaphene (tissue & sediment)[1] Toxicity[4] Trash
Calleguas Creek Reach 6 (was Arroyo Las Posas Reaches 1 and 2 on 1998 303d list)	Ammonia[3] Chloride DDT (sediment)[1] Fecal Coliform Nitrate and Nitrite[3] Nitrate as Nitrate (NO3)[3] Sedimentation/Siltation[1] Sulfates Total Dissolved Solids
Calleguas Creek Reach 7 (was Arroyo Simi Reaches 1 and 2 on 1998 303d list)	Ammonia[3] Boron Chloride Fecal Coliform Organophosphorus Pesticides[4] Sedimentation/Siltation[1] Sulfates Total Dissolved Solids
Calleguas Creek Reach 8 (was Tapo Canyon Reach 1)	Boron Chloride Sedimentation/Siltation[1] Sulfates Total Dissolved Solids

Calleguas Creek Reach 9A (was lower part of Conejo Creek Reach 1 on 1998 303d list)	ChemA (tissue)[1*] Chlordane (tissue)[1] DDT (tissue)[1] Dieldrin (tissue)[1] Endosulfan (tissue)[1] Fecal Coliform Lindane/HCH (tissue)[1] Nitrate as Nitrate (NO3)[3] Nitrogen, Nitrate[3] PCBs (tissue)[1] Sulfates Total Dissolved Solids Toxaphene (tissue & sediment)[1]
Calleguas Creek Reach 9B (was part of Conejo Creek Reaches 1 and 2 on 1998 303d list)	Ammonia[3] ChemA (tissue)[1*] Chloride DDT (tissue)[1] Endosulfan (tissue)[1] Fecal Coliform Sulfates Total Dissolved Solids Toxaphene (tissue & sediment)[1] Toxicity[4]
Calleguas Creek Reach 10 (Conejo Creek (Hill Canyon)-was part of Conejo Ck Reaches 2 & 3, and lower Conejo Ck/Arroyo Conejo N Fk on 1998 303d list)	Ammonia[3] ChemA (tissue)[1*] Chloride DDT (tissue)[1] Endosulfan (tissue)[1] Fecal Coliform Nitrogen, Nitrite[3] Sulfates Total Dissolved Solids Toxaphene (tissue & sediment)[1] Toxicity[4]
Calleguas Creek Reach 11 (Arroyo Santa Rosa, was part of Conejo Creek Reach 3 on 1998 303d list)	Ammonia[3] ChemA (tissue)[1*] DDT (tissue)[1]

	Endosulfan (tissue)[1] Fecal Coliform Sedimentation/Siltation[1] Sulfates Total Dissolved Solids Toxaphene (tissue & sediment)[1] Toxicity[4]
Calleguas Creek Reach 12 (was Conejo Creek/Arroyo Conejo North Fork on 1998 303d list)	Ammonia[3] Chlordane (tissue)[1] DDT (tissue)[1] Sulfates Total Dissolved Solids
Calleguas Creek Reach 13 (Conejo Creek South Fork, was Conejo Cr Reach 4 and part of Reach 3 on 1998 303d list)	Ammonia[3] ChemA (tissue)[1*] Chloride DDT (tissue)[1] Endosulfan (tissue)[1] Sulfates Total Dissolved Solids Toxaphene (tissue & sediment)[1] Toxicity[4]
Duck Pond Agricultural Drains/Mugu Drain/Oxnard Drain No 2	ChemA (tissue)[1*] Chlordane (tissue)[1] DDT (tissue & sediment)[1] Nitrogen[3] Sediment Toxicity[1] Toxaphene (tissue)[1] Toxicity[4]
Fox Barranca (tributary to Calleguas Creek Reach 6)	Boron Sulfates Total Dissolved Solids
Rio De Santa Clara/Oxnard Drain No. 3	ChemA (tissue)* Chlordane (tissue) DDT (tissue) Nitrogen PCBs (tissue) Sediment Toxicity Toxaphene (tissue)

* ChemA refers to the sum of the chemicals aldrin, dieldrin. chlordane, endrin, heptachlor, heptachlor epoxide, HCH (including lindane), endosulfan, and toxaphene

[1]Calleguas Creek, its Tributaries, and Mugu Lagoon OC Pesticides, PCBs, and Siltation TMDL, 2005

[2]Calleguas Creek, its Tributaries, and Mugu Lagoon Metals and Selenium TMDL, 2007
[3]Calleguas Creek Nitrogen TMDL, 2003
[4]Calleguas Creek Toxicity TMDL, 2005

CURRENTLY SCHEDULED TMDLS:

- salts
- trash

Stakeholder Groups

Calleguas Creek Watershed Management Committee and Technical Subcommittees: Recognizing that many of the water quality problems in the lagoon stem from land use practices and pollutant sources above the lagoon, members of these committees meet regularly to exchange data and discuss coordinated approaches to solving the many problems in this watershed, including development of a watershed management plan. The watershed group consists of about 130 stakeholders who have been meeting since November 1996 with the purpose of developing a watershed management plan. As we expect that much effort will need to be focused on resolving agricultural and flood control issues, a concerted effort to include appropriate stakeholders. Besides the main management committee of stakeholders, five technical subcommittees deal with more specific issues such as water quality, flood protection/ sediment management, habitat/open space/recreation, public outreach, and land use. A Steering Committee attends to the details of management plan development. The full Management Plan Committee meets on a quarterly basis, generally conducting business in a half-day session. Staff have been and will continue to work with these committees. For further information concerning this group, please visit their website at http://www.calleguas.com/cc.htm.

A number of the above committee members were also on the *Mugu Lagoon Task Force* which was formed in 1990 in response to concerns about sedimentation filling in Mugu Lagoon which is at the mouth of the Calleguas Creek Watershed. A major focus of the early meetings was exchange of information on the extent of sedimentation with related concerns such as pesticide transfer. A sediment and erosion control plan was prepared for the Ventura County RCD by the U.S. Natural Resource Conservation Service (USNRCS) using Coastal Conservancy funds ("Calleguas Creek Watershed Erosion and Sediment Control Plan for Mugu Lagoon", May 1995). This group no longer meets; however, information gained from this effort continues to be used by the other Calleguas Watershed Committees.

Significant Past Activities

CORE REGULATORY

The majority of Calleguas Creek Watershed permits were revised in June 1996. This watershed, as well as the Ventura River Watershed, were pilot watersheds in our implementation of the watershed management approach. The Ventura County Municipal Stormwater NPDES Permit had most recently been adopted in 2000. The watershed was targeted again for NPDES permit renewals in FY01/02.

MONITORING AND ASSESSMENT

As the first integrated watershed monitoring program in the Region, the six POTWs in the watershed each implemented a portion (Characterization Study) in 2000 which also included other agencies in the effort. In conjunction with the receiving water monitoring, land-use based monitoring was done as a part of the Ventura County Municipal Storm Water Program. The monitoring supported compliance valuation, nonpoint source identification, and potential TMDL development. The expanded monitoring by the dischargers also served to evaluate beneficial uses.

Calleguas Creek was a focus for SWAMP monitoring in FY00/01 as the watershed was targeted in the rotating watershed cycle. Since extensive monitoring has already occurred here, particularly in the lower watershed, a more directed approach to sampling site selection was taken. A short-term watershed-wide regional monitoring program was created to fill in data gaps and eliminate duplicative and unnecessary monitoring. A total of thirteen sites were sampled once by SWAMP in the Calleguas Creek Watershed. Twelve directed sites were sampled for toxicity, bioassessment, conventional water chemistry and organophosphate chemistry in the water column. One estuary station was sampled for bioaccumulation in addition to abovementioned analyses. POTWs contributed significant resources to do a surface and ground water characterization study. It also served to assess nonpoint source pollution from a variety of land uses.

UCLA was under contract with the State Board to provide data needed for establishment of nutrient TMDLs in several watersheds within the Region including Calleguas Creek, Santa Clara River, and Malibu Creek. By understanding the inter-relationships between water quality and habitat condition and the resulting effects that these interactions have on the biological communities of coastal watersheds, this research was intended to further our understanding of the ecology of southern California watersheds. Besides providing information supporting the establishment of nutrient TMDLs for these three impaired coastal watersheds, the data collected would provide insight into how these TMDLs might be complied with in the future. Three specific objectives of this project were: 1) investigate the relationships between water quality (e.g. nutrients), habitat quality, and the biological community, 2) investigate how water quality and biological communities change throughout particular target reaches representing different land uses, and 3) compare the relationships between water quality, habitat quality, and biological communities among different watersheds. The work was a continuation and extension of a Regional Environmental Monitoring and Assessment Program (R-EMAP) project in the watershed. R-EMAP us part of a larger national effort by the USEPA to assess the condition of the nation's ecological resources.

BASIN PLANNING

In 1990, the Regional Board adopted Resolution No. 90-004 (**Drought Policy**) which had a term of three years and provided interim relief to dischargers who experienced difficulty meeting chloride objectives because of a state-wide drought. The policy adjusted effluent limits to the lesser of 1) 250 mg/l or 2) the chloride concentration in the water supply plus 85 mg/l. In 1995, the Regional Board extended the interim limits for three years and directed staff to develop a long-term solution to deal with the impact of changing water supply, especially during droughts. In 1997, the Regional Board adopted Resolution No. 97-002 (**Chloride Policy**) which set the chloride objective at 190 mg/l except in the Calleguas Creek and Santa Clara River Watersheds where, due to the great concern for protection of agriculture, staff were directed to determine the chloride concentrations sufficient to protect agricultural beneficial uses.

WETLANDS PROTECTION AND MANAGEMENT

The Wetlands Recovery Project funded a restoration project in the watershed, the Grimes Canyon Stream Restoration Project.

NONPOINT SOURCE PROGRAM

Work on nonpoint source problems in the watershed has been a long-term effort, initiated in 1990, with the support of 319(h) funds and other funding from, and support by, stakeholders. The 319(h) grant projects, special studies, and other activities that have been completed to date include:

- ***Irrigation Demonstration Project***: In 1994, the Ventura County Resource Conservation District successfully completed an irrigation project that demonstrated the water quality and conservation benefits of drip irrigation. This project was funded through a 319(h) grant.

- ***Toxicity Testing***: In order to detect sources of toxicity, we had collected water samples under three sequential studies (toxicity testing by UC Davis). Results of this sampling indicated sporadic toxicity, generally during wet weather seasons, with strong implication of organophosphate pesticides. A peer-reviewed paper on the results is pending.

- ***Calleguas Creek Watershed Treatment – Phases I and II***: The Ventura County Resource Conservation District served as contractor for this project which focused on Best Management Practices that involved small, individual landowners/ farmers. This demonstration project was designed to implement streambed protection practices. The two phases were funded through 319(h) grants.

Current Activities

The following is a summary of current regional board activities and strategies for dealing with point and nonpoint source pollution as well as other issues of concern in the Calleguas Creek Watershed.

CORE REGULATORY

Current regulatory activities include compliance inspections, review of monitoring reports, response to complaints, and enforcement actions, as needed.

Most urban areas in Ventura County, including this watershed, are implementing Best Management Practices (BMPs) under the Municipal Storm Water Permit (revised in 2000). The "Discharger" consists of the co-permittees Ventura County Flood Control District, the County of Ventura, and the Cities of Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, San Buenaventura, Santa Paula, Simi Valley, and Thousand Oaks. The Discharger is required to implement the Ventura Countywide Stormwater Quality Urban Impact Mitigation Plan (SQUIMP), which requires the implementation of BMPs to reduce the discharge of pollutants in storm water from new development and significant redevelopment. Other requirements of the Municipal Storm Water Permit include a public education program, an educational site inspection program for industrial and commercial facilities, program for construction sites, public agency activities, and a storm water monitoring program.

The Calleguas Creek receives municipal storm drain discharges from the City of Camarillo, City of Moorpark, City of Simi Valley, City of Thousand Oaks (part), and unincorporated Ventura County (part).

The storm water monitoring program has consisted of land-use based monitoring, receiving water and mass emission station monitoring, and bioassessment. The Discharger also participates in regional monitoring activities, such as the Storm Water Monitoring Coalition, organized by the Southern California Coastal Water Research Project. Furthermore, the Discharger participates in the development and implementation of volunteer monitoring programs in the Ventura Coastal watersheds.

Regulation of groundwater protection activities is intended to eventually become fully integrated into the watershed management approach; currently, groundwater monitoring (for POTWs using ponds) is being coordinated with surface water monitoring.

MONITORING AND ASSESSMENT

The BPTCP has identified the lagoon and tidal prism as "toxic hot spots" based on sediment contamination. Staff have completed a preliminary cleanup plan for the areas which was adopted as part of a statewide consolidated plan by the State Board in June 1999. Cleanup/remediation alternatives identified include dredging, in-situ capping, and treatment; however, dedicated funding for cleanup activities has not been provided by the state. Continuing Regional Board activities include working with stakeholders to further characterize historical sources of pollution as well as the extent of existing contributions. While remediation of the lagoon (as part of a military facility) may proceed on its own timeline, in general, there is a concerted effort by all stakeholders to prepare a comprehensive watershed management plan to address all problems in the watershed.

The Calleguas Creek Watershed Management Plan Habitat/Recreation and Land Use Subcommittees are jointly working on aspects of a Watershed Evaluation Study that is scheduled to be finished in 2002. This is a GIS-based effort with the goals of identifying high quality habitat and those areas that would help link them, the current level of protection, land ownership, and information from local entities land use plans. Another goal is to make the information available via the Internet.

NONPOINT SOURCE PROGRAM

We expect that stakeholders will continue work on developing a watershed management plan, which will include measures for reducing pollutants from nonpoint sources. Accordingly, our efforts in the Calleguas Creek watershed will focus on continuing the nonpoint source phase of the watershed cycle, including integrating results of our on-going nonpoint source efforts. The 319(h) grant projects, special studies, and other activities that are currently on-going include:

319(h) Grants

Calleguas Creek Water Quality Monitoring Program: The Wishtoyo Foundation received 319(h) grant funds in 2001 to educate and train volunteers to conduct a citizen monitoring program in the watershed. The goal is to measure the effectiveness of BMPs created to manage the flow of nutrients, pesticides, and sediments. Bioassessments will also be conducted.

We continue to support as high priorities for grant funding projects relating to implementation of TMDLs, habitat enhancement/restoration, and reduction of pollutants from agricultural activities.

Other NPS Activities

Our efforts to involve stakeholders also shall include exploration of funding options (especially for implementation of nonpoint source measures) and continuation of other outreach activities, such as speeches, meetings, and participation in environmental events.

Mugu Lagoon/Revolon Slough is identified as Critical Coastal Area (CCA) #58 in the State Water Resources Control Board's and California Coastal Commission's Critical Coastal Area Draft Strategic Plan. It has been identified as such in 1995 as an impaired water body and one of the few remaining saltwater wetland habitats remaining in Southern California. The major efforts listed to implement NPS management measures include: activities of Wishtoyo Foundation and Ventura CoastKeeper; streambank restoration projects conducted by Ventura County Resources Conservation District for growers; the Calleguas Municipal Water District's Regional Salinity Management Project; work conducted by the Calleguas Creek Watershed Management Plan Committee; the Erosion and Sediment Control Plan prepared in 1995 by the Ventura County Resources Conservation District; the watershed-wide monitoring program; BMPs implemented under the Ventura County municipal stormwater permit; and implementation of various TMDLs.

Laguna Point to Latigo Point is identified as CCA #59 in the CCA Draft Strategic Plan. It has been identified as such since the watersheds drain into a Marine Protected Area. This CCA covers parts of both Los Angeles and Ventura Counties from Calleguas Creek to Malibu. The major efforts listed to implement NPS management measures include: activities of the Malibu Creek Watershed Council and construction of Calleguas Municipal Water District's Regional Salinity Management Project.

BASIN PLANNING

Several high priority issues were identified in the 2005 - 2007 Triennial Review which affect this watershed management area and will require Basin Planning resources. As in all watersheds, adopting TMDLs as Basin Plan amendments is required under the Consent Decree with an estimated resource need of 0.5 PY/TMDL. This is considered a currently funded activity. The ongoing Tiered Aquatic Life Uses Pilot Project may affect many watersheds in the Region. The purpose of tiered aquatic life uses (TALUs) is to have more appropriate goals for protecting

aquatic life that account for these inherent physical limitations. The purpose of this pilot project is to develop more tailored water quality standards (through beneficial use designations and associated biocriteria) to protect the biological communities of semi-arid urban coastal streams and, If deemed appropriate, recommend appropriate tiered aquatic life uses for these semi-arid urban coastal streams. Other high priority issues identified by the Triennial Review common to multiple watersheds may be found in the Region-wide Section.

Review and comment on EIRs for the highest priority projects within the watershed will continue; however, there is currently no funding for this program.

WETLANDS PROTECTION AND MANAGEMENT

The Wetlands Recovery Project has listed the Lower Conejo Creek Acquisition as a priority project on the current workplan. Being listed on the workplan is not a guarantee of funding however. More information about the workplan may be found at http://www.scwrp.org.

A wetlands restoration plan for the watershed has been prepared (with Coastal Conservancy and USEPA funding) by a local consultant through the Habitat Subcommittee of the Calleguas Creek Watershed Plan Committee. This document is available on the Calleguas Creek Watershed Management Plan website at http://www.calleguas.com/ccbrochure/cc.htm. The next step in the process, completion of a Wetlands Restoration Feasibility Study, is ongoing.

The Santa Monica Mountains Conservancy is a state agency created by the Legislature in 1979 charged with primary responsibility for acquiring property with statewide and regional significance, and making those properties accessible to the general public. The Conservancy manages parkland in the Santa Monica Mountains, Santa Susana Mountains, the Simi Hills, the Santa Clarita Woodlands, the Whittier-Puente Hills, the Sierra Pelona, the Los Angeles River Greenway, the Rio Hondo, the Verdugo Mountains, the San Gabriel Mountains, and the San Rafael Hills. The agency's goals are to: 1) implement the Santa Monica Mountains Comprehensive Plan, 2) implement the Rim of the Valley Trails Corridor Master Plan, 3) implement the Los Angeles County River Master Plan, 4) further cooperation with local governments in the region to secure open space and parkland, and 5) expand education, public access, and resource stewardship components in a manner that best serves the public, protects habitat, and provides recreational opportunities. Additional information on their priorities may be found at http://www.smmc.ca.gov/.

DOD SITE CLEANUP PROGRAM

The Regional Board is working with the Department of Toxic Substances Control (DTSC) to investigate soil and groundwater quality at Department of Defense (DoD) facilities. Sites currently under assessment/remediation include Mugu Lagoon, a former landfill, the Naval Exchange gas station, two Installation Restoration Program (IRP) sites, numerous underground storage tanks, and the former oxidation sewage ponds.

The Navy disposed of inert, contaminated and hazardous wastes to an unlined unpermitted landfill constructed by depositing and compacting wastes into Calleguas Creek. An erosion berm was installed as an interim remedial measure to prevent further erosion of the former landfill by storm water flowing through the creek during storm events. Long-term groundwater monitoring will be required for this site. Sediments and surface water at IRP Site 5 are contaminated with chrome. An initial emergency removal action (sediment excavation) failed to adequately

remediate all impacted sediments and additional sediment remediation and surface water monitoring is ongoing.

Soil and groundwater at IRP Site 24 is contaminated with chlorinated solvents. Groundwater is being treated by implementation of a new biodegradation technology. It is not yet determined to what extent groundwater remediation or monitoring will be required to restore this site.

It is anticipated the Navy will implement a base-wide groundwater/surface water investigation to evaluate the overall groundwater and surface water quality, evaluate the interactions of surface water and groundwater, and determine the cumulative risk of multiple groundwater-surface water contamination sites on the overall water quality of the area and the risk to human health and the environment.

Prior to 1979, the Navy was allowed to discharge partially treated wastewater to surface water oxidation ponds that were constructed in the Calleguas Creek tidal prism. The ponds were unlined and allowed to percolate unevaporated water to the underlying groundwater, which is located about four feet below grade. The Regional Board rescinded the Navy's discharge permit in 1979 and required the Navy to pump all wastewater to the Oxnard POTW. However, periodic unpermitted discharges of wastewater continued to the ponds during planned repairs of the wastewater discharge line and wastewater overflow conditions, which occurred during heavy rains.

To prevent additional wastewater discharges to the ponds, the Regional Board issued a Cleanup and Abatement Order to the Navy in 1998 directing the Navy to cease all unpermitted discharges, construct a lined emergency wastewater retention basin, upgrade the wastewater discharge line, and remove the sludge that has accumulated in the ponds.

Current funding for the investigation and remediation of contaminated solids, surface water and groundwater at the base is through the DoD/CalEPA funding agreement; however, this funding is not satisfactory for the investigation or control of contaminants from upstream sources for the protection of Mugu Lagoon and continued funding cuts have had significant impacts on the level of oversight by Regional Board staff on these areas.

Near-term Activities

Specific resource needs are described in the Region-wide Section of this document.

NPDES Permits in the watershed will come up for renewal in FY 2003/04. In the meantime, core regulatory activities will focus on permit compliance, monitoring report review, and enforcement as needed. In addition, integration of stormwater and nonpoint source issues will continue. Members of the watershed team will be involved with periodic updates of the State of the Watershed Report. Additionally, there will be on-going interaction with stakeholders and followup on goals established during the permit renewal phase. Pending results from the discharger pollutant characterization study, a decision on waste load and load allocations will be pursued.

A review of resources for core regulatory activities against cost factors has determined that our region is seriously underfunded for our baseline program. We will be seeking more funding for our core program activities.

We shall have made significant progress later in this watershed's first cycle, toward identifying and assessing problems (through the characterization study) and involving stakeholders. At that point we (and the stakeholders) may also enough information to get a headstart on establishing load allocations for certain pollutants of concern.

Additional monitoring and assessment tasks include continued involvement in updates to the baseline State of the Watershed Report, focusing on filling data gaps and evaluating cumulative impacts as monitoring data become available from dischargers, evaluating the results of the SWAMP monitoring, follow-up on pollutants identified through toxicity identification evaluations, implement TMDLs to actually begin to solve problems found through monitoring, and implementing the municipal storm water program.

Our efforts to involve stakeholders shall also include exploration of funding options (especially for implementation of nonpoint source measures) and continuation of other outreach activities, such as speeches, meetings, and participation in environmental events. We shall continue our involvement in the watershed group's efforts to develop and implement a watershed management plan.

We will maintain involvement with stakeholder activities and pursue funding options, especially those involving implementation of nonpoint source measures (coordinate grant activities) as well as other outreach activities such as speeches, meetings, and participation in environmental events. As resources permit, we will also work with stakeholders to implement provisions of the Coastal Zone Act Reauthorization Amendments.

Potential Mid- to Long-term Activities

In the long-term, activities will include continued participation in both internal and external watershed planning efforts and further implementation of watershed-specific solutions. Several Basin Planning issues will be addressed through the Characterization Study and watershed planning efforts. More resources are needed for these activities.

Other mid- to long-term issues include:

- Beneficial uses: Studies to evaluate beneficial use issues.
- Site specific objectives: Review studies conducted by dischargers or other watershed interests.
- Land use planning: Integrate water supply and quality issues with local land use planning and management.
- Groundwater: Integrate inter-related ground and surface waters--optimizing protection for both.
- Flood control: Institute better coordination of multi-agency reviews of environmental impacts for flood control and development projects, including the consideration of regional mitigation programs. Optimize the use of environmentally-friendly flood control facilities.
- Implementation of watershed-wide biological monitoring is a long-term goal for all of our watersheds.

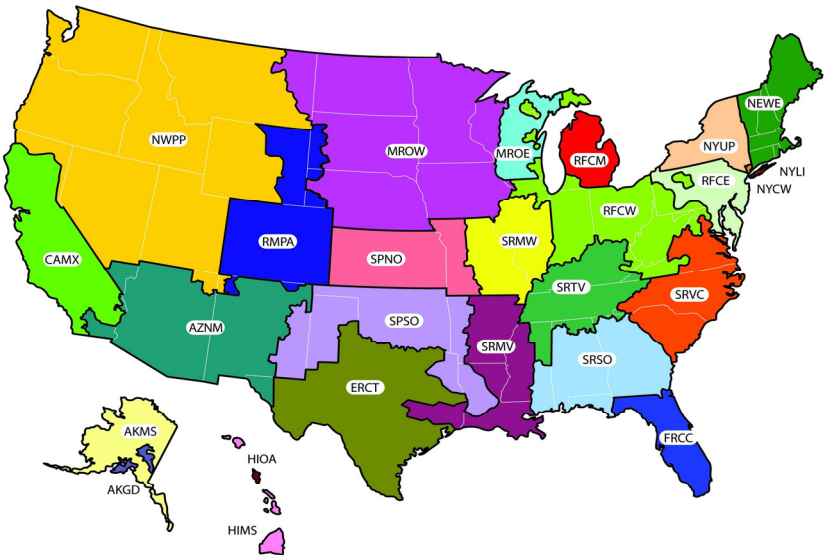
Review and comment on watershed issues in CEQA documents (for the highest priority projects) will also continue; however, this is currently an unfunded program.

Under the BPTCP, we estimated that about 20% of the Western Arm and 10% of the Eastern Arm of Mugu Lagoon contain contaminated sediments (about 725,000 cubic yards). We estimate that about 3 miles of Calleguas Creek contains 50,000 to 100,000 cubic yards of contaminated sediments. We want to work with local groups to develop remediation plans. Due to sensitive nature of Mugu Lagoon, we would suggest no action or in-situ treatment, rather than dredging, as remediation options. Treatment is expensive (probably would exceed $100 per cubic yard). Dredging could be used to remediate Calleguas Creek, although finding a suitable disposal site could be difficult; it would cost $1 to 5 million.

eGRID2012 Version 1.0 Year 2009 GHG Annual Output Emission Rates

Annual total output emission rates for greenhouse gases (GHGs) can be used as default factors for estimating GHG emissions from electricity use when developing a carbon footprint or emission inventory. Annual non-baseload output emission rates should not be used for those purposes, but can be used to estimate GHG emissions reductions from reductions in electricity use.

eGRID subregion acronym	eGRID subregion name	Annual total output emission rates			Annual non-baseload output emission rates		
		Carbon dioxide (CO_2) (lb/MWh)	Methane (CH_4) (lb/GWh)	Nitrous oxide (N_2O) (lb/GWh)	Carbon dioxide (CO_2) (lb/MWh)	Methane (CH_4) (lb/GWh)	Nitrous oxide (N_2O) (lb/GWh)
AKGD	ASCC Alaska Grid	1,280.86	27.74	7.69	1,320.75	33.16	6.34
AKMS	ASCC Miscellaneous	521.26	21.78	4.28	1,469.44	61.53	12.10
AZNM	WECC Southwest	1,191.35	19.13	15.58	1,187.67	22.25	9.12
CAMX	WECC California	658.68	28.94	6.17	993.89	33.52	4.07
ERCT	ERCOT All	1,181.73	16.70	13.10	1,155.44	19.66	7.59
FRCC	FRCC All	1,176.61	39.24	13.53	1,301.40	36.04	11.91
HIMS	HICC Miscellaneous	1,351.66	72.40	13.80	1,615.98	91.06	17.19
HIOA	HICC Oahu	1,593.35	101.74	21.98	1,621.42	107.94	18.73
MROE	MRO East	1,591.65	23.98	27.04	1,868.23	29.40	30.40
MROW	MRO West	1,628.60	28.80	27.79	2,114.93	61.83	37.41
NEWE	NPCC New England	728.41	75.68	13.86	1,157.44	61.72	14.43
NWPP	WECC Northwest	819.21	15.29	12.50	1,404.55	38.56	18.79
NYCW	NPCC NYC/Westchester	610.67	23.75	2.81	1,118.06	22.47	2.31
NYLI	NPCC Long Island	1,347.99	96.86	12.37	1,336.59	30.78	3.51
NYUP	NPCC Upstate NY	497.92	15.94	6.77	1,347.12	41.08	16.87
RFCE	RFC East	947.42	26.84	14.96	1,628.97	32.94	22.46
RFCM	RFC Michigan	1,659.46	31.41	27.89	1,834.66	35.17	29.15
RFCW	RFC West	1,520.59	18.12	25.13	2,001.76	24.56	32.10
RMPA	WECC Rockies	1,824.51	22.25	27.19	1,756.62	23.54	22.51
SPNO	SPP North	1,815.76	21.01	28.89	2,147.53	26.32	31.82
SPSO	SPP South	1,599.02	23.25	21.79	1,513.73	25.22	15.11
SRMV	SERC Mississippi Valley	1,002.41	19.45	10.65	1,201.66	25.72	7.11
SRMW	SERC Midwest	1,749.75	19.57	28.98	2,192.85	25.04	35.89
SRSO	SERC South	1,325.68	22.27	20.78	1,622.00	27.22	23.50
SRTV	SERC Tennessee Valley	1,357.71	17.28	22.09	1,921.12	25.16	30.61
SRVC	SERC Virginia/Carolina	1,035.87	21.51	17.45	1,677.35	38.55	25.56
U.S.		**1,216.18**	**24.03**	**18.08**	**1,555.48**	**30.83**	**19.76**



This is a representational map; many of the boundaries shown on this map are approximate because they are based on companies, not on strictly geographical boundaries.

http://www.epa.gov/egrid