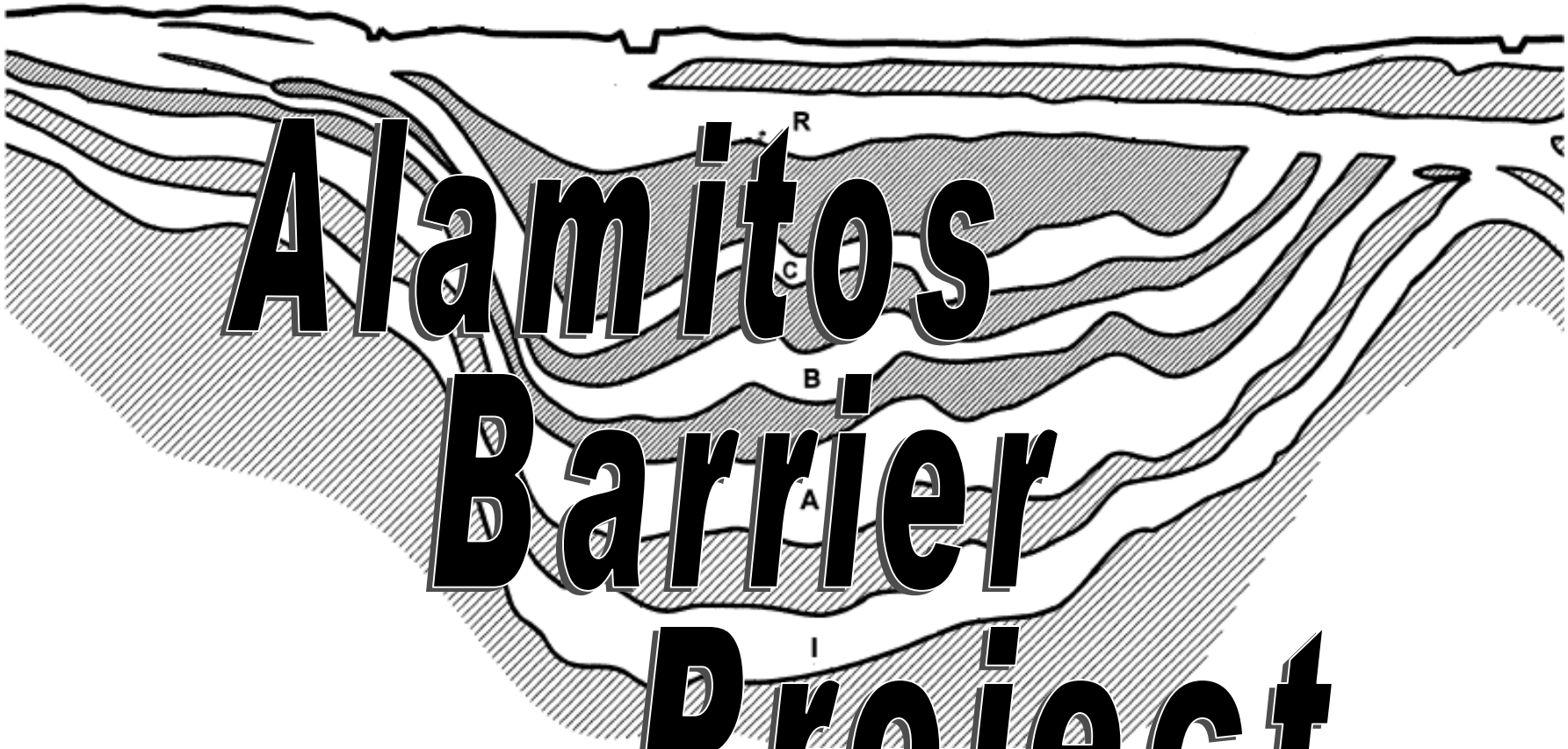


Alamitos Barrier Project

Alamitos Barrier Project

Annual report on the control of seawater intrusion

2005 - 2006

Member Agencies:

Orange County Water District

Water Replenishment District of Southern California

Long Beach Water Department

Golden State Water Company

Los Angeles County Flood Control District

Author:

Matt Frary
Los Angeles County Department of Public Works

Submitted by:

Matt Frary, Secretary
Joint Management Committee

TABLE OF CONTENTS

FIGURES

TABLES

APPENDIX

INTRODUCTION

The Alamitos Barrier Project was designed and constructed to protect the groundwater supplies of the Central Basin of the County of Los Angeles and the southwest portion of the Coastal Plain area in Orange County from the intrusion of seawater through the Alamitos Gap area. The project facilities are located near the Los Angeles-Orange County line about two miles inland from the mouth of the San Gabriel River. The original facilities included injection wells to form a freshwater pressure ridge and extraction wells to form a salt water trough. The freshwater ridge that was intended to block the landward gradient of intruding seawater has proven to be historically effective. However, the salt water trough that was intended to reverse the landward gradient of intruding seawater has proven to be historically ineffective. As a result, the extraction wells are currently not in operation. A map showing all injection and observation wells is shown on page A-19.

The County of Los Angeles Department of Public Works (Public Works) operates and maintains the project and its physical facilities under the direction and approval of the Joint Management Committee (JMC), acting on behalf of the Los Angeles County Flood Control District (LACFCD) and the Orange County Water District (OCWD).

This report summarizes design and construction issues, operation and maintenance activities, hydrologic effects, groundwater chloride concentrations, and project costs for Fiscal Year (FY) 2005-06 (i.e., July 1, 2005 through June 30, 2006).

SUMMARY

During this reporting period, a total of 3,457.8 acre-feet of water were injected at an average rate of 4.8 cubic feet per second and a total cost of $1,602,015. The OCWD purchased 826.7 acre-feet at a cost of $381,900. The Water Replenishment District of Southern California purchased 2,631.1 acre-feet at a cost of $1,220,115.

The cost of services and supplies for injection, excluding the costs of water, was $464.30/acre-foot this year and significantly greater than the $181.21/acre-foot it was last year (FY04-05). The higher cost in FY05-06 is the result of managing multiple repair and improvement projects (PRV Replacement and Cathodic Protection) during the year, the latest cycle of observation well cleanouts, a greater number of injection well redevelopments, new costs related to the reclaim water program, and various fixed costs despite reduced injections. The only one of these four factors that will continue to regularly impact the cost of services and supplies for injection is the reclaim water program costs. The project management costs will vary from year to year depending on the need to repair or improve the barrier facilities. The observation well cleanout costs and injection well redevelopment costs will not be incurred each fiscal year because they are based on cyclical activities.

The barrier as a whole has continued to control the intrusion of seawater during this reporting period (FY 2005-06). As expected, the groundwater levels near the barrier were typically higher than the surrounding areas. Average groundwater levels have increased in the deeper aquifers (the A, I, and Main zones) and slightly decreased in the shallower aquifers (the R, C, and B Zones). Chloride concentrations at the majority of the wells along the barrier alignment indicate freshwater conditions. However, several areas continue to record high chloride concentrations and are discussed in detail later on.

DESIGN AND CONSTRUCTION

Barrier Water Supply Facilities Improvements Project

This project involves bonding the pipe joints and installing sacrificial anodes along the water supply pipeline. It was originally anticipated that construction of this cathodic protection system (known as the Barrier Water Supply Facilities Improvements project) would begin in FY 2005-06. However, the project was postponed for budgetary reasons and final design plans and specifications were not completed. As a result, design plans and specifications were further modified throughout the fiscal year to identify specific joint locations and up-to-date utilities. We expect the contract for this project to be awarded near the end of FY 2006-07 and that construction will begin near the beginning of FY 2007-08.

ABP Replacement of Valves at Pressure Reducing Station

The pressure reduction vault renovation project includes replacement of the aging pressure regulating valves and ball valves and removal of the hydroelectric generation plant. As scheduled, this project (advertised as the Alamitos Barrier Project and Dominguez Gap Barrier Project Replacement of Valves at Pressure Reducing Stations, and Miscellaneous Improvements) began construction in FY 2005-06. The construction was not completed within the same fiscal year, but should be finalized within FY 2006-07.

ABP Telemetry System Phase 1

Phase 1 of the ABP Telemetry System includes the installation of the conduits, pull boxes, new observation well vaults, instrument housing, and antenna poles. Design plans and specifications for this project were completed and the project was advertised and awarded near the end of FY 2005-06. Construction should begin and end in FY 2006-07.

ABP Telemetry System Phase 2

Phase 2 of the ABP Telemetry System includes the installation of the communications cables, the instrumentation, and the software to monitor the well sites remotely. Design plans and specifications were not yet completed during this reporting period, but it is anticipated that design documents will be finalized and the project advertised and awarded near the end of FY 2006-07. Construction is expected to begin at the beginning of FY 2007-08.

INJECTION OPERATIONS

The injection of reclaimed water into the ABP began in October 2005 and contributed 34.0 percent (1175.5 acre-feet) of the total injection volume during this reporting period. The maximum monthly injection of 422.3 acre-feet (217.7 acre-feet imported and 204.6 acre-feet reclaimed) occurred in March 2006. The minimum monthly injection of 0.0 acre-feet occurred in May while the barrier was shutdown to inspect the inside of the supply pipeline for the cathodic protection project. The injection volumes and costs from July through June of both FY 2004-05 and FY 2005-06 are shown in Table 1. As expected, Table 1 shows a decrease in total injection amount from FY 2004-05 to FY 2005-06. This decrease was expected for two reasons. First, the barrier was nonoperational or only partially operational for the last four months of FY 2005-06. Additionally, during the latest reporting period, 26 well casings were redeveloped compared to only 13 casings redeveloped during the previous reporting period.

Below is a summary of events regarding the barrier shutdown at the end of FY 2005-06. Further dates and details will be appropriately provided in future reports.

- April 14, 2006: Public Works shuts down PRV as requested. Shutdown is due to maintenance on the Metropolitan Water District's South Coast Feeder, which will stop the water supply to LB-07A upstream of the PRV. Long Beach Water Department (LBWD) and Water Replenishment District (WRD) are allowed to continue delivery of reclaimed water to the barrier.
- April 24, 2006: LBWD shuts down the reclaim plant to allow Public Works to drain the supply pipeline and maximize the shutdown by performing video inspection for the cathodic protection project.
- June 22, 2006: Public Works completes video inspection and restoration.
- June 26, 2006: Public Works begins to recharge the barrier.
- June 27 & 28, 2006: Public Works identifies a leak near the blow off vault at Station 2+65.00 along the west leg, and LBWD and WRD identify a leak within the reclaim plant. West leg is isolated to allow delivery to the rest of the barrier, but entire barrier is shutdown to accommodate repairs at the reclaim plant.

TABLE 1. INJECTION OPERATIONS

	Imported Water Injections			Reclaimed Water Injections			Total Injections		
	FY04 - 05	FY05 - 06	Percent Change From Previous Year	FY04 - 05	FY05 - 06	Percent Change From Previous Year	FY04 - 05	FY05 - 06	Percent Change From Previous Year
	VOLUME OF WATER INJECTED IN ACRE-FEET								
OCWD[1]	1,915.3	572.1	-70.1	0.0	254.6	N/A	1,915.3	826.7	-56.8
WRD[2]	3,150.8	1,710.2	-45.7	0.0	920.9	N/A	3,150.8	2,631.1	-16.5
TOTAL	5,066.1	2,282.3	-54.9	0.0	1,175.5	N/A	5,066.1	3,457.8	-31.7
	UNIT COST OF WATER PER ACRE-FEET								
JULY - DEC	$423.00	$448.00	5.9	N/A	$480.21	N/A			
JAN	$423.00	$458.00	8.3	N/A	$492.98	N/A			
FEB - JUN	$448.00	$458.00	2.2	N/A	$492.98	N/A			
	COST OF WATER PURCHASED								
OCWD[1]	$825,774	$257,613	-68.8	$0	$124,287	N/A	$825,774	$381,900	-53.8
WRD[2]	$1,356,383	$770,646	-43.2	$0	$449,470	N/A	$1,356,383	$1,220,115	-10.0
TOTAL	$2,182,157	$1,028,258	-52.9	$0	$573,757	N/A	$2,182,157	$1,602,015	-26.6
	AVERAGE INJECTION RATE IN CFS								
OCWD[1]	2.6	0.8	-69.6	0.0	0.4	N/A	2.6	1.1	-56.8
WRD[2]	4.4	2.4	-46.3	0.0	1.3	N/A	4.4	3.6	-16.5
TOTAL	7.0	3.2	-55.0	0.0	1.6	N/A	7.0	4.8	-31.7

[1] Orange County Water District

[2] Water Replenishment District

Figure 1 presents the monthly amounts of water injected during FY 2005-06. Figure 2 illustrates the annual amounts of water injected since 1980.

FIGURE 1 - MONTHLY AMOUNT OF WATER INJECTED

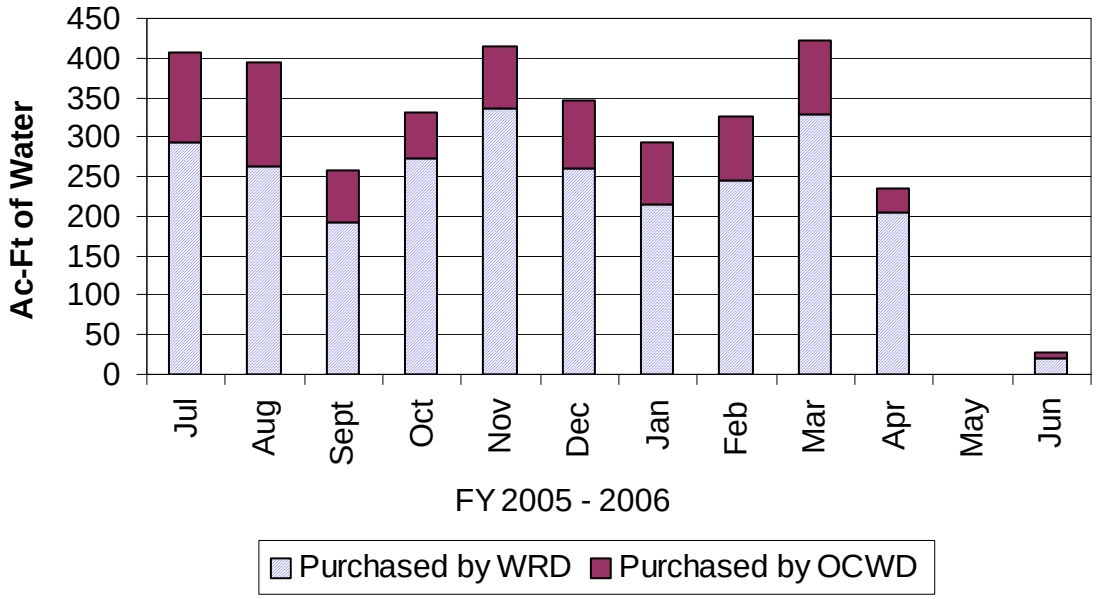
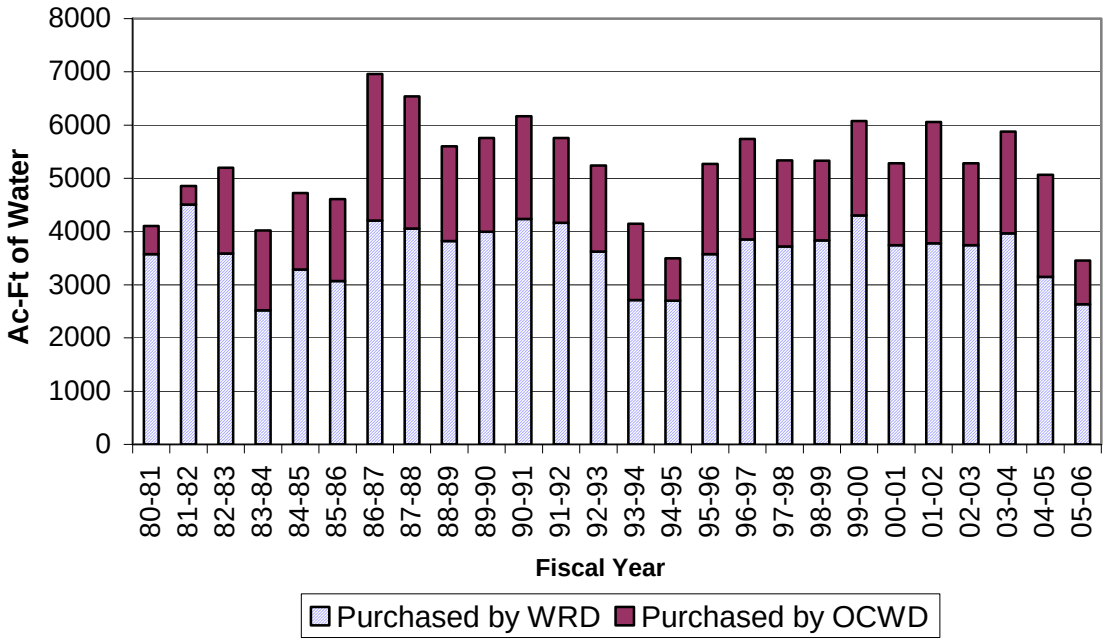


FIGURE 2 - ANNUAL AMOUNT OF WATER INJECTED



EXTRACTION OPERATIONS

There were no extraction activities during FY 2005-06. As recommended by the JMC Committee, these wells were taken out of operation in FY 2002-03. This decision was based on results of the one year extraction well efficiency study, which demonstrated that the chloride levels in the area decreased when the extraction wells were turned off. The extraction wells will continue to receive minimal maintenance so that they can be turned back on if deemed necessary in the future. Since there has been no extraction activity for three consecutive fiscal years, the traditional summary tables are not necessary for this 2005-06 Annual Report.

MAINTENANCE

The purpose of observation well cleanouts is to remove accumulated sediment at the bottom of the well screens to facilitate better chloride sampling of the wells. This year, 91 Alamitos Barrier observation well casings were selected for cleanouts based on the presence of sediment blocking their perforations. Of these, 48 were cleaned out during FY 2005-06, and the remaining casing cleanouts should be completed during FY 2006-07. At the completion of the cycle, the success of each cleanout will be analyzed in order to recommend new wells as necessary. The analysis and recommendations will be discussed in future reports.

The purpose of injection well redevelopments is to remove accumulated sediment and chemical buildup from the well casings to enable each well to operate at its maximum injection capacity. During FY 2005-06, the County of Los Angeles Flood Control District completed the redevelopment of the following 25 injection well casings[1]: 34F(A) (twice), 34F(I), 34G2(I), 34H(A), 34H(I), 34S(A), 34S(B,C), 34S(I), 33Q1(C,B), 34G(I), 34Z(I), 35F(A), 35G(I), 35H2(A,I), 33G(A,I), 33L(A,I), 33Z2(A,I), 33Z(C,B,A,I), 34J(A,I), 33N(A,I), 33Q(A,I), 33S1(C,B), 34L(C,B,A,I), 35H1(A), and 35H1(I).

[1] The capital letters in parenthesis represent the aquifer(s) receiving injections from that well casing. For example, (A) = A Zone aquifer, (A,I) = A and I Zone aquifers, and so forth.

Figure 3 depicts the operating status of each injection and extraction well during FY 2005-06. As indicated, most periods of nonoperation were due to either repairs or redevelopments. Transition time before and after such repairs and redevelopments will continue to be reduced where possible. Additionally, those wells waiting for repairs will receive immediate attention once the barrier resumes operations.

FIGURE 3 - ABP INJECTION AND EXTRACTION WELL STATUS - FY05-06

Well No.	2005																								2006											
	JUL				AUG				SEP				OCT				NOV				DEC				JAN				FEB				MAR				APR			
33G (A,I)																											R	R	D						O	O
33J (A,I)	M	M	M	M	M	M	M	M	M	M								X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O
33L (A,I)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	H	H	H	H	H	H							R	R					O	O
33N (A,I)																																							O	O
33Q (A,I)																																							O	O
33Q1 (C,B)																					R	R	D	D	D	D													O	O
33S (A,I)																																							O	O
33S1 (C,B)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	O	O
33T (A,I)	S	S	S	S																			N	N	N	N	N	N	N	N	N	N	N	N	N	N	O	O
33U (A,I)																																							O	O
33U3 (C,B)																																							O	O
33V (A,I)																																							O	O
33W (C,B,A,I)																																							O	O
33X (C,B,A,I)																																							O	O
33Y (C,B,A,I)	D																																						O	O
33Z (C,B,A,I)																				R	R	R	R	D	D	D	D	D	D	D								O	O
33Z2 (A)																								R	R	R	D	D										O	O
33Z2 (I)																								R	R	R	D	D										O	O
34D (C,B,A,I)	D	D																																					O	O
34E (C,B)																																							O	O
34E (I)																																							O	O
34F (A)		R	R	R																							O	O	O	O							O	O
34F (A,I)			R	R	R																						O	O	O	O							O	O
34G (I)											R	R	D	D						M	M	M	M														O	O
34G2 (C,B)			R	R	D	D																															O	O
34G2 (A,I)			R	R	D	D																															O	O
34H (A)						R	R	M	M	M	M	M	M	M	M								M	M													O	O
34H (I)							R	R	M	M	M	M	M	M	M								M	M													O	O
34J (A)																							M	M							R	R	D	D	O	O	O	O
34J (I)																							M	M							R	R	D	D	O	O	O	O
34L (C,B,A,I)																	O	O																			O	O
34S (A)	X	X	X	X	X	X	X	R	R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O
34S (I)	X	X	X	X	X	X	X	X	X	R	R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O
34S (C,B)	X	X	X	X	X	X	X	X	X	X	R	R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O
34V (A)																																					O	O
34V (I)																																					O	O
34V (C,B)																																					O	O
34Z (I)													R	R																							O	O
35F (I)															R	R																					O	O
35G (A,I)																		R	R	R	D	D	D	D	D	D	D	D	D	D	D	D					O	O
35H1 (A)																							S												R	R	O	O
35H1 (I)																							S														O	O
35H2 (A)																	R	R	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	O	O
* 33V'15P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
* 34H'17P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
* 34H'18P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
* 34S'22P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

*Extraction Well

- **Well in Operation**
- **H - Header Repair**
- **R - Redevelopment**
- **W - Water Quality Sampling**
- **C - Casing Repair**
- **M - Misc. Repair**
- **S - Surface Leakage**
- **X - Waiting for Repair**
- **D - Disassembled**
- **N - Not Needed**
- **T - Tremie Repair**
- **G - Grouted**
- **O - Other Circumstances**
- **U - Under Construction**

HYDROLOGIC EFFECTS

Groundwater Elevations

Table 2 summarizes average groundwater elevations taken during the spring months of the last 13 years. The comparison of groundwater levels taken during spring 2005 and 2006 presented in the last columns of Table 2 shows that average groundwater levels have increased in the deeper aquifers (the A, I, and Main zones) and slightly decreased in the shallower aquifers (the R, C, and B Zones). It is especially significant to note this improvement since all other recent years have shown minimal, if any, increases in groundwater levels in the A and I Zones.

Figures 4 through 8 show the average monthly groundwater elevation against the 10-year average groundwater elevation in the vicinity of the barrier alignment in the R, C, B, A, and I Zones, respectively. The data includes wells within the barrier alignment and landward for approximately 2,000 feet from the barrier. Two graphs were created for each aquifer to account for changes in groundwater elevation trends along the barrier alignment: wells west of the San Gabriel River and wells east of the San Gabriel River.

In each figure, monthly average groundwater elevations during the FY 2005-06 are compared with the averages of the previous 10 years (Fiscal Years 1994-95 to 2004-05). As shown, groundwater levels have typically been at or above historical values on both the west and east side of the San Gabriel River. It is noted that significantly low groundwater levels observed in all graphs during the month of October 2005 are attributable to the shutdown during the last week of September 2005 for the construction of the reclaimed water tie-in to the supply line. Similarly, the downward trends that begin in April 2006 of each graph are attributable to the shutdown that occurred on April 24, 2006, and lasted throughout the remainder of the fiscal year.

Groundwater elevation contours for the R, C, B, A, and I Zones have been prepared from data taken in March and April of 2006 and are included in the Appendix (A-2 through A-6). As expected, these contours show that the groundwater levels typically are lower landward of the barrier than in the immediate vicinity of the barrier.

TABLE 2. GROUNDWATER ELEVATION SUMMARY FOR PREVIOUS YEARS

Zones	Description		Groundwater Elevations (ft)												
			Spring 1994	Spring 1995	Spring 1996	Spring 1997	Spring 1998	Spring 1999	Spring 2000	Spring 2001	Spring 2002	Spring 2003	Spring 2004	Spring 2005	Spring 2006
R	North of Westminster Ave except in the vicinity of the extraction wells	Maximum	2.5	2.6	4.5	5.8	4.3	5.0	5.9	5.0	1.0	-0.9	4.2	4.9	9.3
		Minimum	-5.9	-4.7	-3.0	-5.1	-5.4	0.0	-1.6	-2.2	-3.0	-7.6	-8.8	2.6	-1.7
		Average	-1.4	-1.3	-0.6	-0.3	0.4	1.9	1.4	0.4	-0.9	-1.8	-0.4	3.6	2.7
C & B	Internodal Wells West of San Gabriel River	Maximum	4.8	10.1	9.4	11.1	11.1	11.1	4.1	6.7	10.9	2.1	9.9	8.3	2.3
		Minimum	0.5	1.4	2.4	1.6	1.7	2.7	2.5	2.0	0.5	-0.4	3.7	1.8	-0.2
		Average	2.6	5.8	5.8	6.9	5.5	7.9	7.8	5.0	7.0	1.1	7.3	4.2	0.9
	Internodal Wells East of San Gabriel River	Maximum	2.0	4.8	0.8	-0.4	3.2	8.0	3.8	6.0	7.8	0.4	4.1	7.0	9.3
		Minimum	-2.2	-2.6	-2.2	-2.0	-2.9	2.4	-0.9	-1.1	-2.3	-6.4	3.1	2.6	1.0
		Average	-0.6	0.3	-0.9	-1.1	1.5	4.4	0.6	1.1	1.1	-4.2	3.5	4.8	3.4
	East of Los Alamitos Channel (landward)	Maximum	-2.1	-0.7	-2.0	4.1	6.9	9.3	-3.2	-3.0	-2.4	-7.7	2.4	4.1	3.3
		Minimum	-5.4	-5.4	-6.2	-2.5	-2.3	-2.3	-10.2	-8.0	-7.5	-13.2	-1.5	2.1	2.2
		Average	-3.9	-3.9	-4.4	0.6	2.9	2.3	-6.6	-5.0	-5.1	-11.8	0.2	3.2	2.6
A	Internodal Wells	Maximum	2.5	6.4	6.2	11.1	11.1	8.8	5.4	3.9	6.0	2.6	2.5	7.5	10.8
		Minimum	-8.5	-8.1	-4.5	-3.3	-1.9	-0.3	-2.5	-2.7	3.1	-6.6	-11.0	1.4	-3.3
		Average	-2.7	-0.3	2.7	4.1	4.2	6.0	3.1	1.8	3.5	-3.1	-3.9	4.0	4.6
I	Internodal Wells	Maximum	2.5	6.4	6.2	6.0	8.2	6.2	4.0	2.8	4.3	3.9	2.5	6.7	11.1
		Minimum	-2.7	-3.0	-7.2	-8.7	-5.0	-1.0	-8.3	-6.7	-6.6	-12.9	-13.0	-4.3	-1.4
		Average	0.7	3.7	-1.4	-2.3	4.2	1.9	-3.0	-2.2	-3.5	-7.3	-6.3	1.9	6.0
MAIN	Main Unaffected by Injection Operations	Maximum	2.7	5.4	2.6	5.7	6.9	*	-6.9	-2.5	-5.6	-7.4	1.6	-1.0	11.7
		Minimum	-32.6	-29.7	-33.4	-30.9	-33.0	*	-30.7	-35.2	-39.6	-60.6	-34.9	-39.7	-16.6
		Average	-16.9	-18.3	-14.8	-17.9	-17.1	*	-19.8	-19.6	-23.9	-34.9	-17.8	-23.1	-7.4

*** NO DATA**

DATA FOR MAIN ZONE, SPRING 2005 TAKEN OCT 2005
DATA FOR MAIN ZONE, SPRING 2003 TAKEN JULY 2003

FIGURE 4a RECENT ZONE WEST OF THE SAN GABRIEL RIVER

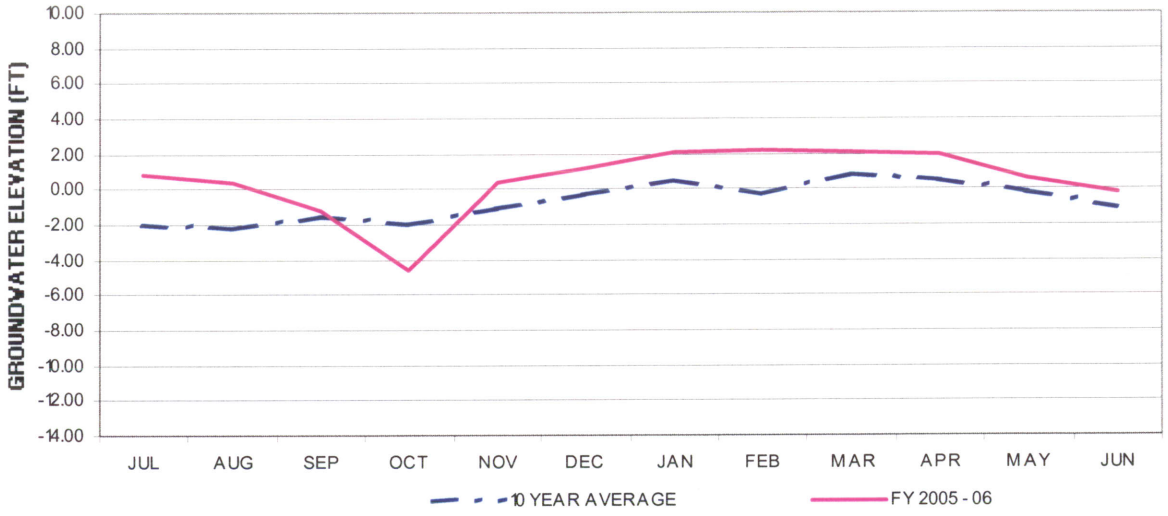


FIGURE 4b RECENT ZONE EAST OF THE SAN GABRIEL RIVER

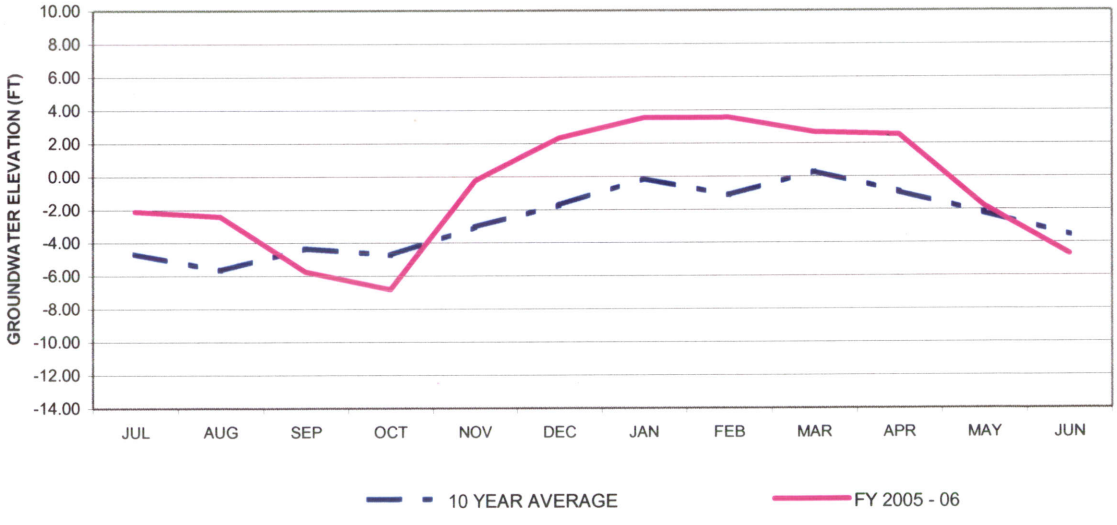


FIGURE 5a C-ZONE WEST OF THE SAN GABRIEL RIVER

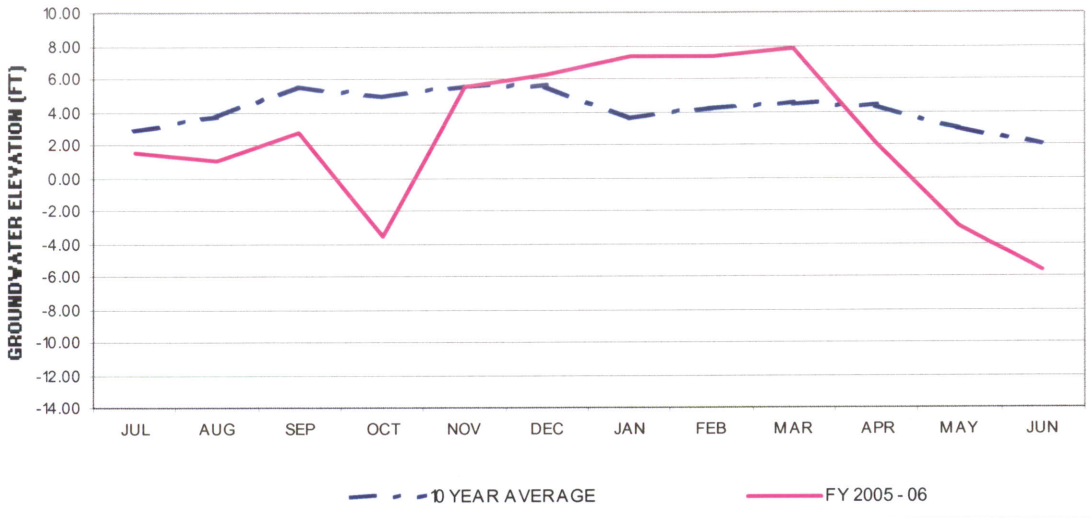


FIGURE 5b C-ZONE EAST OF THE SAN GABRIEL RIVER

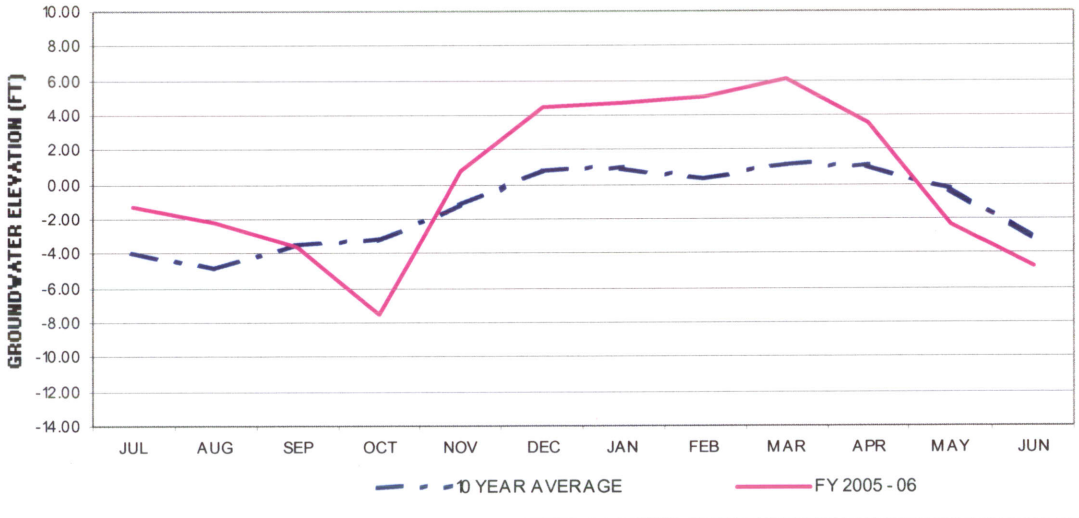


FIGURE 6a B-ZONE WEST OF THE SAN GABRIEL RIVER

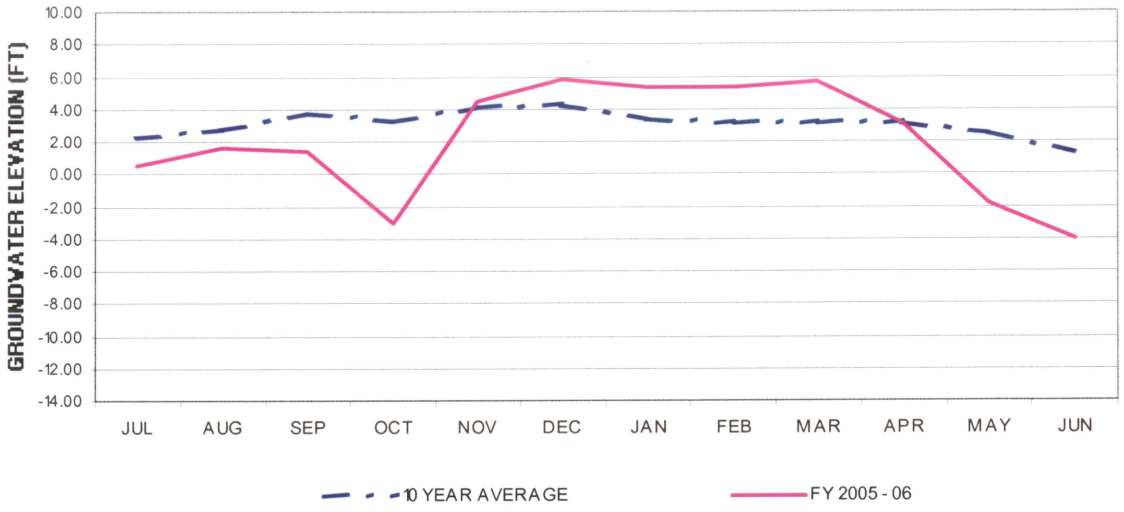


FIGURE 6b B-ZONE EAST OF THE SAN GABRIEL RIVER

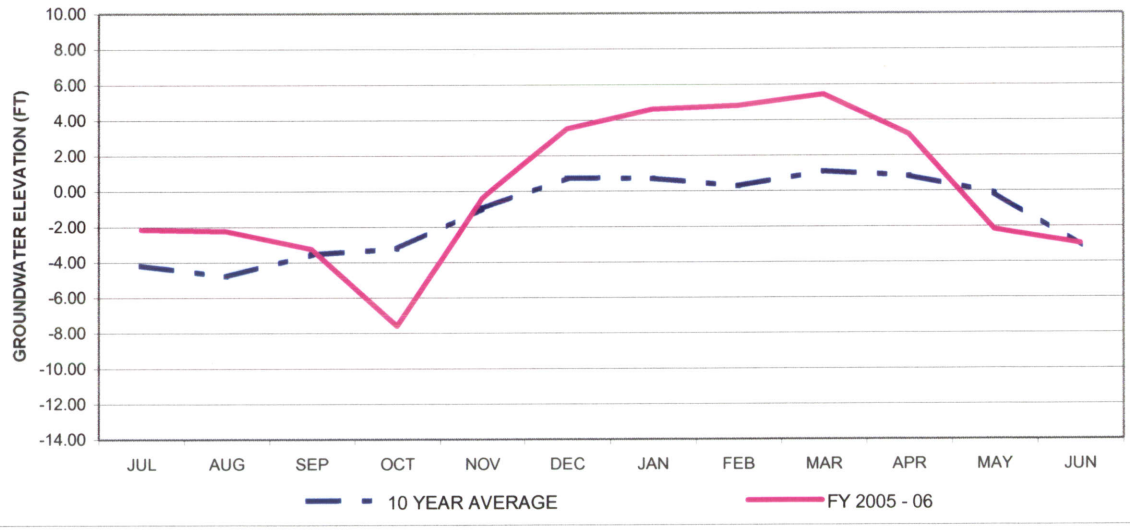


FIGURE 7a A-ZONE WEST OF THE SAN GABRIEL RIVER

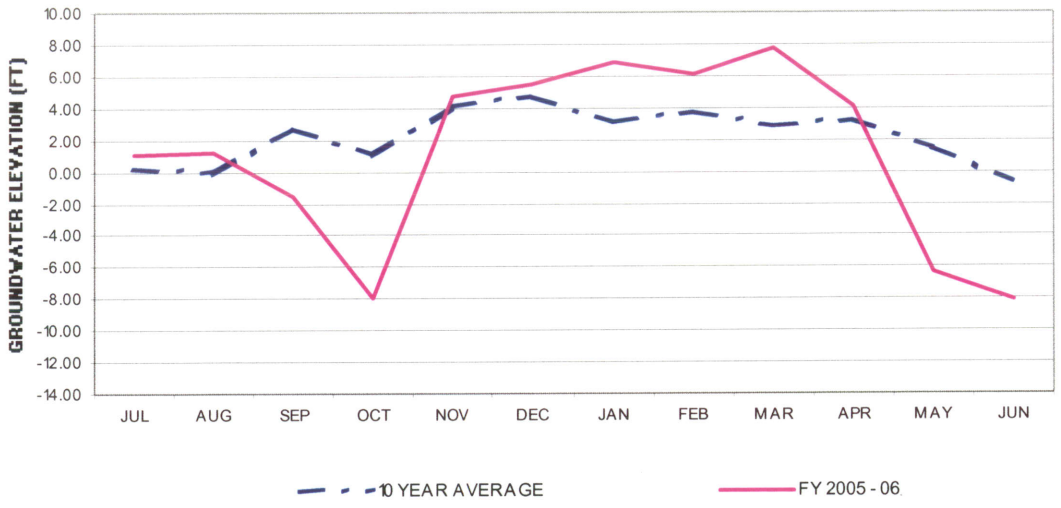


FIGURE 7b A-ZONE EAST OF THE SAN GABRIEL RIVER

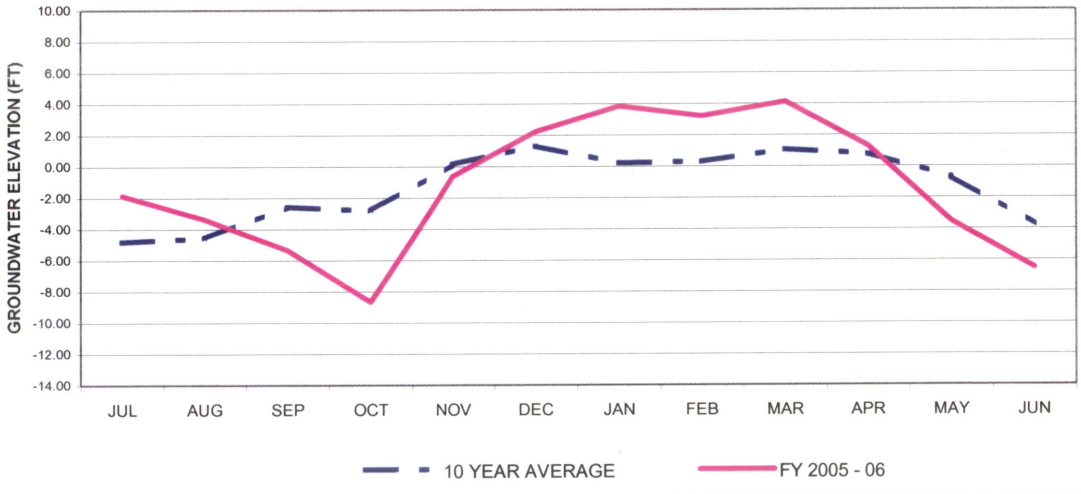


FIGURE 8a I-ZONE WEST OF THE SAN GABRIEL RIVER

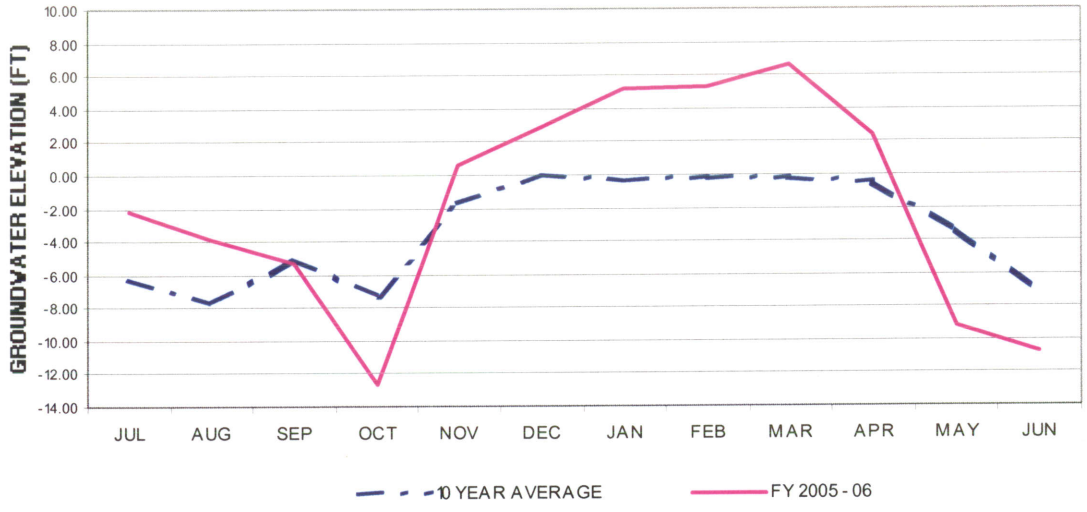
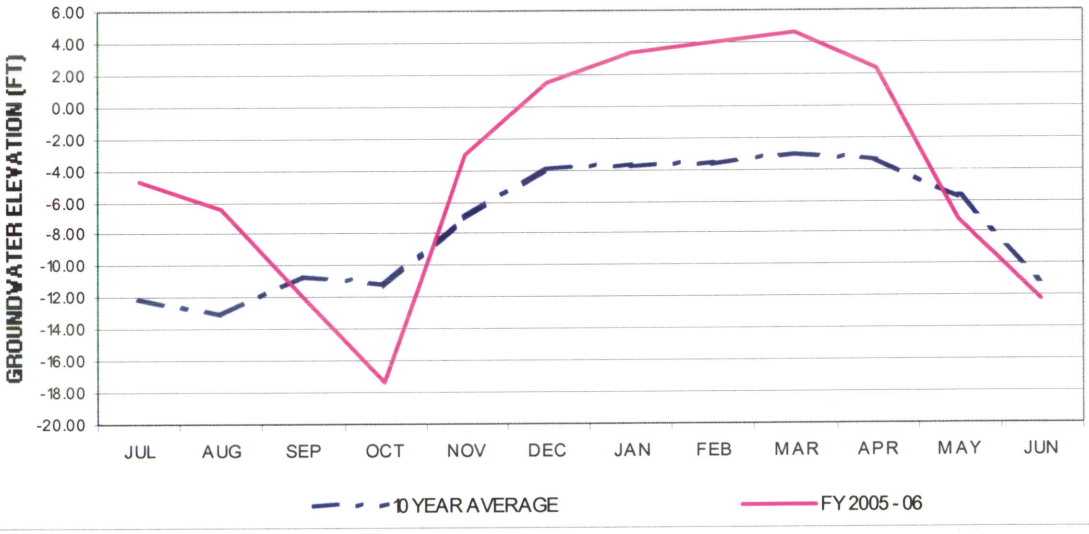


FIGURE 8b I-ZONE EAST OF THE SAN GABRIEL RIVER



CHLORIDES

Table 3 summarizes and compares the chloride concentrations by Zone and Location for FY 2004-05 and FY 2005-06. The majority of the chloride concentrations, both internodal and inland, have decreased from last fiscal year to this fiscal year.

Figures 9 through 13 show the historical amount of seawater intrusion (based on average annual chloride concentrations) in the individual aquifer zones. The data includes wells within the barrier alignment and landward for approximately 2,000 feet from the barrier. Two sets of graphs were created for each aquifer to account for changes in chloride concentration trends in the areas west and east of the San Gabriel River, respectively.

In each figure, the average chloride concentration for the last 11 fiscal years is shown with respect to the freshwater condition (250 mg/L). As shown, chloride concentrations in both regions of the R Zone and in the easterly region of the I Zone remain significantly high. All other zones remain at or near 250 mg/L and typically demonstrate a downward trend over the last few years.

Chloride contour maps for the R, C, B, A, and I Zones have been prepared as presented in the Appendix (Figures A-6, A-7, A-8, A-9, and A-10, respectively). The chloride contour maps for this reporting period are based on the highest chloride ion concentration (mg/L) measured at each observation well. Chloride data were gathered within the immediate vicinity of the barrier and do not represent basin-wide conditions for the groundwater basin protected by the barrier. Wells with chloride concentrations of 250 mg/L or less are considered fresh. The majority of chloride measurements reported this period were taken in June 2006. However, a few older data points as far back as the previous two fiscal years were included where necessary and applicable. The incorporation of these points allowed for a more accurate and more complete

representation of the conditions around the barrier. A list of all data points used for these contours is included in the Appendix (A-12 through A-18).

Intrusion of seawater across the barrier continues to be controlled along most of the alignment and the overall performance of the barrier has improved since the previous reporting period (FY 2004-05). However, several areas continue to record high chloride concentrations. For all zones (especially the I Zone), the southeastern end of the barrier continues to be subject to seawater intrusion. In the shallower aquifers (the C and B Zones), there are simply no injection wells in this southeastern region. However, in the deeper aquifers (the A and I Zones), one possible cause may be the physical limit of our injection rates due to the very thin aquitards in this region. Additional areas of high chloride concentrations are as follows:

- R Zone – North of barrier along Los Cerritos Channel and along the barrier around the San Gabriel River.
- C Zone – Northwest area of the barrier.
- A Zone – Northwest area of the barrier.
- I Zone – East leg of the barrier around well 34LS.

Three possible causes of high chloride concentrations northwest of the barrier (e.g. Zones R, C, and A) include the transportation of seawater inland by the Los Cerritos Channel, insufficient protection on that end of the barrier, and remaining seawater from previous intrusions. High chlorides around 34LS (e.g. Zone I) could have arisen from the prolonged nonoperation of injection well 34S.

TABLE 3. CHLORIDE CONCENTRATION SUMMARY

Zones	Description		June 2005 (mg/L)	June 2006 (mg/L)	% Change
R	North of Westminster Ave	Maximum	15000	17000	13.3
		Minimum	78	62	-20.5
		Average	2543	2371	-6.8
C	Internodal Wells	Maximum	170	138	-18.8
		Minimum	52	66	26.9
		Average	97	86	-11.3
	Inland Wells	Maximum	4550	1800	-60.4
		Minimum	80	76	-5.0
		Average	546	331	-39.4
B	Internodal Wells	Maximum	510	495	-2.9
		Minimum	74	44	-40.5
		Average	146	160	9.6
	Inland Wells	Maximum	2200	2300	4.5
		Minimum	80	74	-7.5
		Average	388	418	7.7
A	Internodal Wells	Maximum	5500	4750	-13.6
		Minimum	42	38	-9.5
		Average	272	241	-11.4
	Inland Wells	Maximum	280	210	-25.0
		Minimum	24	42	75.0
		Average	102	97	-4.9
I	Internodal Wells	Maximum	4900	7250	48.0
		Minimum	22	38	72.7
		Average	285	463	62.5
	Inland Wells	Maximum	3950	410	-89.6
		Minimum	54	26	-51.9
		Average	643	130	-79.8

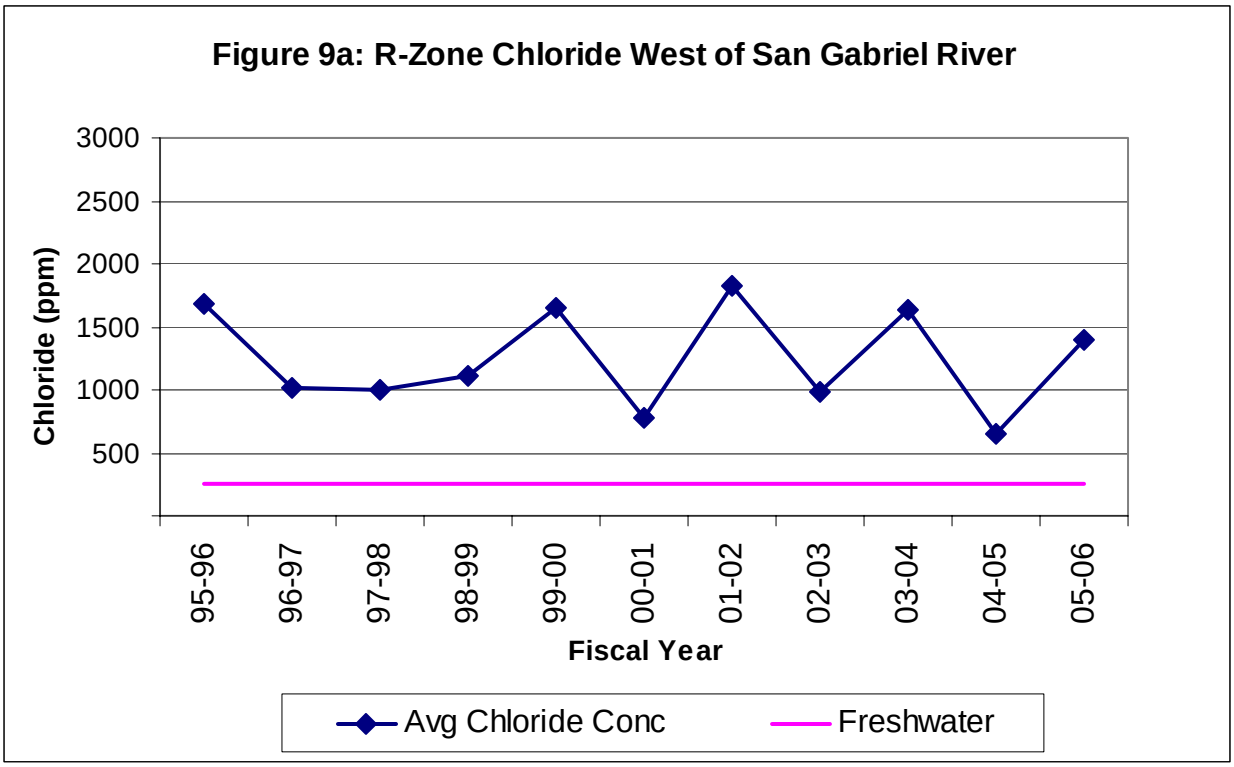


Figure 9a: R-Zone Chloride West of San Gabriel River
Chloride (ppm)
3000
2500
2000
1500
1000
500
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

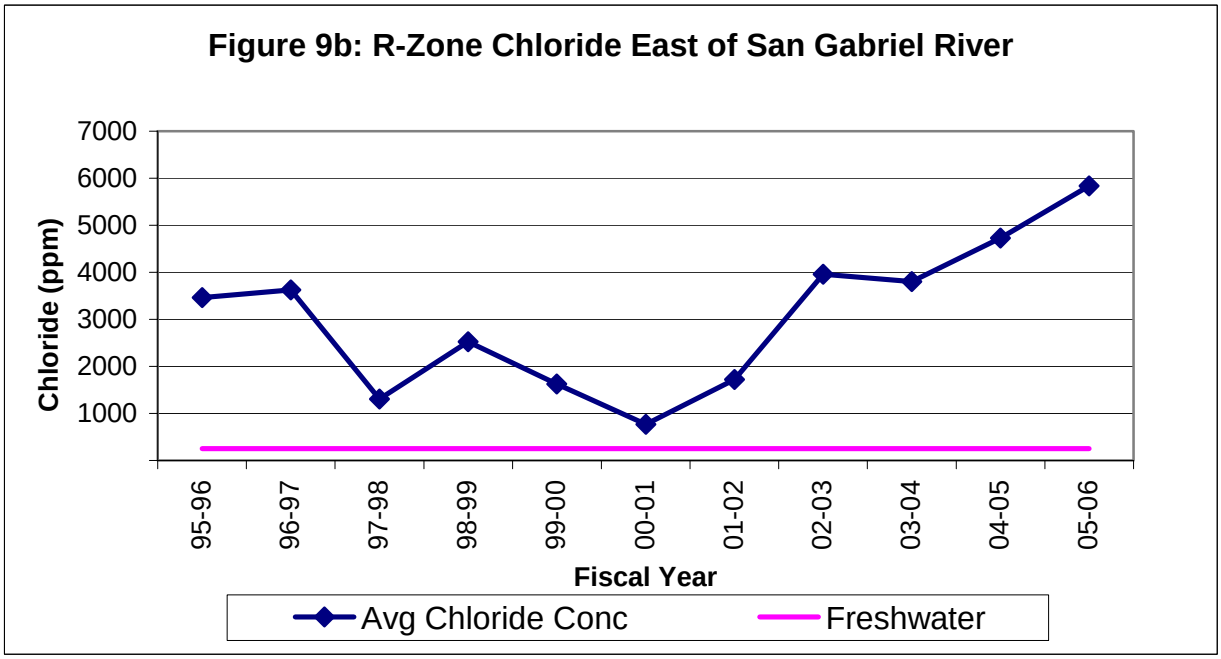


Figure 9b: R-Zone Chloride East of San Gabriel River
Chloride (ppm)
7000
6000
5000
4000
3000
2000
1000
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

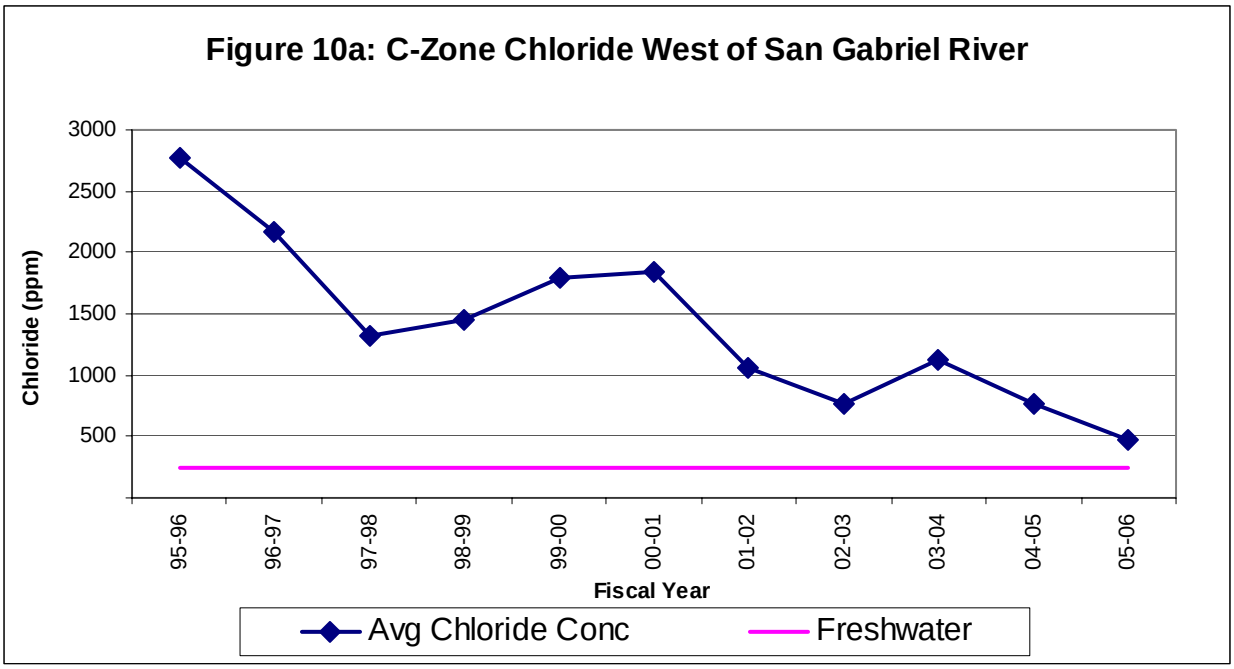


Figure 10a: C-Zone Chloride West of San Gabriel River
Chloride (ppm)
3000
2500
2000
1500
1000
500
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

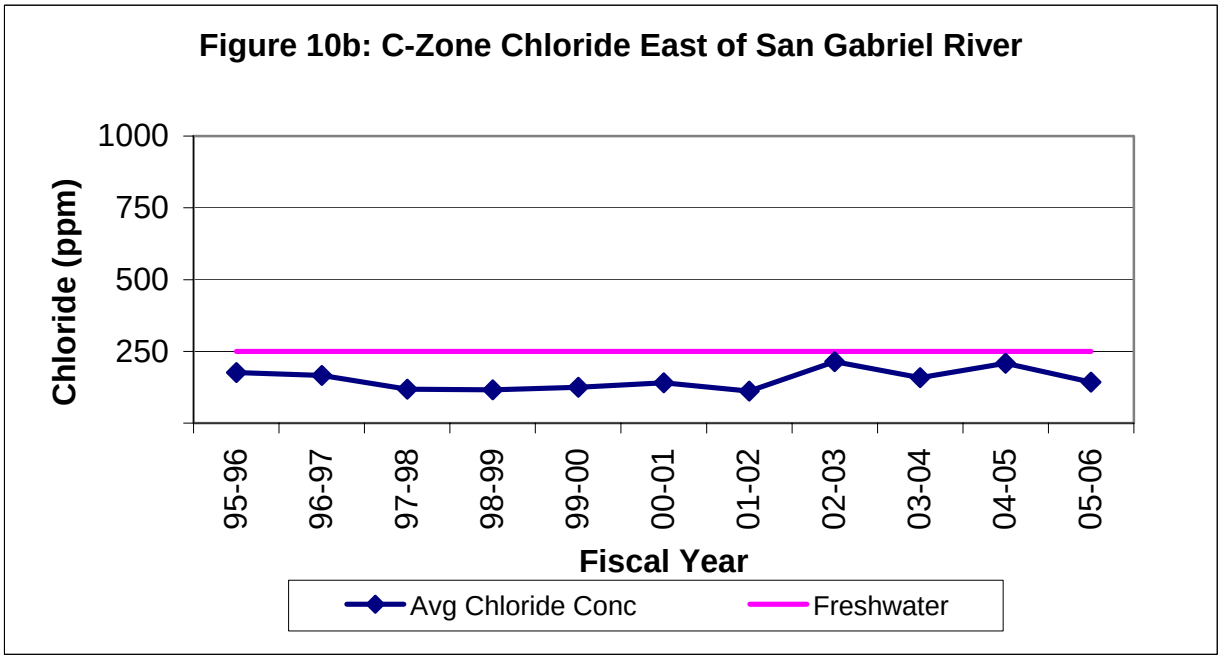


Figure 10b: C-Zone Chloride East of San Gabriel River
Chloride (ppm)
1000
750
500
250
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

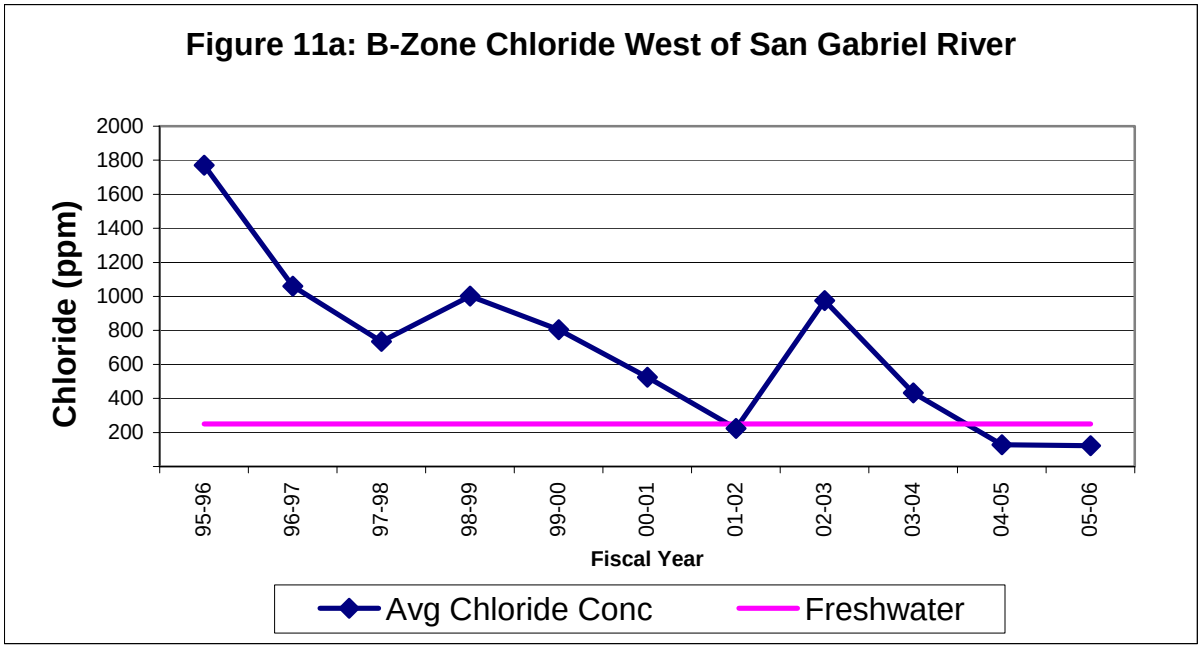


Figure 11a: B-Zone Chloride West of San Gabriel River
Chloride (ppm)
2000
1800
1600
1400
1200
1000
800
600
400
200
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

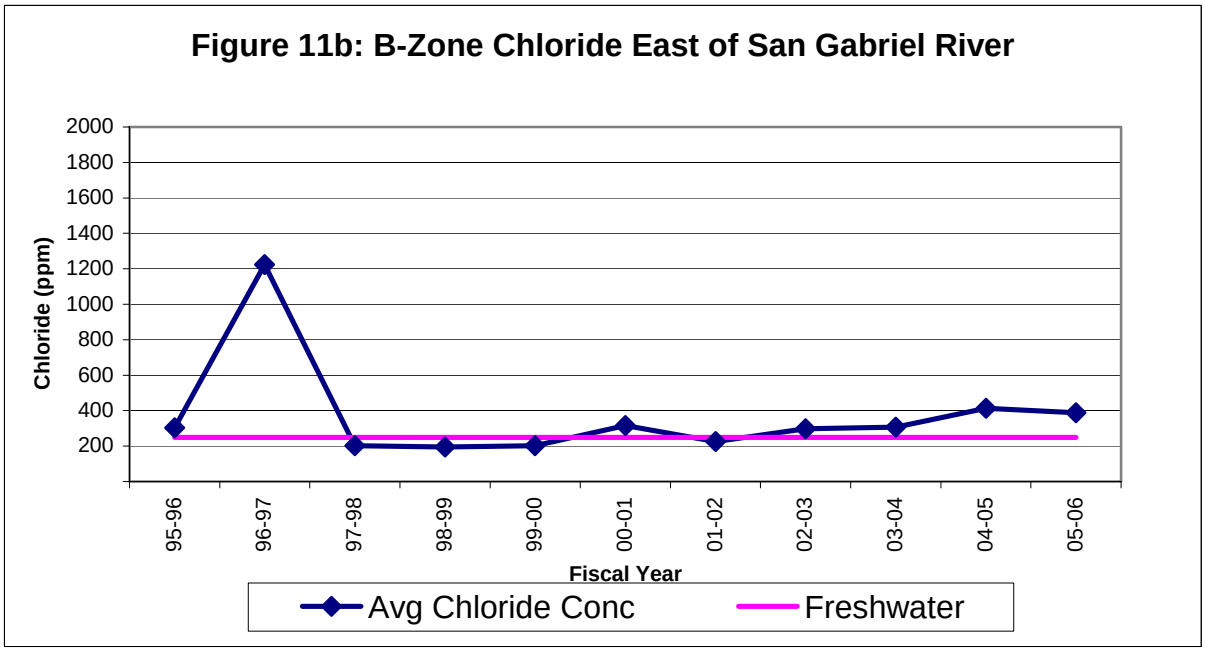


Figure 11b: B-Zone Chloride East of San Gabriel River
Chloride (ppm)
2000
1800
1600
1400
1200
1000
800
600
400
200
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

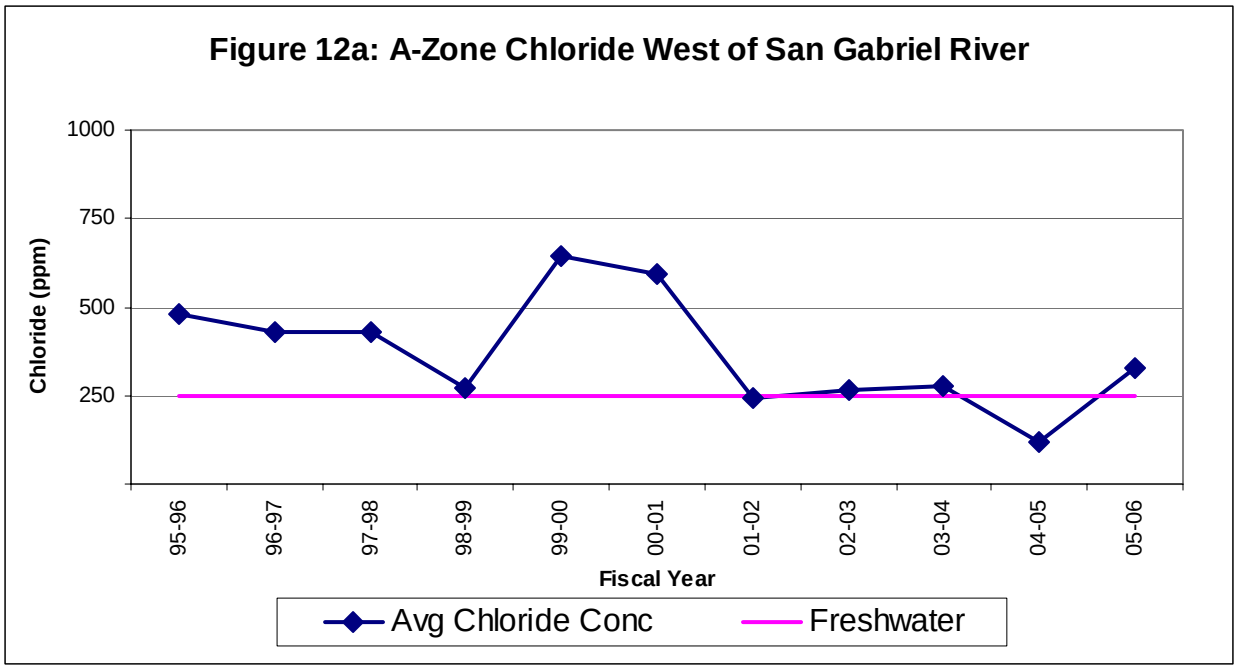


Figure 12a: A-Zone Chloride West of San Gabriel River
1000
750
500
250
Chloride (ppm)
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

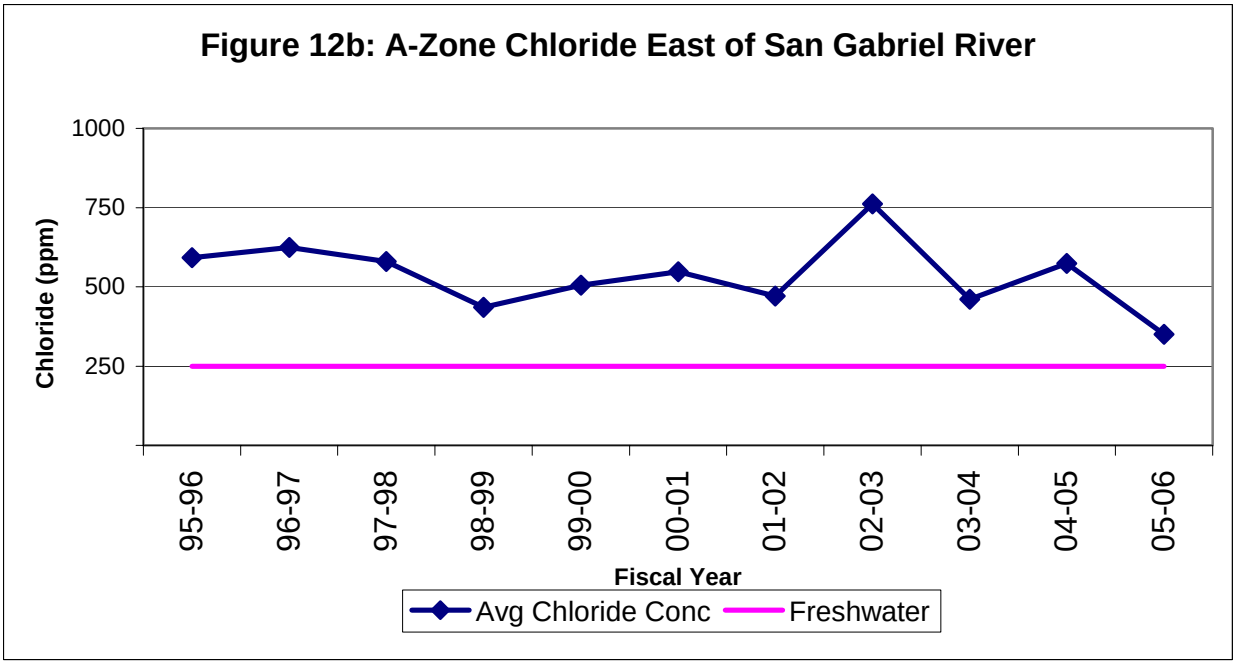


Figure 12b: A-Zone Chloride East of San Gabriel River
1000
750
500
250
Chloride (ppm)
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

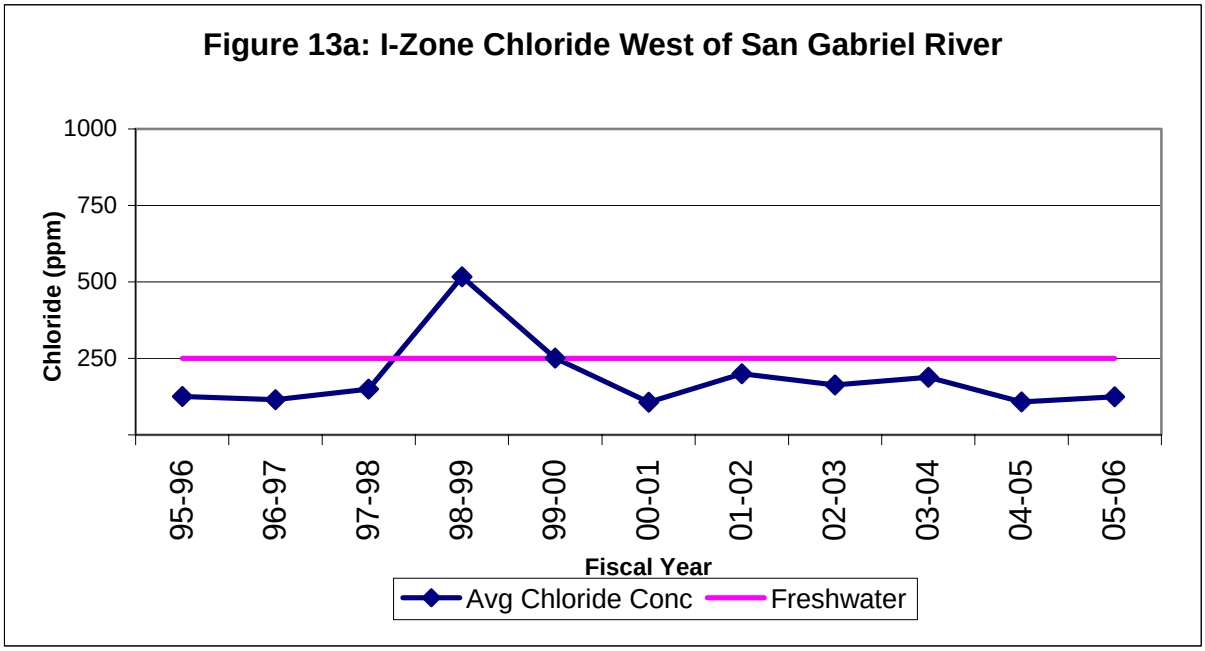


Figure 13a: I-Zone Chloride West of San Gabriel River
1000
750
500
250
Chloride (ppm)
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

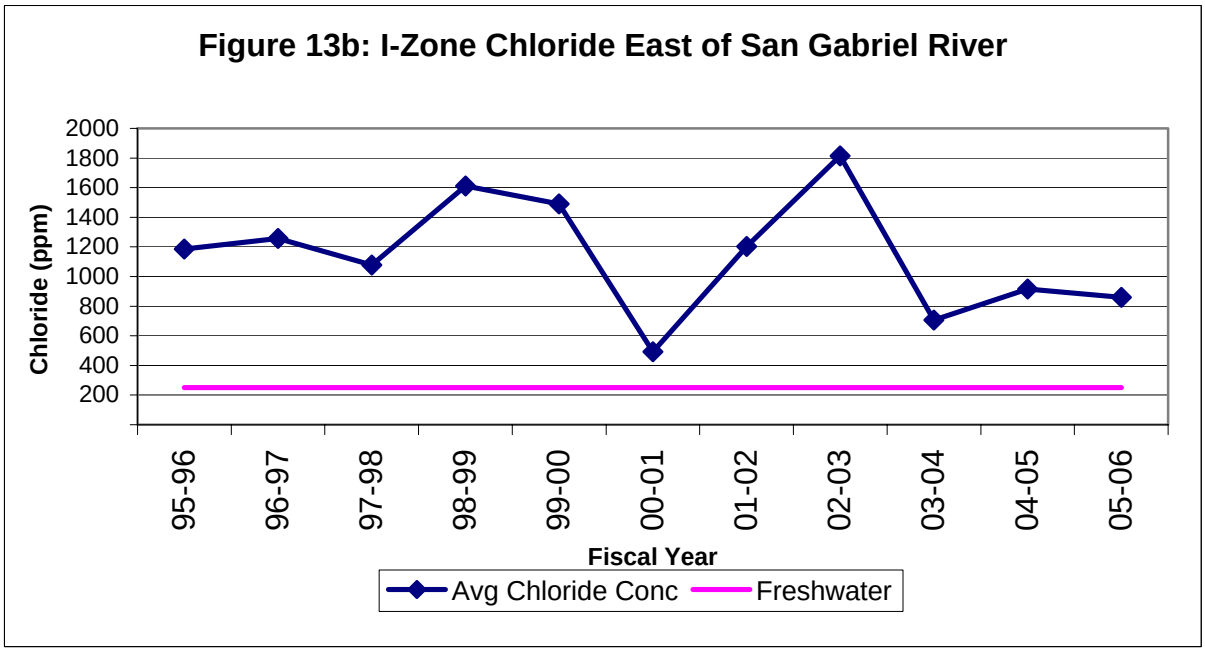


Figure 13b: I-Zone Chloride East of San Gabriel River
2000
1800
1600
1400
1200
1000
800
600
400
200
Chloride (ppm)
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05
05-06
Fiscal Year
Avg Chloride Conc
Freshwater

FINANCING AND COSTS

This section of the report is divided into three parts: Water Costs, Services and Supplies Costs (operation and maintenance), and Fixed Assets Costs (capital outlay). Under the terms of the Cooperative Agreement, fixed assets are divided into facilities paid for by the County of Los Angeles Flood Control District, facilities paid for by the Orange County Water District, and joint facilities paid for by both agencies.

WATER COSTS

During the 2005-06 fiscal year, 3,458 acre-feet of water were injected at a total cost of $1,602,015. The monthly water rates from July 2005 to June 2006 varied periodically as shown in Table 1. The monthly quantity of water injected and the total water costs paid by the respective agencies are shown below in Table 4.

TABLE 4. QUANTITY OF WATER INJECTED AND COSTS

MONTH	AMT BY WATER REPLENISHMENT DISTRICT (AF)	AMT BY ORANGE COUNTY WATER DISTRICT (AF)	TOTAL AMT (AF)
Jul-05	292.5	114.2	406.7
Aug-05	262.7	132.4	395.1
Sep-05	191.4	67.7	259.1
Oct-05	272.0	58.7	330.7
Nov-05	336.4	78.3	414.7
Dec-05	261.2	85.6	346.8
Jan-06	215.3	77.8	293.1
Feb-06	246.3	80.2	326.5
Mar-06	328.4	93.9	422.3
Apr-06	204.5	30.3	234.8
May-06	0.0	0.0	0.0
Jun-06	20.4	7.6	28.0
TOTAL INJECTED (AF)	2631.1	826.7	3457.8
TOTAL COST ($) [From Tbl. 1]	**$1,220,115**	**$381,900**	**$1,602,015**

SERVICES AND SUPPLIES COSTS

A total of $1,608,313 was expended on services and supplies during the 2005-06 fiscal year (not including liability insurance and water costs). Of this total, $2,857 was charged to extraction well maintenance. Pursuant to the Cooperative Agreement, the Orange County Water District pays a percentage of the services and supplies costs for injection operations proportional to the percentage of the total amount of injection water paid for by the District. The distribution of 2005-06 services and supplies costs for injections are summarized in Table 5:

TABLE 5. DISTRIBUTION OF SERVICES AND SUPPLIES COSTS FOR INJECTION AND EXTRACTION ACTIVITIES

ITEM	LOS ANGELES COUNTY	ORANGE COUNTY	TOTAL
Operation and Maintenance of Injection Facilities (including Observation Wells)	$1,038,376	$335,586	$1,373,962
Operation and Maintenance of Extraction Facilities	$2,857	$0	$2,857
Special Programs	$231,494	$0	$231,494
SUBTOTAL	**$1,272,727**	**$335,586**	**$1,608,313**
Liability Insurance	$15,171	$15,171	$30,342
TOTAL	**$1,287,898**	**$350,757**	**$1,638,655**

The yearly costs of the services and supplies for injection operations, excluding water costs, are shown on the following page in Table 6.

TABLE 6. COSTS OF SERVICES AND SUPPLIES FOR INJECTION

Fiscal Year	Volume of Water Injected (Ac-Ft)	Total Cost	Cost Per Ac-Ft Injected
1965-66	4,076.3	$171,888	$42.17
1966-67	3,647.1	$159,711	$43.79
1967-68	4,530.9	$210,115	$46.37
1968-69	5,530.9	$160,983	$29.11
1969-70	4,605.9	$131,929	$28.64
1970-71	4,185.5	$136,937	$32.72
1971-72	4,820.6	$138,043	$28.64
1972-73	4,999.6	$105,883	$21.18
1973-74	6,893.9	$181,518	$26.33
1974-75	5,926.6	$201,183	$33.95
1975-76	4,744.5	$213,504	$45.00
1976-77	5,233.1	$279,440	$53.40
1977-78	5,017.5	$225,982	$45.04
1978-79	5,070.8	$233,358	$46.02
1979-80	4,842.3	$252,359	$52.12
1980-81	4,107.3	$319,641	$77.82
1981-82	4,858.9	$436,558	$89.85
1982-83	5,197.7	$403,241	$77.58
1983-84	4,024.0	$489,302	$121.60
1984-85	4,724.4	$457,116	$96.76
1985-86	4,609.9	$427,278	$92.69
1986-87	6,958.3	$433,325	$62.27
1987-88	6,537.8	$441,706	$67.56
1988-89	5,599.3	$723,965	$129.30
1989-90	5,755.8	$515,964	$89.64
1990-91	6,167.7	$464,584	$75.33
1991-92	5,757.5	$865,016	$150.24
1992-93	5,240.8	$692,864	$132.21
1993-94	4,144.8	$584,975	$141.13
1994-95	3,495.7	$651,845	$186.47
1995-96	5,269.0	$509,377	$96.67
1996-97	5,739.4	$408,064	$71.10
1997-98	5,335.8	$923,342	$173.05
1998-99	5,330.4	$795,044	$149.15
1999-00	6,077.9	$589,168	$96.94
2000-01	5,398.8	$961,649	$178.12
2001-02	6,061.7	$713,299	$117.67
2002-03	5,012.3	$1,555,921	$310.42
2003-04	5,879.7	$730,652	$124.27
2004-05	5,066.1	$918,020	$181.21
2005-06	3,457.8	$1,605,456	$464.30

The costs of the services and supplies for extraction operations for past years, including electrical costs, are shown in Table 7.

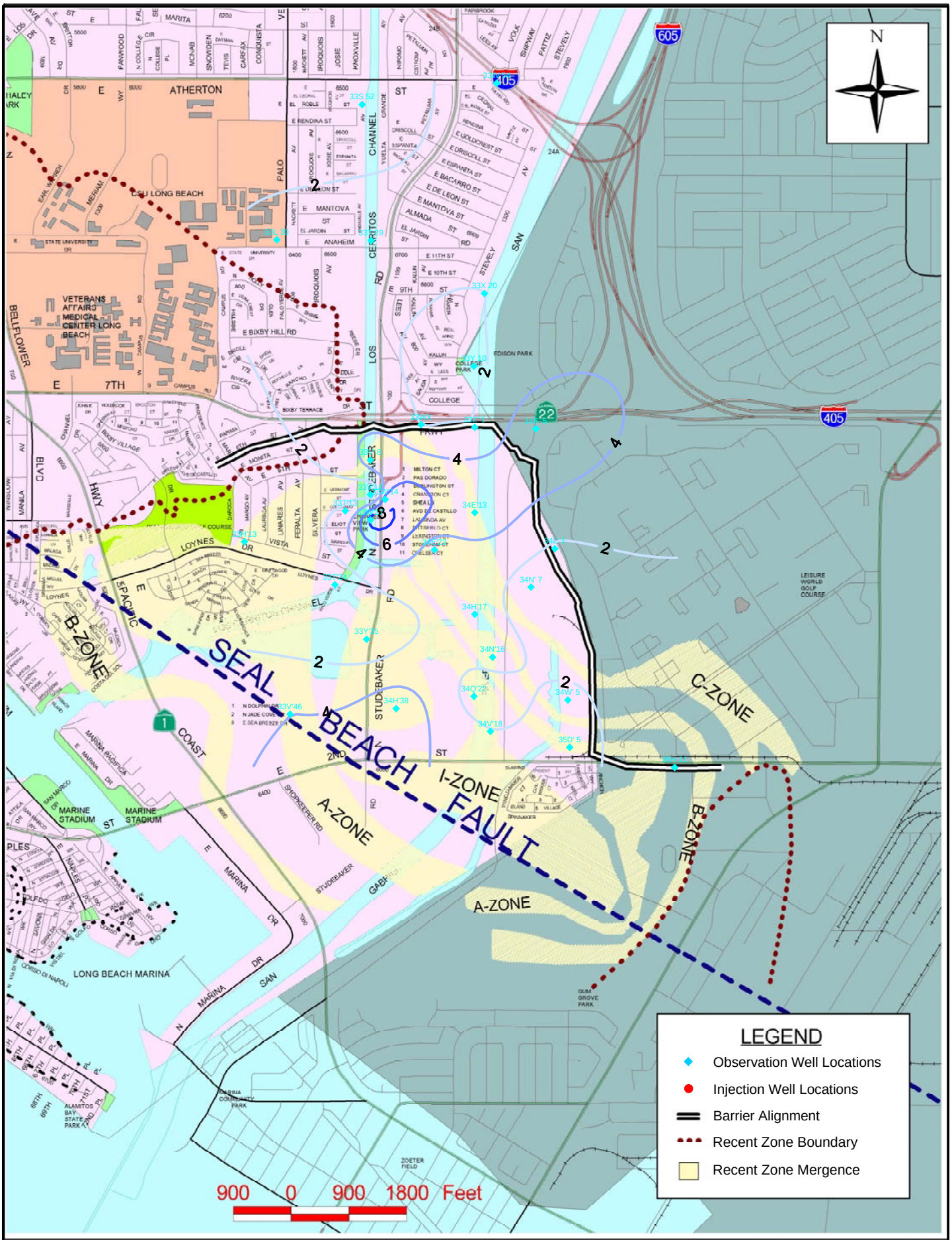
TABLE 7. COSTS OF SERVICES AND SUPPLIES FOR EXTRACTION

Fiscal Year	Volume of Water Extracted (Ac-Ft)	Total Cost	Cost Per Ac-Ft Extracted
1965-66	2,429.3	$33,654	$13.85
1966-67	2,215.4	$48,594	$21.93
1967-68	1,748.6	$57,451	$32.86
1968-69	1,832.8	$50,658	$27.64
1969-70	1,615.7	$39,862	$24.67
1970-71	1,420.5	$32,963	$23.21
1971-72	1,407.3	$23,719	$16.85
1972-73	1,078.6	$14,189	$13.16
1973-74	843.9	$36,209	$42.91
1974-75	133.5	$93,303	$698.90
1975-76	1,134.5	$84,837	$74.78
1976-77	1,283.4	$85,199	$66.39
1977-78	1,363.9	$84,029	$61.61
1978-79	1,326.6	$53,744	$40.51
1979-80	1,215.7	$34,737	$28.57
1980-81	722.6	$79,540	$110.07
1981-82	686.6	$97,808	$142.45
1982-83	962.3	$90,630	$94.18
1983-84	1,466.6	$64,734	$44.14
1984-85	1,621.3	$105,058	$64.80
1985-86	1,640.3	$92,586	$56.44
1986-87	1,700.7	$84,447	$49.65
1987-88	1,513.9	$71,700	$47.36
1988-89	1,522.4	$99,315	$65.24
1989-90	1,544.8	$66,717	$43.19
1990-91	1,278.0	$172,230	$134.77
1991-92	1,378.4	$151,520	$109.92
1992-93	1,136.1	$99,099	$87.23
1993-94	992.0	$169,621	$170.99
1994-95	940.7	$148,122	$157.46
1995-96	998.4	$130,901	$131.11
1996-97	1,200.9	$51,077	$42.53
1997-98	883.5	$64,774	$73.32
1998-99	775.6	$52,043	$67.10
1999-00	679.9	$41,320	$60.77
2000-01	404.8	$49,769	$122.95
2001-02	495.0	$53,153	$107.38
2002-03	262.7	$63,165	$240.45
2003-04	0.0	$6,068	N/A
2004-05	0.0	$3,043	N/A
2005-06	0.0	$2,857	N/A

HYDROELECTRIC REVENUES

No hydroelectric power was generated at the water supply pressure regulation station during the 2005-06 fiscal year.

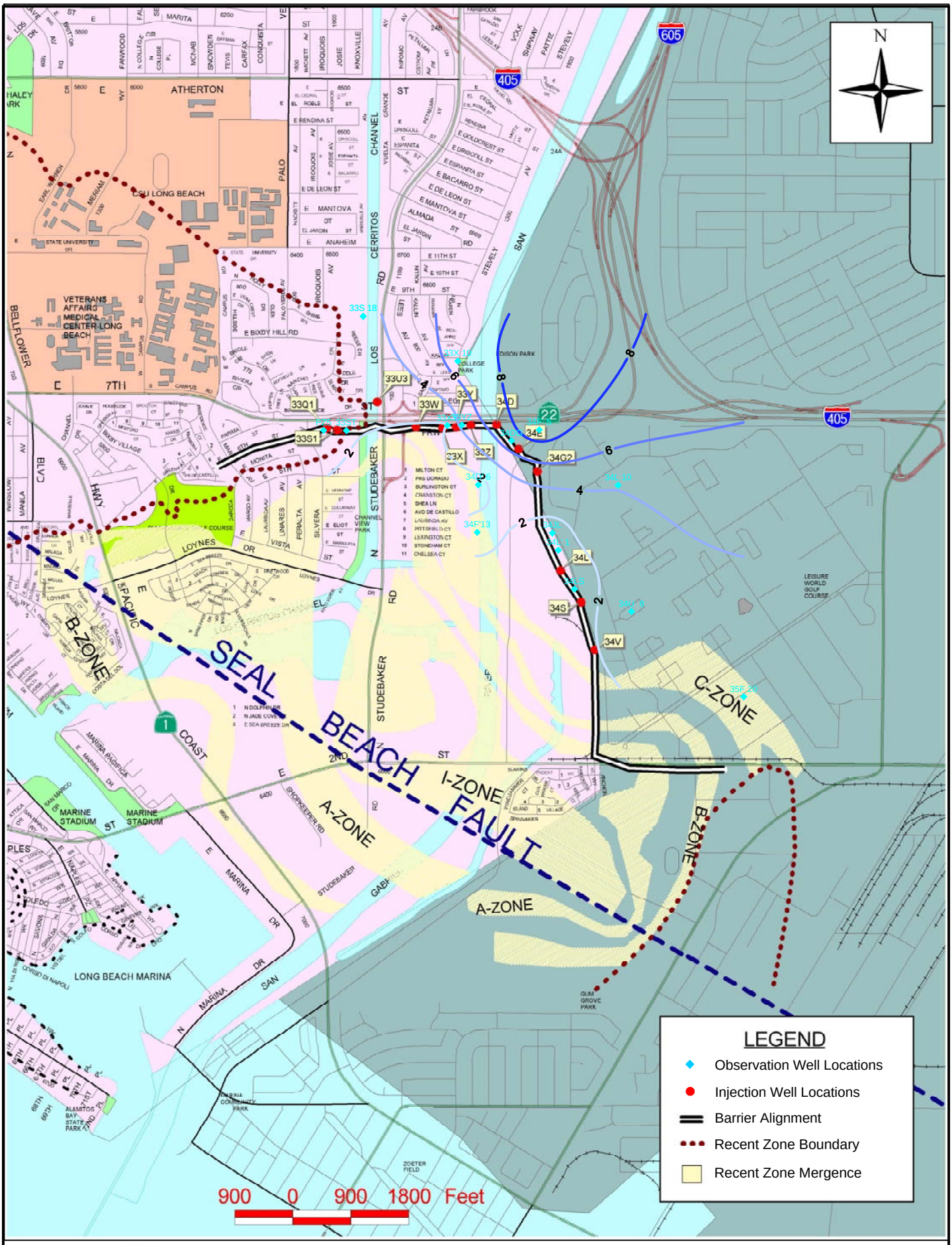
The hydroelectric plant has long been out of service and is currently being decommissioned as part of the pressure regulation vault renovation project.



Alamitos Barrier Project
R Zone Groundwater Elevation (ft) Contours - March/April 2006

A-1

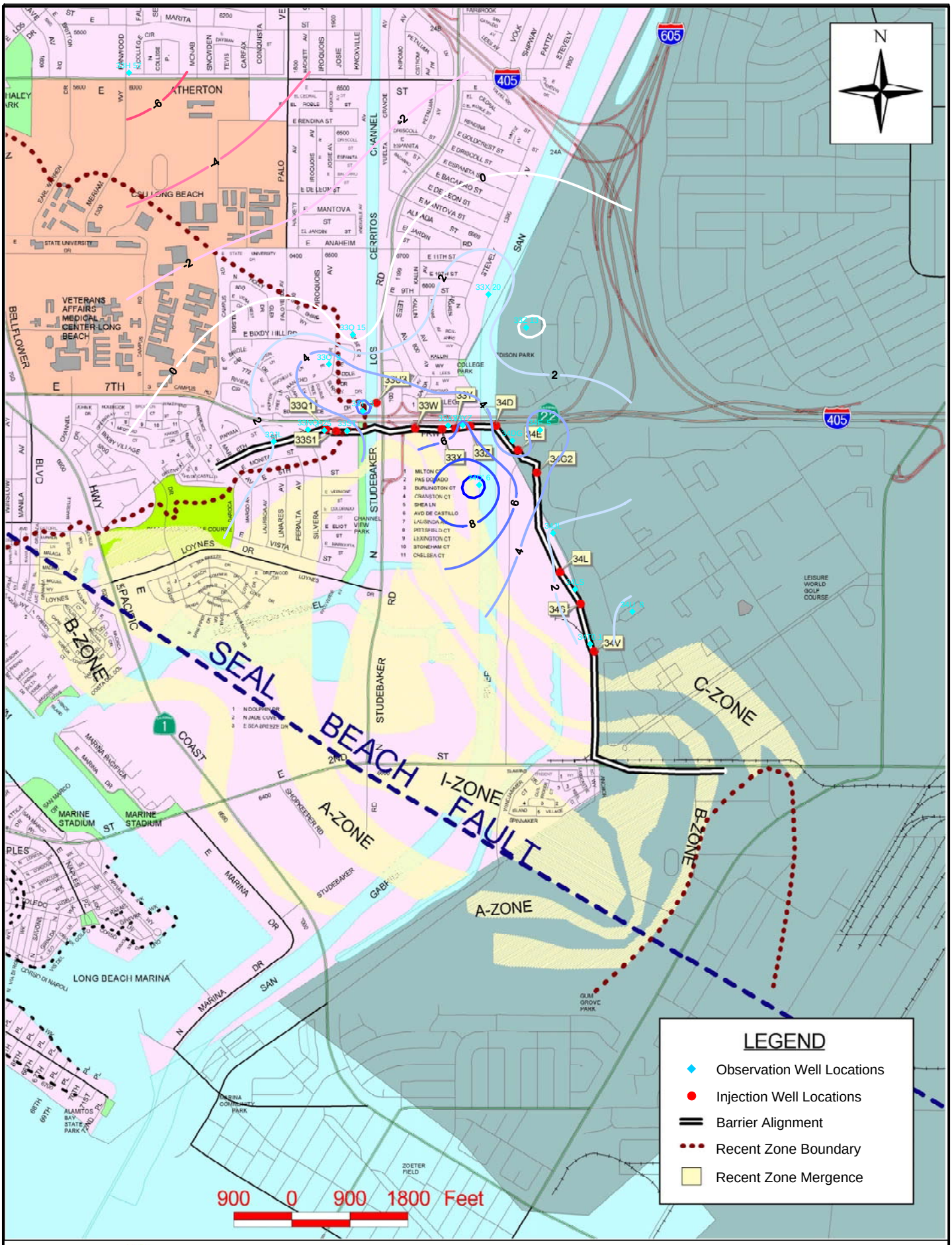
R zone GW.srf



Alamitos Barrier Project
C Zone Groundwater Elevation (ft) Contours - March/April 2006

A-2

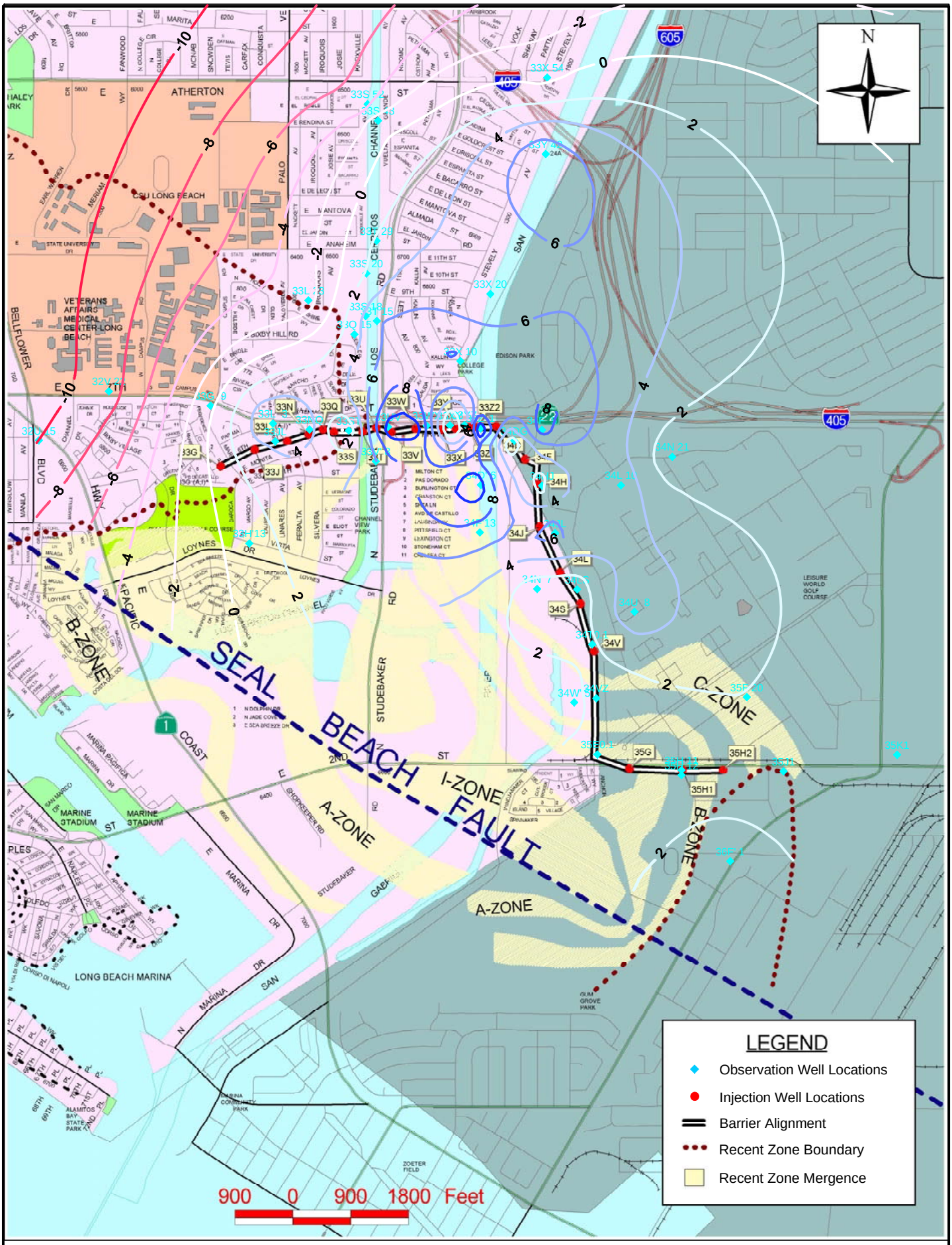
C zone GW.srf



Alamitos Barrier Project
B Zone Groundwater Elevation (ft) Contours - March/April 2006

A-3

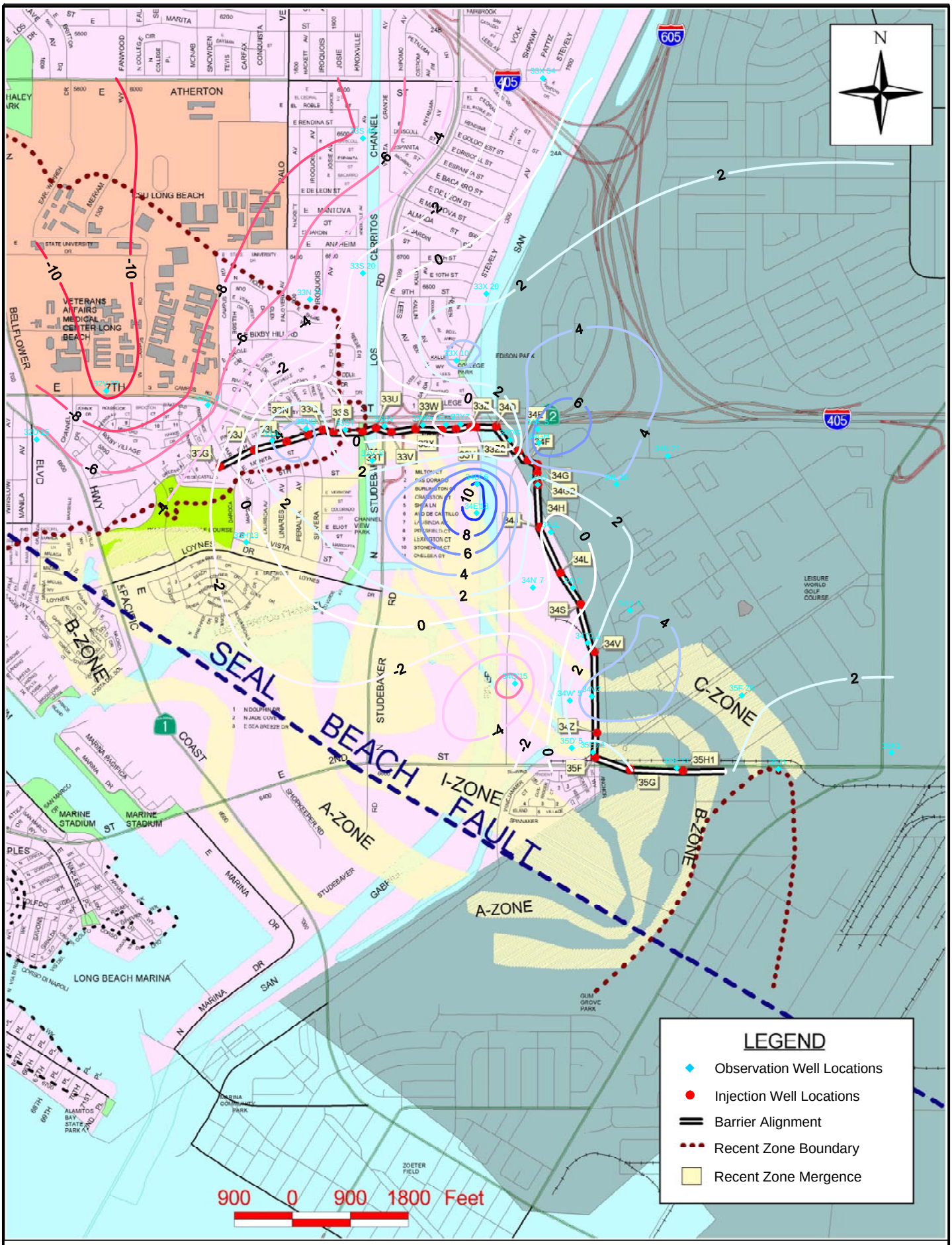
B zone GW.srf



Alamitos Barrier Project
A Zone Groundwater Elevation (ft) Contours - March/April 2006

A-4

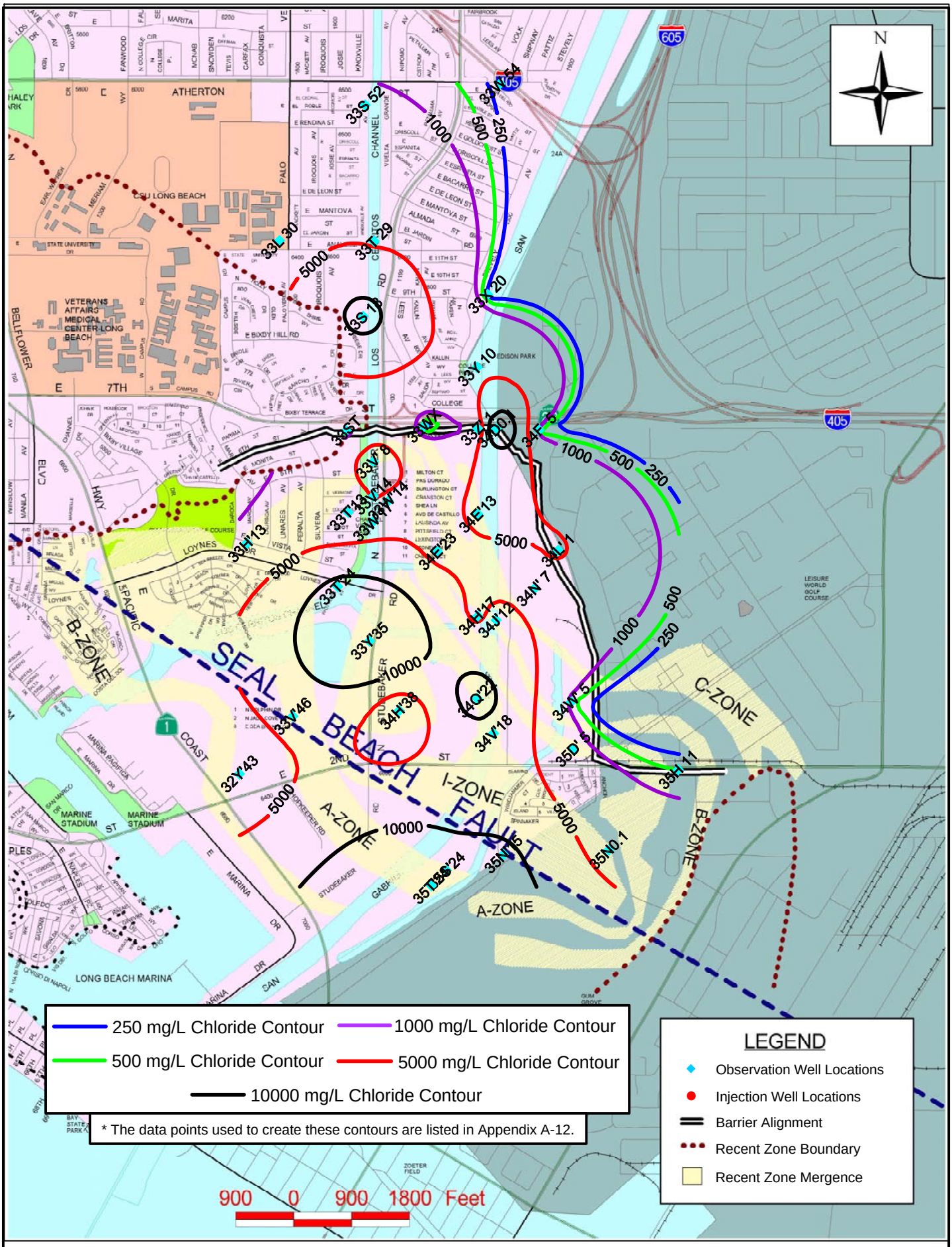
A zone GW.srf



Alamitos Barrier Project
I Zone Groundwater Elevation (ft) Contours - March/April 2006

A-5

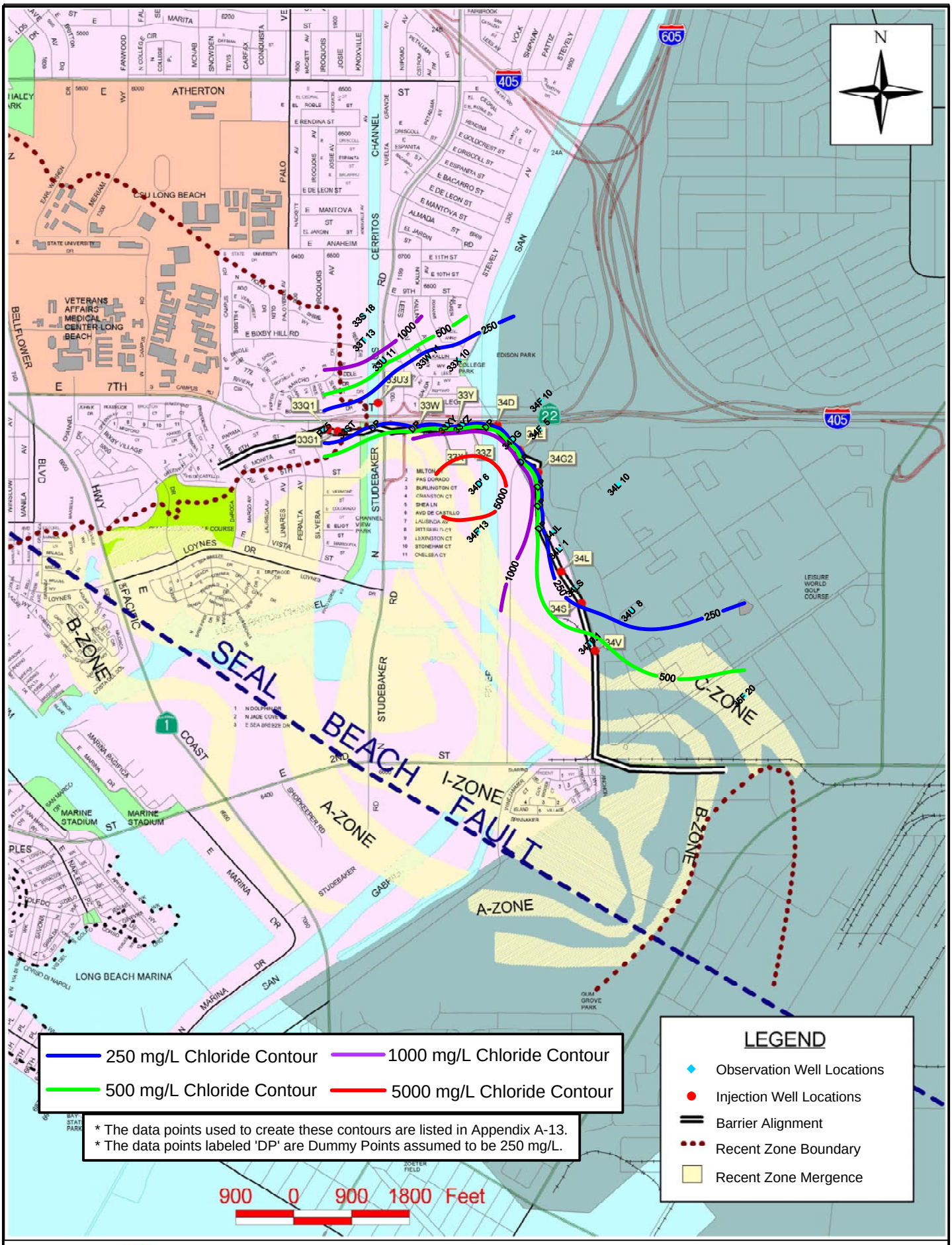
I zone GW.srf



Alamitos Barrier Project
R Zone Chloride Concentration (mg/L) Contours - June 2006*

A-6

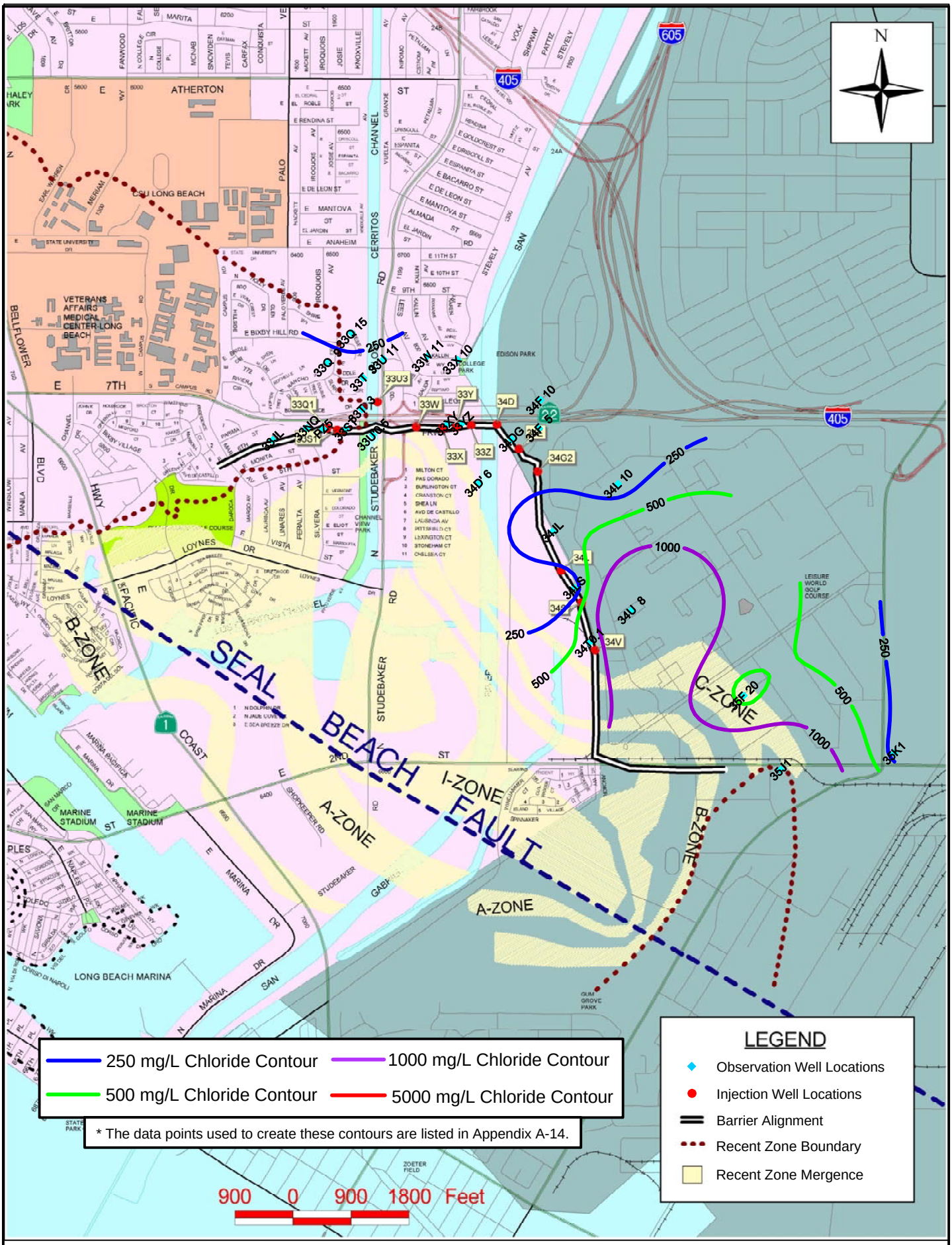
R zone CL.srf



Alamitos Barrier Project
C Zone Chloride Concentration (mg/L) Contours - June 2006*

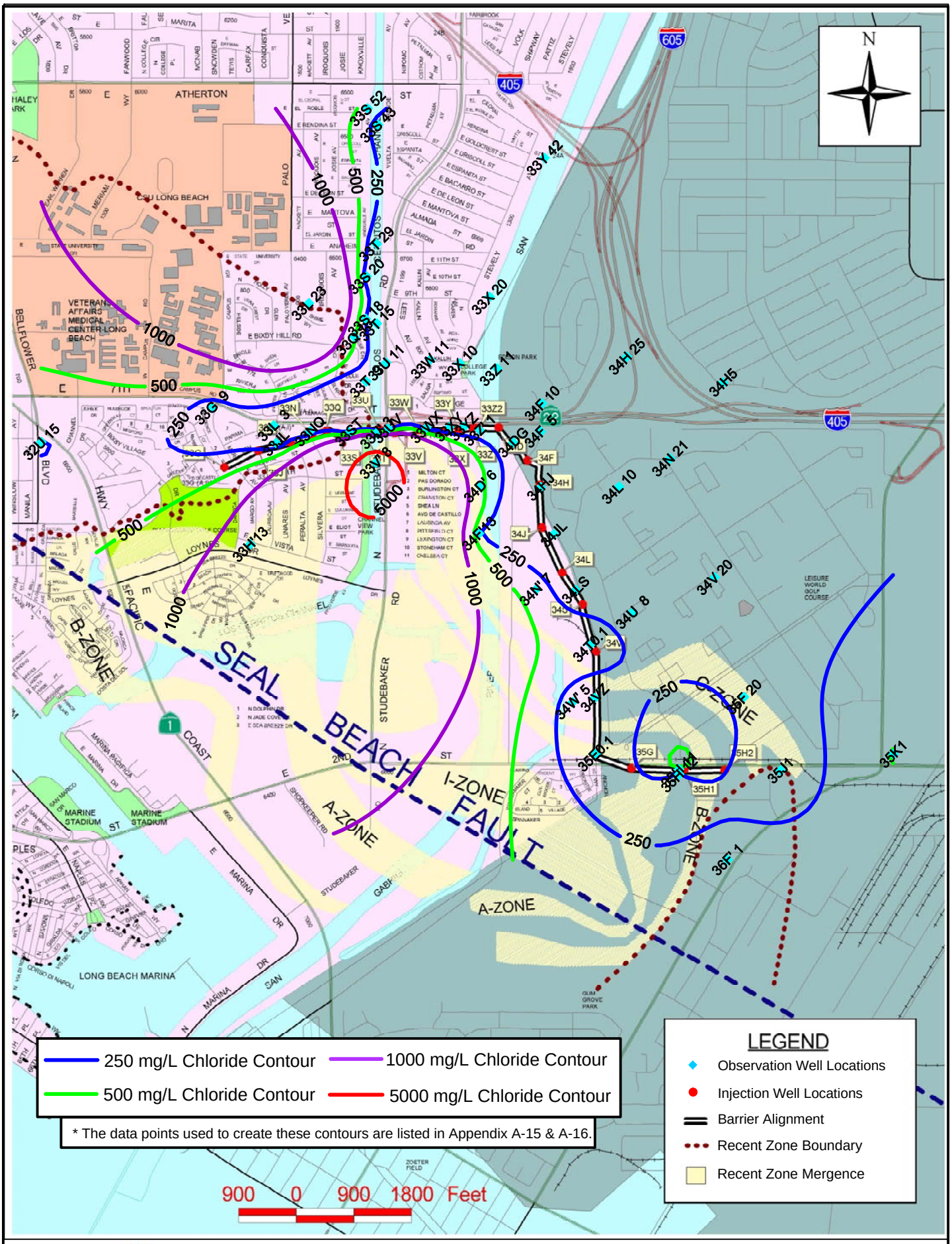
A-7

C zone CL.srf



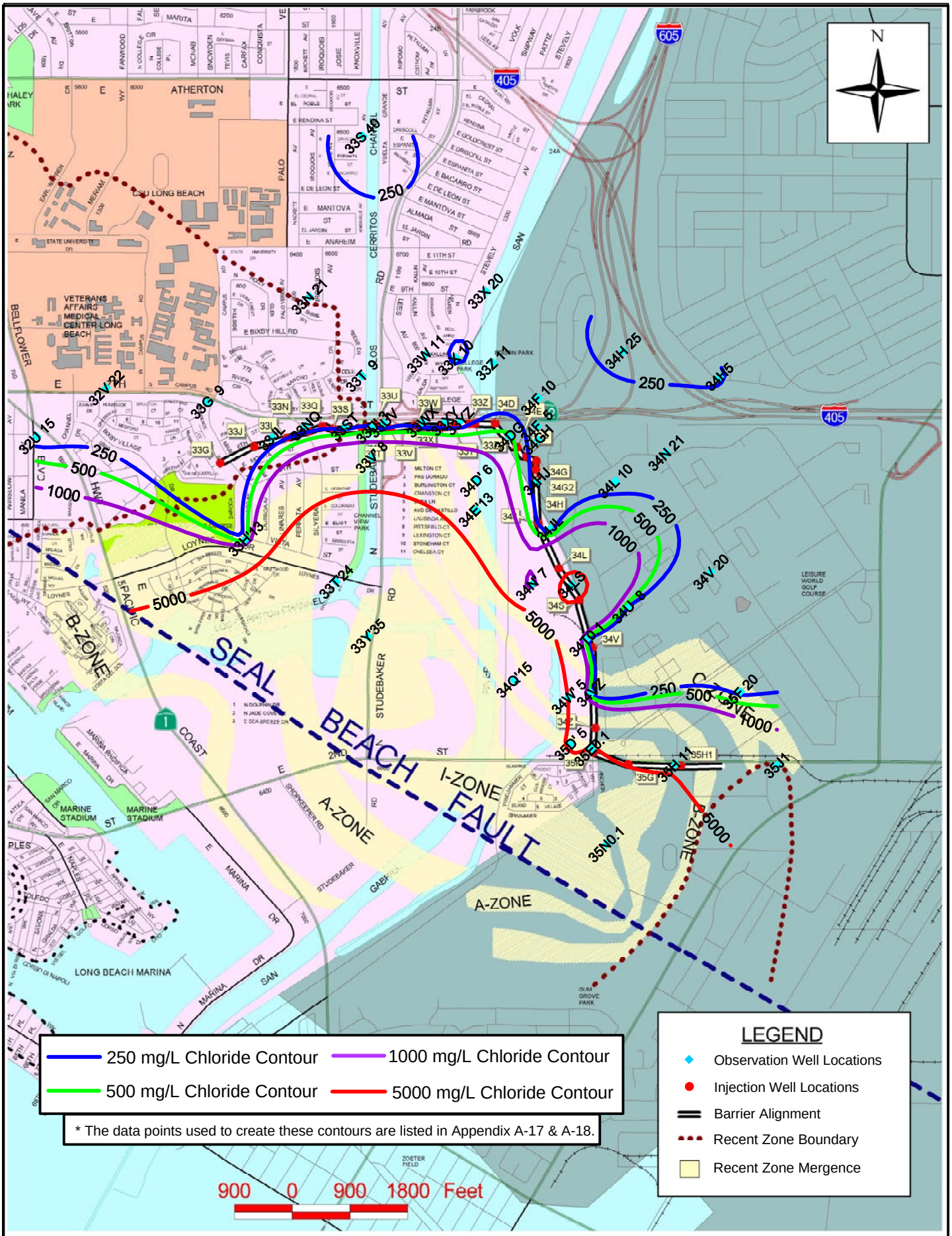
Alamitos Barrier Project
B Zone Chloride Concentration (mg/L) Contours - June 2006*

B zone CL.srf



Alamitos Barrier Project
A Zone Chloride Concentration (mg/L) Contours - June 2006*

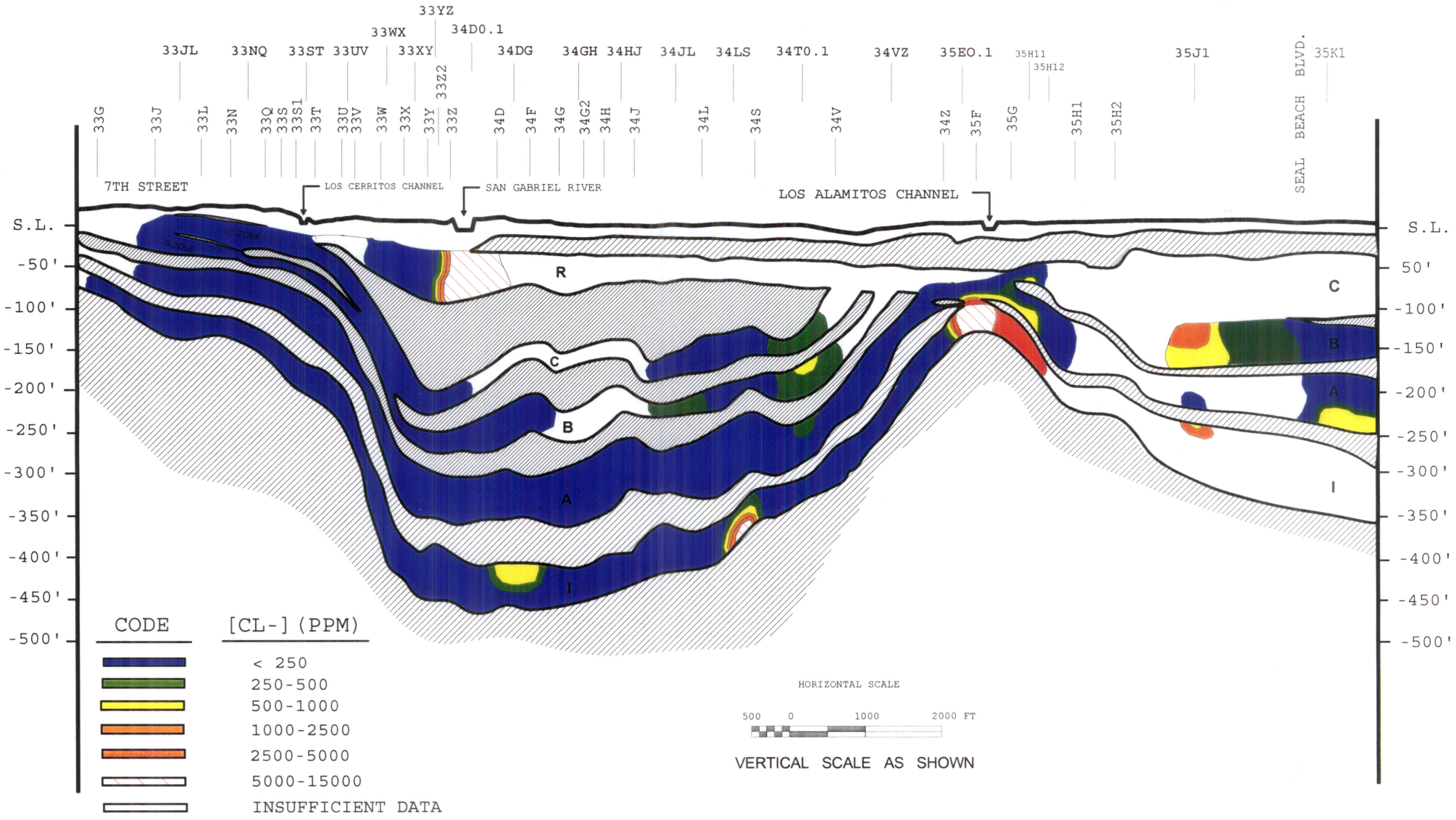
A zone CL.srf



Alamitos Barrier Project
I Zone Chloride Concentration (mg/L) Contours - June 2006*

A-10

I zone CL.srf



CHLORIDE SECTION ALONG THE BARRIER

June 2006

NOTE: The data points used to create this cross section are listed in the Appendix (A-12 through A-18).

ALAMITOS BARRIER PROJECT
RECENT-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

PROJ	FCD	DATE	REF PT EL.	AQUIFER	For Cross-Section **(Internodal Wells in Bold)**						For Contours
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHLORIDE
32Y'43	493WW	20060626	4.10	R	-43	1825					1825
33H'13	493YY	20060613	9.20	(R,A)	-18	650	-38	660	-58	1425	1425
33L 30	491G	20060214	10.00	R	-50	2300					2300
33S 18	*492AH*	*20040107*	*10.80*	*R*	*-67*	*12200*					*12200*
33ST	**492BK**	**20060209**	**14.90**	**(C,B)/R**	**-25**	**120**					**120**
33S 52	491J	20060222	12.50	R	-54	1300					1300
33T 29	491D	20060613	10.70	R	-56	4600					4600
33T'13	492AU	20060613	10.00	R	-41	700	-51	1275			1275
33T'24	493SS	20060221	8.00	R	-29	11600					11600
33V' 8	492BY	20060619	10.00	(R,A)	-24	8200	-54	3550			8200
33V'14	492JJ	20060619	9.60	R	-71	5200					5200
33V'46	493UU	20060223	5.40	R	-61	6600					6600
33W 54	501C	20060608	13.50	R	-33	82	-53	142			142
33W'14	492AT	20060615	15.70	R	-46	775	-66	4000			4000
33W'17	493PP	20060619	9.30	R	-41	2900	-51	3500			3500
33WX	**502AZ**	**20060207**	**10.00**	**R**	**-45**	**80**					**80**
33X 20	502L	20060216	23.40	R	-62	62					62
33Y 10	502BA	20060612	23.00	R	-58	760	-87	4350			4350
33Y'35	493AB	20060615	12.50	R	-36	19900					19900
33Z' 1	502AU	20060523	20.90	R	-46	1100	-56	1050			1100
34D0.1	**502AX**	**20060531**	**21.00**	**R**	**-57**	**17000**					**17000**
34E'13	503AU	20060620	21.00	R	-19	2550	-57	5600			5600
34E'23	503X	20060612	10.10	R	-43	4100					4100
34F 5	502BT	20060502	9.10	R	-136	175	-146	180	-156	285	285
34H'17	503Y	20060621	19.60	R	-46	4000					4000
34H'38	493QQ	20060615	9.40	R	-33	500					500
34J'12	503U	20060621	19.80	R	-28	2500	-36	7350			7350
34L' 1	503P	20060221	10.10	R	-62	5550					5550
34N' 7	503AE	20060621	7.00	R	-51	240	-61	335	-71	2700	2700
34Q'22	503T	20060216	18.30	R	-42	10750	-57	12450			12450
34V'18	503V	20060621	18.30	R	-48	8150					8150
34W' 5	503AH	20060622	13.60	R	-51	535					535
35D' 5	503AL	20060622	13.20	R	-57	1750					1750
35H 11	**514F**	**20060215**	**7.00**	**R**	**-42**	**90**	**-65**	**505**			**505**
35N0.1	504M	20060614	7.30	R	-38	480	-68	3150			3150
35N'15	504P	20060614	7.40	R	-33	780	-58	11300			11300
35S'24	*504K*	*20040127*	*7.30*	*R*	*-55*	*11650*					*11650*
35T'24	504A	20060620	7.90	(R,M)	-67	14500	-134	15800	-201	19300	19300

italicized wells are old values, but included because they're reasonably recent and their historical values are consistently in this range

ALAMITOS BARRIER PROJECT
C-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

PROJ	FCD	DATE	REF PT EL.	AQUIFER	For Cross-Section **(Internodal Wells in Bold)**						For Contours
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHLORIDE
33S 18	492AG	20060607	10.60	C	-225	2350					2350
33ST	**492BK**	**20060209**	**14.90**	**(C,B)**	**-25**	**120**					**120**
DP											**250**
33T 13	492AC	20060214	11.40	C	-199	1800					1800
33U 11	492AL	20060523	13.30	C	-186	580					580
DP											**250**
33W 11	502R	20060213	8.90	C	-183	85	-216	98			98
33X 10	502BB	20060612	10.00	C	-190	84	-215	84			84
33XY	**502BL**	**20060515**	**10.00**	**C**	**-195**	**74**	**-210**	**78**			**78**
33YZ	**502AB**	**20060209**	**10.60**	**C**	**-195**	**72**	**-210**	**72**			**72**
34D' 6	502BF	20060620	20.30	C	-125	11600					11600
DP											**250**
34DG	**502X**	**20060511**	**8.00**	**C**	**-190**	**66**	**-205**	**66**			**66**
DP											**250**
34F 5	502BU	20060502	9.30	C	-191	76	-201	78	-211	78	78
34F 10	502AP	20060517	8.80	C	-211	76					76
DP											**250**
DP											**250**
34F'13	503R	20060216	21.00	C	-79	2500					2500
34JL	**503AR**	**20060221**	**7.20**	**C**	**-161**	**138**					**138**
34L' 1	503N	20060221	10.30	C	-162	60					60
34L 10	502AK	20060614	5.60	C	-169	86					86
DP											**250**
34LS	**503BF**	**20060503**	**7.00**	**C**	**-133**	**100**	**-151**	**78**	**-163**	**84**	**100**
34T0.1	503AB	20060503	6.10	~~B~~ C	-134	285					610
34U 8	513D	20060215	5.40	C	-150	116	-165	110			116
35F 20	513L	20060215	6.50	C	-70	190	-78	410	-85	610	610
PZ5	**492CH**	**20060607**	**16.30**	**(C,B)**	**-25**	**42**					**42**

DP = Dummy point with an assumed chloride concentration of 250 mg/L

ALAMITOS BARRIER PROJECT
B-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

PROJ	FCD	DATE	REF PT EL.	AQUIFER	For Cross-Section **(Internodal Wells in Bold)**						For Contours
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHLORIDE
33JL	**492BQ**	**20060209**	**16.00**	**B**	**3**		**-7**	**135**			**135**
33NQ	**492BN**	**20060510**	**18.40**	**B**	**-4**		**-15**	**44**			**44**
33Q 9	492CM	20060608	35.00	B	-85	82	-95	84	-105	140	140
33Q 15	492AN	20060214	10.00	B	-268	400					400
33ST	**492BK**	**20060209**	**14.90**	**(C,B)**	**-25**	**120**					**120**
33T 3	492CL	20060606	10.00	B	-40	40	-57	42	-75	46	46
33T 9	492YY	20060530	11.20	B	-168	100					100
33U 11	*492AK*	*20050607*	*12.60*	*B*	*-265*	*170*					*170*
33U'0.5	*492BZ*	*20030313*	*10.00*	*B*	*-58*	*212*					*212*
33W 11	502S	20060213	8.90	B	-241	164	-271	210			210
33X 10	502BC	20060612	10.00	B	-275	88					88
33XY	**502BM**	**20060515**	**10.00**	**B**	**-245**	**60**					**60**
33YZ	**502AC**	**20060209**	**10.60**	**B**	**-214**	**70**	**-264**	**70**			**70**
34D' 6	502BG	20060620	20.30	B	-180	125	-200	90			125
34DG	**502Y**	**20060511**	**8.00**	**B**	**-232**	**50**	**-257**	**50**			**50**
34F 5	502BS	20060503	9.30	B	-231	74	-271	76			76
34F 10	502AQ	20060517	8.80	B	-271	82					82
34JL	**503AQ**	**20060221**	**7.20**	**B**	**-196**	**495**	**-211**	**460**			**495**
34L 10	502AL	20060614	5.60	B	-224	88	-249	88			88
34LS	**503BE**	**20060503**	**7.00**	**B**	**-188**	**78**					**78**
34T0.1	503AC	20060503	6.10	~~A~~ B	-174	630	-207	410			630
34U 8	513E	20060215	5.40	B	-225	2300					2300
35F 20	513K	20060215	6.50	B	-115	340					340
35J1	***514M***	***20041227***	***7.42***	***~~A~~ B***	***-135***	***2000***	***-150***	***1030***	***-155***	***555***	***2000***
35K1	***523A***	***20041227***	***7.96***	***~~A~~ B***	***-135***	***134***	***-150***	***155***	***-165***	***170***	***170***
PZ5	**492CH**	**20060607**	**16.30**	**(C,B)**	**-25**	**42**					**42**

italicized wells are old values, but included because they're reasonably recent and their historical values are consistently in this range

ALAMITOS BARRIER PROJECT
A-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

PROJ	FCD	DATE	REF PT EL.	AQUIFER	For Cross-Section (**Internodal Wells in Bold**)						For Contours
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHLORIDE
32U 15	482M	20060213	51.00	A	-17	240					240
33G 9	482F	20060605	57.20	A	57		-23	122			122
33H'13	493YY	20060613	9.20	(R,A)	-18	650	-38	660	-58	1425	1425
33JL	**492BW**	**20060209**	**16.00**	**(A,I)**	**-41**	**84**	**-79**	**80**	**-116**	**84**	**84**
33L 3	492	20060606	25.20	A	-60	74					74
33L 23	492RR	20060214	9.40	A	-344	3800					3800
33NQ	**492BP**	**20060510**	**18.40**	**(A,I)**	**-49**	**64**	**-93**	**46**	**-137**	**38**	**64**
33Q 15	492AM	20060214	10.90	A	-340	500					500
33S 18	492AE	20060607	11.10	A	-351	200					200
33S 20	492BR	20060607	8.90	A	-317	88	-336	76	-355	92	92
33S 43	491E	20060608	13.00	A	-333	142	-344	136			142
33S 52	491H	20060222	12.50	A	-284	450	-309	400			450
33ST	**492BL**	**20060209**	**14.90**	**A**	**-65**	**58**	**-86**	**64**	**-100**	**56**	**64**
33T 9	492TT	20060530	10.50	A	-262	96					96
33T 15	492SS	20060612	11.20	A	-334	108					108
33T 29	491C	20060613	12.20	A	-350	36					36
33U 11	492AJ	20061220	13.60	A	-348	138					138
33U' 3	492WW	20060615	10.90	A	-89	310					310
33UV	**492BH**	**20060510**	**10.80**	**A**	**-106**	**48**	**-131**	**46**	**-155**	**44**	**48**
33V' 8	492BY	20060619	10.00	(R,A)	-24	8200	-54	3550			8200
33W 11	502T	20060213	8.90	A	-321	70	-349	72	-376	82	82
33WX	**502AF**	**20060207**	**10.40**	**A**	**-258**	**64**	**-281**	**122**	**-303**	**112**	**122**
33X 10	502BD	20060619	10.00	A	-320	148	-340	120	-360	150	150
33X 20	502J	20060216	23.20	A	-359	180					180
33XY	**502BN**	**20060515**	**10.00**	**A**	**-279**	**44**	**-296**	**46**	**-314**	**46**	**46**
33Y 42	501A	20060608	24.90	A	-342	200					200
33YZ	**502AD**	**20060207**	**10.60**	**A**	**-296**	**72**	**-318**	**74**			**74**
33Z' 1	502G	20060525	20.00	A	-320	155					155
33Z 11	502V	20060517	23.10	A	-321	72	-351	70			72
34D' 6	502BH	20060620	20.30	A	-270	495	-303	260	-335	590	590
34DG	**502Z**	**20060511**	**8.00**	**A**	**-292**	**130**	**-327**	**155**			**155**
34F 5	502BR	20060502	9.50	A	-297	42	-322	80	-347	84	84
34F 10	502AR	20060517	8.80	A	-311	66	-326	78			78

ALAMITOS BARRIER PROJECT
A-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

Continued…

PROJ	FCD	DATE	REF PT EL.	AQUIFER	For Cross-Section **(Internodal Wells in Bold)**						For Contours
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHLORIDE
34F'13	503Q	20060216	21.20	A	-177	250					250
34H 25	502AH	20060223	8.20	A	-297	112	-312	114	-332	108	114
34H5	*512E*	*20041227*	*7.21*	*A*	*-305*	*82*	*-320*	*82*	*-335*	*96*	*96*
34HJ	**502BX**	**20060222**	**9.40**	**A**	**-301**	**66**	**-321**	**62**	**-331**	**66**	**66**
34JL	**503AP**	**20060221**	**7.20**	**A**	**-263**	**84**	**-288**	**76**	**-308**	**78**	**84**
34L 10	502AM	20060614	5.60	A	-310	78	-330	78	-354	72	78
34LS	**503BD**	**20060503**	**7.00**	**A**	**-238**	**72**	**-283**	**72**			**72**
34N 21	512B	20060614	6.80	A	-328	90	-354	96			96
34N' 7	503AF	20060621	7.00	A	-106	175	-144	150	-181	380	380
34T0.1	**503AC**	**20060503**	**6.10**	**A**					**-239**	**450**	**450**
34U 8	513F	20060227	5.40	A	-280	104	-310	126			126
34V 20	513B	20060525	6.30	A	-234	96	-265	88	-292	90	96
34VZ	**503BH**	**20060227**	**6.20**	**A**	**-146**	**72**	**-156**	**76**			**76**
34W' 5	503AJ	20060621	13.60	A	-81	160	-101	88	-119	115	160
35E0.1	**503BK**	**20060222**	**6.50**	**A**	**-74**	**110**					**110**
35F 20	513J	20060215	6.50	A	7		-158	210			210
35H 11	514G	20060215	7.00	A	-123	650					650
35H 12	514D	20060531	6.50	A	-137	106					106
35J1	***514L***	***20041227***	***7.42***	***~~I~~ A***	***-200***	***75***	***-215***	***610***	***-235***	***1800***	***160***
35K1	***523B***	***20041227***	***7.96***	***~~I~~ A***	***-205***	***34***	***-220***	***240***	***-235***	***515***	***110***
36F' 1	505D	20060620	35.65	A	-103	380					380

italicized wells are old values, but included because they're reasonably recent and their historical values are consistently in this range

ALAMITOS BARRIER PROJECT
I-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

PROJ	FCD	DATE	REF PT EL.	AQUIFER	For Cross-Section **(Internodal Wells in Bold)**						For Contours
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHLORIDE
32U 15	482L	20060213	51.00	I	-74	100					100
32V 22	482N	20060605	73.70	I	-46	132					132
33G 9	482G	20060606	57.20	I	-34	44	-68	60	-78	80	80
33H'13	493XX	20060613	9.20	I	-89	240					240
33JL	**492BW**	**20060209**	**16.00**	**(A,I)**	**-41**	**84**	**-79**	**80**	**-116**	**84**	**84**
33N 21	492BV	20060607	9.00	I	-457	66	-471	66			66
33NQ	**492BP**	**20060510**	**18.40**	**(A,I)**	**-49**	**64**	**-93**	**46**	**-137**	**38**	**64**
33S 40	491F	20060222	11.80	I	-470	400					400
33ST	**492BM**	**20060209**	**14.90**	**I**	**-130**	**132**	**-148**	**120**	**-165**	**120**	**132**
33T 9	*492XX*	*20050607*	*10.50*	*I*	*-373*	*112*					*112*
33T'24	493RR	20060221	8.10	I	-60	17700	-75				17700
33U' 3	492QQ	20060615	9.80	I	-147	300					300
33UV	**492BJ**	**20060510**	**10.80**	**I**	**-209**	**44**	**-228**	**42**	**-246**	**42**	**44**
33V' 8	492BX	20060619	10.00	I	-109	1700	-139	2100			2100
33W 11	502U	20060213	8.90	I	-423	70	-446	80	-468	68	80
33WX	**502AG**	**20060207**	**10.40**	**I**	**-374**	**84**	**-391**	**72**	**-408**	**70**	**84**
33X 10	502BE	20060622	10.00	I	-420	230	-440	315	-460	154	315
33X 20	502H	20060216	23.10	I	-465	220					220
33XY	**502BP**	**20060515**	**10.00**	**I**	**-404**	**62**	**-420**	**74**	**-436**	**64**	**74**
33Y'35	493ZZ	20060615	12.50	I	-67	20300					20300
33YZ	**502AE**	**20060207**	**10.60**	**I**	**-402**	**72**	**-435**	**74**			**74**
33Z 11	502W	20060517	23.10	I	-417	94	-437	90	-457	114	114
34D' 6	502BI	20060620	20.30	I	-400	280	-410	230	-420	2150	2150
34DG	**502AA**	**20060511**	**8.00**	**I**	**-402**	**455**	**-432**	**590**			**590**
34E'13	503AT	20060620	21.00	I	-289	2350	-309	2750			2750
34F 5	502BQ	20060502	9.20	I	-411	58	-426	60	-441	64	64
34F 10	502AS	20060517	8.80	I	-416	74	-446	76			76
34GH	**502BV**	**20060523**	**8.30**	**I**	**-412**	**42**	**-427**	**42**	**-442**	**44**	**44**
34H 25	502AJ	20060223	8.30	I	-407	405	-427	410	-445		410
34H5	*512D*	*20041227*	*7.21*	*I*	*-415*	*280*	*-430*	*172*	*-450*	*148*	*280*

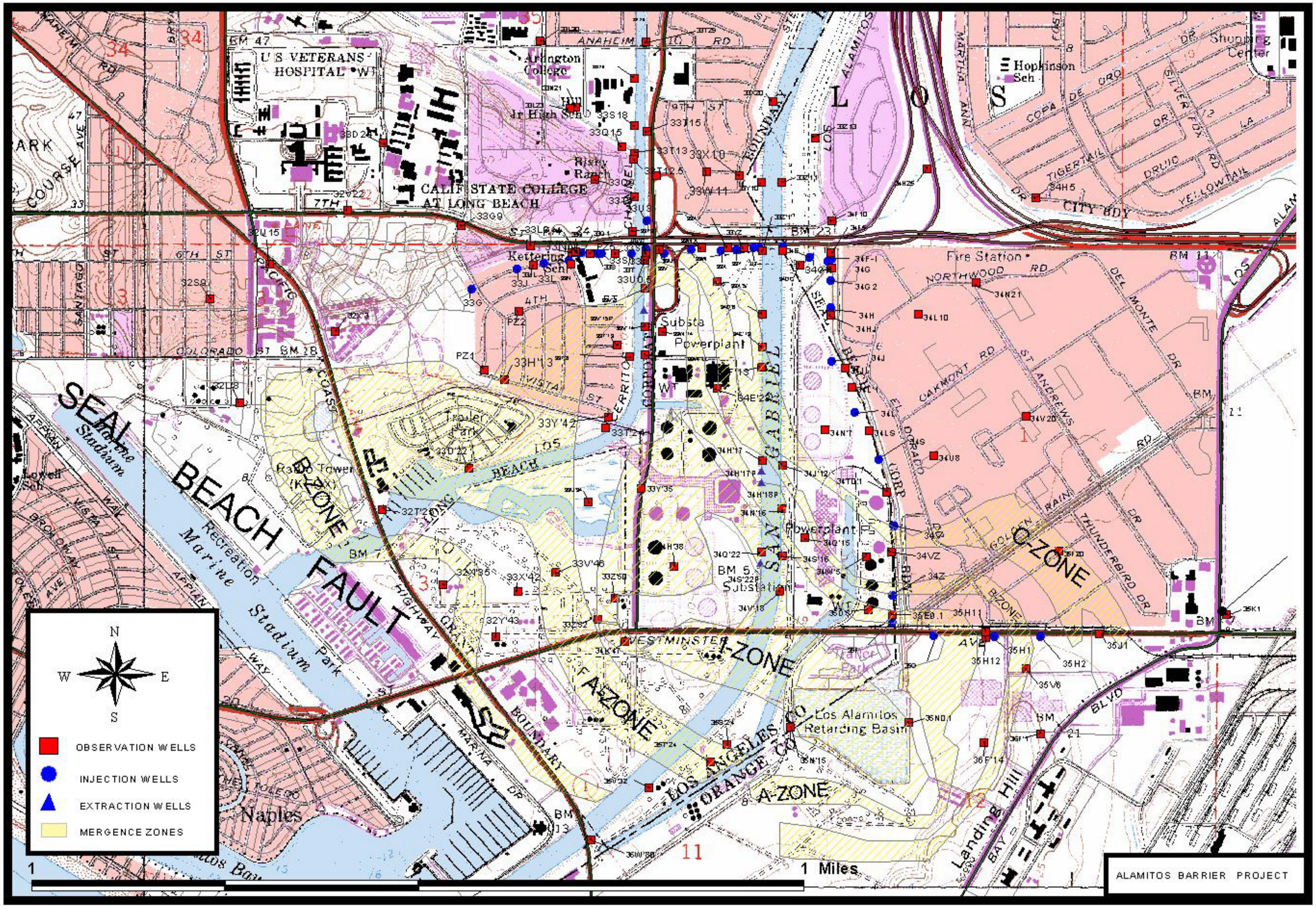
italicized wells are old values, but included because they're reasonably recent and their historical values are consistently in this range

ALAMITOS BARRIER PROJECT
I-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

Continued…

PROJ	FCD	DATE	REF PT EL.	AQUIFER	For Cross-Section **(Internodal Wells in Bold)**						For Contours
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHLORIDE
34HJ	**502BW**	**20060222**	**9.50**	**I**	**-407**	**70**	**-417**	**68**	**-427**	**100**	**100**
34JL	**503AN**	**20060221**	**7.20**	**I**	**-383**	**76**	**-402**	**72**			**76**
34L 10	502AN	20060614	5.60	I	-404	68	-439	70			70
34LS	**503BC**	**20060503**	**6.80**	**I**	**-338**	**410**	**-368**	**7250**			**7250**
34N 21	512C	20060614	6.80	I	-423	102	-453	94			102
34N' 7	503AG	20060621	7.00	I	-221	165	-254	285	-286		285
34Q'15	503H	20060621	8.30	I	-108	17200					17200
34T0.1	**503AD**	**20060503**	**6.10**	**I**	**-289**	**165**	**-312**	**104**	**-334**	**122**	**165**
34U 8	513G	20060215	5.40	I	-360	116	-375	140			140
34V 20	513C	20060525	6.30	I	-386	26					26
34VZ	**503BG**	**20060227**	**6.20**	**I**	**-214**	**74**	**-224**	**76**			**76**
34W' 5	503AK	20060622	13.60	I	-156	4900					4900
35D' 5	503AM	20060622	13.20	I	-89	4150					4150
35E0.1	**503BJ**	**20060222**	**6.50**	**I**	**-114**	**5350**					**5350**
35F 20	513H	20060215	6.50	I	-235	170	-245		-255		170
35H 11	**514G**	**20060215**	**7.00**	~~**A**~~ **I**			**-146**	**4750**			**4750**
35H 11	**514H**	**20060215**	**7.00**	**I**	**-203**	**1490**					**1490**
35J1	***514L***	***20041227***	***7.42***	***I***			***-215***	***610***	***-235***	***1800***	***1800***
35N0.1	504N	20060614	7.30	I	-76	8300					8300

italicized wells are old values, but included because they're reasonably recent and their historical values are consistently in this range


U S VETERANS HOSPITAL
Arlington College
Jr High Sch
Risley Ranch
CALIF STATE COLLEGE AT LONG BEACH
Kettering Sch
Substa
Powerplant
Fire Station
Hopkinson Sch
Shopping Center
CITY BDY
Trailer Park
Radio Tower (KFOX)
SEAL Beach Stadium
Lowell Sch
Recreation Park
Marina
Naples
Los Alamitos Retarding Basin
Landing Hill
BEACH FAULT
I-ZONE
A-ZONE
O-ZONE
BZONE
FAULT
ANAHEIM RD
7TH ST
6TH ST
4TH ST
COLORADO ST
NORTHWOOD RD
OAKMONT RD
WESTMINSTER BLVD
LOS ALAMITOS BLVD
OBSERVATION WELLS
INJECTION WELLS
EXTRACTION WELLS
MERGENCE ZONES
1 Miles
ALAMITOS BARRIER PROJECT