San Joaquin County and Delta Water Quality Coalition Groundwater Quality Assessment Report Appendix, April 27, 2015

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Contents

Figures

Tables

1. Water Level Data

a. Non-Delta

Using data provided by San Joaquin County[1], we created hydrographs from selected wells. Most wells show decreasing water level trends, however five wells show stable to increasing water level trends. Figure A1-1 shows the selected well locations associated with the following hydrographs.

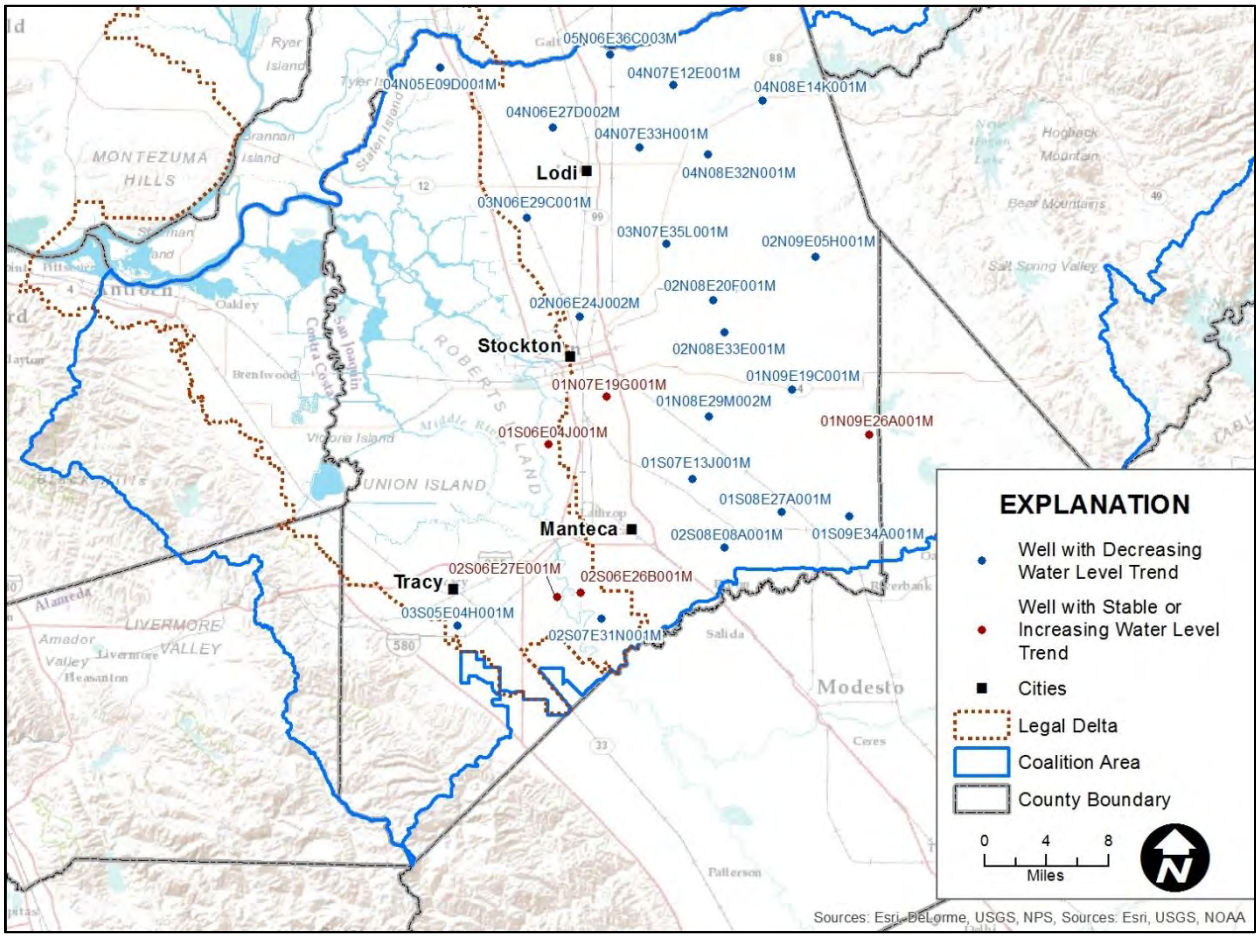
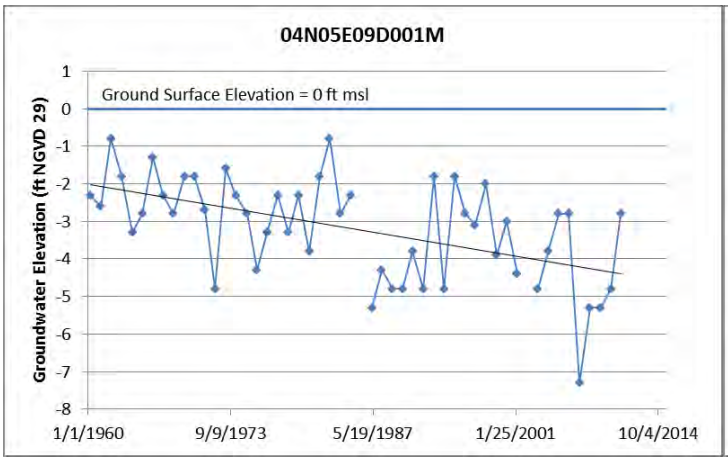
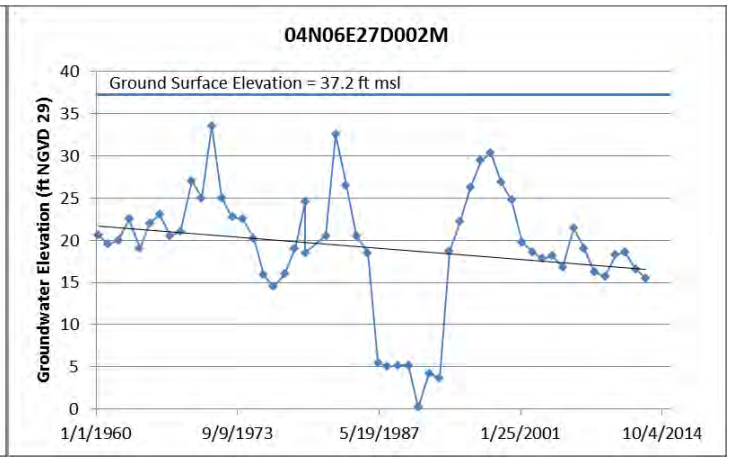
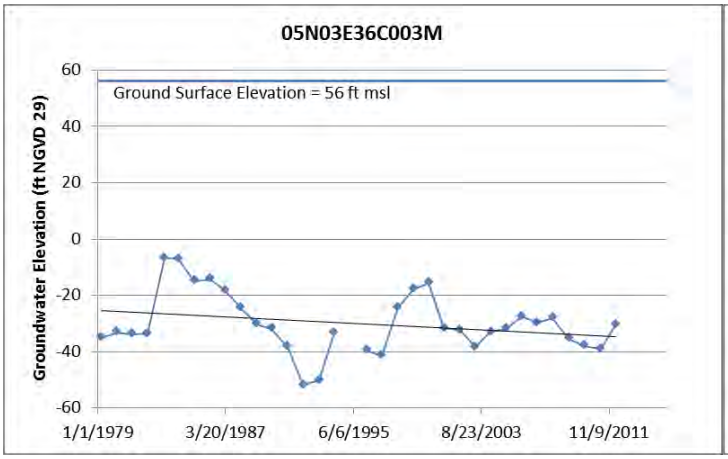


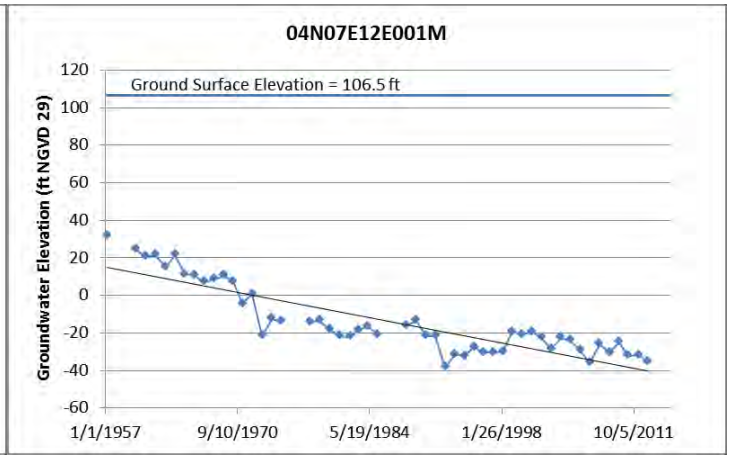
Figure A1-1. Locations of wells with selected hydrographs.

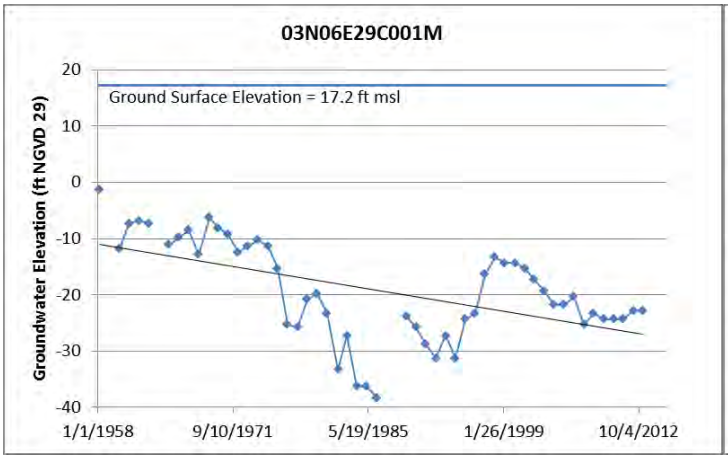
[1] Electronic mail correspondence with Gerardo Dominguez of San Joaquin County Public Works.

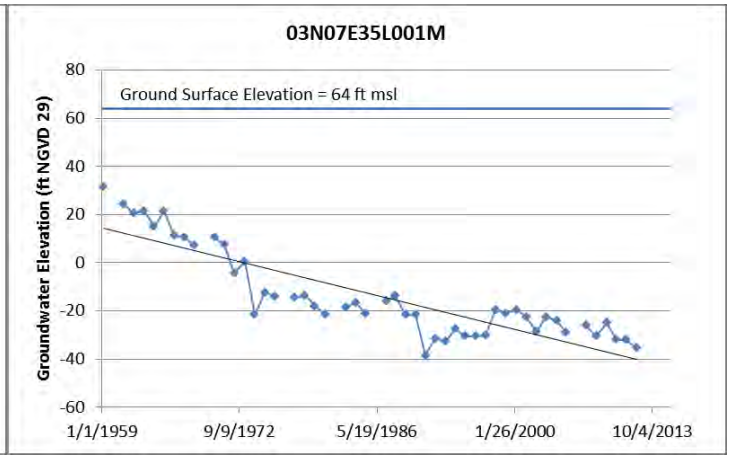

04N05E09D001M
Ground Surface Elevation = 0 ft msl
Groundwater Elevation (ft NGVD 29)
1
0
-1
-2
-3
-4
-5
-6
-7
-8
1/1/1960
9/9/1973
5/19/1987
1/25/2001
10/4/2014

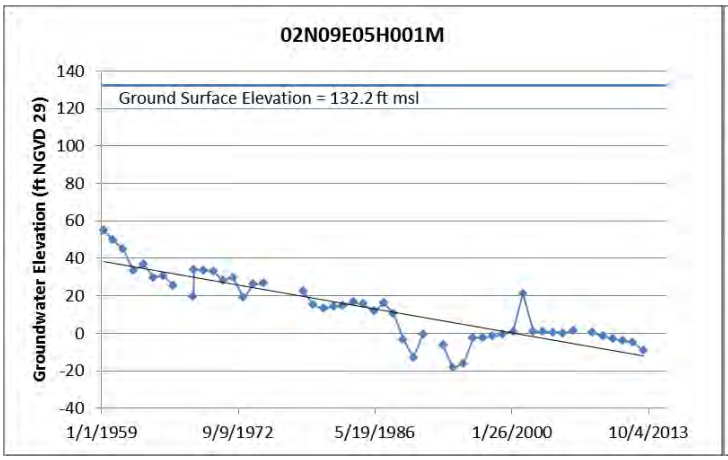

04N06E27D002M
Ground Surface Elevation = 37.2 ft msl
Groundwater Elevation (ft NGVD 29)
40
35
30
25
20
15
10
5
0
1/1/1960
9/9/1973
5/19/1987
1/25/2001
10/4/2014

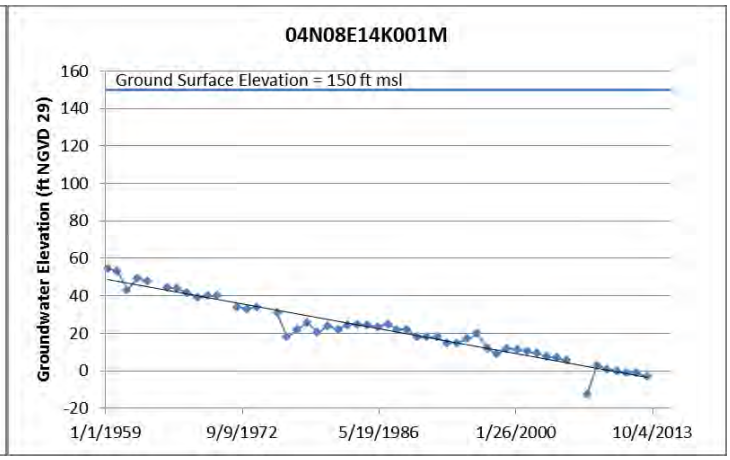

05N03E36C003M
Ground Surface Elevation = 56 ft msl
Groundwater Elevation (ft NGVD 29)
60
40
20
0
-20
-40
-60
1/1/1979
3/20/1987
6/6/1995
8/23/2003
11/9/2011

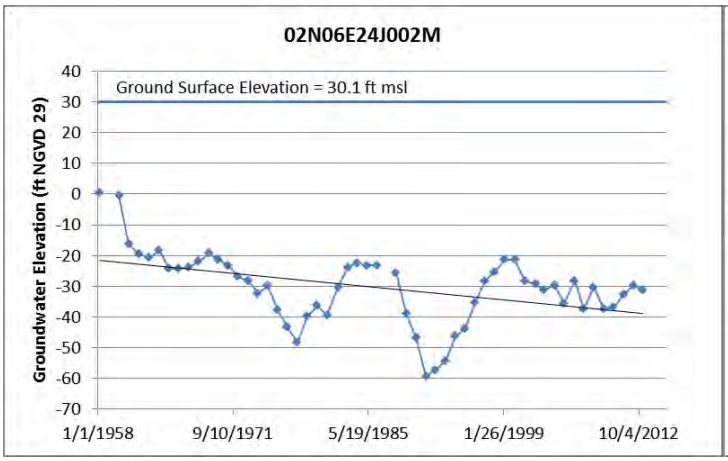

04N07E12E001M
Ground Surface Elevation = 106.5 ft
Groundwater Elevation (ft NGVD 29)
120
100
80
60
40
20
0
-20
-40
-60
1/1/1957
9/10/1970
5/19/1984
1/26/1998
10/5/2011

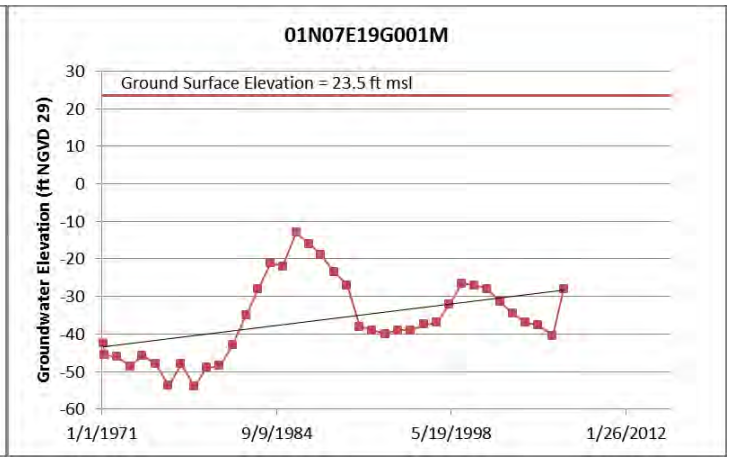

03N06E29C001M
Ground Surface Elevation = 17.2 ft msl
Groundwater Elevation (ft NGVD 29)
20
10
0
-10
-20
-30
-40
1/1/1958
9/10/1971
5/19/1985
1/26/1999
10/4/2012

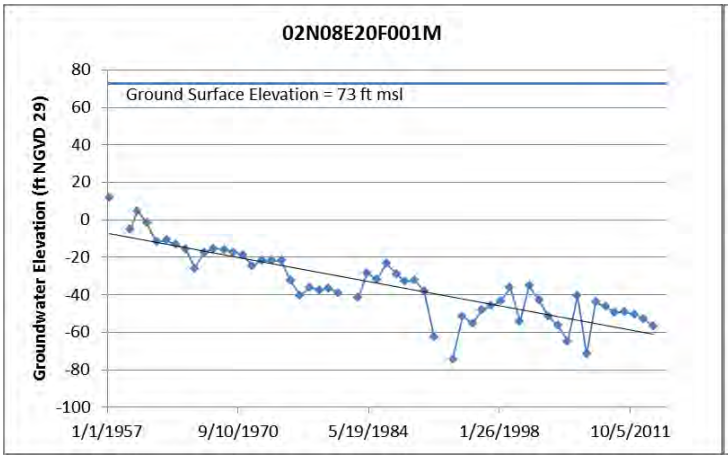

03N07E35L001M
Ground Surface Elevation = 64 ft msl
Groundwater Elevation (ft NGVD 29)
80
60
40
20
0
-20
-40
-60
1/1/1959
9/9/1972
5/19/1986
1/26/2000
10/4/2013

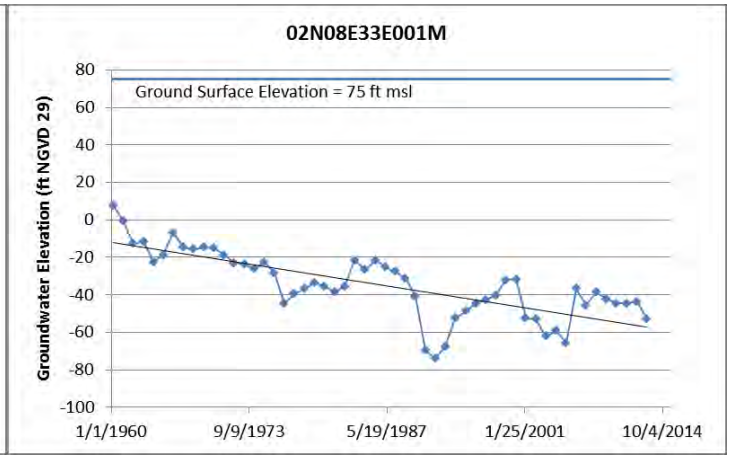

02N09E05H001M
Ground Surface Elevation = 132.2 ft msl
Groundwater Elevation (ft NGVD 29)
140
120
100
80
60
40
20
0
-20
-40
1/1/1959
9/9/1972
5/19/1986
1/26/2000
10/4/2013

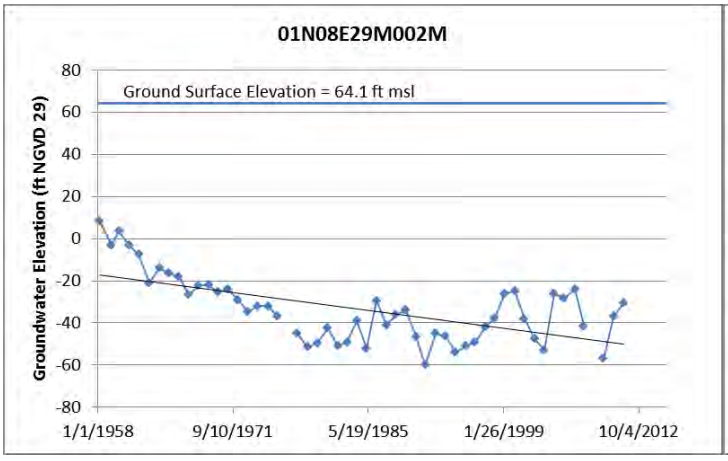

04N08E14K001M
Ground Surface Elevation = 150 ft msl
Groundwater Elevation (ft NGVD 29)
160
140
120
100
80
60
40
20
0
-20
1/1/1959
9/9/1972
5/19/1986
1/26/2000
10/4/2013

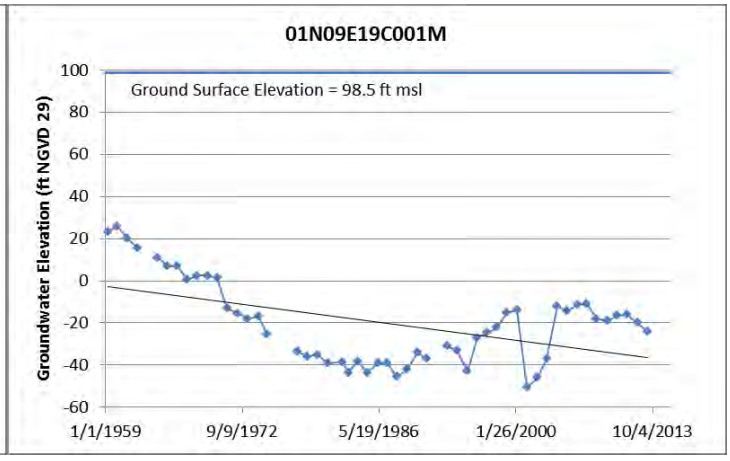

02N06E24J002M
Ground Surface Elevation = 30.1 ft msl
Groundwater Elevation (ft NGVD 29)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
1/1/1958
9/10/1971
5/19/1985
1/26/1999
10/4/2012

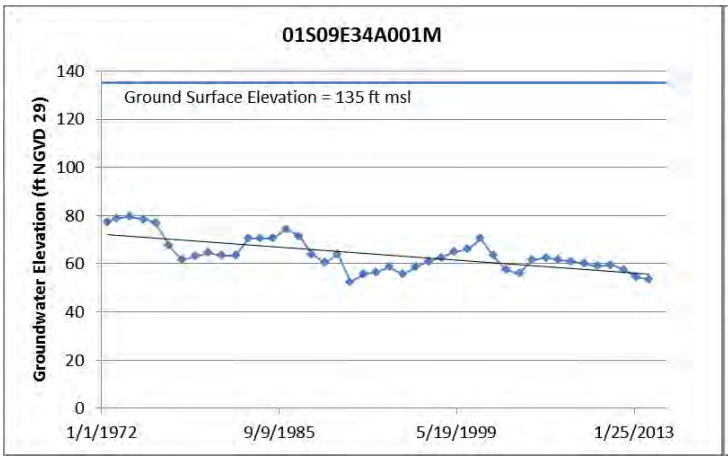

01N07E19G001M
Ground Surface Elevation = 23.5 ft msl
Groundwater Elevation (ft NGVD 29)
30
20
10
0
-10
-20
-30
-40
-50
-60
1/1/1971
9/9/1984
5/19/1998
1/26/2012

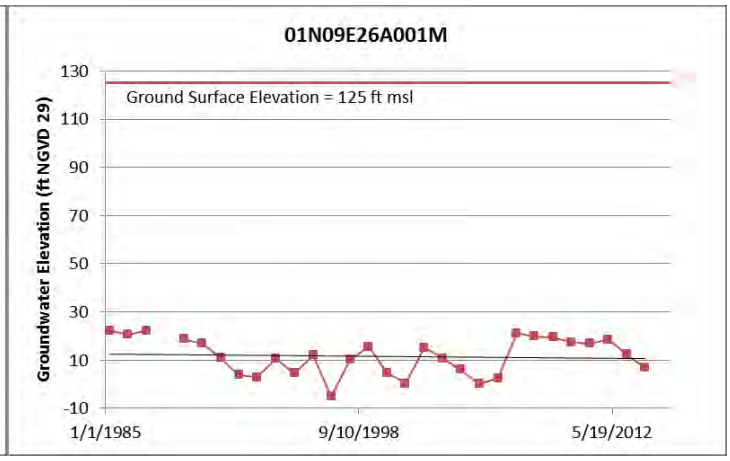

02N08E20F001M
Ground Surface Elevation = 73 ft msl
Groundwater Elevation (ft NGVD 29)
80
60
40
20
0
-20
-40
-60
-80
-100
1/1/1957
9/10/1970
5/19/1984
1/26/1998
10/5/2011

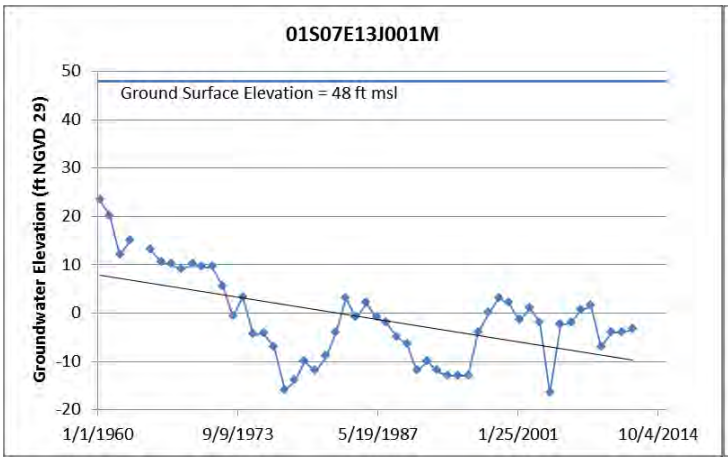

02N08E33E001M
Ground Surface Elevation = 75 ft msl
Groundwater Elevation (ft NGVD 29)
80
60
40
20
0
-20
-40
-60
-80
-100
1/1/1960
9/9/1973
5/19/1987
1/25/2001
10/4/2014

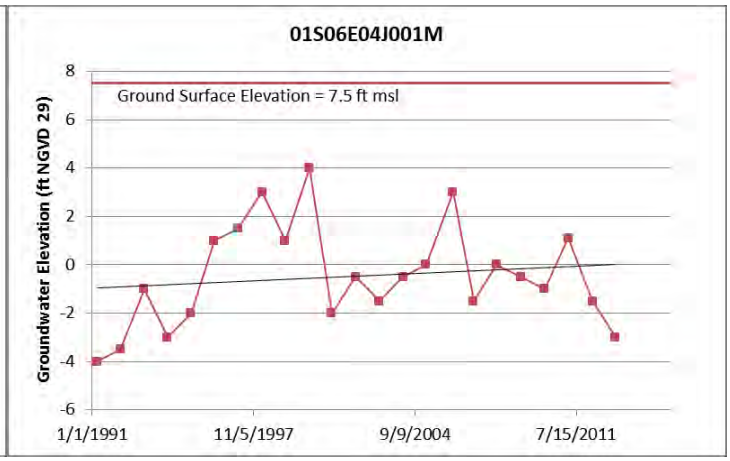

01N08E29M002M
Ground Surface Elevation = 64.1 ft msl
Groundwater Elevation (ft NGVD 29)
80
60
40
20
0
-20
-40
-60
-80
1/1/1958
9/10/1971
5/19/1985
1/26/1999
10/4/2012

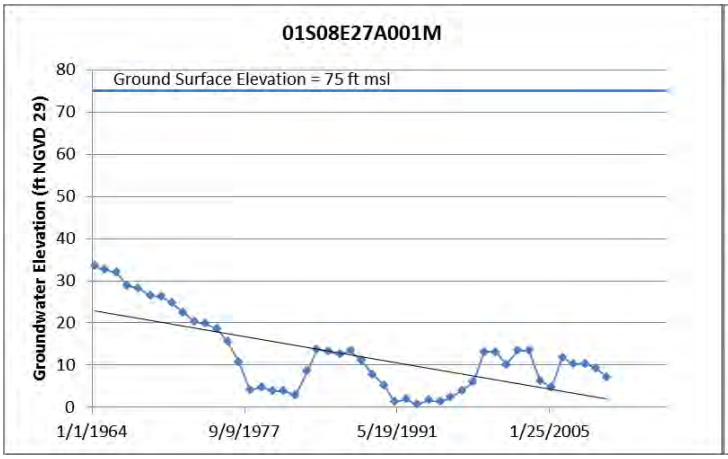

01N09E19C001M
Ground Surface Elevation = 98.5 ft msl
Groundwater Elevation (ft NGVD 29)
100
80
60
40
20
0
-20
-40
-60
1/1/1959
9/9/1972
5/19/1986
1/26/2000
10/4/2013

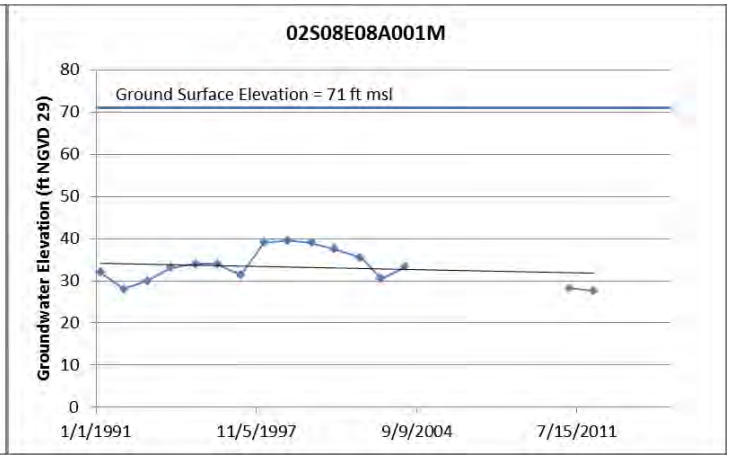

01S09E34A001M
Ground Surface Elevation = 135 ft msl
Groundwater Elevation (ft NGVD 29)
140
120
100
80
60
40
20
0
1/1/1972
9/9/1985
5/19/1999
1/25/2013

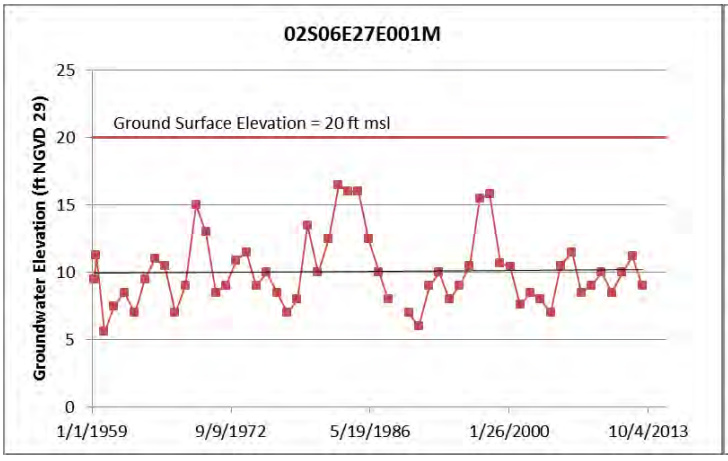

01N09E26A001M
Ground Surface Elevation = 125 ft msl
Groundwater Elevation (ft NGVD 29)
130
110
90
70
50
30
10
-10
1/1/1985
9/10/1998
5/19/2012

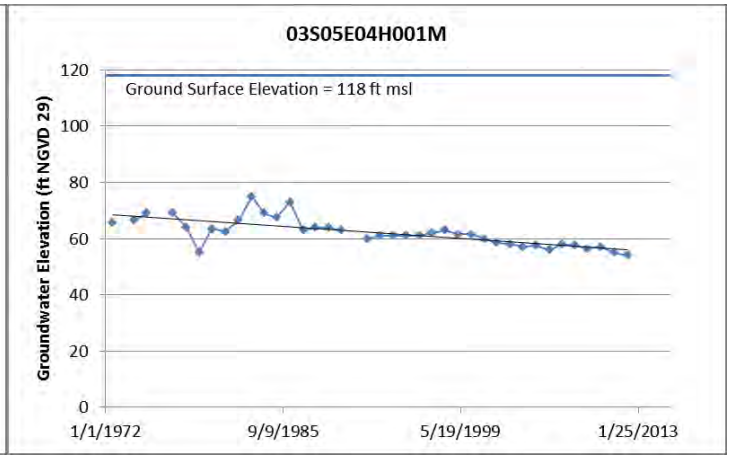

01S07E13J001M
Ground Surface Elevation = 48 ft msl
Groundwater Elevation (ft NGVD 29)
50
40
30
20
10
0
-10
-20
1/1/1960
9/9/1973
5/19/1987
1/25/2001
10/4/2014

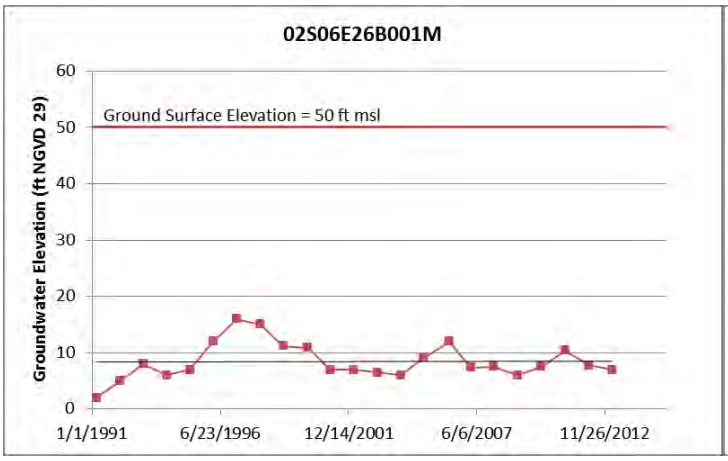

01S06E04J001M
Ground Surface Elevation = 7.5 ft msl
Groundwater Elevation (ft NGVD 29)
8
6
4
2
0
-2
-4
-6
1/1/1991
11/5/1997
9/9/2004
7/15/2011

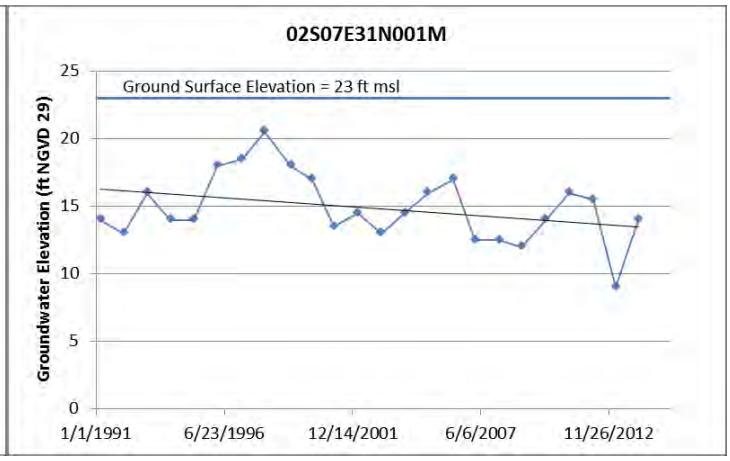

01S08E27A001M
Ground Surface Elevation = 75 ft msl
Groundwater Elevation (ft NGVD 29)
80
70
60
50
40
30
20
10
0
1/1/1964
9/9/1977
5/19/1991
1/25/2005

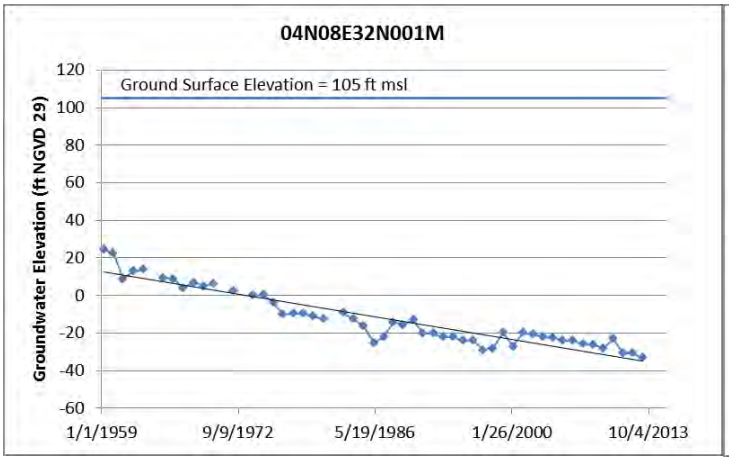

02S08E08A001M
Ground Surface Elevation = 71 ft msl
Groundwater Elevation (ft NGVD 29)
80
70
60
50
40
30
20
10
0
1/1/1991
11/5/1997
9/9/2004
7/15/2011

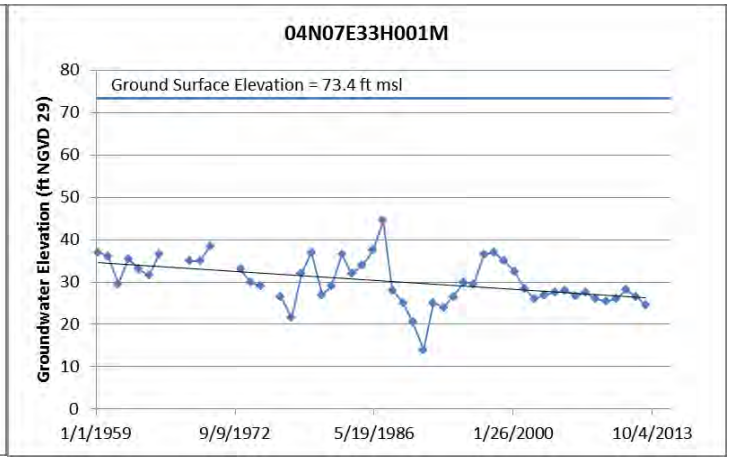

02S06E27E001M
Ground Surface Elevation = 20 ft msl
Groundwater Elevation (ft NGVD 29)
25
20
15
10
5
0
1/1/1959
9/9/1972
5/19/1986
1/26/2000
10/4/2013


03S05E04H001M
Ground Surface Elevation = 118 ft msl
Groundwater Elevation (ft NGVD 29)
120
100
80
60
40
20
0
1/1/1972
9/9/1985
5/19/1999
1/25/2013


02S06E26B001M
Ground Surface Elevation = 50 ft msl
Groundwater Elevation (ft NGVD 29)
60
50
40
30
20
10
0
1/1/1991
6/23/1996
12/14/2001
6/6/2007
11/26/2012


02S07E31N001M
Ground Surface Elevation = 23 ft msl
Groundwater Elevation (ft NGVD 29)
25
20
15
10
5
0
1/1/1991
6/23/1996
12/14/2001
6/6/2007
11/26/2012


04N08E32N001M
Ground Surface Elevation = 105 ft msl
Groundwater Elevation (ft NGVD 29)
120
100
80
60
40
20
0
-20
-40
-60
1/1/1959
9/9/1972
5/19/1986
1/26/2000
10/4/2013


04N07E33H001M
Ground Surface Elevation = 73.4 ft msl
Groundwater Elevation (ft NGVD 29)
80
70
60
50
40
30
20
10
0
1/1/1959
9/9/1972
5/19/1986
1/26/2000
10/4/2013

b. Delta

We obtained Delta Wetlands Project groundwater level data collected from wells located on or near the levees throughout the Delta[2]. Data were presented in tabular format from 1989 to 1990. From 1990 through 1995, data were presented in graphs. We manually digitalized the graphs and extracted the data. Approximate groundwater-level measuring point elevations were reported in the Delta Wetland Project documentation which we used to calculate the groundwater elevations relative to NGVD-29[3].

We also obtained groundwater level data measured by transducers every 15 minutes during 2004 and 2005 as part of the Upper Jones Tract flood monitoring[4]. We used surveyed groundwater-level measuring point elevations to calculate the groundwater elevations by subtracting the depth to water values from the reported elevation. We downloaded water level measurements from a 57-foot deep USGS well on Medford Island with data from 1983 through 1987[5]. Finally, we obtained groundwater level data for Roberts Island from Water Associates Group[6] who has collected baseline data for potential ship channel dredge mater.

Figure A1-2 shows the well locations and associated hydrographs. These and additional data generally show little change in groundwater levels in the Delta over time. Visual examination of groundwater hydrographs generally indicated temporally stable groundwater elevations from 1989 to 1995. First, there was a slight downward trend in groundwater elevations for well WO-26 on Woodward Island. However, data collected during 2003 and 2004 indicate stable groundwater elevations from 1995 to 2004. Second, data collected in wells MC-13 and MC-14 on McDonald Island indicate precipitous declines and recovery during 1990 and 1991 when groundwater levels returned to close to previous levels. Third, there was an apparent downward trend on Medford Island. Recent data for wells on Upper Jones and Palm Tract demonstrate a lack of significant water-level change during the longer term from 1989 to 2004. The hydrograph for Upper Jones Tract shows the effect of the levee breach in 2004 mand then a return to groundwater levels similar to those measured in the 1990s.

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[2] Harding Lawson Associates. 1991. A Report Prepared for Delta Wetlands: Groundwater Data Transmittal No. 2 Delta Wetlands Monitoring Program Sacramento-San Joaquin River Delta.
Hultgren-Tillis Geotechnical Engineers. 1995. Groundwater Data Transmittal No. 4 Delta Wetlands Project Sacramento-San Joaquin River Delta.

[3] The National Geodetic Vertical Datum of 1929 (NGVD-29) established a benchmark datum relative to the sea level stations from 1929.

[4] Hultgren-Tillis Geotechnical Engineers. 2005. Groundwater Monitoring Jones Tract Flood Sacramento-San Joaquin Delta, California. Prepared for the Department of Water Resources, April 15, 2005.

[5] Available online from USGS at
http://nwis.waterdata.usgs.gov/nwis/gwlevels/?site_no=380250121301601&agency_cd=USGS&

[6] Steve Michelson and Tyson Fulmer, Water Associates Group, written communication, 2013

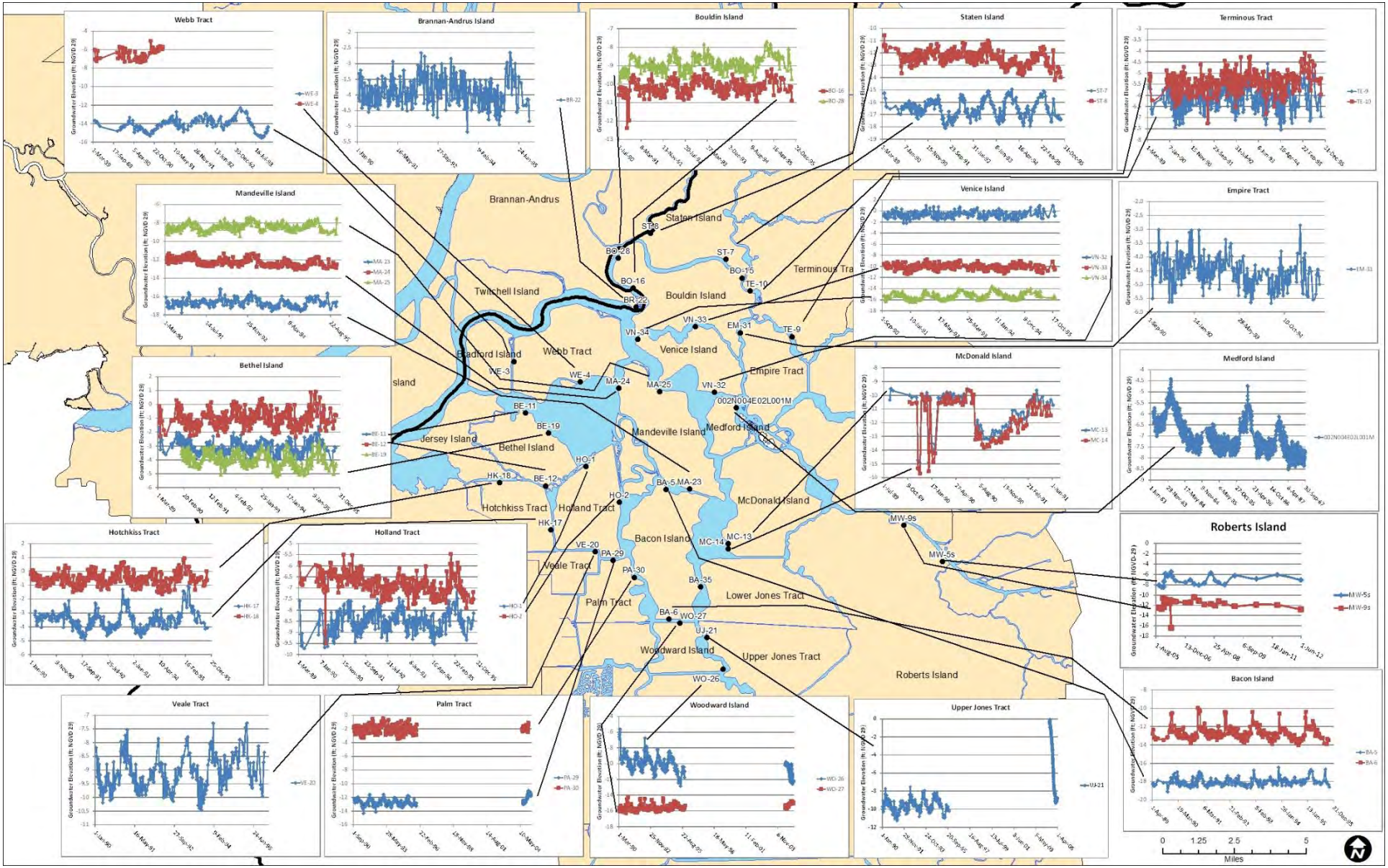


Figure A1-2. Groundwater elevation hydrographs in the Sacramento-San Joaquin Delta.

2. Water Quality Constituent Trends

a. Nitrate

We examined 28 wells with extensive history of nitrate concentrations to determine any significant trends. Nine wells showed a significant increasing trend, three wells showed a significant decreasing trend, and 16 wells did not show a significant trend. Figure A2-1 shows the well locations with their trends and the following graphs show the nitrate concentrations over time from the 28 wells.

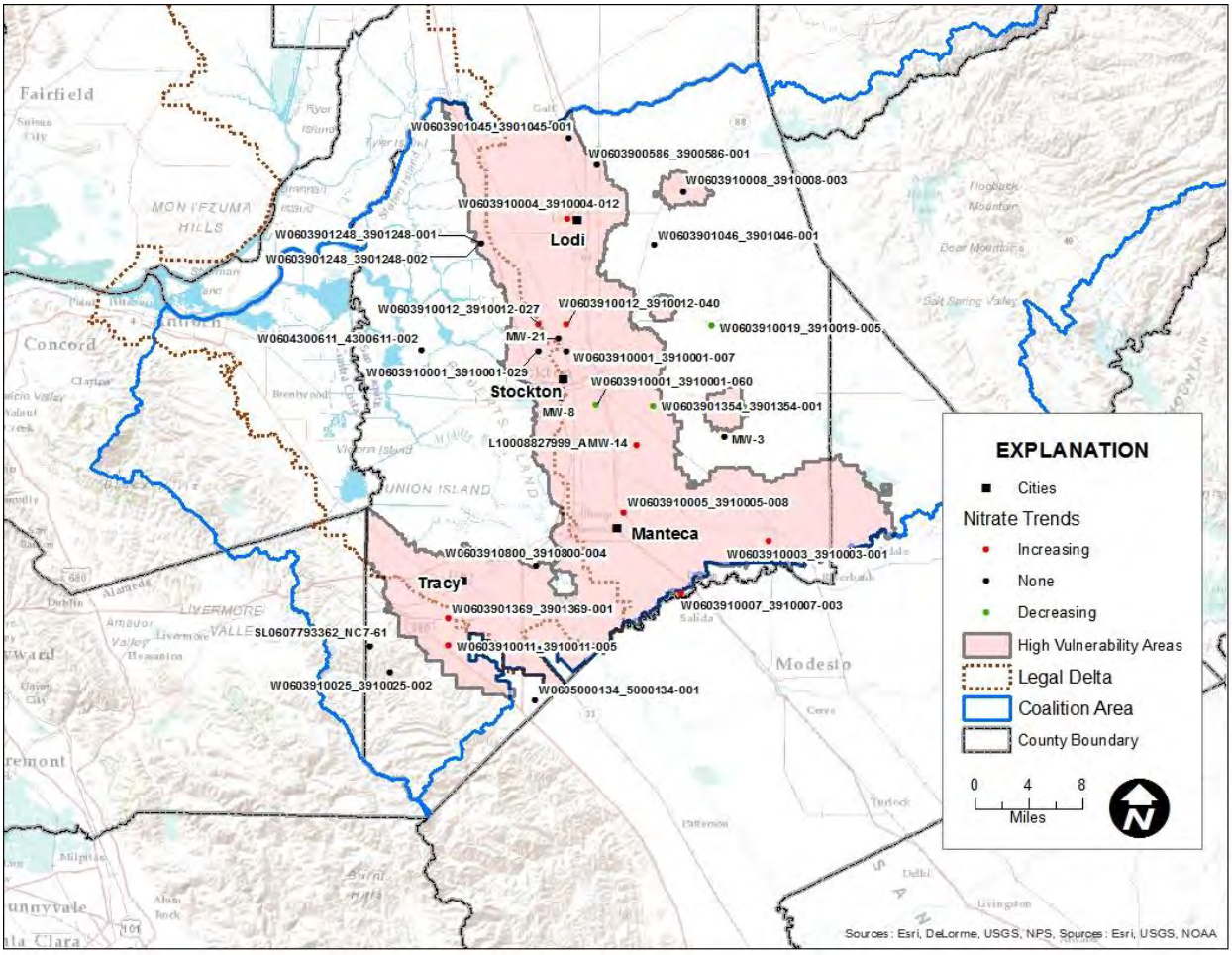
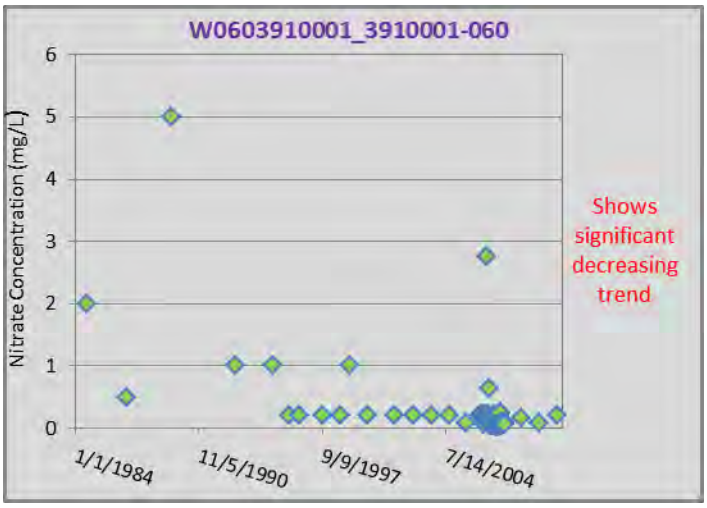
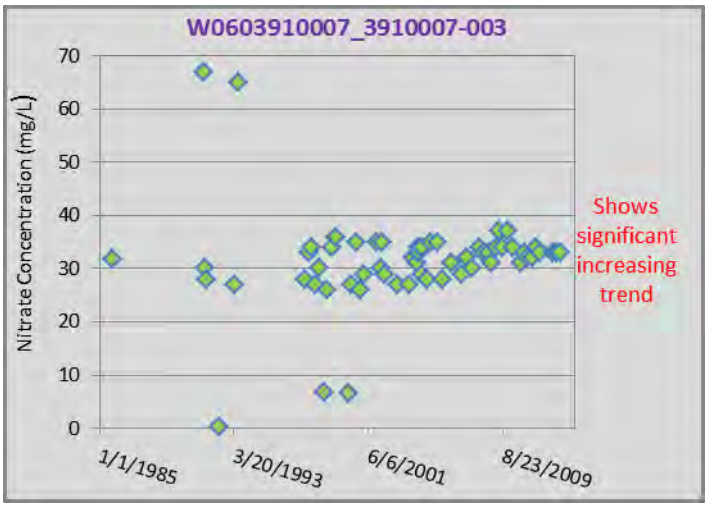
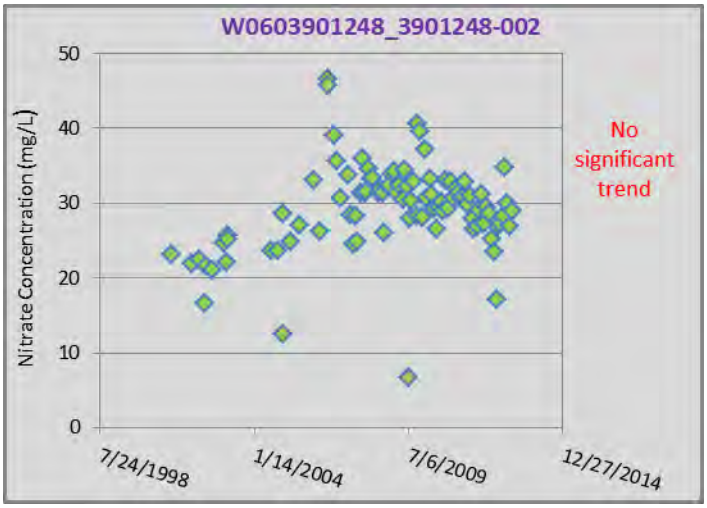
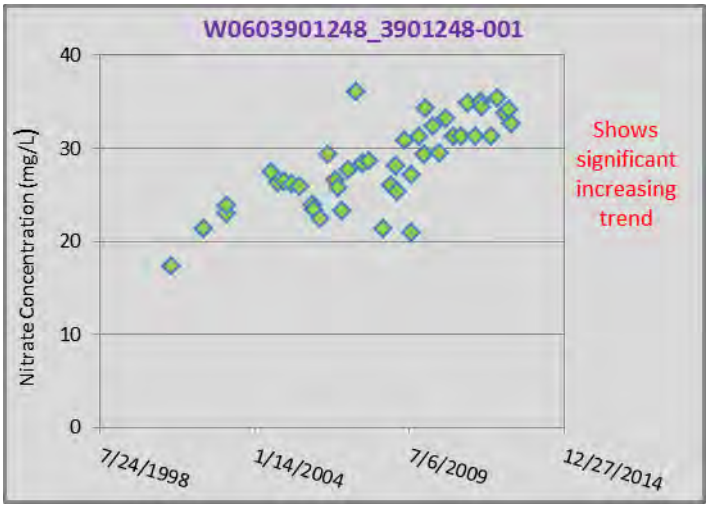


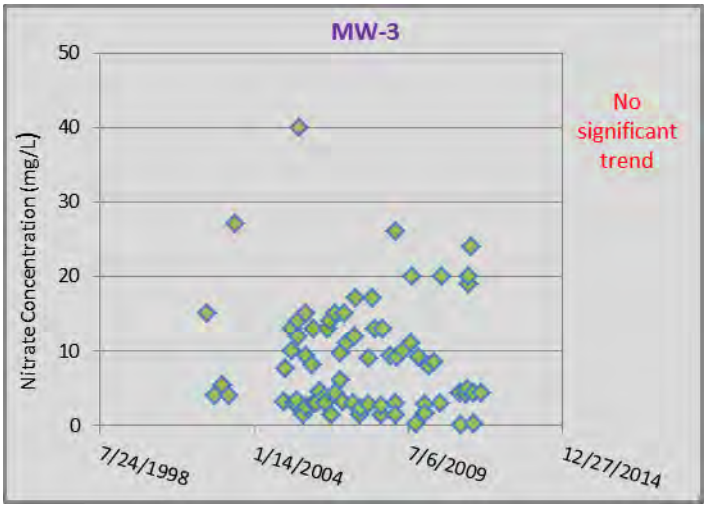
Figure A2-1. Location of wells used for nitrate trend analysis.

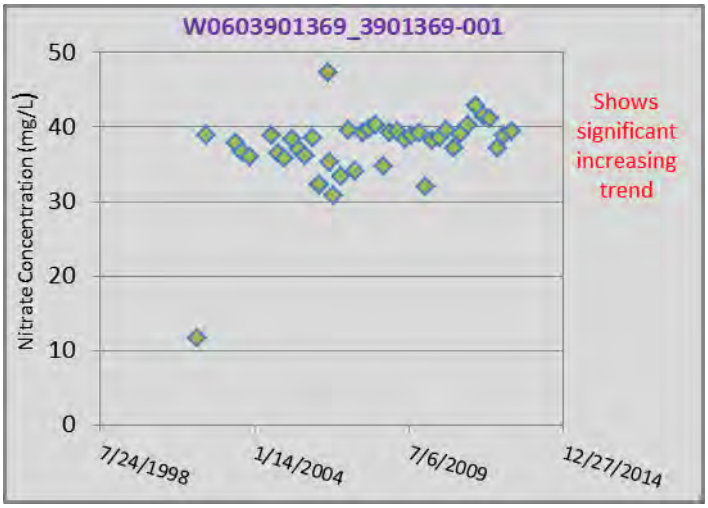

W0603910001_3910001-060
Nitrate Concentration (mg/L)
0
1
2
3
4
5
6
1/1/1984
11/5/1990
9/9/1997
7/14/2004
Shows significant decreasing trend

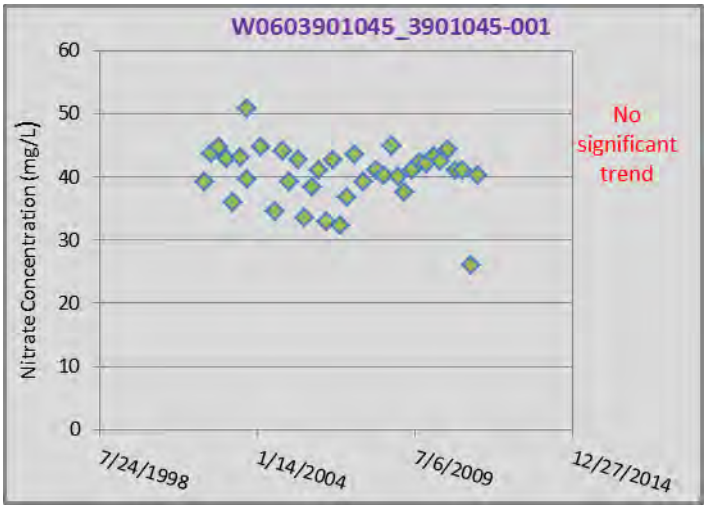

W0603910007_3910007-003
Nitrate Concentration (mg/L)
0
10
20
30
40
50
60
70
1/1/1985
3/20/1993
6/6/2001
8/23/2009
Shows significant increasing trend

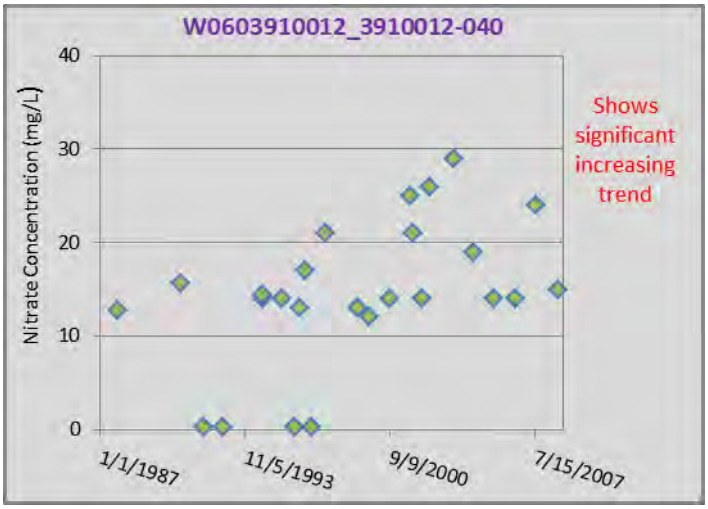

W0603901248_3901248-002
Nitrate Concentration (mg/L)
0
10
20
30
40
50
7/24/1998
1/14/2004
7/6/2009
12/27/2014
No significant trend

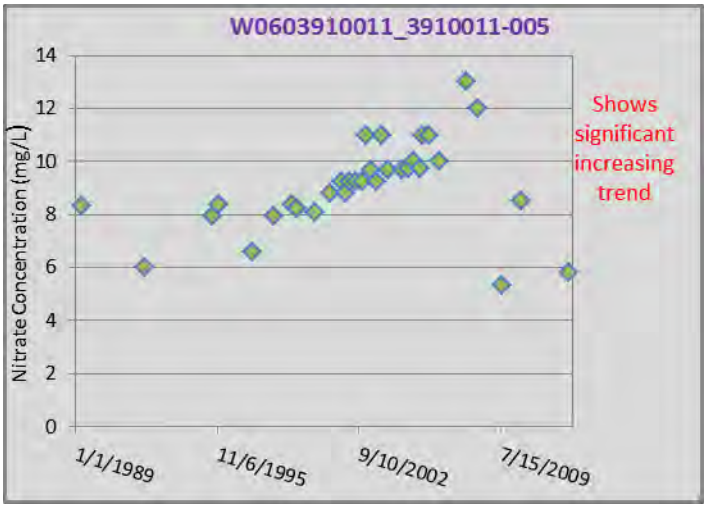

W0603901248_3901248-001
Nitrate Concentration (mg/L)
0
10
20
30
40
7/24/1998
1/14/2004
7/6/2009
12/27/2014
Shows significant increasing trend

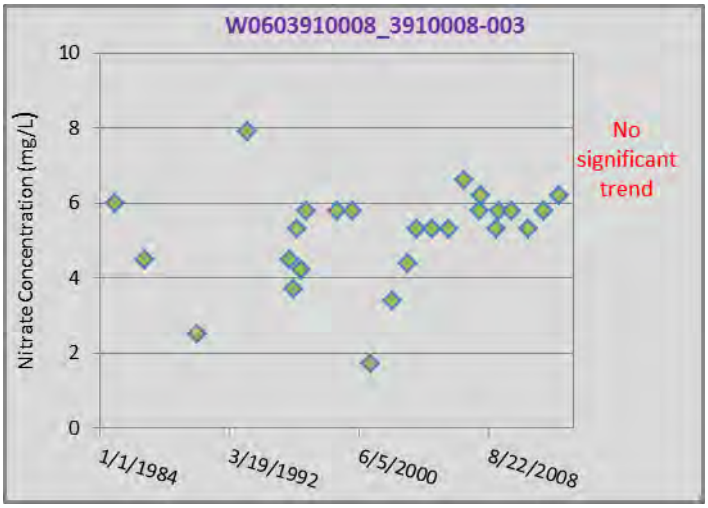

MW-3
Nitrate Concentration (mg/L)
0
10
20
30
40
50
7/24/1998
1/14/2004
7/6/2009
12/27/2014
No significant trend

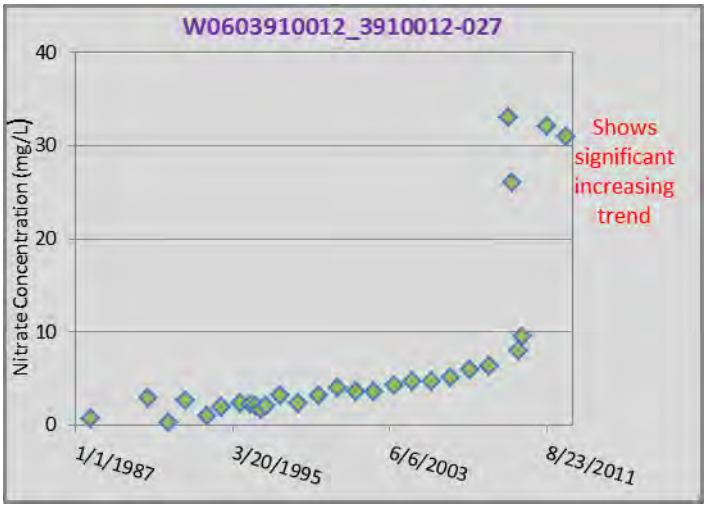

W0603901369_3901369-001
Nitrate Concentration (mg/L)
0
10
20
30
40
50
7/24/1998
1/14/2004
7/6/2009
12/27/2014
Shows significant increasing trend

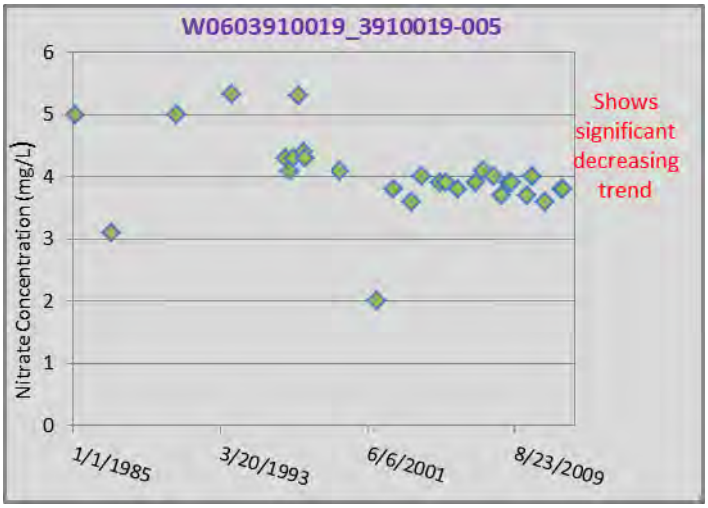

W0603901045_3901045-001
Nitrate Concentration (mg/L)
60
50
40
30
20
10
0
7/24/1998
1/14/2004
7/6/2009
12/27/2014
No significant trend

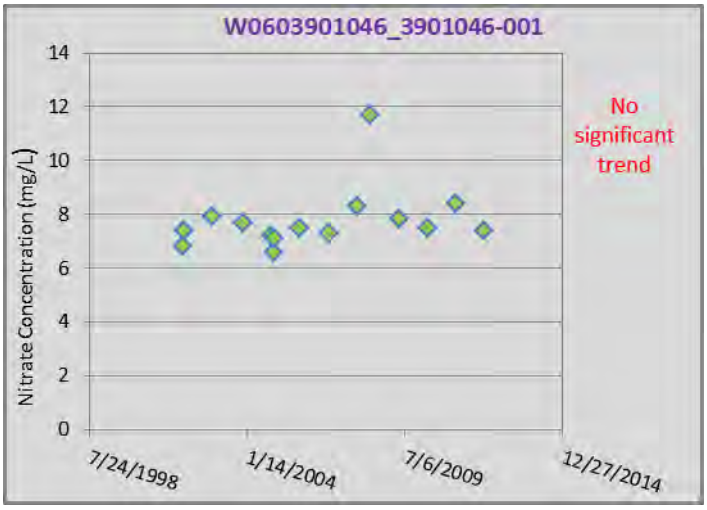

W0603910012_3910012-040
Nitrate Concentration (mg/L)
40
30
20
10
0
1/1/1987
11/5/1993
9/9/2000
7/15/2007
Shows significant increasing trend

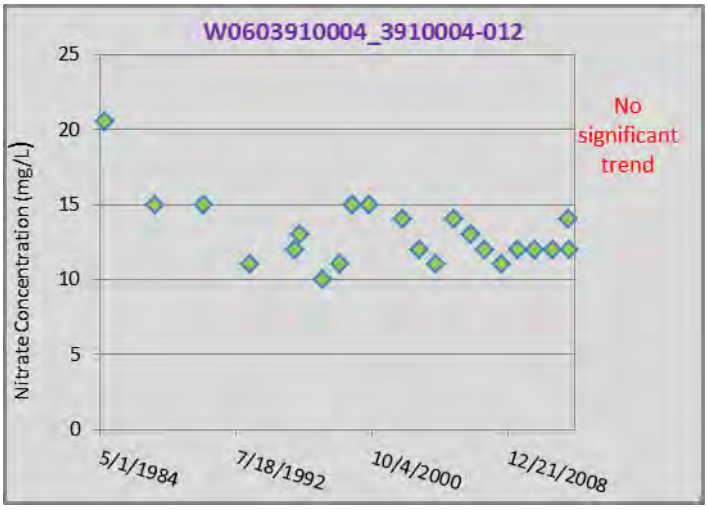

W0603910011_3910011-005
Nitrate Concentration (mg/L)
14
12
10
8
6
4
2
0
1/1/1989
11/6/1995
9/10/2002
7/15/2009
Shows significant increasing trend

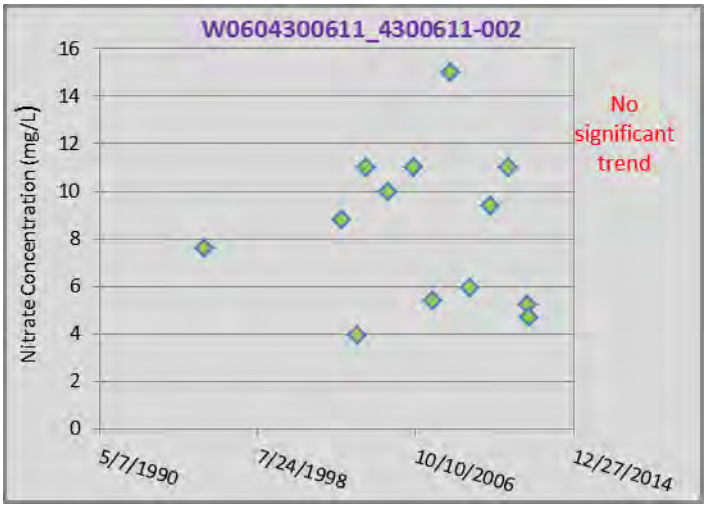

W0603910008_3910008-003
Nitrate Concentration (mg/L)
10
8
6
4
2
0
1/1/1984
3/19/1992
6/5/2000
8/22/2008
No significant trend

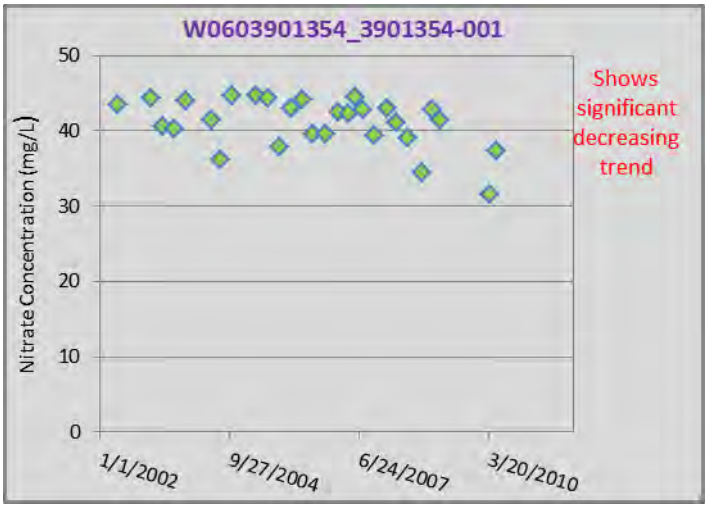

W0603910012_3910012-027
Nitrate Concentration (mg/L)
40
30
20
10
0
1/1/1987
3/20/1995
6/6/2003
8/23/2011
Shows significant increasing trend

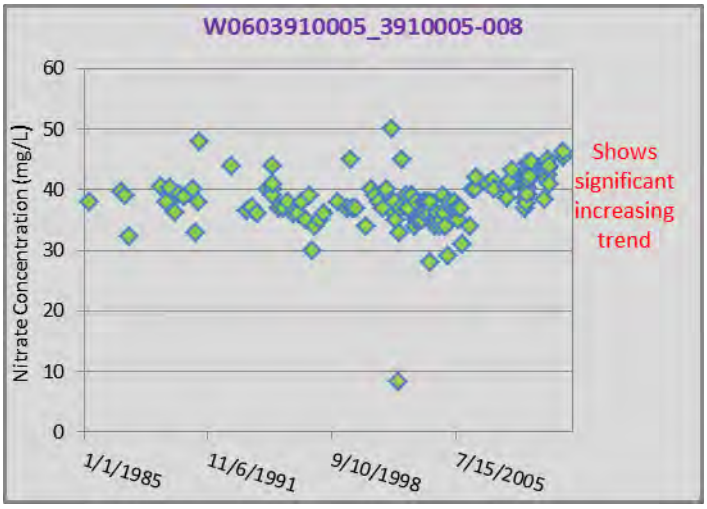

W0603910019_3910019-005
Nitrate Concentration (mg/L)
6
5
4
3
2
1
0
1/1/1985
3/20/1993
6/6/2001
8/23/2009
Shows significant decreasing trend

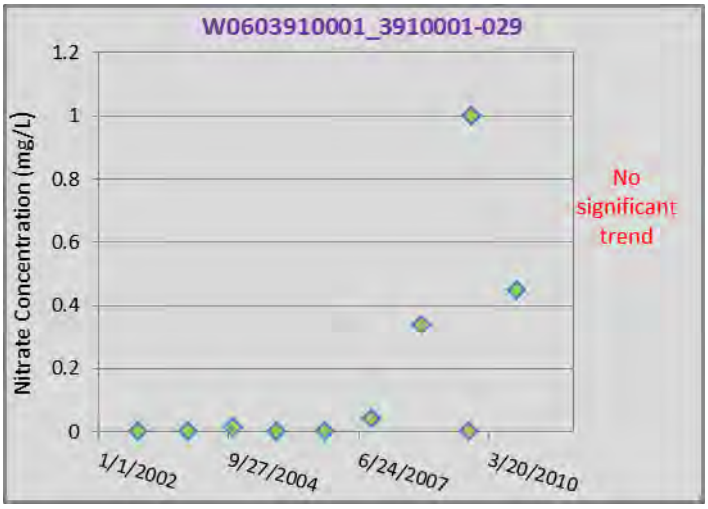

W0603901046_3901046-001
Nitrate Concentration (mg/L)
14
12
10
8
6
4
2
0
7/24/1998
1/14/2004
7/6/2009
12/27/2014
No significant trend

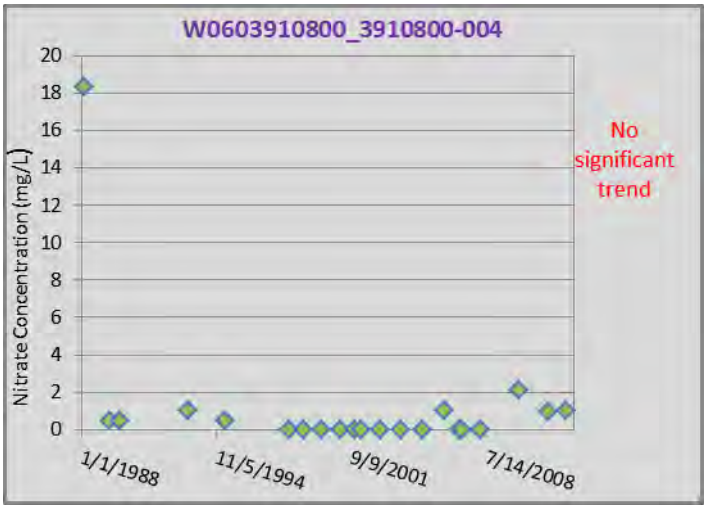

W0603910004_3910004-012
Nitrate Concentration (mg/L)
25
20
15
10
5
0
5/1/1984
7/18/1992
10/4/2000
12/21/2008
No significant trend

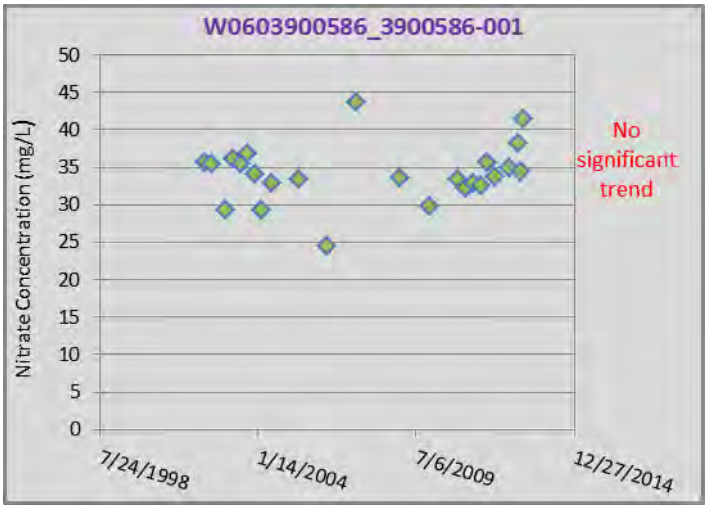

W0604300611_4300611-002
Nitrate Concentration (mg/L)
16
14
12
10
8
6
4
2
0
5/7/1990
7/24/1998
10/10/2006
12/27/2014
No significant trend

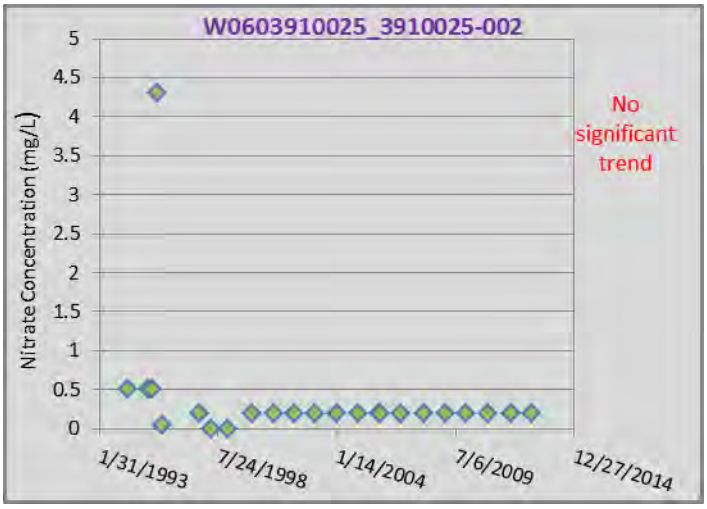

W0603901354_3901354-001
Nitrate Concentration (mg/L)
50
40
30
20
10
0
1/1/2002
9/27/2004
6/24/2007
3/20/2010
Shows significant decreasing trend

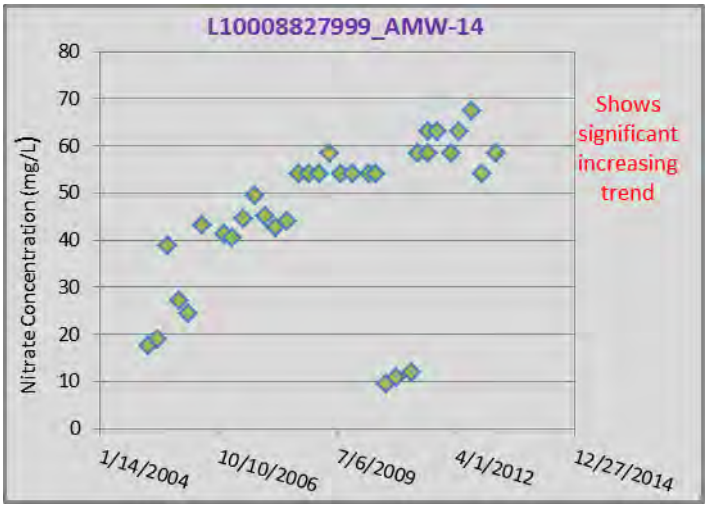

W0603910005_3910005-008
Nitrate Concentration (mg/L)
60
50
40
30
20
10
0
1/1/1985
11/6/1991
9/10/1998
7/15/2005
Shows significant increasing trend

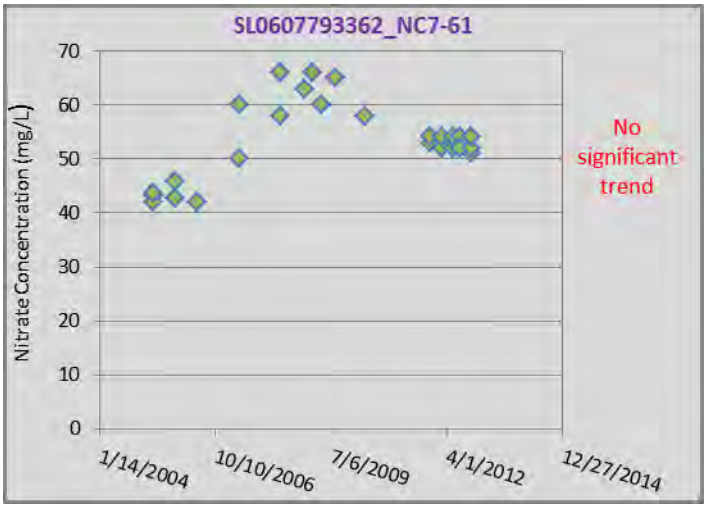

W0603910001_3910001-029
Nitrate Concentration (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
1/1/2002
9/27/2004
6/24/2007
3/20/2010
No significant trend

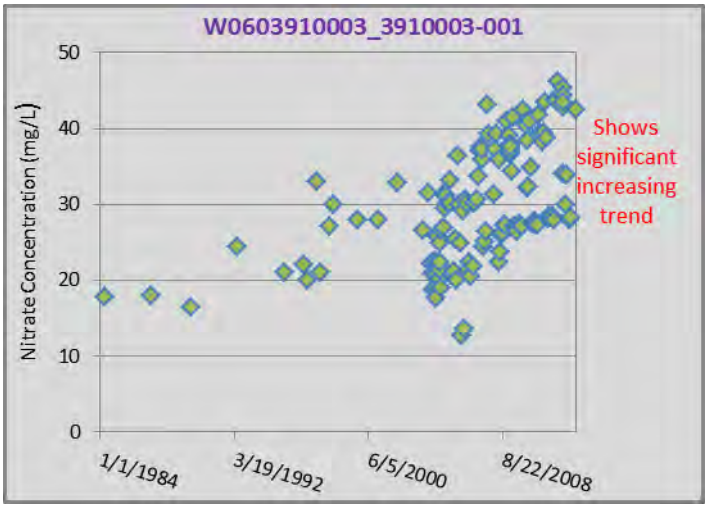

W0603910800_3910800-004
Nitrate Concentration (mg/L)
20
18
16
14
12
10
8
6
4
2
0
1/1/1988
11/5/1994
9/9/2001
7/14/2008
No significant trend

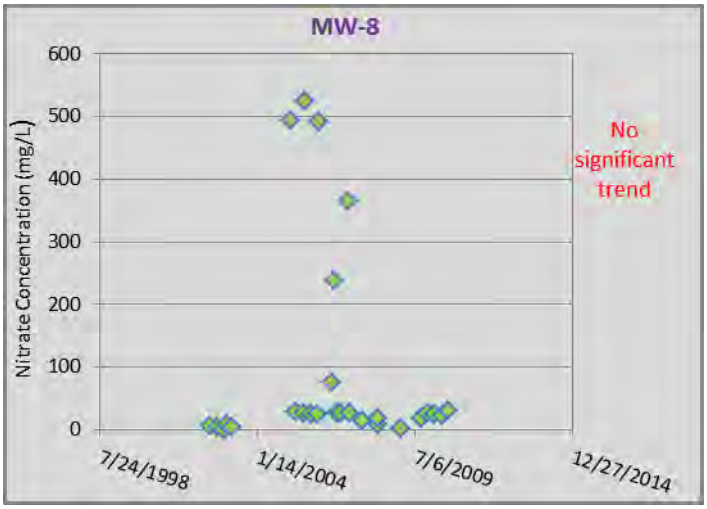

W0603900586_3900586-001
Nitrate Concentration (mg/L)
50
45
40
35
30
25
20
15
10
5
0
7/24/1998
1/14/2004
7/6/2009
12/27/2014
No significant trend

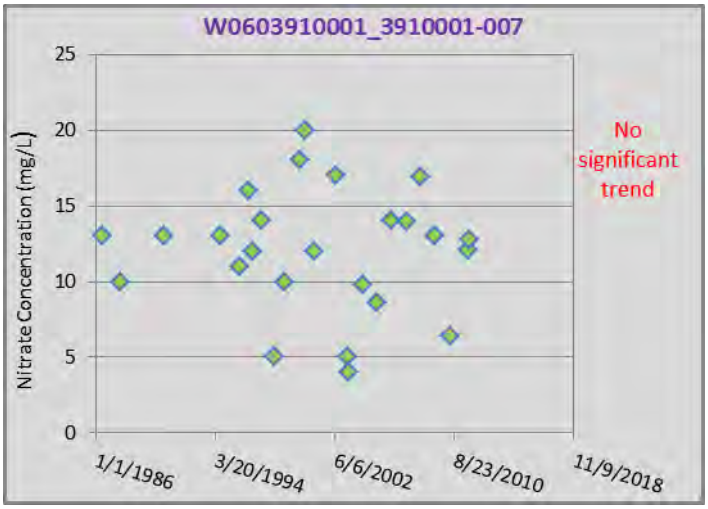

W0603910025_3910025-002
Nitrate Concentration (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1/31/1993
7/24/1998
1/14/2004
7/6/2009
12/27/2014
No significant trend

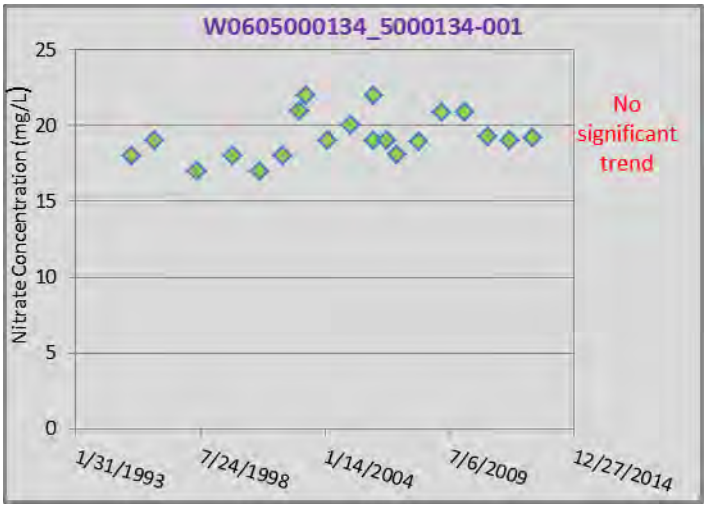

L10008827999_AMW-14
Nitrate Concentration (mg/L)
80
70
60
50
40
30
20
10
0
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
Shows significant increasing trend

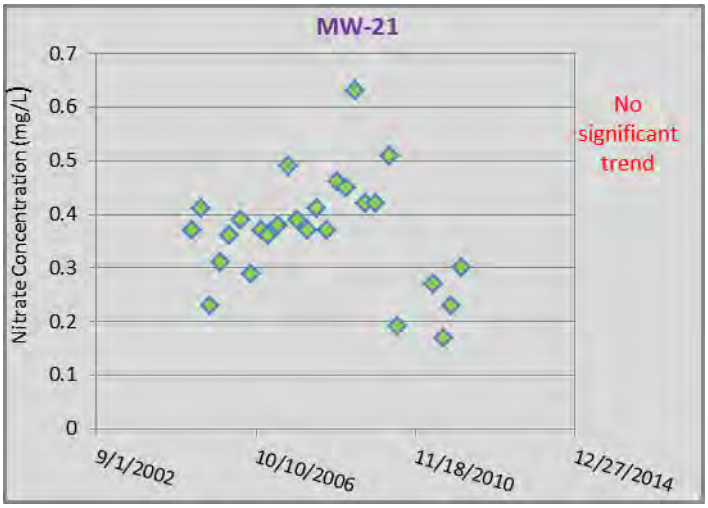

SL0607793362_NC7-61
Nitrate Concentration (mg/L)
70
60
50
40
30
20
10
0
1/14/2004
10/10/2006
7/6/2009
4/1/2012
12/27/2014
No significant trend


W0603910003_3910003-001
Nitrate Concentration (mg/L)
50
40
30
20
10
0
1/1/1984
3/19/1992
6/5/2000
8/22/2008
Shows significant increasing trend


MW-8
Nitrate Concentration (mg/L)
600
500
400
300
200
100
0
7/24/1998
1/14/2004
7/6/2009
12/27/2014
No significant trend


W0603910001_3910001-007
Nitrate Concentration (mg/L)
25
20
15
10
5
0
1/1/1986
3/20/1994
6/6/2002
8/23/2010
11/9/2018
No significant trend


W0605000134_5000134-001
Nitrate Concentration (mg/L)
25
20
15
10
5
0
1/31/1993
7/24/1998
1/14/2004
7/6/2009
12/27/2014
No significant trend


MW-21
Nitrate Concentration (mg/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9/1/2002
10/10/2006
11/18/2010
12/27/2014
No significant trend

b. Total Dissolved Solids

We examined ten wells with extensive history of total dissolved solids (TDS) concentrations to determine any significant trends. Five wells showed a significant increasing trend, one well showed a significant decreasing trend, and three wells did not show a significant trend. Figure A2-2 shows the well locations with their trends and the following graphs show the TDS concentrations over time from the ten wells.

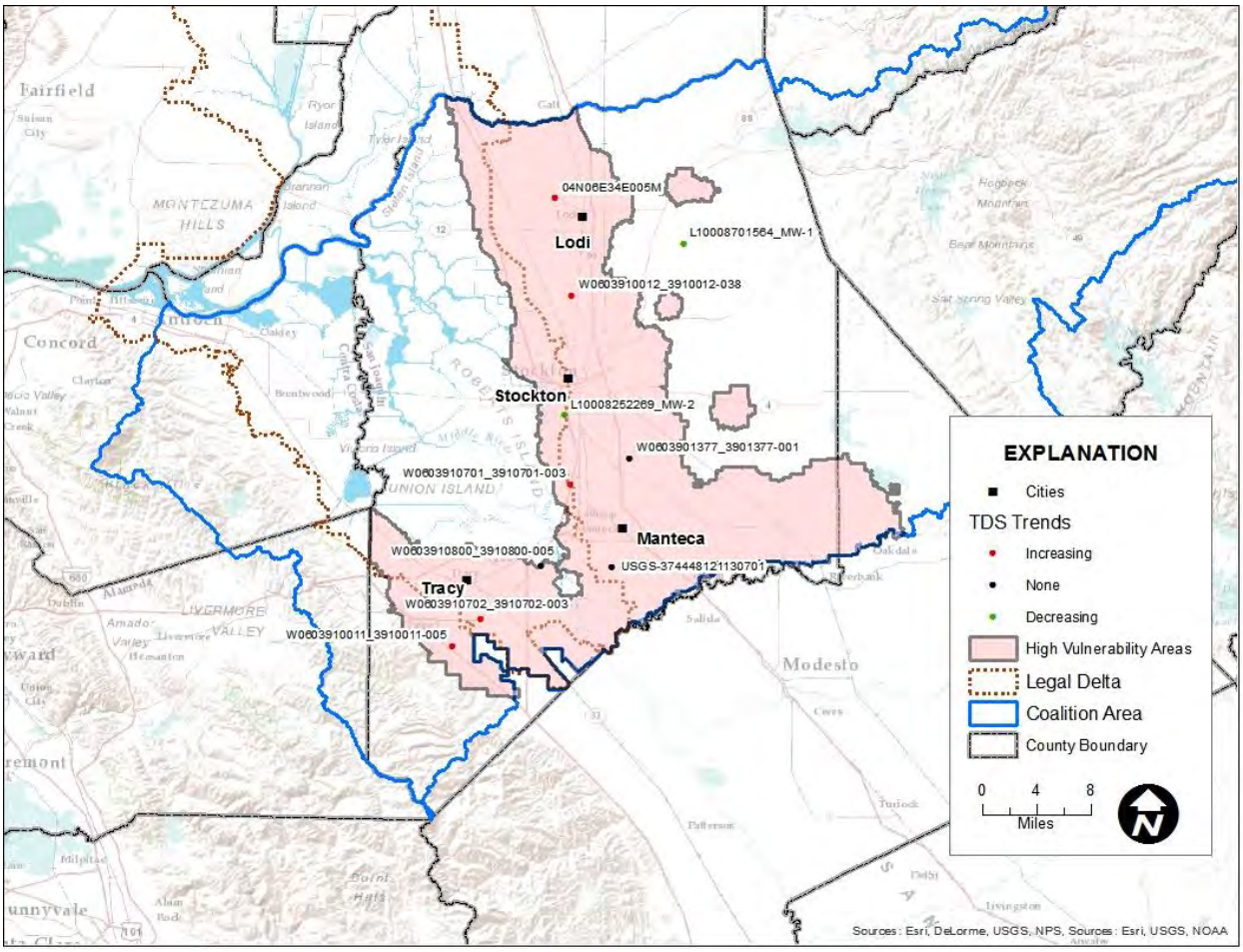
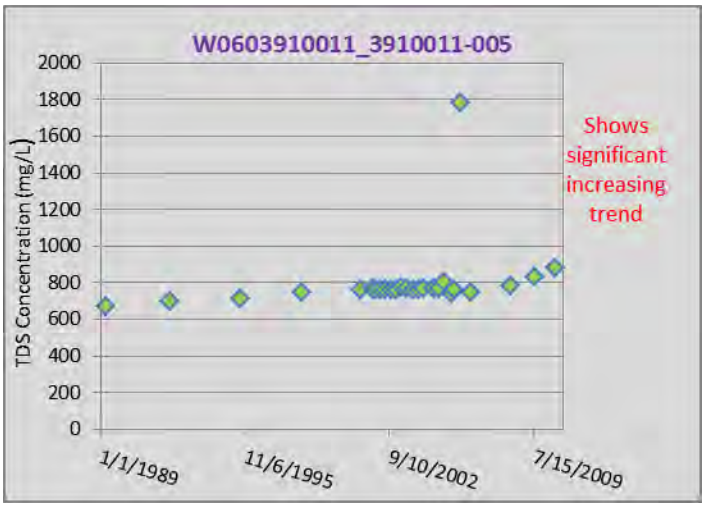
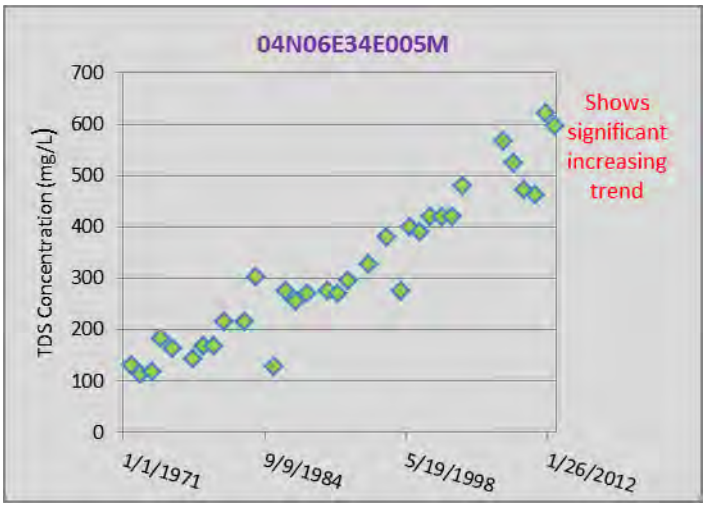
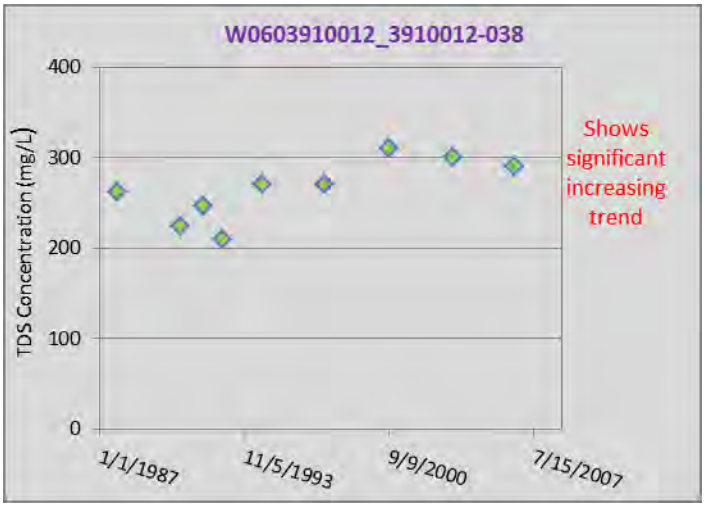
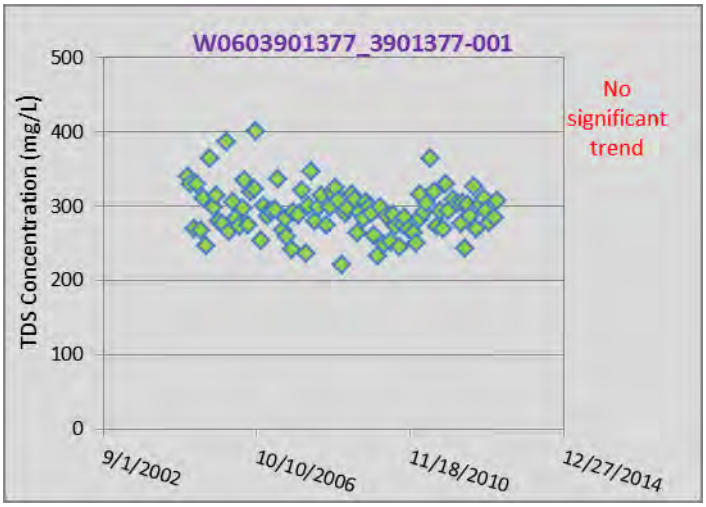


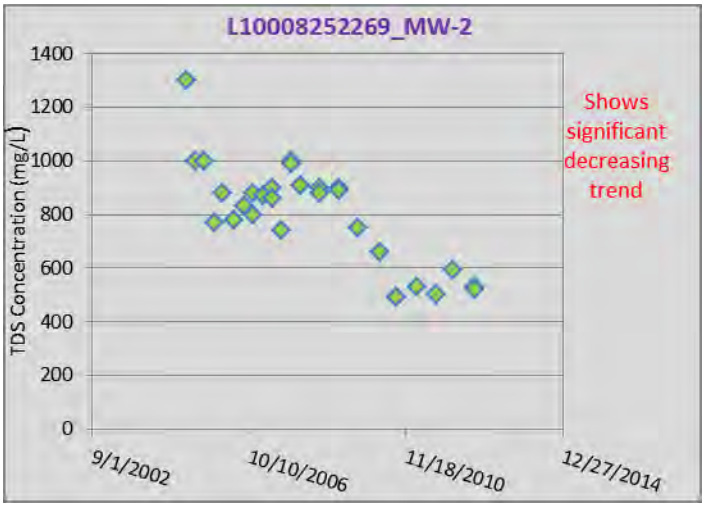
Figure A2-2. Location of wells used for TDS trend analysis.

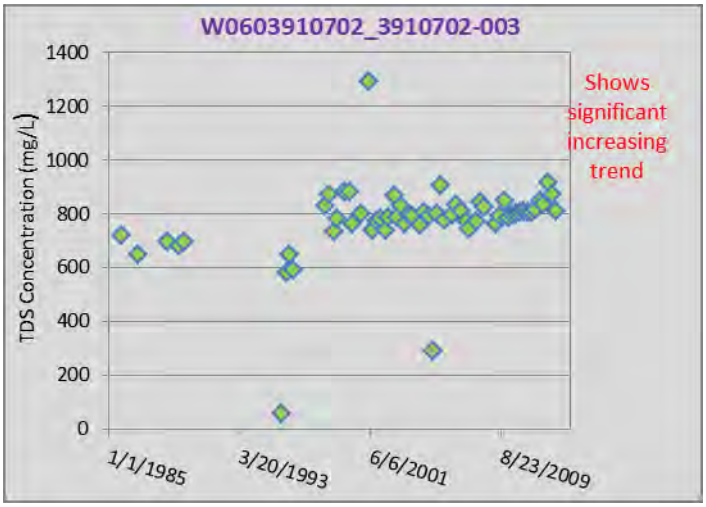

W0603910011_3910011-005
TDS Concentration (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1/1/1989
11/6/1995
9/10/2002
7/15/2009
Shows significant increasing trend

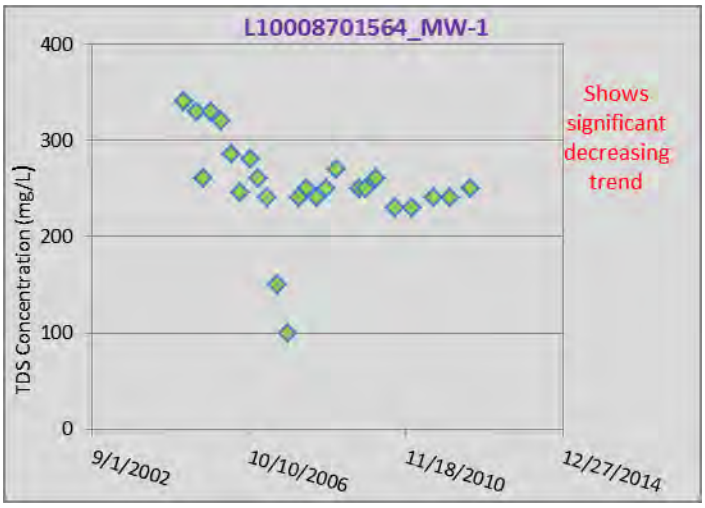

04N06E34E005M
TDS Concentration (mg/L)
700
600
500
400
300
200
100
0
1/1/1971
9/9/1984
5/19/1998
1/26/2012
Shows significant increasing trend

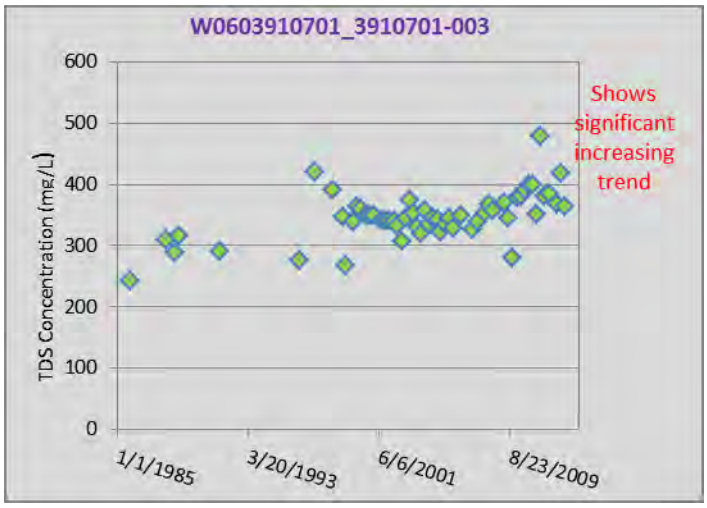

W0603910012_3910012-038
TDS Concentration (mg/L)
400
300
200
100
0
1/1/1987
11/5/1993
9/9/2000
7/15/2007
Shows significant increasing trend

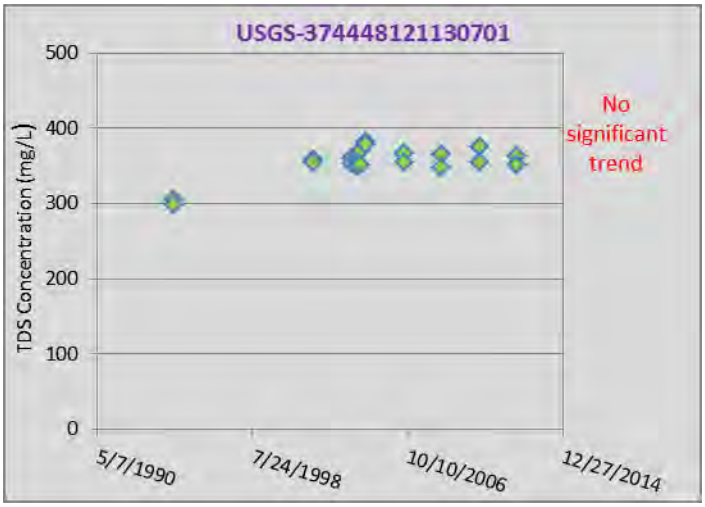

W0603901377_3901377-001
TDS Concentration (mg/L)
500
400
300
200
100
0
9/1/2002
10/10/2006
11/18/2010
12/27/2014
No significant trend

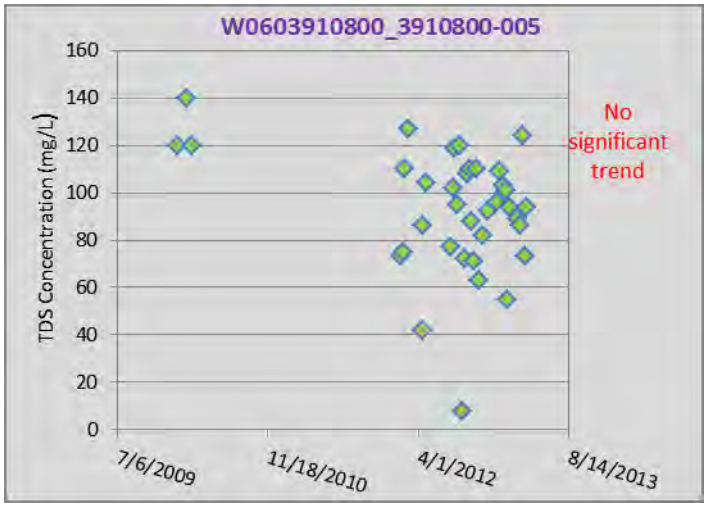

L10008252269_MW-2
TDS Concentration (mg/L)
1400
1200
1000
800
600
400
200
0
9/1/2002
10/10/2006
11/18/2010
12/27/2014
Shows significant decreasing trend


W0603910702_3910702-003
TDS Concentration (mg/L)
1400
1200
1000
800
600
400
200
0
1/1/1985
3/20/1993
6/6/2001
8/23/2009
Shows significant increasing trend


L10008701564_MW-1
TDS Concentration (mg/L)
400
300
200
100
0
9/1/2002
10/10/2006
11/18/2010
12/27/2014
Shows significant decreasing trend


W0603910701_3910701-003
TDS Concentration (mg/L)
600
500
400
300
200
100
0
1/1/1985
3/20/1993
6/6/2001
8/23/2009
Shows significant increasing trend


USGS-374448121130701
TDS Concentration (mg/L)
500
400
300
200
100
0
5/7/1990
7/24/1998
10/10/2006
12/27/2014
No significant trend


W0603910800_3910800-005
TDS Concentration (mg/L)
160
140
120
100
80
60
40
20
0
7/6/2009
11/18/2010
4/1/2012
8/14/2013
No significant trend

3. Contaminated Sites

a. Nitrate

We examined all GeoTracker sites containing at least one well with a high nitrate concentration. Table A5-1 summarizes the GeoTracker site, wells with at least one high nitrate concentration, and a possible explanation for the high nitrate sources. The first ten entries have known nitrate contamination sources, and the remainder of the table has unknown nitrate contamination sources. Figure A3-1 shows the general locations of these sources. Most sites fall within urban areas.

Table A3-1. Hazardous waste sites contaminated with nitrate.

GeoTracker Site ID	Site Name	Well(s)	High-Nitrate Explanation
SL0607707600	LLNL Site 300 High Explosive Process Area	W-6CS, W-815-02, W-815-04, W-815-2803, W-817-03, W-817-03A, W-817-04, W-817-2318, W-817-2609	Nitrate is a contaminant of concern due to high-explosives activities.
SL0607724806	LLNL Site 300 Pit 6	K6-23	Nitrate is a contaminant of concern due to high-explosives activities.
SL0607731692	J.R. Simplot Company	LP-10, LP-11, LP-4, LP-5B, LP-6, LP-8, LP-9	Nitrate (along with TDS, SO42-, and NH4+) contamination in groundwater via storage ponds from fertilizer manufacturing by Occidental Chemical.
SL0607777697	Ripon Farm Service	CRW-2S, MW101, MW102, MW103, MW104, MW5, RMW-1D, RMW-2S, RMW-3S	The site was formerly used for the mixing and distribution of N-based fertilizers.
SL0607793362	LLNL Site 300 Pits 1 and 7/B850	NC7-29	Nitrate is a contaminant of concern due to high-explosives activities.
SL185372909	Koppel Stockton Terminal	KP-10S-R, KP-12S	Former dry fertilizer warehouse and bagging facility.
SL205763037	OXYCHEM Stockton	MW-10, MW-11, MW-2, MW-5B, MW-6, MW-7, MW-8	“Fertilizers” is one of the contaminants of concern listed for this site, ostensibly stemming from OXYCHEM manufacturing operations.
SL205843044	Crop Production Services	E-1, MW-12, MW-14A, MW-16A, MW-16B, MW-	Nitrate (along with 1,2-DCP, 1,2,3-TCP, and NH4+)

GeoTracker Site ID	Site Name	Well(s)	High-Nitrate Explanation
		18A, MW-2, MW-6, MW-9	contamination in groundwater via storage ponds from fertilizer mixing by Crop Production Services.
SLT5S0033055	Occidental Chemical Agricultural Products Company	EW-08A, EW-08B, PW01-129, PW05-063, PW08-076, PW12-078, PW12-139, PW16-083, PW22-071, WS-1-2, WS-1-3, WS-1-4, WS-1-5, WS-1-6, WS-1-7	Nitrate is monitored under this project, but the explanation for contamination is probably former fertilizer operations (see J.R. Simplot project above—same location).
--	Woods Dairy	WOO-MW2, WOO-MW3	Dairy location
L10008827999	Forward Landfill	AMW-2	Landfill activities might introduce nitrate into shallow groundwater, however well with high nitrate is up-gradient of the landfill.
SL185422914	Olin Chlor Alkali Products	MW-1, MW-7	Site used for liquid bleach manufacturing (1975-pres). Previously used for used tire storage (1957-70) and alfalfa dehydration (1948-57). Discharger requested that nitrate be removed from the MRP because (1) there is no nitrate source on site, and (2) it is probably elevated due to regional background. Board approved.
SL185432915	BP/AA-Stockton	MW-11	Gasoline contamination. Pump-&-treat being used to remediate VOCs, mainly TCE. No apparent connection to nitrate.
SL186142972	Continental Grain Co.	EW-11B, MW-13B, MW-2A, MW-2B, MW-3A, MW-3B, MW-4B, MW-5A, MW-5B, MW-7A, MW-7B, MW-8B, MW-9B	Discharger's consultants say high NO3 is regional and attributable to agriculture. They see it is a problem, because it competes with carbon tetrachloride for the reducing iron they are

GeoTracker Site ID	Site Name	Well(s)	High-Nitrate Explanation
			injecting for remediation.
T0607700026	Deuel Vocational Institution – Maintenance Building	MW-2, MW-7	Gasoline contamination with no remediation. No apparent connection to nitrate.
T0607700078	Knowles Station	MW2	Gasoline contamination with no remediation except excavation. No apparent connection to nitrate.
T0607700134	Arco #0548 (Former)	MW-7	Gasoline contamination. Air sparging remediation was conducted intermittently from 2000 to 2010.
T0607700305	Shell #204-7524-4305	MW-3	Gasoline contamination. Remediation techniques included groundwater pumping, vapor extraction, and a free-product skimming system. No apparent connection to nitrate.
T0607700391	Chevron #9-0557	MW-16	Gasoline contamination. Air sparging remediation was conducted from 2002 to 2003.
T0607700632	Center St. Parts	MW-3, MW-5	Gasoline contamination. Soil vapor extraction remediation was conducted. No apparent connection to nitrate.
T0607700697	Shell #204-7524-3505	MW-4	Gasoline contamination. Remediation techniques include pump-&-treat, soil vapor extraction, and (2009-10) a pilot test of in-situ chemical oxidation.
T0607700888	Arco #5469	MW-8, MW-11	Gasoline contamination. Ozone injection remediation conducted starting in 2002.

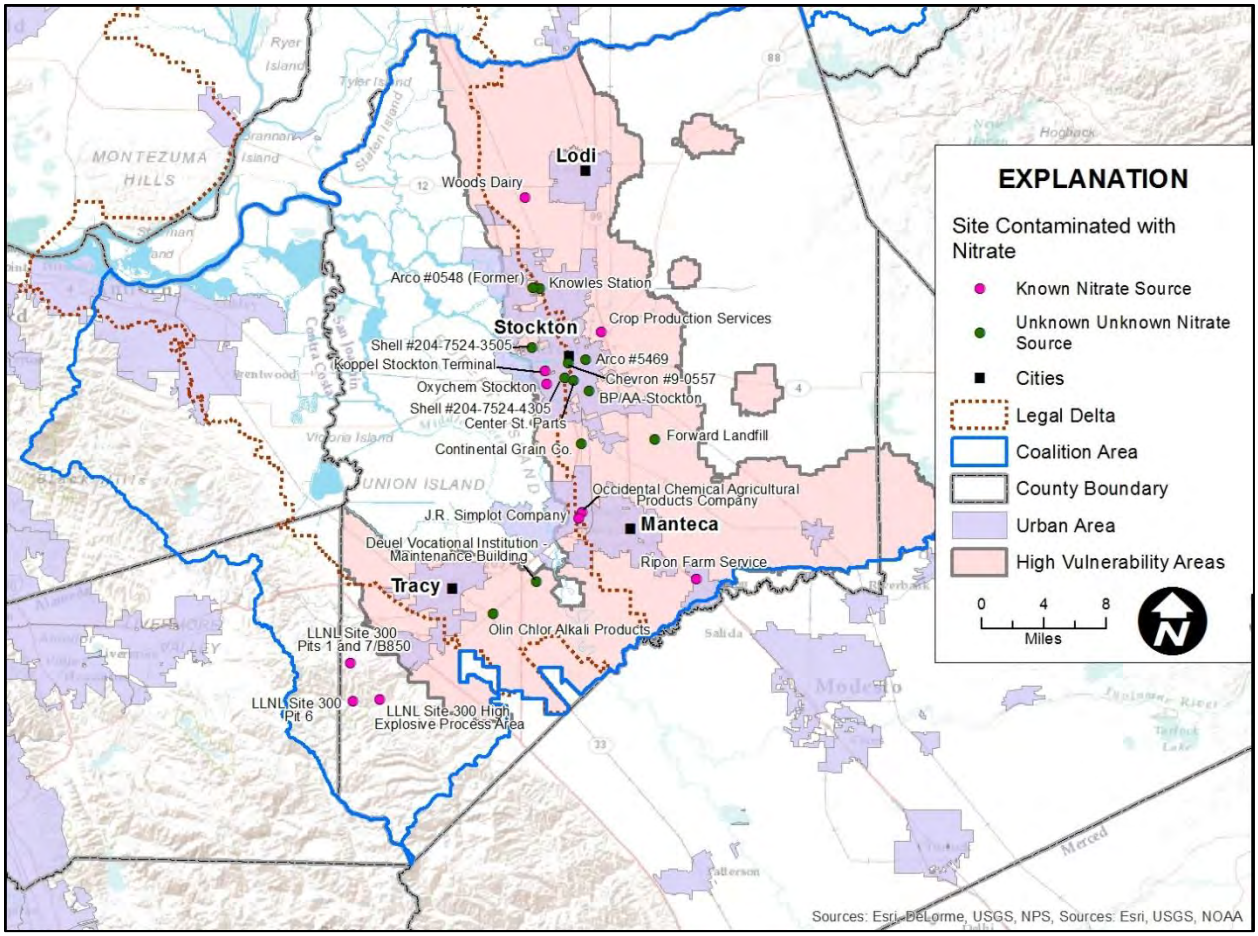


Figure A3-1. Sites contaminated with nitrate.

b. Pesticides

We examined all GeoTracker sites containing at least one well with a pesticide concentration exceedances. There were only three pesticides detected in the Coalition Area, ethylene dibromide (EDB), di-bromo-chloro-propane (DBCP), and Simazine. Table A5-2 summarizes the GeoTracker site, wells with at least one high pesticide concentration, and the chemical of concern. Figure A3-2 shows the general locations of these sources. Most sites fall within urban areas.

Table A3-2. Hazardous waste sites contaminated with EDB, DBCP, or Simazine.

GeoTracker Site ID	Site Name	Well(s)	Chemical of Concern
SLT5S0033055	Occidental Chemical Agricultural Products Company	EW02,EW03, EW04, EW04A, EW06, EW-08A, EW-08B, PW07-203, PW18-199, PW22-071, WS-1-1 to WS-1-7	DBCP & EDB
SL205763037	Oxychem Stockton	MW-5, MW-11	DBCP & Simazine
SL205843044	Crop Production Services - Stockton	E-1,PM-1,PM-2, MW-16,MW-2	DBCP & EDB
T0607700146	Parmar Texaco	PT-MW3	EDB
T0607700882	Stockton City Cab Co.	OS-2D, OS-2S	EDB
T0607700163	Roek Construction	MW13B	EDB
T0607700523	Stallworth Auto Detail	MW-1A	EDB
T0607700685	Former Mobil Station 99CAS	DW3	EDB
T0607700389	E-Z Serve #100966	VEAS-4	EDB
T0607700149	Ocampo Property	MW-5	EDB
T0607700079	Eggiman's Hydraulic Garage	MW2	EDB
SLO607737442	Stockton Terminals Technical Committee	AR/MW-6B	EDB

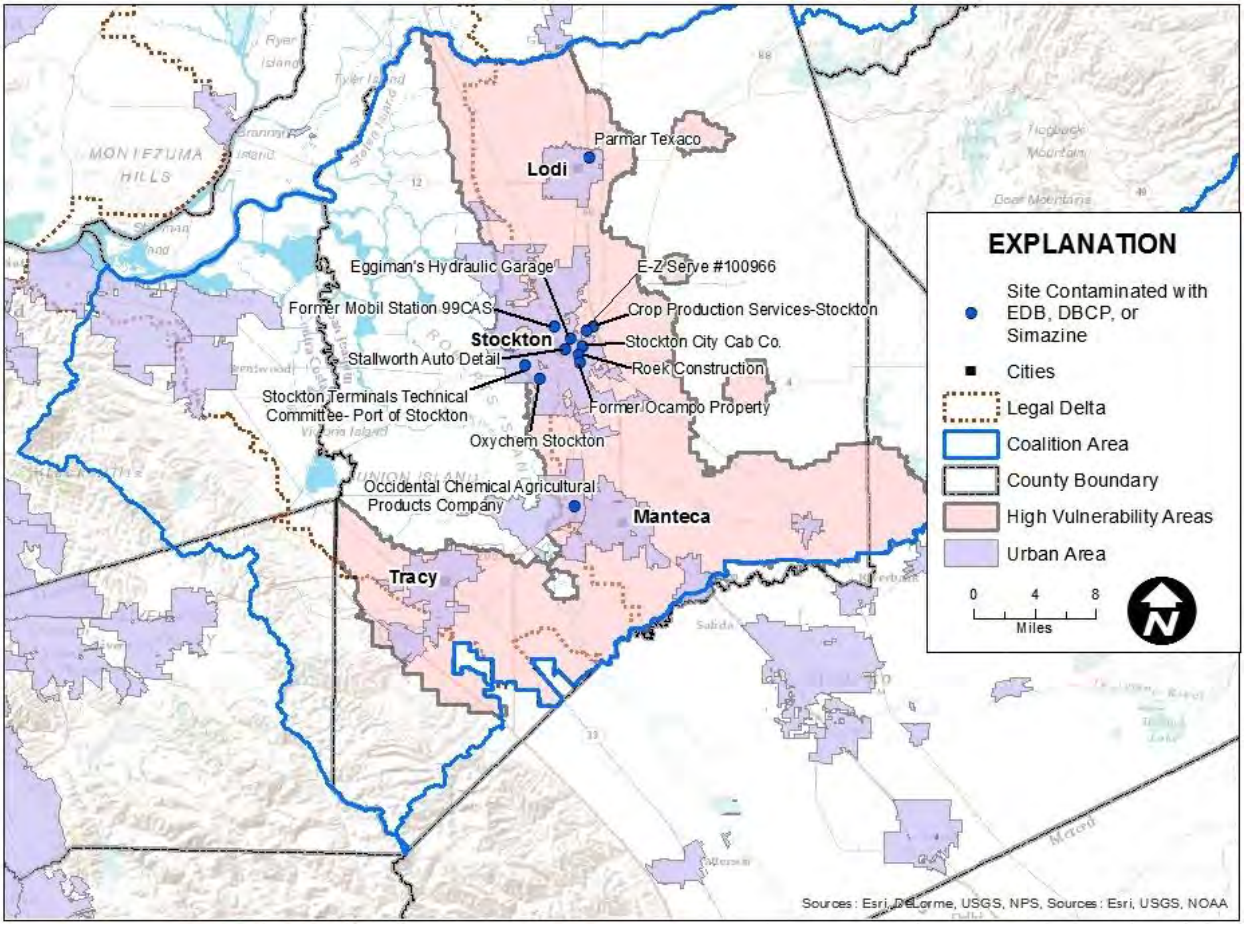


Figure A3-2. Sites contaminated with EDB, DBCP, or Simazine.

Additionally, we plotted the yearly average and maximum pesticide concentrations for 2009 to 2013. Figures A3-3 through A3-7 show the average EDB concentrations and Figures A3-8 through A3-12 show the maximum EDB concentrations for 2009 to 2013. Figure A3-13 through A3-17 show the average DBCP concentrations and Figure A3-18 through A3-22 show the maximum DBCP concentrations for 2009 to 2013. Figure A3-23 through Figure A3-24 shows the average Simazine concentrations for 2009 to 2010 and Figure A3-25 shows the maximum Simazine concentrations for 2010.

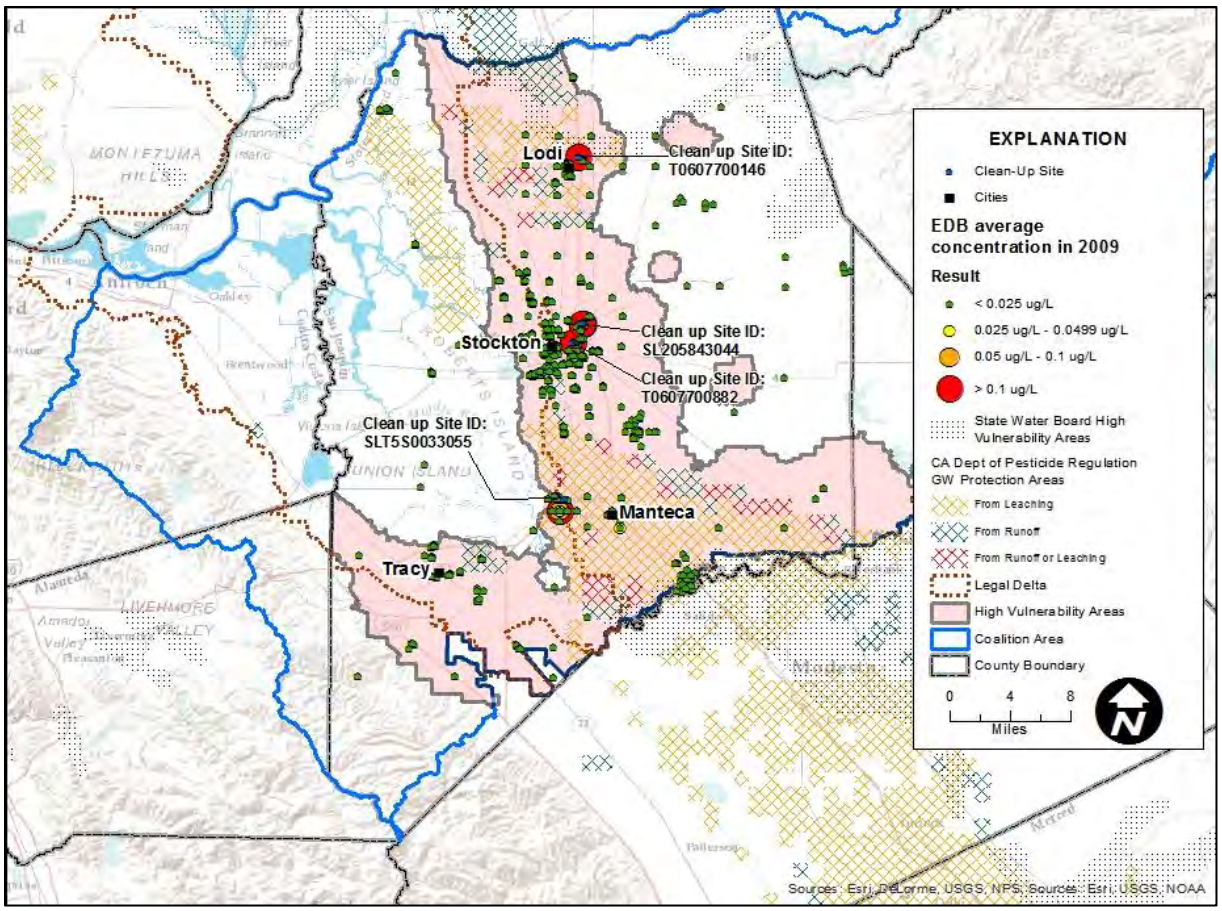


Figure A3-3. Distribution of average EDB concentrations, 2009.

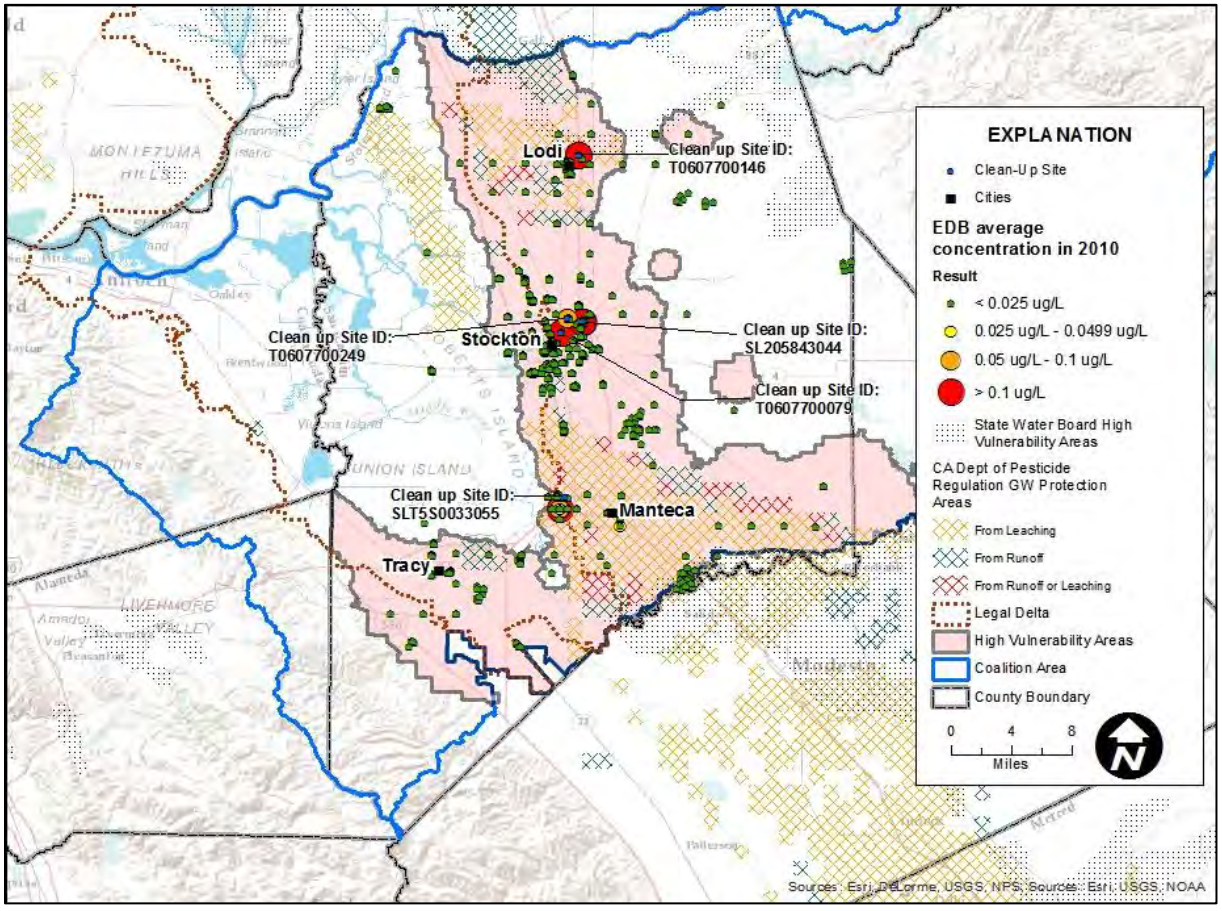


Figure A3-4. Distribution of average EDB concentrations, 2010.

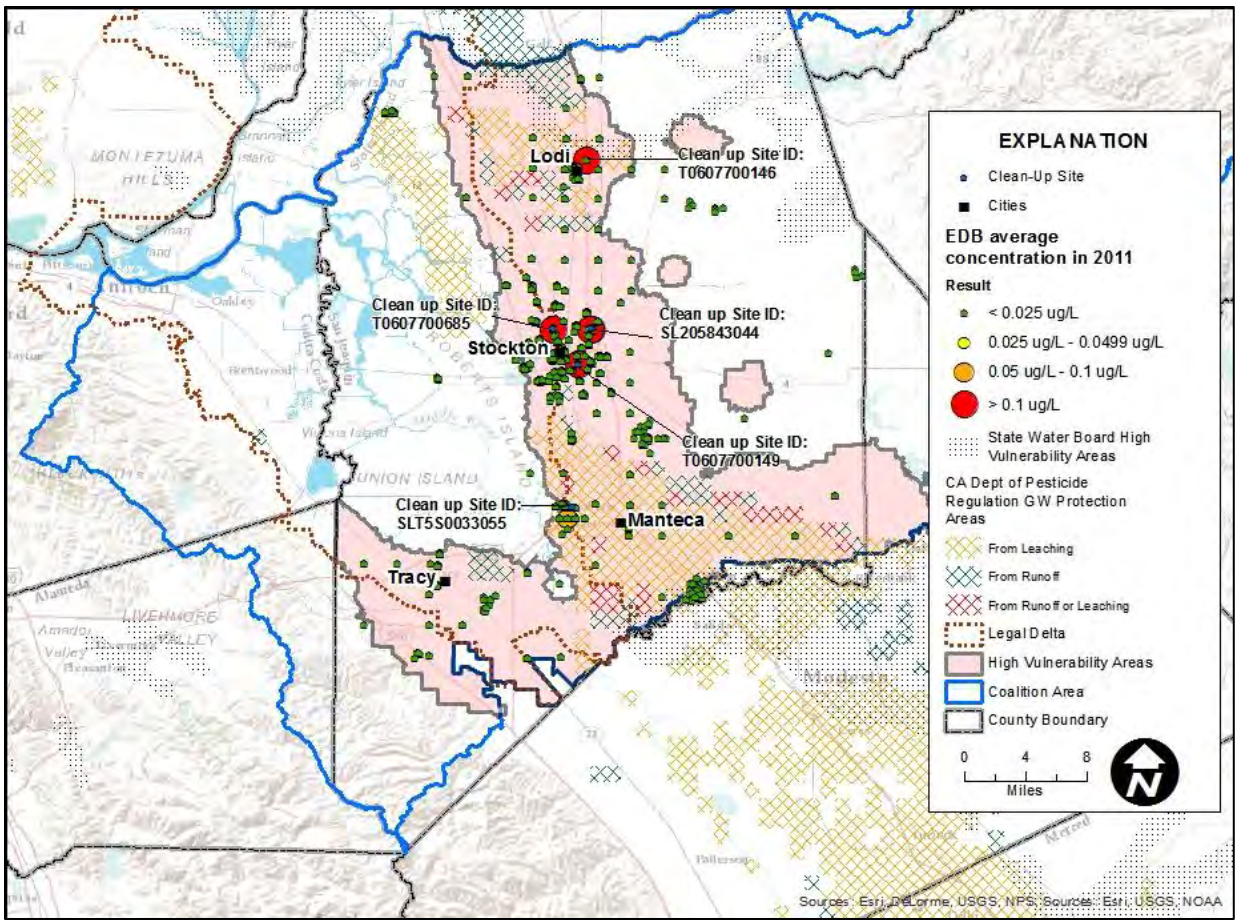


Figure A3-5. Distribution of average EDB concentrations, 2011.

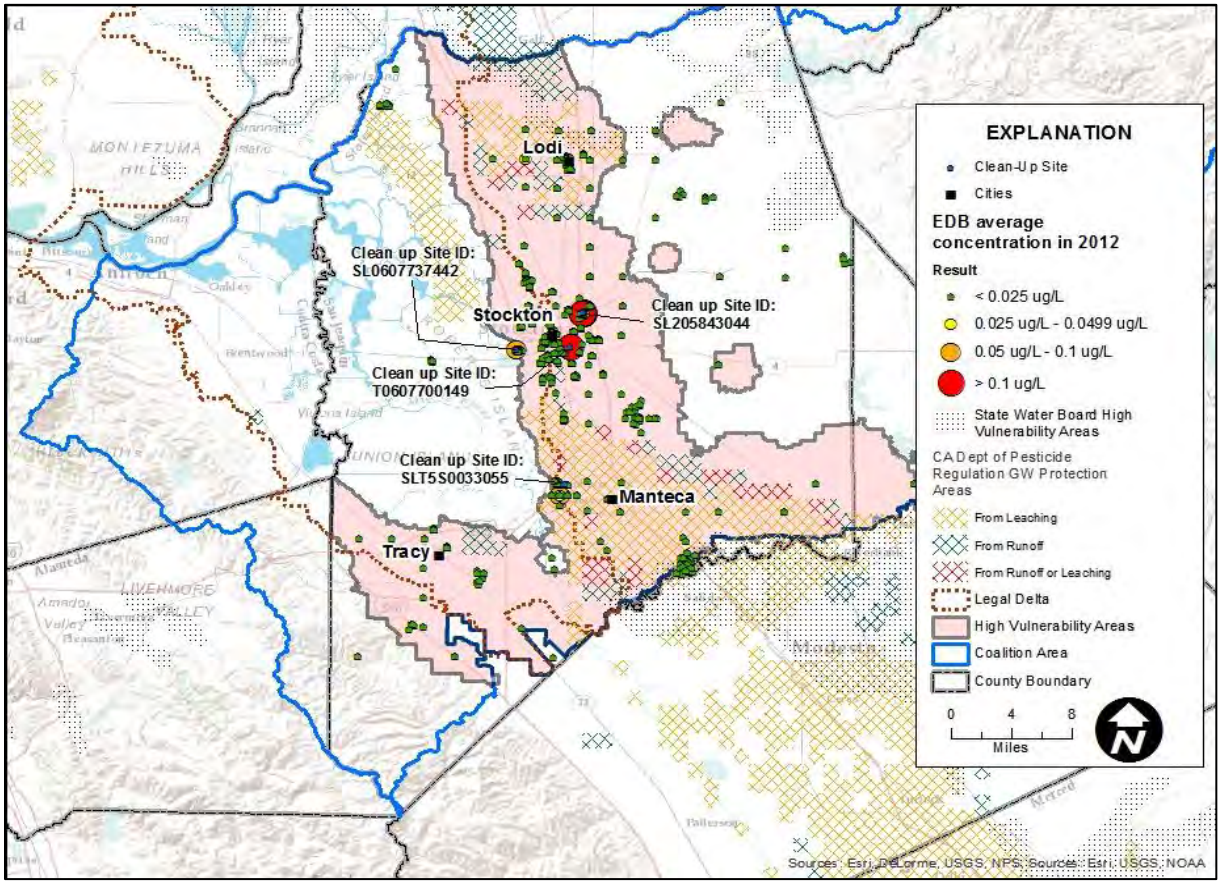


Figure A3-6. Distribution of average EDB concentrations, 2012.

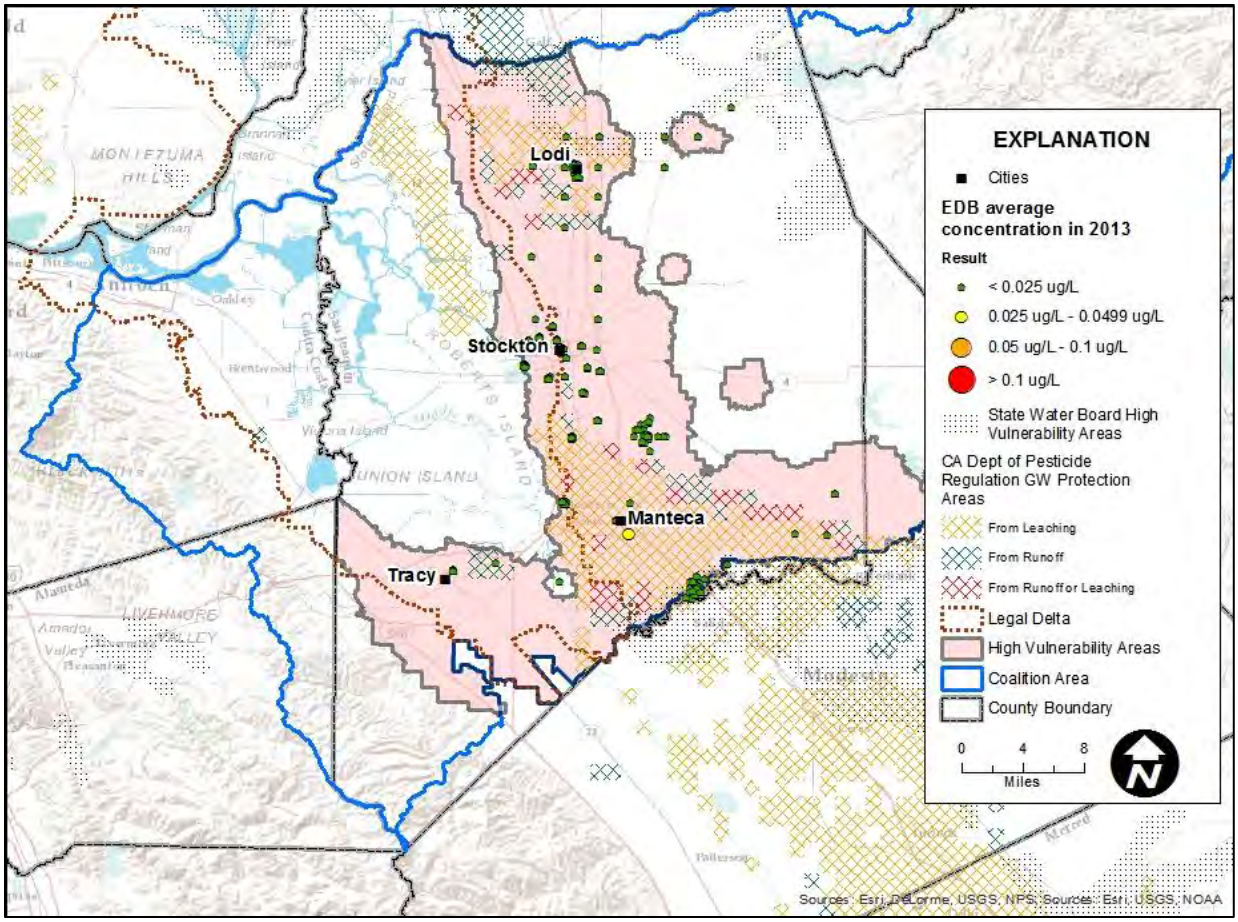


Figure A3-7. Distribution of average EDB concentrations, 2013.

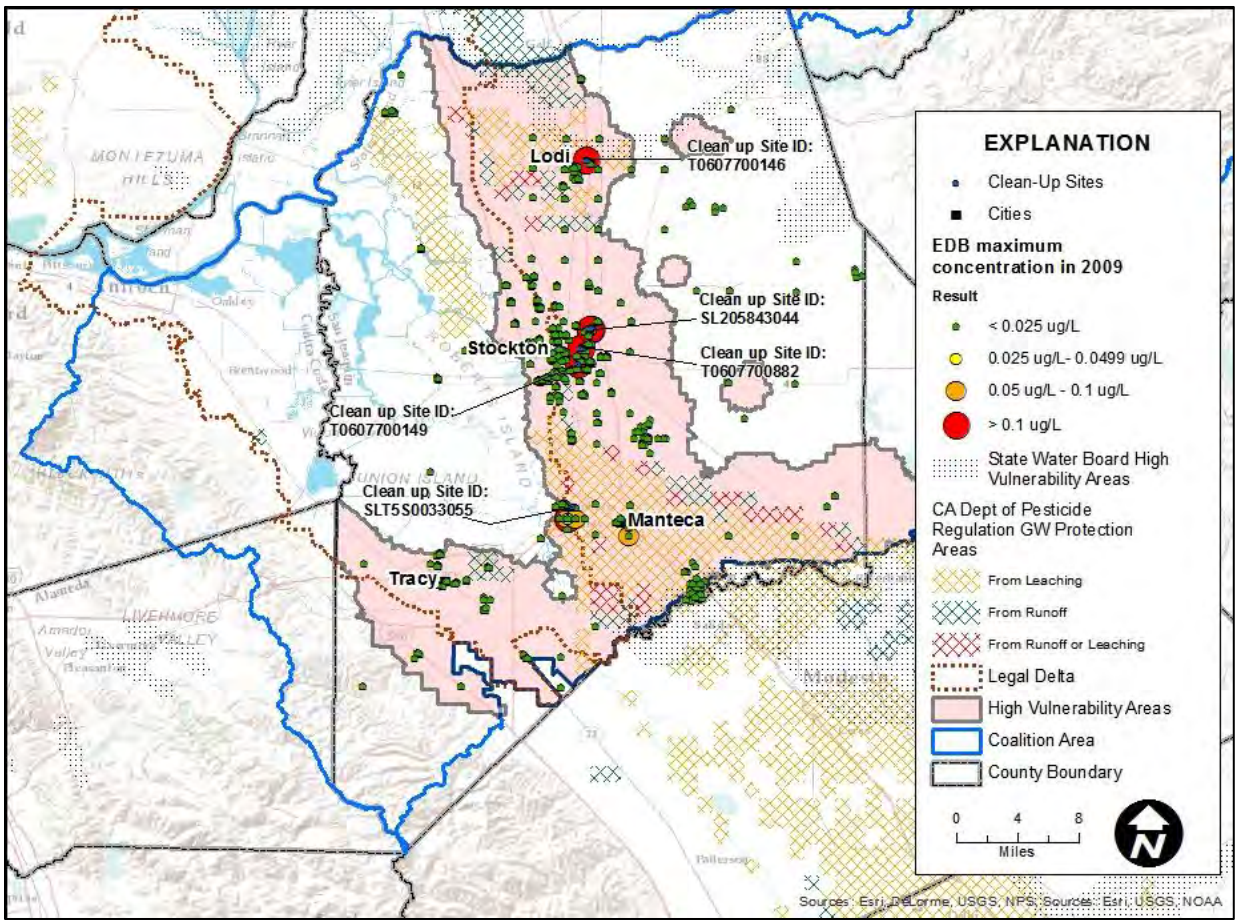


Figure A3-8. Distribution of maximum EDB concentrations, 2009.

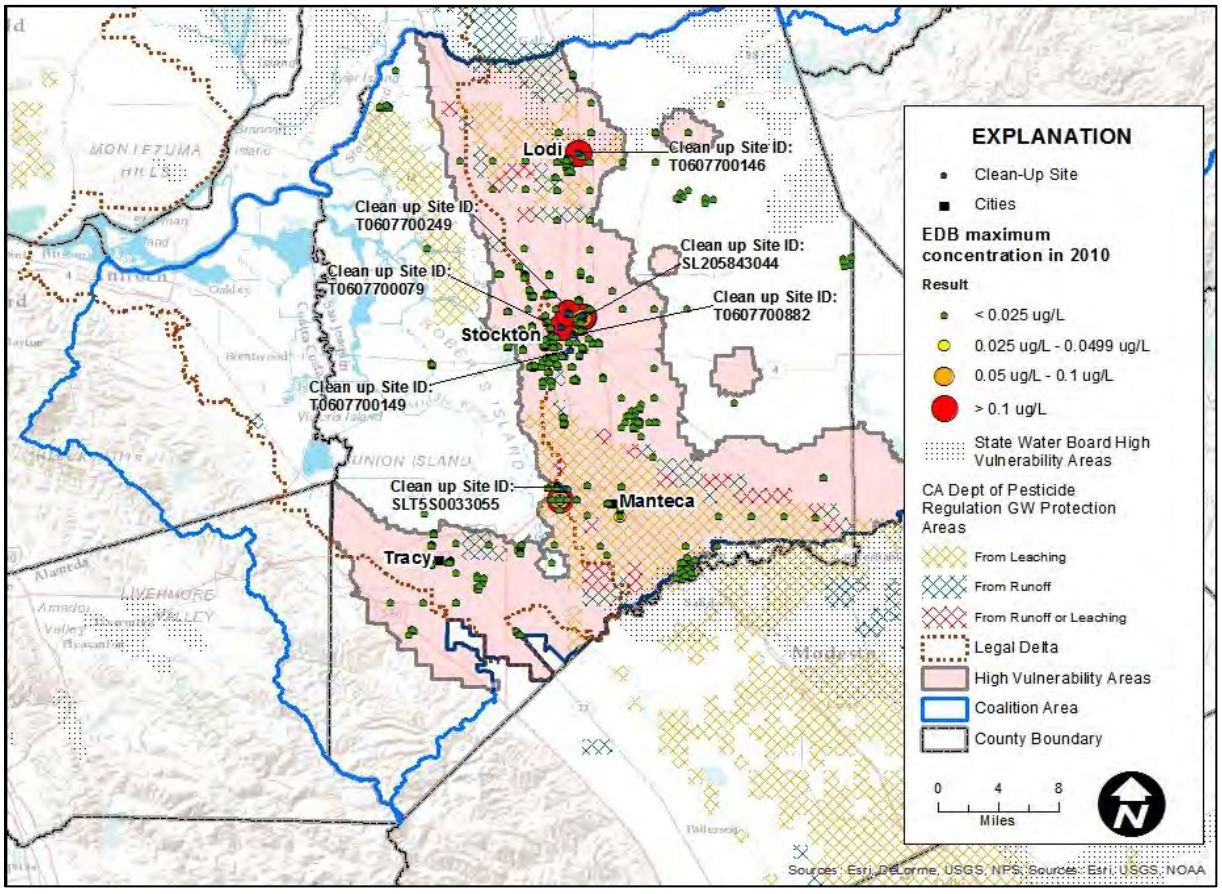


Figure A3-9. Distribution of maximum EDB concentrations, 2010.

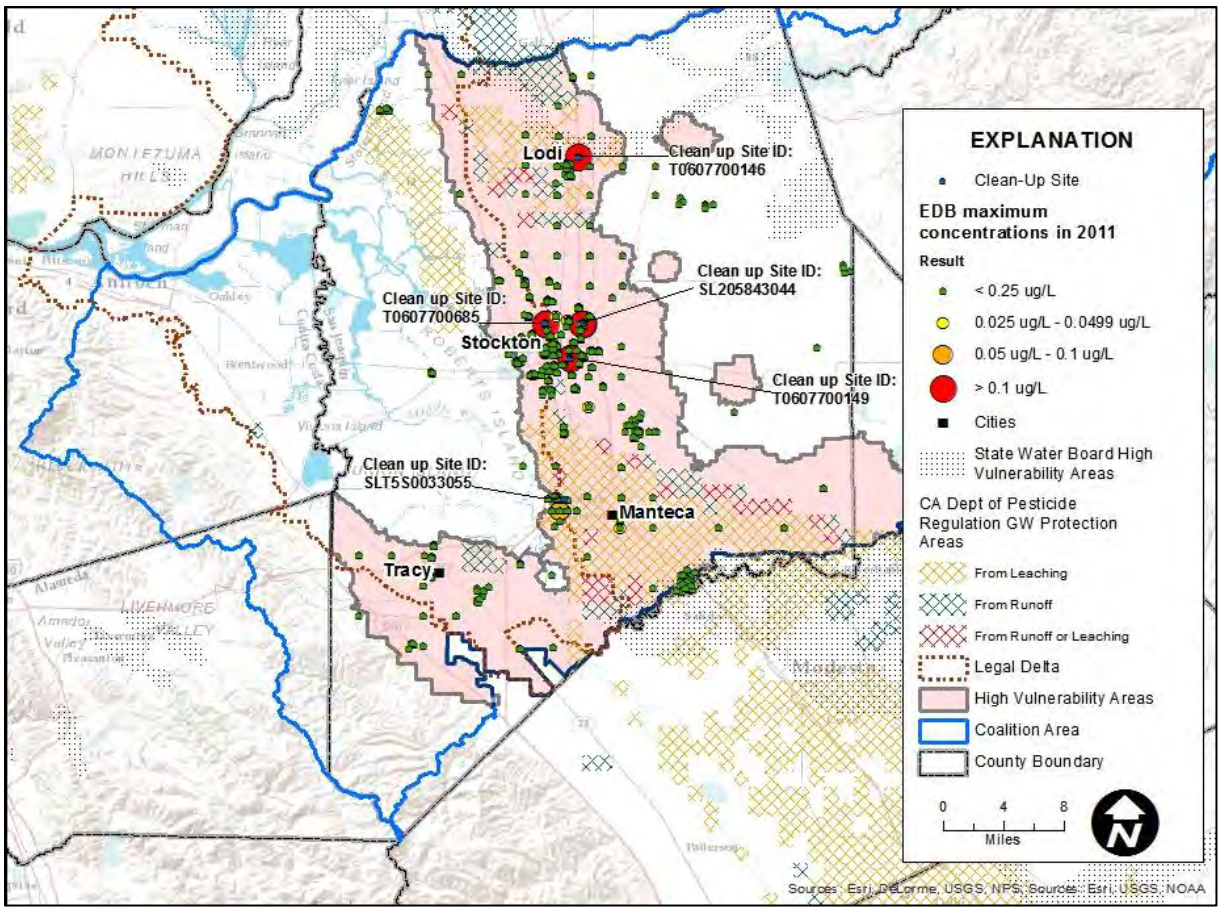


Figure A3-10. Distribution of maximum EDB concentrations, 2011.

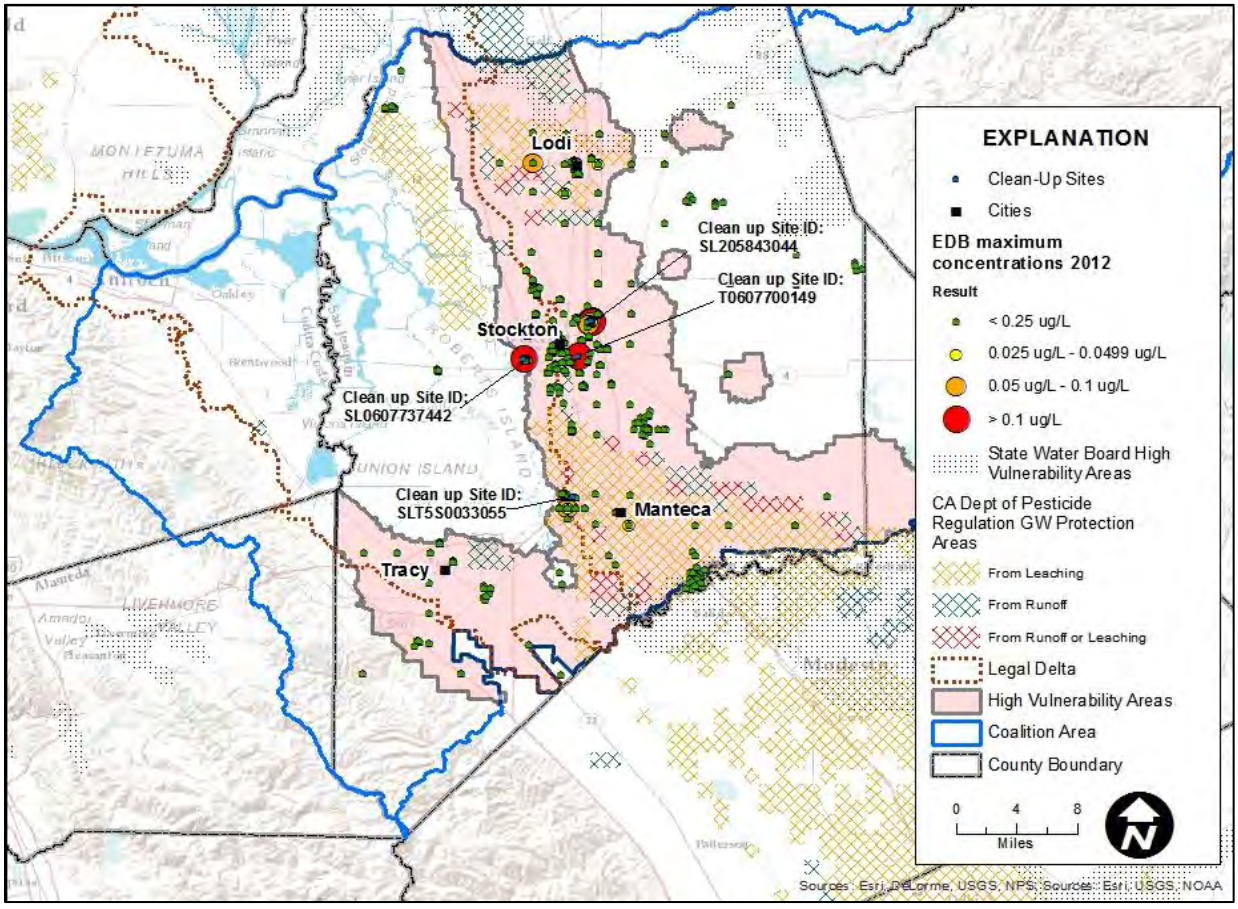


Figure A3-11. Distribution of maximum EDB concentrations, 2012.

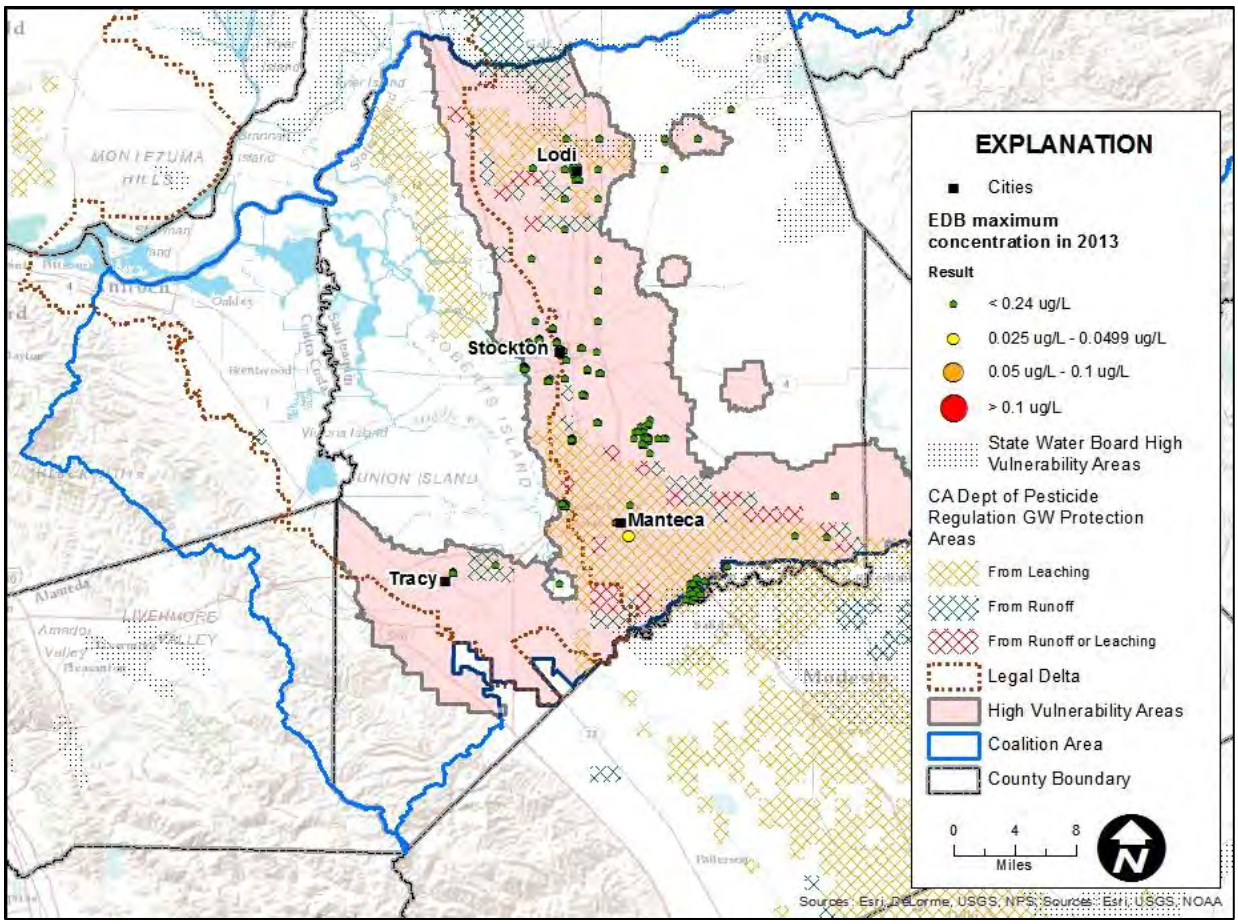


Figure A3-12. Distribution of maximum EDB concentrations, 2013.

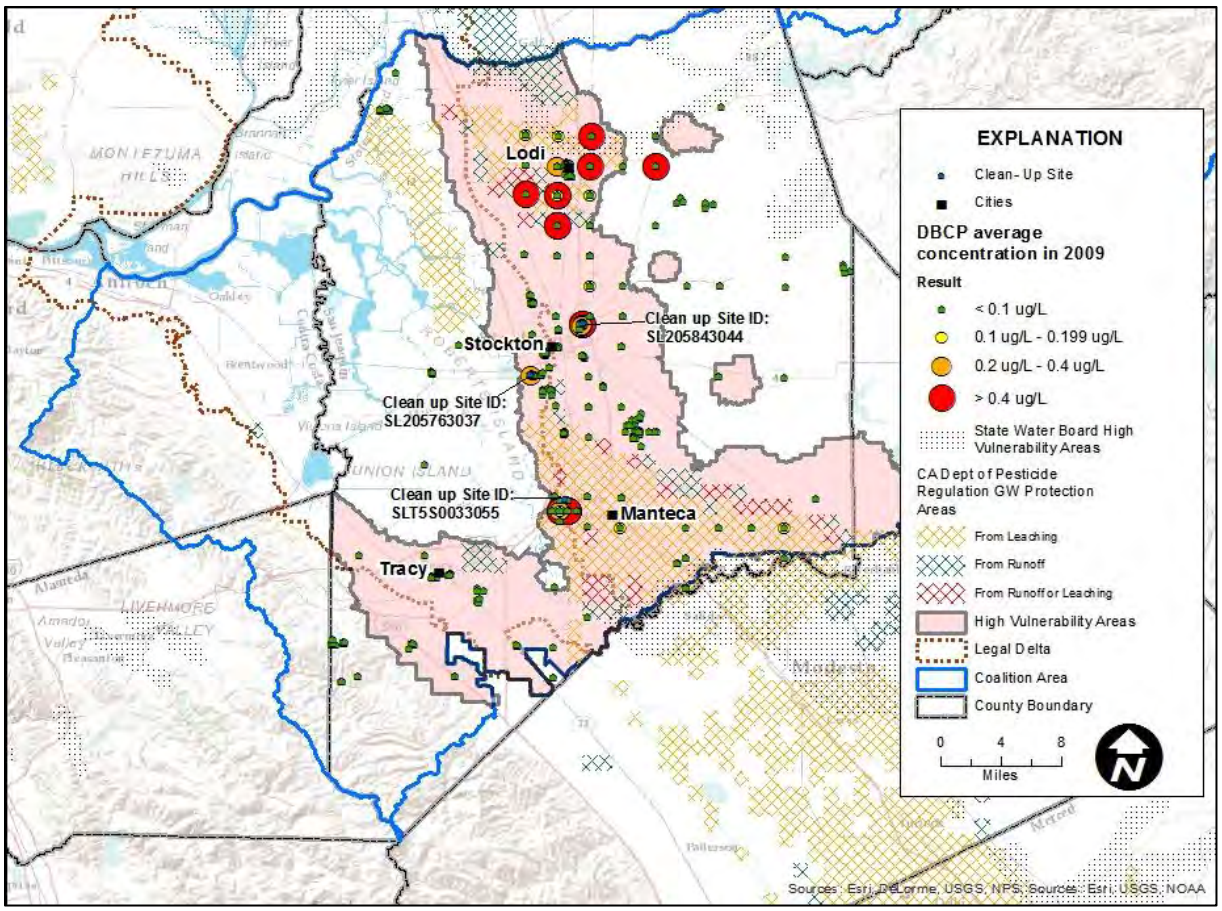


Figure A3-13. Distribution of average DBCP concentrations, 2009.

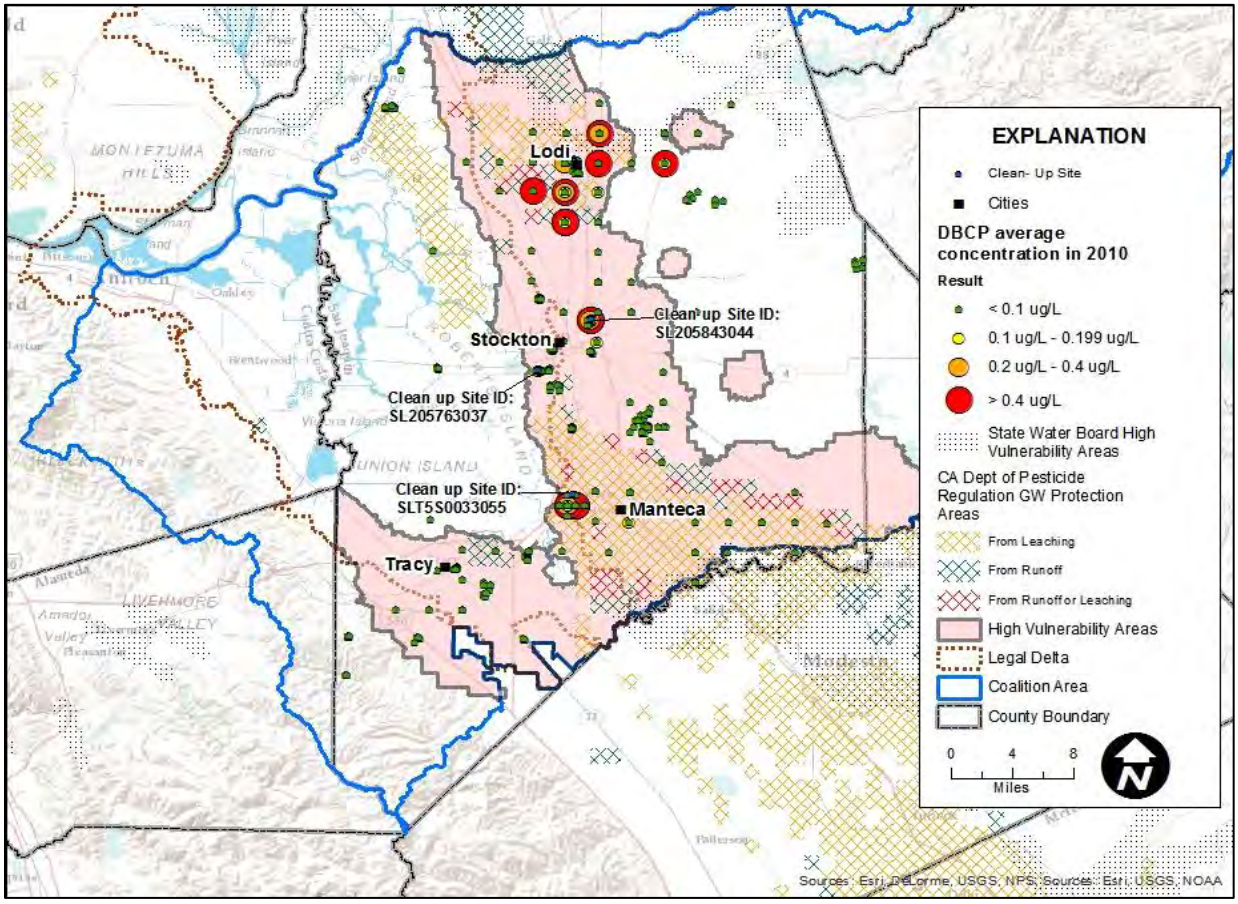


Figure A3-14. Distribution of average DBCP concentrations, 2010.

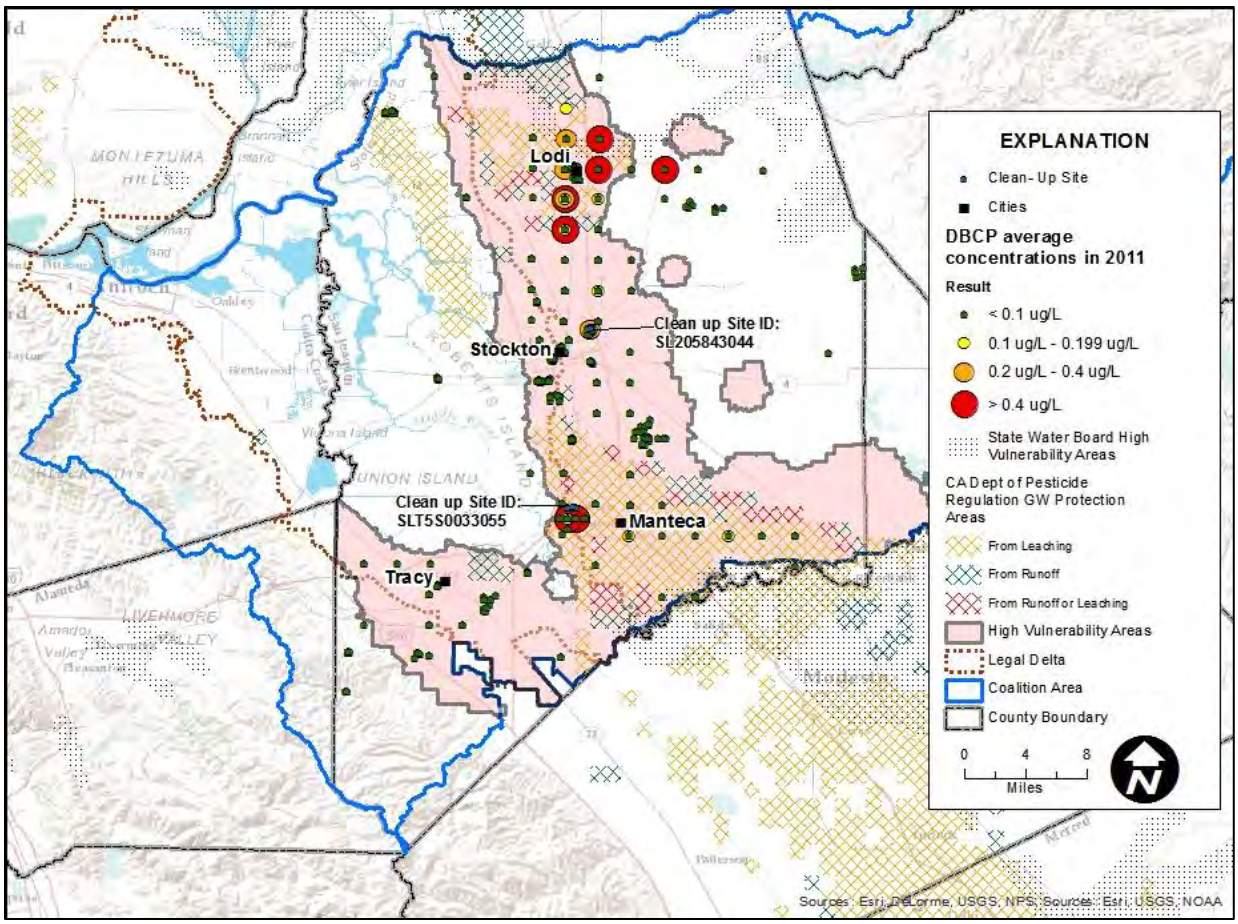


Figure A3-15. Distribution of average DBCP concentrations, 2011.

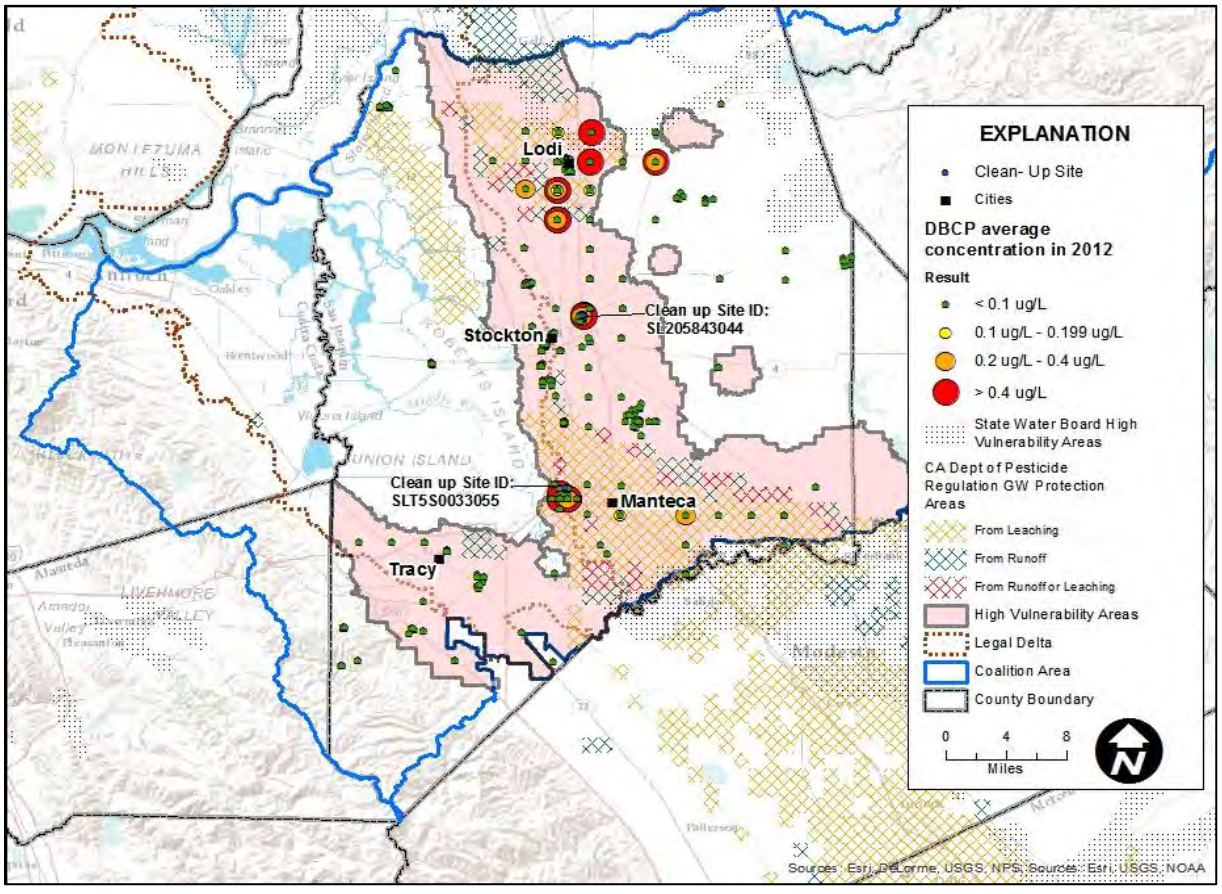


Figure A3-16. Distribution of average DBCP concentrations, 2012.

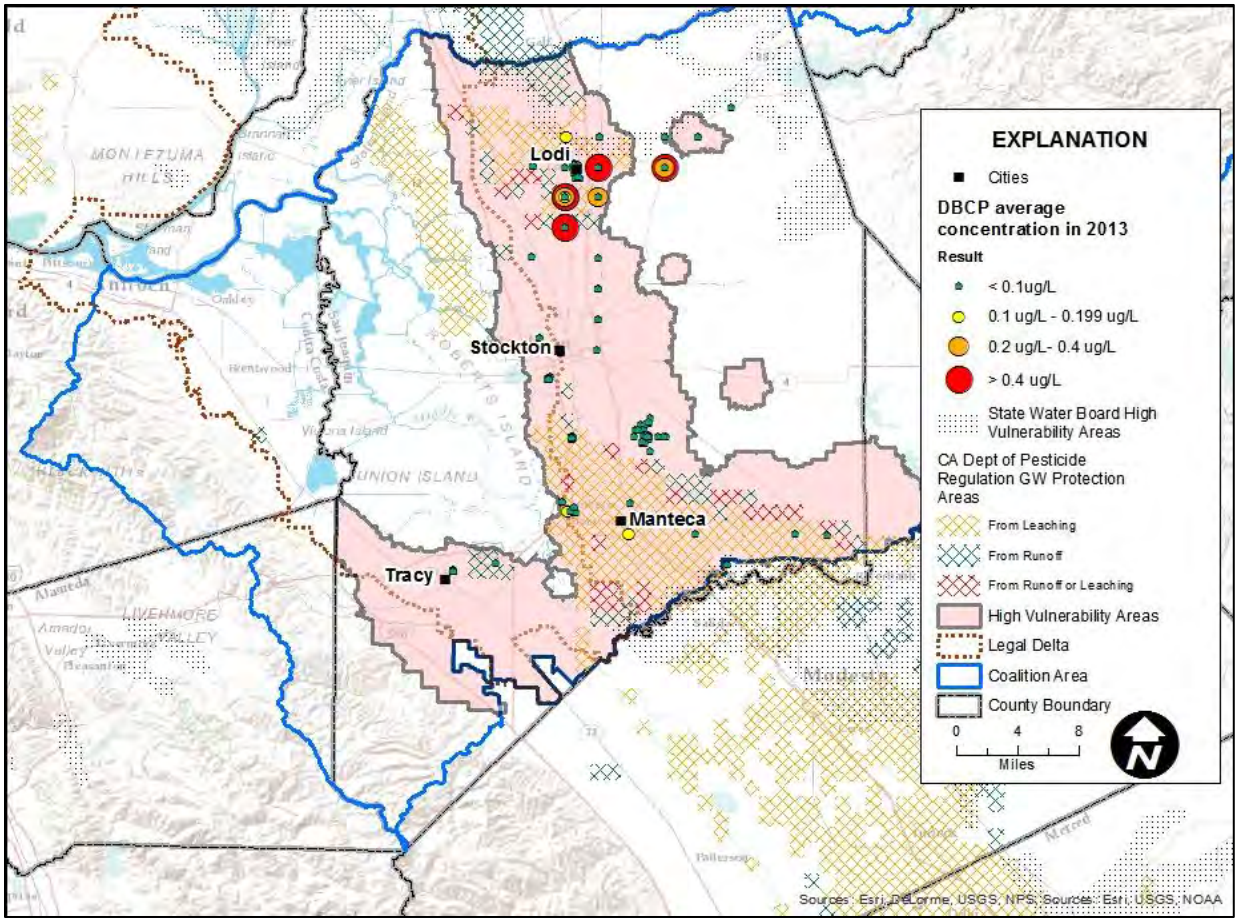


Figure A3-17. Distribution of average DBCP concentrations, 2013.

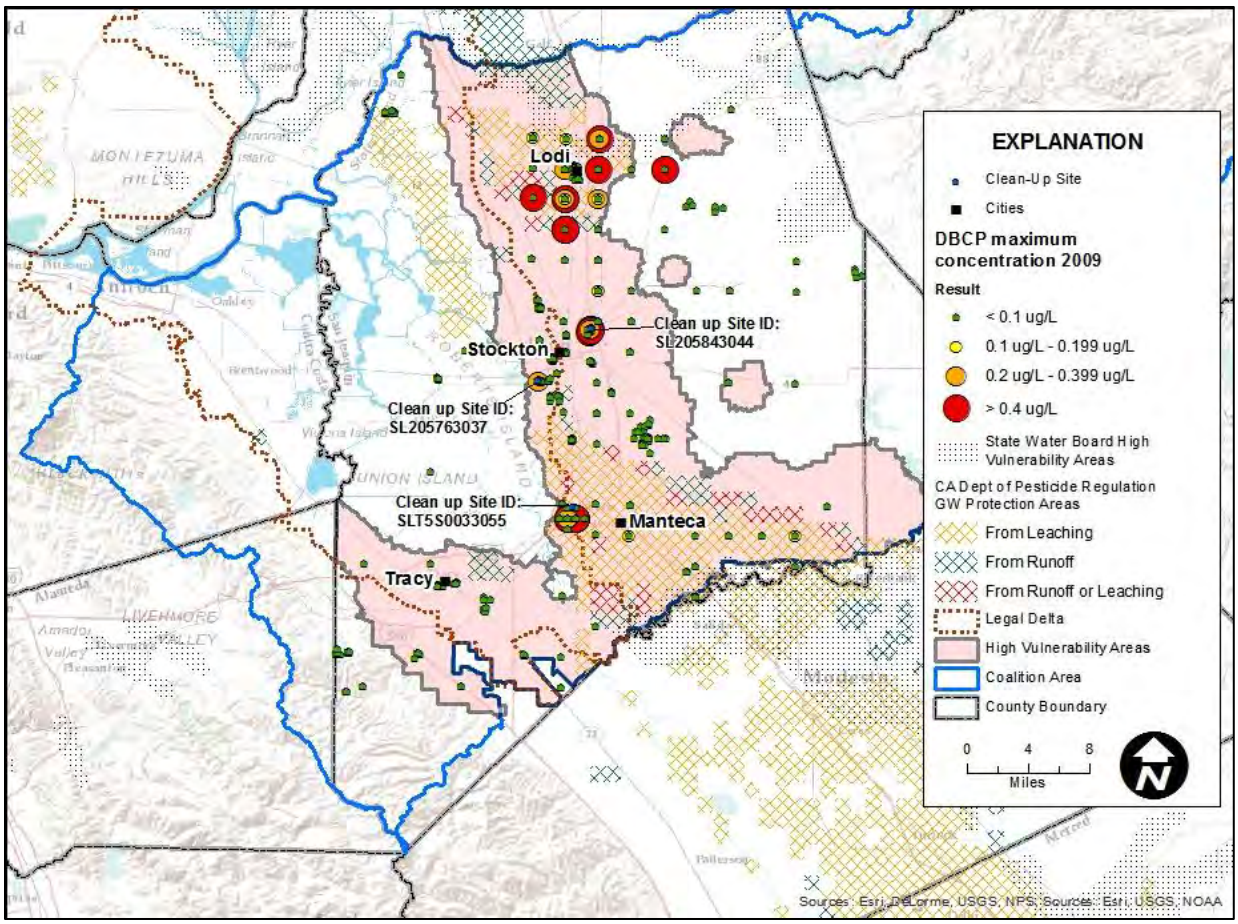


Figure A3-18. Distribution of maximum DBCP concentrations, 2009.

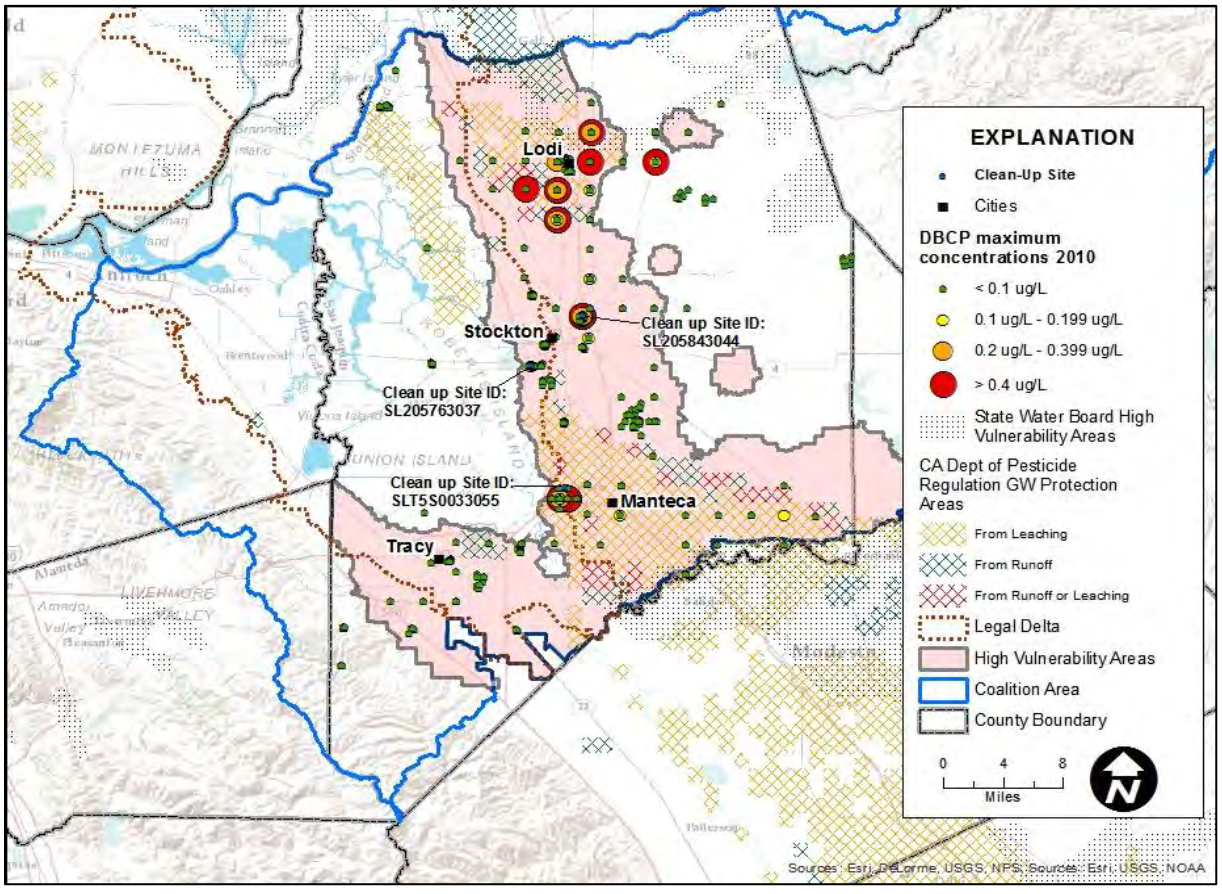


Figure A3-19. Distribution of maximum DBCP concentrations, 2010.

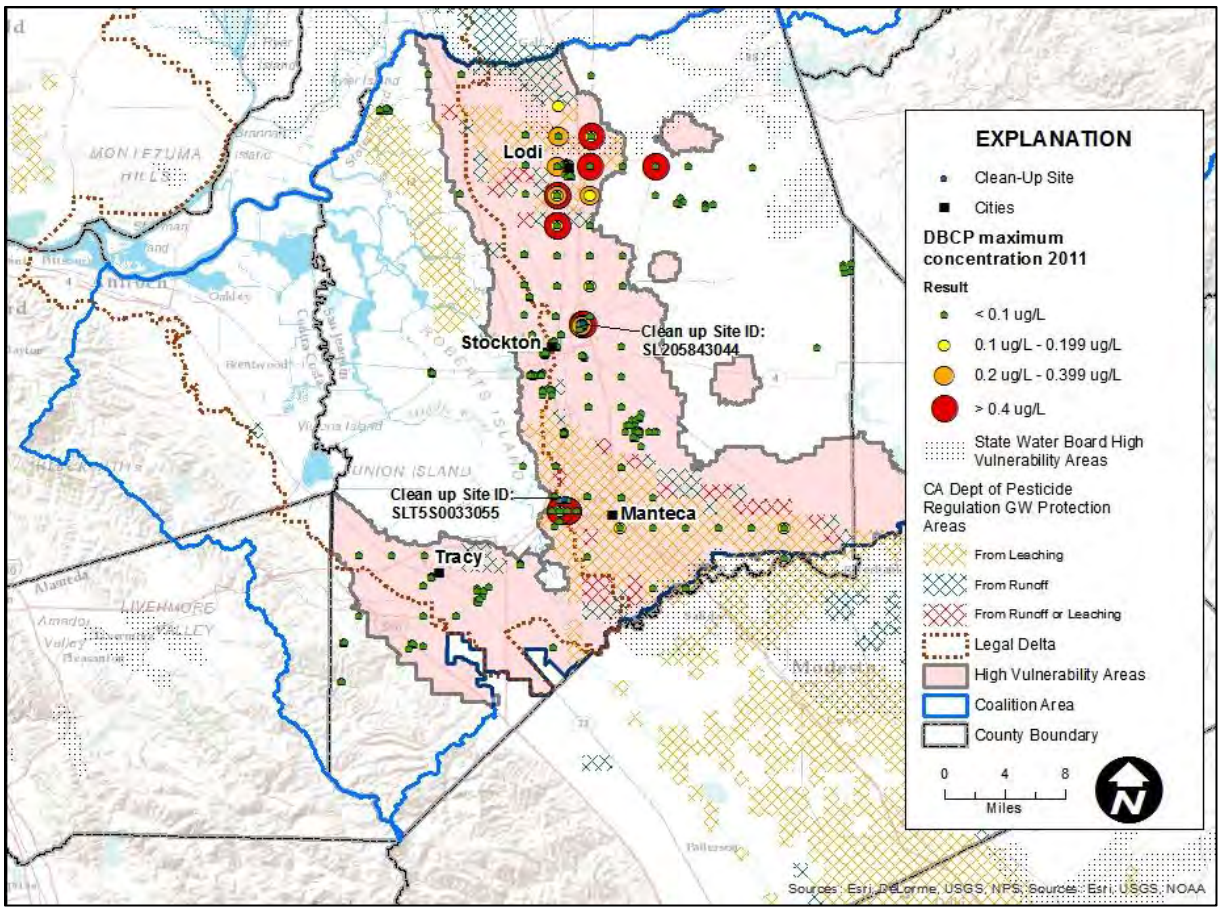


Figure A3-20. Distribution of maximum DBCP concentrations, 2011.

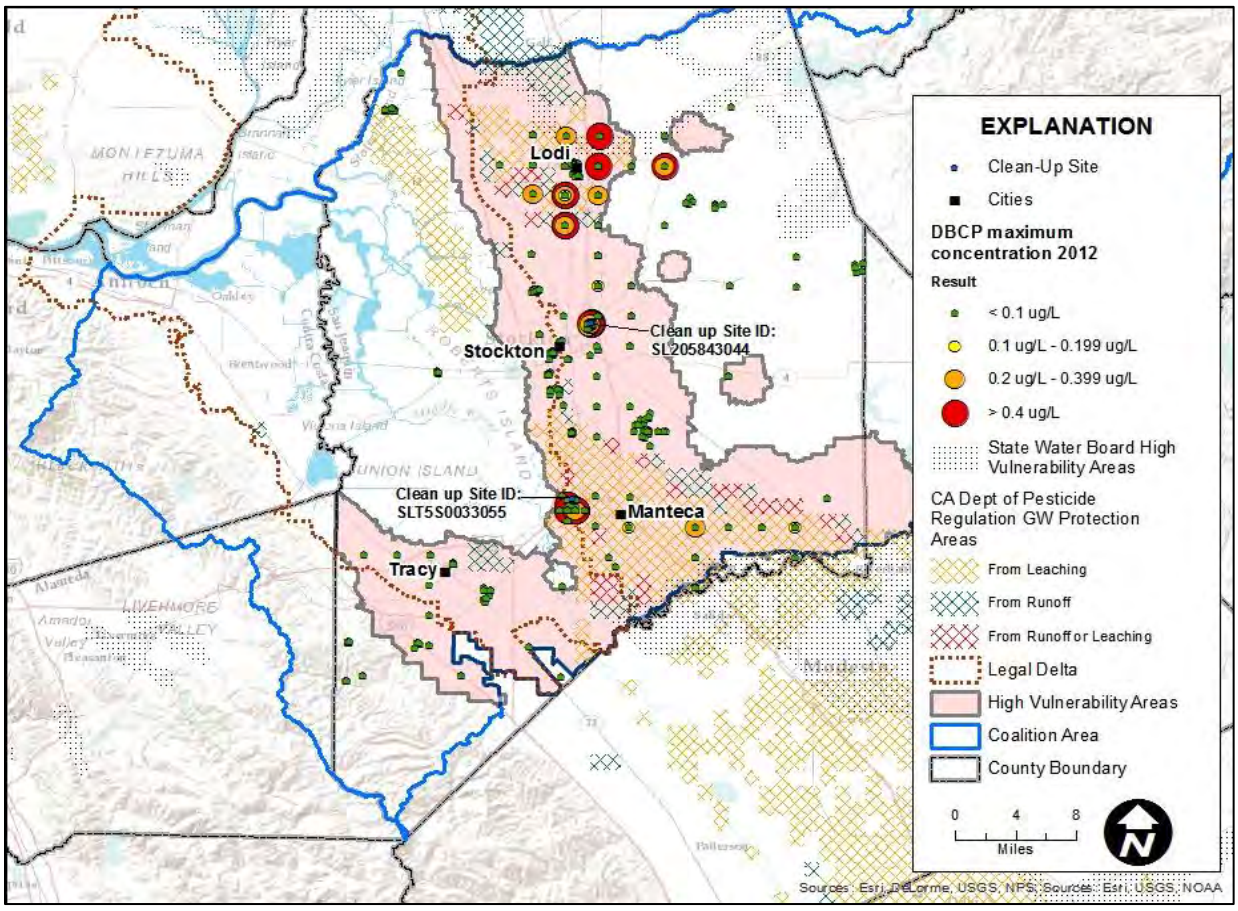


Figure A3-21. Distribution of maximum DBCP concentrations, 2012.

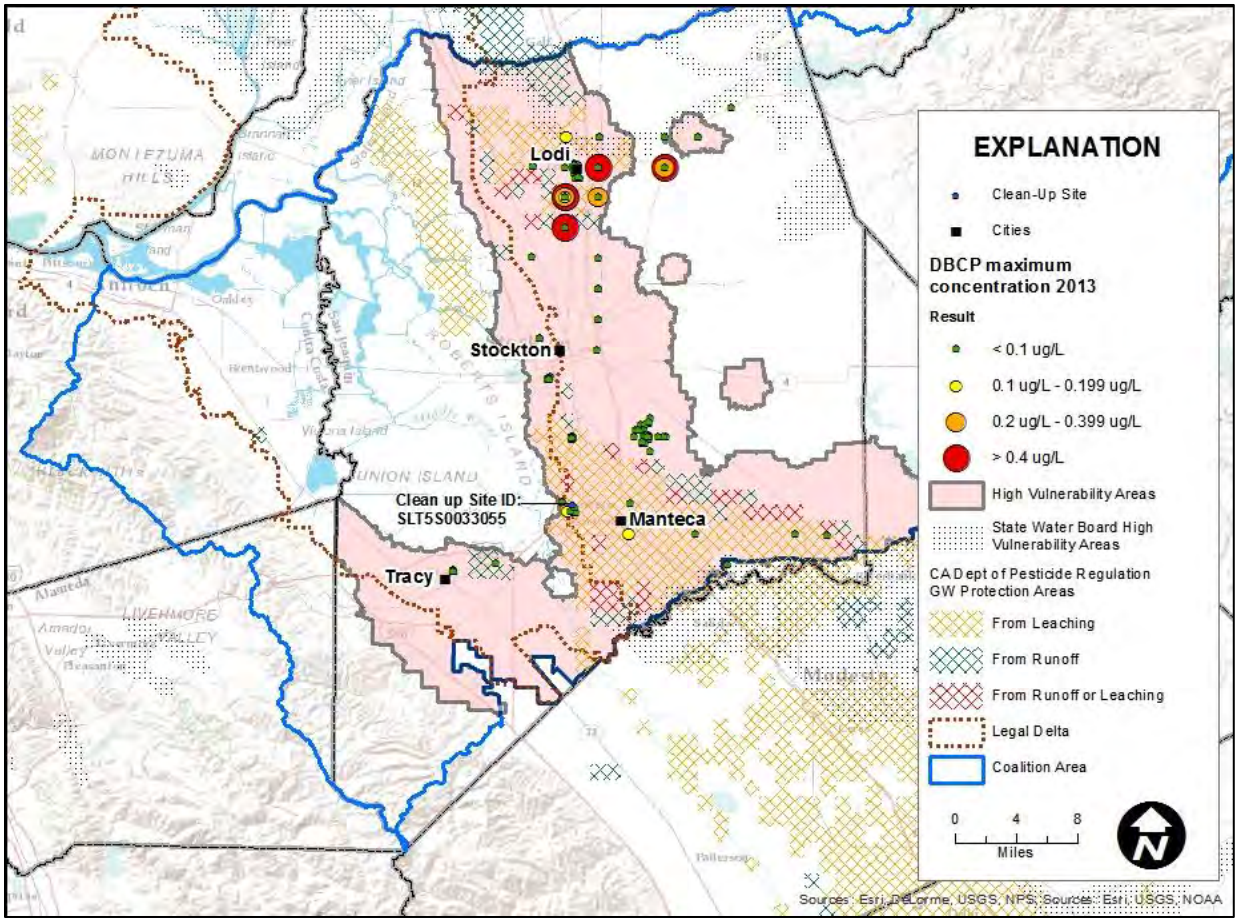


Figure A3-22. Distribution of maximum DBCP concentrations, 2013.

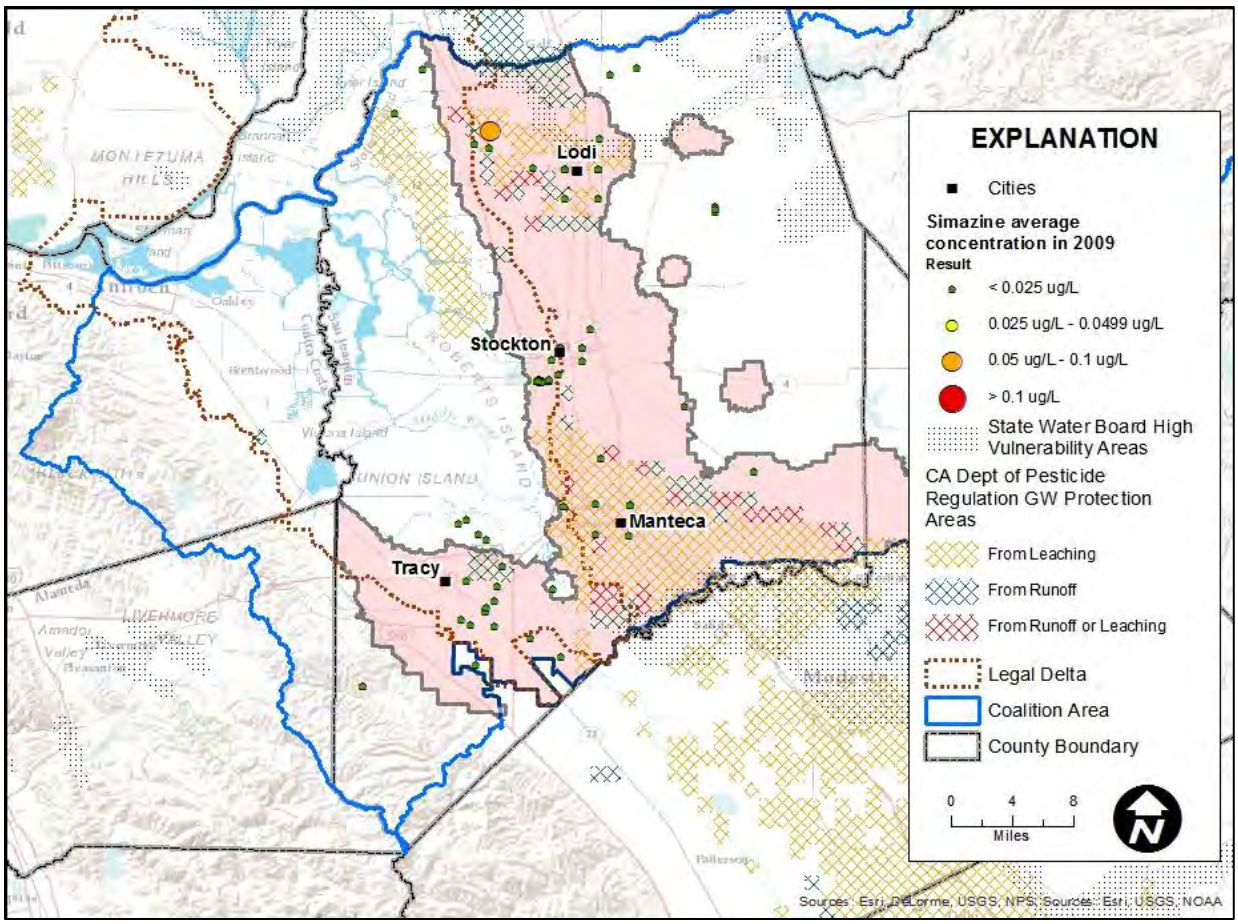


Figure A3-23. Distribution of average Simazine concentrations, 2009.

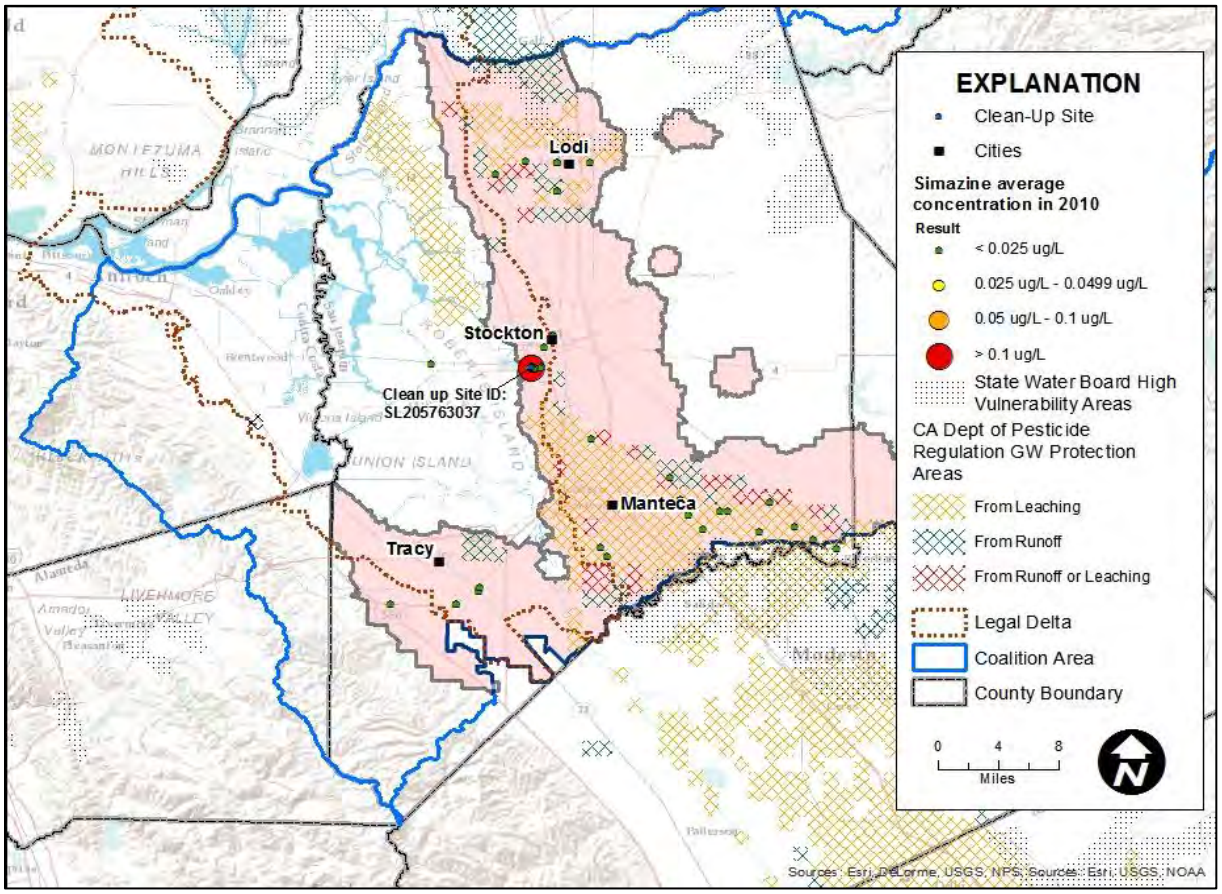


Figure A3-24. Distribution of average Simazine concentrations, 2010.

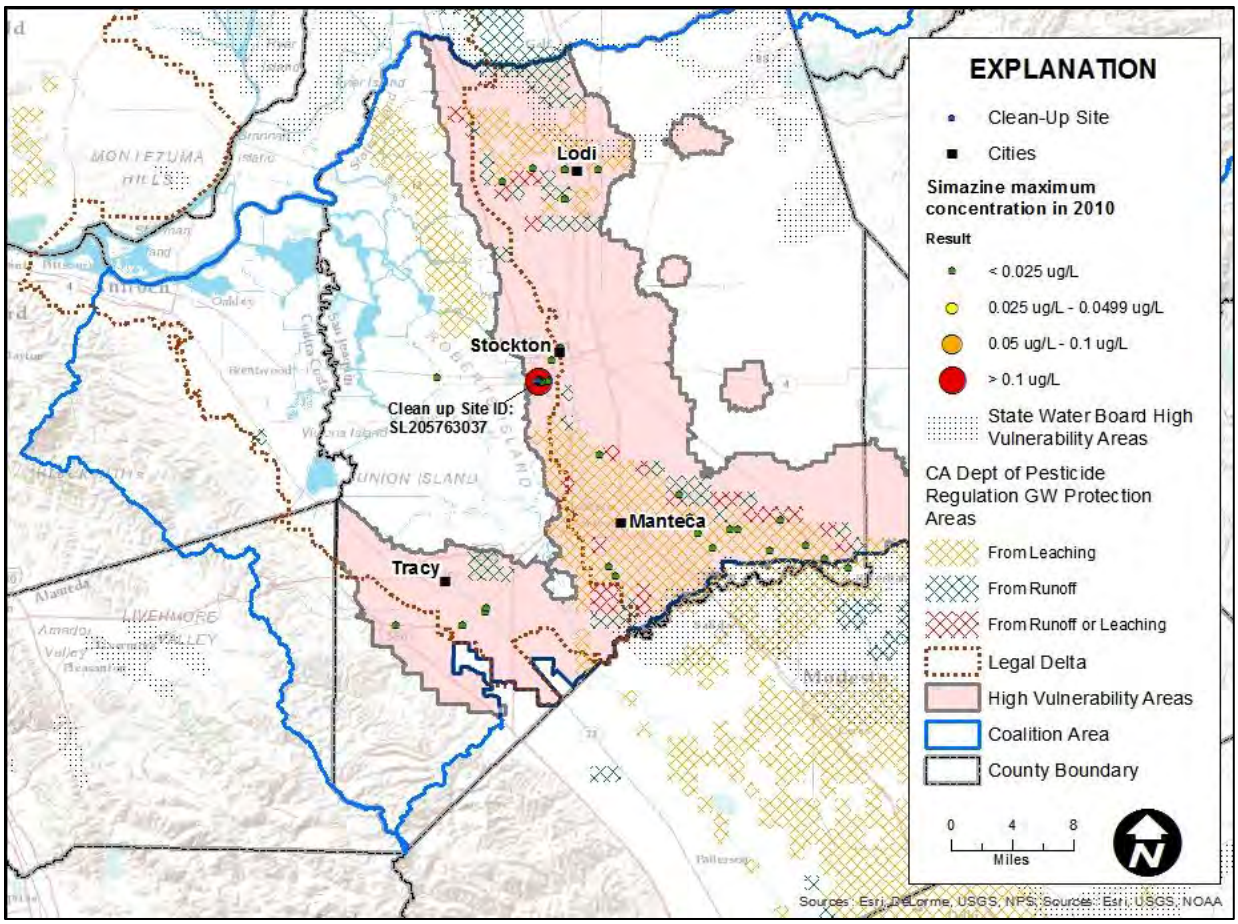


Figure A3-25. Distribution of maximum Simazine concentrations, 2010.

4. Soil Chemistry

We plotted soil pH and salinity in the Coalition area, based on data from the NRCS soil surveys of San Joaquin and northern Stanislaus Counties. Ranges were specified by soil series for both pH and salinity; for plotting we used the mid-point of each soil's respective range. Figure A4-1 shows soil pH and Figure A4-2 shows soil salinity.

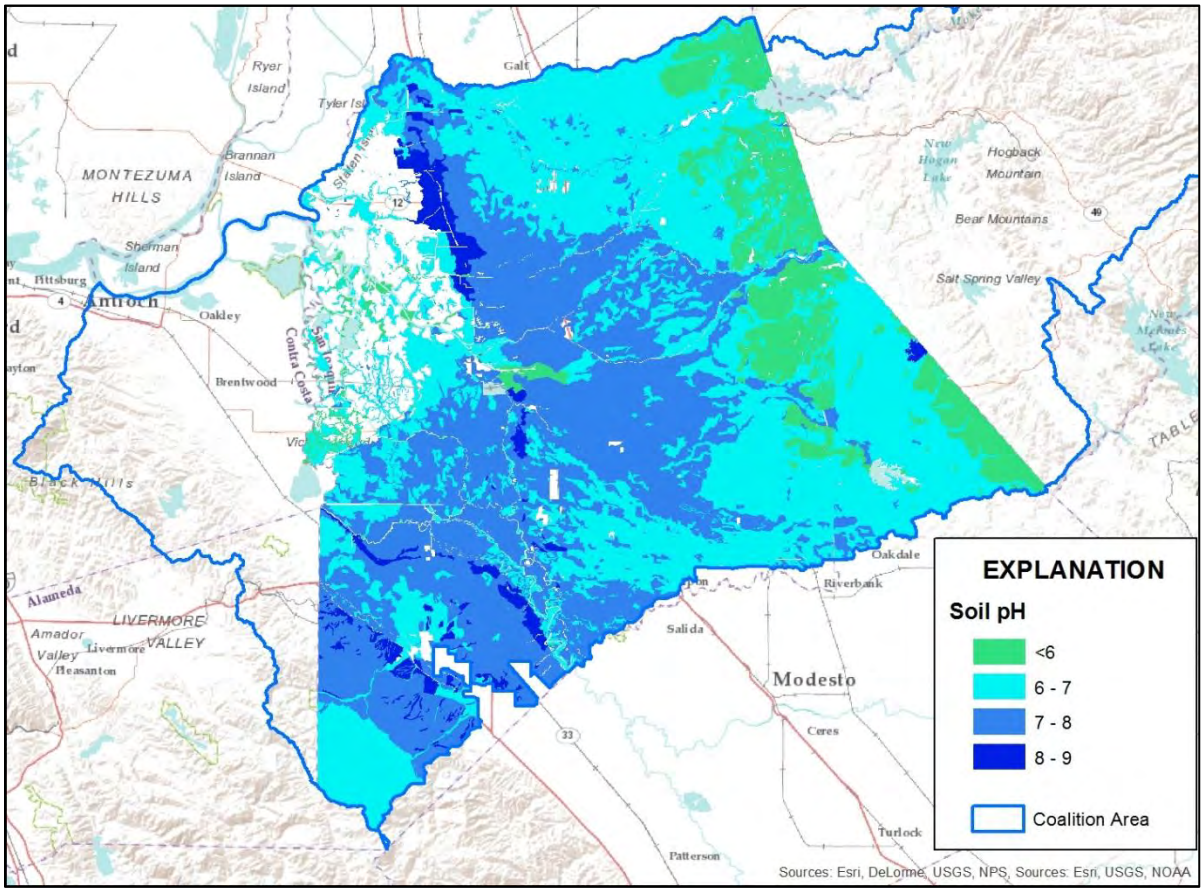


Figure A4-1. Soil pH.

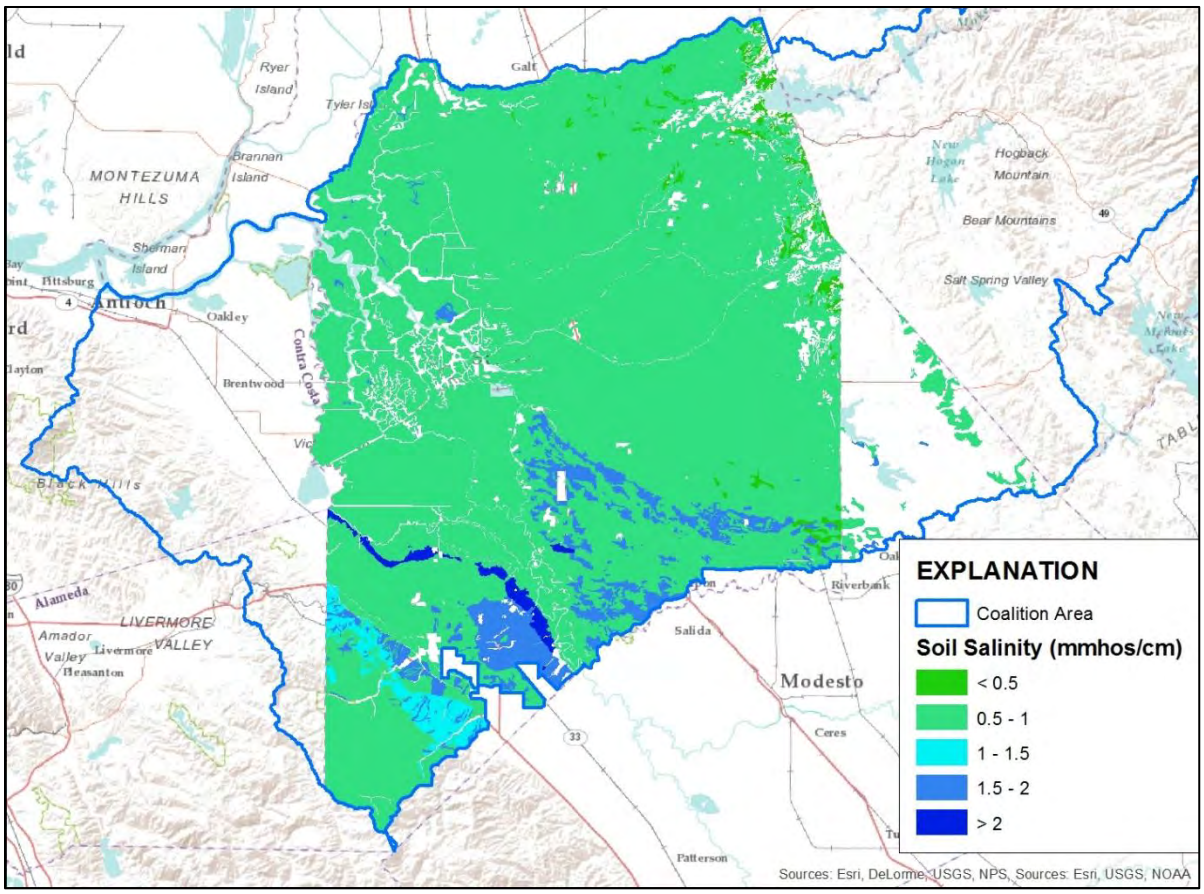


Figure A4-2. Soil salinity.

5. DRASTIC Input Layers

We used GIS raster layers for each of the DRASTIC components to calculate drastic scores. Figures A5-1 through A5-8 below show the individual input layers that were used for DRASTIC, classified according to the model's rating scheme. Both vertical and horizontal conductivity were used in different DRASTIC iterations, so both are included for comparison. Ultimately, vertical conductivity was used for DRASTIC.

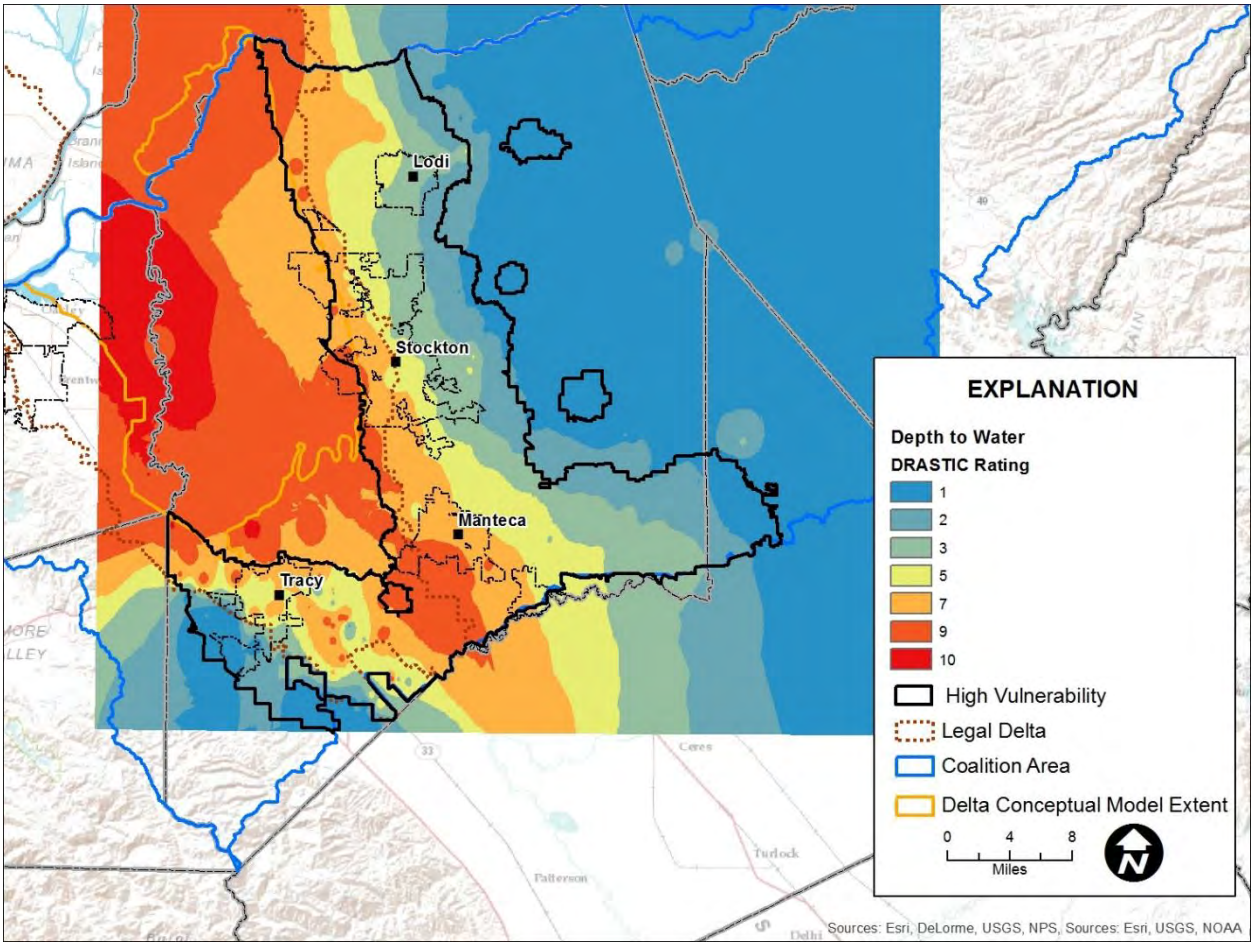


Figure A5-1. DRASTIC input ratings for depth to groundwater.

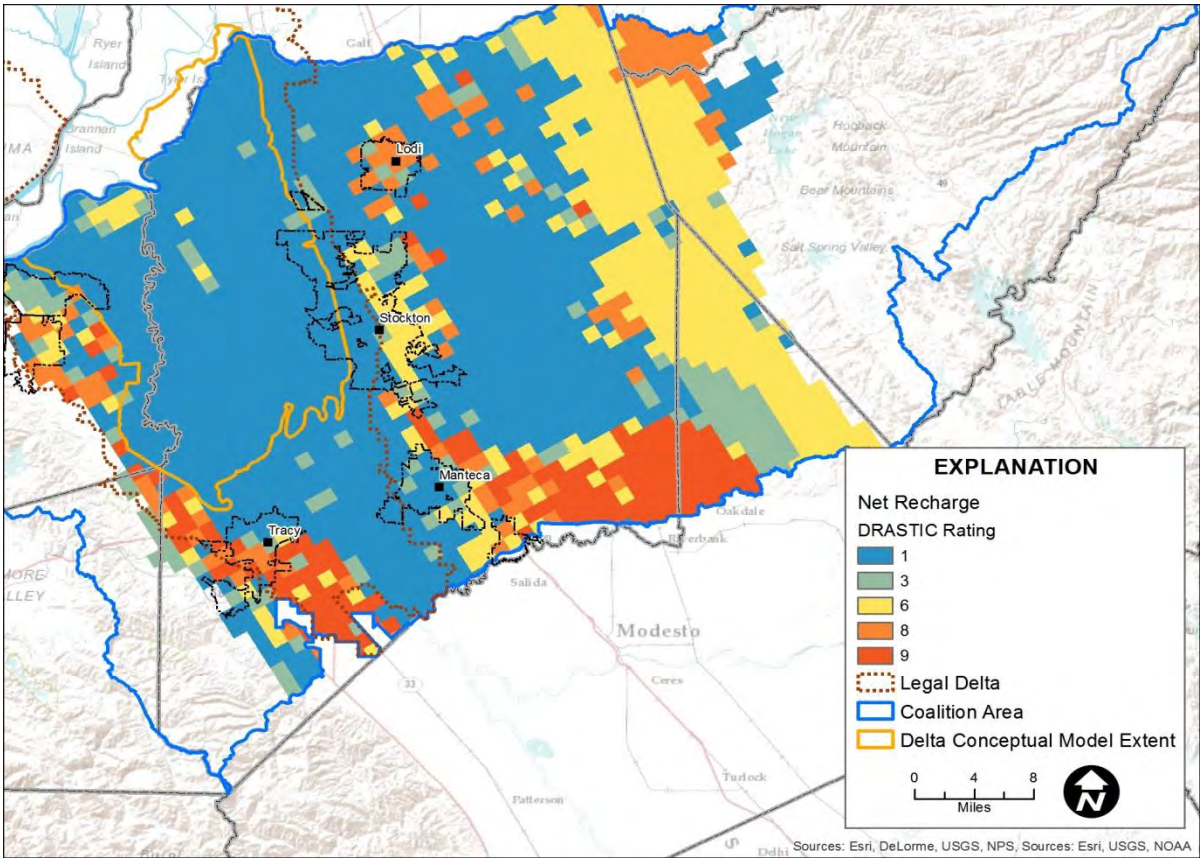


Figure A5-2. DRASTIC input ratings for net recharge.

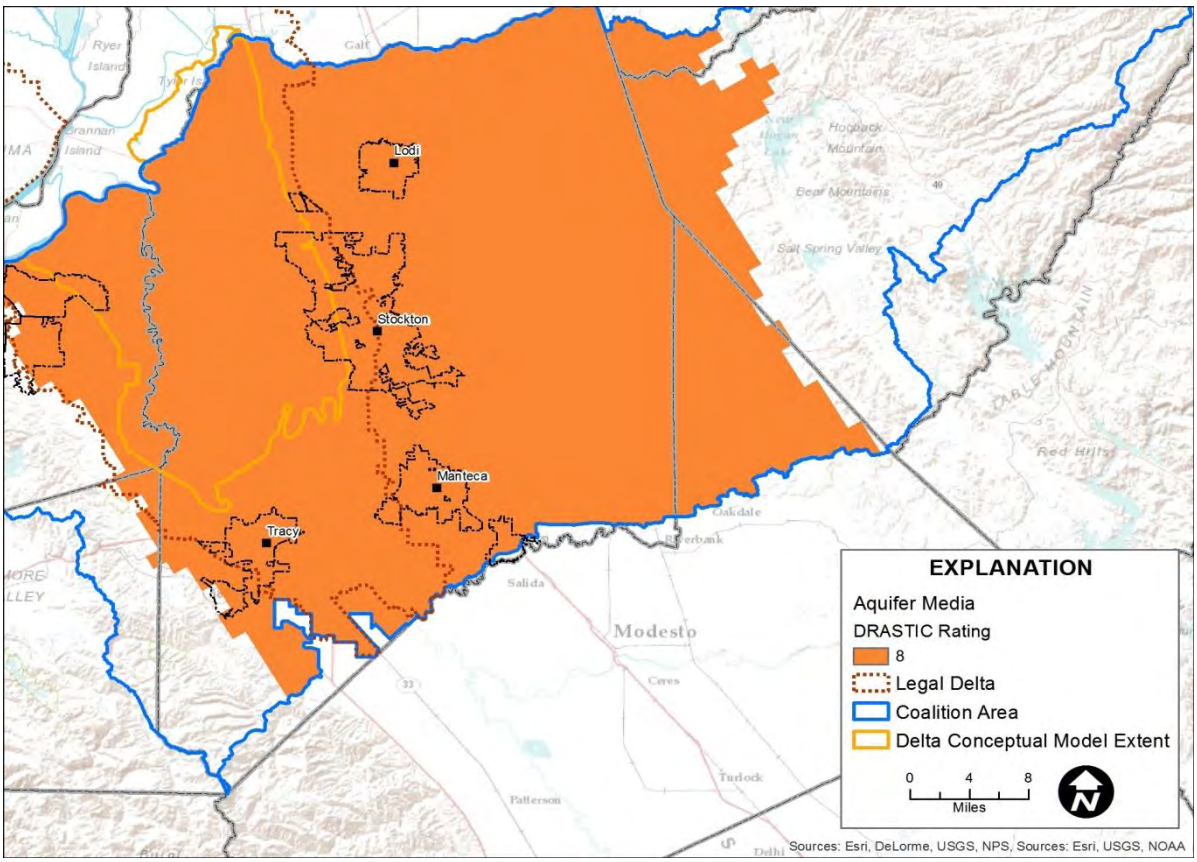


Figure A5-3. DRASTIC input rating for aquifer media.

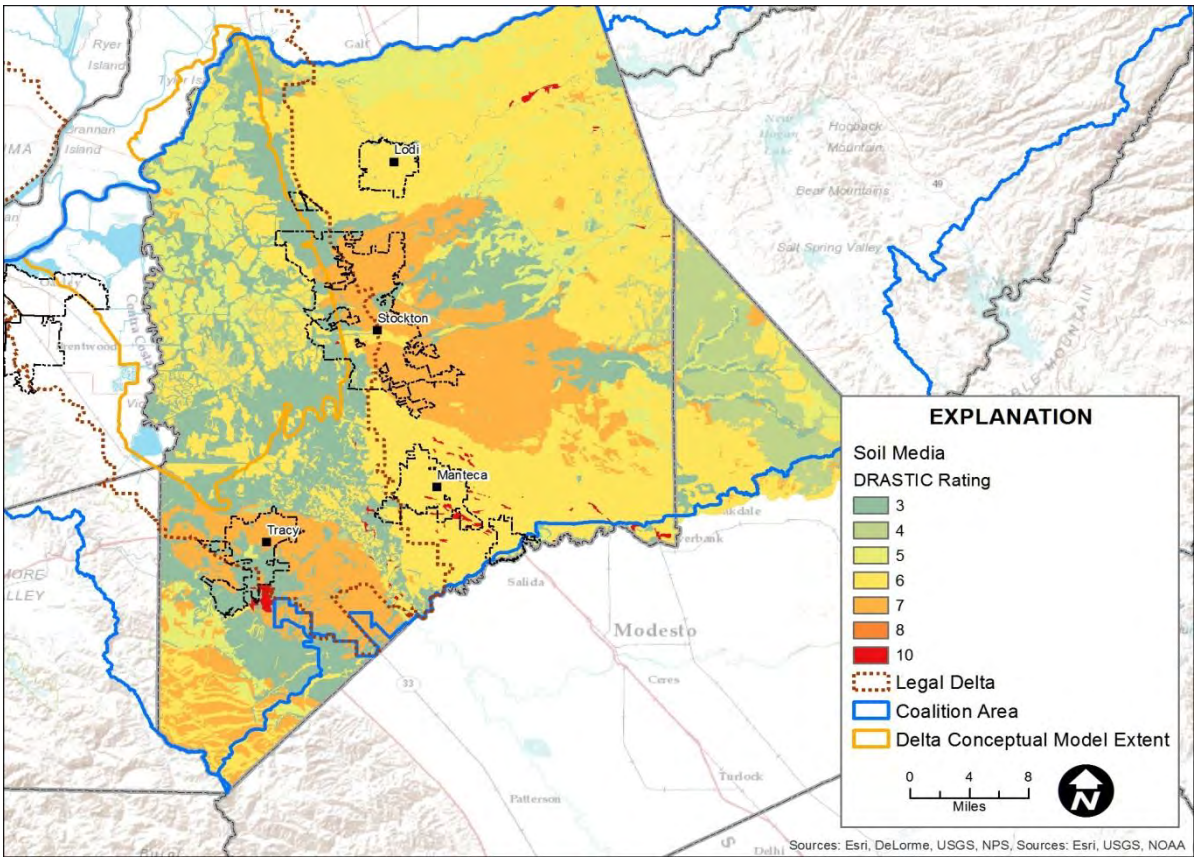


Figure A5-4. DRASTIC input ratings for soil media.

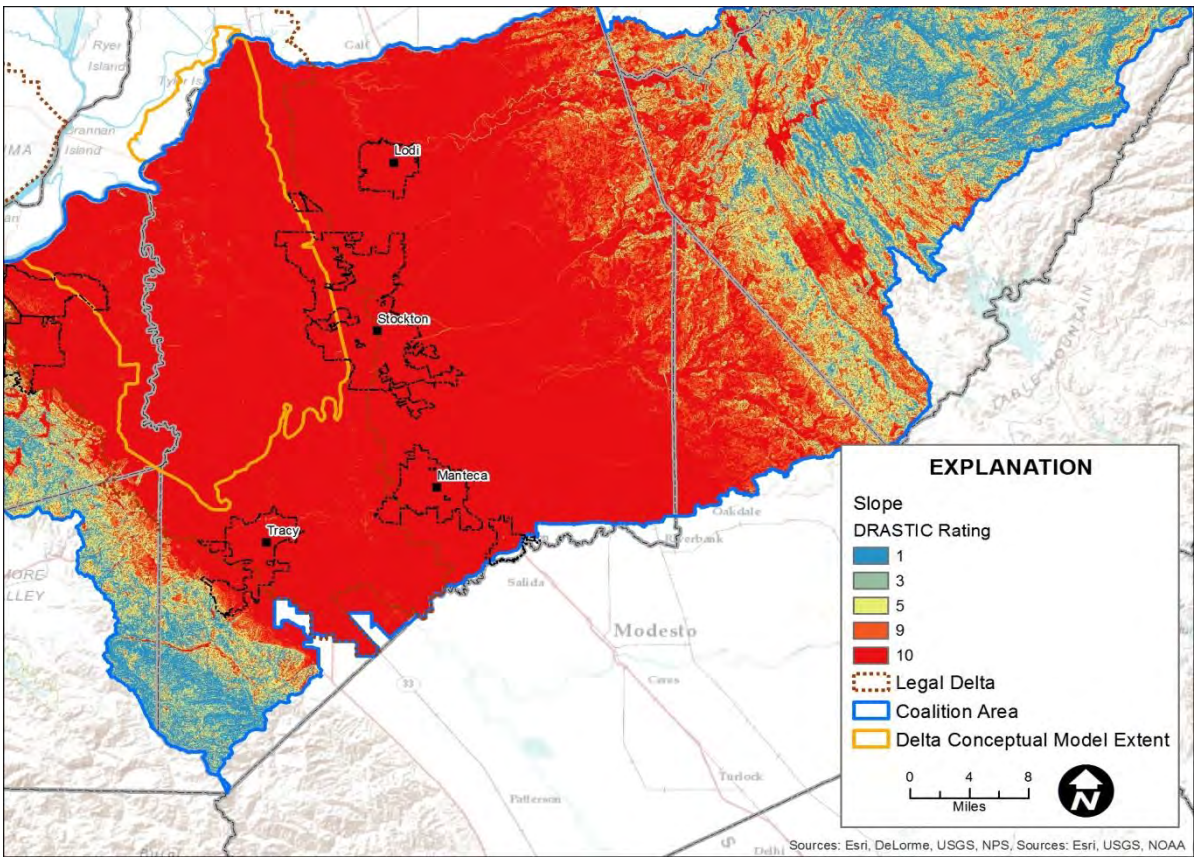


Figure A5-5. DRASTIC input ratings for topography (slope).

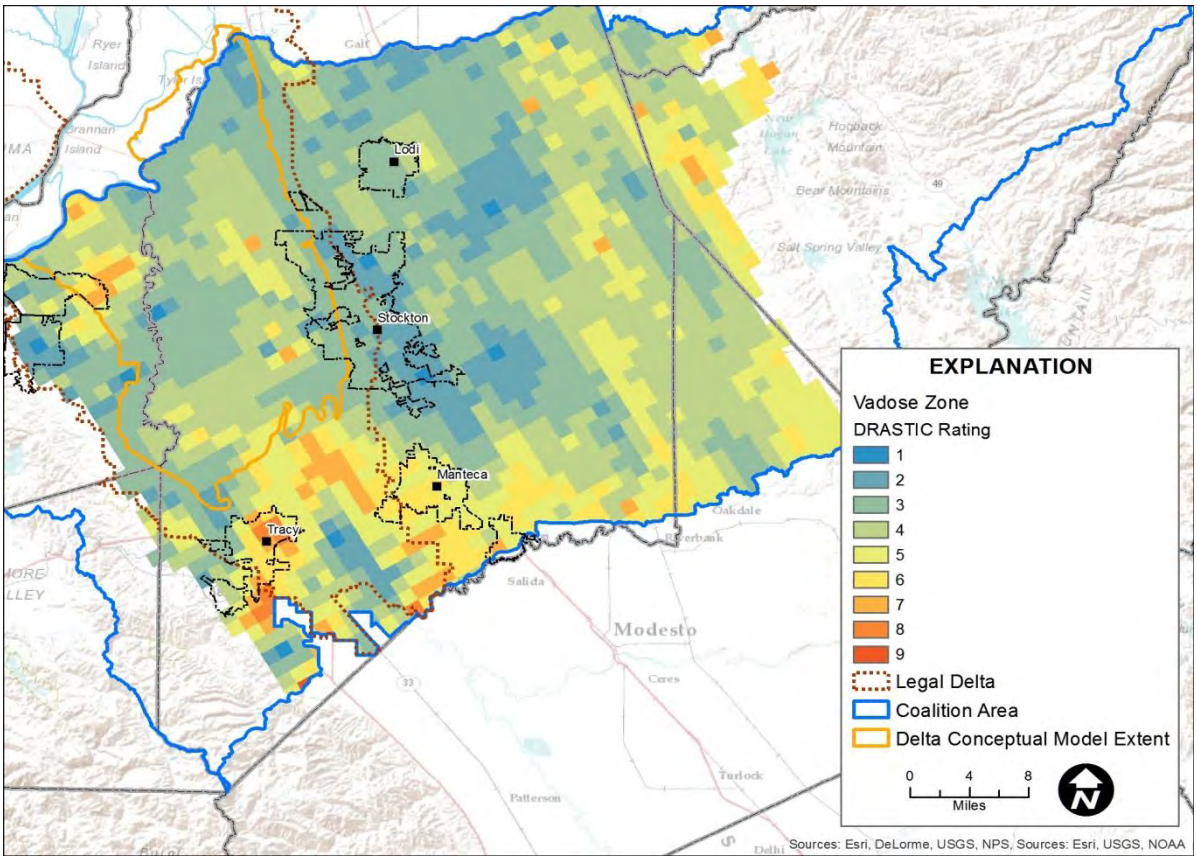


Figure A5-6. DRASTIC input ratings for impact of vadose zone.

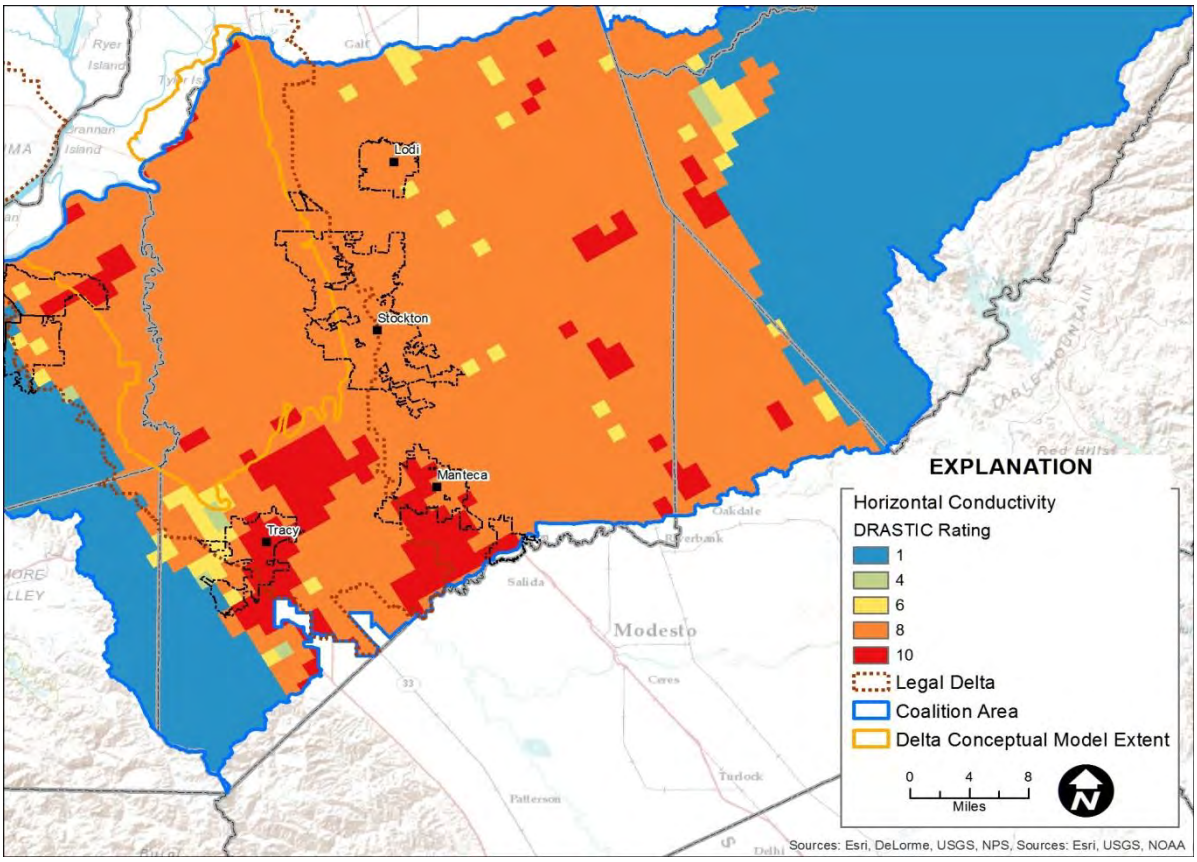


Figure A5-7. DRASTIC input ratings for horizontal hydraulic conductivity.

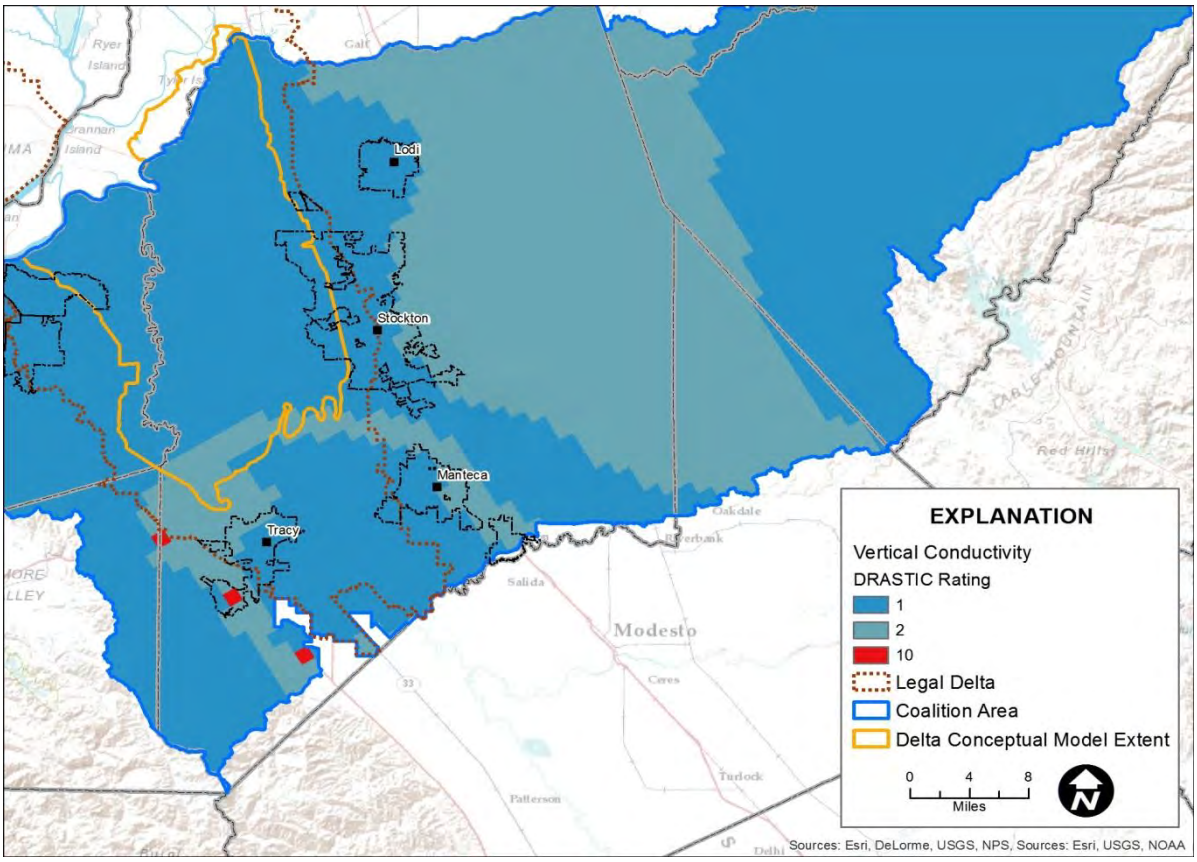


Figure A5-8. DRASTIC input ratings for vertical hydraulic conductivity.

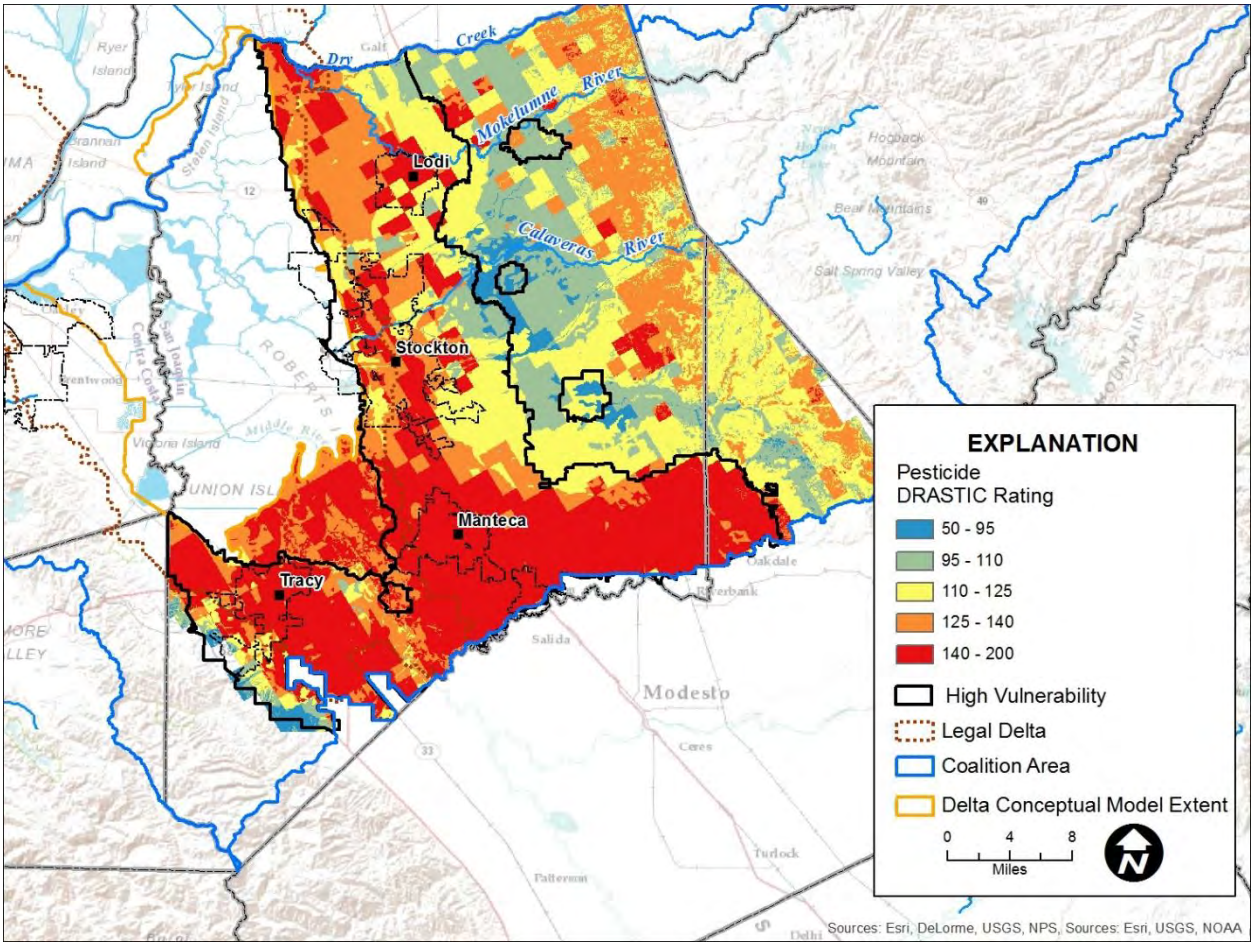


Figure A5-9. Pesticide DRASTIC scores