

RED RIVER ALLUVIAL AQUIFER SUMMARY, 2010

AQUIFER SAMPLING AND ASSESSMENT PROGRAM



APPENDIX 3 TO THE 2012 TRIENNIAL SUMMARY REPORT
PARTIAL FUNDING PROVIDED BY THE CWA



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BACKGROUND

The Louisiana Department of Environmental Quality's (LDEQ) Aquifer Sampling and Assessment Program (ASSET) is an ambient monitoring program established to determine and monitor the quality of groundwater produced from Louisiana's major freshwater aquifers. The ASSET Program samples approximately 200 water wells located in 14 aquifers and aquifer systems across the state. The sampling process is designed so that all fourteen aquifers and aquifer systems are monitored on a rotating basis, within a three-year period so that each well is monitored every three years.

In order to better assess the water quality of a particular aquifer, an attempt is made to sample all ASSET Program wells producing from it in a narrow time frame. To more conveniently and economically promulgate those data collected, a summary report on each aquifer is prepared separately. Collectively, these aquifer summaries will make up, in part, the ASSET Program's Triennial Summary Report for 2012.

Analytical and field data contained in this summary were collected from wells producing from the Red River Alluvial aquifer, during the 2010 state fiscal year (July 1, 2009 - June 30, 2010). This summary will become Appendix 3 of ASSET Program Triennial Summary Report for 2012.

These data show that in October and November 2009, 5 wells were sampled which produce from the Red River Alluvial aquifer. Four of the 5 are classified as irrigation and 1 as domestic. The wells are located in 3 parishes along the Red River in northwest Louisiana.

Figure 3-1 shows the geographic locations of the Red River Alluvial aquifer and the associated wells, whereas Table 3-1 lists the wells in the aquifer along with their total depths, use made of produced waters, and date sampled.

Well data for registered water wells were obtained from the Louisiana Department of Transportation and Development's Water Well Registration Data file.

GEOLOGY

Red River alluvium consists of fining upward sequences of gravel, sand, silt, and clay. The aquifer is poorly to moderately well sorted, with fine-grained to medium-grained sand near the top, grading to coarse sand and gravel in the lower portions. It is confined by layers of silt and clay of varying thicknesses and extent.

HYDROGEOLOGY

The Red River Alluvial aquifer is hydraulically connected with the Red River and its major streams. Recharge is accomplished by direct infiltration of rainfall in the river valley, lateral and upward movement of water from adjacent and underlying aquifers, and overbank stream flooding. The amount of recharge from rainfall depends on the thickness and permeability of the silt and clay layers overlying it. Water levels fluctuate seasonally in response to precipitation trends and river stages. Water levels are generally within 30 to 40 feet of the land surface and

movement is downgradient and toward rivers and streams. Natural discharge occurs by seepage of water into the Red River and its streams, but some water moves into the aquifer when stream stages are above aquifer water levels. The hydraulic conductivity varies between 10 and 530 feet/day.

The maximum depths of occurrence of freshwater in the Red River Alluvial range from 20 feet above sea level, to 160 feet below sea level. The range of thickness of the fresh water interval in the Red River Alluvial is 50 to 200 feet. The depths of the Red River Alluvial wells that were monitored in conjunction with the ASSET Program range from 58 to 89 feet.

PROGRAM PARAMETERS

The field parameters checked at each ASSET well sampling site and the list of conventional parameters analyzed in the laboratory are shown in Table 3-2. The inorganic (total metals) parameters analyzed in the laboratory are listed in Table 3-3. These tables also show the field and analytical results determined for each analyte. For quality control, a duplicate sample was taken for each parameter at well NA-SWANSON.

In addition to the field, conventional and inorganic analytical parameters, the target analyte list includes three other categories of compounds: volatiles, semi-volatiles, and pesticides/PCBs. Due to the large number of analytes in these categories, tables were not prepared showing the analytical results for these compounds. A discussion of any detections from any of these three categories, if necessary, can be found in their respective sections. Tables 3-8, 3-9 and 3-10 list the target analytes for volatiles, semi-volatiles and pesticides/PCBs, respectively.

Tables 3-4 and 3-5 provide a statistical overview of field and conventional data, and inorganic data for the Red River Alluvial aquifer, listing the minimum, maximum, and average results for these parameters collected in the FY 2010 sampling. Tables 3-6 and 3-7 compare these same parameter averages to historical ASSET-derived data for the Red River Alluvial aquifer, from fiscal years 1995, 1998, 2001, 2004, and 2007.

The average values listed in the above referenced tables are determined using all valid, reported results, including non-detects. Per Departmental policy concerning statistical analysis, one-half of the detection limit (DL) is used in place of zero when non-detects are encountered. However, the minimum value is reported as less than the DL, not one-half the DL. If all values for a particular analyte are reported as non-detect, then the minimum, maximum, and average values are all reported as less than the DL. For contouring purposes, one-half the DL is also used for non-detects in the figures and charts referenced below.

Figures 3-2, 3-3, 3-4, and 3-5 respectively, represent the contoured data for pH, total dissolved solids, chloride, and iron. Charts 3-1 through 3-16 represent the trend of the graphed parameter, based on the averaged value of that parameter for each three-year reporting period. Discussion of historical data and related trends is found in the **Water Quality Trends and Comparison to Historical ASSET Data** section.

INTERPRETATION OF DATA

Under the Federal Safe Drinking Water Act, EPA has established maximum contaminant levels (MCLs) for pollutants that may pose a health risk in public drinking water. An MCL is the highest level of a contaminant that EPA allows in public drinking water. MCLs ensure that drinking water does not pose either a short-term or long-term health risk. While not all wells sampled were public supply wells, the ASSET Program uses MCLs as a benchmark for further evaluation.

EPA has set Secondary MCLs (SMCLs), which are defined as non-enforceable taste, odor, or appearance guidelines. Field and laboratory data contained in Tables 3-2 and 3-3 show that one or more SMCLs were exceeded in all of the five wells sampled in the Red River Alluvial aquifer, with a total of nine SMCLs being exceeded.

Field and Conventional Parameters

Table 3-2 shows the field and conventional parameters for which samples are collected at each well and the analytical results for those parameters. Table 3-4 provides an overview of this data for the Red River Alluvial aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analysis listed in Table 3-2 shows that no MCL was exceeded for field or conventional parameters for this reporting period. Those ASSET wells reporting turbidity levels greater than 1.0 NTU do not exceed the MCL of 1.0, as this standard applies to public supply water wells that are under the direct influence of surface water. The Louisiana Department of Health and Hospitals has determined that no public water supply well in Louisiana was in this category.

Federal Secondary Drinking Water Standards: A review of the analysis listed in Table 3-2 shows that four wells exceeded the SMCL for total dissolved solids. Laboratory results override field results in exceedance determinations, thus only lab results will be counted in determining SMCL exceedance numbers for TDS. Following is a list of SMCL parameter exceedances with well number and results:

Total Dissolved Solids (SMCL = 500 mg/L or 0.5 g/L):

	<u>LAB RESULTS (in mg/L)</u>	<u>FIELD MEASURES (in g/L)</u>
CD-431	889 mg/L	0.965 g/L
CD-859	576 mg/L	0.580 g/L
NA-5404Z	559 mg/L	0.596 g/L
NA-SWANSON	561 mg/L, Duplicate 587 mg/L	0.658 g/L, Duplicate 0.658 g/L
RR-345	472 mg/L (< SMCL)	0.575 g/L

Inorganic (Total Metals) Parameters

Table 3-3 shows the inorganic (total metals) parameters for which samples are collected at each well and the analytical results for those parameters. Table 3-5 provides an overview of inorganic data for the Red River Alluvial aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analyses listed on Table 3-3 shows that no primary MCL was exceeded for inorganics (total metals).

Federal Secondary Drinking Water Standards: Laboratory data contained in Table 3-3 shows that all 5 wells exceeded the SMCL for iron:

Iron (SMCL = 300 ug/L):

CD-431	10,400 ug/L
CD-859	1,920 ug/L
NA-5404Z	15,800 ug/L
NA-SWANSON	4,550 ug/L, Duplicate 4,480 ug/L
RR-345	535 ug/L

Volatile Organic Compounds

Table 3-8 shows the volatile organic compound (VOC) parameters for which samples are collected at each well. Due to the number of analytes in this category, analytical results are not tabulated; however, any detection of a VOC would be discussed in this section.

Vinyl chloride was reported in CD-431, an industrial well, at 0.74 ug/L, which is below the MCL of 2.0 ug/L for this compound. Because this well is not a public supply well and the reported concentration is below the MCL, standard procedure does not require additional sampling. This well will be sampled on its normal rotation, in three years.

Also, chloromethane, a common lab contaminant, was reported at 3.5 ug/L in irrigation well NA-5405Z. Because chloromethane was detected at this low concentration, and due to there being no MCL established for this compound, and that chloromethane is a common lab contaminant, this well was not resampled to confirm the occurrence chloromethane. The well owner was given reports of this result and close attention will be given to the occurrence of this compound in upcoming regular sampling activities. No other VOCs were reported at or above their detection limits during the FY 2010 sampling of the Red River Alluvial aquifer.

Semi-Volatile Organic Compounds

Table 3-9 shows the semi-volatile organic compound (SVOC) parameters for which samples are collected at each well. Due to the number of analytes in this category, analytical results are not tabulated; however, any detection of a SVOC would be discussed in this section.

No SVOC was detected at or above its detection limit during the FY 2010 sampling of the Red River Alluvial aquifer.

Pesticides and PCBs

Table 3-10 shows the pesticide and PCB parameters for which samples are collected at each well. Due to the number of analytes in this category, analytical results are not tabulated; however, any detection of a pesticide or PCB would be discussed in this section.

No pesticide or PCB was detected at or above its detection limit during the FY 2010 sampling of the Red River Alluvial aquifer.

WATER QUALITY TRENDS AND COMPARISON TO HISTORICAL ASSET DATA

Analytical and field data show that the quality and characteristics of groundwater produced from the Red River aquifer exhibit some changes when comparing current data to that of the five previous sampling rotations (three, six, nine, twelve, and fifteen years prior). These comparisons can be found in Tables 3-6 and 3-7, and in Charts 3-1 to 3-16 of this summary. Over the fifteen-year period, 4 analytes have shown a general increase in concentration. These analytes are pH, iron, turbidity, and to a lesser degree, nitrate-nitrite. For this same time period, 14 analytes have demonstrated a decrease in concentrations: temperature, field and lab specific conductance, salinity, alkalinity, chloride, color, sulfate, TDS, ammonia, hardness, TKN, copper, lead and zinc. All other analytes demonstrate only subtle fluctuations or have remained non-detect.

Current sample results show that all 5 wells reported one or more secondary exceedances with a total of 9 SMCL exceedances. The FY 2006 sampling of the Red River Alluvial aquifer shows that all 5 wells also reported one or more SMCL exceedances with a total of 8 exceedances.

SUMMARY AND RECOMMENDATIONS

In summary, the data show that the groundwater produced from this aquifer is very hard¹ but is of good quality when considering short-term or long-term health risk guidelines. Laboratory data show that no program well that was sampled during the Fiscal Year 2010 monitoring of the Red River Alluvial aquifer exceeded a primary MCL. The data also show that this aquifer is of poor quality when considering taste, odor, or appearance guidelines, with at least one secondary MCL being exceeded in each of the wells monitored.

Comparison to historical ASSET-derived data shows some change in the quality or characteristics of the Red River Alluvial aquifer, with 4 parameters showing consistent increases in concentration and 14 parameters decreasing in concentration.

It is recommended that the wells assigned to the Red River Alluvial aquifer be re-sampled as planned in approximately three years. In addition, several wells should be added to those currently in place to increase the well density for this aquifer.

¹ Classification based on hardness scale from: Peavy, H.S. et al. *Environmental Engineering*. New York: McGraw-Hill. 1985.

Table 3-1: List of Wells Sampled, Red River Alluvial Aquifer – FY 2010

DOTD Well Number	Parish	Date	Owner	Depth (Feet)	Well Use
CD-431	CADDO	11/3/2009	Certainteed	62	Industrial
CD-859	CADDO	11/3/2009	East Ridge Country Club	58	Irrigation
NA-5404Z	NATCHITOCHES	10/13/2009	Private Owner	80	Irrigation
NA-SWANSON	NATCHITOCHES	10/13/2009	Seven C's Ranch	76	Irrigation
RR-345	RED RIVER	10/50/2009	Bundrick Farms	89	Irrigation

Table 3-2: Summary of Field and Conventional Data, Red River Alluvial Aquifer – FY 2010

DOTD WELL NUMBER	Temp Deg. C	pH SU	Sp. Cond. mmhos/cm	Sal. ppt	TDS g/L	Alk mg/L	Cl mg/L	Color PCU	Sp. Cond. umhos/cm	SO4 mg/L	TDS mg/L	TSS mg/L	Turb. NTU	NH3 mg/L	Hard. mg/L	Nitrite- Nitrate (as N) mg/L	TKN mg/L	Tot. P mg/L
	LABORATORY DETECTION LIMITS →					2	1.25	1	10	5	10	4	1	1	10	0.01	0.3	0.05
	FIELD PARAMETERS					LABORATORY PARAMETERS												
CD-431	20.00	6.91	1.485	0.75	0.965	676	130.0	< 1	1,380	< 5	889	‡54	143.0	< 1	660	< 0.01	0.70	0.883
CD-859	19.85	7.07	0.893	0.44	0.580	382	13.9	< 1	720	38.5	576	6	6.8	< 1	100	< 0.01	0.35	0.512
NA-5404Z	21.17	7.01	0.917	0.45	0.596	386	65.4	4	843	< 5	559	‡44	157.0	< 1	372	< 0.01	0.56	1.330
NA-SWANSON	19.78	7.06	1.012	0.50	0.658	530	29.2	2	953	< 5	561	‡< 4	71.7	< 1	436	< 0.01	< 0.3	0.729
NA-SWANSON*	19.78	7.06	1.012	0.50	0.658	538	29.2	1	955	< 5	587	‡< 4	70.2	< 1	416	< 0.01	< 0.3	0.727
RR-345	19.18	7.12	0.885	0.44	0.575	404	37.1	< 1	847	36.5	472	< 4	5.4	< 1	420	1.97	< 0.3	0.151

*Denotes Duplicate Sample

‡Reported from a Dilution

Shaded cells exceed EPA Secondary Standards

Table 3-3: Summary of Inorganic Data (Total Metals), Red River Alluvial Aquifer – FY 2010

DOTD Well Number	Antimony ug/L	Arsenic ug/L	Barium ug/L	Beryllium ug/L	Cadmium ug/L	Chromium ug/L	Copper ug/L	Iron ug/L	Lead ug/L	Mercury ug/L	Nickel ug/L	Selenium ug/L	Silver ug/L	Thallium ug/L	Zinc ug/L
Laboratory Detection Limits	5	5	5	2	2	4	2	100	1	0.0002	3	5	1	2	6
CD-431	< 5	< 4	585	< 2	< 2	< 4	< 2	10,400	< 1	< 0.0002	< 3	< 5	< 1	< 2	44.4
CD-859	< 5	5.29	760	< 2	< 2	< 4	< 2	1,920	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
NA-5404Z	< 5	< 4	644	< 2	< 2	< 4	7.45	15,800	< 1	< 0.0002	< 3	< 5	< 1	< 2	20.5
NA-SWANSON	< 5	< 4	535	< 2	< 2	< 4	< 2	4,550	< 1	< 0.0002	4.41	< 5	< 1	< 2	< 6
NA-SWANSON*	< 5	< 4	549	< 2	< 2	< 4	< 2	4,480	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
RR-345	< 5	< 4	313	< 2	< 2	< 4	< 2	535	< 1	< 0.0002	< 3	< 5	< 1	< 2	6.31

*Denotes Duplicate Sample.

Shaded cells exceed EPA Secondary Standards

Table 3-4: FY 2010 Field and Conventional Statistics, ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
FIELD	Temperature (°C)	19.18	21.17	19.96
	pH (SU)	6.91	7.12	7.04
	Specific Conductance (mmhos/cm)	0.885	1.485	1.034
	Salinity (ppt)	0.44	0.75	0.51
	TDS (g/L)	0.575	0.965	0.670
LABORATORY	Alkalinity (mg/L)	382	676	486
	Chloride (mg/L)	13.9	130.0	50.8
	Color	< 1	4.0	1.4
	Specific Conductance (umhos/cm)	720	1,380	950
	Sulfate (mg/L)	< 5	38.5	14.2
	TDS (mg/L)	472	889	607
	TSS (mg/L)	< 4	54.0	18.3
	Turbidity (NTU)	5.4	157.0	75.7
	Ammonia, as N (mg/L)	< 1	< 1	< 1
	Hardness (mg/L)	100	660	401
	Nitrite - Nitrate, as N (mg/L)	< 0.01	1.97	0.33
	TKN (mg/L)	< 0.3	0.70	0.34
	Total Phosphorus (mg/L)	0.15	1.33	0.72

Table 3-5: FY 2010 Inorganic (Total Metals) Statistics, ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
	Antimony (ug/L)	< 5	< 5	< 5
	Arsenic (ug/L)	< 4	5.29	<4
	Barium (ug/L)	313	760	564
	Beryllium (ug/L)	< 2	< 2	< 2
	Cadmium (ug/L)	< 2	< 2	< 2
	Chromium (ug/L)	< 4	< 4	< 4
	Copper (ug/L)	< 2	7.5	2.1
	Iron (ug/L)	535	15,800	6,281
	Lead (ug/L)	< 1	< 1	< 1
	Mercury (ug/L)	< 0.0002	< 0.0002	< 0.0002
	Nickel (ug/L)	< 3	4.4	< 3
	Selenium (ug/L)	< 5	< 5	< 5
	Silver (ug/L)	< 1	< 1	< 1
	Thallium (ug/L)	< 2	< 2	< 2
	Zinc (ug/L)	< 6	44.4	13.4

Table 3-6: Triennial Field and Conventional Statistics, ASSET Wells

PARAMETER		AVERAGE VALUES BY FISCAL YEAR					
		FY 1995	FY 1998	FY 2001	FY 2004	FY 2007	FY 2010
FIELD	Temperature (°C)	21.00	19.88	20.50	20.55	20.23	19.96
	pH (SU)	6.67	6.81	7.64	7.22	7.02	7.04
	Specific Conductance (mmhos/cm)	1.128	1.060	1.328	0.940	0.930	1.034
	Salinity (Sal.) (ppt)	0.54	0.53	0.67	0.47	0.46	0.51
	TDS (Total dissolved solids) (g/L)	-	-	-	0.610	0.610	0.670
LABORATORY	Alkalinity (Alk.) (mg/L)	504.4	485.2	446.0	476.0	457.0	486
	Chloride (Cl) (mg/L)	45.3	42.8	163.4	31.8	25.5	50.8
	Color (PCU)	24.6	5.0	30.0	22.5	-	1.4
	Specific Conductance (umhos/cm)	1100	1094	1398	953	892	950
	Sulfate (SO4) (mg/L)	69.3	62.2	52.1	29.9	18.3	14.2
	TDS (Total dissolved solids) (mg/L)	716	699	818	594	517	607
	TSS (Total suspended solids) (mg/L)	18.8	13.6	12.5	17.1	16.4	18.3
	Turbidity (Turb.) (NTU)	56.0	54.4	44.7	68.3	73.6	75.7
	Ammonia, as N (NH3) (mg/L)	1.27	0.54	0.88	0.86	0.77	< 1
	Hardness (mg/L)	507	454	354	454	462	401
	Nitrite - Nitrate, as N (mg/L)	<0.05	0.11	<0.05	<0.05	<0.05	0.33
	TKN (mg/L)	4.96	0.95	1.05	0.81	0.97	0.34
	Total Phosphorus (P) (mg/L)	0.79	0.38	0.51	0.61	0.59	0.72

Table 3-7: Triennial Inorganic (Total Metals) Statistics, ASSET Wells

PARAMETER		AVERAGE VALUES BY FISCAL YEAR					
		FY 1995	FY 1998	FY 2001	FY 2004	FY 2007	FY 2010
Antimony (ug/L)		<5	<5	<5	<5	<1	< 5
Arsenic (ug/L)		<10	<5	<5	<5	<3	<4
Barium (ug/L)		401	102	219	387	461	564
Beryllium (ug/L)		<5	<5	<1	<1	<1	< 2
Cadmium (ug/L)		<5	<5	1.0	<1	<0.5	< 2
Chromium (ug/L)		12.4	<5	<5	<5	<3	< 4
Copper (ug/L)		19.9	968.7	<5.0	10.3	<3.0	2.1
Iron (ug/L)		6,122	3,340	3,396	5,977	7,717	6,281
Lead (ug/L)		32.0	<10	<10	14.0	<3	< 1
Mercury (ug/L)		<0.05	<0.05	<0.05	<0.05	<0.05	< 0.0002
Nickel (ug/L)		10.4	1,041.4	<5	<5	<3	< 3
Selenium (ug/L)		<5	<5	<5	<5	<4	< 5
Silver (ug/L)		<5	<5	1.1	<1	<0.5	< 1
Thallium (ug/L)		<5	<5	<2	<5	<1	< 2
Zinc (ug/L)		185.6	<10.0	41.7	65.5	490.0	13.4

Table 3-8: VOC Analytical Parameters

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
ETHYL BENZENE	624	0.5
CIS-1,3-DICHLOROPROPENE	624	0.5
TRANS-1,3-DICHLOROPROPENE	624	0.5
1,4-DICHLOROBENZENE	624	0.5
1,2-DICHLOROETHANE	624	0.5
TOLUENE	624	0.5
CHLOROBENZENE	624	0.5
DIBROMOCHLOROMETHANE	624	0.5
TETRACHLOROETHYLENE (PCE)	624	0.5
TRANS-1,2-DICHLOROETHENE	624	0.5
TERT-BUTYL METHYL ETHER	624	0.5
1,3-DICHLOROBENZENE	624	0.5
CARBON TETRACHLORIDE	624	0.5
CHLOROFORM	624	0.5
BENZENE	624	0.5
1,1,1-TRICHLOROETHANE	624	0.5
BROMOMETHANE	624	0.5
CHLOROMETHANE	624	0.5
CHLOROETHANE	624	0.5
VINYL CHLORIDE	624	0.5
METHYLENE CHLORIDE	624	0.5
BROMOFORM	624	0.5
BROMODICHLOROMETHANE	624	0.5
1,1-DICHLOROETHANE	624	0.5
1,1-DICHLOROETHENE	624	0.5
TRICHLOROFLUOROMETHANE (FREON-11)	624	0.5
1,2-DICHLOROPROPANE	624	0.5
1,1,2-TRICHLOROETHANE	624	0.5
TRICHLOROETHYLENE (TCE)	624	0.5
1,1,2,2-TETRACHLOROETHANE	624	0.5
1,2,3-TRICHLOROBENZENE	624	0.5
1,2-DICHLOROBENZENE	624	0.5
ETHYL BENZENE	624	0.5
CIS-1,3-DICHLOROPROPENE	624	0.5

Table 3-9: SVOC Analytical Parameters

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
1,2,4-TRICHLOROBENZENE	625	5
2,4,6-TRICHLOROPHENOL	625	5
2,4-DICHLOROPHENOL	625	5
2,4-DIMETHYLPHENOL	625	5
2,4-DINITROPHENOL	625	20
2,4-DINITROTOLUENE	625	5
2,6-DINITROTOLUENE	625	5
2-CHLORONAPHTHALENE	625	5
2-CHLOROPHENOL	625	5
2-NITROPHENOL	625	10
3,3'-DICHLOROBENZIDINE	625	5
4,6-DINITRO-2-METHYLPHENOL	625	10
4-BROMOPHENYL PHENYL ETHER	625	5
4-CHLORO-3-METHYLPHENOL	625	5
4-CHLOROPHENYL PHENYL ETHER	625	5
4-NITROPHENOL	625	20
ACENAPHTHENE	625	5
ACENAPHTHYLENE	625	5
ANTHRACENE	625	5
BENZIDINE	625	20
BENZO(A)ANTHRACENE	625	5
BENZO(A)PYRENE	625	5
BENZO(B)FLUORANTHENE	625	5
BENZO(G,H,I)PERYLENE	625	5
BENZO(K)FLUORANTHENE	625	5
BENZYL BUTYL PHTHALATE	625	5
BIS(2-CHLOROETHOXY) METHANE	625	5
HEXACHLOROCYCLOPENTADIENE	625	5
HEXACHLOROETHANE	625	5
INDENO(1,2,3-C,D)PYRENE	625	5
ISOPHORONE	625	5
NAPHTHALENE	625	5
NITROBENZENE	625	5
N-NITROSODIMETHYLAMINE	625	5
N-NITROSODI-N-PROPYLAMINE	625	5
N-NITROSODIPHENYLAMINE	625	5

Table 3-9: SVOCs (Continued)

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
PENTACHLOROBENZENE	625	5
PENTACHLOROPHENOL	625	10
PHENANTHRENE	625	5
PHENOL	625	5
PYRENE	625	5
TETRACHLOROBENZENE(S), TOTAL	625	10

Table 3-10: Pesticides and PCBs

COMPOUND	METHOD	DETECTION LIMITS (ug/L)
4,4'-DDD	8081	0.1
4,4'-DDE	8081	0.1
4,4'-DDT	8081	0.1
Aldrin	8081	0.05
Alpha-Chlordane	8081	0.05
alpha-BHC	8081	0.05
beta-BHC	8081	0.05
delta-BHC	8081	0.05
gamma-BHC	8081	0.05
Dieldrin	8081	0.1
Endosulfan I	8081	0.05
Endosulfan II	8081	0.1
Endosulfan Sulfate	8081	0.1
Endrin	8081	0.1
Endrin Aldehyde	8081	0.1
Endrin Ketone	8081	0.1
Heptachlor	8081	0.05
Heptachlor Epoxide	8081	0.05
Methoxychlor	8081	0.5
Toxaphene	8081	2
Gamma-Chlordane	8081	0.05
PCB-1016	8082	1
PCB-1221	8082	1
PCB-1232	8082	1
PCB-1242	8082	1
PCB-1248	8082	1
PCB-1254	8082	1
PCB-1260	8082	1

Figure 3-1: Location Plat, Red River Alluvial Aquifer

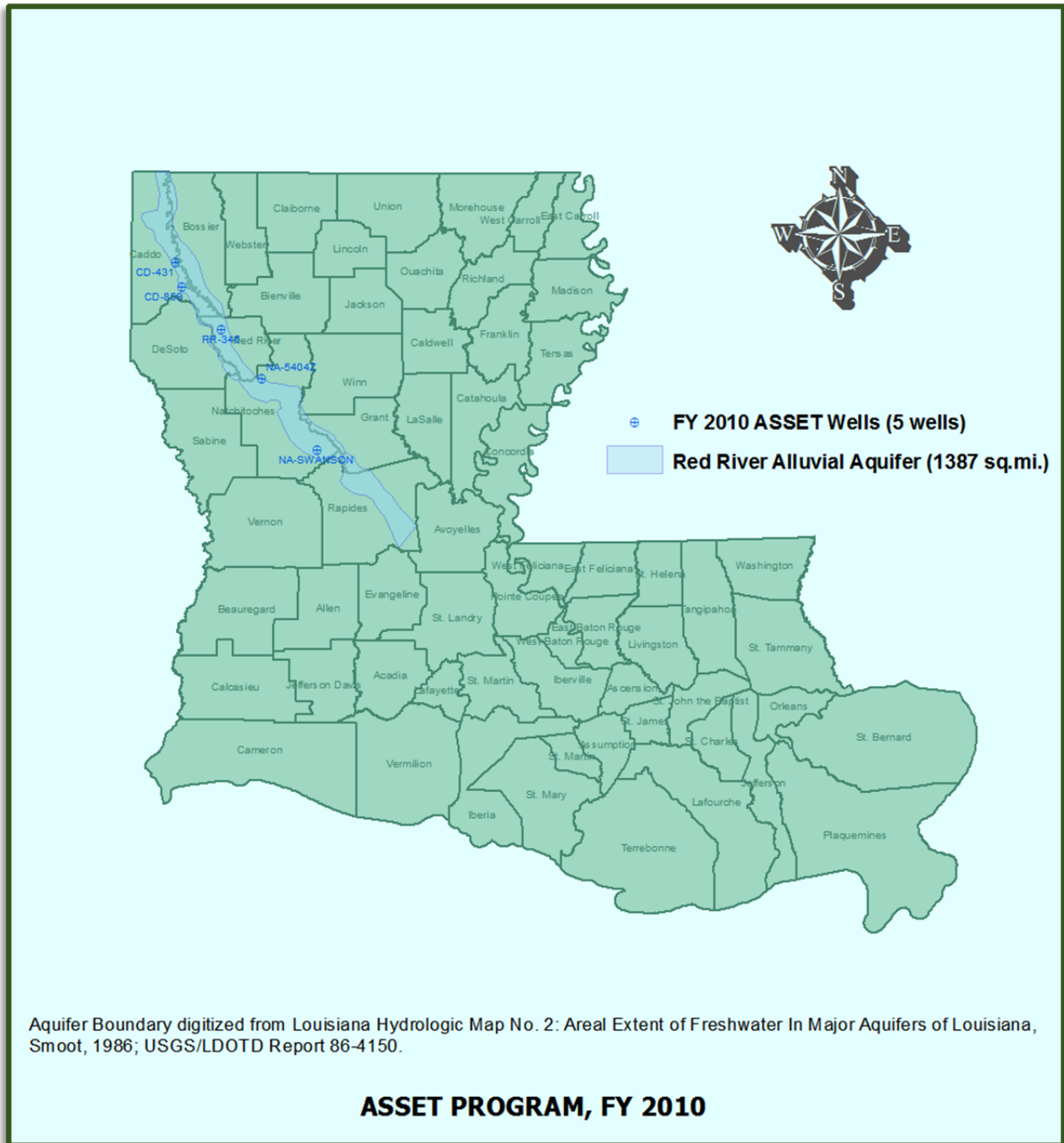


Figure 3-2: Map of pH Data

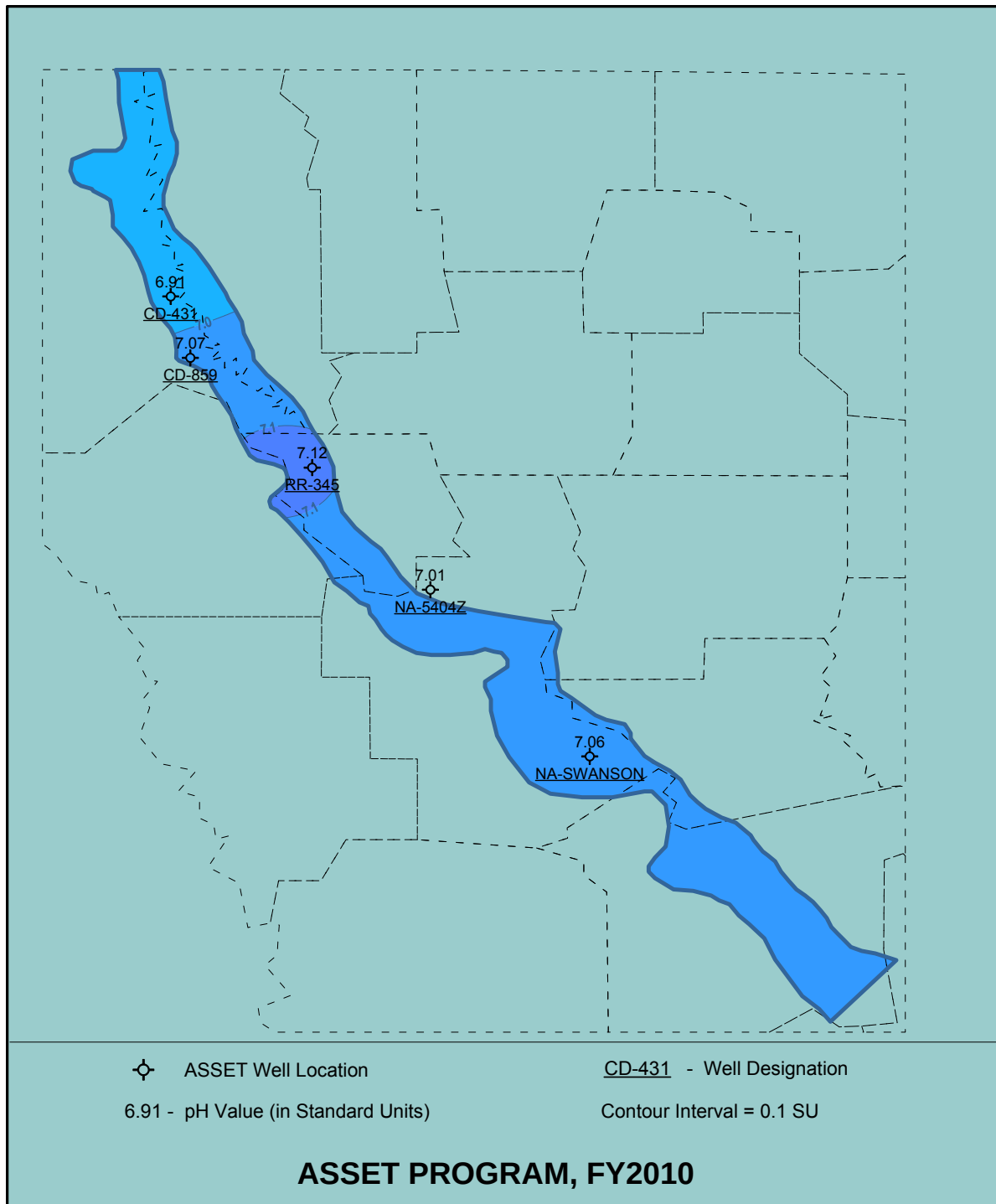


Figure 3-3: Map of TDS Lab Data

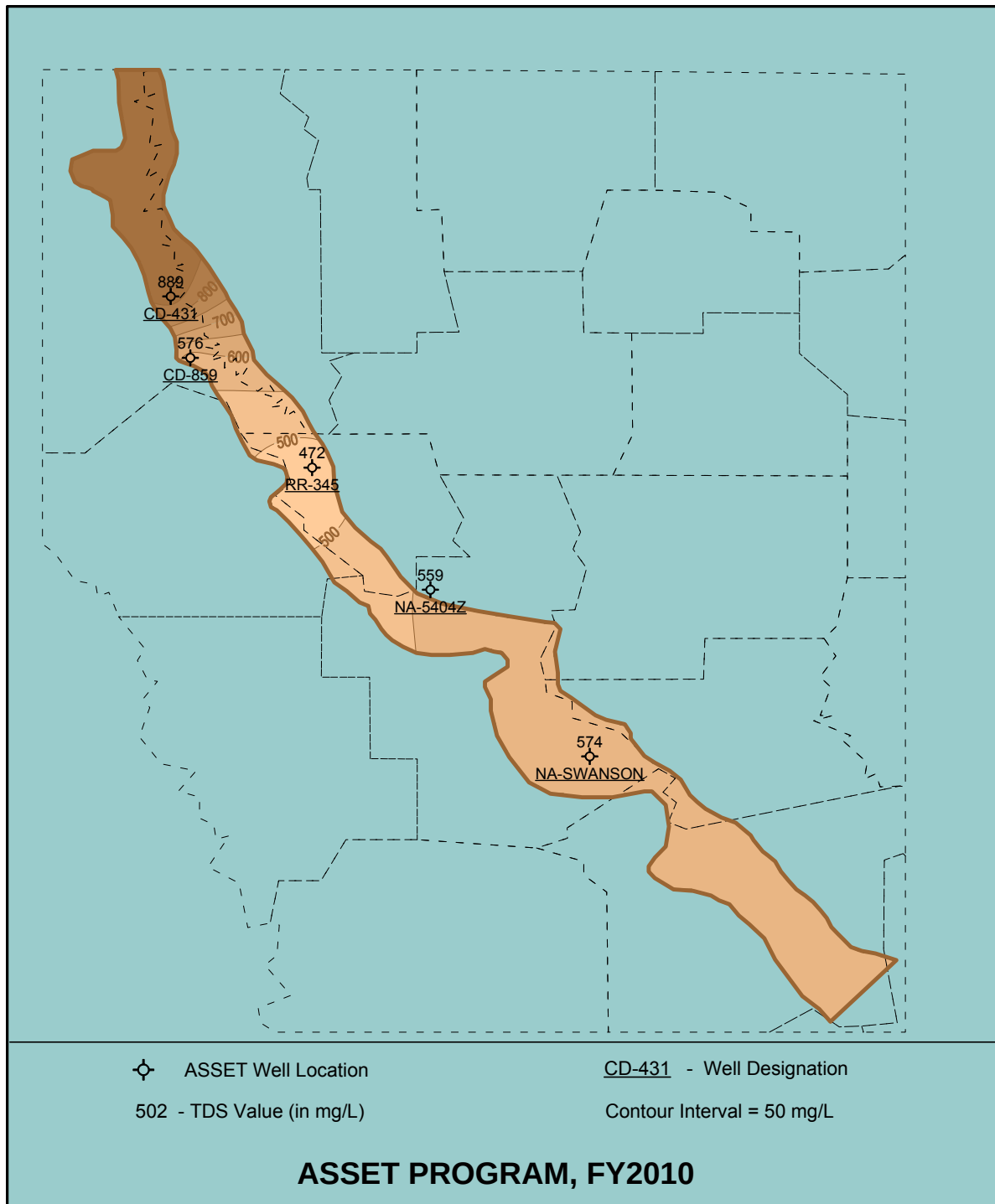


Figure 3-4: Map of Chloride Data

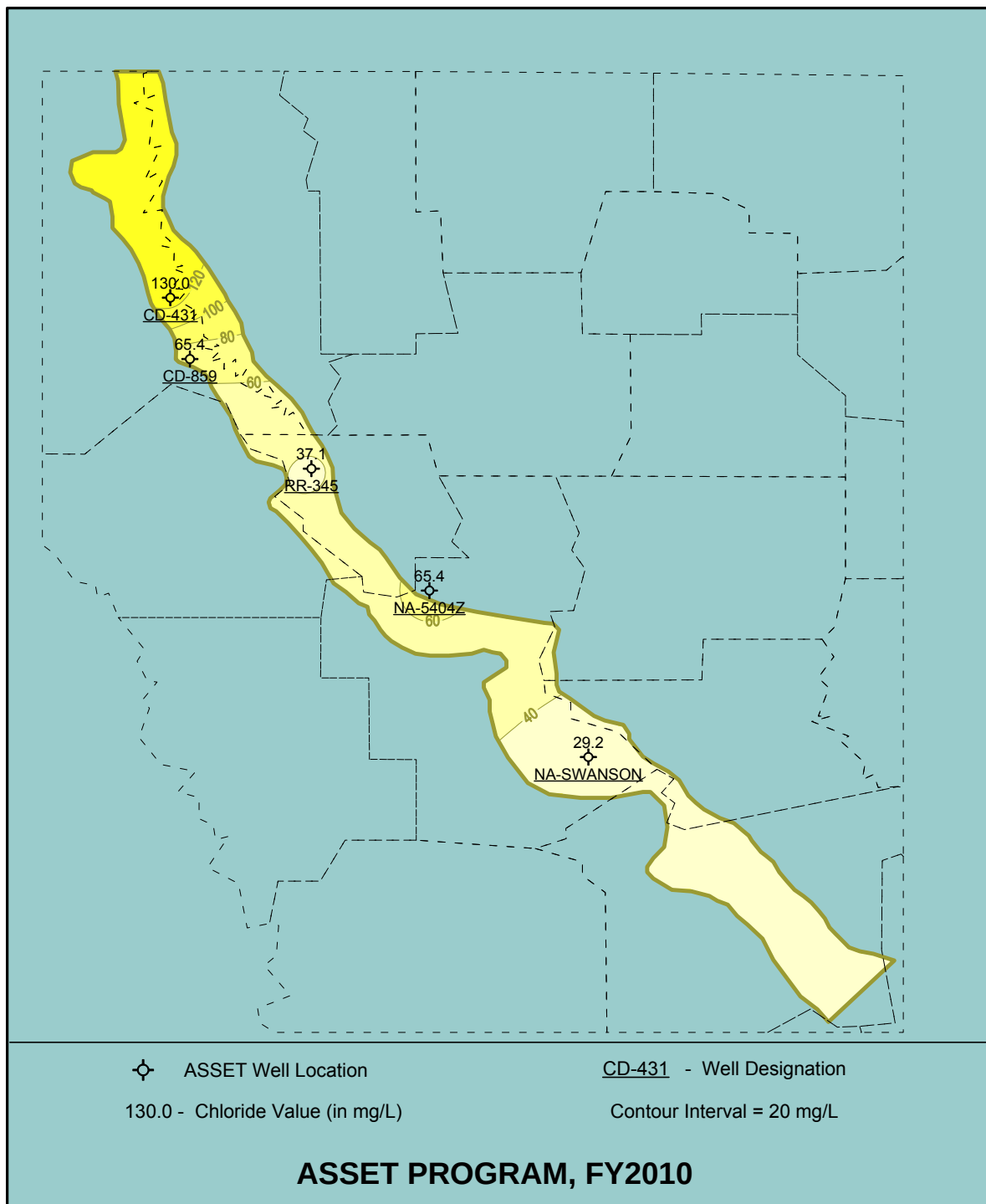


Figure 3-5: Map of Iron Data

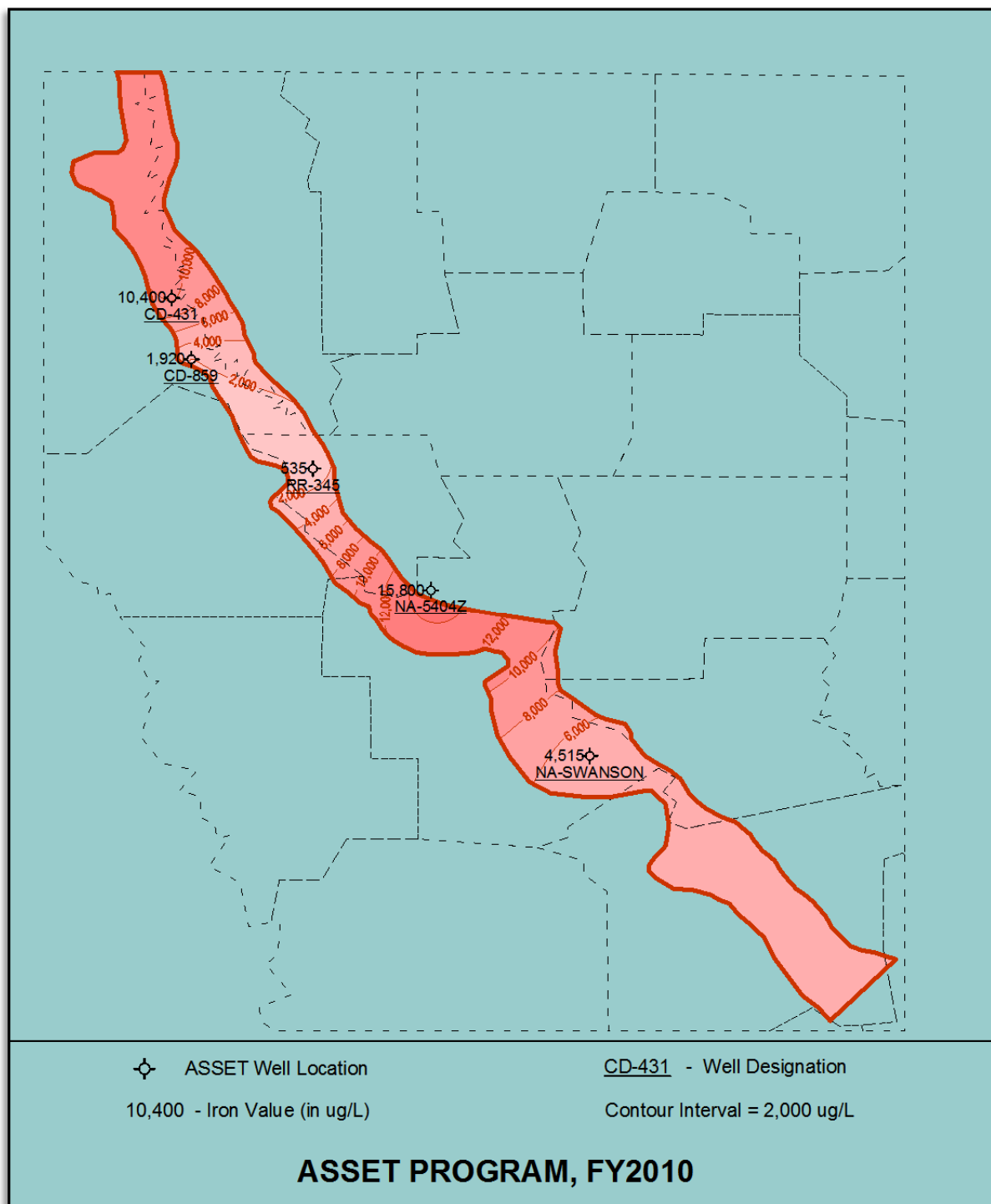


Chart 3-1: Temperature Trend

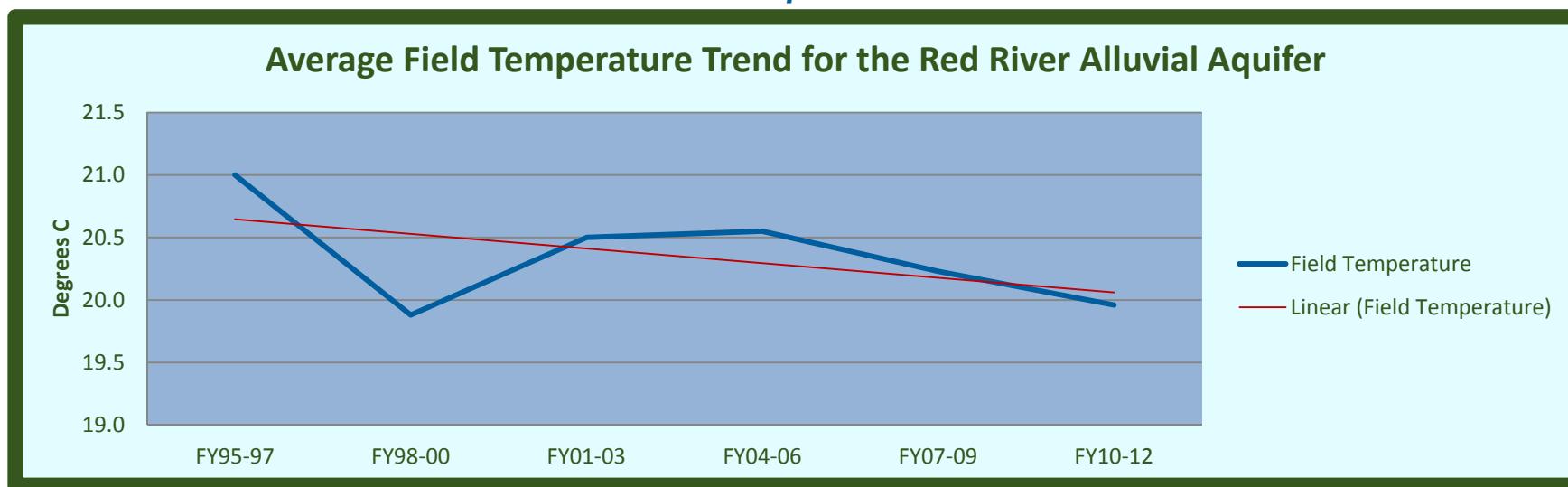


Chart 3-2: pH Trend

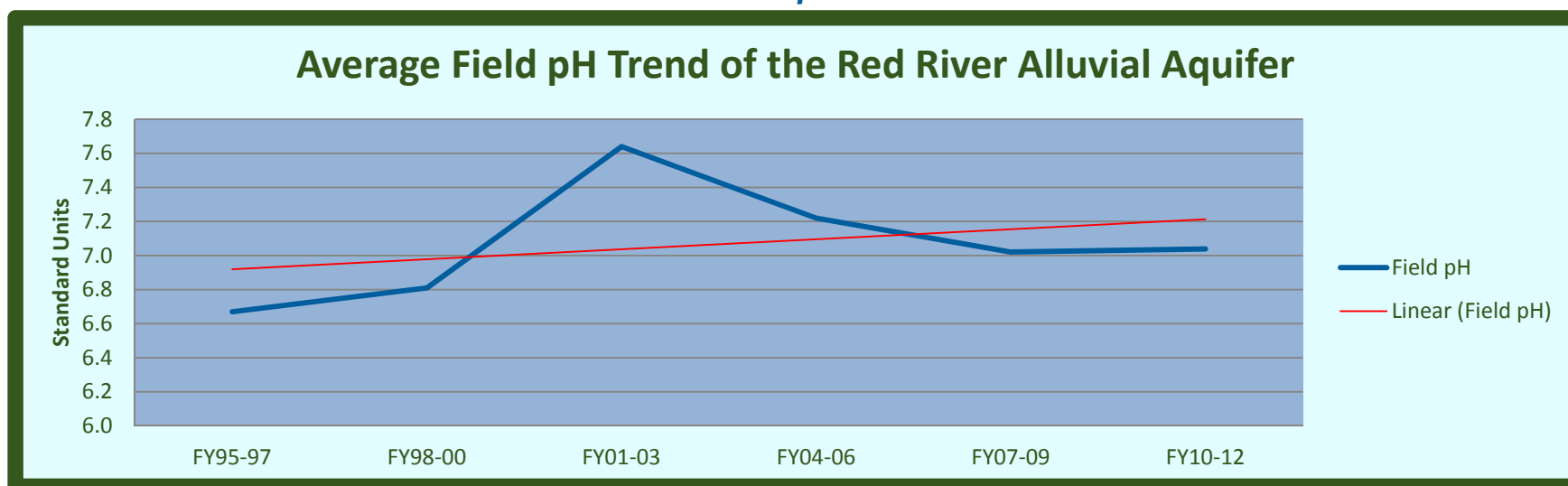


Chart 3-3: Field Specific Conductance Trend

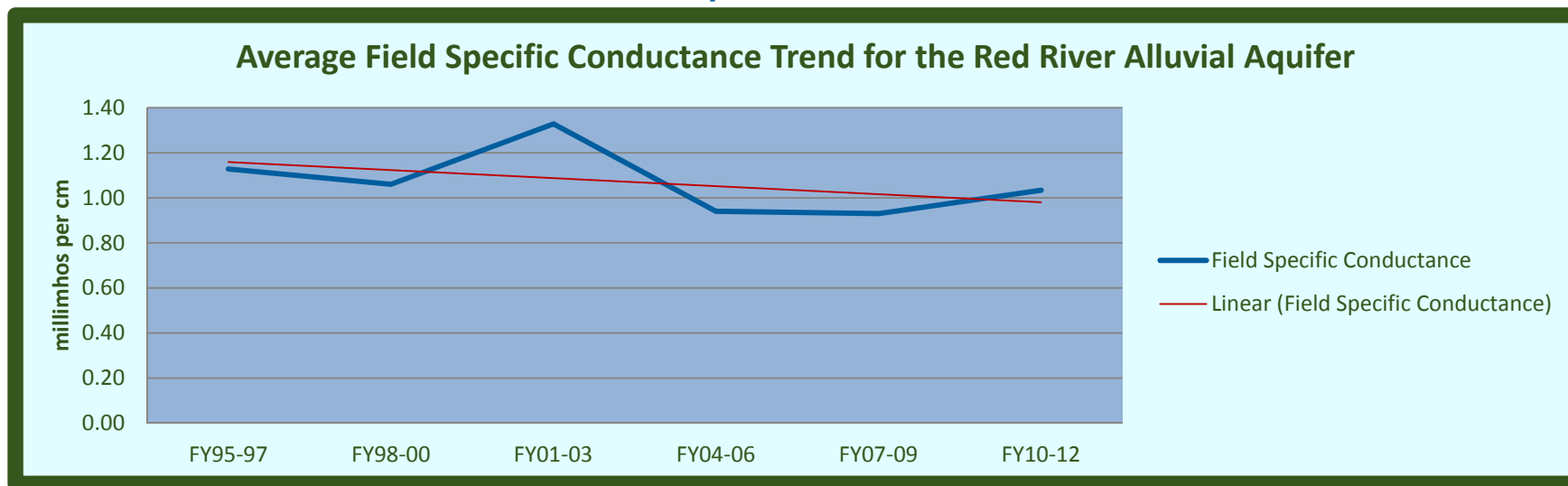


Chart 3-4: Lab Specific Conductance Trend

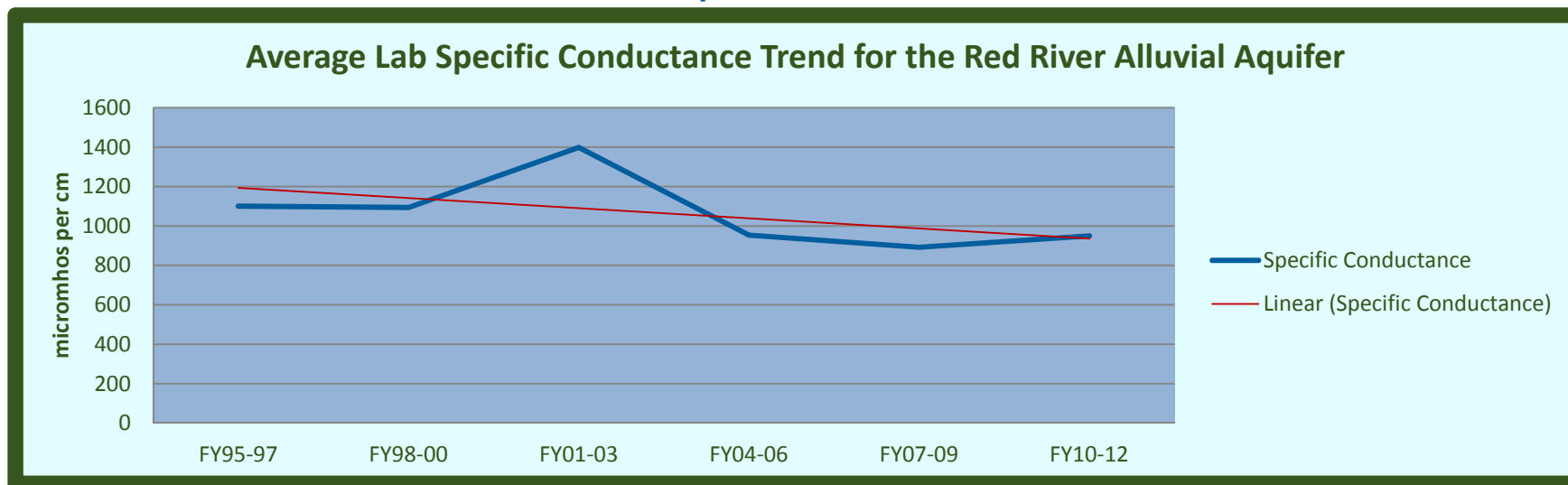


Chart 3-5: Field Salinity Trend

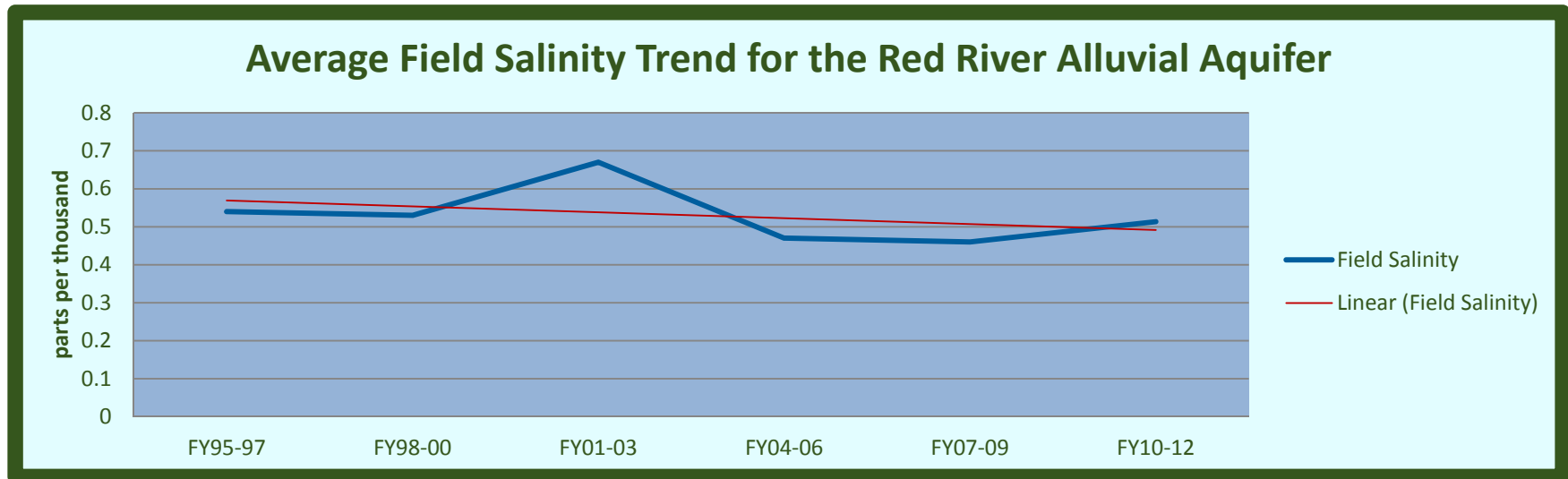


Chart 3-6: Alkalinity Trend

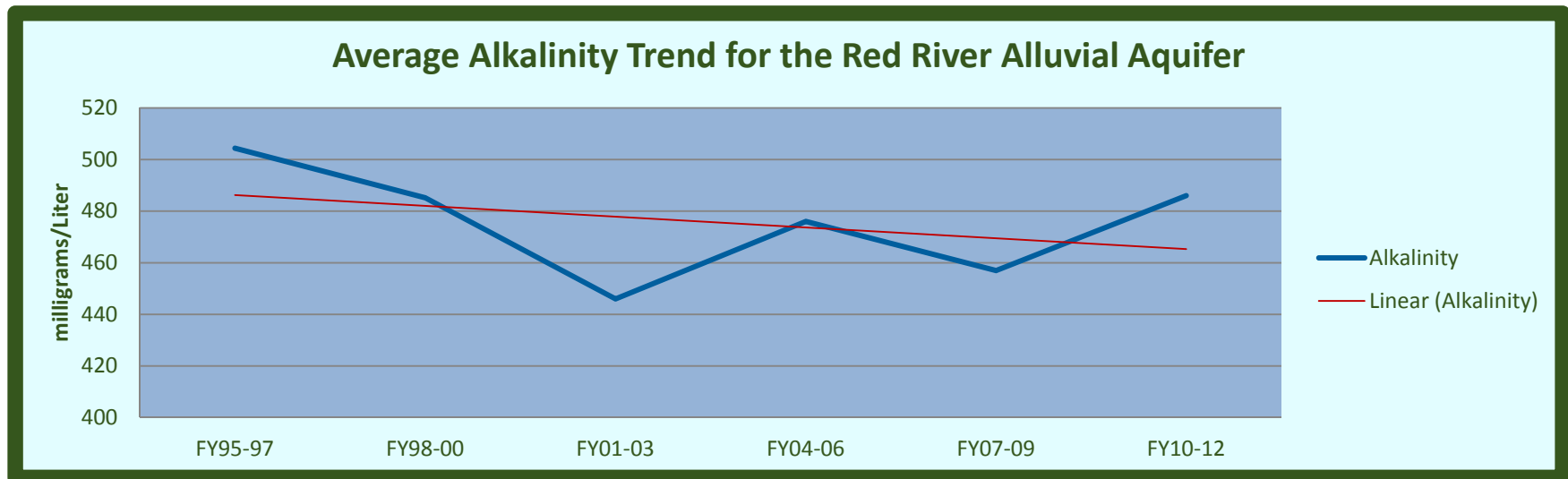


Chart 3-7: Chloride Trend

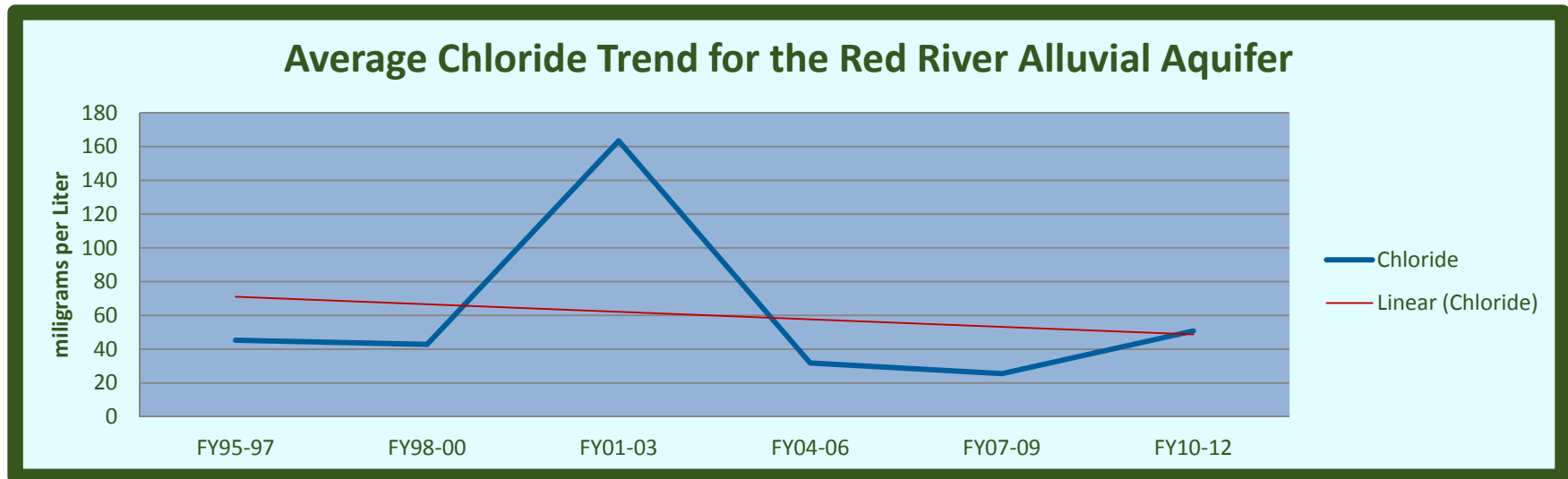


Chart 3-8: Color Trend

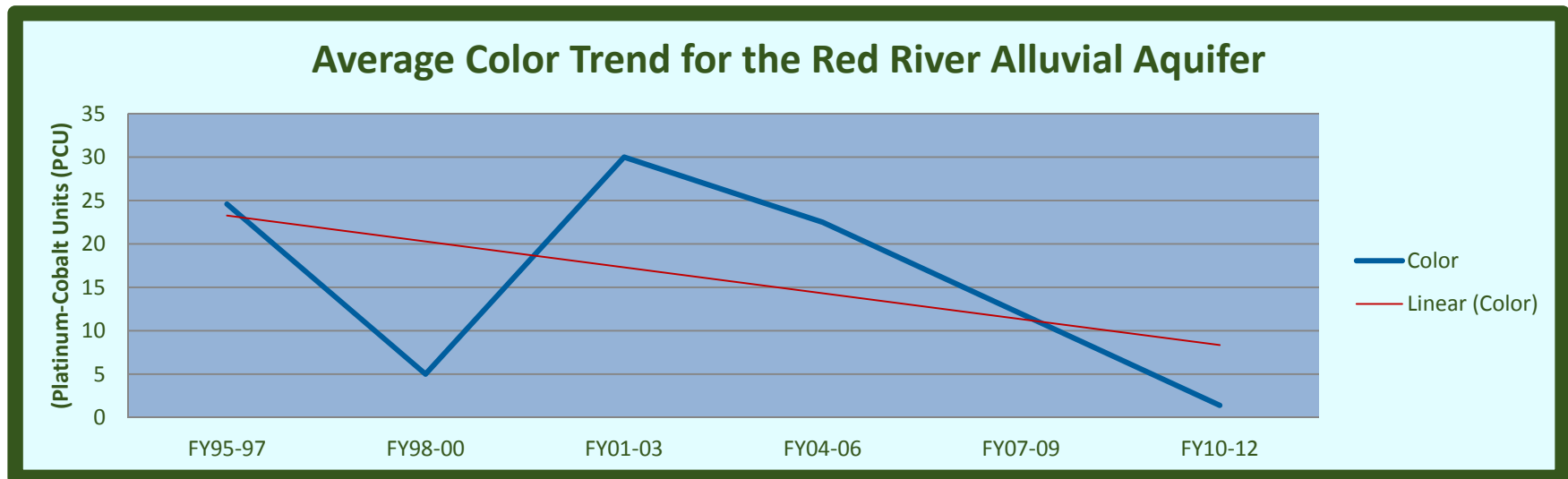


Chart 3-9: Sulfate Trend

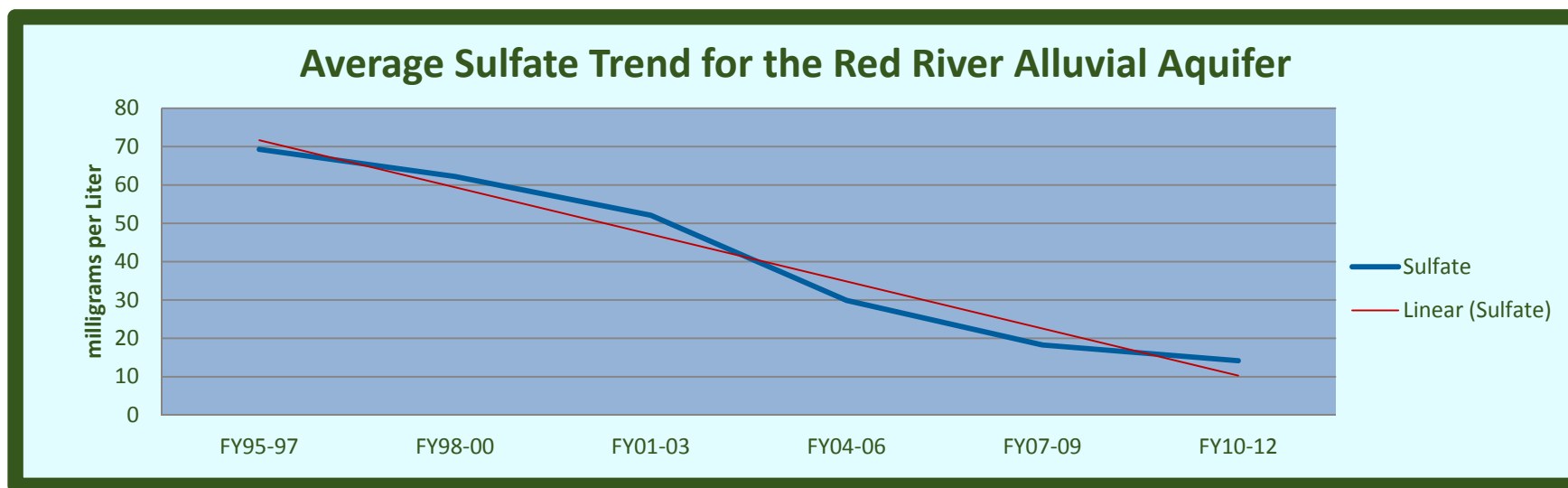


Chart 3-10: Total Dissolved Solids Trend

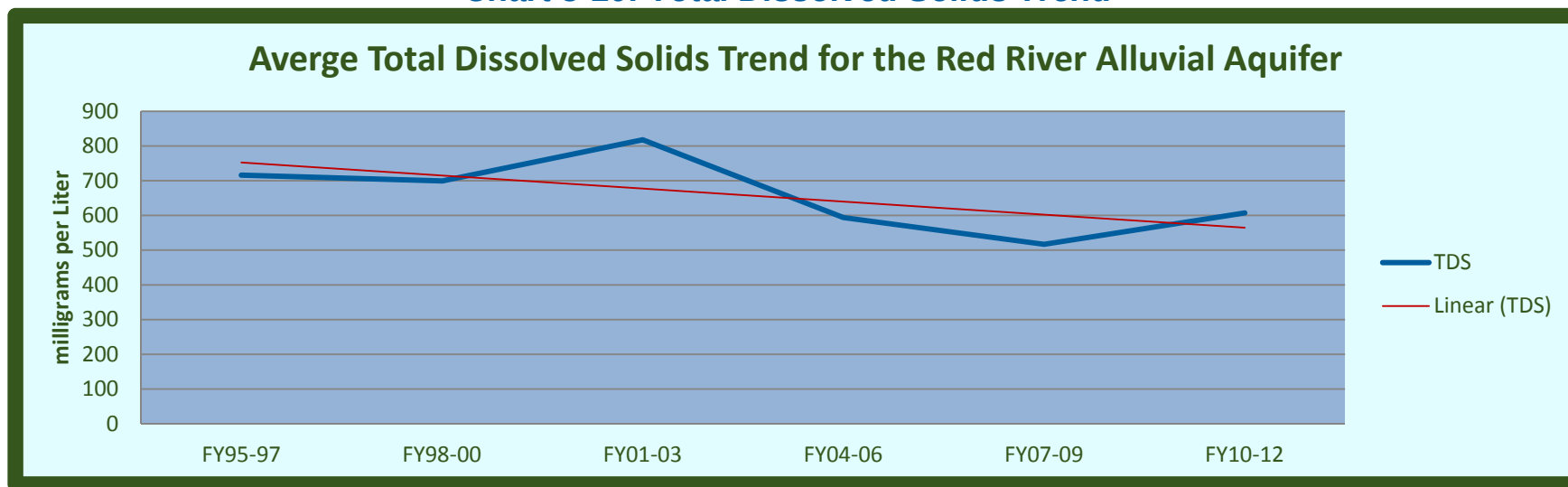


Chart 3-11: Ammonia Trend

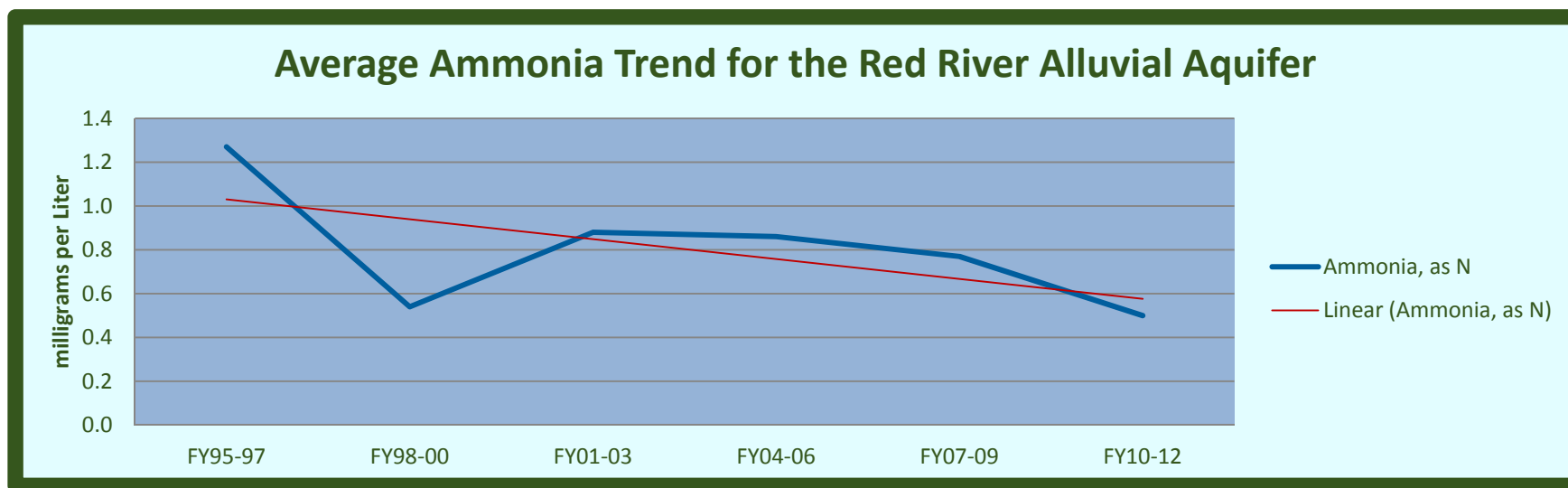


Chart 3-12: Hardness Trend

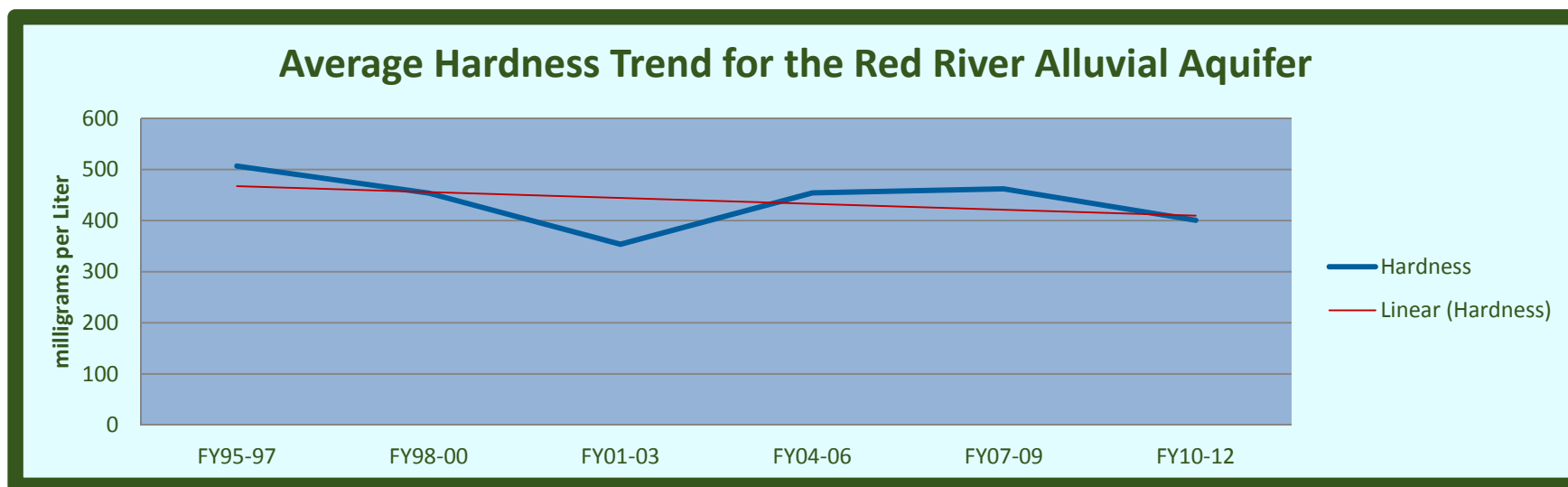


Chart 3-13: Nitrite – Nitrate Trend

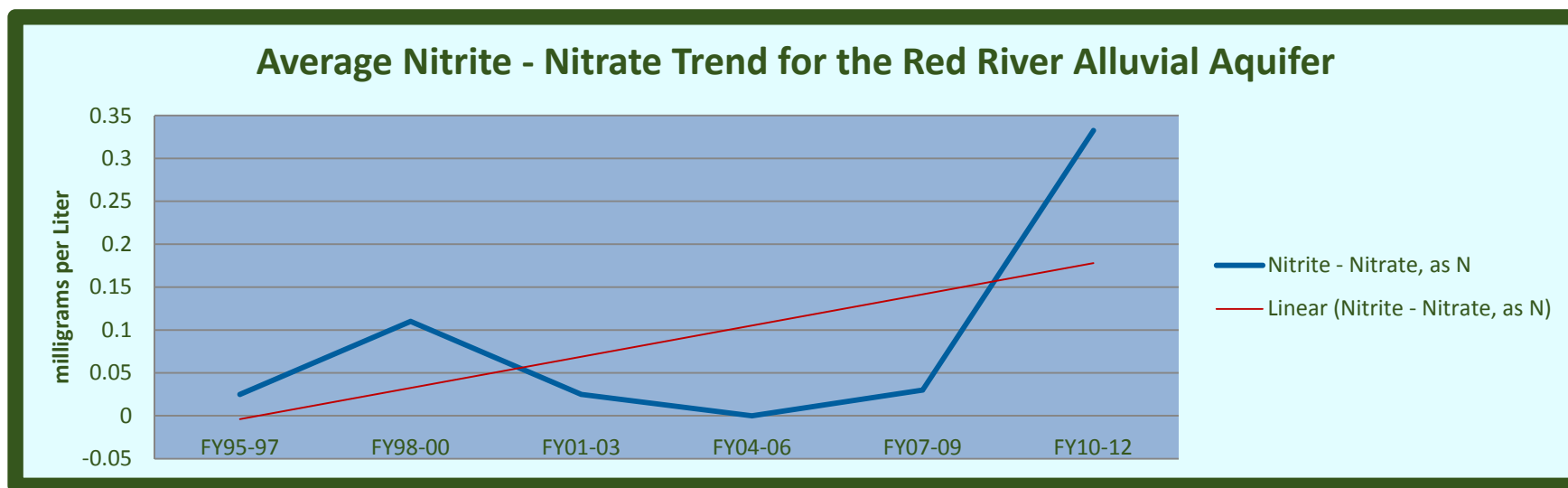


Chart 3-14: TKN Trend

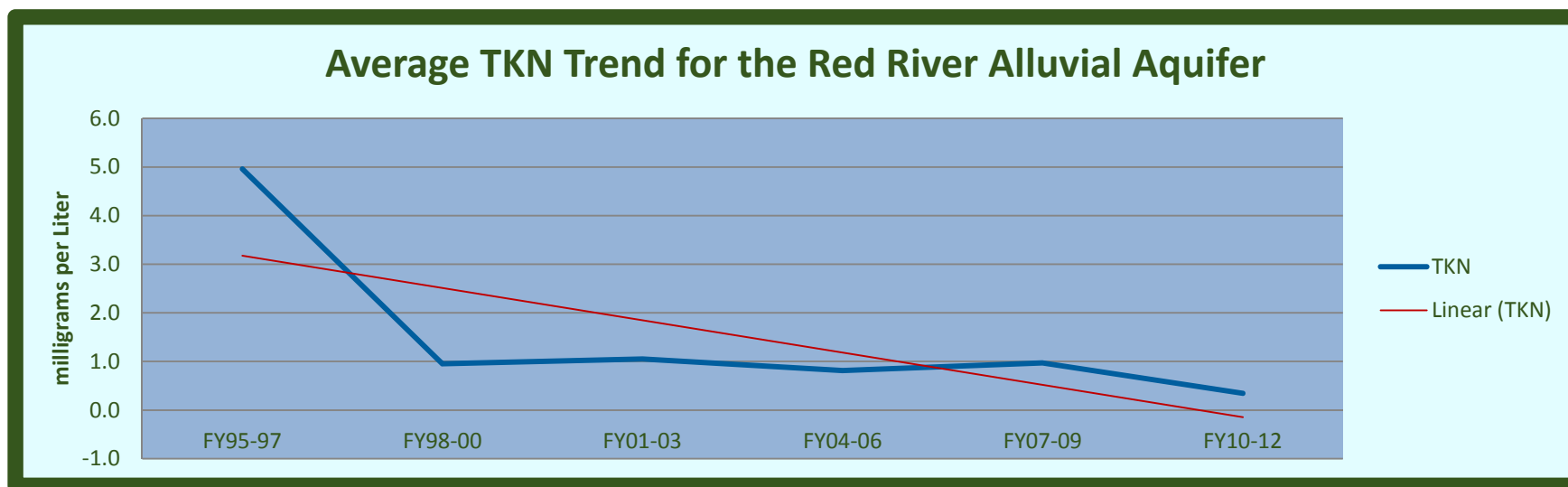


Chart 3-15: Total Phosphorus Trend

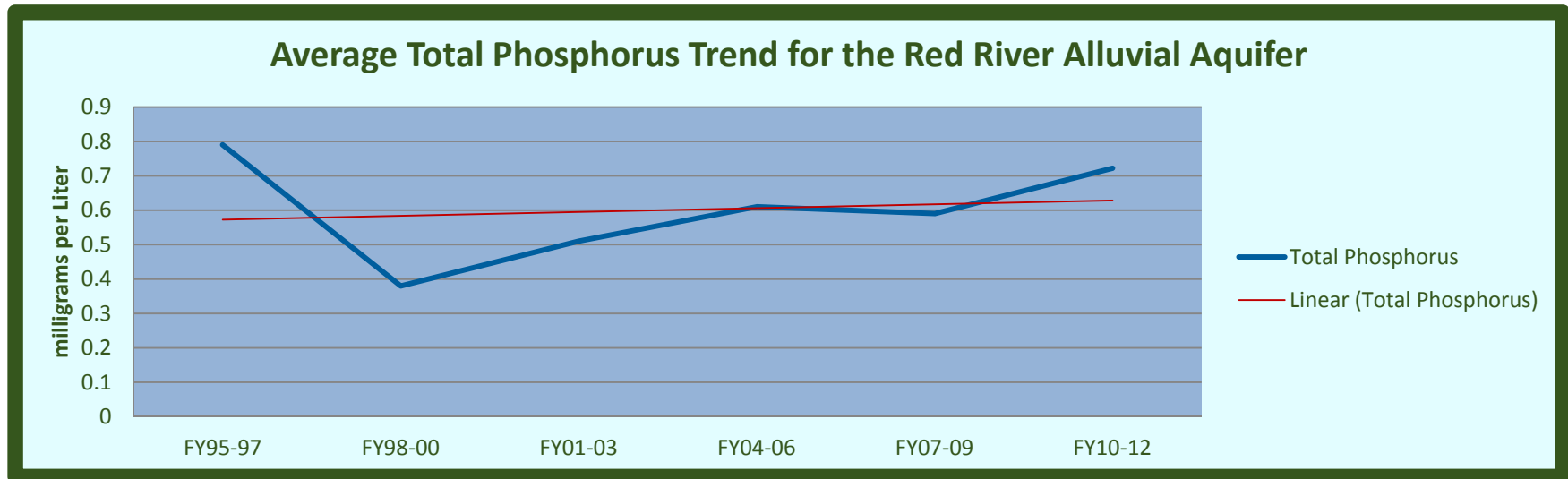


Chart 3-16: Iron Trend

