RED RIVER ALLUVIAL AQUIFER SUMMARY, 2013

AQUIFER SAMPLING AND ASSESSMENT PROGRAM

DEQ
LOUISIANA

APPENDIX 3 TO THE 2015 TRIENNIAL SUMMARY REPORT

PARTIAL FUNDING PROVIDED BY THE CWA

ASSET
AQUIFER SAMPLING AND ASSESSMENT PROGRAM

Contents

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 make up, in part, the ASSET Program's Triennial Summary Report.

Analytical and field data contained in this summary were collected from wells producing from the Red River Alluvial aquifer, during the 2013 state fiscal year (July 1, 2012 - June 30, 2013). This summary will become Appendix 3 of ASSET Program Triennial Summary Report for 2015.

These data show that in September and December 2012, and then in January of 2013, five wells were sampled which produce from the Red River Alluvial aquifer. Three of the five are classified as irrigation and two are classified as domestic. The wells are located in three 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 sampled 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 Resources' 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 47 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.

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 2013 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, 2007, and 2010.

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

Due to the variability in the laboratory's reporting detection limits caused by dilution factors, whenever an analyte in question is not detected, the standard reporting detection limit value for each analytical method is used as the DL when performing statistical calculations.

Figures 3-2, 3-3, 3-4, and 3-5 respectively, represent the contoured data for pH, total dissolved solids, chloride, and iron. It should be noted that the contoured data represented in Figures 3-2 through 3-5 is generalized due to the limited number of data points (wells) available to produce these maps. 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 12 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 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 three wells exceeded the SMCL for color and four wells exceeded the SMCL for total dissolved solids (TDS). 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:

Color (SMCL = 15 color units (PCU)):

CD-11849 – 16.2 PCU
NA-5404Z – 34.0 PCU
NA-SWANSON – 30.0 PCU

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

	LAB RESULTS (in mg/L)	FIELD MEASURES (in g/L)
CD-859	567 mg/L	0.460 g/L
CD-11849	1,140 mg/L	1.173 g/L
NA-SWANSON	560 mg/L	0.668 g/L
RR-345	580 mg/L	0.693 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 µg/L):

CD-859 – 1,650 µg/L
NA-5404Z – 12,600 µg/L
RR-345 – 6,820 µg/L
CD-11849 – 3,480 µg/L
NA-SWANSON – 4,930 µg/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.

There were no confirmed detections of a VOC at or above its detection limit during the FY 2013 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.

There were no confirmed detections of a SVOC at or above its detection limit during the FY 2013 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.

There were no confirmed detections of a pesticide or PCB at or above its detection limit during the FY 2013 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 Alluvial aquifer exhibit some changes when comparing current data to that of the six previous sampling rotations (three, six, nine, twelve, fifteen, and eighteen 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 eighteen-year period, four analytes have shown a general increase in concentration. These analytes are pH, iron, turbidity, and nitrate-nitrite. For this same time period, ten analytes have demonstrated a decrease in concentrations: temperature, field and lab specific conductance, alkalinity, color, sulfate, TDS, ammonia, hardness, TKN, and copper. All other analytes demonstrate some fluctuations or have remained non-detect.

Current sample results show that all five wells reported one or more secondary exceedances with a total of 12 SMCL exceedances. The FY 2010 sampling of the Red River Alluvial aquifer shows that all five wells also reported one or more SMCL exceedances with a total of nine exceedances.

SUMMARY AND RECOMMENDATIONS

In summary, the data show that the groundwater produced from this aquifer is hard[1] 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 2013 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 four parameters showing consistent increases in concentration and ten 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 2013

Well ID	Parish	Date	Owner	Depth (Feet)	Well Use
CD-859	CADDO	12/06/2012	East Ridge Country Club	58	Irrigation
CD-11849Z	CADDO	01/30/2013	Private Owner	47	Domestic
NA-5404Z	NATCHITOCHES	09/24/2012	Seven C's Ranch	76	Domestic
NA-SWANSON	NATCHITOCHES	09/24/2012	Private Owner	80	Irrigation
RR-345	RED RIVER	09/24/2012	Bundrick Farms	89	Irrigation

Table 3-2: Summary of Field and Conventional Data, Red River Alluvial Aquifer – FY 2013

Well ID	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† →					5	2.5/ 12.5	1	10	2.5/ 12.5	10	4	0.3/ 1.5	0.05	5/25	0.01	0.3	0.05
	FIELD PARAMETERS					LABORATORY PARAMETERS												
CD-859	16.78	8.18	0.707	0.35	0.460	358	17.2	Not Analyzed	725	33.5	567	5	5.6	0.16	170	0.034	0.48	0.208
CD-11849Z	17.37	7.48	1.804	0.92	1.173	394	227.0	16.2	1,750	184.0	1140	7	19.0	0.60	328	0.056	1.85	0.277
NA-5404Z	19.75	7.14	0.895	0.44	0.582	371	58.5	34.0	793	< DL	467	31	126.0	2.33	154	< DL	2.46	0.889
NA-SWANSON	18.74	7.08	1.028	0.51	0.668	497	27.6	30.0	970	< DL	560	17	61.5	1.24	221	< DL	1.66	0.594
RR-345	19.27	7.24	1.066	0.53	0.693	449	42.6	8.0	986	52.6	580	26	75.0	0.05	250	< DL	1.59	0.616

†Detection limits vary due to dilution factor

Shaded cells exceed EPA Secondary Standards

Table 3-3: Summary of Inorganic Data (Total Metals), Red River Alluvial Aquifer – FY 2013

Well ID	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†	5/25	5/25	5/25	2/10	2/20	4/20	2/10	100	1/5	0.0002	3/15	5/25	1/5	2/10	6/30
CD-859	< DL	< DL	418	< DL	< DL	< DL	< DL	1,650	< DL	< DL	< DL	< DL	< DL	< DL	< DL
CD-11849Z	< DL	< DL	183	< DL	< DL	< DL	< DL	3,480	< DL	< DL	< DL	< DL	< DL	< DL	< DL
NA-5404Z	< DL	< DL	557	< DL	< DL	< DL	2.35	12,600	< DL	< DL	< DL	< DL	< DL	< DL	< DL
NA-SWANSON	< DL	< DL	531	< DL	< DL	< DL	2.17	4,930	< DL	< DL	< DL	< DL	< DL	< DL	< DL
RR-345	< DL	< DL	308	< DL	< DL	< DL	< DL	6,820	< DL	< DL	< DL	< DL	< DL	< DL	< DL

†Detection limits vary due to dilution factor

Shaded cells exceed EPA Secondary Standards

Table 3-4: FY 2013 Field and Conventional Statistics, ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
FIELD	Temperature (^{O}C)	16.78	19.75	18.38
	pH (SU)	7.08	8.18	7.42
	Specific Conductance (mmhos/cm)	0.707	1.804	1.100
	Salinity (ppt)	0.35	1.17	0.55
	TDS (g/L)	0.460	0.965	0.715
LABORATORY	Alkalinity (mg/L)	358	497	414
	Chloride (mg/L)	17.2	227.0	74.6
	Color	8.0	34.0	22.1
	Specific Conductance (umhos/cm)	725	1,750	1,045
	Sulfate (mg/L)	< DL	184	55
	TDS (mg/L)	467	1,140	663
	TSS (mg/L)	5	31	17
	Turbidity (NTU)	5.6	126.0	57.4
	Ammonia, as N (mg/L)	0.05	2.33	0.88
	Hardness (mg/L)	154	328	225
	Nitrite - Nitrate, as N (mg/L)	< DL	0.056	0.021
	TKN (mg/L)	0.48	2.46	1.61
	Total Phosphorus (mg/L)	0.208	0.889	0.517

Table 3-5: FY 2013 Inorganic (Total Metals) Statistics, ASSET Wells

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (ug/L)	< DL	< DL	< DL
Arsenic (ug/L)	< DL	< DL	< DL
Barium (ug/L)	183	557	400
Beryllium (ug/L)	< DL	< DL	< DL
Cadmium (ug/L)	< DL	< DL	< DL
Chromium (ug/L)	< DL	< DL	< DL
Copper (ug/L)	< DL	2.35	< DL
Iron (ug/L)	1,650	12,600	5,896
Lead (ug/L)	< DL	< DL	< DL
Mercury (ug/L)	< DL	< DL	< DL
Nickel (ug/L)	< DL	< DL	< DL
Selenium (ug/L)	< DL	< DL	< DL
Silver (ug/L)	< DL	< DL	< DL
Thallium (ug/L)	< DL	< DL	< DL
Zinc (ug/L)	< DL	< DL	< DL

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	FY 2013
FIELD	Temperature (^{O}C)	21.00	19.88	20.50	20.55	20.23	19.96	18.38
FIELD	pH (SU)	6.67	6.81	7.64	7.22	7.02	7.04	7.42
FIELD	Specific Conductance (mmhos/cm)	1.128	1.060	1.328	0.940	0.930	1.034	1.100
FIELD	Salinity (Sal.) (ppt)	0.54	0.53	0.67	0.47	0.46	0.51	0.55
FIELD	TDS (Total dissolved solids) (g/L)	-	-	-	0.610	0.610	0.670	0.715
LABORATORY	Alkalinity (Alk.) (mg/L)	504.4	485.2	446.0	476.0	457.0	486	414
LABORATORY	Chloride (Cl) (mg/L)	45.3	42.8	163.4	31.8	25.5	50.8	74.6
LABORATORY	Color (PCU)	24.6	5.0	30.0	22.5	-	1.4	22.1
LABORATORY	Specific Conductance (umhos/cm)	1,100	1,094	1,398	953	892	950	1,045
LABORATORY	Sulfate (SO4) (mg/L)	69.3	62.2	52.1	29.9	18.3	14.2	55
LABORATORY	TDS (Total dissolved solids) (mg/L)	716	699	818	594	517	607	663
LABORATORY	TSS (Total suspended solids) (mg/L)	18.8	13.6	12.5	17.1	16.4	18.3	17
LABORATORY	Turbidity (Turb.) (NTU)	56.0	54.4	44.7	68.3	73.6	75.7	57.4
LABORATORY	Ammonia, as N (NH3) (mg/L)	1.27	0.54	0.88	0.86	0.77	< DL	0.88
LABORATORY	Hardness (mg/L)	507	454	354	454	462	401	225
LABORATORY	Nitrite - Nitrate , as N (mg/L)	< DL	0.11	< DL	< DL	< DL	0.33	0.021
LABORATORY	TKN (mg/L)	4.96	0.95	1.05	0.81	0.97	0.34	1.61
LABORATORY	Total Phosphorus (P) (mg/L)	0.79	0.38	0.51	0.61	0.59	0.72	0.517

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	FY 2013
Antimony (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Arsenic (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Barium (ug/L)	401	102	219	387	461	564	400
Beryllium (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Cadmium (ug/L)	< DL	< DL	1.0	< DL	< DL	< DL	< DL
Chromium (ug/L)	12.4	< DL	< DL	< DL	< DL	< DL	< DL
Copper (ug/L)	19.9	968.7	< DL	10.3	< DL	< DL	< DL
Iron (ug/L)	6,122	3,340	3,396	5,977	7,717	6,281	5,896
Lead (ug/L)	32.0	< DL	< DL	14.0	< DL	< DL	< DL
Mercury (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Nickel (ug/L)	10.4	1,041.4	< DL	< DL	< DL	< DL	< DL
Selenium (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Silver (ug/L)	< DL	< DL	1.1	< DL	< DL	< DL	< DL
Thallium (ug/L)	< DL	< DL	< DL	< DL	< DL	< DL	< DL
Zinc (ug/L)	185.6	<10.0	41.7	65.5	490.0	13.4	< DL

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

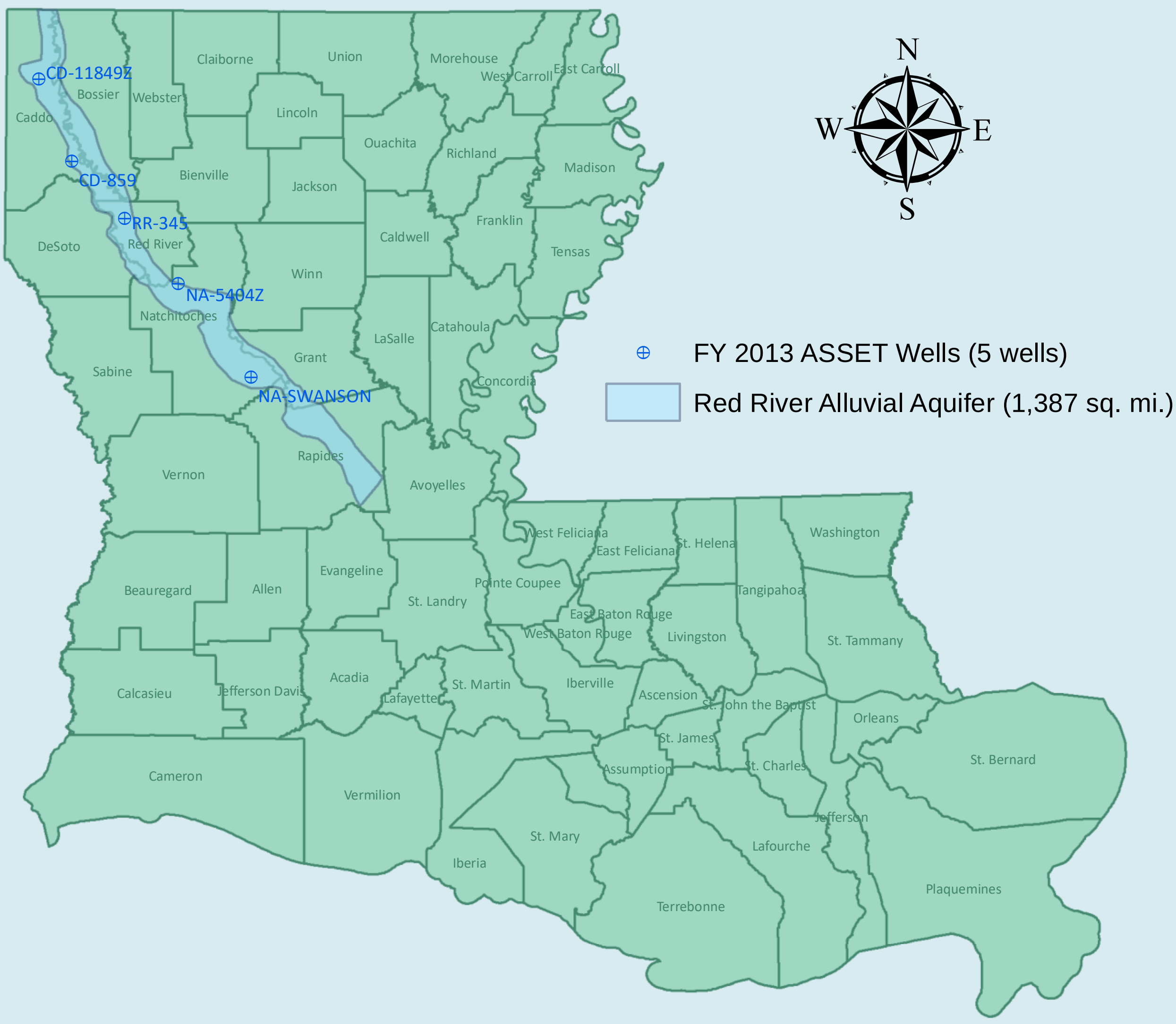
Table 3-9: SVOCs (Continued)

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



Aquifer boundary digitized from Louisiana Hydrologic Map No. 2: Areal Extent of Freshwater in Major Aquifers of Louisiana, Smoot, 1986: USGS/LDOTD Report 86-4150.

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Figure 3-2: Map of pH Data

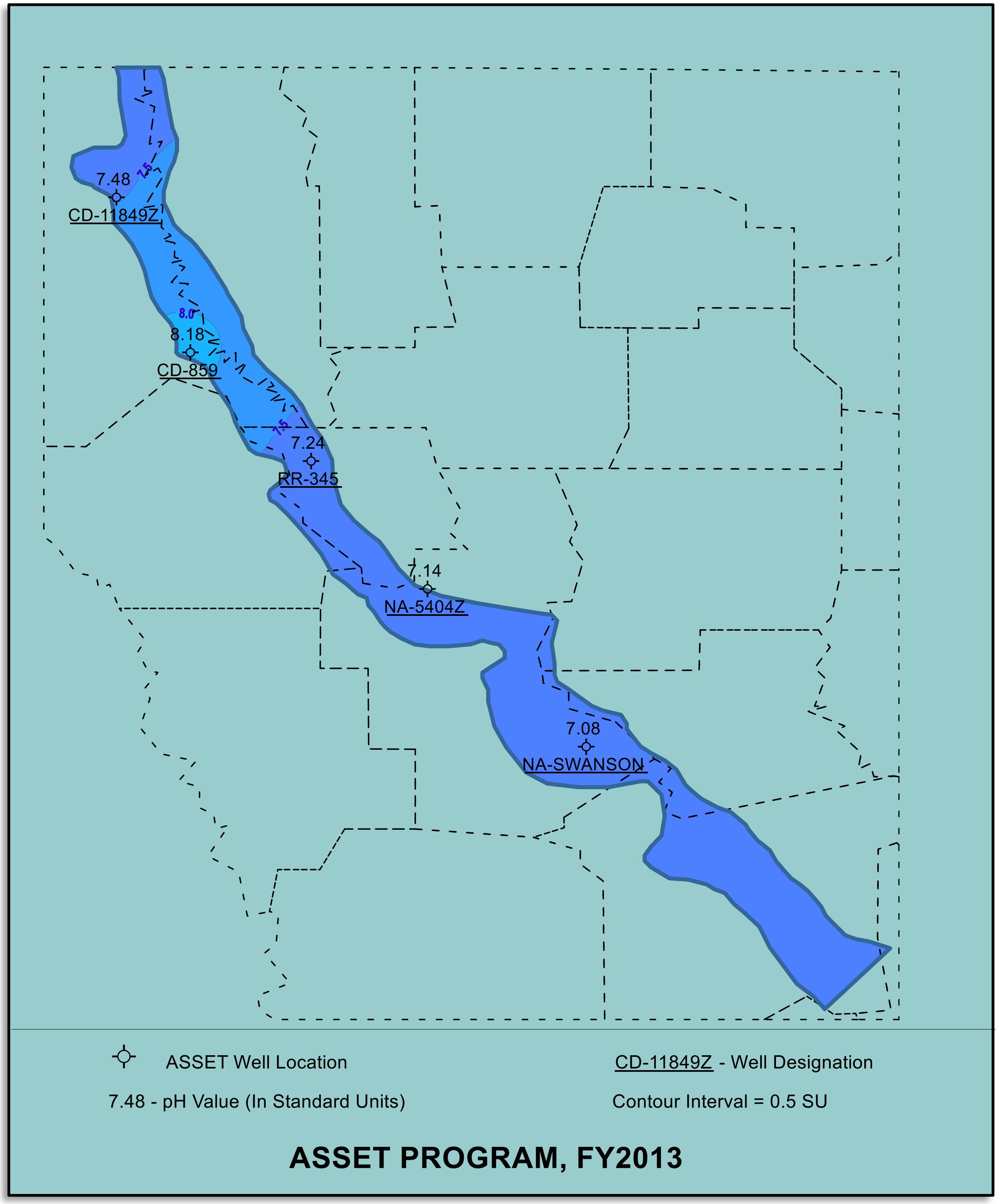

Figure 3-3: Map of TDS Lab Data

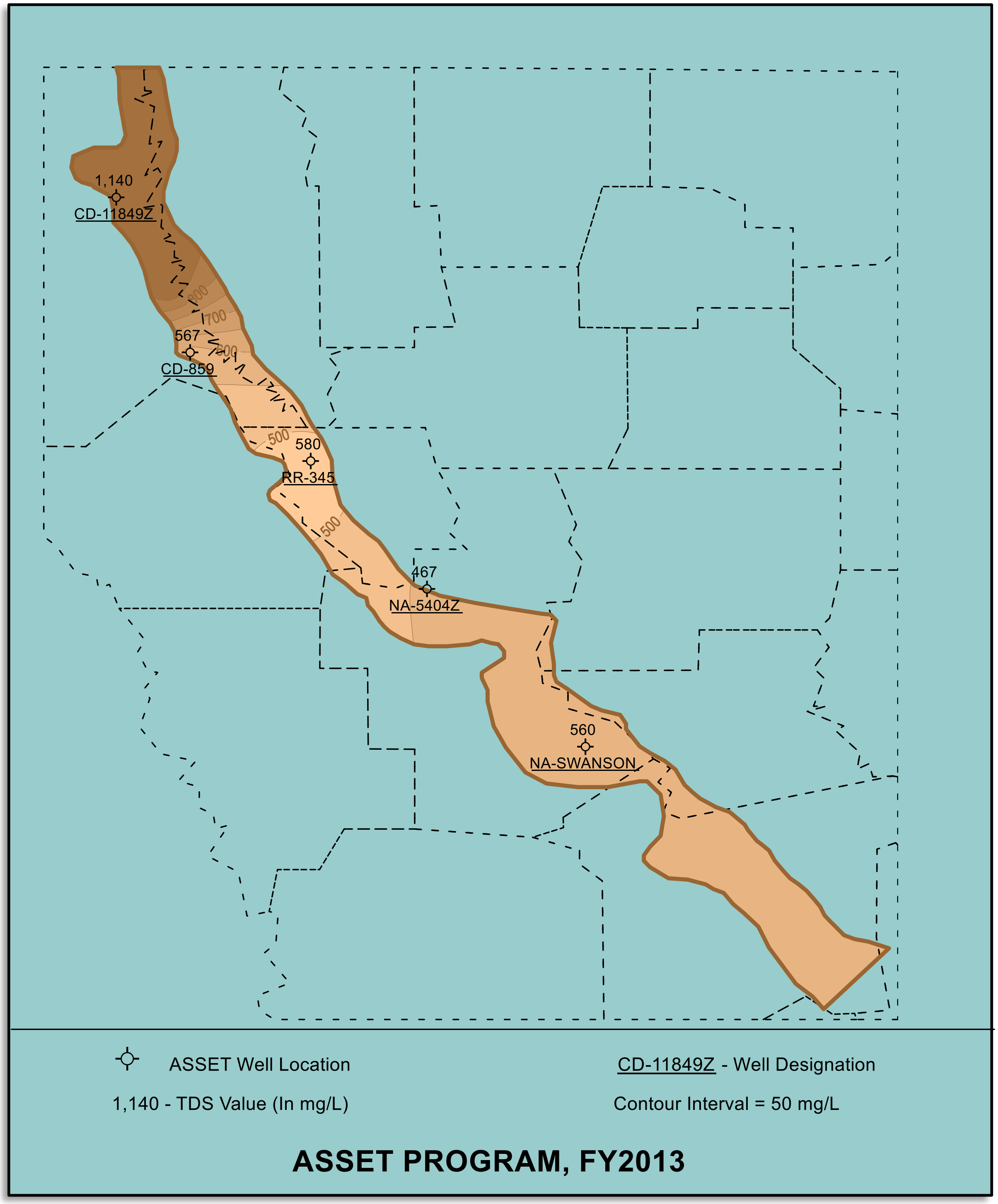

Figure 3-4: Map of Chloride Data

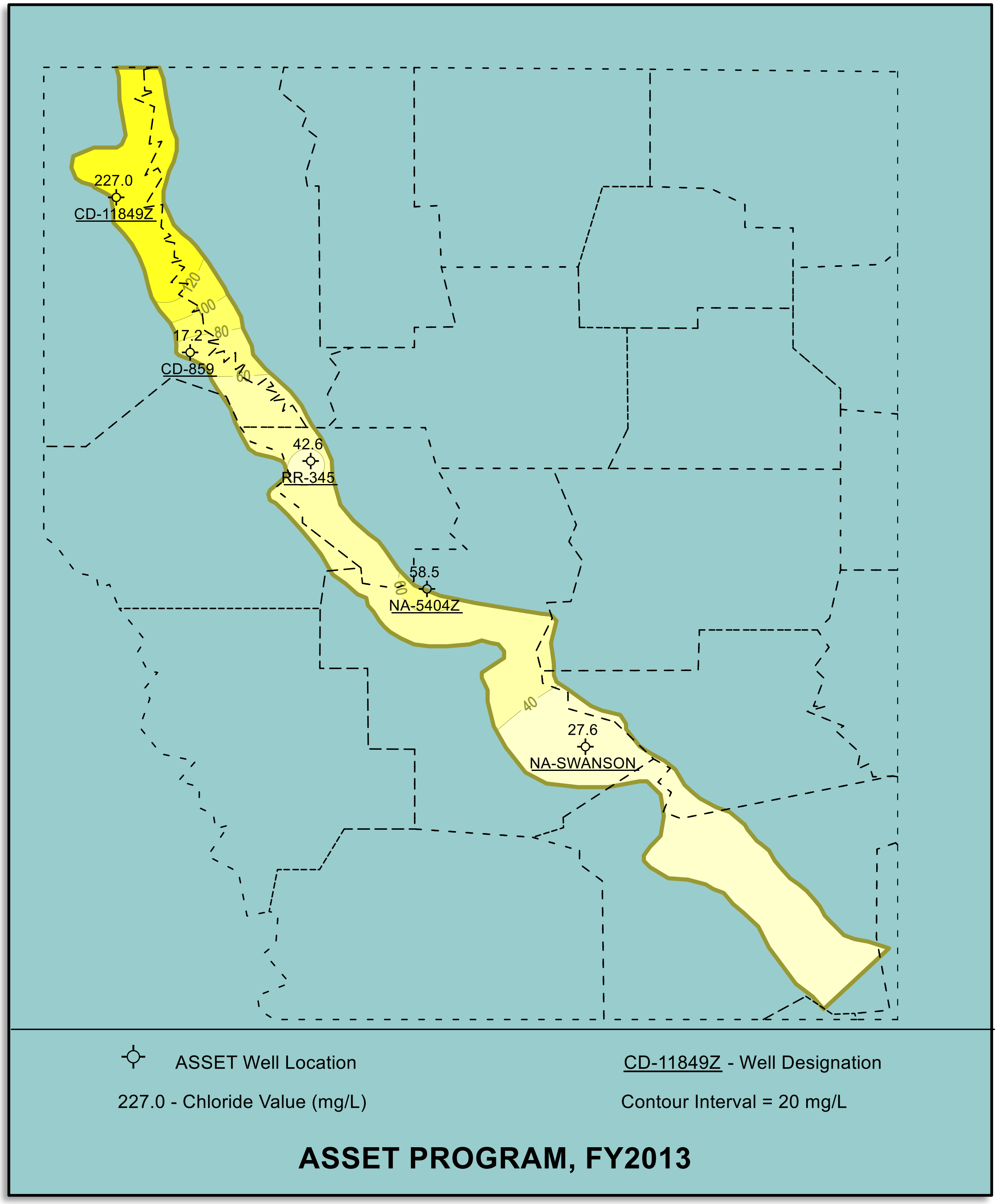

Figure 3-5: Map of Iron Data

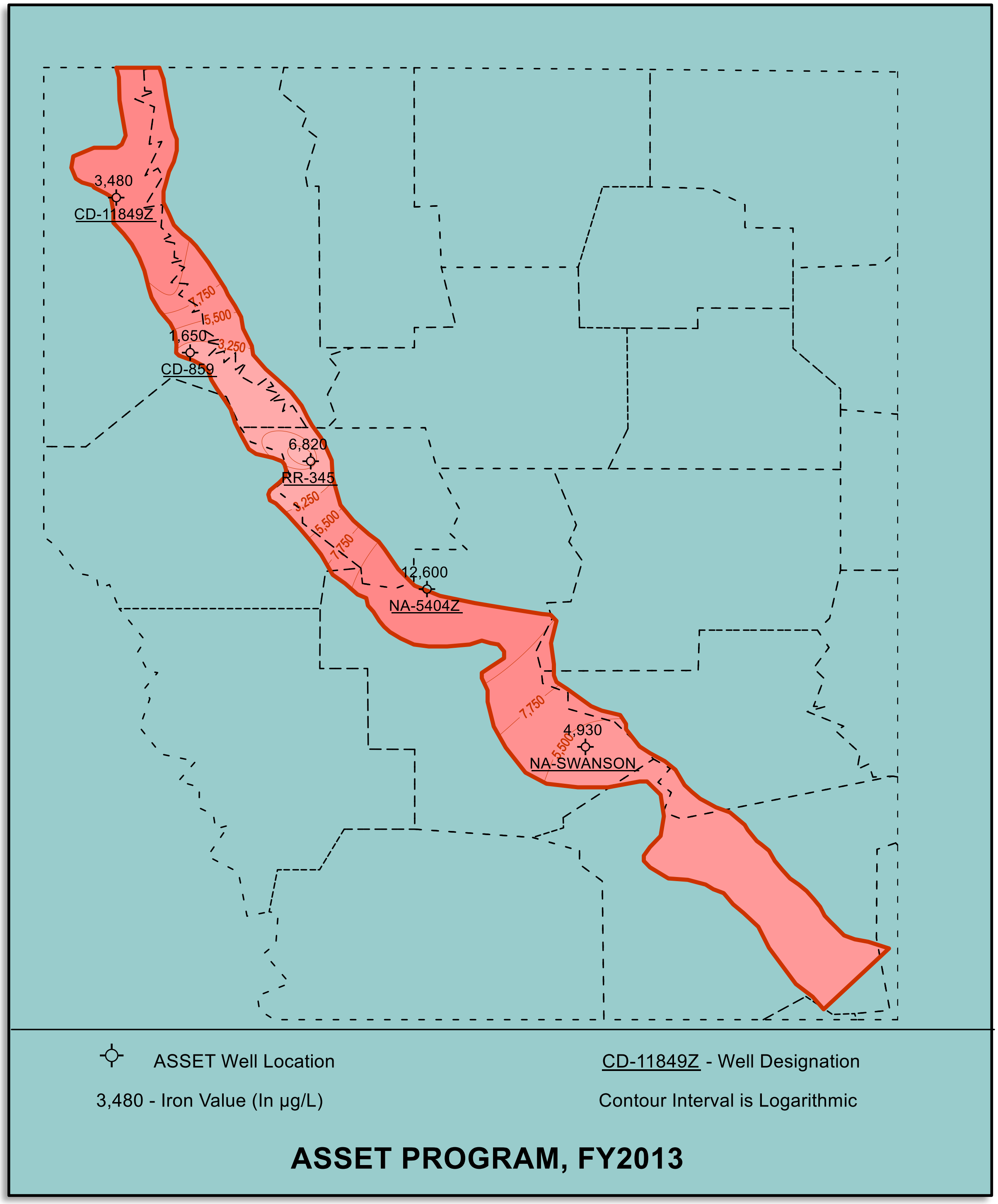

Chart 3-1: Temperature Trend

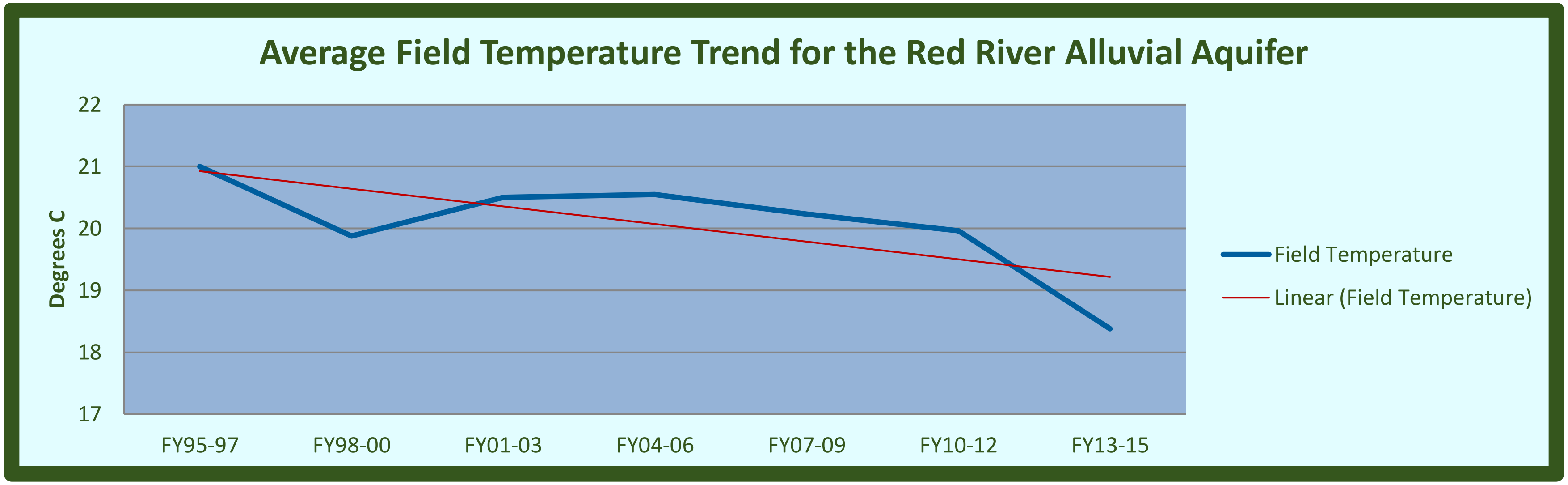

Chart 3-2: pH Trend

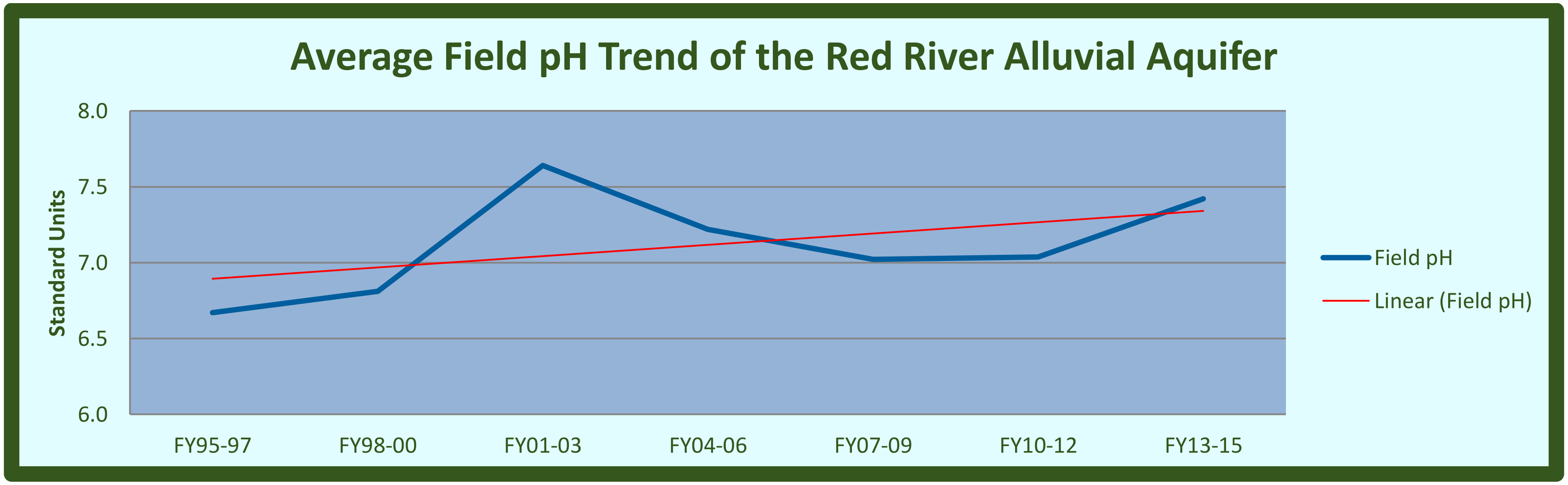

Chart 3-3: Field Specific Conductance Trend

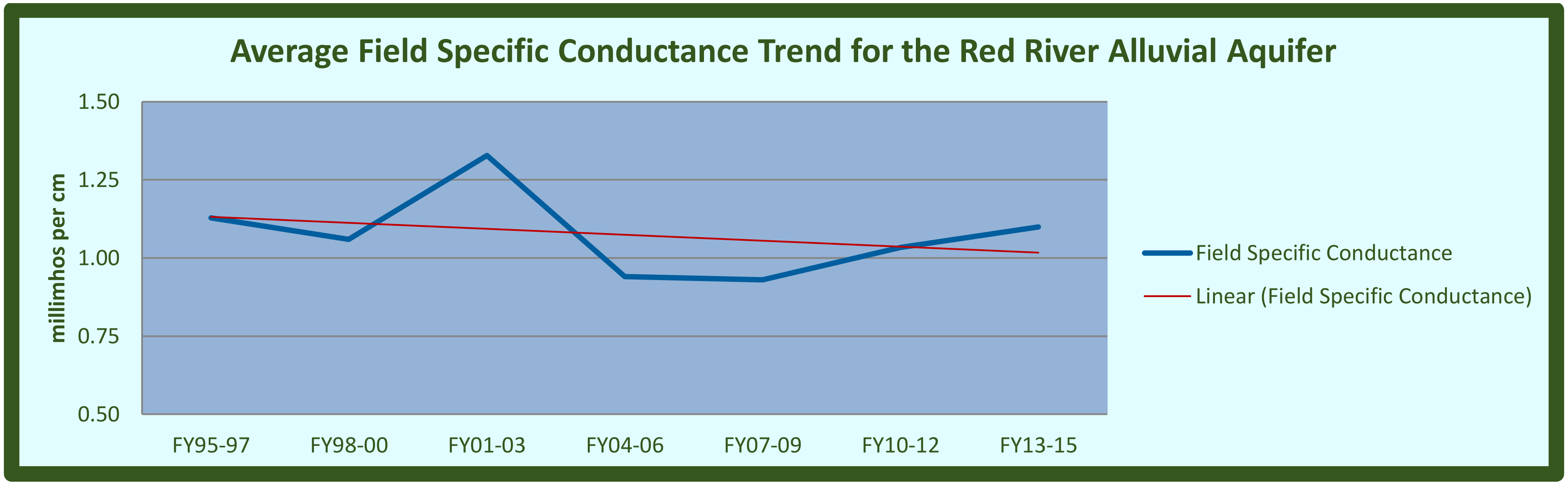

Chart 3-4: Lab Specific Conductance Trend

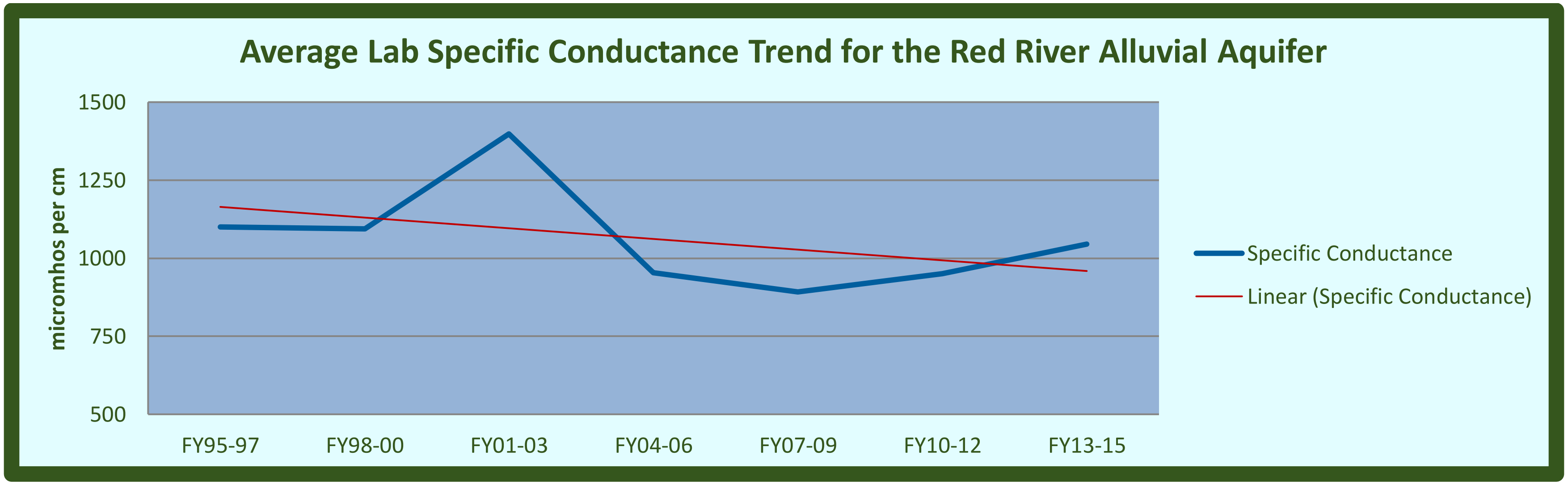

Chart 3-5: Field Salinity Trend

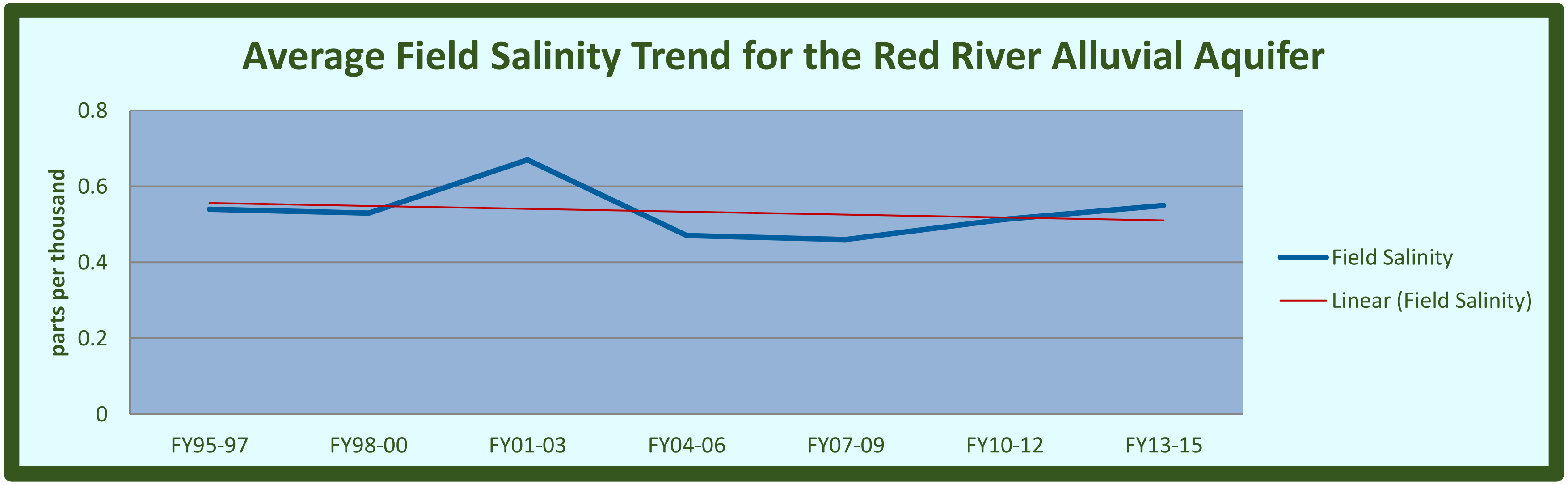

Chart 3-6: Chloride Trend

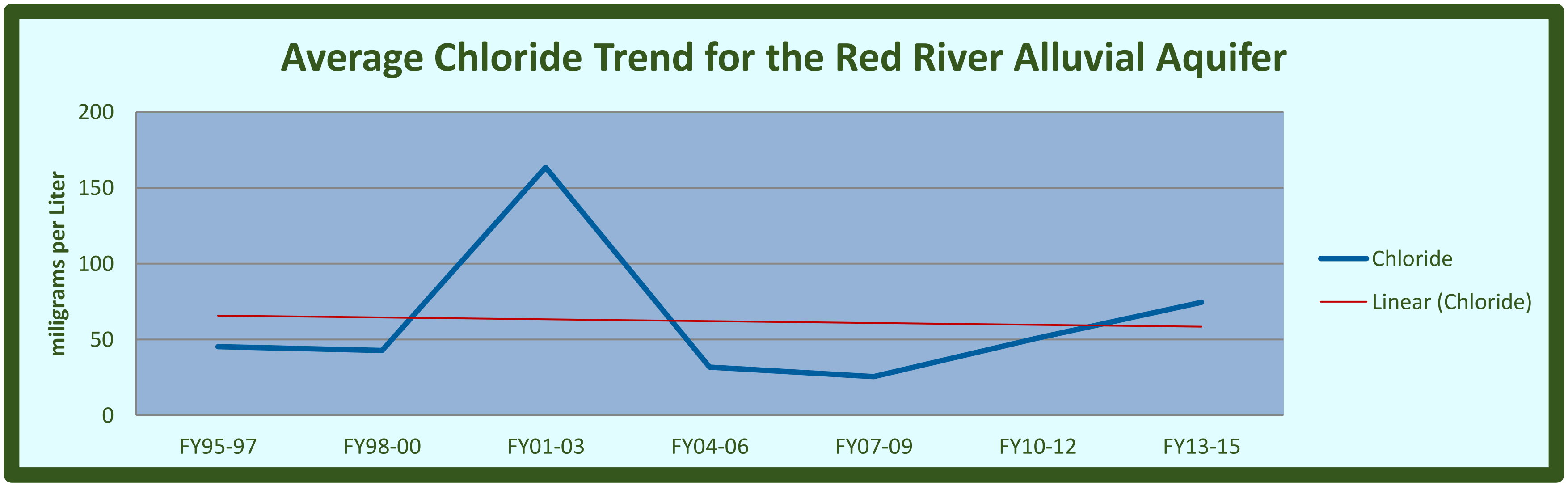

Chart 3-7: Alkalinity Trend

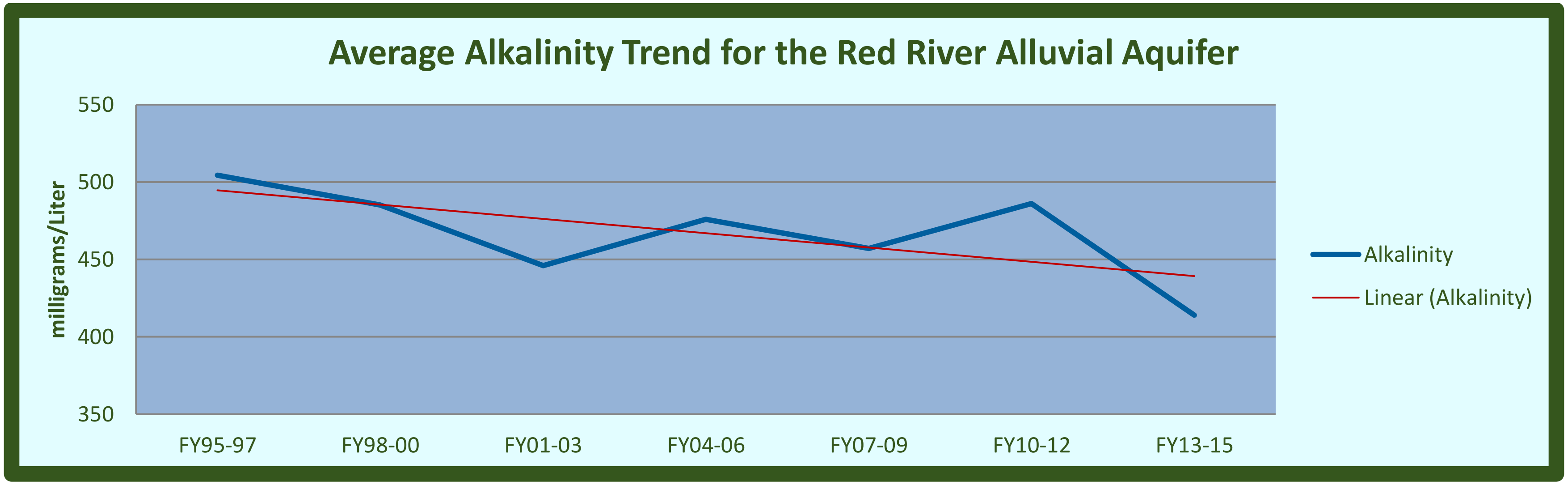

Chart 3-8: Color Trend

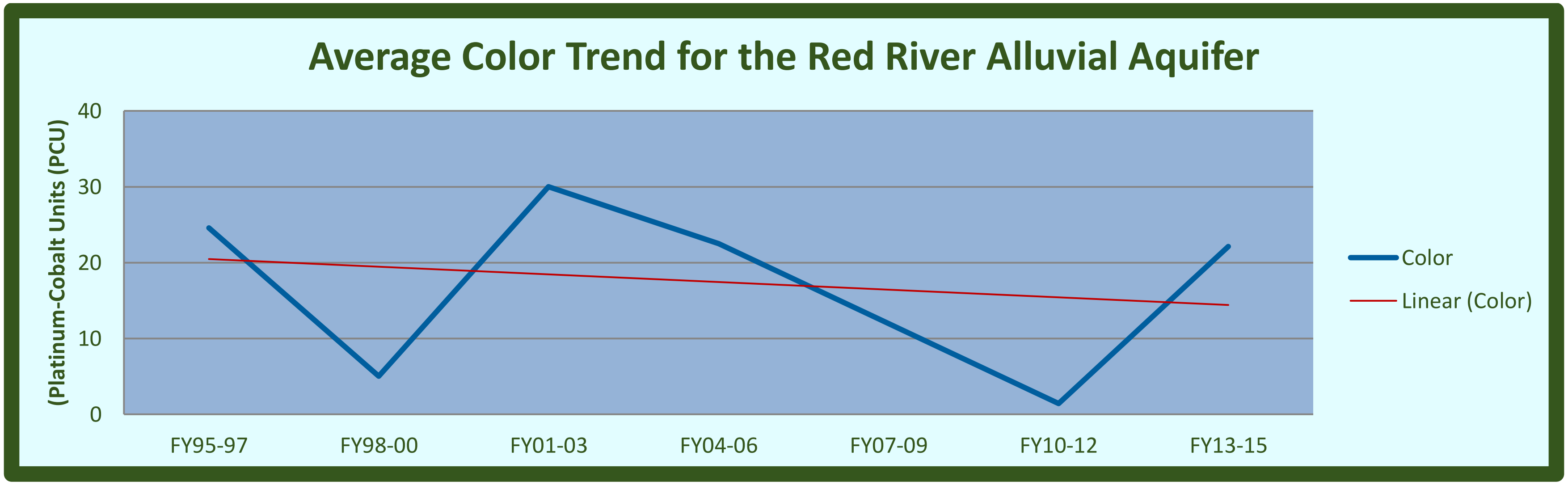

Chart 3-9: Sulfate Trend

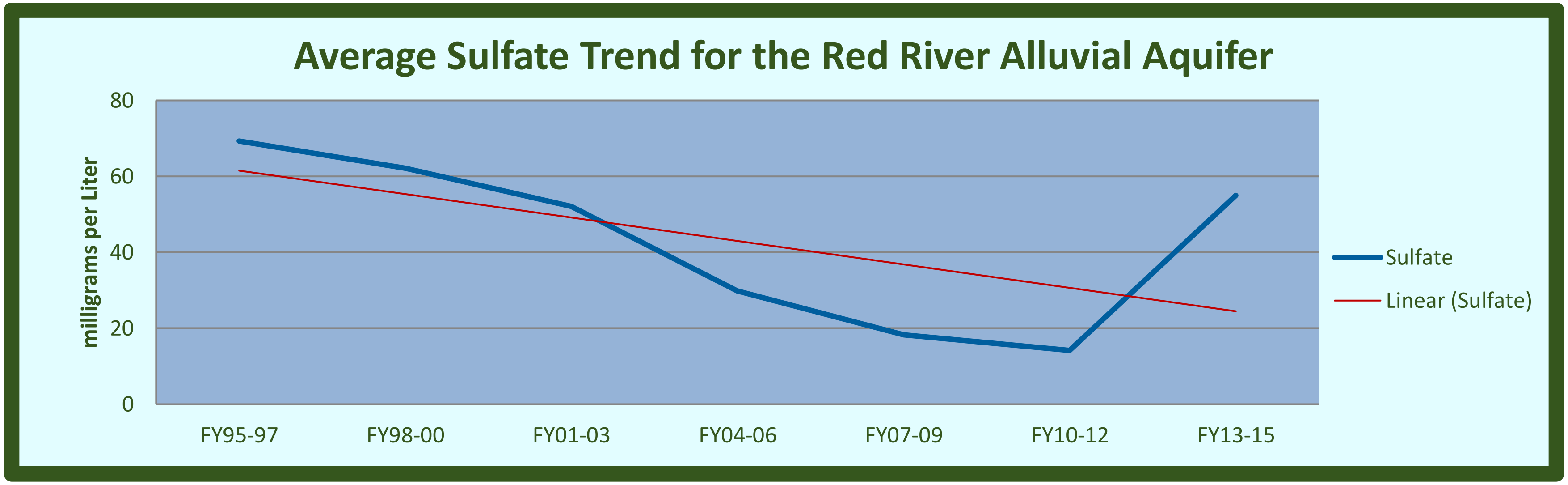

Chart 3-10: Total Dissolved Solids Trend

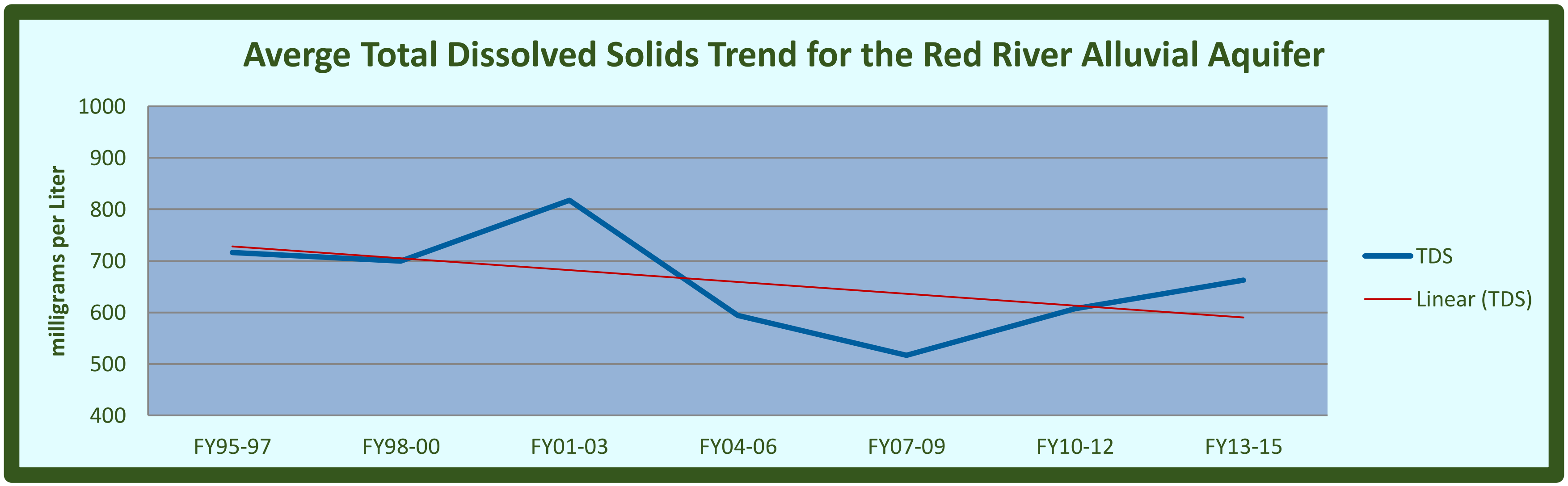

Chart 3-11: Hardness Trend

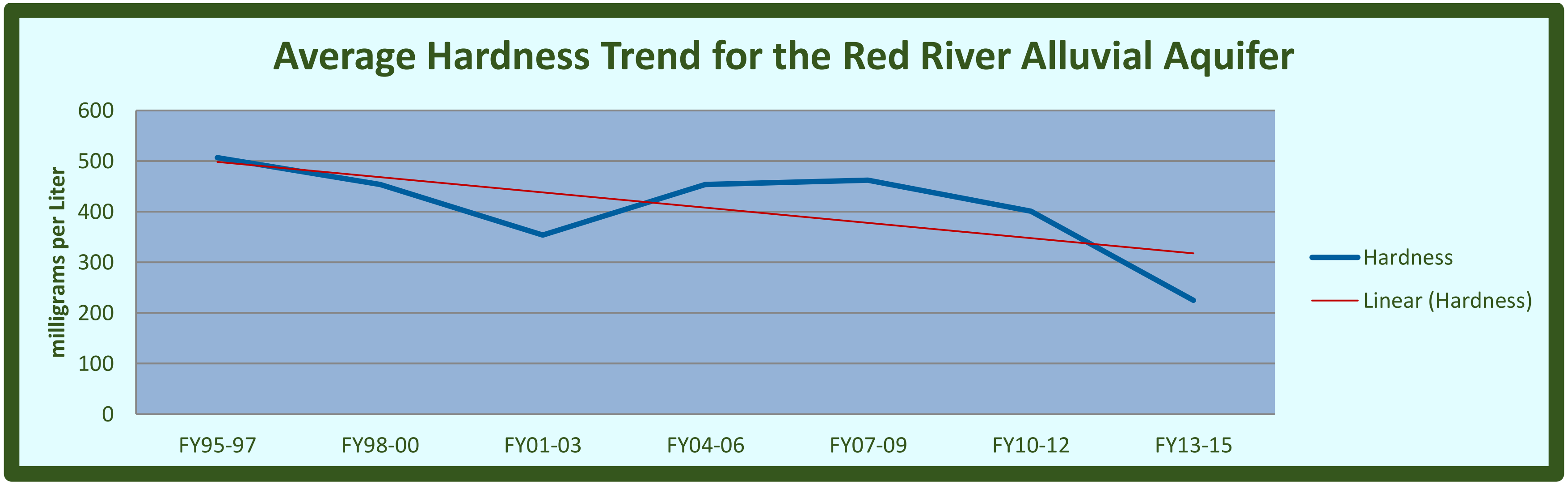

Chart 3-12: Ammonia (NH3) Trend

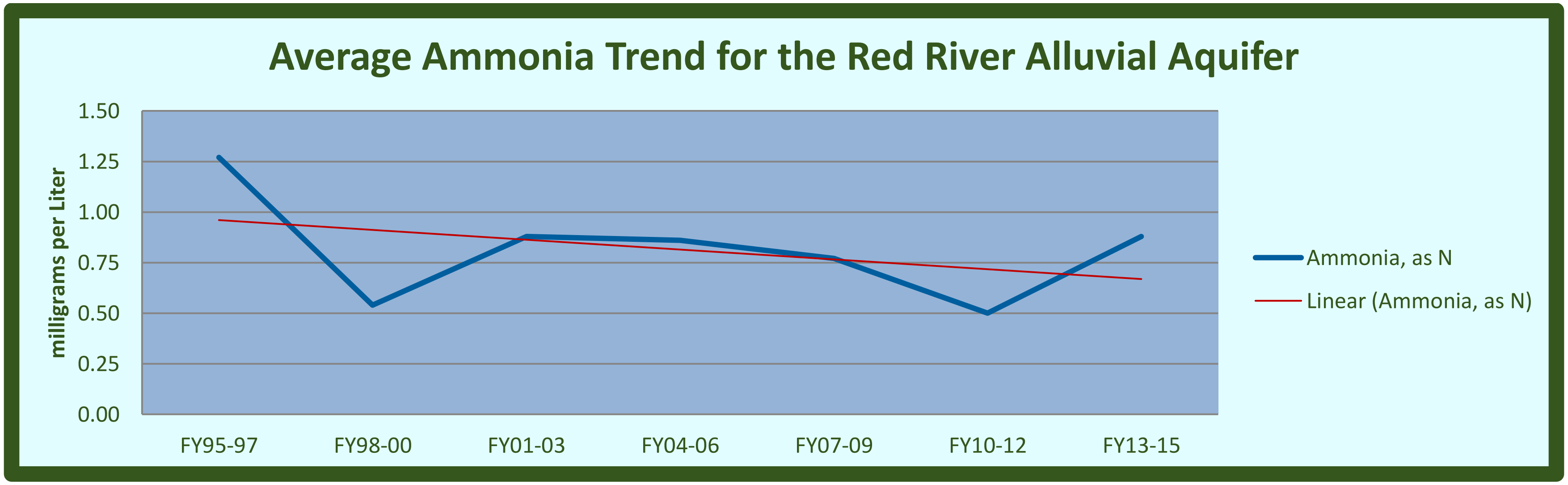

Chart 3-13: Nitrite – Nitrate Trend

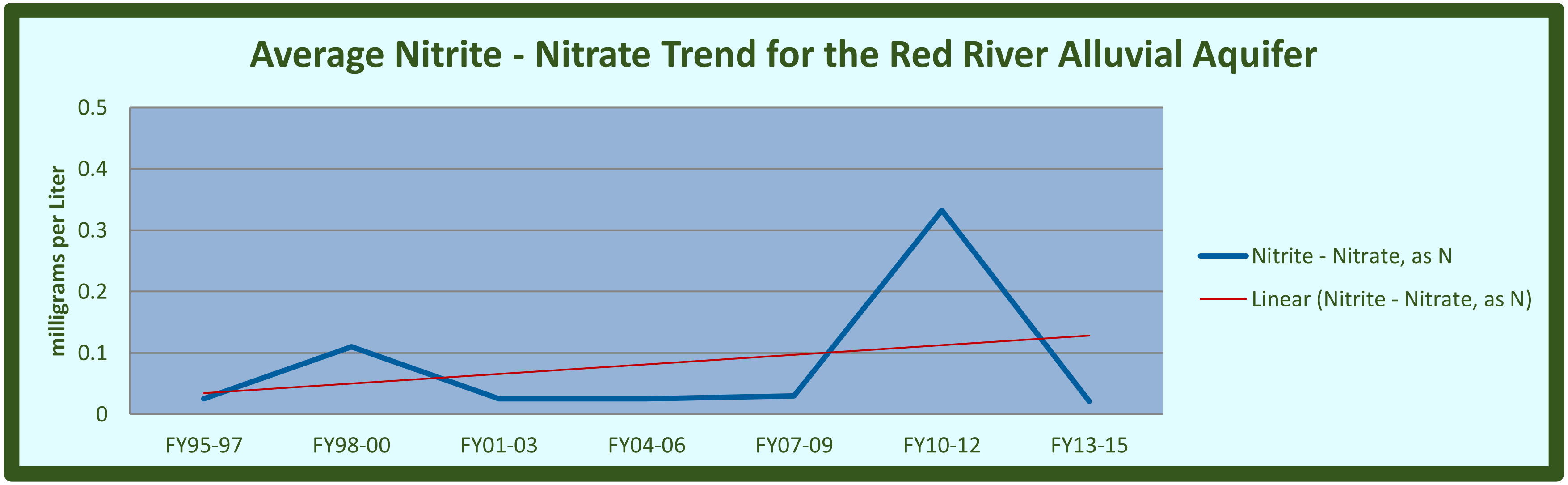

Chart 3-14: TKN Trend

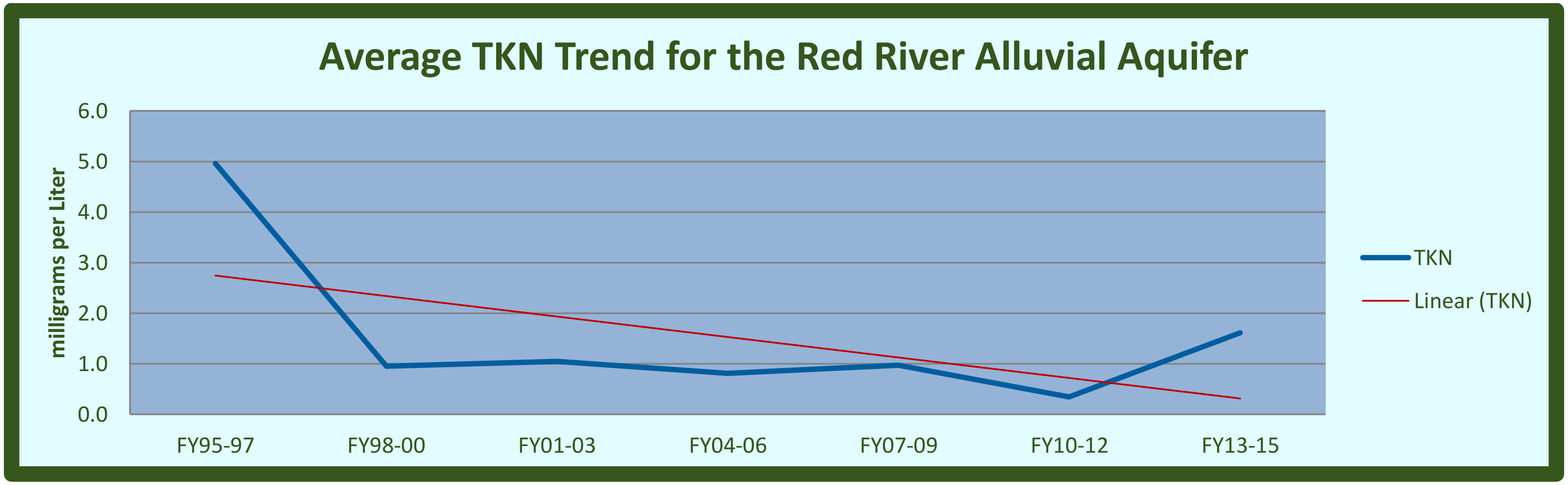

Chart 3-15: Total Phosphorus Trend

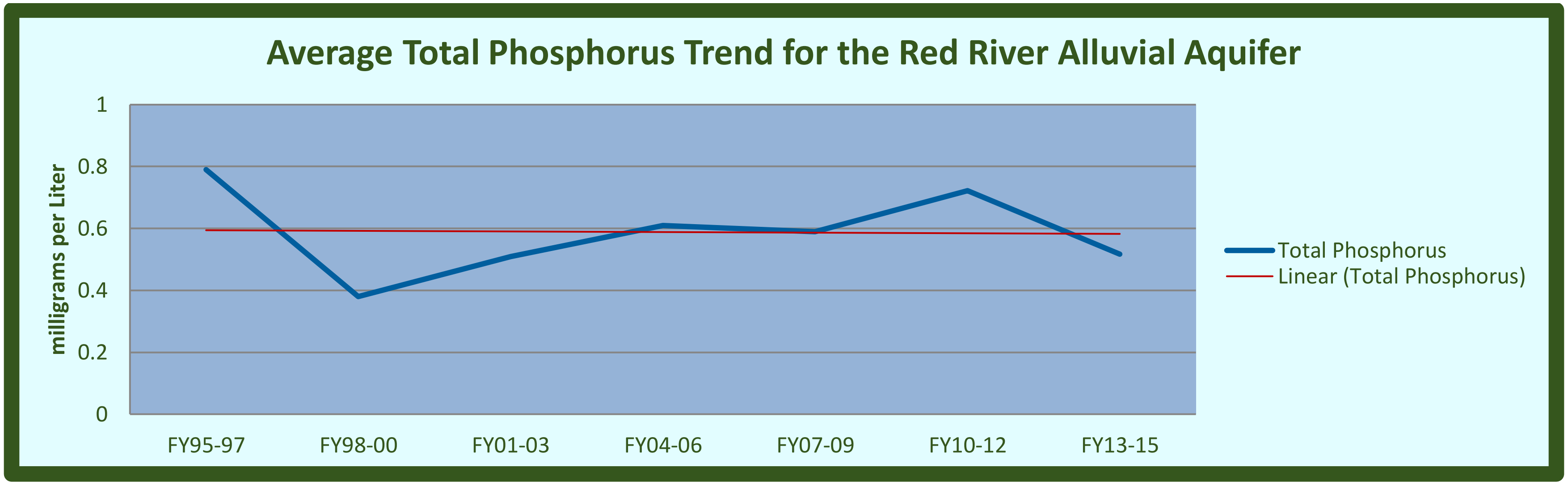

Chart 3-16: Iron Trend