CHICOT AQUIFER SUMMARY, 2011

AQUIFER SAMPLING AND ASSESSMENT PROGRAM

DEQ LOUISIANA

APPENDIX 10 TO THE 2012 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 ground water 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 14 aquifers and aquifer systems and associated wells are 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 Chicot aquifer during the 2011 state fiscal year (July 1, 2010 - June 30, 2011). This summary will become Appendix 10 of the ASSET Program Triennial Summary Report for 2011.

These data show that from May through June, 2011, 23 wells were sampled which produce from the Chicot aquifer. Of these 23 wells, 11 are classified as public supply, four industrial, four observation, two domestic and one each irrigation and recovery. The wells are located in 13 parishes in southwest Louisiana.

Figure 10-1 shows the geographic locations of the Chicot aquifer and the associated wells. Table 10-1 lists those wells and their corresponding parish, date sampled, owner, depth, and use classification.

Well data, including well location and aquifer assignment, for registered water wells were obtained from the Louisiana Department of Natural Resources Water Well Registration Data file.

GEOLOGY

The Chicot aquifer system consists of fining upward sequences of gravels, sands, silts, and clays of the Pleistocene Prairie, intermediate, and high terrace deposits of southwestern Louisiana. The medium to coarse-grained sand and gravel aquifer units dip and thicken toward the Gulf, thin slightly toward the west into Texas, and thicken toward the east where they are overlain by alluvium of the Atchafalaya and Mississippi rivers. The aquifers are confined, have a finer texture, and are increasingly subdivided by silts and clays southward from the northern limit of the outcrop area in southern Vernon and Rapides parishes.

In the Lake Charles area, the Chicot is divided into the shallow alluvial sands, the “200-foot” sand, the “500-foot” sand, and the “700-foot” sand. East of Calcasieu parish the Chicot is divided into the “upper sand” (in hydraulic connection to the Atchafalaya sand, Abbeville sand, and “200-foot” sand) and the “lower sand” (“700-foot” sand). The “500-foot” sand is largely isolated except where it merges with the “700-foot” sand north of Calcasieu Parish. Fresh water in the Chicot and other southwestern Louisiana aquifers is separated from fresh water in southeast Louisiana by a saltwater ridge along the western edge of the Mississippi River valley. Salt water occurs within the Chicot along the coast and in isolated bodies north of the coast.

HYDROGEOLOGY

Recharge to the Chicot occurs primarily through the direct infiltration of rainfall in the interstream, upland outcrop-subcrop areas. Recharge also occurs by water movement from the Atchafalaya alluvium, downward infiltration through the clays south of the primary recharge outcrop area, upward movement from the underlying Evangeline aquifer, and inflow from the Vermilion and Calcasieu rivers. Water movement is generally toward the pumping centers at Lake Charles and Eunice. However, there is little movement of water from the west because of pumping in the Orange, Texas area. The hydraulic conductivity varies between 40-220 feet/day.

The maximum depths of occurrence of freshwater in the Chicot range from 100 feet above sea level, to 1,000 feet below sea level. The range of thickness of the fresh water interval in the Chicot is 50 to 1,050 feet. The depths of the Chicot wells that were monitored in conjunction with the ASSET Program range from 66 to 697 feet.

PROGRAM PARAMETERS

The field parameters checked at each ASSET Program well sampling site and the list of conventional parameters analyzed in the laboratory are shown in Table 10-2. The inorganic (total metals) parameters analyzed in the laboratory are listed in Table 10-3. These tables also show the field and analytical results determined for each analyte. For quality control, duplicate samples were taken for each parameter from wells AC-539, BE-412, R-6947Z, and SMN-109.

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 detections (if any), from any of these three categories, can be found in their respective sections. Tables 10-8, 10-9 and 10-10 list the target analytes for volatiles, semi-volatiles and pesticides/PCBs, respectively.

Tables 10-4 and 10-5 provide a statistical overview of field and conventional data, and inorganic data for the Chicot aquifer, listing the minimum, maximum, and average results for these parameters collected in the FY 2011 sampling. Tables 10-6 and 10-7 compare these same parameter averages to historical ASSET derived data for the Chicot aquifer, from fiscal years 1996, 1999, 2002, 2005, and 2008.

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 results for a particular analyte are reported as non-detect, then the minimum, maximum, and average values are all reported as less than the DL. One-half the DL is also used for contouring purposes, and in the figures and charts referenced below.

Figures 10-2, 10-3, 10-4, and 10-5, respectively, represent the contoured data for pH, total dissolved solids (TDS), chloride, and iron. Charts 10-1 through 10-16 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 the MCLs as a benchmark for further evaluation.

EPA has set secondary standards, which are defined as non-enforceable taste, odor, or appearance guidelines. Field and laboratory data contained in Tables 10-2 and 10-3 show that one or more secondary MCL (SMCL) was exceeded in 20 of the 23 wells sampled in the Chicot aquifer.

Field and Conventional Parameters

Table 10-2 shows the field and conventional parameters for which samples are collected at each well and the analytical results for those parameters. Table 10-4 provides an overview of this data for the Chicot aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analysis listed in Table 10-2 shows that no primary MCL was exceeded for field or conventional parameters for this reporting period. ASSET wells reporting turbidity levels greater than 1.0 NTU do not exceed the Primary 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 10-2 shows that 3 wells exceeded the SMCL for pH, one well exceeded the SMCL for chloride, 5 wells exceeded the SMCL for color, and 7 wells exceeded the SMCL for TDS. Laboratory results override field results in exceedance determination, thus only laboratory results will be counted in determining SMCL exceedance numbers. Following is a list of SMCL parameter exceedances with well number and results:

pH (SMCL = 6.5 – 8.5 SU):

BE-488 – 6.44 SU

V-535 – 5.46 SU

R-6947Z – 5.66 SU (Original and Duplicate)

Chloride (SMCL = 250 mg/L):

CN-92 – 416 mg/L

Color (SMCL = 15 PCU):

EV-673 – 34 PCU

I-7312Z – 30 PCU

LF-572 – 18 PCU	VE-151 – 62 PCU
VE-882 – 33 PCU	

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

	LAB RESULTS (in mg/L)	FIELD MEASURES (in g/L)
AC-8316Z	511 mg/L	0.55 g/L
CN-92	967 mg/L	1.17 g/L
JD-862	583 mg/L	0.63 g/L
SMN-109	694 mg/L, Duplicate – 680 mg/L	0.83 g/L (Original and Duplicate)
VE-151	678 mg/L	0.66 g/L
VE-862	642 mg/L	0.74 g/L
VE-882	518 mg/L	0.53 g/L

Inorganic Parameters

Table 10-3 shows the inorganic (total metals) parameters for which samples are collected at each well and the analytical results for those parameters. Table 10-5 provides an overview of this data for the Chicot aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analyses listed on Table 10-3 shows that no primary MCL was exceeded for total metals.

Federal Secondary Drinking Water Standards: Laboratory data contained in Table 10-3 shows that 16 of the 23 wells sampled exceeded the secondary MCL for iron as shown in the following list:

Iron (SMCL = 300 µg/L):

AC-8316Z – 2,840 µg/L	BE-378 – 2,250 µg/L
CU-1125 – 993 µg/L	CU-1366 – 4,430 µg/L
CU-1471 – 980 µg/L	CU-770 – 609 µg/L
CU-862 – 1,260 µg/L	EV-673 – 1.140 µg/L
I-7312Z – 843 µg/L	JD-862 – 2,360 ugL
LF-572 – 737 µg/L	SL-392 – 11,500 µg/L
SMN-109 – 1,280 µg/L, Duplicate – 1,250 µg/L	VE-151 – 3,470 µg/L
VE-862 – 792 µg/L	VE-882 – 1,300 µg/L

Volatile Organic Compounds

Table 10-8 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.

Of the 23 wells sampled, six reported initial detections of VOCs, most of which are considered to be lab contaminants. However, three VOCs were detected in one of these six wells (CU-770, an observations well) at significant levels. Due to these detections, well CU-770 was resampled for VOCs. The results of the resample show that none of the original VOCs were detected in the resample of this well; however another VOC was detected at a low level. The table below lists all wells with detections of VOCs, resample results and VOCs detected in the field blank collected at the time of the initial sampling event.

Well ID:	CU-770	AC-539	CN-92	EV-673	SL-392	SMN-109	Field Blank
VOCs detected in initial/duplicate* sample (all values given are micrograms per Liter)							
1,1-Dichloroethene	7.3	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.99	ND	0.81	ND	1.3	ND	0.85
1,2-Dichloropropane	25	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	1.1/1.2*	ND	ND	ND	ND	ND
Carbon Tetrachloride	16	ND	ND	ND	ND	ND	ND
Chloroethane	2	ND	ND	ND	ND	ND	ND
Chloroform	ND	2.0/2.2*	ND	ND	ND	ND	ND
Chloromethane	0.78	ND/6.5*	0.83	6.2	ND	ND/0.58*	ND
Dibromochoromethane	ND	0.52/0.57*	ND	ND	ND	ND	ND
Methylene Chloride	ND	2.2/2.3*	ND	ND	ND	ND	2.2

Well ID:	CU-770
VOC RE-SAMPLE RESULTS:	
1,2-Dichloroethane	ND
Methylene Chloride	1.5

Review of the data in the table above show that the initial VOC detections in these wells were due to field/lab contamination. Supporting this finding is that: many of the VOCs detected are common lab contaminants; duplicate samples did not support original samples in each case; two VOCs initially detected were also reported in the field blank; and, the resample did not confirm or support the original findings in well CU-770. Again, considering all findings, it is the opinion that these detections were due to field and/or laboratory contamination and not due to groundwater contamination. Therefore, there were no confirmed detections of VOCs at or above their respective detection limits during the FY 2011 sampling of the Chicot aquifer.

Semi-Volatile Organic Compounds

Table 10-9 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 2011 sampling of the Chicot aquifer.

Pesticides and PCBs

Table 10-10 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 2011 sampling of the Chicot aquifer.

WATER QUALITY TRENDS AND COMPARISON TO HISTORICAL ASSET DATA

Analytical and field data show that the quality and characteristics of ground water produced from the Chicot 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 10-6 and 10-7, and in Charts 10-1 to 10-16 of this summary. Over the fifteen-year period, 8 analytes have shown general increases in average concentrations with another 3 showing only slight increases, while 5 have shown general decreases. Those analytes exhibiting increases are: alkalinity, barium, chloride, hardness, pH, salinity, sulfate, and TKN. Analytes exhibiting slight increases are: ammonia, specific conductance (field and lab), and TDS. Analytes exhibiting decreases are: color, copper, temperature, total phosphorus, and zinc. All other analyte averages have remained consistent, or have been non-detect over this time period. The number of secondary exceedances in the Chicot aquifer has decreased from the previous sampling in FY 2008 of 37 SMCL exceedances, to 35 in FY 2011.

SUMMARY AND RECOMMENDATIONS

In summary, the data show that the ground water 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 ASSET well sampled during the Fiscal Year 2011 monitoring of the Chicot aquifer exceeded a Primary MCL. The data also show that this aquifer is of poor quality when considering taste, odor, or appearance guidelines, due to the number of wells (16) exceeding the SMCL for iron.

Comparison to historical ASSET-derived data shows some change in the quality or characteristics of the Chicot aquifer, with 11 parameters showing increases in average concentrations (3 were slight increases) and 5 parameters showing decreases in average concentrations. The remainder of the parameter averages has continued to be consistent over the previous fifteen year period.

It is recommended that the wells assigned to the Chicot aquifer be re-sampled as planned, in approximately three years. In addition, several wells should be added to the 23 currently in place to increase the well density for this aquifer.

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

Table 10-1: List of Wells Sampled, Chicot Aquifer – FY 2011

DOTD Well Number	Parish	Date	Owner	Depth (Feet)	Well Use
1877 / AC-539	Acadia	2/28/2011	City Of Rayne	251	Public Supply
4014 / AC-8316Z	Acadia	4/14/2011	Private Owner	165	Domestic
1694 / BE-378	Beauregard	5/11/2011	Transcontinental Gas Pipeline	172	Industrial
1776 / BE-412	Beauregard	5/11/2011	Boise - Deridder	202	Industrial
1881 / BE-488	Beauregard	5/11/2011	Singer Water District	262	Public Supply
1695 / CN-92	Cameron	4/28/2011	USGS	443	Observation
3068 / CU-10192Z	Calcasieu	5/10/2011	Axiall	230	Recovery
1883 / CU-1125	Calcasieu	5/10/2011	LDOTD	570	Public Supply
3066 / CU-1366	Calcasieu	5/10/2011	City Of Lake Charles	685	Public Supply
3885 / CU-1471	Calcasieu	5/10/2011	Axiall	525	Industrial
1897 / CU-770	Calcasieu	4/28/2011	USGS	490	Observation
3067 / CU-862	Calcasieu	5/10/2011	Citgo Petroleum Corporation	560	Industrial
1945 / EV-673	Evangeline	2/28/2011	City Of Mamou	247	Public Supply
3749 / I-7312Z	Iberia	3/1/2011	Breaux Electric	180	Public Supply
1943 / JD-862	Jefferson Davis	4/14/2011	City Of Welsh	697	Public Supply
1833 / LF-572	Lafayette	2/28/2011	LUS	570	Public Supply
4013 / R-6947Z	Rapides	4/12/2011	Holloway Nursery	110	Domestic
1698 / SL-392	St Landry	4/27/2011	USGS	126	Observation
1699 / SMN-109	St Martin	4/27/2011	USGS	375	Observation
1810 / V-535	Vernon	4/12/2011	Marlow Fire Station	66	Public Supply
3748 / VE-151	Vermilion	3/1/2011	Abbeville Country Club	250	Irrigation
1717 / VE-862	Vermilion	4/14/2011	Town Of Gueydan	249	Public Supply
1878 / VE-882	Vermilion	3/1/2011	City Of Kaplan	279	Public Supply

Table 10-2: Summary of Field and Conventional Data, Chicot Aquifer – FY 2011

Well ID	pH SU	Sal. ppt	Sp. Cond. mmhos/cm	Temp Deg. C	TDS g/L	Alk mg/L	Cl mg/L	Color PCU	Hard. mg/L	Nitrite-Nitrate (as N) mg/L	NH3 mg/L	Tot. P mg/L	Sp. Cond. umhos/cm	SO4 mg/L	TDS mg/L	TKN mg/L	TSS mg/L	Turb. NTU
	LABORATORY DETECTION LIMITS →					5	1.25	1	5	0.01	0.05	0.05	10	0.25	10	0.1	4	0.3
	FIELD PARAMETERS					LABORATORY PARAMETERS												
AC-539	7.84	0.23	0.480	20.74	0.310	202	29.2	< 1	< 5	0.693	< 0.05	0.11	427	0.62	336	0.53	< 4	< 0.3
AC-539*	7.84	0.23	0.480	20.74	0.310	210	28.9	< 1	< 5	0.651	< 0.05	0.12	429	0.63	364	0.50	< 4	< 0.3
AC-8316Z	7.56	0.42	0.851	19.95	0.553	324	60.8	3	226	< 0.01	1.18	0.20	826	25.90	511	2.03	< 4	22.5
BE-378	6.68	0.15	0.322	20.91	0.209	84	40.5	< 1	28	< 0.01	< 0.05	0.48	304	4.28	217	0.15	99	3.1
BE-412	8.46	0.19	0.394	25.74	0.256	182	7.6	< 1	< 5	< 0.01	0.34	< 0.05	379	7.39	231	0.42	< 4	< 0.3
BE-412*	8.46	0.19	0.394	25.74	0.256	188	7.5	< 1	< 5	< 0.01	0.31	< 0.05	382	7.42	230	0.38	< 4	< 0.3
BE-488	6.44	0.05	0.116	19.83	0.076	48	5.9	< 1	< 5	< 0.01	< 0.05	0.07	122	1.64	94	0.19	< 4	< 0.3
CN-92	7.78	0.91	1.802	21.85	1.171	300	416.0	2	240	< 0.01	0.62	0.09	1,740	8.80	967	0.54	< 4	< 0.3
CU-10192Z	7.96	0.20	0.416	20.92	0.270	200	17.1	< 1	74	< 0.01	0.34	0.15	408	0.73	227	0.31	< 4	< 0.3
CU-1125	7.82	0.16	0.343	20.70	0.223	144	20.9	< 1	24	< 0.01	0.15	0.26	330	1.78	215	0.18	< 4	< 0.3
CU-1366	7.02	0.37	0.752	22.20	0.489	144	128.0	< 1	80	< 0.01	0.15	0.45	683	< 0.25	383	0.24	18	135.0
CU-1471	7.52	0.28	0.580	22.51	0.377	182	79.6	< 1	20	< 0.01	0.14	0.26	562	1.47	320	0.25	< 4	6.0
CU-770	7.22	0.17	0.349	21.15	0.227	150	26.6	8	204	< 0.01	0.10	0.27	340	2.61	244	< 0.1	< 4	< 0.3
CU-862	7.31	0.26	0.548	22.82	0.356	180	65.3	< 1	114	< 0.01	0.14	0.24	531	< 0.25	324	0.16	< 4	11.7
EV-673	7.42	0.36	0.730	20.00	0.470	286	70.5	34	64	< 0.01	0.29	0.38	620	0.46	498	0.54	< 4	10.1
I-7312Z	7.44	0.22	0.450	20.40	0.290	242	4.6	30	86	< 0.01	0.17	0.21	387	< 0.25	332	0.45	< 4	2.9
JD-862	7.18	0.48	0.975	22.59	0.634	122	189.0	10	142	< 0.01	0.29	0.32	941	0.25	583	0.60	4	2.4
LF-572	7.36	0.19	0.390	19.25	0.250	190	5.9	18	< 5	< 0.01	0.24	0.26	330	3.87	356	1.01	< 4	7.0
R-6947Z	5.66	0.03	0.059	18.98	0.038	16	4.3	< 1	< 5	0.454	< 0.05	< 0.05	1,120	0.75	42	0.16	< 4	< 0.3
R-6947Z*	5.66	0.03	0.059	18.98	0.038	14	4.3	< 1	< 5	0.467	< 0.05	< 0.05	56	0.73	43	0.22	< 4	< 0.3
SL-392	7.01	0.21	0.443	19.91	0.288	170	20.0	2	212	< 0.01	0.78	0.15	403	10.40	246	< 0.1	26	64.5
SMN-109	7.40	0.63	1.269	19.90	0.825	480	146.0	11	244	< 0.01	0.77	0.19	1,210	< 0.25	694	0.82	< 4	13.5
SMN-109*	7.40	0.63	1.269	19.90	0.825	480	145.0	10	248	< 0.01	0.70	0.19	1,270	8.44	680	0.86	< 4	13.3

Well ID	pH SU	Sal. ppt	Sp. Cond. mmhos/cm	Temp Deg. C	TDS g/L	Alk mg/L	Cl mg/L	Color PCU	Hard. mg/L	Nitrite-Nitrate (as N) mg/L	NH3 mg/L	Tot. P mg/L	Sp. Cond. umhos/cm	SO4 mg/L	TDS mg/L	TKN mg/L	TSS mg/L	Turb. NTU
	LABORATORY DETECTION LIMITS →					5	1.25	1	5	0.01	0.05	0.05	10	0.25	10	0.1	4	0.3
	FIELD PARAMETERS					LABORATORY PARAMETERS												
V-535	5.46	0.01	0.025	18.14	0.016	5	2.6	< 1	< 5	0.028	< 0.05	< 0.05	23	0.45	< 10	0.17	< 4	< 0.3
VE-151	7.39	0.50	1.020	20.11	0.660	360	113.0	62	182	< 0.01	0.83	0.39	837	0.78	678	0.56	8	25.9
VE-862	7.74	0.57	1.144	21.00	0.744	388	144.0	2	182	< 0.01	1.86	0.19	59	< 0.25	642	4.71	< 4	5.4
VE-882	7.63	0.40	0.810	19.59	0.530	384	45.7	33	148	< 0.01	1.14	0.32	693	< 0.25	518	1.03	< 4	6.6

*Denotes Duplicate Sample   Shaded cells exceed EPA Secondary Standards

Table 10-3: Summary of Inorganic Data, Chicot Aquifer *– FY 2011*

Well ID	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Cadmium µg/L	Chromium µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Mercury µg/L	Nickel µg/L	Selenium µg/L	Silver µg/L	Thallium µg/L	Zinc µg/L
Laboratory Detection Limits	5	4	5	2	2	4	2	100	1	0.0002	3	5	1	2	6
AC-539	< 5	< 4	242	< 2	< 2	< 4	< 2	< 100	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
AC-539*	< 5	< 4	244	< 2	< 2	< 4	< 2	< 100	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
AC-8316Z	< 5	< 4	565	< 2	< 2	< 4	< 2	2,840	< 1	< 0.0002	3.1	< 5	< 1	< 2	< 6
BE-378	< 5	< 4	124	< 2	< 2	< 4	33.4	2,250	< 1	< 0.0002	< 3	< 5	< 1	< 2	14.7
BE-412	< 5	< 4	46	< 2	< 2	< 4	< 2	< 100	< 1	< 0.0002	< 3	< 5	< 1	< 2	9.5
BE-412*	< 5	< 4	46	< 2	< 2	< 4	< 2	< 100	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
BE-488	< 5	< 4	38.8	< 2	< 2	< 4	6.9	< 100	1.27	< 0.0002	< 3	< 5	< 1	< 2	22.6
CN-92	< 5	< 4	936	< 2	< 2	< 4	< 2	138	< 1	< 0.0002	< 3	< 5	< 1	< 2	79.1
CU-10192Z	< 5	< 4	251	< 2	< 2	< 4	< 2	< 100	< 1	< 0.0002	< 3	< 5	< 1	< 2	86.6
CU-1125	< 5	< 4	181	< 2	< 2	< 4	< 2	993	< 1	< 0.0002	< 3	< 5	< 1	< 2	9.2
CU-1366	< 5	< 4	317	< 2	< 2	< 4	< 2	4,430	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
CU-1471	< 5	< 4	252	< 2	< 2	< 4	< 2	980	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
CU-770	< 5	< 4	253	< 2	< 2	< 4	< 2	609	1.38	< 0.0002	< 3	< 5	< 1	< 2	883.0
CU-862	< 5	< 4	325	< 2	< 2	< 4	< 2	1,260	2.11	< 0.0002	< 3	< 5	< 1	< 2	< 6
EV-673	< 5	< 4	274	< 2	< 2	< 4	2.1	1,140	3.55	< 0.0002	< 3	< 5	< 1	< 2	25.0
I-7312Z	< 5	< 4	153	< 2	< 2	< 4	2.7	843	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
JD-862	< 5	< 4	713	< 2	< 2	< 4	< 2	2,360	< 1	< 0.0002	3.7	< 5	< 1	< 2	< 6
LF-572	< 5	< 4	201	< 2	< 2	< 4	< 2	737	< 1	< 0.0002	5.4	< 5	< 1	< 2	< 6
R-6947Z	< 5	< 4	45.8	< 2	< 2	< 4	4.8	< 100	1.25	< 0.0002	< 3	< 5	< 1	< 2	6.2
R-6947Z*	< 5	< 4	45.8	< 2	< 2	< 4	5.1	< 100	1.24	< 0.0002	< 3	< 5	< 1	< 2	7.9
SL-392	< 5	< 4	294	< 2	< 2	< 4	< 2	11,500	< 1	< 0.0002	< 3	< 5	< 1	< 2	15.2
SMN-109	< 5	< 4	773	< 2	< 2	< 4	< 2	1,280	< 1	< 0.0002	< 3	< 5	< 1	< 2	1,010.0
SMN-109*	< 5	< 4	758	< 2	< 2	< 4	< 2	1,250	< 1	< 0.0002	< 3	< 5	< 1	< 2	1,010.0
V-535	< 5	< 4	28	< 2	< 2	< 4	53.4	< 100	2.36	< 0.0002	< 3	< 5	< 1	< 2	23.4

Well ID	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Cadmium µg/L	Chromium µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Mercury µg/L	Nickel µg/L	Selenium µg/L	Silver µg/L	Thallium µg/L	Zinc µg/L
Laboratory Detection Limits	5	4	5	2	2	4	2	100	1	0.0002	3	5	1	2	6
VE-151	< 5	< 4	324	< 2	< 2	< 4	< 2	3,470	< 1	< 0.0002	< 3	< 5	< 1	< 2	83.1
VE-862	< 5	< 4	834	< 2	< 2	< 4	< 2	792	< 1	< 0.0002	< 3	< 5	< 1	< 2	< 6
VE-882	< 5	< 4	561	< 2	< 2	< 4	< 2	1,330	< 1	< 0.0002	< 3	< 5	< 1	< 2	13.2

*Denotes Duplicate Sample. Shaded cells exceed EPA Secondary Standards

Table 10-4: Field and Conventional Statistics, FY 2011 ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
FIELD	Temperature (^{O}C)	18.14	25.74	20.91
	pH (SU)	5.46	8.46	7.28
	Specific Conductance (mmhos/cm)	0.025	1.802	0.61
	Salinity (ppt)	0.01	0.91	0.30
	TDS (g/L)	0.016	1.171	0.40
LABORATORY	Alkalinity (mg/L)	5.0	480.0	210.2
	Chloride (mg/L)	2.6	416.0	67.7
	Color (PCU)	<1	62.0	8.6
	Specific Conductance (umhos/cm)	22.6	1,740.0	570.8
	Sulfate (mg/L)	< 0.25	25.90	3.34
	TDS (mg/L)	< 10	967	369.6
	TSS (mg/L)	< 4	99.0	7.4
	Turbidity (NTU)	< 0.3	135.0	12.3
	Ammonia, as N (mg/L)	< 0.05	1.86	0.40
	Hardness (mg/L)	< 5	248.0	94.1
	Nitrite - Nitrate, as N (mg/L)	< 0.01	0.69	0.09
	TKN (mg/L)	< 0.1	4.71	0.63
	Total Phosphorus (mg/L)	< 0.05	0.48	0.20

Table 10-5: Inorganic Statistics, FY 2011 ASSET Wells

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (µg/L)	< 5	< 5	< 5
Arsenic (µg/L)	< 4	< 4	< 4
Barium (µg/L)	27.8	936.0	326.9
Beryllium (ug/L)	< 2	< 2	< 2
Cadmium (ug/L)	< 2	< 2	< 2
Chromium (µg/L)	< 4	< 4	< 4
Copper (µg/L)	< 2	53.4	4.8
Iron (µg/L)	< 100	11,500	1,432
Lead (µg/L)	< 1	3.6	< 1
Mercury (µg/L)	< 0.0002	< 0.0002	< 0.0002
Nickel (µg/L)	< 3	5.4	< 3
Selenium (µg/L)	< 5	< 5	< 5
Silver (µg/L)	< 1	< 1	< 1
Thallium (µg/L)	< 2	< 2	< 2
Zinc (µg/L)	< 6	1,010.0	123.4

Table 10-6: Triennial Field and Conventional Statistics, ASSET Wells

	PARAMETER	AVERAGE VALUES BY FISCAL YEAR					
		FY 1996	FY 1999	FY 2002	FY 2005	FY 2008	FY 2011
FIELD	Temperature (^{O}C)	22.68	23.20	21.85	22.38	22.47	20.91
FIELD	pH (SU)	7.08	7.01	7.03	7.22	7.33	7.28
FIELD	Specific Conductance (mmhos/cm)	0.534	0.650	0.523	0.54	0.63	0.61
FIELD	Salinity (Sal.) (ppt)	0.26	0.33	0.25	0.27	0.31	0.30
FIELD	TDS (Total dissolved solids) (g/L)	-	-	-	0.35	0.40	0.40
LABORATORY	Alkalinity (Alk.) (mg/L)	199.8	188.7	193.4	190.3	216.2	210.2
LABORATORY	Chloride (Cl) (mg/L)	67.5	59.6	51.6	59.7	85.9	67.7
LABORATORY	Color (PCU)	22.5	13.0	13.5	12.7	24.4	8.6
LABORATORY	Specific Conductance (umhos/cm)	593.9	552.5	501.6	539.2	660.3	570.8
LABORATORY	Sulfate (SO4) (mg/L)	2.09	2.78	1.48	1.99	2.76	3.34
LABORATORY	TDS (Total dissolved solids) (mg/L)	369.1	351.9	302.0	321.5	384.4	369.6
LABORATORY	TSS (Total suspended solids) (mg/L)	19.5	5.4	4.0	17.9	4.1	7.4
LABORATORY	Turbidity (Turb.) (NTU)	13.80	14.63	13.78	16.17	20.82	12.29
LABORATORY	Ammonia, as N (NH3) (mg/L)	0.36	0.35	0.41	0.32	0.36	0.40
LABORATORY	Hardness (mg/L)	129.9	122.8	127.0	133.2	161.6	161.6
LABORATORY	Nitrite - Nitrate , as N (mg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
LABORATORY	TKN (mg/L)	0.35	0.67	0.58	0.50	0.43	0.63
LABORATORY	Total Phosphorus (P) (mg/L)	0.24	0.25	0.13	0.23	0.21	0.20

Table 10-7: Triennial Inorganic Statistics, ASSET Wells

PARAMETER	AVERAGE VALUES BY FISCAL YEAR					
	FY 1996	FY 1999	FY 2002	FY 2005	FY 2008	FY 2011
Antimony (µg/L)	<5	<5	<5	<5	<1	< 5
Arsenic (µg/L)	<5	<5	<5	<5	<3	< 4
Barium (µg/L)	277.6	312.0	297.0	359.0	389.8	326.9
Beryllium (ug/L)	<5	<5	<1	<1	<1	< 2
Cadmium (ug/L)	<5	<5	<1	<1	<0.5	< 2
Chromium (µg/L)	<5	<5	<5	<5	<3	< 4
Copper (µg/L)	14.4	35.8	25.7	42.2	7.2	4.8
Iron (µg/L)	1,824	1,971	1,795	3,074	2,238	1,432
Lead (µg/L)	<10	<10	<10	<10	<3	< 1
Mercury (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	< 0.0002
Nickel (µg/L)	<5	<5	<5	<5	<3	< 3
Selenium (µg/L)	<5	<5	<5	<10	<4	< 5
Silver (µg/L)	<5	<5	<1	<5	<0.5	< 1
Thallium (µg/L)	<5	<5	<5	<50	<1	< 2
Zinc (µg/L)	346.7	152.3	123.5	620.7	105.0	123.4

Table 10-8: VOC Analytical Parameters

COMPOUND	METHOD	DETECTION LIMIT (µg/L)
1,1,1-TRICHLOROETHANE	624	0.5
1,1,2,2-TETRACHLOROETHANE	624	0.5
1,1,2-TRICHLOROETHANE	624	0.5
1,1-DICHLOROETHANE	624	0.5
1,1-DICHLOROETHENE	624	0.5
1,2,3-TRICHLOROBENZENE	624	0.5
1,2-DICHLOROBENZENE	624	0.5
1,2-DICHLOROETHANE	624	0.5
1,2-DICHLOROPROPANE	624	0.5
1,3-DICHLOROBENZENE	624	0.5
1,4-DICHLOROBENZENE	624	0.5
BENZENE	624	0.5
BROMODICHLOROMETHANE	624	0.5
BROMOFORM	624	0.5
BROMOMETHANE	624	0.5
CARBON TETRACHLORIDE	624	0.5
CHLOROBENZENE	624	0.5
CHLOROETHANE	624	0.5
CHLOROFORM	624	0.5
CHLOROMETHANE	624	0.5
CIS-1,3-DICHLOROPROPENE	624	1.5
DIBROMOCHLOROMETHANE	624	0.5
ETHYL BENZENE	624	0.5
METHYLENE CHLORIDE	624	0.5
TERT-BUTYL METHYL ETHER	624	0.5
TETRACHLOROETHYLENE (PCE)	624	0.5
TOLUENE	624	0.5
TRANS-1,2-DICHLOROETHENE	624	0.5
TRANS-1,3-DICHLOROPROPENE	624	0.5
TRICHLOROETHYLENE (TCE)	624	0.5
TRICHLOROFLUOROMETHANE (FREON-11)	624	0.5
VINYL CHLORIDE	624	0.5

Table 10-9: SVOC Analytical Parameters

COMPOUND (SVOC)	METHOD	DETECTION LIMIT (µg/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
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	625	5
BIS(2-CHLOROISOPROPYL) ETHER	625	5
BIS(2-ETHYLHEXYL) PHTHALATE	625	5
CHRYSENE	625	5
DIBENZ(A,H)ANTHRACENE	625	5
DIETHYL PHTHALATE	625	5
DIMETHYL PHTHALATE	625	5
DI-N-BUTYL PHTHALATE	625	5
DI-N-OCTYLPHTHALATE	625	5

COMPOUND (SVOC)	METHOD	DETECTION LIMIT (µg/L)
FLUORANTHENE	625	5
FLUORENE	625	5
HEXACHLOROBENZENE	625	5
HEXACHLOROBUTADIENE	625	5
HEXACHLOROCYCLOPENTADIENE	625	10
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	10
N-NITROSODIPHENYLAMINE	625	5
PENTACHLOROPHENOL	625	10
PHENANTHRENE	625	5
PHENOL	625	5
PYRENE	625	5

Table 10-10: Pesticides and PCBs

COMPOUND	METHOD	DETECTION LIMITS (µg/L)
ALDRIN	608	0.05
ALPHA BHC	608	0.05
ALPHA ENDOSULFAN	608	0.05
ALPHA-CHLORDANE	608	0.05
BETA BHC	608	0.05
BETA ENDOSULFAN	608	0.05
CHLORDANE	608	0.2
DELTA BHC	608	0.05
DIELDRIN	608	0.05
ENDOSULFAN SULFATE	608	0.05
ENDRIN	608	0.05
ENDRIN ALDEHYDE	608	0.05
ENDRIN KETONE	608	0.05
GAMMA BHC	608	0.05
GAMMA-CHLORDANE	608	0.05
HEPTACHLOR	608	0.05
HEPTACHLOR EPOXIDE	608	0.05
METHOXYCHLOR	608	0.05
P,P'-DDD	608	0.05
P,P'-DDE	608	0.05
P,P'-DDT	608	0.05
PCB-1016 (AROCHLOR 1016)	608	0.5
PCB-1221 (AROCHLOR 1221)	608	0.5
PCB-1232 (AROCHLOR 1232)	608	0.5
PCB-1242 (AROCHLOR 1242)	608	0.5
PCB-1248 (AROCHLOR 1248)	608	0.5
PCB-1254 (AROCHLOR 1254)	608	0.5
PCB-1260 (AROCHLOR 1260)	608	0.5
TOXAPHENE	608	3

Figure 10-1: Location Plat, Chicot Aquifer

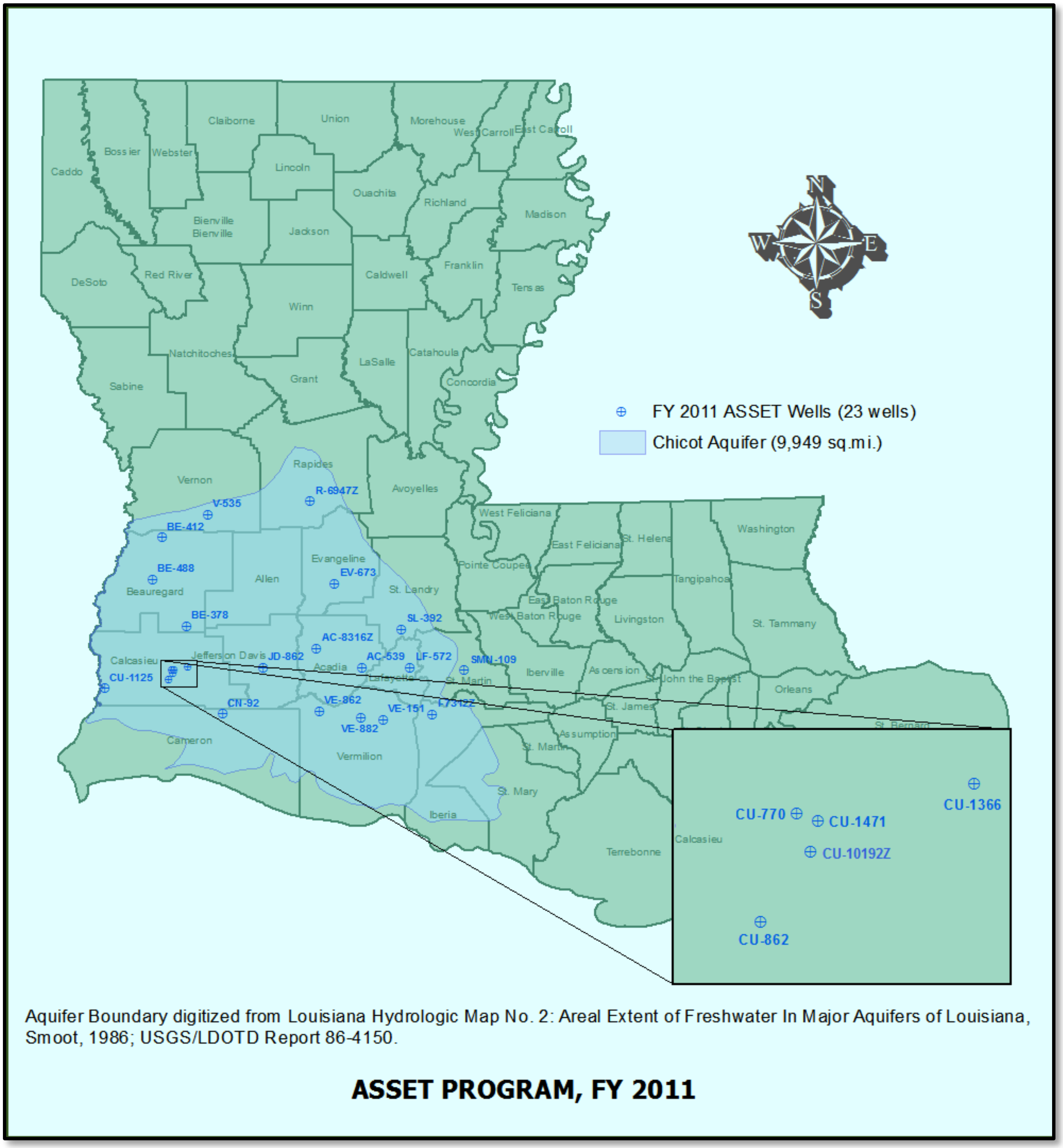

Figure 10-2: Map of pH Data

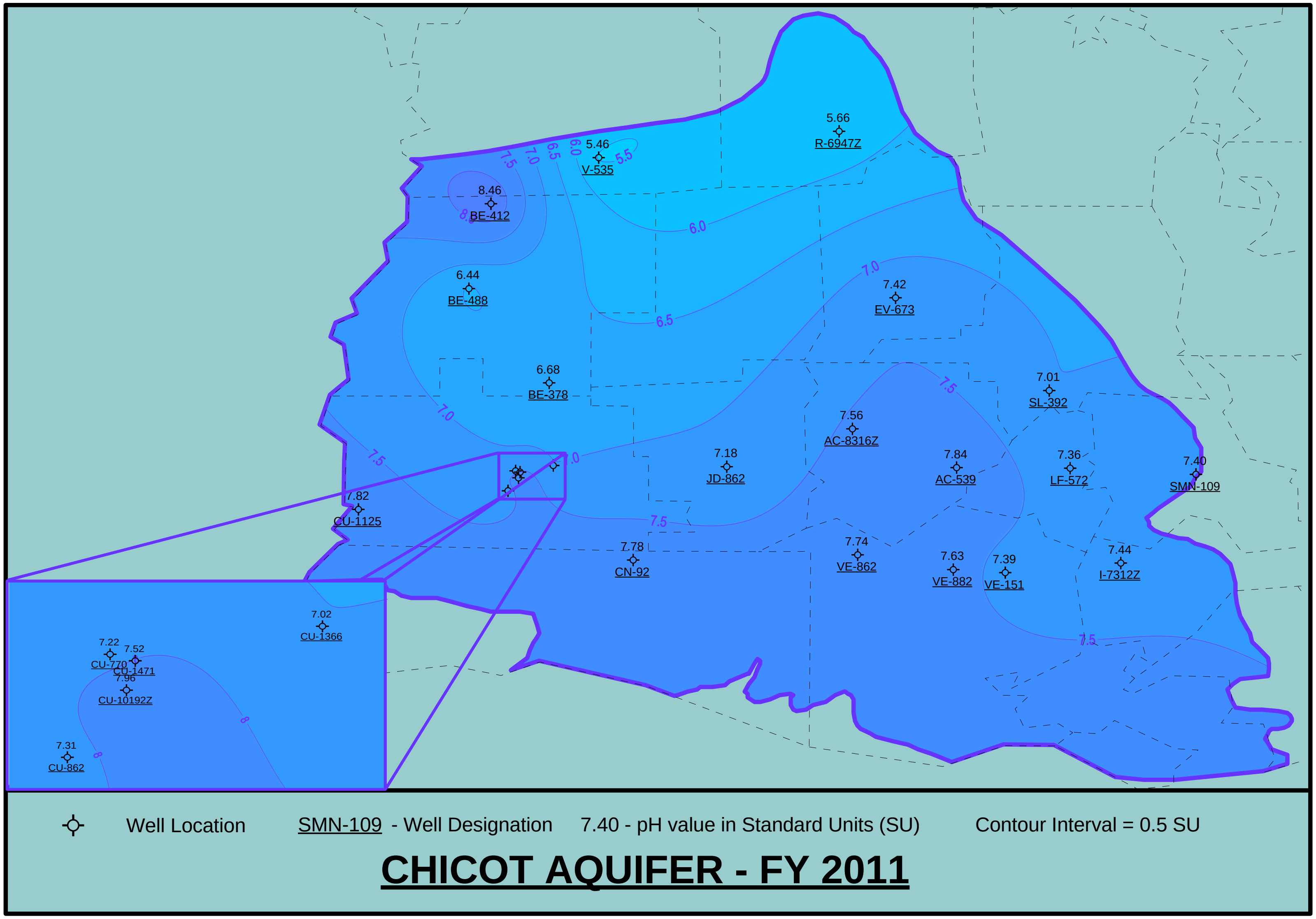

Figure 10-3: Map of TDS Lab Data

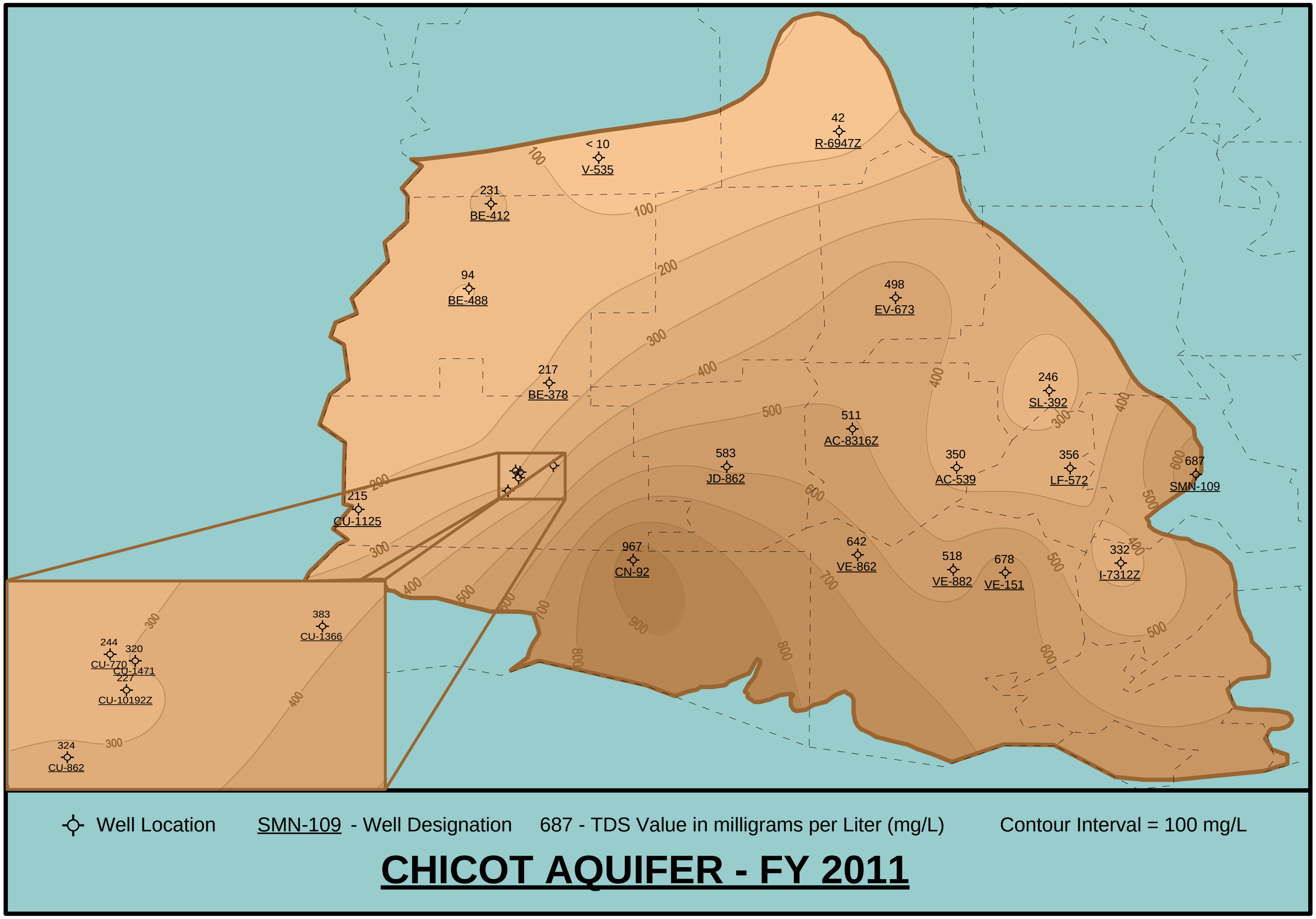

Figure 10-4: Map of Chloride Data

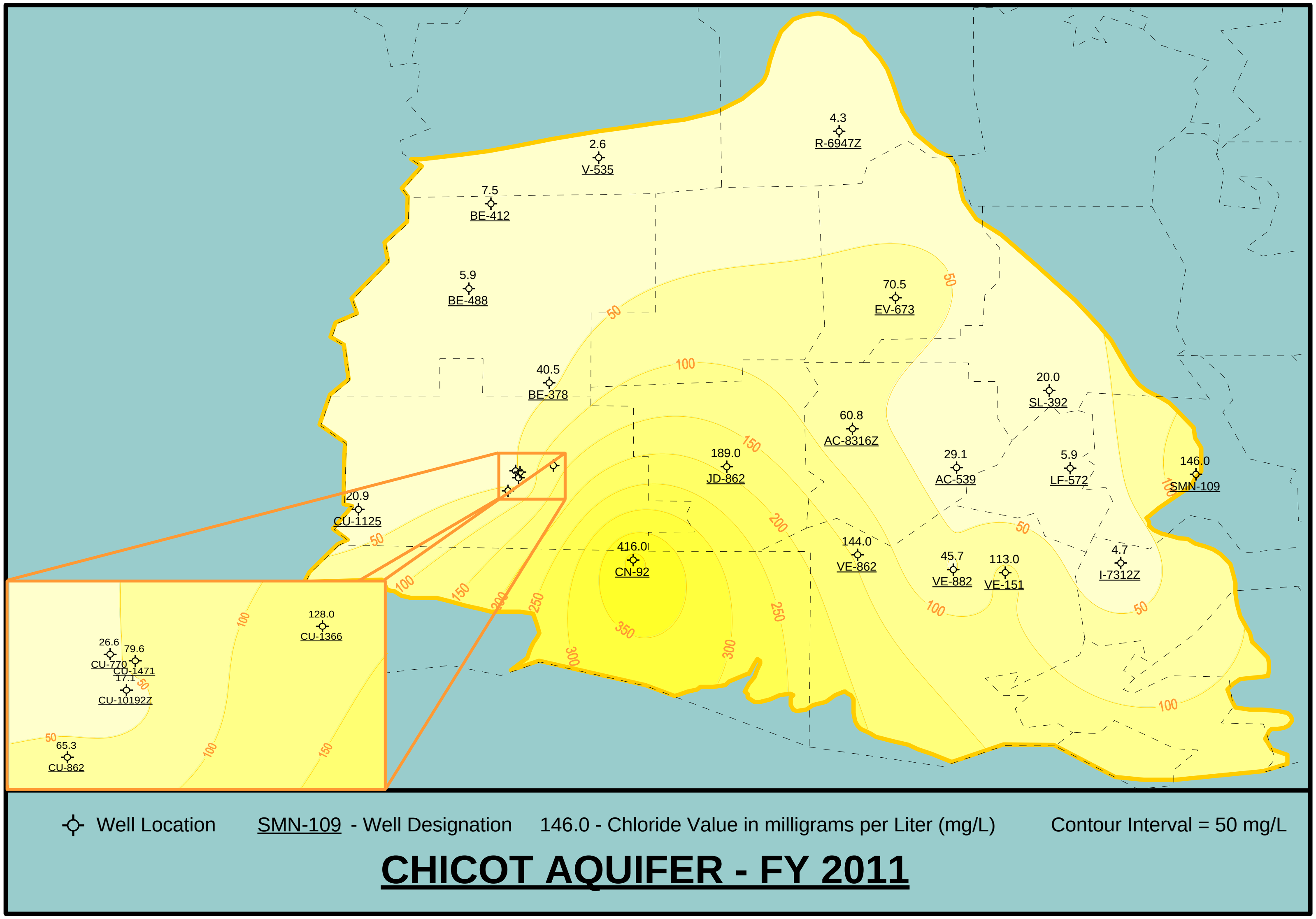

Figure 10-5: Map of Iron Data

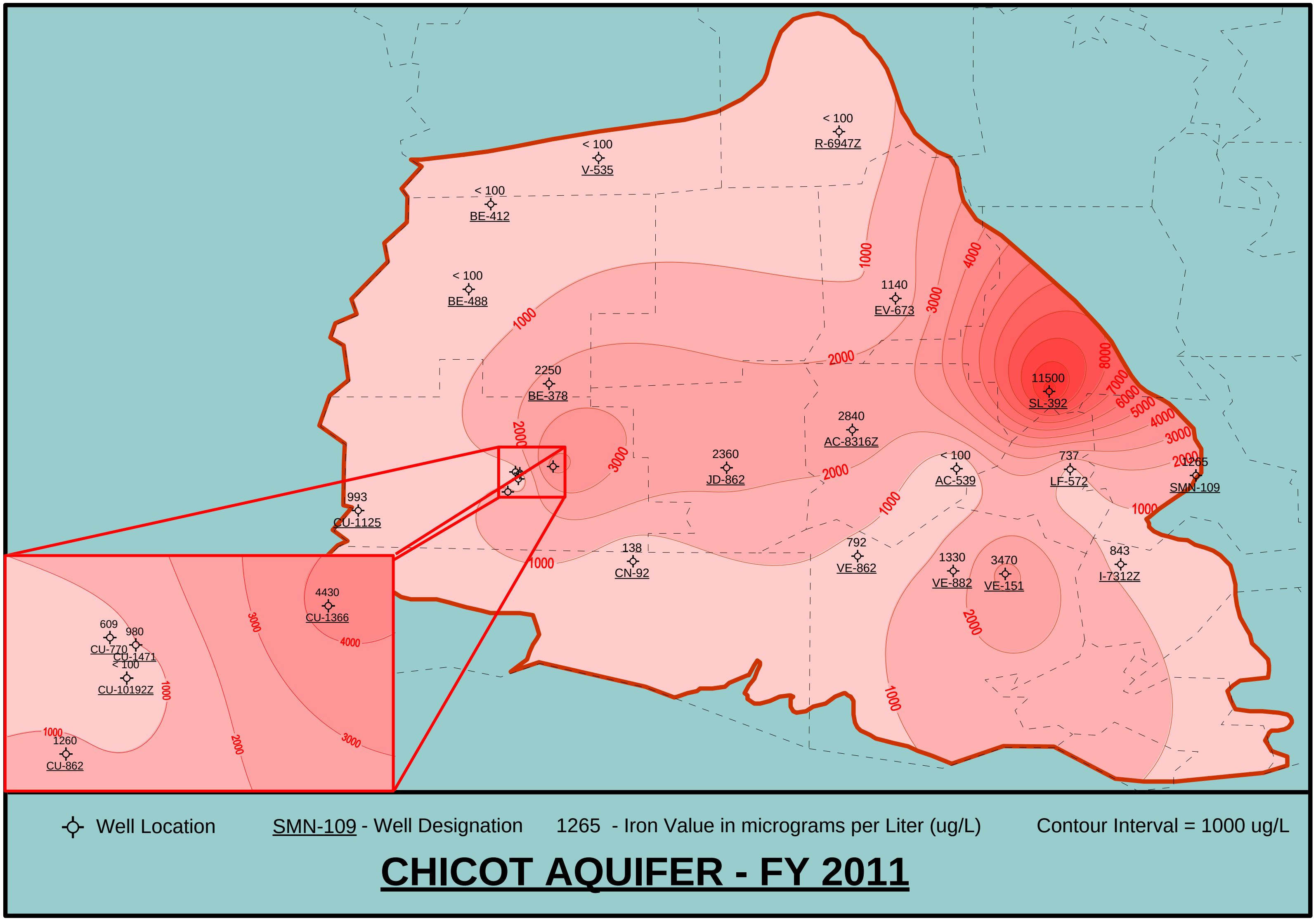

Chart 10-1: Temperature Trend

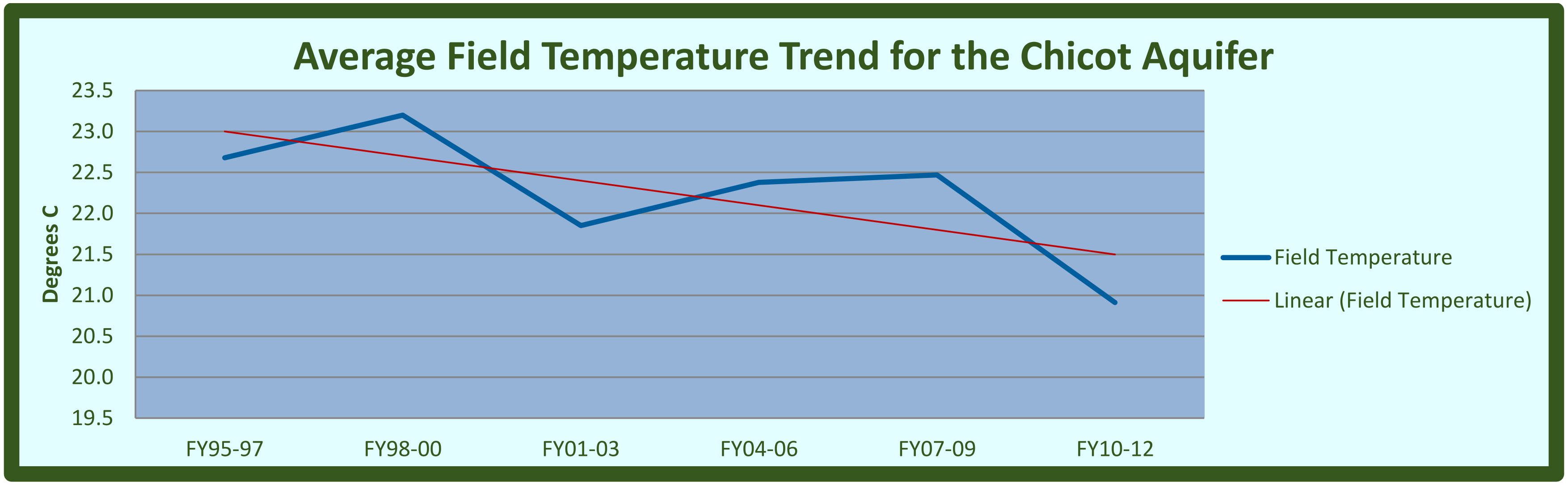

Chart 10-2: pH Trend

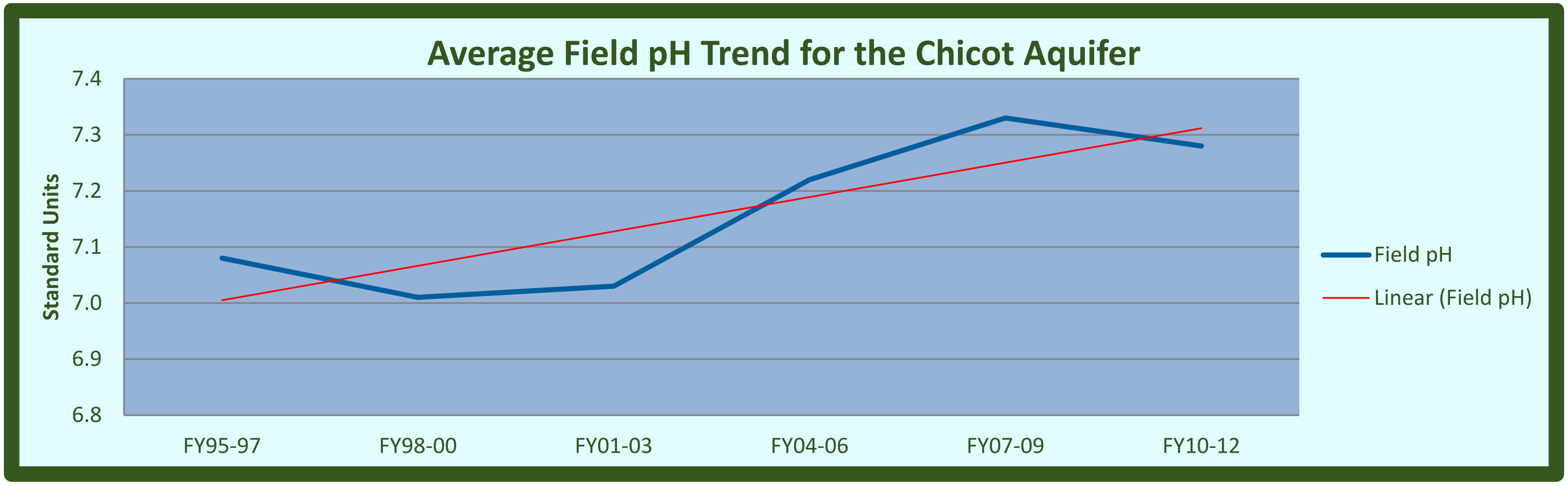

Chart 10-3: Field Specific Conductance Trend

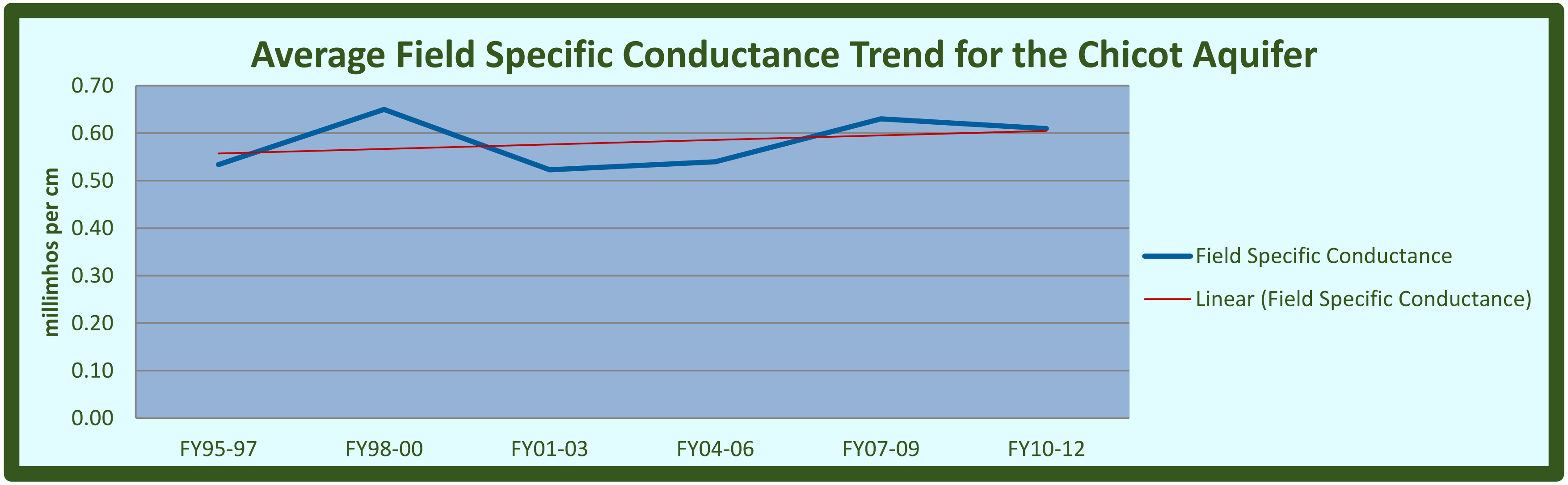

Chart 10-4: Lab Specific Conductance Trend

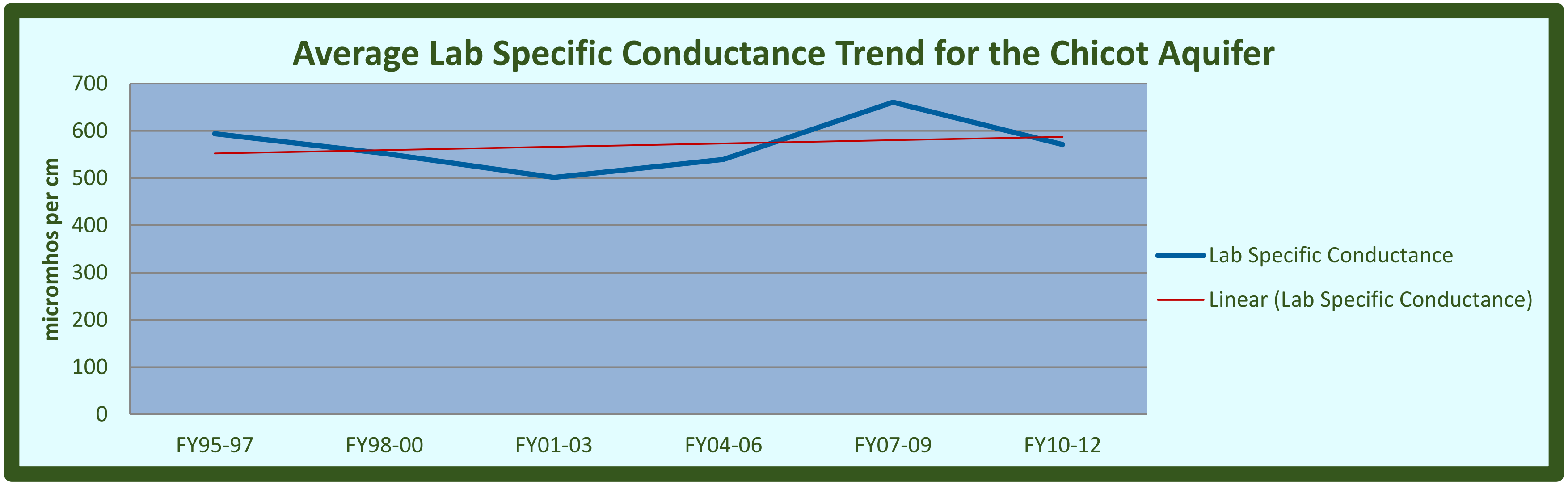

Chart 10-5: Field Salinity Trend

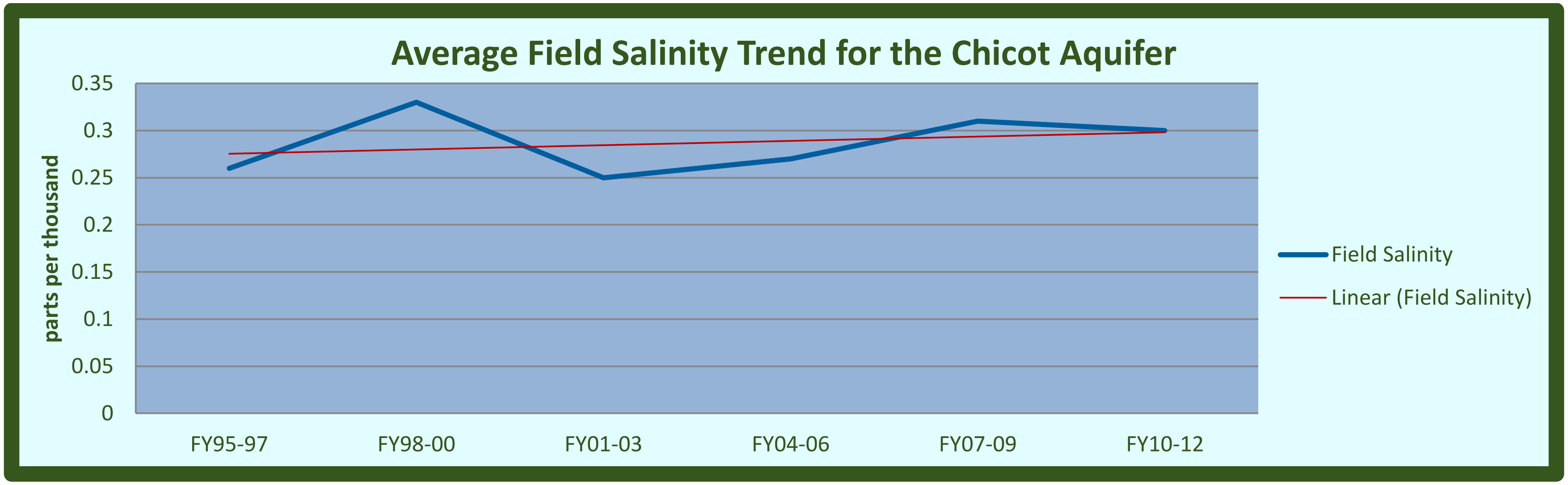

Chart 10-6: Alkalinity Trend

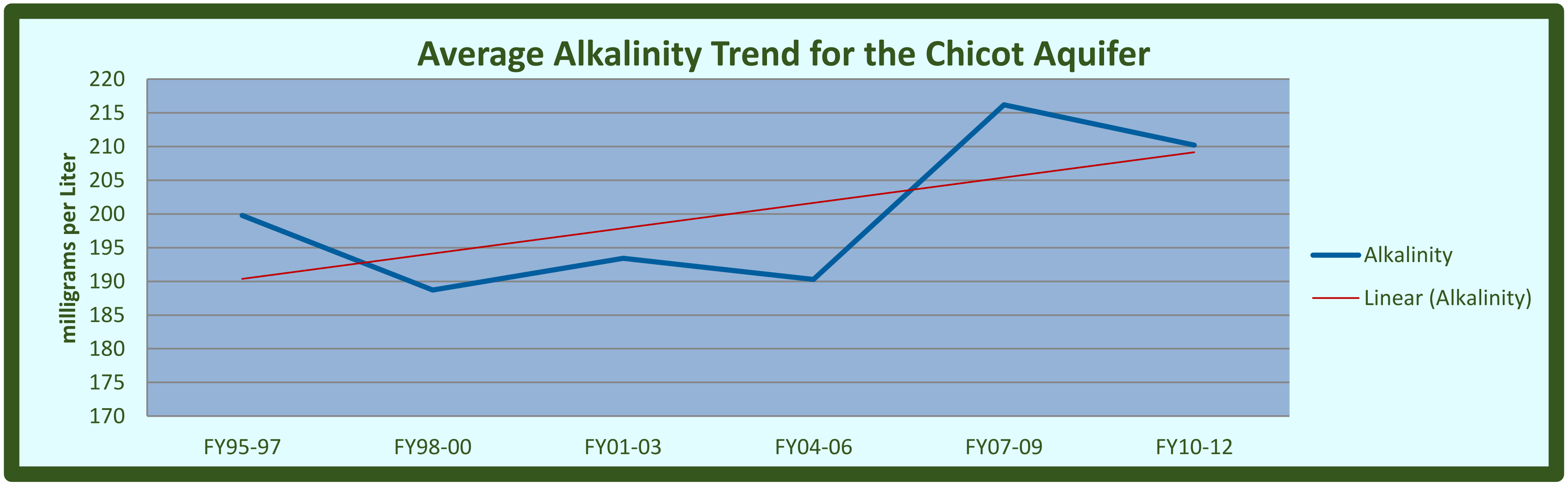

Chart 10-7: Chloride Trend

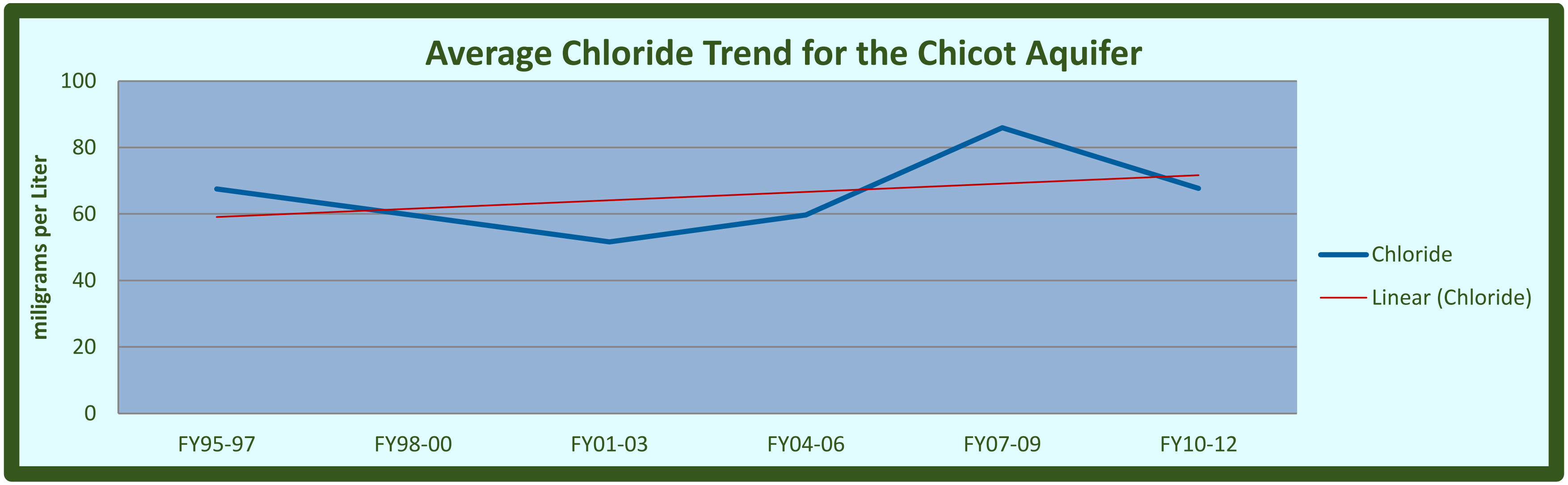

Chart 10-8: Color Trend

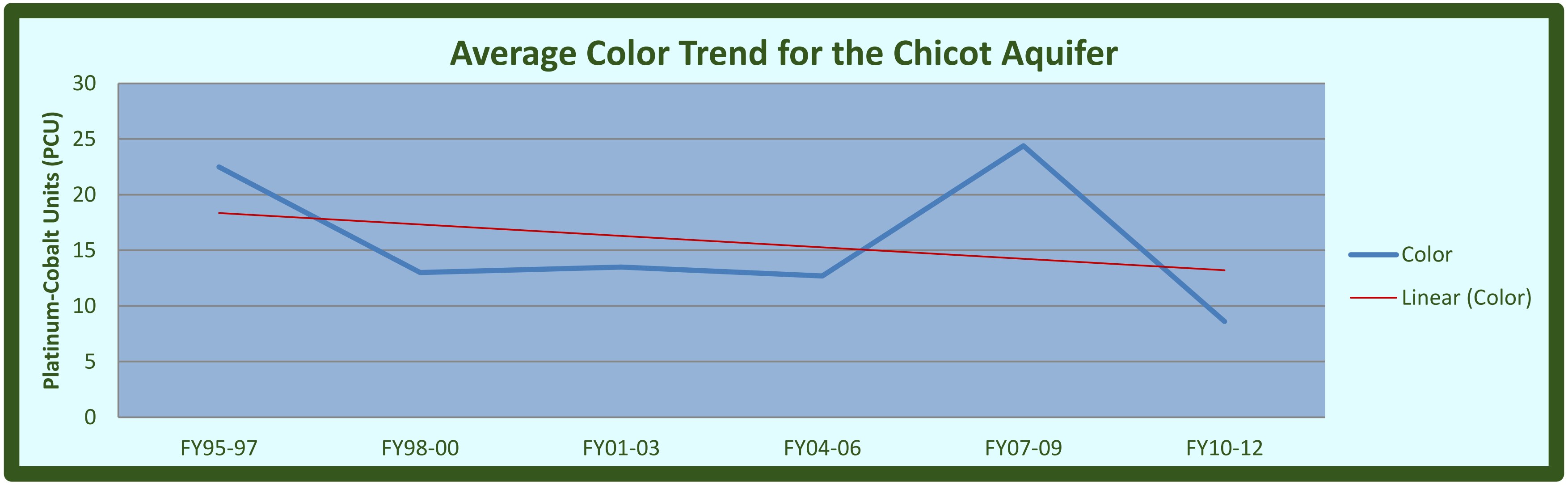

Chart 10-9: Sulfate Trend

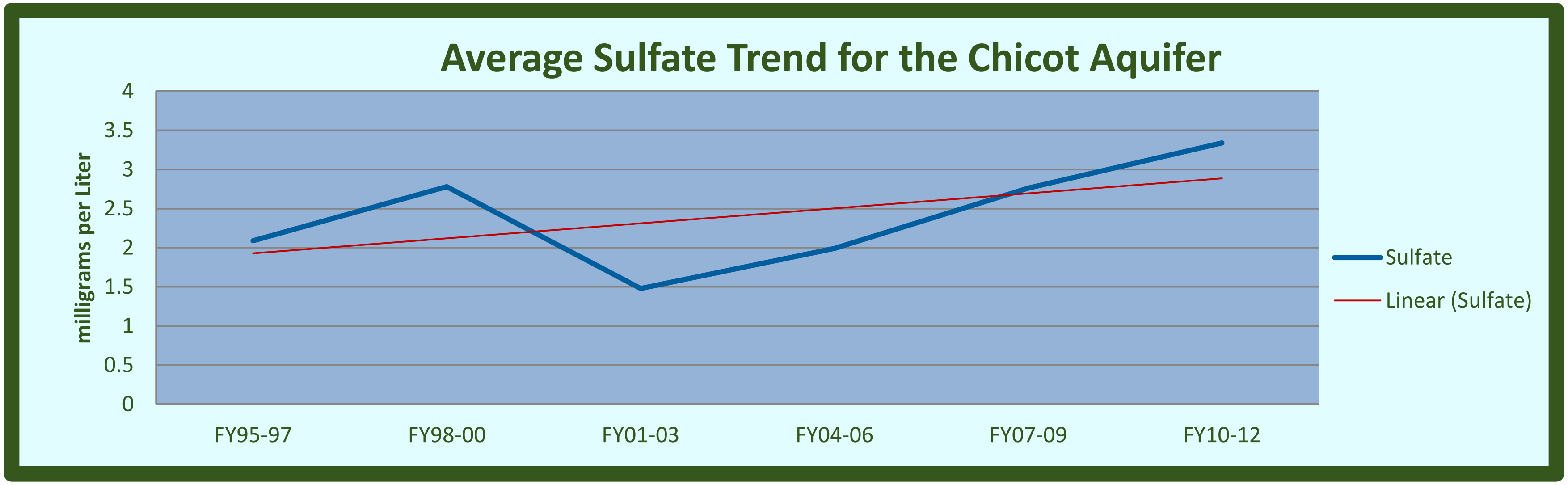

Chart 10-10: Total Dissolved Solids Trend

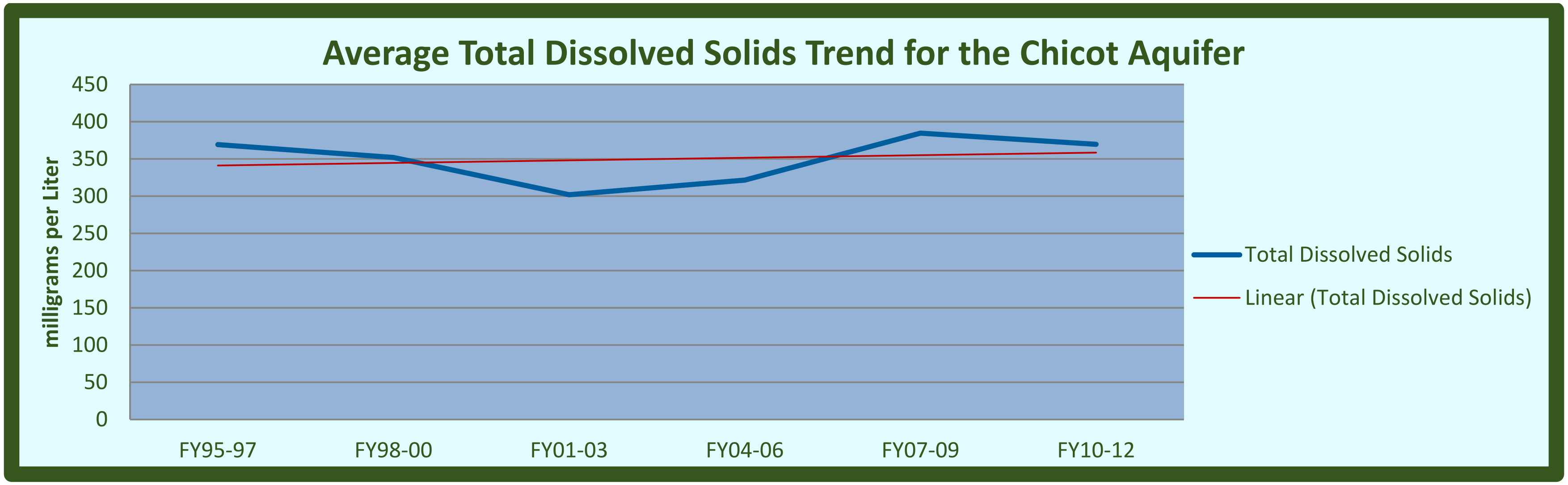

Chart 10-11: Ammonia Trend

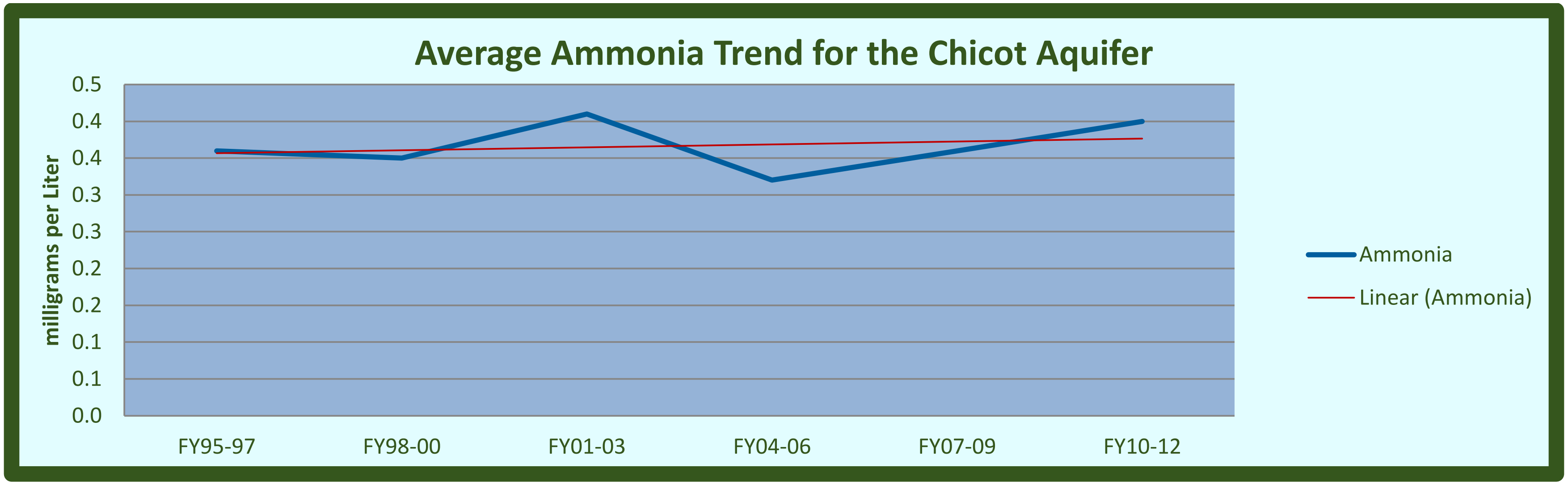

Chart 10-12: Hardness Trend

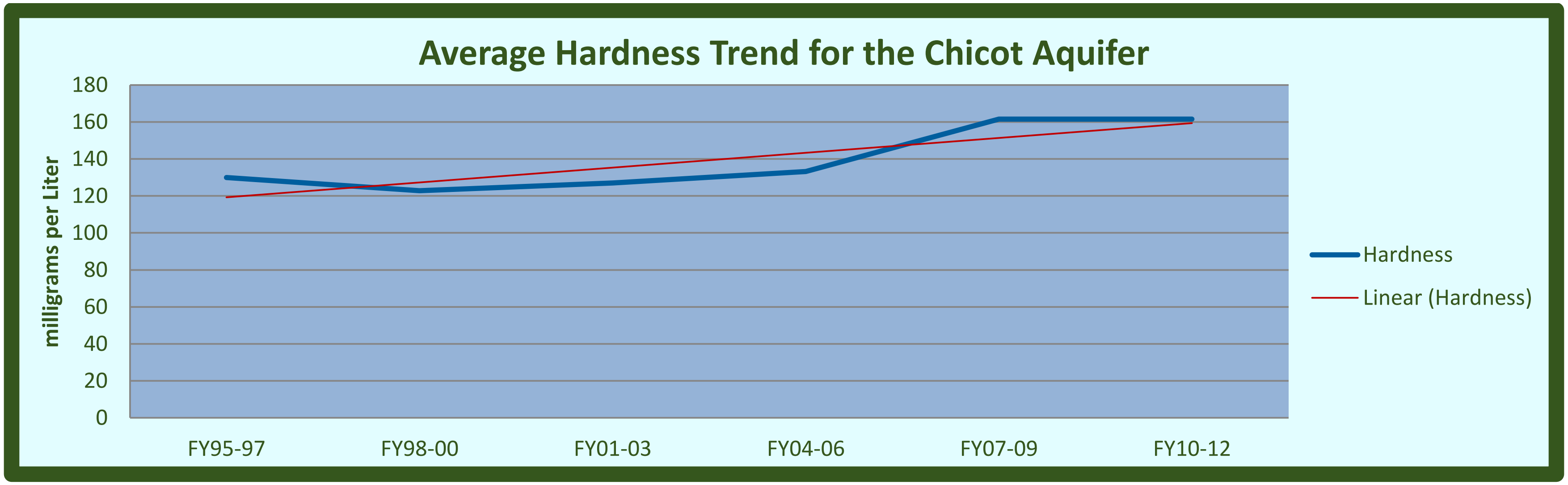

Chart 10-13: Nitrite – Nitrate Trend

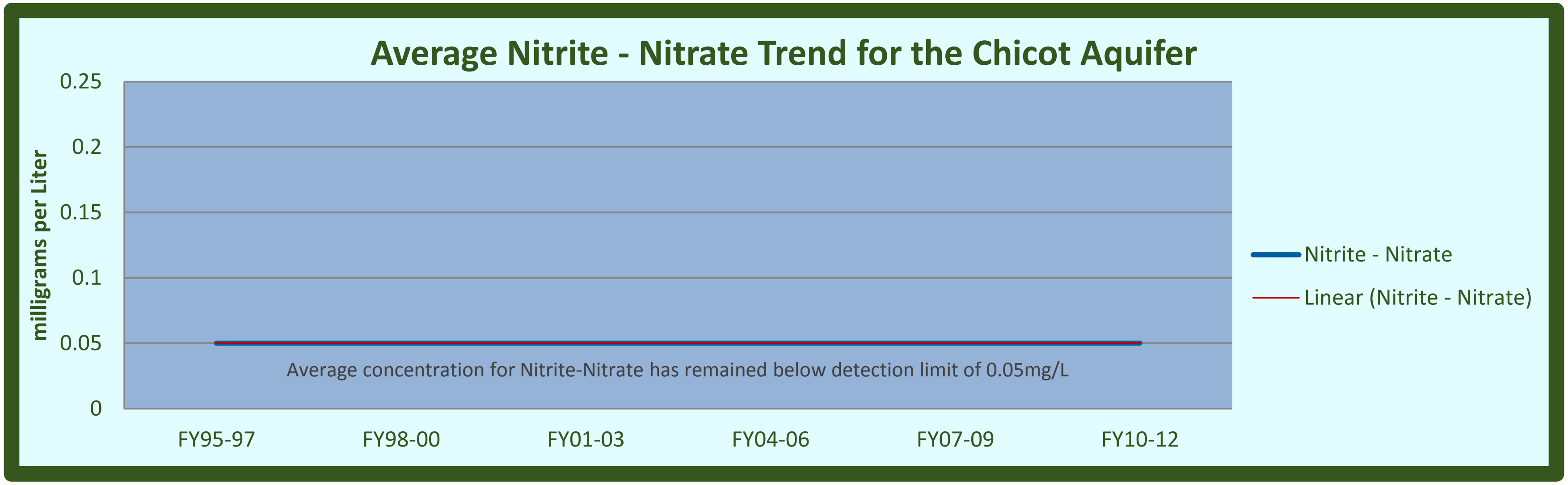

Chart 10-14: TKN Trend

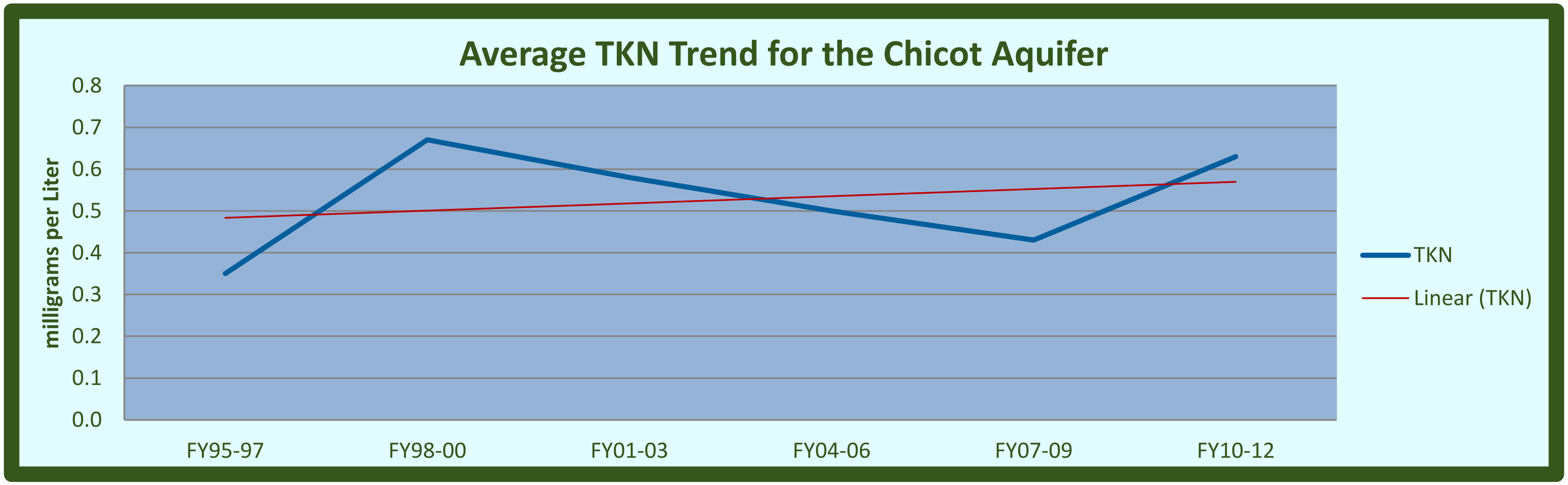

Chart 10-15: Total Phosphorus Trend

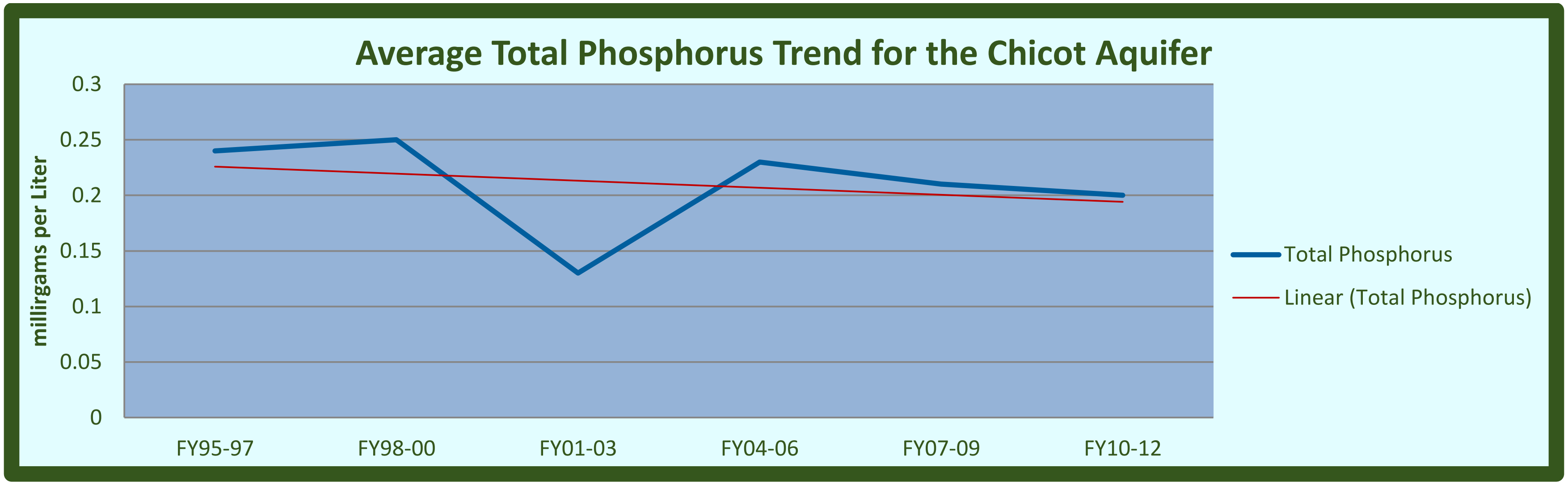

Chart 10-16: Iron Trend