COCKFIELD AQUIFER SUMMARY, 2008

AQUIFER SAMPLING AND ASSESSMENT PROGRAM

DEQ
LOUISIANA

APPENDIX 9 TO THE 2009 TRIENNIAL SUMMARY REPORT

PARTIAL FUNDING PROVIDED BY THE CWA

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 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 2009.

Analytical and field data contained in this summary were collected from wells producing from the Cockfield aquifer, during the 2008 state fiscal year (July 1, 2007 - June 30, 2008). This summary will become Appendix 9 of ASSET Program Triennial Summary Report for 2009.

These data show that beginning in February and continuing through May of 2008, 14 wells were sampled which produce from the Cockfield aquifer. Nine of these fourteen are classified as public supply, 4 are classified as domestic use, and 1 is classified as irrigation well. The wells are located in 10 parishes in the northeast and north-central to western Louisiana.

Figure 9-1 shows the geographic locations of the Cockfield aquifer and the associated wells, whereas Table 9-1 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

The Cockfield aquifer is within the Eocene Cockfield formation of the Claiborne Group, which consists of sands, silts, clays, and some lignite. The aquifer units consist of fine sand with interbedded silt, clay, and lignite, becoming more massive and containing less silt and clay with depth. Beneath the Ouachita River, the Cockfield aquifer has been eroded by the ancestral Ouachita River and replaced by alluvial sands and gravels. The regional confining clays of the overlying Vicksburg and Jackson Groups confine the Cockfield.

HYDROGEOLOGY

In the Mississippi River valley, the Cockfield is overlain by and hydraulically connected to the alluvial aquifers. Recharge to the Cockfield aquifer occurs primarily by the direct infiltration of rainfall in interstream, upland outcrop-subcrop areas, the movement of water through the alluvial

and terrace deposits, and vertical leakage from the underlying Sparta aquifer. The Cockfield contains fresh water in north-central and northeast Louisiana in a narrowing diagonal band extending toward Sabine Parish. Saltwater ridges under the Red River valley and the eastern Ouachita River valley divide areas containing fresh water in the Cockfield aquifer. The hydraulic conductivity varies between 25 and 100 feet/day.

The maximum depths of occurrence of freshwater in the Cockfield range from 200 feet above sea level, to 2,150 feet below sea level. The range of thickness of the fresh water interval in the Cockfield is 50 to 600 feet. The depths of the Cockfield wells that were monitored in conjunction with the ASSET Program range from 70 to 445 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 9-2. The inorganic (total metals) parameters analyzed in the laboratory are listed in Table 9-3. These tables also show the field and analytical results determined for each analyte. For quality control, duplicate samples were taken for each parameter at wells CA-35, RI-127, W-198, W-5120Z, and WC-187.

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 9-8, 9-9 and 9-10 list the target analytes for volatiles, semi-volatiles and pesticides/PCBs, respectively.

Tables 9-4 and 9-5 provide a statistical overview of field and conventional data, and inorganic data for the Cockfield aquifer, listing the minimum, maximum, and average results for these parameters collected in the FY 2008 sampling. Tables 9-6 and 9-7 compare these same parameter averages to historical ASSET-derived data for the Cockfield aquifer, from fiscal years 1996, 1999, 2002, and 2005.

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 9-2, 9-3, 9-4, and 9-5, respectively, represent the contoured data for pH, total dissolved solids (TDS), chloride (Cl), and iron. Charts 9-1 through 9-16 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 Office of Environmental Assessment does use 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 9-2 and 9-3 show that one or more secondary MCLs (SMCLs) were exceeded in 12 of the 14 wells sampled in the Cockfield aquifer, with a total of 22 SMCLs being exceeded.

Field and Conventional Parameters

Table 9-2 shows the field and conventional parameters for which samples are collected at each well and the analytical results for those parameters. Table 9-4 provides an overview of this data for the Cockfield aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analysis listed in Table 9-2 shows that no primary 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 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 9-2 shows that 5 wells exceeded the SMCL for pH, 4 wells exceeded the SMCL for color, and 6 wells exceeded the SMCL for total dissolved solids (TDS). Laboratory results override field results in exceedance determination, thus only laboratory results will be counted in determining SMCL exceedance numbers for TDS. Following is a list of SMCL parameter exceedances with well number and results:

pH (SMCL = 6.5 – 8.5 Standard Units):

NA-5449Z	8.91 SU	UN-167	4.93 SU
W-192	8.95 SU	W-198	8.60 SU (Original and Duplicate)
W-5120Z	5.52 SU (Original and Duplicate)		

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

NA-5449Z	42 PCU	SA-BYRD	40 PCU
W-192	22 PCU	W-198	30 PCU (Original and Duplicate)

(4 wells did not report a result for Color)

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

	LAB RESULTS (in mg/L)	FIELD MEASURES (in g/L)
NA-5449Z	552 mg/L	0.57 g/L
RI-127	526 mg/L, Duplicate – 528 mg/L	0.57 g/L (Original and Duplicate)
SA-BYRD	748 mg/L	0.79 g/L
W-192	572 mg/L	0.59 g/L
W-187	678 mg/L, Duplicate – 688 mg/L	0.77 g/ L (Original and Duplicate)
WC-487	544 mg/L	0.59 g/L

Inorganic Parameters

Table 9-3 shows the inorganic (total metals) parameters for which samples are collected at each well and the analytical results for those parameters. Table 9-5 provides an overview of inorganic data for the Cockfield aquifer, listing the minimum, maximum, and average results for these parameters.

Federal Primary Drinking Water Standards: A review of the analyses listed on Table 9-3 shows that no primary MCL was exceeded for total metals.

Federal Secondary Drinking Water Standards: Laboratory data contained in Table 9-3 shows that 7 wells exceeded the secondary MCL for iron:

Iron (SMCL = 300 ug/L):

CA-35	6,420 ug/L, Duplicate – 6,400 ug/L	MO-479	2,150 ug/L
RI-450	1,950 ug/L	SA-BYRD	698 ug/L
UN-167	5,240 ug/L	WC-187	536 ug/L, Duplicate – 541 ug/L
WC-487	747 ug/L		

Volatile Organic Compounds

Table 9-8 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.

Natchitoches Parish domestic well number NA-5449Z reported detections of methylene chloride and toluene in the March 2008 sampling of the Cockfield aquifer. These compounds were reported at 11.1 ug/L for methylene chloride (MCL for methylene chloride is 5 ug/L) and 3.0 ug/L for toluene (MCL for toluene is 1,000 ug/L). Per ASSET Program standard procedures, the well was resampled (along with a duplicate sample) for VOCs in May 2008. This resampling confirmed the existence of methylene chloride, reporting results of 7.02/2.83 ug/L (resample/duplicate). However, toluene was detected in the original resample at 2.68 ug/L, but was not detected in the duplicate (detection limit for toluene is 2 ug/L).

Because the existence of methylene chloride was confirmed in the resample (and duplicate), and because the reported level of methylene chloride was above the EPA established MCL, this information was forwarded to the Remediation Services Division (formerly known as the Technology Division) within DEQ for further investigation. Even though this well is not used by the owner as a source of drinking water, the well owner was provided information concerning the health effects of these compounds and possible treatment techniques.

In addition to the VOCs discussed above, tetrachloroethene was detected in a Sabine Parish domestic well. Well number SA-BYRD reported tetrachloroethene in this well at just below the drinking water standard for this compound. Laboratory result for tetrachloroethene was 4.41 ug/L (MCL = 5.0 ug/L).

Close attention will be given to these wells in future ASSET operations, as well as coordination with the well owners and the Remediation Services Division. No other wells reported detections of a VOC at or above its detection limit during the FY 2008 sampling of the Cockfield aquifer.

Semi-Volatile Organic Compounds

Table 9-9 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 2008 sampling of the Cockfield aquifer.

Pesticides and PCBs

Table 9-10 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 2008 sampling of the Cockfield 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 Cockfield aquifer exhibit some changes when comparing current data to that of the four previous sampling rotations (three, six, nine and twelve years prior). These comparisons can be found in Tables 9-6 and 9-7, and in Charts 9-1 to 9-16 of this summary. Over the twelve-year period, 8 analytes have shown a general increase in average concentration. These analytes are: pH, chloride, TDS, hardness, nitrite-nitrate, and to lesser degree, salinity, specific conductance (field and lab), and alkalinity. For this same time period, 7 analytes have demonstrated a decrease in average concentration: color, sulfate, ammonia, TKN, iron, copper, and to a lesser degree, total phosphorus (P). Barium and temperature remained consistent for this time period.

The current number of wells with secondary MCL exceedances and the current total number of secondary exceedances have increased since the previous sampling event in FY 2005. Current sample results show that 12 wells reported one or more secondary exceedances with a total of 22 SMCL exceedances. The FY 2005 sampling of the Cockfield aquifer shows that 11 wells reported one or more SMCL exceedances with a total of 17 exceedances.

Also, FY 2008 sampling results reported that one Primary MCL was exceeded in one well while there were no Primary exceedances in FY 2005.

SUMMARY AND RECOMMENDATIONS

In summary, the data show that the ground water produced from this aquifer is moderately hard[1] and that one MCL was exceeded for the volatile organic compound methylene chloride. The data also show that this aquifer is of fair quality when considering taste, odor, or appearance guidelines, with 22 Secondary MCLs exceeded in 12 of the 14 wells sampled.

Comparison to historical ASSET-derived data shows some change in the quality or characteristics of the Cockfield aquifer, with 8 parameters showing consistent increases in concentration, 7 parameters decreasing in concentration, while 2 parameters showed no consistent change over the twelve-year period.

It is recommended that the wells assigned to the Cockfield aquifer be re-sampled as planned, in approximately three years, with close attention given to the occurrence of VOCs in this aquifer. In addition, several wells should be added to the 14 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 9-1: List of Wells Sampled, Cockfield Aquifer–FY 2008

DOTD Well Number	Parish	Date	Owner	Depth (Feet)	Well Use
CA-35	CALDWELL	3/10/2008	CITY OF COLUMBIA	298	PUBLIC SUPPLY
EC-233	E CARROLL	2/12/2008	TOWN OF LAKE PROVIDENCE	371	PUBLIC SUPPLY
MO-479	MOREHOUSE	2/12/2008	BAYOU BONNE IDEE WATER SYSTEM	258	PUBLIC SUPPLY
NA-5449Z	NATCHITOCHES	3/11/2008	PRIVATE OWNER	170	DOMESTIC
OU-FRITH	OUACHITA	3/10/2008	PRIVATE OWNER	80	DOMESTIC
RI-127	RICHLAND	2/11/2008	DELHI WATER WORKS	416	PUBLIC SUPPLY
RI-450	RICHLAND	5/12/2008	RIVER ROAD WATERWORKS	283	PUBLIC SUPPLY
SA-BYRD	SABINE	3/25/2008	PRIVATE OWNER	150	DOMESTIC
UN-167	UNION	2/11/2008	PRIVATE OWNER	110	IRRIGATION
W-192	WINN	3/10/2008	RED HILL WATER SYSTEM	210	PUBLIC SUPPLY
W-198	WINN	3/25/2008	ATLANTA WATER SYSTEM	445	PUBLIC SUPPLY
W-5120Z	WINN	4/15/2008	PRIVATE OWNER	70	DOMESTIC
WC-187	W CARROLL	5/12/2008	NEW CARROLL WTR. ASSN.	110	PUBLIC SUPPLY
WC-487	W CARROLL	2/12/2008	TOWN OF OAK GROVE	396	PUBLIC SUPPLY

Table 9-2: Summary of Field and Conventional Data, Cockfield Aquifer–FY 2008

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 →						2.0	1.3	5	10	1.25/1.3	4	4	1	0.1	5.0	0.05	0.10	0.05
	FIELD PARAMETERS					LABORATORY PARAMETERS												
CA-35	19.72	6.57	0.352	0.17	0.23	95.7	20	5	286	46.4	270	<4	1.5	0.16	116	<0.05	0.25	0.49
CA-35*	19.72	6.57	0.352	0.17	0.23	96.1	19.9	5	316	46.2	266	<4	2.1	0.17	112	<0.05	0.24	0.49
EC-233	19.63	7.74	0.811	0.40	0.53	407	42	NA	816	<1.25	492	<4	<1	1.09	128	<0.05	1.4	0.16
MO-479	19.36	7.21	0.708	0.35	0.46	320	43.1		712	12.3	424	6	27.4	0.33	345	<0.05	‡0.66	0.12
NA-5449Z	19.20	8.91	0.883	0.44	0.57	381	17.3	42	817	67.6	552	<4	1.4	0.69	6.9	<0.05	0.78	0.88
OU-FRITH	18.52	8.17	0.563	0.27	0.37	326	<1.25	5	496	<1.25	350	<4	<1	0.52	41.9	<0.05	0.7	<0.05
RI-127	22.05	7.97	0.874	0.43	0.57	380	67.6	NA	878	<1.25	526	<4	<1	0.75	7.4	<0.05	1.17	‡0.10
RI-127*	22.05	7.97	0.874	0.43	0.57	380	67.6		877	<1.25	528	<4	<1	0.85	7.2	<0.05	0.9	‡0.19
RI-450	20.15	7.15	0.495	0.24	0.32	258	11.2	<5	501	<1.25	288	<4	13	0.31	233	<0.05	0.41	0.28
SA-BYRD	19.11	8.17	1.221	0.61	0.79	435	50.4	‡40	1204	‡147	748	<4	3.6	0.95	45.9	0.07	1.28	0.2
UN-167	19.37	4.93	0.204	0.10	0.13	3.8	17.1	NA	200	27.9	151	<4	†4.1	<0.1	9.7	‡7.7	<0.1	<0.05
W-192	19.90	8.95	0.913	0.45	0.59	361	60	22	879	35.3	572	<4	1.5	0.82	6.6	<0.05	0.96	0.49
W-198	21.96	8.60	0.418	0.20	0.27	204	11.2	30	393	2	252	<4	<1	0.25	<5	<0.05	0.26	‡1.69
W-198*	21.96	8.60	0.418	0.20	0.27	207	11	30	393	2	260	<4	<1	0.24	<5	<0.05	0.29	‡1.79
W-5120Z	19.18	5.52	0.035	0.02	0.02	8.3	2.1	<5	33	<1.25	28	<4	<1	<0.1	8.7	<0.05	<0.1	<0.05
W-5120Z*	19.18	5.52	0.035	0.02	0.02	8.4	2.1	<5	30.2	<1.25	28.7	<4	<1	<0.1	8.7	<0.05	<0.1	<0.05
WC-187	19.06	7.15	1.184	0.59	0.77	329	*189	<5	1200	13	678	<4	5	0.1	467	0.08	0.16	0.09
WC-187*	19.06	7.15	1.184	0.59	0.77	326	*189	<5	1201	13	688	<4	6	0.11	474	0.08	0.11	0.09
WC-487	19.01	7.43	0.906	0.45	0.59	365	102	NA	938	1.4	544	<4	4.1	0.2	104	<0.05	‡0.32	0.06

*Denotes Duplicate Sample †Estimated Value ‡Reported from a Dilution NA = Not analyzed by Lab. Shaded cells exceed EPA Secondary Standards

Table 9-3: Summary of Inorganic Data, Cockfield Aquifer–FY 2008

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	1	3	2	1	0.5	3	3	20	3	0.05	3	4	0.5	1	10
CA-35	<1	<3	141	<1	<0.5	<3	<3	6420	<3	0.26	<3	<4	<0.5	<1	26
CA-35*	<1	<3	141	<1	<0.5	<3	<3	6400	<3	0.05	<3	<4	<0.5	<1	17
EC-233	<1	<3	251	<1	<0.5	<3	<3	<20	<3	0.1	<3	<4	<0.5	<1	<10
MO-479	<1	<3	336	<1	<0.5	<3	<3	2150	<3	<0.05	<3	<4	<0.5	<1	<10
NA-5449Z	<1	<3	14.7	<1	<0.5	<3	9.9	143	<3	<0.05	<3	<4	<0.5	<1	<10
OU-FRITH	<1	<3	121	<1	<0.5	<3	<3	84.9	<3	0.05	<3	<4	<0.5	<1	<10
RI-127	<1	<3	34.7	<1	<0.5	<3	<3	58.9	<3	<0.05	<3	<4	<0.5	<1	<10
RI-127*	<1	<3	34.2	<1	<0.5	<3	<3	61.5	<3	0.19	<3	<4	<0.5	<1	<10
RI-450	<1	<3	167	<1	<0.5	<3	<3	1950	8	R	<3	<4	<0.5	<1	<10
SA-BYRD	<1	<3	50.6	<1	<0.5	<3	21.2	698	3.5	0.07	<3	<4	<0.5	<1	324
UN-167	<1	<3	318	<1	1.3	<3	10.4	5240	<3	0.13	7.6	<4	<0.5	<1	26.2
W-192	<1	<3	11.4	<1	<0.5	<3	<3	<20	<3	0.05	<3	<4	<0.5	<1	<10
W-198	<1	<3	3.8	<1	<0.5	<3	<3	38.3	<3	0.07	<3	<4	<0.5	<1	<10
W-198*	<1	<3	4.8	<1	<0.5	<3	<3	45.6	<3	0.07	<3	<4	<0.5	<1	<10
W-5120Z	<1	<3	15.8	<1	<0.5	<3	14.5	<20	<3	0.05	<3	<4	<0.5	<1	<10
W-5120Z*	<1	<3	15.7	<1	<0.5	<3	8.2	<20	<3	0.05	<3	<4	<0.5	<1	<10
WC-187	<1	5.1	170	<1	<0.5	<3	4.4	536	<3	R	<3	<4	<0.5	<1	<10
WC-187*	<1	4.4	167	<1	<0.5	<3	<3	541	<3	R	<3	<4	<0.5	<1	<10
WC-487	<1	<3	127	<1	<0.5	<3	10.4	747	<3	0.06	<3	<4	<0.5	<1	23.6

*Denotes Duplicate Sample. Exceeds EPA Secondary Standards.

R = Mercury values rejected; mercury reported in Field Blank for the May 2008 sampling.

Table 9-4: FY 2008 Field and Conventional Statistics, ASSET Wells

	PARAMETER	MINIMUM	MAXIMUM	AVERAGE
FIELD	Temperature (^{O}C)	18.52	22.05	19.90
	pH (SU)	4.93	8.95	7.38
	Specific Conductance (mmhos/cm)	0.035	1.221	0.65
	Salinity (ppt)	0.02	0.61	0.32
	TDS (g/L)	0.023	0.793	0.430
LABORATORY	Alkalinity (mg/L)	3.8	435	257.4
	Chloride (mg/L)	<1.25	189	48.6
	Color (PCU)	<5	42	14.7
	Specific Conductance (umhos/cm)	30.2	1204	640.5
	Sulfate (mg/L)	<1.25	147	22.0
	TDS (mg/L)	28	748	402.4
	TSS (mg/L)	<4	6	<4
	Turbidity (NTU)	<1	27.4	3.9
	Ammonia, as N (mg/L)	<0.1	1.09	0.40
	Hardness (mg/L)	<5	474	111.9
	Nitrite - Nitrate, as N (mg/L)	<0.05	7.70	0.44
	TKN (mg/L)	<0.1	1.4	0.53
	Total Phosphorus (mg/L)	<0.05	1.79	0.38

Table 9-5: FY 2008 Inorganic Statistics, ASSET Wells

PARAMETER	MINIMUM	MAXIMUM	AVERAGE
Antimony (ug/L)	<1	<1	<1
Arsenic (ug/L)	<3	5.1	<3
Barium (ug/L)	3.8	336	111.8
Beryllium (ug/L)	<1	<1	<1
Cadmium (ug/L)	<0.5	1.3	<0.5
Chromium (ug/L)	<3	<3	<3
Copper (ug/L)	<3	21.2	5.11
Iron (ug/L)	<20	6420	1323.9
Lead (ug/L)	<3	8	<3
Mercury (ug/L)	<0.05	0.26	0.08
Nickel (ug/L)	<3	7.6	<3
Selenium (ug/L)	<4	<4	<4
Silver (ug/L)	<0.5	<0.5	<0.5
Thallium (ug/L)	<1	<1	<1
Zinc (ug/L)	<10	324	25.6

Table 9-6: Triennial Field and Conventional Statistics, ASSET Wells

	PARAMETER	FY 1996 AVERAGE	FY 1999 AVERAGE	FY 2002 AVERAGE	FY 2005 AVVERAGE	FY 2008 AVERAGE
FIELD	Temperature (^{O}C)	19.91	19.76	20.30	19.82	19.90
	pH (SU)	6.77	6.99	7.39	7.46	7.38
	Specific Conductance (mmhos/cm)	0.564	0.613	0.647	0.70	0.65
	Salinity (Sal.) (ppt)	0.27	0.30	0.32	0.35	0.32
	TDS (Total dissolved solids) (g/L)	-	-	-	0.46	0.430
LABORATORY	Alkalinity (Alk.) (mg/L)	219.2	223.9	262.4	293.7	257.4
	Chloride (Cl) (mg/L)	35.9	52.0	42.2	52.5	48.6
	Color (PCU)	37.5	11.8	11.9	11.0	14.7
	Specific Conductance (umhos/cm)	560.7	618.8	642.8	736.9	640.5
	Sulfate (SO4) (mg/L)	33.36	35.51	98.92	21.9	22.0
	TDS (Total dissolved solids) (mg/L)	320.3	429.7	396.0	437.8	402.4
	TSS (Total suspended solids) (mg/L)	5.3	<4	<4	<4	<4
	Turbidity (Turb.) (NTU)	7.14	9.74	4.71	5.4	3.9
	Ammonia, as N (NH3) (mg/L)	0.66	0.50	0.62	0.36	0.40
	Hardness (mg/L)	115.3	79.3	89.9	139.9	111.9
	Nitrite - Nitrate , as N (mg/L)	0.11	0.08	0.30	0.50	0.44
	TKN (mg/L)	0.80	0.71	0.94	0.47	0.53
	Total Phosphorus (P) (mg/L)	0.32	0.59	0.30	0.30	0.38

Table 9-7: Triennial Inorganic Statistics, ASSET Wells

PARAMETER	FY 1996 AVERAGE	FY 1999 AVERAGE	FY 2002 AVERAGE	FY 2005 AVERAGE	FY 2008 AVERAGE
Antimony (ug/L)	<5	<5	<5	<10	<1
Arsenic (ug/L)	5.43	<5	<5	<10	<3
Barium (ug/L)	121.3	124.5	140.9	161.9	111.8
Beryllium (ug/L)	<5	<5	<5	<1	<1
Cadmium (ug/L)	<5	<5	<5	<1	<0.5
Chromium (ug/L)	<5	<5	<5	<5	<3
Copper (ug/L)	39.62	5.86	11.77	8.34	5.11
Iron (ug/L)	1,835.8	1,623.2	1,319.5	1,084.1	1323.9
Lead (ug/L)	<10	<10	<10	<10	<3
Mercury (ug/L)	<0.05	<0.05	<0.05	<0.05	0.08
Nickel (ug/L)	<5	<5	<5	<5	<3
Selenium (ug/L)	<5	<5	<5	<5	<4
Silver (ug/L)	<5	<5	<5	4.72	<0.5
Thallium (ug/L)	<5	<5	<5	<5	<1
Zinc (ug/L)	117.5	34.1	30.7	<20	25.6

Table 9-8: VOC Analytical Parameters

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
1,1-Dichloroethane	624	2
1,1-Dichloroethene	624	2
1,1,1-Trichloroethane	624	2
1,1,2-Trichloroethane	624	2
1,1,2,2-Tetrachloroethane	624	2
1,2-Dichlorobenzene	624	2
1,2-Dichloroethane	624	2
1,2-Dichloropropane	624	2
1,3- Dichlorobenzene	624	2
1,4-Dichlorobenzene	624	2
Benzene	624	2
Bromoform	624	2
Carbon tetrachloride	624	2
Chlorobenzene	624	2
Dibromochloromethane	624	2
Chloroethane	624	2
trans-1,2-Dichloroethene	624	2
cis-1,3-Dichloropropene	624	2
Bromodichloromethane	624	2
Methylene chloride	624	2
Ethyl benzene	624	2
Bromomethane	624	2
Chloromethane	624	2
o-Xylene	624	2
Styrene	624	2
Methylt-butyl ether	624	2
Tetrachloroethene	624	2
Toluene	624	2
trans-1,3-Dichloropropene	624	2
Trichloroethene	624	2
Trichlorofluoromethane	624	2
Chloroform	624	2
Vinyl chloride	624	2
Xylenes, m & p	624	4

Table 9-9: SVOC Analytical Parameters

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
1,2-Dichlorobenzene	625	10
1,2,3-Trichlorobenzene	625	10
1,2,3,4-Tetrachlorobenzene	625	10
1,2,4-Trichlorobenzene	625	10
1,2,4,5-Tetrachlorobenzene	625	10
1,3-Dichlorobenzene	625	10
1,3,5-Trichlorobenzene	625	10
1,4-Dichlorobenzene	625	10
2-Chloronaphthalene	625	10
2-Chlorophenol	625	20
2-Methyl-4,6-dinitrophenol	625	20
2-Nitrophenol	625	20
2,4-Dichlorophenol	625	20
2,4-Dimethylphenol	625	20
2,4-Dinitrophenol	625	20
2,4-Dinitrotoluene	625	10
2,4,6-Trichlorophenol	625	20
2,6-Dinitrotoluene	625	10
3,3'-Dichlorobenzidine	625	10
4-Bromophenyl phenyl ether	625	10
4-Chloro-3-methylphenol	625	20
4-Chlorophenyl phenyl ether	625	10
4-Nitrophenol	625	20
Acenaphthene	625	10
Acenaphthylene	625	10
Anthracene	625	10
Benzidine	625	20
Benzo[a]pyrene	625	10
Benzo[k]fluoranthene	625	10
Benzo[a]anthracene	625	10
Benzo[b]fluoranthene	625	10
Benzo[g,h,i]perylene	625	10
Bis(2-chloroethoxy)methane	625	10
Bis(2-ethylhexyl)phthalate	625	10
Bis(2-chloroethyl)ether	625	10
Bis(2-chloroisopropyl)ether	625	10

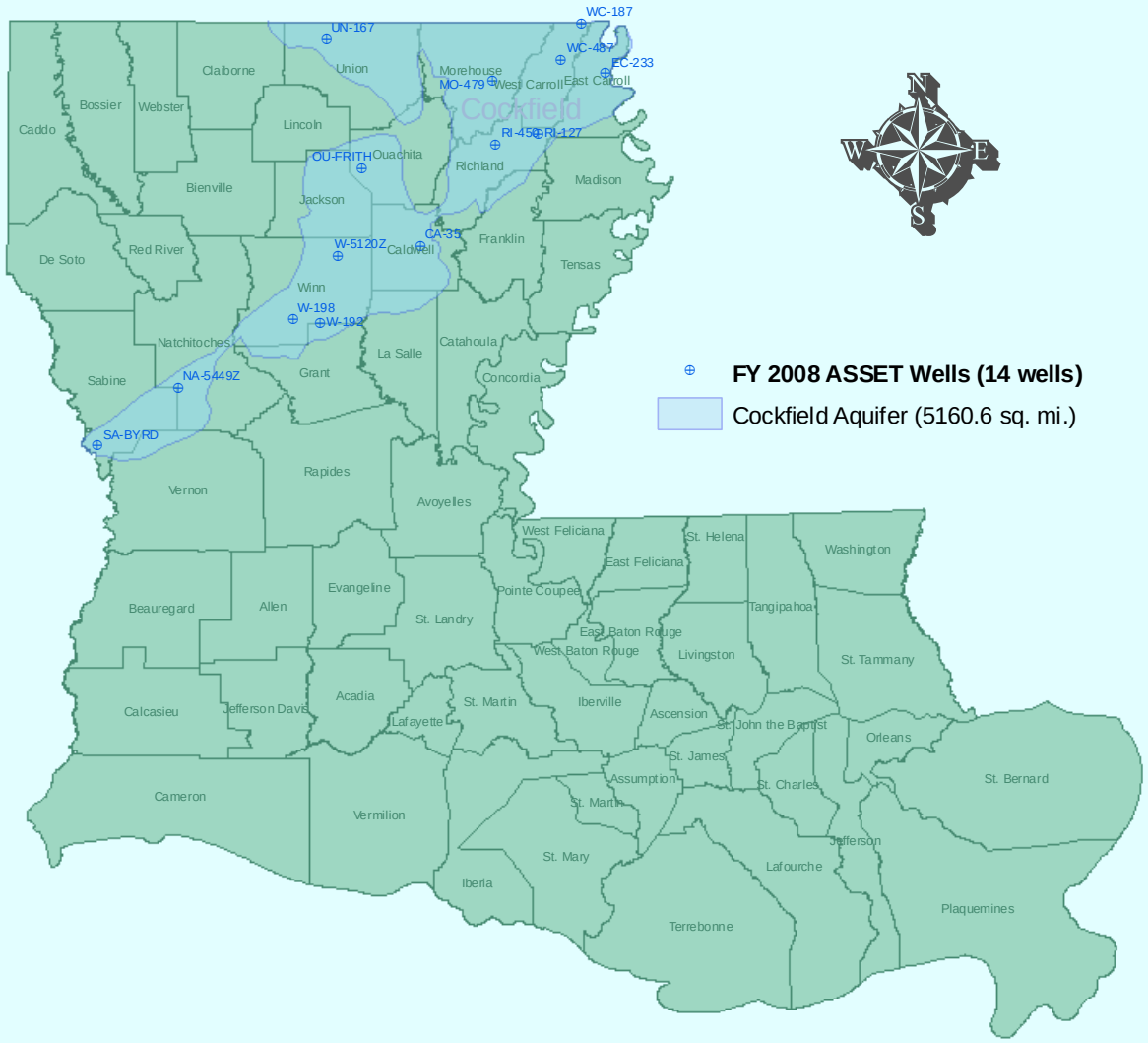
Table 9-9: SVOCs (Continued)

COMPOUND	METHOD	DETECTION LIMIT (ug/L)
Butylbenzylphthalate	625	10
Chrysene	625	10
Dibenzo[a,h]anthracene	625	10
Diethylphthalate	625	10
Dimethylphthalate	625	10
Di-n-butylphthalate	625	10
Di-n-octylphthalate	625	10
Fluoranthene	625	10
Fluorene	625	10
Hexachlorobenzene	625	10
Hexachlorobutadiene	625	10
Hexachlorocyclopentadiene	625	10
Hexachloroethane	625	10
Indeno[1,2,3-cd]pyrene	625	10
Isophorone	625	10
Naphthalene	625	10
Nitrobenzene	625	10
N-Nitrosodimethylamine	625	10
N-Nitrosodiphenylamine	625	10
N-nitroso-di-n-propylamine	625	10
Pentachlorobenzene	625	10
Pentachlorophenol	625	20
Phenanthrene	625	10
Phenol	625	20
Pyrene	625	10

Table 9-10: Pesticides and PCBs

COMPOUND	METHOD	DETECTION LIMITS (ug/L)
4,4'-DDD	608	0.05
4,4'-DDE	608	0.05
4,4'-DDT	608	0.05
Aldrin	608	0.05
Alpha-Chlordane	608	0.05
alpha-BHC	608	0.05
beta-BHC	608	0.05
delta-BHC	608	0.05
gamma-BHC	608	0.05
Chlordane	608	0.2
Dieldrin	608	0.05
Endosulfan I	608	0.05
Endosulfan II	608	0.05
Endosulfan Sulfate	608	0.05
Endrin	608	0.05
Endrin Aldehyde	608	0.05
Endrin Ketone	608	0.05
Heptachlor	608	0.05
Heptachlor Epoxide	608	0.05
Methoxychlor	608	0.05
Toxaphene	608	2
Gamma-Chlordane	608	0.05
PCB-1016	608	1
PCB-1221	608	1
PCB-1232	608	1
PCB-1242	608	1
PCB-1248	608	1
PCB-1254	608	1
PCB-1260	608	1

Figure 9-1: Location Plat, Cockfield 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 9-2: Map of pH Data

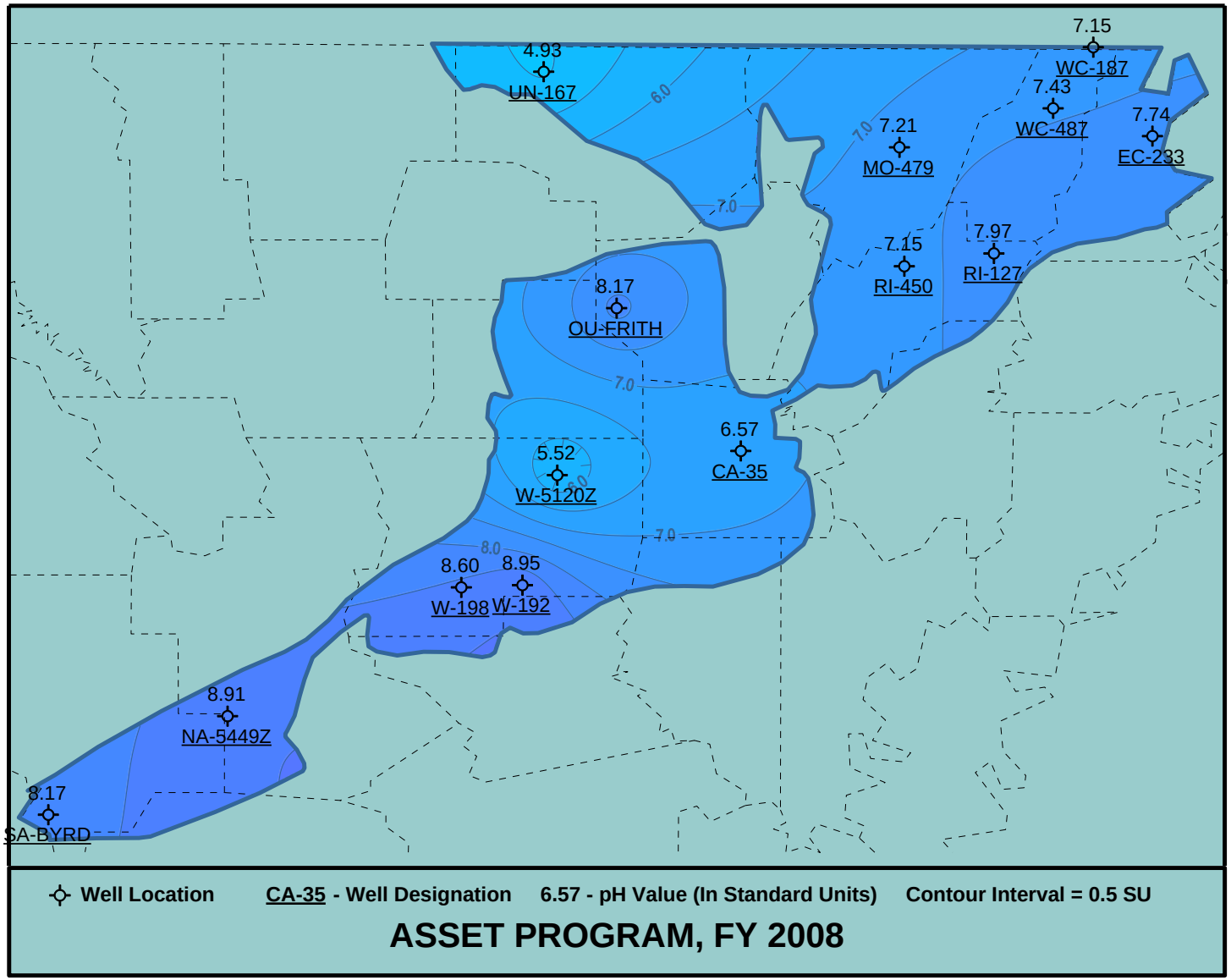

Figure 9-3: Map of TDS Lab Data

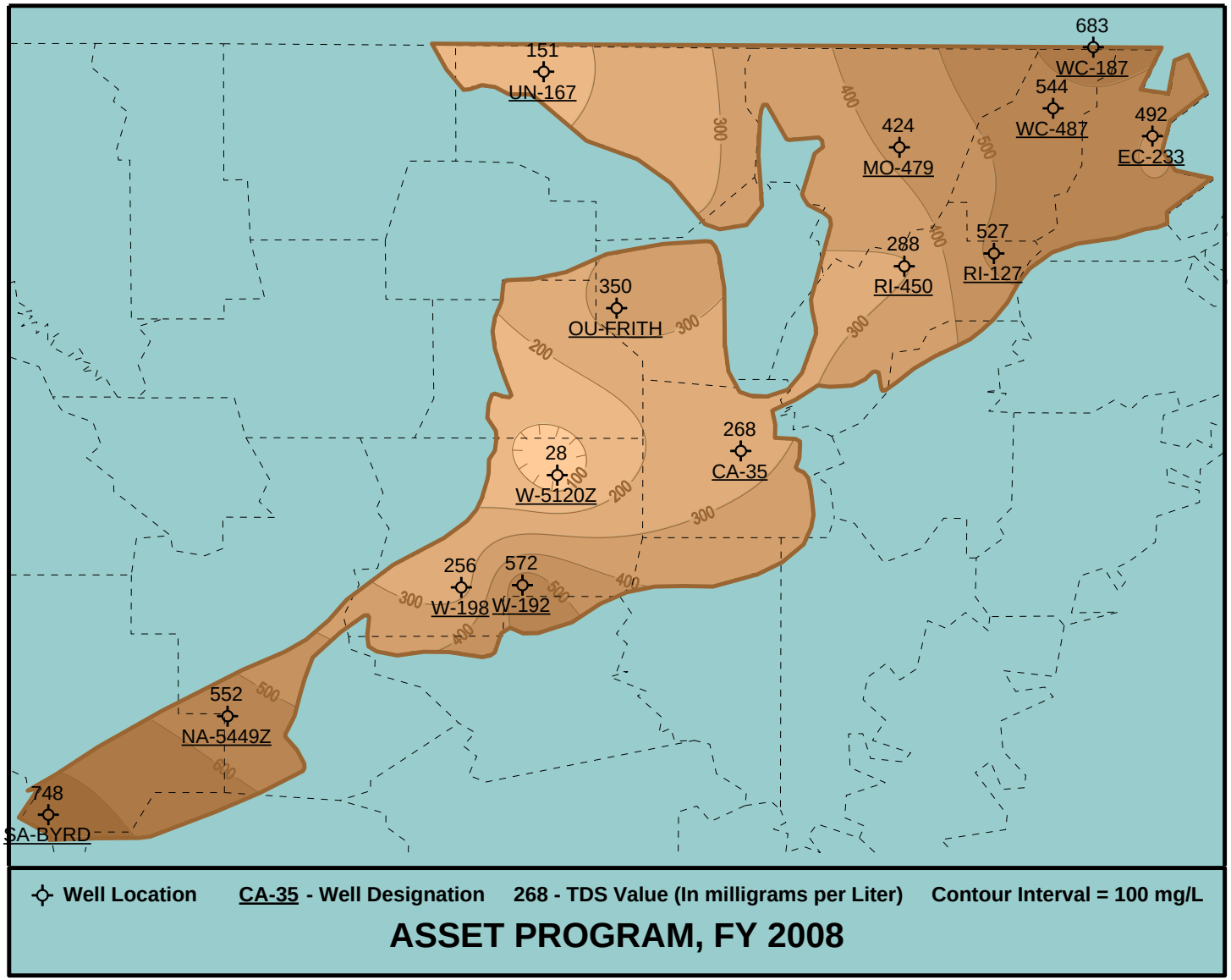

Figure 9-4: Map of Chloride Data

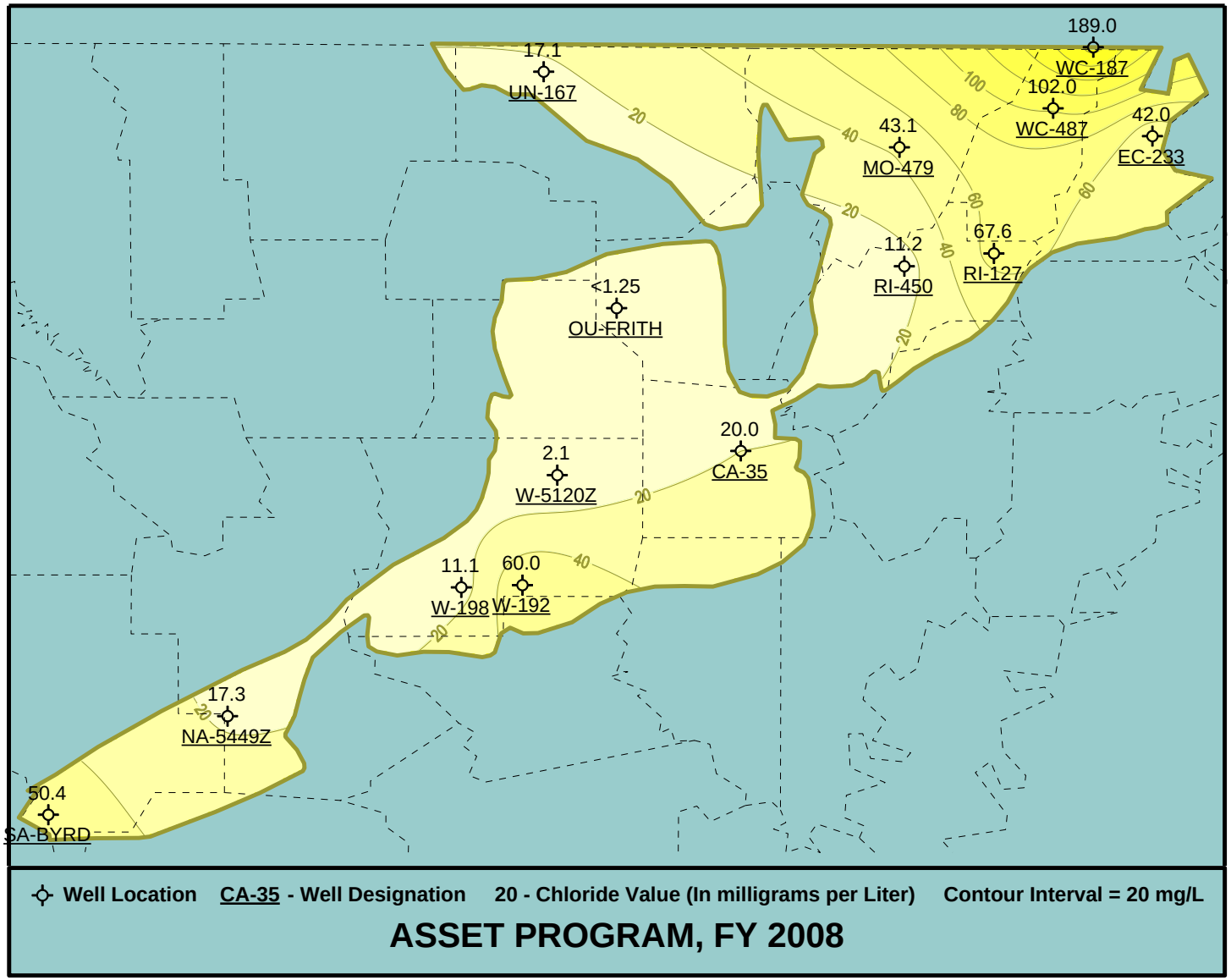

Figure 9-5: Map of Iron Data

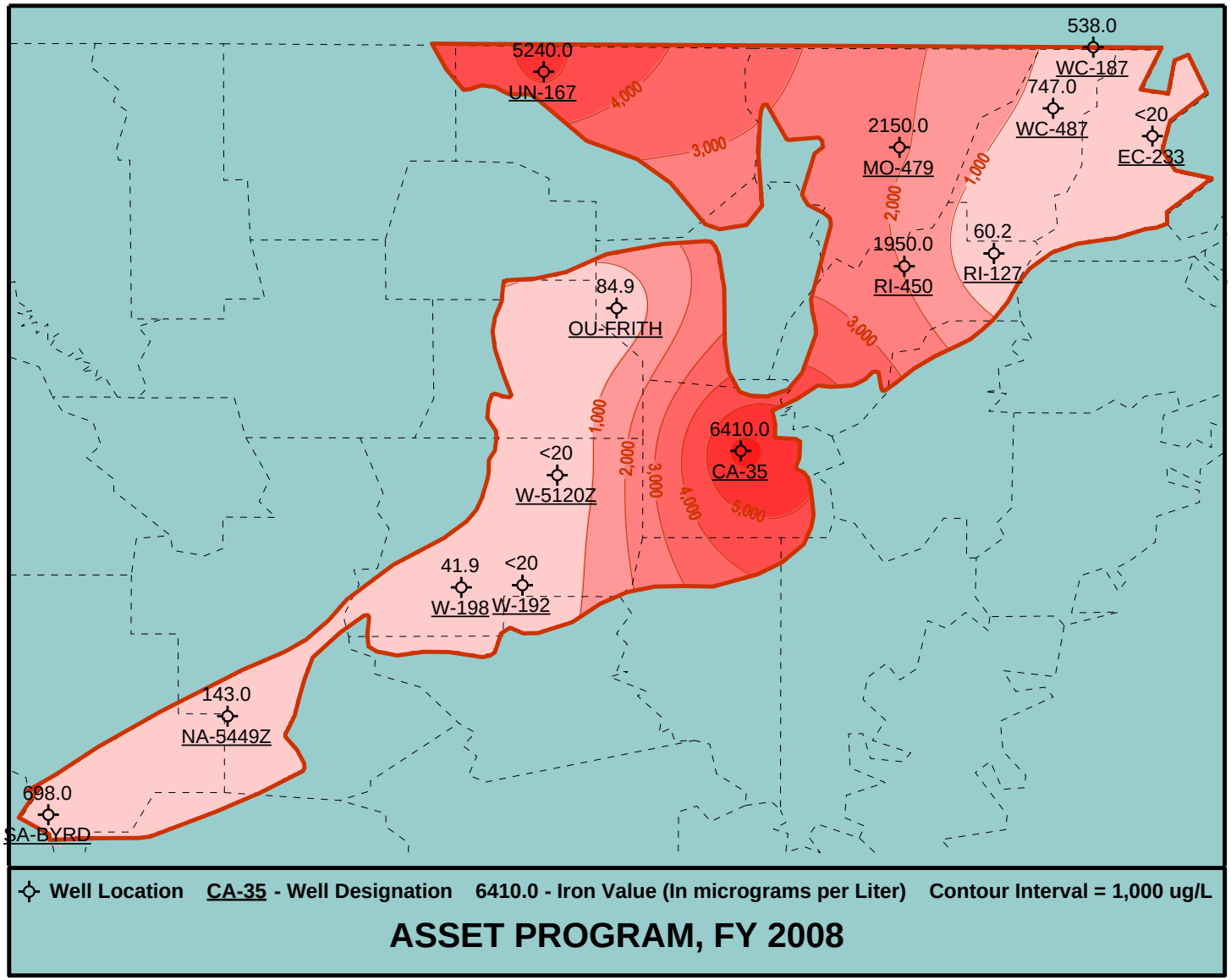

Chart 9-1: Temperature Trend

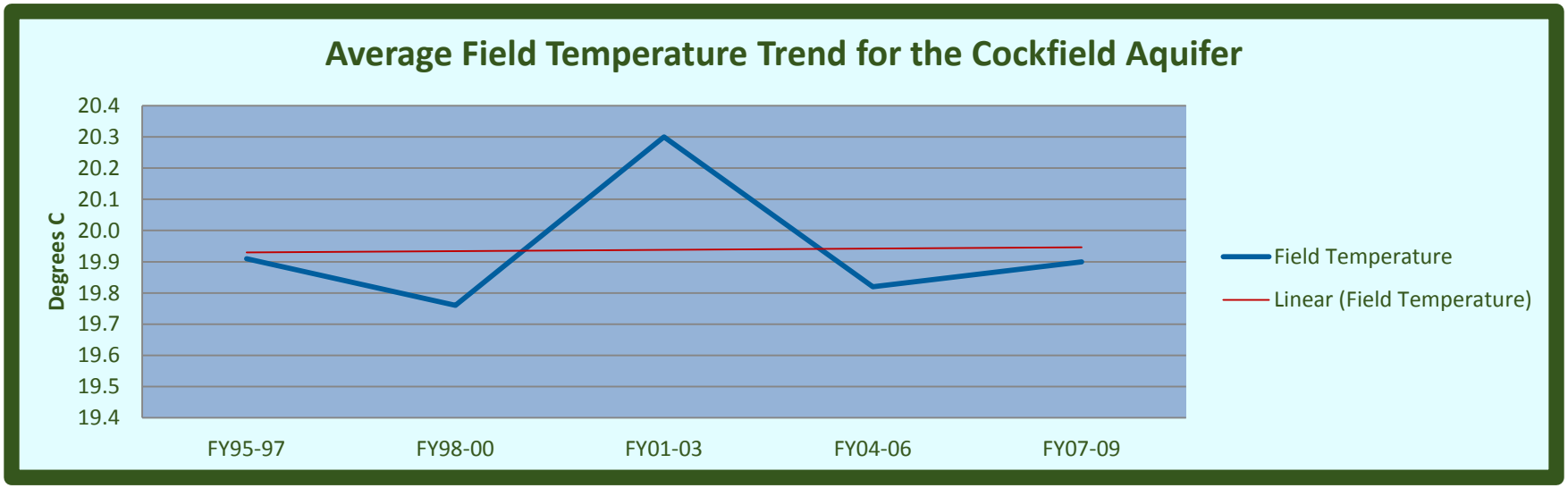

Chart 9-2: pH Trend

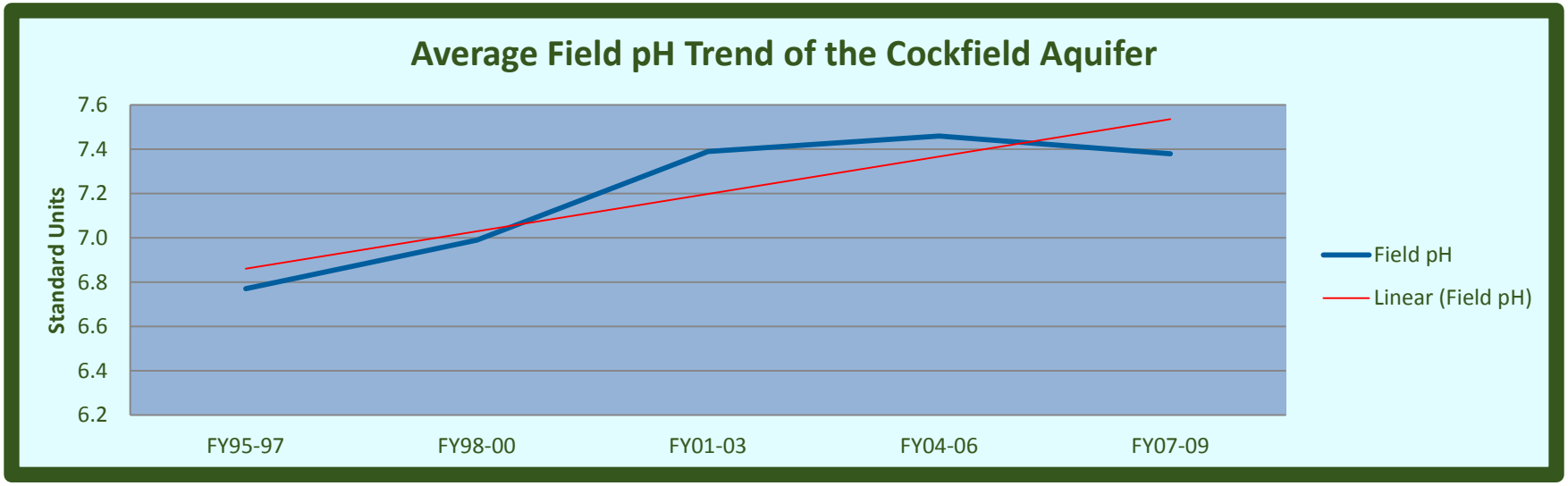

Chart 9-3: Field Specific Conductance Trend

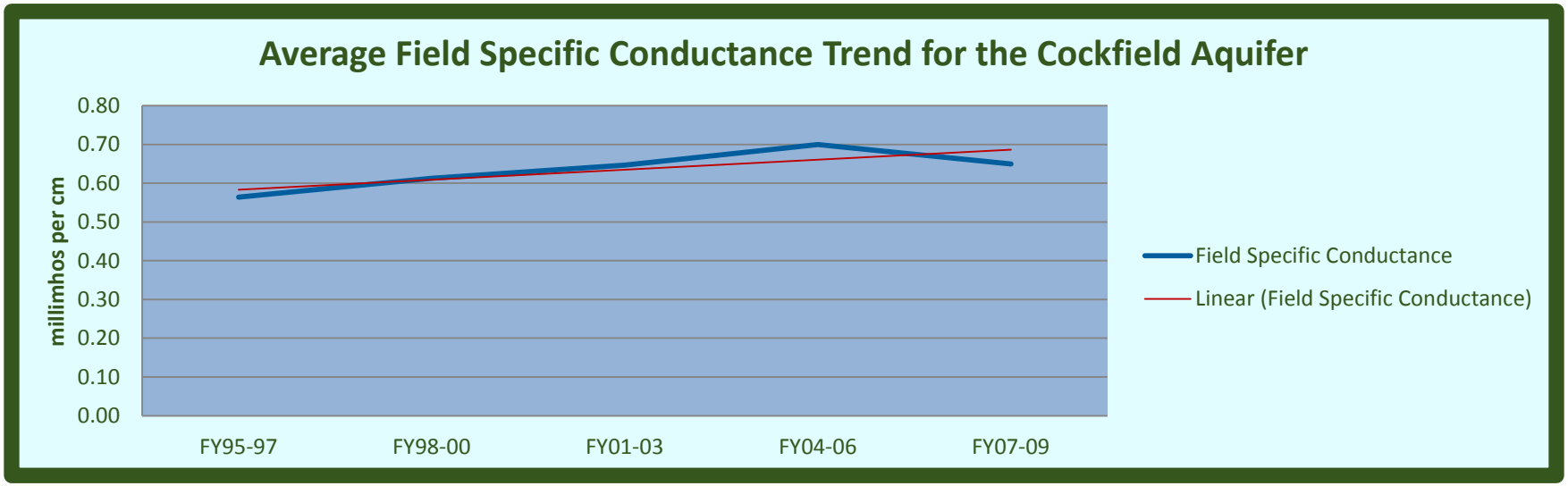

Chart 9-4: Lab Specific Conductance Trend

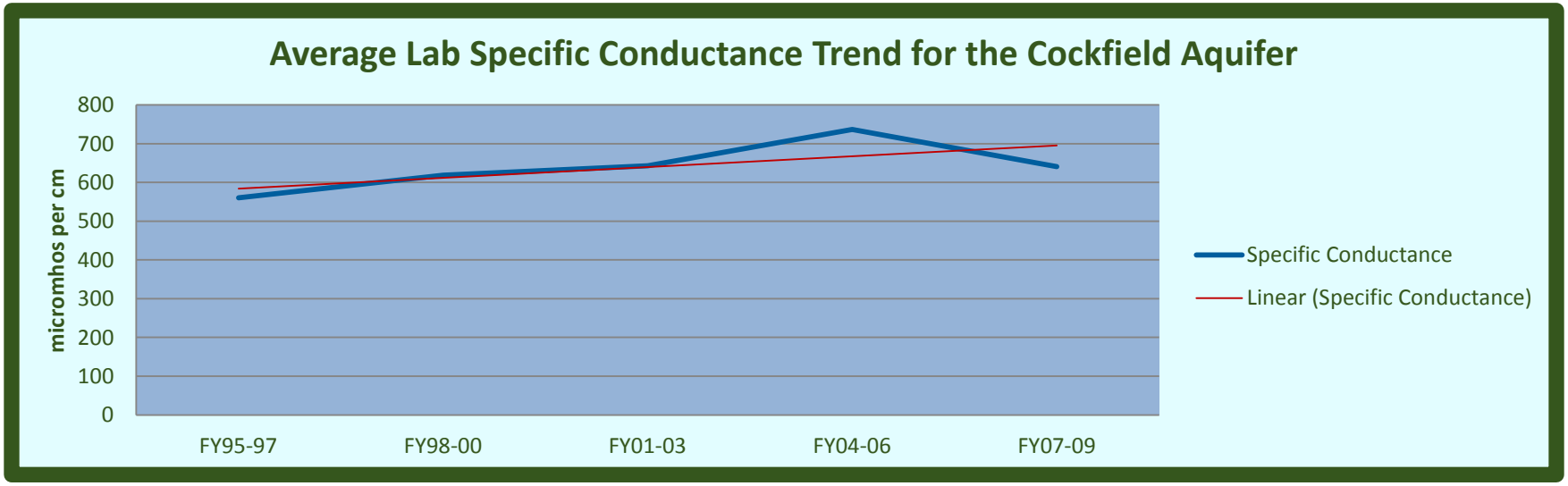

Chart 9-5: Field Salinity Trend

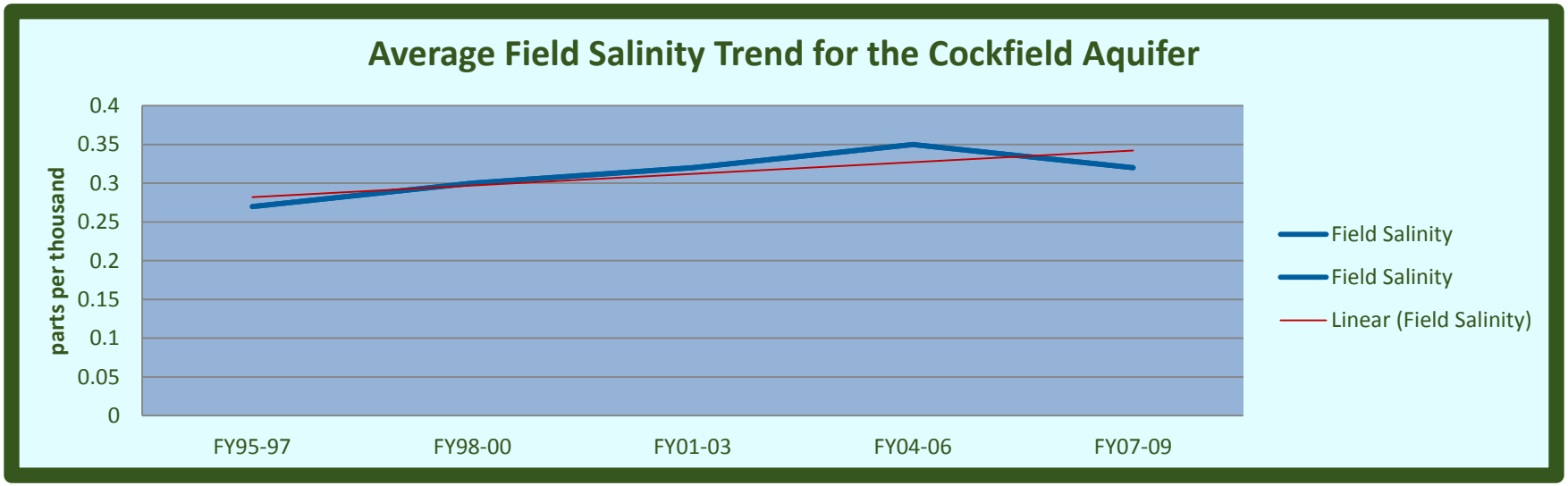

Chart 9-6: Alkalinity Trend

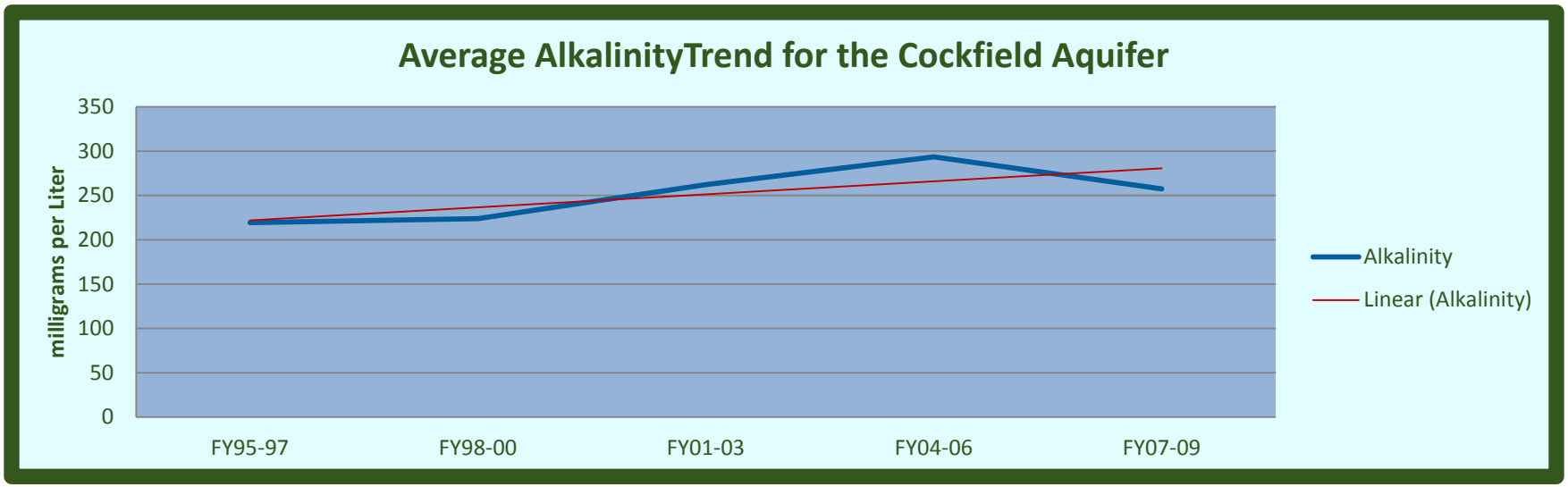

Chart 9-7: Chloride Trend

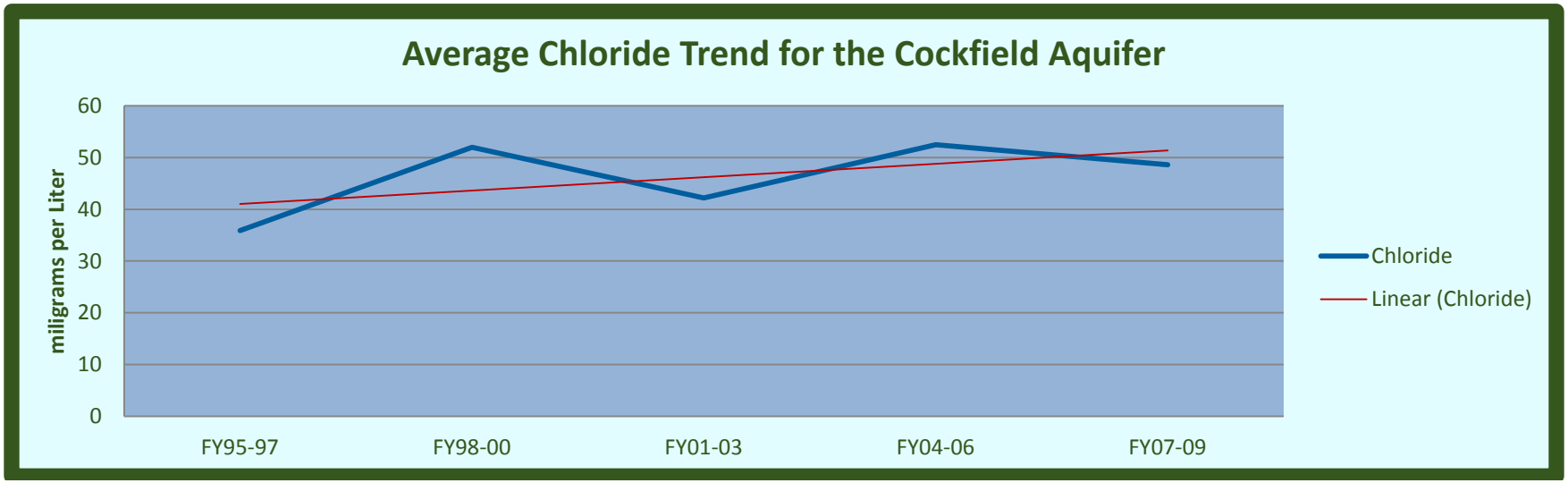

Chart 9-8: Color Trend

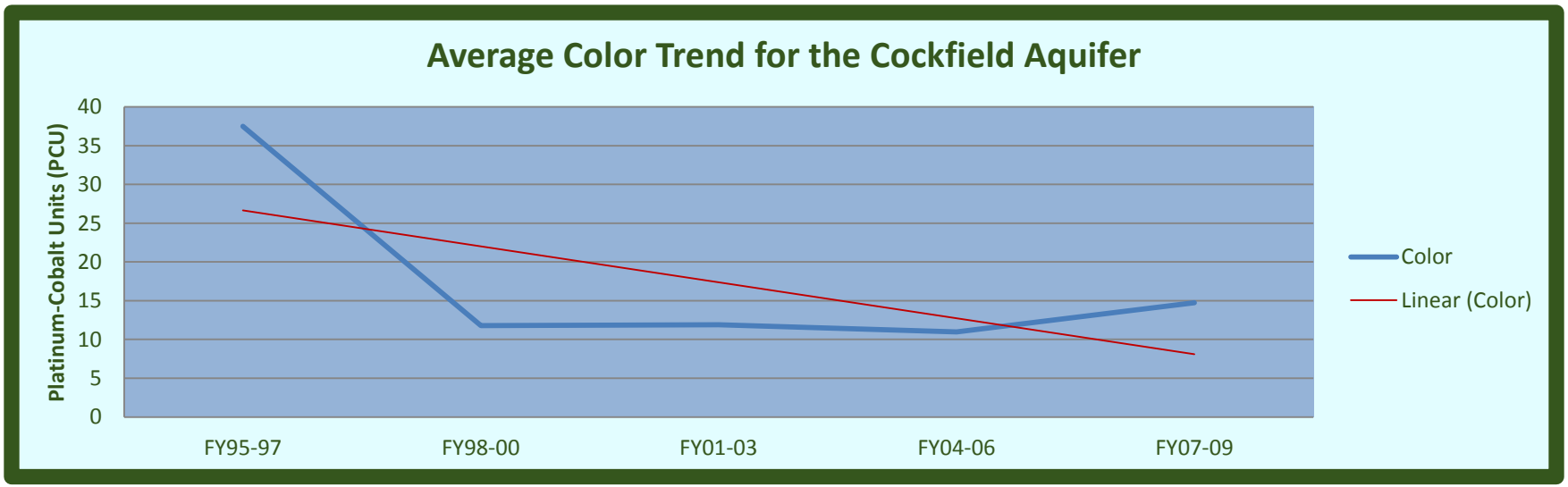

Chart 9-9: Sulfate (SO4) Trend

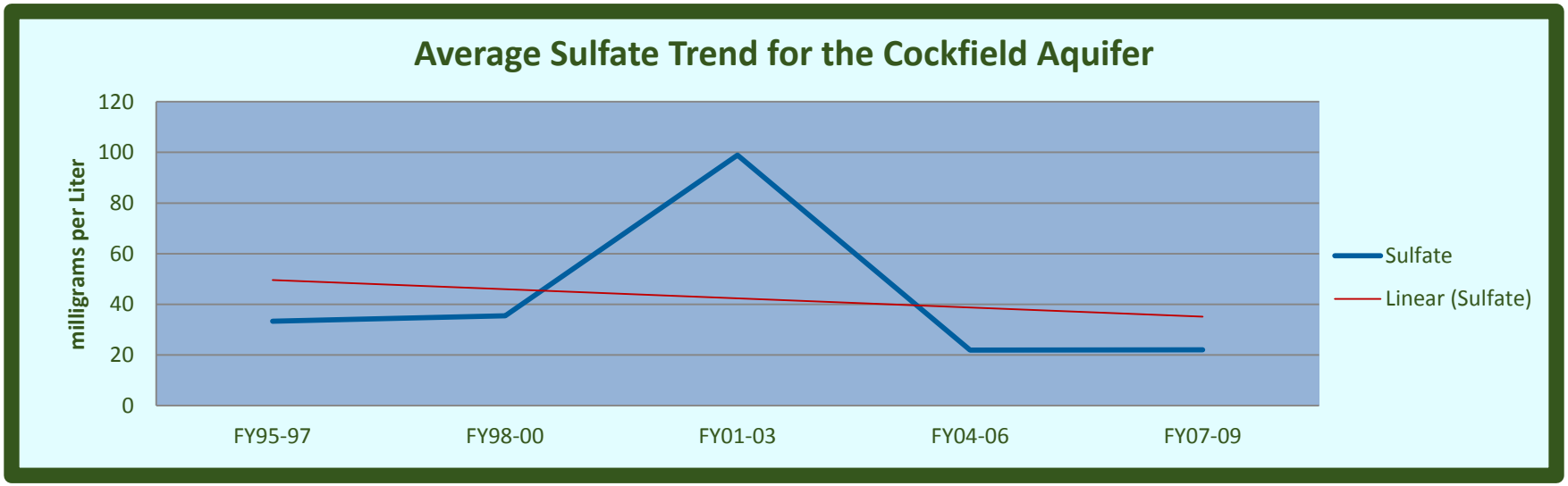

Chart 9-10: Total Dissolved Solids (TDS) Trend

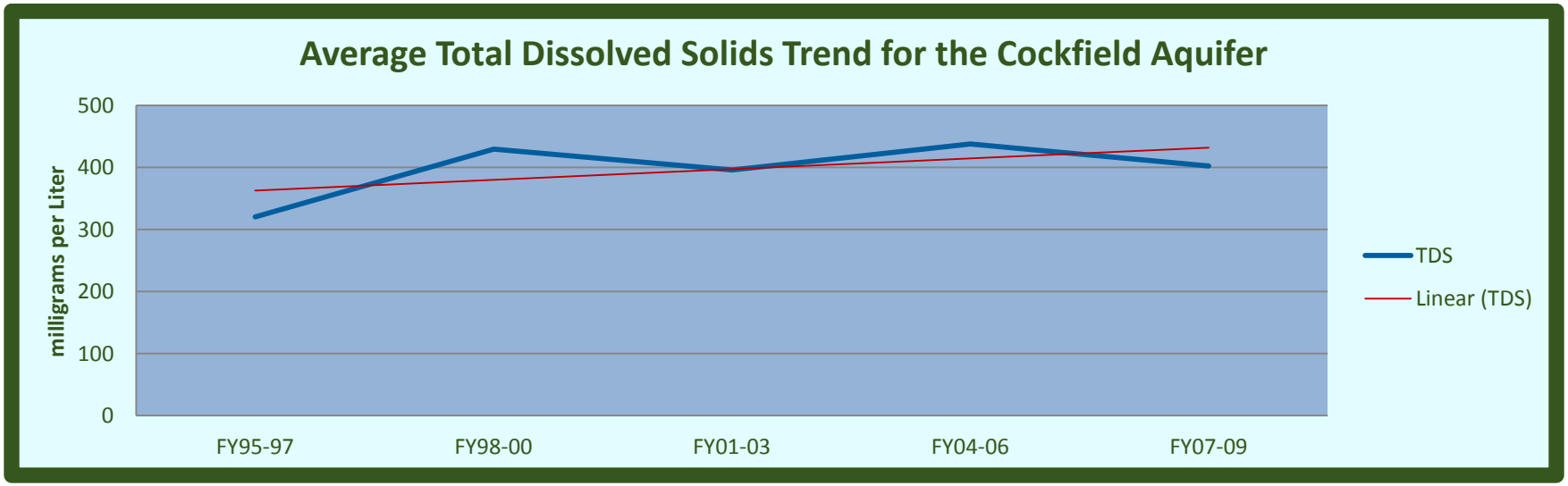

Chart 9-11: Ammonia (NH3) Trend

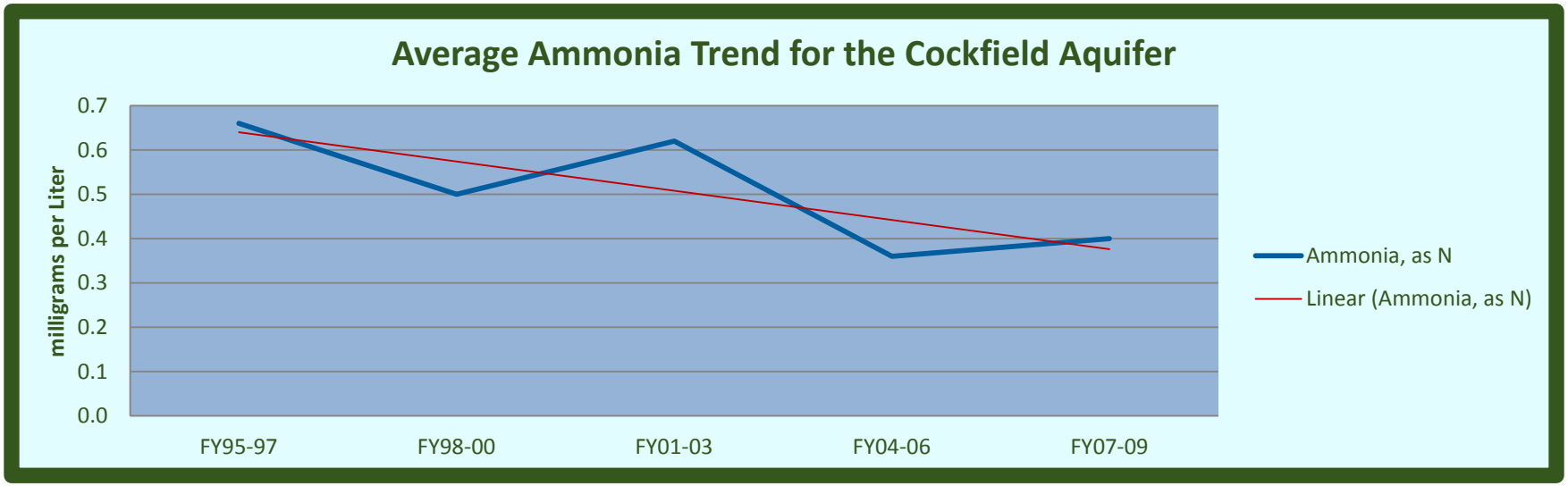

Chart 9-12: Hardness Trend

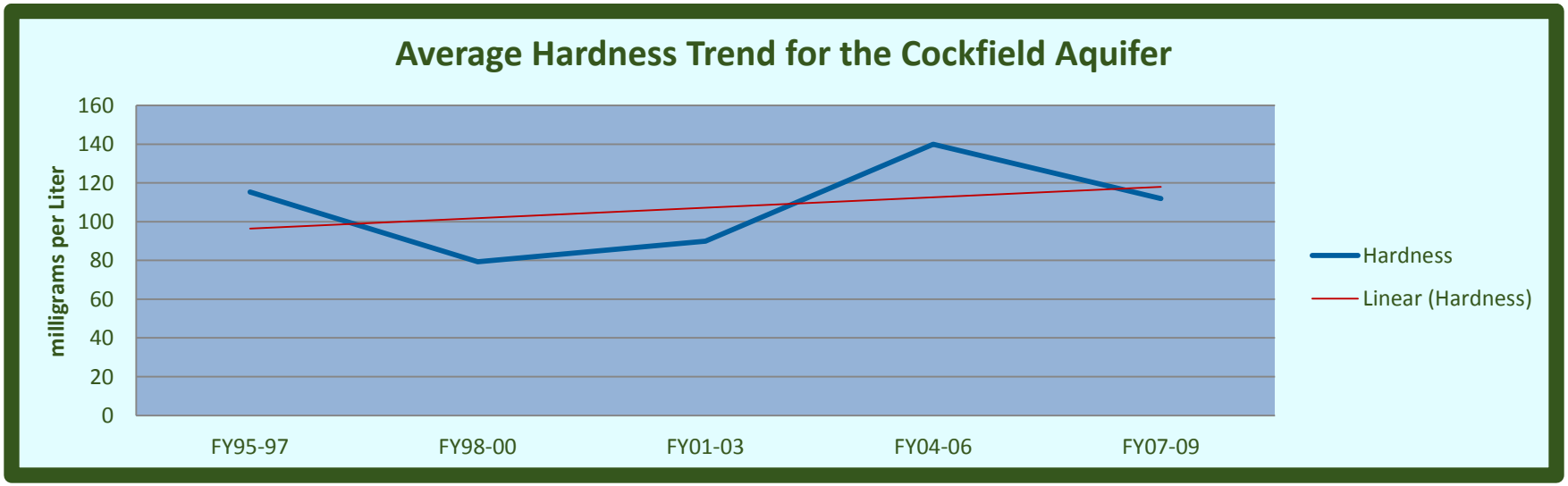

Chart 9-13: Nitrite – Nitrate Trend

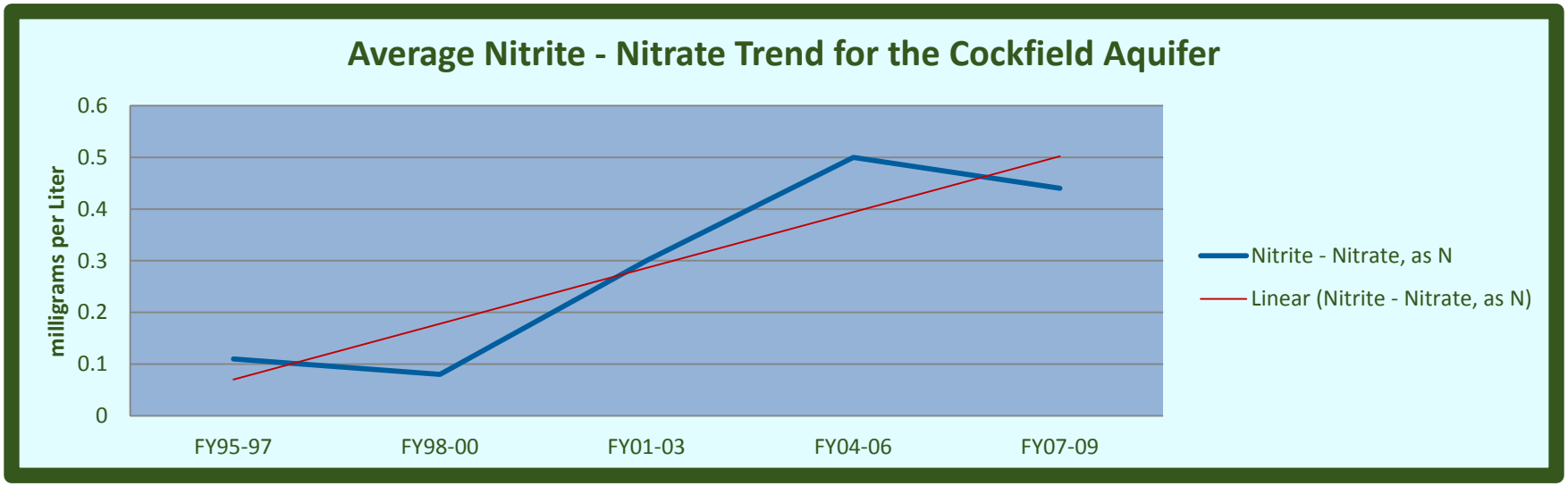

Chart 9-14: TKN Trend

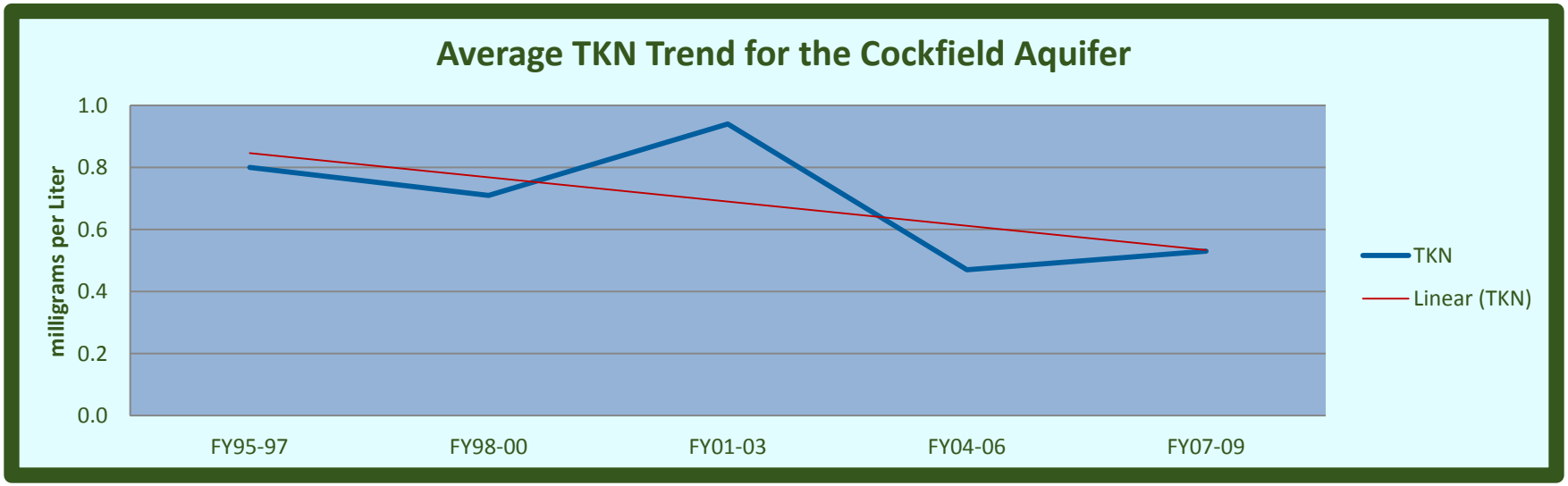

Chart 9-15: Total Phosphorus Trend

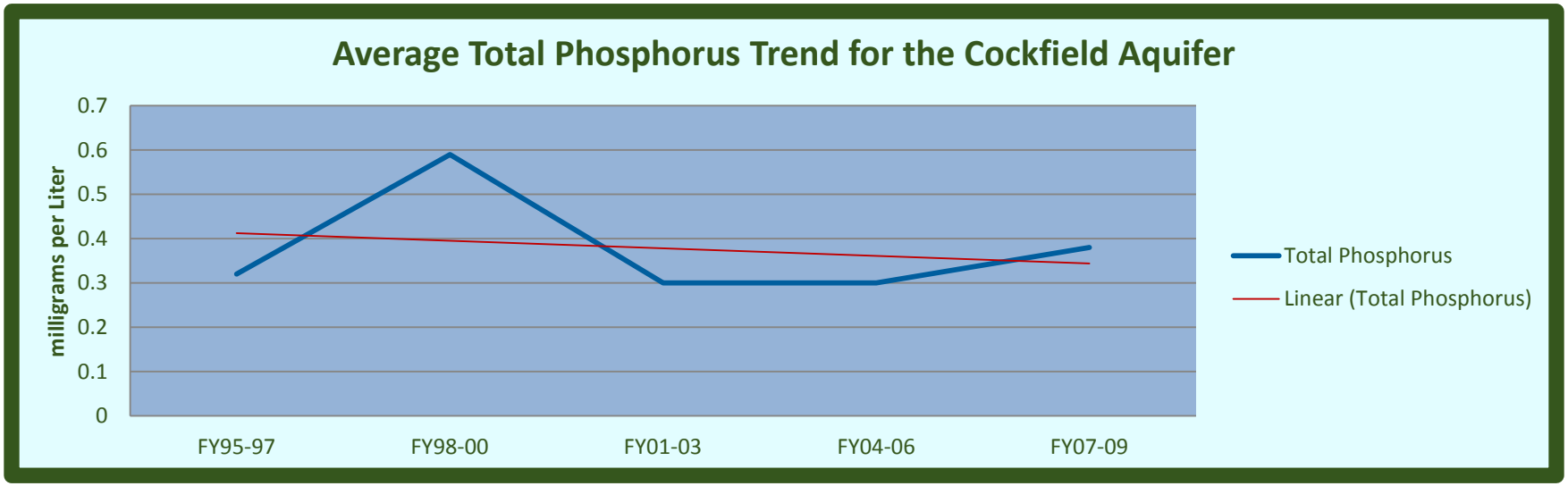

Chart 9-16: Iron Trend