Temporal Variations in the Amount and Distribution of Saltwater and Freshwater

Kansas Geological Survey Open File Report 94-28c

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A cooperative investigation by

The Kansas Geological Survey and
Big Bend Groundwater Management District No. 5

Introduction:

In order to achieve the Mineral Intrusion project goal of describing and understanding the inventories and movements of freshwater and saltwater in the Great Bend Prairie aquifer, an extensive program of water level measurements, well logging, and sampling has been developed for the monitoring well network shown in figure C1. The figure also shows the locations of a "transect area" designated for more intensive study because of the presence of high salinity ground waters, and the Siefkes site where intensive local investigations of the effects of irrigation pumpage on the saltwater interface are being carried out. Additional background information on the objectives, setting and methods of the project may be found in OFR 94-28a and the references contained therein.

This report updates the water-level measurements presented by Young et al. (1993) to include 1994 data, and presents information on variations in transition zone elevations and characteristics based on the results calculated in OFR 94-28b. It also presents the results of chemical analyses showing the relative importance of oil brine and natural salt in the water quality deterioration observed at the Siefkes irrigation well during the limited 1993 pumping season.

The Permian monitoring well at each GMD5 observation well site (except sites 13, 14, and 44) was relogged during March-April, 1994. Sites 13, 14, and 44 have freshwater in the Permian underlying the Quaternary aquifer in southern Pratt County and will be relogged when time permits. Logging of the transect wells is continuing on an approximately monthly schedule. The Siefkes wells are being monitored frequently to determine the effects of irrigation pumping on freshwater/saltwater dynamics. Monitoring and sampling of the Siefkes site during 1994 is particularly important because of the heavy rains, recharge, and minimal pumping which occurred in 1993.

Water Level Variations:

KGS/GMD5 observation well network

The water levels or heads listed and discussed in this section are actual fluid levels measured in wells, corresponding to the point water level (Hip) discussed in OFR 94-28b. Because there was minimal variation in the saltwater contents or transition zone characteristics (see below), these values provide an adequate basis for assessing changes at individual sites without the calculation of the density effects considered in that report.

As a result of the unusually high precipitation and recharge in 1993, water levels rose in virtually every well in the monitoring well network during 1993 (Young et al., 1993). January 1994 water levels were greater than or approximately equal to January 1993 water levels in all wells. A summary table of water levels from the KGS/GMD5 monitoring-well network is contained in Appendix A. The summary table lists all 1993-94 water-level measurements from the study wells and calculated hydraulic-head

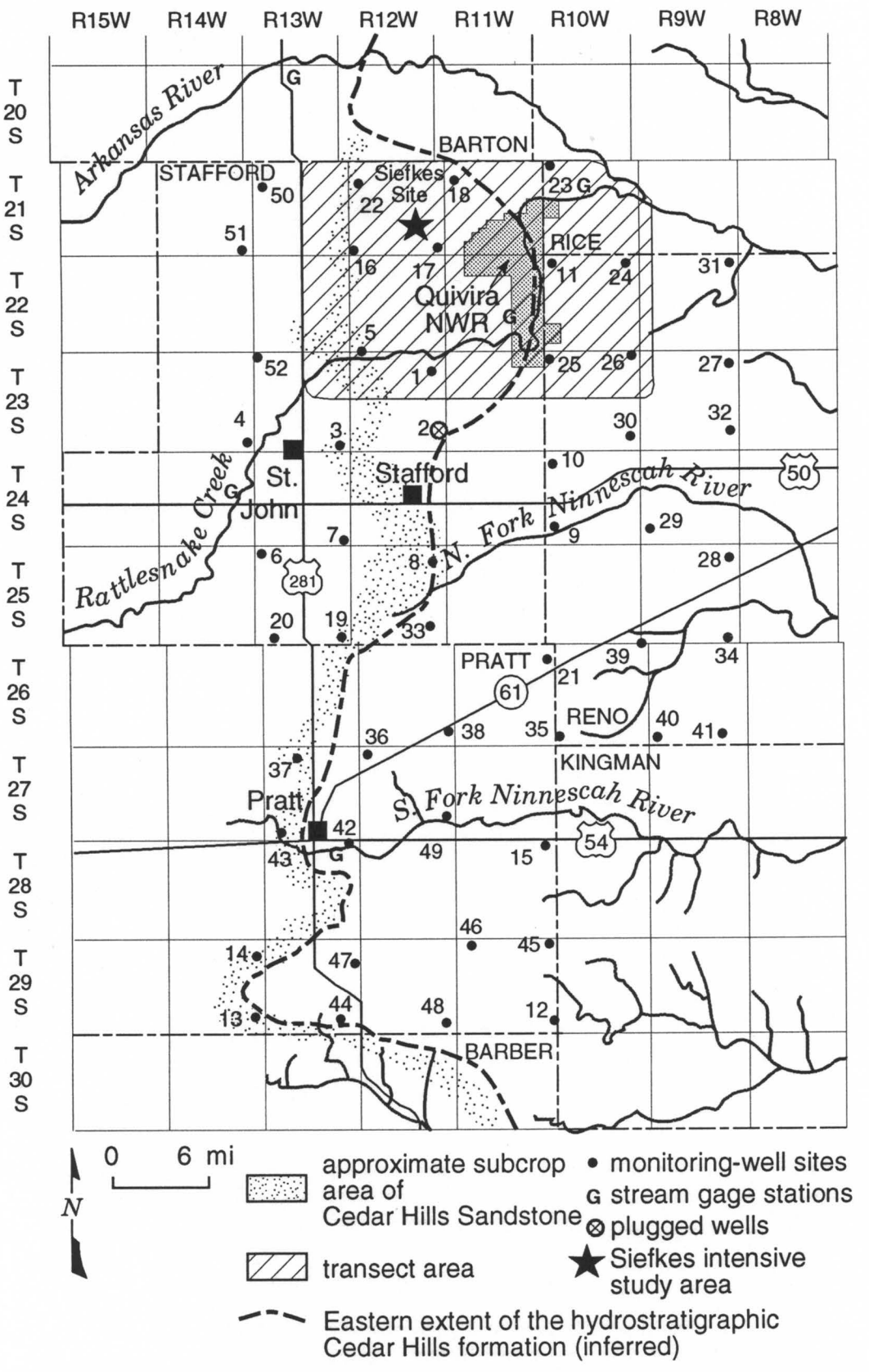

Figure C1. Observation wells and other physical features in the area of the KGS/GMD5 monitoring-well network.

differences among the various wells at each site. Included for comparison are the averages and standard deviations of the heads and head differences for 1993-94 and the period 1987-93. The 1993-94 water levels are typically higher than those in previous years.

Hydrographs illustrating 1993-94 water-level fluctuations in all wells at the saline transition zone sites are contained in Appendix B. The reader is cautioned that the lines connecting data points do not necessarily represent the behavior of the water levels, but are merely for convenience in showing trends. The hydrographs illustrate that at many sites water levels peaked in the second half of 1993 and have fallen over the winter. However, water levels in the first few months of 1994 were generally higher than they were one year earlier. While water-level rises were synchronous in the different wells at many sites, Permian head changes lagged behind shallow aquifer well changes at certain sites, such as site 16. At sites 4 and 6, where a Cretaceous confining layer apparently separates the Permian from the Great Bend Prairie aquifer, Permian heads fluctuated very little.

Observed net head rises in the shallow aquifer and Permian monitoring wells from January 1993 to January 1994 are summarized in figure C2. The greatest water-level rises were observed in the northern part of the study area, north of the North Fork of the Ninnescah River and the Stafford/Pratt county line. Head rises tended to be higher at greater distances from streams or other discharge features. Many of the largest water-level rises were observed in the transect area. At site 18, for example, the head in the shallow well showed a net rise of more than 11 feet and the Permian head rose about 8 feet from January 1993 to January 1994.

Observed Permian head rises were less than or approximately equal to water-table rises at most sites (figure C2). An exception is site 16, where the head in the shallow aquifer well rose 8 feet and the Permian head rose 10 feet. The Permian head remained above the deep aquifer head at sites 5 and 25. At sites 4 and 18, the average Permian head, previously above the average deep aquifer head, has been below the average deep aquifer head in 1993-94. At sites 6 and 18, the deep aquifer head dropped below the Permian head in August 1993, possibly due to nearby pumping (see well hydrographs in Appendix B). This phenomenon was observed at site 18 as early as late May in 1994.

The observed rise in the Permian well at site 1 in April 1994 has been attributed to recent agitation (by airlifting) and possibly a broken well casing. Recent airlifting may also be responsible for the observed rise in the Permian well at site 18 in late March. Those wells and wells at sites 5, 7, 9, 11, and 19 were airlifted in late March 1994 in an attempt to redevelop and remove sediment from the bottom of the wells so they could be logged to greater depths.

Siefkes intensive study site

A primary objective of the logging efforts, particularly at the Siefkes intensive study site (figure C3 and table C1), is to monitor the effects of (irrigation) pumping on

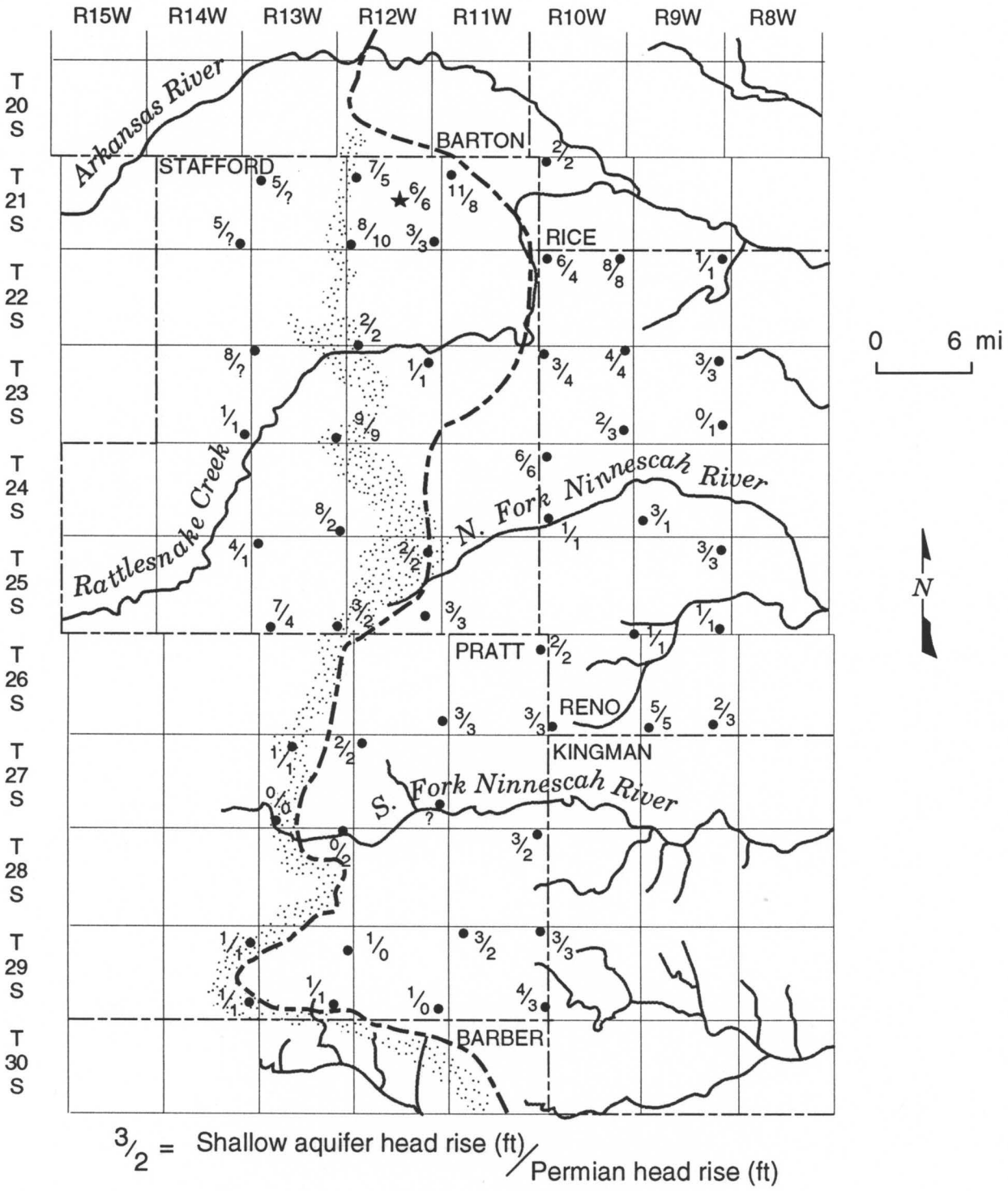

Figure C2. Net water-level rises in shallow aquifer and Permian monitoring wells from January 1993 to January 1994.

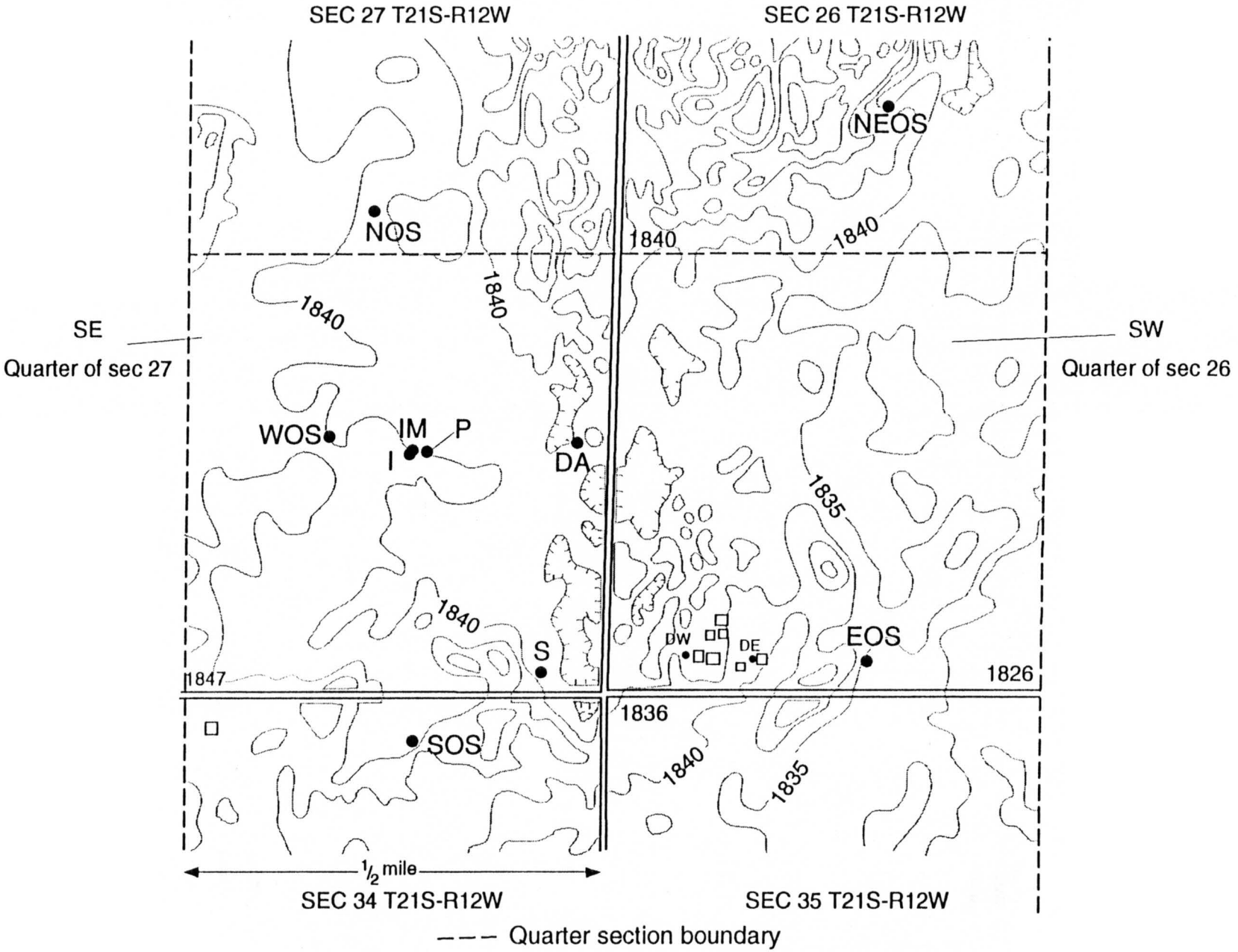

Figure C3. Wells in the Seifkes intensive study area. See Table C1 for well identification and characteristics, and Table C2 for 1993-94 data. Contours indicate approximate elevation of land surface (feet above mean sea level).

Table C1: Information for wells in the Siefkes intensive study area.

Legal location	Well	Description	Top of screen (bls)	Depth (bls)	Land surface elev.	Elev. top of screen	Elev. bottom of well
21-12-27DACC	I	Irrigation well near center of SE Sec. 27 T21S-R12W	60	120	1840.7	1780.7	1720.7
21-12-27DBDC	WOS	Oil-field supply well west of irrigation well	65	85	1839.4	1774.4	1754.4
21-12-27DACC	IM	2" monitoring well near irrigation well	–	60	1840.7	–	1780.7
21-12-27ACDD	NOS	Oil-field supply well north of irrigation well	100	120	1839.0	1739.0	1719.0
21-12-27DDDC	S	Stock well southeast of irrigation well	80	90	1836.3	1756.3	1746.3
21-12-34AAB	SOS	Oil-field supply well south of irrigation well	80	100	1841.0	1761.0	1741.0
21-12-26CDCC	EOS	Oil-field supply well east of irrigation well	80	100	1832.9	1752.9	1732.9
21-12-27DACC	P	KGS Permian monitoring well	198	228	1839.6	1641.6	1611.6
21-12-27DADD	DA	KGS deep aquifer monitoring well	157	167	1839.8	1682.8	1672.8
21-12-26BDB	NEOS	Oil-field supply well north-east of irrigation well	90	105	1840*	1750*	1735*

*Elevations approximate, estimated from topographic map. All other elevations surveyed.

the freshwater-saltwater interface or transition zone. Because of extraordinary amounts of precipitation (and subsequent recharge and ponding) in the spring and summer of 1993, pumping was minimal. However, enough irrigation occurred late in the 1993 season and early in 1994 to provide some observations on responses to the start and stop of pumping. Fluid levels at the Siefkes site are presented in table C2 (which also indicates the dates on which irrigation was occurring) and illustrated in figures C4-C6.

At the Siefkes site, water levels in all wells showed a net increase of about 6 feet between April and October 1993 (large areas of the field and roads at the Siefkes site were under water much of the summer of 1993) and then a drop of about 2 feet over the winter (see table C2 and figures C4-C6). Thus, March-April 1994 water levels were approximately 4 feet higher than March-April 1993 levels. Figures C4-C6 illustrate the rapid drop in water levels when the irrigation well is turned on (for example, in late July 1993 and in April 1994). Among the shallow wells (figs. C4 and C6) the response is greatest in the wells closest to the pumping well. The deep aquifer monitoring well shows a greater response to pumping than does the Permian monitoring well, in spite of being at a greater lateral distance from the pumping well. Both the deep and shallow aquifer heads drop below the Permian head during pumping cycles (see figs. C5 and C6). Notice that such a head reversal was not observed until late July in 1993, but was observed as early as late March in 1994. On May 16, 1994 the deep aquifer head dropped below the Permian head when the irrigation well at the site was not pumping, but when an irrigation well approximately one-half mile west was pumping. Although water levels are still higher than in previous years, 1994 monitoring should yield data more representative of a normal irrigation season than 1993.

Transition Zone Characteristics and Elevation:

KGS/GMD5 observation well network

By processing and analyzing data from the logs and other available information (especially Whittemore, 1993), Young et al. (1993) designated the sites that exhibit elevated salinity (a chloride concentration greater than 250 mg/L) and/or a freshwater-saltwater interface or transition zone above the bedrock as saline transition zone sites; they are identified in figure C7. At sites 4, 6, 7, 50, 51, and 52, the alluvial aquifer presumably is separated from Permian strata by Cretaceous bedrock (Fader and Stullken, 1978), which can act to confine saltwater below the Great Bend Prairie aquifer. However, chloride concentrations greater than 250 mg/L have been observed above bedrock at sites 4, 6, and 51 (Whittemore, 1993)

The Permian well at site 7 yields very saline water. It was not possible to log to bedrock at site 7 to determine where the saline transition zone is located. However, the water samples collected in 1978 and 1983 from the well screened at the base of the Quaternary aquifer both contained chloride concentrations less than 200 mg/L. Also, the second sample had a chloride content slightly less than that of the first sample. A third sample was collected in March 1994; the chloride concentration was 146 mg/L, within 10% of that in the sample obtained in 1983. This confirmed that the saline transition

Table C2A. 1993-94 water levels in wells at the Siefkes site.								
				Depth to water (ft)				
SIEFKES								
SITE	IRR*	P	DA	IM	WOS	SOS	EOS	NOS
3/24/93				15.2	14.2			16.8
3/26/93							18.6	
4/17/93		23.0	22.6					
5/20/93		22.2	20.9					
5/25/93		22.0	20.7	12.8	11.2	14.8	16.0	13.8
7/7/93		21.7	19.5	11.4	9.5	13.4	15.0	12.5
7/8/93		20.9	18.8	10.8	8.9	12.7	14.4	11.8
7/27/93		19.1	18.5	10.0	8.1	11.5	13.5	
7/29/93	x	21.2	23.0	43.9	16.9	16.2	16.3	
8/17/93	x	21.1	21.6	45.0	17.1	15.8	16.5	15.6
8/23/93				13.4		15.4	16.4	
8/24/93	x	22.4	23.4	45.9	17.8	17.3	17.2	
8/25/93		22.5	22.2	44.4	17.4	16.4	16.5	
9/10/93		18.7	17.4	10.2	8.7	11.8	13.1	
9/18/93		18.1	16.4	9.0	7.0	10.7	12.5	
10/12/93	x	18.4	19.6	42.2	13.9	13.1	14.0	
10/13/93		19.1	17.5	10.4	8.2	11.9	13.5	10.7
10/14/93		18.0	17.0					
10/21/93		17.3	16.6	9.8	7.5	11.2	12.9	10.0
3/4/94			17.5	10.8		12.2	13.8	11.1
3/5/94		17.9		10.8	8.6			
3/23/94					8.8			11.4
3/24/94		18.4	18.3	11.4	9.2	12.7	14.4	
3/30/94		18.4	18.0	11.3	9.0	12.6	14.2	11.5
3/31/94	x	18.9	19.2	37.9	13.0	13.3	14.4	12.6
4/1/94	x	18.8	20.4	42.4	15.0	14.2	15.0	13.3
4/8/94					9.6			
4/13/94		18.4	17.9	11.4	9.0	12.6	14.1	11.4
4/19/94		18.6	18.4	11.7	9.3	12.8	14.5	12.0
4/21/94	x	18.9	21.4	42.6		14.9	15.8	
4/22/94	x	20.4	22.8	44.7	17.3	17.2	17.0	
5/16/94		18.6	18.1	11.4			14.3	11.6
5/19/94		19.4	19.8	13.0	11.3	14.2	15.5	13.8
5/26/94		20.2	19.8	12.8			15.8	
*-- x indicates irrigation well pumping								

Table C2B. 1993-94 water levels in wells at the Siefkes site.

Water level elevations (ft above mean sea level)

	IRR*	P	DA	IM	WOS	SOS	EOS	NOS
3/24/93				1825.5	1825.2			1822.2
3/26/93							1814.3	
4/17/93		1816.6	1817.2					
5/20/93		1817.4	1818.9					
5/25/93		1817.6	1819.1	1827.9	1828.2	1826.2	1816.9	1825.2
7/7/93		1817.9	1820.3	1829.3	1829.9	1827.6	1817.9	1826.5
7/8/93		1818.7	1821.0	1829.9	1830.5	1828.3	1818.5	1827.2
7/27/93		1820.5	1821.3	1830.7	1831.3	1829.5	1819.4	
7/29/93	x	1818.4	1816.8	1796.8	1822.5	1824.8	1816.6	
8/17/93	x	1818.5	1818.2	1795.7	1822.3	1825.2	1816.4	1823.4
8/23/93				1827.3		1825.6	1816.5	
8/24/93	x	1817.2	1816.4	1794.8	1821.6	1823.7	1815.7	
8/25/93		1817.1	1817.6	1796.3	1822.0	1824.6	1816.4	
9/10/93		1820.9	1822.4	1830.5	1830.7	1829.2	1819.8	
9/18/93		1821.5	1823.4	1831.7	1832.4	1830.3	1820.4	
10/12/93	x	1821.2	1820.2	1798.5	1825.5	1827.9	1818.9	
10/13/93		1820.5	1822.3	1830.3	1831.2	1829.1	1819.4	1828.3
10/14/93		1821.6	1822.8					
10/21/93		1822.3	1823.2	1830.9	1831.9	1829.8	1820.0	1829.0
3/4/94			1822.3	1829.9		1828.8	1819.1	1827.9
3/5/94		1821.7		1829.9	1830.8			
3/23/94					1830.6			1827.6
3/24/94		1821.2	1821.5	1829.3	1830.2	1828.3	1818.5	
3/30/94		1821.2	1821.8	1829.4	1830.4	1828.4	1818.7	1827.5
3/31/94	x	1820.7	1820.6	1802.8	1826.4	1827.7	1818.5	1826.4
4/1/94	x	1820.8	1819.4	1798.3	1824.4	1826.8	1817.9	1825.7
4/8/94					1829.8			
4/13/94		1821.2	1821.9	1829.3	1830.4	1828.4	1818.8	1827.6
4/19/94		1821.0	1821.4	1829.0	1830.1	1828.2	1818.4	1827.0
4/21/94	x	1820.7	1818.4	1798.1	1839.4	1826.1	1817.1	
4/22/94	x	1819.2	1817.0	1796.0	1822.1	1823.8	1815.9	
5/16/94		1821.0	1821.7	1829.3			1818.6	1827.4
5/19/94		1820.2	1820.0	1827.7	1828.1	1826.8	1817.4	1825.2
5/26/94		1819.4	1820.0	1827.9			1817.1	

*-- x indicates irrigation well pumping

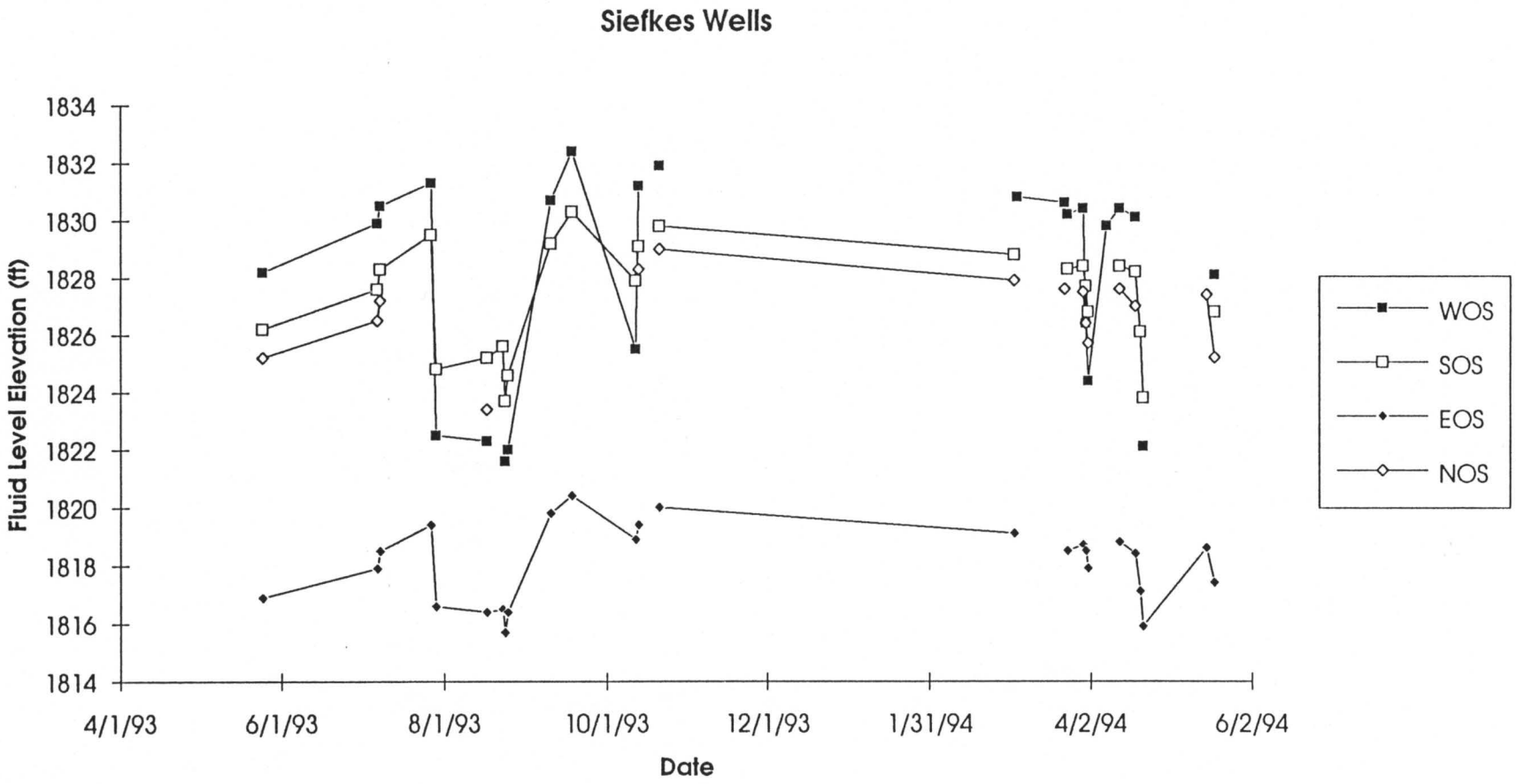

Figure C4. Hydrographs of shallow wells surrounding the Siefkes site. See Figure C3 and Tables C1 and C2 for locations, well characteristics, and data.

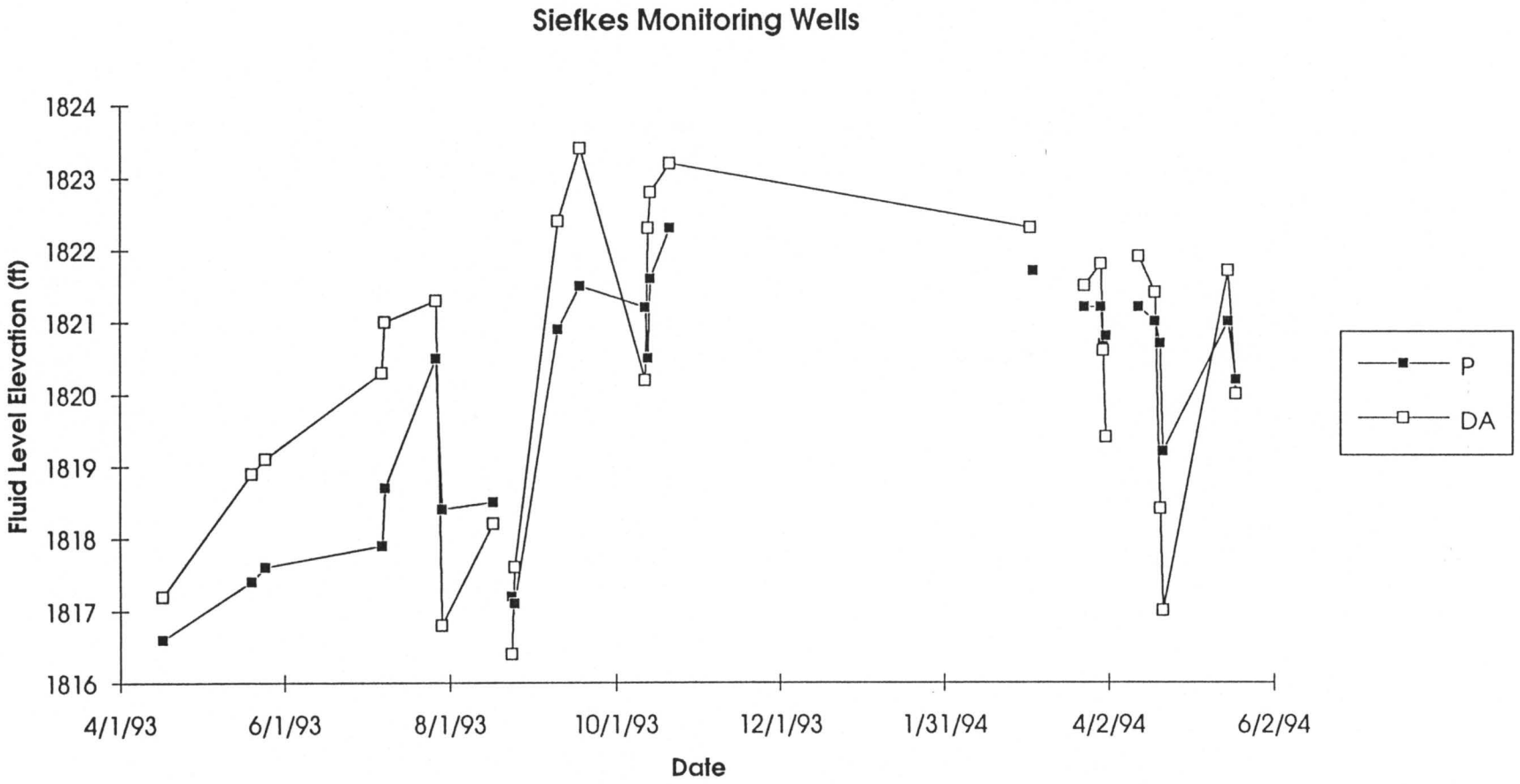

Figure C5. Hydrographs of the Permian (P) and Deep Aquifer (DA - base of Great Bend Prairie Aquifer) monitoring wells at the Siefkes site. See Figure C3 and Tables C1 and C2 for locations, well characteristics, and data.

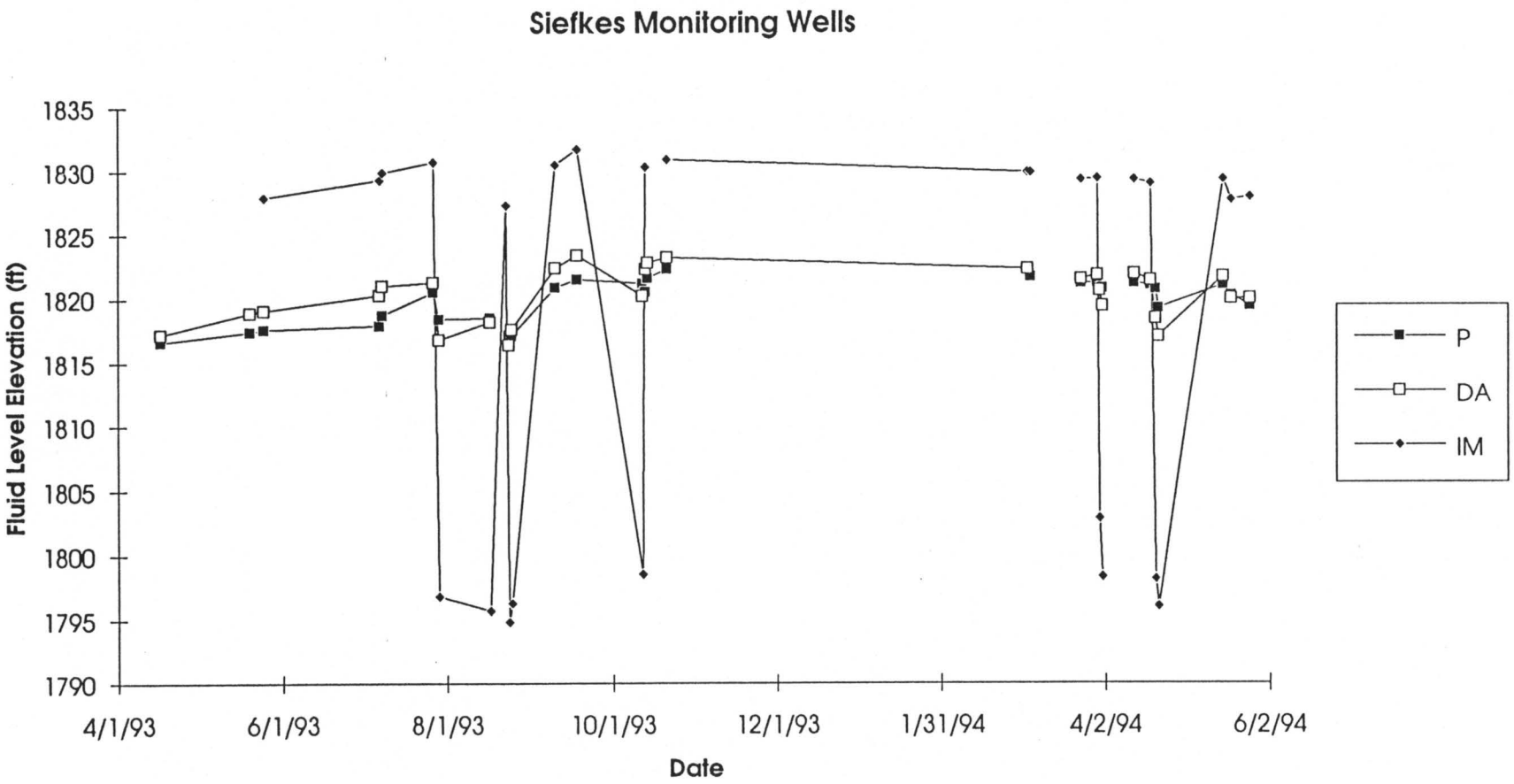

Figure C6. Hydrographs of the Permian (P) and Deep Aquifer (DA - base of Great Bend Prairie Aquifer) monitoring wells at the Siefkes site, rescaled for comparison to the hydrograph of the water table monitoring well (IM) immediately adjacent to the irrigation well. See Figure C3 and Tables C1 and C2 for locations, well characteristics, and data.

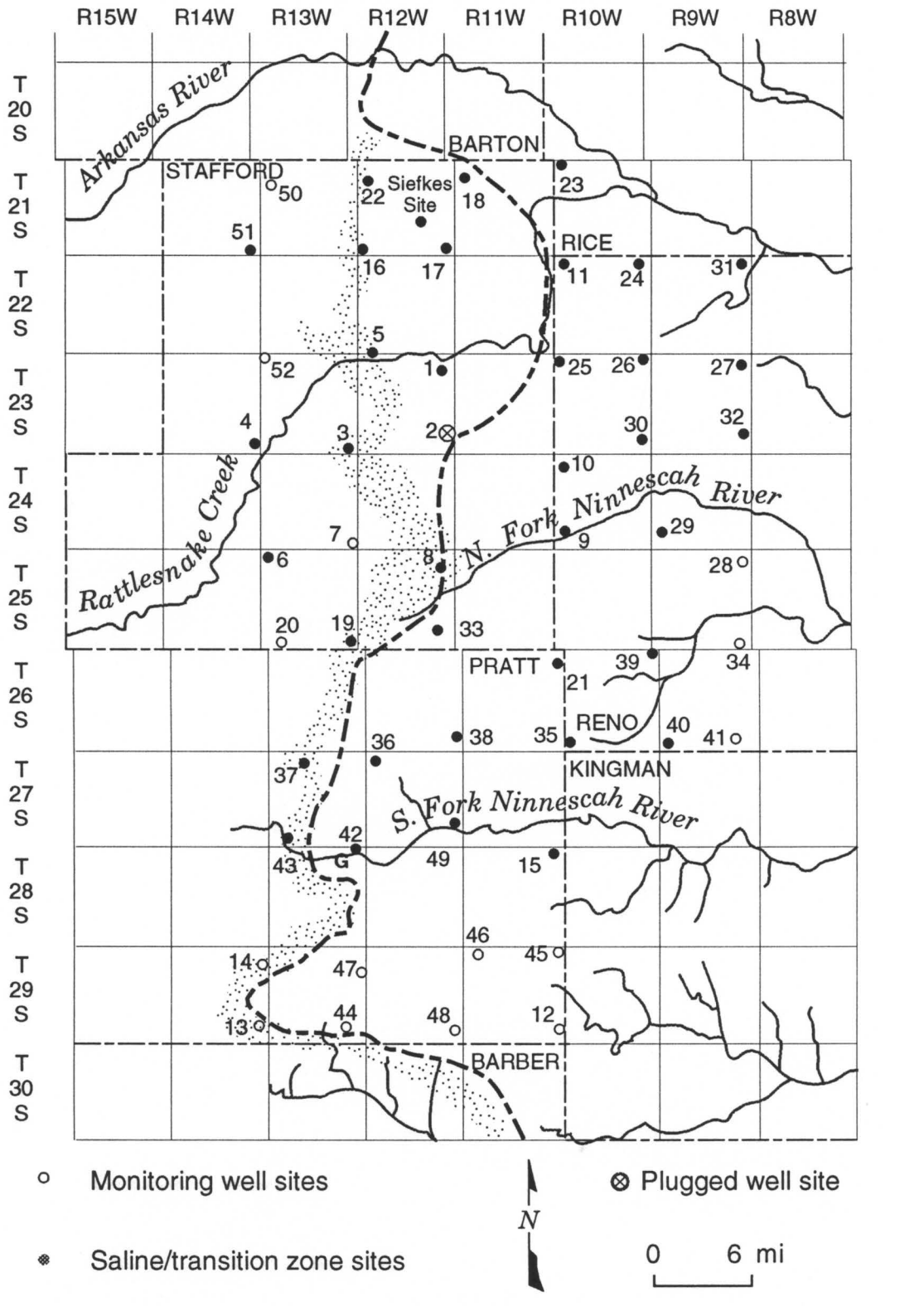

Figure C7. Monitoring well sites and site numbers, indicating the saline transition zone sites.

zone is below the base of the Quaternary aquifer and thus at some position within the bedrock above the screened interval of the Permian well. Therefore this site has been removed from the list of sites with an identified or probable transition zone within the aquifer. Site information and additional chemical data for the new sample from well 2 at site 7 are given in tables C3 and C4, respectively.

Geophysical logging at site 19 indicated a saline transition zone exists near the contact of the Quaternary aquifer and the underlying Permian bedrock (Young et al., 1993). The log analysis showed a marked increase in the water conductivity just above the screened interval of the Permian well. Only one water sample had been collected from the Permian well; the observed chloride concentration (192 mg/L) was much lower than expected based on the distribution of salinity for surrounding Permian observation wells in the GMD5 network and based on the log analysis. The well was further developed in 1994 and then resampled. The analysis (table C4) showed that the water from the Permian at the depth of the well is saline and contains a chloride concentration of 6,210 mg/L. The salinity is close to that in water from the Permian well at site 20, the next site to the west, and fits the general chloride pattern contoured by Whittemore (1993) for the Permian underlying the Quaternary aquifer. Plate 2 in Whittemore (1993) will be revised to reflect the updated information.

Background data for each of the saline transition zone sites are listed in table C5. These data include land surface elevations, elevations of and depths to water and bedrock, and the specific conductance and chloride values of water samples from the Permian wells. Table C6 contains transition zone characteristics and parameter estimates from OFR 94-28b. These data include D1, D2, M0, M1, R, and the depth to the 500 mg/L chloride concentration elevation (based on fitted curves). These values are discussed and defined in OFR 94-28b. Also included is the depth to the 100 mS/m elevation at each of the transition zone sites; this value is read directly from the corrected conductivity profiles. The 100 mS/m C_m' level refers to an aquifer conductance equivalent to a chloride concentration of approximately 3,300 mg/L (see Young et al., 1993). The 500 mg/L elevations listed are estimates based on the curve-fitting approach of the elevation below which fresh water is not expected to occur. See Young et al. (1993) for figures showing the corrected EM logs and water-quality data from earlier measurements.

At sites 8 and 19, the geophysical log analysis suggests that there is saline water (chloride >500 mg/L) perched on clay layers in the profiles with fresher water below; this is not reflected in table C6. The perched saline water in the log profile for site 19 is at a depth of about 70 ft and is marked, while that at site 8 is much less pronounced. Site 19 is within an oil field suggesting the possibility of past brine contamination from the surface that infiltrated and now remains as diluted saltwater resting on a clay, whereas site 8 is not within an oil field.

Young et al. (1993) commented on the apparent stability of the transition zone compared to the substantial changes in head and water level during 1993. Although consideration of the 1994 data and the extended calculation of additional transition zone

Table C3. Identification and Information for Sites Sampled for Water Chemistry in the Mineral Intrusion Study.

Well ID	Legal location	Well description	Well depth ft.
SS-I	21S-12W-27DACC	Siefkes irrigation well	120
SS-IM	21S-12W-27DACC	Siefkes irrigation observ. well	60
SS-P	21S-12W-27DACC	Permian observation well	228
SS-DA	21S-12W-27DADD	Aquifer base observation well	167
SS-S	21S-12W-27DDDC	Siefkes stock well	90
SS-WOS	21S-12W-27DBDC	Oil field supply well W	85
SS-EOS	21S-12W-26CDCC	Oil field supply well E	100
SS-NOS	21S-12W-27ACDD	Oil field supply well N	120
SS-DE	21S-12W-26CC	Siefkes domestic well E	90
SS-DW	21S-12W-26CC	Siefkes domestic well W	96
SS-WI	21S-12W-27C	Irrigation well W	101
SS-SI	21S-12W-34A	Irrigation well S	
SS-OB1	21S-12W-34A	Oil brine, tank near disposal well	
7-2	24S-13W-36DDDD	KGS/GMD5 mon. well 7-2	154
19-1	25S-13W-36DCCC	KGS/GMD5 mon. well 19-1	185

SS = Siefkes Site

Table C4. Chemical Properties and Constituent Concentrations in Water Samples Collected for the Mineral Intrusion Study. Samples are listed in chronological order of collection. See table C3 for site information listed according to well identification.

Well ID	Date collected	Sample time or information	Lab Sp.C. uS/cm	Lab pH	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Sr mg/L	HCO3 mg/L	Cl mg/L	SO4 mg/L	NO3 mg/L	Br mg/L	I mg/L
SS-WOS	03-23-93		750								95.6	11.1	130	0.096	0.001
SS-S	03-23-93		1130								238.2	10.1	26.6	0.860	0.005
SS-DE	04-15-93		820								116.0	14.5	47.9	0.320	0.003
SS-DW	04-15-93		770								125.7	8.0	17.4	0.390	0.002
SS-IM	04-13-93		680								90.6	9.3	107	0.087	0.001
SS-EOS	04-15-93		1320								308	14.2	10.2	0.910	0.002
SS-NOS	04-15-93		680								95.0	14.4	29.8	0.240	0.003
SS-P	04-14-93	200 gal*	55600								20960	2540	3.0		
SS-P	04-15-93	300 gal*	60600	9.55							25240	2870	1.6	3.84	0.081
SS-DA	04-15-93	200 gal*	37300								13620	1500	0.9	2.15	0.049
SS-DA	04-15-93	400 gal*	38400	7.80	347	162	8880	<12	3.20	292	13940	1530	0.6	2.22	0.050
SS-P	06-02-93		70800	7.85	711	370	17800	<25	14.1	277	26670	3180	0.2	4.14	0.108
SS-I	07-28-93	11:45	1085	7.60	136	9.5	53.2	3.4	0.52	157	203.1	15.3	89.2	0.328	0.002
"	07-28-93	14:45	1085								206.7	15.6	86.4	0.337	0.001
"	07-28-93	18:05	1105								210.8	16.2	84.1	0.343	0.001
"	07-29-93	10:00	1135	7.55	132	9.4	68.3	3.7	0.51	164	220.9	17.0	78.2	0.352	0.001
SS-I	08-23-93	9:00	1315	7.60	131	10.1	102	4.3	0.55	194	279.0	21.8	55.8	0.424	0.002
"	08-24-93	9:15	1350								292.9	22.7	53.6	0.432	0.002
"	08-24-93	13:55	1345								291.6	22.8	53.8	0.430	0.002
"	08-25-93	13:50	1350	7.60	128	10.2	114	4.4	0.55	182	292.9	22.8	53.2	0.436	0.002
SS-OB1	08-25-93		93300	7.45	2670	1140	18400	152	429	456	36350	230		137	5.560
SS-I	10-12-93	15:30	1315	7.65	126	9.9	105	4.3	0.55	182	283.8	21.4	52.3	0.429	0.002

Table C4. continued

Well ID	Date collected	Sample time or information	Lab Sp.C. uS/cm	Lab pH	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Sr mg/L	HCO3 mg/L	Cl mg/L	SO4 mg/L	NO3 mg/L	Br mg/L	I mg/L
7-2	03-24-94	14:00	937	8.10	26.9	4.3	166	1.9	0.23	243	146	34.4	15.5		
SS-I	03-31-94	9:22	900	7.60	129	9.2	21.3	3.3	0.5	133	135	13.2	126		
SS-IM	03-31-94	9:40	835								130	10.0	130		
SS-I	04-01-94	10:15	1083								203	15.7			
19-1	04-07-94	8:45	19300	7.80	581	153	3510	12.5	8.91	55.2	6213	796	3.2		
SS-I	04-08-94	12:10	1220		132	9.9	84.9	4.1	0.55		253	18.7	64.9		
"	04-21-94	16:20	1110								212	16.7	75.4		
"	04-22-94	8:40	1280								266	20.6	60.5		
SS-SI	05-18-94	**	532	7.80	69.9	4.6	31.7	3.8	0.27	233	33.4	13.8	25.0	0.026	0.0009
SS-WI	05-19-94	12:00	920	7.60	123	10.1	30.7	4.0	0.52	170	162.7	18.8	46.8	0.097	0.0035

Nitrate concentrations were determined by the ultraviolet spectrophotometric method. Nitrate-N concentrations can be calculated by dividing the nitrate concentration by 4.427.

*Amount pumped before sampling.

** Sample collected from upright--mix from two wells.

Table C5. Background data for saline transition zone sites.

SITE	LOCATION	LAND ELEV	DATE	DTW	DEPTH TO BR	WL ELEV	BR ELEV	COND (mS/m)	Cl (mg/L)
1	23-12-12BAA	1827	3/26/93	5.3	146	1821.7	1681	3690	13200
3	23-13-36DCC	1898	5/19/93	22	130	1876	1768	ND	ND
4	23-14-36DDC	1912	4/22/93	8.7	129	1903.3	1783	7760	31000
5	23-12-06BBB	1855	9/17/93	1.8	181	1853.2	1674	8550	41200
6	25-13-06BCB	1950	4/19/93	19.3	148	1930.7	1802	10200	42640
8	25-12-11AAA	1848	4/21/93	8.8	117	1839.2	1731	10600	43800
9	24-10-31CBC	1755	4/25/93	9	87	1746	1668	1070	3280
10	24-10-06DCC	1790	4/25/93	18.3	156	1771.7	1634	623	1710
11	22-10-06CBB	1763	3/27/93	13.5	208	1749.5	1555	6690	25000
15	28-11-01AAA	1725	4/22/93	29.7	128	1695.3	1597	213	466
16	21-12-31CCC	1872	3/25/93	12	220	1860	1652	8850	34800
17	21-12-36DDC	1804	3/25/93	11.6	114	1792.4	1690	2890	9880
18	21-11-07BBB	1810	3/25/93	19	214	1791	1596	3520	12200
19	25-13-36DCC	1901	4/19/93	11.7	163	1889.3	1738	1930	6210
21	26-11-01DDD	1801	5/20/93	21.6	137	1779.4	1664	3510	11700
22	21-12-06CCB	1855	3/25/93	16.1	215	1838.9	1640	8260	32500
23	21-10-06AAD	1743	4/20/93	22.4	94	1720.6	1649	2130	6480
24	22-10-01ADB	1743	4/20/93	27.3	123	1715.7	1620	631	1820
25	23-10-06BBA	1780	3/28/93	6.3	98	1773.7	1682	4100	17400
26	23-10-01AAA	1738	4/20/93	6.8	177	1731.2	1561	3710	13470
27	23-09-01ADA	1685	4/20/93	9.9	104	1675.1	1581	651	1841
29	24-10-36AAA	1732	4/25/93	38.6	151	1693.4	1581	6000	22000
30	23-10-36DAA	1750	4/25/93	13.1	134	1736.9	1616	652	2410
31	22-09-01ADA	1664	4/20/93	13.4	93	1650.6	1571	652	1771
32	23-09-25DDD	1689	4/24/93	2.5	172	1686.5	1517	715	1864
33	25-12-36CBB	1872	5/20/93	33.9	141	1838.1	1731	425	1160
35	26-10-31CCC	1760	4/21/93	19	153	1741	1607	2140	6750
36	27-12-06BAA	1892	4/21/93	28	195	1864	1697	5680	21800
37	27-13-05CAB	1971	4/21/93	58.7	240	1912.3	1731	770	2310
38	26-12-36ADD	1844	4/21/93	26	189	1818	1655	691	1908
39	26-10-01AAA	1679	10/22/93	3.2	55	1675.8	1624	3630	12300
40	26-09-31DCC	1735	4/22/93	56.2	158	1678.8	1577	272	663
42	28-13-01CBA	1829	4/22/93	13.1	160	1815.9	1669	1550	4900
43	27-13-31DDD	1872	4/22/93	5	65	1867	1807	750	2198
49	27-12-35AAA	1737	7/7/93	-1.3	105	1738.3	1632	8480	32700
51	21-14-36DDD	1916	3/26/93	17.3	200	1898.7	1716	ND	ND
SP	21-12-27DACC	1840	9/18/93	9	186	1831	1654	7080	26670
SDA	21-12-27DADD	1840	9/18/93					3840	13940

DTW- Depth to water (feet below land surface) in shallow wells. Some values estimated.

Water levels in all wells are listed in Appendix B.

COND- Specific conductance of water from Permian wells and Siefkes deep aquifer well.

Cl- Chloride concentration of water from Permian wells and Siefkes deep aquifer well.

Table C6. Transition zone data.								
Site	Date	D1	D2	M0	M1	R	500 mg/L	100 mS/m
1	3/26/93	90	127.7	133.18	17.07	0.9909	94.6	111.7
	4/15/94	90	127.7	134.54	17.89	0.9892	94.1	112
3	5/19/93	94	119	197.41	43.01	0.8229	100.2	
	4/13/94	94	119	192.14	39.93	0.8102	101.9	
4	4/22/93	80	100	177.57	49.71	0.764	65.1	
	4/13/94	80	100	165.23	44.26	0.8814	65.1	
5	9/17/93	66	106	98.88	12.64	0.972	68.3	79.6
	10/16/93	66	106	96.89	13.02	0.9755	67.5	79.3
	4/19/94	66	106	97.27	12.54	0.9754	68.9	80.4
6	4/19/93							
	4/13/94	78	97	156.2	31.73	0.88445	84.5	
8	4/21/93						117	
	4/7/94						117	
9	4/25/93	40	79.5	90.07	17.34	0.5944	50.9	76.5
	4/14/94	40	79.5	88.04	16.18	0.5655	51.4	76.4
10	4/18/93	111	126	164.71	24.53	0.81843	109.2	
	4/7/94	111	126	160.34	21.82	0.82634	111	
11	3/27/93	82	167.1	216.97	60.11	0.9277	81	146.4
	5/20/93	82	167.1	221.95	64.42	0.9289	76.3	146.3
	7/9/93	82	167.1	220.58	63.57	0.9286	76.8	146.3
	7/30/93	82	167.1	220.22	63.29	0.9279	77.1	146.2
	9/22/93	82	167.1	221.78	65.08	0.9276	74.6	146.1
	10/13/93	82	167.1	221.69	65.06	0.9291	74.6	146.1
	4/8/94	82	167.1	226.16	66.18	0.912	76.4	146.9
16	3/25/93	122	187	176.97	21.62	0.9691	128.1	146.7
	5/19/93	122	187	177.19	21.45	0.9695	128.7	146.7
	7/8/93	122	187	177.19	21.76	0.9686	128	146.7
	7/31/93	122	187	176.88	22.3	0.9734	126.4	145.9
	9/8/93	122	187	176.03	19.33	0.9773	132.3	146.8
	10/21/93	122	187	176.88	22.32	0.9704	126.4	145.8
	3/31/94	122	187	176.63	21.89	0.974	127.1	146.2
17	3/25/93	61	100	111.1	20.37	0.9412	65	84
	5/19/93	61	100	112.15	21.58	0.9446	63.3	83.6
	7/8/93	61	100	112.49	21.76	0.9447	63.3	83.5
	7/28/93	61	100	112.95	22.45	0.9455	62.2	83.4
	9/8/93	61	100	111.01	20.18	0.9384	65.4	83.7
	10/21/93	61	100	111.08	20.45	0.9409	64.8	83.6
	4/1/94	61	100	111.02	20.49	0.9395	64.7	83.5
18	3/25/93	107	172	182.26	31.75	0.8504	110.5	143.9
	5/21/93	107	172	183.84	33.19	0.8618	108.8	143.7
	7/9/93	107	172	183.09	32.72	0.85	109.1	143.8
	7/29/93	107	172	183	32.62	0.844	109.2	143.8
	10/14/93	107	172	182.55	32.28	0.8482	109.6	143.9
	4/8/94	107	172	181.63	31.23	0.8407	111	144.5
19	4/19/93	142	163	237.37	41.18	0.78367	144.2	163
	4/7/94	142	163	237.49	41.55	0.78048	143.5	163

Table C6 (continued). Transition zone data.								
Site	Date	D1	D2	M0	M1	R	500 mg/L	100 mS/m
21	5/20/93	80	136.1	161.27	34.2	0.9653	83.9	112.4
	4/7/94	80	136.1	160.13	32.16	0.9642	87.4	113.6
22	3/25/93	133	204	198.15	25.65	0.9338	140.2	175.7
	5/21/93	133	204	197.44	24.72	0.944	141.5	175.4
	7/9/93	133	204	197.91	24.93	0.9262	141.5	175.7
	7/30/93	133	204	197.93	25.11	0.9271	141.1	175.6
	10/14/93	133	204	197.08	24.43	0.938	141.8	175
	3/31/94	133	204	197.82	24.55	0.9523	142.3	175.1
23	4/20/93	52.5	82	123.87	21.59	0.5614	75.1	
	4/19/94	52.5	82	158.41	40.54	0.6778	66.7	
24	4/20/93	88	112	146.88	24.41	0.86403	91.7	
	4/19/94	88	112	148.55	25.44	0.8805	91	
25	3/28/93	8	38	35.68	11.43	0.9346	9.8	25
	7/31/93	8	38	34.9	11.43	0.901	9.1	24.6
	9/14/93	8	38	34.9	11.64	0.8947	8.6	24.8
	10/22/93	8	38	34.91	11.57	0.8944	8.7	25.1
	4/4/94	8	38	35.56	11.1	0.9477	10.5	25
26	4/20/93	64	102	102.11	12.63	0.9278	73.6	80.7
	4/15/94	64	102	106.61	17.43	0.9788	67.2	79.6
27	4/20/93	53	66	78.23	7.59	0.9907	61.1	
	4/15/94	53	66	84.09	11.19	0.9905	58.8	
29	4/25/93	94	150	254.31	67.95	0.634	100.6	
	4/7/94	94	150	248.73	64.38	0.6457	103.1	
30	4/25/93	85	132	216.98	48.91	0.5368	106.4	
	4/14/94	85	132	204.65	42.66	0.4906	108.2	
31	4/20/93	73	90	196.27	52.74	0.8467	77	
	4/15/94	73	90	192	50.26	0.8138	78.3	
32	4/24/93	75	135	158.26	31.29	0.6085	87.5	
	4/19/94	75	135	151.87	27.75	0.551	89.1	
33	5/20/93	120	139	191.41	26.98	0.794	130.4	
	4/7/94	120	139	176.71	18.72	0.8117	134.4	
35	4/21/93	115	142	186.37	27.45	0.8686	124.3	
	4/20/94	115	142	188.79	28.94	0.8685	123.3	
36	4/21/93	121	188	202.18	31.62	0.9544	130.7	164
	9/16/93	121	188	199.77	28.1	0.9635	136.2	164.1
	4/14/94	121	188	203.65	32.83	0.9462	129.4	164.3
37	4/21/93	212	233	260.55	17.5	0.902	221	
	4/13/94	212	233	259.04	16.66	0.9271	221.4	
38	4/21/93	150	177	198.04	19.21	0.8461	154.6	
	4/14/94	150	177	197.33	18.81	0.8577	154.8	
39	10/22/93						55	
	4/20/94						55	
42	4/22/93	74	149	187.52	37.41	0.93	102.9	139.9
	4/14/94	74	149	188.01	37.26	0.9392	103.7	139.9
43	4/22/93	40	55	61.09	7.2	0.9387	44.8	
	4/19/94	40	55	60.55	6.83	0.938	45.1	

Table C6 (continued). Transition zone data.								
Site	Date	D1	D2	M0	M1	R	500 mg/L	100 mS/m
49	6/22/94	40	70	87.13	17.6	0.9264	47.1	102.7
SP	4/17/93	123	180	167.27	16.4	0.9766	130.2	147.9
	5/20/93	123	180	166.63	16.22	0.9743	129.9	147.2
	7/8/93	123	180	166.17	15.49	0.969	131.1	147.3
	7/27/93	123	180	166.04	14.99	0.968	132.1	147.2
	7/29/93	123	180	166.09	15.34	0.9704	131.4	146.8
	9/18/93	123	180	166.63	17.19	0.9702	127.8	147.2
	10/21/93	123	180	166.46	17.71	0.9655	126.4	146.8
	3/24/94	123	180	166.07	16.68	0.9744	128.4	144.7
	3/31/94	123	180	166.08	16.47	0.9753	128.8	144.5
	4/13/94	123	180	166.01	16.17	0.97535	129.5	144.9
	4/21/94	123	180	166.12	16.32	0.9752	129.2	145.9
	5/19/94	123	180	166.25	17.33	0.97624	127.1	144.5
SDA	4/17/93	123	158.3	165.45	15.87	0.8824	129.6	146
	5/20/93	123	158.3	164.17	15.37	0.8888	129.4	145.7
	7/8/93	123	158.3	163.97	15.39	0.8918	129.2	145.7
	7/27/93	123	158.3	163.66	14.79	0.8795	130.2	145.9
	7/29/93	123	158.3	163.85	15.15	0.8863	129.6	145.8
	9/18/93	123	158.3	163.92	15.13	0.9001	129.7	145.7
	10/21/93	123	158.3	164.18	15.33	0.8992	129.5	145.8
	3/31/94	123	158.3	164.31	15.5	0.8608	129.3	147.8
	4/13/94	123	158.3	164.06	15.31	0.87022	129.4	147.1
	4/21/94	123	158.3	164.27	15.57	0.8621	129.1	147.7
	5/19/94	123	158.3	164.4	15.62	0.8656	129.1	147.8

parameters show slightly more movement, the original observation is generally still valid. Water-level changes in many areas have been several feet, but very few of the 100 mS/m saltwater interface elevations change by as much as a foot. The estimated 500 mg/L chloride elevations fluctuated more than the 100 mS/m elevations, but commonly not by more than about two feet, and changes at this low concentration reflect very minor changes in the overall saltwater pattern. These observations are consistent with the calculation that total salt inventories did not change by more than one percent at any of the sites where they could be calculated (OFR 94-28b).

No definite trends or correlations have been observed. However, at sites near discharge zones one or both of the 100 mS/m conductivity and 500 mg/L chloride concentration elevations tended to drop. At site 16, where the Permian head rose more than the shallow aquifer and deep aquifer heads, both the 500 mg/L and the 100 mS/m elevations rose. Overall, the substantial changes in head and water level were not matched by transition zone changes, indicating that the saltwater content and its interface is a more stable and slowly varying feature of the hydrologic system than is the freshwater inventory or the local heads.

Siefkes intensive study site

The monitoring wells at the Siefkes intensive study site showed evidence of continued recovery following installation in April 1993. The wells were drilled with low-conductance drilling fluids, and although they were developed after installation, the steady rise in conductivity (based on the 100 mS/m elevation) following installation indicates that the ambient ground water was gradually flushing away residual drilling fluid. However, changes apparently related to pumping began to be observed on EM logs later in 1993. Changes in water conductivity in the Permian monitoring well are reflected in corresponding changes in the estimated position of the 500 mg/L elevation as determined by curve fitting. Detailed analysis of these changes is in progress.

Water samples from the irrigation well were collected and analyzed during the abbreviated 1993 pumping season. Site information and analytical results are listed in tables C3 and C4, respectively. In spite of limited pumping, deterioration of water quality was noted. Earlier results (Buddemeier et al., 1993) indicated that the saline water appearing in the Siefkes irrigation well was a mixture of natural Permian formation brine and oil-field brine contamination. The method of Whittemore (1988) was used to distinguish the relative proportions of the two components and their variations over the 1993 pumping season. These results are illustrated in figure C8, which shows that the natural salt content increased at a greater rate with pumping than did that from oil-brine contamination.

Similar determinations are being made for the 1994 pumping season (table C3). The first sample collected from the Siefkes irrigation well in 1994 contained a chloride concentration appreciably lower (135 mg/L) than the first sample collected during 1993. The irrigation well had been pumping longer before the first sample was collected in 1993 than in 1994 and thus had apparently caused more upconing of natural saline water.

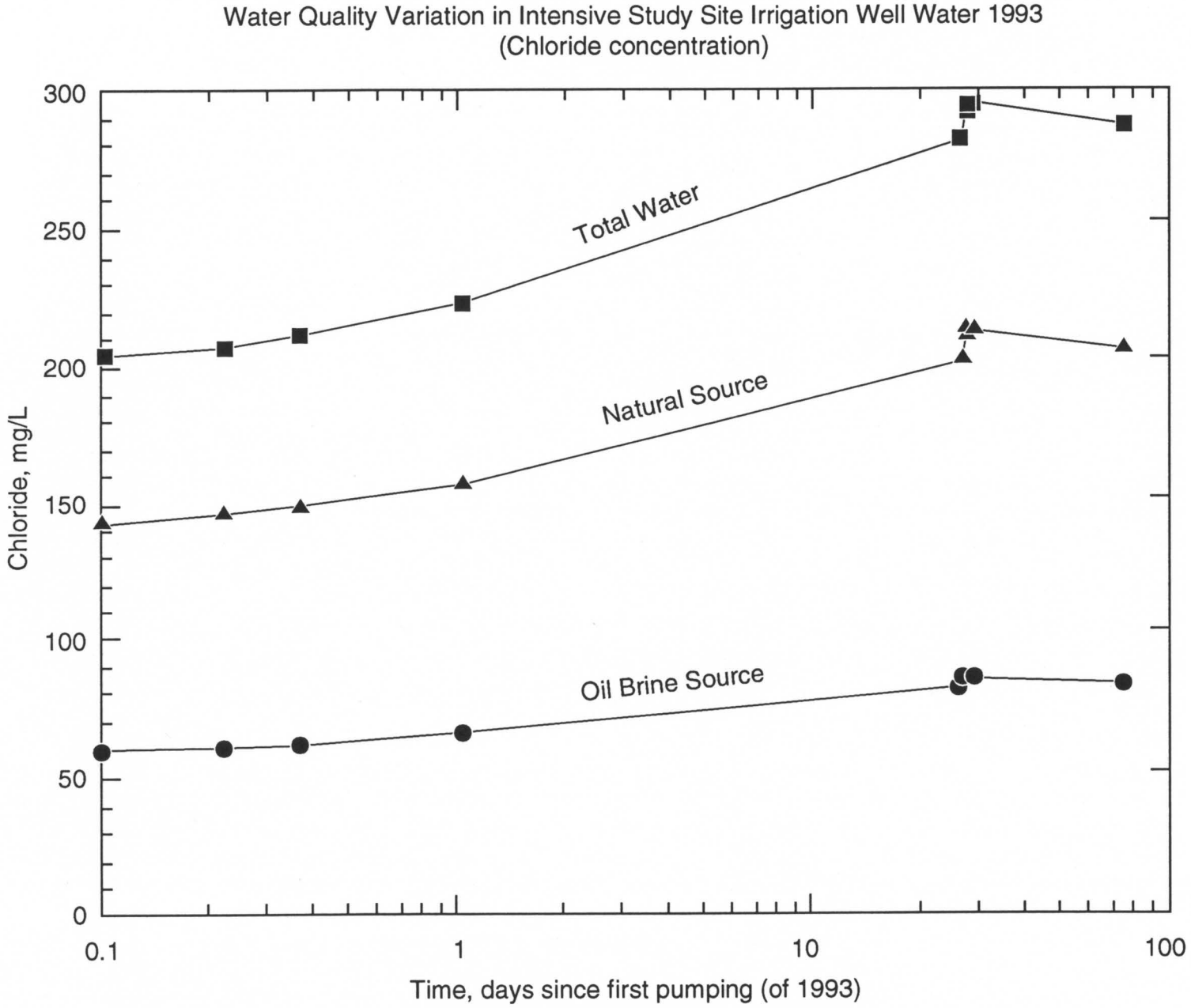

Figure C8. Change in well-water salinity and the sources of salinity as a result of irrigation pumping.

The second 1994 sample was collected a day later and contained essentially the same chloride concentration as the first 1993 sample. The results indicate that the salinity rises appreciably even after the first pumping of a season. Also, the low salinity of the initial sample for 1994 shows that the water quality appeared to recover to at least as good as probably existed at the start of the 1993 irrigation season. Other observation, stock, and irrigation wells are being monitored periodically to compare salinity variations with those observed in the Siefkes irrigation well. Well information and analytical results through May 1994 are listed in tables C3 and C4, respectively.

Saturated Thickness of the Freshwater Zone in the Quaternary Aquifer

Since the total saturated thickness of the alluvial aquifer (difference in elevation between bedrock and water table) is known at each site, it is possible to calculate the proportion of saturated thickness above and below the 500 mg/L chloride concentration elevation (based on the fitted curves) for each of the saline transition zone sites. Ground water below this elevation is not considered suitable for human consumption and is generally unsuitable for irrigation.

The 1994 saturated thickness values and the percent of water below the 500 mg/L chloride elevation are tabulated in table C7. The percent of the total alluvial-aquifer saturated thickness that is below the 500 mg/L elevation ranges from 0 to 95 % at these sites. The spatial pattern of the saltwater saturated thickness in the alluvial aquifer is shown in figure C9. It seems clear that saltwater intrusion is a regional phenomenon in the vicinity of the study transect in northern Stafford County. Also, the area in northeastern Pratt County and along the Stafford-Reno county line appears to be a region of consistent deep aquifer salinity. We have contoured the percent of saturated thickness occupied by high-salinity water (chloride concentration > 500 mg/L) using 40% of total saturation occupied by salt water as the cutoff for contouring. The salt-affected sites are indicated by individual percentages.

Figure C10 shows current (1994) estimates of the freshwater saturated thickness at the monitoring well sites. These are based on the saturated thickness above the 500 mg/L chloride elevation at each site. Critical areas of less than 60 ft and less than 80 ft of saturated thickness are shaded in figure C10.

The implications of these findings for consideration of the saltwater and freshwater budgets and their controlling factors are discussed in OFR 94-28e, and preliminary comments on relevance to eventual considerations of monitoring and management strategies are presented in OFR 94-28g.

Table C7. Saturated thicknesses above and below the 500 mg/L elevation (1994).

SITE	Sat Thick Above	Sat Thick Below	Tot Sat Thick	Percent Below
1	87.8	51.9	139.7	37.2
3	81.3	28.2	109.5	25.7
4	57.3	63.9	121.1	52.7
5	66.8	112.1	178.9	62.7
6	69	63.6	132.6	47.9
8	100.1	0	100.1	0
9	42.1	35.6	77.6	45.8
10	97.2	45	142.3	31.6
11	65	131.6	196.6	66.9
16	119.5	92.9	212.4	43.7
17	54.1	49.3	103.5	47.7
18	99.5	103	202.5	50.9
19	131.8	19.5	151.3	12.9
21	64.3	49.6	113.9	43.6
22	129.6	72.7	202.3	35.9
23	44.3	27.3	71.6	38.1
24	67.1	32	99.1	32.3
25	4.4	87.5	92	95.2
26	58.4	109.8	168.2	65.3
27	47.6	45.2	92.8	48.7
29	67.1	47.9	115	41.6
30	91	29.8	120.8	24.7
31	63.3	14.7	77.9	18.8
32	80	82.9	162.9	50.9
33	102.2	6.6	108.8	6.1
35	104.9	29.7	134.6	22
36	101.6	65.6	167.2	39.2
37	164.3	18.6	182.9	10.2
38	129	34.2	163.2	21
39	51.9	0	51.9	0
42	90.7	56.3	147	38.3
43	40	19.9	59.9	33.2
49	46	58	104	56
SP	114.1	58.9	173	34.1

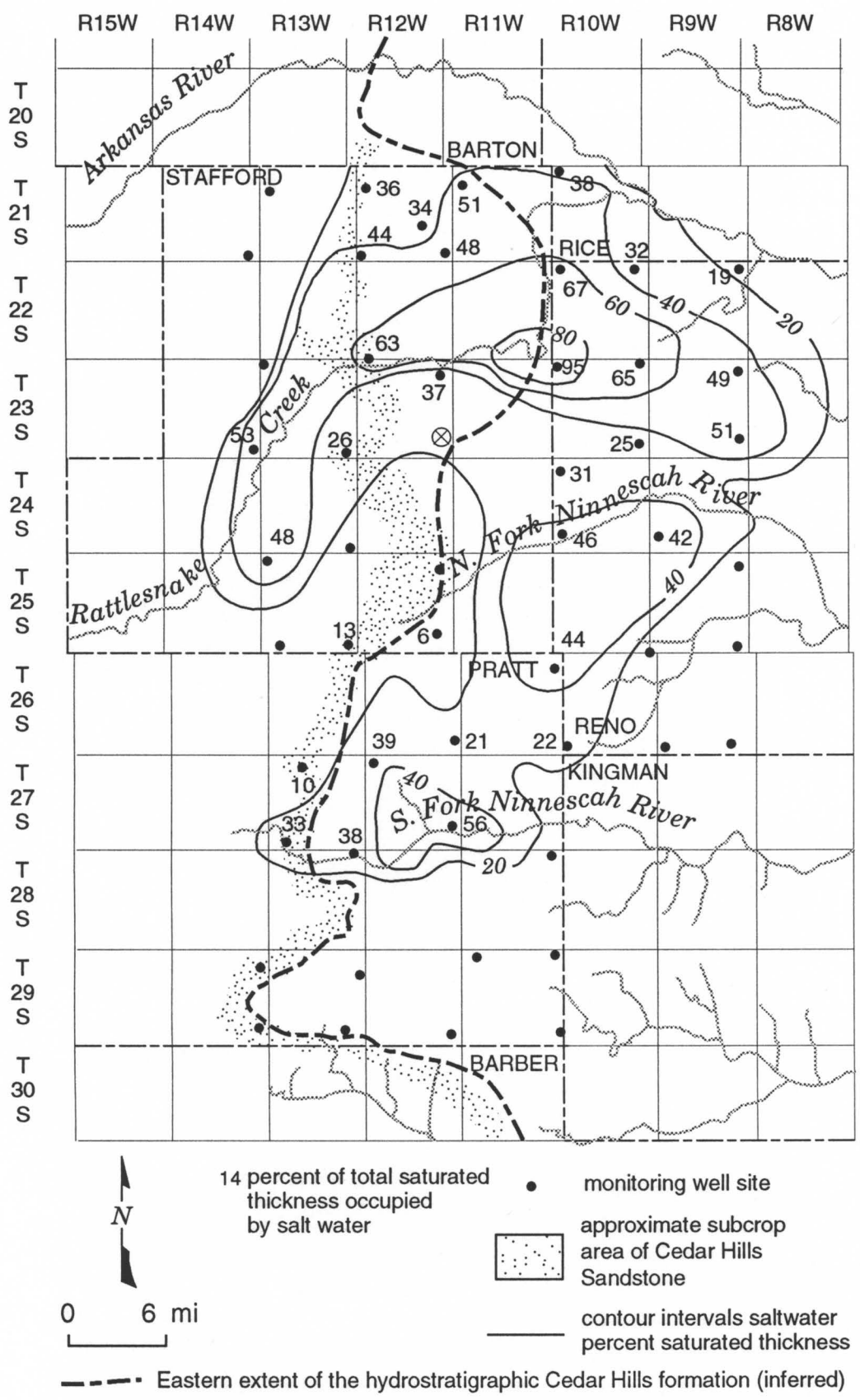

Figure C9. Percent of saturated thickness occupied by salt water (Cl > 500 mg/L) in the Great Bend Prairie aquifer (1994).

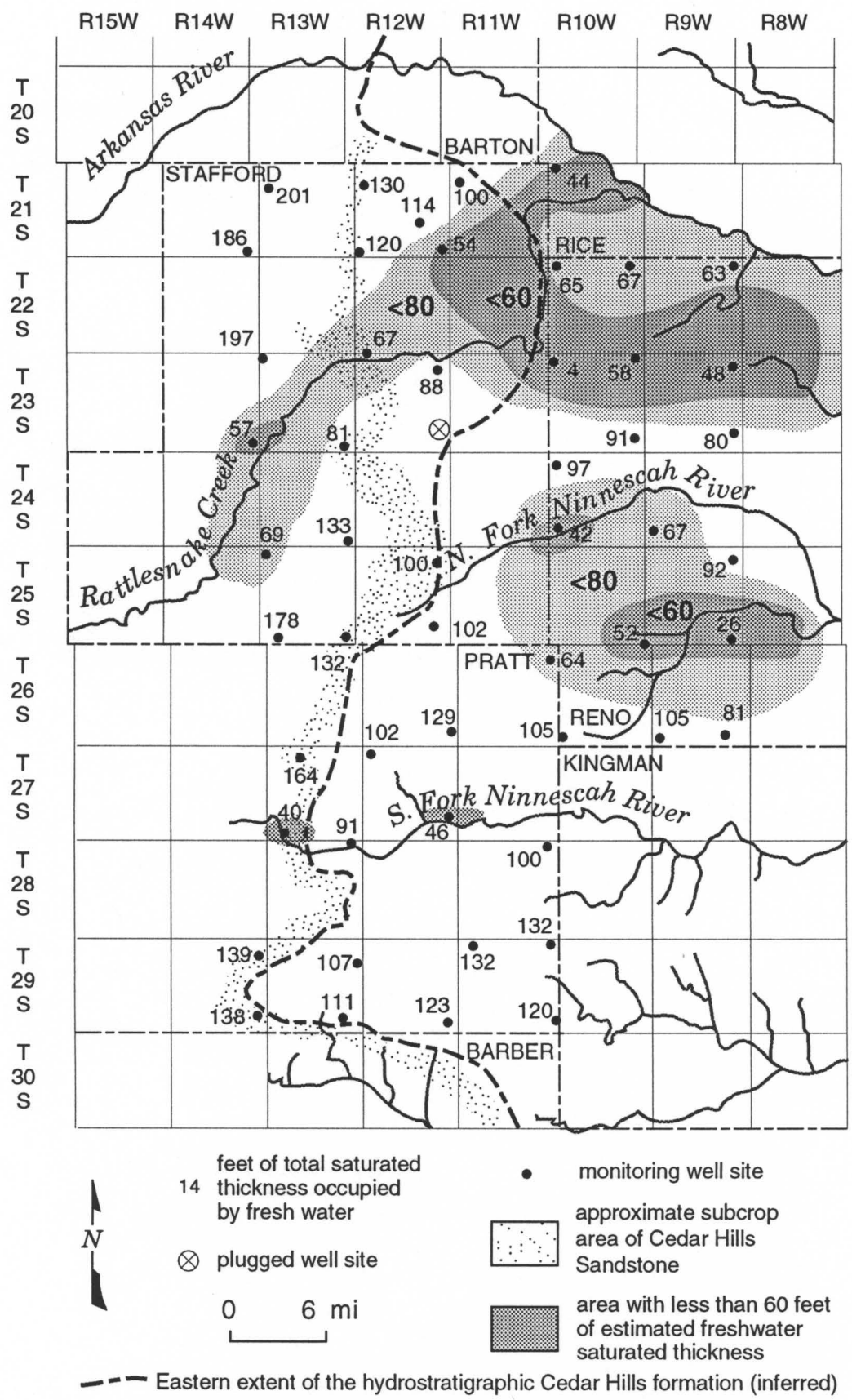

Figure C10. Saturated thickness occupied by fresh water (Cl < 500 mg/L) in the Great Bend Prairie aquifer (1994).

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Appendix A: Depth to Water and Monitoring Site Vertical Head Differences

The following tables summarize recent water level information for the Mineral Intrusion monitoring well sites, with emphasis on 1993-94 observations and summary comparison data for the period 1987-93.

The data are grouped by site number. At each site, well 1 is the deepest, normally completed in Permian bedrock. Well 2 is normally completed near the base of the Great Bend Prairie (alluvial) aquifer. At most sites, well 3 is the shallowest, completed at shallow to intermediate depths in the alluvial aquifer; at a few sites there are four wells, with 4 the shallowest and 3 at intermediate depth.

The data presented in the "well" columns are depths to water (from local ground level) in feet on the dates indicated in the left-hand column. The right-hand group of columns (labeled 1-2, etc.) give the differences (in feet) between the water levels of the indicated wells. A negative number indicates that the deeper well has a higher head than the shallower well, creating the potential for the upward flow of water. These differences are calculated on the assumption that ground level is at the same elevation for all wells at the same site; this is a reasonable approximation, but it is not strictly accurate and the actual elevations may differ by up to a foot at some sites.

The rows labeled AVG 93-94 and STD 93-94 for each site give the appropriate elevation and difference averages and standard deviations for 1993-94 measurements. The rows labeled AVG 87-93 and STD 87-93 give the averages and standard deviations for all measurements during the years 1987-93. These values are included to give a longer term perspective on the values and variabilities, since 1993 was an unusually high recharge year.

SITE 1	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/13/93	9.60	8.52	8.17		1.08	1.43	0.35	
3/26/93	6.8	5.7	5.3		1.1	1.5	0.4	
3/29/93	6.90	5.75	5.34		1.15	1.56	0.41	
7/1/93	4.90	3.60	3.02		1.30	1.88	0.58	
8/25/93	7.0	5.8	5.2		1.2	1.8	0.6	
10/5/93	7.82	6.70	6.25		1.12	1.57	0.45	
1/6/94	8.0	6.83	6.51		1.14	1.46	0.32	
4/15/94	6.0	6.51	6.35		-0.49	-0.33	0.16	
5/26/94	6.5	6.89	6.67		-0.41	-0.19	0.22	
AVG 93-94	7.05	6.26	5.87		0.80	1.19	0.39	
STD 93-94	1.25	1.24	1.33		0.67	0.79	0.14	
AVG 87-93	10.27	9.04	8.67		1.23	1.60	0.37	
STD 87-93	2.04	2.09	2.09		0.60	0.57	0.20	
SITE 3	WELL 1	WELL 2			1-2			
1/14/93	31.44	28.40			3.04			
2/19/93	30.64	27.86			2.78			
3/19/93	29.29	26.86			2.43			
4/19/93	28.31	25.73			2.58			
5/20/93	25.61	21.99			3.62			
6/16/93	24.97	21.75			3.22			
7/13/93	19.62	16.17			3.45			
8/10/93	17.17	13.56			3.61			
9/9/93	19.40	16.32			3.08			
10/5/93	21.05	18.00			3.05			
11/5/93	21.27	18.73			2.54			
12/1/93	21.60	18.90			2.7			
1/3/94	22.01	19.24			2.77			
2/2/94	22.40	19.55			2.85			
2/28/94	22.64	19.87			2.77			
3/28/94	23.04	20.24			2.8			
4/13/94	23.31	20.54			2.77			
AVG 93-94	23.75	20.81			2.94			
STD 93-94	3.96	4.10			0.35			
AVG 87-93	28.19	25.00			3.20			
STD 87-93	4.17	4.12			0.42			
SITE 4	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/14/93	6.00	6.72	9.74		-0.72	-3.74	-3.02	
3/29/93	5.95	6.00	8.70		-0.05	-2.75	-2.70	
4/22/93	5.8	5.8	8.7		0	-2.9	-2.9	
7/1/93	5.44	5.07	7.74		0.37	-2.30	-2.67	
10/5/93	5.38	4.57	8.98		0.81	-3.60	-4.41	
1/5/94	5.12	3.62	8.10		1.5	-2.98	-4.48	
4/13/94	5.54	3.16	7.87		2.38	-2.33	-4.71	
AVG 93-94	5.60	4.99	8.55		0.61	-2.94	-3.56	

STD 93-94	0.30	1.20	0.65		0.97	0.52	0.86	
AVG 87-93	5.07	5.71	9.76		-0.64	-4.69	-4.05	
STD 87-93	1.74	1.41	1.29		0.90	1.33	0.81	
SITE 5	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/14/93	2.61	4.77	3.32		-2.16	-0.71	1.45	
2/9/93	1.55	3.75	2.25		-2.20	-0.70	1.50	
3/8/93	0.97	3.15	1.64		-2.18	-0.67	1.51	
3/29/93	1.43	3.60	2.09		-2.17	-0.66	1.51	
4/19/93	1.33	3.55	2.06		-2.22	-0.73	1.49	
5/20/93	0.75	3.00	1.50		-2.25	-0.75	1.50	
6/16/93	1.95	4.16	2.68		-2.21	-0.73	1.48	
7/15/93	-0.58	1.73	0.18		-2.31	-0.76	1.55	
8/10/93	0.23	2.50	1.00		-2.27	-0.77	1.50	
9/10/93	1.00	3.26	1.77		-2.26	-0.77	1.49	
10/7/93	1.29	3.5	2		-2.21	-0.71	1.5	
11/3/93	0.93	3.16	1.65		-2.23	-0.72	1.51	
12/2/93	0.82	3.04	1.51		-2.22	-0.69	1.53	
1/3/94	0.73	3.01	1.47		-2.28	-0.74	1.54	
2/2/94	0.83	3.05	1.5		-2.22	-0.67	1.55	
2/28/94	0.8	3.01	1.49		-2.21	-0.69	1.52	
3/28/94	1.25	3.47	1.94		-2.22	-0.69	1.53	
4/19/94	1.53	3.6	2.08		-2.07	-0.55	1.52	
AVG 93-94	1.08	3.30	1.79		-2.22	-0.71	1.51	
STD 93-94	0.66	0.62	0.64		0.05	0.05	0.02	
AVG 87-93	2.77	4.92	3.58		-2.05	-0.71	1.34	
STD 87-93	1.52	1.60	1.51		0.63	0.12	0.64	
SITE 6	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/4/93	22.22	15.48	19.84		6.74	2.38	-4.36	
4/1/93	21.96	14.13	19.37		7.83	2.59	-5.24	
4/19/93	21.9	13.8			8.1			
6/29/93	21.53	11.93	17.28		9.60	4.25	-5.35	
8/26/93	21.6	26.8	15.8		-5.2	5.8	11.0	
10/4/93	21.69	11.32	15.77		10.37	5.92	-4.45	
10/20/93	21.8	10.5	15.7		11.3	6.1	-5.2	
1/5/94	21.63	10.08	15.42		11.55	6.21	-5.34	
4/13/94	21.66	10.45	15.42		11.21	6.24	-4.97	
AVG 93-94	21.78	13.83	16.83		7.94	4.94	-2.99	
STD 93-94	0.21	4.92	1.70		4.92	1.54	5.30	
AVG 87-93	20.51	17.11	17.39		3.39	3.71	0.32	
STD 87-93	1.62	7.55	1.67		7.22	3.61	7.62	
SITE 7	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/4/93	39.94	21.23	24.14		18.71	15.80	-2.91	
4/1/93	39.54	18.56	21.72		20.98	17.82	-3.16	

4/18/93	39.4	18.2			21.2			
6/29/93	38.80	15.10	17.55		23.70	21.25	-2.45	
10/4/93	38.65	12.48	15.80		26.17	22.85	-3.32	
1/5/94	37.93	12.97	15.85		24.96	22.08	-2.88	
3/21/94	38.04	13.85			24.19			
4/21/94		15.75	16.92				-1.17	
AVG 93-94	38.90	16.02	18.66		22.84	19.96	-2.65	
STD 93-94	0.71	2.87	3.16		2.43	2.70	0.71	
AVG 87-93	37.65	20.14	21.84		17.51	15.75	-1.62	
STD 87-93	2.64	4.04	2.99		3.36	2.49	1.95	
SITE 8	WELL 1	WELL 2	WELL 3	WELL 4	1-2	1-3	2-3	1-4
1/4/93	25.79	18.97	18.64	13.84	6.82	7.15	0.33	11.95
4/1/93	25.11	15.84	15.52	8.94	9.27	9.59	0.32	16.17
4/21/93	25.1	15.8	15.5	8.8	9.3	9.6	0.3	16.3
6/29/93	23.93	14	13.67	5.68	9.93	10.26	0.33	18.25
8/24/93	23.5	14.6	14.3	7.9	8.9	9.2	0.3	15.6
10/4/93	23.38	15.69	15.36	8.28	7.69	8.02	0.33	15.1
1/5/94	23.15	16.45	16.11	9.68	6.7	7.04	0.34	13.47
4/7/94	23.52	17.19	16.86	11.1	6.33	6.66	0.33	12.42
AVG 93-94	24.19	16.07	15.75	9.28	8.12	8.44	0.32	14.91
STD 93-94	0.93	1.44	1.43	2.25	1.31	1.30	0.01	2.01
AVG 87-93	24.58	18.05	17.74	12.53	6.53	6.84	0.31	
STD 87-93	1.25	2.20	2.19	3.70	1.54	1.55	0.04	
SITE 9	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	9.78	9.66	9.84		0.12	-0.06	-0.18	
4/2/93	8.94	8.75	8.93		0.19	0.01	-0.18	
4/25/93	9.0	8.8	9.0		0.2	0	-0.2	
6/30/93	8.46	8.25	8.42		0.21	0.04	-0.17	
10/4/93	9.10	8.93	9.10		0.17	0	-0.17	
1/5/94	9.07	9	9.1		0.07	-0.03	-0.1	
4/14/94	9.34	9.2	9.36		0.14	-0.02	-0.16	
AVG 93-94	9.10	8.94	9.11		0.16	-0.01	-0.17	
STD 93-94	0.37	0.40	0.40		0.05	0.03	0.03	
AVG 87-93	10.14	10.00	10.20		0.14	-0.06	-0.20	
STD 87-93	0.82	0.94	0.88		0.24	0.19	0.32	
SITE 10	WELL 1	WELL 2	WELL 3	WELL 4	1-2	1-3	2-3	1-4
1/6/93	25.92	25.68	23.69	20.69	0.24	2.23	1.99	5.23
3/29/93	23.89	23.71	21.77	19.25	0.18	2.12	1.94	4.64
4/25/93	22.9	22.7	20.8	18.3	0.2	2.1	1.9	4.6
6/30/93	19.29	19.06	17.19	14.03	0.23	2.10	1.87	5.26
10/4/93	17.72	17.48	15.45	11.31	0.24	2.27	2.03	6.41
1/6/94	19.25	19.02	16.98	12.76	0.23	2.27	2.04	6.49
4/7/94	20.4	20.16	18.12	13.75	0.24	2.28	2.04	6.65

AVG 93-94	21.34	21.12	19.14	15.73	0.22	2.20	1.97	5.61
STD 93-94	2.74	2.75	2.76	3.35	0.02	0.08	0.06	0.82
AVG 87-93	24.96	24.71	22.71	19.50	0.25	2.25	2.00	
STD 87-93	2.45	2.45	2.44	2.54	0.05	0.06	0.05	
SITE 11	WELL 1	WELL 2			1-2			
1/6/93	33.2	17.1			16.1			
3/27/93	31.9	13.5			18.4			
3/29/93	31.89	13.47			18.42			
5/20/93	30.6	10.0			20.6			
6/30/93	29.74	8.89			20.85			
7/9/93	29.6	8.8			20.8			
7/30/93	29.1	7.8			21.3			
8/24/93	29.1	8.7			20.4			
9/22/93	29.1	9.4			19.7			
10/13/93	29.2	9.9			19.3			
1/6/94	29.29	10.59			18.7			
4/8/94	29.37	11.39			17.98			
5/26/94	29.51	10.72			18.79			
AVG 93-94	30.12	10.79			19.33			
STD 93-94	1.30	2.46			1.41			
AVG 87-93	32.07	13.49			18.56			
STD 87-93	1.72	3.09			1.49			
SITE 12	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	25.27	23.03	23.7		2.24	1.57	-0.67	
4/2/93	24.32	22.17	22.68		2.15	1.64	-0.51	
5/23/93	23.8	21.5	22.2		2.3	1.6	-0.7	
6/29/93	21.38	18.78	19.45		2.6	1.93	-0.67	
10/1/93	21.6	19.2	19.6		2.4	2	-0.4	
1/10/94	21.57	19.61	19.58		1.96	1.99	0.03	
4/20/94	22.04	19.87	20.25		2.17	1.79	-0.38	
AVG 93-94	22.85	20.59	21.07		2.26	1.79	-0.47	
STD 93-94	1.46	1.51	1.62		0.19	0.17	0.24	
AVG 87-93	22.23	20.13	20.48		2.11	1.75	-0.35	
STD 87-93	2.36	2.55	2.65		0.34	0.52	0.46	
SITE 13	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/4/93	37.34	34.89	34.94		2.45	2.4	-0.05	
4/1/93	37.47	34.93	34.71		2.54	2.76	0.22	
4/23/93	37.4	34.8	34.7		2.6	2.7	0.1	
6/29/93	36.78	34.09	34.00		2.69	2.78	0.09	
8/25/93	36.2	33.4	33.3		2.8	2.9	0.1	
10/1/93	36.1	33.37	33.32		2.73	2.78	0.05	
1/10/94	36.12	33.44	33.41		2.68	2.71	0.03	
4/4/94	36.09	33.66	33.68		2.43	2.41	-0.02	

AVG 93-94	36.69	34.07	34.01		2.62	2.68	0.06	
STD 93-94	0.59	0.66	0.64		0.12	0.17	0.08	
AVG 87-93	36.59	34.04	34.03		2.56	2.56	0.00	
STD 87-93	0.68	0.63	0.59		0.15	0.22	0.16	
SITE 14	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/4/93	100.55	99.88	99.64		0.67	0.91	0.24	
4/1/93	100.55	99.83	99.74		0.72	0.81	0.09	
4/23/93	100.6	99.7	99.7		0.9	0.9	0	
6/30/93	100.45	99.68	99.57		0.77	0.88	0.11	
8/25/93	100.5	99.7	99.8		0.8	0.7	-0.1	
10/1/93	100.43	99.7	99.56		0.73	0.87	0.14	
1/10/94	99.88	99.45	99.07		0.43	0.81	0.38	
4/4/94	100.11	99.3	99.18		0.81	0.93	0.12	
AVG 93-94	100.38	99.66	99.53		0.73	0.85	0.12	
STD 93-94	0.24	0.18	0.25		0.13	0.07	0.14	
AVG 87-93	99.86	99.16	99.01		0.70	0.84	0.15	
STD 87-93	0.50	0.51	0.52		0.20	0.22	0.12	
SITE 15	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	27.22	31.63	30.66		-4.41	-3.44	0.97	
4/2/93	26.78	30.81	30.00		-4.03	-3.22	0.81	
4/22/93	26.8	30.7	29.7		-3.9	-2.9	1.0	
6/30/93	26.70	28.08	26.99		-1.38	-0.29	1.09	
8/24/93	29.2	28.6	26.7		0.6	2.5	1.9	
10/4/93	25.76	28.17	26.87		-2.41	-1.11	1.30	
1/10/94	25.13	28.22	27.39		-3.09	-2.26	0.83	
4/14/94	25.19	29.16	28.02		-3.97	-2.83	1.14	
AVG 93-94	26.60	29.42	28.29		-2.82	-1.69	1.13	
STD 93-94	1.23	1.32	1.49		1.60	1.88	0.33	
AVG 87-93	27.55	31.07	29.89		-3.52	-2.35	1.17	
STD 87-93	1.86	1.64	1.67		1.42	1.74	0.37	
SITE 16	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/13/93	30.44	21.93	14.99		8.51	15.45	6.94	
2/18/93	30.15	20.94	13.84		9.21	16.31	7.10	
3/18/93	29.20	19.25	11.98		9.95	17.22	7.27	
3/25/93	29.0	19.2			9.8			
4/16/93	28.32	18.52	11.26		9.80	17.06	7.26	
5/19/93	27.67	16.92	9.43		10.75	18.24	7.49	
6/16/93	26.79	16.75	9.42		10.04	17.37	7.33	
7/8/93	25.9	14.6			11.3			
7/15/93	25.57	14.1	6.86		11.47	18.71	7.24	
7/31/93	24.1	12.0			12.1			
8/11/93	23.64	12.3	4.98		11.34	18.66	7.32	
9/8/93	23.7	12.9	5.7		10.8	18.0	7.2	

10/7/93	20.21	13.52	6.23					
10/13/93		13.8	6.6				7.2	
11/3/93	20.28	13.83	6.49		6.45	13.79	7.34	
12/1/93	20.34	14.05	6.82		6.29	13.52	7.23	
1/3/94	20.45	14.34	6.97		6.11	13.48	7.37	
2/2/94	20.53	14.53	7.23		6	13.3	7.3	
2/28/94	20.6	14.67	7.37		5.93	13.23	7.3	
3/28/94	20.75	14.98	7.68		5.77	13.07	7.3	
3/31/94	20.85	14.93	7.64		5.92	13.21	7.29	
5/26/94	20.82	15.39	8.11		5.43	12.71	7.28	
AVG 93-94	24.25	15.61	8.40		8.65	15.49	7.26	
STD 93-94	3.68	2.68	2.69		2.31	2.22	0.11	
AVG 87-93	31.22	22.04	15.66		9.10	15.61	6.56	
STD 87-93	1.92	2.76	2.82		1.22	1.36	0.34	
SITE 17	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/13/93	46.95	12.42	13.16		34.53	33.79	-0.74	
2/18/93	46.41	11.53	12.27		34.88	34.14	-0.74	
3/18/93	45.81	10.87	11.63		34.94	34.18	-0.76	
3/24/93	45.7	10.8	11.6		34.9	34.1	-0.8	
4/16/93	45.16	10.42	11.18		34.74	33.98	-0.76	
5/18/93	44.73	9.68	10.47		35.05	34.26	-0.79	
5/19/93	44.7							
6/15/93	44.61	10.60	11.35		34.01	33.26	-0.75	
7/8/93	44.1							
7/15/93	43.91	8.68	9.5		35.23	34.41	-0.82	
7/28/93	43.3							
8/11/93	43.41	9.12	9.94		34.29	33.47	-0.82	
9/8/93	43.6	9.0	9.8		34.6	33.8	-0.8	
9/10/93	43.46	9.15	10.03		34.31	33.43	-0.88	
10/7/93	44.74	9.74	10.40		35.00	34.34	-0.66	
11/3/93	44.50	9.55	10.22		34.95	34.28	-0.67	
12/1/93	44.25	9.53	10.18		34.72	34.07	-0.65	
1/3/94	44.09	9.55	10.19		34.54	33.9	-0.64	
2/2/94	44.03	9.58	10.22		34.45	33.81	-0.64	
2/28/94	43.96	9.53	10.18		34.43	33.78	-0.65	
3/28/94	43.97	9.83	10.51		34.14	33.46	-0.68	
4/1/94	44.06	9.91	10.54		34.15	33.52	-0.63	
5/26/94	43.96	10.53	11.28		33.43	32.68	-0.75	
AVG 93-94	44.50	10.00	10.73		34.56	33.83	-0.73	
STD 93-94	0.93	0.89	0.89		0.42	0.42	0.07	
AVG 87-93	46.05	13.73	14.42		32.35	31.80	-0.70	
STD 87-93	3.01	1.71	1.72		2.66	2.58	0.19	
SITE 18	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	35.47	34.51	21.35		0.96	14.12	13.16	
1/21/93	35.32	34.34	21.25		0.98	14.07	13.09	

2/19/93	34.99	33.72	20.60		1.27	14.39	13.12	
3/18/93	34.32	32.76	19.25		1.56	15.07	13.51	
3/25/93	34.0	32.5			1.5			
4/14/93	32.60	31.70	17.66		0.90	14.94	14.04	
5/18/93	31.95	30.60	15.81		1.35	16.14	14.79	
5/21/93	31.8	30.4			1.4			
6/15/93	31.03	30.30	14.37		0.73	16.66	15.93	
7/9/93	30.6	29.2			1.4			
7/15/93	30.22	28.83	10.48		1.39	19.74	18.35	
7/29/93	26.9	26.6			0.3			
8/11/93	27.12	27.71	6.33		-0.59	20.79	21.38	
9/9/93	27.28	26.12	7.74		1.16	19.54	18.38	
10/5/93	27.18	25.94	8.27		1.24	18.91	17.67	
10/14/93	27.2	26.1			1.1			
11/3/93	27.2	26.15	8.7		1.05	18.5	17.45	
12/1/93	27.16	26.18	9.34		0.98	17.82	16.84	
1/3/94	27.12	26.4	9.78		0.72	17.34	16.62	
2/2/94	27.08	26.6	10.2		0.48	16.88	16.4	
2/28/94	27.07	26.73	10.49		0.34	16.58	16.24	
3/28/94	26.44	26.97	11.02		-0.53	15.42	15.95	
4/8/94	27.77	27.39			0.38			
5/26/94	28.62	29.15	11.73		-0.53	16.89	17.42	
AVG 93-94	29.85	29.04	13.02		0.81	16.88	16.13	
STD 93-94	3.13	2.85	4.88		0.63	1.97	2.17	
AVG 87-93	34.61	35.05	20.51		-0.45	13.80	14.16	
STD 87-93	2.27	2.89	4.07		1.84	1.98	1.75	
SITE 19	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/21/93	20.03	17.7	14.94		2.33	5.09	2.76	
2/19/93	19.92	16.6	13.44		3.32	6.48	3.16	
3/22/93	19.72	15.15	12.01		4.57	7.71	3.14	
4/16/93	19.52	14.59	11.65		4.93	7.87	2.94	
4/19/93	19.5	14.5			5			
5/20/93	19.21	12.66	10.25		6.55	8.96	2.41	
6/16/93	19.16	13.72	10.95		5.44	8.21	2.77	
7/15/93	18.77	11.75	9.45		7.02	9.32	2.3	
8/10/93	18.68	15.35	10.55		3.33	8.13	4.8	
8/25/93	18.8	17.0			1.8			
9/9/93	18.79	13.32	11.67		5.47	7.12	1.65	
10/6/93	18.65	13.6	11.73		5.05	6.92	1.87	
10/20/93	18.5	13.0			5.5			
11/4/93	18.49	12.97	11.59		5.52	6.9	1.38	
12/1/93	18.3	13.2	11.51		5.1	6.79	1.69	
1/4/94	18.15	13.16	11.56		4.99	6.59	1.6	
2/3/94	17.93	13.23	11.43		4.7	6.5	1.8	
3/1/94	17.92	13.32	11.49		4.6	6.43	1.83	

3/29/94		13.57	11.62				1.95	
4/7/94		13.6						
AVG 93-94	18.89	14.10	11.62		4.73	7.27	2.38	
STD 93-94	0.63	1.51	1.19		1.28	1.06	0.84	
AVG 87-93	18.01	15.40	12.10		2.61	5.61	2.99	
STD 87-93	1.69	2.79	2.38		2.37	1.96	1.34	
SITE 20	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/4/93	30.77	24.40	25.90		6.37	4.87	-1.50	
4/1/93	30.05	21.08	22.06		8.97	7.99	-0.98	
4/19/93	29.8	20.4			9.4			
6/29/93	28.79	18.1	18.52		10.69	10.27	-0.42	
8/25/93	27.9	20.1	18.5		7.8	9.4	1.6	
10/4/93	27.54	18.66	18.61		8.88	8.93	0.05	
10/20/93	27.4	18.1	18.8		9.3	8.6	-0.7	
1/12/94	26.6	17.69	18.88		8.91	7.72	-1.19	
4/21/94	25.91	18.46	19.48		7.45	6.43	-1.02	
AVG 93-94	28.31	19.67	20.09		8.64	8.03	-0.52	
STD 93-94	1.56	2.01	2.46		1.19	1.61	0.92	
AVG 87-93	27.57	22.39	22.64		5.18	4.84	-0.18	
STD 87-93	2.72	4.01	3.95		3.14	2.48	1.58	
SITE 21	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	27.84	25.75	24.85		2.09	2.99	0.90	
4/2/93	26.70	24.43	23.24		2.27	3.46	1.19	
5/20/93	25.2	22.9	21.6		2.3	3.6	1.3	
6/30/93	24.83	22.50	21.24		2.33	3.59	1.26	
10/4/93	25.30	23.09	22.14		2.21	3.16	0.95	
1/6/94	25.52	23.49	22.74		2.03	2.78	0.75	
4/7/94	26.04	23.93	23.07		2.11	2.97	0.86	
AVG 93-94	25.92	23.73	22.70		2.19	3.22	1.03	
STD 93-94	0.97	1.02	1.12		0.11	0.31	0.20	
AVG 87-93	27.03	25.07	23.94		1.97	3.09	1.12	
STD 87-93	1.22	1.40	1.34		0.38	0.41	0.44	
SITE 22	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/13/93	29.75	26.68	19.31		3.07	10.44	7.37	
2/18/93	29.87	26.13	18.02		3.74	11.85	8.11	
3/18/93	29.47	24.96	16.21		4.51	13.26	8.75	
3/25/93	29.3	24.7	16.1		4.6	13.2	8.6	
4/14/93	28.62	24.00	15.58		4.62	13.04	8.42	
5/18/93	28.03	23.17	14.46		4.86	13.57	8.71	
5/21/93	28.0	23.0			5.0			
6/16/93	27.52	22.50	14.14		5.02	13.38	8.36	
7/9/93	26.9	21.3			5.6	26.9	21.3	
7/15/93	26.70	20.79	10.93		5.91	15.77	9.86	

7/30/93	25.8	18.2			7.6			
8/11/93	25.22	18.36	9.26		6.86	15.96	9.1	
9/9/93	24.89	18.89	10.76		6.00	14.13	8.13	
10/5/93	24.79	19.22	11.47		5.57	13.32	7.75	
10/14/93	24.8	19.2			5.6			
11/3/93	24.81	19.36	11.7		5.45	13.11	7.66	
12/1/93	24.71	19.36	12.01		5.35	12.7	7.35	
1/3/94	24.62	19.57	11.67		5.05	12.95	7.9	
2/2/94	24.56	19.72	12.22		4.84	12.34	7.5	
2/28/94	24.5	19.79	12.36		4.71	12.14	7.43	
3/28/94	24.5	20.09	12.61		4.41	11.89	7.48	
3/31/94	24.57	20.11	12.71		4.46	11.86	7.4	
5/26/94	24.6	20.55	13.21		4.05	11.39	7.34	
AVG 93-94	26.37	21.29	13.41		5.08	13.66	8.73	
STD 93-94	1.95	2.50	2.55		0.95	3.30	2.96	
AVG 87-93	30.18	27.80	20.17		2.38	10.32	8.01	
STD 87-93	1.68	2.95	2.94		1.46	2.41	1.56	
SITE 23	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	25.57	23.90	23.80		1.67	1.77	0.10	
3/29/93	24.22	22.99	21.42		1.23	2.80	1.57	
7/1/93	22.44	20.87	19.54		1.57	2.90	1.33	
10/5/93	21.25	18.57	19.20		2.68	2.05	-0.63	
1/6/94	22.89	20.37	21.40		2.52	1.49	-1.03	
4/19/94	23.93	21.95	22.40		1.98	1.53	-0.45	
AVG 93-94	23.38	21.44	21.29		1.94	2.09	0.15	
STD 93-94	1.38	1.75	1.58		0.52	0.57	0.98	
AVG 87-93	25.26	23.98	23.79		1.28	1.48	0.19	
STD 87-93	1.29	1.55	1.73		0.67	1.08	0.96	
SITE 24	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	33.02	31.56			1.46			
3/29/93	31.06	28.48			2.58			
4/20/93	30.0	27.3			2.7			
6/30/93	26.57	22.44	22.46		4.13	4.11	-0.02	
10/5/93	23.18	20.75	20.5		2.43	2.68	0.25	
10/23/93	23.8	21.2	21.0		2.6	2.8	0.2	
1/6/94	24.59	22.64	22.36		1.95	2.23	0.28	
4/19/94	25.94	24.15	23.9		1.79	2.04	0.25	
AVG 93-94	27.27	24.82	22.04		2.46	2.77	0.19	
STD 93-94	3.41	3.63	1.20		0.76	0.73	0.11	
AVG 87-93	31.03	29.39	24.78		1.64	2.58	0.15	
STD 87-93	3.00	3.57	3.11		0.82	0.70	0.09	
SITE 25	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	15.12	15.81	9.28		-0.69	5.84	6.53	

3/28/93	11.4	12.0	6.3		-0.6	5.1	5.7	
3/29/93	11.41	12.01	6.30		-0.60	5.11	5.71	
6/30/93	7.00	7.67	2.81		-0.67	4.19	4.86	
7/31/93	5.9	6.6	2.2		-0.7	3.7	4.4	
9/14/93	8.3	9.2	4.3		-0.9	4.0	4.9	
10/5/93	9.15	9.97	4.70		-0.82	4.45	5.27	
10/13/93	9.4	10.2	4.8		-0.8	4.6	5.4	
10/22/93	9.6	10.5	4.9		-0.9	4.7	5.6	
1/6/94	10.53	11.69	5.54		-1.16	4.99	6.15	
4/4/94	11.8	12.64	6.02		-0.84	5.78	6.62	
AVG 93-94	9.96	10.75	5.20		-0.79	4.77	5.56	
STD 93-94	2.40	2.40	1.81		0.16	0.65	0.66	
AVG 87-93	13.72	14.34	8.29		-0.62	5.42	6.05	
STD 87-93	3.21	3.20	2.53		0.22	0.72	0.74	
SITE 26	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	20.66	16.35	12.15		4.31	8.51	4.20	
3/29/93	17.23	12.21	7.78		5.02	9.45	4.43	
4/20/93	16.2	11.1	6.8		5.1	9.4	4.3	
6/30/93	14.79	9.86	5.70		4.93	9.09	4.16	
10/5/93	15.21	10.83	7.50		4.38	7.71	3.33	
1/6/94	16.07	11.88	8.28		4.19	7.79	3.6	
4/15/94	16.72	12.61	8.76		4.11	7.96	3.85	
AVG 93-94	16.70	12.12	8.14		4.58	8.56	3.98	
STD 93-94	1.79	1.93	1.88		0.39	0.70	0.37	
AVG 87-93	20.17	15.61	11.39		4.56	8.78	4.22	
STD 87-93	2.55	2.69	2.78		0.46	0.81	0.43	
SITE 27	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	13.81	13.36	13.45		0.65	0.63	-0.02	
3/29/93	10.75	10.10	10.12		0.66	1.04	0.38	
6/30/93	8.73	8.07	7.69		0.66	1.04	0.38	
10/5/93	9.80	9.29	9.46		0.51	0.34	-0.17	
1/6/94	10.77	10.22	10.38		0.55	0.39	-0.16	
4/15/94	11.52	11.05	11.22		0.47	0.3	-0.17	
AVG 93-94	10.90	10.35	10.39		0.58	0.62	0.04	
STD 93-94	1.57	1.63	1.75		0.08	0.31	0.25	
AVG 87-93	13.14	12.41	12.51		0.73	0.65	-0.08	
STD 87-93	1.92	2.07	2.10		0.53	0.52	0.17	
SITE 28	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	25.77	25.60	25.52		0.17	0.25	0.08	
3/29/93	24.90	24.37	24.27		0.53	0.63	0.10	
6/30/93	22.47	21.46	21.37		1.01	1.10	0.09	
10/4/93	21.87	21.28	21.18		0.59	0.69	0.10	
1/6/94	22.03	21.83	21.72		0.2	0.31	0.11	

4/20/94	22.62	22.55	22.46		0.07	0.16	0.09	
AVG 93-94	23.28	22.85	22.75		0.43	0.52	0.10	
STD 93-94	1.50	1.60	1.61		0.32	0.32	0.01	
AVG 87-93	24.58	24.35	24.37		0.22	0.21	-0.02	
STD 87-93	1.35	1.60	1.53		0.35	0.34	0.24	
SITE 29	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	50.99	38.56	39.25		12.43	11.74	-0.69	
4/2/93	50.50	38.20	38.72		12.30	11.78	-0.52	
4/25/93	50.3	38.0	38.6		12.3	11.7	-0.6	
6/30/93	49.60	36.27	36.80		13.33	12.80	-0.53	
10/4/93	49.29	35.09	35.66		14.20	13.63	-0.57	
10/22/93	49.3	35.1	35.6		14.2	13.7	-0.5	
1/6/94	49.20	35.14	35.73		14.06	13.47	-0.59	
4/7/94	49.44	35.49	35.99		13.95	13.45	-0.5	
AVG 93-94	49.83	36.48	37.04		13.35	12.78	-0.56	
STD 93-94	0.63	1.43	1.46		0.82	0.85	0.06	
AVG 87-93	50.19	37.15	37.69		13.04	12.49	-0.55	
STD 87-93	0.93	1.52	1.55		0.69	0.71	0.05	
SITE 30	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	20.83	19.14	19.11		1.69	1.72	0.03	
3/29/93	17.30	14.57	14.54		2.73	2.76	0.03	
6/29/93	14.86	11.95	11.93		2.91	2.93	0.02	
10/1/93	16.52	14.94	14.97		1.58	1.55	-0.03	
1/6/94	17.60	16.47	16.53		1.13	1.07	-0.06	
4/14/94	18.59	17.15	17.19		1.44	1.4	-0.04	
AVG 93-94	17.62	15.70	15.71		1.91	1.91	-0.01	
STD 93-94	1.83	2.25	2.26		0.67	0.69	0.04	
AVG 87-93	21.66	20.43	20.49		1.24	1.17	-0.06	
STD 87-93	2.50	3.14	3.19		0.86	0.95	0.21	
SITE 31	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/6/93	14.71	15.02	15.62		-0.31	-0.91	-0.6	
3/29/93	13.43	13.78	13.65		-0.35	-0.22	0.13	
4/20/93	13.1	13.4			-0.3			
6/30/93	12.28	12.66	12.25		-0.38	0.03	0.41	
10/5/93	13.65	14.01	13.67		-0.36	-0.02	0.34	
10/23/93	13.7	14.1	14.0		-0.4	-0.3	0.1	
1/6/94	13.98	14.14	14.73		-0.16	-0.75	-0.59	
4/15/94	14.3	14.6	15.06		-0.3	-0.76	-0.46	
AVG 93-94	13.64	13.96	14.14		-0.32	-0.42	-0.10	
STD 93-94	0.70	0.67	1.03		0.07	0.35	0.41	
AVG 87-93	14.66	14.69	15.67		-0.03	-0.95	-0.94	
STD 87-93	1.05	0.89	1.33		0.29	0.44	0.59	

SITE 32	WELL 1	WELL 2	WELL 3	WELL 4	1-2	1-3	2-3	1-4
1/6/93	48.58	48.40	5.57	7.68	0.18	43.01	42.83	40.90
3/29/93	45.83	45.88	1.48	2.60	-0.05	44.35	44.40	43.23
6/30/93	44.77	44.95	0.69	3.21	-0.18	44.08	44.26	41.56
10/4/93	45.79	46.01	2.54	6.00	-0.22	43.25	43.47	39.79
1/6/94	46.84	47.08	4.10	8.00	-0.24	42.74	42.98	38.84
4/19/94	48.64	47.87	4.95	9.10	0.77	43.69	42.92	39.54
AVG 93-94	46.74	46.70	3.22	6.10	0.04	43.52	43.48	40.64
STD 93-94	1.45	1.20	1.79	2.44	0.35	0.57	0.64	1.46
AVG 87-93	48.34	48.57	5.81	8.81	-0.23	42.54	42.76	
STD 87-93	1.69	1.86	2.96	3.51	0.42	1.47	1.31	
SITE 33	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	35.94	35.17	35.58		0.77	0.36	-0.41	
4/1/93	35.01	34.08	34.70		0.93	0.31	-0.62	
6/29/93	33.25	32.19	32.95		1.06	0.30	-0.76	
10/4/93	32.10	31.12	31.20		0.98	0.90	-0.08	
1/6/94	32.35	31.60	31.77		0.75	0.58	-0.17	
4/7/94	32.88	32.09	32.23		0.79	0.65	-0.14	
AVG 93-94	33.59	32.71	33.07		0.88	0.52	-0.36	
STD 93-94	1.41	1.43	1.57		0.12	0.22	0.26	
AVG 87-93	33.96	33.14	33.37		0.83	0.59	-0.24	
STD 87-93	1.28	1.44	1.49		0.42	0.46	0.24	
SITE 34	WELL 1	WELL 2			1-2			
1/5/93	9.19	8.34			0.85			
4/2/93	7.82	6.94			0.88			
6/30/93	7.73	6.75			0.98			
10/4/93	8.89	7.83			1.06			
1/10/94	8.7	7.83			0.87			
4/20/94	9.09	8.26			0.83			
AVG 93-94	8.57	7.66			0.91			
STD 93-94	0.58	0.61			0.08			
AVG 87-93	9.75	8.95			0.79			
STD 87-93	0.88	0.94			0.12			
SITE 35	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	25.90	25.17	20.93		0.73	4.97	4.24	
4/2/93	24.88	23.95	19.39		0.93	5.49	4.56	
6/30/93	22.79	21.74	16.34		1.05	6.45	5.40	
10/4/93	22.95	21.95	17.38		1.00	5.57	4.57	
1/10/94	22.95	21.98	17.89		0.97	5.06	4.09	
4/20/94	23.45	22.59	18.41		0.86	5.04	4.18	
AVG 93-94	23.82	22.90	18.39		0.92	5.43	4.51	
STD 93-94	1.17	1.25	1.47		0.10	0.51	0.44	

AVG 87-93	24.99	24.06	19.63		0.93	5.36	4.43	
STD 87-93	1.98	2.05	2.16		0.09	0.47	0.46	
SITE 36	WELL 1	WELL 2	WELL 3	WELL 4	1-2	1-3	2-3	1-4
1/5/93	30.64	28.85	27.12	29.53	1.79	3.52	1.73	1.11
4/1/93	30.05	27.96	26.19	28.12	2.09	3.86	1.77	1.93
4/21/93	29.9	27.8	26.0	28.0	2.1	3.9	1.8	1.9
6/29/93	28.68	26.59	24.79	26.77	2.09	3.89	1.8	1.91
9/16/93	28.7	26.6	24.8	27.1	2.1	3.9	1.8	1.6
10/4/93	28.64	27.66	24.8	27.14	0.98	3.84	2.86	1.5
10/15/93	28.6	27.6	24.8	27.2	1.0	3.8	2.8	1.4
1/12/94	28.36	27.61	24.78	27.1	0.75	3.58	2.83	1.26
4/14/94	28.43	27.65	24.83	27.84	0.78	3.6	2.82	0.59
AVG 93-94	29.11	27.59	25.35	27.64	1.52	3.77	2.25	1.47
STD 93-94	0.80	0.65	0.82	0.80	0.59	0.15	0.52	0.42
AVG 87-93	29.04	27.06	25.19	27.73	1.98	3.85	1.87	
STD 87-93	1.08	1.07	1.13	1.05	0.30	0.10	0.28	
SITE 37	WELL 1	WELL 2	WELL 3	WELL 4	1-3		3-4	1-4
1/4/93	60.93		59.61	59.14	1.32		0.47	1.79
4/1/93	60.84		59.06	58.63	1.78		0.43	2.21
6/29/93	60.16		58.77	58.26	1.39		0.51	1.90
10/1/93	60.38		59.55	58.99	0.83		0.56	1.39
1/12/94	59.58		58.09	57.65	1.49		0.44	1.93
4/13/94	59.09		57.53	57.10	1.56		0.43	1.99
AVG 93-94	60.16		58.77	58.30	1.40		0.47	1.87
STD 93-94	0.66		0.75	0.73	0.29		0.05	0.25
AVG 87-93	59.15		58.43	57.70	0.71	1.44	0.73	
STD 87-93	1.29		1.63	1.45	1.14	0.73	0.65	
SITE 38	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	33.48	32.96	28.20		0.52	5.28	4.76	
4/1/93	32.17	31.70	26.35		0.47	5.82	5.35	
6/30/93	29.98	29.42	23.82		0.56	6.16	5.60	
10/4/93	29.94	29.41	24.37		0.53	5.57	5.04	
1/12/94	30.32	29.80	24.82		0.52	5.5	4.98	
4/14/94	30.95	30.42	25.81		0.53	5.14	4.61	
AVG 93-94	31.14	30.62	25.56		0.52	5.58	5.06	
STD 93-94	1.29	1.31	1.45		0.03	0.34	0.34	
AVG 87-93	31.80	31.32	26.38		0.48	5.42	4.94	
STD 87-93	2.46	2.49	2.55		0.09	0.40	0.38	
SITE 39	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	6.10	4.15	2.92		1.95	3.18	1.23	
2/19/93	5.51	3.19	2.04		2.32	3.47	1.15	

3/22/93	5.14	3.00	2.00		2.14	3.14	1.00	
4/16/93	4.98	2.93	1.92		2.05	3.06	1.01	
5/20/93	4.70	2.05	1.15		2.65	3.55	0.90	
6/19/93	4.77	3.02	2.22		1.75	2.55	0.80	
7/15/93	4.95	2.50	1.13		2.45	3.82	1.37	
8/10/93	4.98	3.02	2.30		1.96	2.68	0.72	
9/9/93	5.50	3.99	3.15		1.51	2.35	0.84	
10/6/93	5.97	4.35	3.40		1.62	2.57	0.95	
10/22/93	6.12	4.33	3.18		1.79	2.94	1.15	
11/3/93	6.03	4.25	3.03		1.78	3	1.22	
12/1/93	5.96	4.14	2.92		1.82	3.04	1.22	
1/4/94	5.80	4.22	2.97		1.58	2.83	1.25	
2/3/94	5.92	4.24	2.98		1.68	2.94	1.26	
3/1/94	5.86	4.25	2.97		1.61	2.89	1.28	
3/29/94	5.98	4.48	3.22		1.5	2.76	1.26	
4/20/94	6.00	4.42	3.13		1.58	2.87	1.29	
AVG 93-94	5.57	3.70	2.59		1.87	2.98	1.11	
STD 93-94	0.49	0.75	0.68		0.32	0.36	0.19	
AVG 87-93	6.35	4.71	3.47		1.64	2.80	1.11	
STD 87-93	0.97	1.37	1.26		0.48	0.53	0.42	
SITE 40	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	58.46	58.44	58.57		0.02	-0.11	-0.13	
4/2/93	57.00	56.77	56.85		0.23	0.15	-0.08	
6/30/93	54.60	54.45	54.47		0.15	0.13	-0.02	
10/4/93	57.35	57.20	57.27		0.15	0.08	-0.07	
1/10/94	53.52	53.43	53.39		0.09	0.13	0.04	
4/20/94	53.55	53.41	53.31		0.14	0.24	0.1	
AVG 93-94	55.75	55.62	55.64		0.13	0.10	-0.03	
STD 93-94	1.94	1.95	2.02		0.06	0.11	0.08	
AVG 87-93	57.22	57.10	56.86		0.12	0.36	0.24	
STD 87-93	3.49	3.48	3.18		0.40	0.71	0.74	
SITE 41	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	4.27	4.23	4.03		0.04	0.24	0.20	
4/2/93	3.09	2.55	2.50		0.54	0.59	0.05	
6/30/93	0.40	0.29	0.63		0.11	-0.23	-0.34	
10/4/93	1.39	1.40	1.40		-0.01	-0.01	0.00	
1/10/94	1.09	1.42	1.70		-0.33	-0.61	-0.28	
4/20/94	1.93	1.98	2.18		-0.05	-0.25	-0.2	
AVG 93-94	2.03	1.98	2.07		0.05	-0.05	-0.10	
STD 93-94	1.30	1.22	1.06		0.26	0.38	0.19	
AVG 87-93	2.17	2.29	2.42		-0.11	-0.25	-0.13	
STD 87-93	1.74	1.72	1.60		0.21	0.36	0.28	
SITE 42	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	

1/5/93	21.59	20.68	13.46		0.91	8.13	7.22	
4/1/93	21.28	20.36	13.03		0.92	8.25	7.33	
6/29/93	20.05	19.18	12.85		0.87	7.20	6.33	
10/1/93	19.34	18.47	13.13		0.87	6.21	5.34	
1/12/94	18.77	17.88	13.12		0.89	5.65	4.76	
4/14/94	18.48	17.61	13.01		0.87	5.47	4.6	
AVG 93-94	19.92	19.03	13.10		0.89	6.82	5.93	
STD 93-94	1.18	1.17	0.19		0.02	1.12	1.10	
AVG 87-93	19.43	18.54	13.37		0.89	6.06	5.17	
STD 87-93	0.83	0.69	0.56		0.41	1.07	0.88	
SITE 43	WELL 1	WELL 2						
1/4/93	5.48	5.08			0.40			
4/1/93	5.40	4.87			0.53			
6/29/93	5.32	5.20			0.12			
10/1/93	5.27	5.49			-0.22			
1/12/94	5.23	5.18			0.05			
4/19/94	5.19	5.14			0.05			
AVG 93-94	5.32	5.16			0.16			
STD 93-94	0.10	0.18			0.25			
AVG 87-93	9.86	5.11			4.75			
STD 87-93	6.11	0.38			6.34			
SITE 44	WELL 1	WELL 2	WELL 3	WELL 4	1-2	1-3	2-3	1-4
1/4/93	68.73	68.72	76.63	DRY	0.01	-7.90	-7.91	
4/1/93	68.57	68.55	76.48	DRY	0.02	-7.91	-7.93	
6/29/93	68.13	68.03	75.85	DRY	0.10	-7.72	-7.82	
10/1/93	67.52	67.42	75.28	75.15	0.10	-7.76	-7.86	-7.63
1/10/94	67.26	67.19	75.11	75.07	0.07	-7.85	-7.92	-7.81
4/21/94	67.30	67.25	75.36	75.43	0.05	-8.06	-8.11	-8.13
AVG 93-94	67.92	67.86	75.79		0.06	-7.87	-7.93	
STD 93-94	0.59	0.61	0.59		0.04	0.11	0.09	
AVG 87-93	67.50	67.47	75.73	75.53	0.03	-8.24	-8.26	
STD 87-93	0.91	0.91	0.70	1.28	0.05	0.28	0.26	
SITE 45	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	49.42	49.42	48.58		0.00	0.84	0.84	
4/2/93	48.65	48.69	47.77		-0.04	0.88	0.92	
6/29/93	47.23	47.30	46.44		-0.07	0.79	0.86	
10/1/93	46.66	46.71	45.78		-0.05	0.88	0.93	
1/10/94	46.49	46.54	45.62		-0.05	0.87	0.92	
4/20/94	46.70	46.73	45.69		-0.03	1.01	1.04	
AVG 93-94	47.53	47.57	46.65		-0.04	0.88	0.92	
STD 93-94	1.11	1.10	1.14		0.02	0.07	0.06	
AVG 87-93	46.68	46.66	45.75		0.02	0.93	0.91	

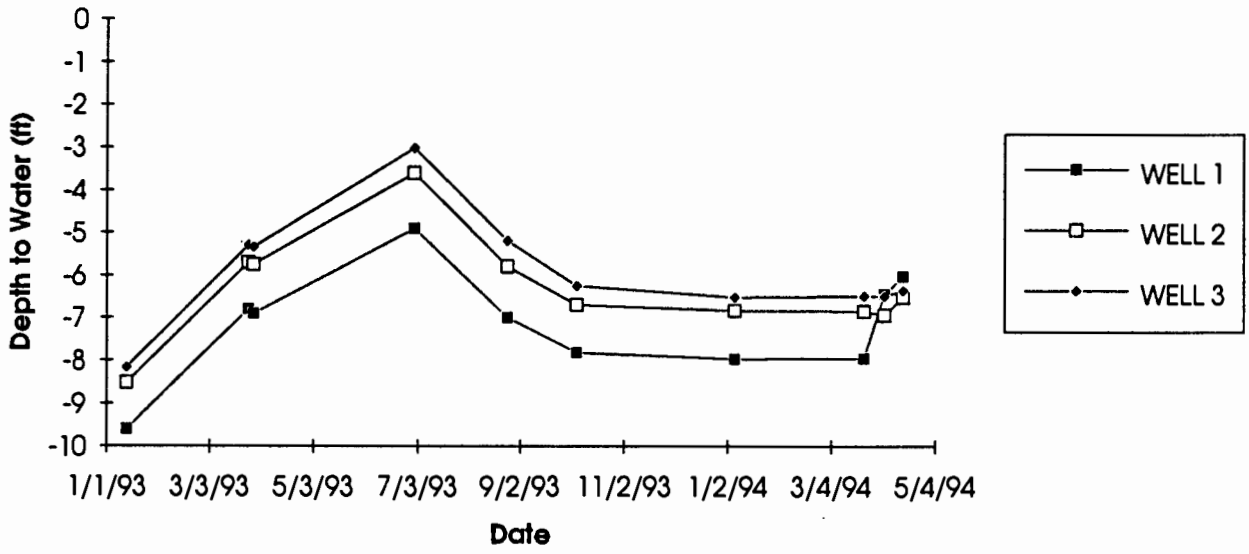
STD 87-93	1.99	2.02	2.06		0.04	0.16	0.14	
SITE 46	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	52.03	47.89	47.83		4.14	4.20	0.06	
4/1/93	51.65	47.37	47.28		4.28	4.37	0.09	
6/29/93	50.74	45.17	45.13		5.57	5.61	0.04	
10/1/93	50.66	45.28	45.18		5.38	5.48	0.10	
1/10/94	50.07	44.55	44.48		5.52	5.59	0.07	
4/21/94	49.79	44.62	44.57		5.17	5.22	0.05	
AVG 93-94	50.82	45.81	45.75		5.01	5.08	0.07	
STD 93-94	0.80	1.32	1.32		0.58	0.58	0.02	
AVG 87-93	49.51	44.80	44.72		4.71	4.79	0.08	
STD 87-93	1.96	2.65	2.63		0.79	0.77	0.04	
SITE 47	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/4/93	77.11	71.94	71.51		5.17	5.60	0.43	
4/1/93	77.05	71.86	71.44		5.19	5.61	0.42	
6/29/93	77.21	71.36	70.93		5.85	6.28	0.43	
10/1/93	77.56	71.59	71.15		5.97	6.41	0.44	
1/10/94	77.67	71.17	70.74		6.5	6.93	0.43	
4/4/94	77.68	70.56	70.04		7.12	7.64	0.52	
AVG 93-94	77.38	71.41	70.97		5.97	6.41	0.45	
STD 93-94	0.26	0.47	0.49		0.69	0.72	0.03	
AVG 87-93	76.25	70.74	70.30		5.51	5.95	0.44	
STD 87-93	0.66	0.80	0.82		0.26	0.27	0.04	
SITE 48	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/5/93	62.86	56.40	56.54		6.46	6.32	-0.14	
4/1/93	62.85	56.36	56.59		6.49	6.26	-0.23	
6/29/93	62.87	55.74	55.83		7.13	7.04	-0.09	
10/1/93	62.90	55.43	55.55		7.47	7.35	-0.12	
1/10/94	62.57	54.96	54.96		7.61	7.61	0	
4/21/94	62.52	55.06	55.18		7.46	7.34	-0.12	
AVG 93-94	62.76	55.66	55.78		7.10	6.99	-0.12	
STD 93-94	0.15	0.57	0.62		0.47	0.52	0.07	
AVG 87-93	61.03	53.72	53.79		7.32	7.24	-0.07	
STD 87-93	1.25	1.78	1.80		0.78	0.80	0.25	
SITE 49	WELL 1	WELL 2	WELL 3	WELL 4			3-4	
4/1/93	CAPPED	CAPPED	0.33	-0.75			1.08	
6/30/93	CAPPED	CAPPED	0.74	-0.75			1.49	
7/7/93	CAPPED	CAPPED	-0.27	-1.30			1.00	
10/1/93	CAPPED	CAPPED	1.60	0.56			1.04	
1/12/94	CAPPED	CAPPED	0.92	-0.08			1.00	
4/4/94	CAPPED	CAPPED	1.02	-0.02			1.04	
AVG 93-94			0.72	-0.39			1.11	

STD 93-94			0.58	0.61			0.17	
AVG 87-93			1.06	-0.01			1.07	
STD 87-93			0.57	0.61			0.12	
SITE 50	WELL 1	WELL 2	WELL 3		1-2	1-3	2-3	
1/14/93	26.95	28.12	27.17		-1.17	-0.22	0.95	
3/29/93	25.94	26.09	26.15		-0.15	-0.21	-0.06	
7/1/93	24.82	25.04	25.09		-0.22	-0.27	-0.05	
9/22/93	22.60	22.84	22.96		-0.24	-0.36	-0.12	
10/20/93	22.32	22.48	22.57		-0.16	-0.25	-0.09	
1/5/94	21.91	22.08	22.09		-0.17	-0.18	-0.01	
3/31/94	22.20	22.29	22.34		-0.09	-0.14	-0.05	
5/26/94	22.96	23.23	23.07		-0.27	-0.11	0.16	
AVG 93-94	23.71	24.02	23.93		-0.31	-0.22	0.09	
STD 93-94	1.80	2.04	1.81		0.33	0.07	0.33	
AVG 87-93	26.28	26.55	26.50		-0.27	-0.22	0.05	
STD 87-93	1.61	1.67	1.56		0.22	0.14	0.24	
SITE 51	WELL 1	WELL 2			1-2			
1/14/93	19.57	19.00			0.57			
3/29/93	17.83	17.30			0.53			
7/1/93	15.94	15.59			0.35			
10/5/93	14.05	13.78			0.27			
1/5/94	13.74	13.28			0.46			
4/19/94	14.17	13.68			0.49			
AVG 93-94	15.88	15.44			0.45			
STD 93-94	2.17	2.11			0.10			
AVG 87-93	19.22	18.51			0.52			
STD 87-93	1.94	2.08			0.11			
SITE 52	WELL 1	WELL 2			1-2			
1/14/93	31.40	31.53			-0.13			
3/29/93	30.40	30.79			-0.39			
7/1/93	27.87	28.64			-0.77			
10/5/93	23.98	24.00			-0.02			
1/5/94	23.40	23.30			0.1			
4/19/94	23.83	23.67			0.16			
AVG 93-94	26.81	26.99			-0.18			
STD 93-94	3.26	3.45			0.32			
AVG 87-93	29.02	28.80			0.22			
STD 87-93	2.55	2.49			0.43			

Appendix B: Monitoring Well Hydrographs, 1993-94

This appendix presents plots of measured water elevations during 1993-94 for monitoring well sites, based on data contained in Appendix A. The lines connecting the data points are for visual assistance in identifying trends, and do not necessarily depict the actual behavior of the water elevations over those periods. See the introduction to Appendix A and the text for further discussion of the significance of the data.

Site 1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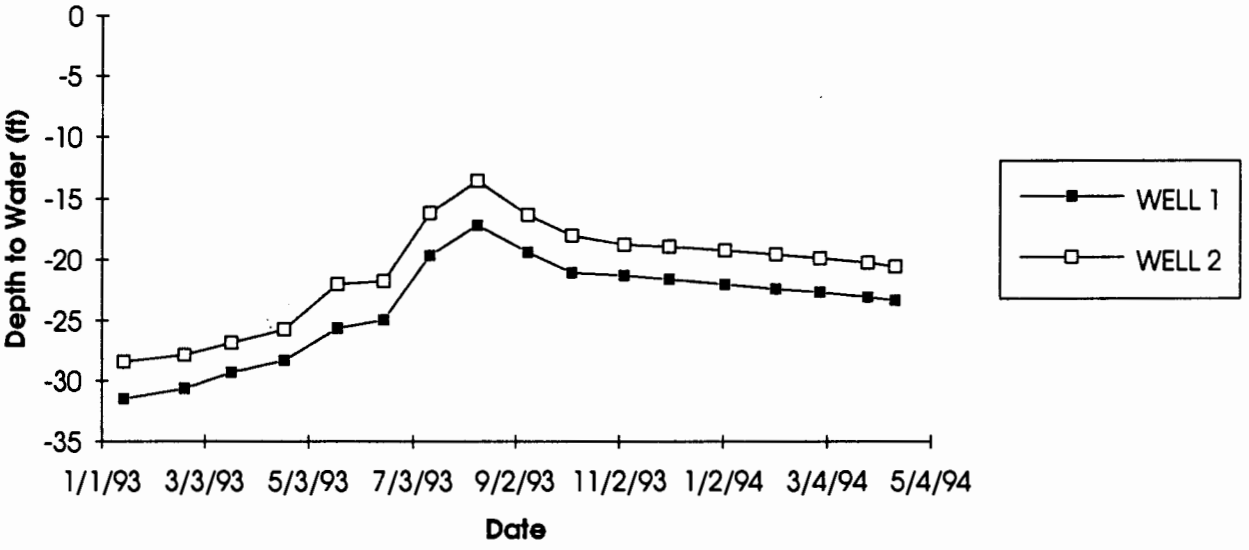
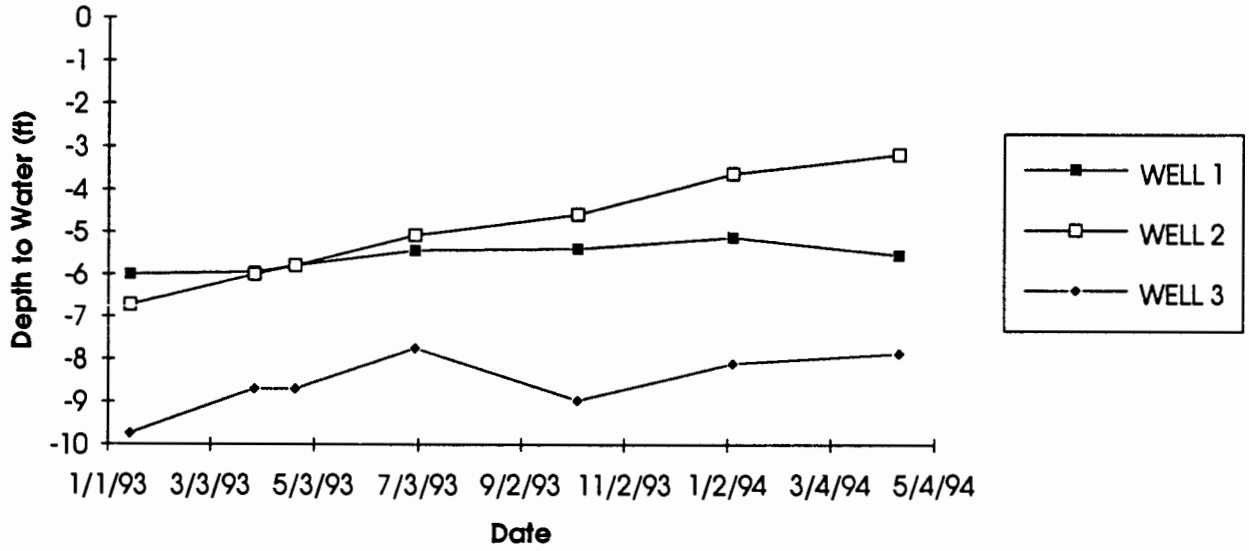
Depth to Water (ft)
1/1/93
3/3/93
5/3/93
7/3/93
9/2/93
11/2/93
1/2/94
3/4/94
5/4/94
Date
WELL 1
WELL 2
WELL 3

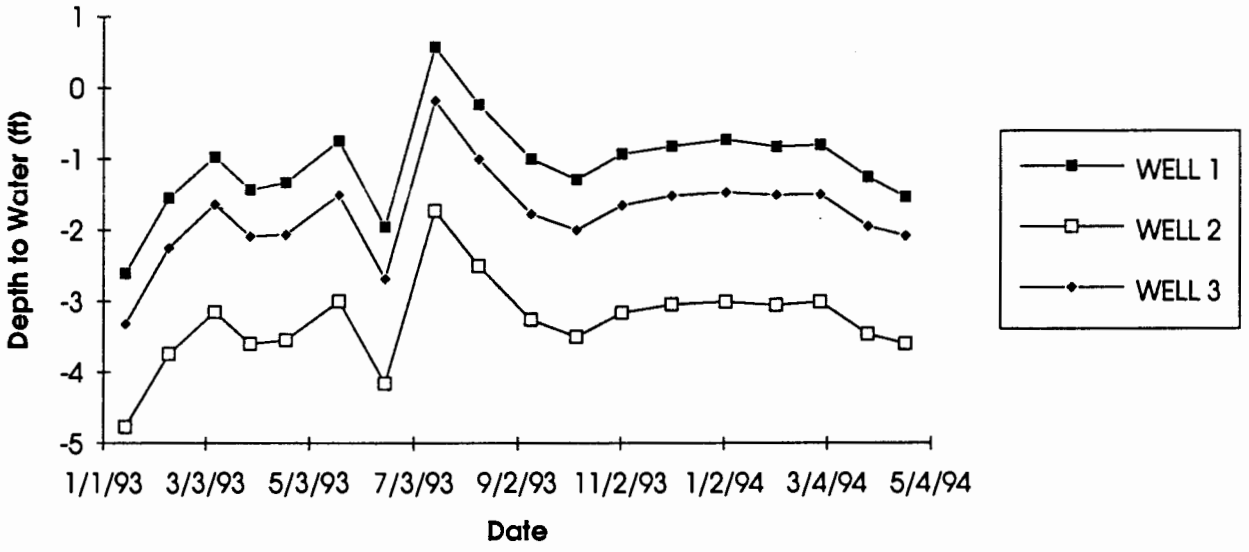
Site 3


0
-5
-10
-15
-20
-25
-30
-35
Depth to Water (ft)
1/1/93
3/3/93
5/3/93
7/3/93
9/2/93
11/2/93
1/2/94
3/4/94
5/4/94
Date
WELL 1
WELL 2

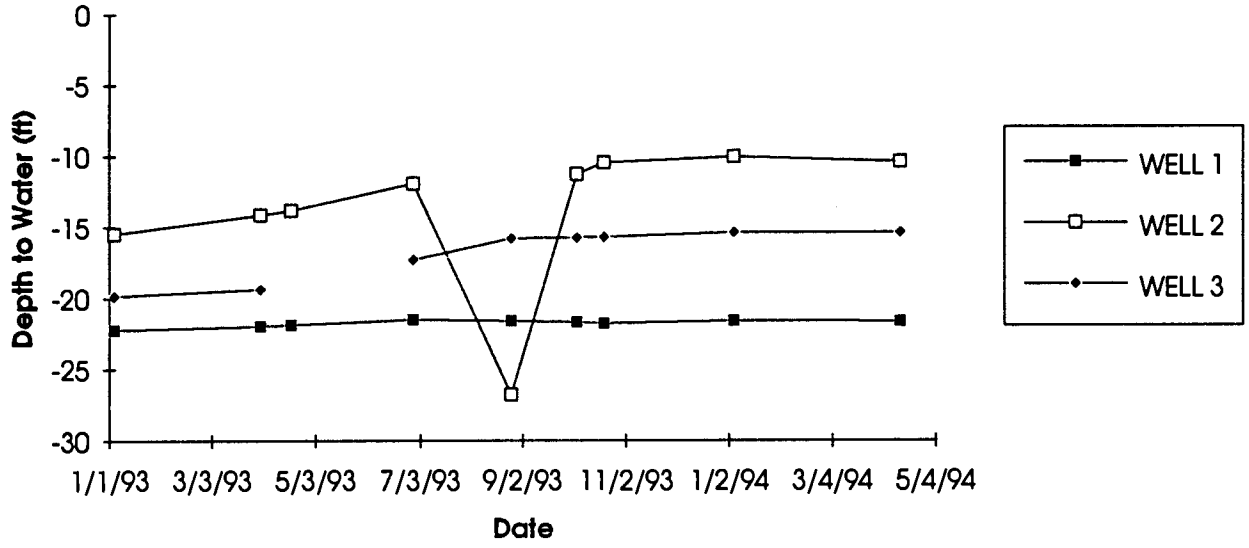
Site 4


0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
Depth to Water (ft)
1/1/93
3/3/93
5/3/93
7/3/93
9/2/93
11/2/93
1/2/94
3/4/94
5/4/94
Date
WELL 1
WELL 2
WELL 3

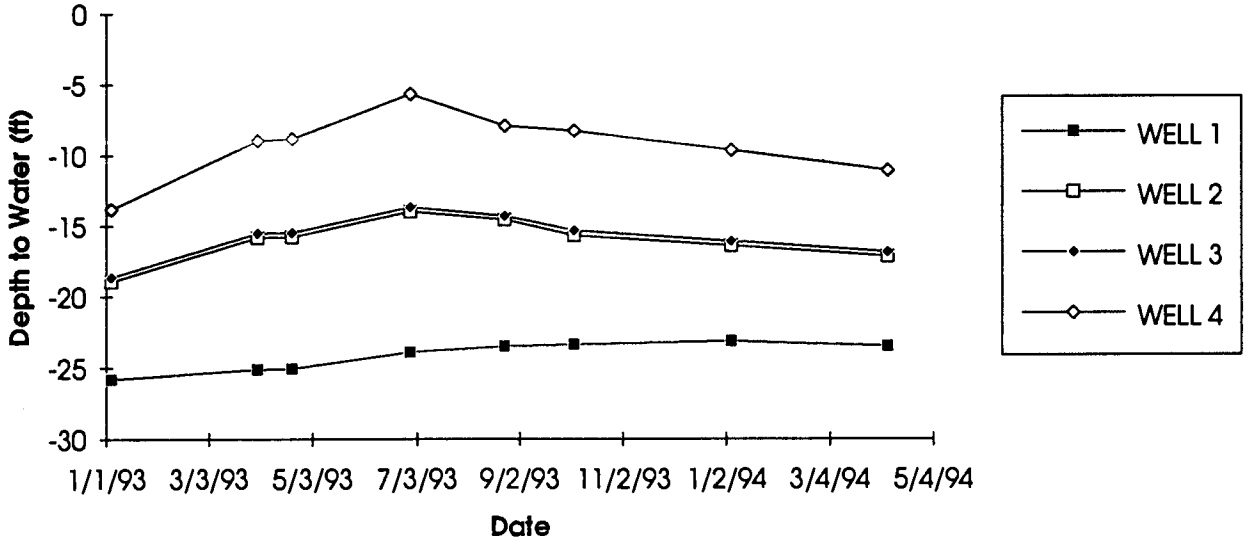
Site 5


1
0
-1
-2
-3
-4
-5
Depth to Water (ft)
1/1/93
3/3/93
5/3/93
7/3/93
9/2/93
11/2/93
1/2/94
3/4/94
5/4/94
Date
WELL 1
WELL 2
WELL 3

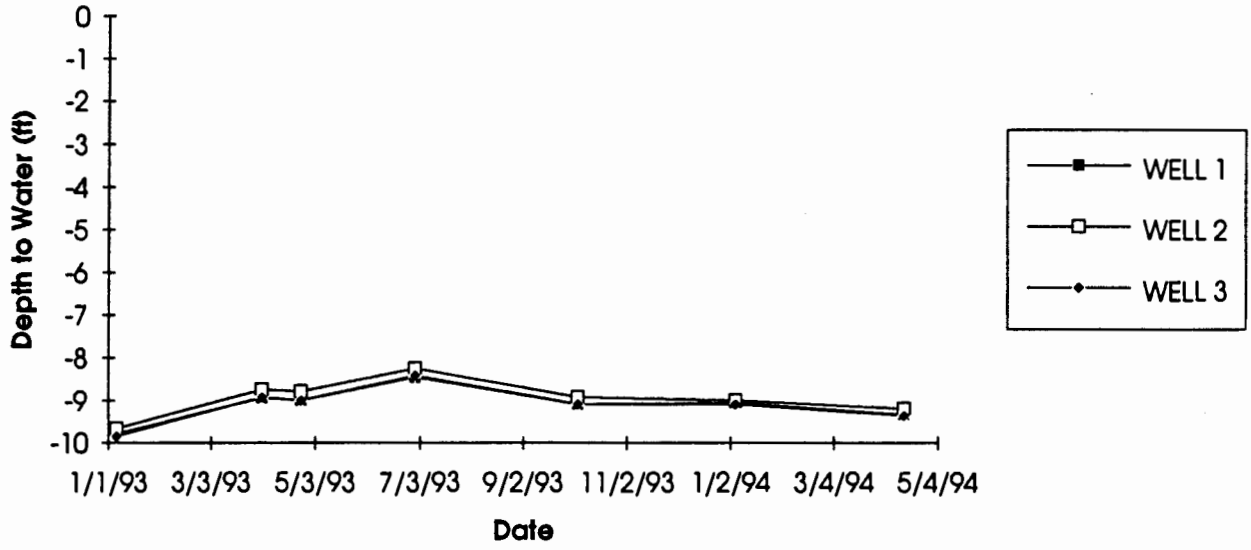
Site 6


0
-5
-10
-15
-20
-25
-30
Depth to Water (ft)
1/1/93
3/3/93
5/3/93
7/3/93
9/2/93
11/2/93
1/2/94
3/4/94
5/4/94
Date
WELL 1
WELL 2
WELL 3

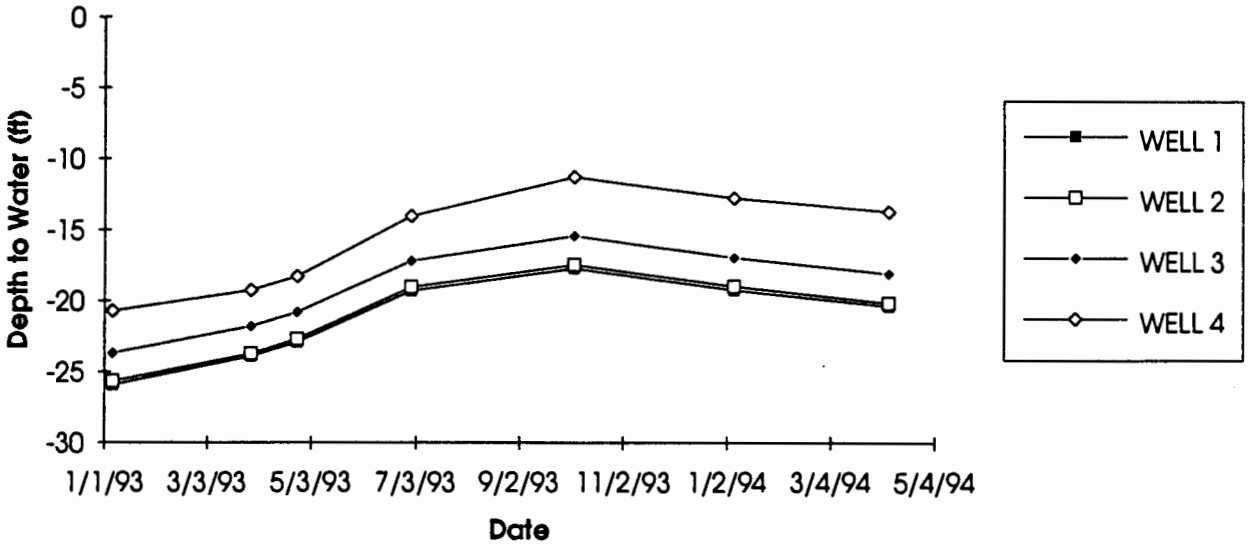
Site 8


0
-5
-10
-15
-20
-25
-30
Depth to Water (ft)
1/1/93
3/3/93
5/3/93
7/3/93
9/2/93
11/2/93
1/2/94
3/4/94
5/4/94
Date
WELL 1
WELL 2
WELL 3
WELL 4

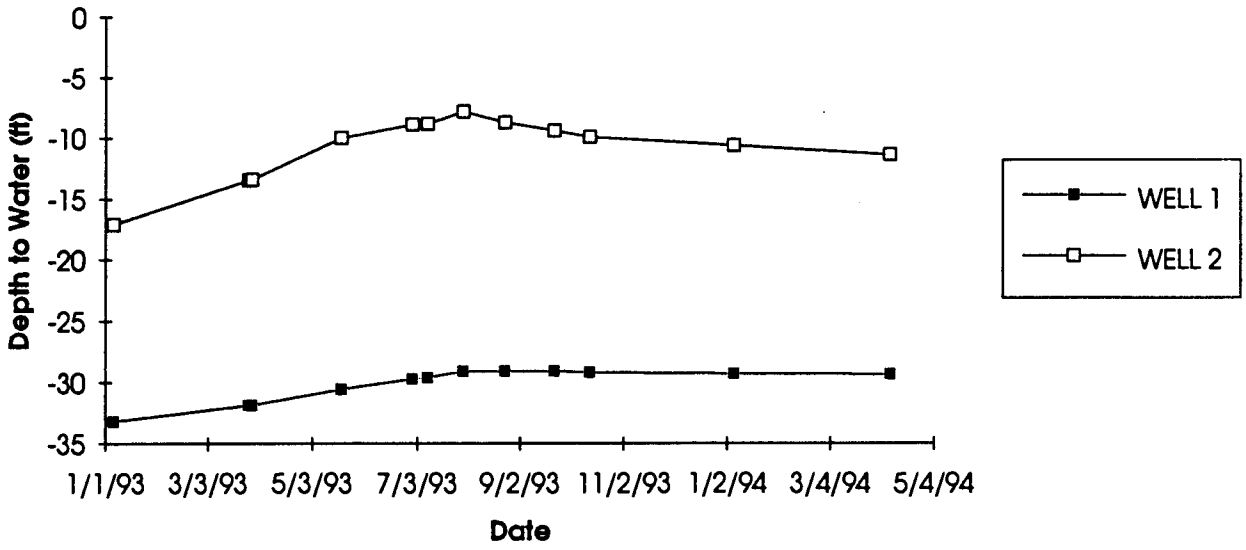
Site 9



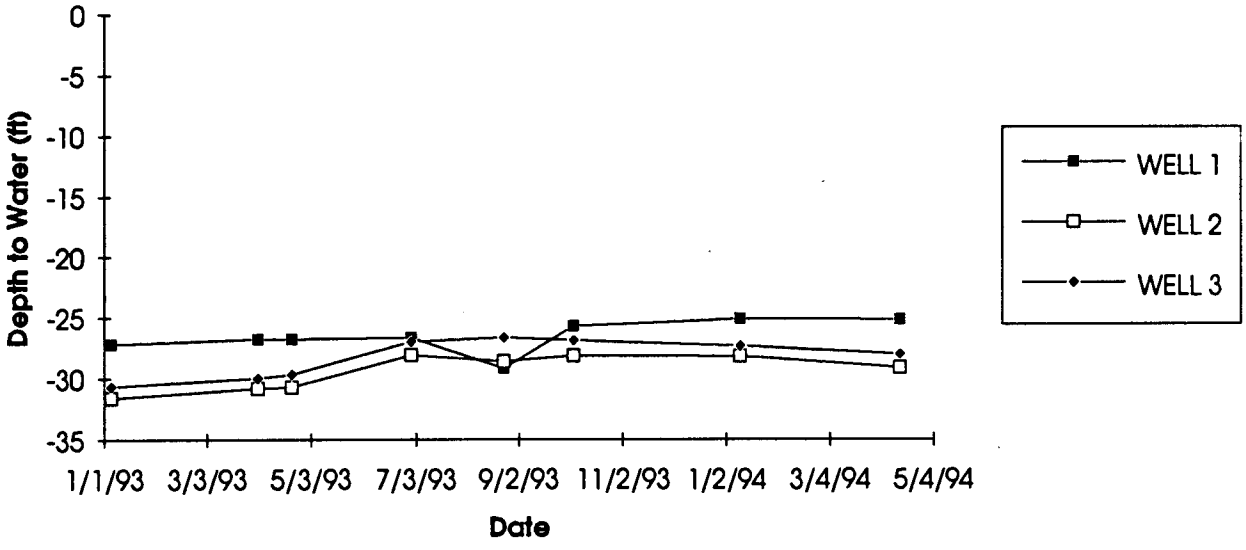
Site 10



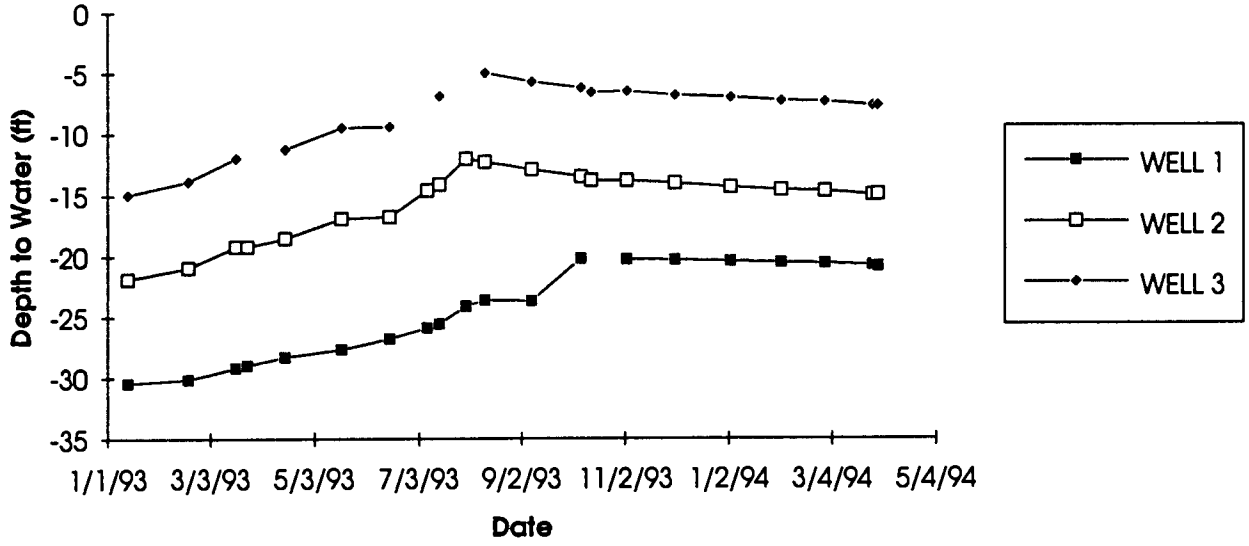
Site 11



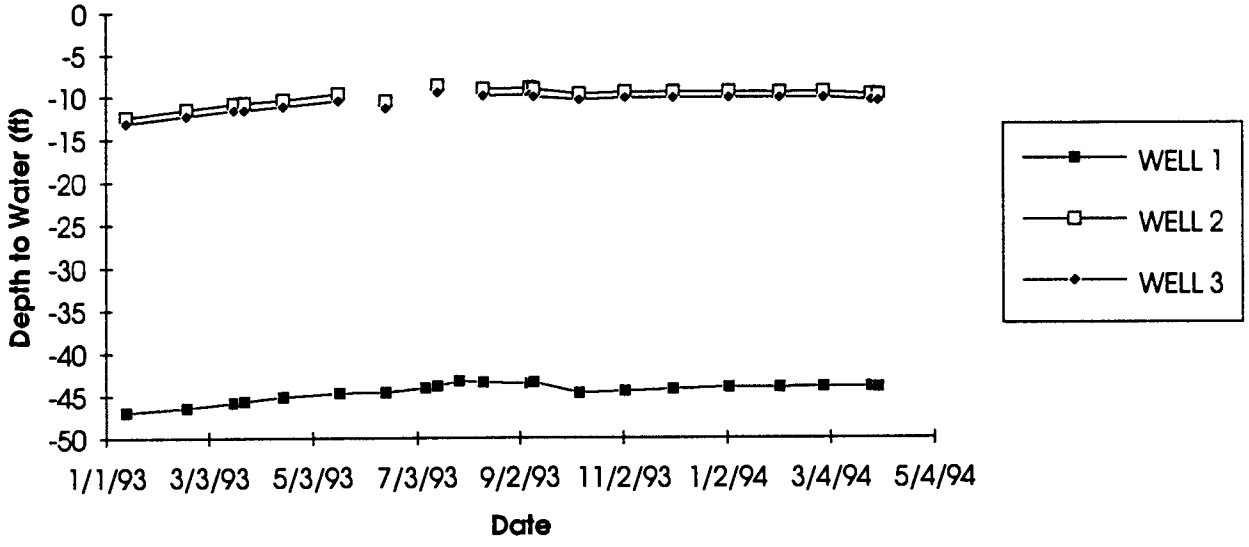
Site 15



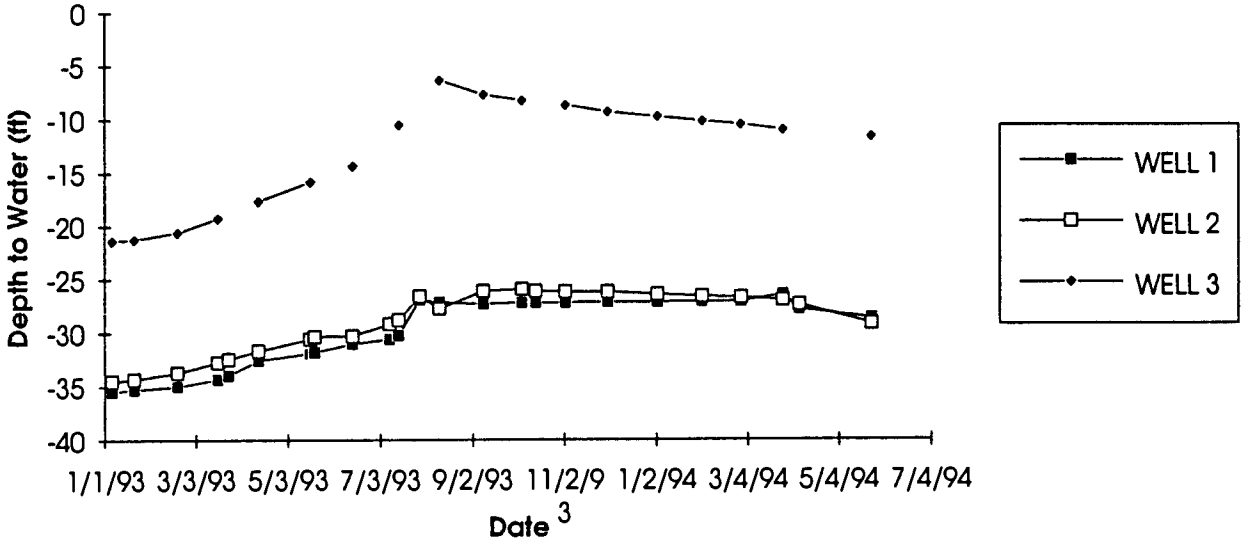
Site 16



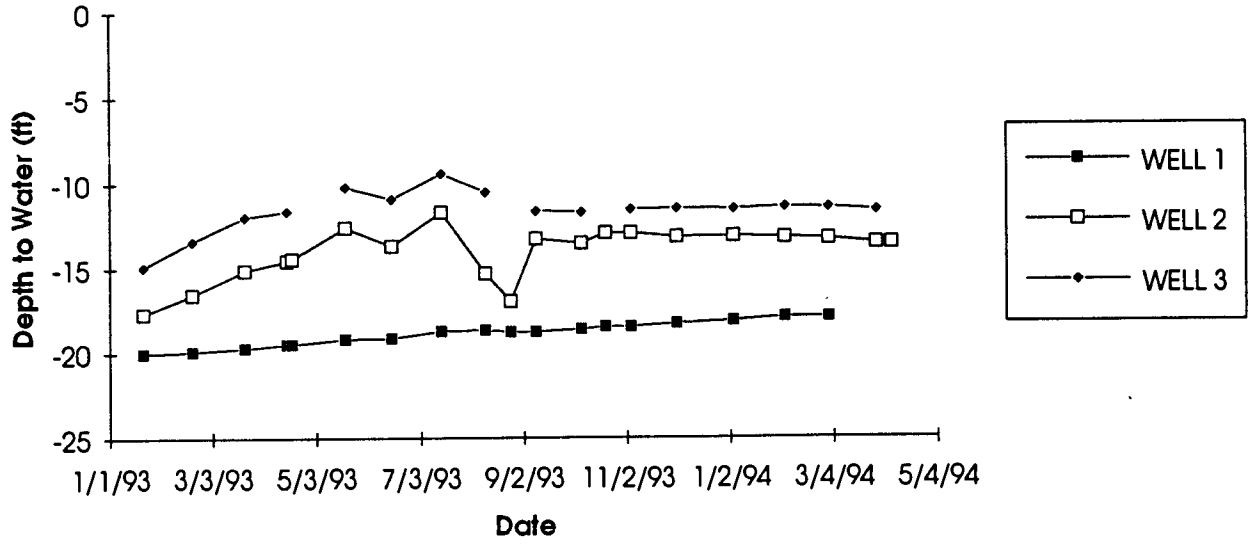
Site 17



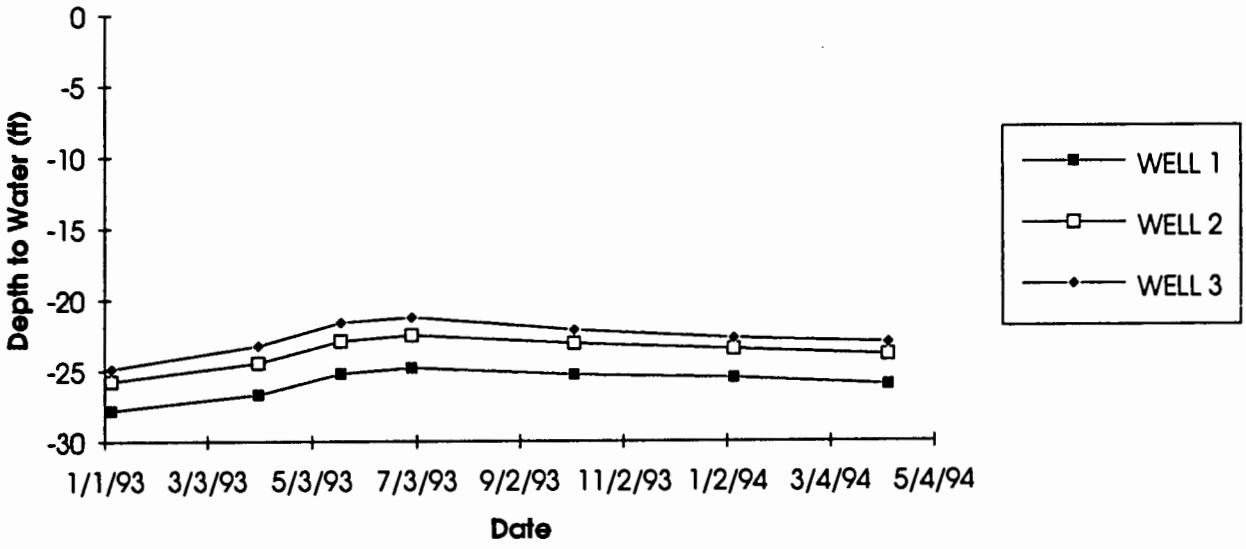
Site 18



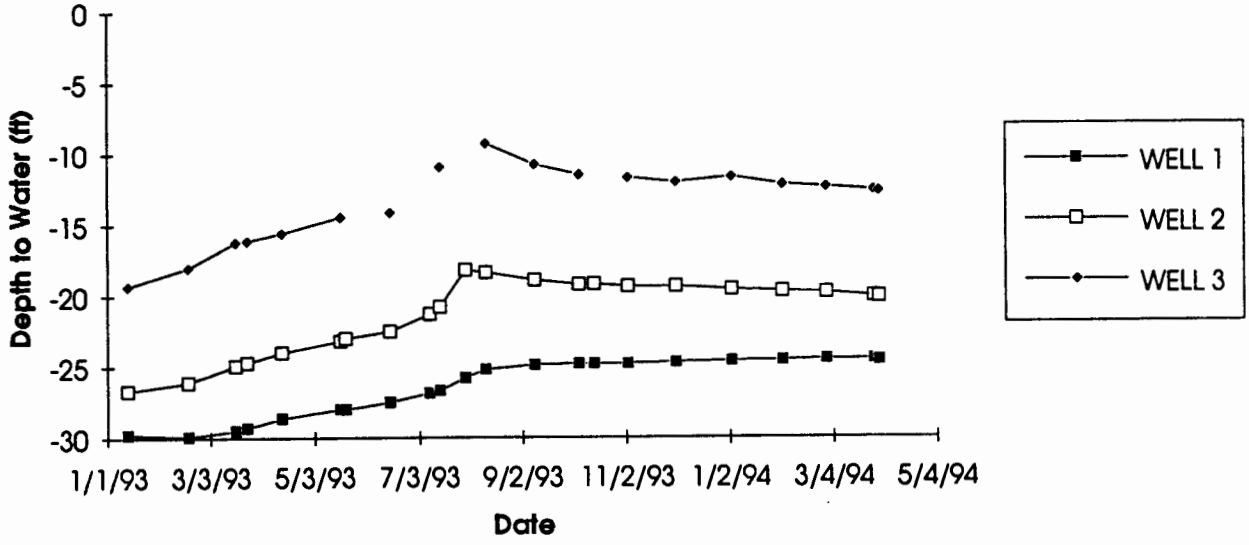
Site 19



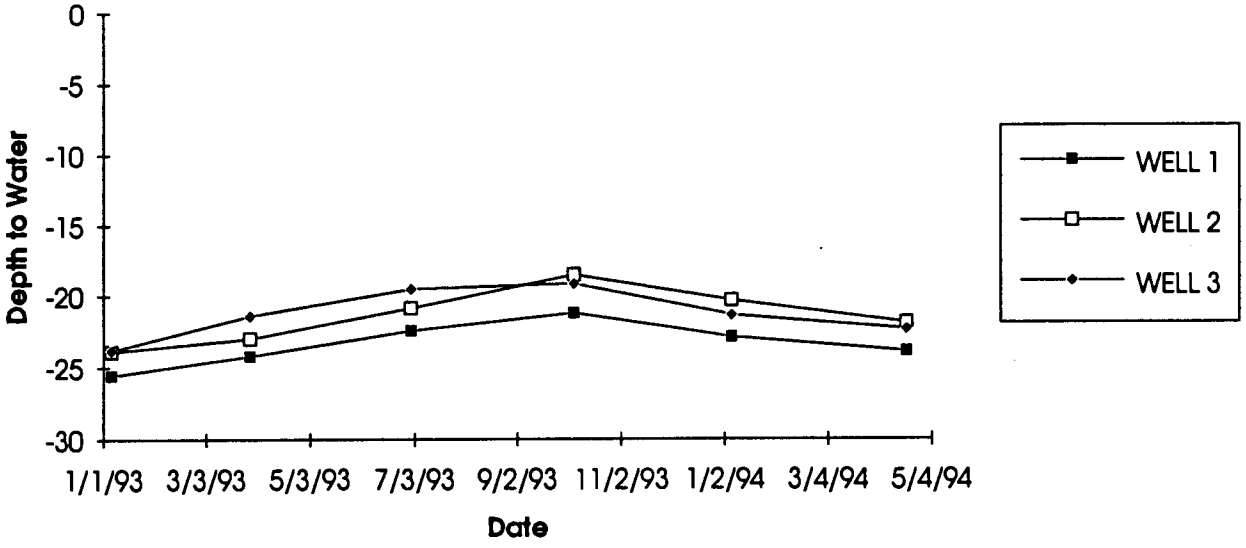
Site 21



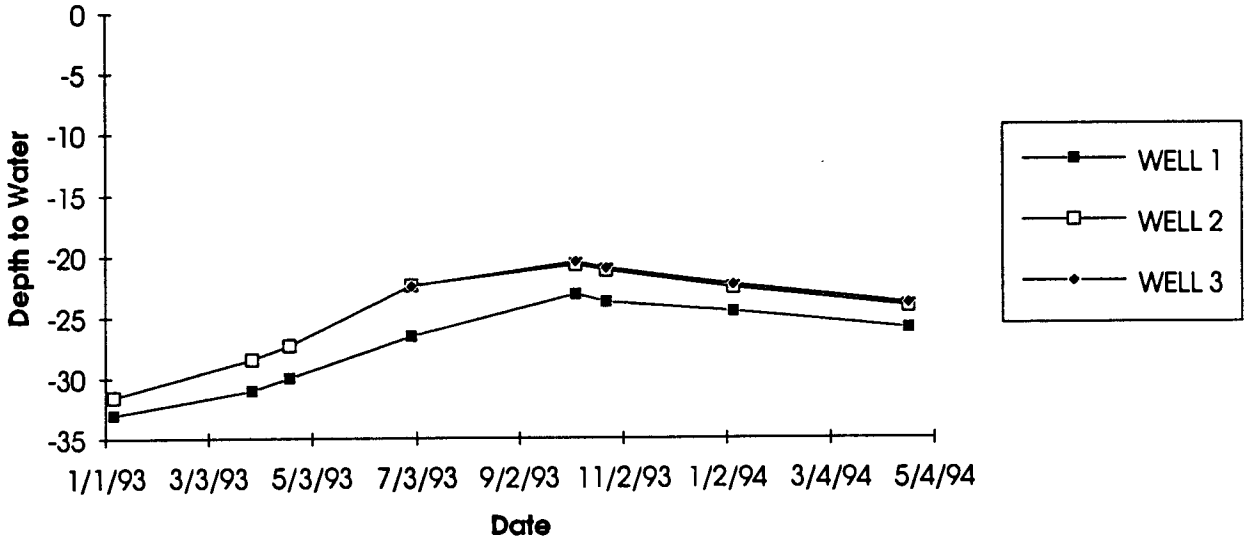
Site 22



Site 23



Site 24



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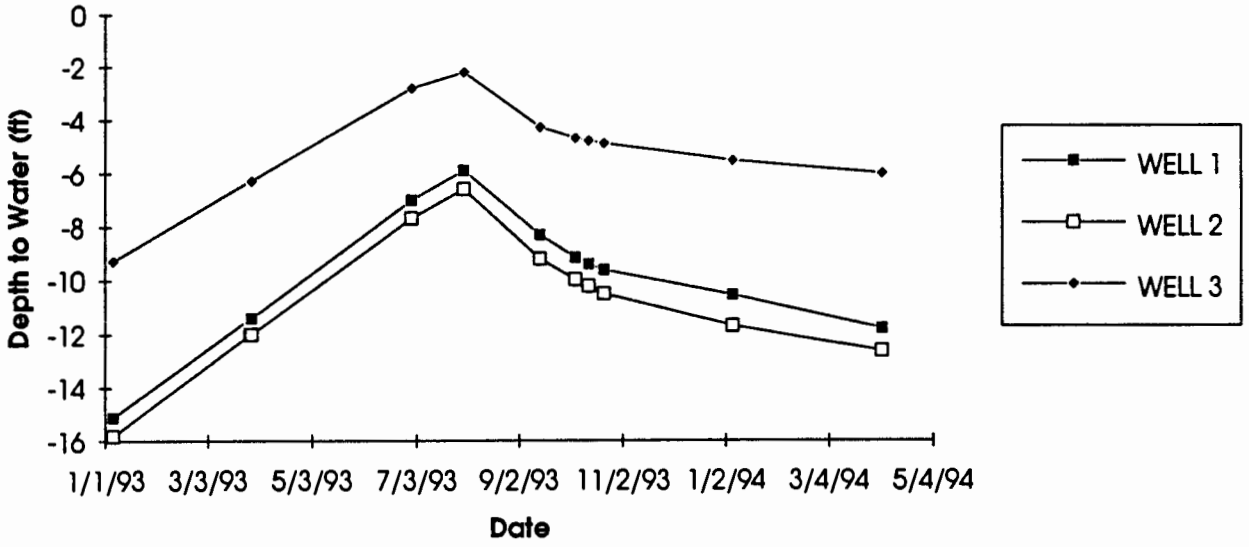
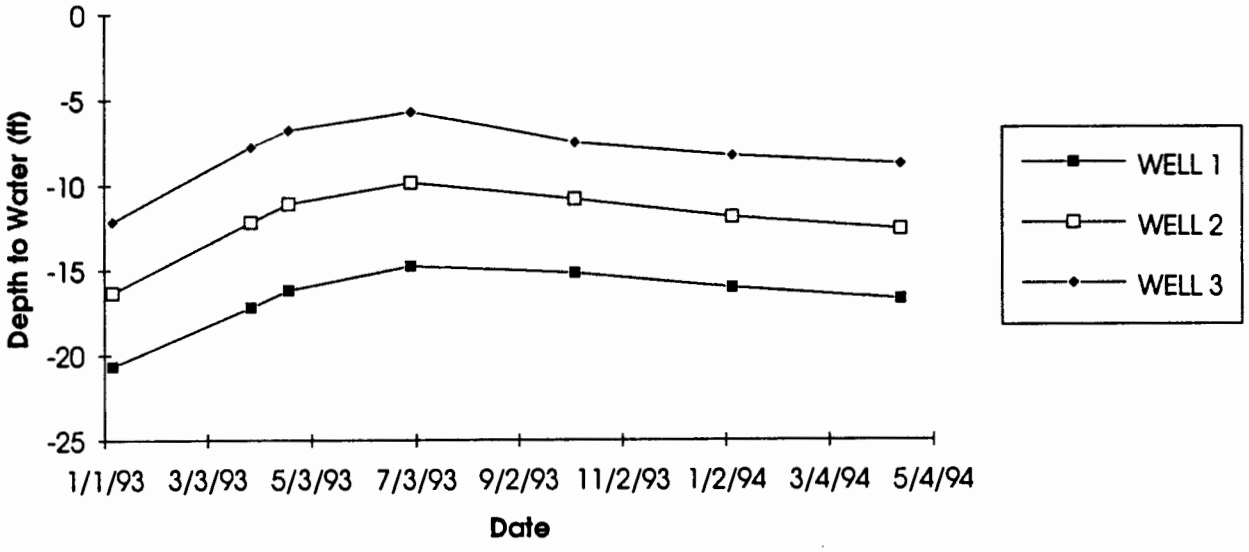
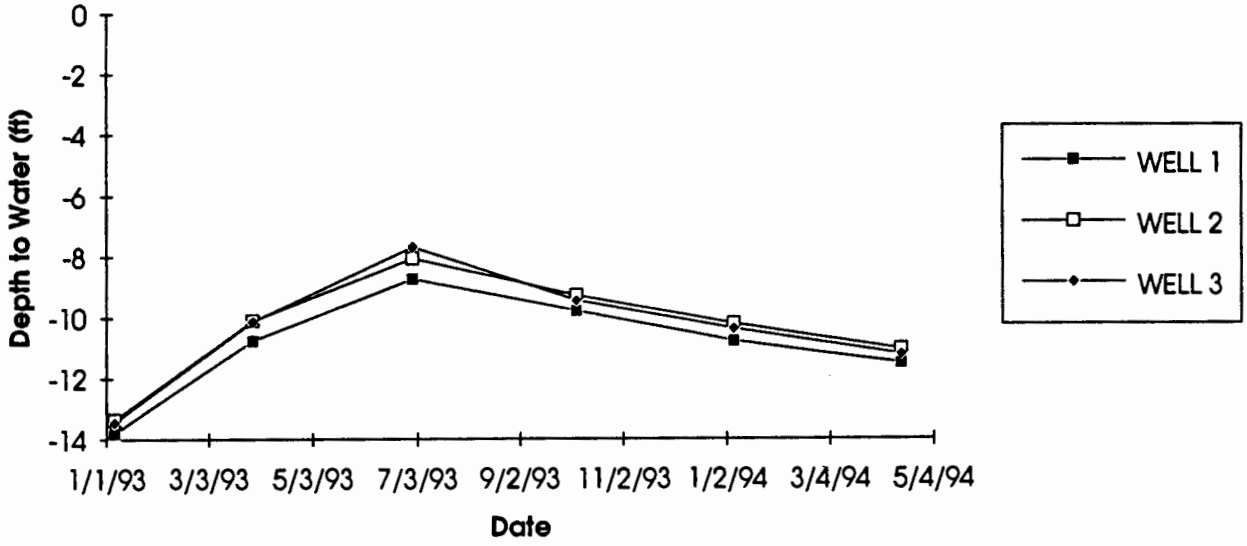


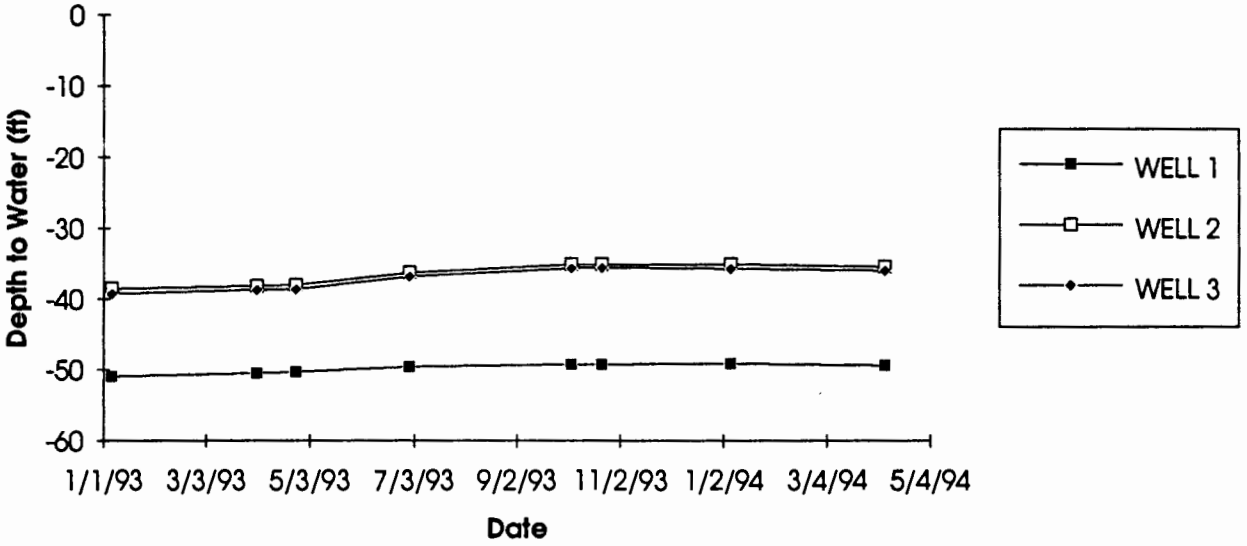
Site 26



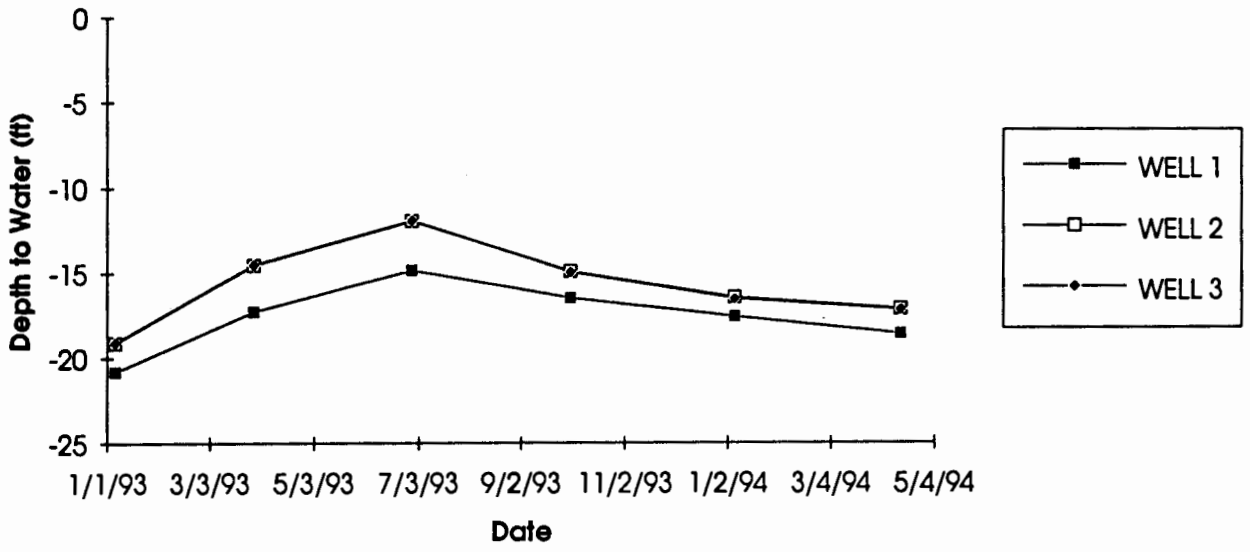
Site 27



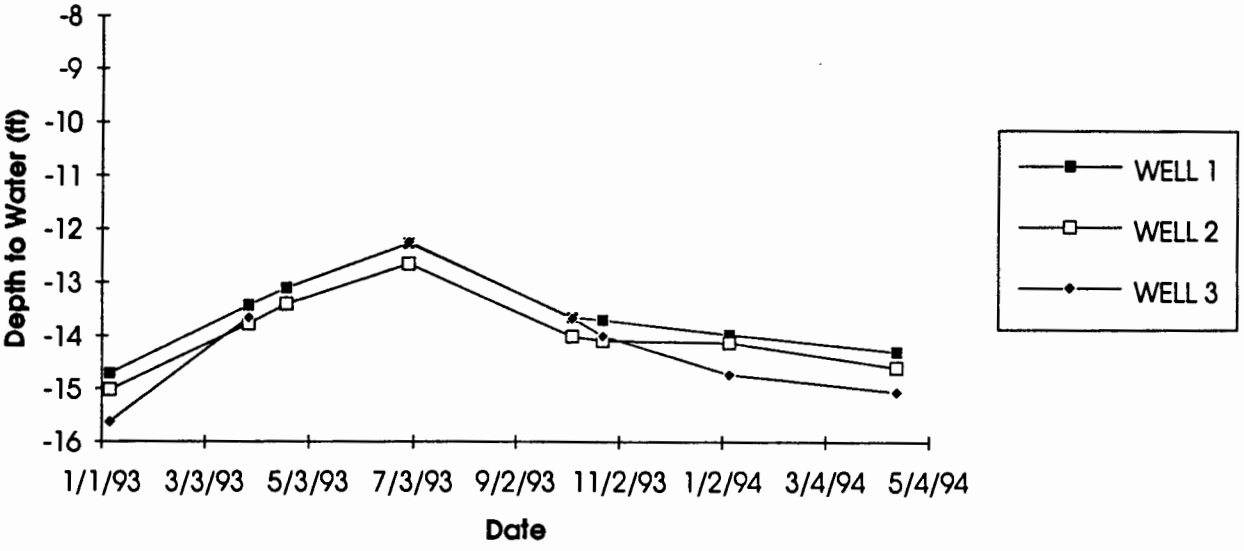
Site 29



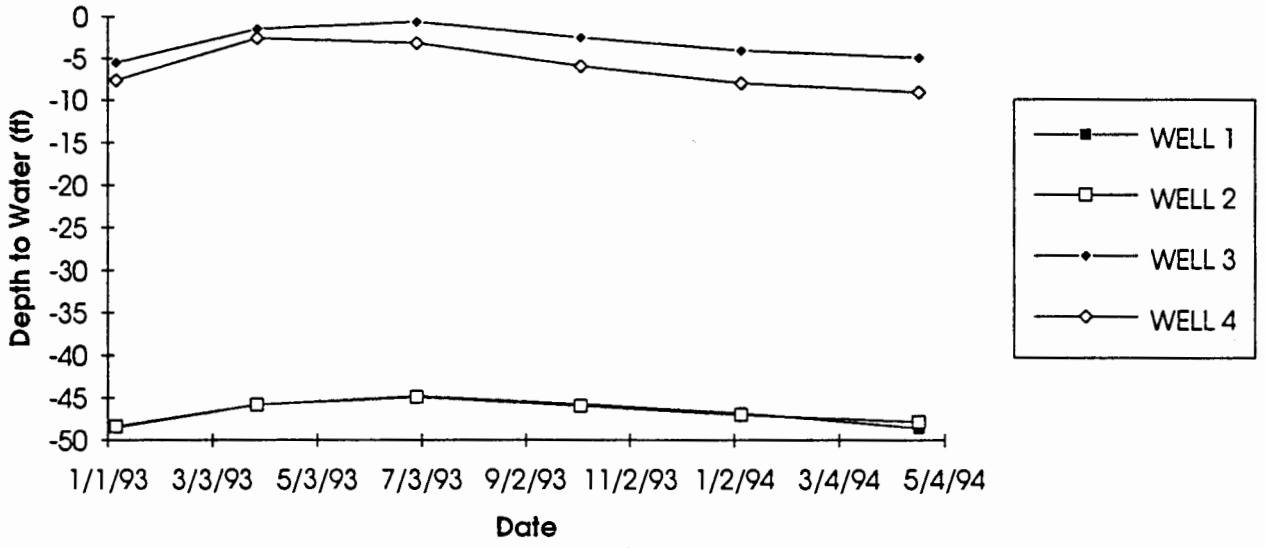
Site 30



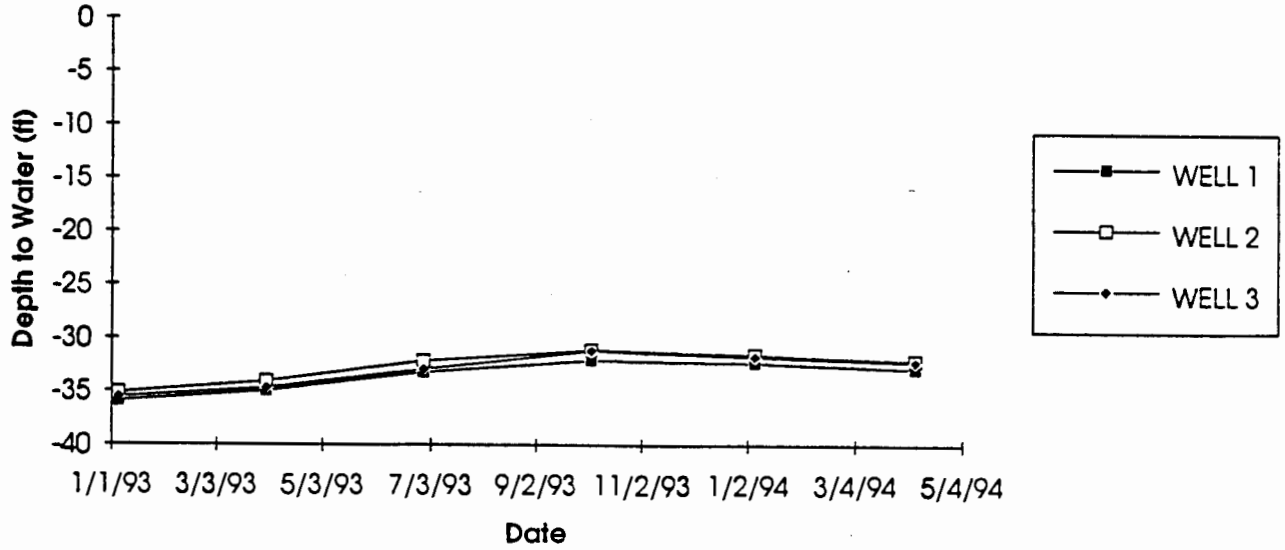
Site 31



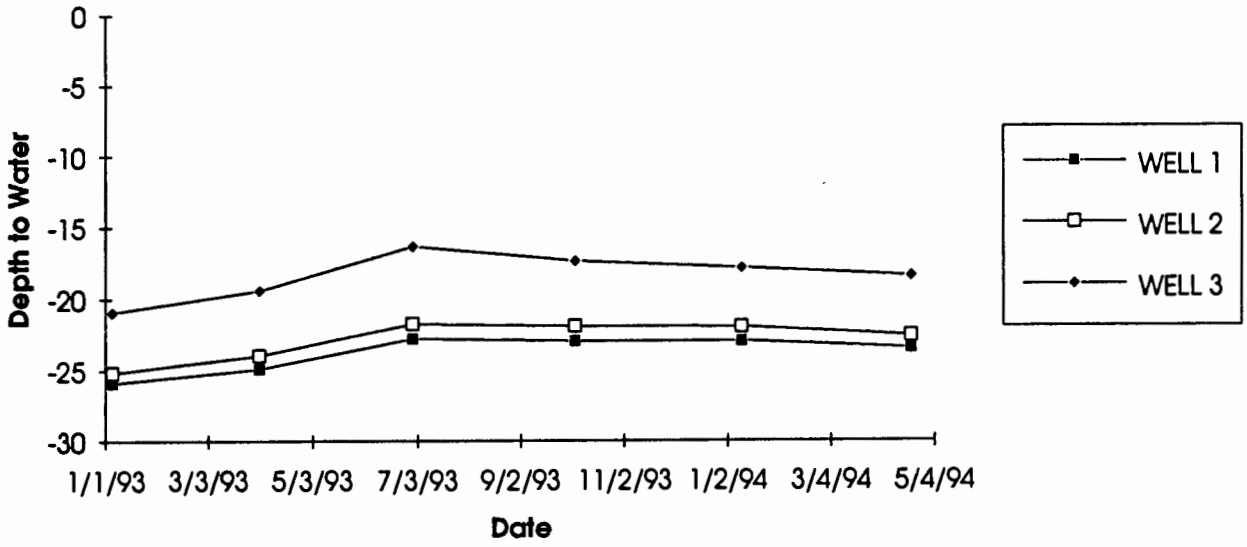
Site 32



Site 33



Site 35



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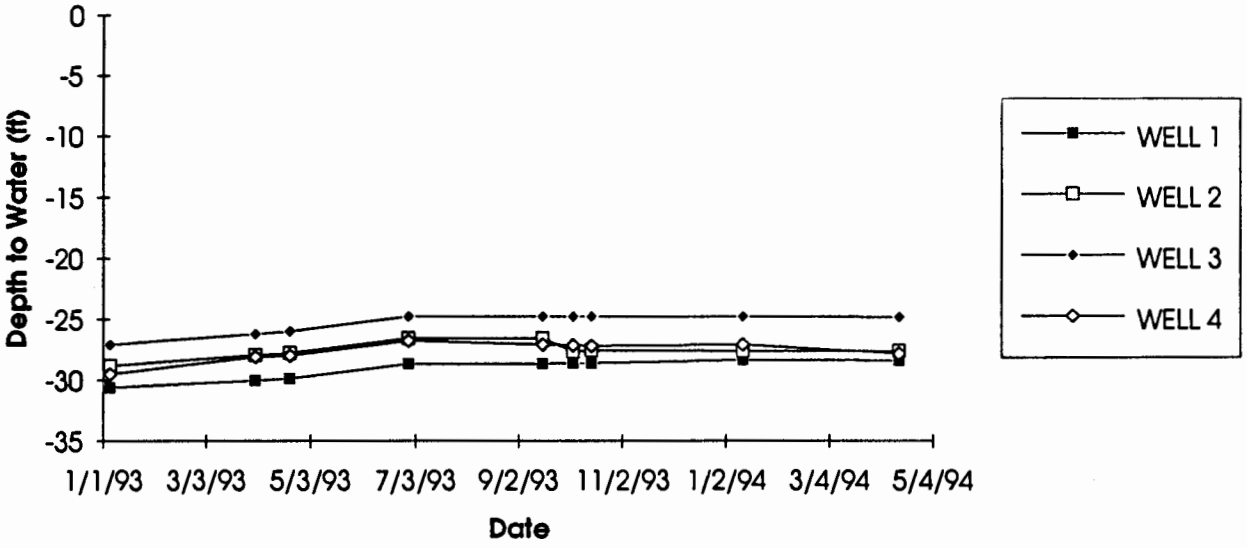
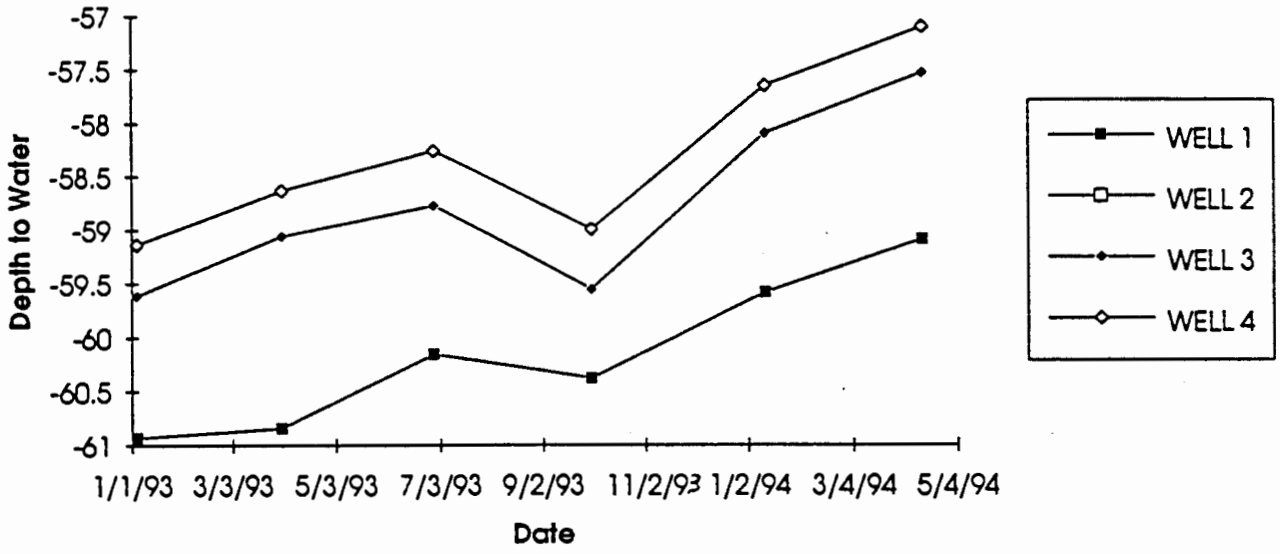
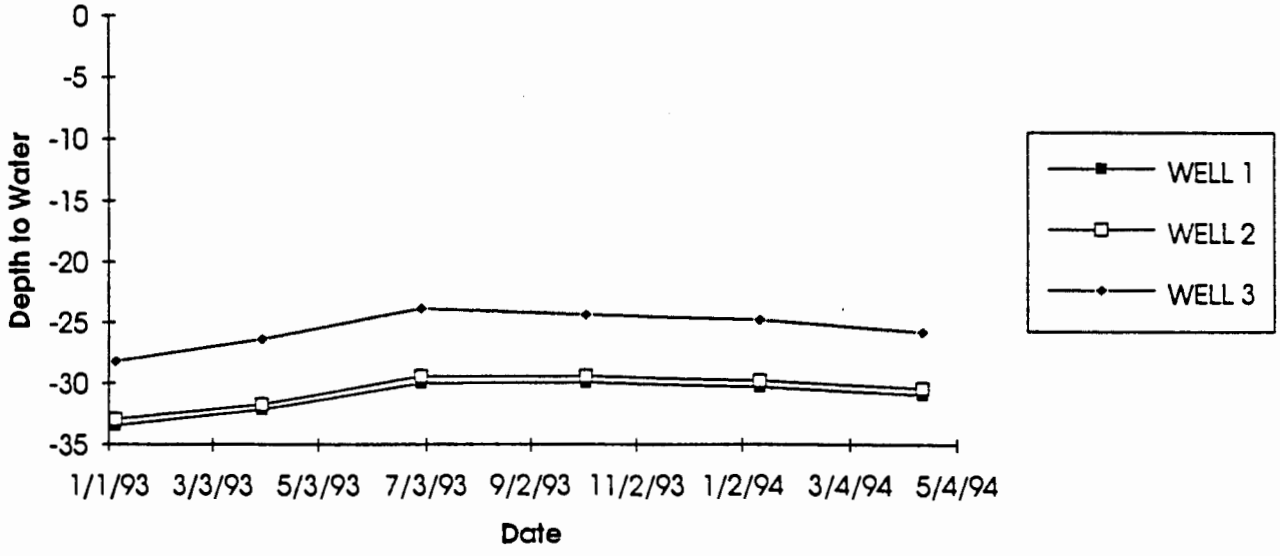


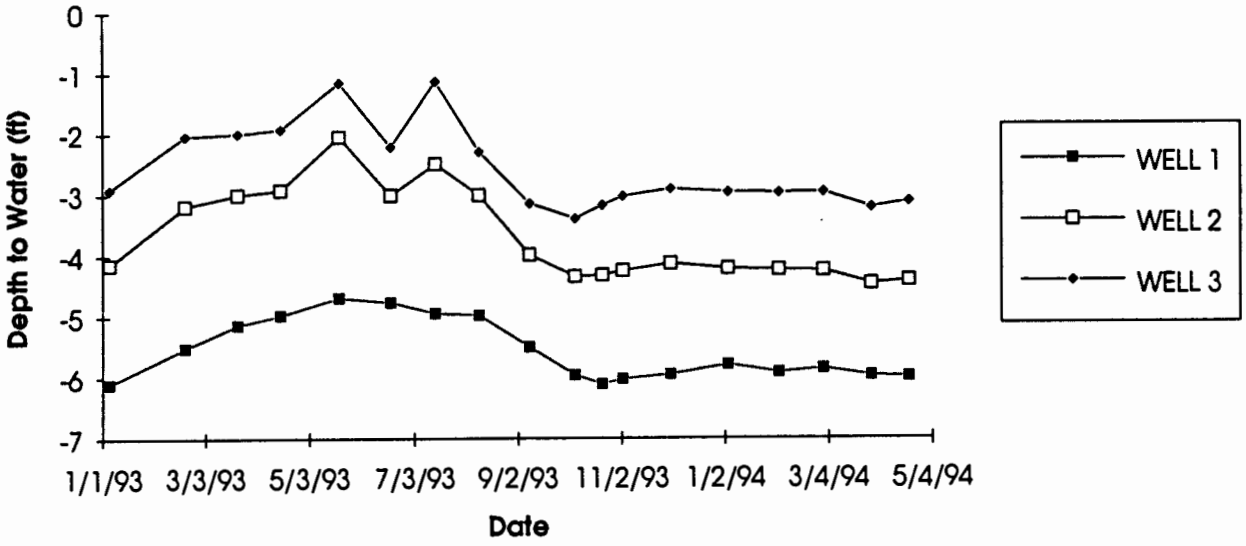
Site 37



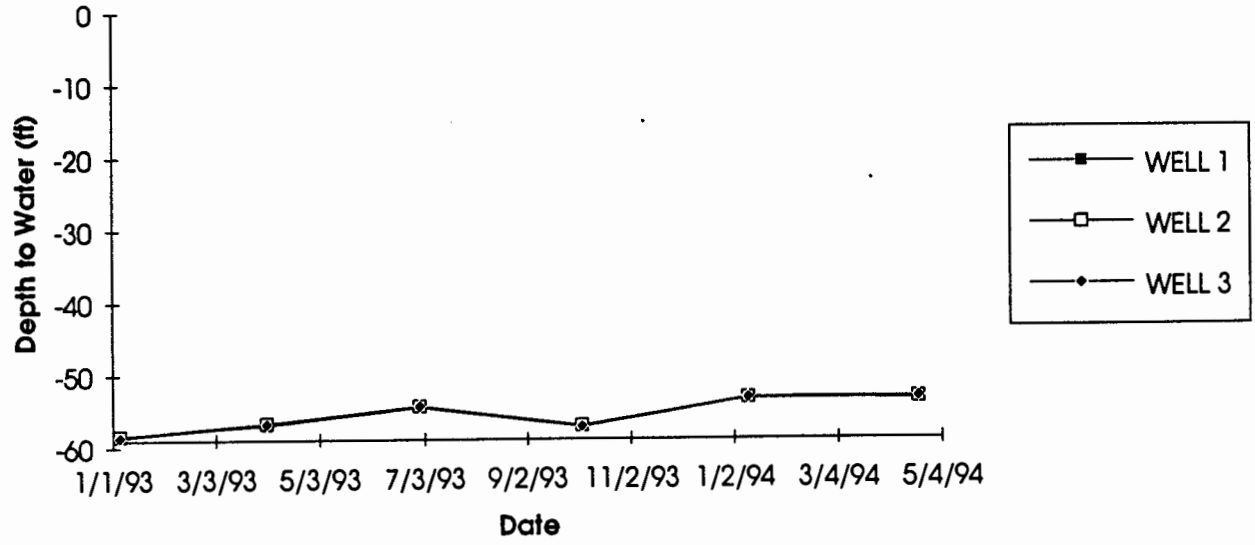
Site 38



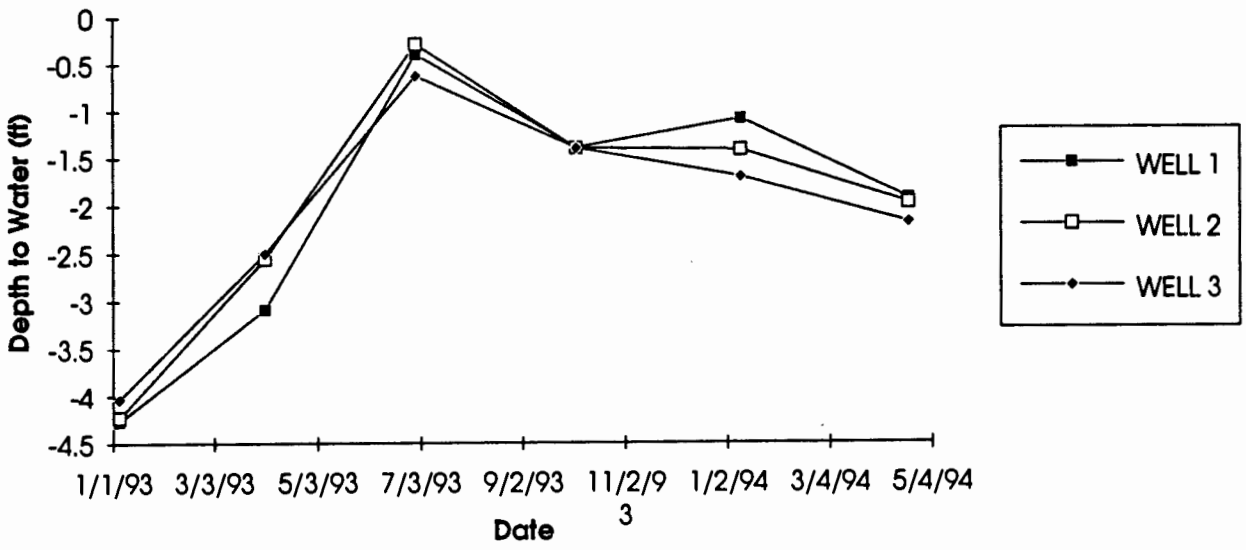
Site 39



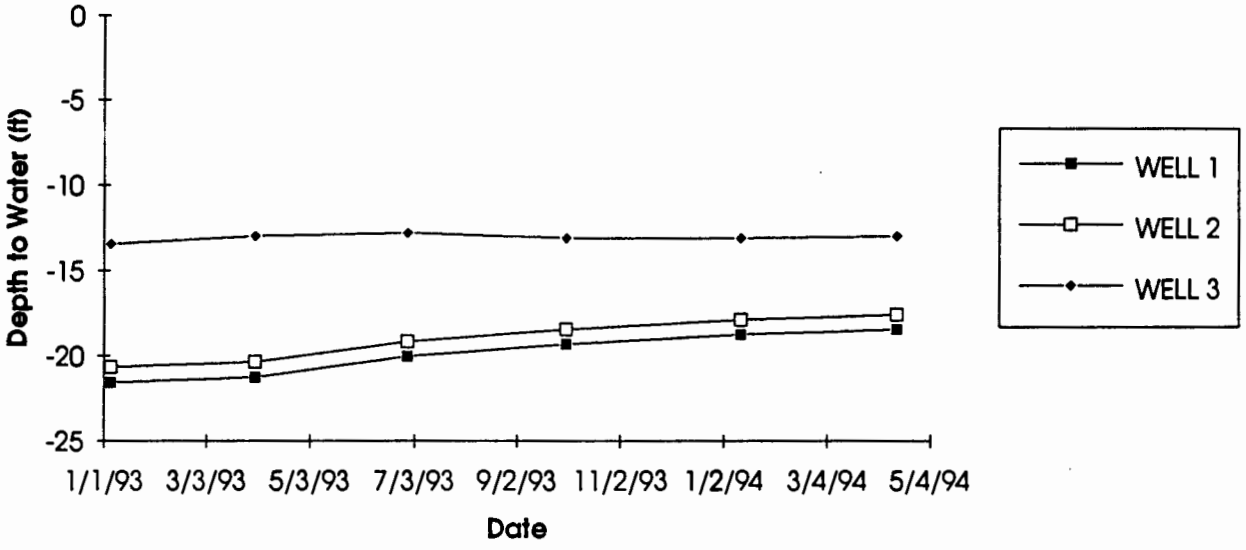
Site 40



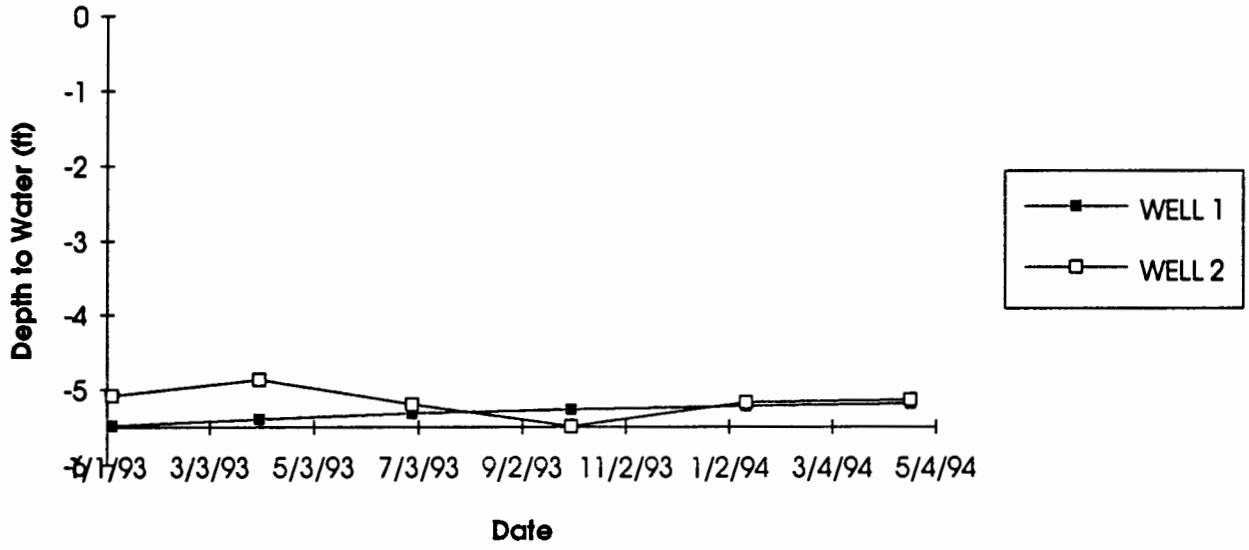
Site 41



Site 42



Site 43



Site 51