Milestone Report

Hydrologic and Hydrochemical Data Compilation for Playa 5 and Pantex Lake

(Activity No. 18 of Appendix C, Additional Supplement to Scope of Work, 1992–1993)

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Playa 5

This report focuses on 2 wells near Playa 5 that have been sampled recently by the Bureau of Economic Geology (Figure 1). Each of these wells is located approximately 2,000 ft from the margin of the floor of Playa 5. On the basis of geochemical analyses, it appears that these wells are completed in the Ogallala aquifer rather than in perched aquifer(s). The well belonging to Mr. and Mrs. Cleo Kirkland, west of Playa 5 across F.M. 683, was sampled in August 1993, whereas the well of Mr. and Mrs. Sam McGregor, south of Playa 5 across U.S. 60, was sampled in May 1993. Sucker rods and service pipe were pulled from the Kirkland well on August 12, 1993, and the static water level was measured as 266.27 ft below land surface. Given an approximate land surface elevation (taken from the Sevenmile Basin topographic sheet) as 3,535 ft above sea level, the water level elevation in the Kirkland well is approximately 3,268.73 ft. For the McGregor well, the static water level on November 4, 1985, taken from the drillers' log, was 232 ft. Given an approximate land surface elevation of 3,510 ft, the water level elevation at that time was approximately 3,278 ft.

The water level elevations are comparable to those observed for wells in the perched aquifer(s) at the Pantex Plant. However, on the basis of the regional potentiometric surface of the Ogallala aquifer constructed from 1992–1993 data by Mullican and others (1993, their Figure 2a), both the Kirkland and McGregor wells are located in the Ogallala aquifer (Figure 2). This mapped surface has been updated to reflect the August 1993 measurements of water levels in the Kirkland well and another well farther west, but the surface does not incorporate the 1985 water level reported on the drillers' log for the McGregor well. That reported level is approximately 10 ft higher than the water level which would be inferred for the well on the basis of the updated potentiometric surface. This discrepancy can be attributed to the decline in the Ogallala water table due to pumpage in the 8 years since the drillers' measurement was taken. The conclusion that both wells have been completed in the Ogallala aquifer is supported by geochemical analyses (Table 1). On plots of Si concentration versus water level elevation and of Ca:Mg molal ratios versus water level elevation (Figures 3 and 4), both wells fall within distinct fields of data from wells completed in the Ogallala aquifer. Both wells are up the hydraulic gradient from Playa 5; the closest downgradient well is the Ogallala monitoring well OM-105 (formerly BEG-PTX No. 2).

In the absence of perched-aquifer data within the basin of Playa 5, the temporal variability of perched-aquifer water levels is being monitored at a well approximately 2.5 mi northwest of Playa 5, on the property of Mr. and Mrs. Clarence Wink (shown at the upper left of Figure 1). Figure 5 illustrates hourly water level measurements recorded from July 28 to September 9, 1993, by a datalogger and pressure transducer installed in the well. Small-scale, diurnal fluctuations are superposed on a longer-term decline of approximately 1 ft in the static water level. On September 3, two additional transducers were hung in the well to verify the observed decline; the data recorded from these transducers will be downloaded and processed at a later date.

Pantex Lake

The depth to the Ogallala water table is greater in the vicinity of Pantex Lake than in the vicinity of Playa 5. Figure 1 depicts the locations of the six City of Amarillo water-supply wells closest to Pantex Lake; the 1991 static water levels (SWL) for those wells are (Ron Freeman, City of Amarillo Utilities, personal communication, 1993):

Well no.	SWL (ft below land surface)
628	492
629	487
630	468
650	487
653	496
654	485

Therefore, wells completed in a perched aquifer in that area (assuming water levels equivalent to the perched water table[s] at the Pantex Plant) would be even less likely than wells in the vicinity of Playa 5 to be confused with Ogallala wells. Because no owners or tenants of property within a mile of Pantex Lake identified any wells with water levels shallower than 300 ft below land surface, no water level measurements were made nor were samples collected by the Bureau in that area.

REFERENCE

Mullican, W. F., III, Fryar, A. E., and Johns, N. D., 1993: The areal extent and hydraulic continuity of perched ground water in the vicinity of the Pantex Plant: The University of Texas at Austin, Bureau of Economic Geology, report prepared for the U.S. Department of Energy under subgrant to DOE grant no. DE-FG04-90AL65847, 17 p.

APPENDIX. Notes on chemical analyses

1. The notation "<" indicates a value below the analytical detection limit.

2. For pH and HCO_3^-, the notations "(lab)" and "(field)" indicate where the measurements were taken.

3. Nitrate values are reported in mg/L as NO_3^-; the conversion to concentration in mg/L as N is $N = 0.226 \times NO_3^-$.

4. "MSL #" refers to the sample ID assigned by the Bureau's Mineral Studies Laboratory, where most analyses were performed. "Sample #" refers to the order in which the well was sampled, relative to other Pantex-project wells, in a given month and year.

5. Analyses of metals and metalloids for the Kirkland well were conducted on unfiltered, 0.45-micron filtered, and 0.2-micron filtered splits; graphs represent 0.45-micron filtered values.

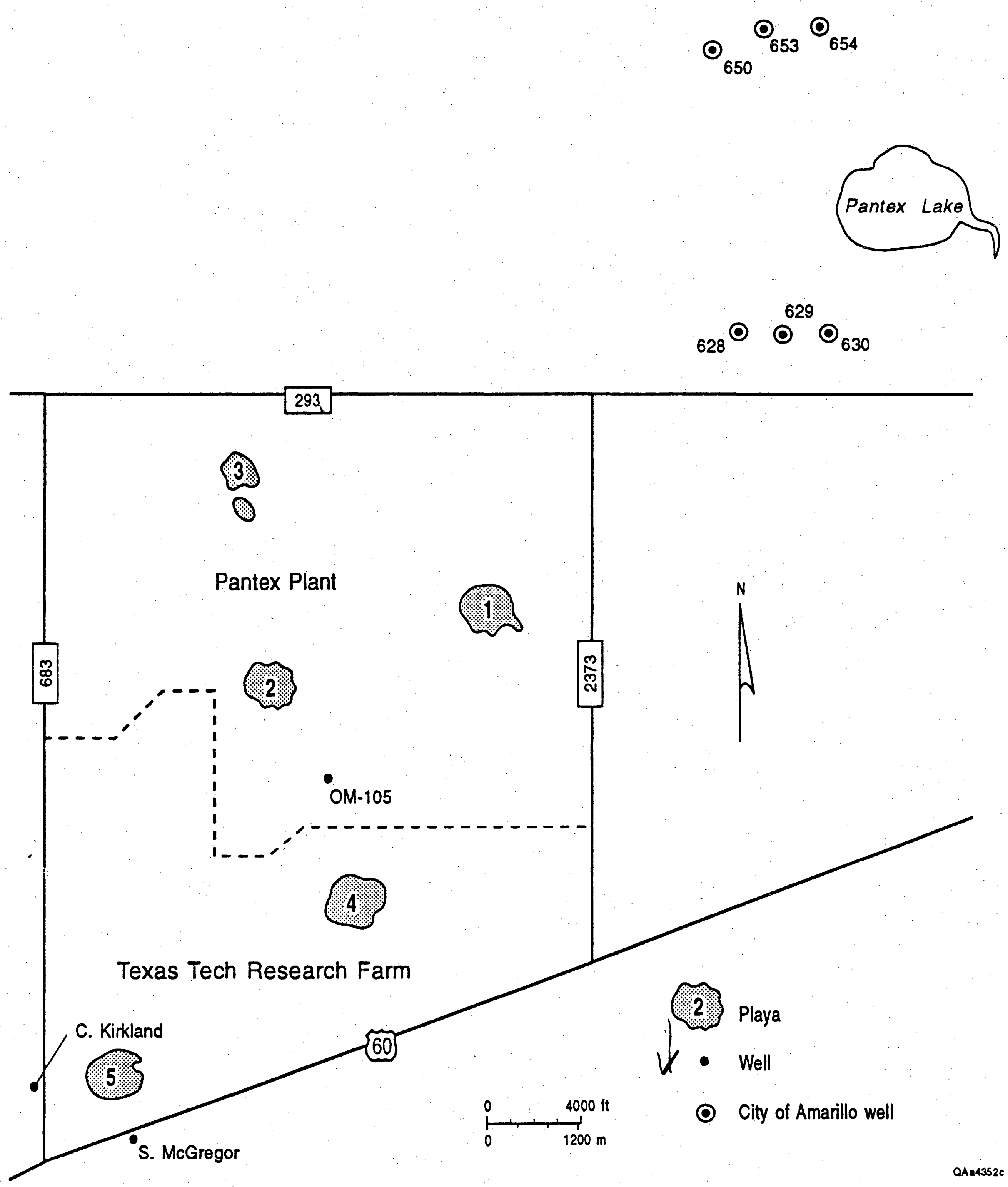

Figure 1. Location map showing Playa 5 and Pantex Lake with wells discussed in report.

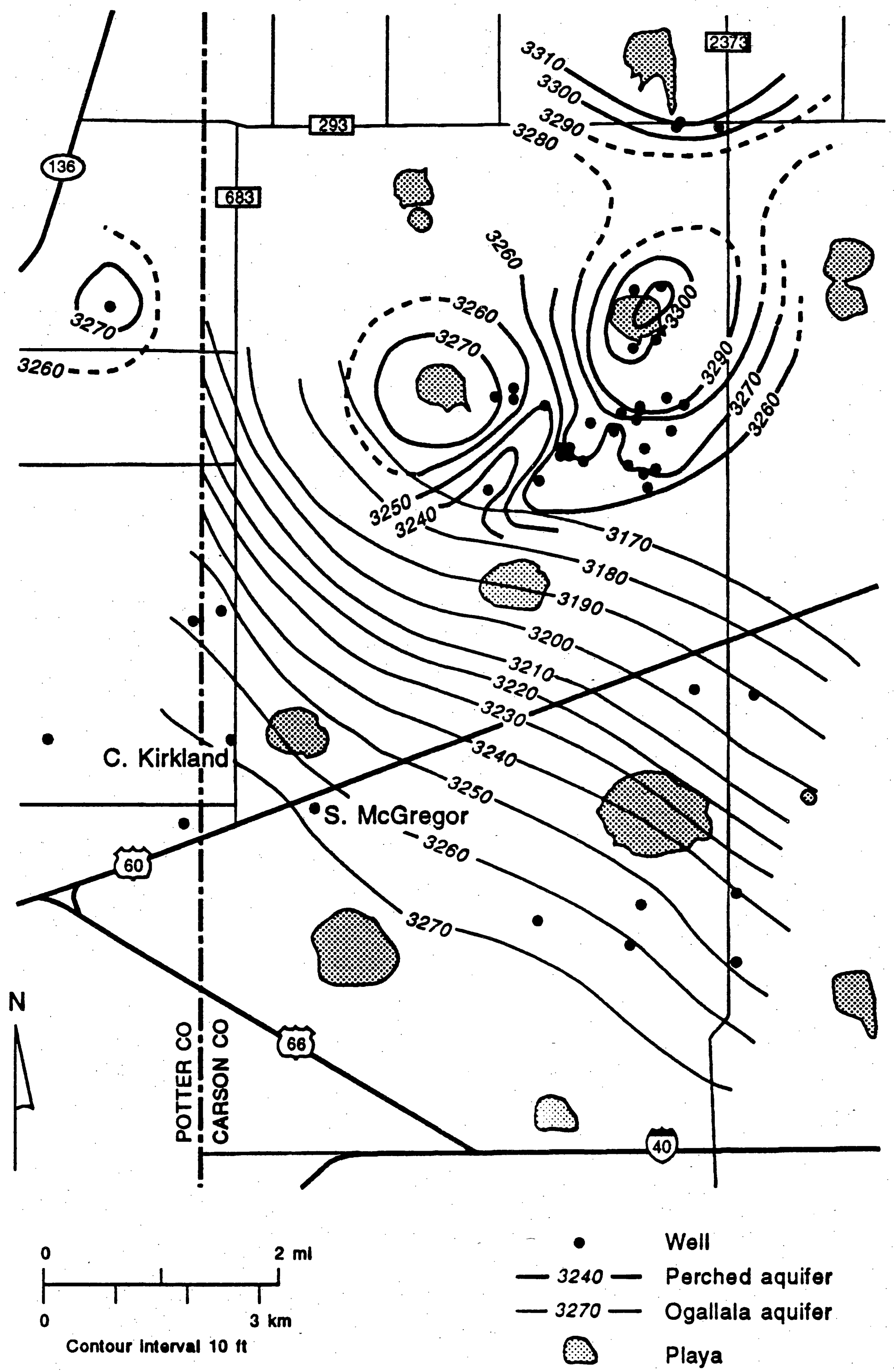

Figure 2. Potentiometric-surface map of the perched aquifer(s) in the area of the Pantex Plant and the Ogallala aquifer in the Sevenmile Basin area (updated from Mullican and others, 1993, their Figure 2a). Elevations given in ft above mean sea level.

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Figure 3. Dissolved silicon (Si) in the perched and Ogallala aquifers

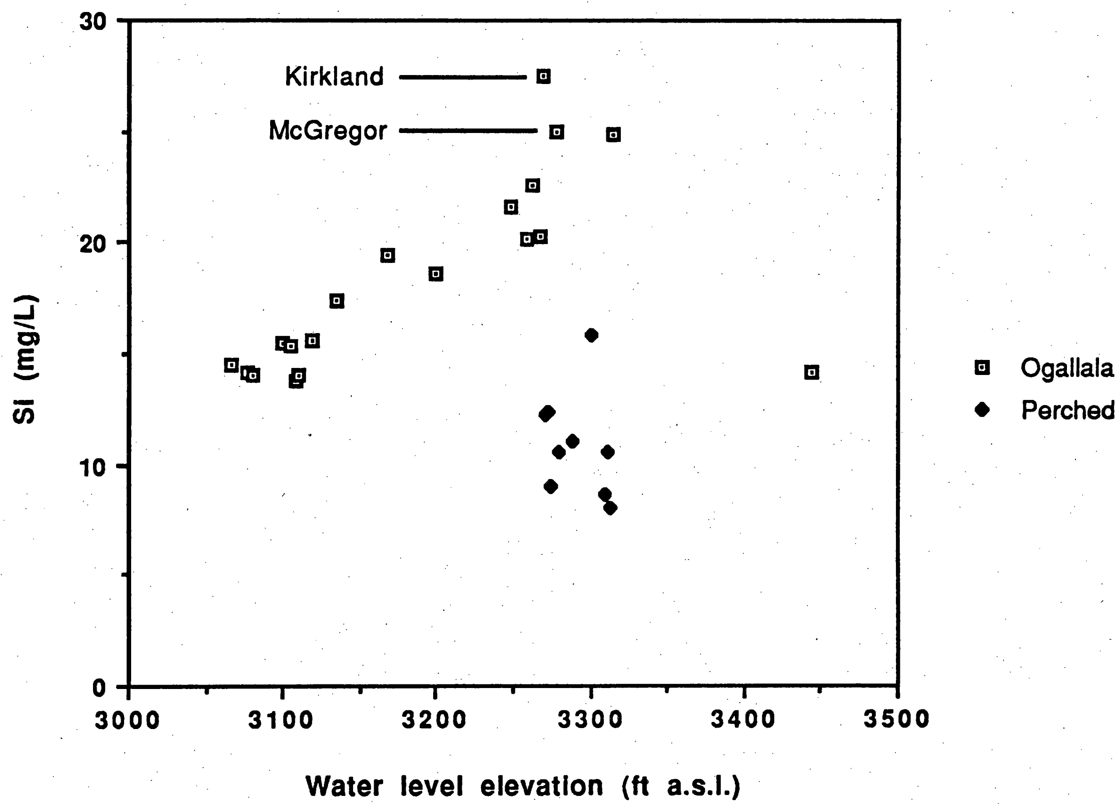

Figure 4. Molal ratio of calcium (Ca^{2+}) to magnesium (Mg^{2+}) dissolved in the perched and Ogallala aquifers

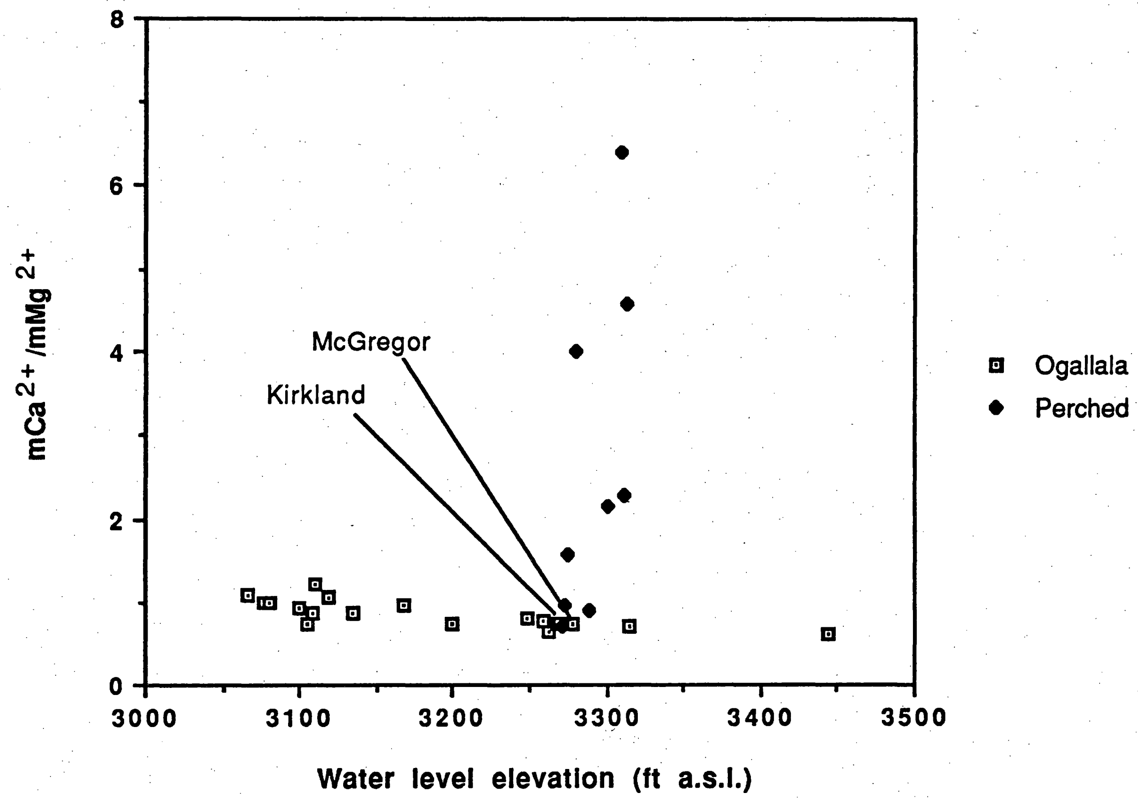

Figure 5. Water level fluctuations in C. Wink perched well, July 28 - September 9, 1993

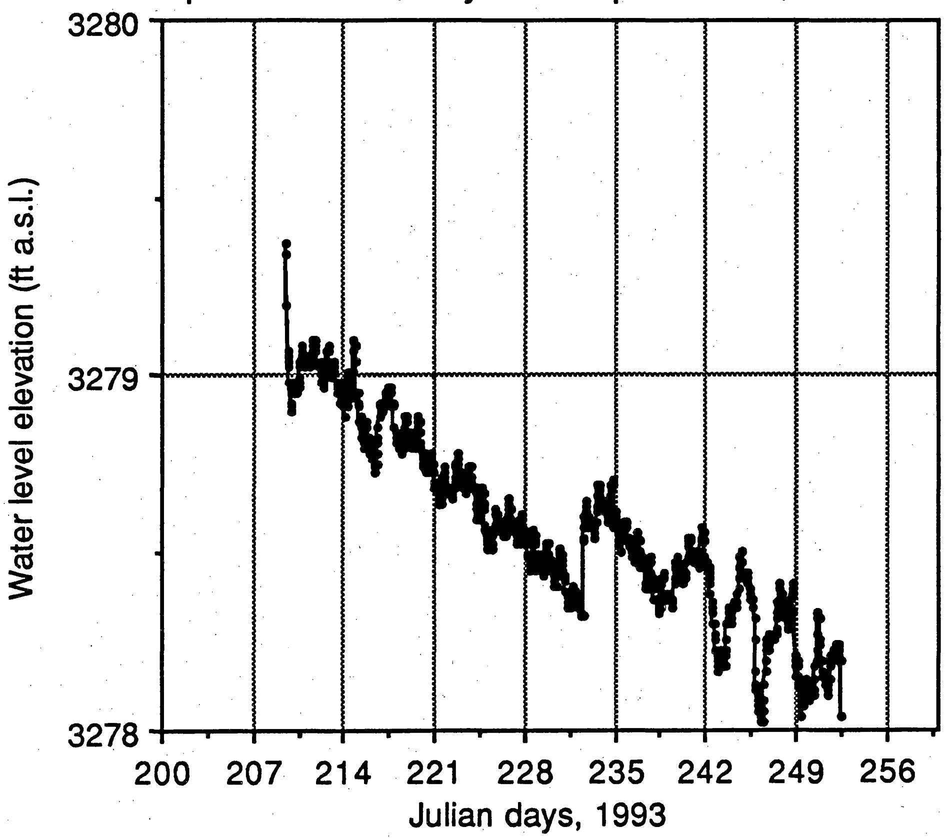

Table 1(a). Data from C. Kirkland well

MSL #	SAMPLE #	Metals filtered?	Sodium(mg/l)	Potassium(mg/l)	Magnesium(mg/l)	Calcium(mg/l)	Vanadium(mg/l)	Aluminum(mg/l)	Iron(mg/l)
93-1418	0893-1	no	24.2	6.01	29.4	36.2	<0.04	<0.27	0.24
		0.45	24.2	6.06	30.5	37.4	<0.04	<0.27	*0.04
		0.20	25.5	5.82	29.6	36.1	<0.04	<0.27	<0.02

Metals filtered?	Titanium(mg/l)	Cobalt(mg/l)	Chromium(mg/l)	Copper(mg/l)	Manganese(mg/l)	Nickel(mg/l)	Molybdenum(mg/l)
no	<0.09	<0.03	<0.03	<0.03	<0.01	<0.08	<0.06
0.45	<0.09	<0.03	<0.03	<0.03	<0.01	<0.08	<0.06
0.20	<0.09	<0.03	<0.03	<0.03	<0.01	<0.08	<0.06

Metals filtered?	Zinc(mg/l)	Arsenic(mg/l)	Cadmium(mg/l)	Lead(mg/l)	Antimony(mg/l)	Selenium(mg/l)	Tin(mg/l)
no	*0.04	<0.33	<0.01	<0.12	<0.89	<0.77	<0.10
0.45	*0.06	<0.33	<0.01	<0.12	<0.89	<0.77	<0.10
0.20	0.09	<0.33	<0.01	<0.12	<0.89	<0.77	<0.10

Metals filtered?	Lithium(mg/l)	Beryllium(mg/l)	Strontium(mg/l)	Barium(mg/l)	Zirconium(mg/l)	Uranium(mg/l)	Thorium(mg/l)
no	0.12	<0.01	1.09	0.1	<0.08	<6.8	<0.42
0.45	0.12	<0.01	1.08	0.1	<0.08	<6.8	<0.42
0.20	0.12	<0.01	1.13	0.36	<0.08	<6.8	<0.42

Metals filtered?	Boron(mg/l)	Phosphorus(mg/l)	Cerium(mg/l)	Lanthanum(mg/l)	Silicon(mg/l)	Rubidium(mg/l)	Fluoride(mg/l)
no	0.18	<0.69	<0.61	<0.06	27	<7.9	2.79
0.45	0.18	<0.69	<0.61	<0.06	27.5	<7.9	
0.20	0.17	<0.69	<0.61	<0.06	27.9	<7.9	

Chloride(mg/l)	Bromide(mg/l)	Nitrate(mg/l)	Sulfate(mg/l)	Bicarbonate(mg/l)-lab	Dissolved Inorganic carbon(as HCO3)(mg/l)	Dissolved Oxygen(mg/l)-field
7.82	*0.15	3.95	19.2	312	306	7.68

Temperature(°C)	Eh(mv)-field	pH-lab	pH-field	Electrical Conductivity(mmho)	Ammonia(mg/l)
18.8	366	7.87	8.10	0.505	<0.2

Oxygen-18(per mil)	Deuterium(per mil)
-5.2	-27

*reported value near detection limit

Table 1(b). Data from S. McGregor well

MSL #	Sample #	Metals filtered?	Sodium(mg/l)	Potassium(mg/l)	Magnesium(mg/l)	Calcium(mg/l)	Vanadium(mg/l)	Aluminum(mg/l)	Iron(mg/l)
93-499, -1229, -1415	0593-4	no	19.5	6.12	29.9	36.5	<0.04	<0.27	<0.02
		0.45	19.5	6.36	29.7	36.5	<0.04	<0.27	<0.02

Metals filtered?	Titanium(mg/l)	Cobalt(mg/l)	Chromium(mg/l)	Copper(mg/l)	Manganese(mg/l)	Nickel(mg/l)	Molybdenum(mg/l)
no	<0.09	<0.03	<0.03	<0.03	<0.01	<0.08	<0.06
0.45	<0.09	<0.03	<0.03	<0.03	<0.01	<0.08	<0.06

Metals filtered?	Zinc(mg/l)	Arsenic(mg/l)	Cadmium(mg/l)	Lead(mg/l)	Antimony(mg/l)	Selenium(mg/l)	Tin(mg/l)
no	0.03	<0.33	<0.01	<0.12	<0.89	<0.77	<0.10
0.45	*0.01	<0.33	<0.01	<0.12	<0.89	<0.77	<0.10

Metals filtered?	Lithium(mg/l)	Beryllium(mg/l)	Strontium(mg/l)	Barium(mg/l)	Zirconium(mg/l)	Uranium(mg/l)	Thorium(mg/l)
no	0.09	<0.01	1.16	0.12	<0.08	<6.8	<0.42
0.45	0.09	<0.01	1.24	0.12	<0.08	<6.8	<0.42

Metals filtered?	Boron(mg/l)	Phosphorus(mg/l)	Cerium(mg/l)	Lanthanum(mg/l)	Silicon(mg/l)	Rubidium(mg/l)	Fluoride(mg/l)
no	0.17	<0.69	<0.61	<0.06	25.0	<7.9	
0.45	0.19	<0.69	<0.61	<0.06	25.0	<7.9	1.81

Chloride(mg/l)	Bromide(mg/l)	Nitrate(mg/l)	Sulfate(mg/l)	Bicarbonate(mg/l)-lab	Bicarbonate(mg/l)-field	Ammonia(mg/l)
8.44	<0.10	4.63	20.9	266	286	<0.2

Dissolved Oxygen(mg/l)-field	Temperature(°C)-field	Eh(mv)-field	pH-lab	pH-field	Tritium(TU)	Deuterium(per mil)
7.34	19.4	210	7.85	7.59	0.23	-32

Carbon-13 DOC(per mil)	Carbon-14(% modern C)	Oxygen-18(per mil)	Nitrogen-15(per mil)	Total Carbon-13(per mil)	Sulfur-34(per mil)	Inorganic Carbon-13(per mil)
-16.04	40.5+/-0.3	-5.8	15.15	-5.95	1.7	-6.4

*reported value near detection limit