DOE–LM/GJ725–2004

Semiannual Performance Report September 2003 through March 2004 for the Shiprock, New Mexico, Site

September 2004

U.S. Department of Energy

Work Performed Under DOE Contract No. DE–AC01–02GJ79491 for the U.S. Department of Energy Office of Legacy Management.
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Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado

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1.0 Introduction

This report evaluates the performance of the ground water remediation system at the Uranium Mill Tailings Remedial Action (UMTRA) Project site in Shiprock, New Mexico, for the period of September 2003 through March 2004. This evaluation is based upon comparison of the site conditions in March 2004 to the baseline site conditions presented in the Shiprock Baseline Performance Report (DOE 2003a). The baseline conditions were established using data collected primarily from March 2003. A detailed description of the site conditions is presented in the Site Observational Work Plan (SOWP) (DOE 2000), and the compliance strategy is presented in the Ground Water Compliance Action Plan (GCAP) (DOE 2002).

The Shiprock site is divided into two distinct areas, the floodplain and the terrace. An escarpment forms the boundary between the two areas. The terrace is further divided into terrace west and terrace east. Initially the remediation system (Figure 1) consisted of two floodplain ground water extraction wells, four terrace east ground water extraction wells, two interceptor drains (one installed in Bob Lee Wash and the other installed in Many Devils Wash), a lined evaporation pond, and a terrace drainage channel diversion structure. The terrace ground water extraction wells and interceptor drains became operational in late February 2003, and the floodplain extraction wells became operational in March 2003. Four additional extraction wells were installed on the terrace east portion of the site in July 2003; they were piped into the remediation system in early August 2003 in an attempt to increase the volume of ground water removed from the terrace.

1.1 Remediation System Performance Standards

This performance assessment is based on the analysis of water quality and water level data obtained from site monitoring wells in addition to ground water flow rates associated with the drains and seeps. Specific performance standards as established for the Shiprock floodplain ground water remediation system in the Baseline Performance Report (DOE 2003a) are summarized as follows:

- Ground water flow directions in the vicinity of the extraction wells should be toward the extraction wells.
- Pumping on the floodplain should intercept contaminants of concern (COCs) that would otherwise discharge to the San Juan River.

Specific performance standards as established for the Shiprock terrace ground water remediation system (Section 3.2) in the Baseline Performance Report (DOE 2003a) are summarized as follows:

- Terrace ground water surface elevations should decrease as water is removed from the terrace system.
- Ground water flow directions in the vicinity of the extraction wells should be toward the extraction wells.
- The volume of water discharging to the interceptor drains located in Bob Lee and Many Devils Washes should decrease over time as ground water levels on the terrace decline.
- The flow rates of seeps located at the escarpment face (locations 0425 and 0426) should decrease over time as ground water levels on the terrace decline.

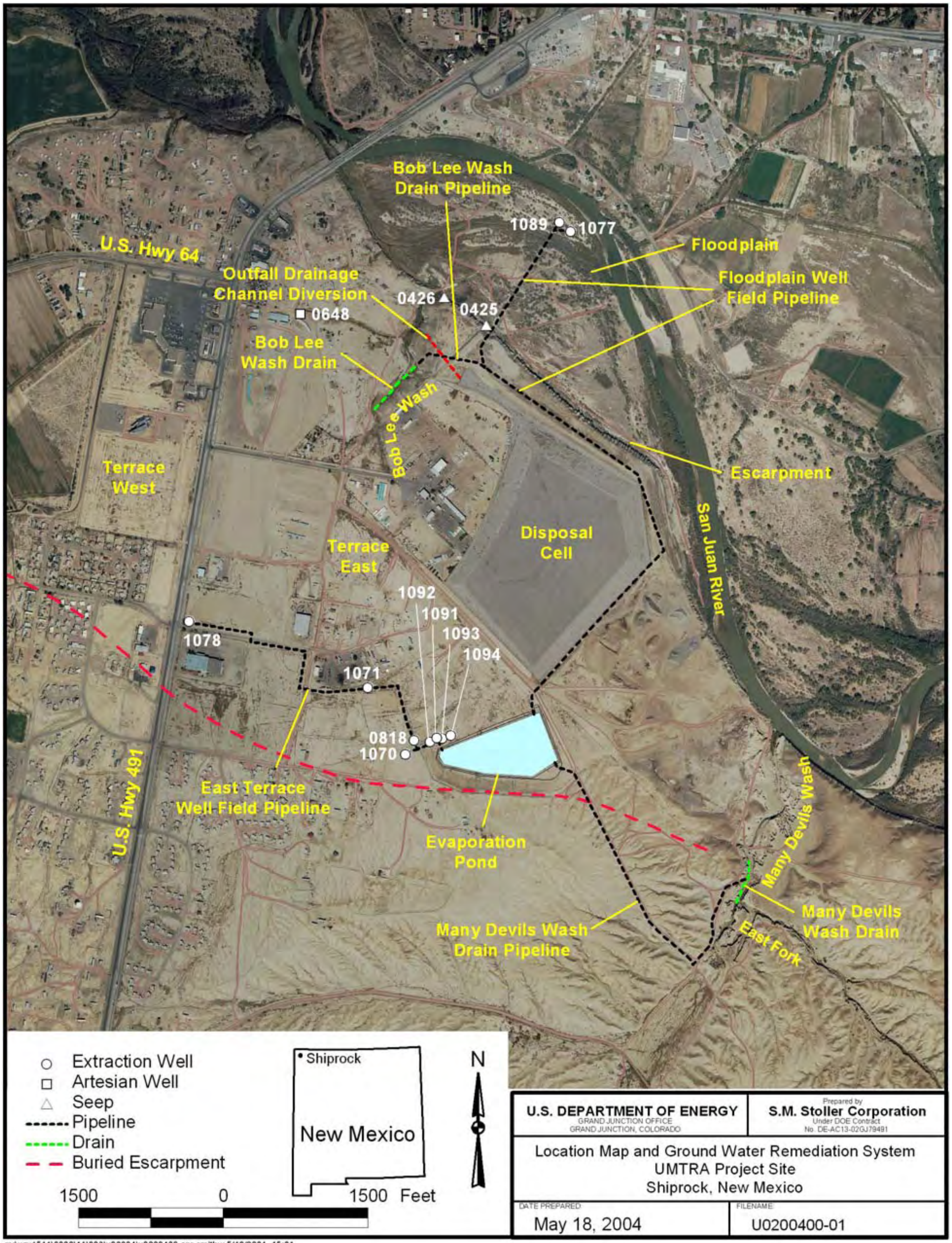

Figure 1. Location Map

1.2 Contaminants of Concern and Remediation Goals

Ground water at the site is contaminated as a result of uranium milling activities between 1954 and 1968. The COCs for both the floodplain and terrace are ammonium, manganese, nitrate, selenium, strontium, sulfate, and uranium. Ground water compliance for the terrace is based on hydrologic control and concentration standards do not apply.

Floodplain compliance standards for uranium and nitrate are their respective UMTRA standards of 0.044 and 44 milligrams per liter (mg/L).

A secondary standard of 250 mg/L for sulfate exists under the Safe Drinking Water Act. However, studies conducted by the Centers for Disease Control in conjunction with the U.S. Environmental Protection Agency (EPA) have shown that no adverse effects from sulfate ingestion occur at concentrations of up to 1,200 mg/L (EPA 1999). The report notes that other studies have shown that concentrations of sulfate exceeding 2,000 mg/L may have little to no adverse effect on humans and animals. Because of the presence of high background sulfate concentrations at the site in the floodplain (up to 1,920 mg/L) and the high sulfate concentration of water entering the floodplain from flowing artesian well 0648 (up to 2,340 mg/L), the proposed cleanup goal for floodplain sulfate is 2,000 mg/L.

Relatively high selenium concentrations in the floodplain make it unlikely that the UMTRA standard of 0.01 mg/L for this constituent can be met while contaminated terrace water is still providing a source. An alternate concentration limit is proposed for selenium of 0.05 mg/L, which is the maximum contaminant level established by EPA.

The cleanup objective for manganese is the maximum background concentration for the floodplain, which is currently 2.74 mg/L. There are no cleanup standards or background concentrations established for ammonium and strontium.

1.3 Hydrogeological Setting

Sections 1.3.1 and 1.3.2 provide a summary of the floodplain and terrace ground water systems, respectively. A more detailed description is provided in the SOWP (DOE 2000).

1.3.1 Floodplain Ground Water System

The thick Mancos Shale of Cretaceous age forms the bedrock underlying the entire site. Floodplain ground water (floodplain alluvial aquifer) occurs in unconsolidated medium- to coarse-grained sand, gravel, and cobbles that were deposited in former channels of the San Juan River above the Mancos Shale. The floodplain aquifer is hydraulically connected to the San Juan River; the river contributes water to the floodplain in some areas, and receives ground water discharge in others. The floodplain aquifer also receives inflow from an artificial ground water system in the terrace area created during milling activities. The floodplain alluvium is up to 20 feet (ft) thick and overlies Mancos Shale, which is typically soft and weathered for the first several feet below the alluvium.

Most ground water contamination in the floodplain lies close to the escarpment east and north of the disposal cell. A plume extends northward from this contaminated area in an arc-shape as it crosses the floodplain and reaches the San Juan River near the two floodplain extraction wells (1089 and 1077, Figure 1). This plume configuration is best characterized by elevated concentrations of sulfate and uranium. Contamination does not occur along the escarpment base in the northwest part of the floodplain because relatively uncontaminated surface water from Bob Lee Wash discharges into the floodplain, recharging local ground water and then flowing to the north and west. Water that enters the floodplain from Bob Lee Wash consists mainly of deep nonpotable ground water from flowing (approximately 65 gallons per minute [gpm]) artesian well 0648 that drains eastward into lower Bob Lee Wash. Background ground water quality in the floodplain aquifer has been defined by monitor wells installed in the floodplain about 1 mile upriver from the site.

1.3.2 Terrace Ground Water System

The terrace ground water system occurs partly in unconsolidated alluvium in the form of medium- to coarse-grained sand, gravel, and cobbles deposited in the floodplain of the ancestral San Juan River. Terrace alluvial material is Quaternary in age, typically 10 to 20 ft thick, and caps the Mancos Shale. Though less well mapped, some terrace ground water also occurs in weathered Mancos Shale underlying the alluvium. The Mancos Shale is exposed in the escarpment overlooking the present floodplain.

The terrace alluvial aquifer extends southwestward from the escarpment separating the terrace from the floodplain for up to 1 mile where it is abruptly bounded by a buried escarpment. Terrace alluvial material is exposed at the terrace/floodplain escarpment, but southwestward from there it is covered by an increasing thickness of silt, which was deposited by wind as loess. At the southwest edge of the terrace aquifer, along the base of the buried escarpment, up to 40 ft of loess overlies the alluvium. The alluvium in this latter area consists of coarse, ancestral San Juan River deposits.

Mancos Shale in the terrace area is weathered (fractured and soft) for up to several feet below its contact with alluvium. Ground water is known to occur in the weathered shale, and may flow through deeper portions of the shale that might be fractured.

2.0 Subsurface Conditions

This section summarizes hydraulic and water quality characteristics of the floodplain and terrace ground water systems in March 2004, approximately 1 year after startup of the treatment system. The response of the floodplain is evaluated in Section 2.1, and the terrace response is evaluated in Section 2.2.

2.1 Floodplain Subsurface Conditions

Performance standards provided in the Baseline Performance Report (DOE 2003a) and presented in Section 1.1 regarding the floodplain are designed to evaluate the effectiveness of the floodplain treatment system. An analysis of the horizontal hydraulic gradients and contaminant distributions in the floodplain are discussed in Sections 2.1.1 and 2.1.2, respectively.

2.1.1 Horizontal Hydraulic Gradients

The Baseline Performance Report contains a map of horizontal hydraulic gradients in the floodplain as determined from three-point analyses of March 2003 water level data. This figure, which represents conditions prior to the start-up of the floodplain extraction wells, is presented as Figure A−1 in Appendix A of this report. Figure A−2 (Appendix A) presents comparable horizontal gradients developed from a three-point analysis of water level data collected in March 2004. Comparison of the two maps shows that the ground water flow directions have changed in response to ground water extraction between March 2003 and March 2004. The river flow on the day the March 2003 water level data were measured was 649 cubic feet per second (cfs), while the flow on the day the March 2004 data were collected was 1,540 cfs. Despite the higher river level, which should increase flow to the floodplain, ground water is directed more toward the extraction wells in 2004.

Appendix B contains graphs of floodplain ground water elevation fluctuations between January 2003 and March 2004 collected using data loggers installed in wells 0617, 0736, 0857, and 1008. A data logger was also installed in well 0854 but it malfunctioned after the instrument was downloaded in August 2003 and the data collected between August 2003 and March 2004 were lost; therefore, its data are not included in Appendix B. This instrument was re-started in March 2004 and will provide ground water elevation data in the next performance report.

Well 0617 is located approximately 600 ft from the river. Wells 0736, 0857, and 1008 are located approximately 200 ft from the river. The ground water elevation data collected from these wells located on the floodplain are plotted with the San Juan River flow data (in cfs) collected from U.S. Geological Survey Gaging Station 09368000 (located in Shiprock) to show how the elevation fluctuates in response to changes in the river stage. The wells located near the river responded quickly to river level fluctuations; however, the river influence was apparently subdued within 600 ft inland.

2.1.2 Contaminant Distributions

Ground water samples were collected from selected floodplain wells in March 2004. The resulting COC concentrations were compared to baseline concentrations measured in March 2003 during the last sampling effort prior to full operation of the treatment system. Table 1 lists both floodplain baseline and March 2004 concentrations for the COCs.

In order to compare the data sets, it was necessary to convert the baseline ammonium and nitrate concentrations. Ammonium concentrations were converted from "ammonia total as NH_4" to "ammonia as total nitrogen." The baseline nitrate concentrations were converted from "nitrate as NO_3" to "nitrate plus nitrite as nitrogen." These conversions were made in response to different analyses being requested with a change in laboratories. As a result, the baseline concentrations in Table 1 are not consistent with the previous semiannual report (DOE 2003b).

The data show that the majority of the contaminant concentrations have not significantly changed compared to the baseline concentrations. Five samples had increases greater than 100 percent compared to the baseline concentrations. Of these five samples (well 0734 ammonium, manganese, nitrate, and selenium concentrations plus well 0736 nitrate concentration) all except the well 0734 nitrate concentration deal with concentrations below 1 mg/L. Of the wells that have changed significantly, it is believed that the concentration

Table 1. March 2004 COC Concentration Comparison to Baseline Data

Well	Ammonium			Manganese			Nitrate			Selenium			Strontium			Sulfate			Uranium		
	Baseline[a] Concentration (mg/L)	March 2004 Concentration (mg/L)	Difference (%)	Baseline Concentration (mg/L)	March 2004 Concentration (mg/L))	Difference (%)	Baseline[b] Concentration (mg/L)	March 2004 Concentration (mg/L)	Difference (%)	Baseline Concentration (mg/L)	March 2004 Concentration (mg/L)	Difference (%)	Baseline Concentration (mg/L)	March 2004 Concentration (mg/L)	Difference (%)	Baseline Concentration (mg/L)	March 2004 Concentration (mg/L)	Difference (%)	Baseline Concentration (mg/L)	March 2004 Concentration (mg/L)	Difference (%)
0608	303	220	**-27.3**	7.8	4.4	**-43.6**	524	510	**-2.7**	0.0065	0.0055	**-15.4**	10.7	12	**12.1**	10,500	11,000	**4.8**	1.78	1.8	**1.1**
0614	39	32	**-18.5**	6.01	5.1	**-15.1**	958	950	**-0.8**	0.291	0.06	**-79.4**	13.1	12	**-8.4**	14,400	13,000	**-9.7**	2.43	2.3	**-5.3**
0615	40	17	**-57.1**	5.56	3.4	**-38.8**	940	950	**1.1**	1.16	0.64	**-44.8**	14.4	14	**-2.8**	19,900	20,000	**0.5**	3.78	3.8	**0.5**
0618	604	54	**-91.1**	11.3	9.48	**-16.1**	278	200	**-28.0**	0.352	0.468	**33.0**	11.2	11.3	**0.9**	13,300	14,000	**5.3**	3.12	3.0	**-3.8**
0619	2.3	1.7	**-24.6**	3.13	2.02	**-35.5**	4.95	0.65	**-86.9**	0.213	0.0596	**-72.0**	7.32	5.7	**-22.1**	6,280	4,400	**-29.9**	0.48	0.345	**-28.1**
0734	0.003	0.1	**3114.2**	0.656	1.37	**108.8**	1.68	5.5	**227.7**	0.0086	0.0309	**259.3**	6.63	9.52	**43.6**	4,940	6,570	**33.0**	0.0735	0.0637	**-13.3**
0735	12	14	**21.6**	3.47	3.1	**-10.7**	454	530	**16.7**	0.159	0.041	**-74.2**	9.3	8.7	**-6.5**	6,980	7,500	**7.4**	0.24	0.25	**4.2**
0736	0.072	0.1	**39.6**	1.54	0.33	**-78.6**	0.019	0.23	**1125.2**	0.0007	0.0009	**28.6**	6.79	6.1	**-10.2**	3,480	5,200	**49.4**	0.146	0.15	**2.7**
1008	22	17	**-23.6**	6.61	6.0	**-9.2**	39	47	**21.0**	0.169	0.24	**42.0**	10.2	9.5	**-6.9**	13,900	12,000	**-13.7**	2.05	1.6	**-22.0**

Notes: a = Baseline ammonium concentrations were converted from "Ammonia Total as NH_4" to "Ammonia as Total N" for comparison purposes
b = Baseline nitrate concentrations were converted from "Nitrate as NO_3" to "Nitrate + Nitrite as N" for comparison purposes

variations may be attributed to other factors (i.e., seasonal fluctuations) as opposed to ground water extraction.

Figure 2 through Figure 8 illustrate the spatial distribution of concentrations measured in March 2004 for ammonium, manganese, nitrate, selenium, strontium, sulfate, and uranium, respectively.

As previously mentioned, the site conceptual model suggests that pumping from the floodplain will not strongly affect COC concentrations. Consequently, concentrations measured in March 2004 were not expected to be significantly different from baseline concentrations. As a result, contouring of contaminant levels in March 2004 did not seem warranted at this time. Sampling is currently ongoing to develop a baseline for contaminant mass removal from both the floodplain and terrace. Future performance reports may include contoured contaminant plume maps as pumping from the floodplain continues.

2.2 Terrace System

Performance standards provided in the Baseline Performance Report (DOE 2003a) and presented in Section 1.1 for the terrace are designed to evaluate the effectiveness of the terrace treatment system. Analyses of horizontal hydraulic gradients, water level trends, drain flow rates, and seep flow rates associated with the terrace are discussed in Sections 2.2.1, 2.2.2, 2.2.3, and 2.2.4, respectively. There are no contaminant concentration performance standards because compliance is based on hydrologic control. As a best management practice, selected contaminant concentrations are being measured for the extraction system. Estimates of mass removal will be presented in the next performance report.

2.2.1 Horizontal Hydraulic Gradients

The Baseline Performance Report (DOE 2003a) contains a map of horizontal hydraulic gradients in the terrace as determined from three-point analyses of March 2003 water level data. This figure, which represents the baseline condition prior to the start-up of the terrace extraction wells, is presented as Figure A−5 of Appendix A in this report. Figure A−6 (Appendix A) presents comparable horizontal gradients developed from three-point analysis of the water level data collected in March 2004.

Comparison of the two gradient maps shows that the flow directions during the two periods are generally the same, except in the vicinity of the terrace extraction wells. The ground water flow direction in the vicinity of well 0604 (which is located near extraction well 0818) has shifted from the northeast in March 2003 to the northwest in March 2004. The impact of the ground water withdrawal in the vicinity of well 0604 from nearby extraction well 0818 is evident based on the datalogger data from well 0604 in Appendix B.

2.2.2 Water Level Trends

The March 2004 water level data were compared to terrace baseline ground water elevations presented in Table 1 of the Baseline Performance Report (DOE 2003a). Table 2 summarizes the resulting changes in ground water levels and Figure 9 presents a map view of ground water elevation increases and decreases. In general, the ground water elevation appears to be consistent or slightly decreasing in the vicinity of the terrace extraction wells and decreasing in the terrace west area.

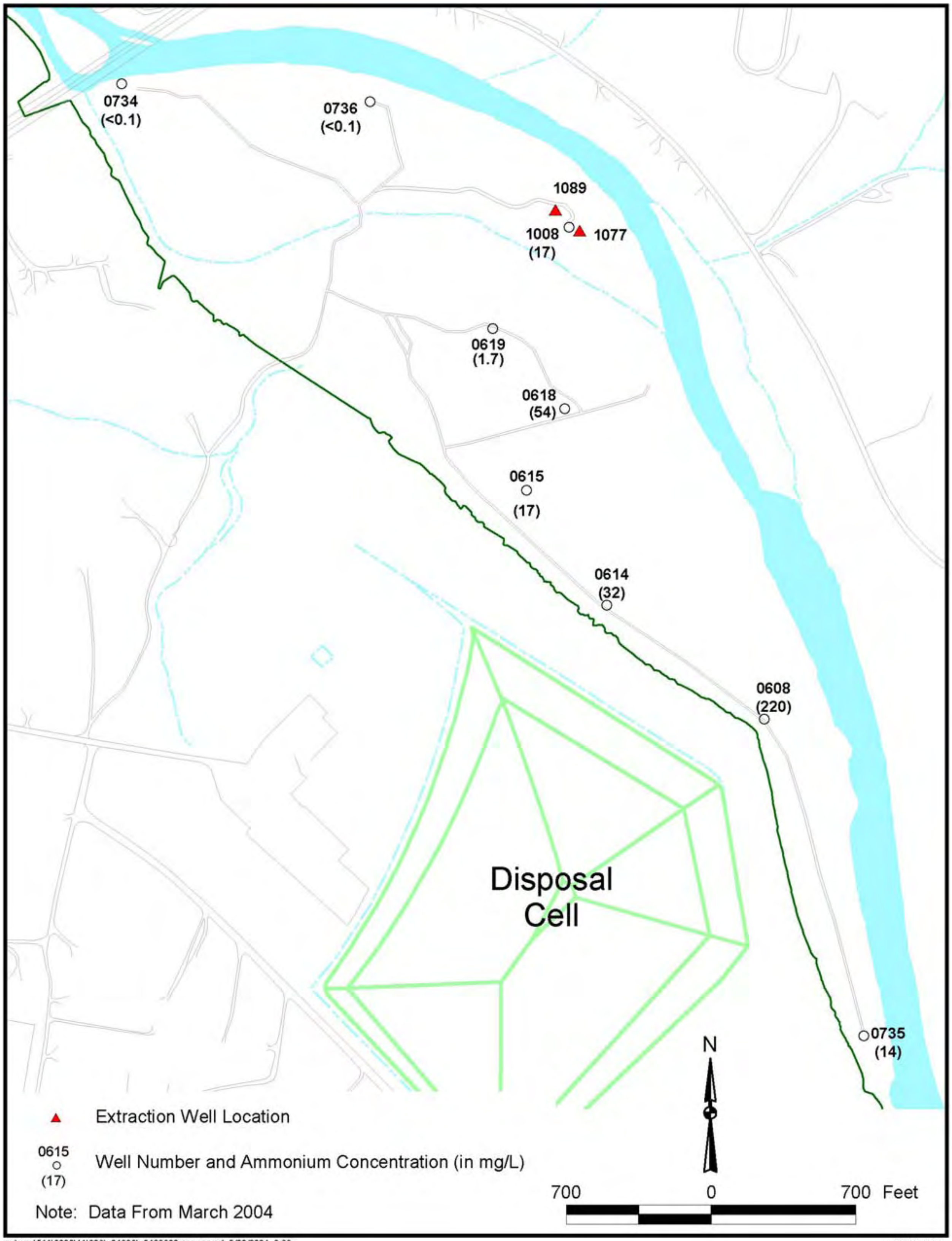

Figure 2. Floodplain Ammonium Ground Water Concentrations

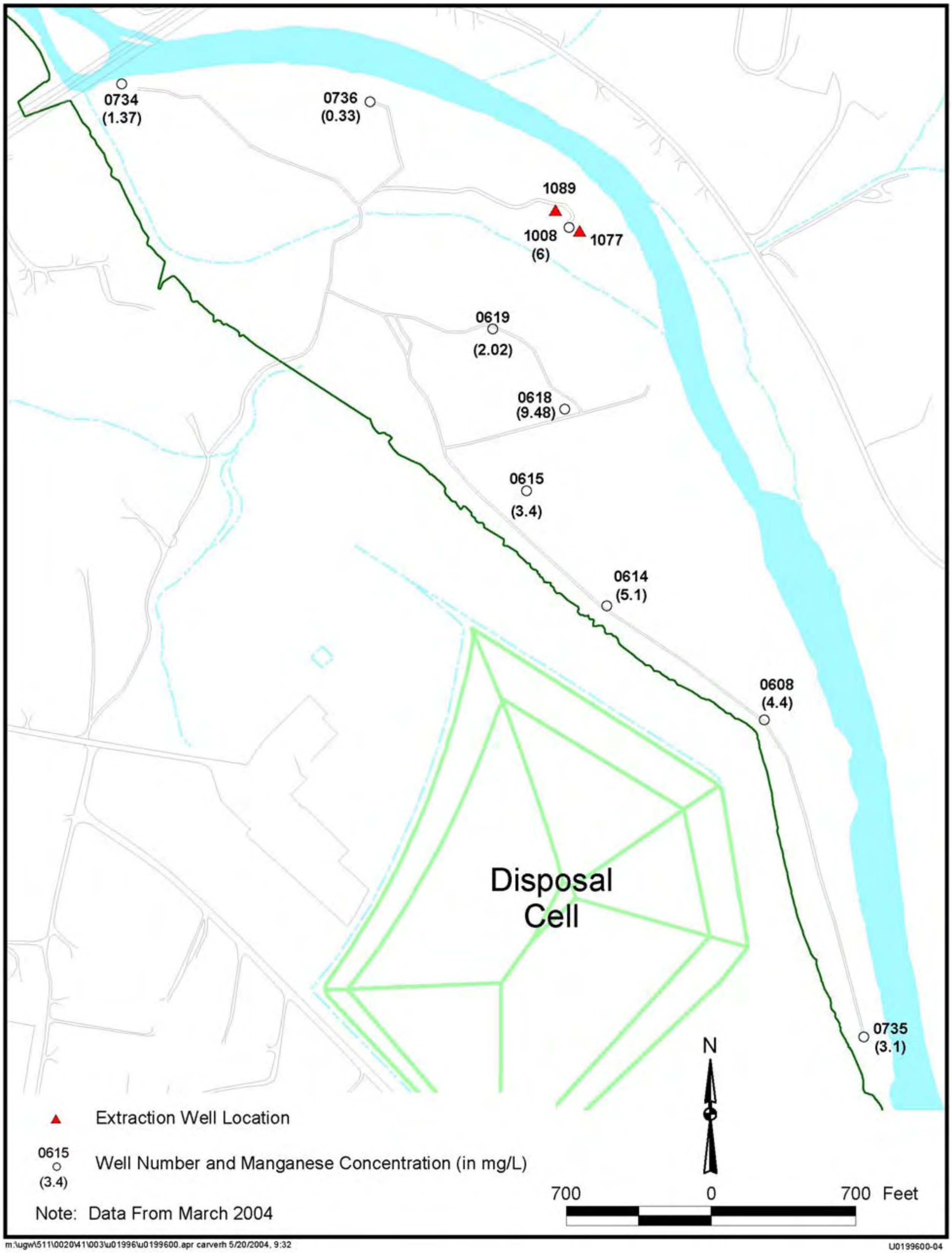

Figure 3. Floodplain Manganese Ground Water Concentrations

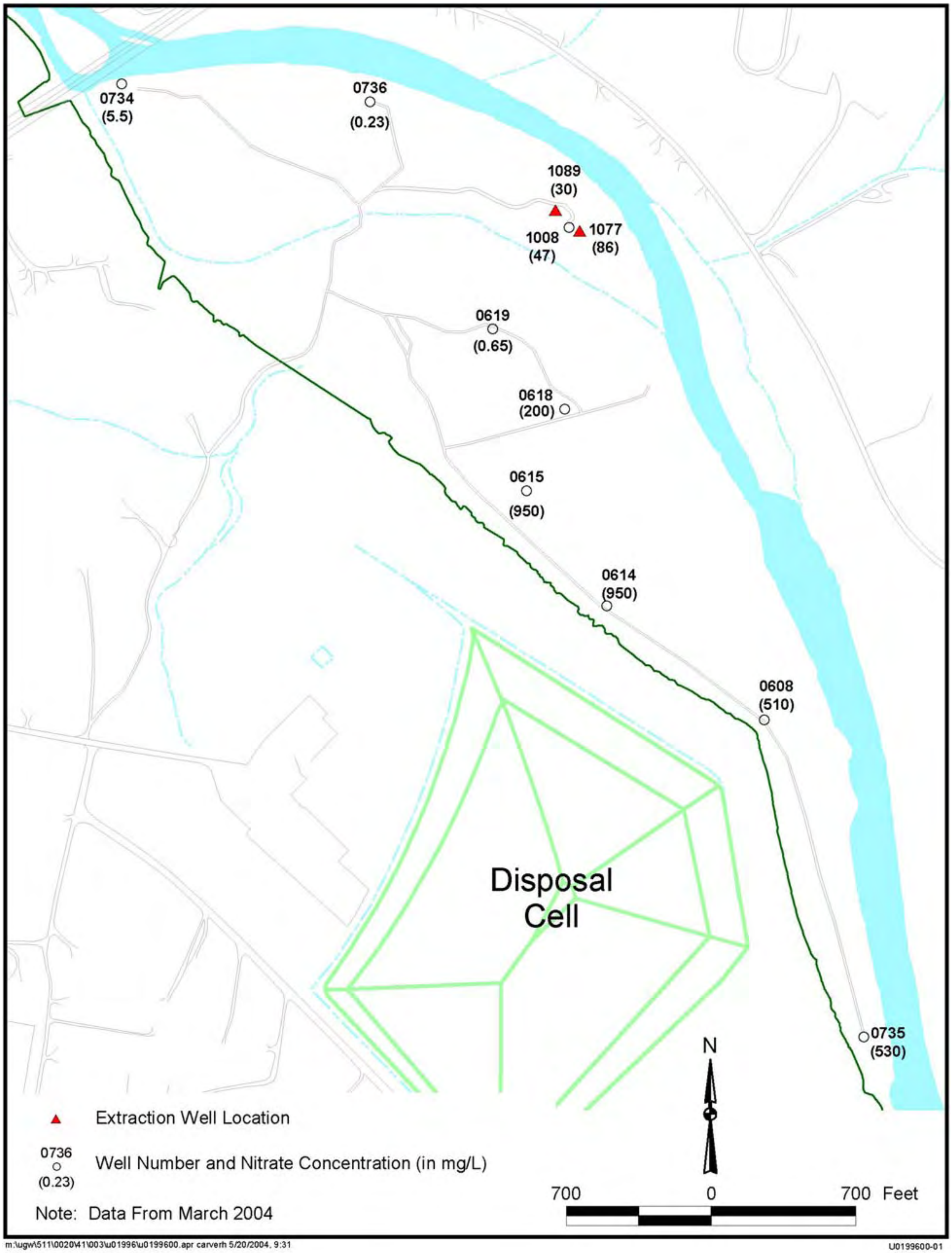

Figure 4. Floodplain Nitrate Ground Water Concentrations

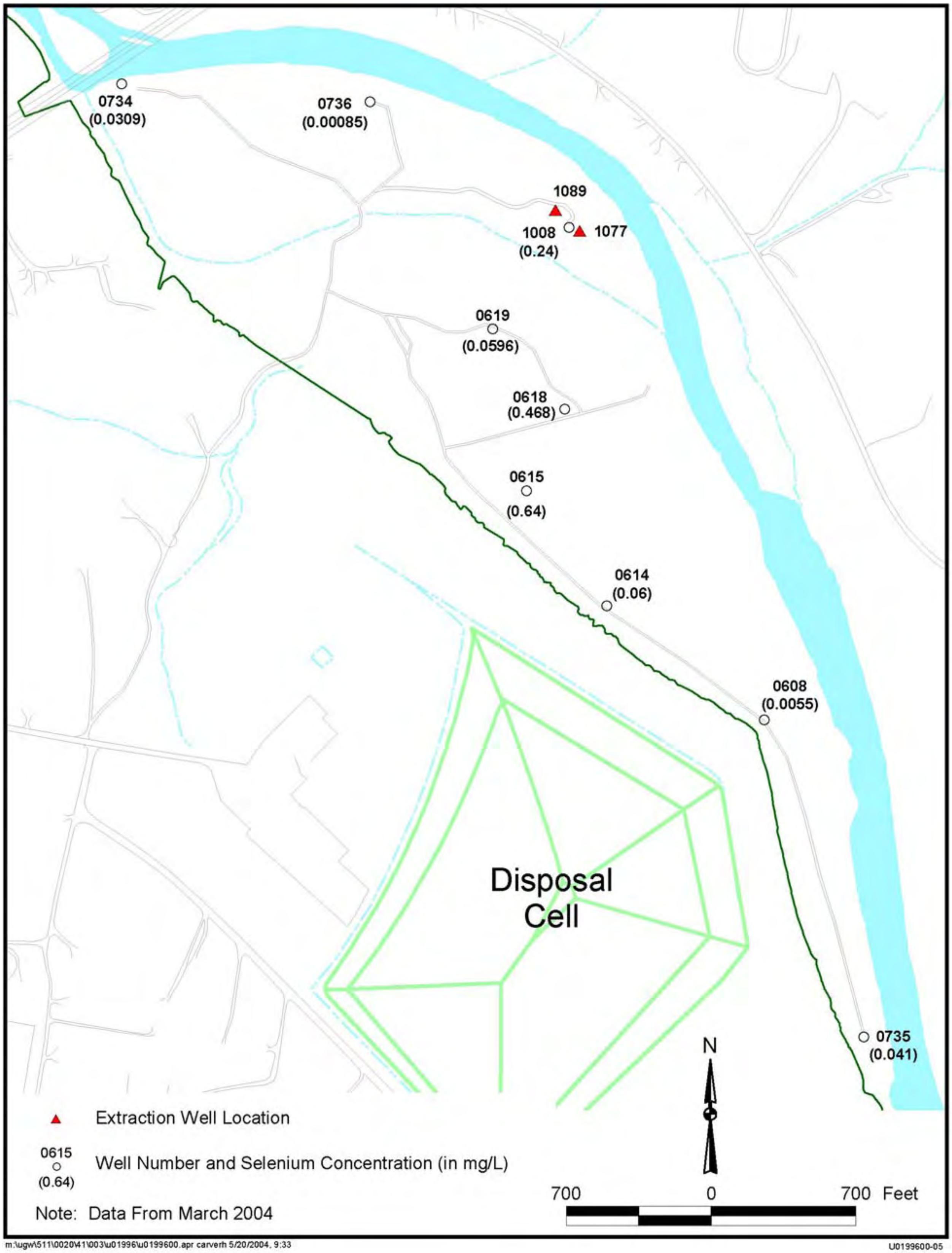

Figure 5. Floodplain Selenium Ground Water Concentrations

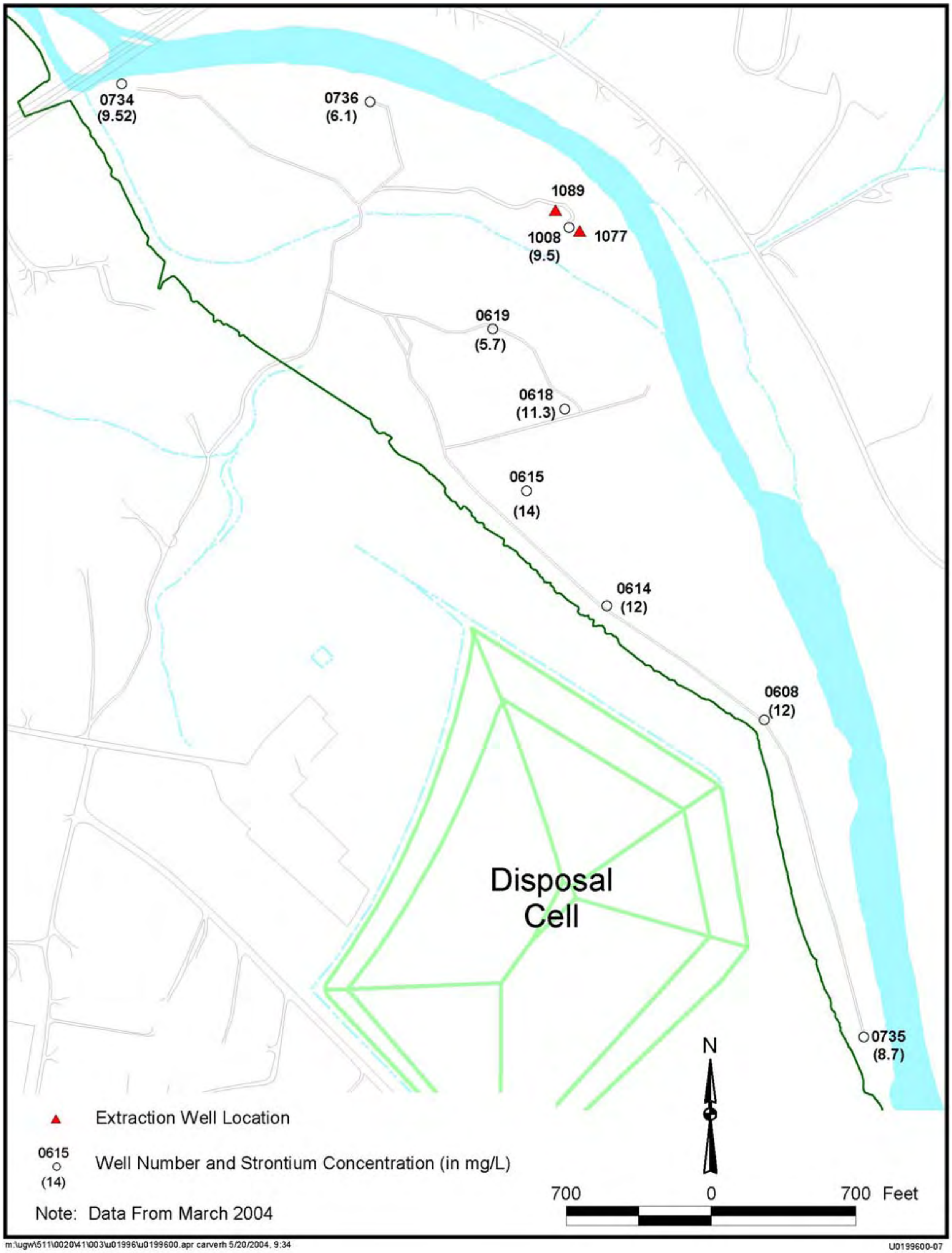

Figure 6. Floodplain Strontium Ground Water Concentrations

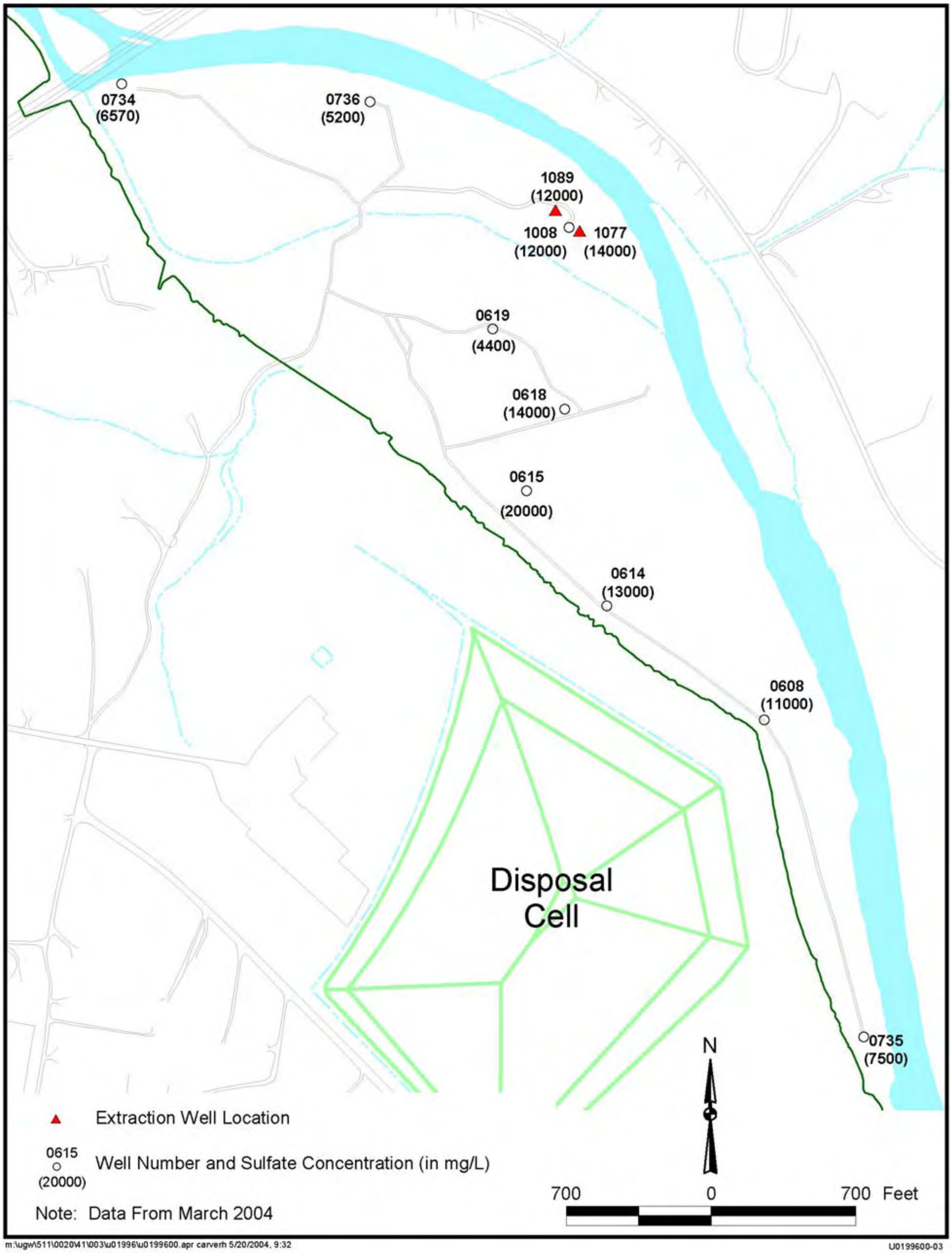

Figure 7. Floodplain Sulfate Ground Water Concentrations

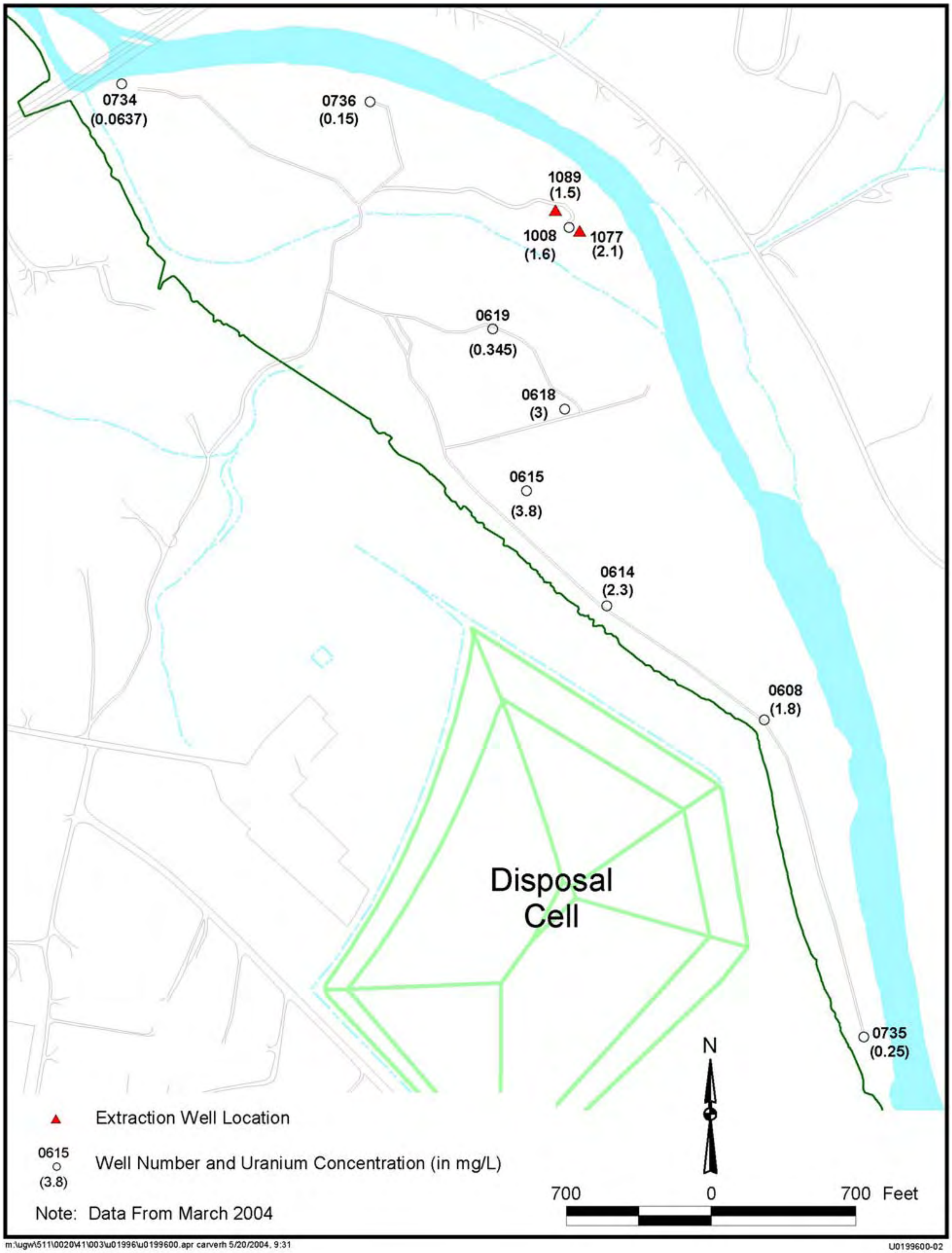

Figure 8. Floodplain Uranium Ground Water Concentrations

Table 2. Comparison of Terrace March 2004 Water Level Data to Baseline Conditions

Well	Zone of Completion	Baseline Ground Water Elevation[a] (ft msl)	March 2004 Ground Water Elevation (ft msl)	Difference in Elevation[b] (ft)
0604*	Mancos	4,944.48	4,943.22	-1.26
0727	Mancos	4,933.89	4,933.70	-0.19
0728*	Alluvium / Mancos	4,940.25	4,940.19	-0.06
0730	Alluvium / Mancos	4,946.26	4,945.08	-1.18
0812*	Alluvium / Mancos	4,944.62	4,944.31	-0.31
0813*	Alluvium / Mancos	4,941.03	4,941.12	0.09
0814*	Alluvium / Mancos	4,936.27	4,936.23	-0.04
0815*	Alluvium / Mancos	4,927.78	4,927.80	0.02
0817*	Mancos	4,938.68	4,938.59	-0.09
0819*	Mancos	4,935.68	4,935.65	-0.03
0826*	Alluvium / Mancos	4,933.02	4,932.83	-0.19
0827	Alluvium / Mancos	4,920.12	4,920.11	-0.01
0828*	Alluvium / Mancos	4,934.83	4,934.17	-0.66
0832*	Alluvium / Mancos	4,936.26	4,936.22	-0.04
0835*	Alluvium	4,911.10	4,910.89	-0.21
0836*	Alluvium	4,878.25	4,878.86	0.61
0838*	Alluvium	4,911.73	4,911.12	-0.61
0839*	Alluvium / Mancos	4,917.32	4,916.76	-0.56
0841*	Alluvium	4,939.06	4,938.65	-0.41
0846*	Alluvium / Mancos	4,910.93	4,910.10	-0.83
1007*	Alluvium / Mancos	4,917.91	4,917.41	-0.50
1057*	Alluvium	4,948.32	4,948.32	0.00
1059*	Mancos	4,947.64	4,947.47	-0.17
1060*	Alluvium / Mancos	4,932.64	4,932.23	-0.41
1067*	Alluvium / Mancos	dry	dry	na
1068*	Alluvium / Mancos	4,920.71	4,920.61	-0.10
1069*	Alluvium / Mancos	4,920.15	4,916.99	-3.16
1073	Alluvium	4,941.99	4,941.63	-0.36
1079*	Alluvium	4,909.89	4,909.39	-0.50

[a]Baseline Water Levels Measured In All Wells In March 2003 With The Exception Of Well 1073 (September 2002)
[b]March 2004 Water Level – Baseline Water Level
Notes: na = not applicable, water level not measured
* = designates a well included in the long-term monitoring plan

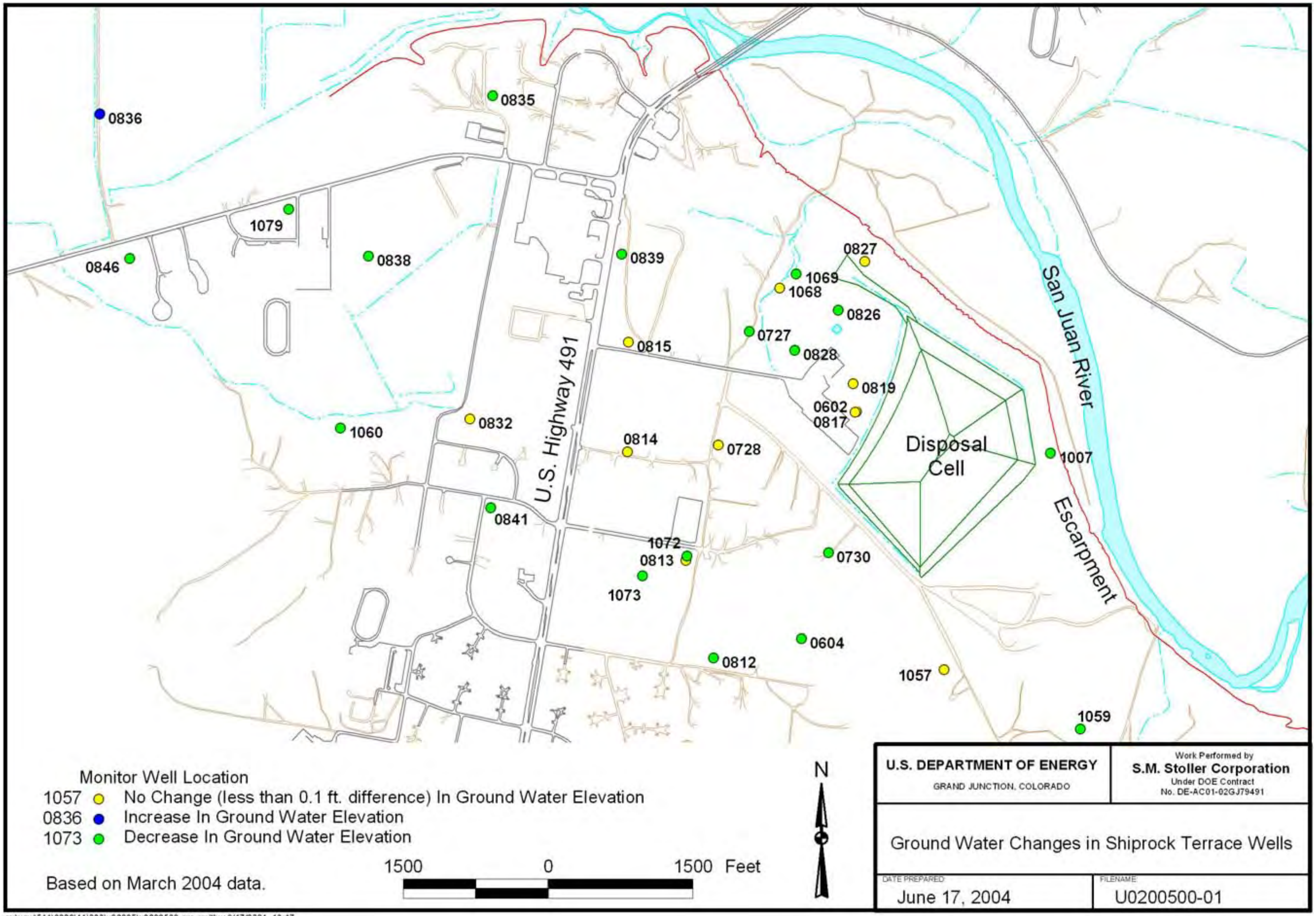

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Figure 9. Terrace Ground Water Elevation Changes Between Baseline Conditions and March 2004

Water levels have also been monitored using pressure transducers that had been installed in selected wells on the terrace prior to treatment system startup. Appendix B contains plots of ground water elevation data collected from pressure transducers connected to dataloggers in terrace east wells 0602, 0604, 0731, 0813, 0819, 0826, 0827, and 0830. These graphs indicate that water levels in the terrace east area from March 2003 to March 2004 in general do not fluctuate significantly and exhibit a slight (approximately a 0.5 ft decrease across the site) declining trend.

Based on previous datalogger results, well 0730 has shown an increasing ground water elevation (DOE 2003b). The surface casing of well 0730 was destroyed shortly after the datalogger was downloaded in August 2003, and the data logger was removed. The well was reconditioned and the datalogger was re-installed in March 2004, and the data will be included in the next performance report.

Appendix B also contains plots of ground water elevation data collected by dataloggers in terrace west wells 0837, 0841, 0843, 0846, and 1060. The graphs indicate ground water elevations in the vicinity of terrace west fluctuate in response to irrigation practices in that area.

2.2.3 Seep Flow Rates

Rates of ground water discharge at seeps 0425 and 0426 were also measured in March 2004. The flow rate at seep 0425 was only 0.04 gpm, which is significantly lower than the rate measured in March 2003 (0.5 gpm). Between October 2002 and March 2003, the minimum flow rate measured was 0.4 gpm. With only 1 year of active remediation from the terrace, it is unlikely that the reduced seep 0425 flow rate is a direct result of the terrace ground water extraction. Rather, it is more likely the rate decreased in March 2004 due to recent drought conditions in the region.

The flow measured at seep 0426 in March 2004 was 2.2 gpm, which is higher than the rate measured in March 2003 (1.8 gpm). Between October 2002 and March 2003, the maximum flow rate measured at seep 0426 was 2.1 gpm, suggesting that flow at the seep has not changed significantly since initiation of the extraction system.

2.2.4 Drain Flow Rates

As discussed in the Baseline Performance Report, the flow rate of the pump removing water from the drains installed in Bob Lee and Many Devils Washes was expected to decrease as ground water levels in the terrace decline. The flow rate data collected over the first 6 months of drain collection (i.e., March through August 2003) indicate the pump in Bob Lee Wash initially was pumping approximately 7 gpm, and that the water pump could not keep up with the water flowing into the drain.

During May 2003, ponded water was no longer on the surface, indicating the pump at that time was removing water from the system as fast as the system recharged the drain. Over the 6-month evaluation period (August 2003 to March 2004), the flow rate decreased at a relatively constant rate. At the end of March 2004, approximately 3.5 gpm was being pumped from the drain. Figure 10 was generated using ground water elevation data collected from wells 1067, 1068, and 1069, all of which are located adjacent to Bob Lee Wash. As this figure shows the ground water elevations decreased significantly in well 1068 after March 2003, when the drain extraction system became operational. The ground water elevation in the vicinity of well 1069 has been more gradual, while well 1067 became dry starting in March 2003, has been dry since that time.

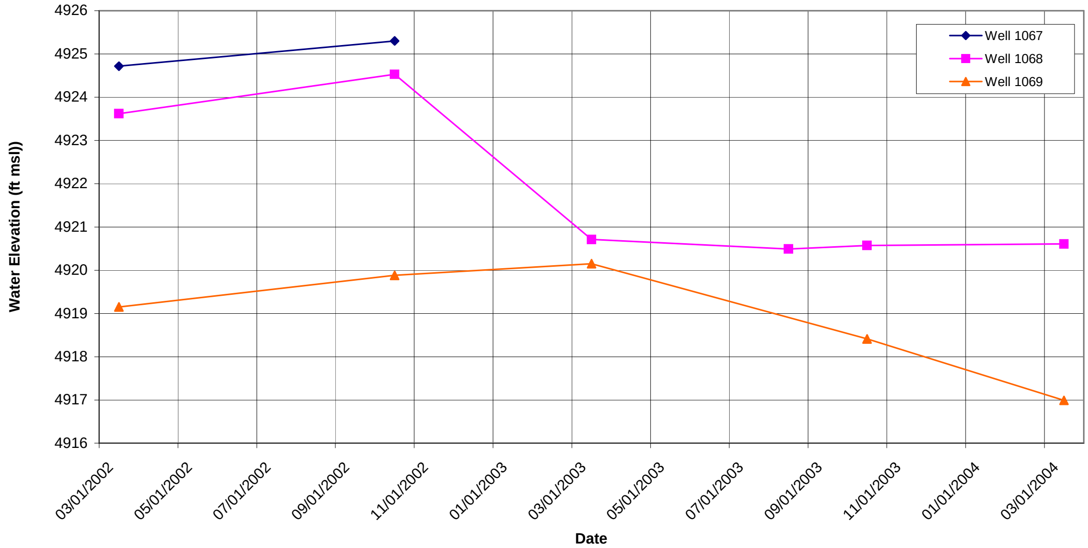

Figure 10. Ground Water Elevation Decrease in the Vicinity of Bob Lee Wash

While the pump at the Many Devils Wash drain removed water at an average rate of about 0.14 gpm between March and August 2003, the average between August 2003 and March 2004 was 0.48 gpm. This increase may be attributed to modifications made to the drain system in June 2003.

3.0 Remediation System Performance

The following sections provide a brief description of the components of the floodplain and terrace ground water remediation systems, and summarize their performance between baseline conditions and March 2004.

3.1 Floodplain Remediation System

The objective of the floodplain ground water extraction system is to remove ground water from the parts of the COC plumes near the San Juan River. Pumping is focused at this location to lessen exposure risk to aquatic life. All ground water collected from the floodplain extraction wells is piped south to the terrace where it discharges into the evaporation pond. A more complete description of the floodplain extraction system is presented in the Baseline Performance Report (DOE 2003a).

This system initially consisted of wells 1075 and 1077. These wells were drilled to approximately 20 ft below ground surface and had saturated alluvial thicknesses of 8 to 10 ft. After nearly 4 months of pumping, neither well was producing more than 3 gpm, far below the goal of 10 to 20 gpm per well. Both wells were re-developed a number of times in an attempt to increase the extraction rates. Ultimately, well 1075 was replaced with well 1089, which was installed just north of 1075 using alternative methods. Specifically, well 1089 was constructed using a slotted culvert placed in a trench excavated to bedrock. After installation of the culvert, the pump was removed from well 1075 and placed inside the new well.

3.1.1 Extraction Well Performance

Figure 11 presents measured pumping rates and cumulative volume of ground water pumped from well 1089 from between September 2003 and March 2004. Increases in the pumping rates during late March 2004 can be attributed to the higher river stage of the nearby San Juan River (at higher river stages the pumping rate tends to increase due to the increased saturated thickness). By the end of March 2004, well 1089 had removed more than 2,512,300 gallons of water from the floodplain ground water system.

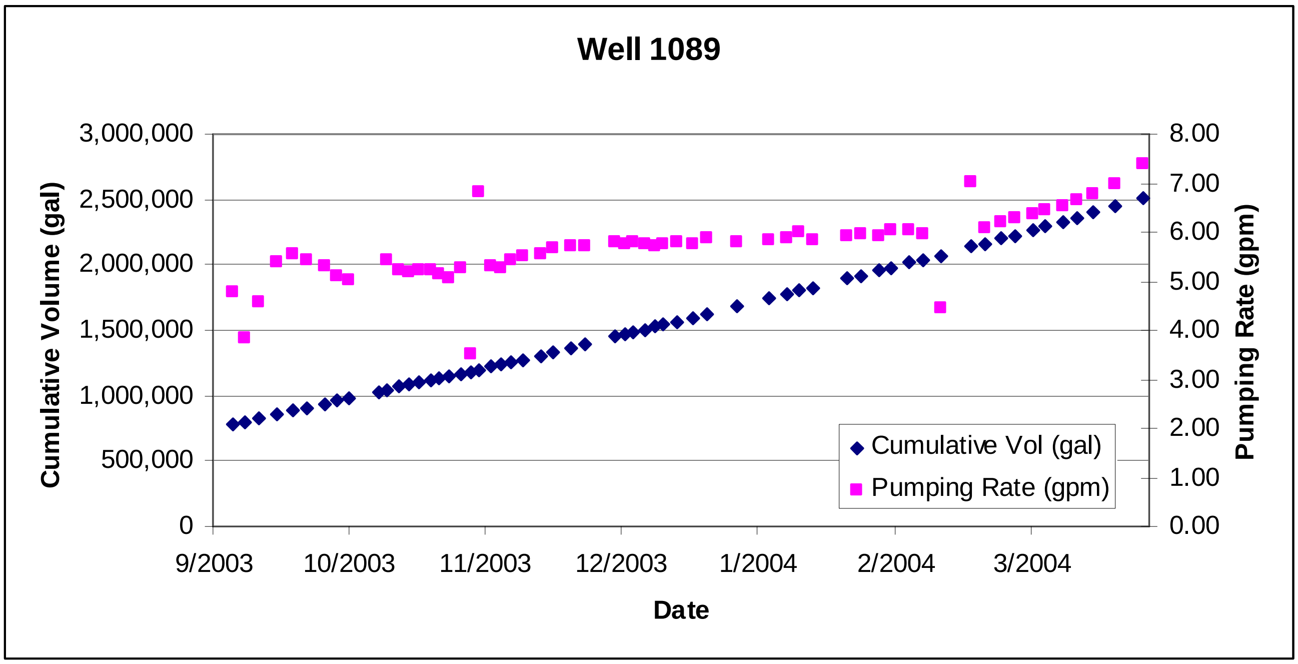

Figure 11. Well 1089 Pumping Rate and Cumulative Ground Water Volume Extracted

Well 1077 has not performed as efficiently as well 1089 (Figure 12). Between September 2003 and March 2004 the average pumping rate was only approximately 0.5 gpm (compared to an average of 5.7 from well 1089), and only approximately 305,131 gallons of ground water had been pumped from this well at the end of the period. Appendix C lists measured flow rates and corresponding volumes of ground water removed from floodplain extraction wells 1089 and 1077.

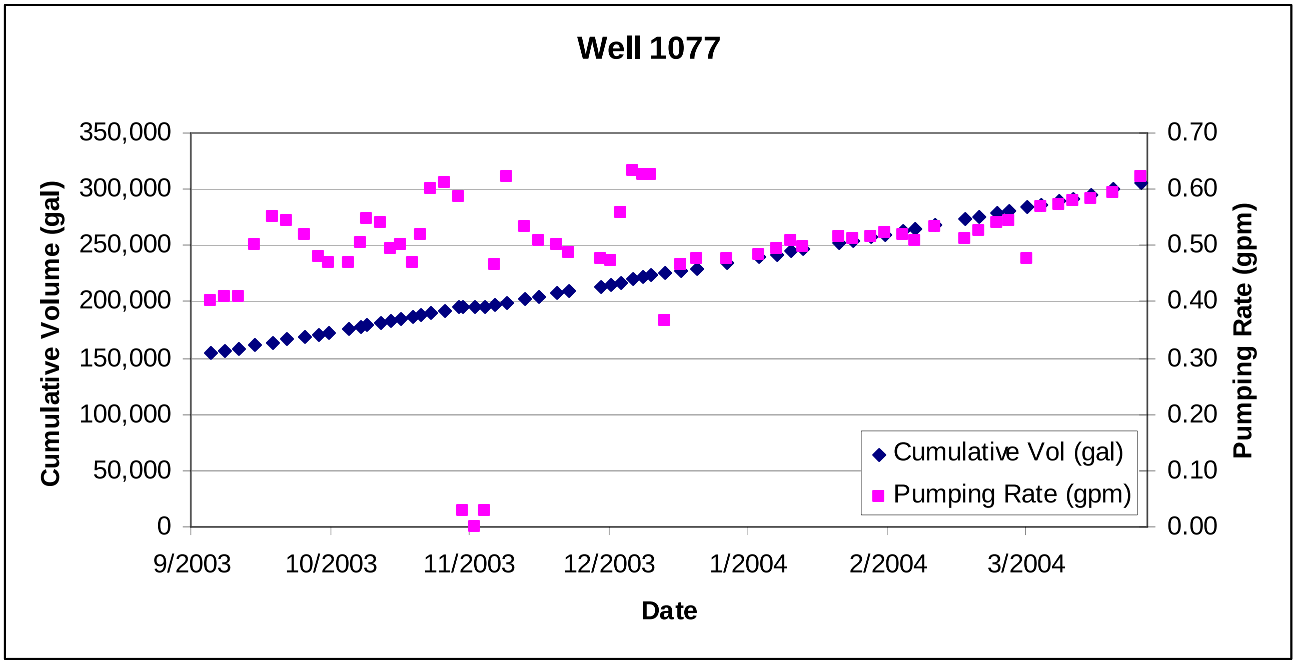

Figure 12. Well 1077 Pumping Rate and Cumulative Ground Water Volume Extracted

3.2 Terrace Remediation System

The terrace remediation system consists of four components: the terrace extraction wells, the terrace drains (Bob Lee and Many Devils Washes), the evaporation pond, and the terrace outfall drainage channel diversion (Figure 1).

Extraction Wells

Three wells (1070, 1071, and 1078) were initially installed for the purposes of ground water extraction on the terrace. In addition, monitor well 0818 was converted to a pumping well. All of the wells, whose total depths range from 40 to 60 ft below ground surface, were located within the terrace east portion of the site. Saturated thickness in the wells ranged from 3 to 7 ft. Ground water extracted from these wells was collected in a pipeline and transported eastward to the evaporation pond.

After 5 months of pumping, and a number of efforts to increase the flow from the initial four extraction wells, additional wells were installed in an attempt to reach a total terrace extraction rate of 10 gpm. Wells 1091, 1092, 1093, and 1094 were installed in July 2003 just north of the west part of the evaporation pond (Figure 1).

Terrace Drain System

The terrace extraction system is also designed to collect seepage along Bob Lee and Many Devils Washes using subsurface interceptor drains. These drains, which consist of perforated pipe surrounded by drain rock and are lined with impermeable geomembrane and geotextile filter fabric, are offset from the centerline of each wash to minimize infiltration of surface water. All water collected by these drains is pumped through a pipeline to the evaporation pond.

Evaporation Pond

The selected method for treating ground water from the interceptor drains and extraction wells is solar evaporation. The contaminated ground water is pumped to a lined evaporation pond in the south part of the radon cover borrow pit area (Figure 1). This pond, with a surface area of approximately 11 acres, has a geosynthetic liner underlain by a compacted soil base.

Terrace Drainage Channel Diversion

During infrequent high-intensity rainfall events, surface water shed from the disposal cell has historically drained northwest to a rock-lined dissipation area, eventually reaching upper Bob Lee Wash. In some instances the water has become ponded in the rock-lined dissipation area, from whence it potentially recharged the aquifer and fed the escarpment seeps.

The outfall drainage channel diversion was installed to better drain surface water from the dissipation area and convey it northwest to the lower part of Bob Lee Wash. It is located such that it will not interfere with the interceptor drain in upper Bob Lee Wash.

A more detailed description of remediation system components are contained in the Baseline Performance Report (DOE 2003a) and GCAP (DOE 2002). The following sections discuss the performance of the extraction wells (3.2.1), terrace drain system (3.2.2), and evaporation pond (3.2.3) between late September 2003 and March 2004. Performance of the outfall drainage channel is omitted because flows in the channel are not being measured.

3.2.1 Extraction Well Performance

The pumping rates and corresponding ground water volumes removed from wells 0818, 1070, 1071, 1078, 1091, 1092, 1093, and 1094 through March 2004 are presented in Figure 13 through Figure 20, respectively. Table 3 lists each well’s average pumping rate and total ground water volume removed as of March 2004. The average pumping rates range from 0.03 (well 1094) to 1.38 gpm (well 0818), and the total ground water volume removed from each well during this same time period ranged from 10,819 (well 1094) to 770,697 gallons (well 0818).

Appendix C lists measured pumping rates and corresponding volumes of ground water removed from all eight terrace ground water extraction wells.

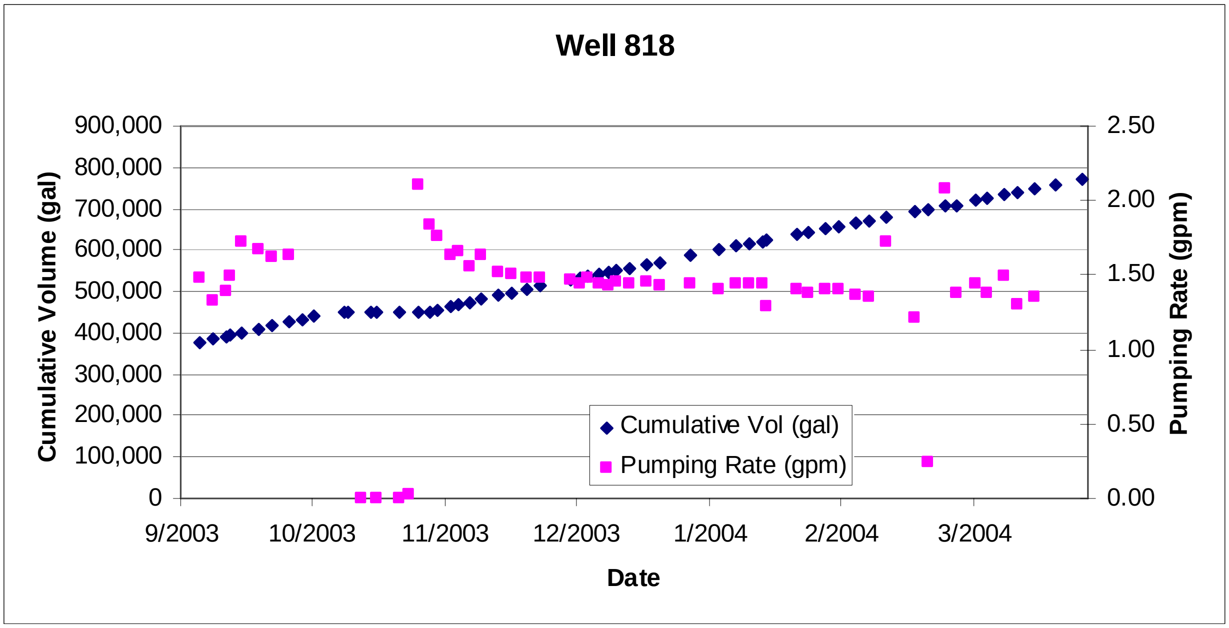

Figure 13. Well 0818 Pumping Rate and Cumulative Ground Water Volume Extracted

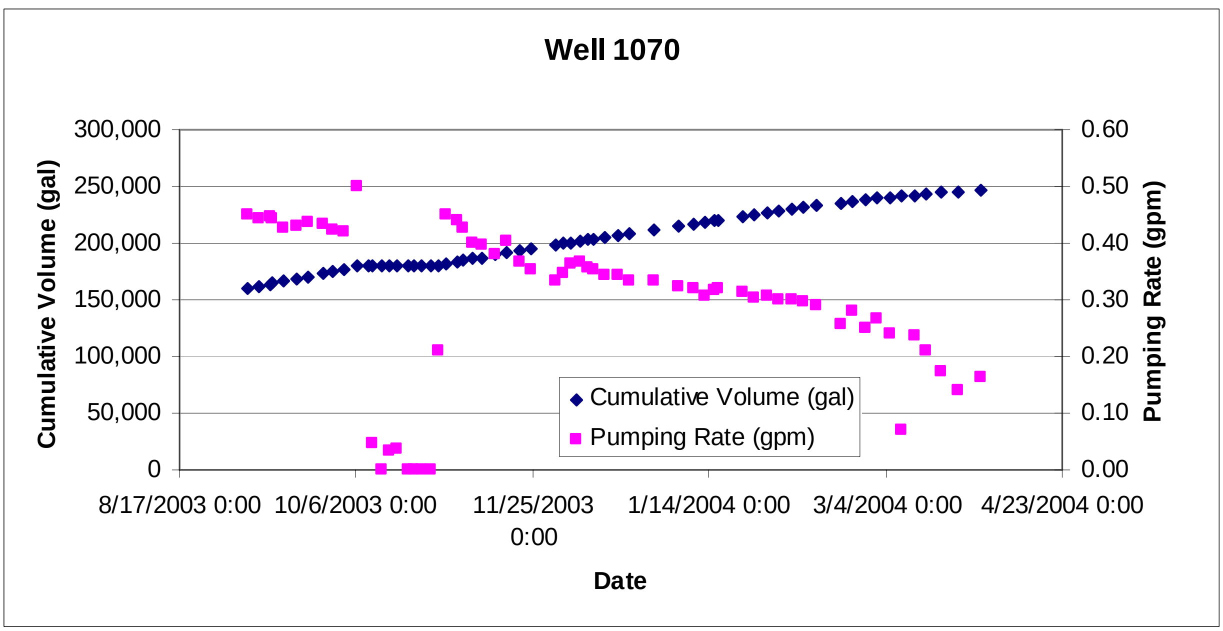

Figure 14. Well 1070 Pumping Rate and Cumulative Ground Water Volume Extracted

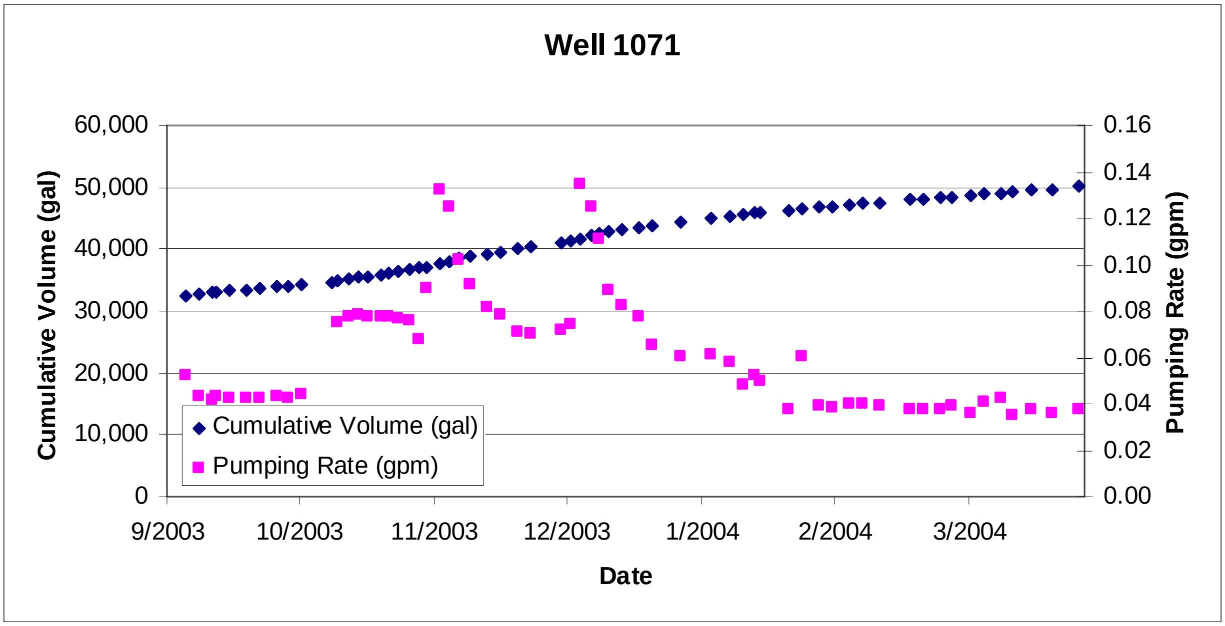

Figure 15. Well 1071 Pumping Rate and Cumulative Ground Water Volume Extracted

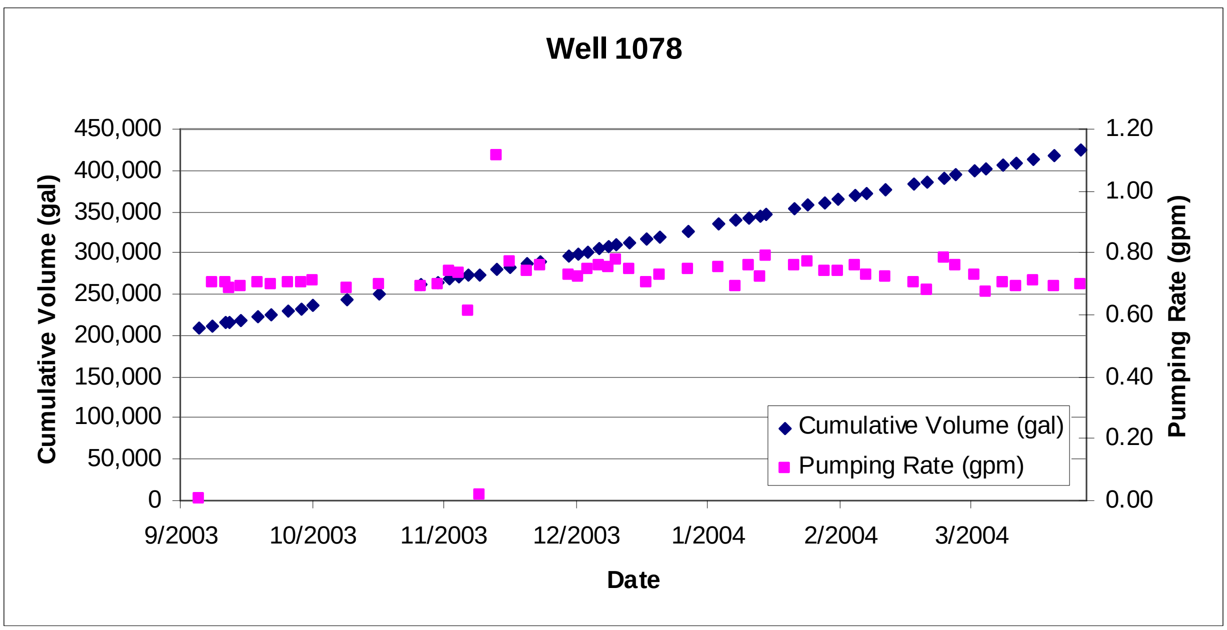

Figure 16. Well 1078 Pumping Rate and Cumulative Ground Water Volume Extracted

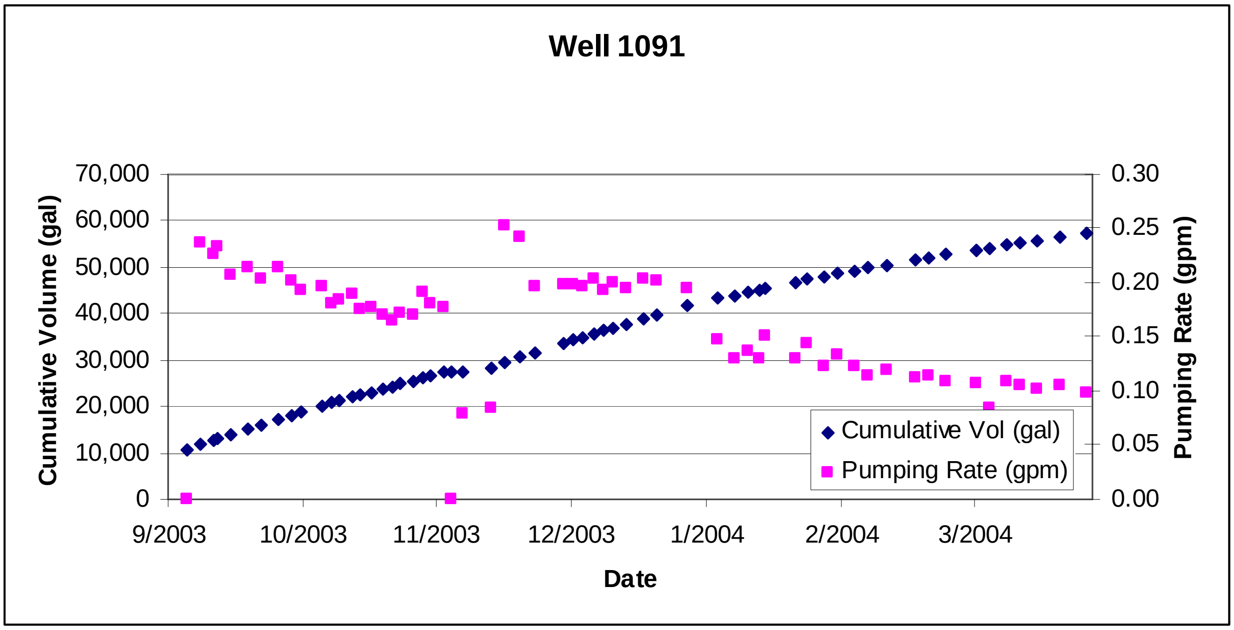

Figure 17. Well 1091 Pumping Rate and Cumulative Ground Water Volume Extracted

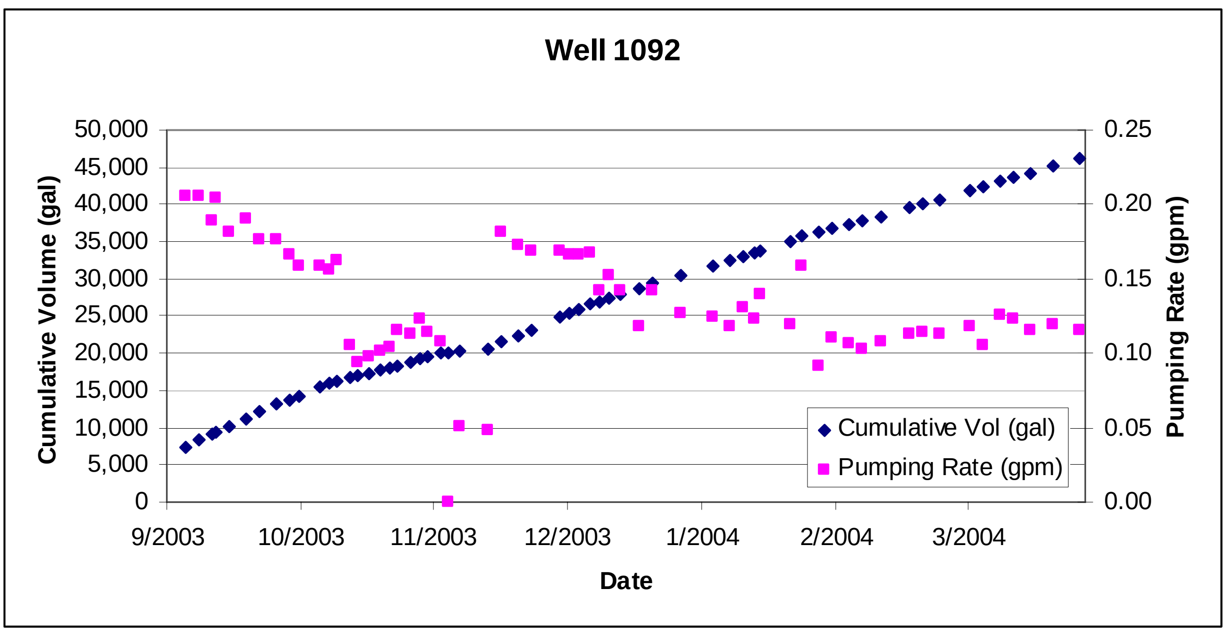

Figure 18. Well 1092 Pumping Rate and Cumulative Ground Water Volume Extracted

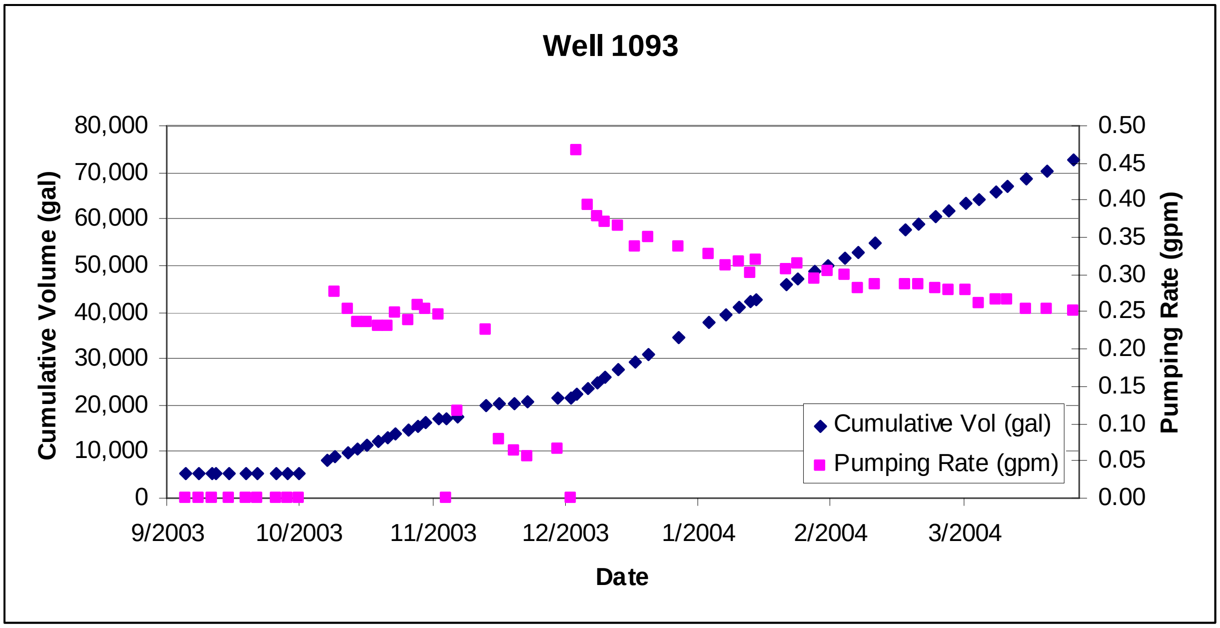

Figure 19. Well 1093 Pumping Rate and Cumulative Ground Water Volume Extracted

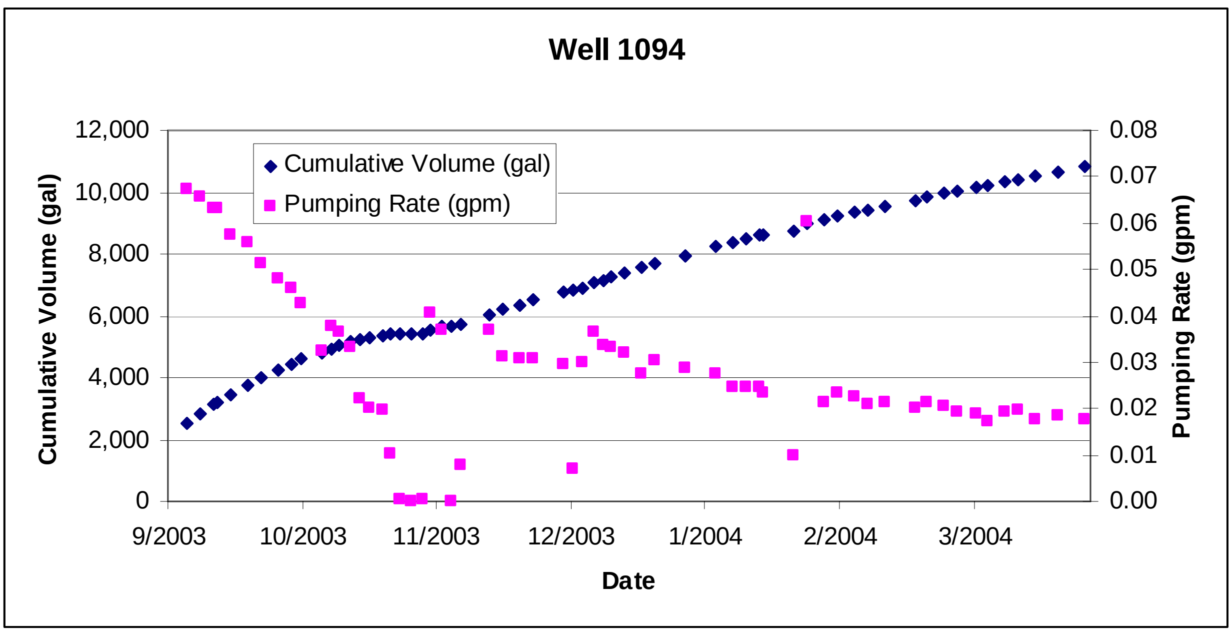

Figure 20. Well 1094 Pumping Rate and Cumulative Ground Water Volume Extracted

Table 3. Terrace Extraction Well Average Pumping Rate and Total Ground Water Volume Removed

Well	Average Pumping Rate, September 2003 through March 2004 (gpm)	Total Ground Water Volume Removed, March 2004 (gallons)
0818	1.38	770,697
1070	0.29	246,641
1071	0.06	50,074
1078	0.70	423,626
1091	0.16	57,467
1092	0.13	46,144
1093	0.22	72,591
1094	0.03	10,819
Total	**2.97**	**1,678,059**

3.2.2 Terrace Drain System Performance

Figure 21 presents extraction rates and cumulative flow volumes for the pump installed in the Bob Lee Wash drain. The data clearly indicate a continued uniform decline in drain flow since startup of the system in late February 2003. The flow rate by the end of March 2004 was 3.3 gpm. During the 6-month performance period (September 2003 to March 2004), the average flow rate was 3.58 gpm, with over 2.3 million gallons of water removed by the drain.

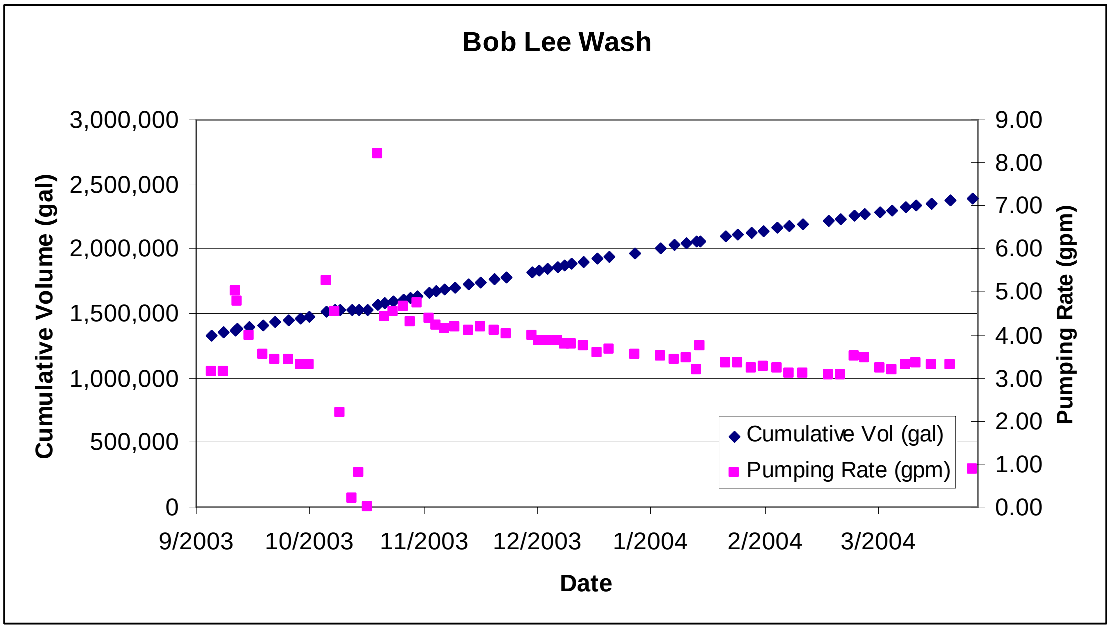

Figure 21. Bob Lee Wash Pumping Rate and Cumulative Ground Water Volume Extracted

As previously discussed, inflow to the drain during its first few months of operation was greater than the ability of the pump installed in the drain to remove the water, as evidence by ponded water present on the surface near the base of the sump containing the pump. By early May 2003, the ponded water was gone, suggesting that the pump discharge was equal to the drain inflow.

During summer months the drain filter at Bob Lee Wash appeared to be affected by scaling that had likely reduced the ability of the ground water to enter the drain. Attempts were made to remove this material and increase the flow rate in July 2003.

The pumping rates and volumes of water removed from the drain installed in Many Devils Wash are presented in Figure 22. Ponded water was present along the wash bottom just east of the buried drain intermittently between September 2003 and March 2004. The flow rate increased in mid-January 2004 from approximately 0.5 to 0.8 gpm and remained at this level through March 2004. By the end of March 2004 the total volume removed by this drain was 207,674 gallons. Appendix C lists the measured pumping rates and corresponding volumes of ground water removed from the Bob Lee Wash and Many Devils Wash drains.

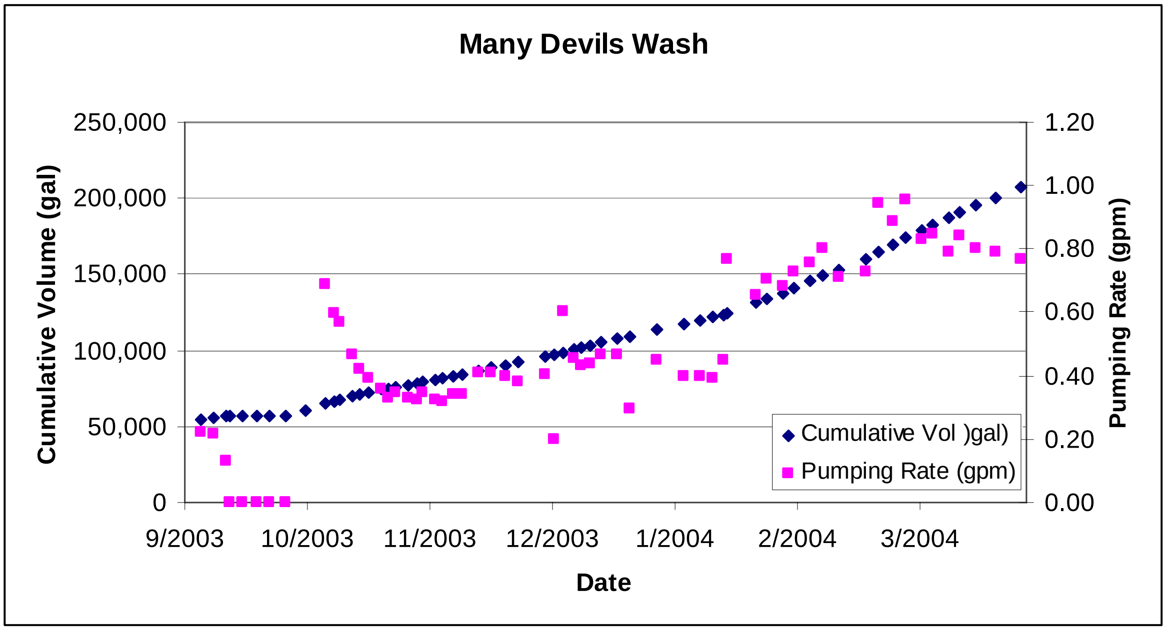

Figure 22. Many Devils Wash Pumping Rate and Cumulative Ground Water Volume Extracted

3.2.3 Evaporation Pond

The bottom of the evaporation pond became completely covered during the 2003/2004 winter, when evaporation rates decreased significantly compared to the summer rates. However, despite the lower evaporation rates, the depth of water in the pond never exceeded more than 0.5 ft in some places of the pond due to limited pumpage from both the floodplain and the terrace. Figure 23 presents the total volume of water transported to the pond, and the relative contributions from the floodplain and terrace systems.

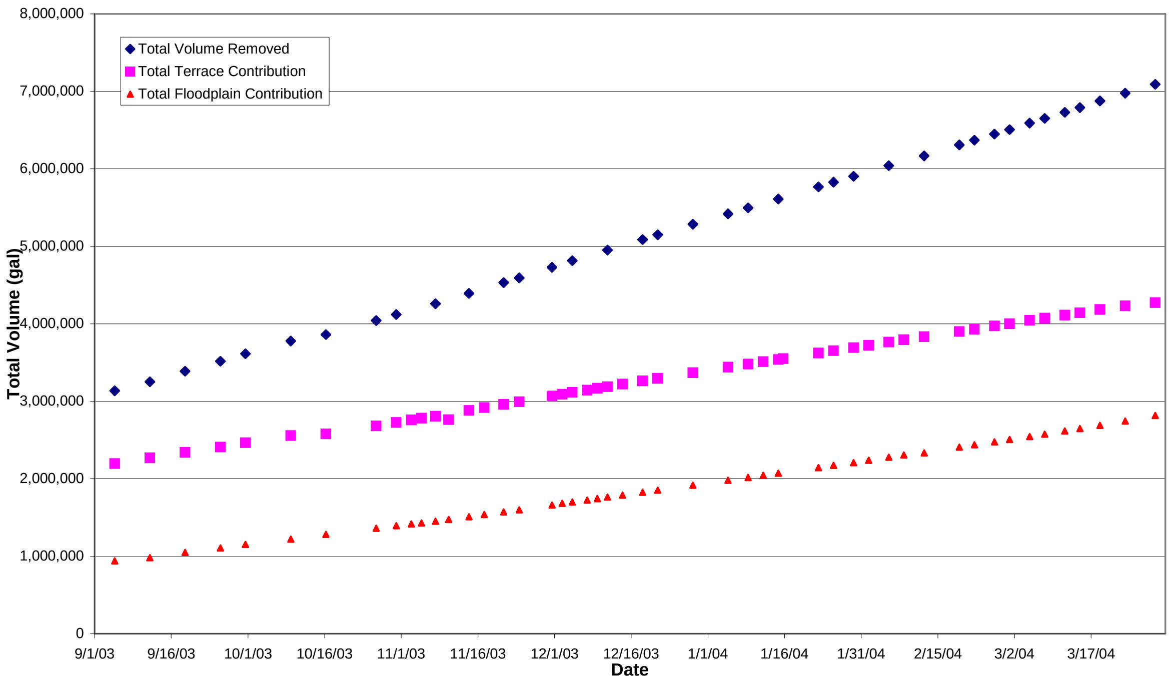

Figure 23. Total Ground Water Volume Transported to the Evaporation Pond

4.0 Performance Summary

No significant changes were expected at the Shiprock site during the initial 12 months of remedial system operation. Findings from the September 2003 through March 2004 performance evaluation of the floodplain remediation system at the site are as follows:

- Three-point analysis of March 2004 water level data in the vicinity of the two floodplain extraction wells indicates that ground water is locally flowing toward the wells in response to pumping.
- No significant reductions in COC concentrations are observed in the floodplain; however, the extraction wells removed some contamination that would have otherwise discharged to the San Juan River.

Findings from the September 2003 through March 2004 performance evaluation of the terrace remediation system are as follows:

- Three-point analysis of the August 2003 water level data indicates the extraction wells are inducing ground water flow towards them.
- The terrace east ground water elevations have been decreasing over the past 5 years, and the March 2004 data indicate the elevations have continued to decline during the previous 6 months. Ground water elevation data collected using data loggers confirm the decline. The terrace west water levels continue to fluctuate in response to irrigation practices in that portion of the site.

- Ground water elevations in the vicinity of the Bob Lee Wash drain have been declining since March 2003, when the ground water extraction system became operational.
- Flow rate data from the pump installed in the Many Devils Wash drain indicate that the average flow rate has more than doubled compared to the average flow rate associated with the first six months of operation. The flow rate increased significantly in mid January 2004.
- The flow rates measured in March 2004 from seeps 0425 and 0426 were below the range measured since October 2002.

5.0 Recommendations

On the basis of the preceding review and the analysis presented in DOE 2004, the following recommendations are provided as means to improve the performance of the Shiprock remediation system and to improve evaluation of the system:

- Increase the volume of ground water extracted from the floodplain to fill the evaporation pond. Well 1077 might be replaced with a new well in a similar manner to which well 1075 was replaced with well 1089.
- Evaluate the effects of well inefficiency on limited pumping rates for wells installed in the floodplain aquifer to remove contaminant mass available to the river; devise methods to reduce well inefficiencies so that better capture of floodplain aquifer contaminants is achieved.
- Assess the potential for ground water flow and contaminant transport in Mancos Shale, both on the terrace and beneath the floodplain, to be affected by preferred flow paths associated with fractures, differential weathering, etc. Develop methods to determine effectiveness of improving contaminant recovery associated with such paths.
- Apply techniques to better understand the migration of contaminated Mancos Shale ground water to the floodplain aquifer, particularly along the escarpment separating the terrace from the floodplain (e.g., at seeps 0425 and 0426). Use associated findings to improve interception of floodplain contaminants via extraction wells, drain trenches, etc.
- Analyze pumping data from wells in alluvium in the southern part of the terrace ground water system to identify possible barrier boundary effects; if possible, revise ground water volume estimates for this area based on the pumping data, and use accordingly for performance evaluation in the terrace ground water system.
- Because ground water extraction rates have been less than anticipated, consider the installation of two to four additional extraction wells in the south part of the terrace east, in an arc between the highest-producing existing extraction wells 0818 and 1078. This spread, or optimization, of extraction wells should result in an increase of the volume of ground water extracted from the south part of terrace east.

6.0 References

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———, 2003b. *Semiannual Performance Report February 2003 through August 2003 for the Shiprock, New Mexico, UMTRA Project Site*, GJO−2003−490−TAC, U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, September.

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Appendix A

Three-Point Analyses of Floodplain and Terrace Ground Water Elevation Data

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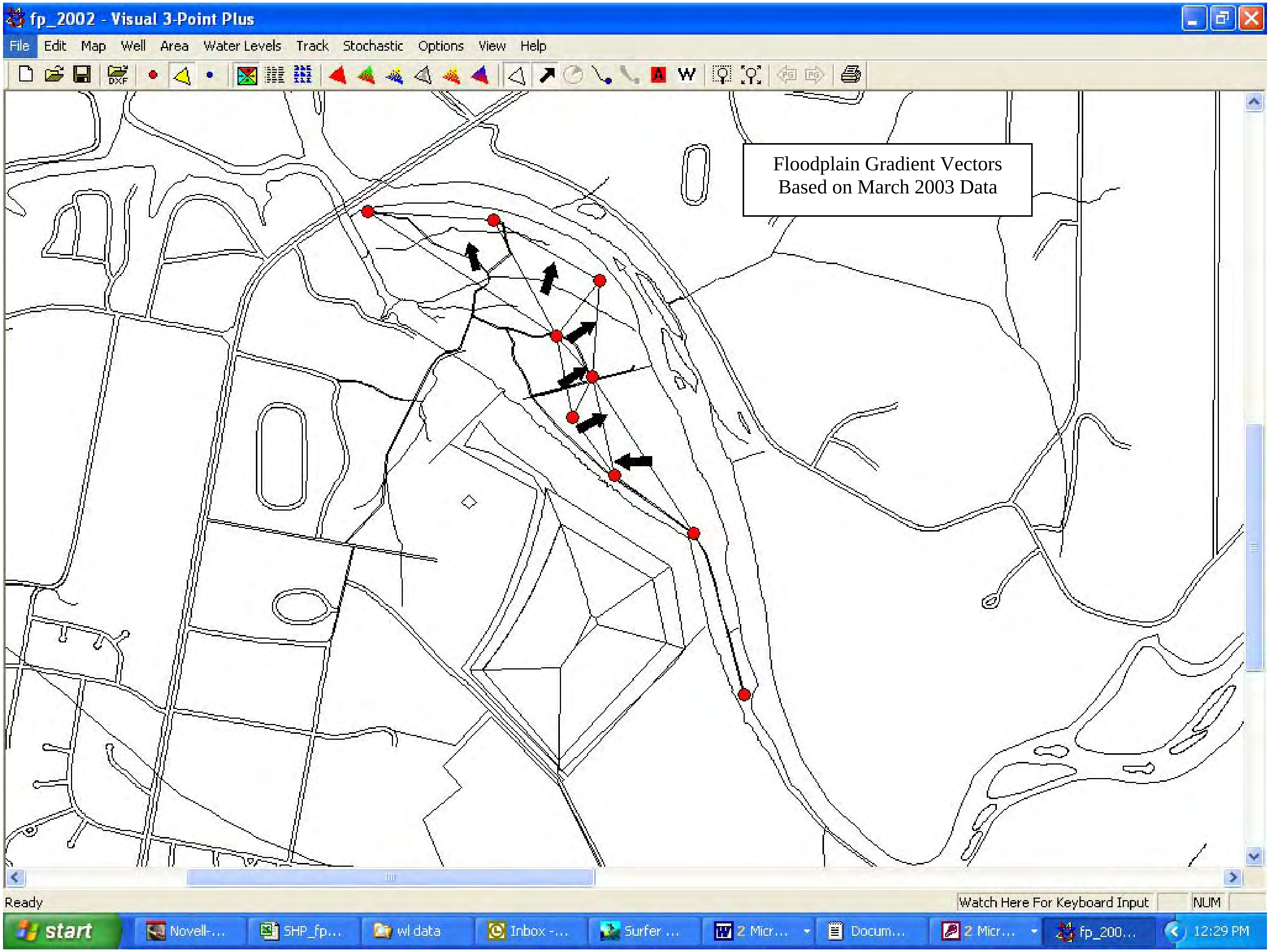
fp_2002 - Visual 3-Point Plus
File Edit Map Well Area Water Levels Track Stochastic Options View Help
Floodplain Gradient Vectors
Based on March 2003 Data
Ready
Watch Here For Keyboard Input
NUM
start
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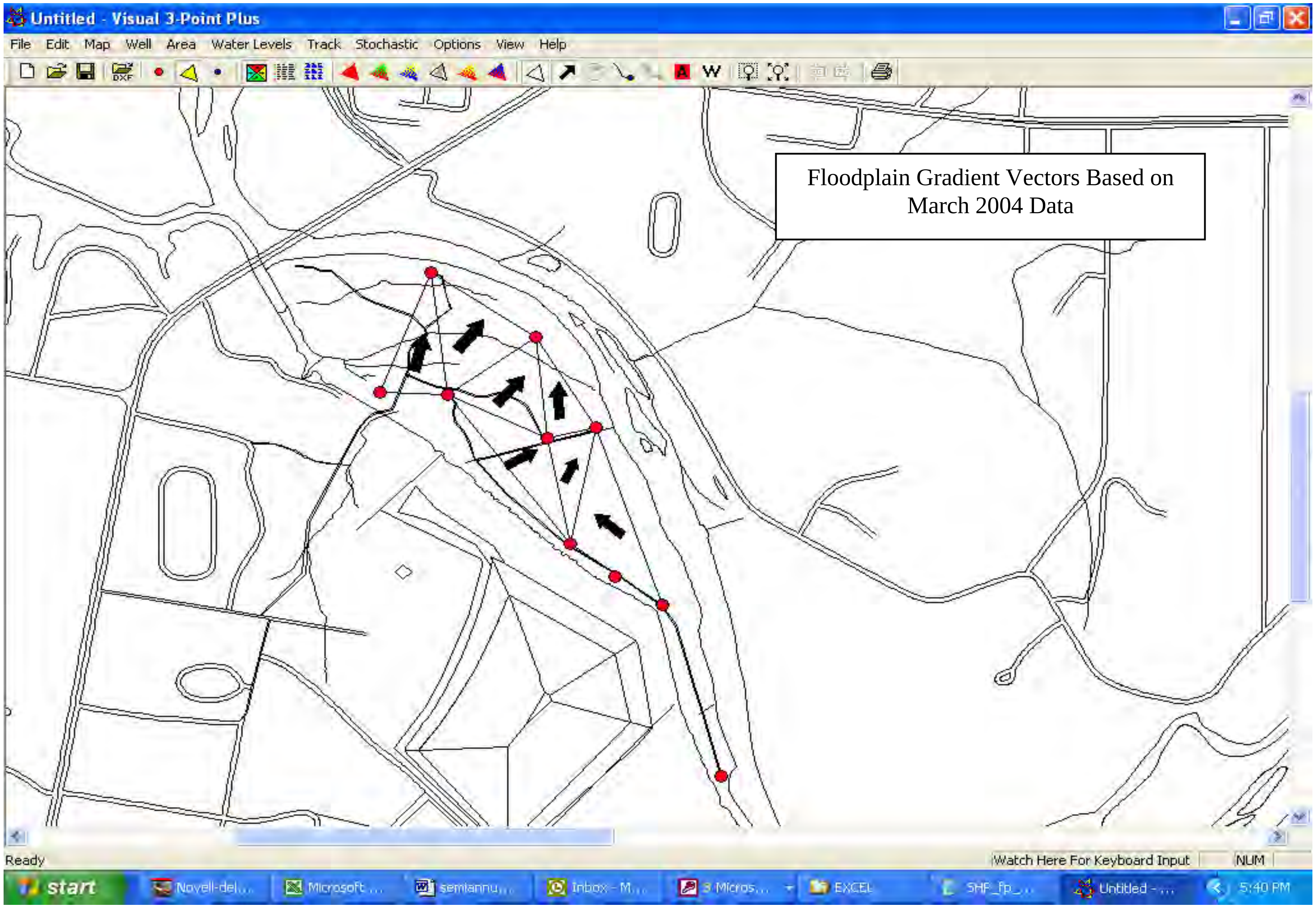
SHP_fp...
wl data
Inbox -...
Surfer ...
2 Micr...
Docum...
2 Micr...
fp_200...
12:29 PM

Figure A–1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Floodplain Gradient Vectors Based on March 2004 Data
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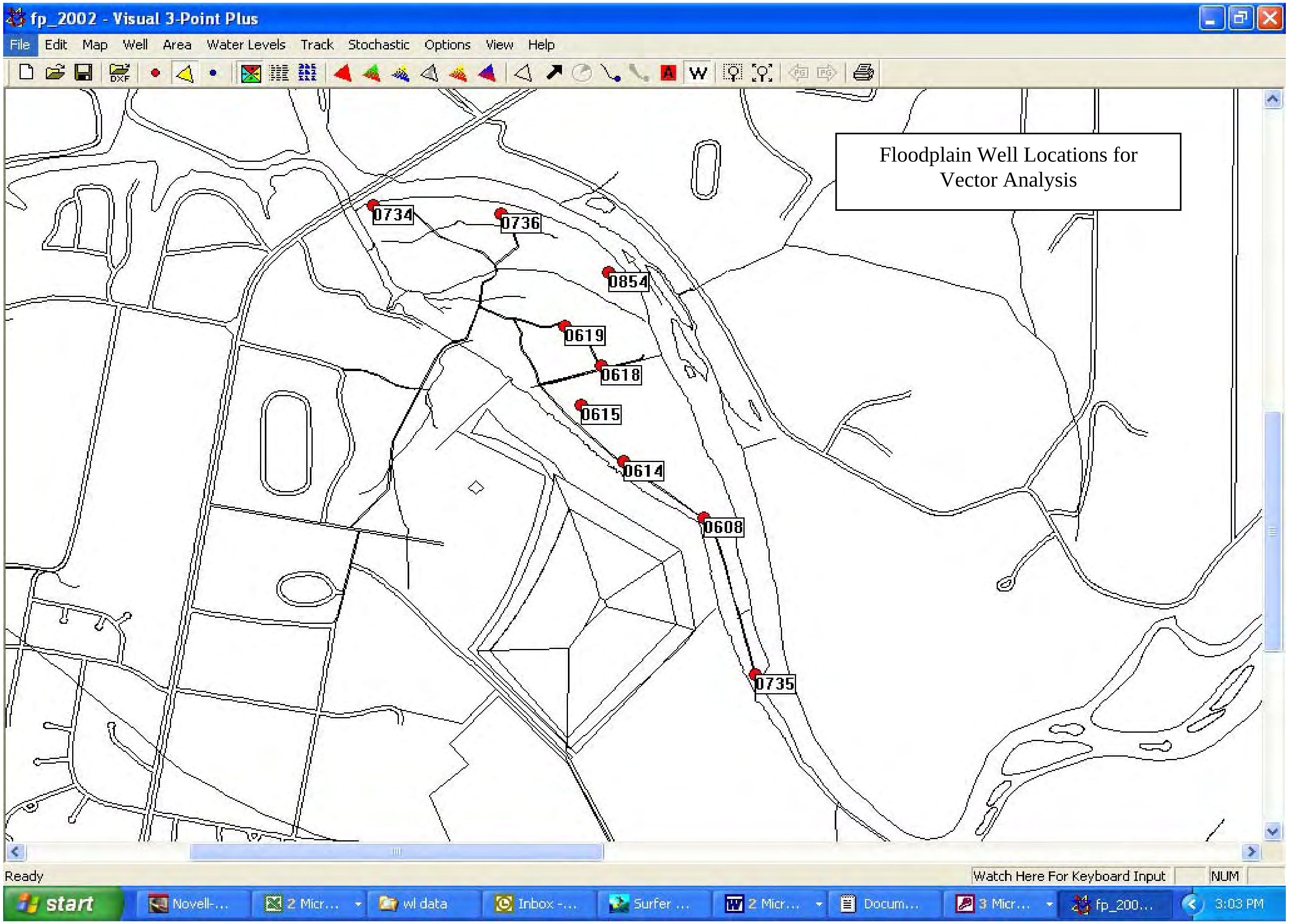
Figure A–2


fp_2002 - Visual 3-Point Plus
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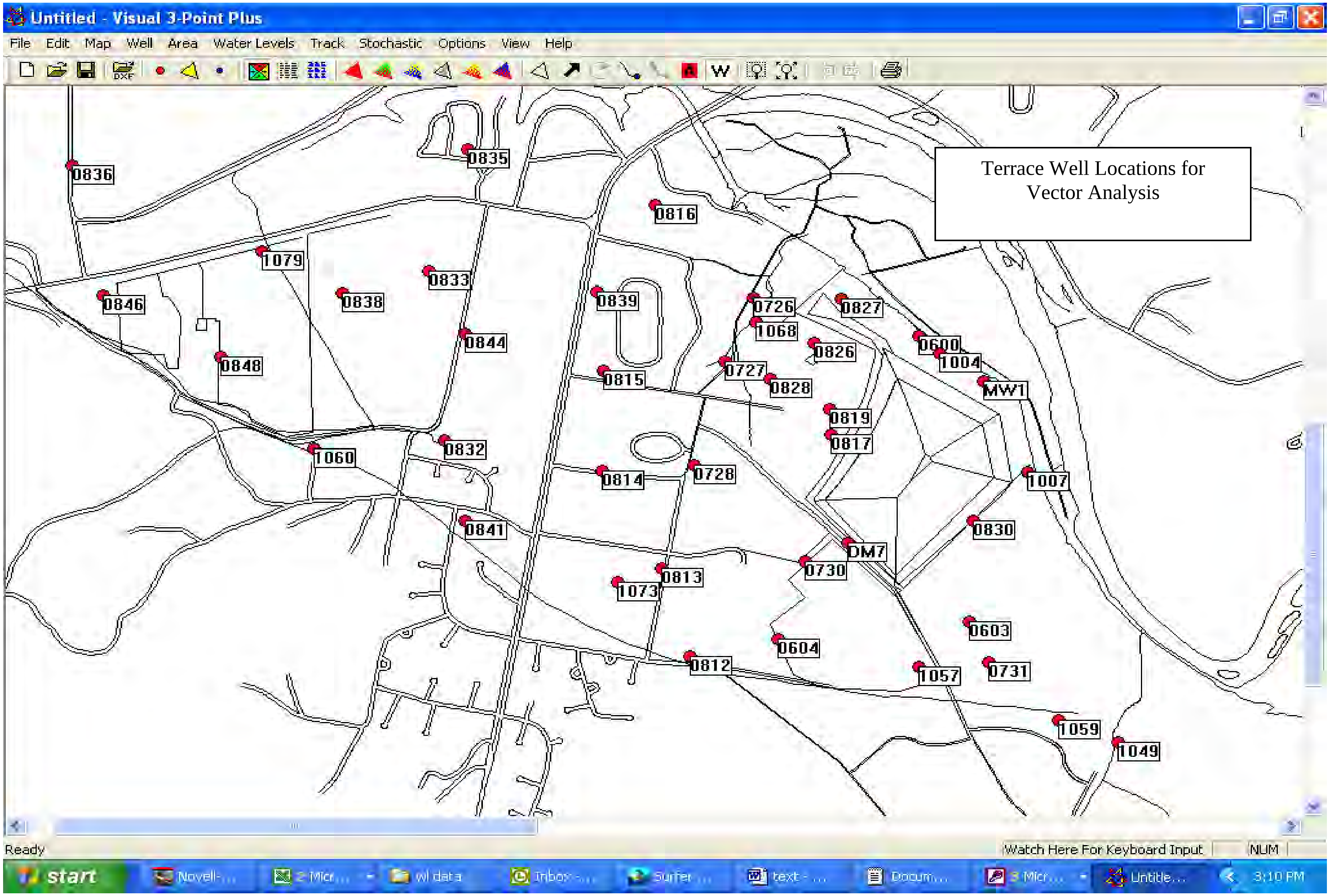
Floodplain Well Locations for
Vector Analysis
0734
0736
0854
0619
0618
0615
0614
0608
0735
Ready
Watch Here For Keyboard Input
NUM
start
Novell-...
2 Micr...
wl data
Inbox -...
Surfer ...
2 Micr...
Docum...
3 Micr...
fp_200...
3:03 PM

Figure A−3


Untitled - Visual 3-Point Plus
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Terrace Well Locations for Vector Analysis
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0838
0846
0839
0726
0827
1068
0844
0826
0600
1004
0848
0727
0815
0828
MW1
0819
0817
1060
0832
0814
0728
1007
0841
0830
DM7
0730
0813
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0603
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1059
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NUM
start
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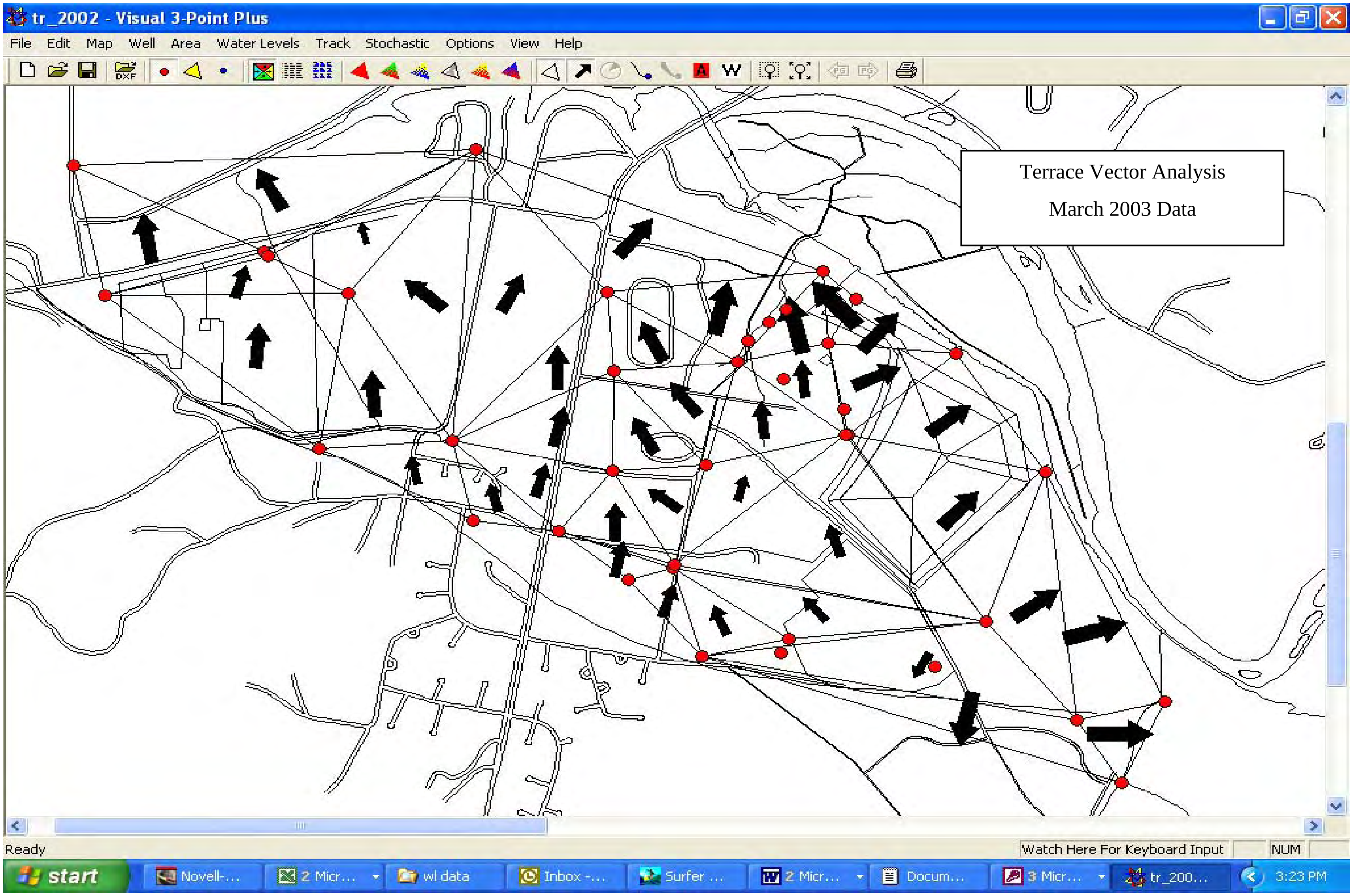
Figure A–4


tr_2002 - Visual 3-Point Plus
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Terrace Vector Analysis
March 2003 Data
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NUM
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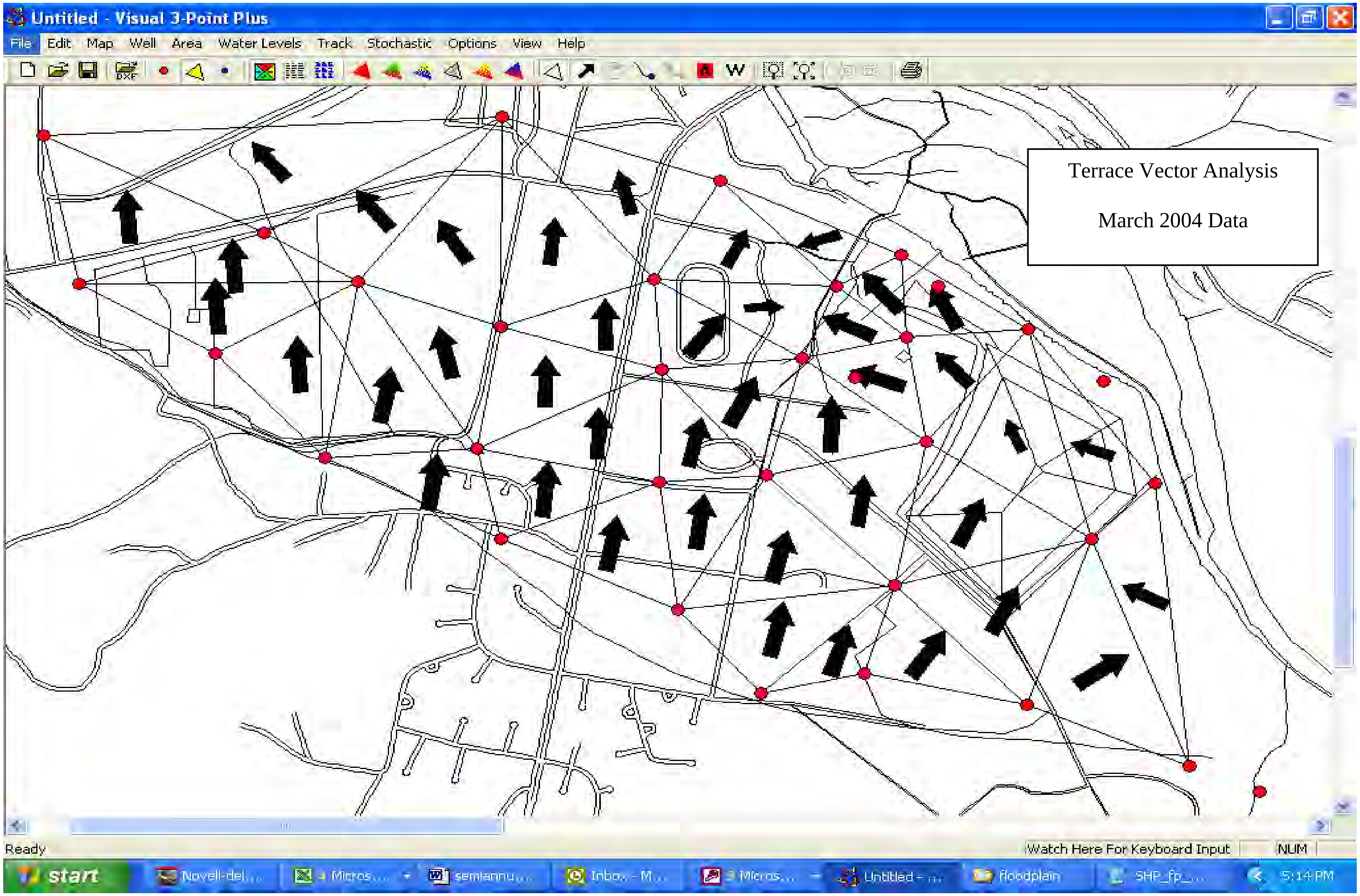
3:23 PM

Figure A–5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File Edit Map Well Area Water Levels Track Stochastic Options View Help
Terrace Vector Analysis
March 2004 Data
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Watch Here For Keyboard Input
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Figure A−6

Appendix B

Shiprock Data Logger Ground Water Elevation Data

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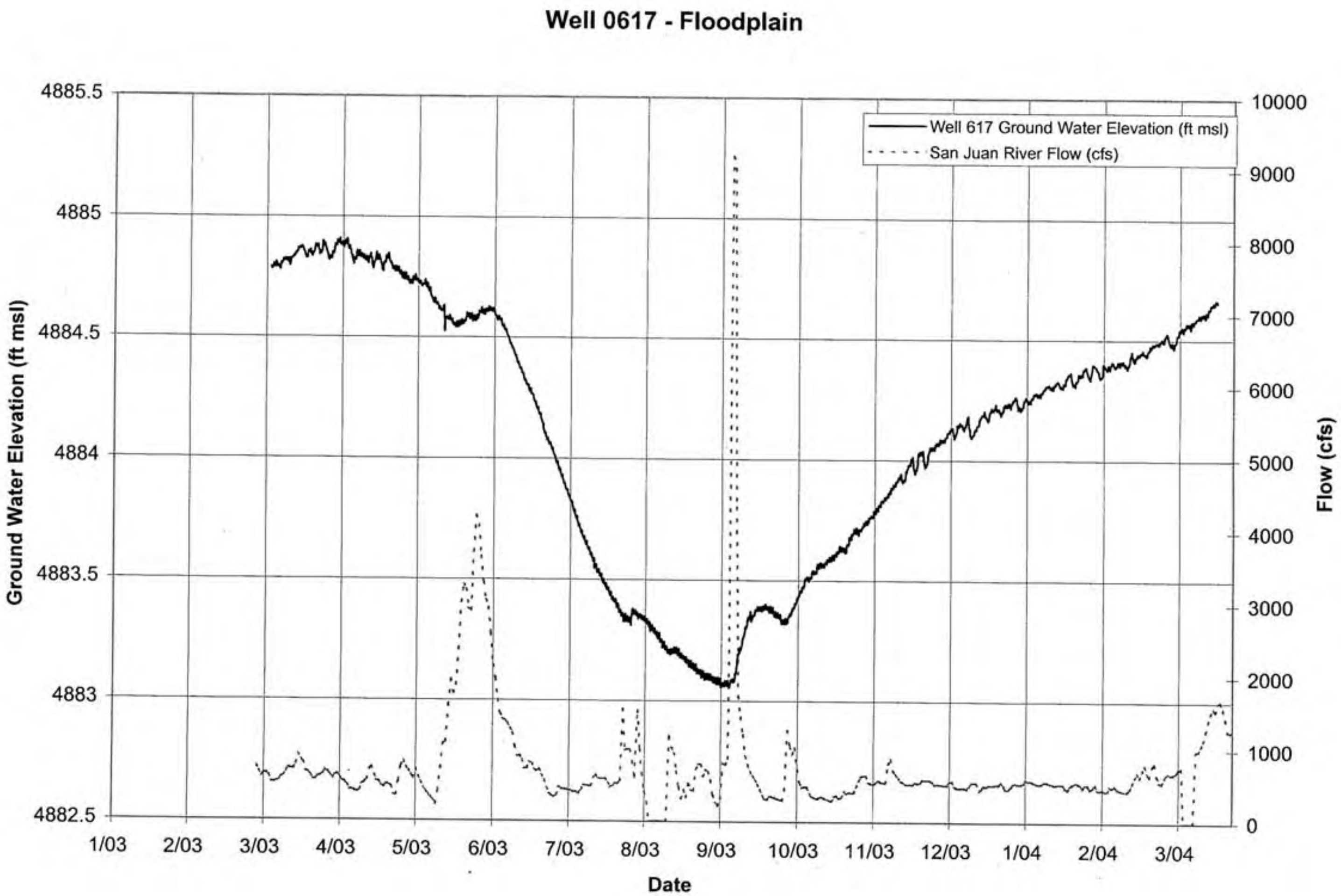
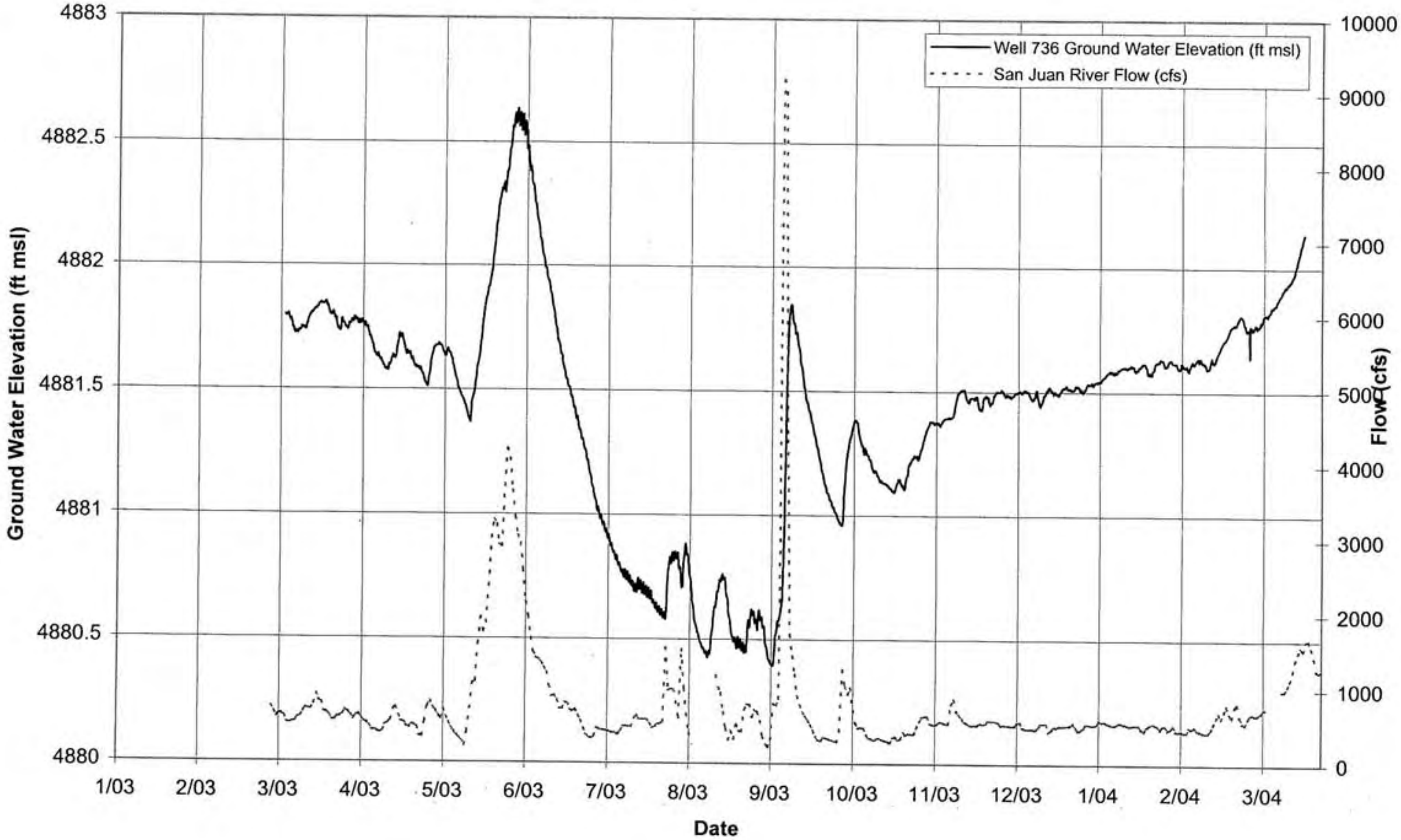
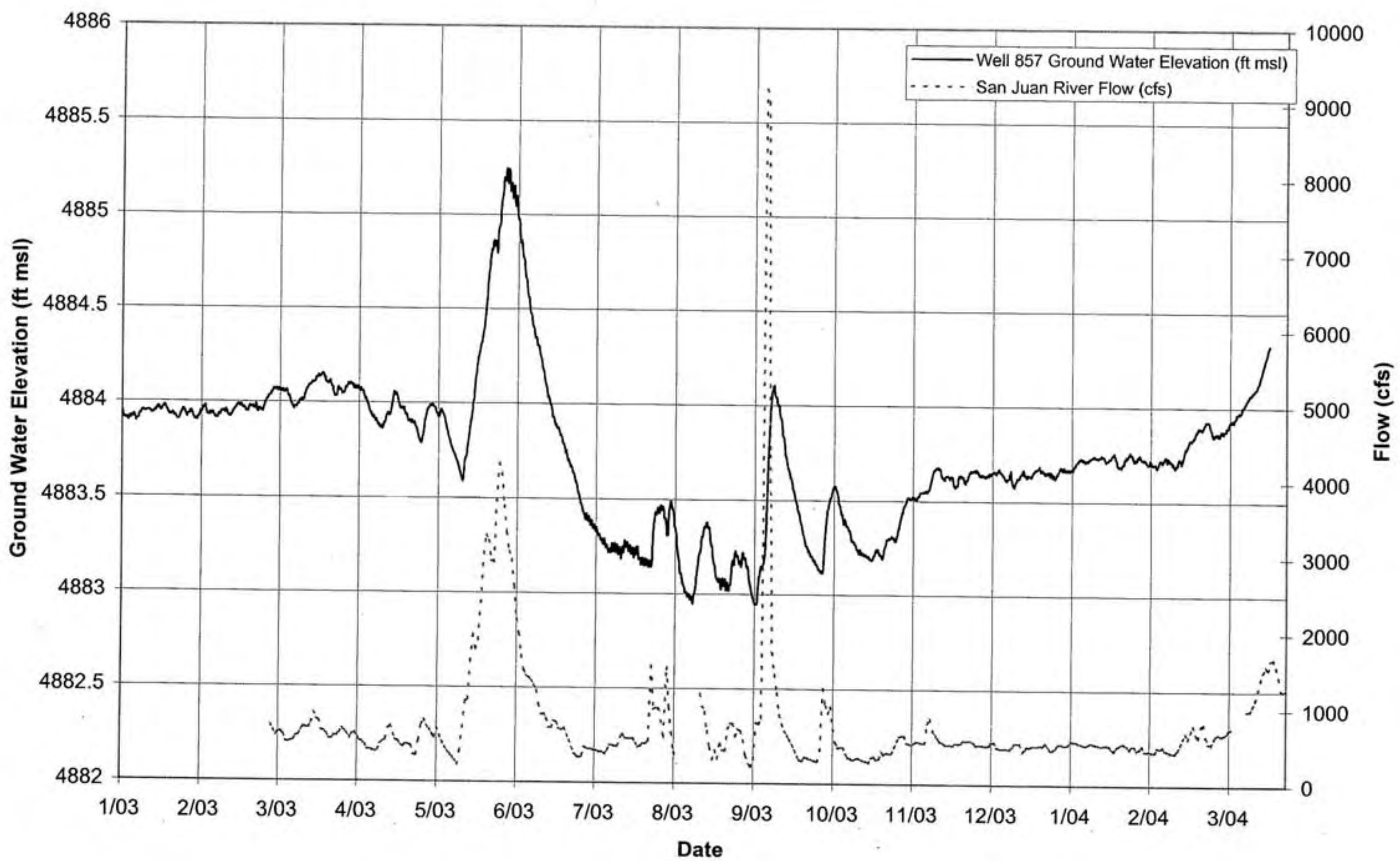
Floodplain Ground Water Elevation Data
(January 2003 through March 2004)

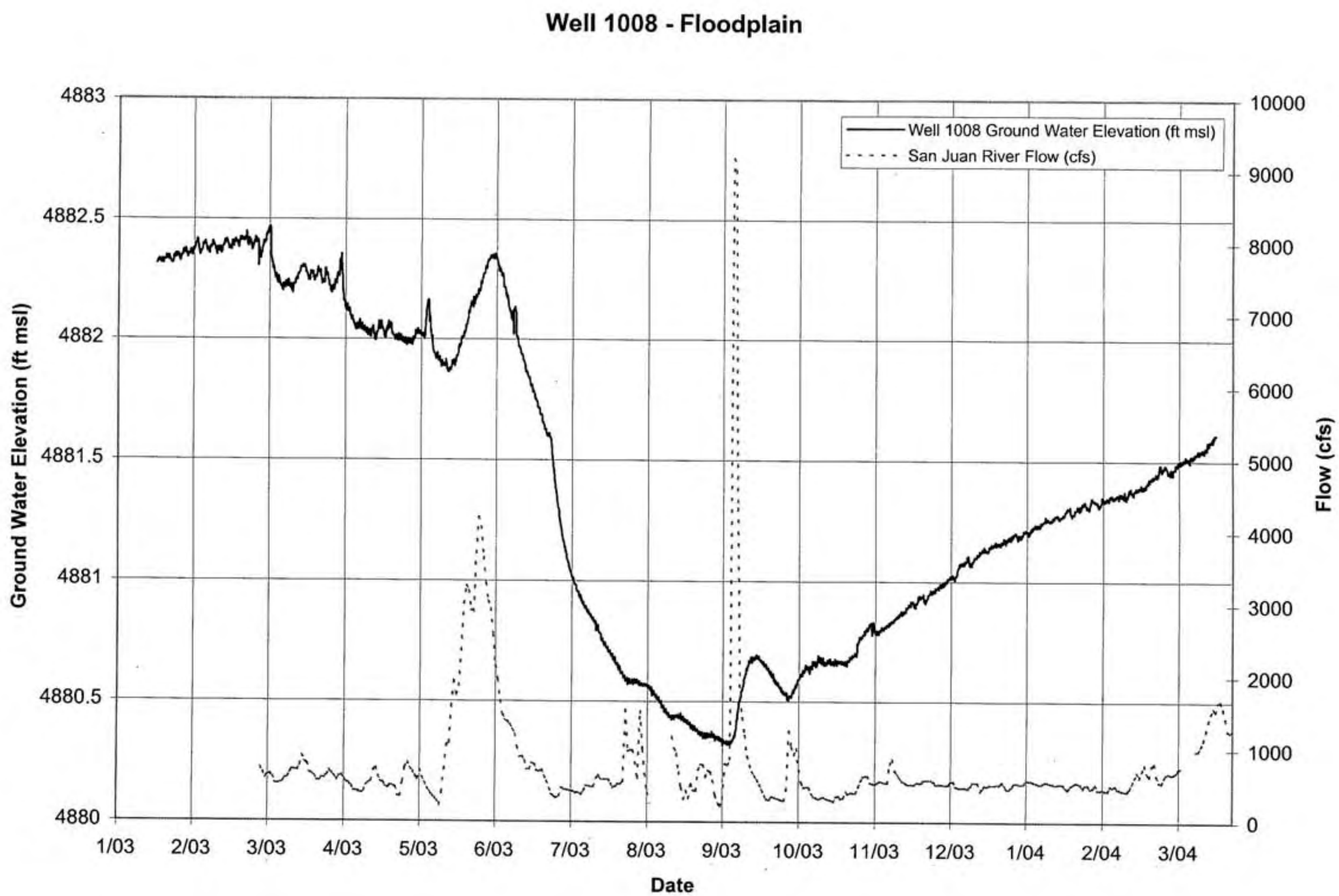

Well 0617 - Floodplain
Well 617 Ground Water Elevation (ft msl)
San Juan River Flow (cfs)
Ground Water Elevation (ft msl)
4885.5
4885
4884.5
4884
4883.5
4883
4882.5
Flow (cfs)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1/03
2/03
3/03
4/03
5/03
6/03
7/03
8/03
9/03
10/03
11/03
12/03
1/04
2/04
3/04
Date

Well 0736 - Floodplain



Well 0857 - Floodplain




Well 1008 - Floodplain
Well 1008 Ground Water Elevation (ft msl)
San Juan River Flow (cfs)
Ground Water Elevation (ft msl)
Flow (cfs)
Date
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4882.5
4882
4881.5
4881
4880.5
4880
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1/03
2/03
3/03
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5/03
6/03
7/03
8/03
9/03
10/03
11/03
12/03
1/04
2/04
3/04

Terrace East Ground Water Elevation Data
(January 2003 through March 2004)

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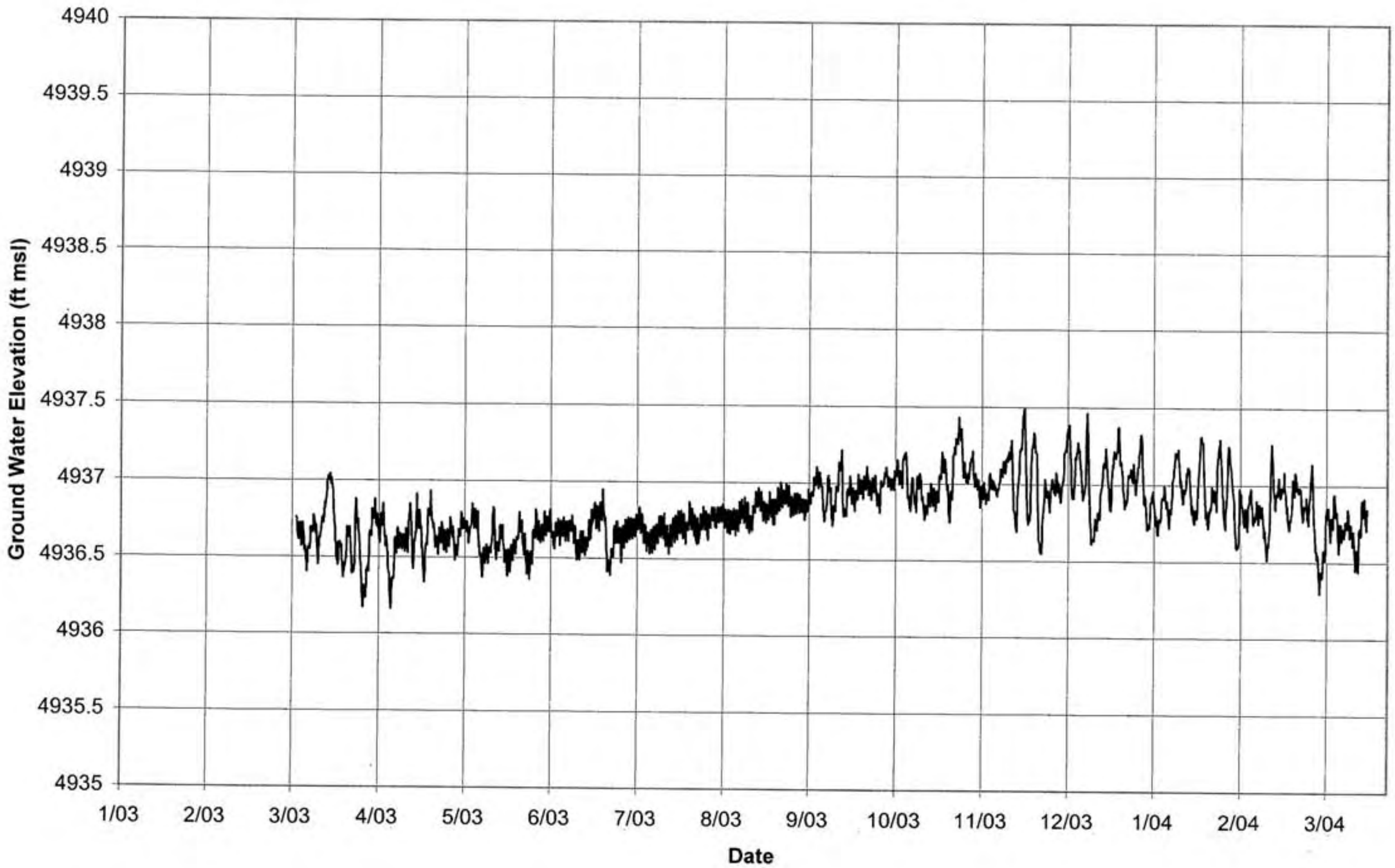
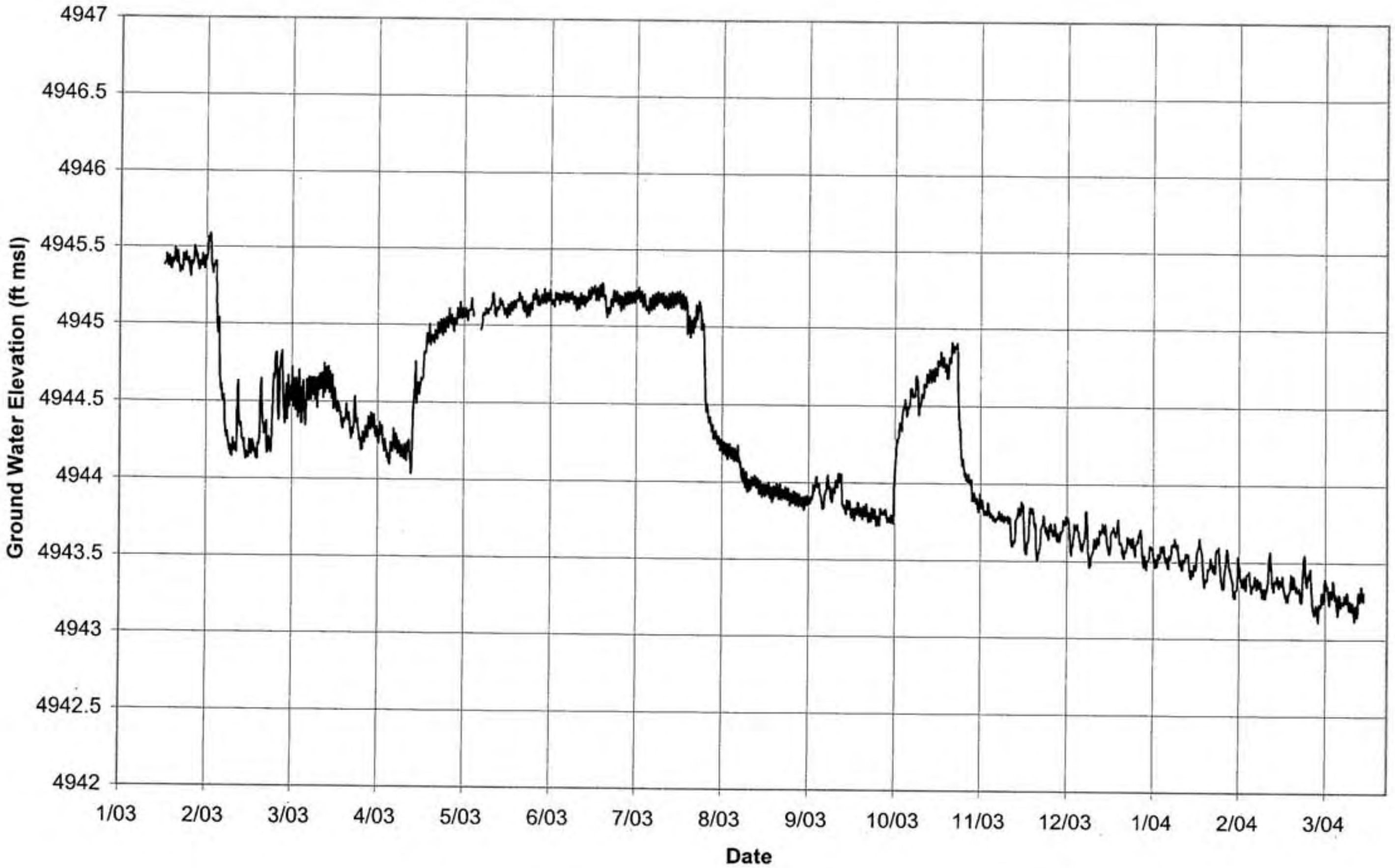
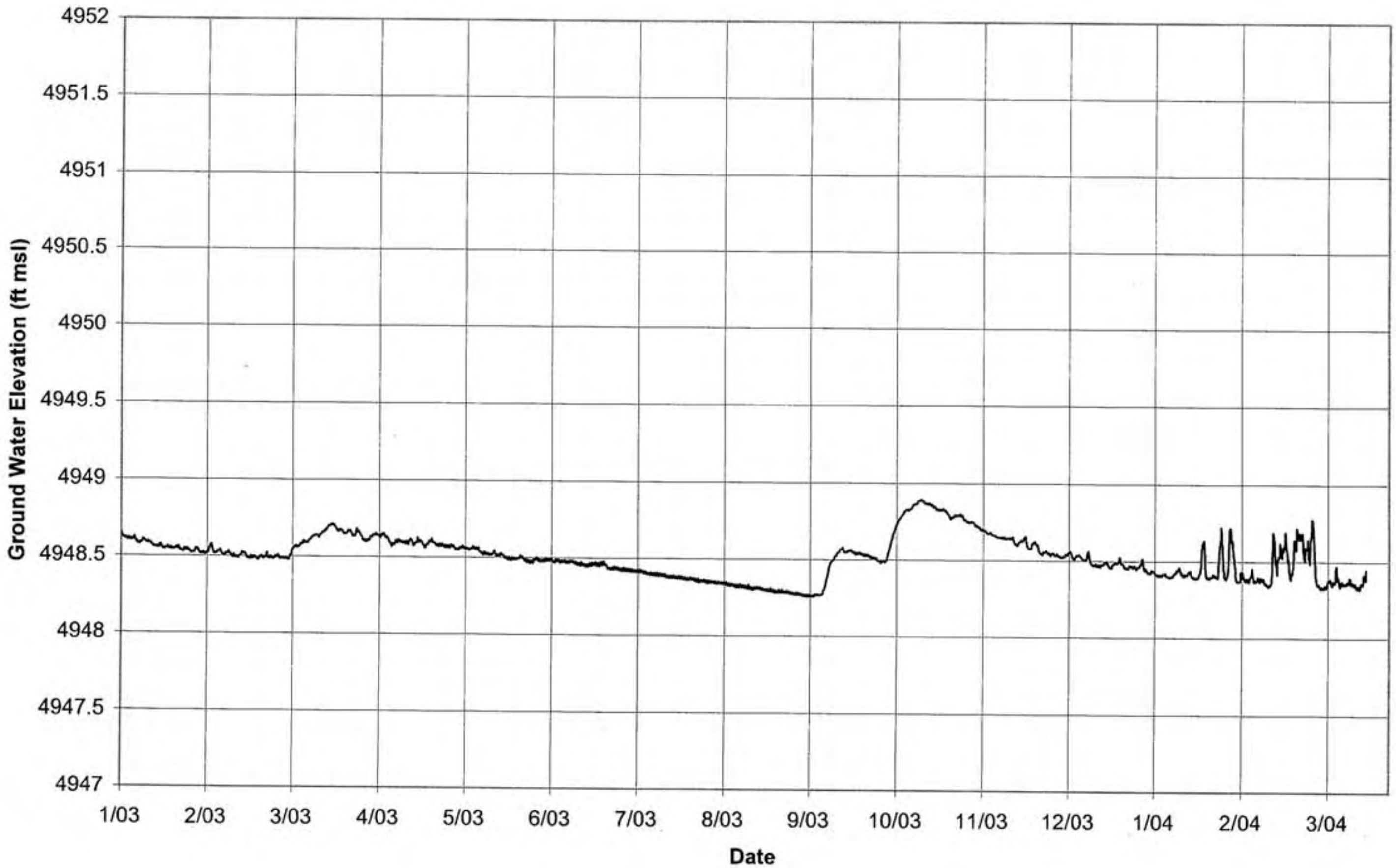
Well 0602 - Terrace East (NECA Yard, NW of Disposal Cell)

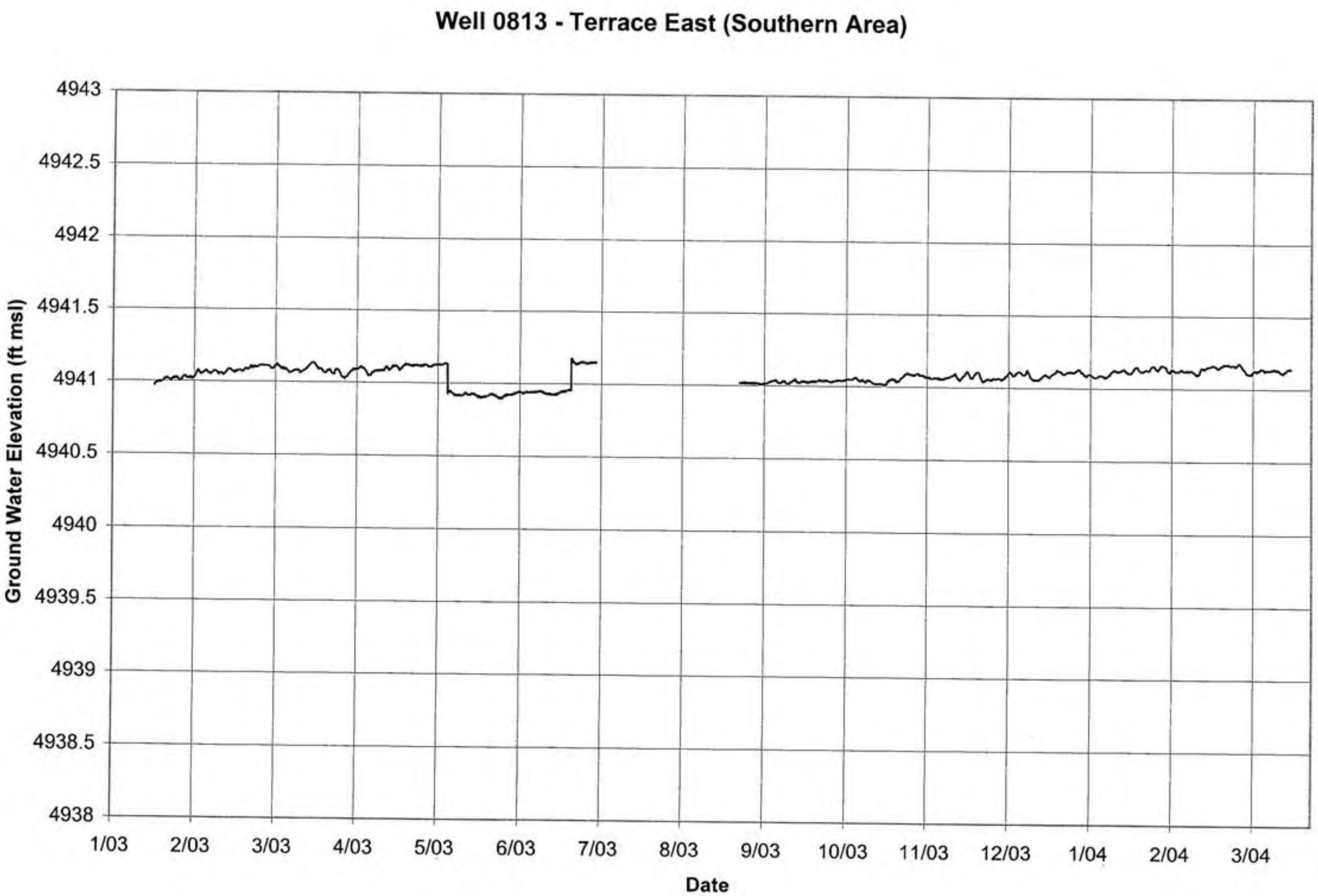


Well 0604 - Terrace East (Off Extraction Well 0818)



Well 0731 - Terrace East (East of the Evaporation Pond)




Well 0813 - Terrace East (Southern Area)
Ground Water Elevation (ft msl)
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4939
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4938
1/03
2/03
3/03
4/03
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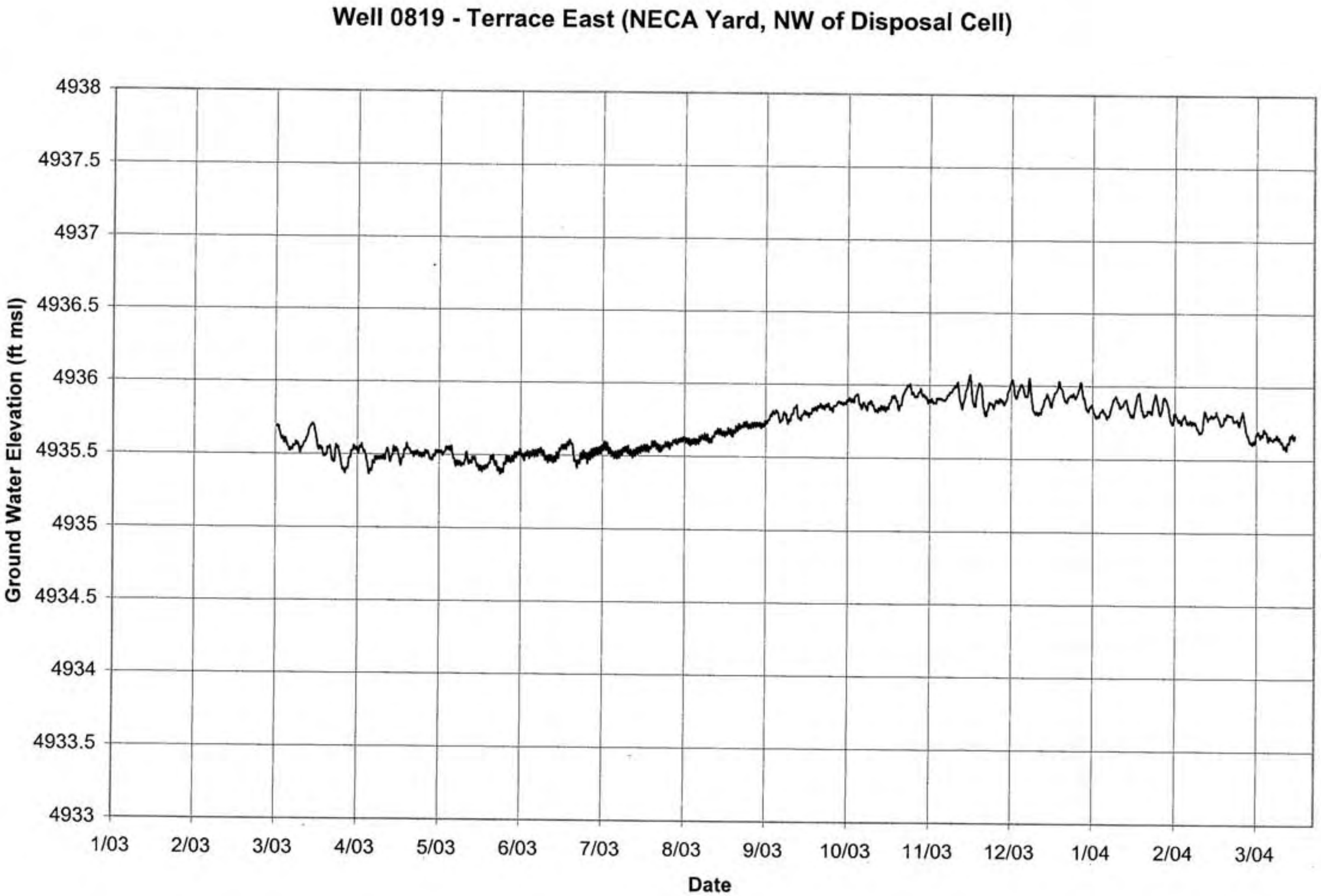
2/04
3/04
Date


Well 0819 - Terrace East (NECA Yard, NW of Disposal Cell)
Ground Water Elevation (ft msl)
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4933
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2/03
3/03
4/03
5/03
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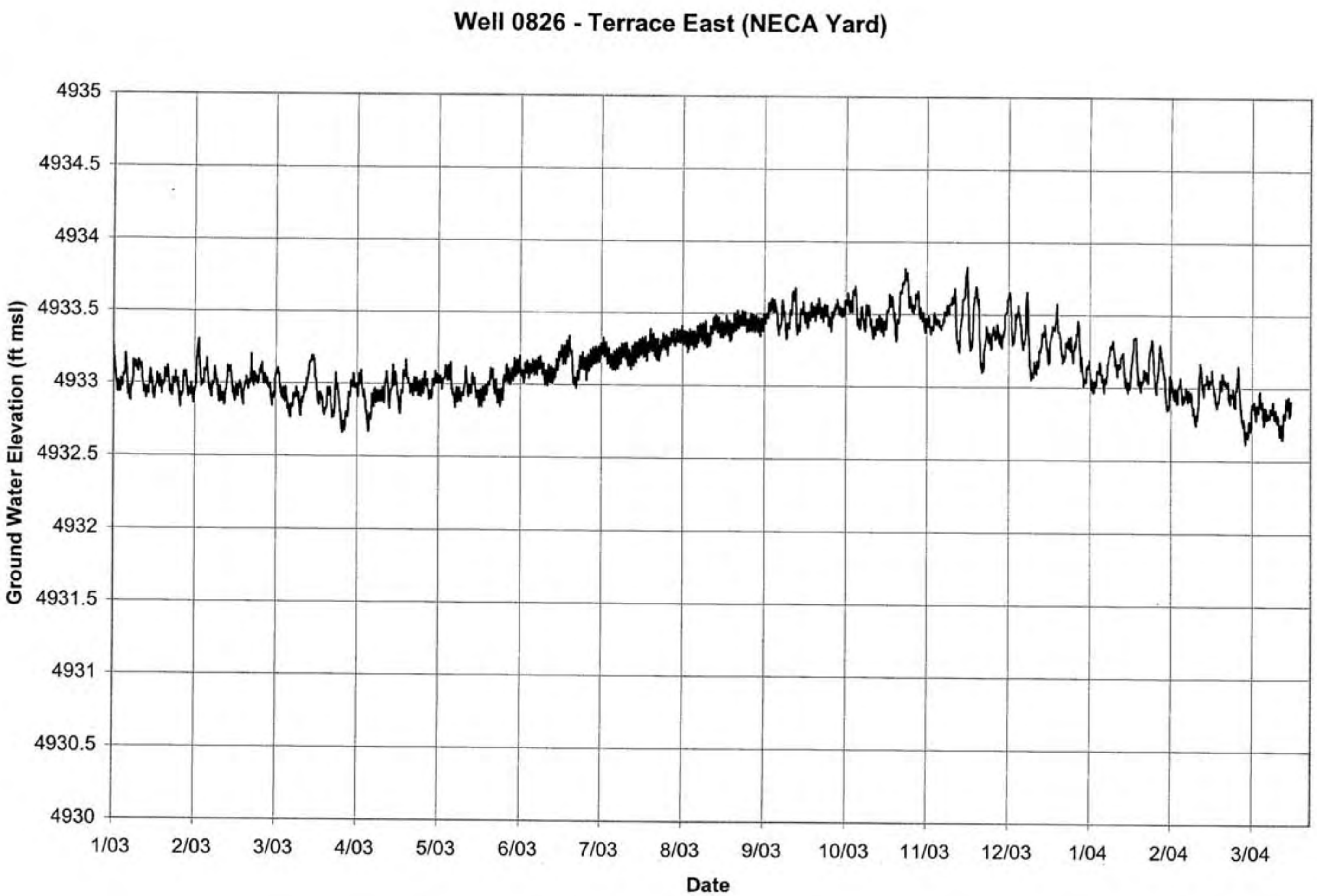
10/03
11/03
12/03
1/04
2/04
3/04
Date


Well 0826 - Terrace East (NECA Yard)
Ground Water Elevation (ft msl)
4935
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4934
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3/03
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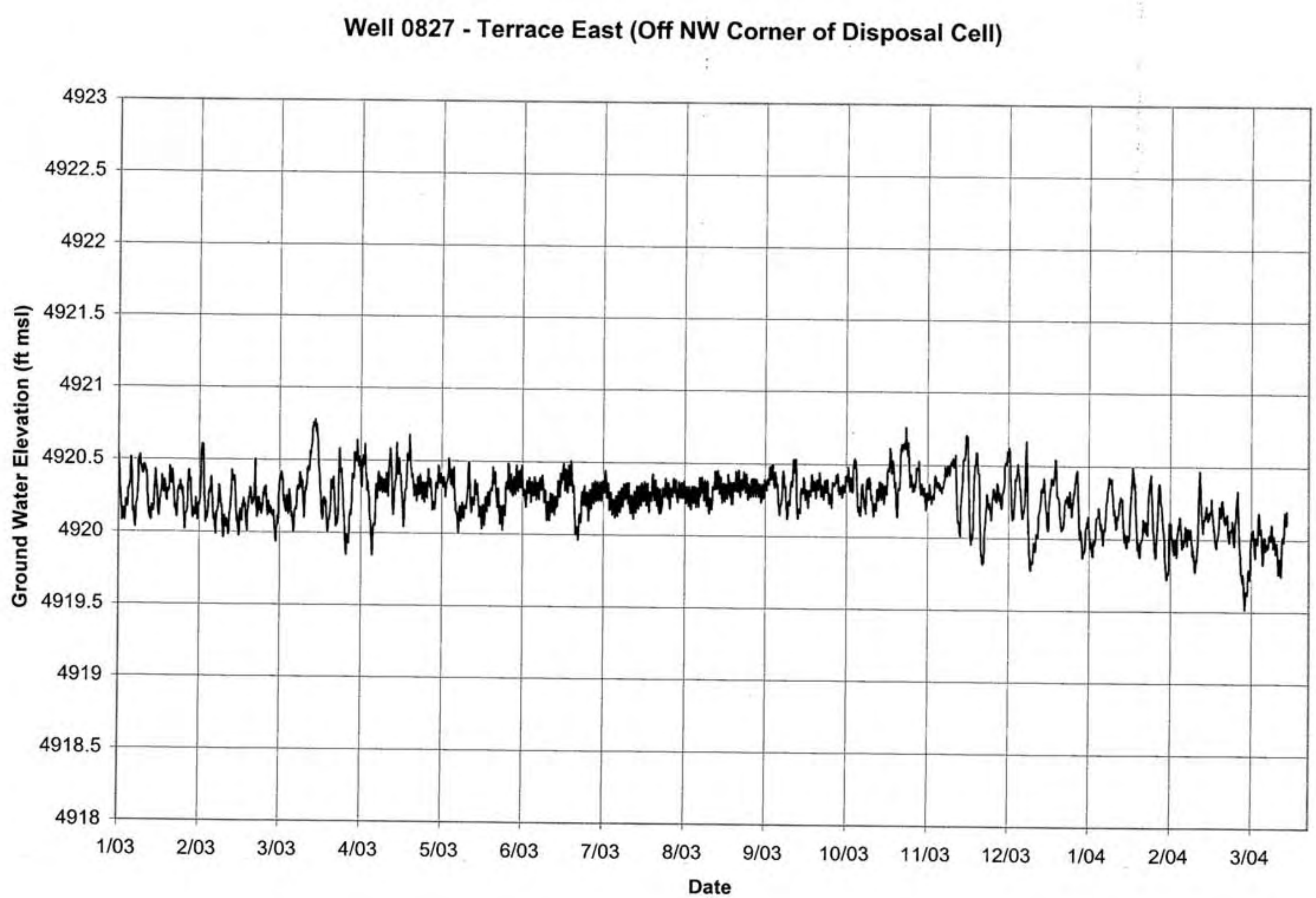
2/04
3/04
Date


Well 0827 - Terrace East (Off NW Corner of Disposal Cell)
Ground Water Elevation (ft msl)
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4921.5
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4918
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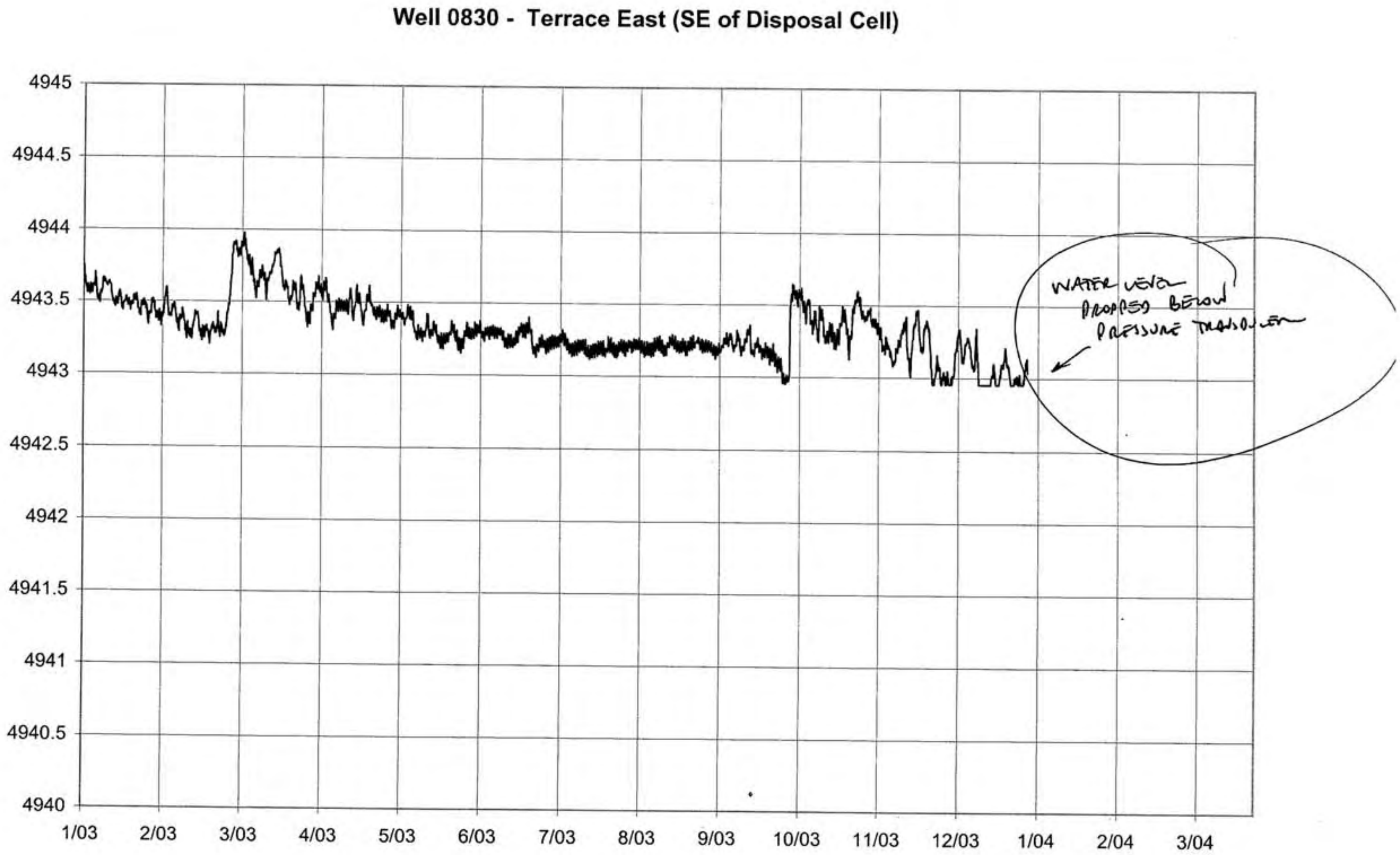
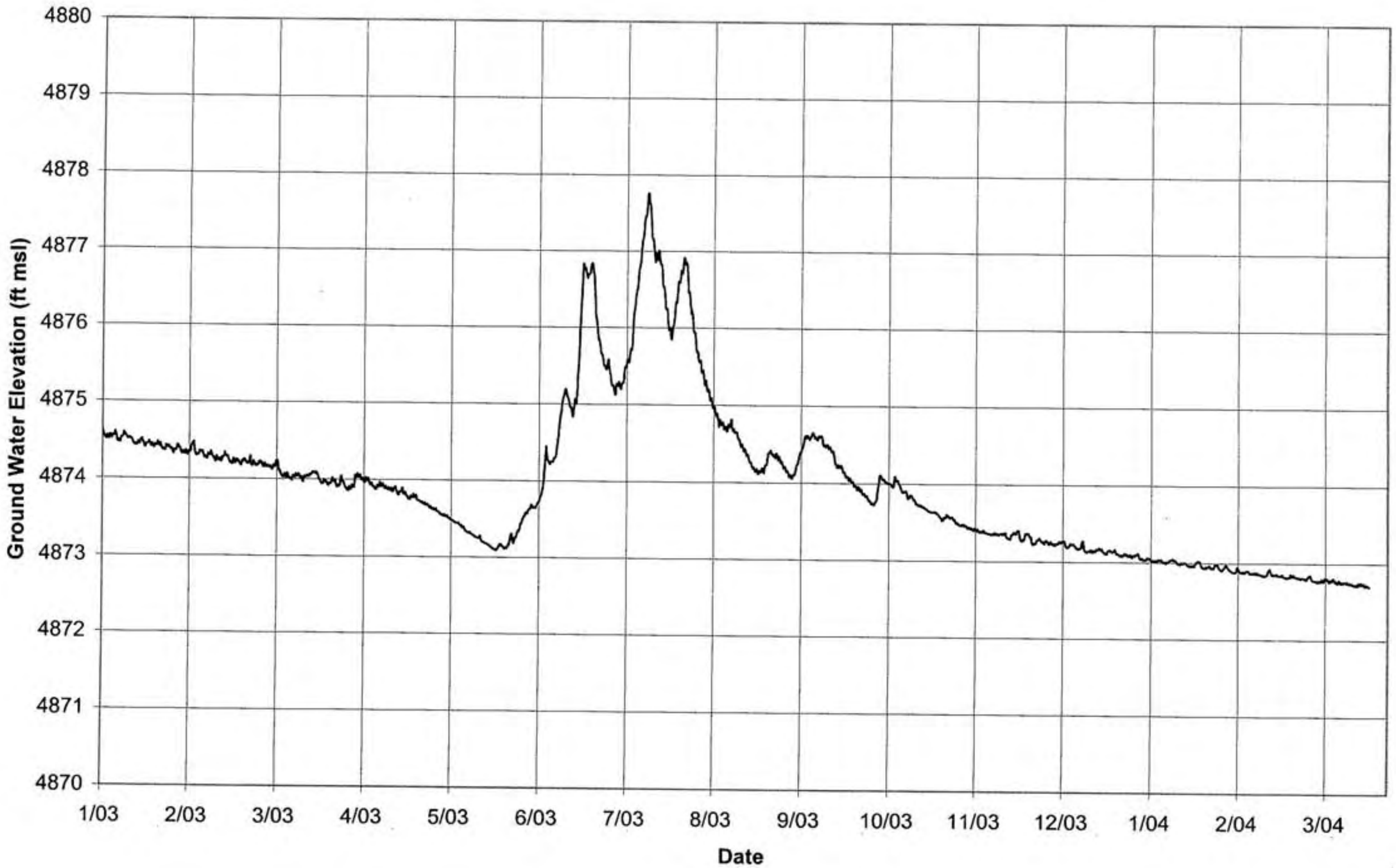
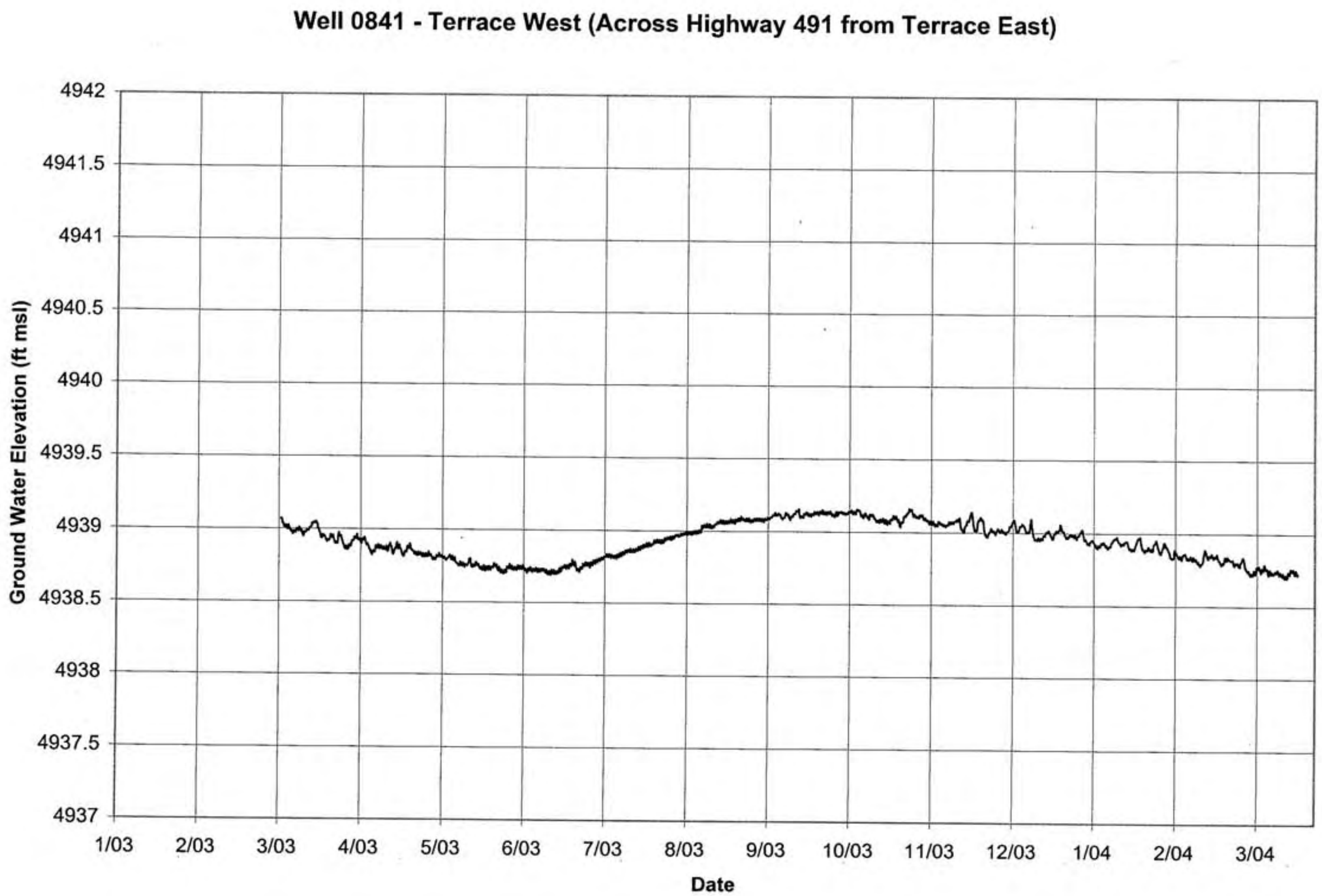
2/03
3/03
4/03
5/03
6/03
7/03
8/03
9/03
10/03
11/03
12/03
1/04
2/04
3/04
Date

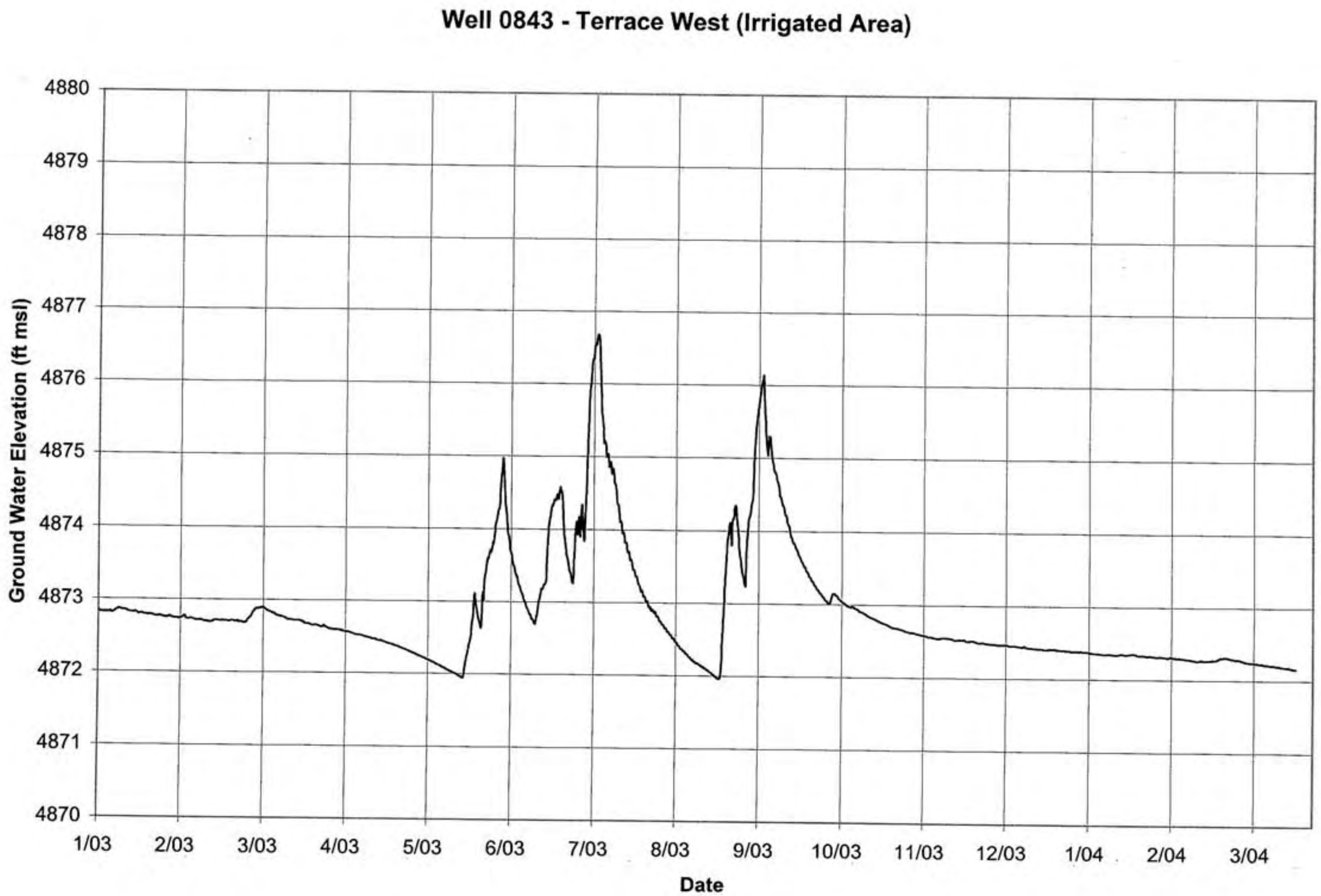

Well 0830 - Terrace East (SE of Disposal Cell)
4945
4944.5
4944
4943.5
4943
4942.5
4942
4941.5
4941
4940.5
4940
1/03
2/03
3/03
4/03
5/03
6/03
7/03
8/03
9/03
10/03
11/03
12/03
1/04
2/04
3/04
WATER LEVEL DROPPED BELOW PRESSURE TRANSDUCER

Terrace West Ground Water Elevation Data
(January 2003 through March 2004)

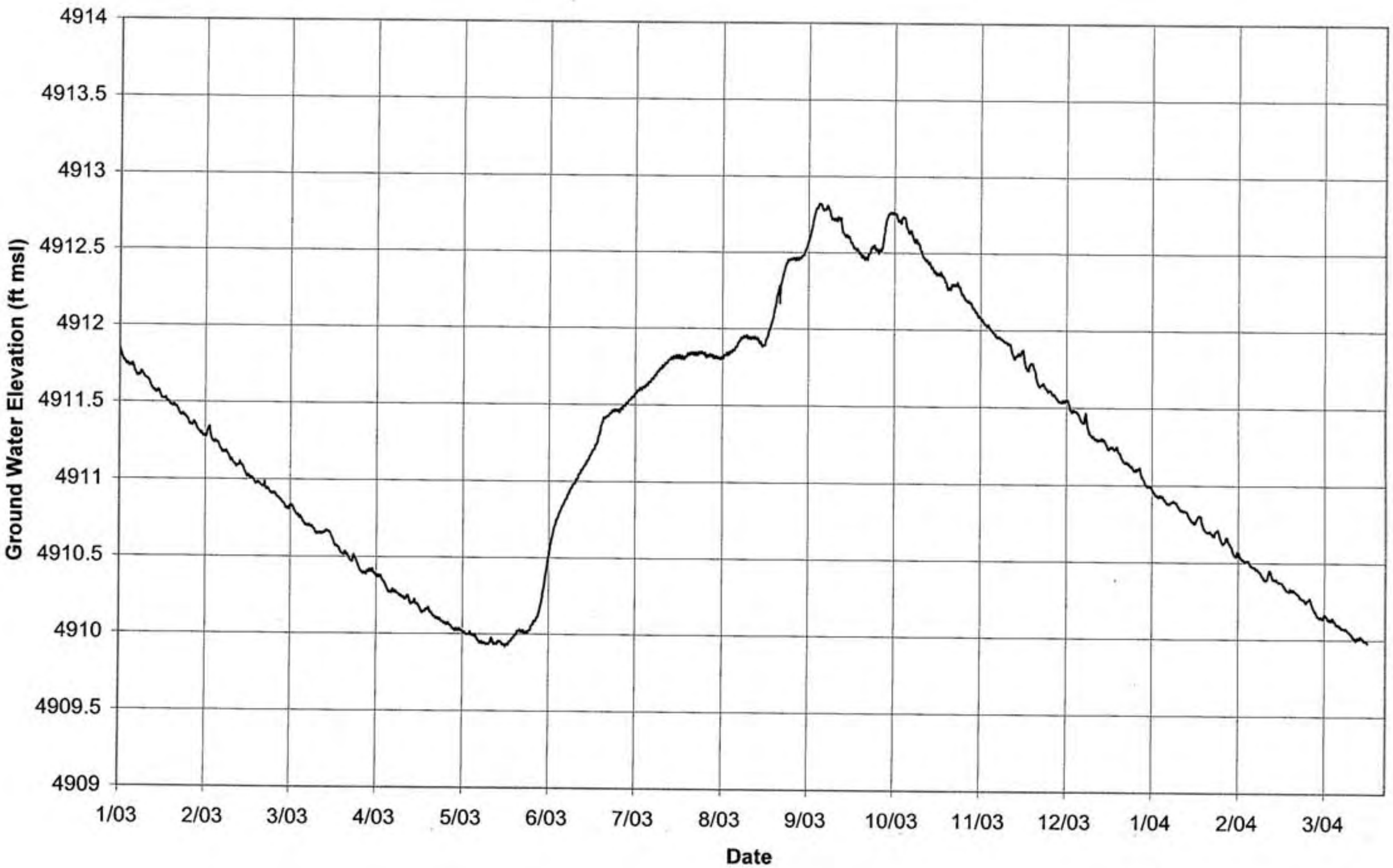
Well 0837 - Terrace West (Irrigated Area)

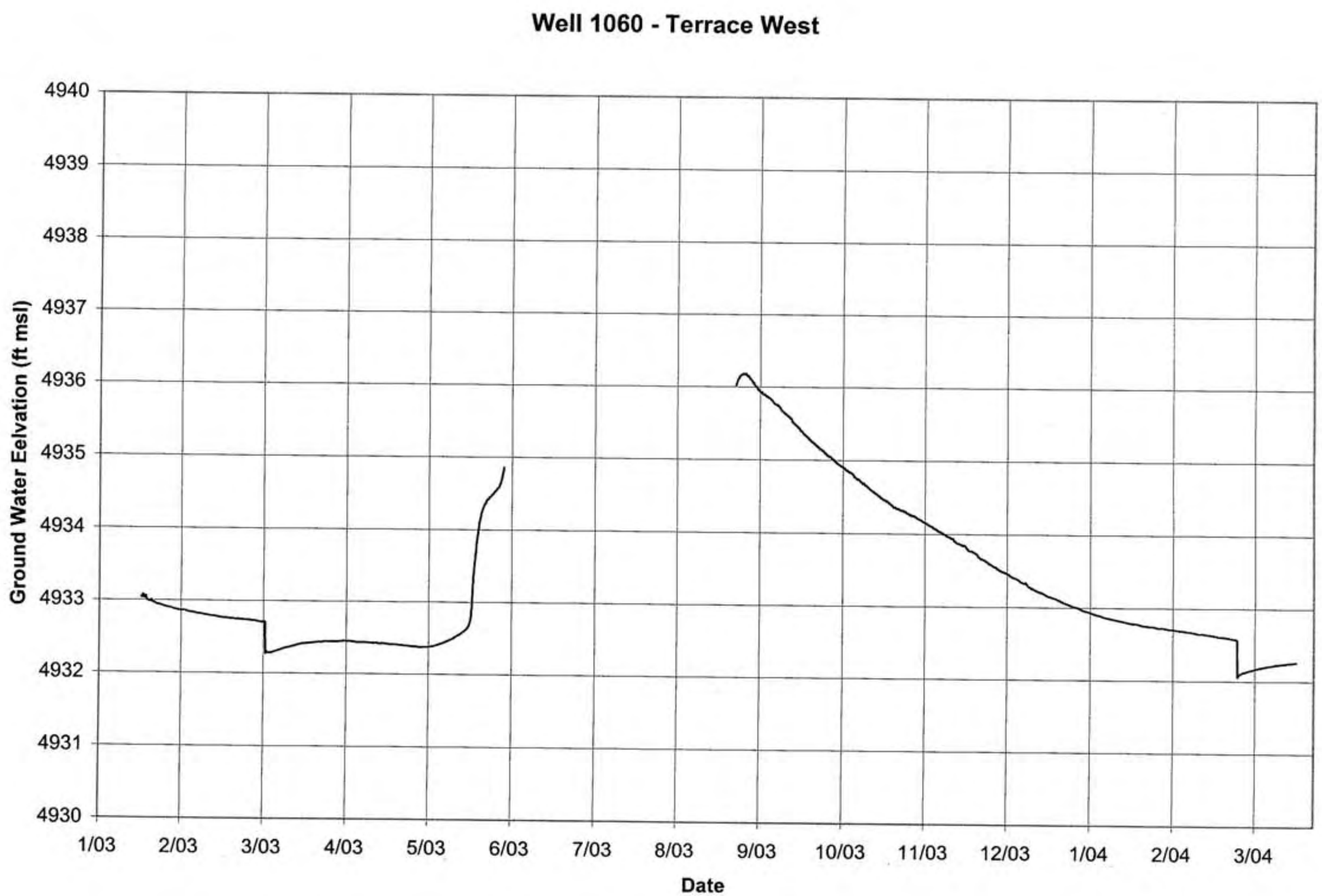



Well 0841 - Terrace West (Across Highway 491 from Terrace East)
Ground Water Elevation (ft msl)
4942
4941.5
4941
4940.5
4940
4939.5
4939
4938.5
4938
4937.5
4937
1/03
2/03
3/03
4/03
5/03
6/03
7/03
8/03
9/03
10/03
11/03
12/03
1/04
2/04
3/04
Date


Well 0843 - Terrace West (Irrigated Area)
Ground Water Elevation (ft msl)
4880
4879
4878
4877
4876
4875
4874
4873
4872
4871
4870
1/03
2/03
3/03
4/03
5/03
6/03
7/03
8/03
9/03
10/03
11/03
12/03
1/04
2/04
3/04
Date

Well 0846 - Terrace West (Just South of Hwy 64)




Well 1060 - Terrace West
Ground Water Eelvation (ft msl)
4940
4939
4938
4937
4936
4935
4934
4933
4932
4931
4930
1/03
2/03
3/03
4/03
5/03
6/03
7/03
8/03
9/03
10/03
11/03
12/03
1/04
2/04
3/04
Date

End of current text

Appendix C

Floodplain and Terrace Ground Water Extraction Well Data (September 2003 through March 2004)

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Shiprock Terrace Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
818	8/29/2003 11:30	246,058	115,822	361,880				
	9/5/2003 9:18	262,785	115,822	378,607	16727	9948	1.68	
	9/8/2003 12:18	269,811	115,822	385,633	7026	4500	1.56	
	9/11/2003 14:09	276,390	115,822	392,212	6579	4431	1.48	
	9/12/2003 9:28	277,926	115,822	393,748	1536	1159	1.33	
	9/15/2003 10:27	284,033	115,822	399,855	6107	4379	1.39	
	9/19/2003 9:25	292,543	115,822	408,365	8510	5698	1.49	
	9/22/2003 10:12	300,061	115,822	415,883	7518	4367	1.72	
	9/26/2003 10:50	309,760	115,822	425,582	9699	5798	1.67	
	9/29/2003 9:12	316,595	115,822	432,417	6835	4222	1.62	diff = 161139
	10/2/2003 9:17	323,641	115,822	439,463	7046	4325	1.63	
	10/6/2003 10:19		115,822					no reading due to sibsidence
	10/9/2003 9:40	333,346	115,822	449,168				
	10/10/2003 10:00			449,168				
	10/13/2003 10:00		115,822					no reading due to sibsidence
	10/15/2003 11:13	333,860	115,822	449,682				
	10/17/2003 0:00	333,860	115,822	449,682	0	2207	0.00	
	10/20/2003 13:50		115,822					no reading due to sibsidence
	10/22/2003 11:30	334,460	115,822	450,282			0.00	
	10/24/2003 11:26		115,822					no reading due to sibsidence
	10/27/2003 0:00	334,460	115,822	450,282			0.00	
	10/29/2003 12:40	334,563	115,822	450,385	103	3640	0.03	
	10/31/2003 11:22	340,459	115,822	456,281	5896	2802	2.10	
	11/3/2003 11:00	348,344	115,822	464,166	7885	4298	1.83	
	11/5/2003 8:24	353,133	115,822	468,955	4789	2724	1.76	changed flow meter batteries
	11/7/2003 19:26	5,798	468,955	474,753	5798	3542	1.64	
	11/10/2003 9:52	11,991	468,955	480,946	6193	3746	1.65	
	11/14/2003 11:15	21,115	468,955	490,070	9124	5843	1.56	
	11/17/2003 12:11	28,278	468,955	497,233	7163	4376	1.64	
	11/21/2003 9:10	36,723	468,955	505,678	8445	5579	1.51	
	11/24/2003 11:10	43,419	468,955	512,374	6696	4440	1.51	
	12/1/2003 10:50	58,319	468,955	527,274	14900	10060	1.48	
	12/3/2003 13:27	62,817	468,955	531,772	4498	3037	1.48	
	12/5/2003 18:10	67,455	468,955	536,410	4638	3163	1.47	
	12/8/2003 10:20	73,000	468,955	541,955	5545	3850	1.44	
	12/10/2003 12:05	77,423	468,955	546,378	4423	2985	1.48	
	12/12/2003 10:51	81,467	468,955	550,422	4044	2806	1.44	
	12/15/2003 11:30	87,709	468,955	556,664	6242	4359	1.43	diff = 67456
	12/19/2003 9:44	95,907	468,955	564,862	8198	5654	1.45	
	12/22/2003 14:15	102,534	468,955	571,489	6627	4591	1.44	
	12/29/2003 11:40	116,919	468,955	585,874	14385	9925	1.45	
	1/5/2004 12:26	131,394	468,955	600,349	14475	10126	1.43	
	1/9/2004 12:19	139,704	468,955	608,659	8310	5753	1.44	
	1/12/2004 13:45	145,893	468,955	614,848	6189	4406	1.40	
	1/15/2004 13:20	152,058	468,955	621,013	6165	4295	1.44	
	1/16/2004 13:18	154,125	468,955	623,080	2067	1438	1.44	inaccurate reading
	1/23/2004 11:45	168,500	468,955	637,455	14375	9987	1.44	used historical data
	1/26/2004 11:30	174,038	468,955	642,993	5538	4305	1.29	
	1/30/2004 9:09	181,909	468,955	650,864	7871	5619	1.40	diff = 67456
	2/2/2004 11:22	188,043	468,955	656,998	6134	4453	1.38	
	2/6/2004 12:33	196,209	468,955	665,164	8166	5831	1.40	
	2/9/2004 11:48	202,205	468,955	671,160	5996	4275	1.40	diff = 67456
	2/13/2004 13:18	210,225	468,955	679,180	8020	5850	1.37	
	2/20/2004 11:40	223,663	468,955	692,618	13438	9982	1.35	
	2/23/2004 12:21	231,162	468,955	700,117	7499	4361	1.72	
	2/27/2004 10:00	237,958	468,955	706,913	6796	5619	1.21	diff = 67456
	3/1/2004 9:19	239,004	468,955	707,959	1046	4279	0.24	reported number low
	3/5/2004 12:30	251,367	468,955	720,322	12363	5951	2.08	
	3/8/2004 12:44	257,359	468,955	726,314	5992	4334	1.38	
	3/12/2004 10:44	265,511	468,955	734,466	8152	5640	1.45	
	3/15/2004 10:48	271,492	468,955	740,447	5981	4324	1.38	
	3/19/2004 11:39	280,150	468,955	749,105	8658	5811	1.49	no reading - flow meter down?
	3/24/2004 10:33	289,475	468,955	758,430	9325	7134	1.31	
	3/30/2004 17:33	301,742	468,955	770,697	12267	9060	1.35	diff = 67456
	avg						1.38	

Shiprock Terrace Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
1070	8/29/2003 11:40	155,632		155,632				
	9/5/2003 9:30	160,114		160,114	4,482	9950	0.45	
	9/8/2003 12:21	162,105		162,105	1,991	4491	0.44	
	9/11/2003 14:07	164,075		164,075	1,970	4426	0.45	
	9/12/2003 9:33	164,590		164,590	515	1166	0.44	
	9/15/2003 10:31	166,456		166,456	1,866	4378	0.43	
	9/19/2003 9:31	168,907		168,907	2,451	5700	0.43	
	9/22/2003 10:17	170,807		170,807	1,900	4366	0.44	
	9/26/2003 10:59	173,315		173,315	2,508	5802	0.43	
	9/29/2003 9:15	175,093		175,093	1,778	4216	0.42	
	10/2/2003 9:40	176,915		176,915	1,822	4345	0.42	
	10/6/2003 10:19	179,819		179,819	2,904	5799	0.50	
	10/9/2003 9:35	179,321		179,321				
	10/10/2003 10:00	179,389		179,389	68	1465	0.05	inadvertantly shut off at times
	10/13/2003 10:00	179,389		179,389	0	4320	0.00	inadvertantly shut off at times
	10/15/2003 11:21	179,492		179,492	103	2961	0.03	inadvertantly shut off at times
	10/17/2003 18:11	179,617		179,617	125	3290	0.04	inadvertantly shut off at times
	10/20/2003 13:59	179,617		179,617	0	4068	0.00	inadvertantly shut off at times
	10/22/2003 11:35	179,617		179,617	0	2736	0.00	inadvertantly shut off at times
	10/24/2003 12:15	179,617		179,617	0	2920	0.00	
	10/27/2003 10:40	179,617		179,617	0	4225	0.00	
	10/29/2003 13:30	180,254		180,254	637	3050	0.21	
	10/31/2003 11:27	181,494		181,494	1,240	2757	0.45	
	11/3/2003 11:11	183,382		183,382	1,888	4304	0.44	
	11/5/2003 8:14	184,537		184,537	1,155	2703	0.43	changed flow meter batteries
	11/7/2003 19:33	1,420	184,537	185,957	1,420	3559	0.40	
	11/10/2003 10:00	2,906	184,537	187,443	1,486	3747	0.40	
	11/14/2003 11:20	5,116	184,537	189,653	2,210	5840	0.38	
	11/17/2003 12:15	6,877	184,537	191,414	1,761	4375	0.40	
	11/21/2003 9:20	8,921	184,537	193,458	2,044	5585	0.37	
	11/24/2003 11:15	10,486	184,537	195,023	1,565	4435	0.35	
	12/1/2003 10:57	13,832	184,537	198,369	3,346	10062	0.33	
	12/3/2003 13:20	14,884	184,537	199,421	1,052	3023	0.35	
	12/5/2003 18:12	16,041	184,537	200,578	1,157	3172	0.36	
	12/8/2003 10:24	17,456	184,537	201,993	1,415	3852	0.37	
	12/10/2003 12:00	18,519	184,537	203,056	1,063	2976	0.36	
	12/12/2003 10:55	19,516	184,537	204,053	997	2815	0.35	
	12/15/2003 11:47	21,023	184,537	205,560	1,507	4372	0.34	
	12/19/2003 9:50	22,961	184,537	207,498	1,938	5643	0.34	
	12/22/2003 14:38	24,501	184,537	209,038	1,540	4608	0.33	
	12/29/2003 11:55	27,803	184,537	212,340	3,302	9917	0.33	
	1/5/2004 12:39	31,093	184,537	215,630	3,290	10124	0.32	
	1/9/2004 12:19	32,935	184,537	217,472	1,842	5740	0.32	
	1/12/2004 13:55	34,292	184,537	218,829	1,357	4416	0.31	
	1/15/2004 13:30	35,651	184,537	220,188	1,359	4295	0.32	
	1/16/2004 13:21	36,110	184,537	220,647	459	1431	0.32	inaccurate reading
	1/23/2004 11:45	39,250	184,537	223,787	3,140	9984	0.31	used historical data
	1/26/2004 11:46	40,555	184,537	225,092	1,305	4321	0.30	
	1/30/2004 9:12	42,265	184,537	226,802	1,710	5606	0.31	
	2/2/2004 11:22	43,596	184,537	228,133	1,331	4450	0.30	
	2/6/2004 12:33	45,348	184,537	229,885	1,752	5831	0.30	
	2/9/2004 11:51	46,611	184,537	231,148	1,263	4278	0.30	
	2/13/2004 13:22	48,314	184,537	232,851	1,703	5851	0.29	
	2/20/2004 11:55	50,886	184,537	235,423	2,572	9993	0.26	
	2/23/2004 12:24	52,110	184,537	236,647	1,224	4349	0.28	
	2/27/2004 10:15	53,526	184,537	238,063	1,416	5631	0.25	
	3/1/2004 9:22	54,669	184,537	239,206	1,143	4267	0.27	
	3/5/2004 12:47	56,099	184,537	240,636	1,430	5965	0.24	
	3/8/04 13:00	56,409	184,537	240,946	310	4333	0.07	
	3/12/2004 10:48	57,739	184,537	242,276	1,330	5628	0.24	
	3/15/2004 11:00	58,642	184,537	243,179	903	4332	0.21	
	3/19/2004 11:42	59,644	184,537	244,181	1,002	5802	0.17	
	3/24/2004 10:38	60,640	184,537	245,177	996	7136	0.14	
	3/30/2004 17:33	62,104	184,537	246,641	1,464	9055	0.16	
	avg						0.29	

Shiprock Terrace Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
1071	8/29/2003 11:10	32,079		32,079				
	9/5/2003 9:10	32,602		32,602	523	9960	0.05	
	9/8/2003 12:15	32,796		32,796	194	4505	0.04	
	9/11/2003 14:20	32,981		32,981	185	4445	0.04	
	9/12/2003 9:05	33,030		33,030	49	1125	0.04	
	9/15/2003 10:20	33,218		33,218	188	4395	0.04	
	9/19/2003 9:00	33,458		33,458	240	5680	0.04	
	9/22/2003 10:08	33,645		33,645	187	4388	0.04	
	9/26/2003 10:30	33,894		33,894	249	5782	0.04	diff = 9862
	9/29/2003 9:00	34,072		34,072	178	4230	0.04	
	10/2/2003 9:50	34,263		34,263	191	4370	0.04	not operating
	10/6/2003 10:19							
	10/9/2003 12:00	34,714		34,714				
	10/10/2003 9:45	34,812		34,812	98	1305	0.08	
	10/13/2003 10:00	35,147		35,147	335	4335	0.08	
	10/15/2003 11:28	35,380		35,380	233	2968	0.08	
	10/17/2003 18:11	35,635		35,635	255	3283	0.08	
	10/20/2003 13:47	35,950		35,950	315	4056	0.08	
	10/22/2003 12:00	36,166		36,166	216	2773	0.08	
	10/24/2003 12:11	36,387		36,387	221	2891	0.08	
	10/27/2003 10:22	36,708		36,708	321	4211	0.08	
	10/29/2003 13:37	36,917		36,917	209	3075	0.07	
	10/31/2003 11:15	37,163		37,163	246	2738	0.09	
	11/3/2003 10:42	37,729		37,729	566	4287	0.13	changed flow meter batteries
	11/5/2003 8:33	38,072		38,072	343	2751	0.12	
	11/7/2003 19:16	359	38,072	38,431	359	3523	0.10	
	11/10/2003 9:48	702	38,072	38,774	343	3752	0.09	
	11/14/2003 10:51	1,179	38,072	39,251	477	5823	0.08	
	11/17/2003 12:07	1,524	38,072	39,596	345	4396	0.08	
	11/21/2003 8:52	1,920	38,072	39,992	396	5565	0.07	
	11/24/2003 10:55	2,232	38,072	40,304	312	4443	0.07	
	12/1/2003 10:35	2,953	38,072	41,025	721	10060	0.07	
	12/3/2003 13:36	3,181	38,072	41,253	228	3061	0.07	
	12/5/2003 18:04	3,604	38,072	41,676	423	3148	0.13	
	12/8/2003 10:17	4,086	38,072	42,158	482	3853	0.13	
	12/10/2003 12:11	4,419	38,072	42,491	333	2994	0.11	
	12/12/2003 10:47	4,668	38,072	42,740	249	2796	0.09	
	12/15/2003 11:22	5,028	38,072	43,100	360	4355	0.08	
	12/19/2003 9:41	5,466	38,072	43,538	438	5659	0.08	
	12/22/2003 13:58	5,765	38,072	43,837	299	4577	0.07	
	12/29/2003 11:30	6,361	38,072	44,433	596	9932	0.06	
	1/5/2004 12:15	6,983	38,072	45,055	622	10125	0.06	
	1/9/2004 12:15	7,318	38,072	45,390	335	5760	0.06	
	1/12/2004 13:38	7,530	38,072	45,602	212	4403	0.05	
	1/15/2004 12:55	7,752	38,072	45,824	222	4277	0.05	
	1/16/2004 13:15	7,825	38,072	45,897	73	1460	0.05	inaccurate reading
	1/23/2004 11:45	8,200	38,072	46,272	375	9990	0.04	used historical data
	1/26/2004 11:20	8,459	38,072	46,531	259	4295	0.06	
	1/30/2004 9:05	8,679	38,072	46,751	220	5625	0.04	
	2/2/2004 11:00	8,850	38,072	46,922	171	4435	0.04	
	2/6/2004 12:15	9,082	38,072	47,154	232	5835	0.04	
	2/9/2004 11:45	9,255	38,072	47,327	173	4290	0.04	
	2/13/2004 13:16	9,483	38,072	47,555	228	5851	0.04	
	2/20/2004 11:26	9,854	38,072	47,926	371	9970	0.04	
	2/23/2004 12:19	10,018	38,072	48,090	164	4373	0.04	
	2/27/2004 9:50	10,229	38,072	48,301	211	5611	0.04	
	3/1/2004 9:10	10,397	38,072	48,469	168	4280	0.04	
	3/5/2004 12:18	10,613	38,072	48,685	216	5948	0.04	
	3/8/2004 12:30	10,790	38,072	48,862	177	4332	0.04	
	3/12/2004 10:41	11,032	38,072	49,104	242	5651	0.04	
	3/15/2004 10:40	11,185	38,072	49,257	153	4319	0.04	
	3/19/2004 11:36	11,402	38,072	49,474	217	5816	0.04	
	3/24/2004 10:29	11,661	38,072	49,733	259	7133	0.04	
	3/30/2004 17:26	12,002	38,072	50,074	341	9057	0.04	
	avg						0.06	

Shiprock Terrace Well Field Pumping Rates

well	date/time	reading (gpm)reading	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm
1078	8/29/2003 10:50	201,917		201,917			
	9/5/2003 8:53	208,779		208,779	208,779	54531893	0.00
	9/8/2003 12:09	211,945		211,945	3,166	4516	0.70
	9/11/2003 14:24	215,093		215,093	3,148	4455	0.71
	9/12/2003 9:00	215,858		215,858	765	1116	0.69
	9/15/2003 10:14	218,907		218,907	3,049	4394	0.69
	9/19/2003 8:49	222,894		222,894	3,987	5675	0.70
	9/22/2003 10:00	225,955		225,955	3,061	4391	0.70
	9/26/2003 10:20	230,033		230,033	4,078	5780	0.71
	9/29/2003 8:50	233,003		233,003	2,970	4230	0.70
	10/2/2003 7:54	236,027		236,027	3,024	4264	0.71
	10/6/2003 10:19						
	10/9/2003 12:15						
	10/10/2003 9:20	244,000		244,000	7,973	11606	0.69
	10/13/2003 9:45						
	10/15/2003 10:45						
	10/17/2003 18:00	251,400		251,400	7,400	10600	0.70
	10/20/2003 13:40						
	10/22/2003 12:10						
	10/24/2003 12:05						
	10/27/2003 10:05	261,000		261,000	9,600	13925	0.69
	10/30/2003 10:30						
	10/31/2003 11:10	1,063	264,000	265,063	4,063	5825	0.70
	11/3/2003 10:30	4,238	264,000	268,238	3,175	4280	0.74
	11/5/2003 8:40	6,279	264,000	270,279	2,041	2770	0.74
	11/7/2003 19:01	8,428	264,000	272,428	2,149	3501	0.61
	11/10/2003 9:37	8,501	264,000	272,501	73	3756	0.02
	11/14/2003 10:51	15,012	264,000	279,012	6,511	5834	1.12
	11/17/2003 12:02	18,395	264,000	282,395	3,383	4391	0.77
	11/21/2003 8:44	22,514	264,000	286,514	4,119	5562	0.74
	11/24/2003 10:45	25,895	264,000	289,895	3,381	4441	0.76
	12/1/2003 10:25	33,195	264,000	297,195	7,300	10060	0.73
	12/3/2003 13:45	35,427	264,000	299,427	2,232	3080	0.72
	12/5/2003 17:58	37,776	264,000	301,776	2,349	3133	0.75
	12/8/2003 10:05	40,690	264,000	304,690	2,914	3847	0.76
	12/10/2003 12:18	42,966	264,000	306,966	2,276	3013	0.76
	12/12/2003 10:41	45,127	264,000	309,127	2,161	2783	0.78
	12/15/2003 11:15	48,373	264,000	312,373	3,246	4354	0.75
	12/19/2003 9:33	52,364	264,000	316,364	3,991	5658	0.71
	12/22/2003 13:45	55,686	264,000	319,686	3,322	4572	0.73
	12/29/2003 11:18	63,117	264,000	327,117	7,431	9933	0.75
	1/5/2004 12:11	70,769	264,000	334,769	7,652	10133	0.76
	1/9/2004 12:06	74,750	264,000	338,750	3,981	5755	0.69
	1/12/2004 13:15	78,080	264,000	342,080	3,330	4389	0.76
	1/15/2004 12:35	81,182	264,000	345,182	3,102	4280	0.72
	1/16/2004 11:27	82,263	264,000	346,263	1,081	1372	0.79
	1/23/2004 11:45	89,900	264,000	353,900	7,637	10098	0.76
	1/26/2004 11:15	93,205	264,000	357,205	3,305	4290	0.77
	1/30/2004 8:59	97,360	264,000	361,360	4,155	5624	0.74
	2/2/2004 11:00	100,660	264,000	364,660	3,300	4441	0.74
	2/6/2004 12:00	105,073	264,000	369,073	4,413	5820	0.76
	2/9/2004 11:40	108,195	264,000	372,195	3,122	4300	0.73
	2/13/2004 13:12	112,407	264,000	376,407	4,212	5852	0.72
	2/20/2004 11:10	119,419	264,000	383,419	7,012	9958	0.70
	2/23/2004 12:15	122,411	264,000	386,411	2,992	4385	0.68
	2/27/2004 9:38	126,786	264,000	390,786	4,375	5603	0.78
	3/1/2004 9:16	130,051	264,000	394,051	3,265	4298	0.76
	3/5/2004 12:00	134,385	264,000	398,385	4,334	5924	0.73
	3/8/2004 12:18	137,314	264,000	401,314	2,929	4338	0.68
	3/12/2004 10:35	141,281	264,000	405,281	3,967	5657	0.70
	3/15/2004 10:29	144,270	264,000	408,270	2,989	4314	0.69
	3/19/2004 11:32	148,392	264,000	412,392	4,122	5823	0.71
	3/24/2004 10:22	153,319	264,000	417,319	4,927	7130	0.69
	3/30/2004 17:20	159,626	264,000	423,626	6,307	9058	0.70
	avg						0.70

Shiprock Terrace Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm
1091	8/29/2003 9:02			8,440			
	9/5/2003 6:47			10,715	10715	54531767	0.00
	9/8/2003 11:21			11,803	1088	4594	0.24
	9/11/2003 15:04			12,832	1029	4543	0.23
	9/12/2003 6:50			13,053	221	946	0.23
	9/15/2003 9:34			13,982	929	4484	0.21
	9/19/2003 6:56			15,185	1203	5602	0.21
	9/22/2003 9:09			16,090	905	4453	0.20
	9/26/2003 8:25			17,315	1225	5716	0.21
	9/29/2003 7:15			18,175	860	4250	0.20
	10/1/2003 17:08			18,845	670	3473	0.19
	10/6/2003 9:23			20,165	1320	6735	0.20
	10/8/2003 16:08			20,759	594	3285	0.18
	10/10/2003 7:55			21,200	441	2387	0.18
	10/13/2003 7:50			22,018	818	4315	0.19
	10/15/2003 9:19			22,539	521	2969	0.18
	10/17/2003 16:30			23,126	587	3311	0.18
	10/20/2003 12:53			23,824	698	4103	0.17
	10/22/2003 13:15			24,301	477	2902	0.16
	10/24/2003 11:27			24,779	478	2772	0.17
	10/27/2003 9:18			25,492	713	4191	0.17
	10/29/2003 16:42			26,129	637	3324	0.19
	10/31/2003 9:50			26,574	445	2468	0.18
	11/3/2003 9:00			27,327	753	4270	0.18
	11/5/2003 7:55			27,327	0	2815	0.00
	11/7/2003 18:00			27,600	273	3485	0.08
	11/10/2003 9:15						
	11/14/2003 9:30	3,026	25,375	28,401	801	9570	0.08
	11/17/2003 11:07	4,143	25,375	29,518	1,117	4417	0.25
	11/21/2003 6:57	5,476	25,375	30,851	1,333	5510	0.24
	11/24/2003 8:50	6,350	25,375	31,725	874	4433	0.20
	12/1/2003 8:30	8,350	25,375	33,725	2,000	10060	0.20
	12/3/2003 12:56	621	33,725	34,346	621	3146	0.20
	12/5/2003 15:29	1,217	33,725	34,942	596	3033	0.20
	12/8/2003 9:12	2,022	33,725	35,747	805	3943	0.20
	12/10/2003 13:54	2,630	33,725	36,355	608	3162	0.19
	12/12/2003 9:48	3,159	33,725	36,884	529	2634	0.20
	12/15/2003 9:50	4,002	33,725	37,727	843	4322	0.20
	12/19/2003 9:02	938	37,950	38,888	1,161	5712	0.20
	12/22/2003 12:50	1,858	37,950	39,808	920	4548	0.20
	12/29/2003 10:20	3,800	37,950	41,750	1,942	9930	0.20
	1/5/2004 11:00	5,300	37,950	43,250	1,500	10120	0.15
	1/9/2004 11:28	750	43,250	44,000	750	5788	0.13
	1/12/2004 12:30	1,348	43,250	44,598	598	4382	0.14
	1/15/2004 9:15	1,886	43,250	45,136	538	4125	0.13
	1/16/2004 11:03	2,119	43,250	45,369	233	1548	0.15
	1/23/2004 11:36	3,429	43,250	46,679	1,310	10113	0.13
	1/26/2004 10:26	4,039	43,250	47,289	610	4250	0.14
	1/30/2004 8:17	4,728	43,250	47,978	689	5631	0.12
	2/2/2004 9:20	5,316	43,250	48,566	588	4383	0.13
	2/6/2004 10:00	6,031	43,250	49,281	715	5800	0.12
	2/9/2004 11:02	6,533	43,250	49,783	502	4382	0.11
	2/13/2004 12:32	7,228	43,250	50,478	695	5850	0.12
	2/20/2004 9:21	8,337	43,250	51,587	1,109	9889	0.11
	2/23/2004 9:27	8,831	43,250	52,081	494	4326	0.11
	2/27/2004 8:45	9,455	43,250	52,705	624	5718	0.11
	3/5/2004 10:20	10,540	43,250	53,790	1,085	10175	0.11
	3/5/2004 10:20	10,540	43,250	53,790			
	3/8/2004 11:12	10,910	43,250	54,160	370	4372	0.08
	3/12/2004 9:50	11,523	43,250	54,773	613	5678	0.11
	3/15/2004 8:51	11,974	43,250	55,224	451	4261	0.11
	3/19/2004 10:43	12,571	43,250	55,821	597	5872	0.10
	3/24/2004 9:16	13,314	43,250	56,564	743	7113	0.10
	3/30/2004 17:51	14,217	43,250	57,467	903	9155	0.10
	avg						0.16

Shiprock Terrace Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
1092	8/29/2003 9:00			5,368				
	9/5/2003 6:48			7,417	2,049	9948	0.21	
	9/8/2003 11:20			8,362	945	4592	0.21	
	9/11/2003 15:03			9,220	858	4543	0.19	
	9/12/2003 6:44			9,412	192	941	0.20	
	9/15/2003 9:33			10,227	815	4489	0.18	
	9/19/2003 7:00			11,293	1066	5607	0.19	
	9/22/2003 9:07			12,076	783	4447	0.18	
	9/26/2003 8:20			13,081	1005	5713	0.18	
	9/29/2003 7:05			13,786	705	4245	0.17	
	10/1/2003 17:05			14,336	550	3480	0.16	
	10/6/2003 9:22			15,405	1069	6737	0.16	
	10/8/2003 16:11			15,920	515	3289	0.16	
	10/10/2003 7:40			16,305	385	2369	0.16	
	10/13/2003 7:58			16,762	457	4338	0.11	
	10/15/2003 9:22			17,041	279	2964	0.09	
	10/17/2003 16:32			17,363	322	3310	0.10	
	10/20/2003 12:50			17,778	415	4098	0.10	
	10/22/2003 13:15			18,080	302	2905	0.10	
	10/24/2003 11:26			18,400	320	2771	0.12	
	10/27/2003 9:07			18,872	472	4181	0.11	
	10/29/2003 16:37			19,282	410	3330	0.12	
	10/31/2003 9:48			19,565	283	2471	0.11	
	11/3/2003 8:22			20,022	457	4234	0.11	
	11/5/2003 7:55			20,022	0	2853	0.00	shut down for winterization
	11/7/2003 18:00			20,200	178	3485	0.05	estimated for weekly
	11/10/2003 9:15							no reading taken
	11/14/2003 8:55	1,054	19,600	20,654	454	9535	0.05	
	11/17/2003 11:05	1,864	19,600	21,464	810	4450	0.18	
	11/21/2003 7:22	2,819	19,600	22,419	955	5537	0.17	
	11/24/2003 9:28	3,571	19,600	23,171	752	4446	0.17	
	12/1/2003 8:15	5,254	19,600	24,854	1,683	10007	0.17	
	12/3/2003 13:02	5,781	19,600	25,381	527	3167	0.17	
	12/5/2003 15:26	6,284	19,600	25,884	503	3024	0.17	
	12/8/2003 9:11	6,945	19,600	26,545	661	3945	0.17	
	12/10/2003 13:53	7,395	19,600	26,995	450	3162	0.14	
	12/12/2003 9:46	7,796	19,600	27,396	401	2633	0.15	
	12/15/2003 9:30	8,409	19,600	28,009	613	4304	0.14	
	12/19/2003 9:00	9,084	19,600	28,684	675	5730	0.12	
	12/22/2003 12:26	9,726	19,600	29,326	642	4526	0.14	
	12/29/2003 9:33	10,983	19,600	30,583	1,257	9907	0.13	
	1/5/2004 11:05	12,245	19,600	31,845	1,262	10172	0.12	
	1/9/2004 11:27	12,927	19,600	32,527	682	5782	0.12	
	1/12/2004 11:50	13,497	19,600	33,097	570	4343	0.13	
	1/15/2004 9:30	14,014	19,600	33,614	517	4180	0.12	
	1/16/2004 11:01	14,227	19,600	33,827	213	1531	0.14	
	1/23/2004 11:30	15,434	19,600	35,034	1,207	10109	0.12	
	1/26/2004 9:44	16,101	19,600	35,701	667	4214	0.16	
	1/30/2004 8:16	16,619	19,600	36,219	518	5672	0.09	
	2/2/2004 9:22	17,102	19,600	36,702	483	4386	0.11	
	2/6/2004 10:20	17,722	19,600	37,322	620	5818	0.11	
	2/9/2004 11:00	18,168	19,600	37,768	446	4360	0.10	
	2/13/2004 12:31	18,801	19,600	38,401	633	5851	0.11	
	2/20/2004 9:27	19,924	19,600	39,524	1,123	9896	0.11	
	2/23/2004 9:26	20,417	19,600	40,017	493	4319	0.11	
	2/27/2004 8:05	21,058	19,600	40,658	641	5679	0.11	
	3/5/2004 10:28	22,260	19,600	41,860	1,202	10223	0.12	
	3/5/2004 10:28	22,260	19,600	41,860				
	3/8/2004 10:39	22,716	19,600	42,316	456	4331	0.11	
	3/12/2004 9:49	23,432	19,600	43,032	716	5710	0.13	
	3/15/2004 8:40	23,956	19,600	43,556	524	4251	0.12	
	3/19/2004 10:41	24,637	19,600	44,237	681	5881	0.12	
	3/24/2004 9:20	25,486	19,600	45,086	849	7119	0.12	
	3/30/2004 17:53	26,544	19,600	46,144	1,058	9153	0.12	
	avg						0.13	

Shiprock Terrace Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
1093	8/29/2003 10:00			5,449				pump not running
	9/5/2003 7:30			5,449	0	9930	0.00	pump not running
	9/8/2003 11:24			5,449	0	4554	0.00	pump not running
	9/11/2003 15:05			5,449	0	4541	0.00	pump not running
	9/12/2003 7:30			5,449	0			pump not running
	9/15/2003 9:35			5,449	0	4445	0.00	pump not running
	9/19/2003 7:30			5,449	0	5635	0.00	pump not running
	9/22/2003 9:10			5,449	0	4420	0.00	pump not running
	9/26/2003 9:00			5,449	0	5750	0.00	pump not running
	9/29/2003 8:00			5,449	0	4260	0.00	pump not running
	10/1/2003 17:12			5,449	0	3432	0.00	pump not running
	10/6/2003 9:26							no reading
	10/8/2003 16:18			8,117				
	10/10/2003 7:45			8,770	653	2367	0.28	
	10/13/2003 8:20			9,872	1102	4355	0.25	
	10/15/2003 9:27			10,571	699	2947	0.24	
	10/17/2003 16:34			11,352	781	3307	0.24	
	10/20/2003 12:54			12,301	949	4100	0.23	
	10/22/2003 13:20			12,975	674	2906	0.23	
	10/24/2003 11:28			13,666	691	2768	0.25	
	10/27/2003 8:37			14,659	993	4149	0.24	
	10/29/2003 17:00			15,531	872	3383	0.26	
	10/31/2003 10:25			16,159	628	2485	0.25	
	11/3/2003 8:40			17,194	1035	4215	0.25	
	11/5/2003 7:55			17,194	0	2835	0.00	shut down for winterization
	11/7/2003 17:51			17,600	406	3476	0.12	estimated for weekly
	11/10/2003 9:15							no reading taken
	11/14/2003 9:50	19,766		19,766	2,166	9599	0.23	flow meter not working, but hr meter running
	11/17/2003 11:09	19,766	350	20,116	350	4399	0.08	flow meter not working, but hr meter running
	11/21/2003 7:10	19,766	700	20,466	350	5521	0.06	flow meter not working, but hr meter running
	11/24/2003 9:45	19,766	950	20,716	250	4475	0.06	
	12/1/2003 9:00	19,766	1,600	21,366	650	10035	0.06	
	12/4/2003 10:00	0	21,366	21,366	0	4380	0.00	new flow meter installed
	12/5/2003 15:33	828	21,366	22,194	828	1773	0.47	pvc casing removed
	12/8/2003 9:14	2,374	21,366	23,740	1,546	3941	0.39	
	12/10/2003 14:04	3,576	21,366	24,942	1,202	3170	0.38	
	12/12/2003 9:50	4,552	21,366	25,918	976	2626	0.37	
	12/15/2003 10:15	6,135	21,366	27,501	1,583	4345	0.36	
	12/19/2003 9:04	8,052	21,366	29,418	1,917	5689	0.34	
	12/22/2003 12:45	9,643	21,366	31,009	1,591	4541	0.35	
	12/29/2003 9:55	12,986	21,366	34,352	3,343	9910	0.34	
	1/5/2004 11:20	16,305	21,366	37,671	3,319	10165	0.33	
	1/9/2004 11:28	18,107	21,366	39,473	1,802	5768	0.31	
	1/12/2004 12:15	19,492	21,366	40,858	1,385	4367	0.32	
	1/15/2004 9:50	20,758	21,366	42,124	1,266	4175	0.30	
	1/16/2004 11:05	21,242	21,366	42,608	484	1515	0.32	
	1/23/2004 11:20	24,331	21,366	45,697	3,089	10095	0.31	
	1/26/2004 10:18	25,671	21,366	47,037	1,340	4258	0.31	
	1/30/2004 8:19	27,329	21,366	48,695	1,658	5641	0.29	
	2/2/2004 9:40	28,665	21,366	50,031	1,336	4401	0.30	
	2/6/2004 10:40	30,404	21,366	51,770	1,739	5820	0.30	
	2/9/2004 11:03	31,626	21,366	52,992	1,222	4343	0.28	
	2/13/2004 12:34	33,297	21,366	54,663	1,671	5851	0.29	
	2/20/2004 9:45	36,142	21,366	57,508	2,845	9911	0.29	
	2/23/2004 9:35	37,376	21,366	58,742	1,234	4310	0.29	
	2/27/2004 8:18	38,981	21,366	60,347	1,605	5683	0.28	
	3/1/2004 8:27	40,186	21,366	61,552	1,205	4329	0.28	
	3/5/2004 11:00	41,831	21,366	63,197	1,645	5913	0.28	
	3/8/2004 10:52	42,962	21,366	64,328	1,131	4312	0.26	
	3/12/2004 9:52	44,477	21,366	65,843	1,515	5700	0.27	
	3/15/2004 9:15	45,617	21,366	66,983	1,140	4283	0.27	
	3/19/2004 10:45	47,107	21,366	68,473	1,490	5850	0.25	
	3/24/2004 9:02	48,915	21,366	70,281	1,808	7097	0.25	
	3/30/2004 17:49	51,225	21,366	72,591	2,310	9167	0.25	
	avg						0.22	

Shiprock Terrace Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
1094	8/29/2003 10:00			1,863				
	9/5/2003 7:47			2,532	669	9947	0.07	
	9/8/2003 11:25			2,830	298	4538	0.07	
	9/11/2003 15:12			3,117	287	4547	0.06	
	9/12/2003 7:50			3,180	63	998	0.06	
	9/15/2003 9:37			3,434	254	4427	0.06	
	9/19/2003 8:00			3,751	317	5663	0.06	
	9/22/2003 9:11			3,976	225	4391	0.05	
	9/26/2003 8:20			4,250	274	5709	0.05	
	9/29/2003 8:00			4,447	197	4300	0.05	
	10/1/2003 17:15			4,594	147	3435	0.04	
	10/6/2003 9:28			4,811	217	6733	0.03	
	10/8/2003 16:25			4,936	125	3297	0.04	
	10/10/2003 7:31			5,022	86	2346	0.04	
	10/13/2003 8:44			5,168	146	4393	0.03	
	10/15/2003 9:30			5,233	65	2926	0.02	
	10/17/2003 16:40			5,299	66	3310	0.02	
	10/20/2003 12:55			5,380	81	4095	0.02	
	10/22/2003 13:20			5,410	30	2905	0.01	
	10/24/2003 11:30			5,411	1	2770	0.00	
	10/27/2003 8:37			5,411	0	4147	0.00	
	10/29/2003 16:33			5,413	2	3356	0.00	
	10/31/2003 10:30			5,515	102	2517	0.04	
	11/3/2003 9:27			5,673	158	4257	0.04	
	11/5/2003 7:55			5,673	0	2788	0.00	shut down for winterization
	11/7/2003 17:51			5,700	27	3476	0.01	estimated for weekly
	11/10/2003 9:15							no reading taken
	11/14/2003 9:10			6,052	352	9559	0.04	
	11/17/2003 11:11			6,191	139	4441	0.03	
	11/21/2003 7:44			6,363	172	5553	0.03	
	11/24/2003 9:20			6,499	136	4416	0.03	
	12/1/2003 9:20			6,796	297	10080	0.03	
	12/3/2003 12:45			6,818	22	3085	0.01	
	12/5/2003 15:37			6,910	92	3052	0.03	screen cleaned
	12/8/2003 9:17			7,054	144	3940	0.04	
	12/10/2003 14:06			7,160	106	3169	0.03	
	12/12/2003 9:52			7,247	87	2626	0.03	
	12/15/2003 10:44			7,387	140	4372	0.03	
	12/19/2003 9:07			7,542	155	5663	0.03	
	12/22/2003 12:47			7,679	137	4540	0.03	
	12/29/2003 10:39			7,963	284	9952	0.03	
	1/5/2004 11:25			8,241	278	10126	0.03	
	1/9/2004 11:29			8,382	141	5764	0.02	
	1/12/2004 12:44			8,491	109	4395	0.02	
	1/15/2004 10:10			8,593	102	4166	0.02	
	1/16/2004 11:06			8,628	35	1496	0.02	
	1/23/2004 11:13			8,726	98	10087	0.01	
	1/26/2004 9:55			8,981	255	4242	0.06	
	1/30/2004 8:21			9,101	120	5666	0.02	
	2/2/2004 10:08			9,204	103	4427	0.02	
	2/6/2004 10:55			9,335	131	5807	0.02	
	2/9/2004 11:06			9,425	90	4331	0.02	
	2/13/2004 12:36			9,549	124	5850	0.02	
	2/20/2004 10:05			9,750	201	9929	0.02	
	2/23/2004 9:37			9,841	91	4292	0.02	
	2/27/2004 8:35			9,958	117	5698	0.02	
	3/1/2004 8:29			10,042	84	4314	0.02	
	3/5/2004 10:45			10,153	111	5896	0.02	
	3/8/2004 11:30			10,228	75	4365	0.02	
	3/12/2004 9:54			10,338	110	5664	0.02	
	3/15/2004 9:25			10,423	85	4291	0.02	
	3/19/2004 10:47			10,526	103	5842	0.02	
	3/24/2004 9:09			10,656	130	7102	0.02	
	3/30/2004 17:47			10,819	163	9158	0.02	
	avg						0.03	

Shiprock Wash Drain Pumping Rates

location	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
bob lee	8/29/2003 10:10	1,302,781		1,302,781				
	9/5/2003 8:00	1,333,921		1,333,921	31,140	9950	3.13	
	9/8/2003 11:37	1,348,226		1,348,226	14,305	4537	3.15	
	9/11/2003 14:32	1,370,774		1,370,774	22,548	4495	5.02	
	9/12/2003 8:00	1,375,762		1,375,762	4,988	1048	4.76	
	9/15/2003 9:50	1,393,453		1,393,453	17,691	4430	3.99	flow diff 502,709
	9/19/2003 8:10	1,413,532		1,413,532	20,079	5660	3.55	
	9/22/2003 9:27	1,428,636		1,428,636	15,104	4397	3.44	
	9/26/2003 9:15	1,448,269		1,448,269	19,633	5748	3.42	
	9/29/2003 8:10	1,462,258		1,462,258	13,989	4255	3.29	
	10/1/2003 17:35	1,473,632		1,473,632	11,374	3445	3.30	
	10/6/2003 9:50	1,509,149		1,509,149	35,517	6735	5.27	
	10/8/2003 17:05	1,524,203		1,524,203	15,054	3315	4.54	
	10/10/2003 8:15	1,529,393		1,529,393	5,190	2350	2.21	not operating properly
	10/13/2003 9:10	1,530,296		1,530,296	903	4375	0.21	not operating properly
	10/15/2003 10:05	1,532,583		1,532,583	2,287	2935	0.78	not operating properly
	10/17/2003 16:09	1,532,583		1,532,583	0	3244	0.00	no reading taken
	10/20/2003 12:16	1,566,053		1,566,053	33,470	4087	8.19	
	10/22/2003 9:45	1,578,162		1,578,162	12,109	2729	4.44	
	10/24/2003 11:40	1,591,734		1,591,734	13,572	2995	4.53	
	10/27/2003 9:40	1,611,317		1,611,317	19,583	4200	4.66	
	10/29/2003 11:49	1,624,260		1,624,260	12,943	3009	4.30	
	10/31/2003 10:45	1,637,550		1,637,550	13,290	2816	4.72	
	11/3/2003 9:42	1,656,206		1,656,206	18,656	4257	4.38	
	11/5/2003 8:57	1,668,137		1,668,137	11,931	2835	4.21	changed flow meter batteries
	11/7/2003 17:51	14,170	1,668,137	1,682,307	14,170	3414	4.15	
	11/10/2003 9:16	30,091	1,668,137	1,698,228	15,921	3805	4.18	
	11/14/2003 10:15	53,852	1,668,137	1,721,989	23,761	5819	4.08	
	11/17/2003 11:36	72,252	1,668,137	1,740,389	18,400	4401	4.18	
	11/21/2003 7:55	95,064	1,668,137	1,763,201	22,812	5539	4.12	
	11/24/2003 10:05	112,976	1,668,137	1,781,113	17,912	4450	4.03	
	12/1/2003 9:38	153,086	1,668,137	1,821,223	40,110	10053	3.99	
	12/3/2003 15:05	165,452	1,668,137	1,833,589	12,366	3207	3.86	
	12/5/2003 17:12	177,055	1,668,137	1,845,192	11,603	3007	3.86	
	12/8/2003 9:42	191,958	1,668,137	1,860,095	14,903	3870	3.85	
	12/10/2003 12:35	203,484	1,668,137	1,871,621	11,526	3053	3.78	
	12/12/2003 10:17	213,857	1,668,137	1,881,994	10,373	2742	3.78	
	12/15/2003 10:52	230,184	1,668,137	1,898,321	16,327	4355	3.75	
	12/19/2003 9:14	250,570	1,668,137	1,918,707	20,386	5662	3.60	
	12/22/2003 13:00	267,221	1,668,137	1,935,358	16,651	4546	3.66	
	12/29/2003 10:45	302,473	1,668,137	1,970,610	35,252	9945	3.54	
	1/5/2004 11:37	337,788	1,668,137	2,005,925	35,315	10132	3.49	
	1/9/2004 11:46	357,482	1,668,137	2,025,619	19,694	5769	3.41	
	1/12/2004 13:00	372,627	1,668,137	2,040,764	15,145	4394	3.45	
	1/15/2004 10:40	385,940	1,668,137	2,054,077	13,313	4180	3.18	
	1/16/2004 11:20	391,457	1,668,137	2,059,594	5,517	1480	3.73	
	1/23/2004 11:45	425,260	1,668,137	2,093,397	33,803	10105	3.35	
	1/26/2004 10:44	439,475	1,668,137	2,107,612	14,215	4259	3.34	
	1/30/2004 8:35	457,563	1,668,137	2,125,700	18,088	5631	3.21	
	2/2/2004 10:08	471,942	1,668,137	2,140,079	14,379	4413	3.26	
	2/6/2004 11:15	490,759	1,668,137	2,158,896	18,817	5827	3.23	
	2/9/2004 11:19	504,245	1,668,137	2,172,382	13,486	4324	3.12	
	2/13/2004 12:47	522,310	1,668,137	2,190,447	18,065	5848	3.09	
	2/20/2004 10:18	552,751	1,668,137	2,220,888	30,441	9931	3.07	
	2/23/2004 11:58	566,288	1,668,137	2,234,425	13,537	4420	3.06	
	2/27/2004 9:00	585,912	1,668,137	2,254,049	19,624	5582	3.52	
	3/1/2004 8:42	600,882	1,668,137	2,269,019	14,970	4302	3.48	
	3/5/2004 11:22	619,979	1,668,137	2,288,116	19,097	5920	3.23	
	3/8/2004 11:42	633,815	1,668,137	2,301,952	13,836	4340	3.19	
	3/12/2004 10:11	652,588	1,668,137	2,320,725	18,773	5669	3.31	
	3/15/2004 9:44	667,018	1,668,137	2,335,155	14,430	4293	3.36	
	3/19/2004 11:06	686,424	1,668,137	2,354,561	19,406	5842	3.32	
	3/24/2004 9:56	709,950	1,668,137	2,378,087	23,526	7130	3.30	
	3/30/2004 16:30	717,885	1,668,137	2,386,022	7,935	9034	0.88	
	avg						3.58	

Shiprock Wash Sump Pumping Rates

location	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
many devils	8/29/2003 8:45	52,883		52,883				
	9/5/2003 6:40	55,073		55,073	2,190	9955	0.22	
	9/8/2003 11:13	56,078		56,078	1,005	4593	0.22	
	9/11/2003 13:56	56,663		56,663	585	4483	0.13	system down, air valve leak
	9/12/2003 6:35	56,663		56,663	0	999	0.00	system down, air valve leak
	9/15/2003 9:24	56,663		56,663	0	4489	0.00	system down, air valve leak
	9/19/2003 6:41	56,663		56,663	0	5597	0.00	system down, air valve leak
	9/22/2003 8:58	56,663		56,663	0	4457	0.00	system down, air valve leak
	9/26/2003 8:00	56,663		56,663	0	5702	0.00	system down, air valve leak
	9/29/2003 7:00							system down, air valve leak
	10/1/2003 16:40	60,121		60,121				
	10/6/2003 9:12	64,775		64,775	4,654	6752	0.69	
	10/8/2003 15:47	66,726		66,726	1,951	3275	0.60	
	10/10/2003 7:15	68,072		68,072	1,346	2368	0.57	
	10/13/2003 7:30	70,105		70,105	2,033	4335	0.47	
	10/15/2003 8:55	71,349		71,349	1,244	2965	0.42	
	10/17/2003 17:00	72,675		72,675	1,326	3365	0.39	
	10/20/2003 12:42	74,125		74,125	1,450	4062	0.36	
	10/22/2003 9:00	75,007		75,007	882	2658	0.33	
	10/24/2003 11:17	76,060		76,060	1,053	3017	0.35	
	10/27/2003 8:15	77,429		77,429	1,369	4138	0.33	
	10/29/2003 15:05	78,493		78,493	1,064	3290	0.32	
	10/31/2003 8:40	79,360		79,360	867	2495	0.35	
	11/3/2003 8:00	80,746		80,746	1,386	4280	0.32	
	11/5/2003 7:55	81,669		81,669	923	2875	0.32	changed flow meter batteries
	11/7/2003 17:51	1,184	81,669	82,853	1,184	3476	0.34	
	11/10/2003 9:02	2,488	81,669	84,157	1,304	3791	0.34	
	11/14/2003 8:30	4,825	81,669	86,494	2,337	5728	0.41	
	11/17/2003 10:52	6,656	81,669	88,325	1,831	4462	0.41	
	11/21/2003 6:40	8,854	81,669	90,523	2,198	5508	0.40	
	11/24/2003 8:30	10,539	81,669	92,208	1,685	4430	0.38	
	12/1/2003 8:00	14,571	81,669	96,240	4,032	10050	0.40	
	12/3/2003 12:30	15,191	81,669	96,860	620	3150	0.20	
	12/5/2003 15:11	17,027	81,669	98,696	1,836	3041	0.60	
	12/8/2003 9:00	18,818	81,669	100,487	1,791	3949	0.45	
	12/10/2003 11:50	20,139	81,669	101,808	1,321	3050	0.43	
	12/12/2003 9:36	21,344	81,669	103,013	1,205	2746	0.44	
	12/15/2003 9:10	23,338	81,669	105,007	1,994	4294	0.46	
	12/19/2003 8:50	26,000	81,669	107,669	2,662	5740	0.46	no reading
	12/22/2003 12:10	27,339	81,669	109,008	1,339	4520	0.30	
	12/29/2003 9:11	31,760	81,669	113,429	4,421	9901	0.45	
	1/5/2004 10:38	35,825	81,669	117,494	4,065	10167	0.40	
	1/9/2004 11:03	38,125	81,669	119,794	2,300	5785	0.40	actual value 37888
	1/12/2004 10:48	39,815	81,669	121,484	1,690	4305	0.39	rec after weekly submitted
	1/15/2004 8:30	41,683	81,669	123,352	1,868	4182	0.45	
	1/16/2004 10:49	42,892	81,669	124,561	1,209	1579	0.77	
	1/23/2004 9:46	49,435	81,669	131,104	6,543	10017	0.65	
	1/26/2004 9:22	52,461	81,669	134,130	3,026	4296	0.70	
	1/30/2004 8:04	56,333	81,669	138,002	3,872	5682	0.68	
	2/2/2004 9:11	59,515	81,669	141,184	3,182	4387	0.73	
	2/6/2004 9:41	63,896	81,669	145,565	4,381	5790	0.76	
	2/9/2004 10:54	67,423	81,669	149,092	3,527	4393	0.80	
	2/13/2004 12:20	71,569	81,669	153,238	4,146	5846	0.71	
	2/20/2004 9:10	78,774	81,669	160,443	7,205	9890	0.73	
	2/23/2004 9:19	82,856	81,669	164,525	4,082	4329	0.94	
	2/27/2004 7:52	87,905	81,669	169,574	5,049	5673	0.89	
	3/1/2004 8:14	92,052	81,669	173,721	4,147	4342	0.96	
	3/5/2004 10:10	96,944	81,669	178,613	4,892	5876	0.83	
	3/8/2004 10:15	100,614	81,669	182,283	3,670	4325	0.85	
	3/12/2004 9:37	105,145	81,669	186,814	4,531	5722	0.79	
	3/15/2004 8:12	108,709	81,669	190,378	3,564	4235	0.84	
	3/19/2004 10:31	113,427	81,669	195,096	4,718	5899	0.80	
	3/24/2004 9:42	119,076	81,669	200,745	5,649	7151	0.79	
	3/30/2004 15:55	126,005	81,669	207,674	6,929	9013	0.77	
	avg						0.48	

Shiprock Floodplain Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
1089	8/29/2003 10:25	737,397		737,397				
	9/5/2003 8:40	784,848		784,848	47,451	9975	4.76	
	9/8/2003 10:48	801,863		801,863	17,015	4448	3.83	
	9/11/2003 14:43	822,614		822,614	20,751	4555	4.56	
	9/12/2003 0:00							no reading due to flooding
	9/15/2003 10:00	852,214		852,214	29,600	5477	5.40	
	9/19/2003 8:30	883,803		883,803	31,589	5670	5.57	
	9/22/2003 9:44	907,712		907,712	23,909	4394	5.44	
	9/26/2003 10:00	938,468		938,468	30,756	5776	5.32	
	9/29/2003 8:20	960,060		960,060	21,592	4220	5.12	iff = 22,219
	10/1/2003 18:00	977,406		977,406	17,346	3460	5.01	
	10/6/2003 10:03							no reading
	10/8/2003 17:45	1,028,514		1,028,514				add 1,000,000 to meter reading
	10/10/2003 9:03	1,041,287		1,041,287	12,773	2358	5.42	
	10/13/2003 9:45	1,064,010		1,064,010	22,723	4362	5.21	
	10/15/2003 10:25	1,079,115		1,079,115	15,105	2920	5.17	
	10/17/2003 17:40	1,096,445		1,096,445	17,330	3315	5.23	
	10/20/2003 13:34	1,117,736		1,117,736	21,291	4074	5.23	
	10/22/2003 10:25	1,131,628		1,131,628	13,892	2691	5.16	
	10/24/2003 11:50	1,146,694		1,146,694	15,066	2965	5.08	
	10/27/2003 10:05	1,168,802		1,168,802	22,108	4215	5.25	
	10/29/2003 12:05	1,179,391		1,179,391	10,589	3000	3.53	
	10/31/2003 11:03	1,198,558		1,198,558	19,167	2818	6.80	
	11/3/2003 9:51	1,221,116		1,221,116	22,558	4248	5.31	
	11/5/2003 9:18	1,236,127		1,236,127	15,011	2847	5.27	changed flow meter batteries
	11/7/2003 18:49	18,665	1,236,127	1,254,792	18,665	3451	5.41	
	11/10/2003 9:26	39,324	1,236,127	1,275,451	20,659	3757	5.50	
	11/14/2003 10:40	71,592	1,236,127	1,307,719	32,268	5834	5.53	
	11/17/2003 11:46	96,472	1,236,127	1,332,599	24,880	4386	5.67	
	11/21/2003 8:30	128,224	1,236,127	1,364,351	31,752	5564	5.71	
	11/24/2003 10:35	153,633	1,236,127	1,389,760	25,409	4445	5.72	
	12/1/2003 10:10	211,822	1,236,127	1,447,949	58,189	10055	5.79	
	12/3/2003 15:50	230,306	1,236,127	1,466,433	18,484	3220	5.74	
	12/5/2003 17:30	247,579	1,236,127	1,483,706	17,273	2980	5.80	
	12/8/2003 9:50	269,827	1,236,127	1,505,954	22,248	3860	5.76	
	12/10/2003 12:43	287,282	1,236,127	1,523,409	17,455	3053	5.72	
	12/12/2003 10:26	303,074	1,236,127	1,539,201	15,792	2743	5.76	
	12/15/2003 11:00	328,320	1,236,127	1,564,447	25,246	4354	5.80	
	12/19/2003 9:22	360,846	1,236,127	1,596,973	32,526	5662	5.74	
	12/22/2003 13:22	387,632	1,236,127	1,623,759	26,786	4560	5.87	
	12/29/2003 11:08	445,306	1,236,127	1,681,433	57,674	9946	5.80	
	1/5/2004 11:55	504,238	1,236,127	1,740,365	58,932	10127	5.82	
	1/9/2004 11:55	538,045	1,236,127	1,774,172	33,807	5760	5.87	
	1/12/2004 13:15	564,396	1,236,127	1,800,523	26,351	4400	5.99	
	1/15/2004 11:25	588,905	1,236,127	1,825,032	24,509	4210	5.82	
	1/16/2004 11:20							no reading (road conditions)
	1/23/2004 11:45	657,100	1,236,127	1,893,227	68,195	11540	5.91	used historical data
	1/26/2004 11:00	683,007	1,236,127	1,919,134	94,102	15815	5.95	
	1/30/2004 8:46	716,396	1,236,127	1,952,523	33,389	5626	5.93	
	2/2/2004 10:44	743,265	1,236,127	1,979,392	26,869	4438	6.05	
	2/6/2004 11:42	778,527	1,236,127	2,014,654	35,262	5818	6.06	
	2/9/2004 11:27	804,176	1,236,127	2,040,303	25,649	4305	5.96	
	2/13/2004 12:58	830,120	1,236,127	2,066,247	25,944	5851	4.43	
	2/20/2004 10:49	900,130	1,236,127	2,136,257	70,010	9951	7.04	
	2/23/2004 12:06	926,913	1,236,127	2,163,040	26,783	4397	6.09	
	2/27/2004 9:21	961,726	1,236,127	2,197,853	34,813	5595	6.22	
	3/1/2004 8:53	988,676	1,236,127	2,224,803	26,950	4292	6.28	
	3/5/2004 11:50	1,026,509	1,236,127	2,262,636	37,833	5937	6.37	
	3/8/2004 12:07	1,054,560	1,236,127	2,290,687	28,051	4337	6.47	
	3/12/2004 10:23	1,091,457	1,236,127	2,327,584	36,897	5656	6.52	
	3/15/2004 10:10	1,120,079	1,236,127	2,356,206	28,622	4307	6.65	
	3/19/2004 11:19	1,159,589	1,236,127	2,395,716	39,510	5829	6.78	
	3/24/2004 10:10	1,209,361	1,236,127	2,445,488	49,772	7131	6.98	
	3/30/2004 16:50	1,276,264	1,236,127	2,512,391	66,903	9040	7.40	
	avg						5.69	

Shiprock Floodplain Well Field Pumping Rates

well	date/time	reading cum vol (gal)	added vol prev meter	actual cum vol (gal)	delta vol (gal)	delta t (min)	avg gpm	
1077	8/29/2003 10:20	150,449		150,449				
	9/5/2003 8:00	154,454		154,454	4,005	9940	0.40	
	9/8/2003 10:53	156,295		156,295	1841	4493	0.41	
	9/11/2003 14:45	158,159		158,159	1864	4552	0.41	
	9/12/2003 0:00							no reading due to flooding
	9/15/2003 10:04	160,902		160,902	2743	5479	0.50	
	9/19/2003 8:22	164,024		164,024	3122	5658	0.55	
	9/22/2003 9:46	166,413		166,413	2389	4404	0.54	
	9/26/2003 9:25	169,390		169,390	2977	5739	0.52	
	9/29/2003 8:20	171,427		171,427	2037	4255	0.48	
	10/1/2003 18:10	173,050		173,050	1623	3470	0.47	
	10/6/2003 10:09	176,202		176,202	3152	6719	0.47	
	10/8/2003 17:50	177,889		177,889	1687	3341	0.50	
	10/10/2003 8:40	179,163		179,163	1274	2330	0.55	
	10/13/2003 9:25	181,522		181,522	2359	4365	0.54	
	10/15/2003 10:30	182,976		182,976	1454	2945	0.49	
	10/17/2003 17:30	184,628		184,628	1652	3300	0.50	
	10/20/2003 13:30	186,541		186,541	1913	4080	0.47	
	10/22/2003 10:45	187,950		187,950	1409	2715	0.52	
	10/24/2003 11:56	189,722		189,722	1772	2951	0.60	
	10/27/2003 9:55	192,291		192,291	2569	4199	0.61	
	10/30/2003 12:00	194,902		194,902	2611	4445	0.59	changed flow meter batteries
	10/31/2003 10:55	39	194,902	194,941	39	1375	0.03	inadvertantly shut off at times
	11/3/2003 9:51	39	194,902	194,941	0	4256	0.00	inadvertantly shut off at times
	11/5/2003 9:18	121	194,902	195,023	82	2847	0.03	inadvertantly shut off at times
	11/7/2003 18:49	1,728	194,902	196,630	1607	3451	0.47	
	11/10/2003 9:30	4,072	194,902	198,974	2344	3761	0.62	
	11/14/2003 10:30	7,173	194,902	202,075	3101	5820	0.53	
	11/17/2003 11:49	9,402	194,902	204,304	2229	4399	0.51	
	11/21/2003 8:10	12,185	194,902	207,087	2783	5541	0.50	
	11/24/2003 10:22	14,349	194,902	209,251	2164	4452	0.49	
	12/1/2003 9:55	19,142	194,902	214,044	4793	10053	0.48	
	12/3/2003 16:00	20,678	194,902	215,580	1536	3245	0.47	
	12/5/2003 17:34	22,335	194,902	217,237	1657	2974	0.56	
	12/8/2003 9:55	24,776	194,902	219,678	2441	3861	0.63	
	12/10/2003 12:46	26,682	194,902	221,584	1906	3051	0.62	
	12/12/2003 10:32	28,400	194,902	223,302	1718	2746	0.63	
	12/15/2003 11:00	29,984	194,902	224,886	1584	4348	0.36	
	12/19/2003 9:22	32,624	194,902	227,526	2640	5662	0.47	
	12/22/2003 13:15	34,787	194,902	229,689	2163	4553	0.48	
	12/29/2003 10:56	39,520	194,902	234,422	4733	9941	0.48	
	1/5/2004 11:40	44,402	194,902	239,304	4882	10124	0.48	
	1/9/2004 11:55	47,251	194,902	242,153	2849	5775	0.49	
	1/12/2004 13:10	49,477	194,902	244,379	2226	4395	0.51	
	1/15/2004 11:40	51,575	194,902	246,477	2098	4230	0.50	
	1/16/2004 11:20							no reading (road conditions)
	1/23/2004 11:45	57,500	194,902	252,402	5,925	11525	0.51	used historical data
	1/26/2004 10:56	59,669	194,902	254,571	8,094	15796	0.51	
	1/30/2004 8:50	62,568	194,902	257,470	2899	5634	0.51	
	2/2/2004 10:30	64,876	194,902	259,778	2308	4420	0.52	
	2/6/2004 11:30	67,902	194,902	262,804	3026	5820	0.52	
	2/9/2004 11:32	70,098	194,902	265,000	2196	4322	0.51	
	2/13/2004 13:02	73,212	194,902	268,114	3114	5850	0.53	
	2/20/2004 10:40	78,293	194,902	273,195	5081	9938	0.51	
	2/23/2004 12:09	80,612	194,902	275,514	2319	4409	0.53	
	2/27/2004 9:10	83,630	194,902	278,532	3018	5581	0.54	
	3/1/2004 8:53	85,964	194,902	280,866	2334	4303	0.54	
	3/5/2004 11:36	88,776	194,902	283,678	2812	5923	0.47	
	3/8/2004 11:55	91,244	194,902	286,146	2468	4339	0.57	
	3/12/2004 10:26	94,482	194,902	289,384	3238	5671	0.57	
	3/15/2004 10:00	96,969	194,902	291,871	2487	4294	0.58	
	3/19/2004 11:22	100,363	194,902	295,265	3394	5842	0.58	
	3/24/2004 10:12	104,597	194,902	299,499	4234	7130	0.59	
	3/30/2004 17:05	110,229	194,902	305,131	5632	9053	0.62	
	avg						0.49	