

February 8, 2010

**SUMMARY OF QUARTERLY
PERFORMANCE MONITORING FOR NORTHERN
AND SOUTHERN AREAS, NOVEMBER 2009**



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30th Anniversary
2009

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**Summary of Quarterly Performance Monitoring for
Northern and Southern Areas
Apache Powder Superfund Site
Cochise County, Arizona**

November 2009

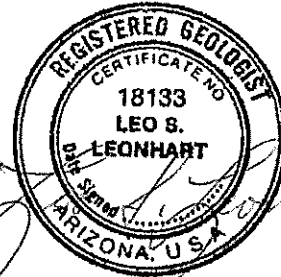
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FOURTH QUARTER 2009
SUMMARY OF QUARTERLY PERFORMANCE MONITORING
NORTHERN AND SOUTHERN AREAS
APACHE POWDER SUPERFUND SITE

INTRODUCTION

This report summarizes the results of the fourth quarter 2009 monitoring activities performed on November 13 and November 16 through 17, 2009, at the Apache Powder Superfund Site (the Site) in Cochise County, Arizona. This work involved water level and water quality performance monitoring performed in accordance with the October 3, 1994, Record of Decision (ROD) and December 29, 1994, Unilateral Administrative Order (UAO) issued by the U.S. Environmental Protection Agency (EPA) pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and subsequent amendments and explanations of significant differences (ESDs) to the ROD (EPA, 1994a and b; 1997, 2000, 2005, 2008). Work was performed according to procedures outlined in approved performance monitoring plans (PMPs) for the Northern and Southern Areas of the Site and the Quality Assurance Project Plan (QAPP) (Hargis + Associates, Inc [H+A], 2007b and 2009a and c).

The November 2009 quarterly monitoring rounds included measurement of groundwater levels in perched zone monitor wells and piezometers, shallow aquifer monitor wells, Molinos Creek Sub-Aquifer (MCA) monitor wells, and selected shallow aquifer private wells, according to the monitoring schedules in the PMPs (Figure 1). Where sufficient formation water was encountered, groundwater samples were collected for analysis of chemicals of concern (COCs) and other selected quality parameters (Tables 1 through 4; Figures 1 through 35). Water samples were also collected at monitoring locations in the San Pedro River for analysis of COCs and other selected quality parameters. A summary of water quality monitoring locations and analyses performed during the November 2009 performance monitoring rounds is included (Table 1). Further discussion of the results is provided in the following sections.

GROUNDWATER LEVEL AND STREAM DISCHARGE MEASUREMENTS

Groundwater and surface water levels were measured across the PMP Network (Figure 1). The following sections report on the results of those measurements in the perched zone; the MCA and Shallow Aquifer portions of the Southern Area and the Northern Area Remediation System (NARS); and Monitored Natural Attenuation (MNA) areas of the Northern Area. Surface water discharge was also measured in the San Pedro River.

GROUNDWATER LEVELS

On November 13, 2009, static water levels were measured in three perched zone piezometers, three perched zone monitor wells, 26 shallow aquifer monitor wells, shallow aquifer extraction well SEW-1, and 11 shallow aquifer private wells (Figure 1). Across the network, results for the November 2009 water level monitoring of perched zone piezometers, monitor wells, shallow aquifer monitor wells, and private wells showed a decrease in the water levels that ranged from 0.08 feet to 2.11 feet as compared with the August 2009 data. A decrease in water levels was observed in the MCA during the period from August 2009 to November 2009. According to historical trends, water level decreases are typical in MCA wells in November (Figures 6, 7, and 8). The results for the November 2009 water level monitoring of perched zone piezometers, monitor wells, shallow aquifer monitor wells and private wells are summarized (Tables 2 and 3). Water level hydrographs are provided (Figures 3 through 19). Historical trends indicate that seasonal variations are typical of the shallow aquifer.

Of note, perched zone piezometer P-03 showed a 0.50 feet decrease in water level from August 2009 to November 2009. Perched zone piezometer P-01 also showed a decrease in water level of 0.54 feet from August 2009 to November 2009 (Figure 3). The water levels in the piezometers appear to have stabilized over the past several quarters and perched zone piezometer P-10 and monitor well MW-29 have remained dry (Table 2; Figure 4). This is firm evidence that there continues to be no drainage from the perched zone into the MCA.

SAN PEDRO RIVER

The San Pedro River was flowing at surface water stations SW-03, and SW-04, during the November 2009 monitoring rounds. Surface water discharge was measured at each station using a Marsh Birney flow meter. Surface water discharge was less than 1 cubic foot per second (cfs) at SW-03 and SW-04. Historical trends indicate that surface water flow decreases are typical at the site during the fall quarter due to decreased run-off and increased evapotranspiration. Surface water stations SW-12, SW-13, and SW-14 were dry during the November quarterly sampling event.

Water Quality

Groundwater and surface water samples were collected across the PMP network for analysis of COCs and other selected water quality parameters. The following sections report on the results of those sampling and analysis findings in the Perched Zone; the MCA and Shallow Aquifer portions of the Southern Area; the NARS and MNA Management Zone of the Northern Area; and the San Pedro River (Figure 2).

SOUTHERN AREA

The Southern Area comprises three different areas that are monitored as part of the Southern Area PMP. These include the Perched Zone, MCA, and the Shallow Aquifer. Contamination comprising both nitrate as nitrogen (nitrate-N) and perchlorate is present only in the first two areas (Figure 2).

Perched Zone

November 2009 groundwater samples were collected at perched zone piezometer P-03 (Table 4). The groundwater samples were analyzed for nitrate-N by EPA Method 300.0, and perchlorate by EPA Method 314. All samples were collected and analyzed in accordance with procedures specified in the Southern Area PMP and the QAPP. Results of the November 2009 groundwater sampling of perched zone piezometers and monitor wells are summarized (Table 4). A time-series graph of historical water quality at this location is provided (Figure 20).

Water quality analyses for the piezometer P-03 water samples showed an increase in the concentration of nitrate-N from 6,800 milligrams per liter (mg/l) in August 2009 to 7,300 mg/l in November 2009 (Figure 20). Perchlorate analyses for the piezometer P-03 water samples showed no change from 570 micrograms per liter ($\mu\text{g/l}$) in August 2009 to 570 $\mu\text{g/l}$ in November 2009.

Perched zone piezometers P-02, -04, -05, -06, -07, -08, -09, -10, and -11, and perched zone monitor wells MW-02, -03, -04, -07, -15, -23, -28, -29, -30, -31, and -32 were not sampled because they were either dry or the residual water in the wells was insufficient to collect representative samples.

Perched Zone Remedy Performance

During the fourth quarter, ANP continued to extract and treat perched groundwater from perched zone piezometer P-03. A total of 2,640 gallons of perched groundwater was extracted from P-03. This corresponds to approximately 153 pounds of nitrate-N and 0.012 pounds of perchlorate removed and treated from the perched zone groundwater. Perched zone groundwater will continue to be extracted and treated during the first quarter of 2010.

MCA

November 2009 groundwater samples were collected at monitor wells MW-21, -24 and -39. All samples were collected and analyzed in accordance with procedures specified in the Southern Area PMP and the QAPP. The groundwater samples were analyzed for nitrate-N by EPA Method 300.0, perchlorate by EPA Method 314. MNA parameters were also collected at the MCA. The MNA parameters included the following: Alkalinity by EPA Method SM2320B, and Total Dissolved Solids by EPA Method SM2540C. Dissolved Iron, Dissolved Oxygen, and Oxidation Reduction Potential were collected using the field meter. Results of the November 2009 groundwater sampling of monitor wells are summarized (Table 4). Time-series graphs of historical water quality at these locations are provided (Figures 21 and 22).

Results of the November 2009 monitoring of MCA monitor well MW-39 showed no change in the concentration of nitrate-N from 120 mg/l in August 2009 to 120 mg/l in November 2009 (Figure 22). Perchlorate concentrations at MW-39 decreased from 120 $\mu\text{g/l}$ in August 2009 to 110 $\mu\text{g/l}$ in November 2009. Monitor well MW-21 showed an increase in the concentration of

nitrate-N from 2,600 mg/l in August 2009 to 2,700 mg/l in November 2009. Perchlorate concentrations at monitor well MW-21 showed no change from 290 µg/l in August 2009 to 290 µg/l in November 2009 (Figure 21). Monitor well MW-24 showed a decrease the concentration of nitrate-N from 1.4 mg/l in May 2009 to 1.3 mg/l in November 2009. Perchlorate concentrations at monitor well MW-24 showed a decrease in the concentration from 3.9 µg/l in May 2009 to 2.3 µg/l in November 2009 (Figure 22).

Shallow Aquifer (Southern Area)

No groundwater samples were collected from shallow aquifer monitor wells during the fourth quarter. The shallow aquifer monitor wells will continue to be sampled on a semi-annual basis during the first and third quarters during 2010 and water levels will continue to be checked on a quarterly basis.

NORTHERN AREA SHALLOW AQUIFER

The Northern Area comprises two different areas that are monitored as part of the Northern Area PMP (Figure 2). These include the NARS and the MNA Management Zone. The NARS includes the area within the capture envelope of extraction well SEW-1 and is situated in the southern portion of the Northern Area, mostly to the west of the San Pedro River. The MNA management zone is generally north of the NARS, extending toward the northern end of the St. David basin. The only COC present in the Northern Area is nitrate-N.

Northern Area Remediation System (NARS)

May 2009 groundwater samples were collected at shallow aquifer monitor wells: MW-08, -13, -17, -18, -19, -35, and -36 (Table 4). These wells are located within the SEW-1 capture zone. These groundwater samples were analyzed for nitrate-N by EPA Method 300.0. All samples were collected in accordance with procedures specified in the Northern Area PMP and the QAPP. Results of the November 2009 groundwater sampling of monitor wells are summarized (Table 4). Time-series graphs of historical water quality at these locations are provided (Figures 23 through 27).

The analytical results showed an increase in the concentration of nitrate-N at shallow aquifer monitor well MW-36, from 200 mg/l in August 2009 to 310 mg/l in November 2009 (Figure 27). There was also an increase in the concentration of nitrate-N at shallow aquifer monitor well MW-35, from 30 mg/l in August 2009 to 63 mg/l in November 2009 (Figure 26). The analytical results also showed a slight increase in the concentration of nitrate-N in monitor wells MW-08 and MW-18, and a slight decrease in the concentration at monitor wells MW-13 and MW-17. The concentration of nitrate-N at monitor well MW-19 remained the same from the third to the fourth quarter. Changes in concentrations observed at monitor well MW-36 are believed to be due to the hydraulic influence of extraction well SEW-1. The movement of upgradient water past the monitor well has historically caused fluctuations in the nitrate-N concentrations detected in samples collected during the quarterly monitoring rounds. Comparatively, static nitrate-N concentrations detected in the remaining monitor wells is probably indicative of relatively stable influence of water upgradient from extraction well SEW-1, where concentrations of extracted water decreased significantly in 2009 and have now apparently stabilized. The chemical quality of water influent to this extraction well is most likely a blend of contaminated water in the upgradient portion of the shallow aquifer coming from the west side of the San Pedro River and uncontaminated water in the upgradient portion of the shallow aquifer coming from the east side of the San Pedro River.

NARS Remedy Performance

During the fourth quarter, ANP continued to extract and treat shallow aquifer groundwater from extraction well SEW-1. A total of 16,042,870 gallons of shallow aquifer groundwater was extracted from SEW-1. This corresponds to approximately 7,329 pounds of nitrate-N removed and treated from the shallow aquifer groundwater. Shallow aquifer groundwater will continue to be extracted and treated during the first quarter of 2010.

MNA Management Zone (Northern Area)

Performance in the MNA Management Zone in the Northern Area is monitored across a network of dedicated monitor wells and shallow aquifer private wells (Figure 2).

Monitor Wells in the MNA Management Zone

November 2009 groundwater samples were collected at shallow aquifer monitor wells: MW-20, -40, -41A, -41B and -42 (Table 4). A groundwater sample could not be collected at monitor well MW-38 during the fourth quarter. The private land owner could not be contacted prior to the sampling event to provide access to the property. Arizona Department of Environmental Quality (ADEQ) sent the private land owner a letter (dated January 12, 2010) requesting that permission be provided to access the property for the purpose of sampling MW-38. The letter referenced the access agreement between the private land owner and ANP (dated April 9, 2005).

Groundwater samples were analyzed for nitrate-N by EPA Method 300.0. MNA Parameters were also collected at monitor wells MW-40, MW-41B, and MW-42. The MNA parameters included the following: Alkalinity by EPA Method SM2320B, Total Dissolved Solids by EPA Method SM2540C, Dissolved Manganese by EPA method 200.7, and Sulfate by EPA method 300.0. Dissolved Iron, Dissolved Oxygen, and Oxidation Reduction Potential were collected using the field meter. All samples were collected in accordance with procedures specified in the Northern Area PMP and the QAPP. Results of the November 2009 groundwater sampling of monitor wells are summarized (Table 4). Time-series graphs of historical water quality at these locations are provided (Figures 28 through 30).

The analytical results showed no significant change in the concentration of nitrate-N in monitor wells MW-20, -40, -41A -41B, and -42. The residual concentrations of nitrate-N in these wells are generally near or below the standard for nitrate-N cleanup of 10 mg/l. Thus, the rate of change between quarters is only slight.

Private Wells in the MNA Management Zone

Fourth quarter 2009 groundwater samples were scheduled for collection at shallow aquifer private wells D(17-20)25bad (Spears), D(17-20)36aad1 (Jacobs), and D(17-20)23acd (Levy/Drow) (Table 4; Figures 31 and 32). Groundwater samples were analyzed for nitrate-N by EPA Method 300.0. MNA Parameters were also collected at private wells D(17-20)25bad (Spears) and D(17-20)23acd (Levy/Drow). The MNA parameters included the following: Alkalinity by EPA Method SM2320B, Total Dissolved Solids by EPA Method SM2540C, Dissolved Manganese by EPA method 200.7, and Sulfate by EPA method 300.0. Dissolved

Iron, Dissolved Oxygen, and Oxidation Reduction Potential were collected using the field meter. All of the samples were collected and analyzed in accordance with procedures specified in the Northern Area PMP and the QAPP. Results of the November 2009 quarterly groundwater sampling of private wells are summarized (Table 4). Time series graphs of historical water quality at these locations are provided.

The analytical results indicated no significant change in the concentration of nitrate-N at the shallow aquifer private wells from August 2009 to November 2009. In general, the results of this sampling round of private wells are consistent with conclusions drawn earlier for the monitor wells in the MNA Management Zone. Concentrations of nitrate-N are near or below the standard for nitrate-N cleanup of 10 mg/l. Thus, the rate of change between quarters is only slight.

SAN PEDRO RIVER WATER QUALITY

Field personnel performed sampling of surface water in the San Pedro River at stations SW-03, and SW-04 on November 17, 2009. All samples were analyzed for nitrate-N by EPA Method 300.0. All samples were collected and analyzed in accordance with procedures specified in the respective PMPs and the QAPP. Time-series graphs of historical water quality at surface water monitoring locations are provided (Figures 33 through 35).

The results indicated an increase in the concentration of nitrate-N at the surface water locations from August 2009 to November 2009. Generally, the nitrate-N is only detected at locations where the San Pedro River is a gaining stream or some distance downstream from such reaches. However, the influence of these groundwater discharges on San Pedro River water quality is also dependent on the magnitude of the runoff component of the stream at the time of sampling. The San Pedro River observed base flow conditions at Surface water locations SW-03 and SW-04. Perchlorate has not been detected in any surface water samples.

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TABLE 1
SUMMARY OF WATER QUALITY MONITORING LOCATIONS
AND ANALYSES PERFORMED NOVEMBER 2009

WELL IDENTIFIER	4TH QUARTER NOVEMBER 2009				
	DRY*	NO ₃ -N	ClO ₄	NH ₃ -N	MNA Parameters
P-03		X	X		
P-10	DRY*				
MW-01	NS				
MW-03	DRY*				
MW-06	NS				
MW-08		X			
MW-10		X		X	
MW-11	NS				
MW-13		X			
MW-14	NS				
MW-15	DRY*				
MW-17		X			
MW-18		X			
MW-19		X			
MW-20		X			
MW-21		X	X		X
MW-22	NS				
MW-23	UTM				
MW-24		X	X		X
MW-29	DRY*				
MW-33	NS				
MW-34	NS				
MW-35		X			
MW-36		X			
MW-38	NS				
MW-39		X	X		X
MW-40		X			X
MW-41A		X			
MW-41B		X			X
MW-42		X			X
D(17-20)25bad (Spears)		X			X
D(17-20)36aad1 (Jacobs)		X			
D(18-21)06bcb (Jones)	NS				
D(17-20)36caa2 (Hyder)	NS				
D(17-20)36cdb (Woolever)	NS				
D(17-20)36caa (Gaynor)	NS				
D(18-20)01aad (McRae)	NS				
D(17-20)24ccd (Kartchner)	NS				
D(17-20)23acd (Levy/Drow)		X			X

TABLE 1
 SUMMARY OF WATER QUALITY MONITORING LOCATIONS
 AND ANALYSES PERFORMED NOVEMBER 2009
 Page 2 of 2

WELL IDENTIFIER	4TH QUARTER NOVEMBER 2009				
	DRY*	NO ₃ -N	ClO ₄	NH ₃ -N	Common Ions
D(17-20)23ada (Dill)	NS				
D(17-20)36ddc (Morales)	NS				
D(17-20)36ddd (Higgenbotham)					
SW-03		X			
SW-04		X			
SW-12	NS				
SW-13	NS				
SW-14	NS				

FOOTNOTES:

ClO₄ = Perchlorate

DO = Dissolved Oxygen

DRY* = Dry or water level insufficient for sample collection

MNA Parameters SA= Alkalinity, Dissolved Fe, DO, ORP, TDS

MNA Parameters NA= Alkalinity, Dissolved Fe, DO, ORP, TDS, Dissolved Mn, Sulfate

NO₃-N = Nitrate as Nitrogen

NH₃-N = Ammonia as Nitrogen

NS = Not Sampled

ORP = Oxidation Reduction Potential

TDS = Total Dissolved Solids

UTM = Unable to Measure

TABLE 2
WATER LEVEL ELEVATION DATA

IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
SHALLOW AQUIFER PRIVATE WELLS				
D(17-20)23ada(Dill)	11/13/2009	3542.81	UTM	---
D(17-20)24ccd(Kartchner)	11/13/2009	3558.56	UTM	---
D(17-20)36aad1 (Jacobs)	11/13/2009	3581.34	25.32	3556.02
D(17-20)36aad3 (Acuña)	11/13/2009	3582.00	24.86	3557.14
D(17-20)36caa (Gaynor)	11/13/2009	3589.65	36	3553.65
D(17-20)36caa2(Hyder)	11/13/2009	3588.84	32.91	3555.93
D(17-20)36cad1 (McCann)	11/13/2009	3591.69	32.8	3558.89
D(17-20)36cdb (Woolever)	11/13/2009	3610.64	51.21	3559.43
D(17-20)36dad (Ohlde)	11/13/2009	3600.00	33.91	3566.09
D(17-20)36ddc (Morales)	11/13/2009	3590.60	29.87	3560.73
D(18-21)06ada (White)	11/13/2009	3626.00	38.59	3587.41
D(18-21)06bab (Alexander)	11/13/2009	3610.00	30.05	3579.95

(see page 6 for explanation of abbreviations)

TABLE 2 (continued)
WATER LEVEL ELEVATION DATA

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IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
SHALLOW AQUIFER PRIVATE WELLS				
D(18-21)06bcb (Jones)				
	11/13/2009	3612.80	UTM	---
D(18-21)06bcc2 (Wooten)				
	11/13/2009	3635.00	UTM	---
D(18-21)08bab (Tenopir)				
	11/13/2009	3625.00	23.97	3601.03
SHALLOW AQUIFER MONITOR WELLS				
MW-01				
	11/13/2009	3631.00	19.11	3611.89
MW-06				
	11/13/2009	3648.44	23.08	3625.36
MW-08				
	11/13/2009	3638.95	69.61	3569.34
MW-11				
	11/13/2009	3615.67	26.92	3588.75
MW-13				
	11/13/2009	3622.12	30	3592.12
MW-14				
	11/13/2009	3623.59	14.91	3608.68
MW-15				
	11/13/2009	3655.59	DRY	---
MW-17				
	11/13/2009	3624.57	55.31	3569.26

(see page 6 for explanation of abbreviations)

TABLE 2 (continued)
WATER LEVEL ELEVATION DATA

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IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
SHALLOW AQUIFER MONITOR WELLS				
MW-18	11/13/2009	3624.53	56.91	3567.62
MW-19	11/13/2009	3641.08	71.89	3569.19
MW-20	11/13/2009	3601.25	29.31	3571.94
MW-21	11/13/2009	3662.87	63.14	3599.73
MW-22	11/13/2009	3624.96	16.31	3608.65
MW-23	11/13/2009	3660.66	UTM	---
MW-24	11/13/2009	3624.50	26.61	3597.89
MW-25	11/13/2009	3621.01	21.21	3599.8
MW-33	11/13/2009	3623.69	20.61	3603.08
MW-34	11/13/2009	3614.00	26.71	3587.29
MW-35	11/13/2009	3596.16	11.61	3584.55
MW-36	11/13/2009	3609.52	24.51	3585.01

(see page 6 for explanation of abbreviations)

TABLE 2 (continued)
WATER LEVEL ELEVATION DATA

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IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
SHALLOW AQUIFER MONITOR WELLS				
MW-39	11/13/2009	3649.14	49.63	3599.51
MW-40	11/13/2009	3589.43	28.95	3560.48
MW-41A	11/13/2009	3574.93	20	3554.93
MW-41B	11/13/2009	3574.93	23.81	3551.12
MW-42	11/13/2009	3603.29	39.33	3563.96
PERCHED ZONE PIEZOMETERS				
P-01	11/13/2009	3688.93	24.48	3664.45
P-03	11/13/2009	3674.45	36.67	3637.78
P-10	11/13/2009	3669.12	DRY	---
PERCHED ZONE MONITOR WELLS				
MW-03	11/13/2009	3670.69	DRY	---
MW-04	11/13/2009	3685.20	DRY	---

(see page 6 for explanation of abbreviations)



TABLE 2 (continued)
WATER LEVEL ELEVATION DATA

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IDENTIFIER	DATE MEASURED	MEASURING POINT ELEVATION (feet msl)	DEPTH TO WATER (feet bmp)	WATER LEVEL ELEVATION (feet msl)
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PERCHED ZONE MONITOR WELLS

MW-29

	11/13/2009	3664.91	DRY	---
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TABLE 2 (continued)
WATER LEVEL ELEVATION DATA

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FOOTNOTES:

feet msl = feet above mean sea level

bmp = below measuring point

UTM = unable to measure

NM = not measured

RP = recently pumped

PWL = pumping water level



TABLE 3
SATURATED THICKNESS OF PERCHED ZONE

IDENTIFIER	DATE MEASURED	WATER LEVEL ELEVATION (feet msl)	ELEVATION OF SCREEN BOTTOM (feet msl)	SATURATED THICKNESS OF PERCHED ZONE (feet)
PERCHED ZONE PIEZOMETERS				
P-01	11/13/2009	3664.45	3662.23	2.22
P-03	11/13/2009	3637.78	3629.03	8.75
P-10	11/13/2009	DRY	3622.78	0.00
PERCHED ZONE MONITOR WELLS				
MW-03	11/13/2009	DRY	3636.88	0.00
MW-04	11/13/2009	DRY	3662.32	0.00

(see page 2 for explanation of abbreviations)



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TABLE 3 (continued)
SATURATED THICKNESS OF PERCHED ZONE

Page 2 of 2

FOOTNOTES:

feet msl = feet above mean sea level



TABLE 4
GROUNDWATER QUALITY DATA
(NITRATE AND PERCHLORATE)

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
SURFACE WATER				
SW-03				
	11/17/2009	10	NA	SPT
	11/17/2009	9.8	NA	ORG
SW-04				
	11/17/2009	9.8	NA	FD
	11/17/2009	9.8	NA	ORG
SHALLOW AQUIFER PRIVATE WELLS				
D(17-20)23acd(Drow)				
	12/15/2009	5.9	NA	ORG
D(17-20)25bad(Spears)				
	11/17/2009	4.6	NA	ORG
D(17-20)36aad1 (Jacobs)				
	11/17/2009	3.3	NA	ORG
SHALLOW AQUIFER MONITOR WELLS				
MW-08				
	11/16/2009	48	NA	ORG

(see page 5 for explanation of abbreviations)

TABLE 4 (continued)
GROUNDWATER QUALITY DATA

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IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
SHALLOW AQUIFER MONITOR WELLS				
MW-13				
	11/17/2009	23	NA	FD
	11/17/2009	24	NA	ORG
MW-17				
	11/16/2009	9.4	NA	SPT
	11/16/2009	8.9	NA	ORG
MW-18				
	11/16/2009	13	NA	ORG
MW-19				
	11/17/2009	16	NA	ORG
MW-20				
	11/17/2009	3.7	NA	ORG
MW-21				
	11/16/2009	2900	360 (E)	SPT
	11/16/2009	2700	290 (E)	ORG
MW-24				
	11/16/2009	1.3	2.3	ORG

(see page 5 for explanation of abbreviations)



TABLE 4 (continued)
GROUNDWATER QUALITY DATA
Page 3 of 5

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
SHALLOW AQUIFER MONITOR WELLS				
MW-24	11/16/2009	1.3	2.8	FD
MW-35	11/17/2009	63	NA	ORG
	11/17/2009	61	NA	FD
MW-36	11/17/2009	310	NA	ORG
MW-39	11/16/2009	120	110	ORG
MW-40	11/16/2009	2.7	NA	ORG
MW-41A	11/16/2009	2.6	NA	ORG
MW-41B	11/16/2009	5.5	NA	ORG
	11/16/2009	5.7 (E)	NA	SPT

(see page 5 for explanation of abbreviations)



TABLE 4 (continued)
GROUNDWATER QUALITY DATA
Page 4 of 5

IDENTIFIER	SAMPLE DATE	NITRATE-N (mg/l)	PERCHLORATE (µg/l)	SAMPLE TYPE
SHALLOW AQUIFER MONITOR WELLS				
MW-42	11/16/2009	7.8	NA	ORG
PERCHED ZONE PIEZOMETERS				
P-03	11/16/2009	7300	570	ORG
BLANKS				
Field Blank	11/16/2009	< 0.5	< 1	FB
	11/17/2009	< 0.5	NA	FB

(see page 5 for explanation of abbreviations)



TABLE 4 (continued)
GROUNDWATER QUALITY DATA
Page 5 of 5

FOOTNOTES:

- mg/l = Milligrams per liter
- Nitrate-N = Nitrate as Nitrogen
- µg/l = Micrograms
- NA = Not Analyzed
- < = Not detected, numerical value is less than the method detection limit
- CAS = Columbia Analytical Service (Primary Lab)
- TAA = Test America Analytical (Split Lab)
- ORG = Original sample
- FD = Field duplicate sample
- SPT = Split sample
- FB = Field blank
- E = Estimated
- HU = Unusable



TABLE 5
WATER QUALITY DATA
SOUTHERN AREA MONITORED NATURAL ATTENUATION

IDENTIFIER	SAMPLE DATE	ALKALINITY (mg/l)	ELECTRICAL CONDUCTIVITY (μ S/cm)	DISSOLVED OXYGEN (mg/l)	FERROUS IRON (mg/l)	ORP (MV)	pH (pH units)	TDS (mg/l)	SAMPLE TYPE
MW-21	11/16/2009	430	1920	0.91	2.04	137	6.23	20000	ORG
MW-23	11/17/2008				UTM				
MW-24	11/16/2009	220	629	0.00	1.36	58	7.49	430	ORG
MW-39	11/16/2009	240	2780	0.76	1.51	135	6.93	2200	ORG

FOOTNOTES:

- E = estimated
- mg/l = milligrams per liter
- μ S/cm = microsiemens per centimeter
- MV = millivolts
- ND = not detected
- ORP = oxidation reduction potential
- TDS = total dissolved solids
- field parameters = ORP, TDS, dissolved oxygen and ferrous Iron
- ORG = original sample, SPT = split sample
- pH= hydrogen ion potential
- UTM = unable to collect a sample



TABLE 6
WATER QUALITY DATA
NORTHERN AREA MONITORED NATURAL ATTENUATION

IDENTIFIER	SAMPLE DATE	ALKALINITY (mg/l)	DISSOLVED OXYGEN (mg/l)	ELECTRICAL CONDUCTIVITY (µS/cm)	FERROUS IRON (mg/l)	Mn (mg/l)	ORP (MV)	pH (pH units)	SULFATE (mg/l)	TDS (mg/l)	SAMPLE TYPE
MW-38											UTM
MW-40	11/16/2009	270	0.00	752	1.19	< 0.010	26.2	7.42	120	480	ORG
MW-41B	11/16/2009	290	0.00	915	1.89	< 0.010	47	7.24	180	610	ORG
MW-42	11/16/2009	160	0.86	1742	0.53	0.018	37.1	7.15	870	1700	ORG
D(17-20)25bad	11/17/2009	250	0.00	769	1.38	0.04	152	7.69	160	560	ORG
D(17-20)23acd	12/15/2009	280	3.53	1033	ND	0.39	13.3	7.19	220	710	ORG

FOOTNOTES:

mg/l = milligrams per liter

µS/cm = microsiemens per centimeter

MV = millivolts

Mn = manganese

ND = not detected

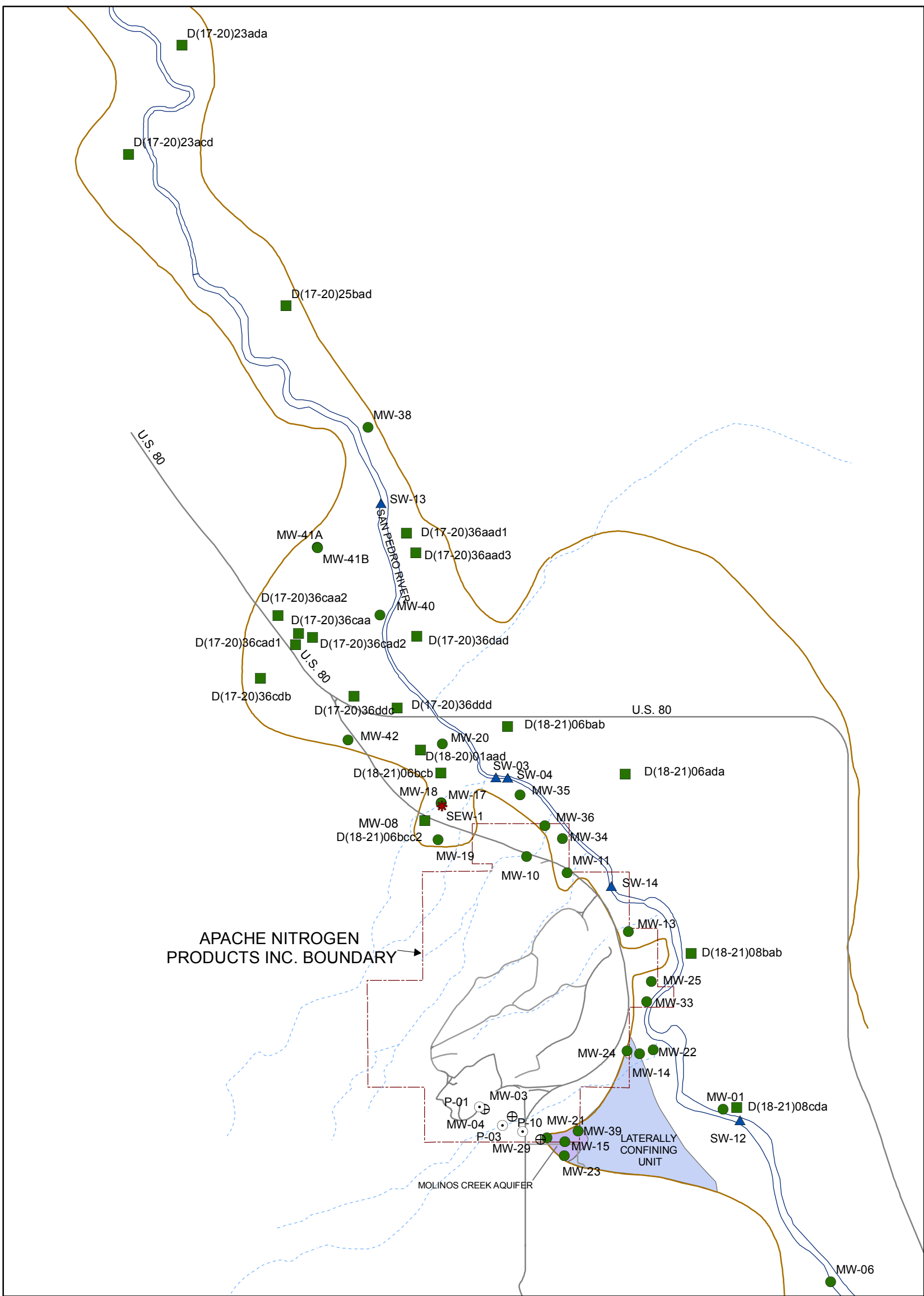
ORP = oxidation reduction potential

TDS = total dissolved solids

field parameters = ORP, pH, electrical conductivity, TDS, dissolved oxygen and ferrous Iron

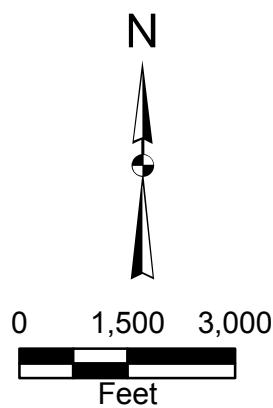
ORG = original sample, SPT = split sample


pH= hydrogen ion potential UTM = unable to collect a sample

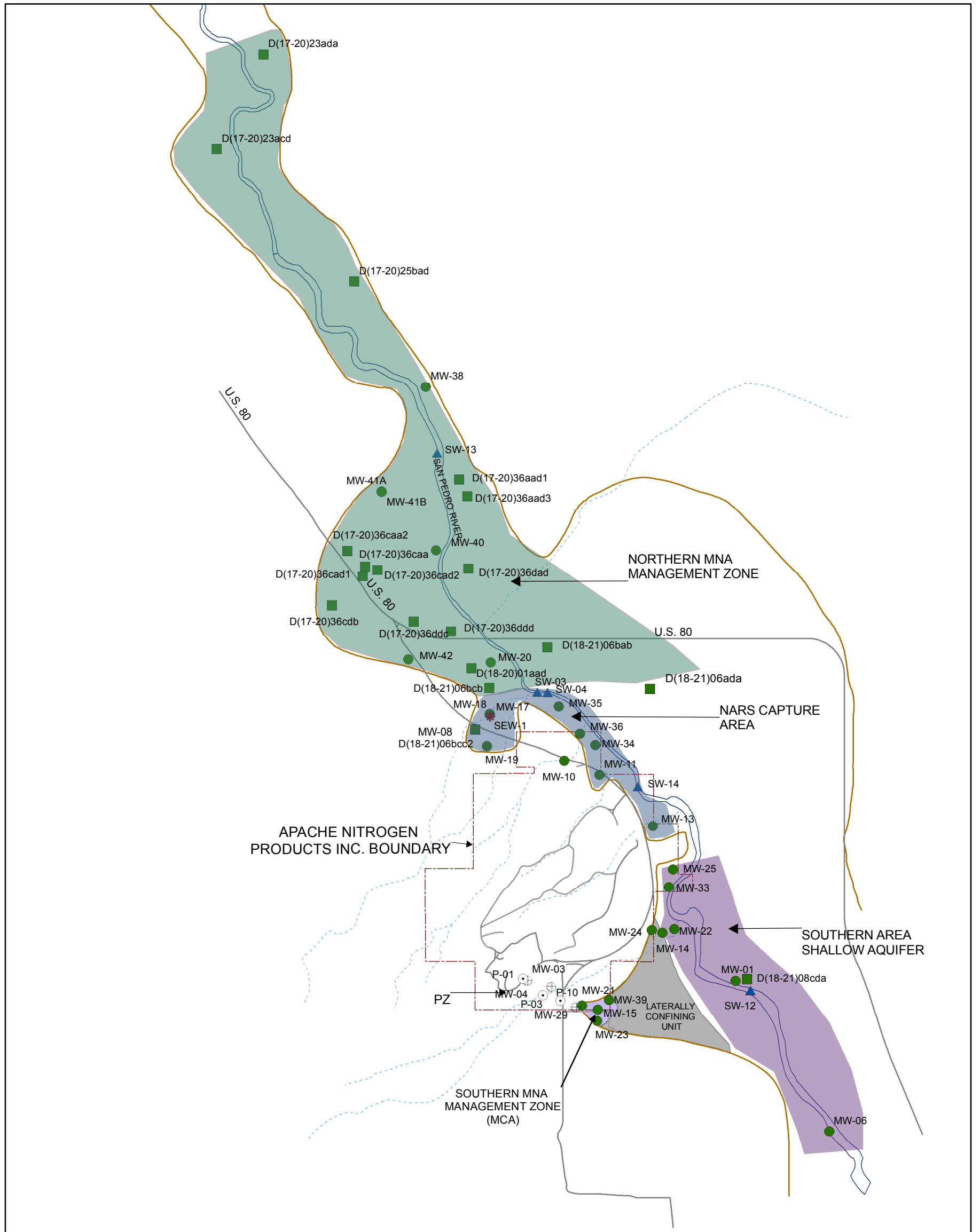


EXPLANATION

- SHALLOW AQUIFER PRIVATE WELL
- SHALLOW AQUIFER MONITOR WELL
- * SHALLOW AQUIFER EXTRACTION WELL
- ⊙ PERCHED ZONE PIEZOMETER
- ⊕ PERCHED MONITOR WELL
- ▲ SAN PEDRO RIVER SURFACE WATER MONITORING STATION
- EPHEMERAL STREAM
- APPROXIMATE BOUNDARY OF SHALLOW AQUIFER

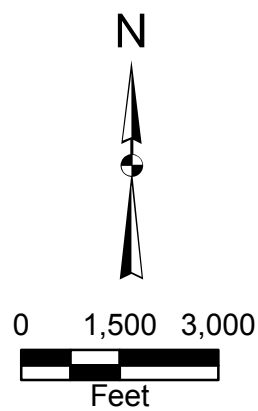



APACHE NITROGEN PRODUCTS, INC.	
BENSON, ARIZONA	
PERFORMANCE MONITORING NETWORK WELLS	
	10/09
FIGURE 1	
PREP BY BAS REV BY LSL RPT NO 130.24 ARC130.24 Q3 09	

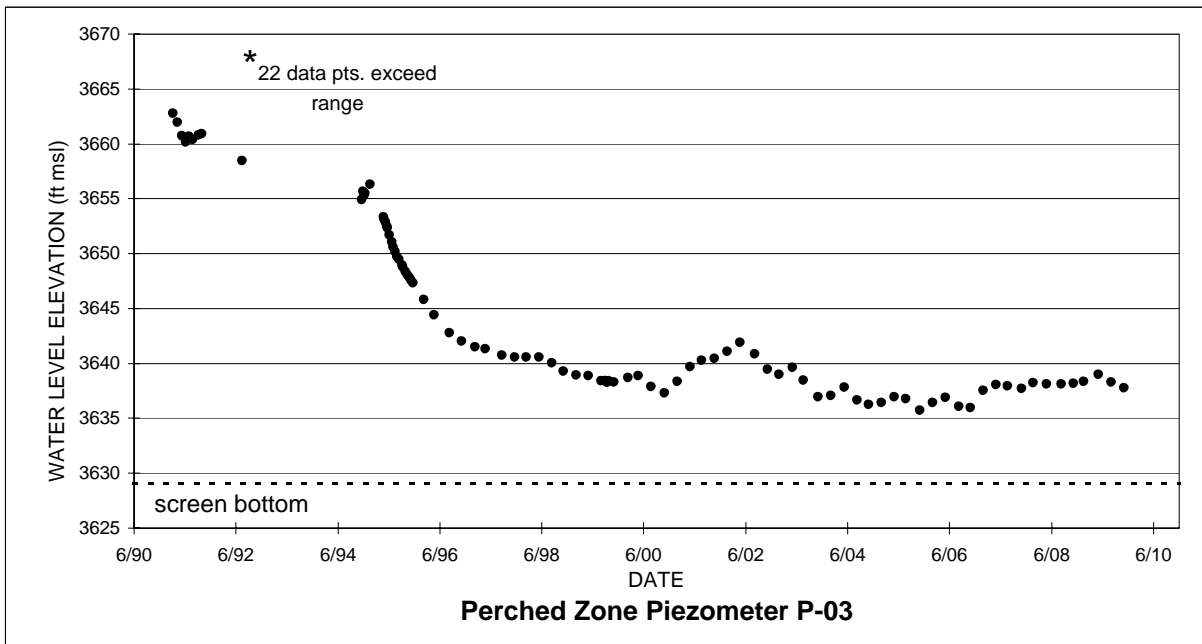
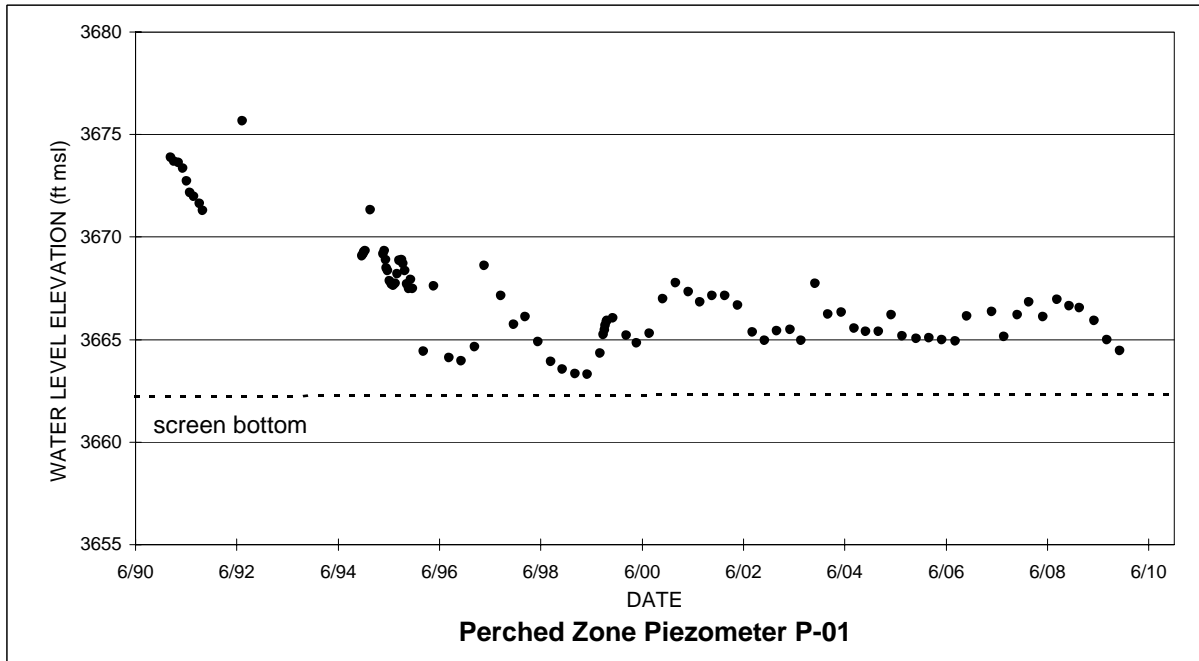


EXPLANATION

- SHALLOW AQUIFER PRIVATE WELL
- SHALLOW AQUIFER MONITOR WELL
- * SHALLOW AQUIFER EXTRACTION WELL
- ⊙ PERCHED ZONE PIEZOMETER
- ⊕ PERCHED MONITOR WELL
- ▲ SAN PEDRO RIVER SURFACE WATER MONITORING STATION
- EPHEMERAL STREAM
- ~ APPROXIMATE BOUNDARY OF SHALLOW AQUIFER

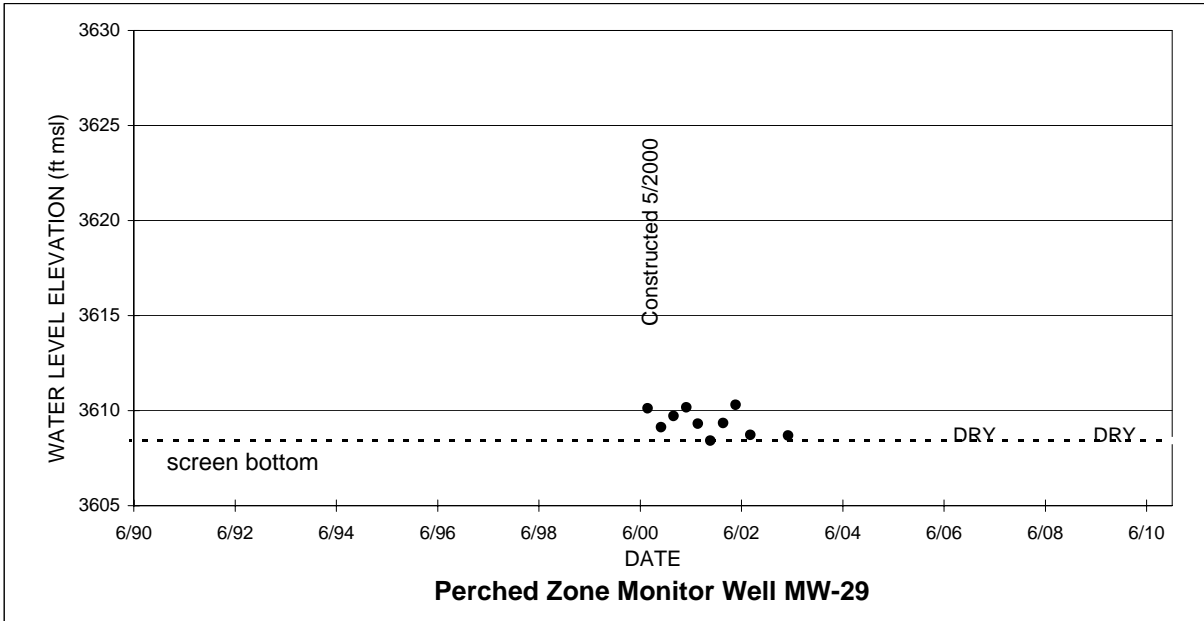
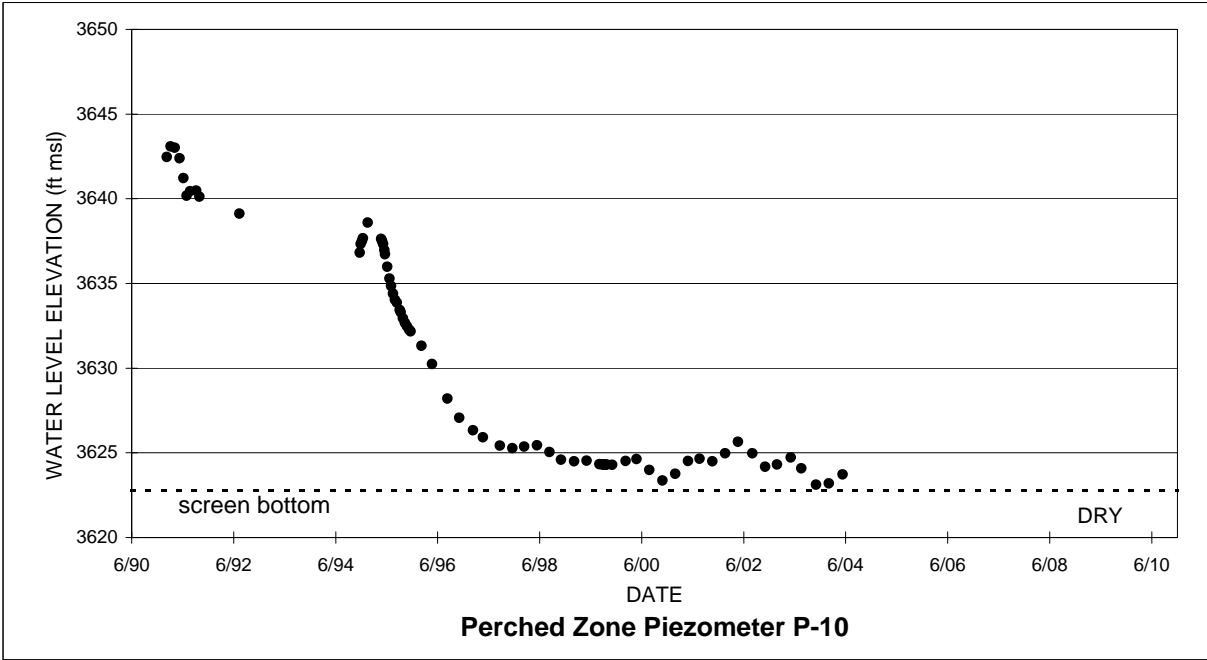


APACHE NITROGEN PRODUCTS, INC.	
BENSON, ARIZONA	
NORTHERN AND SOUTHERN MANAGEMENT AREAS	
	1/10
FIGURE 2	
PREP BY BAS	REV BY LSL RPT NO 130.24 ARC130.24 Q3 09



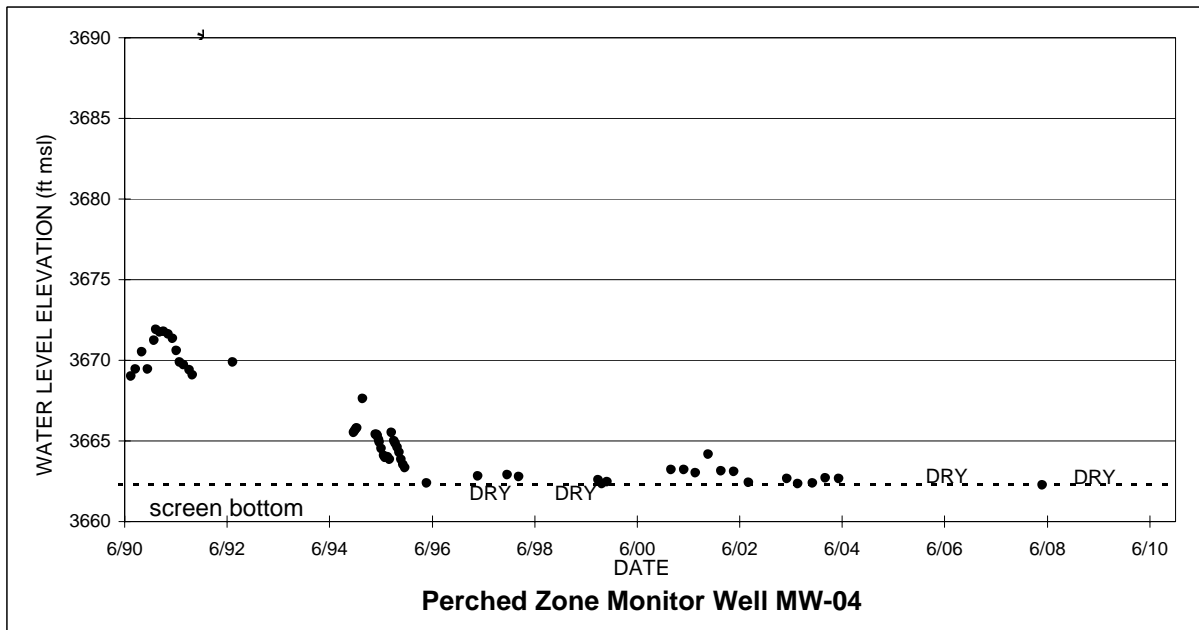
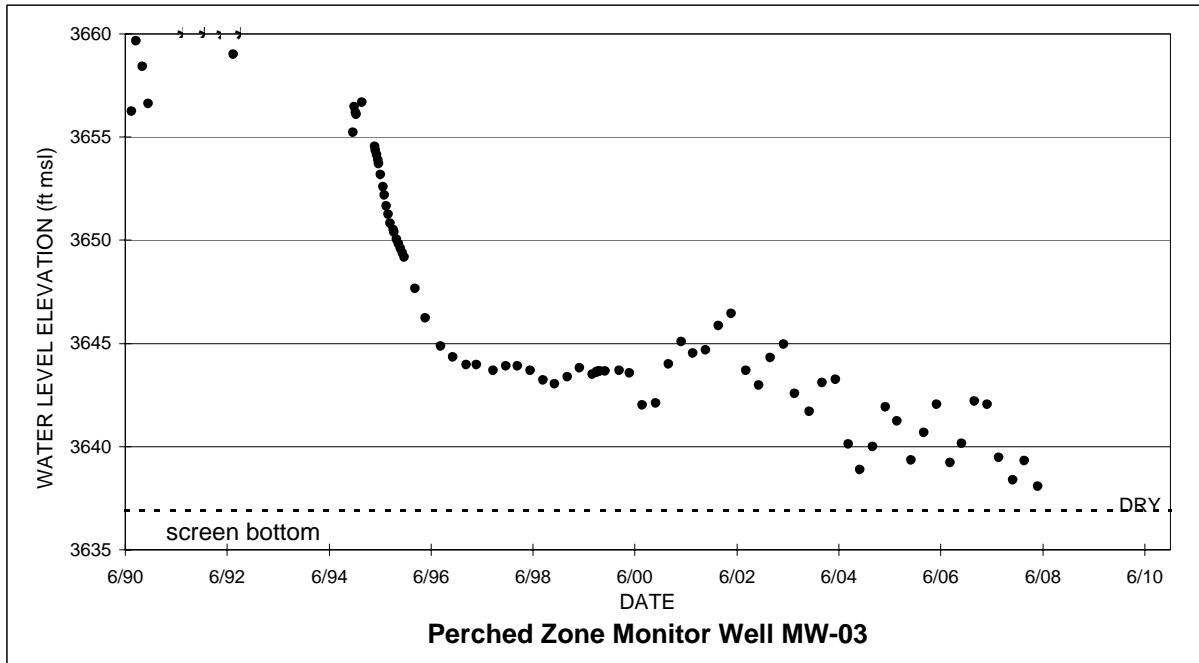
DRY = Water level is below bottom of screen;
No formation water is present
ft msl = Feet above mean sea level
PWL SEW-1= Pumping Water Level for Shallow Aquifer Extraction Well

FIGURE 3. WATER LEVEL HYDROGRAPHS FOR PERCHED ZONE PIEZOMETERS P-01, AND P-03



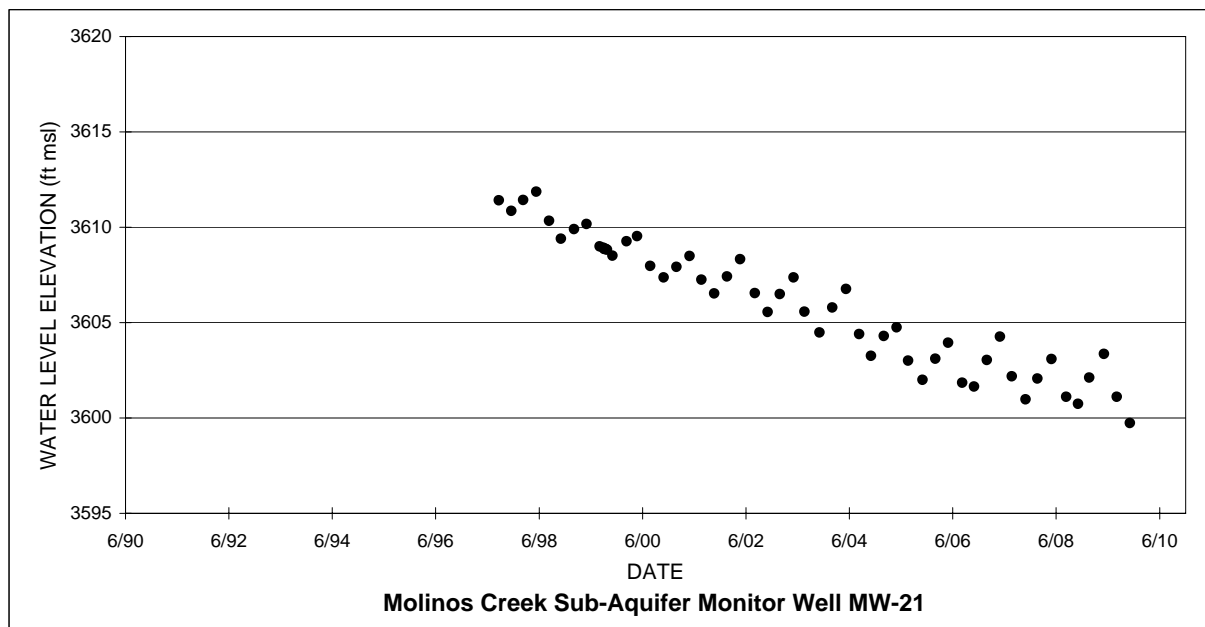
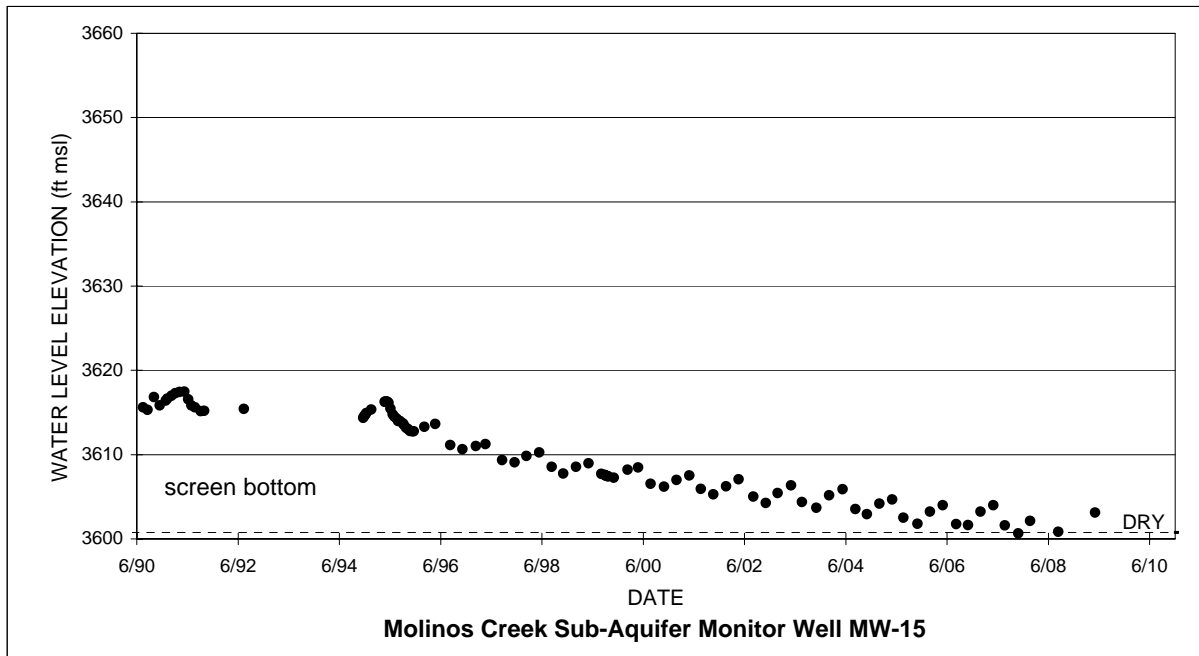
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 4. WATER LEVEL HYDROGRAPHS FOR PERCHED PIEZOMETER P-10 AND PERCHED MONITOR WELL MW-29



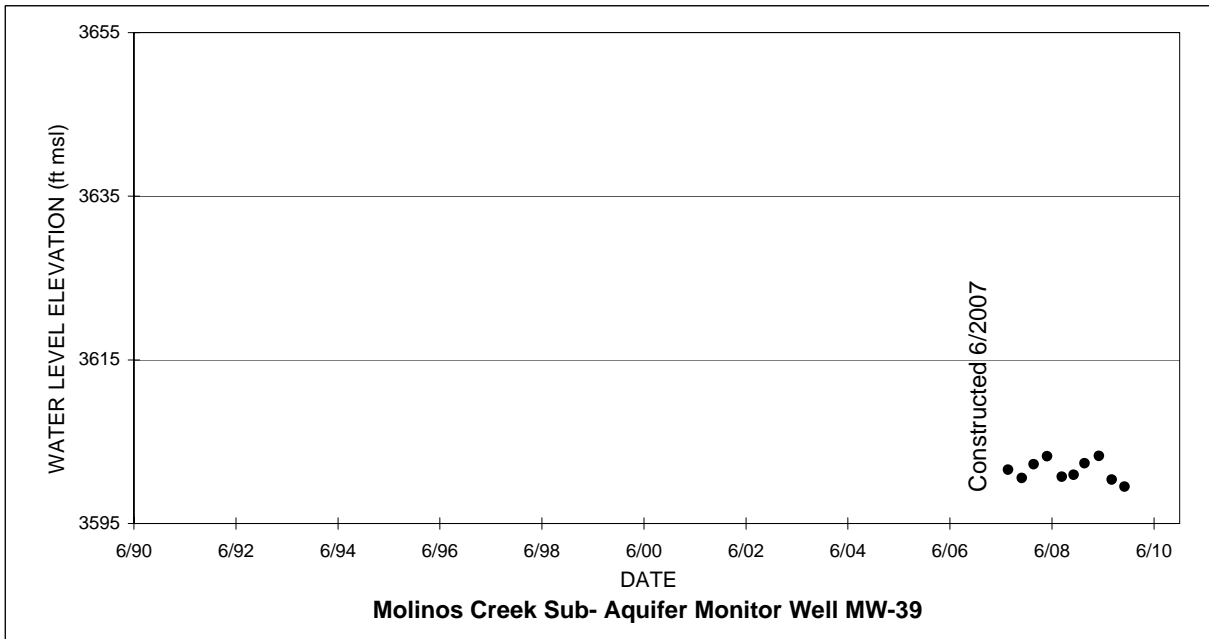
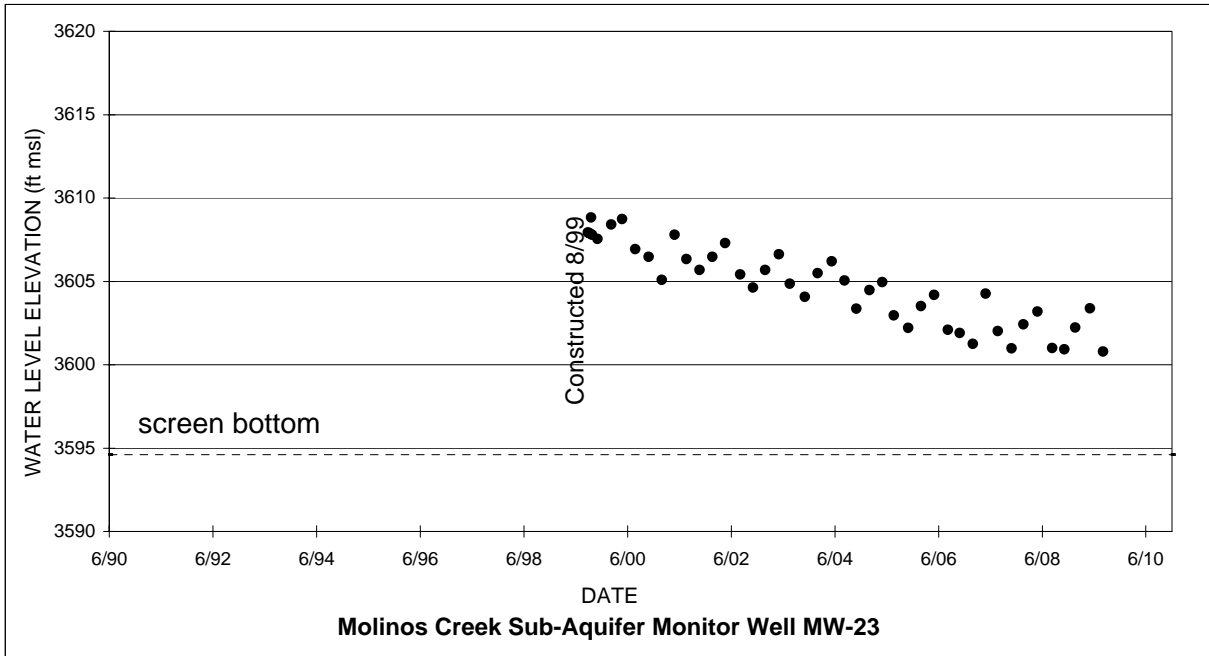
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 5. WATER LEVEL HYDROGRAPHS FOR PERCHED ZONE MONITOR WELLS MW-03, AND MW-04



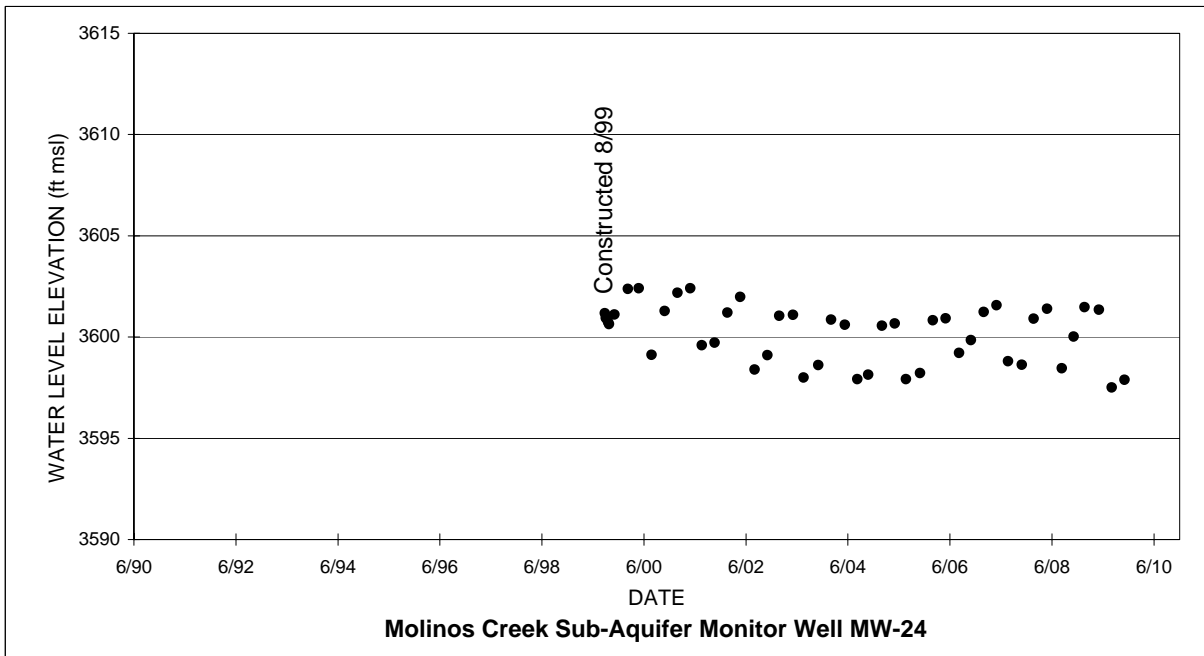
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 6. WATER LEVEL HYDROGRAPHS FOR MOLINOS CREEK MNA MANAGEMENT ZONE MONITOR WELLS MW-15 AND MW-21



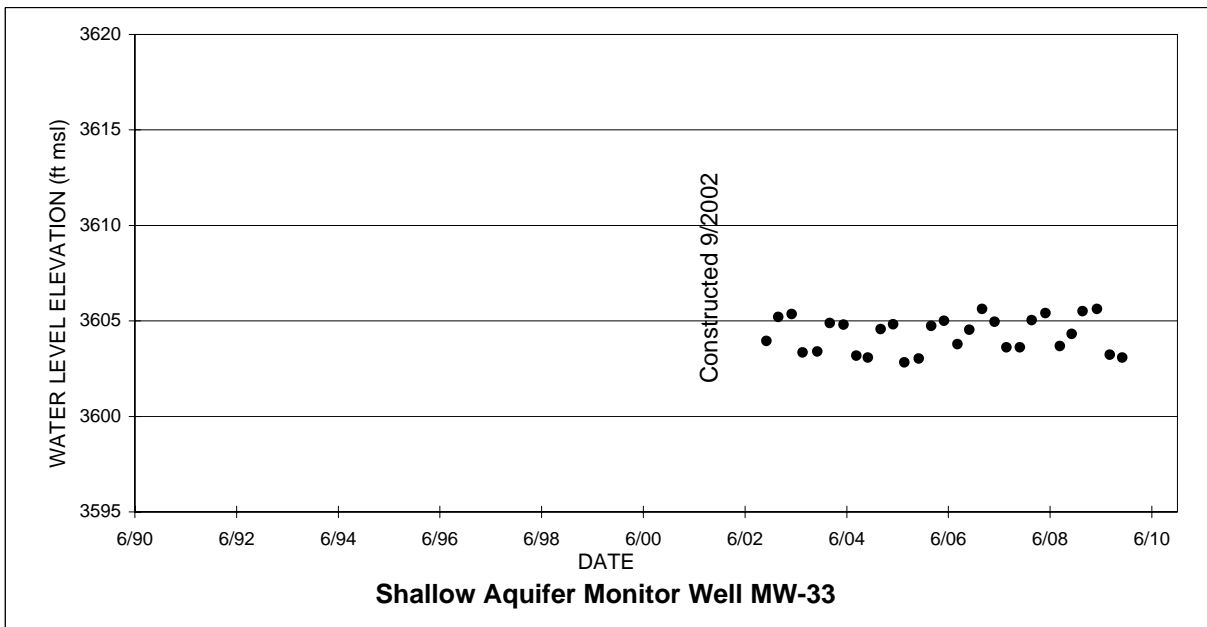
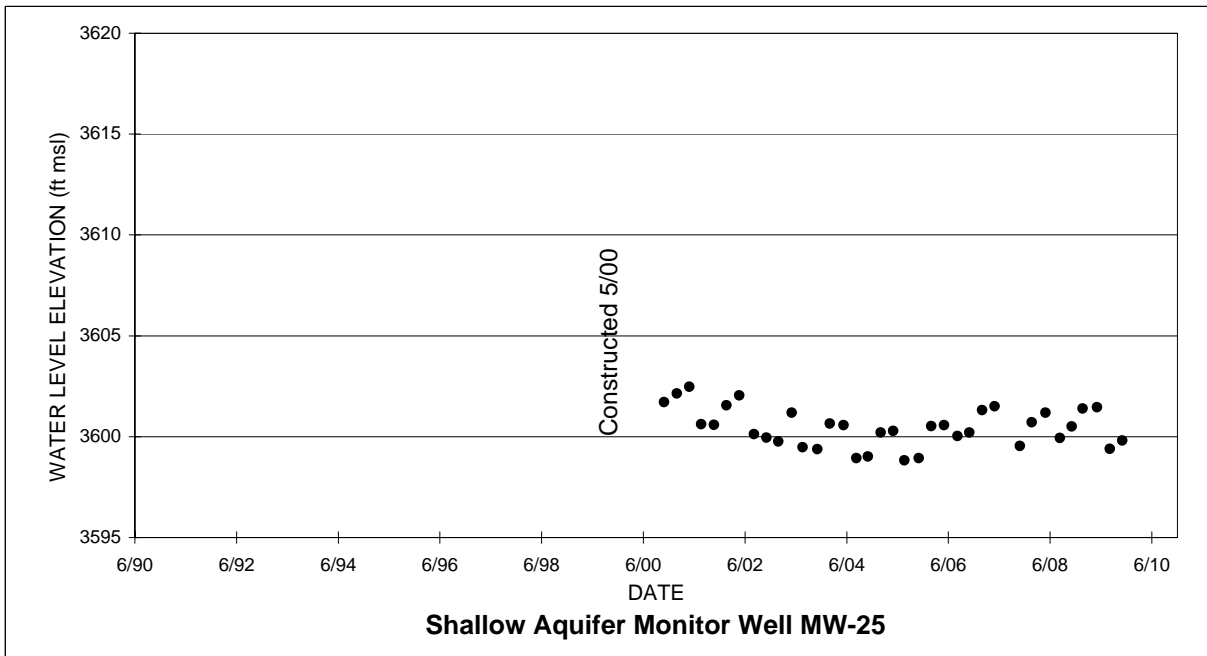
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 7. WATER LEVEL HYDROGRAPHS FOR MOLINOS CREEK MNA MANAGEMENT ZONE MONITOR WELLS MW-23 AND MW-39



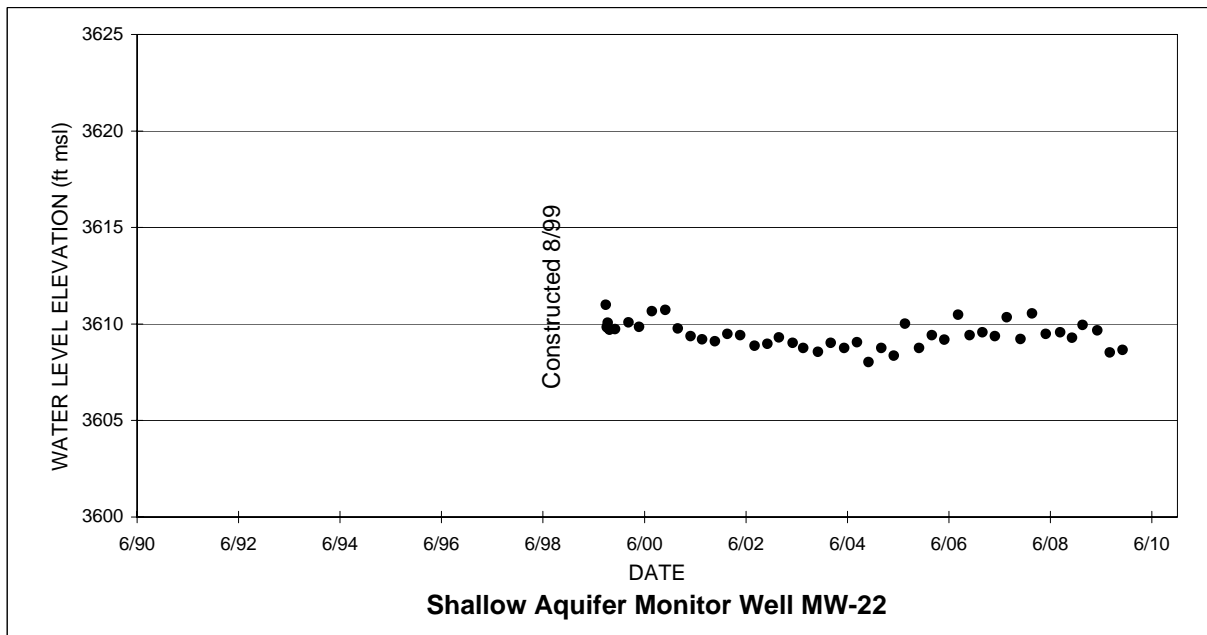
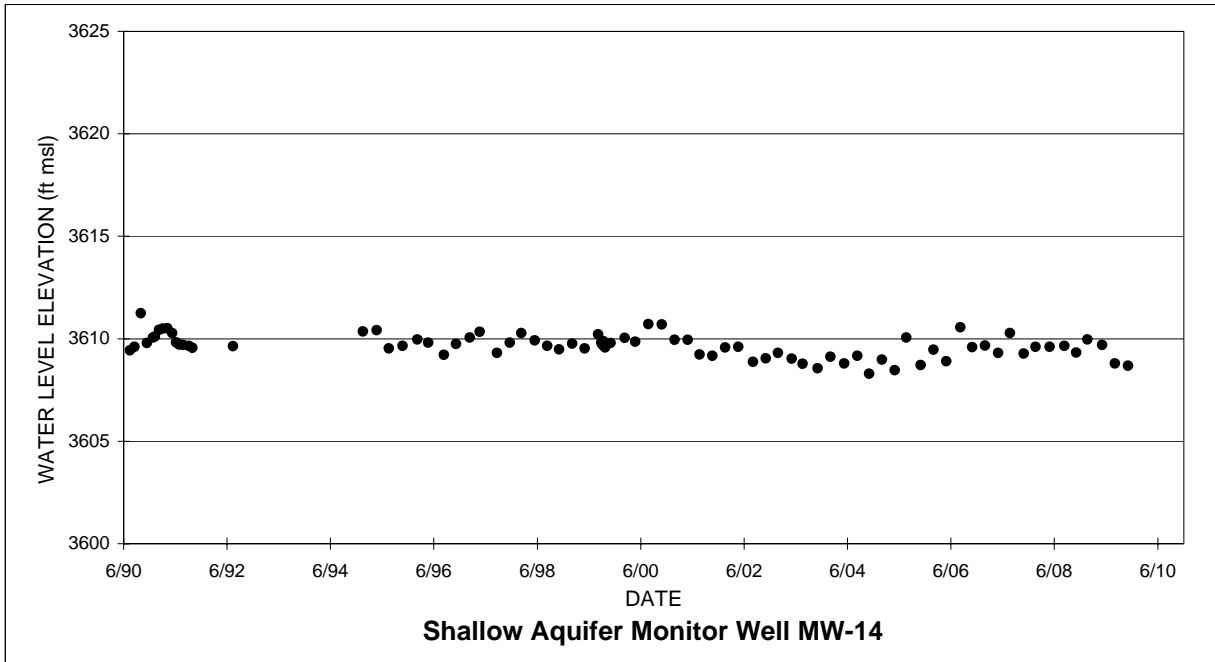
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 8. WATER LEVEL HYDROGRAPHS FOR MOLINOS CREEK MNA MANAGEMENT ZONE MONITOR WELL MW-24



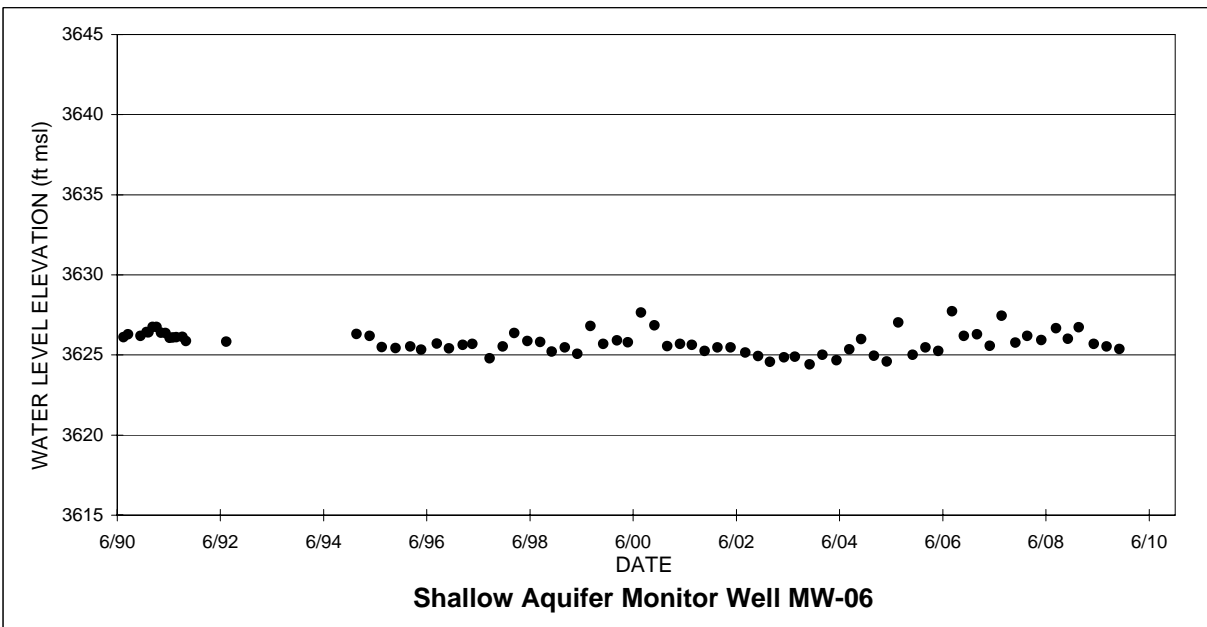
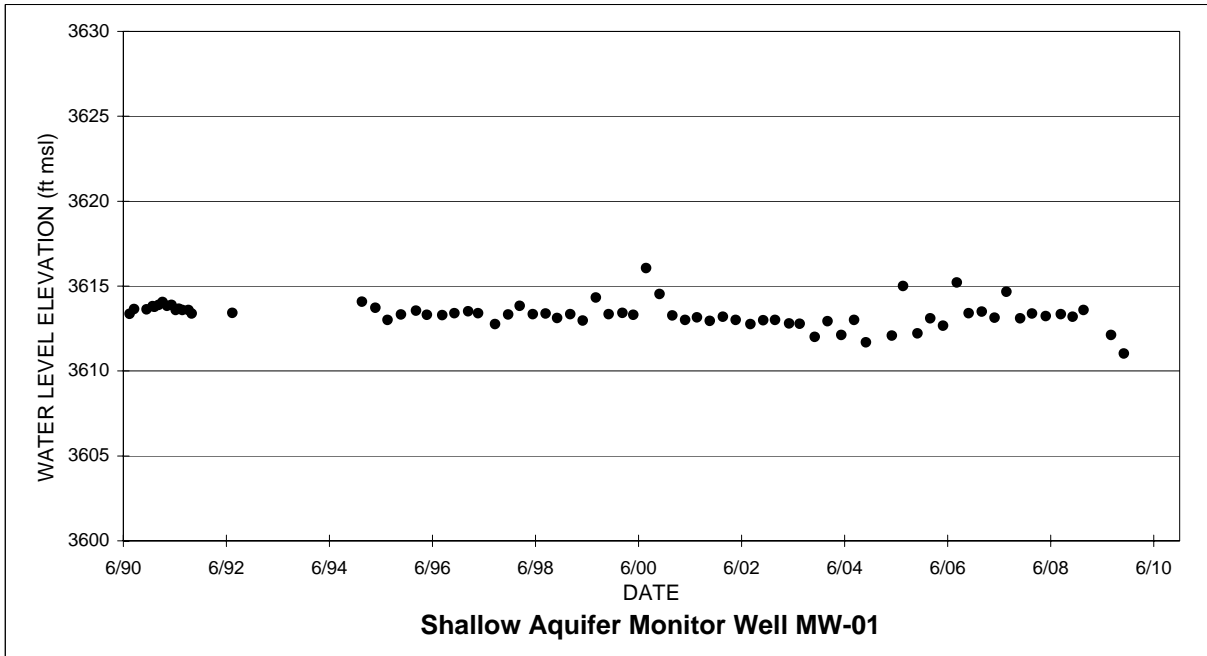
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 9. WATER LEVEL HYDROGRAPHS FOR SOUTHERN AREA MNA BUFFER ZONE MONITOR WELLS MW-25 AND MW-33



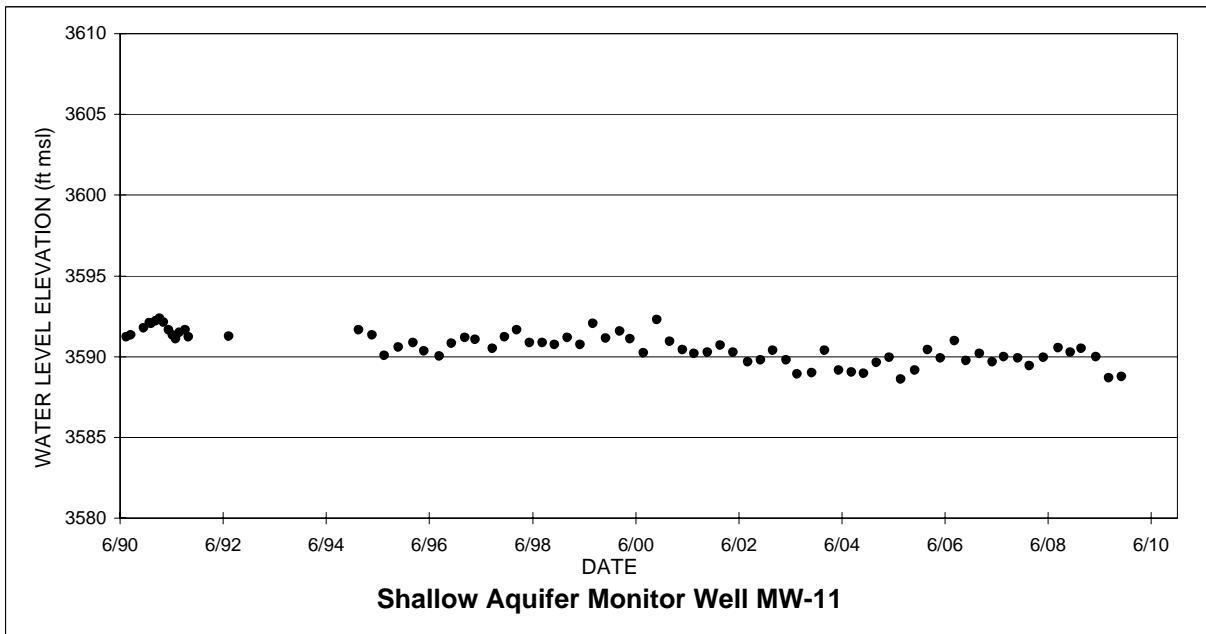
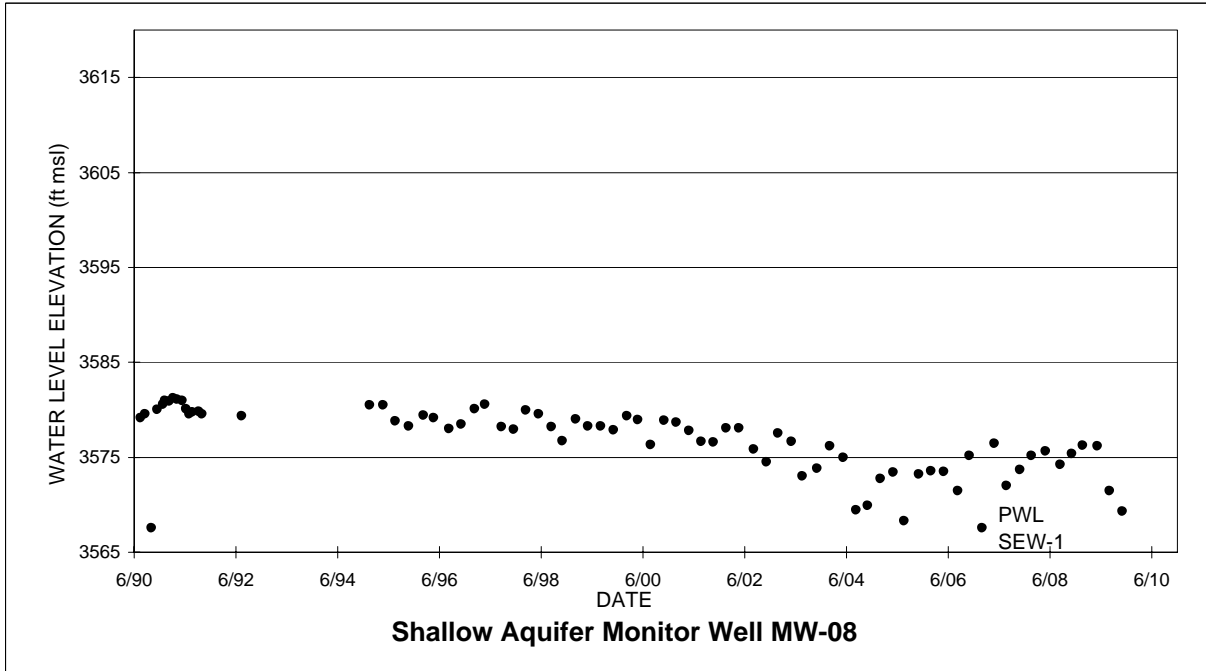
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 10. WATER LEVEL HYDROGRAPHS FOR SOUTHERN AREA MNA SENTINEL MONITOR WELLS MW-14 AND MW-22



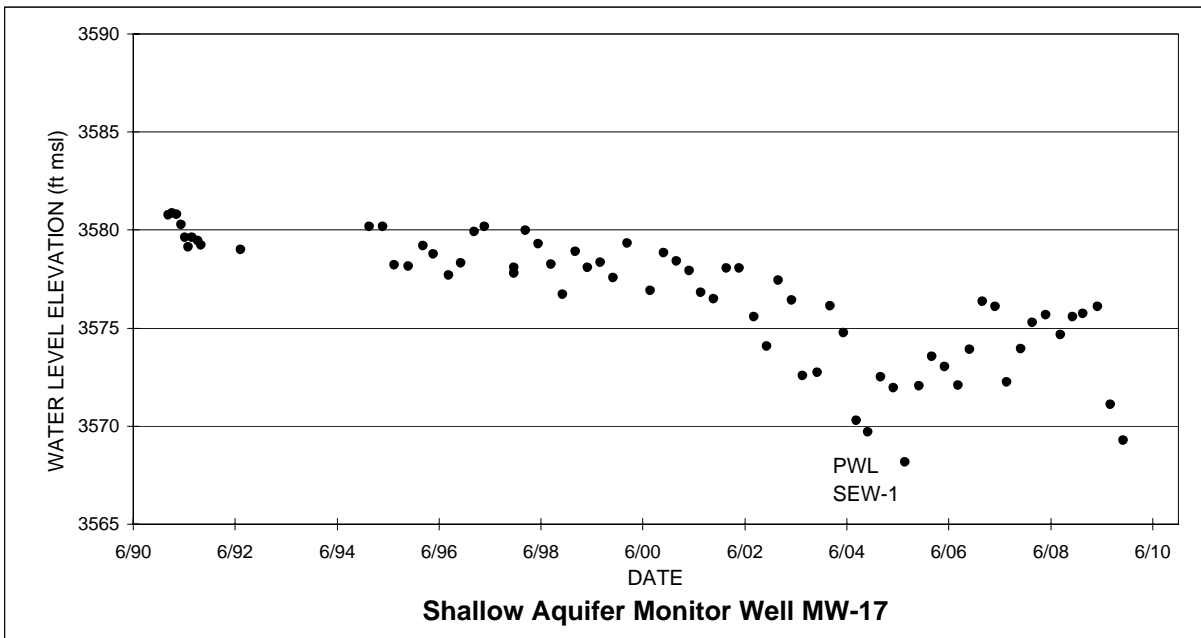
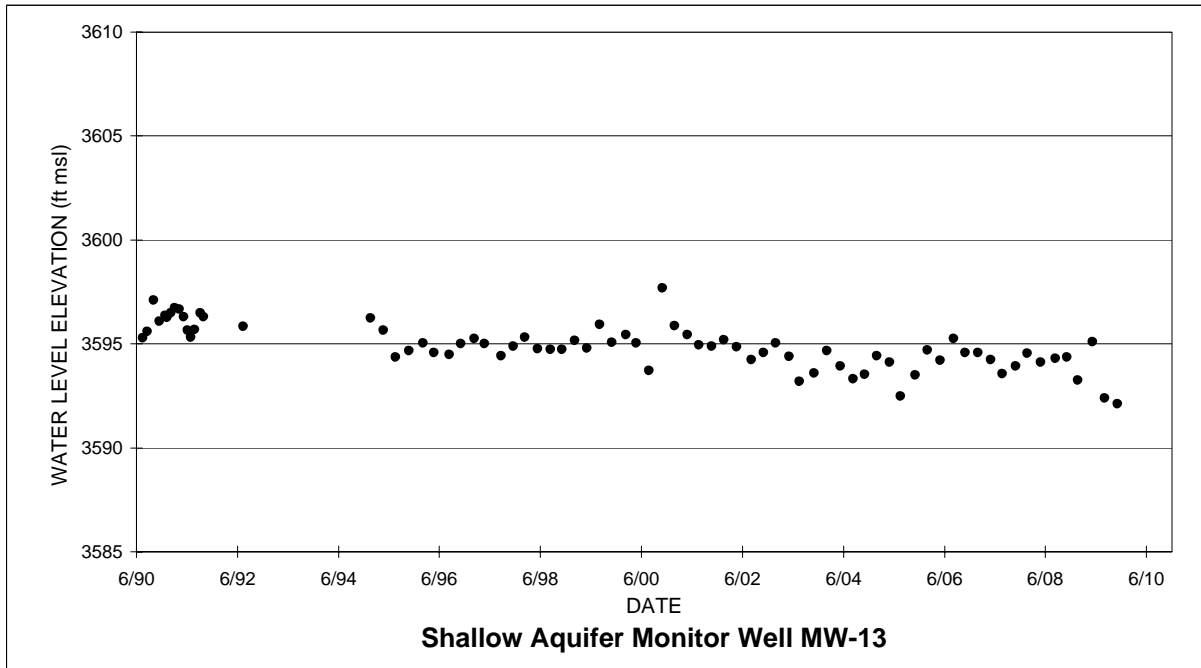
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 11. WATER LEVEL HYDROGRAPHS FOR SOUTHERN AREA MNA UPGRADIENT MONITOR WELLS MW-01 AND MW06



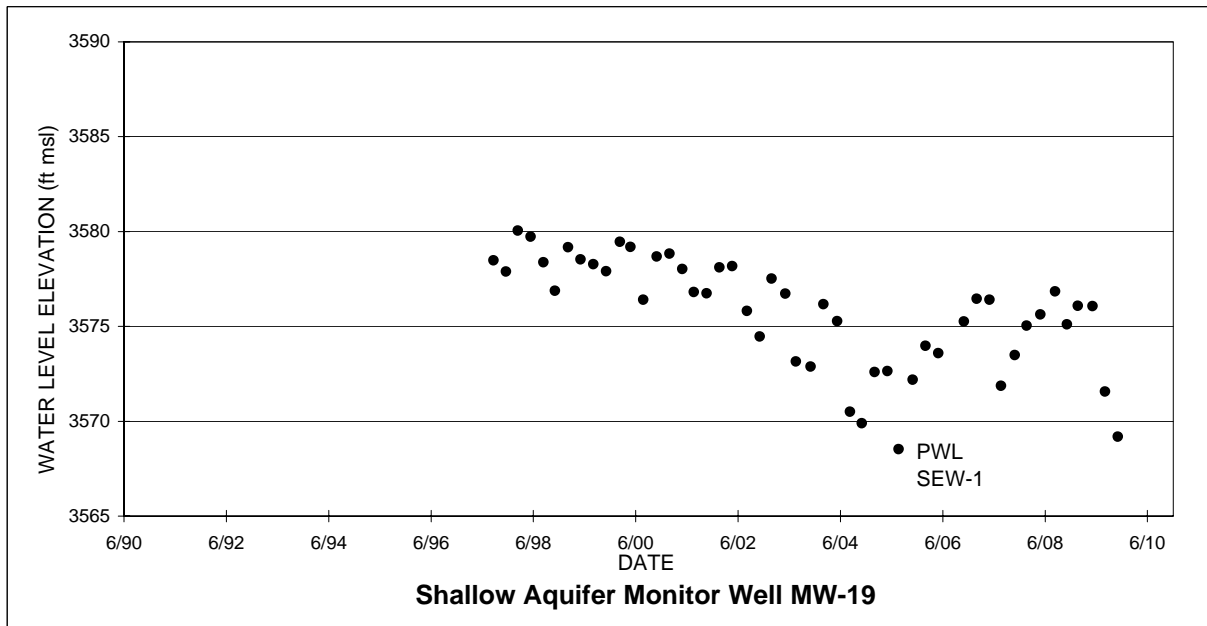
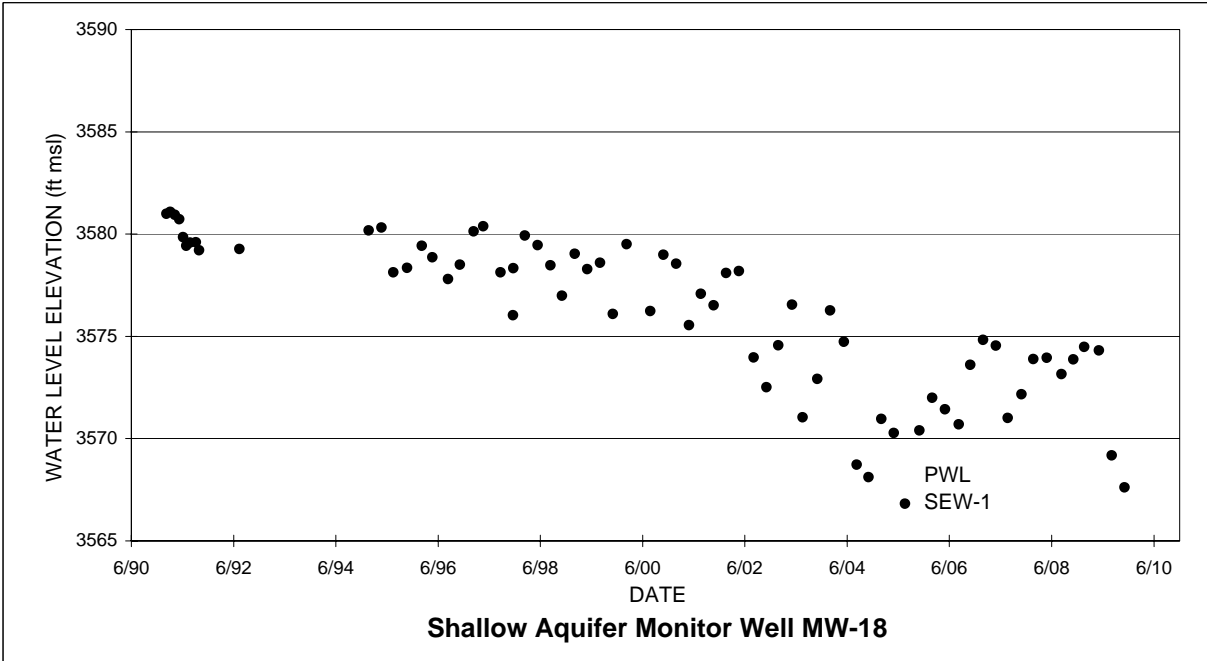
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 12. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA MNA UPGRADIENT WELLS MW-08, AND MW-11



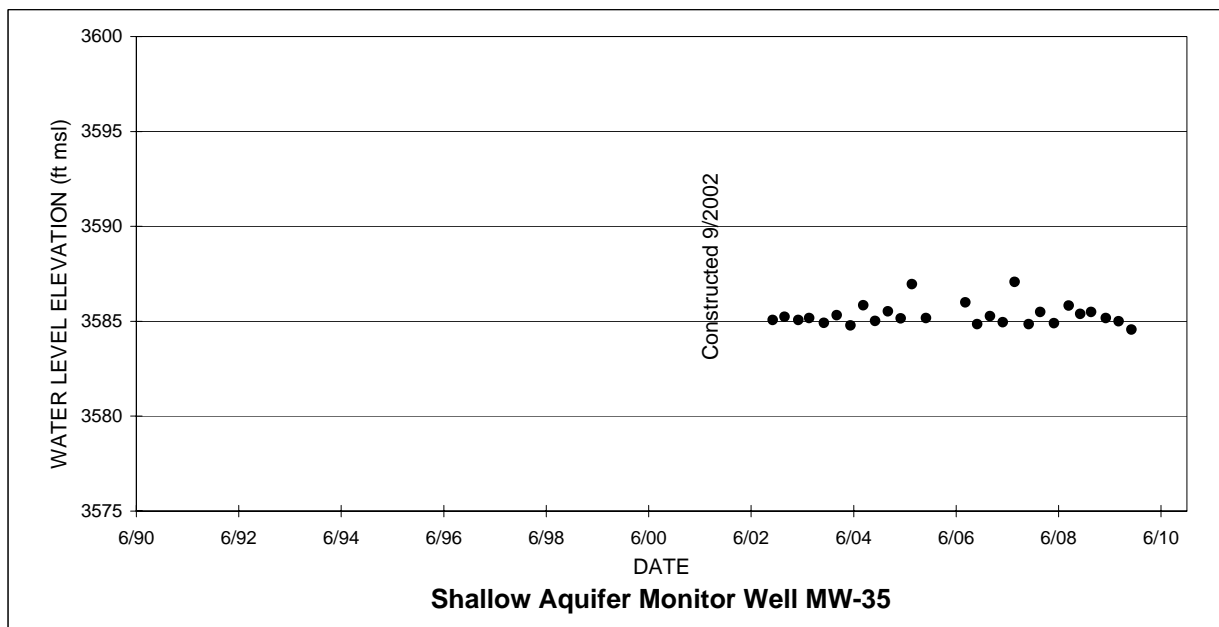
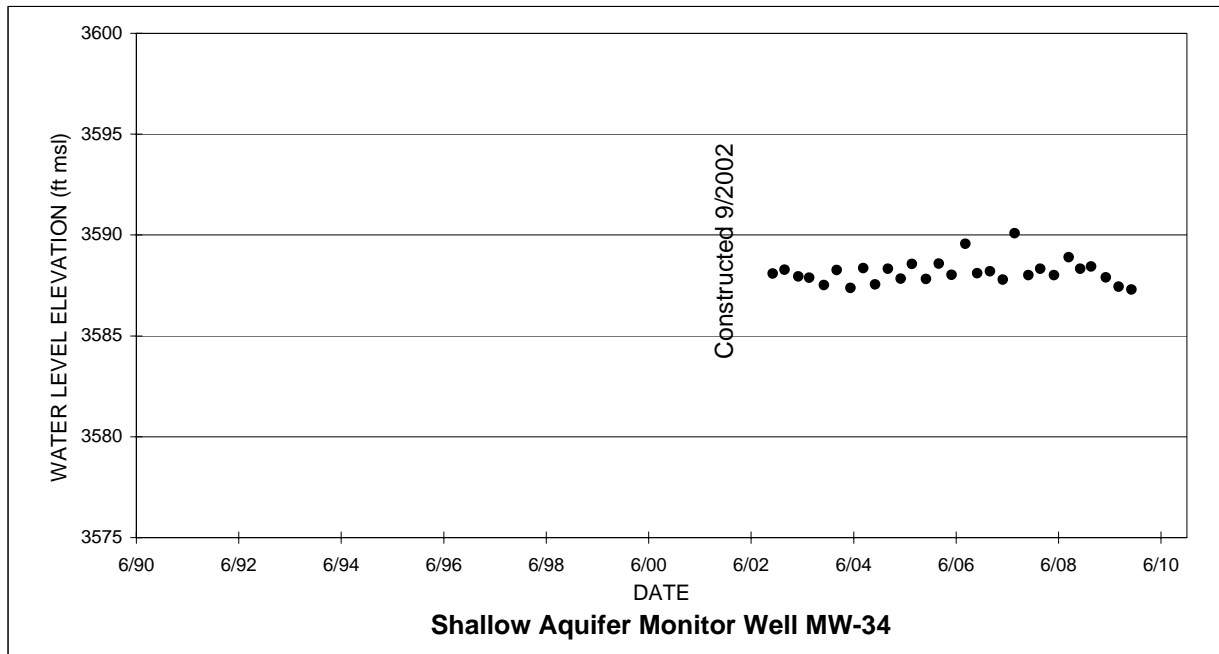
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 13. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA MNA UPGRADIENT MONITOR WELLS MW-13, AND MW-17



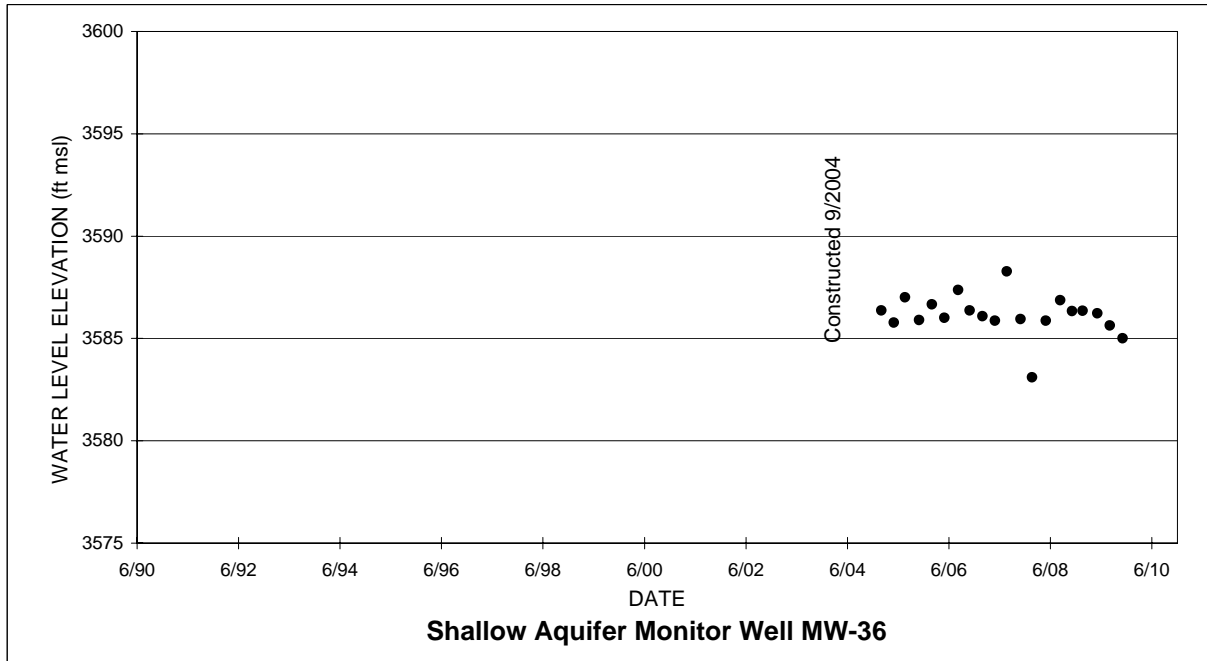
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 14. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA UPGRADIENT MONITOR WELLS MW-18, AND MW-19



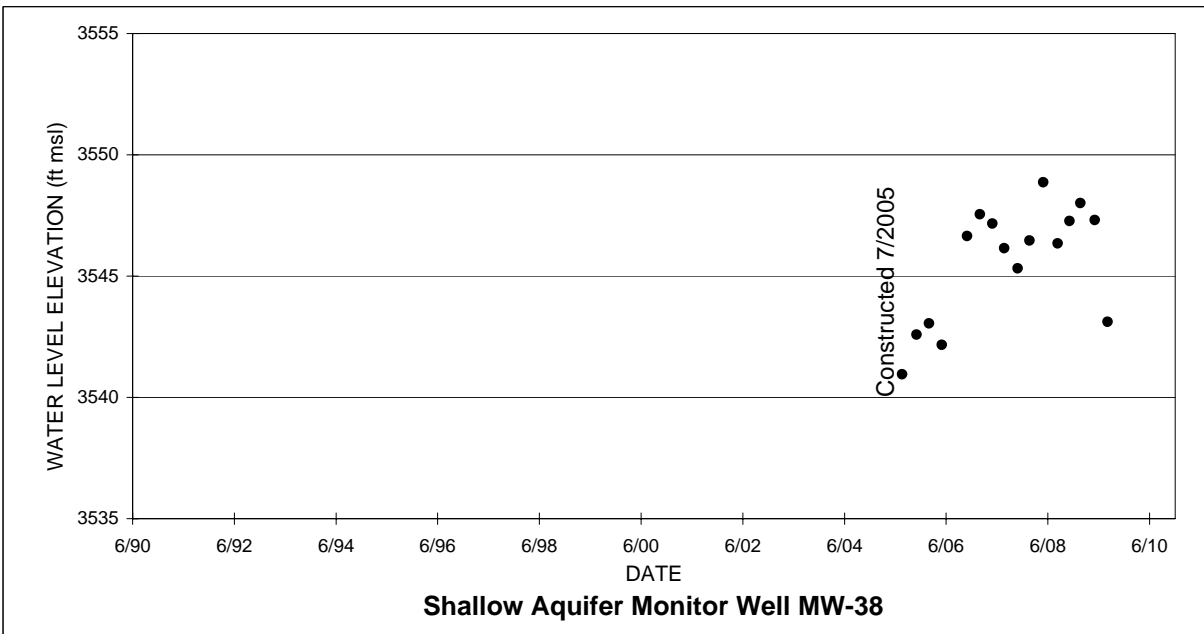
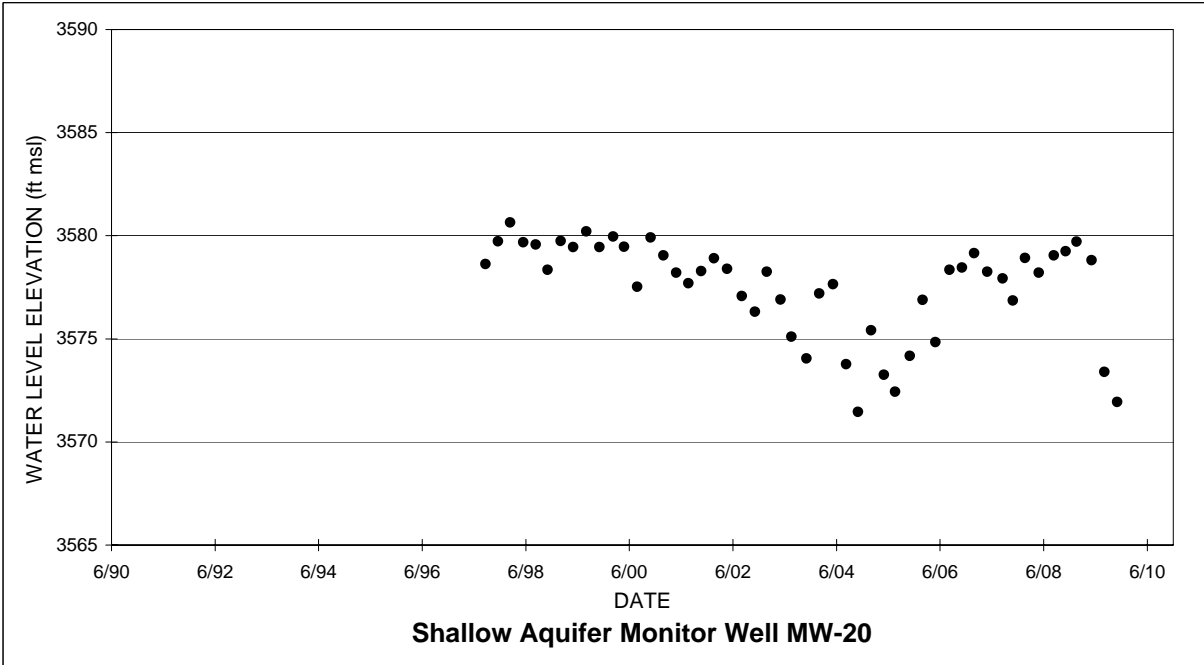
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 15. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA MNA UPGRADIENT MONITOR WELLS MW-34 AND MW-35



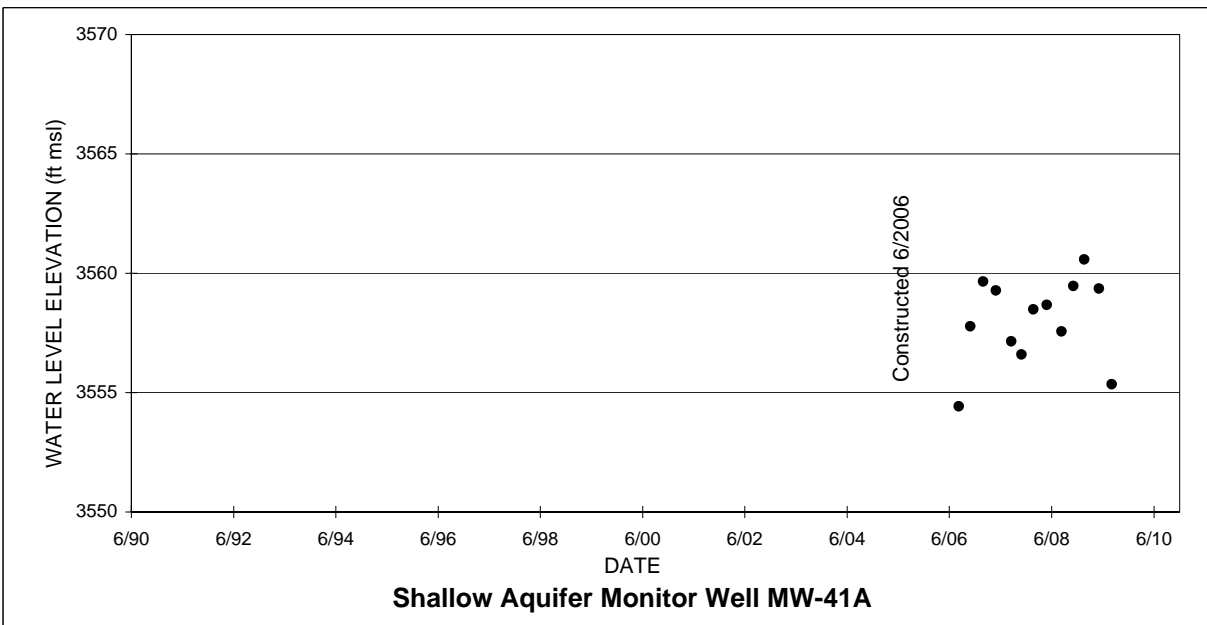
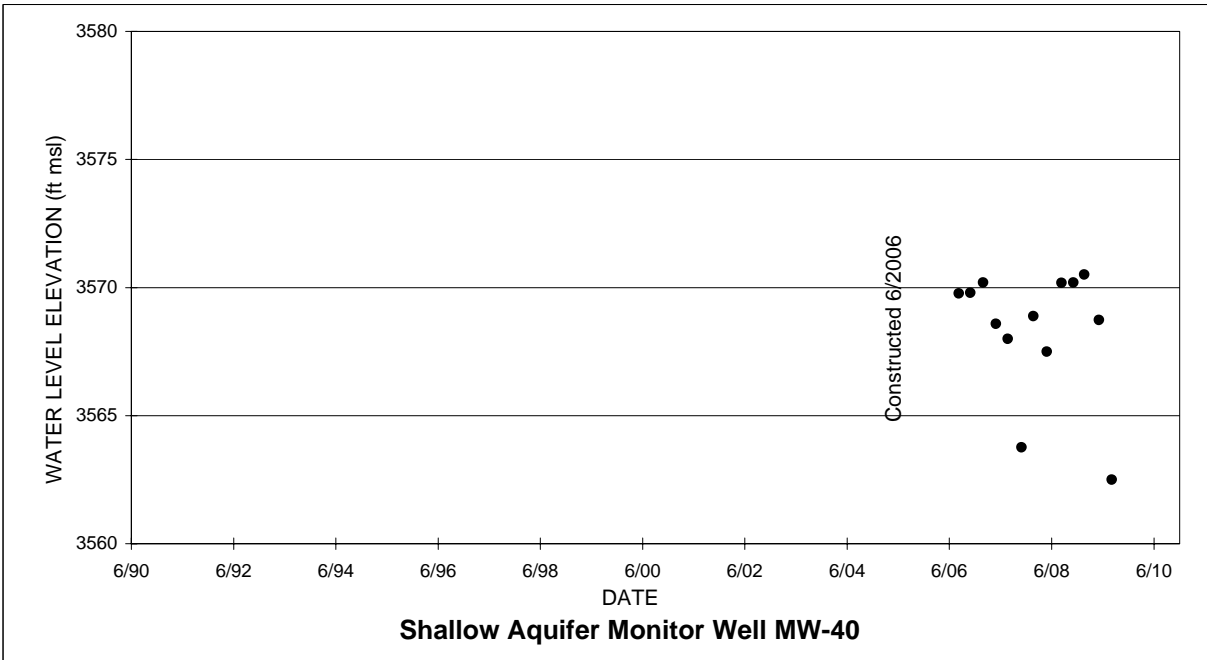
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 16. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA MNA UPGRADIENT MONITOR WELL MW-36



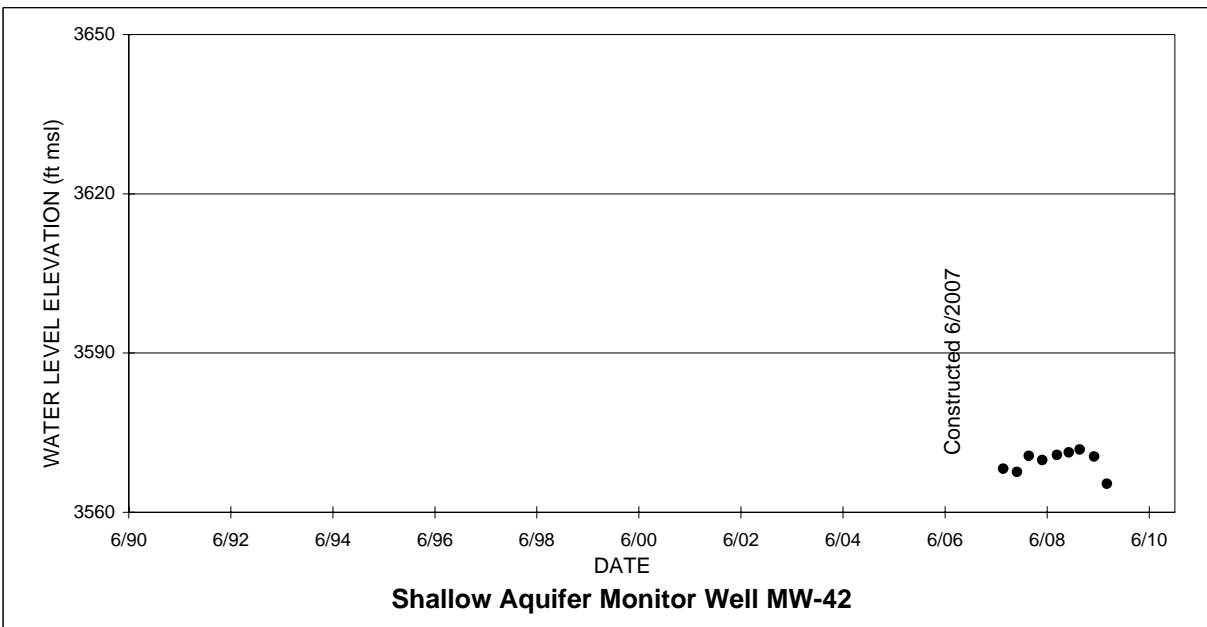
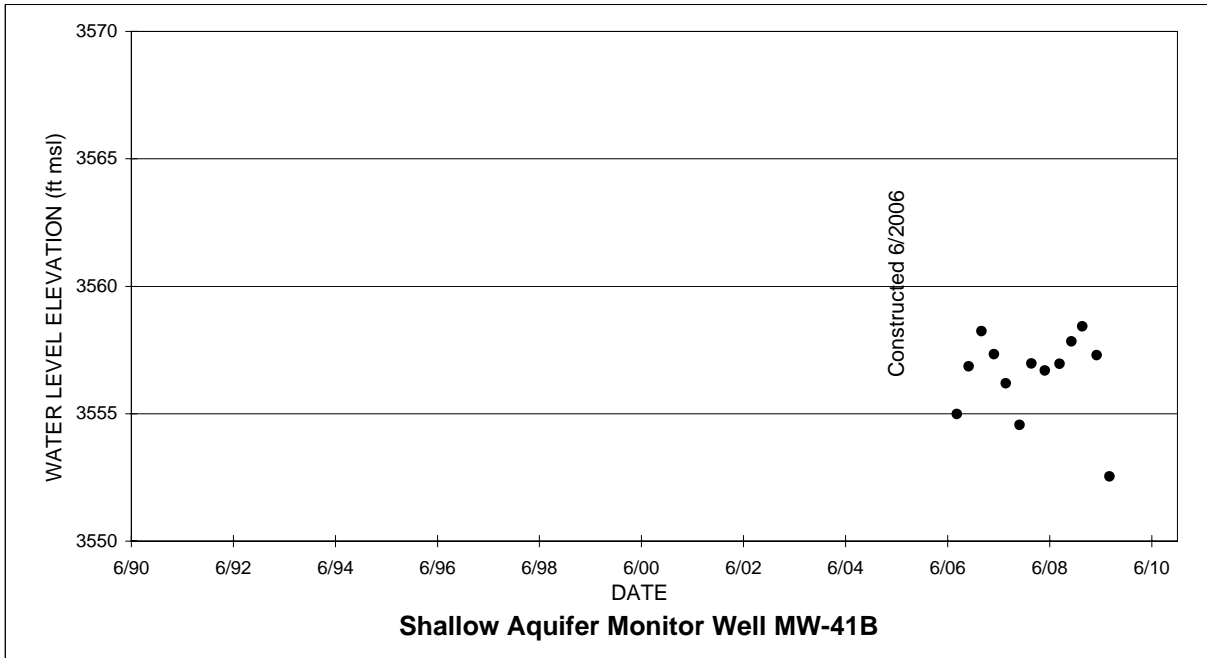
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 17. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA MNA MANAGEMENT ZONE MONITOR WELLS MW-20 AND MW-38



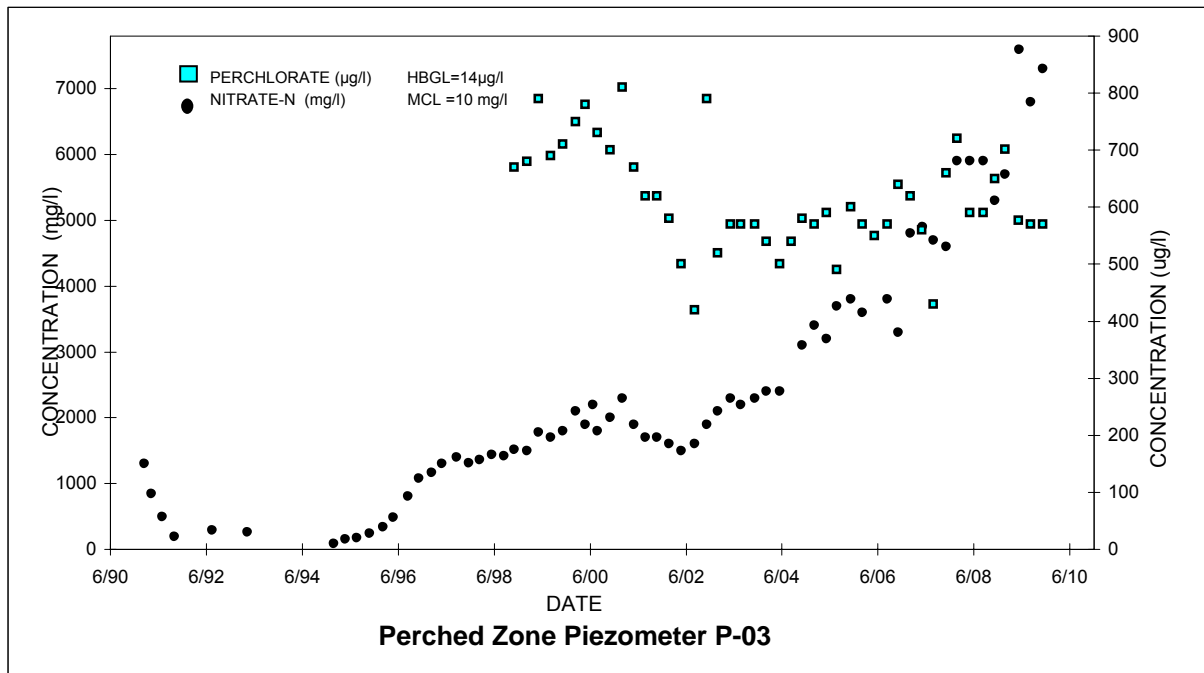
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 18. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA MNA MANAGEMENT ZONE MONITOR WELLS MW-40 AND MW-41A



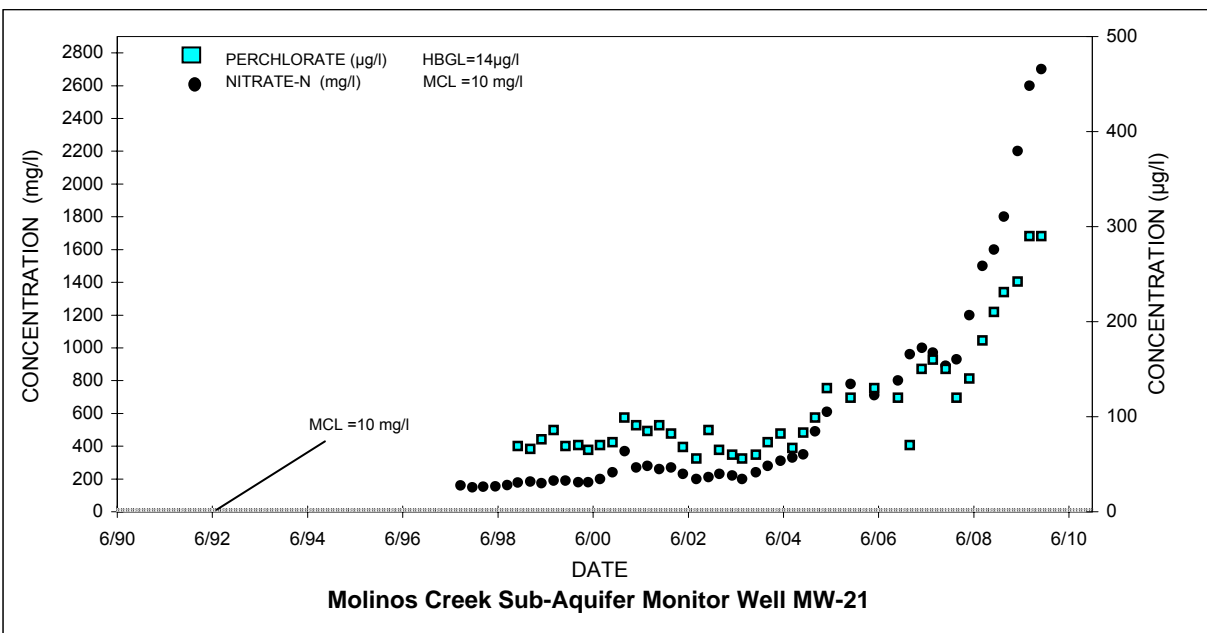
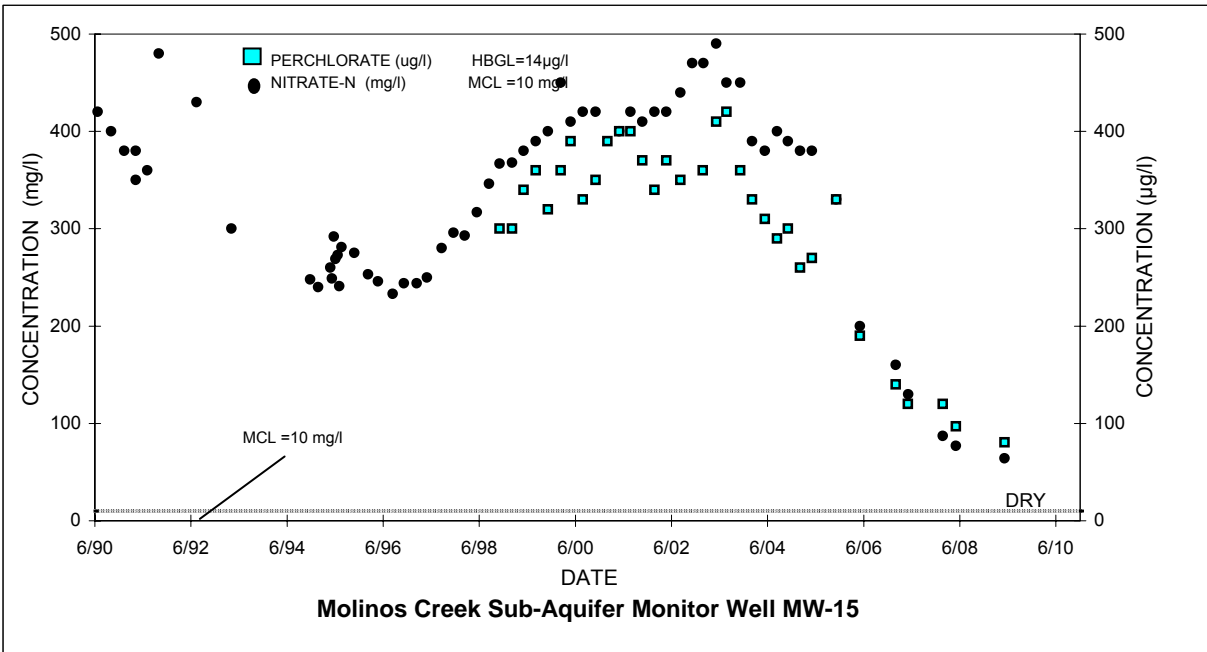
Note: see Figure 3 for explanation of abbreviations and symbols

FIGURE 19. WATER LEVEL HYDROGRAPHS FOR NORTHERN AREA MNA MANAGEMENT ZONE MONITOR WELLS MW-41B, AND MW-42



Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 20. WATER QUALITY HYDROGRAPHS FOR NO₃-N AND ClO₄ IN PERCHED ZONE PIEZOMETER P-03

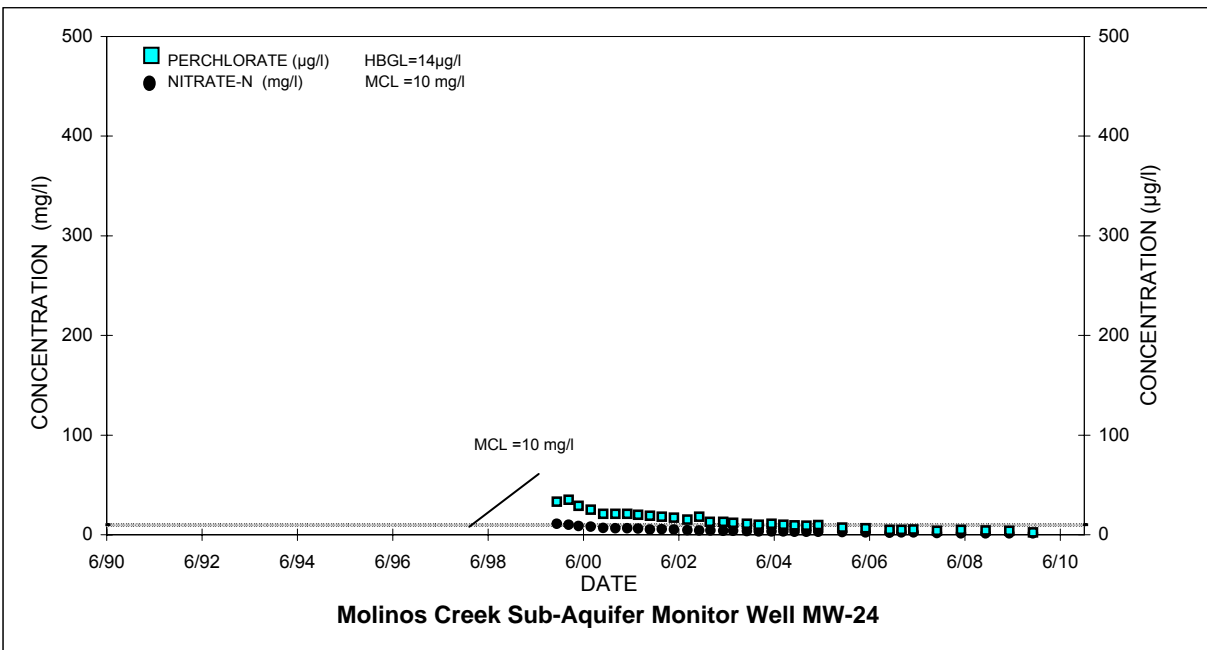
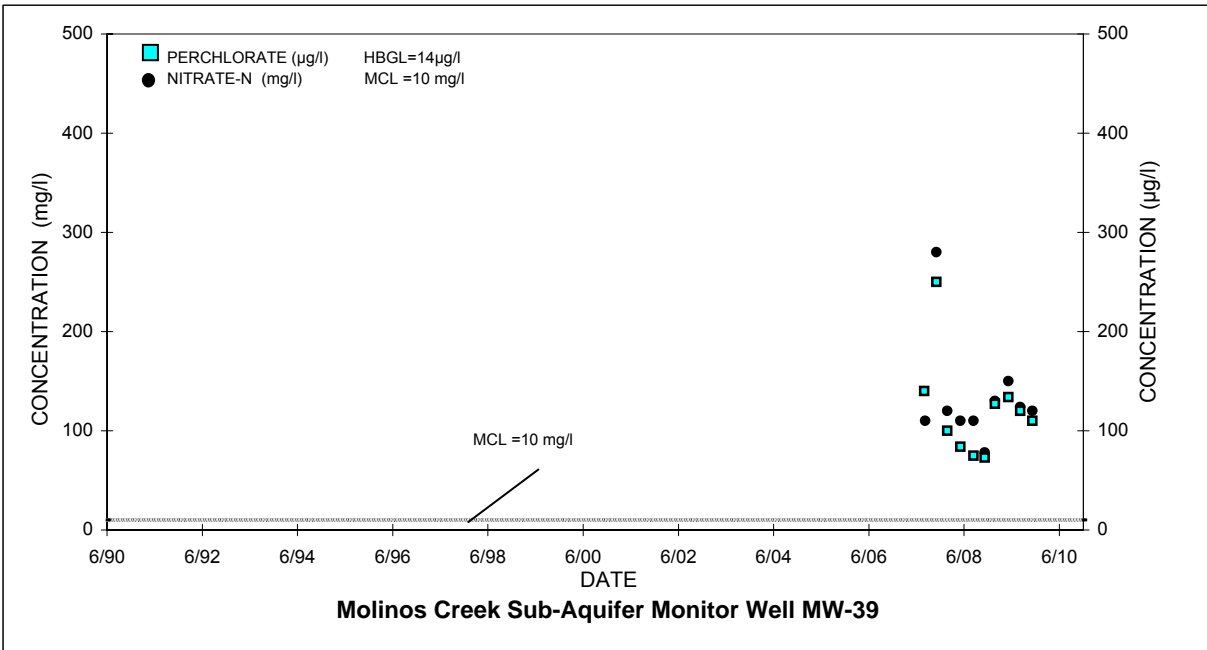


Notes:

MCL = Federal Maximum Contaminant Level
 µg/l= Microgram per liter
 HBGL= Health Based Guidance Level

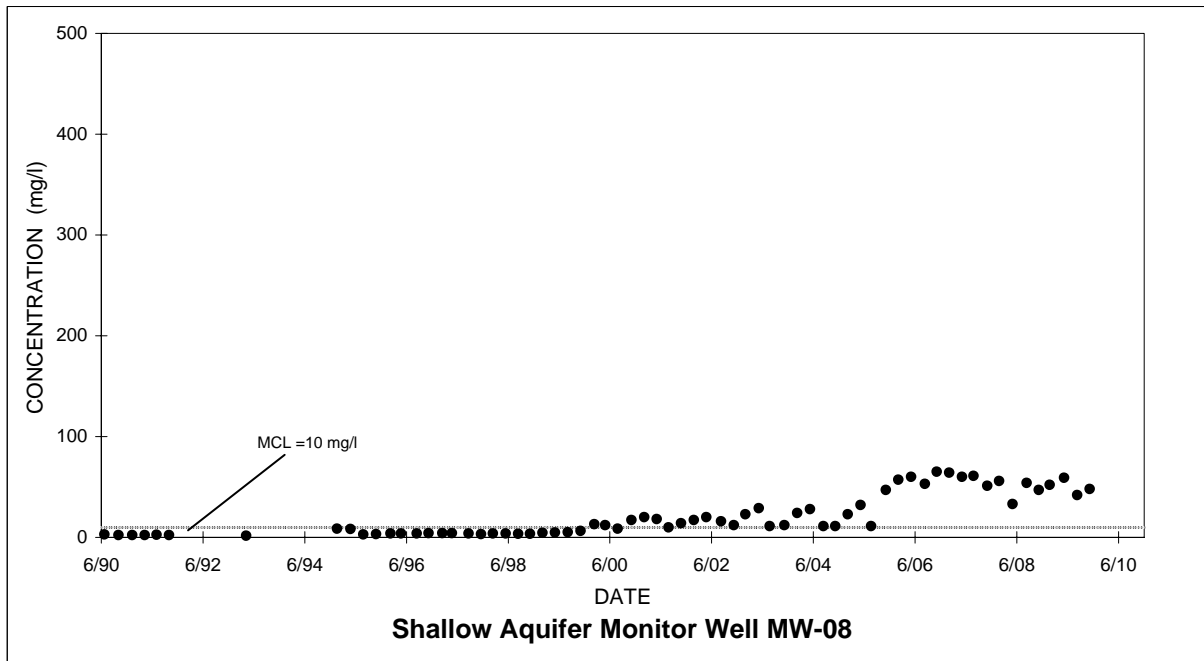
*= data value exceeds range
 NO₃-N= Nitrate as Nitrogen
 mg/l = Milligrams per liter

FIGURE 21. WATER QUALITY HYDROGRAPHS FOR NO₃-N AND ClO₄ IN MOLINOS CREEK MNA MANAGEMENT ZONE MONITOR WELLS MW-15 AND MW-21



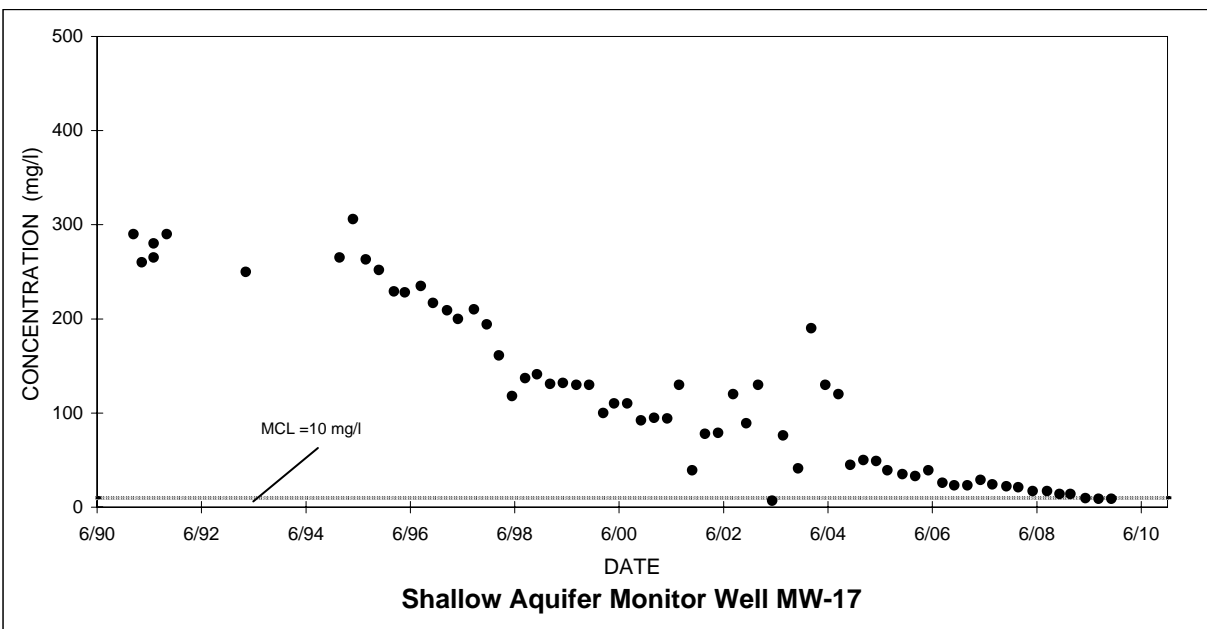
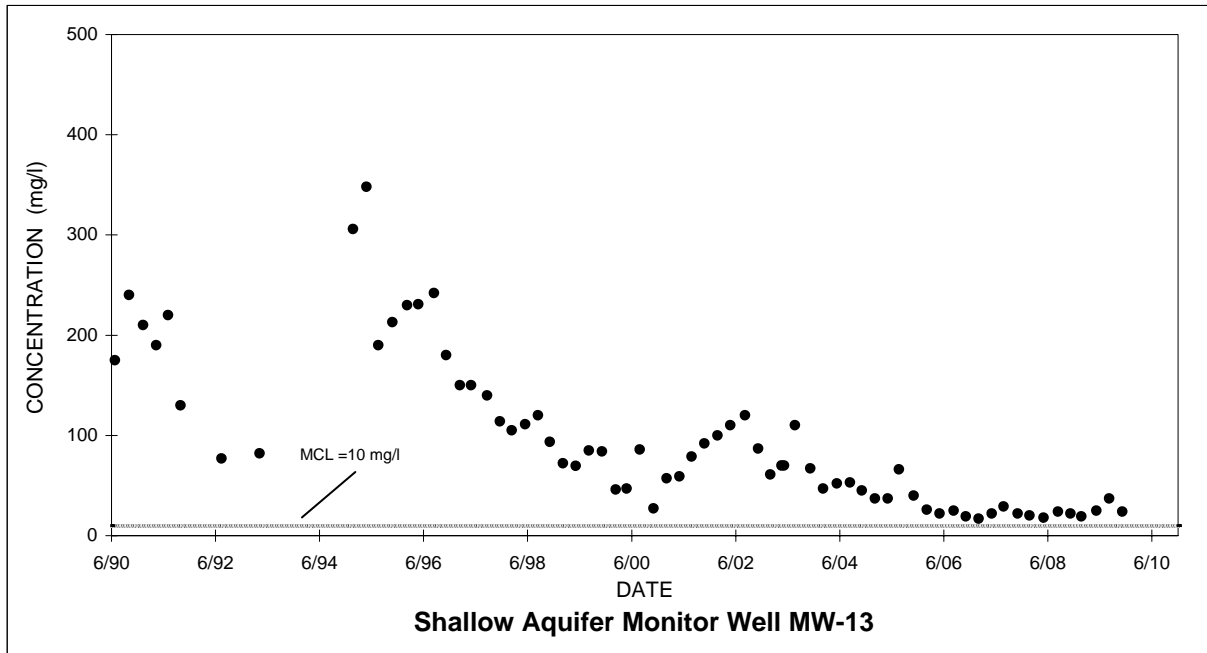
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 22. WATER QUALITY HYDROGRAPHS FOR $\text{NO}_3\text{-N}$ AND ClO_4 MOLINOS CREEK MNA MANAGEMENT ZONE MONITOR WELLS MW-39 AND MW-24



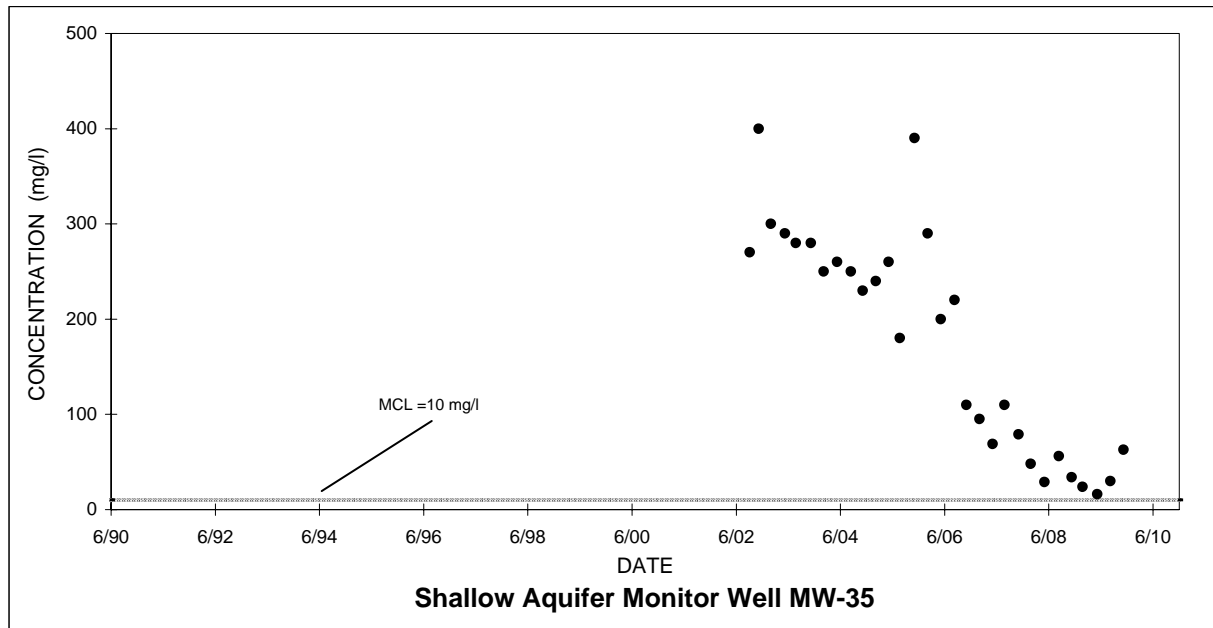
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 23. WATER QUALITY HYDROGRAPHS FOR NO₃-N IN NORTHERN AREA MNA UPGRADIENT MONITOR WELL MW-08



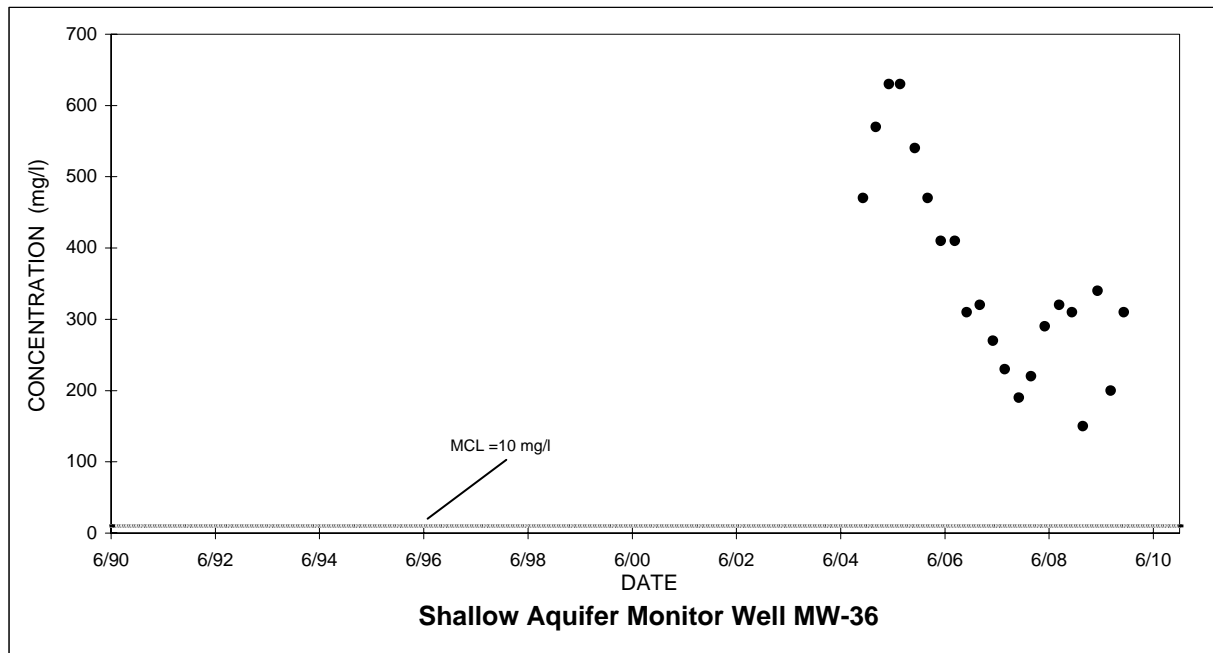
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 24. WATER QUALITY HYDROGRAPHS FOR NO₃-N IN NORTHERN AREA MNA UPGRADIENT MONITOR WELLS MW-13 AND MW-17



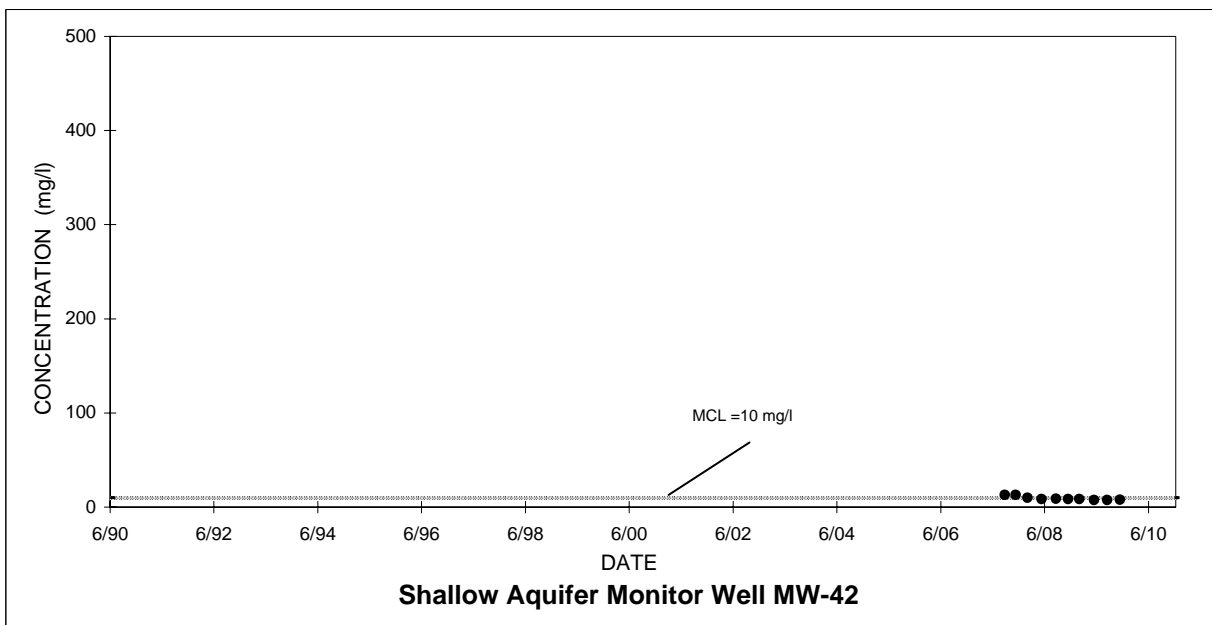
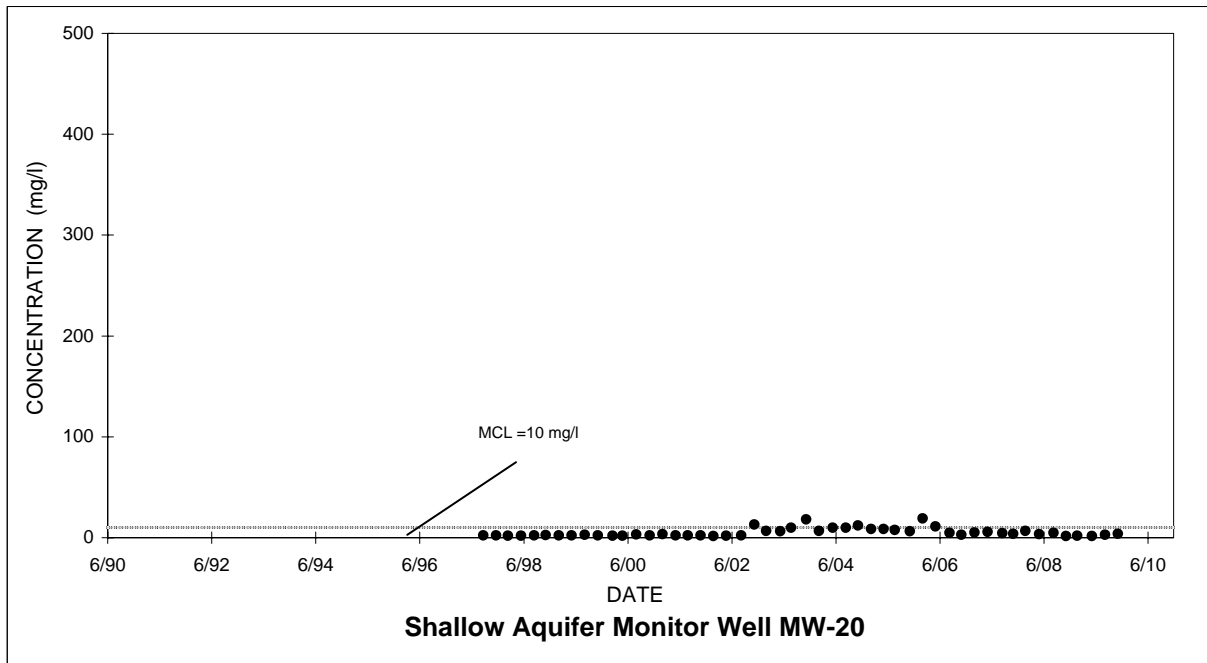
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 26. WATER QUALITY HYDROGRAPHS FOR NO₃-N IN NORTHERN AREA MNA UPGRADIENT MONITOR WELL MW-35



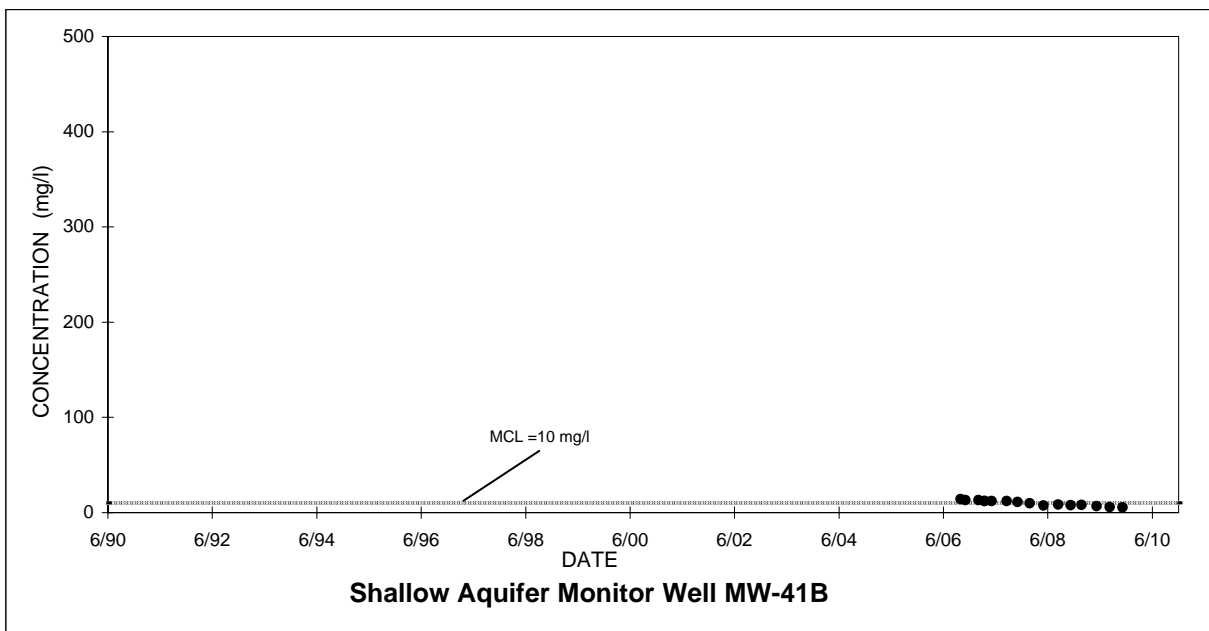
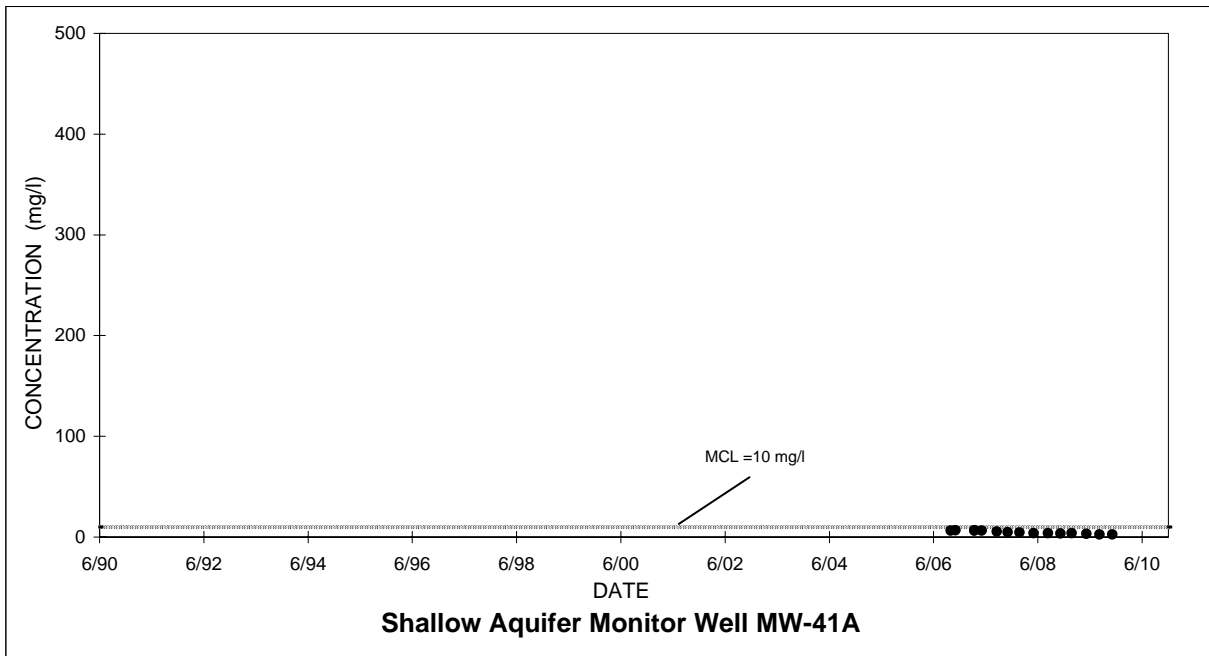
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 27. WATER QUALITY HYDROGRAPH FOR NO₃-N IN NORTHERN AREA MNA UPGRADIENT WELL MW-36



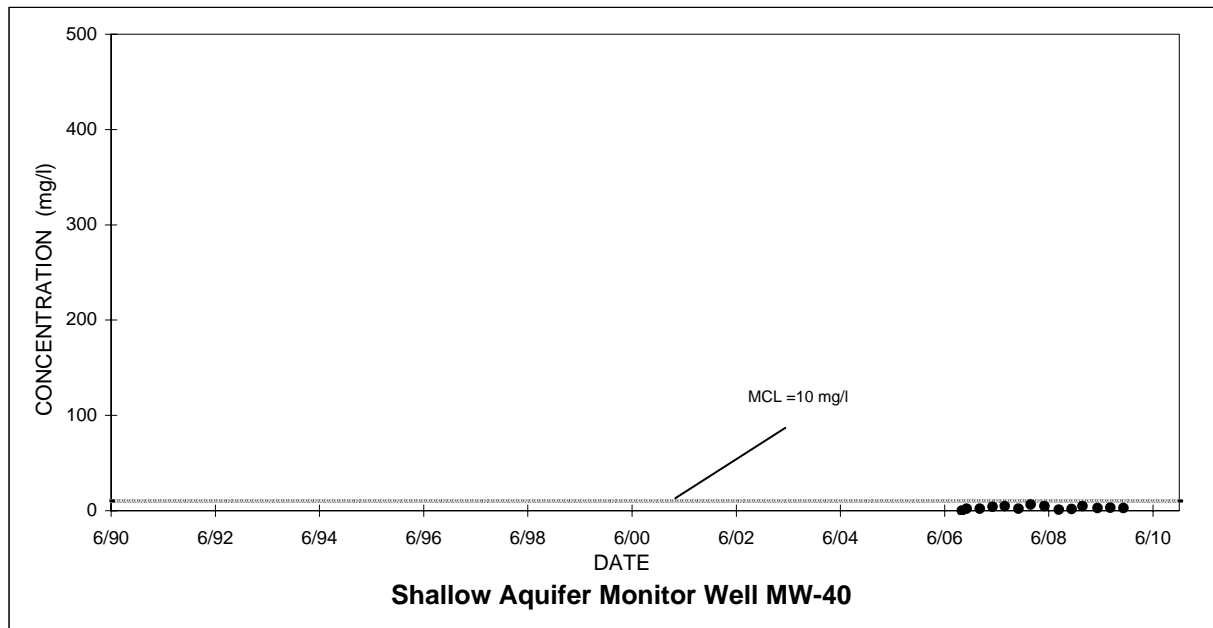
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 28. WATER QUALITY HYDRGRAPHS FOR NO₃-N IN NORTHERN AREA MNA MANAGEMENT ZONE MONITOR WELLS MW-20 AND MW-42



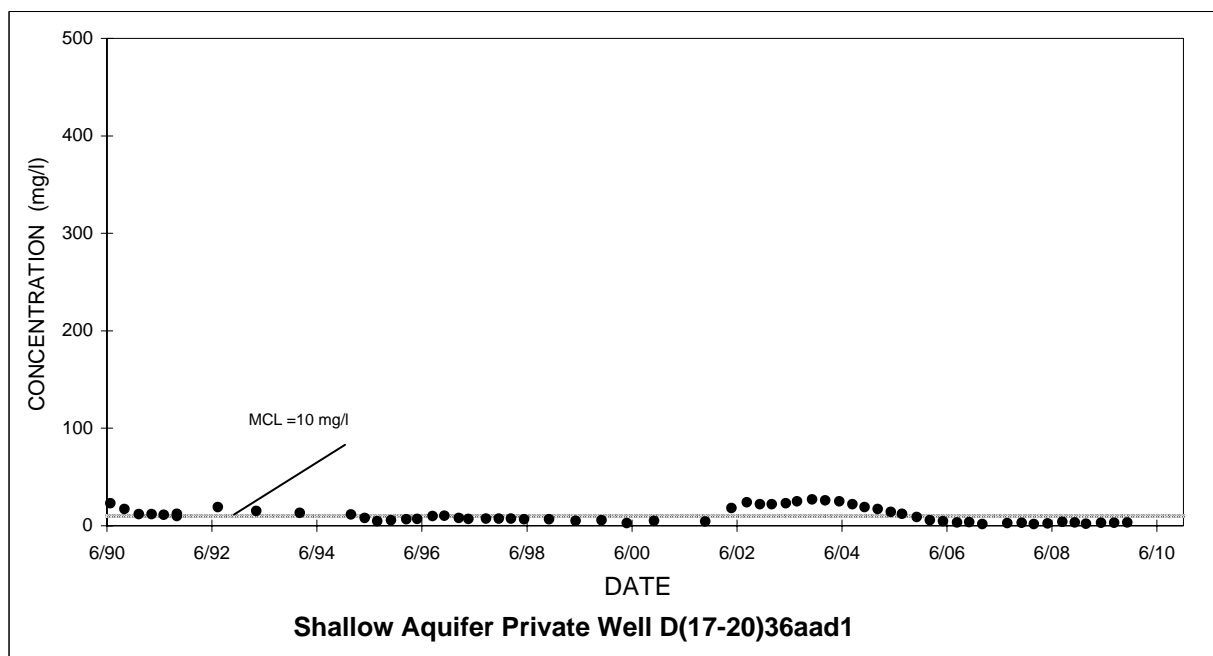
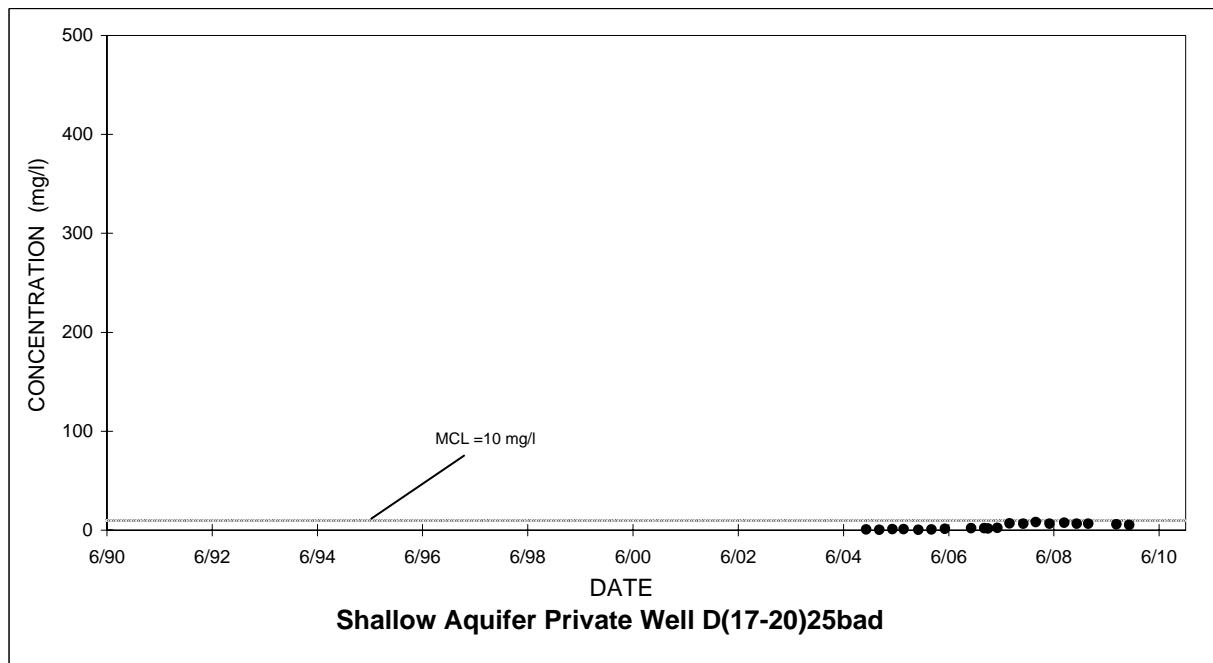
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 29. WATER QUALITY HYDROGRAPH FOR NO₃-N IN NORTHERN AREA MNA MANAGEMENT ZONE MONITOR WELLS MW-41A AND MW-41B



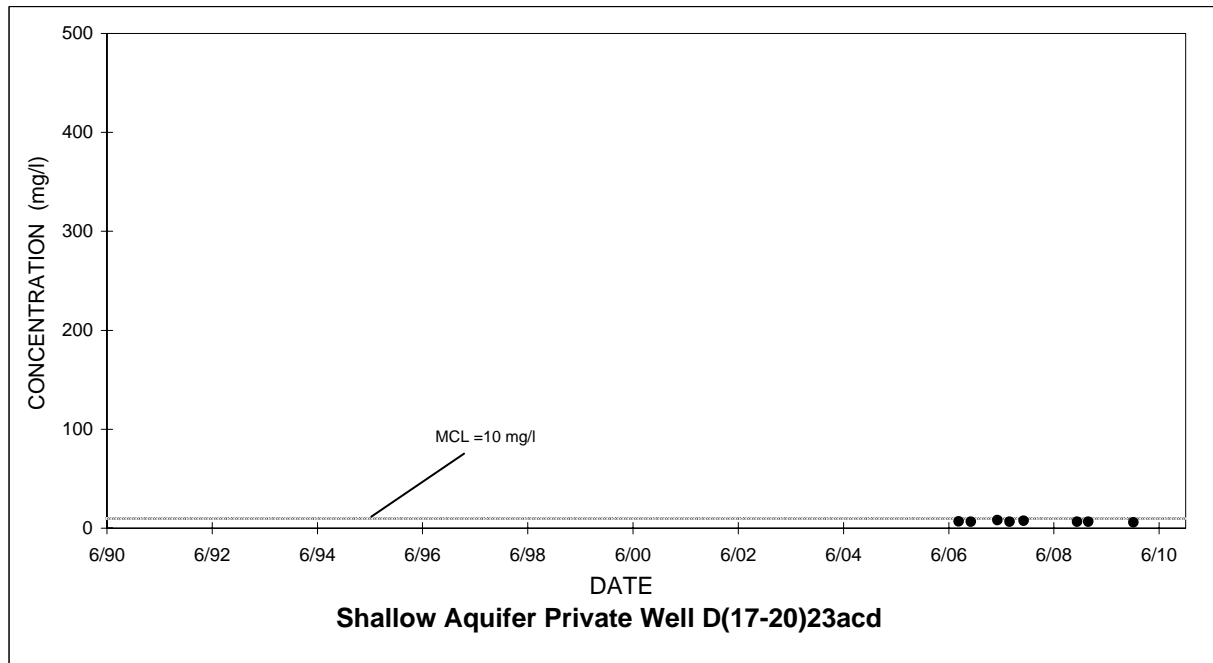
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 30. WATER QUALITY HYDROGRAPH FOR NO₃-N IN NORTHERN AREA MNA MANAGEMENT ZONE SENTINEL WELL MW-40



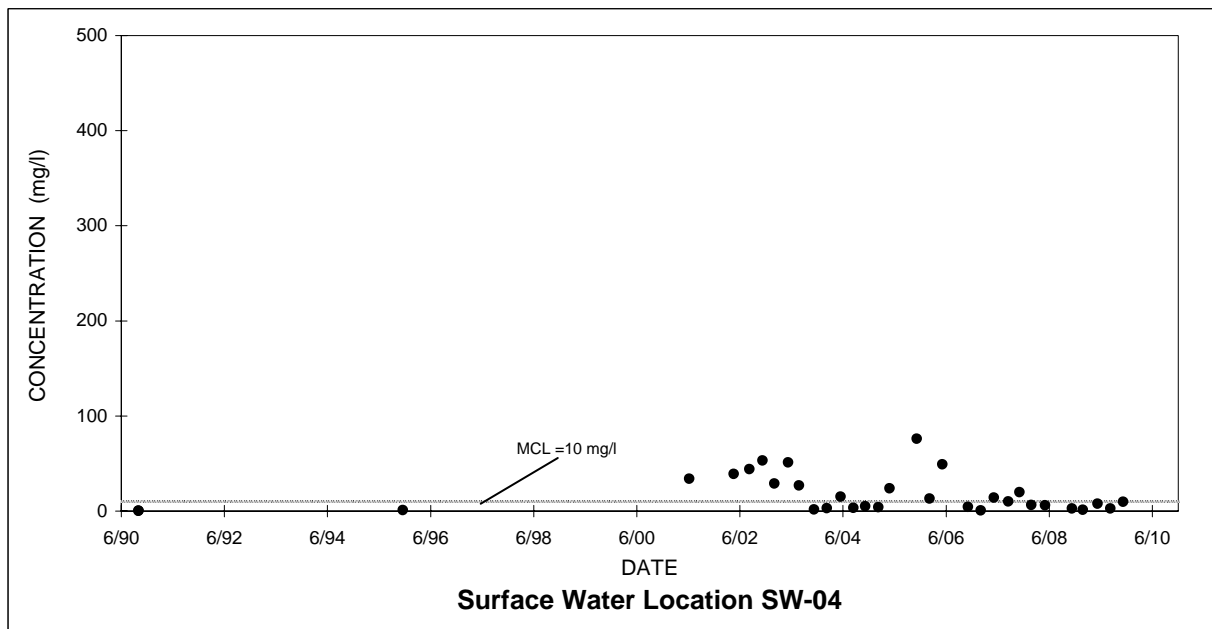
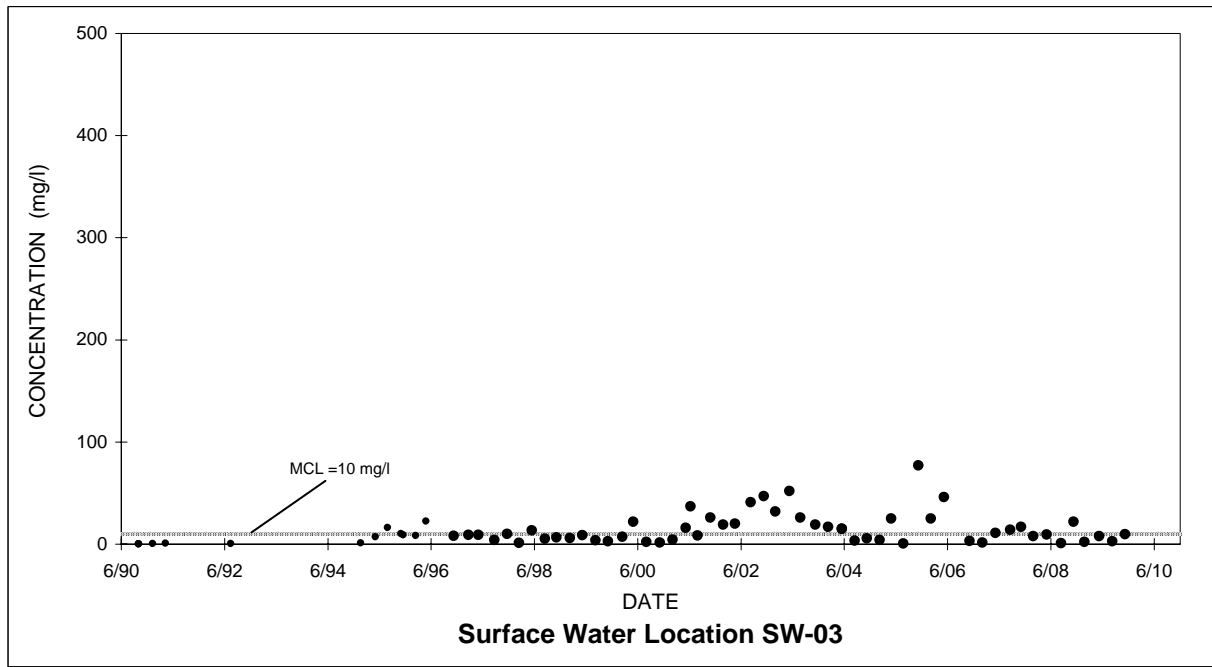
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 31. WATER QUALITY HYDROGRAPH FOR NO₃-N IN NORTHERN AREA MNA MANAGEMENT ZONE MONITOR WELLS D(17-20)25bad, AND D(17-20)36aad1



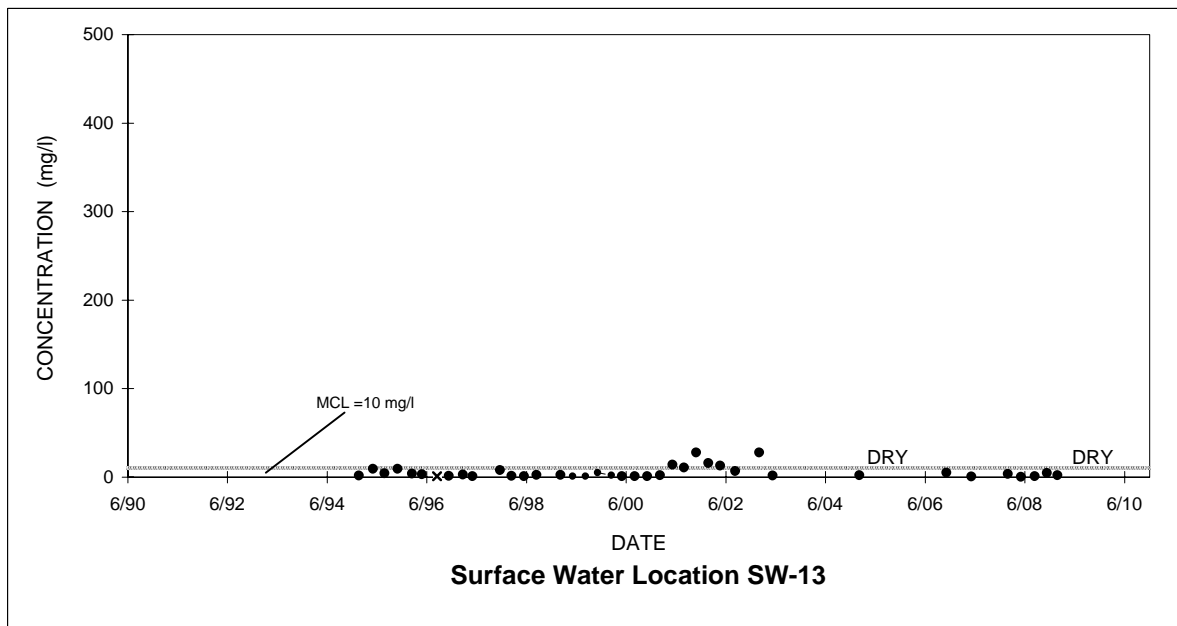
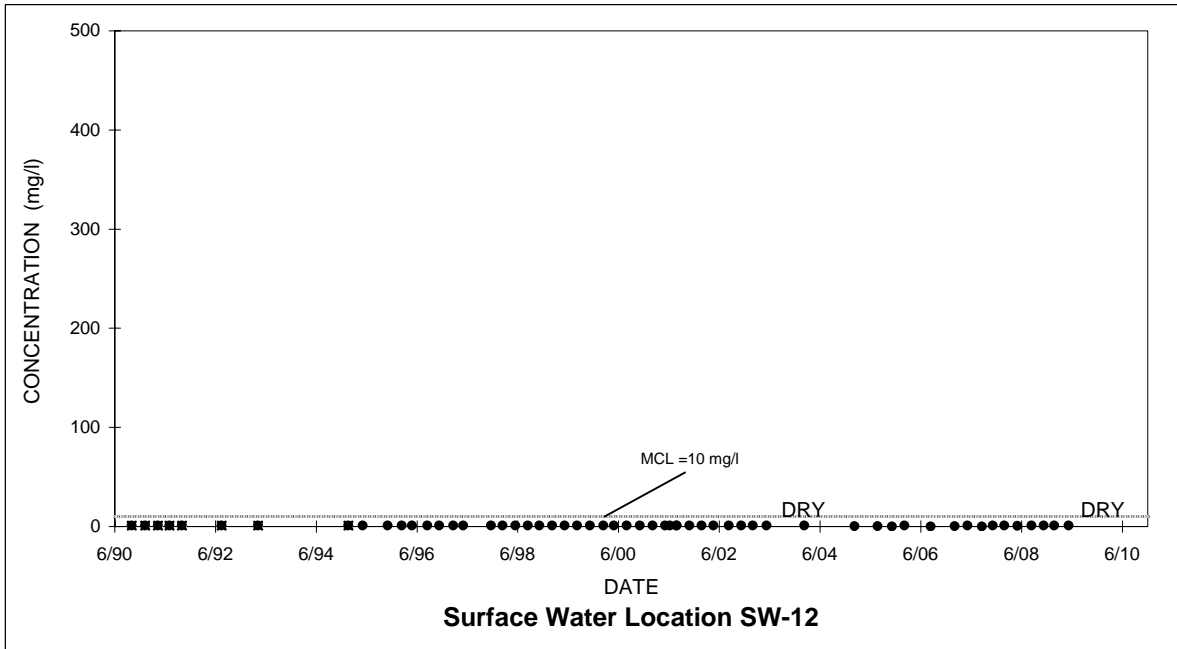
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 32. WATER QUALITY HYDROGRAPH FOR NO₃-N IN NORTHERN AREA MNA MANAGEMENT ZONE MONITOR WELL D(17-20)23acd



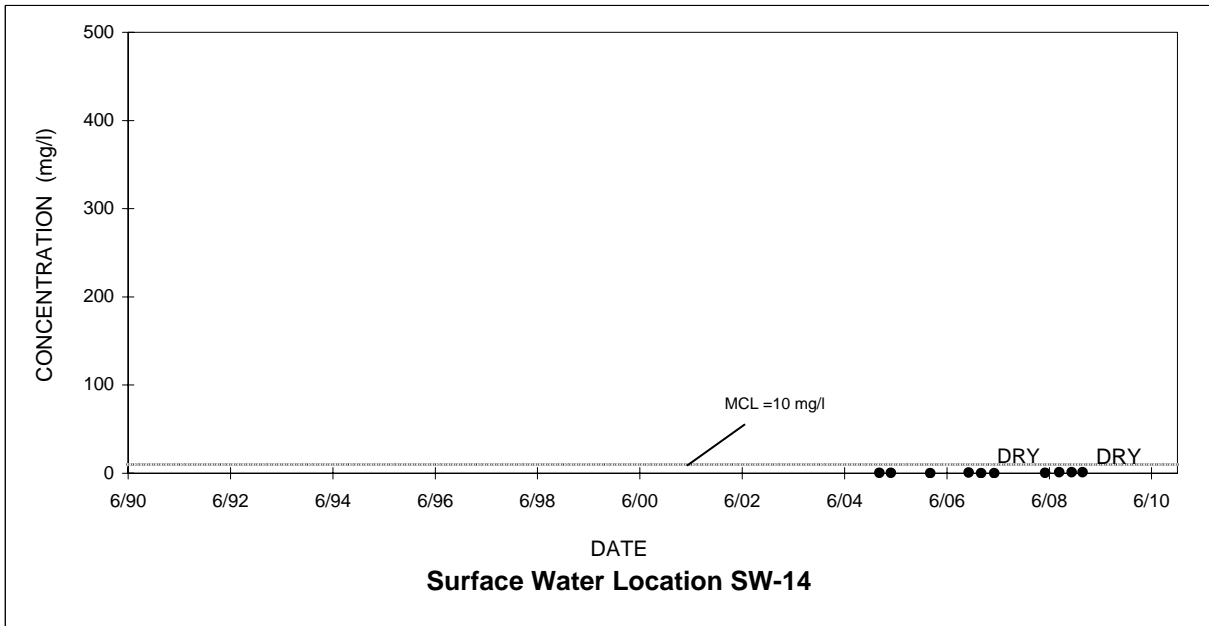
Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 33. WATER QUALITY HYDROGRAPHS FOR NO₃-N IN SURFACE WATER LOCATIONS SW-03, AND SW-04



Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 34. WATER QUALITY HYDROGRAPHS FOR NO₃-N IN SURFACE WATER LOCATIONS SW-12 AND SW-13



Note: see Figure 21 for explanation of abbreviations and symbols

FIGURE 35. WATER QUALITY HYDROGRAPHS FOR NO₃-N IN SURFACE WATER LOCATION SW-14