Allen, Pam, NMENV C TA-21 ENTERED

From: Shen, Hai, NMENV
Sent: Thursday, March 27, 2008 2:34 PM
To: Allen, Pam, NMENV
Cc: Cobrain, Dave, NMENV; Dale, Michael
Subject: FW: Information and Recommendations Concerning the Protection of Supply Well O-4
Attachments: O-4 WL.doc; O-4 WL data.xls; TW-3 WL data.xls; R-6 WL data.xls; O-4 Tritium.pdf; O-4 Perchlorate.pdf; O-4 Nitrate-Nitrite.pdf; O-4 Chromium.pdf; O-4 Chem.xls; Wells_reschedule_extension proposal letter_3-16-082.xls

'am, Please file this email and attachments as LANL General (Los Alamos and Pueblo Canyons, Groundwater, TA-21). Thanks.
Iai

'rom: David Broxton [mailto:broxton@lanl.gov]
ient: Thu 3/27/2008 1:48 PM
'o: Shen, Hai, NMENV
:c: Danny Katzman
iubject: Information and Recommendations Concerning the Protection of Supply Well O-4

Ii Hai,

)n behalf of Danny I am sending you the information you requested to address the low efficiency of the monitoring well ›rotection of supply well O-4. We agree that more focused water-level and water-quality measurements are warranted ;iven that the model simulations do not meet the performance objective for the monitoring well network at this location 'or potential breakthrough locations near O-4. The options to rehabilitate TW-3 and install new monitoring wells are also ›riefly discussed below.

Vater level data for O-4, TW-3, and R-6 and production rates for O-4 are summarized in the attachment O-4 WL.doc vith the supporting Excel files attached as O-4 WL data.xls, TW-3.WL data.xls, and R-6 WL data.xls. The main :onclusion we draw from these data is that the regional aquifer near the water table is poorly connected to the interval of he O-4 well screen because production at O-4 has a negligible affect on water-levels at nearby wells TW-3 and R-6.

'er your request, we are also attaching summaries of O-4 water quality data for representative mobile contaminants :nown to be present beneath this portion of the Los Alamos Canyon watershed. The attachments include plots of the elected analytes (O-4 Tritium.pdf, O-4 Perchlorate.pdf, O-4 Nitrate-Nitrite.pdf, and O-4 Chromium.pdf) and the upporting Excel spreadsheet (O-4 Chem.xls). We are also attaching a spreadsheet showing the current agreement ›etween Los Alamos County and LANL about the sample frequency and analyte suite for O-4 Wells_reschedule_extension proposal letter_3-16-082.xls). Our primary conclusion from our review of these data is that here is no long-term compelling evidence for the presence of Laboratory-derived contamination for these four mobile :ontaminants of concern.

'ou asked us to consider 1) whether TW-3 is a candidate for rehabilitation by sealing off potential leakage along the well ınnulus, and 2) whether TW-3 should be reinstated into the Laboratory's monitoring program to measure tritium as a key ndicator of Laboratory contamination in the upper part of the aquifer in the vicinity of O-4. The types of well materials ısed to construct TW-3 are not specified in reports documenting its installation. Use of carbon steel drive and well :asings was common practice during the time the well was installed, and a well of this age is likely to be highly corroded \n important feature of this well is that cable-tool drilling usually results in a minimal annulus. Rehabilitation of TW-3 ›y injecting grout in the annular space between the well casing and the borehole wall is not practical given the lack of a vell annulus. With regards to sampling TW-3 for tritium, water quality data for alluvial and perched intermediate ;roundwater near the Los Alamos/DP Canyon confluence differ significantly from TW-3 water quality data, suggesting hat the TW-3 annulus is not an important contaminant pathway. Detectable concentrations of tritium at TW-3 ranged rom 1.28 to 52.6 pCi/L, from 1994 to 2006 (measured by electrolytic enrichment at the University of Miami). Between :004 and 2006, they ranged from 0.35 to 15.4 pCi/L, with 15.4 pCi/L measured in a sample collected on January 19,

30323

2006. These tritium measurements are n[illegible] affected by drilling and construction me[illegible]ods at TW-3 (e.g. corrosion of casing). In addition, dating of the TW-3 [illegible]ater indicates an average age of 6700 y[illegible]s based on an unadjusted C-14 measurement. We believe the tritium values and the unadjusted C-14 age are probably representative of regional groundwater near the water table. Based on this information, we recommend that TW-3 be maintained in its current configuration for the sampling of tritium (using the electrolytic enrichment technique) and measuring of water levels on a bi-annual basis.

Given the simulated low efficiency of the monitoring well network for protection of O-4, we make the following recommendations. The recommendations are aimed at understanding how natural hydrologic conditions act to isolate the O-4 well screen from contaminants introduced near the water table.

The recommendations are:
1) Increase the sampling frequency at O-4 so that mobile contaminants of concern (tritium, chromium, perchlorate, molybdenum) are sampled on a quarterly basis.
2) Reinstate TW-3 into the LANL Groundwater Monitoring program to sample for tritium on a semi-annual basis and to conduct automated continuous water-level measurements.
3) Work with Los Alamos County to improve the calibration and collection of water-level data in O-4 (and other water-supply wells).
4) Evaluate the need for additional upgradient monitoring wells completed within the regional aquifer after assessing potential southward diversion of perched-intermediate groundwater along the base of the Guaje Pumice Bed beneath TA-53. This will be implemented through installation of the intermediate perched groundwater well as recommended in Rev. [illegible] of the Los Alamos-Pueblo Canyon well assessment report.

Please contact Danny or me if you have any further questions.

Best regards,

Dave

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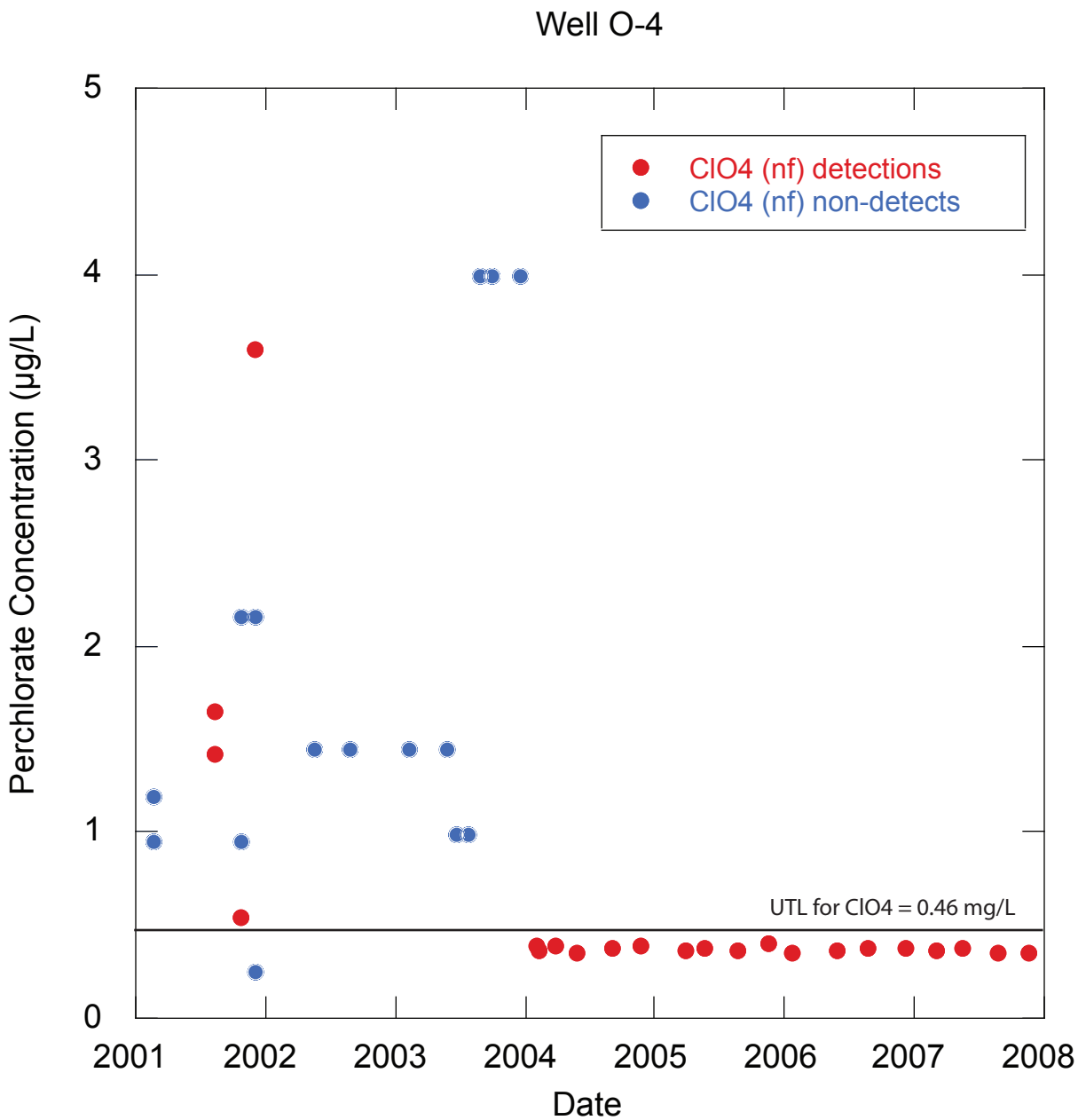
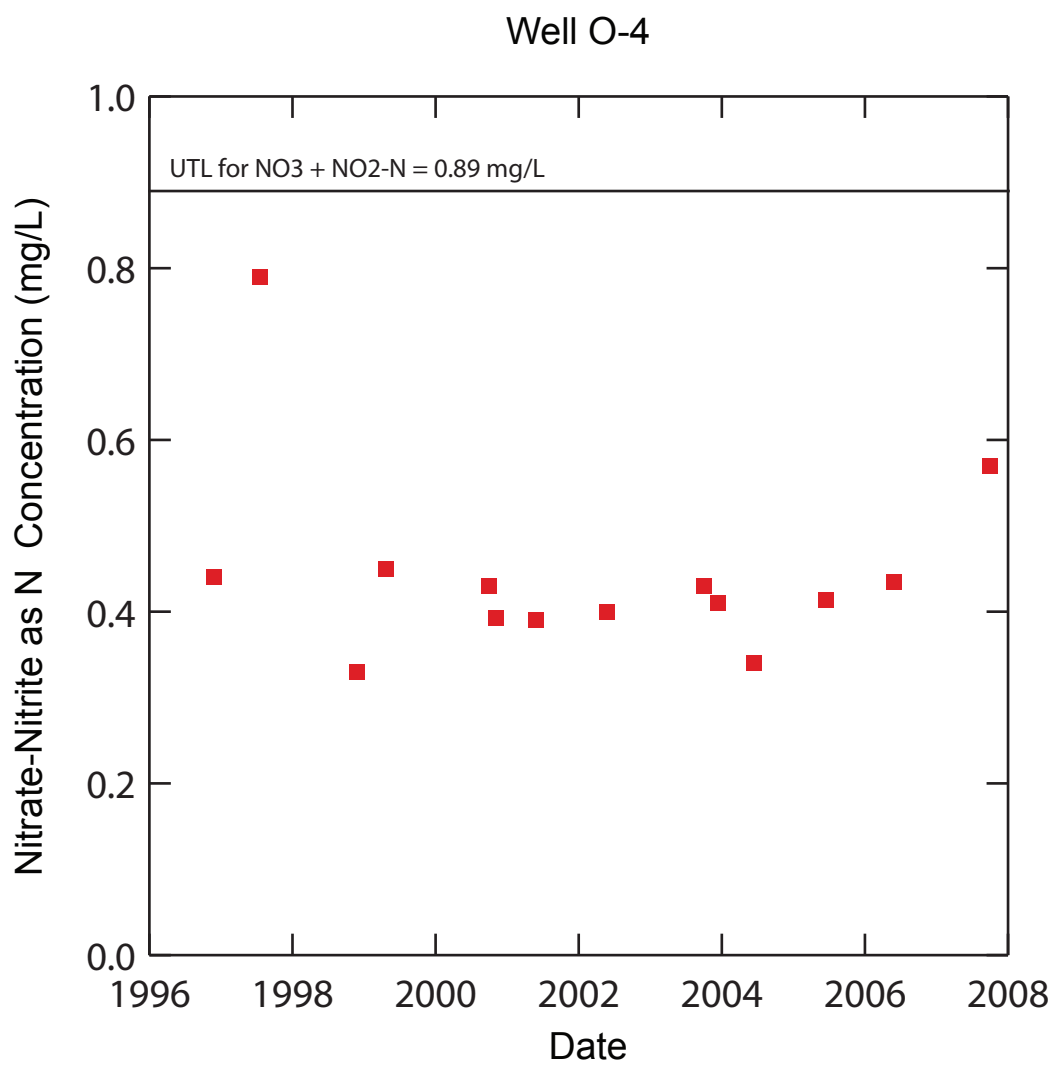
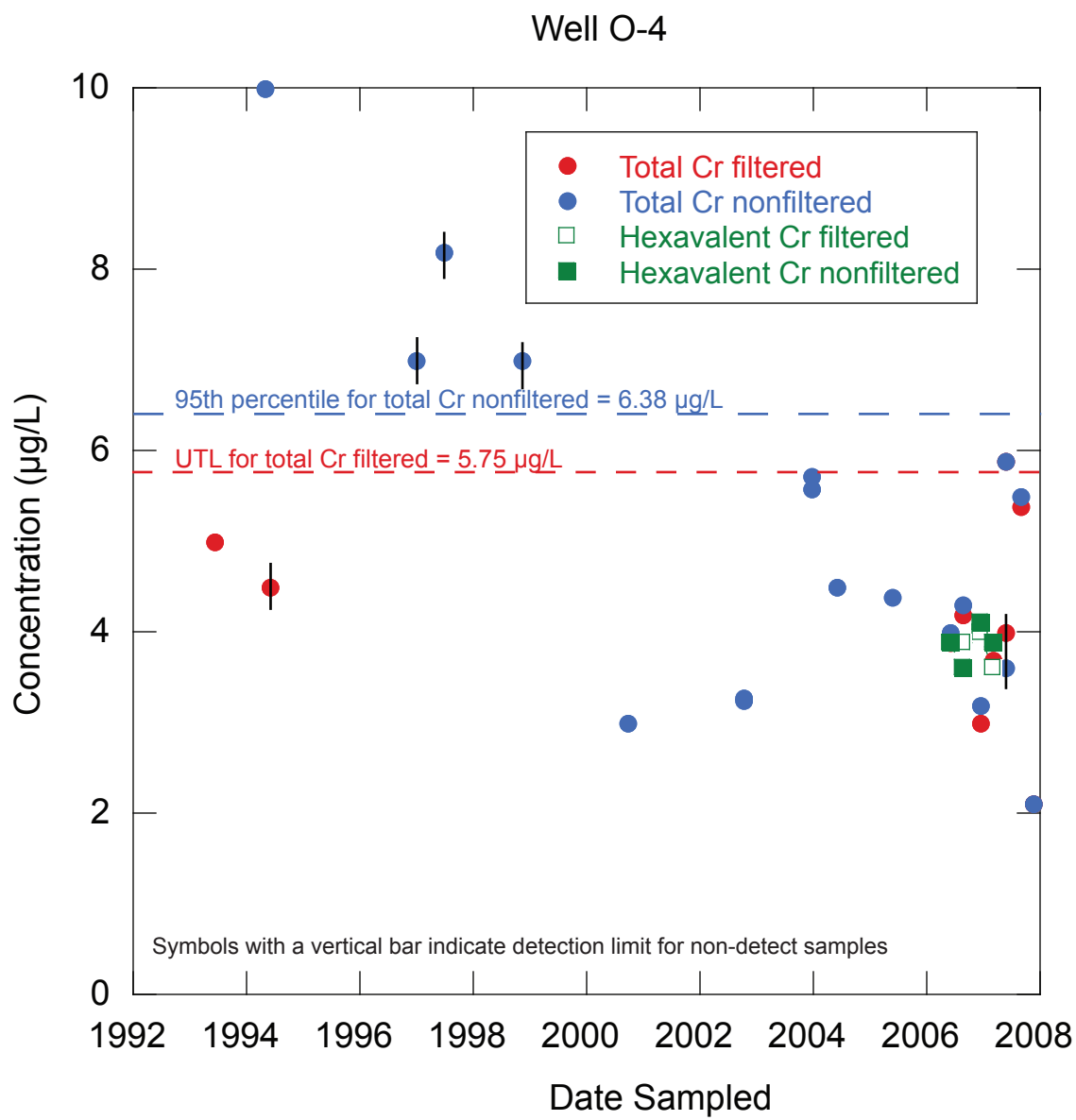
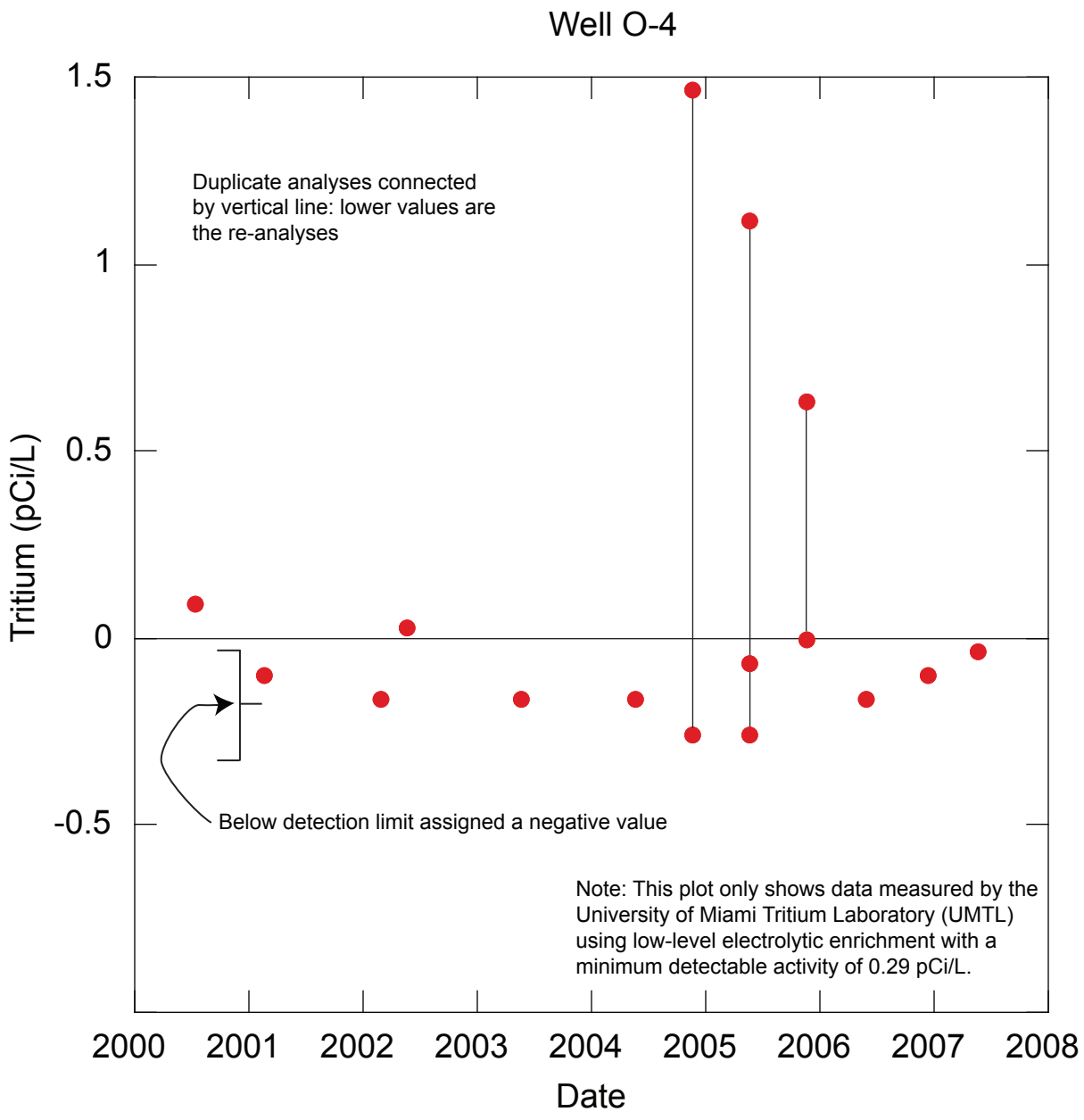


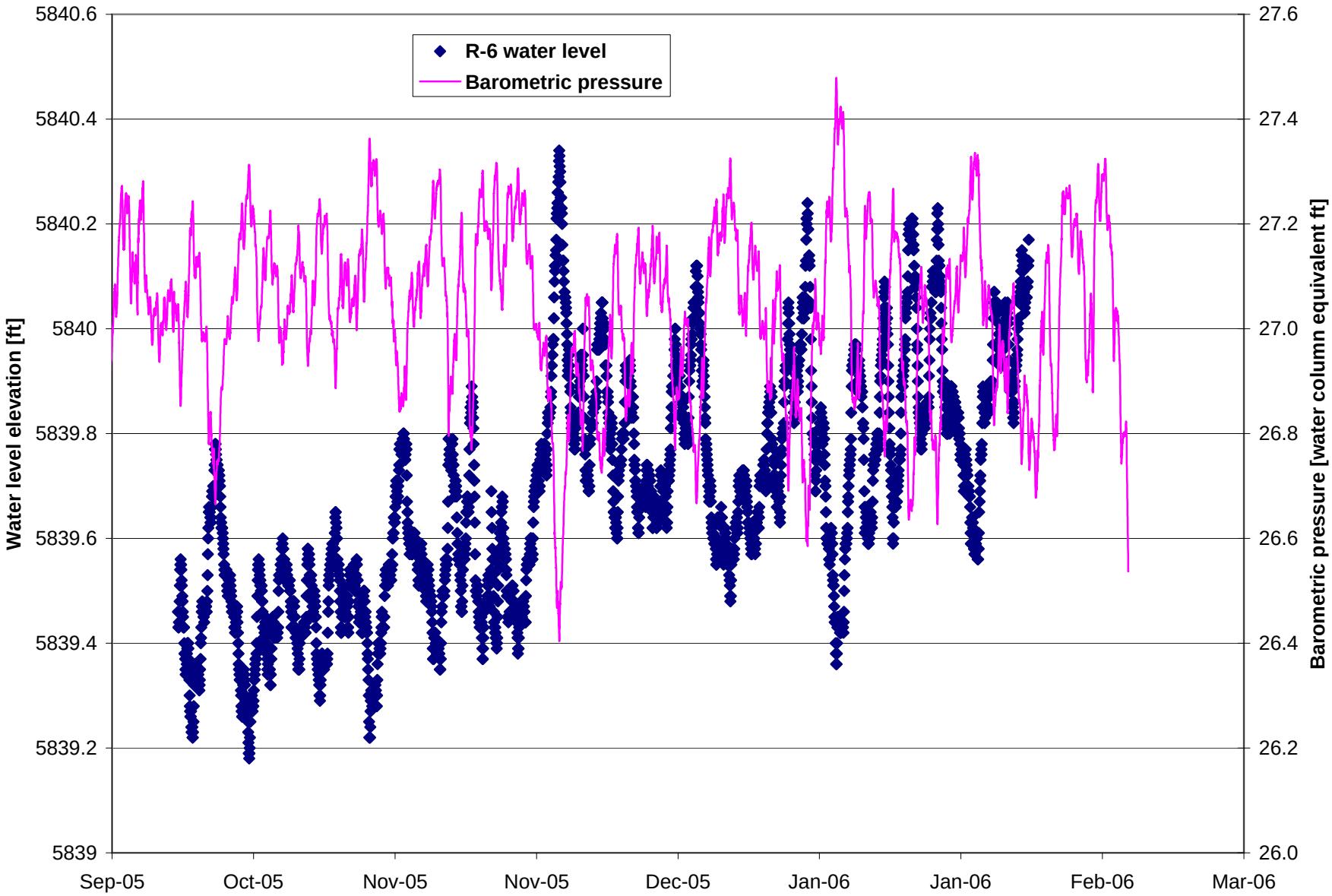
Beginning in 2004, plotted data are limited to those collected by SW-846 method 6850 with a MDL of 0.05; note that data collected before 2004 are much less precise and have MDLs ranging between 0.5 and 4 µg/L.

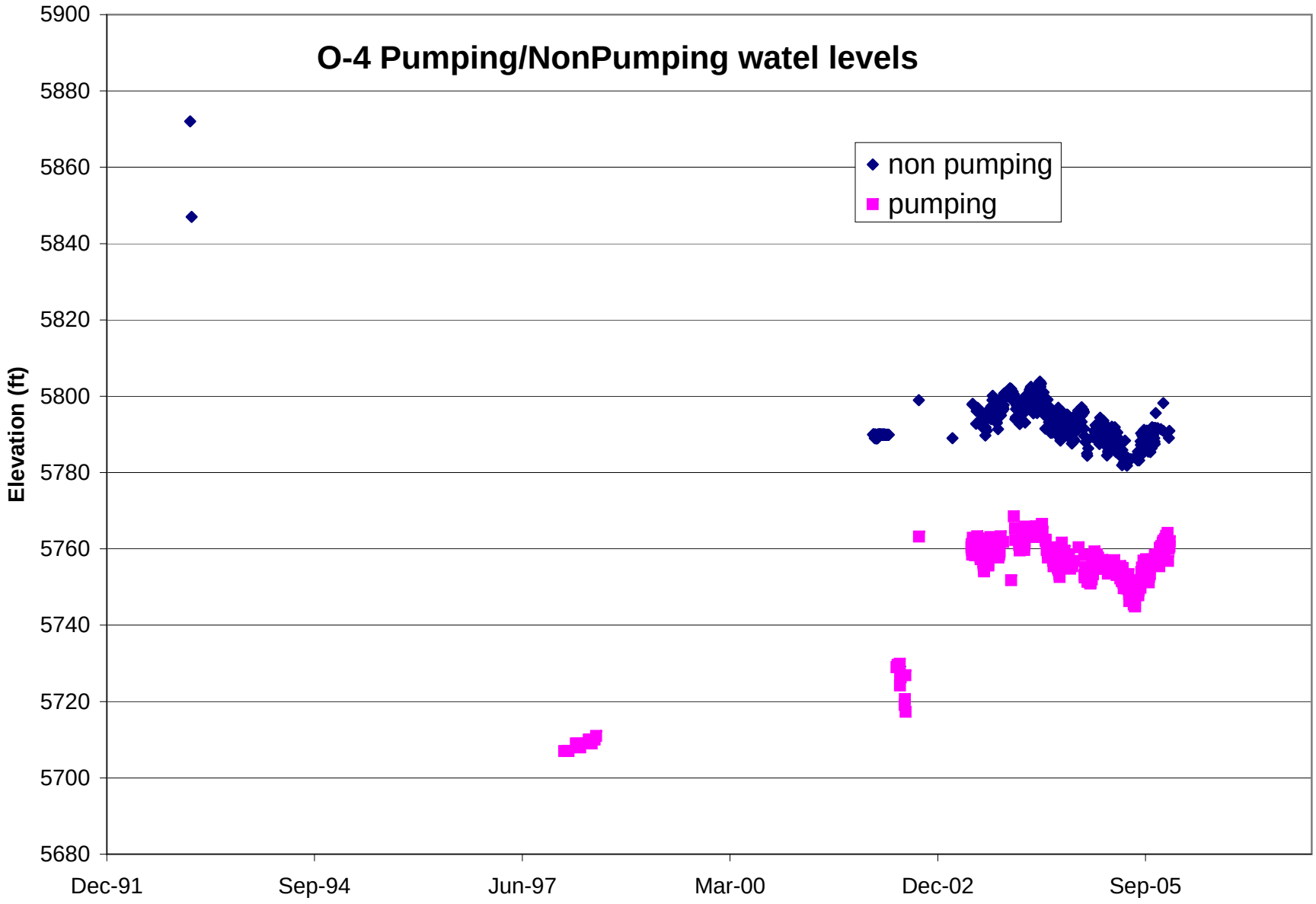

Well O-4
UTL for NO3 + NO2-N = 0.89 mg/L
Nitrate-Nitrite as N Concentration (mg/L)
1.0
0.8
0.6
0.4
0.2
0.0
1996
1998
2000
2002
2004
2006
2008
Date



Note: Prior to 2001, only legacy data are available for this well. These data did not undergo data verification and validation to determine their acceptability for use; these earlier analyses are considered less reliable than data collected after 2001.


Well O-4
Duplicate analyses connected by vertical line: lower values are the re-analyses
Below detection limit assigned a negative value
Note: This plot only shows data measured by the University of Miami Tritium Laboratory (UMTL) using low-level electrolytic enrichment with a minimum detectable activity of 0.29 pCi/L.
Tritium (pCi/L)
1.5
1
0.5
0
-0.5
2000
2001
2002
2003
2004
2005
2006
2007
2008
Date


R-6 water level
Barometric pressure
Water level elevation [ft]
Barometric pressure [water column equivalent ft]
5840.6
5840.4
5840.2
5840
5839.8
5839.6
5839.4
5839.2
5839
27.6
27.4
27.2
27.0
26.8
26.6
26.4
26.2
26.0
Sep-05
Oct-05
Nov-05
Nov-05
Dec-05
Jan-06
Jan-06
Feb-06
Mar-06


O-4 Pumping/NonPumping watel levels
non pumping
pumping
Elevation (ft)
5900
5880
5860
5840
5820
5800
5780
5760
5740
5720
5700
5680
Dec-91
Sep-94
Jun-97
Mar-00
Dec-02
Sep-05

The water level elevation of the regional aquifer at TW-3 is about 5840 ft (Figure 1). The TW-3 water levels are influenced by barometric pressure effects. If the effects are removed, the water levels are less variable. A comparison of the water level data at TW-3 (corrected or not for barometric pressure effects) to the production rate at O-4 does not suggest an influence of O-4 pumping on the TW-3 water levels. It should be noted that the pumping drawdown at O-4 in on the order of 35 ft, and the water-level variations at TW-3 are on the order of a tenth of a foot.

The water level elevation of the regional aquifer at R-6 is also 5840 ft (similar to TW-3). The R-6 water levels are also influenced by barometric pressure effects. The water levels at R-6 do not seem to be influenced by the pumping at O-4 (Figure 2).

The water level elevation at O-4 in February 1993 was measured at about 5872 ft [1,2,3]. Since 1998, daily pressure transducer data have been collected by the Los Alamos County. However, the depth at which the transducer is mounted is uncertain. As a result, the absolute elevation of the water level at the well is not known (i.e., it could be higher or lower than the data presented in Figure 1). Rather the transducer data characterize the temporal changes in the water levels and drawdown occurring during pumping (Fig 1). The non-pumping water-levels appear to be relatively steady with temporal fluctuations within 20 ft. The pumping drawdown is relatively steady and on the order of 30-35 ft. The configuration of the access tubes at O-4 has not allowed measurement of the absolute water level. The Laboratory will work with the County to circumvent this problem. If the absolute water level can be measured, it will then be possible to calibrate existing and future transducer data.

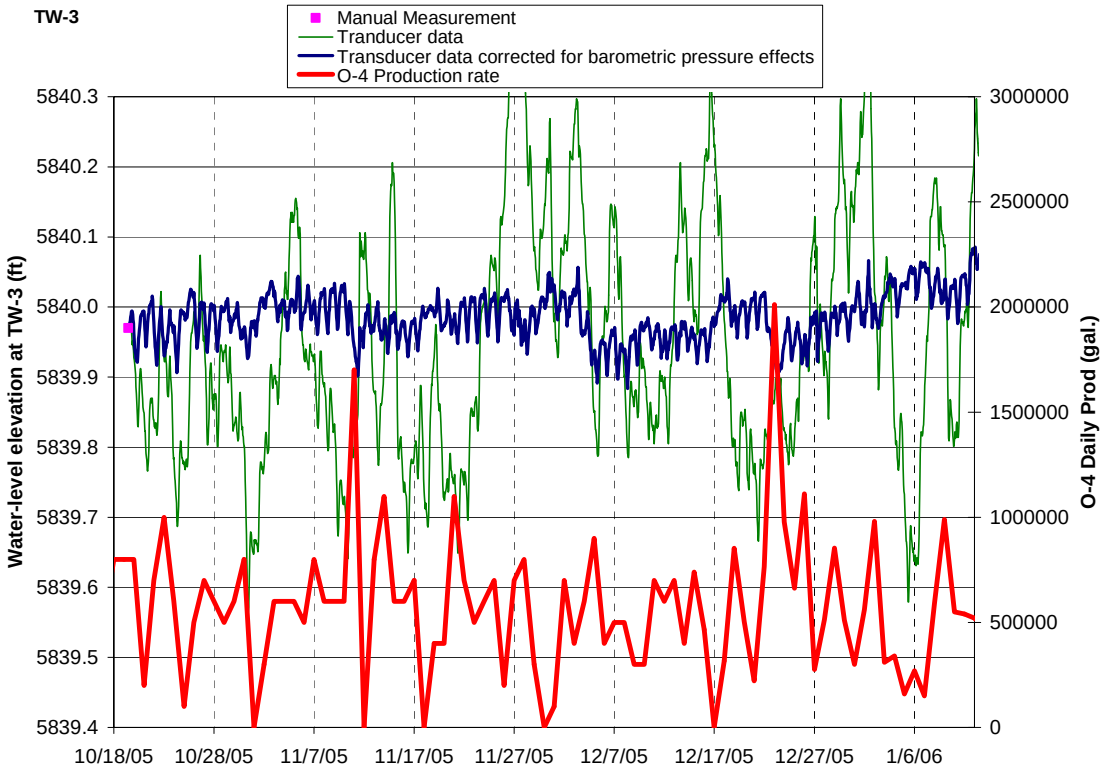


Figure 1. Water level elevation at TW-3 and production rates at O-4.

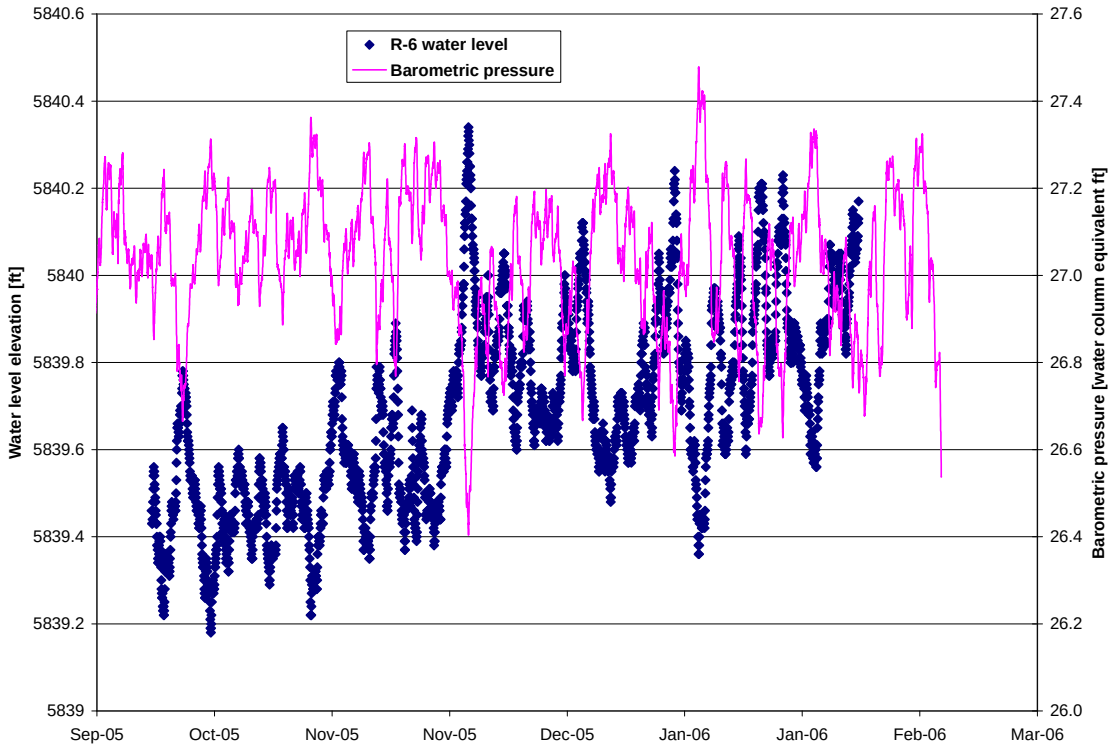


Figure 2. Water level elevation at R-6 and barometric pressure.

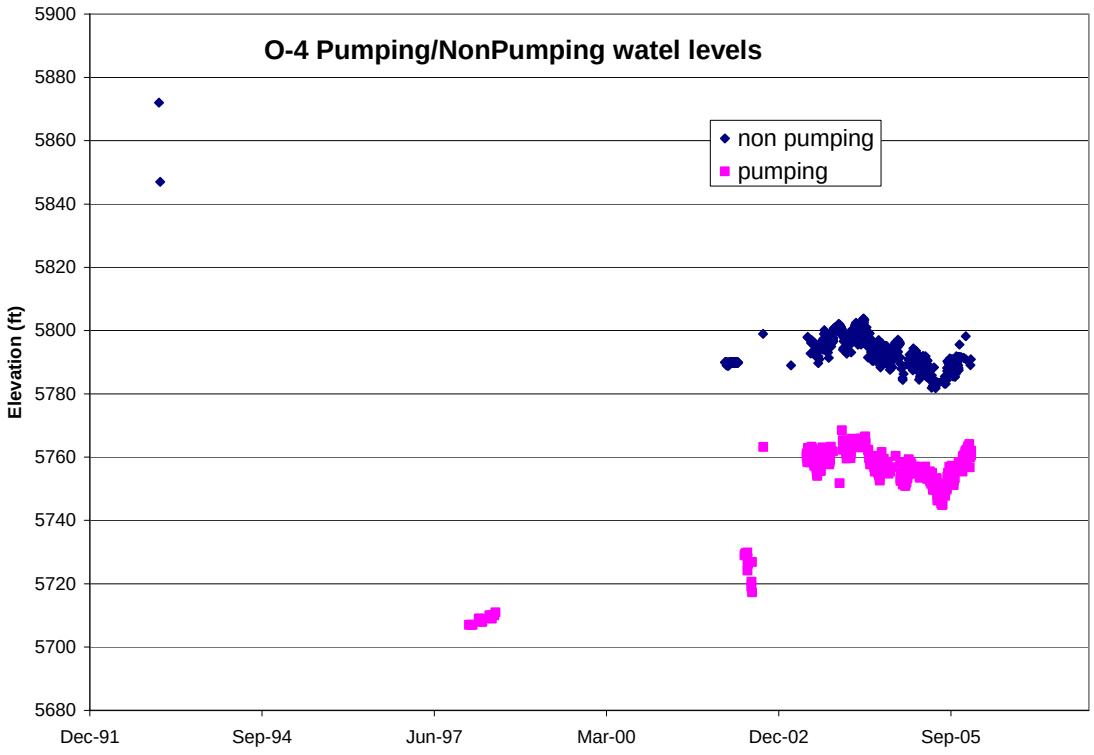
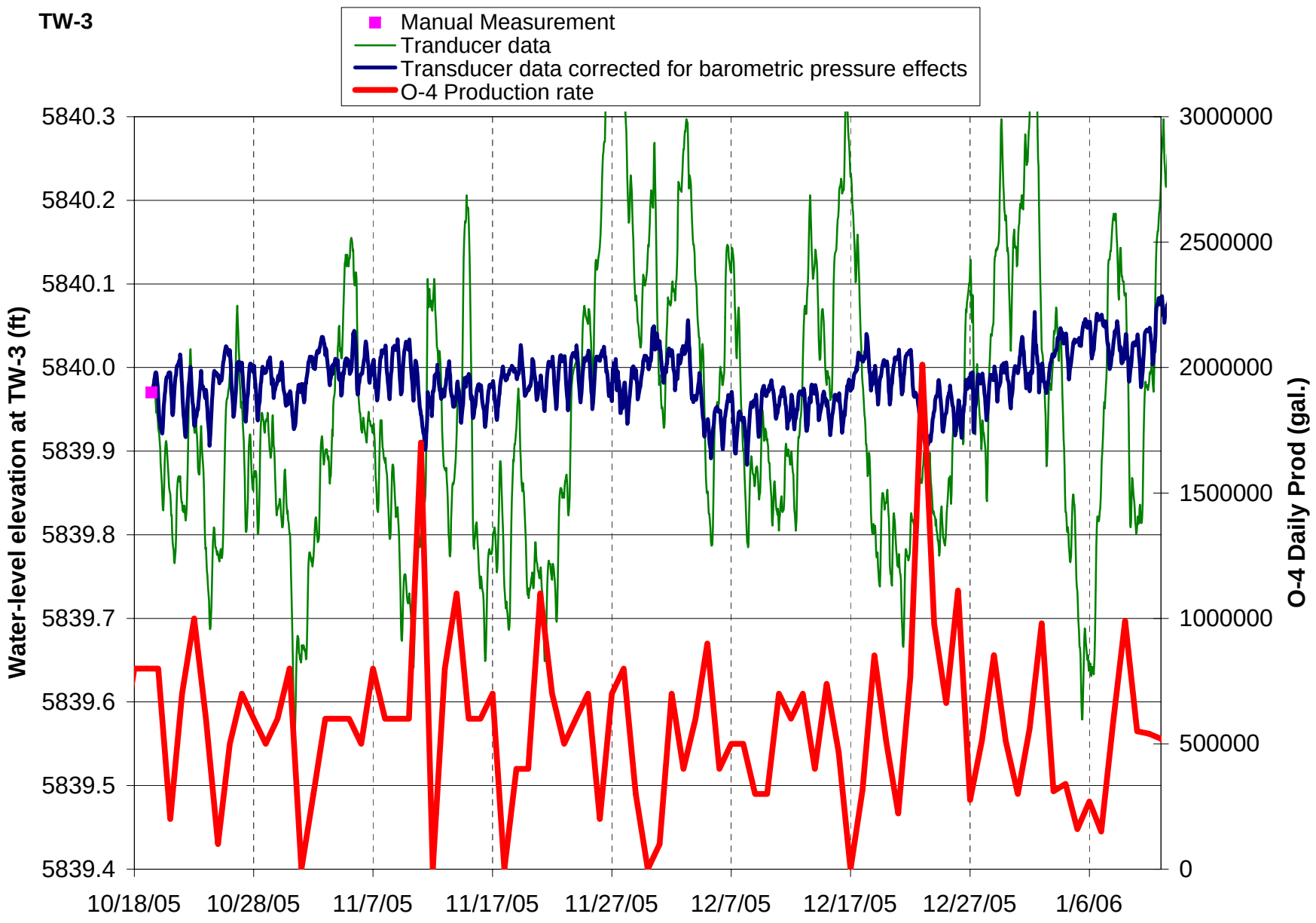


Figure 3. Water level elevations at O-4.

References:

1. Purtymun, W.D., McLin, S.G., Stoker, A.K., Maes, M.N., Hammock, B.G., 1993. Water Supply at Los Alamos during 1990. LA-12471-PR. Progress Report.
2. Purtymun, W.D., McLin, S.G., Stoker, A.K., Maes, M.N., 1995. Water Supply at Los Alamos during 1992. LA-12926-PR. Progress Report.
3. McLin, S.G., Purtymun, W.D., Maes, M.N., 1998. Water Supply at Los Alamos during 1997. LA-13548-PR. Progress Report.

Location	Port Depth (ft)	Date	Suite	Analyte	Request	Sample	F/UF	Martix	QC Type	Lab Type	Symbol	Result	Units	1-s TPU	MDA	Lab Qual	2nd Qual	2nd Reason	Lab	URI
O-4	1115	15-Nov-07	GENINORG	Perchlorate	197855	GU071100G4OW01	UF	WG		CS		0.354	ug/L						GELC	17512991
O-4	1115	15-Nov-07	METALS	Chromium	197855	GU071100G4OW01	UF	WG		CS		2.1	ug/L			J			GELC	17513001
O-4	1115	15-Nov-07	METALS	Chromium	197855	GF071100G4OW01	F	WG		CS		2.1	ug/L			J			GELC	17512961
O-4	1115	22-Aug-07	GENINORG	Nitrate-Nitrite as Nitrogen	192204	GU070800G4OW01	UF	WG		CS		0.57	mg/L						GELC	16641231
O-4	1115	22-Aug-07	GENINORG	Perchlorate	192204	GU070800G4OW01	UF	WG		CS		0.363	ug/L				J	LMS1	GELC	16641211
O-4	1115	22-Aug-07	METALS	Chromium	192204	GU070800G4OW01	UF	WG		CS	<	5.5	ug/L				U	I4a	GELC	16641251
O-4	1115	22-Aug-07	METALS	Chromium	192204	GF070800G4OW01	F	WG		CS	<	5.4	ug/L				U	I4a	GELC	16641181
O-4	1115	16-May-07	GENINORG	Perchlorate	186319	GU070500G4OW01	UF	WG		CS		0.38	ug/L				J-	LMS3	GELC	15861341
O-4	1115	16-May-07	METALS	Chromium	189207	GF070500G4OW01	F	WG		RE		4	ug/L						GELC	16008151
O-4	1115	16-May-07	METALS	Chromium	189207	GU070500G4OW01	UF	WG		RE		3.6	ug/L						GELC	16008161
O-4	1115	16-May-07	METALS	Chromium	186319	GU070500G4OW01	UF	WG		CS		5.9	ug/L				J+	IWQ6	GELC	15861861
O-4	1115	16-May-07	METALS	Chromium	186319	GF070500G4OW01	F	WG		CS		5.9	ug/L				J+	IWQ6	GELC	15860511
O-4	1115	16-May-07	RAD	Tritium	2345	UU070500G4OW01	UF	WG		CS	<	0.03193	pCi/L	0.28737	0.28737		U	R5	UMTL	15880201
O-4	1115	28-Feb-07	GENINORG	Perchlorate	181636	GU070200G4OW01	UF	WG		CS		0.367	ug/L				J	LMS1	GELC	15047901
O-4	1115	28-Feb-07	METALS	Chromium	181636	GF070200G4OW01	F	WG		CS		3.7	ug/L						GELC	15047871
O-4	1115	28-Feb-07	METALS	Chromium	181636	GU070200G4OW01	UF	WG		CS		3.6	ug/L						GELC	15047911
O-4	1115	28-Feb-07	METALS	Chromium hexavalent ion	E7C010243	SF070200G4OW01	F	WG		CS		3.6	ug/L				J	I9, I13b, I14b	STLA	14825921
O-4	1115	28-Feb-07	METALS	Chromium hexavalent ion	E7C010243	SU070200G4OW01	UF	WG		CS		3.9	ug/L				J	I9, I14b, I13b	STLA	14825931
O-4	1115	06-Dec-06	GENINORG	Perchlorate	177264	GU061200G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	14270721
O-4	1115	06-Dec-06	GENINORG	Perchlorate	177264	GU061200G4OW01	UF	WG		CS		0.383	ug/L						GELC	14270711
O-4	1115	06-Dec-06	METALS	Chromium	177264	GU061200G4OW01	UF	WG		CS		3.2	ug/L						GELC	14270731
O-4	1115	06-Dec-06	METALS	Chromium	177264	GF061200G4OW01	F	WG		CS		3	ug/L			J			GELC	14270681
O-4	1115	06-Dec-06	METALS	Chromium hexavalent ion	E6L070413	SF061200G4OW01	F	WG		CS		4	ug/L				J	I14b, I13b, I9	STLA	14311391
O-4	1115	06-Dec-06	METALS	Chromium hexavalent ion	E8L070413	SU061200G4OW01	UF	WG		CS		4.1	ug/L				J	I9, I13b, I14b	STLA	14311401
O-4	1115	06-Dec-06	RAD	Tritium	2293	UU061200G4OW01	UF	WG		CS	<	0.09579	pCi/L	0.28737	0.28737		U	R5	UMTL	14695881
O-4	1115	23-Aug-06	GENINORG	Perchlorate	170029	GU060800G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	13571741
O-4	1115	23-Aug-06	GENINORG	Perchlorate	170029	GU060800G4OW01	UF	WG		CS		0.388	ug/L						GELC	13571731
O-4	1115	23-Aug-06	METALS	Chromium	170029	GF060800G4OW01	F	WG		CS		4.2	ug/L						GELC	13571711
O-4	1115	23-Aug-06	METALS	Chromium	170029	GU060800G4OW01	UF	WG		CS		4.3	ug/L						GELC	13571751
O-4	1115	23-Aug-06	METALS	Chromium hexavalent ion	WG-04967-ST	SU060800G4OW01	UF	WG		CS		3.6	ug/L				J	I9	STSL	13863151
O-4	1115	23-Aug-06	METALS	Chromium hexavalent ion	WG-04967-ST	SF060800G4OW01	F	WG		CS		3.9	ug/L				J	I9	STSL	13863141
O-4	1115	24-May-06	GENINORG	Nitrate-Nitrite as Nitrogen	163796	GU060500G4OW01	UF	WG		CS		0.435	mg/L				J+	I3	GELC	12578011
O-4	1115	24-May-06	GENINORG	Perchlorate	163796	GU060500G4OW01	UF	WG		CS		0.369	ug/L						GELC	12576111
O-4	1115	24-May-06	GENINORG	Perchlorate	163796	GU060500G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	12577971
O-4	1115	24-May-06	METALS	Chromium	163796	GU060500G4OW01	UF	WG		CS		4	ug/L			J			GELC	12578261
O-4	1115	24-May-06	METALS	Chromium	163796	GF060500G4OW01	F	WG		CS		3.9	ug/L			J			GELC	12579131
O-4	1115	24-May-06	METALS	Chromium hexavalent ion	E6E250371	SU060500G4OW01	UF	WG		CS		3.9	ug/L						STLA	12522571
O-4	1115	24-May-06	METALS	Chromium hexavalent ion	E6E250371	SF060500G4OW01	F	WG		CS		3.9	ug/L						STLA	12522561
O-4	1115	24-May-06	RAD	Tritium	163796	GU060500G4OW01	UF	WG		CS	<	-118	pCi/L	79.1	273	U	U	R5	GELC	12575681
O-4	1115	24-May-06	RAD	Tritium	2215	UU060500G4OW01	UF	WG		CS	<	0.15965	pCi/L	0.28737	0.28737		U	R5	UMTL	12529511
O-4	1115	19-Jan-06	GENINORG	Perchlorate	154261	GU060100G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	12029051
O-4	1115	19-Jan-06	GENINORG	Perchlorate	154261	GU060100G4OW01	UF	WG		CS		0.36	ug/L						GELC	12029121
O-4	1115	16-Nov-05	GENINORG	Perchlorate	150367	GU05110G4OW01	UF	WG		CS		0.404	ug/L						GELC	11635361
O-4	1115	16-Nov-05	GENINORG	Perchlorate	150367	GU05110G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	11634911
O-4	1115	16-Nov-05	RAD	Tritium	2143	UU05110G4OW01	UF	WG		CS		0.6386	pCi/L	0.28737	0.28737		J	RWQ2	UMTL	11666851
O-4	1115	16-Nov-05	RAD	Tritium	2143	UU05110G4OW01	UF	WG		RE	<	0	pCi/L	0.28737	0.28737		U	R5	UMTL	11666961
O-4	1115	17-Aug-05	GENINORG	Perchlorate	143462	GU05080G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	10984611
O-4	1115	17-Aug-05	GENINORG	Perchlorate	143462	GU05080G4OW01	UF	WG		CS		0.365	ug/L						GELC	10984671
O-4	1115	18-May-05	GENINORG	Nitrate-Nitrite as Nitrogen	136876	GU05050G4OW01	UF	WG		CS		0.414	mg/L				J+	I3	GELC	10483341
O-4	1115	18-May-05	GENINORG	Perchlorate	136876	GU05050G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	10482901
O-4	1115	18-May-05	GENINORG	Perchlorate	136876	GU05050G4OW01	UF	WG		CS		0.381	ug/L						GELC	10480611
O-4	1115	18-May-05	METALS	Chromium	136876	GU05050G4OW01	UF	WG		CS		4.4	ug/L			J	JN-	IWQ2	GELC	10482051
O-4	1115	18-May-05	RAD	Tritium	2063	UU05050G4OW01	UF	WG		REDP	<	-0.25544	pCi/L	0.28737			U	R5	UMTL	10504861
O-4	1115	18-May-05	RAD	Tritium	2063	UU05050G4OW01	UF	WG		RE	<	0.06386	pCi/L	0.15965			U	R5	UMTL	10504831
O-4	1115	18-May-05	RAD	Tritium	136876	GU05050G4OW01	UF	WG		CS	<	46.7	pCi/L	59.4	199	U	U	R5	GELC	10480921
O-4	1115	18-May-05	RAD	Tritium	2063	UU05050G4OW01	UF	WG		CS		1.11755	pCi/L	0.28737					UMTL	10504741
O-4	1115	23-Mar-05	GENINORG	Perchlorate	133108	GU05030G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	9217181
O-4	1115	23-Mar-05	GENINORG	Perchlorate	133108	GU05030G4OW01	UF	WG		CS		0.376	ug/L				J	LMS1	GELC	9217241
O-4	1115	16-Nov-04	GENINORG	Perchlorate	125808	GU04110G4OW01	UF	WG		CS		0.392	ug/L						GELC	8943201
O-4	1115	16-Nov-04	GENINORG	Perchlorate	125808	GU04110G4OW01	UF	WG		CS	<	4	ug/L			U	UJ	I3e	GELC	8943191
O-4	1115	16-Nov-04	RAD	Tritium	1982	UU04110G4OW01	UF	WG		CS		1.46878	pCi/L	0.19158					UMTL	9068211
O-4	1115	16-Nov-04	RAD	Tritium	1982	UU04110G4OW01	UF	WG		RE	<	-0.25544	pCi/L	0.28737			U	R5	UMTL	9068331
O-4	1115	31-Aug-04	GENINORG	Perchlorate	120403	GU04080G4OW90	UF	WG	FD	CS	<	4	ug/L			U			GELC	8435351
O-4	1115	31-Aug-04	GENINORG	Perchlorate	120403	GU04080G4OW90	UF	WG	FD	CS		0.378	ug/L						GELC	8435371
O-4	1115	31-Aug-04	GENINORG	Perchlorate	120403	GU04080G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	8435341
O-4	1115	31-Aug-04	GENINORG	Perchlorate	120404	GU04080G4OW01	UF	WG		DUP	<	4	ug/L			U			GELC	8424441
O-4	1115	31-Aug-04	GENINORG	Perchlorate	120403	GU04080G4OW01	UF	WG		CS		0.388	ug/L						GELC	8435361
O-4	1115	20-May-04	GENINORG	Nitrate-Nitrite as Nitrogen	113497	GU04050G4OW01	UF	WG		CS		0.34	mg/L						GELC	7846841
O-4	1115	20-May-04	GENINORG	Perchlorate	113497	GU04050G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	7846831
O-4	1115	20-May-04	GENINORG	Perchlorate	113497	GU04050G4OW01	UF	WG		CS		0.358	ug/L						GELC	7845751
O-4	1115	20-May-04	METALS	Chromium	113497	GU04050G4OW01	UF	WG		CS		4.5	ug/L			B			GELC	7840991
O-4	1115	20-May-04	RAD	Chromium-51	113497	GU04050G4OW01	UF	WG		CS	<	-7.66	pCi/L	9.46	33	U	U	R5	GELC	7847451
O-4	1115	20-May-04	RAD	Tritium	113497	GU04050G4OW01	UF	WG		DUP	<	31	pCi/L	49.9	162	U			GELC	7858711
O-4	1115	20-May-04	RAD	Tritium	113497	GU04050G4OW01	UF	WG		CS	<	0	pCi/L	51.4	169	U	U	R5	GELC	7847311
O-4	1115	20-May-04	RAD	Tritium	1895	UU04050G4OW01	UF	WG		CS	<	-0.15965	pCi/L	0.28737			U	R5	UMTL	8364461
O-4	1115	24-Mar-04	GENINORG	Perchlorate	109675	GU04030G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	7442571
O-4	1115	24-Mar-04	GENINORG	Perchlorate	109675	GU04030G4OW01	UF	WG		CS		0.393	ug/L				J+	LMS2	GELC	7442631
O-4	1115	09-Feb-04	GENINORG	Perchlorate	106769	GU04020G4OW01	UF	WG		CS		0.37	ug/L				J	LI4, LRP1	GELC	7353901
O-4	1115	09-Feb-04	GENINORG	Perchlorate	106769	GU04020G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	7353761
O-4	1115	28-Jan-04	GENINORG	Perchlorate	106092	GU04010G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	7323341
O-4	1115	28-Jan-04	GENINORG	Perchlorate	106092	GU04010G4OW01	UF	WG		CS		0.391	ug/L				J	LMS1	GELC	7323381
O-4	1115	17-Dec-03	GENINORG	Nitrate-Nitrite as Nitrogen	104143	GU03110G4OW02	UF	WG		CS		0.41	mg/L				J	I14b, I13b	GELC	7486531
O-4	1115	17-Dec-03	GENINORG	Perchlorate	104143	GU03120G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	7486601
O-4	1115	17-Dec-03	METALS	Chromium	104143	GU03110G4OW02	UF	WG		CS		5.71	ug/L						GELC	7487341
O-4	1115	17-Dec-03	METALS	Chromium	104143	GU03110G4OW02	UF	WG		DUP		5.58	ug/L						GELC	7487531
O-4	1115	24-Sep-03	GENINORG	Perchlorate	88734	GU03090G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	6979431
O-4	1115	21-Aug-03	GENINORG	Nitrate-Nitrite as Nitrogen	86692	GU03080G4OW01	UF	WG		CS		0.43	mg/L						GELC	6870231
O-4	1115	21-Aug-03	GENINORG	Perchlorate	86701	GU03080G4OW02	UF	WG		CS	<	4	ug/L			U			GELC	6803681
O-4	1115	21-Aug-03	GENINORG	Perchlorate	86701	GU03080G4OW02	UF	WG		DUP	<	4	ug/L			U			GELC	6803781
O-4	1115	21-Aug-03	GENINORG	Perchlorate	86692	GU03080G4OW01	UF	WG		CS	<	4	ug/L			U			GELC	6870291
O-4	1115	21-Aug-03	RAD	Chromium-51	86692	GU03080G4OW01	UF	WG		CS	<	4.21	pCi/L	14.8	50	U	U	R5	GELC	6864251
O-4	1115	21-Aug-03	RAD	Tritium	86692	GU03080G4OW01	UF	WG		CS	<	-12.3	pCi/L	54.4	180	U	U	R5	GELC	6864701
O-4	1115	23-Jul-03	GENINORG	Perchlorate	84792	GU03070G4OW01	UF	WG		CS	<	0.989	ug/L			U			GELC	6655261
O-4	1115	18-Jun-03	GENINORG	Perchlorate	82633	GU03060G4OW01	UF	WG		CS	<	0.989	ug/L			U			GELC	6562291
O-4	1115	20-May-03	GENINORG	Perchlorate	80766	GU03050G4OW01	UF	WG		CS	<	1.45	ug/L			U			GELC	6534351
O-4	1115	20-May-03	RAD	Tritium	1779	UU03050G4OW01	UF	WG		CS	<	-0.15965	pCi/L	0.28737			U	R5	UMTL	6993581
O-4	1115	08-Feb-03	GENINORG	Perchlorate	74816	GU03020G4OW01	UF	WG		CS	<	1.45	ug/L			U			GELC	6409261
O-4	1115	09-Oct-02	METALS	Chromium	68610	NSOT4.02.1009	UF	WG		DUP		3.27	ug/L						GELC	6077631
O-4	1115	09-Oct-02	METALS	Chromium	68610	NSOT4.02.1009	UF	WG		CS		3.24	ug/L						GELC	6077191
O-4	1115	24-Aug-02	GENINORG	Perchlorate	66133	GU02080G4OW01	UF	WG		CS	<	1.45	ug/L			U			GELC	6006471
O-4	1115	18-May-02	GENINORG	Nitrate-Nitrite as Nitrogen	60759	GU02050G4OW02	UF	WG		CS		0.4	mg/L						GELC	6376141
O-4	1115	18-May-02	RAD	Chromium-51	60759	GU02050G4OW02	UF	WG		CS	<	3.24	pCi/L	12	40.5	U	U	R5	GELC	6380321
O-4	1115	18-May-02	RAD	Tritium	JB1611	UU02050G4OW01	UF	WG		CS		0.03193	pCi/L	0.12772					UMTL	6119681
O-4	1115	18-May-02	RAD	Tritium	60759	GU02050G4OW02	UF	WG		CS	<	-53.3	pCi/L	48.7	166	U	U	R5	GELC	6380181
O-4	1115	18-May-02	GENINORG	Perchlorate	60759	GU02050G4OW01	UF	WG		CS	<	1.45	ug/L			U			GELC	6376311
O-4	1115	23-Feb-02	RAD	Tritium	JB1583	UU02021G4OW	UF	WG		CS		-0.15965	pCi/L	0.15965					UMTL	6120021
O-4	1115	28-Nov-01	GENINORG	Perchlorate	52658	GU01111G4OW	UF	WG		CS		3.6	ug/L			J			GELC	5275711
O-4	1115	28-Nov-01	GENINORG	Perchlorate	L92970	BU01111G4OW	UF	WG		CS	<	2.17	ug/L			U			BABC	5371431
O-4	1115	28-Nov-01	GENINORG	Perchlorate	G01120007	AU01111G40W	UF	WG		CS	<	0.25	ug/L			U			ACCU	5422181
O-4	1115	24-Oct-01	GENINORG	Perchlorate	51053	GU01101G4OW	UF	WG		CS	<	0.958	ug/L			U	UJ	I13b	GELC	5215171
O-4	1115	24-Oct-01	GENINORG	Perchlorate	G01100473	AU01101G40W	UF	WG		CS		0.55	ug/L			B	J	IWQ6	ACCU	5421091
O-4	1115	24-Oct-01	GENINORG	Perchlorate	L91585	BU01101G4OW	UF	WG		CS	<	2.17	ug/L			U			BABC	5370741
O-4	1115	08-Aug-01	GENINORG	Perchlorate	47470	GU01081G4OW	UF	WG		CS		1.65	ug/L			J			GELC	4896401
O-4	1115	08-Aug-01	GENINORG	Perchlorate	49641	GU01081G4OW	UF	WG		CS		1.43	ug/L			J			GELC	5091391
O-4	1115	09-May-01	GENINORG	Nitrate-Nitrite as Nitrogen	42072	GU01051G4OW	UF	WG		CS		0.39	mg/L						GELC	1689311
O-4	1115	09-May-01	RAD	Chromium-51	42072	GU01051G4OW	UF	WG		CS	<	1.86	pCi/L	9.63	32.6	U	U	R5	GELC	1686651
O-4	1115	09-May-01	RAD	Tritium	42072	GU01051G4OW	UF	WG		CS	<	-116	pCi/L	55.1	196	U	U	R5	GELC	1686861
O-4	1115	14-Feb-01	GENINORG	Perchlorate	L81054	BB01021G4OW	UF	WG		CS	<	1.2	ug/L			U			BABC	5369561
O-4	1115	14-Feb-01	GENINORG	Perchlorate	37858	GB01021G4OW	UF	WG		CS	<	0.958	ug/L			U	UJ	IWQ1	GELC	939701
O-4	1115	14-Feb-01	RAD	Tritium	JB1446	MB01021G4OW	UF	WG		CS		-0.09579	pCi/L	0.15965					UMTL	7323741
O-4	1115	15-Nov-00	GENINORG	Perchlorate	L77356	BM0111G40W	UF	WG		CS	<	1	ug/L			U			BABC	1074261
O-4	1115	27-Sep-00	GENINORG	Nitrate-Nitrite as Nitrogen	2312727	2312727	UF	WG		CS		0.393	mg/L						NMSSL	1073891
O-4	1115	25-Sep-00	METALS	Chromium	2312737	2312737	UF	WG		CS		3	ug/L						NMSSL	1073141
O-4	1115	14-Aug-00	GENINORG	Nitrate as Nitrogen	100046417	CM00081G4OW	UF	WG		CS		0.43	mg/L	0.04						3935221
O-4	1115	14-Aug-00	GENINORG	Nitrate-Nitrite as Nitrogen	100046417	CM00081G4OW	UF	WG		CS		0.430000007	mg/L	0.04					CST	917881
O-4	1115	14-Aug-00	RAD	Tritium	100046417	CM00081G4OW	UF	WG		CS		-60	pCi/L	390					CST	928661
O-4	1115	07-Jul-00	RAD	Tritium	1360	MM00061G40W	UF	WG		CS		0.09579	pCi/L	0.28737					UMTL	1074001
O-4	1115	21-Jun-00	GENINORG	Perchlorate	L70922	BM00061G40W	UF	WG		CS	<	4	ug/L			U			BABC	1071961
O-4	1115	09-Mar-99	GENINORG	Nitrate as Nitrogen	100035888	MM99031G4OW	UF	WG		CS		0.45	mg/L	0.04						2879701
O-4	1115	09-Mar-99	RAD	Tritium	100035888	MM99031G4OW	UF	WG		CS		-140	pCi/L	610	410					2878281
O-4	1115	12-Nov-98	GENINORG	Nitrate as Nitrogen	100033767	MM98111G4OW	UF	WG		CS		0.33	mg/L	0.03					CST	4567811
O-4	1115	12-Nov-98	METALS	Chromium	100033767	MM98111G4OW	UF	WG		CS	<	7	ug/L	7		UL			CST	4566251
O-4	1115	12-Nov-98	RAD	Tritium	100033767	MM98111G4OW	UF	WG		CS		51.25	pCi/L	680	480				CST	4565861
O-4	1115	25-Jun-97	GENINORG	Nitrate as Nitrogen	100020481	MM96071G4OW	UF	WG		CS		0.72	mg/L	0.07					CST	4656861
O-4	1115	25-Jun-97	METALS	Chromium	100020481	MM96071G4OW	UF	WG		CS	<	8.2	ug/L	8.2		UL			CST	2256841
O-4	1115	25-Jun-97	RAD	Tritium	100020481	MM96071G4OW	UF	WG		CS		288	pCi/L	710	865				CST	2354061
O-4	1115	16-Dec-96	GENINORG	Nitrate as Nitrogen	24285	MM96121G4OW	UF	WG		CS		0.44	mg/L	0.04						1851171
O-4	1115	16-Dec-96	METALS	Chromium	24285	MM96121G4OW	UF	WG		CS	<	7	ug/L	7		UL				1851281
O-4	1115	16-Dec-96	RAD	Tritium	24284	MM96121G4OW	UF	WG		CS		-506	pCi/L	138						1844541
O-4	1115	24-May-94	GENINORG	Nitrate as Nitrogen	X	9405WGG40W	F	WG		CS		2.52	mg/L							1886711
O-4	1115	24-May-94	METALS	Chromium	X	9405WGG40W	F	WG		CS	<	4.5	ug/L			UL				1886571
O-4	1115	24-May-94	RAD	Tritium	X	9405WGG40W	UF	WG		CS		0	pCi/L	100						1881601
O-4	1115	28-Apr-94	METALS	Chromium	28-APR-94	9404WGG40W	UF	WG		CS		10	ug/L							2535181
O-4	1115	02-Jun-93	GENINORG	Nitrate as Nitrogen	X	9306WGG40W	F	WG		CS		0.37	mg/L							4064781
O-4	1115	02-Jun-93	METALS	Chromium	X	9306WGG40W	F	WG		CS		5	ug/L							4064891
O-4	1115	02-Jun-93	RAD	Tritium	X	9306WGG40W	UF	WG		CS		300	pCi/L	300						4064681


TW-3
Manual Measurement
Tranducer data
Transducer data corrected for barometric pressure effects
O-4 Production rate
Water-level elevation at TW-3 (ft)
O-4 Daily Prod (gal.)
5840.3
5840.2
5840.1
5840.0
5839.9
5839.8
5839.7
5839.6
5839.5
5839.4
3000000
2500000
2000000
1500000
1000000
500000
0
10/18/05
10/28/05
11/7/05
11/17/05
11/27/05
12/7/05
12/17/05
12/27/05
1/6/06