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June 7, 2005

Norman Shopay
Project Manager
California Department of Toxic Substances Control
Geology and Corrective Action Branch
700 Heinz Avenue, Suite 200
Berkeley, California 94710

Subject: Evaluation of Site-wide Groundwater Data for Hydraulic Gradient Mapping
PG&E Topock Compressor Station, Needles, California

Dear Mr. Shopay:

The enclosed technical memorandum is intended to meet the requirement in Item 5 of the Department of Toxic Substances Control's April 26, 2005 letter. The technical memorandum presents and evaluates recently collected data on site-wide groundwater levels in three aquifer depths at the Pacific Gas and Electric Company Topock Site, and identifies locations where additional wells might be installed to provide additional groundwater level measurements if contouring groundwater levels in multiple depths across the site is determined to be necessary. If you have any questions on the technical memorandum, please call me at (805) 546-5243.

Sincerely,

Cc: Kate Burger
Karen Baker
Fred Zanoria
Aaron Yue

Evaluation of Sitewide Groundwater Data for Hydraulic Gradient Mapping

PG&E Topock Compressor Station

DATE: June 7, 2005

Introduction

At the request of the Department of Toxic Substances Control (DTSC), groundwater elevation data were collected at monitoring wells at the Topock site to assess the horizontal hydraulic gradients in the Alluvial Aquifer. The DTSC requested that Pacific Gas and Electric Company (PG&E) produce sitewide water level contour maps representing three different depths in the Alluvial Aquifer.

Groundwater occurs under unconfined to semi-confined conditions within the alluvial fan and fluvial sediments beneath most of the Topock site. The saturated portion of the alluvial fan and fluvial sediments are collectively referred as the Alluvial Aquifer. Typical of alluvial aquifers in arid regions, the unconsolidated aquifer consists primarily of clayey/silty sand and clayey gravel deposits interbedded with more permeable sand and gravel deposits. The Alluvial Aquifer is underlain by the Miocene conglomerate and pre-Tertiary metamorphic and igneous bedrock with very low permeability; therefore, groundwater movement occurs primarily in the overlying unconsolidated deposits.

The water table in the Alluvial Aquifer is very flat throughout the site and typically equilibrates to an elevation within 2 to 3 feet of the river level. The saturated thickness of the Alluvial Aquifer ranges from about 100 feet in the floodplain to greater than 250 feet in the western portion of the site. The Alluvial Aquifer thins abruptly to the south, pinching out along the Miocene conglomerate and bedrock formations.

Because of vertical gradients in the aquifer, water levels in wells with screens near the bottom of the Alluvial Aquifer exhibit slightly different water levels than nearby wells screened near the top of the aquifer. To screen out the effects of vertical gradients and produce a map of horizontal groundwater gradients only, it is useful to group the wells according to the elevations of their screened intervals. For the Topock site, we have arbitrarily chosen three groupings: shallow, mid-depth, and deep. These groupings are based strictly on screened interval depths and do not correspond to any definable hydrostratigraphic layers in the aquifer.

The water level measurement survey was conducted on May 18, 2005 and involved the manual collection of static water levels at 57 wells over an approximately 2-hour period. The elevation and gradient data reflect a "snap-shot" view of hydraulic conditions in the

aquifer at one point in time. The aquifer across the Topock site responds to changes in river level. Wells near the river respond within hours. Wells located in upland areas further from the river show response over a period of weeks.

The May 18 water level survey followed a large and rather abrupt seasonal rise in the level of the Colorado River. Figure 1 shows the hydrograph of river levels measured at the I-3 gauging station located at the Topock site during the period from January through mid-May 2005. The seasonal rise in river level began in mid-March and continued through mid-April. During this period, the daily average river level rose by about 5 feet. The “snapshot” of water level data collected on May 18 shows the aquifer in a period of transition between winter (low) and summer (high) water level conditions. The direction and magnitude of the gradients measured on May 18 are not considered representative of the average conditions in the aquifer over the course of the year.

Approach

The aquifer at the Topock site is stratified with regard to salinity, with deeper wells typically showing more saline water. There are also variations in groundwater temperature, with higher temperatures found in deeper zones away from the river. The salinity and temperature differences create slight differences in density of the groundwater. Because of the relatively flat gradients at the Topock site, it is necessary to consider these slight density differences in contouring groundwater levels. We have therefore applied a salinity/temperature adjustment to the water level measurements. This adjustment results in a set of groundwater elevations corrected to reflect equivalent freshwater heads. Prior to obtaining the water level measurements, the standing water columns in the casing above the well screens were mixed to minimize the effects of density gradients in the wells and allow an accurate measurement of the salinity and temperature needed to calculate the equivalent freshwater heads.

Table 1 summarizes the well completion and elevation data for the groundwater monitoring and observation wells monitored for this hydraulic gradient evaluation. Long-screen production and test wells and wells completed in bedrock formations are not applicable for hydraulic gradient evaluation of the Alluvial Aquifer and are not used in this assessment.

Groundwater levels in wells located on the floodplain are measured using transducers and reported in the monthly Performance Monitoring Reports. Because the wells on the floodplain respond minute by minute to the river level changes, it is necessary to monitor them with transducers in order to assess the average gradient conditions on the floodplain. Floodplain wells are therefore not included in this “snapshot” of sitewide water levels.

As shown on Table 1, the wells are grouped into the following categories¹:

- **Shallow Wells**, with screen depths less than 30 feet below the water table.
- **Middle-depth Wells**, with screen depths between 30 and 90 feet below the water table.

¹ the mid-point of the well screen is the datum used to group site wells into these three categories

- **Deep Wells**, with screen depths deeper than 90 feet below the water table. The deepest monitoring wells at the site have mid-screen depths exceeding 200 feet below the water table.

In well clusters where a only a shallow and deep monitoring well exist, the groundwater elevations for the shallow and deep wells were used to calculate an interpolated groundwater elevation value for a depth point located midway between the shallow and deep well screens. The locations where interpolated groundwater elevations were calculated include the MW-24 well cluster and the MW-40 well cluster. (See Table 1 for screen and well elevation data for the wells used for interpolating middle-depth groundwater elevation points.)

Table 2 summarizes the water level measurements, salinity and temperature data, and the uncorrected and salinity-adjusted groundwater elevations for the May 18 water level survey. Also listed in Table 2 are the interpolated groundwater elevations for mid-depth aquifer intervals at the MW-24 and MW-40 well clusters.

Groundwater Gradient Assessment

Horizontal Gradient Mapping

Groundwater Elevation Map for Shallow Wells

Figure 2 presents the May 18 groundwater elevation contour map for the shallow monitoring wells. The groundwater elevations for the shallow wells range from 456.20 to 454.56 feet above mean sea level (msl). Groundwater elevation data from 31 wells are used for this gradient map. The contour interval for the groundwater elevation map is 0.2 foot. There are more shallow wells than middle and deep wells available at the site; therefore, a more extensive contour map can be drawn using shallow wells. In particular, the shallow wells in the New Ponds area provide control on water levels in the western portion of the site.

The groundwater gradient for the shallow wells shows a southward gradient in wells nearer the Park Moabi slough and a north to northwestward gradient in wells nearer the mountains. Between these two opposite gradients is a trough extending from the New Ponds area eastward to the MW-20 bench area (well TW-2D pumping location). The southerly gradient in wells nearer the river and the Park Moabi slough is believed to be a reflection of the transient condition of the aquifer as it adjusts to the rapid river level rise that occurred several weeks before these groundwater level measurements were obtained. It is anticipated that this trough will fill as the pressure wave from the rising river moves inland. A trough or cone of depression would be expected to persist in the vicinity of TW-2D, but it is unlikely that the pumping from TW-2D is creating a trough as large as is indicated in the May 18 water level measurements.

Groundwater Elevation Map for Middle-depth Wells

Figure 3 presents the groundwater elevation contour map for the middle-depth monitoring wells, including the three well locations where interpolated groundwater elevations were

calculated for gradient mapping. The groundwater elevations for the middle-depth wells range from 455.83 to 454.75 feet above msl. Groundwater elevation data from 11 well locations are used for this gradient map. The contour interval for the mid-depth wells groundwater elevation map is 0.2 foot.

One additional existing mid-depth well, P-2 (located in the New Ponds area), was monitored during the May 18 water level survey. However, well P-2 is inactive, has not been surveyed since 1992, and has not been sampled since 1995. Based on review of survey data, it is believed that a different elevation datum was used for the original survey of well P-2. This well is accessible and appropriately screened and could serve as a mid-depth monitoring point for this area of the site if it was resurveyed to establish an accurate wellhead elevation. An additional inactive mid-depth well, PT-1, exists at the New Ponds site but is currently welded shut and not accessible. (See Table 1 for P-2 and PT-1 well screen details.)

Except in the vicinity of the pumping well TW-2D, the general direction and magnitude of the gradients in the middle-depth wells are very similar to the shallow depth wells. The cone of depression near the pumping well is not as steep in the shallow wells because TW-2D is selectively screened in the deeper portion of the aquifer. There are fewer middle-depth wells to define contours in the southern portion of the map; therefore, so middle-depth contours were not drawn in this area. It is anticipated that the gradients in the middle-depth wells in this area would be consistent with those in the shallow wells, based on the historical site water level data and the lack of laterally-extensive aquitards in the Alluvial Aquifer.

Groundwater Elevation Map for Deep Wells

Figure 4 presents the May 18 groundwater elevation contour map for the deep monitoring wells. The groundwater elevations for the deep wells range from 456.65 to 454.50 feet above msl. Groundwater elevation data from 15 wells are used for this gradient map. The contour interval for the deep wells groundwater elevation map is 0.5 foot. The gradients shown by the deep wells are very similar to the gradients in the middle-depth wells. There are a limited number of deep wells in the southern portion of the site; therefore, the contour plot is not as extensive as for the shallow wells. However, it is anticipated that gradients in the deeper portion of the aquifer would be consistent with those measured in the shallower portion, except possibly in the vicinity of the TW-2D well, which pumps selectively from the deeper portion of the aquifer.

Vertical Hydraulic Gradients

The May 18, 2005 water level measurements were used to calculate vertical hydraulic gradients at well clusters in the survey area. It is expected that average vertical gradients across most of this site would be upward based on averaged historical groundwater data at the site. Table 3 presents the vertical hydraulic gradients measured during the May 18 water level survey. The measured vertical hydraulic gradients are primarily upward, ranging from 0.0066 feet/foot (ft/ft) to 0.0006 ft/ft. In the MW-40 and OW well clusters, small downward gradients were measured, ranging from 0.002 to 0.0002 ft/ft. The May 18 water level measurements indicated a 0.0079 ft/ft downward gradient at the MW-35 cluster. The

downward gradients observed during this survey may be a result of transient conditions present at the time these water levels were measured.

Data Gaps for Hydraulic Gradient Characterization

Because there are not any laterally-extensive aquitards present at the site, there is no mechanism for deep portions of the aquifer to be hydraulically isolated from the shallow portions. Therefore, it would be expected that hydraulic gradients from wells in different zones would be similar, and this is confirmed by the May 2005 groundwater elevation contours. During periods of rapid river level change, wells at different depths may respond more quickly or more slowly, resulting in transient differences in gradients measured on a given day. Over periods of weeks to months, natural gradients throughout the Alluvial Aquifer at the site would be expected to be similar in direction and magnitude.

It is clear from a comparison of Figures 2 through 4 that there are fewer wells completed in the middle and deep portions of the aquifer than in the shallow portion. There are two existing wells at the New Ponds site that were not used in the May 18 gradient mapping; inactive well P-2 does not have recent well survey control (tied to the current site elevation datum), and the other well (PT-2) is currently welded shut. These two wells could be used as mid-depth monitoring points in future gradient assessments if needed.

If it is determined to be important to be able to map groundwater gradients at different depths in the aquifer across the entire site, additional deep and possibly mid-depth wells are needed. Locations that may be accessible to drilling and where additional wells would provide maximum benefit for water level control include:

- Deep well at the MW-15 location (see Figure 4 for proposed location).
- Deep well at the MW-25 location (see Figure 4 for proposed location).

Installation of middle-depth wells at these locations may not be needed. Rather, the horizontal hydraulic gradient for middle depths in the aquifer at these locations could be obtained by interpolating between the deep and shallow wells at each cluster.

TABLE 1
Well Completion and Elevation Data for Wells
Used in Site-Wide Groundwater Gradient Evaluation
PG&E Topock Compressor Station

Well ID	Ground Surface Elevation (ft AMSL)	Well MP Elevation (ft AMSL)	Depth to Top of Screen (ft BGS)	Depth to Bottom of Screen (ft BGS)	Screen Top Elevation (ft AMSL)	Screen Bottom Elevation (ft AMSL)	Elevation of Mid-screen* (ft AMSL)	Depth of Mid-screen* (ft BWT)
Shallow Wells								
MW-01	660.30	661.76	200.5	210.5	460	450	455	3
MW-04	624.30	625.73	164.5	174.5	460	450	455	3
MW-05	634.80	635.69	175.9	185.4	459	449	454	3
MW-06	642.40	642.84	184.5	193.5	458	449	453	3
MW-08	626.70	627.54	169.0	178.0	458	449	453	3
MW-07	630.20	631.91	172.7	182.7	458	448	453	4
MW-09	534.10	536.56	77.0	87.0	457	447	452	4
MW-21	506.10	505.55	36.0	59.0	470	447	459	4
MW-03	649.10	650.51	193.0	203.0	456	446	451	4
OW-02S	546.17	548.75	71.0	101.0	475	445	460	5
MW-24A	564.90	567.16	104.0	124.5	461	440	451	7
OW-03S	555.83	558.58	86.0	116.0	470	440	455	8
MW-14	570.20	570.99	111.0	131.0	459	439	449	8
MW-15	639.70	641.52	180.5	200.5	459	439	449	8
OW-05S	549.12	551.75	70.0	110.0	479	439	459	8
MW-18	543.50	545.32	85.0	105.0	459	439	449	8
MW-13	486.80	488.64	28.5	48.5	458	438	448	8
MW-11	520.80	522.61	62.5	82.5	458	438	448	8
MW-17	587.90	589.96	130.0	150.0	458	438	448	9
MW-16	655.40	657.31	198.0	218.0	457	437	447	9
MW-25	541.00	542.90	84.5	104.5	457	437	447	9
MW-12	483.10	484.01	27.5	47.5	456	436	446	10
MW-10	529.30	530.65	73.7	93.7	456	436	446	10
OW-01S	547.59	550.15	83.5	113.5	464	434	449	10
MW-31-060	495.10	496.81	41.5	61.5	454	434	444	11
MW-19	499.30	499.92	46.0	66.0	453	433	443	12
MW-26	502.90	502.22	51.5	71.5	451	431	441	14
MW-40S	566.30	566.04	115.0	135.0	451	431	441	14
MW-20-070	499.10	500.15	50.0	70.0	449	429	439	16
MW-35-060	481.10	484.19	41.0	61.0	440	420	430	25
MW-41S	477.41	480.07	40.0	60.0	437	417	427	28
Middle Depth Wells								
MW-37S	483.50	485.97	64.0	84.0	420	400	410	46
MW-20-100	499.00	500.58	89.5	99.5	410	400	405	51
CW-01M	563.36	566.07	140.0	190.0	423	373	398	57
PT-1 ^a	624	NA	220.0	260.0	404	364	384	71
P-2 ^a	625	NA	238.5	248.5	387	377	382	74
MW-20-130 ^b	499.10	500.66	121.0	131.0	378	368	373	82
OW-01M	547.75	550.36	165.5	185.5	382	362	372	83
MW-31-135 ^b	495.10	498.11	113.0	133.0	382	362	372	83
CW-04M	515.80	518.55	119.5	169.5	396	346	371	84
CW-02M	546.64	549.45	152.0	202.0	395	345	370	85
OW-03M	556.20	558.90	180.0	200.0	376	356	366	89

TABLE 1
Well Completion and Elevation Data for Wells
Used in Site-Wide Groundwater Gradient Evaluation
PG&E Topock Compressor Station

Well ID	Ground Surface Elevation (ft AMSL)	Well MP Elevation (ft AMSL)	Depth to Top of Screen (ft BGS)	Depth to Bottom of Screen (ft BGS)	Screen Top Elevation (ft AMSL)	Screen Bottom Elevation (ft AMSL)	Elevation of Mid-screen* (ft AMSL)	Depth of Mid-screen* (ft BWT)
Deep Wells								
MW-24B	562.80	564.76	194.0	213.0	369	350	359	96
MW-35-135	481.20	483.57	120.0	140.0	361	341	351	104
MW-38D	523.00	525.31	163.3	183.3	360	340	350	105
OW-02M ^c	545.87	548.52	190.0	210.0	356	336	346	109
CW-03M ^c	531.55	534.10	172.0	222.0	360	310	335	120
OW-05M ^c	549.01	551.75	210.0	250.0	339	299	319	136
MW-40D	566.50	566.08	240.0	260.0	327	307	317	139
OW-03D	555.91	558.63	242.5	262.5	313	293	303	152
MW-37D	483.70	486.19	180.0	200.0	304	284	294	161
CW-01D	563.77	566.46	250.0	300.0	314	264	289	166
OW-01D	547.77	550.37	257.0	277.0	291	271	281	174
CW-04D	515.91	518.55	233.0	283.0	283	233	258	197
OW-05D	549.52	552.35	300.0	320.0	250	230	240	215
CW-02D	546.72	549.43	285.0	335.0	262	212	237	218
CW-03D	531.53	534.14	270.0	320.0	262	212	237	218
OW-02D	546.67	549.01	310.0	330.0	237	217	227	228
MW-41D	476.88	479.42	271.0	291.0	206	186	196	259
Interpolated Mid-Depth Well Cluster Locations								
MW-24 ^d	564.90						405	50
MW-40 ^e	566.30						379	76

Notes:

ft AMSL - feet above mean sea level

well MP - well measure point datum (typically, top of PVC casing)

ft BGS - feet below ground surface

ft BWT - feet below water table

* depth below water table calculated by subtracting mid-screen elevation from average water table elevation of 455 feet AMSL
 Mid-screen depths and elevations rounded to the whole-foot values

^a Inactive wells P-2 and PT-1 (New Ponds site) have not been surveyed since 1992.

Well measure point elevations on current site datum not available. Ground surface elevations are estimated from adjacent wells.

Test well PT-1 at New Ponds site is currently welded shut and was not accessible for the May 18 water level survey.

^b used for elevation contouring of deep wells for consistency with floodplain performance monitoring

^c used for elevation contouring of middle-depth wells for consistency with IM-3 groundwater investigation

^d mid-screen elevation is the midpoint between the mid-screen elevations of MW-24A and MW-24B

^e mid-screen elevation is the midpoint between the mid-screen elevations of MW-40S and MW-40D

TABLE 2
Groundwater Measurements from May 18, 2005 Water Level Survey
Site-wide Groundwater Gradient Evaluation
PG&E Topock Compressor Station

LocID	Date	Time	Well MP Elevation (ft AMSL)	Depth to Water (ft MP)	Salinity (%)	Raw Water Elevation (ft AMSL)	Temp. (Celsius)	Salinity/Temp Corrected Water Elevation (ft AMSL)
Shallow Wells								
MW-01	18-May-05	6:27 AM	661.76	206.81	0.04	454.95	28.34	454.91
MW-04	18-May-05	6:14 AM	625.73	170.41	0.07	455.32	28.34	455.29
MW-05	18-May-05	6:07 AM	635.69	180.10	0.09	455.59	28.34	455.56
MW-06	18-May-05	6:23 AM	642.84	187.22	0.04	455.62	28.34	455.58
MW-08	18-May-05	6:07 AM	627.54	171.75	0.07	455.79	28.34	455.75
MW-07	18-May-05	6:20 AM	631.91	176.86	0.07	455.05	28.34	455.02
MW-09	18-May-05	6:36 AM	536.56	81.10	0.19	455.46	28.74	455.43
MW-21	18-May-05	7:02 AM	505.55	50.47	0.87	455.08	28.49	455.10
MW-03	18-May-05	6:02 AM	650.51	195.92	0.09	454.59	28.34	454.56
OW-02S	18-May-05	6:26 AM	548.75	92.95	0.14	455.80	25.90	455.73
MW-24A	18-May-05	6:13 AM	567.16	111.75	0.23	455.41	28.37	455.38
OW-03S	18-May-05	6:03 AM	558.58	102.61	0.13	455.97	28.11	455.92
MW-14	18-May-05	7:25 AM	570.99	115.29	0.10	455.70	28.60	455.64
MW-15	18-May-05	6:43 AM	641.52	185.43	0.10	456.09	29.23	456.02
OW-05S	18-May-05	6:18 AM	551.75	95.95	0.13	455.80	28.84	455.74
MW-18	18-May-05	6:56 AM	545.32	89.41	0.09	455.91	28.62	455.83
MW-13	18-May-05	6:12 AM	488.64	32.81	0.12	455.83	28.22	455.77
MW-11	18-May-05	6:24 AM	522.61	67.12	0.16	455.49	28.75	455.42
MW-17	18-May-05	6:51 AM	589.96	133.82	0.11	456.14	29.48	456.07
MW-16	18-May-05	6:52 AM	657.31	201.74	0.09	455.57	29.13	455.51
MW-25	18-May-05	6:08 AM	542.90	87.52	0.11	455.38	29.22	455.31
MW-12	18-May-05	7:15 AM	484.01	28.81	0.22	455.20	28.05	455.15
MW-10	18-May-05	6:32 AM	530.65	75.21	0.21	455.44	28.51	455.38
OW-01S	18-May-05	6:31 AM	550.15	94.37	0.17	455.78	23.70	455.75
MW-31-060*	18-May-05	6:45 AM	496.81	NA	0.20	NA	28.24	455.50
MW-19	18-May-05	6:05 AM	499.92	44.20	0.15	455.72	28.36	455.66
MW-26	18-May-05	6:54 AM	502.22	47.08	0.23	455.14	29.65	455.07
MW-40S	18-May-05	7:11 AM	566.04	110.80	0.12	455.24	30.09	455.16
MW-20-070*	18-May-05	6:45 AM	500.15	NA	0.14	NA	28.71	454.92
MW-38S	18-May-05	6:27 AM	525.51	70.72	0.25	454.79	29.30	454.73
MW-35-060*	18-May-05	6:45 AM	484.19	NA	0.41	NA	26.51	456.44
MW-41S	18-May-05	6:27 AM	480.07	24.13	0.16	455.94	28.26	455.84
Middle Depth Wells								
MW-37S	18-May-05	6:20 AM	485.97	31.00	0.25	454.97	29.63	454.83
MW-20-100*	18-May-05	6:45 AM	500.58	NA	0.30	NA	28.72	454.86
CW-01M	18-May-05	6:36 AM	566.07	110.35	0.24	455.72	27.74	455.56
P-2 ^a	18-May-05	7:17 AM	NA	170.96	NA	NA	NA	NA
PT-1 ^a	18-May-05	NA	NA	NA	NA	NA	NA	NA
MW-20-130 ^{*b}	18-May-05	6:45 AM	500.66	NA	0.75	NA	28.97	454.68
OW-01M	18-May-05	6:32 AM	550.36	94.61	0.34	455.75	28.76	455.60
MW-31-135 ^{*b}	18-May-05	6:45 AM	498.11	NA	0.74	NA	28.61	455.34
CW-04M	18-May-05	6:12 AM	518.55	62.69	0.40	455.86	27.45	455.77
CW-02M	18-May-05	6:35 AM	549.45	93.60	0.42	455.85	26.96	455.79
OW-03M	18-May-05	6:05 AM	558.90	102.95	0.24	455.95	29.26	455.70

TABLE 2
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Site-wide Groundwater Gradient Evaluation
PG&E Topock Compressor Station

LocID	Date	Time	Well MP Elevation (ft AMSL)	Depth to Water (ft MP)	Salinity (%)	Raw Water Elevation (ft AMSL)	Temp. (Celsius)	Salinity/Temp Corrected Water Elevation (ft AMSL)
Deep Wells								
MW-24B	18-May-05	6:11 AM	564.76	109.51	0.82	455.25	29.31	455.43
MW-35-135*	18-May-05	6:45 AM	483.57	NA	0.67	NA	26.38	455.79
MW-38D	18-May-05	6:29 AM	525.31	70.93	1.32	454.38	30.55	454.96
OW-02M ^c	18-May-05	6:24 AM	548.52	92.88	0.50	455.64	28.68	455.59
CW-03M ^c	18-May-05	6:42 AM	534.10	78.31	0.56	455.79	27.61	455.83
OW-05M ^c	18-May-05	6:19 AM	551.75	96.07	0.46	455.68	28.34	455.58
MW-40D	18-May-05	7:09 AM	566.08	111.26	0.97	454.82	31.63	455.13
OW-03D	18-May-05	6:06 AM	558.63	102.60	0.29	456.02	30.19	455.62
MW-37D	18-May-05	6:18 AM	486.19	31.25	0.93	454.94	30.46	455.35
CW-01D	18-May-05	6:37 AM	566.46	110.86	0.71	455.60	27.78	455.88
OW-01D	18-May-05	6:30 AM	550.36	94.83	0.65	455.53	30.00	455.58
CW-04D	18-May-05	6:11 AM	518.55	63.11	0.95	455.44	28.32	456.14
OW-05D	18-May-05	6:20 AM	552.35	96.93	0.66	455.42	30.23	455.49
CW-02D	18-May-05	6:33 AM	549.43	93.89	0.93	455.54	28.11	456.27
CW-03D	18-May-05	6:40 AM	534.14	78.84	1.17	455.30	27.81	456.50
OW-02D	18-May-05	6:27 AM	549.01	93.82	0.96	455.19	30.09	455.80
MW-41D	18-May-05	6:25 AM	479.42	24.36	1.36	455.06	29.23	456.65
Interpolated Mid-Depth Well Cluster Locations								
MW-24 ^d	18-May-05							455.41
MW-40 ^e	18-May-05							455.15

Notes:

ft AMSL - feet above mean sea level

ft MP - feet below well measure point (typically top of PVC casing)

NA - data not available

* Manual water level not measured in the 6:00AM - 7:30AM snapshot window. Salinity/temperature-adjusted elevation obtained from average hydraulic head from transducer data from 6:00AM - 7:30AM window. Salinity and temperature data from recent groundwater sampling.

^a Inactive wells P-2 and PT-1 (New Ponds site) have not been surveyed since 1992.

Well measure point elevations on current site datum not available.

Test well PT-1 at New Ponds site is currently welded shut and was not accessible for the May 18 water level survey.

^b used for elevation contouring of deep wells for consistency with floodplain performance monitoring

^c used for elevation contouring of middle-depth wells for consistency with IM-3 groundwater investigation

^d mid-screen elevation is the midpoint between the mid-screen elevations of MW-24A and MW-24B

^e mid-screen elevation is the midpoint between the mid-screen elevations of MW-40S and MW-40D

TABLE 3
Vertical Hydraulic Gradients in Well Clusters
Site-wide Groundwater Gradient Evaluation
PG&E Topock Compressor Station

Shallow Well Screen Interval (feet bgs) ave. salinity	Deep Well Screen Interval (feet bgs) ave. salinity	Date	Shallow Well Adjusted Elevation (feet AMSL)	Deep Well Adjusted Elevation (feet AMSL)	Water Level Elevation Difference (feet)	Vertical Distance between Screens (feet)	Vertical Hydraulic Gradient (feet/foot)	Direction
MW-24A 104-124.5 salinity 0.23%	MW-24B 194-213 salinity 0.82%	18-May-05	455.38	455.43	-0.05	89	-0.0006	upward
MW-35-60 38.5-58.5 salinity 0.41%	MW-35-135 120-140 salinity 0.67%	18-May-05	456.44	455.79	0.65	82	0.0079	downward
MW-37S 64-84 salinity 0.25%	MW-37D 180-200 salinity 0.93%	18-May-05	454.83	455.35	-0.52	116	-0.0045	upward
MW-38S 75-95 salinity 0.25%	MW-38D 163-183 salinity 1.32%	18-May-05	454.73	454.96	-0.23	88	-0.0026	upward
MW-40S 115-135 salinity 0.12%	MW-40D 240-260 salinity 0.97%	18-May-05	455.16	455.13	0.03	125	0.0002	downward
MW-41S 40-60 salinity 0.16%	MW-41D 271-291 salinity 1.36%	18-May-05	455.84	456.65	-0.81	231	-0.0035	upward
CW-1M 140-190 salinity 0.24%	CW-1D 250-300 salinity 0.71%	18-May-05	455.56	455.88	-0.32	110	-0.0029	upward
CW-2M 156-206 salinity 0.42%	CW-2D 285-335 salinity 0.93%	18-May-05	455.79	456.27	-0.48	129	-0.0037	upward
CW-3M 172-222 salinity 0.56%	CW-3D 273-323 salinity 1.17%	18-May-05	455.83	456.50	-0.67	101	-0.0066	upward
CW-4M 120-170 salinity 0.40%	CW-4D 233-283 salinity 0.95%	18-May-05	455.77	456.14	-0.37	113	-0.0033	upward
OW-1S 84-114 salinity 0.17%	OW-1D 257-277 salinity 0.65%	18-May-05	455.75	455.58	0.17	163	0.0010	downward
OW-3S 102-116 salinity 0.13%	OW-3D 243-263 salinity 0.29%	18-May-05	455.92	455.62	0.30	147	0.0020	downward
OW-5S 70-110 salinity 0.13%	OW-5D 300-320 salinity .66%	18-May-05	455.74	455.49	0.25	210	0.0012	downward

NOTES:

1. Groundwater elevations listed are adjusted groundwater elevations corrected for salinity and temperature
Above mean sea level (AMSL), below ground surface (bgs)
2. Vertical distance between well screens is the distance between screen midpoints

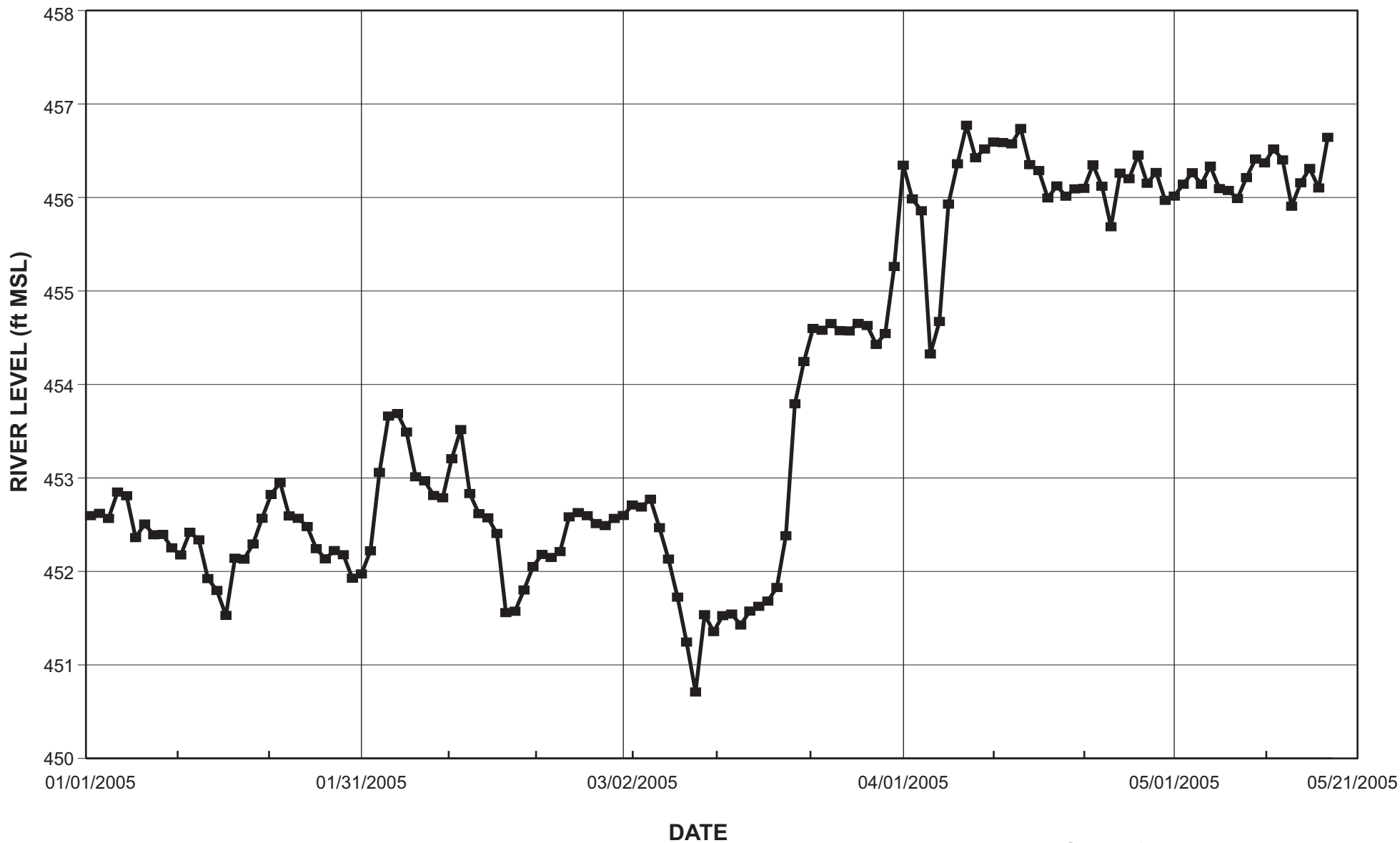


FIGURE 1
DAILY AVERAGE RIVER LEVEL
AT I-3 GAUGE
 GROUNDWATER MONITORING PROGRAM
 PG&E TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

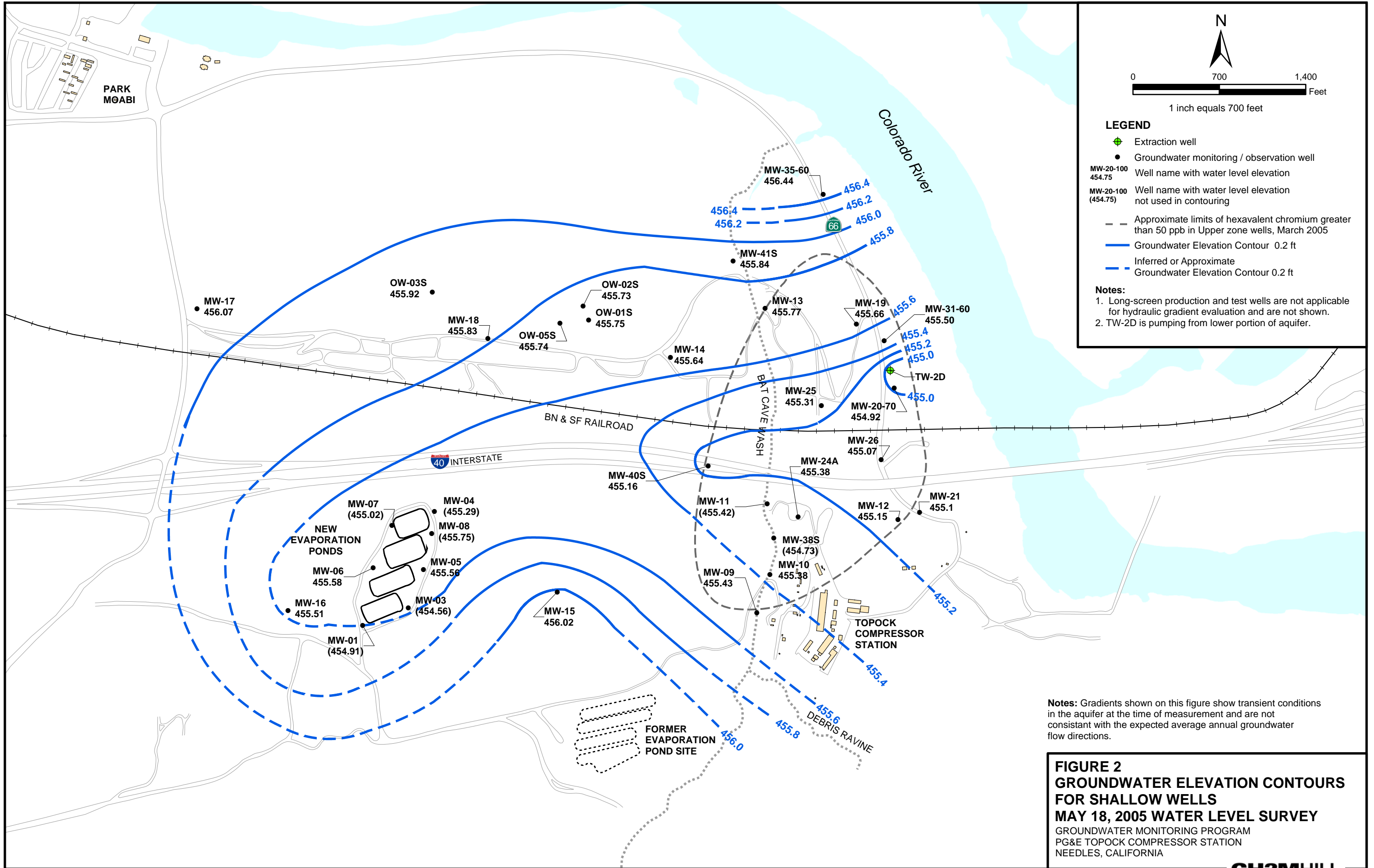


FIGURE 2
GROUNDWATER ELEVATION CONTOURS
FOR SHALLOW WELLS
MAY 18, 2005 WATER LEVEL SURVEY
 GROUNDWATER MONITORING PROGRAM
 PG&E TOPOCK COMPRESSOR STATION
 NEEDLES, CALIFORNIA

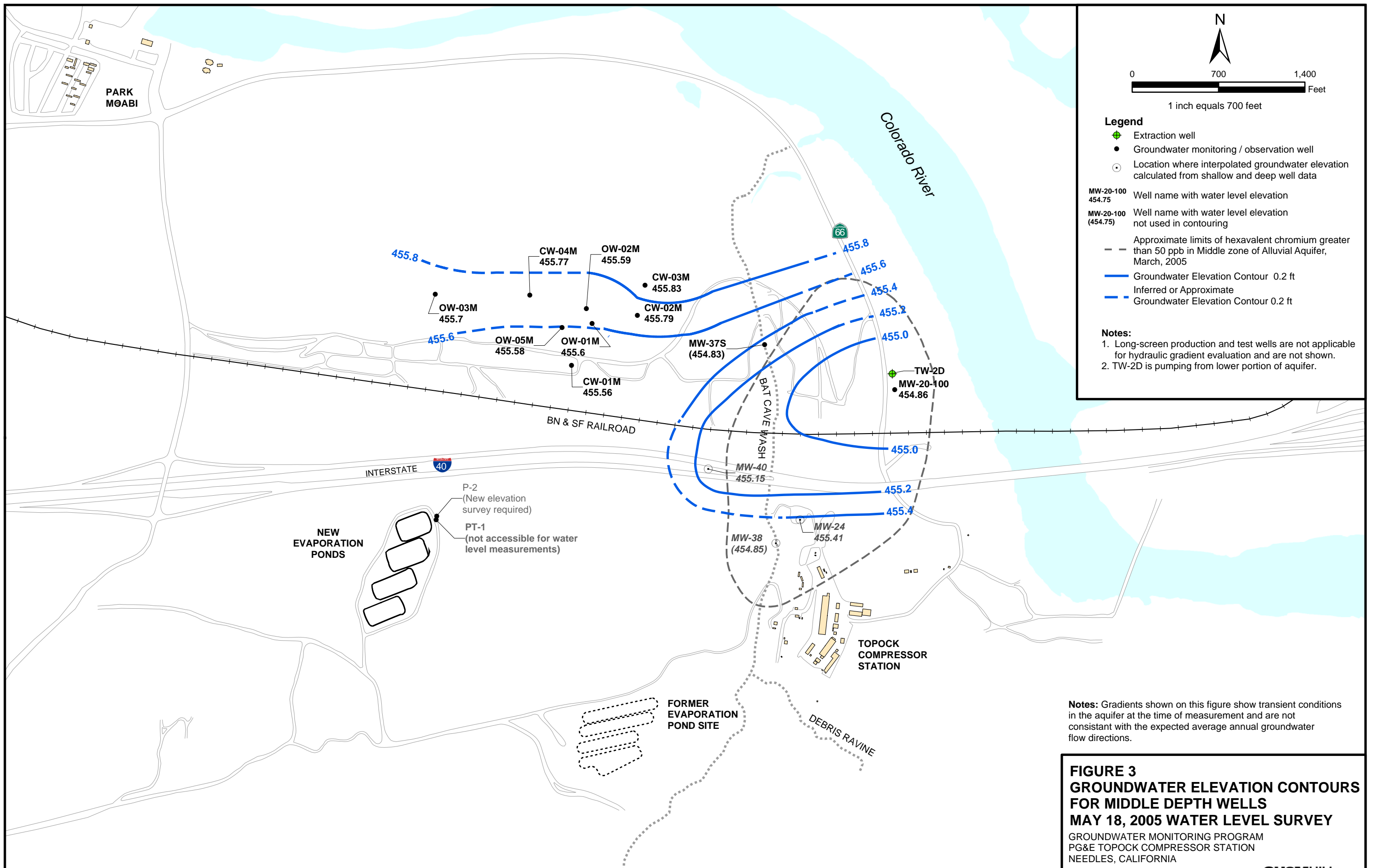


FIGURE 3
GROUNDWATER ELEVATION CONTOURS
FOR MIDDLE DEPTH WELLS
MAY 18, 2005 WATER LEVEL SURVEY
 GROUNDWATER MONITORING PROGRAM
 PG&E TOPECO COMPRESSOR STATION
 NEEDLES, CALIFORNIA

