

1R - 427-177

# WORKPLANS

Date:

6-28-12

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**TETRA TECH**

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June 28, 2012

Mr. Ed Hansen  
New Mexico Energy, Minerals, & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 S. St. Francis Drive  
Santa Fe, New Mexico 87505

**RE: UPDATE REPORT AND PROPOSED GROUNDWATER CHLORIDE REMEDIATION  
RICE OPERATING COMPANY,  
A-2-1 JUNCTION BOX, EME SWD SYSTEM  
UNIT "A", SEC. 2, T20S, R36E  
LEA COUNTY, NEW MEXICO  
NMOCD CASE # 1R0427-177**

Mr. Hansen:

Tetra Tech Inc. (Tetra Tech) submits the following Update Report and Proposed Groundwater Chloride Remediation Plan for the RICE Operating Company (ROC), Jct. A-2-1, located in the Eunice Monument Eumont (EME) SWD System. ROC is the service provider (agent) for the EME SWD System and has no ownership of any portion of the pipeline, well or facility. The EME SWD system is owned by a consortium of oil producers, System Parties, who provide all operating capital on a percentage ownership/usage basis.

## **BACKGROUND & PREVIOUS WORK**

As part of the ROC Junction Box Upgrade Work plan, starting on February 26, 2004, the junction box was moved 85 feet to the west. See Figure 1 for site location. The former junction box site was investigated vertically and horizontally with a backhoe to form a 20 ft. x 20 ft. x 12 ft. deep excavation and soil samples were screened at regular intervals for both hydrocarbons and chlorides. From the excavation, the four wall composite, the bottom composite and the backfill were taken to a commercial laboratory for analysis. Laboratory tests of the four-wall composite showed a chloride reading of 915 mg/kg, a gasoline range organics (GRO) concentration of 677 mg/kg, and a diesel range organics (DRO) concentration of 2,540 mg/kg. The bottom composite showed a chloride laboratory reading of 656 mg/kg, a GRO of 1,550 mg/kg, and a DRO of 4,030 mg/kg.

The excavated soils were blended onsite and backfilled into the excavation to a depth of 6 feet bgs. At 6 feet bgs, a compacted clay barrier was installed to inhibit further

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hydrocarbon and chloride migration. The remaining soils were backfilled on top of the clay barrier and contoured to the surrounding surface. Laboratory analysis of the blended backfill showed a chloride reading of 436 mg/kg, a GRO of 639 mg/kg, and a DRO of 3,250 mg/kg. On June 2, 2004, a hollow-stem auger unit was utilized to conduct one soil boring at the former junction box site. The soil boring was advanced to a total depth of 30 feet bgs. A soil bore sample (shown as 35 feet bgs) was collected from the borehole and exhibited a TPH concentration of 242.5 mg/kg and a chloride concentration of 688 mg/kg. The site was disclosed to the New Mexico Oil Conservation Division (NMOCD) as a potential groundwater impact site on June 29, 2005. Additionally, ROC submitted a Junction Box Disclosure Report to the NMOCD dated July 1, 2005.

On September 29, 2006, ROC submitted the ICP to the NMOCD for review. NMOCD granted approval of the ICP in a letter dated October 4, 2006.

Between October 11 and October 13, 2006, Tetra Tech personnel were onsite to oversee the installation of five additional soil borings (SB-2 through SB-6) within, up, and down gradient of the release area. The affected area measured approximately 45 feet by 75 feet. Soil samples were collected every 5 feet utilizing a split spoon sampler, and field screened for chlorides. In addition, collected soil samples were placed within laboratory supplied containers and delivered to Cardinal Labs of Hobbs, New Mexico under proper chain-of-custody control for chloride analysis by EPA method 4500CL-B, along with select samples for benzene, toluene, ethylbenzene, and xylenes (BTEX) and TPH utilizing EPA method 8021B and 8015M, respectively. With the exception of SB-2, residual chloride impact to subsurface soils were less than 1,000 mg/kg, except near the saturated zone where chloride concentrations increase to near or slightly greater than 1,000 mg/kg. The soil boring logs and analysis were previously submitted in the CAP submitted on May 22, 2007 and approved on July 18, 2007.

As part of implementation of the CAP, ROC extended the existing clay liner to dimensions of 45 feet by 75 feet. Between October 16 and October 31, 2007, an area measuring 25 feet by 25 feet by 7 feet deep was excavated with approximately 84 cubic yards of soil transported offsite for disposal at a NMOCD approved facility. The remaining excavated soils were blended with clean soil and tested for chlorides. The laboratory sample results indicated that chloride levels were 336 mg/kg and a DRO of 56.9 mg/kg. Prior to backfilling of the excavation, a one foot thick clay layer was placed in the bottom of the excavation and compacted around the former clay liner. The density of the compacted clay measured 90.2%. Upon completion of the compaction, the blended soils were placed back within the excavation to ground surface. On November 6, 2007, the entire disturbed area was reseeded with a blend of native vegetation. See Figure 2 for clay liner dimensions and Appendix A for photo documentation of clay liner installation. With the installation and extension of the clay liner, the impacted soils which remain in the soils from the original release area are not likely to allow further vertical migration of the remaining chlorides within the soils and should be protective of the groundwater.



## **MONITOR WELL INSTALLATION**

Between October 11 and October 13, 2005, Tetra Tech personnel were onsite to oversee the installation of 3 monitor wells (MW-1 through MW-3). Groundwater was encountered at approximately 43 feet bgs. Initial gauging, development and sampling of the wells began in November 2006. Since November 2006, the wells have been sampled on a quarterly basis with samples submitted to Cardinal Labs in Hobbs, NM for analysis of chlorides by EPA Method 4500 CL-B, and BTEX by EPA Method 8021B. The results of the groundwater gauging/sampling events are presented in Appendix B. The most recent sampling occurred on February 16<sup>th</sup>, 2012. MW-1, the near-source monitor well, had a chloride reading of 6,100 mg/L. MW-2, the down gradient monitor well, had a chloride reading of 6,900 mg/L and MW-3, the up-gradient monitor well, had a chloride reading of 5,800 mg/L. See Figure 3 for most recent analytical results.

Referring to the groundwater tables in Appendix B, benzene has been detected at levels above the New Mexico Quality Control Commission Standard (NMQCC) of 0.005 mg/L in monitor well MW-1 periodically since November 2006. Since August 2010, the benzene level has decreased exponentially at the site with the most recent quarter (February 16<sup>th</sup>, 2012) being below detection limits. In addition, the chlorides at the site have steadily declined since the installation of the monitor wells in November 2006 with an average decrease of approximately 2,100 mg/L in all three wells (average of 8,370 mg/L in November 2006 to 6,267 mg/L in February 2012).

In comparing the chloride concentration analysis data from EME Jct. A-2-1 with other water quality in the area, specifically the ROC EME D-1 and A-2, it appears the chloride concentrations at the site are consistent with regional impaired groundwater in the area. The EME D-1 data indicates Total Dissolved Solids (TDS) ranging from 7,910 mg/L to 12,900 mg/L in areas located outside the initial release area. As such, the regional groundwater appears to have been historically impaired.

## **PROPOSED GROUNDWATER REMEDIATION**

Since the soils have already been previously addressed with the installation and extension of a clay liner at the site, ROC proposes to remediate the groundwater based on a set volume located within the original soils excavation. In addition, since the groundwater is regionally impacted, ROC proposes to remove the calculated mass volume of groundwater from monitor well MW-2R located at the EME L-6 located approximately 1.2 miles east south east of the EME Jct. A-2-1. See Figure 4 for location of sites.

The footprint of the original soils excavation at the former EME Jct. A-2-1 junction box encompasses an area of approximately 3,375 ft<sup>2</sup>. If we assume the aquifer thickness is 15 feet (NMOCD approved estimation) and the porosity of the underlying formation (fine grain sand) is 0.25, then the volume of impacted groundwater underlying the site is calculated as follows:



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$$3,375 \text{ ft}^2 \times 15 \text{ ft} \times 0.25 = 12,656.25 \text{ ft}^3$$

Assuming there is 28.3168466 liters of water per cubic feet, we end up with the following amount to be removed from the EME L-6 MW-2R:

$$12,656.25 \text{ ft}^3 \times 28.3168466 \text{ liters/ft}^3 = 358,385.09 \text{ liters}$$

Taking the average difference between monitor well MW-2 (down gradient, highest concentration well) and subtract from monitor well MW-3 (up gradient monitor well) yields the following:

$$7,831 \text{ mg/L (MW-2)} - 6,522 \text{ mg/L (MW-3)} = 1,309 \text{ mg/L}$$

This is the average calculated amount of chloride concentration from the original source.

To determine the Total Chloride Mass, the volume of the impacted groundwater below the site (358,385.09 L) is multiplied by chloride concentration calculated from the original source (1,309 mg/L):

$$358,385.09 \text{ L} \times 1,309 \text{ mg/L} = 469,126,082.8 \text{ mg. and converting to kg yields 469 kg of Total Chloride Mass to be removed from the site.}$$

Monitor well MW-2R from site EME L-6 will be utilized for extraction purposes. This well has a chloride concentration of 10,000 mg/L and will be pumped at a constant rate of 1 gal/min. See Appendix C for most recent laboratory analysis. Converting from mg/L to kg/gal yields a conversion factor of 0.03785441 kg/gal. Multiplying the pumping rate (1 gal/min) by the groundwater concentration (0.03785441) in kg/gal yields an extraction rate of 0.03785441 kg/min. Converting this from kg/min to kg/day gives us a result of 22.7126472 kg/day based on pumping for 10 hours per day.

The estimated removal time for the 469 kg of impacted groundwater is approximately 21 days. See Appendix D for Chloride Mass Calculation sheet.

Vegetation has rebounded at the site (Figure 5, dated April 13<sup>th</sup>, 2012) so no revegetation efforts are needed. Upon OCD approval of this groundwater chloride remediation plan, ROC proposes to plug and abandon monitor wells MW-1 through MW-3 at the EME A-2-1 using a cement grout with 1 to 3% bentonite to within 3 feet of the surface, and then complete with a concrete cap to the surface. Upon plugging of the monitoring wells and

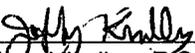


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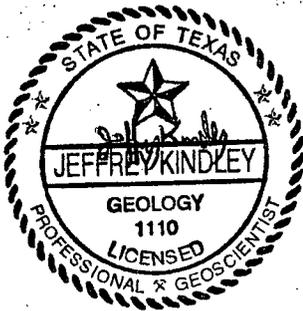
completion of the proposed groundwater extraction at the EME L-6, ROC will submit a Termination Request and Monitor Well Plugging Report to the NMOCD.

Should you have any questions, please contact Hack Conder at (575) 393-9174. Thank you for your attention to this matter.

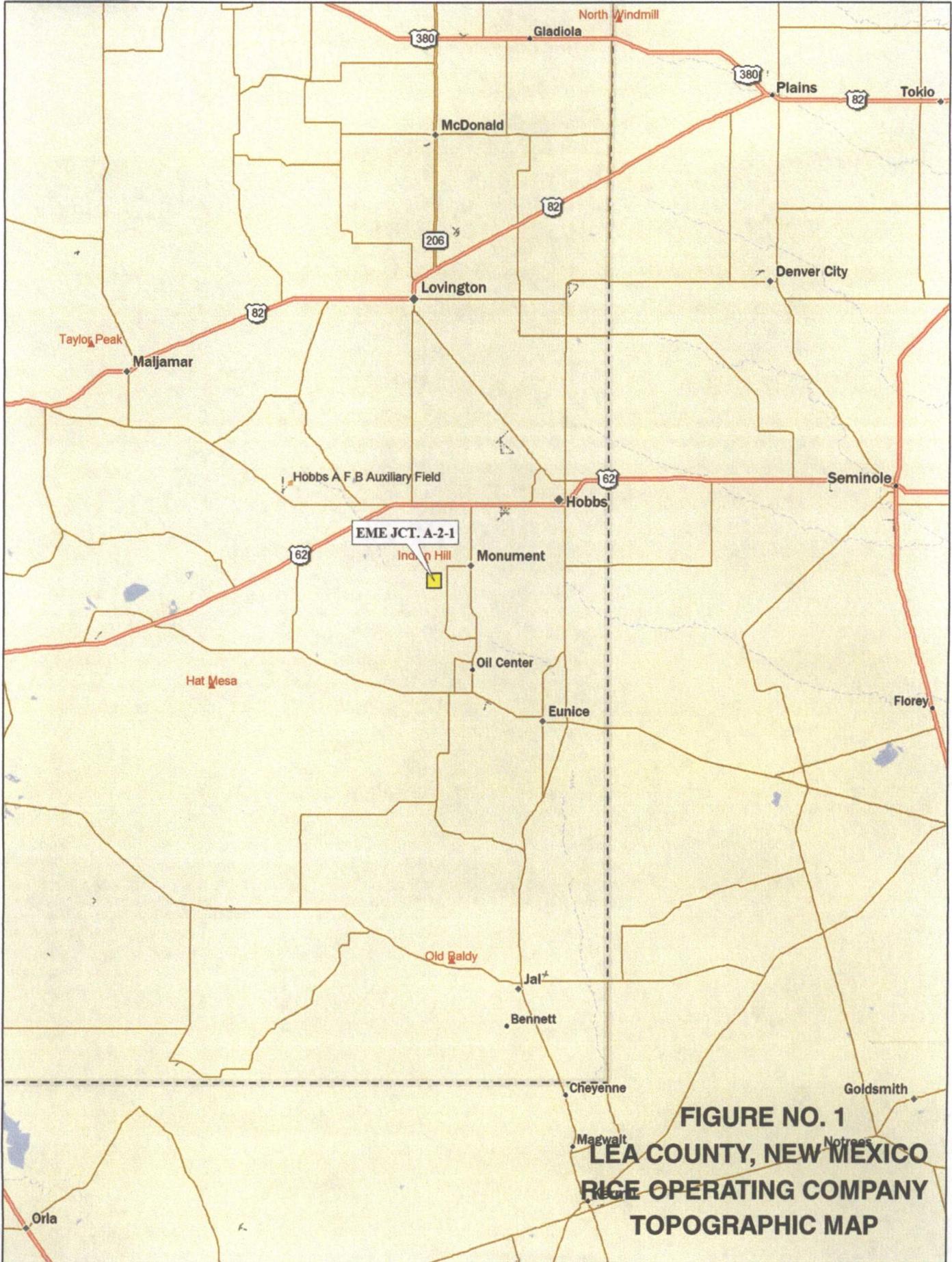
Tetra Tech, Inc.

  
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Jeffrey Kindley, P.G.  
Senior Environmental Geologist

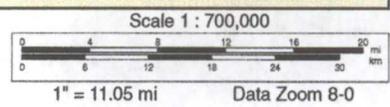
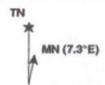
cc: ROC – Hack Conder



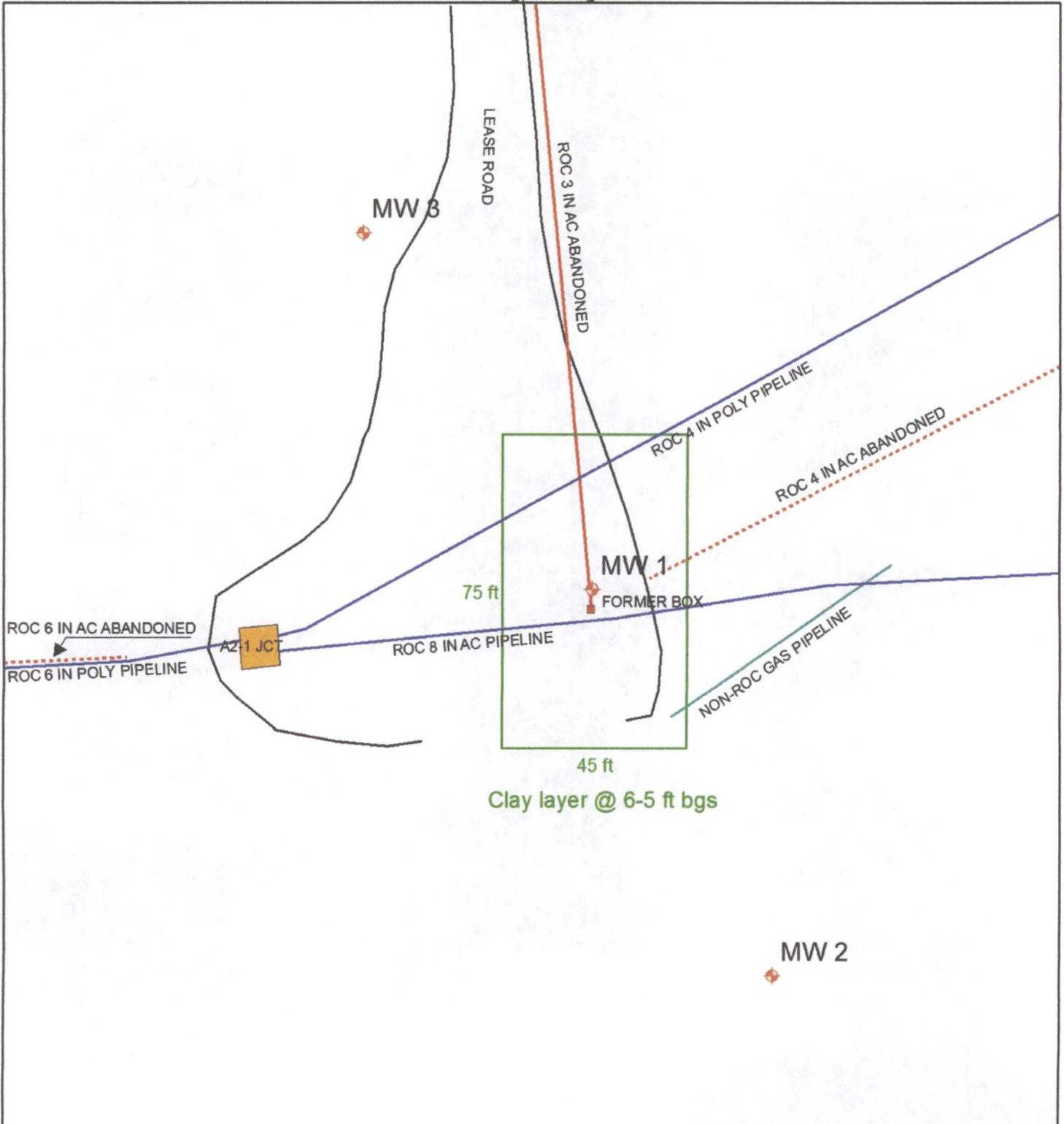
## **FIGURES**



**FIGURE NO. 1**  
**LEA COUNTY, NEW MEXICO**  
**RICE OPERATING COMPANY**  
**TOPOGRAPHIC MAP**



# Clay Layer



DGW = 40 ft

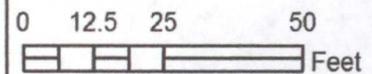


## EME JCT A-2-1

Legals: UL/A SEC 2  
T-20-S R-36-E

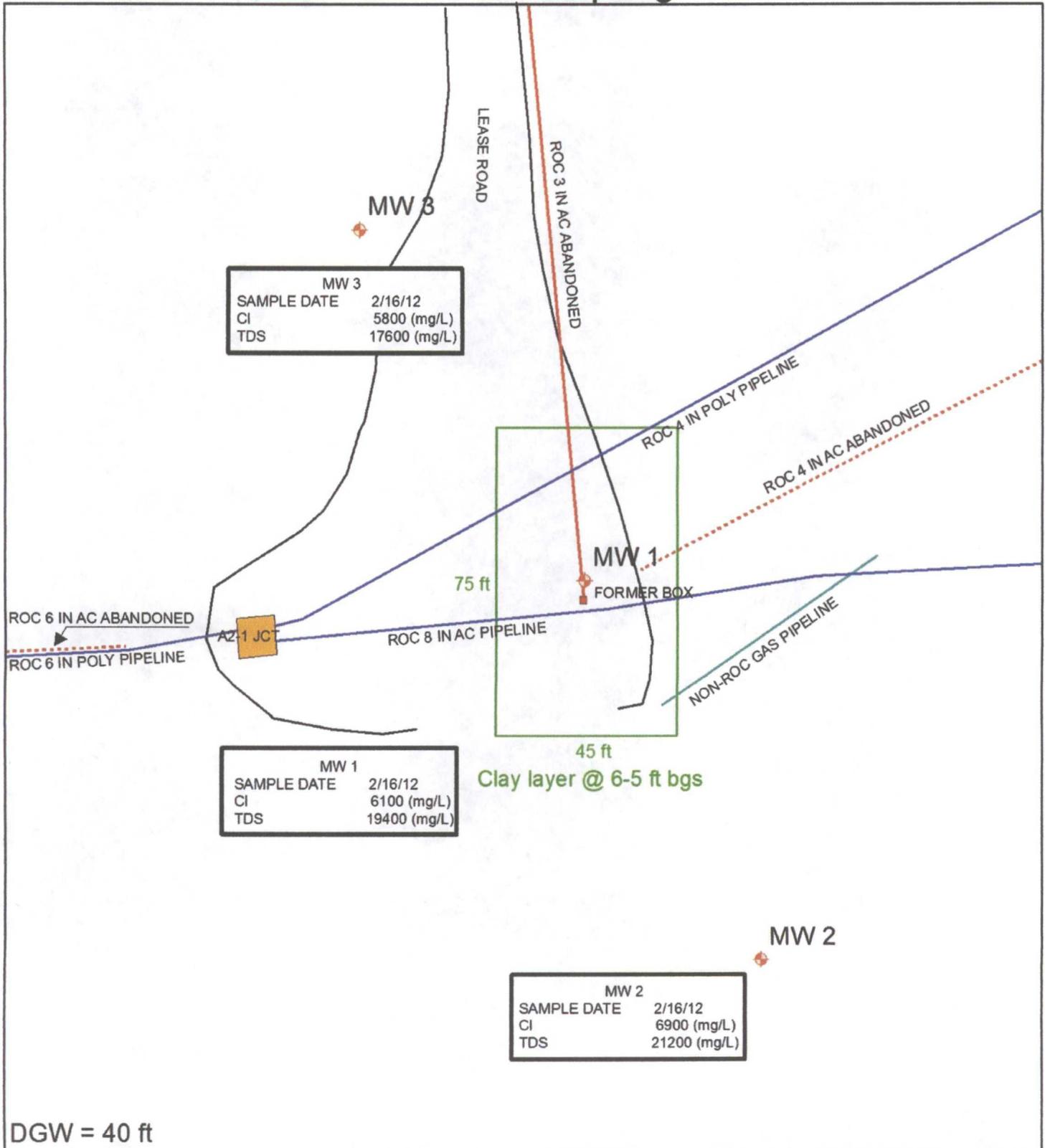
Case #: 1R0427-177

## FIGURE 2



Drawing date: 6/5/12  
Drafted by: L. Weinheimer

# Monitor Well Sampling Data

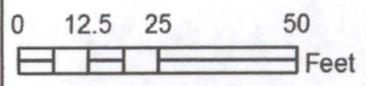


## EME JCT A-2-1

Legals: UL/A SEC 2  
T-20-S R-36-E

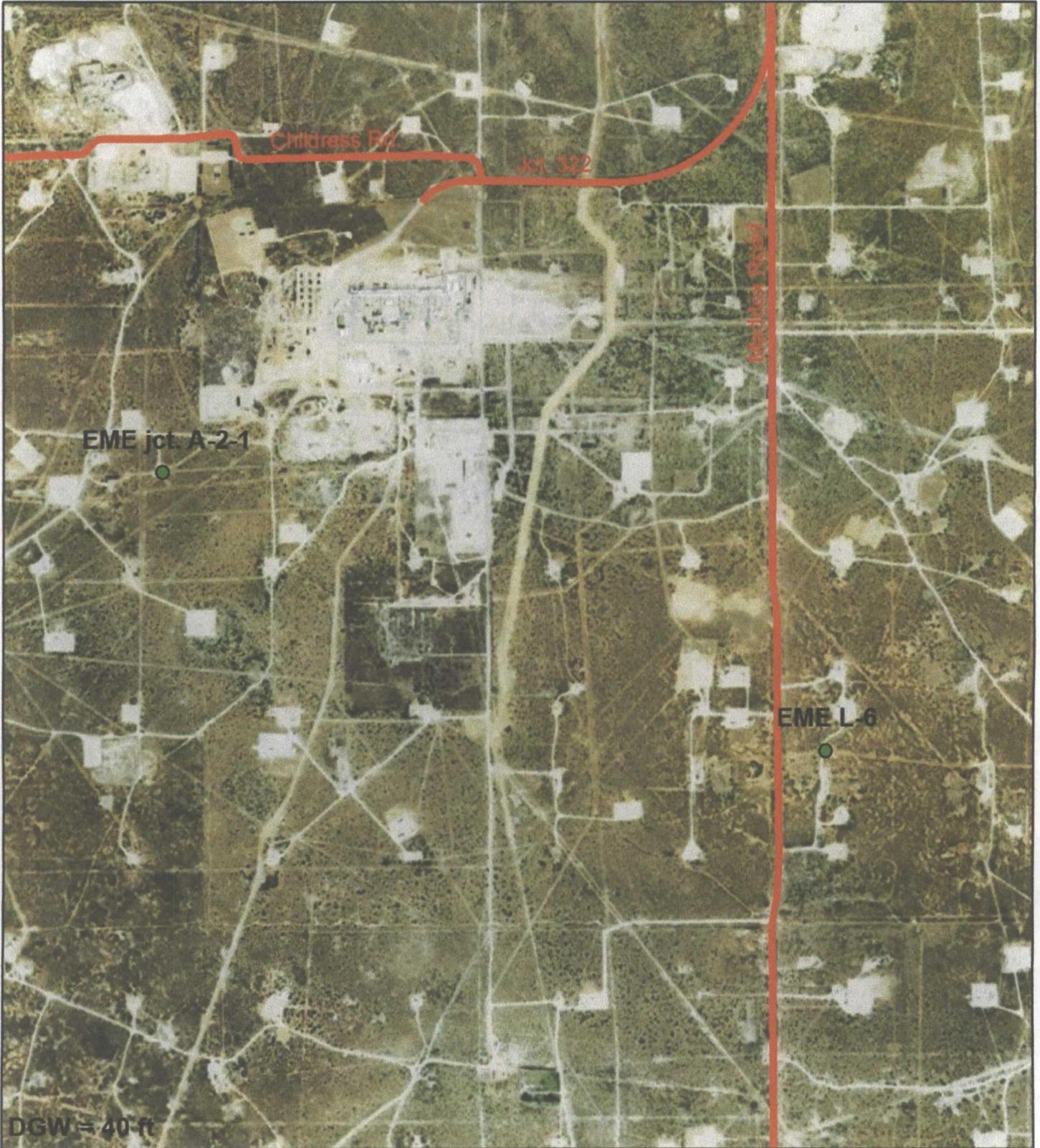
Case #: 1R0427-177

## FIGURE 3



Drawing date: 6/5/12  
Drafted by: L. Weinheimer

# Relation of Site to EME L-6

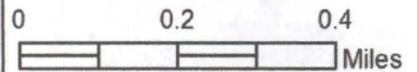


## ***EME JCT A-2-1***

Legals: UL/A SEC 2  
T-20-S R-36-E

Case #: 1R0427-177

## **FIGURE 4**



Drawing date: 5/21/12  
Drafted by: L. Weinheimer

EME Jct. A-2-1 (1R427-177)  
Unit Letter A, Section 2, T20S, R36E



Facing north

4/13/12



Facing west

4/13/12



Facing east

4/13/12



Facing south

4/13/12

Figure 5 EME Jct. A-2-1 Site Photodocumentation

**APPENDIX A**  
**PHOTOGRAPHS OF INSTALLATION OF CLAY LINER**

EME Jct. A-2-1 (1R427-177)  
Unit Letter A, Section 2, T20S, R36E



Site prior to excavation 10/18/07



Importing peanut hay 10/18/07



Locating existing 20' x 20' clay layer at 7' bgs 10/18/07



Excavating site 10/25/07



Blending backfill 10/26/07



Importing clay 10/29/07



Installed clay layer to extended 75' x 45' area at 6' bgs 10/29/07



Compacting existing clay layer and installed clay layer edges 10/30/07



Backfilling excavation up to 1' bgs 10/30/07



Excavation backfilled to ground surface with clean soil and amendments 10/31/07



Seeding site 11/06/07



Site completed 11/6/07

**APPENDIX B**  
**GROUNDWATER SAMPLING TABLES**

Table 1  
 Rice Operating Company  
 EME Jct. A-2-1  
 Lea County, New Mexico

MW	Depth to Water	Total Depth	Well Volume	Volume Purged	Sample Date	Cl mg/L	TDS mg/L	Benzene mg/L	Toluene mg/L	Ethyl Benzene mg/L	Total Xylenes mg/L	Sulfate mg/L	Comments
1	38.13	53.76	2.50	10	11/06/06	8,460	22,800	0.00331	0.00158	0.00337	0.003418	6,780	hydrocar. odr
1	38.30	53.76	2.50	8	02/13/07	10,100	17,900	0.0692	0.00526	0.0313	0.0404	8,190	hydrocar. odr
1	38.50	53.76	2.40	8	06/08/07	8,500	23,900	0.0220	0.00147	0.00799	0.00768	6,760	hydrocar. odr
1	38.71	53.76	2.40	8	08/21/07	8,197	23,775	0.0340	0.004	0.012	0.022	6,611	hydrocar. odr
1	38.47	53.76	2.40	8	12/04/07	8,800	23,481	0.0880	<0.001	0.021	0.01	5,870	hydrocar. odr
1	39.32	53.78	2.30	8	02/13/08	8,500	22,900	0.0340	<0.002	0.017	<0.006	4,710	hydrocar. odr
1	39.50	53.78	2.30	8	05/23/08	8,000	22,400	0.0040	<0.002	<0.002	<0.006	6,340	hydrocar. odr
1	39.85	53.78	2.20	8	08/22/08	7,000	20,200	0.0590	<0.001	0.011	0.008	6,260	hydrocar. odr
1	40.05	53.78	2.20	8	11/21/08	6,600	21,800	0.0110	0.001	0.002	0.004	6,230	hydrocar. odr
1	40.22	53.81	2.20	8	02/19/09	7,000	20,800	0.0020	<0.001	0.001	<0.003	5,900	Clear, light sheen, strong hydrocar. odor
1	40.44	53.81	2.10	8	06/03/09	6,700	20,500	0.0150	<0.001	0.002	0.003	5,530	Clear, light sheen, strong hydrocar. odor
1	40.59	53.81	2.10	8	09/02/09	6,200	18,700	0.0770	<0.001	0.015	0.011	5,130	Clear, light sheen, strong hydrocar. odor
1	40.79	53.81	2.10	8	11/13/09	6,000	17,900	0.0140	<0.001	0.003	0.016	4,380	Clear, light sheen, strong hydrocar. odor
1	41.01	53.81	2.00	8	03/02/10	6,000	18,300	0.1320	0.002	0.019	0.021	6,010	Clear, light sheen, strong hydrocar. odor
1	41.12	53.81	2.00	8	05/27/10	6,000	18,700	0.0640	<0.001	0.014	0.008	5,250	Clear, light sheen, strong hydrocar. odor
1	41.10	53.81	2.00	8	08/19/10	6,600	19,700	0.0210	<0.001	0.004	0.003	5,410	Clear, light sheen, strong hydrocar. odor
1	40.91	53.81	2.10	8	11/15/10	6,700	19,400	0.0010	<0.001	<0.001	<0.003	7,380	Clear, light sheen, strong hydrocar. odor
1	40.80	53.82	2.10	8	03/03/11	6,500	19,500	<0.001	<0.001	<0.001	<0.003	5,470	Clear, light sheen, strong hydrocar. odor
1	41.00	53.82	2.10	8	05/26/11	6,100	18,100	<0.001	<0.001	<0.001	<0.003	5,090	Clear, light sheen, strong hydrocar. odor
1	41.29	53.82	2.00	8	08/25/11	6,700	19,200	0.0060	<0.001	<0.001	<0.003	5,920	Clear, light sheen, strong hydrocar. odor
1	41.56	53.82	2.00	8	11/23/11	6,600	19,700	0.0030	<0.001	<0.001	<0.003	5,650	Clear, light sheen, strong hydrocar. odor
1	41.77	53.82	1.90	8	02/16/12	6,100	19,400	<0.001	0.001	<0.001	<0.003	5,260	Clear, light sheen, strong hydrocar. odor

Graph 1  
 Rice Operating Company  
 MW-1  
 EME Jct A-2-1  
 Lea County, New Mexico

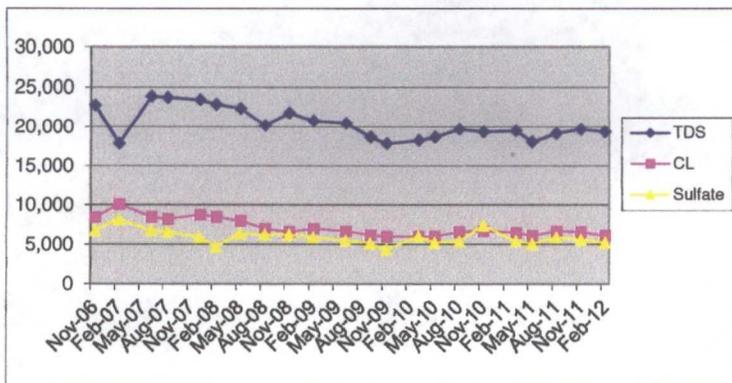


Table 2  
 Rice Operating Company  
 EME Jct. A-2-1  
 Lea County, New Mexico

MW	Depth to Water	Total Depth	Well Volume	Volume Purged	Sample Date	Cl mg/L	TDS mg/L	Benzene mg/L	Toluene mg/L	Ethyl Benzene mg/L	Total Xylenes mg/L	Sulfate mg/L	Comments
2	36.45	48.65	2.00	8	11/06/06	8,680	23,600	<0.001	<0.001	<0.001	<0.001	6,960	Silt/sand to clear, no odor
2	36.62	48.65	1.90	8	02/13/07	10,100	20,300	<0.001	<0.001	<0.001	<0.001	7,990	Silt/sand to clear, no odor
2	36.83	48.65	1.90	8	06/08/07	9,300	25,000	<0.001	<0.001	<0.001	<0.001	7,280	Silt/sand to clear, no odor
2	37.04	48.65	1.90	8	08/21/07	8,797	26,155	<0.004	<0.004	<0.004	<0.012	7,005	Silt/sand to clear, no odor
2	36.79	48.65	1.90	8	12/04/07	8,800	25,329	<0.001	<0.001	<0.001	<0.003	6,570	Silt/sand to clear, no odor
2	37.59	48.65	1.80	8	02/13/08	8,500	24,700	<0.002	<0.002	<0.002	<0.006	6,940	Silt/sand to clear, no odor
2	37.81	48.65	1.70	8	05/23/08	8,400	24,200	<0.002	<0.002	<0.002	<0.006	6,990	Silt/sand to clear, no odor
2	38.15	48.65	1.70	8	08/22/08	8,000	23,900	<0.001	<0.001	<0.001	<0.003	7,250	Silt/sand to clear, no odor
2	38.41	48.65	1.60	6	11/21/08	7,300	23,600	<0.001	<0.001	<0.001	<0.003	6,970	Silt/sand to clear, no odor
2	38.55	48.69	1.60	6	02/19/09	7,800	23,300	<0.001	<0.001	<0.001	<0.003	6,760	Silt/sand to clear, no odor
2	38.79	48.69	1.60	6	06/03/09	7,500	22,600	<0.001	<0.001	<0.001	<0.003	6,360	Silt/sand to clear, no odor
2	39.12	48.69	1.50	6	09/02/09	5,800	18,300	<0.001	<0.001	<0.0001	0.005	4,980	Silt/sand to clear, no odor
2	39.13	48.69	1.50	6	11/13/09	7,500	21,200	<0.001	<0.001	<0.001	<0.003	4,490	Silt/sand to clear, no odor
2	39.38	48.65	1.50	6	03/02/10	7,300	22,200	<0.001	<0.001	<0.001	<0.003	6,520	Silt/sand to clear, no odor
2	39.52	48.65	1.50	6	05/27/10	7,300	21,900	0.001	<0.001	<0.001	<0.003	5,690	Silt/sand to clear, no odor
2	39.50	48.65	1.50	6	08/19/10	7,600	21,800	<0.001	<0.001	<0.001	<0.003	5,850	Silt/sand to clear, no odor
2	39.27	48.65	1.50	6	11/15/10	7,300	21,000	<0.001	<0.001	<0.001	<0.003	7,960	Silt/sand to clear, no odor
2	39.15	48.68	1.50	6	03/03/11	7,200	21,100	<0.001	<0.001	<0.001	<0.003	6,000	Silt/sand to clear, no odor
2	39.34	48.68	1.50	6	05/26/11	7,400	21,100	<0.001	<0.001	<0.001	<0.003	6,070	Silt/sand to clear, no odor
2	39.66	48.68	1.40	6	08/25/11	7,400	20,900	<0.001	<0.001	<0.001	<0.003	6,380	Silt/sand to clear, no odor
2	39.94	48.68	1.40	6	11/23/11	7,400	21,400	<0.001	<0.001	<0.001	<0.003	5,480	Silt/sand to clear, no odor
2	40.12	48.68	1.40	6	02/16/12	6,900	21,200	<0.001	<0.001	<0.001	<0.003	5,030	Silt/sand to clear, no odor

Graph 2  
 Rice Operating Company  
 MW-2  
 EME Jct. A-2-1  
 Lea County, New Mexico

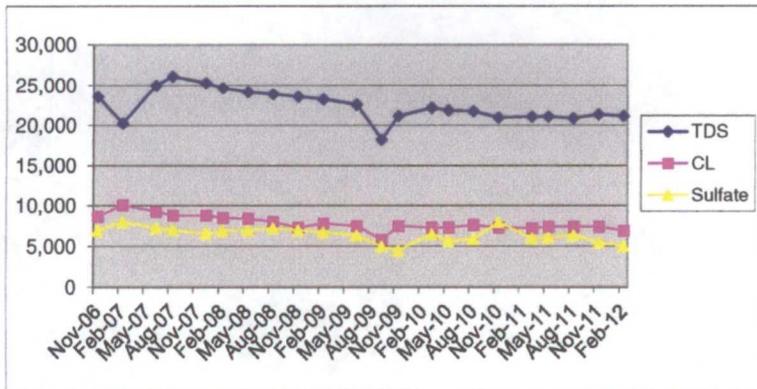
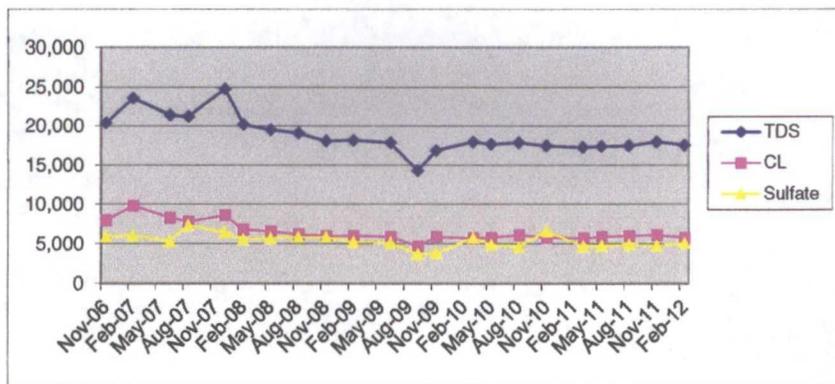


Table 3  
 Rice Operating Company  
 EME Jct. A-2-1  
 Lea County, New Mexico

MW	Depth to Water	Total Depth	Well Volume	Volume Purged	Sample Date	Cl mg/L	TDS mg/L	Benzene mg/L	Toluene mg/L	Ethyl Benzene mg/L	Total Xylenes mg/L	Sulfate mg/L	Comments
3	37.12	47.38	1.60	6	11/06/06	7,970	20,400	<0.001	<0.001	<0.001	<0.001	5,950	Clear no odor
3	37.29	47.38	1.60	6	02/13/07	9,820	23,600	<0.001	<0.001	<0.001	<0.001	6,050	Clear no odor
3	37.50	47.38	1.60	6	06/08/07	8,300	21,400	<0.001	<0.001	<0.001	<0.001	5,350	Clear no odor
3	37.64	47.38	1.60	6	08/21/07	7,798	21,200	<0.004	<0.004	<0.004	<0.012	7,381	Clear no odor
3	37.39	47.38	1.60	6	12/04/07	8,600	24,814	<0.001	<0.001	<0.001	<0.003	6,480	Clear no odor
3	38.22	47.38	1.50	6	02/13/08	6,800	20,200	<0.002	<0.002	<0.002	<0.006	5,560	Clear no odor
3	38.44	47.38	1.40	6	05/20/08	6,600	19,500	<0.002	<0.002	<0.002	<0.006	5,720	Clear no odor
3	38.80	47.38	1.40	6	08/22/08	6,200	19,100	<0.001	<0.001	<0.001	<0.003	5,860	Clear no odor
3	39.06	47.38	1.30	6	11/21/08	6,000	18,100	<0.001	<0.001	<0.001	<0.003	5,860	Clear no odor
3	39.23	47.41	1.30	6	02/19/09	6,000	18,200	<0.001	<0.001	<0.001	<0.003	5,270	Clear no odor
3	39.33	47.41	1.30	6	06/03/09	5,900	17,900	<0.001	<0.001	<0.001	<0.003	5,150	Clear no odor
3	39.64	47.41	1.20	6	09/02/09	4,700	14,300	<0.001	<0.001	<0.001	<0.003	3,720	Clear no odor
3	39.79	47.41	1.20	6	11/13/09	5,900	16,900	<0.001	<0.001	<0.001	<0.003	3,800	Clear no odor
3	40.06	47.39	1.20	6	03/02/10	5,700	18,000	<0.001	<0.001	<0.001	<0.003	5,770	Clear no odor
3	40.18	47.39	1.20	6	05/27/10	5,800	17,700	<0.001	<0.001	<0.001	<0.003	4,900	Clear no odor
3	40.15	47.39	1.20	6	08/19/10	6,100	17,900	<0.001	<0.001	<0.001	<0.003	4,630	Clear no odor
3	39.94	47.39	1.20	6	11/15/10	5,800	17,500	<0.001	<0.001	<0.001	<0.003	6,620	Clear no odor
3	39.86	47.40	1.20	6	03/03/11	5,700	17,300	<0.001	<0.001	<0.001	<0.003	4,690	Clear no odor
3	40.06	47.40	1.20	6	05/26/11	5,900	17,400	<0.001	<0.001	<0.001	<0.003	4,780	Clear no odor
3	40.36	47.40	1.10	6	08/25/11	6,000	17,500	<0.001	<0.001	<0.001	<0.003	4,910	Clear no odor
3	40.63	47.40	1.10	6	11/23/11	6,100	18,000	<0.001	<0.001	<0.001	<0.003	4,800	Clear no odor
3	40.82	47.40	1.10	6	02/16/12	5,800	17,600	<0.001	<0.001	<0.001	<0.003	5,090	Clear no odor

Graph 3  
 Rice Operating Company  
 MW-3  
 EME Jct. A-2-1  
 Lea County, New Mexico



**APPENDIX C**  
**ANALYSIS OF EME L-6 MW-2R**

April 17, 2012

Hack Conder  
Rice Operating Company  
112 W. Taylor  
Hobbs, NM 88240

RE: EME L-6

Enclosed are the results of analyses for samples received by the laboratory on 04/16/12 16:20.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-11-3. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (\*). For a complete list of accredited analytes and matrices visit the TCEQ website at [www.tceq.texas.gov/field/qa/lab\\_accred\\_certif.html](http://www.tceq.texas.gov/field/qa/lab_accred_certif.html).

Cardinal Laboratories is accredited through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2	Haloacetic Acids (HAA-5)
Method EPA 524.2	Total Trihalomethanes (TTHM)
Method EPA 524.4	Regulated VOCs (V1, V2, V3)

Accreditation applies to public drinking water matrices.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Celey D. Keene  
Lab Director/Quality Manager

**Analytical Results For:**

 Rice Operating Company  
 Hack Conder  
 112 W. Taylor  
 Hobbs NM, 88240  
 Fax To: (575) 397-1471

 Received: 04/16/2012  
 Reported: 04/17/2012  
 Project Name: EME L-6  
 Project Number: NONE GIVEN  
 Project Location: EME L-6

 Sampling Date: 04/16/2012  
 Sampling Type: Water  
 Sampling Condition: \*\* (See Notes)  
 Sample Received By: Jodi Henson

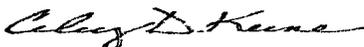
**Sample ID: MW - 2R SAMPLE (H200876-01)**

Chloride, SM4500Cl-B	mg/L	Analyzed By: HM							
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride*	10000	4.00	04/17/2012	ND	100	100	100	0.00	

Cardinal Laboratories

\*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

**Notes and Definitions**

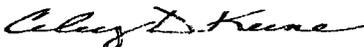
- ND Analyte NOT DETECTED at or above the reporting limit
- RPD Relative Percent Difference
- \*\* Samples not received at proper temperature of 6°C or below.
- \*\*\* Insufficient time to reach temperature.
- Chloride by SM4500Cl-B does not require samples be received at or below 6°C  
Samples reported on an as received basis (wet) unless otherwise noted on report

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Cardinal Laboratories

\*=Accredited Analyte

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Celest D. Keene, Lab Director/Quality Manager



**APPENDIX D**  
**CHLORIDE MASS CALCULATION**

## EME Jct. A-2-1

### Chloride Mass Removal Calculation

#### Estimate of Chloride Mass in Groundwater

Parameter	Unit	Value	Description
Impact area	ft <sup>2</sup>	3,375	Estimated Area of Impact
Aquifer Thickness	ft	15	NMOCD Approved Estimation
Porosity	%	0.25	Professional Estimate for Water Saturated Pore Volume
Volume of Impacted Groundwater Below Site	ft <sup>3</sup>	12,656.25	Impact Area x Aquifer Thickness x Porosity
Volume of Impacted Groundwater Below Site	L	358,385.09	Conversion from ft <sup>3</sup> to Liters
Chloride Concentration from Source	mg/L	1,309	Difference between Concentrations in Monitor Wells (MW-2 = 7,831 mg/L and MW-3 = 6,522 mg/L)
<b>TOTAL CHLORIDE MASS</b>	<b>kg</b>	<b>469</b>	Volume of Impacted Groundwater Below Site x Chloride Concentration Added to Soil from Source

#### Estimated Groundwater Recovery System Removal at the EME L-6

Parameter	Unit	Value	Description
Groundwater Concentration	mg/L	10,000	Groundwater Concentration from MW-2R
Groundwater Concentration	kg/gal	0.03785441	Conversion from mg/L to kg/gal
Pumping Rate	gals/min	1	Given
Extraction Rate	kg/min	0.03785441	Pumping rate x Groundwater Concentration (kg/gal)
Extraction Rate	kg/day	22.7126472	Conversion from kg/min to kg/day
Representative Total Chloride Mass	kg	469	From above
Volume Removal	gals	12,393	Pumping rate x Estimated Removal Time x 60 min/hour x 10 hr/day
Volume Removal	bbls	295	Conversion from gals to bbls
<b>ESTIMATED REMOVAL TIME</b>	<b>day</b>	<b>21</b>	Representative Total Chloride Mass/Extraction Rate