1R - 423-07

# WORKPLANS

Date:
10-24-12

TETRA TECH

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October 24, 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: CORRECTIVE ACTION PLAN (CAP)**
**RICE OPERATING COMPANY,**
**JUSTIS E-26 SWD SYSTEM**
**UNIT "E", SEC. 26, T24S, R37E**
**LEA COUNTY, NEW MEXICO**
**NMOCD CASE # 1R423-07**

Mr. Hansen:

Tetra Tech Inc. (Tetra Tech) submits the following Corrective Action Plan (CAP) for the RICE Operating Company (ROC), E-26, located in the Justis SWD System. ROC is the service provider (agent) for the Justis SWD System and has no ownership of any portion of the pipeline, well or facility. The Justis 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 Workplan, starting on June 27, 2003, the junction box was removed and a new, watertight junction box was installed 25 feet south of the former junction box. The former junction box site was excavated to a depth of 12 feet deep with a backhoe. PID readings and chloride field tests were conducted at regular intervals. Based on the field PID readings and the chloride field tests, both the total petroleum hydrocarbons (TPH) and chlorides did not exhibit a decrease with depth. Upon completion of the excavation, the site was backfilled with clean imported soils and brought up to surface grade. In March 2004, ROC submitted a Junction Box Disclosure Report to the NMOCD. See Figures 1 and 2 for site location.

In order to determine the vertical extent of hydrocarbon and chloride impacts, on March 18, 2004, a soil boring (SB-1) was drilled in the former junction box to a depth of 67 feet below ground surface (bgs). Analytical results from the drilling indicate the TPH concentrations decreased with depth, while the chloride concentrations did not exhibit a significant decline

Tetra Tech
1910 North Big Spring, Midland,TX 79705
Tel 432.682.4559 Fax 432.682.3946 www.tetratech.com

with depth. The chloride concentration was 587 milligrams per kilograms (mg/kg) at 67 feet bgs. Upon completion of the drilling, the soil boring was plugged with bentonite to the ground surface.

Between March 18 and 22, 2010, six additional soil borings (SB-2 through SB-7) and one monitor well (MW-1) were installed in the vicinity of the former junction box in order to delineate the chlorides/TPH within the soil and determine if groundwater was impacted. In SB-2, SB-5, SB-6 and SB-7, laboratory chloride concentrations remained elevated; however, chloride readings decreased with depth. Chloride concentrations were low throughout SB-3 with a concentration of 144 mg/kg at 5 feet and <16 mg/kg at 30 feet. Chloride concentrations also decreased in SB-4 from 592 mg/kg at 20 feet to 160 mg/kg at 50 feet. See Figure 3 for soil analytical results. Groundwater chloride concentrations in monitor well MW-1 were elevated ranging from 1,560 to 2,200 mg/L Groundwater at the site is located at a depth of approximately 68 feet below ground surface. See attached Tables for groundwater analytical results.

On October 24, 2011, an up-gradient monitor well (MW-2) was installed northwest of the former junction box. Since the MW-2 well installation, chloride analytical results for the well have ranged from 1,460 to 1,580 mg/L, which is comparable with results found in monitor well MW-1 indicating there is an up-gradient source contributing to the degradation of groundwater quality.

In order to complete delineation of the soils at the site, two additional soil borings (SB-8 and SB-9) were installed north of SB-7 on April 24, 2012. See Appendix A for Boring Logs. The chloride concentrations in the soils in SB-8 decreased from 4,960 mg/kg at 10 feet bgs to 1,920 mg/kg at 60 feet bgs, while they decreased from 2,920 mg/kg at 20 feet bgs to 96 mg/kg at 40 feet bgs in SB-9.

On August 7, 2012, monitor well MW-1 was plugged and replaced with a 4 inch well (RW-1). The 2-inch PVC casing was removed and the wellbore was filled from 76 feet bgs to 3 feet bgs with a 1% to 3% bentonite slurry mixture. A concrete cap was placed from 3 feet to the surface to complete the capping of the well. RW-1 was installed approximately 10 ft southeast of MW-1. See Appendix A for the RW-1 Boring Log and Appendix B for Well Plugging Log.

**PROPOSED SOIL REMEDIATION**

Based on the results of the soil boring drilling and sampling at the site, ROC proposes to install a 20-mil polyethylene liner in the vicinity of the former junction box. The proposed dimensions of the liner are 113 feet by 43 feet by 4-5 feet deep. (See Figure 3 for proposed liner location). Upon completion of the installation of the liner, soils with laboratory chloride readings of less than 500 mg/kg and a field PID measurement of less than 100 mg/kg will be placed over the liner and brought up to surface grade. Excavated soils will be evaluated for use as backfill and any soils requiring disposal will be properly disposed of at an NMOCD approved facility. Upon completion of the backfill, the site will be seeded with a blend of native vegetation mix.

Based on the US EPA Exposure Assessment Mulitimed Model, the 20-mil polyethylene liner will allow a maximum breakout concentration of approximately 60.49 mg/kg over a course of 180 years. See Appendix C for Mulitimed File. The installation of the liner should prevent further vertical migration of the chlorides within the soil and be protective of the underlying groundwater.

**PROPOSED GROUNDWATER REMEDIATION**

The footprint of the soil chloride impact area for the Justis SWD System E-26 is approximately 4,859 $ft^2$. If we assume the aquifer thickness is 15 feet 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:

4,859 $ft^2$ x 15 ft x 0.25 = 18,221.25 $ft^3$

Assuming there is 28.3168466 liters of water per cubic feet, the following amount calculated to be removed from the proposed onsite RW-1 recovery well:

18,221.25 $ft^3$ x 28.3168466 liters/$ft^3$ = 515,968.34 liters

Taking the average difference between monitor well MW-1 (source area) and subtract from monitor well MW-2 (up gradient monitor well) yields the following:

1,766 mg/L (MW-1) – 1,506 mg/L (MW-2) = 260 mg/L

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

To determine the Total Chloride Mass, the volume of the impacted groundwater below the site (515,968.34 L) is multiplied by chloride concentration calculated from the original source (260 mg/L):

515,968.34 L x 260 mg/L = 134,151,768.4 mg. and converting to kg yields 134 kg of Total Chloride Mass to be removed from the site.

TETRA TECH

The 4 inch well (RW-1) will be utilized for groundwater recovery. This well should have a chloride concentration similar to monitor well MW-1 which was 1,766 mg/L and will be pumped at a constant rate of 1 gal/min. Converting from mg/L to kg/gal yields a conversion factor of 0.00668509 kg/gal. Multiplying the pumping rate (1 gal/min) by the groundwater concentration (0.00668509) in kg/gal yields an extraction rate of 0.00668509 kg/min. Converting this from kg/min to kg/day yields a result of 4.01105349 kg/day based on pumping for 10 hours per day. Removed groundwater will be utilized for pipeline and well maintenance.

The estimated removal time for the 134 kg (20,067 gallons or 478 bbls) of impacted groundwater is approximately 33 days.

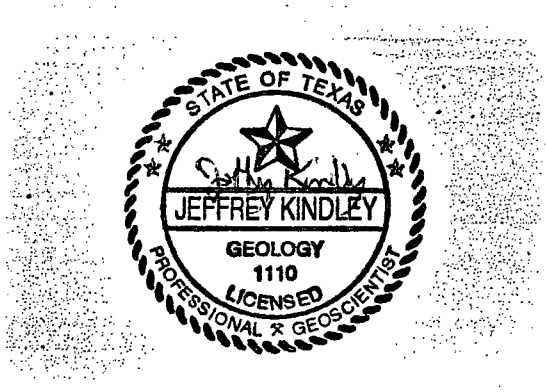
Should you have any questions, please contact Hack Conder at (575) 393-9174. Thank you for your attention to this matter.

Tetra Tech, Inc.

Jeffrey Kindley

Jeffrey Kindley, P.G.
Senior Environmental Geologist

cc: ROC – Hack Conder



# FIGURES

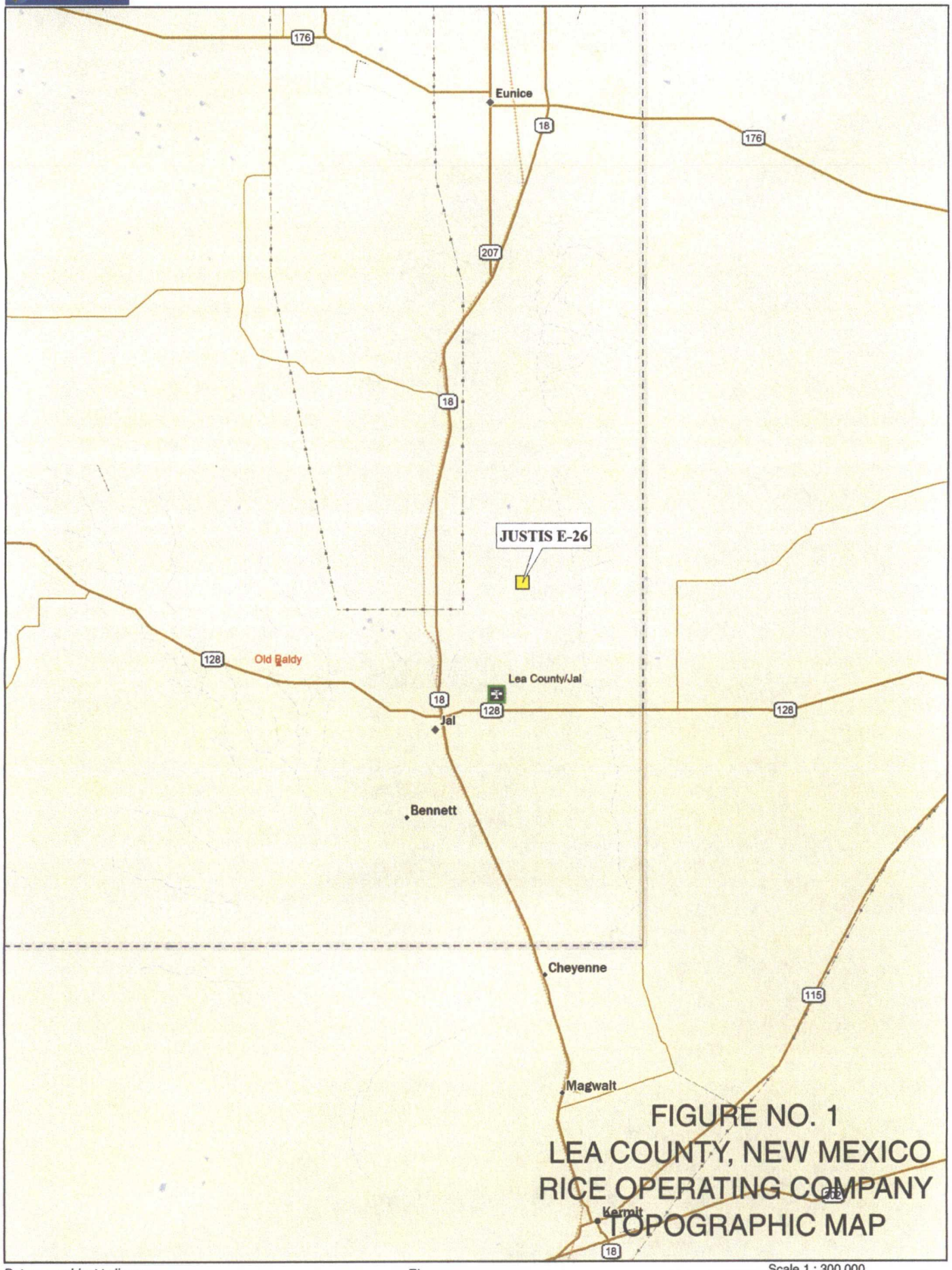



FIGURE NO. 1
LEA COUNTY, NEW MEXICO
RICE OPERATING COMPANY
TOPOGRAPHIC MAP



TN
MN (7.2°E)

Scale 1 : 300,000
1" = 4.73 mi
Data Zoom 9-4

DeLORME

Topo USA® 8

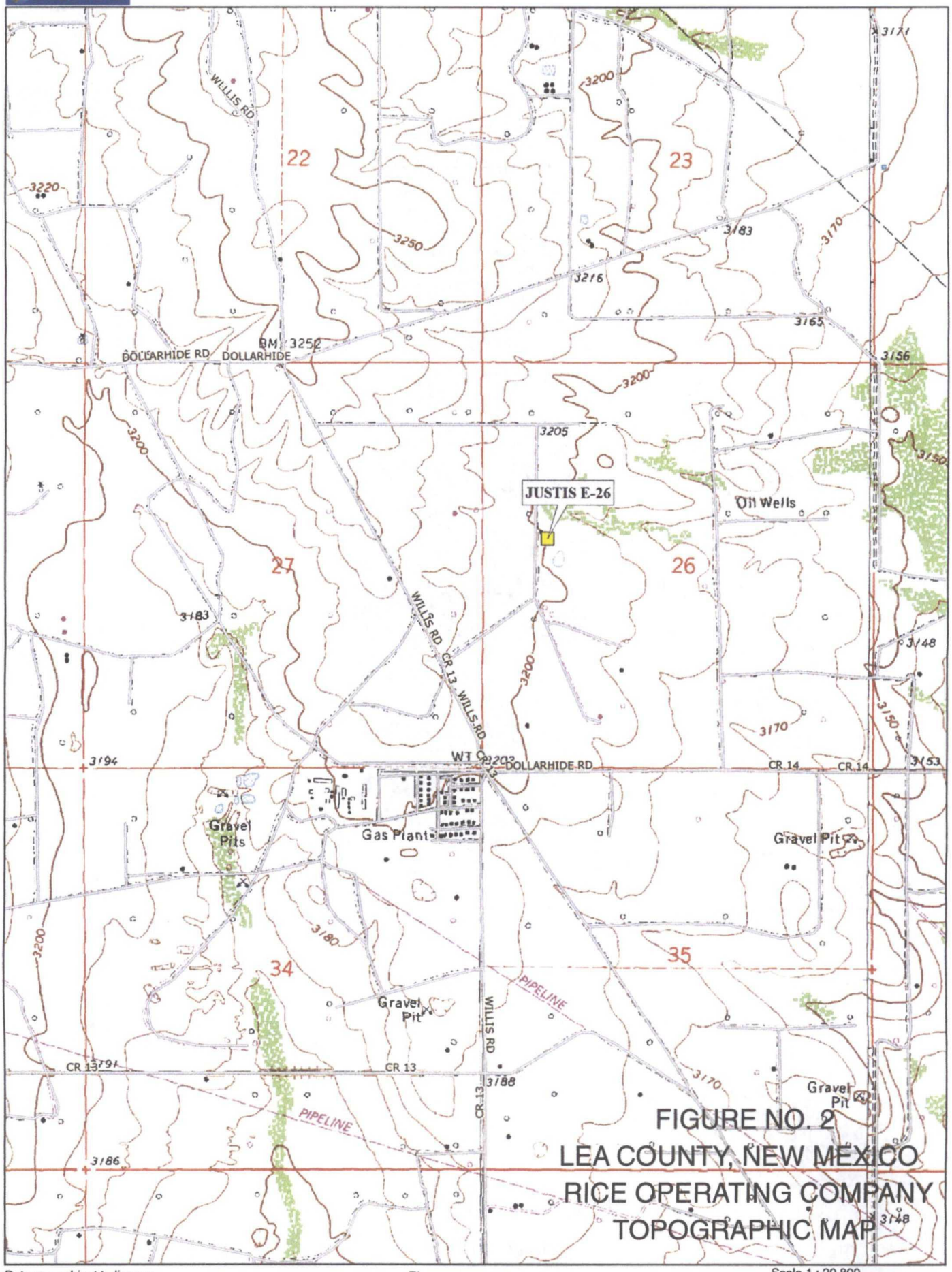
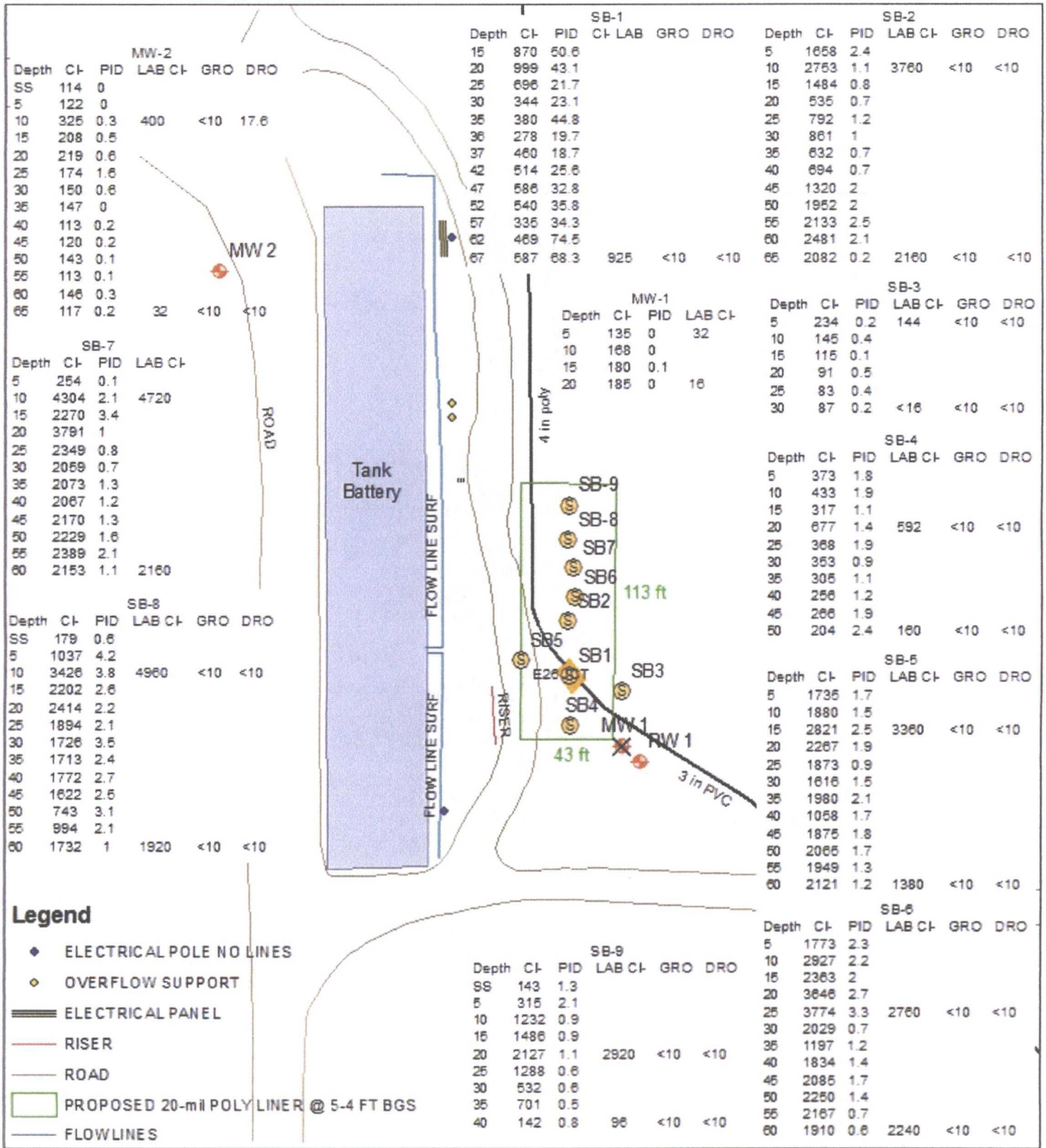



FIGURE NO. 2
LEA COUNTY, NEW MEXICO
RICE OPERATING COMPANY
TOPOGRAPHIC MAP



TN
MN (7.2°E)

Scale 1 : 20,800
0 600 1200 1800 2400 3000 ft
0 180 360 540 720 900 m
1" = 1,733.3 ft
Data Zoom 13-3




RICE ENVIRONMENTAL CONSULTING & SAFETY, LLC

# *Justis E-26*

**LEGALS: UL/E sec. 26**
**T24S R37E**

**NMOCD Case #: 1R423-07**

Figure 3

N W E S

0 15 30 60
Feet

Drawing date: 5/16/12
Drafted by: L. Weinheimer

DGW = 68 ft

# TABLES

Table 1
Rice Operating Company
Justis E-26
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 | 67.93 | 78.65 | 1.70 | 10.0 | 04/11/10 | 1800 | 3400 | <0.001 | <0.001 | <0.001 | <0.003 | 299 | Clear no odor |
| 1 | 67.92 | 78.65 | 1.70 | 10.0 | 06/02/10 | 1580 | 3340 | <0.001 | <0.001 | <0.001 | <0.003 | 265 | Clear no odor |
| 1 | 67.99 | 78.65 | 1.70 | 10.0 | 08/26/10 | 1560 | 3360 | <0.001 | <0.001 | <0.001 | <0.003 | 260 | Clear no odor |
| 1 | 68.02 | 78.65 | 1.70 | 10.0 | 12/01/10 | 1680 | 3650 | <0.001 | <0.001 | <0.001 | <0.003 | 324 | Clear no odor |
| 1 | 68.02 | 78.64 | 1.70 | 10.0 | 03/24/11 | 1840 | 4000 | <0.001 | <0.001 | <0.001 | <0.003 | 260 | Clear no odor |
| 1 | 68.03 | 78.64 | 1.70 | 10.0 | 06/10/11 | 1760 | 3520 | <0.001 | <0.001 | <0.001 | <0.003 | 266 | Clear no odor |
| 1 | 68.06 | 78.64 | 1.70 | 10.0 | 09/14/11 | 1700 | 3550 | <0.001 | <0.001 | <0.001 | <0.003 | 281 | Clear no odor |
| 1 | 68.13 | 78.64 | 1.70 | 10.0 | 12/08/11 | 1680 | 3600 | <0.001 | <0.001 | <0.001 | <0.003 | 281 | Clear no odor |
| 1 | 68.05 | 78.64 | 1.70 | 10.0 | 03/08/12 | 1860 | 3920 | <0.001 | <0.001 | <0.001 | <0.003 | 292 | Clear no odor |
| 1 | 68.07 | 78.64 | 1.70 | 10.0 | 06/05/12 | 2200 | 4330 | <0.001 | <0.001 | <0.001 | <0.003 | 369 | Clear no odor |

Graph 1
Rice Operating Company
MW-1
Justis E-26
Lea County, New Mexico

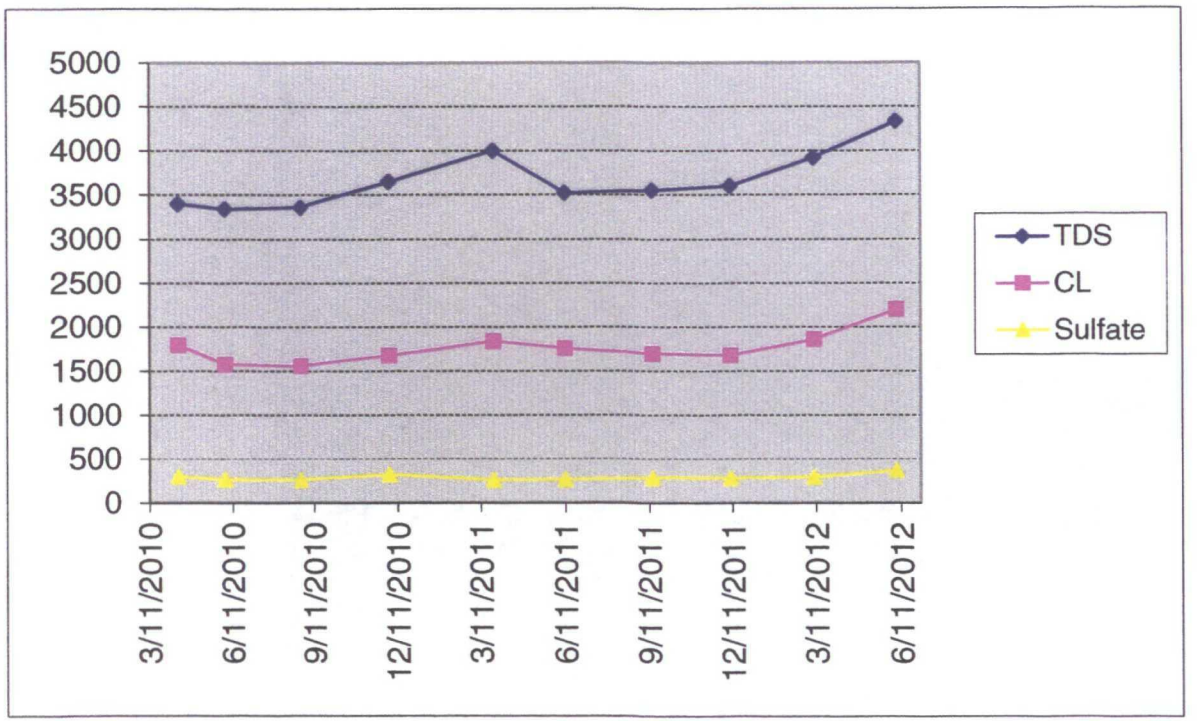
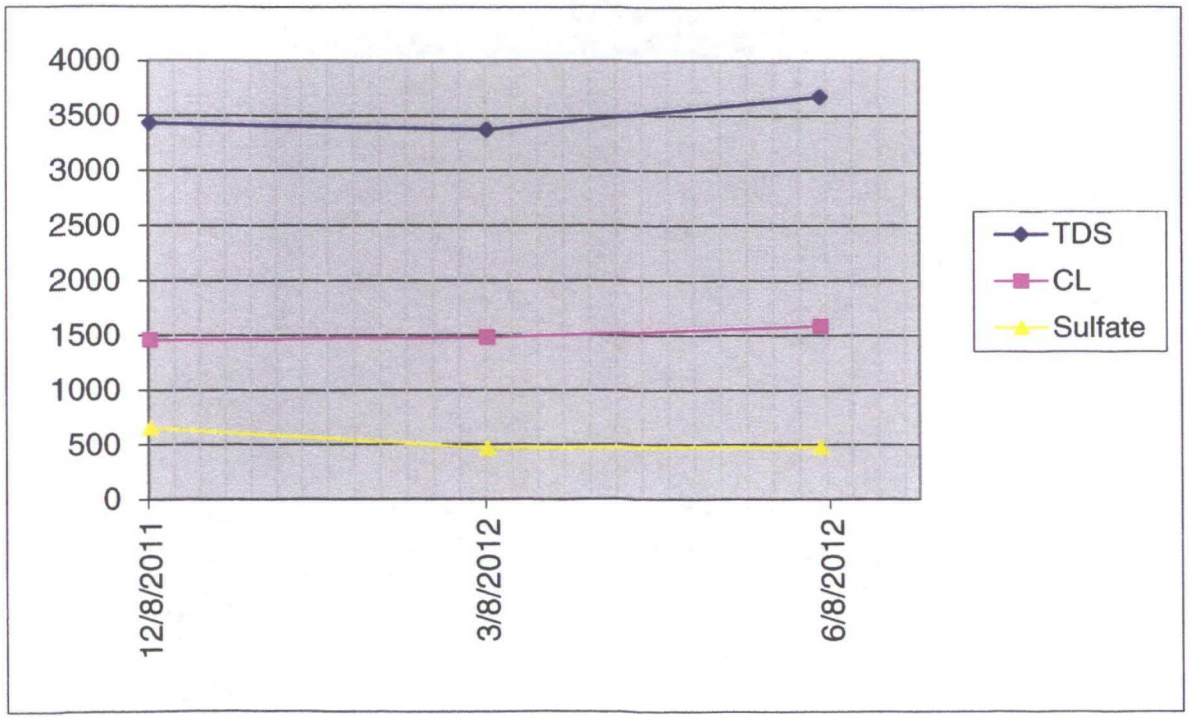


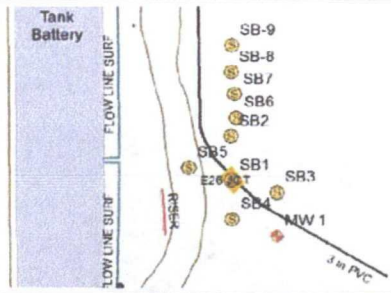
Table 2
Rice Operating Company
Justis E-26
Lea County, New Mexico

| 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 | 68.28 | 78.64 | 1.70 | 10.0 | 12/08/11 | 1460 | 3430 | <0.001 | <0.001 | <0.001 | <0.003 | 652 | Clear no odor |
| 2 | 68.23 | 78.64 | 1.70 | 10.0 | 03/08/12 | 1480 | 3370 | <0.001 | <0.001 | <0.001 | <0.003 | 465 | Clear no odor |
| 2 | 68.27 | 78.64 | 1.70 | 10.0 | 06/05/12 | 1580 | 3670 | <0.001 | <0.001 | <0.001 | <0.003 | 475 | Clear no odor |

Graph 2
Rice Operating Company
MW-2
Justis E-26
Lea County, New Mexico



# APPENDIX A
# BORING LOGS

| | | | |
|---|---|---|---|
| **Logger:** | Kyle Norman |  | RICE ENVIRONMENTAL CONSULTING & SAFETY, LLC — RECS |
| **Driller:** | Harrison & Cooper, Inc. | | |
| **Drilling Method:** | Air rotary | | **Project Name:** Justis E-26 — **Well ID:** SB-8 |
| **Start Date:** | 4/24/2012 | | |
| **End Date:** | 4/24/2012 | | |



Comments: Located 61 ft north of the former junction box site. All samples were from cuttings.

**DRAFTED BY: L. Weinheimer**

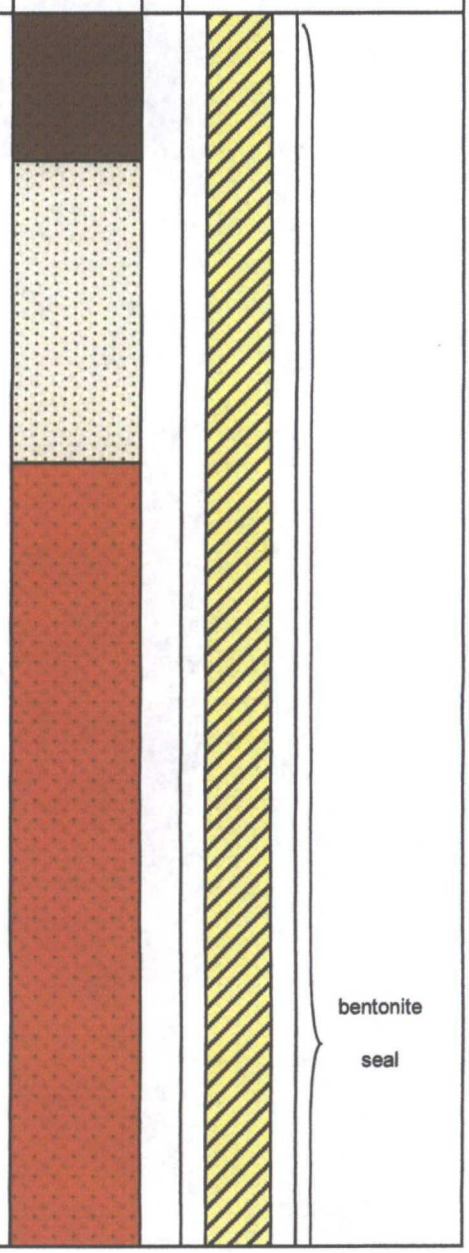
TD = 60 ft GW = 68 ft

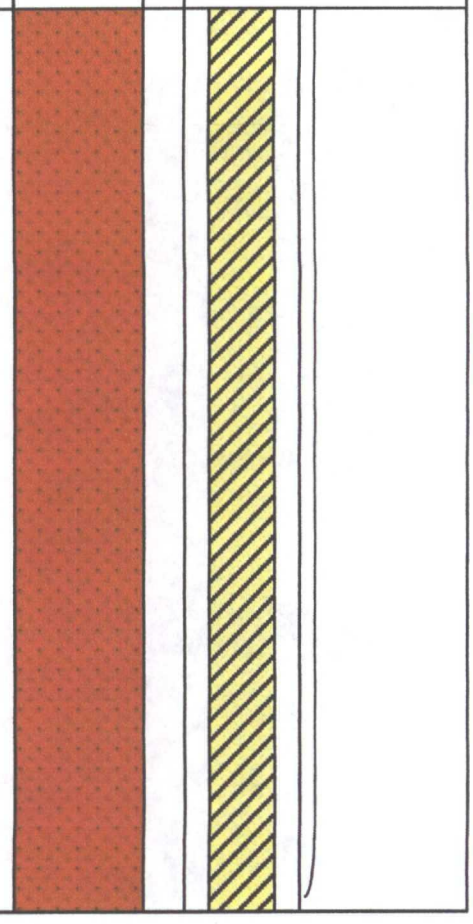
**Location:** UL/E sec. 26 T24S R37E

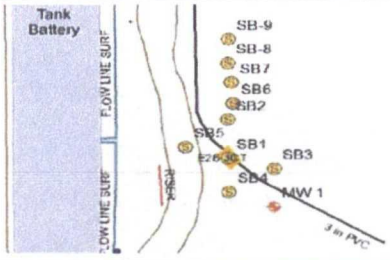
**Lat:** 32°11'21.769"N **County**: Lea

**Long:** 103°8'21.783"W **State**: NM

| Depth (feet) | Chloride field tests | LAB | PID | Description |
|---|---|---|---|---|
| | | | | Brown Sand |
| | | | | |
| SS | 179 | | 0.6 | |
| | | | | Tan Sand With Some Caliche |
| | | | | |
| 5 ft | 1037 | | 4.2 | |
| | | | | |
| | | | | |
| 10 ft | 3426 | Cl- 4960 | 3.8 | |
| | | GRO <10 | | Red Sand |
| | | DRO <10 | | |
| 15 ft | 2202 | | 2.6 | |
| | | | | |
| | | | | |
| 20 ft | 2414 | | 2.2 | |
| | | | | Red Sand, Moist |
| | | | | |
| 25 ft | 1894 | | 2.1 | |
| | | | | |
| | | | | |
| 30 ft | 1726 | | 3.5 | |
| | | | | |
| | | | | |
| 35 ft | 1713 | | 2.4 | |



| Depth (feet) | Chloride field tests | LAB | PID | Description | Lithology | Well Construction |
|---|---|---|---|---|---|---|
| | | | | Red Sand, Moist |  | |
| | | | | | | |
| **40 ft** | 1772 | | 2.7 | | | |
| | | | | | | |
| | | | | | | |
| **45 ft** | 1622 | | 2.5 | | | |
| | | | | | | |
| | | | | | | |
| **50 ft** | 743 | | 3.1 | | | |
| | | | | | | |
| | | | | | | |
| **55 ft** | 994 | | 2.1 | | | |
| | | | | | | |
| | | | | | | |
| **60 ft** | 1732 | Cl- 1920 | 1.0 | | | |
| | | GRO <10 | | | | |
| | | DRO <10 | | | | |

| | | | |
|---|---|---|---|
| **Logger:** | Kyle Norman |  | RICE ENVIRONMENTAL RECS CONSULTING & SAFETY, LLC |
| **Driller:** | Harrison & Cooper, Inc. | | **Project Name:** Justis E-26 **Well ID:** SB-9 |
| **Drilling Method:** | Air rotary | | |
| **Start Date:** | 4/24/2012 | | |
| **End Date:** | 4/24/2012 | | |



Comments: Located 76 ft north of the former junction box site. All samples were from cuttings.

**DRAFTED BY: L. Weinheimer**

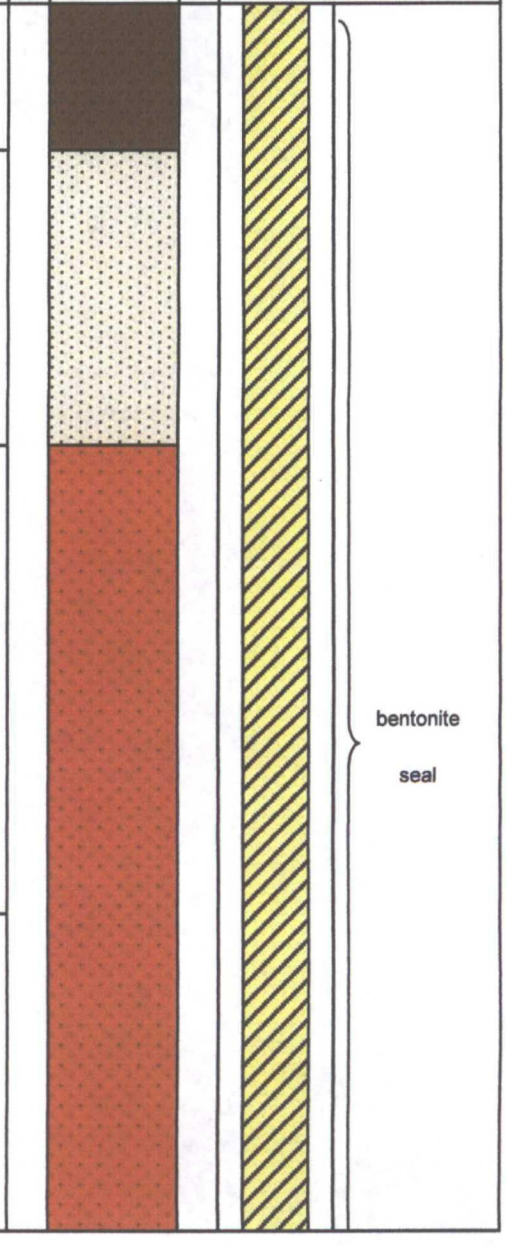
TD = 40 ft GW = 68 ft

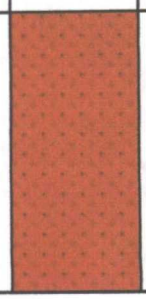
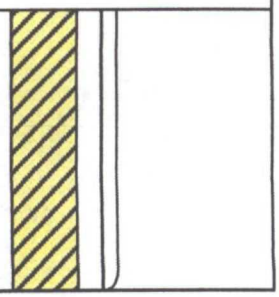
**Location:** UL/E sec. 26 T24S R37E

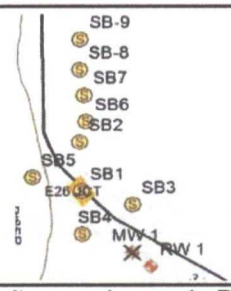
**Lat:** 32°11'21.925"N **County**: Lea

**Long:** 103°8'21.781"W **State**: NM

| Depth (feet) | Chloride field tests | LAB | PID | Description |
|---|---|---|---|---|
| | | | | Brown Sand |
| | | | | |
| SS | 143 | | 1.3 | |
| | | | | Tan Sand With Some Caliche |
| | | | | |
| 5 ft | 315 | | 2.1 | |
| | | | | |
| | | | | |
| 10 ft | 1232 | | 0.9 | |
| | | | | Red Sand |
| | | | | |
| 15 ft | 1486 | | 0.9 | |
| | | | | |
| | | | | |
| 20 ft | 2127 | Cl- 2920 | 1.1 | |
| | | GRO <10 | | |
| | | DRO <10 | | |
| 25 ft | 1288 | | 0.6 | |
| | | | | Red Sand, Moist |
| | | | | |
| 30 ft | 532 | | 0.6 | |
| | | | | |
| | | | | |
| 35 ft | 701 | | 0.5 | |



| Depth (feet) | Chloride field tests | LAB | PID | Description | Lithology | Well Construction |
|---|---|---|---|---|---|---|
| | | | | Red Sand, Moist |  |  |
| | | | | | | |
| 40 ft | 142 | Cl-96 | 0.8 | | | |
| | | GRO <10 | | | | |
| | | DRO <10 | | | | |

| | | | |
|---|---|---|---|
| **Logger:** | Kyle Norman |  | |
| **Driller:** | Harrison & Cooper, Inc. | | |
| **Drilling Method:** | Mud rotary | | **Project Name:** Justis E-26 **Well ID:** RW-1 |
| **Start Date:** | 8/7/2011 | | |
| **End Date:** | 8/7/2011 | | |



Comments: The well was not sampled as it was advanced. RW-1 is located 50 ft SE of the center of the current junction box.

**DRAFTED BY: L. Weinheimer**

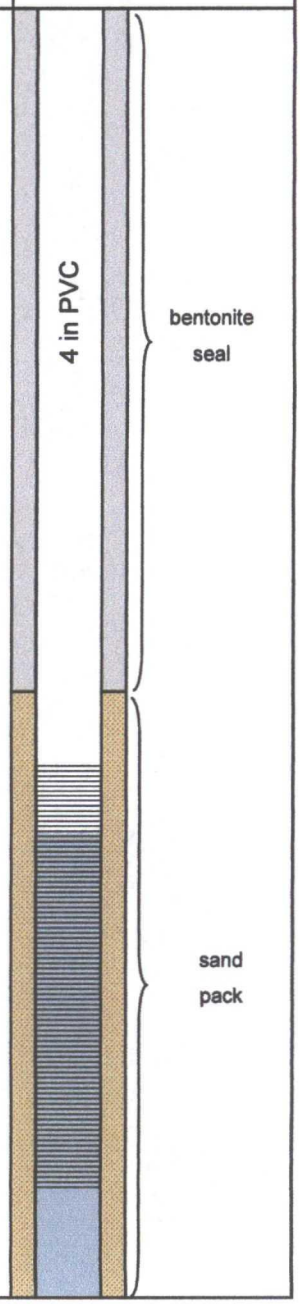
TD = 110 ft GW = 68 ft

**Location:** UL/E sec. 26 T24S R37E

**Lat:** 32°11'20.782"N **County**: Lea

**Long:** 103°8'21.418"W **State**: NM

| Depth (feet) | Chloride field tests | LAB | PID | Description | Lithology | Well Construction |
|---|---|---|---|---|---|---|
| | | | | NO SAMPLES TAKEN | | |
| SS | | | | | | |
| 10 ft | | | | | | |
| 20 ft | | | | | | |
| 30 ft | | | | | | |
| 40 ft | | | | | | |
| 50 ft | | | | | | |
| 60 ft | | | | | | |
| 70 ft | | | | | | |
| 80 ft | | | | | | |
| 90 ft | | | | | | |
| 100 ft | | | | | | |
| 110 ft | | | | | | |



# APPENDIX B
# WELL PLUGGING LOG

**HARRISON & COOPER, INC.**

*Drilling & Pump Professionals*

7414 85th Street, Lubbock, Texas 79424-4951

P.O. Box 96, Wolfforth, Texas 79382-0096

Ph: (806) 866-4026 Fax: (806) 866-4044 hcidrill.com

# Plugging Report

| | |
|---|---|
| Client | Rice Operating |
| Contractor | Harrison & Cooper |
| Date Completed | 8/7/2012 |
| Site | Justis E-26 |
| Well ID | MW-1 |
| Casing Diameter | 2" |
| Well Depth | 76' |
| Casing Material | PVC |
| Plugging Material | Portland/Bentonite Slurry |
| Slurry Interval | 3'-76' |
| Cement Interval | 0'-3' |

Copies: File
Email (Rice)

# APPENDIX C
# MULTIMED FILE

MULTIMED V1.01 DATE OF CALCULATIONS: 26-SEP-2012 TIME: 16:15:36

U. S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.50, 2005)

1
Run options
--- -------

Justis E-26

Chemical simulated is Chloride

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration Specified By User: 7.620E-03 m/yr
Run was transient
Well Times: Entered Explicitly
Reject runs if Y coordinate outside plume
Reject runs if Z coordinate outside plume
Gaussian source used in saturated zone model
1
1
UNSATURATED ZONE FLOW MODEL PARAMETERS
(input parameter description and value)

| | | |
|---|---|---|
| NP | - Total number of nodal points | 240 |
| NMAT | - Number of different porous materials | 1 |
| KPROP | - Van Genuchten or Brooks and Corey | 1 |
| IMSHGN | - Spatial discretization option | 1 |
| NVFLAYR | - Number of layers in flow model | 1 |

OPTIONS CHOSEN
------- ------
Van Genuchten functional coefficients
User defined coordinate system
1

Layer information
-----------------

| LAYER NO. | LAYER THICKNESS | MATERIAL PROPERTY |
|---|---|---|
| 1 | 4.88 | 1 |

DATA FOR MATERIAL 1
---- --- --------
VADOSE ZONE MATERIAL VARIABLES

| VARIABLE NAME | UNITS | DISTRIBUTION | PARAMETERS MEAN | PARAMETERS STD DEV | LIMITS MIN | LIMITS MAX |
|---|---|---|---|---|---|---|
| Saturated hydraulic conductivity | cm/hr | CONSTANT | 3.60 | -999. | -999. | -999. |
| Unsaturated zone porosity | -- | CONSTANT | 0.250 | -999. | -999. | -999. |
| Air entry pressure head | m | CONSTANT | 0.700 | -999. | -999. | -999. |
| Depth of the unsaturated zone | m | CONSTANT | 4.88 | 0.000 | 0.000 | 0.000 |

DATA FOR MATERIAL 1

VADOSE ZONE FUNCTION VARIABLES

| VARIABLE NAME | UNITS | DISTRIBUTION | PARAMETERS MEAN | PARAMETERS STD DEV | LIMITS MIN | LIMITS MAX |
|---|---|---|---|---|---|---|
| Residual water content | -- | CONSTANT | 0.116 | -999. | -999. | -999. |
| Brook and Corey exponent,EN | -- | CONSTANT | -999. | -999. | -999. | -999. |
| ALFA coefficient | 1/cm | CONSTANT | 0.500E-02 | -999. | -999. | -999. |
| Van Genuchten exponent, ENN | -- | CONSTANT | 1.09 | -999. | -999. | -999. |

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UNSATURATED ZONE TRANSPORT MODEL PARAMETERS

| | | | |
|---|---|---|---|
| NLAY | - Number of different layers used | | 1 |
| NTSTPS | - Number of time values concentration calc | | 40 |
| DUMMY | - Not presently used | | 1 |
| ISOL | - Type of scheme used in unsaturated zone | | 2 |
| N | - Stehfest terms or number of increments | | 18 |
| NTEL | - Points in Lagrangian interpolation | | 3 |
| NGPTS | - Number of Gauss points | | 104 |
| NIT | - Convolution integral segments | | 2 |
| IBOUND | - Type of boundary condition | | 3 |
| ITSGEN | - Time values generated or input | | 1 |
| TMAX | - Max simulation time | -- | 0.0 |
| WTFUN | - Weighting factor | -- | 1.2 |

OPTIONS CHOSEN

Convolution integral approach
Exponentially decaying continuous source
Computer generated times for computing concentrations

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DATA FOR LAYER 1

VADOSE TRANSPORT VARIABLES

| VARIABLE NAME | UNITS | DISTRIBUTION | PARAMETERS MEAN | PARAMETERS STD DEV | LIMITS MIN | LIMITS MAX |
|---|---|---|---|---|---|---|
| Thickness of layer | m | CONSTANT | 4.88 | -999. | -999. | -999. |
| Longitudinal dispersivity of layer | m | DERIVED | -999. | -999. | -999. | -999. |
| Percent organic matter | -- | CONSTANT | 0.000 | -999. | -999. | -999. |
| Bulk density of soil for layer | g/cc | CONSTANT | 1.99 | -999. | -999. | -999. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Biological decay coefficient | 1/yr | CONSTANT | 0.000 | -999. | -999. | -999. |

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CHEMICAL SPECIFIC VARIABLES

| VARIABLE NAME | UNITS | DISTRIBUTION | PARAMETERS MEAN | PARAMETERS STD DEV | LIMITS MIN | LIMITS MAX |
|---|---|---|---|---|---|---|
| Solid phase decay coefficient | 1/yr | DERIVED | -999. | -999. | -999. | -999. |
| Dissolved phase decay coefficient | 1/yr | DERIVED | -999. | -999. | -999. | -999. |
| Overall chemical decay coefficient | 1/yr | DERIVED | -999. | -999. | -999. | -999. |
| Acid catalyzed hydrolysis rate | l/M-yr | CONSTANT | 0.000 | -999. | -999. | -999. |
| Neutral hydrolysis rate constant | 1/yr | CONSTANT | 0.000 | -999. | -999. | -999. |
| Base catalyzed hydrolysis rate | l/M-yr | CONSTANT | 0.000 | -999. | -999. | -999. |
| Reference temperature | C | CONSTANT | 25.0 | -999. | -999. | -999. |
| Normalized distribution coefficient | ml/g | CONSTANT | 0.000 | -999. | -999. | -999. |
| Distribution coefficient | -- | DERIVED | -999. | -999. | -999. | -999. |
| Biodegradation coefficient (sat. zone) | 1/yr | CONSTANT | 0.000 | -999. | -999. | -999. |
| Air diffusion coefficient | cm2/s | CONSTANT | -999. | -999. | -999. | -999. |
| Reference temperature for air diffusion | C | CONSTANT | -999. | -999. | -999. | -999. |
| Molecular weight | g/M | CONSTANT | -999. | -999. | -999. | -999. |
| Mole fraction of solute | -- | CONSTANT | -999. | -999. | -999. | -999. |
| Vapor pressure of solute | mm Hg | CONSTANT | -999. | -999. | -999. | -999. |
| Henry's law constant | atm-m^3/M | CONSTANT | -999. | -999. | -999. | -999. |
| Overall 1st order decay sat. zone | 1/yr | DERIVED | 0.000 | 0.000 | 0.000 | 1.00 |
| Not currently used | | CONSTANT | 0.000 | 0.000 | 0.000 | 0.000 |
| Not currently used | | CONSTANT | 0.000 | 0.000 | 0.000 | 0.000 |

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SOURCE SPECIFIC VARIABLES

| VARIABLE NAME | UNITS | DISTRIBUTION | PARAMETERS MEAN | PARAMETERS STD DEV | LIMITS MIN | LIMITS MAX |
|---|---|---|---|---|---|---|
| Infiltration rate | m/yr | CONSTANT | 0.762E-02 | -999. | -999. | -999. |
| Area of waste disposal unit | m^2 | CONSTANT | 451. | -999. | -999. | -999. |
| Duration of pulse | yr | DERIVED | 50.0 | -999. | -999. | -999. |
| Spread of contaminant source | m | DERIVED | -999. | -999. | -999. | -999. |
| Recharge rate | m/yr | CONSTANT | 0.000 | -999. | -999. | -999. |
| Source decay constant | 1/yr | CONSTANT | 0.250E-01 | 0.000 | 0.000 | 0.000 |
| Initial concentration at landfill | mg/l | CONSTANT | 0.140E+04 | -999. | -999. | -999. |
| Length scale of facility | m | DERIVED | -999. | -999. | -999. | -999. |
| Width scale of facility | m | DERIVED | -999. | -999. | -999. | -999. |
| Near field dilution | | DERIVED | 1.00 | 0.000 | 0.000 | 1.00 |

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AQUIFER SPECIFIC VARIABLES

| VARIABLE NAME | UNITS | DISTRIBUTION | PARAMETERS MEAN | PARAMETERS STD DEV | LIMITS MIN | LIMITS MAX |
|---|---|---|---|---|---|---|
| Particle diameter | cm | CONSTANT | -999. | -999. | -999. | -999. |
| Aquifer porosity | -- | CONSTANT | 0.300 | -999. | -999. | -999. |
| Bulk density | g/cc | CONSTANT | 1.86 | -999. | -999. | -999. |
| Aquifer thickness | m | CONSTANT | 6.10 | -999. | -999. | -999. |
| Source thickness (mixing zone depth) | m | DERIVED | -999. | -999. | -999. | -999. |
| Conductivity (hydraulic) | m/yr | CONSTANT | 315. | -999. | -999. | -999. |
| Gradient (hydraulic) | | CONSTANT | 0.400E-02 | -999. | -999. | -999. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Groundwater seepage velocity | m/yr | DERIVED | -999. | -999. | -999. | -999. |
| Retardation coefficient | -- | DERIVED | -999. | -999. | -999. | -999. |
| Longitudinal dispersivity | m | FUNCTION OF X | -999. | -999. | -999. | -999. |
| Transverse dispersivity | m | FUNCTION OF X | -999. | -999. | -999. | -999. |
| Vertical dispersivity | m | FUNCTION OF X | -999. | -999. | -999. | -999. |
| Temperature of aquifer | C | CONSTANT | 20.0 | -999. | -999. | -999. |
| pH | -- | CONSTANT | 7.00 | -999. | -999. | -999. |
| Organic carbon content (fraction) | | CONSTANT | 0.000 | -999. | -999. | -999. |
| Well distance from site | m | CONSTANT | 1.00 | -999. | -999. | -999. |
| Angle off center | degree | CONSTANT | 0.000 | -999. | -999. | -999. |
| Well vertical distance | m | CONSTANT | 0.000 | -999. | -999. | -999. |

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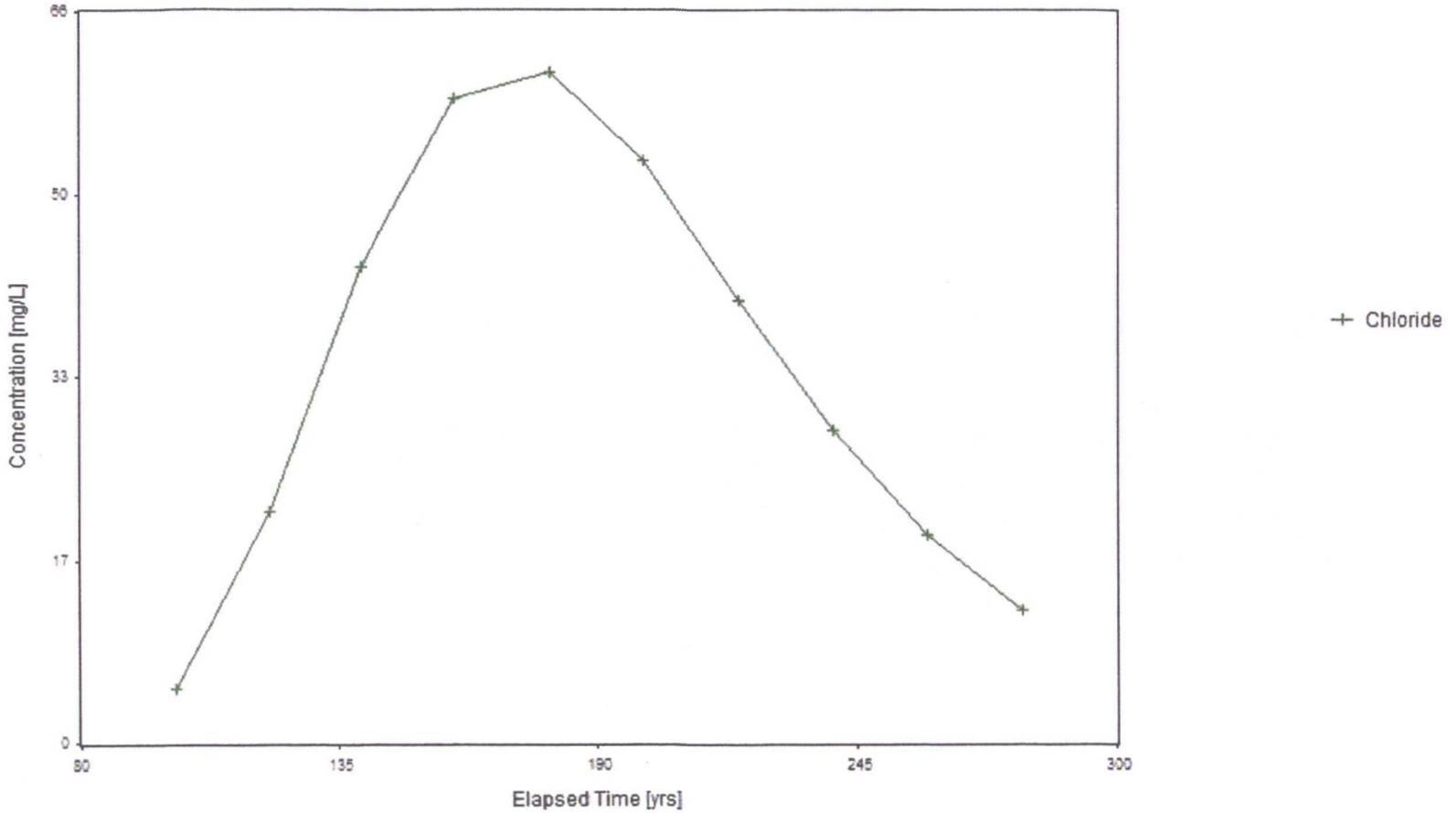
| TIME | CONCENTRATION |
|---|---|
| 0.100E+03 | 0.49545E+01 |
| 0.120E+03 | 0.20904E+02 |
| 0.140E+03 | 0.42942E+02 |
| 0.160E+03 | 0.58208E+02 |
| 0.180E+03 | 0.60491E+02 |
| 0.200E+03 | 0.52540E+02 |
| 0.220E+03 | 0.40017E+02 |
| 0.240E+03 | 0.28230E+02 |
| 0.260E+03 | 0.18840E+02 |
| 0.280E+03 | 0.12066E+02 |

**Chloride Concentration At The Receptor Well**

Justis E-26



## Hansen, Edward J., EMNRD

**From:** Katie Jones <kjones@riceswd.com>
**Sent:** Monday, November 26, 2012 1:14 PM
**To:** Hansen, Edward J., EMNRD
**Cc:** Hack Conder; Laura Pena; Kindley, Jeff
**Subject:** Justis E-26 (1R423-07) CAP Addendum
**Attachments:** Justis E-26 (1R423-07) Chloride Mass.xlsx

Mr. Hansen,

The following is an Addendum to the Justis E-26 (1R423-07) CAP submitted to the NMOCD on October 24th, 2012.

Pages 3-4, Section: Proposed Groundwater Remediation; red lettering will be deleted from the paragraph and blue lettering should be added to the paragraph.

"The footprint of the soil chloride impact area for the Justis SWD System E-26 is approximately 4,859 $ft^2$. If we assume the aquifer thickness is 15 feet 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:

- 4,859 $ft^2$ x 15 ft x 0.25 = 18,221.25 $ft^3$

Assuming there is 28.3168466 liters of water per cubic feet, the following amount calculated to be removed from the proposed onsite RW-1 recovery well:

- 18,221.25 $ft^3$ x 28.3168466 liters/$ft^3$ = 515,968.34 liters

Taking the average difference between monitor well MW-1 (source area) and subtract from monitor well MW-2 (up gradient monitor well) yields the following:

- 1,766 mg/L (MW-1) – 1,506 mg/L (MW-2) = 260 mg/L

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

To determine the Total Chloride Mass, the volume of the impacted groundwater below the site (515,968.34 L) is multiplied by chloride concentration calculated from the original source (260 mg/L):

- 515,968.34 L x 260 mg/L = 134,151,768.4 mg. and converting to kg yields 134 kg of Total Chloride Mass to be removed from the site.

The estimated chloride mass based on residual soil chloride is as follows:

Estimate of Chloride Mass in the Vadose Zone

| Parameter | Unit | Value | Description |
|---|---|---|---|
| Impact area | $ft^2$ | 2,550 | Estimated area of impact with chloride concentrations in |

| | | | |
|---|---|---|---|
| | | | the 10 ft above the water table |
| Vadose Zone Thickness | ft | 10 | 10 ft of vadose above the water table |
| Volume of Impacted Vadose Zone | $ft^3$ | 25,500 | Impact Area x Vadose Zone Thickness |
| Mass of Impacted Vadose Zone | kg | 1,157,700 | Volume of Impacted Vadose Zone x Mass Density (1 $ft^3$ of soil weighs approx. 45.4 kg or 100 $lb/ft^3$) |
| Chloride Concentration Added to Soil From Source | mg/kg | 628 | The average background concentration subtracted from the average soil bore concentrations from the bottom 10 ft of the SB-3, SB-4, SB-5, SB-6, and SB-9 |
| CHLORIDE MASS | kg | 727 | Mass of Impacted Vadose Zone x Chloride Concentration Added to Soil From Source |

| | | | |
|---|---|---|---|
| **TOTAL CHLORIDE MASS** | **kg** | **861** | **Sum of chloride mass in GW and Chloride mass in Vadose** |

Estimated Groundwater Recovery System Removal at the Justis E-26

| Parameter | Unit | Value | Description |
|---|---|---|---|
| Groundwater Concentration | mg/L | 1,766 | Groundwater Concentration from RW-1 |
| Groundwater Concentration | kg/gal | 0.00668509 | Conversion from mg/L to kg/gal |
| Pumping Rate | gals/min | 1 | Given |
| Extraction Rate | kg/min | 0.00668509 | Pumping rate x Groundwater Concentration (kg/gal) |
| Extraction Rate | kg/day | 4.01105349 | Conversion from kg/min to kg/day |
| Representative Total Chloride Mass | kg | 861 | From above |
| Volume Removal | gals | 128,822 | Pumping rate x Estimated Removal Time x 60 min/hour x 10 hr/day |
| Volume Removal | bbls | 3,067.2 | Conversion from gals to bbls |
| **ESTIMATED REMOVAL TIME** | **day** | **215** | Representative Total Chloride Mass/Extraction Rate |

The 4 inch well (RW-1) will be utilized for groundwater recovery. This well should have a chloride concentration similar to monitor well MW-1 which was 1,766 mg/L and will be pumped at a constant rate of 1 gal/min. Converting from mg/L to kg/gal yields a conversion factor of 0.00668509 kg/gal. Multiplying the pumping rate (1 gal/min) by the groundwater concentration (0.00668509) in kg/gal yields an extraction rate of 0.00668509 kg/min. Converting this from kg/min to kg/day yields a result of 4.01105349 kg/day based on pumping for 10 hours per day. Removed groundwater will be utilized for pipeline and well maintenance.

The estimated removal time for the ~~134~~861 kg (~~20,067~~128,822 gallons or ~~478~~3,067.2 bbls) of impacted groundwater is approximately ~~33~~215 days."

If you have any questions or require any additional information, please contact Hack Conder at (575)393-9174.

Thank you.

Katie Jones
Environmental Project Manager
RICE *Operating Company*

# Justis E-26 (1R423-07)

Chloride Mass Calculation

Estimate of Chloride Mass in Groundwater

| Parameter | Unit | Value | Description |
|---|---|---|---|
| Impact area | $ft^2$ | 4,859 | 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 | $ft^3$ | 18,221 | Impact Area x Aquifer Thickness x Porosity |
| Volume of Impacted Groundwater Below Site | L | 515,968.34 | Conversion from $ft^3$ to Liters |
| Chloride Concentration from Source | mg/L | 260 | Difference between Concentrations in Monitor Wells (MW-1 = 1,766 mg/L and MW-2 = 1,506 mg/L) |
| CHLORIDE MASS | kg | 134 | Volume of Impacted Groundwater Below Site x Chloride Concentration Added to Soil from Source |

Estimate of Chloride Mass in the Vadose Zone

| Parameter | Unit | Value | Description |
|---|---|---|---|
| Impact area | $ft^2$ | 2,550 | Estimated Area of Impact |
| Vadose Zone Thickness | ft | 10 | 10 ft of vadose above groundwater |
| Volume of Impacted Vadose Zone | $ft^3$ | 25,500 | Impact Area x Vadose Zone Thickness |
| Mass of Impacted Vadose Zone | kg | 1,157,700 | Volume of Impacted Vadose Zone x Mass Density (1 $ft^3$ of soil weighs approx. 45.4 kg or 100 $lb/ft^3$) |
| Chloride Concentration Added to Soil From Source | mg/kg | 628 | Average Soil Bore Concentrations From the bottom 10 ft of the SB-3, SB-4, SB-5, SB-6, and SB-9 subtracted from the average background concentration |
| CHLORIDE MASS | kg | 727 | Mass of Impacted Vadose Zone x Chloride Concentration Added to Soil From Source |

| | | | |
|---|---|---|---|
| **TOTAL CHLORIDE MASS** | **kg** | **861** | **Sum of chloride mass in GW and Chloride mass in Vadose** |

Estimated Groundwater Recovery System Removal at the Justis E-26

| Parameter | Unit | Value | Description |
|---|---|---|---|
| Groundwater Concentration | mg/L | 1,766 | Groundwater Concentration from RW-1 |
| Groundwater Concentration | kg/gal | 0.00668509 | Conversion from mg/L to kg/gal |
| Pumping Rate | gals/min | 1 | Given |
| Extraction Rate | kg/min | 0.00668509 | Pumping rate x Groundwater Concentration (kg/gal) |
| Extraction Rate | kg/day | 4.01105349 | Conversion from kg/min to kg/day |
| Representative Total Chloride Mass | kg | 861 | From above |
| Volume Removal | gals | 128,822 | Pumping rate x Estimated Removal Time x 60 min/hour x 10 hr/day |
| Volume Removal | bbls | 3,067 | Conversion from gals to bbls |
| **ESTIMATED REMOVAL TIME** | **day** | **215** | Representative Total Chloride Mass/Extraction Rate |