

Ensure BLM concurrence/approval.

## **INVESTIGATION SUMMARY** Red Hills North, Unit #603 Produced Water Spill

Lea County, New Mexico

LAI Project No. 16-0106-01

March 14, 2016

Prepared for:

EOG Resources, Inc. 5509 Champions Drive Midland, TX 79706

Prepared by:

Larson & Associates, Inc. 507 North Marienfeld Street, Suite 205 Midland, Texas 79701

THE STATE OF THE SECRETARY OF THE SECRET

Kimberly M. Huckaba

Hukaba

Staff Geologist

Mark J. Larson, P.G.

CPG #10490



## **Contents**

Introduction	1
Setting	1
Remediation Action Levels	
Soil Investigation	2
Remediation Plan	2

#### **Tables**

Table 1 Investigation Soil Sample Analytical Data Summary

## **Figures**

Figure 1 Topographic Map Figure 2 Aerial Map

Figure 3 Site Map and Sample Locations
Figure 4 Approximate Excavation Area

### Attachments

Attachment A Initial C-141

Attachment B Laboratory Reports

Attachment C Boring Logs Attachment D Photographs

#### Introduction

This investigation summary is prepared on behalf of EOG Resources, Inc. (EOG) by Larson & Associates, Inc. (LAI) for submittal to the New Mexico Oil Conservation Division (OCD) and surface owner, U.S. Bureau of Land Management (BLM), for a produced water spill at the EOG Red Hills North Unit #603 (Site) in Unit M (SW/4, SE/4), Section 6, Township 25 South, Range 34 East, in Lea County, New Mexico. The release occurred on January 30, 2016 due to overpressure of an underground 3" poly line (RHNU #601 going to the RHNU #606 WIW). Between 5 and 10 barrels (bbl) of produced water was released with 0 bbl recovered. The geodetic position is north 32° 09′ 12.8431" and west 103° 30′ 53.1399". The affected area covers approximately 8,100 square feet or about 0.18 acre. The release was reported to the OCD District 1 on February 4, 2016 which issued remediation project (RP) number 1RP-4150. Figure 1 presents a topographic map. Figure 2 presents an aerial map. Figure 3 presents a Site drawing. Attachment A presents the initial C-141.

#### Setting

The setting is as follows:

- The surface elevation is about 3,450 feet above mean sea level (MSL);
- The topography is slightly undulating and slopes to the southwest;
- The nearest surface water feature is intermittent drainage located about 2 miles northeast of the Site that flows northwest;
- The soils are designated as "Simona-Upton Association, 0 to 3 percent slopes", consisting of well drained fine to gravely sandy loam soils and underlain by cemented material (caliche);
- The upper geologic unit is the Tertiary-age Ogallala Formation and is underlain by the Triassicage Chinle formation of the Dockum group;
- Groundwater occurs at about 185 feet bgs according to records from the New Mexico Office of the State Engineer (NMOSE);
- The nearest well (NMOSE POD #02373S) is located about 1.75 miles southwest of the Site and is used for rig supply.

#### **Remediation Action Levels**

Remediation action levels (RRAL) were calculated for benzene, BTEX and TPH based on the following criteria established by the OCD (*Guidelines for Remediation of Leaks, Spills and Releases, August 13,* 1993):

Criteria	Result	Score
Depth-to-Groundwater	>100 feet	0
Wellhead Protection Area	No	0
Distance to Surface Water Body	200 - 1000 Horizontal Feet	0

The following RRAL apply to the release for ranking score:

Benzene 10 mg/Kg
 BTEX 50 mg/Kg
 TPH 5,000 mg/Kg

#### **Soil Investigation**

On February 3, 2016, LAI personnel used a direct push rig to collect soil samples at four (4) locations (DP-1 through DP-4). Soil sampling terminated between approximately 1.5 (DP-4) and 4 (DP-3) feet below ground surface (bgs) due to caliche. Permian Basin Environmental Laboratory (PBEL) in Midland, Texas, analyzed the samples for total petroleum hydrocarbons (TPH) by EPA SW-846 method 8015M and chloride by method 300. Table 1 presents the laboratory analytical data summary. Figure 3 presents the sample location map. Attachment B presents the laboratory report.

0

Referring to Table 1, samples from 0 to 1 foot bgs were analyzed for TPH and reported concentrations below the analytical method reporting limit (RL) except sample DP-3 which reported TPH at 34.2 milligrams per kilogram (mg/Kg) and below the RRAL. Chloride exceeded 250 mg/Kg in the deepest samples and ranged between 561 mg/Kg (DP-1, 1 to 2 feet bgs) to 24,700 mg/Kg (DP-3, 2 to 3 feet bgs).

On February 26, 2016, Scarborough Drilling, Inc. (Scarborough) used an air rotary rig and jam tube sampler to collect samples at DP-3 between approximately 5 feet and 40 feet bgs. The samples were analyzed for chloride by method 300. Chloride decreased to 300 mg/Kg in sample DP-3, 40 feet bgs. Figure 3 presents the boring location. Table 1 presents the laboratory analytical data summary. Attachment B presents the laboratory report.

Groundwater was not observed and the boring was plugged with bentonite. The soil boring log was prepared according to the Unified Soil Classification System (USCS). Attachment C presents the boring log. Attachment D presents the photo documentation.

#### **Remediation Plan**

LAI recommends the following remedial actions:

- Excavate soil to approximately 4 feet bgs in the vicinity of the spill area;
- Install 20 mil thickness poly liner in bottom of the excavation;
- Backfill excavation with clean topsoil and seed to BLM requirements;
- Dispose contaminated soil at OCD approved landfill; and
- Prepare final report for submission to OCD and BLM.

Figure 4 presents the approximate excavation area.

## **TABLES**

Table 1
Investigation Soil Sample Analytical Data Summary
EOG Resources, Inc., Red Hills North, Unit #603 Spill
Unit M (SW/4, SE/4), Section 6, Township 25 South, Range 34 East
Lea County, New Mexico
1RP-4150

Sample	Depth	Collection	Status	C6 - C12	>C12 - C28	>C28 - C35	TPH	Chloride
	(Feet)	Date		(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
OCD RRAL:							5,000	*250
DP-1	0 - 1	2/3/2016	In-Situ	<27.8	<27.8	<27.8	<27.8	52.5
	1 - 2	2/3/2016	In-Situ					561
DP-2	0 - 1	2/3/2016	In-Situ	<30.9	<30.9	<30.9	<30.9	14,200
	1 - 2	2/3/2016	In-Situ					21,400
	2 - 3	2/3/2016	In-Situ					14,500
DP-3	0 - 1	2/3/2016	In-Situ	<29.4	34.2	<29.4	34.2	14,600
	1 - 2	2/3/2016	In-Situ					15,500
	2 - 3	2/3/2016	In-Situ					24,700
	3 - 4	2/3/2016	In-Situ					16,800
SB-1	5	2/26/2016	In-Situ					17,000
	10	2/26/2016	In-Situ					7,790
	15	2/26/2016	In-Situ					2,190
	20	2/26/2016	In-Situ					11,100
	25	2/26/2016	In-Situ					1,360
	30	2/26/2016	In-Situ					953
	35	2/26/2016	In-Situ					378
	40	2/26/2016	In-Situ					300
DP-4	0 - 1	2/3/2016	In-Situ	<28.4	<28.4	<28.4	<28.4	15,400
	1 - 1.5	2/3/2016	In-Situ					15,300

Notes: laboratory analysis performed by Permian Basin Environmental Lab, Midland, Texas, by EPA SW-846 method 8015M (TPH) and 300.0 (chloride)

Depth in feet below ground surface (bgs)

mg/Kg: milligrams per kilogram equivalent to parts per million (ppm)

\*: OCD delineation limit

RRAL: Remediation action level calculated from OCD guidence document (August 13, 1993)

## **FIGURES**

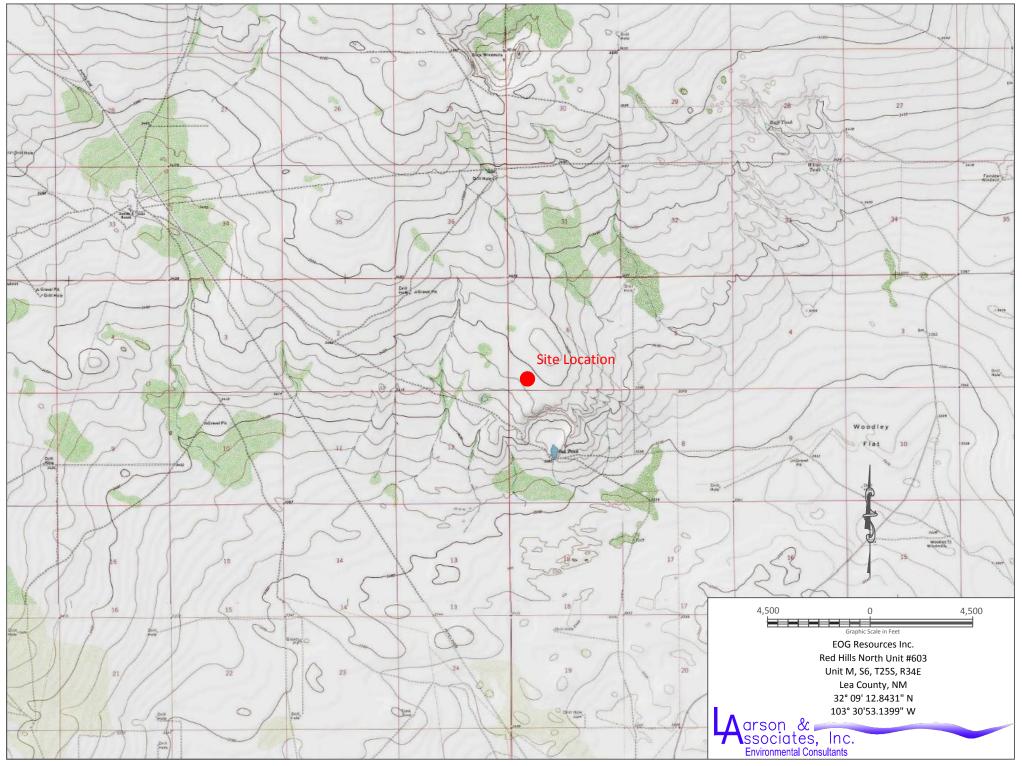


Figure 1 - Topographic Map



Figure 2 - Aerial Map Showing Spill Area

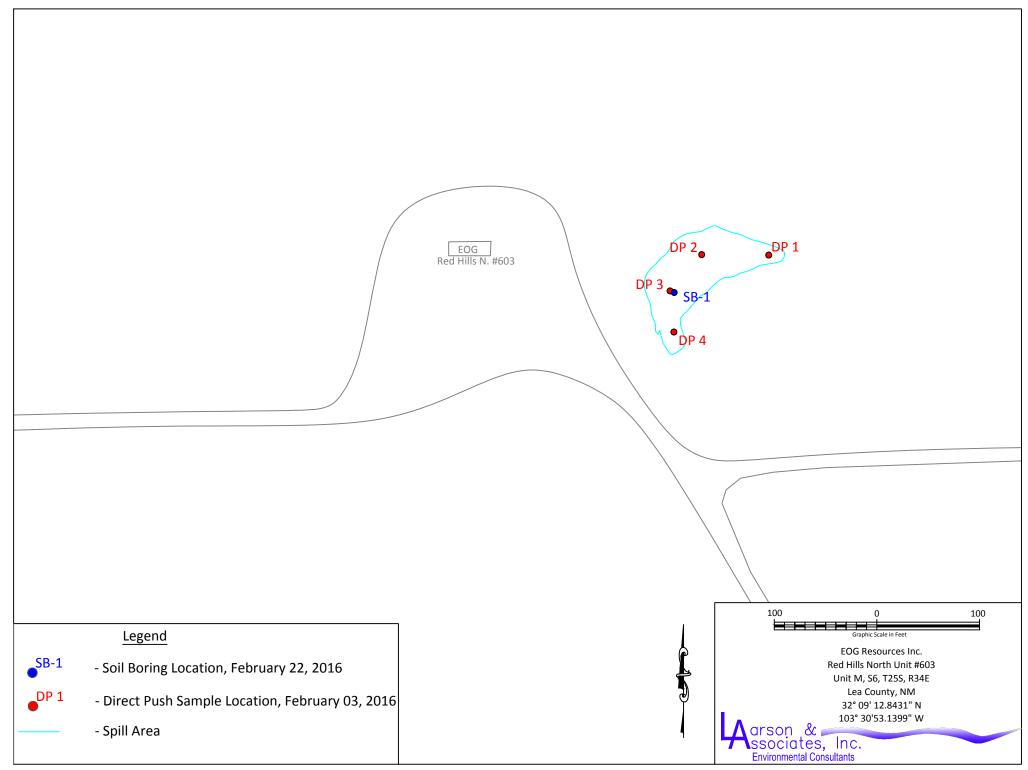


Figure 3 - Site Map Showing Spill Area and Sample Locations

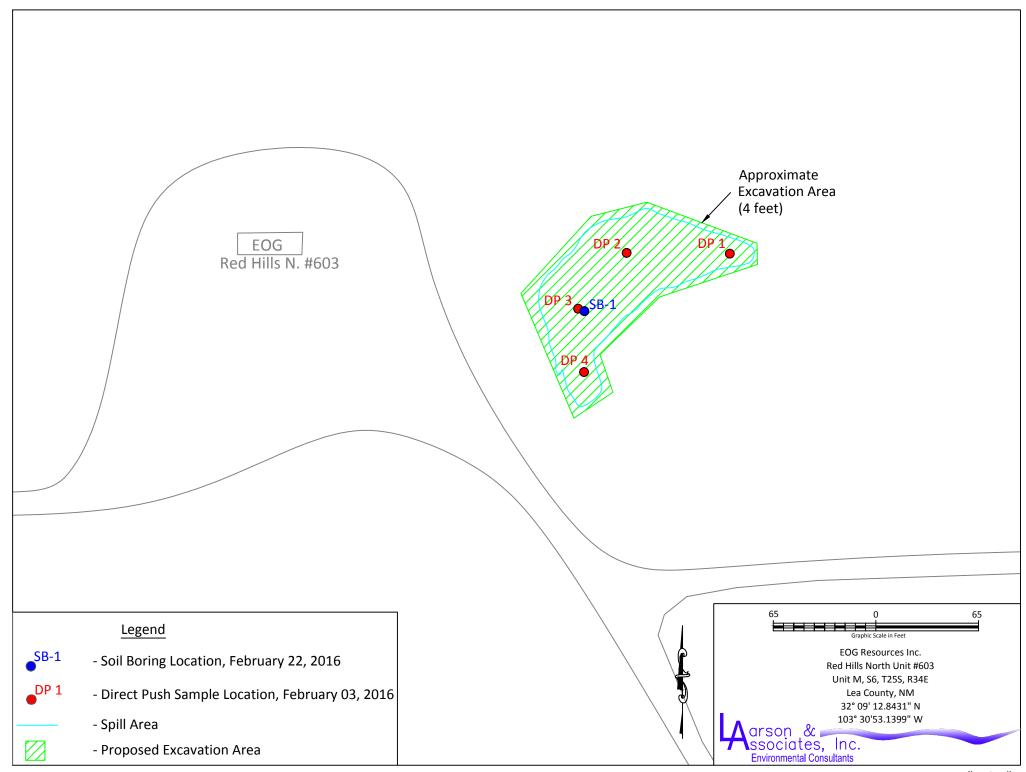


Figure 4 - Site Map showing Approximate Excavation Area

### Attachment A

Initial C-141

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

## State of New Mexico Energy Minerals and Natural Resources

Form C-141 Revised August 8, 2011

Oil Conservation Division 1220 South St. Francis Dr. Santa Fe, NM 87505 Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

	Release Notification and Corrective Action											
						OPERA'	ΓOR	ıl Report		Final Report		
Name of Co		EOG Resou				Contact Zane Kurtz						
				d, TX 79706		Telephone 1		2023				
Facility Nar	me Red	Hills Nash U				Facility Typ	e Oil Well					
Surface Ow	ner EO	G Resources		Mineral (	Owner	EOG Reso	ources		API No	. 30-025-3	2680	
				LOCA	ATIO	N OF RE	LEASE					
Unit Letter	Section	Township	Range	Feet from the	North	/South Line	Feet from the	East/Wo		County	T	
M	6	25S	34E	510		South	660	l w	est		Lea	
	Latitude 32 09' 12.8431" Longitude -103 30' 53.1399"  NATURE OF RELEASE											
Type of Rele	ase Prod	uced Water Sp	oill	7-1		Volume of				Lecovered	0	
Source of Re	elease Bre	eak in Pipeline	(3 iNC	h poly)		Date and F	Hour of Occurrence		Date and 1/30/2016	Hour of Dis	covery	
Was Immedi	ate Notice (					If YES, To	Whom?		1/30/2010	•		
			Yes 🗵	No 🗌 Not R	equired							
By Whom?						Date and I						
Was a Water	course Read		. v 17	71 N.		If YES, V	olume Impacting	the Water	course.			
			Yes 🗵									
If a Watercon	urse was Im	pacted, Descr	ibe Fully.	*								
N/A												
Spill caused fusion weld.	by break in One call wa	as made Mond	nd water t lay, Febru	ransfer line (RHN ary 1, 2015. Spill	area w	as sampled on	HNU 606 WIW). Wednesday, Febr prepared to reme	ruary 3, 2	016 by La	rson and As	e or we	eak spot in s, Inc. to
Describe Are	ea Affected	and Cleanup	Action Tal	ken.*								
regulations a public health should their or the enviro	all operators or the envious to operations to onment. In a	are required to ronment. The nave failed to	to report at acceptana adequately OCD accep	nd/or file certain ce of a C-141 rep y investigate and	release ort by thredia	notifications a he NMOCD m ate contaminat	knowledge and und perform correct harked as "Final Right to that pose a three the operator of	ctive actio Report" do reat to gro	ons for relo es not reli ound water	eases which eve the ope , surface wa	may en rator of ater, hu	idanger Tiability man health
	/	7	1//				OIL CON	SERVA	ATION	DIVISIO	)N	
Signature:	~	\ a	/< ;	/								
Printed Name: Zane Kurtz						Approved by Environmental Specialist:						
Title: Sr. En	vironmenta	ıl Rep.				Approval Da	te:	E	xpiration	Date:		
E-mail Addr	ess: zane	_kurtz@eogre	esources.c	om		Conditions o	f Approval:			Attached	. 🗆	
Data: 2/4/20	11.6	D	hono: 122	425 2022								

<sup>\*</sup> Attach Additional Sheets If Necessary

### Attachment B

**Laboratory Reports** 

## PERMIAN BASIN ENVIRONMENTAL LAB, LP 10014 SCR 1213 Midland, TX 79706



# Analytical Report

## **Prepared for:**

Mark Larson
Larson & Associates, Inc.
P.O. Box 50685
Midland, TX 79710

Project: Red Hills Pipeline
Project Number: 16-0106-01
Location: New Mexico

Lab Order Number: 6B04003



NELAP/TCEQ # T104704156-13-3

Report Date: 02/09/16

Larson & Associates, Inc. Project: Red Hills Pipeline

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
DP-4 (0-1)	6B04003-01	Soil	02/03/16 11:30	02-03-2016 16:10
DP-4 (1-1.5)	6B04003-02	Soil	02/03/16 11:30	02-03-2016 16:10
DP-3 (0-1)	6B04003-03	Soil	02/03/16 11:45	02-03-2016 16:10
DP-3 (1-2)	6B04003-04	Soil	02/03/16 11:45	02-03-2016 16:10
DP-3 (2-3)	6B04003-05	Soil	02/03/16 11:45	02-03-2016 16:10
DP-3 (3-4)	6B04003-06	Soil	02/03/16 11:45	02-03-2016 16:10
DP-1 (0-1)	6B04003-07	Soil	02/03/16 12:00	02-03-2016 16:10
DP-1 (1-2)	6B04003-08	Soil	02/03/16 12:00	02-03-2016 16:10
DP-2 (0-1)	6B04003-09	Soil	02/03/16 12:30	02-03-2016 16:10
DP-2 (1-2)	6B04003-10	Soil	02/03/16 12:30	02-03-2016 16:10
DP-2 (2-3)	6B04003-11	Soil	02/03/16 12:30	02-03-2016 16:10

Fax: (432) 687-0456

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

<b>DP-4</b> (0-1)
6B04003-01 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Perm	ian Basin E	nvironmer	ıtal Lab,	L.P.				
<b>General Chemistry Parameters by EPA</b>	Standard Method	s							
Chloride	15400	56.8	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	12.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	
Total Petroleum Hydrocarbons C6-C35 l	oy EPA Method 80	15M							
C6-C12	ND	28.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C12-C28	ND	28.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C28-C35	ND	28.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: 1-Chlorooctane		104 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: o-Terphenyl		109 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Total Petroleum Hydrocarbon C6-C35	ND	28.4	mg/kg dry	1	[CALC]	02/05/16	02/05/16	calc	

P.O. Box 50685 Project Number: 16-0106-01
Midland TX, 79710 Project Manager: Mark Larson

DP-4 (1-1.5) 6B04003-02 (Soil)

Reporting

Analyte Result Limit Units Dilution Batch Prepared Analyzed Method Notes

Permian Basin Environmental Lab, L.P.

**General Chemistry Parameters by EPA / Standard Methods** 

 Chloride
 15300
 57.5 mg/kg dry
 50 P6B0803
 02/05/16 02/08/16
 EPA 300.0

 % Moisture
 13.0
 0.1 %
 1 P6B0502
 02/05/16 02/05/16
 02/05/16 % calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

## DP-3 (0-1) 6B04003-03 (Soil)

	D. I.	Reporting	TT :	Dil e	D . 1	ъ .		N. d. 1	37.4
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Perm	ian Basin F	Environmen	tal Lab,	L.P.				
General Chemistry Parameters by E	PA / Standard Method	s							
Chloride	14600	58.8	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	15.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	
Total Petroleum Hydrocarbons C6-0	C35 by EPA Method 80	15M							
C6-C12	ND	29.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C12-C28	34.2	29.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C28-C35	ND	29.4	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: 1-Chlorooctane		94.6 %	70-13	0	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: o-Terphenyl		97.5 %	70-13	0	P6B0805	02/05/16	02/05/16	TPH 8015M	
Total Petroleum Hydrocarbon C6-C35	34.2	29.4	mg/kg dry	1	[CALC]	02/05/16	02/05/16	calc	

P.O. Box 50685 Project Number: 16-0106-01
Midland TX, 79710 Project Manager: Mark Larson

DP-3 (1-2) 6B04003-04 (Soil)

									1
		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	15500	58.1 mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0
% Moisture	14 0	0.1 %	1	P6B0502	02/05/16	02/05/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

DP-3 (2-3) 6B04003-05 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	24700	61.0 mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0
% Moisture	18.0	0.1 %	1	P6B0502	02/05/16	02/05/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01
Midland TX, 79710 Project Manager: Mark Larson

DP-3 (3-4) 6B04003-06 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	16800	57.5 mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0
% Maisture	13.0	0.1 %	1	P6B0502	02/05/16	02/05/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

## DP-1 (0-1) 6B04003-07 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	_								
	Per	mian Basin E	nvironme	ntal Lab, l	L.P.				
<b>General Chemistry Parameters by EPA / Stand</b>	dard Metho	ods							
Chloride	52.5	1.11	mg/kg dry	1	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	10.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	
Total Petroleum Hydrocarbons C6-C35 by EPA	A Method 8	8015M							
C6-C12	ND	27.8	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C12-C28	ND	27.8	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C28-C35	ND	27.8	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: 1-Chlorooctane		98.3 %	70-1	130	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: o-Terphenyl		102 %	70-1	130	P6B0805	02/05/16	02/05/16	TPH 8015M	
Total Petroleum Hydrocarbon C6-C35	ND	27.8	mg/kg dry	1	[CALC]	02/05/16	02/05/16	calc	

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

DP-1 (1-2) 6B04003-08 (Soil)

									1
		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	561	1.10 mg/kg dry	1	P6B0803	02/05/16	02/08/16	EPA 300.0
% Moisture	9.0	0.1 %	1	P6B0502	02/05/16	02/05/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

## DP-2 (0-1) 6B04003-09 (Soil)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
	Perm	ian Basin F	Environmen	tal Lab,	L.P.				
<b>General Chemistry Parameters by EPA</b>	Standard Method	s							
Chloride	14200	61.7	mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0	
% Moisture	19.0	0.1	%	1	P6B0502	02/05/16	02/05/16	% calculation	
Total Petroleum Hydrocarbons C6-C35 b	y EPA Method 80	15M							
C6-C12	ND	30.9	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C12-C28	ND	30.9	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
>C28-C35	ND	30.9	mg/kg dry	1	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: 1-Chlorooctane		99.3 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Surrogate: o-Terphenyl		103 %	70-1	30	P6B0805	02/05/16	02/05/16	TPH 8015M	
Total Petroleum Hydrocarbon C6-C35	ND	30.9	mg/kg dry	1	[CALC]	02/05/16	02/05/16	calc	

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

DP-2 (1-2) 6B04003-10 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	21400	64.1 mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0
% Moisture	22.0	0.1 %	1	P6B0502	02/05/16	02/05/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01
Midland TX, 79710 Project Manager: Mark Larson

DP-2 (2-3) 6B04003-11 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	14500	60.2 mg/kg dry	50	P6B0803	02/05/16	02/08/16	EPA 300.0
% Moisture	17.0	0.1 %	1	P6B0502	02/05/16	02/05/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01
Midland TX, 79710 Project Manager: Mark Larson

## General Chemistry Parameters by EPA / Standard Methods - Quality Control Permian Basin Environmental Lab, L.P.

	D 1	Reporting	TT '	Spike	Source	0/DEC	%REC	DDD	RPD	N
Analyte	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes
Batch P6B0502 - *** DEFAULT PREP ***										
Blank (P6B0502-BLK1)				Prepared &	k Analyzed	02/05/16				
% Moisture	ND	0.1	%							
Duplicate (P6B0502-DUP1)	Sou	rce: 6B03009-	-04	Prepared &	t Analyzed:	02/05/16				
% Moisture	3.0	0.1	%		3.0			0.00	20	
Duplicate (P6B0502-DUP2)	Sou	rce: 6B04001-	-01	Prepared &	k Analyzed:	02/05/16				
% Moisture	9.0	0.1	%		9.0			0.00	20	
Batch P6B0803 - *** DEFAULT PREP ***										
Blank (P6B0803-BLK1)				Prepared: (	02/05/16 A	nalyzed: 02	2/08/16			
Chloride	ND	1.00	mg/kg wet							
LCS (P6B0803-BS1)				Prepared: (	02/05/16 A	nalyzed: 02	2/08/16			
Chloride	208	1.00	mg/kg wet	200		104	80-120			
LCS Dup (P6B0803-BSD1)				Prepared: (	02/05/16 A	nalyzed: 02	2/08/16			
Chloride	208	1.00	mg/kg wet	200		104	80-120	0.389	20	
Duplicate (P6B0803-DUP1)	Sou	rce: 6B03010-	-03	Prepared: (	02/05/16 A	nalyzed: 02	2/08/16			
Chloride	6710	25.8	mg/kg dry		6750	-		0.525	20	
Duplicate (P6B0803-DUP2)	Sou	rce: 6B04003-	-09	Prepared: (	02/05/16 A	nalyzed: 02	2/08/16			
Chloride	14100	61.7	mg/kg dry		14200			0.972	20	
Matrix Spike (P6B0803-MS1)	Sou	rce: 6B03010-	-03	Prepared: (	02/05/16 A	nalyzed: 02	2/08/16			
Chloride	19200	25.8	mg/kg dry	11300	6750	110	80-120			

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

# Total Petroleum Hydrocarbons C6-C35 by EPA Method 8015M - Quality Control Permian Basin Environmental Lab, L.P.

		Reporting		Spike	Source		%REC		RPD	
Analyte	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes
Batch P6B0805 - TX 1005										
Blank (P6B0805-BLK1)				Prepared &	Analyzed:	02/05/16				
C6-C12	52.3	25.0	mg/kg wet							
>C12-C28	81.3	25.0	"							
>C28-C35	ND	25.0	"							
Surrogate: 1-Chlorooctane	91.6		"	100		91.6	70-130			
Surrogate: o-Terphenyl	46.9		"	50.0		93.8	70-130			
LCS (P6B0805-BS1)				Prepared &	Analyzed:	02/05/16				
C6-C12	17.7	25.0	mg/kg wet	1000		1.77	75-125			
>C12-C28	32.6	25.0	"	1000		3.26	75-125			
Surrogate: 1-Chlorooctane	110		"	100		110	70-130			
Surrogate: o-Terphenyl	56.7		"	50.0		113	70-130			
LCS Dup (P6B0805-BSD1)				Prepared &	Analyzed:	02/05/16				
C6-C12	27.4	25.0	mg/kg wet	1000		2.74	75-125	43.2	20	
>C12-C28	40.8	25.0	"	1000		4.08	75-125	22.4	20	
Surrogate: 1-Chlorooctane	91.2		"	100		91.2	70-130			
Surrogate: o-Terphenyl	47.5		"	50.0		94.9	70-130			
Matrix Spike (P6B0805-MS1)	Sourc	e: 6B04008	<b>3-01</b>	Prepared &	Analyzed:	02/05/16				
C6-C12	782	26.9	mg/kg dry	1080	ND	72.7	75-125			QM-05
>C12-C28	910	26.9	"	1080	178	68.1	75-125			QM-05
Surrogate: 1-Chlorooctane	121		"	108		112	70-130			
Surrogate: o-Terphenyl	53.3		"	53.8		99.2	70-130			
Matrix Spike Dup (P6B0805-MSD1)	Sourc	e: 6B04008	<b>3-01</b>	Prepared &	Analyzed:	02/05/16				
C6-C12	811	26.9	mg/kg dry	1080	ND	75.4	75-125	3.71	20	
>C12-C28	940	26.9	"	1080	178	70.9	75-125	4.03	20	QM-05
Surrogate: 1-Chlorooctane	124		"	108		116	70-130			
Surrogate: o-Terphenyl	59.9		"	53.8		111	70-130			

P.O. Box 50685 Project Number: 16-0106-01
Midland TX, 79710 Project Manager: Mark Larson

#### **Notes and Definitions**

QM-05	The spike recover	ry was outside	acceptance limits f	for the MS a	and/or MSD	due to matrix	x interference.	The LCS and/or LCSD w	vere

within acceptance limits showing that the laboratory is in control and the data is acceptable.

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis

RPD Relative Percent Difference

LCS Laboratory Control Spike

MS Matrix Spike

Dup Duplicate

	Bren	Sarron			
Report Approved By:			Date:	2/0/2016	

Brent Barron, Laboratory Director/Technical Director

This material is intended only for the use of the individual (s) or entity to whom it is addressed, and may contain information that is privileged and confidential.

If you have received this material in error, please notify us immediately at 432-686-7235.

RELINCOISTED DI. (Signature)  2-3-14 16:41) MAA	DATE/TIME RE	,	TOTAL		0p.2(23) 1\ J J	10 01 (2-1) 2-d	)P2 (0-1) 10a   12:80	09-1 (1-2) 108 1 1	12:00	DP-3 (3-4) TW / /	DP-3 (2-3) -OT	DP-3 (1-2) VY	DP-3 (0-1) 175   11:45	DP-4 Ct-1.5) 102 1 1 1	OP-4 (0-1) 1) 2.346 11:30 S 1	Field Constraint Sample I.D. Lab # Date Time Matrix #		TIME ZONE:	o A=AIR	TRRP report? (=SQIL) P=PAINT		INSOCICIES, INC.		
Wise Wulfm OTHER D	(Signature)						××		× ×				× ×			\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	ESER' DADA ODES	VED VED	TRH TOOL		LAI PROJECT #: 16	432-687-0901 PROJECT LOCATION OR NAME:	•	
☐ CARRIER BILL #	CUSTODY SEALS - BROKEN DINTACT ONOT USED	LABORATORY USE ONLY:														(5) (8) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	CIP VO		9	Red Hills Pipeline	LAB WORK ORDER #: (1604003 g	-

CHAIN-OF-CUSTO

## PERMIAN BASIN ENVIRONMENTAL LAB, LP 10014 SCR 1213 Midland, TX 79706



# Analytical Report

## **Prepared for:**

Mark Larson
Larson & Associates, Inc.
P.O. Box 50685
Midland, TX 79710

Project: EOG Red Hills #603 Spill
Project Number: 16-0106-01
Location: EOG Red Hills #603 Spill

Lab Order Number: 6B29002



NELAP/TCEQ # T104704156-13-3

Report Date: 03/04/16

Larson & Associates, Inc. Project: EOG Red Hills #603 Spill

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SB-1, 5'	6B29002-01	Soil	02/26/16 10:15	02-29-2016 09:10
SB-1, 10'	6B29002-02	Soil	02/26/16 10:20	02-29-2016 09:10
SB-1, 15'	6B29002-03	Soil	02/26/16 10:24	02-29-2016 09:10
SB-1, 20'	6B29002-04	Soil	02/26/16 10:30	02-29-2016 09:10
SB-1, 25'	6B29002-05	Soil	02/26/16 10:38	02-29-2016 09:10
SB-1, 30'	6B29002-06	Soil	02/26/16 10:45	02-29-2016 09:10
SB-1, 35'	6B29002-07	Soil	02/26/16 10:50	02-29-2016 09:10
SB-1, 40'	6B29002-08	Soil	02/26/16 10:55	02-29-2016 09:10

Fax: (432) 687-0456

Larson & Associates, Inc. Project: EOG Red Hills #603 Spill Fax: (432) 687-0456

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

SB-1, 5' 6B29002-01 (Soil)

								I
	Reporting							
Analyte Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

#### Permian Basin Environmental Lab, L.P.

Chloride	17000	58.1 mg/kg dry	50	P6C0104	03/01/16	03/01/16	EPA 300.0
% Moisture	14.0	0.1 %	1	P6C0110	03/01/16	03/01/16	% calculation

Larson & Associates, Inc. Project: EOG Red Hills #603 Spill Fax: (432) 687-0456

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

SB-1, 10' 6B29002-02 (Soil)

									I .
		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

#### Permian Basin Environmental Lab, L.P.

Chloride	7790	28.4 mg/kg dry	25	P6C0104	03/01/16	03/01/16	EPA 300.0
% Moisture	12.0	0.1 %	1	P6C0110	03/01/16	03/01/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

SB-1, 15' 6B29002-03 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	2190	11.5 mg/kg dry	10	P6C0104	03/01/16	03/01/16	EPA 300.0
% Moisture	13.0	0.1 %	1	P6C0110	03/01/16	03/01/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

SB-1, 20' 6B29002-04 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	11100	29.1 mg/kg dry	25	P6C0104	03/01/16	03/01/16	EPA 300.0
% Moisture	14.0	0.1 %	1	P6C0110	03/01/16	03/01/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

SB-1, 25' 6B29002-05 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

### Permian Basin Environmental Lab, L.P.

Chloride	1360	5.26 mg/kg dry	5	P6C0104	03/01/16	03/01/16	EPA 300.0
% Moisture	5.0	0.1 %	1	P6C0110	03/01/16	03/01/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01
Midland TX, 79710 Project Manager: Mark Larson

SB-1, 30' 6B29002-06 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

### Permian Basin Environmental Lab, L.P.

Chloride	953	5.56 mg/kg dry	5	P6C0104	03/01/16	03/01/16	EPA 300.0
% Moisture	10.0	0.1 %	1	P6C0110	03/01/16	03/01/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

SB-1, 35' 6B29002-07 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

### Permian Basin Environmental Lab, L.P.

Chloride	378	1.14 mg/kg dry	1	P6C0104	03/01/16	03/01/16	EPA 300.0
% Moisture	12.0	0.1 %	1	P6C0110	03/01/16	03/01/16	% calculation

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

SB-1, 40' 6B29002-08 (Soil)

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes

Permian Basin Environmental Lab, L.P.

Chloride	300	1.18 mg/kg dry	1	P6C0405	03/04/16	03/04/16	EPA 300.0
% Moisture	15.0	0.1 %	1	P6C0401	03/04/16	03/04/16	% calculation

Larson & Associates, Inc. Project: EOG Red Hills #603 Spill

P.O. Box 50685 Project Number: 16-0106-01 Midland TX, 79710 Project Manager: Mark Larson

Fax: (432) 687-0456

# General Chemistry Parameters by EPA / Standard Methods - Quality Control Permian Basin Environmental Lab, L.P.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P6C0104 - *** DEFAULT PREP ***										
Blank (P6C0104-BLK1)				Prepared &	z Analyzed	03/01/16				
Chloride	ND	1.00	mg/kg wet	Tropurou ca		03,01,10				
LCS (P6C0104-BS1)				Prepared &	z Analyzed:	03/01/16				
Chloride	183	1.00	mg/kg wet	200		91.7	80-120			
LCS Dup (P6C0104-BSD1)				Prepared &	Analyzed:	03/01/16				
Chloride	189	1.00	mg/kg wet	200		94.6	80-120	3.13	20	
Duplicate (P6C0104-DUP1)	Sour	rce: 6B29002	2-01	Prepared &	. Analyzed:	03/01/16				
Chloride	17200	58.1	mg/kg dry	*	17000			0.894	20	
Duplicate (P6C0104-DUP2)	Sour	rce: 6B17007	7-20	Prepared &	Analyzed:	03/01/16				
Chloride	49.6	1.09	mg/kg dry		49.9			0.590	20	
Batch P6C0110 - *** DEFAULT PREP ***										
Blank (P6C0110-BLK1)				Prepared &	Analyzed:	03/01/16				
% Moisture	ND	0.1	%							
Duplicate (P6C0110-DUP1)	Sour	rce: 6B29006	5-01	Prepared &	Analyzed:	03/01/16				
% Moisture	6.0	0.1	%		6.0			0.00	20	
Duplicate (P6C0110-DUP2)	Soui	rce: 6B15001	-02	Prepared &	Analyzed:	03/01/16				
% Moisture	15.0	0.1	%		14.0			6.90	20	
Duplicate (P6C0110-DUP3)	Soui	rce: 6B15003	3-30	Prepared &	Analyzed:	03/01/16				
% Moisture	9.0	0.1	%		9.0			0.00	20	

Larson & Associates, Inc. Project: EOG Red Hills #603 Spill

P.O. Box 50685 Midland TX, 79710 Project Number: 16-0106-01 Project Manager: Mark Larson Fax: (432) 687-0456

## General Chemistry Parameters by EPA / Standard Methods - Quality Control Permian Basin Environmental Lab, L.P.

		Reporting		Spike	Source		%REC		RPD	
Analyte	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes
Batch P6C0401 - *** DEFAULT PREP ***										
Blank (P6C0401-BLK1)				Prepared &	: Analyzed:	03/04/16				
% Moisture	ND	0.1	%							
Duplicate (P6C0401-DUP1)	Sou	rce: 6B19009-	-04	Prepared &	Analyzed:	03/04/16				
% Moisture	5.0	0.1	%		17.0			109	20	
Duplicate (P6C0401-DUP2)	Sou	rce: 6C01005	-02	Prepared &	Analyzed:	03/04/16				
% Moisture	18.0	0.1	%	·	6.0			100	20	
Batch P6C0405 - *** DEFAULT PREP ***										
Blank (P6C0405-BLK1)				Prepared &	: Analyzed:	03/04/16				
Chloride	ND	1.00	mg/kg wet							
LCS (P6C0405-BS1)				Prepared &	: Analyzed:	03/04/16				
Chloride	205	1.00	mg/kg wet	200		102	80-120			
LCS Dup (P6C0405-BSD1)				Prepared &	Analyzed:	03/04/16				
Chloride	209	1.00	mg/kg wet	200		104	80-120	1.73	20	
Duplicate (P6C0405-DUP1)	Sou	Source: 6B19009-03			: Analyzed:	03/04/16				
Chloride	6190	30.5	mg/kg dry		6240			0.711	20	
Duplicate (P6C0405-DUP2)	Sou	rce: 6B25004-	-18	Prepared &	Analyzed:	03/04/16				
Chloride	275	11.1	mg/kg dry		277			0.724	20	

P.O. Box 50685 Project Number: 16-0106-01
Midland TX, 79710 Project Manager: Mark Larson

#### **Notes and Definitions**

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis

RPD Relative Percent Difference

LCS Laboratory Control Spike

MS Matrix Spike

Dup Duplicate

	Burn Barron		
Report Approved By:		Date:	3/4/2016

Brent Barron, Laboratory Director/Technical Director

This material is intended only for the use of the individual (s) or entity to whom it is addressed, and may contain information that is privileged and confidential.

If you have received this material in error, please notify us immediately at 432-686-7235.

bill to	RELINQUISHED BY:(Signature)	RELINQUISHED BY:(Signature)	RELINQUISHEDBX(Signature)	TATOIL				56-1, HO	56-1, 35	Sb-1, 30	56-1, 25	56-1, 20			56-1,5	Field Sample I.D.	MIN VI	TIME ZONE: Time zone/State:	Yes No		Data Reported to:	SSOCIATES, Inc. Environmental Consultants	\ arson 8	
EOF	ignature)	ignature)	ignature)			-		8	3	B	त्रे	5	Z	8	9	Lab#			W=WATER A=AIR	S=SOIL		es, In		
de ha	ſ		2					4							42116	Date				P=P		H H H H H H H H H H H H H H H H H H H		
PhELab	DATE/TIME	DATE/TIME	DATE/TIME					10.55	10:50	10:45	10:38	10:30	10.24	_	10.15	Time			SL=SLUDGE OT=OTHER	P=PAINT			1 An 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
Lab	IME	ME		10				en	(A)	s	5	S	S	ی	5	Matrix	<u> </u>							
	ARE F	RECE	SRECE RECE						<b>eme</b> co						-	# of C	ontai	ners				· ·	507 N	
	AVED BY: (Signature)	RECEIVED BY: (Signature)	RECEIVED BY: (Signature)					-	<i>-</i>	<b>*</b>	<	<		~	/	HCI HNO <sub>3</sub> H <sub>2</sub> SO <sub>4</sub> ICE UNPR	, 🖸 1	NaOH (	PRESERVATION			Midland, TX 79701 432-687-0901	507 N. Marienfeld, Ste.	
																BIRD AND AND AND AND AND AND AND AND AND AN	₹ <sub>L</sub>						200	
																	',\`\	<i>&gt;</i> /			LAIPE	PROJI	DATE: 6/2	
	OTHER []	1 DAY	TURN AROUND TIME													80 87 PC P			TRIT 1006		LAI PROJECT #: 16-0	PROJECT LOCATION OR	.76.	1
HAND DELIVERED		CUSTODY SEALS - BROK	E LABORATORY USE ONLY:							<b>*</b>	<b>4</b>	1		~		80/0°C		\$ CP 4 300	CIP VOC			CATION OR NAME: ECG had Lilla	2016 I AB WORK ORDER #	CHAIN-OF-CU
			<u>.</u>					7							:	180)	18		TOR VIE		TOR:	1 1	I.	Ŷ
		☐ BROKEN ☐ INTACT ☐ NOT USED	CACE.													FIELD NOTES			Leal Mills		ا ج ا	Page	PAGE OF 1 4	-CUSTOI 14

Attachment C

Boring Log

				BORING	RECORD												
			NO O	00	PID READING						s	ΑM			REMARKS		
GEOLOGIC	DEPTH	DESC	DESCRIPTION USCS	GRAPHIC LOG	PI	PM :	x				2	DING	≅RY	DEPTH	BACKGROUN PID READING		
UNIT			Start: 10:12	1 25 2	4	2 4	6	8 10	12	14 16	18	<u> </u>	<b>EA</b>	15	TH	SOIL:	
			Stop: 10:55		3R/							NUMBER	D F	E	E	SOIL:	PPM
	_					+		H	+	+	$^{+}$	+	1	œ			
	0	Silty Clay	v, 7.5 YR 4/4 to 3/4, brown to	CL	777	+			$^{+}$	$\top$	+	+	H		0	10:12	_
	-		wn, very fine grained quartz		NN									1/			-
	_	sano,	moist, very low plasticity		NM									1/			-
	_				N/N									/			-
	5		YR 7/4 to 6/6, pink to reddish	Caliche										1	5	10:15	
			Sandy, very fine quartz sand, rted, round, moderately hard		ЩЩ											10.13	
	_	, ,	,		H									1/			
	_													1/			
	_				H							-		/			
	10				H							-		_	10	10:20	_
	-																-
	-	Sand, 5	YR 6/6, reddish yellow, very	Sand	<del>                                     </del>												
	-	fine Quart	z Sand, round, poorly sorted,	Jana										$\int$			-
		moist, s	slightly consolidated to soft										H	1	15	40.04	-
	15														10	10:24	_
														1/			-
														1/			
	_		(Quartzite), 7.5 YR 7/3 to 6/3 ght brown, very fine grained	Sand- Stone													_
	20		nd, interbedded with thin beds												20	10:30	_
	_	of very I	nard sandstone (crystalline)											1			-
	-													П			-
	-													1/			-
	_				×							-		1			-
	25											-		١.	25	10:38	_
	_		ey Sand, 5 YR 5/6, yellowish	Sand										1/			-
	_		y fine grained Quartz Sand, sorted, slight moisture, soft											1/			-
		poorly	sorted, slight moisture, sort		- "												•
	30													/	30	10:45	
	" _													1			
	_													1/			
	_													$\ $			
	-		y Sand, 2.5 YR 5/3, light olive									$\vdash$	$\vdash$	/	$\vdash$		
	35	brown, ve	ry fine grained Quartz Sand, soft, slightly moist		[ : :										35	10:50	_
	-		os.i, originaly motor		e in												
	-																,
	_	Silty Claye	y Sand, 10 YR 4/2 to 4/3, dark own to brown, very fine Quartz											$\ $			
	40		ind, poorly sorted, soft								_[				40	10:55	_
	40	<b></b>				T-	<b>  T</b>		7			7	Γ-	[_		10.55	
	_		TD : 40'														
	_																
						1/				<u>.                                    </u>	1	<u> </u> 6-ቦ′	106		1 R	l ed Hills Nash #60	3
		JOUS AUGER S		ABLE ( TIME	OF BORING	' I	OTE OR IV									5"	<u> </u>
ST	TANDARD PI	ENETRATION T	EST LABORAT	ORY TEST L	OCATION						_						
UN	NDISTURBE	D SAMPLE	+ PENETRO	METER (TO	NS/ SQ. FT )		LOCATION : DP-3, Lea County, New Mexico  LAI GEOLOGIST : ML										
<del></del> w	ATER TABLI	E ( 24 HRS )	NR NO RECO	VERY													
∧arsoņ .& 🚐			DRILL DATE :		NUMBER :	- 1	DRILLING CONTRACTOR :SDI										
Aarson & ssociates, I	nc. ants		02-26-2016	S	B - 1	D	RILL	ING	ME	ETH	OD	:				Air Rotary	

Attachment D

Photographs



Red Hills North Unit #603, Area of Leak, February 1, 2016



Red Hills North Unit #603 Spill Area, Viewing Southeast, February 1, 2016



Red Hills North Unit #603 Spill Area, Viewing Southeast, February 1, 2016



Red Hills North Unit #603 Spill Area, Viewing Southwest, February 1, 2016