

November 9, 2018

4RP-14

Mr. Randolph Bayliss, P.E.  
Hydrologist, Districts III and IV  
NMOCD Environmental Bureau  
1220 S St Francis St.  
Santa Fe, NM 87505

**RE: Site Assessment for the Libby Minerals 1931 271-1-J CO<sub>2</sub> Well Brine Release, Unit J,  
Section 27, Township 19N, Range 31E, Harding County, New Mexico.**

Mr. Bayliss,

On October 29, 2018 Maverick Natural Resources, LLC (Maverick) personnel met you to conduct a site assessment at the Libby Minerals 1931 27-1-J produced water release site located in Section 27 of Harding County, New Mexico, (35.84636, -103.63163.) This report outlines our findings pursuant to 19.15.29.11 NMAC.

**I. Background**

Maverick Natural Resources operates carbon dioxide wells in Harding County, New Mexico and uses the gas in its oil recovery operations. The area is sparsely populated ranchland. The nearest residence to the subject well is over 2.7 miles away.

Maverick experienced a spill at the subject site after a trucking delay led to a water tank overflow. Released water overtopped a breach in the secondary containment, and approximately 10 barrels of brine were lost. While Maverick employed a vacuum truck to recover fluids at the site, some brine was lost on the south side of the containment area. No fluids migrated off of the well pad. The affected area measured roughly 29' x 46'. The initial C-141 form appears in Appendix A.

**II. Site Topography, Soil, and Climate**

The subject site is located just east of the Black Hills and Ute Creek, predominant physiographic features in the eastern part of Harding County. A USGS topographic map of the site and vicinity is provided at Figure 1. The USDA Soil Conservation Service describes the climate of Harding County as a semiarid continental climate with an average rainfall between 13 and 17 inches per year. According to a 1973 Soil Survey of the County, the near-surface soil profile at the subject site is comprised of Amarillo fine sandy loam and/or Latom fine sandy loam. Visual observation of the upper six feet of soil suggests a preponderance of the Amarillo soil series, given the significant clay content present. The depth to bedrock is unknown, however, bedrock outcrops 725 feet northwest of the well pad. Soil survey maps of the area are presented in Figures 2A and 2B. Descriptions of the referenced soil series are found in Appendix B.

**III. Groundwater**

Maverick consulted the New Mexico Office of the State Engineer and found no water wells in Section 27. A database compiled by the New Mexico Water Resources Research Institute displayed two wells approximately 8 and 10 miles away that were anywhere from 76 to 225 feet deep. The closest known water well is approximately 4,200 feet to the northeast of the release area and is reported to be 15 feet deep according to Maverick's operator, Mr. Edward "Buck" Pollister. It is a windmill used to water cattle, and it is apparently in a groundwater recharge zone as indicated by the USGS topographical map included as Figure 1. The release site, however, is at a higher elevation, and the nearest hydrological

feature is Ute Creek, approximately 1,500 feet away. Therefore, the best reasonable estimate of groundwater elevation is Ute Creek's elevation, which lies some 50-55 feet below the release elevation according to the USGS topographical map. This and additional groundwater information may be found in Appendix B.

#### IV. Regulatory

A risk-based evaluation was performed for the site in accordance with the New Mexico Oil Conservation Division (NMOCD) Guidelines for Remediation of Leaks, Spills, and Releases, updated August 14, 2018. The guidelines require a risk-based evaluation of the site to determine recommended remedial action levels (RRAL) for benzene, toluene, ethylbenzene, and xylene (BTEX) and total petroleum hydrocarbons (TPH) in soil. The proposed RRAL for benzene was determined to be 10 parts per million (ppm) or milligrams per kilogram (mg/kg) and 50 ppm for total BTEX. Based upon the depth to groundwater, the proposed RRAL for TPH is 2,500 mg/kg (GRO + DRO + ORO) or 1,000 mg/kg (GRO + DRO). Additionally, based on the presumed depth to groundwater in the area, the proposed RRAL for chlorides is 10,000 mg/kg.

It is of note that this was a brine release from a carbon dioxide well, and the operator has forgone testing for benzene, BTEX, and TPH as no hydrocarbons are present in the produced water at the site.

#### V. Assessment and Soil Analyses

Maverick personnel conducted a site analysis of the release area on October 29, 2018 with NMOCD officials present. Staff collected fifteen (15) samples from the release area and three (3) background samples to act as a control group. Maverick used a hydraulically-powered auger to collect the samples in five (5) places at two, four, and six feet below grade from each boring. Sampling locations were selected to delineate the most likely spread of contamination, and personnel followed Chapter 4: "Sampling Methods and Protocols," from *Soil Remediation for the Petroleum Extraction Industry*<sup>1</sup>. Cardinal Laboratories in Hobbs, NM analyzed the samples for chlorides using EPA method 300.0. All samples showed chloride levels below the proposed RRAL, and copies of the laboratory analysis and chain-of-custody documentation are included in Appendix C. A summary of the sampling results appears in Table 1, and the sample locations may be found in Figures #3A and #3B and the attached Photos. In reference to Table 1, none of the collected samples showed chloride concentration exceeding the RRAL from the NMOCD.

#### VI. Work Plan

Going forward, Maverick plans to continue horizontal delineation of the release site to assure that contamination did not spread further laterally. We will contact you with a remediation plan if further site clean-up is necessary. If you have any questions concerning the release or the site analysis, please contact me at [steve.niehaus@mavresources.com](mailto:steve.niehaus@mavresources.com) or (989) 731-9324.

Respectfully,



Steve L. Niehaus, P.E.  
Regional HSE Manager

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<sup>1</sup> Lloyd E. Deuel, Jr, Ph.D. and George H. Holliday, Ph.D., P.E., D.E.E., *Soil Remediation for the Petroleum Industry* (Tulsa:PennWell Books, 1994), 57-65.

# Figures

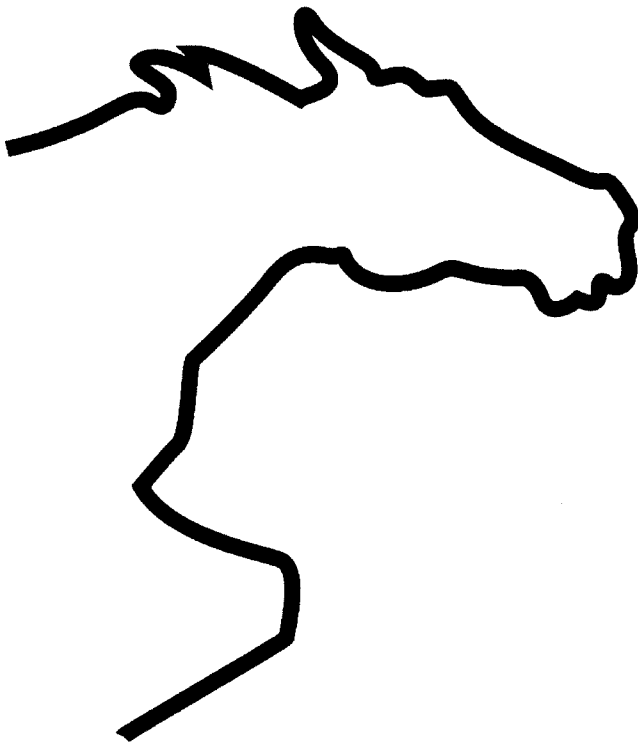
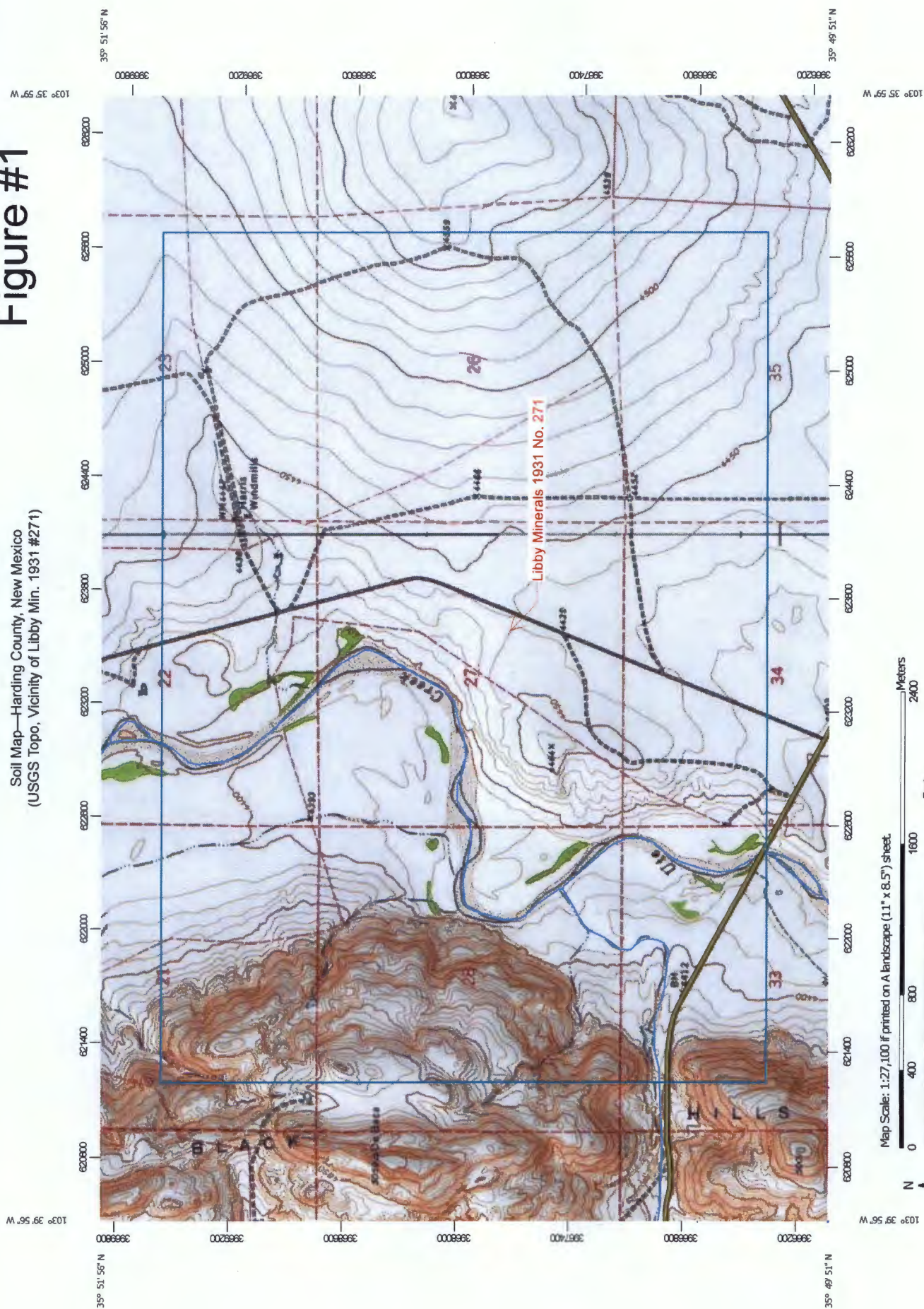


Figure #1: Topographical Map  
Figure #2A: Soil Map (General)  
Figure #2B: Soil Map (Detail)  
Figure #3A: Site Map (General)  
Figure #3B: Site Map (Detail)

# Figure #1

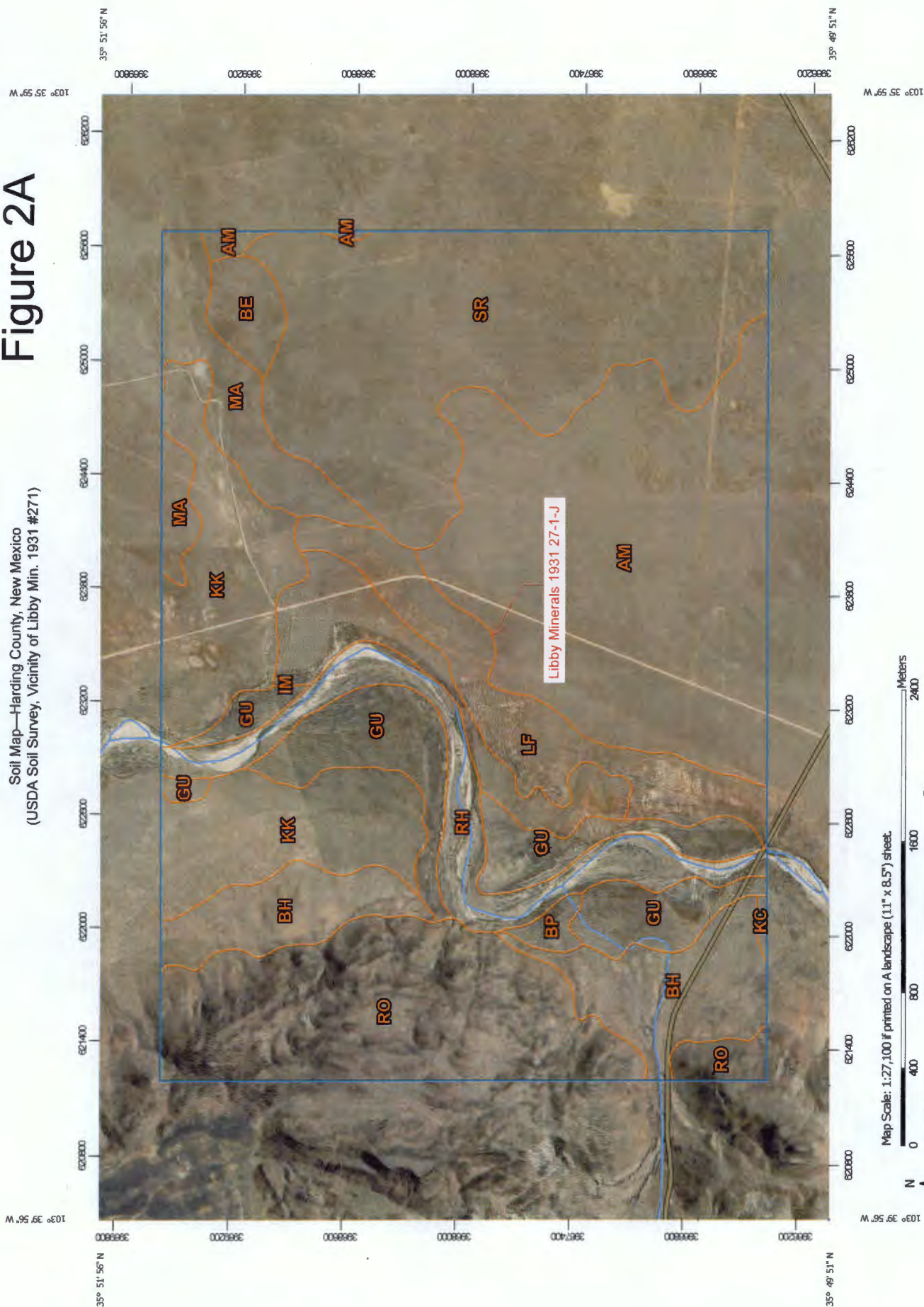
Soil Map—Harding County, New Mexico  
(USGS Topo, Vicinity of Libby Min. 1931 #271)





# Figure 2A

Soil Map—Harding County, New Mexico  
(USDA Soil Survey, Vicinity of Libby Min. 1931 #271)



Map Scale: 1:27,100 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84



# Figure #2B

Soil Map—Harding County, New Mexico  
(USDA Soil Survey, Libby Min. 1931 #271)



Map Scale: 1:9,030 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

USDA  
Natural Resources  
Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

8/22/2018  
Page 1 of 3

## MAP LEGEND



## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:31,700.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Harding County, New Mexico  
 Survey Area Data: Version 15, Sep 7, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.


Date(s) aerial images were photographed: Aug 1, 2010—Oct 26, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

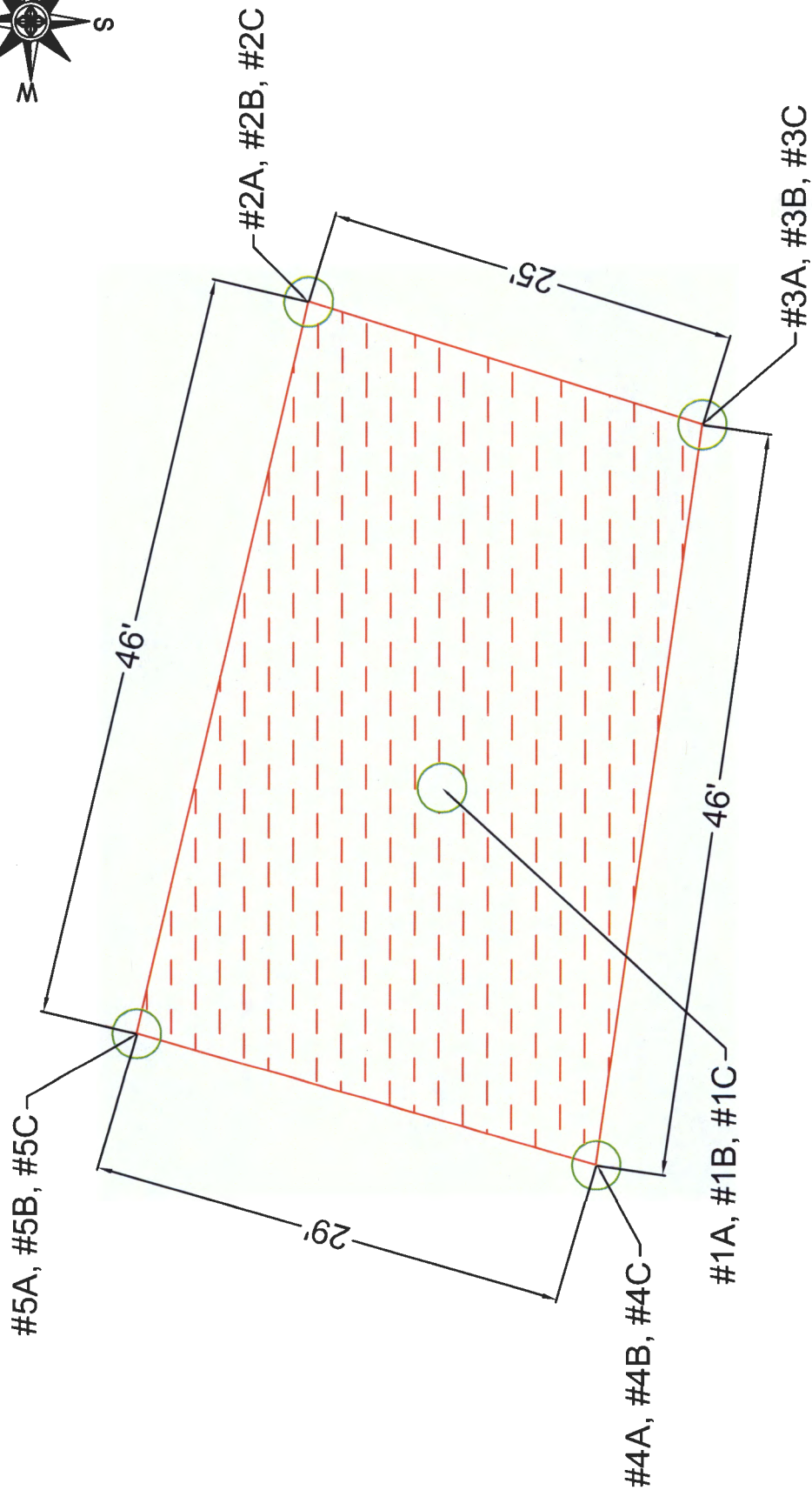


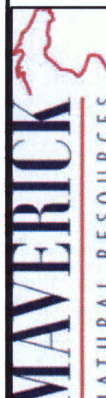


**FIGURE #3A**

TESTS CONDUCTED												
DEPTH	TEST ID	RESULTS	TEST ID	RESULTS	TEST ID	RESULTS	TEST ID	RESULTS	TEST ID	RESULTS	TEST ID	RESULTS
2	1A	2,800	2A	1,200	3A	608	4A	4,000	5A	1,250	BACKGROUND A	32
4	1B	2,200	2B	2,160	3B	1,200	4B	864	5B	1,840	BACKGROUND B	112
6	1C	1,800	2C	1,800	3C	1,020	4C	1,040	5C	2,000	BACKGROUND C	96
Scale: 1"=60'			Drawn By: E. HASSO			35.84650, -103.63132			PROJECT #: PH-102518			
Date: 10/29/18			Checked By: N. PALMER						Remediation Diagram			
Revised:			Sec: 27 T 19N R28E			LIBBY MINERALS 1931 #27-1-J						





TESTS CONDUCTED												
DEPTH	TEST ID	RESULTS	TEST ID	RESULTS	TEST ID	RESULTS	TEST ID	RESULTS	TEST ID	RESULTS	TEST ID	RESULT
2	1A	2,800	2A	1,200	3A	608	4A	4,000	5A	1,250	BACKGROUND A	32
4	1B	2,200	2B	2,160	3B	1,200	4B	864	5B	1,840	BACKGROUND B	112
6	1C	1,800	2C	1,800	3C	1,020	4C	1,040	5C	2,000	BACKGROUND C	96
Scale: 1"=10'			Drawn By: E. HASSO				35.84650, -103.63132			PROJECT #: PH-102518		
Date: 10/29/18			Checked By: N. PALMER							Remediation Diagram		
Revised:			Sec: 27 T 19N R28E							LIBBY MINERALS 1931 #27-1-J		

# Tables



Table #1: Analytical Results



Libby Minerals #27-1-J  
10-29-18 Soil Samples Results - Chlorides mg/kg

Depth	Sample ID	Results	Sample ID	Results	Sample ID	Results	Sample ID	Results	Sample ID	Results	Sample ID	Results
2'	1A	2,800	2A	1,200	3A	608	4A	4,000	5A	1,250	Background A	32
4'	1B	2,200	2B	2,160	3B	1,200	4B	864	5B	1,840	Background B	112
6'	1C	1,800	2C	1,800	3C	1,020	4C	1,040	5C	2,000	Background C	96

Photos







**Spill area facing east**



**Spill area facing southeast**





**Spill area facing north**

# Appendix A



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

Oil Conservation Division  
1220 South St. Francis Dr.  
Santa Fe, NM 87505

Form C-141  
Revised April 3, 2017

Submit 1 Copy to appropriate District Office in  
accordance with 19.15.29 NMAC.

### Release Notification and Corrective Action

#### OPERATOR

☒ Initial Report ☐ Final Report

Name of Company Breitburn Operating LP	Contact Buck Pollister
Address 1111 Bagby Street, Suite 1600 Houston TX 77002	Telephone No. 575-741-0153
Facility Name Libby Minerals 1931 No. 271	Facility Type CO2 Well

Surface Owner: Yesterday Valley Ranch, Inc. (Mary Libby Campbell)	Mineral Owner Libby Minerals LLC Contact: Mary Libby Campbell	API No. 30-021-20581
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#### LOCATION OF RELEASE

Unit Letter J	Section 27	Township 19N	Range 31E	Feet from the 1980	North/South Line South	Feet from the 1980	East/West Line East	County Harding
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Latitude 35.8463631 Longitude -103.6316376 NAD83

#### NATURE OF RELEASE

Type of Release Waste Water	Volume of Release: Est. 10 bbls	Volume Recovered: Est. 10 bbls
Source of Release Water Storage Tank Overflow	Date and Hour of Occurrence 03/2017	Date and Hour of Discovery 03/2017
Was Immediate Notice Given? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.\*

Describe Cause of Problem and Remedial Action Taken.\*

Water hauler was delayed and tank overflowed. All water remained within containment area.

Describe Area Affected and Cleanup Action Taken.\*


Water has been vacuumed from containment area.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

#### OIL CONSERVATION DIVISION

Signature: 

Approved by Environmental Specialist:



Printed Name: Shelly Doescher

Title: Agent

Approval Date: 19Apr17

Expiration Date:

E-mail Address: shelly\_doescher@yahoo.com

Conditions of Approval:

Attached ☐

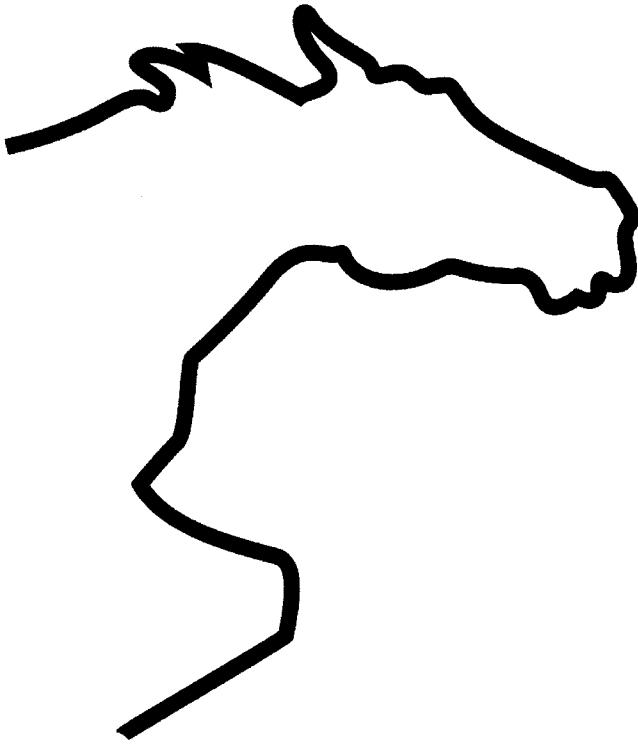
Date: 04/11/2017

Phone: 505-320-5682

\* Attach Additional Sheets If Necessary



# Appendix B



Soil Data

## Harding County, New Mexico

### AM—Amarillo fine sandy loam

#### Map Unit Setting

*National map unit symbol:* dml4  
*Elevation:* 2,500 to 5,000 feet  
*Mean annual precipitation:* 13 to 21 inches  
*Mean annual air temperature:* 57 to 64 degrees F  
*Frost-free period:* 180 to 220 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Amarillo and similar soils:* 85 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Amarillo

##### Setting

*Landform:* Plains  
*Landform position (two-dimensional):* Summit  
*Landform position (three-dimensional):* Talf, rise  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Eolian deposits derived from igneous and sedimentary rock

##### Typical profile

*H1 - 0 to 5 inches:* fine sandy loam  
*H2 - 5 to 48 inches:* sandy clay loam  
*H3 - 48 to 65 inches:* sandy clay loam

##### Properties and qualities

*Slope:* 1 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Well drained  
*Runoff class:* Low  
*Capacity of the most limiting layer to transmit water (Ksat):*  
Moderately high to high (0.60 to 2.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum in profile:* 10 percent  
*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Sodium adsorption ratio, maximum in profile:* 1.0  
*Available water storage in profile:* High (about 9.1 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 3e  
*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* B  
*Ecological site:* Sandy Loam 12-17" PZ (R077BY021TX)  
*Hydric soil rating:* No

#### **Minor Components**

##### **Springer**

*Percent of map unit:*  
*Ecological site:* Sandy Plains (R077CY056NM)  
*Hydric soil rating:* No

##### **Mansker**

*Percent of map unit:*  
*Ecological site:* Sandy Loam 12-17" PZ (R077BY021TX)  
*Hydric soil rating:* No

##### **Portales**

*Percent of map unit:*  
*Ecological site:* Sandy Loam 12-17" PZ (R077BY021TX)  
*Hydric soil rating:* No

##### **Amarillo lfs**

*Percent of map unit:*  
*Ecological site:* Sandy Plains (R077CY056NM)  
*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: Harding County, New Mexico  
Survey Area Data: Version 15, Sep 7, 2017



## Harding County, New Mexico

### LF—Latom fine sandy loam

#### Map Unit Setting

*National map unit symbol:* dmmj  
*Elevation:* 3,800 to 5,000 feet  
*Mean annual precipitation:* 13 to 16 inches  
*Mean annual air temperature:* 57 to 63 degrees F  
*Frost-free period:* 180 to 195 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Latom and similar soils:* 80 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Latom

##### Setting

*Landform:* Structural benches  
*Landform position (two-dimensional):* Shoulder  
*Landform position (three-dimensional):* Nose slope  
*Down-slope shape:* Convex  
*Across-slope shape:* Linear  
*Parent material:* Colluvium, alluvium and residuum weathered from sandstone

##### Typical profile

*H1 - 0 to 16 inches:* fine sandy loam  
*H2 - 16 to 20 inches:* bedrock

##### Properties and qualities

*Slope:* 1 to 5 percent  
*Depth to restrictive feature:* 4 to 20 inches to lithic bedrock  
*Natural drainage class:* Well drained  
*Runoff class:* Low  
*Capacity of the most limiting layer to transmit water (Ksat):*  
Moderately high to high (0.20 to 2.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum in profile:* 35 percent  
*Salinity, maximum in profile:* Nonsaline to very slightly saline (1.0 to 3.0 mmhos/cm)  
*Sodium adsorption ratio, maximum in profile:* 1.0  
*Available water storage in profile:* Very low (about 2.1 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 7s  
*Hydrologic Soil Group:* D

*Ecological site:* Shallow Sandstone 12-18" PZ (R070BY665TX)  
*Hydric soil rating:* No

### **Minor Components**

#### **Ima**

*Percent of map unit:*  
*Ecological site:* Sandy Loam 12-18" PZ (R070BY670TX)  
*Hydric soil rating:* No

#### **Quay**

*Percent of map unit:*  
*Ecological site:* Sandy Loam 12-18" PZ (R070BY670TX)  
*Hydric soil rating:* No

#### **Gallegos**

*Percent of map unit:*  
*Ecological site:* Gravelly (R070BY065NM)  
*Hydric soil rating:* No

#### **Tucumcari**

*Percent of map unit:*  
*Ecological site:* Clay Loam 12-18" PZ (R070BY663TX)  
*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: Harding County, New Mexico  
Survey Area Data: Version 15, Sep 7, 2017



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*New Mexico Office of the State Engineer*  
**Wells with Well Log Information**

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No wells found

**Basin/County Search:**

County: Harding

**PLSS Search:**

Section(s): 27

Township: 19N

Range: 31E

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The data is furnished by the NM/OSE/TSC and is accepted by the recipient with the expressed understanding that the OSE/TSC make no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the data.

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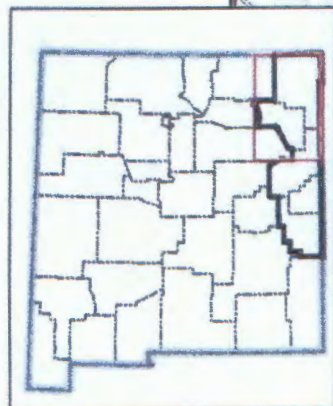
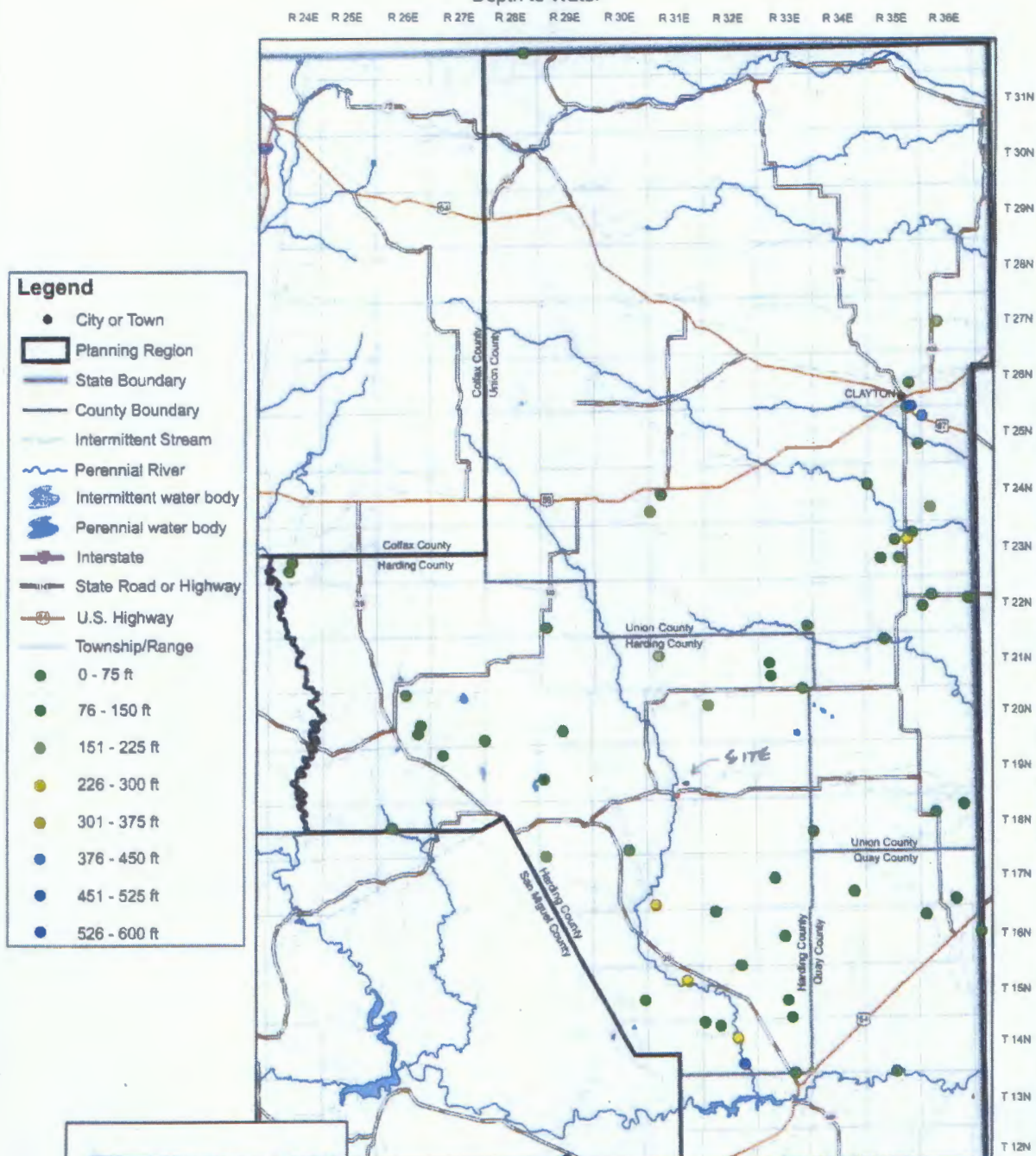
11/9/18 10:16 AM

WELLS WITH WELL LOG INFORMATION



# Northeast New Mexico Regional Water Plan (Northern Portion)

## Depth to Water



Produced by the New Mexico Water Resources Research Institute,  
June 2006

Base map prepared by the U.S. Geological Survey

Compiled from digital data provided by the New Mexico Resources Geographic Information System Program (RGIS). Original base maps digitized from 1:500,000 and 1:1,000,000 scale maps. Boundary of the Northeast New Mexico Water Planning Region is based on county lines and surface drainage divides.

Depth to groundwater points are based on USGS GWSI database records for well locations and water depth.

Horizontal accuracy: At the scale of 1:650,000 at least 90% of the points tested are within 1/30th inch (0.0333 inch), or within 547 ground meters, of their true location.

Projection: Universal Transverse Mercator, Zone 13, Units meters, NAD83.

0 12.5 25 50  
Kilometers

0 12.5 25 50  
Miles

# Appendix C



Lab Analyses & Chain of Custody



PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

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November 07, 2018

NINA PALMER

BREITBURN MANAGEMENT

1264 BUEYEROS

BUEYEROS, NM 88415

RE: LIBBY MINERALS

Enclosed are the results of analyses for samples received by the laboratory on 11/02/18 11:10.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-18-11. 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/ga/lab\\_accred\\_certif.html](http://www.tceq.texas.gov/field/ga/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,

A handwritten signature in black ink, reading "Celey D. Keene". The signature is written in a cursive, flowing style.

Celey D. Keene

Lab Director/Quality Manager

**Analytical Results For:**

 BREITBURN MANAGEMENT  
 NINA PALMER  
 1264 BUEYEROS  
 BUEYEROS NM, 88415  
 Fax To:

 Received: 11/02/2018  
 Reported: 11/07/2018  
 Project Name: LIBBY MINERALS  
 Project Number: #27-1 - J  
 Project Location: NW/4 SE/4 SEC 27,T19N,R31E

 Sampling Date: 10/29/2018  
 Sampling Type: Soil  
 Sampling Condition: \*\* (See Notes)  
 Sample Received By: Tamara Oldaker

**Sample ID: 1A (H803147-01)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2800	16.0	11/07/2018	ND	416	104	400	0.00	

**Sample ID: 1C (H803147-02)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1800	16.0	11/07/2018	ND	416	104	400	0.00	

**Sample ID: 1B (H803147-03)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2200	16.0	11/07/2018	ND	416	104	400	0.00	

**Sample ID: 2A (H803147-04)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1200	16.0	11/07/2018	ND	416	104	400	0.00	

Cardinal Laboratories

\*=Accredited Analyte

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising, whether based in contract or tort, shall be limited to the amount paid by client for analyses. All claims, including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within thirty (30) days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including, without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of the services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise. Results relate only to the samples identified above. This report shall not be reproduced except in full with written approval of Cardinal Laboratories.

Celey D. Keene, Lab Director/Quality Manager



**Analytical Results For:**

BREITBURN MANAGEMENT  
NINA PALMER  
1264 BUEYEROS  
BUEYEROS NM, 88415  
Fax To:

Received: 11/02/2018  
Reported: 11/07/2018  
Project Name: LIBBY MINERALS  
Project Number: #27-1 - J  
Project Location: NW/4 SE/4 SEC 27,T19N,R31E

Sampling Date: 10/29/2018  
Sampling Type: Soil  
Sampling Condition: \*\* (See Notes)  
Sample Received By: Tamara Oldaker

**Sample ID: 2C (H803147-05)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	1800	16.0	11/07/2018	ND	400	100	400	3.92	QM-07	

**Sample ID: 2B (H803147-06)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2160	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: 3A (H803147-07)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	608	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: 3C (H803147-08)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1020	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: 3B (H803147-09)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1200	16.0	11/07/2018	ND	400	100	400	3.92	

Cardinal Laboratories

\*=Accredited Analyte

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Celey D. Keene, Lab Director/Quality Manager

**Analytical Results For:**

 BREITBURN MANAGEMENT  
 NINA PALMER  
 1264 BUEYEROS  
 BUEYEROS NM, 88415  
 Fax To:

 Received: 11/02/2018  
 Reported: 11/07/2018  
 Project Name: LIBBY MINERALS  
 Project Number: #27-1 - J  
 Project Location: NW/4 SE/4 SEC 27,T19N,R31E

 Sampling Date: 10/29/2018  
 Sampling Type: Soil  
 Sampling Condition: \*\* (See Notes)  
 Sample Received By: Tamara Oldaker

**Sample ID: 4A (H803147-10)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	4000	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: 4C (H803147-11)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1040	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: 4B (H803147-12)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	864	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: 5A (H803147-13)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1250	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: 5C (H803147-14)**

Chloride, SM4500CI-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2000	16.0	11/07/2018	ND	400	100	400	3.92	

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Celey D. Keene, Lab Director/Quality Manager

**Analytical Results For:**

 BREITBURN MANAGEMENT  
 NINA PALMER  
 1264 BUEYEROS  
 BUEYEROS NM, 88415  
 Fax To:

 Received: 11/02/2018  
 Reported: 11/07/2018  
 Project Name: LIBBY MINERALS  
 Project Number: #27-1 - J  
 Project Location: NW/4 SE/4 SEC 27,T19N,R31E

 Sampling Date: 10/29/2018  
 Sampling Type: Soil  
 Sampling Condition: \*\* (See Notes)  
 Sample Received By: Tamara Oldaker

**Sample ID: 5B (H803147-15)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1840	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: BACKGROUND A (H803147-16)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	32.0	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: BACKGROUND C (H803147-17)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	96.0	16.0	11/07/2018	ND	400	100	400	3.92	

**Sample ID: BACKGROUND B (H803147-18)**

Chloride, SM4500Cl-B		mg/kg		Analyzed By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	112	16.0	11/07/2018	ND	400	100	400	3.92	

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 Celey D. Keene, Lab Director/Quality Manager

**Notes and Definitions**

QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
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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Celey D. Keene, Lab Director/Quality Manager

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Marland, Hobbs, NM 88240  
 (575) 393-2326 FAX (575) 393-2476

Company Name: <u>Breithurn Operating</u>		P.O. #:		BILL TO		ANALYSIS REQUEST											
Project Manager: <u>Nina Palmer</u>		Company: <u>Breithurn Operating</u>															
Address: <u>1264 Bueyeros Highway</u>		Attn:															
City: <u>Bueyeros</u>		Address: <u>1264 Bueyeros</u>															
State: <u>NM</u> Zip: <u>88445</u>																	
Phone #: <u>575-741-0153</u> Fax #:		City: <u>Bueyeros</u>															
Project #:		State: <u>NM</u> Zip: <u>88445</u>															
Project Name: <u>Lobby Mirale #27-1-J</u>		Phone #: <u>575-741-0153</u>															
Project Location: <u>SW 1/4 Sec 21, T19N, R31E</u>		Fax #:															
Sampler Name: <u>Greg Lynch</u>		PRESERV		SAMPLING													
FOR LAB USE ONLY																	
Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER	ACID/BASE	ICE / COOL	OTHER	DATE	TIME			
<u>H803147</u>	<u>1A</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:18</u>	<u>1</u>			
<u>2</u>	<u>1C</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:19</u>	<u>1</u>			
<u>3</u>	<u>1B</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:21</u>	<u>1</u>			
<u>4</u>	<u>2A</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:23</u>	<u>1</u>			
<u>5</u>	<u>2C</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:25</u>	<u>1</u>			
<u>6</u>	<u>2B</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:26</u>	<u>1</u>			
<u>7</u>	<u>3A</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:27</u>	<u>1</u>			
<u>8</u>	<u>3C</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:28</u>	<u>1</u>			
<u>9</u>	<u>3B</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:29</u>	<u>1</u>			
<u>10</u>	<u>4A</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>12:31</u>	<u>1</u>			

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Relinquished By: Nina Palmer Date: 10-31-8 Time: 5:00PM Received By: Shirley Blalock

Relinquished By: Nina Palmer Date: 11-2-18 Time: 11:10 Received By: Shirley Blalock

Delivered By: (Circle One) UPS 11:12 #497 92

Sampler - UPS - Bus - Other: 11:12 #497 92

Sample Condition: Cool Intact Yes Yes No No

CHECKED BY: (Initials)

REMARKS: Chlorides

Please email to: Edward.Pallister@breithurn.com  
Steve.Niehaus@breithurn.com  
Nina.Palmer@breithurn.com





CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page 2 of 2

101 East Marland, Hobbs, NM 88240  
(575) 393-2326 FAX (575) 393-2476

<b>Company Name:</b> Breitburn Operating <b>Project Manager:</b> Nina Palmer <b>Address:</b> 1264 Bueyeros <b>City:</b> Bueyeros <b>State:</b> NM <b>zip:</b> 88415 <b>Phone #:</b> 575-741-0513 <b>fax #:</b> <b>Project #:</b> <b>Project Owner:</b> Buck Pollister <b>Project Name:</b> Libby Minerals #27-1-J <b>Project Location:</b> NW 1/4 Sec 14, Sec 37, T19N, R31E <b>Sample Name:</b> Greg Lynch		<b>BILL TO</b> <b>P.O. #:</b> <b>Company:</b> Breitburn Operating <b>City:</b> Bueyeros <b>State:</b> NM <b>zip:</b> 88415 <b>Phone #:</b> 575-741-0513 <b>Fax #:</b>	
<b>FOR LAB USE ONLY</b> <b>Lab I.D.</b> <b>Sample I.D.</b>		<b>ANALYSIS REQUEST</b>	
PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy, for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits, incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.			
<b>Relinquished By:</b> Nina Palmer <b>Received By:</b> <b>Date:</b> 10-31-8 <b>Time:</b> 5:00 pm		<b>Relinquished By:</b> <b>Received By:</b> <b>Date:</b> 11-2-18 <b>Time:</b> 11:10	
<b>Delivered By: (Circle One)</b> Sampler - UPS - Bus - Other: 11/12 #77		<b>Sample Condition:</b> Cool <input type="checkbox"/> Intact <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	
<b>Phone Result:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Add'l Phone #:</b> <b>Fax Result:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>Add'l Fax #:</b>		<b>REMARKS:</b> See Page 1 email addresses	

Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX						DATE	TIME	ANALYSIS REQUEST
				GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER			
HS03147	4G	(G)	1							10/24/8	12:32	Chlorides
11	4B	(G)	1							10/24/8	12:33	
12	5H	(G)	1							10/24/8	12:36	
13	3C	(G)	1							10/24/8	12:37	
14	5B	(G)	1							10/24/8	12:40	
15	Background A	(G)	1							10/24/8	12:51	
16	Background B	(G)	1							10/24/8	12:53	
17	Background C	(G)	1							10/24/8	12:55	
18	Background D	(G)	1							10/24/8	12:55	