R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Since 1996
Artesia ▲ Carlsbad ▲ Durango ▲ Midland

February 23, 2018

INFORMATION ONLY

Donnie Brown
Purvis Operating Company
PO Box 51990
Midland, TX 79710

RE: Purvis Operating Antelope #001 Characterization Plan
API: 30-025-38867. Unit A, 7, T15S. R35E. Lea County, NM
1RP-4896 & 1RP-4925

Mr. Brown:

R.T. Hicks Consultants (Hicks Consultants) is pleased to submit this characterization plan to Purvis Operating Company. This characterization plan addresses:

- 1RP-4896 that occurred on December 07, 2017
- 1RP-4929 that occurred on December 18, 2017

The C-141's are reproduced in Appendix A.

As we understand the closure criteria suggested by NMOCD's application to repeal and replace Rule 19.15.29 NMAC (R&R Part 29; Appendix B) will establish delineation and closure limits. Based upon R&R Part 29 Table 1, chloride closure criteria at this location is:

Depth (below ground surface)	Depth to Water (bottom of release)	Chloride (mg/kg)	TPH (GRO+MRO+ORO) (mg/kg)	TPH (GRO+DRO) (mg/kg)	BTEX (mg/kg)	Benzene (mg/kg)
0-4 feet		600	100		50	10
>4 feet	≤50 feet	600	100		50	10
>4 feet	>50 feet	10,000	2,500	1,000	50	10

Exhibit 1: Closure Criteria from R&R Part 29 Table 1

Per 19.15.29.11 of the R&R Part 29 (Site Assessment/Characterization), NMOCD approval is not required for characterization plans. This letter is copied to the OCD and the SLO as courtesy.

Plates 1-9 show that this site meets the criteria established by R&R Part 29 Section 19.15.29.12.B.3 and B.4. Two exceptions are:

1. Based upon the potentiometric surface (Plate 2) and the elevation of the location, depth to water is estimated at 54 feet below ground surface (bgs). If the proposed characterization shows impact greater than 4 feet bgs, closure criteria for groundwater less than 50 ft below the bottom of the release may apply. A variance may be required.

2. A water well exists within 1,000 feet of the release (USGS-13551; Plate 1). According to R&R Part 29; if a water well exists within 1,000 feet of the release the release must use closure criteria as if groundwater was less than 50 feet to groundwater. A variance may be required.

A water well listed on the New Mexico Office of the State Engineer (OSE) database shows a well at the site (L-13339-POD1; Plate 1). This was an exploratory boring conducted by R.T. Hicks Consultants in 2013 to characterize a prior release from the tank batter. The exploratory well was plugged and abandoned after completion. The depth of the boring was 21-feet. No groundwater was encountered. Appendix C contains the plugging record.

December 2017 Initial Response

Within 24 hours of the December 07, 2017 release, the impacted area, which was limited to the production pad as described in the C-141, was excavated to a depth of 0.5 feet and temporarily stockpiled along the western edge of the production pad for off-site disposal. The excavated area was backfilled with clean caliche. On December 18, 2017 a second release occurred covering an area similar to the December 7th release extent. Both releases were due to freezing conditions that caused the flowline valves and unions to burst. The valves and unions have been repaired. To prevent this occurrence in the future, a pressure gauge has been installed that will shut the wellhead down if backpressure increases above 300 psi and manual restart of the wellhead will be required.

Figure 1: Photo of the Dec. 18, 2017 release as observed on Jan. 8th 2018. Photo is viewing south-southwest.

On January 8th and 10th, 2018; Andrew Parker of R.T. Hicks Consultants was on-site to inspect the December 18th release (Figure 1 & Plate 10). During our January 10th inspection, we collected surface soil samples at 3-inches below grade. As shown in Figure 2, below, at 3-inches below grade no hydrocarbon staining was observed. We elected not to submit the surface samples for laboratory testing and to collect samples the following day (January 11th) after the impacted area was excavated.

On January 11th, the December 18th release was excavated to a depth of 0.5 feet – the extent of visual hydrocarbon impairment. The excavated soil, along with the stockpiled soil from the December 7th release, was hauled off-site for proper disposal. The excavated area was backfilled with clean caliche.

Donnie Barr; the pumper for Purvis, collected a soil sample at 5-inches (approximately 0.5 feet) below grade from the northwestern extent of the release. Mr. Barr transferred the sample to Kristin Pope, of R.T. Hicks Consultants. Ms. Pope delivered the soil sample to

Cardinal Laboratories in Hobbs, NM for the analysis of chloride, BTEX, GRO, DRO, and MRO. Table 1 is a summary of the analytical results. Appendix D contains the laboratory Certificate of Analysis.

Depth to water at a nearby windmill located approximately 1,000 feet east-southeast (down gradient) of the release measured 50.28 feet in 1996 (USGS-13551; Plate 1). Current depth to water is expected to be greater than 50 feet below ground surface (bgs). Since 1961, the depth to water in the windmill has been greater than 50 feet with the exception in 1976, when the depth to water was 49.17 feet. Figure 3 shows measured water levels in the windmill since USGS started gauging the well.

Figure 2: No visual impairment at 3-inches below grade from the Dec. 2017 Release. (Jan 11th 2018)

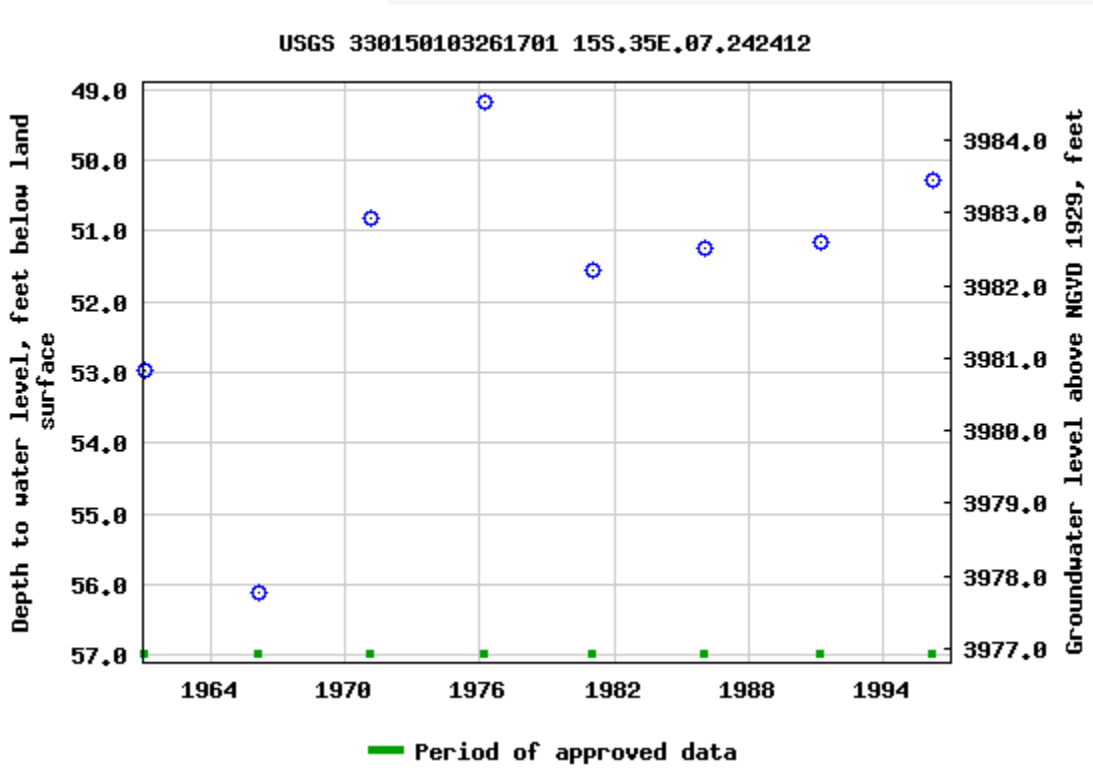

Figure 3: Depth to water over time in USGS-13551 as shown on Plate 1. USGS site number in database is 330150103261701[1]

Based upon 1) expected depth to ground water greater than 50 feet and 2) the proposed R&R Rule 29 that considers the existence of a water supply within 1000 feet a risk factor, we propose closure criteria in soil at groundwater greater than 50 feet and ask for a variance for the nearby water well if soil concentrations for constituents of concern exceed closure criteria for groundwater less than 50 feet. (See Exhibit 1, above.)

Preliminary sampling shows that TPH (GRO+DRO+MRO) concentrations of 4,814.6 mg/kg in Pad Northwest at 5 inches exceed proposed cleanup criteria levels in the uppermost 4 feet. Chloride exhibited 224 mg/kg, which is below the cleanup criteria of 600 mg/kg and BTEX components are also below the proposed closure criteria. Given the nature of the release, we expect TPH concentrations to decline to proposed closure criteria within 2-6 feet below grade and there is no expectation that BTEX or chloride will be elevated in deeper samples.

[1] https://nwis.waterdata.usgs.gov/nm/nwis/gwlevels?site_no=330150103261701&agency_cd=USGS&format=gif

Proposed Actions

We proposed to install five boreholes at the following locations define the horizontal extent of the release:

- the four cardinal directions of the December 2017 release, and
- our January 2018 field observations where we observed the highest potential of liquid pooling

Plate 11 shows the location of the proposed borings.

We will collect soil samples at 2, 4, and 6 feet below ground surface at the four cardinal locations. Vertical delineation will cease at 4 feet if:

- PID readings for VOCs are below 100 ppm (using the heated headspace method of field testing), and
- Chloride titrations are below 600 mg/kg (using field titration method).

One additional soil sample will be collected at total depth.

The boring within the area of the highest potential of liquid pooling (SB-Release 12.2017) will vertically delineate the release. Soil samples will be collected vertically every 2 feet from the surface to 4 feet bgs; then every 5 feet to total depth. Vertical delineation will cease when:

- PID readings for VOCs are below 100 ppm, and
- Chloride titrations are below 600 mg/kg.

Soil samples will be submitted for laboratory testing for TPH (GRO, DRO, MRO), BTEX, Benzene, and Chloride.

If sampling results show that concentrations are similar to the 5-inch sample and exceed cleanup criteria, we will ask for a variance to the proposed R&R Part 29 remediation and closure requirements. We will argue the release is located entirely on an active production pad and re-vegetation of the pad is neither desired nor allowed. More importantly, observation of the Laws of Fluid Mechanics and the Second Law of Thermodynamics will cause degradation of petroleum hydrocarbons.

Protocols for chloride field titrations and VOC screening with a photoionization detector (PID) are located in Appendix E.

The initial characterization will be followed by a report presenting corrective actions based upon the closure criteria concentrations proposed in the R&R Part 29.

Please contact me at 970-570-9535 with any questions or comments.

Sincerely,
R.T. Hicks Consultants, Ltd.

Andrew Parker
Project Scientist

Copy: Hobbs NMOCD office – Oliva Yu (Olivia.Yu@state.nm.us)
NMOCD – Brad Billings (bradford.billings@state.nm.us)
NM SLO - Mark Naranjo (mnaranjo@slo.state.nm.us)

TABLES

Table 1
Antelope #1

Sample Name	Date	Cl mg/kg	BTEX mg/kg	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	TPH mg/kg	GRO+DRO mg/kg	GRO mg/kg	DRO mg/kg	MRO mg/kg
Proposed 19.15.29 NMAC												
Ground water < 50 ft		600	50	10				100				
Ground water 50 to 100 ft		10,000	50	10				2,500	1,000			
Pad Northwest @ 5"	1/11/2018	224	2.5	<0.050	0.426	0.546	1.53	4814.6	4,056.6	56.6	4,000	758

PLATES

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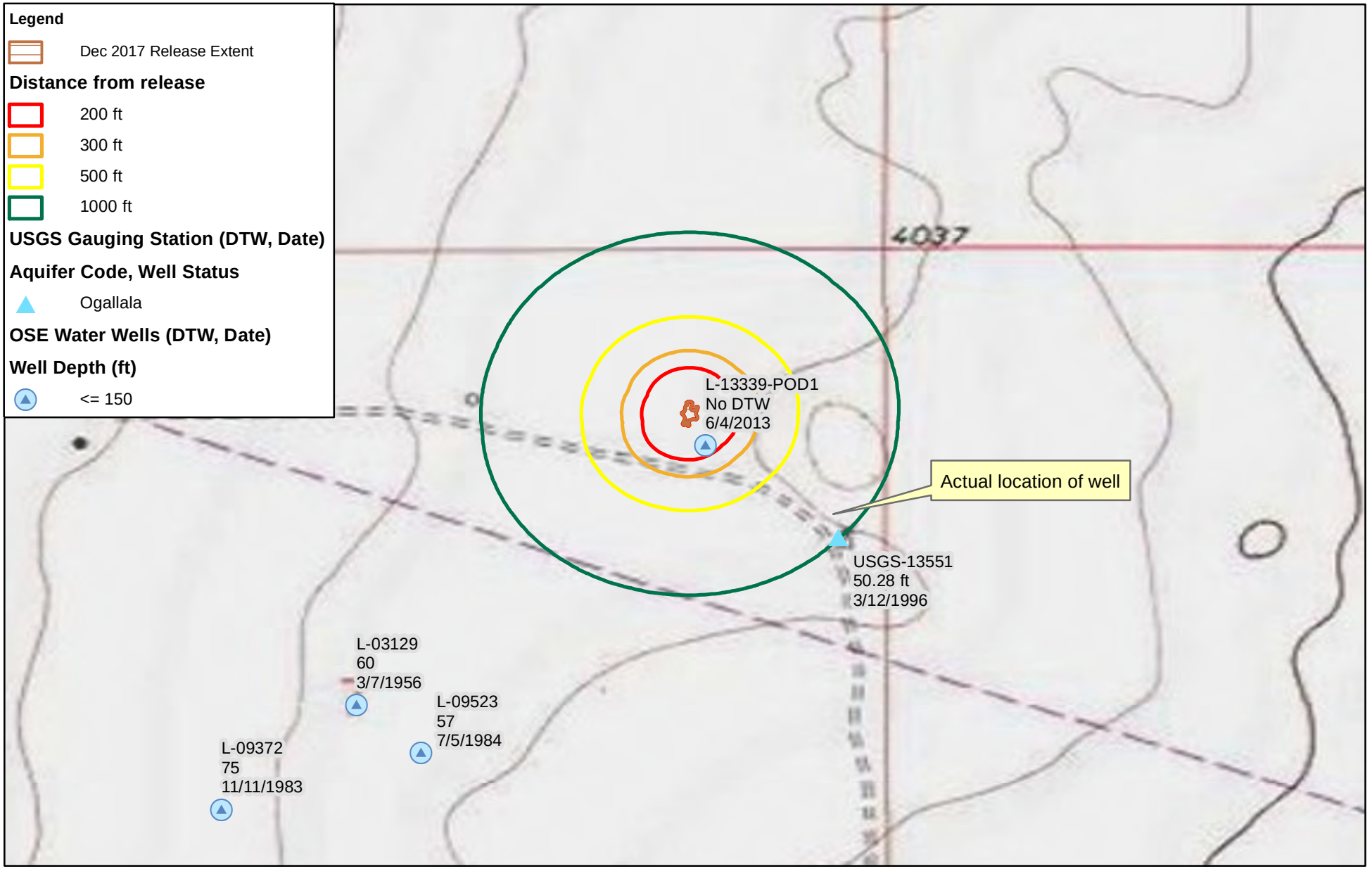

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Depth To Water	Plate 1
	Purvis Operating Company Antelope #001	February 2018

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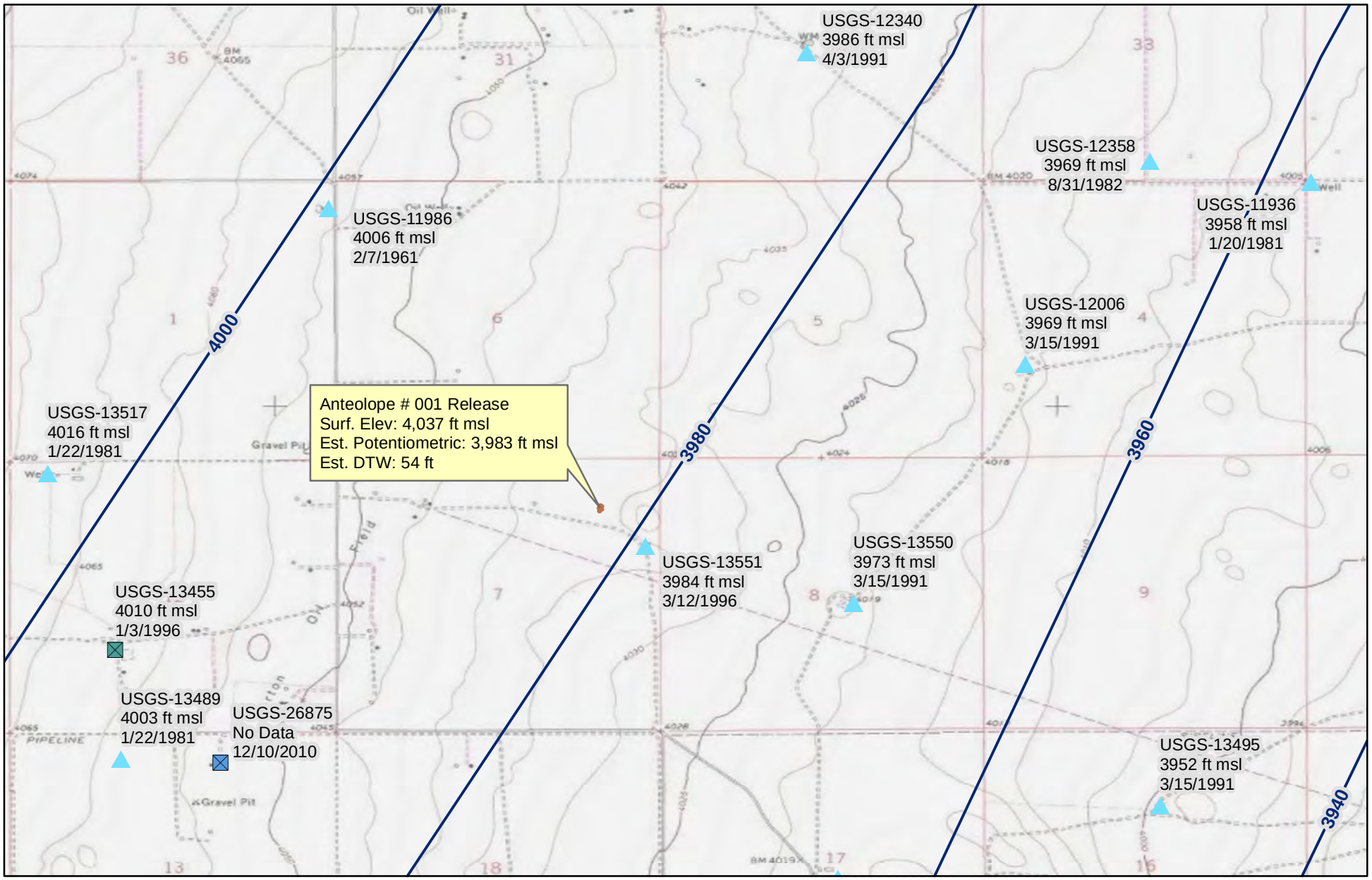

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R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Potentiometric Surface and Groundwater Elevation	Plate 2
	Purvis Operating Company Antelope #001	February 2018

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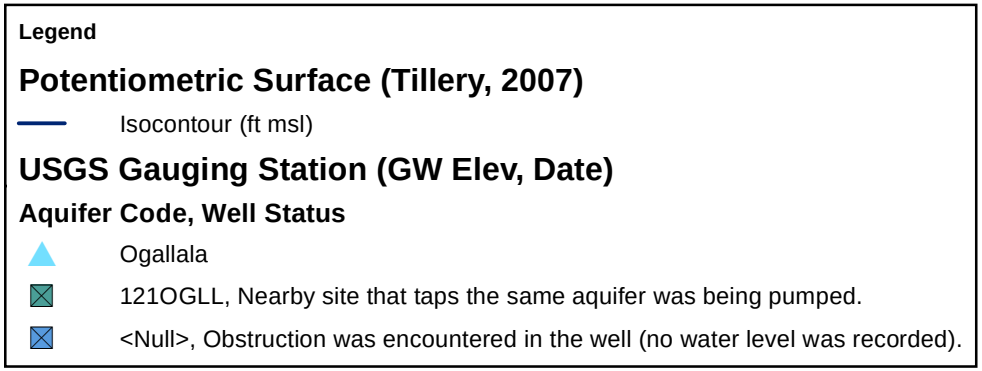

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Potentiometric Surface and Groundwater Elevation	Plate 2 LEGEND
	Purvis Operating Company Antelope #001	February 2018

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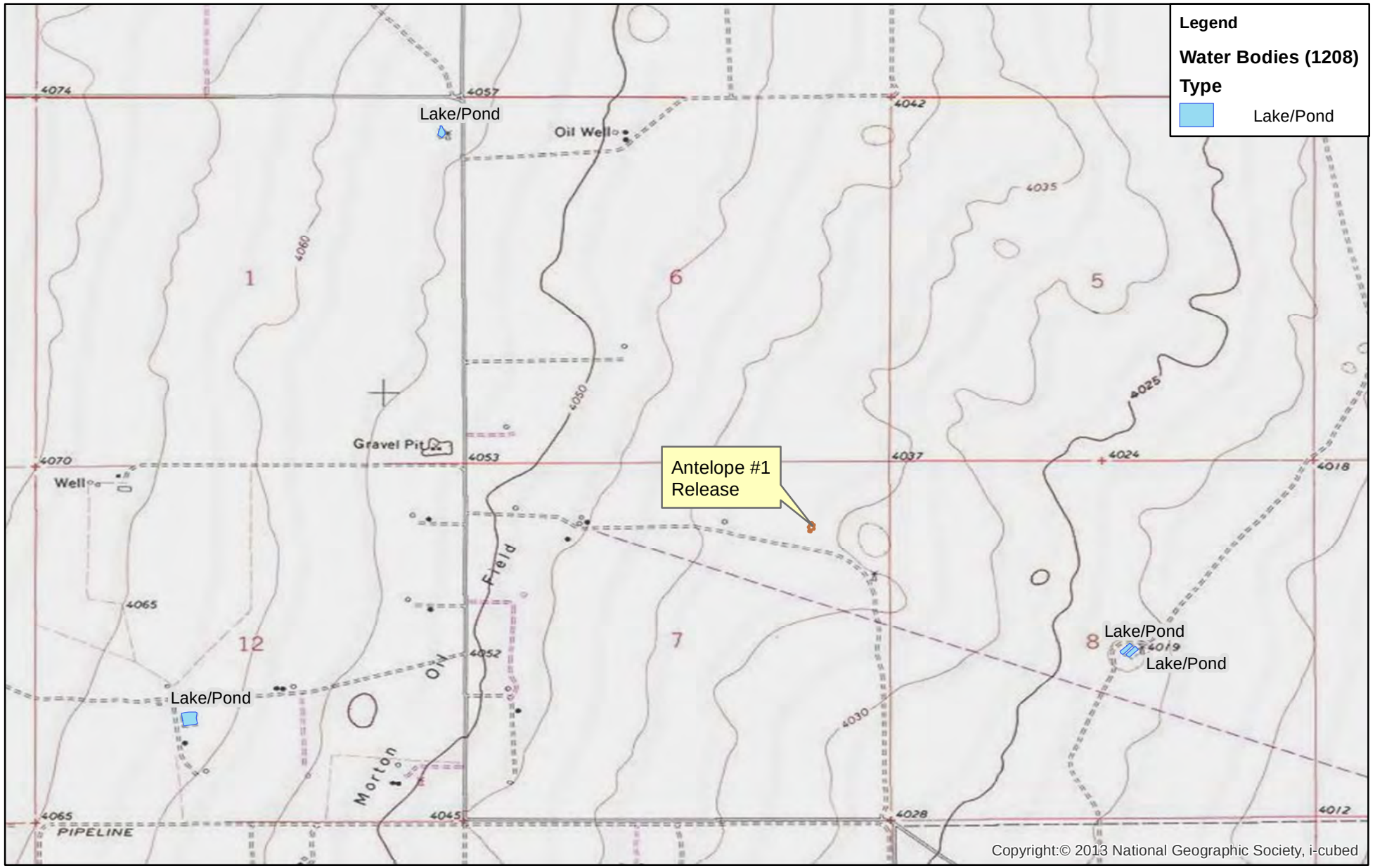

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R.T. Hicks Consultants, Ltd
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Albuquerque, NM 87104
Ph: 505.266.5004

Surface Water and Topography	Plate 3
Purvis Operating Company Antelope #001	February 2018

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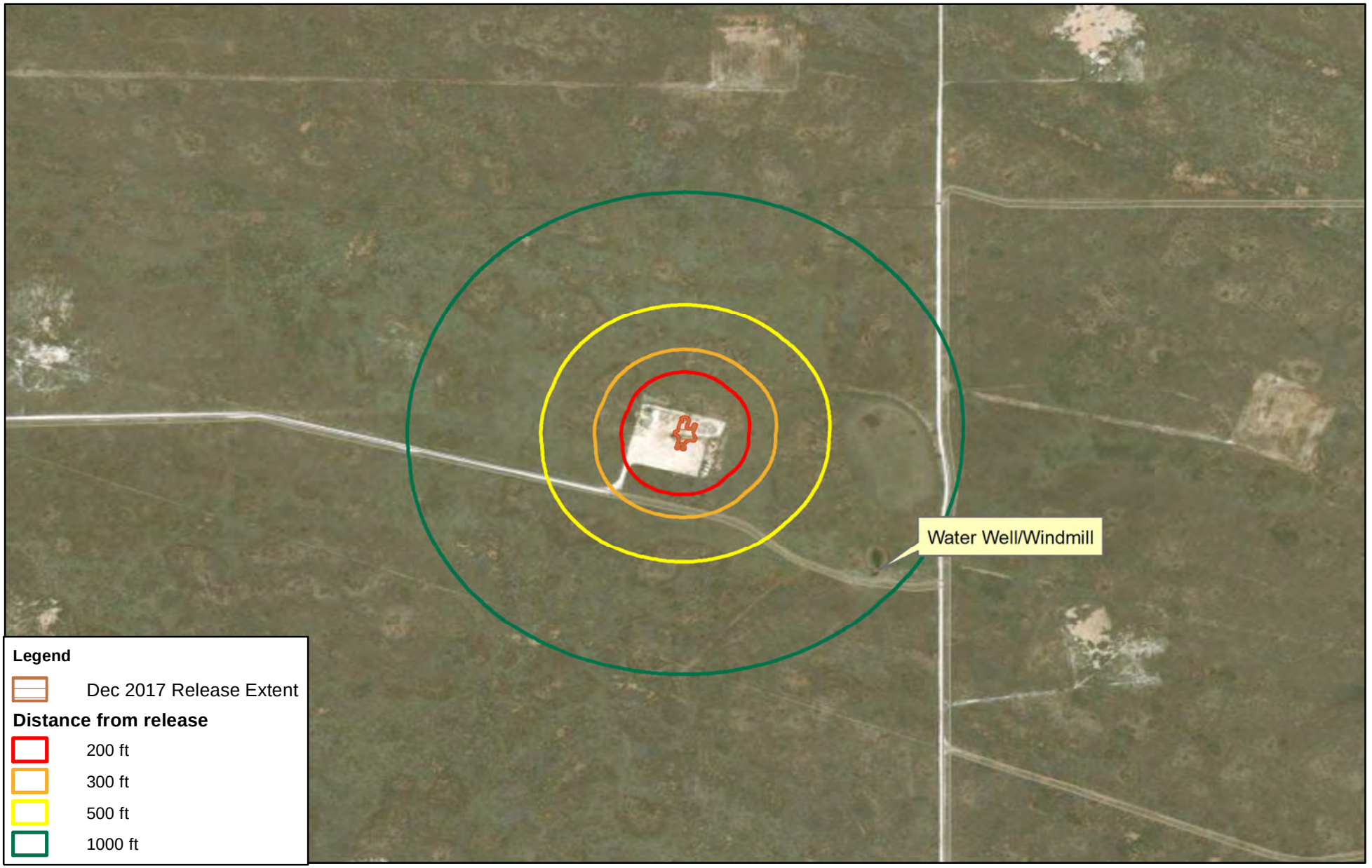

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Structures	Plate 4
	Purvis Operating Company Antelope #001	February 2018

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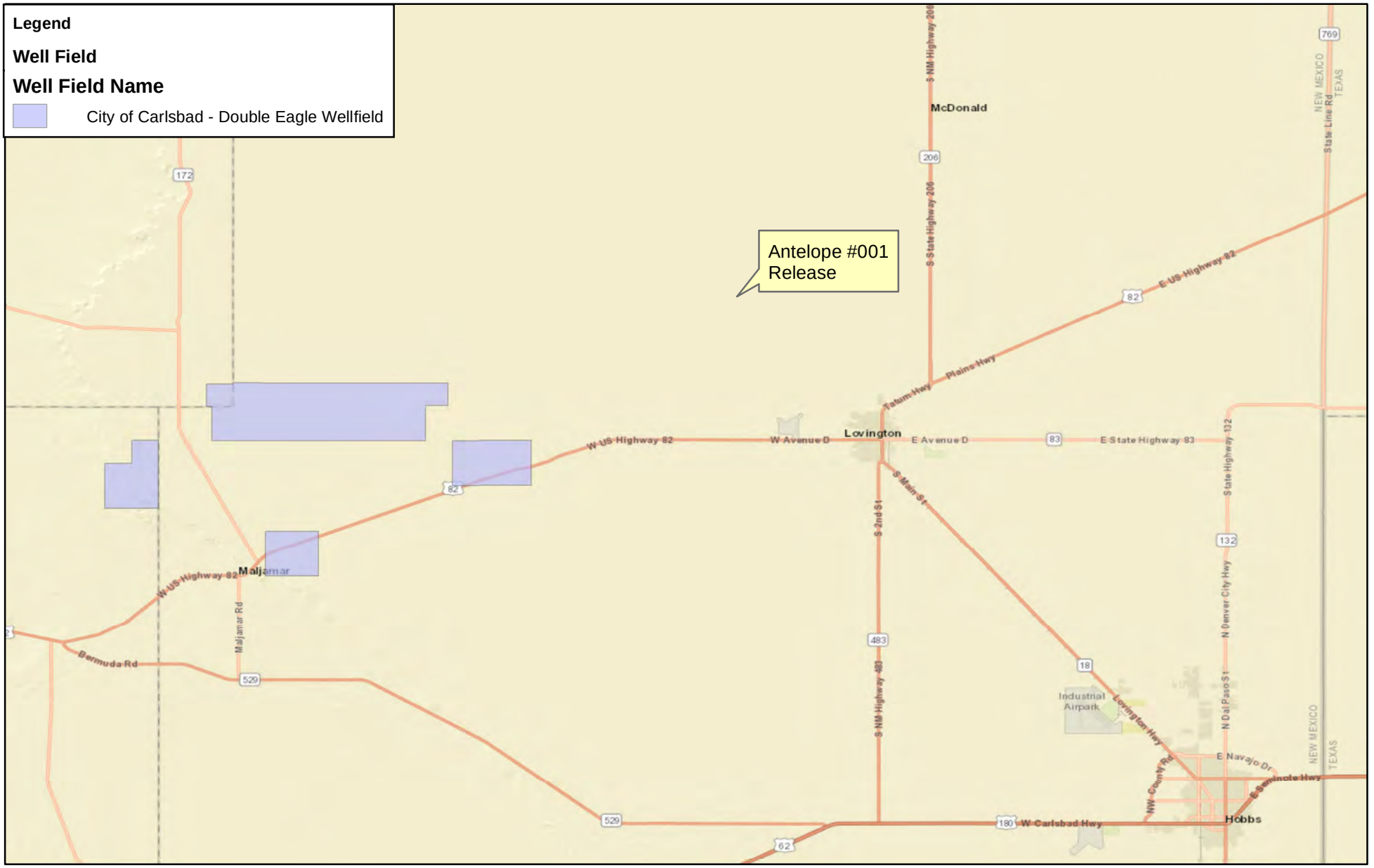

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Nearby Municipalities and Well Fields	Plate 5
Purvis Operating Company Antelope #001	February 2018

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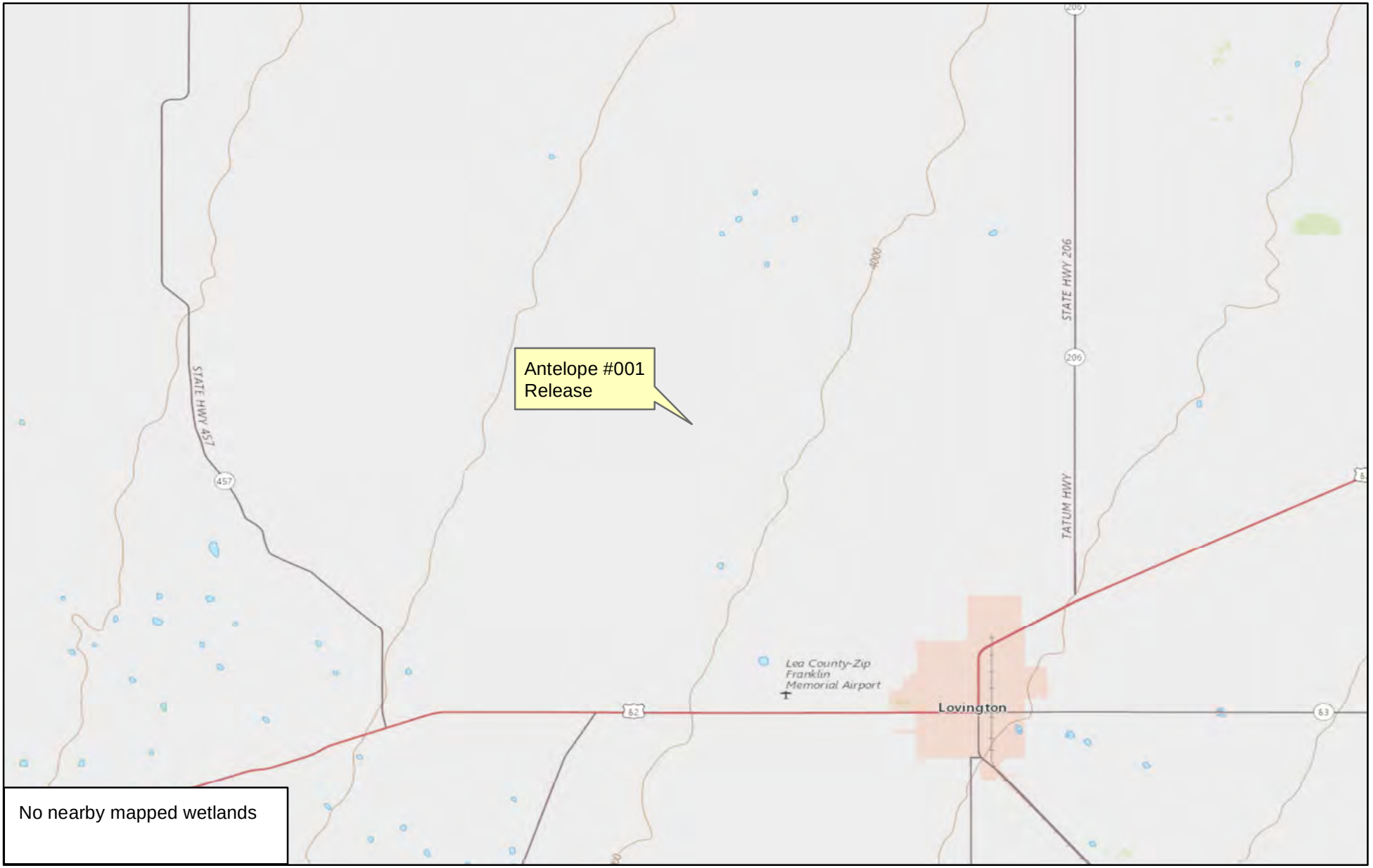

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R.T. Hicks Consultants, Ltd
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Albuquerque, NM 87104
Ph: 505.266.5004

Nearby Wetlands

Plate 6

Purvis Operating Company
Antelope #001

February
2018

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R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Mines and Minerals	Plate 7
	Purvis Operating Company Antelope #001	February 2018

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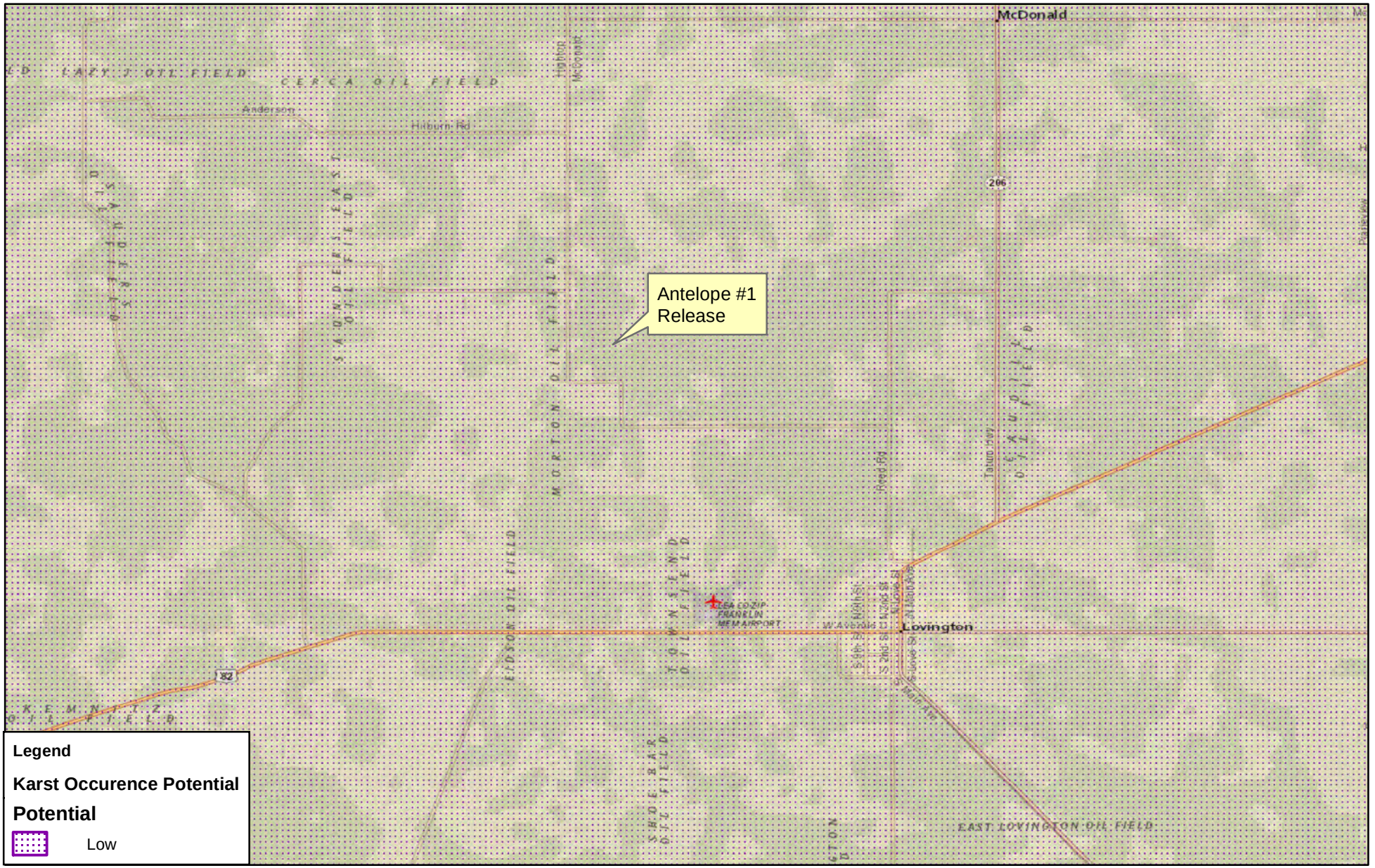

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Karst Potential	Plate 8
	Purvis Operating Company Antelope #001	February 2018

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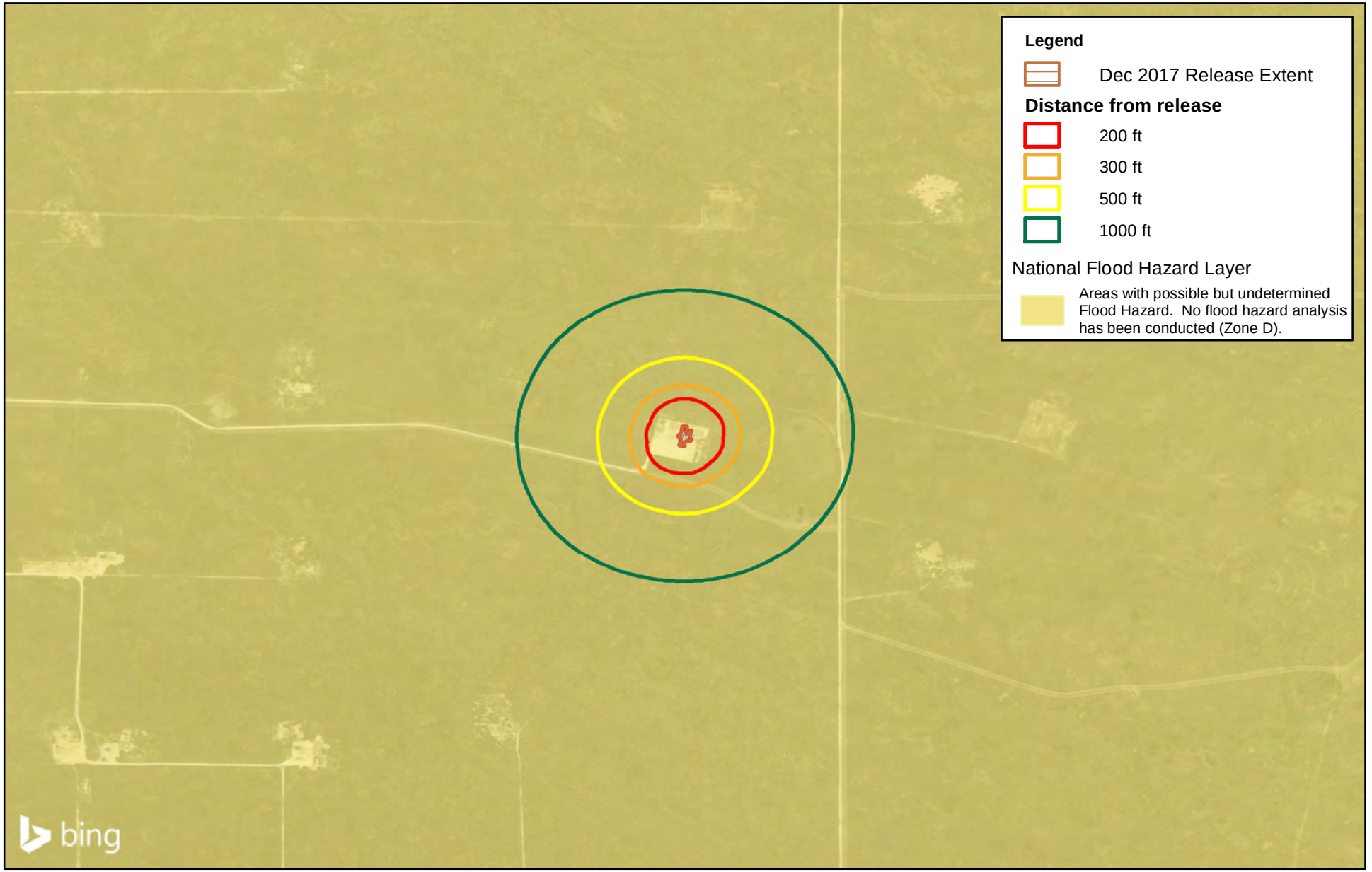

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R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

FEMA Flood Map

Plate 9

Purvis Operating Company
Antelope #001

February
2018

M:\Purvis Operating\Antelope\GIS\Figures\Plate 10 - release extent.mxd

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Release Extent Mapped on Jan 10th, 2018	Plate 10
	Purvis Operating Company Antelope #001	February 2018

M:\Purvis Operating\Antelope\GIS\Figures\Plate 11 - proposed boring.mxd

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R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

Proposed Borings	Plate 11
Purvis Operating Company Antelope #001	February 2018

APPENDIX A

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First Street, 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

HOBBS OCD
DEC 15 2017
RECEIVED

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	PURVIS OPERATING CO.	Contact	Donnie E. Brown
Address	PO Box 51990, Midland, TX 79710	Telephone No.	432-682-7346
Facility Name	Antelope	Facility Type	Wellhead

Surface Owner	Jean C. Jones	Mineral Owner	Fee	API No. 30-025-38867

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
A	7	15-S	35-E	1077	North	893	East	Lea

Latitude 33.035967°N **Longitude** 103.440805°W **NAD27**

NATURE OF RELEASE

Type of Release	Oil	Volume of Release	unknown
Source of Release	Wellhead	Volume Recovered	3 bbls.
Was Immediate Notice Given? ☐ Yes ☐ No ☒ Not Required		Date and Hour of Occurrence 12-7-17	Date and Hour of Discovery 12-7-2017
By Whom?		If YES, To Whom?	
Was a Watercourse Reached? ☐ Yes ☒ No		Date and Hour	
If a Watercourse was Impacted, Describe Fully.*		If YES, Volume Impacting the Watercourse.	

RECEIVED
By Olivia Yu at 1:10 pm, Dec 18, 2017

Describe Cause of Problem and Remedial Action Taken area. .* Back-pressure valve on wellhead became plugged with a piece of rod guide causing the stuffing box to leak. A spray of oil estimated at between 2-3 barrels resulted. The impacted area around the wellhead was covered with caliche to soak up the oil. The oil soaked caliche was removed and fresh caliche was spread over the affected area.

Describe Area Affected and Cleanup Action Taken.*
The area affected was north of the wellhead about 5' wide and 40' long. The oil film was soaked up with caliche and picked up. Fresh caliche was then spread on the affected 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.

Signature: Donnie E Brown		OIL CONSERVATION DIVISION	
Printed Name:	Donnie E. Brown	Approved by	
Title:	Petroleum Engineer	Approval Date: 12/18/2017	Expiration Date:
E-mail Address:	eng@purvisop.com	Conditions of Approval: see attached directive	Attached ☑
Date: 12-12-2017	Phone: 432-682-7346		

* Attach Additional Sheets If Necessary

1RP-4896 nOY1735248031 pOY1735249301

Operator/Responsible Party,

The OCD has received the form C-141 you provided on _12/15/2017_ regarding an unauthorized release. The information contained on that form has been entered into our incident database and remediation case number _1RP-4896__ has been assigned. **Please refer to this case number in all future correspondence.**

It is the Division's obligation under both the Oil & Gas Act and Water Quality Act to provide for the protection of public health and the environment. Our regulations (19.15.29.11 NMAC) state the following,

> *The responsible person shall complete division-approved corrective action for releases that endanger public health or the environment. The responsible person shall address releases in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with 19.15.30 NMAC.* [emphasis added]

Release characterization is the first phase of corrective action unless the release is ongoing or is of limited volume and all impacts can be immediately addressed. Proper and cost-effective remediation typically cannot occur without adequate characterization of the impacts of any release. Furthermore, the Division has the ability to impose reasonable conditions upon the efforts it oversees. **As such, the Division is requiring a workplan for the characterization of impacts associated with this release be submitted to the OCD District _1_ office in __Hobbs____ on or before _1/18/2018_. If and when the release characterization workplan is approved, there will be an associated deadline for submittal of the resultant investigation report. Modest extensions of time to these deadlines may be granted, but only with acceptable justification.**

The goals of a characterization effort are: 1) determination of the lateral and vertical extents along with the magnitude of soil contamination. 2) determine if groundwater or surface waters have been impacted. 3) If groundwater or surface waters have been impacted, what are the extents and magnitude of that impact. 4) The characterization of any other adverse impacts that may have occurred (examples: impacts on vegetation, impacts on wildlife, air quality, loss of use of property, etc.). To meet these goals as quickly as possible, the following items must, at a minimum, be addressed in the release characterization workplan and subsequent reporting:

● Horizontal delineation of soil impacts in each of the four cardinal compass directions. Adsorbed soil contamination must be characterized for the following constituents using the associated laboratory methods: benzene, toluene, ethylbenzene, and total xylenes by either Method 8260 or 8021, total petroleum hydrocarbons by Method 8015 extended range (GRO+DRO+MRO; C_6 thru C_{36}), and for chloride by Method 300. This is not an exclusive list of potential contaminants. Analyzed parameters should be modified based on the nature of the released substance(s). Soil sampling must be both within the impacted area and beyond.

● Vertical delineation of soil impacts. Adsorbed soil contamination must be characterized for the following constituents using the associated laboratory methods: benzene, toluene, ethylbenzene, and total xylenes by either Method 8260 or 8021, total petroleum hydrocarbons by Method 8015 extended range (GRO+DRO+MRO; C_6 thru C_{36}), and for chloride by Method 300. As above, this is not an exclusive list of potential contaminants and can be modified. Vertical characterization samples should be taken at depth intervals no greater than five feet apart. Lithologic description of encountered soils must also be provided. At least ten vertical feet of soils with contaminant concentrations at or below these values must be demonstrated as existing above the water table.

● Nominal detection limits for field and laboratory analyses must be provided.

● Composite sampling is not generally allowed.

● Field screening and assessment techniques are acceptable (headspace, titration, EC [include algorithm for validation purposes], EM, etc.), but the sampling and assay procedures must be clearly defined. Copies of field notes are highly desirable. A statistically significant set of split samples must be submitted for confirmatory laboratory analysis, including the laterally farthest and vertically deepest sets of soil samples. Make sure there are at least two soil samples submitted

for laboratory analysis from each borehole or test pit (highest observed contamination and deepest depth investigated). Copies of the actual laboratory results must be provided including chain of custody documentation.

●Probable depth to shallowest protectable groundwater and lateral distance to nearest surface water. If there is an estimate of groundwater depth, the information used to arrive at that estimate must be provided. If there is a reasonable assumption that the depth to protectable water is 50 feet or less, the responsible party should anticipate the need for at least one groundwater monitoring well to be installed in the area of likely maximum contamination.

● If groundwater contamination is encountered, an additional investigation workplan may be required to determine the extents of that contamination. Groundwater and/or surface water samples, if any, must be analyzed by a competent laboratory for volatile organic hydrocarbons (typically Method 8260 full list), total dissolved solids, pH, major anions and cations including chloride and sulfate, dissolved iron, and dissolved manganese. The investigation workplan must provide the groundwater sampling method(s) and sample handling protocols. To the fullest extent possible, aqueous analyses must be undertaken using nominal method detection limits. As with the soil analyses, copies of the actual laboratory results must be provided including chain of custody documentation.

● Accurately scaled and well-drafted site maps must be provided providing the location of borings, test pits, monitoring wells, potentially impacted areas, and significant surface features including roads and site infrastructure that might limit either the release characterization or remedial efforts. Field sketches may be included in subsequent reporting, but should not be considered stand-alone documentation of the site's layout. Digital photographic documentation of the location and fieldwork is recommended, especially if unusual circumstances are encountered.

Nothing herein should be interpreted to preclude emergency response actions or to imply immediate remediation by removal cannot proceed as warranted. Nonetheless, characterization of impacts and confirmation of the effectiveness of remedial efforts must still be provided to the OCD before any release incident will be closed.

Jim Griswold
OCD Environmental Bureau Chief
1220 South St. Francis Drive
Santa Fe, New Mexico 87505
505-476-3465
jim.griswold@state.nm.us

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First Street, 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	PURVIS OPERATING CO.	Contact	Donnie E. Brown
Address	PO Box 51990, Midland, TX 79710	Telephone No.	432-682-7346
Facility Name	Antelope	Facility Type	Flow line

Surface Owner	Jean C. Jones	Mineral Owner	Fee	API No. 30-025-38867

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
A	7	15-S	35-E	1077	North	893	East	Lea

Latitude 33.035967°N **Longitude** 103.440805°W **NAD27**

NATURE OF RELEASE

Type of Release: Oil	Volume of Release 4.5 bbls.	Volume Recovered 1.5 bbls. oil
Source of Release: Flow line connection	Date and Hour of Occurrence 12-18-2017	Date and Hour of Discovery 12-18-2017
Was Immediate Notice Given? ☐ Yes ☐ No ☒ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

RECEIVED
By Olivia Yu at 4:08 pm, Jan 10, 2018

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken area.

A flow line connection washed out causing an oil leak near the wellhead and surrounding area.

Describe Area Affected and Cleanup Action Taken.*

The area affected was north and west of the wellhead about 40' long and varying width of 2'-6'. The contaminated caliche will be picked up and hauled off. Soil samples under the dug-out caliche will be taken before fresh caliche is placed in the affected area and fresh caliche is placed in the affected 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.

Signature: Donnie E. Brown

Printed Name: Donnie E. Brown

Title: Petroleum Engineer

E-mail Address: eng@purvisop.com

Date: 1-08-2018 Phone: 432-682-7346

OIL CONSERVATION DIVISION

Approved by District Supervisor: DJ

Approval Date: 1/10/2018 Expiration Date:

Conditions of Approval: see attached directive

Attached ☑

* Attach Additional Sheets If Necessary

1RP-4925 nOY1801057914

pOY1801058371

Operator/Responsible Party,

The OCD has received the form C-141 you provided on _1/10/2018_ regarding an unauthorized release. The information contained on that form has been entered into our incident database and remediation case number _1RP-4925__ has been assigned. **Please refer to this case number in all future correspondence.**

It is the Division's obligation under both the Oil & Gas Act and Water Quality Act to provide for the protection of public health and the environment. Our regulations (19.15.29.11 NMAC) state the following,

> *The responsible person shall complete division-approved corrective action for releases that endanger public health or the environment. The responsible person shall address releases in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with 19.15.30 NMAC.* [emphasis added]

Release characterization is the first phase of corrective action unless the release is ongoing or is of limited volume and all impacts can be immediately addressed. Proper and cost-effective remediation typically cannot occur without adequate characterization of the impacts of any release. Furthermore, the Division has the ability to impose reasonable conditions upon the efforts it oversees. **As such, the Division is requiring a workplan for the characterization of impacts associated with this release be submitted to the OCD District _1_ office in __Hobbs____ on or before _2/10/2018_. If and when the release characterization workplan is approved, there will be an associated deadline for submittal of the resultant investigation report. Modest extensions of time to these deadlines may be granted, but only with acceptable justification.**

The goals of a characterization effort are: 1) determination of the lateral and vertical extents along with the magnitude of soil contamination. 2) determine if groundwater or surface waters have been impacted. 3) If groundwater or surface waters have been impacted, what are the extents and magnitude of that impact. 4) The characterization of any other adverse impacts that may have occurred (examples: impacts on vegetation, impacts on wildlife, air quality, loss of use of property, etc.). To meet these goals as quickly as possible, the following items must, at a minimum, be addressed in the release characterization workplan and subsequent reporting:

● Horizontal delineation of soil impacts in each of the four cardinal compass directions. Adsorbed soil contamination must be characterized for the following constituents using the associated laboratory methods: benzene, toluene, ethylbenzene, and total xylenes by either Method 8260 or 8021, total petroleum hydrocarbons by Method 8015 extended range (GRO+DRO+MRO; C_6 thru C_{36}), and for chloride by Method 300. This is not an exclusive list of potential contaminants. Analyzed parameters should be modified based on the nature of the released substance(s). Soil sampling must be both within the impacted area and beyond.

● Vertical delineation of soil impacts. Adsorbed soil contamination must be characterized for the following constituents using the associated laboratory methods: benzene, toluene, ethylbenzene, and total xylenes by either Method 8260 or 8021, total petroleum hydrocarbons by Method 8015 extended range (GRO+DRO+MRO; C_6 thru C_{36}), and for chloride by Method 300. As above, this is not an exclusive list of potential contaminants and can be modified. Vertical characterization samples should be taken at depth intervals no greater than five feet apart. Lithologic description of encountered soils must also be provided. At least ten vertical feet of soils with contaminant concentrations at or below these values must be demonstrated as existing above the water table.

● Nominal detection limits for field and laboratory analyses must be provided.

● Composite sampling is not generally allowed.

● Field screening and assessment techniques are acceptable (headspace, titration, EC [include algorithm for validation purposes], EM, etc.), but the sampling and assay procedures must be clearly defined. Copies of field notes are highly desirable. A statistically significant set of split samples must be submitted for confirmatory laboratory analysis, including the laterally farthest and vertically deepest sets of soil samples. Make sure there are at least two soil samples submitted

for laboratory analysis from each borehole or test pit (highest observed contamination and deepest depth investigated). Copies of the actual laboratory results must be provided including chain of custody documentation.

●Probable depth to shallowest protectable groundwater and lateral distance to nearest surface water. If there is an estimate of groundwater depth, the information used to arrive at that estimate must be provided. If there is a reasonable assumption that the depth to protectable water is 50 feet or less, the responsible party should anticipate the need for at least one groundwater monitoring well to be installed in the area of likely maximum contamination.

● If groundwater contamination is encountered, an additional investigation workplan may be required to determine the extents of that contamination. Groundwater and/or surface water samples, if any, must be analyzed by a competent laboratory for volatile organic hydrocarbons (typically Method 8260 full list), total dissolved solids, pH, major anions and cations including chloride and sulfate, dissolved iron, and dissolved manganese. The investigation workplan must provide the groundwater sampling method(s) and sample handling protocols. To the fullest extent possible, aqueous analyses must be undertaken using nominal method detection limits. As with the soil analyses, copies of the actual laboratory results must be provided including chain of custody documentation.

● Accurately scaled and well-drafted site maps must be provided providing the location of borings, test pits, monitoring wells, potentially impacted areas, and significant surface features including roads and site infrastructure that might limit either the release characterization or remedial efforts. Field sketches may be included in subsequent reporting, but should not be considered stand-alone documentation of the site's layout. Digital photographic documentation of the location and fieldwork is recommended, especially if unusual circumstances are encountered.

Nothing herein should be interpreted to preclude emergency response actions or to imply immediate remediation by removal cannot proceed as warranted. Nonetheless, characterization of impacts and confirmation of the effectiveness of remedial efforts must still be provided to the OCD before any release incident will be closed.

Jim Griswold
OCD Environmental Bureau Chief
1220 South St. Francis Drive
Santa Fe, New Mexico 87505
505-476-3465
jim.griswold@state.nm.us

APPENDIX B

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

IN THE MATTER OF THE: **CASE NO. 15959**

APPLICATION OF THE NEW MEXICO OIL CONSERVATION DIVISION TO REPEAL AND REPLACE RULE 19.15.29 NMAC; STATEWIDE.

APPLICATION

The New Mexico Oil Conservation Division hereby applies to the Oil Conservation Commission to rename and repeal and replace 19.15.29 NMAC. The proposed name change from "Release Notification" to "Releases" and the purpose of the repealed and replaced rule is to refine existing terms, define new terms, and clarify the process for responding to releases of oil, gases, produced water, condensate, or oil field waste including regulated NORM, or other oil field related chemicals, contaminants or mixtures of those chemicals or contaminants that occur during drilling, producing, storing, disposing, injecting, transporting, servicing, or processing and to establish reporting, site assessment, remediation, closure, variance, and enforcement procedures.

A draft of the proposed amendments to 19.15.29 NMAC is attached hereto as *Exhibit A*. A proposed legal notice for publication is attached hereto as *Exhibit B*. A copy of the New Mexico Commission of Public Records approval of the name change is attached hereto as *Exhibit C*.

Respectfully submitted,

Keith Herrmann
Assistant General Counsel
New Mexico Energy Minerals and Natural Resources Department
1220 S. St. Francis Drive
Santa Fe, NM 87505
(505) 476-3463
Keith.Herrmann@state.nm.us

Exhibit A – Proposed Rule 19.15.29 NMAC:

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 15 OIL AND GAS
PART 29 RELEASES

19.15.29.1 ISSUING AGENCY: Oil Conservation Commission.
[19.15.29.1 NMAC – Rp, 19.15.29.1 NMAC, XX/XX/201?]

19.15.29.2 SCOPE: 19.15.29 NMAC applies to persons engaged in oil and gas development and production within New Mexico.
[19.15.29.2 NMAC – Rp, 19.15.29.2 NMAC, XX/XX/201?]

19.15.29.3 STATUTORY AUTHORITY: 19.15.29 NMAC is adopted pursuant to the Oil and Gas Act, Section 70-2-11 NMSA 1978 (1977) and Section 70-2-12 NMSA 1978 (2004).
[19.15.29.3 NMAC – Rp, 19.15.29.3 NMAC, XX/XX/201?]

19.15.29.4 DURATION: Permanent.
[19.15.29.4 NMAC - Rp, 19.15.29.4 NMAC, XX/XX/201?]

19.15.29.5 EFFECTIVE DATE: _____, unless a later date is cited at the end of a section.
[19.15.29.5 NMAC – Rp, 19.15.29.5 NMAC, XX/XX/201?]

19.15.29.6 OBJECTIVE: To require persons who operate or control the release or the location of the release to report the unauthorized release of oil, gases, produced water, condensate or oil field waste including regulated NORM, or other oil field related chemicals, contaminants or mixtures of those chemicals or contaminants that occur during drilling, producing, storing, disposing, injecting, transporting, servicing or processing and to establish reporting, site assessment, remediation, closure, variance and enforcement procedures.
[19.15.29.6 NMAC – Rp, 19.15.29.6 NMAC, XX/XX/201?]

19.15.29.7 DEFINITIONS:

A. "Major release" means:

(1) an unauthorized release of a volume, excluding gases, of 25 barrels or more;

(2) an unauthorized release of a volume that:

(a) results in a fire or a fire causes;

(b) may with reasonable probability reach a watercourse;

(c) may with reasonable probability endanger public health; or

(d) substantially damages property or the environment;

(3) an unauthorized release of gases exceeding 500 MCF; or

(4) a release of a volume that may with reasonable probability be detrimental to fresh water.

B. "Minor release" means an unauthorized release, which is not a major release and is a volume greater than five barrels but less than 25 barrels; or for gases, greater than 50 MCF but less than 500 MCF.

C. "Responsible Party" means the operator, as defined in 19.15.2 NMAC. Notwithstanding the foregoing, the division, in its sole discretion, may also consider a person causing the release, or controlling the location of the release as the responsible party.
[19.15.29.7 NMAC – Rp, 19.15.29.7 NMAC, XX/XX/201?]

19.15.29.8 RELEASE NOTIFICATION:

A. The responsible party must notify the division on form C-141 of a major or minor release occurring during the drilling, producing, storing, disposing, injecting, transporting, servicing or processing of oil, gases, produced water, condensate or oil field waste including regulated NORM, or other oil field related chemicals, contaminants or mixture of the chemicals or contaminants, in accordance with the requirements of 19.15.29 NMAC.

B. If state, federal or tribal lands are involved, the responsible party must send a copy of the form C-141 to the appropriate land managing agency including the State Land Office, the Bureau of Land Management or tribal authority, as applicable.
[19.15.29.8 NMAC – Rp, 19.15.29.8 NMAC, XX/XX/201?]

19.15.29.9 RELEASE NOTIFICATION REPORTING REQUIREMENTS: The responsible party must notify the division of releases in 19.15.29.8 NMAC as follows.

A. Reporting a Major Release.

(1) The responsible party must notify the division's environmental bureau chief and the appropriate division district office verbally or by e-mail within 24 hours of discovery of the release. The notification must provide the information required on form C-141.

(2) The responsible party must also notify the appropriate division district office in writing within 15 days of discovering the release by completing and filing form C-141. The written notification must verify the prior verbal or e-mail notification and include additions or corrections to the information contained in the prior verbal or e-mail notification.

B. Reporting a Minor Release. The responsible party must notify the appropriate division district office in writing within 15 days of discovery of the release by completing and filing form C-141.

[19.15.29.9 NMAC – Rp, 19.15.29.9 NMAC, XX/XX/201?]

19.15.29.10 INITIAL RESPONSE: The responsible party must take the following immediate actions unless the actions could create a safety hazard that would result in injury.

A. Source Elimination and Site Security. The responsible party must take appropriate measures to stop the source of the release and limit access to the site as necessary to protect human health and the environment.

B. Containment. Once the site is secure, the responsible party must contain the materials released by construction of berms or dikes, the use of absorbent pads or other containment actions to limit the area affected by the release and prevent potential fresh water contaminants from migrating to watercourses or areas which could pose a threat to public health and environment. The responsible party must monitor the containment to ensure that it is effectively containing the material and not being degraded by weather or onsite activity.

C. Site Stabilization. After containment, the responsible party must recover any free liquids and recoverable product that can be physically removed from the surface within the containment area. The responsible party must deliver material removed from the site to a division-approved facility.

[19.15.29.10 NMAC – Rp, 19.15.29.10 NMAC, XX/XX/201?]

19.15.29.11 SITE ASSESSMENT/CHARACTERIZATION: After the responsible party has removed all free liquids and recoverable products, the responsible party must assess soils both vertically and horizontally for potential environmental impacts from the release.

A. Characterization Requirements: The responsible party must submit information characterizing the release to the appropriate division district office within 90 days of discovery of the release or characterize the site by submitting a final closure report within 90 days of discovery of the release in accordance with 19.15.29 NMAC. The responsible party may seek an extension of time to submit characterization information for good cause as determined by the division. The responsible party must submit the following information to the division.

(1) Site Map. The responsible party must provide a scaled diagram that shows the potentially impacted area, significant surface features including roads and site infrastructure, location of borings, sample points, monitoring wells and subsurface features such as known pipelines to the extent known at the time of submittal including the source of information regarding subsurface features.

(2) Depth to Ground Water. The responsible party must determine the depth to ground water where the release occurred. If the exact depth to ground water is unknown, the responsible party must provide a reasonable determination of probable ground water depth using data generated by numeric models, cathodic well lithology, water well data, published information or other tools as approved by the appropriate division district office. If the responsible party uses water well data, the responsible party must provide all pertinent well information.

(3) Wellhead Protection Area. The responsible party must determine the horizontal distance from all known water sources within a half mile of the release including private and domestic water sources. Water sources are wells, springs or other sources of fresh water extraction. Private and domestic water sources are those water sources used by less than five households for domestic or stock purposes.

(4) Distance to Nearest Significant Watercourse. The responsible party must determine the horizontal distance to the nearest significant watercourse as defined in Subsection P of 19.15.17.7 NMAC.

(5) Soil/Waste Characteristics. The responsible party must determine the lateral and vertical extents of soil contamination, as follows.

(a) If the release occurred within a lined containment area, the responsible party must demonstrate liner integrity after affected material is removed and the affected area of the liner is exposed and provide:

(i) certification on form C-141 that the responsible party has visually inspected the liner where the release occurred and the liner remains intact and had the ability to contain the leak in question; and

(ii) at least two business days' notice to the appropriate division district office before conducting the liner inspection.

(b) If the responsible party is unable to demonstrate liner integrity or the release occurred outside of a lined containment area, the responsible party must delineate the release horizontally and vertically using Table I constituents or other constituents as appropriate for the type of the release. The operator may use the following soil sampling methods for characterization.

(i) NRCS Field Guide;

(ii) EPA SW-846;

(iii) ASTM Method 4547;

(iv) EPA 600; or

(v) or other division-approved methods.

(c) In addition to Subparagraph (b) of Paragraph (5) of Subsection A of 19.15.29.11 NMAC, if the release occurred outside of a lined containment area and is in an area where depth to ground water is greater than 50 feet and less than or equal to 100 feet, the responsible party must delineate the vertical extent of the release to the greater of 600 mg/kg chloride or background chloride level, if:

(i) the release contains produced water that exceeds 10,000 mg/l of chloride (if the responsible party contends the fluid is less than 10,000 mg/l, the responsible party must provide current sample results to the division); and

(ii) the release is of an unknown quantity or results in greater than 200 barrels of unrecovered produced water.

(d) If the conditions are met in Subparagraph (c) of Paragraph (5) of Subsection A of 19.15.29.11 NMAC, the responsible party must submit at least two soil samples for laboratory analysis from each borehole or sample point (highest observed contamination and deepest depth investigated). Field screening and assessment techniques are acceptable (headspace, titration, electrical conductivity [include algorithm for validation purposes], electromagnetics, etc.), but the sampling procedures must be clearly defined. The responsible party must submit copies of field notes attributable to field sampling and provide copies of the actual laboratory results including chain of custody documentation.

B. Unless the site characterization report includes completed efforts at remediation, the report must include a proposed remediation plan in accordance with 19.15.29.12 NMAC, which includes the anticipated timelines for beginning and completing the remediation.

C. If the division determines that more information is needed to understand the character of the release and its potential impact on fresh water, public health and the environment, the division may request the responsible party submit additional information. Should the division request additional information, it must do so in writing to the responsible party within 30 days from receipt of the characterization report or remediation plan with what specific information the division is requesting and reasons why the additional information is needed. The responsible party has 14 days to respond to a written request for additional information. If the responsible party disagrees with the request for additional information, it may consult with the division, or file an application for hearing pursuant to 19.15.4 NMAC within 30 days of the issuance of the conditions.

19.15.29.12 REMEDIATION AND CLOSURE:

A. The responsible party must remediate all releases regardless of volume.

B. The responsible party must complete division-approved remediation for releases that endanger public health or the environment within 90 days of division approval of a remediation plan or with an abatement plan the responsible party submitted to the division in accordance with 19.15.30 NMAC. The responsible party may request an extension of time to remediate upon a showing of good cause as determined by the division. If the director determines that the release has caused water pollution in excess of the standards and requirements of 19.15.30 NMAC, the director may notify the responsible party that an abatement plan may be required pursuant to 19.15.30 NMAC.

(1) **Remediation Plan Requirements.** The responsible party must submit a detailed description of proposed remediation measures in accordance with the findings of the site assessment/characterization plan that includes:

(a) delineation results, including laboratory analysis;

(b) a scaled sitemap showing release area with horizontal and vertical delineation points;

(c) estimated volume of impacted material to be remediated;

(d) proposed remediation technique; and

(e) proposed timeline for remediation activities.

(2) The responsible party shall restore the impacted surface area of a release occurring on a lined, bermed or otherwise contained exploration, development, production or storage site to the condition that existed prior to the release. Restoration of the site must include, but is not limited to, removal of materials the release contaminated and replacement with clean, uncontaminated materials. The responsible party must place the replacement materials to the near original relative positions and contour the replacement materials so as to achieve erosion control, long-term stability and preservation of surface water.

(3) The responsible party shall remediate the impacted surface area of a release not occurring on a lined, bermed or otherwise contained exploration, development, production or storage site to meet the standards of Table I of 19.15.29.12 NMAC and contain a minimum of four feet of non-waste material containing, uncontaminated, earthen material with chloride concentrations less than 600 mg/kg as analyzed by EPA Method 300.0. The soil cover must include a top layer which is either the background thickness of topsoil or one foot of suitable material to establish vegetation at the site, whichever is greater.

(4) If a release occurs within the following areas, the responsible party must treat the release as if it occurred less than 50 feet to ground water in Table I of 19.15.29.12 NMAC:

(a) within

(i) 300 feet of any continuously flowing watercourse or any other significant watercourse, or

(ii) 200 feet of any lakebed, sinkhole or playa lake (measured from the ordinary high-water mark);

(b) within 300 feet from an occupied permanent residence, school, hospital, institution or church;

(c) within

(i) 500 feet of a spring or a private, domestic fresh water well used by less than five households for domestic or stock watering purposes, or

(ii) 1000 feet of any fresh water well or spring;

(d) within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to Section 3-27-3 NMSA 1978 as amended, unless the municipality specifically approves;

(e) within 100 feet of a wetland;

(f) within the area overlying a subsurface mine;

(g) within an unstable area; or

(h) within a 100-year floodplain.

B. The division has 30 days from receipt of the proposed remediation plan to review and approve, approve with conditions, or deny the remediation plan. If 30 days have lapsed without response from the division, then the plan is deemed denied and the responsible party may file an application for a hearing pursuant to 19.15.4 NMAC within 30 days. If the responsible party disagrees with any conditions of approval or denial of the plan, it may consult with the division or file an application for hearing pursuant to 19.15.4 NMAC within 30 days of the denial or issuance of the conditions.

C. Closure Requirements.

(1) The responsible party must test the remediated areas for contamination with representative five-point composite samples and individual grab samples from any wet or discolored areas. The samples must be analyzed for the constituents listed in Table I of 19.15.29.12 NMAC.

(a) The responsible party must verbally notify the appropriate division district office two business days prior to conducting final sampling. If the division district office does not respond to the notice within the two business days, the responsible party may proceed with final sampling. The responsible party may request a variance from this requirement upon a showing of good cause as determined by the division.

(b) There must be separate representative wall and base 5-point composite samples to show horizontal and vertical remediation. Each composite sample must not be representative of more than 200 ft^2. The division may add additional sampling requirements dependent on the material released and any risks to human health or the environment.

(c) The responsible party may submit an alternative sampling plan for the division's review and approval. If a division inspector is witnessing the samples, the division inspector is authorized to verbally approve an alternative sampling plan based on site observations.

(2) If all composite and grab sample concentrations are less than or equal to the parameters listed in Table I or any conditions of approval, then the responsible party may proceed to backfill any excavated areas.

D. Closure Reporting.

(1) The responsible party must submit to the division a closure report on form C-141, including required attachments, to document all closure activities including sampling results and the details on any backfilling, capping or covering, where applicable. The responsible party must certify that all information in the closure report and attachments is correct and that the responsible party has complied with all applicable closure requirements and conditions specified in division rules or directives. The responsible party must submit closure report along with form C-141 to the division within 90 days of the remediation plan approval. The responsible party may apply for additional time to submit the final closure report upon a showing of good cause as determined by the division. The final report must include:

(a) a scaled site and sampling diagram;

(b) photographs of the remediated site prior to backfill;

(c) laboratory analyses of final sampling; and

(d) a description of all remedial activities.

(2) The division district office has 60 days to review and approve or deny the closure report. If the responsible party disagrees with denial of the closure report, it may consult with the division or file an application for hearing pursuant to 19.15.4 NMAC within 30 days of the denial.

Table I
Closure Criteria for Soils Impacted by a Release

Depth below bottom of release to ground water less than 10,000 mg/l TDS	Constituent	Method*	Limit**
≤ 50 feet	Chloride***	EPA 300.0	600 mg/kg
	TPH	EPA SW-846 Method 8015M	100 mg/kg
	BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
	Benzene	EPA SW-846 Method 8021B or 8015M	10 mg/kg
51 feet-100 feet	Chloride***	EPA 300.0	10,000 mg/kg
	TPH	EPA SW-846 Method 8015M	2,500 mg/kg
	GRO+DRO	EPA SW-846 Method 8015M	1,000 mg/kg
	BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
	Benzene	EPA SW-846 Method 8021B or 8260B	10 mg/kg
➢ 100 feet	Chloride***	EPA 300.0	20,000 mg/kg
	TPH	EPA SW-846 Method 8015M	2,500 mg/kg
	GRO+DRO	EPA SW-846 Method 8015M	1,000 mg/kg

	BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
	Benzene	EPA SW-846 Method 8021B or 8015M	10 mg/kg

*Or other test methods approved by the division.
**Numerical limits or natural background level, whichever is greater.
***This applies to releases of produced water or other fluids which may contain chloride.
[19.15.29.12 NMAC – N, XX/XX/201?]

19.15.29.13 RESTORATION, RECLAMATION AND RE-VEGETATION:

A. The responsible party must substantially restore the impacted surface areas to the condition that existed prior to the release. Restoration of the site must include the replacement of removed material and must be replaced to the near original relative positions and contoured to achieve erosion control, long-term stability and preservation of surface water flow patterns.

B. Areas reasonably needed for production operations or for subsequent drilling operations must be compacted, covered, paved or otherwise stabilized and maintained in such a way as to minimize dust and erosion to the extent practical.

C. The responsible party must construct the soil cover to the site's existing grade and prevent ponding of water and erosion of the cover material.

D. Reclamation of Areas No Longer in Use. The responsible party shall reclaim all areas disturbed by the remediation and closure, except areas reasonably needed for production operations or for subsequent drilling operations, as early and as nearly as practical to their original condition or their final land use and maintain those areas to control dust and minimize erosion to the extent practical.

(1) The responsible party must reseed disturbed area in the first favorable growing season following closure of the site.

(2) The division will consider reclamation of all disturbed areas complete when uniform vegetative cover has been established that reflects a life-form ratio of plus or minus fifty percent of pre-disturbance levels and a total percent plant cover of at least seventy percent of pre-disturbance levels, excluding noxious weeds.

(3) The responsible party must notify the division when reclamation and re-vegetation are complete.

E. The surface restoration, reclamation and re-vegetation obligations imposed by federal, state agencies or tribes on lands managed or owned by those agencies supersede these provisions and govern the obligations of any responsible party subject to those provisions, provided that the other requirements provide equal or better protection of fresh water, human health and the environment.
[19.15.29.13 NMAC – N, XX/XX/201?]

19.15.29.14 VARIANCES:

A. A responsible party may file a written request for a variance from any requirement of 19.15.29 NMAC with the appropriate division district office. The variance request must include:

(1) a detailed statement explaining the need for a variance; and

(2) a detailed written demonstration that the variance will provide equal or better protection of fresh water, public health and the environment.

B. The division district office must approve or deny the variance in writing within 60 days of receipt. If the division district office denies the variance, it must provide the responsible party with the reasons for denial.

C. If the division district office does not approve or deny a request for variance from the requirements of this rule within 60 days, of the date of the request for variance is received by the division district office, then the plan is deemed denied and the responsible party may file an application for a hearing pursuant to 19.15.4 NMAC within 30 days of the denial.

D. If the responsible party requests a hearing pursuant to 19.15.4 NMAC within 30 days after receipt of notice, the division must set the matter for hearing with notice to the responsible and appropriate division district office.

E. In addition to the notice provisions in 19.15.4 NMAC, the responsible party must provide notice of the hearing on the request for variance to the surface owner of the site by certified mail, return receipt requested, at least 20 days prior to the date of the hearing.

F. Variances must receive division approval prior to implementation.
[19.15.29.14 NMAC – N, XX/XX/201?]

19.15.29.15 ENFORCEMENT:

A. The responsible party must comply with all the requirements of 19.15.29 NMAC. The division may take enforcement action against any responsible party who does not comply with 19.15.29 NMAC.

B. A responsible party may enter an agreed compliance order with the division for any violation of 19.15.29 NMAC, except for 19.15.29.9 NMAC. An agreed compliance order may be entered prior to or after the filing of an application by the division or any other party for an administrative compliance proceeding. Any administrative compliance order will have the same force and effect as a compliance order issued after an adjudicatory hearing.

C. The director or the director's designee may deny a permit to drill, deepen or plug back any application if the responsible party is not in compliance with a court order, agreed compliance order or administrative compliance order arising from 19.15.29 NMAC.

D. If the division or other party files an administrative enforcement application, the provisions of 19.15.4 NMAC apply to the enforcement proceeding, unless altered or amended by 19.15.5.10 NMAC or 19.15.29 NMAC.

[19.15.29.15 NMAC – N, XX/XX/201?]

19.15.29.16 TRANSITIONAL PROVISIONS:

A. Responsible parties with current ongoing corrective actions/remediation with approved plans and timelines as of _____ (effective date of rule) do not have to submit revised plans.

B. Responsible parties with ongoing corrective actions/remediation without approved timelines or plans as of _____ (effective date of rule) must submit a characterization plan or corrective action/remediation plan with proposed timeframes within 90 days of ____ (effective date of rule).

[19.15.29.16 NMAC – N, XX/XX/201?]

APPENDIX C

PLUGGING RECORD

NOTE: A Well Plugging Plan of Operations shall be approved by the State Engineer prior to plugging - 19.27.4 NMAC

I. GENERAL / WELL OWNERSHIP:

State Engineer Well Number: L-13339

Well owner: Purvis Operating Company Phone No.: 432-682-7346

Mailing address: 3101 N PECOS

City: Midland State: TEXAS Zip code: 79705

II. WELL PLUGGING INFORMATION:

1) Name of well drilling company that plugged well: Atkins Engineering Associates, Inc.

2) New Mexico Well Driller License No.: 1249 Expiration Date: 4/30/2015

3) Well plugging activities were supervised by the following well driller(s)/rig supervisor(s): Chris Phillips

4) Date well plugging began: 6-4-2013 Date well plugging concluded: 6-4-2013

5) GPS Well Location: Latitude: 33 deg, 2 min, 8.77 sec
Longitude: 103 deg, 26 min, 28.56 sec, WGS 84

6) Depth of well confirmed at initiation of plugging as: 21 ft below ground level (bgl),
by the following manner: Weighted Tape/ Average Measurement.

7) Static water level measured at initiation of plugging: NA ft bgl

8) Date well plugging plan of operations was approved by the State Engineer: 5/30/2013

9) Were all plugging activities consistent with an approved plugging plan? YES If not, please describe differences between the approved plugging plan and the well as it was plugged (attach additional pages as needed):

STATE ENGINEER OFFICE
2013 JUN 13 A 8:33

10) Log of Plugging Activities - Label vertical scale with depths, and indicate separate plugging intervals with horizontal lines as necessary to illustrate material or methodology changes. Attach additional pages if necessary.

For each interval plugged, describe within the following columns:

Depth (ft bgl)	Plugging Material Used (include any additives used)	Volume of Material Placed (gallons)	Theoretical Volume of Borehole/ Casing (gallons)	Placement Method (tremie pipe, other)	Comments ("casing perforated first", "open annular space also plugged", etc.)
0	Baroid Hole Plug	Approx. 15 gallons (3 bags)	30.35	Through HSA	landed through HSA some sluff when removing augers
5					
10					
15	backfill				
20					
21 T.D.					

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ROSWELL, NEW MEXICO
2013 JUN 13 A 8:33

MULTIPLY		BY		AND OBTAIN
cubic feet	x	7.4805	=	gallons
cubic yards	x	201.97	=	gallons

III. SIGNATURE:

I, Jackie D. Atkins, say that I am familiar with the rules of the Office of the State Engineer pertaining to the plugging of wells and that each and all of the statements in this Plugging Record and attachments are true to the best of my knowledge and belief.

Jackie D. Atkins — Signature of Well Driller

6/12/2013 — Date

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
SB-1	L-13339
WELL OWNER NAME(S)	**PHONE (OPTIONAL)**
Purvis Operating Company	432-682-7346
WELL OWNER MAILING ADDRESS	**CITY / STATE / ZIP**
3101 N PECOS	MIDLAND / TX / 79705

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	33	2	8.77	N
LONGITUDE	103	26	28.56	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS

Near Tank Battery of Purvis Operating Co. Antelope No.1 well (API: 30-025-38867)

2. OPTIONAL

(2.5 ACRE)	(10 ACRE)	(40 ACRE)	(160 ACRE)	SECTION	TOWNSHIP	RANGE
¼	¼	¼	¼		☐ NORTH ☐ SOUTH	☐ EAST ☐ WEST

SUBDIVISION NAME	LOT NUMBER	BLOCK NUMBER	UNIT/TRACT

HYDROGRAPHIC SURVEY	MAP NUMBER	TRACT NUMBER

3. DRILLING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
1249	Jackie D. Atkins	Atkins Engineering Associates, Inc

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
6/4/2013	6/4/2013	NA	21	NA

COMPLETED WELL IS: ☐ ARTESIAN ☑ DRY HOLE ☐ SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): NA

DRILLING FLUID: ☐ AIR ☐ MUD ☐ ADDITIVES - SPECIFY: None

DRILLING METHOD: ☐ ROTARY ☐ HAMMER ☐ CABLE TOOL ☑ OTHER - SPECIFY: HSA

DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)
0	21	8.625	NA	NA	NA	NA	NA

4. WATER BEARING STRATA

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	YIELD (GPM)
0	21	NA	NA	NA

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: NA

TOTAL ESTIMATED WELL YIELD (GPM): NA

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FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	L-13339	POD NUMBER	1	TRN NUMBER	528530
LOCATION	Exp1	15S.35E.7.223		PAGE 1 OF 2	

5. SEAL AND PUMP

TYPE OF PUMP: ☐ SUBMERSIBLE ☐ JET ☐ NO PUMP – WELL NOT EQUIPPED
☐ TURBINE ☐ CYLINDER ☐ OTHER – SPECIFY: NA

ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
	0	21	8.625	NA	NA	NA

6. GEOLOGIC LOG OF WELL

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
0	2	2	Silt Clay dark brown, with some silt & very fine grain sand.	☐ YES ☑ NO
2	10	8	Caliche grayish brown, with some silt & very fine grain sand.	☐ YES ☑ NO
10	11	1	Silt and light grayish brown Caliche.	☐ YES ☑ NO
11	19	8	Caliche light grayish brown, hard, turning more silty with depth.	☐ YES ☑ NO
19	21	2	Silty Sand light grayish brown, very fine grain, poorly sorted.	☐ YES ☑ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO

ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL

7. TEST & ADDITIONAL INFO

WELL TEST — METHOD: ☐ BAILER ☐ PUMP ☐ AIR LIFT ☐ OTHER – SPECIFY: NA

TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

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2013 JUN 13 A 8:32

ADDITIONAL STATEMENTS OR EXPLANATIONS:
Dry Bore Hole.

8. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

SIGNATURE OF DRILLER — DATE: 6/12/2013

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

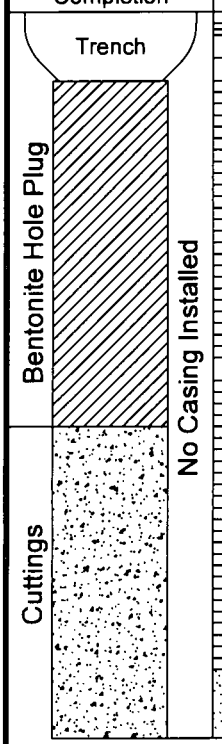
FILE NUMBER	L-13339	POD NUMBER	1	TRN NUMBER	528530
LOCATION	Exp1	15S.35E.7.223		PAGE 2 OF 2	

LITHOLOGIC LOG (Soil Boring)

R.T. Hicks Consultants, LTD

P O Box 7624
Midland, Texas 79708

SOIL BORING NO.: SB-1 | TOTAL DEPTH: 21 Feet
SITE ID: Antelope Battery | CLIENT: Purvis Operating Co.
SURFACE ELEVATION: 4,037 (C-102) | COUNTY: Lea County
CONTRACTOR: Atkins Engineering | STATE: New Mexico
DRILLING METHOD: Hollow-Stem | LOCATION: T15S R35E Sec 7
INSTALLATION DATE: June 4, 2013 | FIELD REP: D. Littlejohn
WELL PLACEMENT: West of Oil Tanks | FILE NAME: \Purvis\SB-1
BORING LAT /LONG: Lat. 33° 2' 8.77" North, Long. 103° 26' 28.56" West



Lithology	Type	% Rec	Cl (mg/kg)	PID (ppm)	Depth (feet)	Lithologic Description: LITHOLOGY, Color, grain size, sorting, rounding, special features
						SILT CLAY Dark brown capped by 6-inch caliche pad.
	Excav.	100	496 (lab)	13.1 (benz)		CALICHE Grayish brown, with some silt and very fine grain sand.
					5	
	Spoon	<5	101	14		Very hard, recovered sample only from shoe
					10	
	Spoon	10	111	0		SILT and Light grayish brown caliche.
						CALICHE Light grayish brown, hard, becoming more silty with depth.
					15	
	Cutting	–	82	0		
	Spoon	100	59	0	20	SILTY SAND Light grayish brown, very fine grain, poorly sorted.

TD = 21 Feet

L-13339
528530

Atkins
ENGINEERING ASSOCIATES INC.

2904 W 2nd St.
Roswell, NM 88201
voice: 575.624.2420
fax: 575.624.2421
www.atkinseng.com

6/12/2013

Office of the State Engineer, District II
1900 W 2nd St.
Roswell, NM 88201

Hand-delivered to the District II Office of the State Engineer on the date of this letter.

RE: Drilling and Abandonment of L-13339-POD1

To whom it may concern:

Atkins Engineering Associates, Inc. (AEA) has completed the drilling and the plugging and abandonment of exploratory well L-13339-POD1.

Attached please find the well record and the plugging record.

If you have any questions, please contact me at (575)624-2420 or chris@atkinseng.com

Sincerely,

Justin Noles

Enclosures: well record (3) , Plugging Record (3)

APPENDIX D

CARDINAL Laboratories

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

January 18, 2018

ANDREW PARKER

R T HICKS CONSULTANTS

901 RIO GRANDE BLVD SUITE F-142

ALBUQUERQUE, NM 87104

RE: PURVIS ANTELOPE #1

Enclosed are the results of analyses for samples received by the laboratory on 01/12/18 10:50.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-17-10. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

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

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

Accreditation applies to public drinking water matrices.

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

Sincerely,

Celey D. Keene

Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

R T HICKS CONSULTANTS
ANDREW PARKER
901 RIO GRANDE BLVD SUITE F-142
ALBUQUERQUE NM, 87104
Fax To: NONE

Received:	01/12/2018	Sampling Date:	01/11/2018
Reported:	01/18/2018	Sampling Type:	Soil
Project Name:	PURVIS ANTELOPE #1	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Tamara Oldaker
Project Location:	NOT GIVEN		

Sample ID: PAD NORTHWEST @ 5" (H800138-01)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	01/15/2018	ND	2.14	107	2.00	0.521	
Toluene*	**0.426**	0.050	01/15/2018	ND	2.16	108	2.00	0.239	
Ethylbenzene*	**0.546**	0.050	01/15/2018	ND	2.15	107	2.00	0.359	
Total Xylenes*	**1.53**	0.150	01/15/2018	ND	6.67	111	6.00	0.965	
Total BTEX	**2.50**	0.300	01/15/2018	ND					

Surrogate: 4-Bromofluorobenzene (PID *112 %* *72-148*

Chloride, SM4500Cl-B mg/kg Analyzed By: AC

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**224**	16.0	01/15/2018	ND	448	112	400	3.64	

TPH 8015M mg/kg Analyzed By: MS S-04

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10*	**56.6**	10.0	01/16/2018	ND	228	114	200	1.07	
DRO >C10-C28*	**4000**	10.0	01/16/2018	ND	231	115	200	5.45	
EXT DRO >C28-C36	**758**	10.0	01/16/2018	ND					

Surrogate: 1-Chlorooctane *98.4 %* *41-142*

Surrogate: 1-Chlorooctadecane *216 %* *37.6-147*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Notes and Definitions

S-04	The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.
QR-03	The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.
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

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

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

Company Name: R.T. Hicks Consultants
Project Manager: Andrew Parker
Address: 901 Rio Grande Blvd NW, F-142
City: Albuquerque State: NM Zip: 87104
Phone #: 505-266-5004 Fax #:
Project #: Project Owner:
Project Name: Purvis Antelope #1
Project Location:
Sampler Name: D. Barr

BILL TO

P.O. #:
Company: RT Hicks
Attn:
Address:
City:
State: Zip:
Phone #:
Fax #:

ANALYSIS REQUEST

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRESERV.: ACID/BASE:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME	BTEX	DRO/GRO/MRO	Chloride
H800138-1	Pad NorthWest @ 5 in.	G	1			X					X		1-11-18	1412	X	X	X

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.

Relinquished By: Donnie Barr	Date: 1-12-18 Time: 1022	Received By: Kristin Pope	
Relinquished By: Kristin Pope	Date: 1-12-18 Time: 10:50	Received By: Tamara	
Delivered By: (Circle One) Sampler - UPS - Bus - Other:	3.4° Corrected 3.4°	Sample Condition: Cool Yes / No; Intact Yes / No	CHECKED BY: (Initials) TO #75

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☐ Yes ☐ No Add'l Fax #:
REMARKS: andrew@rthicksconsult.com

Cardinal cannot accept verbal changes. Please fax written changes to (575) 393-2326

APPENDIX E

Standard Operating Procedures

- PID Soil Screening
- Chloride Titration

Photo-Ionization Detector (PID) Standard Operating Procedures

Headspace analysis procedures should be conducted according to NMOCD approved industry standards or other NMOCD-approved procedures. Accepted NMOCD procedures are as follows:

a) Fill a 0.5 liter or larger jar half full of sample and seal the top tightly with aluminum foil or fill a one quart zip-lock bag one-half full of sample and seal the top of the bag leaving the remainder of the bag filled with air.

b) Ensure that the sample temperature is between 15 to 25 degrees Celsius (59-77 degrees Fahrenheit).

c) Allow aromatic hydrocarbon vapors to develop within the headspace of the sample jar or bag for 5 to 10 minutes. During this period, the sample jar should be shaken vigorously for 1 minute or the contents of the bag should be gently massaged to break up soil clods.

d) If using a jar, pierce the aluminum foil seal with the probe of either a PID or FID organic vapor meter (OVM), and then record the highest (peak) measurement. If using a bag, carefully open one end of the bag and insert the probe of the OVM into the bag and re-seal the bag around the probe as much as possible to prevent vapors from escaping. Record the peak measurement. The OVM must be calibrated to assume a benzene response factor.

FIELD PROCEDURE
Chloride Titration Using
0.282 Normal Silver Nitrate Solution

1.0 Purpose

This procedure is to be used to determine the concentration of chloride in soil and other solids (e.g. drilling waste).

2.0 Scope

This procedure is to be used as the standard field measurement for soil chloride concentrations.

3.0 Sample Collection and Preparation

3.1 Collect at least 80 grams of soil from the sample collection point. Take care to ensure that the sample is representative of the general area of concern to include visible concentrations of hydrocarbons and soil types. If necessary, prepare a composite sample for soils obtained at several points in the sample area.

3.2 The soil sample(s) shall be immediately inserted into a one-quart or larger polyethylene freezer bag. Care should be taken to insure that no cross-contamination occurs between the soil sample and the collection tools or sample processing equipment.

3.3 The sealed sample bag should be massaged to break up any clods.

4.0 Sample Preparation

4.1 Tare a clean glass vial having a minimum 40 ml capacity. Add at least 10 grams of the soil sample and record the weight.

4.2 Add at least 10 grams of reverse osmosis water or distilled water to the soil sample and shake or agitate for 20 seconds.

4.3 Allow the sample to set for a period of 5 minutes or until the separation of soil and water.

4.4 Carefully pour the free liquid extract from the sample, through a paper filter if necessary, into a clean plastic cup.

5.0 Titration Procedure

5.1 Using a graduated pipette, remove 10 ml extract and dispense into a clean plastic cup.

5.2 Add 2-3 drops potassium chromate (K_2CrO_4) to mixture.

5.3 If the sample contains any sulfides (hydrogen or iron sulfides are common to oilfield soil samples) add 2-3 drops of hydrogen peroxide (H_2O_2) to mixture.

5.4 Using a 1 ml pipette, carefully add .282 normal silver nitrate (one drop at a time) to the sample while constantly agitating it. Stop adding silver nitrate when the solution begins to change from yellow to red. Be consistent with endpoint recognition.

5.5 Record the ml of silver nitrate used.

6.0 Calculation

To obtain the chloride concentration, insert measured data into the following formula:

$$\frac{.282 \times 35{,}450 \times \text{ml } AgNO_3}{\text{ml water extract}} \times \frac{\text{grams of water in mixture}}{\text{grams of soil in mixture}}$$

Using Step 5.0, determine the chloride concentration of the RO water used to mix with the soil sample. Record this concentration and subtract it from the formula results to find the net chloride in the soil sample.

Record all results on a field form.

Additional Notes

1) Make sure the scale is weighing in grams.
2) "Zero" the scale with clean, empty 40 ml container (including the cap) sitting on the scale.
3) Add 10 to 20 grams of sample soil to the container. Record the weight.
4) "Re-zero" the scale.
5) Add distilled water to almost fill the container. Record the weight.
6) Screw the cap on, and shake the container to thoroughly mix the sample with the distilled water. Set aside to allow settling of the sample. This will take only a few minutes for coarse grained material and up to 20 minutes for very fine grained sediments. The solution does not need to be perfectly clear to continue the procedure.
7) Add 3 drops of Potassium Chromate to a small, clean, plastic cup.
8) Extract 10 ml (using a large pipette – at least 10 ml) of solution from the sample container and put it into the plastic cup. Record ml of solution placed in the cup.
    a. This can be kept track of by careful recording of "before" and "after" fluid levels in the pipette.
    b. Or: Place the plastic cup on the scale with the potassium chromate and "zero" the scale. Add solution to the cup until 10 grams is indicated on the scale.
9) Swirl the solution and the potassium chromate to mix them.
10) Using a 1 ml pipette, add silver nitrate to the mixed solution drop by drop while swirling. The entire solution will change from a pale lemon yellow color to a brick red color when sufficient silver nitrate has been added. STOP when it all turns brick red. It does not need to be a deep brick red color. This will result in an overly high result. Record ml of silver nitrate used.
11) The chloride concentration of the sample is given by:

$$C_{sam} = (35{,}450 * 0.282) * \frac{\text{(grams of water)}}{\text{(grams of soil)}} * \frac{\text{(ml of silver nitrate)}}{\text{(ml of solution)}}$$

or:

$$C_{sam} = (9997) * \frac{\text{(grams of water (Step 5))}}{\text{(grams of soil (Step 3))}} * \frac{\text{(ml of silver nitrate (Step 10))}}{\text{(ml of solution (Step 8))}}$$

Units are: mg(of chloride)/kg(of soil)

Equipment List:

Scale
10 ml pipettes
1 ml pipettes
Controllers for pipettes (small and large),
press pipette into open end (carefully)
40 ml sample containers
Small plastic cups
Silver Nitrate
Potassium Chromate
Distilled water
Waste container for final solution. A robust plastic jug with lid will do for field use.
DO NOT pour this down a drain. Dispose of with a chemical lab.
Waste bags for used plastic cups (rinse and pour rinsing fluid into robust jug)

Calculator
Nitrile gloves
Safety glasses
Paper towels

Safety Data

http://ptcl.chem.ox.ac.uk/~hmc/hsci/chemicals/silver_nitrate.html

http://ptcl.chem.ox.ac.uk/~hmc/hsci/chemicals/potassium_chromate.html