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

August 30, 2018

REVIEWED
By Olivia Yu at 7:20 am, Oct 04, 2018

Olivia Yu
NMOCD District 1
1625 N. French Dr.
Hobbs, NM 88240

RE: 1RP-4624, Pride Energy Company
NM 87 State #001 (Wellhead), API#: 30-025-23655
Section 33-14S-34E: Unit K, Lea County, New Mexico
Site Characterization Report and Remediation Plan

Ms. Yu:

R.T. Hicks Consultants (Hicks Consultants) is pleased to submit the above-referenced document on behalf of Pride Energy. This document addresses 1RP-4624. The C-141 is reproduced in Appendix A.

The proposed remediation plan relies on data collected during our:

- January 2018 initial characterization, and
- April 2018 delineation and characterization

We followed NMOCD's new release rule 19.15.29 NMAC (the Rule) to characterize and delineate the release. Thus, proposed activities will be conducted under the new Rule.

On June 26, 2018 we submitted a request to NMOCD to defer the remediation plan until the approval of the new release rule. On July 26, 2018 NMOCD declined our request along with the below partial response:

> "Vertical delineation on the well pad- North and Southeast locations- must be completed before evaluation of proposed remediation."

Our response to NMOCD's above request is addressed in the section titled "Proposed Remediation Plan"

Characterization Results

Three out of five sample locations (SE Pad, SW Pad, North Pad) are contained on the active production pad. NMAC 19.15.29.12.C(2) states that releases on a developed well pad is subject to restoration rather than reclamation.

The remaining two sample locations (SE Pasture, SW Pasture), are subject to reclamation.

Table 1, attached, presents the result of all sampling conducted at the site. Plates 1-11 show that this site meets the characterization criteria established by NMAC

19.15.29.11.A.1-4. Plate 2 shows the depth to groundwater at the location is approximately 65-feet below ground surface; calculated from USGS 2007 potentiometric surface[1].

Plate 10 shows the locations of the trench and soil boring locations relative to the production pad. Plate 11 presents chloride concentration at depths between zero and 4 feet at each location during the January and April 2018 characterization activities. Appendix B discusses our January and April 2018 characterization activities.

Below is a summary of observations during characterization. Please refer to Table 1 and Appendix D for summary of analytical and trench/auger logs, respectively.

- SE Pasture
  Chloride, Benzene, BTEX, and TPH concentrations are below Closure Criteria. No reclamation is necessary.

Photo 1: SE Pasture viewing northeast toward wellhead. Area shows vegetation and evidence of cattle wallows where water collects. Aug. 15 2018.

- SW Pasture
  Chloride, Benzene, BTEX, and TPH concentrations are below Closure Criteria. No reclamation is necessary.

[1] Current (2004-07) Conditions and Changes in Ground-Water Levels from Predevelopment to 2007, Southern High Plains Aquifer, Southeast New Mexico-Lea County Underground Water Basin; 2008; SIM; 3044; Tillery, Anne

Photo 2: SW Pasture viewing east toward wellhead. Area shows vegetation and evidence of cattle wallows where water collects.Aug. 15, 2018

- SW Pad
  Chloride, Benzene, BTEX, and TPH concentrations shows no impairment to the release area. Well pad in-use, no restoration is necessary.
- SE Pad
  Chloride concentrations below Table 1 Closure Criteria (10,000 mg/kg chloride) for areas in-use. The area is subject to restoration. Reclamation will occur at the time of P&A.

Photo 3: SE Pad viewing northwest. Tire tracks from field service vehicles shows that the area is "in-use". Just beyond the SE Pad location surface shows good vegetation (photo bottom). July 19, 2018.

- North Pad

  Chloride concentrations below Table 1 Closure Criteria (10,000 mg/kg chloride) for areas in-use and review of aerial photos places the North Pad sample location within a former reserve pit. Evidence of the former reserve pit is visible in the aerial photograph on Plate 10. The area is subject to restoration. Reclamation will occur at the time of P&A.

Proposed Remediation Plan

The Rule states:

> *19.15.29.12.C.*
> *(2) The responsible party shall restore the impacted surface area of a release occurring on a developed well pad, central tank battery, drilling site, compressor site or other exploration, development, production or storage sites to meet the standards of Table I of 19.15.29.12 NMAC or other applicable remediation standards and restore and reclaim the area pursuant to 19.15.29.13 NMAC.*
> *(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 or other …*

As the characterization clearly shows, concentrations of constituents of concern are below the limits established by Table 1.

However, for areas no longer in use, the following section of the Rule establishes concentration standards for a "soil cover":

> *19.15.29.12.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 …*
> *(1) The reclamation must contain a minimum of four feet of non-waste containing, uncontaminated, earthen material with chloride concentrations less than 600 mg/kg… 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 …*

Reclamation of areas no longer in use at this site are discussed below.

With respect to other areas impacted by the release, the Rule states:

> *19.15.29.12.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.*

Exhibit 1 summarizes the closure criteria for areas "in use" and areas reasonably needed for operations.

Depth (below ground surface)	Depth to Water (bottom of release)	Chloride (mg/kg)	TPH (GRO+DRO+MRO) (mg/kg)	TPH (GRO+DRO) (mg/kg)	BTEX (mg/kg)	Benzene (mg/kg)
Areas no longer in use and above 4-feet.		600	2,500	1,000	50	10
Areas no long in use and below 4-feet	>50 feet	10,000	2,500	1,000	50	10
Areas in use	>50 feet	10,000	2,500	1,000	50	10

Exhibit 1: Closure Criteria. Table 1 NMAC 19.15.29.

Of the five sample locations:

- Three locations are located on an active well pad and are within an area that is "in-use". Two of these locations (SE Pad and Pad North) require reclamation at the time of well P&A. The remaining location that is "in-use" is SW Pad and no restoration or reclamation is required. All three locations meet Table 1 Closure Criteria. We propose no further action until the well is P&A, at which time reclamation will occur because these areas will no longer be "in use".
- Two of the locations (SW Pasture and SE Pasture)
  - meet Table 1 Closure Criteria for areas no longer in-use
  - test below 600 mg/kg chloride in the upper four feet and
  - shows signs of surface vegetation (see above photos).
  - We propose no further action at these two locations.

NMOCD Request on July 26, 2018 (via email)

On July 26, 2018 NMOCD provided the following request via email:

> "Vertical delineation on the well pad- North and Southeast locations- must be completed before evaluation of proposed remediation."

Our response is provided below.

- North Pad location is located within a former reserve pit and meets Table 1 Closure Criteria for areas "in-use". The reserve pit will be reclaimed at the time of wellhead P&A.

- The SE Pad location meets Table 1 Closure Criteria for areas "in-use". The area will be reclaimed at the time of wellhead P&A.

- The SE Pasture location, like most other sample locations, contains very hard caliche at 2-feet below ground surface. The upper two feet meet Table 1 Closure Criteria. The area shows signs of good surface vegetation (see above photo). The

chloride concentrations of the upper 2-feet at the SW Pad and SW Pasture are also 30 mg/kg. Re-vegetation and data from similar sampling points show that chloride concentrations at the SE Pasture location meet the criteria for a soil cap and no action is required.

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)

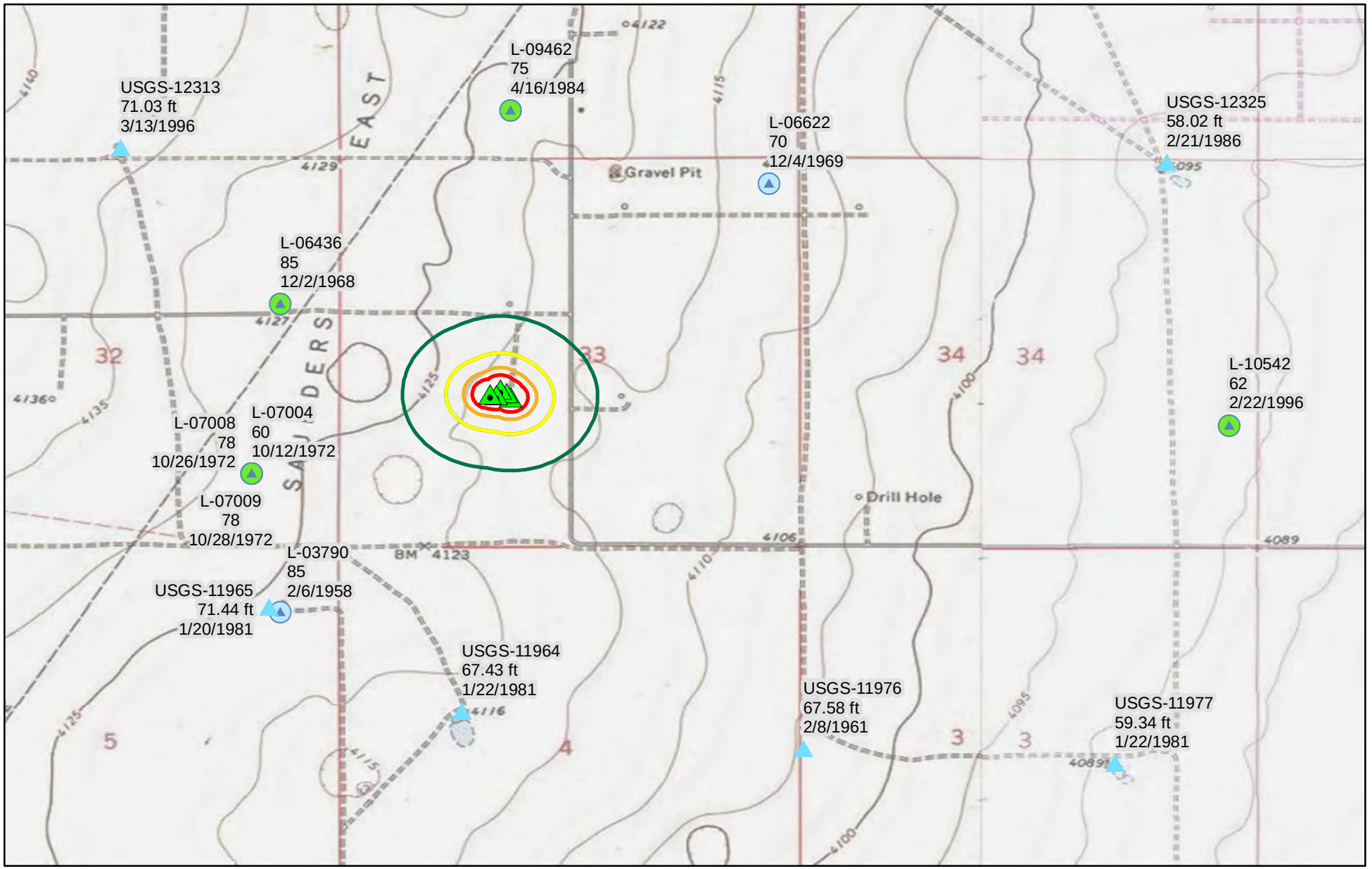
TABLES

Table 1
Summary of Analtyical
Pride NM 87 State 001 (Wellhead)

Sample Name	Date	Cl (lab) mg/kg	BTEX mg/kg	Benzene mg/kg	TPH (GRO+DRO+MRO) mg/kg	TPH (GRO+DRO) mg/kg
Table 1 (19.15.17 NMAC)						
Upper 4 ft (Not in-use)		600				
In-use or > 4ft		10,000	50	10	2,500	1,000
SE Pasture @ 2 ft	1/8/2018	<30	<0.219	<0.024	<64.9	<14.9
SE Pad @ 2 ft	1/8/2018	5,500	<0.224	<0.025	<60.2	<14.2
SE Pad @ 0 ft	4/2/2018	7,300			<209	<39
SE Pad @ 2 ft	4/2/2018	1,700	<0.217	<0.024	<62.5	<14.5
SE Pad @ 4 ft	4/2/2018	1,400	<0.213	<0.024	<63.4	<14.4
SE Pad @ 6 ft	4/2/2018	900				
SE Pad @ 10 ft	4/2/2018	1,300				
North Pad @ 2 ft	1/8/2018	1,500	<0.221	<0.025	<83.3	<14.3
North Pad @ 10 ft	1/8/2018	1,600				
SW Pad @ 2 ft	1/8/2018	300	<0.21	<0.023	<64.5	<14.5
SW Pad @ 0 ft	4/2/2018	<30				
SW Pad @ 2 ft	4/2/2018	73	<0.217	<0.024	<62.5	<14.5
SW Pad @ 4 ft	4/2/2018	<30	<0.213	<0.024	<58.7	<13.7
SW Pad @ 6 ft	4/2/2018	<30				
SW Pasture @ 0.5 ft	1/8/2018	<30	<0.22	<0.024	<62.6	<14.6
SW Pasture @ 6 ft	1/8/2018	<30				

PLATES

M:\Pride Energy\NM 87 State 001 Wellhead 1RP_4624\gis_ap\Figures\plate1_DTW.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	Depth To Water	Plate 1
	Pride Energy Company NM 87 State #001 (Wellhead)	March 2018

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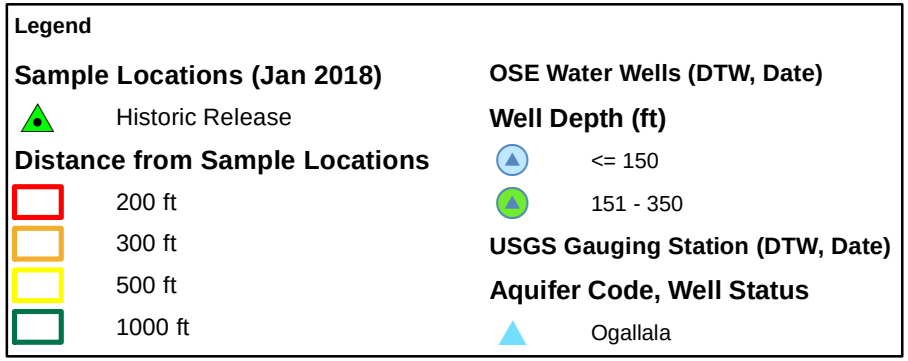

R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

Depth To Water

Pride Energy Company
NM 87 State #001 (Wellhead)

Plate 1
Legend

March 2018

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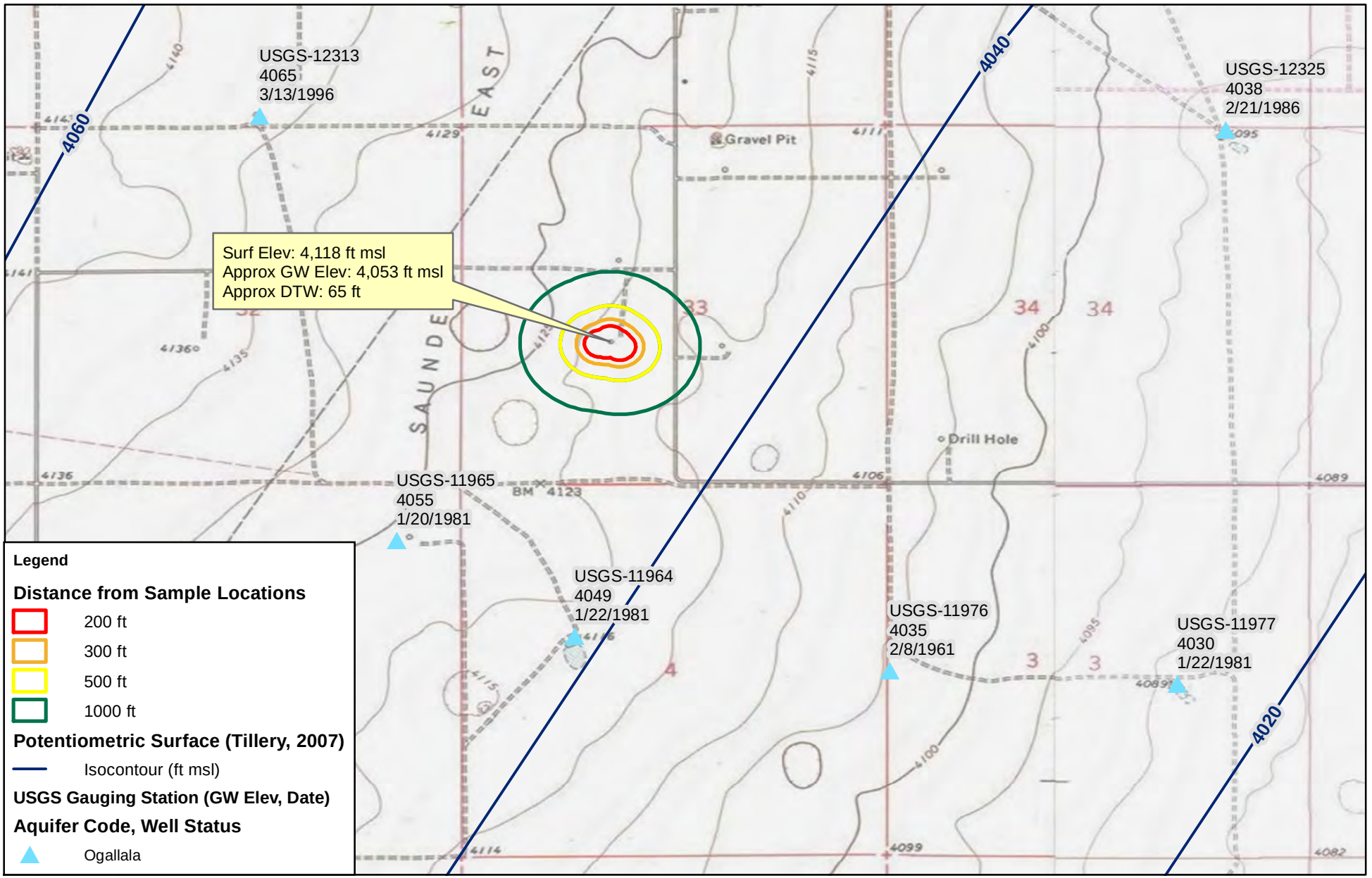
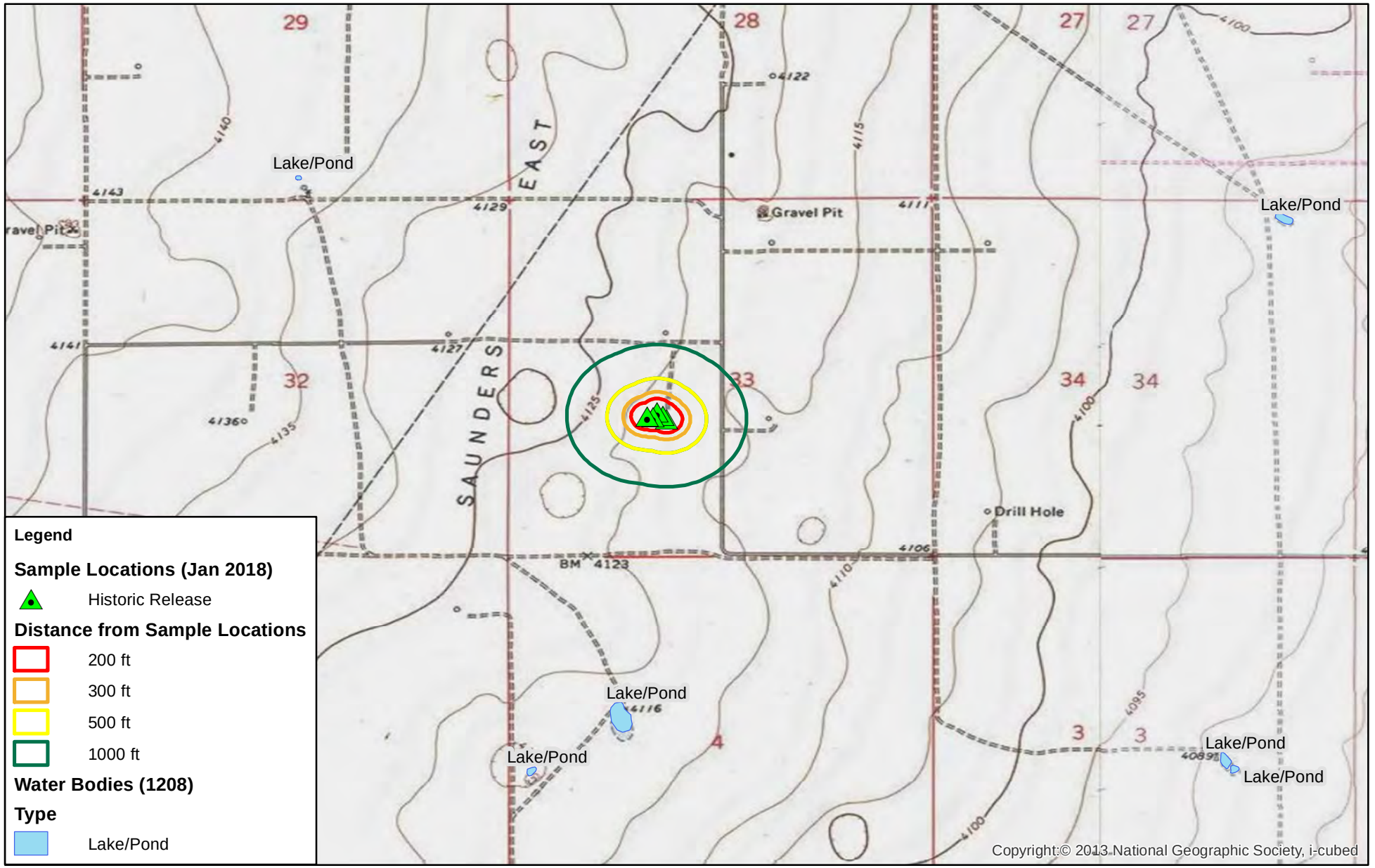


R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Potentiometric Surface and Groundwater Elevation Pride Energy Company NM 87 State #001 (Wellhead)	Plate 2 March 2018

M:\Pride Energy\NM 87 State 001 Wellhead 1RP_4624\gis_ap\Figures\plate3_SurfaceWater.mxd



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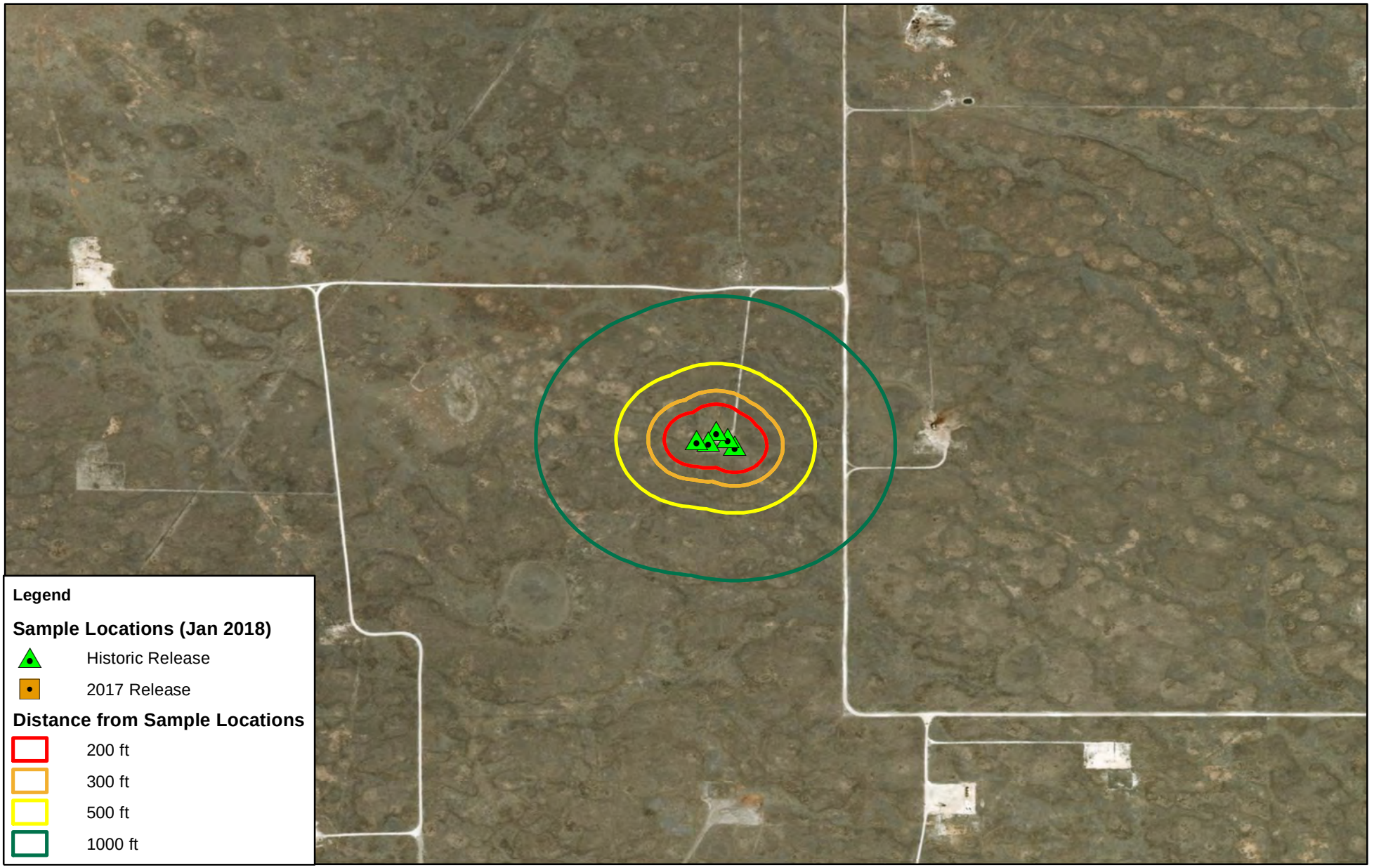
R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

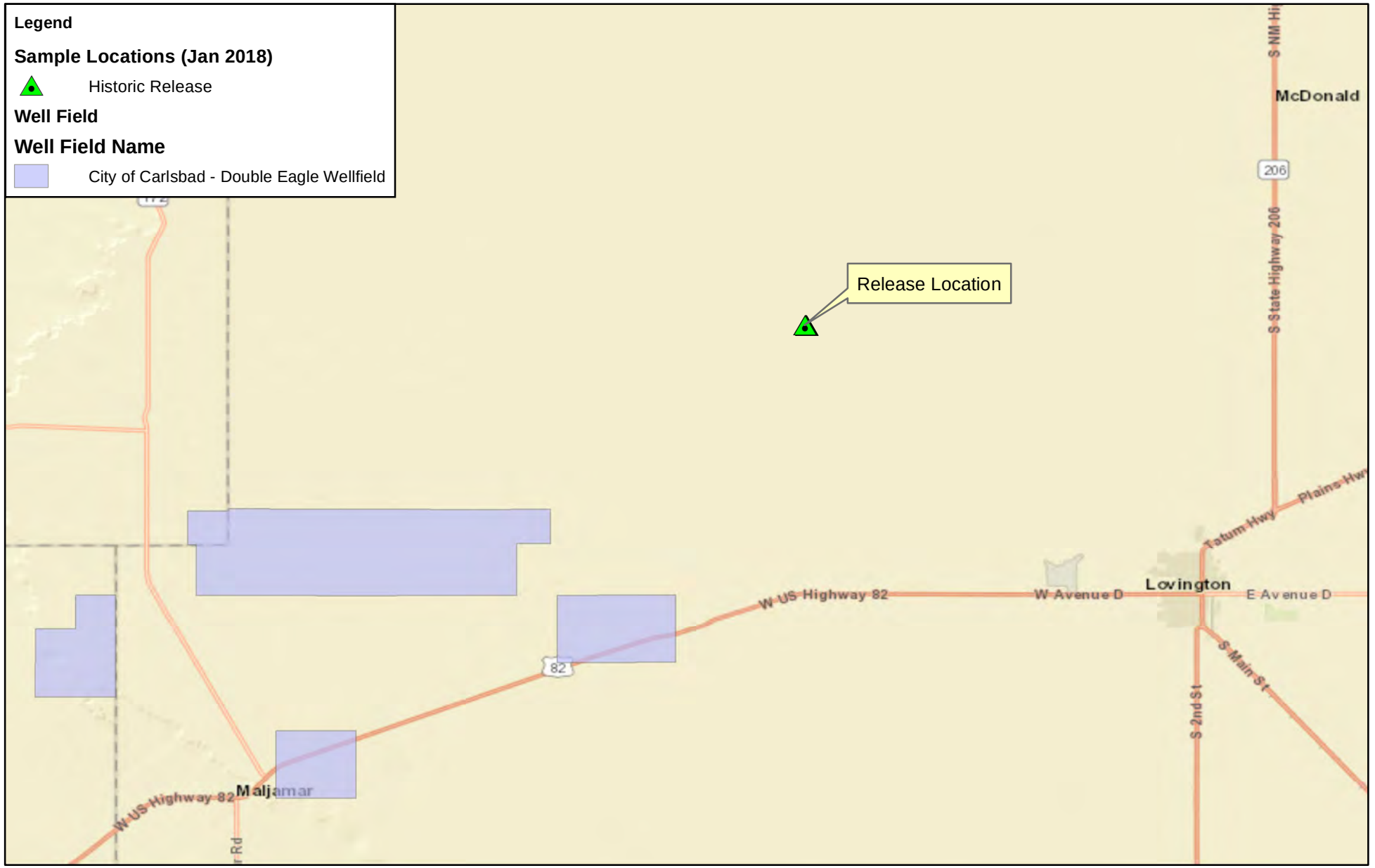
Surface Water and Topography	Plate 3
Pride Energy Company NM 87 State #001 (Wellhead)	March 2018

M:\Pride Energy\NM 87 State 001 Wellhead 1RP_4624\gis_ap\Figures\plate4_NearbyStructures.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Structures	Plate 4
	Pride Energy Company NM 87 State #001 (Wellhead)	March 2018

M:\Pride Energy\NM 87 State 001 Wellhead 1RP_4624\gis_ap\Figures\plate5_wellFields.mxd



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

Nearby Municipalities and Well Fields

Plate 5

Pride Energy Company
NM 87 State #001 (Wellhead)

March 2018

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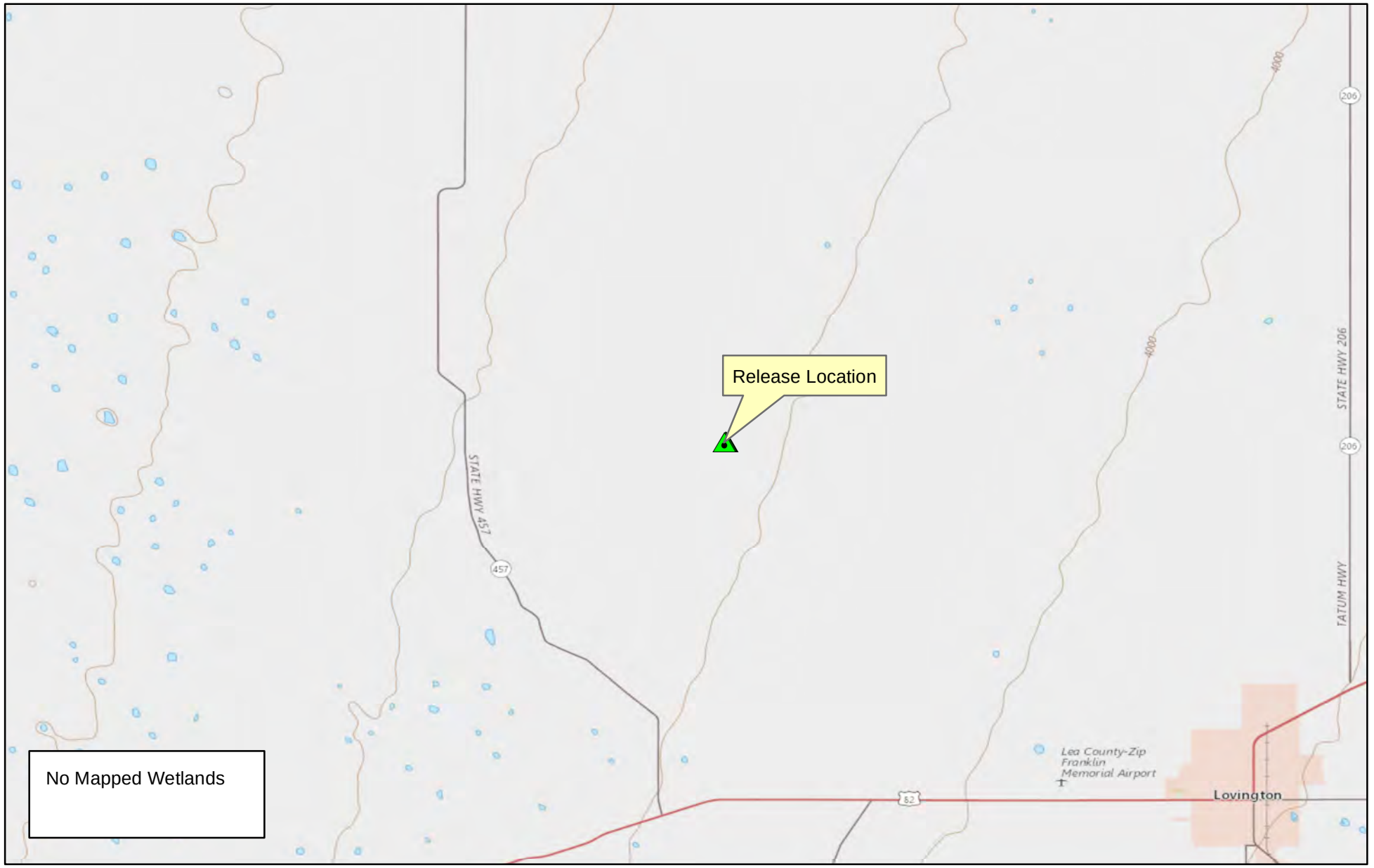

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R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Wetlands	Plate 6
	Pride Energy Company NM 87 State #001 (Wellhead)	March 2018

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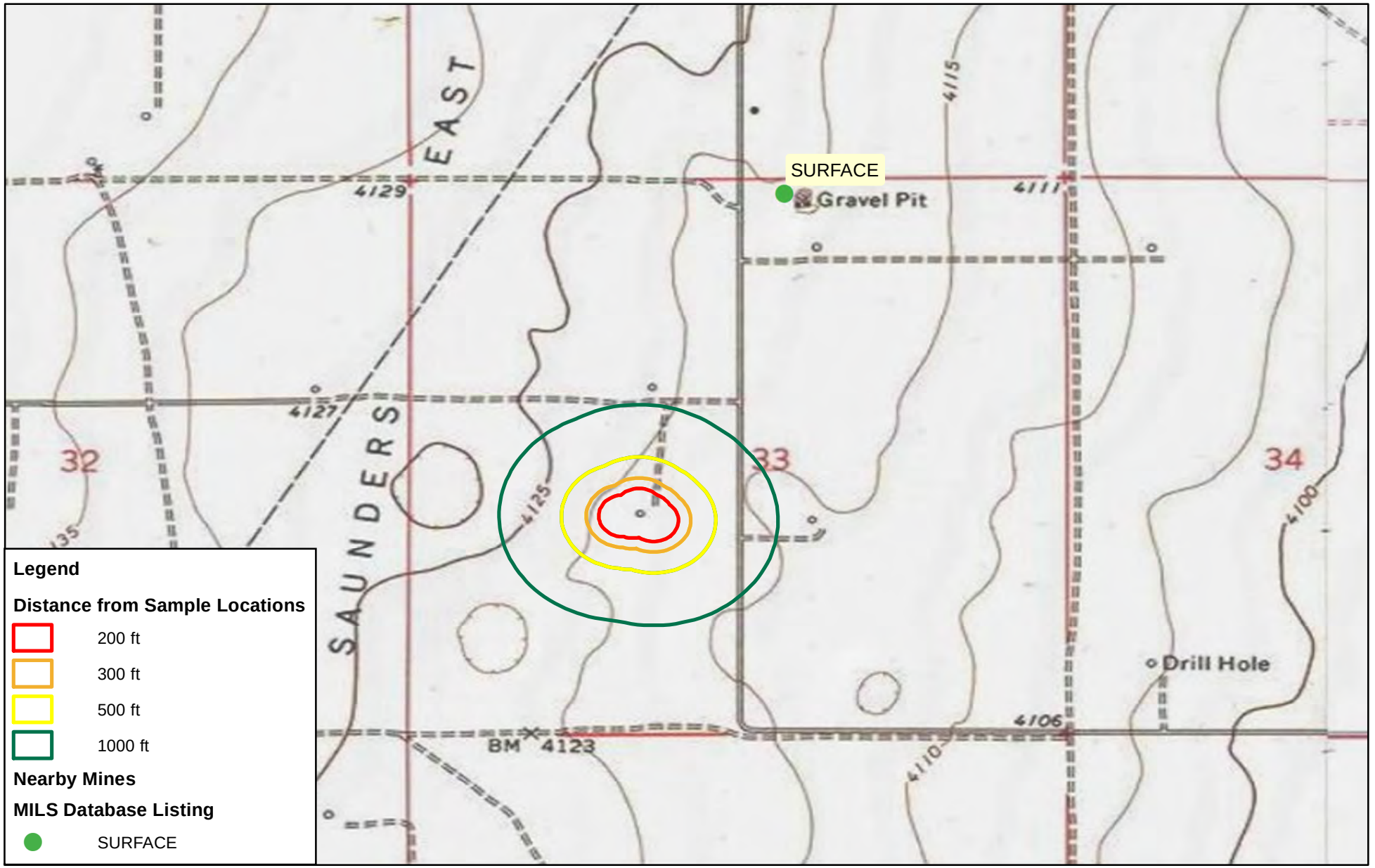

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R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

Nearby Mines and Minerals

Plate 7

Pride Energy Company
NM 87 State #001 (Wellhead)

March 2018

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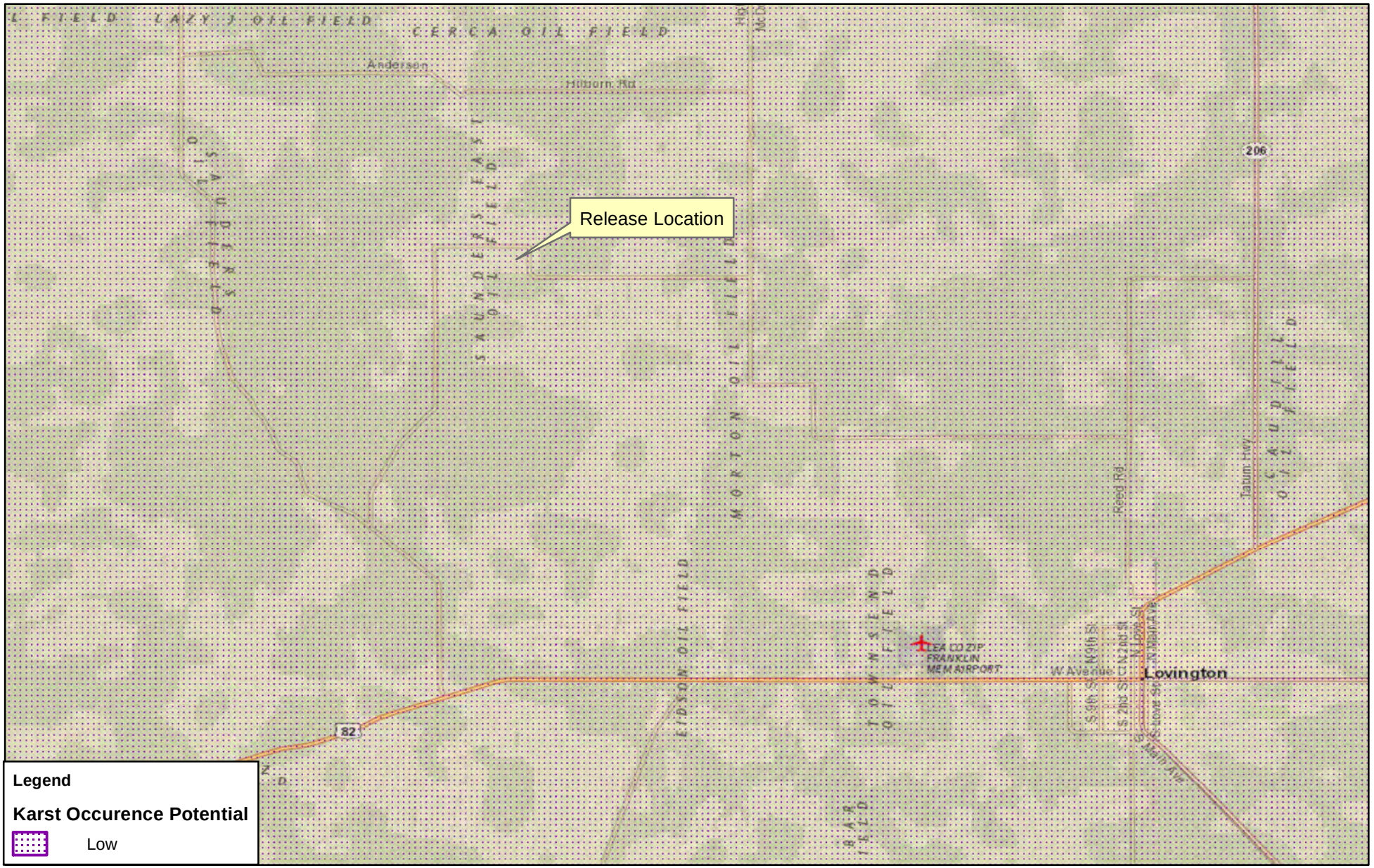

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Karst Potential	Plate 8
	Pride Energy Company NM 87 State #001 (Wellhead)	March 2018

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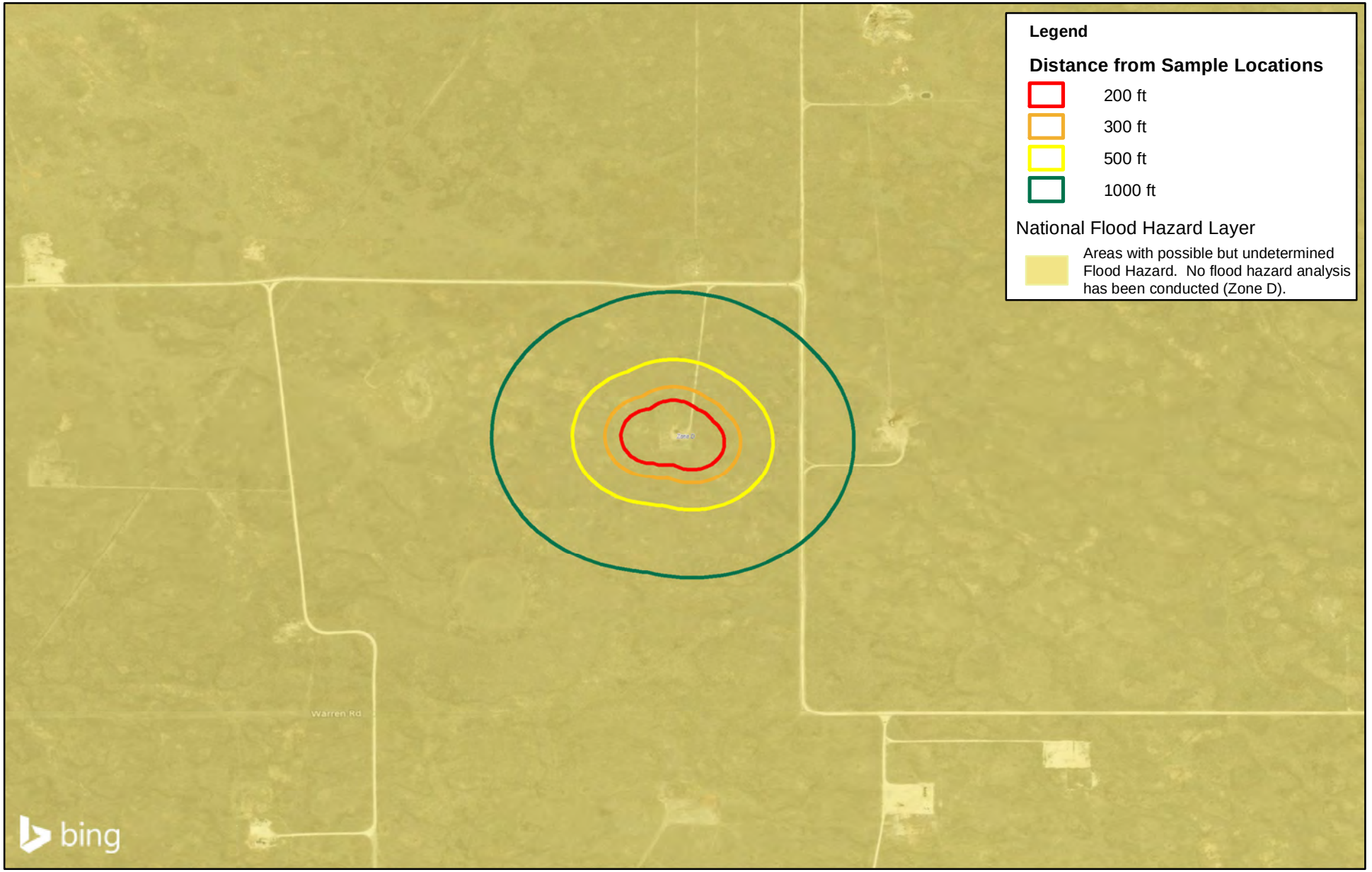

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Feet

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

Pride Energy Company
NM 87 State #001 (Wellhead)

March 2018

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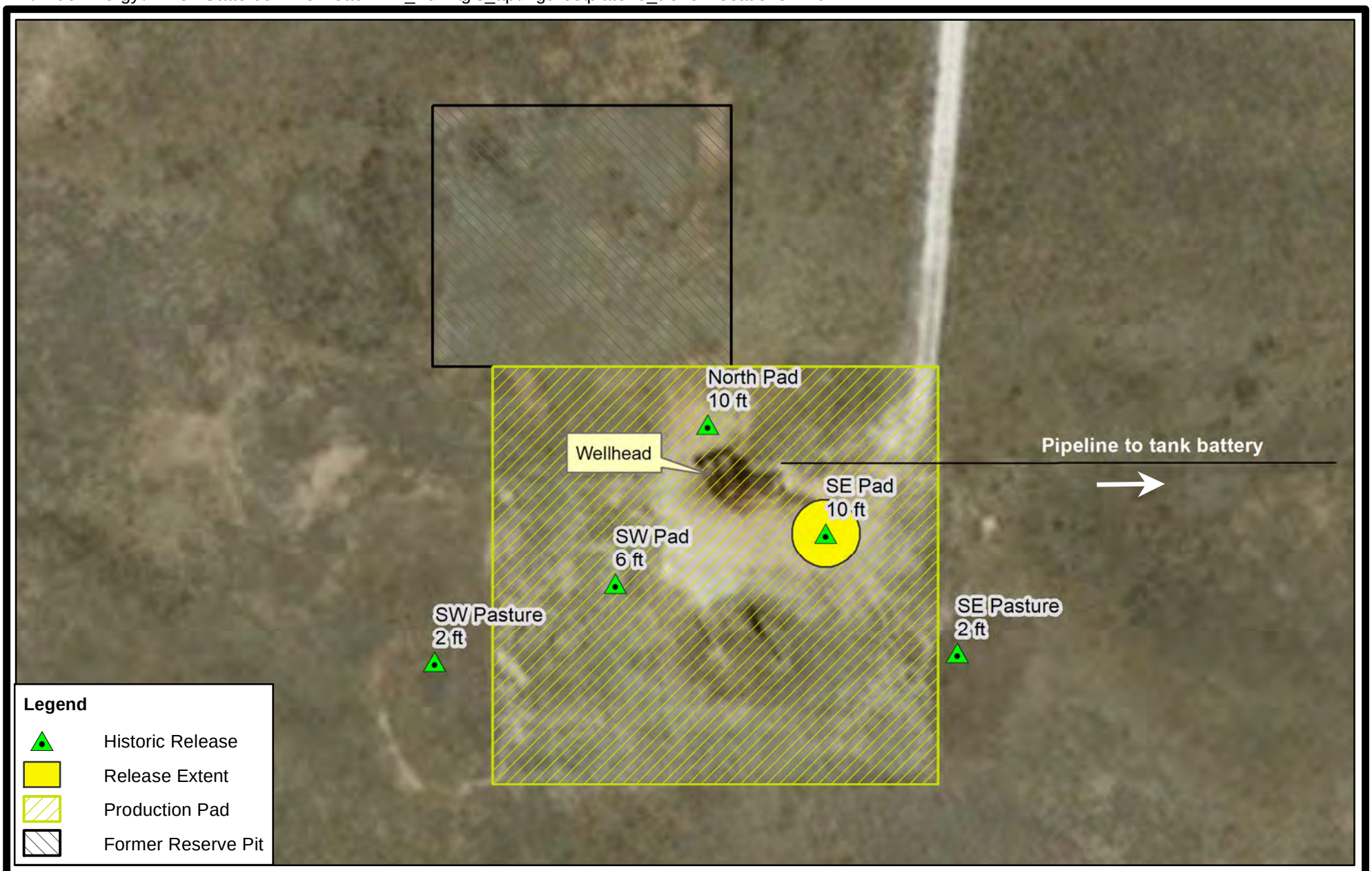
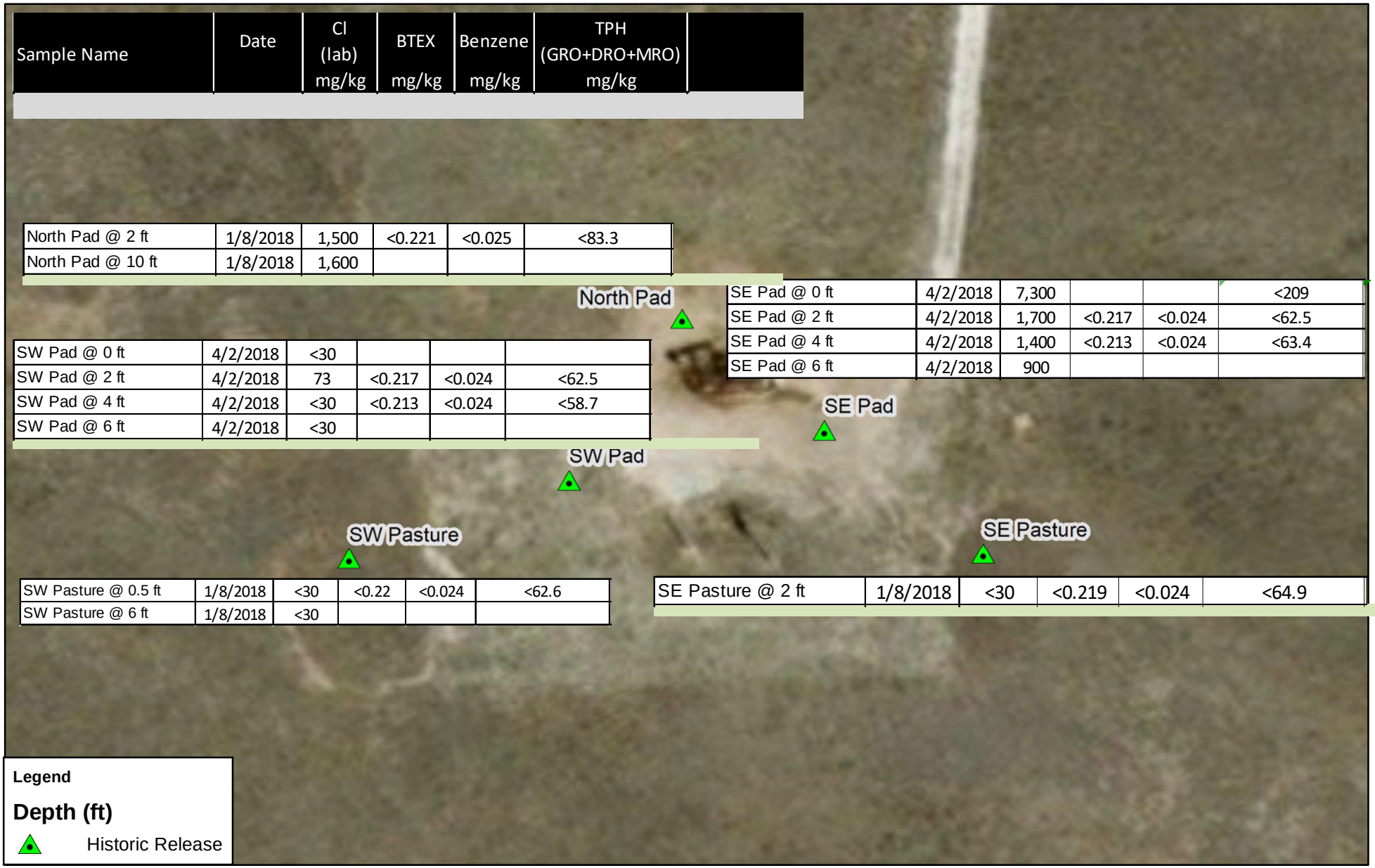


R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Sample Locations with Total Depth (ft) (Jan & April 2018)	Plate 10
	Pride Energy Company NM 87 State #001 (Wellhead)	May 2018

M:\Pride Energy\NM 87 State 001 Wellhead 1RP_4624\gis_ap\Figures\plate11_chloride.mxd



Sample Name	Date	Cl (lab) mg/kg	BTEX mg/kg	Benzene mg/kg	TPH (GRO+DRO+MRO) mg/kg	
North Pad @ 2 ft	1/8/2018	1,500	<0.221	<0.025	<83.3	
North Pad @ 10 ft	1/8/2018	1,600				
SW Pad @ 0 ft	4/2/2018	<30				
SW Pad @ 2 ft	4/2/2018	73	<0.217	<0.024	<62.5	
SW Pad @ 4 ft	4/2/2018	<30	<0.213	<0.024	<58.7	
SW Pad @ 6 ft	4/2/2018	<30				
SW Pasture @ 0.5 ft	1/8/2018	<30	<0.22	<0.024	<62.6	
SW Pasture @ 6 ft	1/8/2018	<30				
SE Pad @ 0 ft	4/2/2018	7,300			<209	
SE Pad @ 2 ft	4/2/2018	1,700	<0.217	<0.024	<62.5	
SE Pad @ 4 ft	4/2/2018	1,400	<0.213	<0.024	<63.4	
SE Pad @ 6 ft	4/2/2018	900				
SE Pasture @ 2 ft	1/8/2018	<30	<0.219	<0.024	<64.9	

Legend

Depth (ft)

Historic Release

N W E S

0 30 60 Feet

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

Concentrations < 6 ft (Jan/April 2018)

Plate 11

Pride Energy Company
NM 87 State #001 (Wellhead)

May 2018

APPENDIX A

PRIDE ENERGY COMPANY

(918) 524-9200 ♦ Fax (918) 524-9292 ♦ www.pride-energy.com

Physical Address: 4641 E. 91st Street
Tulsa, OK 74137

Mailing Address: P.O. Box 701950
Tulsa, OK 74170-1950

Email Address: taylorp@pride-energy.com

February 23, 2017

Via Certified Mail
Return Receipt #
91 7199 9991 7034 8165 7748

New Mexico Oil Conservation Division
1625 N. French Drive
Hobbs, NM 88240

Attn: Olivia Yu
Environmental Specialist

RE: New Mexico 87 State #001
API # 30-025-23655
Section 33-14S-34E: 2086' FSL and 1,874' FWL (Unit Letter K)
Lea County, New Mexico

Dear Olivia,

In reference to the above described well, please find enclosed a completed Form C-141 (Initial Report).

Thank you and if there are any questions, please feel free to contact me at 918-524-9200.

Sincerely,

Taylor Pride
Pride Energy Company

mp15649.tp

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 August 8, 2011

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 Pride Energy Company	Contact Matthew Pride
Address P.O. Box 701950, Tulsa, OK 74170	Telephone No. 918-524-9200
Facility Name New Mexico 87 State #1	Facility Type Oil Well

Surface Owner	Mineral Owner	API No.
State of New Mexico	State	30-025-23655

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
K	33	14S	34E	2086	South	1874	West	Lea

Latitude 33.0595398 Longitude -103.5185318

NATURE OF RELEASE

Type of Release Oil and Water	Volume of Release unknown	Volume Recovered unknown
Source of Release Tank Battery	Date and Hour of Occurrence unknown	Date and Hour of Discovery (see below)
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 9:44 am, Mar 01, 2017

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken.*

Before Pride Energy assumed responsibility as operator of this well, there was a historical release near the wellhead at the above described lease.

Describe Area Affected and Cleanup Action Taken.*

Pride Energy will be taking oil samples in the near future at the location of the historical release, which occurred before Pride Energy Company became operator, with the approval of both the State Land Office and the NMOCD. In this manner, Pride Energy will be working closely with Amber Groves (from State Land Office) and Olivia Yu (from NMOCD) to be sure that the site has been fully remediated according to standards.

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: Matthew L. Pride	OIL CONSERVATION DIVISION
Printed Name: Matthew L. Pride	Approved by Environmental Specialist:
Title: President of Pride Production Co., Inc. General Partner of Pride Energy Company	Approval Date: 3/1/2017 Expiration Date:
E-mail Address: mattp@pride-energy.com	Conditions of Approval: see attached directive Attached ☑
Date: 2/27/17 Phone: 918-524-9200	

* Attach Additional Sheets If Necessary

1RP-4624 nOY1706035716 pOY1706035943

mp15650.tp

Operator/Responsible Party,

The OCD has received the form C-141 you provided on _2/27/2017_ regarding an unauthorized release. The information contained on that form has been entered into our incident database and remediation case number __1R-_4624_ 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 _4/1/2017_. 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

January 2018 Sample Locations

On January 08, 2018 Andrew Parker of Hicks Consultants mobilized to the Pride Energy State New Mexico 87 State 001 (Wellhead) location to conduct a limited characterization of an accidental historic release. The release is of unknown volume and source type (i.e. produced water/crude oil).

Gandy Backhoe Services provided backhoe trenching services.

We excavated five (5) backhoe trenches to characterize the historic release. Excavation depth was determined by the extent of the backhoe reach or bucket refusal caused by the underlying caliche.

Soil samples were collected for the analysis of chloride, BTEX, and GRO/DRO/MRO. Soil samples were submitted to Hall Environmental Laboratory in Albuquerque, NM; on-ice and under strict chain-of-custody. Appendix C contains the laboratory Certificate of Analysis.

Plate 10 shows the location of the sample locations. Exhibit A, below, shows the latitude, longitude, depth, and sampling type. Table 1 is a summary of the laboratory analysis. Appendix D contains the lithologic logs for the sample locations.

Sample Location	Latitude (WGS84)	Longitude (WGS84)	Sample Type	Depth (ft)
SE Pasture	33.05935056	-103.5181049	Backhoe	2
SE Pad	33.05950108	-103.5182984	Backhoe	2
North Pad	33.05963708	-103.5184714	Backhoe	10
SW Pad	33.0594403	-103.5186093	Backhoe	2
SW Pasture	33.05934481	-103.5188772	Backhoe	2

Exhibit A: Sample location and type.

April 2018 Sample Locations

On April 02, 2018 Andrew Parker and Kristin Pope of Hicks Consultants mobilized to the Pride Energy State New Mexico 87 State 001 (Wellhead) location to perform additional vertical characterization of two areas (SE Pad and SW Pad) that showed potential for vertical impairment within the historic releases. Atkins Engineering provided drilling services.

We drilled two boreholes at the locations identified above and adjacent and northeast of the two trench locations identified during our January 2018 characterization (Plate 11 and Exhibit A). SE Pad was drilled to a depth of 10-feet below ground surface (bgs). SW Pad was drilled to a depth of 6-feet bgs.

We collected split-spoon soil samples at 0, 2, 4, 6 feet bgs and total depth. Vertical delineation ceased at 6 feet when:

- PID readings for VOCs were below 100 ppm (using the heated headspace method of field testing), and

- Chloride titrations were below 600 mg/kg (using field titration method).

Appendix D contains the lithologic logs for the sample locations.

Soil samples were submitted for laboratory testing of TPH (GRO, DRO, MRO), BTEX, Benzene, and Chloride. Soil samples were submitted to Hall Environmental Laboratory in Albuquerque, NM; on-ice and under strict chain-of-custody. Appendix C contains the laboratory Certificates of Analysis.

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

Exhibit B: Trench sample at SW Pad. Hard caliche encountered at 1-foot below ground surface. Total depth was 2-feet below ground surface. Land surface is undergoing natural restoration/re-vegetation.

Exhibit C: Backfilling trench sample at SE Pad. Hard caliche encountered at 1-foot below ground surface. Total depth was 2-feet below ground surface.

Exhibit D: Drilling SE Pad. The production pad is beginning to revegetate (foreground center).

Exhibit E: Split-spoon core from 4-feet (right) to 6-feet (left) at SE Pad. Caliche dominates the core sample.

Exhibit F: Drilling SW Pad. The production pad is beginning to revegetate (foreground center).

Exhibit G: Split-spoon core from 4-feet (right) to 6-feet (left) at SW Pad. Caliche dominates the core sample.

APPENDIX C

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

March 07, 2018

Andrew Parker

R.T. Hicks Consultants, LTD
901 Rio Grande Blvd. NW
Suite F-142
Albuquerque, NM 87104
TEL: (505) 266-5004
FAX (505) 266-0745

RE: NM 87 State 001 Wellhead OrderNo.: 1801668

Dear Andrew Parker:

Hall Environmental Analysis Laboratory received 7 sample(s) on 1/11/2018 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued February 01, 2018.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman

Laboratory Manager

4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1801668**
Date Reported: **3/7/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SE PAD @ 2 ft
Project: NM 87 State 001 Wellhead
Collection Date: 1/8/2018 3:15:00 PM
Lab ID: 1801668-001
Matrix: SOIL
Received Date: 1/11/2018 2:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	5500	150		mg/Kg	100	1/19/2018 10:47:47 PM	36090
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.2		mg/Kg	1	1/16/2018 7:09:25 PM	36022
Motor Oil Range Organics (MRO)	ND	46		mg/Kg	1	1/16/2018 7:09:25 PM	36022
Surr: DNOP	96.2	70-130		%Rec	1	1/16/2018 7:09:25 PM	36022
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	5.0		mg/Kg	1	1/15/2018 9:03:57 PM	36006
Surr: BFB	90.8	15-316		%Rec	1	1/15/2018 9:03:57 PM	36006
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.025		mg/Kg	1	1/15/2018 4:36:26 PM	36006
Toluene	ND	0.050		mg/Kg	1	1/15/2018 4:36:26 PM	36006
Ethylbenzene	ND	0.050		mg/Kg	1	1/15/2018 4:36:26 PM	36006
Xylenes, Total	ND	0.099		mg/Kg	1	1/15/2018 4:36:26 PM	36006
Surr: 4-Bromofluorobenzene	105	70-130		%Rec	1	1/15/2018 4:36:26 PM	36006
Surr: Toluene-d8	94.3	70-130		%Rec	1	1/15/2018 4:36:26 PM	36006

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SW Pasture @ 0.5 ft
Project: NM 87 State 001 Wellhead
Collection Date: 1/8/2018 1:30:00 PM
Lab ID: 1801668-002
Matrix: SOIL
Received Date: 1/11/2018 2:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **CJS**	
Chloride	ND	30		mg/Kg	20	1/18/2018 3:03:04 PM	36090
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	1/16/2018 7:33:13 PM	36022
Motor Oil Range Organics (MRO)	ND	48		mg/Kg	1	1/16/2018 7:33:13 PM	36022
Surr: DNOP	107	70-130		%Rec	1	1/16/2018 7:33:13 PM	36022
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	1/15/2018 9:27:36 PM	36006
Surr: BFB	90.4	15-316		%Rec	1	1/15/2018 9:27:36 PM	36006
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.024		mg/Kg	1	1/15/2018 4:59:22 PM	36006
Toluene	ND	0.049		mg/Kg	1	1/15/2018 4:59:22 PM	36006
Ethylbenzene	ND	0.049		mg/Kg	1	1/15/2018 4:59:22 PM	36006
Xylenes, Total	ND	0.098		mg/Kg	1	1/15/2018 4:59:22 PM	36006
Surr: 4-Bromofluorobenzene	110	70-130		%Rec	1	1/15/2018 4:59:22 PM	36006
Surr: Toluene-d8	92.5	70-130		%Rec	1	1/15/2018 4:59:22 PM	36006

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SW Pasture @ 6 ft
Project: NM 87 State 001 Wellhead
Collection Date: 1/8/2018 1:35:00 PM
Lab ID: 1801668-003
Matrix: SOIL
Received Date: 1/11/2018 2:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **CJS**	
Chloride	ND	30		mg/Kg	20	1/18/2018 3:15:28 PM	36090

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: North PAD @ 2 ft
Project: NM 87 State 001 Wellhead
Collection Date: 1/8/2018 2:10:00 PM
Lab ID: 1801668-004 **Matrix:** SOIL **Received Date:** 1/11/2018 2:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	1500	75		mg/Kg	50	1/19/2018 11:00:11 PM	36090
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	9.4	9.3		mg/Kg	1	1/17/2018 1:32:59 PM	36022
Motor Oil Range Organics (MRO)	69	47		mg/Kg	1	1/17/2018 1:32:59 PM	36022
Surr: DNOP	93.1	70-130		%Rec	1	1/17/2018 1:32:59 PM	36022
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	1/15/2018 9:51:13 PM	36006
Surr: BFB	87.6	15-316		%Rec	1	1/15/2018 9:51:13 PM	36006
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.025		mg/Kg	1	1/15/2018 5:22:19 PM	36006
Toluene	ND	0.049		mg/Kg	1	1/15/2018 5:22:19 PM	36006
Ethylbenzene	ND	0.049		mg/Kg	1	1/15/2018 5:22:19 PM	36006
Xylenes, Total	ND	0.098		mg/Kg	1	1/15/2018 5:22:19 PM	36006
Surr: 4-Bromofluorobenzene	109	70-130		%Rec	1	1/15/2018 5:22:19 PM	36006
Surr: Toluene-d8	97.3	70-130		%Rec	1	1/15/2018 5:22:19 PM	36006

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: North Pad @ 10 ft
Project: NM 87 State 001 Wellhead
Collection Date: 1/8/2018 2:20:00 PM
Lab ID: 1801668-005 **Matrix:** SOIL **Received Date:** 1/11/2018 2:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	1600	75		mg/Kg	50	1/19/2018 11:12:36 PM	36090

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SE Pasture @ 2 ft
Project: NM 87 State 001 Wellhead
Collection Date: 1/8/2018 2:50:00 PM
Lab ID: 1801668-006
Matrix: SOIL
Received Date: 1/11/2018 2:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **CJS**	
Chloride	ND	30		mg/Kg	20	1/18/2018 4:17:31 PM	36090
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	1/16/2018 8:20:58 PM	36022
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	1/16/2018 8:20:58 PM	36022
Surr: DNOP	92.4	70-130		%Rec	1	1/16/2018 8:20:58 PM	36022
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	1/15/2018 10:14:43 PM	36006
Surr: BFB	88.9	15-316		%Rec	1	1/15/2018 10:14:43 PM	36006
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.024		mg/Kg	1	1/15/2018 5:45:16 PM	36006
Toluene	ND	0.049		mg/Kg	1	1/15/2018 5:45:16 PM	36006
Ethylbenzene	ND	0.049		mg/Kg	1	1/15/2018 5:45:16 PM	36006
Xylenes, Total	ND	0.097		mg/Kg	1	1/15/2018 5:45:16 PM	36006
Surr: 4-Bromofluorobenzene	109	70-130		%Rec	1	1/15/2018 5:45:16 PM	36006
Surr: Toluene-d8	92.7	70-130		%Rec	1	1/15/2018 5:45:16 PM	36006

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SW Pad @ 2 ft
Project: NM 87 State 001 Wellhead
Collection Date: 1/8/2018 1:15:00 PM
Lab ID: 1801668-007
Matrix: SOIL
Received Date: 1/11/2018 2:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **CJS**	
Chloride	300	30		mg/Kg	20	1/18/2018 4:54:44 PM	36090
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.9		mg/Kg	1	1/16/2018 8:45:01 PM	36022
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	1/16/2018 8:45:01 PM	36022
Surr: DNOP	89.8	70-130		%Rec	1	1/16/2018 8:45:01 PM	36022
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.6		mg/Kg	1	1/15/2018 10:38:16 PM	36006
Surr: BFB	87.9	15-316		%Rec	1	1/15/2018 10:38:16 PM	36006
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.023		mg/Kg	1	1/15/2018 6:08:12 PM	36006
Toluene	ND	0.046		mg/Kg	1	1/15/2018 6:08:12 PM	36006
Ethylbenzene	ND	0.046		mg/Kg	1	1/15/2018 6:08:12 PM	36006
Xylenes, Total	ND	0.092		mg/Kg	1	1/15/2018 6:08:12 PM	36006
Surr: 4-Bromofluorobenzene	112	70-130		%Rec	1	1/15/2018 6:08:12 PM	36006
Surr: Toluene-d8	93.5	70-130		%Rec	1	1/15/2018 6:08:12 PM	36006

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1801668**

07-Mar-18

Client: R.T. Hicks Consultants, LTD

Project: NM 87 State 001 Wellhead

Sample ID	**MB-36090**	SampType:	**mblk**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**PBS**	Batch ID:	**36090**	RunNo:	**48535**					
Prep Date:	**1/18/2018**	Analysis Date:	**1/18/2018**	SeqNo:	**1561668**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	1.5								

Sample ID	**LCS-36090**	SampType:	**lcs**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**LCSS**	Batch ID:	**36090**	RunNo:	**48535**					
Prep Date:	**1/18/2018**	Analysis Date:	**1/18/2018**	SeqNo:	**1561669**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	15	1.5	15.00	0	97.9	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1801668**

07-Mar-18

Client: R.T. Hicks Consultants, LTD

Project: NM 87 State 001 Wellhead

Sample ID	**LCS-36022**	SampType:	**LCS**		TestCode:	**EPA Method 8015M/D: Diesel Range Organics**				
Client ID:	**LCSS**	Batch ID:	**36022**		RunNo:	**48464**				
Prep Date:	**1/15/2018**	Analysis Date:	**1/16/2018**		SeqNo:	**1557778**	Units:	**mg/Kg**		

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	45	10	50.00	0	90.4	70	130			
Surr: DNOP	4.4		5.000		88.3	70	130			

Sample ID	**MB-36022**	SampType:	**MBLK**		TestCode:	**EPA Method 8015M/D: Diesel Range Organics**				
Client ID:	**PBS**	Batch ID:	**36022**		RunNo:	**48464**				
Prep Date:	**1/15/2018**	Analysis Date:	**1/16/2018**		SeqNo:	**1557779**	Units:	**mg/Kg**		

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	9.4		10.00		93.6	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1801668**

07-Mar-18

Client: R.T. Hicks Consultants, LTD

Project: NM 87 State 001 Wellhead

Sample ID	**MB-36006**	SampType:	**MBLK**	TestCode:	**EPA Method 8015D: Gasoline Range**					
Client ID:	**PBS**	Batch ID:	**36006**	RunNo:	**48452**					
Prep Date:	**1/12/2018**	Analysis Date:	**1/15/2018**	SeqNo:	**1557550**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	930		1000		93.2	15	316			

Sample ID	**LCS-36006**	SampType:	**LCS**	TestCode:	**EPA Method 8015D: Gasoline Range**					
Client ID:	**LCSS**	Batch ID:	**36006**	RunNo:	**48452**					
Prep Date:	**1/12/2018**	Analysis Date:	**1/15/2018**	SeqNo:	**1557551**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	24	5.0	25.00	0	94.0	75.9	131			
Surr: BFB	1000		1000		101	15	316			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1801668**

07-Mar-18

Client: R.T. Hicks Consultants, LTD

Project: NM 87 State 001 Wellhead

Sample ID	**lcs-36006**	SampType:	**LCS4**	TestCode:	**EPA Method 8260B: Volatiles Short List**
Client ID:	**BatchQC**	Batch ID:	**36006**	RunNo:	**48454**
Prep Date:	**1/12/2018**	Analysis Date:	**1/15/2018**	SeqNo:	**1557603** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.83	0.025	1.000	0	82.8	80	120			
Toluene	0.89	0.050	1.000	0	88.7	80	120			
Ethylbenzene	0.90	0.050	1.000	0	90.2	80	120			
Xylenes, Total	2.6	0.10	3.000	0	87.1	80	120			
Surr: 4-Bromofluorobenzene	0.50		0.5000		99.5	70	130			
Surr: Toluene-d8	0.48		0.5000		95.9	70	130			

Sample ID	**MB-36006**	SampType:	**MBLK**	TestCode:	**EPA Method 8260B: Volatiles Short List**
Client ID:	**PBS**	Batch ID:	**36006**	RunNo:	**48454**
Prep Date:	**1/12/2018**	Analysis Date:	**1/15/2018**	SeqNo:	**1557604** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	0.55		0.5000		110	70	130			
Surr: Toluene-d8	0.47		0.5000		93.4	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: RT HICKS | Work Order Number: 1801668 | RcptNo: 1

Received By: Dennis Suazo 1/11/2018 2:15:00 PM

Completed By: Dennis Suazo 1/12/2018 9:48:47 AM

Reviewed By: mg | VDS 01 | 12 | 18

Chain of Custody

1. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2. How was the sample delivered?	Client		

Log In

3. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
5. Sample(s) in proper container(s)?	Yes ☑	No ☐	
6. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
7. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
8. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
9. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
10. Were any sample containers received broken?	Yes ☐	No ☑	
11. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	# of preserved bottles checked for pH: (<2 or >12 unless noted)
12. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	Adjusted?
13. Is it clear what analyses were requested?	Yes ☑	No ☐	
14. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	Checked by:

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:

By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

16. Additional remarks:

17. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	4.7	Good	Not Present			

Chain-of-Custody Record

Client: R.T. Hicks Consultants

Mailing Address: on-file

Phone #: 970-570-9535

email or Fax#: andrew@rthicksconsult.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation:
☐ NELAP ☐ Other

☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush

Project Name: NM 87 State 001 Wellhead

Project #:

Project Manager: Andrew Parker

Sampler: Andrew Parker

On Ice: ☒ Yes ☐ No

Sample Temperature: 5.1-0.4(rf)=4.7

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1801668	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel) plus MRO	TPH (Method 418.1)	EDB (Method 504.1)	8310 (PNA or PAH)	RCRA 8 Metals	Anions (F, Cl, NO_3, NO_2, PO_4, SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA) BTEX ONLY	8270 (Semi-VOA)	Chloride				Air Bubbles (Y or N)
1/8/18	13:15	Soil	SW PAD @ 2 ft	4oz Jar-2	ICE	001			X							X		X				
	13:30		SW Pasture @ 0.5ft			002			X							X		X				
	13:35		SW Pasture @ 6 ft			003												X				
	14:10		North PAD @ 2 ft			004			X							X		X				
	14:20		North Pad @ 10 ft			005												X				
	14:50 15:00		SE Pasture @ 2 ft			006			X							X		X				
↓	15:15	↓	SE PAD @ 2 ft	↓	↓	007			X							X		X				
	1315		MJ 25/07/18 per standard																			

Date:	Time:	Relinquished by:	Received by:	Date	Time
1/11/18	14:15			1/11/18	1415
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

April 20, 2018

Andrew Parker

R.T. Hicks Consultants, LTD
901 Rio Grande Blvd. NW
Suite F-142
Albuquerque, NM 87104
TEL: (505) 266-5004
FAX (505) 266-0745

RE: Pride 87 St 001 Well Head OrderNo.: 1804277

Dear Andrew Parker:

Hall Environmental Analysis Laboratory received 9 sample(s) on 4/4/2018 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1804277**
Date Reported: **4/20/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SE Pad 0'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 9:05:00 AM
Lab ID: 1804277-001
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	7300	300		mg/Kg	200	4/17/2018 7:36:18 PM	37606
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **AG**	
Gasoline Range Organics (GRO)	ND	5.0		mg/Kg	1	4/10/2018 4:54:04 AM	37463
Surr: BFB	124	70-130		%Rec	1	4/10/2018 4:54:04 AM	37463
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	34	8.9		mg/Kg	1	4/9/2018 1:35:51 PM	37471
Motor Oil Range Organics (MRO)	170	44		mg/Kg	1	4/9/2018 1:35:51 PM	37471
Surr: DNOP	99.9	70-130		%Rec	1	4/9/2018 1:35:51 PM	37471

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SE Pad-2'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 9:25:00 AM
Lab ID: 1804277-002
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	1700	75		mg/Kg	50	4/17/2018 7:48:43 PM	37606
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **AG**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	4/10/2018 5:17:08 AM	37463
Surr: BFB	112	70-130		%Rec	1	4/10/2018 5:17:08 AM	37463
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	4/9/2018 12:07:33 PM	37471
Motor Oil Range Organics (MRO)	ND	48		mg/Kg	1	4/9/2018 12:07:33 PM	37471
Surr: DNOP	97.6	70-130		%Rec	1	4/9/2018 12:07:33 PM	37471
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.024		mg/Kg	1	4/10/2018 5:17:08 AM	37463
Toluene	ND	0.048		mg/Kg	1	4/10/2018 5:17:08 AM	37463
Ethylbenzene	ND	0.048		mg/Kg	1	4/10/2018 5:17:08 AM	37463
Xylenes, Total	ND	0.097		mg/Kg	1	4/10/2018 5:17:08 AM	37463
Surr: 4-Bromofluorobenzene	113	70-130		%Rec	1	4/10/2018 5:17:08 AM	37463
Surr: Toluene-d8	79.8	70-130		%Rec	1	4/10/2018 5:17:08 AM	37463

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SE Pad 4'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 9:35:00 AM
Lab ID: 1804277-003
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	1400	75		mg/Kg	50	4/17/2018 8:25:57 PM	37613
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **AG**	
Gasoline Range Organics (GRO)	ND	4.7		mg/Kg	1	4/10/2018 5:40:11 AM	37463
Surr: BFB	119	70-130		%Rec	1	4/10/2018 5:40:11 AM	37463
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	4/9/2018 12:29:45 PM	37471
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	4/9/2018 12:29:45 PM	37471
Surr: DNOP	94.0	70-130		%Rec	1	4/9/2018 12:29:45 PM	37471
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.024		mg/Kg	1	4/10/2018 5:40:11 AM	37463
Toluene	ND	0.047		mg/Kg	1	4/10/2018 5:40:11 AM	37463
Ethylbenzene	ND	0.047		mg/Kg	1	4/10/2018 5:40:11 AM	37463
Xylenes, Total	ND	0.095		mg/Kg	1	4/10/2018 5:40:11 AM	37463
Surr: 4-Bromofluorobenzene	120	70-130		%Rec	1	4/10/2018 5:40:11 AM	37463
Surr: Toluene-d8	84.0	70-130		%Rec	1	4/10/2018 5:40:11 AM	37463

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SE Pad 6'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 9:40:00 AM
Lab ID: 1804277-004
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	900	30		mg/Kg	20	4/16/2018 1:15:02 PM	37613

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SE Pad 10'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 10:00:00 AM
Lab ID: 1804277-005
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	1300	75		mg/Kg	50	4/17/2018 8:38:21 PM	37613

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SW Pad 0'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 10:35:00 AM
Lab ID: 1804277-006
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	ND	30		mg/Kg	20	4/16/2018 1:39:51 PM	37613

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SW Pad 2'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 10:48:00 AM
Lab ID: 1804277-007
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	73	30		mg/Kg	20	4/16/2018 1:52:16 PM	37613
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **AG**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	4/10/2018 6:03:19 AM	37463
Surr: BFB	117	70-130		%Rec	1	4/10/2018 6:03:19 AM	37463
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	4/9/2018 12:51:44 PM	37471
Motor Oil Range Organics (MRO)	ND	48		mg/Kg	1	4/9/2018 12:51:44 PM	37471
Surr: DNOP	79.4	70-130		%Rec	1	4/9/2018 12:51:44 PM	37471
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.024		mg/Kg	1	4/10/2018 6:03:19 AM	37463
Toluene	ND	0.048		mg/Kg	1	4/10/2018 6:03:19 AM	37463
Ethylbenzene	ND	0.048		mg/Kg	1	4/10/2018 6:03:19 AM	37463
Xylenes, Total	ND	0.097		mg/Kg	1	4/10/2018 6:03:19 AM	37463
Surr: 4-Bromofluorobenzene	118	70-130		%Rec	1	4/10/2018 6:03:19 AM	37463
Surr: Toluene-d8	75.5	70-130		%Rec	1	4/10/2018 6:03:19 AM	37463

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SW Pad 4'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 11:00:00 AM
Lab ID: 1804277-008
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	ND	30		mg/Kg	20	4/16/2018 2:04:41 PM	37613
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **AG**	
Gasoline Range Organics (GRO)	ND	4.7		mg/Kg	1	4/10/2018 6:26:24 AM	37463
Surr: BFB	120	70-130		%Rec	1	4/10/2018 6:26:24 AM	37463
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.0		mg/Kg	1	4/9/2018 1:13:57 PM	37471
Motor Oil Range Organics (MRO)	ND	45		mg/Kg	1	4/9/2018 1:13:57 PM	37471
Surr: DNOP	94.2	70-130		%Rec	1	4/9/2018 1:13:57 PM	37471
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **AG**	
Benzene	ND	0.024		mg/Kg	1	4/10/2018 6:26:24 AM	37463
Toluene	ND	0.047		mg/Kg	1	4/10/2018 6:26:24 AM	37463
Ethylbenzene	ND	0.047		mg/Kg	1	4/10/2018 6:26:24 AM	37463
Xylenes, Total	ND	0.095		mg/Kg	1	4/10/2018 6:26:24 AM	37463
Surr: 4-Bromofluorobenzene	121	70-130		%Rec	1	4/10/2018 6:26:24 AM	37463
Surr: Toluene-d8	81.8	70-130		%Rec	1	4/10/2018 6:26:24 AM	37463

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: SB-SW Pad 6'
Project: Pride 87 St 001 Well Head
Collection Date: 4/3/2018 11:10:00 AM
Lab ID: 1804277-009
Matrix: SOIL
Received Date: 4/4/2018 9:55:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	ND	30		mg/Kg	20	4/16/2018 2:17:06 PM	37613

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1804277**

20-Apr-18

Client: R.T. Hicks Consultants, LTD

Project: Pride 87 St 001 Well Head

Sample ID	**MB-37606**	SampType:	**mblk**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**PBS**	Batch ID:	**37606**	RunNo:	**50585**					
Prep Date:	**4/13/2018**	Analysis Date:	**4/16/2018**	SeqNo:	**1641438**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	1.5								

Sample ID	**LCS-37606**	SampType:	**lcs**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**LCSS**	Batch ID:	**37606**	RunNo:	**50585**					
Prep Date:	**4/13/2018**	Analysis Date:	**4/16/2018**	SeqNo:	**1641439**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	14	1.5	15.00	0	96.4	90	110			

Sample ID	**MB-37613**	SampType:	**mblk**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**PBS**	Batch ID:	**37613**	RunNo:	**50586**					
Prep Date:	**4/16/2018**	Analysis Date:	**4/16/2018**	SeqNo:	**1641514**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	1.5								

Sample ID	**LCS-37613**	SampType:	**lcs**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**LCSS**	Batch ID:	**37613**	RunNo:	**50586**					
Prep Date:	**4/16/2018**	Analysis Date:	**4/16/2018**	SeqNo:	**1641515**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	14	1.5	15.00	0	93.7	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1804277**

20-Apr-18

Client: R.T. Hicks Consultants, LTD

Project: Pride 87 St 001 Well Head

Sample ID **MB-37471**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **37471**	RunNo: **50391**
Prep Date: ***4/6/2018***	Analysis Date: ***4/9/2018***	SeqNo: **1633657** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	9.9		10.00		98.9	70	130			

Sample ID **LCS-37471**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **37471**	RunNo: **50391**
Prep Date: ***4/6/2018***	Analysis Date: ***4/9/2018***	SeqNo: **1633785** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	46	10	50.00	0	91.6	70	130			
Surr: DNOP	4.3		5.000		86.2	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1804277**

20-Apr-18

Client: R.T. Hicks Consultants, LTD

Project: Pride 87 St 001 Well Head

Sample ID	**lcs-37463**	SampType:	**LCS4**	TestCode:	**EPA Method 8260B: Volatiles Short List**
Client ID:	**BatchQC**	Batch ID:	**37463**	RunNo:	**50421**
Prep Date:	**4/6/2018**	Analysis Date:	**4/9/2018**	SeqNo:	**1634695** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.93	0.025	1.000	0	92.8	80	120			
Toluene	0.99	0.050	1.000	0	98.6	80	120			
Ethylbenzene	1.1	0.050	1.000	0	108	80	120			
Xylenes, Total	3.2	0.10	3.000	0	108	80	120			
Surr: 4-Bromofluorobenzene	0.52		0.5000		105	70	130			
Surr: Toluene-d8	0.45		0.5000		89.6	70	130			

Sample ID	**mb-37463**	SampType:	**MBLK**	TestCode:	**EPA Method 8260B: Volatiles Short List**
Client ID:	**PBS**	Batch ID:	**37463**	RunNo:	**50421**
Prep Date:	**4/6/2018**	Analysis Date:	**4/9/2018**	SeqNo:	**1634697** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	0.60		0.5000		119	70	130			
Surr: Toluene-d8	0.42		0.5000		83.6	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1804277**

20-Apr-18

Client: R.T. Hicks Consultants, LTD

Project: Pride 87 St 001 Well Head

Sample ID	**lcs-37463**	SampType:	**LCS**		TestCode:	**EPA Method 8015D Mod: Gasoline Range**					
Client ID:	**LCSS**	Batch ID:	**37463**		RunNo:	**50421**					
Prep Date:	**4/6/2018**	Analysis Date:	**4/9/2018**		SeqNo:	**1634632**	Units:	**mg/Kg**			
Analyte		Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)		24	5.0	25.00	0	96.2	70	130			
Surr: BFB		530		500.0		106	70	130			

Sample ID	**mb-37463**	SampType:	**MBLK**		TestCode:	**EPA Method 8015D Mod: Gasoline Range**					
Client ID:	**PBS**	Batch ID:	**37463**		RunNo:	**50421**					
Prep Date:	**4/6/2018**	Analysis Date:	**4/9/2018**		SeqNo:	**1634634**	Units:	**mg/Kg**			
Analyte		Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)		ND	5.0								
Surr: BFB		590		500.0		118	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: RT HICKS | Work Order Number: 1804277 | RcptNo: 1

Received By: Anne Thorne 4/4/2018 9:55:00 AM Anne Thorne

Completed By: Anne Thorne 4/5/2018 12:48:06 PM Anne Thorne

Reviewed By: PDS 4/5/18 MW 4/5/18

Chain of Custody

1. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2. How was the sample delivered?	Client		

Log In

3. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
5. Sample(s) in proper container(s)?	Yes ☑	No ☐	
6. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
7. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
8. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
9. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
10. Were any sample containers received broken?	Yes ☐	No ☑	
11. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	# of preserved bottles checked for pH: (<2 or >12 unless noted)
12. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	Adjusted? MW 4/5/18
13. Is it clear what analyses were requested?	Yes ☑	No ☐	
14. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	Checked by:

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date

By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

16. Additional remarks:

17. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Not Present			

Chain-of-Custody Record

Client: RT Hicks Consultants
901 Rio Grande Blvd NW
Mailing Address: Suite F-142
Albuquerque, NM 87104
Phone #: 970-570-9535
email or Fax#: andrea@rthicksconsult.com
QA/QC Package:
☑ Standard ☐ Level 4 (Full Validation)
Accreditation:
☐ NELAP ☐ Other
☐ EDD (Type)

Turn-Around Time:
☑ Standard ☐ Rush
Project Name: Pride-87 St. #001 Wellhead (87 well)
Project #:
Project Manager: Andrea Parker
Sampler: Andrea Parker
On Ice: ☑ Yes ☐ No
Sample Temperature: 1.6

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1804277	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel)	TPH (Method 418.1)	EDB (Method 504.1)	8310 (PNA or PAH)	RCRA 8 Metals	Anions ($F, Cl, NO_3, NO_2, PO_4, SO_4$)	8081 Pesticides / 8082 PCB's	8260B (VOA) BTEX only	8270 (Semi-VOA)	PAHs (see pest. list)	Chloride			Air Bubbles (Y or N)
4-3-18	9:05	soil	SB SE pad - 0 ft	4oz / 2 glass	ice	201										X		X	X			
	9:25		SB SE pad - 2 ft	"		202										X		X	X			
	9:35		SB SE pad 4 ft	"		203										X		X	X			
	9:40		SB SE pad 6 ft	"		204													X			
	10:00		SB SE pad 10 ft	"		205													X			
4/3/18	10:35		SB SW Pad 0 ft	"		206													X			
	10:48		SB SW Pad 2 ft	"		207										X		X	X			
	11:00		SB SW Pad 4 ft	"		208										X		X	X			
	11:10		SB SW Pad 6 ft	"		209													X			

Date:	Time:	Relinquished by:	Received by:	Date Time	Remarks:
04/4/4	0955			04/04/18 0955	
Date:	Time:	Relinquished by:	Received by:	Date Time	

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

APPENDIX D

Logger:	Andrew Parker	**Client:**	**Trench ID:**
Driller:	Gandy Backhoe	Pride Energy	SE Pasture
Drilling Method:	Backhoe	**Project Name:**	
Start Date:	1/8/2018	1RP-4624 (NM 87 State 001 Wellhead)	
End Date:	1/8/2018	**Location:**	
		33.059361, -103.518124 (WGS84/NAD83)	

Depth (feet)	Description	Lithology	Comments	Chloride Lab (mg/kg)	Trench Completion	Borehole Diameter	Depth (feet)
0.0	0 - 2 ft						0.0
1.0	Silt; Brown					Backfill with excavated material	1.0
2.0	2 feet		Very hard	<30			2.0
3.0							3.0
4.0							4.0
5.0							5.0
6.0							6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0
11.0							11.0
12.0							12.0
13.0							13.0
14.0							14.0
15.0							15.0
16.0							16.0
17.0							17.0
18.0							18.0
19.0							19.0
20.0							20.0
21.0							21.0
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23.0							23.0
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42.0							42.0
43.0							43.0
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55.0							55.0

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901 Rio Grande Blvd NW
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Albuquerque, NM 87104
505-266-5004

Pride Energy	**Appendix D**
Trench Sampling Log	**May-2018**

Logger:	Andrew Parker	**Client:**	**Trench ID:**
Driller:	Gandy Backhoe	Pride Energy	
Drilling Method:	Hollow Stem Auger	**Project Name:**	
Start Date:	4/3/2018	1RP-4624 (NM 87 State 001 Wellhead)	SE Pad
End Date:	4/3/2018	**Location:**	
		33.059515, -103.518274 (WGS84/NAD83)	

Depth (feet)	Description	Lithology	Comments	Chloride Field/Lab	Borehole Completion	Borehole Diameter	Depth (feet)
0.0	0 - 3 inches Caliche pad			--/7300			0.0
1.0	3 inches - 2 ft Silty; Brown						1.0
2.0				--/1700			2.0
3.0							3.0
4.0	2 - 7 ft Caliche, tan, light pink		Very hard	1470/1400		Hydrated Bentonite	4.0
5.0							5.0
6.0				1194/900			6.0
7.0							7.0
8.0	7 - 10 ft Silt, caliche; light brown, light orange						8.0
9.0							9.0
10.0				1085/1300			10.0
11.0							11.0
12.0							12.0
13.0							13.0
14.0							14.0
15.0							15.0
16.0							16.0
17.0							17.0
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Pride Energy	**Appendix D**
Borehole Log	**April 2018**

Logger:	Andrew Parker	**Client:**	**Trench ID:**
Driller:	Gandy Backhoe	Pride Energy	North Pad
Drilling Method:	Backhoe	**Project Name:**	
Start Date:	1/8/2018	1RP-4624 (NM 87 State 001 Wellhead)	
End Date:	1/8/2018	**Location:**	
		33.059651, -103.518501 (WGS84/NAD83)	

Depth (feet)	Description	Lithology	Comments	**Chloride** Lab (mg/kg)	Trench Completion	Borehole Diameter	**Depth (feet)**
0.0	0 - 6 ft Silty sand; brown		Filled with one tire and 4 boards			Backfill with excavated material	0.0
1.0							1.0
2.0				1,500			2.0
3.0							3.0
4.0							4.0
5.0							5.0
6.0							6.0
7.0	6 - 10 ft Caliche; Light pink		Interbedded sand lenses (medium brown)				7.0
8.0							8.0
9.0							9.0
10.0			Hard at 9 ft	1,600			10.0
11.0							11.0
12.0							12.0
13.0							13.0
14.0							14.0
15.0							15.0
16.0							16.0
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505-266-5004

Pride Energy | **Appendix D**

Trench Sampling Log | **May-2018**

Logger:	Andrew Parker	**Client:**	**Trench ID:**
Driller:	Gandy Backhoe	Pride Energy	SW Pad
Drilling Method:	Hollow Stem Auger	**Project Name:**	
Start Date:	4/3/2018	1RP-4624 (NM 87 State 001 Wellhead)	
End Date:	4/3/2018	**Location:**	
		33.059449, -103.518665 (WGS84/NAD83)	

Depth (feet)	Description	Lithology	Comments	Chloride Field/Lab	Trench Completion	Borehole Diamater	Depth (feet)
0.0	0 - 0.5 ft Caliche Pad			<30			0.0
1.0	0 - 1.5 Silt, dark brown						1.0
2.0	1 - 2.5 ft Calcihe; light grey		Very hard	--/73		Hydrated Bentonite	2.0
3.0							3.0
4.0	2.5 - 6 ft Caliche; light orange, grey			<30			4.0
5.0							5.0
6.0				65/<30			6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0
11.0							11.0
12.0							12.0
13.0							13.0
14.0							14.0
15.0							15.0
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55.0							55.0

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505-266-5004

Pride Energy | **Appendix D**

Trench Sampling Log | **May-2018**

Logger:	Andrew Parker	**Client:**	**Trench ID:**
Driller:	Gandy Backhoe	Pride Energy	SW Pasture
Drilling Method:	Backhoe	**Project Name:**	
Start Date:	1/8/2018	1RP-4624 (NM 87 State 001 Wellhead)	
End Date:	1/8/2018	**Location:**	
		33.059484, -103.518905 (WGS84/NAD83)	

Depth (feet)	Description	Lithology	Comments	**Chloride** Lab (mg/kg)	Trench Completion	Borehole Diameter	**Depth (feet)**
0.0	0 - 1 ft						0.0
1.0	Silt; dark brown			<30 @ 0.5 ft			1.0
2.0	1 - 2 ft Silt, sand; Medium brown					Backfill with excavated material	2.0
3.0	2 - 4.5 ft						3.0
4.0	Caliche; Light pink						4.0
5.0	4.5 - 6 ft						5.0
6.0	Caliche; Tan; orange		Very hard at 6 ft	<30			6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0
11.0							11.0
12.0							12.0
13.0							13.0
14.0							14.0
15.0							15.0
16.0							16.0
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40.0							40.0
41.0							41.0
42.0							42.0
43.0							43.0
44.0							44.0
45.0							45.0
46.0							46.0
47.0							47.0
48.0							48.0
49.0							49.0
50.0							50.0
51.0							51.0
52.0							52.0
53.0							53.0
54.0							54.0
55.0							55.0

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Pride Energy	**Appendix D**
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APPENDIX E

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

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.