Bratcher, Mike, EMNRD

From: Mike Stubblefield <mike@rthicksconsult.com>
Sent: Monday, July 31, 2017 11:59 AM
To: Weaver, Crystal, EMNRD
Cc: Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD; 'Michael Barrett'; 'Jerry Smith'; 'Randall Hicks'; 'Kristin Pope'
Subject: ASAU 150 Trunk line release monitor well sampling

Dear Ms. Weaver,

On Wednesday 8/2/2017 at 10:00am R.T. Hicks Consultants will be collecting water samples from monitor wells no.3 and no.4 located at the Lime Rock Resources ASAU 150 Trunk line release site. The water samples collected for laboratories analysis will be tested for BTEX only. Please contact me if further information is required.

Sincerely,

_____
Mike Stubblefield
RT Hicks Consultants
Cell: 575-365-5034

Bratcher, Mike, EMNRD

From: Weaver, Crystal, EMNRD
Sent: Thursday, September 7, 2017 8:11 AM
To: Kristin Pope
Cc: mike@rthicksconsult.com; mbarrett@limerockresources.com; Randy Hicks; 'Jerry Smith'; Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Subject: RE: Lime Rock ASAU #150

Hello gang,

I can not stress enough that when you email one of us here at the OCD and not all of us that are working on a project it creates communication issues. Please if you can make a point to any time there is something going on that you are talking to me about or Mike Bratcher about that is within District II jurisdiction please email both Mike and myself every time. He and I work here in District II as a team. Also in this case since it is a ground water impact project you would want to email Mike, Bradford Billings and myself on anything that you send in.

Thank you and I hope this helps to clarify a little more how things work on our side.

Crystal Weaver
Environmental Specialist
OCD – Artesia District II
811 S. 1st Street
Artesia, NM 88210
Office: 575-748-1283 ext. 101
Cell: 575-840-5963
Fax: 575-748-9720

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Wednesday, September 6, 2017 4:50 PM
To: Weaver, Crystal, EMNRD <Crystal.Weaver@state.nm.us>
Cc: mike@rthicksconsult.com; mbarrett@limerockresources.com; Randy Hicks <r@rthicksconsult.com>; 'Jerry Smith' <JSmith@limerockresources.com>
Subject: Lime Rock ASAU #150

Crystal,

We are notifying OCD that we will sample the Lime Rock – ASAU #150 monitoring wells for hydrocarbon characterization on Monday, Sept. 11, 2017 at 9:00 am. As discussed during our Aug. 23 meeting, we will sample the top of the water column for laboratory analysis. You will receive the SOP for bailer sampling and the Sampling and Analysis Plan for this work before week's end.
Contact me if you have any questions. Thanks.

Kristin Pope

R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: Michael Barrett <mbarrett@limerockresources.com>
Sent: Thursday, September 7, 2017 8:21 AM
To: Weaver, Crystal, EMNRD
Cc: Kristin Pope; mike@rthicksconsult.com; Randy Hicks; Jerry Smith; Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Subject: Re: Lime Rock ASAU #150

Understood, thx!

Sent from my iPhone

On Sep 7, 2017, at 8:11 AM, Weaver, Crystal, EMNRD <Crystal.Weaver@state.nm.us<mailto:Crystal.Weaver@state.nm.us>> wrote:

Hello gang,

I can not stress enough that when you email one of us here at the OCD and not all of us that are working on a project it creates communication issues. Please if you can make a point to any time there is something going on that you are talking to me about or Mike Bratcher about that is within District II jurisdiction please email both Mike and myself every time. He and I work here in District II as a team. Also in this case since it is a ground water impact project you would want to email Mike, Bradford Billings and myself on anything that you send in.

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Crystal Weaver
Environmental Specialist
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811 S. 1st Street
Artesia, NM 88210
Office: 575-748-1283 ext. 101
Cell: 575-840-5963
Fax: 575-748-9720

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Wednesday, September 6, 2017 4:50 PM
To: Weaver, Crystal, EMNRD <Crystal.Weaver@state.nm.us<mailto:Crystal.Weaver@state.nm.us>>
Cc: mike@rthicksconsult.com<mailto:mike@rthicksconsult.com>; mbarrett@limerockresources.com<mailto:mbarrett@limerockresources.com>; Randy Hicks <r@rthicksconsult.com<mailto:r@rthicksconsult.com>>; 'Jerry Smith' <JSmith@limerockresources.com<mailto:JSmith@limerockresources.com>>
Subject: Lime Rock ASAU #150

Crystal,

We are notifying OCD that we will sample the Lime Rock – ASAU #150 monitoring wells for hydrocarbon characterization on Monday, Sept. 11, 2017 at 9:00 am. As discussed during our Aug. 23 meeting, we will sample the top of the water column for laboratory analysis. You will receive the SOP for bailer sampling and the Sampling and Analysis Plan for this work before week's end.
Contact me if you have any questions. Thanks.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Friday, September 8, 2017 3:51 PM
To: Weaver, Crystal, EMNRD; Bratcher, Mike, EMNRD; Billings, Bradford, EMNRD
Cc: mike@rthicksconsult.com; mbarrett@limerockresources.com; Randy Hicks; 'Jerry Smith'
Subject: RE: Lime Rock ASAU #150
Attachments: SamplingPlanHydrocarbon.pdf

Crystal, Brad, and Mike,

Please find the attached sampling plan for the characterization of BTEX on Monday. Should you have any questions or any other comments, please call me any time. Thanks and have a good weekend.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Wednesday, September 06, 2017 4:50 PM
To: Crystal Weaver (Crystal.Weaver@state.nm.us)
Cc: mike@rthicksconsult.com; Michael Barrett (mbarrett@limerockresources.com) (mbarrett@limerockresources.com); Randy Hicks; 'Jerry Smith' (JSmith@limerockresources.com)
Subject: Lime Rock ASAU #150

Crystal,

We are notifying OCD that we will sample the Lime Rock – ASAU #150 monitoring wells for hydrocarbon characterization on Monday, Sept. 11, 2017 at 9:00 am. As discussed during our Aug. 23 meeting, we will sample the top of the water column for laboratory analysis. You will receive the SOP for bailer sampling and the Sampling and Analysis Plan for this work before week's end.
Contact me if you have any questions. Thanks.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

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

September 8, 2017

Mr. Bradford Billings, Ms. Crystal Weaver, Mr. Mike Bratcher
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210
VIA EMAIL

RE: Sampling and Analysis Plan for Hydrocarbon Characterization
Lime Rock – ASAU #150 Trunkline Release, #2RP-3893

Dear Ms. Weaver, Mr. Billings, and Mr. Bratcher,

As you requested at the meeting at the Artesia OCD office on August 23, 2017, we will sample the monitoring wells at the above-referenced location for the characterization of regulated hydrocarbon constituents in groundwater. As stated in an email on September 6, we will begin collecting these samples at 9:00 am on Monday, September 11, 2017.

On behalf of Lime Rock, please accept this submission is the Sampling and Analysis Plan for this event and will serve as characterization only. This method does not satisfy compliance monitoring requirements of OCD Rules. Generally, the sampling will follow our SOP for Sampling of Monitoring Wells Using a Bailer (attached), but with the following notable specifications and deviations:

- Three full bailers will be purged from the well prior to sample collection. If the sample is turbid, we will discard the sample, wait up to an hour and repeat.
- The analyzing laboratory will be Hall Environmental Analysis Laboratory in Albuquerque and will be delivered by its courier, Keynote Express, within two days of collection.
- Samples will be collected for BTEX analyses. At the time of sample collection, the bailer will be outfitted with a specialized nozzle tip to minimize agitation of VOC samples. Per laboratory specifications, containers will consist of three 40-mL glass VOAs with Teflon-lined, septum caps.
- Samples will be preserved with HgCl and ice[1].
- Approximately 6-inches of LNAPL was last measured on MW-1. Collection of a sample from MW-1 is *not* included in this Plan.

[1] http://www.hallenvironmental.com/samples/

We plan to sample the wells later this month or in early October for quarterly compliance OCD will be notified of this event at least 48 hours in advance. After the receipt of analysis, we will submit summaries of data collected. Please contact me with any questions regarding these actions. Thank you for your help with this project.
Sincerely,

R.T. Hicks Consultants

Kristin Pope
Project Geologist

Enclosure: SOP for bailer sampling

Copy: Lime Rock Resources

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

September 8, 2017

Standard Operating Procedure for Sampling of Monitoring Wells by Bailer

This procedure applies to the use of a hand bailer for the purpose of monitoring groundwater quality. The reader should be familiar with relevant sections of the following document as it is the source of this field method:

Groundwater Sampling, U.S. EPA, Region 4, March 6, 2013
www.epa.gov/sites/production/files/2015-06/documents/Groundwater-Sampling.pdf

The sampler shall review the well construction and previous groundwater analyses (if applicable) prior to the field program. Begin with the well that exhibits the lowest degree of contamination and end with the most contaminated well. The sampler shall also check the laboratory's requirements for containers and sample handling according to the intended analyses. A new pair of disposable nitrile or latex gloves, bailer, and cord, shall be used for each sample. Data Quality Objectives and Quality Assurance protocols in the sampling plan must be followed.

Documentation and Preparation

1. This SOP is appended to the Health and Safety Plan associated with the field program. Don nitrile gloves prior to work.
2. Documentation of all sampling is imperative. Documentation prior to purging and sampling includes, at a minimum
    a. Location (site name, well identification)
    b. Sampler name, date, time sample was collected
    c. Well diameter, total depth of well
    d. Measure and record static depth to water (from the north side of the top of casing) and calculate and record volume of the water column in the casing:
    $V = \pi r^2 h$ r = radius. Radius is ½ of the inside diameter of casing.
    h = height of column; total depth minus depth to water.
    Check units carefully and convert units for volume if needed.
    Decontamination of the portion of the measuring tape that entered the well should be done at this time.
    e. Chain of Custody forms completed except for sample-specific data
    f. Sample labels completed except for the sample-specific data
3. Prepare a sample preparation surface by using a clean drop cloth, plastic sheeting, or other non-reactive material. Stage all materials needed for sampling near the well (refer to checklist at the end of this document).

Purging

This SOP purges three times the volume of standing water in the well. Well conditions and stability of water parameters may dictate a greater or lesser volume purged; this decision will be made by the project manager.

1. Using the water volume calculated above, calculate three times this volume to determine the purge volume goal and record in field notes.
2. Tie nylon cord (or other non-reactive twine) onto a new disposable bailer and slowly lower the bailer to the water level. Do not cause unnecessary turbidity by letting the empty bailer splash into the water. Slowly sink the bailer and allow it to fill. Avoid sinking the bailer farther than necessary to fill as withdrawal of the bailer may cause surging and cause turbidity of the sample.
3. Empty the bailer into a 1-gallon bucket in which is instrumentation to measure field parameters such as temperature, conductance, pH, etc.
4. Carefully retrieve the bailer and evacuate the contents into the waste container. Lower the bailer into the water again and repeat until the targeted purge volume is achieved.
5. After about 1 gallon is purged, empty this container into a larger waste container with a known volume to mark the targeted purge volume using tape, marker, etc.

Sampling

1. After appropriately purging and with pre-labeled containers staged for the expected samples, transfer the water from the bailer directly into the sample container(s), filling containers for VOC analyses first (if applicable). Preserve the sample according to the sampling plan and the requirements of the laboratory for the intended analyses.
2. Immediately cap the containers. Check condition of sample. If sampling for VOCs, ensure than no air bubbles are present in the capped container. Attach a custody seal to the cap, if required.
3. Complete sampling records in logbook or data sheets, including the appearance and odor of the sample water. Complete labels and custody forms.
4. After containers are completely labeled, place all containers for each sample into a zip-lock bag, pre-labeled with identifying information. Immediately place samples into a cooler with ice for transport to the laboratory.
5. Appropriately dispose of the drop cloth, bailer, cord or twine, and other disposable material used.
6. Secure the well before leaving the location.
7. Appropriately dispose of the purged water and decontamination waste. Note the disposition of this material in the sample sheet or notebook. Disposal of waste shall follow federal, state, and/or municipal regulations.

Equipment Checklist

- ☐ Site-specific plans (e.g, health and safety and sampling plan)
- ☐ Plastic zip-top bags to hold samples in cooler
- ☐ Field logbook
- ☐ Personal protective clothing (see HASP)
- ☐ Indelible black ink pens and markers
- ☐ Plastic sheeting as drop cloth for sample preparation area and other uses
- ☐ Clear, waterproof tape to cover sample labels
- ☐ Disposable nitrile or appropriate gloves
- ☐ Appropriate sample containers with labels
- ☐ Bags of ice
- ☐ Decontamination supplies: three buckets, Simple Green, Alconox, or equivalent detergent, fresh and/or distilled water
- ☐ Chain of custody forms
- ☐ Wipes or paper towels
- ☐ Insulated cooler(s)
- ☐ Water level indicator tape
- ☐ Trash Bags
- ☐ New bailers in sealed containers
- ☐ Nylon cord
- ☐ Waste containers
- ☐ Non-reactive brush for decon.
- ☐ Monitoring/screening instruments as required by the health and safety plan

From: Kristin Pope
To: Weaver, Crystal, EMNRD; Bratcher, Mike, EMNRD; Billings, Bradford, EMNRD
Cc: mbarrett@limerockresources.com; mike@rthicksconsult.com; Randy Hicks; "Jerry Smith"
Subject: Lime Rock - ASAU #150 Release
Date: Monday, October 9, 2017 2:02:31 PM
Attachments: BTEXSamplingReport.pdf

Crystal, Mike, and Brad,

Please find the attached sampling report and proposal of additional actions for the Lime Rock ASAU#150 release. We planned to conduct additional sampling on Wednesday, October 11 but forgot that today was a holiday. If this is not enough notice for you, please let us know and we can reschedule. I will call Crystal in the morning to discuss. Thank you.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266.0745
Artesia ▲ Carlsbad ▲ Durango ▲ Midland

October 9, 2017

Mr. Bradford Billings
Ms. Crystal Weaver, Mr. Mike Bratcher
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210 *VIA EMAIL*

RE: Report of Hydrocarbon Characterization and Proposed Actions
Lime Rock – ASAU #150 Trunkline Release, #2RP-3893

Dear Ms. Weaver, Mr. Billings and Mr. Bratcher:

On behalf of Lime Rock Resources, R.T. Hicks Consultants, Ltd. submits this update of activities performed at the above-referenced release location. As requested by NMOCD during a meeting at the District office on August 28, 2017, samples were collected from the top of the water column as a means to characterize the extent and magnitude of hydrocarbon constituents. NMOCD was emailed notification of the scheduled sampling on September 6 and provided a Sampling and Analysis Plan (Plan) on September 8. We report the results of this characterization sampling herein.

Method and Observations

Witnessed by Ms. Weaver, we began at MW-3 and the procedure followed the submitted Plan.

MW-3

- Depth to water (from TOC) was measured at 47.95 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- The third bailer for the sample was observed to be turbid/silty. As specified in the Plan, we waited at least two hours before sampling again.
- We returned to this well and repeated the procedure and obtained a sample at 12:08 pm. The sample was again observed to be silty, as shown in the adjacent photograph.

Silty samples from MW-3

MW-2

- Depth to water (from TOC) was measured at 52.08 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- During bailing, the bailer was observed to have LNAPL sheen on the outside and the water had a sheen on the surface.
- The sample was collected at 10:40 am.

MW-4

- Depth to water (from TOC) was measured at 48.87 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- During bailing and sampling, the water was observed to be clear with no noticeable odor.
- The sample was collected at 11:08 am.

MW-1

- Ms. Weaver stated that NMOCD requests a product thickness measurement in this well.
- We explained that after consistently measuring approximately 6 inches of product thickness, a1-inch "measuring tube" was installed to facilitate accurate DTW measurements (adjacent photograph). Since installation of the sampling tube, we are unable to measure the product.
- DTW was measured in the sampling tube at 52.98 feet on September 11, 2017.

Installation of "Measuring tube" in MW-1

Samples were delivered to Hall Environmental Analysis Laboratory in Albuquerque via its courier service.

Analysis and Evaluation

The sampling data and BTEX analysis provided by Hall is summarized in the table below.

Well ID	DTW from TOC (ft)	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total BTEX	Observations
MW-2	52.08	370	0	51	66	487	Sheen; film on bailer
MW-3	47.95	41	0	0	0	41	Turbid at 1st attempt; waited 2 hrs, sample is silty
MW-4	48.87	3300	0	470	0	3770	Clear
MW-1	52.98	---	---	---	---	---	DTW only; measured from steel sampling tube
WQCC std		10	750	750	620		

all concentrations are µg/L

Table 1: BTEX characterization sampling (9/11/2017)

When compared to the concentrations from the last compliance sampling event for each well, the data show the following relationships:

- MW-2, approximately 60 feet southeast of MW-1, yielded 930 µg/L benzene when sampled using a bailer-purge method soon after installation on June 12, 2017. Although the September 11 characterization sampling method is not comparable to the compliance sampling method, the characterization sampling revealed a decrease in benzene of more than 60% in this well.

- MW-3 was sampled for compliance on August 2, 2017 using a low-flow purge and sample method[1] which yielded benzene concentration of 61 µg/L. When compared to the

[1] https://www.epa.gov/sites/production/files/2015-06/documents/EQASOP-GW001.pdf

compliance sampling, the September characterization sampling shows a benzene decrease of approximately 33%.

- MW-4 displayed a marked increase when the characterization sampling is compared to the last compliance sampling which 1530 µg/L benzene. The well was sampled for August 2, 2017 using a bailer-purge method instead of the low-flow method due to a problem with the pump. When compared to the recent characterization sampling, benzene in this well demonstrated an increase of 116%.

Additional Proposed Actions

VOC chemistry appears to demonstrate a southeastern groundwater gradient and DTW measurements from this event confirm a south-southeastern vector (Figure 1) of 0.214, significantly steeper gradient than was last measured in August. Benzene is the only regulated BTEX component in these samples that exceeded WQCC standards (Table 1). Concentrations of BTEX components, observations of the samples, and our experience, however, suggest that the concentrations are more indicative of a lighter product such as gasoline or natural gas condensate. We propose three additional actions to further characterize the groundwater impact at this site.

To provide clarity regarding the nature of the release and as an exercise of academic interest, we propose a **chemical comparison of product sample floating in MW-1 to the product in Lime Rock's system** following these steps:

1. Remove the measuring tube in MW-1 at least two days prior to the compliance sampling event to allow time for the water and LNAPL to return to an equilibrium state.
2. Measure and record DTW and thickness of LNAPL.
3. Collect a sample of only LNAPL using a bailer and preserve for analysis at Lime Rock's usual laboratory used for product analysis.
4. Collect a representative product sample from Lime Rock's system in accordance with the laboratory's instructions.
5. Submit both samples for comparative analysis for physical and chemical characteristics as defined by Lime Rock.

Given the contradictory nature of prior VOC chemistry at this site, we propose **additional samples to confirm the characterization samples** collected on September 11 using a bailer. **Compliance monitoring sampling of wells MW-2, -3, and -4** for the final 2017 quarter are planned for Wednesday, October 11, 2017. Because these wells were installed up to several months apart, this will be the first sampling event where all data from each well will be collected on the same day. We will employ the low-flow sampling procedure referenced in the previous page with the following addition:

1. After compliance sampling of the well for VOCs and inorganic constituents using the low-flow method, the pump rate will be reduced and the intake will be raised to a level of approximately 1 foot from the DTW level, the same interval from which the characterization sample was collected on September 11 using a bailer.
2. Collect sample during the low-flow pumping from the top of the column for BTEX analysis per the laboratory's requirements.
3. Since the shallower samples will also not fulfill the quarterly sampling requirement, these will be placed on a separate chain of custody form from the compliance samples collected previously on the same day.

Thank you for your consideration of this data and your help with this project. NMOCD will be notified of significant events at least 48 hours in advance. Please consider this report written notice for the sampling activities planned for October 11, 2017 at 9:00 am.

A copy of this report will be provided to the surface owner. The data gathered thus far leads us to the opinion that there is minimal danger of hydrocarbon impact from this release to existing and future down-gradient water wells installed using contemporary construction standards, as domestic and irrigation wells pump from deeper zones of the aquifer. We acknowledge the exceedance of regulated hydrocarbon constituents at this site and recognize a likely requirement of 1-2 additional down-gradient monitoring wells in the future. We request that NMOCD allow the collection of the proposed data to facilitate the best assessment regarding the possible placement of future wells and the remediation of this release.

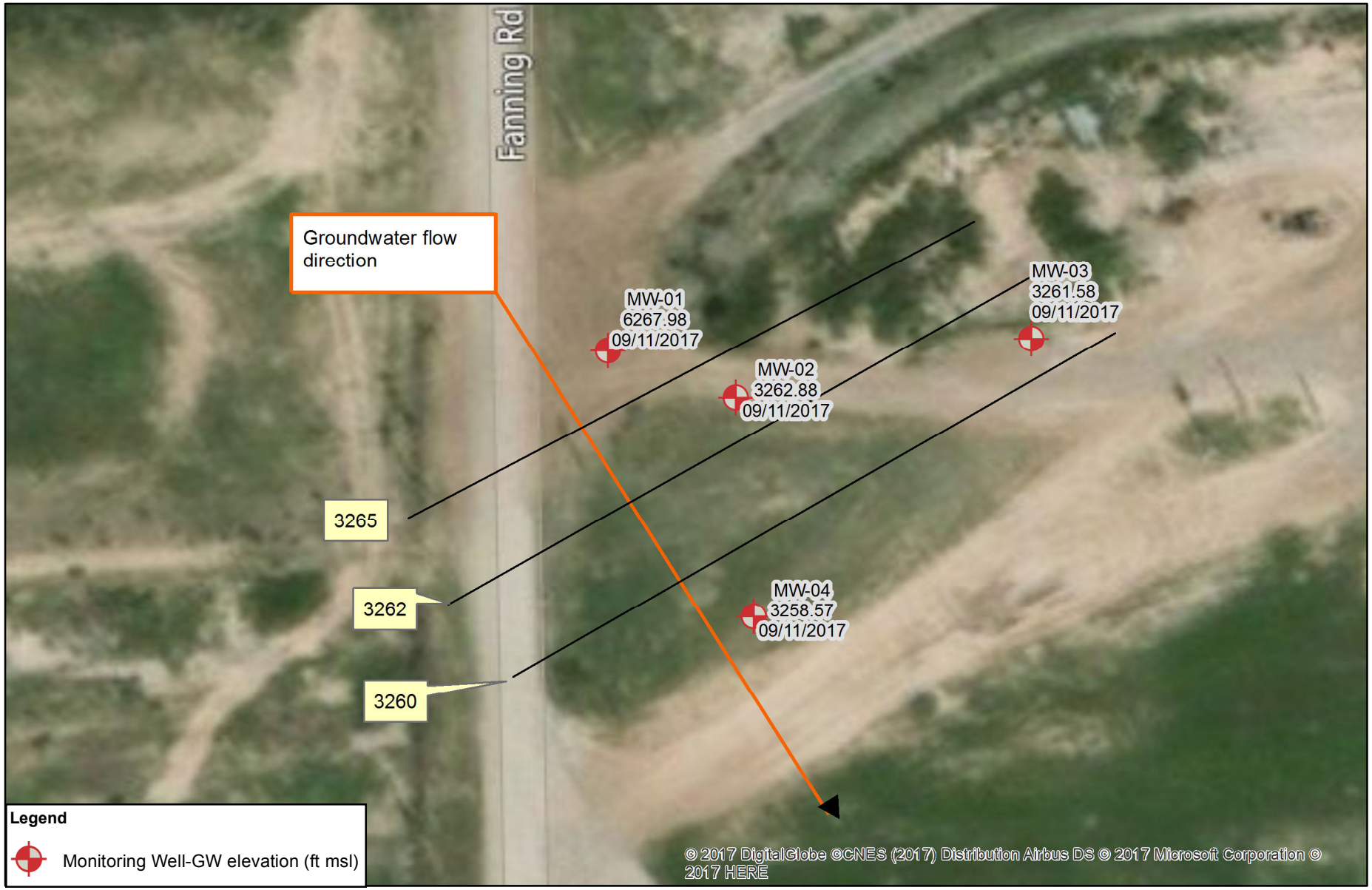
Sincerely,
R.T. Hicks Consultants

Kristin Pope
Project Geologist

Enclosures: Figure 1, laboratory report

Copy: Lime Rock Resources, Gray Holdings (surface owner)

M:\Lime Rock Resources\asau trunk\PitRuleTemplate_10_1\Figures\May 2017\Figure 1 gw direction sept 11 2017.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Flow Direction	Figure 1
	Limerock Resources: ASAU #150 Release	Oct 2017

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

September 21, 2017

Kristin Pope

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: Lime Rock ASAU 150 Release OrderNo.: 1709837

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 9/14/2017 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 **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 10:40:00 AM
Lab ID: 1709837-001 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	370	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Toluene	ND	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Ethylbenzene	51	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Xylenes, Total	66	10		µg/L	10	9/20/2017 8:04:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	90.3	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: 4-Bromofluorobenzene	95.8	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Dibromofluoromethane	96.7	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Toluene-d8	90.4	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 12:08:00 PM
Lab ID: 1709837-002 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	41	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Toluene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Ethylbenzene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:28:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	91.6	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Dibromofluoromethane	96.9	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Toluene-d8	91.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 11:28:00 AM
Lab ID: 1709837-003 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	3300	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Toluene	ND	1.0		µg/L	1	9/20/2017 8:52:00 AM	B45748
Ethylbenzene	470	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:52:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	97.0	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.5	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Dibromofluoromethane	95.8	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Toluene-d8	89.2	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748

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QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **100ng lcs2**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453586** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	22	1.0	20.00	0	110	70	130			
Toluene	20	1.0	20.00	0	98.6	70	130			
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.6	70	130			
Surr: 4-Bromofluorobenzene	9.6		10.00		95.5	70	130			
Surr: Dibromofluoromethane	9.7		10.00		97.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb2**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453587** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.0		10.00		89.7	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		94.8	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		88.6	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454013** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	21	1.0	20.00	0	107	70	130			
Surr: 1,2-Dichloroethane-d4	9.2		10.00		91.6	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		95.4	70	130			
Surr: Dibromofluoromethane	9.5		10.00		95.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Ethylbenzene	ND	1.0								
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.9	70	130			

Qualifiers:

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QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1709837**
21-Sep-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150 Release

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 4-Bromofluorobenzene	9.6		10.00		95.6	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		89.3	70	130			

Qualifiers:

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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: 1709837 RcptNo: 1

Received By: Isaiah Ortiz 9/14/2017 9:42:00 AM

Completed By: Ashley Gallegos 9/15/2017 9:43:33 AM

Reviewed By: 9/15/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted?

Checked by:

Special Handling (if applicable)

16. 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:

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

RT

Chain-of-Custody Record

Client: [illegible] Consultants

Mailing Address: 301 Rio Grande Blvd NW

Albuquerque [illegible]

Phone #: (505) [illegible]

email or Fax: R[illegible]@rthicksconsult.com

QA/QC:

Standard ☐ Level 4 (Full Validation)

Accreditation:

☐ NELAP ☐ Other

☐ EDD (Type)

Turn-Around Time:

☒ Standard ☐ Rush

Project Name: ~~Marathon~~ Lime Rock ASAU #150 Release

Project #:

Project Manager: Kristin Pope

Sampler: ~~Kristin Pope~~ M. Stubblefield

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.0

Hall Environmental Analysis Laboratory

[illegible] Albuquerque, NM 87109

Tel. 505-345-[illegible] Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1709837	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel) 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)	8270 (Semi-VOA)		100 grams			Air Bubbles (Y or N)
9/11/17	1040	grd water	MW-2	3 40-mL VOA glass	ice, HgCl2	-001	X															
"	1208	"	MW-3	"	"	-002	X															
"	1128	"	MW-4	"	"	-003	X															

Date:	Time:	Relinquished by:	Received by:	Date	Time
9/13/2017	9:00 AM	[signature]	[signature]	9/14/17	0942
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email results to R, kristin@rthicksconsult.com, mike@ "

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.

From: Kristin Pope
To: Weaver, Crystal, EMNRD; Bratcher, Mike, EMNRD; Billings, Bradford, EMNRD
Cc: mbarrett@limerockresources.com; mike@rthicksconsult.com; Randy Hicks; "Jerry Smith"
Subject: RE: Lime Rock - ASAU #150 Release
Date: Tuesday, October 10, 2017 1:26:34 PM

Brad,

Thanks for discussing this project with me today. As you requested, we will request analysis for the long list of volatiles using EPA method 8260. Since this event is our quarterly sampling, we will also analize for Chloride, TDS, and Sulfate for these samples.

You also requested TPH analysis so we'll also run the 8015 method on the characterization samples we collect near the top of the column.

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Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Monday, October 09, 2017 2:02 PM
To: Crystal Weaver (Crystal.Weaver@state.nm.us); Mike Bratcher; 'Billings, Bradford, EMNRD' (Bradford.Billings@state.nm.us)
Cc: Michael Barrett (mbarrett@limerockresources.com) (mbarrett@limerockresources.com); mike@rthicksconsult.com; Randy Hicks; 'Jerry Smith' (JSmith@limerockresources.com)
Subject: Lime Rock - ASAU #150 Release

Crystal, Mike, and Brad,

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R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

From: Billings, Bradford, EMNRD
To: Kristin Pope
Cc: Bratcher, Mike, EMNRD; Weaver, Crystal, EMNRD
Subject: RE: Lime Rock - ASAU #150 Release
Date: Tuesday, October 10, 2017 1:30:54 PM

Hi,

Your welcome. Please do not forget the forensic look at the product proper, against that supplied by well being serviced by the line that leaked.. and the purging of the wells post sampling. Pictures would be good. Also, what is the product thickness in MW-1. Thanks.

Brad Billings

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Tuesday, October 10, 2017 1:26 PM
To: Weaver, Crystal, EMNRD <Crystal.Weaver@state.nm.us>; Bratcher, Mike, EMNRD <mike.bratcher@state.nm.us>; Billings, Bradford, EMNRD <Bradford.Billings@state.nm.us>
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To: Billings, Bradford, EMNRD
Cc: Bratcher, Mike, EMNRD; Weaver, Crystal, EMNRD
Subject: RE: Lime Rock - ASAU #150 Release
Date: Tuesday, October 10, 2017 1:35:18 PM

Absolutely, we will. Thanks!

Kristin Pope
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575.302.6755

From: Billings, Bradford, EMNRD [mailto:Bradford.Billings@state.nm.us]
Sent: Tuesday, October 10, 2017 1:31 PM
To: Kristin Pope
Cc: Bratcher, Mike, EMNRD; Weaver, Crystal, EMNRD
Subject: RE: Lime Rock - ASAU #150 Release

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575.302.6755

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Friday, October 13, 2017 4:01 PM
To: Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD; Weaver, Crystal, EMNRD
Cc: mbarrett@limerockresources.com; Randy Hicks; mike@rthicksconsult.com; 'Jerry Smith'
Subject: RE: Lime Rock - ASAU #150 Release
Attachments: IMG_3344.JPG; IMG_3351.JPG

Brad, Crystal, and Mike,

We attempted to sample these wells beginning with MW-3 on the morning of Wednesday, October 11, but due to the failure of our pump, we weren't able to sample any of the three.

We measured the LNAPL thickness on MW-1 to be approximately 1.5 inches (attached). We submitted a sample of the product to Laboratory Services in Hobbs for comparative analysis as stated in our plan.

We also purged 13.5 gallons from MW-3 by hand to attempt to clear the silt from the well. The attached photo is of the last bailer that shows the water did not clear up.

We ordered a new pump on the same day and it arrived today. We plan to return to sample the wells on Tuesday, October 17 beginning at 9:00 am. We plan to purge MW-3 after sampling on that same day. Please contact me with any questions or if we need to reschedule this to fit your availability. Thank you.

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575.302.6755

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Tuesday, October 10, 2017 1:35 PM
To: 'Billings, Bradford, EMNRD'
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575.302.6755

Bratcher, Mike, EMNRD

From: Billings, Bradford, EMNRD
Sent: Friday, October 13, 2017 4:08 PM
To: Kristin Pope; Bratcher, Mike, EMNRD; Weaver, Crystal, EMNRD
Cc: mbarrett@limerockresources.com; Randy Hicks; mike@rthicksconsult.com; 'Jerry Smith'
Subject: RE: Lime Rock - ASAU #150 Release

Short point for the moment, as a thought, get a metal bailer and shock bail the well a bunch. Similar to like drill rigs dropping their heavy bailer in to develop a newly placed monitor well. By the by, was this done (the drill rig thing) on these wells when placed?

Di you also get a sample from the feeder well to do the comparison for product?

Is there a problem with the pump and fines content of the water in well? If this is a possibility, then serious consideration should be given to above suggestion I think.

Thank you for the update.

Brad

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Sent: Friday, October 13, 2017 4:01 PM
To: Billings, Bradford, EMNRD <Bradford.Billings@state.nm.us>; Bratcher, Mike, EMNRD <mike.bratcher@state.nm.us>; Weaver, Crystal, EMNRD <Crystal.Weaver@state.nm.us>
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R.T. Hicks Consultants
Carlsbad Field Office

575.302.6755

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Tuesday, October 10, 2017 1:35 PM
To: 'Billings, Bradford, EMNRD'
Cc: 'Bratcher, Mike, EMNRD'; 'Weaver, Crystal, EMNRD'
Subject: RE: Lime Rock - ASAU #150 Release

Absolutely, we will. Thanks!

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Yes, we used our oil interface probe in MW-1. Depth to LNAPL was 52.23 ft. DTW was approximately 52.50 ft. Even though we lowered the probe slowly and tried to minimize turbity, the DTW measurement was difficult to ascertain and was not clear. So between the measurements in the well and observations in the bailer, LNAPL thickness is approximately 1.50-3.24 Inches. When we bailed the LNAPL down, moved to bail MW-3, and then returned to MW-1 after approximately 1 hour, the thickness in the first bailer was about the same as observed in the photo of the initial bailer trip.

We will measure MW-1 again next week when we are there sampling the other wells.

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Attachments: BTEXSamplingReport.pdf

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Our pump has arrived and is working, and we have a backup on hand. We will sample MW-2, MW-3, and MW-4 tomorrow, **Tuesday, October 24, beginning at 9:00 am**. We will collect the quarterly compliance samples for each well using the low-flow procedure. Then we will collect a sample from the top of the column for hydrocarbon characterization as stated in the attached, previously-submitted report. As requested by NMOCD, we will analyze for the long list of Method 8260 and TPH 8015 on the characterization samples.

If this schedule is inconvenient for you, please let me know as soon as possible. Thank you.

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Artesia ▲ Carlsbad ▲ Durango ▲ Midland

October 9, 2017

Mr. Bradford Billings
Ms. Crystal Weaver, Mr. Mike Bratcher
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210 *VIA EMAIL*

RE: Report of Hydrocarbon Characterization and Proposed Actions
Lime Rock – ASAU #150 Trunkline Release, #2RP-3893

Dear Ms. Weaver, Mr. Billings and Mr. Bratcher:

On behalf of Lime Rock Resources, R.T. Hicks Consultants, Ltd. submits this update of activities performed at the above-referenced release location. As requested by NMOCD during a meeting at the District office on August 28, 2017, samples were collected from the top of the water column as a means to characterize the extent and magnitude of hydrocarbon constituents. NMOCD was emailed notification of the scheduled sampling on September 6 and provided a Sampling and Analysis Plan (Plan) on September 8. We report the results of this characterization sampling herein.

Method and Observations

Witnessed by Ms. Weaver, we began at MW-3 and the procedure followed the submitted Plan.

MW-3

- Depth to water (from TOC) was measured at 47.95 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- The third bailer for the sample was observed to be turbid/silty. As specified in the Plan, we waited at least two hours before sampling again.
- We returned to this well and repeated the procedure and obtained a sample at 12:08 pm. The sample was again observed to be silty, as shown in the adjacent photograph.

Silty samples from MW-3

MW-2

- Depth to water (from TOC) was measured at 52.08 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- During bailing, the bailer was observed to have LNAPL sheen on the outside and the water had a sheen on the surface.
- The sample was collected at 10:40 am.

MW-4

- Depth to water (from TOC) was measured at 48.87 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- During bailing and sampling, the water was observed to be clear with no noticeable odor.
- The sample was collected at 11:08 am.

MW-1

- Ms. Weaver stated that NMOCD requests a product thickness measurement in this well.
- We explained that after consistently measuring approximately 6 inches of product thickness, a1-inch "measuring tube" was installed to facilitate accurate DTW measurements (adjacent photograph). Since installation of the sampling tube, we are unable to measure the product.
- DTW was measured in the sampling tube at 52.98 feet on September 11, 2017.

Installation of "Measuring tube" in MW-1

Samples were delivered to Hall Environmental Analysis Laboratory in Albuquerque via its courier service.

Analysis and Evaluation

The sampling data and BTEX analysis provided by Hall is summarized in the table below.

Well ID	DTW from TOC (ft)	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total BTEX	Observations
MW-2	52.08	370	0	51	66	487	Sheen; film on bailer
MW-3	47.95	41	0	0	0	41	Turbid at 1st attempt; waited 2 hrs, sample is silty
MW-4	48.87	3300	0	470	0	3770	Clear
MW-1	52.98	---	---	---	---	---	DTW only; measured from steel sampling tube
WQCC std		10	750	750	620		

all concentrations are µg/L

Table 1: BTEX characterization sampling (9/11/2017)

When compared to the concentrations from the last compliance sampling event for each well, the data show the following relationships:

- MW-2, approximately 60 feet southeast of MW-1, yielded 930 µg/L benzene when sampled using a bailer-purge method soon after installation on June 12, 2017. Although the September 11 characterization sampling method is not comparable to the compliance sampling method, the characterization sampling revealed a decrease in benzene of more than 60% in this well.

- MW-3 was sampled for compliance on August 2, 2017 using a low-flow purge and sample method[1] which yielded benzene concentration of 61 µg/L. When compared to the

[1] https://www.epa.gov/sites/production/files/2015-06/documents/EQASOP-GW001.pdf

compliance sampling, the September characterization sampling shows a benzene decrease of approximately 33%.

- MW-4 displayed a marked increase when the characterization sampling is compared to the last compliance sampling which 1530 µg/L benzene. The well was sampled for August 2, 2017 using a bailer-purge method instead of the low-flow method due to a problem with the pump. When compared to the recent characterization sampling, benzene in this well demonstrated an increase of 116%.

Additional Proposed Actions

VOC chemistry appears to demonstrate a southeastern groundwater gradient and DTW measurements from this event confirm a south-southeastern vector (Figure 1) of 0.214, significantly steeper gradient than was last measured in August. Benzene is the only regulated BTEX component in these samples that exceeded WQCC standards (Table 1). Concentrations of BTEX components, observations of the samples, and our experience, however, suggest that the concentrations are more indicative of a lighter product such as gasoline or natural gas condensate. We propose three additional actions to further characterize the groundwater impact at this site.

To provide clarity regarding the nature of the release and as an exercise of academic interest, we propose a **chemical comparison of product sample floating in MW-1 to the product in Lime Rock's system** following these steps:

1. Remove the measuring tube in MW-1 at least two days prior to the compliance sampling event to allow time for the water and LNAPL to return to an equilibrium state.
2. Measure and record DTW and thickness of LNAPL.
3. Collect a sample of only LNAPL using a bailer and preserve for analysis at Lime Rock's usual laboratory used for product analysis.
4. Collect a representative product sample from Lime Rock's system in accordance with the laboratory's instructions.
5. Submit both samples for comparative analysis for physical and chemical characteristics as defined by Lime Rock.

Given the contradictory nature of prior VOC chemistry at this site, we propose **additional samples to confirm the characterization samples** collected on September 11 using a bailer. **Compliance monitoring sampling of wells MW-2, -3, and -4** for the final 2017 quarter are planned for Wednesday, October 11, 2017. Because these wells were installed up to several months apart, this will be the first sampling event where all data from each well will be collected on the same day. We will employ the low-flow sampling procedure referenced in the previous page with the following addition:

1. After compliance sampling of the well for VOCs and inorganic constituents using the low-flow method, the pump rate will be reduced and the intake will be raised to a level of approximately 1 foot from the DTW level, the same interval from which the characterization sample was collected on September 11 using a bailer.
2. Collect sample during the low-flow pumping from the top of the column for BTEX analysis per the laboratory's requirements.
3. Since the shallower samples will also not fulfill the quarterly sampling requirement, these will be placed on a separate chain of custody form from the compliance samples collected previously on the same day.

Thank you for your consideration of this data and your help with this project. NMOCD will be notified of significant events at least 48 hours in advance. Please consider this report written notice for the sampling activities planned for October 11, 2017 at 9:00 am.

A copy of this report will be provided to the surface owner. The data gathered thus far leads us to the opinion that there is minimal danger of hydrocarbon impact from this release to existing and future down-gradient water wells installed using contemporary construction standards, as domestic and irrigation wells pump from deeper zones of the aquifer. We acknowledge the exceedance of regulated hydrocarbon constituents at this site and recognize a likely requirement of 1-2 additional down-gradient monitoring wells in the future. We request that NMOCD allow the collection of the proposed data to facilitate the best assessment regarding the possible placement of future wells and the remediation of this release.

Sincerely,
R.T. Hicks Consultants

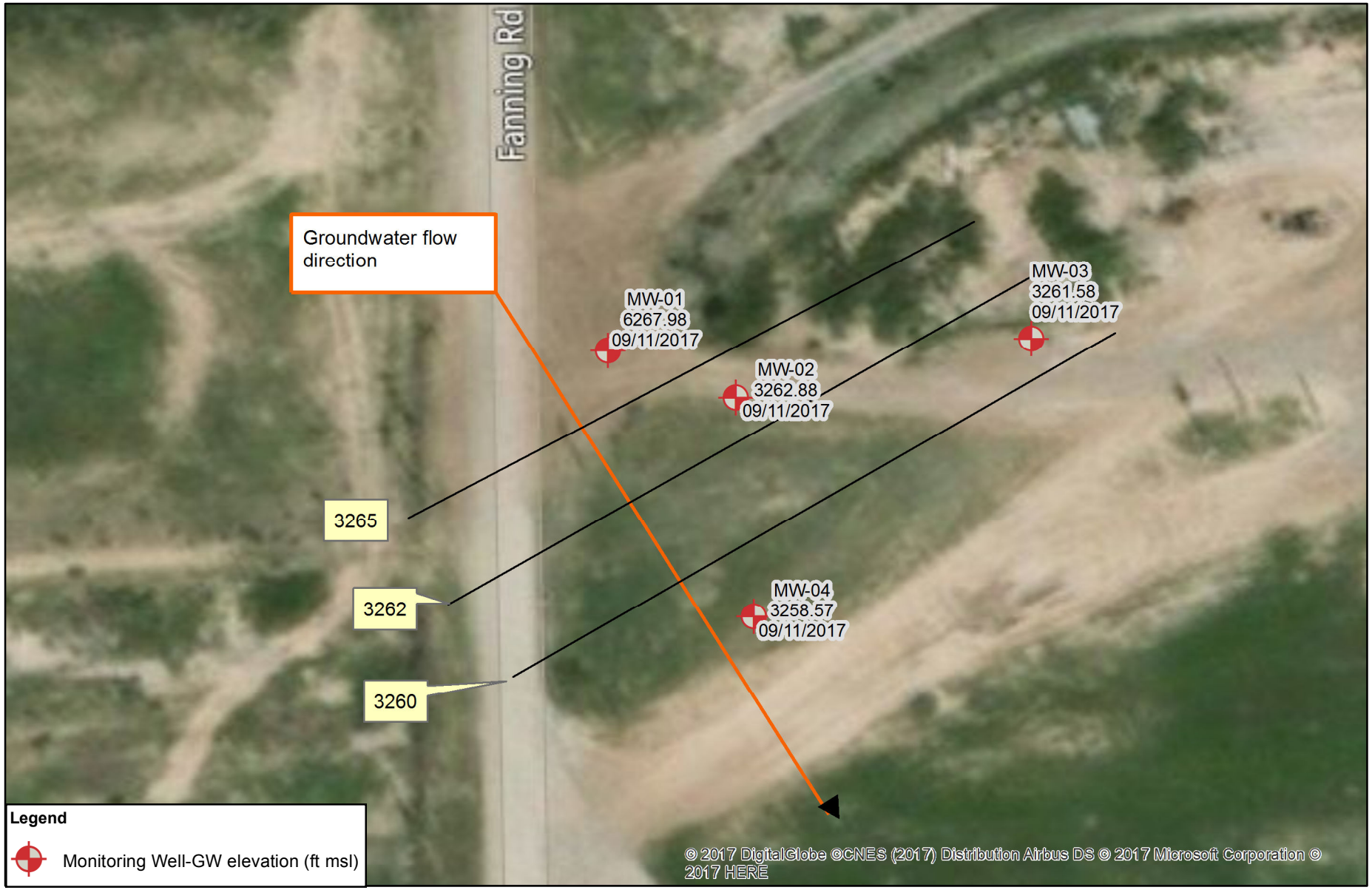
Kristin Pope

Kristin Pope
Project Geologist

Enclosures: Figure 1, laboratory report

Copy: Lime Rock Resources, Gray Holdings (surface owner)

M:\Lime Rock Resources\asau trunk\PitRuleTemplate_10_1\Figures\May 2017\Figure 1 gw direction sept 11 2017.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Flow Direction	Figure 1
	Limerock Resources: ASAU #150 Release	Oct 2017

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

September 21, 2017

Kristin Pope

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: Lime Rock ASAU 150 Release OrderNo.: 1709837

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 9/14/2017 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 **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 10:40:00 AM
Lab ID: 1709837-001 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	370	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Toluene	ND	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Ethylbenzene	51	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Xylenes, Total	66	10		µg/L	10	9/20/2017 8:04:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	90.3	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: 4-Bromofluorobenzene	95.8	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Dibromofluoromethane	96.7	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Toluene-d8	90.4	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 12:08:00 PM
Lab ID: 1709837-002 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	41	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Toluene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Ethylbenzene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:28:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	91.6	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Dibromofluoromethane	96.9	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Toluene-d8	91.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 11:28:00 AM
Lab ID: 1709837-003 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	3300	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Toluene	ND	1.0		µg/L	1	9/20/2017 8:52:00 AM	B45748
Ethylbenzene	470	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:52:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	97.0	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.5	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Dibromofluoromethane	95.8	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Toluene-d8	89.2	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748

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#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **100ng lcs2**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453586** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	22	1.0	20.00	0	110	70	130			
Toluene	20	1.0	20.00	0	98.6	70	130			
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.6	70	130			
Surr: 4-Bromofluorobenzene	9.6		10.00		95.5	70	130			
Surr: Dibromofluoromethane	9.7		10.00		97.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb2**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453587** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.0		10.00		89.7	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		94.8	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		88.6	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454013** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	21	1.0	20.00	0	107	70	130			
Surr: 1,2-Dichloroethane-d4	9.2		10.00		91.6	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		95.4	70	130			
Surr: Dibromofluoromethane	9.5		10.00		95.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Ethylbenzene	ND	1.0								
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.9	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
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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#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 4-Bromofluorobenzene	9.6		10.00		95.6	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		89.3	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
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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: 1709837 RcptNo: 1

Received By: Isaiah Ortiz 9/14/2017 9:42:00 AM

Completed By: Ashley Gallegos 9/15/2017 9:43:33 AM

Reviewed By: 9/15/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. 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: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

RT

Chain-of-Custody Record

Client: [illegible] Consultants

Mailing Address: 301 Rio Grande Blvd NW

Albuquerque [illegible]

Phone #: (505) [illegible]

email or Fax: R[illegible]@rthicksconsult.com

QA/QC:

☒ Standard ☐ Level 4 (Full Validation)

Accreditation:

☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:

☒ Standard ☐ Rush _____

Project Name: ~~Marathon~~ Lime Rock

ASAU #150 Release

Project #:

Project Manager:

Kristin Pope

Sampler: ~~Kristin Pope~~ M. Stubblefield

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.0

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. 1709837	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel) 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)	8270 (Semi-VOA)		100 grams		Air Bubbles (Y or N)
9/11/17	1040	grd water	MW-2	3 40-mL VOA glass	ice, HgCl2	-001	X														
"	1208	"	MW-3	"	"	-002	X														
"	1128	"	MW-4	"	"	-003	X														

Date	Time	Relinquished by:	Received by:	Date	Time
9/13/2017	9:00 AM	[signature]	[signature]	9/14/17	0942
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email results to R, kristin@rthicksconsult.com, mike@ "

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.

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Tuesday, November 14, 2017 6:57 AM
To: Bratcher, Mike, EMNRD; Weaver, Crystal, EMNRD; Billings, Bradford, EMNRD
Cc: mike@rthicksconsult.com; mbarrett@limerockresources.com; 'Jerry Smith'; Randy Hicks
Subject: Lime Rock: ASAU #150

Wanted to give everyone a quick update about the ASAU #150 site. We sampled for hydrocarbon characterization and quarterly compliance last month. We also submitted a sample of the LNAPL in MW-1 for comparative analysis to the crude in Lime Rock's system. It appears that the static LNAPL thickness in MW-1 is now around 1.5 inches.

We received the last set of lab analysis late last week and we are working on report to be submitted OCD that includes a proposal of removal of LNAPL from MW-1. Thanks for your help.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Friday, December 22, 2017 1:02 PM
To: Weaver, Crystal, EMNRD; Bratcher, Mike, EMNRD
Cc: Randy Hicks; mike@rthicksconsult.com; mbarrett@limerockresources.com; 'Jerry Smith'
Subject: Lime Rock ASAU #150 Release #2RP-3893
Attachments: ASAU150_SummaryAndProposal.pdf

Crystal and Mike,

Please find the attached report and proposal for the Lime Rock ASAU #150 Release . It includes:

- A summary of the compliance sampling performed to date
- A summary of the hydrocarbon characterization samples OCD required from the top of the water.
- A summary of the oil analysis on MW-1. Last measurement showed 1.5" thickness.
- A proposal for recovery of product on MW-1 using a sock. It was installed today and we will check it weekly.
- A proposal for at least one more well and possibly more after Q1 2018 analyses are received.

Let me know if you have any questions. Merry Christmas and enjoy your holiday.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266.0745
Artesia ▲ Carlsbad ▲ Durango ▲ Midland

December 22, 2017

Mr. Bradford Billings
Ms. Crystal Weaver, Mr. Mike Bratcher
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210 *VIA EMAIL*

RE: **Groundwater Sampling Report and Proposed Actions**
Lime Rock – ASAU #150 Trunkline Release, #2RP-3893

Dear Ms. Weaver, Mr. Billings, and Mr. Bratcher:

On behalf of Lime Rock Resources, R.T. Hicks Consultants, Ltd. submits the report and proposal for the above-referenced site. The following report summarizes data collected thus far and proposes actions to characterize and mitigate potential environmental impact caused by this release with the aim of closure of the regulatory file.

Summary of Previous Actions, Site Conditions, & Submissions

- The initial response actions to the August 30, 2016 release and proposed monitoring wells were described in a December 2016 report to OCD.
- MW-1, nearest to the release, has exhibited measurable Light Non-Aqueous Phase Liquid (LNAPL) ranging in thickness from 6 inches soon after installation, to 1.5 inches most recently.
- Lime Rock and Hicks Consultants met with OCD on May 23, 2017 to discuss placement criteria of additional wells.
- A total of four 2-inch monitoring wells were installed at the site this year and three of them are sampled on a quarterly basis (Appendix A). Plate 1 is an aerial image that displays the location of the monitoring wells at the release site, in relation to the junction of Fanning (CR 44) and Thistle (CR 24) Roads.
- At a meeting with Lime Rock and Hicks Consultants on August 23, 2017, OCD requested sampling of the top of the water column for hydrocarbon analysis.
- A proposal for characterization sampling for hydrocarbon at the top of the water was submitted to OCD on September 8, 2017.
- On October 9, 2017, a report of the September characterization sampling was submitted to OCD, which included a proposal for further characterization sampling (Appendices B and C).

The monitoring wells were installed per New Mexico Guidance and OCD approval, with 10 feet of screen below the water table and 5-feet above groundwater. The wells were sampled no sooner than 48 hours after appropriate development. Most of the samples were collected using

a low-flow sampling procedure[1] except when pump failure required sample collection using the conventional hand bail method with purging of three casing volumes.

Compliance Sampling of Monitoring Wells
Appendix A includes a summary of all monitoring events (Table 1) including depth to water measurements and analyses and laboratory reports from the fourth quarter (October 24) sampling. From these data, we make the following observations:

- LNAPL in MW-1 has diminished in thickness by 75% since initial installation. Compliance sampling of this well for dissolved constituents provides no value.
- MW-2 has exhibited a sheen and hydrocarbon odor since installation.
- Benzene concentrations in each well exceed WQCC standards (0.01 mg/L) at each sampling event. Benzene concentrations in each well show significant variation due to sampling methods and possibly other factors.
- Sulfate concentrations in each well exceed WQCC standards (600 mg/L) at each sampling event.
- Analyses of total dissolved solids (TDS) in each well exhibit concentrations that exceed WQCC standards (1000 mg/L), except MW-2. The TDS concentration of the first sampling event of MW-2 appears to be a laboratory error.
- Chloride concentrations of all monitoring samples are below the WQCC standard (250 mg/L).
- Groundwater elevation is decreasing from August to October. Plate 2, a map of October groundwater flow direction illustrations a relatively flat southeastern gradient. VOC groundwater chemistry from the October 24 sampling demonstrate a southeastern groundwater gradient from the pipeline release and g confirm a southeastern vector, but a significantly flatter gradient than was measured in August.

Additional Proposed Actions

Additional Monitoring Well
Characterization of the magnitude and extent of hydrocarbons in shallow groundwater is required by OCD and additional wells are necessary. In mid- January 2018, we will conduct the quarterly compliance sampling of the wells except for MW-1. We will continue to employ the low-stress, low-flow procedure and will analyze for BTEXN, chloride, sulfate, and TDS. OCD will be given at least 48 hours' notice of each sampling event. In February, we will present the first quarter sampling data to OCD in the form of a potentiometric surface map, updated data table and a benzene isocontour map of the plume. Unless these new data are unexpected, the observed benzene concentration gradient and the relatively constant groundwater flow vector, suggest a well in the vicinity of the area marked on Plate 1 and should define the concentration gradient within the impacted area. This next well, MW-5, will be installed and developed in early March 2018 in order to provide representative samples for the second quarterly compliance monitoring event in April 2018.

The submission of second quarter results in May 2018 will include a proposal for the additional monitoring well(s) which we anticipate will complete the groundwater monitoring network.

[1] https://www.epa.gov/quality/low-stress-low-flow-purging-and-sampling-procedure-collection-groundwater-samples-monitoring

LNAPL Recovery in MW-1

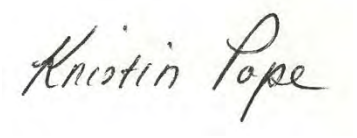
Recovery of LNAPL in MW-1 will begin on December 22, 2017. We will employ a passive system using a stainless steel cage-like bailer containing an oil-absorbing sock[2] to be monitored on a weekly basis. Each week, depth to water and depth to LNAPL measurements will be recorded, as well as the condition of the sock (degree of oil soak). The sock will be changed on a weekly basis, or more frequently if needed, and used socks will be secured and disposed of properly. If the amount of LNAPL increases and causes this system to be inadequate, we will propose a more robust recovery method.

Thank you for your consideration of this data and meeting with us many times regarding this project. OCD will be notified of significant events at least 48 hours in advance.

A copy of this report is provided to the landowner. The data gathered thus far suggest that the potential of hydrocarbon impact from this release to existing, down-gradient water wells is so small as to be nil. We believe it also highly unlikely that the observed hydrocarbon concentrations would impair water quality in future water supply wells installed using contemporary construction standards. This opinion of a low risk to the environment and public health causes us to allow site data to guide the assessment of the impact and thence to determine the most appropriate response.

Sincerely,

R.T. Hicks Consultants



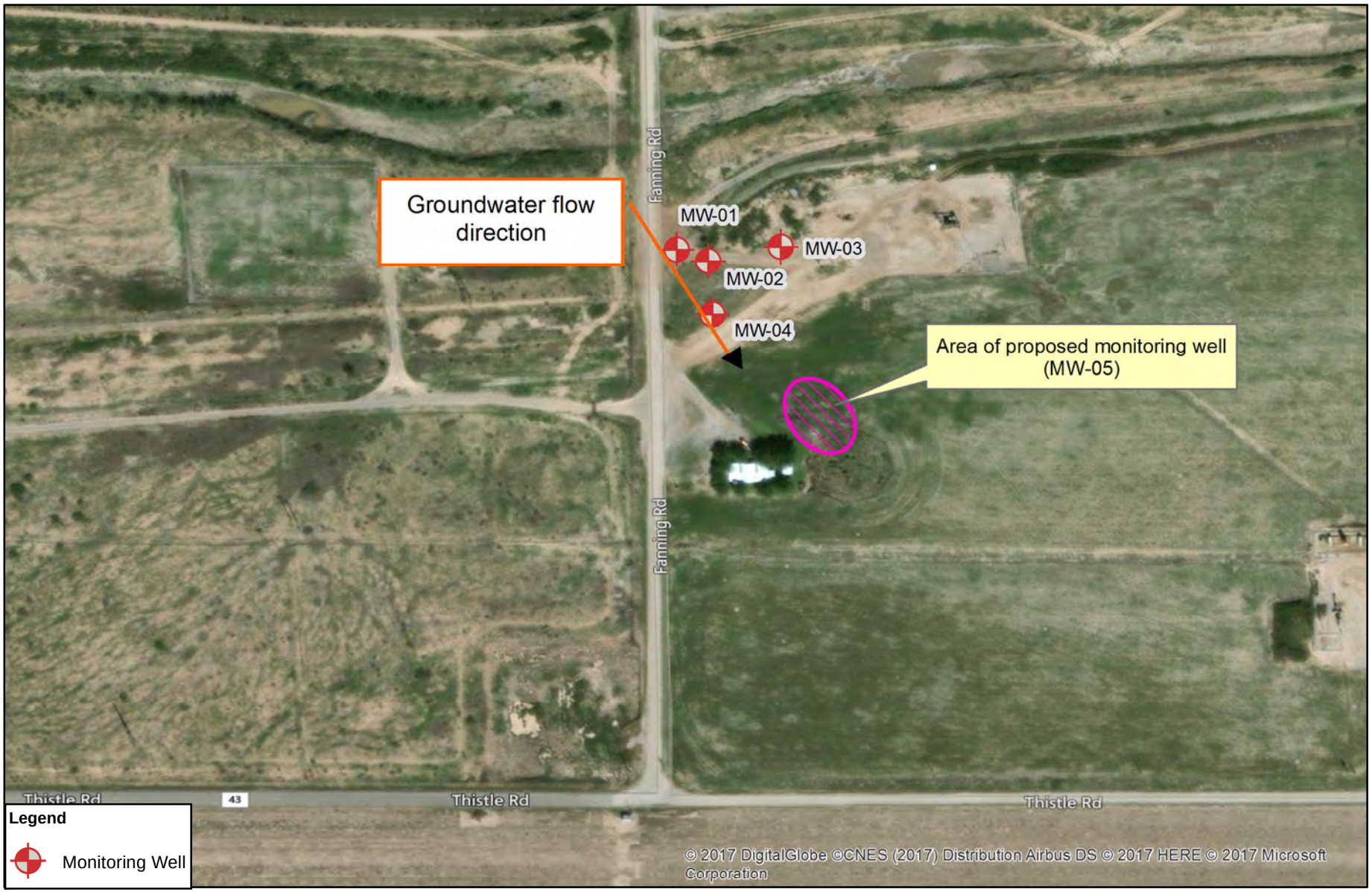
Kristin Pope
Project Geologist

Enclosures: Plates 1 and 2, Appendices A-C

Copy: Lime Rock Resources, Gray Holdings (surface owner)

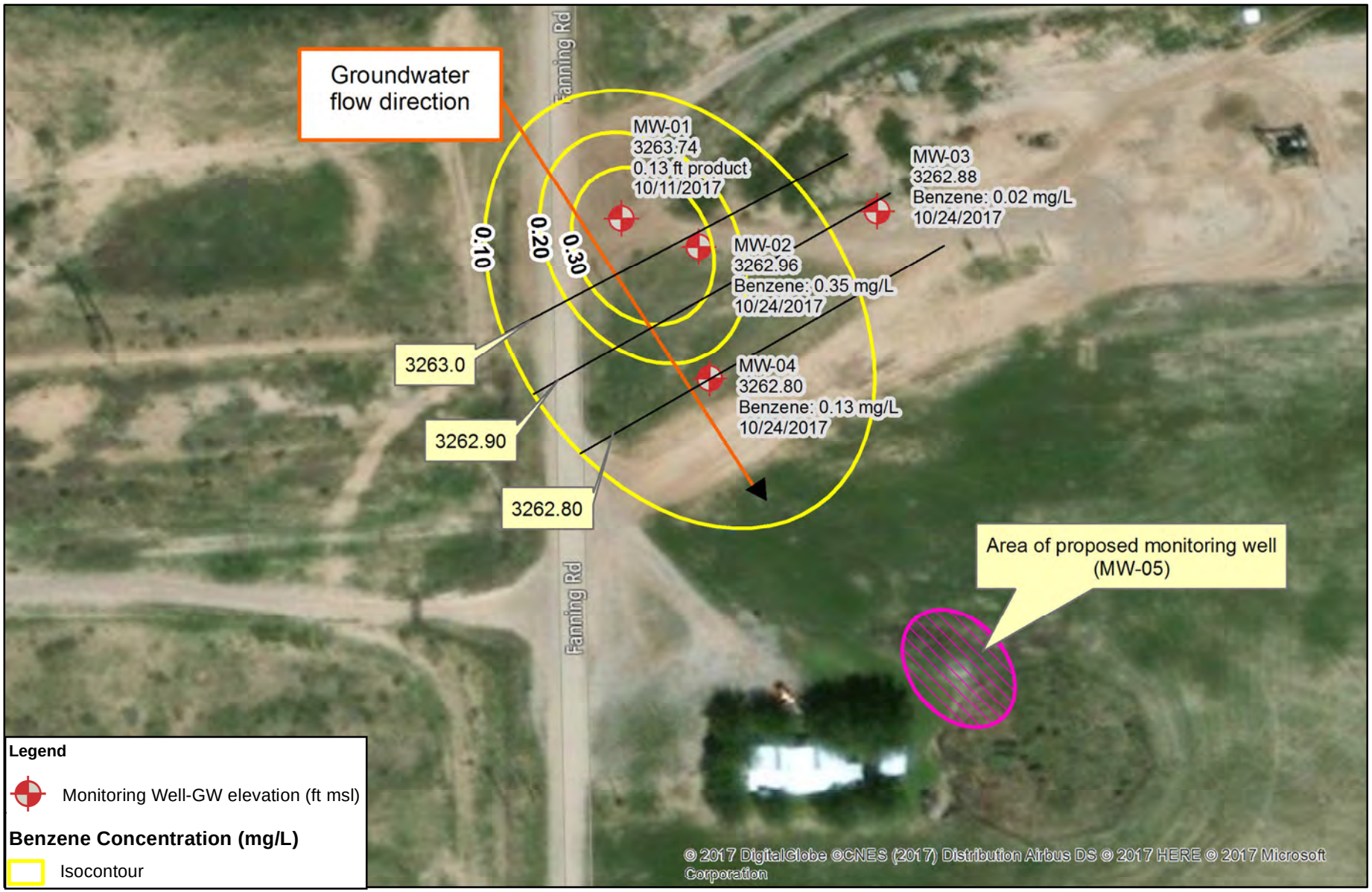
[2] http://www.geotechenv.com/pdf/free_phase_ground_water_remediation/geosorb.pdf

M:\Lime Rock Resources\asau trunk releases\PitRuleTemplate_10_1\Figures\yearEndReport2017\Plate 1 general location.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Monitoring Well Locations Relative to Environs	Plate 1
	Lime Rock Resources: ASAU #150 Release	December 2017

M:\Lime Rock Resources\asau trunk releases\PitRuleTemplate_10_1\Figures\yearEndReport2017\Figure 2 gw direction with Benzene October 2017.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Flow Direction with Benzene Isocontours (mg/L) Lime Rock Resources: ASAU #150 Release	Plate 2 December 2017

Appendix A

Compliance Sampling Summary and Laboratory Report

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

Well ID	DTW ft (from TOC)	Sample Date	LNAPL in.	Benzene 0.01	Toluene	Ethyl benzene	Total Xylenes	Naphtha-lene 0.03	Total BTEX	Chloride 250	Sulfate 600	TDS 1000	Sampling method	Lab	Notes
MW-1	51.62	3/8/17	6.00	19.2	8.5	2.31	5.17	---	35.2	188	1460	2800	bail	Cardinal	by oil/water interface meter
	51.62		6.24	---	---	---	---	---	---	---	---	---	---	---	baildown test
	51.9	7/19/17	---	---	---	---	---	---	---	---	---	---	---	---	from nested measuring tube
	52.36	10/11/17	1.5	---	---	---	---	---	---	---	---	---	bail		sampled LNAPL
MW-2	51.11	6/12/17	none	0.93	0.0047	0.011	0.034	---	0.0497	200	2100	381	bail	Hall	
54	grab samples for comparison	7/13/17	none	ND	ND	ND	ND	---	ND	---	---	---	low-flow pump	Hall	sampled at 54'
59		7/13/17	none	0.0082	ND	ND	ND	---	0.0082	---	---	---	low-flow pump	Hall	sampled at 59'
	52.00	10/24/2017	none	0.35	0.0078	0.063	0.079	0.013	---	180	2200	---	low-flow pump	Hall	
MW-3	46.4	8/2/17	none	0.061	ND	ND	ND	---	0.061	212	2010	3920	low-flow pump	Cardinal	
	47.57	10/24/2017	none	0.02	ND	ND	ND	ND	---	190	2100	---	low-flow pump	Hall	
MW-4	46.8	8/2/17	none	1.53	<0.020	0.101	<0.060	---	1.64	200	1840	3460	bail	Cardinal	
	48.75	10/24/2017	none	0.13	ND	0.016	ND	0.0092	---	180	2000	---	low-flow pump	Hall	

all concentrations are mg/L

Table 1

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

November 02, 2017

Kristin Pope

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: Lime Rock ASAU 150 OrderNo.: 1710F09

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 10/26/2017 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

Hall Environmental Analysis Laboratory, Inc.

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 11:53:00 AM
Lab ID: 1710F09-001 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	180	50		mg/L	100	10/30/2017 1:19:10 PM	R46764
Sulfate	2200	50	*	mg/L	100	10/30/2017 1:19:10 PM	R46764
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
Benzene	350	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Toluene	7.8	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Ethylbenzene	63	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Methyl tert-butyl ether (MTBE)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2,4-Trimethylbenzene	29	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,3,5-Trimethylbenzene	9.8	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2-Dichloroethane (EDC)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2-Dibromoethane (EDB)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Naphthalene	13	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
1-Methylnaphthalene	ND	20		µg/L	5	11/1/2017 5:32:00 AM	A46777
2-Methylnaphthalene	ND	20		µg/L	5	11/1/2017 5:32:00 AM	A46777
Acetone	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Bromobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Bromodichloromethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Bromoform	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Bromomethane	ND	15		µg/L	5	11/1/2017 5:32:00 AM	A46777
2-Butanone	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Carbon disulfide	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Carbon Tetrachloride	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Chlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Chloroethane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
Chloroform	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Chloromethane	ND	15		µg/L	5	11/1/2017 5:32:00 AM	A46777
2-Chlorotoluene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
4-Chlorotoluene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
cis-1,2-DCE	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
cis-1,3-Dichloropropene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2-Dibromo-3-chloropropane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
Dibromochloromethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Dibromomethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2-Dichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,3-Dichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,4-Dichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Dichlorodifluoromethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1-Dichloroethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1-Dichloroethene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 11:53:00 AM
Lab ID: 1710F09-001 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
1,2-Dichloropropane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,3-Dichloropropane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
2,2-Dichloropropane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1-Dichloropropene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Hexachlorobutadiene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
2-Hexanone	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Isopropylbenzene	12	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
4-Isopropyltoluene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
4-Methyl-2-pentanone	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Methylene Chloride	ND	15		µg/L	5	11/1/2017 5:32:00 AM	A46777
n-Butylbenzene	ND	15		µg/L	5	11/1/2017 5:32:00 AM	A46777
n-Propylbenzene	15	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
sec-Butylbenzene	5.1	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Styrene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
tert-Butylbenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1,1,2-Tetrachloroethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1,2,2-Tetrachloroethane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
Tetrachloroethene (PCE)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
trans-1,2-DCE	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
trans-1,3-Dichloropropene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2,3-Trichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2,4-Trichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1,1-Trichloroethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1,2-Trichloroethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Trichloroethene (TCE)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Trichlorofluoromethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2,3-Trichloropropane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
Vinyl chloride	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Xylenes, Total	79	7.5		µg/L	5	11/1/2017 5:32:00 AM	A46777
Surr: 1,2-Dichloroethane-d4	98.1	70-130		%Rec	5	11/1/2017 5:32:00 AM	A46777
Surr: 4-Bromofluorobenzene	99.1	70-130		%Rec	5	11/1/2017 5:32:00 AM	A46777
Surr: Dibromofluoromethane	99.2	70-130		%Rec	5	11/1/2017 5:32:00 AM	A46777
Surr: Toluene-d8	99.0	70-130		%Rec	5	11/1/2017 5:32:00 AM	A46777

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 9:52:00 AM
Lab ID: 1710F09-002 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	190	50		mg/L	100	10/30/2017 1:44:00 PM	R46764
Sulfate	2100	50	*	mg/L	100	10/30/2017 1:44:00 PM	R46764
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
Benzene	20	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Toluene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Ethylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2,4-Trimethylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Naphthalene	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1-Methylnaphthalene	ND	4.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2-Methylnaphthalene	ND	4.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Acetone	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Bromobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Bromodichloromethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Bromoform	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Bromomethane	ND	3.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2-Butanone	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Carbon disulfide	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Carbon Tetrachloride	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Chlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Chloroethane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Chloroform	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Chloromethane	ND	3.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2-Chlorotoluene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
4-Chlorotoluene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
cis-1,2-DCE	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Dibromochloromethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Dibromomethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,3-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,4-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Dichlorodifluoromethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1-Dichloroethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1-Dichloroethene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 9:52:00 AM
Lab ID: 1710F09-002 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
1,2-Dichloropropane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,3-Dichloropropane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2,2-Dichloropropane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Hexachlorobutadiene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2-Hexanone	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Isopropylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
4-Isopropyltoluene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
4-Methyl-2-pentanone	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Methylene Chloride	ND	3.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
n-Butylbenzene	ND	3.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
n-Propylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
sec-Butylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Styrene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
tert-Butylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
trans-1,2-DCE	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1,1-Trichloroethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1,2-Trichloroethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Trichloroethene (TCE)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Trichlorofluoromethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2,3-Trichloropropane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Vinyl chloride	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Xylenes, Total	ND	1.5		µg/L	1	11/1/2017 5:56:00 AM	A46777
Surr: 1,2-Dichloroethane-d4	99.0	70-130		%Rec	1	11/1/2017 5:56:00 AM	A46777
Surr: 4-Bromofluorobenzene	97.5	70-130		%Rec	1	11/1/2017 5:56:00 AM	A46777
Surr: Dibromofluoromethane	102	70-130		%Rec	1	11/1/2017 5:56:00 AM	A46777
Surr: Toluene-d8	96.2	70-130		%Rec	1	11/1/2017 5:56:00 AM	A46777

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 10:46:00 AM
Lab ID: 1710F09-003 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	180	50		mg/L	100	10/30/2017 2:08:48 PM	R46764
Sulfate	2000	50	*	mg/L	100	10/30/2017 2:08:48 PM	R46764
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
Benzene	130	10		µg/L	10	11/1/2017 6:43:00 AM	A46777
Toluene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Ethylbenzene	16	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2,4-Trimethylbenzene	2.1	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,3,5-Trimethylbenzene	1.8	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Naphthalene	9.2	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1-Methylnaphthalene	5.3	4.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2-Methylnaphthalene	ND	4.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Acetone	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Bromobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Bromodichloromethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Bromoform	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Bromomethane	ND	3.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2-Butanone	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Carbon disulfide	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Carbon Tetrachloride	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Chlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Chloroethane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Chloroform	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Chloromethane	ND	3.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2-Chlorotoluene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
4-Chlorotoluene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
cis-1,2-DCE	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Dibromochloromethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Dibromomethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,3-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,4-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Dichlorodifluoromethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1-Dichloroethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1-Dichloroethene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 10:46:00 AM
Lab ID: 1710F09-003 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
1,2-Dichloropropane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,3-Dichloropropane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2,2-Dichloropropane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Hexachlorobutadiene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2-Hexanone	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Isopropylbenzene	4.0	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
4-Isopropyltoluene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
4-Methyl-2-pentanone	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Methylene Chloride	ND	3.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
n-Butylbenzene	ND	3.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
n-Propylbenzene	1.9	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
sec-Butylbenzene	1.4	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Styrene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
tert-Butylbenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
trans-1,2-DCE	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1,1-Trichloroethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1,2-Trichloroethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Trichloroethene (TCE)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Trichlorofluoromethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2,3-Trichloropropane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Vinyl chloride	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Xylenes, Total	ND	1.5		µg/L	1	11/1/2017 3:37:00 PM	A46812
Surr: 1,2-Dichloroethane-d4	103	70-130		%Rec	1	11/1/2017 3:37:00 PM	A46812
Surr: 4-Bromofluorobenzene	98.6	70-130		%Rec	1	11/1/2017 3:37:00 PM	A46812
Surr: Dibromofluoromethane	105	70-130		%Rec	1	11/1/2017 3:37:00 PM	A46812
Surr: Toluene-d8	98.6	70-130		%Rec	1	11/1/2017 3:37:00 PM	A46812

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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID	**LCS**	SampType:	**lcs**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**LCSW**	Batch ID:	**R46764**	RunNo:	**46764**					
Prep Date:		Analysis Date:	**10/30/2017**	SeqNo:	**1490509**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.9	0.50	5.000	0	98.9	90	110			
Sulfate	10	0.50	10.00	0	100	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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **100ng lcs2** SampType: **LCS** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW** Batch ID: **A46777** RunNo: **46777**
Prep Date: Analysis Date: **11/1/2017** SeqNo: **1491518** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	20	1.0	20.00	0	102	70	130			
Toluene	20	1.0	20.00	0	97.8	70	130			
Chlorobenzene	20	1.0	20.00	0	99.8	70	130			
1,1-Dichloroethene	22	1.0	20.00	0	109	70	130			
Trichloroethene (TCE)	20	1.0	20.00	0	98.8	70	130			
Surr: 1,2-Dichloroethane-d4	10		10.00		101	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		100	70	130			
Surr: Dibromofluoromethane	9.9		10.00		98.6	70	130			
Surr: Toluene-d8	9.7		10.00		97.1	70	130			

Sample ID **rb3** SampType: **MBLK** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW** Batch ID: **A46777** RunNo: **46777**
Prep Date: Analysis Date: **11/1/2017** SeqNo: **1491520** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								

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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **rb3**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **A46777**	RunNo: **46777**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1491520** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								

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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **rb3**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **A46777**	RunNo: **46777**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1491520** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.7		10.00		97.4	70	130			
Surr: 4-Bromofluorobenzene	9.9		10.00		98.7	70	130			
Surr: Dibromofluoromethane	10		10.00		102	70	130			
Surr: Toluene-d8	9.7		10.00		96.6	70	130			

Sample ID **100ng lcs**	SampType: **LCS4**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **BatchQC**	Batch ID: **A46812**	RunNo: **46812**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1492499** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Toluene	19	1.0	20.00	0	95.9	70	130			
Ethylbenzene	19	1.0	20.00	0	96.5	70	130			
Methyl tert-butyl ether (MTBE)	42	1.0	40.00	0	106	70	130			
1,2,4-Trimethylbenzene	19	1.0	20.00	0	95.1	70	130			
1,3,5-Trimethylbenzene	19	1.0	20.00	0	93.6	70	130			
1,2-Dichloroethane (EDC)	20	1.0	20.00	0	99.7	62.2	143			
1,2-Dibromoethane (EDB)	20	1.0	20.00	0	102	70	130			
Naphthalene	19	2.0	20.00	0	96.3	70	130			
1-Methylnaphthalene	20	4.0	20.00	0	101	60	140			
2-Methylnaphthalene	15	4.0	20.00	0	76.4	60	140			
Acetone	38	10	40.00	0	95.4	60	140			
Bromobenzene	20	1.0	20.00	0	97.8	70	130			
Bromodichloromethane	20	1.0	20.00	0	101	70	130			
Bromoform	20	1.0	20.00	0	100	70	130			
Bromomethane	17	3.0	20.00	0	83.5	60	140			
2-Butanone	47	10	40.00	0	117	60	140			
Carbon disulfide	41	10	40.00	0	102	60	140			
Carbon Tetrachloride	20	1.0	20.00	0	99.3	70	130			
Chlorobenzene	20	1.0	20.00	0	97.7	70	130			
Chloroethane	20	2.0	20.00	0	98.7	60	140			
Chloroform	20	1.0	20.00	0	101	70	130			
Chloromethane	21	3.0	20.00	0	105	60	140			
2-Chlorotoluene	19	1.0	20.00	0	94.9	70	130			
4-Chlorotoluene	19	1.0	20.00	0	96.0	70	130			
cis-1,2-DCE	21	1.0	20.00	0	105	70	130			
cis-1,3-Dichloropropene	19	1.0	20.00	0	93.8	70	130			
1,2-Dibromo-3-chloropropane	20	2.0	20.00	0	102	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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **100ng lcs** SampType: **LCS4** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **BatchQC** Batch ID: **A46812** RunNo: **46812**
Prep Date: Analysis Date: **11/1/2017** SeqNo: **1492499** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Dibromochloromethane	19	1.0	20.00	0	92.9	70	130			
Dibromomethane	21	1.0	20.00	0	107	70	130			
1,2-Dichlorobenzene	19	1.0	20.00	0	94.4	70	130			
1,3-Dichlorobenzene	19	1.0	20.00	0	94.6	70	130			
1,4-Dichlorobenzene	19	1.0	20.00	0	95.1	67.2	141			
Dichlorodifluoromethane	23	1.0	20.00	0	115	60	140			
1,1-Dichloroethane	21	1.0	20.00	0	104	52.6	157			
1,1-Dichloroethene	20	1.0	20.00	0	100	70	130			
1,2-Dichloropropane	20	1.0	20.00	0	102	63.7	138			
1,3-Dichloropropane	20	1.0	20.00	0	99.0	70	130			
2,2-Dichloropropane	21	2.0	20.00	0	105	70	130			
1,1-Dichloropropene	20	1.0	20.00	0	101	70	130			
Hexachlorobutadiene	18	1.0	20.00	0	88.4	70	130			
2-Hexanone	42	10	40.00	0	104	60	140			
Isopropylbenzene	19	1.0	20.00	0	96.1	70	130			
4-Isopropyltoluene	19	1.0	20.00	0	95.6	70	130			
4-Methyl-2-pentanone	45	10	40.00	0	112	60	140			
Methylene Chloride	21	3.0	20.00	0	104	70	130			
n-Butylbenzene	18	3.0	20.00	0	90.7	70	130			
n-Propylbenzene	19	1.0	20.00	0	94.6	70	130			
sec-Butylbenzene	18	1.0	20.00	0	92.1	70	130			
Styrene	19	1.0	20.00	0	95.1	70	130			
tert-Butylbenzene	19	1.0	20.00	0	92.7	70	130			
1,1,1,2-Tetrachloroethane	19	1.0	20.00	0	94.6	70	130			
1,1,2,2-Tetrachloroethane	22	2.0	20.00	0	108	65.9	133			
Tetrachloroethene (PCE)	20	1.0	20.00	0	100	70	130			
trans-1,2-DCE	20	1.0	20.00	0	100	70	130			
trans-1,3-Dichloropropene	18	1.0	20.00	0	91.2	70	130			
1,2,3-Trichlorobenzene	19	1.0	20.00	0	94.9	70	130			
1,2,4-Trichlorobenzene	19	1.0	20.00	0	92.5	70	130			
1,1,1-Trichloroethane	20	1.0	20.00	0	98.6	70	130			
1,1,2-Trichloroethane	20	1.0	20.00	0	99.2	70	130			
Trichloroethene (TCE)	20	1.0	20.00	0	99.8	70	130			
Trichlorofluoromethane	21	1.0	20.00	0	104	70	130			
1,2,3-Trichloropropane	21	2.0	20.00	0	106	69.7	129			
Vinyl chloride	20	1.0	20.00	0	99.6	70	130			
Xylenes, Total	58	1.5	60.00	0	95.9	70	130			
Surr: 1,2-Dichloroethane-d4	9.9		10.00		99.0	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		100	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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **100ng lcs**	SampType: **LCS4**	TestCode: **EPA Method 8260B: VOLATILES**						
Client ID: **BatchQC**	Batch ID: **A46812**	RunNo: **46812**						
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1492499**	Units: **µg/L**					

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Dibromofluoromethane	10		10.00		101	70	130			
Surr: Toluene-d8	9.8		10.00		98.2	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**						
Client ID: **PBW**	Batch ID: **A46812**	RunNo: **46812**						
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1492500**	Units: **µg/L**					

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								

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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **A46812**	RunNo: **46812**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1492500** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	10		10.00		102	70	130			
Surr: 4-Bromofluorobenzene	9.8		10.00		98.3	70	130			
Surr: Dibromofluoromethane	10		10.00		105	70	130			
Surr: Toluene-d8	9.6		10.00		95.8	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: 1710F09 RcptNo: 1

Received By: Richie Eriacho 10/26/2017 10:00:00 AM

Completed By: Ashley Gallegos 10/27/2017 4:03:35 PM

Reviewed By: SRL 10/30/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. 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: _____

17. Additional remarks: 1 VOA from each sample was received broken from being frozen.

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.4	Good	Yes			

1115 RL 10/30/17

Chain-of-Custody Record

Client: R. T. Hicks Consultants

901 Rio Grande Blvd NW
Mailing Address: Suite F-142
Albuquerque, NM 87104
Phone #: (505) 266-5004
email or Fax#: R@rthicksconsult.com
QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)
Accreditation:
☐ NELAP ☐ Other
☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush
Project Name: Lime Rock - ASAU #150
Project #:
Project Manager: Kristin Pope (575) 302-6755
Sampler: M. Stubblefield
On Ice: ☒ Yes ☐ No
Sample Temperature: 1.2+0.2 = 1.4

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. 1710F09	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) long list	8270 (Semi-VOA)					Air Bubbles (Y or N)
10/23/17	1153	water	MW-2	3 VOA	HgCl, ice	-001										X						
10/23/17	1153	water	MW-2	1 HDP	ice									X								
10/23/17	0952	water	MW-3	3 VOA	HgCl, ice	-002										X						
10/23/17	0952	water	MW-3	1 HDP	ice									X								
10/23/17	1046	water	MW-4	3 VOA	HgCl, ice	-003										X						
10/23/17	1046	water	MW-4	1 HDP	ice									X								

10-24-2017 KP/m.s.

Date:	Time:	Relinquished by:	Received by:	Date	Time
10/25/2017	2:15A	Mike Stubblefield		10/26/17	1000
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email to R@rthicksconsult.com, kristin..., mike...

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.

Courier

Appendix B

Hydrocarbon Characterization Sampling Summary and Laboratory Reports

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

Appendix B – Hydrocarbon Characterization Sampling

As requested by NMOCD at a meeting on August 23, 2017, samples were collected from the top of the water column as a means to characterize the extent and magnitude of hydrocarbon constituents. As specified by NMOCD and in accordance with the submitted plan, these samples were collected on September 11, 2017 using a bailer. Results of this characterization event were reported to NMOCD on October 9, 2017.

For further characterization and comparison, we informed NMOCD that after collecting the last quarterly samples, we would then collect samples from the top of the water column using a low-flow pump. During a phone discussion, Mr. Billings requested the full spectrum of Method 8260B analysis for volatiles and also TPH 8015B analysis of the characterization samples. A summary of the two characterization sampling events using the two collection methods are shown in Table 2 below and associated laboratory reports are in Appendix B. As mentioned in the laboratory report for the October 24 event, samples were collected for 8260 and 8015 analyses but the transport cooler was packed too tightly with ice and many of the containers arrived broken. The laboratory informed us that DRO and MRO analyses were not possible and GRO was only available for MW-3 and MW-4 samples.

Hydrocarbon Characterization Samples from Top of Water Column

Well ID	Method	Date	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total BTEX	Naph-thalene	GRO* mg/L	Observations
MW-2	bailer	9/11/2017	370	ND	51	66	487	*not analyzed*	*not analyzed*	Sheen; film on bailer
MW-2	low flow pump	10/24/2017	*No analyses; Sample containers arrived at lab frozen and broken*							Collected from top of column after low-flow sampling of well from middle of column
MW-3	bailer	9/11/2017	41	ND	ND	ND	41	*not analyzed*	*not analyzed*	Turbid at 1st attempt; waited 2 hrs, sample is silty
MW-3	low flow pump	10/24/2017	29	ND	ND	ND	*not analyzed*	ND	0.067	Collected from top of column after low-flow sampling of well from middle of column
MW-4	bailer	9/11/2017	3300	ND	470	ND	3770	*not analyzed*	*not analyzed*	Clear
MW-4	low flow pump	10/24/2017	300	ND	86	ND	*not analyzed*	56	2.5	Collected from top of column after low-flow sampling of well from middle of column

all concentrations are µg/L except GRO

* GRO, DRO, MRO analyses requested but containers arrived frozen and broken

Table 2

These comparative analyses suggest that low-flow sampling delivers considerably lower concentrations than those collected using a bailer; however, both methods confirm that MW-3 and MW-4 exceed the WQCC benzene standard.

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

September 21, 2017

Kristin Pope

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: Lime Rock ASAU 150 Release OrderNo.: 1709837

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 9/14/2017 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 **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 10:40:00 AM
Lab ID: 1709837-001 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	370	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Toluene	ND	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Ethylbenzene	51	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Xylenes, Total	66	10		µg/L	10	9/20/2017 8:04:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	90.3	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: 4-Bromofluorobenzene	95.8	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Dibromofluoromethane	96.7	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Toluene-d8	90.4	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 12:08:00 PM
Lab ID: 1709837-002 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	41	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Toluene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Ethylbenzene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:28:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	91.6	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Dibromofluoromethane	96.9	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Toluene-d8	91.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 11:28:00 AM
Lab ID: 1709837-003 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	3300	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Toluene	ND	1.0		µg/L	1	9/20/2017 8:52:00 AM	B45748
Ethylbenzene	470	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:52:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	97.0	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.5	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Dibromofluoromethane	95.8	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Toluene-d8	89.2	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748

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Qualifiers:

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QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **100ng lcs2**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453586** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	22	1.0	20.00	0	110	70	130			
Toluene	20	1.0	20.00	0	98.6	70	130			
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.6	70	130			
Surr: 4-Bromofluorobenzene	9.6		10.00		95.5	70	130			
Surr: Dibromofluoromethane	9.7		10.00		97.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb2**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453587** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.0		10.00		89.7	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		94.8	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		88.6	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454013** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	21	1.0	20.00	0	107	70	130			
Surr: 1,2-Dichloroethane-d4	9.2		10.00		91.6	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		95.4	70	130			
Surr: Dibromofluoromethane	9.5		10.00		95.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Ethylbenzene	ND	1.0								
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.9	70	130			

Qualifiers:

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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
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QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 4-Bromofluorobenzene	9.6		10.00		95.6	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		89.3	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
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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: 1709837 RcptNo: 1

Received By: Isaiah Ortiz 9/14/2017 9:42:00 AM

Completed By: Ashley Gallegos 9/15/2017 9:43:33 AM

Reviewed By: 9/15/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. 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: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

RT

Chain of Custody Record

Turnaround Time: ☒ Standard ☐ Rush

Project Name: Hare Rock ~~Marathon~~ ASAU #150 Release

Project #:

Project Manager: Kristin Pope

Sampler: ~~Kristin Pope~~ M. Stubblefield

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.0

Tel. 505-[illegible] Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1709837	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel) 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)	8270 (Semi-VOA)		100 grams		Air Bubbles (Y or N)
9/11/17	1040	grd water	MW-2	40-mL 3 VOA glass	ice, HgCl2	-001	X														
"	1208	"	MW-3	"	"	-002	X														
"	1128	"	MW-4	"	"	-003	X														

Date	Time	Relinquished by:	Received by:	Date	Time
9/13/2017	9:00 AM	[signature]	[signature]	9/14/17	0942
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email results to R, kristin@rthicksconsult.com, mike@ "

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

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

November 07, 2017

Kristin Pope

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: ASAU 150 Characterization OrderNo.: 1710E76

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 10/26/2017 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 **1710E76**
Date Reported: **11/7/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3 @ 49ft
Project: ASAU 150 Characterization
Collection Date: 10/24/2017 9:55:00 AM
Lab ID: 1710E76-002 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **DJF**	
Gasoline Range Organics (GRO)	0.067	0.050		mg/L	1	11/3/2017 4:53:24 PM	G46875
Surr: BFB	98.1	70-130		%Rec	1	11/3/2017 4:53:24 PM	G46875
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
Benzene	29	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Toluene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Ethylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2,4-Trimethylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Naphthalene	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1-Methylnaphthalene	ND	4.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2-Methylnaphthalene	ND	4.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Acetone	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Bromobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Bromodichloromethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Bromoform	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Bromomethane	ND	3.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2-Butanone	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Carbon disulfide	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Carbon Tetrachloride	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Chlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Chloroethane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Chloroform	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Chloromethane	ND	3.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2-Chlorotoluene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
4-Chlorotoluene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
cis-1,2-DCE	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Dibromochloromethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Dibromomethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,3-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,4-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Dichlorodifluoromethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1-Dichloroethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1-Dichloroethene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875

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Analytical Report
Lab Order **1710E76**
Date Reported: **11/7/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3 @ 49ft
Project: ASAU 150 Characterization
Collection Date: 10/24/2017 9:55:00 AM
Lab ID: 1710E76-002 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
1,2-Dichloropropane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,3-Dichloropropane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2,2-Dichloropropane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Hexachlorobutadiene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2-Hexanone	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Isopropylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
4-Isopropyltoluene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
4-Methyl-2-pentanone	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Methylene Chloride	ND	3.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
n-Butylbenzene	ND	3.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
n-Propylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
sec-Butylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Styrene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
tert-Butylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
trans-1,2-DCE	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1,1-Trichloroethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1,2-Trichloroethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Trichloroethene (TCE)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Trichlorofluoromethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2,3-Trichloropropane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Vinyl chloride	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Xylenes, Total	ND	1.5		µg/L	1	11/3/2017 4:53:24 PM	W46875
Surr: 1,2-Dichloroethane-d4	106	70-130		%Rec	1	11/3/2017 4:53:24 PM	W46875
Surr: 4-Bromofluorobenzene	109	70-130		%Rec	1	11/3/2017 4:53:24 PM	W46875
Surr: Dibromofluoromethane	105	70-130		%Rec	1	11/3/2017 4:53:24 PM	W46875
Surr: Toluene-d8	101	70-130		%Rec	1	11/3/2017 4:53:24 PM	W46875

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

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Analytical Report
Lab Order **1710E76**
Date Reported: **11/7/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4 @ 50ft
Project: ASAU 150 Characterization
Collection Date: 10/24/2017 10:50:00 AM
Lab ID: 1710E76-003 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **DJF**	
Gasoline Range Organics (GRO)	2.5	0.050		mg/L	1	11/3/2017 5:22:29 PM	G46875
Surr: BFB	94.9	70-130		%Rec	1	11/3/2017 5:22:29 PM	G46875
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
Benzene	300	20		µg/L	20	11/6/2017 12:38:21 PM	W46900
Toluene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Ethylbenzene	86	20		µg/L	20	11/6/2017 12:38:21 PM	W46900
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2,4-Trimethylbenzene	40	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,3,5-Trimethylbenzene	21	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Naphthalene	56	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1-Methylnaphthalene	34	4.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2-Methylnaphthalene	ND	4.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Acetone	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Bromobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Bromodichloromethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Bromoform	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Bromomethane	ND	3.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2-Butanone	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Carbon disulfide	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Carbon Tetrachloride	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Chlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Chloroethane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Chloroform	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Chloromethane	ND	3.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2-Chlorotoluene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
4-Chlorotoluene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
cis-1,2-DCE	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Dibromochloromethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Dibromomethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,3-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,4-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Dichlorodifluoromethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1-Dichloroethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1-Dichloroethene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875

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

Analytical Report
Lab Order **1710E76**
Date Reported: **11/7/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4 @ 50ft
Project: ASAU 150 Characterization
Collection Date: 10/24/2017 10:50:00 AM
Lab ID: 1710E76-003 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
1,2-Dichloropropane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,3-Dichloropropane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2,2-Dichloropropane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Hexachlorobutadiene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2-Hexanone	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Isopropylbenzene	47	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
4-Isopropyltoluene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
4-Methyl-2-pentanone	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Methylene Chloride	ND	3.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
n-Butylbenzene	ND	3.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
n-Propylbenzene	32	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
sec-Butylbenzene	7.5	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Styrene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
tert-Butylbenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
trans-1,2-DCE	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1,1-Trichloroethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1,2-Trichloroethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Trichloroethene (TCE)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Trichlorofluoromethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2,3-Trichloropropane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Vinyl chloride	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Xylenes, Total	ND	1.5		µg/L	1	11/3/2017 5:22:29 PM	W46875
Surr: 1,2-Dichloroethane-d4	102	70-130		%Rec	1	11/3/2017 5:22:29 PM	W46875
Surr: 4-Bromofluorobenzene	102	70-130		%Rec	1	11/3/2017 5:22:29 PM	W46875
Surr: Dibromofluoromethane	99.9	70-130		%Rec	1	11/3/2017 5:22:29 PM	W46875
Surr: Toluene-d8	101	70-130		%Rec	1	11/3/2017 5:22:29 PM	W46875

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#: **1710E76**
07-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: ASAU 150 Characterization

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **W46875**	RunNo: **46875**
Prep Date:	Analysis Date: **11/3/2017**	SeqNo: **1495595** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								

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#: **1710E76**
07-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: ASAU 150 Characterization

Sample ID **rb** SampType: **MBLK** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW** Batch ID: **W46875** RunNo: **46875**
Prep Date: Analysis Date: **11/3/2017** SeqNo: **1495595** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	10		10.00		101	70	130			
Surr: 4-Bromofluorobenzene	11		10.00		106	70	130			
Surr: Dibromofluoromethane	10		10.00		102	70	130			
Surr: Toluene-d8	10		10.00		100	70	130			

Sample ID **100ng lcs** SampType: **LCS** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW** Batch ID: **W46875** RunNo: **46875**
Prep Date: Analysis Date: **11/3/2017** SeqNo: **1495597** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	20	1.0	20.00	0	99.8	70	130			
Toluene	20	1.0	20.00	0	102	70	130			
Chlorobenzene	21	1.0	20.00	0	105	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#: **1710E76**
07-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: ASAU 150 Characterization

Sample ID **100ng lcs** SampType: **LCS** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW** Batch ID: **W46875** RunNo: **46875**
Prep Date: Analysis Date: **11/3/2017** SeqNo: **1495597** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloroethene	23	1.0	20.00	0	114	70	130			
Trichloroethene (TCE)	18	1.0	20.00	0	91.7	70	130			
Surr: 1,2-Dichloroethane-d4	10		10.00		103	70	130			
Surr: 4-Bromofluorobenzene	11		10.00		108	70	130			
Surr: Dibromofluoromethane	10		10.00		104	70	130			
Surr: Toluene-d8	10		10.00		104	70	130			

Sample ID **rb** SampType: **MBLK** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW** Batch ID: **W46900** RunNo: **46900**
Prep Date: Analysis Date: **11/6/2017** SeqNo: **1496555** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Ethylbenzene	ND	1.0								
Surr: 1,2-Dichloroethane-d4	9.5		10.00		94.8	70	130			
Surr: 4-Bromofluorobenzene	11		10.00		108	70	130			
Surr: Dibromofluoromethane	9.7		10.00		96.8	70	130			
Surr: Toluene-d8	10		10.00		102	70	130			

Sample ID **100ng lcs** SampType: **LCS** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW** Batch ID: **W46900** RunNo: **46900**
Prep Date: Analysis Date: **11/6/2017** SeqNo: **1496556** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	18	1.0	20.00	0	89.5	70	130			
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.6	70	130			
Surr: 4-Bromofluorobenzene	11		10.00		105	70	130			
Surr: Dibromofluoromethane	9.4		10.00		93.9	70	130			
Surr: Toluene-d8	9.8		10.00		97.9	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#: **1710E76**

07-Nov-17

Client: R.T. Hicks Consultants, LTD

Project: ASAU 150 Characterization

Sample ID	**rb**	SampType:	**MBLK**	TestCode:	**EPA Method 8015D: Gasoline Range**					
Client ID:	**PBW**	Batch ID:	**G46875**	RunNo:	**46875**					
Prep Date:		Analysis Date:	**11/3/2017**	SeqNo:	**1495610**	Units:	**mg/L**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.050								
Surr: BFB	9.5		10.00		95.1	70	130			

Sample ID	**2.5ug gro lcs**	SampType:	**LCS**	TestCode:	**EPA Method 8015D: Gasoline Range**					
Client ID:	**LCSW**	Batch ID:	**G46875**	RunNo:	**46875**					
Prep Date:		Analysis Date:	**11/3/2017**	SeqNo:	**1495611**	Units:	**mg/L**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.54	0.050	0.5000	0	108	70	130			
Surr: BFB	9.7		10.00		96.6	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

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: 1710E76 RcptNo: 1

Received By: Richie Eriacho 10/26/2017 10:00:00 AM

Completed By: Ashley Gallegos 10/27/2017 12:45:56 PM

Reviewed By: IMO 10/27/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

Special Handling (if applicable)

16. 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:

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.4	Good	Yes			

Chain-of-Custody Record

Client: R. T. Hicks Consultants

Mailing Address: 901 Rio Grande Blvd NW, Suite F-142, Albuquerque, NM 87104

Phone #: (505) 266-5004

email or Fax#: R@rthicksconsult.com

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

Accreditation: ☐ NELAP ☐ Other ________

☐ EDD (Type) ________

Turn-Around Time: ☒ Standard ☐ Rush

Project Name: ASAU #150 CHARACTERIZATION

Project #:

Project Manager: Kristin Pope (575) 302-6755

Sampler: M. Stubblefield

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.2 +0.2 = 1.4

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. 1710E76	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel) 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) long list	8270 (Semi-VOA)					Air Bubbles (Y or N)
10/23/17	1203	water	MW-2 @ 53 ft	3 VOA	HgCl, ice	-001										X						
10/23/17	1203	water	MW-2 @ 53 ft	1 amber	ice				X													
10/23/17	0955	water	MW-3 @ 49 ft	3 VOA	HgCl, ice	-002										X						
10/23/17	0955	water	MW-3 @ 49 ft	1 amber	ice				X													
10/23/17	1050	water	MW-4 @ 50 ft	3 VOA	HgCl, ice	-003										X						
10/23/17	1050	water	MW-4 @ 50 ft	1 amber	ice				X													

10-24-2017 KP

Date	Time	Relinquished by	Received by	Date	Time
			[signature]	10/26/17	1000

Remarks: Email to R@rthicksconsult.com, kristin..., mike...

8260 for all - GRO only for MW-3 and MW-4

No DRO Bottles froze during shipping 10/27 spoke w/ Kristin

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.

Courier

Appendix C

LNAPL Analysis and Comparison

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

Appendix C – LNAPL Characterization & Comparison

We performed characterization of the floating oil in MW-1 by bailing a sample on October 24 according to the proposal submitted to NMOCD of October 9. The sample was submitted to Laboratory Services of Hobbs for LNAPL analysis. On October 26, Lime Rock collected three samples of crude from the same service line as the ASAU #150 release and submitted those samples to the same laboratory for specific gravity, sulfur percentage, and API gravity analyses. Table 3 summarizes the comparative analyses of these samples and full laboratory reports are located in Appendix C.

Comparison of product in MW-1 to product in Lime Rock system

									Calculated by R.T. Hicks Consultants								
Well ID	**Sample Date**	**Total Sulfer** wt.%	**API Gravity**	**Specific Gravity**	**Benzene** wt %	**Toluene** wt %	**Ethyl Benzene** wt %	**Xylenes** wt %	**BTEX** %	**Benzene** mg/kg	**Toluene** mg/kg	**Ethyl Benzene** mg/kg	**Xylenes** mg/kg	**Benzene /BTEX**	**T/BTEX**	**E/BTEX**	**X/BTEX**
MW-1	10/24/2017	0.000	39.9	0.8254	0.5737	2.2494	0.5931	3.1928	6.609	5737	22494	5931	31928	9%	34%	9%	48%
Atoka San Andres #150	10/26/2017	0.811	39.2	0.8289	Not Analyzed												
Atoka San Andres #152	10/26/2017	0.995	38.8	0.8308													
Atoka San Andres #153	10/26/2017	0.797	39.0	0.8299													

Table 3

API gravities and specific gravities of the Lime Rock samples are similar to those of the MW-1 LNAPL. When sulfur percentage is compared amongst the samples, sulfur in the MW-1 LNAPL is noticeably absent. No further analysis is planned.

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575.397.3713 2609 W Marland Hobbs NM 88240

Total Sulfur in Crude

Lime Rock Resources
Attention: Jerry Smith
1111 Bagby Street, Suite 4700A
Houston, Texas 77002

10/26/17

	Total Sulfur	API Gravity	Specific Gravity
Atoka San Andres #150	0.811 wt.%	39.2	0.8289
Atoka San Andres #152	0.995 wt.%	38.8	0.8308
Atoka San Andres #153	0.797 wt.%	39.0	0.8299

Test Method ASTM D4294 Sulfur
Test Method ASTM D287 API Gravity

www.permianls.com
575.397.3713 2609 W Marland Hobbs NM 88240

SUMMARY OF CHROMATOGRAPHIC ANALYSIS

COMPANY:		**JOB #:**	1710005
SAMPLE ID:	CRUDE OIL	**SAMPLE #:**	1710005-01
SAMPLE TYPE:	SPOT	**DATE ON:**	
STATION:	ASAU #150	**DATE OFF:**	
SAMPLE PRESS.,psig:	AMBIENT	**TIME ON:**	
SAMPLE TEMPERATURE, F	AMBIENT	**TIME OFF:**	
ANALYSIS DATE:	10/24/2017	**SAMPLED BY:**	CLIENT
ANALYSIS COMMENTS:		**ANALYST:**	JAMES R. PRITCHARD

COMPONENT	MOLE %	WEIGHT %	VOLUME %
HYDROGEN SULFIDE	0.0000	0.0000	0.0000
NITROGEN	0.0000	0.0000	0.0000
OXYGEN	0.0000	0.0000	0.0000
METHANE	0.0000	0.0000	0.0000
CARBON DIOXIDE	0.0000	0.0000	0.0000
ETHANE	0.0005	0.0001	0.0002
PROPANE	0.0057	0.0016	0.0024
ISO-BUTANE	0.0935	0.0341	0.0465
N-BUTANE	1.6601	0.6047	0.7944
ISO-PENTANE	4.6758	2.1143	2.5974
N-PENTANE (C-5)	5.0364	2.2773	2.7687
2,2 DIMETHYL BUTANE	0.6106	0.3298	0.3873
CYCLOPENTANE	0.1158	0.0509	0.0514
2-METHYLPENTANE	3.0578	1.6516	1.9266
3-METHYLPENTANE	1.5775	0.8520	0.9773
N-HEXANE (C-6)	2.2729	1.2276	1.4191
METHYLCYCLOPENTANES	1.9131	1.0091	1.0270
BENZENE	1.1719	0.5737	0.4986
CYCLOHEXANE	3.2994	1.7403	1.7044
2-METHYLHEXANE	0.3896	0.2447	0.2752
3-METHYLHEXANE	1.2879	0.8088	0.8958
DIMETHYLCYCLOPENTANES	0.5196	0.3198	0.3245
HEPTANES	1.6775	1.0534	1.1744
N-HEPTANE (C-7)	1.8477	1.1603	1.2936
METHYLCYCLOHEXANE	3.3898	2.0431	2.0236
2-2-4 TRIMETHYLPENTANE	0.5633	0.4033	0.3994
TOLUENE	3.8953	2.2494	1.9742
OCTANES	4.0178	2.8764	3.1220
N-OCTANE (C-8)	1.4068	1.0071	1.0931
ETHYL BENZENE	0.8914	0.5931	0.5205
P-M-XYLENE	3.5421	2.3569	2.0834
O-XYLENE	1.2562	0.8359	0.7249
NONANES	3.9103	3.1433	3.3414
N-NONANE (C-9)	1.2156	0.9771	1.0387

CALCULATED PARAMETERS

TOTAL ANALYSIS SUMMARY

AVE MOLE WT	159.5593
SP GRAV, 60F/60	0.8254
API GRAVITY	39.9
REL DENS, AIR=1	5.5090
VAPOR PRESS PSIA	3.83

HEXANES PLUS SUMMARY

AVE MOLE WT	171.1664
SP GRAV, 60F/60	0.8518
API GRAVITY	34.6
LBS/GAL	6.815
REL DENS, AIR=1	5.9097
VAPOR PRESS PSIA	1.30

BTEX SUMMARY

WT % BENZENE	0.5737
WT % TOLUENE	2.2494
WT % E BENZENE	0.5931
WT % XYLENES	3.1928

DECANES PLUS SUMMARY

AVE MOLE WT	240.8143
SP GRAV, 60F/60	0.9443
API GRAVITY	18.4
LBS/GAL	7.555
REL DENS, AIR=1	8.3144
VAPOR PRESS PSIA	0.01

CONTINUED ON NEXT PAGE

ASAU #150
CRUDE OIL

COMPONENT	MOLE %	WEIGHT %	VOLUME %
DECANES	4.8375	4.3136	4.5083
N-DECANE (C-10)	2.0498	1.8278	1.9103
UNDECANES	3.3145	3.2470	3.3465
N-UNDECANE (C-11)	0.7495	0.7342	0.7567
DODECANES	1.8728	1.9993	2.0379
N-DODECANE (C-12)	0.5349	0.5710	0.5820
TRIDECANES	1.4069	1.6256	1.6374
N-TRIDECANE (C-13)	0.4490	0.5188	0.5226
TETRADECANES	1.0049	1.2495	1.2560
N-TETRADECANE (C-14)	0.3807	0.4733	0.4758
PENTADECANES	0.7394	0.9844	0.9782
N-PENTADECANE (C-15)	0.2948	0.3925	0.3900
HEXADECANES	0.4035	0.5726	0.5653
N-HEXADECANE (C-16)	0.2199	0.3121	0.3081
HEPTADECANES	0.3733	0.5626	0.5537
N-HEPTADECANE (C-17)	0.1980	0.2984	0.2937
OCTADECANES	0.3563	0.5683	0.5577
N-OCTADECANE (C-18)	0.1490	0.2377	0.2333
NONADECANES	0.1952	0.3285	0.3203
N-NONADECANE (C-19)	0.1556	0.2619	0.2554
EICOSANES	0.1232	0.2182	0.2116
N-EICOSANES (C-20)	0.1112	0.1969	0.1909
HENEICOSANE + (C-21+)	24.7782	45.9661	43.6223
TOTALS	100.0000	100.0000	100.0000

CRUDE OIL FINGERPRINT
C-n/C-13 RATIO SUMMARY

C-n	C-n/C-13
10.0	3.523
11.0	1.415
12.0	1.101
13.0	1.000
14.0	0.912
15.0	0.757
16.0	0.602
17.0	0.575
18.0	0.458
19.0	0.505
20.0	0.380

BIO-MARKER SUMMARY

Farnesane/C-14	0.128
Pristane/C-17	0.659
Phytane/C-18	0.679
Wt. % Sulfur	0.0000
Gravity, API @ 60 F	0.0

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SUMMARY OF CHROMATOGRAPHIC ANALYSIS

COMPANY:		**JOB #:**	1710005
SAMPLE ID:	CRUDE OIL	**SAMPLE #:**	1710005-01
SAMPLE TYPE:	SPOT	**DATE ON:**	
STATION:	ASAU #150	**DATE OFF:**	
SAMPLE PRESS.,psig:	AMBIENT	**TIME ON:**	
SAMPLE TEMPERATURE, F	AMBIENT	**TIME OFF:**	
ANALYSIS DATE:	10/24/2017	**SAMPLED BY:**	CLIENT
ANALYSIS COMMENTS:		**ANALYST:**	JAMES R. PRITCHARD

TANKS DATA INPUT REPORT

COMPONENT	MOLE %	WEIGHT %	VOLUME %
CARBON DIOXIDE	0.0000	0.0000	0.0000
NITROGEN	0.0000	0.0000	0.0000
METHANE	0.0000	0.0000	0.0000
ETHANE	0.0005	0.0001	0.0002
PROPANE	0.0057	0.0016	0.0024
ISO-BUTANE	0.0935	0.0341	0.0465
N-BUTANE	1.6601	0.6047	0.7944
ISO-PENTANE	4.6758	2.1143	2.5974
N-PENTANE	5.0364	2.2773	2.7687
N-HEXANE	2.2729	1.2276	1.4191
OTHER HEXANES	10.5742	5.6337	6.0740
HEPTANES	9.1121	5.6301	5.9871
OCTANES	5.4246	3.8835	4.2151
NONANES	5.1259	4.1204	4.3801
BENZENE	1.1719	0.5737	0.4986
TOLUENE	3.8953	2.2494	1.9742
ETHYLBENZENE	0.8914	0.5931	0.5205
XYLENES	4.7983	3.1928	2.8083
2,2,4 TRIMETHYLPENTANE	0.5633	0.4033	0.3994
DECANES PLUS	44.6981	67.4603	65.5140
TOTAL	100.0000	100.0000	100.0000

CALCULATED PARAMETERS

TOTAL ANALYSIS SUMMARY

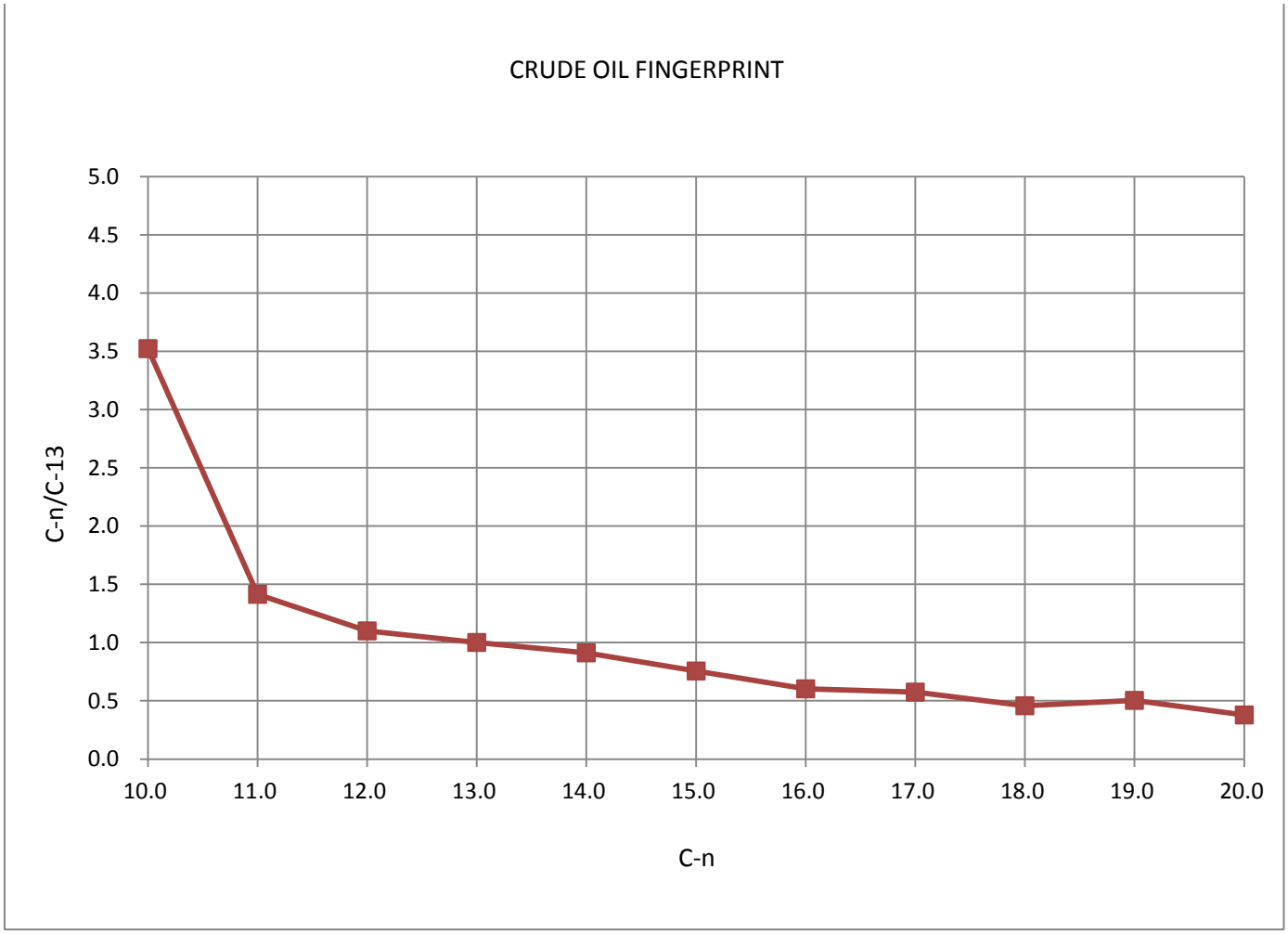
AVE MOLE WT	159.5593
SP GRAV, 60F/60	0.8254
API GRAVITY	39.9
REL DENS, AIR=1	5.5090
VAPOR PRESS PSIA	3.83
CU FT VAPOR/GAL	18.09

DECANES PLUS SUMMARY

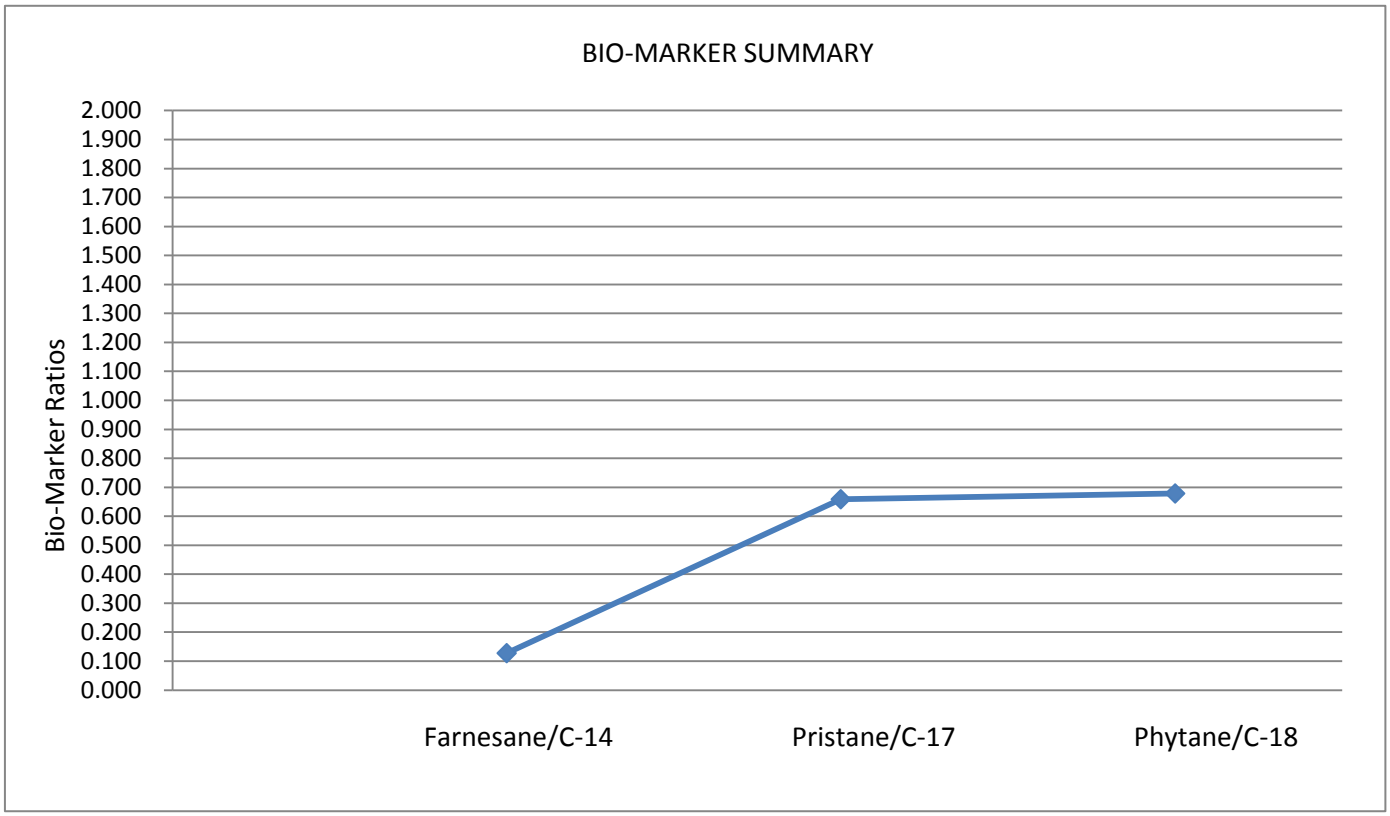
AVE MOLE WT	240.8143
SP GRAV, 60F/60	0.9443
API GRAVITY	18.4
LBS/GAL	7.5550
REL DENS, AIR=1	8.3144
VAPOR PRESS PSIA	0.01

CHARACTERISTICS OF STOCK TANK OIL

API GRAVITY @ 60 F	**(ASTM D287)**	34.7
REID VAPOR PRESSURE, psia	**(ASTM D323)**	NA
WEIGHT % SULFUR	**(ASTM D4294)**	NA


CRUDE OIL FINGERPRINT
C-n/C-13
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
C-n

ASAU #150


BIO-MARKER SUMMARY
Bio-Marker Ratios
2.000
1.900
1.800
1.700
1.600
1.500
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Farnesane/C-14
Pristane/C-17
Phytane/C-18

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Friday, January 19, 2018 1:47 PM
To: Billings, Bradford, EMNRD; Weaver, Crystal, EMNRD; Bratcher, Mike, EMNRD
Cc: mike@rthicksconsult.com; Randy Hicks; 'Jerry Smith'; mbarrett@limerockresources.com
Subject: Notice of MW sampling: Lime Rock ASAU #150

Brad, Crystal, Mike,

We will sample MW-2, MW-3, and MW-4 on **Wednesday, January 24, beginning at 9:00 am**. We will collect the quarterly compliance samples for each well using the low-flow procedure. The samples will be shipped to Hall Env. Lab in Albuquerque the next day using their courier.
If this schedule is inconvenient for you, please let me know as soon as possible. Thank you.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: Weaver, Crystal, EMNRD
Sent: Wednesday, March 14, 2018 11:54 AM
To: Kristin Pope; Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Cc: mike@rthicksconsult.com; Randy Hicks; 'Jerry Smith'; mbarrett@limerockresources.com
Subject: RE: Notice of MW sampling: Lime Rock ASAU #150

Kristin,

Just following up on this one. Where are the sample results at? Did they only go to Bradford or something?

Thanks in advance for addressing my questions.

Sincerely,

Crystal Weaver
Environmental Specialist
OCD – Artesia District II
811 S. 1st Street
Artesia, NM 88210
Office: 575-748-1283 ext. 101
Cell: 575-840-5963
Fax: 575-748-9720

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Friday, January 19, 2018 1:47 PM
To: Billings, Bradford, EMNRD <Bradford.Billings@state.nm.us>; Weaver, Crystal, EMNRD <Crystal.Weaver@state.nm.us>; Bratcher, Mike, EMNRD <mike.bratcher@state.nm.us>
Cc: mike@rthicksconsult.com; Randy Hicks <r@rthicksconsult.com>; 'Jerry Smith' <JSmith@limerockresources.com>; mbarrett@limerockresources.com
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Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office

575.302.6755

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Wednesday, March 14, 2018 1:20 PM
To: Weaver, Crystal, EMNRD; Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Cc: mike@rthicksconsult.com; 'Randy Hicks'; 'Jerry Smith'; mbarrett@limerockresources.com
Subject: RE: Notice of MW sampling: Lime Rock ASAU #150

No, you didn't miss them. Lime Rock is working with the landowner to secure placement of another MW. Atkins has a busy schedule but the drilling scheduled for April. As soon as we can pin down an exact location and date, I'll submit a short report to OCD. The results were more of the same and recovery at MW-1 is ongoing.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

From: Weaver, Crystal, EMNRD [mailto:Crystal.Weaver@state.nm.us]
Sent: Wednesday, March 14, 2018 11:54 AM
To: Kristin Pope; Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Cc: mike@rthicksconsult.com; Randy Hicks; 'Jerry Smith'; mbarrett@limerockresources.com
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Thanks in advance for addressing my questions.

Sincerely,

Crystal Weaver
Environmental Specialist
OCD – Artesia District II
811 S. 1st Street
Artesia, NM 88210
Office: 575-748-1283 ext. 101
Cell: 575-840-5963
Fax: 575-748-9720

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Friday, January 19, 2018 1:47 PM
To: Billings, Bradford, EMNRD <Bradford.Billings@state.nm.us>; Weaver, Crystal, EMNRD

<Crystal.Weaver@state.nm.us>; Bratcher, Mike, EMNRD <mike.bratcher@state.nm.us>
Cc: mike@rthicksconsult.com; Randy Hicks <r@rthicksconsult.com>; 'Jerry Smith' <JSmith@limerockresources.com>; mbarrett@limerockresources.com
Subject: Notice of MW sampling: Lime Rock ASAU #150

Brad, Crystal, Mike,

We will sample MW-2, MW-3, and MW-4 on **Wednesday, January 24, beginning at 9:00 am**. We will collect the quarterly compliance samples for each well using the low-flow procedure. The samples will be shipped to Hall Env. Lab in Albuquerque the next day using their courier.
If this schedule is inconvenient for you, please let me know as soon as possible. Thank you.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Tuesday, March 20, 2018 12:01 PM
To: Weaver, Crystal, EMNRD; Bratcher, Mike, EMNRD; Billings, Bradford, EMNRD
Cc: Randy Hicks; mike@rthicksconsult.com; mbarrett@limerockresources.com; 'Jerry Smith'
Subject: RE: Lime Rock ASAU #150 Release #2RP-3893
Attachments: ASAU150_MW-5location.pdf

Brad, Crystal, & Mike,

Please find the attached proposal for the installation of another well (MW-5) at the Lime Rock ASAU #150 site. The work is scheduled for April 10, 2018. Please let me know if you have any comments or questions. Thanks.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Friday, December 22, 2017 1:02 PM
To: Crystal Weaver (Crystal.Weaver@state.nm.us); Mike Bratcher
Cc: Randy Hicks; mike@rthicksconsult.com; Michael Barrett (mbarrett@limerockresources.com) (mbarrett@limerockresources.com); 'Jerry Smith' (JSmith@limerockresources.com)
Subject: Lime Rock ASAU #150 Release #2RP-3893

Crystal and Mike,

Please find the attached report and proposal for the Lime Rock ASAU #150 Release . It includes:

- A summary of the compliance sampling performed to date
- A summary of the hydrocarbon characterization samples OCD required from the top of the water.
- A summary of the oil analysis on MW-1. Last measurement showed 1.5” thickness.
- A proposal for recovery of product on MW-1 using a sock. It was installed today and we will check it weekly.
- A proposal for at least one more well and possibly more after Q1 2018 analyses are received.

Let me know if you have any questions. Merry Christmas and enjoy your holiday.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266.0745
Artesia ▲ Carlsbad ▲ Durango ▲ Midland

March 20, 2018

Mr. Bradford Billings
Ms. Crystal Weaver, Mr. Mike Bratcher
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210 *VIA EMAIL*

RE: **Proposed Installation of MW-5**
Lime Rock – ASAU #150 Trunkline Release, #2RP-3893

Dear Ms. Weaver, Mr. Billings, and Mr. Bratcher:

On behalf of Lime Rock Resources, R.T. Hicks Consultants, Ltd. submits a proposed monitoring well location as specified in the December 22, 2017 report:

> Characterization and delineation of the plume is not complete and at least one additional down-gradient monitoring well is needed. In mid- to late January 2018, we will conduct the quarterly compliance sampling of the wells except for MW-1. We will continue to employ the low-stress, low-flow procedure and will analyze for BTEXN, chloride, sulfate, and TDS. NMOCD will be given at least 48 hours' notice of each sampling event. We will employ the additional data gathered from the first quarter sampling to create a potentiometric surface map of the updated groundwater levels and chemistry and include isocontours of the plume. This data will be used to provide the best location for the new well. We anticipate this location to be in the vicinity of the area marked on Plate 1. A proposal for the additional monitoring well(s) will be submitted to NMOCD before the end of the first quarter of 2018.

Compliance samples for the 2018 first quarter were collected on January 23, 2018 using a bailer due to a failure of the low-flow pump. As presented in Table 1, benzene concentrations increased markedly in all three wells samples. Passive recovery of LNAPL in MW-1 is ongoing and observations and measurements are summarized in Table 2. Average thickness of LNAPL remains relatively consistent at 0.25 feet or 3 inches. We intend to continue this system of recovery unless the amount of LNAPL increases and causes this system to be inadequate. We will then propose a more suitable recovery method to NMOCD.

Stained sock removed from MW-1 on 2/20/2018

Plate 1 displays the potentiometric surface of groundwater during the January sampling event. The water levels from this event formed a more southerly gradient than has been observed yet at the site. On the day of sampling, we observed that nearby fields directly south and southwest of the site were being watered and conjecture that pumping of irrigation wells may be influencing the gradient.

Plate 2 draws isocontours of benzene concentrations from the January sampling with an area marked for the proposed MW-5. Lime Rock discussed this location with the surface owner and tenant and conducted an on-site inspection and together, selected the location of MW-5 that will not interfere with the residence's septic tank, leach lines, or access to other facilities by the occupant. Atkins Engineering Associates is scheduled to install the 2-inch monitoring well on April 10, 2018 in accordance with New Mexico Environment Department guidelines[1] after modification of the screen length pursuant to OCD recommendations. After appropriate development of MW-5, we will then schedule sampling of all wells for second quarter compliance, giving at least 48 hours' notice to NMOCD.

Thank you for your consideration of this data and meeting with us many times regarding this project. Please consider this submission a notice of installation of MW-5 but if the schedule changes, we will notify NMOCD with a phone call and email.

A copy of this report is provided to the landowner. The data gathered thus far suggest that there is minimal potential of hydrocarbon impact from this release to existing and future down-gradient water wells installed using contemporary construction standards and placement in the aquifer.

Sincerely,
R.T. Hicks Consultants

Kristin Pope
Project Geologist

Enclosures: Table 1, Table 2, Plate 1, Plate 2

Copy: Lime Rock Resources, Gray Holdings (surface owner)

[1] www.env.nm.gov/gwb/documents/MonitoringWellGuidelinesFINAL-March2011.pdf

Well ID	DTW ft (from TOC)	Sample Date	LNAPL in.	Benzene 0.01	Toluene	Ethyl benzene	Total Xylenes	Naphtha-lene 0.03	Total BTEX	Chloride 250	Sulfate 600	TDS 1000	Sampling method	Lab	Notes
MW-1	51.62	3/8/17	6.00	19.2	8.5	2.31	5.17	---	35.2	188	1460	2800	bail	Cardinal	by oil/water interface meter
	51.62		6.24	---	---	---	---	---	---	---	---	---	---	---	baildown test
	51.9	7/19/17	---	---	---	---	---	---	---	---	---	---	---	---	from nested measuring tube
	52.36	10/11/17	1.5	---	---	---	---	---	---	---	---	---	bail		sampled LNAPL
MW-2	51.11	6/12/17	none	0.93	0.0047	0.011	0.034	---	0.0497	200	2100	381	bail	Hall	Q2 2017
54	grab samples for comparison	7/13/17	none	ND	ND	ND	ND	---	ND	---	---	---	low-flow pump	Hall	sampled at 54'
59		7/13/17	none	0.0082	ND	ND	ND	---	0.0082	---	---	---	low-flow pump	Hall	sampled at 59'
	52.00	10/24/2017	film	0.35	0.0078	0.063	0.079	0.013	---	180	2200	---	low-flow pump	Hall	Q4 2017
	49.43	1/23/2018	film	2.4	ND	0.17	0.027	0.048	---	180	1400	3040	hand bail	Hall	Q1 2018
MW-3	46.4	8/2/17	none	0.061	ND	ND	ND	---	0.061	212	2010	3920	low-flow pump	Cardinal	Q3 2017
	47.57	10/24/2017	none	0.02	ND	ND	ND	ND	---	190	2100	---	low-flow pump	Hall	Q4 2017
	44.88	1/23/2018	none	0.066	ND	ND	ND	ND	---	190	1900	3610	hand bail	Hall	Q1; silty
MW-4	46.8	8/2/17	none	1.53	<0.020	0.101	<0.060	---	1.64	200	1840	3460	bail	Cardinal	Q3 2017
	48.75	10/24/2017	none	0.13	ND	0.016	ND	0.0092	---	180	2000	---	low-flow pump	Hall	Q4 2017
	46.41	1/23/2018	none	0.95	ND	0.09	ND	0.022	---	190	1100	2560	hand bail	Hall	Q1 2018; silty

all concentrations are mg/L

Table 1

Lime Rock - ASAU #150 Release

MW-1 LNAPL Recovery

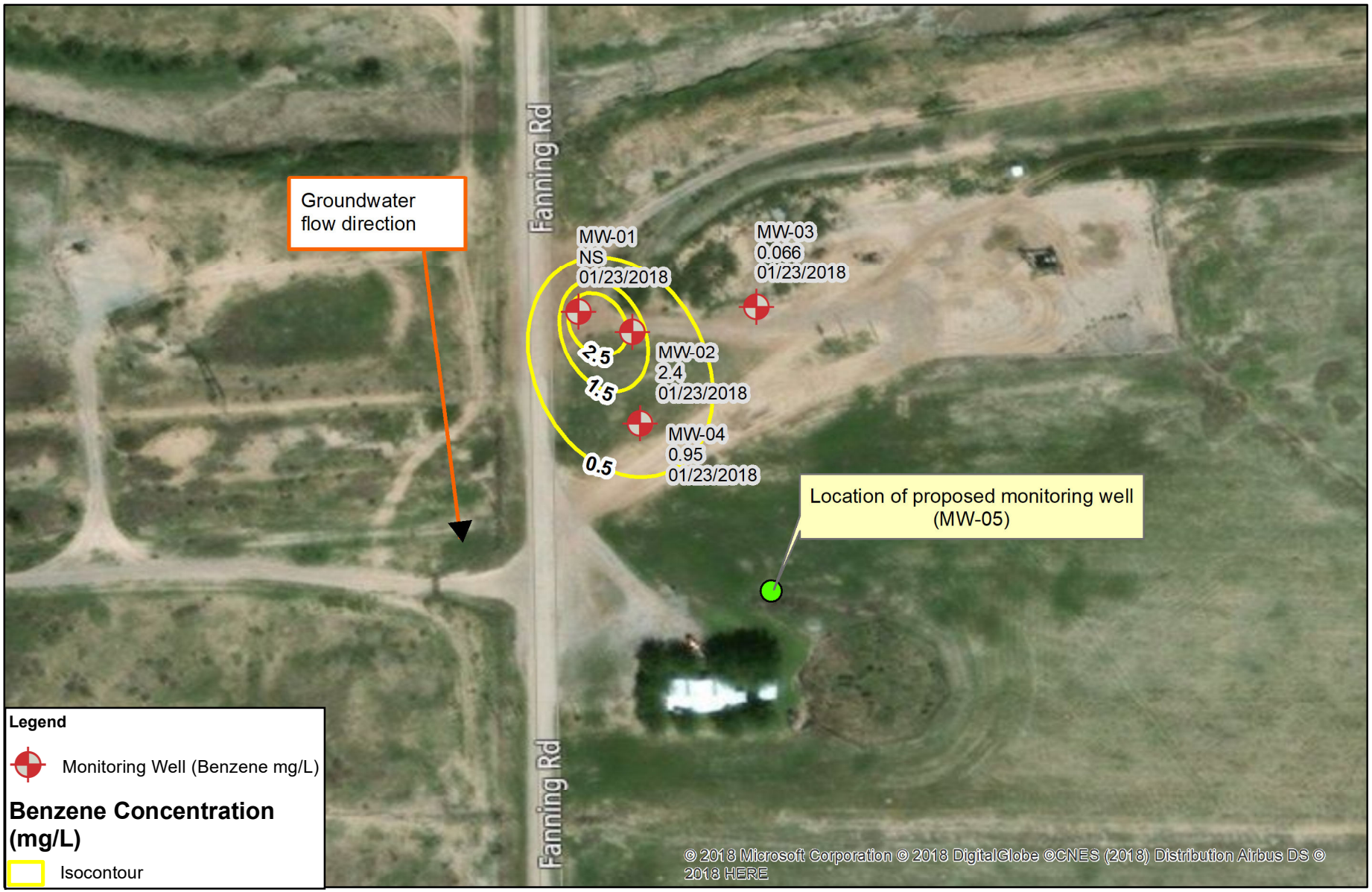
Date	Depth to Water ft	Depth to LNAPL ft	LNAPL thickness ft	Observations	Action
12/22/2017	51.83	51.58	0.25	Measured using interface probe	Installed oil-absorbing sock at interface
1/5/2018	51.04	50.87	0.17	sock appeared saturated	replaced sock
1/19/2018	50.75	50.25	0.50	Moderate stain on sock	replaced sock
1/23/2018	---	---	---	Moderate stain on sock	replaced sock
2/6/2018	49.85	49.70	0.15	Moderate stain on sock	replaced sock
2/20/2018	50.45	50.20	0.25	Heavy stain; very light film on probe	replaced sock
3/2/2018	50.85	50.62	0.23	Heavy stain; very light film on probe	replaced sock
3/19/2018	51.34	51.16	0.18	Heavy stain on bottom half of sock	replaced sock
		AVERAGE	0.25		

Table 2

M:\Lime Rock Resources\asau trunk releases\PitRuleTemplate_10_1\Figures\May 2017\Figure 1 gw direction Jan 2018.mxd

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Flow Direction	DRAFT
	Limerock Resources: ASAU Tank Release	February 2018

M:\Lime Rock Resources\asau trunk releases\PitRuleTemplate_10_1\Figures\Figure 2 gw Benzene Jan 2018.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Flow Direction and Benzene Concentration	Plate 2
	Limerock Resources: ASAU Tank Release	March 2018

Bratcher, Mike, EMNRD

From: Weaver, Crystal, EMNRD
Sent: Wednesday, March 21, 2018 10:33 AM
To: Billings, Bradford, EMNRD
Cc: Bratcher, Mike, EMNRD
Subject: RE: Lime Rock ASAU #150 Release #2RP-3893

Bradford,

I think we will leave it to your call on discussing with them on their proposed well placement for new MW-5. Seems really far away to me… but I am not really versed much on how this stuff works. If you have time and that placement makes sense to you could you possibly get a chance to let me know why, and let me know if you think that only one additional well is sufficient since their contamination numbers went up and plume doesn't appear to be defined as far as I could decipher.

Thank you kindly busy sir,

Crystal Weaver
Environmental Specialist
OCD – Artesia District II
811 S. 1st Street
Artesia, NM 88210
Office: 575-748-1283 ext. 101
Cell: 575-840-5963
Fax: 575-748-9720

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Tuesday, March 20, 2018 12:01 PM
To: Weaver, Crystal, EMNRD <Crystal.Weaver@state.nm.us>; Bratcher, Mike, EMNRD <mike.bratcher@state.nm.us>; Billings, Bradford, EMNRD <Bradford.Billings@state.nm.us>
Cc: Randy Hicks <r@rthicksconsult.com>; mike@rthicksconsult.com; mbarrett@limerockresources.com; 'Jerry Smith' <JSmith@limerockresources.com>
Subject: RE: Lime Rock ASAU #150 Release #2RP-3893

Brad, Crystal, & Mike,

Please find the attached proposal for the installation of another well (MW-5) at the Lime Rock ASAU #150 site. The work is scheduled for April 10, 2018. Please let me know if you have any comments or questions. Thanks.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office

575.302.6755

From: Kristin Pope [mailto:kristin@rthicksconsult.com]
Sent: Friday, December 22, 2017 1:02 PM
To: Crystal Weaver (Crystal.Weaver@state.nm.us); Mike Bratcher
Cc: Randy Hicks; mike@rthicksconsult.com; Michael Barrett (mbarrett@limerockresources.com) (mbarrett@limerockresources.com); 'Jerry Smith' (JSmith@limerockresources.com)
Subject: Lime Rock ASAU #150 Release #2RP-3893

Crystal and Mike,

Please find the attached report and proposal for the Lime Rock ASAU #150 Release . It includes:

- A summary of the compliance sampling performed to date
- A summary of the hydrocarbon characterization samples OCD required from the top of the water.
- A summary of the oil analysis on MW-1. Last measurement showed 1.5" thickness.
- A proposal for recovery of product on MW-1 using a sock. It was installed today and we will check it weekly.
- A proposal for at least one more well and possibly more after Q1 2018 analyses are received.

Let me know if you have any questions. Merry Christmas and enjoy your holiday.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Friday, August 10, 2018 4:20 PM
To: Weaver, Crystal, EMNRD; Bratcher, Mike, EMNRD; Billings, Bradford, EMNRD
Cc: Randy Hicks; mbarrett@limerockresources.com; 'Jerry Smith'; David Hamilton
Subject: Lime Rock ASAU #150 Release #2RP-3893

Brad, Crystal, & Mike,

Please consider this email as notice that we'll be conducting quarterly compliance sampling of the MWs at the Lime Rock ASAU #150 site on **Monday, August 13, 2018**, no earlier than 12:00 noon. We will also be conducting additional testing to include recovery testing to help us design an appropriate abatement plan. Please let me know if you have any comments or questions or stop by and see us in the field.
Thanks.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: Billings, Bradford, EMNRD
Sent: Monday, August 13, 2018 4:19 PM
To: Kristin Pope; Weaver, Crystal, EMNRD; Bratcher, Mike, EMNRD
Cc: Randy Hicks; mbarrett@limerockresources.com; 'Jerry Smith'; David Hamilton
Subject: RE: Lime Rock ASAU #150 Release #2RP-3893

Roger,

Keep in mind now to eliminate Crystal from email as she is no longer with OCD. Good idea to begin formulation of AP as new rule will push us to that.

Thanks.

Bradford Billings

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Friday, August 10, 2018 4:20 PM
To: Weaver, Crystal, EMNRD <Crystal.Weaver@state.nm.us>; Bratcher, Mike, EMNRD <mike.bratcher@state.nm.us>; Billings, Bradford, EMNRD <Bradford.Billings@state.nm.us>
Cc: Randy Hicks <r@rthicksconsult.com>; mbarrett@limerockresources.com; 'Jerry Smith' <JSmith@limerockresources.com>; David Hamilton <david@rthicksconsult.com>
Subject: Lime Rock ASAU #150 Release #2RP-3893

Brad, Crystal, & Mike,

Please consider this email as notice that we'll be conducting quarterly compliance sampling of the MWs at the Lime Rock ASAU #150 site on **Monday, August 13, 2018**, no earlier than 12:00 noon. We will also be conducting additional testing to include recovery testing to help us design an appropriate abatement plan. Please let me know if you have any comments or questions or stop by and see us in the field.
Thanks.

Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: David Hamilton <david@rthicksconsult.com>
Sent: Tuesday, November 13, 2018 2:19 PM
To: Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Cc: Michael Barrett; Jerry Smith; Randall Hicks
Subject: [EXT] ASAU Releease Site #2RP-3893
Attachments: Stage12APASSEMBLYred.pdf

Dear Mr. Billings and Mr. Bratcher,
Attached is the **entire** Stage 1/2 Abatement Submission for the above referenced site.
Last week, on Nov 9, we sent a partial submission.
This submission is complete so that there is nothing for you to join.

Please let us know of any questions or comments.

_____
David Hamilton
RT Hicks Consultants
Office: 505-266-5004

November, 2018

Stage 1/2 Abatement Plan
ASAU 150 Release Site
#2RP-3893
Unit O of Section 14, T18S, R26E
Eddy County, New Mexico

Prepared for:
Lime Rock Resources

Prepared by:
R.T. Hicks Consultants, Ltd.
Albuquerque, New Mexico

Executive Summary

The September 3, 2017 release was initially assigned the tracking number #2RP-3893. This document is a voluntary submission of a Stage 1 and Stage 2 Abatement Plan.

The Stage 1 Abatement Plan presents the results of the site investigation that began with excavation, sampling and exportation of impacted soil in September of 2017. After removal to disposal of nearly all of the impacted soil to a depth of 10-15 feet, Lime Rock installed a liner on the base of the excavation and backfilled with clean soil to grade. Because impacted soil remained below the practical limit of excavation and "clean closure" was not possible, a series of subsurface investigative phases ensued. These phases included

- Installation and testing of a soil boring on February 9, 2017 that documented transport of hydrocarbons from the pipeline release source to the groundwater surface
- Conversion of the boring to a monitoring well (MW-1) that demonstrated the presence of floating hydrocarbons (light non-aqueous phase liquid or LNAPL)
- Installation of MW-2 on June 6, 2017, located about 45 feet east southeast (generally down gradient) from MW-1. In January of 2018, this well showed benzene concentration of 2.4 mg/L (0.1 mg/L is the standard) and naphthalene concentration of 0.048 mg/L (0.03 mg/L is the standard). Results from the August 2018 sampling detected 0.290 mg/L of benzene and 0.018 mg/L of ethylbenzene in this well.
- Installation of MW-3 and MW-4 on August 14, 2017 that are located about 150 feet west and 130 feet southeast (down gradient) from MW-1. The May 2018 and August 2018 analysis of MW-3 exhibited benzene concentrations below the 0.01 mg/L standard. The May 2018 benzene concentration in MW-4 was 1.7 mg/L. In August 2018, benzene concentrations were 1.2 mg/L (at 0.5 feet below the water table) and 0.710 mg/L (at 2.5 feet below the water table).
- Seven groundwater monitoring events from June 2017 to August 2018 provided better understanding of groundwater flow directions and benzene concentration trends. These data caused a high level of confidence in the selection of a location for MW-5, which is about 325 feet down gradient from release location (MW-1). Duplicate samples from this well in May of 2018 did not detect benzene or other regulated hydrocarbons. The August 2018 sample also did not detect benzene or other regulated hydrocarbons.

The apparent recent migration of LNAPL from the source area to MW-2 and the lack of any evidence of hydrocarbons in the down gradient well MW-5 convinced Lime Rock that a voluntary, robust groundwater remedy is prudent. The investigations described above provided sufficient information to allow the design of an appropriate abatement option.

30.11.13.
C. The stage 1 of the abatement plan's purpose is to design and conduct a site investigation that adequately defines site conditions, and provide the data necessary to select and design an effective abatement option….

30.11.13
D. (1) A responsible person shall submit a stage 2 abatement plan … The responsible person may submit a stage 1 and 2 abatement plan proposal together. Stage 2 of the abatement plan's purpose is to select and design, if necessary, an abatement option that, when implemented, results in attainment of the abatement standards and requirements set forth in 19.15.30.9 NMAC, including post-closure maintenance activities.

The Stage 2 Plan describes a pump-and-dispose strategy to remove a significant mass of hydrocarbons that are dissolved in the uppermost portion of the groundwater zone. After hydrocarbon mass removal is complete, the last step of the remedy is monitored natural attenuation.

The specific steps already completed or proposed to implement the remedy are listed below.

- During the August 2018 sampling event, the measured thickness of the LNAPL on ground water in MW-1 was 0.6 inches. This depth has declined from 6.0 inches in March 2017.
- The use of low-flow pumping allowed samples to be collected from 0.5 feet and 2.5 feet below the water table in MW-4. The sample concentrations show a benzene concentration gradient declining with depth. The shortness of the water column in MW-2 did not allow similar measurements.
- Through boring, install an impacted groundwater recovery system between MW-1 and MW-4. The recovery system will be screened in a manner that will maximize removal of LNAPL and highly impacted groundwater and minimize the removal of groundwater that is amenable to natural restoration processes.
- After a 2-4 month pilot testing program of the installed remediation system, additional remediation wells may be installed to accelerate the abatement process.

We anticipate the completed system may operate for 1-2 years followed by a period of monitored natural attenuation. Closure of the regulatory file will be requested when the requirements of the Rule are met.

1.0 Stage 1 Abatement Plan

Location, Nearby Land Use and Directions to the Site

Stage 1 of the abatement plan may include the following information depending on the media affected, and as needed to select and implement an expeditious abatement option:

(1) descriptions of the site, including a site map, and of site history including the nature of the release that caused the water pollution,

The crude oil pipeline release is

- latitude 32.74266, longitude -104.34846
- Section 14, T18S, R26E, Unit letter O (990 FSL, 1650 FEL),
- about 9.25 miles south and east of Artesia, NM
- on private property belonging to Gray Holdings, LLC

Plate 1 is a topographic map that shows the pipeline release relative to the Pecos River, Rio Peñasco and nearby water supply wells. The land use surrounding the site is displayed on Plate 2, which is a recent aerial photograph at the same scale as Plate 1. Irrigated agriculture, pasture, residences and oil and gas production are obvious in this image.

To access the site from downtown Artesia

- Head south on S 1st St/US Hwy 285 N for 6.0 mi
- Turn left onto NM-229 N and proceed east for 2.0 mi
- Continue straight onto E Four Dinkus Rd for an additional 0.7 mi

- Turn right onto Fanning Rd and proceed south for 0.8 mi
- The site is on the east side of the road after crossing the typically dry Rio Peñasco

and a summary of previous investigations;

1.1 Site History and Nature of Release

As described in the 10/7-2016 Release Notification (Form C-141) that described the 9/30/2016 release:

> "A 3" below grade FG flow line developed a leak due to corrosion, the line was immediately shut-in, and the line was excavated and then repaired. The volume of the release caused by the below grade flow line was unknown."

The flow line that released petroleum hydrocarbons and water was installed prior to Lime Rock's ownership. It moves fluids from multiple wells to a tank battery located about 3,600 feet to the northeast.

1.2 Recent Release Events and Summary of Response Actions

January 2, 2017 Remediation Plan (Appendix A)
In addition to shut in of the flow line, Lime Rock initiated an excavation and removal program in an attempt to "clean close" the release site. The excavation program commenced immediately after Lime Rock detected the release. This report describes the results of sampling that defined the horizontal extent of soil impairment as well as a soil boring designed to define the vertical extent. The report concluded that a groundwater monitoring well would be necessary to identify any impact to groundwater quality.

May 30, 2017 Notice of Groundwater Impact (Appendix B).
The monitoring well located adjacent to the flow line release detected floating hydrocarbons on groundwater (aka light non-aqueous phase liquid, LNAPL). This report describes the sampling events and proposed installation of three additional monitoring wells to help define the horizontal extent of groundwater impairment.

October 9, 2017 Hydrocarbon Characterization of Groundwater (Appendix C)
All three of the newly-installed monitoring wells detected concentrations of benzene that exceeded the standards. MW-4 exhibited 3.300 mg/L benzene. This report proposed several quarters of monitoring prior to the installation of one or more additional wells to define the magnitude and extent of hydrocarbon impact.

December 22, 2017 Groundwater Sampling Report (Appendix D)
This report summarizes the findings of several monitoring events that provided information regarding groundwater flow direction and magnitude of the impact at and near the release point. From these data, we selected a down gradient monitoring well (MW-5) location for approval by OCD.

Appendix E of this Stage 1 Abatement Plan presents the lithologic logs, monitor well construction details of all borings (MW-1 to MW-5) as well as the analytical results of the August 2018 sampling event. During this sampling, there was no detection of hydrocarbon s in MW-5, the down-gradient monitoring well approximately 350 feet directly down gradient of the release point. At this time, we are confident that the magnitude and extent of hydrocarbon impairment of groundwater is sufficiently characterized to permit the recommended remedial response that is described in the attached Stage 2 Abatement Plan.

(2) site investigation work plan that defines: (a) site geology and hydrogeology;

1.3 Site Vicinity Geology

Two good sources of geologic data for the area are the Geologic Map of the Spring Lake Quadrangle[1] (and the accompanying report[2]) and the Geologic Map of the Lake McMillan North quadrangle[3]. A portion of this geologic map is reproduced as Plate 3. The release site is located on the Older Lakewood Terrace unit (Qlt1), which is described in both reports as:

> Comprised of occasional gravels and pebbles, brown (10YR5/3) to dark yellowish brown (10YR3/4), unconsolidated, moderately sorted, coarse- to fine- grained sand, silty sand, silt and sandy clay. Pedogenic carbonate increases from stage I to stage II+ (occasionally III) from Qlt3 to Qlt1. Mostly non-gypsiferous.

Although the cross section in the Lake McMillan North Quadrangle Map displays only the bedrock units, the mapped cross section of the Spring Lake Quadrangle, which is about 4 miles north of the release site, suggests the Lakewood Terrace deposits are approximately 300 feet thick. However the text of both reports state that the thickness of the Older Terrace is 2-12 meters (about 6-40 feet). The cross section thickness obviously represents the total thickness of the alluvium overlying the Permian bedrock, which we believe is called the Pecos River braided alluvial deposits (upper Pleistocene to lower Holocene, Qabp). This unit is described as

> Gravels and pebbles of dolomite, limestone, sandstone, chert, and quartzite in a reddish brown (2.5YR4/6) to light reddish-brown (5YR6/4), unconsolidated, poorly to moderately sorted, coarse- to fine-grained sand, silty sand, sandy clay, and clay. Thicknesses vary (based upon Lyford, 1973) from about 5 to 30 m.

The 30 meter thickness of Qabp plus 20 meters of the terrace deposit does not sum to the 300-foot thickness shown on the cross section. Moreover, driller's logs from nearby water supply wells suggest a total thickness of alluvium of about 200 feet (see Appendix E).

[1] https://geoinfo.nmt.edu/publications/maps/geologic/ofgm/downloads/214/SpringLake.pdf
[2] https://geoinfo.nmt.edu/publications/maps/geologic/ofgm/downloads/214/SpringLakeReport.pdf
[3] See https://geoinfo.nmt.edu/publications/maps/geologic/ofgm/details.cfml?volume=167

For the purpose of this Abatement Plan, we will assume that about 200 feet of alluvial fill overlie the bedrock in the area of the release site and the permeable alluvium is composed of material similar to that described above for the Lakewood Terrace and the braided alluvial deposits. This lithology is consistent with the monitor well boring logs provided in Appendix E.

The saturated alluvium throughout the area is locally called the shallow aquifer and is used extensively for irrigation and domestic use.

2(a) continued

subsurface hydraulic conductivity; transmissivity, storativity and rate and direction of contaminant migration;

1.4 Site Hydrology

On a regional scale, the shallow aquifer is not under confining pressure and is a water-table aquifer. Thus, we believe that static measurements of water supply wells (as deep as 225 feet) and shallow monitoring wells can be used to construct a reasonable estimate of the groundwater surface elevation. A map of the potentiometric surface of the nearby area is displayed in Plate 4. The data presented in Plate 4 show a southeast groundwater flow direction with a gradient of (20/8400=) 0.002.

Plate 5 is a potentiometric surface map of the release site that employs only the four monitoring wells that do not exhibit LNAPL. This plate also shows groundwater flow to the southeast, a measured gradient of 0.002, and groundwater elevations that conform with those on Plate 4.

The Stage 2 Abatement Plan provides for tests to determine the hydraulic conductivity and storativity of the uppermost groundwater zone in order to develop an appropriate remedy. The northwest-southeast cross section through MW-1 to MW-4, shown as Plate 6, identifies the uppermost groundwater zone as a sand and gravel zone with some silt and clay. We anticipate a relatively high hydraulic conductivity and storativity within the more permeable sand and gravel layers and lower conductivity within clay/silt layers. The transmissivity of the uppermost water bearing unit obviously varies with the total thickness of the more permeable layers.

2(a) continued

inventory of water wells inside and within one mile from the perimeter of the three-dimensional body where the standards set forth in Subsection C of 19.15.30.9 NMAC are exceeded; and location and number of wells the pollution actually or potentially affects

The water supply wells listed on the database of the Office of the State Engineer are shown on Plate 7 and satisfy the requirement for an inventory of water wells. No water supply wells are impaired by the release that is the subject of this Abatement Plan.

2(a)

the vertical and horizontal extent and magnitude of vadose-zone and <u>ground-water contamination</u>;

1.5 Magnitude and Extent of Groundwater Impairment

Plate 8 shows an estimated extent of benzene in excess of the 0.01 mg/L in the uppermost 10-feet of groundwater.

Table 1 (at the end of the text) presents the laboratory data for all constituents upon which Plate 8 is based. The area of impairment lies up gradient (northwest) from the pipeline release point (essentially

MW-1 is located at the release point) because the excavation remedy identified soil impacts to the north and east of the release point. The eastern extent is defined by recent benzene concentrations observed in MW-3, which have formerly exceeded the 0.01 mg/L standard but are currently below the standard. Soil impairment also extended beneath Fanning Road to the west, which justifies the western extent of groundwater impairment. The estimate of the western extent also makes use of the observed eastern horizontal spread of impairment defined by MW-3. The 250-foot down gradient extent of impairment is an estimate based upon ➢ the decline in benzene concentrations between MW-2 and MW-4, ➢ the lack of detected benzene in MW-5 and ➢ the knowledge that dissolved hydrocarbons decrease in concentration during groundwater transport and ➢ an obvious conclusion that the pipeline release occurred many years prior to the September 2016 discovery of oil at the ground surface above the pipeline release For the purpose of designing a remedy, we conclude the data are sufficient to define the horizontal extent of groundwater impairment and the southeastern flow direction of groundwater and dissolved hydrocarbons. At this time, we believe that contaminant migration to the southeast (down gradient) is limited by natural restoration processes such as biodegradation and dispersion. Thus, we hypothesize that the cessation of input of hydrocarbons to the vadose zone and thence to groundwater will cause the hydrocarbon plume shown in Plate 8 to diminish over time. Thus, we believe Plate 8 represents the maximum extent of hydrocarbon impairment of groundwater under current groundwater flow conditions. As Table 1 shows, limited low-flow sampling data from MW-2 and MW-4 suggest that the vertical extent of impairment does not extend more than 5-feet below the water table. However, the clay/silt layers observed in the boring logs provide a significant permeability contrast with the sand and gravel layers and thereby retard downward migration of hydrocarbons. It would not be surprising if additional testing shows that, near the source area, the vertical extent of impairment is limited. The impact to groundwater presents no imminent threat to public health, because there is no water supply well between the release source area and the “clean” down gradient well, MW-5. The release poses no threat to the environment because the nearest source of surface water, the Pecos River, is about 2.5 miles down gradient and natural processes will remove any hydrocarbons from groundwater long before they could migrate this distance. The impact has caused impairment of fresh water and abatement is required by NM OCD Rules.	2(a) continued and rate and direction of contaminant migration; 2(a) the vertical and horizontal extent and magnitude of vadose-zone and ground-water contamination;

1.6 Magnitude and Extent of Vadose Zone Conditions

The January 2, 2017 submission (Appendix A) presents the results of the investigation of vadose zone impacts. One boring near the release documented hydrocarbon impact to the water table.

As described in the January submission, the extent of the impact caused Lime Rock to remove more than 200 cubic yards of impacted earth and place a liner over all areas within the excavation. Hydrocarbons below the 15-foot reach of excavation equipment exist underneath the liner in an area north of and directly beneath the pipeline release.

30.11.13.C

2(b) surface water hydrology, seasonal stream flow characteristics, ground water/surface water relationships, the vertical and horizontal extent and magnitude of contamination and impacts to surface water and stream sediments…

1.7 Impacts to Surface Water

Although the channel of the Rio Peñasco is about 150 feet north of the pipeline release location, there exists no evidence that the release did or will impact surface water of this drainage. More than 8,000 feet separate the release location and the Pecos River. We believe that this distance precludes any possibility of impairment of surface water in the Pecos River.

Thus, we respectfully request that a discussion of surface water hydrology be omitted from this plan.

1.8 Proposed Monitoring And Remediation Testing

Over the past year, Lime Rock conducted quarterly sampling of the five (5) monitoring wells as they were installed. All wells were gauged for water levels and thickness of LNAPL. We obtained groundwater samples from all wells that did not exhibit LNAPL. Results are presented in Table 1. We propose to continue quarterly monitoring using hand-bailing protocols or low-flow protocols of all wells that do not exhibit measurable LNAPL. The proposed quarterly groundwater sampling is:

- August
- November
- February
- May

(3) monitoring program, including sampling stations and frequencies, for the abatement plan's duration that may be modified, after the director's approval, as the responsible person creates additional sampling stations;

As described in the Stage 2 Abatement Plan, the presumptive remedy is removal of a large mass of LNAPL along with removal of highly-impacted groundwater in the uppermost portion of the groundwater zone via one or two extraction wells. After the hydrocarbon mass removal via pumping, monitored natural attenuation may be employed as a final remediation strategy.

Lime Rock will recover LNAPL if possible and transfer the hydrocarbons for sale. We anticipate the pumping rate for extracted groundwater will be less than 2 GPM for about 12 hours each day. The resulting 35 bbls/day of groundwater will be added to the salt water disposal system

of Lime Rock.

In order to properly design the remedy, we have performed or will be completing these activities:

- the August 2018 sampling event demonstrates that the possibility of removing LNAPL directly from the water table is not practical given the current thickness of LNAPL in MW-1 (0.6 in.), the well exhibiting the greatest thickness of LNAPL.
- An estimate of the hydraulic conductivity of the uppermost groundwater zone through a recovery test at MW-4 suggests that the upper 5-feet of the aquifer have a hydraulic conductivity on the order of hundreds of feet/day
- low-flow sampling of MW-4 resulted in samples showing a decreasing benzene concentration with depth. (We elected not to sample MW-2 in an identical manner as there was concern that the high sediment load in the lower water column would disrupt the pump.)
- perform pilot-scale testing over several weeks of groundwater extraction in the first remediation wells to be placed southeast of MW-1 as shown on Plates 6 and 8.

Appendix F presents the recovery test used to estimate the hydraulic conductivity of the groundwater zone adjacent to MW-4. Appendix G provides the low flow sampling protocol employed by Hicks Consultants at MW-4.

The design of the remediation well is based upon the results of the testing performed at MW-1 and MW-4.The objective of the initial testing program is to determine the pumping rates and depths that will efficiently extract the greatest mass of hydrocarbon from the saturated zone within shortest time. The pumping of the hydrocarbon-impacted groundwater will continue as the first phase of the proposed remedy.

1.9 Quality Assurance Plan for Sampling And Testing

Appendix H includes the Health and Safety Plan for the proposed groundwater sampling and other work conducted at the Site. Groundwater sampling will follow the protocol in Appendix G.

1.10 Schedule for Stage 1 Abatement Plan Work

August 2018 (Completed work)

- Quarterly sampling of all monitor wells
- Low-flow sampling of MW-4 to estimate benzene concentration profile (similar sampling of MW-2 was not practical)
- Hydraulic testing of MW-4
- LNAPL recovery testing of MW-1 was planned, but was not practical due to the LNAPL thickness, 0.6 inches.

(4) quality assurance plan, consistent with the sampling and analytical techniques listed in Subsection B of 20.6.2.3107 NMAC and with 20.6.4.14 NMAC of the water quality standards for interstate and intrastate surface waters in New Mexico, for all work to be conducted pursuant to the abatement plan;

(5) a schedule for stage 1 abatement plan activities, including the submission of summary

November 2018 – Quarterly Report ➢ Laboratory results and groundwater surface map ➢ Proposed design of first remediation well(s) ➢ Routine sampling of monitoring wells December 2018 – Quarterly Report ➢ Laboratory results and groundwater surface map ➢ Installation of Remediation well ➢ Pilot testing of remediation well.	quarterly progress reports, and the submission, for the director's approval, of a detailed final site investigation report; and

2.0 Stage 2 Abatement Plan

The apparent recent migration of LNAPL from the source area to MW-2 and the lack of any evidence of hydrocarbons in the down gradient well MW-5 convinced Lime Rock that a voluntary, robust groundwater remedy is prudent. The Stage 2 Plan describes a LNAPL recovery program combined with a pump-and-dispose strategy to remove a significant mass of hydrocarbons that are dissolved in the uppermost portion of the groundwater zone. After hydrocarbon mass removal is complete, the last step of the remedy is monitored natural attenuation.

2.1 Description of Current Vadose Zone Conditions

Section 1.6 of the Stage 1 Abatement Plan describes the current conditions of vadose zone impact. The presumptive vadose zone remedy is complete and includes:

- abandonment of the pipeline that caused the vadose zone impact,
- excavation and removal of impacted soils to a depth of 15 feet,
- placement of liner in the bottom of the excavation, and
- backfilling of the excavation with clean soil.

2.2 Description of Current Groundwater Conditions

Section 1.5 describes the current groundwater conditions.

2.3 Description of Abatement Options – Vadose Zone

Proposed quarterly evaluation of the groundwater remedy during the next 12-18 months may demonstrate that the remedy described above meets the criteria of Section 19.15.30.9 of the Rule, which states:

> A. The responsible person shall abate the vadose zone so that water contaminants in the vadose zone will not with reasonable probability contaminate ground water or surface water, in excess of the standards in Subsections B and C of 19.15.30.9 NMAC, through leaching, percolation or other transport mechanisms, or as the water table elevation fluctuates.

We know that released hydrocarbons will continue to migrate to groundwater for several years after abandonment of the pipeline. We suspect that the continued migration to groundwater is the cause of the more recently-measured LNAPL in MW-2. We also know that pipeline abandonment and the placement of the liner will cause the flux of hydrocarbons to groundwater to decrease over time. What is unknown is <u>when</u> the rate of hydrocarbon input to groundwater is negligible with respect to rate of natural restoration processes. We believe that monitoring LNAPL thickness and benzene concentration in MW-1 during the groundwater remediation program will provide useful data to

D. Stage 2 abatement plan.
(1) A responsible person shall submit a stage 2 abatement plan ... Stage 2 of the abatement plan's purpose is to select and design, if necessary, an abatement option that, when implemented, results in attainment of the abatement standards and requirements set forth in 19.15.30.9 NMAC, including post-closure maintenance activities.

(2) Stage 2 of the abatement plan should include, at a minimum, the following information: (a) a brief description of the current situation at the site;

determine if additional vadose zone remedial efforts might be necessary. The conversion of MW-1 to a Soil Vapor Extraction (SVE) well and/or the placement of additional SVE well(s) within the footprint of the vadose zone impact remains under consideration as an additional vadose zone remedy. *2.4 DESCRIPTION OF ABATEMENT OPTIONS – GROUNDWATER* The preferred abatement option for groundwater is 1. LNAPL removal via a skimming pump system 2. Removal to disposal of the most highly-impacted groundwater from the uppermost 1-3 feet of the groundwater zone to the Lime Rock salt water disposal system 3. Install the LNAPL skimming and groundwater pumping systems in large diameter borings to minimize well efficiency effects 4. Monitored natural attenuation (MNA) after sufficient hydrocarbon mass is removed from groundwater to allow for effective and time-efficient natural restoration. We evaluated each of the three actions (Nos. 1, 2, and 4) independently and we determined that combining all three to the extent possible made the most sense in terms of cost and schedule. MNA by itself may require decades. Employing only LNAPL removal plus MNA would probably require less than 20 years but more than 5 years before standards are met in all wells for more than two consecutive quarters of monitoring. Removal to disposal of highly-impacted groundwater and entrained LNAPL may create some logistical problems associated with potential emulsification of hydrocarbons in the transport lines and pumps. LNAPL skimming alone does allow recovery of the hydrocarbon resource. After 1-year of operation of the preferred option, we will examine the data and may propose an alternative to disposal of groundwater into the Lime Rock SWD system. Based upon our current knowledge of the site, the following options may be viable: A. Pump groundwater from the uppermost 10-feet of the groundwater zone to storage in a lined containment where aerobic processes will reduce dissolved hydrocarbons concentrations. B. Use the water for a. hydraulic stimulation of oil wells b. dust suppression on oilfield lease roads c. Irrigation of pasture to cause additional polishing of water quality via phytoremediation but with limited infiltration. Pumping and treating the water to discharge standards is not a cost-effective alternative remedy.	(b) development and assessment of abatement options;

2.5 Description, Justification And Design Of The Preferred Abatement Option

The final design of the abatement system will be established after the series of tests and reports described below.

A. An LNAPL recovery test in MW-1 to provide an estimate of the LNAPL migration rate was not possible due to lack of LNAPL thickness in August, 2018.
B. Low flow pumping was used to collect samples from different depths in MW-4 in the August sampling. A benzene concentration gradient declining with depth was observed.
C. To maximize the removal of only the highly-impacted groundwater, the groundwater removal system will consist of two wells. One well will be screened such that the bottom of its screen will be five feet below the high water elevation observed in MW-1 and MW-4. The other well will be screened such that the bottom of its screen will be five feet below the low water elevation observed in MW-1 and MW-4. These planned wells are shown as RMW-1 and RMW-2 on Plate 6 and their proposed location is shown on Plate 8. Depending upon the water table elevation, pumping will occur in the well offering best access to the highly-impacted upper groundwater zone.
D. Upon installation of the groundwater removal system, begin a 2-4 month pilot testing program of the remediation system.

(c) a description, justification and design, if necessary, of the preferred abatement option;

E. In the unlikely event that the November sampling finds a sufficient thickness of LNAPL, a design for a large-diameter boring LNAPL recovery system will be submitted. Such a system would be placed in a 30- or 36-inch diameter boring located between MW-1 and MW-2 and would have an LNAPL recovery system in a 6-12 inch well casing.
F. Such an LNAPL recovery system will be screened in a manner that will maximize LNAPL recovery and provide for the SVE option if necessary. The top of the screen would be 5-10 feet above the high LNAPL elevation in MW-1 and the bottom of the screen would be about 1 foot below the low water elevation observed in MW-1 and MW-2.

(d) modification, if necessary, of the monitoring program the director approved pursuant to stage 1 of the abatement plan, including the designation of pre- and post-abatement-completion sampling stations and sampling

G. Evaluate efficacy of the system as proposed in the monitoring plan and report findings to OCD and the surface owner (January-March). This report will provide any necessary modifications to the abatement system and provide the justification of the final design as required by the Rule.

Depending upon results, additional borings may be installed to accelerate

the abatement process. We anticipate the completed system may operate for 1-2 years followed by a period of monitored natural attenuation. Closure of the regulatory file will be requested when the requirements or the Rule are met. *2.6 PROPOSED MONITORING PLAN* Quarterly groundwater monitoring of all five wells will continue. As stated above, a plan to measure the efficacy of the remediation system during pilot testing will be submitted to the OCD in September. *2.7 OPERATION AND MAINTENANCE PLAN* An O&M plan will be submitted to the OCD with the final system design plan, which is scheduled for submission after the pilot testing is complete (December-February) *2.8 SCHEDULE OF ACTIVITIES AND REPORTING* The schedule of the abatement activities will be presented in the final design report in the first quarter of 2019. *2.9 PUBLIC NOTIFICATION* The public notification process will be implemented pursuant to the Rule.	frequencies to be used to demonstrate compliance with the standards and requirements set forth in 19.15.30.9 NMAC; (e) site maintenance activities, if needed, the responsible person proposes to perform after abatement activities terminate; (f) a schedule for the duration of abatement activities, including the submission of summary quarterly progress reports; (g) a public notification proposal designed to satisfy the requirements of Subsections B and C of 19.15.30.15 NMAC; and (h) additional information that may be reasonably required to select, describe, justify and design an effective abatement option.

Lime Rock - ASAU #150 Release

Table 1

Monitoring Well Analyses

Well ID	DTW ft (from TOC)	Sample Date	LNAPL in.	Benzene 0.01	Toluene 0.75	Ethylbenzene 0.75	Total Xylene 0.62	Naphthalene 0.03	Total BTEX	Chloride 250	Sulfate 600	TDS 1000	Sampling method	Lab	Notes
MW-1	51.62	3/8/17	6.00	19.2	8.5	2.31	5.17	---	35.2	188	1460	2800	bail	Cardinal	by oil/water interface meter
	51.62	3/8/17	6.24	---	---	---	---	---	---	---	---	---	---	---	baildown test
	51.9	7/19/17	---	---	---	---	---	---	---	---	---	---	---	---	from nested measuring tube
	52.55	8/22/17	---	---	---	---	---	---	---	---	---	---	---	---	"
	52.36	10/11/17	1.5	---	---	---	---	---	---	---	---	---	bail		sampled LNAPL
	55.15	8/14/18	0.6	12	.022	.410	.290	.089					bail		by oil/water interface meter
MW-2	51.11	6/12/17	none	0.93	0.0047	0.011	0.034	---	0.0497	200	2100	381	bail	Hall	
54	grab samples for comparison	7/13/17	none	ND	ND	ND	ND	---	ND	---	---	---	low-flow pump	Hall	sampled at 54'
59		7/13/17	none	0.0082	ND	ND	ND	---	0.0082	---	---	---	low-flow pump	Hall	sampled at 59'
	51.0	7/19/17	none	---	---	---	---	---	---	---	---	---	---	---	DTW only
	51.69	8/22/17	none	---	---	---	---	---	---	---	---	---	---	---	DTW only
	52.00	10/24/2017	lt. film	0.35	0.0078	0.063	0.079	0.013	---	180	2200	---	low-flow pump	Hall	Q4 2017
	49.43	1/23/2018	film	2.4	ND	0.17	0.027	0.048	---	180	1400	3040	hand bail	Hall	Q1 2018
	52.65	5/14/2018	0.72	*No Sample; measurable LNAPL*											Q2 2018
	54.35	8/13/2018	none	0.290	ND	.018	ND	ND					low-flow pump		Q3 2018
MW-3	46.4	8/2/17	none	0.061	ND	ND	ND	---	0.061	212	2010	3920	low-flow pump	Cardinal	
	47.22	8/22/17	none	---	---	---	---	---	---	---	---	---	---	---	DTW only
	47.57	10/24/2017	none	0.02	ND	ND	ND	ND	---	190	2100	---	low-flow pump	Hall	Q4 2017
	44.88	1/23/2018	none	0.066	ND	ND	ND	ND	---	190	1900	3610	hand bail	Hall	Q1; silty
	48.10	5/14/2018	none	0.0017	ND	ND	ND	ND		180	1900	3570	hand bail	Hall	Q2 2018; slow recovery during bailing
	49.94	8/13/2018	none	ND	ND	ND	ND	ND		190	2000	3900	low-flow pump		Q3 2018
MW-4	46.8	8/2/17	none	1.53	<0.020	0.101	<0.060	---	1.64	200	1840	3460	bail	Cardinal	Q3 2017
	48.47	8/22/17	none	---	---	---	---	---	---	---	---	---	---	---	DTW only
	48.75	10/24/2017	none	0.13	ND	0.016	ND	0.0092	---	180	2000	---	low-flow pump	Hall	Q4 2017
	46.41	1/23/2018	none	0.95	ND	0.09	ND	0.022	---	190	1100	2560	hand bail	Hall	Q1; silty
	49.35	5/14/2018	none	1.7	ND	0.096	ND	0.033		190	1400	3060	hand bail	Hall	Q2 2018
	52.05	8/14/2018	none	1.2	ND	.260	ND	.034					low-flow pump		Q3 2018, Pump set at 52.5 feet
	52.05	8/14/2018	none	0.710	ND	.110	ND	.016					low-flow pump		Q3 2018, Pump set at 54.5 feet
MW-5	51.72	5/14/2018	none	ND	ND	ND	ND	ND	ND	---	---	---	hand bail	Hall	NO PURGE; characterization only
	51.72	5/14/2018	none	ND	ND	ND	ND	ND	ND	180	1900	3710	hand bail	Hall	Q2 2018
	53.48	8/13/2018	none	ND	ND	ND	ND	ND	ND	200	2200	4200	low-flow pump		Q3 2018

All concentrations are mg/L

Plates

Stage 1/2 Abatement Plan

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

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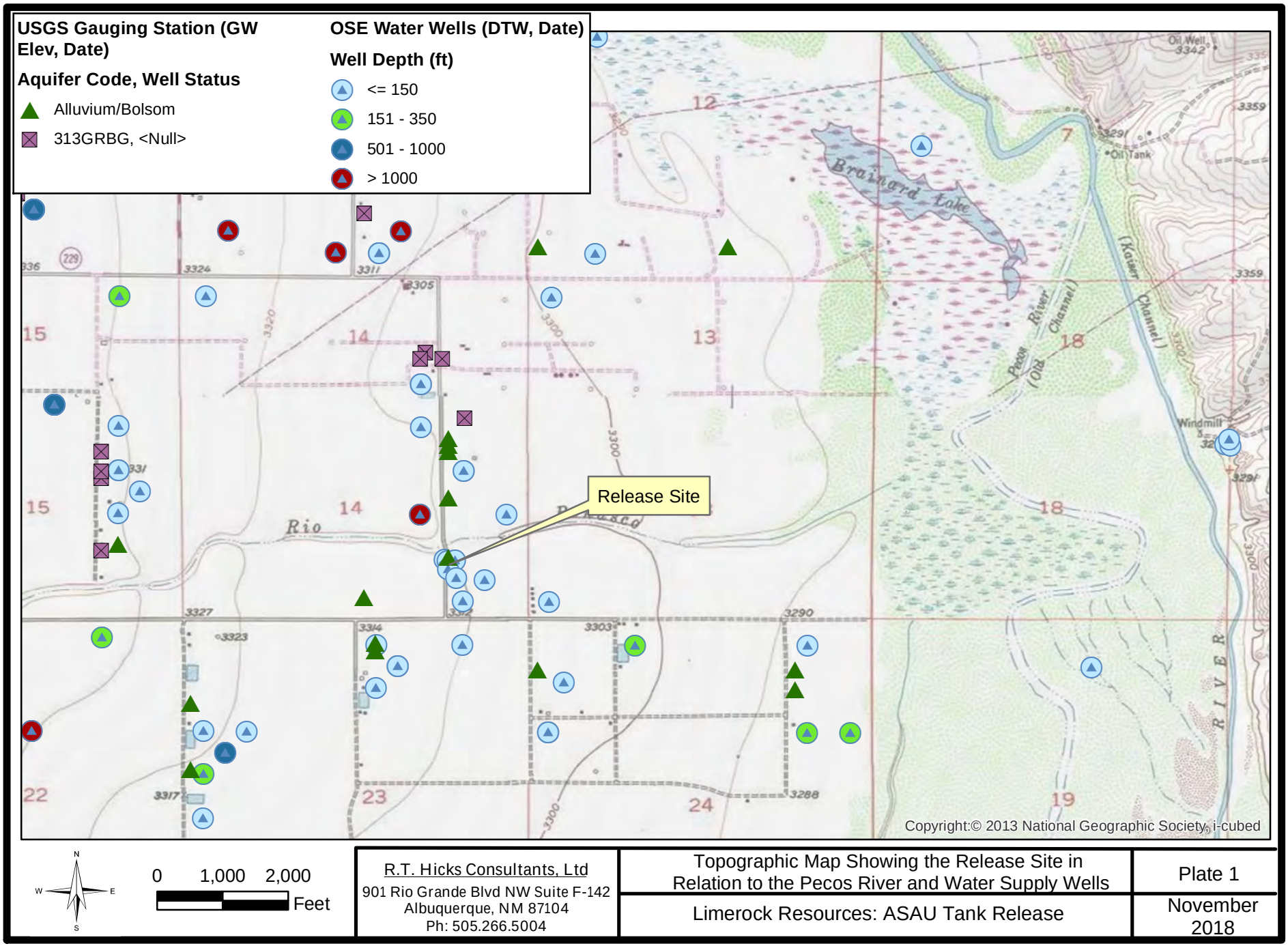

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R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Aerial Photograph Showing the Release Site in Relation to the Pecos River and the Rio Penasco	Plate 2
	Limerock Resources: ASAU Tank Release	November 2018

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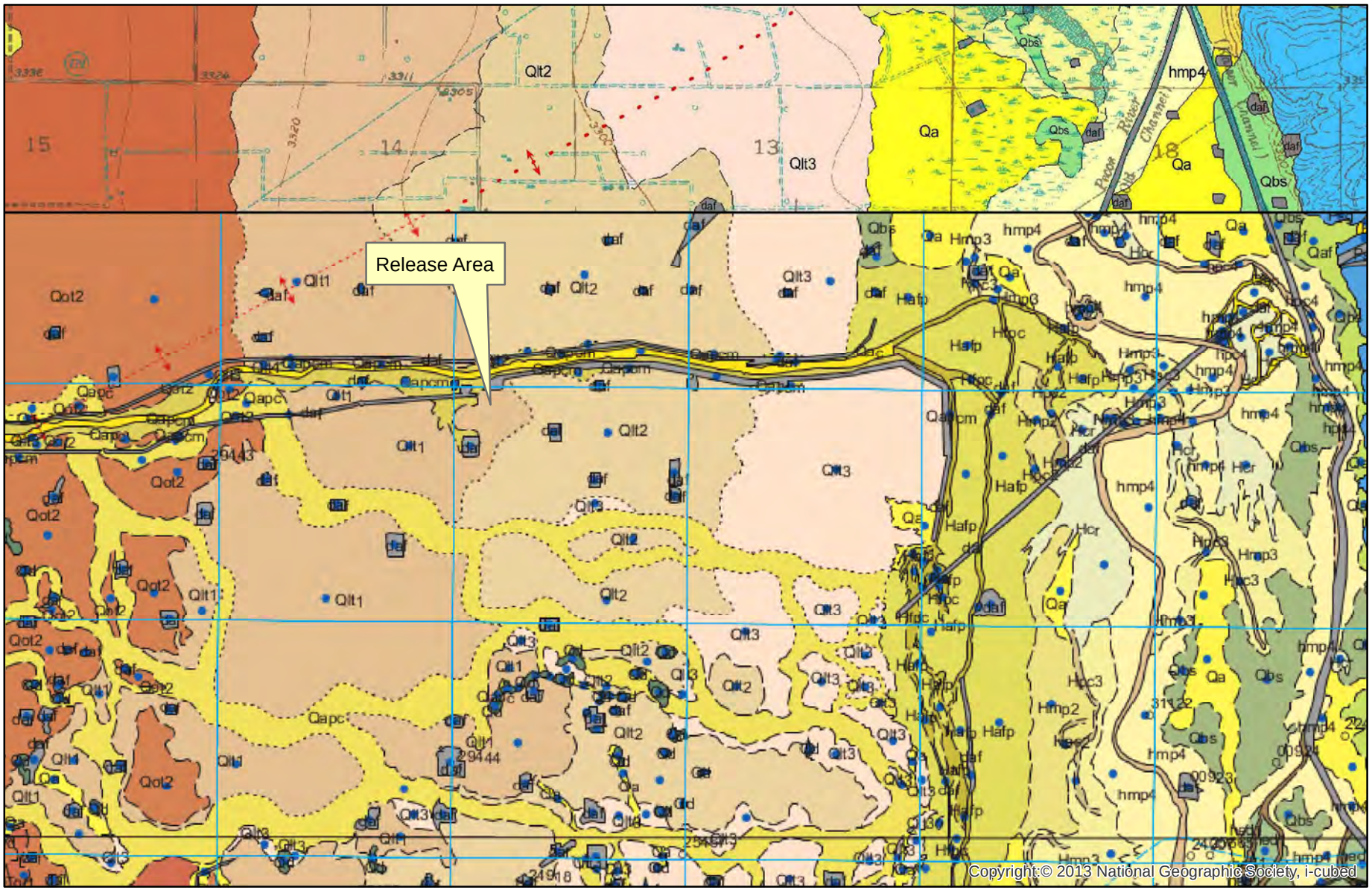

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R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
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Geologic Map of the Release Site Area

Limerock Resources: ASAU Tank Release

Plate 3

November 2018

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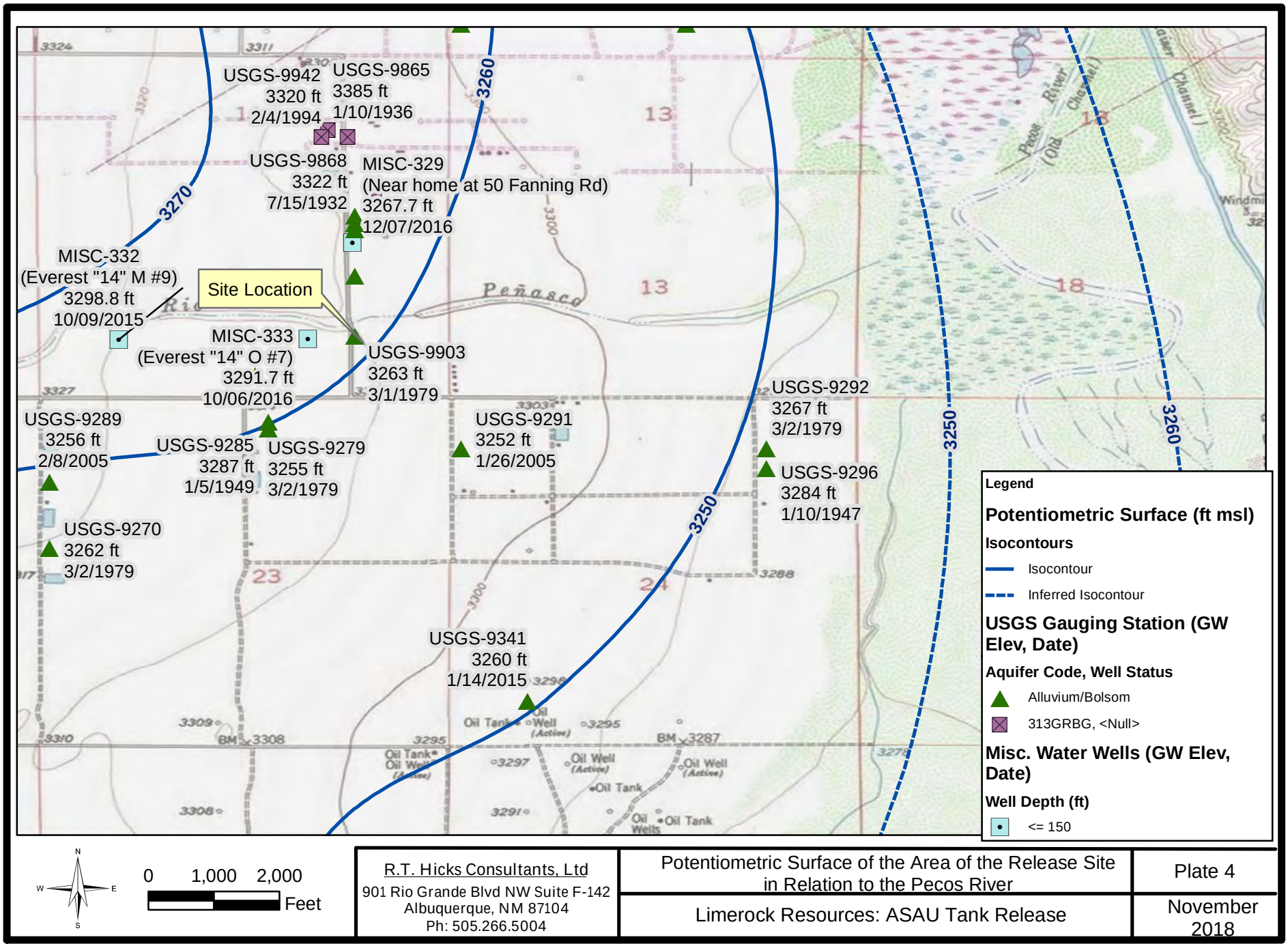
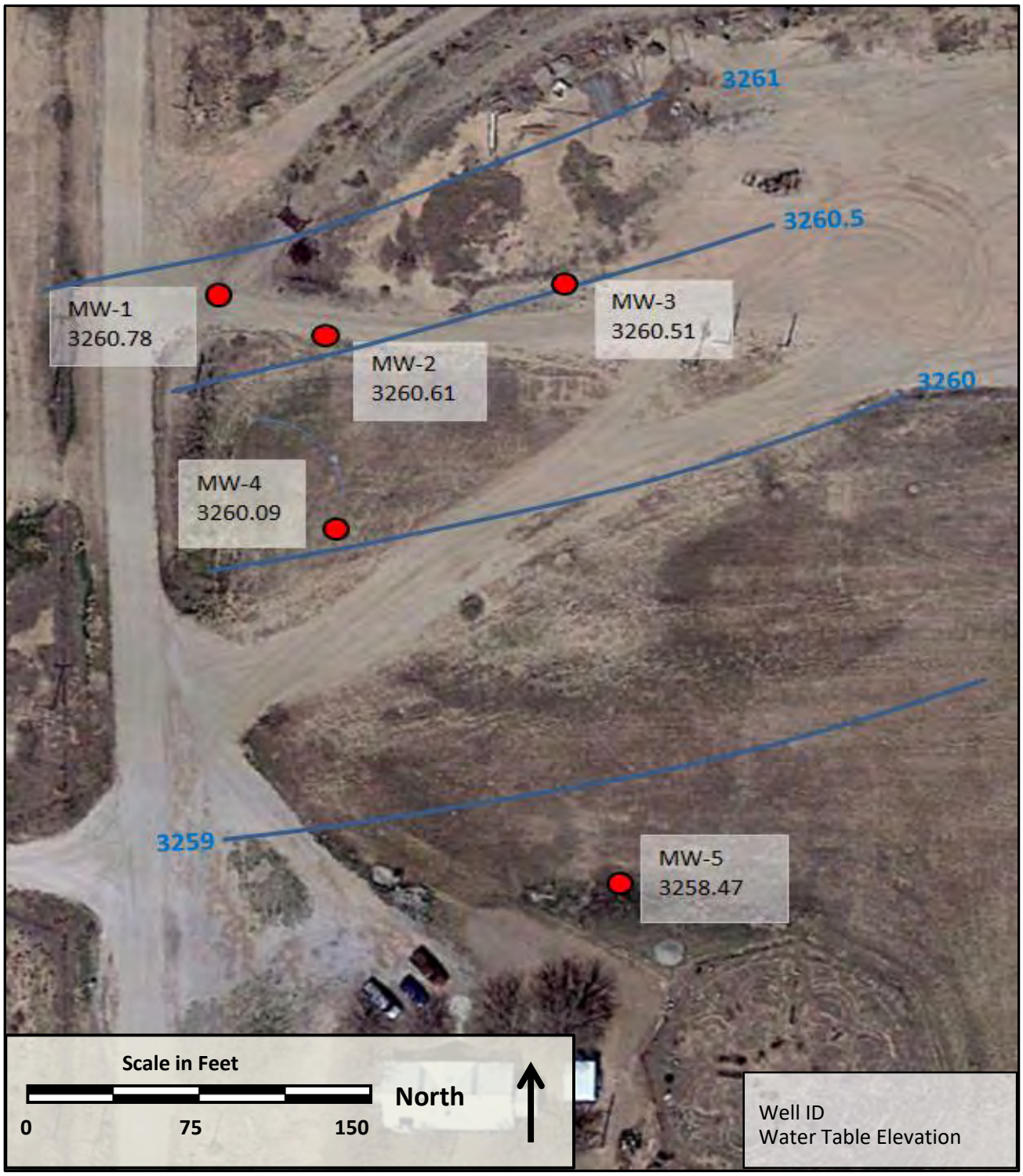
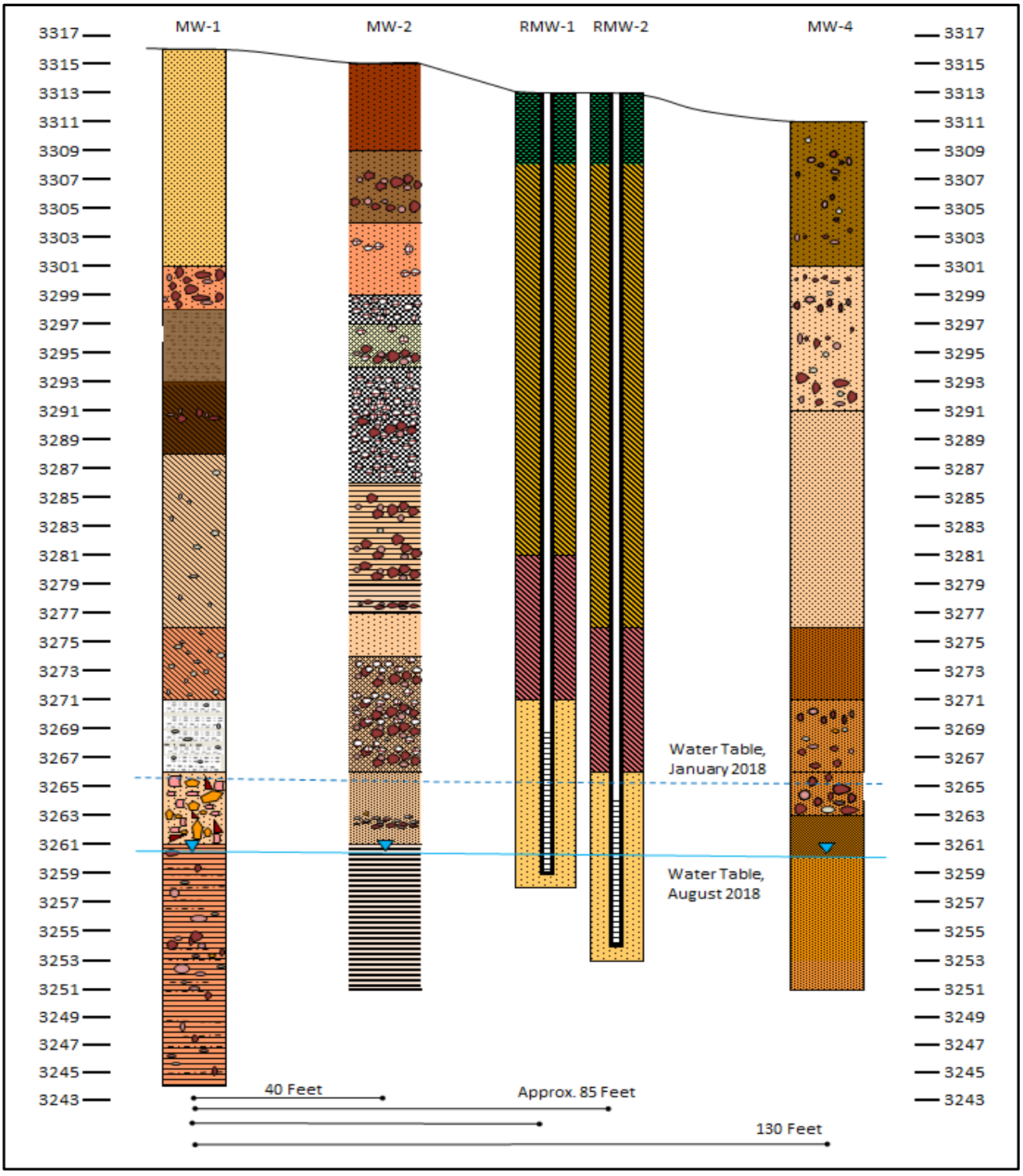


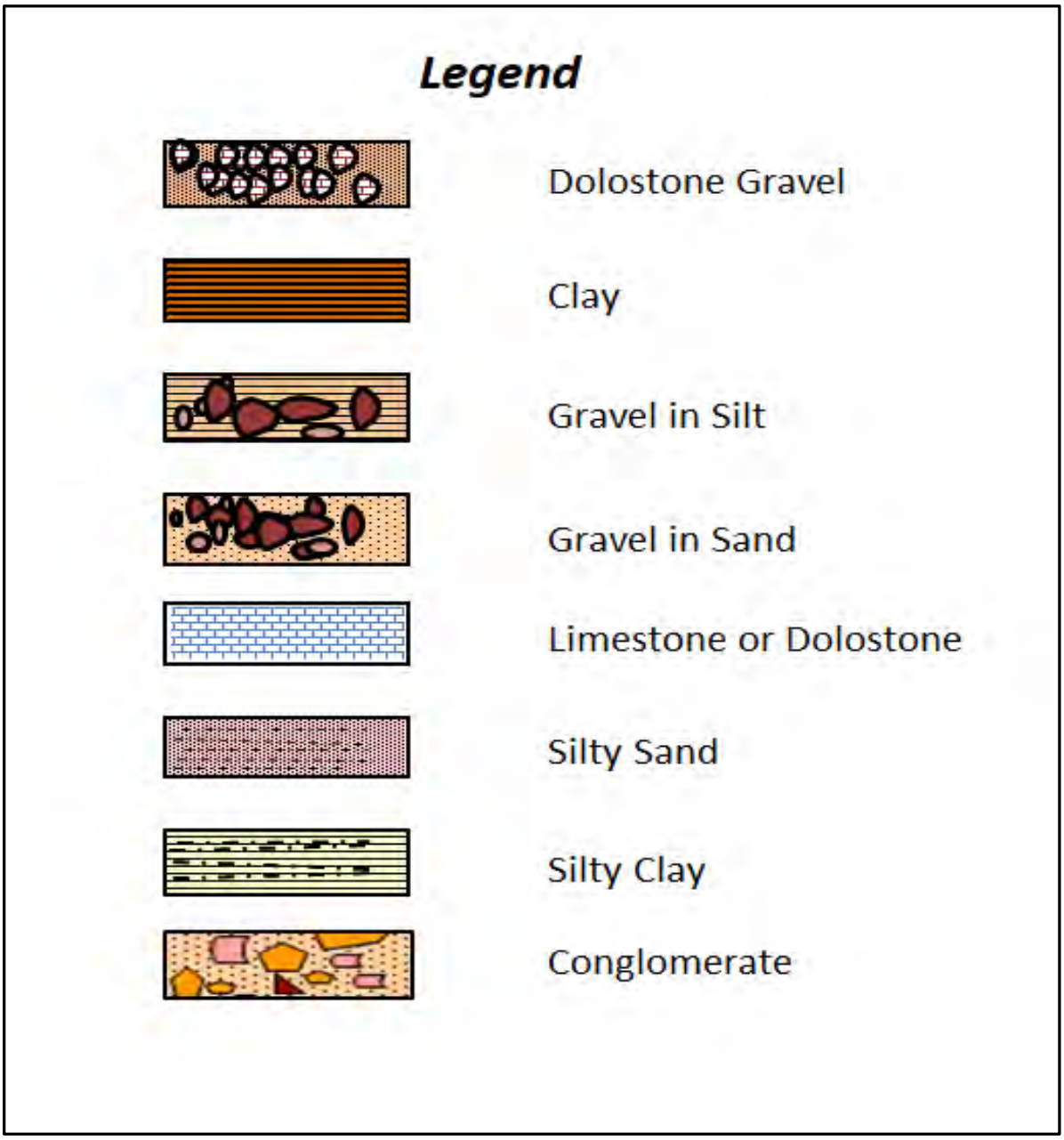
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Potentiometric Surface of the Area of the Release Site in Relation to the Pecos River	Plate 4
	Limerock Resources: ASAU Tank Release	November 2018



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	**Water Table Contours** **August 2018 Sampling**	**Plate 5**
	Lime Rock Resources: ASAU Release	**November, 2018**



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	**Cross Section Parallel to Groundwater Flow, MW-1 through MW-4 With Proposed Remediation Wells**	**Plate 6a**
	Lime Rock Resources: ASAU Release	**November, 2018**



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	**Lithology Legend for Cross Section**	**Plate Cb**
	Lime Rock Resources: ASAU Release	**November, 2018**

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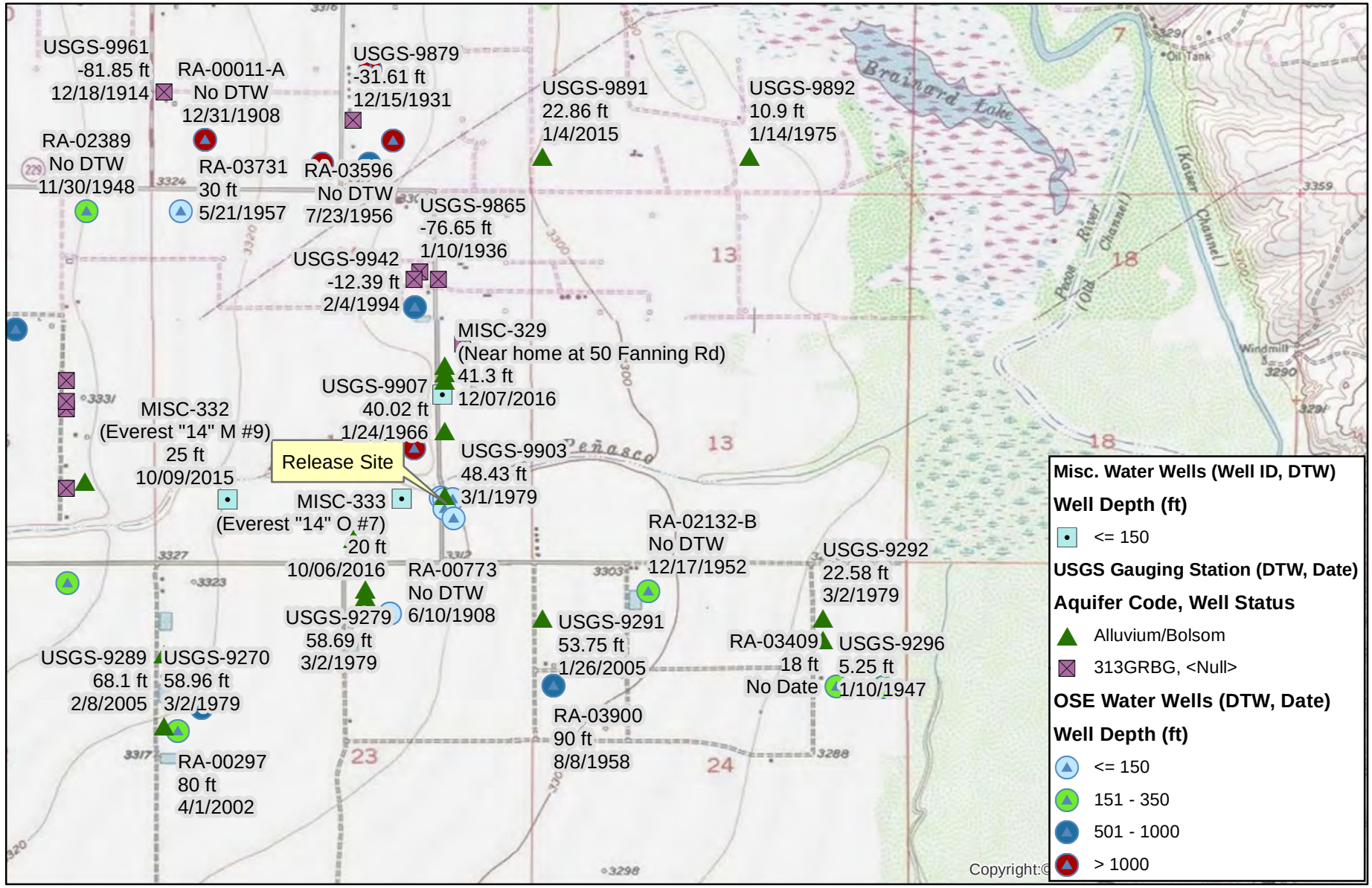

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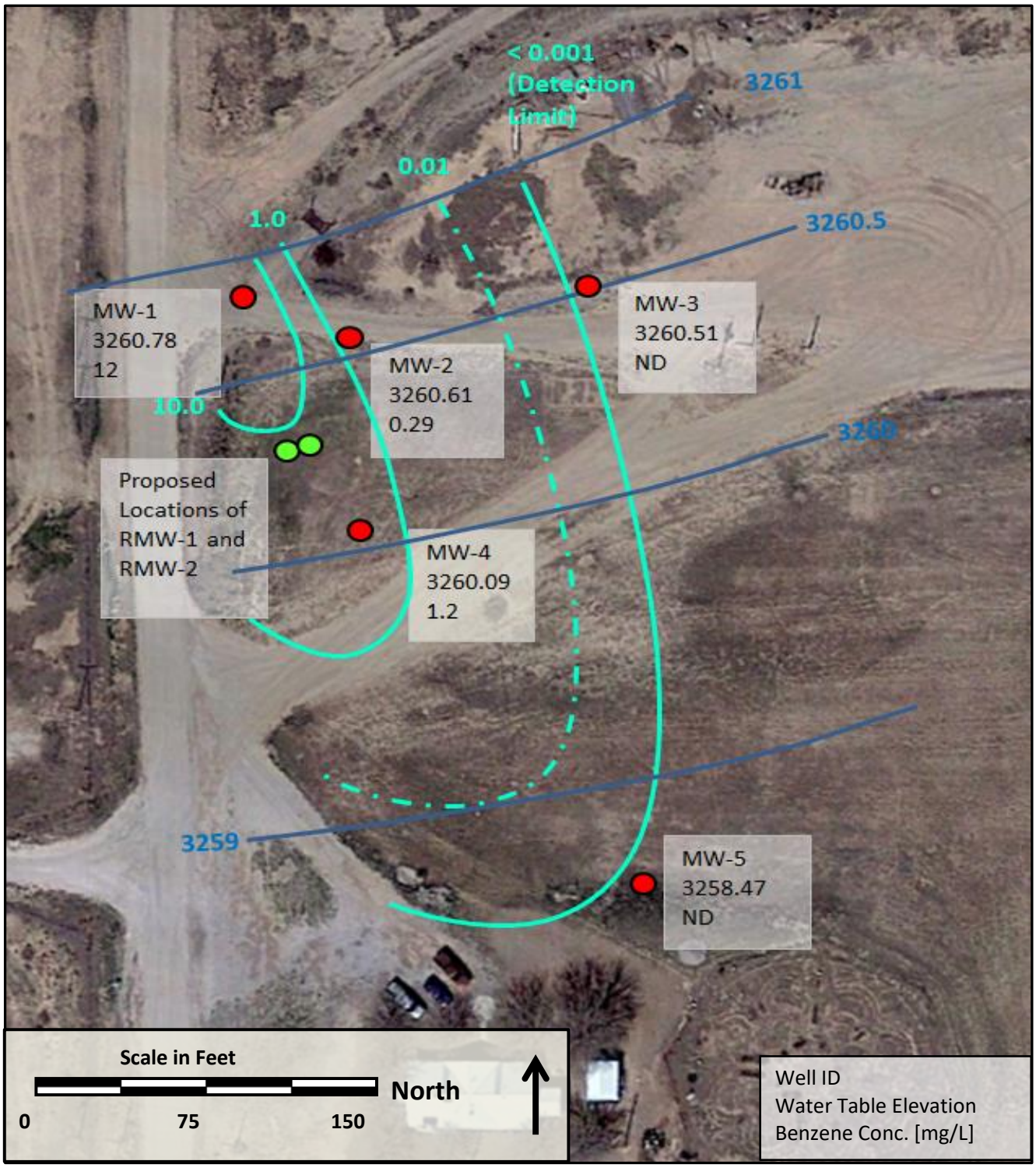
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Topographic Map Showing the Release Site in Relation to the Pecos River and Water Supply Wells	Plate 7
	Limerock Resources: ASAU Tank Release	November 2018



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	**Benzene Concentration Contours** **August 2018 Sampling** **(Logarithnic Scale Contours)**	**Plate 8**
	Lime Rock Resources: ASAU Release	**November, 2018**

Appendix A
Stage 1/2 Abatement Plan

R.T. Hicks Consultants, Ltd.
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Albuquerque, NM 87104

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

January 2, 2017

Mr. Bradford Billings and Mr. Mike Bratcher
New Mexico Oil Conservation Division
811 S. 1st Street
Artesia, NM 88210
Via E-Mail

RE: Lime Rock – ASAU 150 Trunk Line Release Remediation Plan
#2RP-3893

Mr. Billings and Mr. Bratcher:

On behalf of Lime Rock Resources, R.T. Hicks Consultants, Ltd. is pleased to submit the remediation plan for the above-referenced release. Plate 1 is a Google Earth image showing the location of the release relative to the junction of Fanning Road (CR 44) and Thistle Road (CR 24).

Initial Response Actions

The initial excavation and disposal response was an effort to create a "clean closure" for this release. Soil sampling, summarized in the next section, shows that this effort effectively defined the horizontal extent of subsurface impact. The reach of the excavation equipment was not sufficient to delineate the vertical extent of petroleum hydrocarbons. The data demonstrate that chloride concentrations are not a material concern at this release site.

Following excavation and removal of 223 cubic yards of impacted material, Lime Rock installed a 20-mil LLDPE six feet below grade within the footprint of the 6-15 foot deep excavation:

North 32.74325-104.34811
South 32.74313, -104.34815
West 32.74319,-104.34818
East 32.74321 ,-104.34807

Lime Rock imported clean fill to restore grade. As the release is adjacent to an Eddy County Road, restoration of grade in a short time frame was necessary to maintain safety.

The purpose of the liner was twofold:

1. Minimization of water infiltration over residual impacted earth material, thereby reducing any moisture flux that could mobilize the hydrocarbons downward to groundwater.
2. Creation of a vapor barrier between the residual impacted earth below the liner and the clean fill (and atmosphere) that lay above the liner. Soil Vapor Extraction (SVE) is often a successful hydrocarbon remedial measure and planning for potentially employing SVE was prudent.

Because the vertical impact of the release was not sufficiently delineated by excavation, Lime Rock installed a boring near the center of the excavated area and collected samples at regular intervals from below the liner to the capillary fringe of the shallow water table.

Figure 1 is a scale sketch map showing the general extent of the excavation the location of the soil boring and general location of samples. Figures 2-4 at the end of this submission are photographs of the extent of excavation and the placement of the liner.

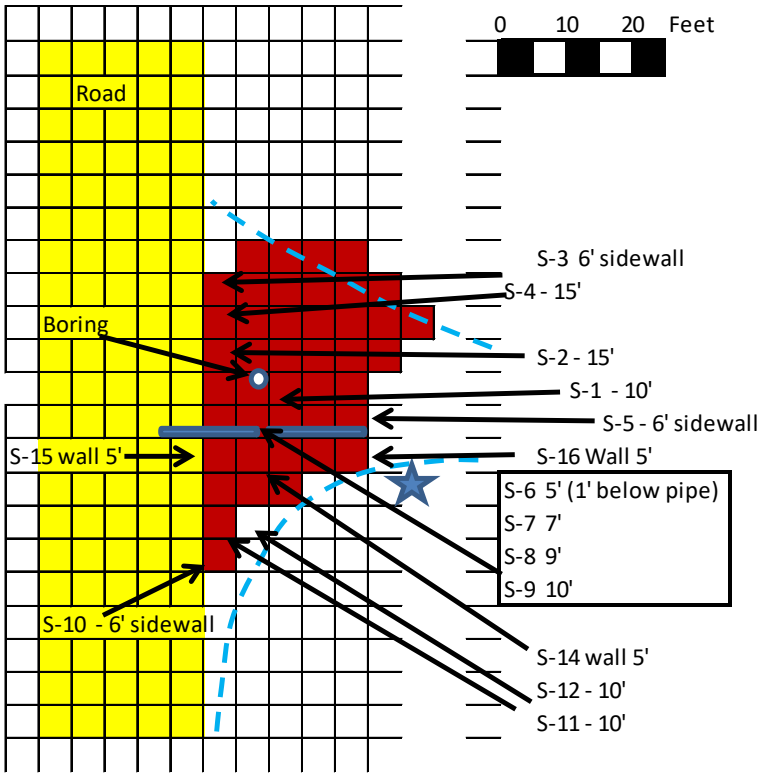


Figure 1: Scaled drawing of release excavation (red), location of pipeline (dark blue), Eddy County Road (yellow) and edge of lease road (dashed light blue). General location of samples and boring are shown. The blue star is the proposed location of a groundwater monitoring well discussed later in this submission.

Sampling and Results

All the data are summarized in Table 1. Table 1 consists of samples from the bottom of the excavation after removal of obvious hydrocarbon impact. Sidewall samples S-3, S-14, S15 and S-16 were taken after the horizontal extent of obvious hydrocarbon impairment was removed to a landfill. The yellow highlighted data comes from below the active pipeline and was not excavated and removed due to safety concerns. The data demonstrate that:

- The horizontal extent of impacts to earth material from the line release is well-defined by the four sidewall samples described above, all of which show BTEX concentrations below laboratory detection limits.
- The residual chloride concentration from the sidewalls and base of the final excavation is less than 600 mg/kg.
- The average BTEX concentration at the base of the excavation is 329 mg/kg, demonstrating that the vast majority of earth material impacted by the release was removed to the landfill

Table 1 - Soil Sampling Results (mg/kg)

Sample Name	Depth	BTEX	Benzene	GRO	DRO	MRO	TPH	Chloride
S-1 12' deep	12'	<0.300	<0.50	<10.0	14.7	10.2	14.7	160
S-2 15' deep	15'	503	25.3	2750	8130	1020	10880	144
S-3 N. sidewall 6' bgs	6'	<0.300	<0.050	<10.0	<10.0	<10.0	<10.0	160
S-4 15' deep	15'	812	75.7	5310	11000	1440	16300	48
S-5 East wall 6' bgs	6'	0.346	0.104	<10.0	<10.0	<10.0	<10.0	576
S-6 below P.L. 5'	5'	1550	192	14400	21600	2900	36000	2520
S-7 below P.L. 7'	7'	542	43.2	3900	8460	1260	12360	13200
S-8 below PL 9' bgs	9'	824	82.7	4290	9520	1350	13810	11200
S-9 below P.L. 10'	10'	1380	151	9470	15000	2040	24470	3120
S-10 W.wall 6' bgs	6'	703	44.6	6300	12800	1860	19100	640
S-11 S. wall 6' bgs	6'	0.676	0.133	<0.10	<0.10	<0.10	<0.10	576
S-12 Trench 10' bgs	10'	0.728	0.094	<10.0	85.4	13.3	85.4	32
S-13 6' deep	6'	<0.300	<0.50	<10.0	<10.0	<10.0	<10.0	896
S-14 S. Wall 5' bgs	5'	<0.300	<0.50	<10.0	<10.0	<10.0	<10.0	416
S-15 W. Wall 5' bgs	5'	<0.300	<0.50	<10.0	19.9	<10.0	19.9	224
S-16 E. Wall 5' bgs	5'	<0.300	<0.50	<10.0	<10.0	<10.0	<10.0	608
Average impact below pipeline		1074						7510
Average Final Sidewall		<0.300						352
Average excavation base		329						256
Expanded excavation removed these sample locations								

The data from the boring is summarized in the log attached at the end of this submission. These data show that BTEX concentration in the boring decreases from 995 mg/kg at the 15-foot depth interval to average concentration of 150 mg/kg for the interval from 20 feet to 45 feet. The boring data also show that BTEX concentrations do not decrease with depth.

Discussion of Data

The data from the boring and the excavation show that chloride is not a material threat to groundwater quality at this release site. A narrow zone of high chloride impact does exist below the pipeline. This soil could not be removed for obvious reasons associated with the support of the active line. Moreover, the area beneath the pipeline represents a small mass of salt.

Excavation and removal of impacted earth material removed a significant mass of hydrocarbons to a landfill. However, a relatively small residual hydrocarbon mass exists between 15 feet below grade to the capillary fringe. As presented in the boring log BTEX is 995 mg/kg at the 15-foot sample and average BTEX concentrations below this depth are:

142 mg/kg	20-30 feet below grade (3 samples)
159 mg/kg	35-45 feet below grade (3 samples)

Although the BTEX concentrations are relatively low from 20-45 feet below grade, the proximity of groundwater to obvious hydrocarbon impact requires an evaluation of groundwater quality down gradient from the release. Additionally, the BTEX concentrations and the lithology of the

boring log suggests that SVE may be an effective remedy to further minimize the potential of vertical migration of hydrocarbons from the unsaturated zone to ground water.

Proposed Actions

Monitor Well Installation

Plate 2 is a topographic and geologic map of the general area showing the locations of shallow wells (less than 150 feet deep) from the Office of the State Engineer database. Also plotted is the water table elevation based upon

- selected driller's data from the OSE database,
- Four wells that were measured by Hicks Consultants in December of 2016,
- one well measured in 1959 from a published report, and
- two USGS wells gauged by a professional.

From this potentimetric surface map, we estimated the groundwater flow direction in the area of the release is to the southeast. The data suggest a groundwater mound west and north of the release site and south of the release site is a groundwater trough. The reason for the mound may be irrigation recharge. The groundwater trough corresponds to an area without irrigation, which permits a speculation that valley fill topsoil derived from the ancestral Pecos River is not present and groundwater in this area comes principally from the underlying Artesia Group bedrock.

Based upon the presumed groundwater flow path, we propose to install a groundwater monitoring well within 5 feet of the down gradient edge of the area subject to the excavation and removal initial response. The construction of the well will follow New Mexico Guidance (attached).

In order to make full use of the mobilized drilling rig during installation of the monitoring well, Lime Rock will use the existing open soil boring near the center of the excavated area as the conduit to install two Soil Vapor Extraction wells.

Soil Vapor Extraction Well #1d

The proposed completion design is

- Total depth is 49 feet, which the original depth of the soil boring
- Two-inch PVC pipe with screened interval between 46-49 feet
- Two-inch threaded PVC casing from 46 feet to ground surface
- Clean sand filter pack in annular space from total depth to 40 feet
- Neat cement grout from 40 feet to 20 feet below grade
- Sub grade well vault for surface completion

Vapor Extraction Well #1s

In the same boring as SVE Well 1d, the completion design is

- Total depth of 19-20 feet
- Two-inch pipe with screened interval between 16-19 feet
- Two-inch threaded PVC casing from 16 feet to ground surface
- Clean sand filter pack in annular space from total depth to 15 feet
- Neat cement grout from 15 feet to grade
- Sub grade well vault for surface completion

One week after development of the well, Hicks Consultants will collect a groundwater sample using EPA/ASTM methods that require appropriate purging of standing water in the casing. Sixty days after the initial groundwater sampling event, the well will be re-sampled and the results compared to the initial sampling. Within 5 days after receipt of the laboratory report for the second sampling event, we will submit the results to OCD. Within 120 days from the submission of this document, we will submit a plan for further action.

Please contact me if you have any questions. Please accept this letter as our notification per the approved CAP. Lime Rock has alerted the surface owner of regarding this proposed action.

Sincerely,
R.T. Hicks Consultants

Randall Hicks

Copy: Lime Rock

N
W E
S

0 1,000 Feet

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

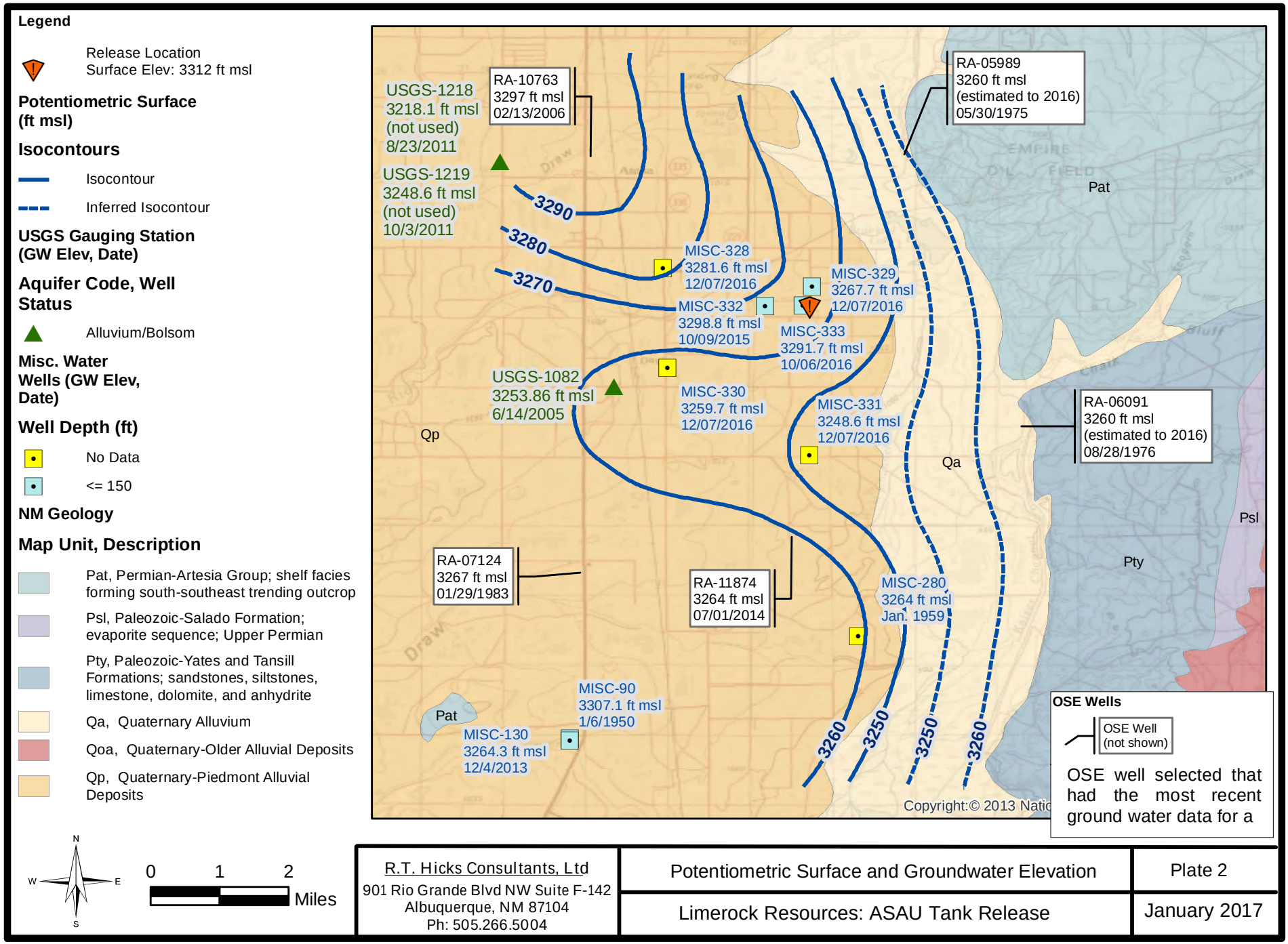
Release Location and Nearby Roads

Plate 1

ASAU Trunk Line Release

Sept 2016

M:\Lime Rock Resources\asau trunk\PitRuleTemplate_10_1\Figures\Figure2_topographyGW.mxd



Excavated area before placing liner looking to north

Excavated area before placing liner looking to south

Excavated area after placing liner looking to north

Excavated area after placing liner looking to south

CARDINAL Laboratories

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

September 22, 2016

RANDALL HICKS

R T HICKS CONSULTANTS

901 RIO GRANDE BLVD SUITE F-142

ALBUQUERQUE, NM 87104

RE: ASAU TRUNK LINE RELEASE

Enclosed are the results of analyses for samples received by the laboratory on 09/21/16 12:30.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

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

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

Accreditation applies to public drinking water matrices.

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

Sincerely,

Celey D. Keene

Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 1 - 12' DEEP (H602118-01)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	09/21/2016	ND	2.24	112	2.00	0.900	
Toluene*	<0.050	0.050	09/21/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	<0.050	0.050	09/21/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	<0.150	0.150	09/21/2016	ND	6.68	111	6.00	1.74	
Total BTEX	<0.300	0.300	09/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *98.7 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**160**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**14.7**	10.0	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**10.2**	10.0	09/21/2016	ND					

Surrogate: 1-Chlorooctane *78.7 %* *35-147*

Surrogate: 1-Chlorooctadecane *90.1 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 2 - 15' DEEP (H602118-02)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**25.3**	2.00	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**133**	2.00	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**103**	2.00	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**242**	6.00	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**503**	12.0	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *107 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**144**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**2750**	100	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**8130**	100	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**1020**	100	09/21/2016	ND					

Surrogate: 1-Chlorooctane *179 %* *35-147*

Surrogate: 1-Chlorooctadecane *210 %* *28-171*

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Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 3 - N SIDEWALL 6' BGS (H602118-03)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	09/21/2016	ND	2.24	112	2.00	0.900	
Toluene*	**0.060**	0.050	09/21/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**0.067**	0.050	09/21/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**0.163**	0.150	09/21/2016	ND	6.68	111	6.00	1.74	
Total BTEX	<0.300	0.300	09/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *99.0 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**160**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	<10.0	10.0	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	<10.0	10.0	09/21/2016	ND					

Surrogate: 1-Chlorooctane *72.7 %* *35-147*

Surrogate: 1-Chlorooctadecane *82.0 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 4 - 15' (H602118-04)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**75.7**	2.00	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**247**	2.00	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**149**	2.00	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**341**	6.00	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**812**	12.0	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *112 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**48.0**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**5310**	100	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**11000**	100	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**1440**	100	09/21/2016	ND					

Surrogate: 1-Chlorooctane *200 %* *35-147*

Surrogate: 1-Chlorooctadecane *286 %* *28-171*

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Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 5 - E SIDEWALL 6' (H602118-05)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**0.104**	0.050	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**0.170**	0.050	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**0.072**	0.050	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	<0.150	0.150	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**0.346**	0.300	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *98.3 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**576**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	<10.0	10.0	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	<10.0	10.0	09/21/2016	ND					

Surrogate: 1-Chlorooctane *75.5 %* *35-147*

Surrogate: 1-Chlorooctadecane *88.0 %* *28-171*

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Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 6 - 5' BGS @ LEAK (H602118-06)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**192**	2.00	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**493**	2.00	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**268**	2.00	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**601**	6.00	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**1550**	12.0	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *116 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**2520**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**14400**	100	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**21600**	100	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**2900**	100	09/21/2016	ND					

Surrogate: 1-Chlorooctane *364 %* *35-147*

Surrogate: 1-Chlorooctadecane *571 %* *28-171*

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Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 7 - 7' BGS @ LEAK (H602118-07)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**43.2**	2.00	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**153**	2.00	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**104**	2.00	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**242**	6.00	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**542**	12.0	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID	*107 %*	*73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**13200**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**3900**	100	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**8460**	100	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**1260**	100	09/21/2016	ND					

Surrogate: 1-Chlorooctane	*180 %*	*35-147*
Surrogate: 1-Chlorooctadecane	*220 %*	*28-171*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 8 - 9' BGS @ LEAK (H602118-08)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**82.7**	2.00	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**247**	2.00	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**152**	2.00	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**342**	6.00	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**824**	12.0	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID	*108 %*	*73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**11200**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**4290**	100	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**9520**	100	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**1350**	100	09/21/2016	ND					

Surrogate: 1-Chlorooctane	*185 %*	*35-147*
Surrogate: 1-Chlorooctadecane	*243 %*	*28-171*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 9 - 10' BGS @ LEAK (H602118-09)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**151**	2.00	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**435**	2.00	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**245**	2.00	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**548**	6.00	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**1380**	12.0	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *115 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**3120**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**9470**	100	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**15000**	100	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**2040**	100	09/21/2016	ND					

Surrogate: 1-Chlorooctane *250 %* *35-147*

Surrogate: 1-Chlorooctadecane *372 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 10 - W SIDEWALL 6' (H602118-10)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**44.6**	2.00	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**198**	2.00	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**136**	2.00	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**324**	6.00	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**703**	12.0	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *114 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**640**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**6300**	100	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**12800**	100	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**1860**	100	09/21/2016	ND					

Surrogate: 1-Chlorooctane *216 %* *35-147*

Surrogate: 1-Chlorooctadecane *330 %* *28-171*

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

Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 11 - S SIDEWALL 6' (H602118-11)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**0.113**	0.050	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**0.219**	0.050	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**0.120**	0.050	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**0.225**	0.150	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**0.676**	0.300	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *98.0 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**576**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	<10.0	10.0	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	<10.0	10.0	09/21/2016	ND					

Surrogate: 1-Chlorooctane *77.3 %* *35-147*

Surrogate: 1-Chlorooctadecane *91.0 %* *28-171*

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Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	09/21/2016	Sampling Date:	09/20/2016
Reported:	09/22/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	NOT GIVEN	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S 12- S TRENCH 10' (H602118-12)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**0.094**	0.050	09/22/2016	ND	2.24	112	2.00	0.900	
Toluene*	**0.211**	0.050	09/22/2016	ND	2.28	114	2.00	1.29	
Ethylbenzene*	**0.118**	0.050	09/22/2016	ND	2.20	110	2.00	1.49	
Total Xylenes*	**0.304**	0.150	09/22/2016	ND	6.68	111	6.00	1.74	
Total BTEX	**0.728**	0.300	09/22/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *99.8 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**32.0**	16.0	09/22/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/21/2016	ND	196	98.2	200	2.00	
DRO >C10-C28	**85.4**	10.0	09/21/2016	ND	204	102	200	0.832	
EXT DRO >C28-C35	**13.3**	10.0	09/21/2016	ND					

Surrogate: 1-Chlorooctane *71.2 %* *35-147*

Surrogate: 1-Chlorooctadecane *81.8 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Notes and Definitions

S-06	The recovery of this surrogate is outside control limits due to sample dilution required from high analyte concentration and/or matrix interference's.
QR-03	The RPD value for the sample duplicate or MS/MSD was outside if QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

BILL TO Lime Rock ARTESIA

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

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

Company Name:	R.T. Hicks
Project Manager:	RTH
Address:	R@rthicksconsult.com
City:	State: Zip:
Phone #:	505-238-9515 Fax #:
Project #:	Project Owner:
Project Name:	~~ARTESIA~~ ASAH TRUNK LINE Release
Project Location:	ARTESIA
Sampler Name:	RT Hicks

BILL TO	
P.O. #:	
Company:	Lime Rock
Attn:	
Address:	
City:	
State: Zip:	
Phone #:	
Fax #:	

FOR LAB USE ONLY				MATRIX						PRESERV.			SAMPLING		ANALYSIS REQUEST		
Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER :	ACID/BASE:	ICE / COOL	OTHER :	DATE	TIME	TPH = GRO + DRO + MRO	BTEX	Chloride
H602118-																	
01	S1 - 12' deep												9/20	1033	X	X	X
02	S2 - 15' deep													1123	X	X	X
03	S3 - N Sidewall 6' bgs													1141	X	X	X
04	S4 - 15'													1151	X	X	X
05	S5 - E SIDEWALL 6'													1158	X	X	X
06	S6 - 5' bgs @ leak													1205	X	X	X
07	S7 - 7' bgs @ leak													1209	X	X	X
08	S8 - 9' bgs @ leak													1212	X	X	X
09	S-9 10' bgs @ leak													1214	X	X	X

Relinquished By:	Date: 9/21/16	Received By:	Jodi Henson
Relinquished By:	Time: 1230	Received By:	
	Date:		
	Time:		

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☐ Yes ☐ No Add'l Fax #:
REMARKS:

ETOVAR@limerockresources.com
MBarnett@limerockresources.com
mike@rthicksconsult.com
RUSH

Delivered By: (Circle One)	Sample Condition	CHECKED BY: (Initials)
Sampler - UPS - Bus - Other: 4.7°C	Cool: ☑ Yes ☐ No Intact: ☑ Yes ☐ No	

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

+1.5

INVOICE TO LIME ROCK ARTESIA

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

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

Company Name:	R.T. Hicks
Project Manager:	R. T. Hicks
Address:	R@rthicksconsult.com
City:	State: Zip:
Phone #:	505-238-9515 Fax #:
Project #:	Project Owner:
Project Name:	
Project Location:	
Sampler Name:	

BILL TO

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

ANALYSIS REQUEST

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER :	PRESERV.: ACID/BASE:	ICE / COOL	OTHER :	SAMPLING: DATE	TIME	TPH = GRO + DRO + MRO	BTEX	Chloride
H602118-10	S-10 W Sidewall 6'												9/20	1213	X	X	X
11	S-11 S Sidewall 6'													306	X	X	X
12	S-12 S Trench 10'													300	X	X	X

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequental damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Relinquished By:	Date: 9/21/16	Received By: Jodi Henson	
Relinquished By:	Time: 1230	Received By:	
	Date:		
	Time:		

Delivered By: (Circle One)
Sampler - UPS - Bus - Other: 4.7°C

Sample Condition: Cool: ☑ Yes ☐ No; Intact: ☑ Yes ☐ No

CHECKED BY: (Initials)

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☐ Yes ☐ No Add'l Fax #:
REMARKS: RUSH
etovar@limerockresources.com
mbarrett@limerockresources.com
mike@rthicksconsult.com

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

#75

CARDINAL Laboratories

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

September 26, 2016

R T HICKS CONSULTANTS

R T HICKS CONSULTANTS

901 RIO GRANDE BLVD SUITE F-142

ALBUQUERQUE, NM 87104

RE: ASAU TRUNK LINE RELEASE

Enclosed are the results of analyses for samples received by the laboratory on 09/23/16 11:05.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

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

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

Accreditation applies to public drinking water matrices.

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

Sincerely,

Mike Snyder For Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	09/23/2016	Sampling Date:	09/21/2016
Reported:	09/26/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	** (See Notes)
Project Number:	30.015.0028N	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S-13 6' DEEP BOTTOM (H602140-01)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	09/25/2016	ND	2.26	113	2.00	1.18	
Toluene*	<0.050	0.050	09/25/2016	ND	2.30	115	2.00	1.47	
Ethylbenzene*	<0.050	0.050	09/25/2016	ND	2.20	110	2.00	1.07	
Total Xylenes*	<0.150	0.150	09/25/2016	ND	6.63	110	6.00	1.11	
Total BTEX	<0.300	0.300	09/25/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *99.4 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**896**	16.0	09/23/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/24/2016	ND	199	99.4	200	2.82	
DRO >C10-C28	<10.0	10.0	09/24/2016	ND	212	106	200	5.31	
EXT DRO >C28-C35	<10.0	10.0	09/24/2016	ND					

Surrogate: 1-Chlorooctane *81.5 %* *35-147*

Surrogate: 1-Chlorooctadecane *96.5 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Mike Snyder For Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	09/23/2016	Sampling Date:	09/21/2016
Reported:	09/26/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	** (See Notes)
Project Number:	30.015.0028N	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S-14 S. SIDEWALL 5' BGS (H602140-02)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	09/25/2016	ND	2.26	113	2.00	1.18	
Toluene*	<0.050	0.050	09/25/2016	ND	2.30	115	2.00	1.47	
Ethylbenzene*	**0.069**	0.050	09/25/2016	ND	2.20	110	2.00	1.07	
Total Xylenes*	**0.190**	0.150	09/25/2016	ND	6.63	110	6.00	1.11	
Total BTEX	<0.300	0.300	09/25/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *98.8 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**416**	16.0	09/23/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/24/2016	ND	199	99.4	200	2.82	
DRO >C10-C28	<10.0	10.0	09/24/2016	ND	212	106	200	5.31	
EXT DRO >C28-C35	<10.0	10.0	09/24/2016	ND					

Surrogate: 1-Chlorooctane *82.4 %* *35-147*

Surrogate: 1-Chlorooctadecane *95.9 %* *28-171*

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Mike Snyder For Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	09/23/2016	Sampling Date:	09/21/2016
Reported:	09/26/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	** (See Notes)
Project Number:	30.015.0028N	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S-15 W. SIDEWALL 5' BGS (H602140-03)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	09/25/2016	ND	2.26	113	2.00	1.18	
Toluene*	<0.050	0.050	09/25/2016	ND	2.30	115	2.00	1.47	
Ethylbenzene*	<0.050	0.050	09/25/2016	ND	2.20	110	2.00	1.07	
Total Xylenes*	<0.150	0.150	09/25/2016	ND	6.63	110	6.00	1.11	
Total BTEX	<0.300	0.300	09/25/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *97.2 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**224**	16.0	09/23/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/24/2016	ND	199	99.4	200	2.82	
DRO >C10-C28	**19.9**	10.0	09/24/2016	ND	212	106	200	5.31	
EXT DRO >C28-C35	<10.0	10.0	09/24/2016	ND					

Surrogate: 1-Chlorooctane *86.8 %* *35-147*

Surrogate: 1-Chlorooctadecane *101 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Mike Snyder For Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	09/23/2016	Sampling Date:	09/21/2016
Reported:	09/26/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	** (See Notes)
Project Number:	30.015.0028N	Sample Received By:	Jodi Henson
Project Location:	ARTESIA		

Sample ID: S-16 E. SIDEWALL 5' BGS (H602140-04)

BTEX 8021B mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	09/25/2016	ND	2.26	113	2.00	1.18	
Toluene*	<0.050	0.050	09/25/2016	ND	2.30	115	2.00	1.47	
Ethylbenzene*	<0.050	0.050	09/25/2016	ND	2.20	110	2.00	1.07	
Total Xylenes*	<0.150	0.150	09/25/2016	ND	6.63	110	6.00	1.11	
Total BTEX	<0.300	0.300	09/25/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *97.7 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**608**	16.0	09/23/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: MS

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	09/24/2016	ND	199	99.4	200	2.82	
DRO >C10-C28	<10.0	10.0	09/24/2016	ND	212	106	200	5.31	
EXT DRO >C28-C35	<10.0	10.0	09/24/2016	ND					

Surrogate: 1-Chlorooctane *79.3 %* *35-147*

Surrogate: 1-Chlorooctadecane *94.2 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Mike Snyder For Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Notes and Definitions

QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

Cardinal Laboratories *=Accredited Analyte

Mike Snyder For Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

RUSH!!

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

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

Company Name:	R.T. Hicks Consultants	BILL TO P.O. #:	
Project Manager:	Mike Stubblefield	Company:	Lime Rock
Address:	2411 S. 13th Street	Attn:	Mike Barrett
City:	Artesia State: NM Zip: 88210	Address:	
Phone #:	575-365-5084 Fax #:	City:	
Project #:	Project Owner: Lime Rock Res.	State: Zip:	
Project Name:	ASAW Trunk Line release	Phone #:	
Project Location:	Un. P sec. 14 - T18S - R26E	Fax #:	
Sampler Name:	Mike Stubblefield		

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER :	PRESERV.: ACID/BASE:	ICE / COOL	OTHER :	SAMPLING: DATE	TIME	ANALYSIS REQUEST: TPH - GRO + DRO + MRO	BTEX	Chloride
H602140-1	S-13 6' deep bottom	G				X					X		9/21/16	12:13p	X	X	X
2	S-14 So. Sidewall 5' bgs	G				X					X		9/21/16	2:18p	X	X	X
3	S-15 We Sidewall 5' bgs	G				X					X		9/21/16	2:20p	X	X	X
4	S-16 E. Sidewall 5' bgs	G				X					X		9/21/16	2:25p	X	X	X

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Relinquished By:	Mike Stubblefield	Date: 9/23/16 Time: 11:05	Received By: Jodi Henson
Relinquished By:		Date: Time:	Received By:
Delivered By: (Circle One)	Sampler - UPS - Bus - Other:	3.8°c	Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No
CHECKED BY: (Initials)			

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☐ Yes ☐ No Add'l Fax #:
REMARKS:
RT Hicks consult.com
Mike Barrett @ Lime Rock Res.com
rush ooo

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

#75

CARDINAL Laboratories

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

October 21, 2016

MIKE STUBBLEFIELD

R T HICKS CONSULTANTS

901 RIO GRANDE BLVD SUITE F-142

ALBUQUERQUE, NM 87104

RE: ASAU TRUNK LINE RELEASE

Enclosed are the results of analyses for samples received by the laboratory on 10/20/16 12:05.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

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

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

Accreditation applies to public drinking water matrices.

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

Sincerely,

Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	10/20/2016	Sampling Date:	10/19/2016
Reported:	10/21/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	30.015.0028N	Sample Received By:	Celey D. Keene
Project Location:	UT P SEC 14-T18S-R26E		

Sample ID: BH - 1 15' (H602353-01)

BTEX 8021B mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**132**	2.00	10/21/2016	ND	1.99	99.4	2.00	1.67	
Toluene*	**319**	2.00	10/21/2016	ND	2.24	112	2.00	1.57	
Ethylbenzene*	**169**	2.00	10/21/2016	ND	2.24	112	2.00	1.80	
Total Xylenes*	**375**	6.00	10/21/2016	ND	6.76	113	6.00	1.70	
Total BTEX	**995**	12.0	10/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *112 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**48.0**	16.0	10/20/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: CK S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**7990**	50.0	10/21/2016	ND	192	95.9	200	3.20	
DRO >C10-C28	**9410**	50.0	10/21/2016	ND	210	105	200	12.0	
EXT DRO >C28-C35	**1430**	50.0	10/21/2016	ND					

Surrogate: 1-Chlorooctane *197 %* *35-147*

Surrogate: 1-Chlorooctadecane *211 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	10/20/2016	Sampling Date:	10/19/2016
Reported:	10/21/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	30.015.0028N	Sample Received By:	Celey D. Keene
Project Location:	UT P SEC 14-T18S-R26E		

Sample ID: BH - 1 20' (H602353-02)

BTEX 8021B mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**2.30**	0.500	10/21/2016	ND	1.99	99.4	2.00	1.67	
Toluene*	**11.0**	0.500	10/21/2016	ND	2.24	112	2.00	1.57	
Ethylbenzene*	**14.3**	0.500	10/21/2016	ND	2.24	112	2.00	1.80	
Total Xylenes*	**38.1**	1.50	10/21/2016	ND	6.76	113	6.00	1.70	
Total BTEX	**65.7**	3.00	10/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *111 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**112**	16.0	10/20/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**544**	50.0	10/21/2016	ND	192	95.9	200	3.20	
DRO >C10-C28	**1670**	50.0	10/21/2016	ND	210	105	200	12.0	
EXT DRO >C28-C35	**243**	50.0	10/21/2016	ND					

Surrogate: 1-Chlorooctane *144 %* *35-147*

Surrogate: 1-Chlorooctadecane *127 %* *28-171*

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Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	10/20/2016	Sampling Date:	10/19/2016
Reported:	10/21/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	30.015.0028N	Sample Received By:	Celey D. Keene
Project Location:	UT P SEC 14-T18S-R26E		

Sample ID: BH - 1 25' (H602353-03)

BTEX 8021B mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**14.7**	0.500	10/21/2016	ND	1.99	99.4	2.00	1.67	
Toluene*	**54.9**	0.500	10/21/2016	ND	2.24	112	2.00	1.57	
Ethylbenzene*	**42.5**	0.500	10/21/2016	ND	2.24	112	2.00	1.80	
Total Xylenes*	**104**	1.50	10/21/2016	ND	6.76	113	6.00	1.70	
Total BTEX	**216**	3.00	10/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *121 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**256**	16.0	10/20/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: CK S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**1310**	50.0	10/21/2016	ND	192	95.9	200	3.20	
DRO >C10-C28	**2220**	50.0	10/21/2016	ND	210	105	200	12.0	
EXT DRO >C28-C35	**378**	50.0	10/21/2016	ND					

Surrogate: 1-Chlorooctane *156 %* *35-147*

Surrogate: 1-Chlorooctadecane *98.3 %* *28-171*

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Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	10/20/2016	Sampling Date:	10/19/2016
Reported:	10/21/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	30.015.0028N	Sample Received By:	Celey D. Keene
Project Location:	UT P SEC 14-T18S-R26E		

Sample ID: BH - 1 30' (H602353-04)

BTEX 8021B mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**14.6**	0.500	10/21/2016	ND	1.99	99.4	2.00	1.67	
Toluene*	**41.8**	0.500	10/21/2016	ND	2.24	112	2.00	1.57	
Ethylbenzene*	**26.9**	0.500	10/21/2016	ND	2.24	112	2.00	1.80	
Total Xylenes*	**63.7**	1.50	10/21/2016	ND	6.76	113	6.00	1.70	
Total BTEX	**147**	3.00	10/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *113 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**176**	16.0	10/20/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**565**	50.0	10/21/2016	ND	192	95.9	200	3.20	
DRO >C10-C28	**1030**	50.0	10/21/2016	ND	210	105	200	12.0	
EXT DRO >C28-C35	**162**	50.0	10/21/2016	ND					

Surrogate: 1-Chlorooctane *134 %* *35-147*

Surrogate: 1-Chlorooctadecane *123 %* *28-171*

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Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	10/20/2016	Sampling Date:	10/19/2016
Reported:	10/21/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	30.015.0028N	Sample Received By:	Celey D. Keene
Project Location:	UT P SEC 14-T18S-R26E		

Sample ID: BH - 1 35' (H602353-05)

BTEX 8021B mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**32.9**	0.500	10/21/2016	ND	1.99	99.4	2.00	1.67	
Toluene*	**81.8**	0.500	10/21/2016	ND	2.24	112	2.00	1.57	
Ethylbenzene*	**46.9**	0.500	10/21/2016	ND	2.24	112	2.00	1.80	
Total Xylenes*	**108**	1.50	10/21/2016	ND	6.76	113	6.00	1.70	
Total BTEX	**270**	3.00	10/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *117 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**128**	16.0	10/20/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: CK S-06

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**1730**	50.0	10/21/2016	ND	192	95.9	200	3.20	
DRO >C10-C28	**2340**	50.0	10/21/2016	ND	210	105	200	12.0	
EXT DRO >C28-C35	**393**	50.0	10/21/2016	ND					

Surrogate: 1-Chlorooctane *165 %* *35-147*

Surrogate: 1-Chlorooctadecane *110 %* *28-171*

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Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	10/20/2016	Sampling Date:	10/19/2016
Reported:	10/21/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	30.015.0028N	Sample Received By:	Celey D. Keene
Project Location:	UT P SEC 14-T18S-R26E		

Sample ID: BH - 1 40' (H602353-06)

BTEX 8021B mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**1.98**	0.200	10/21/2016	ND	1.99	99.4	2.00	1.67	
Toluene*	**5.32**	0.200	10/21/2016	ND	2.24	112	2.00	1.57	
Ethylbenzene*	**3.32**	0.200	10/21/2016	ND	2.24	112	2.00	1.80	
Total Xylenes*	**7.65**	0.600	10/21/2016	ND	6.76	113	6.00	1.70	
Total BTEX	**18.3**	1.20	10/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *106 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**96.0**	16.0	10/20/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**56.0**	10.0	10/21/2016	ND	192	95.9	200	3.20	
DRO >C10-C28	**83.2**	10.0	10/21/2016	ND	210	105	200	12.0	
EXT DRO >C28-C35	**18.3**	10.0	10/21/2016	ND					

Surrogate: 1-Chlorooctane *73.3 %* *35-147*

Surrogate: 1-Chlorooctadecane *71.3 %* *28-171*

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Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

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

Received:	10/20/2016	Sampling Date:	10/19/2016
Reported:	10/21/2016	Sampling Type:	Soil
Project Name:	ASAU TRUNK LINE RELEASE	Sampling Condition:	Cool & Intact
Project Number:	30.015.0028N	Sample Received By:	Celey D. Keene
Project Location:	UT P SEC 14-T18S-R26E		

Sample ID: BH - 1 45' (H602353-07)

BTEX 8021B mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	**20.8**	0.500	10/21/2016	ND	1.99	99.4	2.00	1.67	
Toluene*	**60.2**	0.500	10/21/2016	ND	2.24	112	2.00	1.57	
Ethylbenzene*	**32.8**	0.500	10/21/2016	ND	2.24	112	2.00	1.80	
Total Xylenes*	**76.6**	1.50	10/21/2016	ND	6.76	113	6.00	1.70	
Total BTEX	**190**	3.00	10/21/2016	ND					

Surrogate: 4-Bromofluorobenzene (PID *117 %* *73.6-140*

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

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	<16.0	16.0	10/20/2016	ND	432	108	400	0.00	

TPH 8015M mg/kg Analyzed By: CK

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	**626**	50.0	10/21/2016	ND	192	95.9	200	3.20	
DRO >C10-C28	**1140**	50.0	10/21/2016	ND	210	105	200	12.0	
EXT DRO >C28-C35	**192**	50.0	10/21/2016	ND					

Surrogate: 1-Chlorooctane *113 %* *35-147*

Surrogate: 1-Chlorooctadecane *93.7 %* *28-171*

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Notes and Definitions

S-06	The recovery of this surrogate is outside control limits due to sample dilution required from high analyte concentration and/or matrix interference's.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

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

Company Name:	R.T. Hicks Consultants	**BILL TO**	
Project Manager:	Mike Stubblefield	P.O. #:	
Address:	2411 South 13th	Company:	Lime Rock Res.
City:	Aztec	State: NM Zip: 88210	Attn: Mike Barrett
Phone #:	505-365-5034	Fax #:	Address:
Project #:		Project Owner: Lime Rock Res.	City:
Project Name:	ASAU Trunk Line release		State: Zip:
Project Location:	UT. P Sec. 14 - T18S - R26E		Phone #:
Sampler Name:	Mike Stubblefield		Fax #:

FOR LAB USE ONLY				MATRIX						PRESERV.			SAMPLING		ANALYSIS REQUEST		
Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER :	ACID/BASE:	ICE / COOL	OTHER :	DATE	TIME	8015M GRO DRO ERO	8020B - BTEX	Total Chloride
H602353-																	
01	BH - 1 15'	G				✓							10/19/16	11:53A	✓	✓	✓
02	BH - 1 20'	G				✓							10/19/16	12:21P	✓	✓	✓
03	BH - 1 25'	G				✓							10/19/16	12:52P	✓	✓	✓
04	BH - 1 30'	G				✓							10/19/16	1:41P	✓	✓	✓
05	BH - 1 35'	G				✓							10/19/16	2:05P	✓	✓	✓
06	BH - 1 40'	G				✓							10/19/16	2:33P	✓	✓	✓
07	BH - 1 45'	G				✓							10/19/16	3:07	✓	✓	✓

Relinquished By:	Date: 10/20/16	Received By:	Phone Result: ☐ Yes ☐ No Add'l Phone #:
Mike Stubblefield	Time: 12:05		Fax Result: ☐ Yes ☐ No Add'l Fax #:
Relinquished By:	Date:	Received By:	REMARKS: Rush
	Time:		

Delivered By: (Circle One)
Sampler - UPS - Bus - (Other:) 4.4°

Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No

CHECKED BY: (Initials) CH #75

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

Appendix B
Stage 1/2 Abatement Plan

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

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266.0745
Artesia ▲ Carlsbad ▲ Durango ▲ Midland

May 30, 2017

Mr. Bradford Billings
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210
VIA EMAIL to bradford.billing@state.nm.us

RE: Lime Rock Resources – ASAU 150 Trunkline Release, #2RP-3893

Dear Mr. Billings:

On behalf of Lime Rock Resources, thank you for your feedback after our submission of a draft on May 16 and subsequent phone call and meeting between OCD, Lime Rock, and Hicks Consultants regarding this release to groundwater. In accordance with NMAC 19.15.29.8, we now submit this notice of groundwater impact and propose three additional wells to reflect our discussions.

On February 8, 2017, a 2-inch monitoring well was installed at the release location within the excavation footprint and in the same location as the investigative soil boring installation last year. Total depth of the well is 61.54 feet and the top of screen is at 46 feet. The surface completion is flush-mount and the construction was completed by Adkins Engineering in accordance with New Mexico Environment Department guidelines[1] after modification of the screen length pursuant to OCD recommendations.

3/23/2017: LNAPL at MW-1

The well was developed and then sampled; however, light non-aqueous phase liquids (LNAPL) was observed on the water surface during the first sampling event and since installation. On March 23 Hicks Consultants measured approximately 6 inches of LNAPL in the well as shown in the photograph above. Evaluation of nearby wells suggests an east-southeast groundwater gradient as depicted on Figure 1. On May 2 Hicks Consultants performed a baildown test[2] at the monitoring well to determine LNAPL transmissivity within the well and the surrounding groundwater. At the time of the test, we used an electronic oil/water indicator and found the depth to LNAPL was 51.1 feet below surface and depth to water was 51.62 feet. Thus, equilibrium LNAPL thickness is 0.52 feet or 6.24 inches. Results of this test will be used to evaluate treatment/remediation

[1] www.env.nm.gov/gwb/documents/MonitoringWellGuidelinesFINAL-March2011.pdf
[2] www.api.org/~/media/4762%20LNAPL%20Tn%20wkbk%20Baildown%20userguide%20Apr2016%20(2).pdf

options. Initial assessment of the test suggests that LNAPL in the well returns to equilibrium thickness in approximately 2 hours.

We propose the installation of 3 additional wells to determine an appropriate remedy:

- Install an initial down-gradient monitoring well (MW-2) approximately 50 feet from MW-1 as shown on Figure 2 on June 9, 2017. The exact location of all wells will be determined in the field and based upon the distance from MW-1, logistics such as steep slopes or pipelines, OCD guidance, and more accurate groundwater flow vectors based upon site data.

- If LNAPL or elevated aromatics resulting from heated headspace analysis using a photoionization detector (PID>100 ppm) are present on groundwater or capillary fringe of MW-2, two additional wells will be installed down gradient during the week of June 26. The approximate location of MW-3 in this scenario is shown on Figure 2. The location of MW-4 is dependent on the presence or absence of impact observed in MW-3 during installation and will determined jointly with the District.

- If MW-2 shows no obvious signs of impact (odor or LNAPL), then the well will be developed, sampled, and surveyed to determine the placement of 2 additional wells (MW-3, MW-4) to be installed the week of June 26, 2017. The locations of MW-3, -4 will be proposed to NMOCD after analytical results are returned and before installation.

The 2-inch monitoring wells will be drilled by Atkins Engineering using the same standards and construction specifications as MW-1. We will employ low-flow sampling in accordance with the EPA procedure. Water elevations and LNAPL thickness will also be determined during each sampling event. Samples will be analyzed for BTEX, TDS, chloride, and sulfate. MW-1 will now only be monitored for LNAPL thickness and will only be sampled as needed.

Thank you for your help regarding this release. Upon OCD's concurrence, the outlined work will begin during the first week of June. OCD will be notified at least 48 hours prior to the commencement of significant events and we will maintain real-time contact with the District during field programs. Should you have any questions or comments regarding this proposed work, please contact me.

Sincerely,

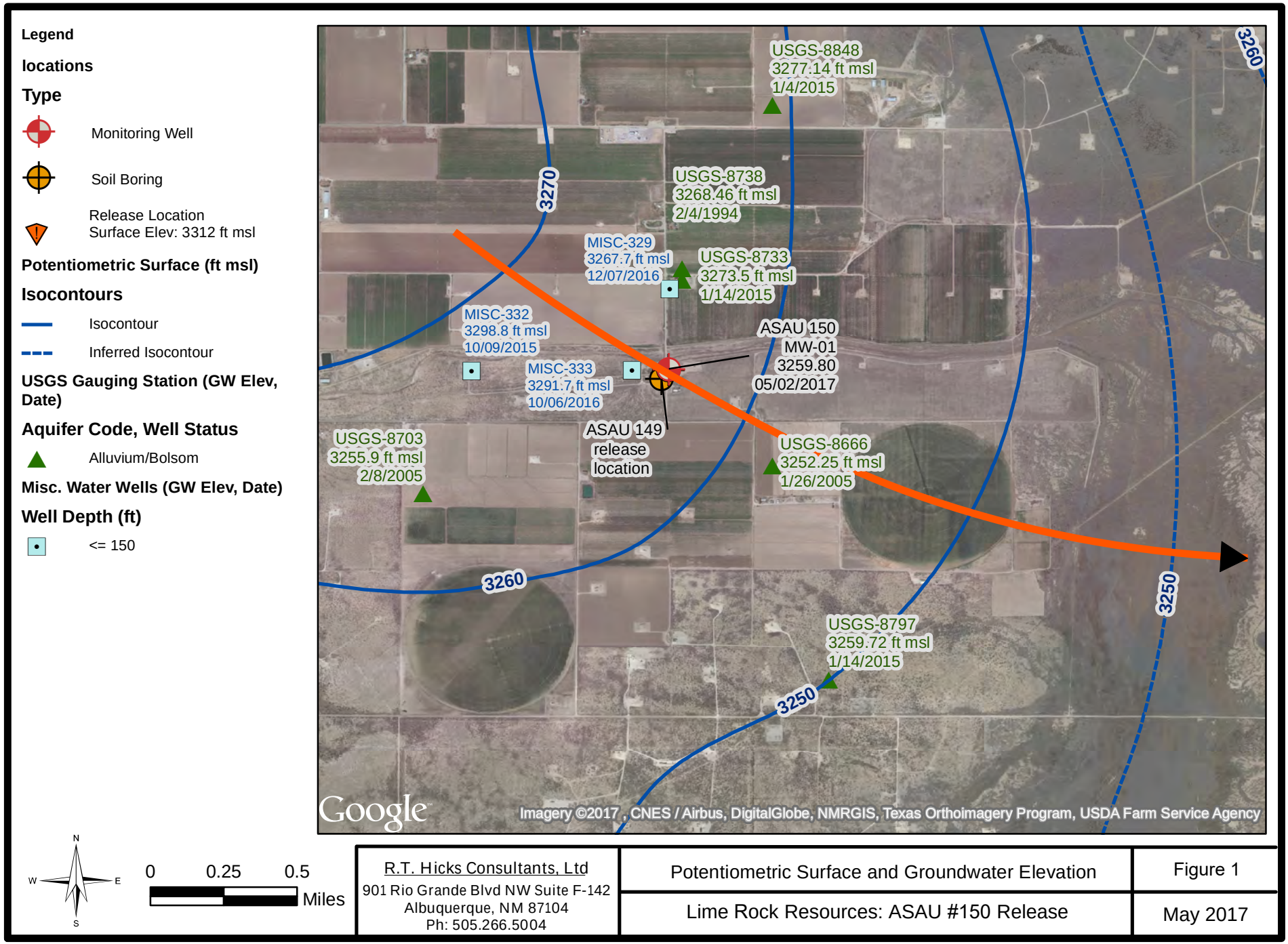
R.T. Hicks Consultants

Kristin Pope

Kristin Pope

Enclosures: Figures, lab report Copy: Lime Rock

M:\Lime Rock Resources\asau trunk\PitRuleTemplate_10_1\gw_vectors.mxd



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

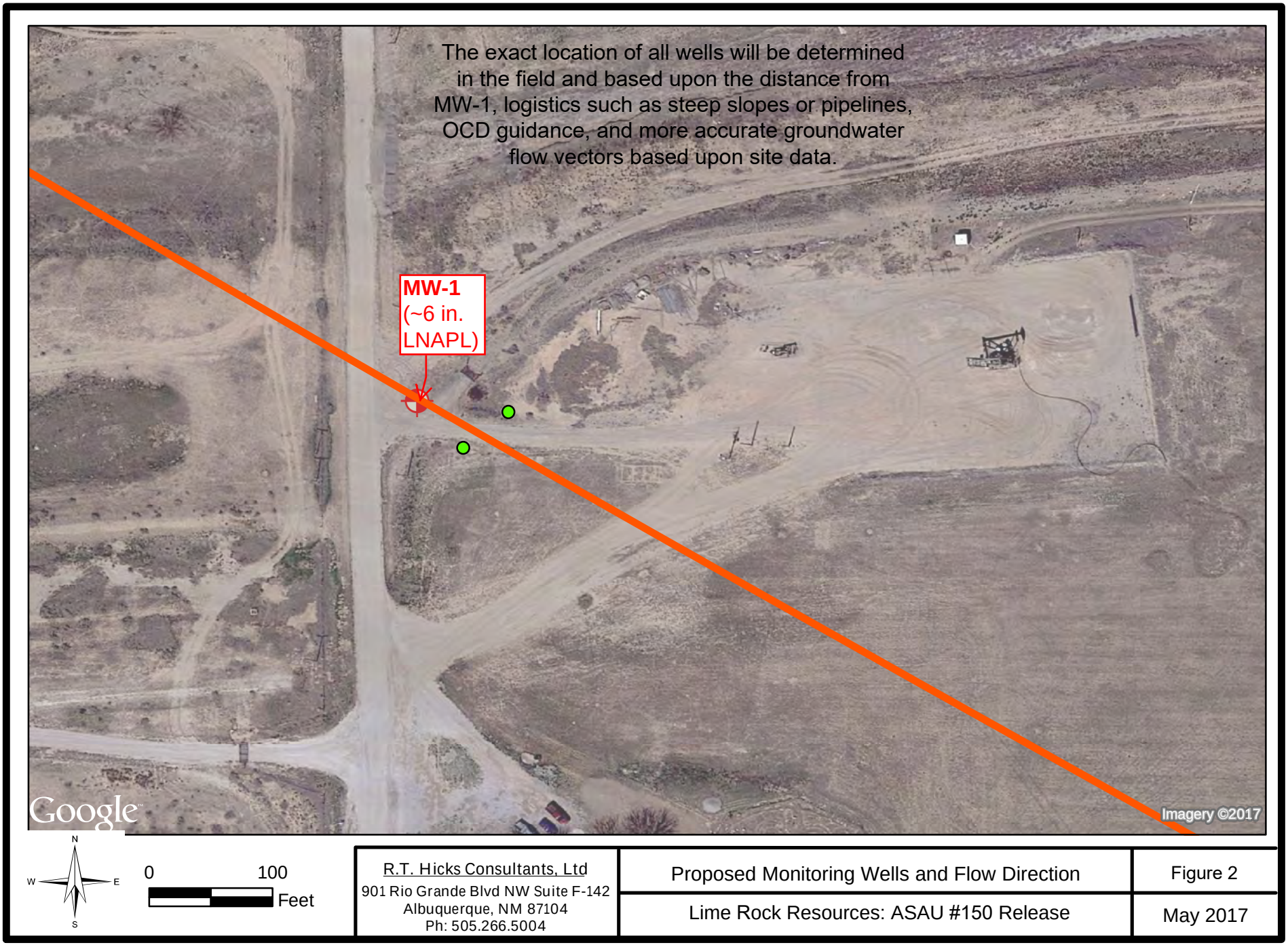
Potentiometric Surface and Groundwater Elevation

Figure 1

Lime Rock Resources: ASAU #150 Release

May 2017

Y:\Shared\Documents\Projects\LocoHillsPermPit2016\Communications\gw_vectorsRTH.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Proposed Monitoring Wells and Flow Direction	Figure 2
	Lime Rock Resources: ASAU #150 Release	May 2017

CARDINAL Laboratories

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

March 21, 2017

MIKE STUBBLEFIELD

R T HICKS CONSULTANTS

901 RIO GRANDE BLVD SUITE F-142

ALBUQUERQUE, NM 87104

RE: ASAU 150 TRUNK LINE RELEASE

Enclosed are the results of analyses for samples received by the laboratory on 03/08/17 16:55.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

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

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

Cardinal Laboratories is accredited through the State of New Mexico Environment Department for:

Method SM 9223-B	Total Coliform and E. coli (Colilert MMO-MUG)
Method EPA 524.2	Regulated VOCs and Total Trihalomethanes (TTHM)
Method EPA 552.2	Total Haloacetic Acids (HAA-5)

Accreditation applies to public drinking water matrices for State of Colorado and New Mexico.

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

Sincerely,

Celey D. Keene

Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
S-1 MONITOR WELL	H700605-01	Water	08-Mar-17 11:37	08-Mar-17 16:55

Cardinal Laboratories

*=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

S-1 MONITOR WELL

H700605-01 (Water)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Cardinal Laboratories										
Inorganic Compounds										
Alkalinity, Bicarbonate	**573**		5.00	mg/L	1	7022210	AC	10-Mar-17	310.1	
Alkalinity, Carbonate	<1.00		1.00	mg/L	1	7022210	AC	10-Mar-17	310.1	
Chloride*	**188**		4.00	mg/L	1	7030902	AC	09-Mar-17	4500-Cl-B	
Conductivity*	**3070**		1.00	uS/cm	1	7030904	AC	10-Mar-17	120.1	
pH*	**7.10**		0.100	pH Units	1	7030903	AC	09-Mar-17	150.1	
Sulfate*	**1460**		250	mg/L	25	7031002	AC	10-Mar-17	375.4	QM-07
TDS*	**2800**		5.00	mg/L	1	7022808	AC	13-Mar-17	160.1	
Alkalinity, Total*	**470**		4.00	mg/L	1	7022210	AC	10-Mar-17	310.1	
Volatile Organic Compounds by EPA Method 8021										
Benzene*	**19.2**		0.500	mg/L	500	7030901	MS	10-Mar-17	8021B	
Toluene*	**8.50**		0.500	mg/L	500	7030901	MS	10-Mar-17	8021B	
Ethylbenzene*	**2.31**		0.500	mg/L	500	7030901	MS	10-Mar-17	8021B	
Total Xylenes*	**5.17**		1.50	mg/L	500	7030901	MS	10-Mar-17	8021B	
Total BTEX	**35.2**		3.00	mg/L	500	7030901	MS	10-Mar-17	8021B	
Surrogate: 4-Bromofluorobenzene (PID)			*101 %*	*81.3-128*		*7030901*	MS	*10-Mar-17*	*8021B*	
Petroleum Hydrocarbons by GC FID										**S-04**
GRO C6-C10	**274**		1.00	mg/L	0.1	7031302	MS	14-Mar-17	8015B	
DRO >C10-C28	**435**		1.00	mg/L	0.1	7031302	MS	14-Mar-17	8015B	
EXT DRO >C28-C36	**73.7**		1.00	mg/L	0.1	7031302	MS	14-Mar-17	8015B	
Surrogate: 1-Chlorooctane			*143 %*	*37.1-138*		*7031302*	MS	*14-Mar-17*	*8015B*	
Surrogate: 1-Chlorooctadecane			*148 %*	*44.6-151*		*7031302*	MS	*14-Mar-17*	*8015B*	
Green Analytical Laboratories										
Total Recoverable Metals by ICP (E200.7)										
Calcium*	**1600**		2.50	mg/L	25	B703116	LLG	15-Mar-17	EPA200.7	
Magnesium*	**240**		2.50	mg/L	25	B703116	LLG	15-Mar-17	EPA200.7	

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

S-1 MONITOR WELL

H700605-01 (Water)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Batch	Analyst	Analyzed	Method	Notes
Green Analytical Laboratories										
Total Recoverable Metals by ICP (E200.7)										
Potassium*	<25.0		25.0	mg/L	25	B703116	LLG	15-Mar-17	EPA200.7	
Sodium*	**150**		25.0	mg/L	25	B703116	LLG	15-Mar-17	EPA200.7	

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*=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

Inorganic Compounds - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7022210 - General Prep - Wet Chem										
Blank (7022210-BLK1)				Prepared & Analyzed: 22-Feb-17						
Alkalinity, Carbonate	ND	1.00	mg/L							
Alkalinity, Bicarbonate	5.00	5.00	mg/L							
Alkalinity, Total	4.00	4.00	mg/L							
LCS (7022210-BS1)				Prepared & Analyzed: 22-Feb-17						
Alkalinity, Carbonate	ND	1.00	mg/L				80-120			
Alkalinity, Bicarbonate	127	5.00	mg/L				80-120			
Alkalinity, Total	104	4.00	mg/L	100		104	80-120			
LCS Dup (7022210-BSD1)				Prepared & Analyzed: 22-Feb-17						
Alkalinity, Carbonate	ND	1.00	mg/L				80-120		20	
Alkalinity, Bicarbonate	127	5.00	mg/L				80-120	0.00	20	
Alkalinity, Total	104	4.00	mg/L	100		104	80-120	0.00	20	
Batch 7022808 - Filtration										
Blank (7022808-BLK1)				Prepared: 28-Feb-17 Analyzed: 02-Mar-17						
TDS	ND	5.00	mg/L							
LCS (7022808-BS1)				Prepared: 28-Feb-17 Analyzed: 02-Mar-17						
TDS	215	5.00	mg/L	213		101	80-120			
Duplicate (7022808-DUP1)		**Source: H700474-04**		Prepared: 28-Feb-17 Analyzed: 02-Mar-17						
TDS	992	5.00	mg/L		1010			2.19	20	
Batch 7030902 - General Prep - Wet Chem										
Blank (7030902-BLK1)				Prepared & Analyzed: 09-Mar-17						
Chloride	ND	4.00	mg/L							

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Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

Inorganic Compounds - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7030902 - General Prep - Wet Chem										
LCS (7030902-BS1)				Prepared & Analyzed: 09-Mar-17						
Chloride	100	4.00	mg/L	100		100	80-120			
LCS Dup (7030902-BSD1)				Prepared & Analyzed: 09-Mar-17						
Chloride	100	4.00	mg/L	100		100	80-120	0.00	20	
Batch 7030903 - General Prep - Wet Chem										
LCS (7030903-BS1)				Prepared & Analyzed: 09-Mar-17						
pH	7.11		pH Units	7.00		102	90-110			
Duplicate (7030903-DUP1)		**Source: H700605-01**		Prepared & Analyzed: 09-Mar-17						
pH	7.12	0.100	pH Units		7.10			0.281	20	
Batch 7030904 - General Prep - Wet Chem										
LCS (7030904-BS1)				Prepared: 09-Mar-17 Analyzed: 10-Mar-17						
Conductivity	491		uS/cm	500		98.2	80-120			
Duplicate (7030904-DUP1)		**Source: H700605-01**		Prepared: 09-Mar-17 Analyzed: 10-Mar-17						
Conductivity	3060	1.00	uS/cm		3070			0.326	20	
Batch 7031002 - General Prep - Wet Chem										
Blank (7031002-BLK1)				Prepared & Analyzed: 10-Mar-17						
Sulfate	ND	10.0	mg/L							

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Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

Inorganic Compounds - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7031002 - General Prep - Wet Chem										
LCS (7031002-BS1)				Prepared & Analyzed: 10-Mar-17						
Sulfate	23.4	10.0	mg/L	20.0		117	80-120			
LCS Dup (7031002-BSD1)				Prepared & Analyzed: 10-Mar-17						
Sulfate	24.4	10.0	mg/L	20.0		122	80-120	4.18	20	BS1

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Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

Volatile Organic Compounds by EPA Method 8021 - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7030901 - Volatiles										
Blank (7030901-BLK1)				Prepared: 09-Mar-17 Analyzed: 10-Mar-17						
Benzene	ND	0.001	mg/L							
Toluene	ND	0.001	mg/L							
Ethylbenzene	ND	0.001	mg/L							
Total Xylenes	ND	0.003	mg/L							
Total BTEX	ND	0.006	mg/L							
Surrogate: 4-Bromofluorobenzene (PID)	*0.0500*		mg/L	*0.0500*		*100*	*81.3-128*			
LCS (7030901-BS1)				Prepared: 09-Mar-17 Analyzed: 10-Mar-17						
Benzene	0.020	0.001	mg/L	0.0200		101	86.6-118			
Toluene	0.020	0.001	mg/L	0.0200		97.5	84.5-122			
Ethylbenzene	0.020	0.001	mg/L	0.0200		101	83.9-122			
Total Xylenes	0.059	0.003	mg/L	0.0600		98.5	81.8-124			
Surrogate: 4-Bromofluorobenzene (PID)	*0.0507*		mg/L	*0.0500*		*101*	*81.3-128*			
LCS Dup (7030901-BSD1)				Prepared: 09-Mar-17 Analyzed: 10-Mar-17						
Benzene	0.020	0.001	mg/L	0.0200		101	86.6-118	0.0298	7.71	
Toluene	0.020	0.001	mg/L	0.0200		97.6	84.5-122	0.0769	8.86	
Ethylbenzene	0.020	0.001	mg/L	0.0200		101	83.9-122	0.391	11.8	
Total Xylenes	0.059	0.003	mg/L	0.0600		97.9	81.8-124	0.602	11.9	
Surrogate: 4-Bromofluorobenzene (PID)	*0.0504*		mg/L	*0.0500*		*101*	*81.3-128*			

Cardinal Laboratories

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Celey D. Keene, Lab Director/Quality Manager

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Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

Petroleum Hydrocarbons by GC FID - Quality Control

Cardinal Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7031302 - General Prep - Organics										
Blank (7031302-BLK1)				Prepared: 13-Mar-17 Analyzed: 14-Mar-17						
GRO C6-C10	ND	1.00	mg/L							
DRO >C10-C28	ND	1.00	mg/L							
EXT DRO >C28-C35	ND	1.00	mg/L							
EXT DRO >C28-C36	ND	1.00	mg/L							
Surrogate: 1-Chlorooctane	*4.16*		mg/L	*5.00*		*83.2*	*37.1-138*			
Surrogate: 1-Chlorooctadecane	*4.82*		mg/L	*5.00*		*96.3*	*44.6-151*			
LCS (7031302-BS1)				Prepared & Analyzed: 13-Mar-17						
GRO C6-C10	45.1	1.00	mg/L	50.0		90.2	72.8-108			
DRO >C10-C28	46.6	1.00	mg/L	50.0		93.1	77.5-117			
EXT DRO >C28-C35	ND	1.00	mg/L	0.00			0-0			
Surrogate: 1-Chlorooctane	*5.03*		mg/L	*5.00*		*101*	*37.1-138*			
Surrogate: 1-Chlorooctadecane	*4.78*		mg/L	*5.00*		*95.7*	*44.6-151*			
LCS Dup (7031302-BSD1)				Prepared: 13-Mar-17 Analyzed: 14-Mar-17						
GRO C6-C10	46.2	1.00	mg/L	50.0		92.5	72.8-108	2.42	12	
DRO >C10-C28	48.0	1.00	mg/L	50.0		96.0	77.5-117	2.98	12.1	
EXT DRO >C28-C35	ND	1.00	mg/L	0.00			0-0		20	
Surrogate: 1-Chlorooctane	*5.16*		mg/L	*5.00*		*103*	*37.1-138*			
Surrogate: 1-Chlorooctadecane	*5.26*		mg/L	*5.00*		*105*	*44.6-151*			

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Analytical Results For:

R T HICKS CONSULTANTS 901 RIO GRANDE BLVD SUITE F-142 ALBUQUERQUE NM, 87104	Project: ASAU 150 TRUNK LINE RELEASE Project Number: NONE GIVEN Project Manager: MIKE STUBBLEFIELD Fax To: NONE	Reported: 21-Mar-17 11:52

Total Recoverable Metals by ICP (E200.7) - Quality Control

Green Analytical Laboratories

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B703116 - EPA 200.2 Total Rec.										
Blank (B703116-BLK1)				Prepared & Analyzed: 15-Mar-17						
Magnesium	ND	0.100	mg/L							
Calcium	ND	0.100	mg/L							
Potassium	ND	1.00	mg/L							
Sodium	ND	1.00	mg/L							
LCS (B703116-BS1)				Prepared & Analyzed: 15-Mar-17						
Magnesium	19.0	0.100	mg/L	20.0		94.8	85-115			
Potassium	7.40	1.00	mg/L	8.00		92.5	85-115			
Calcium	3.69	0.100	mg/L	4.00		92.2	85-115			
Sodium	6.21	1.00	mg/L	6.48		95.9	85-115			
LCS Dup (B703116-BSD1)				Prepared & Analyzed: 15-Mar-17						
Sodium	6.12	1.00	mg/L	6.48		94.4	85-115	1.54	20	
Potassium	7.21	1.00	mg/L	8.00		90.2	85-115	2.56	20	
Magnesium	18.6	0.100	mg/L	20.0		93.2	85-115	1.72	20	
Calcium	3.62	0.100	mg/L	4.00		90.6	85-115	1.78	20	
Matrix Spike (B703116-MS2)	**Source: 1703076-01**			Prepared & Analyzed: 15-Mar-17						
Calcium	18.6	0.100	mg/L	4.00	14.9	92.1	70-130			

Cardinal Laboratories

*=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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

Notes and Definitions

S-04	The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
BS1	Blank spike recovery above laboratory acceptance criteria. Results for analyte potentially biased high.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

Cardinal Laboratories *=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

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

Company Name:	R.T. Hicks Consultants
Project Manager:	mike Stubblefield
Address:	2411 S. 13th
City:	Artesia State: NM Zip: 88210
Phone #:	Fax #:
Project #:	Project Owner:
Project Name:	ASAU 150 Trunkline release
Project Location:	Ut. P sec 14 - T18S - R26E
Sampler Name:	Mike Stubblefield

BILL TO

P.O. #:	
Company:	Lime Rock Res.
Attn:	Mike Barrett
Address:	
City:	
State:	Zip:
Phone #:	
Fax #:	

ANALYSIS REQUEST

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER :	PRESERV.: ACID/BASE:	ICE / COOL	OTHER :	SAMPLING: DATE	TIME	Cation/Anions	Chlorides	TDS	Sulphates	BTEX	TPH
H200605-1	S.1 monitor well		4	✓							✓		3/8/2017	11:39	✓	✓	✓	✓	✓	✓

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Relinquished By:	Date:	Received By:	
Mike Stubblefield	Time:		
Relinquished By:	Date: 3-8-17	Received By:	
	Time: 4:55	Tamara Oldaker	

Delivered By: (Circle One)
Sampler - UPS - Bus - Other: 2.4°C

Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No
CHECKED BY: (Initials) TO - #15

Phone Result: ☐ Yes ☐ No Add'l Phone #:
Fax Result: ☐ Yes ☐ No Add'l Fax #:
REMARKS:

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

Appendix C
Stage 1/2 Abatement Plan

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

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266.0745
Artesia ▲ Carlsbad ▲ Durango ▲ Midland

October 9, 2017

Mr. Bradford Billings
Ms. Crystal Weaver, Mr. Mike Bratcher
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210 *VIA EMAIL*

RE: Report of Hydrocarbon Characterization and Proposed Actions
Lime Rock – ASAU #150 Trunkline Release, #2RP-3893

Dear Ms. Weaver, Mr. Billings and Mr. Bratcher:

On behalf of Lime Rock Resources, R.T. Hicks Consultants, Ltd. submits this update of activities performed at the above-referenced release location. As requested by NMOCD during a meeting at the District office on August 28, 2017, samples were collected from the top of the water column as a means to characterize the extent and magnitude of hydrocarbon constituents. NMOCD was emailed notification of the scheduled sampling on September 6 and provided a Sampling and Analysis Plan (Plan) on September 8. We report the results of this characterization sampling herein.

Method and Observations

Witnessed by Ms. Weaver, we began at MW-3 and the procedure followed the submitted Plan.

MW-3

- Depth to water (from TOC) was measured at 47.95 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- The third bailer for the sample was observed to be turbid/silty. As specified in the Plan, we waited at least two hours before sampling again.
- We returned to this well and repeated the procedure and obtained a sample at 12:08 pm. The sample was again observed to be silty, as shown in the adjacent photograph.

Silty samples from MW-3

MW-2

- Depth to water (from TOC) was measured at 52.08 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- During bailing, the bailer was observed to have LNAPL sheen on the outside and the water had a sheen on the surface.
- The sample was collected at 10:40 am.

MW-4

- Depth to water (from TOC) was measured at 48.87 feet.
- Two full bailers were purged by slowly lowering the bailer into the top 1 foot of column.
- During bailing and sampling, the water was observed to be clear with no noticeable odor.
- The sample was collected at 11:08 am.

MW-1

- Ms. Weaver stated that NMOCD requests a product thickness measurement in this well.
- We explained that after consistently measuring approximately 6 inches of product thickness, a1-inch "measuring tube" was installed to facilitate accurate DTW measurements (adjacent photograph). Since installation of the sampling tube, we are unable to measure the product.
- DTW was measured in the sampling tube at 52.98 feet on September 11, 2017.

Installation of "Measuring tube" in MW-1

Samples were delivered to Hall Environmental Analysis Laboratory in Albuquerque via its courier service.

Analysis and Evaluation

The sampling data and BTEX analysis provided by Hall is summarized in the table below.

Well ID	DTW from TOC (ft)	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total BTEX	Observations
MW-2	52.08	370	0	51	66	487	Sheen; film on bailer
MW-3	47.95	41	0	0	0	41	Turbid at 1st attempt; waited 2 hrs, sample is silty
MW-4	48.87	3300	0	470	0	3770	Clear
MW-1	52.98	---	---	---	---	---	DTW only; measured from steel sampling tube
WQCC std		10	750	750	620		

all concentrations are µg/L

Table 1: BTEX characterization sampling (9/11/2017)

When compared to the concentrations from the last compliance sampling event for each well, the data show the following relationships:

- MW-2, approximately 60 feet southeast of MW-1, yielded 930 µg/L benzene when sampled using a bailer-purge method soon after installation on June 12, 2017. Although the September 11 characterization sampling method is not comparable to the compliance sampling method, the characterization sampling revealed a decrease in benzene of more than 60% in this well.

- MW-3 was sampled for compliance on August 2, 2017 using a low-flow purge and sample method[1] which yielded benzene concentration of 61 µg/L. When compared to the

[1] https://www.epa.gov/sites/production/files/2015-06/documents/EQASOP-GW001.pdf

compliance sampling, the September characterization sampling shows a benzene decrease of approximately 33%.

- MW-4 displayed a marked increase when the characterization sampling is compared to the last compliance sampling which 1530 µg/L benzene. The well was sampled for August 2, 2017 using a bailer-purge method instead of the low-flow method due to a problem with the pump. When compared to the recent characterization sampling, benzene in this well demonstrated an increase of 116%.

Additional Proposed Actions

VOC chemistry appears to demonstrate a southeastern groundwater gradient and DTW measurements from this event confirm a south-southeastern vector (Figure 1) of 0.214, significantly steeper gradient than was last measured in August. Benzene is the only regulated BTEX component in these samples that exceeded WQCC standards (Table 1). Concentrations of BTEX components, observations of the samples, and our experience, however, suggest that the concentrations are more indicative of a lighter product such as gasoline or natural gas condensate. We propose three additional actions to further characterize the groundwater impact at this site.

To provide clarity regarding the nature of the release and as an exercise of academic interest, we propose a **chemical comparison of product sample floating in MW-1 to the product in Lime Rock's system** following these steps:

1. Remove the measuring tube in MW-1 at least two days prior to the compliance sampling event to allow time for the water and LNAPL to return to an equilibrium state.
2. Measure and record DTW and thickness of LNAPL.
3. Collect a sample of only LNAPL using a bailer and preserve for analysis at Lime Rock's usual laboratory used for product analysis.
4. Collect a representative product sample from Lime Rock's system in accordance with the laboratory's instructions.
5. Submit both samples for comparative analysis for physical and chemical characteristics as defined by Lime Rock.

Given the contradictory nature of prior VOC chemistry at this site, we propose **additional samples to confirm the characterization samples** collected on September 11 using a bailer. **Compliance monitoring sampling of wells MW-2, -3, and -4** for the final 2017 quarter are planned for Wednesday, October 11, 2017. Because these wells were installed up to several months apart, this will be the first sampling event where all data from each well will be collected on the same day. We will employ the low-flow sampling procedure referenced in the previous page with the following addition:

1. After compliance sampling of the well for VOCs and inorganic constituents using the low-flow method, the pump rate will be reduced and the intake will be raised to a level of approximately 1 foot from the DTW level, the same interval from which the characterization sample was collected on September 11 using a bailer.
2. Collect sample during the low-flow pumping from the top of the column for BTEX analysis per the laboratory's requirements.
3. Since the shallower samples will also not fulfill the quarterly sampling requirement, these will be placed on a separate chain of custody form from the compliance samples collected previously on the same day.

Thank you for your consideration of this data and your help with this project. NMOCD will be notified of significant events at least 48 hours in advance. Please consider this report written notice for the sampling activities planned for October 11, 2017 at 9:00 am.

A copy of this report will be provided to the surface owner. The data gathered thus far leads us to the opinion that there is minimal danger of hydrocarbon impact from this release to existing and future down-gradient water wells installed using contemporary construction standards, as domestic and irrigation wells pump from deeper zones of the aquifer. We acknowledge the exceedance of regulated hydrocarbon constituents at this site and recognize a likely requirement of 1-2 additional down-gradient monitoring wells in the future. We request that NMOCD allow the collection of the proposed data to facilitate the best assessment regarding the possible placement of future wells and the remediation of this release.

Sincerely,
R.T. Hicks Consultants

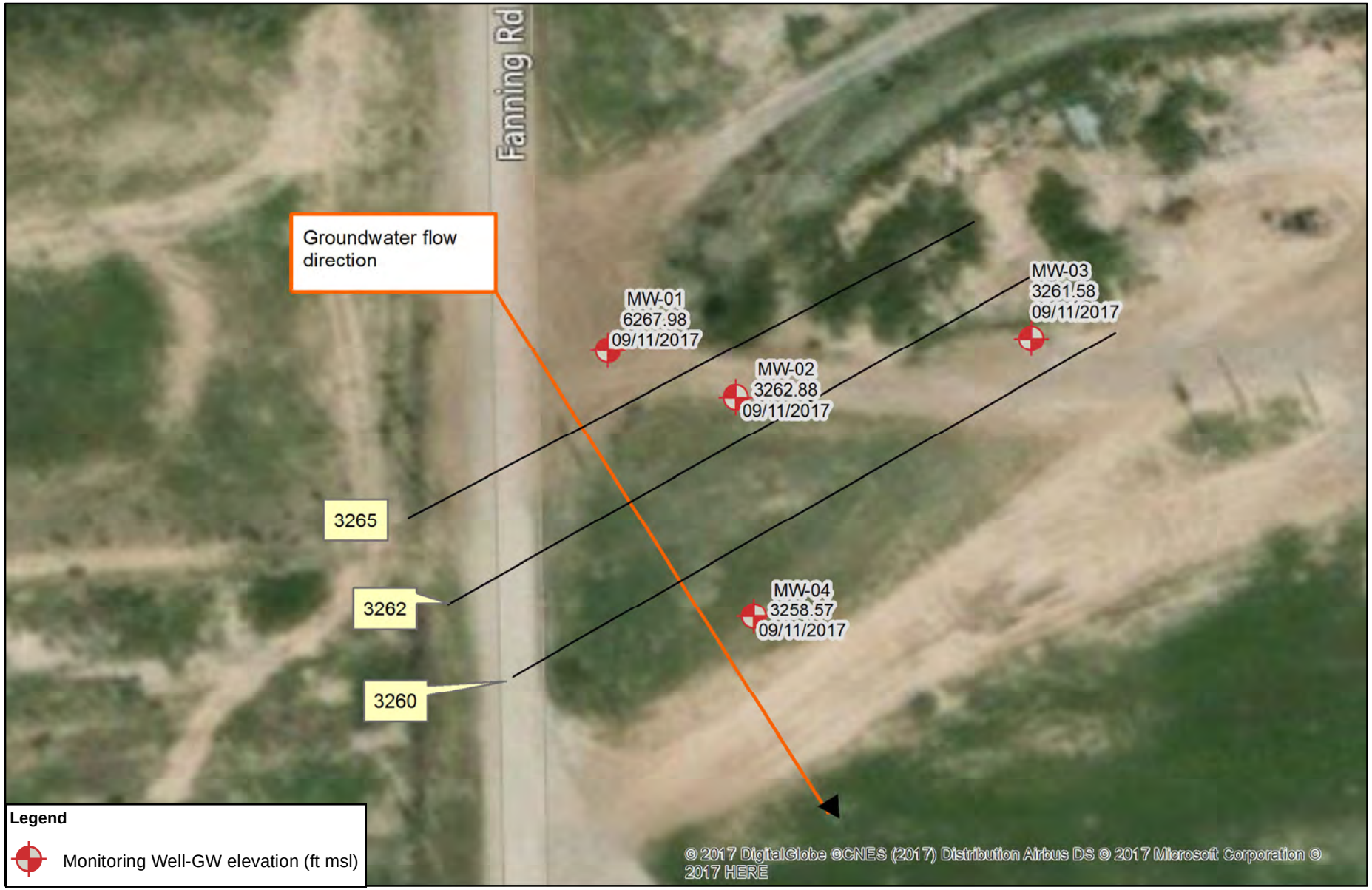
Kristin Pope

Kristin Pope
Project Geologist

Enclosures: Figure 1, laboratory report

Copy: Lime Rock Resources, Gray Holdings (surface owner)

M:\Lime Rock Resources\asau trunk\PitRuleTemplate_10_1\Figures\May 2017\Figure 1 gw direction sept 11 2017.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Flow Direction	Figure 1
	Limerock Resources: ASAU #150 Release	Oct 2017

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

September 21, 2017

Kristin Pope

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: Lime Rock ASAU 150 Release OrderNo.: 1709837

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 9/14/2017 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 **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 10:40:00 AM
Lab ID: 1709837-001 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	370	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Toluene	ND	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Ethylbenzene	51	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Xylenes, Total	66	10		µg/L	10	9/20/2017 8:04:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	90.3	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: 4-Bromofluorobenzene	95.8	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Dibromofluoromethane	96.7	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Toluene-d8	90.4	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 12:08:00 PM
Lab ID: 1709837-002 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	41	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Toluene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Ethylbenzene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:28:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	91.6	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Dibromofluoromethane	96.9	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Toluene-d8	91.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 11:28:00 AM
Lab ID: 1709837-003 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	3300	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Toluene	ND	1.0		µg/L	1	9/20/2017 8:52:00 AM	B45748
Ethylbenzene	470	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:52:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	97.0	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.5	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Dibromofluoromethane	95.8	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Toluene-d8	89.2	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748

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#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **100ng lcs2**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453586** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	22	1.0	20.00	0	110	70	130			
Toluene	20	1.0	20.00	0	98.6	70	130			
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.6	70	130			
Surr: 4-Bromofluorobenzene	9.6		10.00		95.5	70	130			
Surr: Dibromofluoromethane	9.7		10.00		97.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb2**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453587** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.0		10.00		89.7	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		94.8	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		88.6	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454013** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	21	1.0	20.00	0	107	70	130			
Surr: 1,2-Dichloroethane-d4	9.2		10.00		91.6	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		95.4	70	130			
Surr: Dibromofluoromethane	9.5		10.00		95.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Ethylbenzene	ND	1.0								
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.9	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
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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#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 4-Bromofluorobenzene	9.6		10.00		95.6	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		89.3	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
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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: 1709837 RcptNo: 1

Received By: Isaiah Ortiz 9/14/2017 9:42:00 AM

Completed By: Ashley Gallegos 9/15/2017 9:43:33 AM

Reviewed By: 9/15/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. 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: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

RT

Chain-of-Custody Record

sult.com

Turn-Around Time: ☑ Standard ☐ Rush

Project Name: Lime Rock ~~Murchison~~ - ASAU #150 Release

Project #:

Project Manager: Kristin Pope

Sampler: ~~Kristin Pope~~ M. Stubblefield

On Ice: ☑ Yes ☐ No

Sample Temperature: 1.0

☐ Level 4 (Full Validation)

Accreditation: ☐ NELAP ☐ Other ____

☐ EDD (Type) ____

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

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1709837	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, NO3, NO2, PO4, SO4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)		100 grams		Air Bubbles (Y or N)
9/11/17	1040	grd water	MW-2	40-mL 3 VOA glass	ice, HgCl2	-001	X														
"	1208	"	MW-3	"	"	-002	X														
"	1128	"	MW-4	"	"	-003	X														

Date	Time	Relinquished by	Received by	Date	Time
8/13/2017	9:00 AM	M. Stubblefield	[signature]	9/14/17	0942
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email results to R, kristin@rthicksconsult.com, mike@ "

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
Stage 1/2 Abatement Plan

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

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266.0745
Artesia ▲ Carlsbad ▲ Durango ▲ Midland

December 22, 2017

Mr. Bradford Billings
Ms. Crystal Weaver, Mr. Mike Bratcher
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210 *VIA EMAIL*

RE: **Groundwater Sampling Report and Proposed Actions**
Lime Rock – ASAU #150 Trunkline Release, #2RP-3893

Dear Ms. Weaver, Mr. Billings, and Mr. Bratcher:

On behalf of Lime Rock Resources, R.T. Hicks Consultants, Ltd. submits the report and proposal for the above-referenced site. The following report summarizes data collected thus far and proposes actions to characterize and mitigate potential environmental impact caused by this release with the aim of closure of the regulatory file.

Summary of Previous Actions, Site Conditions, & Submissions

- The initial response actions to the August 30, 2016 release and proposed monitoring wells were described in a December 2016 report to OCD.
- MW-1, nearest to the release, has exhibited measurable Light Non-Aqueous Phase Liquid (LNAPL) ranging in thickness from 6 inches soon after installation, to 1.5 inches most recently.
- Lime Rock and Hicks Consultants met with OCD on May 23, 2017 to discuss placement criteria of additional wells.
- A total of four 2-inch monitoring wells were installed at the site this year and three of them are sampled on a quarterly basis (Appendix A). Plate 1 is an aerial image that displays the location of the monitoring wells at the release site, in relation to the junction of Fanning (CR 44) and Thistle (CR 24) Roads.
- At a meeting with Lime Rock and Hicks Consultants on August 23, 2017, OCD requested sampling of the top of the water column for hydrocarbon analysis.
- A proposal for characterization sampling for hydrocarbon at the top of the water was submitted to OCD on September 8, 2017.
- On October 9, 2017, a report of the September characterization sampling was submitted to OCD, which included a proposal for further characterization sampling (Appendices B and C).

The monitoring wells were installed per New Mexico Guidance and OCD approval, with 10 feet of screen below the water table and 5-feet above groundwater. The wells were sampled no sooner than 48 hours after appropriate development. Most of the samples were collected using

a low-flow sampling procedure[1] except when pump failure required sample collection using the conventional hand bail method with purging of three casing volumes.

Compliance Sampling of Monitoring Wells
Appendix A includes a summary of all monitoring events (Table 1) including depth to water measurements and analyses and laboratory reports from the fourth quarter (October 24) sampling. From these data, we make the following observations:

- LNAPL in MW-1 has diminished in thickness by 75% since initial installation. Compliance sampling of this well for dissolved constituents provides no value.
- MW-2 has exhibited a sheen and hydrocarbon odor since installation.
- Benzene concentrations in each well exceed WQCC standards (0.01 mg/L) at each sampling event. Benzene concentrations in each well show significant variation due to sampling methods and possibly other factors.
- Sulfate concentrations in each well exceed WQCC standards (600 mg/L) at each sampling event.
- Analyses of total dissolved solids (TDS) in each well exhibit concentrations that exceed WQCC standards (1000 mg/L), except MW-2. The TDS concentration of the first sampling event of MW-2 appears to be a laboratory error.
- Chloride concentrations of all monitoring samples are below the WQCC standard (250 mg/L).
- Groundwater elevation is decreasing from August to October. Plate 2, a map of October groundwater flow direction illustrations a relatively flat southeastern gradient. VOC groundwater chemistry from the October 24 sampling demonstrate a southeastern groundwater gradient from the pipeline release and g confirm a southeastern vector, but a significantly flatter gradient than was measured in August.

Additional Proposed Actions

Additional Monitoring Well
Characterization of the magnitude and extent of hydrocarbons in shallow groundwater is required by OCD and additional wells are necessary. In mid- January 2018, we will conduct the quarterly compliance sampling of the wells except for MW-1. We will continue to employ the low-stress, low-flow procedure and will analyze for BTEXN, chloride, sulfate, and TDS. OCD will be given at least 48 hours' notice of each sampling event. In February, we will present the first quarter sampling data to OCD in the form of a potentiometric surface map, updated data table and a benzene isocontour map of the plume. Unless these new data are unexpected, the observed benzene concentration gradient and the relatively constant groundwater flow vector, suggest a well in the vicinity of the area marked on Plate 1 and should define the concentration gradient within the impacted area. This next well, MW-5, will be installed and developed in early March 2018 in order to provide representative samples for the second quarterly compliance monitoring event in April 2018.

The submission of second quarter results in May 2018 will include a proposal for the additional monitoring well(s) which we anticipate will complete the groundwater monitoring network.

[1] https://www.epa.gov/quality/low-stress-low-flow-purging-and-sampling-procedure-collection-groundwater-samples-monitoring

LNAPL Recovery in MW-1

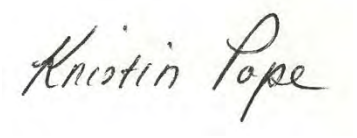
Recovery of LNAPL in MW-1 will begin on December 22, 2017. We will employ a passive system using a stainless steel cage-like bailer containing an oil-absorbing sock[2] to be monitored on a weekly basis. Each week, depth to water and depth to LNAPL measurements will be recorded, as well as the condition of the sock (degree of oil soak). The sock will be changed on a weekly basis, or more frequently if needed, and used socks will be secured and disposed of properly. If the amount of LNAPL increases and causes this system to be inadequate, we will propose a more robust recovery method.

Thank you for your consideration of this data and meeting with us many times regarding this project. OCD will be notified of significant events at least 48 hours in advance.

A copy of this report is provided to the landowner. The data gathered thus far suggest that the potential of hydrocarbon impact from this release to existing, down-gradient water wells is so small as to be nil. We believe it also highly unlikely that the observed hydrocarbon concentrations would impair water quality in future water supply wells installed using contemporary construction standards. This opinion of a low risk to the environment and public health causes us to allow site data to guide the assessment of the impact and thence to determine the most appropriate response.

Sincerely,

R.T. Hicks Consultants



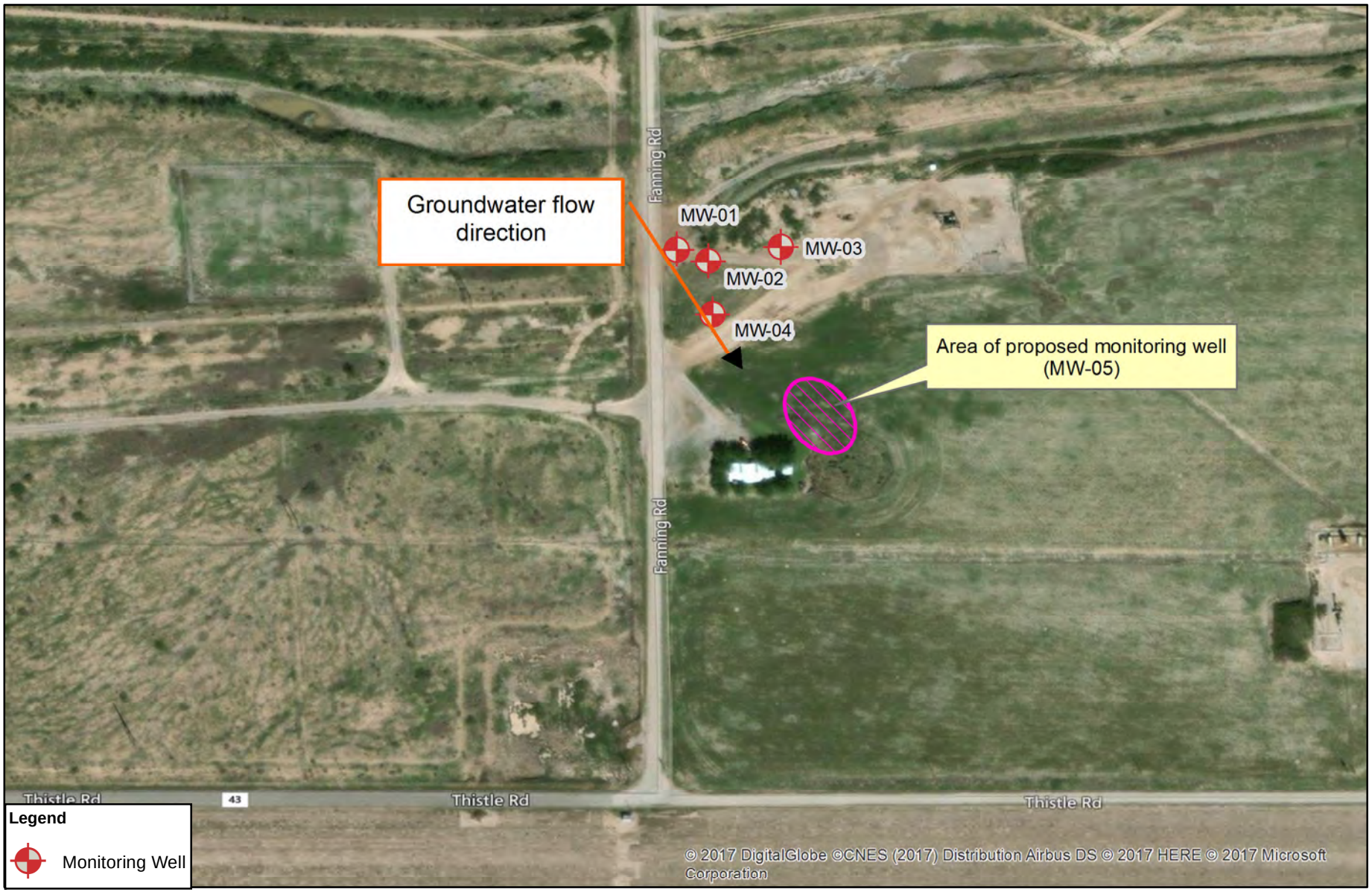
Kristin Pope
Project Geologist

Enclosures: Plates 1 and 2, Appendices A-C

Copy: Lime Rock Resources, Gray Holdings (surface owner)

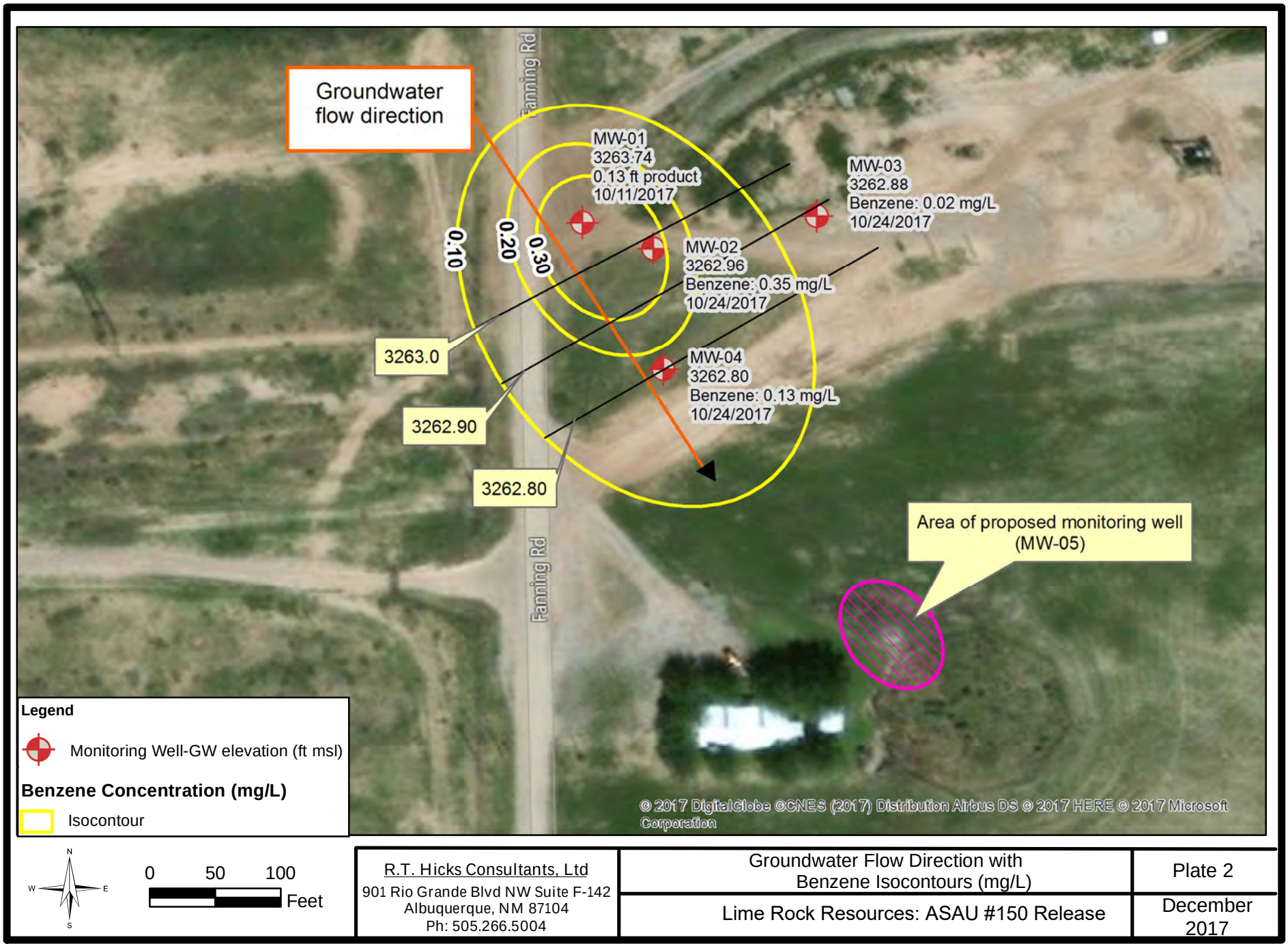
[2] http://www.geotechenv.com/pdf/free_phase_ground_water_remediation/geosorb.pdf

M:\Lime Rock Resources\asau trunk releases\PitRuleTemplate_10_1\Figures\yearEndReport2017\Plate 1 general location.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Monitoring Well Locations Relative to Environs	Plate 1
	Lime Rock Resources: ASAU #150 Release	December 2017

M:\Lime Rock Resources\asau trunk releases\PitRuleTemplate_10_1\Figures\yearEndReport2017\Figure 2 gw direction with Benzene October 2017.mxd



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Flow Direction with Benzene Isocontours (mg/L) Lime Rock Resources: ASAU #150 Release	Plate 2 December 2017

Appendix A

Compliance Sampling Summary and Laboratory Report

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

Well ID	DTW ft (from TOC)	Sample Date	LNAPL in.	Benzene 0.01	Toluene	Ethyl benzene	Total Xylenes	Naphtha-lene 0.03	Total BTEX	Chloride 250	Sulfate 600	TDS 1000	Sampling method	Lab	Notes
MW-1	51.62	3/8/17	6.00	19.2	8.5	2.31	5.17	---	35.2	188	1460	2800	bail	Cardinal	by oil/water interface meter
	51.62		6.24	---	---	---	---	---	---	---	---	---	---	---	baildown test
	51.9	7/19/17	---	---	---	---	---	---	---	---	---	---	---	---	from nested measuring tube
	52.36	10/11/17	1.5	---	---	---	---	---	---	---	---	---	bail		sampled LNAPL
MW-2	51.11	6/12/17	none	0.93	0.0047	0.011	0.034	---	0.0497	200	2100	381	bail	Hall	
54	grab samples for comparison	7/13/17	none	ND	ND	ND	ND	---	ND	---	---	---	low-flow pump	Hall	sampled at 54'
59		7/13/17	none	0.0082	ND	ND	ND	---	0.0082	---	---	---	low-flow pump	Hall	sampled at 59'
	52.00	10/24/2017	none	0.35	0.0078	0.063	0.079	0.013	---	180	2200	---	low-flow pump	Hall	
MW-3	46.4	8/2/17	none	0.061	ND	ND	ND	---	0.061	212	2010	3920	low-flow pump	Cardinal	
	47.57	10/24/2017	none	0.02	ND	ND	ND	ND	---	190	2100	---	low-flow pump	Hall	
MW-4	46.8	8/2/17	none	1.53	<0.020	0.101	<0.060	---	1.64	200	1840	3460	bail	Cardinal	
	48.75	10/24/2017	none	0.13	ND	0.016	ND	0.0092	---	180	2000	---	low-flow pump	Hall	

all concentrations are mg/L

Table 1

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

November 02, 2017

Kristin Pope

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: Lime Rock ASAU 150 OrderNo.: 1710F09

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 10/26/2017 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 **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 11:53:00 AM
Lab ID: 1710F09-001 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	180	50		mg/L	100	10/30/2017 1:19:10 PM	R46764
Sulfate	2200	50	*	mg/L	100	10/30/2017 1:19:10 PM	R46764
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
Benzene	350	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Toluene	7.8	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Ethylbenzene	63	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Methyl tert-butyl ether (MTBE)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2,4-Trimethylbenzene	29	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,3,5-Trimethylbenzene	9.8	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2-Dichloroethane (EDC)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2-Dibromoethane (EDB)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Naphthalene	13	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
1-Methylnaphthalene	ND	20		µg/L	5	11/1/2017 5:32:00 AM	A46777
2-Methylnaphthalene	ND	20		µg/L	5	11/1/2017 5:32:00 AM	A46777
Acetone	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Bromobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Bromodichloromethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Bromoform	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Bromomethane	ND	15		µg/L	5	11/1/2017 5:32:00 AM	A46777
2-Butanone	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Carbon disulfide	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Carbon Tetrachloride	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Chlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Chloroethane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
Chloroform	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Chloromethane	ND	15		µg/L	5	11/1/2017 5:32:00 AM	A46777
2-Chlorotoluene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
4-Chlorotoluene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
cis-1,2-DCE	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
cis-1,3-Dichloropropene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2-Dibromo-3-chloropropane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
Dibromochloromethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Dibromomethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2-Dichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,3-Dichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,4-Dichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Dichlorodifluoromethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1-Dichloroethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1-Dichloroethene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 11:53:00 AM
Lab ID: 1710F09-001 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
1,2-Dichloropropane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,3-Dichloropropane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
2,2-Dichloropropane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1-Dichloropropene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Hexachlorobutadiene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
2-Hexanone	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Isopropylbenzene	12	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
4-Isopropyltoluene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
4-Methyl-2-pentanone	ND	50		µg/L	5	11/1/2017 5:32:00 AM	A46777
Methylene Chloride	ND	15		µg/L	5	11/1/2017 5:32:00 AM	A46777
n-Butylbenzene	ND	15		µg/L	5	11/1/2017 5:32:00 AM	A46777
n-Propylbenzene	15	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
sec-Butylbenzene	5.1	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Styrene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
tert-Butylbenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1,1,2-Tetrachloroethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1,2,2-Tetrachloroethane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
Tetrachloroethene (PCE)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
trans-1,2-DCE	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
trans-1,3-Dichloropropene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2,3-Trichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2,4-Trichlorobenzene	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1,1-Trichloroethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,1,2-Trichloroethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Trichloroethene (TCE)	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Trichlorofluoromethane	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
1,2,3-Trichloropropane	ND	10		µg/L	5	11/1/2017 5:32:00 AM	A46777
Vinyl chloride	ND	5.0		µg/L	5	11/1/2017 5:32:00 AM	A46777
Xylenes, Total	79	7.5		µg/L	5	11/1/2017 5:32:00 AM	A46777
Surr: 1,2-Dichloroethane-d4	98.1	70-130		%Rec	5	11/1/2017 5:32:00 AM	A46777
Surr: 4-Bromofluorobenzene	99.1	70-130		%Rec	5	11/1/2017 5:32:00 AM	A46777
Surr: Dibromofluoromethane	99.2	70-130		%Rec	5	11/1/2017 5:32:00 AM	A46777
Surr: Toluene-d8	99.0	70-130		%Rec	5	11/1/2017 5:32:00 AM	A46777

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 9:52:00 AM
Lab ID: 1710F09-002 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	190	50		mg/L	100	10/30/2017 1:44:00 PM	R46764
Sulfate	2100	50	*	mg/L	100	10/30/2017 1:44:00 PM	R46764
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
Benzene	20	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Toluene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Ethylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2,4-Trimethylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Naphthalene	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1-Methylnaphthalene	ND	4.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2-Methylnaphthalene	ND	4.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Acetone	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Bromobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Bromodichloromethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Bromoform	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Bromomethane	ND	3.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2-Butanone	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Carbon disulfide	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Carbon Tetrachloride	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Chlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Chloroethane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Chloroform	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Chloromethane	ND	3.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2-Chlorotoluene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
4-Chlorotoluene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
cis-1,2-DCE	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Dibromochloromethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Dibromomethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,3-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,4-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Dichlorodifluoromethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1-Dichloroethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1-Dichloroethene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 9:52:00 AM
Lab ID: 1710F09-002 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
1,2-Dichloropropane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,3-Dichloropropane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2,2-Dichloropropane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Hexachlorobutadiene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
2-Hexanone	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Isopropylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
4-Isopropyltoluene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
4-Methyl-2-pentanone	ND	10		µg/L	1	11/1/2017 5:56:00 AM	A46777
Methylene Chloride	ND	3.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
n-Butylbenzene	ND	3.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
n-Propylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
sec-Butylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Styrene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
tert-Butylbenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
trans-1,2-DCE	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1,1-Trichloroethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,1,2-Trichloroethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Trichloroethene (TCE)	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Trichlorofluoromethane	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
1,2,3-Trichloropropane	ND	2.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Vinyl chloride	ND	1.0		µg/L	1	11/1/2017 5:56:00 AM	A46777
Xylenes, Total	ND	1.5		µg/L	1	11/1/2017 5:56:00 AM	A46777
Surr: 1,2-Dichloroethane-d4	99.0	70-130		%Rec	1	11/1/2017 5:56:00 AM	A46777
Surr: 4-Bromofluorobenzene	97.5	70-130		%Rec	1	11/1/2017 5:56:00 AM	A46777
Surr: Dibromofluoromethane	102	70-130		%Rec	1	11/1/2017 5:56:00 AM	A46777
Surr: Toluene-d8	96.2	70-130		%Rec	1	11/1/2017 5:56:00 AM	A46777

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 10:46:00 AM
Lab ID: 1710F09-003 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	180	50		mg/L	100	10/30/2017 2:08:48 PM	R46764
Sulfate	2000	50	*	mg/L	100	10/30/2017 2:08:48 PM	R46764
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
Benzene	130	10		µg/L	10	11/1/2017 6:43:00 AM	A46777
Toluene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Ethylbenzene	16	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2,4-Trimethylbenzene	2.1	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,3,5-Trimethylbenzene	1.8	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Naphthalene	9.2	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1-Methylnaphthalene	5.3	4.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2-Methylnaphthalene	ND	4.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Acetone	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Bromobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Bromodichloromethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Bromoform	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Bromomethane	ND	3.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2-Butanone	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Carbon disulfide	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Carbon Tetrachloride	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Chlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Chloroethane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Chloroform	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Chloromethane	ND	3.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2-Chlorotoluene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
4-Chlorotoluene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
cis-1,2-DCE	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Dibromochloromethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Dibromomethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,3-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,4-Dichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Dichlorodifluoromethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1-Dichloroethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1-Dichloroethene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812

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

Analytical Report
Lab Order **1710F09**
Date Reported: **11/2/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150
Collection Date: 10/24/2017 10:46:00 AM
Lab ID: 1710F09-003 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **RAA**	
1,2-Dichloropropane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,3-Dichloropropane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2,2-Dichloropropane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Hexachlorobutadiene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
2-Hexanone	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Isopropylbenzene	4.0	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
4-Isopropyltoluene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
4-Methyl-2-pentanone	ND	10		µg/L	1	11/1/2017 3:37:00 PM	A46812
Methylene Chloride	ND	3.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
n-Butylbenzene	ND	3.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
n-Propylbenzene	1.9	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
sec-Butylbenzene	1.4	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Styrene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
tert-Butylbenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
trans-1,2-DCE	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1,1-Trichloroethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,1,2-Trichloroethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Trichloroethene (TCE)	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Trichlorofluoromethane	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
1,2,3-Trichloropropane	ND	2.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Vinyl chloride	ND	1.0		µg/L	1	11/1/2017 3:37:00 PM	A46812
Xylenes, Total	ND	1.5		µg/L	1	11/1/2017 3:37:00 PM	A46812
Surr: 1,2-Dichloroethane-d4	103	70-130		%Rec	1	11/1/2017 3:37:00 PM	A46812
Surr: 4-Bromofluorobenzene	98.6	70-130		%Rec	1	11/1/2017 3:37:00 PM	A46812
Surr: Dibromofluoromethane	105	70-130		%Rec	1	11/1/2017 3:37:00 PM	A46812
Surr: Toluene-d8	98.6	70-130		%Rec	1	11/1/2017 3:37:00 PM	A46812

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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID	**LCS**	SampType:	**lcs**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**LCSW**	Batch ID:	**R46764**	RunNo:	**46764**					
Prep Date:		Analysis Date:	**10/30/2017**	SeqNo:	**1490509**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.9	0.50	5.000	0	98.9	90	110			
Sulfate	10	0.50	10.00	0	100	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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **100ng lcs2**	SampType: **LCS**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW**	Batch ID: **A46777**	RunNo: **46777**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1491518** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	20	1.0	20.00	0	102	70	130			
Toluene	20	1.0	20.00	0	97.8	70	130			
Chlorobenzene	20	1.0	20.00	0	99.8	70	130			
1,1-Dichloroethene	22	1.0	20.00	0	109	70	130			
Trichloroethene (TCE)	20	1.0	20.00	0	98.8	70	130			
Surr: 1,2-Dichloroethane-d4	10		10.00		101	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		100	70	130			
Surr: Dibromofluoromethane	9.9		10.00		98.6	70	130			
Surr: Toluene-d8	9.7		10.00		97.1	70	130			

Sample ID **rb3**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **A46777**	RunNo: **46777**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1491520** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								

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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **rb3**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **A46777**	RunNo: **46777**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1491520** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								

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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **rb3**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **A46777**	RunNo: **46777**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1491520** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.7		10.00		97.4	70	130			
Surr: 4-Bromofluorobenzene	9.9		10.00		98.7	70	130			
Surr: Dibromofluoromethane	10		10.00		102	70	130			
Surr: Toluene-d8	9.7		10.00		96.6	70	130			

Sample ID **100ng lcs**	SampType: **LCS4**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **BatchQC**	Batch ID: **A46812**	RunNo: **46812**
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1492499** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Toluene	19	1.0	20.00	0	95.9	70	130			
Ethylbenzene	19	1.0	20.00	0	96.5	70	130			
Methyl tert-butyl ether (MTBE)	42	1.0	40.00	0	106	70	130			
1,2,4-Trimethylbenzene	19	1.0	20.00	0	95.1	70	130			
1,3,5-Trimethylbenzene	19	1.0	20.00	0	93.6	70	130			
1,2-Dichloroethane (EDC)	20	1.0	20.00	0	99.7	62.2	143			
1,2-Dibromoethane (EDB)	20	1.0	20.00	0	102	70	130			
Naphthalene	19	2.0	20.00	0	96.3	70	130			
1-Methylnaphthalene	20	4.0	20.00	0	101	60	140			
2-Methylnaphthalene	15	4.0	20.00	0	76.4	60	140			
Acetone	38	10	40.00	0	95.4	60	140			
Bromobenzene	20	1.0	20.00	0	97.8	70	130			
Bromodichloromethane	20	1.0	20.00	0	101	70	130			
Bromoform	20	1.0	20.00	0	100	70	130			
Bromomethane	17	3.0	20.00	0	83.5	60	140			
2-Butanone	47	10	40.00	0	117	60	140			
Carbon disulfide	41	10	40.00	0	102	60	140			
Carbon Tetrachloride	20	1.0	20.00	0	99.3	70	130			
Chlorobenzene	20	1.0	20.00	0	97.7	70	130			
Chloroethane	20	2.0	20.00	0	98.7	60	140			
Chloroform	20	1.0	20.00	0	101	70	130			
Chloromethane	21	3.0	20.00	0	105	60	140			
2-Chlorotoluene	19	1.0	20.00	0	94.9	70	130			
4-Chlorotoluene	19	1.0	20.00	0	96.0	70	130			
cis-1,2-DCE	21	1.0	20.00	0	105	70	130			
cis-1,3-Dichloropropene	19	1.0	20.00	0	93.8	70	130			
1,2-Dibromo-3-chloropropane	20	2.0	20.00	0	102	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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **100ng lcs** SampType: **LCS4** TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **BatchQC** Batch ID: **A46812** RunNo: **46812**
Prep Date: Analysis Date: **11/1/2017** SeqNo: **1492499** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Dibromochloromethane	19	1.0	20.00	0	92.9	70	130			
Dibromomethane	21	1.0	20.00	0	107	70	130			
1,2-Dichlorobenzene	19	1.0	20.00	0	94.4	70	130			
1,3-Dichlorobenzene	19	1.0	20.00	0	94.6	70	130			
1,4-Dichlorobenzene	19	1.0	20.00	0	95.1	67.2	141			
Dichlorodifluoromethane	23	1.0	20.00	0	115	60	140			
1,1-Dichloroethane	21	1.0	20.00	0	104	52.6	157			
1,1-Dichloroethene	20	1.0	20.00	0	100	70	130			
1,2-Dichloropropane	20	1.0	20.00	0	102	63.7	138			
1,3-Dichloropropane	20	1.0	20.00	0	99.0	70	130			
2,2-Dichloropropane	21	2.0	20.00	0	105	70	130			
1,1-Dichloropropene	20	1.0	20.00	0	101	70	130			
Hexachlorobutadiene	18	1.0	20.00	0	88.4	70	130			
2-Hexanone	42	10	40.00	0	104	60	140			
Isopropylbenzene	19	1.0	20.00	0	96.1	70	130			
4-Isopropyltoluene	19	1.0	20.00	0	95.6	70	130			
4-Methyl-2-pentanone	45	10	40.00	0	112	60	140			
Methylene Chloride	21	3.0	20.00	0	104	70	130			
n-Butylbenzene	18	3.0	20.00	0	90.7	70	130			
n-Propylbenzene	19	1.0	20.00	0	94.6	70	130			
sec-Butylbenzene	18	1.0	20.00	0	92.1	70	130			
Styrene	19	1.0	20.00	0	95.1	70	130			
tert-Butylbenzene	19	1.0	20.00	0	92.7	70	130			
1,1,1,2-Tetrachloroethane	19	1.0	20.00	0	94.6	70	130			
1,1,2,2-Tetrachloroethane	22	2.0	20.00	0	108	65.9	133			
Tetrachloroethene (PCE)	20	1.0	20.00	0	100	70	130			
trans-1,2-DCE	20	1.0	20.00	0	100	70	130			
trans-1,3-Dichloropropene	18	1.0	20.00	0	91.2	70	130			
1,2,3-Trichlorobenzene	19	1.0	20.00	0	94.9	70	130			
1,2,4-Trichlorobenzene	19	1.0	20.00	0	92.5	70	130			
1,1,1-Trichloroethane	20	1.0	20.00	0	98.6	70	130			
1,1,2-Trichloroethane	20	1.0	20.00	0	99.2	70	130			
Trichloroethene (TCE)	20	1.0	20.00	0	99.8	70	130			
Trichlorofluoromethane	21	1.0	20.00	0	104	70	130			
1,2,3-Trichloropropane	21	2.0	20.00	0	106	69.7	129			
Vinyl chloride	20	1.0	20.00	0	99.6	70	130			
Xylenes, Total	58	1.5	60.00	0	95.9	70	130			
Surr: 1,2-Dichloroethane-d4	9.9		10.00		99.0	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		100	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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **100ng lcs**	SampType: **LCS4**	TestCode: **EPA Method 8260B: VOLATILES**						
Client ID: **BatchQC**	Batch ID: **A46812**	RunNo: **46812**						
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1492499**	Units: **µg/L**					

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Dibromofluoromethane	10		10.00		101	70	130			
Surr: Toluene-d8	9.8		10.00		98.2	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**						
Client ID: **PBW**	Batch ID: **A46812**	RunNo: **46812**						
Prep Date:	Analysis Date: **11/1/2017**	SeqNo: **1492500**	Units: **µg/L**					

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								

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#: **1710F09**
02-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **rb**	SampType: **MBLK**		TestCode: **EPA Method 8260B: VOLATILES**		
Client ID: **PBW**	Batch ID: **A46812**		RunNo: **46812**		
Prep Date:	Analysis Date: **11/1/2017**		SeqNo: **1492500**	Units: **µg/L**	

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	10		10.00		102	70	130			
Surr: 4-Bromofluorobenzene	9.8		10.00		98.3	70	130			
Surr: Dibromofluoromethane	10		10.00		105	70	130			
Surr: Toluene-d8	9.6		10.00		95.8	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: 1710F09 RcptNo: 1

Received By: Richie Eriacho 10/26/2017 10:00:00 AM

Completed By: Ashley Gallegos 10/27/2017 4:03:35 PM

Reviewed By: SRR 10/30/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. 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: _____

17. Additional remarks: 1 VOA from each sample was received broken from being frozen.

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.4	Good	Yes			

1115 RR 10/30/17

Chain-of-Custody Record

Client: R. T. Hicks Consultants

Mailing Address: 901 Rio Grande Blvd NW, Suite F-142, Albuquerque, NM 87104

Phone #: (505) 266-5004

email or Fax#: R@rthicksconsult.com

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

Accreditation:
☐ NELAP ☐ Other
☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush

Project Name: Lime Rock - ASAU #150

Project #:

Project Manager: Kristin Pope (575) 302-6755

Sampler: M. Stubblefield

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.2+0.2 = 1.4

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. 1710F09	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) long list	8270 (Semi-VOA)					Air Bubbles (Y or N)
10/23/17	1153	water	MW-2	3 VOA	HgCl, ice	-001										X						
10/23/17	1153	water	MW-2	1 HDP	ice									X								
10/23/17	0952	water	MW-3	3 VOA	HgCl, ice	-002										X						
10/23/17	0952	water	MW-3	1 HDP	ice									X								
10/23/17	1046	water	MW-4	3 VOA	HgCl, ice	-003										X						
10/23/17	1046	water	MW-4	1 HDP	ice									X								

KP/m.s. 10-24-2017

Date:	Time:	Relinquished by:	Received by:	Date	Time
10/25/2017	2:15A	Mike Stubblefield		10/26/17	1000
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email to R@rthicksconsult.com, kristin..., mike...

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.

Courier

Appendix B

Hydrocarbon Characterization Sampling Summary and Laboratory Reports

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

Appendix B – Hydrocarbon Characterization Sampling

As requested by NMOCD at a meeting on August 23, 2017, samples were collected from the top of the water column as a means to characterize the extent and magnitude of hydrocarbon constituents. As specified by NMOCD and in accordance with the submitted plan, these samples were collected on September 11, 2017 using a bailer. Results of this characterization event were reported to NMOCD on October 9, 2017.

For further characterization and comparison, we informed NMOCD that after collecting the last quarterly samples, we would then collect samples from the top of the water column using a low-flow pump. During a phone discussion, Mr. Billings requested the full spectrum of Method 8260B analysis for volatiles and also TPH 8015B analysis of the characterization samples. A summary of the two characterization sampling events using the two collection methods are shown in Table 2 below and associated laboratory reports are in Appendix B. As mentioned in the laboratory report for the October 24 event, samples were collected for 8260 and 8015 analyses but the transport cooler was packed too tightly with ice and many of the containers arrived broken. The laboratory informed us that DRO and MRO analyses were not possible and GRO was only available for MW-3 and MW-4 samples.

Hydrocarbon Characterization Samples from Top of Water Column

Well ID	Method	Date	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total BTEX	Naph-thalene	GRO* mg/L	Observations
MW-2	bailer	9/11/2017	370	ND	51	66	487	*not analyzed*	*not analyzed*	Sheen; film on bailer
MW-2	low flow pump	10/24/2017	*No analyses; Sample containers arrived at lab frozen and broken*							Collected from top of column after low-flow sampling of well from middle of column
MW-3	bailer	9/11/2017	41	ND	ND	ND	41	*not analyzed*	*not analyzed*	Turbid at 1st attempt; waited 2 hrs, sample is silty
MW-3	low flow pump	10/24/2017	29	ND	ND	ND	*not analyzed*	ND	0.067	Collected from top of column after low-flow sampling of well from middle of column
MW-4	bailer	9/11/2017	3300	ND	470	ND	3770	*not analyzed*	*not analyzed*	Clear
MW-4	low flow pump	10/24/2017	300	ND	86	ND	*not analyzed*	56	2.5	Collected from top of column after low-flow sampling of well from middle of column

all concentrations are µg/L except GRO

* GRO, DRO, MRO analyses requested but containers arrived frozen and broken

Table 2

These comparative analyses suggest that low-flow sampling delivers considerably lower concentrations than those collected using a bailer; however, both methods confirm that MW-3 and MW-4 exceed the WQCC benzene standard.

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

September 21, 2017

Kristin Pope

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: Lime Rock ASAU 150 Release OrderNo.: 1709837

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 9/14/2017 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 **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 10:40:00 AM
Lab ID: 1709837-001 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	370	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Toluene	ND	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Ethylbenzene	51	5.0		µg/L	10	9/20/2017 8:04:00 AM	B45748
Xylenes, Total	66	10		µg/L	10	9/20/2017 8:04:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	90.3	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: 4-Bromofluorobenzene	95.8	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Dibromofluoromethane	96.7	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748
Surr: Toluene-d8	90.4	70-130		%Rec	10	9/20/2017 8:04:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 12:08:00 PM
Lab ID: 1709837-002 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	41	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Toluene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Ethylbenzene	ND	1.0		µg/L	1	9/20/2017 8:28:00 AM	B45748
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:28:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	91.6	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Dibromofluoromethane	96.9	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748
Surr: Toluene-d8	91.1	70-130		%Rec	1	9/20/2017 8:28:00 AM	B45748

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

Analytical Report
Lab Order **1709837**
Date Reported: **9/21/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4
Project: Lime Rock ASAU 150 Release
Collection Date: 9/11/2017 11:28:00 AM
Lab ID: 1709837-003 **Matrix:** AQUEOUS **Received Date:** 9/14/2017 9:42:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	3300	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Toluene	ND	1.0		µg/L	1	9/20/2017 8:52:00 AM	B45748
Ethylbenzene	470	100		µg/L	100	9/20/2017 8:01:00 PM	SL45765
Xylenes, Total	ND	1.5		µg/L	1	9/20/2017 8:52:00 AM	B45748
Surr: 1,2-Dichloroethane-d4	97.0	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: 4-Bromofluorobenzene	96.5	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Dibromofluoromethane	95.8	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748
Surr: Toluene-d8	89.2	70-130		%Rec	1	9/20/2017 8:52:00 AM	B45748

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#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **100ng lcs2**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453586** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	22	1.0	20.00	0	110	70	130			
Toluene	20	1.0	20.00	0	98.6	70	130			
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.6	70	130			
Surr: 4-Bromofluorobenzene	9.6		10.00		95.5	70	130			
Surr: Dibromofluoromethane	9.7		10.00		97.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb2**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **B45748**	RunNo: **45748**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1453587** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.0		10.00		89.7	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		94.8	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		88.6	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454013** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	21	1.0	20.00	0	107	70	130			
Surr: 1,2-Dichloroethane-d4	9.2		10.00		91.6	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		95.4	70	130			
Surr: Dibromofluoromethane	9.5		10.00		95.5	70	130			
Surr: Toluene-d8	8.9		10.00		89.0	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Ethylbenzene	ND	1.0								
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.9	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#: **1709837**

21-Sep-17

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150 Release

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL45765**	RunNo: **45765**
Prep Date:	Analysis Date: **9/20/2017**	SeqNo: **1454014** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 4-Bromofluorobenzene	9.6		10.00		95.6	70	130			
Surr: Dibromofluoromethane	9.6		10.00		96.4	70	130			
Surr: Toluene-d8	8.9		10.00		89.3	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: 1709837 RcptNo: 1

Received By: Isaiah Ortiz 9/14/2017 9:42:00 AM

Completed By: Ashley Gallegos 9/15/2017 9:43:33 AM

Reviewed By: 9/15/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. 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: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

RT

Chain-of-Custody Record

Turn-Around Time:

☒ Standard ☐ Rush

Project Name: ~~Murchison~~ Lime Rock - ASAU #150 Release

Project #:

Project Manager:

Kristin Pope

Sampler: ~~Kristin Pope~~ M. Stubblefield

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.0

sult.com

QA/QC Package:

☐ Standard ☐ Level 4 (Full Validation)

Accreditation:

☐ NELAP ☐ Other ______

☐ EDD (Type) ______

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

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1709837	(BTEX) + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel) /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)	8270 (Semi-VOA)		100 grams			Air Bubbles (Y or N)
9/11/17	1040	grd water	MW-2	3 VOA 40-mL glass	ice, HgCl2	-001	X															
"	1208	"	MW-3	"	"	-002	X															
"	1128	"	MW-4	"	"	-003	X															

Date	Time	Relinquished by	Received by	Date	Time
8/13/2017	9:00Am	[signature]	[signature]	9/14/17	0942
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email results to R, kristin@rthicksconsult.com, mike@ "

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

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

November 07, 2017

Kristin Pope

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: ASAU 150 Characterization OrderNo.: 1710E76

Dear Kristin Pope:

Hall Environmental Analysis Laboratory received 3 sample(s) on 10/26/2017 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 **1710E76**
Date Reported: **11/7/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3 @ 49ft
Project: ASAU 150 Characterization
Collection Date: 10/24/2017 9:55:00 AM
Lab ID: 1710E76-002 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **DJF**	
Gasoline Range Organics (GRO)	0.067	0.050		mg/L	1	11/3/2017 4:53:24 PM	G46875
Surr: BFB	98.1	70-130		%Rec	1	11/3/2017 4:53:24 PM	G46875
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
Benzene	29	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Toluene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Ethylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2,4-Trimethylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Naphthalene	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1-Methylnaphthalene	ND	4.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2-Methylnaphthalene	ND	4.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Acetone	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Bromobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Bromodichloromethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Bromoform	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Bromomethane	ND	3.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2-Butanone	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Carbon disulfide	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Carbon Tetrachloride	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Chlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Chloroethane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Chloroform	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Chloromethane	ND	3.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2-Chlorotoluene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
4-Chlorotoluene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
cis-1,2-DCE	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Dibromochloromethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Dibromomethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,3-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,4-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Dichlorodifluoromethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1-Dichloroethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1-Dichloroethene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875

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Analytical Report
Lab Order **1710E76**
Date Reported: **11/7/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3 @ 49ft
Project: ASAU 150 Characterization
Collection Date: 10/24/2017 9:55:00 AM
Lab ID: 1710E76-002 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
1,2-Dichloropropane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,3-Dichloropropane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2,2-Dichloropropane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Hexachlorobutadiene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
2-Hexanone	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Isopropylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
4-Isopropyltoluene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
4-Methyl-2-pentanone	ND	10		µg/L	1	11/3/2017 4:53:24 PM	W46875
Methylene Chloride	ND	3.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
n-Butylbenzene	ND	3.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
n-Propylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
sec-Butylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Styrene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
tert-Butylbenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
trans-1,2-DCE	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1,1-Trichloroethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,1,2-Trichloroethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Trichloroethene (TCE)	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Trichlorofluoromethane	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
1,2,3-Trichloropropane	ND	2.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Vinyl chloride	ND	1.0		µg/L	1	11/3/2017 4:53:24 PM	W46875
Xylenes, Total	ND	1.5		µg/L	1	11/3/2017 4:53:24 PM	W46875
Surr: 1,2-Dichloroethane-d4	106	70-130		%Rec	1	11/3/2017 4:53:24 PM	W46875
Surr: 4-Bromofluorobenzene	109	70-130		%Rec	1	11/3/2017 4:53:24 PM	W46875
Surr: Dibromofluoromethane	105	70-130		%Rec	1	11/3/2017 4:53:24 PM	W46875
Surr: Toluene-d8	101	70-130		%Rec	1	11/3/2017 4:53:24 PM	W46875

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
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Analytical Report
Lab Order **1710E76**
Date Reported: **11/7/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4 @ 50ft
Project: ASAU 150 Characterization
Collection Date: 10/24/2017 10:50:00 AM
Lab ID: 1710E76-003 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **DJF**	
Gasoline Range Organics (GRO)	2.5	0.050		mg/L	1	11/3/2017 5:22:29 PM	G46875
Surr: BFB	94.9	70-130		%Rec	1	11/3/2017 5:22:29 PM	G46875
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
Benzene	300	20		µg/L	20	11/6/2017 12:38:21 PM	W46900
Toluene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Ethylbenzene	86	20		µg/L	20	11/6/2017 12:38:21 PM	W46900
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2,4-Trimethylbenzene	40	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,3,5-Trimethylbenzene	21	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Naphthalene	56	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1-Methylnaphthalene	34	4.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2-Methylnaphthalene	ND	4.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Acetone	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Bromobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Bromodichloromethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Bromoform	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Bromomethane	ND	3.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2-Butanone	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Carbon disulfide	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Carbon Tetrachloride	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Chlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Chloroethane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Chloroform	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Chloromethane	ND	3.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2-Chlorotoluene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
4-Chlorotoluene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
cis-1,2-DCE	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Dibromochloromethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Dibromomethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,3-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,4-Dichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Dichlorodifluoromethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1-Dichloroethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1-Dichloroethene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875

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

Analytical Report
Lab Order **1710E76**
Date Reported: **11/7/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4 @ 50ft
Project: ASAU 150 Characterization
Collection Date: 10/24/2017 10:50:00 AM
Lab ID: 1710E76-003 **Matrix:** AQUEOUS **Received Date:** 10/26/2017 10:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
1,2-Dichloropropane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,3-Dichloropropane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2,2-Dichloropropane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Hexachlorobutadiene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
2-Hexanone	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Isopropylbenzene	47	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
4-Isopropyltoluene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
4-Methyl-2-pentanone	ND	10		µg/L	1	11/3/2017 5:22:29 PM	W46875
Methylene Chloride	ND	3.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
n-Butylbenzene	ND	3.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
n-Propylbenzene	32	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
sec-Butylbenzene	7.5	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Styrene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
tert-Butylbenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
trans-1,2-DCE	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1,1-Trichloroethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,1,2-Trichloroethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Trichloroethene (TCE)	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Trichlorofluoromethane	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
1,2,3-Trichloropropane	ND	2.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Vinyl chloride	ND	1.0		µg/L	1	11/3/2017 5:22:29 PM	W46875
Xylenes, Total	ND	1.5		µg/L	1	11/3/2017 5:22:29 PM	W46875
Surr: 1,2-Dichloroethane-d4	102	70-130		%Rec	1	11/3/2017 5:22:29 PM	W46875
Surr: 4-Bromofluorobenzene	102	70-130		%Rec	1	11/3/2017 5:22:29 PM	W46875
Surr: Dibromofluoromethane	99.9	70-130		%Rec	1	11/3/2017 5:22:29 PM	W46875
Surr: Toluene-d8	101	70-130		%Rec	1	11/3/2017 5:22:29 PM	W46875

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#: **1710E76**
07-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: ASAU 150 Characterization

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **W46875**	RunNo: **46875**
Prep Date:	Analysis Date: **11/3/2017**	SeqNo: **1495595** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								

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#: **1710E76**
07-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: ASAU 150 Characterization

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **W46875**	RunNo: **46875**
Prep Date:	Analysis Date: **11/3/2017**	SeqNo: **1495595** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	10		10.00		101	70	130			
Surr: 4-Bromofluorobenzene	11		10.00		106	70	130			
Surr: Dibromofluoromethane	10		10.00		102	70	130			
Surr: Toluene-d8	10		10.00		100	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW**	Batch ID: **W46875**	RunNo: **46875**
Prep Date:	Analysis Date: **11/3/2017**	SeqNo: **1495597** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	20	1.0	20.00	0	99.8	70	130			
Toluene	20	1.0	20.00	0	102	70	130			
Chlorobenzene	21	1.0	20.00	0	105	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#: **1710E76**
07-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: ASAU 150 Characterization

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260B: VOLATILES**						
Client ID: **LCSW**	Batch ID: **W46875**	RunNo: **46875**						
Prep Date:	Analysis Date: **11/3/2017**	SeqNo: **1495597**	Units: **µg/L**					

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloroethene	23	1.0	20.00	0	114	70	130			
Trichloroethene (TCE)	18	1.0	20.00	0	91.7	70	130			
Surr: 1,2-Dichloroethane-d4	10		10.00		103	70	130			
Surr: 4-Bromofluorobenzene	11		10.00		108	70	130			
Surr: Dibromofluoromethane	10		10.00		104	70	130			
Surr: Toluene-d8	10		10.00		104	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**						
Client ID: **PBW**	Batch ID: **W46900**	RunNo: **46900**						
Prep Date:	Analysis Date: **11/6/2017**	SeqNo: **1496555**	Units: **µg/L**					

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Ethylbenzene	ND	1.0								
Surr: 1,2-Dichloroethane-d4	9.5		10.00		94.8	70	130			
Surr: 4-Bromofluorobenzene	11		10.00		108	70	130			
Surr: Dibromofluoromethane	9.7		10.00		96.8	70	130			
Surr: Toluene-d8	10		10.00		102	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260B: VOLATILES**						
Client ID: **LCSW**	Batch ID: **W46900**	RunNo: **46900**						
Prep Date:	Analysis Date: **11/6/2017**	SeqNo: **1496556**	Units: **µg/L**					

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	18	1.0	20.00	0	89.5	70	130			
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.6	70	130			
Surr: 4-Bromofluorobenzene	11		10.00		105	70	130			
Surr: Dibromofluoromethane	9.4		10.00		93.9	70	130			
Surr: Toluene-d8	9.8		10.00		97.9	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#: **1710E76**
07-Nov-17

Client: R.T. Hicks Consultants, LTD
Project: ASAU 150 Characterization

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBW**	Batch ID: **G46875**	RunNo: **46875**
Prep Date:	Analysis Date: **11/3/2017**	SeqNo: **1495610** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.050								
Surr: BFB	9.5		10.00		95.1	70	130			

Sample ID **2.5ug gro lcs**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSW**	Batch ID: **G46875**	RunNo: **46875**
Prep Date:	Analysis Date: **11/3/2017**	SeqNo: **1495611** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.54	0.050	0.5000	0	108	70	130			
Surr: BFB	9.7		10.00		96.6	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

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: 1710E76 RcptNo: 1

Received By: Richie Eriacho 10/26/2017 10:00:00 AM
Completed By: Ashley Gallegos 10/27/2017 12:45:56 PM
Reviewed By: IMO 10/27/17

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

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

Special Handling (if applicable)

16. 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:

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.4	Good	Yes			

Chain-of-Custody Record

Client: R. T. Hicks Consultants

Mailing Address: 901 Rio Grande Blvd NW, Suite F-142, Albuquerque, NM 87104

Phone #: (505) 266-5004

email or Fax#: R@rthicksconsult.com

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

Accreditation: ☐ NELAP ☐ Other ☐ EDD (Type)

Turn-Around Time: ☒ Standard ☐ Rush

Project Name: ASAU #150 CHARACTERIZATION

Project #:

Project Manager: Kristin Pope (575) 302-6755

Sampler: M. Stubblefield

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.2+0.2=1.4

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. 1710E760	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) long list	8270 (Semi-VOA)	Air Bubbles (Y or N)
10/23/17	1203	water	MW-2 @ 53 ft	3 VOA	HgCl, ice	-001										X		
10/23/17	1203	water	MW-2 @ 53 ft	1 amber	ice				X									
10/23/17	0955	water	MW-3 @ 49 ft	3 VOA	HgCl, ice	-002										X		
10/23/17	0955	water	MW-3 @ 49 ft	1 amber	ice				X									
10/23/17	1050	water	MW-4 @ 50 ft	3 VOA	HgCl, ice	-003										X		
10/23/17	1050	water	MW-4 @ 50 ft	1 amber	ice				X									

10-24-2017 KP

Date:	Time:	Relinquished by	Received by	Date	Time
				10/26/17	1000
Date:	Time:	Relinquished by:	Received by	Date	Time

Remarks: Email to R@rthicksconsult.com, kristin..., mike...
B266 for all - GRO only for MW-3 and MW-4
No DRO Bottles frozen during shipping 10/27
spoke w/ Kristin.

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.

Courier

Appendix C

LNAPL Analysis and Comparison

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

Appendix C – LNAPL Characterization & Comparison

We performed characterization of the floating oil in MW-1 by bailing a sample on October 24 according to the proposal submitted to NMOCD of October 9. The sample was submitted to Laboratory Services of Hobbs for LNAPL analysis. On October 26, Lime Rock collected three samples of crude from the same service line as the ASAU #150 release and submitted those samples to the same laboratory for specific gravity, sulfur percentage, and API gravity analyses. Table 3 summarizes the comparative analyses of these samples and full laboratory reports are located in Appendix C.

Comparison of product in MW-1 to product in Lime Rock system

									Calculated by R.T. Hicks Consultants								
Well ID	**Sample Date**	**Total Sulfer** wt.%	**API Gravity**	**Specific Gravity**	**Benzene** wt %	**Toluene** wt %	**Ethyl Benzene** wt %	**Xylenes** wt %	**BTEX** %	**Benzene** mg/kg	**Toluene** mg/kg	**Ethyl Benzene** mg/kg	**Xylenes** mg/kg	**Benzene /BTEX**	**T/BTEX**	**E/BTEX**	**X/BTEX**
MW-1	10/24/2017	0.000	39.9	0.8254	0.5737	2.2494	0.5931	3.1928	6.609	5737	22494	5931	31928	9%	34%	9%	48%
Atoka San Andres #150	10/26/2017	0.811	39.2	0.8289	Not Analyzed												
Atoka San Andres #152	10/26/2017	0.995	38.8	0.8308													
Atoka San Andres #153	10/26/2017	0.797	39.0	0.8299													

Table 3

API gravities and specific gravities of the Lime Rock samples are similar to those of the MW-1 LNAPL. When sulfur percentage is compared amongst the samples, sulfur in the MW-1 LNAPL is noticeably absent. No further analysis is planned.

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Total Sulfur in Crude

Lime Rock Resources
Attention: Jerry Smith
1111 Bagby Street, Suite 4700A
Houston, Texas 77002

10/26/17

	Total Sulfur	API Gravity	Specific Gravity
Atoka San Andres #150	0.811 wt.%	39.2	0.8289
Atoka San Andres #152	0.995 wt.%	38.8	0.8308
Atoka San Andres #153	0.797 wt.%	39.0	0.8299

Test Method ASTM D4294 Sulfur
Test Method ASTM D287 API Gravity

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SUMMARY OF CHROMATOGRAPHIC ANALYSIS

COMPANY:		**JOB #:**	1710005
SAMPLE ID:	CRUDE OIL	**SAMPLE #:**	1710005-01
SAMPLE TYPE:	SPOT	**DATE ON:**	
STATION:	ASAU #150	**DATE OFF:**	
SAMPLE PRESS.,psig:	AMBIENT	**TIME ON:**	
SAMPLE TEMPERATURE, F	AMBIENT	**TIME OFF:**	
ANALYSIS DATE:	10/24/2017	**SAMPLED BY:**	CLIENT
ANALYSIS COMMENTS:		**ANALYST:**	JAMES R. PRITCHARD

COMPONENT	MOLE %	WEIGHT %	VOLUME %
HYDROGEN SULFIDE	0.0000	0.0000	0.0000
NITROGEN	0.0000	0.0000	0.0000
OXYGEN	0.0000	0.0000	0.0000
METHANE	0.0000	0.0000	0.0000
CARBON DIOXIDE	0.0000	0.0000	0.0000
ETHANE	0.0005	0.0001	0.0002
PROPANE	0.0057	0.0016	0.0024
ISO-BUTANE	0.0935	0.0341	0.0465
N-BUTANE	1.6601	0.6047	0.7944
ISO-PENTANE	4.6758	2.1143	2.5974
N-PENTANE (C-5)	5.0364	2.2773	2.7687
2,2 DIMETHYL BUTANE	0.6106	0.3298	0.3873
CYCLOPENTANE	0.1158	0.0509	0.0514
2-METHYLPENTANE	3.0578	1.6516	1.9266
3-METHYLPENTANE	1.5775	0.8520	0.9773
N-HEXANE (C-6)	2.2729	1.2276	1.4191
METHYLCYCLOPENTANES	1.9131	1.0091	1.0270
BENZENE	1.1719	0.5737	0.4986
CYCLOHEXANE	3.2994	1.7403	1.7044
2-METHYLHEXANE	0.3896	0.2447	0.2752
3-METHYLHEXANE	1.2879	0.8088	0.8958
DIMETHYLCYCLOPENTANES	0.5196	0.3198	0.3245
HEPTANES	1.6775	1.0534	1.1744
N-HEPTANE (C-7)	1.8477	1.1603	1.2936
METHYLCYCLOHEXANE	3.3898	2.0431	2.0236
2-2-4 TRIMETHYLPENTANE	0.5633	0.4033	0.3994
TOLUENE	3.8953	2.2494	1.9742
OCTANES	4.0178	2.8764	3.1220
N-OCTANE (C-8)	1.4068	1.0071	1.0931
ETHYL BENZENE	0.8914	0.5931	0.5205
P-M-XYLENE	3.5421	2.3569	2.0834
O-XYLENE	1.2562	0.8359	0.7249
NONANES	3.9103	3.1433	3.3414
N-NONANE (C-9)	1.2156	0.9771	1.0387

CALCULATED PARAMETERS	
TOTAL ANALYSIS SUMMARY	
AVE MOLE WT	159.5593
SP GRAV, 60F/60	0.8254
API GRAVITY	39.9
REL DENS, AIR=1	5.5090
VAPOR PRESS PSIA	3.83
HEXANES PLUS SUMMARY	
AVE MOLE WT	171.1664
SP GRAV, 60F/60	0.8518
API GRAVITY	34.6
LBS/GAL	6.815
REL DENS, AIR=1	5.9097
VAPOR PRESS PSIA	1.30
BTEX SUMMARY	
WT % BENZENE	0.5737
WT % TOLUENE	2.2494
WT % E BENZENE	0.5931
WT % XYLENES	3.1928
DECANES PLUS SUMMARY	
AVE MOLE WT	240.8143
SP GRAV, 60F/60	0.9443
API GRAVITY	18.4
LBS/GAL	7.555
REL DENS, AIR=1	8.3144
VAPOR PRESS PSIA	0.01

CONTINUED ON NEXT PAGE

ASAU #150
CRUDE OIL

COMPONENT	MOLE %	WEIGHT %	VOLUME %
DECANES	4.8375	4.3136	4.5083
N-DECANE (C-10)	2.0498	1.8278	1.9103
UNDECANES	3.3145	3.2470	3.3465
N-UNDECANE (C-11)	0.7495	0.7342	0.7567
DODECANES	1.8728	1.9993	2.0379
N-DODECANE (C-12)	0.5349	0.5710	0.5820
TRIDECANES	1.4069	1.6256	1.6374
N-TRIDECANE (C-13)	0.4490	0.5188	0.5226
TETRADECANES	1.0049	1.2495	1.2560
N-TETRADECANE (C-14)	0.3807	0.4733	0.4758
PENTADECANES	0.7394	0.9844	0.9782
N-PENTADECANE (C-15)	0.2948	0.3925	0.3900
HEXADECANES	0.4035	0.5726	0.5653
N-HEXADECANE (C-16)	0.2199	0.3121	0.3081
HEPTADECANES	0.3733	0.5626	0.5537
N-HEPTADECANE (C-17)	0.1980	0.2984	0.2937
OCTADECANES	0.3563	0.5683	0.5577
N-OCTADECANE (C-18)	0.1490	0.2377	0.2333
NONADECANES	0.1952	0.3285	0.3203
N-NONADECANE (C-19)	0.1556	0.2619	0.2554
EICOSANES	0.1232	0.2182	0.2116
N-EICOSANES (C-20)	0.1112	0.1969	0.1909
HENEICOSANE + (C-21+)	24.7782	45.9661	43.6223
TOTALS	100.0000	100.0000	100.0000

CRUDE OIL FINGERPRINT
C-n/C-13 RATIO SUMMARY

C-n	C-n/C-13
10.0	3.523
11.0	1.415
12.0	1.101
13.0	1.000
14.0	0.912
15.0	0.757
16.0	0.602
17.0	0.575
18.0	0.458
19.0	0.505
20.0	0.380

BIO-MARKER SUMMARY

Farnesane/C-14	0.128
Pristane/C-17	0.659
Phytane/C-18	0.679
Wt. % Sulfur	0.0000
Gravity, API @ 60 F	0.0

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SUMMARY OF CHROMATOGRAPHIC ANALYSIS

COMPANY:		**JOB #:**	1710005
SAMPLE ID:	CRUDE OIL	**SAMPLE #:**	1710005-01
SAMPLE TYPE:	SPOT	**DATE ON:**	
STATION:	ASAU #150	**DATE OFF:**	
SAMPLE PRESS.,psig:	AMBIENT	**TIME ON:**	
SAMPLE TEMPERATURE, F	AMBIENT	**TIME OFF:**	
ANALYSIS DATE:	10/24/2017	**SAMPLED BY:**	CLIENT
ANALYSIS COMMENTS:		**ANALYST:**	JAMES R. PRITCHARD

TANKS DATA INPUT REPORT

COMPONENT	MOLE %	WEIGHT %	VOLUME %
CARBON DIOXIDE	0.0000	0.0000	0.0000
NITROGEN	0.0000	0.0000	0.0000
METHANE	0.0000	0.0000	0.0000
ETHANE	0.0005	0.0001	0.0002
PROPANE	0.0057	0.0016	0.0024
ISO-BUTANE	0.0935	0.0341	0.0465
N-BUTANE	1.6601	0.6047	0.7944
ISO-PENTANE	4.6758	2.1143	2.5974
N-PENTANE	5.0364	2.2773	2.7687
N-HEXANE	2.2729	1.2276	1.4191
OTHER HEXANES	10.5742	5.6337	6.0740
HEPTANES	9.1121	5.6301	5.9871
OCTANES	5.4246	3.8835	4.2151
NONANES	5.1259	4.1204	4.3801
BENZENE	1.1719	0.5737	0.4986
TOLUENE	3.8953	2.2494	1.9742
ETHYLBENZENE	0.8914	0.5931	0.5205
XYLENES	4.7983	3.1928	2.8083
2,2,4 TRIMETHYLPENTANE	0.5633	0.4033	0.3994
DECANES PLUS	44.6981	67.4603	65.5140
TOTAL	100.0000	100.0000	100.0000

CALCULATED PARAMETERS

TOTAL ANALYSIS SUMMARY

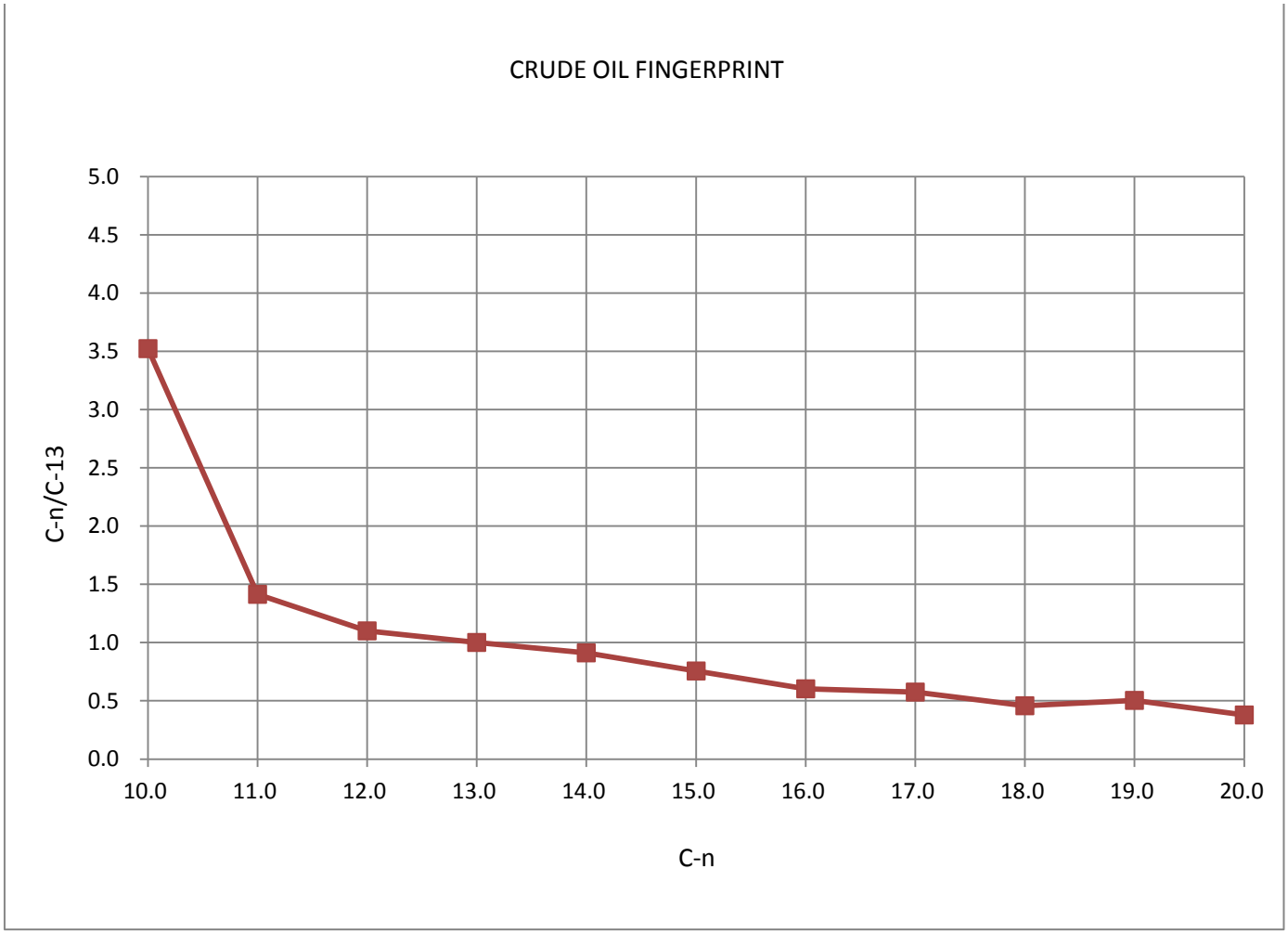
AVE MOLE WT	159.5593
SP GRAV, 60F/60	0.8254
API GRAVITY	39.9
REL DENS, AIR=1	5.5090
VAPOR PRESS PSIA	3.83
CU FT VAPOR/GAL	18.09

DECANES PLUS SUMMARY

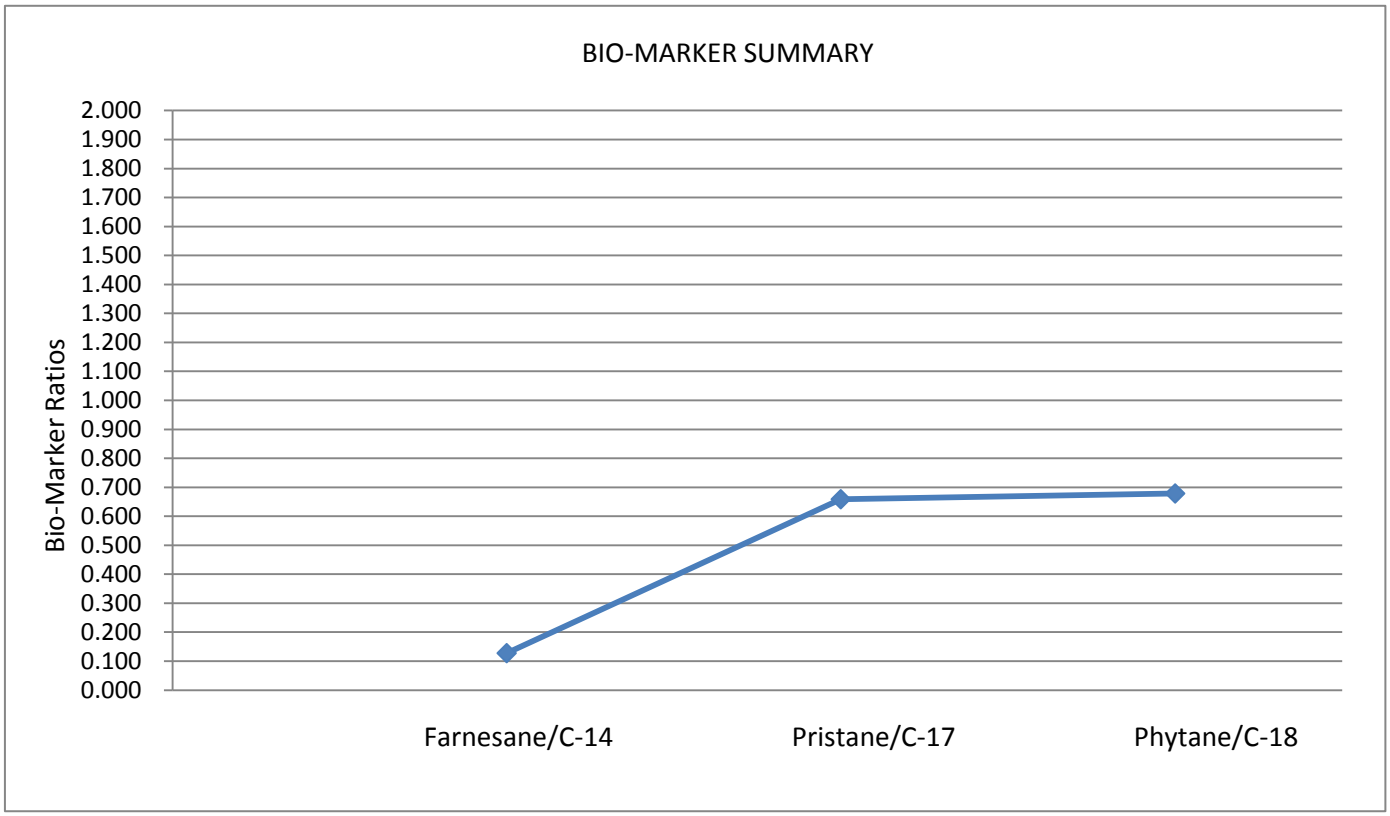
AVE MOLE WT	240.8143
SP GRAV, 60F/60	0.9443
API GRAVITY	18.4
LBS/GAL	7.5550
REL DENS, AIR=1	8.3144
VAPOR PRESS PSIA	0.01

CHARACTERISTICS OF STOCK TANK OIL

API GRAVITY @ 60 F	**(ASTM D287)**	34.7
REID VAPOR PRESSURE, psia	**(ASTM D323)**	NA
WEIGHT % SULFUR	**(ASTM D4294)**	NA


CRUDE OIL FINGERPRINT
C-n/C-13
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
C-n

ASAU #150


BIO-MARKER SUMMARY
Bio-Marker Ratios
2.000
1.900
1.800
1.700
1.600
1.500
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Farnesane/C-14
Pristane/C-17
Phytane/C-18

Appendix E
Stage 1/2 Abatement Plan

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

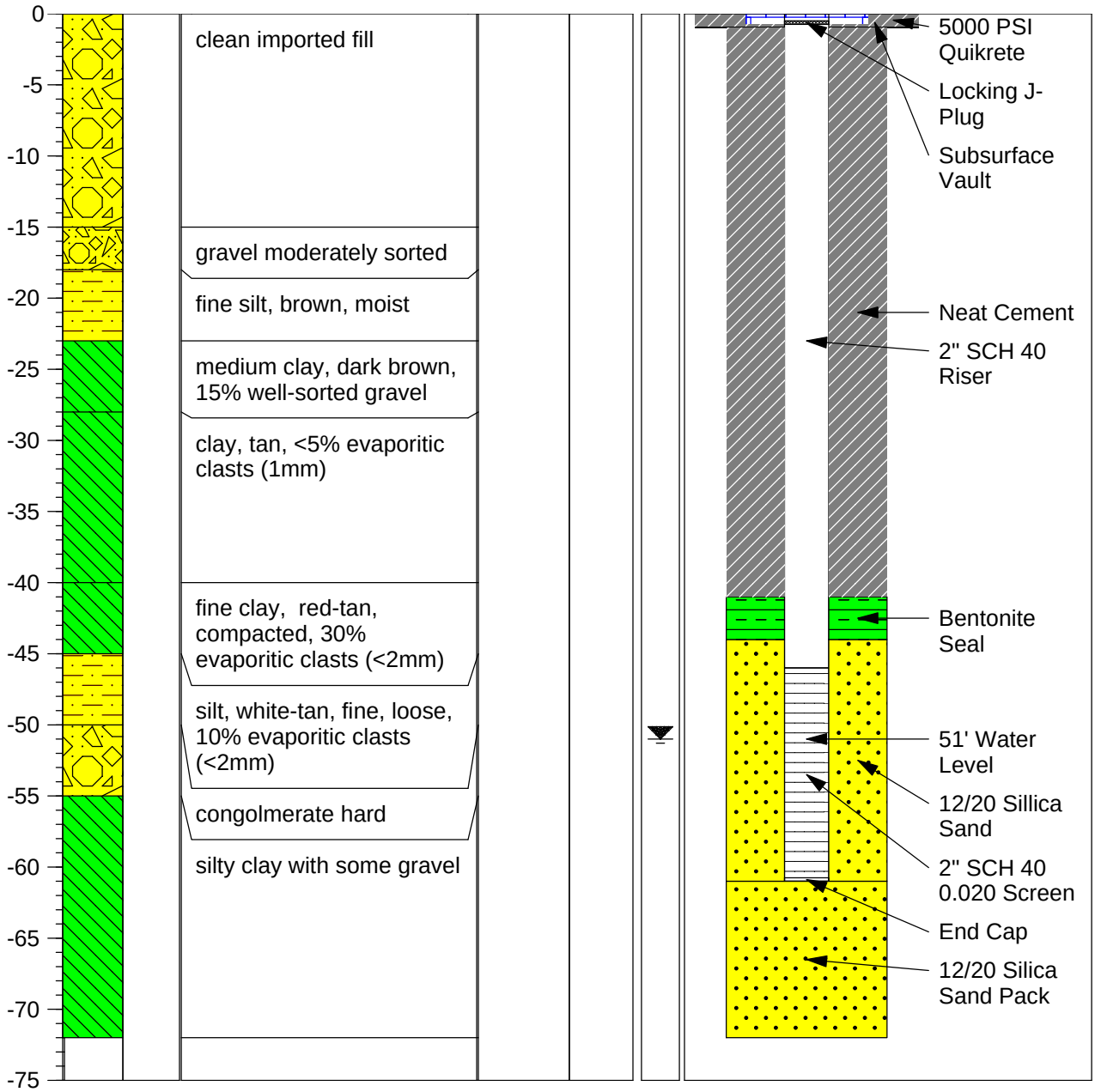
Atkins ENGINEERING ASSOCIATES
2904 W. 2nd St. Roswell, NM 88201

Log RA-12483 POD 1 (Site MW-1)

Page 1 of 1

Client	Lime Rock Resources II-A, L.P.	**Completion Date**	02/09/2017	**Latitude**	32°44'35.5"N
Location	R-347-2 North 26th St Artesia, NM 88210	**Drilling Contractor**	Atkins Engineering Assoc. Inc.	**Longitude**	104°20'53.3"W
		Drilling Method	Hollow-Stem Auger	**Surface Elevation (ft)**	-
Purpose	Groundwater Monitor Well	**Boring Diameter**	8"	**TOC Elevation (ft)**	-
Project	rthlime.drl.16	**Well Diameter**	2" Sch. 40 PVC	**Boring Depth (ft)**	72
		Well Screen	2" Sch. 40 PVC 0.020 slot	**Well Depth (ft)**	61

Depth in feet	Lithology	USCS	Description	LAB TPH GRO/DRO MRO	PID ppm-v	Well Construction Detail



Bottom of Boring (ft) = 72 BGS

Logger:	Kristin Pope	**Client:**	**Well ID:**
Driller:	Atkins Engineering Associates, Inc.	Lime Rock Resources	**MW-2**
Drilling Method:	Hollow-Stem Auger; 8" borehole	**Project Name:**	
Start Date:	6/6/2017	ASAU #150 Trunkline Release	
End Date:	6/6/2017	**Location:** Sec. 14, T18S, R26E	
East side of Fanning Road, south of Artesia, NM (Atoka)		32.743127°, -104.347963°	

Depth (feet)	Description	Lithology	Comments
0.0 – 5.0	Surface, dark brown soil		0-5 ft
6.0 – 10.0	fine sand, brown, 25% fine gravel, poorly sorted, sub-rounded, 0.5-3 cm		5-10 ft 9-12 ft core **PID =0.8 ppm**
11.0 – 15.0	Medium sand, light brown, 20% brown dolostone		10-15 ft
16.0 – 17.0	Gravel, poorly sorted, angular,dark-gray dolostone clasts, 15% silt, pink-brown		15-17 ft
18.0 – 20.0	Silt, light tan, 50% gravel, poorly sorted, sub-rounded, includes dolostone clasts		17-20 ft
21.0 – 28.0	Gravel, moderately sorted (2.5-5 cm), moderately rounded, mostly dolostone		20-28 ft
29.0 – 35.0	Clay, tan, globular (~3 cm), 40% gravel, moderately sorted, moderately rounded		28-35 ft
36.0 – 37.0	Medium clay, pink-brown, soft, 5% gravel, poorly sorted (<1-4 mm), angular		35-37 ft
38.0 – 40.0	Coarse sand, light pink-tan, loose, "sugar sand"		37-40 ft 40-41 ft core **PID = 17 ppm**
41.0 – 48.0	Medium sand, tan, gravel, poorly sorted (2mm-2cm), moderately rounded, mostly dark-brown dolostone clasts		40-48 ft *hard drilling 45-48 ft; no returns in spoon*
49.0 – 53.0	Fine sand, tan, 5% gravel (~2mm)		48-53 ft 50 ft core **PID = 14 ppm** **PID = 1.3 ppm**
54.0 – 56.0	Clay, tan, 30% medium sand; moist at 53 ft; wet 54+ ft		*wet*

Well Construction

- Subsurface vault
- neat cement
- 2-inch, Sch. 40 PVC riser
- bentonite seal
- 2-in. Sch. 40 PVC 0.020 screen 47-62 ft
- 12/20 silica sand pack

DTW = 51.41 ft

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	**Lime Rock Resources**	
	Monitoring Well Log and Well Completion Drawing	**June 2017**

Logger:	Kristin Pope/Randall Hicks	**Client:**	**Well ID:**
Driller:	Atkins Engineering Associates, Inc.	Lime Rock Resources	
Drilling Method:	Hollow-Stem Auger; 8" borehole	**Project Name:**	
Start Date:	6/27/2017 - 6/30/2017 (plugged)	ASAU #150 Trunkline Release	**MW-3**
End Date:	Re-enter 7/12 and complete 7/14	**Location:** Sec. 14, T18S, R26E	
East side of Fanning Road, south of Artesia, NM (Atoka)		32.743166°, -104.347632°	

Depth (feet)	Description	Lithology	Comments	Well Construction	Depth (feet)
0.0	Surface, dark brown soil		0-7 ft trash at 1-5 ft (glass, pipe fittings, tile pieces, etc.) 4-6 ft core **PID =0.0 ppm**	Subgrade vault	0.0
1.0					1.0
2.0					2.0
3.0					3.0
4.0					4.0
5.0					5.0
6.0					6.0
7.0					7.0
8.0	Clay, dark black-brown, tacky, some moisture		7-11 ft 9-11 ft core **PID =0.0 ppm**		8.0
9.0					9.0
10.0					10.0
11.0					11.0
12.0	Pebbles (1+cm) of dark brown dolostone, hard, poorly-sorted, mod. rounded; 30% dark brown clay		11-19 ft thin layers of light brown silt w/loose gravel		12.0
13.0					13.0
14.0					14.0
15.0					15.0
16.0					16.0
17.0					17.0
18.0				Grout	18.0
19.0					19.0
20.0	Clay, light brown; 40% gravel		19-22 ft		20.0
21.0			19-21 ft core **PID =0.1 ppm**		21.0
22.0					22.0
23.0	Silty clay, red-brown, 10% soft, tan evaporitic lenses		22-31 ft		23.0
24.0			24-26 ft core **PID =0.1 ppm**		24.0
25.0					25.0
26.0					26.0
27.0					27.0
28.0					28.0
29.0			29-31 ft core **PID =0.0 ppm**		29.0
30.0					30.0
31.0					31.0
32.0	Dolostone, dark brown-gray		31-32 ft		32.0
33.0	Silty clay, tan, globular		32-33 ft		33.0
34.0	Coarse sand, pink-tan, loose, "sugar sand"		33-35 ft		34.0
35.0			PID @ 34 ft = 0.0 ppm		35.0
36.0	Gravel (0.60-2 cm), unconsolidated in silty matrix		35-40 ft No returns; cobbles caused auger to get stuck	Hydrated Bentonite 41.3-35.3	36.0
37.0					37.0
38.0					38.0
39.0					39.0
40.0					40.0
41.0	Open hole to 31 feet, clearing slough, at 41 feet very hard drilling, no returns, Split spoon at 44.25 feet dusty dry "caliche" . 39-44' drilled 30 minutes- 1251-1319		PID appears to read 32-25 ppm (wroing?)	2" PVC flush joint 0.02 size screen 58.3-43.3 feet Filter Pack 12/20 silica sand from 58.3 to 41.3 feet	41.0
42.0					42.0
43.0					43.0
44.0					44.0
45.0					45.0
46.0	Very hard drilling, "feels" like the caliche from 45-53. Will drill easy for 1-2 inches, then hard, no returns at surface. 49-54' = 1535-1541 54-59 = 1544-1548 TD=58.3		Dropped mud packet and water @47' to cause returns and at 50 '		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
51 feet			*Note change in depth scale*		**51 feet**
53 feet	53-59 drilling feels like gravel				**53 feet**
55 feet			Good penetration rate but no returns		**55 feet**
57 feet					**57 feet**
59 feet					**59 feet**

R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
505-266-5004

Lime Rock Resources

Soil Boring Log and Completion Drawing

July 2017

Logger:	Randall Hicks	**Client:**	**Well ID:**
Driller:	Atkins Engineering Associates, Inc.	Lime Rock Resources	
Drilling Method:	Hollow-Stem Auger; 8" borehole	**Project Name:**	
Start Date:	7/13/2017	ASAU #150 Trunkline Release	**MW-4**
End Date:	7/14/2017	**Location:** Sec. 14, T18S, R26E	
East side of Fanning Road, south of Artesia, NM (Atoka)		32.742789°, -104.347967°	

Depth (feet)	Description	Lithology	Comments	Well Construction	Depth (feet)
0.0	Brown/Light Brown sand with soil, some gravel clsts 1-2 mm		Added mud packet at 7 feet to ease drilling	Subgrade vault	0.0
1.0					1.0
2.0					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	Gravel with clasts 1/2 inch +/-, light brown, gravel size increases with depth - clasts at 14-19 re 1/2-1/5 inches				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	Muddy returns, light brown to buff color, appears finer grained than above, but hard to tell			Grout	20.0
21.0					21.0
22.0					22.0
23.0					23.0
24.0					24.0
25.0					25.0
26.0					26.0
27.0					27.0
28.0					28.0
29.0					29.0
30.0					30.0
31.0					31.0
32.0					32.0
33.0					33.0
34.0					34.0
35.0	Darker brown, muddy returns, as above				35.0
36.0					36.0
37.0					37.0
38.0					38.0
39.0					39.0
40.0	Gravel with clasts 1/4 to 1/2 inch, darker than above, still light brown, muddy			Hydrated Bentonite 42.8-39.8	40.0
41.0					41.0
42.0					42.0
43.0					43.0
44.0					44.0
45.0	poor return, sand and gravel, lt. brown, 1/2-1 inch clasts, no odor		Split spoon @ 45' PID= 60		45.0
46.0					46.0
47.0			Clean hole, no returns	2" PVC flush joint 0.02 size screen 58.3-44.8 feet Filter Pack 12/20 silica sand from 58.3 to 41.3 feet	47.0
48.0	Wet sand, no gravel, med sand at base of core, fining upward, thin bedding, lt brown				48.0
49.0			Split Spooon @ 49' PID= 5.2		49.0
50.0					50.0
51.0	Drilled to 60 feet, flowing sand into hole observed from pulling out bit, no returns, drilled to 64 feet and set auger to minimize flowing sand				51.0
52.0					52.0
					51 feet
54 feet			*note change of depth scale*		**53 feet**
56 feet					**55 feet**
58 feet					**57 feet**
60 feet					**59 feet**

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	**Lime Rock Resources**	
	Soil Boring Log and Completion Drawing	**July 2017**

Logger:	K. Pope	**Client:**	**Well ID:**
Driller:	Atkins Engineering	Lime Rock Resources	**MW-5**
Drilling Method:	Auger	**Name:**	
Start Date:	4/10/2018	ASAU Trunkline Release	
End Date:	4/10/2018	**Location:**	
		Unit P, Section 14, T18S, R 26E	32.74319°, -104.34813°

Depth (feet)	Description	Lithology	Well Completion	Depth (feet)
0.0	Sand and gravel, large cobbles, brown, dry, 0-9 feet		Quikrete	0.0
1.0				1.0
2.0				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	Clay, brown , dry, 9-14 feet			9.0
10.0				10.0
11.0				11.0
12.0				12.0
13.0				13.0
14.0	Clay, some caliche streaks, brown, dry, 14-20 feet			14.0
15.0				15.0
16.0				16.0
17.0				17.0
18.0				18.0
19.0			Type i/II Neat Cement	19.0
20.0	Silty clay, slightly tacky, light red, dry, 20-34.5 feet			20.0
21.0				21.0
22.0				22.0
23.0				23.0
24.0				24.0
25.0				25.0
26.0				26.0
27.0				27.0
28.0				28.0
29.0				29.0
30.0				30.0
31.0				31.0
32.0				32.0
33.0				33.0
34.0	Clayey silt with 10% subangular cobbles, tan, dry, 34.5-39 feet			34.0
35.0				35.0
36.0				36.0
37.0				37.0
38.0				38.0
39.0	Coarse "sugar" quartz sand, light tan, 10% red clay nodules, dry, 39-44 feet			39.0
40.0			Baroid Hole Plug	40.0
41.0				41.0
42.0				42.0
43.0				43.0
44.0	Sand and gravel, large cobbles, brown, dry, 44-59 feet			44.0
45.0				45.0
46.0				46.0
47.0				47.0
48.0				48.0
49.0				49.0
50.0			12/20 Silica Sand	50.0
51.0				51.0
52.0				52.0
53.0				53.0
54.0				54.0
55.0				55.0
56.0				56.0
57.0				57.0
58.0				58.0
59.0				59.0

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	**Lime Rock Resources**	**Plate 5**
	MW-5 Drilling Log	**November, 2018**

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

August 23, 2018

David Hamilton

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: Lime Rock ASAU 150 OrderNo.: 1808A80

Dear David Hamilton:

Hall Environmental Analysis Laboratory received 5 sample(s) on 8/15/2018 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 #NM0901

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1808A80**
Date Reported: **8/23/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4 @ 52.5ft
Project: Lime Rock ASAU 150
Collection Date: 8/13/2018 3:22:00 PM
Lab ID: 1808A80-001 **Matrix:** AQUEOUS **Received Date:** 8/15/2018 9:22:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	1200	50		µg/L	50	8/22/2018 4:09:00 PM	SL53645
Toluene	ND	2.5		µg/L	5	8/21/2018 7:50:00 PM	SL53604
Ethylbenzene	260	2.5		µg/L	5	8/21/2018 7:50:00 PM	SL53604
Naphthalene	34	5.0		µg/L	5	8/21/2018 7:50:00 PM	SL53604
1-Methylnaphthalene	18	10		µg/L	5	8/21/2018 7:50:00 PM	SL53604
2-Methylnaphthalene	ND	10		µg/L	5	8/21/2018 7:50:00 PM	SL53604
Xylenes, Total	ND	5.0		µg/L	5	8/21/2018 7:50:00 PM	SL53604
Surr: 1,2-Dichloroethane-d4	100	70-130		%Rec	5	8/21/2018 7:50:00 PM	SL53604
Surr: 4-Bromofluorobenzene	104	70-130		%Rec	5	8/21/2018 7:50:00 PM	SL53604
Surr: Dibromofluoromethane	98.0	70-130		%Rec	5	8/21/2018 7:50:00 PM	SL53604
Surr: Toluene-d8	97.0	70-130		%Rec	5	8/21/2018 7:50:00 PM	SL53604

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

Analytical Report
Lab Order **1808A80**
Date Reported: **8/23/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-4 @ 54.5ft
Project: Lime Rock ASAU 150
Collection Date: 8/13/2018 3:25:00 PM
Lab ID: 1808A80-002 **Matrix:** AQUEOUS **Received Date:** 8/15/2018 9:22:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	710	50		µg/L	50	8/22/2018 4:33:00 PM	SL53645
Toluene	ND	2.5		µg/L	5	8/21/2018 8:14:00 PM	SL53604
Ethylbenzene	110	2.5		µg/L	5	8/21/2018 8:14:00 PM	SL53604
Naphthalene	16	5.0		µg/L	5	8/21/2018 8:14:00 PM	SL53604
1-Methylnaphthalene	ND	10		µg/L	5	8/21/2018 8:14:00 PM	SL53604
2-Methylnaphthalene	ND	10		µg/L	5	8/21/2018 8:14:00 PM	SL53604
Xylenes, Total	ND	5.0		µg/L	5	8/21/2018 8:14:00 PM	SL53604
Surr: 1,2-Dichloroethane-d4	99.6	70-130		%Rec	5	8/21/2018 8:14:00 PM	SL53604
Surr: 4-Bromofluorobenzene	105	70-130		%Rec	5	8/21/2018 8:14:00 PM	SL53604
Surr: Dibromofluoromethane	98.8	70-130		%Rec	5	8/21/2018 8:14:00 PM	SL53604
Surr: Toluene-d8	96.8	70-130		%Rec	5	8/21/2018 8:14:00 PM	SL53604

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

Analytical Report
Lab Order **1808A80**
Date Reported: **8/23/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-2 @ 55.5ft
Project: Lime Rock ASAU 150
Collection Date: 8/13/2018 4:30:00 PM
Lab ID: 1808A80-003 **Matrix:** AQUEOUS **Received Date:** 8/15/2018 9:22:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	290	2.5		µg/L	5	8/21/2018 8:38:00 PM	SL53604
Toluene	ND	2.5		µg/L	5	8/21/2018 8:38:00 PM	SL53604
Ethylbenzene	18	2.5		µg/L	5	8/21/2018 8:38:00 PM	SL53604
Naphthalene	ND	5.0		µg/L	5	8/21/2018 8:38:00 PM	SL53604
1-Methylnaphthalene	ND	10		µg/L	5	8/21/2018 8:38:00 PM	SL53604
2-Methylnaphthalene	ND	10		µg/L	5	8/21/2018 8:38:00 PM	SL53604
Xylenes, Total	ND	5.0		µg/L	5	8/21/2018 8:38:00 PM	SL53604
Surr: 1,2-Dichloroethane-d4	98.4	70-130		%Rec	5	8/21/2018 8:38:00 PM	SL53604
Surr: 4-Bromofluorobenzene	104	70-130		%Rec	5	8/21/2018 8:38:00 PM	SL53604
Surr: Dibromofluoromethane	96.1	70-130		%Rec	5	8/21/2018 8:38:00 PM	SL53604
Surr: Toluene-d8	97.5	70-130		%Rec	5	8/21/2018 8:38:00 PM	SL53604

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

Analytical Report
Lab Order **1808A80**
Date Reported: **8/23/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-1 @ 56 ft
Project: Lime Rock ASAU 150
Collection Date: 8/14/2018 9:40:00 AM
Lab ID: 1808A80-004 **Matrix:** AQUEOUS **Received Date:** 8/15/2018 9:22:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	12000	500		µg/L	500	8/22/2018 4:57:00 PM	SL53645
Toluene	22	2.5		µg/L	5	8/21/2018 9:02:00 PM	SL53604
Ethylbenzene	410	2.5		µg/L	5	8/21/2018 9:02:00 PM	SL53604
Naphthalene	89	5.0		µg/L	5	8/21/2018 9:02:00 PM	SL53604
1-Methylnaphthalene	57	10		µg/L	5	8/21/2018 9:02:00 PM	SL53604
2-Methylnaphthalene	44	10		µg/L	5	8/21/2018 9:02:00 PM	SL53604
Xylenes, Total	290	5.0		µg/L	5	8/21/2018 9:02:00 PM	SL53604
Surr: 1,2-Dichloroethane-d4	107	70-130		%Rec	5	8/21/2018 9:02:00 PM	SL53604
Surr: 4-Bromofluorobenzene	104	70-130		%Rec	5	8/21/2018 9:02:00 PM	SL53604
Surr: Dibromofluoromethane	98.5	70-130		%Rec	5	8/21/2018 9:02:00 PM	SL53604
Surr: Toluene-d8	97.4	70-130		%Rec	5	8/21/2018 9:02:00 PM	SL53604

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

Analytical Report
Lab Order **1808A80**
Date Reported: **8/23/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD **Client Sample ID:** Trip Blank
Project: Lime Rock ASAU 150 **Collection Date:**
Lab ID: 1808A80-005 **Matrix:** AQUEOUS **Received Date:** 8/15/2018 9:22:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	1.0		µg/L	1	8/22/2018 5:22:00 PM	SL53645
Toluene	ND	1.0		µg/L	1	8/22/2018 5:22:00 PM	SL53645
Ethylbenzene	ND	1.0		µg/L	1	8/22/2018 5:22:00 PM	SL53645
Naphthalene	ND	2.0		µg/L	1	8/22/2018 5:22:00 PM	SL53645
1-Methylnaphthalene	ND	4.0		µg/L	1	8/22/2018 5:22:00 PM	SL53645
2-Methylnaphthalene	ND	4.0		µg/L	1	8/22/2018 5:22:00 PM	SL53645
Xylenes, Total	ND	1.5		µg/L	1	8/22/2018 5:22:00 PM	SL53645
Surr: 1,2-Dichloroethane-d4	106	70-130		%Rec	1	8/22/2018 5:22:00 PM	SL53645
Surr: 4-Bromofluorobenzene	102	70-130		%Rec	1	8/22/2018 5:22:00 PM	SL53645
Surr: Dibromofluoromethane	101	70-130		%Rec	1	8/22/2018 5:22:00 PM	SL53645
Surr: Toluene-d8	97.9	70-130		%Rec	1	8/22/2018 5:22:00 PM	SL53645

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#: **1808A80**
23-Aug-18

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **100ng lcs** SampType: **LCS** TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW** Batch ID: **SL53604** RunNo: **53604**
Prep Date: Analysis Date: **8/21/2018** SeqNo: **1767606** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	20	1.0	20.00	0	99.5	70	130			
Toluene	19	1.0	20.00	0	95.8	70	130			
Surr: 1,2-Dichloroethane-d4	10		10.00		101	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		101	70	130			
Surr: Dibromofluoromethane	10		10.00		99.6	70	130			
Surr: Toluene-d8	9.7		10.00		97.1	70	130			

Sample ID **rb** SampType: **MBLK** TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW** Batch ID: **SL53604** RunNo: **53604**
Prep Date: Analysis Date: **8/21/2018** SeqNo: **1767607** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	10		10.00		100	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		104	70	130			
Surr: Dibromofluoromethane	9.9		10.00		98.8	70	130			
Surr: Toluene-d8	9.7		10.00		96.7	70	130			

Sample ID **100ng lcs** SampType: **LCS** TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW** Batch ID: **SL53645** RunNo: **53645**
Prep Date: Analysis Date: **8/22/2018** SeqNo: **1769151** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	20	1.0	20.00	0	98.2	70	130			
Toluene	19	1.0	20.00	0	94.1	70	130			
Surr: 1,2-Dichloroethane-d4	10		10.00		103	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		103	70	130			
Surr: Dibromofluoromethane	10		10.00		99.6	70	130			
Surr: Toluene-d8	9.7		10.00		96.7	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#: **1808A80**
23-Aug-18

Client: R.T. Hicks Consultants, LTD
Project: Lime Rock ASAU 150

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL53645**	RunNo: **53645**
Prep Date:	Analysis Date: **8/22/2018**	SeqNo: **1769152** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	10		10.00		103	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		101	70	130			
Surr: Dibromofluoromethane	10		10.00		101	70	130			
Surr: Toluene-d8	9.6		10.00		96.2	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
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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: 1808A80 RcptNo: 1

Received By: **Ashley Gallegos** 8/15/2018 9:22:00 AM

Completed By: **Ashley Gallegos** 8/16/2018 3:57:37 PM

Reviewed By: ENM 8/17/18 labeled by: JAB 08/17/18

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 ☐	
12. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
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 ☐	

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: JAB 08/17/18

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	2.1	Good	Not Present			

Chain-of-Custody Record

Client: R. T. Hicks Consultants

Mailing Address: 901 Rio Grande Blvd NW, Suite F-142, Albuquerque, NM 87104

Phone #: (505) 266-5004

email or Fax#: R@rthicksconsult.com

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

Accreditation:
☐ NELAP ☐ Other

☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush

Project Name: Lime Rock - ASAU #150

Project #:

Project Manager: David Hamilton

Sampler: David Hamilton

On Ice: ☒ Yes ☐ No

Sample Temperature: 2

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. 1808A80	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 N	8270 (Semi-VOA)	Air Bubbles (Y or N)
8/13/18	1522	water	MW-4 @52.5 ft	3 VOA	ice, HCl	-001										X		
"	1525	"	MW-4 @54.5 ft	"	"	-002										X		
8/13 8/14/18	1630	"	MW-2 @55.5 ft	"	"	-003										X		
8/14/18	0940	"	MW-1 @56+ ft	"	"	-004										X		
			Trip Blank		HCL	-005												
			JAB 08/17/18															

Date	Time	Relinquished by:	Received by:	Date	Time
8-15-18	9-22	David Hamilton		08/15/18	0922
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email to R@rthicksconsult.com, kristin@..., david@...

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

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

August 22, 2018

David Hamilton

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: Lime Rock ASAU 150 OrderNo.: 1808A15

Dear David Hamilton:

Hall Environmental Analysis Laboratory received 2 sample(s) on 8/15/2018 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 #NM0901

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1808A15**
Date Reported: **8/22/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-3
Project: Lime Rock ASAU 150
Collection Date: 8/13/2018 1:48:00 PM
Lab ID: 1808A15-001 **Matrix:** AQUEOUS **Received Date:** 8/15/2018 9:22:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	190	50		mg/L	100	8/16/2018 3:51:19 PM	R53517
Sulfate	2000	50	*	mg/L	100	8/16/2018 3:51:19 PM	R53517
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **sat**	
Total Dissolved Solids	3900	20.0	*	mg/L	1	8/21/2018 8:39:00 AM	39858
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	1.0		µg/L	1	8/18/2018 12:44:00 AM	SL53547
Toluene	ND	1.0		µg/L	1	8/18/2018 12:44:00 AM	SL53547
Ethylbenzene	ND	1.0		µg/L	1	8/18/2018 12:44:00 AM	SL53547
Naphthalene	ND	2.0		µg/L	1	8/18/2018 12:44:00 AM	SL53547
Xylenes, Total	ND	1.5		µg/L	1	8/18/2018 12:44:00 AM	SL53547
Surr: 1,2-Dichloroethane-d4	100	70-130		%Rec	1	8/18/2018 12:44:00 AM	SL53547
Surr: 4-Bromofluorobenzene	101	70-130		%Rec	1	8/18/2018 12:44:00 AM	SL53547
Surr: Dibromofluoromethane	104	70-130		%Rec	1	8/18/2018 12:44:00 AM	SL53547
Surr: Toluene-d8	90.8	70-130		%Rec	1	8/18/2018 12:44:00 AM	SL53547

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

Analytical Report
Lab Order **1808A15**
Date Reported: **8/22/2018**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: R.T. Hicks Consultants, LTD
Client Sample ID: MW-5
Project: Lime Rock ASAU 150
Collection Date: 8/13/2018 2:33:00 PM
Lab ID: 1808A15-002 **Matrix:** AQUEOUS **Received Date:** 8/15/2018 9:22:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Chloride	200	5.0		mg/L	10	8/16/2018 4:28:32 PM	R53517
Sulfate	2200	50	*	mg/L	100	8/16/2018 4:40:57 PM	R53517
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **sat**	
Total Dissolved Solids	4200	20.0	*	mg/L	1	8/21/2018 8:39:00 AM	39858
EPA METHOD 8260: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	1.0		µg/L	1	8/18/2018 1:08:00 AM	SL53547
Toluene	ND	1.0		µg/L	1	8/18/2018 1:08:00 AM	SL53547
Ethylbenzene	ND	1.0		µg/L	1	8/18/2018 1:08:00 AM	SL53547
Naphthalene	ND	2.0		µg/L	1	8/18/2018 1:08:00 AM	SL53547
Xylenes, Total	ND	1.5		µg/L	1	8/18/2018 1:08:00 AM	SL53547
Surr: 1,2-Dichloroethane-d4	97.4	70-130		%Rec	1	8/18/2018 1:08:00 AM	SL53547
Surr: 4-Bromofluorobenzene	101	70-130		%Rec	1	8/18/2018 1:08:00 AM	SL53547
Surr: Dibromofluoromethane	104	70-130		%Rec	1	8/18/2018 1:08:00 AM	SL53547
Surr: Toluene-d8	90.3	70-130		%Rec	1	8/18/2018 1:08:00 AM	SL53547

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#: **1808A15**

22-Aug-18

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150

Sample ID	**MB**	SampType:	**mblk**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**PBW**	Batch ID:	**R53517**	RunNo:	**53517**					
Prep Date:		Analysis Date:	**8/16/2018**	SeqNo:	**1763915**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	0.50								
Sulfate	ND	0.50								

Sample ID	**LCS**	SampType:	**lcs**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**LCSW**	Batch ID:	**R53517**	RunNo:	**53517**					
Prep Date:		Analysis Date:	**8/16/2018**	SeqNo:	**1763916**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.7	0.50	5.000	0	93.7	90	110			
Sulfate	9.3	0.50	10.00	0	92.7	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#: **1808A15**

22-Aug-18

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **LCSW**	Batch ID: **SL53547**	RunNo: **53547**
Prep Date:	Analysis Date: **8/17/2018**	SeqNo: **1764898** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	23	1.0	20.00	0	117	70	130			
Toluene	20	1.0	20.00	0	101	70	130			
Surr: 1,2-Dichloroethane-d4	9.8		10.00		98.0	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		101	70	130			
Surr: Dibromofluoromethane	10		10.00		103	70	130			
Surr: Toluene-d8	9.1		10.00		91.5	70	130			

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260: Volatiles Short List**
Client ID: **PBW**	Batch ID: **SL53547**	RunNo: **53547**
Prep Date:	Analysis Date: **8/17/2018**	SeqNo: **1764899** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Naphthalene	ND	2.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.6		10.00		96.0	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		102	70	130			
Surr: Dibromofluoromethane	10		10.00		102	70	130			
Surr: Toluene-d8	9.2		10.00		92.0	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#: **1808A15**

22-Aug-18

Client: R.T. Hicks Consultants, LTD

Project: Lime Rock ASAU 150

Sample ID	**MB-39858**	SampType:	**MBLK**	TestCode:	**SM2540C MOD: Total Dissolved Solids**					
Client ID:	**PBW**	Batch ID:	**39858**	RunNo:	**53576**					
Prep Date:	**8/17/2018**	Analysis Date:	**8/21/2018**	SeqNo:	**1766280**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID	**LCS-39858**	SampType:	**LCS**	TestCode:	**SM2540C MOD: Total Dissolved Solids**					
Client ID:	**LCSW**	Batch ID:	**39858**	RunNo:	**53576**					
Prep Date:	**8/17/2018**	Analysis Date:	**8/21/2018**	SeqNo:	**1766281**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	991	20.0	1000	0	99.1	80	120			

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: 1808A15 RcptNo: 1

Received By: **Ashley Gallegos** 8/15/2018 9:22:00 AM

Completed By: **Ashley Gallegos** 8/15/2018 5:49:21 PM

Reviewed By: JAB 08/16/18 labeled by: JO 08/16/18

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 ☐
12. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
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 ☐

# of preserved bottles checked for pH: JO (<2 or >12 unless noted)
Adjusted? _____
8/16/18 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	2.1	Good	Not Present			

Chain-of-Custody Record

Client: R. T. Hicks Consultants

901 Rio Grande Blvd NW
Mailing Address: Suite F-142
Albuquerque, NM 87104

Phone #: (505) 266-5004
email or Fax#: R@rthicksconsult.com
QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)
Accreditation:
☐ NELAP ☐ Other
☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush

Project Name: Lime Rock - ASAU #150
Project #:
Project Manager: David Hamilton
Sampler: David Hamilton
On Ice: ☒ Yes ☐ No
Sample Temperature: 2

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. 1808A15	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) BTEXN	8270 (Semi-VOA)	TDS				Air Bubbles (Y or N)
8/13/18	1348	water	MW-3	3 VOA, 1L	ice, HgCl2	-001								X		X		X				
"	1433	"	MW-5	"	"	-002								X		X		X				

Date	Time	Relinquished by:	Received by:	Date	Time
8-15-18	9:22	David Hamilton		08/15/18	0922
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks: Email to R@rthicksconsult.com, kristin@..., david@...

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 F
Stage 1/2 Abatement Plan

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

MW-4 Drawdown Test Results

R.T. Hicks Consultants, Ltd., (Hicks Consultants) conducted a drawdown/recovery test of MW-4 at the ASAU release site in Eddy County, New Mexico on August 14, 2018.

Conditions of the well at the beginning of the test were:

Depth to water:	51.21 feet
Total Depth of well:	56.10 feet
Water column:	4.89

The pump was set at a depth of 3 feet below the water table surface so as to keep the pump submersed and to keep the intake clear of sediment in the lower water column.

The pump test was started at 11:05 am. The pump was turned off at 11:21 am.

The pumping rate was set at the maximum rate possible for the Proactive Tempest pump. This resulted in an average withdrawal of 1.25 gal/min (20 gallons in 16 minutes).

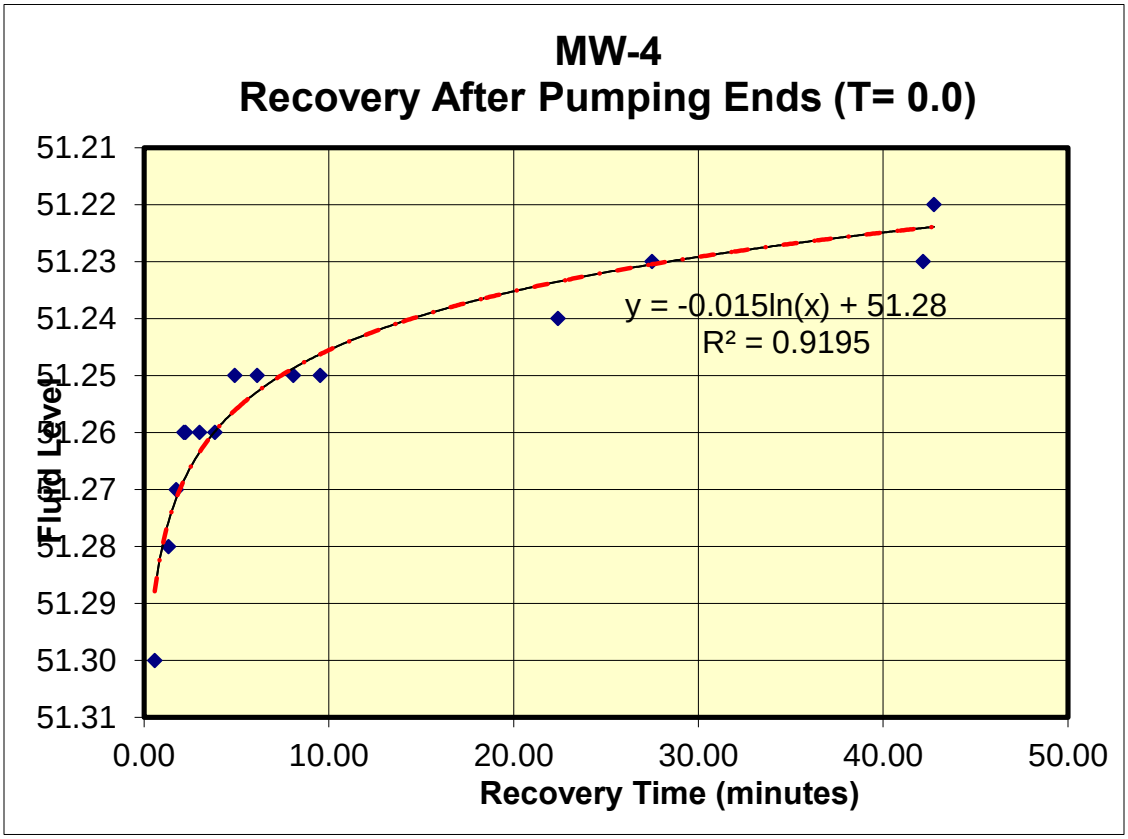
Table 1, below, presents time, depth to water, and drawdown after the pump was turned off.

Table 1

Seconds after Pump Turned Off	Converted to Minutes	Depth to Water [feet]	Drawdown from Initial Depth of 51.21 feet
35	0.58	51.30	0.09
80	1.33	51.28	0.07
105	1.75	51.27	0.06
130	2.17	51.26	0.05
135	2.25	51.26	0.05
180	3.00	51.26	0.05
230	3.83	51.26	0.05
295	4.92	51.25	0.04
368	6.13	51.25	0.04
485	8.08	51.25	0.04
572	9.53	51.25	0.04
1344	22.40	51.24	0.03
1650	27.50	51.23	0.02
2530	42.17	51.23	0.02
2565	42.75	51.22	0.01

Figure 1 shows the fluid level as a function of time (plotted as blue diamonds) since pumping ended. Note that total drawdown was 0.09 feet and that water level could not be measured more finely than).01 feet.

Figure 1



The dashed, red line is a logarithmic trendline fitted to the data. The R^2 value of 0.92 is much closer to 1.0 than to 0.0. An R^2 value close to 1.0 means that the trendline is a "good fit" compared to an R^2 value of 0.0.

A semi log method of pump-test interpretation was applied to the data. Because there was so little drawdown (and insufficient ability to measure the small changes - note the step like nature of the data points in Figure 1), the method did not yield results that we consider highly accurate. The calculated hydraulic conductivity was on the order of hundreds of feet/day. These are consistent with reported hydraulic conductivities for gravels and sands and in agreement with materials observed in the boring logs.

Observations and Conclusions

- Hydraulic conductivity in the upper water table is relatively high at the release site. A pumping rate of 1.25 gallons/minute resulted in a near steady state drawdown of less than 0.1 feet.

- While the pump test interpretation method did not yield a robust value for hydraulic conductivity, the trendline fitted well to the drawdown data confirming that the hydraulic conductivity is "high", consistent with lithology observed in the wells.

- Wells with small casings (2-inch or 4 inch diameter) will be sufficient.

- The planned remediation pumping rates (about 1.0 gal /minute) will not cause a large area drawdown

- Based upon experience with the planned remediation wells, additional wells maybe necessary to create a sufficient capture zone.

Appendix G
Stage 1/2 Abatement Plan

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

Standard Operating Procedure for Low-Stress (Low-Flow)/ Minimal Drawdown Ground-W ater Sample Collection

INTRODUCTION

The collection of “representative” water samples from wells is neither straightforward nor easily accomplished. Ground-water sample collection can be a source of variability through differences in sample personnel and their individual sampling procedures, the equipment used, and ambient temporal variability in subsurface and environmental conditions. Many site inspections and remedial investigations require the sampling at ground-water monitoring wells within a defined criterion of data confidence or data quality, which necessitates that the personnel collecting the samples are trained and aware of proper sample-collection procedures.

The purpose of this standard operating procedure (SOP) is to provide a method that minimizes the impact the purging process has on the ground-water chemistry and the volume of water that is being purged and disposed of during sample collection. This will take place by placing the pump intake within the screen interval and by keeping the drawdown at a minimal level (0.33 feet) (Puls and Barcelona, 1996) until the water quality parameters have stabilized and sample collection is complete. The flow rate at which the pump will be operating will depend upon both hydraulic conductivity of the aquifer and the drawdown with the goal of minimizing the drawdown. The flow rate from the pump during purging and sampling will be at a rate that will not compromise the integrity of the analyte that is being sampled. This sampling procedure may or may not provide a discrete ground-water sample at the location of the pump intake. The flow of ground-water to the pump intake will be dependent on the distribution of the hydraulic conductivity (K) of the aquifer within the screen interval. In order to minimize the drawdown in the monitoring well, a low-flow rate must be used. “Low-Flow” refers to the velocity with which water enters the pump intake from the surrounding formation in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface, which can be affected by flow regulators or restrictions (Puls and Barcelona, 1996). This SOP was developed by the Superfund/RCRA Ground Water Forum and draws from an USEPA’s Ground Water Issue Paper, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedure, by Robert W. Puls and Michael J. Barcelona. Also, available USEPA Regional SOPs regarding Low-Stress (Low-Flow) Purging and Sampling were used for this SOP.

SCOPE AND APPLICATION

This SOP should be used primarily at monitoring wells that have a screen or an open interval with a length of ten feet or less and can accept a sampling device that minimizes the disturbance to the aquifer or the water column in the well casing. The screen or open interval should have been optimally located to intercept an existing contaminant plume(s) or along flowpaths of potential contaminant releases. Knowledge of the contaminant distribution within the screen interval is highly recommended and is essential for the success of this sampling procedure. The ground-water samples that are collected using this procedure are acceptable for the analyses of ground-water contaminants that may be found at Superfund and RCRA contamination sites. The analytes may be volatile, semi-volatile organic compounds, pesticides, PCBs, metals, and other inorganic compounds. The screened interval should be located within the contaminant plume(s) and the pump intake should be placed at or near the known source of the contamination within the screened interval. It is critical to place the pump intake in the exact location or depth for each sampling event. This argues for the use of dedicated, permanently installed, sampling devices whenever possible. If this is not possible, then the placement of the pump intake should be positioned with a calibrated sampling pump hose sounded with a weighted-tape or using a pre-measured hose. The pump intake should not be placed near the bottom of the screened interval to avoid disturbing any sediment that may have settled at the bottom of the well.

Water-quality-indicator parameters and water levels must be measured during purging, prior to sample collection. Stabilization of the water-quality-indicator parameters as well as monitoring water levels are a prerequisite to sample collection. The water-quality-indicator parameters that are recommended include the following: specific electrical conductance, dissolved oxygen, turbidity, oxidation-reduction potential, pH, and temperature. The latter two parameters are useful data, but are generally insensitive as purging parameters. Oxidation-reduction potential may not always be appropriate stabilization parameter, and will depend on site-specific conditions. However, readings

should be recorded because of its value as a double check for oxidation conditions and for fate and transport issues.

Also, when samples are collected for metals, semi-volatile organic compounds, and pesticides, every effort must be made to reduce turbidity to 10 NTUs or less (not just the stabilization of turbidity) prior to the collection of the water sample. In addition to the measurement of the above parameters, depth to water must be measured during purging (U.S. Environmental Protection Agency, 1995).

Proper well construction, development, and maintenance are essential for any ground-water sampling procedure. Prior to conducting the field work, information on the construction of the well and well development should be obtained and that information factored into the site specific sampling procedure. The Sampling Checklist at the end of this attachment is an example of the type of information that is useful.

Stabilization of the water-quality-indicator parameters is the criterion for sample collection. But if stabilization is not occurring and the procedure has been strictly followed, then sample collection can take place once three (minimum) to six (maximum) casing volumes have been removed (Schuller et al., 1981 and U.S. Environmental Protection Agency., 1986; Wilde et al., 1998; Gibs and Imbrigiotta., 1990). The specific information on what took place during purging must be recorded in the field notebook or in the ground-water sampling log.

This SOP is not to be used where non-aqueous phase liquids (NAPL) (immiscible fluids) are present in the monitoring well.

EQUIPMENT

- Depth-to-water measuring device - An electronic water-level indicator or steel tape and chalk, with marked intervals of 0.01 foot. Interface probe for determination of liquid products (NAPL) presence, if needed.
- Steel tape and weight - Used for measuring total depth of well. Lead weight should not be used.
- Sampling pump - Submersible or bladder pumps with adjustable rate controls are preferred. Pumps are to be constructed of inert materials, such as stainless steel and Teflon®. Pump types that are acceptable include gear and helical driven, centrifugal (low-flow type), and air-activated piston. An adjustable rate, peristaltic pump can be used when the depth to water is 20 feet or less.
- Tubing - Teflon® or Teflon®-lined polyethylene tubing is preferred when sampling for organic compounds. Polyethylene tubing can be used when sampling inorganics.
- Power source - If a combustion type (gasoline or diesel-driven) generator is used, it must be placed downwind of the sampling area.
- Flow measurement supplies - flow meter, graduated cylinder, and a stop watch.
- Multi-parameter meter with flow-through cell - This can be one instrument or more contained in a flow-through cell. The water-quality-indicator parameters that are monitored are pH, ORP/Eh, (ORP) dissolved oxygen (DO), turbidity, specific conductance, and temperature. Turbidity readings must be collected before the flow cell because of the potential for sediment buildup, which can bias the turbidity measurements. Calibration fluids for all instruments should be NIST-traceable and there should be enough for daily calibration throughout the sampling event. The inlet of the flow cell must be located near the bottom of the flow cell and the outlet near the top. The size of the flow cell should be kept to a minimum and a closed cell is preferred. The flow cell must not contain any air or gas bubbles when monitoring for the water-quality-indicator parameters.
- Decontamination supplies - Including a reliable and documented source of distilled water and any solvents (if used). Pressure sprayers, buckets or decontamination tubes for pumps, brushes and non-phosphate soap will also be needed.
- Sample bottles, sample preservation supplies, sample tags or labels, and chain-of-custody forms.
- Approved Field Sampling and Quality Assurance Project Plan.
- Well construction, field, and water quality data from the previous sampling event.
- Well keys and map of well locations.
- Field notebook, ground-water sampling logs, and calculator. A suggested field data sheet (ground-water sampling record or ground-water sampling log) are provided at the end of this attachment.

- Filtration equipment, if needed. An in-line disposable filter is recommended.
- Polyethylene sheeting placed on ground around the well head.
- Personal protective equipment as specified in the site Health and Safety Plan.
- Air monitoring equipment as specified in the Site Health and Safety Plan.
- Tool box - All needed tools for all site equipment used.
- A 55-gallon drum or container to contain the purged water.

Construction materials of the sampling equipment (bladders, pumps, tubing, and other equipment that comes in contact with the sample) should be limited to stainless steel, Teflon®, glass, and other inert material. This will reduce the chance that sampling materials alter the ground-water where concentrations of the site contaminants are expected to be near the detection limits. The sample tubing diameter should be maximized and the tubing length should be minimized so that the loss of contaminants into and through the tubing walls may be reduced and the rate of stabilization of ground-water parameters is maximized. The tendency of organics to sorb into and out of material makes the appropriate selection of sample tubing material critical for trace analyses (Pohlmann and Alduino, 1992; Parker and Ranney, 1998).

PURGING AND SAMPLING PROCEDURES

The following describes the purging and sampling procedures for the Low-Stress (Low-Flow)/ Minimal Drawdown method for the collection of ground-water samples. These procedures also describe steps for dedicated and non-dedicated systems.

Pre-Sampling Activities (Non-dedicated and dedicated system)

1. Sampling must begin at the monitoring well with the least contamination, generally up-gradient or farthest from the site or suspected source. Then proceed systematically to the monitoring wells with the most contaminated ground water.

2. Check and record the condition of the monitoring well for damage or evidence of tampering. Lay out polyethylene sheeting around the well to minimize the likelihood of contamination of sampling/purging equipment from the soil. Place monitoring, purging and sampling equipment on the sheeting.

3. Unlock well head. Record location, time, date, and appropriate information in a field logbook or on the ground-water sampling log (See attached ground-water sampling record and ground-water sampling log as examples).

4. Remove inner casing cap.

5. Monitor the headspace of the monitoring well at the rim of the casing for volatile organic compounds (VOC) with a photo-ionization detector (PID) or flame ionization detector (FID) and record in the logbook. If the existing monitoring well has a history of positive readings of the headspace, then the sampling must be conducted in accordance with the Health and Safety Plan.

6. Measure the depth to water (water level must be measured to nearest 0.01 feet) relative to a reference measuring point on the well casing with an electronic water level indicator or steel tape and record in logbook or ground-water sampling log. If no reference point is found, measure relative to the top of the inner casing, then mark that reference point and note that location in the field logbook. Record information on depth to ground water in the field logbook or ground-water sampling log. Measure the depth to water a second time to confirm initial measurement; measurement should agree within 0.01 feet or re-measure.

7. Check the available well information or field information for the total depth of the monitoring well. Use the information from the depth of water in step six and the total depth of the monitoring well to calculate the volume of the water in the monitoring well or the volume of one casing. Record information in field logbook or ground-water sampling log.

Purging and Sampling Activities

8A. Non-dedicated system - Place the pump and support equipment at the wellhead and slowly lower the pump and tubing down into the monitoring well until the location of the pump intake is set at a predetermined location within the screen interval. The placement of the pump intake should be positioned

with a calibrated sampling pump hose, sounded with a weighted-tape, or using a pre-measured hose. Refer to the available monitoring well information to determine the depth and length of the screen interval. Measure the depth of the pump intake while lowering the pump into location. Record pump location in field logbook or ground-water sampling log.

8B. Dedicated system - Pump has already been installed, refer to the available monitoring well information and record the depth of the pump intake in the field logbook or ground-water sampling log.

9. Non-dedicated system and dedicated systems - Measure the water level (water level must be measured to nearest 0.01 feet) and record information on the ground-water sampling log, leave water level indicator probe in the monitoring well.

10. Non-dedicated and dedicated systems - Connect the discharge line from the pump to a flow-through cell. A “T” connection is needed prior to the flow-through cell to allow for the collection of water for the turbidity measurements. The discharge line from the flow-through cell must be directed to a container to contain the purge water during the purging and sampling of the monitoring well.

11. Non-dedicated and dedicated systems - Start pumping the well at a low flow rate (0.2 to 0.5 liter per minute) and slowly increase the speed. Check water level. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet (Puls and Barcelona, 1996). If drawdown is greater than 0.33 feet, lower the flow rate. 0.33 feet is a goal to help guide with the flow rate adjustment. It should be noted that this goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience (Puls and Barcelona, 1996).

12. Non-dedicated and dedicated systems - Measure the discharge rate of the pump with a graduated cylinder and a stop watch. Also, measure the water level and record both flow rate and water level on the ground-water sampling log. Continue purging, monitor and record water level and pump rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to ensure minimal drawdown in the monitoring well.

13. Non-dedicated and dedicated systems - During the purging, a minimum of one tubing volume (including the volume of water in the pump and flow cell) must be purged prior to recording the water-quality indicator parameters. Then monitor and record the water-quality- indicator parameters every three to five minutes. The water-quality indicator field parameters are turbidity, dissolved oxygen, specific electrical conductance, pH, redox potential, and temperature. Oxidation-reduction potential may not always be an appropriate stabilization parameter, and will depend on site-specific conditions. However, readings should be recorded because of its value as a double check for oxidizing conditions. Also, for the final dissolved oxygen measurement, if the readings are less than 1 milligram per liter, it should be collected and analyze with the spectrophotometric method (Wilde et al., 1998 Wilkin et al., 2001), colorimetric or Winkler titration (Wilkin et al., 2001). The stabilization criterion is based on three successive readings of the water quality field parameters; the following are the criteria which must be used:

Parameter	Stabilization Criteria	Reference
pH	+/- 0.1 pH units	Puls and Barcelona, 1996; Wilde et al., 1998
specific electrical conductance (SEC)	+/- 3% S/cm	Puls and Barcelona, 1996
oxidation-reduction potential (ORP)	+/- 10 millivolts	Puls and Barcelona, 1996
turbidity	+/- 10% NTUs (when turbidity is greater than 10 NTUs)	Puls and Barcelona, 1996; Wilde et al., 1998
dissolved oxygen	+/- 0.3 milligrams per liter	Wilde et al., 1998

Once the criteria have been successfully met indicating that the water quality indicator parameters have stabilized, then sample collection can take place.

14. If a stabilized drawdown in the well can't be maintained at 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off (for 15 minutes) and allow for recovery. It should be noted whether or not the pump has a check valve. A check valve is required if the pump is shut off. Under no circumstances should the well be pumped dry. Begin pumping at a lower flow rate, if the water draws down to the top of the screened interval again, turn pump off and allow for recovery. If two tubing volumes (including the volume of water in the pump and flow cell) have been removed during purging, then sampling can proceed next time the pump is turned on. This information should be noted in the field notebook or ground-water sampling log with a recommendation for a different purging and sampling procedure.

15. Non-dedicated and dedicated systems - Maintain the same pumping rate or reduce slightly for sampling (0.2 to 0.5 liter per minute) in order to minimize disturbance of the water column. Samples should be collected directly from the discharge port of the pump tubing prior to passing through the flow-through cell. Disconnect the pump's tubing from the flow-through cell so that the samples are collected from the pump's discharge tubing. For samples collected for dissolved gases or VOC analyses, the pump tubing needs to be completely full of ground water to prevent the ground water from being aerated as it flows through the tubing. The sequence of the samples is immaterial unless filtered (dissolved) samples are collected and they must be collected last (Puls and Barcelona, 1996). All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container. When filling the VOC samples, a meniscus must be formed over the mouth of the vial to eliminate the formation of air bubbles and head space prior to capping. In the event that the ground water is turbid, (greater then 10 NTUs), a filtered metal (dissolved) sample also should be collected.

If filtered metal sample is to be collected, then an in-line filter is fitted at the end of the discharge tubing and the sample is collected after the filter. The in-line filter must be pre-rinsed following manufacturer's recommendations and if there are no recommendations for rinsing, a minimum of 0.5 to 1 liter of ground water from the monitoring well must pass through the filter prior to sampling.

16A. Non-dedicated system - Remove the pump from the monitoring well. Decontaminate the pump and dispose of the tubing if it is non-dedicated.

16B. Dedicated system - Disconnect the tubing that extends from the plate at the wellhead (or cap) and discard after use.

17. Non-dedicated system - Before locking the monitoring well, measure and record the well depth (to 0.1 feet).

Measure the total depth a second time to confirm initial measurement; measurement should agree within 0.01 feet or re-measure.

18. Non-dedicated and dedicated systems - Close and lock the well.

DECONTAMINATION PROCEDURES

Decontamination procedures for the water level meter and the water quality field parameter sensors.
The electronic water level indicator probe/steel tape and the water-quality field parameter sensors will be decontaminated by the following procedures:

1. The water level meter will be hand washed with phosphate-free detergent and a scrubber, then thoroughly rinsed with distilled water.

2. Water quality field parameter sensors and flow-through cell will be rinsed with distilled water between sampling locations. No other decontamination procedures are necessary or recommended for these probes since they are sensitive. After the sampling event, the flow cell and sensors must be cleaned and maintained per the manufacturer's requirements.

Decontamination Procedure for the Sampling Pump

Upon completion of the ground water sample collection the sampling pump must be properly decontaminated between monitoring wells. The pump and discharge line including support cable and electrical

wires which were in contact with the ground water in the well casing must be decontaminated by the following procedure:

1. The outside of the pump, tubing, support cable and electrical wires must be pressure-sprayed with soapy water, tap water, and distilled water. Spray outside of tubing and pump until water is flowing off of tubing after each rinse. Use bristle brush to help remove visible dirt and contaminants.
2. Place the sampling pump in a bucket or in a short PVC casing (4-in. diameter) with one end capped. The pump placed in this device must be completely submerged in the water. A small amount of phosphate-free detergent must be added to the potable water (tap water).
3. Remove the pump from the bucket or 4-in. casing and scrub the outside of the pump housing and cable.
4. Place pump and discharge line back in the 4-in. casing or bucket, start pump and recirculate this soapy water for 2 minutes (wash).
5. Re-direct discharge line to a 55-gallon drum. Continue to add 5 gallons of potable water (tap water) or until soapy water is no longer visible.
6. Turn pump off and place pump into a second bucket or 4-in. casing that contains tap water. Continue to add 5 gallons of tap water (rinse).
7. Turn pump off and place pump into a third bucket or 4-in. casing which contains distilled/deionized water, continue to add 3 to 5 gallons of distilled/deionized water (final rinse).
8. If a hydrophobic contaminant is present (such as separate phase, high levels of PCBs, etc.), an additional decontamination step, or steps, may be added. For example, an organic solvent, such as reagent-grade isopropanol alcohol may be added as a first spraying/bucket prior to the soapy water rinse/bucket.

FIELD QUALITY CONTROL

Quality control (QC) samples must be collected to verify that sample collection and handling procedures were performed adequately and that they have not compromised the quality of the ground-water samples. The appropriate EPA program guidance must be consulted in preparing the field QC sample requirements for the site-specific Quality Assurance Project Plan (QAPP).

There are five primary areas of concern for quality assurance (QA) in the collection of representative ground-water samples:

1. Obtaining a ground-water sample that is representative of the aquifer or zone of interest in the aquifer. Verification is based on the field log documenting that the field water-quality parameters stabilized during the purging of the well, prior to sample collection.
2. Ensuring that the purging and sampling devices are made of materials, and utilized in a manner that will not interact with or alter the analyses.
3. Ensuring that results generated by these procedures are reproducible; therefore, the sampling scheme should incorporate co-located samples (duplicates).
4. Preventing cross-contamination. Sampling should proceed from least to most contaminated wells, if known. Field equipment blanks should be incorporated for all sampling and purging equipment, and decontamination of the equipment is therefore required.
5. Properly preserving, packaging, and shipping samples.

All field QC samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The chain-of-custody procedures for the QC samples will be identical to the field ground-water samples. The following are QC samples that must be collected during the sampling event:

Sample Type	Frequency
● Field duplicates	1 per 20 samples
● Matrix spike	1 per 20 samples
● Matrix spike duplicate	1 per 20 samples
● Equipment blank	per Regional require-ments or policy
● Trip blank (VOCs)	1 per sample cooler
● Temperature blank	1 per sample cooler

HEALTH AND SAFETY CONSIDERATIONS

Depending on the site-specific contaminants, various protective programs must be implemented prior to sampling the first well. The site Health and Safety Plan should be reviewed with specific emphasis placed on the protection program planned for the sampling tasks. Standard safe operating practices should be followed, such as minimizing contact with potential contaminants in both the liquid and vapor phase through the use of appropriate personal protective equipment.

Depending on the type of contaminants expected or determined in previous sampling efforts, the following safe work practices will be employed:

Particulate or metals contaminants

1. Avoid skin contact with, and incidental ingestion of, purge water.
2. Use protective gloves and splash protection.

Volatile organic contaminants

1. Avoid breathing constituents venting from well.
2. Pre-survey the well head space with an appropriate device as specified in the site Health and Safety Plan.
3. If monitoring results indicate elevated organic constituents, sampling activities may be conducted in level C protection. At a minimum, skin protection will be afforded by disposable protective clothing, such as Tyvek®.

General practices should include avoiding skin contact with water from preserved sample bottles, as this water will have pH less than 2 or greater than 10. Also, when filling pre-acidified VOA bottles, hydrochloric acid fumes may be released and should not be inhaled.

POST-SAMPLING ACTIVITIES

Several activities need to be completed and documented once ground-water sampling has been completed. These activities include, but are not limited to the following:

1. Ensuring that all field equipment has been decontaminated and returned to proper storage location. Once the individual field equipment has been decontaminated, tag it with date of cleaning, site name, and name of individual responsible.
2. Processing all sample paperwork, including copies provided to the Regional Laboratory, Sample Management Office, or other appropriate sample handling and tracking facility.
3. Compiling all field data for site records.
4. Verifying all analytical data processed by the analytical laboratory against field sheets to ensure all data has been returned to sampler.

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SAMPLING CHECKLIST

Well Identification:_____

Map of Site Included: Y or N
Wells Clearly Identified with Roads: Y or N
Well Construction Diagram Attached: Y or N

Well Construction:

Diameter of Borehole:_____ Diameter of Casing:_____
Casing Material:_____ Screen Material:_____
Screen Length:_____ Total Depth:_____

Approximate Depth to Water:_____
Maximum Well Development Pumping Rate:_____
Date of Last Well Development:_____

Previous Sampling Information:

Was the Well Sampled Previously: Y or N
(If Sampled, Fill Out Table Below)

Table of Previous Sampling Information

Parameter	Previously Sampled	Number of Times Sampled	Maximum Concentration	Notes (include previous purge rates)

Ground Water Sampling Log

Site Name: **Well #:** **Date:**

Well Depth(Ft-BTOC[1]): **Screen Interval**(Ft):

Well Dia.: **Casing Material:** **Sampling Device:**

Pump placement(Ft from TOC[2]):

Measuring Point: **Water level (static)**(Ft):

Water level (pumping)(Ft): **Pump rate**(Liter/min):

Sampling Personnel:

Other info: (such as sample numbers, weather conditions and field notes)

Water Quality Indicator Parameters

Time	Pumping rates (L/Min)	Water level (ft)	DO (mg/L)	ORP (mv)	Turb. (NTU)	SEC[3] (S/cm)	pH	Temp. (C^0)	Volume pumped (L)

Type of Samples collected:

1 casing volume was:

Total volume purged prior to sample collection:

[1]**BTOC-Below Top of Casing**
[2]**TOC-Top of Casing**
[3]**Specific Electrical Conductance**

Stabilization Criteria

D.O.	+/- 0.3 mg/l
Turb.	+/- 10%
S.C.	+/- 3%
ORP	+/- 10 mV
pH	+/- 0.1 unit

Appendix H
Stage 1/2 Abatement Plan

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

HEALTH AND SAFTEY PLAN:
Monitoring Well Sampling and Maintenance

Lime Rock Resources
ASAU #150 Release – Abatement Plan

Eddy County, NM

November 2018

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

R. T. Hicks Consultants, Ltd.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

1.0 EMERGENCY CONTACTS:

In the event of an accident:

1. Stop all activities;
2. Go to the designated safe zone as determined in the health and safety briefing,
3. Verify every worker is present and is not injured,
4. If an accidental release occurred, take remedial actions as appropriate.
5. Contact the personnel listed below as appropriate – cell phone coverage may be spotty:

Ambulance	911
Fire Department	911
Police Department	911
State Police	911
Hospital: Artesia General Hospital 702 N 13th Street, Artesia, NM	575-748-3333
Eddy County Sherriff	575-887-7551
NM Environment Department Occupational Health and Safety Bureau Santa Fe, NM	505-827-4230
Hicks Consultants Health and Safety Manager	505-238-9515 (mobile); Randall Hicks
Hicks Consultants Principal	505-238-9515 (mobile); Randall Hicks
Lime Rock Resources contact: Mike Barrett, Production Superintendent	505-353-2644 (mobile) 575-365-9724 (office)

2.0 ROUTE TO HOSPITAL

The closest hospital with an emergency room is the Artesia General Hospital. The total distance to the hospital is approximately 11 miles, and the drive time is approximately 20 minutes. Map and directions to the medical center is attached at the end of this HASP, which will be located in the RT Hicks Consultants work vehicle.

3.0 SITE LOCATION

The work is to occur on the east side of Fanning Road (CR-44), just south of the Peñasco Draw, south of Artesia, NM. The site coordinates are latitude 32.74266°, longitude ¯104.34846°. Approximate street location is 86 Fanning Road, Artesia, NM.

4.0 SITE TYPE AND SURROUNDING POPULATION

The area is a mixture of farm and oilfield use. Paved county roads service the area from US Highway 285 between Carlsbad and Artesia. An occupied residence is located due south of the Site.

5.0 SCOPE OF WORK

The scope of work will involves regular sampling of groundwater from and routine maintenance of monitoring wells and recovery wells in accordance with communications with NMOCD and Lime Rock, the Abatement Plan, and the sampling protocol.

6.0 REGULATORY STATUS

The site is under regulation by NMOCD.

7.0 WASTE TYPES AND CHARACTERISTICS

Waste consists of purged groundwater removed during the sampling of monitoring wells. Groundwater will also be removed through the recovery well(s). The groundwater removed will likely include elevated concentrations of dissolved hydrocarbon components, chloride, and sulfate, as well as floating hydrocarbon associated with the pipeline release. This waste will be secured on site and monitored by Lime Rock personnel until it will be disposed of into a salt water disposal well.

8.0 SITE AND PROJECT PERSONNEL

David Hamilton Site Health and Safety Officer

9.0 ADDITIONAL PERSONNEL

10.0 PERSONAL PROTECTIVE EQUIPMENT AND GENERAL FIELD WORK RULES

R.T. Hicks Consultants, Ltd. considers all field activities to be potentially hazardous and have a high level of risk. The risk of serious injury or death is always present. If there is any discomfort or apprehension in performing the activities required, or if any concern arises, inform the Site Health and Safety Officer (SHSO). If there is any discomfort or apprehension in performing a task, immediately stop that activity, stabilize the situation (if safely possible) and contact the SHSO. As a policy, normal fieldwork with Hicks Consultants will not involve work in level C PPE. **We will make every effort to modify the work environment to permit work in level D PPE**.

Level D Personal Protection Equipment (PPE) includes but is not limited to the following:

- Hard Hats
- Gloves
- Steel-Toed Boots
- Safety Glasses
- Hearing Protection (when near operating equipment)
- Fire Resistant Coveralls (optional)

1) The SHSO will determine required PPE. Consideration must be given to H_2S, dusts, vapors, fumes, corrosive materials, flying objects, high-noise levels, slippery footing, trip hazards, temperature extremes, weather conditions and other known or suspected hazards.

2) Level C PPE requirements include all level D equipment as well as the following.

   - Coveralls (material depends on specific conditions)
   - Under-gloves
   - Respiratory Protection (APR with appropriate cartridge based on known contaminants)

3) Workers must be aware of, and carefully monitored for, heat stress and/or hypothermia (See Attachment A).

4) No persons will enter any excavations over four (4) feet in depth unless the excavation has been sloped, shored, or braced in accordance with OSHA requirements. Special fall arresting and retrieval equipment may be required where the potential of a fall hazard of over four (4) feet exists.

5) All persons must wash hands and face before hand-mouth contact and at the end of the task.

6) Decontaminate clothing (such as gloves and boots) that have come into contact with sources of contamination.

7) All work operations shall cease at sunset unless proper auxiliary light has been provided and approved by the Site Health and Safety Officer.

8) Eating, drinking, smoking, chewing and application of makeup shall be done only in areas designated by the Site Health and Safety Officer.

9) Each day, all personnel will attend a safety meeting prior to beginning work on site. They will sign a form stating their understanding of site hazards and agreement to abide by provisions of the Site Health and Safety Plan.

10) Please notify the Site Health and Safety Officer, as well as co-workers, to any allergies to insects, plants, or medications.

11) Waste groundwater will only be disposed of into secure containers approved by Lime Rock. Only waste groundwater from the on-site sampling and recovery wells will be put into the containers.

11.0 PHYSICAL HAZARDS

1) Utilities: Contact with overhead power lines on the site may result in shock, electrocution or burns. Special work procedures are required for any work under overhead power lines. Before any ground intrusive activities are initiated, the location(s) of any buried utilities shall be determined. Digging in the vicinity of buried utilities will require special work procedures to prevent contact with the utilities and/or stabilize utility lines.

2) Water Impoundments: Water impoundments present a potential drowning hazard. OSHA requirements for working over or near water must be followed (29 CFR 1926.106).

3) Hazardous Energy Sources: Energy sources associated with the site may consistute a hazard. A "Zero-Energy" or "Lockout-Tagout" program will protect site workers from hazardous sources (29 CFR 1926.146).

4) Ladders: Ladders present a potential fall hazard. Any inplace ladders shall not be used until a competent person certifies their structural integrity. Portable ladders shall comply with OSHA requirements (29 CFR 1926, Subpart X).

5) Slips, Trips and Falls: Poor housekeeping, topography and weather conditions are some of the factors that may expose worker to injury from slips, trips or falls.

6) Solar Exposure: Project worker should be aware that solar irradiation is possible. Contact with petroleum hydrocarbon can intensify solar irradiation and can cause serious burns. Protection is necessary to prevent sunburn and reduce the risk of skin cancer.

7) Topography: The topography of the site may present hazards or contribute to other listed hazards. For example, work on a hillside or gradually sloped surface may increase the potential of slips, trips and falls, or the potential for vehicles or equipment to move unexpectedly.

8) Unstable Structures and Materials: Some site structures, piles of materials and scrap may be unstable. Personnel should not enter such structures or work on such piles without adequate precautions to control hazards.

9) Sharps: Protruding nails, wire, sheet metal, scrap metal, lumber and natural trees and plants may present cut, puncture and abrasion hazards.

10) **Fire and Explosion: Refined petroleum products as well as natural vegetation present a fire and/or explosion hazard. Extreme caution must be observed when performing work involving potential sources of ignition. OSHA fire protection and prevention requirements are addressed in 29 CFR 1926.24 and 29 CFR, subpart F.**

11) Power and Hand Tool Operation: The operation of power and hand tools will expose worker to the possibility of cuts, pinches, crushing of extremities, punctures, eye injuries, shock and electrocution (29 CFR 1926, Subpart I).

12) Vehicle Operation: The operation of vehicles to access the site and perform tasks may subject workers to hazards associated with improper vehicle operation, slick roads, narrow bridges, construction traffic and livestock and wildlife on the road.

13) **Heavy Equipment Operation: Some of the hazards that may be associated with the operation of heavy equipment include: noise, crushing, pinch points, collisions, rollovers, electrocution and fire. Carefully designed and followed traffic patterns for heavy equipment, proper inspection and maintenance and worker awareness are crucial requirements for controlling these hazards (29 CFR 1926.602).**

14) Working at Elevation: Project site work may involve work at some distance above the ground or other surfaces. Falls can result in serious injury or death if adequate fall protection is not used (29 CFR 1926, Subpart M).

15) Sampling groundwater: Some sample containers may include a liquid preservative chemical compound provided by the laboratory. Consult Safety Data Sheets for the material named on the container label.

16) Biological: Indigenous wildlife posses potential human health hazards. Appendix B contains further information on this topic.

12.0 CHEMICAL HAZARDS

Potential chemical hazards and exposure information are provided in Appendix C. Workers must constantly be aware of the possibility of chemical exposure. Always work in a well-ventilated area and be aware of the physiological effects of chemical exposure. Some symptoms of exposure are:

- Irritation of eyes, nose, throat and/or skin
- Lightheadedness
- Nausea
- Headache
- Dizziness
- Confusion
- Difficulty Breathing

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The primary known chemical hazards associated with this site are volital organic compounds. Appendix C contains Material Safety Sheets for the chemical hazards suspected at this site.

13.0 OPERATIONAL PROTECTIVE EQUIPMENT

Operational Protective Equipment will be used to secure the work site if necessary. Examples of Operational Protective Equipment include:

- Warning Signs
- Barricade Traps
- Fire Protection Equipment

14.0 COMMUNICATION

While constructing the boreholes or water wells with a drilling rig heavy equipment operators must be able to communicate with persons within the restricted areas at all times. Communication methods include:

- Visual Hand Signals
- Sound (Voice)
- Tactile (Touching)

Means of communication must be readily available in the event of emergency conditions such as personnel injury, fire or severe weather conditions. Mobile phones or two-way radios typically provide this capability.

15.0 ALCOHOL/DRUG USE/FIREARMS

The use of alcohol and/or other drugs (including prescription and non-prescription medications) endangers the safety of yourself and others around you. Please inform the SHOS of any medications in use. Anyone under the influence of alcohol and/or other drugs will not be allowed on site.

Alcohol consumption during working hours is strictly forbidden by Hicks Consultants. Employees are subject to immediate termination. Contractors will be terminated from the assignment.

Cigarette smoking is also not permitted on site.

Firearms are not permitted on site.

16.0 SAMPLING

Sampling of cuttings during the drilling of a well will be conducted in accordance with a Sampling Plan. Routine sampling of grounddwater from monitoring or recovery wells will be conducted in accordance with the Sampling Protocol.

17.0 SITE HEALTH AND SAFETY PLAN APPROVALS

Prepared by: Kristin Pope

Signature: Kristin Pope

Site Health and Safety Officer: David Hamilton

Signature: David J. Hamilton

ATTACHMENT A. HEAT AND COLD STRESS

ATTACHMENT A

HEAT AND COLD STRESS

Introduction

Stress can contribute significantly to accidents or harm workers in other ways.

The term stress denotes the physical (gravity, mechanical force, heat, cold, pathogen, injury) and psychological (fear, anxiety, joy) forces that are experienced by individuals.

The body's response to stress occurs in three stages:

- **Alarm reaction** in which the body recognizes the stressor and the pituitary-adreno-cortical system responds by increasing the heart rate and blood sugar level, decreasing digestive activity and dilating the pupils.
- **Adaptive stage** in which the body repairs the effects of stimulation and the stress symptoms disappear.
- **Exhaustion stage** in which the body can no longer adapt to stress and individuals may develop emotional disturbances and/or cardiovascular and renal diseases.

The most common types of stress that affect field personnel are heat stress and cold stress. Current thinking is that heat and cold stress may be the most serious hazards to workers at waste sites with low chemical or radiological hazard levels.

Heat Stress

For field workers, heat stress usually is a result of protective clothing decreasing natural body ventilation, although it may occur at any time work is being performed at elevated temperatures.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal. Because heat stress is one of the most common and potentially serious illnesses at hazardous waste sites, regular monitoring and other preventative measures are vital.

Site workers must learn to recognize and treat the various forms of heat stress. The best approach is preventative heat stress management. In general:

- **Have workers drink 16 ounces of water before beginning work**, such as in the morning or after lunch. Provide disposable 4-ounce cups and water that is maintained at 50 - 60 degrees Fahrenheit (°F). Urge workers to drink 1 - 2 of these cups of water every 20 minutes, for a total of 1 - 2 gallons per day. Provide a cool, preferably air-conditioned area for rest breaks. Discourage the use of alcohol in non-working hours, and discourage the intake of coffee during working hours. Monitor for signs of heat stress.
- **Acclimate workers** to site work conditions by slowly increasing workloads, ie., do not begin site work activities with extremely demanding activities.
- **Provide cooling devices** to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear which acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- **Install mobile showers** and/or hose-down facilities to reduce body temperature and cool protective clothing.
- **In hot weather, conduct field activities in the early morning or evening.**

- **Ensure that adequate shelter is available** to protect personnel against heat, cold, rain, snow, etc., which can decrease physical efficiency and increase the probability of both heat and cold stress. If possible, set up the command post in the shade.
- In hot weather, **rotate shifts of workers** wearing impervious clothing.
- **Good hygienic standards must be maintained** by frequent changes of clothing and by showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of heat-regulating mechanisms of the body - the individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

- **Symptoms:** Red, hot, dry skin, although person may have been sweating earlier; nausea; dizziness; confusion; extremely *high* body temperature, rapid respiratory and pulse rate; unconsciousness or coma.
- **Treatment:** Cool the victim quickly. If the body temperature is not brought down fast, permanent brain damage or death will result. Soak the victim in cool but not cold water, sponge the body with cool water, or pour water on the body to reduce the temperature to a safe level (102 °F). Observe the victim and obtain medical help. Do not give coffee, tea or alcoholic beverages.

Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. This condition is much less dangerous than heat stroke, but it nonetheless must be treated.

- **Symptoms:** Pale, clammy, moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit, and may be dizzy.
- **Treatment:** Remove the person to a cool, air conditioned place, loosen clothing, place in a head-low position, and provide bed rest. Consult physician, especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink 1 - 2 cups water immediately, and every 20-minutes thereafter, until symptoms subside. Total water consumption should be about 1 - 2 gallons per day.

Heat Cramps

Heat cramps are caused by perspiration that is not balanced by adequate fluid intake. Heat cramps are often the first sign of a condition that can lead to heat stroke.

- **Symptoms:** Acute painful spasms of voluntary muscles, e.g., abdomen and extremities.
- **Treatment:** Remove victim to a cool area and loosen clothing. Have patient drink 1 - 2 cups of water immediately, and every 20 minutes thereafter, until symptoms subside. Total water consumption should be 1 - 2 gallons per day. Consult with physician.

Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and aggravated by chafing clothes. The condition decreases ability to tolerate heat.

- **Symptoms:** Mild red rash, especially in areas of the body in contact with protective gear.
- **Treatment:** Decrease amount of time in protective gear, and provide powder to help absorb moisture and decrease chafing.

Heat Stress Monitoring and Work Cycle Management

For strenuous field activities that are part of on-going site work activities in hot weather, the following procedures shall be used to monitor the body's physiological response to heat and to manage the work cycle, even if workers are not wearing impervious clothing.

These procedures are to be instituted when the temperature exceeds 70 °F.

If these procedures are required, a qualified Site Health and Safety Coordinatory (SHSC) will perform and record them.

- **Measure Heart Rate (HR).** Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats/minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats/minute.
- **Measure Body Temperature.** Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99.6 °F. If it does, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the OT exceeds 99.6 °F at the beginning of the next period, the following work cycle should be further shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6 °F.
- Temperature and pulse can be simultaneously recorded using an oral/temp probe.
- Manage Work/Rest Schedule. The following work/rest schedule shall be used as a guideline.

Attachment A (continued)

WORK/REST SCHEDULE	
Adjusted Temperature (°F)	Work Time (min/hr) Using Level B/C Gear
75 or less	50
80	40
85	30
90	20
95	10
100	0
Calculate the adjusted temperature: T (adjusted) = T (actual) + (13 x fraction sunshine)	

Measure the air temperature with standard thermometer. Estimate fraction of sunshine by judging what percent the sun is out: 100% sunshine = no cloud cover = 1.0; 50% sunshine = 50% cloud cover = 0.5; 0% sunshine = full cloud cover = 0.0).

Reduce or increase the work cycle according to the guidelines under heart rate and body temperature.

Cold Stress

Persons working outdoors in low temperatures, especially at or below freezing, are subject to cold stress. Exposure to extreme cold for a short time causes severe injury to the surface of the body, or results in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible.

Protective clothing generally does not afford protection against cold stress. In many instances, it increases susceptibility.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is perspiration soaked.

Frostbite

Local injury resulting from cold is included in the generic term frostbite. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite is characterized by sudden blanching or whitening of skin.
- Superficial frostbite is characterized by skin with a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

- Deep frostbite is characterized by tissues that are cold, pale, and solid.

To administer first aid for frostbite: Take the victim indoors and rewarm the areas quickly in water that is between 39 °C and 41 °C (102 °F - 105 °F). Give a warm drink - not coffee, tea or alcohol. The victim must not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws. Then elevate the injured area and protect it from injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm and get immediate medical care.

After thawing, the victim should try to move the injured areas a little, but no more than can be done alone, without help.

Note:

- Do *not* rub the frostbitten part (this may cause gangrene)
- Do *not* use ice, snow, gasoline or anything cold on the frostbitten area.
- Do *not* use heat lamps or hot water bottles to rewarm the part.
- Do *not* place the part near a hot stove.

Hypothermia

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages:

- Shivering
- Apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95 °F
- Unconsciousness, glassy stare, slow pulse, and slow respiratory rate
- Freezing of the extremities
- Death

As a general rule, field activities shall be curtailed if equivalent chill temperature as defined in Table 1 is below zero (0 °F) unless the activity is of an emergency nature.

Table 1

Cooling Power On Exposed Flesh Expressed As An Equivalent Temperature Under Calm Conditions *

Estimated Wind Speed [miles per hour (mph)]	ACTUAL TEMPERATURE READING (°F)											
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53-	67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER in <hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
Trenchfoot and immersion foot may occur at any point on this chart.												

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.
SOURCE: ACGIH, Threshold Limit Values for Chemical Substances in the Work Environment for 1984-1985.

ATTACHMENT B. BIOLOGICAL HAZARDS

ATTACHMENT B

BIOLOGICAL / BIOTA HAZARDS

Snakes and venomous arthropods, including insects, spiders, ticks, scorpions, centipedes, and others, create a hazard when their habitats are disturbed. Wasp and bee stings account for a number of fatalities each year. In the United States, snake bites rarely kill because effective treatments have been developed. The best defense is to understand where these creatures may be found and avoid them. Should a bite or sting occur, first aid should be applied immediately and medical treatment sought as indicated below.

Black Widow Spider (*Latrodectus* spp.) is a sedentary web spider found in most warm parts of the world. Only the females bite and then only if threatened or molested. The spider's perception of threat may be different than your intent. The bite may go unnoticed and may not hurt, but the subsequent severe abdominal pain from a black widow's bite resembles appendicitis. There is pain also in muscles and in the soles of the feet but usually no swelling at the site of the bite. Alternately, the saliva flows freely, then the mouth is dry. The bite victim sweats profusely. The eyelids are swollen. The patient usually recovers after several days of agony. Physicians can relieve the severe pain by injection of calcium gluconate. Antivenin is available; however, there is no first-aid treatment for any spider bite. Black widows are common throughout New Mexico, except perhaps at high altitudes.

Brown Spider (also known as brown recluse spider, violin spider) (*Loxosceles* spp.) commonly lives in houses or on the floor or behind furniture. Bites occur when a spider rests in clothing or in a towel or when a human reaches to or walks closely by one of the spiders remote hiding places. Bites may cause no harm at all. In very severe cases, a red zone appears around the bite, then a crust forms and falls off. The wound grows deeper and does not heal for several months. The spider's venom may cause destruction of red blood cells and other blood changes. The victim may develop chills, fever, joint pains, nausea, and vomiting. In some cases, a generalized rash develops one to two days after the bite. Victim should consult a physician as soon as signs of illness appear. Brown recluse bites and suspected bites have been reported from various parts of New Mexico, especially the southeastern part of the state. However, a specimen of the spider has yet to be collected from the state.

Scorpions of the family Vejovidae are common throughout the desert regions of the southwestern United States and southern California. Vejovid scorpions rarely exceed three inches in length. Scorpions feed at night on insects and spiders, catching them with their pincers and sometimes stinging them. The stinger is in the tip of the tail. Vejovid scorpions burrow in the earth and are sometimes found under rocks and other objects lying on the ground. Scorpions sting in self-defense. Most stings are not serious, but may produce excruciating pain at the site of the sting. The victim may develop nausea, vomiting, and severe abdominal pain. First aid consists of applying cold to the site of the sting and possibly a soothing lotion, such as calamine.

Black Scorpion, *Centruroides exilacauda* (once known as *Centruroides sculpturatus*) of the Buthidae family, is found along the Colorado River and the pine forests in Arizona and southwestern New Mexico. It is the only dangerous scorpion found in the continental United States. They are typically only an inch in length and are a translucent straw color. Its poison affects the nerves, causing severe pain. The sting from this scorpion has been responsible for deaths of small children.

Ticks (suborder *Ixodides*) are external parasites of reptiles, birds, and mammals. Most drop off their host after feeding. They molt and then wait on the tips of leaves, forelegs outstretched, ready to attach to any animal brushing past. The bites of some soft-bodied ticks may cause mild paralysis to man. Ticks transmit many seases, most important, Rocky Mountain spotted fever and Lyme Disease. Ticks attach themselves to the host only with their mouth parts and feed on blood. In removing a tick, take care not to leave mouth parts behind. Ticks are best removed by pulling them off with steady, gentle pressure. The pull must be light enough to not injure the tick. It may take more than 10 minutes of pulling to remove the tick. Be patient! After tick is removed, wash area thoroughly with soap and water, gently scrubbing the area of the tick bite.

Fleas (order *Siphonaptera*) in central New Mexico can be carriers of bubonic plague. The plague is usually limited to rodent populations, including squirrels and various species of wild mice and rats. The fleas that parasitize rodents will rarely parasitize people; however, contact with freshly dead or ill animals should be avoided. Fleas from these animals will bite humans providing a pathway for the plague bacillus to enter the body.

Ants, bees, wasps, hornets, and yellow jackets (order *Hymenoptera*) occasionally cause death. Death from the sting of such creatures is almost always due to acute allergic reaction. The stinging apparatus and venom sac sometimes remain at the site of the sting and must be removed. Some relief from the pain can be obtained by applying cold. Soothing lotions, such as calamine, may reduce itching.

If the victim has a history of allergic reactions to insect bites or is subject to attacks of hay fever or asthma, or if he is not promptly relieved of symptoms, call a physician or take the victim immediately to the nearest location where medical treatment is available. In a highly sensitive person, do not wait for symptoms to appear, since delay can be fatal. If a site worker knows he is sensitive to Hymenoptera stings or bites, he is responsible for notifying the agency responsible for his medical surveillance, the taskleader, and the site safety officer.

Rattlesnakes are common in the wilder parts of the United States and New Mexico. Rattlesnakes belong to the family of pit vipers (*Crotalinae*). These snakes have a pit between the eye and nostril on each side of the head, elliptical pupils, from one to six fangs (but usually two well-developed fangs), and one row of plates beneath the tail. The head is triangular and wider than the neck and body. The venom of these snakes affects the circulatory system. All reactions from snakebites are aggravated by acute fear and anxiety. Nonpoisonous snakes have two round pupils, no fangs or pit, a double row of plates beneath the tail, and the head is not wider than the neck and body.

Some of the pit vipers found in New Mexico are described below. These are the only poisonous snakes found in New Mexico.

Timber rattlesnake, *Crotalus horridus* (also called banded rattlesnake, mountain rattler, and black rattler), is found in uplands and mountains. Adults range 36 to 60 inches in length.

Western Diamondback rattlesnakes, *Crotalus atrox* and *C. ruber*, are found in the desert areas of New Mexico, as far north as Albuquerque. They can grow to 72 inches in length.

Western or Prairie rattlesnakes, *Crotalus viridis*, are found almost everywhere in New Mexico. Adult snakes range 30 to 60 inches in length.

Attachment B (continued)

Blacktail Rattlesnake, *Crotalus viridis*, is typically found in mountains and canyons of southern New Mexico. It can reach 60 inches in length.

First Aid

The bite of a rattlesnake is extremely painful and swells rapidly. The bite is marked by one or more puncture wounds created by fangs. Within hours after the venom is injected, the skin becomes discolored and ecchymosis develops and progresses to petechiae and hemorrhagic vesiculation. Weakness, sweating, faintness, nausea, tender lymph nodes, and tingling or numbness of the tongue, mouth, or scalp are common.

The objective of the first aid to the snake bite victim is to:

- Reduce circulation of blood through the bite area
- Delay absorption of venom
- Prevent aggravation of the local wound
- Sustain respiration.

The most important step is to get the victim to the hospital quickly. Meanwhile, take the following first-aid measures:

- Keep the victim from moving around.
- Keep the victim as calm as possible and preferably lying down.
- Immobilize the bitten extremity and keep it at or below the heart level. If the victim can reach a hospital within 4 or 5 hours and if no symptoms develop, no further first-aid measures need be applied.
- If mild to moderate symptoms develop, apply a constricting band 2 to 4 inches above the bite but not around a joint (elbow, wrist, knee, or ankle) and not around the neck, head, or trunk. The band should be 3/4 to 1/2 inches wide, not thin like a rubber band. The band should be snug but loose enough for a finger to be slipped underneath. Watch out for swelling. Loosen the band if it becomes too tight, but do not remove it. Periodically check the pulse in the extremity beyond the bite to ensure the blood flow has not stopped.
- Treat for shock. Keep the victim lying down and comfortable. Maintain his body temperature.
- If breathing stops, give mouth-to-mouth resuscitation. If breathing stops and there is no pulse, perform CPR.
- Identify the snake. If the snake can be killed without risk or delay, bring it to the hospital for identification. Use extreme caution when handling the snake, even when presumed dead. Postmortem nerve reactions can cause a deadly strike.
- Wash the area of the bite with soap and water. Blot dry with sterile gauze.
- Do not give alcohol, sedatives, aspirin, or any medicine containing aspirin.
- Cold therapy is not recommended.

Attachment B (continued)

ANTAVIRUS The Four Corner's Mystery Illness is an unexplained respiratory disease that has claimed eral lives in New Mexico. Preliminary evidence has shown that the illness may be caused by a hantavirus that y be carried in the urine, saliva, and feces of rodents (particularly rats and mice). With the current concerns over the illness, field personnel, especially those who work in remote locations, should be aware of the presence of any rodents and to take precautions when cleaning or otherwise disturbing areas where rodents may have been. The State of New Mexico Department of Health's preliminary recommendations, as of June 5, 1993, for rodent control follow. Some of the recommendations are geared towards living quarters but have been supplied here for your general information. Wherever possible, these recommendations should be applied to activities at SNL.

CONTROLLING EXPOSURES TO RODENT POPULATIONS

- Reduce the amount of food that is available for the rodents.
  - Food should be kept covered or in refrigerators.
  - Dirty dishes should not be left for long periods of time or left to soak in water.
  - Keep all bulk grains and animal foods outside the house in secure containers.
  - Do not overfeed birds.

- Whenever possible, do not sleep on the floor.

INDOOR AREAS

- Rodent droppings:
  - Use bleach (diluted as 1 part bleach to 10 parts water), alcohol, Lysol (or other diphenols) diluted as recommended on the bottle, or hospital disinfectants (benzalkonium chloride) to kill the virus.
  - Apply these cleaning solutions liberally (pour or spray them on the material) before sweeping or mopping floors.

- Animal bedding or nests:
  - First, fumigate with any commercially available insecticide that is indicated for fleas. It is not necessary to use more than the recommended amount. [NOTE: SNL employees and contractors are not permitted to apply their own pesticides. If you have a need for pesticide application, please contact Michael Vickers in Department 7816 at 844-7387.]

  - Bedding and nests should then be soaked in one of the solutions mentioned above. After they are thoroughly soaked, but before they have dried, these materials may be removed. Preferably, use a long-handled shovel to remove the materials. Rubber gloves must be worn.

Attachment B (concluded)

- OUTDOOR AREAS

  - Any possible rodent harborages, such as wood piles or pinon caches, SHOULD NOT be moved or cleared of rodents at this time. There is probably more danger if they are disturbed than if they are left alone.

Attachment B (concluded)

DISPOSAL OF CONTAMINATED MATERIALS

- Rural Areas:
  - The bedding, nests, or dead animals should be taken outside and buried in a two foot deep hole. They may be safely burned prior to burial.
  - Following disposal of the rodent material, gloves should be washed in the solutions mentioned above before discarding them.

- Urban Areas:
  - Contaminated materials should be soaked with the disinfectants mentioned above and then double bagged for refuse collection.

BUBONIC PLAGUE has returned to Albuquerque's mountain area. The plague is an illness that is caused by bacteria and is most often transmitted to humans by the fleas of rodents. The recommendations provided above for controlling exposures to rodent populations should be followed and all dead rodents, including rabbits and squirrels, should be avoided.

Industrial Hygiene personnel are available at 844-3665 for consultation and evaluation if you feel that your work area has a rodent problem. As mentioned previously, SNL employees and contractors are <u>not</u> permitted to apply their own pesticides. Michael Vickers in Department 7816 should be contacted at 844-7387 if you have a need for rodent control and/or pesticide application. If you have medical concerns, contact Dr. Sara Snider of Department 130 at 845-8159.

ATTACHMENT C. Material Safety Sheets

BELL FUELS -- LEAD-FREE GASOLINE; NO-LEAD GASOLINE - GASOLINE,UNLEADED
MATERIAL SAFETY DATA SHEET
NSN: 9130012084172
Manufacturer's CAGE: 8P539
Part No. Indicator: A
Part Number/Trade Name: LEAD-FREE GASOLINE; NO-LEAD GASOLINE

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General Information

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Item Name: GASOLINE,UNLEADED
Company's Name: BELL FUELS, INC
Company's Street: 4116 WEST PATERSON AVE
Company's City: CHICAGO
Company's State: IL
Company's Country: US
Company's Zip Code: 60646
Company's Emerg Ph #: 312-286-0200
Company's Info Ph #: 312-286-0200
Record No. For Safety Entry: 060
Tot Safety Entries This Stk#: 064
Status: SP
Date MSDS Prepared: 23FEB90
Safety Data Review Date: 21OCT94
Supply Item Manager: KY
MSDS Serial Number: BVHJT
Specification Number: VV-G-1690
Spec Type, Grade, Class: CIVGAS
Hazard Characteristic Code: F2
Unit Of Issue: DR
Unit Of Issue Container Qty: 55 GALLONS
Type Of Container: DRUM, 18 GAGE
Net Unit Weight: 325.2 LBS

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: HYDROCARBONS, AROMATIC
Ingredient Sequence Number: 01
Percent: 15-35
NIOSH (RTECS) Number: 1008732HA
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: SATURATED HYDROCARBONS
Ingredient Sequence Number: 02
Percent: 60-75
NIOSH (RTECS) Number: 1006886SH
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: UNSATURATED HYDROCARBONS
Ingredient Sequence Number: 03
Percent: 1-15
NIOSH (RTECS) Number: 1006887UH
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: DYE AND OTHER ADDITIVES
Ingredient Sequence Number: 04
Percent: 0.02
NIOSH (RTECS) Number: 1003746AD
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: BLUE OR CLEAR, TYPICAL HYDROCARBON ODOR.
Boiling Point: 90.0F,32.2C
Vapor Pressure (MM Hg/70 F): 414 @100C
Vapor Density (Air=1): 3-4
Specific Gravity: 0.71-0.77
Solubility In Water: NEGLIGIBLE.

Fire and Explosion Hazard Data

Flash Point: -50F,-46C
Flash Point Method: TCC
Lower Explosive Limit: 1.3
Upper Explosive Limit: 6
Extinguishing Media: ANY UL APPROVED CLASS B MEDIA SUCH AS FOAM, CARBON DIOXIDE, DRY CHEMICAL.
Special Fire Fighting Proc: NONE SPECIFIED BY MFG; HOWEVER USE APPROPRIATE PROTECTIVE EQPMT INCLUDING SELF-CONTAINED BREATHING APPARATUS.
Unusual Fire And Expl Hazrds: NONE SPECIFIED BY MFG; HOWEVER MATL IS HEAVIER THAN AIR AND WILL TRAVEL LONG DISTANCES & FLASHBACK. EXPLOSIVE MIXTURE FORMS W/GASOLINE & AIR.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MFG; HOWEVER AVOID OPEN FLAMES/HEAT/SPARKS/OTHER IGNITION SOURCES.
Materials To Avoid: OXIDIZERS.
Hazardous Decomp Products: NONE SPECIFIED BY MFG.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT.

Health Hazard Data

LD50-LC50 Mixture: UNKNOWN
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE:EYE:IRRIT @ HIGH VAP LEVELS OR DIRECT CONTACT W/FLUID. SKIN:IRRIT ON PROLONG CONTACT W/LIQ, DERM RESULTING FROM DEFATTING NATURE OF LIQ. SYSTEMATIC:CNS EFFECTS (NARCOSIS) @ HIGH VAP LEVELS; MUC MEMBRANE IRRIT, PNEUMONIA. INGEST:GASTROINTESTINAL DISTRUBANCES. CHRONIC:PERIPERAL NERVOUS SY EFFECTS, BLOOD ALTERATIONS
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: PER MSDS:NONE STATED; HOWEVER CONTAINS GASOLINE WHICH IS CONSIDERED BY IARC TO BE POTENTIAL CARCINOGEN.
Signs/Symptoms Of Overexp: EYE & SKIN IRRITATION. DERMATITIS. NARCOSIS. GI DISTURBANCES:NAUSEA, DIARRHEA, STOMACH PAINS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MFG.
THOROUGHLY WASH AREA W/SOAP & WATER. INHAL:REMOVE FROM CONTAMINATED AREA. ADMINISTER ARTIFICIAL RESP IF NECESSARY. CALL PHYSICIAN. INGEST:GIVE A

VEGETABLE OIL TO RETARD ABSORPTION. DO NOT INDUCE VOMITING. CALL PHYSICIAN.
FATAL DOSE ADULT HUMAN APPROX 350G, CHILD APPROX 10-13G.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: KEEP PUBLIC AWAY. SHUT OFF SOURCE W/O RISK. ADVISE POLICE & NAT RESP CENTER 800-424-8802 IF SUBSTANCE HAS ENTERED A WATER COURSE OR SEWER. CONTAIN LIQ W/EARTH, SAND. RECOVER FREE LIQ BY PPUMPING OR W/SUITABLE ABSORBENT.
Neutralizing Agent: NONE SPECIFIED BY MFG.
Waste Disposal Method: UNDER MANY SPILL SITUATIONS LIQ CAN BE RECOVERED & RECLAIMED. WHERE SOLID ABSORBENTS ARE USED THEY SHOULD BE INCINERATED PER APPLICABLE STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: USE APPROPRIATE GROUNDING-DISPENSING PROCEDURES. STORE IN RELATIVELY COOL PLACE. DO NOT EXPOSE TO HEAT, OPEN FLAME OR OXIDANTS.
Other Precautions: NONE SPECIFIED BY MFG.

Control Measures

Respiratory Protection: FOR EXPOSURES IN EXCESS OF EXPOSURE LIMITS CHEMICAL CARTRIDGE RESPIRATOR OR AIR SUPPLIED EQUIPMENT.
Ventilation: LOCAL EXHAUST REQUIRED & EXPLOSION PROOF EQUIPMENT.
Protective Gloves: IMPERMEABLE GLOVES.
Eye Protection: NONE SPECIFIED HOWEVER SAF GLASSES/GOGG
Other Protective Equipment: NONE SPEICFIED BY MFG.
Work Hygienic Practices: WASH HANDS AFTER HANDLING & PRIOR TO EAT/DRINK/SMOKE/USE OF TOILET FACILITIES. FOLLOW GOOD WORK HYGIENE PRACTICES.

Transportation Data

Trans Data Review Date: 94294
DOT PSN Code: GTN
DOT Proper Shipping Name: GASOLINE
DOT Class: 3
DOT ID Number: UN1203
DOT Pack Group: II
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: HRV
IMO Proper Shipping Name: GASOLINE
IMO Regulations Page Number: 3141
IMO UN Number: 1203
IMO UN Class: 3.1
IMO Subsidiary Risk Label: -
IATA PSN Code: MUC
IATA UN ID Number: 1203
IATA Proper Shipping Name: GASOLINE
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: MUC
AFI Prop. Shipping Name: GASOLINE
AFI Class: 3
AFI ID Number: UN1203
AFI Pack Group: II
AFI Basic Pac Ref: 7-7

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 21OCT94

Label Status: F
Common Name: LEAD-FREE GASOLINE; NO-LEAD GASOLINE
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE:EYE:IRRIT @ HIGH VAP LEVELS OR DIRECT CONTACT W/FLUID. SKIN:IRRIT ON PROLONG CONTACT W/LIQ, DERM RESULTING FROM DEFATTING NATURE OF LIQ. SYSTEMATIC:CNS EFFECTS (NARCOSIS) @ HIGH VAP LEVELS; MUC MEMBRANE IRRIT, PNEUMONIA. INGEST:GASTROINTESTINAL DISTRUBANCES. CHRONIC:PERIPERAL NERVOUS SYS EFFECTS, BLOOD ALTERATIONS. 1STAID:EYE:FLUSH FOR @ LEAST 15MINS W/WATER. SKIN:THOROUGHLY WASH AREA W/ SOAP & WATER. INHAL:REMOVE FROM CONTAMINATED AREA. ADMINISTER ARTIFICIAL RESP IF NECESSARY. CALL PHYSICIAN. INGEST:GIVE A VEGETABLE OIL TO RETARD ABSORPTION. DO NOT INDUCE VOMITING. CALL PHYSICIAN. FATAL DOSE ADULT HUMAN APPROX 350G, CHILD APPROX 10-13G.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: BELL FUELS, INC
Label Street: 4116 WEST PATERSON AVE
Label City: CHICAGO
Label State: IL
Label Zip Code: 60646
Label Country: US
Label Emergency Number: 312-286-0200

ATTACHMENT D. EMPLOYEE INCIDENT REPORT

Employee Injury/Exposure Incident Report

Name: _____ SSN: _____

Site Name/Client: _____

_____

Date of Report: _____ Task/Phase: _____

Incident Type: [ ] Possible Excessive Exposure [ ] Excessive Exposure [ ] Injury

Date of Incident: _____ Time of Incident: _____

Site Conditions at the Time of the Incident

Temperature: _____ Relative Humidity: _____ Precipitation: _____

Cloud Cover %: _____ Wind Speed & Direction: _____

Other Factors That May Have Impacted the Site: _____

Nature of Exposure/Injury

Material Exposed To: _____ Concentration: _____

Matrix: _____ Physical State: _____

Part(s) of Body Exposed or Injured: _____

Type or Extent of Injury or Exposure: _____

Medical Care Received

When: _____ Where: _____

Name of Physician: _____

Result of Exposure/Injury

[ ] Death [ ] Permanent Disability [ ] Temporary Disability [ ] Loss of Work Time

[ ] Other Explain: _____

Was Operation Conducted According to an Approved Health and Safety Plan

[ ] yes [ ] no Explain: _____

Who Witnessed the Injury/Incident: _____

Was the Injury/Incident due to the Failure of Protective Equipment [ ] yes [ ] no

Possible Cause of Injury/Incident: _____

_____

_____

Possible Prevention of the Injury/Incident: _____

Signature of Person Completing Report: _____

Name of Person Completing Report: _____

Employee Injury/Exposure Incident Report

In the event of an injury or incident:

- decontaminate the individual as much as possible without inflicting further injury
- if decontamination is not possible, wrap the individual in a tarp to prevent the contamination of the vehicle and medical treatment facility
- transport the victim to a medical treatment facility

The decision to use an ambulance or to use a vehicle from the site will depend upon the nature and severity of the injury. Minor injuries can usually be treated faster at a free- standing medical emergency center (Lovelace Urgent Care Center, Family Medical Center, etc.) than at a hospital emergency room. A more serious injury will often be referred to a hospital emergency room from a free-standing emergency center, this will of course result in additional delay, discomfort for the victim, and cost.

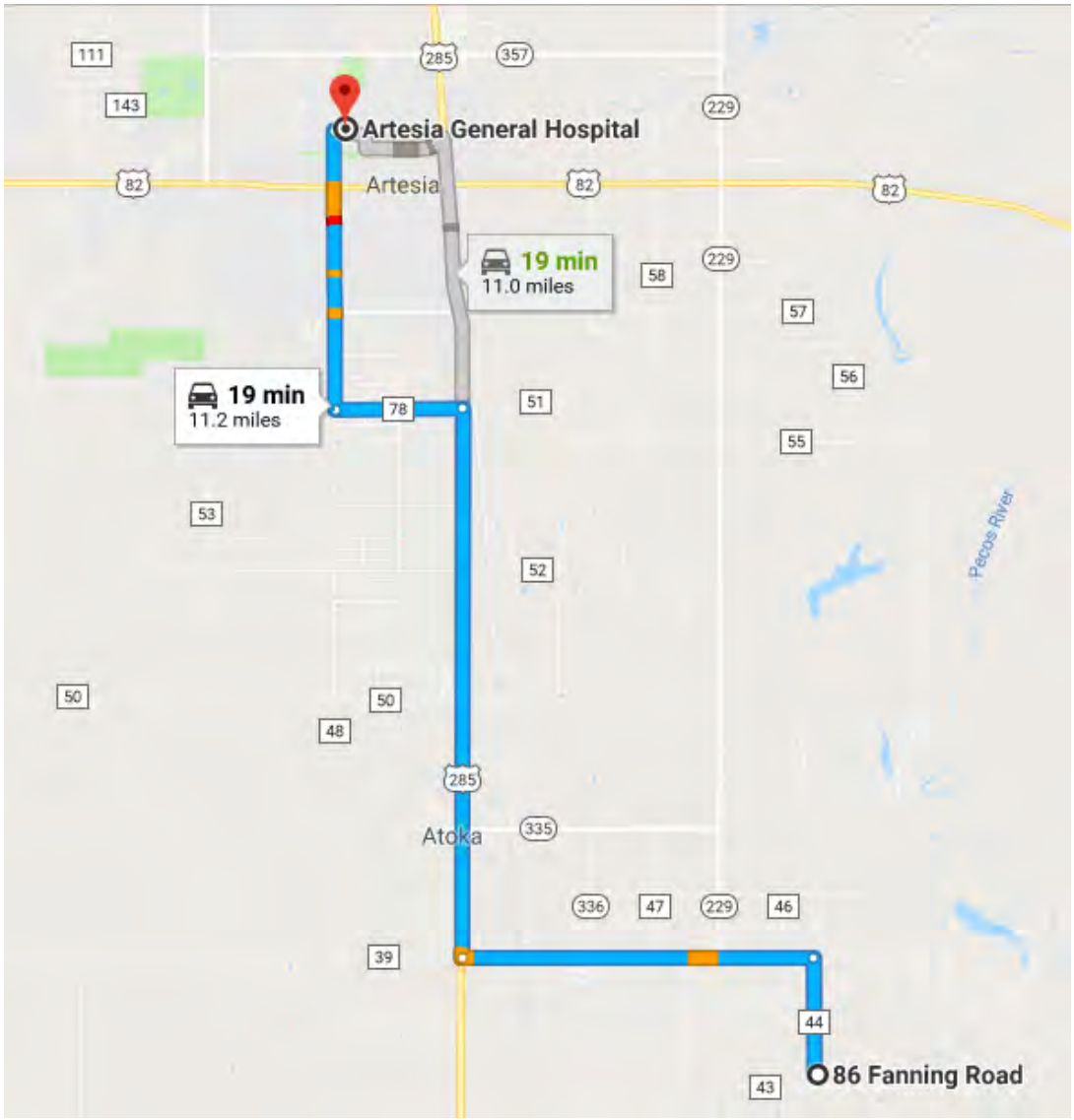
This form should be filled out by the site supervisor as soon as they have knowledge of a potential over-exposure or injury. Return the completed form to the Health and Safety Manager as soon as possible.

ATTACHMENT E. SIGNATURE PAGE

DAILY HEALTH AND SAFETY MEETING SIGN-IN SHEET

Date	Name – Printed	Name - Signature	Company

Driving routes to **Artesia General Hospital**
702 N 13th Street, Artesia, New Mexico



Head NORTH on Fanning Rd	0.9 mi
Turn LEFT onto E Four Dinkus Rd	2.7 mi
Turn RIGHT onto US Hwy 285 N	4.3 mi
Turn LEFT onto W Castleberry Rd	1.0 mi
Turn RIGHT onto S 13th St	2.2 mi
Turn RIGHT onto W Memorial Dr	476 ft

HEALTH AND SAFETY PLAN

Bratcher, Mike, EMNRD

From: David Hamilton <david@rthicksconsult.com>
Sent: Tuesday, November 27, 2018 10:22 AM
To: Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Cc: Michael Barrett; Jerry Smith; kristin@rthicksconsult.com
Subject: [EXT] FW: Lime Rock ASAU #150 Release #2RP-3893

Brad and Mike,
As Mr. Barrett kindly notes, Wednesday and Nov. 29 are not the same time period.
We will be sampling on **Wednesday, November 28, 2018**, and continuing on Thursday if necessary.

_____
David Hamilton
RT Hicks Consultants
Office: 505-266-5004

From: Michael Barrett [mailto:mbarrett@limerockresources.com]
Sent: Tuesday, November 27, 2018 9:37 AM
To: David Hamilton
Cc: Jerry Smith; Randall Hicks; kristin@rthicksconsult.com
Subject: RE: Lime Rock ASAU #150 Release #2RP-3893

FYI
The 29th is on Thursday…

From: David Hamilton [mailto:david@rthicksconsult.com]
Sent: Monday, November 26, 2018 11:34 AM
To: bradford.billings@state.nm.us; mike.bratcher@state.nm.us
Cc: Michael Barrett; Jerry Smith; Randall Hicks; kristin@rthicksconsult.com
Subject: Lime Rock ASAU #150 Release #2RP-3893

Brad and Mike,

Please consider this email as notice that we'll be conducting quarterly compliance sampling of the MWs at the Lime Rock ASAU #150 site on Wednesday, November 29, 2018, no earlier than 12:00 noon. Should we need additional time, we'll resume work on Thursday morning, November 30, 2018. Please let me know if you have any comments or questions or stop by and see us in the field.
Thanks.

_____
David Hamilton
RT Hicks Consultants
Office: 505-266-5004

Bratcher, Mike, EMNRD

From: Kristin Pope <kristin@rthicksconsult.com>
Sent: Monday, February 25, 2019 1:38 PM
To: Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Cc: Randy Hicks; 'Jerry Smith'; mbarrett@limerockresources.com; David Hamilton
Subject: [EXT] Notice of MW sampling: Lime Rock ASAU #150 (2RP-3893)

Brad & Mike,

Hicks Consultants will sample the 5 monitoring wells at the Lime Rock – ASAU #150 (2RP-3893) on **Thursday, February 28**. We will collect the quarterly compliance samples for each well using the low-flow pumping procedure. Please let us know if you have any questions. Thank you.

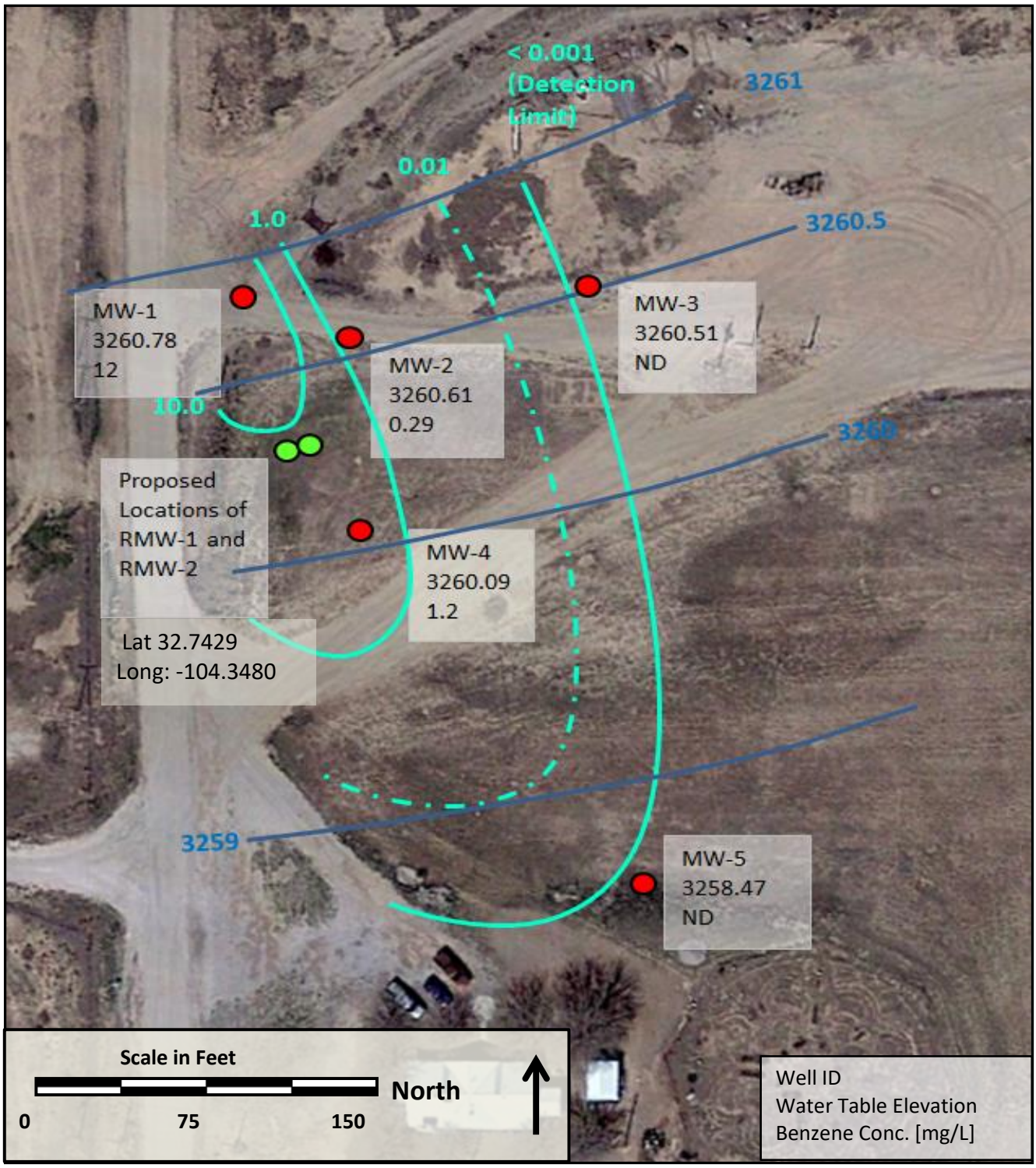
Kristin Pope
R.T. Hicks Consultants
Carlsbad Field Office
575.302.6755

Bratcher, Mike, EMNRD

From: David Hamilton <david@rthicksconsult.com>
Sent: Wednesday, January 2, 2019 3:17 PM
To: Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Cc: Michael Barrett; Jerry Smith; kristin@rthicksconsult.com
Subject: [EXT] Recovery Well location for ASAU 150 Release Site #2RP3893
Attachments: Plate8WithLatLong.pdf

Brad and Mike,
As we have an opportunity to install a recovery well at this site soon, we are calling/emailing to inform you of the recovery well plans for this site. Please let us know of any requests or questions that NMOCD has regarding this action. The attached plate shows the location of the proposed recovery well as presented in the previously submitted Stage1/2 Abatement Plan (November 2018).

_____
David Hamilton
RT Hicks Consultants
Office: 505-266-5004



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	**Benzene Concentration Contours** **August 2018 Sampling** **(Logarithnic Scale Contours)**	**Plate 8**
	Lime Rock Resources: ASAU Release	**November, 2018**

Bratcher, Mike, EMNRD

From: David Hamilton <david@rthicksconsult.com>
Sent: Tuesday, May 7, 2019 11:39 AM
To: Billings, Bradford, EMNRD; Bratcher, Mike, EMNRD
Cc: Michael Barrett; Jerry Smith; kristin@rthicksconsult.com; Randall Hicks
Subject: [EXT] Notice of Monitoring well sampling at the ASAU #150 site (2RP-3893)

Brad & Mike,

Hicks Consultants will sample the 5 monitoring wells at the Lime Rock – ASAU #150 (2RP-3893) on **Thursday, May 9**.
We will collect the quarterly compliance samples for each well using the low-flow pumping procedure.
Please let us know if you have any questions. Thank you.

_____
Dave Hamilton
RT Hicks Consultants
Office: 505-266-5004

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 383999

CONDITIONS

Operator: RILEY PERMIAN OPERATING COMPANY, LLC 29 E Reno Avenue, Suite 500 Oklahoma City, OK 73104	OGRID: 372290
	Action Number: 383999
	Action Type: [IM-SD] Incident File Support Doc (ENV) (IM-BNF)

CONDITIONS

Created By	Condition	Condition Date
amaxwell	Historical document upload.	9/16/2024