



2180 South Ivanhoe Street, Suite 5  
Denver, Colorado 80222-5710  
303-759-8373  
www.agwco.com

June 21, 2019

Grand Mesa Operating Company  
1700 North Waterfront Parkway  
Building 600  
Wichita, Kansas 67206

Doc #2100100

Attention: Ms. Phyllis Brewer

Subject: Zion #1-1 Drill Site (COGCC Location ID: 456580)  
Background and Pit Sampling  
Lincoln County, Colorado  
AGW Project Number: 180234

Dear Ms. Brewer:

As requested, A. G. Wasseenaar, Inc. (AGW) collected mud samples from one unlined drill pit at the Zion #1-1 drill site in Lincoln County, Colorado operated by Grand Mesa Operating Company (Grand Mesa). This letter summarizes the project activities and analytical results.

## BACKGROUND

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The subject site is located in an agricultural area in the northwest  $\frac{1}{4}$  of the northwest  $\frac{1}{4}$  of Section 1, Township 8 South, Range 55 West. It is approximately 750 feet southeast of the intersection of Lincoln County Road 3R and Lincoln County Road 30. Based on U.S. Geological Survey (USGS) Topographic Map data, the ground surface in the vicinity of the site generally slopes towards the east. Figure 1 in Attachment A illustrates the site location and topography.

In 2018, one (1) unlined drill pit and one lined water pit were constructed on the western portion of the site to facilitate drilling of the Zion #1-1 well. To help restore the site after drilling and to comply with Colorado Oil and Gas Conservation Commission (COGCC) pit closure requirements, AGW was asked to collect mud samples from the base of the unlined pit. The samples were analyzed for total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene, and xylenes (BTEX); sodium adsorption ratio (SAR); specific conductance (EC); arsenic; and pH. In accordance with COGCC rules, the TPH values were derived by adding the concentrations of gasoline range organics (GRO) and diesel range organics (DRO). The lined pit was used exclusively for clean water, so soil beneath the liner was not sampled. AGW also collected background soil samples from the area surrounding the well pad.

## BACKGROUND SOIL SAMPLING METHODS

On May 13, 2019, an AGW geologist visited the site to collect background soil samples for baseline characteristics. At that time, construction had been completed and the oil/gas well had been plugged and abandoned. The site location consisted of grassland.

To evaluate the background soil conditions, AGW collected one composite sample from three discrete and random locations. The discrete samples were collected adjacent to the constructed well site location. To collect the discrete samples, AGW utilized a clean stainless-steel trowel. Prior to use, the trowel was cleaned in a solution of Alconox® detergent and municipal water followed by a municipal water rinse. To control potential cross contamination, the AGW geologist also wore new nitrile gloves for this sampling event. Each sample was collected from a depth ranging from two to four inches below ground surface (BGS).

Each discrete sample was immediately transferred into one Ziploc bag and sufficiently combined to create one representative composite sample. The final composited sample was transferred to clean, laboratory-supplied glass jars, labeled, and placed into a cooler with ice (a preservative) for laboratory submittal. During this project, AGW followed chain-of-custody procedures in general accordance with EPA guidelines. AGW delivered the samples to Origins Laboratory, Inc. (Origins) in Denver, Colorado for testing.

## BACKGROUND ANALYTICAL RESULTS

Origins analyzed the composite soil sample for arsenic by EPA Method 6020A, EC by EPA Method 2510B-2011 MOD, pH by EPA Method 9045D, and SAR by methods from the USDA Handbook 60. The arsenic, EC, pH, and SAR results are included below in Table 1. The laboratory report is included in Attachment B.

**Table 1: Background Soil Analytical Results**  
**Zion #1-1 Drill Site**  
**May 13, 2019**

Sample Number	Arsenic (mg/kg) <sup>1</sup>	Specific Conductance (mmhos/cm) <sup>2</sup>	pH	Sodium Adsorption Ratio
0234-BG	3.81	0.0209	7.31	0.47
COGCC Standard <sup>3</sup>	0.39*	< 4	6 - 9	< 12

**Legend:**

1: mg/kg - milligrams per kilogram (parts per million)

2: mmhos/cm - millimhos per centimeter

3: Standards from Colorado Oil and Gas Conservation Commission Table 910-1, effective January 30, 2015

\*: Naturally occurring elevated levels of arsenic are common in Colorado

## PIT SAMPLING METHODS

Because drilling was completed and the mud at the base of the pit was sufficiently dry, on May 13, 2019 an AGW geologist collected samples from the base of the unlined drill pit. The unlined pit measured approximately 140 feet by 160 feet across and was 3 to 6 feet deep.

To evaluate the base of the pit, AGW collected three discrete mud samples. The first sample, 0234-1-P1, was collected from the east center of the pit; the second sample, 0234-1-P2, was obtained from the northwest corner of the pit; and 0234-1-P3 was collected from the southwest corner of the pit.

The AGW geologist wore new nitrile gloves at each sample location. Each sample was collected from a depth of approximately zero to eight inches beneath the base of the pit.

The samples were immediately transferred into three laboratory-supplied glass jars, labeled, and placed into a cooler with ice (a preservative) for laboratory submittal. During this project, AGW followed chain-of-custody procedures in general accordance with EPA guidelines. AGW delivered the samples to Origins for testing.

## ANALYTICAL RESULTS

Origins analyzed each pit sample for DRO and GRO by EPA Method 8015B, BTEX by EPA Method 8260B, and arsenic, EC, pH, and SAR by EPA Methods listed above for the background soil sample. In accordance with COGCC requirements as published in Table 910-1 of their Rules, each set of DRO and GRO values were added together to obtain the TPH concentration for comparison to the COGCC TPH standard. The DRO, GRO, TPH, BTEX, EC, pH, and SAR results are included below in Table 2. The results are also illustrated on Figure 2 in Attachment A. The laboratory report is included in Attachment B.

**Table 2: Pit Sampling Results**  
**Zion #1-1 Drill Site**  
**May 13, 2019**

Sample Number	0234-BG <sup>1</sup>	0234-1-P1	0234-1-P2	0234-1-P3	COGCC Standard <sup>2</sup>
DRO (mg/kg) <sup>3</sup>	NA <sup>4</sup>	ND <sup>6</sup>	ND	ND	500
GRO (mg/kg)	NA <sup>4</sup>	ND	ND	ND	
TPH <sup>5</sup> (mg/kg)	NA <sup>4</sup>	ND	ND	ND	
Benzene (mg/kg)	NA <sup>4</sup>	ND	ND	ND	0.17
Toluene (mg/kg)	NA <sup>4</sup>	ND	ND	ND	85
Ethylbenzene (mg/kg)	NA <sup>4</sup>	ND	ND	ND	100
Xylenes (mg/kg)	NA <sup>4</sup>	ND	ND	ND	175
Arsenic (mg/kg)	3.81	4.63	4.57	4.87	0.39 <sup>7</sup>
Specific Conductance (mmhos/cm) <sup>8</sup>	0.0209	1.01	1.91	1.22	< 4

Sample Number	0234-BG <sup>1</sup>	0234-1-P1	0234-1-P2	0234-1-P3	COGCC Standard <sup>2</sup>
pH	7.31	7.83	7.82	7.89	6 – 9
Sodium Adsorption Ratio	0.47	18.98	19.76	16.90	< 12

**Legend:**

1: Background sample collected from surficial soil on May 13, 2019

2: Standards from Colorado Oil and Gas Conservation Commission Table 910-1, effective January 30, 2015

3: mg/kg - Milligrams per kilogram

4: NA - Not analyzed

5: TPH - Total petroleum hydrocarbons. Value determined by adding DRO and GRO per COGCC Table 910-1 Rules

6: ND - Not detected at or above laboratory reporting limit

7: Naturally occurring elevated levels of arsenic are common in Colorado

8: mmhos/cm - millimhos per centimeter

To evaluate the analytical results, AGW compared detected concentrations to the regulatory standards published in Table 910-1 of the COGCC Series 900 Rules. Elevated levels of SAR were detected in samples 0234-1-P1, 0234-1-P2, and 0234-1-P3. The analytical laboratory reports for the background and pit sampling are included in Attachment B.

Arsenic was detected at levels greater than the COGCC Table 910-1 standard; however, elevated levels of arsenic are common in Colorado, as indicated by the background sample collected in May 2019 from surficial soil. The CDPHE has issued a risk management guidance document for evaluating arsenic concentrations in soil, reviewed/revised July 2014, which relies on an EPA study of background levels in Colorado. The data indicate arsenic concentrations commonly range from 3 to 14 mg/kg on native grassland, rangeland, and other agricultural uses. The arsenic concentrations in the samples collected from the pit are within this range and therefore do not require further action in this regard.

## CONCLUSIONS AND RECOMMENDATIONS

To help evaluate the condition of soils/bentonitic drilling mud at the base of pits at the Zion #1-1 drill site, AGW visited the site on May 13, 2019 and collected a total of three discrete samples from the base of the pit for analytical testing. The pit was generally dry. The samples were analyzed for TPH, BTEX, arsenic, EC, pH, and SAR.

Based on the analytical results, SAR was detected at levels greater than background and regulatory guidance in all three pit samples.

Arsenic was detected at levels greater than the COGCC Table 910-1 standard in all samples, including the background sample; however, elevated levels of arsenic are common in Colorado. The Colorado Department of Public Health and Environment (CDPHE) has issued a risk management guidance document for evaluating arsenic concentrations in soil, reviewed/revised July 2014, which relies on an EPA study of background levels in Colorado. The data indicate arsenic concentrations commonly range from 3 mg/kg to 14 mg/kg on native grassland, rangeland, and other agricultural uses. The arsenic concentrations in the samples collected from the pit are within this range and are consistent with background levels and therefore do not require further action.

Based on the depth of the pit (approximately 3-6 feet BGS), in which the minor analytical exceedances of SAR occur, backfilling with native soils currently stockpiled on site will result in this material being completely buried, therefore, not impacting future uses of the site. Following approval from the COGCC, site reclamation activities can take place in order to return the site back to the surface owner.

Thank you for the opportunity to assist you with this project. If you have any questions or require further information, please call us at (303) 759-8373.

Sincerely,  
A.G. Wassenaar, Inc.

A handwritten signature in black ink that reads "Rachel A. Peterson". The signature is written in a cursive style and is positioned above a solid horizontal line.

Rachel A. Peterson, P.G.  
Principal Geologist

RAP/ALB

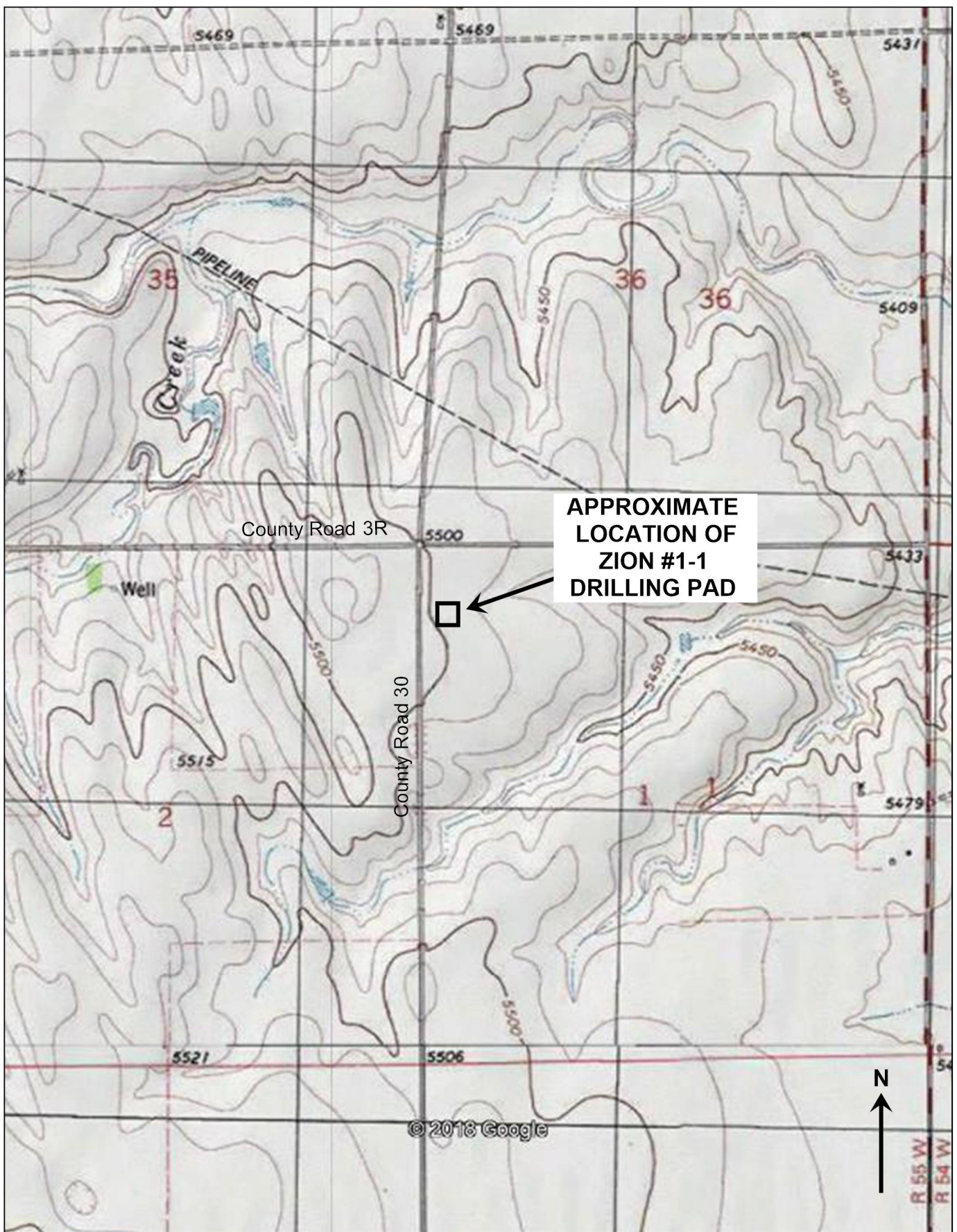
Attachments

**ATTACHMENT A**

**FIGURES**



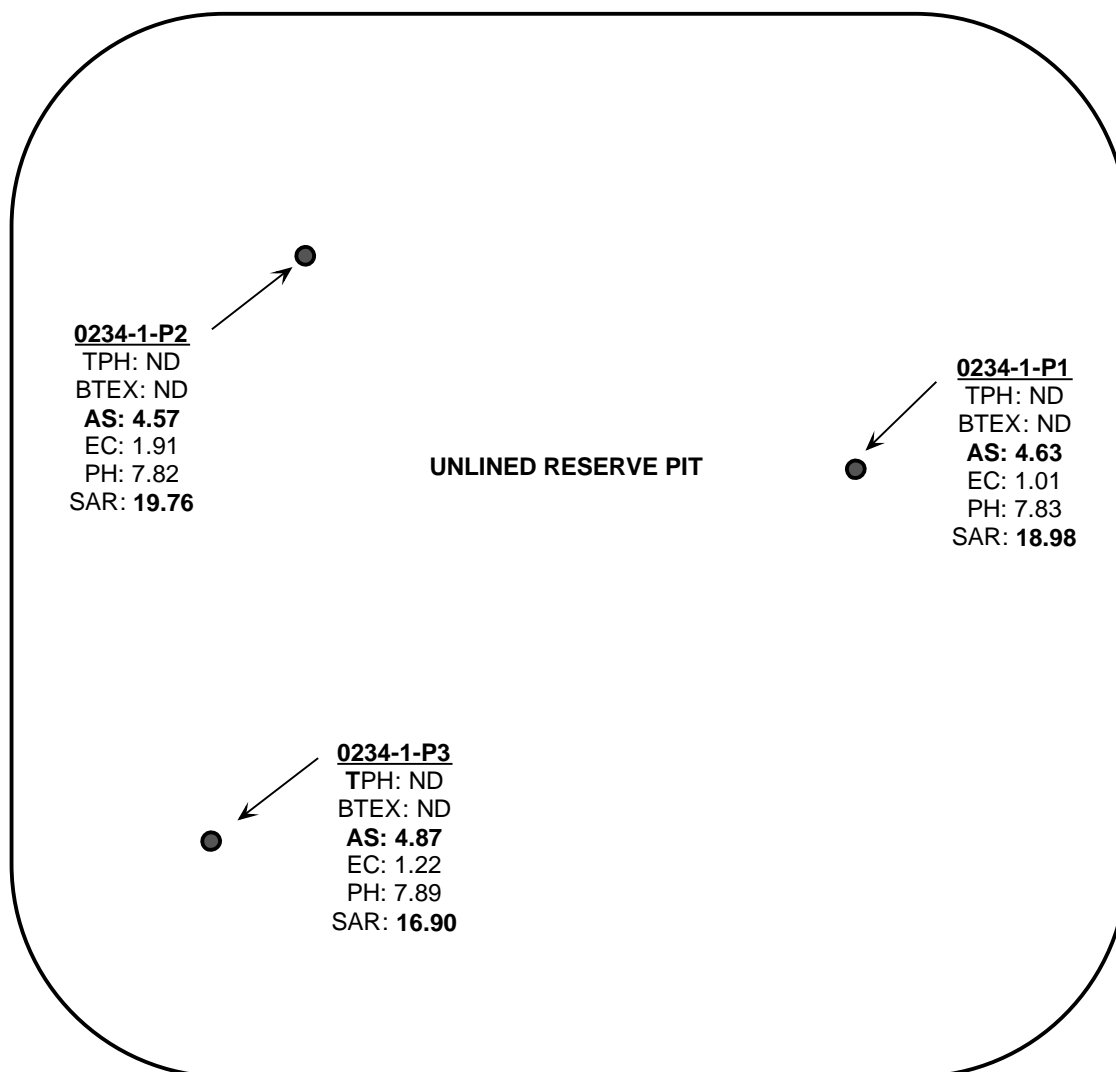




**A.G. WASSENAAR** | **INC.**  
GEOTECHNICAL • ENVIRONMENTAL  
CONSULTANTS

**Zion #1-1 WELL SITE  
LINCOLN COUNTY, COLORADO  
GRAND MESA OPERATING COMPANY**

**FIGURE 1  
SITE TOPOGRAPHY AND  
LOCATION  
PROJECT: 180234**



#### LEGEND

● - SAMPLE LOCATION

TPH- TOTAL PETROLEUM HYDROCARBONS

B - BENZENE

T - TOLUENE

E - ETHYLBENZENE

X - TOTAL XYLENE

AS - ARSENIC

EC - SPECIFIC CONDUCTIVITY

SAR - SODIUM ADSORPTION RATIO

ND - NOT DETECTED

NOTE: TPH, BTEX, AND ARSENIC CONCENTRATIONS ARE IN MILLIGRAMS PER KILOGRAM (mg/kg)

EC CONCENTRATIONS ARE IN MILLIMHOS PER CENTIMETER

VALUES IN BOLD ARE GREATER THAN THE RESPECTIVE COGCC TABLE 910-1 STANDARD

ALL LOCATIONS ARE APPROXIMATE



**A.G. WASSENAAR** | **INC.**

GEOTECHNICAL • ENVIRONMENTAL  
CONSULTANTS

ZION #1-1 WELL SITE  
LINCOLN COUNTY, COLORADO  
GRAND MESA OPERATING COMPANY

**FIGURE 2**  
**ANALYTICAL RESULTS**  
MAY 13, 2019  
PROJECT #: 180234



**ATTACHMENT B**

**LABORATORY REPORT**





May 17, 2019

A.G. Wassenaar

Rachel Peterson

2180 South Ivanhoe Street - Suite 5

Denver

CO 80222

**Project Name - Zion 1-1**

**Project Number - 180234**

Attached are your analytical results for Zion 1-1 received by Origins Laboratory, Inc. May 14, 2019. This project is associated with Origins project number Y905197-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.  
303.433.1322  
o-squad@oelabinc.com



1725 Elk Place, Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

## CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
0234-1-P1	Y905197-01	Soil	May 13, 2019 11:30	05/14/2019 08:27
0234-1-P2	Y905197-02	Soil	May 13, 2019 11:45	05/14/2019 08:27
0234-1-P3	Y905197-03	Soil	May 13, 2019 11:45	05/14/2019 08:27
0234-BG	Y905197-04	Soil	May 13, 2019 12:00	05/14/2019 08:27

Origins Laboratory, Inc.



*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

Jen Pellegrini For Noelle Doyle Mathis, President



A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

Origins Laboratory

F-012207-01-R1  
Effective Date: 01/09/12

### Sample Receipt Checklist

Origins Work Order: 1905197

Client: A.G. Wassenaar

Client Project ID: Zion 1-1

Checklist Completed by: JG

Shipped Via: HD  
(UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 5/14/2019

Airbill #: N/A

Matrix(s) Received: (Check all that apply): X Soil/Solid          Water          Other:         

Cooler Number/Temperature: 1 / 3.8 °C          /          °C          /          °C          /          °C (Describe)

Thermometer ID: T003

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is there ice present (document if blue ice is used)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were all samples received intact <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was adequate sample volume provided <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are short holding time analytes or samples with HTs due within 48 hours present <sup>(1)</sup> ?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Is a chain-of-custody (COC) present and filled out completely <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Does the COC agree with the number and type of sample bottles received <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Do the sample IDs on the bottle labels match the COC <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is the COC properly relinquished by the client with date and time recorded <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
For volatiles in water – is there headspace (> ¼ inch bubble) present? If yes, contact client and note in narrative.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Are samples preserved that require preservation and was it checked <sup>(1)</sup> ? (note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)(pH <2 for samples preserved with HNO <sub>3</sub> , HCL, H <sub>2</sub> SO <sub>4</sub> ) / (pH >10 for samples preserved with NaAsO <sub>2</sub> +NaOH, ZnAc+NaOH)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Additional Comments (if any):				

<sup>(1)</sup> If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

Reviewed by (Project Manager) JP

Date/Time Reviewed 5/15/19

Origins Laboratory, Inc.

*Jefe Pellegrini*

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

0234-1-P1

5/13/2019 11:30:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
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**Origins Laboratory, Inc.**  
Y905197-01 (Soil)

**BTEX by EPA 8260D**

Benzene	ND	0.002	mg/kg	1	B9E1411	KDK	05/14/2019	05/15/2019	Ua
Toluene	ND	0.002	"	"	"	KDK	"	"	Ua
Ethylbenzene	ND	0.002	"	"	"	KDK	"	"	Ua
Xylenes, total	ND	0.002	"	"	"	KDK	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4

105 %

70-130

"

"

"

Surrogate: Toluene-d8

97.2 %

70-130

"

"

"

Surrogate: 4-Bromofluorobenzene

106 %

70-130

"

"

"

**Metals (Saturated Paste Prep)**

Calcium	25.68		me/L	1	'[none]'		05/15/2019	05/17/2019	
Magnesium	28.06		"	"	"		"	"	
Sodium	98.36		"	"	"		"	"	

**pH in Soil by EPA 9045D**

pH	7.83		pH Units	1	B9E1406	OLAB	05/14/2019	05/14/2019	
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**SAR by 20B Saturated Paste**

SAR	18.98			1	'[none]'		05/15/2019	05/17/2019	
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**Specific Conductance by Modified 9050A**

Specific Conductance (EC)	1.01	0.00502	mmhos/cm	1	B9E1407	OLAB	05/14/2019	05/14/2019	
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Origins Laboratory, Inc.



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A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

0234-1-P1

5/13/2019 11:30:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
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**Origins Laboratory, Inc.**  
**Y905197-01 (Soil)**

**Total Metals by 6010C**

Arsenic	4.63	4.17	mg/kg dry	1	1877377	LS	05/16/2019	05/17/2019	
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**TPH-Carbon Chain by EPA 8015D**

Gasoline (C6-C10)	ND	50.0	mg/kg	1	B9E1404	JTD	05/14/2019	05/15/2019	Ua
Diesel (C10-C28)	ND	50.0	"	"	"	JTD	"	"	Ua
Residual Range Organics (C28-C40)	ND	200	"	"	"	JTD	"	"	Ua

Surrogate: o-Terphenyl	97.3 %	50-150			"	"	"	
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Origins Laboratory, Inc.



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A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

0234-1-P2

5/13/2019 11:45:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
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**Origins Laboratory, Inc.**  
Y905197-02 (Soil)

**BTEX by EPA 8260D**

Benzene	ND	0.002	mg/kg	1	B9E1411	JTD	05/14/2019	05/16/2019	Ua
Toluene	ND	0.002	"	"	"	JTD	"	"	Ua
Ethylbenzene	ND	0.002	"	"	"	JTD	"	"	Ua
Xylenes, total	ND	0.002	"	"	"	JTD	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4

111 %

70-130

"

"

"

Surrogate: Toluene-d8

95.3 %

70-130

"

"

"

Surrogate: 4-Bromofluorobenzene

104 %

70-130

"

"

"

**Metals (Saturated Paste Prep)**

Calcium	23.99		me/L	1	'[none]'		05/15/2019	05/17/2019	
Magnesium	16.84		"	"	"		"	"	
Sodium	89.30		"	"	"		"	"	

**pH in Soil by EPA 9045D**

pH	7.82		pH Units	1	B9E1406	OLAB	05/14/2019	05/14/2019	
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**SAR by 20B Saturated Paste**

SAR	19.76			1	'[none]'		05/15/2019	05/17/2019	
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**Specific Conductance by Modified 9050A**

Specific Conductance (EC)	1.91	0.00501	mmhos/cm	1	B9E1407	OLAB	05/14/2019	05/14/2019	
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Origins Laboratory, Inc.



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A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

0234-1-P2

5/13/2019 11:45:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
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**Origins Laboratory, Inc.**  
**Y905197-02 (Soil)**

**Total Metals by 6010C**

Arsenic	4.57	4.63	mg/kg dry	1	1877377	LS	05/16/2019	05/17/2019	J
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**TPH-Carbon Chain by EPA 8015D**

Gasoline (C6-C10)	ND	50.0	mg/kg	1	B9E1404	JTD	05/14/2019	05/15/2019	Ua
Diesel (C10-C28)	ND	50.0	"	"	"	JTD	"	"	Ua
Residual Range Organics (C28-C40)	ND	200	"	"	"	JTD	"	"	Ua

Surrogate: o-Terphenyl	85.4 %	50-150			"	"	"	
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Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

0234-1-P3

5/13/2019 11:45:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
---------	--------	-----------------	-------	----------	-------	---------	----------	----------	-------

**Origins Laboratory, Inc.**  
Y905197-03 (Soil)

**BTEX by EPA 8260D**

Benzene	ND	0.002	mg/kg	1	B9E1411	KDK	05/14/2019	05/15/2019	Ua
Toluene	ND	0.002	"	"	"	KDK	"	"	Ua
Ethylbenzene	ND	0.002	"	"	"	KDK	"	"	Ua
Xylenes, total	ND	0.002	"	"	"	KDK	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4

98.6 %

70-130

"

"

"

Surrogate: Toluene-d8

98.3 %

70-130

"

"

"

Surrogate: 4-Bromofluorobenzene

106 %

70-130

"

"

"

**Metals (Saturated Paste Prep)**

Calcium	24.18		me/L	1	'[none]'		05/15/2019	05/17/2019	
Magnesium	12.93		"	"	"		"	"	
Sodium	72.81		"	"	"		"	"	

**pH in Soil by EPA 9045D**

pH	7.89		pH Units	1	B9E1406	OLAB	05/14/2019	05/14/2019	
----	------	--	----------	---	---------	------	------------	------------	--

**SAR by 20B Saturated Paste**

SAR	16.90			1	'[none]'		05/15/2019	05/17/2019	
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**Specific Conductance by Modified 9050A**

Specific Conductance (EC)	1.22	0.00500	mmhos/cm	1	B9E1407	OLAB	05/14/2019	05/14/2019	
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Origins Laboratory, Inc.



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A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

0234-1-P3

5/13/2019 11:45:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
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**Origins Laboratory, Inc.**  
**Y905197-03 (Soil)**

**Total Metals by 6010C**

Arsenic	4.87	3.70	mg/kg dry	1	1877377	LS	05/16/2019	05/17/2019	
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**TPH-Carbon Chain by EPA 8015D**

Gasoline (C6-C10)	ND	50.0	mg/kg	1	B9E1404	JTD	05/14/2019	05/15/2019	Ua
Diesel (C10-C28)	ND	50.0	"	"	"	JTD	"	"	Ua
Residual Range Organics (C28-C40)	ND	200	"	"	"	JTD	"	"	Ua

Surrogate: o-Terphenyl	95.0 %	50-150			"	"	"	
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Origins Laboratory, Inc.



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A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

**0234-BG****5/13/2019 12:00:00PM**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
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**AAL, Inc.**  
**Y905197-04 (Soil)****Metals (Saturated Paste Prep)**

Calcium	3.46		me/L	1	'[none]'		05/15/2019	05/17/2019	
Magnesium	1.58		"	"	"		"	"	
Sodium	0.74		"	"	"		"	"	

**pH in Soil by EPA 9045D**

pH	7.31		pH Units	1	B9E1406	OLAB	05/14/2019	05/14/2019	
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**SAR by 20B Saturated Paste**

SAR	0.47			1	'[none]'		05/15/2019	05/17/2019	
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**Specific Conductance by Modified 9050A**

Specific Conductance (EC)	0.0209	0.00500	mmhos/cm	1	B9E1407	OLAB	05/14/2019	05/14/2019	
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**Total Metals by 6010C**

Arsenic	3.81	3.67	mg/kg dry	1	1877377	LS	05/16/2019	05/17/2019	
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Origins Laboratory, Inc.



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Rachel Peterson

Project Number: 180234

Project: Zion 1-1

## Extractable Petroleum Hydrocarbons by 8015D - Quality Control Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B9E1404 - EPA 3580										
Blank (B9E1404-BLK1)					Prepared: 05/14/2019 Analyzed: 05/14/2019					
Gasoline (C6-C10)	ND	50.0	mg/kg							Ua
Diesel (C10-C28)	ND	50.0	"							Ua
Residual Range Organics (C28-C40)	ND	200	"							Ua
Surrogate: o-Terphenyl	51.3		"	50.0		103	50-150			

Origins Laboratory, Inc.



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Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

## Extractable Petroleum Hydrocarbons by 8015D - Quality Control

Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B9E1404 - EPA 3580

### LCS (B9E1404-BS1)

Prepared: 05/14/2019 Analyzed: 05/14/2019

Gasoline (C6-C10)	1110	50.0	mg/kg	1000		111	70-130			
Diesel (C10-C28)	1090	50.0	"	1000		109	70-130			
Residual Range Organics (C28-C40)	1100	200	"	1000		110	70-130			
Surrogate: o-Terphenyl	62.9		"	50.0		126	50-150			

Origins Laboratory, Inc.



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Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

## Extractable Petroleum Hydrocarbons by 8015D - Quality Control Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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### Batch B9E1404 - EPA 3580

Matrix Spike (B9E1404-MS1)		Source: Y905186-01			Prepared: 05/14/2019 Analyzed: 05/14/2019					
Gasoline (C6-C10)	1090	50.0	mg/kg	1000	19.4	107	70-130			
Diesel (C10-C28)	1090	50.0	"	1000	ND	109	70-130			
Residual Range Organics (C28-C40)	1100	200	"	1000	8.46	109	70-130			
Surrogate: o-Terphenyl	62.2		"	50.0		124	50-150			

Origins Laboratory, Inc.



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Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

## Extractable Petroleum Hydrocarbons by 8015D - Quality Control

Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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### Batch B9E1404 - EPA 3580

Matrix Spike Dup (B9E1404-MSD1)		Source: Y905186-01			Prepared: 05/14/2019 Analyzed: 05/14/2019					
Gasoline (C6-C10)	961	50.0	mg/kg	1000	19.4	94.2	70-130	12.2	35	
Diesel (C10-C28)	945	50.0	"	1000	ND	94.5	70-130	14.4	35	
Residual Range Organics (C28-C40)	905	200	"	1000	8.46	89.7	70-130	19.5	35	
Surrogate: o-Terphenyl	50.9		"	50.0		102	50-150			

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Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

## Extractable Petroleum Hydrocarbons by 8015D - Quality Control

### Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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#### Batch B9E1411 - EPA 5030 (soil)

#### Blank (B9E1411-BLK1)

Prepared: 05/14/2019 Analyzed: 05/14/2019

Benzene	ND	0.002	mg/kg							Ua
Toluene	ND	0.002	"							Ua
Ethylbenzene	ND	0.002	"							Ua
Xylenes, total	ND	0.002	"							Ua
Surrogate: 1,2-Dichloroethane-d4	0.12		"	0.125		96.2	70-130			
Surrogate: Toluene-d8	0.12		"	0.125		99.5	70-130			
Surrogate: 4-Bromofluorobenzene	0.13		"	0.125		106	70-130			

Origins Laboratory, Inc.



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Jen Pellegrini For Noelle Doyle Mathis, President

A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

**Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control**  
**Origins Laboratory, Inc.**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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**Batch B9E1411 - EPA 5030 (soil)**

**LCS (B9E1411-BS1)**

Prepared: 05/14/2019 Analyzed: 05/14/2019

Benzene	0.117	0.002	mg/kg	0.100		117	70-130			
Toluene	0.110	0.002	"	0.100		110	70-130			
Ethylbenzene	0.117	0.002	"	0.100		117	70-130			
m,p-Xylene	0.187	0.004	"	0.200		93.3	70-130			
o-Xylene	0.104	0.002	"	0.100		104	70-130			
Surrogate: 1,2-Dichloroethane-d4	0.12		"	0.125		99.9	70-130			
Surrogate: Toluene-d8	0.13		"	0.125		100	70-130			
Surrogate: 4-Bromofluorobenzene	0.13		"	0.125		102	70-130			

Origins Laboratory, Inc.



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A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

**Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control**  
**Origins Laboratory, Inc.**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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**Batch B9E1411 - EPA 5030 (soil)**

Matrix Spike (B9E1411-MS1)		Source: Y905196-05			Prepared: 05/14/2019 Analyzed: 05/15/2019					
Benzene	0.087	0.002	mg/kg	0.100	ND	87.0	70-130			
Toluene	0.092	0.002	"	0.100	ND	92.1	70-130			
Ethylbenzene	0.097	0.002	"	0.100	ND	96.6	70-130			
m,p-Xylene	0.151	0.004	"	0.200	ND	75.6	70-130			
o-Xylene	0.086	0.002	"	0.100	0.001	85.2	70-130			
Surrogate: 1,2-Dichloroethane-d4	0.12		"	0.125		96.0	70-130			
Surrogate: Toluene-d8	0.13		"	0.125		102	70-130			
Surrogate: 4-Bromofluorobenzene	0.13		"	0.125		102	70-130			

Origins Laboratory, Inc.



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A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

## Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control

### Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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#### Batch B9E1411 - EPA 5030 (soil)

Matrix Spike Dup (B9E1411-MSD1)		Source: Y905196-05			Prepared: 05/14/2019 Analyzed: 05/15/2019					
Benzene	0.084	0.002	mg/kg	0.100	ND	83.6	70-130	3.94	20	
Toluene	0.088	0.002	"	0.100	ND	87.6	70-130	4.99	20	
Ethylbenzene	0.093	0.002	"	0.100	ND	92.7	70-130	4.18	20	
m,p-Xylene	0.145	0.004	"	0.200	ND	72.4	70-130	4.38	20	
o-Xylene	0.084	0.002	"	0.100	0.001	83.0	70-130	2.58	20	
Surrogate: 1,2-Dichloroethane-d4	0.12		"	0.125		94.7	70-130			
Surrogate: Toluene-d8	0.13		"	0.125		101	70-130			
Surrogate: 4-Bromofluorobenzene	0.13		"	0.125		103	70-130			

Origins Laboratory, Inc.



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A.G. Wassenaar  
2180 South Ivanhoe Street - Suite 5  
Denver CO 80222

Rachel Peterson  
Project Number: 180234  
Project: Zion 1-1

## Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control

### Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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## Classical Chemistry Parameters - Quality Control

### Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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#### Batch B9E1406 - NO PREP

<b>Duplicate (B9E1406-DUP1)</b>		<b>Source: Y905197-01</b>			Prepared: 05/14/2019 Analyzed: 05/14/2019					
pH	7.75		pH Units		7.83			1.03	25	

#### Batch B9E1407 - NO PREP

<b>Blank (B9E1407-BLK1)</b>		Prepared: 05/14/2019 Analyzed: 05/14/2019								
Specific Conductance (EC)	0.00180	0.00500	mmhos/cm							
<b>Duplicate (B9E1407-DUP1)</b>		<b>Source: Y905197-01</b>			Prepared: 05/14/2019 Analyzed: 05/14/2019					
Specific Conductance (EC)	0.852	0.00500	mmhos/cm		1.01			16.6	25	

Origins Laboratory, Inc.



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A.G. Wassenaar  
2180 South Ivanhoe Street - Suite 5  
Denver CO 80222

Rachel Peterson  
Project Number: 180234  
Project: Zion 1-1

## Total Metals by 6010C - Quality Control GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Batch 1877377 - SW846 3050B</b>										
<b>BLANK (1204284834-BLK)</b>					Prepared: 05/16/2019 Analyzed: 05/17/2019					
Arsenic	ND	2.88	mg/kg				-			U
<b>LCS (1204284835-BKS)</b>					Prepared: 05/16/2019 Analyzed: 05/17/2019					
Arsenic	39.0	2.76	mg/kg	46.0		84.7	80-120			
<b>DUP (1204284836 D)</b>					Prepared: 05/16/2019 Analyzed: 05/17/2019					
<b>Source: 479167001</b>										
Arsenic	2.99	3.59	mg/kg dry		4.87		0-20	47.9	20	J
<b>MS (1204284837 S)</b>					Prepared: 05/16/2019 Analyzed: 05/17/2019					
<b>Source: 479167001</b>										
Arsenic	51.3	3.57	mg/kg dry	59.6	4.87	78	75-125			

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A.G. Wassenaar

2180 South Ivanhoe Street - Suite 5

Denver CO 80222

Rachel Peterson

Project Number: 180234

Project: Zion 1-1

### Notes and Definitions

Ua Sample is Non-Detect.

U Result not detected above the detection limit

J Greater than the detection limit but less than the reporting limit

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

All soil results are reported at a wet weight basis.

Origins Laboratory, Inc.



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Jen Pellegrini For Noelle Doyle Mathis, President