

November 21, 2017

Mr. Phil Hamlin, REM, CSEM  
Senior HSE Representative  
Kerr-McGee Oil & Gas Onshore LP  
1099 18th Street, Suite 1800  
Denver, Colorado 80202

**RE: Sump Closure Report  
Cresswell 1  
API# 05-123-10699  
Location ID # 319108  
Remediation # 10713  
SENW Sec 14-T4N-R68W  
Weld County, Colorado**

Dear Mr. Hamlin:

LT Environmental, Inc. (LTE) was contracted by Kerr-McGee Oil & Gas Onshore LP (Kerr-McGee) to conduct environmental oversight activities at the above-referenced site. The oversight activities included documenting field activities, collecting soil samples, and reviewing laboratory analytical results.

The objective of the soil sampling was to determine if petroleum hydrocarbon impact to subsurface soil resulted from Kerr-McGee operating a produced water sump at the site. The soil sampling activities, laboratory analytical results, and conclusions are summarized below. The general site layout, soil sample location, and sump excavation dimensions are depicted on the Excavation Site Map provided as Figure 1.

On June 6, 2017, following removal of the produced water sump, soil samples were collected from the sidewalls and base of the excavation. The soil samples were field-screened for volatile organic compounds using a photoionization detector (PID). Soil staining, odor, and/or elevated headspace readings were not observed or identified through PID screening; the highest PID reading recorded was 3.9 parts per million. Based on field screening results, the excavation base soil sample (B01@4') was submitted for laboratory analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) and total petroleum hydrocarbons (TPH)-gasoline range organics (GRO) by United States Environmental Protection Agency (USEPA) Method 8260C, TPH-diesel range organics (DRO) and oil range organics (ORO) by USEPA Method 8015C, pH by USEPA Method 9045D, and specific conductance (EC) by USEPA Method 9050A. Laboratory analytical results for soil sample B01@4' indicated that BTEX, TPH, pH, and EC concentrations and levels were compliant with COGCC Table 910-1 allowable levels. The soil sample analytical results are summarized in Table 1, and the laboratory analytical report is attached.



The sump excavation extent measured approximately 20 feet north to south by 20 feet east to west to an approximate depth of 4 feet bgs. Groundwater and impacted soil were not encountered in the excavation. A liner was not present beneath the sump at this site. The produced water sump at this facility will be replaced.

LTE appreciates the opportunity to provide environmental services to Kerr-McGee. Please contact LTE at (303) 433-9788 if you have any questions regarding this Sump Closure Report or if you require additional information.

Sincerely,

LT ENVIRONMENTAL, INC.

A handwritten signature in blue ink that reads 'Katharine Howe'. The signature is written in a cursive, flowing style.

Katharine Howe, E.I.  
Staff Engineer

Reviewed by

A handwritten signature in blue ink that reads 'Brian Sulzberger'. The signature is written in a cursive, flowing style.

Brian Sulzberger, P.E., P.G.  
Senior Engineer

Attachments



## ATTACHMENTS



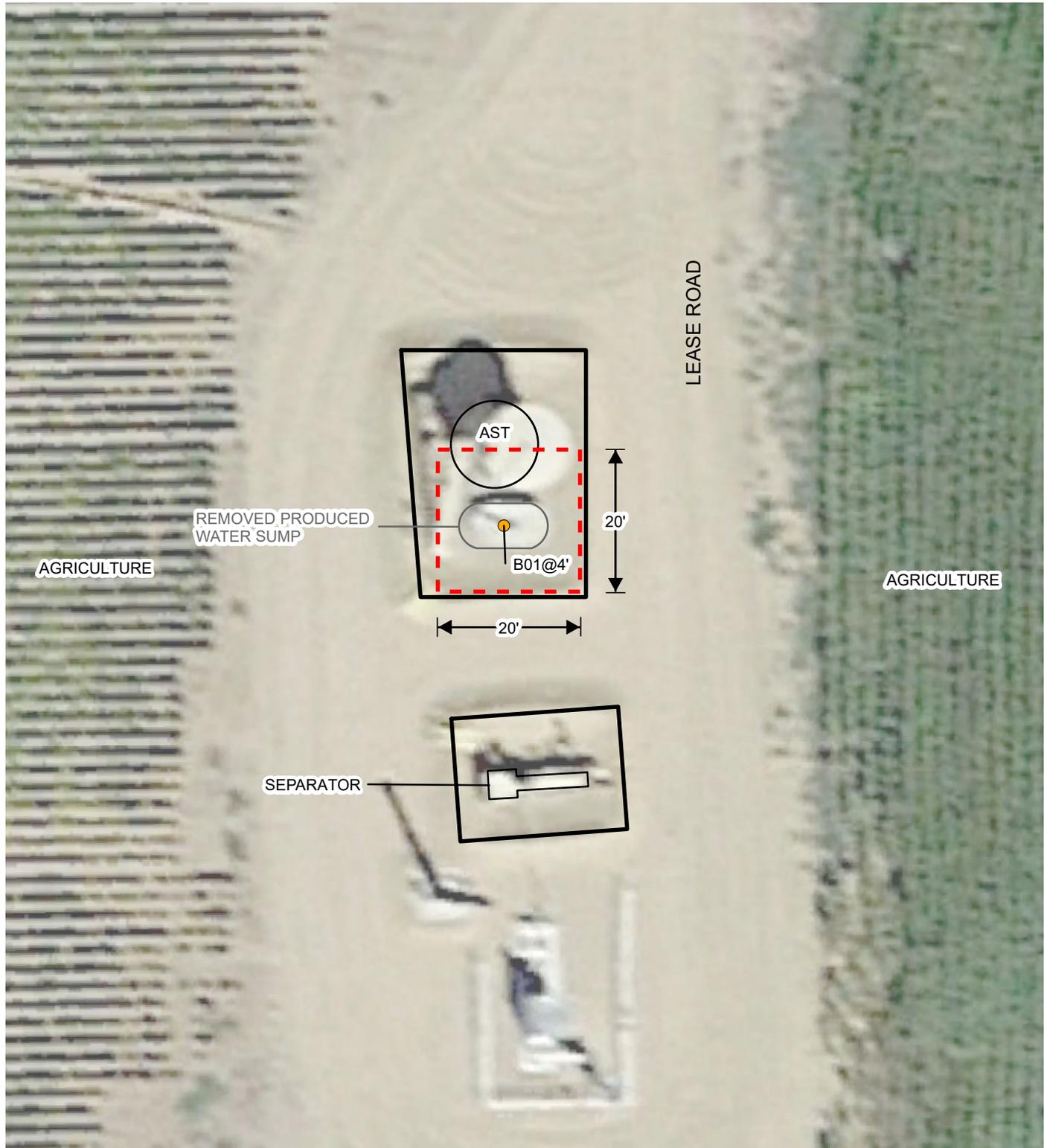
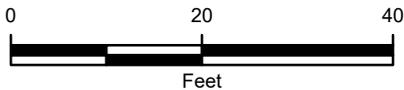


IMAGE COURTESY OF GOOGLE EARTH 2016

**LEGEND**

-  SOIL SAMPLE
-  EXCAVATION EXTENT
-  BERM
- AST: ABOVEGROUND STORAGE TANK



**FIGURE 1**  
**EXCAVATION SITE MAP**  
**CRESSWELL 1**  
**SENW SEC 14-T4N-R68W**  
**WELD COUNTY, COLORADO**  
**KERR-MCGEE OIL & GAS ONSHORE LP**



**TABLE 1**  
**SOIL SAMPLE ANALYTICAL RESULTS**  
**CRESSWELL 1**  
**WELD COUNTY, COLORADO**  
**KERR-MCGEE OIL & GAS ONSHORE LP**

Soil Sample ID	Depth (bgs)	Date	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	DRO (mg/kg)	GRO (mg/kg)	ORO (mg/kg)	pH (su)	Specific Conductance (mmhos/cm)
B01@4'	4'	06/06/2017	<0.002	<0.002	<0.002	<0.002	<25.0	<0.200	<100	8.14	0.103
<b>COGCC Allowable Levels</b>			<b>0.17</b>	<b>85</b>	<b>100</b>	<b>175</b>	<b>500*</b>	<b>500*</b>	<b>500*</b>	<b>6-9</b>	<b>4</b>

Notes: bgs - below ground surface

COGCC - Colorado Oil and Gas Conservation Commission

DRO - diesel range organics

GRO - gasoline range organics

mg/kg - milligrams per kilogram

mmhos/cm - millimhos per centimeter

NA - not analyzed/not available

ORO - oil range organics

su - standard units

TPH - total petroleum hydrocarbons

\* - TPH standard applies to combined DRO-GRO-ORO

< - less than laboratory reporting limit

Bold indicates result exceeds allowable level.





June 07, 2017

LT Environmental, Inc.

Brian Sulzberger

4600 West 60th Avenue

Arvada CO 80003

Project Name - KMG - Cresswell 1

Project Number - 014217120

Attached are your analytical results for KMG - Cresswell 1 received by Origins Laboratory, Inc. June 06, 2017. This project is associated with Origins project number Y706076-01.

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

LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Brian Sulzberger  
Project Number: 014217120  
Project: KMG - Cresswell 1

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
B01@4'	Y706076-01	Soil	June 6, 2017 16:50	06/06/2017 18:55

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

LT Environmental, Inc.  
 4600 West 60th Avenue  
 Arvada CO 80003

Brian Sulzberger  
 Project Number: 014217120  
 Project: KMG - Cresswell 1

www.originslaboratory.com

page 1 of 1

Y700076

**ORIGINS**  
LABORATORY, INC

Client: LT Environmental, Inc.  
 Address: 4600 W 60th Avenue  
 Arvada, CO 80003  
 Telephone Number: 303-433-9788  
 Email Address: bsulzberger@ltenv.com

Project Manager: Brian Sulzberger  
 Project Name: Cresswell 1  
 Project Number: 014217120  
 Samples Collected By: Daniel Thomas

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

Sample ID Description	Date Sampled	Time Sampled	# of Containers	Preservative				Matrix			Analysis				Sample Instructions	
				Unpreserved	HCl	HNO <sub>3</sub>	Other	Groundwater	Soil	Air Summa #	Other	GSTX	TPH	PH		EC
B01041	06-06-17	1650	2	X				X				X	X	X	Run	1
NO1051		1655	2	X				X				X	X	X	Hold	2
FO1051		1700	2	X				X				X	X	X		3
SO1051		1705	2	X				X				X	X	X		4
WO1051		1710	2	X				X				X	X	X		5
B601		1715	2	X				X				X	X	X		6
																7
																8
																9
																10
Relinquished By: <i>[Signature]</i>	Date: 06-06-17	Time: 1855		Received By: <i>[Signature]</i>	Date: 06/17	Time: 1855		Turnaround Time: Same Day <input checked="" type="checkbox"/> 24 Hr <input type="checkbox"/> 48 Hr <input type="checkbox"/> 72 Hr <input type="checkbox"/> Standard <input type="checkbox"/>								

Temp Received: 58  
 Date Results Needed

Origins Laboratory, Inc.

*Jefe Pellegrini*

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LT Environmental, Inc.  
 4600 West 60th Avenue  
 Arvada CO 80003

Brian Sulzberger  
 Project Number: 014217120  
 Project: KMG - Cresswell 1

Origins Laboratory

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

**Sample Receipt Checklist**

Origins Work Order: Y706076 Client: LTE  
 Client Project ID: KMG - Cresswell 1  
 Checklist Completed by: Dan Shipped Via: HD  
 Date/time completed: 6-6-17 (UPS, FedEx, Hand Delivered, Pick-up, etc.)  
 Airbill #: N/A  
 Matrix(s) Received: (Check all that apply):  Soil/Solid  Water  Other: \_\_\_\_\_  
 Cooler Number/Temperature: 1158 °C 1 °C 1 °C (Describe)  
 Thermometer ID: 1003

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"/>			
Is there ice present (document if blue ice is used)	<input checked="" type="checkbox"/>			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		<input checked="" 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 checked="" type="checkbox"/>		
Were all samples received intact <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Was adequate sample volume provided <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Are short holding time analytes or samples with HTs due within 48 hours present <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			? 4
Is a chain-of-custody (COC) present and filled out completely <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Does the COC agree with the number and type of sample bottles received <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Do the sample IDs on the bottle labels match the COC <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Is the COC properly relinquished by the client with date and time recorded <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
For volatiles in water – is there headspace (> ¼ inch bubble) present? <b>If yes, contact client and note in narrative.</b>			<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 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) [Signature] Date/Time Reviewed 6-6-17

Origins Laboratory, Inc.

*Jefe Pellegrini*

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LT Environmental, Inc.  
 4600 West 60th Avenue  
 Arvada CO 80003

Brian Sulzberger  
 Project Number: 014217120  
 Project: KMG - Cresswell 1

**B01@4'**  
**6/6/2017 4:50:00PM**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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**Origins Laboratory, Inc.**  
**Y706076-01 (Soil)**

**DRO/RRO by EPA8015C**

Diesel (C10-C28)	ND	25.0	mg/kg	1	B7F0602	06/06/2017	06/06/2017	U
Residual Range Organics (C28-C40)	ND	100	"	"	"	"	"	U

*Surrogate: o-Terphenyl* 80.3 % 59-131 " " "

**GBTEX by EPA 8260C**

Gasoline Range Hydrocarbons	ND	0.200	mg/kg	1	B7F0601	06/06/2017	06/06/2017	U
Benzene	ND	0.002	"	"	"	"	"	U
Toluene	ND	0.002	"	"	"	"	"	U
Ethylbenzene	ND	0.002	"	"	"	"	"	U
Xylenes, total	ND	0.002	"	"	"	"	"	U

*Surrogate: 1,2-Dichloroethane-d4* 110 % 70-130 " " "  
*Surrogate: Toluene-d8* 97.6 % 70-130 " " "  
*Surrogate: 4-Bromofluorobenzene* 98.9 % 70-130 " " "

**pH in Soil by EPA 9045D**

pH	8.14		pH Units	1	B7F0605	06/06/2017	06/06/2017	
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**Specific Conductance by Modified 9050A**

Specific Conductance (EC)	0.103		mmhos/cm	"	B7F0606	"	06/06/2017	
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Origins Laboratory, Inc.



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LT Environmental, Inc.  
 4600 West 60th Avenue  
 Arvada CO 80003

Brian Sulzberger  
 Project Number: 014217120  
 Project: KMG - Cresswell 1

**Volatile Organic Compounds by GC/MS SW846 8260C - 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 B7F0601 - EPA 5030 (soil)**

**Blank (B7F0601-BLK1)**

Prepared: 06/06/2017 Analyzed: 06/06/2017

Gasoline Range Hydrocarbons	ND	0.200	mg/kg							U
Benzene	ND	0.002	"							U
Toluene	ND	0.002	"							U
Ethylbenzene	ND	0.002	"							U
Xylenes, total	ND	0.002	"							U
Surrogate: 1,2-Dichloroethane-d4	66		ug/kg	62.5		105	70-130			
Surrogate: Toluene-d8	62		"	62.5		99.1	70-130			
Surrogate: 4-Bromofluorobenzene	60		"	62.5		96.4	70-130			

Origins Laboratory, Inc.



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 Arvada CO 80003

Brian Sulzberger  
 Project Number: 014217120  
 Project: KMG - Cresswell 1

**Volatile Organic Compounds by GC/MS SW846 8260C - 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 B7F0601 - EPA 5030 (soil)

**LCS (B7F0601-BS1)**

Prepared: 06/06/2017 Analyzed: 06/06/2017

Benzene	0.100	0.002	mg/kg	0.100		99.9	77.1-124			
Toluene	0.099	0.002	"	0.100		99.1	74.5-128			
Ethylbenzene	0.099	0.002	"	0.100		99.4	66.4-127			
m,p-Xylene	0.195	0.004	"	0.200		97.7	76.6-124			
o-Xylene	0.099	0.002	"	0.100		99.1	76.6-124			
Surrogate: 1,2-Dichloroethane-d4	62		ug/kg	62.5		99.1	70-130			
Surrogate: Toluene-d8	62		"	62.5		99.6	70-130			
Surrogate: 4-Bromofluorobenzene	62		"	62.5		98.9	70-130			

Origins Laboratory, Inc.



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 Project Number: 014217120  
 Project: KMG - Cresswell 1

**Volatile Organic Compounds by GC/MS SW846 8260C - 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 B7F0601 - EPA 5030 (soil)

Matrix Spike (B7F0601-MS1)	Source: Y706025-04			Prepared: 06/06/2017 Analyzed: 06/06/2017						
Benzene	0.096	0.002	mg/kg	0.100	ND	96.1	71.8-126			
Toluene	0.096	0.002	"	0.100	ND	95.5	65.1-130			
Ethylbenzene	0.101	0.002	"	0.100	ND	101	62.2-130			
m,p-Xylene	0.197	0.004	"	0.200	ND	98.5	46.5-137			
o-Xylene	0.100	0.002	"	0.100	ND	100	54.2-134			
Surrogate: 1,2-Dichloroethane-d4	59		ug/kg	62.5		94.4	70-130			
Surrogate: Toluene-d8	64		"	62.5		102	70-130			
Surrogate: 4-Bromofluorobenzene	63		"	62.5		101	70-130			

Origins Laboratory, Inc.



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LT Environmental, Inc.  
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 Arvada CO 80003

Brian Sulzberger  
 Project Number: 014217120  
 Project: KMG - Cresswell 1

**Volatile Organic Compounds by GC/MS SW846 8260C - 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 B7F0601 - EPA 5030 (soil)

Matrix Spike Dup (B7F0601-MSD1)	Source: Y706025-04			Prepared: 06/06/2017 Analyzed: 06/06/2017						
Benzene	0.090	0.002	mg/kg	0.100	ND	89.8	71.8-126	6.77	11.3	
Toluene	0.085	0.002	"	0.100	ND	85.4	65.1-130	11.2	15.4	
Ethylbenzene	0.085	0.002	"	0.100	ND	85.3	62.2-130	16.9	19.6	
m,p-Xylene	0.169	0.004	"	0.200	ND	84.4	46.5-137	15.3	19.2	
o-Xylene	0.087	0.002	"	0.100	ND	87.2	54.2-134	14.0	17.9	
Surrogate: 1,2-Dichloroethane-d4	64		ug/kg	62.5		102	70-130			
Surrogate: Toluene-d8	61		"	62.5		97.5	70-130			
Surrogate: 4-Bromofluorobenzene	63		"	62.5		100	70-130			

Origins Laboratory, Inc.



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LT Environmental, Inc.  
 4600 West 60th Avenue  
 Arvada CO 80003

Brian Sulzberger  
 Project Number: 014217120  
 Project: KMG - Cresswell 1

**Volatile Organic Compounds by GC/MS SW846 8260C - 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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**Extractable Petroleum Hydrocarbons by 8015C - 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 B7F0602 - EPA 3580**

**Blank (B7F0602-BLK1)**

Prepared: 06/06/2017 Analyzed: 06/06/2017

Diesel (C10-C28)	ND	50.0	mg/kg							U
Residual Range Organics (C28-C40)	ND	200	"							U
Surrogate: o-Terphenyl	36		"	50.0		72.4	59-131			

**LCS (B7F0602-BS1)**

Prepared: 06/06/2017 Analyzed: 06/06/2017

Diesel (C10-C28)	936	50.0	mg/kg	1000		93.6	64-121			
Residual Range Organics (C28-C40)	1000	200	"	1000		100	58-124			
Surrogate: o-Terphenyl	47		"	50.0		93.1	59-131			

**Matrix Spike (B7F0602-MS1)**

**Source: Y706025-04**

Prepared: 06/06/2017 Analyzed: 06/06/2017

Diesel (C10-C28)	963	50.0	mg/kg	1000	ND	96.3	53-125			
Residual Range Organics (C28-C40)	1010	200	"	1000	13.6	99.9	47-133			
Surrogate: o-Terphenyl	50		"	50.0		99.7	59-131			

**Matrix Spike Dup (B7F0602-MSD1)**

**Source: Y706025-04**

Prepared: 06/06/2017 Analyzed: 06/06/2017

Diesel (C10-C28)	943	50.0	mg/kg	1000	ND	94.3	53-125	2.13	20	
Residual Range Organics (C28-C40)	1030	200	"	1000	13.6	102	47-133	1.81	20	
Surrogate: o-Terphenyl	52		"	50.0		103	59-131			

Origins Laboratory, Inc.



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LT Environmental, Inc.  
 4600 West 60th Avenue  
 Arvada CO 80003

Brian Sulzberger  
 Project Number: 014217120  
 Project: KMG - Cresswell 1

**Classical Chemistry Parameters - Quality Control**  
**Origins Laboratory, Inc.**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Batch B7F0605 - NO PREP</b>										
<b>Duplicate (B7F0605-DUP1)</b>		<b>Source: Y706074-01</b>			Prepared: 06/06/2017 Analyzed: 06/06/2017					
pH	8.71		pH Units		7.76			11.5	25	
<b>Batch B7F0606 - NO PREP</b>										
<b>Blank (B7F0606-BLK1)</b>		Prepared: 06/06/2017 Analyzed: 06/06/2017								
Specific Conductance (EC)	0.00390		mmhos/cm							
<b>Duplicate (B7F0606-DUP1)</b>		<b>Source: Y706074-01</b>			Prepared: 06/06/2017 Analyzed: 06/06/2017					
Specific Conductance (EC)	0.0843		mmhos/cm		0.0850			0.827	25	

Origins Laboratory, Inc.



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LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Brian Sulzberger  
Project Number: 014217120  
Project: KMG - Cresswell 1

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**Notes and Definitions**

U Sample is Non-Detect.

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