

January 4, 2016

Mr. Randall Ferguson  
EHS Senior Compliance Specialist  
PDC Energy, Inc.  
1775 Sherman Street, Suite 3000  
Denver, CO 80203

Re: **Produced Water Vessel Closure Report**  
**Carlson 18-1 Tank Battery**  
**Facility ID: 322875**  
**NWNE S18 T4N R67W**  
**Blanket Remediation #: 9440**

Dear Mr. Ferguson,

On behalf of PDC Energy, Inc. (PDC), Tasman Geosciences, Inc. (Tasman) has prepared this Produced Water Vessel Closure Report (Report) to document environmental sampling activities performed at the above-referenced site. This Report is being submitted under the Form 27 Management Plan for Closure of Produced Water Vessels, which has been assigned Blanket Remediation #9440 by the Colorado Oil and Gas Conservation Commission (COGCC).

A summary of excavation and environmental sampling activities is provided below.

#### **Site Assessment Activities**

On September 16, 2015, confirmation sampling activities were completed following the removal of the partially buried produced water vessel. Soil encountered in the excavation area was field screened for volatile organic compound (VOC) concentrations using a photoionization detector (PID). One soil sample (SS01) was collected below the former vessel location at approximately 6 feet below ground surface (bgs). The sample was submitted to Summit Scientific Laboratories in Golden, Colorado for analysis of benzene, toluene, ethylbenzene, total xylenes (BTEX), naphthalene, and total petroleum hydrocarbons (TPH) - gasoline range organics (GRO) by Environmental Protection Agency (EPA) Method 8260B, TPH - diesel range organics (DRO) by EPA Method 8015, electrical conductivity (EC), and pH.

Analytical results indicated organic compound concentrations and physical parameters were in compliance with COGCC Table 910-1 standards in soil sample SS01.

The excavation extent and soil sample location are illustrated on Figure 1. Soil analytical data is summarized in Table 1 and the laboratory analytical report is provided in Attachment A.

#### **Conclusions**

Based on the soil analytical data described herein, petroleum hydrocarbon impacts were not encountered during the removal of the produced water vessel. Consequently, no further site investigation is recommended at this time. The facility was decommissioned following site assessment activities.

Please contact me at (720) 409-8791 if you have any questions regarding this report.

Sincerely,






Christine Wasko  
Project Manager  
Tasman Geosciences, Inc.

**Enclosures:**

Figure 1 – Soil Sample Location Map  
Table 1 – Soil Analytical Results Summary Table  
Attachment A – Laboratory Analytical Report



DRAWN BY: MAP	<b>Facility Diagram</b> PDC Energy – DJ Basin Carlson 18-1 Tank Battery NWNE S18 T4N R67W Weld County, CO	 <b>TASMAN</b> GEOSCIENCES 6899 Pecos St., Unit C Denver, CO 80221	<b>LEGEND</b>  Excavation Extent  Soil Sample Location <p>All locations are approximate unless otherwise noted</p>	<b>FIGURE 1</b>  <b>SOIL SAMPLE LOCATION MAP</b>
DATE: 12/22/2015				

**TABLE 1**  
**CARLSON 18-1 TANK BATTERY**  
**SOIL ANALYTICAL RESULTS SUMMARY TABLE**

Sample ID	Date Sampled	Depth (feet bgs)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	Naphthalene (mg/kg)	TPH <sup>(2)</sup> (mg/kg)	EC (mmhos/cm)	pH (units)
<b>COGCC standards for soil (mg/kg) <sup>(1)</sup></b>			<b>0.17</b>	<b>85</b>	<b>100</b>	<b>175</b>	<b>23</b>	<b>500</b>	<b>4 or 2x BG</b>	<b>6-9</b>
SS01 @ 6'	9/16/2015	6	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	0.836	8.97

**Notes:**

- Standards for soil are taken from 2 CCR 404-1, Table 910-1, effective February 1, 2014.
  - TPH - Total volatile and extractable petroleum hydrocarbons. Value calculated by adding GRO and DRO concentrations.
- COGCC = Colorado Oil and Gas Conservation Commission  
(<) = Analytical result is less than the indicated laboratory reporting limit.  
GRO = Total volatile petroleum hydrocarbons - gasoline range organics  
DRO = Total extractable petroleum hydrocarbons - diesel range organics  
mg/kg = Milligrams per kilogram  
bgs = Below ground surface  
EC = Electrical Conductivity  
mmhos/cm = Millimhos per centimeter  
**BOLD** = Analytical result is in exceedance of COGCC soil standards.

## **ATTACHMENT A**

# Summit Scientific

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741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

September 24, 2015

Mark Longhurst  
PDC Energy  
1775 Sherman St. STE. 3000  
Denver, CO 80203  
RE: Carlson 18-1

Enclosed are the results of analyses for samples received by Summit Scientific on 09/16/15 17:00. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read 'P. Shrewsbury', with a stylized, cursive script.

Paul Shrewsbury  
President





PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Carlson 18-1  
Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
09/24/15 08:14

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@6'	1509141-01	Soil	09/16/15 14:45	09/16/15 17:00

## Summit Scientific

1509141

741 Corporate Circle Suite I • Golden, Colorado 80401  
303-277-9310 • 303-374-5933 Fax

Page 1 of 1

Client: PDC Energy

Address:

City/State/Zip:

Phone:

Sampler Name: Matt P

Fax:

Project Manager: Mark Longhurst

E-Mail: Mark.Longhurst@PDCE.com

Project Name: Carlson 18-1

Project Number:

Sample Description	Date Sampled	Time Sampled	Number of Containers	Preservative				Matrix				Analyze For:				Special Instructions	
				HCl	HNO <sub>3</sub>	None	Other (Specify)	Groundwater	Soil	Air - Canister Serial #	Other (Specify)	GBTEXN	DRO	EC	PH		SAR (w/old)
<del>SS01@6'</del> SS01@6'	9/16/15	14:45	1			X		X				X	X	X	X	1 SAR (w/old)	Some day Early AM.
Relinquished by:	Date/Time: 9/15/16 17:00	Received by:	Date/Time: 9/16/15 17:00	Turn Around Time (Check)				Notes:									
Relinquished by:	Date/Time: 9/16/15 17:45	Received by:	Date/Time:	Same Day <input checked="" type="checkbox"/> 72 Hours <input type="checkbox"/>				on ice									
Relinquished by:	Date/Time:	Received in Lab by:	Date/Time:	24 Hours <input type="checkbox"/> 48 Hours <input type="checkbox"/>													
Sample Integrity:				Temperature Upon Receipt:													
Intact: Yes <input type="checkbox"/> No <input type="checkbox"/>																	

www.s2scientific.com

Summit Scientific

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.



PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Carlson 18-1  
Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
09/24/15 08:14

SS01@6'  
1509141-01 (Soil)

### Summit Scientific

#### Extractable Petroleum Hydrocarbons by 8015

Date Sampled: 09/16/15 14:45

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1509185	09/21/15	09/22/15	8015M	

Date Sampled: 09/16/15 14:45

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		96.2 %	30-150		"	"	"	"	

#### Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 09/16/15 14:45

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	ND	0.010	mg/kg	1	1509186	09/21/15	09/21/15	EPA 8260B	
Benzene	ND	0.0020	"	"	"	"	"	"	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: 09/16/15 14:45

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		128 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		108 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		111 %	21-167		"	"	"	"	

#### Physical Parameters by APHA/ASTM/EPA Methods

Date Sampled: 09/16/15 14:45

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	0.836	0.0100	mmhos/cm	1	1509191	09/21/15	09/24/15	SM 2510B	

Summit Scientific

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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Carlson 18-1  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
09/24/15 08:14

**SS01@6'**  
**1509141-01 (Soil)**

**Summit Scientific**

**Physical Parameters by APHA/ASTM/EPA Methods**

Date Sampled: **09/16/15 14:45**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
<b>pH</b>	<b>8.97</b>	0.100	pH Units	1	1509190	09/21/15	09/24/15	EPA 9045	

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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Carlson 18-1  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
09/24/15 08:14

**Extractable Petroleum Hydrocarbons by 8015 - Quality Control**  
**Summit Scientific**

Analyte	Reporting			Spike	Source		%REC		RPD	
	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes

**Batch 1509185 - EPA 3550A**

**Blank (1509185-BLK1)**

Prepared & Analyzed: 09/21/15

C10-C28 (DRO) ND 50 mg/kg

Surrogate: o-Terphenyl 11.6 " 12.2 94.9 30-150

**LCS (1509185-BS1)**

Prepared & Analyzed: 09/21/15

C10-C28 (DRO) 516 50 mg/kg 499 103 73-134

Surrogate: o-Terphenyl 11.8 " 12.2 96.6 30-150

**Matrix Spike (1509185-MS1)**

Source: 1509141-01

Prepared: 09/21/15 Analyzed: 09/22/15

C10-C28 (DRO) 453 50 mg/kg 485 8.86 91.6 50-148

Surrogate: o-Terphenyl 11.5 " 11.9 97.1 30-150

**Matrix Spike Dup (1509185-MSD1)**

Source: 1509141-01

Prepared: 09/21/15 Analyzed: 09/22/15

C10-C28 (DRO) 452 50 mg/kg 463 8.86 95.8 50-148 0.295 13

Surrogate: o-Terphenyl 11.4 " 11.3 101 30-150

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1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Carlson 18-1  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
09/24/15 08:14

**Volatile Organic Compounds by EPA Method 8260B - Quality Control**  
**Summit Scientific**

Analyte	Reporting			Spike	Source		%REC		RPD	
	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes

**Batch 1509186 - EPA 5030 Soil MS**

**Blank (1509186-BLK1)**

Prepared & Analyzed: 09/21/15

Naphthalene	ND	0.010	mg/kg							
Benzene	ND	0.0020	"							
Toluene	ND	0.0050	"							
Ethylbenzene	ND	0.0050	"							
Xylenes (total)	ND	0.010	"							
Gasoline Range Hydrocarbons	ND	0.50	"							
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0456</i>		<i>"</i>	<i>0.0396</i>		<i>115</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0422</i>		<i>"</i>	<i>0.0400</i>		<i>105</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0431</i>		<i>"</i>	<i>0.0400</i>		<i>108</i>	<i>21-167</i>			

**LCS (1509186-BS1)**

Prepared & Analyzed: 09/21/15

Naphthalene	ND	0.010	mg/kg				66-138			
Benzene	0.104	0.0020	"	0.100		104	58-130			
Toluene	0.0934	0.0050	"	0.100		93.4	61-134			
Ethylbenzene	0.0992	0.0050	"	0.0992		100	74-139			
m,p-Xylene	0.192	0.010	"	0.200		96.1	73-137			
o-Xylene	0.102	0.0050	"	0.0984		104	73-141			
Xylenes (total)	0.294	0.010	"				0-200			
Gasoline Range Hydrocarbons	2.10	0.50	"				30-150			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0445</i>		<i>"</i>	<i>0.0396</i>		<i>112</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0448</i>		<i>"</i>	<i>0.0400</i>		<i>112</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0437</i>		<i>"</i>	<i>0.0400</i>		<i>109</i>	<i>21-167</i>			

**Matrix Spike (1509186-MS1)**

Source: 1509141-01

Prepared & Analyzed: 09/21/15

Naphthalene	ND	0.010	mg/kg		ND		10-158			
Benzene	0.112	0.0020	"	0.100	ND	112	30-131			
Toluene	0.101	0.0050	"	0.100	ND	101	30-134			
Ethylbenzene	0.109	0.0050	"	0.0992	ND	110	22-153			
m,p-Xylene	0.211	0.010	"	0.200	ND	106	10-159			
o-Xylene	0.113	0.0050	"	0.0984	ND	114	31-151			
Xylenes (total)	0.324	0.010	"		0.00		30-160			
Gasoline Range Hydrocarbons	2.27	0.50	"		ND		30-160			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0482</i>		<i>"</i>	<i>0.0396</i>		<i>122</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0443</i>		<i>"</i>	<i>0.0400</i>		<i>111</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0436</i>		<i>"</i>	<i>0.0400</i>		<i>109</i>	<i>21-167</i>			

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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Carlson 18-1  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
09/24/15 08:14

**Volatile Organic Compounds by EPA Method 8260B - Quality Control**  
**Summit Scientific**

Analyte	Reporting			Spike	Source		%REC		RPD	
	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes

**Batch 1509186 - EPA 5030 Soil MS**

Matrix Spike Dup (1509186-MSD1)		Source: 1509141-01			Prepared & Analyzed: 09/21/15					
Naphthalene	ND	0.010	mg/kg		ND		10-158		42	
Benzene	0.116	0.0020	"	0.100	ND	116	30-131	3.61	34	
Toluene	0.105	0.0050	"	0.100	ND	105	30-134	4.12	30	
Ethylbenzene	0.118	0.0050	"	0.0992	ND	119	22-153	7.68	24	
m,p-Xylene	0.225	0.010	"	0.200	ND	113	10-159	6.68	68	
o-Xylene	0.121	0.0050	"	0.0984	ND	123	31-151	6.89	38	
Xylenes (total)	0.346	0.010	"		0.00		30-160	6.76	30	
Gasoline Range Hydrocarbons	2.45	0.50	"		ND		30-160	7.56	30	
Surrogate: 1,2-Dichloroethane-d4	0.0487		"	0.0396		123	23-173			
Surrogate: Toluene-d8	0.0430		"	0.0400		108	20-170			
Surrogate: 4-Bromofluorobenzene	0.0442		"	0.0400		111	21-167			

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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Carlson 18-1  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
09/24/15 08:14

**Physical Parameters by APHA/ASTM/EPA Methods - Quality Control**  
**Summit Scientific**

Analyte	Reporting			Spike	Source	%REC		RPD		
	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes

**Batch 1509190 - General Preparation**

**LCS (1509190-BS1)** Prepared: 09/21/15 Analyzed: 09/24/15

pH	7.96	0.100	pH Units	8.00	99.5	95-105
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**Duplicate (1509190-DUP1)** Source: **1509118-01** Prepared: 09/21/15 Analyzed: 09/24/15

pH	8.61	0.100	pH Units	8.65	0.463	20
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**Batch 1509191 - General Preparation**

**Blank (1509191-BLK1)** Prepared: 09/21/15 Analyzed: 09/24/15

Specific Conductance (EC)	ND	0.0100	mmhos/cm
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**LCS (1509191-BS1)** Prepared: 09/21/15 Analyzed: 09/24/15

Specific Conductance (EC)	502	0.0100	mmhos/cm	500	100	90-110
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**Duplicate (1509191-DUP1)** Source: **1509118-01** Prepared: 09/21/15 Analyzed: 09/24/15

Specific Conductance (EC)	3.73	0.0100	mmhos/cm	4.03	7.76	20
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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Carlson 18-1  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
09/24/15 08:14

### Notes and Definitions

DET Analyte DETECTED  
ND Analyte NOT DETECTED at or above the reporting limit  
NR Not Reported  
dry Sample results reported on a dry weight basis  
RPD Relative Percent Difference

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A handwritten signature in black ink, appearing to be 'MSM'.