

**TABLE 1**  
**LUDWIG #3 SPREADFIELD**  
**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)	pH (units)	EC (mmhos/cm)	SAR (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>6-9</b>	<b>&lt;4</b>	<b>&lt;12</b>
BG01 @ .25'	11/6/2018	0.25	NA	NA	NA	NA	NA	NA	6.42	0.253	0.174
BG02 @ .25'	11/6/2018	0.25	NA	NA	NA	NA	NA	NA	7.22	0.267	0.359
BG03 @ 3"	11/20/2018	0.25	NA	NA	NA	NA	NA	NA	7.49	0.458	0.943
SS01 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.58	1.49	1.22
SS02 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.65	1.04	0.652
SS03 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	7.97	1.79	0.798
SS04 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.26	2.52	1.92
SS05 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	<b>9.07</b>	1.06	2.21
SS06 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	<b>9.22</b>	1.99	1.83
SS07 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	<b>9.31</b>	1.72	1.36
SS08 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	<b>9.67</b>	0.958	1.09
SS09 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.32	1.17	1.08
SS10 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	7.96	1.28	1.08
SS11 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.19	1.54	0.650
SS12 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	<b>10.0</b>	0.941	0.840
SS13 @ .25'	11/6/2018	0.25	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	<b>13.3</b>	1.11	0.790
SS05-R @ 3"	11/20/2018	0.25	NA	NA	NA	NA	NA	NA	7.24	0.532	0.805
SS06-R @ 3"	11/20/2018	0.25	NA	NA	NA	NA	NA	NA	7.22	1.26	1.25
SS07-R @ 3"	11/20/2018	0.25	NA	NA	NA	NA	NA	NA	7.43	0.901	1.14
SS08-R @ 3"	11/20/2018	0.25	NA	NA	NA	NA	NA	NA	7.38	0.631	0.781
SS12-R @ 3"	11/20/2018	0.25	NA	NA	NA	NA	NA	NA	7.38	0.731	0.996
SS13-R @ 3"	11/20/2018	0.25	NA	NA	NA	NA	NA	NA	7.53	0.748	0.871

**Notes:**

1. Standards for soil are taken from 2 CCR 404-1, Table 910-1, effective May 1, 2018.

2. 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

SAR = Sodium adsorption ratio

NA = Constituent not analyzed

**BOLD** = Analytical result is in exceedance of COGCC soil standards.

## **ATTACHMENT A**

# Summit Scientific

---

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

November 08, 2018

Mark Longhurst

PDC Energy

1775 Sherman St. STE. 3000

Denver, CO 80203

RE: Ludwig #3

Enclosed are the results of analyses for samples received by Summit Scientific on 11/06/18 18:08. 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: Ludwig #3

Project Number: [none]

Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@.25'	1811059-01	Soil	11/06/18 11:53	11/06/18 18:08
SS02@.25'	1811059-02	Soil	11/06/18 11:56	11/06/18 18:08
BG01@.25'	1811059-03	Soil	11/06/18 11:59	11/06/18 18:08
SS03@.25'	1811059-04	Soil	11/06/18 12:04	11/06/18 18:08
BG02@.25'	1811059-05	Soil	11/06/18 12:07	11/06/18 18:08
SS04@.25'	1811059-06	Soil	11/06/18 12:15	11/06/18 18:08
SS05@.25'	1811059-07	Soil	11/06/18 12:23	11/06/18 18:08
SS06@.25'	1811059-08	Soil	11/06/18 12:32	11/06/18 18:08
SS07@.25'	1811059-09	Soil	11/06/18 12:37	11/06/18 18:08
SS08@.25'	1811059-10	Soil	11/06/18 12:41	11/06/18 18:08
SS09@.25'	1811059-11	Soil	11/06/18 12:45	11/06/18 18:08
SS10@.25'	1811059-12	Soil	11/06/18 12:50	11/06/18 18:08
SS11@.25'	1811059-13	Soil	11/06/18 12:54	11/06/18 18:08
SS12@.25'	1811059-14	Soil	11/06/18 12:59	11/06/18 18:08
SS13@.25'	1811059-15	Soil	11/06/18 13:05	11/06/18 18:08

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.*

# Summit Scientific

741 Corporate Circle Suite 1 ♦ Golden, Colorado 80401  
303-277-9310 ♦ 303-374-5933 Fax

1811059.1

Page 1 of 2

Client: PDC Energy  
Address: \_\_\_\_\_  
City/State/Zip: \_\_\_\_\_  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
Sampler Name: Barb Nelson

Project Manager: Mark Longhurst  
E-Mail: \_\_\_\_\_  
Project Name: Ludwig #3  
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)	BTEX-N 8260	TPH-GRO	TPH-D20	EC	pH	SAR						
SS010.25'	11/6/18	1153	1			X			X				X	X	X	X	X						
SS020.25'		1156	1			X			X				X	X	X	X	X						
B6010.25'		1157	1			X			X				X	X	X	X	X						B61
SS030.25'		1204	1			X			X				X	X	X	X	X						
B6020.25'		1207	1			X			X				X	X	X	X	X						B61
SS040.25'		1215	1			X			X				X	X	X	X	X						Please run B601
SS050.25'		1223	1			X			X				X	X	X	X	X						+ B602 only
SS060.25'		1232	1			X			X				X	X	X	X	X						for pH EC
SS070.25'		1237	1			X			X				X	X	X	X	X						SAR
SS080.25'		1241	1			X			X				X	X	X	X	X						
Relinquished by: _____ Date/Time: <u>11/6/18 1200</u>				Received by: _____ Date/Time: <u>11.6.18 1815</u>				Turn Around Time (Check) Same Day <input type="checkbox"/> 72 Hours <input type="checkbox"/> 24 Hours <input checked="" type="checkbox"/> Standard <input type="checkbox"/> 48 Hours <input type="checkbox"/>										Notes:					
Relinquished by: _____ Date/Time: _____				Received by: _____ Date/Time: _____				Sample Integrity: Temperature Upon Receipt: <u>2.9</u> Intact: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>															
Relinquished by: _____ Date/Time: _____				Received in Lab by: _____ Date/Time: _____																			

## Summit Scientific

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

1811059-2

Page 7 of 2

Client:	PDC / Tasman
Address:	6899 N Pecos
City/State/Zip:	Denver/CO/80221
Phone:	Fax:
Sampler Name:	Baucke Nelson

Project Manager: Mark Longhurst  
E-Mail: mark.longhurst@pdce.com  
Project Name: Ludwig #3  
Project Number:

[illegible]

# Sample Receipt Checklist

S2 Work Order 1811059

Client: POC Energy Client Project ID: Ludwig #3

Shipped Via: H.D./P.U./FedEx/UPS/USPS/Other P.U. Airbill #: \_\_\_\_\_

Matrix (check all that apply): ☐ Air ☒ Soil/Solid ☐ Water ☐ Other: \_\_\_\_\_  
(Describe)

Temp (°C)	<u>2.9</u>
-----------	------------

Thermometer ID: 61857155-K

	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature at 4°C +/- 2°C <sup>(1)</sup> ? NOTE: If samples are delivered the same day of sampling, this requirement is met provided that there is evidence that cooling has begun.	<input checked="" type="checkbox"/>	<input 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"/>	
If custody seals are present, are they intact <sup>(1)</sup> ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Are samples with holding times due within 48 hours sample due within 48 hours present?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Is a chain-of-custody (COC) form 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 w/ date and time recorded <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
For volatiles in water – is there headspace 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 (excluding cooling) <sup>(1)</sup> ? Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, ect	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If samples are acid preserved for metals, is the pH ≤ 2 <sup>(1)</sup> ? Record the pH in Comments.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If dissolved metals are requested, were samples field filtered?	<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 in case narrative.				

UP  
Custodian Printed Name or Initials

[Signature]  
Signature of Custodian

11.6.18 1815  
Date/Time



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

Project: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS01@.25'**  
**1811059-01 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 11:53**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 11:53**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: 1,2-Dichloroethane-d4		119 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		100 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		111 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 11:53**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 11:53**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: o-Terphenyl		41.3 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 11:53**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	1030	10.4	mg/kg dry	1	1811080	11/06/18	11/06/18	EPA 6020B	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS01@.25'**  
**1811059-01 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Magnesium	127	5.21	mg/kg dry	1	1811080	11/06/18	11/06/18	EPA 6020B
Sodium	156	5.21	"	"	"	"	"	"

**Calculated Analysis**

Date Sampled: **11/06/18 11:53**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	1.22	0.100	units	1	1811082	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 11:53**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	96.0		%	1	1811081	11/06/18	11/07/18	Calculation	
pH	8.58		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 11:53**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	1.49	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS02@.25'**  
**1811059-02 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 11:56**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 11:56**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		116 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		100 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		116 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 11:56**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 11:56**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		59.7 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 11:56**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	756	10.5	mg/kg dry	1	1811080	11/06/18	11/06/18	EPA 6020B	
Magnesium	101	5.24	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS02@.25'**  
**1811059-02 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	71.9	5.24	mg/kg dry	1	1811080	11/06/18	11/06/18	EPA 6020B
--------	------	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 11:56**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	0.652	0.100	units	1	1811082	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 11:56**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	95.5		%	1	1811081	11/06/18	11/07/18	Calculation	
pH	8.65		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 11:56**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	1.04	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**BG01@.25'**  
**1811059-03 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 11:59**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	11.9	10.0	mg/kg dry	1	1811080	11/06/18	11/06/18	EPA 6020B	
Magnesium	7.35	5.00	"	"	"	"	"	"	
Sodium	ND	5.00	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/06/18 11:59**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	0.174	0.100	units	1	1811082	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 11:59**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	948		%	1	1811081	11/06/18	11/07/18	Calculation	
pH	6.42		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 11:59**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	0.253	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
11/08/18 06:20

**SS03@.25'**  
**1811059-04 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 12:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		125 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		104 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		112 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 12:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		65.7 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	1720	10.5	mg/kg dry	1	1811080	11/06/18	11/06/18	EPA 6020B	
Magnesium	234	5.27	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS03@.25'**  
**1811059-04 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

<b>Sodium</b>	<b>133</b>	5.27	mg/kg dry	1	1811080	11/06/18	11/06/18	EPA 6020B
---------------	------------	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>Sodium Adsorption Ratio</b>	<b>0.798</b>	0.100	units	1	1811082	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 12:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>% Solids</b>	<b>94.8</b>		%	1	1811081	11/06/18	11/07/18	Calculation	
<b>pH</b>	<b>7.97</b>		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>Specific Conductance (EC)</b>	<b>1.79</b>	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**BG02@.25'**  
**1811059-05 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:07**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	146	10.5	mg/kg dry	1	1811080	11/06/18	11/06/18	EPA 6020B	
Magnesium	109	5.26	"	"	"	"	"	"	
Sodium	23.5	5.26	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/06/18 12:07**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	0.359	0.100	units	1	1811082	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 12:07**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	95.1		%	1	1811081	11/06/18	11/07/18	Calculation	
pH	7.22		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:07**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	0.267	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
11/08/18 06:20

**SS04@.25'**  
**1811059-06 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 12:15**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:15**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Surrogate: 1,2-Dichloroethane-d4		129 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		104 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		120 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 12:15**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:15**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Surrogate: o-Terphenyl		31.7 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:15**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Calcium	2980	10.3	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	159	5.17	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS04@.25'**  
**1811059-06 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	396	5.17	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	-----	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:15**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	1.92	0.100	units	1	1811104	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 12:15**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	96.6		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	8.26		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:15**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	2.52	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
11/08/18 06:20

**SS05@.25'**  
**1811059-07 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 12:23**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:23**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: 1,2-Dichloroethane-d4		127 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		108 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		112 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 12:23**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:23**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: o-Terphenyl		31.7 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:23**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	1890	10.3	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	87.0	5.16	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS05@.25'**  
**1811059-07 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	173	5.16	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	-----	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:23**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	1.06	0.100	units	1	1811104	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 12:23**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	96.8		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	9.07		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:23**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	2.21	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS06@.25'**  
**1811059-08 (Soil)**

### Summit Scientific

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

Date Sampled: **11/06/18 12:32**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:32**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		124 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		105 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		115 %	21-167		"	"	"	"	

#### Extractable Petroleum Hydrocarbons by 8015

Date Sampled: **11/06/18 12:32**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:32**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		95.4 %	30-150		"	"	"	"	

#### Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis

Date Sampled: **11/06/18 12:32**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	1320	10.4	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	110	5.18	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS06@.25'**  
**1811059-08 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	257	5.18	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	-----	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:32**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	1.83	0.100	units	1	1811104	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 12:32**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	96.6		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	9.22		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:32**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	1.99	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS07@.25'**  
**1811059-09 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 12:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		122 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		102 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		118 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 12:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		95.4 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	2560	11.0	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	197	5.51	"	"	"	"	"	"	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS07@.25'**  
**1811059-09 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	265	5.51	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	-----	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	1.36	0.100	units	1	1811104	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 12:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	90.8		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	9.31		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	1.72	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS08@.25'**  
**1811059-10 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 12:41**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:41**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		131 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		107 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		121 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 12:41**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:41**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		91.4 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:41**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	1100	10.3	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	90.6	5.13	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS08@.25'**  
**1811059-10 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

<b>Sodium</b>	<b>140</b>	5.13	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
---------------	------------	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:41**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>Sodium Adsorption Ratio</b>	<b>1.09</b>	0.100	units	1	1811104	11/07/18	11/07/18	Calculation	

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

Date Sampled: **11/06/18 12:41**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>% Solids</b>	<b>97.5</b>		%	1	1811090	11/07/18	11/07/18	Calculation	
<b>pH</b>	<b>9.67</b>		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:41**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>Specific Conductance (EC)</b>	<b>0.958</b>	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS09@.25'**  
**1811059-11 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 12:45**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:45**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		120 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		103 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		115 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 12:45**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:45**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		96.0 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:45**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	528	10.3	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	42.9	5.15	"	"	"	"	"	"	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS09@.25'**  
**1811059-11 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	96.1	5.15	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	------	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:45**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	1.08	0.100	units	1	1811104	11/07/18	11/08/18	Calculation	

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

Date Sampled: **11/06/18 12:45**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	97.1		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	8.32		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:45**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	1.17	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS10@.25'**  
**1811059-12 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 12:50**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:50**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		129 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		105 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		123 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 12:50**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:50**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		109 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:50**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	539	10.5	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	62.0	5.24	"	"	"	"	"	"	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS10@.25'**  
**1811059-12 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	99.7	5.24	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	------	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:50**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	1.08	0.100	units	1	1811104	11/07/18	11/08/18	Calculation	

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

Date Sampled: **11/06/18 12:50**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	95.4		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	7.96		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:50**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	1.28	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
11/08/18 06:20

SS11@.25'  
1811059-13 (Soil)

### Summit Scientific

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

Date Sampled: 11/06/18 12:54

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: 11/06/18 12:54

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		142 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		106 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		118 %	21-167		"	"	"	"	

#### Extractable Petroleum Hydrocarbons by 8015

Date Sampled: 11/06/18 12:54

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: 11/06/18 12:54

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		110 %	30-150		"	"	"	"	

#### Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis

Date Sampled: 11/06/18 12:54

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	1030	10.3	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	84.1	5.15	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS11@.25'**  
**1811059-13 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	81.1	5.15	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	------	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:54**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	0.650	0.100	units	1	1811104	11/07/18	11/08/18	Calculation	

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

Date Sampled: **11/06/18 12:54**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	97.0		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	8.19		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:54**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	1.54	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS12@.25'**  
**1811059-14 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 12:59**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 12:59**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		122 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		99.6 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		117 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 12:59**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 12:59**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		111 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 12:59**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	2120	10.4	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	171	5.22	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS12@.25'**  
**1811059-14 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	150	5.22	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	-----	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 12:59**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	0.840	0.100	units	1	1811104	11/07/18	11/08/18	Calculation	

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

Date Sampled: **11/06/18 12:59**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	95.8		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	10.0		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 12:59**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	0.941	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS13@.25'**  
**1811059-15 (Soil)**

**Summit Scientific**

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

Date Sampled: **11/06/18 13:05**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1811079	11/06/18	11/07/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **11/06/18 13:05**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		118 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		104 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		117 %	21-167		"	"	"	"	

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **11/06/18 13:05**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1811078	11/06/18	11/07/18	EPA 8015M	

Date Sampled: **11/06/18 13:05**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		110 %	30-150		"	"	"	"	

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/06/18 13:05**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	1490	10.6	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B	
Magnesium	142	5.32	"	"	"	"	"	"	

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: Ludwig #3  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**SS13@.25'**  
**1811059-15 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Sodium	119	5.32	mg/kg dry	1	1811099	11/07/18	11/07/18	EPA 6020B
--------	-----	------	-----------	---	---------	----------	----------	-----------

**Calculated Analysis**

Date Sampled: **11/06/18 13:05**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Sodium Adsorption Ratio	0.790	0.100	units	1	1811104	11/07/18	11/08/18	Calculation	

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

Date Sampled: **11/06/18 13:05**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
% Solids	94.1		%	1	1811090	11/07/18	11/07/18	Calculation	
pH	13.3		pH Units	"	1811100	11/07/18	11/07/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/06/18 13:05**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	1.11	0.0100	mmhos/cm	1	1811101	11/07/18	11/07/18	EPA 120.1	

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

## Volatile Organic Compounds by EPA Method 8260B - Quality Control

### Summit Scientific

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

#### Batch 1811079 - EPA 5030 Soil MS

##### Blank (1811079-BLK1)

Prepared: 11/06/18 Analyzed: 11/07/18

Benzene	ND	0.0020	mg/kg							
Toluene	ND	0.0050	"							
Ethylbenzene	ND	0.0050	"							
Xylenes (total)	ND	0.010	"							
Naphthalene	ND	0.010	"							
Gasoline Range Hydrocarbons	ND	0.50	"							
Surrogate: 1,2-Dichloroethane-d4	0.0484		"	0.0396	122	23-173				
Surrogate: Toluene-d8	0.0411		"	0.0400	103	20-170				
Surrogate: 4-Bromofluorobenzene	0.0485		"	0.0400	121	21-167				

##### LCS (1811079-BS1)

Prepared: 11/06/18 Analyzed: 11/07/18

Benzene	0.102	0.0020	mg/kg	0.100	102	70-130				
Toluene	0.103	0.0050	"	0.100	103	70-130				
Ethylbenzene	0.109	0.0050	"	0.100	109	70-130				
m,p-Xylene	0.217	0.010	"	0.200	108	70-130				
o-Xylene	0.108	0.0050	"	0.100	108	70-130				
Surrogate: 1,2-Dichloroethane-d4	0.0350		"	0.0396	88.5	23-173				
Surrogate: Toluene-d8	0.0387		"	0.0400	96.7	20-170				
Surrogate: 4-Bromofluorobenzene	0.0388		"	0.0400	97.0	21-167				

##### Matrix Spike (1811079-MS1)

Source: 1811059-01

Prepared: 11/06/18 Analyzed: 11/07/18

Benzene	0.0799	0.0020	mg/kg	0.100	ND	79.9	70-130			
Toluene	0.0818	0.0050	"	0.100	ND	81.8	70-130			
Ethylbenzene	0.0966	0.0050	"	0.100	ND	96.6	70-130			
m,p-Xylene	0.184	0.010	"	0.200	ND	91.8	70-130			
o-Xylene	0.0974	0.0050	"	0.100	ND	97.4	70-130			
Surrogate: 1,2-Dichloroethane-d4	0.0363		"	0.0396	91.7	23-173				
Surrogate: Toluene-d8	0.0394		"	0.0400	98.4	20-170				
Surrogate: 4-Bromofluorobenzene	0.0393		"	0.0400	98.2	21-167				

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: Ludwig #3

Project Number: [none]

Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

## 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 1811079 - EPA 5030 Soil MS

Matrix Spike Dup (1811079-MSD1)	Source: 1811059-01			Prepared: 11/06/18 Analyzed: 11/07/18						
Benzene	0.0755	0.0020	mg/kg	0.100	ND	75.5	70-130	5.60	30	
Toluene	0.0766	0.0050	"	0.100	ND	76.6	70-130	6.55	30	
Ethylbenzene	0.0901	0.0050	"	0.100	ND	90.1	70-130	6.91	30	
m,p-Xylene	0.155	0.010	"	0.200	ND	77.5	70-130	16.8	30	
o-Xylene	0.0910	0.0050	"	0.100	ND	91.0	70-130	6.78	30	
Surrogate: 1,2-Dichloroethane-d4	0.0353		"	0.0396		89.2	23-173			
Surrogate: Toluene-d8	0.0388		"	0.0400		96.9	20-170			
Surrogate: 4-Bromofluorobenzene	0.0391		"	0.0400		97.6	21-167			

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

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

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

**Batch 1811078 - EPA 3550A**

**Blank (1811078-BLK1)**

Prepared: 11/06/18 Analyzed: 11/07/18

C10-C28 (DRO) ND 50 mg/kg

**LCS (1811078-BS1)**

Prepared: 11/06/18 Analyzed: 11/07/18

C10-C28 (DRO) 506 50 mg/kg 500 101 70-130

**Matrix Spike (1811078-MS1)**

**Source: 1811059-01**

Prepared: 11/06/18 Analyzed: 11/07/18

C10-C28 (DRO) 432 50 mg/kg 500 18.7 82.6 70-130

**Matrix Spike Dup (1811078-MSD1)**

**Source: 1811059-01**

Prepared: 11/06/18 Analyzed: 11/07/18

C10-C28 (DRO) 405 50 mg/kg 500 18.7 77.2 70-130 6.47 20

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

## Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis - Quality Control

### Summit Scientific

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

#### Batch 1811080 - General Preparation

##### Blank (1811080-BLK1)

Prepared & Analyzed: 11/06/18

Calcium	ND	10.0	mg/kg wet
Magnesium	ND	5.00	"
Sodium	ND	5.00	"

##### LCS (1811080-BS1)

Prepared & Analyzed: 11/06/18

Calcium	559	10.0	mg/kg wet	500	112	70-130
Magnesium	563	5.00	"	500	113	70-130
Sodium	558	5.00	"	500	112	70-130

##### Duplicate (1811080-DUP1)

Source: 1811054-01

Prepared & Analyzed: 11/06/18

Calcium	1030	12.0	mg/kg dry	1030	0.0349	20
Magnesium	807	6.00	"	944	15.6	20
Sodium	72.1	6.00	"	69.0	4.38	20

##### Matrix Spike (1811080-MS1)

Source: 1811054-01

Prepared & Analyzed: 11/06/18

Calcium	1630	12.0	mg/kg dry	600	1030	99.3	70-130
Magnesium	1450	6.00	"	600	944	84.6	70-130
Sodium	628	6.00	"	600	69.0	93.3	70-130

##### Matrix Spike Dup (1811080-MSD1)

Source: 1811054-01

Prepared & Analyzed: 11/06/18

Calcium	1770	12.0	mg/kg dry	600	1030	124	70-130	8.76	25
Magnesium	1490	6.00	"	600	944	90.6	70-130	2.44	25
Sodium	638	6.00	"	600	69.0	95.0	70-130	1.59	25

#### Batch 1811099 - General Preparation

##### Blank (1811099-BLK1)

Prepared & Analyzed: 11/07/18

Calcium	ND	10.0	mg/kg wet
Magnesium	ND	5.00	"
Sodium	ND	5.00	"

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis - Quality Control**

**Summit Scientific**

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

**Batch 1811099 - General Preparation**

**LCS (1811099-BS1)**

Prepared & Analyzed: 11/07/18

Calcium	498	10.0	mg/kg wet	500		99.5	70-130
Magnesium	477	5.00	"	500		95.4	70-130
Sodium	528	5.00	"	500		106	70-130

**Duplicate (1811099-DUP1)**

Source: 1811059-06

Prepared & Analyzed: 11/07/18

Calcium	3320	10.3	mg/kg dry	2980		10.8	20
Magnesium	179	5.17	"	159		11.9	20
Sodium	385	5.17	"	396		2.80	20

**Matrix Spike (1811099-MS1)**

Source: 1811059-06

Prepared & Analyzed: 11/07/18

Calcium	3610	10.3	mg/kg dry	517	2980	122	70-130
Magnesium	666	5.17	"	517	159	97.9	70-130
Sodium	882	5.17	"	517	396	93.8	70-130

**Matrix Spike Dup (1811099-MSD1)**

Source: 1811059-06

Prepared & Analyzed: 11/07/18

Calcium	3620	10.3	mg/kg dry	517	2980	124	70-130	0.337	25
Magnesium	688	5.17	"	517	159	102	70-130	3.22	25
Sodium	892	5.17	"	517	396	95.9	70-130	1.23	25

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**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 1811081 - General Preparation**

**Duplicate (1811081-DUP1)**      **Source: 1811054-01**      Prepared: 11/06/18 Analyzed: 11/07/18

% Solids	80.2		%		83.4			3.91	20	
----------	------	--	---	--	------	--	--	------	----	--

**Batch 1811090 - General Preparation**

**Duplicate (1811090-DUP1)**      **Source: 1811031-03**      Prepared & Analyzed: 11/07/18

% Solids	81.2		%		81.4			0.245	20	
----------	------	--	---	--	------	--	--	-------	----	--

**Batch 1811100 - General Preparation**

**LCS (1811100-BS1)**      Prepared & Analyzed: 11/07/18

pH	9.1		pH Units	9.18		99.5	95-105			
----	-----	--	----------	------	--	------	--------	--	--	--

**Duplicate (1811100-DUP1)**      **Source: 1810368-02**      Prepared & Analyzed: 11/07/18

pH	8.7		pH Units		8.4			3.62	20	
----	-----	--	----------	--	-----	--	--	------	----	--

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: Ludwig #3

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/08/18 06:20

**Specific Conductance by EPA Method 120.1 - Quality Control**  
**Summit Scientific**

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

**Batch 1811101 - General Preparation**

**Blank (1811101-BLK1)**

Prepared & Analyzed: 11/07/18

Specific Conductance (EC) ND 0.0100 mmhos/cm

**LCS (1811101-BS1)**

Prepared & Analyzed: 11/07/18

Specific Conductance (EC) 0.751 0.0100 mmhos/cm 0.750 100 90-110

**Duplicate (1811101-DUP1)**

**Source: 1810368-02**

Prepared & Analyzed: 11/07/18

Specific Conductance (EC) 3.15 0.0100 mmhos/cm 3.19 1.21 20

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: Ludwig #3

Project Number: [none]

Project Manager: Mark Longhurst

**Reported:**

11/08/18 06:20

### 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

# Summit Scientific

---

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

November 21, 2018

Mark Longhurst

PDC Energy

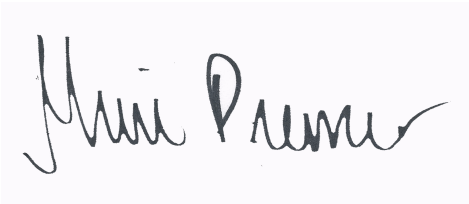
1775 Sherman St. STE. 3000

Denver, CO 80203

RE: Ludwig #3 Spreadfeld

Enclosed are the results of analyses for samples received by Summit Scientific on 11/20/18 18:35. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink on a light blue background. The signature is written in a cursive style and reads "Muri Premier".

Muri Premier For Paul Shrewsbury

President



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

Project: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS05-R@3"	1811239-01	Soil	11/20/18 10:19	11/20/18 18:35
SS06-R@3"	1811239-02	Soil	11/20/18 10:31	11/20/18 18:35
SS07-R@3"	1811239-03	Soil	11/20/18 10:38	11/20/18 18:35
SS08-R@3"	1811239-04	Soil	11/20/18 10:49	11/20/18 18:35
SS012-R@3"	1811239-05	Soil	11/20/18 10:57	11/20/18 18:35
SS13-R@3"	1811239-06	Soil	11/20/18 11:09	11/20/18 18:35
BG03@3"	1811239-07	Soil	11/20/18 11:20	11/20/18 18:35

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.*

# Summit Scientific

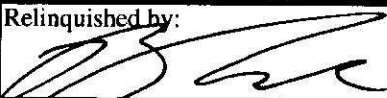
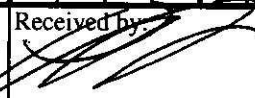
1811239

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

Page 1 of 1

Client: PDC  
Address: \_\_\_\_\_  
City/State/Zip: \_\_\_\_\_  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
Sampler Name: Brack Nelson

Project Manager: Mark Longhurst  
E-Mail: Mark.Longhurst@pdce.com  
Project Name: Ludwig #3 Spreadfield  
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)	EC	PH	SAR												
SS05-R03"	11/20/18	1019	1			X			X				X	X	X											
SS06-R03"		1031	1			X			X				X	X	X											
SS07-R03"		1038	1			X			X				X	X	X											
SS08-R03"		1049	1			X			X				X	X	X											
SS12-R03"		1057	1			X			X				X	X	X											
SS13-R03"	↓	1109	1			X			X				X	X	X											
B60303"	↓	1120	1			X			X				X	X	X											
Relinquished by: 	Date/Time: 11/20/18 11:05 AM	Received by: 	Date/Time: 11.20.18 1045	Turn Around Time (Check)																						
Relinquished by:	Date/Time:	Received by:	Date/Time:	Same Day	<input checked="" type="checkbox"/>	72 Hours	<input type="checkbox"/>																			
				24 Hours	<input type="checkbox"/>	Standard	<input type="checkbox"/>																			
				48 Hours	<input type="checkbox"/>																					
Relinquished by:	Date/Time:	Received in Lab by:	Date/Time:	Sample Integrity:																						
				Temperature Upon Receipt: 4.5																						
				Intact: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>																						

# Sample Receipt Checklist

S2 Work Order 1811239

Client: PDC Client Project ID: Ludwig #3 Spreadfield

Shipped Via: H.D./P.U./FedEx/UPS/USPS/Other 920 Airbill #: \_\_\_\_\_

Matrix (check all that apply):    Air    ☒ Soil/Solid    Water    Other: \_\_\_\_\_  
(Describe)

Temp (°C)	<u>4.5</u>
-----------	------------

Thermometer ID: 61857155-K

	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature at 4°C +/- 2°C <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
NOTE: If samples are delivered the same day of sampling, this requirement is met provided that there is evidence that cooling has begun.				
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"/>	
If custody seals are present, are they intact <sup>(1)</sup> ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Are samples with holding times due within 48 hours sample due within 48 hours present?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Is a chain-of-custody (COC) form 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 w/ date and time recorded <sup>(1)</sup> ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
For volatiles in water – is there headspace 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 (excluding cooling) <sup>(1)</sup> ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, ect			<input checked="" type="checkbox"/>	
If samples are acid preserved for metals, is the pH ≤ 2 <sup>(1)</sup> ? Record the pH in Comments.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If dissolved metals are requested, were samples field filtered?	<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 in case narrative.

Custodian Printed Name or Initials

Signature of Custodian

11.20.18 1845  
Date/Time



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

Project: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**SS05-R@3"**  
**1811239-01 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/20/18 10:19**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	<b>2290</b>	10.7	mg/kg dry	1	1811272	11/20/18	11/20/18	EPA 6020B	
Magnesium	<b>362</b>	5.35	"	"	"	"	"	"	
Sodium	<b>157</b>	5.35	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/20/18 10:19**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	<b>0.805</b>	0.100	units	1	1811278	11/21/18	11/21/18	Calculation	

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

Date Sampled: **11/20/18 10:19**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	<b>93.4</b>		%	1	1811271	11/20/18	11/21/18	Calculation	
pH	<b>7.24</b>		pH Units	"	1811270	"	11/20/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/20/18 10:19**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	<b>0.532</b>	0.0100	mmhos/cm	1	1811269	11/20/18	11/20/18	EPA 120.1	

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**SS06-R@3"**  
**1811239-02 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/20/18 10:31**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	2720	10.9	mg/kg dry	1	1811272	11/20/18	11/20/18	EPA 6020B	
Magnesium	453	5.44	"	"	"	"	"	"	
Sodium	268	5.44	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/20/18 10:31**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	1.25	0.100	units	1	1811278	11/21/18	11/21/18	Calculation	

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

Date Sampled: **11/20/18 10:31**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	91.9		%	1	1811271	11/20/18	11/21/18	Calculation	
pH	7.22		pH Units	"	1811270	"	11/20/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/20/18 10:31**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	1.26	0.0100	mmhos/cm	1	1811269	11/20/18	11/20/18	EPA 120.1	

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**SS07-R@3"**  
**1811239-03 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/20/18 10:38**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	<b>1900</b>	10.7	mg/kg dry	1	1811272	11/20/18	11/20/18	EPA 6020B	
Magnesium	<b>380</b>	5.36	"	"	"	"	"	"	
Sodium	<b>208</b>	5.36	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/20/18 10:38**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	<b>1.14</b>	0.100	units	1	1811278	11/21/18	11/21/18	Calculation	

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

Date Sampled: **11/20/18 10:38**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	<b>93.2</b>		%	1	1811271	11/20/18	11/21/18	Calculation	
pH	<b>7.43</b>		pH Units	"	1811270	"	11/20/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/20/18 10:38**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	<b>0.901</b>	0.0100	mmhos/cm	1	1811269	11/20/18	11/20/18	EPA 120.1	

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**SS08-R@3"**  
**1811239-04 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/20/18 10:49**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	1270	10.6	mg/kg dry	1	1811272	11/20/18	11/20/18	EPA 6020B	
Magnesium	243	5.29	"	"	"	"	"	"	
Sodium	116	5.29	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/20/18 10:49**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	0.781	0.100	units	1	1811278	11/21/18	11/21/18	Calculation	

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

Date Sampled: **11/20/18 10:49**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	94.5		%	1	1811271	11/20/18	11/21/18	Calculation	
pH	7.38		pH Units	"	1811270	"	11/20/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/20/18 10:49**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	0.631	0.0100	mmhos/cm	1	1811269	11/20/18	11/20/18	EPA 120.1	

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**SS012-R@3"**  
**1811239-05 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/20/18 10:57**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	1340	10.8	mg/kg dry	1	1811272	11/20/18	11/20/18	EPA 6020B	
Magnesium	344	5.41	"	"	"	"	"	"	
Sodium	158	5.41	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/20/18 10:57**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	0.996	0.100	units	1	1811278	11/21/18	11/21/18	Calculation	

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

Date Sampled: **11/20/18 10:57**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	92.4		%	1	1811271	11/20/18	11/21/18	Calculation	
pH	7.38		pH Units	"	1811270	"	11/20/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/20/18 10:57**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	0.731	0.0100	mmhos/cm	1	1811269	11/20/18	11/20/18	EPA 120.1	

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**SS13-R@3"**  
**1811239-06 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/20/18 11:09**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	<b>810</b>	10.9	mg/kg dry	1	1811272	11/20/18	11/20/18	EPA 6020B	
Magnesium	<b>311</b>	5.47	"	"	"	"	"	"	
Sodium	<b>115</b>	5.47	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/20/18 11:09**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	<b>0.871</b>	0.100	units	1	1811278	11/21/18	11/21/18	Calculation	

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

Date Sampled: **11/20/18 11:09**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	<b>91.4</b>		%	1	1811271	11/20/18	11/21/18	Calculation	
pH	<b>7.53</b>		pH Units	"	1811270	"	11/20/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/20/18 11:09**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	<b>0.748</b>	0.0100	mmhos/cm	1	1811269	11/20/18	11/20/18	EPA 120.1	

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**BG03@3"**  
**1811239-07 (Soil)**

**Summit Scientific**

**Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis**

Date Sampled: **11/20/18 11:20**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Calcium	<b>966</b>	10.4	mg/kg dry	1	1811272	11/20/18	11/20/18	EPA 6020B	
Magnesium	<b>223</b>	5.20	"	"	"	"	"	"	
Sodium	<b>125</b>	5.20	"	"	"	"	"	"	

**Calculated Analysis**

Date Sampled: **11/20/18 11:20**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Sodium Adsorption Ratio	<b>0.943</b>	0.100	units	1	1811278	11/21/18	11/21/18	Calculation	

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

Date Sampled: **11/20/18 11:20**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
% Solids	<b>96.2</b>		%	1	1811271	11/20/18	11/21/18	Calculation	
pH	<b>7.49</b>		pH Units	"	1811270	"	11/20/18	EPA 9045D	

**Specific Conductance by EPA Method 120.1**

Date Sampled: **11/20/18 11:20**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Specific Conductance (EC)	<b>0.458</b>	0.0100	mmhos/cm	1	1811269	11/20/18	11/20/18	EPA 120.1	

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

## Soluble Nutrients by EPA 6020/USDA60 6(2, 3A) - Dry Weight Basis - Quality Control

### Summit Scientific

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

#### Batch 1811272 - General Preparation

##### Blank (1811272-BLK1)

Prepared & Analyzed: 11/20/18

Calcium	ND	10.0	mg/kg wet
Magnesium	ND	5.00	"
Sodium	ND	5.00	"

##### LCS (1811272-BS1)

Prepared & Analyzed: 11/20/18

Calcium	566	10.0	mg/kg wet	500	113	70-130
Magnesium	566	5.00	"	500	113	70-130
Sodium	549	5.00	"	500	110	70-130

##### Duplicate (1811272-DUP1)

Source: 1811229-01

Prepared & Analyzed: 11/20/18

Calcium	1230	11.4	mg/kg dry	1200	2.81	20
Magnesium	404	5.68	"	431	6.63	20
Sodium	80.2	5.68	"	68.3	16.1	20

##### Matrix Spike (1811272-MS1)

Source: 1811229-01

Prepared & Analyzed: 11/20/18

Calcium	1690	11.4	mg/kg dry	568	1200	86.7	70-130
Magnesium	995	5.68	"	568	431	99.3	70-130
Sodium	686	5.68	"	568	68.3	109	70-130

##### Matrix Spike Dup (1811272-MSD1)

Source: 1811229-01

Prepared & Analyzed: 11/20/18

Calcium	1650	11.4	mg/kg dry	568	1200	79.9	70-130	2.30	25
Magnesium	1000	5.68	"	568	431	101	70-130	0.804	25
Sodium	656	5.68	"	568	68.3	104	70-130	4.46	25

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**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 1811270 - General Preparation**

**LCS (1811270-BS1)**

Prepared & Analyzed: 11/20/18

pH	7.0	pH Units	6.85	102	95-105
----	-----	----------	------	-----	--------

**Duplicate (1811270-DUP1)**

**Source: 1811239-01**

Prepared & Analyzed: 11/20/18

pH	7.3	pH Units	7.2	0.688	20
----	-----	----------	-----	-------	----

**Batch 1811271 - General Preparation**

**Duplicate (1811271-DUP1)**

**Source: 1811229-01**

Prepared: 11/20/18 Analyzed: 11/21/18

% Solids	97.3	%	88.0	10.0	20
----------	------	---	------	------	----

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

**Specific Conductance by EPA Method 120.1 - Quality Control**  
**Summit Scientific**

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

**Batch 1811269 - General Preparation**

**Blank (1811269-BLK1)**

Prepared & Analyzed: 11/20/18

Specific Conductance (EC) ND 0.0100 mmhos/cm

**LCS (1811269-BS1)**

Prepared & Analyzed: 11/20/18

Specific Conductance (EC) 0.765 0.0100 mmhos/cm 0.750 102 90-110

**Duplicate (1811269-DUP1)**

**Source: 1811239-01**

Prepared & Analyzed: 11/20/18

Specific Conductance (EC) 0.525 0.0100 mmhos/cm 0.532 1.42 20

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: Ludwig #3 Spreadfield

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
11/21/18 14:57

### 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