

PDC Energy, Inc.
Second Quarter 2019 Groundwater Monitoring Summary

June 11, 2019

Former JR #1 Tank Battery
SESW Section 13 T6N R65W
Remediation # 12319

This groundwater monitoring summary has been prepared by Tasman Geosciences, Inc. for the former JR #1 tank battery. On May 30, 2019, groundwater monitoring was conducted at five monitoring well locations (BH01 – BH05). Due to farming activities during the second quarter, 2019, BH06 was destroyed and therefore could not be sampled. Five groundwater samples were submitted to Summit Scientific Laboratory for analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) by USEPA Method 8260B.

Second quarter 2019 analytical results indicated that the benzene concentration was above the applicable COGCC Table 910-1 groundwater standard in monitoring well BH01. BTEX concentrations were below regulatory standards in the four remaining monitoring well locations.

Monitored natural attenuation (MNA) was selected as the remediation strategy for this site during the first quarter 2019 and will remain the selected remediation strategy for the third quarter 2019.

Third quarter 2019 groundwater sampling will be conducted during August 2019. Analytical results are summarized in Table 1 and the laboratory report is included as Attachment A. Sample locations and corresponding analytical results are illustrated on Figure 1. Groundwater elevation data is illustrated in Figure 2.



DATE: June 11, 2019

DESIGNED BY: C. Hamlin

DRAWN BY: J. McCarver



Tasman Geosciences, Inc.
6899 Pecos Street – Unit C
Denver, CO 80221

PDC Energy, Inc. – DJ Basin
Former JR #1 Tank Battery
SESW, Section 13, Township 6 North, Range 65 West
Weld County, Colorado

GROUNDWATER
ANALYTICAL RESULTS
MAP

FIGURE
1



- Legend**
- Monitoring Well Location (Collected via Trimble GPS)
 - Monitoring Well Location - Destroyed (Collected via Trimble GPS)
 - Excavation Extent (Collected via Trimble GPS)
 - Excavation Groundwater Sample
 - Groundwater Elevation Contour (Dashed where inferred)
- 4680.45** Groundwater Elevation (ft. AMSL)
- Point of Release
 - Groundwater Flow Direction (2Q19)

Notes

All locations are approximate unless otherwise noted.

Surface drainage direction is estimated based on site topography and is not related to regional topography.

GPS – Global Positioning System

ft. AMSL – Feet Above Mean Sea Level

0 ft. 15 ft. 40 ft.

Image Source: Google Earth; 2016 Google
Projection: WGS 84 UTM Zone 13 North

DATE:	May 30, 2019
DESIGNED BY:	C. Hamlin
DRAWN BY:	C. Olson



Tasman Geosciences, Inc.
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Denver, CO 80221

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Weld County, Colorado

GROUNDWATER ELEVATION CONTOUR MAP (05/30/2019)

FIGURE 2

TABLE 1
FORMER JR #1 TANK BATTERY
GROUNDWATER ANALYTICAL RESULTS SUMMARY TABLE

Sample ID	Date Sampled	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Depth to Water ⁽²⁾ (feet)	Groundwater Elevation (ft AMSL)
COGCC Table 910-1 Groundwater Standard (µg/L) ⁽¹⁾		5	560	700	1,400		
GW01	1/4/2019	5.2	<1.0	1.1	11	~ 16	NM
BH01	2/22/2019	81	7.7	88	1,300	15.12	4681.14
BH01	5/30/2019	180	1.0	<1.0	2,400	15.39	4680.45
BH02	2/22/2019	<1.0	<1.0	<1.0	<2.0	15.29	4681.30
BH02	5/30/2019	<1.0	<1.0	<1.0	<2.0	15.71	4680.65
BH03	2/22/2019	<1.0	<1.0	<1.0	<2.0	15.11	4681.50
BH03	5/30/2019	<1.0	<1.0	<1.0	<2.0	15.54	4680.85
BH04	2/22/2019	8.5	<1.0	<1.0	<2.0	15.12	4680.82
BH04	5/30/2019	<1.0	<1.0	<1.0	<2.0	16.67	4678.97
BH05	2/22/2019	<1.0	<1.0	<1.0	<2.0	15.43	4680.29
BH05	5/30/2019	<1.0	<1.0	<1.0	<2.0	16.06	4679.56
BH06	2/22/2019	<1.0	<1.0	<1.0	<2.0	15.29	4680.56
BH06	5/30/2019	Destroyed					

Notes:

1. Groundwater standards referenced from 2 CCR 404-1, Table 910-1, effective May 1, 2018.
2. Depth to water measurements were measured from ground surface for excavation samples. Monitoring well measurements were collected from top of casing and adjusted using survey data to reflect depth of water from ground surface.

COGCC = Colorado Oil and Gas Conservation Commission

µg/L = Micrograms per liter

(<) = Analytical result is less than the indicated laboratory reporting limit.

ft AMSL = Feet Above Mean Sea Level

BOLD = Analytical result is in exceedance of COGCC groundwater standards.

Attachment A

Summit Scientific

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

June 06, 2019

Mark Longhurst

PDC Energy

1775 Sherman St. STE. 3000

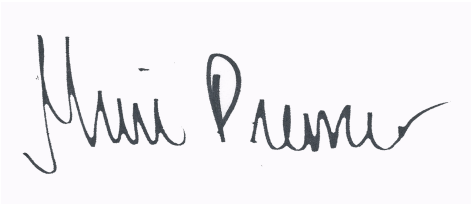
Denver, CO 80203

RE: JR #1

Work Order # 1905334

Enclosed are the results of analyses for samples received by Summit Scientific on 05/30/19 17:30. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads "Muri Premer". The signature is written in a cursive style with a large initial "M" and a long, sweeping underline.

Muri Premer For Paul Shrewsbury

President



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

Project: JR #1

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
06/06/19 15:54

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BH01	1905334-01	Water	05/30/19 12:20	05/30/19 17:30
BH02	1905334-02	Water	05/30/19 12:05	05/30/19 17:30
BH03	1905334-03	Water	05/30/19 12:00	05/30/19 17:30
BH04	1905334-04	Water	05/30/19 12:15	05/30/19 17:30
BH05	1905334-05	Water	05/30/19 12:10	05/30/19 17:30

Summit Scientific

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Summit Scientific

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

Page 1 of 1

Client: PDC / Tasman Geosciences
Address: 6899 Pecos St, Unit C
City/State/Zip: Denver, CO 80221
Phone: 303-487-1228 Fax: _____
Sampler Name: Brian Gabel

Project Manager: Mark Longhurst
E-Mail: mark.longhurst@pdce.com
Project Name: JR #1
Project Number: N/A

Sample Description	Date Sampled	Time Sampled	Number of Containers	Preservative				Matrix			Analyze For:						Special Instructions			
				HCl	HNO ₃	None	Other (Specify)	Groundwater	Soil	Air - Canister Serial #	Other (Specify)	BTEX - 8260								
BH01	5/30/19	1220	3			X		X					X							
BH02	↓	1205	↓			↓		↓					↓							
BH03	↓	1200	↓			↓		↓					↓							
BH04	↓	1215	↓			↓		↓					↓							
BH05	↓	1210	↓			↓		↓					↓							
Relinquished by: <u>Dr. Lall</u> Date/Time: <u>5/30/19 1640</u>				Received by: <u>Tasman Lock Box</u> Date/Time: <u>5/30/19 1640</u>				Turn Around Time (Check)				Notes:								
Relinquished by: <u>Tasman Lock Box</u> Date/Time: _____				Received by: _____ Date/Time: _____				Same Day <input type="checkbox"/> 72 Hours <input checked="" type="checkbox"/>				24 Hours <input type="checkbox"/> Standard <input checked="" type="checkbox"/>								
Relinquished by: _____ Date/Time: _____				Received in Lab by: _____ Date/Time: _____				48 Hours <input type="checkbox"/>				Sample Integrity:								
								Temperature Upon Receipt: _____				Intact: Yes <input type="checkbox"/> No <input type="checkbox"/>								

Sample Receipt Checklist

S2 Work Order 1905334

Client: PDC/Tasman Client Project ID: JR #1

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

Matrix (check all that apply): Air Soil/Solid Water Other: _____
(Describe)

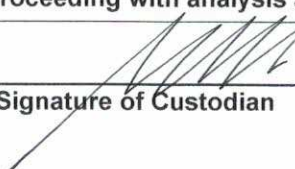
Temp (°C)	4.9
-----------	-----

Thermometer ID: 61857155-K

	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature at 4°C +/- 2°C ⁽¹⁾ ? NOTE: If samples are delivered the same day of sampling; this requirement is met provided that there is evidence that cooling has begun.	✓			On Ice
Were all samples received intact ⁽¹⁾ ?	✓			
Was adequate sample volume provided ⁽¹⁾ ?	✓			
If custody seals are present, are they intact ⁽¹⁾ ?			✓	
Are samples with holding times due within 48 hours sample due within 48 hours present?			✓	
Is a chain-of-custody (COC) form present and filled out completely ⁽¹⁾ ?	✓			
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	✓			
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	✓			
Is the COC properly relinquished by the client w/ date and time recorded ⁽¹⁾ ?	✓			
For volatiles in water – is there headspace present? If yes, contact client and note in narrative.		✓		
Are samples preserved that require preservation (excluding cooling) ⁽¹⁾ ? Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, ect	✓			HCL
If samples are acid preserved for metals, is the pH ≤ 2 ⁽¹⁾ ? Record the pH in Comments.			✓	
If dissolved metals are requested, were samples field filtered?			✓	
Additional Comments (if any):				

⁽¹⁾ If NO, then contact the client before proceeding with analysis and note in case narrative.

Paul Shrewsbury
Custodian Printed Name or Initials


Signature of Custodian

5/30/19
Date/Time



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

Project: JR #1

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 06/06/19 15:54

BH01
1905334-01 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **05/30/19 12:20**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	180	10	ug/l	10	1906001	06/04/19	06/05/19	EPA 8260B	
Toluene	1.0	1.0	"	1	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	2400	20	"	10	"	"	"	"	

Date Sampled: **05/30/19 12:20**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		99.2 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		104 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		103 %	21-167		"	"	"	"	

Summit Scientific

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

Project: JR #1

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 06/06/19 15:54

BH02
1905334-02 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **05/30/19 12:05**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1906001	06/04/19	06/05/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **05/30/19 12:05**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		97.6 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		96.9 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		86.1 %		21-167		"	"	"	"	

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

Project: JR #1

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 06/06/19 15:54

BH03
1905334-03 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **05/30/19 12:00**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1906001	06/04/19	06/05/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **05/30/19 12:00**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		100 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		98.7 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		103 %		21-167		"	"	"	"	

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

Project: JR #1

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 06/06/19 15:54

BH04
1905334-04 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **05/30/19 12:15**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1906001	06/04/19	06/05/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **05/30/19 12:15**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		101 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		98.6 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		101 %		21-167		"	"	"	"	

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

Project: JR #1

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 06/06/19 15:54

BH05
1905334-05 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **05/30/19 12:10**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1906001	06/04/19	06/05/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **05/30/19 12:10**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		98.9 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		99.7 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		100 %		21-167		"	"	"	"	

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

Project: JR #1

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
06/06/19 15:54

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Summit Scientific

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

Batch 1906001 - EPA 5030 Water MS

Blank (1906001-BLK1)

Prepared: 06/04/19 Analyzed: 06/05/19

Benzene	ND	1.0	ug/l								
Toluene	ND	1.0	"								
Ethylbenzene	ND	1.0	"								
Xylenes (total)	ND	2.0	"								
Surrogate: 1,2-Dichloroethane-d4	11.8		"	13.3		88.7	23-173				
Surrogate: Toluene-d8	12.7		"	13.3		95.5	20-170				
Surrogate: 4-Bromofluorobenzene	11.8		"	13.3		88.4	21-167				

LCS (1906001-BS1)

Prepared: 06/04/19 Analyzed: 06/05/19

Benzene	34.6	1.0	ug/l	33.3		104	70-130				
Toluene	37.1	1.0	"	33.3		111	70-130				
Ethylbenzene	35.5	1.0	"	33.3		106	70-130				
m,p-Xylene	71.2	2.0	"	66.7		107	70-130				
o-Xylene	36.9	1.0	"	33.3		111	70-130				
Surrogate: 1,2-Dichloroethane-d4	12.5		"	13.3		93.7	23-173				
Surrogate: Toluene-d8	13.4		"	13.3		100	20-170				
Surrogate: 4-Bromofluorobenzene	11.8		"	13.3		88.3	21-167				

Matrix Spike (1906001-MS1)

Source: 1905334-02

Prepared: 06/04/19 Analyzed: 06/05/19

Benzene	36.3	1.0	ug/l	33.3	ND	109	70-130				
Toluene	38.7	1.0	"	33.3	ND	116	70-130				
Ethylbenzene	37.9	1.0	"	33.3	ND	114	70-130				
m,p-Xylene	74.9	2.0	"	66.7	ND	112	70-130				
o-Xylene	39.4	1.0	"	33.3	ND	118	70-130				
Surrogate: 1,2-Dichloroethane-d4	12.6		"	13.3		94.5	23-173				
Surrogate: Toluene-d8	13.1		"	13.3		98.6	20-170				
Surrogate: 4-Bromofluorobenzene	11.9		"	13.3		89.5	21-167				

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

Project: JR #1

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 06/06/19 15:54

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

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

Batch 1906001 - EPA 5030 Water MS

Matrix Spike Dup (1906001-MSD1)

Source: 1905334-02

Prepared: 06/04/19 Analyzed: 06/05/19

Benzene	36.3	1.0	ug/l	33.3	ND	109	70-130	0.0275	30	
Toluene	39.0	1.0	"	33.3	ND	117	70-130	0.953	30	
Ethylbenzene	38.1	1.0	"	33.3	ND	114	70-130	0.395	30	
m,p-Xylene	76.2	2.0	"	66.7	ND	114	70-130	1.83	30	
o-Xylene	40.0	1.0	"	33.3	ND	120	70-130	1.49	30	
Surrogate: 1,2-Dichloroethane-d4	12.9		"	13.3		96.8	23-173			
Surrogate: Toluene-d8	13.0		"	13.3		97.2	20-170			
Surrogate: 4-Bromofluorobenzene	11.7		"	13.3		88.0	21-167			

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

Project: JR #1

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
06/06/19 15:54

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