



Nicholson GeoSolutions, LLC

3433 East Lake Drive
Centennial, CO 80121

Groundwater Monitoring Report for the P32-596 Water Management Facility, Fall 2020

Nicholson GeoSolutions LLC conducted groundwater monitoring near the Berry Petroleum Company P32-596 water management facility located on Old Mountain in Garfield County, Colorado on September 26th, 2020 and again on October 20th, 2020. Three monitoring wells were installed around the facility in 2014 to provide groundwater monitoring capability for the permit. Figure 1 provides the locations of the monitoring wells. The facility is located on the top of Old Mountain adjacent to Deep Gulch. The three wells are gauged semi-annually to check for groundwater in accordance with the facility permit and samples are collected if sufficient water is present.

Total Depth and Water Levels

Total depth and water levels were measured in each monitoring well using an electronic water level indicator. The water level data are provided in Table 1.

Table 1 P-32 Water Facility Total Depths and Water Levels – September 26, 2020

Monitoring Well ID	Total Depth (feet below top of casing)	Water Level (feet below top of casing)	Water Column Thickness (feet)
MW-1	31.73	31.73	Dry
MW-2	33.65	33.65	Dry
MW-3	32.37	30.40	1.97

Wells MW-1 and MW-2 were dry. Approximately 1.97 feet of clear water was present in well MW-3.

Sampling Procedures

Two unpurged groundwater sample were collected from monitoring well MW-3. The samples were collected into new, pre-preserved sample containers provided by the laboratories. The sample bottles were labeled, placed in plastic zip-lock bags, and stored immediately on ice in a cooler.

Insufficient sample was available on September 26th to complete the entire suite of analyses or conduct measurements of field parameters. This sample was shipped to the Pace Analytical National Laboratory in Mt. Juliet, Tennessee for analysis. Laboratory analyses consisted of the following: benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8021B; chloride, fluoride, nitrate, nitrite, and sulfate by EPA Method 9056A; nitrate-nitrite by EPA Method 353.2; ammonia by EPA Method 350.1; methane, ethane, and ethene by Method

RSKSOP-175M; and Total Petroleum Hydrocarbons (diesel and gasoline range) by EPA Method 8015.

Because the methane concentration in the first sample was above 1.0 mg/l, and in accordance with COGCC regulations, a second sample was collected from well MW-3 on October 20, 2020 and hand-delivered to SGS North America Laboratory in Wheat Ridge, Colorado to confirm the methane result and provide additional volume for isotopic analysis of methane. Only 1.20 feet of water was present in the well at the time of resampling.

Analytical Results

Table 2 summarizes the laboratory analytical results for the sample collected on September 26, 2020. The laboratory analytical report is included in Appendix A. All results are below the associated Federal and Colorado aquatic life standards except for ammonia at 2.65 mg/l.

Methane was detected at a concentration of 9.23 mg/l. In addition, diesel-range TPH was detected at the trace concentration of 0.377 mg/l. The source of the methane is not likely to be the P-32 pit because other indicators of produced water influence, including chloride at 4.81 mg/l, are within the normal ranges for this well.

Table 2 P-32 Water Facility Groundwater Monitoring Results for Fall 2020

Parameter	Standards		Sample ID and Date
	Colorado Aquatic Life Standards ³	EPA Drinking Water Standards	MW-3 (Sept 26, 2020)
Organic Constituents			
total petroleum hydrocarbons, diesel range			0.377
total petroleum hydrocarbons, gasoline range			<0.1
benzene	5.3	0.005 ¹	<0.0005
toluene	17.5	1 ¹	<0.001
ethylbenzene	32	0.7 ¹	<0.0005
xylenes	C ⁴	10 ¹	<0.0015
methane			9.23
ethane			<0.013
ethene			<0.013
Anions			
ammonia	0.02 ⁵		2.65
chloride		250 ²	4.81
fluoride		4 ¹ , 2 ²	<0.15
nitrate		10 ¹	<0.1
nitrite		1 ¹	R
nitrate-nitrite			<0.1
sulfate		250 ²	24.4

All results in mg/l except where indicated R = value rejected during data validation

¹Federal Drinking Water Maximum Contaminant Level (MCL)

²Federal Drinking Water Secondary Standard ³Chronic aquatic life standard (Colorado Water Quality Standards, 5 CCR 1002-31). ⁴Carcinogenic compounds as classified by the EPA

⁵Chronic. Acute ammonia standard calculated based on 0.43/FT/FPH/2, where FT = acute temperature adjustment and FPH = acute pH adjustment.

A second sample was collected from well MW-3 on October 20, 2020 to confirm the methane results from the first sample. Methane was detected at 4.10 mg/l in the second sample. The lab report is provided in Appendix A.

This sample was then forwarded to Dolan Integration Group in Westminster, Colorado for stable isotope analysis. Stable isotope interpretive plots were provided with the stable isotope report and are included with the DIG lab report in Appendix B. The results indicate that the methane is dry, post-mature, kerogen Type II, thermogenic gas. Additional evaluation of the potential source of the methane is currently being conducted.

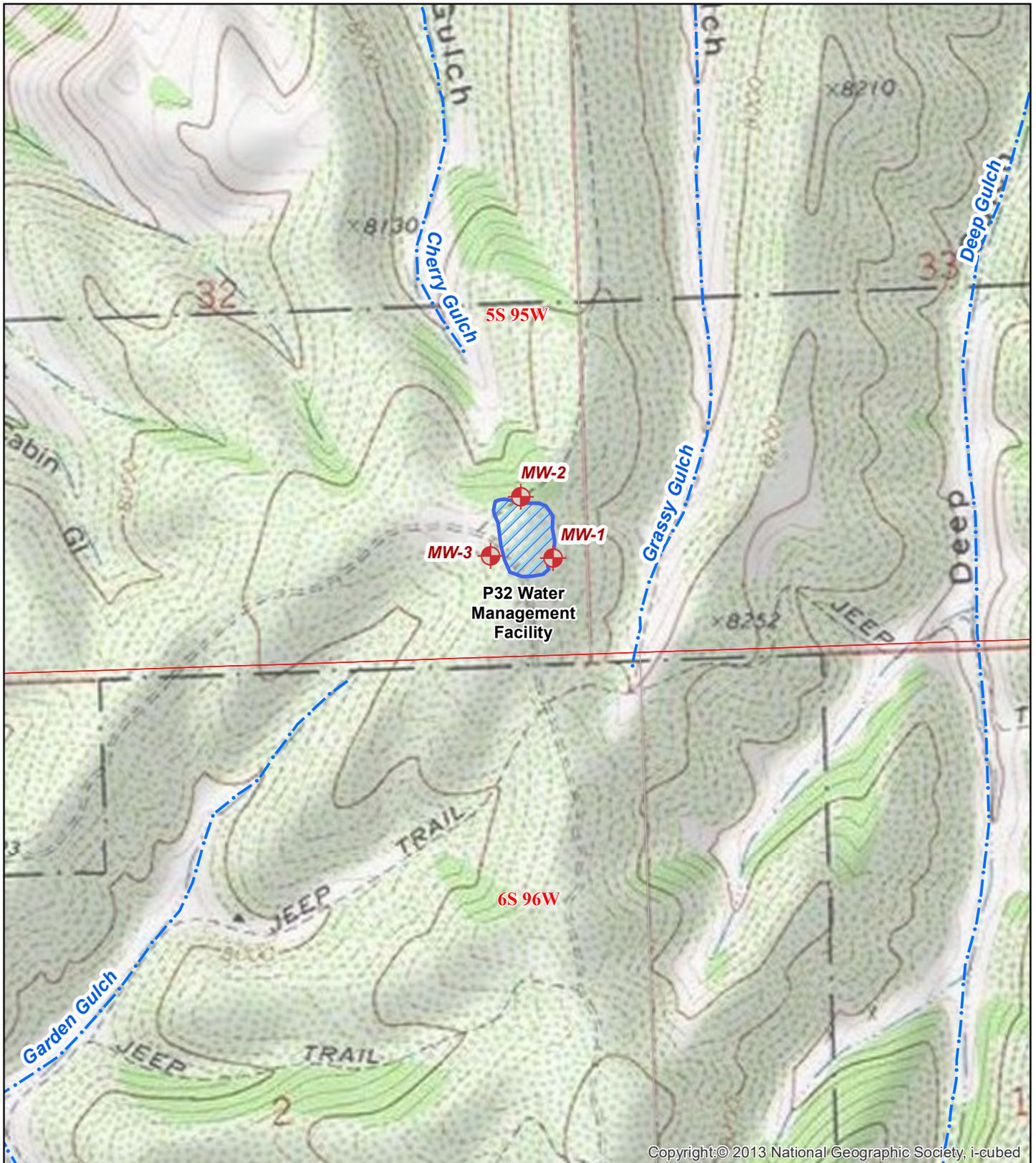
Data Validation

A data review was conducted using the quality assurance reports supplied by the laboratories and standard EPA data validation guidelines. All analyses were conducted within the recommended holding times, except for nitrite. Nitrite was reported as not detected and rejected "R" because it exceeded the holding time by more than 100%. All method blank results were reported as not detected. All laboratory control sample (LCS), laboratory duplicate, surrogate, and matrix spike/matrix spike duplicate (MS/MSD) recoveries (for QA samples prepared using the samples from this event only) were within the laboratory control limits. No problems were noted for the stable isotope analyses.

Nicholson GeoSolutions LLC has prepared this report using all available site data. If you have any questions please call me at 303-601-2023.

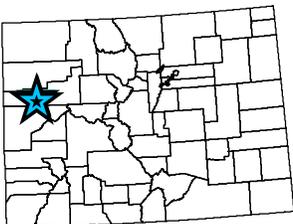


David K. Nicholson, P.G.
Principal Geologist



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Project Location



Legend

-  Monitoring Well
-  Surface Water
-  P-32 Water Management Facility



Berry Petroleum Company

Groundwater Monitoring Locations
 P-32 Water Management Facility
 Garfield County, Colorado

June 2017

Nicholson GeoSolutions, LLC

APPENDIX A
Laboratory Reports

October 09, 2020

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

Berry Petroleum - Denver, CO

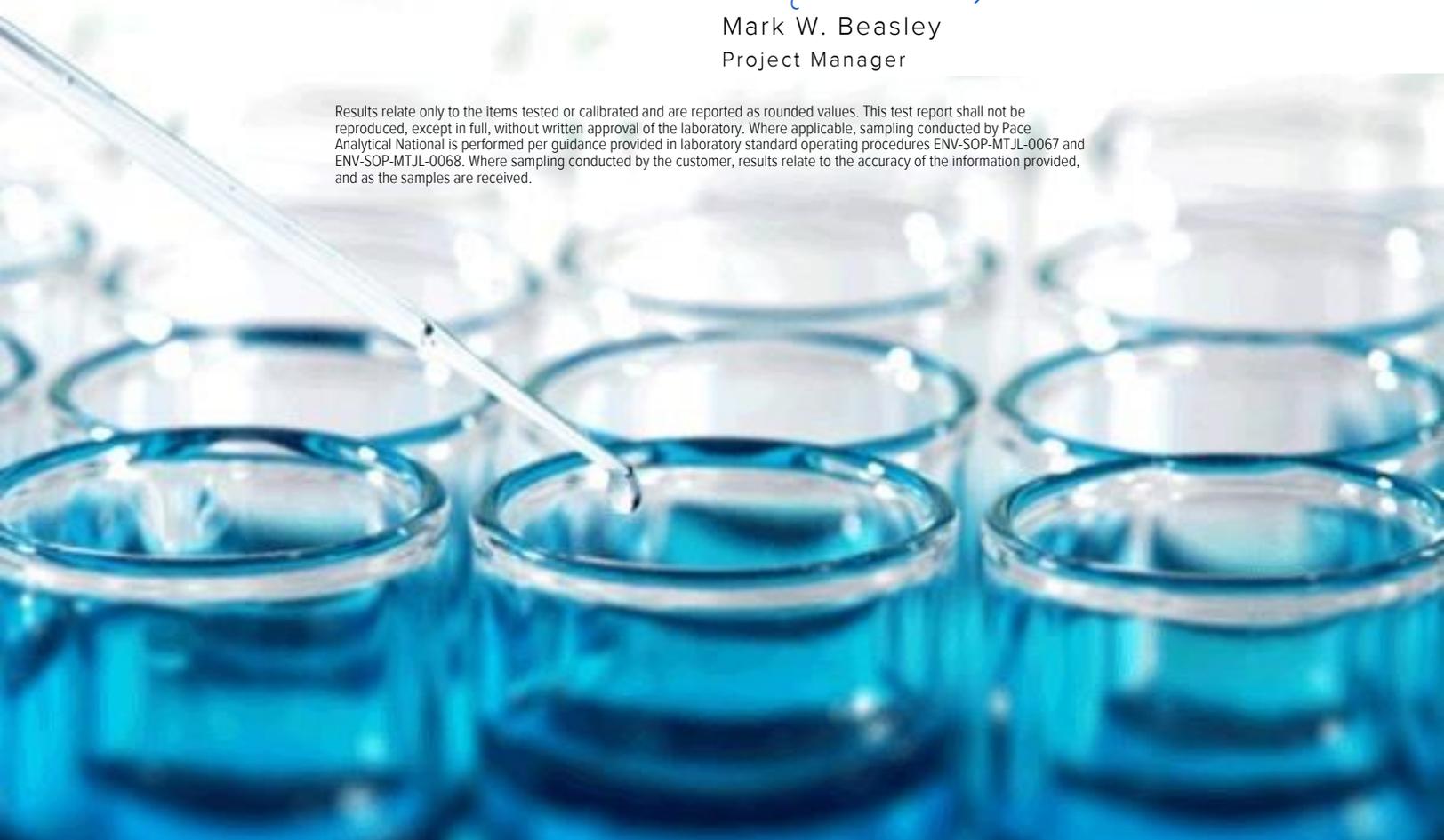
Sample Delivery Group: L1267957
Samples Received: 09/30/2020
Project Number:
Description: P32

Report To: Dave Nicholson
3433 E. Lake Dr
Centennial, CO 80121

Entire Report Reviewed By:

Mark W. Beasley
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.





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Tc: Table of Contents	2	
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Cn: Case Narrative	4	
Sr: Sample Results	5	
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SAMPLE SUMMARY



MW-3 L1267957-01 GW

Collected by: DK Nicholson
 Collected date/time: 09/26/20 09:00
 Received date/time: 09/30/20 09:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 350.1	WG1553711	1	10/06/20 23:09	10/06/20 23:09	DGR	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG1554508	1	10/07/20 17:22	10/07/20 17:22	MCG	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1551934	1	10/01/20 13:07	10/01/20 13:07	LBR	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015/8021	WG1555224	1	10/07/20 09:14	10/07/20 09:14	AV	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method RSK175	WG1552258	1	10/01/20 15:35	10/01/20 15:35	DAH	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method RSK175	WG1552626	10	10/01/20 15:51	10/01/20 15:51	DAH	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1555602	3	10/08/20 09:49	10/09/20 05:34	JDG	Mt. Juliet, TN

- ¹ Cp
- ² Tc
- ³ Ss
- ⁴ Cn
- ⁵ Sr
- ⁶ Qc
- ⁷ Gl
- ⁸ Al
- ⁹ Sc



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Mark W. Beasley
Project Manager

- ¹ Cp
- ² Tc
- ³ Ss
- ⁴ Cn
- ⁵ Sr
- ⁶ Qc
- ⁷ Gl
- ⁸ Al
- ⁹ Sc



Wet Chemistry by Method 350.1

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Ammonia Nitrogen	2.65		0.250	1	10/06/2020 23:09	WG1553711

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Nitrate-Nitrite	ND		0.100	1	10/07/2020 17:22	WG1554508

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Chloride	4.81		1.00	1	10/01/2020 13:07	WG1551934
Fluoride	ND		0.150	1	10/01/2020 13:07	WG1551934
Nitrate as (N)	ND	T8	0.100	1	10/01/2020 13:07	WG1551934
Nitrite as (N)	ND	T8	0.100	1	10/01/2020 13:07	WG1551934
Sulfate	24.4		5.00	1	10/01/2020 13:07	WG1551934

Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Benzene	ND		0.000500	1	10/07/2020 09:14	WG1555224
Toluene	ND		0.00100	1	10/07/2020 09:14	WG1555224
Ethylbenzene	ND		0.000500	1	10/07/2020 09:14	WG1555224
Total Xylene	ND		0.00150	1	10/07/2020 09:14	WG1555224
TPH (GC/FID) Low Fraction	ND		0.100	1	10/07/2020 09:14	WG1555224
(S) a,a,a-Trifluorotoluene(FID)	107		78.0-120		10/07/2020 09:14	WG1555224
(S) a,a,a-Trifluorotoluene(PID)	94.2		79.0-125		10/07/2020 09:14	WG1555224

Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Methane	9.23		0.100	10	10/01/2020 15:51	WG1552626
Ethane	ND		0.0130	1	10/01/2020 15:35	WG1552258
Ethene	ND		0.0130	1	10/01/2020 15:35	WG1552258

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	0.377		0.300	3	10/09/2020 05:34	WG1555602
(S) o-Terphenyl	39.6		31.0-160		10/09/2020 05:34	WG1555602

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc



Method Blank (MB)

(MB) R3578601-1 10/06/20 22:14

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
Ammonia Nitrogen	U		0.117	0.250

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ Gl

⁸ Al

⁹ Sc

L1267938-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1267938-02 10/06/20 22:22 • (DUP) R3578601-5 10/06/20 22:24

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Ammonia Nitrogen	ND	ND	1	0.000		10

L1267973-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1267973-02 10/06/20 23:04 • (DUP) R3578601-7 10/06/20 23:05

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Ammonia Nitrogen	ND	ND	1	0.000		10

Laboratory Control Sample (LCS)

(LCS) R3578601-2 10/06/20 22:15

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Ammonia Nitrogen	7.50	7.11	94.8	90.0-110	

L1267938-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1267938-01 10/06/20 22:17 • (MS) R3578601-3 10/06/20 22:19 • (MSD) R3578601-4 10/06/20 22:20

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Ammonia Nitrogen	5.00	ND	4.73	4.14	94.7	82.7	1	90.0-110		J3 J6	13.4	10

L1267965-02 Original Sample (OS) • Matrix Spike (MS)

(OS) L1267965-02 10/06/20 23:00 • (MS) R3578601-6 10/06/20 23:02

Analyte	Spike Amount	Original Result	MS Result	MS Rec.	Dilution	Rec. Limits	MS Qualifier
Ammonia Nitrogen	5.00	ND	4.65	93.0	1	90.0-110	



Method Blank (MB)

(MB) R3579009-1 10/07/20 17:03

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
Nitrate-Nitrite	U		0.0500	0.100

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ Gl

⁸ Al

⁹ Sc

L1267956-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1267956-04 10/07/20 17:19 • (DUP) R3579009-5 10/07/20 17:20

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Nitrate-Nitrite	ND	ND	1	0.000		20

L1268284-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1268284-01 10/07/20 17:42 • (DUP) R3579009-7 10/07/20 17:43

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Nitrate-Nitrite	1.58	1.58	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3579009-2 10/07/20 17:04

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
Nitrate-Nitrite	4.00	2.59	104	90.0-110	

L1267956-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1267956-03 10/07/20 17:11 • (MS) R3579009-3 10/07/20 17:13 • (MSD) R3579009-4 10/07/20 17:14

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Nitrate-Nitrite	2.50	ND	2.25	2.34	88.0	91.6	1	90.0-110	J6		3.92	20

L1268273-03 Original Sample (OS) • Matrix Spike (MS)

(OS) L1268273-03 10/07/20 17:40 • (MS) R3579009-6 10/07/20 17:41

Analyte	Spike Amount	Original Result	MS Result	MS Rec.	Dilution	Rec. Limits	MS Qualifier
Nitrate-Nitrite	2.50	1.26	3.55	91.6	1	90.0-110	



Method Blank (MB)

(MB) R3576686-1 10/01/20 03:07

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	mg/l		mg/l	mg/l
Chloride	U		0.379	1.00
Fluoride	U		0.0640	0.150
Nitrate	U		0.0480	0.100
Nitrite	U		0.0420	0.100
Sulfate	U		0.594	5.00

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

L1267956-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1267956-01 10/01/20 09:20 • (DUP) R3576686-3 10/01/20 09:37

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	mg/l	mg/l		%		%
Chloride	11.1	11.1	1	0.420		15
Fluoride	ND	ND	1	0.000		15
Nitrate	0.402	0.397	1	1.15		15
Nitrite	ND	ND	1	0.000		15
Sulfate	62.4	62.3	1	0.155		15

6 Qc

7 Gl

8 Al

9 Sc

Laboratory Control Sample (LCS)

(LCS) R3576686-2 10/01/20 03:24

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	mg/l	mg/l	%	%	
Chloride	40.0	40.4	101	80.0-120	
Fluoride	8.00	8.09	101	80.0-120	
Nitrate	8.00	8.13	102	80.0-120	
Nitrite	8.00	8.13	102	80.0-120	
Sulfate	40.0	41.2	103	80.0-120	

L1267956-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1267956-04 10/01/20 10:27 • (MS) R3576686-4 10/01/20 10:44 • (MSD) R3576686-5 10/01/20 11:01

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%
Chloride	50.0	22.9	70.7	70.9	95.4	95.8	1	80.0-120			0.283	15
Fluoride	5.00	0.209	4.97	4.98	95.3	95.4	1	80.0-120			0.131	15
Nitrate	5.00	ND	4.82	4.94	96.4	98.7	1	80.0-120			2.33	15
Nitrite	5.00	ND	4.94	4.96	98.9	99.2	1	80.0-120			0.321	15
Sulfate	50.0	74.9	121	121	91.8	91.6	1	80.0-120	E	E	0.0527	15



Method Blank (MB)

(MB) R3578861-3 10/07/20 01:09

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000190	0.000500
Toluene	U		0.000412	0.00100
Ethylbenzene	U		0.000160	0.000500
Total Xylene	U		0.000510	0.00150
TPH (GC/FID) Low Fraction	U		0.0314	0.100
(S) a,a,a-Trifluorotoluene(FID)	106			78.0-120
(S) a,a,a-Trifluorotoluene(PID)	93.8			79.0-125

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

Laboratory Control Sample (LCS)

(LCS) R3578861-1 10/06/20 23:50

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Benzene	0.0500	0.0450	90.0	77.0-122	
Toluene	0.0500	0.0448	89.6	80.0-121	
Ethylbenzene	0.0500	0.0468	93.6	80.0-123	
Total Xylene	0.150	0.139	92.7	47.0-154	
(S) a,a,a-Trifluorotoluene(FID)			105	78.0-120	
(S) a,a,a-Trifluorotoluene(PID)			92.4	79.0-125	

7 Gl

8 Al

9 Sc

Laboratory Control Sample (LCS)

(LCS) R3578861-2 10/07/20 00:18

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) Low Fraction	5.50	5.00	90.9	72.0-127	
(S) a,a,a-Trifluorotoluene(FID)			94.5	78.0-120	
(S) a,a,a-Trifluorotoluene(PID)			99.3	79.0-125	



Method Blank (MB)

(MB) R3576721-2 10/01/20 14:26

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	mg/l		mg/l	mg/l
Ethane	U		0.00407	0.0130
Ethene	U		0.00426	0.0130

1 Cp

2 Tc

3 Ss

4 Cn

L1267905-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1267905-01 10/01/20 14:28 • (DUP) R3576721-3 10/01/20 15:18

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	mg/l	mg/l		%		%
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20

5 Sr

6 Qc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3576721-1 10/01/20 14:00 • (LCSD) R3576721-4 10/01/20 15:53

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	mg/l	mg/l	mg/l	%	%	%			%	%
Ethane	0.129	0.132	0.127	102	98.4	85.0-115			3.86	20
Ethene	0.127	0.128	0.122	101	96.1	85.0-115			4.80	20

7 Gl

8 Al

9 Sc



Method Blank (MB)

(MB) R3576728-2 10/01/20 14:26

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Methane	U		0.00291	0.0100

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3576728-1 10/01/20 14:00 • (LCSD) R3576728-3 10/01/20 15:53

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methane	0.0678	0.0696	0.0680	103	100	85.0-115			2.33	20

¹Cp

²Tc

³Ss

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc



Method Blank (MB)

(MB) R3579813-1 10/08/20 23:42

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TPH (GC/FID) High Fraction	U		0.0247	0.100
<i>(S) o-Terphenyl</i>	99.0			31.0-160

Laboratory Control Sample (LCS)

(LCS) R3579813-2 10/09/20 00:03

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) High Fraction	1.50	1.63	109	50.0-150	
<i>(S) o-Terphenyl</i>			94.0	31.0-160	

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J3	The associated batch QC was outside the established quality control range for precision.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
T8	Sample(s) received past/too close to holding time expiration.



Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
 * Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey-NELAP	TN002
California	2932	New Mexico ¹	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina ¹	DW21704
Georgia	NELAP	North Carolina ³	41
Georgia ¹	923	North Dakota	R-140
Idaho	TN00003	Ohio-VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
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Kansas	E-10277	Rhode Island	LA000356
Kentucky ^{1,6}	90010	South Carolina	84004
Kentucky ²	16	South Dakota	n/a
Louisiana	AI30792	Tennessee ^{1,4}	2006
Louisiana ¹	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

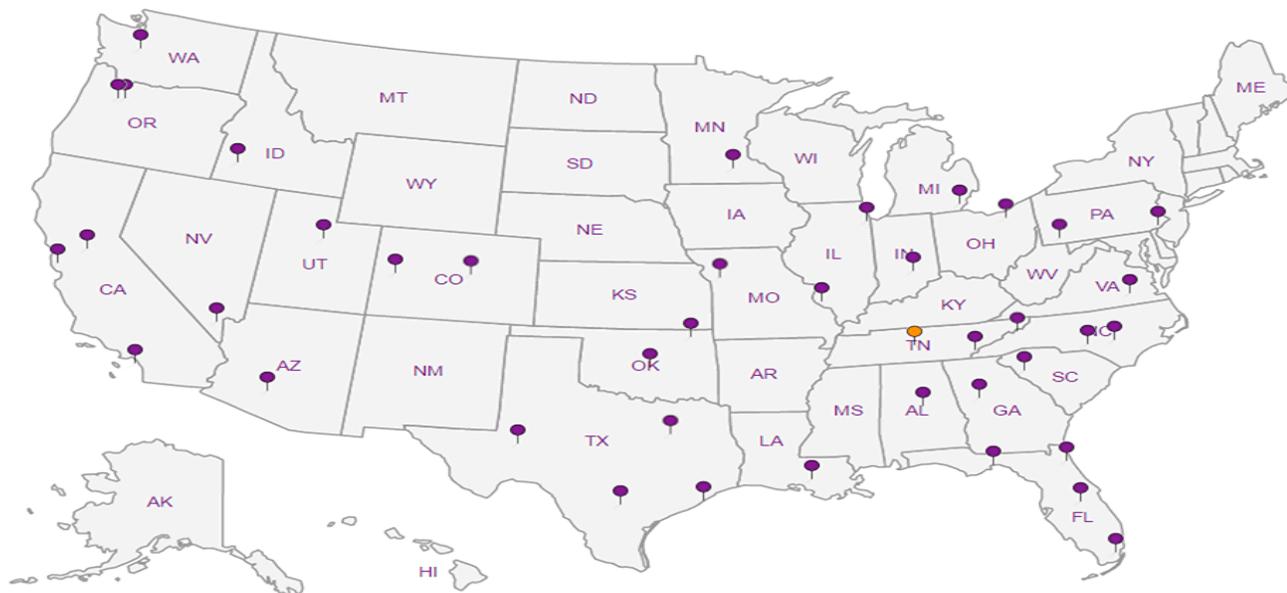
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 ⁵	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA-Crypto	TN00003		

¹ Drinking Water ² Underground Storage Tanks ³ Aquatic Toxicity ⁴ Chemical/Microbiological ⁵ Mold ⁶ Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

Nicholson GeoSolutions, LLC

3433 E. Lake Dr.
Centennial, CO 80121

Billing Information:
Don Wilbourn
Berry Petroleum Company
235 Callahan Ave
Parachute, CO 81635

Report to:
Dave Nicholson

Email To: *dknicholson@bpc.com*
dnicholson@q.com

Project Description: **Berry Garden Gulch Water** *P32*

City/State Collected:
Lab Project #
BERPETDCO-NICHOLSON

Phone: **303-601-2023**
Fax:

Client Project #
Lab Project #
BERPETDCO-NICHOLSON

Collected by (print):

Site/Facility ID #
P.O. #

Collected by (signature):
DK Nicholson

Rush? (Lab MUST Be Notified)
 Same Day Five Day
 Next Day 5 Day (Rad Only)
 Two Day 10 Day (Rad Only)
 Three Day
 Date Results Needed

Immediately Packed on Ice N Y

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	**CL,F,NO2,NO3,SO4** 125ml HDPE No PI	ALK, TDS - 250ml HDPE No Pres	BTEXGRO (2) 40ml Amber w/HCL	DROLVI (2) 40ml Amber w/HCL-BT	Diss. Sodium - 250ml HDPE No Pres	NH3, NO2NO3 - 250ml HDPE w/H2SO4	RSK175 (2) 40ml Amber w/HCI
AW-3 MW-3		GW				10	X	X	X	X	X	X	X
		GW		9/26	0900	8	X	X	X	X	X	X	X
		GW											
		GW											
		GW											
		GW											
		GW											
		GW											
		GW											

* Matrix:
 SS - Soil AIR - Air F - Filter
 GW - Groundwater B - Bioassay
 WW - WasteWater
 DW - Drinking Water
 OT - Other

Remarks:
 pH _____ Temp _____
 Flow _____ Other _____
 Samples returned via:
 UPS FedEx Courier _____
 Tracking # *9159 8781 8718*

Sample Receipt Checklist
 COC Seal Present/Intact: Y N
 COC Signed/Accurate: Y N
 Bottles arrive intact: Y N
 Correct bottles used: Y N
 Sufficient volume sent: Y N
 If Applicable
 VOA Zero Headspace: Y N
 Preservation Correct/Checked: Y N

Relinquished by: (Signature)
DK Nicholson

Date: *9/28/20*
Time: *1200*

Received by: (Signature)
Fedex

Trip Blank Received: Yes/No
HCL / MeOH
TBR

Relinquished by: (Signature)

Date: _____ Time: _____

Received by: (Signature)

Temp: *15.2:1.3°C*
Bottles Received: *8*

If preservation required by Login: Date/Time

Relinquished by: (Signature)

Date: _____ Time: _____

Received for lab by: (Signature)
Wappes

Date: *9-30-20* Time: *915*

Hold: _____ Condition: NCF /

Analysis / Container / Preservative

Chain of Custody Page 1 of 1



12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859



L# *126795*

H069

Acctnum: **BERPETDCO**

Template:

Prelogin:

TSR: **Mark Beasley**

PB:

Shipped Via:

Remarks Sample # (lab only)

-c1

RAD SCREEN: <0.5 mR/hr

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

Nicholson GeoSolutions

P-32

SGS Job Number: DA29885

Sampling Date: 10/20/20

Report to:

**Nicholson GeoSolutions
3433 East Lake Drive
Centennial, CO 80121
dknicholson@q.com**

ATTN: Dave Nicholson

Total number of pages in report: 13



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

A handwritten signature in black ink, appearing to read "Jason Savoie".

Jason Savoie
General Manager

Client Service contact: Elizabeth Sutcliffe 303-425-6021

Certifications: CO (CO00049), NE (NE-OS-06-04), ND (R-027), UT (NELAP CO00049)
LA (LA150028), TX (T104704511), WY (8TMS-L)

This report shall not be reproduced, except in its entirety, without the written approval of SGS.
Test results relate only to samples analyzed.

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1

2

3

4

5



Sample Summary

Nicholson GeoSolutions

Job No: DA29885

P-32

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
DA29885-1	10/20/20	12:00 DN	10/20/20	AQ	Ground Water	MW-3

Summary of Hits

Job Number: DA29885
Account: Nicholson GeoSolutions
Project: P-32
Collected: 10/20/20

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

DA29885-1 MW-3

Methane ^a	4.10	0.0080	0.0070	mg/l	RSK175 MOD
----------------------	------	--------	--------	------	------------

(a) Sample was not preserved to a pH < 2.

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: MW-3		Date Sampled: 10/20/20
Lab Sample ID: DA29885-1		Date Received: 10/20/20
Matrix: AQ - Ground Water		Percent Solids: n/a
Method: RSK175 MOD		
Project: P-32		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 ^a	FK1874.D	10	10/21/20 12:39	JB	n/a	n/a	GFK127
Run #2							

Run #	Initial Volume	Headspace Volume	Volume Injected	Temperature
Run #1	39.0 ml	4.0 ml	500 ul	20.1 Deg. C
Run #2				

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	4.10	0.0080	0.0070	mg/l	

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL = Method Detection Limit
 RL = Reporting Limit
 E = Indicates value exceeds calibration range

J = Indicates an estimated value
 B = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS Sample Receipt Summary

Job Number: DA29885

Client: NICHOLSON GEOSOLUTIONS

Project: P-32

Date / Time Received: 10/20/2020 4:40:00 PM

Delivery Method:

Airbill #'s: HD

Cooler Temps (Initial/Adjusted): #1: (5/5):

Cooler Security

- | | Y or N | | | Y or N | |
|---------------------------|-------------------------------------|--------------------------|-----------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. COC Present: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Custody Seals Intact: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. Smpl Dates/Time OK | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Cooler Temperature

- | | Y or N | |
|------------------------------|-------------------------------------|--------------------------|
| 1. Temp criteria achieved: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Cooler temp verification: | IR Gun; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

Quality Control Preservation

- | | Y or N | | N/A |
|---------------------------------|-------------------------------------|-------------------------------------|--------------------------|
| 1. Trip Blank present / cooler: | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Trip Blank listed on COC: | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3. Samples preserved properly: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 4. VOCs headspace free: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Comments

Sample Integrity - Documentation

- | | Y or N | |
|--|-------------------------------------|--------------------------|
| 1. Sample labels present on bottles: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Container labeling complete: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3. Sample container label / COC agree: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Sample Integrity - Condition

- | | Y or N | |
|----------------------------------|-------------------------------------|--------------------------|
| 1. Sample recvd within HT: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. All containers accounted for: | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3. Condition of sample: | Intact | |

Sample Integrity - Instructions

- | | Y or N | | N/A |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Analysis requested is clear: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 2. Bottles received for unspecified tests | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 3. Sufficient volume recvd for analysis: | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 4. Compositing instructions clear: | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 5. Filtering instructions clear: | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

4.1
4

DA29885: Chain of Custody

Page 2 of 2

GC Volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: DA29885
Account: NIGECOC Nicholson GeoSolutions
Project: P-32

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFK127-MB	FK1869.D	1	10/21/20	JB	n/a	n/a	GFK127

The QC reported here applies to the following samples:

Method: RSK175 MOD

DA29885-1

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00070	mg/l	

5.1.1
5

Blank Spike Summary

Job Number: DA29885
Account: NIGECOC Nicholson GeoSolutions
Project: P-32

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFK127-BS	FK1868.D	10	10/21/20	JB	n/a	n/a	GFK127

The QC reported here applies to the following samples:

Method: RSK175 MOD

DA29885-1

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	Limits
74-82-8	Methane	0.512	0.585	114	70-130

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: DA29885
Account: NIGECOC Nicholson GeoSolutions
Project: P-32

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
DA19448-10MS	FK1871.D	10	10/21/20	JB	n/a	n/a	GFK127
DA19448-10MSD	FK1872.D	10	10/21/20	JB	n/a	n/a	GFK127
DA19448-10	FK1870.D	1	10/21/20	JB	n/a	n/a	GFK127

The QC reported here applies to the following samples:

Method: RSK175 MOD

DA29885-1

CAS No.	Compound	DA19448-10 Spike		MS	MS	Spike	MSD	MSD	RPD	Limits
		mg/l	Q mg/l	mg/l	%	mg/l	mg/l	%		Rec/RPD
74-82-8	Methane	ND	0.512	0.585	114	0.512	0.580	113	1	15-200/30

* = Outside of Control Limits.

5.3.1
5

APPENDIX B
Methane Stable Isotope Report



dig
Dolan Integration Group

Geochemistry for Energy

11025 Dover Street Unit 800
Westminster, CO 80021
p: 303.531.2030

**Hydrocarbon Gas Composition and Stable Isotopes
Data and Interpretation**

Job #: 20104723
Lab #: DIG-023938
Client: SGS Accutest
Sample Name(s): MW-3

The analytical results, opinions, or interpretations contained in this report are based upon information and material supplied by the client for whose exclusive and confidential use this report has been made. The analytical results, opinions, or interpretations expressed represent the best judgment of Dolan Integration Group based on its experience, but any interpretation of test or other data, and any recommendation(s) based upon such interpretations, are opinions based upon inferences from measurements and empirical relationships and assumptions which are not infallible, and with respect to which professional engineers and analysts may differ. Accordingly, Dolan Integration Group makes no warranty or representation, expressed or implied, of any type, and expressly disclaims same as to the productivity, proper operations, or profitableness of any oil, gas, coal, or other mineral, property, well, or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, in whole or in part, without the written approval of Dolan Integration Group.

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Analytical Report



Job #: 20104723
 Lab #: DIG-023938
 Client: SGS Accutest
 Sample Name: MW-3
 Date Sampled: 10/20/20
 Time Sampled: 12:00
 Sample Description: Isoflask
 Sampling Notes:
 Date Received: 10/27/20
 Date Analyzed: Gas Composition: 10/31/20 δ13C: 11/10/20 δD: 11/11/20
 Date Reported: 11/16/20
 Comments:

Measured Values:	Measured ppm	Analyte mol % ^a	HC mol %	δ ¹³ C ‰ VPDB	δD ‰ VSMOW	Comments
Nitrogen (N ₂)	417598	62.24	-	-	-	
Oxygen + Argon (O ₂ +Ar)	57955	8.64	-	-	-	
Carbon Dioxide (CO ₂)	48159	7.18	-	-	-	
Helium (He) ^b	na	na	-	-	-	Helium added to create headspace.
Hydrogen (H ₂)	nd	nd	-	-	-	
Methane (CH ₄)	146978	21.91	99.82	-32.3	-384	
Ethane (C ₂ H ₆)	53	0.01	0.04	-	-	
Ethene (C ₂ H ₄)	nd	nd	nd	-	-	
Propane (C ₃ H ₈)	206	0.03	0.14	-	-	
iso-Butane (C ₄ H ₁₀)	nd	nd	nd	-	-	
n-Butane (C ₄ H ₁₀)	nd	nd	nd	-	-	
iso-Pentane (C ₅ H ₁₂)	nd	nd	nd	-	-	
n-Pentane (C ₅ H ₁₂)	nd	nd	nd	-	-	
Hexanes + (C ₆ H ₁₄)	nd	nd	nd	-	-	

Calculated Values:	
Total HCs (ppm)	147237
Gas Wetness (mol % C ₂ +C ₁ +))	0.18
C ₁ /(C ₂ +C ₃) (mol/mol)	568

^a Analyte concentrations normalized to 100% (Mol. % is approximately equal to Vol. %)

^b Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

HC= Hydrocarbons

nd = not detected

na = not analyzed

Stable isotope results based on multi-point laboratory calibration

Error δ¹³C < 0.5 ‰

Error δD < 5.0 ‰

Stable Isotope Interpretive Plots

