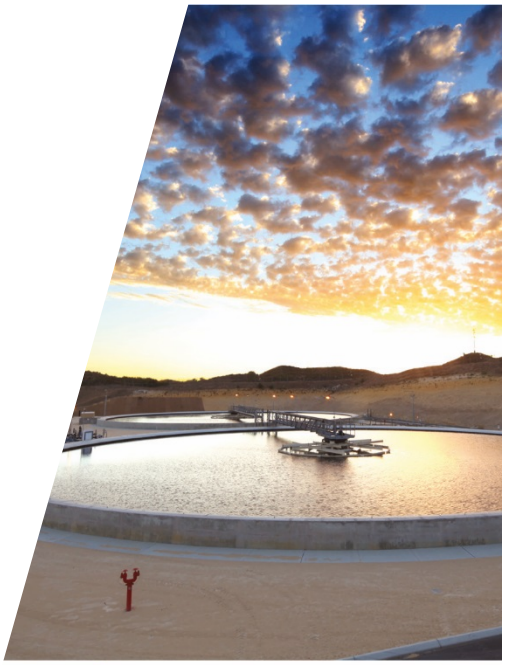
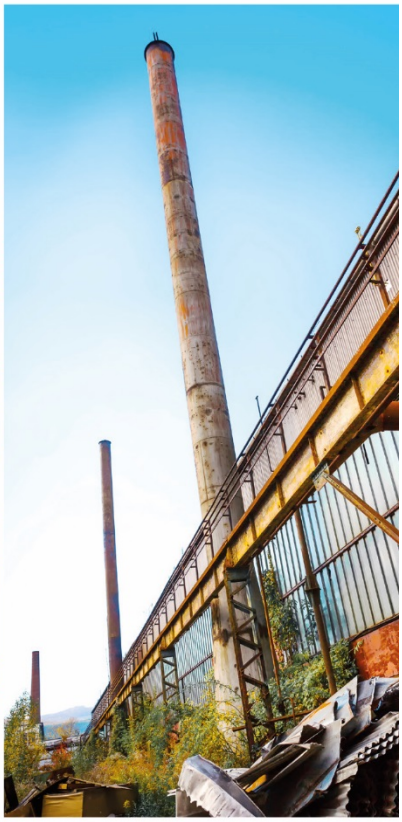


2019 Annual Groundwater Monitoring and Site Assessment Report

Mangum No. 1
S27, T29N, R11W
San Juan County, New Mexico
API# 30 045 07835
NMOCD# 3R 1038

Hilcorp Energy Company



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1. Introduction

This report, compiled by GHD Services Inc. (GHD), presents the results of the 2019 groundwater monitoring events for the Mangum No. 1 site (hereafter referred to as the "Site"). Monitoring activities and data collection were performed by Hilcorp Energy Company (Hilcorp). The Site is located on federal land in Section 27, Township 29N, Range 11W of San Juan County, New Mexico. Geographical coordinates for the Site are 36.6965° North, 107.9840°West. The Site consists of a natural gas well and associated equipment. The Site Location Map and Site Plan are presented as Figures 1 and 2, respectively.

2. Site History

Site remediation was performed in February 2016 to address soil impacts from an historical release of produced water and condensate. An excavation with dimensions of approximately 100 feet (ft) by 40 ft, from 9 ft to 17 ft deep was completed. Approximately 1,400 cubic yards (cy) of impacted soils were hauled away for off Site disposal at the Industrial Ecosystems, Inc. (IEI) landfarm in Aztec, New Mexico. Groundwater was encountered in the excavation at 16 ft below ground surface (bgs). Approximately 1 foot of groundwater saturated soil was removed from beneath the water table. The groundwater accumulation at the bottom of the excavation was evacuated using a vacuum truck. Groundwater was allowed to recharge overnight and was evacuated for three consecutive days. Approximately 275 barrels (bbls) of groundwater were removed and transported for off Site disposal at IEI.

Subsequent to the vacuum truck removal from the excavation, a sample of the groundwater was obtained for laboratory analyses. The groundwater sample was analyzed for volatile organic hydrocarbons, dissolved metals including arsenic, barium, cadmium, calcium, chromium, iron, manganese, magnesium, sodium, and zinc, and for general chemistry analytes including chloride, potassium, nitrate, sulfate, fluoride, total alkalinity, bicarbonate, total hardness, pH, and specific conductivity. The groundwater sample indicated analytical results exceeding the applicable New Mexico Water Quality Control Commission (NMWQCC) groundwater quality standards for benzene, xylenes, dissolved manganese, and sulfate. The excavation was backfilled with segregated field screened soils (i.e., below 100 parts per million (ppm) on photo ionization detector) and clean, imported fill. A report summarizing the soil excavation and subsequent groundwater recovery and sampling activities was submitted April 7, 2016.

In May 2016, four groundwater monitoring wells (MW) were installed at the Site to assess the extent of impacts to groundwater. Following the installation and development of the new wells, groundwater samples have been collected on a quarterly basis, beginning June 2016.

3. Regulatory Framework

The Site has been assigned an Abatement Plan number 3RP-468 by the New Mexico Oil Conservation Division (NMOCD) Environmental Bureau. The NMOCD guidelines require groundwater to be analyzed for potential contaminants as defined by the NMWQCC Standards

20.6.2.3103 Section A. The NMWQCC Standard 20.6.2.3103, Section A, provides the Human Health Standards for Groundwater. The constituents of concern (COCs) in affected groundwater at the Site currently are benzene, toluene, ethylbenzene and xylenes (BTEX), sulfate, dissolved iron and manganese and total dissolved solids (TDS). The regulation also states that non-aqueous phase liquids (NAPL) shall not be present floating atop or immersed within groundwater, as can be reasonably measured. In this report, groundwater analytical results for the COCs are compared to the NMWQCC standards as shown in the following table:

Analyte	NMWQCC Standard for Groundwater
Benzene	0.01 mg/L
Toluene	0.75 mg/L
Ethylbenzene	0.75 mg/L
Total Xylenes	0.62 mg/L
Sulfate	600 mg/L
Iron	1.0 mg/L
Manganese	0.2 mg/L
TDS	1000 mg/L
Benzene	0.01 mg/L

4. Groundwater Plume Delineation

4.1 Soil Borings

GHD and subcontractor EnviroDrill, Inc. mobilized to the Site in late May-early June 2019 to install upgradient and downgradient monitoring wells to further delineate groundwater impacts. EnviroDrill, Inc. was selected for its purported ODEX equipment capability, desired for drilling through the large gravels and cobbles encountered during installation of the original set of Site monitor wells in 2016. Permitting of groundwater monitoring wells was obtained through the New Mexico Office of the State Engineer (NMOSE) (Appendix A) and access to drilling locations was granted by the Bureau of Land Management as secured by Hilcorp.

Prior to initiation of drilling activities, subsurface utilities were located through the NM811 line locating service. Seven individual active and/or inactive buried gas and/or water lines were located north of the Site pad, trending northwest-southeast and beneath the concrete channel (Figure 2). MW-7 was placed between two of these lines. IEI was also mobilized to the Site to pre-drill the four proposed monitor well locations. Holes were hydroexcavated to a depth of 5 ft bgs and to an approximate 12 to 14-inch diameter. Cuttings and water were collected in the hydrovac truck and disposed of at the IEI landfarm near Aztec, New Mexico.

The borings generally encountered unconsolidated, dry sand and gravel in the upper portion of the explorations from the surface to depths of from 10 to 20 ft bgs, underlain by discontinuous layers of clayey sand and/or clay. The lithologic inconsistency between borings of relatively close horizontal distance is indicative of disturbed soils (non-native) likely from construction of the irrigation channel and/or the under-boring of the channel for pipeline installations. Borehole soils were sampled at 5 ft intervals with a split-spoon sampler and field screened with a photo-ionization detector (PID). Some of the clayey material encountered in the MW-5 and MW-7 borings were visibly stained and

exhibited petroleum odors. PID readings of the stained soils ranged 817.3 to 435.8 parts per million (ppm) in MW-5 at 15 ft and 20 ft bgs, respectively, and 225 ppm in MW-7 at 25 ft bgs. The soils encountered in MW-6 did not exhibit hydrocarbon impacts and PID readings were 2.4 ppm or below. Three soil samples (MW-5 at 17 ft, MW-5 at 21 ft, and MW-7 at 26 ft) were collected in glass laboratory-provided glass containers and submitted to Hall laboratory in Albuquerque. The samples were analyzed for BTEX by EPA method 8260 and for full range total petroleum hydrocarbons (TPH) by EPA Method 8015. Results are below:

Monitor Well Soil Boring Sample Results (mg/kg)							
Well	Date	Benzene	BTEX	GRO	DRO	MRO	TPH
MW-5-17'	5/29/2019	<0.12	<1.12	65	34	<50	99
MW-5-21'	5/29/2019	<0.12	<1.12	<25	<10	<50	<85
MW-7-26'	5/30/2019	<0.12	<1.12	56	18	<49	74

Note:
BTEX-benzene, toluene, ethylbenzene, xylenes
GRO-gasoline-range organics
DRO-diesel-range organics
MRO-motor oil-range organics
TPH-total petroleum hydrocarbons
mg/kg-milligrams per kilogram

The soil boring for MW-8, located south of the Site, and intended as a hydrogeologically up-gradient location, encountered refusal to auger drilling at a depth of 26 ft bgs. EnviroDrill, Inc. retooled their drilling equipment to ODEX but were incapable of any further progress at this location. The borehole was offset approximately 5 horizontal ft but, again, failed to advance the boring. The borehole was abandoned and no monitor well was set at this location. Lithologic logs of borings and monitoring well completion diagrams are presented in Appendix B and soils laboratory results are included as Appendix C.

4.2 Monitor Well Installation

Installation of monitoring wells began with the drilling of MW-5, immediately adjacent to the concrete channel (Figure 2). The MW-5 boring was drilled to a depth that, assuming some degree of homogeneity with respect to lithology and the occurrence of groundwater at relatively small (aerially) sites such as the Mangum #1, should have intercepted groundwater, based on depths in existing Site wells. The MW-5 boring was drilled to a depth of 40 ft bgs, well past the anticipated depth to groundwater with no groundwater coming into the boring. The borehole was left open overnight and groundwater did finally show at a depth of approximately 23 ft bgs. The borehole was subsequently backfilled to 32 ft bgs and well casing set. This general procedure was used for the installation of MW-6 and MW-7. These wells were drilled to a depth of 30 ft bgs and left overnight to let groundwater seep into borehole and then casings set. Wells were completed with 2-inch diameter Schedule 40 PVC casing using a 20 ft section of 0.01-inch screen. Screened sections were sand packed with a 10/20 gradation silica sand to 2 ft above the top of screen. A 2 ft seal was then placed above the sand pack using hydrated 3/8-inch bentonite chips followed by a portland cement grout to the surface. Surface completions consisted of a 3 ft metal "stick up' embedded in concrete.

The new monitor wells were developed by Hilcorp by bailing and then sampled during the next quarterly groundwater monitoring event. Well development and sampling were delayed due to access issues with the Bureau of Reclamation and the Hammond Ditch entities.

5. Groundwater Monitoring

5.1 Groundwater Monitoring Methodology

Quarterly groundwater monitoring was conducted at the Site March 11-12, May 22, August 22-23 and December 2, 2019 by Hilcorp. Depth to groundwater was gauged in Site monitoring wells using an oil/water interface probe prior to sampling. A summary of historical depths to water and groundwater elevations can be found in Table 1. Groundwater potentiometric surface maps detailing groundwater elevations and groundwater flow direction using data collected during the reporting period are presented as Figures 3, 4, 5 and 6. Groundwater flow direction at the site varies seasonally from north northeast to west northwest. Groundwater levels in newly installed MW-5, MW-6, and MW-7 could not be correlated with existing Site wells.

It is evident from the large disparity between water levels in the new wells as compared to existing wells-differences in ground surface elevations notwithstanding-that the new wells, placed next to the concrete channel are completed in a separate, perched aquifer. This scenario is supported not only by the significant disparity in elevations between existing wells and new wells, but also by the anomalous water elevations even between the three new wells that are next to each other.

Prior to sample collection, MW-1 through MW-4 (all four quarters), MW-5, MW-6, and MW-7 (third and fourth quarters) were purged of up to three casing volumes of water using a dedicated polyethylene bailer prior to sampling. Groundwater quality parameters including pH, temperature, oxidation reduction potential, total dissolved solids, and conductivity were collected and are included in Table 2. Field parameters were not collected during the December 2019 monitoring event.

Groundwater samples were placed in laboratory prepared bottles, packed on ice and shipped under chain of custody documentation to Pace Analytical Laboratories. Groundwater samples were analyzed for BTEX by EPA Method 8260, for dissolved manganese and iron by EPA Method 6010B, for sulfate by EPA Method 300.0 and for TDS by SM 2540.

5.2 Analytical Results

Concentrations of benzene and xylenes were above the NMWQCC standard in groundwater from MW-2, MW-3, and MW-4 for all four quarterly events in 2019. Benzene was above the standard for both sampling events in 2019 for MW-6 while xylenes were above the standard during the third quarter. Dissolved manganese concentrations were above the regulatory limit across all wells and dates in 2019. Sulfates concentrations were above the regulatory limit in MW-4, MW-5, and MW-7 for all sampled events and in August 2019 at MW-1. Iron concentrations were above their standard in the March and May 2019 samples collected from MW-2. TDS concentrations were above the standard for this compound in all wells for all sampled quarters in 2019.

A summary of historical laboratory analytical results is presented as Table 3. Groundwater laboratory analytical reports are included as Appendix D.

6. Conclusions and Recommendations

Based on analytical results from the groundwater samples collected from Site monitor wells to date, the following observations and recommendations are made:

- Three new monitor wells, MW-5, MW-6, and MW-7, were installed at the Site in May and June 2019, in the down gradient direction of existing monitor wells, along the irrigation channel and partially within a multiple natural gas and water pipeline right of way. Completed monitor wells exhibit anomalous water levels as compared with each other and when compared with existing wells located on the Site well pad and are not believed to be hydraulically connected;
- That one of the three new wells, MW-6, exhibits hydrocarbon impacts, while only trace concentrations of xylenes were detected in adjacent MW-7 and MW-5 is non-detect is further indication that these wells are completed in disturbed soils representing a heterogeneous mixture of dumped sands and clays resulting from the construction of the adjacent irrigation channel and pipeline under-burrowing and are not homogenous with the perched aquifer materials in which the existing Site wells are completed;
- Further, the (perched) groundwater elevation at the bottom of MW-5, MW-6, and MW-7 are at an elevation *higher* than the surface of Sullivan Road (San Juan County Rd. 4990), 200 ft north and in the up-gradient direction of existing Site wells, meaning groundwater should be seeping from the side of the steep hill between the Site and Sullivan Road. That the hillside is dry with no sign of seeping groundwater is evidence of the limited, perched nature of these groundwater features in which the existing wells and new wells are completed and that there is no migration of groundwaters off the pad on which the Site lies;
- Though the irrigation channel is lined with concrete, it has not always been so and water features such as this can be “leaky” via joints and cracks and this is a likely contribution to the perched water found in the monitor wells next to the channel;
- The evidence for two separate, perched and apparently limited and discontinuous aquifer systems, that of the existing monitor wells and that of the newly installed wells, presents few if any options or reason for further attempts at down-gradient plume delineation.
- Concentrations of BTEX constituents, dissolved manganese and iron, sulfates and TDS occur in Site groundwater at levels above NMWQCC standards in Site wells. It is indeed plausible and in fact more likely, based on the hydrogeologic disconnect between existing monitor wells and the newly installed wells along the channel, that groundwater impacts detected in MW-6 are a result of releases from the adjacent old natural gas pipelines that were bored under the irrigation channel;

GHD/Hilcorp make the following recommendations for 2020 remediation and groundwater monitoring activities:

- Several remedial technologies, including dual phase extraction and air sparging, are being considered for active remediation at the Site. A workplan describing the planned remedial activities will be presented to NMOCD for approval prior to implementation;
- Complete an up-gradient well at the previously attempted MW-8 location;

- Continue quarterly groundwater monitoring through 2020.

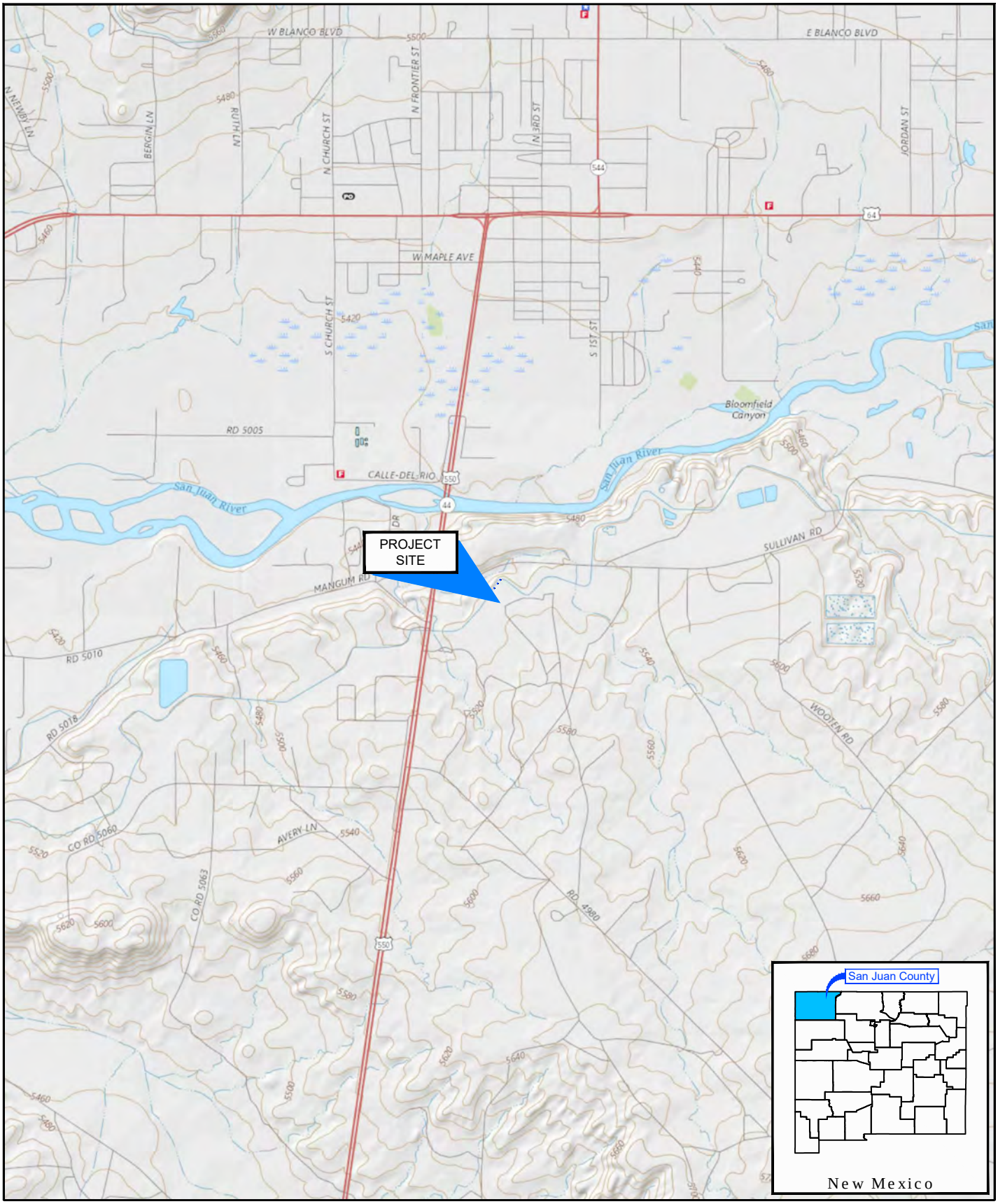
Respectfully Submitted,

GHD

Jeff Walker
Senior Project Manager

Rebecca Haskell
Senior Project Manager

Figures



Source: USGS 7.5 Minute Quad "Bloomfield and Horn Canyon, New Mexico"

Lat/Long: 36.6955° North, 107.9840° West

0 1000 2000ft

Coordinate System:
NAD 1983 StatePlane-
New Mexico West (US Feet)

HILCORP ENERGY COMPANY
SAN JUAN COUNTY, NEW MEXICO
MANGUM No. 1

11207747-00

Mar 12, 2020

SITE LOCATION MAP

FIGURE 1

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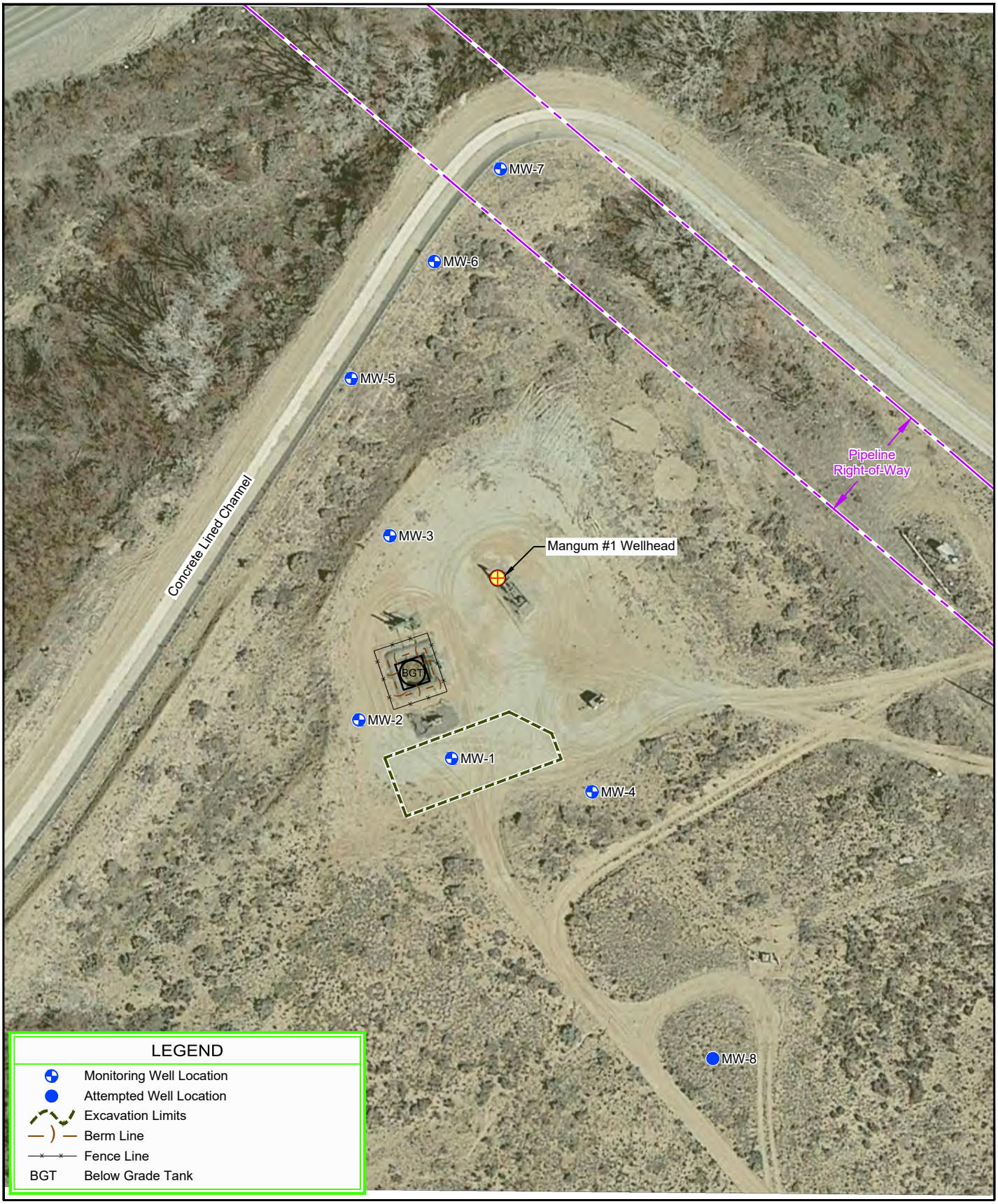

Source: Image © 2018 Google - Imagery Date: April 6, 2019

Lat/Long: 36.6955° North, 107.9840° West

0 20 60ft

Coordinate System:
NAD 1983 StatePlane-
New Mexico West (US Feet)

HILCORP ENERGY COMPANY
SAN JUAN COUNTY, NEW MEXICO
MANGUM No. 1

MONITORING WELL LOCATION MAP

11207747-00

Mar 20, 2020

FIGURE 2

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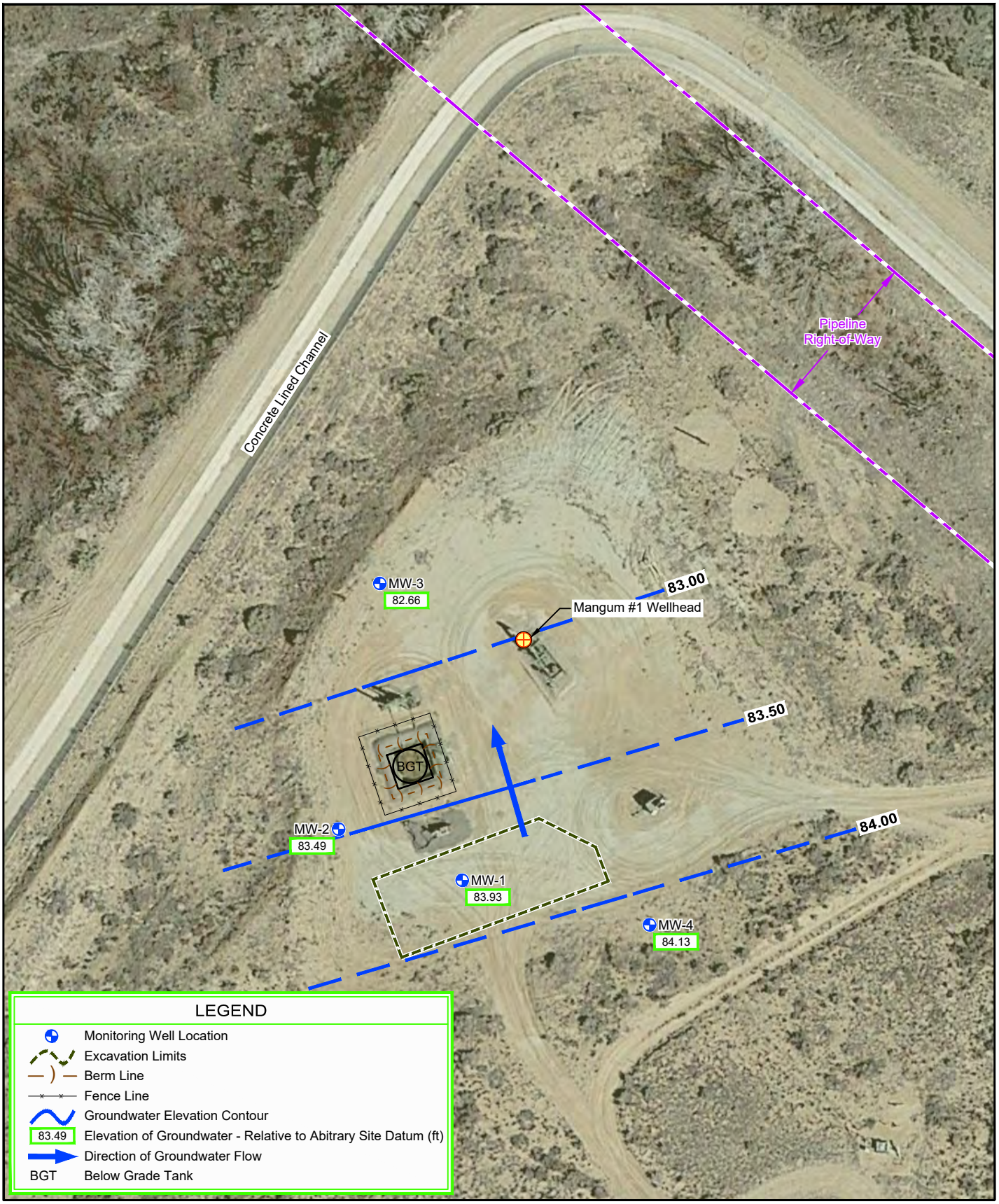

Source: Image © 2018 Google - Imagery Date: April 6, 2019

Lat/Long: 36.6955° North, 107.9840° West

0 20 60ft

Coordinate System:
NAD 1983 StatePlane-
New Mexico West (US Feet)

HILCORP ENERGY COMPANY
SAN JUAN COUNTY, NEW MEXICO
MANGUM No. 1

MARCH 2019 GROUNDWATER ELEVATION CONTOUR MAP

11207747-00

Mar 18, 2020

FIGURE 3

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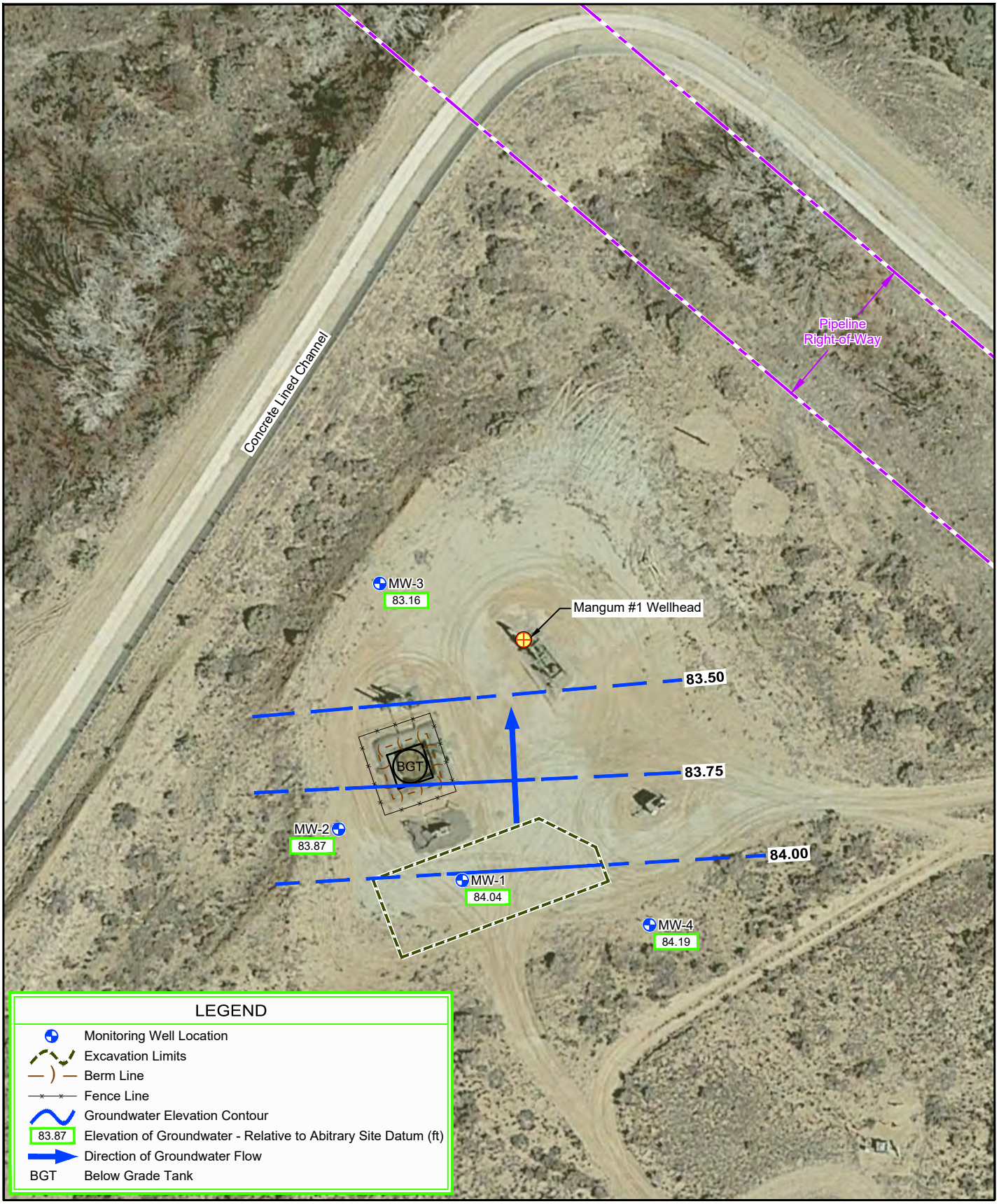

Source: Image © 2018 Google - Imagery Date: April 6, 2019

Lat/Long: 36.6955° North, 107.9840° West

0 20 60ft

Coordinate System:
NAD 1983 StatePlane-
New Mexico West (US Feet)

GHD

HILCORP ENERGY COMPANY
SAN JUAN COUNTY, NEW MEXICO
MANGUM No. 1

MAY 2019 GROUNDWATER ELEVATION CONTOUR MAP

11207747-00

Mar 18, 2020

FIGURE 4

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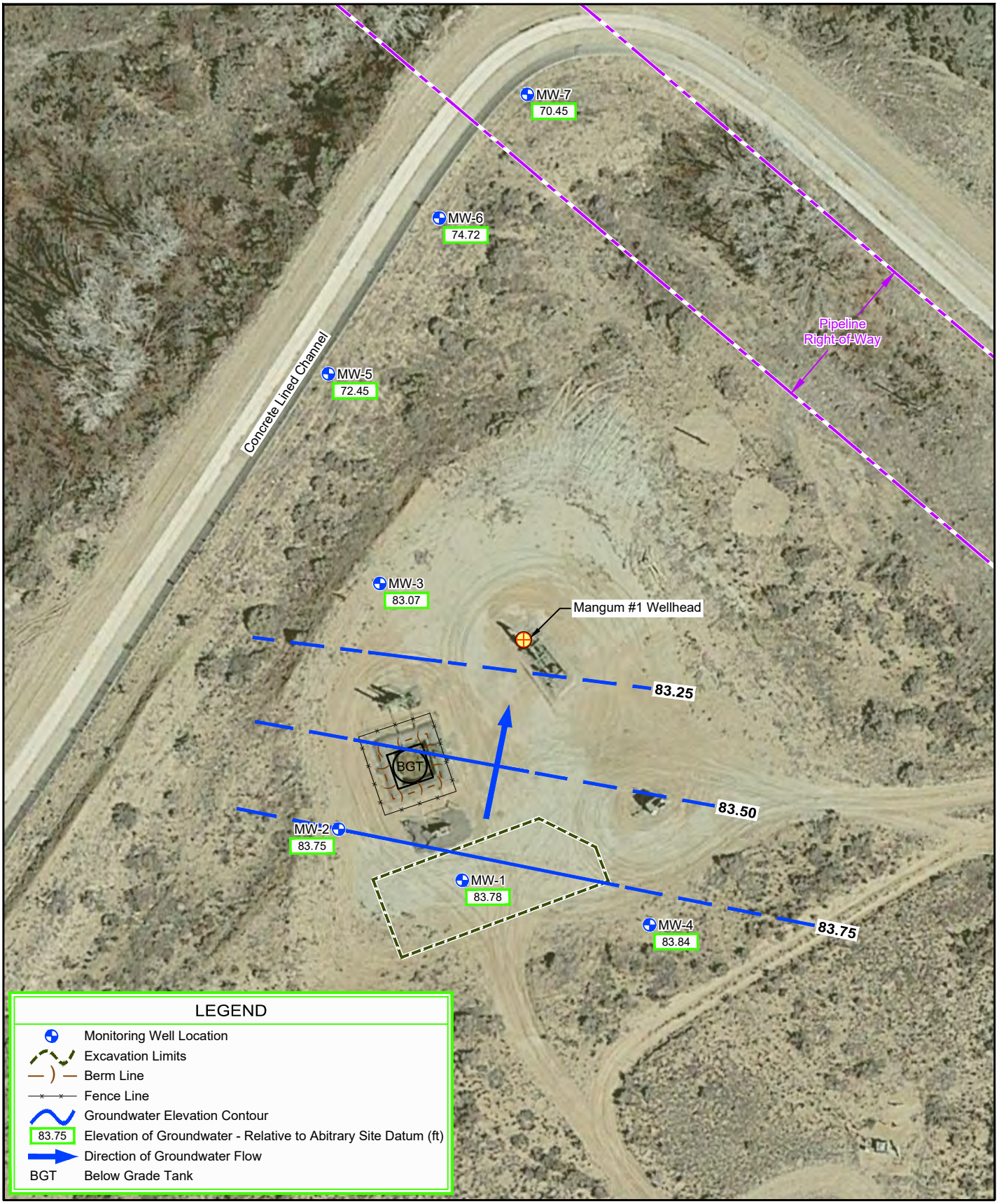

Source: Image © 2018 Google - Imagery Date: April 6, 2019

Lat/Long: 36.6955° North, 107.9840° West

0 20 60ft

Coordinate System:
NAD 1983 StatePlane-
New Mexico West (US Feet)

HILCORP ENERGY COMPANY
SAN JUAN COUNTY, NEW MEXICO
MANGUM No. 1

AUGUST 2019 GROUNDWATER ELEVATION CONTOUR MAP

11207747-00

Mar 18, 2020

FIGURE 5

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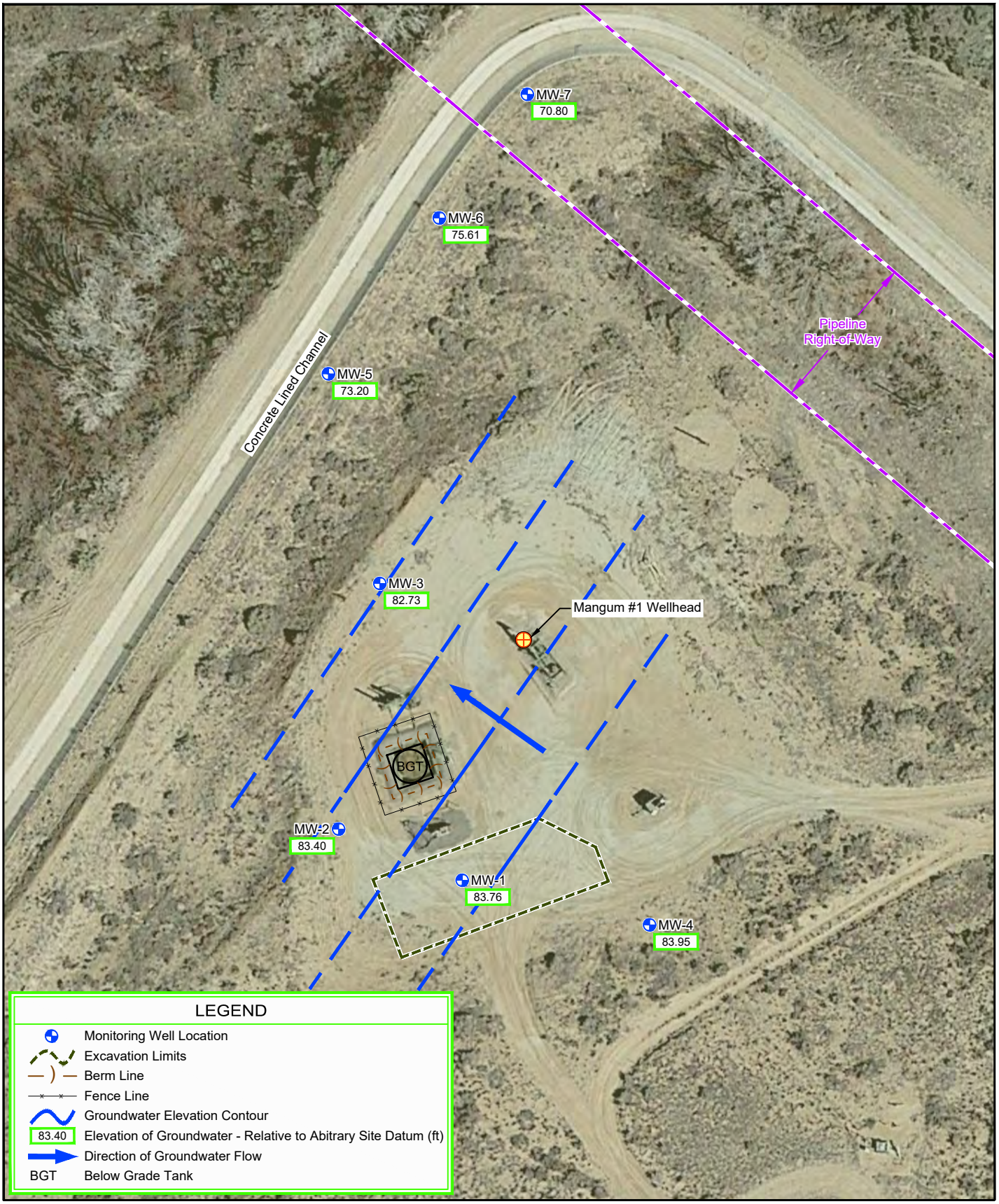


Source: Image © 2018 Google - Imagery Date: April 6, 2019

Lat/Long: 36.6955° North, 107.9840° West

0 20 60ft

Coordinate System:
NAD 1983 StatePlane-
New Mexico West (US Feet)

HILCORP ENERGY COMPANY
SAN JUAN COUNTY, NEW MEXICO
MANGUM No. 1

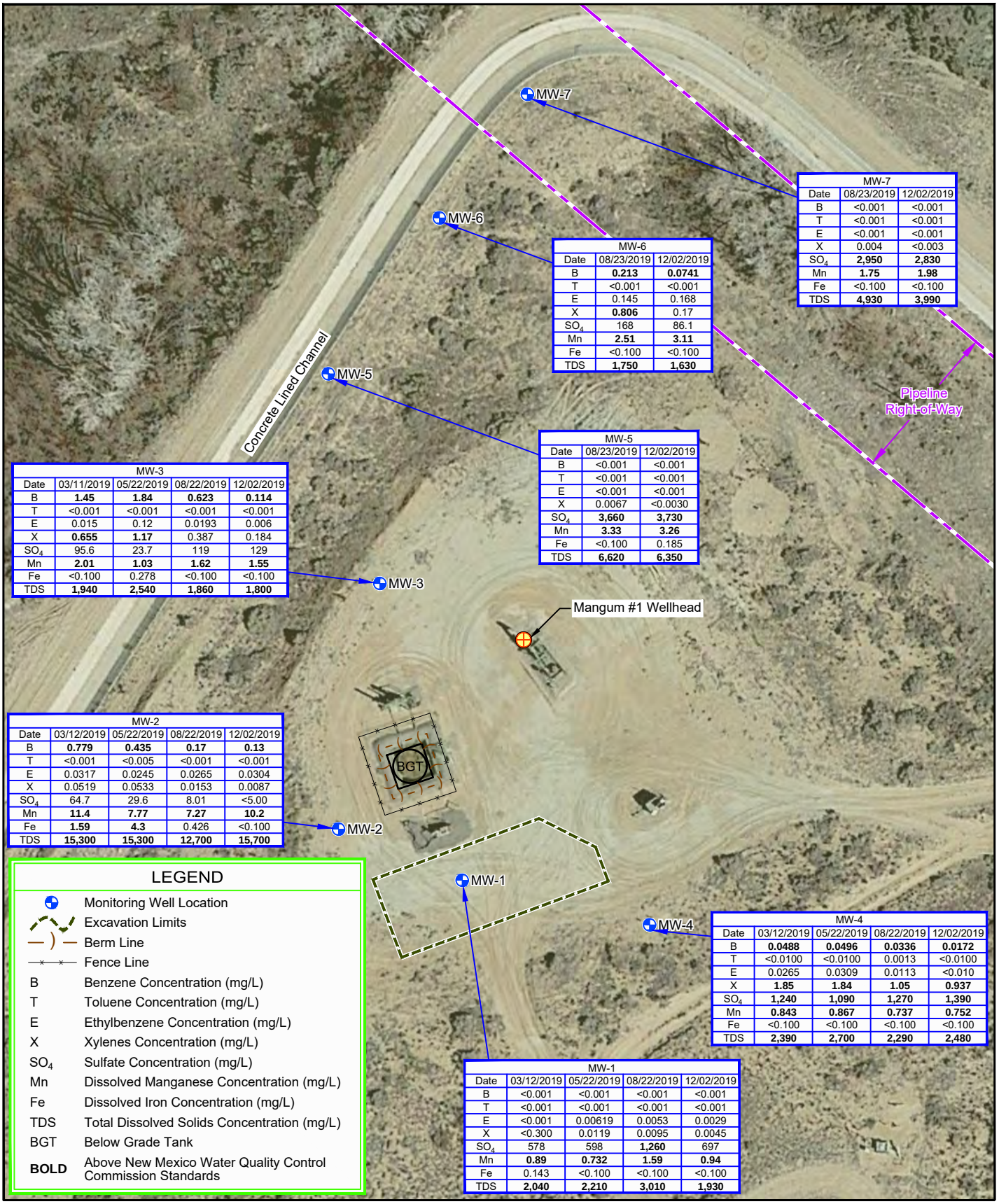
11207747-00

Mar 23, 2020

DECEMBER 2019 GROUNDWATER ELEVATION CONTOUR MAP

FIGURE 6

CAD File: I:\CAD\Files\Eight Digit Job Numbers\112-----\11207747-Mangum #1\11207747-00\11207747-00(001)\11207747-00(001)GN-DL001.dwg



MW-7		
Date	08/23/2019	12/02/2019
B	<0.001	<0.001
T	<0.001	<0.001
E	<0.001	<0.001
X	0.004	<0.003
SO_4	**2,950**	**2,830**
Mn	**1.75**	**1.98**
Fe	<0.100	<0.100
TDS	**4,930**	**3,990**

MW-6		
Date	08/23/2019	12/02/2019
B	**0.213**	**0.0741**
T	<0.001	<0.001
E	0.145	0.168
X	**0.806**	0.17
SO_4	168	86.1
Mn	**2.51**	**3.11**
Fe	<0.100	<0.100
TDS	**1,750**	**1,630**

MW-5		
Date	08/23/2019	12/02/2019
B	<0.001	<0.001
T	<0.001	<0.001
E	<0.001	<0.001
X	0.0067	<0.0030
SO_4	**3,660**	**3,730**
Mn	**3.33**	**3.26**
Fe	<0.100	0.185
TDS	**6,620**	**6,350**

MW-3				
Date	03/11/2019	05/22/2019	08/22/2019	12/02/2019
B	**1.45**	**1.84**	**0.623**	**0.114**
T	<0.001	<0.001	<0.001	<0.001
E	0.015	0.12	0.0193	0.006
X	**0.655**	**1.17**	0.387	0.184
SO_4	95.6	23.7	119	129
Mn	**2.01**	**1.03**	**1.62**	**1.55**
Fe	<0.100	0.278	<0.100	<0.100
TDS	**1,940**	**2,540**	**1,860**	**1,800**

MW-2				
Date	03/12/2019	05/22/2019	08/22/2019	12/02/2019
B	**0.779**	**0.435**	**0.17**	**0.13**
T	<0.001	<0.005	<0.001	<0.001
E	0.0317	0.0245	0.0265	0.0304
X	0.0519	0.0533	0.0153	0.0087
SO_4	64.7	29.6	8.01	<5.00
Mn	**11.4**	**7.77**	**7.27**	**10.2**
Fe	**1.59**	**4.3**	0.426	<0.100
TDS	**15,300**	**15,300**	**12,700**	**15,700**

MW-4				
Date	03/12/2019	05/22/2019	08/22/2019	12/02/2019
B	**0.0488**	**0.0496**	**0.0336**	**0.0172**
T	<0.0100	<0.0100	0.0013	<0.0100
E	0.0265	0.0309	0.0113	<0.010
X	**1.85**	**1.84**	**1.05**	**0.937**
SO_4	**1,240**	**1,090**	**1,270**	**1,390**
Mn	**0.843**	**0.867**	**0.737**	**0.752**
Fe	<0.100	<0.100	<0.100	<0.100
TDS	**2,390**	**2,700**	**2,290**	**2,480**

MW-1				
Date	03/12/2019	05/22/2019	08/22/2019	12/02/2019
B	<0.001	<0.001	<0.001	<0.001
T	<0.001	<0.001	<0.001	<0.001
E	<0.001	0.00619	0.0053	0.0029
X	<0.300	0.0119	0.0095	0.0045
SO_4	578	598	**1,260**	697
Mn	**0.89**	**0.732**	**1.59**	**0.94**
Fe	0.143	<0.100	<0.100	<0.100
TDS	**2,040**	**2,210**	**3,010**	**1,930**

LEGEND

	Monitoring Well Location
	Excavation Limits
	Berm Line
	Fence Line
B	Benzene Concentration (mg/L)
T	Toluene Concentration (mg/L)
E	Ethylbenzene Concentration (mg/L)
X	Xylenes Concentration (mg/L)
SO_4	Sulfate Concentration (mg/L)
Mn	Dissolved Manganese Concentration (mg/L)
Fe	Dissolved Iron Concentration (mg/L)
TDS	Total Dissolved Solids Concentration (mg/L)
BGT	Below Grade Tank
BOLD	Above New Mexico Water Quality Control Commission Standards

Source: Image © 2018 Google - Imagery Date: April 6, 2019

Lat/Long: 36.6955° North, 107.9840° West

0 20 60ft

Coordinate System:
NAD 1983 StatePlane-
New Mexico West (US Feet)

HILCORP ENERGY COMPANY
SAN JUAN COUNTY, NEW MEXICO
MANGUM No. 1

2019 CONTAMINANT CONCENTRATION MAP

11207747-00

Mar 23, 2020

FIGURE 7

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Tables

Table 1
Groundwater Elevations
Hilcorp Energy Company
Mangum No.1
San Juan County, New Mexico

Well ID	Top of Casing (feet)	Date of Measurement	Depth to Water (feet)	Groundwater Elevation (feet)
MW-1	98.97	6/8/2016	15.12	83.85
		9/12/2016	14.75	84.22
		11/29/2016	15.06	83.91
		3/6/2017	14.91	84.06
		6/12/2017	14.96	84.01
		10/26/2017	15.00	83.97
		12/4/2017	15.08	83.89
		3/13/2018	15.22	83.75
		6/25/2018	15.23	83.74
		9/4/2018	15.39	83.58
		12/10/2018	15.12	83.85
		3/12/2019	15.04	83.93
		5/22/2019	14.93	84.04
		8/22/2019	15.19	83.78
		12/2/2019	15.21	83.76
MW-2	101.05	6/8/2016	17.49	83.56
		9/12/2016	17.28	84.07
		11/29/2016	17.62	83.43
		3/6/2017	17.49	83.56
		6/12/2017	17.40	83.65
		10/26/2017	17.49	83.56
		12/4/2017	17.57	83.48
		3/13/2018	17.74	83.31
		6/25/2018	17.32	83.73
		9/5/2018	17.64	83.41
		12/10/2018	17.58	83.47
		3/12/2019	17.56	83.49
		5/22/2019	17.18	83.87
		8/22/2019	17.3	83.75
		12/2/2019	17.65	83.40
MW-3	101.35	6/8/2016	18.47	82.88
		9/12/2016	18.41	82.94
		11/29/2016	18.84	82.51
		3/6/2017	19.01	82.34
		6/12/2017	18.32	83.03
		10/26/2017	18.50	82.85
		12/4/2017	18.87	82.48
		3/13/2018	19.13	82.22
		6/25/2018	18.14	83.21
		9/5/2018	18.54	82.81
		12/10/2018	18.71	82.64
		3/11/2019	18.69	82.66
		5/22/2019	18.19	83.16
		8/22/2019	18.28	83.07
		12/22/2019	18.62	82.73

Table 1
Groundwater Elevations
Hilcorp Energy Company
Mangum No.1
San Juan County, New Mexico

Well ID	Top of Casing (feet)	Date of Measurement	Depth to Water (feet)	Groundwater Elevation (feet)
MW-4	103.76	6/8/2016	19.72	84.04
		9/12/2016	19.43	84.33
		11/29/2016	19.62	84.14
		3/6/2017	19.50	84.26
		6/21/2017	19.76	84.00
		10/26/2017	19.59	84.17
		12/4/2017	19.62	84.14
		3/13/2018	19.76	84.00
		6/25/2018	19.89	83.87
		9/4/2018	19.03	84.73
		12/10/2018	19.69	84.07
		3/12/2019	19.63	84.13
		5/22/2019	19.57	84.19
		8/22/2019	19.92	83.84
		12/2/2019	19.81	83.95
MW-5	95.77	8/23/2019	23.32	72.45
		9/19/2019	23.13	72.64
		12/4/2019	22.51	73.26
MW-6	94.70	8/23/2019	19.98	74.72
		9/19/2019	18.63	76.07
		12/4/2019	19.09	75.61
MW-7	94.49	8/23/2019	24.04	70.45
		9/19/2019	23.66	70.83
		12/4/2019	23.69	70.80

Table 2
Field Parameters Summary
Hilcorp Energy Company
Mangum No.1
San Juan County, New Mexico

Well ID	Date	Temp˚C	pH	TDS (mg/L)	SC (µS/cm)	DO (mg/L)	ORP (mV)	Volume (gal)
MW-1	11/29/2016	16.54	7.42	--	2.607	1.52	-155.3	--
	3/6/2017	13.37	7.37	1.993	3057	1.48	-262.6	2
	6/12/2017	14.35	7.14	1.82	2800	0.89	-197.6	2
	10/26/2017	18	7.19	--	2600	1.85	-156	2.25
	12/4/2017	15.47	7.07	1.787	2748	1.3	-209.9	2
	3/13/2018	19.94	7.31	--	2502	-0.02	-203.58	1.7
	6/25/2018	15.81	7.22	--	2109.5	0.51	-198.3	1.75
	3/12/2019	13.1	7.57	1.37	2.72	NA	-24.9	NA
	5/22/2019	16.8	7.29	1.45	2.92	0	-27.5	NA
	8/22/2019	21.1	7.2	2.01	4.03	27.9	-16.1	NA
	12/2/2019	13.6	6.8	1.53	3.05	--	-26.5	NA
MW-2	11/29/2016	16.04	7.2	--	2.299	2.21	-109.3	--
	3/6/2017	12.74	7.15	1.744	2683	2.05	-171.7	1.5
	6/12/2017	13.5	6.95	1.558	2396	1.61	-155.8	1.5
	10/26/2017	18.7	7.01	--	2264	1.74	-92.8	1.5
	12/4/2017	15.41	7	1.517	2333	1.11	-178	1.5
	3/13/2018	14.67	7.21	--	2334	-0.08	-180.73	1.3
	6/25/2018	17.63	6.62	--	1905.7	0.94	-187.2	1.75
	3/12/2019	13.7	7.57	9.5	18.86	NA	7.3	NA
	5/22/2019	13.7	6.67	9.54	19.07	29	5	NA
	8/22/2019	23	6.49	8.63	17.27	24.3	10	NA
	12/2/2019	16.2	5.84	10	20	--	9.2	NA
MW-3	11/29/2016	15.01	7.09	--	3.091	2.52	-91	--
	3/6/2017	12.74	7.05	2.193	3376	4.17	-151.6	1
	6/12/2017	15.4	7.18	2.189	3360	6.7	-136	0.5
	10/26/2017	17.71	7.06	--	2653	1.8	-177.4	1.25
	12/4/2017	14.19	7.04	1.838	2835	3.05	-153.5	0.25
	3/13/2018	14.84	7.18	--	2641	0.17	-167.03	1.6
	6/25/2018	No parameters due to low volume						
	3/11/2019	14.3	7.24	1.41	2.83	NA	-31.5	NA
	5/22/2019	13.3	7.11	1.36	2.73	5.8	-35.6	NA
	8/22/2019	20.8	7.19	1.43	2.86	27.6	-25.2	NA
	12/2/2019	15.2	6.55	1.49	2.96	--	-25.4	NA
MW-4	6/23/2016	15.1	7.29	--	2.95	1.04	-148.5	1.5
	11/29/2016	16.01	7.4	--	2.396	1.59	-127.5	--
	3/6/2017	13.01	7.39	2.337	3608	2.01	-237.2	2
	6/21/2017	14.49	7.08	1.917	2955	1.36	-188.7	1.25
	10/26/2017	17.37	7.29	--	2830	1.74	-193.2	1.75
	12/4/2017	15.26	3.33	2.055	3161	0.66	-244.2	1.5
	3/13/2018	15.08	7.41	--	3437	-0.07	-214.88	1.5
	6/25/2018	15.85	7.33	--	2580	0.97	-224.9	1.75
	3/12/2019	14.1	7.49	1.48	2.96	NA	-31.5	NA
	5/22/2019	15.4	7.35	1.67	3.3	1.44	-33.6	NA
	8/22/2019	19.5	7.35	1.55	3.09	6.9	-22.4	NA
	12/2/2019	15.3	6.65	1.69	3.31	--	-32.7	NA

Table 2
Field Parameters Summary
Hilcorp Energy Company
Mangum No.1
San Juan County, New Mexico

Well ID	Date	Temp˚C	pH	TDS (mg/L)	SC (µS/cm)	DO (mg/L)	ORP (mV)	Volume (gal)
MW-5	8/23/2019	18.2	6.79	3.54	7.1	26.3	6.6	NA
	12/4/2019	12.6.	6.11	3.28	6.54	--	-1.1	NA
MW-6	8/23/2019	21.1	6.96	1.29	2.59	26.2	0.7	NA
	12/4/2019	12.7	6.29	1.21	2.43	--	-5	NA
MW-7	8/23/2019	21.8	6.95	2.63	5.24	44.8	-12.2	NA
	12/4/2019	12.8	6.11	2.4	4.8	--	-8	NA

Notes:
TDS = total dissolved solids
SC = Soil Conductivity
DO = dissolved oxygen
ORP = oxidation-reduction potential
-- Not Measured
NA = Data not collected

°C = degrees Centigrade
mg/L = milligrams per liter
µS/cm = micro Siemens per centimeter
mV = millivolts
gal = gallons

Table 3
Groundwater Analytical Results Summary
Hilcorp Energy Company
Mangum No.1
San Juan County, New Mexico

Well ID	Sample ID	Date	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (Total) (mg/L)	Sulfate (mg/L)	Manganese (Dissolved) (mg/L)	Iron (Dissolved) (mg/L)	Total Dissolved Solids (mg/L)
NMWQCC Groundwater Quality Standards			**0.01**	**0.75**	**0.75**	**0.62**	**600**	**0.2**	**1.0**	**1000**
MW-1	WT-11102646-060816-JWMW1	6/8/2016	**0.0388**	<0.020	0.358	**4.01**	**1170**	**1.69**	--	**2590**
	GW-11102646-091216-CM-MW-1	9/12/2016	**0.0111**	< 0.001	0.0946	0.382	577	**0.925**	--	--
	GW-11102646-112916-CN-MW-1	11/29/2016	**0.0132**	< 0.001	0.119	0.445	240	**0.99**	--	--
	GW-11102646-030617-CN-MW-1	3/6/2017	0.0041	< 0.001	0.0481	0.167	387	**0.876**	--	**1920**
	GW-11102646-061217-CN-MW-1	6/12/2017	0.002	< 0.001	0.0265	0.12	312	**0.8**	--	**1830**
	GW-11146006-102617-CM-MW-1	10/26/2017	< 0.001	< 0.001	0.0081	0.0307	424	**0.71**	0.256	**1940**
	GW-11145006-120417-SP-MW-1	12/4/2017	<0.005	< 0.005	0.021	0.0814	321	**0.674**	--	**1710**
	GW-11146006-031318-CN-MW-1	3/13/2018	< 0.001	< 0.001	0.008	0.0353	319	**0.68**		**1410**
	GW-11146006-062518-CN-MW-1	6/25/2018	< 0.001	< 0.001	0.0067	0.0229	349	**0.705**	--	**1820**
	GW-11146006-090418-JP-MW-1	9/4/2018	<0.005	<0.005	0.0154	0.0499	481	**0.694**	--	**2000**
	MW-1	12/10/2018	<0.001	<0.001	<0.001	<0.003	343	**0.712**	<0.10	**1980**
	MW-1	3/12/2019	<0.001	<0.001	<0.001	<.300	578	**0.89**	0.143	**2040**
	MW-1	5/22/2019	<0.001	<0.001	0.00619	0.0119	598	**0.732**	<0.100	**2210**
	MW-1	8/22/2019	<0.001	<0.001	0.0053	0.0095	**1260**	**1.59**	<0.100	**3010**
	MW-1	12/2/2019	<0.001	<0.001	0.0029	0.0045	**697**	**0.94**	<0.100	**1930**
MW-2	WT-11102646-060816-JW-MW-2	6/8/2016	**0.103**	< 0.001	0.0072	0.0448	3.0	**1.06**	--	**1580**
	GW-11102646-091216-CM-MW-2	9/12/2016	**0.0647**	< 0.001	0.0021	0.0032	2.8	**1.73**	--	--
	GW-11102646-112916-CN-MW-2	11/29/2016	**0.0257**	< 0.001	0.0021	< 0.003	2.6	**1.41**	--	--
	GW-11102646-030617-CN-MW-2	3/6/2017	**0.0347**	< 0.001	0.0022	< 0.003	7.9	**1.45**	--	**1510**
	GW-11102646-061217-CN-MW-2	6/12/2017	0.009	< 0.001	0.0011	< 0.003	3.1	**1.39**	--	**1550**
	GW-11146006-102617-CM-MW-2	10/26/2017	0.0013	< 0.001	< 0.001	< 0.003	4.5	**1.26**	**5.1**	**1560**
	GW-11145006-120417-SP-MW-2	12/4/2017	0.0039	< 0.001	0.0011	< 0.003	14.3	**1.23**	--	**1470**
	GW-11146006-031318-CN-MW-2	3/13/2018	0.0036	< 0.001	0.0011	< 0.003	154	**1.25**	--	**1450**
	GW-11146006-062518-CN-MW-2	6/25/2018	**0.0079**	< 0.001	< 0.001	< 0.003	31.3	**1.37**	--	**1600**
	GW-11146006-090418-JP-MW-2	9/4/2018	< 0.001	< 0.001	< 0.001	< 0.003	87	**1.13**	--	**1730**
	MW-2	12/10/2018	**0.0543**	< 0.001	0.0015	< 0.003	27.7	**1.15**	<0.1	**1470**
	MW-2	3/12/2019	**0.779**	< 0.001	0.0317	0.0519	64.7	**11.4**	1.59	**15300**
	MW-2	5/22/2019	**0.435**	< 0.005	0.0245	0.0533	29.6	**7.77**	**4.30**	**15300**
	MW-2	8/22/2019	**0.170**	< 0.001	0.0265	0.0153	8.01	**7.27**	0.426	**12700**
	MW-2	12/2/2019	**0.130**	< 0.001	0.0304	0.0087	<5.00	**10.2**	<0.100	**15700**

Table 3
Groundwater Analytical Results Summary
Hilcorp Energy Company
Mangum No.1
San Juan County, New Mexico

Well ID	Sample ID	Date	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (Total) (mg/L)	Sulfate (mg/L)	Manganese (Dissolved) (mg/L)	Iron (Dissolved) (mg/L)	Total Dissolved Solids (mg/L)
NMWQCC Groundwater Quality Standards			**0.01**	**0.75**	**0.75**	**0.62**	**600**	**0.2**	**1.0**	**1000**
MW-3	WT-11102646-060816-JW-MW-3	6/8/2016	**2.95**	< 0.020	**0.813**	**7.78**	110	**2.65**	--	**2190**
	GW-11102646-091216-CM-MW-3	9/12/2016	**2.27**	< 0.001	0.44	**2.49**	112	**3.62**	--	--
	GW-11102646-091216-CN-MW-3	11/29/2016	**2.97**	< 0.001	**0.845**	**5.44**	22.5	**3.12**	--	--
	GW-11102646-030617-CN-MW-3	3/6/2017	**1.89**	< 0.02	0.259	**3.06**	14.7	**2.52**	--	**1880**
	GW-11102646-061217-CN-MW-3	6/12/2017	**1.68**	< 0.02	0.329	**1.93**	372	**3.09**	--	**2280**
	GW-11146006-102617-CM-MW-3	10/26/2017	**1.88**	< 0.001	0.417	**2.91**	65.6	**2.15**	**3.58**	**2000**
	GW-11145006-120417-SP-MW-3	12/4/2017	**2.00**	< 0.025	0.346	**2.43**	35.5	**2.36**	--	**1750**
	GW-11146006-031318-CN	3/13/2018	**1.43**	< 0.025	0.107	**1.93**	24.6	**2.34**	**--**	**1530**
	GW-11146006-062618-CN-MW-3	6/26/2018	**2.02**	< 0.025	0.287	**2.69**	**606**	**3.52**	--	**2560**
	GW-11146006-090518-JP-MW-3	9/5/2018	**1.82**	<0.005	0.160	**1.40**	241	**2.08**	--	**2300**
	MW-3	12/10/2018	**1.49**	<0.10	0.133	**0.639**	170	**1.94**	0.142	**2050**
	MW-3	3/11/2019	**1.45**	<0.001	0.015	**0.655**	95.6	**2.01**	<0.100	**1940**
	MW-3	5/22/2019	**1.84**	<0.001	0.120	**1.17**	23.7	**1.03**	0.278	**2540**
	MW-3	8/22/2019	**0.623**	<0.001	0.0193	0.387	119	**1.62**	<0.100	**1860**
	MW-3	12/2/2019	**0.114**	<0.001	0.006	0.184	129	**1.55**	<0.100	**1800**
MW-4	GW-11102646-062316-SP-MW-4	6/23/2016	**0.118**	< 0.001	0.186	**1.06**	**838**	**0.983**	--	--
	GW-11102646-091216-CM-MW-4	9/12/2016	**0.0742**	< 0.001	0.114	**0.803**	**735**	**1.32**	--	--
	GW-11102646-112916-CN-MW-4	11/29/2016	**0.0853**	< 0.001	0.0929	**0.967**	382	**1.26**	--	--
	GW-11102646-030617-CN-MW-4	3/6/2017	**0.0886**	< 0.02	0.0804	**1.23**	**814**	**1.22**	--	**2260**
	GW-11102646-061217-CN-MW-4	6/12/2017	**0.1**	< 0.005	0.0747	**1.44**	**738**	**1.01**	--	**2140**
	GW-11146006-102617-CM-MW-4	10/26/2017	**0.0462**	< 0.001	0.0226	**0.849**	**1120**	**0.73**	0.507	**2370**
	GW-11145006-120417-SP-MW-4	12/4/2017	**0.0632**	<0 .020	0.0386	**1.45**	**993**	**0.893**	--	**2150**
	GW-11145006-120417-SP-DUP	12/4/2017	**0.064**	<0.020	0.0421	**1.7**	**--**	**--**	--	**--**
	GW-11146006-031318-CN-MW-4	3/13/2018	**0.0467**	<0.10	0.0292	**1.33**	**1370**	**0.827**	--	**2350**
	GW-11146006-062518-CN-MW-4	6/25/2018	**0.0561**	<0.020	<0.020	**1.74**	**1230**	**0.888**	--	**2540**
	GW-11146006-090418-JP-MW-4	9/4/2018	**0.0257**	< 0.005	< 0.005	**0.848**	**1450**	**0.889**	--	**2410**
	MW-4	12/10/2018	**0.108**	<0.020	0.0484	**2.93**	439	**0.801**	0.209	**1900**
	MW-4	3/12/2019	**0.0488**	<0.0100	0.0265	**1.85**	**1240**	**0.843**	<0.100	**2390**
	MW-4	5/22/2019	**0.0496**	<0.0100	0.0309	**1.84**	**1090**	**0.867**	<0.100	**2700**
	MW-4	8/22/2019	**0.0336**	0.0013	0.0113	**1.05**	**1270**	**0.737**	<0.100	**2290**
	MW-4	12/2/2019	**0.0172**	<0.0100	<0.0100	**0.937**	**1390**	**0.752**	<0.100	**2480**

Table 3
Groundwater Analytical Results Summary
Hilcorp Energy Company
Mangum No.1
San Juan County, New Mexico

Well ID	Sample ID	Date	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (Total) (mg/L)	Sulfate (mg/L)	Manganese (Dissolved) (mg/L)	Iron (Dissolved) (mg/L)	Total Dissolved Solids (mg/L)
NMWQCC Groundwater Quality Standards			**0.01**	**0.75**	**0.75**	**0.62**	**600**	**0.2**	**1.0**	**1000**
MW-5	MW-5	8/23/2019	<0.001	<0.001	<0.001	0.0067	**3660**	**3.33**	<0.100	**6620**
	MW-5	12/2/2019	<0.001	<0.001	<0.0010	<0.0030	**3730**	**3.26**	0.185	**6350**
MW-6	MW-6	8/23/2019	**0.213**	<0.001	0.145	**0.806**	168	**2.51**	<0.100	**1750**
	MW-6	12/2/2019	**0.0741**	<0.001	0.168	0.170	86.1	**3.11**	<0.100	**1630**
MW-7	MW-7	8/23/2019	<0.001	<0.001	<0.001	0.004	**2950**	**1.75**	<0.100	**4930**
	MW-7	12/2/2019	<0.001	<0.001	<0.001	<0.003	**2830**	**1.98**	<0.100	**3990**

Notes:
NMWQCC = New Mexico Water Quality Control Commission
mg/L = milligrams per liter (parts per million)
< 0.001 = Below Laboratory Detection Limit of 0.001 mg/L, etc
-- = Not Analyzed

Appendices

Appendix A
NMOSE Well Permits

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
AZTEC

John R. D'Antonio, Jr., P.E.
State Engineer

100 Gossett Drive, Suite A
Aztec, New Mexico 87410

May 9, 2019

Hilcorp Energy Company
via GHD, as Agent
382 Road 3100
Aztec, NM 87410

RE: Permit Approval for Monitoring Wells, SJ-4198 POD5-POD8; Hilcorp Energy Company; Mangum No. 1 Release Investigation; Bloomfield, New Mexico

Dear Ms. Cardoza:

On May 9, 2019, the New Mexico Office of the State Engineer received an application for a permit for the drilling and use of four proposed new monitoring wells at the above referenced location. Enclosed is a copy of the above numbered permit that has been approved subject to the conditions set forth on the approval page and in the attached Conditions of Approval. A receipt for the fees paid is also attached.

Please be aware that there are deadlines to submit well records for the newly installed monitoring wells. These deadlines can be found in the attached Conditions of Approval. A standardized plugging method has also been included in the Conditions of Approval for the future abandonment of the wells covered by this permit. This eliminates the need to submit a separate Well Plugging Plan of Operations for approval by the NMOSE prior to plugging, unless an alternate plugging method is proposed, required by a separate oversight agency, necessary due to incompatibility with actual conditions, or artesian conditions are encountered. The well and plugging records should be sent to the NMOSE District V, 100 Gossett Drive, Suite A, Aztec, NM, 87410.

If you have any questions regarding this permitting action, please feel free to contact me at (505) 334-4571.

Sincerely,

Miles Juett
Assistant Watermaster
Water Rights Division – District V

Enclosures

cc: Aztec Reading (w/o enclosures)
SJ-4198 File
WATERS
Jeff Walker, GHD Services, Inc., via e-mail: Jeff.Walker@ghd.com
Brandon Powell, NMOCD District 3, via email: brandon.powell@state.nm.us

OFFICE OF THE STATE ENGINEER/INTERSTATE STREAM COMMISSION – AZTEC OFFICE

OFFICIAL RECEIPT NUMBER: 5 - **6354** DATE: 4-23-19 FILE NO.: SJ-4198 POD 5-8

TOTAL: 20.00 RECEIVED: twenty DOLLARS ☐ CASH: X CHECK NO.: 4653

PAYOR: Jeffrey Walker ADDRESS: 11105 Kielich NE

CITY: Albuquerque STATE: NM ZIP: 87111 RECEIVED BY: MJ

INSTRUCTIONS: Indicate the number of actions to the left of the appropriate type of filing. Complete the receipt information. **Original** to payor; **pink** copy to Program Support/ASD; **yellow** copy remains in district office; and **goldenrod** copy to accompany application being filed. If a mistake is made, void the original and all copies and submit to Program Support/ASD as part of the daily deposit.

A. Ground Water Filing Fees

___	1. Change of Ownership of Water Right	$ 2.00
___	2. Application to Appropriate or Supplement Domestic 72-12-1 Well	$ 125.00
___	3. Application to Repair or Deepen 72-12-1 Well	$ 75.00
___	4. Application for Replacement 72-12-1 Well	$ 75.00
___	5. Application to Change Purpose of Use 72-12-1 Well	$ 75.00
___	6. Application for Stock Well/Temp. Use	$ 5.00
___	7. Application to Appropriate Irrigation, Municipal, or Commercial Use	$ 25.00
___	8. Declaration of Water Right	$ 1.00
___	9. Application for Supplemental Non 72-12-1 Well	$ 25.00
___	10. Application to Change Place or Purpose of Use Non 72-12-1 Well	$ 25.00
___	11. Application to Change Point of Diversion and Place and/or Purpose of Use from Surface Water to Ground Water	$ 50.00
___	12. Application to Change Point of Diversion and Place and/or Purpose of Use from Ground Water to Ground Water	$ 50.00
___	13. Application to Change Point of Diversion of Non 72-12-1 Well	$ 25.00
___	14. Application to Repair or Deepen Non 72-12-1 Well	$ 5.00
4	15. Application for Test, Expl. Observ. Well	$ 5.00
___	16. Application for Extension of Time	$ 25.00
___	17. Proof of Application to Beneficial Use	$ 25.00
___	18. Notice of Intent to Appropriate	$ 25.00

B. Surface Water Filing Fees

___	1. Change of Ownership of a Water Right	$ 5.00
___	2. Declaration of Water Right	$ 10.00
___	3. Amended Declaration	$ 25.00
___	4. Application to Change Point of Diversion and Place and/or Purpose of Use from Surface Water to Surface Water	$ 200.00
___	5. Application to Change Point of Diversion and Place and/or Purpose of Use from Ground Water to Surface Water	$ 200.00
___	6. Application to Change Point of Diversion	$ 100.00
___	7. Application to Change Place and/or Purpose of Use	$ 100.00
___	8. Application to Appropriate	$ 25.00
___	9. Notice of Intent to Appropriate	$ 25.00
___	10. Application for Extension of Time	$ 50.00
___	11. Supplemental Well to a Surface Right	$ 100.00
___	12. Return Flow Credit	$ 100.00
___	13. Proof of Completion of Works	$ 25.00
___	14. Proof of Application of Water to Beneficial Use	$ 25.00
___	15. Water Development Plan	$ 100.00
___	16. Declaration of Livestock Water Impoundment	$ 10.00
___	17. Application for Livestock Water Impoundment	$ 10.00

All fees are non-refundable.

C. Well Driller Fees

___	1. Application for Well Driller's License	$ 50.00
___	2. Application for Renewal of Well Driller's License	$ 50.00

D. Reproduction of Documents

___ @ 25¢/copy $_____

___ Map(s) $_____

E. Certification $_____

F. *Credit Card Convenience Fee $_____

G. Other_____ $_____

Comments: Hilcorp

Magnum #1 Site

NW-5,-6,-7, & -8

File No. SJ-4198 POD5-8

NEW MEXICO OFFICE OF THE STATE ENGINEER

WR-07 APPLICATION FOR PERMIT TO DRILL

A WELL WITH NO WATER RIGHT

(check applicable box):

For fees, see State Engineer website: http://www.ose.state.nm.us/

Purpose:	☐ Pollution Control And/Or Recovery	☐ Ground Source Heat Pump
☐ Exploratory Well (Pump test)	☐ Construction Site/Public Works Dewatering	☐ Other(Describe):
☒ Monitoring Well	☐ Mine Dewatering	

A separate permit will be required to apply water to beneficial use regardless if use is consumptive or nonconsumptive.

☐ Temporary Request - Requested Start Date: May 29, 2019 Requested End Date: Dec 31, 2019

Plugging Plan of Operations Submitted? ☐ Yes ☒ No

1. APPLICANT(S)

Name: Jeff Walker-Agent for Hilcorp Energy	Name:
Contact or Agent: check here if Agent ☒ Clara Cardoza-Hilcorp Energy	Contact or Agent: check here if Agent ☐
Mailing Address: 382 CR 3100	Mailing Address:
City: Aztec	City:
State: NM Zip Code: 87410	State: Zip Code:
Phone: 505-564-0733 ☐ Home ☐ Cell Phone (Work):	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): ccardoza@hilcorp.com	E-mail (optional):

2019 MAY -9 PM 2:00 STATE ENGINEER OFFICE AZTEC, NEW MEXICO

2019 MAY 10 AM 8:58 AZTEC, NEW MEXICO

FOR OSE INTERNAL USE Application for Permit, Form WR-07, Rev 11/17/16

File No.: SJ-4198 POD5-8	Trn. No.:	Receipt No.: 5-6354
Trans Description (optional):		
Sub-Basin:	PCW/LOG Due Date: 5-9-~~2019~~ 2020	

2. **WELL(S)** Describe the well(s) applicable to this application.

Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) and District VII (Cimarron) customers, provide a PLSS location in addition to above.

☐ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☐ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

■ Lat/Long (WGS84) (to the nearest 1/10th of second)

Well Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
MW-5 (SJ-4198 POD5)	107.98451	36.69576	NW 1/4 SW 1/4 Sec 27 T29N R11W
MW-6 (SJ-4198 POD6)	107.98422	36.69617	NW 1/4 SW 1/4 Sec 27 T29N R11W
MW-7 (SJ-4198 POD7)	107.98376	36.69633	NW 1/4 SW 1/4 Sec 27 T29N R11W
MW-8 (SJ-4198 POD8	107.98384	36.69496	NW 1/4 SW 1/4 Sec 27 T29N R11W

NOTE: If more well locations need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional well descriptions are attached: ☐ Yes ☐ No **If yes, how many**_____

Other description relating well to common landmarks, streets, or other:
S. of Sullivan Rd., 1 mile S. of Int. US550/US 64

Well is on land owned by: US BLM

Well Information: NOTE: If more than one (1) well needs to be described, provide attachment. Attached? ☐ Yes ■ No
If yes, how many_____

Approximate depth of well (feet): 26	Outside diameter of well casing (inches): 2.0
Driller Name: Enviro-Drill, Inc.	Driller License Number: 1186

3. **ADDITIONAL STATEMENTS OR EXPLANATIONS**

Monitoring wells MW-5 thru MW-8 are being installed due to the New Mexico Oil Conservation Division request for additional groundwater quality assessment at the Mangum No. 1 natural gas well site. MW-8 will serve as an up-gradient well to monitor background conditions. Monitoring will continue until remediation site closure is granted by the NMOCD. Wells will be constructed with 2-in. PVC casing with stick-up or flush mounted completions. The wells will consist of a minimum of 15 feet of 0.010 screen with a 10/20 sand pack. A bentonite seal will be placed above the sandpack and the annulus grouted to ground surface. A well completion diagram of a similar monitoring well and the proposed well locations are attached. Also attached is access permission by US BLM, property owner.

2019 MAY -9 PM 2:00
STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

FOR OSE INTERNAL USE — Application for Permit, Form WR-07

File No.: SJ-4198 POD5-8	Trn No.:

4. SPECIFIC REQUIREMENTS: The applicant must include the following, as applicable to each well type. Please check the appropriate boxes, to indicate the information has been included and/or attached to this application:

Exploratory: ☐ Include a description of any proposed pump test, if applicable.	**Pollution Control and/or Recovery:** ☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for the pollution control or recovery operation. ☐ The estimated maximum period of time for completion of the operation. ☐ The annual diversion amount. ☐ The annual consumptive use amount. ☐ The maximum amount of water to be diverted and injected for the duration of the operation. ☐ The method and place of discharge.	**Construction De-Watering:** ☐ Include a description of the proposed dewatering operation, ☐ The estimated duration of the operation, ☐ The maximum amount of water to be diverted, ☐ A description of the need for the dewatering operation, and, ☐ A description of how the diverted water will be disposed of.	**Mine De-Watering:** ☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for mine dewatering. ☐ The estimated maximum period of time for completion of the operation. ☐ The source(s) of the water to be diverted. ☐ The geohydrologic characteristics of the aquifer(s). ☐ The maximum amount of water to be diverted per annum. ☐ The maximum amount of water to be diverted for the duration of the operation. ☐ The quality of the water. ☐ The method of measurement of water diverted. ☐ The recharge of water to the aquifer. ☐ Description of the estimated area of hydrologic effect of the project. ☐ The method and place of discharge. ☐ An estimation of the effects on surface water rights and underground water rights from the mine dewatering project. ☐ A description of the methods employed to estimate effects on surface water rights and underground water rights. ☐ Information on existing wells, rivers, springs, and wetlands within the area of hydrologic effect.
Monitoring: ☒ Include the reason for the monitoring well, and, ☒ The duration of the planned monitoring.	☐ The method of measurement of water produced and discharged. ☐ The source of water to be injected. ☐ The method of measurement of water injected. ☐ The characteristics of the aquifer. ☐ The method of determining the resulting annual consumptive use of water and depletion from any related stream system. ☐ Proof of any permit required from the New Mexico Environment Department. ☐ An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located.	**Ground Source Heat Pump:** ☐ Include a description of the geothermal heat exchange project, ☐ The number of boreholes for the completed project and required depths. ☐ The time frame for constructing the geothermal heat exchange project, and, ☐ The duration of the project. ☐ Preliminary surveys, design data, and additional information shall be included to provide all essential facts relating to the request.	

ACKNOWLEDGEMENT

I, We (name of applicant(s)) Jeff Walker, as agent for Hilcorp Energy
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this 9th day of May 20 19, for the State Engineer,

John R. D'Antonio, Jr., P.E., State Engineer

By: Miles Juett
Signature Print

Title: Assistant Watermaster
Print

FOR OSE INTERNAL USE Application for Permit, Form WR-07

File No.: SJ-4198 POD5-8	Trn No.:

Coordinate System
GCS WGS 1984

HILLCORP ENERGY COMPANY
MAGNUM #1
SAN JUAN COUNTY, NM

OSE File: SJ-4198 POD5-8

2019 MAY -9 PM 2:14

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

11146006-00
Mar 13, 2019

PROPOSED MONITORING WELL
LOCATION MAP

FIGURE 1

GIS File C:\Users\plorang\Documents\Projects\HEC\MAPS\MAG1.mxd

NMOSE Permit to Drill a Well(s) With No Water Right - Conditions of Approval
SJ-4198 POD5–POD8

The New Mexico Office of the State Engineer (NMOSE) has determined that existing water rights will not be impaired by this activity. This application is approved without publication provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state. This application approval (i.e., permit) is further subject to the following conditions of approval.

1. This permit is approved as follows:

Permittee(s):	Hilcorp Energy Company (via GHD, as Agent) 382 Road 3100 Aztec, NM 87410
Permit Number:	SJ-4198
Application File Date:	May 9, 2019
Priority:	N/A
Source:	Groundwater
Point(s) of Diversion:	Four points of diversion (PODs), SJ-4198 POD5 through POD8, are proposed. The PODs consist of four proposed monitoring wells (Table 1) that will be used for periodic groundwater sampling. The wells will be located at the Hilcorp Mangum No. 1 release site located on land owned by The U.S. Department of the Interior Bureau of Land Management in Bloomfield, New Mexico. The PODs will be located within the NW/4 SW/4 of Section 27, Township 29 North, Range 11 West, NMPM, at the following approximate point locations (Long/Lat, WGS84).

Table 1: Proposed New Monitoring Wells

POD Number and Owner's Well Name	Casing: Diameter (inches) and Depth (feet)		Longitude (Decimal Deg.)	Latitude (Decimal Deg.)
SJ-4198 POD5 (MW-5)	2	26	107.98451° W	36.69576° N
SJ-4198 POD6 (MW-6)	2	26	107.98422° W	36.69617° N
SJ-4198 POD7 (MW-7)	2	26	107.98376° W	36.69633° N
SJ-4198 POD8 (MW-8)	2	26	107.98384° W	36.69496° N

Purpose of Use:	Groundwater sampling
Place of Use:	N/A
Amount of Water:	N/A

2. No water shall be appropriated and beneficially used from any wells or borings approved under this permit.

3. No water shall be diverted from the well(s) except for initial well development and periodic sampling purposes. Upon completion of monitoring activities the well(s) shall be plugged in accordance with Subsection C of 19.27.4.30 NMAC, unless a permit to use water is acquired from the NMOSE.

4. The well(s) may continue to be used indefinitely for groundwater sampling or monitoring required for the current site investigation and any associated remediation, so long as they remain in good repair. **A new permit shall be obtained from the NMOSE prior to replacing a well(s) or for any change in use as approved herein.**

5. Water well drilling and well drilling activities, including well plugging, are regulated under NMOSE Regulations 19.27.4 NMAC. These regulations apply, and provide both general and specific direction regarding the drilling of wells in New Mexico. Note that the construction of any well that allows groundwater to flow uncontrolled to the land surface or to move appreciably between geologic units is prohibited.

6. In accordance with Subsection A of 19.27.4.29 NMAC, on-site supervision of well drilling/plugging is required by the holder of a New Mexico Well Driller License or a NMOSE-registered Drill Rig Supervisor. The New Mexico licensed Well Driller shall ensure that well drilling activities are completed in accordance with 19.27.4.29, 19.27.4.30 and 19.27.4.31 NMAC. However, pursuant to 72-12-12 NMSA 1978 and 19.27.4.8 NMAC, a driller's license is not required for the construction of a driven well with an outside casing diameter of 2⅜ inches or less and that does not require the use of a drill rig (e.g., auger) for installation. This exemption is not applicable to well plugging.

7. The permittee has not stated whether artesian conditions are likely to be encountered at the proposed well/borehole location(s). However, if artesian conditions are encountered during drilling, all rules and regulations pertaining to the drilling and casing and plugging of artesian wells shall be followed.

8. A Well Record documenting the as-built well construction and materials used shall be filed for each of the new wells in accordance with Subsection N of 19.27.4.29 NMAC. **Well Records shall be filed with the State Engineer (NMOSE District V, 100 Gossett Drive, Suite A, Aztec, NM, 87410) within 30 days after completion of the well(s).** Well installation(s) shall be complete and the well record(s) filed no later than one year from the date of approval of this permit.

9. If the required Well Record documentation is not received within one year of the date of permit approval, this permit will automatically expire.

10. When the permittee receives approval or direction to permanently abandon the well(s)/borehole(s) covered by this permit, plugging shall be performed by a New Mexico licensed well driller. The well(s)/borehole(s) shall be plugged pursuant to Subsection C of 19.27.4.30 NMAC using the following method, unless an alternate plugging method has been proposed by or on behalf of the well owner and approved by the NMOSE. If a well/borehole has encountered artesian conditions, a Well Plugging Plan of Operations shall be submitted and NMOSE approval obtained *prior* to the initiation of *any* well plugging activities concerning artesian wells. Additionally, if the following standardized plugging sealant is not appropriate for use due to incompatibility with the water quality or any soil and water contaminates encountered,

a Well Plugging Plan of Operations shall be submitted and NMOSE approval obtained *prior* to the initiation of *any* well plugging activities.

a. Obstructions in a well/borehole shall be identified and removed if possible. If an obstruction cannot be removed, the method used to grout below and around the obstruction shall be described in detail in the plugging record.

b. Prior to plugging, calculate the theoretical volume of sealant needed for abandonment of the well/borehole based on the actual measured pluggable depth of the well/borehole and the volume factor for the casing/borehole diameter. Compare the actual volume of sealant placed in the well/borehole with the theoretical volume to verify the actual volume of sealant is equal to or exceeds the theoretical volume.

c. Portland Type I/II cement shall be used for the plugging sealant. The water mixed with the cement to create the plugging sealant shall be potable water or of similar quality. Portland cement has a fundamental water demand of 5.2 gallons of water per 94-lb sack of cement. Up to a maximum of 6.0 gallons per 94-lb sack is acceptable to allow for greater pumpability.

   Pure bentonite powder ("90 barrel yield") is allowed as a cement additive by NMOSE and American Water Works Association (AWWA) guidelines. If a bentonite additive is used, the following rates and mixing guidelines shall be followed. For a rate or a mixing procedure other than that provided below, the NMOSE District V office must be contacted for pre-approval. Neither granular bentonite nor extended-yield bentonite shall be mixed with cement for the purpose of this plugging activity. When supplementing a cement slurry with bentonite powder, water demand for the mix increases at a rate of approximately 0.65 gallon of water for each 1% increment of bentonite bdwc (by dry weight cement) above the stated base water demand of 5.2 gallons water per 94-lb sack of cement for neat cement. Bentonite powder must be hydrated separately with its required increment of water before being mixed into the wet neat cement. If water is otherwise added to the combination of dry ingredients or the dry bentonite is blended into wet cement, the alkalinity of the cement will restrict the yield of the bentonite powder, resulting in excess free water in the slurry and excessive cement shrinkage upon curing.

d. Placement of the sealant within the well/borehole shall be by pumping through a tremie pipe extended to near the bottom of the well/borehole and kept below the top of the slurry column (i.e., immersed in the slurry) as the well/borehole is plugged from bottom upwards in a manner that displaces the standing water column.

e. Prior to, or upon completion of plugging, the well casing may be cut-off below grade as necessary to allow for approved construction onsite, provided a minimum six-inch thickness of reinforced abandonment plugging sealant or concrete completely covers the top of the cut-off casing. Any remaining void to the surface may be filled with native soil, concrete, or asphalt as needed to match the surrounding surface material and blended with the surface topography to prevent ponding.

f. **Within 30 days after completion of well/borehole plugging, a complete Plugging Record shall be filed with the State Engineer** in accordance with Paragraph (3) of Subsection C of 19.27.4.30 NMAC for each well/boring plugged. The Well Plugging Record(s) shall be filed with the State Engineer at the NMOSE District V Office, 100 Gossett Drive, Suite A, Aztec, NM 87410. The required well plugging record form is available at http://www.ose.state.nm.us/STST/wdForms.php.

11. In accordance with Subsection C of 19.27.4.30 NMAC, a well/borehole that does not encounter groundwater may be immediately plugged by filling with drill cuttings or clean native fill to within 10 feet of land surface and by plugging the remaining 10 feet to the land surface with a sealant approved by the Office of the State Engineer. A Plugging Record shall be filed with the State Engineer as described above.

12. Should another regulatory agency sharing jurisdiction of the project authorize, or by regulation require, more stringent requirements than stated herein, the more stringent procedure should be followed. These, among others, may include provisions regarding pre-authorization to proceed, type of methods and materials used, inspection, or prohibition of free discharge of any fluid or other material to or from the well that is related to the drilling and/or monitoring process.

13. Pursuant to 72-12-3 NMSA 1978, the applicant may or may not have provided written documentation with the application, which the applicant claims as confirmation that access has been granted for the aforementioned well(s) to be located on property owned by someone other than the well owner/applicant. NMOSE approval of this permit in no way infers the right of access to land not owned by the well owner/applicant.

14. The State Engineer retains jurisdiction of this permit.

The application for drilling well(s) SJ-4198 POD5-POD8 without a water right, submitted on May 9, 2019, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Witness my hand and seal this 9th day of May, A.D. 2019.
John R. D'Antionio, Jr., P.E., State Engineer

By: _____
Miles Jueff, Assistant Watermaster
District V Office, Water Rights Division

Map Description: Hilcorp Energy Company
Mangum No. 1 Site Investigation
Data sources: Application materials
File number: SJ-4198 POD5-POD8
Aerial Photography: SJC 2017

STATE OF NEW MEXICO
Office of the State Engineer
John R. D'Antonio Jr., P.E.
State Engineer

District V Office, Aztec
Well Location Map

Appendix B
Boring Logs/Well Completion Diagrams

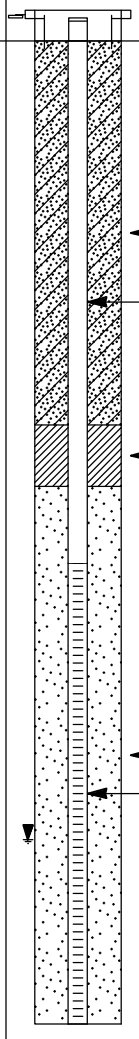
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Mangum
PROJECT NUMBER: 11146006
CLIENT: Hilcorp
LOCATION: Bloomfield, New Mexico
DRILLER: Juan Baraza

HOLE DESIGNATION: MW-5
DATE COMPLETED: 29 May 2019
DRILLING METHOD: Hollow Stem Auger
FIELD PERSONNEL: Charles Neligh
DRILLING COMPANY: EDI

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
	Hydroexcavated.	
5.00	No recovery in split spoon - very loose dry sands and gravels.	
15.00	CLAY (CH); black, odor present.	
30.00	SANDY CLAY (CL); brown, dry. sand is fine grained.	
40.50	- A few solid quartzite chips recovered at 40.0ft BGS END OF BOREHOLE @ 40.5ft BGS	

Monitor Well



WELL DETAILS

BOREHOLE DIAMETER 8-inch

SAMPLE DEPTH (ft)	INTERVAL	REC (ft)	PP (tsf)	PID (ppm)
	HV			
		0.0		
		0.0		
		0.5		817.3
		1.0		435.8
		0.0		
		0.5		3.4
		2.0		3.1
		0.5		

NOTES: Groundwater infiltration slow, no water produced until next day.

OVERBURDEN LOG 11146006 HILCORP MANGUM.GPJ CRA_CORP.GDT 17/12/19

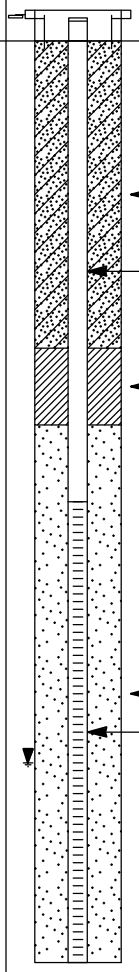
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Mangum
PROJECT NUMBER: 11146006
CLIENT: Hilcorp
LOCATION: Bloomfield, New Mexico
DRILLER: Juan Baraza

HOLE DESIGNATION: MW-6
DATE COMPLETED: 30 May 2019
DRILLING METHOD: Hollow Stem Auger
FIELD PERSONNEL: Charles Neligh
DRILLING COMPANY: EDI

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
	Hydroexcavated.	
5.00	No recovery in split spoon - very loose dry sands and gravels.	
10.00	CLAYEY SAND (SC); medium grained, brown, damp.	
25.00	CLAY (CH); gray, dry.	
36.00	END OF BOREHOLE @ 36.0ft BGS	

Monitor Well



WELL DETAILS

BOREHOLE DIAMETER 8-inch

SAMPLE	DEPTH (ft)	INTERVAL	REC (ft)	PP (tsf)	PID (ppm)
		HV			
			0.0		
			0.5		2.2
			1.0		2.4
			0.5		1.8
			1.0		1.6
			1.0		1.3
			1.0		1.7

NOTES: Groundwater infiltration slow, no water produced until next day.

OVERBURDEN LOG 11146006 HILCORP MANGUM.GPJ CRA_CORP.GDT 17/12/19

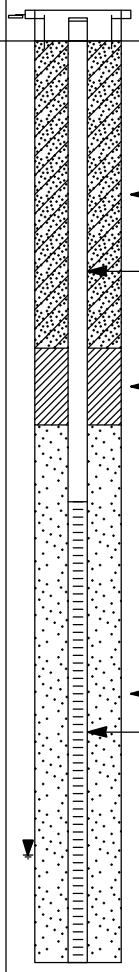
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Mangum
PROJECT NUMBER: 11146006
CLIENT: Hilcorp
LOCATION: Bloomfield, New Mexico
DRILLER: Juan Baraza

HOLE DESIGNATION: MW-7
DATE COMPLETED: 30 May 2019
DRILLING METHOD: Hollow Stem Auger
FIELD PERSONNEL: Charles Neligh
DRILLING COMPANY: EDI

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS
	Hydroexcavated.	
5.00	No recovery in split spoon - very loose dry sands and gravels.	
20.00	CLAYEY SAND (SC); fine grained, white to gray, damp.	
25.00	CLAY (CH); gray, damp.	
	- some fine to medium grained gravel present at 35.0ft BGS	
36.00	END OF BOREHOLE @ 36.0ft BGS	

Monitor Well



WELL DETAILS

BOREHOLE DIAMETER 8-inch

SAMPLE	DEPTH (ft)	INTERVAL	REC (ft)	PP (tsf)	PID (ppm)
		HV			
			0.0		
			0.0		
			0.0		
			1.0		2.8
			1.0		225.8
			1.0		3.1
			1.0		2.4

NOTES: Groundwater infiltration slow, no water produced until next day.

OVERBURDEN LOG 11146006 HILCORP MANGUM.GPJ CRA_CORP.GDT 17/12/19

STRATIGRAPHIC LOG
(OVERBURDEN)

PROJECT NAME: Mangum
PROJECT NUMBER: 11146006
CLIENT: Hilcorp
LOCATION: Bloomfield, New Mexico
DRILLER: Juan Baraza

HOLE DESIGNATION: MW-8
DATE COMPLETED: 30 May 2019
DRILLING METHOD: Hollow Stem Auger
FIELD PERSONNEL: Charles Neligh
DRILLING COMPANY: EDI

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH ft BGS	SAMPLE DEPTH (ft)	SAMPLE INTERVAL	SAMPLE REC (ft)	SAMPLE PP (tsf)	SAMPLE PID (ppm)
	Hydroexcavated.			HV			
5	SAND (SP); fine to medium grained, trace of fine gravels, brown.	5.00			2.0		1.8
10					2.0		2.0
15					2.0		2.1
20					2.0		1.7
22	SAND (SP); medium grained sand with fine to medium grained gravels, white.	21.00					1.6
25					0.0		
26	END OF BOREHOLE @ 26.0ft BGS	26.00					
30							
35							
40							
44							

NOTES: Auger refusal at 26 ft. Switch to ODEX drilling. No further progress. Abandon boring.

OVERBURDEN LOG 11146006 HILCORP MANGUM.GPJ CRA_CORP.GDT 17/12/19

Appendix C
Soils Laboratory Analytical Report

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

July 19, 2019

Jeff Walker

GHD
6121 Indian School Road, NE #200
Albuquerque, NM 87110
TEL: (505) 884-0672
FAX

RE: Mangum No 1 OrderNo.: 1906056

Dear Jeff Walker:

Hall Environmental Analysis Laboratory received 3 sample(s) on 6/3/2019 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued June 11, 2019.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman

Laboratory Manager

4901 Hawkins NE
Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

CLIENT: GHD **Lab Order:** 1906056
Project: Mangum No 1

Lab ID: 1906056-001 **Collection Date:** 5/29/2019 1:10:00 PM
Client Sample ID: S-11146006-052919-CN-17'-MW-5 **Matrix:** SOIL

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	65	25		mg/Kg	5	6/6/2019 9:07:13 PM	45394
Surr: BFB	105	70-130		%Rec	5	6/6/2019 9:07:13 PM	45394
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **BRM**	
Diesel Range Organics (DRO)	34	10		mg/Kg	1	6/6/2019 10:51:49 AM	45383
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	6/6/2019 10:51:49 AM	45383
Surr: DNOP	101	70-130		%Rec	1	6/6/2019 10:51:49 AM	45383
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.12	D	mg/Kg	5	6/6/2019 9:07:13 PM	45394
Toluene	ND	0.25	D	mg/Kg	5	6/6/2019 9:07:13 PM	45394
Ethylbenzene	ND	0.25	D	mg/Kg	5	6/6/2019 9:07:13 PM	45394
Xylenes, Total	ND	0.50	D	mg/Kg	5	6/6/2019 9:07:13 PM	45394
Surr: 1,2-Dichloroethane-d4	80.7	70-130	D	%Rec	5	6/6/2019 9:07:13 PM	45394
Surr: 4-Bromofluorobenzene	86.4	70-130	D	%Rec	5	6/6/2019 9:07:13 PM	45394
Surr: Dibromofluoromethane	95.5	70-130	D	%Rec	5	6/6/2019 9:07:13 PM	45394
Surr: Toluene-d8	79.4	70-130	D	%Rec	5	6/6/2019 9:07:13 PM	45394

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

CLIENT: GHD
Lab Order: 1906056
Project: Mangum No 1

Lab ID: 1906056-002
Collection Date: 5/29/2019 1:20:00 PM
Client Sample ID: S-11146006-052919-CN-MW-5-21'
Matrix: SOIL

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	25		mg/Kg	5	6/6/2019 10:33:19 PM	45394
Surr: BFB	100	70-130		%Rec	5	6/6/2019 10:33:19 PM	45394
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **BRM**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	6/6/2019 1:28:06 PM	45383
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	6/6/2019 1:28:06 PM	45383
Surr: DNOP	129	70-130		%Rec	1	6/6/2019 1:28:06 PM	45383
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.12		mg/Kg	5	6/6/2019 10:33:19 PM	45394
Toluene	ND	0.25		mg/Kg	5	6/6/2019 10:33:19 PM	45394
Ethylbenzene	ND	0.25		mg/Kg	5	6/6/2019 10:33:19 PM	45394
Xylenes, Total	ND	0.50		mg/Kg	5	6/6/2019 10:33:19 PM	45394
Surr: 1,2-Dichloroethane-d4	83.4	70-130		%Rec	5	6/6/2019 10:33:19 PM	45394
Surr: 4-Bromofluorobenzene	84.3	70-130		%Rec	5	6/6/2019 10:33:19 PM	45394
Surr: Dibromofluoromethane	100	70-130		%Rec	5	6/6/2019 10:33:19 PM	45394
Surr: Toluene-d8	83.5	70-130		%Rec	5	6/6/2019 10:33:19 PM	45394

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

CLIENT: GHD
Project: Mangum No 1
Lab Order: 1906056

Lab ID: 1906056-003
Collection Date: 5/30/2019 12:28:00 PM
Client Sample ID: S-11146006-053019-CN-MW-7-26'
Matrix: SOIL

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 8015D MOD: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	56	25		mg/Kg	5	6/6/2019 11:59:39 PM	45394
Surr: BFB	98.1	70-130		%Rec	5	6/6/2019 11:59:39 PM	45394
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **BRM**	
Diesel Range Organics (DRO)	18	9.9		mg/Kg	1	6/6/2019 1:50:27 PM	45383
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	6/6/2019 1:50:27 PM	45383
Surr: DNOP	108	70-130		%Rec	1	6/6/2019 1:50:27 PM	45383
EPA METHOD 8260B: VOLATILES SHORT LIST						Analyst: **RAA**	
Benzene	ND	0.12	D	mg/Kg	5	6/6/2019 11:59:39 PM	45394
Toluene	ND	0.25	D	mg/Kg	5	6/6/2019 11:59:39 PM	45394
Ethylbenzene	ND	0.25	D	mg/Kg	5	6/6/2019 11:59:39 PM	45394
Xylenes, Total	ND	0.50	D	mg/Kg	5	6/6/2019 11:59:39 PM	45394
Surr: 1,2-Dichloroethane-d4	79.7	70-130	D	%Rec	5	6/6/2019 11:59:39 PM	45394
Surr: 4-Bromofluorobenzene	83.1	70-130	D	%Rec	5	6/6/2019 11:59:39 PM	45394
Surr: Dibromofluoromethane	97.3	70-130	D	%Rec	5	6/6/2019 11:59:39 PM	45394
Surr: Toluene-d8	81.1	70-130	D	%Rec	5	6/6/2019 11:59:39 PM	45394

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1906056**

19-Jul-19

Client: GHD

Project: Mangum No 1

Sample ID: **MB-45383**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **45383**	RunNo: **60435**
Prep Date: **6/5/2019**	Analysis Date: **6/6/2019**	SeqNo: **2044124** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	12		10.00		120	70	130			

Sample ID: **LCS-45383**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **45383**	RunNo: **60435**
Prep Date: **6/5/2019**	Analysis Date: **6/6/2019**	SeqNo: **2044126** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	51	10	50.00	0	103	63.9	124			
Surr: DNOP	4.7		5.000		94.9	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1906056**

19-Jul-19

Client: GHD

Project: Mangum No 1

Sample ID: **mb-45394** SampType: **MBLK** TestCode: **EPA Method 8260B: Volatiles Short List**

Client ID: **PBS** Batch ID: **45394** RunNo: **60493**

Prep Date: **6/5/2019** Analysis Date: **6/6/2019** SeqNo: **2046257** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 1,2-Dichloroethane-d4	0.42		0.5000		83.7	70	130			
Surr: 4-Bromofluorobenzene	0.45		0.5000		90.5	70	130			
Surr: Dibromofluoromethane	0.51		0.5000		101	70	130			
Surr: Toluene-d8	0.40		0.5000		80.1	70	130			

Sample ID: **1906056-001ams** SampType: **MS** TestCode: **EPA Method 8260B: Volatiles Short List**

Client ID: **S-11146006-052919-** Batch ID: **45394** RunNo: **60493**

Prep Date: **6/5/2019** Analysis Date: **6/6/2019** SeqNo: **2047644** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.2	0.12	0.9747	0	127	68.9	131			
Toluene	1.2	0.24	0.9747	0	118	64.3	137			
Surr: 1,2-Dichloroethane-d4	1.9		2.437		79.4	70	130			
Surr: 4-Bromofluorobenzene	1.9		2.437		79.8	70	130			
Surr: Dibromofluoromethane	2.3		2.437		94.9	70	130			
Surr: Toluene-d8	1.9		2.437		79.1	70	130			

Sample ID: **1906056-001amsd** SampType: **MSD** TestCode: **EPA Method 8260B: Volatiles Short List**

Client ID: **S-11146006-052919-** Batch ID: **45394** RunNo: **60493**

Prep Date: **6/5/2019** Analysis Date: **6/6/2019** SeqNo: **2047645** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.3	0.12	0.9960	0	129	68.9	131	3.11	20	
Toluene	1.2	0.25	0.9960	0	124	64.3	137	6.97	20	
Surr: 1,2-Dichloroethane-d4	2.0		2.490		79.0	70	130	0	0	
Surr: 4-Bromofluorobenzene	2.0		2.490		79.8	70	130	0	0	
Surr: Dibromofluoromethane	2.4		2.490		95.9	70	130	0	0	
Surr: Toluene-d8	2.0		2.490		80.6	70	130	0	0	

Sample ID: **lcs-45394** SampType: **LCS** TestCode: **EPA Method 8260B: Volatiles Short List**

Client ID: **LCSS** Batch ID: **45394** RunNo: **60493**

Prep Date: **6/5/2019** Analysis Date: **6/6/2019** SeqNo: **2048785** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.99	0.025	1.000	0	99.5	70	130			
Toluene	0.91	0.050	1.000	0	90.7	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1906056**

19-Jul-19

Client: GHD

Project: Mangum No 1

Sample ID: **lcs-45394**	SampType: **LCS**	TestCode: **EPA Method 8260B: Volatiles Short List**
Client ID: **LCSS**	Batch ID: **45394**	RunNo: **60493**
Prep Date: **6/5/2019**	Analysis Date: **6/6/2019**	SeqNo: **2048785** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 1,2-Dichloroethane-d4	0.43		0.5000		85.6	70	130			
Surr: 4-Bromofluorobenzene	0.43		0.5000		86.7	70	130			
Surr: Dibromofluoromethane	0.51		0.5000		102	70	130			
Surr: Toluene-d8	0.40		0.5000		79.1	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1906056**

19-Jul-19

Client: GHD

Project: Mangum No 1

Sample ID: **1906056-002ams** SampType: **MS** TestCode: **EPA Method 8015D Mod: Gasoline Range**

Client ID: **S-11146006-052919-** Batch ID: **45394** RunNo: **60493**

Prep Date: **6/5/2019** Analysis Date: **6/6/2019** SeqNo: **2046297** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	38	25	24.93	0	151	68.2	135			S
Surr: BFB	2500		2493		99.8	70	130			

Sample ID: **1906056-002amsd** SampType: **MSD** TestCode: **EPA Method 8015D Mod: Gasoline Range**

Client ID: **S-11146006-052919-** Batch ID: **45394** RunNo: **60493**

Prep Date: **6/5/2019** Analysis Date: **6/6/2019** SeqNo: **2046298** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	130	25	24.78	0	527	68.2	135	110	20	RS
Surr: BFB	2500		2478		99.2	70	130	0	0	

Sample ID: **lcs-45394** SampType: **LCS** TestCode: **EPA Method 8015D Mod: Gasoline Range**

Client ID: **LCSS** Batch ID: **45394** RunNo: **60493**

Prep Date: **6/5/2019** Analysis Date: **6/6/2019** SeqNo: **2046319** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	21	5.0	25.00	0	82.7	70	130			
Surr: BFB	510		500.0		101	70	130			

Sample ID: **mb-45394** SampType: **MBLK** TestCode: **EPA Method 8015D Mod: Gasoline Range**

Client ID: **PBS** Batch ID: **45394** RunNo: **60493**

Prep Date: **6/5/2019** Analysis Date: **6/6/2019** SeqNo: **2046321** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	510		500.0		102	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: **GHD** Work Order Number: **1906056** RcptNo: **1**

Received By: **Erin Melendrez** **6/3/2019 12:00:00 PM**

Completed By: **Erin Melendrez** **6/3/2019 4:03:04 PM**

Reviewed By: DAD 6/4/19

Chain of Custody

1. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2. How was the sample delivered?	Client		

Log In

3. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
5. Sample(s) in proper container(s)?	Yes ☑	No ☐	
6. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
7. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
8. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
9. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
10. Were any sample containers received broken?	Yes ☐	No ☑	
11. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	# of preserved bottles checked for pH: (<2 or >12 unless noted)
12. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	Adjusted?
13. Is it clear what analyses were requested?	Yes ☑	No ☐	
14. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	Checked by: JC 6-4-19

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: _____ Date: _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

16. Additional remarks:

17. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	4.6	Good	Not Present			

Chain-of-Custody Record

Client: CHD Services

Mailing Address: 6121 Indian School Rd NE #200

Phone #: 5058840672

email or Fax#: Christine.Mathews@ghd.com

QA/QC Package:
☐ Standard ☐ Level 4 (Full Validation)

Accreditation:
☐ NELAP ☐ Other_____
☐ EDD (Type) _____

Turn-Around Time:
☐ XStandard ☐ Rush_____

Project Name: Mangum NO.1 ~~IMT Alamogordo~~ 7/19/18 per J.W.

Project #: 11146006

Project Manager: Jeff Walker

Sampler: CN

On Ice: ☐ XYes ☐ No

Sample Temperature: 4.4+0.2(CF)=4.6°C

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1906056	Analysis Request: Full List TPH EPA 8015	BTEX	Air Bubbles (Y or N)
5/29/2019	1310	S	S-11146006-052919-CN-17'-MW-5	1 4oz Jar		-001	X	X	
5/29/2019	1320	S	S-11146006-052919-CN-MW-5-21'	1 4oz Jar		-002	X	X	
5/30/2019	1228	S	S-11146006-053019-CN-MW-7-26'	1 4oz Jar		-003	X	X	

Date	Time	Relinquished by:	Received by:	Date	Time	Remarks:
6-3-19	~~1200~~			6/3/19	1200	
Date:	Time:	Relinquished by:	Received by:	Date	Time	

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Appendix D
Groundwater Laboratory Analytical Reports

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

March 21, 2019

HilCorp-Farmington, NM

Sample Delivery Group:	L1078890
Samples Received:	03/14/2019
Project Number:	
Description:	Mangum 1
Site:	MANGUM #1
Report To:	Clara Cardoza 382 Road 3100 Aztec, NM 87401

Entire Report Reviewed By: Daphne R Richards

Daphne Richards
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 National is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

TABLE OF CONTENTS

MW1 L1078890-01 GW

Collected by: Kurt | Collected date/time: 03/12/19 11:50 | Received date/time: 03/14/19 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1251856	1	03/19/19 15:33	03/19/19 16:55	AJS	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1252509	10	03/20/19 20:29	03/20/19 20:29	ELN	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG1250431	1	03/19/19 13:37	03/20/19 23:01	RDS	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1251138	100	03/17/19 12:27	03/17/19 12:27	TJJ	Mt. Juliet, TN

MW2 L1078890-02 GW

Collected by: Kurt | Collected date/time: 03/12/19 13:10 | Received date/time: 03/14/19 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1251856	1	03/19/19 15:33	03/19/19 16:55	AJS	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1252509	5	03/20/19 20:44	03/20/19 20:44	ELN	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG1250431	1	03/19/19 13:37	03/20/19 23:04	RDS	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1251138	10	03/17/19 12:47	03/17/19 12:47	TJJ	Mt. Juliet, TN

MW3 L1078890-03 GW

Collected by: Kurt | Collected date/time: 03/11/19 16:15 | Received date/time: 03/14/19 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1250511	1	03/16/19 16:46	03/16/19 17:51	AJS	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1252509	5	03/20/19 20:59	03/20/19 20:59	ELN	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG1250431	1	03/19/19 13:37	03/20/19 23:07	RDS	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1251138	1	03/17/19 13:07	03/17/19 13:07	TJJ	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1252335	10	03/19/19 21:41	03/19/19 21:41	DWR	Mt. Juliet, TN

MW4 L1078890-04 GW

Collected by: Kurt | Collected date/time: 03/12/19 10:20 | Received date/time: 03/14/19 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1251856	1	03/19/19 15:33	03/19/19 16:55	AJS	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1252509	20	03/20/19 21:14	03/20/19 21:14	ELN	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG1250431	1	03/19/19 13:37	03/20/19 23:10	RDS	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1252335	10	03/19/19 22:01	03/19/19 22:01	DWR	Mt. Juliet, TN

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.

Daphne R Richards

Daphne Richards
Project Manager

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	2040		50.0	1	03/19/2019 16:55	WG1251856

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	578		50.0	10	03/20/2019 20:29	WG1252509

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	0.143		0.100	1	03/20/2019 23:01	WG1250431
Manganese,Dissolved	0.890		0.0100	1	03/20/2019 23:01	WG1250431

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	ND		0.100	100	03/17/2019 12:27	WG1251138
Toluene	ND		0.100	100	03/17/2019 12:27	WG1251138
Ethylbenzene	ND		0.100	100	03/17/2019 12:27	WG1251138
Total Xylenes	ND		0.300	100	03/17/2019 12:27	WG1251138
(S) Toluene-d8	*114*		*80.0-120*		*03/17/2019 12:27*	WG1251138
(S) a,a,a-Trifluorotoluene	*111*		*80.0-120*		*03/17/2019 12:27*	WG1251138
(S) 4-Bromofluorobenzene	*97.5*		*77.0-126*		*03/17/2019 12:27*	WG1251138
(S) 1,2-Dichloroethane-d4	*97.0*		*70.0-130*		*03/17/2019 12:27*	WG1251138

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	15300		400	1	03/19/2019 16:55	WG1251856

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	64.7		25.0	5	03/20/2019 20:44	WG1252509

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	1.59		0.100	1	03/20/2019 23:04	WG1250431
Manganese,Dissolved	11.4		0.0100	1	03/20/2019 23:04	WG1250431

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.779		0.0100	10	03/17/2019 12:47	WG1251138
Toluene	ND		0.0100	10	03/17/2019 12:47	WG1251138
Ethylbenzene	0.0137		0.0100	10	03/17/2019 12:47	WG1251138
Total Xylenes	0.0519		0.0300	10	03/17/2019 12:47	WG1251138
(S) Toluene-d8	*94.4*		*80.0-120*		*03/17/2019 12:47*	WG1251138
(S) a,a,a-Trifluorotoluene	*107*		*80.0-120*		*03/17/2019 12:47*	WG1251138
(S) 4-Bromofluorobenzene	*90.9*		*77.0-126*		*03/17/2019 12:47*	WG1251138
(S) 1,2-Dichloroethane-d4	*97.9*		*70.0-130*		*03/17/2019 12:47*	WG1251138

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	1940		50.0	1	03/16/2019 17:51	WG1250511

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	95.6		25.0	5	03/20/2019 20:59	WG1252509

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	03/20/2019 23:07	WG1250431
Manganese,Dissolved	2.01		0.0100	1	03/20/2019 23:07	WG1250431

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	1.45		0.0100	10	03/19/2019 21:41	WG1252335
Toluene	ND		0.00100	1	03/17/2019 13:07	WG1251138
Ethylbenzene	0.0150		0.00100	1	03/17/2019 13:07	WG1251138
Total Xylenes	0.656		0.0300	10	03/19/2019 21:41	WG1252335
(S) Toluene-d8	*106*		*80.0-120*		*03/17/2019 13:07*	WG1251138
(S) Toluene-d8	*87.8*		*80.0-120*		*03/19/2019 21:41*	WG1252335
(S) a,a,a-Trifluorotoluene	*103*		*80.0-120*		*03/17/2019 13:07*	WG1251138
(S) a,a,a-Trifluorotoluene	*116*		*80.0-120*		*03/19/2019 21:41*	WG1252335
(S) 4-Bromofluorobenzene	*112*		*77.0-126*		*03/17/2019 13:07*	WG1251138
(S) 4-Bromofluorobenzene	*91.6*		*77.0-126*		*03/19/2019 21:41*	WG1252335
(S) 1,2-Dichloroethane-d4	*101*		*70.0-130*		*03/17/2019 13:07*	WG1251138
(S) 1,2-Dichloroethane-d4	*85.1*		*70.0-130*		*03/19/2019 21:41*	WG1252335

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	2390		50.0	1	03/19/2019 16:55	WG1251856

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	1240		100	20	03/20/2019 21:14	WG1252509

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	03/20/2019 23:10	WG1250431
Manganese,Dissolved	0.843		0.0100	1	03/20/2019 23:10	WG1250431

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.0448		0.0100	10	03/19/2019 22:01	WG1252335
Toluene	ND		0.0100	10	03/19/2019 22:01	WG1252335
Ethylbenzene	0.0265		0.0100	10	03/19/2019 22:01	WG1252335
Total Xylenes	1.85		0.0300	10	03/19/2019 22:01	WG1252335
(S) Toluene-d8	*91.9*		*80.0-120*		*03/19/2019 22:01*	WG1252335
(S) a,a,a-Trifluorotoluene	*119*		*80.0-120*		*03/19/2019 22:01*	WG1252335
(S) 4-Bromofluorobenzene	*156*	J1	*77.0-126*		*03/19/2019 22:01*	WG1252335
(S) 1,2-Dichloroethane-d4	*90.4*		*70.0-130*		*03/19/2019 22:01*	WG1252335

Method Blank (MB)

(MB) R3392620-1 03/16/19 17:51

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dissolved Solids	U		2.82	10.0

L1078023-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1078023-01 03/16/19 17:51 • (DUP) R3392620-3 03/16/19 17:51

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	252	255	1	1.18		5

Laboratory Control Sample (LCS)

(LCS) R3392620-2 03/16/19 17:51

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800	8530	96.9	85.0-115	

Method Blank (MB)

(MB) R3393921-1 03/19/19 16:55

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dissolved Solids	U		2.82	10.0

Laboratory Control Sample (LCS)

(LCS) R3393921-2 03/19/19 16:55

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800	7960	90.5	85.0-115	

Method Blank (MB)

(MB) R3393631-1 03/20/19 15:17

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Sulfate	U		0.0774	5.00

L1078837-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1078837-01 03/20/19 18:45 • (DUP) R3393631-3 03/20/19 19:00

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	1960	1970	1	0.268	E	15

L1078975-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1078975-03 03/21/19 00:13 • (DUP) R3393631-6 03/21/19 00:28

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	12.3	12.3	1	0.117		15

Laboratory Control Sample (LCS)

(LCS) R3393631-2 03/20/19 15:32

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Sulfate	40.0	40.0	100	80.0-120	

L1078837-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1078837-01 03/20/19 18:45 • (MS) R3393631-4 03/20/19 19:15 • (MSD) R3393631-5 03/20/19 19:30

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Sulfate	50.0	1960	1940	1940	0.000	0.000	1	80.0-120	E V	E V	0.0824	15

L1078975-03 Original Sample (OS) • Matrix Spike (MS)

(OS) L1078975-03 03/21/19 00:13 • (MS) R3393631-7 03/21/19 00:43

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Sulfate	50.0	12.3	63.7	103	1	80.0-120	

Method Blank (MB)

(MB) R3393811-1 03/21/19 09:25

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Iron,Dissolved	U		0.0141	0.100
Manganese,Dissolved	U		0.00120	0.0100

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

(LCS) R3393811-2 03/21/19 09:27 • (LCSD) R3393811-3 03/21/19 09:30

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 %
Iron,Dissolved	10.0	10.4	9.95	104	99.5	80.0-120			4.25	20
Manganese,Dissolved	1.00	1.02	1.01	102	101	80.0-120			1.20	20

L1078441-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1078441-03 03/21/19 09:33 • (MS) R3393811-5 03/21/19 09:38 • (MSD) R3393811-6 03/21/19 09:41

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Iron,Dissolved	10.0	U	10.1	9.94	101	99.4	1	75.0-125			1.82	20
Manganese,Dissolved	1.00	0.00605	1.01	0.982	100	97.6	1	75.0-125			2.41	20

Method Blank (MB)

(MB) R3393095-3 03/17/19 06:36

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000331	0.00100
Ethylbenzene	U		0.000384	0.00100
Toluene	U		0.000412	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*103*			*80.0-120*
(S) a,a,a-Trifluorotoluene	*99.3*			*80.0-120*
(S) 4-Bromofluorobenzene	*104*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*90.9*			*70.0-130*

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

(LCS) R3393095-1 03/17/19 05:33 • (LCSD) R3393095-2 03/17/19 05:54

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 %
Benzene	0.0250	0.0260	0.0250	104	100	70.0-123			4.05	20
Ethylbenzene	0.0250	0.0257	0.0261	103	104	79.0-123			1.64	20
Toluene	0.0250	0.0245	0.0250	97.8	100	79.0-120			2.35	20
Xylenes, Total	0.0750	0.0764	0.0776	102	103	79.0-123			1.56	20
(S) Toluene-d8				*97.4*	*102*	*80.0-120*				
(S) a,a,a-Trifluorotoluene				*105*	*101*	*80.0-120*				
(S) 4-Bromofluorobenzene				*98.9*	*106*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*98.8*	*103*	*70.0-130*				

Method Blank (MB)

(MB) R3393498-2 03/19/19 20:20

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000331	0.00100
Ethylbenzene	U		0.000384	0.00100
Toluene	U		0.000412	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*91.6*			*80.0-120*
(S) a,a,a-Trifluorotoluene	*115*			*80.0-120*
(S) 4-Bromofluorobenzene	*83.7*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*79.7*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3393498-1 03/19/19 19:39

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Benzene	0.0250	0.0288	115	70.0-123	
Ethylbenzene	0.0250	0.0258	103	79.0-123	
Toluene	0.0250	0.0248	99.2	79.0-120	
Xylenes, Total	0.0750	0.0740	98.7	79.0-123	
(S) Toluene-d8			*88.4*	*80.0-120*	
(S) a,a,a-Trifluorotoluene			*120*	*80.0-120*	
(S) 4-Bromofluorobenzene			*93.0*	*77.0-126*	
(S) 1,2-Dichloroethane-d4			*89.1*	*70.0-130*	

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.

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.

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
V	The sample concentration is too high to evaluate accurate spike recoveries.

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
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
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

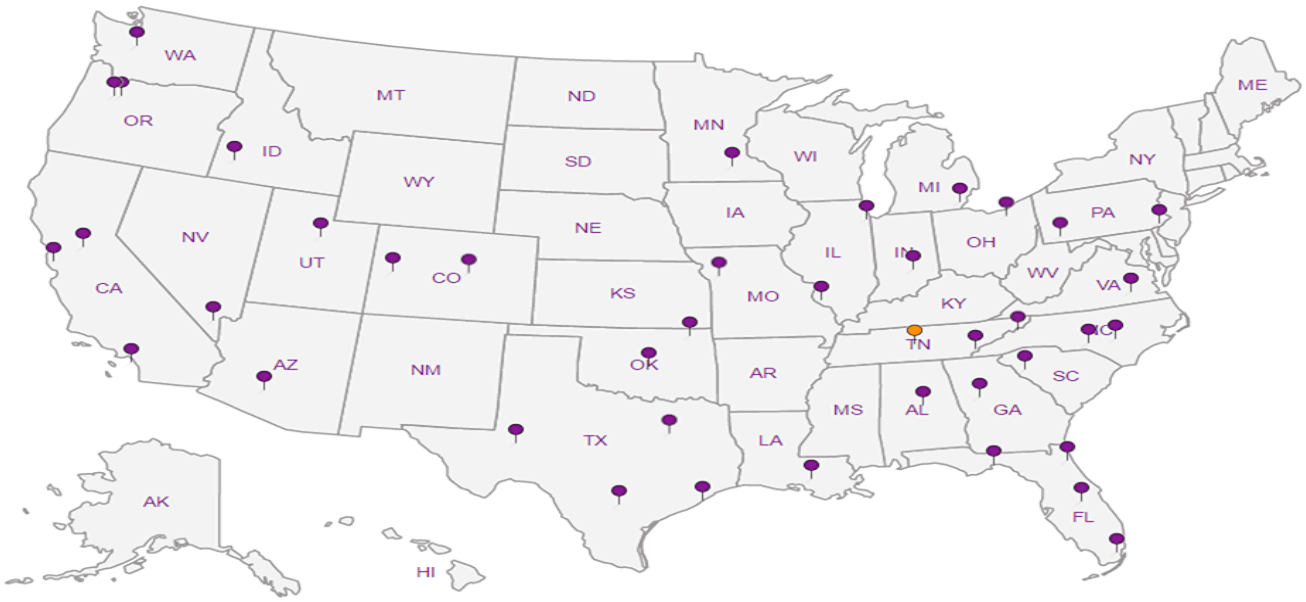
Third Party Federal Accreditations

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.



HilCorp-Farmington, NM

382 Road 3100
Aztec, NM 87401

Billing Information:
PO Box 61529
Houston, TX 77208
khoekstra@hilcorp.com

Email To: jdeal@hilcorp.com
ccardoza@hilcorp.com;khoekstra@hilcorp.com

Report to: **Clara Cardoza**

Project Description: **Mangum 1**

City/State Collected:

Phone: **505-486-9543**
Fax:

Client Project #

Lab Project # **HILCORANM-MANGUM**

Collected by (print): KYRT

Site/Facility ID # MANGUM # 1

P.O. #

Collected by (signature): Kurt Hoekstra

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day X Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Pres Chk

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace Analytical® National Center for Testing & Innovation

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

L# L1078890

E113

Acctnum: **HILCORANM**
Template: **T146865**
Prelogin: **P696221**
TSR: **288 - Daphne Richards**
PB:

Shipped Via: **FedEX Ground**

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Diss Fe, Mn, TDS 250mlHDPE-NoPres NOT FIELD FILTERED	SULFATE 125mlHDPE-NoPres	V8260BTEX 40mlAmb-HCl	Remarks	Sample # (lab only)
MW1		GW	15.04	3-12-19	11:50	5	X	X	X		-01
MW2		GW	17.56	3-12-19	1:10	5	X	X	X		02
MW3		GW	18.69	3-11-19	4:15	5	X	X	X		03
MW4		GW	19.63	3-12-19	10:20	5	X	X	X		04

* 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 # 4794 0829 9601

Sample Receipt Checklist
COC Seal Present/Intact: NP ___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

RAD SCREEN: <0.5 mR/hr

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Kurt Hoekstra	3-13-19	9:30	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)
			ASM

Trip Blank Received: Yes / No
HCL / MeoH
TBR

Temp: 4.5 °F °C
2.8+.2=3.0

Bottles Received: 20

Date: 3/14/19 Time: 930

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

June 05, 2019

HilCorp-Farmington, NM

Sample Delivery Group:	L1102662
Samples Received:	05/25/2019
Project Number:	MANGUM #1
Description:	Mangum #1
Site:	MANGUM #1
Report To:	Kurt Hoekstra 382 Road 3100 Aztec, NM 87401

Entire Report Reviewed By:

Daphne R Richards

Daphne Richards
Project Manager

TABLE OF CONTENTS

MW1 L1102662-01 GW

Collected by: Kurt | Collected date/time: 05/22/19 03:05 | Received date/time: 05/25/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1287425	1	05/29/19 09:09	05/29/19 10:01	MCG	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1290504	10	06/04/19 21:33	06/04/19 21:33	ELN	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG1287661	1	05/29/19 15:13	05/30/19 13:20	CCE	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1290353	1	06/04/19 03:55	06/04/19 03:55	JHH	Mt. Juliet, TN

MW2 L1102662-02 GW

Collected by: Kurt | Collected date/time: 05/22/19 09:30 | Received date/time: 05/25/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1287425	1	05/29/19 09:09	05/29/19 10:01	MMF	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1290504	5	06/04/19 21:51	06/04/19 21:51	ELN	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG1287661	1	05/29/19 15:13	05/30/19 15:46	CCE	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1289530	5	06/01/19 15:57	06/01/19 15:57	ACE	Mt. Juliet, TN

MW3 L1102662-03 GW

Collected by: Kurt | Collected date/time: 05/22/19 12:35 | Received date/time: 05/25/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1287425	1	05/29/19 09:09	05/29/19 10:01	MMF	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1290504	1	06/05/19 09:59	06/05/19 09:59	ELN	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG1287661	1	05/29/19 15:13	05/30/19 15:49	CCE	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1289530	10	06/01/19 16:18	06/01/19 16:18	ACE	Mt. Juliet, TN

MW4 L1102662-04 GW

Collected by: Kurt | Collected date/time: 05/22/19 02:00 | Received date/time: 05/25/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1287425	1	05/29/19 09:09	05/29/19 10:01	MMF	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1290504	20	06/04/19 22:26	06/04/19 22:26	ELN	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG1287661	1	05/29/19 15:13	05/30/19 15:52	CCE	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1289530	10	06/01/19 16:38	06/01/19 16:38	ACE	Mt. Juliet, TN

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.

Daphne R Richards

Daphne Richards
Project Manager

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	2210		50.0	1	05/29/2019 10:01	WG1287425

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	598		50.0	10	06/04/2019 21:33	WG1290504

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	05/30/2019 13:20	WG1287661
Manganese,Dissolved	0.732		0.0100	1	05/30/2019 13:20	WG1287661

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	ND		0.00100	1	06/04/2019 03:55	WG1290353
Toluene	ND		0.00100	1	06/04/2019 03:55	WG1290353
Ethylbenzene	0.00619		0.00100	1	06/04/2019 03:55	WG1290353
Total Xylenes	0.0119		0.00300	1	06/04/2019 03:55	WG1290353
(S) Toluene-d8	*109*		*80.0-120*		*06/04/2019 03:55*	WG1290353
(S) a,a,a-Trifluorotoluene	*1.17*	J2	*80.0-120*		*06/04/2019 03:55*	WG1290353
(S) 4-Bromofluorobenzene	*176*	J1	*77.0-126*		*06/04/2019 03:55*	WG1290353
(S) 1,2-Dichloroethane-d4	*94.6*		*70.0-130*		*06/04/2019 03:55*	WG1290353

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	15300		200	1	05/29/2019 10:01	WG1287425

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	29.6		25.0	5	06/04/2019 21:51	WG1290504

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	4.30		0.100	1	05/30/2019 15:46	WG1287661
Manganese,Dissolved	7.77		0.0100	1	05/30/2019 15:46	WG1287661

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.435		0.00500	5	06/01/2019 15:57	WG1289530
Toluene	ND		0.00500	5	06/01/2019 15:57	WG1289530
Ethylbenzene	0.0245		0.00500	5	06/01/2019 15:57	WG1289530
Total Xylenes	0.0533		0.0150	5	06/01/2019 15:57	WG1289530
(S) Toluene-d8	*90.4*		*80.0-120*		*06/01/2019 15:57*	WG1289530
(S) a,a,a-Trifluorotoluene	*106*		*80.0-120*		*06/01/2019 15:57*	WG1289530
(S) 4-Bromofluorobenzene	*111*		*77.0-126*		*06/01/2019 15:57*	WG1289530
(S) 1,2-Dichloroethane-d4	*102*		*70.0-130*		*06/01/2019 15:57*	WG1289530

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	2540		50.0	1	05/29/2019 10:01	WG1287425

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	23.7		5.00	1	06/05/2019 09:59	WG1290504

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	0.278		0.100	1	05/30/2019 15:49	WG1287661
Manganese,Dissolved	1.03		0.0100	1	05/30/2019 15:49	WG1287661

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	1.84		0.0100	10	06/01/2019 16:18	WG1289530
Toluene	ND		0.0100	10	06/01/2019 16:18	WG1289530
Ethylbenzene	0.120		0.0100	10	06/01/2019 16:18	WG1289530
Total Xylenes	1.17		0.0300	10	06/01/2019 16:18	WG1289530
(S) Toluene-d8	*90.2*		*80.0-120*		*06/01/2019 16:18*	WG1289530
(S) a,a,a-Trifluorotoluene	*109*		*80.0-120*		*06/01/2019 16:18*	WG1289530
(S) 4-Bromofluorobenzene	*105*		*77.0-126*		*06/01/2019 16:18*	WG1289530
(S) 1,2-Dichloroethane-d4	*102*		*70.0-130*		*06/01/2019 16:18*	WG1289530

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Dissolved Solids	2700	J3	50.0	1	05/29/2019 10:01	WG1287425

Wet Chemistry by Method 9056A

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Sulfate	1090		100	20	06/04/2019 22:26	WG1290504

Metals (ICP) by Method 6010B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Iron,Dissolved	ND		0.100	1	05/30/2019 15:52	WG1287661
Manganese,Dissolved	0.867		0.0100	1	05/30/2019 15:52	WG1287661

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	0.0496		0.0100	10	06/01/2019 16:38	WG1289530
Toluene	ND		0.0100	10	06/01/2019 16:38	WG1289530
Ethylbenzene	0.0309		0.0100	10	06/01/2019 16:38	WG1289530
Total Xylenes	1.84		0.0300	10	06/01/2019 16:38	WG1289530
(S) Toluene-d8	*105*		*80.0-120*		*06/01/2019 16:38*	WG1289530
(S) a,a,a-Trifluorotoluene	*111*		*80.0-120*		*06/01/2019 16:38*	WG1289530
(S) 4-Bromofluorobenzene	*163*	J1	*77.0-126*		*06/01/2019 16:38*	WG1289530
(S) 1,2-Dichloroethane-d4	*101*		*70.0-130*		*06/01/2019 16:38*	WG1289530

Method Blank (MB)

(MB) R3416415-1 05/29/19 10:01

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dissolved Solids	U		2.82	10.0

L1102662-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1102662-04 05/29/19 10:01 • (DUP) R3416415-3 05/29/19 10:01

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	2700	2510	1	7.49	J3	5

Laboratory Control Sample (LCS)

(LCS) R3416415-2 05/29/19 10:01

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800	8810	100	85.0-115	

Method Blank (MB)

(MB) R3417903-1 06/04/19 17:33

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Sulfate	U		0.0774	5.00

L1102624-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1102624-05 06/04/19 18:37 • (DUP) R3417903-3 06/04/19 18:54

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	6.23	6.25	1	0.361		15

Original Sample (OS) • Duplicate (DUP)

(OS) • (DUP) R3417903-6 06/04/19 23:01

Analyte	Original Result	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate		916	1	0.397	E	15

Laboratory Control Sample (LCS)

(LCS) R3417903-2 06/04/19 17:51

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Sulfate	40.0	40.5	101	80.0-120	

L1102624-05 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1102624-05 06/04/19 18:37 • (MS) R3417903-4 06/04/19 19:12 • (MSD) R3417903-5 06/04/19 19:30

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Sulfate	50.0	6.23	55.8	56.0	99.1	99.5	1	80.0-120			0.354	15

Original Sample (OS) • Matrix Spike (MS)

(OS) • (MS) R3417903-7 06/04/19 23:19

Analyte	Spike Amount mg/l	Original Result	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Sulfate	50.0		881	0.000	1	80.0-120	E V

Method Blank (MB)

(MB) R3416283-1 05/30/19 13:12

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Iron,Dissolved	U		0.0141	0.100
Manganese,Dissolved	U		0.00120	0.0100

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

(LCS) R3416283-2 05/30/19 13:15 • (LCSD) R3416283-3 05/30/19 13:17

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 %
Iron,Dissolved	10.0	10.5	10.5	105	105	80.0-120			0.821	20
Manganese,Dissolved	1.00	0.913	0.899	91.3	89.9	80.0-120			1.48	20

L1102662-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1102662-01 05/30/19 13:20 • (MS) R3416283-5 05/30/19 13:25 • (MSD) R3416283-6 05/30/19 13:28

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Iron,Dissolved	10.0	ND	10.6	10.8	105	107	1	75.0-125			1.87	20
Manganese,Dissolved	1.00	0.732	1.62	1.62	88.8	89.1	1	75.0-125			0.239	20

Method Blank (MB)

(MB) R3417372-2 06/01/19 10:00

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000331	0.00100
Ethylbenzene	U		0.000384	0.00100
Toluene	U		0.000412	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*90.4*			*80.0-120*
(S) a,a,a-Trifluorotoluene	*107*			*80.0-120*
(S) 4-Bromofluorobenzene	*104*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*99.5*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3417372-1 06/01/19 09:20

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Benzene	0.0250	0.0291	116	70.0-123	
Ethylbenzene	0.0250	0.0266	107	79.0-123	
Toluene	0.0250	0.0239	95.7	79.0-120	
Xylenes, Total	0.0750	0.0741	98.8	79.0-123	
(S) Toluene-d8			*92.0*	*80.0-120*	
(S) a,a,a-Trifluorotoluene			*108*	*80.0-120*	
(S) 4-Bromofluorobenzene			*108*	*77.0-126*	
(S) 1,2-Dichloroethane-d4			*110*	*70.0-130*	

Method Blank (MB)

(MB) R3417613-3 06/03/19 19:39

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000331	0.00100
Ethylbenzene	U		0.000384	0.00100
Toluene	0.000481	J	0.000412	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*107*			*80.0-120*
(S) a,a,a-Trifluorotoluene	*1.20*	J2		*80.0-120*
(S) 4-Bromofluorobenzene	*101*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*92.2*			*70.0-130*

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

(LCS) R3417613-1 06/03/19 18:40 • (LCSD) R3417613-2 06/03/19 19:00

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 %
Benzene	0.0250	0.0231	0.0229	92.2	91.4	70.0-123			0.900	20
Ethylbenzene	0.0250	0.0247	0.0250	98.8	100	79.0-123			1.25	20
Toluene	0.0250	0.0241	0.0243	96.5	97.2	79.0-120			0.694	20
Xylenes, Total	0.0750	0.0727	0.0733	96.9	97.7	79.0-123			0.822	20
(S) Toluene-d8				*107*	*107*	*80.0-120*				
(S) a,a,a-Trifluorotoluene				*1.21*	*1.34*	*80.0-120*	J2	J2		
(S) 4-Bromofluorobenzene				*102*	*102*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*99.9*	*98.9*	*70.0-130*				

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.

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.

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.
V	The sample concentration is too high to evaluate accurate spike recoveries.

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
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
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

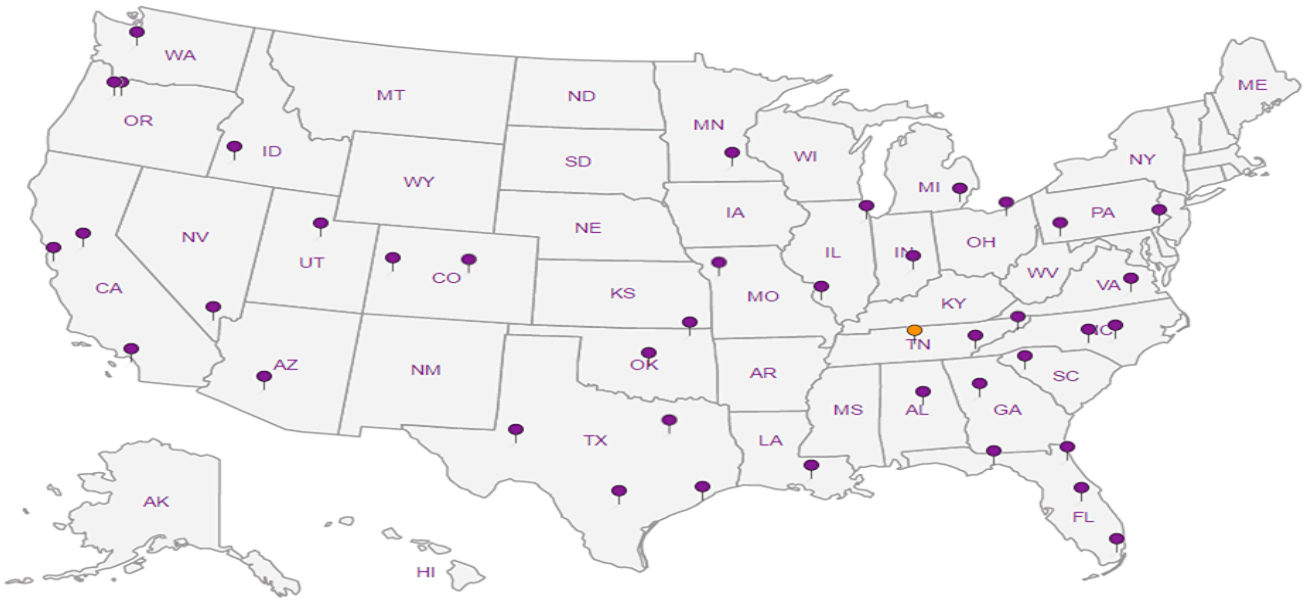
Third Party Federal Accreditations

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.



HilCorp-Farmington, NM

382 Road 3100
Aztec, NM 87401

Billing Information:

Pres Chk

ccardoza@hilcorp.com
jdeal@hilcorp.com

Report to: **Kurt Hoekstra**

Email To: **khoekstra@hilcorp.com**

Project Description: **Mangum 1**

City/State Collected:

Phone: **505-486-9543**
Fax:

Client Project #

Lab Project #

Collected by (print): KURT

Site/Facility ID # MANGUM #1

P.O. #

Collected by (signature): Kurt Hoekstra

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day X Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	V8260BTEX/ 40mL amber/ HCl	Dissolved, Fe, Mn/ 250mL HDPE/ No Pres	TDS, Sulfates/ 250ml HDPE/ No Pres	No Samples Field Filtered	Remarks	Sample # (lab only)
MW1		GW		5-22	3:05	4	X	X	X	X		-01
MW2		GW		5-23	9:30	4	X	X	X	X		-02
MW3		GW		5-22	12:35	4	X	X	X	X		-03
MW4		GW		5-22	2:00	4	X	X	X	X		-04

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

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

L # 1102662

G243

Acctnum: **HILCORANM**

Template:

Prelogin:

TSR: **Daphne Richards**

PB:

Shipped Via:

* 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 #

Sample Receipt Checklist
COC Seal Present/Intact: NP __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

RAD SCREEN: <0.5 mR/hr

	Date:	Time:	
Relinquished by : (Signature) Kurt Hoekstra	5-24-19	6:40	Received by: (Signature)
Relinquished by : (Signature)			Received by: (Signature)
Relinquished by : (Signature)			Received for lab by: (Signature)

Trip Blank Received: Yes / No
HCL / MeoH
TBR

Temp: A3BF °C 1.3+.1=1.4

Bottles Received: 16

Date: 5/25/19 Time: 845

If preservation required by Login: Date/Time

Hold:

Condition: NCF OK

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

September 04, 2019

HilCorp-Farmington, NM

Sample Delivery Group:	L1133291
Samples Received:	08/27/2019
Project Number:	MANGUM 1
Description:	Mangum 1
Site:	MANGUM 1
Report To:	Kurt Hoekstra 382 Road 3100 Aztec, NM 87401

Entire Report Reviewed By:

Daphne R Richards

Daphne Richards
Project Manager

TABLE OF CONTENTS

MW1 L1133291-01 GW

Collected by: Kurt | Collected date/time: 08/22/19 11:45 | Received date/time: 08/27/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1335941	1	08/28/19 08:25	08/28/19 10:04	JD	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1336828	20	08/29/19 11:53	08/29/19 11:53	ST	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1336032	1	08/28/19 09:34	08/28/19 18:03	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338473	1	09/01/19 03:49	09/01/19 03:49	TJJ	Mt. Juliet, TN

MW2 L1133291-02 GW

Collected by: Kurt | Collected date/time: 08/22/19 13:15 | Received date/time: 08/27/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1335941	1	08/28/19 08:25	08/28/19 10:04	JD	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1336828	1	08/29/19 12:46	08/29/19 12:46	ST	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1336032	1	08/28/19 09:34	08/28/19 18:08	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338473	1	09/01/19 04:10	09/01/19 04:10	TJJ	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338688	5	09/02/19 08:01	09/02/19 08:01	JCP	Mt. Juliet, TN

MW3 L1133291-03 GW

Collected by: Kurt | Collected date/time: 08/22/19 15:10 | Received date/time: 08/27/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1335941	1	08/28/19 08:25	08/28/19 10:04	JD	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1336828	5	08/29/19 13:03	08/29/19 13:03	ST	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1336032	1	08/28/19 09:34	08/28/19 18:12	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338473	1	09/01/19 04:32	09/01/19 04:32	TJJ	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338688	5	09/02/19 08:23	09/02/19 08:23	JCP	Mt. Juliet, TN

MW4 L1133291-04 GW

Collected by: Kurt | Collected date/time: 08/22/19 10:50 | Received date/time: 08/27/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1335941	1	08/28/19 08:25	08/28/19 10:04	JD	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1336828	20	08/29/19 13:21	08/29/19 13:21	ST	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1336032	1	08/28/19 09:34	08/28/19 18:17	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338473	1	09/01/19 04:54	09/01/19 04:54	TJJ	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338688	10	09/02/19 08:45	09/02/19 08:45	JCP	Mt. Juliet, TN

MW5 L1133291-05 GW

Collected by: Kurt | Collected date/time: 08/23/19 10:15 | Received date/time: 08/27/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1335941	1	08/28/19 08:25	08/28/19 10:04	JD	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1336828	50	08/29/19 13:39	08/29/19 13:39	ST	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1336032	1	08/28/19 09:34	08/28/19 18:22	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338473	1	09/01/19 05:16	09/01/19 05:16	TJJ	Mt. Juliet, TN

MW6 L1133291-06 GW

Collected by: Kurt | Collected date/time: 08/23/19 12:00 | Received date/time: 08/27/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1335941	1	08/28/19 08:25	08/28/19 10:04	JD	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1336828	5	08/29/19 13:56	08/29/19 13:56	ST	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1336032	1	08/28/19 09:34	08/28/19 18:26	LD	Mt. Juliet, TN

MW6 L1133291-06 GW

Collected by: Kurt
Collected date/time: 08/23/19 12:00
Received date/time: 08/27/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338473	1	09/01/19 05:38	09/01/19 05:38	TJJ	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338688	5	09/02/19 09:08	09/02/19 09:08	JCP	Mt. Juliet, TN

MW7 L1133291-07 GW

Collected by: Kurt
Collected date/time: 08/23/19 14:00
Received date/time: 08/27/19 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1335941	1	08/28/19 08:25	08/28/19 10:04	JD	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1336828	50	08/29/19 14:14	08/29/19 14:14	ST	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1336032	1	08/28/19 09:34	08/28/19 18:31	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1338473	1	09/01/19 06:00	09/01/19 06:00	TJJ	Mt. Juliet, TN

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.

Daphne R Richards

Daphne Richards
Project Manager

Sample Delivery Group (SDG) Narrative

VOC pH outside of method requirement.

Lab Sample ID	Project Sample ID	Method
L1133291-01	MW1	8260B
L1133291-02	MW2	8260B
L1133291-03	MW3	8260B
L1133291-04	MW4	8260B
L1133291-05	MW5	8260B
L1133291-06	MW6	8260B
L1133291-07	MW7	8260B

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	3010	J3	50.0	1	08/28/2019 10:04	WG1335941

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	1260		100	20	08/29/2019 11:53	WG1336828

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	08/28/2019 18:03	WG1336032
Manganese,Dissolved	1.59		0.00500	1	08/28/2019 18:03	WG1336032

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	ND		0.00100	1	09/01/2019 03:49	WG1338473
Toluene	ND		0.00100	1	09/01/2019 03:49	WG1338473
Ethylbenzene	0.00525		0.00100	1	09/01/2019 03:49	WG1338473
Total Xylenes	0.00945		0.00300	1	09/01/2019 03:49	WG1338473
(S) Toluene-d8	*117*		*80.0-120*		*09/01/2019 03:49*	WG1338473
(S) 4-Bromofluorobenzene	*162*	J1	*77.0-126*		*09/01/2019 03:49*	WG1338473
(S) 1,2-Dichloroethane-d4	*92.1*		*70.0-130*		*09/01/2019 03:49*	WG1338473

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Dissolved Solids	12700		200	1	08/28/2019 10:04	WG1335941

Wet Chemistry by Method 9056A

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Sulfate	8.01		5.00	1	08/29/2019 12:46	WG1336828

Metals (ICPMS) by Method 6020

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Iron,Dissolved	0.426		0.100	1	08/28/2019 18:08	WG1336032
Manganese,Dissolved	7.27		0.00500	1	08/28/2019 18:08	WG1336032

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	0.170		0.00500	5	09/02/2019 08:01	WG1338688
Toluene	ND		0.00100	1	09/01/2019 04:10	WG1338473
Ethylbenzene	0.0265		0.00100	1	09/01/2019 04:10	WG1338473
Total Xylenes	0.0153		0.00300	1	09/01/2019 04:10	WG1338473
(S) Toluene-d8	*98.7*		*80.0-120*		*09/01/2019 04:10*	WG1338473
(S) Toluene-d8	*83.1*		*80.0-120*		*09/02/2019 08:01*	WG1338688
(S) 4-Bromofluorobenzene	*136*	J1	*77.0-126*		*09/01/2019 04:10*	WG1338473
(S) 4-Bromofluorobenzene	*98.5*		*77.0-126*		*09/02/2019 08:01*	WG1338688
(S) 1,2-Dichloroethane-d4	*86.9*		*70.0-130*		*09/01/2019 04:10*	WG1338473
(S) 1,2-Dichloroethane-d4	*100*		*70.0-130*		*09/02/2019 08:01*	WG1338688

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	1860		50.0	1	08/28/2019 10:04	WG1335941

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	119		25.0	5	08/29/2019 13:03	WG1336828

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	08/28/2019 18:12	WG1336032
Manganese,Dissolved	1.62		0.00500	1	08/28/2019 18:12	WG1336032

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.623		0.00500	5	09/02/2019 08:23	WG1338688
Toluene	ND		0.00100	1	09/01/2019 04:32	WG1338473
Ethylbenzene	0.0193		0.00100	1	09/01/2019 04:32	WG1338473
Total Xylenes	0.387		0.00300	1	09/01/2019 04:32	WG1338473
(S) Toluene-d8	*106*		*80.0-120*		*09/01/2019 04:32*	WG1338473
(S) Toluene-d8	*92.4*		*80.0-120*		*09/02/2019 08:23*	WG1338688
(S) 4-Bromofluorobenzene	*117*		*77.0-126*		*09/01/2019 04:32*	WG1338473
(S) 4-Bromofluorobenzene	*100*		*77.0-126*		*09/02/2019 08:23*	WG1338688
(S) 1,2-Dichloroethane-d4	*87.0*		*70.0-130*		*09/01/2019 04:32*	WG1338473
(S) 1,2-Dichloroethane-d4	*100*		*70.0-130*		*09/02/2019 08:23*	WG1338688

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	2290		50.0	1	08/28/2019 10:04	WG1335941

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	1270		100	20	08/29/2019 13:21	WG1336828

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	08/28/2019 18:17	WG1336032
Manganese,Dissolved	0.737		0.00500	1	08/28/2019 18:17	WG1336032

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.0336		0.00100	1	09/01/2019 04:54	WG1338473
Toluene	0.00132		0.00100	1	09/01/2019 04:54	WG1338473
Ethylbenzene	0.0113		0.00100	1	09/01/2019 04:54	WG1338473
Total Xylenes	1.05		0.0300	10	09/02/2019 08:45	WG1338688
(S) Toluene-d8	*122*	J1	*80.0-120*		*09/01/2019 04:54*	WG1338473
(S) Toluene-d8	*90.4*		*80.0-120*		*09/02/2019 08:45*	WG1338688
(S) 4-Bromofluorobenzene	*123*		*77.0-126*		*09/01/2019 04:54*	WG1338473
(S) 4-Bromofluorobenzene	*93.4*		*77.0-126*		*09/02/2019 08:45*	WG1338688
(S) 1,2-Dichloroethane-d4	*86.1*		*70.0-130*		*09/01/2019 04:54*	WG1338473
(S) 1,2-Dichloroethane-d4	*102*		*70.0-130*		*09/02/2019 08:45*	WG1338688

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	6620		100	1	08/28/2019 10:04	WG1335941

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	3660		250	50	08/29/2019 13:39	WG1336828

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	08/28/2019 18:22	WG1336032
Manganese,Dissolved	3.33		0.00500	1	08/28/2019 18:22	WG1336032

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	ND		0.00100	1	09/01/2019 05:16	WG1338473
Toluene	ND		0.00100	1	09/01/2019 05:16	WG1338473
Ethylbenzene	0.00103		0.00100	1	09/01/2019 05:16	WG1338473
Total Xylenes	0.00673		0.00300	1	09/01/2019 05:16	WG1338473
(S) Toluene-d8	*109*		*80.0-120*		*09/01/2019 05:16*	WG1338473
(S) 4-Bromofluorobenzene	*104*		*77.0-126*		*09/01/2019 05:16*	WG1338473
(S) 1,2-Dichloroethane-d4	*88.9*		*70.0-130*		*09/01/2019 05:16*	WG1338473

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	1750		50.0	1	08/28/2019 10:04	WG1335941

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	168		25.0	5	08/29/2019 13:56	WG1336828

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	08/28/2019 18:26	WG1336032
Manganese,Dissolved	2.51		0.00500	1	08/28/2019 18:26	WG1336032

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.213		0.00500	5	09/02/2019 09:08	WG1338688
Toluene	ND		0.00100	1	09/01/2019 05:38	WG1338473
Ethylbenzene	0.145		0.00100	1	09/01/2019 05:38	WG1338473
Total Xylenes	0.806		0.0150	5	09/02/2019 09:08	WG1338688
(S) Toluene-d8	*102*		*80.0-120*		*09/01/2019 05:38*	WG1338473
(S) Toluene-d8	*91.5*		*80.0-120*		*09/02/2019 09:08*	WG1338688
(S) 4-Bromofluorobenzene	*103*		*77.0-126*		*09/01/2019 05:38*	WG1338473
(S) 4-Bromofluorobenzene	*92.0*		*77.0-126*		*09/02/2019 09:08*	WG1338688
(S) 1,2-Dichloroethane-d4	*88.1*		*70.0-130*		*09/01/2019 05:38*	WG1338473
(S) 1,2-Dichloroethane-d4	*101*		*70.0-130*		*09/02/2019 09:08*	WG1338688

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	4930		100	1	08/28/2019 10:04	WG1335941

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	2950		250	50	08/29/2019 14:14	WG1336828

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	08/28/2019 18:31	WG1336032
Manganese,Dissolved	1.75		0.00500	1	08/28/2019 18:31	WG1336032

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	ND		0.00100	1	09/01/2019 06:00	WG1338473
Toluene	ND		0.00100	1	09/01/2019 06:00	WG1338473
Ethylbenzene	ND		0.00100	1	09/01/2019 06:00	WG1338473
Total Xylenes	0.00405		0.00300	1	09/01/2019 06:00	WG1338473
(S) Toluene-d8	*101*		*80.0-120*		*09/01/2019 06:00*	WG1338473
(S) 4-Bromofluorobenzene	*100*		*77.0-126*		*09/01/2019 06:00*	WG1338473
(S) 1,2-Dichloroethane-d4	*91.2*		*70.0-130*		*09/01/2019 06:00*	WG1338473

Method Blank (MB)

(MB) R3445581-1 08/28/19 10:04

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dissolved Solids	U		2.82	10.0

L1133291-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1133291-01 08/28/19 10:04 • (DUP) R3445581-3 08/28/19 10:04

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	3010	2840	1	5.65	J3	5

Laboratory Control Sample (LCS)

(LCS) R3445581-2 08/28/19 10:04

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800	8530	96.9	85.0-115	

Method Blank (MB)

(MB) R3445729-1 08/29/19 08:44

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Sulfate	U		0.0774	5.00

L1133280-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1133280-01 08/29/19 10:25 • (DUP) R3445729-3 08/29/19 10:42

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	62.8	62.5	1	0.374		15

L1133423-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1133423-01 08/29/19 15:07 • (DUP) R3445729-6 08/29/19 15:24

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	86.7	86.9	1	0.134		15

Laboratory Control Sample (LCS)

(LCS) R3445729-2 08/29/19 09:02

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Sulfate	40.0	39.5	98.8	80.0-120	

L1133280-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1133280-01 08/29/19 10:25 • (MS) R3445729-4 08/29/19 11:00 • (MSD) R3445729-5 08/29/19 11:18

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Sulfate	50.0	62.8	109	109	92.8	91.7	1	80.0-120	E	E	0.524	15

L1133423-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L1133423-01 08/29/19 15:07 • (MS) R3445729-7 08/29/19 16:17

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Sulfate	50.0	86.7	130	87.5	1	80.0-120	E

Method Blank (MB)

(MB) R3445214-1 08/28/19 17:08

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	mg/l		mg/l	mg/l
Iron,Dissolved	U		0.0150	0.100
Manganese,Dissolved	0.000359	J	0.000250	0.00500

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

(LCS) R3445214-2 08/28/19 17:13 • (LCSD) R3445214-3 08/28/19 17:17

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	%	%	%			%	%
Iron,Dissolved	5.00	4.79	4.73	95.8	94.5	80.0-120			1.34	20
Manganese,Dissolved	0.0500	0.0479	0.0472	95.8	94.4	80.0-120			1.41	20

L1132699-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1132699-01 08/28/19 17:22 • (MS) R3445214-5 08/28/19 17:31 • (MSD) R3445214-6 08/28/19 17:36

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	%	%		%			%	%
Iron,Dissolved	5.00	ND	4.57	4.45	90.5	88.0	1	75.0-125			2.80	20
Manganese,Dissolved	0.0500	0.0192	0.0617	0.0617	85.1	85.0	1	75.0-125			0.0641	20

Method Blank (MB)

(MB) R3446417-4 09/01/19 01:15

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000331	0.00100
Ethylbenzene	U		0.000384	0.00100
Toluene	U		0.000412	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*101*			*80.0-120*
(S) 4-Bromofluorobenzene	*98.0*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*92.0*			*70.0-130*

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

(LCS) R3446417-1 08/31/19 23:48 • (LCSD) R3446417-2 09/01/19 00:10

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 %
Benzene	0.0250	0.0285	0.0280	114	112	70.0-123			1.97	20
Ethylbenzene	0.0250	0.0232	0.0220	92.7	88.1	79.0-123			5.07	20
Toluene	0.0250	0.0246	0.0244	98.4	97.5	79.0-120			0.968	20
Xylenes, Total	0.0750	0.0673	0.0653	89.7	87.1	79.0-123			3.02	20
(S) Toluene-d8				*88.9*	*89.7*	*80.0-120*				
(S) 4-Bromofluorobenzene				*87.8*	*89.0*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*99.6*	*96.6*	*70.0-130*				

Method Blank (MB)

(MB) R3446854-3 09/02/19 02:28

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000331	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*96.6*			*80.0-120*
(S) 4-Bromofluorobenzene	*94.8*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*102*			*70.0-130*

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

(LCS) R3446854-1 09/02/19 01:20 • (LCSD) R3446854-2 09/02/19 01:43

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 %
Benzene	0.0250	0.0214	0.0238	85.7	95.1	70.0-123			10.3	20
Xylenes, Total	0.0750	0.0760	0.0813	101	108	79.0-123			6.74	20
(S) Toluene-d8				*94.6*	*97.7*	*80.0-120*				
(S) 4-Bromofluorobenzene				*103*	*103*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*107*	*106*	*70.0-130*				

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.

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J3	The associated batch QC was outside the established quality control range for precision.

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
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
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

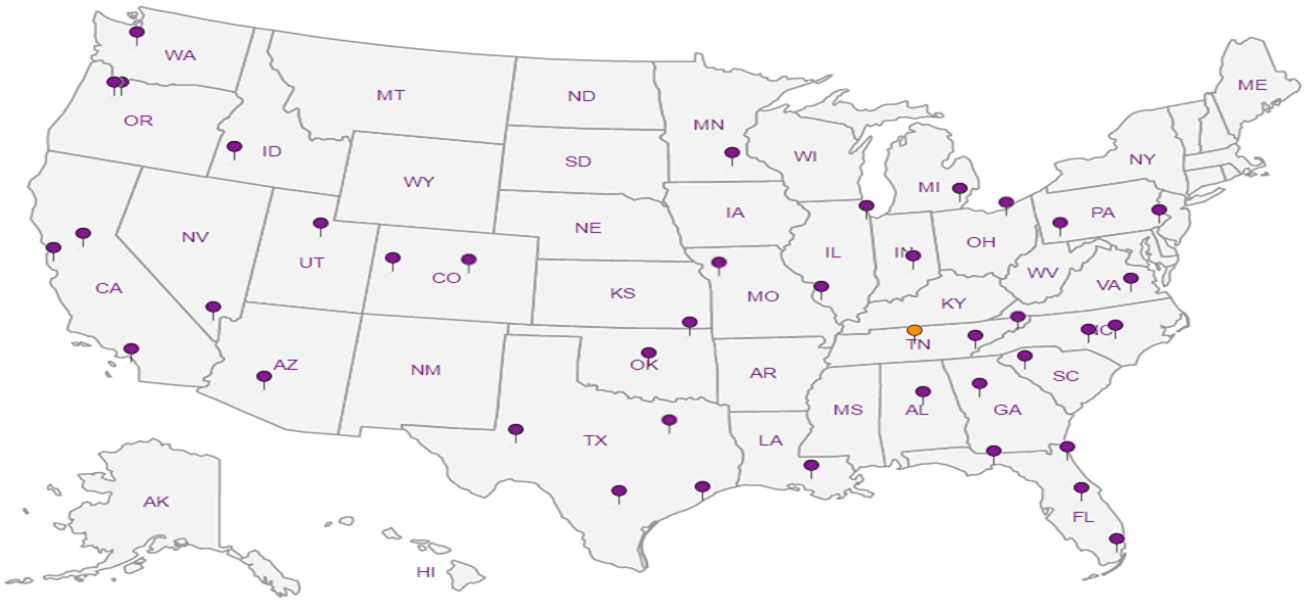
Third Party Federal Accreditations

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.



HilCorp-Farmington, NM

382 Road 3100
Aztec, NM 87401

Billing Information:

PO Box 61529
Houston, TX 77208

Pres Chk

Report to: **Kurt Hoekstra**

Email To: ccardoza@hilcorp.com;khoekstra@hilcorp.com;jde

Project Description: **Mangum 1**

City/State Collected:

Phone: **505-486-9543**
Fax:

Client Project # **MANGUM 1**

Lab Project # **HILCORANM-MANGUM**

Collected by (print): Kurt

Site/Facility ID # **MANGUM 1**

P.O. #

Collected by (signature): Kurt Hoekstra

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day X Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Date Results Needed

Quote #

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace Analytical® National Center for Testing & Innovation

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

L# 1133591

Table F168

Acctnum: HILCORANM

Template: T153792

Prelogin: P722247

TSR: 288 - Daphne Richards

PB:

Shipped Via: FedEX Ground

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Dissolved Fe, Mn 250mlHDPE-NoPres	SULFATE, TDS 250mlHDPE-NoPres	V8260BTEX 40mlAmb-HCl	No Samples Field Filtered							Remarks	Sample # (lab only)
MW1		GW		8-22	11:45	5	X	X	X	X								01
MW2		GW		8-22	1:15	5	X	X	X	X								02
MW3		GW		8-22	3:10	5	X	X	X	X								03
MW4		GW		8-22	10:50	5	X	X	X	X								04
MW5		GW		8-23	10:15	5	X	X	X	X								05
MW6		GW		8-23	12:00	5	X	X	X	X								06
MW7		GW		8-23	2:00	5	X	X	X	X								07

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

Remarks:

RAD SCREEN: <0.5 mR/hr

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking # 4794 8844 2251

Sample Receipt Checklist

COC Seal Present/Intact:	NP	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)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	If preservation required by Login: Date/Time
Kurt Hoekstra	8-26-19	7:15			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 4.2 °C Bottles Received: 35	
				0.7+3=1.0	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 8/27 Time: 0845	Hold: Condition: NCF / OK
			Rcglra		

Pace Analytical®
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ANALYTICAL REPORT

December 12, 2019

HilCorp-Farmington, NM

Sample Delivery Group:	L1168208
Samples Received:	12/06/2019
Project Number:	MANGUM 1
Description:	Mangum 1
Site:	MANGUM 1
Report To:	Kurt Hoekstra 382 Road 3100 Aztec, NM 87401

Entire Report Reviewed By:

Olivia Studebaker
Project Manager

TABLE OF CONTENTS

MW1 L1168208-01 GW

Collected by: Kurt | Collected date/time: 12/02/19 11:45 | Received date/time: 12/06/19 08:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1393104	1	12/08/19 09:32	12/08/19 10:43	TH	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1393259	20	12/09/19 03:55	12/09/19 03:55	ELN	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1392749	1	12/09/19 07:55	12/09/19 12:08	TM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1393123	1	12/08/19 11:35	12/08/19 11:35	BMB	Mt. Juliet, TN

MW2 L1168208-02 GW

Collected by: Kurt | Collected date/time: 12/02/19 12:35 | Received date/time: 12/06/19 08:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1393104	1	12/08/19 09:32	12/08/19 10:43	TH	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1393259	1	12/09/19 10:39	12/09/19 10:39	ELN	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1392749	1	12/09/19 07:55	12/09/19 12:11	TM	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1392749	5	12/09/19 07:55	12/09/19 12:45	TM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1393123	1	12/08/19 11:55	12/08/19 11:55	BMB	Mt. Juliet, TN

MW3 L1168208-03 GW

Collected by: Kurt | Collected date/time: 12/02/19 14:30 | Received date/time: 12/06/19 08:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1393104	1	12/08/19 09:32	12/08/19 10:43	TH	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1393259	10	12/09/19 04:17	12/09/19 04:17	ELN	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1392749	1	12/09/19 07:55	12/09/19 12:15	TM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1393123	1	12/08/19 12:16	12/08/19 12:16	BMB	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1394307	10	12/10/19 23:26	12/10/19 23:26	ADM	Mt. Juliet, TN

MW4 L1168208-04 GW

Collected by: Kurt | Collected date/time: 12/02/19 10:30 | Received date/time: 12/06/19 08:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1393104	1	12/08/19 09:32	12/08/19 10:43	TH	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1393259	50	12/09/19 04:49	12/09/19 04:49	ELN	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1392749	1	12/09/19 07:55	12/09/19 12:18	TM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1394307	10	12/10/19 23:46	12/10/19 23:46	ADM	Mt. Juliet, TN

MW5 L1168208-05 GW

Collected by: Kurt | Collected date/time: 12/02/19 14:30 | Received date/time: 12/06/19 08:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1393104	1	12/08/19 09:32	12/08/19 10:43	TH	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1393259	100	12/09/19 05:00	12/09/19 05:00	ELN	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1392749	1	12/09/19 07:55	12/09/19 12:21	TM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1393123	1	12/08/19 12:36	12/08/19 12:36	BMB	Mt. Juliet, TN

MW6 L1168208-06 GW

Collected by: Kurt | Collected date/time: 12/02/19 13:15 | Received date/time: 12/06/19 08:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1393104	1	12/08/19 09:32	12/08/19 10:43	TH	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1393259	10	12/09/19 05:11	12/09/19 05:11	ELN	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1392749	1	12/09/19 07:55	12/09/19 12:31	TM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1393123	1	12/08/19 12:57	12/08/19 12:57	BMB	Mt. Juliet, TN

MW6 L1168208-06 GW

Collected by: Kurt
Collected date/time: 12/02/19 13:15
Received date/time: 12/06/19 08:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1394307	20	12/11/19 00:06	12/11/19 00:06	ADM	Mt. Juliet, TN

MW7 L1168208-07 GW

Collected by: Kurt
Collected date/time: 12/02/19 12:10
Received date/time: 12/06/19 08:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1393104	1	12/08/19 09:32	12/08/19 10:43	TH	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1393259	100	12/09/19 05:22	12/09/19 05:22	ELN	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1392749	1	12/09/19 07:55	12/09/19 12:34	TM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1393123	1	12/08/19 13:17	12/08/19 13:17	BMB	Mt. Juliet, TN

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.

Olivia Studebaker
Project Manager

Sample Delivery Group (SDG) Narrative

VOC pH outside of method requirement.

Lab Sample ID	Project Sample ID	Method
L1168208-03	MW3	8260B
L1168208-06	MW6	8260B

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	1930		25.0	1	12/08/2019 10:43	WG1393104

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	697		100	20	12/09/2019 03:55	WG1393259

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	12/09/2019 12:08	WG1392749
Manganese,Dissolved	0.940		0.00500	1	12/09/2019 12:08	WG1392749

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	ND		0.00100	1	12/08/2019 11:35	WG1393123
Toluene	ND		0.00100	1	12/08/2019 11:35	WG1393123
Ethylbenzene	0.00290		0.00100	1	12/08/2019 11:35	WG1393123
Total Xylenes	0.00454		0.00300	1	12/08/2019 11:35	WG1393123
(S) Toluene-d8	*98.9*		*80.0-120*		*12/08/2019 11:35*	WG1393123
(S) 4-Bromofluorobenzene	*118*		*77.0-126*		*12/08/2019 11:35*	WG1393123
(S) 1,2-Dichloroethane-d4	*88.6*		*70.0-130*		*12/08/2019 11:35*	WG1393123

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	16700		200	1	12/08/2019 10:43	WG1393104

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	ND		5.00	1	12/09/2019 10:39	WG1393259

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	12/09/2019 12:11	WG1392749
Manganese,Dissolved	10.2		0.0250	5	12/09/2019 12:45	WG1392749

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.130		0.00100	1	12/08/2019 11:55	WG1393123
Toluene	ND		0.00100	1	12/08/2019 11:55	WG1393123
Ethylbenzene	0.0304		0.00100	1	12/08/2019 11:55	WG1393123
Total Xylenes	0.00869		0.00300	1	12/08/2019 11:55	WG1393123
(S) Toluene-d8	*103*		*80.0-120*		*12/08/2019 11:55*	WG1393123
(S) 4-Bromofluorobenzene	*128*	J1	*77.0-126*		*12/08/2019 11:55*	WG1393123
(S) 1,2-Dichloroethane-d4	*88.8*		*70.0-130*		*12/08/2019 11:55*	WG1393123

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	1800		25.0	1	12/08/2019 10:43	WG1393104

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	129		50.0	10	12/09/2019 04:17	WG1393259

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	12/09/2019 12:15	WG1392749
Manganese,Dissolved	1.55		0.00500	1	12/09/2019 12:15	WG1392749

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.114		0.0100	10	12/10/2019 23:26	WG1394307
Toluene	ND		0.00100	1	12/08/2019 12:16	WG1393123
Ethylbenzene	0.00598		0.00100	1	12/08/2019 12:16	WG1393123
Total Xylenes	0.184		0.00300	1	12/08/2019 12:16	WG1393123
(S) Toluene-d8	*105*		*80.0-120*		*12/08/2019 12:16*	WG1393123
(S) Toluene-d8	*106*		*80.0-120*		*12/10/2019 23:26*	WG1394307
(S) 4-Bromofluorobenzene	*112*		*77.0-126*		*12/08/2019 12:16*	WG1393123
(S) 4-Bromofluorobenzene	*104*		*77.0-126*		*12/10/2019 23:26*	WG1394307
(S) 1,2-Dichloroethane-d4	*88.1*		*70.0-130*		*12/08/2019 12:16*	WG1393123
(S) 1,2-Dichloroethane-d4	*101*		*70.0-130*		*12/10/2019 23:26*	WG1394307

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	2480		25.0	1	12/08/2019 10:43	WG1393104

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	1390		250	50	12/09/2019 04:49	WG1393259

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	12/09/2019 12:18	WG1392749
Manganese,Dissolved	0.752		0.00500	1	12/09/2019 12:18	WG1392749

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.0172		0.0100	10	12/10/2019 23:46	WG1394307
Toluene	ND		0.0100	10	12/10/2019 23:46	WG1394307
Ethylbenzene	ND		0.0100	10	12/10/2019 23:46	WG1394307
Total Xylenes	0.937		0.0300	10	12/10/2019 23:46	WG1394307
(S) Toluene-d8	*108*		*80.0-120*		*12/10/2019 23:46*	WG1394307
(S) 4-Bromofluorobenzene	*114*		*77.0-126*		*12/10/2019 23:46*	WG1394307
(S) 1,2-Dichloroethane-d4	*97.3*		*70.0-130*		*12/10/2019 23:46*	WG1394307

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	6350		100	1	12/08/2019 10:43	WG1393104

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	3730		500	100	12/09/2019 05:00	WG1393259

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	0.185	B	0.100	1	12/09/2019 12:21	WG1392749
Manganese,Dissolved	3.26		0.00500	1	12/09/2019 12:21	WG1392749

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	ND		0.00100	1	12/08/2019 12:36	WG1393123
Toluene	ND		0.00100	1	12/08/2019 12:36	WG1393123
Ethylbenzene	ND		0.00100	1	12/08/2019 12:36	WG1393123
Total Xylenes	ND		0.00300	1	12/08/2019 12:36	WG1393123
(S) Toluene-d8	*103*		*80.0-120*		*12/08/2019 12:36*	WG1393123
(S) 4-Bromofluorobenzene	*105*		*77.0-126*		*12/08/2019 12:36*	WG1393123
(S) 1,2-Dichloroethane-d4	*87.5*		*70.0-130*		*12/08/2019 12:36*	WG1393123

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	1630		20.0	1	12/08/2019 10:43	WG1393104

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	86.1		50.0	10	12/09/2019 05:11	WG1393259

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	12/09/2019 12:31	WG1392749
Manganese,Dissolved	3.11		0.00500	1	12/09/2019 12:31	WG1392749

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	0.0741		0.0200	20	12/11/2019 00:06	WG1394307
Toluene	ND		0.00100	1	12/08/2019 12:57	WG1393123
Ethylbenzene	0.168		0.00100	1	12/08/2019 12:57	WG1393123
Total Xylenes	0.170		0.0600	20	12/11/2019 00:06	WG1394307
(S) Toluene-d8	*119*		*80.0-120*		*12/08/2019 12:57*	WG1393123
(S) Toluene-d8	*106*		*80.0-120*		*12/11/2019 00:06*	WG1394307
(S) 4-Bromofluorobenzene	*110*		*77.0-126*		*12/08/2019 12:57*	WG1393123
(S) 4-Bromofluorobenzene	*102*		*77.0-126*		*12/11/2019 00:06*	WG1394307
(S) 1,2-Dichloroethane-d4	*84.3*		*70.0-130*		*12/08/2019 12:57*	WG1393123
(S) 1,2-Dichloroethane-d4	*97.9*		*70.0-130*		*12/11/2019 00:06*	WG1394307

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	3990	J3	50.0	1	12/08/2019 10:43	WG1393104

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Sulfate	2830		500	100	12/09/2019 05:22	WG1393259

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Iron,Dissolved	ND		0.100	1	12/09/2019 12:34	WG1392749
Manganese,Dissolved	1.98		0.00500	1	12/09/2019 12:34	WG1392749

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Benzene	ND		0.00100	1	12/08/2019 13:17	WG1393123
Toluene	ND		0.00100	1	12/08/2019 13:17	WG1393123
Ethylbenzene	ND		0.00100	1	12/08/2019 13:17	WG1393123
Total Xylenes	ND		0.00300	1	12/08/2019 13:17	WG1393123
(S) Toluene-d8	*109*		*80.0-120*		*12/08/2019 13:17*	WG1393123
(S) 4-Bromofluorobenzene	*111*		*77.0-126*		*12/08/2019 13:17*	WG1393123
(S) 1,2-Dichloroethane-d4	*85.8*		*70.0-130*		*12/08/2019 13:17*	WG1393123

Method Blank (MB)

(MB) R3480870-1 12/08/19 10:43

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dissolved Solids	U		2.82	10.0

L1168208-07 Original Sample (OS) • Duplicate (DUP)

(OS) L1168208-07 12/08/19 10:43 • (DUP) R3480870-3 12/08/19 10:43

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	3990	4600	1	14.3	J3	5

Laboratory Control Sample (LCS)

(LCS) R3480870-2 12/08/19 10:43

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800	8670	98.5	85.0-115	

Method Blank (MB)

(MB) R3480458-1 12/08/19 21:16

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Sulfate	0.672	J	0.0774	5.00

L1167057-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1167057-01 12/08/19 22:39 • (DUP) R3480458-3 12/08/19 22:50

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	17.7	17.5	1	0.957		15

L1167919-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1167919-01 12/09/19 03:22 • (DUP) R3480458-7 12/09/19 03:33

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	31.9	32.4	1	1.32		15

Laboratory Control Sample (LCS)

(LCS) R3480458-2 12/08/19 21:27

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Sulfate	40.0	39.9	99.8	80.0-120	

L1167057-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L1167057-01 12/08/19 22:39 • (MS) R3480458-4 12/08/19 23:00

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Sulfate	50.0	17.7	71.4	107	1	80.0-120	

Method Blank (MB)

(MB) R3480469-1 12/09/19 10:40

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Iron,Dissolved	0.0472	J	0.0150	0.100
Manganese,Dissolved	U		0.000250	0.00500

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

(LCS) R3480469-2 12/09/19 10:43 • (LCSD) R3480469-3 12/09/19 10:47

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 %
Iron,Dissolved	5.00	5.15	4.97	103	99.4	80.0-120			3.49	20
Manganese,Dissolved	0.0500	0.0498	0.0502	99.6	100	80.0-120			0.854	20

L1167156-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1167156-03 12/09/19 10:50 • (MS) R3480469-5 12/09/19 10:56 • (MSD) R3480469-6 12/09/19 11:00

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Iron,Dissolved	5.00	ND	4.91	4.91	97.8	97.8	1	75.0-125			0.0450	20
Manganese,Dissolved	0.0500	ND	0.0499	0.0504	96.7	97.6	1	75.0-125			0.926	20

Method Blank (MB)

(MB) R3481001-2 12/08/19 07:45

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000331	0.00100
Ethylbenzene	U		0.000384	0.00100
Toluene	U		0.000412	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*111*			*80.0-120*
(S) 4-Bromofluorobenzene	*110*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*89.7*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3481001-1 12/08/19 07:04

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Benzene	0.00500	0.00587	117	70.0-123	
Ethylbenzene	0.00500	0.00598	120	79.0-123	
Toluene	0.00500	0.00568	114	79.0-120	
Xylenes, Total	0.0150	0.0183	122	79.0-123	
(S) Toluene-d8			*110*	*80.0-120*	
(S) 4-Bromofluorobenzene			*110*	*77.0-126*	
(S) 1,2-Dichloroethane-d4			*89.3*	*70.0-130*	

Method Blank (MB)

(MB) R3481142-3 12/10/19 18:48

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.000331	0.00100
Ethylbenzene	U		0.000384	0.00100
Toluene	U		0.000412	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*105*			*80.0-120*
(S) 4-Bromofluorobenzene	*102*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*98.8*			*70.0-130*

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

(LCS) R3481142-1 12/10/19 17:47 • (LCSD) R3481142-2 12/10/19 18:07

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 %
Benzene	0.00500	0.00444	0.00449	88.8	89.8	70.0-123			1.12	20
Ethylbenzene	0.00500	0.00510	0.00522	102	104	79.0-123			2.33	20
Toluene	0.00500	0.00469	0.00496	93.8	99.2	79.0-120			5.60	20
Xylenes, Total	0.0150	0.0144	0.0150	96.0	100	79.0-123			4.08	20
(S) Toluene-d8				*105*	*106*	*80.0-120*				
(S) 4-Bromofluorobenzene				*98.9*	*101*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*103*	*100*	*70.0-130*				

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.

Qualifier	Description
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J3	The associated batch QC was outside the established quality control range for precision.

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
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
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

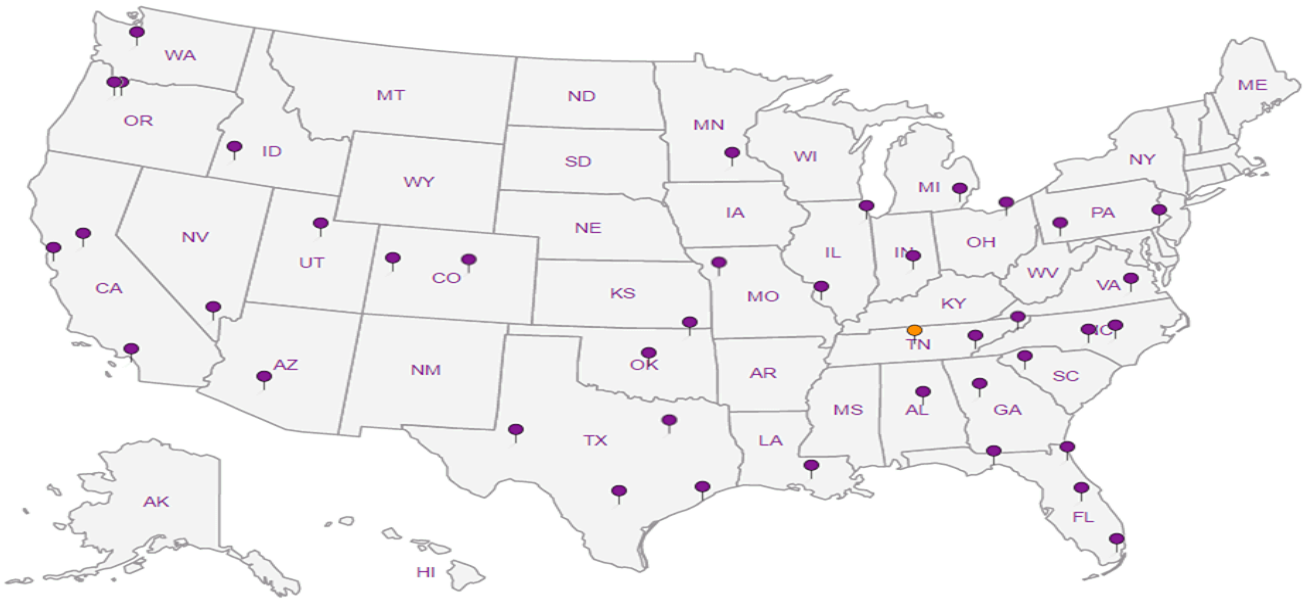
Third Party Federal Accreditations

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.



HilCorp-Farmington, NM

382 Road 3100
Aztec, NM 87401

Billing Information:

PO Box 61529
Houston, TX 77208

Pres Chk

Report to: **Kurt Hoekstra**

Email To: ccardoza@hilcorp.com;khoekstra@hilcorp.com;jde

Project Description: **Mangum 1**

City/State Collected:

Please Circle: PT MT CT ET

Phone: **505-486-9543**
Fax:

Client Project # **MANGUM 1**

Lab Project # **HILCORANM-MANGUM**

Collected by (print): Kurt

Site/Facility ID # **MANGUM 1**

P.O. #

Collected by (signature): Kurt Hoekstra

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day X Five Day
~~___ Next Day~~ ~~___ 5 Day (Rad Only)~~
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Dissolved Fe, Mn 250mlHDPE-NoPres	SULFATE, TDS 250mlHDPE-NoPres	V8260BTEX 40mlAmb-HCl	No Samples Field Filtered						Remarks	Sample # (lab only)
MW1		GW		12-2	11:45	5	X	X	X	X							-01
MW2		GW		12-2	12:35	5	X	X	X	X							-02
MW3		GW		12-2	2:30	5	X	X	X	X							-03
MW4		GW		12-2	10:30	5	X	X	X	X							-04
MW5		GW		12-4	2:30	5	X	X	X	X							-05
MW6		GW		12-4	1:15	5	X	X	X	X							-06
MW7		GW		12-4	12:10	5	X	X	X	X							-07

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

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

SDG # L1168208
D170

Acctnum: **HILCORANM**
Template: **T153792**
Prelogin: **P735174**
PM: **823 - Olivia Studebaker**
PB: TB 10-10-19
Shipped Via: **FedEX Ground**

* 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 # 1203 5789 5221

Sample Receipt Checklist

COC Seal Present/Intact:	NP	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
RAD Screen <0.5 mR/hr:		Y N

Relinquished by : (Signature) Kurt Hoekstra	Date: 12-5-19	Time: 8:00	Received by: (Signature)	Trip Blank Received: Yes / (No) HCL / MeoH TBR
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: WW A2 °C 8-.3=.5 Bottles Received: 35
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature) Hayley M	Date: 12/6/19 Time: 830

If preservation required by Login: Date/Time

Hold:

Condition: NCF / (OK)

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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