2017 Remediation and Annual Groundwater Monitoring Report

Johnston Federal No. 4 Metering Station
San Juan County, New Mexico
API# 30-045-10130
NMOCD # 3RP-071

Hilcorp Energy Company

GHD | 6121 Indian School Rd NE Suite 200 Albuquerque NM 87110 USA

11145957| MN00 | Report No 1 | December 13, 2017

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1. Introduction

This report presents the results of the 2017 annual groundwater monitoring events. Activities were conducted by GHD Services, Inc. (GHD) at the Hilcorp Energy Company (Hilcorp) Johnston Federal No. 4 Metering Station (hereafter referred to as the "Site").

The Johnston Federal No. 4 wellhead is located approximately 1.5 mile to the southwest of the metering station. The Site is located on both Bureau of Land Management (BLM) and private land, approximately 13 miles east-northeast of Aztec, San Juan County, New Mexico, in Unit Letter M, Section 27, Township 31N, Range 9W (Figure 1). Geographic coordinates for the Site are 36.8626° North and 107.7723° West. A Site Plan is included as Figure 2.

1.1 Background

Burlington Resources (Burlington) conducted initial site assessments of two production pits in August 1998. Soil from the separator pit was collected and analyzed for total petroleum hydrocarbons (TPH). The concentration of TPH in separator pit (Production Pit #1, Figure 2) soil was found to be below New Mexico Oil Conservation Division (NMOCD) recommended remedial action levels for this constituent, and the pit was subsequently granted closure by NMOCD. Soil from the tank drain pit (Production Pit #2, Figure 2) was collected and analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) and TPH. Concentrations of these constituents were found to be above NMOCD recommended action levels. Based on laboratory results, approximately 3,055 cubic yards of hydrocarbon-impacted soil was excavated in December 1998. Once complete, the excavation was backfilled with clean fill material, and the NMOCD granted pit closure.

A groundwater monitoring well, MW-1, was installed at the Site to a depth of 50 feet below ground surface (bgs) in May of 1999. Burlington sampled MW-1 on a quarterly basis until the acquisition of Burlington by ConocoPhillips in March of 2006. Following the acquisition, Tetra Tech, Inc. (Tetra Tech) began sampling MW 1 in November 2007. In August 2008, three additional groundwater monitoring wells (MW-2, MW-3 and MW-4) were installed under the supervision of Tetra Tech by WDC Exploration and Drilling of Peralta, NM. Based on information obtained during monitoring well installation in 2008, a generalized geologic cross section was completed for the Site and is presented as Figure 3. Monitoring wells MW-1, MW-2, MW-3, and MW-4 were incorporated into an annual sampling schedule beginning on October 24, 2008.

El Paso CGP Company (El Paso) is a co-producer on the Site well pad and owns additional Site monitoring wells, from which non-aqueous phase liquid, or free product, is being recovered. El Paso groundwater impacts are down gradient from the ConocoPhillips monitoring wells.

On June 15, 2011, Site consulting responsibilities were transferred from Tetra Tech to GHD (formerly CRA) of Albuquerque, NM. Site ownership was transferred from ConocoPhillips Company to Hilcorp in April 2017.

A historical timeline for the Site is presented in Table 1.

2. Mobile Dual Phase Extraction

GHD provided oversight for a mobile dual phase extraction (MDPE) event conducted November 9-10, 2017 by AcuVac Remediation, LLC (AcuVac) of Houston, TX. A permit for the use of existing wells for temporary pollution recovery was obtained through the New Mexico Office of the State Engineer prior to the event. The application and permit are included in Appendix A. MDPE is a process combining soil vapor extraction (SVE) with groundwater depression to maximize mass removal of liquid and vapor phase hydrocarbons. Monitoring well MW-1 was used as the extraction well for this event. A submersible pump was used to simultaneously remove dissolved-phase contaminated groundwater and to induce a hydraulic gradient toward the extraction well, creating a groundwater depression and exposing the capillary fringe or smear zone to SVE. Recovered liquids were discharged to the on Site evaporation tank. Recovered vapors were used as fuel and burned in the MDPE internal combustion engine (ICE). Power generated by the ICE was used to create the induced vacuum for SVE.

During the 2 days of MDPE, approximately 26 gallons equivalent of hydrocarbons (liquid and vapor) were extracted from monitoring well MW-1. The November 2017 MDPE event follows previous MDPE events conducted in April 2015, November 2014 and August 2013 in which approximately 134 gallons, 44 gallons and 94 gallons of hydrocarbons, respectively, were extracted from MW-1. Data from the September 2017 groundwater monitoring event indicate that, while the MDPE events continue to be very effective in removing a mass of hydrocarbons, elevated concentrations remain in the groundwater in the vicinity of MW-1 (see Section 3.2). The complete report for MDPE activities performed at the Site was provided by AcuVac and is included as Appendix B.

3. Groundwater Sampling Methodology and Analytical Results

3.1 Groundwater Sampling Methodology

Groundwater Elevation Measurements

On September 27, 2017, groundwater elevation measurements were obtained for monitoring wells MW-1, MW-2, MW-3, and MW-4 using an oil/water interface probe. Groundwater elevations were within 0.05-foot on average as compared with 2016 gauging data. Groundwater elevations are detailed in Table 2. A groundwater potentiometric surface map based on the September 2017 data is presented as Figure 4. Groundwater flow is to the east and is consistent with historical data at the Site.

Groundwater sampling

Groundwater samples for the 2017 annual monitoring event were collected from monitoring wells MW-1, MW 2, MW-3, and MW-4 on September 27, 2017. Approximately three well volumes were purged from each monitoring well with a dedicated polyethylene 1.5 inch bailer prior to sampling. While bailing each well, groundwater parameters including temperature, pH and conductivity were periodically collected. Field parameters are summarized on Table 3.

Groundwater samples were placed in laboratory prepared bottles, packed on ice, and shipped under chain of custody documentation to Pace Analytical Services, Inc. of Lenexa, Kansas. The samples were analyzed for the presence of BTEX in accordance with EPA Method 8260, sulfate by EPA Method 300.0 and for dissolved manganese by EPA Method 6010.

3.2 Groundwater Analytical Results Summary

Exceedances of New Mexico Water Quality Control Commission (NMWQCC) groundwater quality standards in Site monitoring wells are discussed below. Results are summarized in Table 4. The complete analytical laboratory report is presented in Appendix C.

September 2017

- Benzene
  - The NMWQCC standard for benzene is 0.01 milligrams per liter (mg/L). Groundwater samples collected from MW-1 and MW-4 detected benzene at concentrations of 2.34 mg/L and 0.0266 mg/L, respectively.
- Toluene
  - The NMWQCC standard for toluene is 0.75 mg/L. The groundwater sample collected from MW-1 detected toluene at a concentration of 2.86 mg/L.
- Ethylbenzene
  - The NMWQCC standard for ethylbenzene is 0.75 mg/L. The groundwater sample collected from MW-1 detected ethylbenzene at a concentration of 0.949 mg/L.
- Xylenes
  - The NMWQCC standard for total xylenes is 0.620 mg/L. The groundwater sample collected from MW-1 detected total xylenes at a concentration of 9.5 mg/L.
- Sulfate
  - The NMWQCC standard for sulfate is 600 mg/L. The groundwater samples collected from MW-2, MW-3, and MW-4 exceeded the standard for sulfate with concentrations 1150 mg/L, 680 mg/L, and 948 mg/L, respectively.
- Dissolved Manganese
  - The NMWQCC standard for dissolved manganese is 0.2 mg/L. The groundwater samples collected from MW-1, MW-3, and MW-4 exceeded the standard for dissolved manganese with concentrations 0.739 mg/L, 0.471 mg/L, and 2.46 mg/L, respectively.

4. Conclusions and Recommendations

A 2-day MDPE event was conducted in November 2017 resulting in the removal of approximately 26 gallons of hydrocarbons from the subsurface in the vicinity of MW-1. The MDPE events are very effective at mass removal at sites with favorable subsurface conditions, such as the Johnston Federal No. 4. However, relatively high concentrations of BTEX remain in dissolved phase groundwater at the Site. Sulfates and dissolved manganese also continue to be detected above

NMWQCC groundwater quality standards in Site monitoring wells. GHD recommends another MDPE event be conducted in 2018 and the continued annual sampling of Site monitoring wells until monitored groundwater quality parameters approach NMWQCC standards. GHD will begin a quarterly sampling schedule once parameters are near or below NMWQCC standards or background levels.

The next groundwater monitoring event at the Site is scheduled for September 2018 and will include analyses for BTEX, naphthalenes, dissolved manganese and sulfate in all Site monitoring wells.

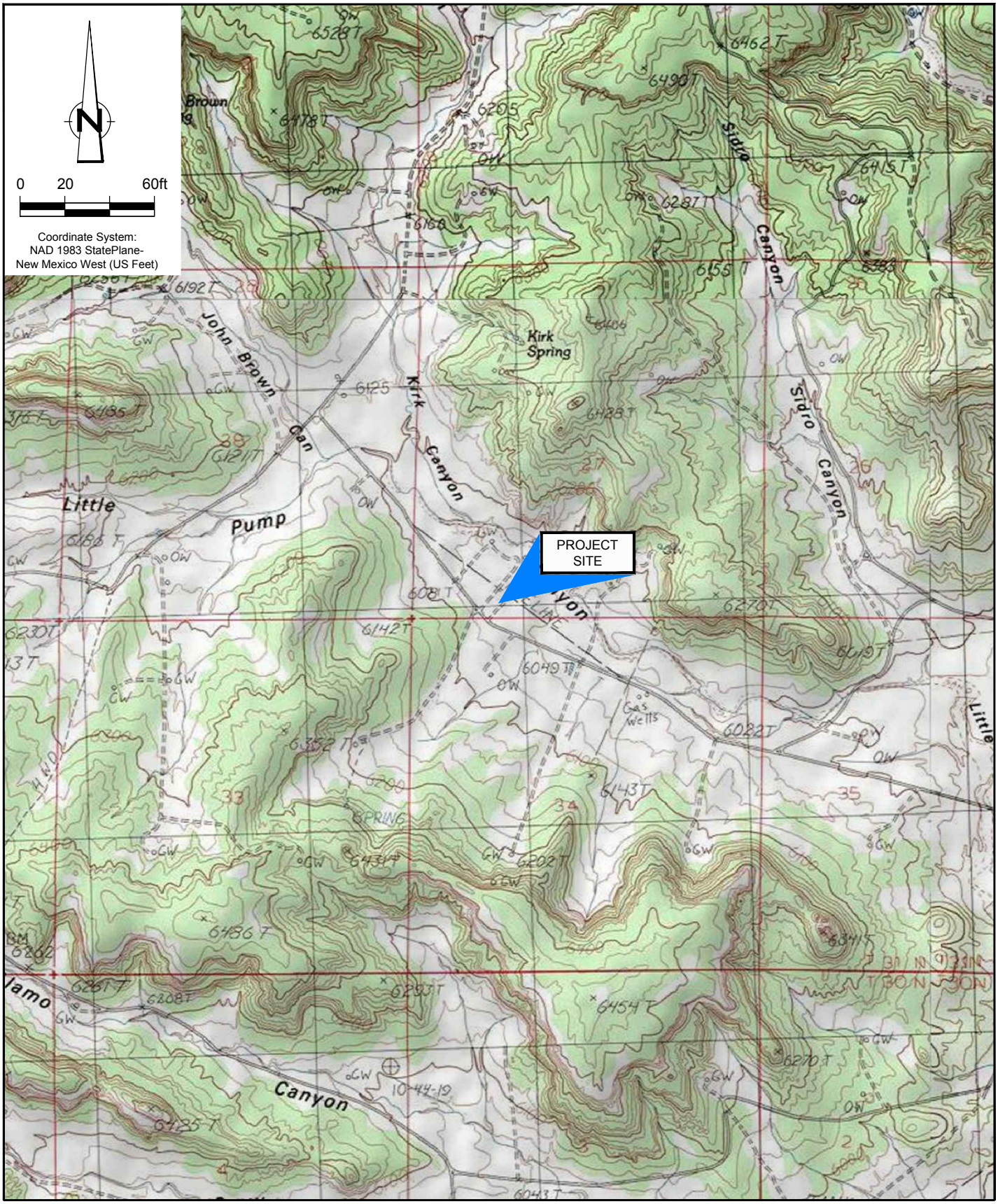
All of Which is Respectfully Submitted,

GHD

Jeff Walker, CPG, PMP
Sr. Project Manager

Bernie Bockisch
Albuquerque Operations Manager

Figures



Source: USGS 7.5 Minute Quad "Turley, New Mexico"

Lat/Long: 36.8626° North, 107.7723° West

HILCORP ENERGY COMPANY
SECTION 27, T31N-R09W, SAN JUAN COUNTY, NEW MEXICO
JOHNSTON FEDERAL No. 4 METERING STATION

11145957-MN00

Nov 30, 2017

SITE LOCATION MAP

FIGURE 1

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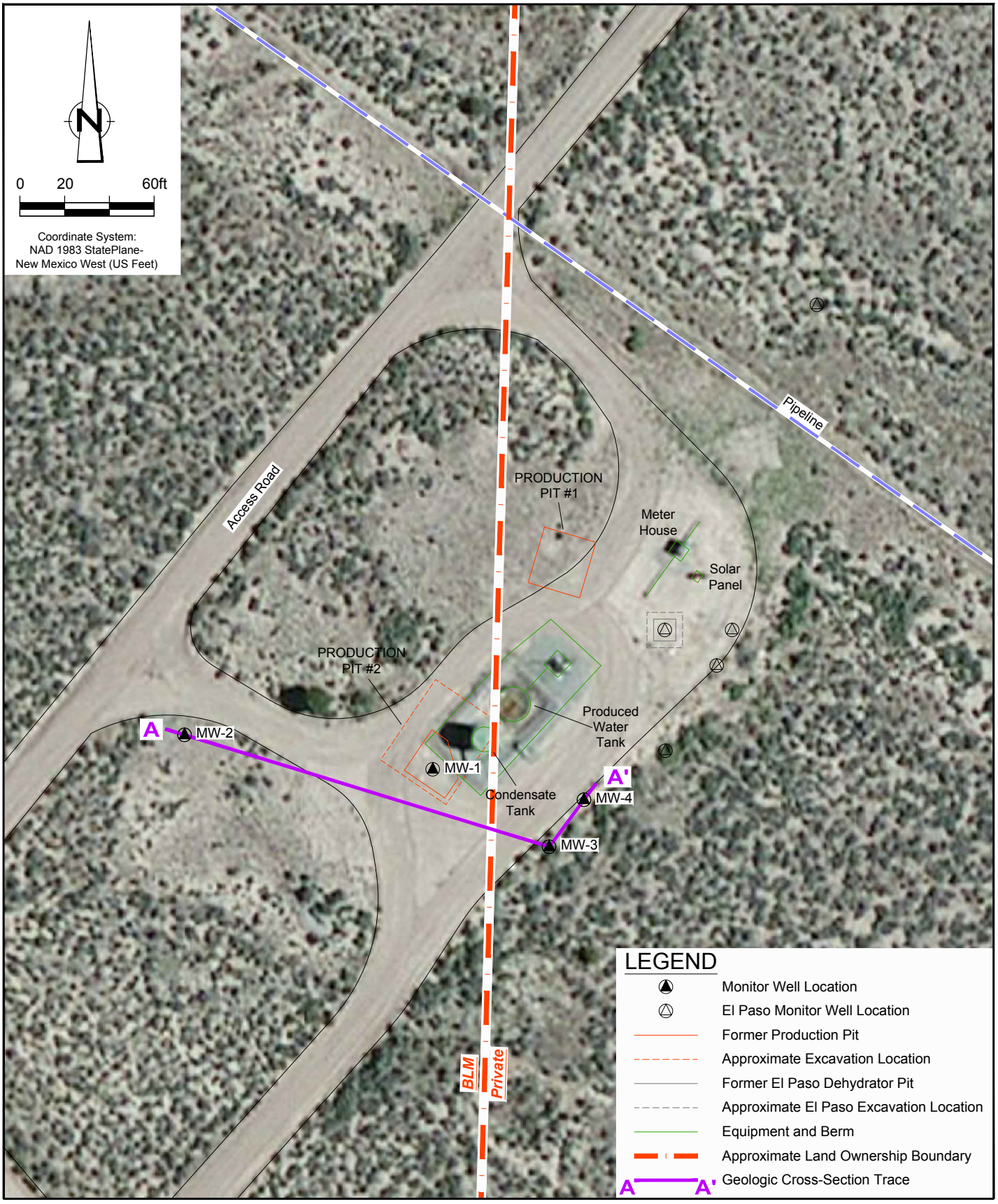

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Dec 13, 2017

SITE PLAN

FIGURE 2

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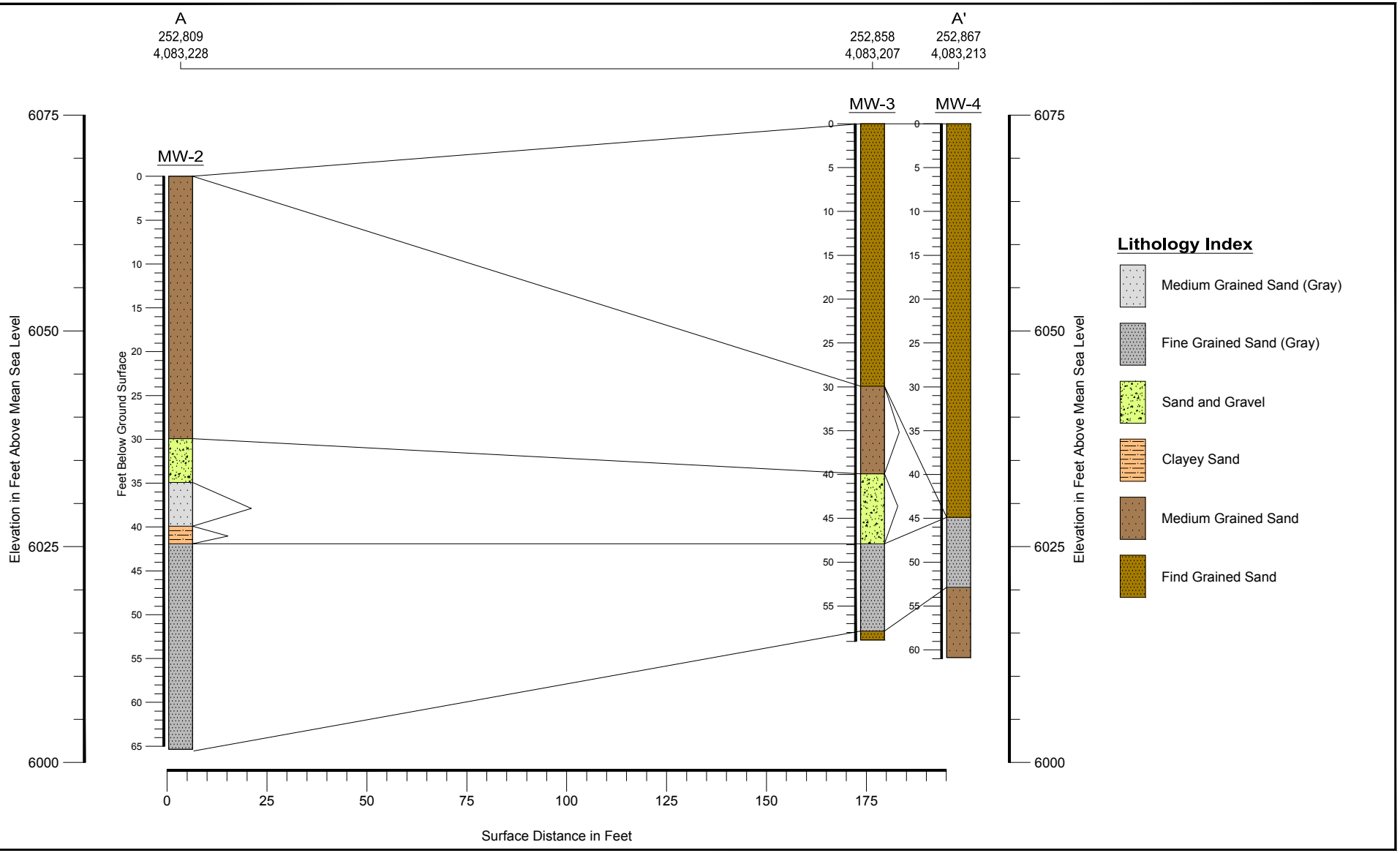

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GEOLOGICAL CROSS SECTION

FIGURE 3

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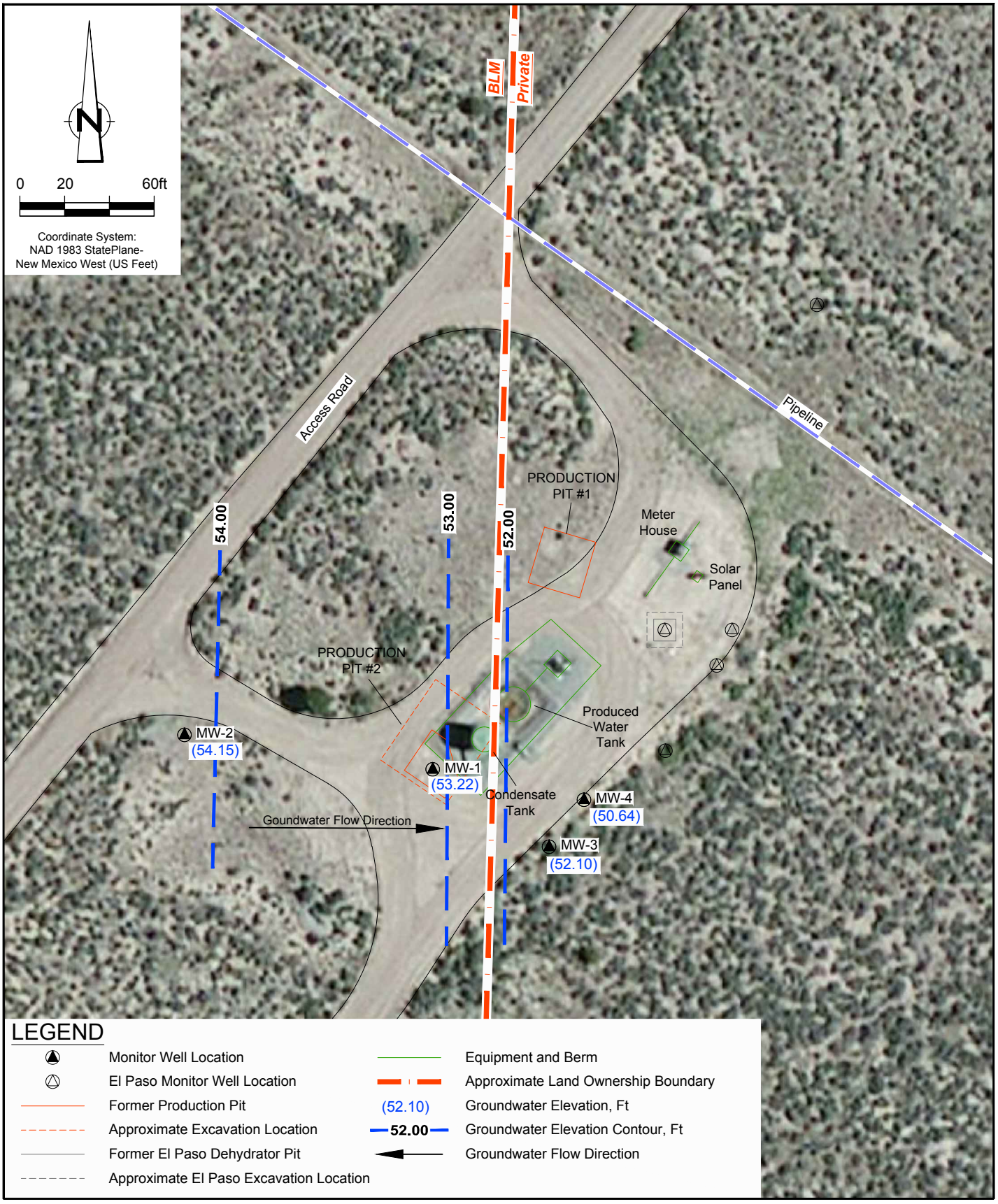

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SEPTEMBER 2017
GROUNDWATER POTENTIOMETRIC SURFACE MAP

FIGURE 4

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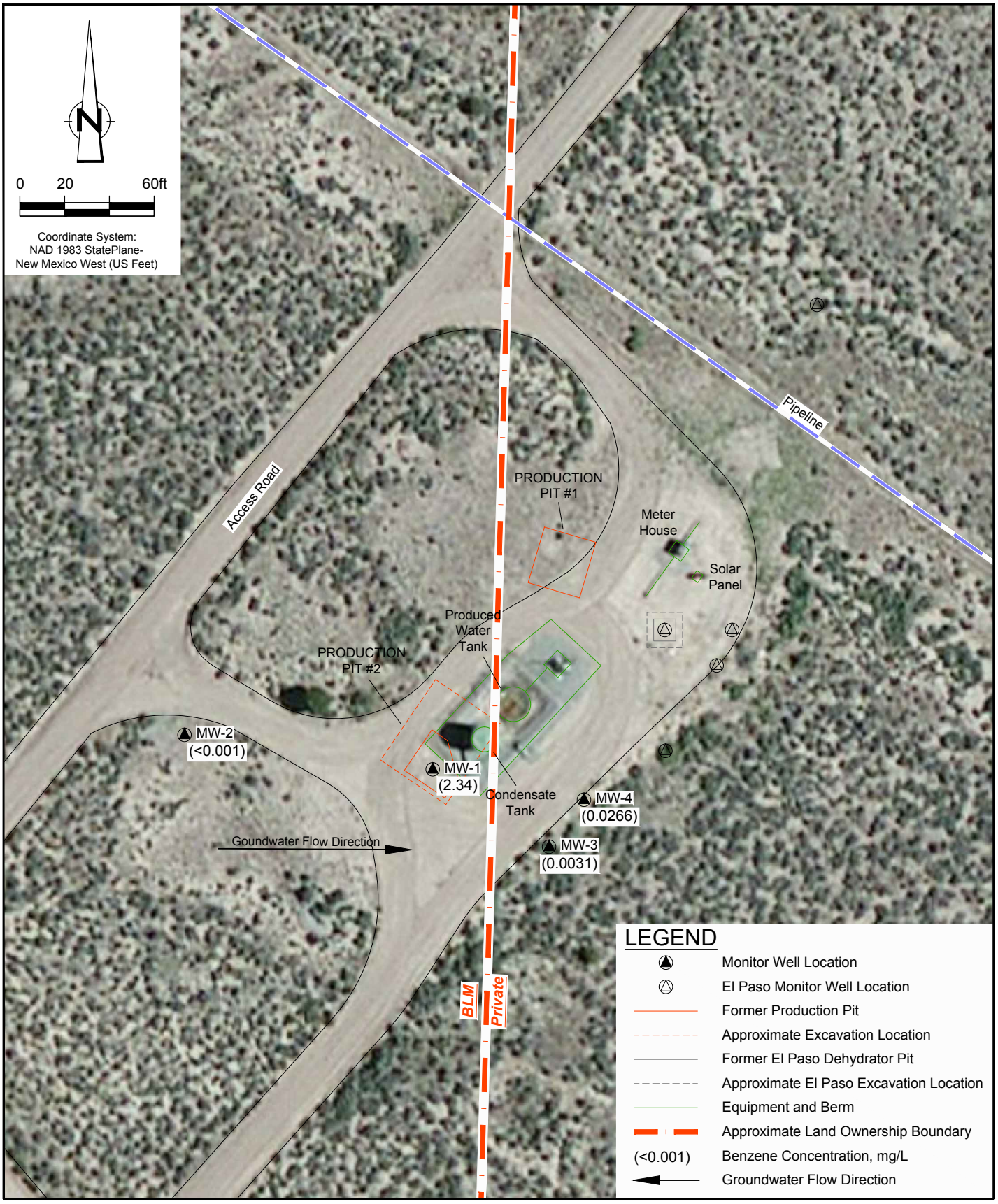

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JOHNSTON FEDERAL No. 4 METERING STATION

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Nov 30, 2017

SEPTEMBER 2017
BENZENE CONCENTRATION MAP

FIGURE 5

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Tables

Table 1

Site History Timeline
Hilcorp Energy Company
Johnston Federal No. 4 Metering Station
San Juan County, New Mexico

Date/Time Period	***Event/Action***	***Description/Comments***
August 1952	Well Spudded	Well was spudded by Anderson-Prichard Oil Corporation on August 21, 1952.
April 1961	Transfer of Well Ownership	Ownership of the well transferred from Anderson-Prichard Oil Corporation to Union Texas Natural Gas Corporation on April 26, 1961.
September 1971	Transfer of Well Ownership	Meridian Oil Inc., a wholly-owned subsidiary of Burlington Resources, took over operation of well from Union Texas Petroleum Corporation on September 17, 1991.
August 1994	Initial Site Assesment	El Paso Energy conducted a site assessment of a former unlined pit near the metering station.
September 1994	Pit Excavation	El Paso Energy excavated ~60 cubic yards of soil from their former unlined pit.
August 1995	Monitor Well Installation	El Paso contracted Philip Environmental Services Corporation to install a monitor well in the vicinity of their former pit on August 9, 1995.
December 1995	Monitor Well Installation	El Paso contracted Philip Environmental Services Corporation to install two downgradient monitor wells between December 12 and 15, 1995.
August 1997	Product Removal	El Paso Energy commenced product removal from their MW-1 on August 26, 1997.
September 1997	Piezometer Installation	El Paso contracted Philip Environmental Services Corp. to install 3 temporary piezometers on September 15, 1997.
July 1998	NMOCD Communication With Site Operators	New Mexico Oil Conservation Division (NMOCD) issued a response letter to El Paso Field Services (EPFS) on July 8, 1998, indicating that they would be sending letters to the operators of the sites (including Burlington Resources) and that EPFS should work cooperatively with the operators on investigation and remediation activities.
July 1998	NMOCD Requests Groundwater Investigation by Burlington Resources	NMOCD issued a letter to Burlington Resources on July 9, 1998, referencing work done at the Site by EPFS and requiring Burlington Resources (BR) to immediately implement their previously approved pit closure plan. The letter also required BR to submit a comprehensive groundwater investigation and remediation plan for all pit closure Sites in the San Juan Basin that encounter groundwater.
August 1998	Burlington Resources Granted Closure of Pit #1	Burlington Resources sampled Pit #1 on August 10, 1998 and laboratory analytical results indicated closure was warranted.
August 1998	Initial Site Assessment	Initial site assessment conducted on the site separator pit. Soil from this area was collected and analyzed for total petroleum hydrocarbons (TPH) and was found to contain TPH below NMOCD recommended action levels. The pit was subsequently granted closed status by NMOCD.
August 1998	Initial Site Assessment	Initial site assessment conducted on the tank drain pit. Soil from this area was collected and analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) and for TPH. Concentrations of these constituents were found to be above NMOCD recommended action levels.
December 1998	Pit Excavation	Burlington Resources excavated ~3,055 cubic yards of hydrocarbon-impacted soil from Pit #2 (58 ft x 45 ft x 30 ft deep), starting on December 17, 1998. The excavation extended to ~30 feet below ground surface (practical extent). The bottom of the excavation was sampled on December 28, 1998.
May 1999	Monitor Well Installation	Monitor Well MW-1 installed to a depth of 50 feet below ground surface (bgs); the screened interval was placed from 35 to 50 feet bgs, and was installed in the center of pit #2. Burlington Resources began monitoring MW-1 on a quarterly basis.
June 1999	Confirmation of Groundwater Impacts	Laboratory analysis of groundwater from MW-1 shows levels of benzene, toluene, and total xylenes in excess of New Mexico Water Quality Control Commission (NMWQCC) groundwater quality standards. Burlington Resources notified NMOCD via E-mail on June 1, 1999.
July 2001	NMOCD Communication With Site Operators	NMOCD response letter sent to EPFS on July 18, 2001 again urges EPFS to work cooperatively with the operators to investigate and remediate contaminated groundwater.
April 2003	NMOCD Requests Monitor Well Installation	NMOCD response letter to EPFS sent on April 3, 2003, requires EPFS to install additional monitor wells to determine the real extent of groundwater impacts.
March 2006	Acquisition of Burlington Resources by ConocoPhilips Company	ConocoPhillips Company acquired Burlington Resources on March 31, 2006.
November 2007 and January 2008	3rd and 4th Quarter 2007 Groundwater Monitoring	Johnston Federal No. 4 Monitoring Station groundwater sampled during November 2007 and January 2008 by Tetra Tech.
March 2008	Reporting	2007 Annual Groundwater Monitoring Report submitted to NMOCD.
March 2008	Groundwater Monitoring	Tetra Tech conducts quarterly groundwater monitoring at the Site for BTEX.
April 2008	NMOCD Requests Further Investigation	NMOCD indicates additional investigation and sampling is necessary for closure consideration during a meeting with Glenn Von Gonten.
April 2008	1st Quarter 2008 Groundwater Monitoring	Tetra Tech conducts quarterly groundwater monitoring at the Site for BTEX in MW-1 on April 30, 2008. Note: Prior to this date the location of MW-1 was not clear and the incorrect well was sampled. This was the first quarter that ConocoPhillips MW-1 was sampled. BTEX constituents were found to be above NMWQCC standards in MW-1.

Table 1

Site History Timeline
Hilcorp Energy Company
Johnston Federal No. 4 Metering Station
San Juan County, New Mexico

Date/Time Period	***Event/Action***	***Description/Comments***
July 2008	2nd Quarter 2008 Groundwater Monitoring	Tetra Tech conducts quarterly groundwater monitoring at the Site for BTEX in MW-1.
August 2008	Groundwater Monitor Well Installation	Monitor Wells MW-2, MW-3, and MW-4 installed under the supervision of Tetra Tech by WDC Exploration and Wells of Peralta, NM.
October 2008	3rd Quarter 2008 groundwater Monitoring	Tetra Tech conducts quarterly monitoring at the Site for MW-1 through MW-4. MW-2, MW-3 and MW-4 groundwater samples are analyzed for baseline parameters including major ions, total metals, semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs) including BTEX, diesel range organics, and gasoline range organics as requested by the NMOCD. In addition, an expanded list (beyond BTEX analysis) of VOCs were included for MW-1.
January 2009	4th Quarter 2008 Groundwater Monitoring	Tetra Tech conducts quarterly monitoring at the Site for MW-1 through MW-4. The groundwater sample obtained for MW-1 is analyzed for baseline parameters including major ions, total metals, SVOCs, VOCs, diesel range organics, and gasoline range organics. As of January 2009, baseline parameters have been collected for all 4 groundwater monitor wells at the Site.
September 25, 2009	2009 Annual Groundwater Monitoring	Tetra Tech conducts annual groundwater monitoring at the Site for MW-1 through MW-4 with analyses for BTEX, naphthalene, dissolved Fe and Mn and sulfate.
September 22, 2010	2010 Annual Groundwater Monitoring	Tetra Tech conducts annual groundwater monitoring at the Site for MW-1 through MW-4 with analyses for BTEX, naphthalene, dissolved Mn and sulfate.
June 15, 2011	Transfer of Site Consulting Responsibilities	Site consulting responsibilities tranferred from Tetra Tech, Inc. to Conestoga-Rovers & Associates, Inc. (CRA) of Albuquerque, NM.
September 28, 2011	2011 Annual Groundwater Monitoring	CRA conducts annual groundwater monitoring at the Site for MW-1 through MW-4 with analyses for BTEX, naphthalene, dissolved Mn, dissolved Fe, and sulfate.
September 26, 2012	2012 Annual Groundwater Monitoring	CRA conducts annual groundwater monitoring at the Site for MW-1 through MW-4 with analyses for BTEX, naphthalene, dissolved Mn, dissolved Fe, and sulfate.
August 23, 2013 - August 27, 2013	Dual-Phase Extraction	AcuVac, under CRA oversight, performs three days of dual-phase extraction on MW-1.
September 17, 2013	2013 Annual Groundwater Monitoring	CRA conducts annual groundwater monitoring at the Site for MW-1 through MW-4 with analyses for BTEX, naphthalene, dissolved Mn, dissolved Fe, and sulfate.
September 23, 2014	2014 Annual Groundwater Monitoring	CRA conducts annual groundwater monitoring at the Site for MW-1 through MW-4 with analyses for BTEX, naphthalene, dissolved Mn, dissolved Fe, and sulfate.
November 12, 2014 - November 13, 2014	Dual-Phase Extraction	AcuVac, under CRA oversight, performs two days of dual-phase extraction on MW-1.
December 17, 2014	2014 Post-MDPE Groundwater Monitoring	CRA conducts post-MDPE groundwater monitoring at the Site for MW-1, MW-3, and MW-4 with analyses for BTEX and naphthalene.
January 8, 2015	2015 Post-MDPE Groundwater Monitoring	CRA conducts post-MDPE groundwater monitoring at the Site for MW-1 with analyses for BTEX and naphthalene.
April 20, 2015 - April 23, 2015	Dual-Phase Extraction	AcuVac, under CRA oversight, performs four days of dual-phase extraction on MW-1.
June 18, 2015	2015 Post-MDPE Groundwater Monitoring	GHD conducts post-MDPE groundwater monitoring at the Site for MW-1 and MW-4 with analyses for BTEX and naphthalene.
September 22, 2015	2015 Annual Groundwater Monitoring	GHD conducts annual groundwater monitoring at the Site for MW-1 through MW-4 with analyses for BTEX, naphthalene, dissolved, Mn, dissolved Fe and sulfate.
September 14, 2016	2016 Annual Groundwater Monitoring	GHD conducts annual groundwater monitoring at the Site for MW-2 through MW-4 with analyses for BTEX, naphthalene, dissolved, Mn, dissolved Fe and sulfate. MW-1 not sampled due to presense of product on the water table.
April 13, 2007	Sale of San Juan Asset to Hilcorp Energy	Site sold as part of ConocoPhillips Company announced sale of San Juan Asset to Hilcorp Energy Company.
September 29, 2017	2017 Annual Groundwater Monitoring	GHD conducts annual groundwater monitoring at the Site for MW-1 through MW-4 with analyses for BTEX, dissolved, Mn and sulfate.
November 9-10, 2017	Dual-Phase Extraction	AcuVac, under GHD oversight, performs 2 days of dual-phase extraction on MW-1.

Monitoring Well Specifications and Groundwater Elevations
Hilcorp Energy Company
Johnston Federal No. 4
San Juan County, New Mexico

Well ID	Total Depth (ft bgs)	Screen Interval (ft)	*Elevation (ft) (TOC)	Date Measured	Depth to LNAPL (ft below TOC)	Depth to Groundwater (ft below TOC)	Relative Groundwater Elevation
MW-1	51.79	35 - 50	100	5/25/1999	--	NM	NM
				9/1/1999	--	47.02	52.98
				12/1/1999	--	46.96	53.04
				1/18/2000	--	44.05	55.95
				5/17/2000	--	46.90	53.10
				9/8/2000	--	46.91	53.09
				12/20/2000	--	46.88	53.12
				3/27/2001	--	NM	NM
				6/27/2001	--	47.05	52.95
				9/17/2001	--	46.93	53.07
				12/19/2001	--	46.97	53.03
				3/25/2002	--	46.99	53.01
				6/25/2002	--	47.01	52.99
				9/24/2002	--	46.98	53.02
				12/30/2002	--	47.40	52.60
				3/27/2003	--	NM	NM
				6/27/2003	--	NM	NM
				10/10/2003	--	NM	NM
				12/10/2003	--	NM	NM
				3/16/2004	--	47.28	52.72
				6/22/2004	--	47.06	52.94
				9/30/2004	--	47.24	52.76
				12/13/2004	--	47.14	52.86
				3/23/2005	--	46.91	53.09
				6/22/2005	--	46.93	53.07
				10/28/2005	--	46.87	53.13
				12/14/2005	--	46.72	53.28
				3/20/2006	--	46.75	53.25
				6/21/2006	--	46.84	53.16
				10/20/2006	--	46.89	53.11
				12/13/2006	--	46.92	53.08
				11/9/2007	--	NM	NM
				1/15/2008	--	NM	NM
				4/30/2008	--	46.45	53.55
				7/23/2008	--	46.63	53.37
				10/24/2008	--	46.60	53.40
				1/29/2009	--	46.57	53.43
				4/23/2009	--	46.40	53.60
				9/25/2009	--	46.52	53.48
				9/22/2010	--	46.60	53.40
				9/28/2011	--	46.65	53.35
				9/26/2012	--	46.80	53.20
				9/17/2013	--	46.88	53.12
				9/23/2014	--	46.94	53.06
				12/17/2014	--	46.94	53.06
				1/8/2015	--	46.92	53.08
				6/18/2015	--	46.94	53.06
				9/22/2015	--	46.91	53.09
				9/14/2016	46.70	46.71	53.30
				9/27/2017	--	46.78	53.22

Monitoring Well Specifications and Groundwater Elevations
Hilcorp Energy Company
Johnston Federal No. 4
San Juan County, New Mexico

Well ID	Total Depth (ft bgs)	Screen Interval (ft)	*Elevation (ft) (TOC)	Date Measured	Depth to LNAPL (ft below TOC)	Depth to Groundwater (ft below TOC)	Relative Groundwater Elevation
MW-2	65.5	41.5 - 61.5	97.71	10/24/2008	--	42.85	54.86
				1/29/2009	--	42.83	54.88
				4/23/2009	--	42.75	54.96
				9/25/2009	--	42.82	54.89
				9/22/2010	--	43.01	54.70
				9/28/2011	--	43.14	54.57
				9/26/2012	--	43.33	54.38
				9/17/2013	--	43.51	54.20
				9/23/2014	--	43.56	54.15
				12/17/2014	--	43.59	54.12
				6/18/2015	--	43.57	54.14
				9/22/2015	--	43.58	54.13
				9/14/2016	--	43.51	54.20
				9/27/2017	--	43.56	54.15
MW-3	59	35 - 55	94.65	10/24/2008	--	43.91	50.74
				1/29/2009	--	41.97	52.68
				4/23/2009	--	41.87	52.78
				9/25/2009	--	42.04	52.61
				9/22/2010	--	42.17	52.48
				9/28/2011	--	42.22	52.43
				9/26/2012	--	42.36	52.29
				9/17/2013	--	42.47	52.18
				9/23/2014	--	42.70	51.95
				12/17/2014	--	42.62	52.03
				6/18/2015	--	43.67	50.98
				9/22/2015	--	42.65	52.00
				9/14/2016		42.47	52.18
				9/27/2017	--	42.54	52.10
MW-4	61	37 - 57	94.79	10/24/2008	--	43.11	51.68
				1/29/2009	--	43.11	51.68
				4/23/2009	--	43.06	51.73
				9/25/2009	--	43.20	51.59
				9/22/2010	--	43.39	51.40
				9/28/2011	--	43.45	51.34
				9/26/2012	--	43.57	51.22
				9/17/2013	--	43.65	51.14
				9/23/2014	--	44.81	49.98
				12/17/2014	--	44.80	49.99
				6/18/2015	--	45.85	48.94
				9/22/2015	--	44.73	50.06
				9/14/2016	--	44.16	50.63
				9/27/2017	--	44.15	50.64

Notes:

ft = Feet
TOC = Top of casing
bgs = below ground surface
* Elevation relative to the TOC of MW-1, set at arbitrary 100 feet.
LNAPL = light non aqueoud phase liquid
When LNAPL present: GW Elevation + (LNAPL Thickness X LNAPL Density [0.75])
NM = Not Measured

Table 3

Field Parameters Summary
Hilcorp Energy Company
Johnston Federal No. 4
San Juan County, New Mexico

Well ID	Sample Date	Temperature (°C)	pH	TDS (g/L)	Conductivity (µS/cm)	DO (mg/L)	ORP (mV)	Volume (gallons)
MW-1		No parameters collected due to LNAPL sheen.						
	6/18/2015	No parameters collected due to LNAPL sheen.						
	9//22/2015	No parameters collected due to LNAPL sheen.						
	9/14/2016	No parameters collected due to LNAPL sheen.						
	9/27/2017	14.06	6.55	--	1662.00	--	--	0.80
MW-2	9/23/2014	15.00	7.22	1.50	2310	11.30	57.0	9.50
	9/23/2014	14.80	7.18	1.50	2360	10.89	63.0	10.00
	9/23/2014	14.80	7.17	1.50	2360	10.70	67.0	10.50
	9/22/2015	13.95	7.62	0.80	1235	12.50	59.2	9.00
	9/22/2015	13.69	6.98	1.48	2276	5.62	82.6	9.50
	9/22/2015	13.55	6.64	1.48	2273	5.05	93.0	10.00
	9/14/2016	13.53	7.26	1.53	2368	5.10	6.9	10.00
	9/27/2016	12.52	7.13	--	1884	--	--	3.32
MW-3	9/23/2014	15.70	7.01	1.20	1820	10.13	-104.0	6.25
	9/23/2014	15.70	7.01	1.20	1840	9.12	-127.0	6.75
	9/23/2014	15.70	7.01	1.20	1850	8.48	-137.0	7.25
	12/17/2014	14.76	7.48	1.379	2123	2.40	-149.1	5.75
	12/17/2014	14.72	7.48	1.402	2158	2.66	-159.7	6.25
	12/17/2014	14.78	7.49	1.441	2218	2.39	-164.0	6.75
	9/22/2015	15.11	7.71	0.735	1130	9.05	5.7	6.25
	9/22/2015	15.07	7.50	1.321	2032	4.70	-53.7	6.75
	9/22/2015	15.07	7.32	1.314	2021	2.34	-79.2	7.25
	9/14/2016	14.91	7.21	1.206	1856	2.01	-158.8	7.00
	9/27/2017	13.91	6.79	--	1534	--	--	2.40
MW-4	9/23/2014	16.40	6.65	1.400	2130	10.81	-124.0	3.50
	9/23/2014	16.00	6.72	1.400	2110	9.17	-136.0	4.00
	9/23/2014	15.80	6.77	1.300	2110	8.42	-142.0	4.50
	9/23/2014	15.90	6.81	1.300	2110	8.10	-150.0	5.00
	12/17/2014	14.79	7.22	1.508	2320	4.74	-145.4	6.25
	12/17/2014	14.91	7.35	1.511	2324	3.70	-158.7	6.75
	12/17/2014	14.98	7.37	1.509	2323	2.94	-166.6	7.25
	6/18/2015	15.65	6.67	1.421	2186	2.52	-133.8	6.00
	6/18/2015	15.49	6.68	1.420	2184	2.44	-130.2	6.25
	6/18/2015	15.38	6.71	1.419	2183	2.20	-129.3	6.50
	6/18/2015	15.38	6.72	1.418	2182	2.21	-146.6	6.75
	6/18/2015	15.37	6.73	1.417	2184	2.05	-140.1	7.00
	9/22/2015	15.17	7.15	1.327	2042	2.45	-105.6	6.50
	9/22/2015	15.14	6.89	1.328	2043	2.07	-12.5	7.00
	9/22/2015	15.13	6.82	1.326	2041	2.04	-126.5	7.50
	9/14/2016	14.92	7.23	1.363	2096	7.69	-205.4	5.00
	9/27/2017	14.01	6.95	--	1671	--	--	2.52

Notes:

TDS = total dissolved solids
DO = dissolved oxygen
ORP = oxidation-reduction potential

Groundwater Laboratory Analytical Results Summaty
Hilcorp Energy Company
Johnston Federal No. 4
San Juan County, New Mexico

Well ID	Sample ID	Date	Sample Type	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (total) (mg/L)	Napthalene (mg/L)	Sulfate (mg/L)	Iron (dissolved) (mg/L)	Manganese (dissolved) (mg/L)
NMWQCC Groundwater Quality Standards				**0.01**	**0.75**	**0.75**	**0.62**	**0.03**	**600**	**1**	**0.2**
MW-1	MW-1	5/25/1999	(orig)	**8.7**	**2.9**	**2.8**	**2.9**	--	--	--	--
	MW-1	12/1/1999	(orig)	**4.7**	**1.3**	**0.9**	**10**	--	--	--	--
	MW-1	1/18/2000	(orig)	**3.6**	**0.82**	**0.84**	**7.5**	--	--	--	--
	MW-1	5/17/2000	(orig)	**6.9**	**1.1**	**1.5**	**17**	--	--	--	--
	MW-1	9/8/2000	(orig)	**4.6**	0.62	**0.93**	**10**	--	--	--	--
	MW-1	12/20/2000	(orig)	< 0.0002	0.0005	0.034	0.061	--	--	--	--
	MW-1	3/27/2001	(orig)	**5.43**	0.641	**0.991**	**9.83**	--	--	--	--
	MW-1	6/27/2001	(orig)	**5.87**	**0.9**	**0.99**	**10.4**	--	--	--	--
	MW-1	9/17/2001	(orig)	**5.91**	0.75	**0.98**	**10.7**	--	--	--	--
	MW-1	12/19/2001	(orig)	**7.2**	0.65	**1.02**	**11.3**	--	--	--	--
	MW-1	3/25/2002	(orig)	**5.52**	**0.83**	**1.19**	**10.5**	--	--	--	--
	MW-1	6/26/2002	(orig)	**0.516**	0.0662	0.0787	**0.863**	--	--	--	--
	MW-1	9/24/2002	(orig)	**5.31**	**8**	**0.88**	**13.96**	--	--	--	--
	MW-1	12/30/2002	(orig)	**7.66**	**10.2**	**0.76**	**14.14**	--	--	--	--
	MW-1	6/22/2004	(orig)	**6.16**	**8.1**	0.47	**15.84**	--	--	--	--
	MW-1	3/20/2006	(orig)	**3.17**	**3.74**	**1.06**	**30.13**	--	--	--	--
	MW-1	6/21/2006	(orig)	**4.9**	**3.28**	0.448	**2.39**	--	--	--	--
	MW-1	12/13/2006	(orig)	**5.3**	**7.2**	**0.87**	**15.45**	--	--	--	--
	MW-1	3/27/2007	(orig)	**6.87**	**5.72**	0.21	**12.16**	--	--	--	--
	MW-1	6/25/2007	(orig)	**5.68**	**1.83**	0.4	**9.48**	--	--	--	--
	MW-1	4/30/2008	(orig)	**6.3**	**1.8**	0.28 J	**8.6**	--	--	--	--
	MW-1	7/23/2008	(orig)	**7.1**	**2.2**	0.45	**10.6**	--	--	--	--
	MW-1	10/24/2008	(orig)	**6**	**2.1**	0.4	**9**	**0.044**	--	--	--
	MW-1	1/29/2009	(orig)	**6.7**	**2.2**	0.63	**14.5**	**0.061**	315	--	--
	MW-1	9/25/2009	(orig)	**3.9**	**1.5**	0.68	**9.8**	**0.04**	429	< 0.02	**1.11**
	MW-1	9/22/2010	(orig)	**3.5**	**0.98**	0.63	**7.5**	**0.049**	190	--	**0.752**
	GW-074925-092811-CM-004	9/28/2011	(orig)	**3.36**	**1.05**	0.667	**6.81**	**0.037**	202	< 0.05	**0.774**
	GW-074925-092811-CM-005	9/28/2011	(Duplicate)	**3.43**	**1.12**	**0.779**	**8.29**	--	--	--	--
	GW-074925-092612-CM-MW-1	9/26/2012	(orig)	**3.07**	0.599	0.577	**5.16**	**0.0398**	113	< 0.05	**0.67**
	August 2013 Mobile Dual Phase Extraction Event										
	GW-074925-091713-CM-MW-1	9/17/2013	(orig)	**4.69**	**7.55**	**1.17**	**11**	**0.0365**	371	< 0.05	**0.89**
	GW-074925-091713-CM-DUP	9/17/2013	(Duplicate)	**4.7**	**7.21**	**1.04**	**9.97**	--	--	--	--
	GW-074925-092314-SP-MW-1	9/23/2014	(orig)	**2.97**	**4.25**	**0.778**	**6.89**	**0.0446**	155	<0.050	**0.85**
	GW-074925-092314-SP-DUP	9/23/2014	(Duplicate)	**2.82**	**3.88**	**0.754**	**6.69**	--	--	--	--
	November 2014 Mobile Dual Phase Extraction Event										
	GW-074925-010815-JW-MW-1	1/8/2015	(orig)	**4.35**	**6.15**	**1.07**	**10**	**0.0787**	--	--	--
	GW-074925-061815-CB-MW-1	6/18/2015	(orig)	**4.05**	**6.26**	**1.04**	**10.8**	**0.0625**	--	--	--
	GW-074925-061815-CB-DUP	6/18/2015	(Duplicate)	**4.34**	**6.46**	**0.933**	**11.1**	--	--	--	--
	April 2015 Mobile Dual Phase Extraction Event										
	GW-074925-092215-CB-MW-1	9/22/2015	(orig)	**3.36**	**4.57**	0.741	**8.62**	**0.0504**	44.2	< 0.050	**0.72**
	GW-074925-092215-CB-DUP	9/22/2015	(Duplicate)	**3.37**	**4.28**	0.724	**7.98**	--	--	--	--
		9/14/2016		Not sampled due to presense of LNAPL							
	GW-11145957-092717-SP-MW-1	9/27/2017	(orig)	**2.34**	**2.86**	**0.949**	**9.50**	--	10	--	**0.739**
	November 2017 Mobile Dual Phase Extraction Event										
MW-2	MW-2	10/24/2008	(orig)	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.005	**974**	--	--
	MW-2	1/29/2009	(orig)	< 0.0005	< 0.0005	< 0.0005	< 0.0005	--	--	--	--
	MW-2	9/25/2009	(orig)	< 0.001	< 0.001	< 0.001	< 0.002	< 0.001	**1260**	< 0.02	0.04
	MW-2	9/22/2010	(orig)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**1350**	--	0.0074
	GW-074925-092811-CM-002	9/28/2011	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.0001	**1290**	**2.49**	0.0956
	GW-074925-092612-CM-MW-2	9/26/2012	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.0005	**1210**	< 0.05	< 0.005
	GW-074925-091713-CM-MW-2	9/17/2013	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.0005	**1230**	< 0.05	< 0.005
	GW-074925-092314-SP-MW-2	9/23/2014	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.00045	**1190**	< 0.05	< 0.005
	GW-074925-092215-CB-MW-2	9/22/2015	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.0005	**1210**	< 0.050	< 0.005
	GW-074925-091516-CM-MW-2	9/14/2016	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.00045	**1270**	< 0.050	< 0.005
	GW-11145957-092717-SP-MW-2	9/27/2017	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	-0-	**1150**	--	< 0.005
MW-3	MW-3	10/24/2008	(orig)	**0.02**	< 0.0005	< 0.0005	0.024	< 0.005	**714**	--	--
	MW-3	1/29/2009	(orig)	**0.012**	< 0.0005	< 0.0005	0.005	--	--	--	--
	MW-3	9/25/2009	(orig)	0.0021	< 0.001	< 0.001	< 0.002	< 0.001	**1070**	< 0.02	**1.24**
	MW-3	9/22/2010	(orig)	0.0042	< 0.001	< 0.001	< 0.001	< 0.001	**1060**	--	**1.11**
	GW-074925-092811-CM-003	9/28/2011	(orig)	0.0038	< 0.001	< 0.001	< 0.003	< 0.0001	**809**	**1.58**	**0.704**
	GW-074925-092612-CM-MW-3	9/26/2012	(orig)	0.0016	< 0.001	< 0.001	< 0.003	< 0.0005	**892**	0.063	**0.67**
	GW-074925-091713-CM-MW-3	9/17/2013	(orig)	0.0012	< 0.001	< 0.001	< 0.003	< 0.0005	**808**	0.8	**0.67**
	GW-074925-092314-SP-MW-3	9/23/2014	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.00053	598	0.83	**0.65**
	GW-074925-121714-CM-MW-3	12/17/2014	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.00045	--	--	--
	GW-074925-092215-CB-MW-3	9/22/2015	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.00045	**943**	0.079	**0.79**
	GW-074925-091516-CM-MW-3	09/14/2016	(orig)	< 0.001	< 0.001	< 0.001	< 0.003	< 0.00045	**671**	0.22	**0.48**
	GW-11145957-092717-SP-MW-3	9/27/2017	(orig)	0.0031	< 0.001	< 0.001	< 0.003	--	**680**	--	**0.471**
MW-4	MW-4	10/24/2008	(orig)	**0.024**	< 0.0005	0.006	0.01	< 0.005	**678**	--	--
	MW-4	1/29/2009	(orig)	**0.11**	0.006	0.009	0.147	< 0.005	--	--	--
	MW-4	9/25/2009	(orig)	0.0088	< 0.001	0.0057	0.002	< 0.001	**968**	0.508	**1.24**
	MW-4	9/22/2010	(orig)	**0.019**	0.005	0.0069	0.0057	< 0.001	**1040**	--	**1.27**
	GW-074925-092811-CM-001	9/28/2011	(orig)	**0.0256**	0.0078	0.0017	0.0106	< 0.0001	**960**	0.532	**1.82**
	GW-074925-092612-CM-MW-4	9/26/2012	(orig)	**0.0124**	0.0023	< 0.001	< 0.003	< 0.0005	**949**	0.57	**1.5**
	GW-074925-092612-CM-DUP	9/26/2012	(Duplicate)	**0.013**	0.0022	< 0.001	0.0031	--	**--**	--	**--**
	August 2013 Mobile Dual Phase Extraction Event										
	GW-074925-091713-CM-MW-4	9/17/2013	(orig)	0.0065	< 0.001	< 0.001	< 0.003	< 0.0005	**925**	0.51	**1.6**
	GW-074925-092314-SP-MW-4	9/23/2014	(orig)	0.0068	< 0.001	0.0011	< 0.003	< 0.00053	**905**	0.39	**2.2**
	November 2014 Mobile Dual Phase Extraction Event										
	GW-074925-121714-CM-MW-4	12/17/2014	(orig)	0.003	< 0.001	< 0.001	< 0.003	< 0.00045	--	--	--
	GW-074925-092314-CM-DUP	12/17/2014	(Duplicate)	0.0039	< 0.001	< 0.001	< 0.003	--	--	--	--
	April 2015 Mobile Dual Phase Extraction Event										
	GW074925-061815-CB-MW-4	6/18/2015	(orig)	0.0039	< 0.001	< 0.001	< 0.003	< 0.00045	--	--	--
	GW-074925-092215-CB-MW-4	9/22/2015	(orig)	0.0018	< 0.001	< 0.001	< 0.003	< 0.0005	**911**	0.21	**1.9**
	GW-074925-091516-CM-MW-4	9/14/2016	(orig)	0.0047	< 0.001	< 0.001	< 0.003	< 0.00045	**943**	0.24	**2**
	GW-11145957-092717-SP-MW-4	9/27/2017	(orig)	**0.0266**	< 0.001	< 0.001	0.004	--	**948**	--	**2.46**
	November 2017 Mobile Dual Phase Extraction Event										

Notes:

NMWQCC = New Mexico Water Quality Control Commission
mg/L = milligrams per liter (parts per million)
<0.7 = Below laboratory detection limit of 0.7 mg/L
-- Constituent not analyzed for during this monitoring event
J = Estimated value between MDL and PQL
Bold = concentrations that exceed the NMWQCC groundwater quality standard

Appendix A
NMOSE Pollution Recovery Permit

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
AZTEC

Tom Blaine, P.E.
State Engineer

100 Gossett Drive, Suite A
Aztec, New Mexico 87410

October 20, 2017

Jeff Walker, Project Manager
GHD Services, Inc.
6121 Indian School Rd., NE, Ste 200
Albuquerque, NM 87110

RE: Permit for Use of Existing Well MW-1 for Monitoring and Temporary Pollution Recovery, SJ-4262 POD1, Hilcorp Energy Company, LLC, Johnston Fed #4 Release Investigation and LNAPL Recovery

Dear Mr. Walker:

On October 18, 2017, the New Mexico Office of the State Engineer received an application for a permit for the temporary use of an existing monitoring well for groundwater monitoring and pollution recovery activities 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. Also enclosed is a receipt for the fees paid.

Please be aware that there are time and extraction volume limitations for this pollution recovery permit (Condition 3 of the Condition of Approval). Also, quarterly reporting of the volumes of water extracted is required in accordance with Condition 4 of the Conditions of Approval. The pollution control component of the permit has an expiration date of November 9, 2018, but the well may continue to be used for groundwater monitoring and sampling indefinitely for this release investigation.

Additionally, a standardized plugging method has also been included in the Conditions of Approval for the future abandonment of the well 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. Well completion 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) 334-4282.

Sincerely,

Blaine Watson

Blaine Watson, P.G.
District Manager
Water Rights Division – District V Office

Enclosures

Aztec Reading (w/o enclosures)
SJ-4262 File
WATERS
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: 5-5924 DATE: 10-18-2017 FILE NO.: SJ-4082 & SJ-4262

TOTAL: 25.00 RECEIVED: twenty-five and no/100 DOLLARS CHECK NO.: 4603 & 4604 CASH: _____

PAYOR: J Walker ADDRESS: 11105 Kielich NE CITY: Albuquerque STATE: NM

ZIP: 87111 RECEIVED BY: M Jnett

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 you make an error, void original and all copies and submit to Program Support/ASD along with other valid receipts.

A. Ground Water Rights Filling Fees

___ 1.	Declaration of Water Right	$ 1.00
___ 2.	Application to Appropriate or Supplement Domestic 72-12-1 Well	$125.00
___ 3.	Application for Stock Well	$ 5.00
___ 4.	Application to Repair or Deepen 72-12-1 Well	$ 75.00
___ 5.	Application for Replacement 72-12-1-1 Well	$ 75.00
___ 6.	Application to Change Purpose of Use 72-12-1 Well	$ 75.00
___ 7.	Application to Appropriate Irrig., Mun., or Comm. Use	$ 25.00
___ 8.	Application for Supplemental Non 72-12-1 Well	$ 25.00
___ 9.	Application to Change Point of Diversion of 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	$ 50.00
___ 12.	Application for Extension of Time	$ 25.00
___ 13.	Proof of Application to Beneficial Use	$ 25.00
___ 14.	Application to Change Point of Diversion and Place and/or Purpose of Use from Surface Water to Ground Water	$ 50.00
___ 15.	Application to Change Point of Diversion and Place and/or Purpose of Use from Ground Water to Ground Water	$ 50.00
5 16.	Application for Test, Expl. Observ. Well ~~$ 5.00~~	
___ 17.	Change of Ownership of Water Right	$ 2.00
___ 18.	Application to Repair or Deepen Non 72-12-1 Well	$ 5.00
___ 19.	Application for Replacement Well Non 72-12-1 Well	$ 5.00

B. Surface Water Rights Filing Fees

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

...fees are non-refundable

C. Miscellaneous Fees

___ 1.	Application for Well Driller's License	$ 50.00
___ 2.	Application for Renewal of Well Driller's License	$ 50.00
___ 3.	Application to Amend Well Driller's License	$ 50.00

D. Reproduction of Documents

_____ @ 0.20¢/copy $ _____

_____ Maps(s) $ _____

E. Certification $ _____

F. Other $ _____

G. Comments:

- Permit application for Pollution Control/Recovery via SJ-4082 PODs 1-4 (four existing permitted wells) @ ConocoPhillips/Hilcorp's State Com J6 Central Compressor Release

- Permit application for Pollution Control/Recovery @ Johnson Federal #4 recovery site for 1 existing unpermitted well. SJ-4262 POD1

File No. SJ-4262 POD1

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: November 9, 2017 Requested End Date: November 9, 2018

Plugging Plan of Operations Submitted? ☐ Yes ☒ No

1. APPLICANT(S)

Name: Hilcorp Energy Company	Name:
Contact or Agent: check here if Agent ☒ Jeff Walker-GHD Services, Inc.	Contact or Agent: check here if Agent ☐
Mailing Address: 6121 Indian School Rd. NE, Suite 200	Mailing Address:
City: Albuquerque	City:
State: NM Zip Code: 87110	State: Zip Code:
Phone: 505-884-0672 (Work) ☐ Home ☐ Cell Phone (Work):	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): jeff.walker@ghd.com	E-mail (optional):

STATE ENGINEER OFFICE AZTEC, NEW MEXICO 2017 OCT 18 PM 1:10

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

File No.: SJ-4262 POD1	Trn. No.:	Receipt No.: 5-5924
Trans Description (optional):		
Sub-Basin:	PCW/LOG Due Date: N/A existing well	

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-1	-107.77260	36.86258	See below

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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:
SW 1/4 of SW 1/4 Section 27, Township 31N, Range 9W Hilcorp : Johnston Federal #4

Well is on land owned by: Bureau of Land Management

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): 51 feet	Outside diameter of well casing (inches): 2 inches
Driller Name: unknown	Driller License Number: unknown

3. ADDITIONAL STATEMENTS OR EXPLANATIONS

Well MW-1, is an un-permitted groundwater monitoring well installed in 1999 constructed of 2-in. dia. PVC to approx. 51 ft below surface. The purpose of this application is to extract groundwater and free-product from MW-1 via dual-phase extraction for site remediation. Estimated maximum 300 gallons of groundwater with minor amounts (<2%) non-aqueous phase liquid are anticipated to be recovered during 2-day extraction event. See the attached Work Plan for more information regarding planned remedial action/groundwater withdrawal.

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

File No.: SJ-4262 POD1	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
Print Name(s)

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

Jeff Walker
Applicant Signature

Applicant Signature

2017 OCT 18 PM 1:10
STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

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 20th day of October 20 17, for the State Engineer,

Tom Blaine, P.E., State Engineer

By: Blaine Watson
Signature

Blaine Watson
Print

Title: District V Manager
Print

FOR OSE INTERNAL USE

Application for Permit, Form WR-07

File No.: SJ-4262 POD1	Trn No.:

NMOSE Permit for a Well(s) With No Water Right and for Temporary Use of Groundwater for Contaminant Remediation
Conditions of Approval
SJ-4262 POD1

Upon review of the proposed pollution recovery plan, the New Mexico Office of the State Engineer (NMOSE) has determined that existing water rights will not be permanently 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 is further subject to the following conditions of approval.

1. This application is approved as follows:

Permittee(s): Hilcorp Energy Company
via Jeff Walker, GHD Services, Inc., as Agent
6121 Indian School Rd., NE, Ste 200
Albuquerque, NM 87110

Permit Number: SJ-4262

Application File Date: October 18, 2017

Priority: N/A

Source: Groundwater

Point(s) of Diversion: SJ-4262 POD1, an existing and previously unpermitted monitoring well, proposed for temporary use for groundwater monitoring and pollution recovery. The well (aka, point of diversion; POD) is located on land owned by the U.S. Department of Interior Bureau of Land Management in San Juan County, New Mexico, within the SW/4 SW/4 of Section 27, Township 31 North, Range 9 West, NMPM, associated with the Johnston Fed #4 site investigation, at the following approximate point locations (Lat/Long, WGS84)

POD Number and Owner's Well Name	Casing - Inside Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
SJ-4262 POD1 (MW-1)	2	36.86258 N	107.77260 W

Purpose of Use: Groundwater monitoring and dual phase pollution recovery

Place of Use: N/A

Amount of Water: The permittee my produce up to a total volume of **one acre-foot (325,851 gallons)**, including light non-aqueous phase liquid (LNAPL).

2. No extraction of water which is inconsistent with the purpose, date, and volume limitation amounts authorized by this permit shall occur from the wells identified herein.

3. Only *de minimis* amounts of water generated as a result of pollution remediation activities are permitted to be removed from the approved PODs. The application states that contaminants will be removed from the well using a dual-phase extraction system operated in successive extraction events between November 9, 2017, and November 9, 2018. **Approval under this permit to use well SJ-4262 POD1 for the purpose of pollution extraction/recovery shall expire November 9, 2018, or once the total volume extracted from all approved PODs is equal to one acre-foot, whichever occurs first.**

4. The total volume of water extracted shall be determined quarterly using a totalizing flow meter(s) and submitted to the NMOSE District V office in Aztec based on the following schedule. The quarterly reports shall include the beginning and ending meter readings with units of measurement, meter information, and total volume extracted for the quarterly period. Should no extraction occur during a quarterly measurement period a statement indicating such shall be included in the quarterly report(s). Meter reporting forms are available at: http://www.ose.state.nm.us/Meter/index.php.

   Total volumes extracted shall be determined for the following quarters and submitted as follows:
   - January 1st through March 31st - due by May 1st
   - April 1st through June 30th - due by August 1st
   - July 1st through September 30th - due by November 1st
   - October 1st through December 31st - due by February 1st

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

6. 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.

7. 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.

8. When the permittee receives approval or direction to permanently abandon the well(s), the District V Office of NMOSE shall be notified and provided with a plugging plan for review, modification as necessary, and approval. Approval of a plugging plan is required *prior* to initiation of *any* well plugging activities. The well(s) shall be plugged in accordance with Subsection C of 19.27.4.30 NMAC.

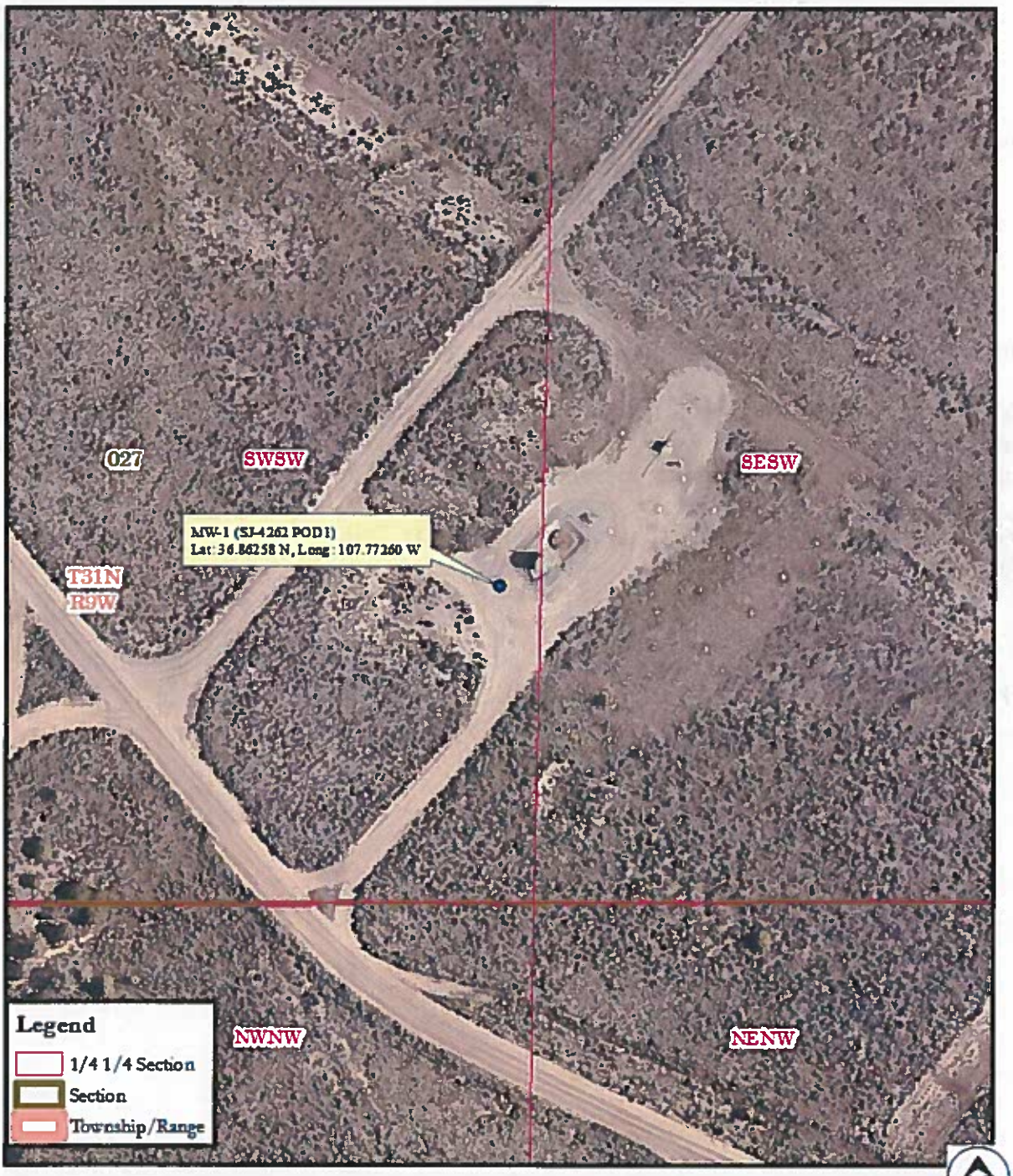
9. Should another regulatory agency sharing jurisdiction of the project authorize, or by regulation require, more stringent requirements than stated herein, the more stringent procedure should be followed. These, among others, may include provisions regarding pre-authorization to proceed, type of methods 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.

10. The State Engineer retains jurisdiction of this permit.

The application for temporary use of non-consumptive use well(s) SJ-4262 POD1 for pollution recovery purposes, submitted October 18, 2017 , is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Witness my hand and seal this 20th day of October , A.D. 2017 .
Tom Blaine, P.E., State Engineer

By: Blaine Watson
Blaine Watson, Manager
District V Office, Water Rights Division



Map Description: Hilcorp Energy Company;
Johnston Fed #4 Release Investigation
Data sources: Application filed October 168 2017
File number: SJ-4262
Aerial Photography: 2015

STATE OF NEW MEXICO
Office of the State Engineer
Tom Blaine, P.E.
State Engineer

District V Office, Aztec
Well Location Map

Appendix B
AcuVac Remediation Report

AcuVac Remediation, LLC
1656-H Townhurst, Houston, Texas 77043
713.468.6688 • www.acuvac.com

November 15, 2017

Mr. Jeff Walker, CPG, PMP
Project Manager
GHD Services, Inc.
6121 Indian School Road NE
Albuquerque, NM 67110

Dear Jeff:

Re: MDPE Events, Johnston Federal No. 4, San Juan, NM

At your request, we performed two 8.0-hour Mobile Dual Phase Extraction (MDPE) Events as follows:

- One 8.0 hour, Event #6A, on Well MW-1 on November 9, 2017
- One 8.0 hour, Event #6B, on Well MW-1 on November 10, 2017

Following is the Report and a copy of the operating data collected during Event #6. Additionally:

- Table #1 contains the Summary Well Data
- Table #2 contains the Summary Recovery Data

The purpose of the MDPE events was to maximize recovery of Phase Separated Hydrocarbons (PSH). PSH is referred to as Light Non-Aqueous Phase Liquids (LNAPL). The source of the LNAPL is a historical release of natural gas condensate.

OBJECTIVES

The objectives of an MDPE Event are to:

- Evaluate the potential for removing liquid and vapor phase LNAPL from the groundwater and soils in the subsurface formations.
- Expose the capillary fringe area and below to the extraction well induced vacuums.
- Increase the groundwater and contaminant specific yields with high induced vacuums.
- Provide an induced hydraulic gradient to gain hydraulic control of the area during the Event period.
- Select the groundwater depression and pump rates to accomplish the above objectives.

METHODS AND EQUIPMENT

AcuVac owns and maintains an inventory of equipment to perform MDPE events. No third party equipment is utilized. The events at the above referenced site were conducted using the AcuVac I-6 System with Roots RAI-33 blower used as a vacuum pump and Roots RAI-22 positive displacement blower. The following table lists equipment and instrumentation employed in these events and the data element captured by each.

Instrumentation Employed by AcuVac	
Measurement Equipment	**Data Element**
Extraction Well Induced Vacuum and Flow	
Dwyer Magnehelic Gauges	Extraction Well Vacuum
Dwyer Averaging Pitot Tubes / Magnehelic Gauges	Extractions Well Vapor Flow
Observation Wells	
Dwyer Digital Manometer	Vacuum / Pressure Influence
Well Vapor Samples	
V-1 vacuum box	Extraction Well Non-Diluted Vapor Samples
HORIBA® Analyzer	Extraction Well Vapor TPH Concentration
QRae Mini II O_2 Monitor	Extraction Well Vapor Oxygen Content
LNAPL Thickness (if present)	
Solinst Interface Probes Model 122	Depth to NAPL and Depth to Groundwater
Liquid Recovery	
Totalizer Flow Meter	Liquid Flow and Total Volume
In-Well Pump	Redi Flo2 Total Fluids Pump
Pump Speed, Other Diagnostics	Redi Flo/Baldor Pump Controller
Groundwater Depression / Upwelling	
In-Situ Level Troll 700 Data Logger	Liquid Column in Extraction and Observation Wells
In-Situ Vented Cable with Chamber	Equalize Well Vacuum/Pressure
In-Situ Rugged Reader Data Logger Interface	Capture Readings from Data Logger Trolls
Atmospheric Conditions	
Testo Model 511	Relative and Absolute Barometric Pressure

The vacuum extraction portion of the AcuVac System consists of a vacuum pump driven by an internal combustion (IC) engine. The vacuum pump is connected to the extraction well, and the vacuum created on the extraction well causes light hydrocarbons in the soil and on the groundwater to volatilize and flow through a moisture knockout tank to the vacuum pump and the IC engine where they are burned as part of the normal combustion process. Propane is used as auxiliary fuel to help power the engine if the well vapors do not provide the required energy.

The AcuVac IC engine is fully loaded for the maximum power necessary to achieve and maintain high induced vacuums and/or high well vapor flows required to maximize the vacuum radius of influence for pilot tests and short term event remediation.

Emissions from the engine are passed through two of three catalytic converters to maximize destruction of removed hydrocarbon vapors. The engine's fuel–to-air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for the equipment, all systems stop when the engine stops, thus eliminating any uncontrolled release of hydrocarbons.

Since the AcuVac System is held entirely under vacuum, any leaks in the seals or connections are leaked into the system and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure, over speed, or overheating.

Groundwater extraction was provided by an in-well Redi Flo2 total fluids pump that had the discharge line connected to a total volume meter. The discharge line from the volume meter was then connected to the stand-by tank. The electrical power for the groundwater pump was supplied from a 120v Honda generator. The groundwater flow rate was adjusted to maintain a target level. Interface meters were used to collect depth to groundwater and depth to LNAPL measurements. Groundwater samples were taken periodically in a graduated cylinder to determine the average LNAPL percentages and volume.

The design of the AcuVac System enables independent control of both the induced well vacuum and the groundwater pumping functions such that the AcuVac team can control the induced hydraulic gradient to increase exposure of the formation to SVE. The ability to separate the vacuum and liquid flows within the extraction well improves the LNAPL recovery rates and enables the AcuVac team to record data specific to each media.

SUMMARY OF MDPE EVENT #6A - WELL MW-1

- The total event time was 8.0 hours. The event was conducted on November 9, 2017. The data is compared to Event #5 conducted on April 20 through 23, 2015 which had a total event time of 79.0 hours.
- The total liquid volume recovered was 71 gals, with no measurable LNAPL present.
- Total vapor LNAPL burned as IC engine fuel was 10.90 gals, **for a total liquid and vapor LNAPL recovery of 10.90 gals. This equates to an average of 1.36 gals/hr.**
- Average HORIBA® analytical data from the influent vapor samples was:
  TPH = 38,283 ppmv, CO_2 = 6.70%, CO = 0.58%, O_2 = 4.6% and H_2S = 0 ppm.
- Compared with MDPE Event #5 data, the average TPH levels decreased 17,148 ppmv, CO_2 decreased 1.08%, CO decreased 0.92%, O_2 increased 1.0% and H_2S was steady at 0 ppm.
- The maximum HORIBA® Analytical Data from the influent vapor samples for TPH was 43,940 ppmv. Compared with MDPE Event #5 data, the maximum TPH levels decreased 14,641 ppmv.
- The average extraction well induced vacuum was 70.00"H_2O with a maximum vacuum of 70.00"H_2O. Compared with MDPE Event #5 data, the average extraction well induced vacuum increased 40.00"H_2O and the maximum induced vacuum increased 40.00"H_2O.
- The average extraction well vapor flow was 18.29 scfm with a maximum well vapor flow of 19.78 scfm. Compared with MDPE Event #5 data, the average extraction well vapor flow increased 3.22 scfm, and the maximum well vapor flow increased at 4.71 scfm.
- The total depth of the well was measured at 51.67 ft BTOC. The groundwater pump inlet was set at 51.0 ft BTOC, which is essentially the bottom of the well. The average groundwater pump rate was 0.14 gpm, and the maximum groundwater pump rate was 0.30 gpm.
- The average groundwater depression, based on the positioning of the groundwater pump, was 2.0 ft below static level.
- There was no LNAPL thickness recorded prior to the start of Event #6A, and no LNAPL thickness was recorded at the conclusion of the event.

The total LNAPL removed, including liquid and vapor, during the 8.0 hour Event #6A well MW-1 was 10.60 gals.

ADDITIONAL INFORMATION

- Although there was sheen on the recovered liquid, there was no measurable liquid LNAPL in the recovered liquid during the 8.0 hour event.
- The high TPH vapor levels indicate contaminant in the LNAPL range.
- The TPH vapor levels remained mostly steady throughout the event.
- The low O_2 levels in the influent vapors indicate SVE short circuiting from the ground surface did not occur.

SUMMARY OF MDPE EVENT #6B: WELL MW-1

- The total event time was 8.0 hours. The event was conducted on November 10, 2017. The data is compared to Event #6A conducted on November 9, 2017 which had a total event time of 8.0 hours.
- The total liquid volume recovered was 87 gals, with no measurable LNAPL present.
- Total vapor LNAPL burned as IC engine fuel was 15.14 gals, **for a total liquid and vapor LNAPL recovery of 15.14 gals. This equates to an average of 1.89 gals/hr.**
- Average HORIBA® analytical data from the influent vapor samples was: TPH = 41,270 ppmv, CO_2 = 6.53%, CO = 0.77%, O_2 = 2.7% and H_2S = 19.23 ppm.
- Compared with MDPE Event #6A data, the TPH levels decreased 2,670 ppmv, CO_2 decreased 0.17%, CO increased 0.19%, O_2 decreased 1.9% and H_2S increased 19.23 ppm.
- The maximum HORIBA® analytical data from the influent vapor samples for TPH was 43,560 ppmv. Compared with MDPE Event #6A data, the maximum TPH levels increased 5,277 ppmv.
- The average extraction well induced vacuum was 70.00"H_2O with a maximum vacuum of 76.00"H_2O. Compared with MDPE Event #6A data, the average extraction well induced vacuum was steady at 70.00"H_2O and the maximum extraction well induced vacuum increased 6.00"H_2O.
- The average extraction well vapor flow was 22.34 scfm with a maximum extraction well vapor flow of 23.17 scfm. Compared with MDPE Event #6A data, the average extraction well vapor flow increased 4.05 scfm, and the maximum extraction well flow increased 3.39 scfm.
- The total depth of the well was measured at 51.67 ft BTOC. The groundwater pump inlet was set at 51.0 ft BTOC, which is essentially the bottom of the well. The average groundwater pump rate was 0.17 gpm, and the maximum groundwater pump rate was 0.23 gpm.
- The average groundwater depression, based on the positioning of the groundwater pump, was 2.0 ft below static level.
- No LNAPL thickness was recorded prior to the start of Event #6B, and no LNAPL was recorded at the conclusion of the event.

The total LNAPL removed, including liquid and vapor, during the 8.0 hour Event #6B Well MW-1 was 15.14 gals.

ADDITIONAL INFORMATION

- Although there was sheen on the recovered liquid, there was no measurable liquid LNAPL in the recovered liquid during the 8.0 hour event.
    - The high TPH vapor levels indicate contaminant in the LNAPL range.
    - The TPH vapors levels remained mostly steady throughout the Event.
    - The low O_2 levels in the influent vapors indicate SVE short circuiting from the ground surface did not occur.

CONCLUSION

All LNAPL recovery was a result of the Soil Vapor Extraction portion of the event. Our recommendation for future events would be to utilize the same configuration as Event #5 and operate the AcuVac computer controlled unit for the same time period as the events that will be performed at the Hilcorp State Com J6 site. The extended time period will recover a greater volume of LNAPL vapors at a lower overall cost.

METHOD OF CALIBRATION AND CALCULATIONS

The HORIBA® Analytical instrument is calibrated with Hexane and CO_2. In all subsequent Events, the test data will be compared to the previous Event to evaluate the progress for this remediation project.

The formula used to calculate the emission rate is:

$$ER = HC\ (ppmv) \times MW\ (Hexane) \times Flow\ Rate\ (scfm) \times 1.58E^{-7} \frac{(min)(lb\ mole)}{(hr)(ppmv)(ft^3)} = lbs/hr$$

ADDITIONAL INFORMATION INCLUDED WITH REPORT

- Table #1 Summary Well Data for well MW-1
- Table #2 Summary Recovery Data for well MW-1
- Recorded Data
- Photographs of the MDPE System and well MW-1.

After you have reviewed the report and if you have any questions, please contact me. We appreciate you selecting AcuVac to provide this service.

Sincerely,

ACUVAC REMEDIATION, LLC

Paul D. Faucher
Vice President, Operations

Summary Well Data

Table #1

Event		6A	5B
WELL NO.		**MW-1**	**MW-1**
Total Event Hours		8.0	8.0
Cumulative Event Hours		128.0	136.0
TD	ft	51.67	51.67
Well Screen	ft	15' to 45'	15' to 45'
Well Size	in	2.0	2.0
Well Data			
DTGW - Static - Start Event	ft	46.67	46.99
DTLNAPL - Static - Start Event	ft	-	-
NAPL	ft	-	-
Hydro-Equivalent- Beginning	ft	46.67	46.99
DTGW - End Event	ft	48.82	47.34
DTLNAPL - End Event	ft	-	-
LNAPL	ft	-	-
Hydro-Equivalent- Ending	ft	48.82	47.34
Extraction Data			
Average Extraction Well Vacuum	"H_2O	70.00	70.00
Maximum Extraction Well Vacuum	"H_2O	70.00	76.00
Average Extraction Well Vapor Flow	scfm	18.29	22.34
Maximum Extraction Well Vapor Flow	scfm	19.78	23.17
Average GW/LNAPL Pump Rate	gpm	0.14	0.17
Maximum GW/LNAPL Pump Rate	gpm	0.30	0.23
Influent Data			
Maximum TPH	ppmv	43,940	43,350
Average TPH	ppmv	38,283	41,270
Average CO_2	%	6.70	6.53
Average CO	%	0.58	0.77
Average O_2	%	4.6	2.7
Average H_2S	ppm	0	19.23

Summary Recovery Data

Table #2

Event		6A	6B
WELL NO.		**MW-1**	**MW-1**
Recovery Data- Current Event			
Total Liquid Volume Recovered	gals	71	87
Total Liquid LNAPL Recovered	gals	0	0
Total Liquid LNAPL Recovered / Total Liquid	%	0	0
Total Liquid LNAPL Recovered / Total LNAPL	%	0	0
Total Vapor LNAPL Recovered	gals	10.90	15.14
Total Vapor LNAPL Recovered / Total LNAPL	%	100.00	100.00
Total Vapor and Liquid LNAPL Recovered	gals	10.90	15.14
Average LNAPL Recovery	gals/hr	1.36	1.89
Total LNAPL Recovered	lbs	76	106
Total Volume of Well Vapors	cu. ft	8,779	10,723
Recovery Data- Cumulative			
Total Liquid Volume Recovered	gals	933	1,020
Total Liquid LNAPL Recovered	gals	181.66	196.81
Total Vapor LNAPL Recovered	gals	272.73	287.88
Total Vapor and Liquid LNAPL Recovered	gals	672.91	960.79
Average LNAPL Recovery	gals/hr	1.42	1.45
Total LNAPL Recovered	lbs	1,909	2,015
Total Volume of Well Vapors	cu. ft	156,782	167,506

AcuVac Remediation

OPERATING DATA – EVENT # 6A **PAGE # 1** **ACUVAC MDP SYSTEM**

Location: Johnston Federal #4, San Juan County, NM **Project Managers: Faucher/George**

Well # MW-1		Date	11/9/17					
		Time	0630	0700	0730	0800	0830	0900
		Hr Meter	8307.0	8307.5	8308.0	8308.5	8309.0	8309.5
ENGINE / BLOWER	Engine Speed	RPM	2000	1900	1900	1900	1900	1900
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	120	120	120	120	120	120
	Alternator	Volts	14	14	14	14	14	14
	Intake Vacuum	"Hg						
	Gas Flow Fuel/Propane	cfh	100	95	95	95	95	95
ATMOSPHERE VACUUM / AIR	Extraction Well Vac.	"H_2O	70	70	70	70	70	70
	Extraction Well Flow	scfm	16.62	16.62	16.62	16.62	16.62	16.62
	Influent Vapor Temp.	°F	52	52	52	52	52	52
	Air Temp	°F	27	27	30	30	32	35
	Barometric Pressure	"Hg	29.97	29.97	30.01	29.99	29.98	29.96
VAPOR / INFLUENT	TPH	ppmv	-	32,130	-	-	-	36,780
	CO_2	%	-	7.06	-	-	-	7.12
	CO	%	-	.40	-	-	-	.53
	O_2	%	-	1.0	-	-	-	6.3
	H_2S	ppm	-	0	-	-	-	0
NOTES	ARRIVED ON SITE AT 0615 HRS. AcuVac SYSTEM AND EQUIPMENT MOBILIZED ON 11/8/17. CONNECTED GW PUMP DISCHARGE HOSE TO TOTALIZER FLOW METER AND COLLECTION TANK. GW PUMP INLET 1.5 FT ABOVE WELL BOTTOM. 0630 HRS EVENT STARTED. INITIAL WELL VAC 70 "H_2O, WVF 16.62 SCFM. INITIAL TPH VAPOR CONCENTRATION 32,130 PPMV. AT 0900 HRS TPH VAPORS ↑ 36,780 PPMV. VERY LOW LIQUID RECOVERY BASED ON RECENT DRY CONDITIONS NO MEASURABLE NAPL IN RECOVERED LIQUID.							
RECOVERY	Totalizer	gals	13423	13426	13429	13432	13435	13438
	Pump Rate	gals/min	-	-	-	-	-	-
	Total Volume	gals	-	3	6	9	12	15
	NAPL	% Vol	-	SHEEN	SHEEN	SHEEN	SHEEN	SHEEN
	NAPL	Gals	-	-	-	-	-	-
EW	Data Logger Head	ft	-	-	-	-	-	-
	GW Depression	ft	(3.25)	(3.25)	(3.25)	(3.25)	(3.25)	(3.25)
	Extraction Well	DTNAPL	-					
	Extraction Well	DTGW	46.97					

NAPL Ø

AcuVac Remediation

OPERATING DATA – EVENT # 6A PAGE # 2 ACUVAC MDP SYSTEM

Location: Johnston Federal #4, San Juan County, NM **Project Managers:** Faucher/George

Well # MW-1		Date	8/9/17					
		Time	0930	1000	1030	1100	1130	1200
		Hr Meter	8310.0	8310.5	8311.0	8311.5	8312.0	8312.5
ENGINE / BLOWER	Engine Speed	RPM	1900	1900	1900	1900	1900	1900
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	120	120	120	120	120	125
	Alternator	Volts	14	14	14	14	14	14
	Intake Vacuum	"Hg	16	16	16	16	16	16
	Gas Flow Fuel/Propane	cfh	95	95	90	80	80	80
ATMOSPHERE VACUUM / AIR	Extraction Well Vac.	"H_2O	70	70	70	70	70	70
	Extraction Well Flow	scfm	16.62	16.62	19.78	19.78	19.78	19.78
	Influent Vapor Temp.	°F	54	54	56	56	56	58
	Air Temp	°F	41	43	47	49	54	55
	Barometric Pressure	"Hg	29.55	29.54	29.53	29.53	29.53	29.50
VAPOR / INFLUENT	TPH	ppmv	-	-	-	43,540	-	-
	CO_2	%	-	-	-	6.3	-	-
	CO	%	-	-	-	.88	-	-
	O_2	%	-	-	-	4.6	-	-
	H_2S	ppm	-	-	-	0	-	-
RECOVERY	Totalizer	gals	13439	13440	13442	13451	13455	13463
	Pump Rate	gals/min	-	-	-	-	-	-
	Total Volume	gals	16	17	19	28	32	40
	NAPL	% Vol	SHEEN	SHEEN	SHEEN	SHEEN	SHEEN	SHEEN
	NAPL	Gals	-	-	-	-	-	-
EW	Data Logger Head	ft	-	-	-	-	-	-
	GW Depression	ft	(3.25)	(3.25)	(3.25)	(3.25)	(3.25)	(3.25)
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

NOTES

WELL VAC STEADY DURING PERIOD. AT 1030 HRS WVF ↑ 19.78 SCFM. GW PUMP SET TO STEADY STATE RATHER THAN ON/OFF. PREVENTED UPWELLING WHICH WAS AFFECTING THE WVF AS THE UPWELLING WAS OCCLUDING THE WELL SCREEN. NO MEASURABLE NAPL IN THE RECOVERED LIQUID.

AcuVac Remediation

OPERATING DATA – EVENT # 6A | PAGE # 3 | ACUVAC MDP SYSTEM

Location: Johnston Federal #4, San Juan County, NM | **Project Managers:** Faucher/George

		Date	11/9/17					
Well #		Time	1230	1300	1330	1400	1430	
MW-1		Hr Meter	8313.0	8313.5	8314.0	8314.5	8315.0	
ENGINE / BLOWER	Engine Speed	RPM	1900	1900	1900	1900	1900	
	Oil Pressure	psi	50	50	50	50	50	
	Water Temp	°F	125	125	125	125	125	
	Alternator	Volts	14	14	14	14	14	
	Intake Vacuum	"Hg	16	16	16	16	16	
	Gas Flow Fuel/Propane	cfh	80	80	80	80	80	
ATMOSPHERE VACUUM / AIR	Extraction Well Vac.	"H_2O	70	70	70	70	70	
	Extraction Well Flow	scfm	19.78	19.78	19.78	19.78	19.78	
	Influent Vapor Temp.	°F	58	58	58	58	58	
	Air Temp	°F	56	57	59	59	61	
	Barometric Pressure	"Hg	29.88	29.86	29.86	29.85	29.85	
VAPOR / INFLUENT	TPH	ppmv	-	40,280	-	-	-	
	CO_2	%	-	6.3	-	-	-	
	CO	%	-	.51	-	-	-	
	O_2	%	-	6.3	-	-	-	
	H_2S	ppm	-	0	-	-	-	

NOTES

WELL VAC AND WVF STEADY AT 70"H_2O & 19.78 SCFM
TPH VAPOR CONCENTRATIONS ↑ 40,280 PPMV AT 1300 HRS.
LIQUID RECOVERY VERY LOW. NO MEASURABLE NAPL IN RECOVERED LIQUID.
AT 1425 HRS STOPPED VACUUM TO PUMP AND NAPL THAT MAY BE IN OR
AROUND THE WELL BORE. AT 1430 HRS EVENT CONCLUDED. GAUGED
WELL, NO NAPL PRESENT.

RECOVERY	Totalizer	gals	13469	13477	13482	13488	13494	
	Pump Rate	gals/min	-	-	-	-	-	
	Total Volume	gals	46	54	59	65	71	
	NAPL	% Vol	SHEEN	SHEEN	SHEEN	SHEEN	SHEEN	
	NAPL	Gals	-	-	-	-	-	
EW	Data Logger Head	ft	-	-	-	-	-	
	GW Depression	ft	(3.25)	(3.25)	(3.25)	(3.25)	(3.25)	
	Extraction Well	DTNAPL					-	
	Extraction Well	DTGW					48.82	

NAPL @

AcuVac Remediation

OPERATING DATA – EVENT # 6B **PAGE # 1** **ACUVAC MDP SYSTEM**

Location: Johnston Federal #4, San Juan County, NM **Project Managers: Faucher/George**

Well # MW-1		Date	11/10/17					
		Time	0630	0700	0730	0800	0830	0900
		Hr Meter	8315.5	8316.0	8316.5	8317.0	8317.5	8318.0
ENGINE / BLOWER	Engine Speed	RPM	2000	1900	1900	1900	1900	1900
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	120	120	120	120	120	120
	Alternator	Volts	14	14	14	14	14	14
	Intake Vacuum	"Hg	12	12	12	12	12	12
	Gas Flow Fuel/Propane	cfh	90	90	90	75	75	75
ATMOSPHERE VACUUM / AIR	Extraction Well Vac.	"H_2O	70	70	70	76	76	72
	Extraction Well Flow	scfm	19.78	19.78	19.78	22.72	22.72	22.12
	Influent Vapor Temp.	°F	52	54	54	56	56	56
	Air Temp	°F	28	28	29	33	36	39
	Barometric Pressure	"Hg	29.88	29.90	29.90	29.91	29.89	29.88
VAPOR / INFLUENT	TPH	ppmv	-	38070	-	-	-	43,560
	CO_2	%	-	6.84	-	-	-	6.41
	CO	%	-	.63	-	-	-	.85
	O_2	%	-	2.8	-	-	-	5.1
	H_2S	ppm	-	2.1	-	-	-	11.2
NOTES	ARRIVED ON SITE AT 0615 HRS. GAUGED WELL MW-1, DTGW 46.55 FT, NO NAPL. CONNECTED IN-WELL PUMP TO TOTALIZER/FLOW METER AND THEN TO COLLECTION TANK. PERFORMED ALL SAFETY CHECKS - ALL OK. 0630 HRS EVENT STARTED. INITIAL WELL VAC 70 "H_2O, WVF 19.78 SCFM. AT 0800 HRS WELL VAC ↑ 80.0 "H_2O, WVF 22.72 SCFM. AT 0900 WELL VAC ↓ 72 "H_2O, WVF 22.12 SCFM. INITIAL TPH VAPOR CONCENTRATIONS AT 0700 HRS 38,070 PPMV. AT 0900 TPH VAPORS ↑ 43,650 PPMV. LIQUID RECOVERY STEADY AT 7.0 GAL / 30 MIN PERIOD.							
RECOVERY	Totalizer	gals	13494	13494	13498	13505	13512	13519
	Pump Rate	gals/min	-	-	-	-	-	-
	Total Volume	gals	-	-	4.0	11	18	25
	NAPL	% Vol	-	-	SHEEN	SHEEN	SHEEN	SHEEN
	NAPL	Gals	-	-	-	-	-	-
EW	Data Logger Head	ft	-	-	-	-	-	-
	GW Depression	ft	<3.0>	<3.0>	<3.0>	<3.0>	<3.0>	<3.0>
	Extraction Well	DTNAPL	-					
	Extraction Well	DTGW	46.99					

NAPL 9

AcuVac Remediation

OPERATING DATA – EVENT # 6B | PAGE #2 | ACUVAC MDP SYSTEM

Location: Johnston Federal #4, San Juan County, NM | **Project Managers:** Faucher/George

Well # MW-1		Date	11/10/17					
		Time	0930	1000	1030	1100	1130	1200
		Hr Meter	8318.5	8319.0	8319.5	8320.0	8320.5	8321.0
ENGINE / BLOWER	Engine Speed	RPM	1900	1900	1900	1900	1900	1900
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	120	120	120	130	130	130
	Alternator	Volts	14	14	14	14	14	14
	Intake Vacuum	"Hg	10	10	10	10	10	10
	Gas Flow Fuel/Propane	cfh	75	75	75	75	75	75
ATMOSPHERE VACUUM / AIR	Extraction Well Vac.	"H_2O	72	72	68	68	68	68
	Extraction Well Flow	scfm	22.15	22.15	23.17	23.17	23.17	23.17
	Influent Vapor Temp.	°F	56	56	56	56	56	56
	Air Temp	°F	43	46	49	54	57	60
	Barometric Pressure	"Hg	29.87	29.86	29.85	29.83	29.82	29.81
VAPOR / INFLUENT	TPH	ppmv	–	–	–	43,310	–	–
	CO_2	%	–	–	–	6.58	–	–
	CO	%	–	–	–	.88	–	–
	O_2	%	–	–	–	1.8	–	–
	H_2S	ppm	–	–	–	31.9	–	–

NOTES

1000 HRS WELL @ TO 68"H_2O, WVF ↑ 23.17 SCFM. 1100 HRS TPH VAPORS MOSTLY STEADY W/ 0900 HR READING. LIQUID RECOVERY STEADY AT 5-6 GAL/30 MIN. NO MEASURABLE NAPL IN LIQUID.

RECOVERY	Totalizer	gals	13524	13530	13537	13543	13549	13555
	Pump Rate	gals/min	–	–	–	–	–	
	Total Volume	gals	30	36	43	49	55	61
	NAPL	% Vol	SHEEN	SHEEN	SHEEN	SHEEN	SHEEN	SHEEN
	NAPL	Gals	–	–	–	–	–	–
EW	Data Logger Head	ft	–	–	–	–	–	–
	GW Depression	ft	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

AcuVac Remediation

OPERATING DATA – EVENT # 6B | PAGE # 3 | ACUVAC MDP SYSTEM

Location: Johnston Federal #4, San Juan County, NM | **Project Managers:** Faucher/George

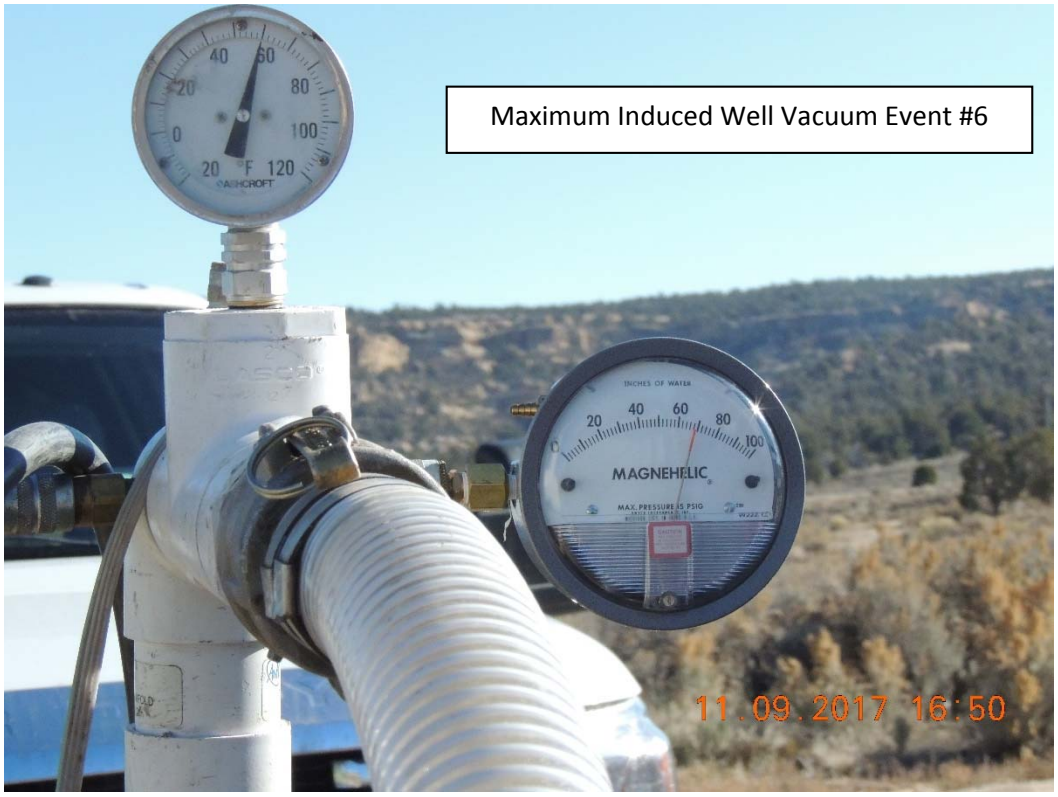
Well # MW-1		Date	11/10/17					
		Time	1230	1300	1330	1400	1430	
		Hr Meter	8321.5	8322.0	8322.5	8323.0	8323.5	
ENGINE / BLOWER	Engine Speed	RPM	1900	1900	1900	1900	1900	
	Oil Pressure	psi	50	50	50	50	50	
	Water Temp	°F	130	130	130	130	130	
	Alternator	Volts	14	14	14	14	14	
	Intake Vacuum	"Hg	10	10	10	10	10	
	Gas Flow Fuel/Propane	cfh	75	75	75	75	75	
ATMOSPHERE VACUUM / AIR	Extraction Well Vac.	"H_2O	68	68	68	68	68	
	Extraction Well Flow	scfm	23.17	23.17	23.17	23.17	23.17	
	Influent Vapor Temp.	°F	58	58	60	60	60	
	Air Temp	°F	63	64	65	65	66	
	Barometric Pressure	"Hg	29.78	29.76	25.75	25.74	25.73	
VAPOR / INFLUENT	TPH	ppmv	–	40,140	–	–	–	
	CO_2	%	–	6.30	–	–	–	
	CO	%	–	.71	–	–	–	
	O_2	%	–	1.1	–	–	–	
	H_2S	ppm	–	31.7	–	–	–	
NOTES								
RECOVERY	Totalizer	gals	13561	13566	13571	13576	13581	
	Pump Rate	gals/min	–	–	–	–	–	
	Total Volume	gals	67	72	77	82	87	
	NAPL	% Vol	SHEEN	SHEEN	SHEEN	SHEEN	SHEEN	
	NAPL	Gals	–	–	–	–	–	
EW	Data Logger Head	ft	–	–	–	–	–	
	GW Depression	ft	<3.0>	<3.07	<3.0>	<3.05	<3.0>	
	Extraction Well	DTNAPL					–	
	Extraction Well	DTGW					47.34	

JOHNSTON FEDERAL NO. 4 SITE
AZTEC, SAN JUAN COUNTY, NM

AcuVac MDPE System Event #6

AcuVac MDPE System Event #6

JOHNSTON FEDERAL NO. 4 SITE
AZTEC, SAN JUAN COUNTY, NM



Appendix C
Groundwater Laboratory Analytical Reports

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

October 10, 2017

Jeff Walker
GHD Services
6121 indian School Rd
Ste 200
Albuquerque, NM 87110

RE: Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Dear Jeff Walker:
Enclosed are the analytical results for sample(s) received by the laboratory on September 29, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Alice Spiller

Alice Spiller
alice.spiller@pacelabs.com
(913)563-1409
Project Manager

Enclosures

cc: Angela Bown, GHD Services
Christine Mathews, GHD Services

Pace Analytical Services, LLC
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CERTIFICATIONS

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
WY STR Certification #: 2456.01
Arkansas Certification #: 15-016-0
Illinois Certification #: 003097
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212008A
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407
Utah Certification #: KS00021
Kansas Field Laboratory Accreditation: # E-92587
Missouri Certification: 10070

Pace Analytical Services, LLC
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Lenexa, KS 66219
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SAMPLE SUMMARY

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60254337001	**GW-11145957-092717-SP-MW-1**	Water	09/27/17 08:35	09/29/17 08:35
60254337002	**GW-11145957-092717-SP-MW-2**	Water	09/27/17 08:45	09/29/17 08:35
60254337003	**GW-11145957-092717-SP-MW-3**	Water	09/27/17 09:24	09/29/17 08:35
60254337004	**GW-11145957-092717-SP-MW-4**	Water	09/27/17 09:34	09/29/17 08:35
60254337005	**TRIP BLANK**	Water	09/27/17 08:35	09/29/17 08:35

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SAMPLE ANALYTE COUNT

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60254337001	**GW-11145957-092717-SP-MW-1**	EPA 6010	TDS	1	PASI-K
		EPA 8260	JTK	8	PASI-K
		EPA 300.0	OL	1	PASI-K
60254337002	**GW-11145957-092717-SP-MW-2**	EPA 6010	TDS	1	PASI-K
		EPA 8260	PGH	8	PASI-K
		EPA 300.0	OL	1	PASI-K
60254337003	**GW-11145957-092717-SP-MW-3**	EPA 6010	TDS	1	PASI-K
		EPA 8260	PGH	8	PASI-K
		EPA 300.0	OL	1	PASI-K
60254337004	**GW-11145957-092717-SP-MW-4**	EPA 6010	TDS	1	PASI-K
		EPA 8260	PGH	8	PASI-K
		EPA 300.0	OL	1	PASI-K

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ANALYTICAL RESULTS

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Sample: GW-11145957-092717-SP-MW-1 **Lab ID: 60254337001** Collected: 09/27/17 08:35 Received: 09/29/17 08:35 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP, Dissolved	Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Manganese, Dissolved	**739**	ug/L	5.0	1	10/09/17 12:18	10/09/17 18:14	7439-96-5	
8260 MSV UST, Water	Analytical Method: EPA 8260							
Benzene	**2340**	ug/L	100	100		10/04/17 12:16	71-43-2	
Ethylbenzene	**949**	ug/L	100	100		10/04/17 12:16	100-41-4	
Toluene	**2860**	ug/L	100	100		10/04/17 12:16	108-88-3	
Xylene (Total)	**9500**	ug/L	300	100		10/04/17 12:16	1330-20-7	
Surrogates								
Toluene-d8 (S)	98	%	80-108	100		10/04/17 12:16	2037-26-5	
4-Bromofluorobenzene (S)	98	%	80-113	100		10/04/17 12:16	460-00-4	
1,2-Dichloroethane-d4 (S)	94	%	80-114	100		10/04/17 12:16	17060-07-0	
Preservation pH	**1.0**		1.0	100		10/04/17 12:16		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**10.0**	mg/L	1.0	1		10/07/17 19:25	14808-79-8	M1

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Sample: GW-11145957-092717-SP-MW-2 **Lab ID: 60254337002** Collected: 09/27/17 08:45 Received: 09/29/17 08:35 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP, Dissolved	Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Manganese, Dissolved	ND	ug/L	5.0	1	10/09/17 12:18	10/09/17 18:21	7439-96-5	
8260 MSV UST, Water	Analytical Method: EPA 8260							
Benzene	ND	ug/L	1.0	1		10/05/17 01:32	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		10/05/17 01:32	100-41-4	
Toluene	ND	ug/L	1.0	1		10/05/17 01:32	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		10/05/17 01:32	1330-20-7	
Surrogates								
Toluene-d8 (S)	101	%	80-108	1		10/05/17 01:32	2037-26-5	
4-Bromofluorobenzene (S)	99	%	80-113	1		10/05/17 01:32	460-00-4	
1,2-Dichloroethane-d4 (S)	101	%	80-114	1		10/05/17 01:32	17060-07-0	
Preservation pH	**1.0**		1.0	1		10/05/17 01:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**1150**	mg/L	100	100		10/08/17 21:32	14808-79-8	M1

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Sample: GW-11145957-092717-SP-MW-3 **Lab ID: 60254337003** Collected: 09/27/17 09:24 Received: 09/29/17 08:35 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP, Dissolved	Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Manganese, Dissolved	**471**	ug/L	5.0	1	10/09/17 12:18	10/09/17 18:24	7439-96-5	
8260 MSV UST, Water	Analytical Method: EPA 8260							
Benzene	**3.1**	ug/L	1.0	1		10/05/17 01:46	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		10/05/17 01:46	100-41-4	
Toluene	ND	ug/L	1.0	1		10/05/17 01:46	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		10/05/17 01:46	1330-20-7	
Surrogates								
Toluene-d8 (S)	98	%	80-108	1		10/05/17 01:46	2037-26-5	
4-Bromofluorobenzene (S)	100	%	80-113	1		10/05/17 01:46	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	80-114	1		10/05/17 01:46	17060-07-0	
Preservation pH	**1.0**		1.0	1		10/05/17 01:46		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**680**	mg/L	100	100		10/08/17 22:16	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

ANALYTICAL RESULTS

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Sample: GW-11145957-092717-SP-MW-4 **Lab ID: 60254337004** Collected: 09/27/17 09:34 Received: 09/29/17 08:35 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP, Dissolved	Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Manganese, Dissolved	**2460**	ug/L	5.0	1	10/09/17 12:18	10/09/17 18:26	7439-96-5	
8260 MSV UST, Water	Analytical Method: EPA 8260							
Benzene	**26.6**	ug/L	1.0	1		10/05/17 02:00	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		10/05/17 02:00	100-41-4	
Toluene	ND	ug/L	1.0	1		10/05/17 02:00	108-88-3	
Xylene (Total)	**4.0**	ug/L	3.0	1		10/05/17 02:00	1330-20-7	
Surrogates								
Toluene-d8 (S)	98	%	80-108	1		10/05/17 02:00	2037-26-5	
4-Bromofluorobenzene (S)	100	%	80-113	1		10/05/17 02:00	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	80-114	1		10/05/17 02:00	17060-07-0	
Preservation pH	**1.0**		1.0	1		10/05/17 02:00		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**948**	mg/L	100	100		10/08/17 22:30	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

QC Batch: 497830 Analysis Method: EPA 6010
QC Batch Method: EPA 3010 Analysis Description: 6010 MET Dissolved
Associated Lab Samples: 60254337001, 60254337002, 60254337003, 60254337004

METHOD BLANK: 2036648 Matrix: Water
Associated Lab Samples: 60254337001, 60254337002, 60254337003, 60254337004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Manganese, Dissolved	ug/L	ND	5.0	10/09/17 18:07	

LABORATORY CONTROL SAMPLE: 2036649

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Manganese, Dissolved	ug/L	1000	976	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2036650 2036651

Parameter	Units	60254337001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Manganese, Dissolved	ug/L	739	1000	1000	1720	1750	98	101	75-125	2	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

QC Batch: 497060
QC Batch Method: EPA 8260
Analysis Method: EPA 8260
Analysis Description: 8260 MSV UST-WATER
Associated Lab Samples: 60254337001

METHOD BLANK: 2033502
Matrix: Water
Associated Lab Samples: 60254337001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	10/04/17 07:30	
Ethylbenzene	ug/L	ND	1.0	10/04/17 07:30	
Toluene	ug/L	ND	1.0	10/04/17 07:30	
Xylene (Total)	ug/L	ND	3.0	10/04/17 07:30	
1,2-Dichloroethane-d4 (S)	%	97	80-114	10/04/17 07:30	
4-Bromofluorobenzene (S)	%	99	80-113	10/04/17 07:30	
Toluene-d8 (S)	%	99	80-108	10/04/17 07:30	

LABORATORY CONTROL SAMPLE: 2033503

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	19.4	97	82-115	
Ethylbenzene	ug/L	20	19.8	99	83-112	
Toluene	ug/L	20	19.0	95	78-113	
Xylene (Total)	ug/L	60	59.0	98	83-114	
1,2-Dichloroethane-d4 (S)	%			103	80-114	
4-Bromofluorobenzene (S)	%			103	80-113	
Toluene-d8 (S)	%			99	80-108	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

QC Batch: 497169 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV UST-WATER
Associated Lab Samples: 60254337002, 60254337003, 60254337004

METHOD BLANK: 2033893 Matrix: Water
Associated Lab Samples: 60254337002, 60254337003, 60254337004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	10/05/17 00:21	
Ethylbenzene	ug/L	ND	1.0	10/05/17 00:21	
Toluene	ug/L	ND	1.0	10/05/17 00:21	
Xylene (Total)	ug/L	ND	3.0	10/05/17 00:21	
1,2-Dichloroethane-d4 (S)	%	97	80-114	10/05/17 00:21	
4-Bromofluorobenzene (S)	%	98	80-113	10/05/17 00:21	
Toluene-d8 (S)	%	97	80-108	10/05/17 00:21	

LABORATORY CONTROL SAMPLE: 2033894

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	20.2	101	82-115	
Ethylbenzene	ug/L	20	19.8	99	83-112	
Toluene	ug/L	20	19.7	99	78-113	
Xylene (Total)	ug/L	60	60.1	100	83-114	
1,2-Dichloroethane-d4 (S)	%			101	80-114	
4-Bromofluorobenzene (S)	%			99	80-113	
Toluene-d8 (S)	%			100	80-108	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

QC Batch: 497680 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60254337001

METHOD BLANK: 2036026 Matrix: Water
Associated Lab Samples: 60254337001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	1.0	10/07/17 18:23	

LABORATORY CONTROL SAMPLE: 2036027

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.9	97	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2036028 2036029

Parameter	Units	60254337001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	10.0	5	5	16.4	14.5	126	88	80-120	12	15	M1

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

QC Batch: 497695 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60254337002, 60254337003, 60254337004

METHOD BLANK: 2036420 Matrix: Water
Associated Lab Samples: 60254337002, 60254337003, 60254337004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	1.0	10/08/17 21:03	

LABORATORY CONTROL SAMPLE: 2036421

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.9	98	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2036422 2036423

Parameter	Units	60254337002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	1150	500	500	1850	1900	139	150	80-120	3	15	M1

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REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

BATCH QUALIFIERS

Batch: 497060

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

Batch: 497169

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

ANALYTE QUALIFIERS

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 11145957 JOHNSTON FEDERAL
Pace Project No.: 60254337

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60254337001	**GW-11145957-092717-SP-MW-1**	EPA 3010	497830	EPA 6010	497899
60254337002	**GW-11145957-092717-SP-MW-2**	EPA 3010	497830	EPA 6010	497899
60254337003	**GW-11145957-092717-SP-MW-3**	EPA 3010	497830	EPA 6010	497899
60254337004	**GW-11145957-092717-SP-MW-4**	EPA 3010	497830	EPA 6010	497899
60254337001	**GW-11145957-092717-SP-MW-1**	EPA 8260	497060		
60254337002	**GW-11145957-092717-SP-MW-2**	EPA 8260	497169		
60254337003	**GW-11145957-092717-SP-MW-3**	EPA 8260	497169		
60254337004	**GW-11145957-092717-SP-MW-4**	EPA 8260	497169		
60254337001	**GW-11145957-092717-SP-MW-1**	EPA 300.0	497680		
60254337002	**GW-11145957-092717-SP-MW-2**	EPA 300.0	497695		
60254337003	**GW-11145957-092717-SP-MW-3**	EPA 300.0	497695		
60254337004	**GW-11145957-092717-SP-MW-4**	EPA 300.0	497695		

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Sample Condition Upon Receipt

WO# : 60254337

60254337

AFS

Client Name: GHD

Courier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐

Tracking #: 7878 4032 2276 Pace Shipping Label Used? Yes ☐ No ☐

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☒ Foam ☐ None ☐ Other ☐

Thermometer Used: (CF 0.0) T-266 / CF +0.3 T-239 **Type of Ice:** (Wet) Blue None

Cooler Temperature (°C): **As-read** 4.6 **Corr. Factor** (CF 0.0) CF +0.3 **Corrected** 4.6

Date and initials of person examining contents: JB 9/29

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☐Yes ☒No ☐N/A	
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☐No ☐N/A	
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☒Yes ☐No ☐N/A	9/29/17
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	
Cyanide water sample checks: ☒N/A Lead acetate strip turns dark? (Record only) Potassium iodide test strip turns blue/purple? (Preserve)	☐Yes ☐No ☐Yes ☐No	
Trip Blank present:	☒Yes ☐No ☐N/A	
Headspace in VOA vials (>6mm):	☐Yes ☒No ☐N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: Alice Date: 10/03/17

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 **Of** 1

Section A
Required Client Information:

Company:	GHD Services, New Mexico
Address:	6121 Indian School Road
	Albuquerque, NM 87110
Email:	christine.mathews@ghd.com
Phone:	505-884-0672 Fax:
Requested Due Date:	

Section B
Required Project Information:

Report To:	Christine Mathews
Copy To:	
Purchase Order #:	
Project Name:	11145957 Johnston Federal
Project #:	

Section C
Invoice Information:

Attention:	
Company Name:	
Address:	
Pace Quote:	
Pace Project Manager:	alice.spiller@pacelabs.com,
Pace Profile #:	10540, line 1

Regulatory Agency
State / Location
NM

SAMPLE ID
One Character per box.
(A-Z, 0-9 / , -)
Sample Ids must be unique

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	START TIME	END DATE	END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	8260 BTEX	300.0 Sulfate	Dissolved Mn-field filtered	Additional analyses			Residual Chlorine (Y/N)	60254337
1	GW-11145957-092717-SP-MW-1	✓	G	9-27-17	0835				5		↓	↓	↓						↓	↓	↓	BP3U	BP3F	(3) DG9H		001
2	GW-11145957-092717-SP-MW-2	↓	↓	↓	0845				↓		↓	↓	↓						↓	↓	↓	↓	↓	↓		002
3	GW-11145957-092717-SP-MW-3	↓	↓	↓	0924				↓		↓	↓	↓						↓	↓	↓	↓	↓	↓		003
4	GW-11145957-092717-SP-MW-4	↓	↓	↓	0934				↓		↓	↓	↓						↓	↓	↓	↓	↓	↓		004
5																								(2) DG4H TB		005
6																										
7																										
8																										
9																										
10																										
11																										
12																										

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Steven Perez	9/28/17	1100	[signature]	9/29/17	0835	4.6	Y	Y	Y
							TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Steven Perez

SIGNATURE of SAMPLER: Steven Perez DATE Signed: 9/28/17