

## **FREMONT ENVIRONMENTAL INC.**

November 16, 2014

Mr. Jacob Evans  
Noble Energy Inc.  
1625 Broadway  
Denver, CO 80202

Subject:     **Ground Water Monitoring Report**  
Noble Energy Inc.  
Libsack R G27-15  
SWSE Sec 27, T4N, R65W  
API # 05-123-13256  
Weld County, Colorado  
Fremont Project No. C013-009  
Facility ID# 323601

Dear Mr. Jacobs:

Enclosed please find a copy of the above referenced Ground Water Monitoring Report for the Libsack R G27-15 site in Weld County, Colorado. The enclosed report describes monitoring and sampling efforts to assess ground water quality at the site. Please contact me at (303) 956-8714 if you require any additional information.

Fremont appreciates the opportunity to provide this service.

Sincerely,  
**FREMONT ENVIRONMENTAL INC.**



Paul V. Henehan, P.E.  
Senior Consultant

Enclosure

cc/enc:

**GROUND WATER MONITORING REPORT**

**NOBLE ENERGY INC.**

**LIBSACK R G27-15**

**WELD COUNTY, COLORADO**

**FREMONT PROJECT NO. C013-009**

**FACILITY #323601**

**Prepared by:**

**Fremont Environmental Inc.**

**1759 Redwing Lane  
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(303) 956-8714**

**November 16, 2014**

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# **GROUND WATER MONITORING REPORT**

**NOBLE ENERGY INC.**

**LIBSACK R G27-15**

**WELD COUNTY, COLORADO**

**FREMONT PROJECT NO. C013-009**

**FACILITY #323601**

## **1.0 INTRODUCTION**

The purpose of this document is to present ground water quality data collected subsequent to excavation and remediation efforts at the Libsack R G27-15 tank battery site. Impacted soil and ground water were identified at this location due to a release from a buried flow line between the well and the separator. Excavation of the impacted soil was completed in June 2013. Further, 30 monitoring wells were installed at this site between June 14, 2013 and July 19, 2013 to delineate the magnitude and extent of subsurface impacts.

Due to the continued presence of elevated dissolved petroleum constituents in the ground water in several monitoring wells, Noble proceeded with the application of chemical injection amendment into the subsurface during the week of November 11, 2013 in an effort to reduce those concentrations. The chemical injection did not appear to be as beneficial as had been anticipated, therefore, another injection event occurred on May 6, 2014. Finally, permeable trenches partially backfilled with the amendment were installed in the impacted area in August 2014.

## **2.0 BACKGROUND INFORMATION**

### **2.1 Site Location**

The Libsack R G27-15 facility is located approximately seven miles east of Gilcrest, Colorado in Weld County as shown on Figure 1. The site includes one storage tank as well as separation and metering equipment.

The facility is located in an agricultural area 0.2 miles west of County Road 45 and 0.1 miles north of County Road 40. The location is further described as the SW  $\frac{1}{4}$  of the SE  $\frac{1}{4}$  of section 27, township 4N, range 65W. A Site Map is included as Figure 2.

## **2.2 Site History**

The site is a natural gas production and oil storage facility for the Libsack R G27-15 natural gas well. This well was drilled in 1986 to a depth of approximately 7,225 feet. Surface impacts were identified at the facility during routine operations when stained soil was observed near the flow line adjacent to the separator.

Remediation efforts included the excavation of impacted soil adjacent to the flow line and separator. A total of 1,860 cubic yards of soil were removed in June 2013; the impacted soil was disposed of as non-hazardous waste. Ground water was present in the excavation at a depth of approximately four feet.

## **2.3 Remediation by Chemical Injection**

Due to the continued presence of dissolved petroleum constituents downgradient from the area of excavation, the site was injected with a 14% solution of chemically oxygenated granular activated carbon (COGAC), which is a combination of calcium peroxide and granulated activated carbon (GAC). Calcium peroxide is utilized to provide dissolved oxygen to ground water. The GAC is used to absorb residual organics and prevent them from migrating with ground water movement.

During the week of November 11, 2013, 107 borings were advanced by Remington Technologies Inc. (RemTech) to a depth of seven feet with a Geoprobe rig to facilitate the injection of the COGAC solution. After the borehole was advanced, an inflatable packer was placed in the borehole and inflated such that the borehole was sealed below

four feet. The 14% COGAC solution was then injected under pressure and forced into the interval between four and seven feet. This work was undertaken during November 2013.

A second injection event took place on May 6, 2014. On that date, approximately 1,200 gallons of 12% COGAC slurry were injected into the subsurface via 14 temporary injection points.

The final COGAC application took place when permeable trenches were placed across the site in August 2014. A mixture of COGAC and native soil, which consists primarily of sand and gravel, were installed as shown on Figure 6. The COGAC was placed at a depth between two and five feet such that it is within the upper portion of the ground water.

Based on the quarterly sampling that has taken place since the COGAC injections, the effectiveness of this approach is unclear. The monitoring wells will continue to be sampled to determine the long term effectiveness of this remedial approach.

### **3.0 GROUND WATER MONITORING ACTIVITIES**

#### **3.1 Ground Water Level Measurements**

As part of the quarterly monitoring program for this site, ground water levels were measured in 29 of the 30 monitoring wells on October 8, 2014 in accordance with the Sampling Plan included in Appendix A. Monitoring well MW-12 has been destroyed by agricultural operations at this location. The water level data are summarized in Table 1. Water table contours inferred from the October 2014 data are illustrated on Figure 3.

Based on these data, ground water is inferred to flow to the northeast. The water table gradient was calculated at approximately 0.003 feet per foot (ft/ft) for the October 2014 data.

### **3.2 Ground Water Sampling and Analysis**

Ground water samples were collected from the 29 remaining monitoring wells on October 8, 2014. The ground water samples were submitted to eAnalytics Laboratory, Inc. in Loveland, Colorado for analyses of benzene, toluene, ethylbenzene and xylenes (BTEX) by EPA Method 8260C. The ground water chemistry is illustrated on Figures 4 and 5.

The laboratory data indicated that the BTEX constituents were above their respective Colorado Oil and Gas Conservation Commission (COGCC) limits for water samples collected from MW-13, MW-17 and MW-25. The maximum benzene concentration was observed in MW-17 which had a concentration of 461 ug/L.

The ground water analytical data are summarized in Table 1. A copy of the laboratory reports, quality control data, and chain-of-custody documentation are presented in Appendix B.

## **4.0 DISCUSSION**

As a result of a release from the flow line near the separator at the Libsack R G27-15 location, an excavation was conducted in June 2013 to remove petroleum impacted soil. A total of 1,860 cubic yards of impacted soil was removed and transported to a landfill as non-hazardous waste. Subsequent to the excavation, a total of 30 monitoring wells have been advanced at the site to determine the extent of subsurface impacts in ground water. One of these monitoring wells, MW-12, was destroyed during agricultural operations.

As a result of elevated dissolved petroleum constituents in several monitoring wells, several chemical injection application events have been conducted. The COGAC is intended to increase dissolved oxygen content with the calcium peroxide component as well as absorb dissolved petroleum constituents with the granular activated carbon (GAC) component.

Ground water samples were collected in October 2014 from the 29 remaining monitoring wells; BTEX concentrations were below the COGCC Table 910-1 levels in 26 of the 29 monitoring wells. However, benzene concentrations exceeding the COGCC Table 910-1 limit were present in the other three wells. Monitoring well MW-17 had the highest benzene concentration with a level of 461 ug/L. During the October 2013 sampling event, which was prior to the first COGAC application, the benzene concentration in this well was 961 ug/L.

Noble will continue to sample the ground water on a quarterly basis to monitor the ground water quality at this location. If warranted, additional remediation will be conducted. After four consecutive quarters of COGCC-compliant BTEX concentrations, Noble will request closure of this site.

### **5.0 REMARKS**

The discussion and conclusions contained in this report represent our professional opinions. These opinions are based on currently available information and are arrived at in accordance with currently accepted hydrogeologic and engineering practices at this time and location. Other than this, no warranty is implied or intended.

This report was prepared by **FREMONT ENVIRONMENTAL INC.**



11/16/14

Date \_\_\_\_\_

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Paul V. Henehan, P.E.

Senior Consultant

**TABLE**

TABLE 1  
SUMMARY OF GROUND WATER ELEVATION DATA AND CHEMISTRY DATA  
NOBLE ENERGY INC.  
LIBSACK R G27-15, WELD COUNTY, COLORADO  
FREMONT PROJECT NO. C013-009

SAMPLE LOCATION	DATE	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	TOC ELEVATION (feet)	DEPTH TO GROUND WATER (ft)	GROUND WATER ELEVATION (ft)	FREE PRODUCT THICKNESS (ft)
MW-1	06/14/13	<1.0	<1.0	<1.0	<1.0	99.89	2.93	96.96	NP
	06/24/13	NS	NS	NS	NS		2.66	97.23	NP
	07/09/13	NS	NS	NS	NS		2.53	97.36	NP
	07/19/13	NS	NS	NS	NS		Inundated	Inundated	Inundated
	10/18/13	<1	<1	<1	<1		1.66	98.23	NP
	01/13/14	<1	<1	<1	<1		2.25	97.64	NP
	04/02/14	<1	<1	<1	<1		2.74	97.15	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.52	97.37	NP
10/07/14	<1.0	<1.0	<1.0	<1.0	1.86	98.03	NP		
MW-2	06/14/13	<1.0	<1.0	<1.0	<1.0	100.00	3.01	96.99	NP
	06/24/13	NS	NS	NS	NS		2.75	97.25	NP
	07/09/13	NS	NS	NS	NS		2.62	97.38	NP
	07/19/13	NS	NS	NS	NS		1.95	98.05	NP
	10/18/13	<1	<1	<1	<1		1.75	98.25	NP
	01/13/14	<1	<1	<1	<1		2.36	97.64	NP
	04/02/14	<1	<1	<1	<1		2.82	97.18	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.61	97.39	NP
10/07/14	<1.0	<1.0	<1.0	<1.0	1.97	98.03	NP		
MW-3	06/14/13	<1.0	<1.0	<1.0	<1.0	99.92	3.05	96.87	NP
	06/24/13	NS	NS	NS	NS		2.78	97.14	NP
	07/09/13	NS	NS	NS	NS		2.65	97.27	NP
	07/19/13	NS	NS	NS	NS		2.02	97.90	NP
	10/18/13	1.3	<1	<1	<1		1.88	98.04	NP
	01/13/14	<1	<1	<1	<1		2.40	97.52	NP
	04/02/14	<1	<1	<1	<1		2.84	97.08	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.66	97.26	NP
10/07/14	<1.0	<1.0	<1.0	<1.0	2.02	97.90	NP		
MW-4	06/14/13	<b>4,523</b>	<1.0	<1.0	168	99.47	2.69	96.78	NP
	06/24/13	NS	NS	NS	NS		2.42	97.05	NP
	07/09/13	<b>868</b>	<1.0	<1.0	<1.0		2.28	97.19	NP
	07/19/13	NS	NS	NS	NS		1.61	97.86	NP
	10/18/13	<1	<1	<1	<1		1.46	98.01	NP
	01/13/14	<1	<1	<1	<1		2.07	97.40	NP
	04/02/14	<b>33.1</b>	<1	<1	<1		2.55	96.92	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.31	97.16	NP

SAMPLE LOCATION	DATE	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	TOC ELEVATION (feet)	DEPTH TO GROUND WATER (ft)	GROUND WATER ELEVATION (ft)	FREE PRODUCT THICKNESS (ft)
MW-4	10/07/14	<1.0	<1.0	<1.0	<1.0		1.68	97.79	NP
MW-5	06/14/13	494	<1.0	1.8	15.7	99.29	2.68	96.61	NP
	06/24/13	NS	NS	NS	NS		2.39	96.90	NP
	07/09/13	535	<1.0	<1.0	<1.0		2.26	97.03	NP
	07/19/13	NS	NS	NS	NS		Inundated	Inundated	Inundated
	10/18/13	<1	<1	<1	<1		1.31	97.98	NP
	01/13/14	<1	<1	<1	<1		2.01	97.28	NP
	04/02/14	<1	<1	<1	<1		2.49	96.80	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.26	97.03	NP
10/07/14	<1.0	<1.0	<1.0	<1.0	1.65	97.64	NP		
MW-6	06/14/13	<1.0	<1.0	<1.0	<1.0	99.66	3.01	96.65	NP
	06/24/13	NS	NS	NS	NS		2.74	96.92	NP
	07/09/13	NS	NS	NS	NS		2.61	97.05	NP
	07/19/13	NS	NS	NS	NS		2.01	97.65	NP
	10/18/13	<1	<1	<1	<1		1.79	97.87	NP
	01/13/14	2.9	<1	<1	<1		1.33	98.33	NP
	04/02/14	258	<1	<1	<1		2.82	96.84	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.61	97.05	NP
10/07/14	<1.0	<1.0	<1.0	<1.0	1.98	97.68	NP		
MW-7	06/14/13	1,063	27.8	<1.0	104	99.38	2.72	96.66	NP
	06/24/13	NS	NS	NS	NS		2.43	96.95	NP
	07/09/13	2,226	100	58.9	164		2.3	97.08	NP
	07/19/13	NS	NS	NS	NS		1.76	97.62	NP
	10/18/13	108	<1	3.9	1.9		1.44	97.94	NP
	01/13/14	<1	<1	<1	<1		2.02	97.36	NP
	04/02/14	<1	<1	<1	<1		2.47	96.91	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.28	97.10	NP
10/07/14	<1.0	<1.0	<1.0	<1.0	1.63	97.75	NP		
MW-8	06/14/13	<1.0	<1.0	<1.0	<1.0	99.46	2.69	96.77	NP
	06/24/13	NS	NS	NS	NS		2.39	97.07	NP
	07/09/13	NS	NS	NS	NS		2.27	97.19	NP
	07/19/13	NS	NS	NS	NS		Inundated	Inundated	Inundated
	10/18/13	<1	<1	<1	<1		1.79	97.67	NP
	01/13/14	<1	<1	<1	<1		2.08	97.38	NP
	04/02/14	<1	<1	<1	<1		2.46	97.00	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.25	97.21	NP
10/07/14	<1.0	<1.0	<1.0	<1.0	1.69	97.77	NP		
MW-9	06/14/13	<1.0	<1.0	<1.0	<1.0	99.51	3.05	96.46	NP
	06/24/13	NS	NS	NS	NS	99.03	2.25	96.78	NP

SAMPLE LOCATION	DATE	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	TOC ELEVATION (feet)	DEPTH TO GROUND WATER (ft)	GROUND WATER ELEVATION (ft)	FREE PRODUCT THICKNESS (ft)
MW-9	07/09/13	NS	NS	NS	NS		2.14	96.89	NP
	07/19/13	NS	NS	NS	NS		1.18	97.85	NP
	10/18/13	<1	<1	<1	<1		1.28	97.75	NP
	01/13/14	<1	<1	<1	<1		1.82	97.69	NP
	04/02/14	<1	<1	<1	<1		2.31	96.72	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.11	97.40	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		1.44	98.07	NP
MW-10	06/14/13	<1.0	<1.0	<1.0	<1.0	100.01	3.61	96.40	NP
	06/24/13	NS	NS	NS	NS	99.44	2.7	96.74	NP
	07/09/13	NS	NS	NS	NS		2.59	96.85	NP
	07/19/13	NS	NS	NS	NS		1.89	97.55	NP
	10/18/13	<1	<1	<1	<1		1.73	97.71	NP
	01/13/14	<1	<1	<1	<1		2.29	97.72	NP
	04/02/14	<1	<1	<1	<1		2.76	96.68	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.54	97.47	NP
10/07/14	<1.0	<1.0	<1.0	<1.0		1.91	98.10	NP	
MW-11	06/14/13	<1.0	<1.0	<1.0	<1.0	100.50	4.1	96.40	NP
	06/24/13	NS	NS	NS	NS	99.98	3.23	96.75	NP
	07/09/13	NS	NS	NS	NS		3.12	96.86	NP
	07/19/13	NS	NS	NS	NS		2.48	97.50	NP
	10/18/13	<1	<1	<1	<1		2.24	97.74	NP
	01/13/14	<1	<1	<1	<1		2.82	97.68	NP
	04/02/14	<1	<1	<1	<1		3.31	96.67	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		3.42	97.08	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		2.43	98.07	NP
MW-12	07/09/13	<1.0	<1.0	<1.0	<1.0	99.68	2.62	97.06	NP
	07/19/13	NS	NS	NS	NS		2.14	97.54	NP
	10/18/13	<1	<1	<1	<1		1.74	97.94	NP
	01/13/14	<1	<1	<1	<1		2.32	97.36	NP
	04/02/14	<1	<1	<1	<1		2.81	96.87	NP
	07/15/14	WD	WD	WD	WD		WD	WD	WD
MW-13	07/09/13	71.1		160	2,606	99.76	2.78	96.98	NP
	07/19/13	NS	NS	NS	NS		2.28	97.48	NP
	10/18/13	131	<1	9.4	200		1.93	97.83	NP
	01/13/14	112	<1	91.7	4.3		2.51	97.25	NP
	04/02/14	75.5	1.7	47.9	125		3.07	96.69	NP
	07/15/14	71.2	<1.0	31.4	168		2.84	96.92	NP
	10/07/14	96.9	<1.0	56.6	2.1		1.19	98.57	NP
MW-14	07/09/13	9.2		1.6	16.8	99.42	2.5	96.92	NP

SAMPLE LOCATION	DATE	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	TOC ELEVATION (feet)	DEPTH TO GROUND WATER (ft)	GROUND WATER ELEVATION (ft)	FREE PRODUCT THICKNESS (ft)
MW-14	07/19/13	NS	NS	NS	NS		1.96	97.46	NP
	10/18/13	10.6	<1	<1	<1		1.63	97.79	NP
	01/13/14	1.2	<1	<1	<1		2.28	97.14	NP
	04/02/14	2	<1	<1	4		2.78	96.64	NP
	07/15/14	1.6	<1.0	<1.0	1.5		2.58	96.84	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		1.92	97.50	NP
MW-15	07/09/13	<1.0	<1.0	<1.0	<1.0	99.59	2.68	96.91	NP
	07/19/13	NS	NS	NS	NS		2.12	97.47	NP
	10/18/13	<1	<1	<1	<1		1.82	97.77	NP
	01/13/14	<1	<1	<1	<1		2.39	97.20	NP
	04/02/14	<1	<1	<1	<1		2.88	96.71	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.65	96.94	NP
10/07/14	<1.0	<1.0	<1.0	<1.0		2.01	97.58	NP	
MW-16	07/09/13	177		394	5,089	99.18	2.3	96.88	NP
	07/19/13	NS	NS	NS	NS		1.74	97.44	NP
	10/18/13	166	<1	104	405		1.41	97.77	NP
	01/13/14	249	<1	268	1733		2.02	97.16	NP
	04/02/14	149	3.1	127	852		2.49	96.69	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.29	96.89	NP
10/07/14	<1.0	<1.0	<1.0	<1.0		1.61	97.57	NP	
MW-17	07/09/13	851		390	9,256	99.45	2.5	96.95	NP
	07/19/13	NS	NS	NS	NS		2.02	97.43	NP
	10/18/13	961	<1	82.2	8473		1.43	98.02	NP
	01/13/14	455	<1	101	4781		2.19	97.26	NP
	04/02/14	435	4.4	69.1	5184		2.69	96.76	NP
	07/15/14	1081	<1.0	106	5741		2.46	96.99	NP
10/07/14	461	<1.0	247	2008		1.85	97.60	NP	
MW-18	07/09/13	<1.0	<1.0	<1.0	<1.0	98.28	1.54	96.74	NP
	07/19/13	NS	NS	NS	NS		1.02	97.26	NP
	10/18/13	<1	<1	<1	<1		0.66	97.62	NP
	01/13/14	<1	<1	<1	<1		1.15	97.13	NP
	04/02/14	<1	<1	<1	<1		1.68	96.60	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		1.49	96.79	NP
10/07/14	<1.0	<1.0	<1.0	<1.0		0.81	97.47	NP	
MW-19	07/09/13	<1.0	<1.0	<1.0	<1.0	98.47	1.71	96.76	NP
	07/19/13	NS	NS	NS	NS		1.1	97.37	NP
	10/18/13	<1	<1	<1	<1		1.78	96.69	NP
	01/13/14	<1	<1	<1	<1		1.33	97.14	NP
	04/02/14	<1	<1	<1	<1		1.84	96.63	NP

SAMPLE LOCATION	DATE	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	TOC ELEVATION (feet)	DEPTH TO GROUND WATER (ft)	GROUND WATER ELEVATION (ft)	FREE PRODUCT THICKNESS (ft)
MW-19	07/15/14	<1.0	<1.0	<1.0	<1.0		1.65	96.82	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		0.99	97.48	NP
MW-20	07/19/13	<1.0	<1.0	<1.0	<1.0	99.40	1.33	98.07	NP
	10/18/13	<1	<1	<1	<1		1.51	97.89	NP
	01/13/14	<1	<1	<1	<1		2.11	97.29	NP
	04/02/14	<1	<1	<1	<1		2.57	96.83	NP
	07/15/14	<b>8.4</b>	<1.0	<1.0	<1.0		2.32	97.08	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		1.70	97.70	NP
MW-21	07/19/13	<1.0	<1.0	<1.0	<1.0	99.31	1.67	97.64	NP
	10/18/13	<1	<1	<1	<1		1.51	97.80	NP
	01/13/14	<1	<1	<1	<1		2.10	97.21	NP
	04/02/14	<1	<1	<1	<1		2.56	96.75	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.33	96.98	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		1.71	97.60	NP
MW-22	07/19/13	<1.0	<1.0	<1.0	<1.0	99.12	2.01	97.11	NP
	10/18/13	<1	<1	<1	<1		1.73	97.39	NP
	01/13/14	<1	<1	<1	<1		2.01	97.11	NP
	04/02/14	<1	<1	<1	<1		2.49	96.63	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.30	96.82	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		1.85	97.27	NP
MW-23	07/19/13	<1.0	<1.0	<1.0	<1.0	98.77	1.41	97.36	NP
	10/18/13	<1	<1	<1	<1		0.98	97.79	NP
	01/13/14	<1	<1	<1	<1		1.52	97.25	NP
	04/02/14	<1	<1	<1	<1		2.01	96.76	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		1.82	96.95	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		1.16	97.61	NP
MW-24	07/19/13	2.4	<1.0	36.6	1,364	99.08	1.57	97.51	NP
	10/18/13	<1	<1	<1	<1		1.2	97.88	NP
	01/13/14	3.3	<1	23.7	64.4		1.74	97.34	NP
	04/02/14	1.9	<1	10.3	35.7		2.23	96.85	NP
	07/15/14	<1.0	<1.0	4.0	1.4		2.01	97.07	NP
	10/07/14	<1.0	<1.0	<1.0	1.5		1.40	97.68	NP
MW-25	07/19/13	<b>803</b>	<1.0	473	<b>10,322</b>	99.36	1.96	97.40	NP
	10/18/13	<b>435</b>	<1	119	<b>1572</b>		1.49	97.87	NP
	01/13/14	<b>47.8</b>	<1	6.3	159		2.03	97.33	NP
	04/02/14	<b>44.1</b>	<1	24.3	200		2.58	96.78	NP
	07/15/14	<b>115</b>	<1.0	39.2	120		2.35	97.01	NP
	10/07/14	<b>57.1</b>	<1.0	9.3	12.1		1.69	97.67	NP

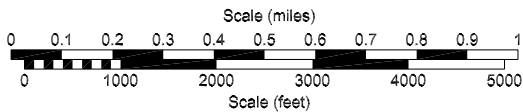
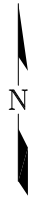
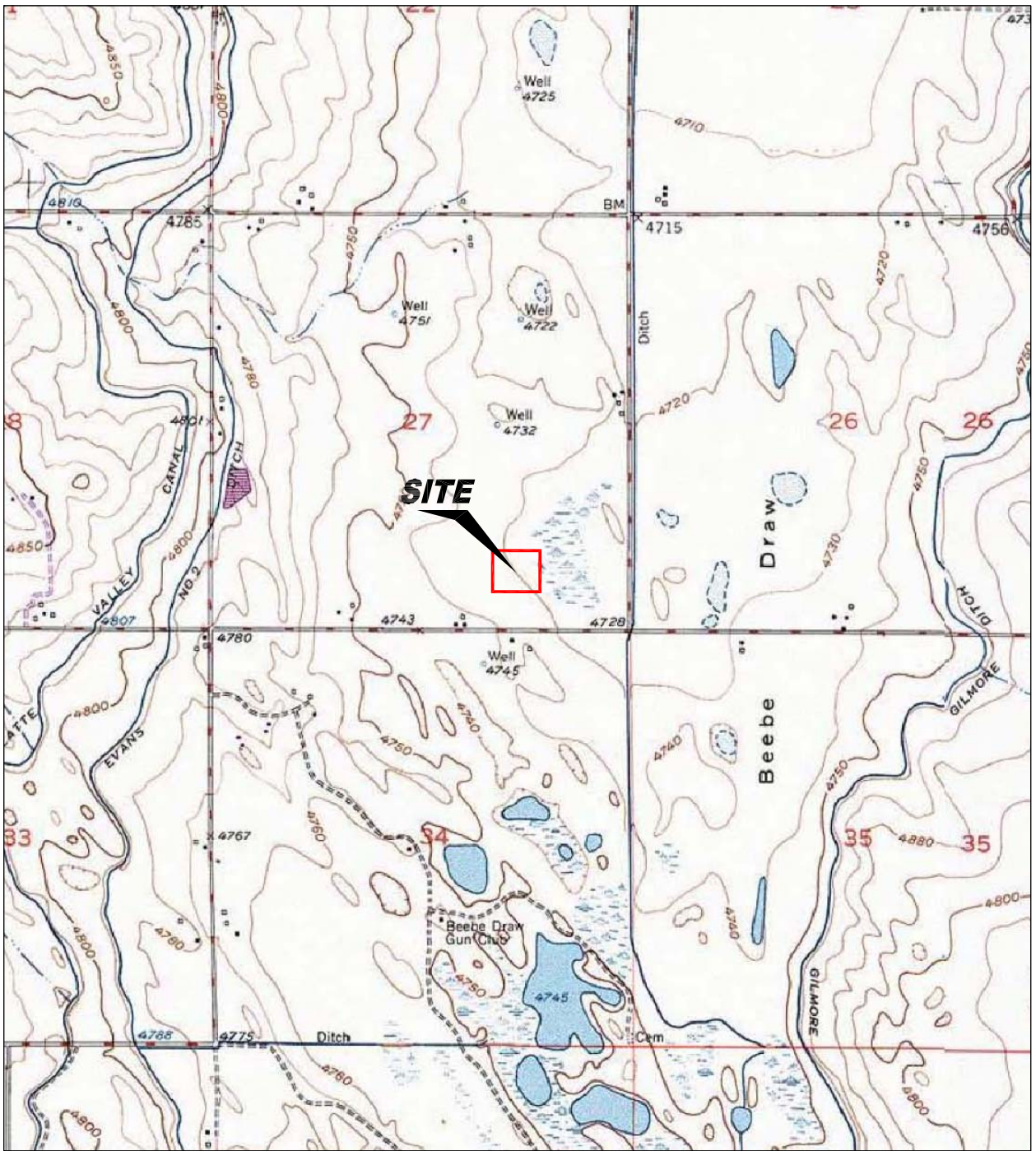
SAMPLE LOCATION	DATE	BENZENE (µg/L)	TOLUENE (µg/L)	ETHYL BENZENE (µg/L)	TOTAL XYLENES (µg/L)	TOC ELEVATION (feet)	DEPTH TO GROUND WATER (ft)	GROUND WATER ELEVATION (ft)	FREE PRODUCT THICKNESS (ft)
MW-26	07/19/13	<b>198</b>	<1.0	344	<b>2,547</b>	99.30	1.88	97.42	NP
	10/18/13	<b>109</b>	<1	83.9	894		1.49	97.81	NP
	01/13/14	<1	<1	<1	<1		2.01	97.29	NP
	04/02/14	<1	<1	<1	<1		2.54	96.76	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		2.29	97.01	NP
	10/07/14	2.7	<1.0	<1.0	1.2		1.64	97.66	NP
MW-27	07/19/13	<1.0	<1.0	<1.0	<1.0	98.40	0.91	97.49	NP
	10/18/13	<1	<1	<1	<1		0.7	97.70	NP
	01/13/14	<1	<1	<1	<1		1.23	97.17	NP
	04/02/14	<1	<1	<1	<1		1.73	96.67	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		3.41	94.99	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		0.87	97.53	NP
MW-28	07/19/13	<1.0	<1.0	<1.0	<1.0	98.64	1.14	97.50	NP
	10/18/13	<1	<1	<1	<1		0.79	97.85	NP
	01/13/14	<1	<1	<1	<1		1.28	97.36	NP
	04/02/14	<1	<1	<1	<1		1.79	96.85	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		1.59	97.05	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		0.95	97.69	NP
MW-29	07/19/13	<1.0	<1.0	<1.0	<1.0	101.04	3.45	97.59	NP
	10/18/13	<1	<1	<1	<1		3.03	98.01	NP
	01/13/14	<1	<1	<1	<1		3.58	97.46	NP
	04/02/14	<1	<1	<1	<1		4.13	96.91	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		3.96	97.08	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		3.32	97.72	NP
MW-30	07/19/13	<1.0	<1.0	<1.0	<1.0	100.22	2.73	97.49	NP
	10/18/13	<1	<1	<1	<1		2.3	97.92	NP
	01/13/14	<1	<1	<1	<1		2.82	97.40	NP
	04/02/14	<1	<1	<1	<1		3.35	96.87	NP
	07/15/14	<1.0	<1.0	<1.0	<1.0		3.22	97.00	NP
	10/07/14	<1.0	<1.0	<1.0	<1.0		2.59	97.63	NP
Table 910-1 Limits		5	560	700	1,400				

Bold face values exceed the COGCC limits

NP - No Free Product

NS- Not Sampled

## FIGURES



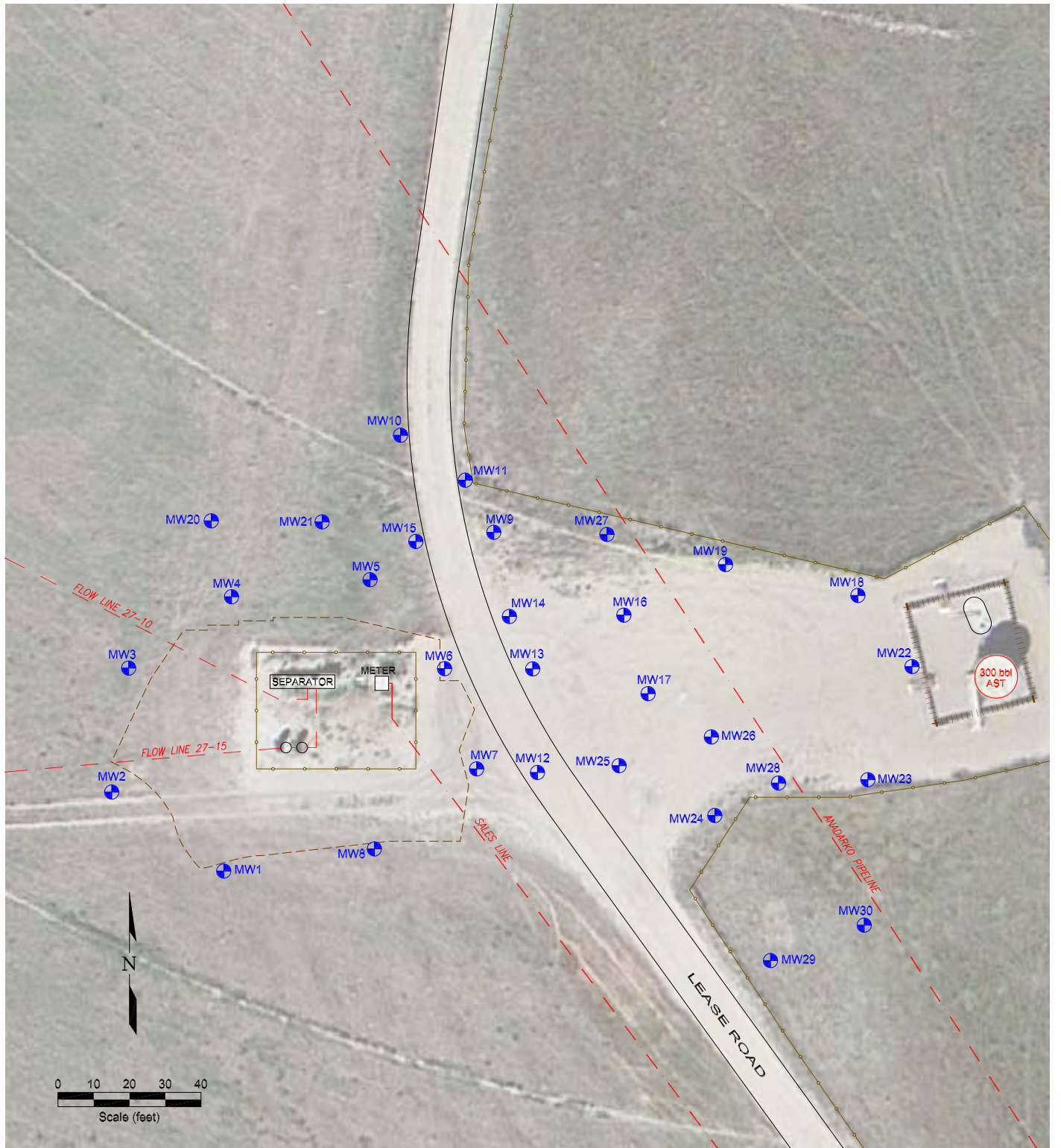
USGS 7.5 MINUTE SERIES (TOPOGRAPHIC)

Figure 1  
SITE LOCATION MAP

Noble Lipsack R G27-15  
SW SE Section 27, T4N, R65W  
Weld County, Colorado

Project No. C013-009	Prepared by	Drawn by JMA
Date 5/21/13	Reviewed by	Filename 13009T





**LEGEND**






-  MONITORING WELL
-  FENCE LINE
-  PIPELINE
-  CONTAINMENT BERM
-  ABOVE GROUND STORAGE TANK

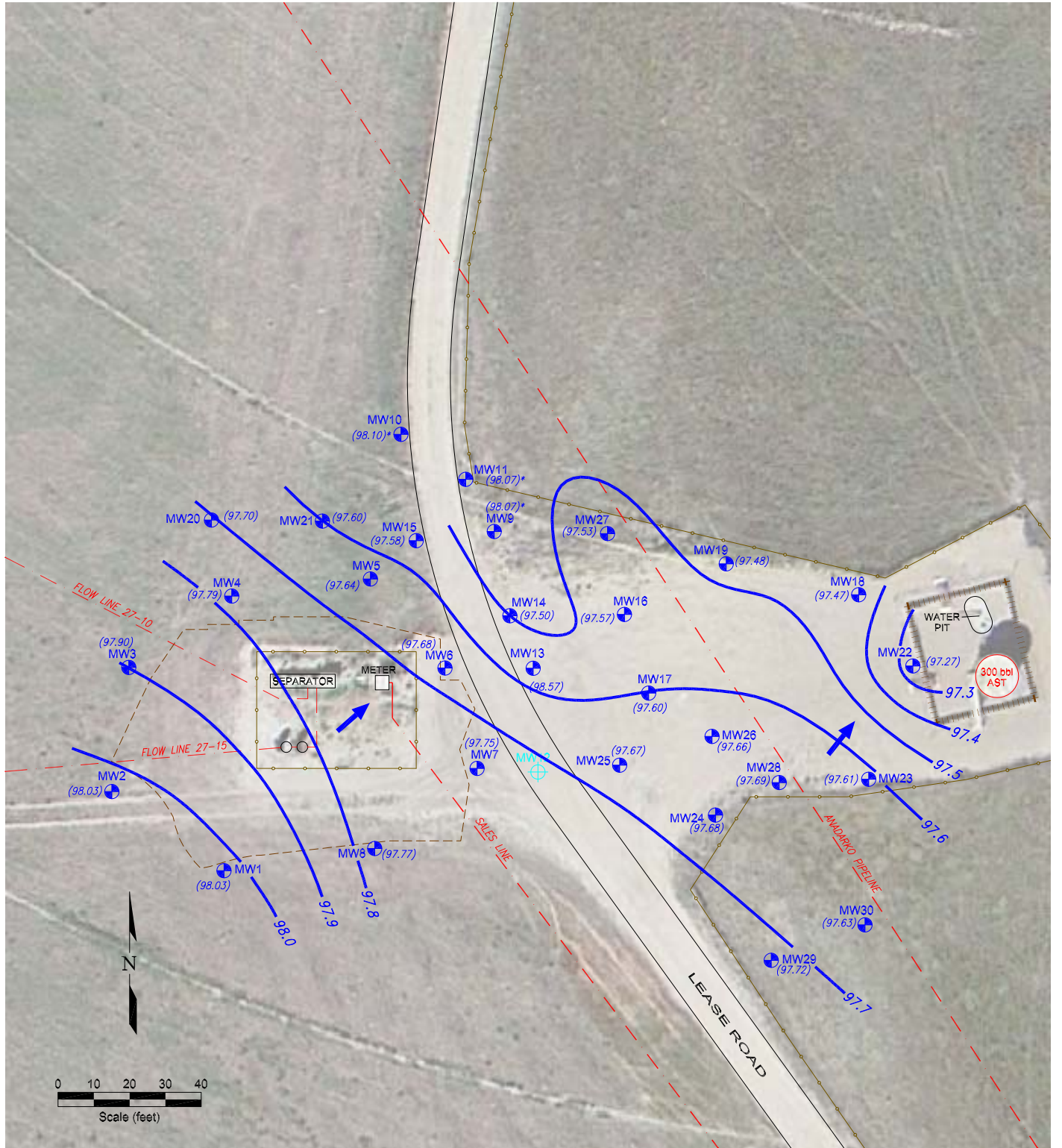
Figure 2

**SITE MAP**

**Noble Libsack R G27-15**  
 SW SE Section 27, T4N, R65W  
 Weld County, Colorado

Project No. C013-009	Prepared by	Drawn by JMA
Date 7/24/13	Reviewed by	Filename 13009R





**LEGEND**








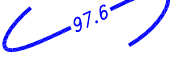


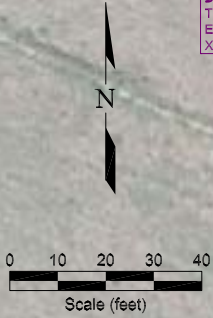
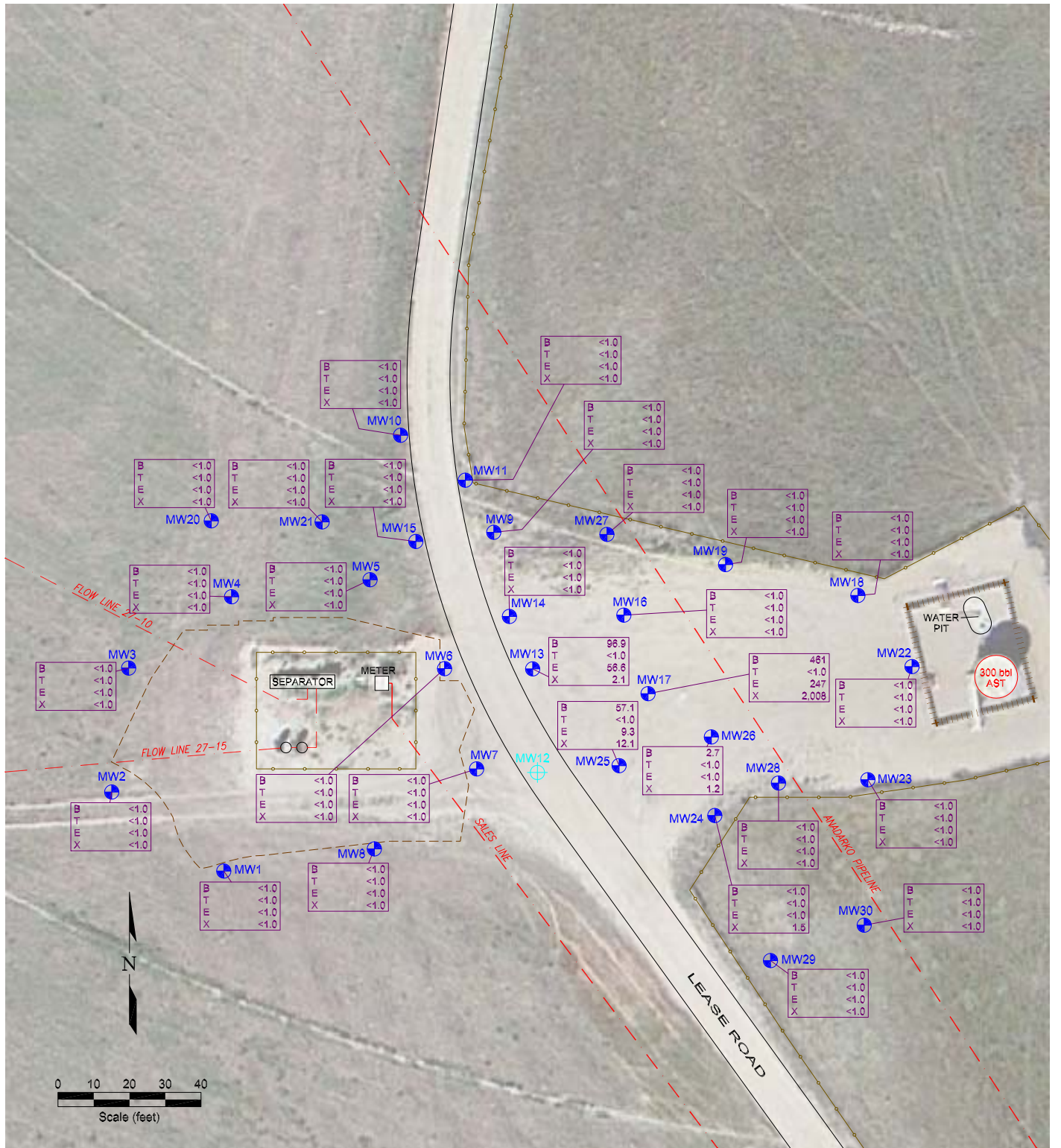
-  MONITORING WELL
-  DESTROYED MONITORING WELL
-  FENCE LINE
-  PIPELINE
-  CONTAINMENT BERM
-  ABOVE GROUND STORAGE TANK
-  GROUND WATER ELEVATION (ft above arbitrary datum)
-  WATER TABLE CONTOUR
-  GROUND WATER FLOW DIRECTION
-  NOT USED FOR CONTOURING

Figure 3  
**INFERRED GROUNDWATER CONTOUR**  
**OCTOBER 7, 2014**

**Noble Libsack R G27-15**  
 SW SE Section 27, T4N, R65W  
 Weld County, Colorado

Project No. <b>C013-009</b>	Prepared by	Drawn by <b>JMA</b>
Date <b>10/23/14</b>	Reviewed by	Filename <b>13009R</b>





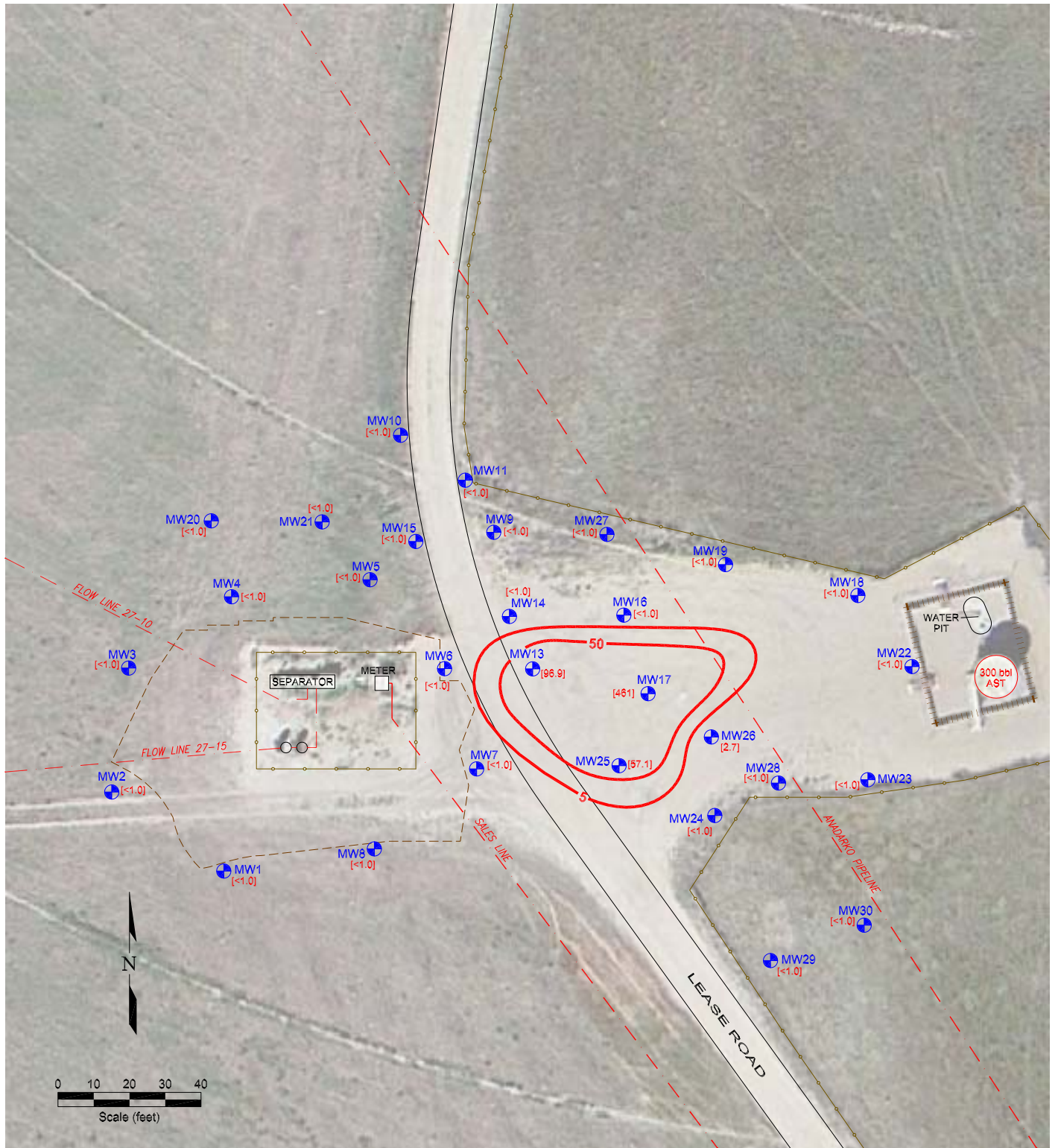
- LEGEND**
- MONITORING WELL
  - DESTROYED MONITORING WELL
  - FENCE LINE
  - PIPELINE
  - CONTAINMENT BERM
  - ABOVE GROUND STORAGE TANK
- |   |      |
|---|------|
| B | <1.0 |
| T | <1.0 |
| E | <1.0 |
| X | <1.0 |
- BENZENE (ug/L)
  - TOLUENE (ug/L)
  - ETHYLBENZENE (ug/L)
  - TOTAL XYLENES (ug/L)

Figure 4  
**GROUND WATER CHEMISTRY MAP**  
 OCTOBER 7, 2014

**Noble Libsack R G27-15**  
 SW SE Section 27, T4N, R65W  
 Weld County, Colorado

Project No. C013-009	Prepared by	Drawn by JMA
Date 10/23/14	Reviewed by	Filename 13009R





**LEGEND**

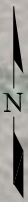
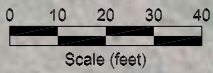
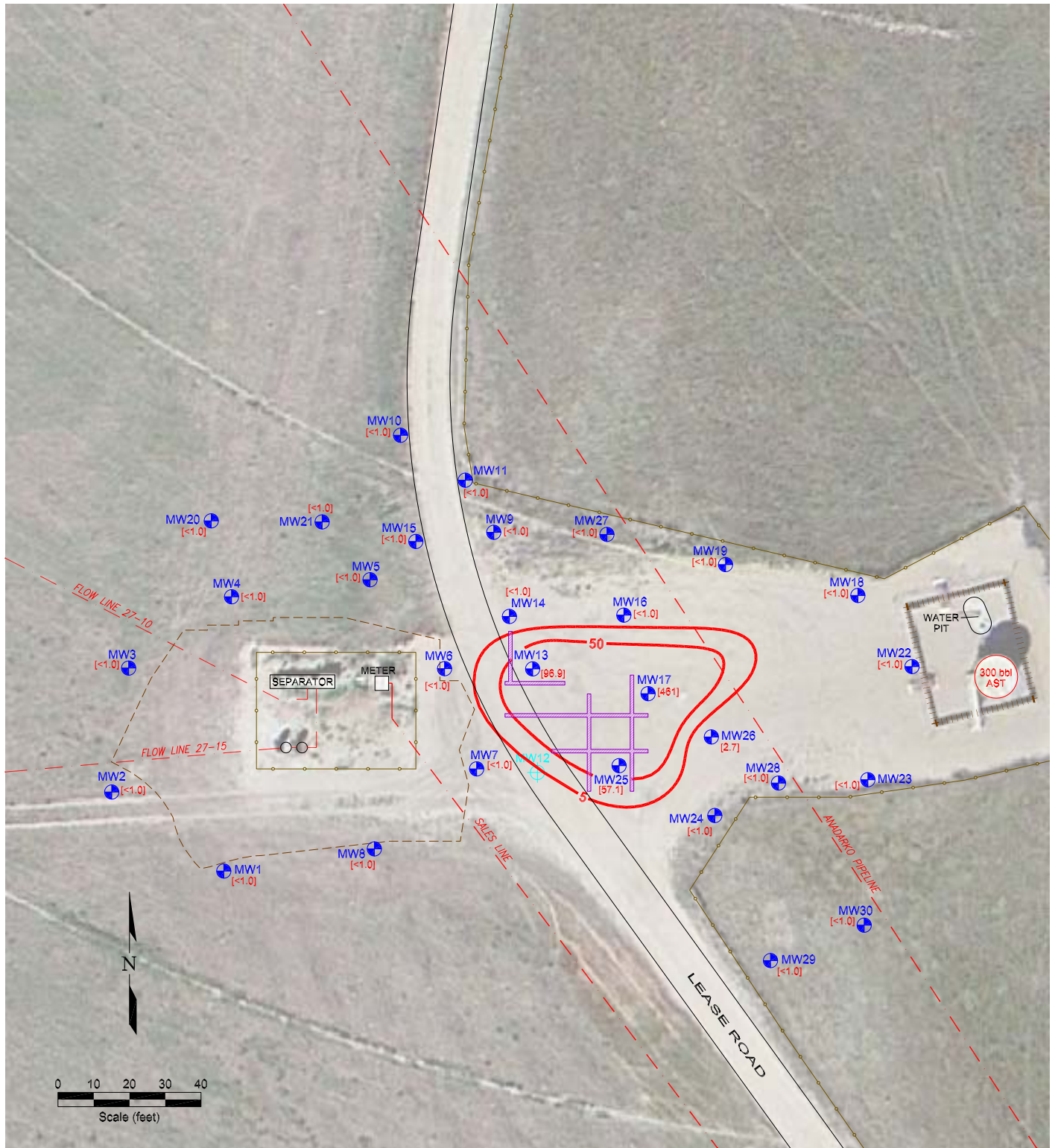
- MONITORING WELL
- FENCE LINE
- PIPELINE
- CONTAINMENT BERM
- ABOVE GROUND STORAGE TANK
- BENZENE CONCENTRATION (µg/L)
- BENZENE ISOCONCENTRATION (µg/L)

Figure 5  
**BENZENE ISOCONCENTRATION MAP**  
**OCTOBER 7, 2014**

**Noble Libsack R G27-15**  
 SW SE Section 27, T4N, R65W  
 Weld County, Colorado

Project No. C013-009	Prepared by	Drawn by JMA
Date 10/23/14	Reviewed by	Filename 13009R





**LEGEND**










-  MONITORING WELL
-  DESTROYED MONITORING WELL
-  FENCE LINE
-  PIPELINE
-  CONTAINMENT BERM
-  ABOVE GROUND STORAGE TANK
-  COGAC-infused trench
-  BENZENE CONCENTRATION 11/7/14 (ug/L)
-  BENZENE ISOCENTRATION 11/7/14 (ug/L)

Figure 6  
LOCATION OF COGAC TRENCHES

Noble Libsack R G27-15  
SW SE Section 27, T4N, R65W  
Weld County, Colorado

Project No. <b>C013-009</b>	Prepared by	Drawn by <b>JMA</b>
Date <b>11/17/14</b>	Reviewed by	Filename <b>13009R</b>



APPENDIX A  
SAMPLING PLAN

## SAMPLING METHODS AND PROCEDURES

### Water Level Measurements

All ground water level measurements will be obtained using an electric measuring device, which indicates when a probe is in contact with ground water. Measurements will be obtained by lowering the device into the well until the water surface had been encountered, and by measuring the distance from the top of the inside riser pipe to the probe. All of the measurements will be recorded to the nearest 0.01'. To minimize cross-contamination, the water level indicator will be decontaminated with isopropyl alcohol and distilled water between each well.

### Monitoring Well Sampling

All monitoring wells were sampled from the “cleanest” to the “most contaminated” according to the protocols listed below.

#### Field Protocol

- Step 1            Measure water level in each well.
- Step 2            Purge each monitoring well by evacuating a minimum of three well bore volumes using a disposable polyethylene bailer.
- Step 3            Collect water samples using a disposable polyethylene bailer.
- Step 4            Cool samples to approximately 4°C for transportation.
- Step 5            Store water samples and transport to a specific laboratory, following all documentation and chain-of-custody procedures.

Upon completion of ground water sampling, a chain-of-custody log will be completed. Chain-of-custody records include the following information: project, project number, shipped by, shipped to, suspected hazard, sampling point, location, field identification number, date collected, sample type, number of containers, analysis required, and sampler's signature.

The chain-of-custody records will be shipped with the samples to the laboratory. Upon arrival at the laboratory the samples will be checked in and signed by the appropriate laboratory personnel. Laboratory identification numbers will be noted on the chain-of-custody record. Upon completion of the laboratory analysis, the completed chain-of-custody record will be returned to the project manager.

### **Analytical Methods**

The following list identifies the various chemical constituents and analytical methods which will be used for their quantification.

<u>Chemical Parameter</u>	<u>Method</u>
Benzene, Toluene, Ethylbenzene and Total Xylenes (BTEX)	EPA Method - 8260C

**APPENDIX B**

**LABORATORY DOCUMENTATION**

# Test Report

## eANALYTICS LABORATORY

October 13, 2014

Client: Fremont Environmental / Noble Energy  
Project: Libsack RG27-15  
Lab ID: 2251  
Date Samples Received: 10/9/2014  
Number of Samples: 29  
Sample Condition: Samples arrived intact and in appropriate sample containers  
Sample Temperature: Within acceptable range of 2-6° C, or as specified in EPA Method

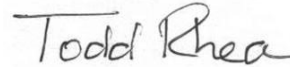
The quality control procedures associated with the requested analyses were satisfactorily passed before the samples were run.

Thank you for allowing eAnalytics Laboratory to provide laboratory services for you.

Sincerely,



Christopher Dieken  
Quality Assurance Manager



Todd Rhea  
Laboratory Manager

**eAnalytics Laboratory**

1767 Rocky Mountain Avenue Loveland CO 80538

Chain of Custody

# eANALYTICS

## LABORATORY

Chain of Custody Form

**eANALYTICS LABORATORY**

1767 Rocky Mountain Avenue Loveland CO 80538 | Phone: (970) 667-6975 | Fax: (970) 669-0941 | www.eAnalyticsLab.com

CLIENT INFORMATION <small>(*New Clients please fill out completely)</small>			ANALYSIS INFORMATION <small>(Select analysis by checking box on corresponding sample line)</small>															
Company: Fremont Environmental			Number of Containers	Matrix: (S) Soil (W) Water (V) Vapor (O) Other	BTEX (EPA 8260)	BTEX Naphthalene (EPA 8260)	TPH - GRO/DRO (EPA 8260/8015)	SAR (US Dept of Ag Method 20B)	EC (US Dept of Ag Method 3)	pH (EPA 9045D)	Other Analysis							
Project: C013-009 Libsack RG27-15																		
Project Manager: Paul Henehan																		
Sampler: Mark T																		
Phone/Email: 303-956-8714																		
Address: P.O. Box 1289 Wellington CO 80549																		
Lab ID	Sample Name	Sampling Date/Time																
1	Mwl	10/8/14 AM/PM	2	W	X													
2	2																	
3	3																	
4	4																	
5	5																	
6	6																	
7	7																	
8	8																	
9	9																	
10	10																	
11	11																	
12	12																	
13	13																	
14	14																	
15	15																	
16	16																	

Comments:

**Turnaround Time (Business Days)**  
TAT begins when sample is received by eANALYTICS

Normal (5-10 Days)  
 3 Day (1.25x)  
 2 Day (1.5x)  
 1 Day (2x)  
 Same Day (3x)

Rush analysis requires an extra charge.  
If possible please inform eANALYTICS in advance for rush analysis.

**For eANALYTICS Use**

Samples Received Intact  Yes  No  
 Received Within Temperature Range (2-6°C)  Yes  No  
 Sample Preservative: Ice  None, Acid  Other

**Record of Custody**

Relinquished by: *Mark Tylek* Date: 10/9/14  
 Company: FREMONT ENVIRONMENTAL Time: 0800

Received by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Company: \_\_\_\_\_ Time: \_\_\_\_\_

Relinquished by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Company: \_\_\_\_\_ Time: \_\_\_\_\_

Received by: *Todd Rhin* Date: 10/9/14  
 Company: eANALYTICS Time: 7:50 AM

WO # 2251

eANALYTICS: Environmental testing made Easy

Page 1 of 2

**eAnalytics Laboratory**

1767 Rocky Mountain Avenue Loveland CO 80538

Chain of Custody

# eANALYTICS

## LABORATORY

Chain of Custody Form

**eANALYTICS**  
**LABORATORY**

1767 Rocky Mountain Avenue Loveland CO 80538 | Phone: (970) 667-6975 | Fax: (970) 669-0941 | www.eAnalyticsLab.com

CLIENT INFORMATION <small>(*New Clients please fill out completely)</small>			ANALYSIS INFORMATION <small>(Select analysis by checking box on corresponding sample line)</small>															
Company: Fremont Environmental			Number of Containers	Matrix: (S) Soil (W) Water (V) Vapor (O) Other	BTEX (EPA 8260)	BTEX Naphthalene (EPA 8260)	TPH - GRO/DRO (EPA 8260/8015)	SAR (US Dept of Ag Method 20B)	EC (US Dept of Ag Method 3)	pH (EPA 9045D)	Other Analysis							
Project: <b>CO13-009 Libsack RG27-15</b>																		
Project Manager: Paul Henehan																		
Sampler: <b>Mark T</b>																		
Phone/Email: 303-956-8714																		
Address: P.O. Box 1289 Wellington CO 80549																		
Lab ID	Sample Name	Sampling Date/Time																
16	17	10/8/14	AM/PM	2w	X													
17	18	[Wavy line]	AM/PM															
18	19		AM/PM															
19	20		AM/PM															
20	21		AM/PM															
21	22		AM/PM															
22	23		AM/PM															
23	24		AM/PM															
24	25		AM/PM															
25	26		AM/PM															
26	27		AM/PM															
27	28		AM/PM															
28	29		AM/PM															
29	30		AM/PM															

Comments:

**Turnaround Time (Business Days)**  
TAT begins when sample is received by eANALYTICS

Normal (5-10 Days)  
 3 Day (1.25x)  
 2 Day (1.5x)  
 1 Day (2x)  
 Same Day (3x)

Rush analysis requires an extra charge.  
If possible please inform eANALYTICS in advance for rush analysis.

**For eANALYTICS Use**

Samples Received Intact  Yes  No  
 Received Within Temperature Range (2-6°C)  Yes  No  
 Sample Preservative: Ice  None  Acid  Other

**Record of Custody**

Relinquished by: *Mark T* Date: 10/9/14  
 Company: FREMONT ENVIRONMENTAL Time: 0800 AM

Received by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Company: \_\_\_\_\_ Time: \_\_\_\_\_

Relinquished by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Company: \_\_\_\_\_ Time: \_\_\_\_\_

Received by: *Todd K* Date: 10/9/14  
 Company: eANALYTICS Time: 1:30 PM

WO # 2251

eANALYTICS: Environmental testing made Easy

Page 2 of 2

### eAnalytics Laboratory

1767 Rocky Mountain Avenue Loveland CO 80538



eANALYTICS  
LABORATORY

Client: Fremont Environmental / Noble Energy      Lab ID: 2251

Project: Libsack RG27-15

Analysis: Volatile Organics      Method: EPA8260

Sample Name	Benzene ug/L	Toluene ug/L	Ethyl- benzene ug/L	Total Xylenes ug/L	Date	Date	Lab ID
					Sampled	Analyzed	
MW1	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 1
MW2	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 2
MW3	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 3
MW4	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 4
MW5	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 5
MW6	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 6
MW7	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 7
MW8	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 8
MW9	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 9
MW10	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 10
MW11	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 11
MW13	<b>96.9</b>	< 1.0	<b>56.6</b>	<b>2.1</b>	10/08/14	10/11/14	2251 12
MW14	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 13
MW15	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 14
MW16	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/11/14	2251 15
MW17	<b>461</b>	< 1.0	<b>247</b>	<b>2008</b>	10/08/14	10/11/14	2251 16
MW18	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 17
MW19	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 18
MW20	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 19
MW21	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 20



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**eANALYTICS**  
LABORATORY

Client: Fremont Environmental / Noble Energy      Lab ID: 2251

Project: Libsack RG27-15

Analysis: Volatile Organics      Method: EPA8260

Sample Name	Benzene ug/L	Toluene ug/L	Ethyl- benzene ug/L	Total Xylenes ug/L	Date	Date	Lab ID
					Sampled	Analyzed	
MW22	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 21
MW23	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 22
MW24	< 1.0	< 1.0	< 1.0	<b>1.5</b>	10/08/14	10/12/14	2251 23
MW25	<b>57.1</b>	< 1.0	<b>9.3</b>	<b>13.1</b>	10/08/14	10/12/14	2251 24
MW26	<b>2.7</b>	< 1.0	< 1.0	<b>1.2</b>	10/08/14	10/12/14	2251 25
MW27	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 26
MW28	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 27
MW29	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 28
MW30	< 1.0	< 1.0	< 1.0	< 1.0	10/08/14	10/12/14	2251 29

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**eANALYTICS**  
LABORATORY

Client: Fremont Environmental / Noble Energy

Lab ID: 2251

Project: Libsack RG27-15

Method: EPA8260

Sample Name	Dibromo- fluoromethane % Recovery	1,2 Dichloro- ethane-D4 % Recovery	Toluene-D8 % Recovery	Bromo- fluorobenzene % Recovery	Date Sampled	Date Analyzed	Lab ID
MW1	108	87	93	106	10/08/14	10/11/14	2251 1
MW2	88	91	86	95	10/08/14	10/11/14	2251 2
MW3	93	87	109	93	10/08/14	10/11/14	2251 3
MW4	99	109	109	94	10/08/14	10/11/14	2251 4
MW5	106	98	92	86	10/08/14	10/11/14	2251 5
MW6	90	93	90	103	10/08/14	10/11/14	2251 6
MW7	100	109	88	104	10/08/14	10/11/14	2251 7
MW8	95	98	100	107	10/08/14	10/11/14	2251 8
MW9	108	104	97	95	10/08/14	10/11/14	2251 9
MW10	107	92	108	103	10/08/14	10/11/14	2251 10
MW11	92	89	104	94	10/08/14	10/11/14	2251 11
MW13	91	101	95	104	10/08/14	10/11/14	2251 12
MW14	90	95	89	100	10/08/14	10/11/14	2251 13
MW15	107	94	94	92	10/08/14	10/11/14	2251 14
MW16	94	109	103	88	10/08/14	10/11/14	2251 15
MW17	95	102	101	95	10/08/14	10/11/14	2251 16
MW18	86	108	103	101	10/08/14	10/12/14	2251 17
MW19	97	101	108	97	10/08/14	10/12/14	2251 18
MW20	100	107	92	95	10/08/14	10/12/14	2251 19
MW21	102	94	99	86	10/08/14	10/12/14	2251 20

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**eANALYTICS**  
LABORATORY

Client: Fremont Environmental / Noble Energy      Lab ID: 2251  
Project: Libsack RG27-15      Method: EPA8260

Sample Name	Dibromo- fluoromethane % Recovery	1,2 Dichloro- ethane-D4 % Recovery	Toluene-D8 % Recovery	Bromo- fluorobenzene % Recovery	Date Sampled	Date Analyzed	Lab ID
MW22	102	105	92	99	10/08/14	10/12/14	2251 21
MW23	99	92	105	91	10/08/14	10/12/14	2251 22
MW24	91	97	102	95	10/08/14	10/12/14	2251 23
MW25	105	90	98	94	10/08/14	10/12/14	2251 24
MW26	94	90	100	91	10/08/14	10/12/14	2251 25
MW27	105	90	94	92	10/08/14	10/12/14	2251 26
MW28	94	94	95	97	10/08/14	10/12/14	2251 27
MW29	97	101	100	93	10/08/14	10/12/14	2251 28
MW30	99	98	94	96	10/08/14	10/12/14	2251 29

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Client: Fremont Environmental / Noble Energy      Lab ID: 2251  
 Project: Libsack RG27-15  
 Analysis: Volatile Organics      Method: EPA8260

Sample Name	Benzene % Rec	Toluene % Rec	Ethyl- benzene % Rec	Total Xylenes % Rec	Date Analyzed	Lab ID
Laboratory Control Sample (70-130%)	94	90	103	101	10/11/14	LCS 2251 1
Method Blank	< 1.0	< 1.0	< 1.0	< 1.0	10/11/14	MB 2251 1
	ug/L	ug/L	ug/L	ug/L		

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**eANALYTICS**  
L A B O R A T O R Y

Client: Fremont Environmental / Noble Energy      Lab ID: 2251  
 Project: Libsack RG27-15  
 Analysis: Volatile Organics      Method: EPA8260

Sample Name	Benzene % Rec	Toluene % Rec	Ethyl- benzene % Rec	Total Xylenes % Rec	Date Analyzed	Lab ID
Laboratory Control Sample (70-130%)	94	97	102	92	10/12/14	LCS 2251 2
Method Blank	< 1.0	< 1.0	< 1.0	< 1.0	10/12/14	MB 2251 2
	ug/L	ug/L	ug/L	ug/L		

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