

**REMEDICATION INJECTION RULE
AUTHORIZATION APPLICATION**

**KERR-MCGEE OIL & GAS ONSHORE LP
HSR-CHAKNOVA 14-5, HSR-MOORHEAD 13-5,
HSR-BELL 12-5, HSR CREASON 11-5
TANK BATTERY
SWSW SEC 5 T3N-R66W
PLATTEVILLE, COLORADO 80651**

February 2015

Prepared for:

**U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 8
1595 Wynkoop Street
Denver, Colorado 80202-1129**

Prepared by:

**LT ENVIRONMENTAL, INC.
4600 West 60th Avenue
Arvada, Colorado 80003
(303) 433-9788**

UNDERGROUND INJECTION RULE AUTHORIZATION APPLICATION
KERR-MCGEE OIL & GAS ONSHORE LP
HSR-CHAKNOVA 14-5, HSR-MOORHEAD 13-5,
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February 2015

1. Property owner of facility including a physical and mailing address; phone and fax numbers.

Property Owner:

Platteville Vista, LLC

Property Physical Address:

13129 County Road 36
Platteville, Colorado 80651

Property Owner Mailing Address:

Platteville Vista, LLC
6194 S. Benton Ct.
Littleton, CO 80123-3702

Facility Owner Mailing Address:

Anadarko Petroleum Corporation
1099 18th Street, Suite 1800
Denver, Colorado 80202
Contact: Mr. Paul Schneider, PG
HSE Manager - Colorado
(720) 929-6726
Paul.Schneider@anadarko.com

2. Operator of facility including a physical and mailing address; phone and fax numbers.

Anadarko Petroleum Corporation
1099 18th Street, Suite 1800
Denver, Colorado 80202
Contact: Mr. Paul Schneider, PG
HSE Manager - Colorado
(720) 929-6726
Paul.Schneider@anadarko.com

3. Responsible party for the operation, maintenance, and closure of the injection system including a physical and mailing address and phone number.

LT Environmental, Inc. (LTE)
4600 West 60th Avenue
Arvada, Colorado 80003
(303) 433-9788 phone
(303) 433-1432 fax
jsolomon@ltenv.com
Contact: Mr. Justin Solomon

4. Contact persons representing any other regulatory agencies that have an interest in the site; include a physical and mailing address and phone number.

Mr. Bob Chesson
Environmental Protection Specialist
Colorado Oil and Gas Conservation Commission (COGCC)
1120 Lincoln Street, Suite 801
Denver, Colorado 80203
(303) 894-1200 ext. 5112
robert.chesson@state.co.us

5. Briefly outline the type of contamination and when it occurred.

On January 22, 2010, petroleum-impacted soil was discovered while excavating lines for an emissions control device. The date and volume of the release is unknown. Approximately 500 cubic yards of impacted soil were excavated and removed. Prior to backfilling, ten gallons of MicroBlaze[®] Emergency Liquid Spill Control was applied to the excavation groundwater. MicroBlaze[®] is a water soluble solution of cultured, non-pathogenic Bacillus bacteria (400 billion/gallon), water, nutrients and surfactants. MicroBlaze[®] is designed for in-situ remediation of organic compounds and hydrocarbons under aerobic and anaerobic conditions.

6. Map of the site location (1:24,000 topographic map or similar)

A topographic Site Location Map is attached as Figure 1. The global positioning system coordinates for the site are 40.24689607° latitude and -104.806636136° longitude.

- 7. Analysis of groundwater from the receiving formation (up gradient from the contamination) and from the contaminated formation (near the source) include tabular data and a map of the contamination plume with the local groundwater flow direction shown.**

Groundwater analytical results (BTEX) are provided in Table 1. The monitoring well locations, aerial extent of the contaminant plume, and surveyed groundwater flow direction are depicted on the Site Map attached as Figure 2.

- 8. Analysis of contaminants. Include BTEX and MTBE if fuel spill related.**

BTEX concentrations for the quarterly groundwater monitoring events are presented in Table 1. MTBE is not a potential contaminant because unrefined product was released at the site.

- 9. Type of proposed injection well. (example: water well, trench, injection gallery, etc.)**

The proposed air injection (air sparging) wells will be constructed with 2.0-inch polyvinyl chloride (PVC) casing and have 2 feet of 0.010-slot PVC screen at the base of the well. The well screen will be surrounded by a 10/20 silica sand pack that extends 1 foot above the well screen. Each air injection well will be completed to a depth approximately 10 feet below the groundwater table (~ 14 feet bgs). A 4-foot bentonite seal will be installed above the sand pack followed by approximately 6 feet of cement grout (90%) with bentonite (10%) to 1 foot bgs. The annulus will be completed from 1 foot bgs to the ground surface with native fill. The proposed pilot test injection well location is shown on Figure 3 and the proposed injection well locations for the full-scale system are shown on Figure 4.

- 10. Analysis of the proposed injectate.**

The air sparging (AS) system is designed to introduce ambient air into the subsurface water column to promote volatilization and aerobic microbial decomposition of dissolved-phase petroleum hydrocarbons.

- 11. Hydrogeologic description, location, depth, and current use (if any) of the receiving formations. Include hydrological studies if available.**

The site consists of an oil and gas production facility (tank battery) surrounded by land utilized for agriculture. The depth to the observed water table is approximately 4 feet bgs. The surveyed groundwater flow direction at the site is to the northwest. Soil identified at the site consists of fine to medium grained sand (surface to ~ 8 feet bgs) and silty, clayey-sand (8 feet to 15 feet bgs).

12. Location of existing monitoring wells (if any) and the location of proposed monitoring wells.

Seventeen monitoring wells (MW01 through MW17) have been installed at the site, as presented in Figure 2. The aerial extent of the dissolved-phase petroleum hydrocarbon plume has been defined. Utilities permitting, LTE will install three observation wells to the north of the former excavation prior to the pilot testing (see Figure 3).

13. Explain how the monitoring system proposed will be able to track contaminant migration and how the proposed remediation system will minimize further migration.

The existing monitoring wells will be sampled on a quarterly basis to ensure a stable and decreasing contaminant plume. Quarterly groundwater monitoring will be conducted until four consecutive quarters of site-wide BTEX concentrations are in compliance with COGCC allowable levels (Table 910-1). The four compliant sampling events used to close the site will occur with the system off to allow for static monitoring.

In order to prevent further migration of the contaminant plume, the AS system will operate within the groundwater plume, applying pressurized ambient air to the saturated zone until dissolved-phase BTEX concentrations achieve cleanup goals. Established point of compliance wells will be monitored on a quarterly basis to ensure no further plume migration is occurring.

14. If injection is into an alluvial aquifer, provide locations of surface water bodies, i.e. rivers, streams, and lakes, within one mile of injection site (may substitute topographic map).

The injection zone is not in an alluvial aquifer. A topographic Site Location Map showing the area around the site is provided as Figure 1.

15. Provide location and description of any drinking water wells within ¼ mile that may be impacted by the proposed injection.

Two domestic water wells are located within one-quarter mile of the site. One well (permit #248054) is located approximately 700 feet to the southeast (up-gradient) of the site and one well (permit #248032) is located approximately 750 feet south (up-gradient) of the site. The water well locations are depicted on Figure 1.

16. Description of the remediation system including operational procedures.

Description of the Remediation System

The AS system is designed to introduce ambient air into the subsurface water column to promote volatilization and aerobic microbial decomposition of

dissolved-phase petroleum hydrocarbons. Pilot testing of one AS well and one SVE well will be performed to determine a radius of influence (ROI) for each. The proposed locations of the pilot test wells are depicted on Figure 3.

LTE has installed and operated AS/SVE systems in the region and within similar geology. Data from the operation of these systems indicates that a conservative, but reliable, ROI of 15 feet for both the AS and SVE wells can be anticipated. Based upon this assumption, LTE is presenting a full-scale system design, in addition to the pilot test, at this time.

The final AS/SVE system is proposed to operate through nine AS wells and ten SVE wells. The SVE system is designed to volatilize any residual petroleum hydrocarbons adsorbed onto soil particles and to remove petroleum hydrocarbon vapors volatilized from the groundwater by the AS process by applying a vacuum to the unsaturated interval. The AS and SVE wells will be connected to a remediation trailer that houses the equipment and controls for the AS/SVE systems. The layout of the proposed full-scale AS/SVE system is depicted on Figure 4.

Equipment

The final remediation system will include the following equipment or an equivalent replacement:

Natural gas powered 28 kW generator (Arrow Engines VRG-260);
AS blower (Gardner Denver DLR-150 (04));
SVE blower (Roots 47 U-RAI DSL);
Air conveyance high density polyethylene piping and flow control valves; and various gauges and sensors.

Operational Procedure

The AS/SVE systems are designed to operate continuously. AS air flow will be directed to the subsurface at an approximate rate of 100 cubic feet per minute and an expected pressure of approximately 10 pounds per square inch. The SVE system is designed to recover the ambient air introduced by the AS system and remove petroleum hydrocarbon vapors volatilized from the groundwater by the AS process.

System parameters including AS/SVE air flow rates, monitoring well pressure and vacuum influence, monitoring well head space volatile organic compound (VOC) concentrations, groundwater dissolved oxygen (DO) concentrations, groundwater oxidation reduction potential, monitoring well depth to water, and SVE stack emission VOC concentrations will be monitored on a regular basis in order to optimize system operations and ensure site cleanup goals are achieved.

17. If injectate is treated water, is it expected to meet current drinking water standards? If not, what exceedances are expected?

The injectate is ambient air.

18. Describe effect of injectate on groundwater: reaction products or by-products that are anticipated.

The AS system is designed to introduce ambient air into the subsurface water column to volatilize and promote aerobic microbial decomposition of dissolved-phase petroleum hydrocarbons. The SVE system is designed to volatilize any residual petroleum hydrocarbons adsorbed onto soil particles and to remove petroleum hydrocarbon vapors volatilized from the groundwater by the AS process. The injection of ambient air is expected to increase groundwater DO concentrations.

19. Bench scale-testing results if available.

A bench scale-test will not be performed.

20. A specific closure plan for the removal, closure, or plugging of the injections system, including an estimate of closing costs.

All monitoring wells and injection holes will be abandoned following Colorado Department of Water Resources guidelines.

21. An executive summary of the approved Corrective Action Plan.

LTE conducted a site assessment to determine the extent of impact. Per the COGCC, petroleum hydrocarbon impacts in groundwater must be remediated to meet the current Colorado Groundwater Quality Standards. Thus, LTE is initiating a remediation program to achieve this cleanup goal. Remediation at the site will consist of using AS/SVE technology to promote dissolved hydrocarbon volatilization and aerobic microbial decomposition of petroleum hydrocarbons while recovering hydrocarbon vapors released from the groundwater by the AS process. Vapors recovered by the SVE system will be monitored to ensure compliance with the Colorado Department of Public Health and the Environment air regulations.

22. Estimate the time period required to complete the task covered in this Rule authorization request.

It is estimated that all injection activities will be completed in approximately 1 year following system startup.

FIGURES

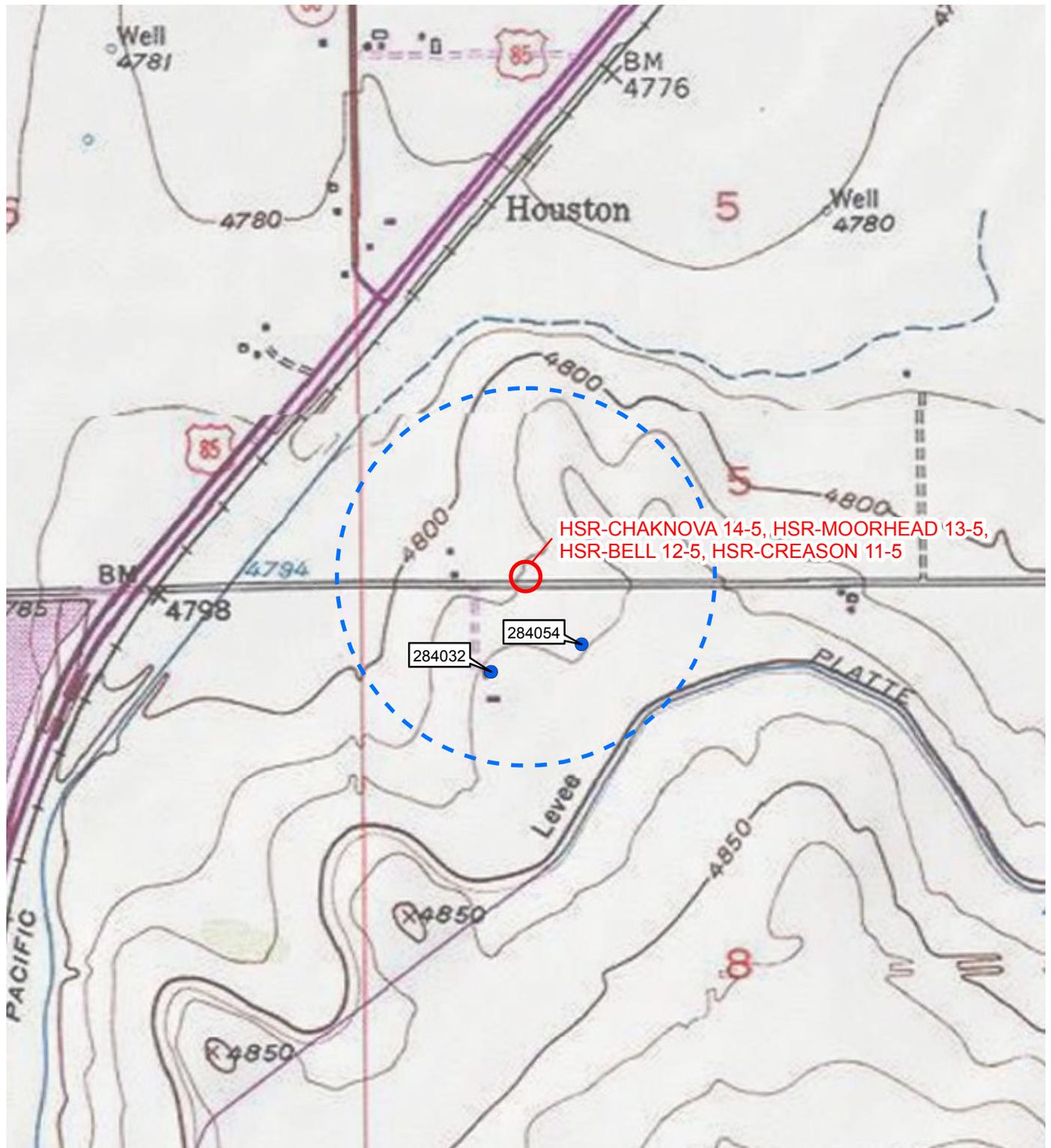


IMAGE COURTESY OF ESRI/USGS

LEGEND

- SITE LOCATION
- WATER WELL
- ⋯ QUARTER MILE RADIUS

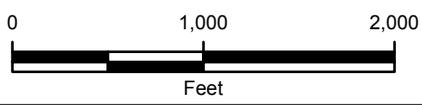
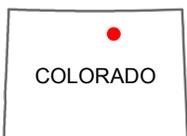


FIGURE 1
WATER WELL LOCATION MAP
 HSR-CHAKNOVA 14-5, HSR-MOORHEAD 13-5,
 HSR-BELL 12-5, HSR-CREASON 11-5
 SWSW SEC 5-T3N-R66W
 WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP



GROUNDWATER SAMPLE ID
 B: BENZENE CONCENTRATION
 RESULTS IN MICROGRAMS PER LITER (µg/L)
BOLD INDICATES RESULT ABOVE STANDARD

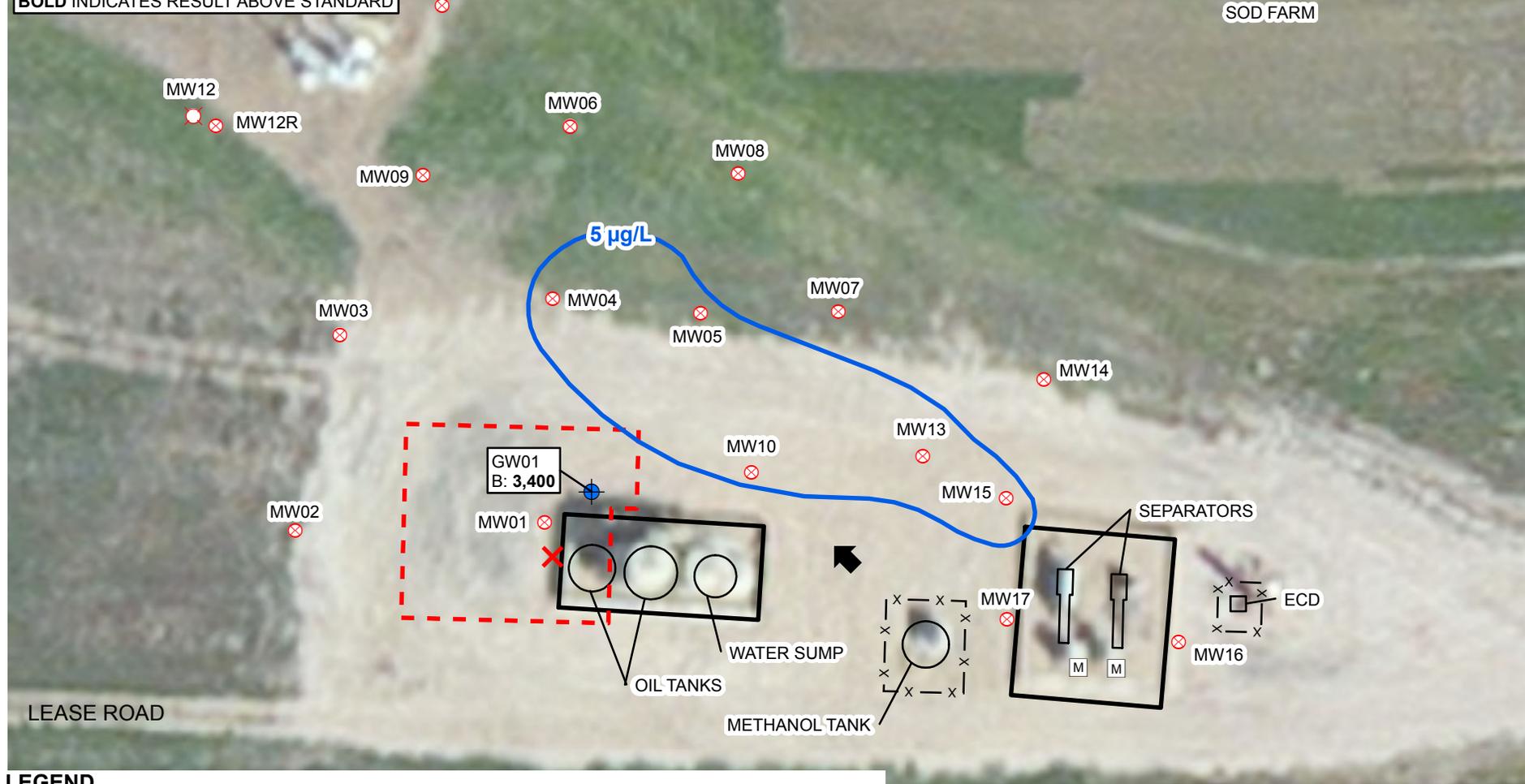


IMAGE COURTESY OF ESRI

LEGEND

- ✗ RELEASE
- ⊗ MONITORING WELL
- ⊗ DESTROYED MONITORING WELL
- ⊕ GROUNDWATER SAMPLE
- M METER HOUSE
- ↑ SURVEYED GROUNDWATER FLOW DIRECTION
- x — x FENCE
- CURRENT BENZENE ISOCONCENTRATION CONTOUR (BASED ON DECEMBER 2, 2014 SAMPLING EVENT)
- EXCAVATION EXTENT
- BERM
- ECD: EMISSION CONTROL DEVICE

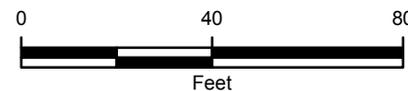
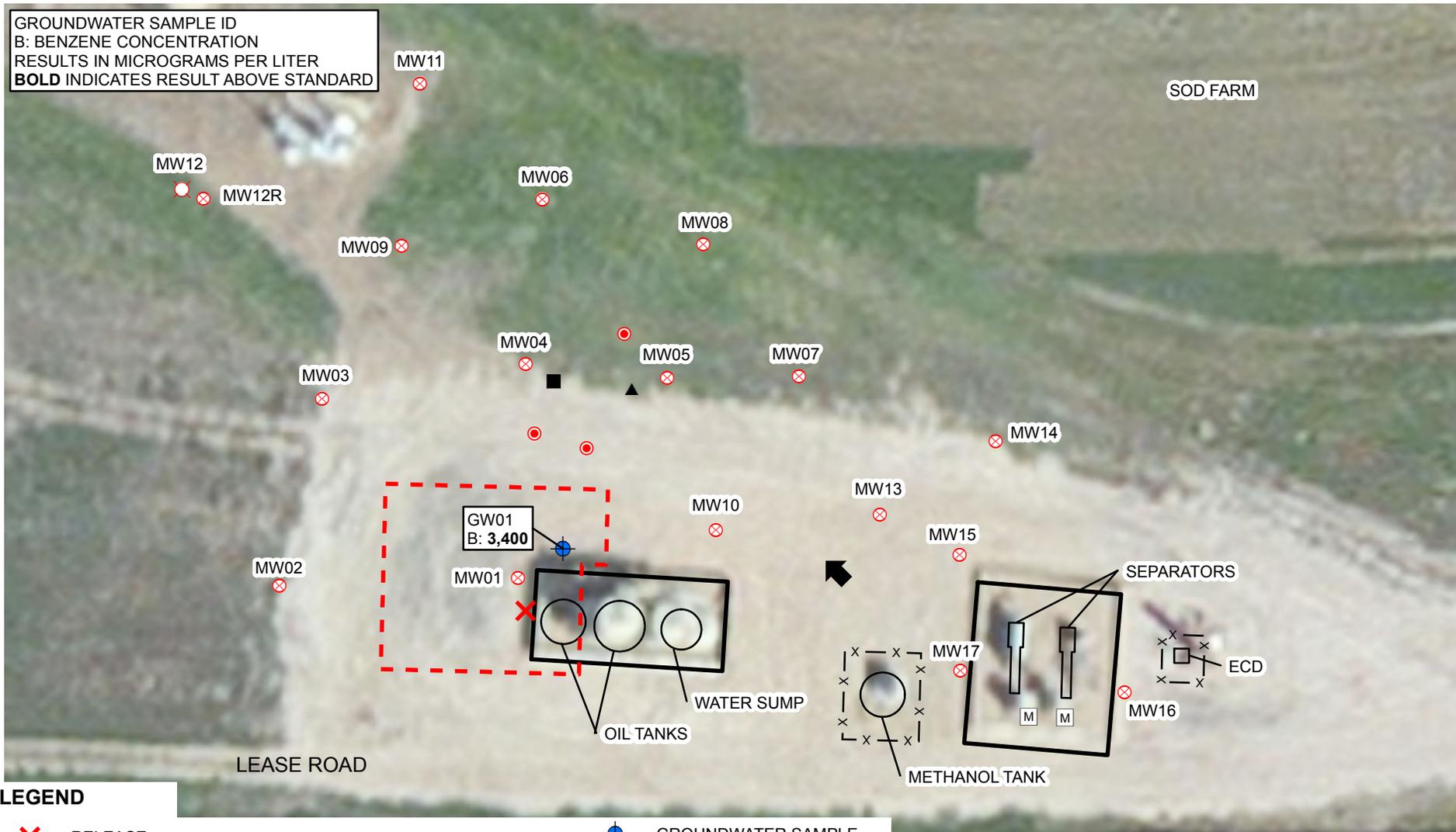


FIGURE 2
 BENZENE ISOCONCENTRATION RESULTS
 HSR-CHAKNOVA 14-5, HSR-MOORHEAD 13-5,
 HSR-BELL 12-5, HSR-CREASON 11-5
 SWSW SEC 5-T3N-R66W
 WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP



GROUNDWATER SAMPLE ID
 B: BENZENE CONCENTRATION
 RESULTS IN MICROGRAMS PER LITER
BOLD INDICATES RESULT ABOVE STANDARD



LEGEND

- ✕ RELEASE
- ▲ PROPOSED AIR SPARGING (AS) PILOT TEST WELL
- PROPOSED SOIL VAPOR EXTRACTION (SVE) PILOT TEST WELL
- PROPOSED OBSERVATION WELL
- ⊗ MONITORING WELL
- ⊘ DESTROYED MONITORING WELL
- ⊕ GROUNDWATER SAMPLE
- M METER HOUSE
- ▲ SURVEYED GROUNDWATER FLOW DIRECTION
- x — x FENCE
- EXCAVATION EXTENT
- BERM
- ECD: EMISSION CONTROL DEVICE

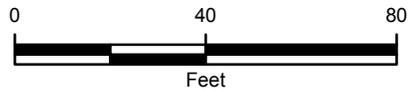


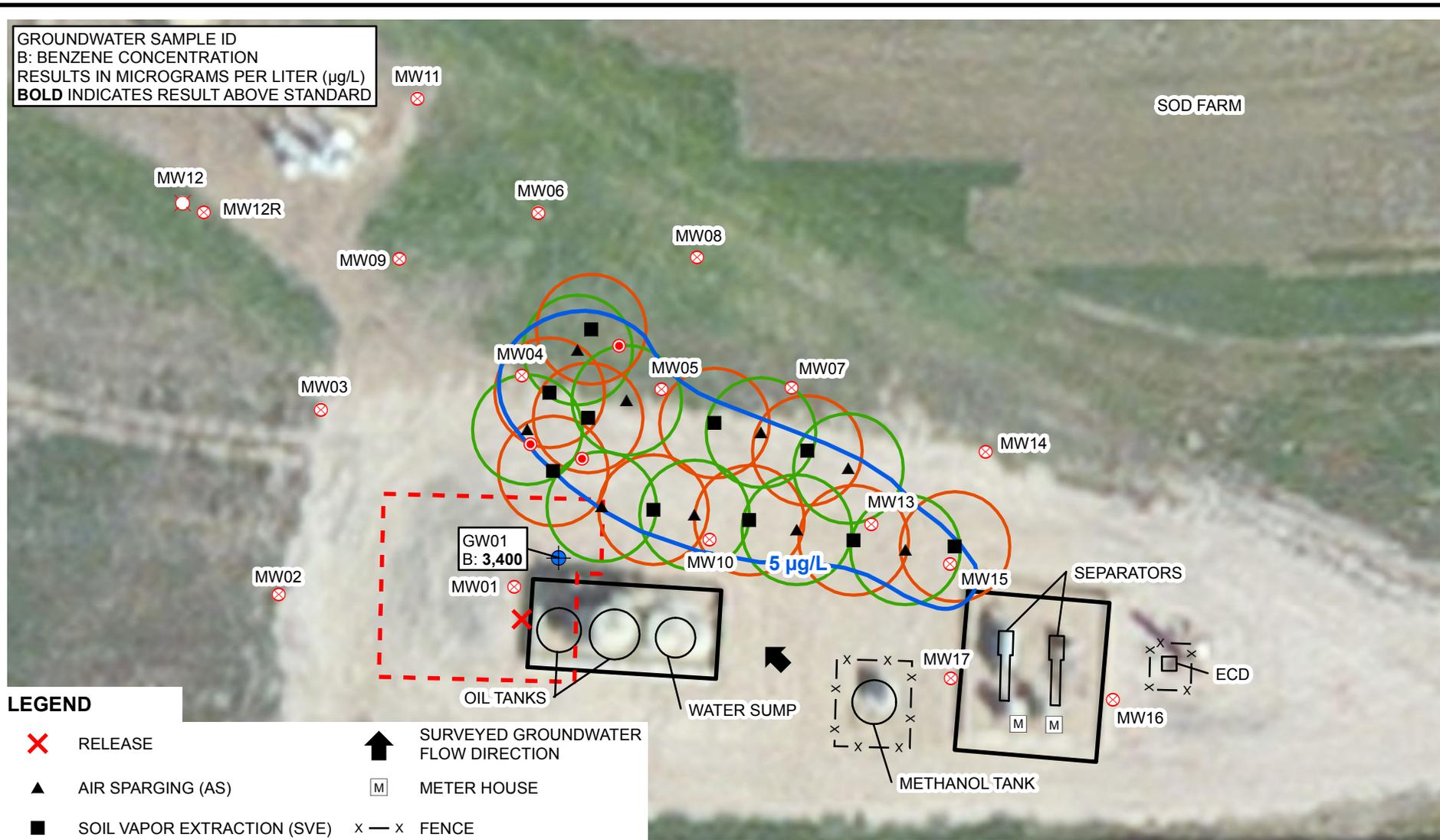
IMAGE COURTESY OF ESRI



FIGURE 3
 AS/SVE PILOT TEST
 HSR-CHAKNOVA 14-5, HSR-MOORHEAD 13-5,
 HSR-BELL 12-5, HSR-CREASON 11-5
 SWSW SEC 5-T3N-R66W
 WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP



GROUNDWATER SAMPLE ID
 B: BENZENE CONCENTRATION
 RESULTS IN MICROGRAMS PER LITER (µg/L)
BOLD INDICATES RESULT ABOVE STANDARD



LEGEND

- ✗ RELEASE
- ▲ AIR SPARGING (AS)
- SOIL VAPOR EXTRACTION (SVE)
- OBSERVATION WELL
- ⊗ MONITORING WELL
- ⊗ DESTROYED MONITORING WELL
- GROUNDWATER SAMPLE
- ▲ SURVEYED GROUNDWATER FLOW DIRECTION
- M METER HOUSE
- x — x FENCE
- AIR SPARGING (AS) 15 FOOT RADIUS OF INFLUENCE
- SOIL VAPOR EXTRACTION (SVE) 15 FOOT RADIUS OF INFLUENCE
- CURRENT BENZENE ISOCONCENTRATION CONTOUR (BASED ON DECEMBER 2, 2014 SAMPLING EVENT)
- EXCAVATION EXTENT
- BERM
- ECD: EMISSION CONTROL DEVICE

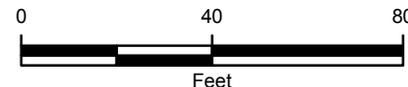


IMAGE COURTESY OF ESRI



FIGURE 4
 FULL SCALE AS/SVE SYSTEM
 HSR-CHAKNOVA 14-5, HSR-MOORHEAD 13-5,
 HSR-BELL 12-5, HSR-CREASON 11-5
 SWSW SEC 5-T3N-R66W
 WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP



TABLE

TABLE 1
GROUNDWATER ANALYTICAL AND FIELD RESULTS
HSR-CHAKNOVA 14-5, HSR- MOORHEAD 13-5, HSR-BELL 12-5, HSR-CREASON 11-5
WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth Water/ (Product Thickness) (ft bgs)
MW01	06/08/2010	4.2	<1.0	4.4	22	4.02
	09/03/2010	<1.0	<1.0	<1.0	<1.0	4.32
	12/06/2010	<1.0	<1.0	<1.0	<1.0	4.50
	03/01/2011	<1.0	<1.0	<1.0	<1.0	5.71
	06/21/2011	<1.0	<1.0	5.6	13	3.29
	09/13/2011	<1.0	<1.0	<1.0	<1.0	2.78
	12/20/2011	<1.0	<1.0	<1.0	<1.0	3.01
	03/13/2012	<1.0	<1.0	<1.0	<1.0	4.58
	06/13/2012	<1.0	<1.0	<1.0	<1.0	4.52
	09/21/2012	<1.0	<1.0	<1.0	<1.0	3.24
	12/17/2012	<1.0	<1.0	<1.0	<1.0	3.40
	03/13/2013	<1.0	<1.0	<1.0	<1.0	3.97
	06/25/2013	<1.0	<1.0	<1.0	<1.0	3.33
	09/18/2013	<1.0	<1.0	<1.0	<1.0	0.75
	12/23/2013	<4.0	<4.0	<4.0	<4.0	3.56
	03/06/2014	<1.0	<1.0	<1.0	<1.0	4.31
	06/03/2014	<1.0	<1.0	<1.0	<1.0	3.73
09/18/2014	<1.0	<1.0	<1.0	<1.0	4.18	
12/02/2014	<1.0	<1.0	<1.0	<3.0	4.66	
MW02	06/08/2010	<1.0	<1.0	<1.0	<1.0	4.69
	09/03/2010	<1.0	<1.0	<1.0	<1.0	4.93
	12/06/2010	<1.0	<1.0	<1.0	<1.0	5.13
	03/01/2011	<1.0	<1.0	<1.0	<1.0	6.41
	06/21/2011	<1.0	<1.0	<1.0	<1.0	3.78
	09/13/2011	<1.0	<1.0	<1.0	<1.0	3.43
	12/20/2011	<1.0	<1.0	<1.0	<1.0	3.60
	03/13/2012	<1.0	<1.0	<1.0	<1.0	5.02
	06/13/2012	<1.0	<1.0	<1.0	<1.0	4.49
	09/21/2012	<1.0	<1.0	<1.0	<1.0	3.99
	12/17/2012	<1.0	<1.0	<1.0	<1.0	4.14
	03/13/2013	<1.0	<1.0	<1.0	<1.0	4.79
	06/25/2013	<1.0	<1.0	<1.0	<1.0	4.24
	09/18/2013	<1.0	<1.0	<1.0	<1.0	1.34
	12/23/2013	<4.0	<4.0	<4.0	<4.0	4.19
	03/06/2014	<1.0	<1.0	<1.0	<1.0	5.16
	06/03/2014	<1.0	<1.0	<1.0	<1.0	4.09
09/18/2014	<1.0	<1.0	<1.0	<1.0	4.51	
12/02/2014	<1.0	<1.0	<1.0	<3.0	5.02	



TABLE 1 (Continued)
GROUNDWATER ANALYTICAL AND FIELD RESULTS
HSR-CHAKNOVA 14-5, HSR- MOORHEAD 13-5, HSR-BELL 12-5, HSR-CREASON 11-5
WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth Water/ (Product Thickness) (ft bgs)
MW03	06/08/2010	1.7	<1.0	<1.0	<1.0	4.83
	09/03/2010	<1.0	<1.0	<1.0	<1.0	5.08
	12/06/2010	<1.0	<1.0	<1.0	<1.0	5.34
	03/01/2011	1.3	<1.0	<1.0	<1.0	6.55
	06/21/2011	<1.0	<1.0	<1.0	<1.0	4.19
	09/13/2011	<1.0	<1.0	<1.0	<1.0	3.68
	12/20/2011	<1.0	<1.0	<1.0	<1.0	3.94
	03/13/2012	<1.0	<1.0	<1.0	<1.0	5.27
	06/13/2012	<1.0	<1.0	<1.0	<1.0	5.15
	09/21/2012	<1.0	<1.0	<1.0	<1.0	4.25
	12/17/2012	<1.0	<1.0	<1.0	<1.0	4.36
	03/13/2013	<1.0	<1.0	<1.0	<1.0	4.96
	06/25/2013	<1.0	<1.0	<1.0	<1.0	4.34
	09/18/2013	<1.0	<1.0	<1.0	<1.0	1.66
	12/23/2013	<4.0	<4.0	<4.0	<4.0	4.31
	03/06/2014	<1.0	<1.0	<1.0	<1.0	5.40
	06/03/2014	102	<1.0	2.0	14.4	4.29
09/18/2014	<1.0	<1.0	<1.0	<1.0	4.62	
12/02/2014	<1.0	<1.0	<1.0	<3.0	5.09	
MW04	06/08/2010	840	<1.0	260	2900	4.38
	09/03/2010	200	<1.0	71	200	4.51
	12/06/2010	86	<1.0	3.5	85	4.74
	03/01/2011	11	<1.0	<1.0	19	5.98
	06/21/2011	1400	<1.0	400	4300	3.73
	09/13/2011	2300	<1.0	280	6000	3.20
	12/20/2011	2100	<1.0	330	5100	3.33
	03/13/2012	160	<1.0	230	1600	4.70
	06/13/2012	3100	<1.0	260	4500	4.58
	09/21/2012	480	<1.0	100	180	3.70
	12/17/2012	2000	<1.0	120	230	4.36
	03/13/2013	690	<1.0	66	210	4.28
	06/25/2013	21	<1.0	1.8	6.6	3.62
	09/18/2013	720	<1.0	140	210	1.25
	12/23/2013	171	<4.0	18.8	34.9	4.16
	03/06/2014	39.4	<1.0	1.1	<1.0	4.76
	06/03/2014	227	<1.0	32.7	93.6	3.77
09/18/2014	135	<4.0	<4.0	<4.0	4.08	
12/02/2014	90.9	<1.0	<1.0	<1.0	4.51	



TABLE 1 (Continued)
GROUNDWATER ANALYTICAL AND FIELD RESULTS
HSR-CHAKNOVA 14-5, HSR- MOORHEAD 13-5, HSR-BELL 12-5, HSR-CREASON 11-5
WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth Water/ (Product Thickness) (ft bgs)
MW05	04/26/2011	36	<1.0	3.5	41	5.27
	06/21/2011	1500	<1.0	200	1800	3.39
	09/13/2011	2900	<1.0	180	3200	3.29
	12/20/2011	2100	<1.0	120	2500	3.58
	03/13/2012	610	<1.0	170	690	4.75
	06/13/2012	3900	<1.0	250	3500	4.68
	09/21/2012	1900	<1.0	150	500	3.77
	12/17/2012	1500	<1.0	130	1100	3.82
	03/13/2013	1400	<1.0	56	480	4.44
	06/25/2013	16	<1.0	1.1	5.6	3.80
	09/18/2013	1800	<1.0	32	1300	1.30
	12/23/2013	167	<4.0	17.1	93.6	3.86
	03/06/2014	5.5	<1.0	1.5	11.9	4.86
	06/03/2014	187	<1.0	12.6	117	3.74
	09/18/2014	62.0	<4.0	<4.0	8.8	4.04
	12/02/2014	57.7	<1.0	6.8	22.3	4.47
MW06	04/26/2011	<1.0	<1.0	<1.0	<1.0	6.16
	06/21/2011	<1.0	<1.0	<1.0	<1.0	4.18
	09/13/2011	<1.0	<1.0	<1.0	<1.0	3.60
	12/20/2011	<1.0	<1.0	<1.0	<1.0	3.84
	03/13/2012	<1.0	<1.0	<1.0	<1.0	5.12
	06/13/2012	<1.0	<1.0	<1.0	<1.0	5.05
	09/21/2012	<1.0	<1.0	<1.0	<1.0	4.15
	12/17/2012	<1.0	<1.0	<1.0	<1.0	4.30
	03/13/2013	<1.0	<1.0	<1.0	<1.0	4.75
	06/25/2013	<1.0	<1.0	<1.0	<1.0	4.18
	09/18/2013	<1.0	<1.0	<1.0	<1.0	1.80
	12/23/2013	<4.0	<4.0	<4.0	<4.0	4.10
	03/06/2014	<1.0	<1.0	<1.0	<1.0	5.18
	06/03/2014	<1.0	<1.0	<1.0	<1.0	4.35
	09/18/2014	<1.0	<1.0	<1.0	<1.0	4.61
	12/02/2014	<1.0	<1.0	<1.0	<1.0	5.09



TABLE 1 (Continued)
GROUNDWATER ANALYTICAL AND FIELD RESULTS
HSR-CHAKNOVA 14-5, HSR- MOORHEAD 13-5, HSR-BELL 12-5, HSR-CREASON 11-5
WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth Water/ (Product Thickness) (ft bgs)
MW07	12/20/2011	<1.0	<1.0	<1.0	<1.0	3.43
	03/13/2012	<1.0	<1.0	<1.0	<1.0	4.78
	06/13/2012	<1.0	<1.0	<1.0	<1.0	4.74
	09/21/2012	<1.0	<1.0	<1.0	<1.0	3.78
	12/17/2012	<1.0	<1.0	<1.0	<1.0	3.89
	03/13/2013	<1.0	<1.0	<1.0	<1.0	4.43
	06/25/2013	<1.0	<1.0	<1.0	<1.0	3.84
	09/18/2013	<1.0	<1.0	<1.0	<1.0	1.43
	12/23/2013	<4.0	<4.0	<4.0	<4.0	3.94
	03/06/2014	<1.0	<1.0	<1.0	<1.0	4.91
	06/03/2014	<1.0	<1.0	<1.0	<1.0	3.84
	09/18/2014	<1.0	<1.0	<1.0	<1.0	4.20
	12/02/2014	<1.0	<1.0	<1.0	<1.0	4.57
MW08	12/20/2011	<1.0	<1.0	<1.0	<1.0	3.94
	03/13/2012	<1.0	<1.0	<1.0	<1.0	5.29
	06/13/2012	<1.0	<1.0	<1.0	<1.0	5.21
	09/21/2012	<1.0	<1.0	<1.0	<1.0	4.29
	12/17/2012	<1.0	<1.0	<1.0	<1.0	4.38
	03/13/2013	<1.0	<1.0	<1.0	<1.0	4.98
	06/25/2013	<1.0	<1.0	<1.0	<1.0	4.36
	09/18/2013	<1.0	<1.0	<1.0	<1.0	2.01
	12/23/2013	<4.0	<4.0	<4.0	<4.0	3.37
	03/06/2014	<1.0	<1.0	<1.0	<1.0	5.37
	06/03/2014	<1.0	<1.0	<1.0	<1.0	4.28
	09/18/2014	<1.0	<1.0	<1.0	<1.0	4.57
	12/02/2014	<1.0	<1.0	<1.0	<1.0	4.96
MW09	12/20/2011	44	<1.0	<1.0	<1.0	4.04
	03/13/2012	280	<1.0	9.8	73	5.37
	06/13/2012	81	<1.0	<1.0	<1.0	5.31
	09/21/2012	1.3	<1.0	<1.0	<1.0	4.37
	12/17/2012	200	<1.0	3.0	<1.0	4.48
	03/13/2013	56	<1.0	2.8	11	4.95
	06/25/2013	150	<1.0	<1.0	<1.0	4.31
	09/18/2013	<1.0	<1.0	<1.0	<1.0	1.99
	12/23/2013	<4.0	<4.0	<4.0	<4.0	4.40
	03/06/2014	33.6	<1.0	<1.0	<1.0	5.48
	06/03/2014	<1.0	<1.0	<1.0	<1.0	4.45
	09/18/2014	Inaccessible - Not Sampled				NM
	12/02/2014	1.7	<1.0	<1.0	<1.0	5.13



TABLE 1 (Continued)
GROUNDWATER ANALYTICAL AND FIELD RESULTS
HSR-CHAKNOVA 14-5, HSR- MOORHEAD 13-5, HSR-BELL 12-5, HSR-CREASON 11-5
WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth Water/ (Product Thickness) (ft bgs)
MW10	04/26/2012	190	15	240	7900	3.20
	06/13/2012	12	<1.0	59	2500	4.50
	09/21/2012	48	1.4	120	750	3.91
	12/17/2012	25	<1.0	62	730	3.90
	03/13/2013	54	1.4	89	1100	4.25
	06/25/2013	9.6	<1.0	53	600	3.70
	09/18/2013	31	<1.0	67	870	0.45
	12/23/2013	5.9	<4.0	7.4	85.8	4.10
	03/06/2014	1.7	<1.0	5.4	88.1	4.77
	06/03/2014	7.9	<1.0	16.8	284	4.39
	09/18/2014	20.2	<1.0	35.1	241	4.78
	12/02/2014	14.7	<1.0	3.7	21.6	5.19
MW11	04/26/2012	<1.0	<1.0	<1.0	3.1	5.85
	06/13/2012	<1.0	<1.0	<1.0	<1.0	5.52
	09/21/2012	<1.0	<1.0	<1.0	<1.0	5.32
	12/17/2012	<1.0	<1.0	<1.0	<1.0	5.42
	03/13/2013	<1.0	<1.0	<1.0	<1.0	5.25
	06/25/2013	<1.0	<1.0	<1.0	<1.0	4.62
	09/18/2013	<1.0	<1.0	<1.0	<1.0	2.97
	12/23/2013	<4.0	<4.0	<4.0	<4.0	5.23
	03/06/2014	<1.0	<1.0	<1.0	<1.0	6.40
	06/03/2014	<1.0	<1.0	<1.0	<1.0	5.22
	09/18/2014	<1.0	<1.0	<1.0	<1.0	5.40
	12/02/2014	<1.0	<1.0	<1.0	<1.0	5.88
MW12	04/26/2012	13	<1.0	<1.0	<1.0	5.44
	06/13/2012	3.2	<1.0	<1.0	<1.0	5.15
	09/21/2012	<1.0	<1.0	<1.0	<1.0	5.03
	12/17/2012	<1.0	<1.0	<1.0	<1.0	5.10
	03/13/2013	<1.0	<1.0	<1.0	<1.0	5.75
	06/25/2013	2.7	<1.0	<1.0	<1.0	5.20
	09/18/2013	Damaged - Not Sampled				NM
MW12 destroyed as of 9/18/2013						
MW12R	12/23/2013	<4.0	<4.0	<4.0	<4.0	4.99
	03/06/2014	9.2	<1.0	<1.0	<1.0	6.10
	06/03/2014	2.9	<1.0	<1.0	<1.0	7.63
	09/18/2014	<1.0	<1.0	<1.0	<1.0	5.33
	12/02/2014	<1.0	<1.0	<1.0	<1.0	5.73



TABLE 1 (Continued)
GROUNDWATER ANALYTICAL AND FIELD RESULTS
HSR-CHAKNOVA 14-5, HSR- MOORHEAD 13-5, HSR-BELL 12-5, HSR-CREASON 11-5
WELD COUNTY, COLORADO
KERR-MCGEE OIL & GAS ONSHORE LP

Well Name	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Depth Water/ (Product Thickness) (ft bgs)
MW13	03/13/2013	820	<1.0	150	3000	4.08
	06/25/2013	350	1.5	38	440	3.77
	09/18/2013	4500	2.2	<1.0	7000	0.30
	12/23/2013	94.7	<4.0	33.8	384	3.75
	03/06/2014	70.8	<1.0	28.6	300	4.09
	06/03/2014	542	<1.0	44.5	441	4.24
	09/18/2014	578	<4.0	60.6	724	4.65
	12/02/2014	133	<1.0	30.8	110	5.01
MW14	12/23/2013	<4.0	<4.0	<4.0	<4.0	3.65
	03/06/2014	<1.0	<1.0	<1.0	<1.0	4.58
	06/03/2014	<1.0	<1.0	<1.0	<1.0	3.46
	09/18/2014	<1.0	<1.0	<1.0	<1.0	3.79
	12/02/2014	<1.0	<1.0	<1.0	<1.0	4.13
MW15	12/02/2014	98.9	<1.0	83.6	112	4.33
MW16	12/02/2014	<1.0	<1.0	<1.0	<1.0	6.41
MW17	12/02/2014	<1.0	<1.0	<1.0	<1.0	6.57
Colo GW Quality Standards		5	1000	700	1400	

Notes: NM - Not Measured
ug/L - micrograms per Liter
NA - Not Analyzed/Not Available

GW - Groundwater ft bgs - feet below ground surface
< - less than laboratory reporting limit
Bold numbers indicate result equaled or exceeded standard.

