3R – 450

GW REPORT

01 / 27 / 2015

3R-450

KOCH

KOCH EXPLORATION COMPANY, LLC

January 27, 2015

Glenn von Gonten
New Mexico Oil Conservation Division
1220 South St Francis Drive
Santa Fe, NM 87505

RE: OCD Case No. 3R-450
Koch Exploration Company, LLC
Dryden 2E - Groundwater Investigation - Final Report
San Juan County, NM

Dear Mr. von Gonten:

Please find attached the final Groundwater Investigation report for the Dryden 2E well site located in San Juan County, NM, OCD Case No. 3R-450. Also attached is the May 14, 2009 work plan revised with your comments provided to Koch Exploration on September 26, 2014.

Koch Exploration requests that the OCD provide written closure for this project.

Please feel free to contact me at 720.201.4941 or radinj@kochind.com with any questions regarding this submittal.

Sincerely,

Jordan K. Radin, PE
Compliance Manager

cc: NMOCD District 3, Charlie Perrin, 1000 Rio Brazos Road, Aztec, NM 87410

303.325.2560 Tel
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950 17th Street, Suite 1900
Denver, Colorado 80202

COMPLIANCE / ENGINEERING / REMEDIATION

LT Environmental, Inc.
2243 Main Avenue, Suite 3
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T 970.385.1096 / F 970.385.1873

January 27, 2015

Mr. Jordan Radin, P.E.
Koch Exploration Company, LLC
950 17th Street, Suite 1900
Denver, Colorado 80202

RE: Report of Subsurface Investigation
Koch Exploration Company, LLC
Dryden #2E Production Well
NMOCD Case Number 3R-450
San Juan County, New Mexico

Dear Mr. Radin:

LT Environmental, Inc. (LTE), under the direction of Koch Exploration Company, LLC (Koch), conducted a subsurface investigation consisting of soil borings, soil sampling, and groundwater sampling at the Dryden #2E production well (Site) near Carrizo Canyon in San Juan County, New Mexico. The New Mexico Oil Conservation Division (NMOCD) assigned case number 3R-450 to this project. The purpose of the investigation was to define the magnitude and extent of potential petroleum hydrocarbon impacts to soil and groundwater following a crude oil and produced water release in 2009. Although the impacted soil was removed, groundwater within the excavation contained elevated concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX).

As described in this report, LTE's subsurface investigation concludes that no soil or groundwater impacts remain at the Site. Although total dissolved solids (TDS) in groundwater samples exceeds New Mexico Water Quality Control Commission (NMWQCC) standards, values are consistent in all groundwater samples including the upgradient monitoring well. Koch successfully removed the source of soil and groundwater impact during the initial response excavation and any residual contaminants have naturally attenuated.

This investigation report complies with the work plan approved by NMOCD in a letter dated September 26, 2014. The NMOCD approval letter specified several conditions that are incorporated into this report. These conditions are called out with an asterisk (*).

Site Description and History

The Site is located in the northeast quarter of the southeast quarter of Section 22, Township 28 North, and Range 8 West in San Juan County, New Mexico, near Carrizo Canyon as depicted on Figure 1. Carrizo Canyon is located approximately 310 feet to the southwest of the Site. Carrizo Canyon drains to Largo Canyon, which enters the San Juan River approximately 10.5 miles to the northwest. No water wells permitted by the New

Mexico Office of the State Engineer (NMOSE) are located within a one-mile radius of the Site. Based on depth to groundwater observed during this subsurface investigation, groundwater is 21 feet to 26 feet below ground surface (bgs).

Koch excavated impacted soil at the Site in 2009 in response to the release of crude oil and produced water from a tank battery. Confirmation soil samples collected from the sidewalls of the excavation indicated impacted soil had been removed. However, a groundwater sample collected from standing water at the bottom of the excavation contained elevated concentrations of BTEX. Subsequently, Koch submitted a groundwater investigation work plan dated May 14, 2009, to the NMOCD. The work plan was approved on September 26, 2014, with conditions by the NMOCD. The following report details the results of the subsurface investigation conducted by LTE according to the approved work plan.

Soil Sampling

LTE advanced a total of four soil borings on December 16, 2014, with a track-mounted Geoprobe® direct push drilling rig operated by Earth Worx Environmental Services and converted the soil borings to groundwater monitoring wells. Koch was on site to identify the former excavation area and assist with the borehole/monitoring well placements. A site map with soil boring/monitoring well locations is depicted on Figure 2. Continuous soil samples were logged by an LTE geologist and described using the Unified Soil Classification System (USCS). The boring logs are included as Attachment A.

The total depths of the soil borings were between 28 feet and 36 feet bgs. The intervals from immediately beneath the ground surface and then every two feet thereafter were screened for volatile aromatic hydrocarbons as well as any soil that was stained or had a hydrocarbon odor. Screening was conducted with a photo-ionization detector (PID) equipped with a 10.5 electron volt lamp in accordance with the NMOCD *Guidelines for Remediation of Leaks, Spills and Releases*, August 13, 1993. The soil samples with the highest field screening result in each borehole or the soil sample from the just above the water table in clean boreholes were collected in pre-cleaned glass jars, labeled with location, date, time, sampler, and method of analysis and immediately placed on ice. The samples were shipped at 4 degrees Celsius (°C) under strict chain-of-custody (COC) procedures to Hall Environmental Analytical Laboratories (HEAL) in Albuquerque, New Mexico. HEAL analyzed the soil samples for BTEX using United States Environmental Protection Agency (EPA) Method 8021B, total petroleum hydrocarbons (TPH) using EPA Method 418.1*, and gasoline range organics (GRO) and diesel range organics (DRO) using USEPA Method 8015D within the required holding times.

Groundwater Monitoring Well Installation and Sampling

LTE converted the soil borings to monitoring wells, which were constructed of schedule 40, 2-inch diameter polyvinyl chloride (PVC) and included 15 feet of 0.01-inch machine

slotted flush-threaded PVC well screen. LTE attempted to set at least 10 feet of screen beneath the water table and approximately 5 feet above to allow for seasonal fluctuations and a proper seal during well construction. A clean 10-20 grade silica sand gravel pack was placed from the bottom of the boring to two feet above the top of the screen, and 3/8-inch natural bentonite chips were set above the gravel pack to the ground surface. The monitoring well completion diagrams are included in Attachment A.

LTE surveyed the new groundwater monitoring wells after construction with a Trimble® GeoExplorer® 3000 series Global Positioning System (GPS) to determine the latitude and longitude. Top-of-casing elevations were surveyed to an accuracy of no less than plus or minus (±) 0.01 feet so that groundwater flow direction and gradient could be determined.

In accordance with Title 19, Chapter 27, Part 4 of the New Mexico Administrative Code (NMAC), LTE filed an application form WR-07 to permit four monitoring wells with the NMOSE as presented in Attachment B. Upon completion of the monitoring wells, LTE submitted well completion diagrams to document well installation.

At least 24 hours after installation*, monitoring wells MW-1, MW-2, MW-3, and MW-4 were developed utilizing clean, disposable PVC bailers. LTE removed a minimum of 10 saturated well casing volumes of water while monitoring pH, specific conductivity, and temperature until these parameters stabilized and turbidity was reduced to the greatest extent possible. All purge water was collected and disposed in the below-grade produced water tank on site.

LTE allowed the monitoring wells to recharge a minimum of 24 hours, then measured depth to groundwater in the monitoring wells with a Keck oil/water interface probe. The interface probe was decontaminated with Alconox™ soap and rinsed with de-ionized water prior to each measurement. The depth to groundwater data were used to calculate the groundwater elevation in each monitoring well.

The volume of water in each monitoring well was calculated, and a minimum of three well casing volumes of water was purged from each monitoring well using a new disposable PVC bailer. As water was removed from the monitoring well, pH, electric conductivity, and temperature were monitored. Monitoring wells were purged until these properties stabilized, indicating the purge water was representative of aquifer conditions, or until the well was purged dry. Stabilization was defined as three consecutive stable readings for each water property (±0.4 units for pH, ±10 percent for electric conductivity, and ±2° C for temperature). All purge water was containerized and disposed of on site in the below-grade produced water tank. A copy of the sampling logs are presented in Attachment C.

Once each monitoring well was properly purged, groundwater samples were collected by filling five 40-milliliter (ml) glass vials, two 500-milliliter plastic vials, and one 250-milliliter amber vial. The laboratory supplied vials were filled and capped with no air

inside to prevent degradation of the sample. Samples were labeled with the date and time of collection, monitoring well designation, project name, collector's name, and parameters to be analyzed. They were immediately sealed and packed on ice. The samples were transferred to HEAL under strict COC procedures for analysis. COC forms were completed documenting the date and time sampled, sample number, type of sample, sampler's name, preservative used (if any), analyses required, and sampler's signature. HEAL analyzed the samples for the following:

- BTEX according to EPA Method 8021B;
- TPH according to EPA Method 8015D (GRO and DRO);
- Total dissolved solids according to EPA Method SM2540C;
- Dissolved metals according to EPA Methods 6010B and 7470; and
- Chloride according to EPA Method 300.0.

Soil Analytical Results

Soil samples collected during advancement of the soil boring for MW-1 were predominantly composed of fill from the excavation consisting of dark yellowish brown silty sand and poorly sorted sand from the ground surface to approximately 24 feet bgs. Below 24 feet, the soil was composed of naturally occurring dark yellowish brown silty sand with interbedded yellowish brown clay and clayey sands to a depth of 36 feet bgs. Soil samples collected at MW-2, MW-3, and MW-4 were composed of dark yellowish brown silty sands from ground surface to approximately 19 feet bgs; below 19 feet, the soil was composed of dark yellowish brown silty sand with interbedded brown clay layers to a depth of 28 feet to 32 feet bgs. Saturated soil was observed in the silty to clayey sand at depths ranging from 20 feet bgs in MW-4 to 27 feet bgs in MW-3. There was no visual staining, hydrocarbon odor, or elevated field screening observed in any of the boreholes. Figure 3 is a cross section from MW-3 to MW-1 across the excavation depicting lithology and soil analytical results.

Based on the site setting, the following NMOCD ranking criteria are applied: depth to groundwater is less than 50 feet bgs and a surface water body is located within 1,000 feet. As such, the remediation action levels are 10 milligrams per kilogram (mg/kg) for benzene, 50 mg/kg for total BTEX, and 100 mg/kg for TPH. Laboratory analytical results confirmed the field observations and indicated soil samples from MW-1, MW-2, MW-3, and MW-4 contained no detectable concentrations of BTEX or TPH. The soil analytical results as compared to the NMOCD standards are presented in Table 1. The HEAL analytical report is included as Attachment D.

Groundwater Analytical Results

Groundwater elevations in monitoring wells ranged from 5,722.35 feet above mean sea level (AMSL) in MW-2 to 5,722.09 feet AMSL in MW-3. Based on surface topography, MW-4 was originally anticipated to be the downgradient monitoring well; however, results from the subsurface investigation indicated groundwater flow is relatively flat and flow direction is more to the west, toward Carrizo Canyon. The surface topography at the Site was modified to direct surface runoff away from the well pad upon backfilling of the excavation. A groundwater potentiometric surface map is depicted on Figure 4 and groundwater elevations are presented in Table 2.

Laboratory analytical results indicate no groundwater samples contained concentrations of chloride, BTEX, TPH, or dissolved metals exceeding NMWQCC standards. Total dissolved solids exceeded NMWQCC standards in all samples including groundwater sampled in the upgraident monitoring well MW-2. The groundwater analytical results are compared to the NMWQCC standards in Table 3. The HEAL laboratory analytical report is included as Attachment D.

Conclusions

No soil or groundwater impacts were identified at the Site. Although TDS exceeds NMWQCC standards, values are consistent in all groundwater samples including the upgraident monitoring well. Koch successfully removed the source of soil and groundwater impact during the initial response excavation and any residual contaminants have naturally attenuated.

Recommendations

LTE recommends Koch request site closure and immediately plug and abandon the monitoring wells according to Part 4, of Chapter 19, of Title 19 NMAC.

LTE appreciates the opportunity to provide this report to Koch. If you have any questions or comments, do not hesitate to contact me at (970) 385-1096 or via email at aager@ltenv.com.

Sincerely,

LT ENVIRONMENTAL, INC.

Daniel Newman
Staff Geologist

Ashley L. Ager, M.S.
Senior Geologist

Attachments

Figure 1 – Site Location Map
Figure 2 – Site Map
Figure 3* – Geologic Cross Section A-A'
Figure 4 – Groundwater Potentiometric Surface Map
Table 1 – Soil Analytical Results
Table 2 – Groundwater Elevation Data
Table 3 – Groundwater Analytical Results
Attachment A – Borehole Logs and Monitoring Well Completion Diagrams
Attachment B – NMOSE Forms
Attachment C –Monitoring Well Sampling Forms
Attachment D – Laboratory Analytical Reports

FIGURES

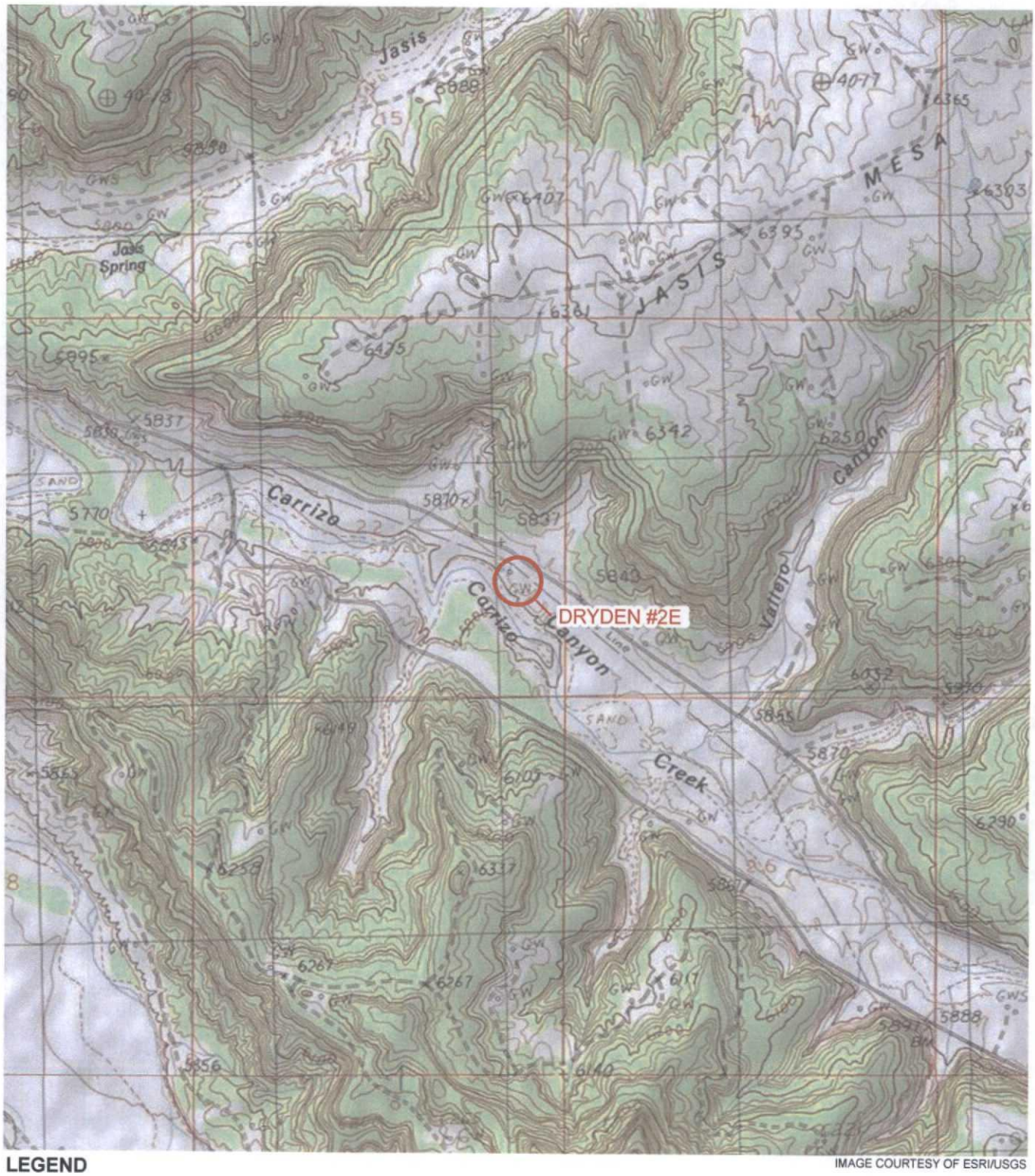

IMAGE COURTESY OF ESRI/USGS

LEGEND

SITE LOCATION

0 2,000 4,000

Feet

N

NEW MEXICO

FIGURE 1
SITE LOCATION MAP
DRYDEN #2E
NESE SEC 22 T28N R8W
SAN JUAN COUNTY, NEW MEXICO
KOCH EXPLORATION COMPANY, LLC

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