LT Environmental, Inc.
4600 West 60th Avenue
Arvada, Colorado 80003
303.433.9788

November 7, 2018

Mr. Mike Bratcher
New Mexico Oil Conservation Division
811 South First Street
Artesia, New Mexico 88210

RE: Elk Wallow 11 State #001H Battery
2RP-4967
Proposed Remediation Workplan
Eddy County, New Mexico
XTO Energy, Inc.

Dear Mr. Bratcher:

LT Environmental, Inc. (LTE), on behalf of XTO Energy Inc. (XTO), has prepared this remediation workplan for the Elk Wallow State #001H Battery (Site). This workplan has been developed following completion and submission of the Release Notification Form C-141 and has been prepared in accordance with the New Mexico Administrative Code (NMAC) Title 19, Chapter 15, Part 29. This correspondence will summarize recent activities conducted at the Site, and outline proposed future actions designed to bring the Site into compliance with New Mexico Oil and Conservation Division (NMOCD) regulations. The Site is in Unit D of Section 11, Township 25 South, Range 29 East, in Eddy County, New Mexico. The Site Location Map is provided as Figure 1.

BACKGROUND

On August 27, 2018, the battery at the Site was struck by lightning which caused a fire that spread to all the above ground storage tanks in the western tank battery containment. All associated wells and equipment were shut down at the time of the event. The incident caused a release of approximately 723 barrels (bbl) of produced water and 33 bbl of crude oil. The released fluids pooled in the northwest corner of the pad and flowed northwest from the pad down a dry wash for approximately 690 feet. The release impacted approximately 8,360 square feet of caliche pad (onsite) and approximately 12,800 square feet of soil along the dry wash. A vacuum truck was used to recover approximately 468 bbl of the released produced water and 22 bbl of the released crude oil. XTO gave immediate verbal notification to the NMOCD and reported the release on a Release Notification and Corrective Action Form C-141 on September 11, 2018.

XTO and LTE immediately began removing surface and subsurface soil impacts on the production pad. Onsite work is currently ongoing to complete source removal of all impacted soil on the production pad.

Depth to groundwater at the Site is estimated to be greater than 150 feet below ground surface (bgs) based on the nearest water well data and known aquifer properties. The nearest permitted water well is known as Water Right File Number C 02459, located approximately 0.74 miles north-northeast of the Site, with a total depth of 150 feet bgs. Groundwater was not encountered per the drilling log associated with water well C 02359. Additionally, water well C 02371, located approximately 1.7 miles south-southwest of the Site, was drilled to a total depth of 200 feet bgs. According to the associated drilling log, groundwater was encountered at 162 feet bgs with a static water level of 60 feet bgs after completion of the well. The closest surface water to the Site is Obe Stream located approximately 104 feet west of the Site. The Site is greater than 300 feet from any occupied residence, school, hospital, institution, church or wetland. The Site is greater than 1,000 feet to a freshwater well or spring and is not within an unstable area, 100-year floodplain, or overlying a subsurface mine. Because the release flowed into an ephemeral dry wash, the Site will be remediated to the most stringent closure criteria for soils impacted by a release. The cleanup criteria is listed in Table I of the NMAC Title 19, Chapter 15, part 20 (600 milligrams per kilograms [mg/kg] chloride, 100 mg/kg total petroleum hydrocarbons (TPH), 50 mg/kg combined benzene, toluene, ethylbenzene, and total xylenes [BTEX], and 10 mg/kg benzene).

INITIAL REMEDIATION AND SITE CHARACTERIZATION

Onsite work has included removing over 1,000 yards of impacted soil and collecting confirmation samples on the production pad area. Source removal on the production pad is ongoing and will continue until confirmation soil samples demonstrate compliance with the most stringent closure criteria listed in the NMAC Table I. Once remediation is complete onsite, clean imported backfill will replace the excavated soil.

Impact to the downgradient dry wash has yet to be remediated. To date, initial assessment activities have been conducted, consisting of soil characterization and mapping of the visual extent of impacts. Assessment data include sampling the release pathway down the wash, in locations labeled SS01 through SS04 on Figure 2. These samples included an initial surface sample collected at 0.5 feet bgs on September 25, 2018, and subsequent vertical delineation sampling conducted with a hand auger, labeled as PH07 through PH09 on October 3 and 8, 2018. At each vertical delineation sampling location, soil samples were collected from two intervals at depths between 3 feet and 5 feet bgs. Based on the assessment data, it is estimated that approximately 2,000 to 2,500 cubic yards of impacted soil are located off pad in the wash.

The assessment activities of the dry wash indicate that TPH or chloride concentrations greater than NMOCD applicable standards exist in all sample locations throughout the identified flow path. TPH concentrations in surficial samples through the flow path are similar in magnitude, ranging from 452 mg/kg in soil sample SS03 to 868 mg/kg in soil sample SS04, indicating that the released product was generally consistent in nature, and distributed in relatively equal amounts throughout the flow path. Chloride concentrations in surficial samples are less consistent,

ranging from 666 mg/kg in soil sample SS02 to 5,510 mg/kg in soil sample SS03. This may be due to local topography and differing soil permeability along the flow path, as well as the increased solubility and mobility of chlorides relative to hydrocarbons. TPH concentrations greater than applicable cleanup standards were not identified in the deeper vertical delineation soil samples.

All vertical delineation soil samples collected from intervals between 3 feet and 5 feet bgs were in compliance with applicable TPH standards. This indicates that hydrocarbon impacts are only apparent at the surface, where natural processes will be most robust in oxidizing, volatilizing, and degrading the remaining organic impacts.

Inorganic impacts, characterized by the chloride data, is more variable laterally along the release pathway and vertically into the soil column. Chloride concentrations in samples collected from the center of the release pathway (PH09 and SS03 area) range between 3,390 mg/kg and 5,510 mg/kg while chloride concentrations at the release terminus (SS01 and PH07 area) range between 17.3 mg/kg to 2,090 mg/kg. The laboratory analytical results are summarized in Table 1 and shown on Figure 2.

This data indicates that the crude oil and produced water have both inorganic and organic constituents greater than applicable cleanup standards, with the organic impacts limited to the surface, as the soils absorb the hydrocarbons and prevents downward migration. The more soluble and less polarized ions dissolved in the produced water and crude oil (inorganic impact) are distributed to a greater vertical extent, indicating impacts within the flow path have migrated to at least five feet bgs. Vertical delineation of chloride concentrations greater than applicable cleanup standards was achieved at the PH07 location, but was not achieved at the PH08 or PH09 sampling locations during initial assessment activities. Additional assessment activities will be conducted to identify the vertical extent of chloride impacts at the beginning of the dry wash and at the PH08 and PH09 sampling locations.

PROPOSED REMEDIATION PROGRAM

Continuing source removal along the flow path off the production pad area would be detrimental to the local flora, fauna, and local public health and environment. The benefit of securely removing the subsurface impact would be offset by the greater environmental damage that would ensue as a result of heavy equipment, earth moving, loading, transporting, erosion, backfill, reseeding, and reclamation work. Alternately, XTO proposes an enhanced attenuation remediation plan. This plan will enhance the attenuation rate for inorganics in the subsurface by increasing the solubility and facilitating downward vertical migration of inorganic impacts. This process will be accomplished by adding a liquid calcium amendment to flush water to promote the vertical migration of impacts. The ion exchange reaction initiated from the calcium amendment in the soil will ensure that soil structure will promote water absorption, penetration, and constituent of concern dissolution.

The release pathway followed gravity conditions into a dry wash, creating advantageous natural conditions to remediate the subsurface. These natural advantages include a location where any surface water will be channelized and located during precipitation events. Additionally, field observations indicate areas of coarse soil and high porosity, where the natural channelized precipitation will have ample opportunities to migrate into the affected subsurface. Considering how the released product flowed down the dry wash and migrated into the subsurface preferentially at locations with high porosity, the channeled precipitation water will follow the same migration pathways.

PULSED FLOOD IRRIGATION SYSTEM

Remediation of inorganic impacts requires water contact with the impacted soil, combined with adequate drainage, to vertically migrate salts downward via gravity head into the subsurface and away from the root zone. The sandy loam soil observed along the wash at the Site is well-draining, which is a favorable condition for natural attenuation of chloride impacts by transporting salts below the root zone during natural precipitation events. XTO proposes to enhance natural attenuation by conducting pulsed flood irrigation events of fresh water mixed with a liquid calcium amendment. The flushing liquid will be delivered by installation of a semi-permanent network of 1-inch high-density polyethylene (HDPE) piping along the wash. Four irrigation zones that can be operated independently will be located along the wash and treatment coverage will extend through all affected areas. The HDPE piping will be designed to deliver flush fluids at a rate that will percolate into the subsurface, rather than creating runoff down the wash and carrying inorganic constituents beyond the release terminus. The HDPE piping will be connected to a 200 bbl water storage tank staged on the pad at the beginning of the wash to facilitate delivery of the flush fluids. A surface cover of organic mulch will be applied along the wash to reduce runoff and evaporation during flood irrigation events. The organic mulch surface cover will also encourage fluid infiltration into the subsurface, rather than runoff, during natural precipitation events. The 1-inch HDPE piping will be fastened to the ground using driven rebar and ties to secure the piping and allow for removal at the close of the project with minimal ground disturbance. The pulsed flood irrigation events will be conducted on a monthly schedule to allow sufficient time for the flush liquids to dilute and mobilize chloride ions downward vertically into the subsurface.

Pending additional assessment data, it is anticipated that a minimum of 12 monthly pulsed flood irrigation events will adequately dilute and remediate the identified chloride concentrations at the Site to achieve compliance with applicable NMOCD standards.

SOIL REMEDIATION PERFORMANCE MONITORING

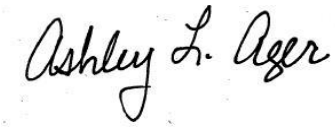
Soil monitoring along the wash will be conducted and reported on a quarterly schedule to monitor the remediation progress of TPH and chloride impact to soil along the wash. A hand auger will be used to collect soil samples for laboratory analysis of TPH and chloride from the

locations where previous exceedances of applicable NMOCD standards were observed. Once laboratory analytical results for each location indicate compliance with NMOCD standards, the location will be removed from monitoring. The pulsed flood irrigation zones will be adjusted based on the results of each soil performance monitoring event to focus remedial efforts accordingly. Soil will continue to be monitored and reported for the analytes in Table I, until compliance with all applicable standards are achieved. Once all locations demonstrate compliance with applicable NMOCD standards, the pulsed flood irrigation system will be removed from the Site.

Sincerely,

LT ENVIRONMENTAL, INC.

Adrian Baker
Project Geologist



Ashley L. Ager, M.S., P.G.
Senior Geologist

cc: Kyle Littrell, XTO
Jim Amos, BLM
Shelly Tucker, BLM

Attachments:

Figure 1	Site Location Map
Figure 2	Soil Sample Locations
Table 1	Soil Analytical Results
Attachment 1	Initial NMOCD Form C-141

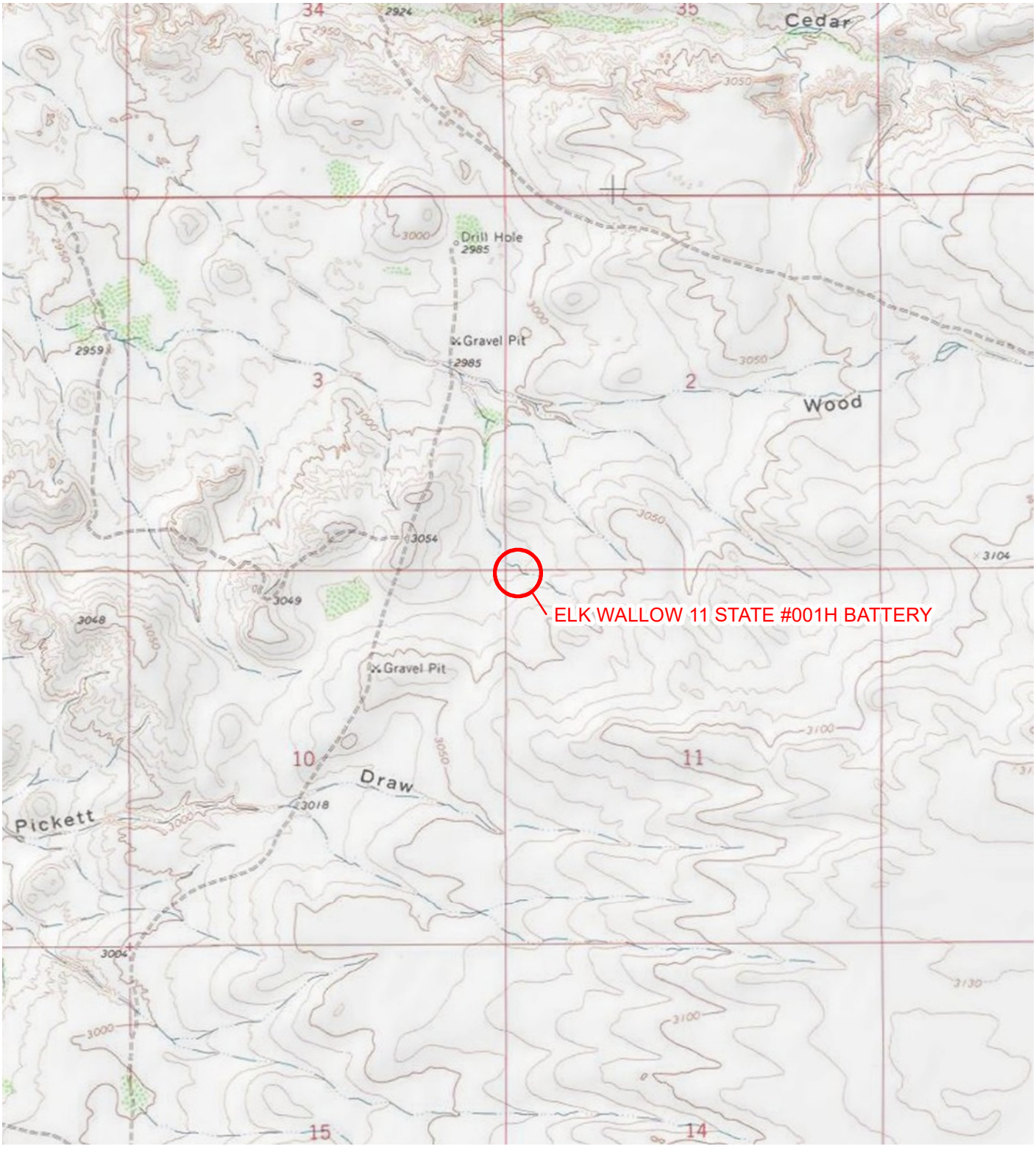


IMAGE COURTESY OF ESRI/USGS

LEGEND

SITE LOCATION

0 2,000 4,000

Feet

N

NEW MEXICO

NOTE: REMEDIATION PERMIT NUMBER 2RP-4967

FIGURE 1
SITE LOCATION MAP
ELK WALLOW 11 STATE #001H BATTERY
UNIT D SEC 11 T25S R29E
EDDY COUNTY, NEW MEXICO
XTO ENERGY, INC.

P:\XTO Energy\GIS\MXD\012918147_ELK WALLOW\012918147_FIG01_SL_SITE_2018.mxd

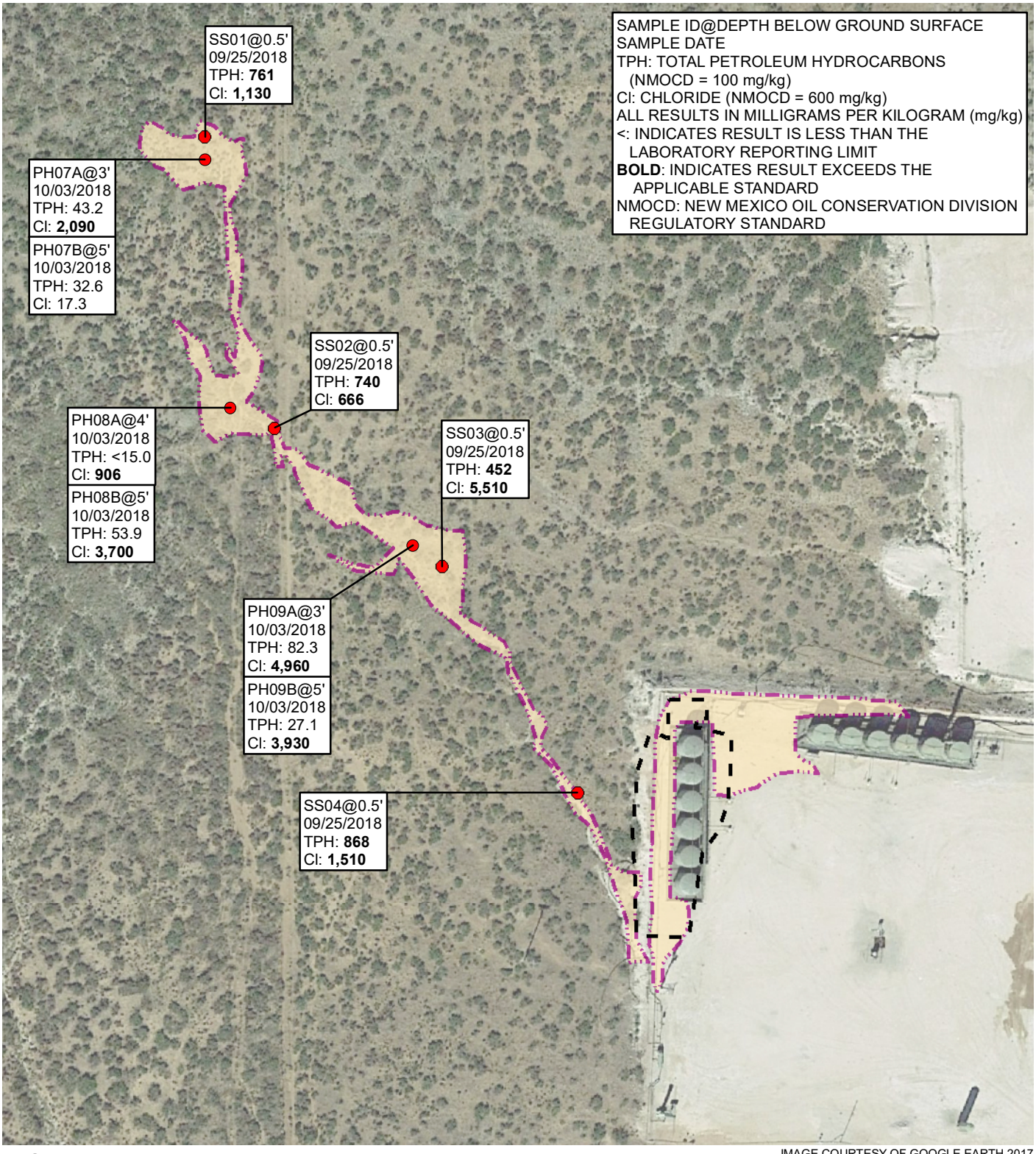


IMAGE COURTESY OF GOOGLE EARTH 2017

LEGEND

- PRELIMINARY SOIL SAMPLE
- RELEASE EXTENT
- EXCAVATION EXTENT

NOTE: BENZENE AND TOTAL BTEX NOT INCLUDED BECAUSE ALL RESULTS WERE NEAR OR BELOW LABORATORY DETECTION LIMITS

NOTE: REMEDIATION PERMIT NUMBER 2RP-4967

0 100 200
Feet

N

FIGURE 2
SOIL SAMPLE LOCATIONS
ELK WALLOW 11 STATE #001H BATTERY
UNIT D SEC 11 T25S R29E
EDDY COUNTY, NEW MEXICO
XTO ENERGY, INC.

P:\XTO Energy\GIS\MXD\012918147_ELK WALLOW\012918147_FIG03_OFFSITE_2018.mxd

TABLE 1
SOIL ANALYTICAL RESULTS

ELK WALLOW 11 STATE #001H BATTERY
REMEDIATION PERMIT NUMBER 2RP-4967
EDDY COUNTY, NEW MEXICO
XTO ENERGY, INC.

Sample Name	Sample Depth (feet bgs)	Sample Date	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	Total BTEX (mg/kg)	C6-C10 GRO (mg/kg)	C10-C28 DRO (mg/kg)	C28-C40 ORO (mg/kg)	GRO and DRO (mg/kg)	TPH (mg/kg)	Chloride (mg/kg)
SS01	0.5	09/25/2018	<0.00202	<0.00202	<0.00202	<0.00202	<0.00202	<15.0	744	17.2	744	**761**	**1,130**
SS02	0.5	09/25/2018	<0.00199	<0.00199	<0.00199	<0.00199	<0.00199	<15.0	714	25.9	714	**740**	**666**
SS03	0.5	09/25/2018	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<15.0	452	<15.0	452	**452**	**5,510**
SS04	0.5	09/25/2018	<0.00201	<0.00201	<0.00201	<0.00201	<0.00201	<15.0	815	53.4	815	**868**	**1,510**
PH07A	3	10/03/2018	<0.00201	<0.00201	<0.00201	<0.00201	<0.00201	<15.0	43.2	<15.0	43.2	43.2	**2,090**
PH07B	5	10/03/2018	<0.00202	<0.00202	<0.00202	<0.00202	<0.00202	<15.0	32.6	<15.0	32.6	32.6	17.3
PH08A	4	10/03/2018	<0.00199	<0.00199	<0.00199	<0.00199	<0.00199	<15.0	<15.0	<15.0	<15.0	<15.0	**906**
PH08B	5	10/03/2018	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<15.0	53.9	<15.0	53.9	53.9	**3,700**
PH09A	3	10/03/2018	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<14.9	64.9	17.4	64.9	82.3	**4,960**
PH09B	5	10/03/2018	<0.00201	<0.00201	<0.00201	<0.00201	<0.00201	<15.0	27.1	<15.0	27.1	27.1	**3,930**
NMOCD Remediation Action Levels			10	NE	NE	NE	50	NE	NE	NE	NE	100	600

Notes:
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and total xylenes
mg/kg - milligrams per kilogram
NE - not established
NMOCD - New Mexico Oil Conservation Division
DRO - diesel range organics
GRO - gasoline range organics
ORO - oil range organics
TPH - total petroleum hydrocarbons
< - indicates result is below laboratory reporting limits
Bold - indicates result exceeds the applicable regulatory standard.

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources Department

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 24, 2018
Submit to appropriate OCD District office

Incident ID	NMAP1825459428
District RP	2RP-4967
Facility ID	N/A
Application ID	pMAP1825459097

Release Notification

Responsible Party

Responsible Party XTO Energy	OGRID 5380
Contact Name Kyle Littrell	Contact Telephone 432-221-7331
Contact email Kyle_Littrell@xtoenergy.com	Incident # *(assigned by OCD)*
Contact mailing address 522 W. Mermod, Suite 704 Carlsbad, NM 88220	

Location of Release Source

Latitude 32.151330 Longitude -103.96267
(NAD 83 in decimal degrees to 5 decimal places)

Site Name Elk Wallow 11 State #001H Battery	Site Type Tank Battery
Date Release Discovered 8/27/18 at 2pm	API# 30-015-37588

Unit Letter	Section	Township	Range	County
D	11	25S	29E	Eddy

Surface Owner: ☒ State ☐ Federal ☐ Tribal ☐ Private (*Name:* _____)

Nature and Volume of Release

Material(s) Released (Select all that apply and attach calculations or specific justification for the volumes provided below)

☒ Crude Oil	Volume Released (bbls) 33.12	Volume Recovered (bbls) 21.56
☒ Produced Water	Volume Released (bbls) 723.13	Volume Recovered (bbls) 468.44
	Is the concentration of dissolved chloride in the produced water >10,000 mg/l?	☐ Yes ☐ No
☐ Condensate	Volume Released (bbls)	Volume Recovered (bbls)
☐ Natural Gas	Volume Released (Mcf)	Volume Recovered (Mcf)
☐ Other (describe)	Volume/Weight Released (provide units)	Volume/Weight Recovered (provide units)

Cause of Release
Battery was struck by lightning which caused a fire that spread to all the tanks in the west tank battery containment. All the associated wells had already been shut at the time of the event. The fire department extinguished the fire.

State of New Mexico
Oil Conservation Division

Incident ID	NMAP1825459428
District RP	2RP-4967
Facility ID	N/A
Application ID	pMAP1825459097

Was this a major release as defined by 19.15.29.7(A) NMAC? ☒ Yes ☐ No	If YES, for what reason(s) does the responsible party consider this a major release? An unauthorized release of a volume, excluding gases, of 25 barrels or more
If YES, was immediate notice given to the OCD? By whom? To whom? When and by what means (phone, email, etc)? Yes, Amy Ruth, contacted Mike Bratcher (NMOCD), Maria Pruett (NMOCD), Ryan Mann (SLO), By email on August 28, 2018 at 8:57 am	

Initial Response

The responsible party must undertake the following actions immediately unless they could create a safety hazard that would result in injury

☒ The source of the release has been stopped.

☒ The impacted area has been secured to protect human health and the environment.

☒ Released materials have been contained via the use of berms or dikes, absorbent pads, or other containment devices.

☒ All free liquids and recoverable materials have been removed and managed appropriately.

If all the actions described above have not been undertaken, explain why:

Per 19.15.29.8 B. (4) NMAC the responsible party may commence remediation immediately after discovery of a release. If remediation has begun, please attach a narrative of actions to date. If remedial efforts have been successfully completed or if the release occurred within a lined containment area (see 19.15.29.11(A)(5)(a) NMAC), please attach all information needed for closure evaluation.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Printed Name: Kyle Littrell Title: SH&E Coordinator

Signature: Date: 9/11/2018

email: Kyle_Littrell@xtoenergy.com Telephone: 432-221-7331

OCD Only

Received by: Date: 09/11/18