

**C-144 Permit Package  
Salado Draw Pad 419, Temporary Pit  
Section 15 of T26S, R32E, Lea County**

SD 15 FEDERAL P419 #011H  
SD 15 FEDERAL P419 #012H  
SD 15 FEDERAL P419 #013H  
SD 15 FEDERAL P419 #014H

Chevron USA Incorporated  
6301 Deauville Blvd.  
Midland, TX 79706  
(432) 687-7866



August 5, 2020

New Mexico Oil Conservation Division  
Energy, Minerals, and Natural Resources Department  
5200 Oakland Avenue  
Albuquerque, NM 87113

Via Electronic Submittal

**RE: Chevron USA Incorporated Temporary Pit Application**

Salado Draw Pad 419  
Section 15 of T26S, R32E, Lea County

Ms. Lucas Kamat,

Enclosed is a complete C-144 permit application for a Temporary Pit with non-low chloride drilling fluid located at an existing Chevron USA Inc. BLM lease #NMNM118722 located in Section 15, T26S R32E. This package includes the following documentation:

- C-144 for Non-Low Chloride Temporary Pit
- Siting Criteria Demonstration
- Siting Criteria Figures 1-10
- Variance Requests
- Appendix A – USGS Groundwater Data
- Appendix B – NMOSE Water Data
- Appendix C – Hydrogeologic Data
- Appendix D – Design Plan
- Appendix E – Operating and Maintenance Plan
- Appendix F – Closure Plan
- Appendix G – Evaluation of Unstable Conditions
- Attachments 1-4

Please do not hesitate to contact us if you require any additional information or clarification supporting the approval of this application.

Sincerely,

**Jacob Chu**  
Natural Resources Advisor  
[JNakoaChu@Chevron.com](mailto:JNakoaChu@Chevron.com)

**Jonathon Fisher**  
Wells Engineer  
[JonathonFisher@Chevron.com](mailto:JonathonFisher@Chevron.com)

**Cas Bridge, PhD, PG (LA1175)**  
Environmental Scientist  
[Cas.Bridge@Chevron.com](mailto:Cas.Bridge@Chevron.com)

**Chevron USA Incorporated**  
Chevron USA Inc.  
6301 Deauville Blvd  
Midland, TX 79706  
Tel 432 687 7866

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-144
Revised April 3, 2017

For temporary pits, below-grade tanks, and multi-well fluid management pits, submit to the appropriate NMOCD District Office.
For permanent pits submit to the Santa Fe Environmental Bureau office and provide a copy to the appropriate NMOCD District Office.

Pit, Below-Grade Tank, or
Proposed Alternative Method Permit or Closure Plan Application

- Type of action:
[ ] Below grade tank registration
[X] Permit of a pit or proposed alternative method
[ ] Closure of a pit, below-grade tank, or proposed alternative method
[ ] Modification to an existing permit/or registration
[ ] Closure plan only submitted for an existing permitted or non-permitted pit, below-grade tank, or proposed alternative method

Instructions: Please submit one application (Form C-144) per individual pit, below-grade tank or alternative request

Please be advised that approval of this request does not relieve the operator of liability should operations result in pollution of surface water, ground water or the environment. Nor does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.

1.
Operator: Chevron USA Inc. OGRID #: 4323
Address: 6301 Deauville Blvd., Midland, TX 79706
Facility or well name: SD 14 FED P419
API Number: 30-025-46730, 46731, 46732, 46810 OCD Permit Number:
U/L or Qtr/Qtr SE 1/4 Section 15 Township 26S Range 32E County: Lea
Center of Proposed Design: Latitude 32.037891 Longitude -103.657266 NAD83
Surface Owner: [X] Federal [ ] State [ ] Private [ ] Tribal Trust or Indian Allotment

2.
[X] Pit: Subsection F, G or J of 19.15.17.11 NMAC
Temporary: [X] Drilling [ ] Workover
[ ] Permanent [ ] Emergency [ ] Cavitation [ ] P&A [ ] Multi-Well Fluid Management Low Chloride Drilling Fluid [ ] yes [X] no
[X] Lined [ ] Unlined Liner type: Thickness 40 mil [ ] LLDPE [X] HDPE [ ] PVC [ ] Other
[ ] String-Reinforced
Liner Seams: [X] Welded [ ] Factory [ ] Other Volume: 2 x 25,000 bbl Dimensions: L244ft x W 313 ft x D 10 ft

3.
[ ] Below-grade tank: Subsection I of 19.15.17.11 NMAC
Volume: bbl Type of fluid:
Tank Construction material:
[ ] Secondary containment with leak detection [ ] Visible sidewalls, liner, 6-inch lift and automatic overflow shut-off
[ ] Visible sidewalls and liner [ ] Visible sidewalls only [ ] Other
Liner type: Thickness mil [ ] HDPE [ ] PVC [ ] Other

4.
[ ] Alternative Method:
Submittal of an exception request is required. Exceptions must be submitted to the Santa Fe Environmental Bureau office for consideration of approval.

5.
Fencing: Subsection D of 19.15.17.11 NMAC (Applies to permanent pits, temporary pits, and below-grade tanks)
[ ] Chain link, six feet in height, two strands of barbed wire at top (Required if located within 1000 feet of a permanent residence, school, hospital, institution or church)
[X] Four-foot height, four strands of barbed wire evenly spaced between one and four feet
[ ] Alternate. Please specify

6.  
**Netting:** Subsection E of 19.15.17.11 NMAC (*Applies to permanent pits and permanent open top tanks*)  
 Screen  Netting  Other:  
 Monthly inspections (If netting or screening is not physically feasible)

7.  
**Signs:** Subsection C of 19.15.17.11 NMAC  
 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers  
 Signed in compliance with 19.15.16.8 NMAC

8.  
**Variations and Exceptions:**  
 Justifications and/or demonstrations of equivalency are required. Please refer to 19.15.17 NMAC for guidance.  
**Please check a box if one or more of the following is requested, if not leave blank:**  
 Variance(s): Requests must be submitted to the appropriate division district for consideration of approval. **See Variance Requests**  
 Exception(s): Requests must be submitted to the Santa Fe Environmental Bureau office for consideration of approval.

9.  
**Siting Criteria (regarding permitting):** 19.15.17.10 NMAC  
*Instructions: The applicant must demonstrate compliance for each siting criteria below in the application. Recommendations of acceptable source material are provided below. Siting criteria does not apply to drying pads or above-grade tanks.*

<b>General siting</b>	
<b>Ground water is less than 25 feet below the bottom of a low chloride temporary pit or below-grade tank.</b>	<input type="checkbox"/> Yes <input type="checkbox"/> No
- <input type="checkbox"/> NM Office of the State Engineer - iWATERS database search; <input type="checkbox"/> USGS; <input type="checkbox"/> Data obtained from nearby wells	<input checked="" type="checkbox"/> NA
<b>Ground water is less than 50 feet below the bottom of a Temporary pit, permanent pit, or Multi-Well Fluid Management pit.</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
- <input checked="" type="checkbox"/> NM Office of the State Engineer - iWATERS database search; <input checked="" type="checkbox"/> USGS; <input type="checkbox"/> Data obtained from nearby wells <b>See Appendices A, B, Figure 7</b>	<input type="checkbox"/> NA
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended. <b>(Does not apply to below grade tanks)</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
- Written confirmation or verification from the municipality; Written approval obtained from the municipality <b>See Figures 2 &amp; 7</b>	
Within the area overlying a subsurface mine. <b>(Does not apply to below grade tanks)</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
- Written confirmation or verification or map from the NM EMNRD-Mining and Mineral Division <b>See Figure 4</b>	
Within an unstable area. <b>(Does not apply to below grade tanks)</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
- Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; Topographic map <b>See Figures 6, 8 &amp; 9, Appendix G</b>	
Within a 100-year floodplain. <b>(Does not apply to below grade tanks)</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
- FEMA map <b>See Figure 3</b>	
<b>Below Grade Tanks</b>	
Within 100 feet of a continuously flowing watercourse, significant watercourse, lakebed, sinkhole, wetland or playa lake (measured from the ordinary high-water mark).	<input type="checkbox"/> Yes <input type="checkbox"/> No
- Topographic map; Visual inspection (certification) of the proposed site	
Within 200 horizontal feet of a spring or a fresh water well used for public or livestock consumption;	<input type="checkbox"/> Yes <input type="checkbox"/> No
- NM Office of the State Engineer - iWATERS database search; Visual inspection (certification) of the proposed site	
<b>Temporary Pit using Low Chloride Drilling Fluid (maximum chloride content 15,000 mg/liter)</b>	
Within 100 feet of a continuously flowing watercourse, or any other significant watercourse or within 200 feet of any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark). (Applies to low chloride temporary pits.)	<input type="checkbox"/> Yes <input type="checkbox"/> No
- Topographic map; Visual inspection (certification) of the proposed site	
Within 300 feet from a occupied permanent residence, school, hospital, institution, or church in existence at the time of initial application.	<input type="checkbox"/> Yes <input type="checkbox"/> No

<p>- Visual inspection (certification) of the proposed site; Aerial photo; Satellite image</p> <p>Within 200 horizontal feet of a spring or a private, domestic fresh water well used by less than five households for domestic or stock watering purposes, or 300feet of any other fresh water well or spring, in existence at the time of the initial application.                  NM Office of the State Engineer - iWATERS database search; Visual inspection (certification) of the proposed site</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>Within 100 feet of a wetland.</p> <p>- US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p><b><u>Temporary Pit Non-low chloride drilling fluid</u></b></p>	
<p>Within 300 feet of a continuously flowing watercourse, or any other significant watercourse, or within 200 feet of any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).</p> <p>- Topographic map; Visual inspection (certification) of the proposed site  <b>See Figure 6</b></p>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<p>Within 300 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.</p> <p>- Visual inspection (certification) of the proposed site; Aerial photo; Satellite image  <b>See Figure 2</b></p>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<p>Within 500 horizontal feet of a spring or a private, domestic fresh water well used by less than five households for domestic or stock watering purposes, or 1000 feet of any other fresh water well or spring, in the existence at the time of the initial application;</p> <p>- NM Office of the State Engineer - iWATERS database search; Visual inspection (certification) of the proposed site  <b>See Appendices A &amp; B, and Figures 1 &amp; 2</b></p>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<p>Within 300 feet of a wetland.</p> <p>- US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site  <b>See Figures 2, 5 &amp; 6</b></p>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<p><b><u>Permanent Pit or Multi-Well Fluid Management Pit</u></b></p>	
<p>Within 300 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, or lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).</p> <p>- Topographic map; Visual inspection (certification) of the proposed site</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.</p> <p>- Visual inspection (certification) of the proposed site; Aerial photo; Satellite image</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application.</p> <p>- NM Office of the State Engineer - iWATERS database search; Visual inspection (certification) of the proposed site</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>Within 500 feet of a wetland.</p> <p>- US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No

10.

**Temporary Pits, Emergency Pits, and Below-grade Tanks Permit Application Attachment Checklist:** Subsection B of 19.15.17.9 NMAC

*Instructions: Each of the following items must be attached to the application. Please indicate, by a check mark in the box, that the documents are attached.*

Hydrogeologic Report (Below-grade Tanks) - based upon the requirements of Paragraph (4) of Subsection B of 19.15.17.9 NMAC

Hydrogeologic Data (Temporary and Emergency Pits) - based upon the requirements of Paragraph (2) of Subsection B of 19.15.17.9 NMAC  
**See Appendix C**

Siting Criteria Compliance Demonstrations - based upon the appropriate requirements of 19.15.17.10 NMAC **Attached**

Design Plan - based upon the appropriate requirements of 19.15.17.11 NMAC **See Appendix D**

Operating and Maintenance Plan - based upon the appropriate requirements of 19.15.17.12 NMAC **See Appendix E**

Closure Plan (Please complete Boxes 14 through 18, if applicable) - based upon the appropriate requirements of Subsection C of 19.15.17.9 NMAC and 19.15.17.13 NMAC **See Appendix F**

Previously Approved Design (attach copy of design) API Number: \_\_\_\_\_ or Permit Number: \_\_\_\_\_

11.

**Multi-Well Fluid Management Pit Checklist:** Subsection B of 19.15.17.9 NMAC

*Instructions: Each of the following items must be attached to the application. Please indicate, by a check mark in the box, that the documents are attached.*

Design Plan - based upon the appropriate requirements of 19.15.17.11 NMAC

Operating and Maintenance Plan - based upon the appropriate requirements of 19.15.17.12 NMAC

A List of wells with approved application for permit to drill associated with the pit.

Closure Plan (Please complete Boxes 14 through 18, if applicable) - based upon the appropriate requirements of Subsection C of 19.15.17.9 NMAC and 19.15.17.13 NMAC

Hydrogeologic Data - based upon the requirements of Paragraph (4) of Subsection B of 19.15.17.9 NMAC

Siting Criteria Compliance Demonstrations - based upon the appropriate requirements of 19.15.17.10 NMAC

Previously Approved Design (attach copy of design) API Number: \_\_\_\_\_ or Permit Number: \_\_\_\_\_

12.

**Permanent Pits Permit Application Checklist:** Subsection B of 19.15.17.9 NMAC

**Instructions:** Each of the following items must be attached to the application. Please indicate, by a check mark in the box, that the documents are attached.

- Hydrogeologic Report - based upon the requirements of Paragraph (1) of Subsection B of 19.15.17.9 NMAC
- Siting Criteria Compliance Demonstrations - based upon the appropriate requirements of 19.15.17.10 NMAC
- Climatological Factors Assessment
- Certified Engineering Design Plans - based upon the appropriate requirements of 19.15.17.11 NMAC
- Dike Protection and Structural Integrity Design - based upon the appropriate requirements of 19.15.17.11 NMAC
- Leak Detection Design - based upon the appropriate requirements of 19.15.17.11 NMAC
- Liner Specifications and Compatibility Assessment - based upon the appropriate requirements of 19.15.17.11 NMAC
- Quality Control/Quality Assurance Construction and Installation Plan
- Operating and Maintenance Plan - based upon the appropriate requirements of 19.15.17.12 NMAC
- Freeboard and Overtopping Prevention Plan - based upon the appropriate requirements of 19.15.17.11 NMAC
- Nuisance or Hazardous Odors, including H<sub>2</sub>S, Prevention Plan
- Emergency Response Plan
- Oil Field Waste Stream Characterization
- Monitoring and Inspection Plan
- Erosion Control Plan
- Closure Plan - based upon the appropriate requirements of Subsection C of 19.15.17.9 NMAC and 19.15.17.13 NMAC

13.

**Proposed Closure:** 19.15.17.13 NMAC **See Appendix F**

**Instructions:** Please complete the applicable boxes, Boxes 14 through 18, in regards to the proposed closure plan.

Type:  Drilling  Workover  Emergency  Cavitation  P&A  Permanent Pit  Below-grade Tank  Multi-well Fluid Management Pit  
 Alternative

Proposed Closure Method:  Waste Excavation and Removal  
 Waste Removal (Closed-loop systems only)  
 On-site Closure Method (Only for temporary pits and closed-loop systems)  
 In-place Burial  On-site Trench Burial  
 Alternative Closure Method

14.

**Waste Excavation and Removal Closure Plan Checklist:** (19.15.17.13 NMAC) **Instructions:** Each of the following items must be attached to the closure plan. Please indicate, by a check mark in the box, that the documents are attached.

- Protocols and Procedures - based upon the appropriate requirements of 19.15.17.13 NMAC
- Confirmation Sampling Plan (if applicable) - based upon the appropriate requirements of Subsection C of 19.15.17.13 NMAC
- Disposal Facility Name and Permit Number (for liquids, drilling fluids and drill cuttings)
- Soil Backfill and Cover Design Specifications - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC
- Re-vegetation Plan - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC
- Site Reclamation Plan - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC

15.

**Siting Criteria (regarding on-site closure methods only):** 19.15.17.10 NMAC

**Instructions:** Each siting criteria requires a demonstration of compliance in the closure plan. Recommendations of acceptable source material are provided below. Requests regarding changes to certain siting criteria require justifications and/or demonstrations of equivalency. Please refer to 19.15.17.10 NMAC for guidance.

- |  |  |
|--|--|
| Ground water is less than 25 feet below the bottom of the buried waste.<br>- <input checked="" type="checkbox"/> NM Office of the State Engineer - iWATERS database search; <input checked="" type="checkbox"/> USGS; <input type="checkbox"/> Data obtained from nearby wells<br><b>See Appendices A &amp; B, Figure 7</b>  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br><input type="checkbox"/> NA |
| Ground water is between 25-50 feet below the bottom of the buried waste<br>- <input checked="" type="checkbox"/> NM Office of the State Engineer - iWATERS database search; <input checked="" type="checkbox"/> USGS; <input type="checkbox"/> Data obtained from nearby wells<br><b>See Appendices A &amp; B, Figure 7</b>  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br><input type="checkbox"/> NA |
| Ground water is more than 100 feet below the bottom of the buried waste.<br>- <input checked="" type="checkbox"/> NM Office of the State Engineer - iWATERS database search; <input checked="" type="checkbox"/> USGS; <input type="checkbox"/> Data obtained from nearby wells<br><b>See Appendices A &amp; B, Figure 7</b> | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br><input type="checkbox"/> NA |
| Within 100 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).<br>- Topographic map; Visual inspection (certification) of the proposed site<br><b>See Figure 6</b>                                  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                |
| Within 300 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.<br>- Visual inspection (certification) of the proposed site; Aerial photo; Satellite image<br><b>See Figure 2</b>  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                |

Within 300 horizontal feet of a private, domestic fresh water well or spring used for domestic or stock watering purposes, in existence at the time of initial application. - NM Office of the State Engineer - iWATERS database; Visual inspection (certification) of the proposed site <b>See Appendices A &amp; B, Figure 7</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Written confirmation or verification from the municipality; Written approval obtained from the municipality	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Within 300 feet of a wetland. US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site <b>See Figures 2, 5 &amp; 6</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended. - Written confirmation or verification from the municipality; Written approval obtained from the municipality <b>See Figure 2</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Within the area overlying a subsurface mine. - Written confirmation or verification or map from the NM EMNRD-Mining and Mineral Division <b>See Figure 4</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Within an unstable area. - Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; Topographic map <b>See Figures 6, 8 &amp; 9, Appendix G</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Within a 100-year floodplain. - FEMA map <b>See Figure 3</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

16. **On-Site Closure Plan Checklist:** (19.15.17.13 NMAC) *Instructions: Each of the following items must be attached to the closure plan. Please indicate, by a check mark in the box, that the documents are attached.*

- Siting Criteria Compliance Demonstrations - based upon the appropriate requirements of 19.15.17.10 NMAC **Attached**
- Proof of Surface Owner Notice - based upon the appropriate requirements of Subsection E of 19.15.17.13 NMAC
- Construction/Design Plan of Burial Trench (if applicable) based upon the appropriate requirements of Subsection K of 19.15.17.11 NMAC
- Construction/Design Plan of Temporary Pit (for in-place burial of a drying pad) - based upon the appropriate requirements of 19.15.17.11 NMAC  
**See Appendix D**
- Protocols and Procedures - based upon the appropriate requirements of 19.15.17.13 NMAC **See Appendix F**
- Confirmation Sampling Plan (if applicable) - based upon the appropriate requirements of 19.15.17.13 NMAC **See Appendix F**
- Waste Material Sampling Plan - based upon the appropriate requirements of 19.15.17.13 NMAC **See Appendix F**
- Disposal Facility Name and Permit Number (for liquids, drilling fluids and drill cuttings or in case on-site closure standards cannot be achieved)  
**See Appendix F**
- Soil Cover Design - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC **See Appendix F**
- Re-vegetation Plan - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC **See Appendix F**
- Site Reclamation Plan - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC **See Appendix F**

17. **Operator Application Certification:**

I hereby certify that the information submitted with this application is true, accurate and complete to the best of my knowledge and belief.

Name (Print): Laura Becerra Title: Sr. Regulatory Affairs Coordinator

Signature:  Date: 8/5/2020

e-mail address: LBecerra@Chevron.com Telephone: (432) 687-7665

18. **OCD Approval:**  Permit Application (including closure plan)  Closure Plan (only)  OCD Conditions (see attachment)

OCD Representative Signature: \_\_\_\_\_ Approval Date: \_\_\_\_\_

Title: \_\_\_\_\_ OCD Permit Number: \_\_\_\_\_

19. **Closure Report (required within 60 days of closure completion):** 19.15.17.13 NMAC

*Instructions: Operators are required to obtain an approved closure plan prior to implementing any closure activities and submitting the closure report. The closure report is required to be submitted to the division within 60 days of the completion of the closure activities. Please do not complete this section of the form until an approved closure plan has been obtained and the closure activities have been completed.*

Closure Completion Date: \_\_\_\_\_

20.

**Closure Method:**

- Waste Excavation and Removal     On-Site Closure Method     Alternative Closure Method     Waste Removal (Closed-loop systems only)
- If different from approved plan, please explain.

21.

**Closure Report Attachment Checklist:** *Instructions: Each of the following items must be attached to the closure report. Please indicate, by a check mark in the box, that the documents are attached.*

- Proof of Closure Notice (surface owner and division)
- Proof of Deed Notice (required for on-site closure for private land only)
- Plot Plan (for on-site closures and temporary pits)
- Confirmation Sampling Analytical Results (if applicable)
- Waste Material Sampling Analytical Results (required for on-site closure)
- Disposal Facility Name and Permit Number
- Soil Backfilling and Cover Installation
- Re-vegetation Application Rates and Seeding Technique
- Site Reclamation (Photo Documentation)

On-site Closure Location: Latitude \_\_\_\_\_ Longitude \_\_\_\_\_ NAD:  1927  1983

22.

**Operator Closure Certification:**

I hereby certify that the information and attachments submitted with this closure report is true, accurate and complete to the best of my knowledge and belief. I also certify that the closure complies with all applicable closure requirements and conditions specified in the approved closure plan.

Name (Print):     Laura Becerra     Title:     Sr. Regulatory Affairs Coordinator    

Signature:     ,     Date:     8/5/2020    

e-mail address:     LBecerra@Chevron.com     Telephone:     (432) 687-7665

**Siting Criteria Demonstration (19.15.17.10)**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E

### **Depth to Groundwater, 19.15.17.10.3(a)**

**Figure 7, Appendices A & B**, and the discussion presented below demonstrate that the groundwater within the broader area of the proposed site is in excess of 100 feet beneath the Temporary Pit.

**Figure 7** depicts the location of the pit relative to the locations of water wells within 5 miles of the pit for which water level data are available, and the estimated potentiometric surface in the area. Depth to water for the most recent, reliable measurement and the well identification number are shown adjacent to each well on **Figure 7**. The approximate boundary of the Pecos River Basin alluvial aquifer is shown and green and is located ~1.5 miles to the southwest of the Temporary Pit. Water well data, including gauging dates, are detailed in **Appendix A** (USGS) and **Appendix B** (NMOSE).

All water wells located within 5 miles of the temporary pit were gauged by USGS at > 100 ft bgs.

- The nearest water wells to the pit location are located in a cluster approximately 1.7 miles to the southwest. Water level was measured at 220 ft bgs in 2013 (2,938 ft above NGVD29) within a USGS well within the cluster.
- To the northwest, the nearest well is located 3.3 miles away and is completed in the Santa Rosa Sandstone. Water level was measured at 290 ft bgs (3,004 ft above NAVD88) in 1987.
- To the northeast, the nearest well is located 4.4 miles away and is completed in the Chinle Formation. Water level was measured at 190 ft bgs (3,193 ft above NAVD88) in 1986.

A thick layer of Quaternary alluvium is present at surface in the vicinity of the proposed location and is composed of eroded and reworked eolian and fluvial material. The alluvium generally ranges from 100 to 200 feet-thick in this area (Meyer et al., 2012). The Quaternary deposits are underlain by the Triassic-age Santa Rosa and Chinle formations and deeper, Permian-age strata (**Figure 9**). The Chinle Formation outcrops approximately 1.5 miles to the east of the proposed location and exhibits a regional dip of about 1 degree to the east and south. Permian strata outcrop approximately 20 miles to the west along the course of the Pecos River.

Geotechnical reports and boring logs were obtained for two frac ponds located ~1.2-miles to the east of the proposed pit location (**Figure G.3 and Attachments 2 and 3**). Most borings were <35-feet deep but one was advanced to 80-feet. All borings, including to 80-feet, were dry and did not fill with water after 24-hours after drilling.

**Proximity to Surface Water, 19.15.17.10.3(b)**

**Figure 6** visualizes USGS contour lines and the USGS National Hydrography Dataset. The map demonstrates that the location is not within 1,000 feet of a continuously flowing waterway course, any other significant watercourse or lakebed, sinkhole, or playa lake.

- The nearest stream (ephemeral) is more than 2000 feet northwest of the pit location.
- The nearest surface water feature (intermittent pond) is in excess of 2 miles east-southeast of the pit location.

**Proximity to Occupied Residences, Schools, Hospitals, Institutions or Churches, 19.15.17.10.3(c)**

The DigitalGlobe aerial imagery in **Figure 2** demonstrates that the location is not within 300 feet of occupied residences, schools, hospitals, institutions or churches.

- All structures within 1,000 feet of the location are associated with oil & gas activity.

**Proximity to Springs and/or Domestic Freshwater Wells 19.15.17.10.3(d)**

No springs or domestic freshwater wells have been mapped within 300 ft of the pit location.

**Proximity to Incorporated Municipal Boundaries and Fresh Water Well Fields 19.15.17.10.3(e)**

**Figure 1** demonstrates that the location is not within incorporated municipal boundaries or defined municipal fresh water well fields covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended.

- The closest municipality is the city of Jal, approximately 27 miles to the west-northwest.

**Proximity to Wetlands, 19.15.17.10.3(f)**

Utilizing USFWS wetland data, **Figure 5** demonstrates that the proposed location is not located within 300 feet of a wetland.

- A pond associated with oil and gas development is the nearest "freshwater pond" identified by USFWS and is located approximately 4,000 feet away.
- The nearest Freshwater Emergent Wetland is located approximately 2 miles east southeast of the project location.

**Proximity to Subsurface Mines, 19.15.17.10.3(g)**

Analysis of aerial imagery in the vicinity of the proposed temporary pit show that the nearest mines are all surficial caliche pits. There are no subsurface mines in the area as indicated in **Figure 4**.

### **Proximity to Unstable Area, 19.15.17.10.3(h)**

Figure 8 identifies the location of the proposed temporary pit with respect to BLM Karst areas. The proposed Temporary Pit is mapped in a “Medium Potential” karst area. Evidence of karst in the area consists predominantly of large depressions that formed over millions of years via dissolution of the Rustler and Salado formations (Bachman, 1973). There are, however, no indications that voids or other karst features are present or are likely to form in the vicinity of the proposed location. Therefore, local karst potential is likely to be low. An Evaluation of Unstable Conditions is presented in **Appendix G** that details several lines of evidence in support of this position. In summary:

1. There are no dissolution features within 2.2-miles of the proposed location (**Figure G.1**),
2. Karst forming strata are over 1,000-feet deep beneath the proposed location (**Figure G.4**),
3. An Arcadis field study of the area indicated no closed depressions, caves, or fissures in the immediate vicinity of the proposed pit (**Figure G.3, Attachment 1**),
4. TetraTech geotechnical reports and boring logs from <1.2 miles-away indicated low karst potential and were dry after 24 hours (**Figure G.5, Attachments 2 and 3**),
5. The Bureau of Land Management, Paul Murphy prepared the Environmental Assessment (EA), document number - DOI-BLM-P020-2020-0198-EA, evaluating SD 15 Fed Pads 418 & 419. This EA notes that during on-site inspection, no known features exist within the proposed area. (**Section 3.4, Attachment 4**).

In the unlikely event that a void occurs during construction or operation activities, all activities must stop immediately, and the BLM should then be contacted within 24 hours to devise the best management plan to protect the environment and human safety.

### **Proximity to Floodplains, 19.15.17.10.3(i)**

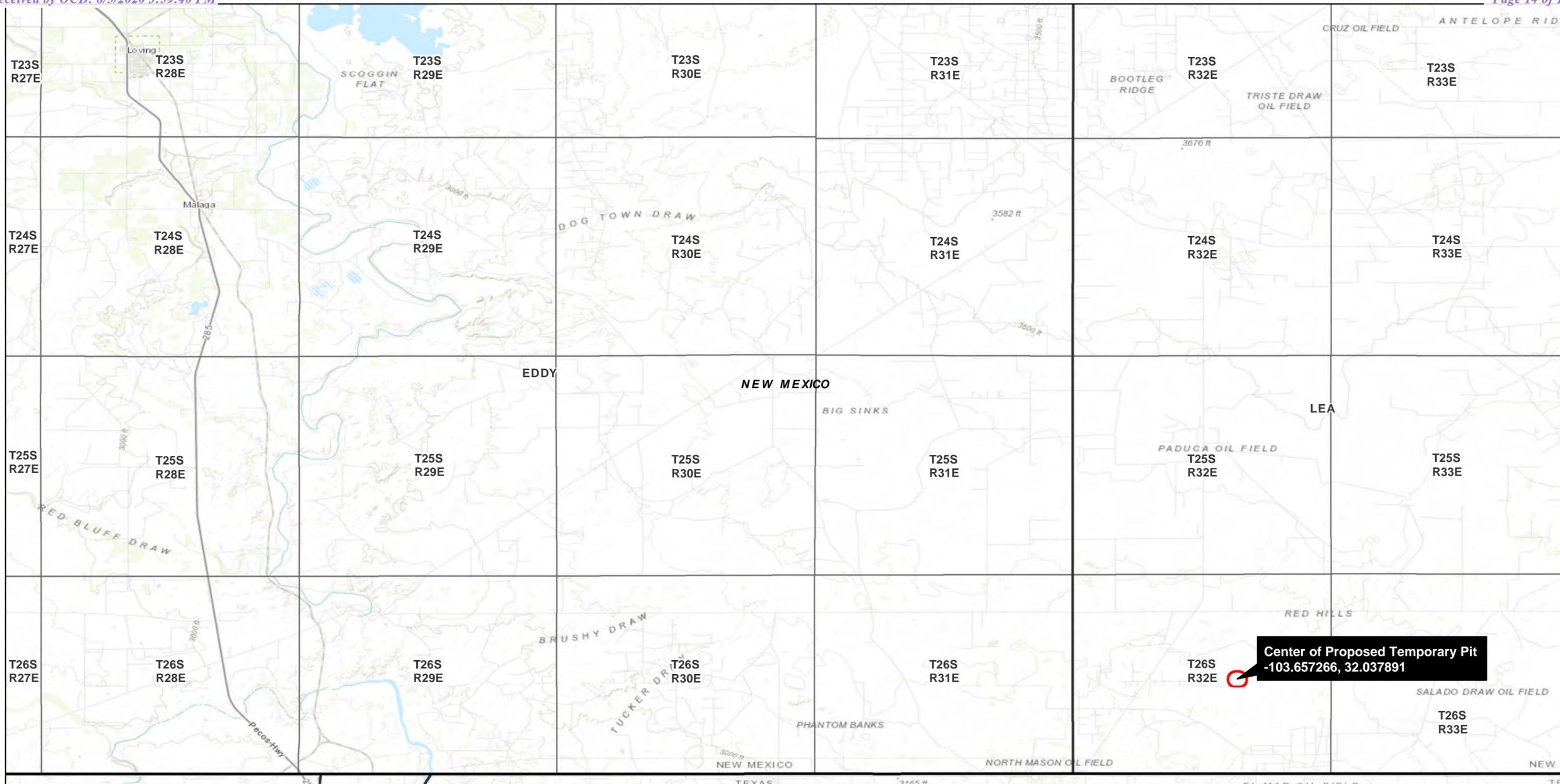
The location is within an area that has not yet been mapped by the Federal Emergency Management Agency with respect to the Flood Insurance Rate 100-Year Floodplain. In lieu of FEMA data, **Figure 3** visualizes the USDA – SSURGO Soils data for dominant flooding frequency condition. The location is not located within an area with any indication of flooding. The nearest area determined to have “Rare” flooding frequency is in excess of 1 mile away. As defined by the USDA, “*Rare*’ means that flooding is unlikely but possible under unusual weather conditions. The chance of flooding is 1 to 5 percent in any year”.

**Site Specific Information, Figures 1-10**

Temporary Pit containing non-low chloride fluids

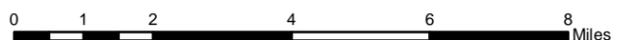
Salado Draw P419 Pit

Section 15, T26S, R32E



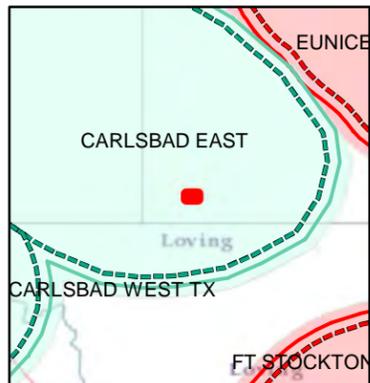
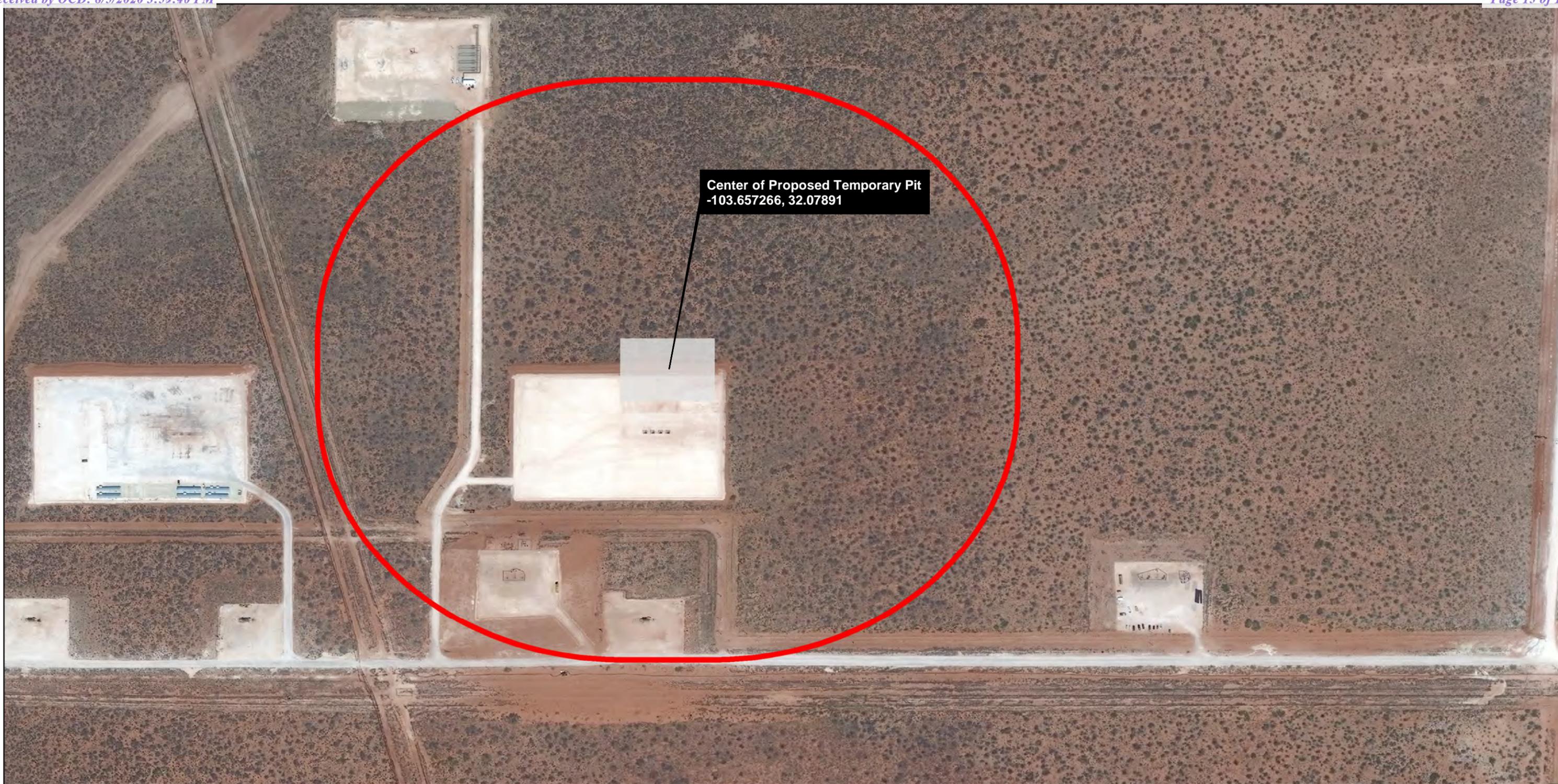
**LEGEND**

- Proposed Temporary Pit
- 1,000 ft Buffer



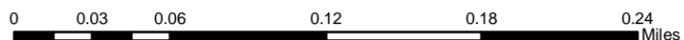
THE DOCUMENT HAS BEEN PREPARED IN THE INTEREST OF FACILITATING AND PRESENTING A VARIETY OF COMPLEX AND MULTI-SOURCE DATA, THE INFORMATION IS LIMITED AND NOT DEFINITIVE, IT IS SUBJECT TO CHANGE, AND FINAL PROJECT DECISIONS CANNOT BE BASED ON THE DATA IN THIS TOOL ALONE. CONSULT WITH LOCAL BIOLOGISTS FOR MORE LOCALIZED INFORMATION. ABSENCE OF A SPECIFIC SPECIES WITHIN THE MAP DOES NOT MEAN IT IS NOT PRESENT IN THE AREA.

<b>SD 15 FED P419 Temporary Pit</b>	
Figure 1: Vicinity Map	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production Mid-Continent Business Unit</b> CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS	
LAND GRID: TOBIN	IMAGERY: ESRI
DATA SOURCE: ESRI	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 5/28/2020



**LEGEND**

- Proposed Temporary Pit
- 1,000 ft Buffer



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<b>SD 15 FED P419 Temporary Pit</b>	
<b>Figure 2: Site Overview</b>	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: DigitalGlobe
DATA SOURCE: DigitalGlobe - Spatial on Demand Imagery	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 5/28/2020



**Center of Proposed Temporary Pit**  
 -103.657266, 32.037891



**LEGEND**

Proposed Temporary Pit	Very frequent	Frequent
1,000 ft Buffer	Very rare	Occasional
	Common	Rare

0 0.3 0.6 1.2 1.8 2.4 Miles

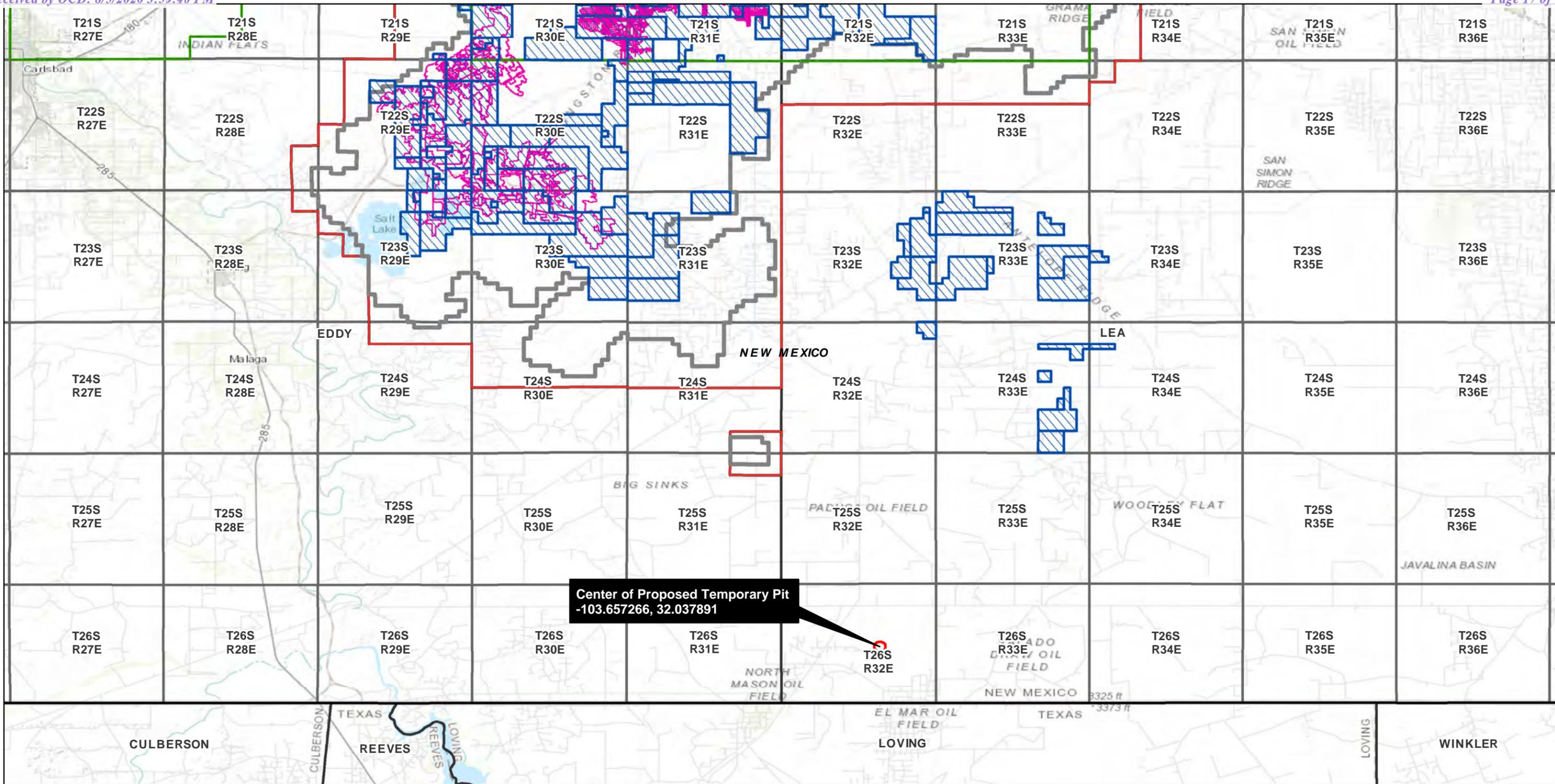
**SD 15 FED P419 Temporary Pit**

Figure 3: Floodplain Map  
 STATE: NEW MEXICO COUNTY: LEA

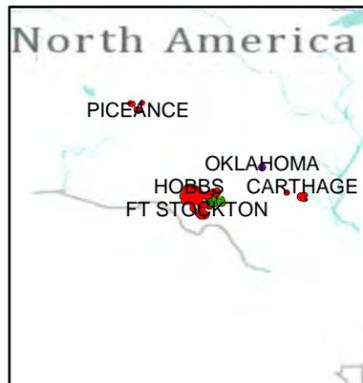
**Chevron North America Exploration & Production**  
 Mid-Continent Business Unit  
 CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS

LAND GRID: TOBIN | IMAGERY: ESRI  
 DATA SOURCE: USDA - SSURGO Soils  
 PIPELINE DATA: N/A  
 Coordinate System: GCS North American 1983  
 DRAWN BY: MCBU HSE | PROJECT PHASE: CURRENT | DATE: 5/28/2020

THE DOCUMENT HAS BEEN PREPARED IN THE INTEREST OF FACILITATING AND PRESENTING A VARIETY OF COMPLEX AND MULTI-SOURCE DATA, THE INFORMATION IS LIMITED AND NOT DEFINITIVE, IT IS SUBJECT TO CHANGE, AND FINAL PROJECT DECISIONS CANNOT BE BASED ON THE DATA IN THIS TOOL ALONE. CONSULT WITH LOCAL BIOLOGISTS FOR MORE LOCALIZED INFORMATION. ABSENCE OF A SPECIFIC SPECIES WITHIN THE MAP DOES NOT MEAN IT IS NOT PRESENT IN THE AREA.

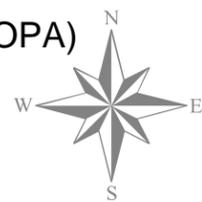


Center of Proposed Temporary Pit  
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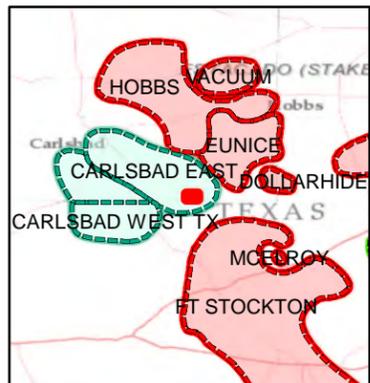
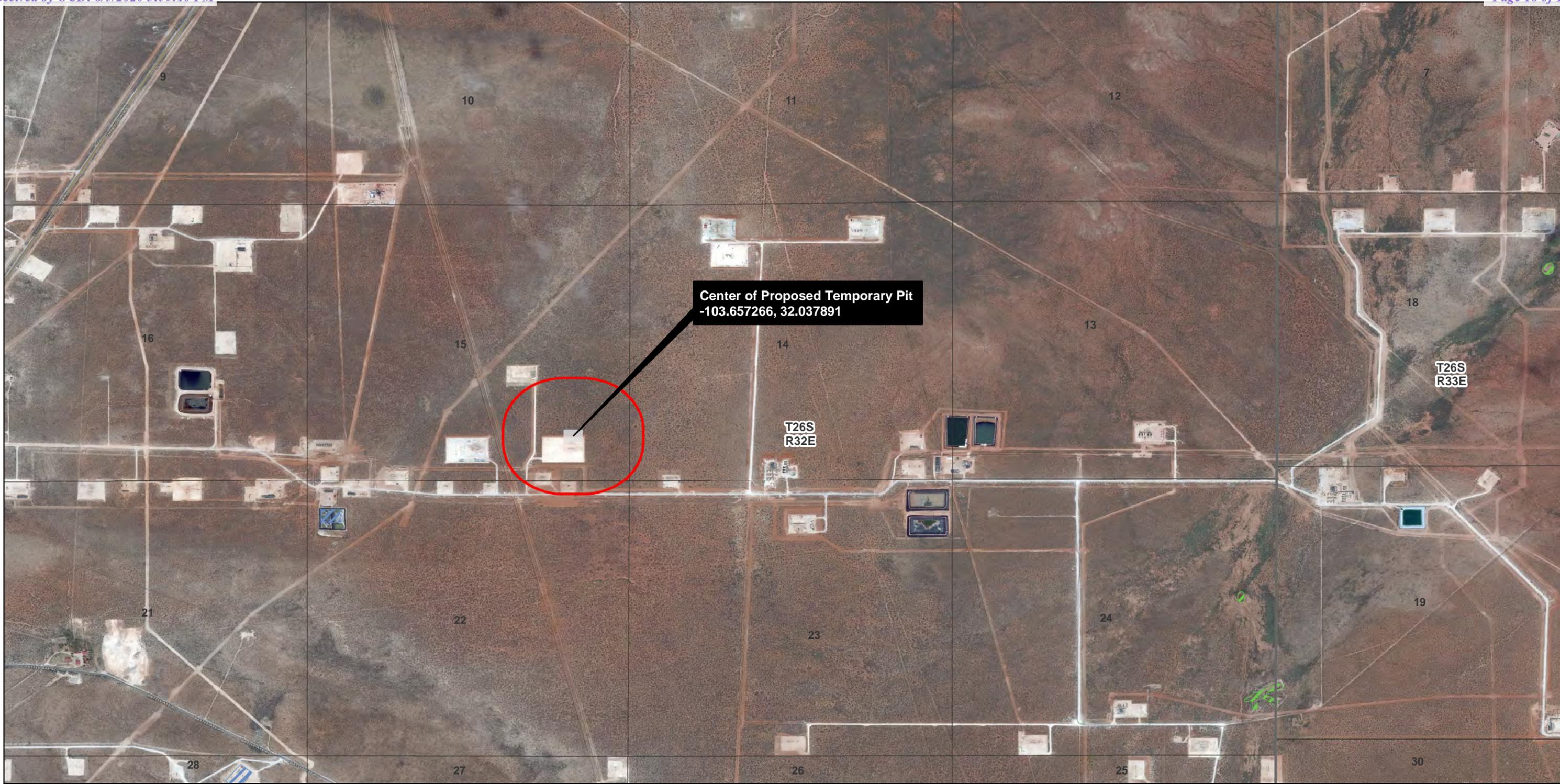
**LEGEND**

- Proposed Temporary Pit
- 1,000 ft Buffer
- Potash Leases
- Four String Casing Area
- Mine Workings
- Known Potash Leasing Area (KPLA)
- Schedule of Proposed Actions (SOPA)



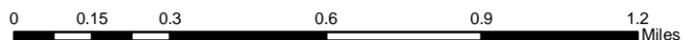
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<b>SD 15 FED P419 Temporary Pit</b>	
Figure 4: Subsurface Mines - Potash	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production</b> <b>Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: ESRI
DATA SOURCE: Bureau of Land Management - Potash	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 5/28/2020



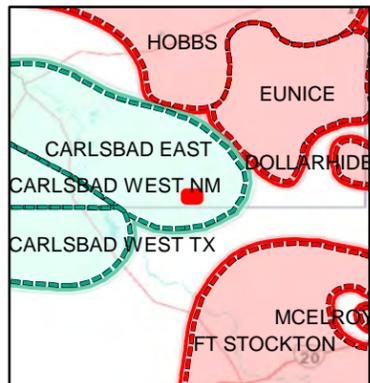
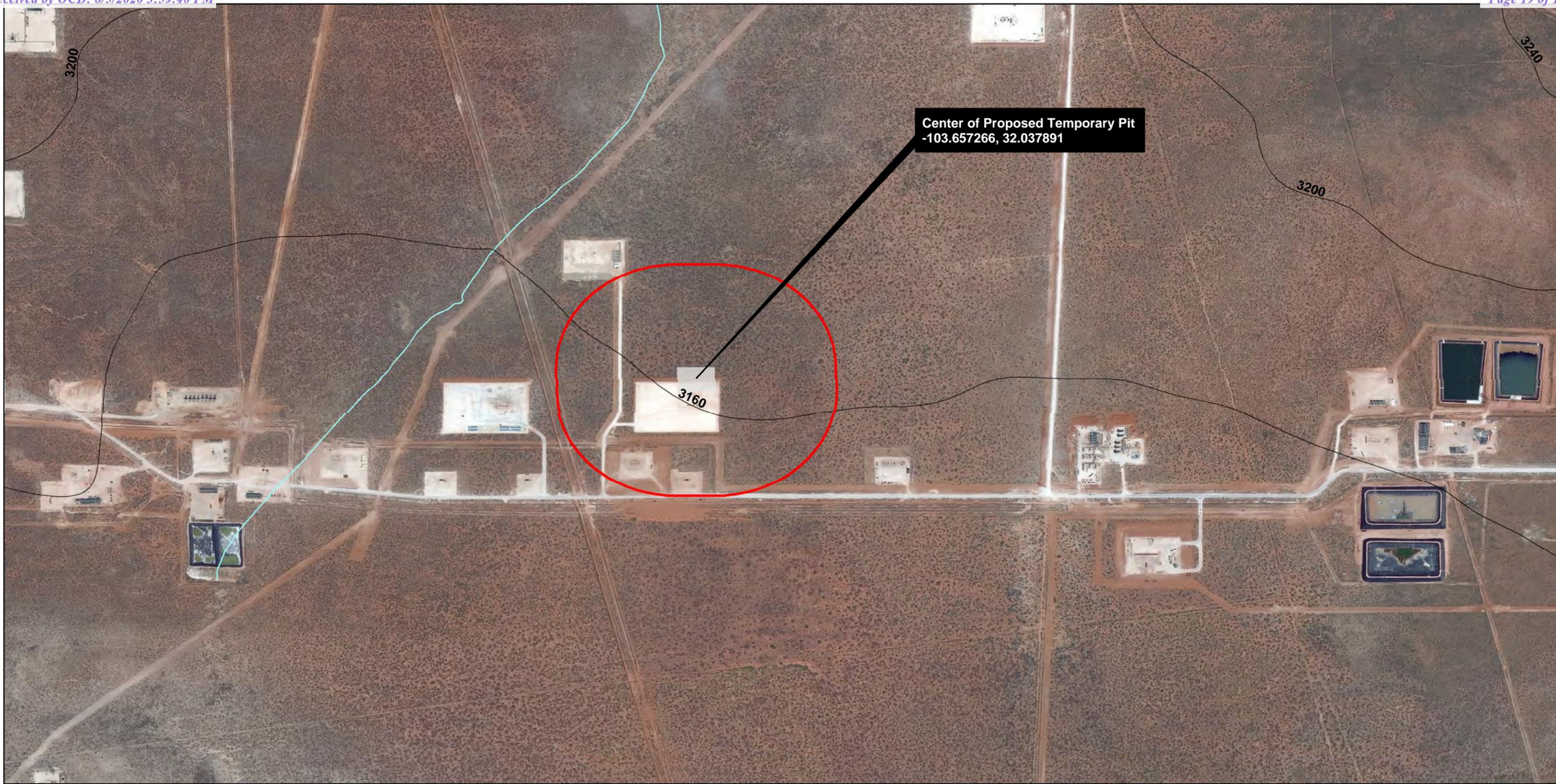
**LEGEND**

- Proposed Temporary Pit
- 1,000 ft Buffer
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond



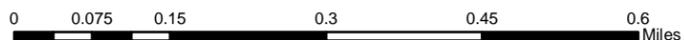
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<b>SD 15 FED P419 Temporary Pit</b>	
Figure 5: Wetlands Map	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: DigitalGlobe
DATA SOURCE: US Fish & Wildlife Service	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 5/28/2020



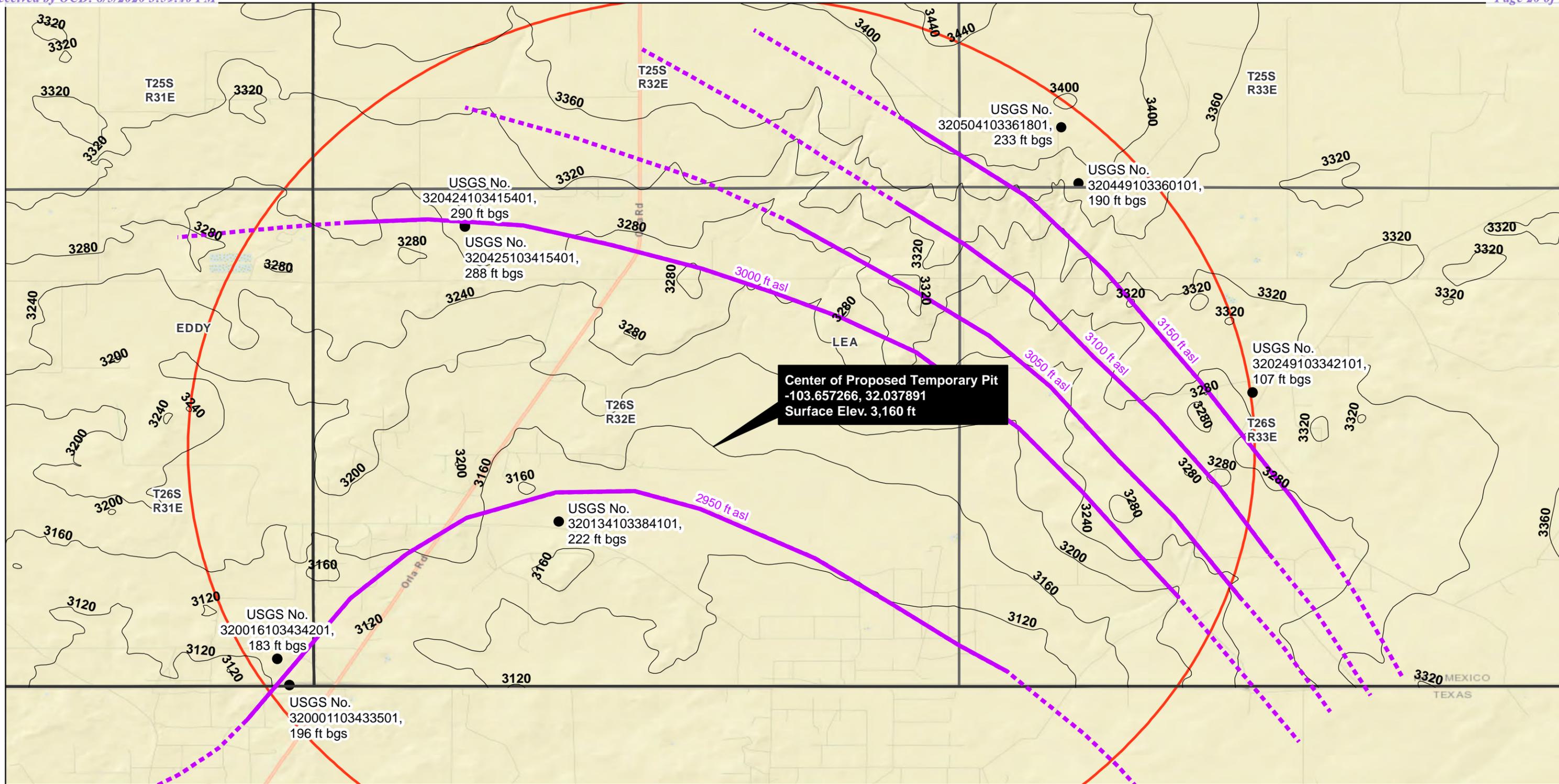
**LEGEND**

- Proposed Temporary Pit
- 1,000 ft Buffer
- USGS Contour Lines NM
- Stream/River, NHD FCode 46007: Ephemeral



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<b>SD 15 FED P419 Temporary Pit</b>	
Figure 6: Elevation Contour & NHD Map	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production Mid-Continent Business Unit</b> CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS	
LAND GRID: TOBIN	IMAGERY: DigitalGlobe
DATA SOURCE: USGS	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT DATE: 7/24/2020



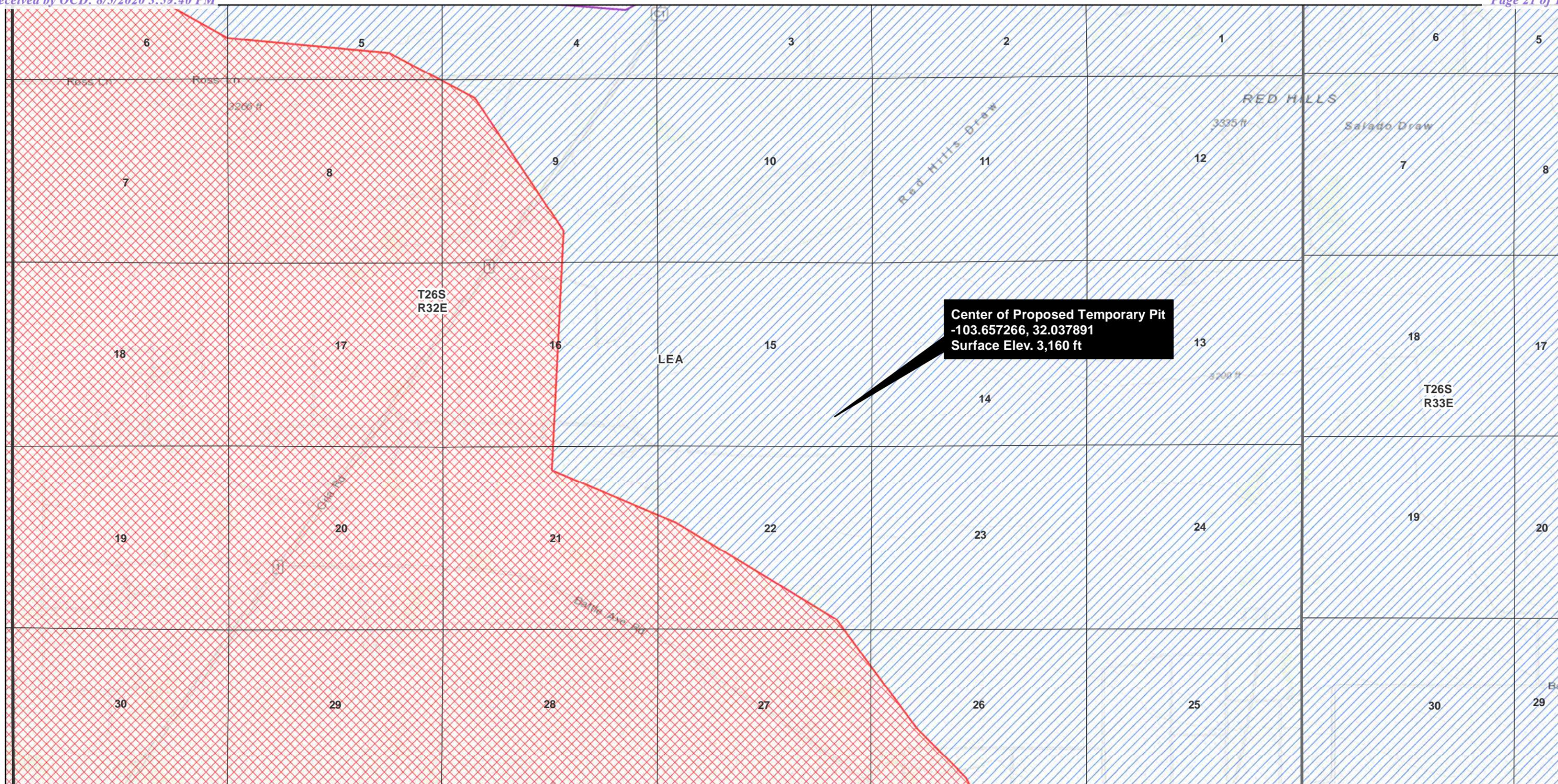
**LEGEND**

- 5 mile buffer
- Potentiometric Surface
- USGS Wells
- USGS Contour Lines NM



<b>SD 15 FED P419 Temporary Pit</b>	
Figure 7: USGS Wells and Potentiometric Surface Map	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production</b> <b>Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: ESRI
DATA SOURCE: USGS	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 7/24/2020

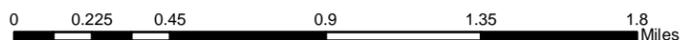
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**LEGEND**

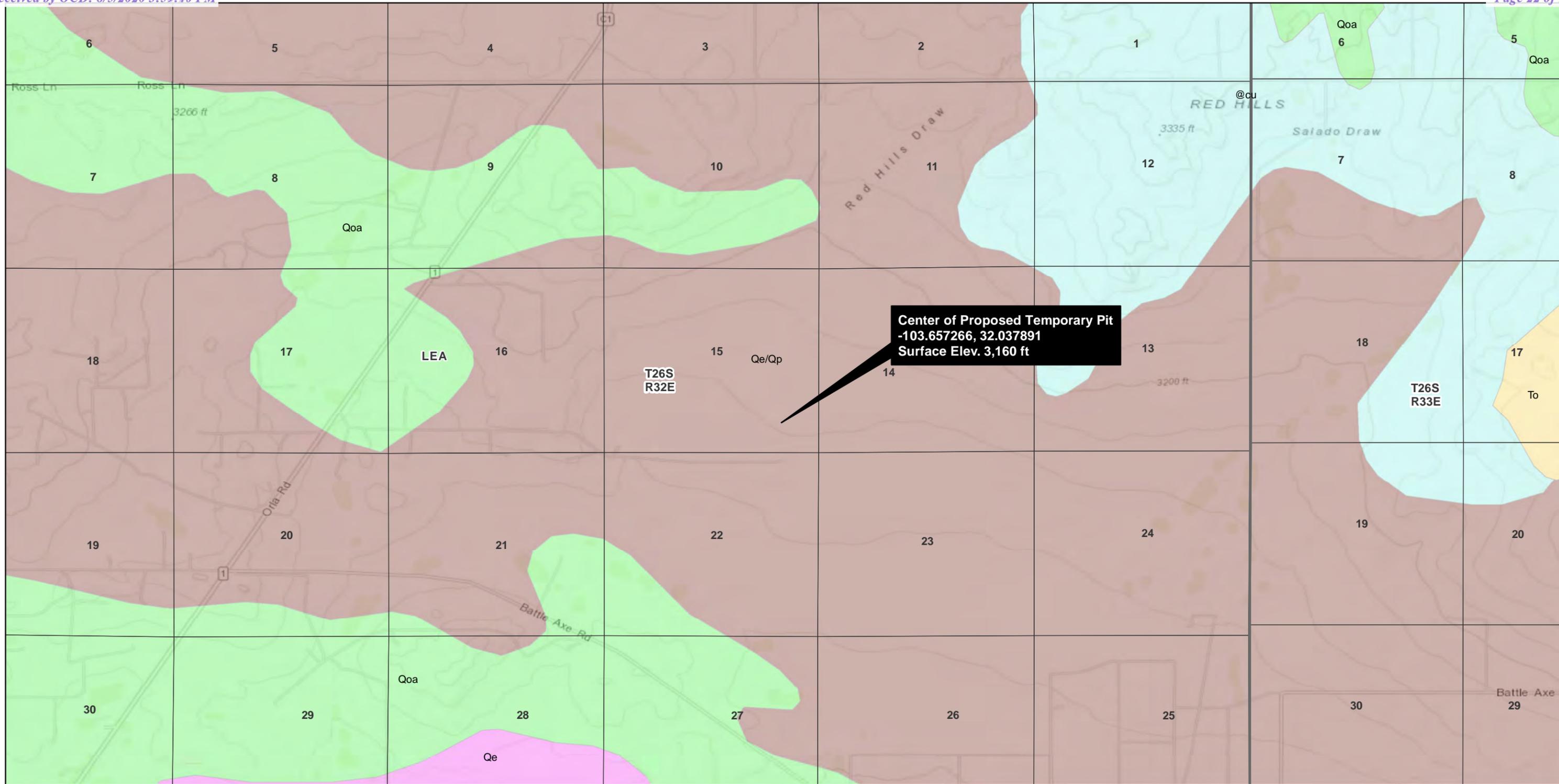
**Karst Occurrence Potential**

-  High
-  Medium
-  Low



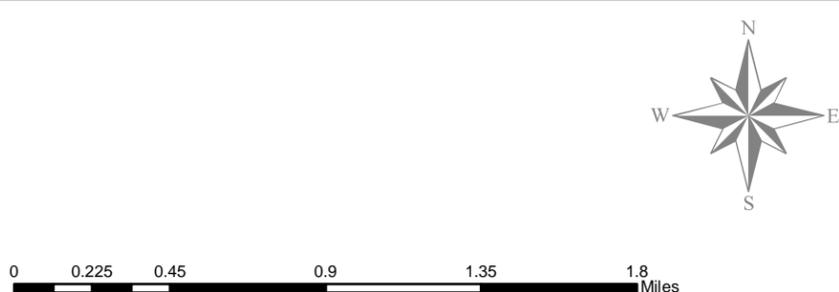
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<b>SD 15 FED P419 Temporary Pit</b>	
Figure 8: Karst Potential	
STATE: NEW MEXICO COUNTY: LEA	
 <b>Chevron North America Exploration &amp; Production</b> <b>Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: ESRI
DATA SOURCE: Bureau of Land Management	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 7/24/2020



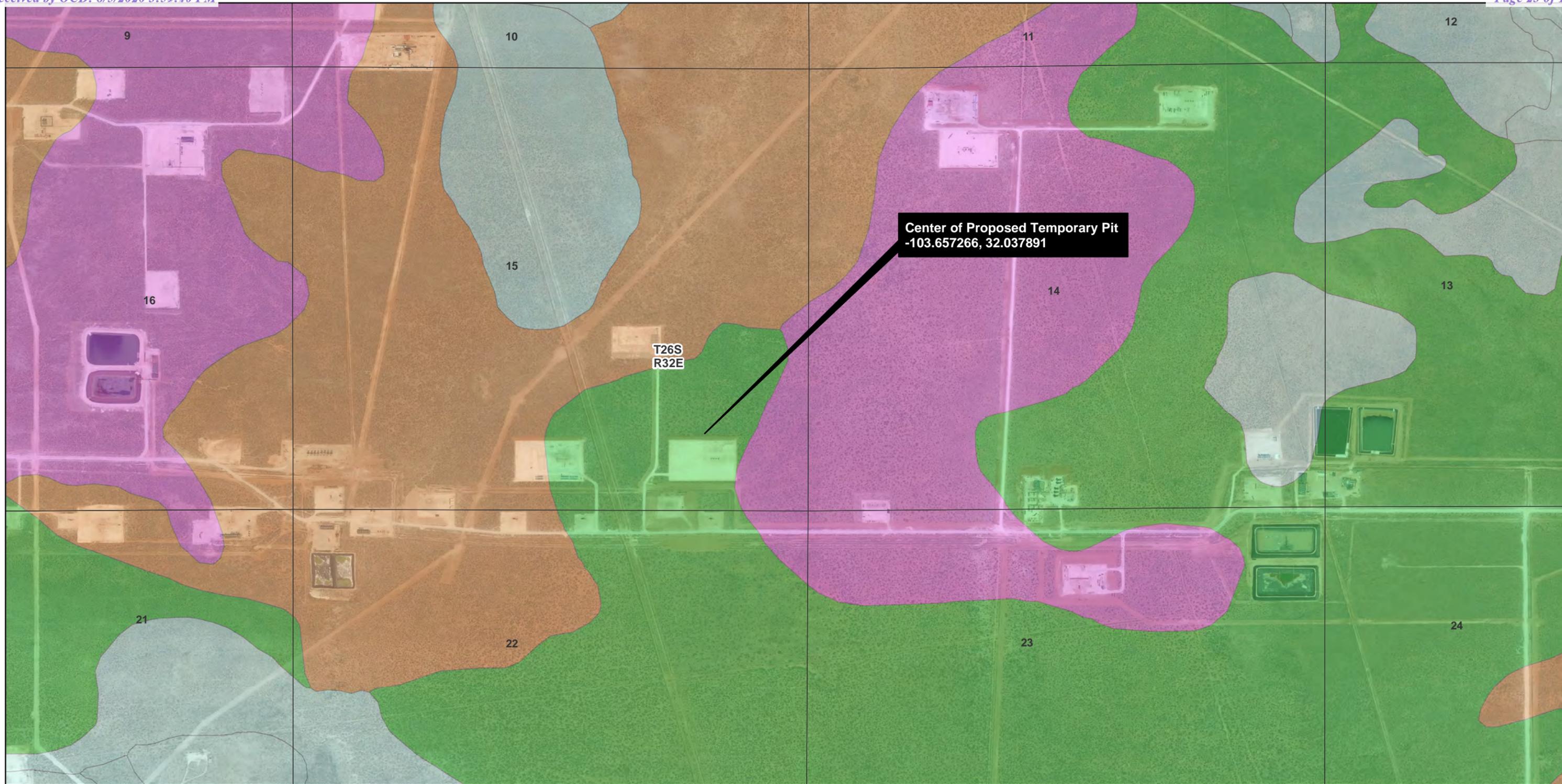
**LEGEND**

- Geology**
- Upper Chinle Group
  - Ogalala Formation
  - Quaternary - Eolian Deposits
  - Quaternary - Eolian / Piedmont Alluvial Deposits
  - Quaternary - Older Alluvial Deposits



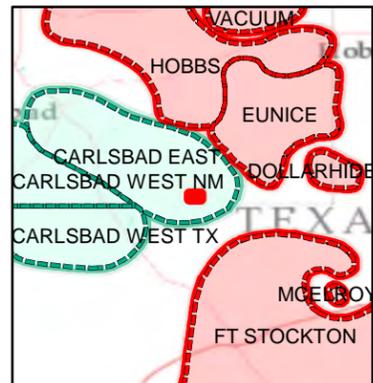
<b>SD 15 FED P419 Temporary Pit</b>	
Figure 9: Local Geology	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production</b> <b>Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: ESRI
DATA SOURCE: Bureau of Land Management	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 7/27/2020

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Center of Proposed Temporary Pit  
 -103.657266, 32.037891

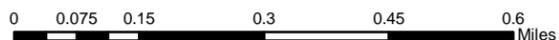
T26S  
 R32E



**LEGEND**

**Lea County Soil Data**

- Berino-Cacique association soils, hummocky
- Pyote and Maljamar fine sands
- Pyote soils and dune land
- all other values



**SD 15 FED P419 Temporary Pit**

<b>Figure 10: Soils</b>	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production</b> <b>Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: DigitalGlobe
DATA SOURCE: Bureau of Land Management, US Department of Agriculture	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT DATE: 7/24/2020

THE DOCUMENT HAS BEEN PREPARED IN THE INTEREST OF FACILITATING AND PRESENTING A VARIETY OF COMPLEX AND MULTI-SOURCE DATA, THE INFORMATION IS LIMITED AND NOT DEFINITIVE, IT IS SUBJECT TO CHANGE, AND FINAL PROJECT DECISIONS CANNOT BE BASED ON THE DATA IN THIS TOOL ALONE. CONSULT WITH LOCAL BIOLOGISTS FOR MORE LOCALIZED INFORMATION. ABSENCE OF A SPECIFIC SPECIES WITHIN THE MAP DOES NOT MEAN IT IS NOT PRESENT IN THE AREA.

**Variance Requests**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E

**Variance Requests  
Salado Draw P419  
Temporary Pit**

**Variance Request 1 of 2 – Extension of Closure Timeline for Temporary Pit**

**Reason for the requested variance**

The Operator wishes to standardize closure practices and procedures across all active development areas where Temporary Pits are used. A closure timeline extension allows for improved flexibility in managing closure operations and would improve efficiency by allowing the closure of multiple pits during a single campaign.

The closure timeline is stated with the definition of a Temporary Pit, in that a pit *“must be closed within six months from the date the operator releases the drilling or workover rig from the first well using the pit”*.

For purposes of this variance, the Operator proposes a timeline based on the earliest Rig Down Move Out (RDMO) date. RDMO is defined as the date the drilling rig is moved off location, typically after the completion of drilling the last well on the pad. The Operator proposes dewatering the pit within 30 days of RDMO and proposes closing the pits within 1 year of RDMO.

The Operator uses a batch drilling process for drilling multiple wells on a single pad. The common procedure is to drill all the surface hole sections first followed by intermediate hole sections and finally production hole sections. The drilling rig skid moves to the next well without performing rig down activities when batch drilling. For the proposed four-well pad, the rig drills surfaces in the order of wells one to four, then intermediates in the order of wells four to one, and finally productions in the order of one to four. Note that specific orders may change based off well design and location specific factors, but the process of skidding and batch drilling is consistent throughout.

If the Operator ceases operations before drilling is complete and the rig is moved off the pad location, this constitutes a RDMO date and the 1-year closure criteria is based off the earliest RDMO date.

The Operator may utilize a smaller surface rig for the drilling of surface holes if permitted to do so. The rig down and move out of the surface rig does not constitute an RDMO date if the larger rig intending to drill production holes arrives within 3 months.

**Demonstration that the variance will provide equal or better protection of fresh water, public health and the environment.**

In order to uphold the Operator's commitment to people and the environment, the following assurances will be provided in excess of the baseline requirements of 19.15.17 NMAC.

- The Operator will dewater the Temporary Pit within 30 days after RDMO.
- The Operator will utilize a 40-mil HDPE liner, as proposed in **Variance 2**.
- No fluid will be stored in the pit for any purpose after the completion of drilling activities other than in the event of emergency actions as described in 19.15.17.14 NMAC.
- The pits will be visually inspected on a monthly basis between RDMO and closure.
- If fluid is seen in the pit during inspection, then the Operator will mobilize equipment to have the pits drained within 7 days.
- The operator will maintain a fence around the perimeter of the pits and ensure it remains in good repair until closure.

## Variance Request 2 of 2 – Proposed Use of High-Density Polyethylene (HDPE) Liner for Temporary Pit in lieu of Linear Low-Density Polyethylene (LLDPE) Liner

### Memorandum

To: New Mexico Oil Conservation Division (NMOCD)

From: Chevron MCBU - Facilities Engineering Group

Subject: Variance Request for Use of HDPE Liner Material for Temporary Reserve Pits in New Mexico

Date: 7/23/2020

Chevron requests a variance to NMAC 19.15.17.11 (F) for use of high-density polyethylene (HDPE) geomembrane for the lining of temporary drilling reserve pits. HDPE is a preferred material which Chevron will install during drilling reserve pit construction. Chevron will utilize an HDPE geomembrane which offers equal or better performance than a typically available 20-mil string reinforced linear low-density polyethylene (LLDPE) material detailed in 19.15.17.11 (F), NMAC. An HDPE liner of equivalent thickness or greater than the 20-mil LLDPE will be installed. The following are considered in the design for implementation of the HDPE material to ensure the product is an equivalent, to the LLDPE material described, for temporary reserve drilling pits in New Mexico.

- An HDPE liner that has a thickness of less than 30-mils will be installed in a reserve pit as a shop-fabricated, extruded liner, and will not be field welded. Only HDPE liners of 30-mils in thickness or greater will be field welded for use in the temporary reserve pits.
- HDPE has lower permeability compared to LLDPE. This provides high barrier protection for soils during drilling operations and usage of the pits.
- HDPE may be installed with an underlying geotextile or similar material to provide additional protection from puncture or stress cracking. The subgrade for the liner system will be screened of deleterious materials and rocks and will be suitable for the liner installation. The use of geotextile or similar material will be evaluated on a specific case-by-case basis by Chevron.
- The HDPE liner used in Chevron's temporary reserve pits will have an equivalent or higher tear resistance and puncture resistance than that of a typical 20-mil string reinforced liner.
- HDPE material properties and liner has improved UV resistance to degradation when compared to LLDPE. This allows for extended life and improved long-term durability in pit liner applications.

All requirements for temporary pits' design and construction will be met in accordance with NMAC 19.15.17.11 and liner compatibility will comply with EPA SW-846 Method 9090A. Any requirements that may not be able to be adequately addressed, will be addressed under a separate variance request on a case-by-case basis.

*Disclaimer: Tetra Tech, Inc. has not evaluated the full design of temporary reserve pits for Chevron and is not involved in the construction or operation of Chevron's lined, temporary reserve pits. Chevron understands that they will ensure that specific pit designs meet the criteria and intent of the NMAC and applicable codes for each pit location and construction.*



7/23/2020  
Nathan Langford, P.E.  
Tetra Tech, Inc.



# TECHNICAL DATA SHEET

## HDPE Series, 40 mils

### Black, Smooth

2801 Boul. Marie-Victorin Varennes, Quebec Canada J3X 1P7  
 Tel: (450) 929-1234 Sales: (450) 929-2544 Toll free in North America: 1-800-571-3904 www.Solmax.com www.solmax.com

PROPERTY	TEST METHOD	FREQUENCY <sup>(1)</sup>	UNIT Imperial	
<b>SPECIFICATIONS</b>				
Thickness (min. avg.)	ASTM D5199	Every roll	mils	40.0
Thickness (min.)	ASTM D5199	Every roll	mils	36.0
Melt Index - 190/2.16 (max.)	ASTM D1238	1/Batch	g/10 min	1.0
Sheet Density (8)	ASTM D792	Every 10 rolls	g/cc	≥ 0.940
Carbon Black Content	ASTM D4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D5596	Every 10 rolls	Category	Cat. 1 & Cat. 2
OIT - standard (avg.)	ASTM D3895	1/Batch	min	100
Tensile Properties (min. avg.) (2)	ASTM D6693	Every 2 rolls		
Strength at Yield			ppi	88
Elongation at Yield			%	13
Strength at Break			ppi	162
Elongation at Break			%	700
Tear Resistance (min. avg.)	ASTM D1004	Every 5 rolls	lbf	28
Puncture Resistance (min. avg.)	ASTM D4833	Every 5 rolls	lbf	80
Dimensional Stability	ASTM D1204	Certified	%	± 2
Stress Crack Resistance (SP-NCTL)	ASTM D5397	1/Batch	hr	500
Oven Aging - % retained after 90 days	ASTM D5721	Per formulation		
HP OIT (min. avg.)	ASTM D5885		%	80
UV Res. - % retained after 1600 hr	ASTM D7238	Per formulation		
HP-OIT (min. avg.)	ASTM D5885		%	50
Low Temperature Brittleness	ASTM D746	Certified	°F	- 106

### SUPPLY SPECIFICATIONS (Roll dimensions may vary ±1%)

## NOTES

1. Testing frequency based on standard roll dimension and one batch is approximately 180,000 lbs (or one railcar).
2. Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction.
8. Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.

\* All values are nominal test results, except when specified as minimum or maximum.

\* The information contained herein is provided for reference purposes only and is not intended as a warranty of guarantee. Final determination of suitability for use contemplated is the sole responsibility of the user. SOLMAX assumes no liability in connection with the use of this information.

Solmax is not a design professional and has not performed any design services to determine if Solmax's goods comply with any project plans or specifications, or with the application or use of Solmax's goods to any particular system, project, purpose, installation or specification.



# TECHNICAL DATA SHEET

**HDPE Series, 40 mils**  
Black, Top Side Single Textured

2801 Boul. Marie-Victorin Varennes, Quebec Canada J3X 1P7  
Tel: (450) 929-1234 Sales: (450) 929-2544 Toll free in North America: 1-800-571-3904 www.Solmax.com www.solmax.com

PROPERTY	TEST METHOD	FREQUENCY <sup>(1)</sup>	UNIT Imperial	
<b>SPECIFICATIONS</b>				
Nominal Thickness		-	mils	40
Thickness (min. avg.)	ASTM D5994	Every roll	mils	38.0
Lowest ind. for 8 out of 10 values			mils	36.0
Lowest ind. for 10 out of 10 values			mils	34.0
Asperity Height (min. avg.) (3)	ASTM D7466	Every roll	mils	16
Textured side		-		Top
Melt Index - 190/2.16 (max.)	ASTM D1238	1/Batch	g/10 min	1.0
Sheet Density (8)	ASTM D792	Every 10 rolls	g/cc	≥ 0.940
Carbon Black Content	ASTM D4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D5596	Every 10 rolls	Category	Cat. 1 & Cat. 2
OIT - standard (avg.)	ASTM D3895	1/Batch	min	100
Tensile Properties (min. avg) (2)	ASTM D6693	Every 2 rolls		
Strength at Yield			ppi	88
Elongation at Yield			%	13
Strength at Break			ppi	88
Elongation at Break			%	150
Tear Resistance (min. avg.)	ASTM D1004	Every 5 rolls	lbf	30
Puncture Resistance (min. avg.)	ASTM D4833	Every 5 rolls	lbf	90
Dimensional Stability	ASTM D1204	Certified	%	± 2
Stress Crack Resistance (SP-NCTL)	ASTM D5397	1/Batch	hr	500
Oven Aging - % retained after 90 days	ASTM D5721	Per formulation		
HP OIT (min. avg.)	ASTM D5885		%	80
UV Res. - % retained after 1600 hr	ASTM D7238	Per formulation		
HP-OIT (min. avg.)	ASTM D5885		%	50
Low Temperature Brittleness	ASTM D746	Certified	°F	- 106
<b>SUPPLY SPECIFICATIONS</b> (Roll dimensions may vary ±1%)				

## NOTES

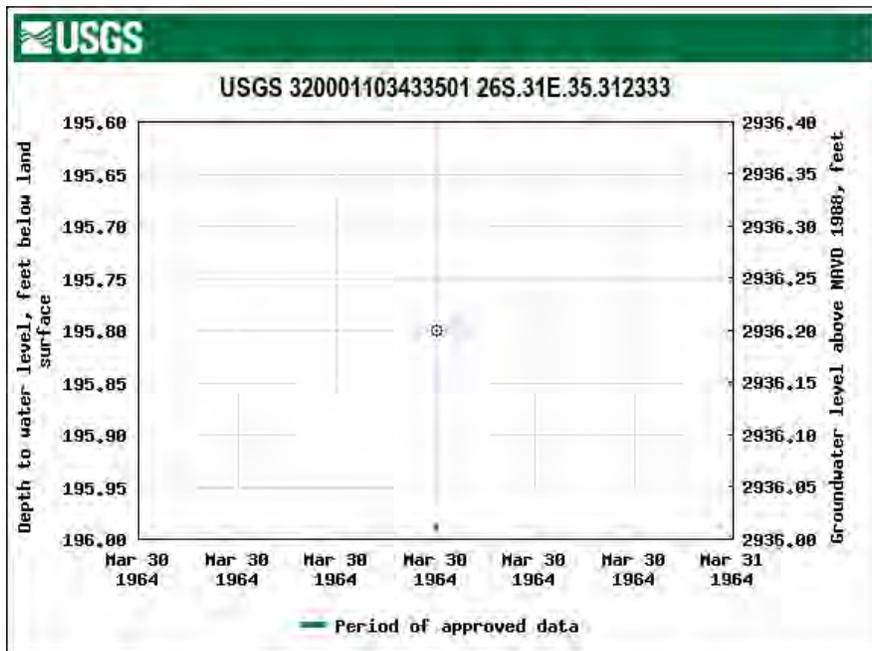
1. Testing frequency based on standard roll dimension and one batch is approximately 180,000 lbs (or one railcar).
2. Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction.
3. Lowest individual and 8 out of 10 readings as per GRI-GM13 / 17, latest version.
8. Correlation table is available for ASTM D792 vs ASTM D1505. Both methods give the same results.

## **Appendix A**

United States Geological Survey

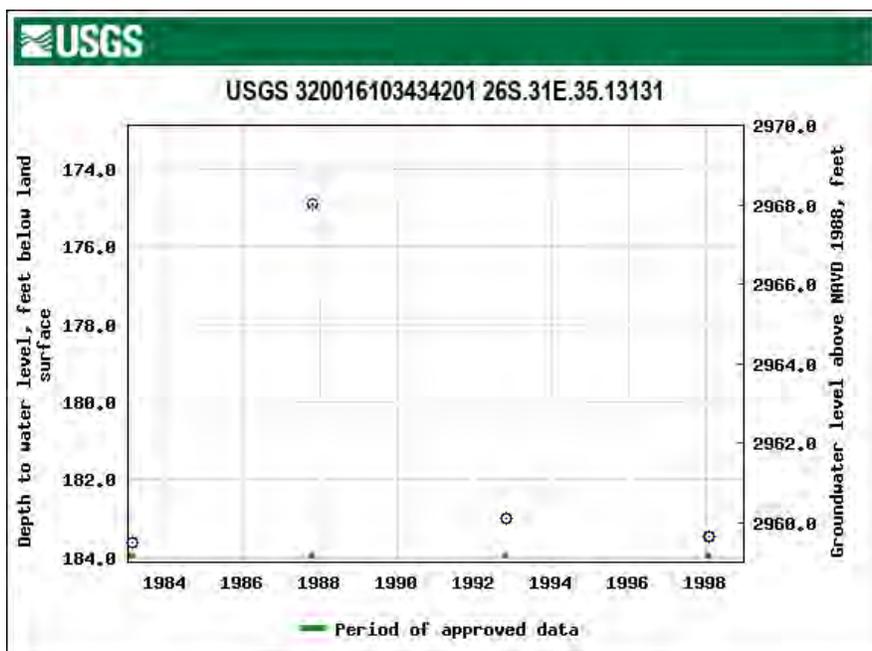
Groundwater Data

**USGS 320001103433501, 26S.31E.35.312333**  
Eddy County, New Mexico  
Hydrologic Unit Code 13070001  
Latitude 32°00'01", Longitude 103°43'35" NAD27  
Land-surface elevation 3,132 feet above NAVD88



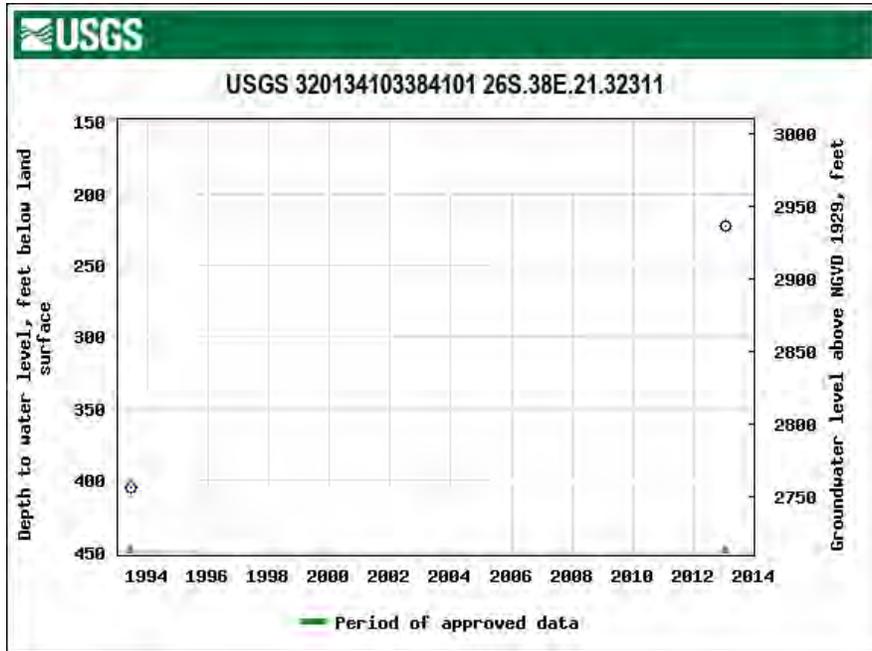
**USGS 320016103434201 26S.31E.35.13131**

Eddy County, New Mexico  
Hydrologic Unit Code 13070001  
Latitude 32°00'16", Longitude 103°43'42" NAD27  
Land-surface elevation 3,143 feet above NAVD88  
This well is completed in the Alluvium, Bolson Deposits and Other Surface Deposits (110AVMB) local aquifer.



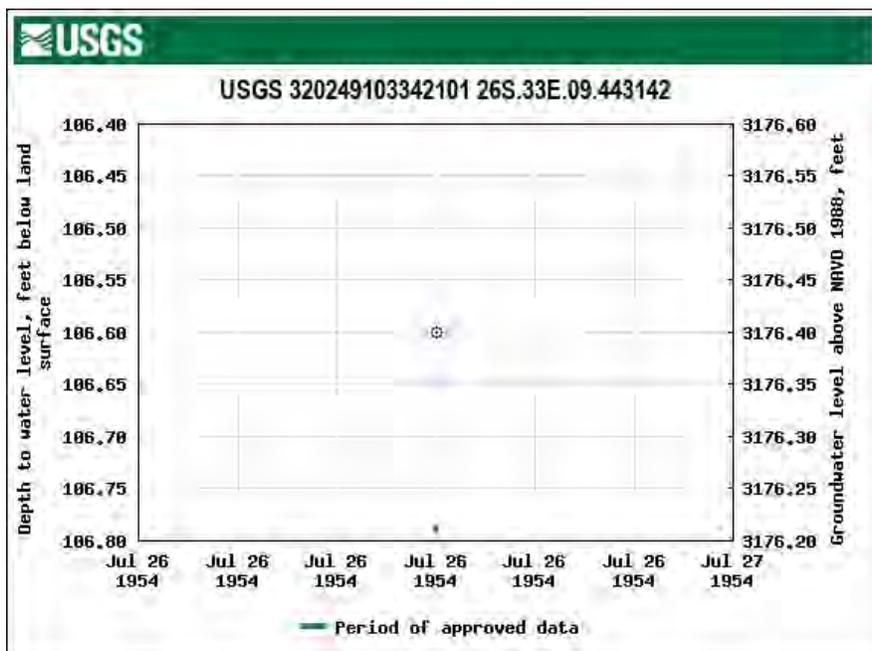
**USGS 320134103384101 26S.38E.21.32311**

Latitude 32°01'35.2", Longitude 103°41'01.8" NAD83  
Lea County, New Mexico , Hydrologic Unit 13070007  
Well depth: 405. feet Hole depth: 405. feet  
Land surface altitude: 3,160 feet above NGVD29.  
Well completed in "Dockum Group" (231DCKM) local aquifer



**USGS 320249103342101 26S.33E.09.443142**

Lea County, New Mexico, Hydrologic Unit Code 13070001  
Latitude 32°02'49", Longitude 103°34'21" NAD27  
Land-surface elevation 3,283 feet above NAVD88  
This well is completed in the Alluvium, Bolson Deposits and Other Surface Deposits (110AVMB) local aquifer



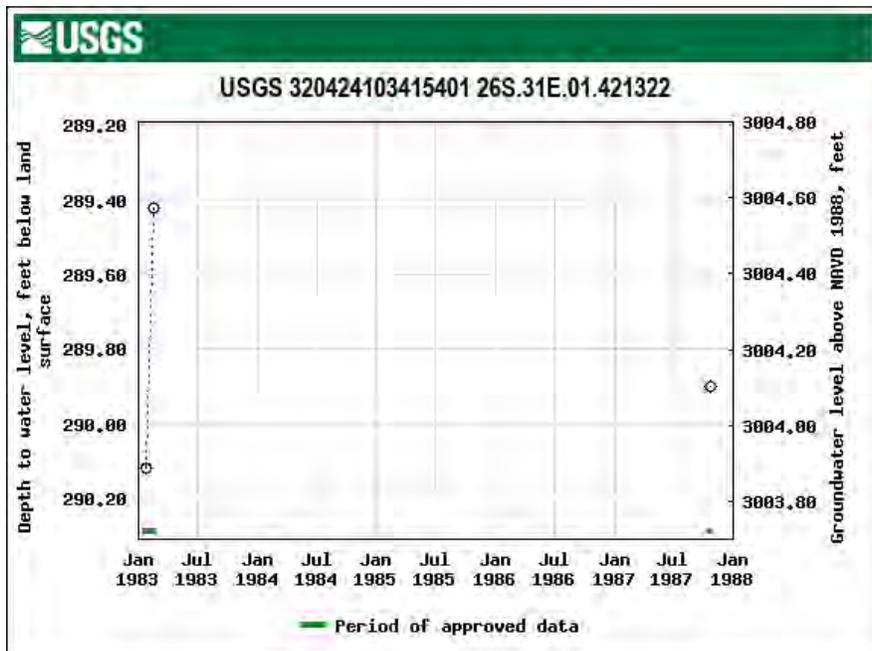
**USGS 320424103415401 26S.31E.01.421322**

Eddy County, New Mexico, Hydrologic Unit Code 13070001

Latitude 32°04'24", Longitude 103°41'54" NAD27

Land-surface elevation 3,294 feet above NAVD88

This well is completed in the Santa Rosa Sandstone (231SNRS) local aquifer.



**USGS 320425103415401 26S.31E.01.42110**

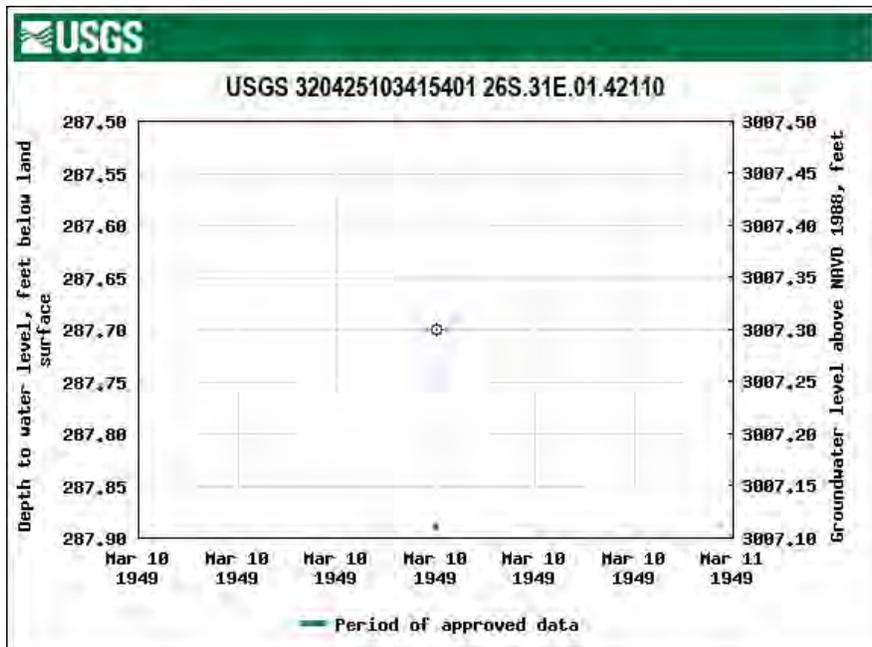
Eddy County, New Mexico, Hydrologic Unit Code 13070001

Latitude 32°04'25", Longitude 103°41'54" NAD27

Land-surface elevation 3,295 feet above NAVD88

The depth of the well is 340 feet below land surface.

This well is completed in the Rustler Formation (312RSLR) local aquifer.



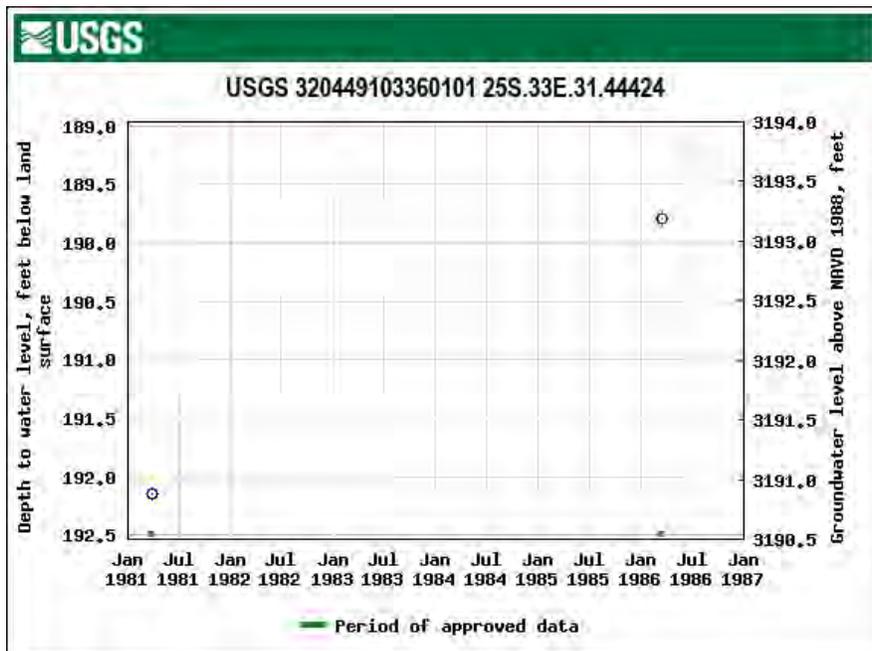
**USGS 320449103360101 25S.33E.31.44424**

Lea County, New Mexico, Hydrologic Unit Code 13070001

Latitude 32°04'49", Longitude 103°36'01" NAD27

Land-surface elevation 3,383 feet above NAVD88

This well is completed in the Chinle Formation (231CHNL) local aquifer.



**USGS 320504103361801 25S.33E.31.24232**

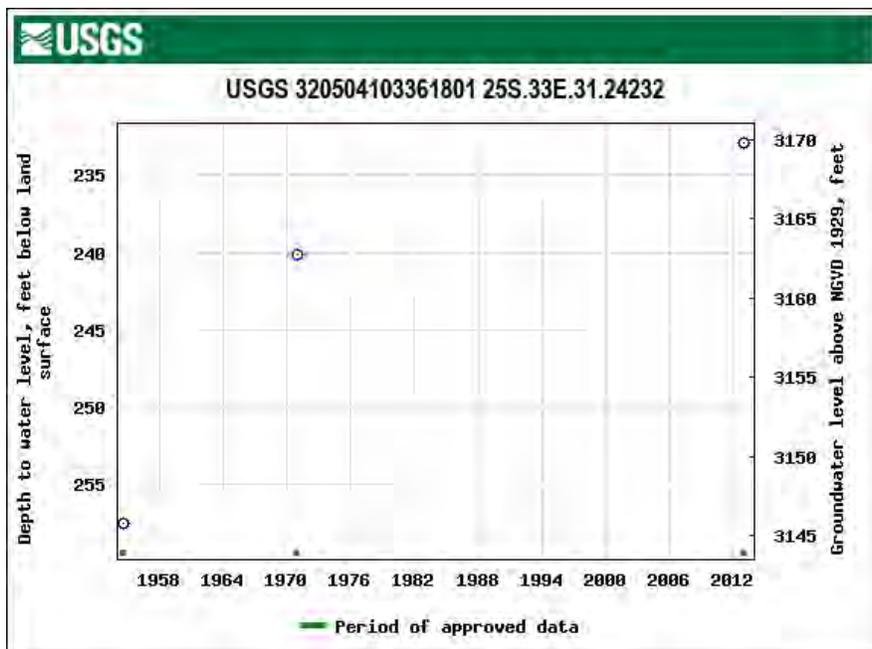
Lea County, New Mexico, Hydrologic Unit Code 13070001

Latitude 32°05'21.6", Longitude 103°36'12.7" NAD83

Land-surface elevation 3,403.00 feet above NGVD29

The depth of the well is 320 feet below land surface.

This well is completed in the Ogallala Formation (121OGLL) local aquifer.



**Appendix B**

New Mexico Office of the State Engineer

Water Column/Average Depth to Water Data



# New Mexico Office of the State Engineer

## Water Column/Average Depth to Water

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed) (quarters are 1=NW 2=NE 3=SW 4=SE) (quarters are smallest to largest) (NAD83 UTM in meters)

(In feet)

POD Number	POD Sub-Code	basin	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Depth Well	Depth Water	Water Column	
<a href="#">C 02271</a>	R	CUB	LE	2	3	21	26S	32E	624449	3544111*		150	125	25	
<a href="#">C 02271 POD2</a>		CUB	LE	3	2	3	21	26S	32E	624348	3544010*		270	250	20
<a href="#">C 02274</a>		CUB	LE	2	1	2	31	26S	32E	621742	3541730*		300	295	5
<a href="#">C 02323</a>	C	LE		3	2	3	21	26S	32E	624348	3544010*		405	405	0
<a href="#">C 03537 POD1</a>		CUB	LE	3	2	3	21	26S	32E	624250	3543985		850		
<a href="#">C 03595 POD1</a>		CUB	LE	4	2	3	21	26S	32E	624423	3544045		280	180	100
<a href="#">C 03829 POD1</a>		CUB	LE	3	3	1	06	26S	32E	620628	3549186		646	350	296
<a href="#">C 04209 POD1</a>		CUB	LE	2	3	3	06	26S	32E	620903	3548619		360	155	205
<a href="#">C 04209 POD2</a>	C	LE		2	3	3	06	26S	32E	620818	3548657		340	155	185

Average Depth to Water: **239 feet**  
 Minimum Depth: **125 feet**  
 Maximum Depth: **405 feet**

**Record Count:** 9

**PLSS Search:**

**Township:** 26S      **Range:** 32E

\*UTM location was derived from PLSS - see Help

The data is furnished by the NMOSE/ISC and is accepted by the recipient with the expressed understanding that the OSE/ISC make no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the data.

## **Appendix C – Hydrogeologic Data**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E

## Appendix C – Hydrogeologic Data

### Salado Draw P419

### Temporary Pit

#### Topography and Surface Hydrology

The location of the proposed temporary pit lies at an elevation of 3,160 ft above sea level between the Mescalero Ridge and the Pecos River in the Pecos Valley section of the Great Plains physiographic province. The general area is characterized by an irregular erosional surface that gently slopes to the southwest (~25 ft per mile). There is no integrated surface drainage in the vicinity of the proposed location: surface drainage flows ephemerally during precipitation events and collects in depressions, infiltrates soil, or evaporates. There are no perennial watercourses in the area and the distance to the nearest ephemeral watercourse, the Red Hills Draw, is approximately 2,000 ft to the northwest (**Figure 6**). Downgradient from the proposed location (~3.5 miles to the southwest) is a depression at 3,080 < 3,100 ft above sea level, demarcated by closed contours. No surface depressions, evidenced by closed topographic contours, are present within 3.5 miles of the proposed location.

#### Soils

Below is a description of soils in the vicinity of the proposed location according to USGS SSURGO soils data (**Figure 10**):

- Underlying the location and extending southward are Pyote and Maljamar fine sands (PU) characterized as: loamy and siliceous, forming on slopes of less than 5 percent, well drained, with very slow to negligible runoff, and moderately rapid permeability.
- To the east, are hummocky, Berino-Cacique association soils (BH) characterized as: loamy fine sands, with up to 90% siliceous material, occurring on level to undulating sandy plains with coppice mounds, well drained, with very slow runoff, and moderate permeability.
- To the west are Pyote soils and dune land (PY), which have similar characteristics to PU with the addition of intermingled dune land, consisting of fine sands forming ~4 ft-high dunes, similar to those found in active dune land.

#### Geology

A thick layer of Quaternary alluvium is present at surface in the vicinity of the proposed location and is composed of eroded and reworked eolian and fluvial material. The alluvium generally greater than 100 feet-thick in this area (Meyer et al., 2012). The Quaternary deposits are underlain by the Triassic-age Santa Rosa and Chinle formations and deeper, Permian-age strata (**Figure 9**). The Chinle Formation outcrops approximately 1.5 miles to the east of the proposed location and exhibits a regional dip of about 1 degree to the east and south. Permian strata outcrop approximately 20 miles to the west along the course of the Pecos River. No mapped faults are present within 22 miles of the proposed location per a review of publicly available USGS geologic maps for New Mexico and Texas.

## Groundwater

Groundwater within 5 miles of the proposed location is present within the Pecos River Basin Alluvial aquifer contained within Quaternary deposits present at surface. The proposed location, however, is not located above the mapped extent of the Pecos River Basin Alluvial aquifer (**Figure 7**). The Triassic formations that outcrop to the northeast of the proposed location are also sources of potable water. There are very few (<20) water wells within 5 miles of the location and zero water wells within 1 mile, indicating that yield is very low in this area. The Permian rocks that underlie the Quaternary and Triassic formations do not contain potable water (Hutchison, 2011).

Depth to Water: An analysis of publicly available data from the MNOSE and USGS and nearby drillers logs indicated that groundwater beneath the proposed location is well in excess of 100 ft:

- The nearest water wells to the pit location are in a cluster approximately 1.7 miles to the southwest. Water level was measured at 220 ft bgs in 2013 (2,938 ft above NGVD29) within a USGS well within the cluster.
- To the northwest, the nearest well is located 3.3 miles away and is completed in the Santa Rosa Sandstone. Water level was measured at 290 ft bgs (3,004 ft above NAVD88) in 1987.
- To the northeast, the nearest well is located 4.4 miles away and is completed in the Chinle Formation. Water level was measured at 190 ft bgs (3,193 ft above NAVD88) in 1986.
- To the east, the nearest well is POD C 02273 with a measured water depth of 120 ft bgs (3,155 ft).
- A geotechnical boring located ~1.2-miles to the east of the proposed location was advanced to 80-feet (**Figure G.3**). The boring was dry and remained dry 24-hours after drilling.

### Recharge:

Recharge is by direct precipitation, infiltration from intermittent streamflow, and subsurface flow from older formations. The region is characterized by an annual precipitation of 10 to 20 inches and high average annual evaporation rates approaching 70 inches (Boghici, 1999). Most recharge is episodic and associated with periods of heavy rainfall. Recharge is only likely to occur during long-duration rainfall events or periods of frequent, smaller rainfall events; otherwise the water is lost to evapotranspiration. Recharge only occurs after moisture in the vadose zone is high enough to overcome the effects of surface tension that would otherwise adhere the water to sand grains (Ashworth, 1990). The average annual recharge rate for the Pecos River Basin aquifer in Lea Co., NM is between 0 and 0.5 inches/year (Hutchison et al., 2011).

## References

Ashworth, J.B. 1990, Evaluation of ground-water resources in parts of Loving, Pecos, Reeves, Ward, and Winkler counties, Texas: Texas Water Development Board, Report 317, 51 p

Boghici, R., 1999, Changes in groundwater conditions in parts of Trans-Pecos Texas, 1988-1998: Texas Water Development Board, Report 348, 29 p

Hutchison, W.R., I.C. Jones, and R. Anaya, 2011, Update of the groundwater availability model for the Edwards-Trinity (plateau) and Pecos Valley aquifers of Texas.

Meyer, J.E, M.R. Wise, and S. Kalaswad, 2012, Pecos Valley Aquifer, west Texas: structure and brackish groundwater: Texas Water Development Board, Report 382, 95 p.

Reeves, C.C., Jr., 1972, Tertiary-Quaternary stratigraphy and geomorphology of west Texas and southeastern New Mexico, in Guidebook, East-Central New Mexico, ed. V.C. Kelley and F.D. Trauger: New Mexico Geological Society, pp. 103-117

Sabin, T.J. and V.T. Holiday, 1995, Playas and lunettes on the Southern High Plains, morphometric and spatial relationships: Anals of the Association of American Geographers, Vol. 85, No. 2, pp.286-305.

Smith, L.M., 2003, Playas of the Great Plains: University of Texas Press, pp. 31-39.

## **Appendix D – Design Plan**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E

	Appendix D - Design Plan Salado Draw P419 <h2 style="margin: 0;">Construction Work Package</h2>		
	CWP #: 1	Date Printed: 6/24/2020	

### 1.0 Scope

Construction of 4-well below “megapad” and associated access roads, and drilling reserve pit.

- 20ft wide roads ~900’
- Actual Pad dimensions are 690’x480’
- Construction of drilling reserve pit

A onecall will need to be initiated by the contractor. Once onecall is received by Chevron, a dig plan will be completed and sent for approval. Please allow one week from time onecall is initiated to dig plan approval.

### Contracting Plan

Contract Type	Contractor	Contact Information
Unit Rates	Sweatt	
T&M (if not defined in unit rates)	TBD	

### 2.0 Location

<b>Facility</b>	Salado Pad 419			
<b>Pad 419</b>	<b>LAT</b>	32.037268	<b>LONG</b>	-103.657465

### 3.0 Execution Plan

**Well Pad (Pad 419):**

**Contractor will construct one four well ‘megapads’ with drilling reserve pit**

- Clear and complete subgrade for two 690’x480’ pads according to standards in the master service agreement including the 6” caliche cap.
- Construct drilling reserve pit according to standard drawing attached. Reserve pit will overlap pad by 100’
- Walking areas specified in drawings shall be brought to compaction as per Geotech recommendations.
- Silo area to be compacted to the same compaction requirements as the walking area.
- Caliche shall be watered and compacted to obtain a smooth surface that will drain rainwater without ponding
- Chevron construction rep to call out cellar/conductor. The layout for each well is attached.

**Road:**

- Construct 900 ft of 20-ft wide access road according to the drawings.

	Appendix D - Design Plan Salado Draw P419  <h2 style="margin: 0;">Construction Work Package</h2>	
CWP #: 1		Date Printed: 6/24/2020

**Chevron Scope:**

- Conduct geotechnical work and provide geotechnical report to contractor for strong back compaction

**4.0 Materials**

**4.1 Chevron Order**

All materials will need to be provided by the Contractor.

**5.0 Project Drawings & Figures**

5.1	Factory Standard 4-Well Pad Plan, Open Loop	
5.2	Dimension Plat - New Disturbance	
5.3	Dimension Plat - Reserve Pit	



T  
26  
S

R 32 E

Sec. 15

Bureau of Land Management

Sec. 14

Proposed Access Road

Proposed Pad 368

Existing Maelstrom SWD Access

**PROPOSED RESERVE PIT (New Acreage) ±1.25 Acres**

333'

Proposed Pipeline ROW

Proposed Access Road

Proposed EDS ROW

Existing Pad 419

Existing Access Road

Existing CVX ROW

Existing Access Road

Existing Pad 9

Existing Pad

Sec. 23

Existing Pipelines

Existing Lease Road

Sec. 22

Bureau of Land Management

FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.

I, Robert L. Lastrapes, Professional Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

DIMENSION PLAT

Page 1 of 2

**CHEVRON U.S.A. INC.**

PROPOSED RESERVE PIT  
SALADO DRAW PAD 419  
SECTION 15, T26S-R32E  
LEA COUNTY, NEW MEXICO

**LEGEND**

	Proposed Pit
	Proposed ROW
	Existing Pipeline
	Proposed Road/Pad
	Existing Road/Pad
	Section Line
	Fnd. Monument

Scale: 1" = 300'

300' 0 150' 300'



C. H. Fenstermaker & Associates, L.L.C.  
135 Regency Sq. Lafayette, LA 70508  
Ph. 337-237-2200 Fax. 337-232-3299  
www.fenstermaker.com

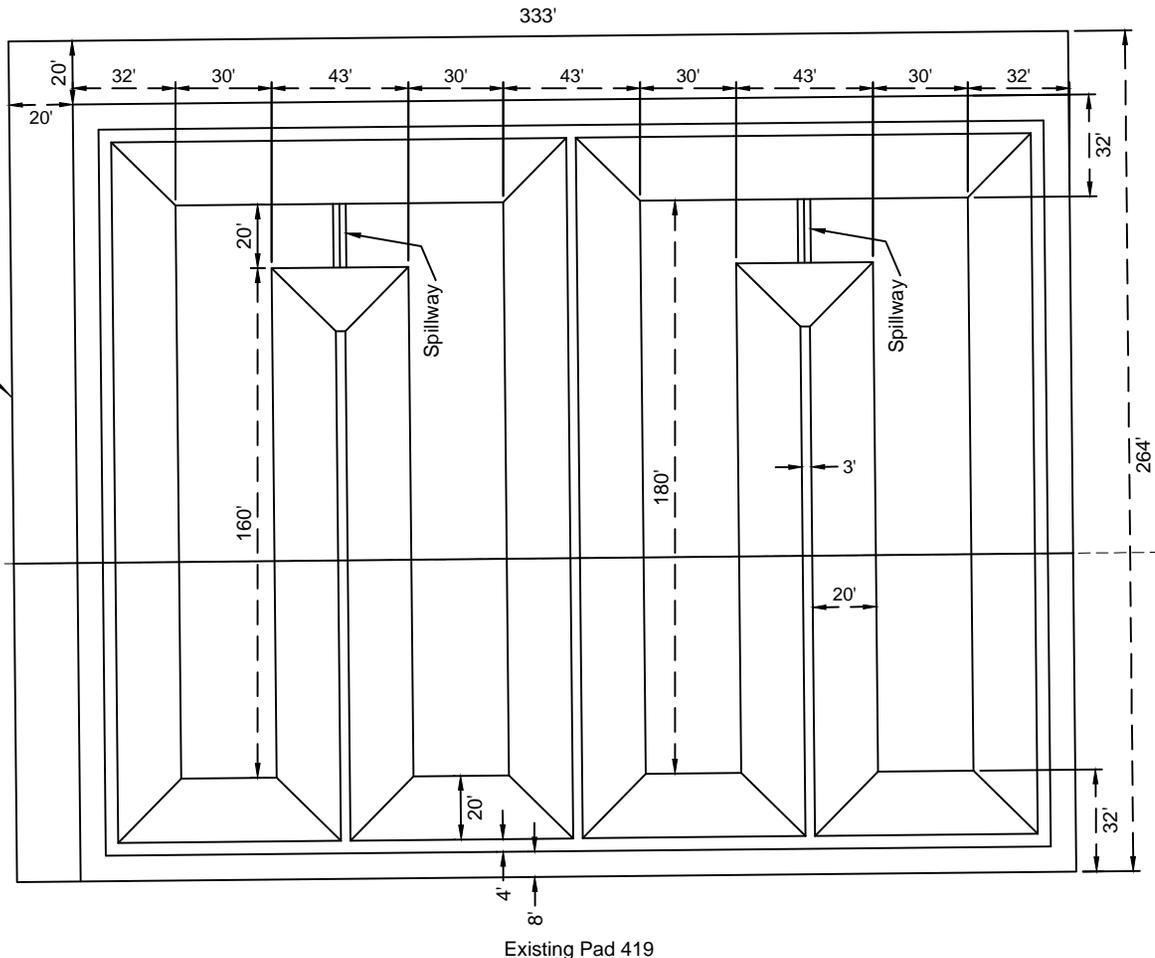
Not to be used for construction, bidding, recordation, conveyance, sales, or engineering design.

**PRELIMINARY**

Robert L. Lastrapes  
Registration No. 23006

REVISIONS

DRAWN BY: RMB	#	BY:	DATE:	DESCRIPTION:
PROJ. MGR.: VHV				
DATE: 06/24/2020				
FILENAME: T:\2019\2190459\DWG\Salado Draw Pad 419 Reserve Pit_Dimensions.dwg				



PROPOSED RESERVE PIT (New Acreage)

**NOTE:**  
Please be advised, that while reasonable efforts are made to locate and verify pipelines and anomalies using our standard pipeline locating equipment, it is impossible to be 100 % effective. As such, we advise using caution when performing work as there is a possibility that pipelines and other hazards, such as fiber optic cables, PVC pipelines, etc. may exist undetected on site.

**NOTE:**  
Many states maintain information centers that establish links between those who dig (excavators) and those who own and operate underground facilities (operators). It is advisable and in most states, law, for the contractor to contact the center for assistance in locating and marking underground utilities. For guidance, New Mexico One Call [www.nm811.org](http://www.nm811.org)

Existing Pad 419



**DISCLAIMER:** At this time, C. H. Fenstermaker & Associates, L.L.C. has not performed nor was asked to perform any type of engineering, hydrological modeling, flood plain, or "No Rise" certification analyses, including but not limited to determining whether the project will impact flood hazards in connection with federal/FEMA, state, and/or local laws, ordinances and regulations. Accordingly, Fenstermaker makes no warranty or representation of any kind as to the foregoing issues, and persons or entities using this information shall do so at their own risk.

FOR THE EXCLUSIVE USE OF CHEVRON U.S.A. INC.  
I, Robert L. Lastrapes, Professional Surveyor, do hereby state this plat is true and correct to the best of my knowledge.

*Not to be used for construction, bidding, recordation, conveyance, sales, or engineering design.*

**PRELIMINARY**

Robert L. Lastrapes  
Registration No. 23006



C. H. Fenstermaker & Associates, L.L.C.  
135 Regency Sq. Lafayette, LA 70508  
Ph. 337-237-2200 Fax. 337-232-3299  
[www.fenstermaker.com](http://www.fenstermaker.com)

DIMENSION PLAT

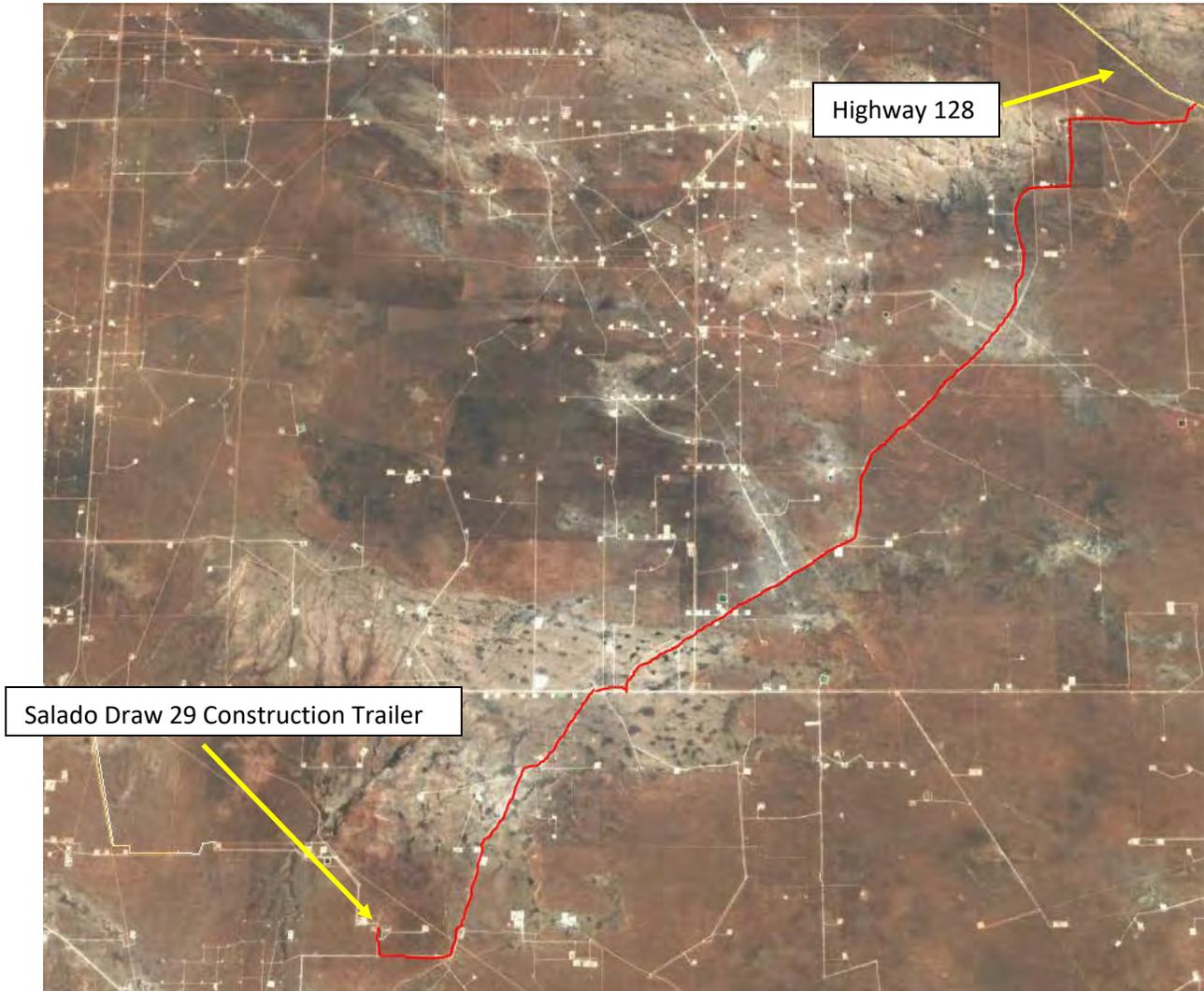
Page 2 of 2

**CHEVRON U.S.A. INC.**  
PROPOSED RESERVE PIT  
SALADO DRAW PAD 419  
SECTION 15, T26S-R32E  
LEA COUNTY, NEW MEXICO

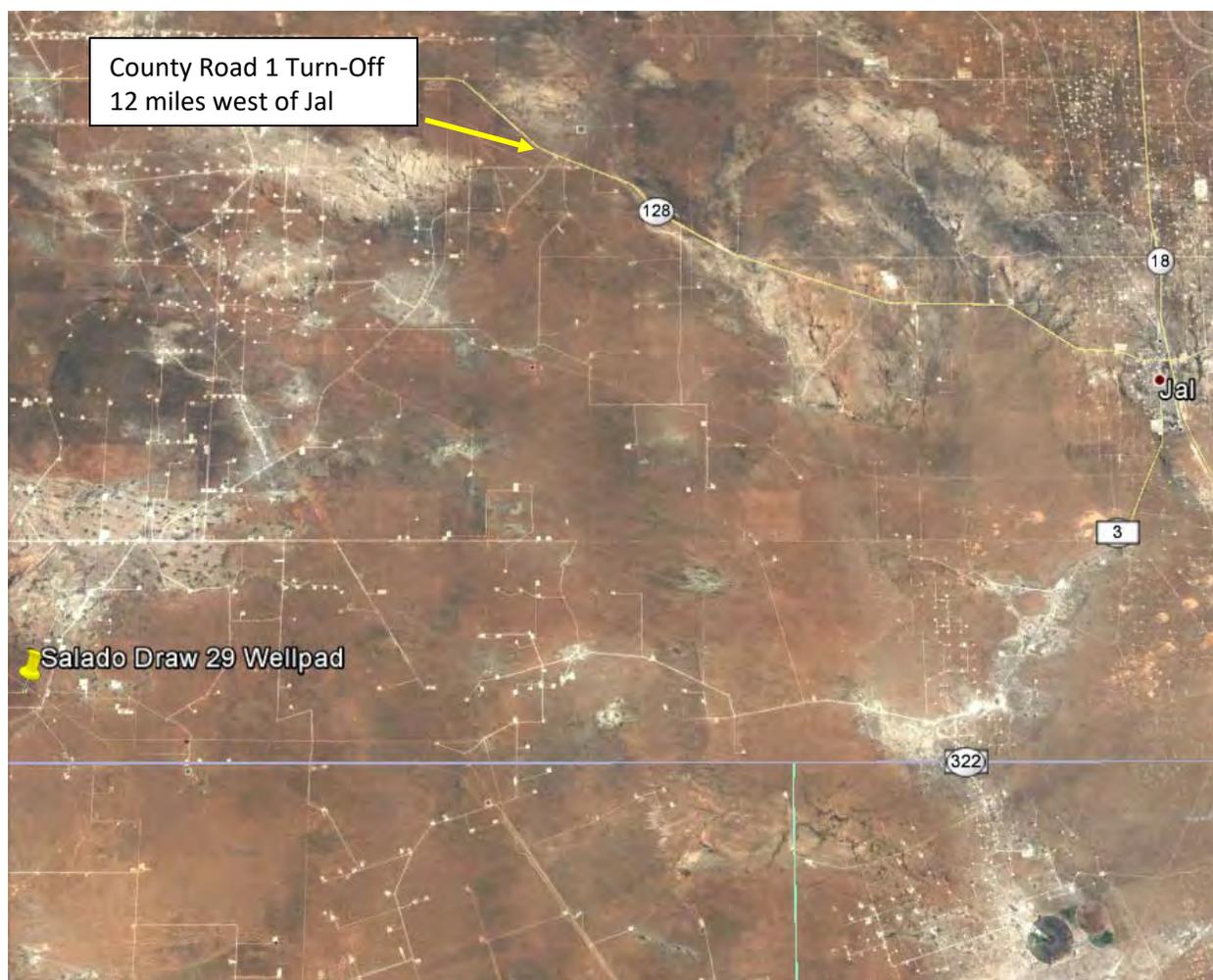
REVISIONS

DRAWN BY: RMB	#	BY:	DATE:	DESCRIPTION:
PROJ. MGR.: VHV				
DATE: 06/24/2020				
FILENAME: T:\2019\2190459\DWG\Salado Draw Pad 419 Reserve Pit_Dimensions.dwg				

### Salado Draw Driving Directions



## Salado Draw Driving Directions



Head West out of Jal, NM

- Continue for roughly 13 miles, turn left (south) onto County Road 1 (Battle Axe Road)
- Continue on Battle Axe Road for roughly 18 miles, before turning right into the Salado Draw development. There will be a sign "Chevron Salado Draw Development" on the lease road.
- Continue up the road ½ mile to reach the Salado Draw Construction Trailer.

GPS: 32.022717, -103.604360

### **Delivery Contacts:**

Art Strickland – 361-500-2217

Jason Bobo – 903-738-9435

## **Appendix E – Operating and Maintenance Plan**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E

## **Appendix E – Operating and Maintenance Plan Salado Draw P419 Pit Temporary Pit**

The Operator and Rig Contractor will operate and maintain the Temporary Pit to contain liquids and solids, maintain the integrity of the liner system in a manner that prevents contamination of fresh water and protects public health and the environment as described below.

The operation of the Temporary Pit is summarized below.

Prior to arrival of the drilling rig, the separate pit sections are filled with the fluid required for drilling operations of the wells on the well pad. Typically, these fluids are a low chloride brackish water and a high chloride saturated brine.

During open loop drilling operations, fluid is pulled from one end of the Temporary Pit and sent to the rig pumps to be transferred downhole as the drilling fluid. Upon returning to the surface, the fluid and associated drilled solids flow to the opposite end of the Temporary Pit.

When conducting Closed Loop drilling activities, the Temporary Pit may be utilized for cuttings disposal for purposes of maintaining mud weight, mitigating downhole hazards, and managing other unforeseen circumstances. The Temporary Pit is only to be utilized in conjunction with Closed Loop drilling when drilling activities are done using Water Based Drilling Fluids. In this circumstance, drilled solids are separated from the drilling fluid with solids control equipment and then moved to the Temporary Pit.

During well cementing operations, if the low chloride fluid in the Temporary Pit meets specifications set by the Operator and Cementing Contractor, that fluid will be used as mix water for the blending of the cement slurry. During cementing operations, excess cement returns may be placed in the Temporary Pit.

Throughout well construction, if the fluid in the Temporary Pit meets the specifications set by the Operator and Rig Contractor, that fluid may be used as rig water for component cleaning and engine cooling.

If downhole problems occur during drilling operations, such as fluid losses or waterflows, the Temporary Pit is used to assist with fluid management into and out of the well. Transfer pumps and hoses are used to move these fluids.

After the drilling rig is mobilized off the well pad, any remaining fluids in the Temporary Pit will be removed and reused, recycled, or disposed of in a manner consistent with Division rules.

The operation of the Temporary Pit will follow the requirements listed below:

- All cuttings placed into the Temporary Pit will be produced and disposed of within the boundaries of one single lease, pursuant to the Pit Rule definition of “Onsite”.
- The Operator will not discharge into or store any hazardous waste (as defined by 40 CFR 261 and NMAC 19.15.2.7.H.3) in the pits.
- If the pit liner’s integrity is compromised above the water line, then the Operator will repair the damage within 48 hours of discovery.
- If the pit develops a leak, or if any penetration of the pit liner occurs below the liquid’s surface, then the Operator shall notify the appropriate division office pursuant to the requirements of 19.15.29 NMAC, remove all liquid above the damage or leak within 48 hours of discovery, and repair the damage or replace the pit liner as applicable.
- The injection or withdrawal of liquids from a pit is accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.
- Engineering drawings demonstrate that the elevation and slopes of the pit prevent the collection of surface water run-on.
- The Operator will maintain on site an oil absorbent boom to contain and remove oil from the pit’s surface.
- The Operator will maintain the pit free of miscellaneous solid waste or debris.
- The Operator will maintain at least two feet of freeboard for the Temporary Pit. If, during extenuating circumstances, a freeboard of less than two feet is required, then a log will be maintained describing such circumstances.
- The Operator will remove all free liquids from the surface of a temporary pit within 30 days from the date the Operator releases the last drilling or workover rig associated with the relevant pit permit. The Operator will note the date of the drilling or workover rig’s release on form C-105 or C-103 upon well or workover completion.

## **Appendix F – Closure Plan**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E

## **Appendix F – Closure Plan Salado Draw P419 Pit Temporary Pit**

### **Discussion of Onsite Cuttings Disposal**

The proposed Temporary Pit will contain drill cuttings from the vertical sections of wells 30-025-46730, 46731, 46732, and 46810. All cuttings from vertical drilling will be produced and disposed of within the boundaries of one single lease, pursuant to the Pit Rule definition of "Onsite". The disposal and closure activities will take place within the design footprint of the Temporary Pit. Proposed closure operations will be conducted in accordance with the Closure and Site Reclamation Requirements detailed in 19.15.17.13 NMAC.

### **Closure Notice**

If planned activities deviate from this Closure Plan, an updated Closure Plan will be submitted to the Division for approval prior to initiating any closure activities.

The Operator will notify the Bureau of Land Management at least 72 hours, but not more than one week, prior to any closure activities as per approved sundry Conditions of Approval. This notice will include the well names, API numbers, and location.

The Operator shall additionally notify the district office verbally and in writing at least 72 hours, but not more than one week, prior to any closure operation. This notice will include the Operator's name and the location to be closed by unit letter, section, township and range.

### **Protocols and Procedures**

1. The Operator will remove all liquids from the Temporary Pit within 30 days of RDMO and either:
  - a. Dispose of the liquids in a division-approved facility,  
or
  - b. Recycle, reuse or reclaim the water for reuse in drilling and stimulation.
2. A five-point (minimum) composite sample will be collected from the contents of the Temporary Pit and sent to an accredited laboratory for analysis of the constituents listed in Table 2 of 19.15.17.13 NMAC.
  - a. If any concentration is higher than limits listed in Table 2, blending calculations will be used to determine the amount of soil or non-waste material needed to blend with the pit contents to achieve the Table 2 limit. The mixing ratio of soil or non-waste material to pit contents shall not exceed 3:1.
  - b. If all constituent concentrations are less than or equal to the parameters listed in Table 2 of 19.15.17.13 NMAC, no mixing shall occur.

3. The Operator will conduct blending operations, as required, and conduct a paint filter liquids test to ensure that the contents of the former pit are sufficiently stabilized to support the cover materials.
4. Cover materials will be installed as described in 'Cover Design' (below).
5. Following the implementation of the cover design, the Operator will revegetate the area as outlined in 'Reclamation and Revegetation' (below).

### **Soil Cover Design**

After blending with non-waste containing, uncontaminated, earthen material, the Operator will cover the former Temporary Pit according to the following procedure.

1. The contents of the former pit will be positively contoured ('turtle-backed') to promote drainage away from the former pit contents and reduce infiltration. Compaction of pit materials over time and as a result of placement of overburden will be taken into consideration.
2. A 20-mil string reinforced LLDPE geomembrane liner will be installed above the pit materials.
3. At least 4-feet of compacted, uncontaminated, non-waste containing earthen fill with chloride concentrations less than 600 mg/kg will be placed above the liner.
4. Either the background thickness of topsoil or 1-foot of suitable material to establish vegetation at the site, whichever is greater, will be placed over the earthen fill.
5. The location will be recontoured to match the pre-disturbance topography and prevent surface erosion and ponding.
6. The Operator will revegetate the area as described below in 'Reclamation and Revegetation'.

### **Closure Report**

1. Within 60 days of completing closure activities, the Operator will submit a closure report on form C-144, with necessary attachments to document all closure activities including sampling results, information required by 19.15.17 NMAC, a plot plan including the exact location of the former pit, details of the cover design, and photographs.
2. In the closure report, the Operator will certify that all information in the report and attachments is correct and that the Operator has complied with all applicable closure requirements and conditions specified in the approved closure plan.
3. A steel marker will be placed at the location per the requirements in Subsection F of 19.15.17.13 NMAC.

## Closure Timing

As discussed in **Variance 1**, the Operator proposes closure activities will be completed within a timeline not to exceed 1 year from the RDMO date. This date will be noted on form C-105 or C-103, filed with the Division upon the well's completion.

## Reclamation and Revegetation

The Operator will reclaim the disturbed area to a safe and stable condition that existed prior to oil and gas operations and that blends with the surrounding undisturbed area. Areas with ongoing production or drilling operations will not be reclaimed as described herein, but will be stabilized and maintained to minimize dust and erosion

For all areas relevant to the closure process that will not be used for production operations or future drilling, the Operator will:

1. Replace topsoils and subsoils to their original relative positions and regrade the area to achieve erosion control, long-term stability, preservation of surface water flow patterns, and prevent ponding.
2. Notify the Division when the surface grading work is complete.
3. Reseed the area with an appropriate seed mix in the first favorable growing season following closure. Reseeding and weed control measures will be taken, if necessary.
4. Notify the Division when reclamation is complete: vegetative cover has been established that reflects a life-form ratio of plus or minus 50 % of pre-disturbance levels and a total percent plant cover of at least 70 % of pre-disturbance levels, excluding noxious weeds.

## Alternative to Closure in Place

In the event the concentration of any contaminant in the contents, after mixing with soil or non-waste material, is higher than constituent concentrations shown in 19.15.17.13 NMAC, then the waste shall be removed from the Temporary Pit and disposed of at one of the following Division approved off-site facilities.

Sundance Services (Parabo, Inc.)  
M-29-21S-38E  
Permit No. NM-01-003

R360 Permian Basin, LLC  
4507 W. Carlsbad Hwy, Hobbs, NM 88240  
Permit No. NM-01-0006

## **Appendix G – Evaluation of Unstable Conditions**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E

## Appendix G – Evaluation of Unstable Conditions Salado Draw P419 Pit Temporary Pit

### Summary

**Figure 8** identifies the location of the proposed temporary pit with respect to BLM Karst areas. The proposed Temporary Pit is mapped in a “Medium Potential” karst area. Evidence of karst in the area consists predominantly of large depressions that formed over millions of years via dissolution of the Rustler and Salado formations at >1000-feet below the surface (Bachman, 1973). There are, however, no indications that voids or other karst features are present or are likely to form in the vicinity of the proposed location. Therefore, local karst potential is likely to be low. The following lines of evidence, detailed in the sections below, support this position:

1. There are no dissolution features within 2.2-miles of the proposed location (**Figure G.1**),
2. Karst forming strata are over 1,000-feet deep beneath the proposed location (**Figure G.4**),
3. An Arcadis field study of the area indicated no closed depressions, caves, or fissures in the immediate vicinity of the proposed pit (**Figure G.3, Attachment 1**),
4. TetraTech geotechnical reports and boring logs from <1.2 miles-away indicated low karst potential and were dry 24 hours after drilling (**Figure G.5, Attachments 2 and 3**).
5. The Bureau of Land Management, Paul Murphy prepared the Environmental Assessment (EA), document number - DOI-BLM-P020-2020-0198-EA, evaluating SD 15 Fed Pads 418 & 419. This EA notes that during on-site inspection, no known features exist within the proposed area. (**Section 3.4, Attachment 4**).

Structurally, the region surrounding the proposed pit location is relatively undeformed, with a 1-degree dip to the east, and the nearest mapped fault is 22-miles to the northwest (**Figure G.2**).

### Dissolution Features Evident on Aerial Imagery

The nearest apparent dissolution features to the proposed location are (**Figure G.1**):

- ~2.5 miles southwest of the proposed temporary pit location is a topographic depression represented by closed contours. It is unnamed, approximately 1 mile-wide, and less than 20 feet-deep.
- ~5.5 miles northeast of the proposed pit location is an area with small (<500-feet in diameter) depressions. These are co-located with a ~6 square mile outcrop of Triassic clastics (**Figure 9**) and may have formed along joint planes.
- Bell Lake Sink and three other unnamed sinks, each ~2-miles in diameter, are present approximately 15-miles north of the proposed location.
- San Simon Swale and San Ramon Sink are present ~20-miles northeast of the proposed location.

### Depth to Karst-Forming Rocks

**Figure G.4** shows a stratigraphic section of the formations beneath the proposed pit. The upper 1,000-feet of subsurface consists of insoluble, clastic material. These deposits are underlain by soluble, karst-forming strata.

- Surface to ~1,000-feet: Based on a review of available literature for the region, no significant intervals of soluble rocks are present in the Quaternary and Triassic deposits that constitute the upper ~1,000-feet of subsurface. Because this material is largely insoluble, the potential for karst features to form within this interval is very low (Lucas and Anderson, 1993).
- Deeper formations at >1,000-feet: The top of the Rustler Formation is >1,000-feet beneath the surface at the location of the proposed pit (Crowl et al., 2011). The Rustler Formation overlies the Salado Formation. These formations both contain thick, highly soluble beds of anhydrite and halite. The Bell Lake Sink, San Simon Swale, and San Simon Sink formed by the dissolution of salt from these deep formations. The resulting surface subsidence (as a result of deep dissolution) is a very slow process that has been ongoing for millions of years to form these large depressions (Bachman, 1973 and Berg, 2012).

Period	Formation	Thickness (ft)	Description
Quaternary		100	Unconsolidated eolian and unconsolidated to partially consolidated alluvial deposits
Triassic	Chinle	200 - 300	Red shales and thinly interbedded sandstone
	Santa Rosa	200 - 300	Sandstone and interbedded siltstone and red shale
Permotriassic	Quartermaster (Dewey Lake)	560	Mudstone, siltstone, claystone, and interbedded sandstone
Permian	Rustler	295 - 425	Anhydrite, halite, dolomite, sandy siltstone, and polyhalite
	Salado	1300 - 2300	Anhydrite, halite, and clay

*Figure G.4: Stratigraphic section beneath the location of the proposed temporary pit (modified from: Crowl et al., 2011 and Lucas and Anderson, 1993)*

### Arcadis Environmental Field Survey

An environmental field survey was conducted by Arcadis in 2017 and 2018 in the area surrounding the location of the proposed pit (**Figure G.3 and Attachment 1**). The on-site survey did not identify any closed depressions, caves, or fissures. The survey determined that the occurrence of voids in the surveyed area was “unlikely” based on a review of the literature, aerial photography, and an assessment of on-site conditions.

## TetraTech Geotechnical Reports and Boring Logs

Geotechnical reports from 2016 for two, nearby frac ponds were reviewed (**Figure G.3 and Attachments 2 and 3**). The frac ponds are located <1.2 miles-away and in an almost identical geomorphological and geological setting as the proposed pit location. The majority of borings were terminated at less than 35-feet, but one was advanced to 80-feet. All borings consisted predominantly of clastic material (mostly sand with some silt and clay) and some calcareous material. Standard penetration testing showed subsurface materials to be generally dense to very dense at depths greater than 5-feet.

- Salado Draw Section 13 Frac Pond
  - 1.2 miles east of proposed pit location
  - Boring B1 (center) was drilled to 80 ft
  - Borings B2 through B5 were drilled to 25 ft
  - 1.5 ft to 3.5 ft
    - 1 – 9 blows per foot (bpf)
    - Loose sand with clay
  - 3.5 ft to 80 ft
    - 14 – 100+ bpf
    - Medium dense to very dense silty sand
  - Groundwater was not encountered at the time of drilling and borings were dry 24 hours after drilling.
  
- Salado Draw Section 23 Frac Pond
  - 1.1 miles east of proposed pit location
  - Borings B1 and B3 through B5 drilled to 35 ft
  - Boring B2 drilled to 25 ft
  - Surface to 35 ft
    - Loose to dense sand with varying amounts of silt and clay
    - 8 – 100+ bpf, increasing with depth
  - Groundwater was not encountered at the time of drilling and borings were dry 24 hours after drilling.

## **BLM Mitigation of Karst Potential**

### Construction Mitigation

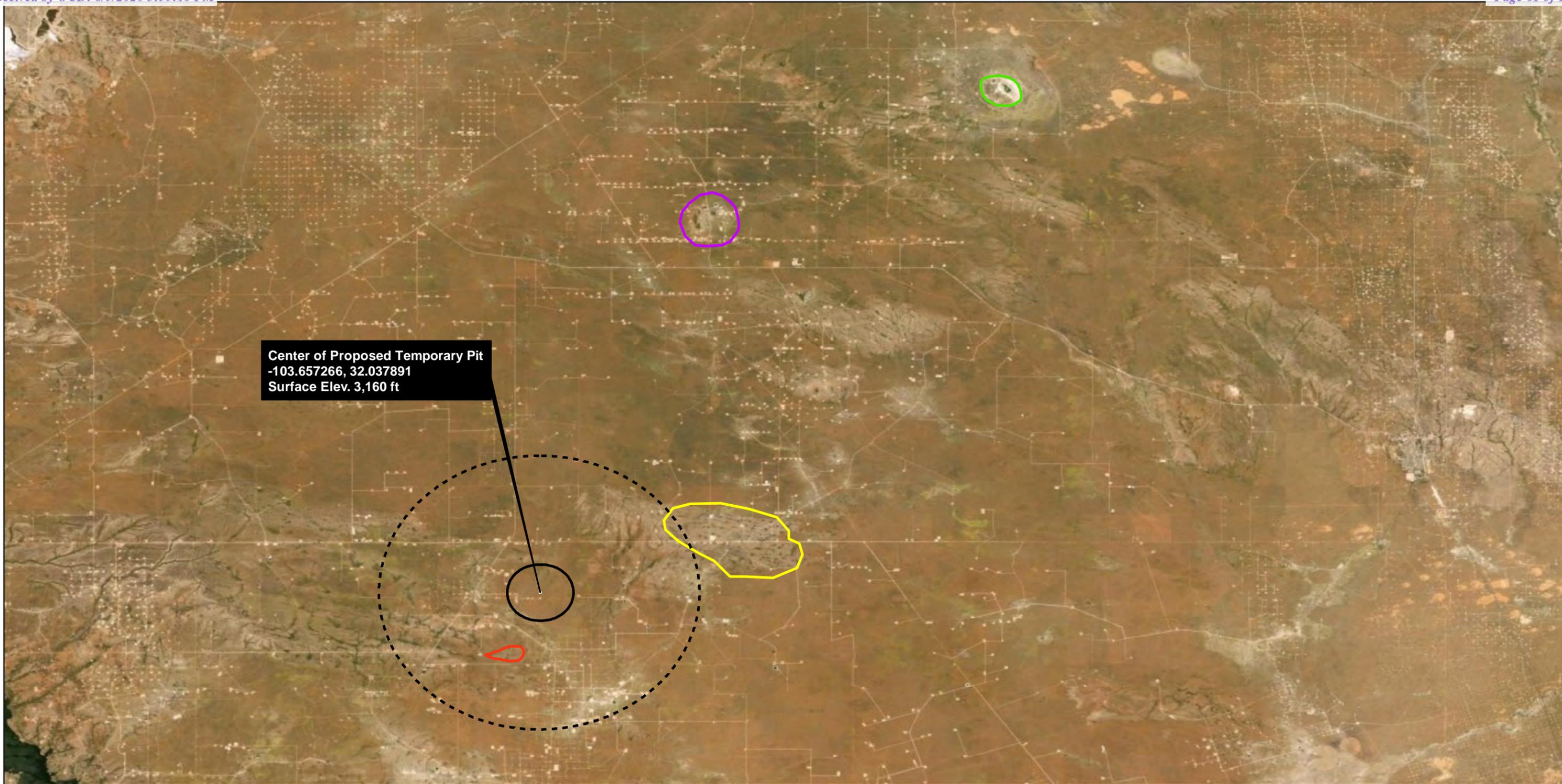
In order to mitigate the impacts from construction activities on cave and karst resources, the following Conditions of Approval will apply to this APD or project:

#### General Construction:

- No blasting
- The BLM, Carlsbad Field Office, will be informed immediately if any subsurface drainage channels, cave passages, or voids are penetrated during construction, and no additional construction shall occur until clearance has been issued by the Authorized Officer.
- All linear surface disturbance activities will avoid sinkholes and other karst features to lessen the possibility of encountering near surface voids during construction, minimize changes to runoff, and prevent untimely leaks and spills from entering the karst drainage system.
- All spills or leaks will be reported to the BLM immediately for their immediate and proper treatment.

#### Pad Construction:

- The pad will be constructed and leveled by adding the necessary fill and caliche – no blasting.
- The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.
- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g., caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised (i.e. an access road crossing the berm cannot be lower than the berm height).
- Following a rain event, all fluids will be vacuumed off of the pad and hauled off-site and disposed at a proper disposal facility.

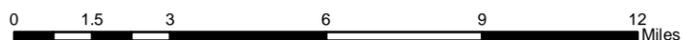


**Center of Proposed Temporary Pit**  
 -103.657266, 32.037891  
 Surface Elev. 3,160 ft



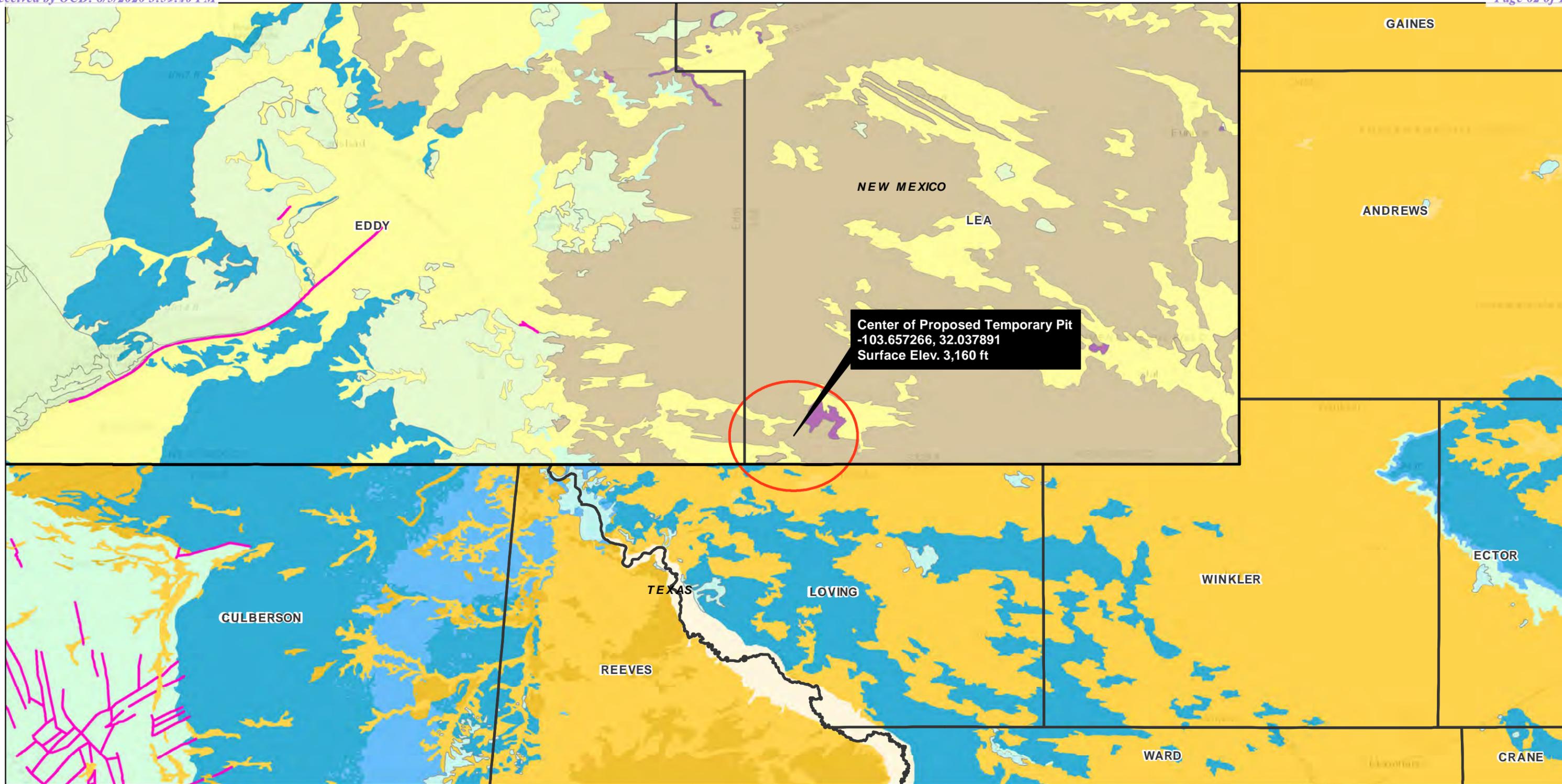
**LEGEND**

- Unnamed, Shallow Depression
- San Simon Sink
- Bell Lake Sink
- Area with Multiple Small Depressions
- 5 mile buffer
- 1 mi Buffer

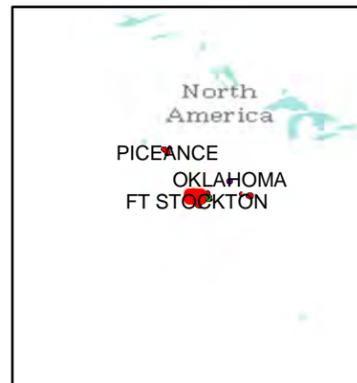


<b>SD 15 FED P419 Temporary Pit</b>	
G1: Aerial Imagery of Dissolution Features	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: ESRI
DATA SOURCE: Berg, 2012 and Bachman, 1973	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 7/27/2020

THE DOCUMENT HAS BEEN PREPARED IN THE INTEREST OF FACILITATING AND PRESENTING A VARIETY OF COMPLEX AND MULTI-SOURCE DATA, THE INFORMATION IS LIMITED AND NOT DEFINITIVE, IT IS SUBJECT TO CHANGE, AND FINAL PROJECT DECISIONS CANNOT BE BASED ON THE DATA IN THIS TOOL ALONE. CONSULT WITH LOCAL BIOLOGISTS FOR MORE LOCALIZED INFORMATION. ABSENCE OF A SPECIFIC SPECIES WITHIN THE MAP DOES NOT MEAN IT IS NOT PRESENT IN THE AREA.

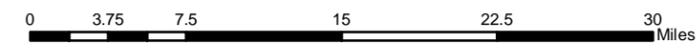


Center of Proposed Temporary Pit  
 -103.657266, 32.037891  
 Surface Elev. 3,160 ft



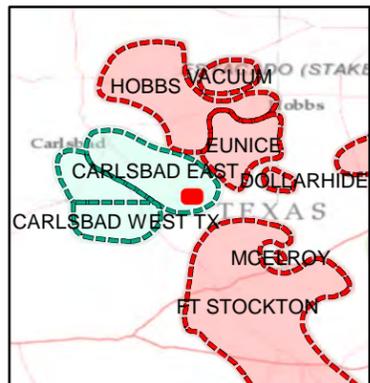
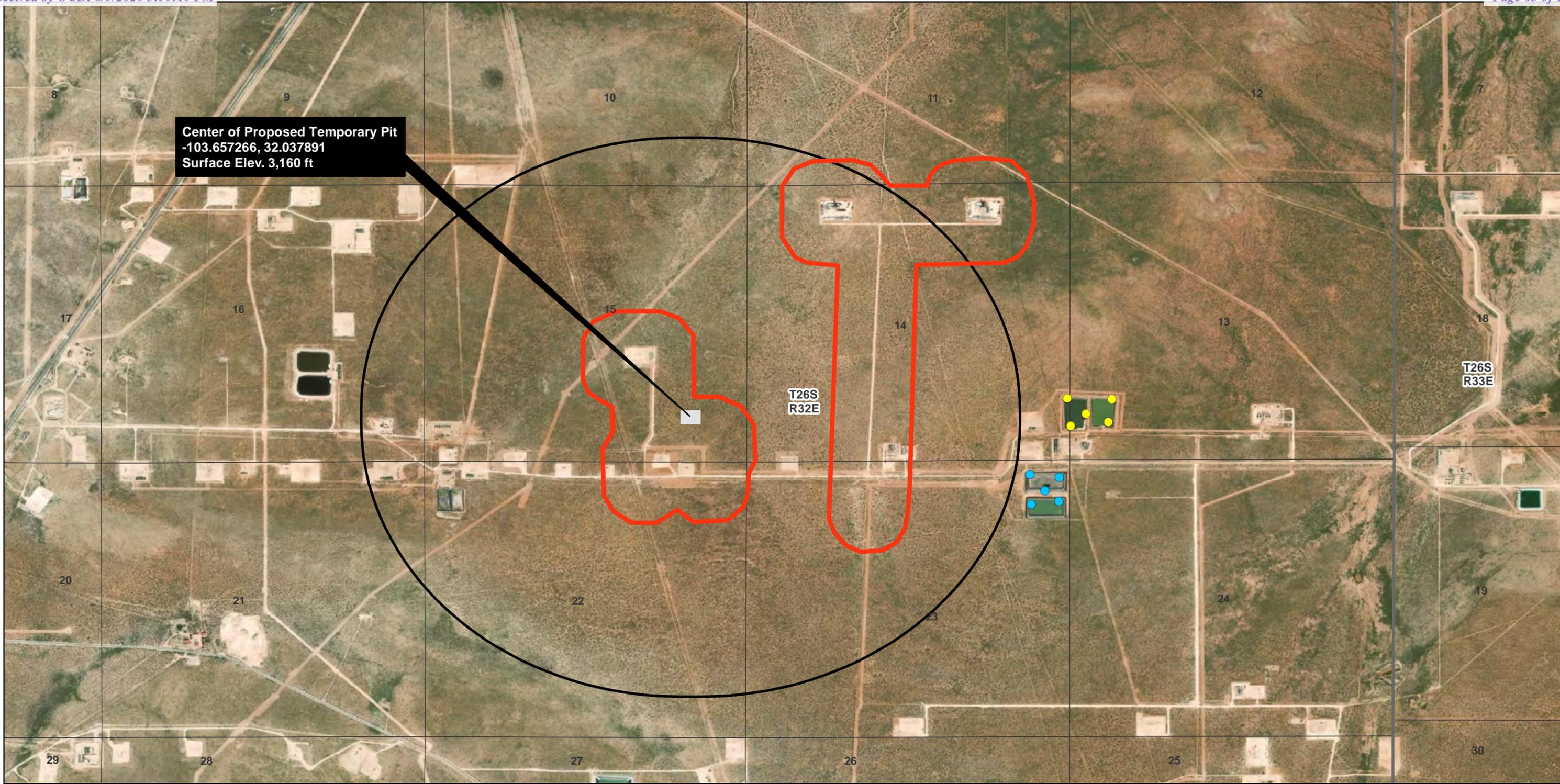
**LEGEND**

<b>NM Geology</b>	<b>TX Geology</b>	<b>5 mile buffer</b>	<b>TX Faults</b>
<all other values>	<all other values>		
eolian	evaporite		
medium-grained mixed clastic	sandstone		
alluvium	sand		
sandstone	gravel		
evaporite	limestone		



<b>SD 15 FED P419 Temporary Pit</b>	
Figure G2: Regional Geology and Fault Lines	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production</b> <b>Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: ESRI
DATA SOURCE: USGS	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 7/27/2020

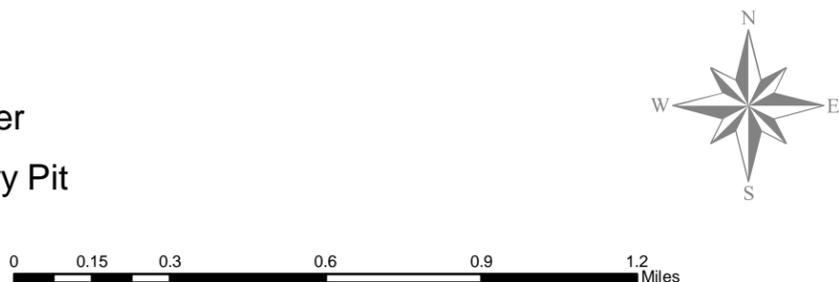
THE DOCUMENT HAS BEEN PREPARED IN THE INTEREST OF FACILITATING AND PRESENTING A VARIETY OF COMPLEX AND MULTI-SOURCE DATA, THE INFORMATION IS LIMITED AND NOT DEFINITIVE, IT IS SUBJECT TO CHANGE, AND FINAL PROJECT DECISIONS CANNOT BE BASED ON THE DATA IN THIS TOOL ALONE. CONSULT WITH LOCAL BIOLOGISTS FOR MORE LOCALIZED INFORMATION. ABSENCE OF A SPECIFIC SPECIES WITHIN THE MAP DOES NOT MEAN IT IS NOT PRESENT IN THE AREA.



LEGEND

### Legend

- Section 23 Boreholes (2016)
- Sec 13 Boreholes (2016)
- Arcadis Survey Area (2017-2018)
- 1 mi Buffer
- Temporary Pit



SD 15 FED P419 Temporary Pit	
Figure G3: Historical Survey Area	
STATE: NEW MEXICO COUNTY: LEA	
<b>Chevron North America Exploration &amp; Production Mid-Continent Business Unit</b> <small>CONSULT THE LAND DEPARTMENT REGARDING ANY CHEVRON LAND ASSETS</small>	
LAND GRID: TOBIN	IMAGERY: ESRI
DATA SOURCE: Arcadis, Tetra Tech	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT   DATE: 7/27/2020

THE DOCUMENT HAS BEEN PREPARED IN THE INTEREST OF FACILITATING AND PRESENTING A VARIETY OF COMPLEX AND MULTI-SOURCE DATA, THE INFORMATION IS LIMITED AND NOT DEFINITIVE, IT IS SUBJECT TO CHANGE, AND FINAL PROJECT DECISIONS CANNOT BE BASED ON THE DATA IN THIS TOOL ALONE. CONSULT WITH LOCAL BIOLOGISTS FOR MORE LOCALIZED INFORMATION. ABSENCE OF A SPECIFIC SPECIES WITHIN THE MAP DOES NOT MEAN IT IS NOT PRESENT IN THE AREA.

## References

Bachman, G.O. 1973. Surficial features and late Cenozoic history in southeastern New Mexico. United States Geological Survey Open-File Report USGS-4339-8.

Berg, W.R. 2012. Environmental geology assessment report for issues related to the proposed Ochoa Mine, Lea County, New Mexico. Prepared for the Bureau of Land Management, Carlsbad Field Office by AECOM, Fort Collins, CO.

Crowl, W.J., D.E. Hulse, T.A. Land, and D. Malhotra. 2011. NI 43-101 Technical report on the polyhalite resources and updated preliminary economic assessment of the Ochoa project, Lea County, southeast New Mexico. Prepared for IC Potash Corp. by Gustavson Associates.

Lucas, S.G., and O.J. Anderson. 1993. Stratigraphy of the Permian-Triassic boundary in southeastern New Mexico and west Texas *in* Carlsbad Region (New Mexico and West Texas), New Mexico Geological Society 44th Annual Fall Field Conference Guidebook, 357 p.

## **Attachments 1-4**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E

### Attachment 1

Arcadis Environmental Field Survey, Section 10, Karst Evaluation, Salado Draw (2018)

### Attachment 2

Tetra Tech Geotechnical Study Report, Salado Draw, Section 13 (2016)

### Attachment 3

Tetra Tech Geotechnical Study Report, Salado Draw, Section 23 (2016)

### Attachment 4

BLM EA DOI-BLM-NM-P020-2020-0198-EA, Section 3.4, Karst Resources (2019)

**Attachment 1 – Arcadis Environmental Field Survey for Salado Draw,  
Abbreviated to Karst Section (2018)**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E



Chevron U.S.A. Inc.

## ENVIRONMENTAL FIELD SURVEY

Salado Draw Development Area  
Pads 16-21, Maelstrom SWD

March 2018



ENVIRONMENTAL FIELD SURVEY

**ENVIRONMENTAL  
FIELD SURVEY**

Salado Draw Development Area  
Residue Line

Prepared for:

W. Mark Woodard  
Surface Land Representative  
Chevron U.S.A. Inc.  
6301 Deauville Boulevard  
Midland, Texas 79706

Prepared by:

Arcadis U.S., Inc.  
630 Plaza Drive  
Suite 100  
Highlands Ranch  
Colorado 80129  
Tel 720 344 3500  
Fax 720 344 3535

Our Ref.:

B0048822.0000

Date:

March 30, 2018

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## ENVIRONMENTAL FIELD SURVEY

## 10 KARST

The term karst describes distinct terranes that are attributable to the high solubility of underlying bedrock. Common features of such terranes include sinkholes and caves, which are formed as the bedrock is dissolved by groundwater. Karst aquifers represent saturated bedrock where dissolution processes have enhanced its permeability. Such aquifers can be important sources of potable groundwater.

The proposed project area lies near the northeast margin of the Delaware Basin. As discussed in further detail in Section 11.2, bedrock cropping out beneath the proposed project area consists of the Triassic-aged Dockum Group. Underlying the Dockum Group are the Dewey Lake redbeds. Both of these formations are composed chiefly of clastic (insoluble), non-karst-forming rocks. Beneath these formations are Permian-aged rocks of the Rustler and Salado Formations. These rocks contain significant beds of halite (i.e., rock salt) and anhydrite, making them susceptible to karst formation. The top of the Rustler Formation in the proposed project area is approximately 1,000 feet below the land surface (Crowl et al. 2011).

Despite the great depth to karst-forming rocks, a number of large depressions and “sinks” are noted in the area. Bell Lake Sink and three other unnamed sinks, each about two miles in diameter, occur approximately 15 miles north of the project area (Berg 2012). San Simon Swale, an approximately 18-mile long by 6-mile wide closed depression that terminates at San Simon Sink is located approximately 20 miles northeast of the project area (Bachman 1973, Berg 2012). Using Google Earth Imagery (dated 11/20/2015), the dimensions of San Simon Sink are approximately one mile long by one-half mile wide by 75 feet deep. These depressions formed by the dissolution of salt from the upper part of the Salado Formation as well as from the overlying Rustler Formation (Bachman 1973). Solution subsidence in San Simon Swale has been active within the past century; however, solution and subsidence in this area of southeastern New Mexico has been ongoing for millions of years (Bachman 1973). USGS topographic mapping of the area identifies a region encompassing approximately 10 square miles that is pockmarked with smaller closed depressions, typically 500 feet or less in diameter. This region lies about five miles northeast of the survey area. Arcadis found no information in the available geologic literature regarding the genesis of these depressions. Our review of topographic maps and Google Earth imagery for the survey area itself did not identify any closed depressions.

In summary, evidence of karst in the region consists predominantly of large depressions that likely formed over millions of years; although there is evidence that subsidence is ongoing, at least at San Simon Sink. These depressions were created by the dissolution of salt beds in the upper part of the Salado Formation and in the Rustler Formation, even though these are overlain by approximately 1,000 feet of insoluble rocks. No evidence of depressions in the survey area were identified on available topographic mapping or by examining recent Google Earth imagery.

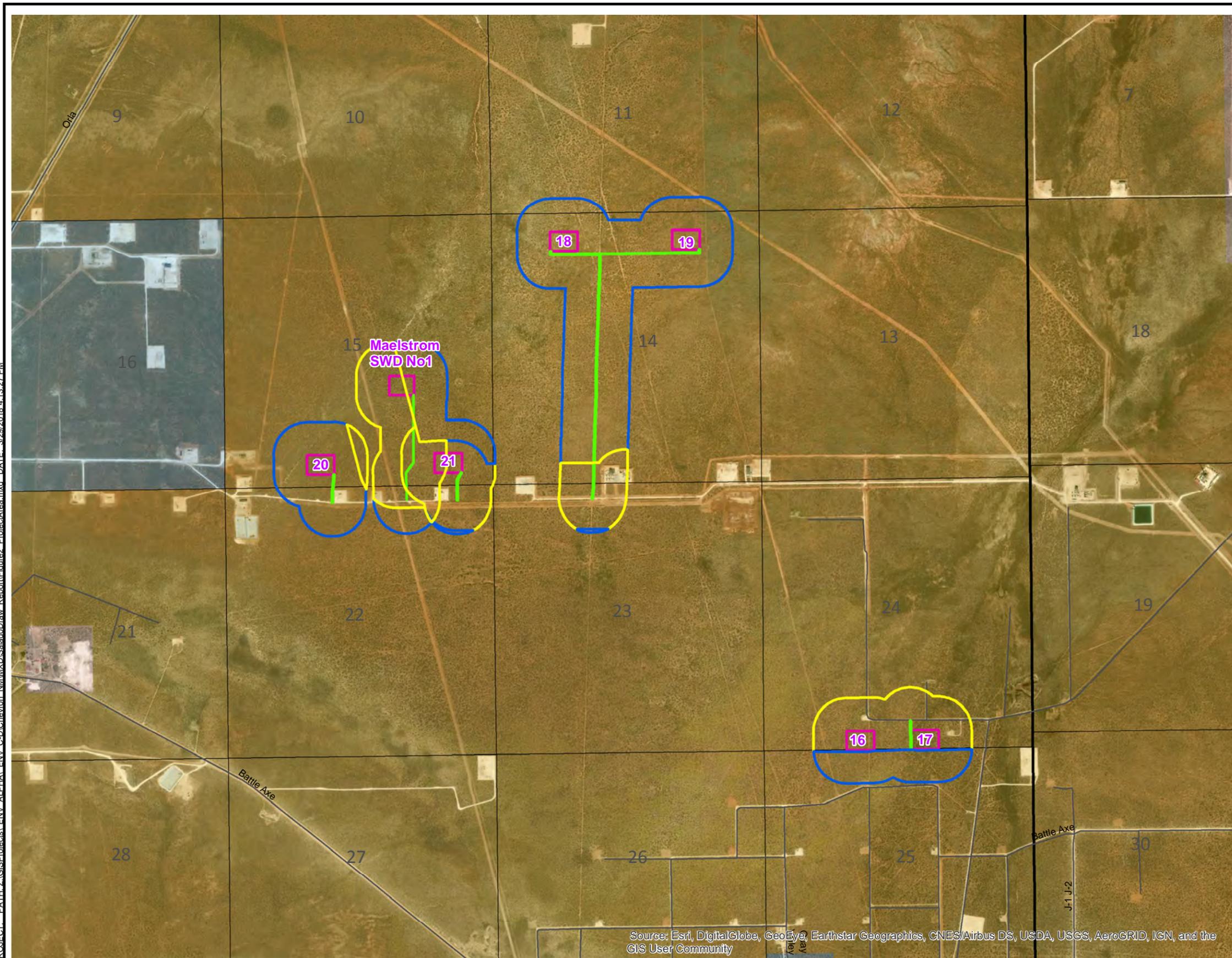
### 10.1 Survey Findings and Mitigation

Karst potential is mapped by the BLM as “medium” in the survey area (Figure 11). This is presumably due to the presence of large depressions in the region as described above. No closed depressions, caves, or fissures were identified during the environmental field survey. Limestone fragments and outcroppings were observed within the survey area along the access road to pads 18 and 19 (Figure 12). These

## ENVIRONMENTAL FIELD SURVEY

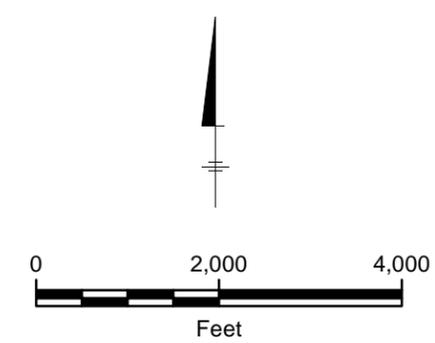
limestone observations occurred in a previously-disturbed linear ROW, approximately 12" below the surrounding grade. No limestone outcroppings or fragments were observed in non-disturbed, grade-level areas within the survey area. Based on our review of available geologic literature for the region, no significant beds of soluble rocks have been mapped in the Dockum Group. In the unlikely event that a void occurs during construction activities, all activities must stop immediately and the BLM should then be contacted within 24 hours to devise the best management plan to protect karst and human safety.

DIV/GRP: ENV/IMDV DB: adavis LD: PIC: PM: TM: PROJECT: PATH: Z:\GIS\Projects\ENV\_ALPHA\ENV\_C\DChevron\_NMMXD\SaladoDraw\_Report\Figure2\_ProjectArea.mxd DATE: 3/29/2018 4:13:27 PM



**LEGEND**

- Survey Area (March, 2018)
- Survey Area (September, 2017)
- Proposed Access Roads and ROW
- Proposed Pad
- Lea County Roads
- Townships
- Sections
- Surface Ownership**
- Bureau of Land Management
- Private
- State



CHEVRON U.S.A. INC.  
ENVIRONMENTAL FIELD SURVEYS  
SALADO DRAW DEVELOPMENT AREA  
LEA COUNTY, NEW MEXICO

**ENVIRONMENTAL FIELD SURVEY AREA**



FIGURE  
**2**

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

# APPENDIX A

## Resumes



## PERSONNEL RESUME



## KHUA MOUA

### SCIENTIST 2

#### EDUCATION

BS Wildlife Biology The University  
of Montana

#### YEARS OF EXPERIENCE

Total – 8 years

With Arcadis – 3 years

#### PROFESSIONAL REGISTRATIONS

None

#### PROFESSIONAL ASSOCIATIONS

None

#### CERTIFICATION

First/Aid/CPR

HAZWOPER 40hr

HAZWOPER 8hr Refresher

MSHA Surface

Safeland

Wetland Delineation Training

Chevron 101

Asbestos Awareness Training

Annual Medical Monitoring

**Ms. Moua** is a field biologist with over three years of experience in environmental field work with Arcadis. She has the following field skills; avian surveys, electrofishing, and radio-telemetry. She has also been exposed to: small mammal trapping, vegetation collocation, paint sampling, soil sampling, archaeological surveys, development of Draft Environmental Impac Statements, construction oversight for windfarm projects, permitting for windfarm projects, report writing, and data entry while with Arcadis. Prior to Arcadis, she has worked for the Bighorn Institute, a non-profit organization focusing their efforts on the Peninsular Bighorn Sheep. In addition, she has also done work with the Peace Corps and the USDA Forest Service. The diversity in her field work encompasses the passion she has for working with the environment.

### Project Experience with Arcadis

#### Ironwood & Cimarron II Wind Farm PCMM Surveys Duke Energy Power Services, Gray County, Kansas

Participated in two years of post-construction mortality monitoring, completed Ironwood in late winter 2015 and Cimarron II in early spring 2016. Prepared an annual report to Duke Energy detailing the results of the PCMM surveys. Conducted whooping crane surveys for spring and fall migrations and prepared a report for each season in which surveys were conducted. Reports addressed the diversity of bird migrants that passed through the project area.

#### 2014 Swisher Wildlife Surveys Exelon Corporation, Swisher, Texas

Conducted eagle use surveys at the Swisher Wind Farm project site during winter 2014 and prepared a report to Exelon. During spring 2015, conducted raptor nest surveys to document raptor nest presence in and near the project area.

#### Fieldwork Supporting Buffalo, Wyoming, Office Multiple Clients, Various Locations

Assisted with SPCC field surveys at three Enbridge Sites in North Dakota. Performed soil sampling at a Citation site in Chinook, Montana, due to a previous year's spill at the location. Performed an archaeological survey

PERSONNEL RESUME - Khua Moua

## Project Experience Continued

near Douglas, Wyoming, at a Cameco site. Conducted abandoned mine land surveys at five locations in the south and southwestern portions of Wyoming.

### **Confidential Client 06840 - 2015 Rasmussen Valley DEIS Confidential Client 06840, Soda Springs, Idaho**

Assisted with entering comments that were received from the Bureau of Land Management addressing the Rasmussen Valley Project's Draft EIS. Each comment was entered in the database, and sorted based on the issue it was addressing or referring to in the Draft EIS.

### **Bluestem Wind Farm Construction Oversight Exelon Corporation, Beaver County, Oklahoma**

Performed field monitoring, permitting and planning for the construction phase of the Bluestem Wind Farm project. Field visits were conducted as needed to address SPCC, SWPPP BMPs, environmental constraints, and changes requested by the construction contractors. Taking field notes and photos and preparing a summary memo of each visit to inform the client of construction progress, changes made, and issues or concerns addressed.

### **North and South Maybe Mines 2016 Fieldwork & 2017 Reporting Confidential Client 06840, Soda Springs, Idaho**

Participated in small mammal trapping on six to seven grids in the South and North Maybe Mines. Conducted avian point count surveys on adjacent mine sites. Entered field data in Excel upon completion of field surveys. Assisted with the reporting process for both mine sites.

### **DTSC/Exide Project Winter 2017 Confidential Client, Los Angeles, California**

Data entry and figure quality assurances were completed.

### **Tailing Facility Vegetation and Wildlife Studies Confidential Client (00701), Questa, New Mexico**

Conducted gopher mound field surveys in June 2016 and vegetation collocation field surveys in August 2016. Currently assisting in elk game camera installation task for elk absence presence survey at tailing facility.

### **System wide Tower Assessment Program 2016 and ongoing Confidential Client (01534), Various Locations, California**

Conducted paint sampling surveys on transmission towers from northern California to Bakersfield, CA. Currently supporting the remediation field effort.

## Project Experience Continued

### **TLRR Biological Surveys**

#### **Southern California Edison, Various Locations, Southern California**

Hiked along transmission lines and conducted biological surveys, which incorporated documenting sensitive wildlife with emphasis on Desert Tortoises and plant species. Also assisted with bio-monitoring for the soil boring phase.

### **Wetland Surveys**

#### **Owl Ridge, Winter Park, Colorado**

Assisted in wetland surveys in Winter Park, Colorado.

### **Groundwater Monitoring Reports - ongoing**

#### **Confidential Clients, Wyoming and Kansas**

Currently assisting with the reporting process of completed groundwater monitoring events for multiple sites located in Wyoming and Kansas on a semi-annual and yearly basis.

### **Southern Nevada Surveys - ongoing**

#### **Southwestern Gas, Southern Nevada**

Biological surveys were conducted along a proposed pipeline south of Las Vegas to Laughlin. Waters of the U.S. surveys were also conducted. Assisted with the Mojave Desert Tortoise Report and Biological Memo.

### **Wetland and Biological Survey**

#### **Kinder Morgan, Northern Colorado**

Conducted wetland and biological survey on a proposed expansion to an existing compression station in northern Colorado.

## Experience outside of Arcadis

### **Peninsular Bighorn Sheep Field Surveys**

#### **Bighorn Institute, Palm Desert, California**

Performed field surveys for a non-profit organization that focuses its research on the Peninsular desert bighorn and conducts a captive breeding and wild population augmentation program. Fieldwork incorporated tracking radio-collared endangered Peninsular Bighorn Sheep in the northern Santa Rosa Mountains (NSRM) and San Jacinto Mountains (SJM) by means of telemetry. Investigated sheep mortalities in the NSRM and SJM. Participated in the release of captive herd yearlings into the wild Peninsular bighorn sheep population of the NSRM and SJM. Contributed to a capture and re-collaring effort for non-functioning radio-collared sheep and radio-collaring wild sheep.

PERSONNEL RESUME - Khua Moua

## Project Experience Continued

### **Ecotourism Volunteer**

#### **Peace Corps - Environmental Sector, Trelawny,**

Stationed as a volunteer at Southern Trelawny Environmental Agency in Jamaica, working alongside local colleagues on ecotourism. Educated the local community about ecotourism and sustainability.

### **Seasonal Work**

#### **USDA Forest Service, Southwestern Montana,**

In summer 2001, worked in Wisdom, Montana, on surveys conducted in and around lake(s)/pond(s) to determine the presence or absence of amphibians in the water area in the Wisdom and Wise River Ranger District. Collected water samples and performed pH and conductivity tests on the water source. Performed stream surveys, culvert measurements and electro-shocking in summer 2002. Took culvert measurements to determine suitability of water flow during high and low flows. Conducted electro-shocking at streams to determine the presence or absence of west-slope cutthroat. Fought forest fires as a ground crew member. During summer 2003 in Darby, Montana, retrieved lynx pads and conducted goshawk calling to determine nesting locations. Conducted Flammulated Owl surveys in the evenings to document distribution in the area. Also, performed peregrine falcon surveys and bird banding. During summer 2004 in Butte, Montana, conducted fieldwork on streams that had potential west-slope cutthroat habitat. Performed electrofishing to determine the presence or absence of west-slope cutthroat in streams. Surveyed streams that contained west-slope cutthroat to determine habitat distribution and suitability. In addition to season work, assisted part-time at the USDA Forest Service Regional One office in Missoula, Montana, from fall 2001 to spring 2005.

## PERSONNEL RESUME



# LAUREN SWIERK



## EDUCATION

MS Environmental Science Indiana  
University-Bloomington 2015  
BS Environmental Science Indiana  
University-Bloomington 2014

## YEARS OF EXPERIENCE

Total – 2.5 years  
With ARCADIS – 2.5 years

## PROFESSIONAL TRAINING

OSHA 40-Hour HAZWOPER, 2015  
(Latest refresher - 2017)

MSHA, 2017

HAZMAT #1, 2017

First Aid/CPR/AED, 2016

OSHA 10-Hour Construction, 2016

OSHA Site Supervisor, 2015

Lauren Swierk has 2.5 years of professional experience. She has worked on a wide range of projects with focus on groundwater monitoring, groundwater remediation, biological field surveys and desktop flood analysis.

## Project Experience

### Biological Field Surveys

#### Various Oil & Gas Clients, New Mexico (2016- )

Worked with a team to complete biological field surveys for proper placement of well pads at various places in southern New Mexico.

### Groundwater Monitoring

#### General Electric, Greenville, SC (2016- )

Assist with the development of groundwater sampling plans, field coordination, sample tracking, and groundwater monitoring reports. Support with budget tracking, financial planning and invoicing.

### Groundwater Remediation

#### Pitch Reclamation Project (2015- )

Conduct phosphorus injections to remediate groundwater. Repair system and collect groundwater and surface water samples using Grundfos pump, bailer, or Hydrasleeve. Assist in report preparation and budget tracking.

### Environmental Monitoring

#### Chevron, Questa, NM (2015- )

Conduct O&M activities including: runoff data collection, groundwater sampling, Sonde & system repair and calibration. Assist with other tasks such as pump installation and wildlife studies. Aid in data analysis and report writing.

### Pipeline Crossing Analysis

#### Various Clients (2016- )

Work with HEC-SSP, FEMA flood data, and Google Earth to determine pipeline risk rankings based on scour, erosion and avulsion.

PERSONNEL RESUME - Lauren E Swierk

**Groundwater Monitoring**

**Marathon Petroleum, Bennett, CO (2015- )**

Assist in sample event planning, data analysis and report development. Compile reimbursement packages for Colorado Oil and Public Safety Tank Storage Fund.

**Annual Report Development**

**Agrium, Soda Springs, ID (2015- )**

Assist with many tasks related to the development of DSR and RIFFS reports including constituent trend charts, hydrograph data interpretation, table generation and report QC.

**SPCC Plan Development**

**Enbridge Energy Partners, L.P., Buffalo, Wyoming (2016)**

Worked with a team to develop Spill Prevention, Control and Countermeasures plans for multiple locations in the Chicago region.

**CalRecycle Wildfires**

**California Environmental Protection Agency, Lake County, California (2015)**

Supported restoration of wildfires in northern California. Tasks included site assessments, communication of potential hazards and property owner requests to debris removal crews, and organization of documentation. Served as the on-site safety officer.

**Emergency Release Response**

**Confidential Client, Midland, Texas (2015)**

Worked with the community to improve water quality by sampling groundwater and installing filtration systems. Organized documentation and helped provide information to inform residents of water quality.

**Attachment 2 – Tetra Tech Geotechnical Study Report, Salado Draw,  
Section 13 (2016)**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E



**TETRA TECH**

**Report of Geotechnical Study  
Salado Draw, Section 13 - Water Recycling  
Ponds**

**Lea County, New Mexico**

**November 29, 2016**

complex world

**CLEAR SOLUTIONS™**

# Report of Geotechnical Study Proposed Salado Draw, Section 13 – Water Recycling Ponds

Lea County  
Near Jal, New Mexico

Prepared for:  
**Mr. Russell Dotson**  
**Chevron North America Exploration and Production  
Company**  
15 Smith Road, Midland, Texas  
Phone: (432) 687-7796

Prepared by:  
**Tetra Tech**  
4000 North Big Spring Street, Suite 401  
Midland, Texas 79705  
Phone (432) 682-4559; Fax (432) 682-3946  
**Texas Registered Engineering Firm 3924**

Tetra Tech Project No. 212C-DS-00649

  
Rajendra Meruva, P.E.  
Senior Geotechnical Engineer



November 29, 2016

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Appendix A Exploratory Boring Logs

## EXECUTIVE SUMMARY

Chevron North America Exploration and Production Company has proposed water recycling ponds (frac pond) at the Salado Draw area located in Lea County, New Mexico. The frac ponds will have a combined storage capacity of approximately 700,000 to 800,000 barrels (bbls) and will service the well drilling operations. We understand the frac ponds are to be constructed with double liner and a leak detection system. The bottom of the pond will be sloped and equipped with a liner leak detection sump. The purposes of this study were to obtain information on subsurface conditions, perform laboratory testing and analysis, and to provide geotechnical design criteria for the excavation of the proposed pond. The general site location is shown on the Site Location Map, Figure 1.

Tetra Tech mobilized to the site on October 26, 2016 with a track-mounted drilling rig to drill five (5) exploratory soil borings, B-1 through B-5, at this site to identify subsurface conditions. The boring locations had been marked in the field by Chevron personnel, and the locations were cleared for drilling by New Mexico Utility Locate. Boring B-1 was drilled to a depth of 80 feet below the existing ground surface to identify presence of groundwater. Borings, B-2 through B-5, were terminated at a depth of approximately 25 feet below the existing ground surface due to auger refusal. Approximate locations of the borings are shown on the Soil Test Boring Location Plan, Figure 2.

The borings indicated the subsurface conditions consisted of very loose to loose sand with clay. This stratum was encountered from the ground surface and extended to depths ranging from approximately 1½ feet to 3½ feet below existing ground surface. Standard Penetration Test (SPT) N-values within this stratum ranged from 1 blow per foot (bpf) to 9 bpf. The second stratum consisted of medium dense to very dense silty sand. This stratum was encountered below Stratum 1 at depths ranging from approximately 1½ feet to 3½ feet below existing ground surface and extended to the borings termination depth of 80 feet in B-1 and 25 feet in B-2 through B-5. Standard Penetration Test (SPT) N-values within this stratum ranged from 14 blows per foot (bpf) to greater than 100 bpf. No groundwater was encountered at the time of drilling. The borings were dry 24 hours after drilling.

In general, the subsurface soils consist primarily of dense to very dense sands within the depths of the proposed excavation. Borings indicate excavations at this site beyond a depth of approximately 1½ feet to 3 feet below the existing grade will be difficult and will require some heavy rock cutting equipment. Although the subsurface conditions are very dense, when disturbed, this type of material has a tendency to cave-in, especially in a dry state. During excavation, the excavation slopes, embankment interior and exterior slopes, should be constructed with 3H:1V, with soil compacted to at least 95 percent of the maximum dry density as determined by ASTM D 1557, modified Proctor to at least 3 percent above the optimum moisture content. Wetting of the exposed excavated sides may also be necessary to keep the slopes from failure during construction. Detailed discussions and recommendations are provided in the following sections of this report.

We have prepared this executive summary solely to provide a general overview, and it should not be used for any purpose except that for which it was intended. Carefully review the entire report in detail for information about our findings, recommendations and other concerns related to geotechnical conditions for the site.

## 1.0 PURPOSE AND SCOPE OF STUDY

The purpose of this investigation was to characterize the subsurface soils at the site for the proposed frac ponds and to provide excavation recommendations.



<b>Legend</b>  Exploratory Boring Location	CHEVRON	DWG BY: DH
 <b>TETRA TECH</b> <small>Texas Registered Engineering Firm P-3924</small>	SITE LOCATION MAP SALADO DRAW SECTION 13-FRAC PONDS LEE COUNTY, NEW MEXICO	CK BY: RM
		APP BY:
		DATE: 11/03/16
PROJECT NO: 212C-MD-00649	FIGURE 2	REV. 10

## 2.0 SITE CONDITIONS

The site for the proposed frac pond(s) is located near unnamed oil-field lease roads south of NM Highway 128 in Lea County, approximately 27 miles west of Jal, New Mexico, at GPS coordinates 32.03741N and 103.63703W.

Based on visual observations, the site was wooded and appeared to be relatively flat. The survey indicates a 2% grade from north to south. The upper two feet of the ground surface was covered with windblown cover sand and was very loose. This made access to site very difficult with standard truck mounted drilling rig. Active flow lines crossed the site that delayed vehicles from accessing the site.

### **3.0 PROPOSED DEVELOPMENT**

Based on the information provided by Chevron, the proposed development will consist of water recycling ponds (frac ponds) to service the well drilling operations. The frac ponds will have a combined storage capacity of approximately 700,000 to 800,000 barrels (bbls) and will be mostly below ground. The ponds will be double lined and equipped with a leak detection system. The bottom of the ponds will be sloped and a liquid leak detection sump will be installed.

## 4.0 GEOLOGIC CONDITIONS

The Hobbs Sheet of the Geologic Atlas of Texas locates the project site within sand, silt, and clay deposits (Windblown sand, alluvium, playa, and fluvial terrace deposits, Qcs, Qp,) underlain by Blackwater Draw (Qbd) Formation consisting of caliche. The caliche and windblown deposits consist of sand and silt in sheets and may sometimes be associated with playa deposits that are generally associated with organics. The windblown cover sands are fine to medium grained, silty, calcareous, and include caliche nodules. Generally, these deposits are 20 to 50 feet thick. The caliche is a conglomerate of various materials such as clay, silt, sand, and gravel that included precipitated calcium carbonate. Often, the calcium carbonate cements the soil grains together. The level of cementation can vary and can be highly cemented to weakly cemented. These deposits can often be soft or loose, especially in the presence of groundwater. Our findings of the exploration are consistent with this within the depths explored.

## **5.0 FIELD EXPLORATION**

### **5.1 Exploratory Soil Borings**

Tetra Tech mobilized to the site on October 26, 2016 with a track-mounted drilling rig to drill five (5) exploratory soil borings, B-1 through B-5 within the footprint of the proposed pond to identify subsurface conditions. A combination of hollow stem auger (HAS) and air-rotary drilling techniques were used to drill the borings. The boring locations had been marked in the field by Chevron personnel. The boring locations had been marked in the field by Chevron personnel, and the locations were cleared for drilling by New Mexico Utility Locate. Boring B-1 was drilled to a depth of 80 feet below the existing ground surface to identify presence of groundwater. Borings, B-2 through B-5, were terminated at a depth of approximately 25 feet below the existing ground surface due to auger refusal. Approximate locations of the borings are shown on the Soil Test Boring Location Plan, Figure 2.

## 6.0 SUBSURFACE CONDITIONS

The borings indicated the subsurface conditions consisted of very loose to loose sand with clay. This stratum was encountered from the ground surface and extended to depths ranging from approximately 1½ feet to 3½ feet below existing ground surface. Standard Penetration Test (SPT) N-values within this stratum ranged from 1 blow per foot (bpf) to 9 bpf. The second stratum consisted of medium dense to very dense silty sand. This stratum was encountered below Stratum 1 at depths ranging from approximately 1½ feet to 3½ feet below existing ground surface and extended to the borings termination depth of 80 feet in B-1 and 25 feet in B-2 through B-5. Standard Penetration Test (SPT) N-values within this stratum ranged from 14 blows per foot (bpf) to greater than 100 bpf.

Groundwater was not encountered at the time of drilling. The borings were dry 24 hours after drilling. It should be noted that a detailed groundwater study was beyond the scope of our current investigation. Our observations are only indicative of conditions at the time and boring locations indicated. Groundwater levels can vary due to many factors, including seasonal changes, site topography, surface runoff, post development conditions, the layering and permeability of subsurface strata, water levels in waterways, utilities, and other factors that may not have been evident at the time this study. Long-term observations would be necessary to more accurately evaluate the groundwater behavior and fluctuations.

## **7.0 ENGINEERING ANALYSES AND RECOMMENDATIONS**

### **7.1 Primary Geotechnical Considerations**

Based on the type of proposed development at this site, the primary concern that would preclude the proposed development is the presence of dense to very dense silty sand within the proposed depths of excavation. Excavation in this type of material will be difficult, especially when dry, the excavation sides will tend to cave in.

In our opinion, these constraints can be mitigated by proper engineering design and careful construction of the embankment in accordance with the recommendations below.

### **7.2 Site Preparation**

The construction footprint should be stripped of vegetation, roots, organic material, existing construction materials, debris, and other unsuitable materials. Obstructions that could hinder preparation of the site should also be removed, with special attention given to unknown or un-documented below ground appurtenances and the existing above and below ground flow lines. A typical stripping depth is approximately 6 inches; however, the actual depth will vary and should be based on field observations. After stripping, the widely spaced borings indicate a moderately stable surface for support of construction equipment using tracks. Rubber-tired equipment will potentially get stuck. Unsuitable areas (such as those with loose, wet, soft, yielding, and/or pumping subgrade) should be corrected before construction proceeds. We recommend the stripping and site preparation extend to at least 5 feet beyond the planned construction footprint.

Care should be taken not to damage the existing buried utilities located within the footprint of the proposed construction. Buried utilities in conflict with the proposed development should be relocated appropriately. The resulting utility trenches/excavations should be backfilled as discussed in the Fill Placement and Compaction section of this report.

### **7.3 Excavation**

Based on the data from the borings, dense to very dense sands are present beneath the thin layer of windblown loose sand. These soils will be difficult to excavate beyond depths of approximately 1½ to 3 feet below the existing grade, especially with the presence of limestone fragments. Some heavy duty rock cutting equipment will be necessary. In addition to difficult to excavate material, caving potential should be anticipated due to the presence of limestone rocks and the dry nature of the material. The general contractor should review the subsurface conditions and appropriately select excavation equipment and initial slope of the excavation to minimize cave-in. Wetting of the exposed excavation sides may be necessary to stabilize the slopes during construction.

### **7.4 Liner Protection**

The existing liner will be removed and replaced with new liner, double lined. Any rock protrusions will potentially damage the liner. The subsurface conditions at this site indicate silty fine to medium grained sand with limestone fragments; thus increasing the need for geotextile and a cushioning layer to prevent damage to the liner.

## 7.5 Fill Placement and Compaction

The proposed frac ponds will be constructed to balance cut and fill depths. Due to the presence of very dense sand and potential difficulty to excavate, significant fill placement and compaction is anticipated at this site. A loss of 15 to 20 percent in volume of the on-site soils should be anticipated.

The on-site soils, free of organics and debris, are suitable for use as structural fill or backfill. Fill and backfill should not be placed on organics or other deleterious materials, and should be moisture-conditioned to +3 percent of optimum moisture content. If additional fill is needed for the construction of the embankment, the imported fill should be a well-graded aggregate base course, or imported soils with engineering properties that are similar to on-site soils (depending on the intended use of the fill). For structural support, a uniform, granular material having 100 percent passing the 1 inch sieve, 30 to 70 percent passing the No. 4 sieve, and 3 to 15 percent passing the number 200 sieve is recommended. For on-site and imported fill and backfill, moisture should be adjusted and the soils thoroughly mixed prior to placement and compaction to provide uniform water content throughout the fill. Fill and backfill should be placed in uniform lifts of 8 inches loose thickness or less. Backfill should be compacted to at least 95 percent of modified Proctor maximum dry density (ASTM D 1557).

Prior to placement and compaction, the moisture content should be brought to at least 3 percent above the optimum moisture content. Fill should be compacted using heavy vibratory equipment. In areas with limited space for heavy equipment, appropriate compacting equipment such as a jumping jack or other hand tools should be used. Where smaller compacting equipment or hand tools are used, the fill lifts should be 6 to 8 inches loose thickness. The contractor should select the equipment type based upon the situation. Each lift should be tested by proof rolling using a loaded water truck or loaded dump truck to confirm it has the specified moisture and compaction. Each vertical foot of compacted fill placed should be tested for compaction. A minimum of one moisture/density verification test should be performed for every 5,000-square-feet of compacted area, or for every 150-lineal feet of utility trench backfill. For smaller areas, a minimum of 3 verification tests should be provided for every lift. Subsequent lifts should not be placed until the exposed lift has been tested to confirm the specified moisture and density. Lifts failing to meet the moisture and density requirements should be reworked to meet the required specifications.

The specified moisture content must be maintained until compaction of the overlying lift, or until the cushioning sand layer or geotextile fabric and liner are installed. Failure to maintain the specified moisture content could result in excessive soil movement resulting in embankment failure. The contractor must provide some means of controlling the moisture content (such as water hoses, water trucks, etc.). Maintaining subgrade moisture is always critical, but will require the most effort during warm, windy and/or sunny conditions. Density and moisture verification testing is recommended to provide some indication that adequate earthwork is being performed. However, the quality of the fill and compaction is the sole responsibility of the contractor. Satisfactory verification testing is not a guarantee of the quality of the contractor's earthwork operations.

## 7.6 Proof Rolling

Following fill placement, compaction, and testing, we recommend the embankments be proof rolled every two feet or for every four lifts of fill placed. Proof rolling should be used to detect areas of soft and/or pumping soil and should be based upon NMDOT Standard Specification. Proof rolling should be conducted using a heavy, rubber-tired vehicle weighing at least 25 tons,

with the tires inflated to the manufacturer's specified operating pressure. The entire area should be proof rolled, with each succeeding pass offset by not greater than one tire width. The geotechnical engineer should be present during proof rolling activities to assist with the identification of unsuitable soil. Unsuitable soil should be undercut and reworked, or otherwise improved in a manner that is suitable to the geotechnical engineer.

## 7.7 Excavation and Embankment Slopes

Using the limited data from the soil borings, we analyzed the soil types based on potential depth of excavation and embankment height. For soil design parameters, an angle of internal friction of 30 degrees is recommended with a compacted/improved subgrade soil unit weight of 115 psf.

According to the OSHA, the on-site soil type is classified as Type C with a recommended exterior and interior slope of 3H:1V. This should provide a factor of safety of 1.5.

Analysis of the embankment was conducted according to Natural Resources Conservation Service (NRCS) TR-60 (NRCS TR-60, 2005) criteria governing the design and construction of earth dams and reservoirs. This reference recommends the minimum factors of safety under given conditions as shown in Table 1. The most stringent (highest) minimum factor of safety was used as a design guideline. The horizontal acceleration used for the pseudo-static analysis was 0.20g, which corresponds to Peak Ground Acceleration (PGA) with a two percent probability of exceedance in 50 years for this site, according to the U.S. Geologic Survey (USGS) 2010 Earthquake Hazards Program Seismic Hazard Maps (USGS, 2010).

**Table 1. Minimum Safety Factors for Slope Stability Analyses**

Design Condition	Minimum Factor of Safety (NRCS TR-60, 2005)
End-of-construction	1.4
Rapid drawdown	1.1
Steady seepage, static loading	1.5
Steady seepage, pseudo-static loading	1.1

## 7.8 Freeboard

An important aspect of embankment stability and performance is maintaining the appropriate freeboard (the vertical distance from the water surface to the crest of the embankment). If the freeboard is insufficient, the embankment could overtop, leading to excessive erosion and possible failure. New Mexico (NMOCD) regulations require a minimum freeboard of three feet for the proposed ponds (or "permanent pits"). This minimum freeboard requirement must be maintained at all times.

## 7.9 Settlement of Embankment Materials

Settlement of embankment material is an important aspect of embankment stability and total fluid storage potential over time. It is anticipated that the embankment will be constructed of fill consisting of on-site material and imported fill. The on-site soils are non-expansive soils, consisting primarily of sand with silt. These soils have a low potential for settlement. Potential settlement of the embankment can be reduced by implementing good construction practices. Fill

placement and compaction should be as discussed in Section 7.5: Fill Placement and Compaction.

### **7.10 Permitting and Closure**

If applicable, a permit application should be filed with the NMOCD in accordance with NMOCD regulations prior to construction. Construction and installation in accordance with NMOCD regulations and the design drawings and construction specifications is recommended. The NMOCD may require notification prior to construction and prior to operation of a water recycling pond (pit).

## 8.0 CONCLUSIONS

Geotechnical and civil engineering investigations indicate the proposed frac ponds can be constructed in accordance with NMOCD regulations, as described herein. The design and investigation were based on the five (5) soil borings.

Construction should be conducted in accordance with NMOCD regulations, the engineering drawings and specifications prepared by Tetra Tech, and this report. We believe this investigation was conducted in a manner consistent with generally accepted geotechnical and civil engineering principles and according to methods normally used in the vicinity of the project at this time. No warranty is made, express or implied. Should additional information become available that could alter the analyses, conclusions, or recommendations in this report, Tetra Tech should be contacted to review the design documents in the light of that information to determine if revisions are needed.

## 9.0 REFERENCES

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## 10.0 LIMITATIONS

This report was prepared from data developed during our field exploration, laboratory testing, and engineering analysis. Calculations and design recommendations were based on subsurface data, laboratory testing, and our experience with similar projects. Our borings were spaced to obtain a reasonable interpretation of subsurface conditions. Variations in the subsoils not indicated in our borings are likely.

A qualified geotechnical engineer or their designated representative should observe the construction to look for evidence that would indicate differences in subsurface conditions from those described in this report. If any information becomes available that would alter our assumptions or our calculations, the opinions presented in this report should be considered invalid until we have been contacted to review our recommendations based on new information. The geotechnical engineer should review plans and specifications during the design. If applicable, placement and compaction of engineered fill, backfill, subgrade and other fills should be observed and tested by a representative of a Construction Materials Testing (CMT) firm during construction, and Tetra Tech should be retained to review these data.

We believe this study was conducted in a manner consistent with that level of skill and care ordinarily used by members of the profession currently practicing under similar conditions in the locality of this project. No warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or in the analysis of the planned project from the geotechnical point of view, please contact us.

As mentioned previously, field observations, monitoring, and quality assurance testing during foundation installation are an extension of the geotechnical design. We recommend that you retain these services and that we be allowed to continue our involvement in the project through the phases of construction.

## **APPENDIX A EXPLORATORY BORING LOGS**



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-1**  
 PAGE 1 OF 2

CLIENT Chevron PROJECT NAME Salado Draw Section 13 Frac Pond  
 PROJECT NUMBER 212C-MD-00649 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: **10/26/2016** GROUND ELEVATION: **N/A** METHOD: **HSA/Air Rotary**  
 CONSULTANT: **Tetra Tech, Inc.** LATITUDE: **32.038060N** LOGGED BY: **James Kennedy**  
 DRILLING CONTRACTOR: **Yellow Jacket** LONGITUDE: **103.636220W** DRILLED BY: **Jason**  
 Notes: **No groundwater encountered**

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					
	SS	1		Very Loose, Brown, Fine to Medium Grained <b>SAND</b> with Silt, Dry, with some roots	
	SS	8			
3.5					Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained <b>SAND</b> , Calcareous, with Limestone Fragments, Dry
	SS	41			
5					
	SS	50/5"			
10	SS	50/1"			
15	SS	50/2"			
20	SS	50/2"			
25	SS	50/2"			
30	SS	50/3"			
35	SS	50/1"			
40	SS	50/1"			

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16

(Continued Next Page)



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-1**  
 PAGE 2 OF 2

CLIENT Chevron PROJECT NAME Salado Draw Section 13 Frac Pond  
 PROJECT NUMBER 212C-MD-00649 PROJECT LOCATION Lea County, New Mexico

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
40				
45				
50	SS	50/0"		Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained <b>SAND</b> , Calcareous, with Limestone Fragments, Dry ( <i>continued</i> )
55				
60				
65				
70				
75				
80				
			80.0	Borehole terminated at 80.0 feet.

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-2**  
 PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Section 13 Frac Pond  
 PROJECT NUMBER 212C-MD-00649 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: **10/26/2016** GROUND ELEVATION: **N/A** METHOD: **HSA/Air Rotary**  
 CONSULTANT: **Tetra Tech, Inc.** LATITUDE: **32.038880N** LOGGED BY: **James Kennedy**  
 DRILLING CONTRACTOR: **Yellow Jacket** LONGITUDE: **103.637220W** DRILLED BY: **Jason**  
 Notes: **No groundwater encountered**

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
	SS	8		Very Loose, Brown, Fine to Medium Grained <b>SAND</b> with Silt, Dry, with some roots
	SS	52		1.5
5	SS	36		
	SS	48		
10	SS	50/1"		
	SS	50/2"		
15				
	SS	50/1"		
20				
	SS	50/2"		
25				25.0
				Borehole terminated at 25.0 feet due to refusal.

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-3**  
 PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Section 13 Frac Pond  
 PROJECT NUMBER 212C-MD-00649 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: **10/26/2016** GROUND ELEVATION: **N/A** METHOD: **HSA/Air Rotary**  
 CONSULTANT: **Tetra Tech, Inc.** LATITUDE: **32.038840N** LOGGED BY: **James Kennedy**  
 DRILLING CONTRACTOR: **Yellow Jacket** LONGITUDE: **103.634830W** DRILLED BY: **Jason**  
 Notes: **No groundwater encountered**

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
1.5	SS	9		Very Loose, Brown, Fine to Medium Grained <b>SAND</b> with Silt, Dry, with some roots
	SS	14		Medium Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained <b>SAND</b> , Calcareous, with Limestone Fragments, Dry
5	SS	44		
	SS	34		
10	SS	50/5"		
15	SS	50/1"		
20	SS	50/3"		
25	SS	50/1"		
				Borehole terminated at 25.0 feet due to refusal.

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-4**  
 PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Section 13 Frac Pond  
 PROJECT NUMBER 212C-MD-00649 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: **10/26/2016** GROUND ELEVATION: **N/A** METHOD: **HSA/Air Rotary**  
 CONSULTANT: **Tetra Tech, Inc.** LATITUDE: **31.037490N** LOGGED BY: **James Kennedy**  
 DRILLING CONTRACTOR: **Yellow Jacket** LONGITUDE: **103.639800W** DRILLED BY: **Jason**  
 Notes: **No groundwater encountered**

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
	SS	9		Very Loose, Brown, Fine to Medium Grained <b>SAND</b> with Silt, Dry, with some roots
	SS	44		1.5
	SS	40		Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained <b>SAND</b> , Calcareous, with Limestone Fragments, Dry
5	SS			
	SS			
	SS	50/2"		
10				
	SS	50/4"		
15				
	SS	50/1"		
20				
	SS	50/1"		
25				25.0
				Borehole terminated at 25.0 feet due to refusal.

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-5**  
 PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Section 13 Frac Pond  
 PROJECT NUMBER 212C-MD-00649 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: **10/26/2016** GROUND ELEVATION: **N/A** METHOD: **HSA/Air Rotary**  
 CONSULTANT: **Tetra Tech, Inc.** LATITUDE: **32.037410N** LOGGED BY: **James Kennedy**  
 DRILLING CONTRACTOR: **Yellow Jacket** LONGITUDE: **103.637030W** DRILLED BY: **Jason**  
 Notes: **No groundwater encountered**

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
1.5	SS	4		Very Loose, Brown, Fine to Medium Grained <b>SAND</b> with Silt, Dry, with some roots
5	SS	50		Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained <b>SAND</b> , Calcareous, with Limestone Fragments, Dry
	SS	32		
	SS	37		
10	SS	40		
15	SS	78		
20	SS	50/0"		
25	SS	50/2"		25.0
				Borehole terminated at 25.0 feet due to refusal.

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16

**Attachment 3 – Tetra Tech Geotechnical Study Report, Salado Draw,  
Section 23 (2016)**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

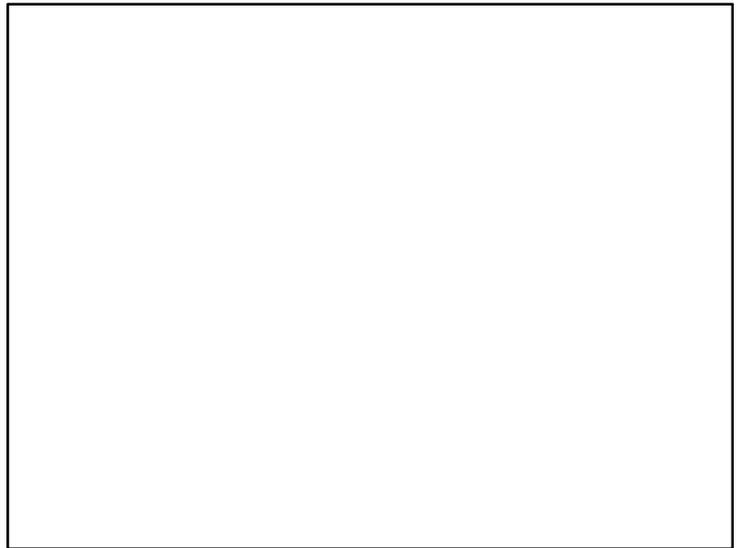
Section 15, T26S, R32E



**TETRA TECH**

**Report of Geotechnical Study  
Salado Draw, Section 23 - Water Recycling  
Ponds**

**Lea County, New Mexico**



**September 15, 2015**

complex world

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# Report of Geotechnical Study Proposed Salado Draw, Section 23 – Water Recycling Ponds

Lea County  
Near Jal, New Mexico

Prepared for:  
**Mr. Russell Dotson**  
**Chevron North America Exploration and Production  
Company**  
15 Smith Road, Midland, Texas  
Phone: (432) 687-7796

Prepared by:  
**Tetra Tech**  
4000 North Big Spring Street, Suite 401  
Midland, Texas 79705  
Phone (432) 682-4559; Fax (432) 682-3946  
**Texas Registered Engineering Firm 3924**

Tetra Tech Project No. 212C-DS-00546

  
Rajendra Meruva, P.E.  
Senior Geotechnical Engineer



September 15, 2016

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Appendix A Exploratory Boring Logs

## EXECUTIVE SUMMARY

Chevron North America Exploration and Production Company has proposed water recycling ponds (frac pond) at the Salado Draw area located in Lea County, New Mexico. The frac ponds will have a combined storage capacity of approximately 700,000 barrels (bbls) and will service the well drilling operations. We understand the frac ponds are to be constructed with double liner and a leak detection system. The bottom of the pond will be sloped and equipped with a liner leak detection sump. The purposes of this study were to obtain information on subsurface conditions, perform laboratory testing and analysis, and to provide geotechnical design criteria for the excavation of the proposed pond and foundations to support proposed pump structures. The general site location is shown on the Site Location Map, Figure 1.

After the first two attempts by Tetra Tech (June 6, 2016 and July 19, 2016) to access the site with the truck mounted drilling rig, Chevron contracted an independent driller with a track mounted drilling rig contractor on July 26, 2016 to drill the borings.

Based on the boring logs provided by Chevron, on July 26, 2016, five (5) exploratory soil borings, B-1 through B-5, were drilled by others at the site to identify subsurface conditions. The boring locations had been marked in the field by Chevron personnel, and the locations were cleared for drilling by New Mexico Utility Locate. The borings, B-1, and B-3 through B-5, were terminated at a depth of approximately 35 feet below the existing ground surface. Boring B-2 was terminated at a depth of approximately 20 feet below the existing ground surface. Approximate locations of the borings are shown on the Soil Test Boring Location Plan, Figure 2.

The borings indicated the subsurface conditions consisted of loose to very dense sand with varying contents of silt and clay. This stratum was encountered from the ground surface and extended to the boring termination depths of 20 and 35 feet below existing ground surface. Standard Penetration Test (SPT) N-values within this stratum ranged from 8 blows per foot (bpf) to greater than 100 bpf. The borings were dry at time of drilling.

In general, the subsurface soils consist primarily of loose to dense sands within the depths of the proposed excavation. Excavation at this site can be achieved with nominal effort. When disturbed, this type of material has a tendency to cave-in, especially in a dry state. During excavation, the excavation slope and embankment interior and exterior slopes should be constructed with 3H:1V, with soil compacted to at least 95 percent of the maximum dry density as determined by ASTM D 698, standard Proctor to at least 2 percent above the optimum moisture content. Detailed discussions and recommendations are provided in the following sections of this report.

We have prepared this executive summary solely to provide a general overview, and it should not be used for any purpose except that for which it was intended. Carefully review the entire report in detail for information about our findings, recommendations and other concerns related to geotechnical conditions for the site.

## 1.0 PURPOSE AND SCOPE OF STUDY

The purpose of this investigation was to characterize the subsurface soils at the site for the proposed frac ponds and to provide excavation recommendations.

## 2.0 SITE CONDITIONS

The site for the proposed frac pond(s) is located near unnamed oil-field lease roads south of NM Highway 128 in Lea County, approximately 27 miles west of Jal, New Mexico.

Based on visual observations, the site was moderately wooded and appeared to be relatively flat. The upper two feet of the ground surface was covered with windblown cover sand and was very loose. This made access to site very difficult with standard truck mounted drilling rig. Active flow lines crossed the site that prevented vehicles from accessing the site.

### **3.0 PROPOSED DEVELOPMENT**

Based on the information provided by Chevron, the proposed development will consist of water recycling ponds (frac ponds) to service the well drilling operations. The frac ponds will have a storage capacity of approximately 700,000 barrels (bbls) and will be mostly below ground. The ponds will be double lined and equipped with a leak detection system. The bottom of the pond will be sloped and a liquid leak detection sump will be installed.

## 4.0 GEOLOGIC CONDITIONS

The Hobbs Sheet of the Geologic Atlas of Texas locates the project site within sand, silt, and clay deposits (Windblown sand, alluvium, playa, and fluvial terrace deposits, Qcs, Qp,) underlain by Blackwater Draw (Qbd) Formation consisting of caliche. The caliche and windblown deposits consist of sand and silt in sheets and may sometimes be associated with playa deposits that are generally associated with organics. The windblown cover sands are fine to medium grained, silty, calcareous, and include caliche nodules. Generally, these deposits are 20 to 50 feet thick. The caliche is a conglomerate of various materials such as clay, silt, sand, and gravel that included precipitated calcium carbonate. Often, the calcium carbonate cements the soil grains together. The level of cementation can vary and can be highly cemented to weakly cemented. These deposits can often be soft or loose, especially in the presence of groundwater. Our findings of the exploration are consistent with this within the depths explored.

## 5.0 FIELD EXPLORATION

### 5.1 Exploratory Soil Borings

Tetra Tech mobilized to the site on June 6, 2016 with a truck mounted drilling rig. Due to the presence of very loose sand, trees, and flow lines, the site was inaccessible. Chevron field personnel indicated the site will be cleared and be made accessible. Tetra Tech again mobilized to the site on July 19, 2017. Although the site was cleared of trees and other large vegetation, the site was still inaccessible to the truck mounted drilling rig because of the very loose sandy surface and flow lines.

On July 26, 2016, Chevron contracted an independent drilling company with a track-mounted drilling rig to drill five (5) exploratory soil borings, B-1 through B-5 within the footprint of the proposed pond to identify subsurface conditions. The drillers logged the borings and the field logs were provided to Tetra Tech by Chevron. We understand from Chevron that the boring locations had been marked in the field by Chevron personnel. Based on these logs, the borings, B-1, and B-3 through B-5, were terminated at a depth of approximately 35 feet below the existing ground surface. Boring B-2 was terminated at a depth of 20 feet below the existing ground surface. Approximate locations of the borings are shown on the Soil Test Boring Location Plan, Figure 2.

## 6.0 SUBSURFACE CONDITIONS

Based on the data from the borings, the subsurface conditions consisted of loose to dense sand with varying contents of silt and clay. This stratum was encountered from the ground surface and extended to the boring termination depths of 20 and 35 feet below existing ground surface. Standard Penetration Test (SPT) N-values within this stratum ranged from 8 blows per foot (bpf) to greater than 100 bpf. The blow counts generally increased with depth. The borings were dry 24 hours after drilling.

We understand that at the time of drilling, groundwater was not encountered in the borings and that the borings were backfilled with soil from auger cutting to the ground surface. It should be noted that a detailed groundwater study was beyond the scope of our current investigation. Our observations are only indicative of conditions at the time and boring locations indicated. Groundwater levels can vary due to many factors, including seasonal changes, site topography, surface runoff, post development conditions, the layering and permeability of subsurface strata, water levels in waterways, utilities, and other factors that may not have been evident at the time this study. Long-term observations would be necessary to more accurately evaluate the groundwater behavior and fluctuations.

## **7.0 ENGINEERING ANALYSES AND RECOMMENDATIONS**

### **7.1 Primary Geotechnical Considerations**

Based on the type of proposed development at this site, the primary concern that would preclude the proposed development is the presence of loose sand within the proposed depths of excavation. Excavation in sandy material, especially when dry and loose, will tend to cave in.

In our opinion, these constraints can be mitigated by proper engineering design and careful construction of the embankment in accordance with the recommendations below.

### **7.2 Site Preparation**

The construction footprint should be stripped of vegetation, roots, organic material, existing construction materials, debris, and other unsuitable materials. Obstructions that could hinder preparation of the site should also be removed, with special attention given to unknown or un-documented below ground appurtenances and the existing below ground pipelines. A typical stripping depth is approximately 6 inches; however, the actual depth will vary and should be based on field observations. After stripping, the widely spaced borings indicate a moderately stable surface for support of construction equipment using tracks. Rubber-tired equipment will potentially get stuck. Unsuitable areas (such as those with loose, wet, soft, yielding, and/or pumping subgrade) should be corrected before construction proceeds. We recommend the stripping and site preparation extend to at least 5 feet beyond the planned construction footprint. Depending on finished subgrades, all cuts should be made at this time.

Care should be taken not to damage the existing buried utilities located within the footprint of the proposed construction. Buried utilities in conflict with the proposed development should be relocated appropriately. The resulting utility trenches/excavations should be backfilled as discussed in the Fill Placement and Compaction section of this report.

### **7.3 Excavation**

Based on the data from the borings, loose to dense sands are present beneath the topsoil. These soils can be excavated with nominal effort using standard excavating equipment within the upper 20 feet. Beyond this depth, difficult to excavate material should be anticipated. The general contractor should review the subsurface conditions and appropriately select excavation equipment and initial slope of the excavation to minimize cave-in.

### **7.4 Liner Protection**

The existing liner will be removed and replaced with new liner, double lined. Any rock protrusions will potentially damage the liner. The subsurface conditions at this site indicate fine to medium grained sand; thus the need for geotextile and a cushioning layer may be eliminated after inspection and approval by the geotechnical engineer.

### **7.5 Fill Placement and Compaction**

The proposed frac ponds will be constructed to balance cut and fill depths. Significant fill placement and compaction is anticipated at this suite due to the presence of very loose sands. A loss of 20 percent in volume of the on-site soils should be anticipated.

The on-site soils, free of organics and debris, are suitable for use as structural fill or backfill. Fill and backfill should not be placed on organics or other deleterious materials, and should be moisture-conditioned to +2 percent of optimum moisture content. If additional fill is needed for the construction of the embankment, the imported fill should be a well-graded aggregate base course, or imported soils with engineering properties that are similar to on-site soils (depending on the intended use of the fill). For structural support, a uniform, granular material having 100 percent passing the 1 inch sieve, 30 to 70 percent passing the No. 4 sieve, and 3 to 15 percent passing the number 200 sieve is recommended. For on-site and imported fill and backfill, moisture should be adjusted and the soils thoroughly mixed prior to placement and compaction to provide uniform water content throughout the fill. Fill and backfill should be placed in uniform lifts of 8 inches loose thickness or less. Backfill should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698).

Prior to placement and compaction, the moisture content should be brought to at least 2 percent above the optimum moisture content. Fill should be compacted using heavy vibratory equipment. In areas with limited space for heavy equipment, appropriate compacting equipment such as a jumping jack or other hand tools should be used. Where smaller compacting equipment or hand tools are used, the fill lifts should be 6 to 8 inches loose thickness. The contractor should select the equipment type based upon the situation. Each lift should be tested by proof rolling using a loaded water truck or loaded dump truck to confirm it has the specified moisture and compaction. Each vertical foot of compacted fill placed should be tested for compaction. A minimum of one moisture/density verification test should be performed for every 5,000-square-feet of compacted area, or for every 150-lineal feet of utility trench backfill. For smaller areas, a minimum of 3 verification tests should be provided for every lift. Subsequent lifts should not be placed until the exposed lift has been tested to confirm the specified moisture and density. Lifts failing to meet the moisture and density requirements should be reworked to meet the required specifications.

The specified moisture content must be maintained until compaction of the overlying lift, or until the cushioning sand layer or geotextile fabric and liner are installed. Failure to maintain the specified moisture content could result in excessive soil movement resulting in embankment failure. The contractor must provide some means of controlling the moisture content (such as water hoses, water trucks, etc.). Maintaining subgrade moisture is always critical, but will require the most effort during warm, windy and/or sunny conditions. Density and moisture verification testing is recommended to provide some indication that adequate earthwork is being performed. However, the quality of the fill and compaction is the sole responsibility of the contractor. Satisfactory verification testing is not a guarantee of the quality of the contractor's earthwork operations.

## 7.6 Proof Rolling

Following fill placement, compaction, and testing, we recommend the embankments be proof rolled every two feet or for every four lifts of fill placed. Proof rolling should be used to detect areas of soft and/or pumping soil and should be based upon TxDOT Standard Specification Item 216. Proof rolling should be conducted using a heavy, rubber-tired vehicle weighing at least 25 tons, with the tires inflated to the manufacturer's specified operating pressure. The entire area should be proof rolled, with each succeeding pass offset by not greater than one tire width. The geotechnical engineer should be present during proof rolling activities to assist with the identification of unsuitable soil. Unsuitable soil should be undercut and reworked, or otherwise improved in a manner that is suitable to the geotechnical engineer.

## 7.7 Excavation and Embankment Slopes

Using the limited data from the soil borings, we analyzed the soil types based on potential depth of excavation and embankment height. For soil design parameters, an angle of internal friction of 32 degrees is recommended with a compacted/improved subgrade soil unit weight of 110 psf.

According to the OSHA, the on-site soil type is classified as Type C with a recommended exterior and interior slope of 3H:1V. This should provide a factor of safety of 1.5.

Analysis of the embankment was conducted according to Natural Resources Conservation Service (NRCS) TR-60 (NRCS TR-60, 2005) criteria governing the design and construction of earth dams and reservoirs. This reference recommends the minimum factors of safety under given conditions as shown in Table 1. The most stringent (highest) minimum factor of safety was used as a design guideline. The horizontal acceleration used for the pseudo-static analysis was 0.20g, which corresponds to Peak Ground Acceleration (PGA) with a two percent probability of exceedance in 50 years for this site, according to the U.S. Geologic Survey (USGS) 2010 Earthquake Hazards Program Seismic Hazard Maps (USGS, 2010).

**Table 1. Minimum Safety Factors for Slope Stability Analyses**

Design Condition	Minimum Factor of Safety (NRCS TR-60, 2005)
End-of-construction	1.4
Rapid drawdown	1.1
Steady seepage, static loading	1.5
Steady seepage, pseudo-static loading	1.1

## 7.8 Freeboard

An important aspect of embankment stability and performance is maintaining the appropriate freeboard (the vertical distance from the water surface to the crest of the embankment). If the freeboard is insufficient, the embankment could overtop, leading to excessive erosion and possible failure. New Mexico (NMOCD) regulations require a minimum freeboard of three feet for the proposed ponds (or "permanent pits"). This minimum freeboard requirement must be maintained at all times.

## 7.9 Settlement of Embankment Materials

Settlement of embankment material is an important aspect of embankment stability and total fluid storage potential over time. The embankment will be constructed of fill consisting of on-site material and imported fill. The on-site soils are non-expansive soils, consisting primarily of sand with silt and clay. These soils have a low potential for settlement. Potential settlement of the embankment can be reduced by implementing good construction practices. Fill placement and compaction should be as discussed in Section 7.5: Fill Placement and Compaction.

## 7.10 Permitting and Closure

If applicable, a permit application should be filed with the NMOCD in accordance with NMOCD regulations prior to construction. Construction and installation in accordance with NMOCD

regulations and the design drawings and construction specifications is recommended. The NMOCD may require notification prior to construction and prior to operation of a water recycling pond (pit).

## 8.0 CONCLUSIONS

Geotechnical and civil engineering investigations indicate the proposed frac ponds can be constructed in accordance with NMOCD regulations, as described herein. The design and investigation were based on the five (5) soil borings.

Construction should be conducted in accordance with NMOCD regulations, the engineering drawings and specifications prepared by Tetra Tech, and this report. We believe this investigation was conducted in a manner consistent with generally accepted geotechnical and civil engineering principles and according to methods normally used in the vicinity of the project at this time. No warranty is made, express or implied. Should additional information become available that could alter the analyses, conclusions, or recommendations in this report, Tetra Tech should be contacted to review the design documents in the light of that information to determine if revisions are needed.

## 9.0 REFERENCES

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## 10.0 LIMITATIONS

This report was prepared from data developed during our field exploration, laboratory testing, and engineering analysis. Calculations and design recommendations were based on subsurface data, laboratory testing, and our experience with similar projects. Our borings were spaced to obtain a reasonable interpretation of subsurface conditions. Variations in the subsoils not indicated in our borings are likely.

A qualified geotechnical engineer or their designated representative should observe the construction to look for evidence that would indicate differences in subsurface conditions from those described in this report. If any information becomes available that would alter our assumptions or our calculations, the opinions presented in this report should be considered invalid until we have been contacted to review our recommendations based on new information. The geotechnical engineer should review plans and specifications during the design. If applicable, placement and compaction of engineered fill, backfill, subgrade and other fills should be observed and tested by a representative of a Construction Materials Testing (CMT) firm during construction, and Tetra Tech should be retained to review these data.

We believe this study was conducted in a manner consistent with that level of skill and care ordinarily used by members of the profession currently practicing under similar conditions in the locality of this project. No warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or in the analysis of the planned project from the geotechnical point of view, please contact us.

As mentioned previously, field observations, monitoring, and quality assurance testing during foundation installation are an extension of the geotechnical design. We recommend that you retain these services and that we be allowed to continue our involvement in the project through the phases of construction.

# **APPENDIX A EXPLORATORY BORING LOGS**



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-1**  
 PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Frac Pit  
 PROJECT NUMBER 212C-MD-00546 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: 07/26/2016 GROUND ELEVATION: N/A METHOD: Mud Rotary  
 CONSULTANT: Tetra Tech, Inc. LATITUDE: 32.034833N LOGGED BY: Not Recorded  
 DRILLING CONTRACTOR: Not Recorded LONGITUDE: 103.639200W DRILLED BY: Not Recorded  
 Notes: No Groundwater Encountered during Drilling.

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
	SS	5		Loose to Very Dense, Orange and White, Fine to Medium Grained <b>SAND</b> with some Silt and Clay, Calcareous, Rock Fragments, Dry
	SS	11		
5	SS	14		
	SS	50+		
10	SS	48		
15	SS	14		
20	SS	19		
25	SS	37		
30	SS	50+		
35	SS	50+		
			35.0	Borehole terminated at 35.0 feet.

BOREHOLE/TP/WELL - VECTOR SALADOGPJ LAB SUMMARY.GDT 9/19/16



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-2**  
 PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Frac Pit  
 PROJECT NUMBER 212C-MD-00546 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: 07/26/2016 GROUND ELEVATION: N/A METHOD: Mud Rotary  
 CONSULTANT: Tetra Tech, Inc. LATITUDE: 32.000167N LOGGED BY: Not Recorded  
 DRILLING CONTRACTOR: Not Recorded LONGITUDE: 103.639017W DRILLED BY: Not Recorded  
 Notes: No Groundwater Encountered during Drilling.

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
	SS	8		Loose to Very Dense, Orange and White, Fine to Medium Grained <b>SAND</b> with some Silt and Clay, Calcareous, Rock Fragments, Dry
	SS	10		
5	SS	17		
	SS	35		
10	SS	40		
15	SS	50+		
20	SS	50+	20.0	Borehole terminated at 20.0 feet.

BOREHOLE/TP/WELL - VECTOR SALADO.GPJ LAB SUMMARY.GDT 9/19/16



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-3**  
 PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Frac Pit  
 PROJECT NUMBER 212C-MD-00546 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: 07/26/2016 GROUND ELEVATION: N/A METHOD: Mud Rotary  
 CONSULTANT: Tetra Tech, Inc. LATITUDE: 32.033966N LOGGED BY: Not Recorded  
 DRILLING CONTRACTOR: Not Recorded LONGITUDE: 103.638400W DRILLED BY: Not Recorded  
 Notes: No Groundwater Encountered during Drilling.

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
	SS	10		Medium Dense to Very Dense, Orange and White, Fine to Medium Grained <b>SAND</b> with some Silt and Clay, Calcareous, Rock Fragments, Dry
	SS	11		
5	SS	21		
	SS	27		
10	SS	50+		
15	SS	27		
20	SS	39		
25	SS	50+		
30	SS	45		
35	SS	50+		
			35.0	Borehole terminated at 35.0 feet.

BOREHOLE/TP/WELL - VECTOR SALADOGPJ LAB SUMMARY.GDT 9/19/16



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-4**

PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Frac Pit  
 PROJECT NUMBER 212C-MD-00546 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: 07/26/2016 GROUND ELEVATION: N/A METHOD: Mud Rotary  
 CONSULTANT: Tetra Tech, Inc. LATITUDE: 32.033417N LOGGED BY: Not Recorded  
 DRILLING CONTRACTOR: Not Recorded LONGITUDE: 103.637650W DRILLED BY: Not Recorded  
 Notes: No Groundwater Encountered during Drilling.

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
	SS	8		Medium Dense to Very Dense, Orange and White, Fine to Medium Grained <b>SAND</b> with some Silt and Clay, Calcareous, Rock Fragments, Dry
	SS	10		
5	SS	39		
	SS	33		
10	SS	50+		
15	SS	35		
20	SS	50+		
25	SS	50+		
30	SS	50+		
35	SS	50+		
			35.0	Borehole terminated at 35.0 feet.

BOREHOLE/TP/WELL - VECTOR SALADOGPJ LAB SUMMARY.GDT 9/19/16



Tetra Tech Inc.  
 4000 N. Big Spring, Suite 401  
 Midland, TX, 79705  
 Telephone: 432-682-4559  
 Fax: 432-682-3946

**BOREHOLE ID: B-5**  
 PAGE 1 OF 1

CLIENT Chevron PROJECT NAME Salado Draw Frac Pit  
 PROJECT NUMBER 212C-MD-00546 PROJECT LOCATION Lea County, New Mexico

DATE(S) OF EXCAVATION: 07/26/2016 GROUND ELEVATION: N/A METHOD: Mud Rotary  
 CONSULTANT: Tetra Tech, Inc. LATITUDE: 32.034700N LOGGED BY: Not Recorded  
 DRILLING CONTRACTOR: Not Recorded LONGITUDE: 103.637633W DRILLED BY: Not Recorded  
 Notes: No Groundwater Encountered during Drilling.

DEPTH (ft)	SAMPLE TYPE	N Value	GRAPHIC LOG	MATERIAL DESCRIPTION
0				
	SS	13		Medium Dense to Dense, Orange and White, Fine to Medium Grained <b>SAND</b> with some Silt and Clay, Calcareous, Rock Fragments, Dry
	SS	15		
5	SS	26		
	SS	22		
10	SS	11		
15	SS	24		
20	SS	15		
25	SS	19		
30	SS	31		
35	SS	35	35.0	Borehole terminated at 35.0 feet.

BOREHOLE/TP/WELL - VECTOR SALADOGPJ LAB SUMMARY.GDT 9/19/16

**Attachment 4 – Carlsbad Field Office EA**

**DOI-BLM-NM-P020-2020-0198-EA, Section 3.4, Karst Resources (2019)**

Temporary Pit containing non-low chloride fluids

Salado Draw P419 Pit

Section 15, T26S, R32E



# Carlsbad Field Office

## Environmental Assessment

**Environmental Assessment DOI-BLM-NM-P020-2020-0198-EA**

**CHEVRON U.S.A. INC**

**SD 15 FED P418 7H, 8H, 9H, 10H**

**&**

**SD 15 FED P419 11H, 12H, 13H, 14H**

**Lease Number NMNM118722**

**APD**

Department of the Interior  
Bureau of Land Management  
Pecos District  
Carlsbad Field Office  
620 E Greene Street  
Carlsbad, NM 88220  
Phone: (575) 234-5972

### **Confidentiality Policy**

Any comments, including names and street addresses of respondents, you submit may be made available for public review. Individual respondents may request confidentiality. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

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- Any water erosion that may occur due to the construction of the well pad during the life of the well will be quickly corrected and proper measures will be taken to prevent future erosion.

## 3.4. Karst Resources

### 3.4.1. *Affected Environment*

The proposed project is located within a gypsum karst terrane – a landform characterized by underground drainage through solutionally enlarged conduits. Gypsum karst terranes may contain sinkholes, sinking streams, caves, and springs. These karst features, as well as occasional fissures and discontinuities in the bedrock, provide the primary sources for rapid recharge of the groundwater aquifers of the region.

The BLM categorizes all areas within the Carlsbad Field Office as having either low, medium, high or critical cave potential based on geology, occurrence of known caves, density of karst features, and potential impacts to fresh water aquifers. This project occurs within a medium karst zone. A medium karst zone is defined as an area that contains known soluble rocks within 300 feet of the surface with shallow insoluble overburden or soils that could mask surface features. These areas may contain isolated karst features such as caves and sinkholes. Groundwater recharge may not be wholly dependent on karst features but the karst features still provide the most rapid aquifer recharge in response to surface runoff.

Field notes from the on-site inspection indicate that no known features exist within the proposed area. Unknown features may also exist. Due to these factors, this action is subject to mitigation measures designed to adequately protect known and potential cave/karst resources.

Sinkholes and cave entrances collect water and can accumulate rich organic materials and soils. This, in conjunction with the stable microclimate near cave entrances, support a greater diversity and density of plant life which provides habitat for a greater diversity and density of wildlife such as raptors, rodents, mammals, and reptiles.

The interior of the caves support a large variety of troglobitic, or cave environment dependent, species. These species have adapted specifically to the cave environment due to constant temperatures, constant high humidity, and total darkness. Some caves may contain bat colonies. Many of the caves in this area contain fragile cave formations known as speleothems.

### 3.4.2. *Impacts from the Proposed Action*

#### Direct and Indirect Impacts

##### General Impact Analysis

Cave and karst features provide direct conduits leading to groundwater. These conduits can quickly transport surface and subsurface contaminants directly into underground water systems and freshwater aquifers without filtration or biodegradation. In addition, contaminants spilled or leaked into or onto cave/karst zone surfaces and subsurface may lead directly to the disruption, displacement, or extermination of cave species and critical biological processes. In extreme and rare cases, a buildup of hydrocarbons in cave systems associated with surface leaks or spills could potentially cause underground ignitions or asphyxiation of wildlife or humans within the cave.

In cave and karst terranes, rainfall and surface runoff is directly channeled into natural underground water systems and aquifers. Changes in geologic formation integrity, runoff quantity/quality, drainage course, rainfall percolation factors, vegetation, surface contour, and other surface factors can negatively impact cave ecosystems and aquifer recharge processes. Blasting, heavy vibrations, and focusing of surface drainages can lead to slow subsidence, sudden collapse of subsurface voids, and/or cave ecosystem damage.

A more complete discussion of the impacts of oil and gas drilling can be found in the *Dark Canyon Environmental Impact Statement of 1993*, published by the U.S. Department of the Interior, Bureau of Land Management.

To mitigate or lessen the probability of impacts associated with the drilling and production of oil and gas wells in karst areas, the guidelines listed in Appendix 3, Practices for Oil and Gas Drilling and Production in Cave and Karst Areas, as approved in the Carlsbad Resource Management Plan Amendment of 1997, page AP3-4 through AP 3-7 will be followed.

BLM maintains up to date locations and surveys of known cave and karst features. New surveys may be required for projects in areas where the BLM does not have sufficient information. Projects will be moved away from these features. Drilling pads, roads, utilities, pipelines, flowlines and other facilities or projects will be relocated or routed around cave and karst features at an adequate distance to mitigate adverse impacts. Wellbore engineering plans will incorporate required cave and aquifer protection protocols.

Highly sensitive cave and karst areas with critical freshwater aquifer recharge concerns may have a number of special surface and subsurface planning and construction requirements based upon the risk of adverse impacts created by a specific location or process.

### **Construction Impact Analysis**

The construction of roads, pipelines, well pads and utilities can impact bedrock integrity and reroute, impede, focus, or erode natural surface drainage systems. Increased silting and sedimentation from construction can plug downstream sinkholes, caves, springs, and other components of aquifer recharge systems and result in adverse impacts to aquifer quality and cave environments. Any contaminants released into the environment during or after construction can impact aquifers and cave systems. A possibility exists for slow subsidence or sudden surface collapse during construction operations due to collapse of underlying cave passages and voids. This would cause associated safety hazards to the operator and the potential for increased environmental impact. Subsidence processes can be triggered by blasting, intense vibrations, rerouting of surface drainages, focusing of surface drainage, and general surface disturbance.

Blasting fractures in bedrock can serve as direct conduits for transfer of contaminants into cave and groundwater systems. Blasting also creates an expanded volume of rock rubble that cannot be reclaimed to natural contours, soil condition, or native vegetative condition. As such, surface and subsurface disruptions from blasting procedures can lead to permanent changes in vegetation, rainfall percolation, silting/erosion factors, aquifer recharge, and freshwater quality and can increase the risk of contaminant migration from drilling/production facilities built atop the blast area.

### **Drilling Impact Analysis**

During drilling, previously unknown cave and karst features could be encountered. If a void is encountered while drilling and a loss of circulation occurs, lost drilling fluids can directly contaminate groundwater recharge areas, aquifers, and groundwater quality. Drilling operations can also lead to sudden collapse of underground voids. Cementing operations may plug or alter groundwater flow, potentially reducing the water quantity at springs and water wells. Inadequate subsurface cementing, casing, and cave/aquifer protection measures can lead to the migration of oil, gas, drilling fluids, and produced saltwater into cave systems and freshwater aquifers.

### **Production Impact Analysis**

Production facilities such as tank batteries, pump-jacks, compressors, transfer stations, and pipe may fail and allow contaminants to enter caves and freshwater systems. Downhole casing and cementing failures can allow migration of fluids and/or gas between formations and aquifers. Facilities may also be subject to slow subsidence or sudden collapse of the underlying bedrock.

## Residual and Cumulative Impact Analysis

Any industrial activities that take place upon or within karst terranes or freshwater aquifer zones have the potential to create both short-term and long-term negative impacts to freshwater aquifers and cave systems. While a number of mitigation measures can be implemented to mitigate many impacts, it is still possible for impacts to occur from containment failures, well blowouts, accidents, spills, and structural collapses. It is therefore necessary to implement long-term monitoring studies to determine if current mitigations measures are sufficient enough to prevent long-term or cumulative impacts.

## Plugging and Abandonment Impact Analysis

Failure of a plugged and abandoned well can lead to migration of contaminants to karst resources and fresh water aquifers. While this action does not specifically approve plugging and abandonment procedures, the operator should be made aware that additional or special Conditions of Approval may apply at that time.

## Mitigation Measures

### Construction Mitigation

In order to mitigate the impacts from construction activities on cave and karst resources, the following Conditions of Approval will apply to this APD or project:

#### General Construction:

- No blasting
- The BLM, Carlsbad Field Office, will be informed immediately if any subsurface drainage channels, cave passages, or voids are penetrated during construction, and no additional construction shall occur until clearance has been issued by the Authorized Officer.
- All linear surface disturbance activities will avoid sinkholes and other karst features to lessen the possibility of encountering near surface voids during construction, minimize changes to runoff, and prevent untimely leaks and spills from entering the karst drainage system.
- All spills or leaks will be reported to the BLM immediately for their immediate and proper treatment.

#### Pad Construction:

- The pad will be constructed and leveled by adding the necessary fill and caliche – no blasting.
- The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.
- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g., caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised (i.e. an access road crossing the berm cannot be lower than the berm height).
- Following a rain event, all fluids will vacuumed off of the pad and hauled off-site and disposed at a proper disposal facility.

**Road Construction:**

- Turnout ditches and drainage leadoffs will not be constructed in such a manner as to alter the natural flow of water into or out of cave or karst features.
- Special restoration stipulations or realignment may be required if subsurface features are discovered during construction.

**Buried Pipeline/Cable Construction:**

- Rerouting of the buried line(s) may be required if a subsurface void is encountered during construction to minimize the potential subsidence/collapse of the feature(s) as well as the possibility of leaks/spills entering the karst drainage system.

**Powerline Construction:**

- Smaller powerlines will be routed around sinkholes and other karst features to avoid or lessen the possibility of encountering near surface voids and to minimize changes to runoff or possible leaks and spills from entering karst systems.
- Larger powerlines will adjust their pole spacing to avoid cave and karst features.
- Special restoration stipulations or realignment may be required if subsurface voids are encountered.

**Surface Flowlines Installation:**

- Flowlines will be routed around sinkholes and other karst features to minimize the possibility of leaks/spills from entering the karst drainage system.

**Drilling Mitigation**

Federal regulations and standard Conditions of Approval applied to all APDs require that adequate measures are taken to prevent contamination to the environment. Due to the extreme sensitivity of the cave and karst resources in this project area, the following additional Conditions of Approval will be added to this APD.

To prevent cave and karst resource contamination the following will be required:

- Closed loop system using steel tanks - all fluids and cuttings will be hauled off-site and disposed of properly at an authorized site
- Rotary drilling with fresh water where cave or karst features are expected to prevent contamination of freshwater aquifers.
- Directional drilling is only allowed at depths greater than 100 feet below the cave occurrence zone to prevent additional impacts resulting from directional drilling.
- Lost circulation zones will be logged and reported in the drilling report so BLM can assess the situation and work with the operator on corrective actions.
- Additional drilling, casing, and cementing procedures to protect cave zones and fresh water aquifers. See drilling COAs.

**Production Mitigation**

In order to mitigate the impacts from production activities and due to the nature of karst terrane, the following Conditions of Approval will apply to this APD:

- Tank battery locations and facilities will be bermed and lined with a 20 mil thick permanent liner that has a 4 oz. felt backing, or equivalent, to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.
- Development and implementation of a leak detection system to provide an early alert to operators when a leak has occurred.
- Automatic shut off, check valves, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

The No Action Alternative is used as the baseline for comparison of environmental effects of the analyzed alternatives. Under the No Action Alternative, the proposed project would not be drilled, built or constructed and there would be no new direct or indirect impacts to natural or cultural resources from oil and gas production. The natural and cultural resources in the project area would continue to be managed under the current land and resource uses.

### 3.14. Cumulative Impacts

Cumulative impacts are the combined effect of past projects, specific planned projects, and other reasonably foreseeable future actions within the project study area to which oil and gas exploration and development may add incremental impacts. This includes all actions, not just oil and gas actions that may occur in the area including foreseeable non-federal actions.

The combination of all land use practices across a landscape has the potential to change the visual character, disrupt natural water flow and infiltration, disturb cultural sites, cause increases in greenhouse gas emissions, fragment wildlife habitat and contaminate groundwater. Cumulative impacts analysis to air quality, GHG emissions, water use and quality is included in Chapter 3, under sections 3.1 and 3.2. The likelihood of these impacts occurring is minimized through standard mitigation measures, special Conditions of Approval and ongoing monitoring studies.

All resources are expected to sustain some level of cumulative impacts over time, however these impacts fluctuate with the gradual abandonment and reclamation of wells. As new wells are being drilled, there are others being abandoned and reclaimed. As the oil field plays out, the cumulative impacts will lessen as more areas are reclaimed and less are developed.

## 4. SUPPORTING INFORMATION

### 4.1. List of Preparers

Prepared by: Project Lead Paul Murphy, Natural Resource Specialist, BLM-CFO

Date: 11/15/2019

The following individuals aided in the preparation of this document:

Aaron Whaley, Archaeologist, BLM-CFO

Cassandra Brooks, Wildlife Biologist, BLM-CFO

Sharay Dixon, Air Resource Specialist, BLM-NMSO

David Herrell, Hydrologist, BLM-NMSO

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**District I**  
 1625 N. French Dr., Hobbs, NM 88240  
 Phone:(575) 393-6161 Fax:(575) 393-0720

**District II**  
 811 S. First St., Artesia, NM 88210  
 Phone:(575) 748-1283 Fax:(575) 748-9720

**District III**  
 1000 Rio Brazos Rd., Aztec, NM 87410  
 Phone:(505) 334-6178 Fax:(505) 334-6170

**District IV**  
 1220 S. St Francis Dr., Santa Fe, NM 87505  
 Phone:(505) 476-3470 Fax:(505) 476-3462

**State of New Mexico**  
**Energy, Minerals and Natural Resources**  
**Oil Conservation Division**  
**1220 S. St Francis Dr.**  
**Santa Fe, NM 87505**

CONDITIONS  
  
 Action 9530

**CONDITIONS**

Operator: CHEVRON U S A INC 6301 Deauville Blvd Midland, TX 79706	OGRID: 4323
	Action Number: 9530
	Action Type: [C-144] PIT Generic Plan (C-144)

**CONDITIONS**

Created By	Condition	Condition Date
vvenegas	None	10/20/2021