TPIT-SDP149-01

Salado Draw Reserve Pit
SD 14 Fed P149
Temporary Pit
Permit Application
Package 2 of 2

Chevron USA Inc

August 5, 2020

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(1)	UNIT Imperial	
SPECIFICATIONS				
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 responsability 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(1)	UNIT Imperial	
SPECIFICATIONS				
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
SUPPLY SPECIFICATIONS (Roll dimensions may vary ±1%)				

NOTES

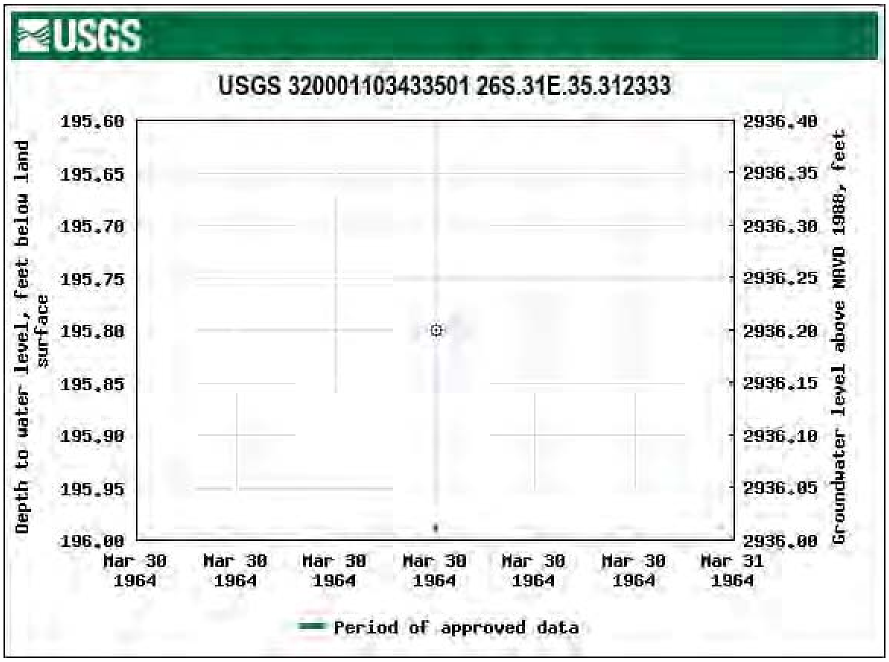
1. Testing frequency based on standard roll dimension and one batch is approximately 180,000 lbs (or one railcar).
2. Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction.
3. Lowest individual and 8 out of 10 readings as per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

Appendix A

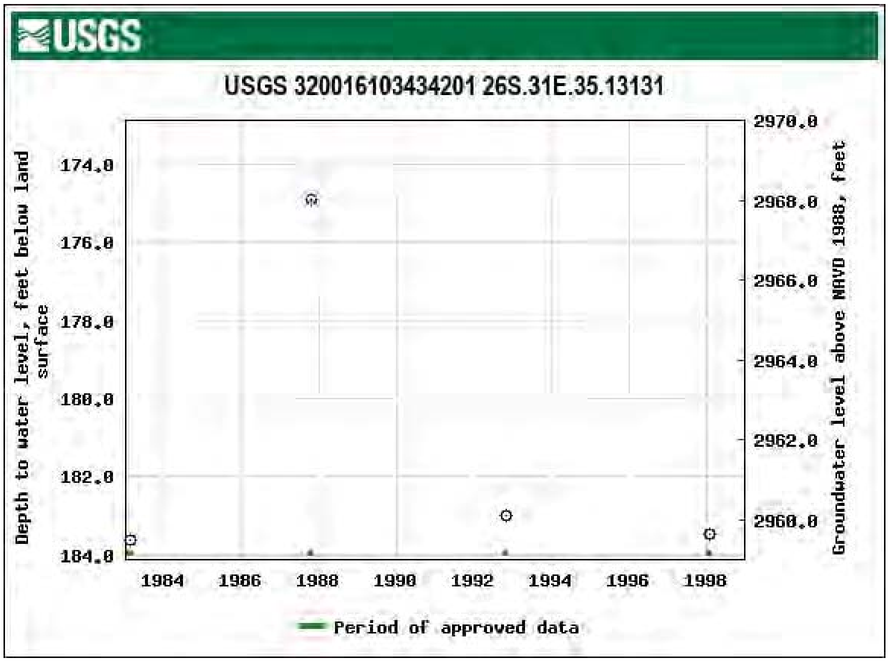
United States Geological Survey

Groundwater Data

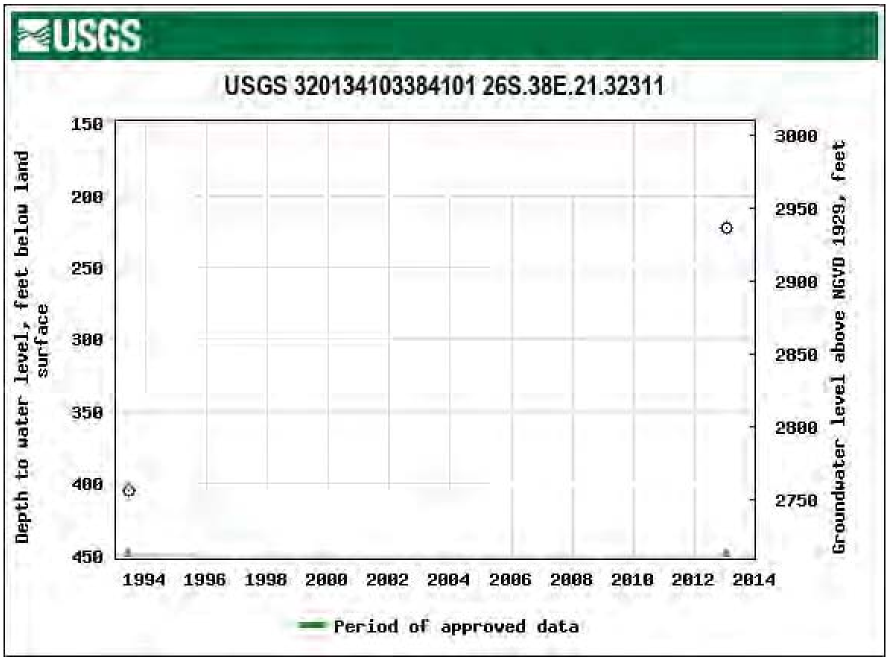
USGS 320001103433501, 26S.31E.35.312333
Eddy County, New Mexico
Hydrologic Unit Code 13070001
Latitude 32°00'01", Longitude 103°43'35" NAD27
Land-surface elevation 3,132 feet above NAVD88



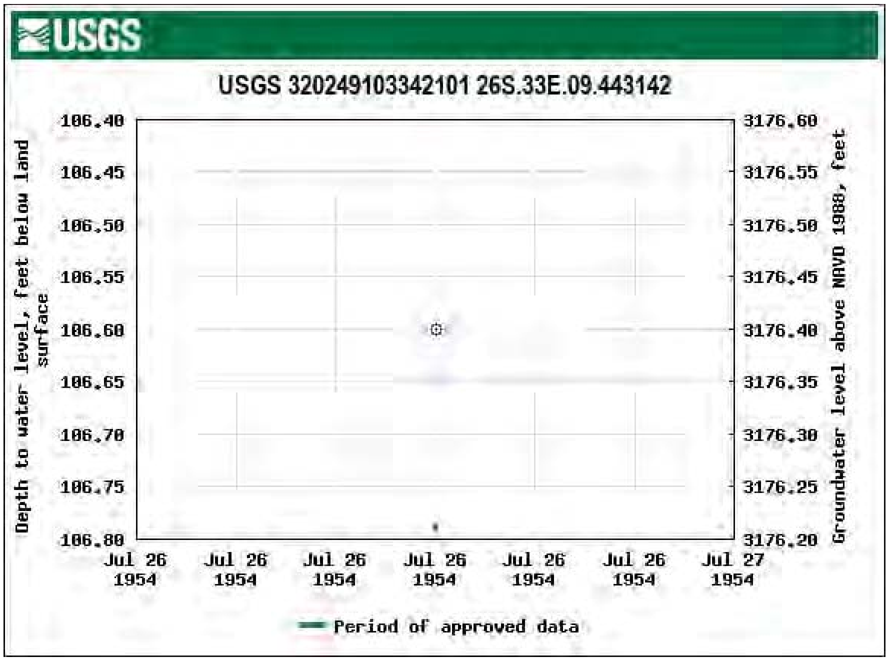
USGS 320016103434201 26S.31E.35.13131
Eddy County, New Mexico
Hydrologic Unit Code 13070001
Latitude 32°00'16", Longitude 103°43'42" NAD27
Land-surface elevation 3,143 feet above NAVD88
This well is completed in the Alluvium, Bolson Deposits and Other Surface Deposits (110AVMB) local aquifer.



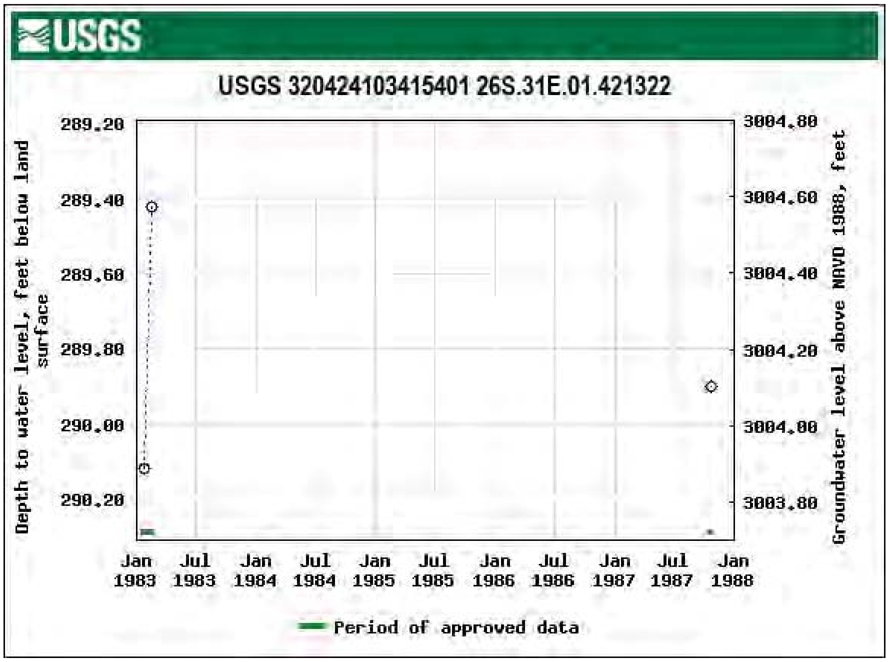
USGS 320134103384101 26S.38E.21.32311
Latitude 32°01'35.2", Longitude 103°41'01.8"   NAD83
Lea County, New Mexico   , Hydrologic Unit 13070007
Well depth: 405. feet   Hole depth: 405. feet
Land surface altitude: 3,160 feet above NGVD29.
Well completed in "Dockum Group" (231DCKM) local aquifer



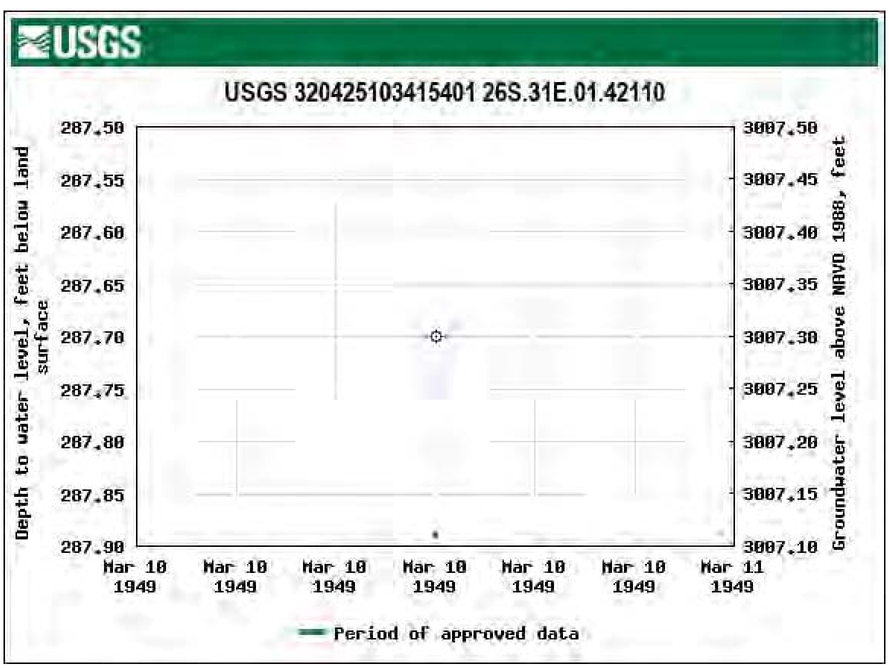
USGS 320249103342101 26S.33E.09.443142
Lea County, New Mexico, Hydrologic Unit Code 13070001
Latitude 32°02'49", Longitude 103°34'21" NAD27
Land-surface elevation 3,283 feet above NAVD88
This well is completed in the Alluvium, Bolson Deposits and Other Surface Deposits (110AVMB) local aquifer



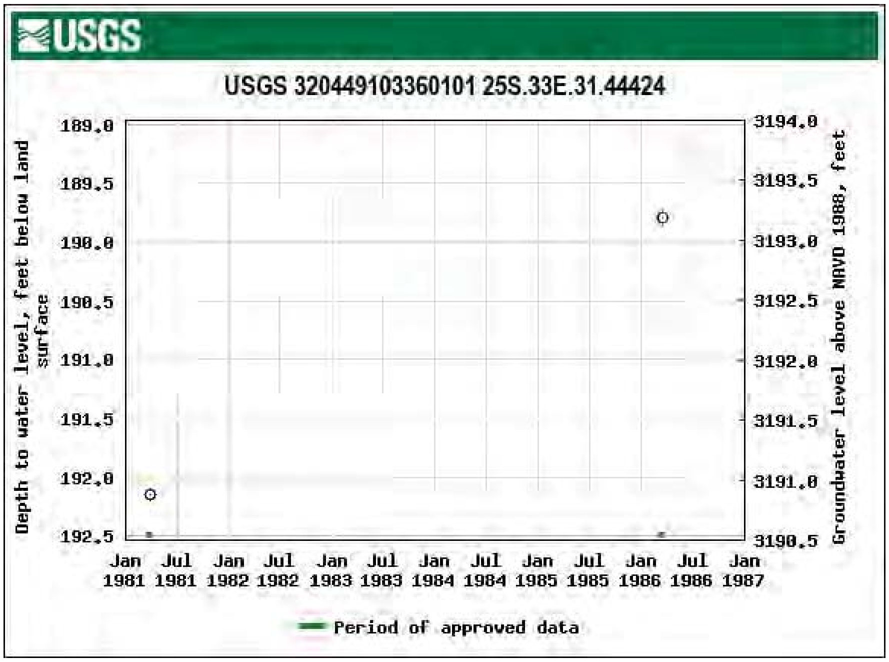
USGS 320424103415401 26S.31E.01.421322
Eddy County, New Mexico, Hydrologic Unit Code 13070001
Latitude 32°04'24", Longitude 103°41'54" NAD27
Land-surface elevation 3,294 feet above NAVD88
This well is completed in the Santa Rosa Sandstone (231SNRS) local aquifer.



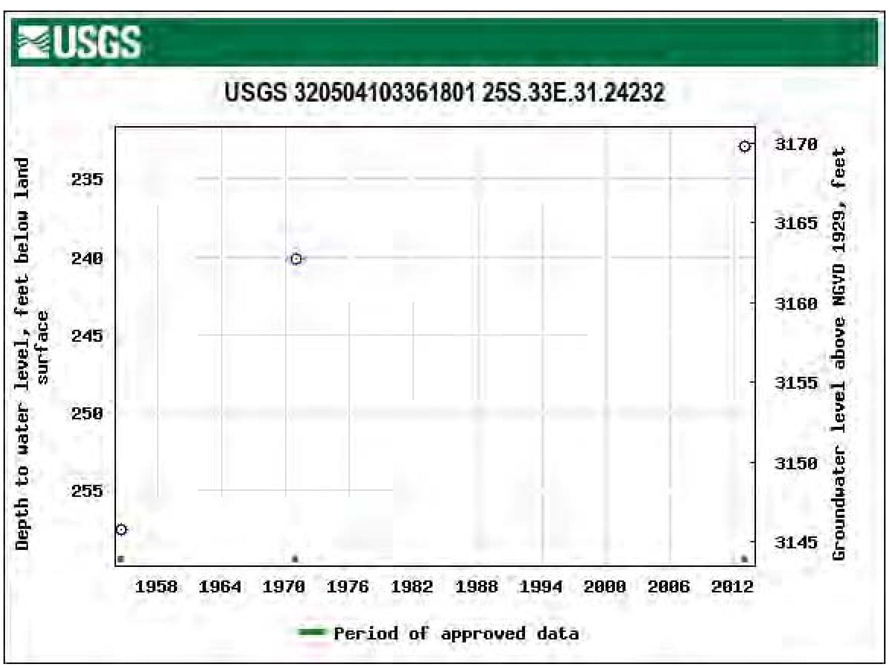
USGS 320425103415401 26S.31E.01.42110
Eddy County, New Mexico, Hydrologic Unit Code 13070001
Latitude 32°04'25", Longitude 103°41'54" NAD27
Land-surface elevation 3,295 feet above NAVD88
The depth of the well is 340 feet below land surface.
This well is completed in the Rustler Formation (312RSLR) local 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	Code	POD Sub-basin	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Depth Well	Depth Water	Water Column
C 02271	R	CUB	LE		2	3	21	26S	32E	624449	3544111*	150	125	25
C 02271 POD2		CUB	LE	3	2	3	21	26S	32E	624348	3544010*	270	250	20
C 02274		CUB	LE	2	1	2	31	26S	32E	621742	3541730*	300	295	5
C 02323		C	LE	3	2	3	21	26S	32E	624348	3544010*	405	405	0
C 03537 POD1		CUB	LE	3	2	3	21	26S	32E	624250	3543985	850		
C 03595 POD1		CUB	LE	4	2	3	21	26S	32E	624423	3544045	280	180	100
C 03829 POD1		CUB	LE	3	3	1	06	26S	32E	620628	3549186	646	350	296
C 04209 POD1		CUB	LE	2	3	3	06	26S	32E	620903	3548619	360	155	205
C 04209 POD2		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**

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**):

- Underlaying 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).

<u>Depth to Water</u>: 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.

<u>Recharge</u>:
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

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	

Construction Work Package

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

Facility	Salado Pad 419			
Pad 419	**LAT**	32.037268	**LONG**	-103.657465

3.0 Execution Plan

Well Pad (Pad 419):

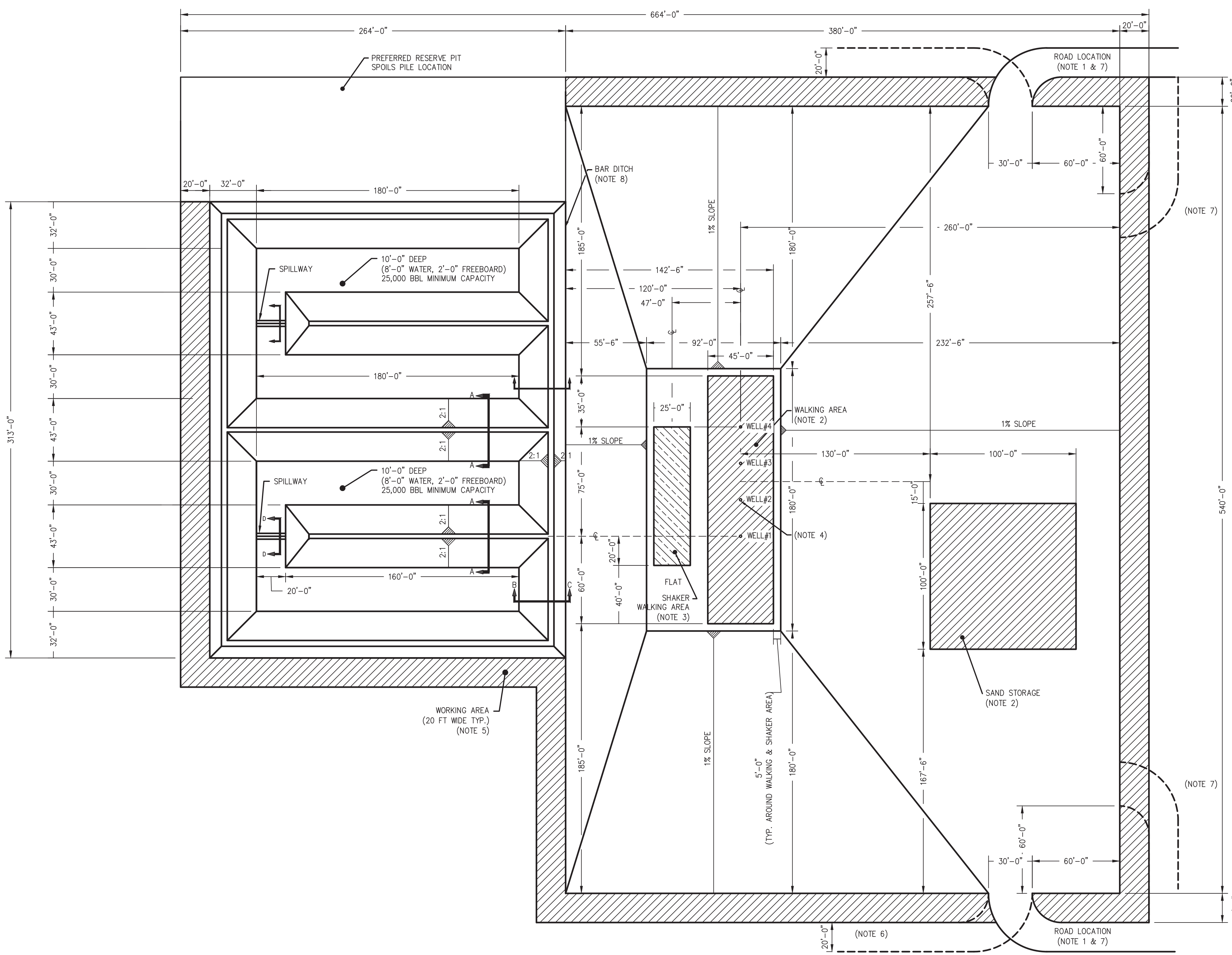
Contractor will construct one four well 'megapads' with drilling reserve pit

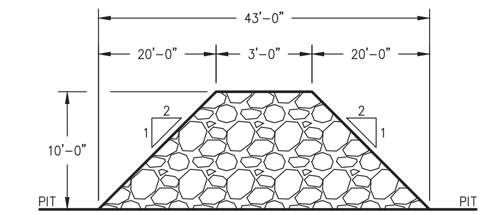
- Clear and complete subgrade for two 690'x480' pads according to standards in the master service agreement including the 6" caliche cap.
- Construct drilling reserve pit according to standard drawing attached. Reserve pit will overlap pad by 100'
- Walking areas specified in drawings shall be brought 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:

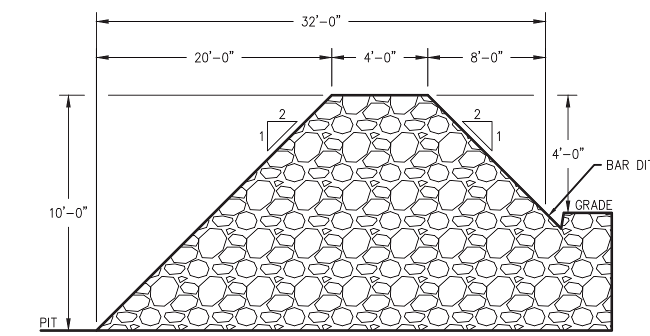
- Construct 900 ft of 20-ft wide access road according to the drawings.

MAGNETIC NORTH

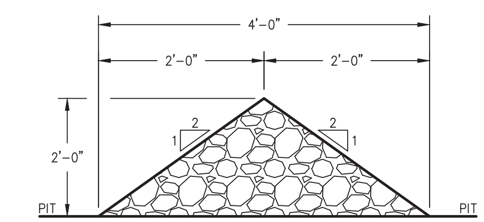




SECTION A–A
NOT TO SCALE



SECTION B–C
NOT TO SCALE



SECTION D–D
NOT TO SCALE

NOTES:
1. PRIMARY PAD ENTRANCE MUST BE ON WEST OR EAST SIDE OF PAD FOR DRILLING LAYOUT.
2. SEE GEO–TECHNICAL INVESTIGATION REPORT FOR COMPACTION RECOMMENDATION. SEE DRILLING MAT LAYOUT FOR DETAILS.
3. SHAKER WALKING AREA IS REQUIRED WHEN USING NABORS M800 SERIES DRILLING RIG.
4. FOR COMPLETIONS GRAVEL LOCATIONS, SEE DWG. FACTSTD–COMGRVL–CIV–PVD–MCB–0001–01.
5. SHADED WORKING AREA IS NOT A PART OF THE PERMITTED PAD. PERMITTED PAD AREA IS 540 FT X 380 FT FOR A 3 WELL PAD.
6. ROAD CAN COME FROM EITHER THE NORTH OR SOUTH DIRECTION DEPENDING ON LEASE ORIENTATION.
7. SECONDARY ACCESS ROAD IS REQUIRED FOR COMPLETIONS DRIVE–THROUGH. SECONDARY ACCESS ROAD CAN BE EITHER ON EAST/WEST EDGE OF PAD OR SOUTH EDGE OF PAD, BUT MUST BE OPPOSITE OF PRIMARY PAD ENTRANCE (REF. NOTE 1) FE MUST CONSULT D&C ADVISOR TO COMPLETE PMOC IF SECONDARY ROAD IS NOT FEASIBLE.
8. 1FT. X 1FT. BAR DITCHING TO BE PROVIDED BETWEEN PAD AND RESERVE PIT, DITCH WILL BE FILLED WITH 1" CLEAN ROCK.
9. 6 LOADS OF ROCK FOR DRILLING TRAILERS & DITCH COM ROCK DROPPED IN NEW CORNER.

80' 40' 0' 20' 40' 60' 80'

SCALE: 1"=40'

SHEET CIV008

REVISIONS								
2019 DESIGN BASIN DESIGN, DRF 19249	JLH 06/21/19	/	/					

AFC
APPROVED FOR CONSTRUCTION

Chevron U.S.A. Inc.

FACTORY STANDARD DRAWINGS
PROJECT DESCRIPTION – COUNTY, STATE

CIVIL – FACTORY STANDARD 4 WELL PAD PLAN – OPEN LOOP

DR. JLH
ENG. KVPY

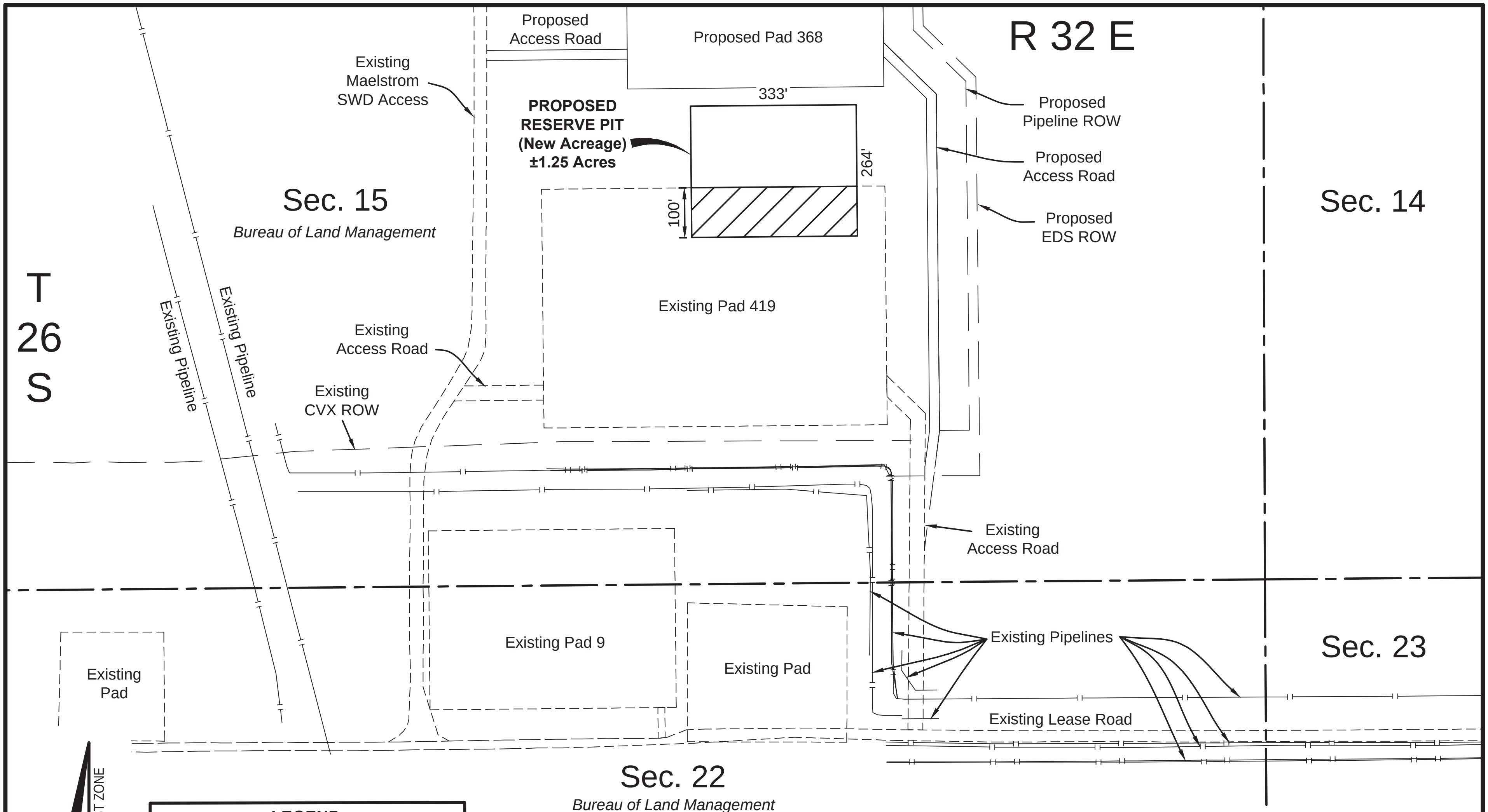
FACTSTD-4WPADOPN-CIV-PVD-MCB-0001-01

PLOT DATE: 06/20/2019, FILE NAME: CIV008-FACTSTD-4WPADOPN-CIV-PVD-MCB-0001-01

LEASE NUMBER *

API NUMBER

ALTERNATE DWG NUMBER



LEGEND

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

Scale: 1" = 300'

300' 0 150' 300'

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

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

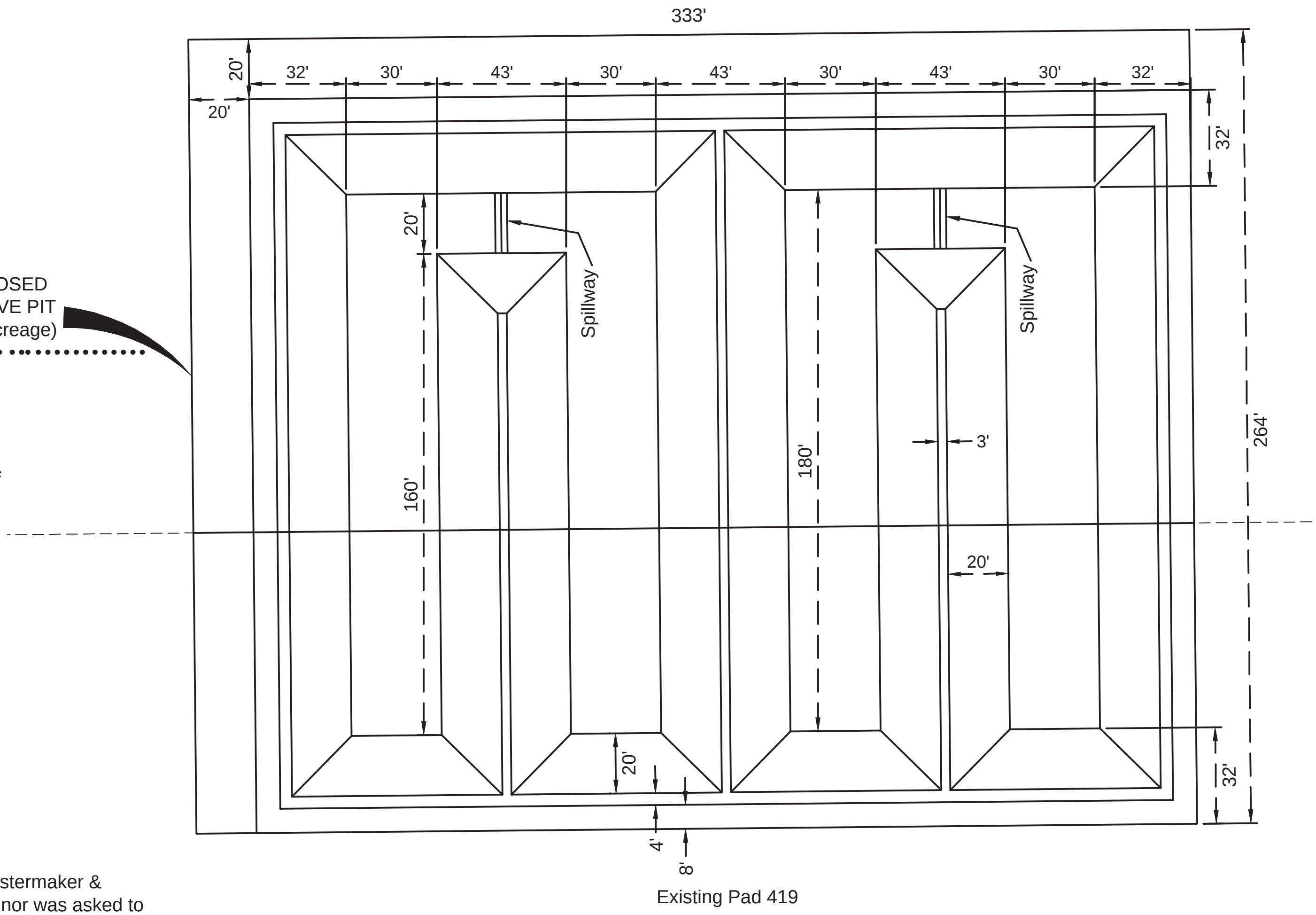
DIMENSION PLAT

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



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

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.

Scale: 1" = 60'

60' 0 30' 60'

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

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

DIMENSION PLAT

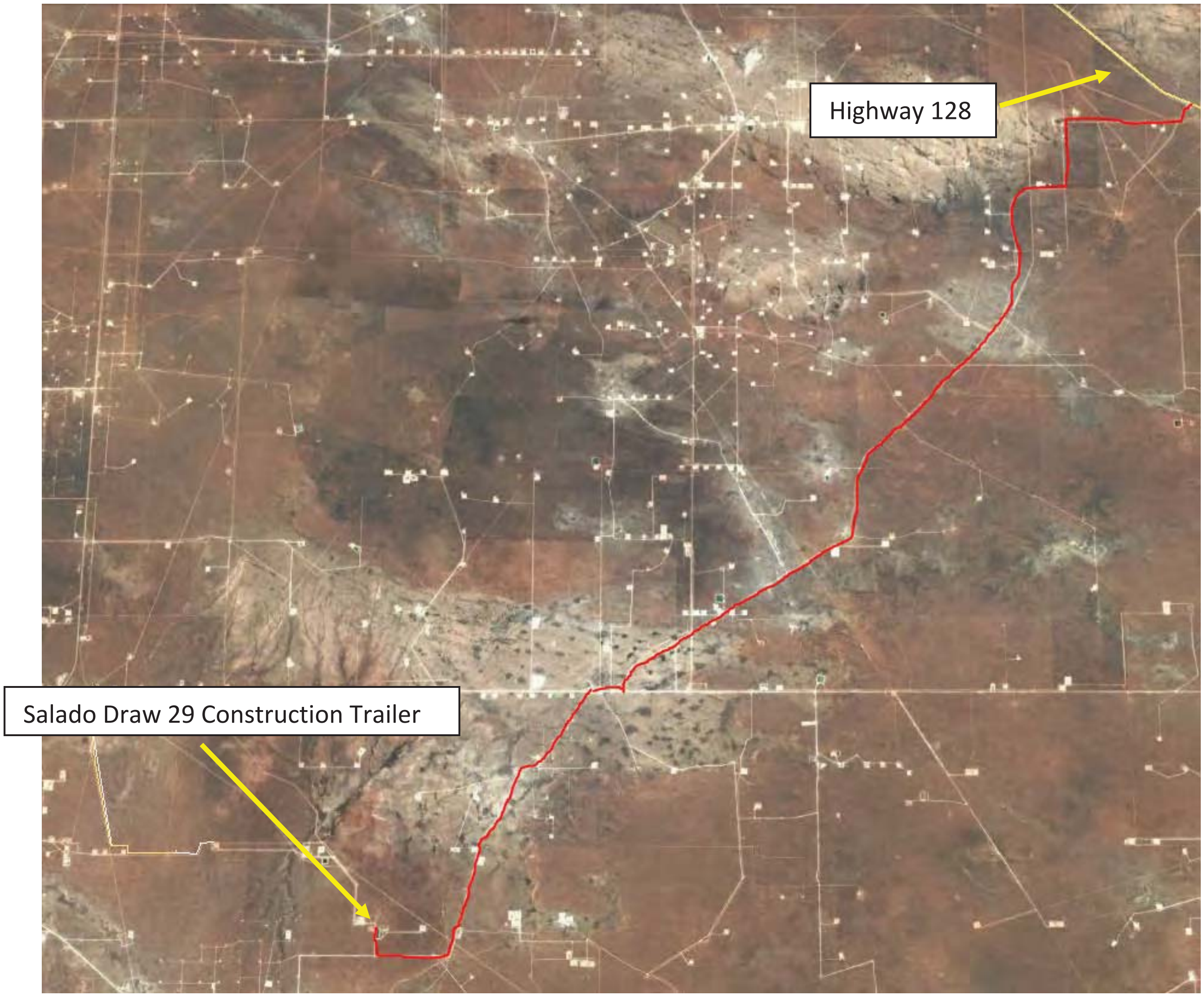
CHEVRON U.S.A. INC.

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

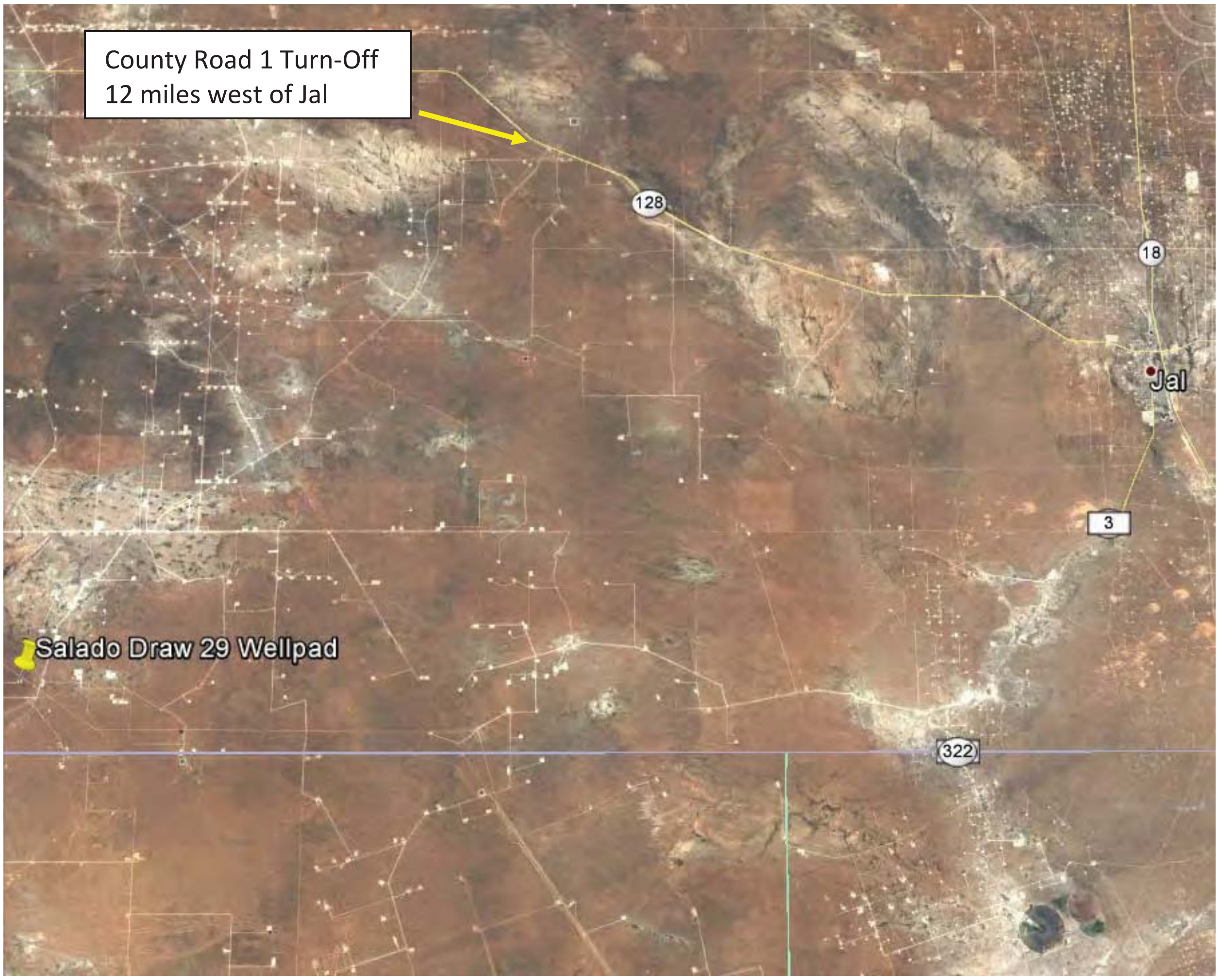
	REVISIONS			
DRAWN BY: RMB	#	BY:	DATE:	DESCRIPTION:
PROJ. MGR.: VHV				
DATE: 06/24/2020				

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

<u>Delivery Contacts:</u>
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.)	R360 Permian Basin, LLC
M-29-21S-38E	4507 W. Carlsbad Hwy, Hobbs, NM 88240
Permit No. NM-01-003	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

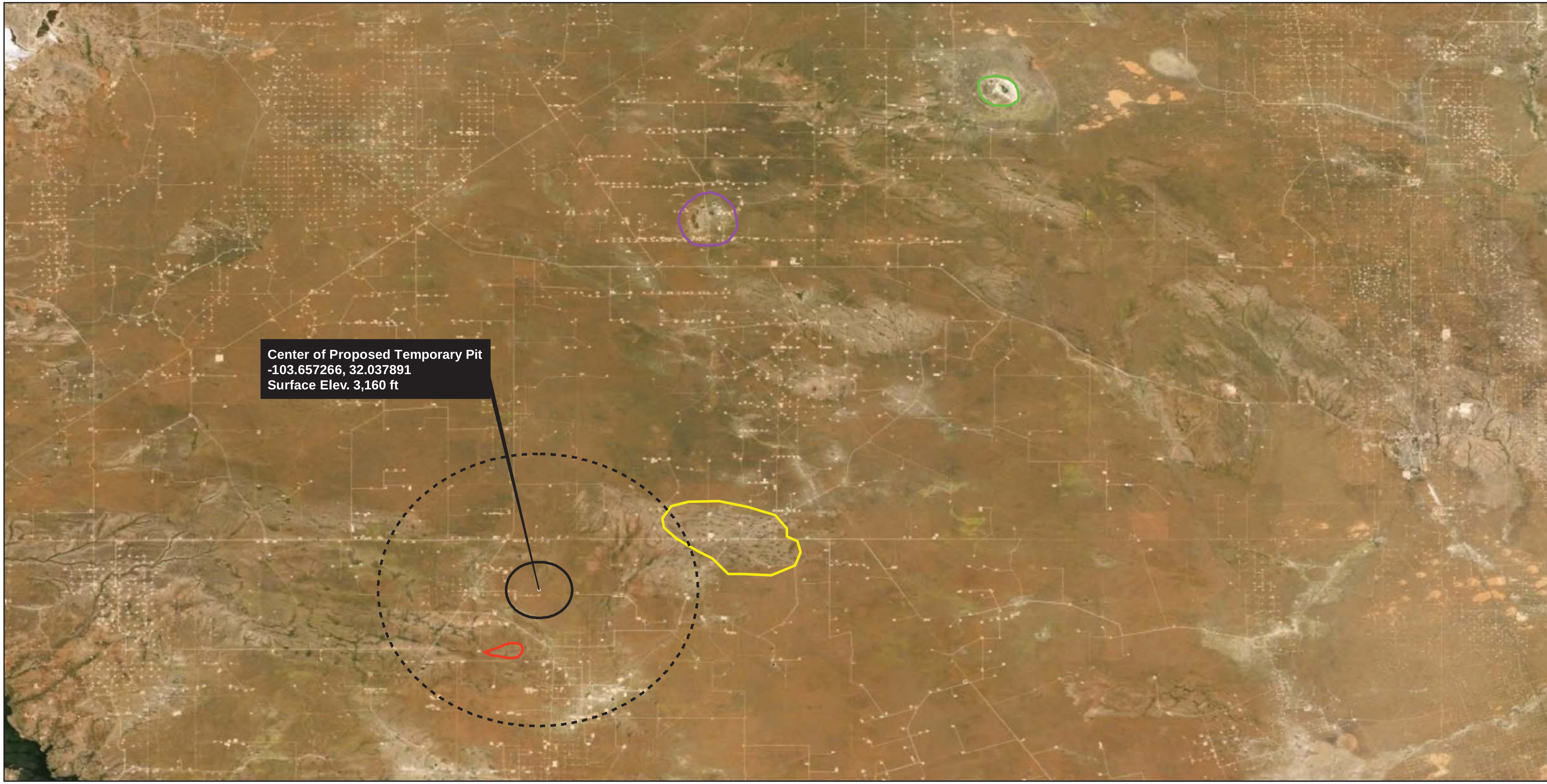
In order to mitigate the impacts from construction activities on cave and karst resources, the following Conditions of Approval will apply to this APD or project:

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.



LEGEND

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

0 1.5 3 6 9 12 Miles

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.

SD 15 FED P419 Temporary Pit

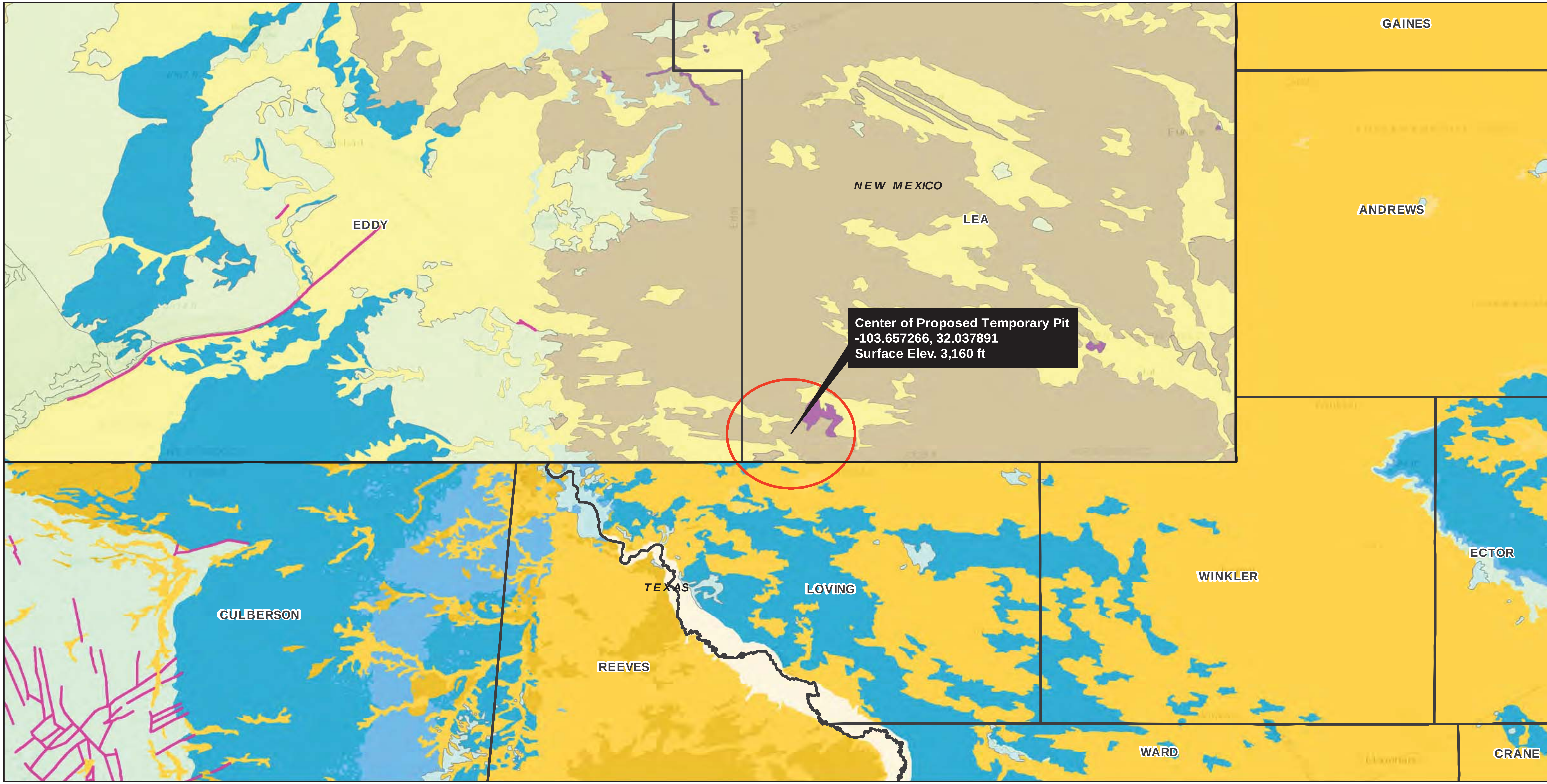
G1: Aerial Imagery of Dissolution Features

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: 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



LEGEND

NM Geology

- <all other values>
- eolian
- medium-grained mixed clastic
- alluvium
- sandstone
- evaporite

TX Geology

- <all other values>
- evaporite
- sandstone
- sand
- gravel
- limestone

- 5 mile buffer
- TX Faults

N W E S

0 3.75 7.5 15 22.5 30 Miles

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.

SD 15 FED P419 Temporary Pit

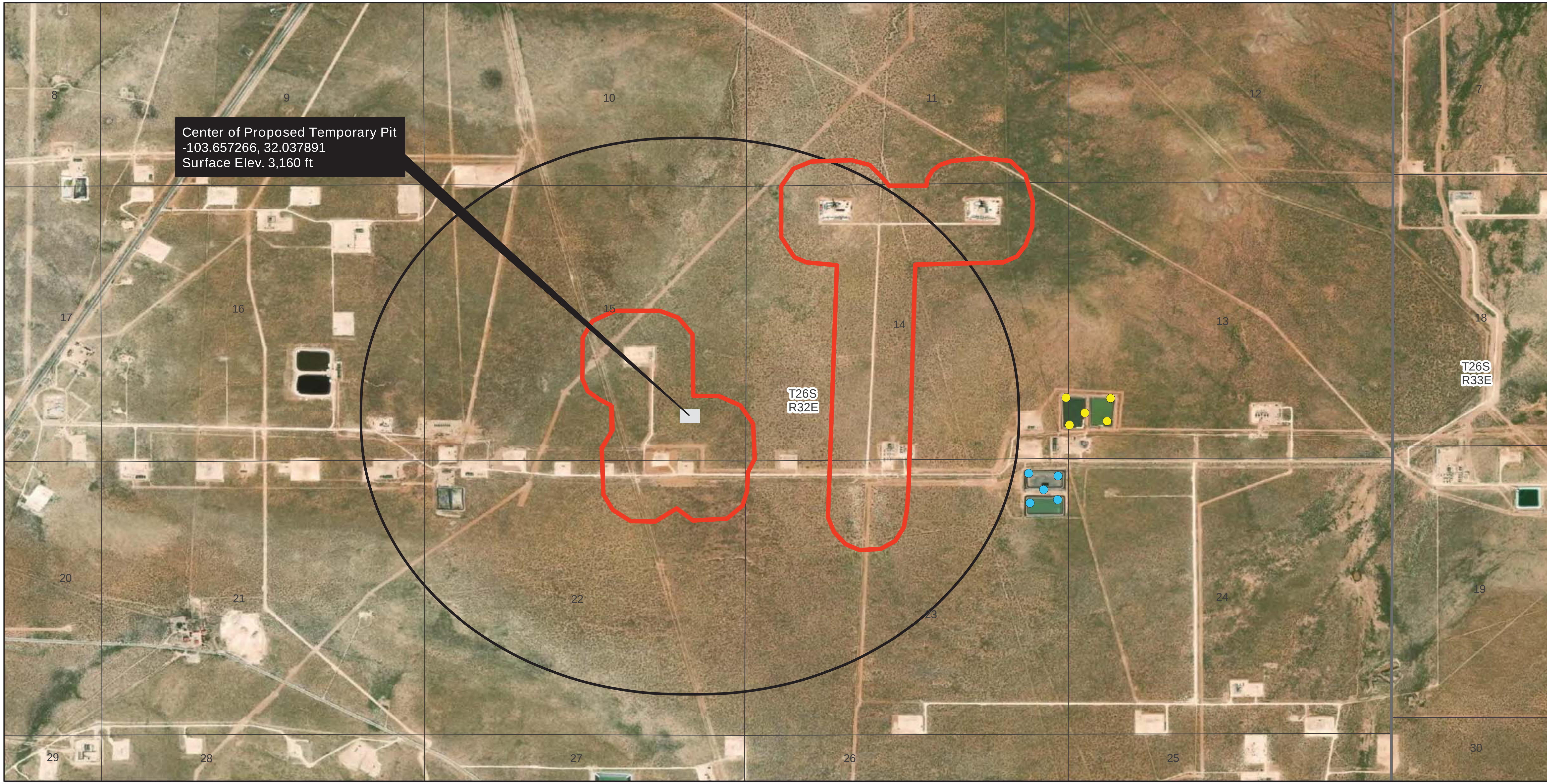
Figure G2: Regional Geology and Fault Lines

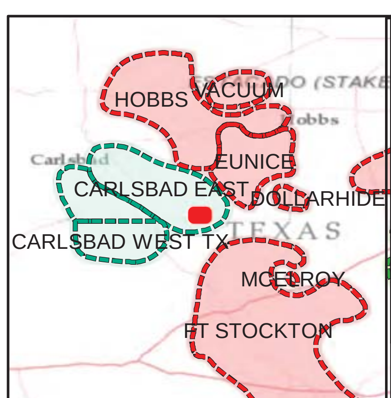
STATE: NEW MEXICO **COUNTY:** LEA

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: USGS	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT / DATE: 7/27/2020





LEGEND

Legend

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

0 0.15 0.3 0.6 0.9 1.2 Miles

N E S W

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.

SD 15 FED P419 Temporary Pit	
Figure G3: Historical Survey Area	
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: Arcadis, Tetra Tech	
PIPELINE DATA: N/A	
Coordinate System: GCS North American 1983	
DRAWN BY: MCBU HSE	PROJECT PHASE: CURRENT / DATE: 7/27/2020

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

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

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.

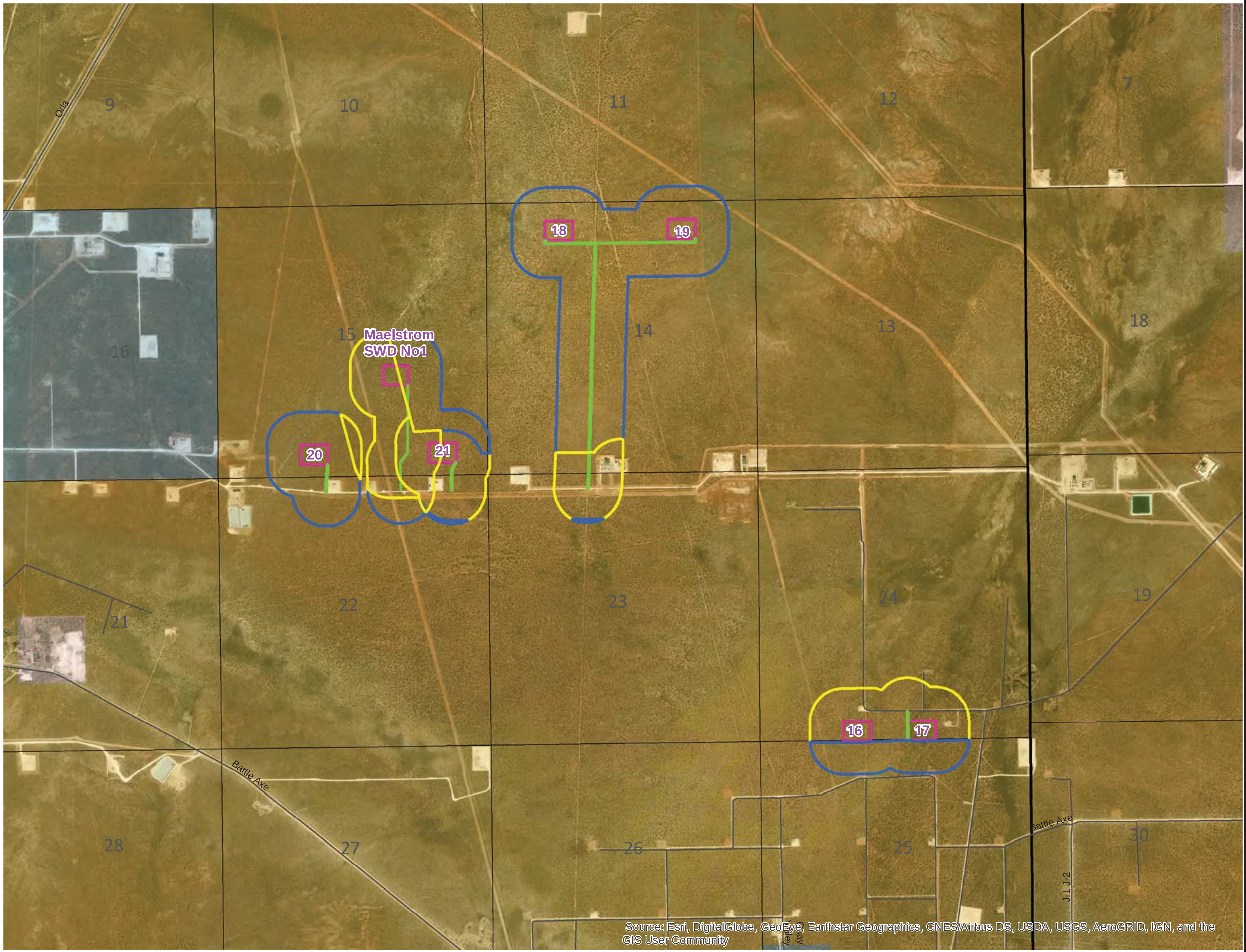
The proposed project area lies near the northeast margin of the Delaware Basin. As discussed in further detail in Section 11.2, bedrock cropping out beneath the proposed project area consists of the Triassic-aged Dockum Group. Underlying the Dockum Group are the Dewey Lake redbeds. Both of these formations 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 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.



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

0 2,000 4,000

Feet

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

ENVIROMENTAL FIELD SURVEY AREA

ARCADIS

FIGURE
2

DIV/GROUP: ENV/IMDV DB: adavis LD: PIC: PM: TM:
PROJECT: PATH: Z:\GISProjects_ENV_ALPHA_ENV_C-D\Chevron_NM\MXD\SaladoDraw_Report\Figure2_ProjectArea.mxd DATE: 3/29/2018 4:13:27 PM

APPENDIX A

Resumes

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

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.

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.

ARCADIS Design & Consultancy for natural and built assets

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.

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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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.

Legend: Exploratory Boring Location

	CHEVRON	DWG BY: DH
TETRA TECH Texas Registered Engineering Firm F-3924	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. 0

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 fluviatile 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

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 **SAND** with Silt, Dry, with some roots
	SS	8		
3.5	SS	41		Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry
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"		

(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

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				Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry *(continued)*
45				
50	SS	*50/0"*		
55				
60				
65				
70				
75				
80			80.0	Borehole terminated at 80.0 feet.

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

BOREHOLE ID: B-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: 32.038880N

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 **SAND** with Silt, Dry, with some roots
1.5	SS	52		Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry
	SS	36		
5				
	SS	48		
	SS	50/1"		
10				
	SS	50/2"		
15				
	SS	50/1"		
20				
	SS	50/2"		
25.0				Borehole terminated at 25.0 feet due to refusal.

TETRA TECH

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

BOREHOLE ID: B-3

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	SS	9		Very Loose, Brown, Fine to Medium Grained **SAND** with Silt, Dry, with some roots
1.5	SS	14		Medium Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, 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"		
25.0				Borehole terminated at 25.0 feet due to refusal.

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

BOREHOLE ID: B-4

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 **SAND** with Silt, Dry, with some roots
1.5	SS	44		Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry
	SS	40		
5				
	SS			
	SS	50/2"		
10				
	SS	50/4"		
15				
	SS	50/1"		
20				
	SS	50/1"		
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

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	SS	4		Very Loose, Brown, Fine to Medium Grained **SAND** with Silt, Dry, with some roots
1.5	SS	50		Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry
5	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.

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

CLEAR SOLUTIONS™

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
NEW MEXICO
21161
PROFESSIONAL ENGINEER
9/15/2016

Rajendra Meruva, P.E.
Senior Geotechnical Engineer

September 15, 2016

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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 fluviatile 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

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 **SAND** 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.

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

BOREHOLE ID: B-2

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 **SAND** 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.

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

BOREHOLE ID: B-3

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 **SAND** 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.

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

BOREHOLE ID: B-4

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 **SAND** 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.

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

BOREHOLE ID: B-5

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 **SAND** 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 SALADO.GPJ 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

U.S. Department of the Interior
Bureau of Land Management

2019

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

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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, contaminates 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 values, 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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From:	OCDOnline@state.nm.us
To:	Becerra, Laura
Subject:	[**EXTERNAL**] OCD Receipt of Fee Application Payment
Date:	Wednesday, August 05, 2020 5:00:25 PM
Attachments:	OCDReceiptOfFeePayment.pdf

Thank you for your fee application payment! Your receipt is attached.

PO Number:	XDB8J-200805-C-1440
Payment Date:	8/5/2020
Payment Amount:	$150.00
Payment Type:	Credit Card

Application Type:	Application for administrative approval of a proposed alternative method permit or closure plan application.
Fee Amount:	$150.00
Application Status:	Under OCD Review

OGRID:	4323
First Name:	Laura
Last Name:	Becerra
Email:	LBecerra@chevron.com

IMPORTANT: If you are mailing or delivering your application, you must print and include your receipt of payment as the first page on your application. All mailed and delivered applications must be sent to the following address: 1220 S. St. Francis Dr., Santa Fe, NM 87505. For inquiries, reference the PO Number listed above.

Oil Conservation Division * 1220 South St. Francis Drive * Santa Fe, New Mexico 87505
(505) 476-3441 * ocd.fees@state.nm.us * www.emnrd.state.nm.us/OCD

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

Receipt of Fee Application Payment

PO Number: XDB8J-200805-C-1440

Payment Date:	8/5/2020 3:59:40 PM
Payment Amount:	$150.00
Payment Type:	Credit Card
Application Type:	Application for administrative approval of a proposed alternative method permit or closure plan application.
Fee Amount:	$150.00
Application Status:	Under OCD Review
OGRID:	4323
First Name:	Laura
Last Name:	Becerra
Email:	LBecerra@chevron.com

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