

Incident ID	nAPP2222130109
District RP	
Facility ID	
Application ID	

Closure

The responsible party must attach information demonstrating they have complied with all applicable closure requirements and any conditions or directives of the OCD. This demonstration should be in the form of a comprehensive report (electronic submittals in .pdf format are preferred) including a scaled site map, sampling diagrams, relevant field notes, photographs of any excavation prior to backfilling, laboratory data including chain of custody documents of final sampling, and a narrative of the remedial activities. Refer to 19.15.29.12 NMAC.

Closure Report Attachment Checklist: *Each of the following items must be included in the closure report.*

- ☐ A scaled site and sampling diagram as described in 19.15.29.11 NMAC
- ☒ Photographs of the remediated site prior to backfill or photos of the liner integrity if applicable (Note: appropriate OCD District office must be notified 2 days prior to liner inspection)
- ☐ Laboratory analyses of final sampling (Note: appropriate ODC District office must be notified 2 days prior to final sampling)
- ☐ Description of remediation activities

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations. The responsible party acknowledges they must substantially restore, reclaim, and re-vegetate the impacted surface area to the conditions that existed prior to the release or their final land use in accordance with 19.15.29.13 NMAC including notification to the OCD when reclamation and re-vegetation are complete.

Printed Name: Jim Raley Title: Environmental Specialist

Signature: _____ Date: _____

email: jim.raley@dmv.com Telephone: 575-689-7597

OCD Only

Received by: Jocelyn Harimon Date: 09/26/2022

Closure approval by the OCD does not relieve the responsible party of liability should their operations have failed to adequately investigate and remediate contamination that poses a threat to groundwater, surface water, human health, or the environment nor does not relieve the responsible party of compliance with any other federal, state, or local laws and/or regulations.

Closure Approved by: Robert Hamlet Date: 12/14/2022

Printed Name: Robert Hamlet Title: Environmental Specialist - Advanced



September 21, 2022

Vertex Project #: 22E-02951

Spill Closure Report: RDX Federal 17 #035H
Section 17, Township 26 South, Range 30 East
API: 30-015-43884
County: Eddy
Incident Report: nAPP2222130109

Prepared For: WPX Energy Permian, LLC
5315 Buena Vista Drive
Carlsbad, New Mexico 88220

New Mexico Oil Conservation Division – District 2 – Artesia

811 South 1st Street
Artesia, New Mexico 88210

WPX Energy Permian, LLC (WPX) retained Vertex Resource Services Inc. (Vertex) to conduct a Spill Assessment for a release of produced water caused by a pinhole that developed in the produced water dump line at RDX Federal 17 #035H, API 30-015-43884, Incident nAPP2222130109 (hereafter referred to as “RDX”). WPX provided spill notification to the New Mexico Oil Conservation District (NMOCD) District 2, via submission of an initial C-141 Release Notification (Attachment 1). This letter provides a description of the Spill Assessment and includes a request for Spill Closure. The spill area is located at N 32.0492796, W -103.909725.

Background

The site is located approximately 14.96 miles southeast of Malaga, New Mexico (Google Inc., 2022). The legal location for the site is Section 17, Township 26 South and Range 30 East in Eddy County, New Mexico. The spill area is located on Bureau of Land Management (BLM) property.

The Geological Map of New Mexico (New Mexico Bureau of Geology and Mineral Resources, 2022) indicates the site’s surface geology is comprised primarily of Qoa -Older alluvial deposits of upland plains and piedmont areas and is characterized as calcic soils and eolian cover sediments of High Plains region (middle to lower Pleistocene). The Natural Resources Conservation Service *Web Soil Survey* characterizes the predominant soil texture on the site is Potter-Simona complex. It tends to be well drained with high runoff and very low available moisture levels in the soil profile (United States Department of Agriculture, Natural Resources Conservation Service, 2022).

The surrounding landscape is associated with ridges, hills, plains, and alluvial fans at elevations of 2,750 to 5,000 feet above sea level. The climate is semi-arid, with an annual precipitation ranging between 8 to 16 inches. Historically, the plant community has grassland aspect, dominated by grasses with shrubs. Black grama is dominant with a mixture of creosotebush, mesquite, and catclaw mimosa shrubs. Overgrazing and extended drought can reduce grass cover (United States Department of Agriculture, Natural Resources Conservation Service, 2022).

[vertex.ca](https://www.vertex.ca)

3101 Boyd Drive, Carlsbad, New Mexico 88220, USA | P 575.725.5001

WPX Energy Permian, LLC
RDX Federal 17 #035H, nAPP2222130109

2022 Spill Assessment and Closure
September 2022

There is no surface water located on-site. The nearest significant watercourse, as defined in Subsection P of 19.15.17.7 Mexico Administrative Code (NMAC; New Mexico Oil Conservation Division, 2018) is the Pecos River located approximately 4.9 miles southwest of the site (Google Inc., 2022). There are no continuous flowing watercourses or significant watercourses, lakebeds, sinkholes, playa lakes, or other critical water or community features as outlined in Paragraph (4) of Subsection C of 19.15.29.12 NMAC.

Incident Description

The spill occurred on August 8, 2022, due to pinhole leak on the produced water dump line. The spill was reported on August 9, 2022, and involved the release of approximately 5 barrels (bbl.) of produced water into the lined containment of the tank battery. Approximately 5 bbl. of free fluid was removed during initial spill clean-up. The NMOCD C-141 Report: nAPP2222130109 is included in Attachment 1. The Daily Field Report (DFRs) and site photographs are included in Attachment 2.

Closure Criteria Determination

The depth to groundwater was determined using information from the United States Geological Survey National Water Information Mapping System and Office of the State Engineers Water Rights Database. A 0.5-mile search radius was used to determine groundwater depth. The closest recorded depth to groundwater was determined to be 200 feet below ground surface (bgs) and 1.42 miles from the site (New Mexico Office of the State Engineer, New Mexico Water Rights Reporting System, 2022). Documentation used in Closure Criteria Determination research is included in Attachment 3.

WPX Energy Permian, LLC
RDX Federal 17 #035H, nAPP2222130109

2022 Spill Assessment and Closure
September 2022

Closure Criteria Worksheet				
Site Name: RDX Federal 17 #035H				
Spill Coordinates:		X: 32.0492796	Y: -103.909725	
Site Specific Conditions		Value	Unit	Reference
1	Depth to Groundwater	125	feet	1
2	Within 300 feet of any continuously flowing watercourse or any other significant watercourse	25,860	feet	2
3	Within 200 feet of any lakebed, sinkhole or playa lake (measured from the ordinary high-water mark)	5,537	feet	3
4	Within 300 feet from an occupied residence, school, hospital, institution or church	56,660	feet	4
5	i) Within 500 feet of a spring or a private, domestic fresh water well used by less than five households for domestic or stock watering purposes, or	7,500	feet	5
	ii) Within 1000 feet of any fresh water well or spring	4,986	feet	5
6	Within incorporated municipal boundaries or within a defined municipal fresh water field covered under a municipal ordinance adopted pursuant to Section 3-27-3 NMSA 1978 as amended, unless the municipality specifically approves	No	(Y/N)	6
7	Within 300 feet of a wetland	484	feet	7
8	Within the area overlying a subsurface mine	No	(Y/N)	8
9	Within an unstable area (Karst Map)		Critical High Medium Low	9
10	Within a 100-year Floodplain	500	year	10
11	Soil Type	Upton-Simona complex		11
12	Ecological Classification	Shallow, Shallow Sandy		12
13	Geology	Qoa		13
	NMAC 19.15.29.12 E (Table 1) Closure Criteria	<50'	<50' 51-100' >100'	

Based on data included in the closure criteria determination worksheet, the release at RDX would not be subject to the requirements of Paragraph (4) of Subsection C of 19.15.29.12 NMAC and the closure criteria for the site would be determined to be associated with the following constituent concentration limits based on depth to groundwater. The

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WPX Energy Permian, LLC
RDX Federal 17 #035H, nAPP2222130109

2022 Spill Assessment and Closure
September 2022

closure criteria determined for the site are associated with the following constituent concentration limits as presented in Table 1.

Table 1. Closure Criteria for Soils Impacted by a Release		
Minimum depth below any point within the horizontal boundary of the release to groundwater less than 10,000 mg/l TDS	Constituent	Limit
< 50 feet	Chloride	600 mg/kg
	TPH (GRO+DRO+MRO)	100 mg/kg
	BTEX	50 mg/kg
	Benzene	10 mg/kg

TDS - Total dissolved solids

TPH - Total petroleum hydrocarbons = gasoline range organics (GRO) + diesel range organics (DRO) + motor oil range organics (MRO)

BTEX - Benzene, toluene, ethylbenzene, and xylenes

Remedial Actions Taken

An initial site inspection of the spill area was completed on September 16, 2022, which identified the area of the spill specified in the initial C-141 Report. The DFR associated with the site inspection is included in Attachment 2.

Notification that a liner inspection was scheduled to be completed was provided to the NMOCD on September 12, 2022. Visual observation of the liner was completed on all sides and the base of the containment, around equipment, and of all seams in the liner. As evidenced in the DFR (Attachment 2) liner integrity was confirmed. The Liner Inspection Notification email is included in Attachment 4.

Closure Request


Vertex recommends no remediation action to address the release at RDX Federal 17 #035H. The secondary containment liner appeared to be intact and had the ability to contain the release, as shown in the inspection photographs included with the DFR (Attachment 2). There are no anticipated risks to human, ecological or hydrological receptors associated with the release site.

Vertex requests that incident nAPP2222130109 be closed as all closure requirements set forth in Subsection E of 19.15.29.12 NMAC have been met. WPX certifies that all information in this report and the attachments is correct, and that they have complied with all applicable closure requirements and conditions specified in Division rules and directives to meet NMOCD requirements to obtain closure on the open release at RDX Federal 17 #035H.

WPX Energy Permian, LLC
RDX Federal 17 #035H, nAPP2222130109

2022 Spill Assessment and Closure
September 2022

Should you have any questions or concerns, please do not hesitate to contact the undersigned at 575.361.9880 or mpeppin@vertex.ca.



September 21, 2022

Monica Peppin
PROJECT MANAGER, REPORTING

Date

Attachments

- Attachment 1. NMOCD C-141 Report
- Attachment 2. Daily Field Report(s) with Pictures
- Attachment 3. Closure Criteria for Soils Impacted by a Release Research Determination Documentation
- Attachment 4. Required 48-hr Notification of Liner Inspection to Regulatory Agencies

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WPX Energy Permian, LLC
RDX Federal 17 #035H, nAPP2222130109

2022 Spill Assessment and Closure
September 2022

References

- Google Inc. (2022). *Google Earth Pro (Version 7.3.4)* [Software]. Retrieved from <http://www.google.com/earth> on September 1, 2022.
- New Mexico Bureau of Geology and Mineral Resources. (2022). *Interactive Geologic Map*. Retrieved from <http://geoinfo.nmt.edu>.
- New Mexico Mining and Minerals Division. (2022). *Coal Mine Resources in New Mexico*. Retrieved from <http://www.emnrd.state.nm.us/MMD/gismapminedata.html>
- New Mexico Oil Conservation Division. (2018). *New Mexico Administrative Code – Natural Resources and Wildlife Oil and Gas Releases*. Santa Fe, New Mexico.
- New Mexico Office of the State Engineer, New Mexico Water Rights Reporting System. (2022). *Water Column/Average Depth to Water Report*. Retrieved from <http://nmwrrs.ose.state.nm.us/nmwrrs/waterColumn.html>
- United States Department of Agriculture, Natural Resources Conservation Service. (2022). *Web Soil Survey*. Retrieved from <https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>.
- United States Department of Homeland Security, FEMA Flood Map Service Center. (2020). *Flood Map Number 35015C1875D*. Retrieved from <https://msc.fema.gov/portal/search?AddressQuery=malaga%20new%20mexico#searchresultsanchor>
- United States Department of the Interior, Bureau of Land Management. (2018). *New Mexico Cave/Karsts*. Retrieved from <https://www.blm.gov/programs/recreation/recreation-programs/caves/new-mexico>.
- United States Fish and Wildlife Service. (2022). *National Wetlands Inventory Surface Waters and Wetland*. Retrieved from <https://www.fws.gov/wetlands/data/Mapper.html>.

WPX Energy Permian, LLC
RDX Federal 17 #035H, nAPP2222130109

2022 Spill Assessment and Closure
September 2022

Limitations

This report has been prepared for the sole benefit of WPX Energy Permian, LLC. This document may not be used by any other person or entity, with the exception of the New Mexico Oil Conservation Division and Bureau of Land Management, without the express written consent of Vertex Resource Services Inc. (Vertex) and WPX Energy Permian, LLC. Any use of this report by a third party, or any reliance on decisions made based on it, or damages suffered as a result of the use of this report are the sole responsibility of the user.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted scientific practices current at the time the work was performed. The conclusions and recommendations presented represent the best judgement of Vertex based on the data collected during the assessment. Due to the nature of the assessment and the data available, Vertex cannot warrant against undiscovered environmental liabilities. Conclusions and recommendations presented in this report should not be considered legal advice.

ATTACHMENT 1

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

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

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

Incident ID	nAPP2222130109
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Facility ID	
Application ID	

Release Notification

Responsible Party

Responsible Party WPX Energy Permian, LLC	OGRID 246289
Contact Name Jim Raley	Contact Telephone 575-689-7597
Contact email Jim.Raley@dvn.com	Incident # (assigned by OCD) nAPP2222130109
Contact mailing address 5315 Buena Vista Drive, Carlsbad, NM 88220	

Location of Release Source

Latitude 32.0492796 Longitude -103.909725
(NAD 83 in decimal degrees to 5 decimal places)

Site Name: RDX FEDERAL 17 #035H	Site Type: Oil Well
Date Release Discovered: 8/8/2022	API# (if applicable) 30-015-43884

Unit Letter	Section	Township	Range	County
D	17	26S	30E	Eddy

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

Nature and Volume of Release

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

<input type="checkbox"/> Crude Oil	Volume Released (bbls)	Volume Recovered (bbls)
<input checked="" type="checkbox"/> Produced Water	Volume Released (bbls) 10	Volume Recovered (bbls) 10
	Is the concentration of dissolved chloride in the produced water >10,000 mg/l?	<input type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> Condensate	Volume Released (bbls)	Volume Recovered (bbls)
<input type="checkbox"/> Natural Gas	Volume Released (Mcf)	Volume Recovered (Mcf)
<input type="checkbox"/> Other (describe)	Volume/Weight Released (provide units)	Volume/Weight Recovered (provide units)

Cause of Release: Produced water dump line developed pinhole leak, allowing for release of approx.. 10 bbls produced water to lined secondary containment.

Released Volume estimate = Recovered Volume as lined containment.


State of New Mexico
Oil Conservation Division

Incident ID	nAPP2222130109
District RP	
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Was this a major release as defined by 19.15.29.7(A) NMAC? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If YES, for what reason(s) does the responsible party consider this a major release? Volume exceeded 25 bbls.
If YES, was immediate notice given to the OCD? By whom? To whom? When and by what means (phone, email, etc)?	

Initial Response

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

<input checked="" type="checkbox"/> The source of the release has been stopped. <input checked="" type="checkbox"/> The impacted area has been secured to protect human health and the environment. <input checked="" type="checkbox"/> Released materials have been contained via the use of berms or dikes, absorbent pads, or other containment devices. <input checked="" type="checkbox"/> All free liquids and recoverable materials have been removed and managed appropriately.
If all the actions described above have <u>not</u> been undertaken, explain why:
Per 19.15.29.8 B. (4) NMAC the responsible party may commence remediation immediately after discovery of a release. If remediation has begun, please attach a narrative of actions to date. If remedial efforts have been successfully completed or if the release occurred within a lined containment area (see 19.15.29.11(A)(5)(a) NMAC), please attach all information needed for closure evaluation.
I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations. Printed Name: <u>Jim Raley</u> Title: <u>Environmental Professional</u> Signature: <u></u> Date: <u>8/09/2022</u> email: <u>jim.raley@dvn.com</u> Telephone: <u>575-689-7597</u>
<u>OCD Only</u> Received by: _____ Date: _____

Incident ID	nAPP2222130109
District RP	
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Site Assessment/Characterization

This information must be provided to the appropriate district office no later than 90 days after the release discovery date.

What is the shallowest depth to groundwater beneath the area affected by the release?	_____ 200 _____ (ft bgs)
Did this release impact groundwater or surface water?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release within 300 feet of a continuously flowing watercourse or any other significant watercourse?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release within 200 feet of any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release within 300 feet of an occupied permanent residence, school, hospital, institution, or church?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release within 500 horizontal feet of a spring or a private domestic fresh water well used by less than five households for domestic or stock watering purposes?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release within 1000 feet of any other fresh water well or spring?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release within incorporated municipal boundaries or within a defined municipal fresh water well field?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release within 300 feet of a wetland?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release overlying a subsurface mine?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release overlying an unstable area such as karst geology?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Are the lateral extents of the release within a 100-year floodplain?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Did the release impact areas not on an exploration, development, production, or storage site?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

Attach a comprehensive report (electronic submittals in .pdf format are preferred) demonstrating the lateral and vertical extents of soil contamination associated with the release have been determined. Refer to 19.15.29.11 NMAC for specifics.

Characterization Report Checklist: *Each of the following items must be included in the report.*

- | | |
|---------------------------------------|---|
| <input type="checkbox"/> N/A | Scaled site map showing impacted area, surface features, subsurface features, delineation points, and monitoring wells. |
| <input checked="" type="checkbox"/> X | Field data |
| <input type="checkbox"/> N/A | Data table of soil contaminant concentration data |
| <input checked="" type="checkbox"/> X | Depth to water determination |
| <input checked="" type="checkbox"/> X | Determination of water sources and significant watercourses within ½-mile of the lateral extents of the release |
| <input type="checkbox"/> N/A | Boring or excavation logs |
| <input checked="" type="checkbox"/> X | Photographs including date and GIS information |
| <input type="checkbox"/> N/A | Topographic/Aerial maps |
| <input type="checkbox"/> N/A | Laboratory data including chain of custody |

If the site characterization report does not include completed efforts at remediation of the release, the report must include a proposed remediation plan. That plan must include the estimated volume of material to be remediated, the proposed remediation technique, proposed sampling plan and methods, anticipated timelines for beginning and completing the remediation. The closure criteria for a release are contained in Table 1 of 19.15.29.12 NMAC, however, use of the table is modified by site- and release-specific parameters.

State of New Mexico
Oil Conservation Division

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District RP	
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Printed Name: Jim Raley Title: Environmental Specialist

Signature: _____ Date: _____

email: jim.raley@dm.com Telephone: 575-689-7597

OCD Only

Received by: Jocelyn Harimon Date: 09/26/2022

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Closure

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- ☐ A scaled site and sampling diagram as described in 19.15.29.11 NMAC
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Printed Name: Jim Raley Title: Environmental Specialist

Signature: _____ Date: _____

email: jim.raley@dvn.com Telephone: 575-689-7597

OCD Only

Received by: Jocelyn Harimon Date: 09/26/2022

Closure approval by the OCD does not relieve the responsible party of liability should their operations have failed to adequately investigate and remediate contamination that poses a threat to groundwater, surface water, human health, or the environment nor does not relieve the responsible party of compliance with any other federal, state, or local laws and/or regulations.

Closure Approved by: _____ Date: _____

Printed Name: _____ Title: _____

ATTACHMENT 2



Daily Site Visit Report

Client:	Devon Energy Corporation	Inspection Date:	9/16/2022
Site Location Name:	RDX Federal 17 #035H	Report Run Date:	9/16/2022 6:10 PM
Client Contact Name:	Wes Matthews	API #:	
Client Contact Phone #:	(575) 748-0176		
Unique Project ID		Project Owner:	
Project Reference #		Project Manager:	

Summary of Times

Arrived at Site	9/16/2022 9:10 AM
Departed Site	9/16/2022 10:06 AM

Field Notes

9:40 Arrived on site and filled out JSA

9:40 Liner inspection to be done with Monica Peppin

10:05 Liner cleaned

10:05 No signs of potential breach

Next Steps & Recommendations

1 Closer report

Daily Site Visit Report



Site Photos

Viewing Direction: East



North side inside containment wall facing east

Viewing Direction: South



In between tanks on west end on containment

Viewing Direction: South



In between tanks

Viewing Direction: South



In between tanks



Daily Site Visit Report

Viewing Direction: South



In between tanks

Viewing Direction: South



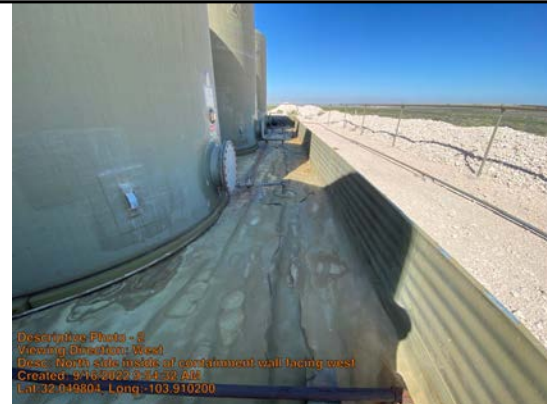
In between tanks

Viewing Direction: South



In between tanks and western wall

Viewing Direction: West



North side inside of containment wall facing west



Daily Site Visit Report

Viewing Direction: Southwest



West side of containment wall facing southwest

Viewing Direction: East



In between tanks facing east

Viewing Direction: East



South side of containment wall inside facing east

Viewing Direction: North



West side of containment wall facing north



Daily Site Visit Report

Viewing Direction: West



Inside containment wall facing west on southern wall

Viewing Direction: West



In between tanks facing west

Viewing Direction: West



Inside of containment wall on north side facing west

Daily Site Visit Report



Daily Site Visit Signature

Inspector: Jacob Reta

Signature:

A handwritten signature in black ink, appearing to be 'JR', written over a horizontal line. The word 'Signature' is faintly visible below the line.

ATTACHMENT 3

RDX Federal 17 #035H



5/18/2022, 2:15:04 PM

GIS WATERS PODs

Active

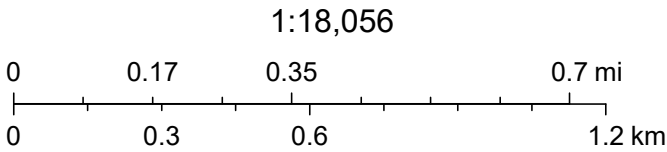
Pending

OSE District Boundary

New Mexico State Trust Lands

Both Estates

SiteBoundaries



Esri, HERE, Garmin, (c) OpenStreetMap contributors, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, U.S. Department of Energy Office of Legacy Management



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE OF NEW MEXICO
ROSWELL, NEW MEXICO

2022 MAY 17 PM 1:58

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) C-4068 POD1				OSE FILE NUMBER(S) C-4068			
	WELL OWNER NAME(S) RKI Exploration and Production, LLC				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 3500 One Williams Center MD 35,				CITY Tulsa		STATE OK	ZIP 74172
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE	MINUTES 32	SECONDS 2	43.95	N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND	
		LONGITUDE	103	53	39.23	W	* DATUM REQUIRED: WGS 84	
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE NW/4SW/4NW/4 Section 16, Township 26S, Range 30 E, N.M.P.M.								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER 1249		NAME OF LICENSED DRILLER Jackie D. Atkins			NAME OF WELL DRILLING COMPANY Atkins Engineering Associates, Inc.		
	DRILLING STARTED 5/11/2017		DRILLING ENDED 5/12/2017		DEPTH OF COMPLETED WELL (FT) n/a	BORE HOLE DEPTH (FT) 125		DEPTH WATER FIRST ENCOUNTERED (FT) none encountered
	COMPLETED WELL IS: <input type="checkbox"/> ARTESIAN <input checked="" type="checkbox"/> DRY HOLE <input type="checkbox"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT) n/a	
	DRILLING FLUID: <input checked="" type="checkbox"/> AIR <input type="checkbox"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input checked="" type="checkbox"/> OTHER - SPECIFY: hollow stem auger with air rotary							
	DEPTH (feet bgl) FROM TO		BORE HOLE DIAM. (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
	0	125						
3. ANNULAR MATERIAL	DEPTH (feet bgl) FROM TO		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	n/a	n/a						n/a

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 10/29/15)

FILE NUMBER	C-4068	POD NUMBER	1	TRN NUMBER	606777
LOCATION	26S-30E-16-1-3-1			EXPL	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

5. TEST; RIG SUPERVISION

6. SIGNATURE

FOR USE INTERNAL USE		WR-20 WELL RECORD & LOG (Version 10/29/2015)	
FILE NUMBER	C-4068	POD NUMBER	1
LOCATION	26S 30E 11.1.3.1	TRN NUMBER	606777
			EXP1
			PAGE 2 OF 2

Tom Blaine, P.E.
State Engineer



Roswell Office
1900 WEST SECOND STREET
ROSWELL, NM 88201

**STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER**

Trn Nbr: 606777
File Nbr: C 04068
Well File Nbr: C 04068 POD1

Jun. 12, 2017

JUSTIN BARMORE
RKI EXPLORATION AND PRODUCTION LLC
3500 ONE WILLIAMS CENTER MD 35
TULSA, OK 74172

Greetings:

The above numbered permit was issued in your name on 05/08/2017.

The Well Record was received in this office on 05/17/2017, stating that it had been completed on 05/12/2017, and was a dry well. The well is to be plugged or capped or otherwise maintained in a manner satisfactory to the State Engineer.

Please note that another well can be drilled under this permit if the well is completed and the well log filed on or before 05/15/2018.

If you have any questions, please feel free to contact us.

Sincerely,

A handwritten signature in cursive script, appearing to read "D. Dunaway".

Deborah Dunaway
(575) 622-6521

drywell

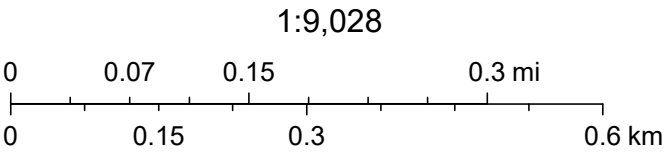
RDX Federal 17 #035H



5/18/2022, 2:30:39 PM

- Override 1
- Pending
- New Mexico State Trust Lands
- Both Estates
- SiteBoundaries
- GIS WATERS PODs
- OSE District Boundary

●

Active

Esri, HERE, Garmin, (c) OpenStreetMap contributors, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, U.S. Department of Energy Office of Legacy Management




New Mexico Office of the State Engineer

Point of Diversion Summary

(quarters are 1=NW 2=NE 3=SW 4=SE)

(quarters are smallest to largest)

(NAD83 UTM in meters)

Well Tag	POD Number	Q64 Q16 Q4	Sec	Tws	Rng	X	Y
C	03483	4 4 4	05	26S	30E	604296	3548251 

x

Driller License: 1509 **Driller Company:** BMS DRILLING COMPANY

Driller Name: BEAUREGARD, RICHARD

Drill Start Date: 06/03/2011	Drill Finish Date: 06/08/2011	Plug Date:
Log File Date: 07/14/2011	PCW Rcv Date:	Source: Shallow
Pump Type: SUBMER	Pipe Discharge Size:	Estimated Yield: 35 GPM
Casing Size: 8.00	Depth Well: 700 feet	Depth Water: 200 feet

x

Water Bearing Stratifications:	Top	Bottom	Description
	200	255	Sandstone/Gravel/Conglomerate
	285	320	Sandstone/Gravel/Conglomerate
	320	360	Sandstone/Gravel/Conglomerate
	510	650	Shale/Mudstone/Siltstone

x

Casing Perforations:	Top	Bottom
	180	260
	280	360
	500	680

x

Meter Number: 14452	Meter Make: MASTERMETER
Meter Serial Number: 32530329	Meter Multiplier: 100.0000
Number of Dials: 6	Meter Type: Diversion
Unit of Measure: Gallons	Return Flow Percent:
Usage Multiplier:	Reading Frequency:

x

Meter Readings (in Acre-Feet)

Read Date	Year	Mtr Reading	Flag	Rdr	Comment	Mtr Amount Online
07/11/2011	2011	10	A	bd	WELL TO BE SET UP FOR COM SALE	0
04/01/2014	2014	188668	A	RPT		0
04/02/2014	2014	44195	A	RPT		0
07/01/2014	2014	62284	A	RPT		5.551
10/01/2014	2014	91448	A	RPT		8.950
12/31/2014	2014	126199	A	RPT		10.665
02/01/2015	2015	138888	A	RPT		3.894
03/02/2015	2015	150578	A	RPT		3.588
04/01/2015	2015	157715	A	RPT		2.190
04/30/2015	2015	170037	A	RPT		3.781
05/31/2015	2015	182144	A	RPT		3.716
07/01/2015	2015	188338	A	RPT		1.901

08/31/2015	2015	209416	A	RPT	6.469
01/01/2016	2015	244328	A	mb	10.714
02/01/2016	2016	245605	A	mb	0.392
03/02/2016	2016	246331	A	mb	0.223
04/01/2016	2016	246331	A	mb	0
05/01/2016	2016	248057	A	mb	0.530
06/01/2016	2016	262631	A	mb	4.473
07/01/2016	2016	271192	A	mb	2.627
08/01/2016	2016	273040	A	mb	0.567
09/01/2016	2016	283123	A	mb	3.094
10/01/2016	2016	290786	A	mb	2.352

**YTD Meter Amounts:	Year	Amount
	2011	0
	2014	25.166
	2015	36.253
	2016	14.258

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5/4/22 2:37 PM

POINT OF DIVERSION SUMMARY



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	Distance	DepthWell	DepthWater	Water Column
C 04068 POD1		CUB	ED	1	3	1	16	26S	30E	604397	3546018	1520			
C 01360		CUB	ED	4	3	3	05	26S	30E	602997	3548152	1735	770	173	597
C 01361		CUB	ED	3	4	3	05	26S	30E	603240	3548157	1766	775	184	591
C 03483		C	ED	4	4	4	05	26S	30E	604296	3548251	2286	700	200	500
C 03581 POD1		CUB	ED	4	4	4	05	26S	30E	604298	3548291	2320	800	320	480
C 04561 POD1		CUB	ED	4	3	3	24	26S	29E	599924	3543208	4397			

Average Depth to Water: **219 feet**

Minimum Depth: **173 feet**

Maximum Depth: **320 feet**

Record Count: 6

UTM NAD83 Radius Search (in meters):

Easting (X): 602930

Northing (Y): 3546418

Radius: 5000

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5/4/22 2:37 PM

WATER COLUMN/ AVERAGE DEPTH TO WATER

RDX Federal 17 #035H Proximity Map

Nearest Active Well

C 04068 POD1 Exploration Well

Distance: 0.94 miles (4986 feet)

Nearest Depth to Groundwater (DTGW) Reference



C 03483 Livestock Water Well

Distance: 1.42 miles (7500 feet)

DTGW: 200 feet

DTGW: 06/08/2011

Legend

-  RDX Federal 17 #035
-  Water Wells

RDX Federal 17 #035

C 03483

C 04068 POD1

Google Earth

Released to Imaging: 12/14/2022 2:19:12 PM

1 mi





RDX Federal 17 #035H Watercourse



May 11, 2022

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland

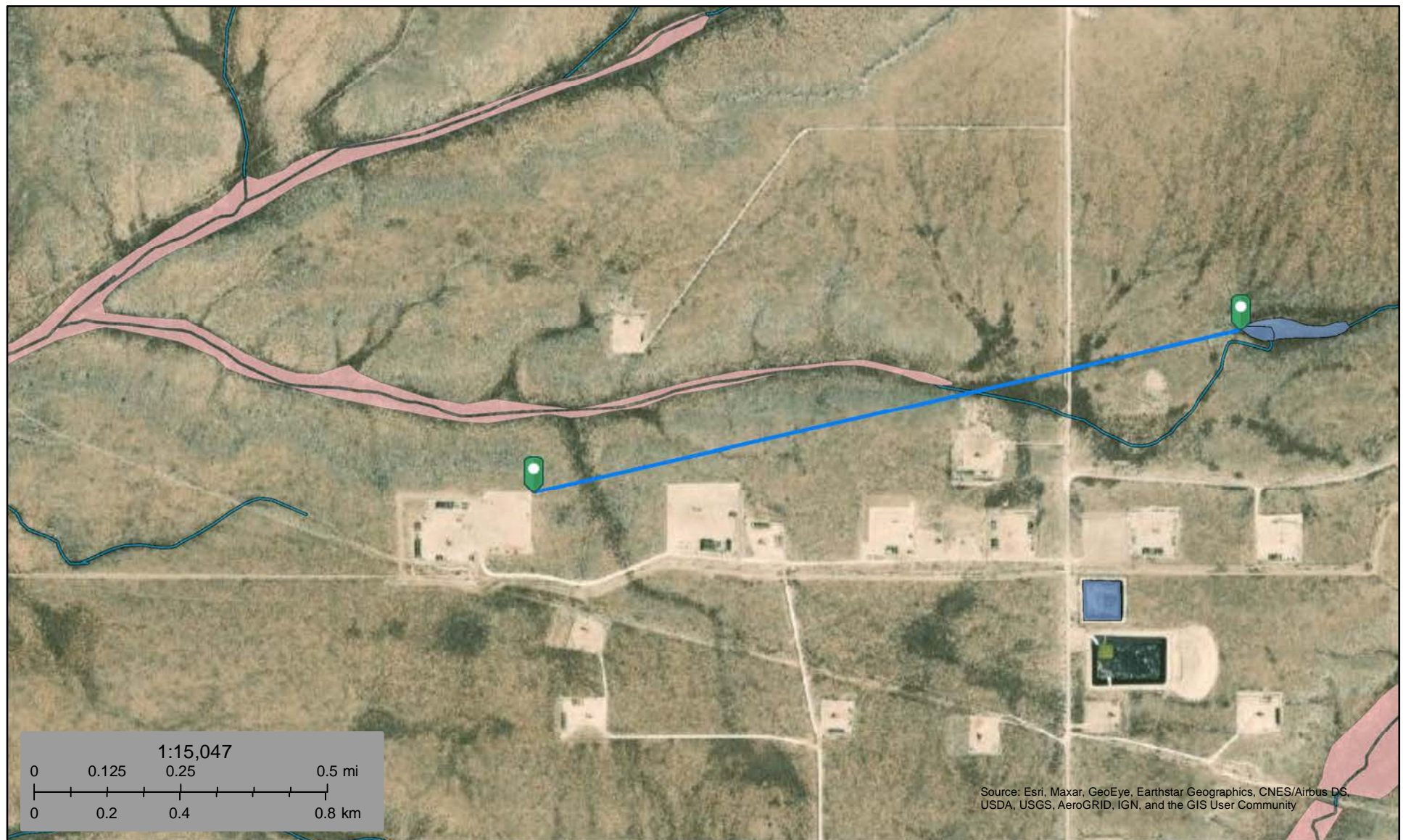
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond

- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.



Pond 5537 feet



May 4, 2022

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond

- Lake
- Other
- Riverine




This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

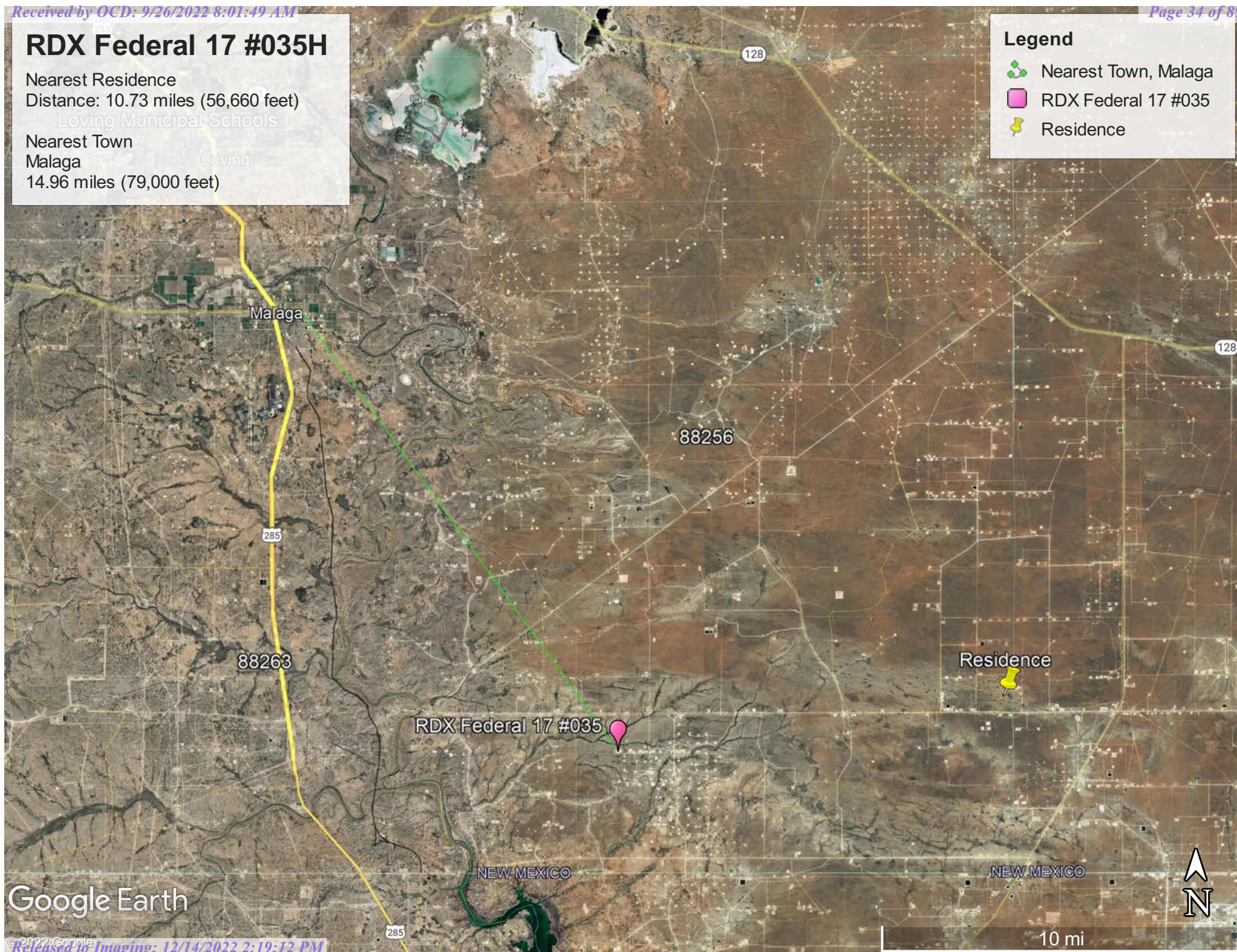
RDX Federal 17 #035H

Nearest Residence
Distance: 10.73 miles (56,660 feet)

Nearest Town
Malaga
14.96 miles (79,000 feet)

Legend

-  Nearest Town, Malaga
-  RDX Federal 17 #035
-  Residence




Google Earth



New Mexico Office of the State Engineer

Point of Diversion Summary

(quarters are 1=NW 2=NE 3=SW 4=SE)
(quarters are smallest to largest) (NAD83 UTM in meters)

Well Tag	POD Number	Q64	Q16	Q4	Sec	Tws	Rng	X	Y
C	04068 POD1	1	3	1	16	26S	30E	604397	3546018 

x

Driller License:	1249	Driller Company:	ATKINS ENGINEERING ASSOC. INC.
Driller Name:	JACKIE D ATKINS		
Drill Start Date:	05/11/2017	Drill Finish Date:	05/12/2017
Log File Date:	05/17/2017	PCW Rev Date:	
Pump Type:		Pipe Discharge Size:	
Casing Size:		Depth Well:	

x

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5/4/22 2:53 PM

POINT OF DIVERSION SUMMARY

OSE POD Locations 0.5 miles



5/4/2022, 2:50:56 PM

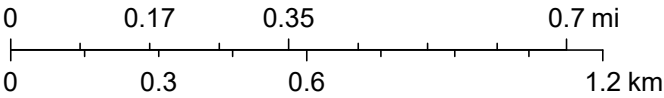
GIS WATERS PODs

- Plugged
- Active
- Pending
- OSE District Boundary

New Mexico State Trust Lands

- Both Estates
- ▤ SiteBoundaries

1:18,056



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, U.S. Department of Energy Office of Legacy



New Mexico Office of the State Engineer

Water Right Summary


[get image list](#)

WR File Number: C 03483

Subbasin: C

Cross Reference: -

Primary Purpose: STK 72-12-1 LIVESTOCK WATERING

Primary Status: PMT PERMIT

Total Acres:

Subfile: -

Header: -

Total Diversion: 3

Cause/Case: -




Owner: DBA PASCHAL RANCH LLC

Contact: JANEY LOREE PASCHAL

Documents on File

Trn #	Doc	File/Act	Status		Transaction Desc.	From/ To	Acres	Diversion	Consumptive
			1	2					
721910	COWNF	2022-03-17	CHG	PRC	C 03483 POD1	T		0	
588093	72121	2016-05-31	PMT	APR	C 03483 POD1	T		3	
543409	COWNF	2014-03-17	CHG	PRC	C 03483	T	0	0	
476565	EXPL	2011-04-15	PMT	LOG	C 03483	T	0	0	

Current Points of Diversion

(NAD83 UTM in meters)											
POD Number	Well Tag	Source	Q						X	Y	Other Location Desc
			64	Q16	Q4	Sec	Tws	Rng			
C 03483		Shallow	4	4	4	05	26S	30E	604296	3548251	 .5 MI E. OF C-1361;PIPELINE RD
C 03483 POD2				3	3	04	26S	30E	604566	3548253	
C 03483 POD3			4	3	3	04	26S	30E	604558	3548291	

Source

Acres	Diversion	CU	Use	Priority	Source Description
0	0		EXP		GW

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5/4/22 2:44 PM

WATER RIGHT SUMMARY



New Mexico Office of the State Engineer

Water Right Summary


[get image list](#)
WR File Number: C 04068**Subbasin:** CUB**Cross Reference:** -**Primary Purpose:** EXP EXPLORATION**Primary Status:** PMT PERMIT**Total Acres:****Subfile:** -**Header:** -**Total Diversion:** 0**Cause/Case:** -**User:** RKI EXPLORATION & PROD., LLC**Contact:** JUSTIN BARMORE

Documents on File


[get images](#)

Trn #	Doc	File/Act	Status		Transaction Desc.	From/ To	Acres	Diversion	Consumptive
			1	2					
606777	EXPL	2017-05-08	PMT	APR	C 04068 POD1	T	0	0	

Current Points of Diversion

POD Number	Well Tag	Source	Q						X	Y	Other Location Desc
			64	Q16	Q4	Sec	Tws	Rng			
C 04068 POD1			1	3	1	16	26S	30E	604397	3546018	SB-1

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5/4/22 2:53 PM

WATER RIGHT SUMMARY



New Mexico Office of the State Engineer

Active & Inactive Points of Diversion

(with Ownership Information)

(acre ft per annum)						(R=POD has been replaced and no longer serves this file, C=the file is closed)				(quarters are 1=NW 2=NE 3=SW 4=SE) (quarters are smallest to largest)				(NAD83 UTM in meters)							
WR File Nbr	Sub basin	Use	Diversion	Owner	County	POD Number	Well Tag	Code	Grant	Source	q	q	q	X	Y	Distance					
C 01360	CUB	IND	0	EL PASO NATURAL GAS	ED	C 01360				Shallow	4	3	3	05	26S	30E	602996	3548152		1735	
C 01361	CUB	IND	0	EL PASO NATURAL GAS	ED	C 01361				Shallow	3	4	3	05	26S	30E	603240	3548157		1766	
C 03448	C	PRO	0	DEVON ENERGY CORP.	ED	C 01360				Shallow	4	3	3	05	26S	30E	602996	3548152		1735	
C 03449	C	PRO	0	OGX RESOURCES	ED	C 01360				Shallow	4	3	3	05	26S	30E	602996	3548152		1735	
C 03483	C	STK	3	DBA PASCHAL RANCH LLC	ED	C 03483				Shallow	4	4	4	05	26S	30E	604296	3548251		2286	
					ED	C 03483 POD2						3	3	04	26S	30E	604565	3548253		2458	
					ED	C 03483 POD3						4	3	3	04	26S	30E	604557	3548291		2481
C 03501	C	PRO	0	DEVON ENERGY CO.	ED	C 03483				Shallow	4	4	4	05	26S	30E	604296	3548251		2286	
C 03502	C	PRO	0	DEVON ENERGY CO	ED	C 03483				Shallow	4	4	4	05	26S	30E	604296	3548251		2286	
C 03503	C	PRO	0	DEVON ENERGY CO.	ED	C 03483				Shallow	4	4	4	05	26S	30E	604296	3548251		2286	
C 03581	CUB	EXP	0	BUREAU OF LAND MANAGEMENT	ED	C 03581 POD1				Shallow	4	4	4	05	26S	30E	604298	3548291		2320	
C 03608	C	PRO	0	DEVON ENERGY CORP.	ED	C 03581 POD1				Shallow	4	4	4	05	26S	30E	604298	3548291		2320	
C 03686	CUB	CPS	0	C P MASTERS INC	ED	C 03686 POD1					1	1	4	16	26S	30E	605257	3545585		2471	
C 03792	C	STK	3	BECKHAM RANCH INC	ED	C 03792 POD1					1	1	1	29	26S	30E	602879	3543094		3324	
C 03793	C	STK	3	BECKHAM RANCH INC	ED	C 03793 POD1					1	4	2	30	26S	30E	602348	3542716		3747	
C 04068	CUB	EXP	0	RKI EXPLORATION & PROD., LLC	ED	C 04068 POD1					1	3	1	16	26S	30E	604397	3546018		1520	
C 04561	CUB	MON	0	WSP GLOBAL INC	ED	C 04561 POD1	NA				4	3	3	24	26S	29E	599923	3543208		4397	
C 04612	C	STK	3	BUREAU OF LAND MANAGEMENT	ED	C 04612 C-3581	NA				4	4	4	05	26S	30E	604298	3548291		2320	
LWD 01190	CUB	PLS	8.1	BUCK & LARUE JACKSON TRUST	ED	LWD 01190 POD1					1	4	3	09	26S	30E	604838	3546802*		1946	

Record Count: 19

UTMNAD83 Radius Search (in meters):

Easting (X): 602930

Northing (Y): 3546418

Radius: 5000

Sorted by: File Number

*UTM location was derived from PLSS - see Help

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5/4/22 2:28 PM

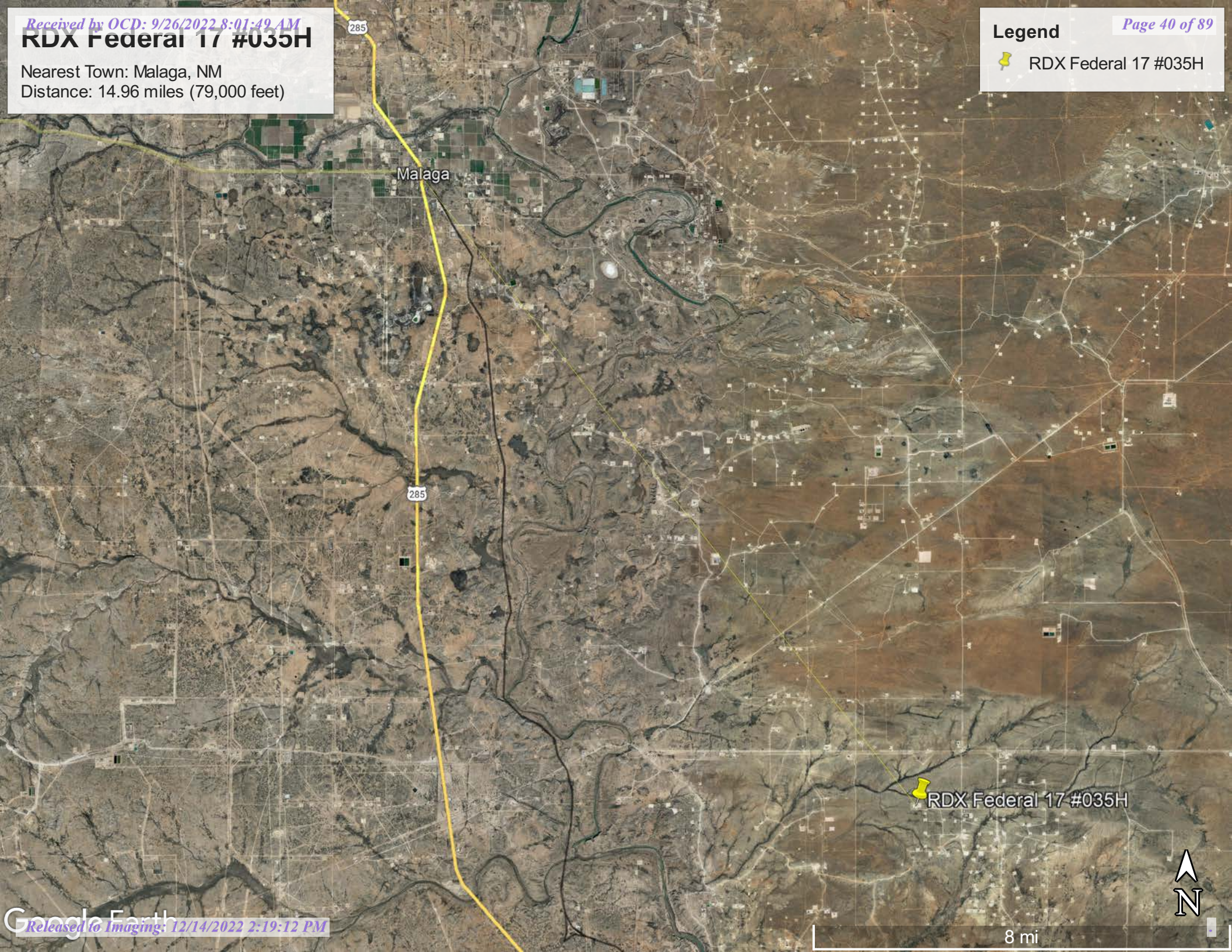
ACTIVE & INACTIVE POINTS OF DIVERSION

Nearest Town: Malaga, NM
Distance: 14.96 miles (79,000 feet)


Page 40 of 89

Legend

 RDX Federal 17 #035H



8 mi





Riparian Zone 484 feet



May 4, 2022

Wetlands

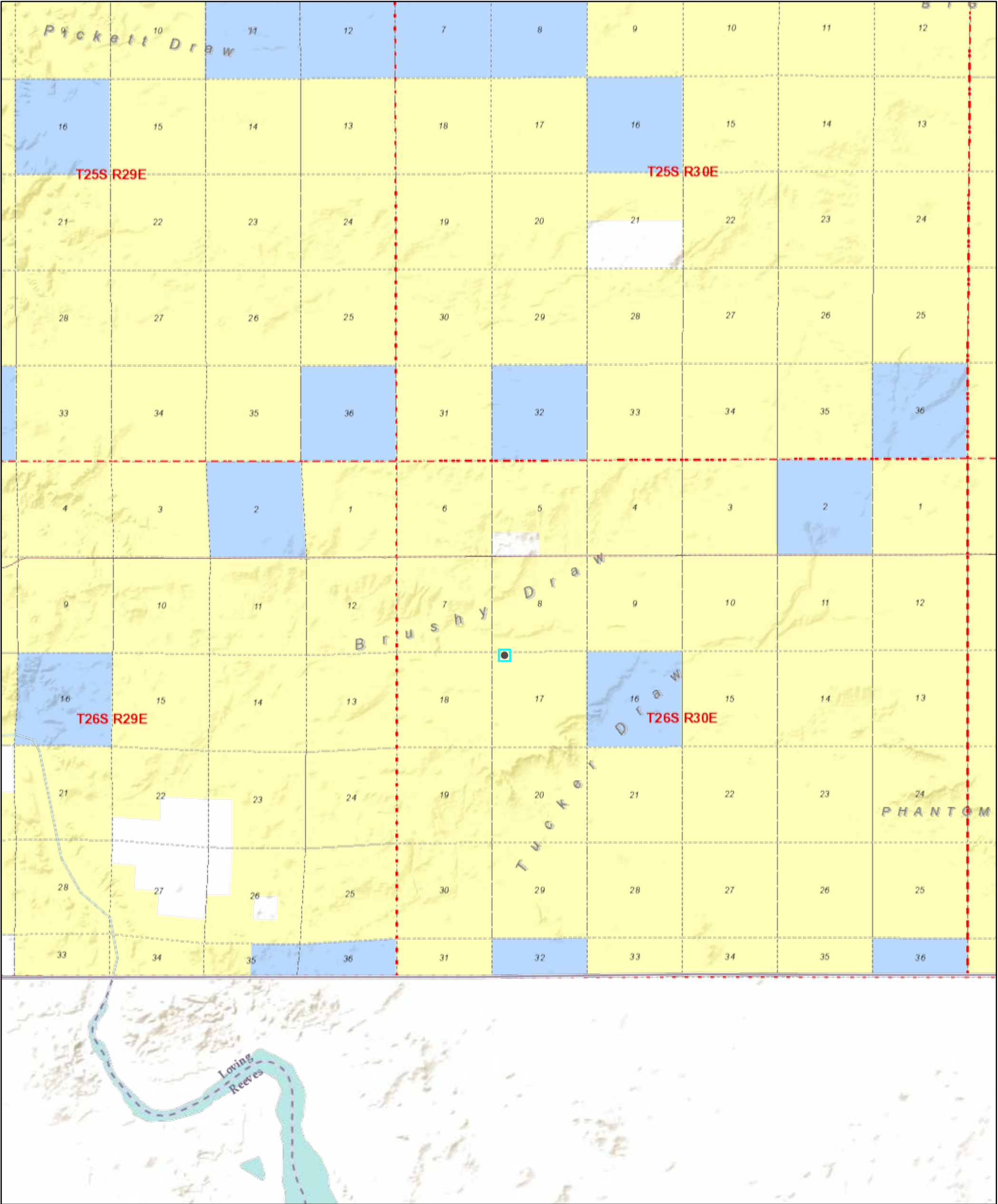
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond

- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

Active Mines in New Mexico



5/4/2022, 4:14:27 PM

Township / Range

Sections

Land Ownership

Bureau of Land Management

Bureau of Reclamation

Department of Agriculture

Department of Defense

Department of Energy

National Park Service

Private Land

State Game and Fish

State Land

State Parks

Tribal

US Fish and Wildlife Service

US Forest Service

Registered Mines

Aggregate, Stone etc.

1:72,224

00.512

mi

012

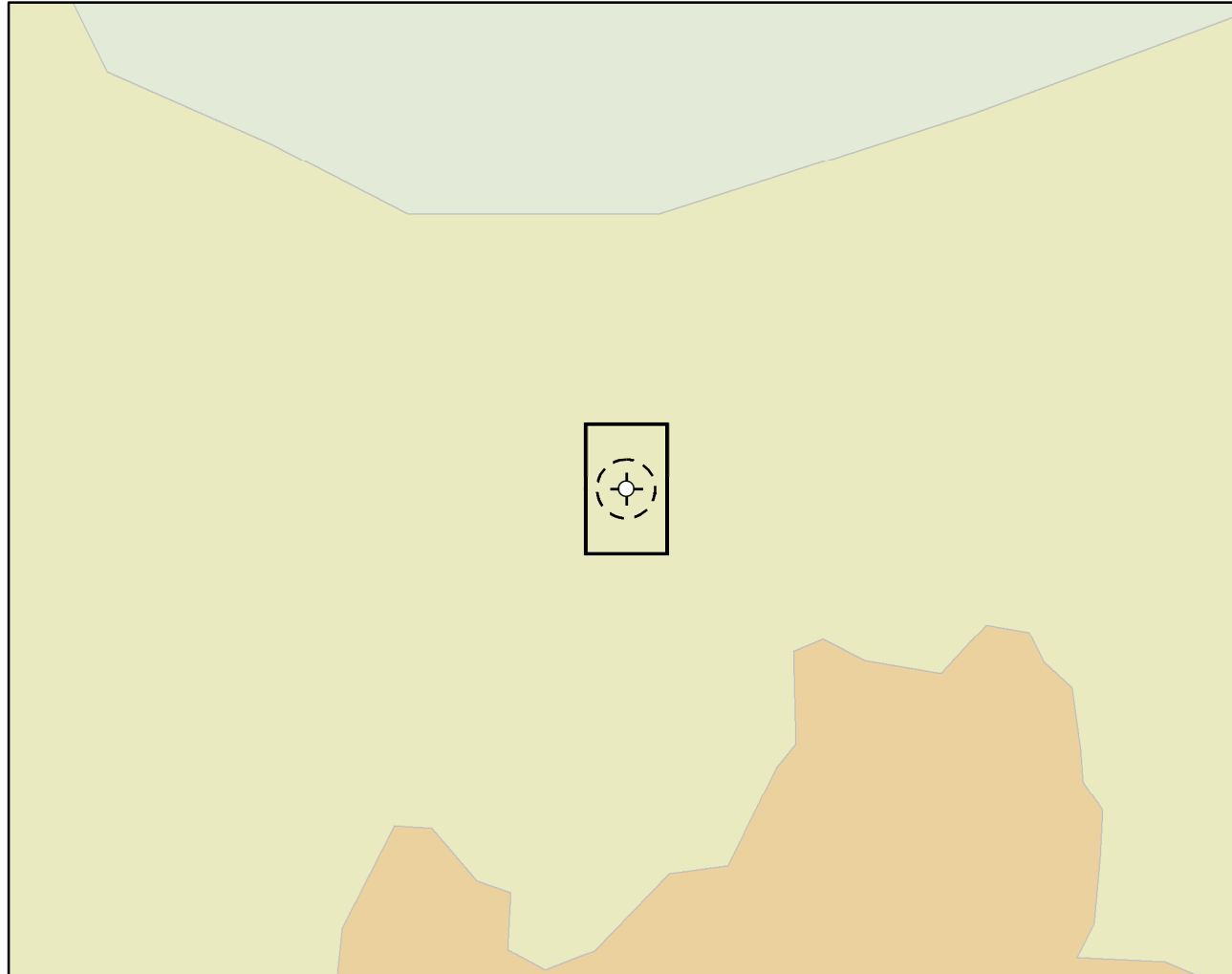
km

U.S. Bureau of Land Management - New Mexico State Office,
Sources: Esri, USGS, NOAA, Sources: Esri, Garmin, USGS, NPS

Released to Imaging: 12/14/2022 2:19:12 PM

EMNRD MMD GIS Coordinator
NM Energy, Minerals and Natural Resources Department (<http://nm-emnrd.maps.arcgis.com/apps/webappviewer/index.html?id=1b5e577974664d689b47790897ca2795>)

Document Path: G:\Projects\US PROJECTS\Devon Energy Corporation\2022\22E-01520 - RDS Federal 17 #035\Figure 1 Karst Potential RDX Federal 17 #035.mxd

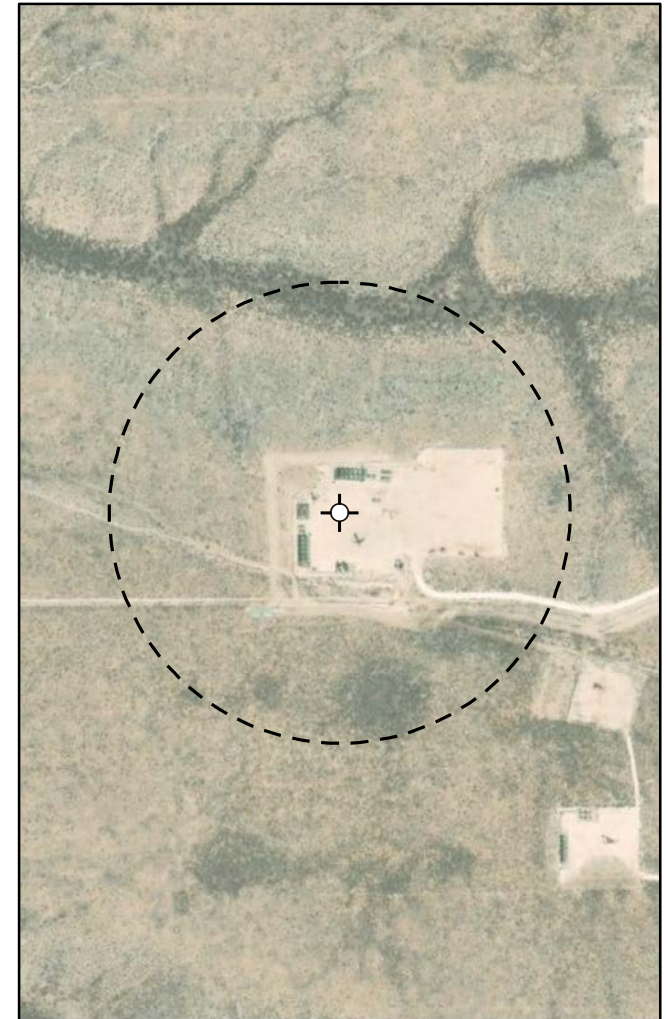


Karst Potential

- Critical
 - High
 - Medium
 - Low
- Site Location
 - Site Buffer (1,000 ft.)

Overview Map

0 0.25 0.5 1 mi



Detail Map

0 150 300 600 ft.



Map Center:
Lat/Long: 32.049285, -103.910368

NAD 1983 UTM Zone 13N
Date: May 19/22



Karst Potential RDX Federal 17 #35

FIGURE:

X



Geospatial data presented in this figure may be derived from external sources and Vertex does not assume any liability for inaccuracies. This figure is intended for reference use only and is not certified for legal, survey, or engineering purposes.

Note: Inset Map, ESRI 2022; Overview Map: ESRI World Topographic. Karst potential data sourced from Roswell Field Office, Bureau of Land Management, 2020 or United States Department of the Interior, Bureau of Land Management. (2018). Karst Potential.

VERSATILITY. EXPERTISE.

National Flood Hazard Layer FIRMette



103°54'54"W 32°3'13"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

103°54'16"W 32°2'42"N

Released to Imaging: 12/14/2022 2:19:12 PM

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/4/2022 at 6:11 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Eddy Area, New Mexico



May 4, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

Preface..... 2

How Soil Surveys Are Made.....5

Soil Map..... 8

 Soil Map.....9

 Legend.....10

 Map Unit Legend..... 11

 Map Unit Descriptions.....11

 Eddy Area, New Mexico.....13

 PS—Potter-Simona complex, 5 to 25 percent slopes..... 13

 US—Upton-Simona complex, 1 to 15 percent slopes, eroded..... 15

References..... 18

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

Custom Soil Resource Report

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.


Custom Soil Resource Report Soil Map



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MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)


Soils


 Soil Map Unit Polygons


 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit


 Clay Spot


 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water


 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole

 Slide or Slip


 Sodic Spot


 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals


Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eddy Area, New Mexico
Survey Area Data: Version 17, Sep 12, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 7, 2020—May 12, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PS	Potter-Simona complex, 5 to 25 percent slopes	0.0	0.2%
US	Upton-Simona complex, 1 to 15 percent slopes, eroded	14.2	99.8%
Totals for Area of Interest		14.3	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

Custom Soil Resource Report

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Custom Soil Resource Report

Eddy Area, New Mexico**PS—Potter-Simona complex, 5 to 25 percent slopes****Map Unit Setting**

National map unit symbol: 1w57
Elevation: 2,750 to 5,000 feet
Mean annual precipitation: 8 to 16 inches
Mean annual air temperature: 57 to 70 degrees F
Frost-free period: 180 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Potter and similar soils: 80 percent
Simona and similar soils: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Potter**Setting**

Landform: Ridges, hills
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, crest, nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 10 inches: gravelly loam
H2 - 10 to 60 inches: cemented material

Properties and qualities

Slope: 5 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: R042XC025NM - Shallow
Hydric soil rating: No

Custom Soil Resource Report

Description of Simona**Setting**

Landform: Plains, alluvial fans
Landform position (three-dimensional): Rise
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Mixed alluvium and/or eolian sands

Typical profile

H1 - 0 to 11 inches: gravelly fine sandy loam
H2 - 11 to 19 inches: gravelly fine sandy loam
H3 - 19 to 60 inches: cemented material

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: 7 to 20 inches to petrocalcic
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R042XC002NM - Shallow Sandy
Hydric soil rating: No

Minor Components**Simona**

Percent of map unit: 3 percent
Ecological site: R042XC002NM - Shallow Sandy
Hydric soil rating: No

Rock outcrop

Percent of map unit: 2 percent
Hydric soil rating: No

Custom Soil Resource Report

US—Upton-Simona complex, 1 to 15 percent slopes, eroded**Map Unit Setting**

National map unit symbol: 1w66
Elevation: 2,000 to 5,700 feet
Mean annual precipitation: 6 to 14 inches
Mean annual air temperature: 57 to 70 degrees F
Frost-free period: 180 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Upton and similar soils: 40 percent
Simona and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Upton**Setting**

Landform: Ridges, fans
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from limestone

Typical profile

H1 - 0 to 9 inches: gravelly loam
H2 - 9 to 13 inches: gravelly loam
H3 - 13 to 21 inches: cemented
H4 - 21 to 60 inches: very gravelly loam

Properties and qualities

Slope: 1 to 15 percent
Depth to restrictive feature: 7 to 20 inches to petrocalcic
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high
(0.01 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 75 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 1.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Custom Soil Resource Report

Hydrologic Soil Group: D
Ecological site: R042XC025NM - Shallow
Hydric soil rating: No

Description of Simona**Setting**

Landform: Plains, alluvial fans
Landform position (three-dimensional): Rise
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Mixed alluvium and/or eolian sands

Typical profile

H1 - 0 to 6 inches: gravelly fine sandy loam
H2 - 6 to 20 inches: gravelly fine sandy loam
H3 - 20 to 24 inches: indurated

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 7 to 20 inches to petrocalcic
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R042XC002NM - Shallow Sandy
Hydric soil rating: No

Minor Components**Rock outcrop**

Percent of map unit: 9 percent
Hydric soil rating: No

Dune land

Percent of map unit: 8 percent
Hydric soil rating: No

Pajarito

Percent of map unit: 8 percent
Ecological site: R042XC003NM - Loamy Sand
Hydric soil rating: No

Custom Soil Resource Report

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Ecological site R042XC002NM Shallow Sandy

Accessed: 05/04/2022

General information



Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Associated sites

R042XC004NM	Sandy Sandy sites often occur in association or in a complex with Shallow Sandy Sites.
-------------	--

Similar sites

R042XC004NM	Sandy Sandy ecological sites are similar to Shallow Sandy sites in species composition and Transition pathways.
-------------	---

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on plains, alluvial fans, uplands, or fan piedmonts. The parent material consists of mixed loamy alluvium or eolian material derived from igneous and sedimentary bedrock. The petrocalcic layer is at a depth of 10 to 25 inches and undulating.

Slopes are nearly level to undulating, usually less than 9 percent. Elevations range from 2,842 to 4,500 feet.

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Fan piedmont (3) Alluvial fan
Elevation	2,842–4,500 ft
Slope	1–9%
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation ranges from 8 to 13 inches. Variations of 5 inches, more or less, are common. Over 80 percent of the precipitation falls from April through October. Most of the summer precipitation comes in the form of high intensity – short duration thunderstorms.

Temperatures are characterized by distinct seasonal changes and large annual and diurnal temperature changes. The average annual temperature is 61 degrees with extremes of 25 degrees below zero in the winter to 112 degrees in the summer.

The average frost-free season is from 207 to 220 days. The last killing frost is in late March or early April, and the first killing frost is in late October or early November.

Temperature and rainfall both favor warm season perennial plant growth. In years of abundant spring moisture, annual forbs and cool season grasses can make up an important component of the site. The vegetation of this site can take advantage of the moisture and the time it falls. Because of the soil profile, little moisture can be stored in the soil for any length of time. Moisture is readily available to the plants from the time it falls. Strong winds from the southwest blow from January through June which rapidly dries out the soil profile during a critical period for plant growth.

Climate data was obtained from <http://www.wrcc.sage.dri.edu/summary/climsmnm.html> web site using 50% probability for freeze-free and frost-free seasons using 28.5 degrees F and 32.5 degrees F respectively.

Table 3. Representative climatic features

Frost-free period (average)	221 days
Freeze-free period (average)	240 days
Precipitation total (average)	13 in

Influencing water features

This site is not influenced from water from wetlands or streams.

Soil features

Soils are very shallow to shallow, less than 20 inches in depth. Surface and subsurface textures are gravelly loamy sand, gravelly fine sandy loam or fine sandy loam.

An indurated caliche layer occurs at depths of 6 to 25 inches and is at an average of 15 inches from the surface. Underlying material textures are very gravelly fine sandy loam, very gravelly sandy loam, gravelly fine sandy loam. Gravels are calcium carbonate concretions, calcium carbonate content ranges from 30 to 65 percent.

The indurated caliche layer typically holds water up in the profile for short periods within the root zone of plants. These soils will blow if left unprotected by vegetation.

Minimum and maximum values listed below represent the characteristic soils for this site.

Characteristic soils are:

Simona

Jerag

Table 4. Representative soil features

Surface texture	(1) Fine sandy loam (2) Loamy fine sand (3) Gravelly fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to moderately well drained
Permeability class	Moderately slow to moderate
Soil depth	7–24 in
Surface fragment cover ≤3"	5–25%
Surface fragment cover >3"	0%
Available water capacity (0–40in)	1–2 in
Calcium carbonate equivalent (0–40in)	5–15%
Electrical conductivity (0–40in)	0–4 mmhos/cm
Sodium adsorption ratio (0–40in)	0
Soil reaction (1:1 water) (0–40in)	7.4–8
Subsurface fragment volume ≤3" (Depth not specified)	5–25%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Overview

The Shallow Sandy site occurs on upland plains, and tops of low ridges and mesas, associated with Sandy, Loamy Sand, and Shallow sites. Coarse to moderately coarse soil surface textures, shallow depth (<20 inches) to an indurated caliche layer (petrocalcic horizon), and an overwhelming dominance by black grama help to distinguish this site. The historic plant community of the Shallow Sandy site is a black grama dominated grassland sparsely dotted with shrubs. Shrubs, especially mesquite and creosotebush can increase or colonize due to the dispersal of shrub seeds by livestock or wildlife. This increase in mesquite and colonization of creosotebush may be enhanced by proximity to areas with existing high shrub densities. Fire suppression, and the loss of grass cover due to overgrazing or drought may facilitate the increase and encroachment of shrubs. Persistent loss of grass cover, competition for resources by shrubs, and periods of climate with increased winter precipitation and dry summers, may initiate the transition to a shrub-dominated state.

State and transition model

Plant Communities and Transitional Pathways (diagram)

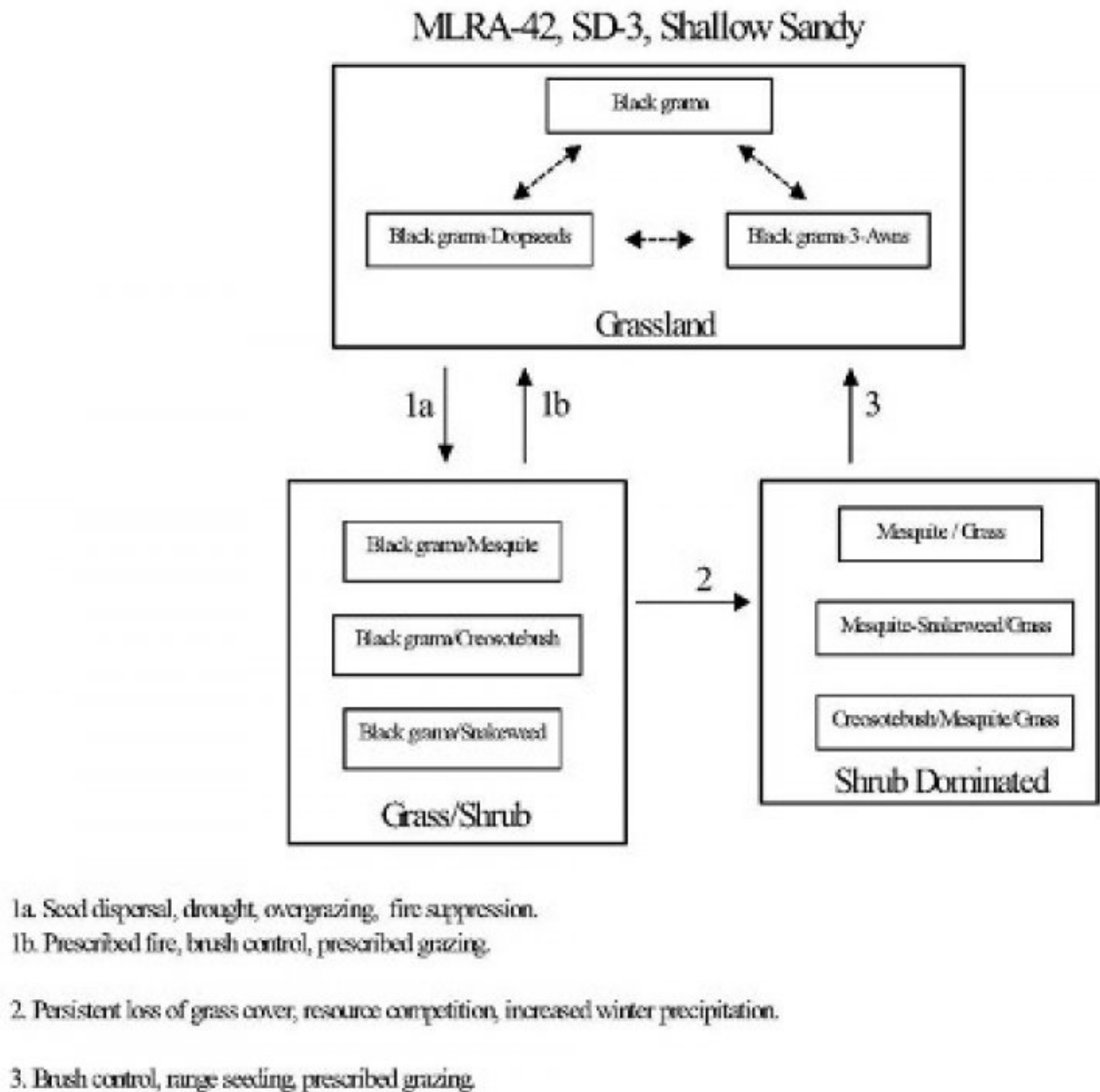


Figure 4.

State 1 Historic Climax Plant Community

Community 1.1 Historic Climax Plant Community

Grassland: This site responds well to management and is resistant to state change, due to the shallow depth to petrocalcic horizon and sandy surface textures. The sandy surface textures allow rapid water infiltration and the petrocalcic horizon helps to keep water perched and available to shallow rooted grasses. Black grama is the dominant species in the historic plant community, averaging 50 to 60 percent of the total production for this site. Bush muhly, blue grama, and dropseeds are present as sub-dominants. Typically, yucca, javalinabush, range

ratany, prickly pear, and mesquite are sparsely dotted across the landscape. Leatherweed croton, cutleaf happlopappus, wooly groundsel, and threadleaf groundsel are common forbs. Continuous heavy grazing or extended periods of drought will cause a loss of grass cover characterized by a decrease in black grama, bush muhly, blue and sideoats grama, plains bristlegrass, and Arizona cottontop. Dropseeds and or threeawns may increase and become sub-dominant to black grama. Continued loss of grass cover in conjunction with dispersal of shrub seeds and fire suppression is believed to cause the transition to a state with increased amounts of shrubs (Grass/Shrub state).

Diagnosis: Black grama is the dominant grass species. Grass cover uniformly distributed. Shrubs are a minor component averaging only two to five percent canopy cover. Litter cover is high (40-50 percent of area), and litter movement is limited to smaller size class litter and short distances (<. 5m).

Other grasses that could appear on this site would include: six-weeks grama, fluffgrass, false-buffalograss, hairy grama, little bluestem, bristle panicum, cane bluestem, Indian ricegrass, tridens spp., and red lovegrass.

Other woody plants include: pricklypear, cholla, fourwing saltbush, catclaw mimosa, winterfat, American tarbush and mesquite.

Other forbs include: globemallow, verbena, desert holly, senna, plains blackfoot, trailing fleabane, fiddleneck, deerstongue, wooly Indianwheat, and locoweed.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	474	652	830
Forb	78	107	136
Shrub/Vine	48	66	84
Total	600	825	1050

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	30-35%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	40-50%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	15-25%

Figure 6. Plant community growth curve (percent production by month). NM2802, R042XC002NM-Shallow Sandy-HCPC. SD-3 Shallow Sandy - Warm season plant community.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	5	10	10	25	30	12	5	0	0

State 2

Grass/Shrub

Community 2.1 Grass/Shrub

Grass/Shrub: This state is characterized by the notable presence of shrubs, especially mesquite, broom snakeweed, and/or creosotebush, however grasses remain as the dominant species. Black grama is the dominant grass species. Threeawns and or dropseeds are sub-dominant. The susceptibility of the Shallow Sandy site to shrub encroachment may be higher when located adjacent to other sites with high densities of mesquite or creosotebush. Retrogression within this site is characterized by decreases in grass cover and increasing densities of shrubs.

Diagnosis: Black grama remains as the dominant grass species. Grass cover varies in response to the amount of shrub increase, ranging from uniform to patchy. Shrubs are found at increased densities relative to the grassland state, especially mesquite, creosotebush, or broom snakeweed.

Transition to Grass/Shrub (1a) Historically fire may have kept mesquite and other shrubs in check by completely killing some species and disrupting seed production cycles and suppressing the establishment of shrub seedlings in others. Fire suppression combined with seed dispersal by livestock and wildlife is believed to be the factors responsible for the establishment and increase in shrubs.^{1, 3} Loss of grass cover due to overgrazing, prolonged periods of drought, or their combination, reduces fire fuel loads and increases the susceptibility of the site to shrub establishment.

Key indicators of approach to transition:

Increase in the relative abundance of dropseeds and threeawns

Presence of shrub seedlings

Loss of organic matter—evidenced by an increase in physical soil crusts ⁸

Transition back to Grassland (1b) Brush control is necessary to initiate the transition back to the grassland state. If adequate fuel loads remain, possibly the reintroduction of fire as a management tool will assist in the transition back, however, mixed results have been observed concerning the effects of fire on black grama grasslands.⁶ Prescribed grazing will help ensure adequate rest following brush control and will assist in the establishment and maintenance of grass cover capable of sustaining fire.

State 3 Shrub Dominated

Community 3.1 Shrub Dominated

Shrub-Dominated: Across the range of soil types included in the Shallow Sandy site, mesquite is typically the dominant shrub, but it does occur as a co-dominant or sub-dominant species with creosotebush or broom snakeweed. Mesquite tends to dominate when the Shallow Sandy site occurs as part of a complex or in association with Sandy or Loamy Sand sites. Creosotebush tends to dominate on Shallow Sandy sites that occur as part of, or adjacent to Shallow Sites. Broom snakeweed increases in response to heavy grazing, but tends to cycle in and out depending on timing of rainfall. However, once the site is dominated by shrubs and snakeweed becomes well established, it tends to remain as a major component in the shrub dominated state.

Diagnosis: Mesquite, creosotebush, or snakeweed cover is high, exceeding that of grasses. Grass cover is patchy with large connected bare areas present. Black grama, threeawns, or dropseeds may be the dominant grass. Evidence of accelerated wind erosion in the form of pedestalling of plants, and soil deposition around shrub bases may be common.

Transition to Shrub-Dominated (2) Persistent loss of grass cover and the resulting increased competition between shrubs and remaining grasses for dwindling resources (especially soil moisture) may drive this transition.⁵ Additionally periods of increased winter precipitation may facilitate periodic episodes of shrub expansion and establishment. ⁴

Key indicators of approach to transition:

Increase in size and frequency of bare patches.

Loss of grass cover in shrub interspaces.

Increased signs of erosion, evidenced by pedestalling of plants, and soil and litter deposition on leeward side of plants. 7

Transition back to Grassland (3) Brush control is necessary to reduce competition from shrubs and reestablish grasses. Range seeding may be necessary if insufficient grasses remain, The benefits, and costs, will vary depending upon the degree of site degradation, and adequate precipitation following seeding.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Warm Season			413–495	
	black grama	BOER4	<i>Bouteloua eriopoda</i>	413–495	–
2	Warm Season			41–83	
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	41–83	–
3	Warm Season			41–83	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	41–83	–
4	Warm Season			25–41	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	25–41	–
5	Warm Season			41–83	
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	41–83	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	41–83	–
	mesa dropseed	SPFL2	<i>Sporobolus flexuosus</i>	41–83	–
6	Warm Season			17–41	
	threeawn	ARIST	<i>Aristida</i>	17–41	–
7	Warm Season			41–83	
	Arizona cottontop	DICA8	<i>Digitaria californica</i>	41–83	–
	plains bristlegrass	SEVU2	<i>Setaria vulpiseta</i>	41–83	–
8	Warm Season			41–83	
	mat sandbur	CELO3	<i>Cenchrus longispinus</i>	41–83	–
	hooded windmill grass	CHCU2	<i>Chloris cucullata</i>	41–83	–
9	Other Perennial Grasses			25–41	
	Grass, perennial	2GP	<i>Grass, perennial</i>	25–41	–
Shrub/Vine					
10	Shrub			8–25	
	javelina bush	COER5	<i>Condalia ericoides</i>	8–25	–
11	Shrub			8–25	
	yucca	YUCCA	<i>Yucca</i>	8–25	–
12	Shrub			8–25	
	jointfir	EPHED	<i>Ephedra</i>	8–25	–
	littleleaf ratany	KRER	<i>Krameria erecta</i>	8–25	–
13	Shrub			8–25	

13	Shrub			8–25	–
	featherplume	DAFO	<i>Dalea formosa</i>	8–25	–
14	Shrub			8–25	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	8–25	–
15	Other Shrubs			25–41	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	25–41	–
Forb					
16	Forb			17–41	
	leatherweed	CRPOP	<i>Croton pottsii</i> var. <i>pottsii</i>	17–41	–
	Goodding's tansyaster	MAPIG2	<i>Machaeranthera pinnatifida</i> ssp. <i>gooddingii</i> var. <i>gooddingii</i>	17–41	–
17	Forb			17–41	
	woolly groundsel	PACA15	<i>Packera cana</i>	17–41	–
	threadleaf ragwort	SEFLF	<i>Senecio flaccidus</i> var. <i>flaccidus</i>	17–41	–
18	Forb			8–25	
	whitest evening primrose	OEAL	<i>Oenothera albicaulis</i>	8–25	–
19	Other Forbs			8–25	
	Forb (herbaceous, not grass nor grass-like)	2FORB	<i>Forb (herbaceous, not grass nor grass-like)</i>	8–25	–

Animal community

This site provides habitats which support a resident animal community that is characterized by pronghorn antelope, swift fox, black-tailed jackrabbit, spotted ground squirrel, Ord's kangaroo rat, northern grasshopper mouse, coyote, horned lark, meadowlark, lark bunting, scaled quail, morning dove, side-blotched lizard, round-tailed horned lizard, marbled whiptail, prairie rattlesnake and ornate box turtle.

Hydrological functions

The runoff curve numbers are determined by field investigations using hydraulic cover conditions and hydrologic soil groups.

Hydrologic Interpretations
Soil Series Hydrologic Group
Jarag D
Simona D

Recreational uses

This site offers recreation for hiking, horseback riding, nature observation and photography, and quail and dove hunting. During years of abundant spring moisture, this site displays a riot of color from wildflowers during May and June. A few summer and fall flowers also occur.

Wood products

The natural potential plant community of this site affords little or no wood products. Where the site has been invaded by mesquite or cholla cactus the roots and stems of these plants provide attractive material for a variety of curiosities, such as lamps and small furniture.

Other products

This site is suitable for grazing by all kinds and classes of livestock during all seasons of the year. Because of the sandy textures and shallow profile, this site will respond rapidly to management. As this site deteriorates, plants such as black grama, bush muhly, blue and sideoats grama, plains bristlegrass and Arizona cottontop, will decrease and be replaced by plants such as threeawns, mesquite, creosote bush, and broom snakeweed. This also causes a decrease in ground cover, leaving the soil to blow. This site responds best to a system of management that rotates the season of use.

Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index Ac/AUM

100 - 76 2.5 – 3.5

75 – 51 3.2 – 4.6

50 – 26 4.5 – 7.5

25 – 0 7.6 +

Inventory data references

Data collection for this site was done in conjunction with the progressive soil surveys within the Southern Desertic Basins, Plains and Mountains, Major Land Resource Areas of New Mexico. This site has been mapped and correlated with soils in the following soil surveys. Eddy County, Lea County, and Chaves County.

Other references

Literature References:

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2. Hennessy, J.T., R.P. Gibbens, J.M. Tromble, and M. Cardenas. 1983. Water properties of caliche. J. Range Manage. 36: 723-726.
3. Humphrey, R.R. 1974. Fire in the deserts and desert grassland of North America. In: Kozlowski, T. T.; Ahlgren, C. E., eds. Fire and ecosystems. New York: Academic Press: 365-400.
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Contributors

David Trujillo
Don Sylvester

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**
-
12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant:
- Sub-dominant:
- Other:
- Additional:
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
-
14. **Average percent litter cover (%) and depth (in):**
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**
-
16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**
-
17. **Perennial plant reproductive capability:**
-

Ecological site R042XC025NM Shallow

Accessed: 05/04/2022

General information

**Figure 1. Mapped extent**

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on knolls, ridges, hillslopes alluvial fans and escarpments. Slopes range from 0 to 25 percent and average about 7 percent. Direction of slope varies and is usually not significant. Elevations range from 2,842 to 4,500 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge (3) Fan piedmont
Flooding frequency	None
Ponding frequency	None
Elevation	2,842–4,500 ft
Slope	0–25%
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation ranges from 8 to 13 inches. Variations of 5 inches, more or less, are common. Over 80 percent of the precipitation falls from April through October. Most of the summer precipitation comes in the form of high intensity – short duration thunderstorms.

Temperatures are characterized by distinct seasonal changes and large annual and diurnal temperature changes. The average annual temperature is 61 degrees with extremes of 25 degrees below zero in the winter to 112 degrees in the summer.

The average frost-free season is 180 to 220 days. The last killing frost is late March or early April, and the first killing frost is in late October or early November.

Temperature and rainfall both favor warm season perennial plant growth. In years of abundant spring moisture, annual forbs and cool season grasses can make up an important component of this site. Because of the shallow soil depth, the vegetation on this site can take advantage of moisture almost anytime it falls. Strong winds that blow from the west and southwest blow from January through June, which accelerates soil drying at a critical time for cool season plant growth.

Climate data was obtained from <http://www.wrcc.sage.dri.edu/summary/climsmnm.html> web site using 50% probability for freeze-free and frost-free seasons using 28.5 degrees F and 32.5 degrees F respectively.

Table 3. Representative climatic features

Frost-free period (average)	220 days
Freeze-free period (average)	240 days
Precipitation total (average)	13 in

Influencing water features

This site is not influenced from water from wetlands or streams.

Soil features

The soils of this site are shallow to very shallow. Soils are derived from mixed calcareous eolian deposits derived from sedimentary rock. Surface layers are very cobbly loam, very gravelly loam, gravelly loam, cobbly loam, gravelly fine sandy loam or gravelly sandy loam.

There is an indurated caliche layer or limestone bedrock that occurs within 20 inches and averages less than 10 inches. Limestone or caliche layer may be the restrictive layer.

Minimum and maximum values listed below represent the characteristic soils for this site.

Characteristic soils:

Lozier
Potter
Tencee
Upton
Ector
Kimbrough

Table 4. Representative soil features

Surface texture	(1) Gravelly loam (2) Extremely gravelly loam (3) Extremely cobbly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderately slow
Soil depth	4–20 in
Surface fragment cover <=3"	15–40%
Available water capacity (0–40in)	1 in
Calcium carbonate equivalent (0–40in)	15–60%
Electrical conductivity (0–40in)	0–2 mmhos/cm
Sodium adsorption ratio (0–40in)	0–1
Soil reaction (1:1 water) (0–40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	13–42%
Subsurface fragment volume >3" (Depth not specified)	0–1%

Ecological dynamics

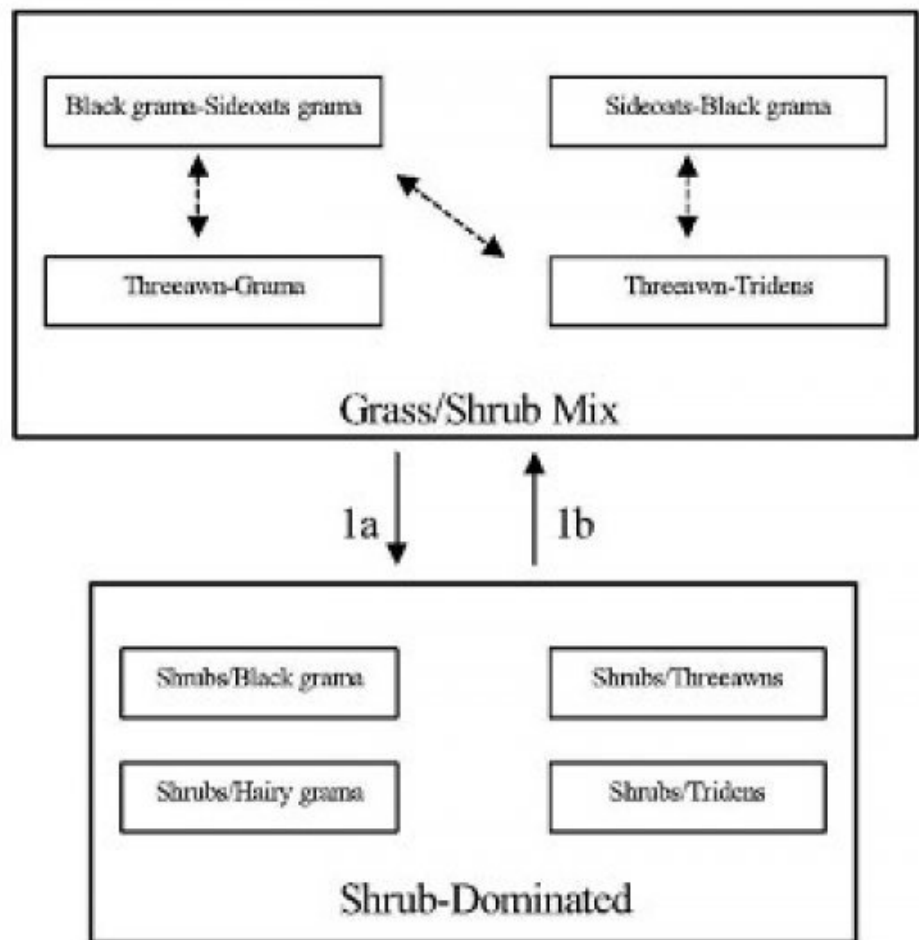
Overview:

The Shallow site is associated with and Limestone Hills, Loamy, and Shallow Sandy sites. When associated with Limestone Hills, the Shallow site occurs on the summits, foot slopes and toeslopes of hills. Loamy sites often occur as areas between low elongated hills with rounded crests (Shallow site). When the Shallow Sandy site and Shallow site occur in association, the Shallow Sandy soils occupy the tops of low ridges and the Shallow site soils occur on the steeper sideslopes of the ridge. The historic plant community of the Shallow site has the aspect of a grassland/shrub mix, dominated by grasses, but with shrubs common throughout the site. Black grama is the dominant grass species; creosotebush, mesquite, and catclaw mimosa are common shrubs. Overgrazing and or extended drought can reduce grass cover, effect a change in grass species dominance, and may result in a shrub-dominated state. 1

State and transition model

Plant Communities and Transitional Pathways (diagram)

MLRA-42, SD-3, Shallow



1a. Extended drought, overgrazing, no fire

1b. Brush control, Prescribed grazing

Figure 4.

State 1 Grass/Shrub Mix

Community 1.1 Grass/Shrub Mix

Grassland/Shrub Mix: The historic plant community is dominated by black grama with sideoats grama as the sub-dominant. Blue grama, hairy grama, bush muhly, and sand dropseed also occur in significant amounts. Sideoats grama can occur as the dominant grass with black grama as sub-dominant on the western side of the Land Resource Unit SD-3. This may be due to higher average elevation on the west side. Retrogression within this state due to extended drought or overgrazing will cause a decrease in species such as black grama, sideoats grama, blue grama, and bush muhly. Threeawns may become the dominant grass species due to a decline in more palatable grasses or because of its ability to quickly recover following drought. Continued loss of grass cover and associated increase in amount of bare ground may result in a shrub-dominated state. Decreased fire frequencies may also be

an important component in the cause of this transition.

Diagnosis: Grass cover is fairly uniform, however, surface gravel, cobble, and bare ground make up a large percent of total ground cover, and grass production during unfavorable years may only average 150-175 pounds per acre. Shrubs are common with canopy cover averaging five to ten percent. Evidence of erosion such as rills and gullies are rare, but may occur on slopes greater than eight percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	168	352	536
Shrub/Vine	63	131	200
Forb	20	42	64
Total	251	525	800

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-10%
Grass/grasslike foliar cover	10-15%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-8%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	40-60%

**Figure 6. Plant community growth curve (percent production by month).
NM2825, R042XC025NM Shallow HCPC. R042XC025NM Shallow HCPC Warm
Season Plant Community.**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	5	10	10	25	30	12	5	0	0

State 2 Shrub-Dominated

Community 2.1 Shrub-Dominated

Shrub-Dominated: This state is characterized by an increase in shrubs and a decrease in grass cover relative to grassland/shrub mix. As grass cover decreases shrubs increase, especially creosotebush, catclaw mimosa, whitethorn acacia, and mesquite. Each of these shrub species may become dominant in localized areas or across the site, depending on the spatial variability in soil characteristics and landscape position. Black grama, threeawns, hairy grama, or hairy tridens may be the dominant grass species. Fluffgrass, burrograss and broom snakeweed increase in representation. The Shallow site is resistant to state change, due to the natural rock armor of the soil and a shallow impermeable layer. The amount of rock fragments on the soil surface assist in retarding erosion. On Shallow sites with low slope, the shallow depth to either a petrocalcic layer or limestone bedrock helps to keep water perched and available to shallow rooted grasses for extended periods. 2

Diagnosis: Shrubs are the dominant species, especially creosotebush, catclaw mimosa, whitethorn acacia, or mesquite. Grass cover is variable ranging from patchy with large connected bare areas present to sparse with only a limited amount in shrub inter-spaces.

Transition to Shrub-Dominated (1a) Overgrazing and or extended periods of drought, and suppression of natural fire regimes are thought to cause this transition. As grass cover is lost, soil fertility and available soil moisture decline, due to the reduction of organic matter and decreased infiltration.³ Shrubs have the ability to extract nutrients and water from a greater area of soil than grasses and are better able to utilize limited water. Competition by shrubs for water and nutrients limits grass recruitment and establishment. Fire historically may have played a part in suppressing shrub expansion; fire suppression may therefore facilitate shrub expansion.

Key indicators of approach to transition:

*Decrease or change in composition or distribution of grass cover.

*Increase in size and frequency of bare patches.

*Increase in amount of shrub seedlings.

Transition back to Grassland/Shrub Mix (1b) Brush control is necessary to re-establish grasses. Prescribed grazing will help to ensure proper forage utilization and sustain grass cover. Once the transition is reversed and grass cover is re-established, periodic use of prescribed fire may assist in maintaining the Grassland/Shrub state.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				105–158	
	black grama	BOER4	<i>Bouteloua eriopoda</i>	105–158	–
2				79–105	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	79–105	–
3				79–105	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	79–105	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	79–105	–
4				26–53	
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	26–53	–
5				16–26	
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	16–26	–
6				26–53	
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	26–53	–
7				16–26	
	hairy woollygrass	ERPI5	<i>Erioneuron pilosum</i>	16–26	–
8				5–16	
	ear muhly	MUAR	<i>Muhlenbergia arenacea</i>	5–16	–
9				5–16	
	New Mexico feathergrass	HENE5	<i>Hesperostipa neomexicana</i>	5–16	–
10				5–16	
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	5–16	–
11				16–26	
	Grass, perennial	2GP	<i>Grass, perennial</i>	16–26	–

Forb					
12				11–26	
	stemless four-nerve daisy	TEACE	<i>Tetraneuris acaulis</i> var. <i>epunctata</i>	11–26	–
13				5–16	
	woolly groundsel	PACA15	<i>Packera cana</i>	5–16	–
14				5–16	
	globemallow	SPHAE	<i>Sphaeralcea</i>	5–16	–
15				5–16	
	bladderpod	LESQU	<i>Lesquerella</i>	5–16	–
16				5–16	
	cassia	CASSI	<i>Cassia</i>	5–16	–
17				11–26	
	Forb (herbaceous, not grass nor grass-like)	2FORB	<i>Forb (herbaceous, not grass nor grass-like)</i>	11–26	–
Shrub/Vine					
18				5–16	
	littleleaf sumac	RHMI3	<i>Rhus microphylla</i>	5–16	–
19				5–16	
	creosote bush	LATR2	<i>Larrea tridentata</i>	5–16	–
20				5–16	
	littleleaf ratany	KRER	<i>Krameria erecta</i>	5–16	–
21				5–16	
	javelina bush	COER5	<i>Condalia ericoides</i>	5–16	–
22				5–16	
	American tarwort	FLCE	<i>Flourensia cernua</i>	5–16	–
23				5–16	
	crown of thorns	KOSP	<i>Koeberlinia spinosa</i>	5–16	–
24				11–26	
	honey mesquite	PRGL2	<i>Prosopis glandulosa</i>	11–26	–
	honey mesquite	PRGL2	<i>Prosopis glandulosa</i>	11–26	–
25				5–16	
	catclaw mimosa	MIACB	<i>Mimosa aculeaticarpa</i> var. <i>biuncifera</i>	5–16	–
26				5–16	
	pricklypear	OPUNT	<i>Opuntia</i>	5–16	–
27				11–26	
	mariola	PAIN2	<i>Parthenium incanum</i>	11–26	–
	mariola	PAIN2	<i>Parthenium incanum</i>	11–26	–
28				5–16	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	5–16	–
29				16–26	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	16–26	–

Animal community

This site provides habitats which support a resident animal community that is characterized by desert cottontail, spotted ground squirrel, Merriam's kangaroo rat, cactus mouse, white-throated woodrat, gray fox, spotted skunk, roadrunner, Swainson's hawk, white-necked raven, cactus wren, pyrrhuloxia, lark sparrow, mourning dove, scaled quail, leopard lizard, round-tailed horned lizard, prairie rattlesnake, marbled whiptail, and greater earless lizard. Where associated with limestone hills, mule deer utilize this site.

Where large woody shrubs occur, most resident birds and scissor-tailed flycatcher, morning dove, lark sparrow and Swainson's hawk nest.

Hydrological functions

The runoff curve numbers are determined by field investigations using hydraulic cover conditions and hydrologic soil groups.

Hydrologic Interpretations

Soil Series----- Hydrologic Group

Lozier----- D

Potter----- C

Tencee----- D

Upton----- C

Kimbrough----- D

Upton----- D

Ector----- D

Recreational uses

This site offers recreation potential for hiking, horseback riding, rock hunting, nature photography and bird hunting and birding. During years of abundant spring moisture, a colorful array of wild flowers is displayed during May and June. A few summer and fall flowers also occur.

Wood products

This site has no potential for wood production.

Other products

This site is suited for grazing by all kinds and classes of livestock during all seasons of the year. Missmanagement will cause a decrease in black grama, sideoats grama, and blue grama, bush muhly and New Mexico feathergrass. A corresponding increase in bare ground will occur. There will also be an increase in muhlys, fluffgrass, creosotebush, javalinabush, catclaw, and mesquite. This site will respond best to a system of management that rotates the season of use.

Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index----- Ac/AUM

100 - 76----- 3.7 – 4.5

75 – 51----- 4.3 – 5.5

50 – 26----- 5.3 – 10.0

25 – 0----- 10.1 +

Inventory data references

Data collection for this site was done in conjunction with the progressive soil surveys within the Southern Deseritic Basins, Plains and Mountains, Major Land Resource Areas of New Mexico (SD-3). This site has been mapped and

correlated with soils in the following soil surveys. Eddy County, Lea County, and Chaves County.

Other references

Literature Cited:

1. Humphrey, R.R. 1974. Fire in the deserts and desert grassland of North America. In: Kozlowski, T. T.; Ahlgren, C. E., eds. Fire and ecosystems. New York: Academic Press: 365-400.
2. Hennessy, J.T., R.P. Gibbens, J.M. Tromble, and M. Cardenas. 1983. Water properties of caliche. J. Range Manage. 36: 723-726.
3. U.S. Department of Agriculture, Natural Resources Conservation Service. 2001. Soil Quality Information Sheets. Rangeland Soil Quality—Infiltration, Organic Matter, Rangeland Sheets 5,6. [Online]. Available: <http://www.statlab.iastate.edu/survey/SQL/range.html>

Contributors

David Trujillo
Don Sylvester

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills:

2. Presence of water flow patterns:

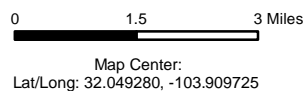
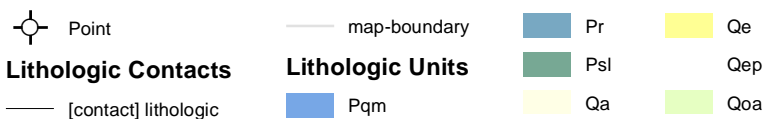
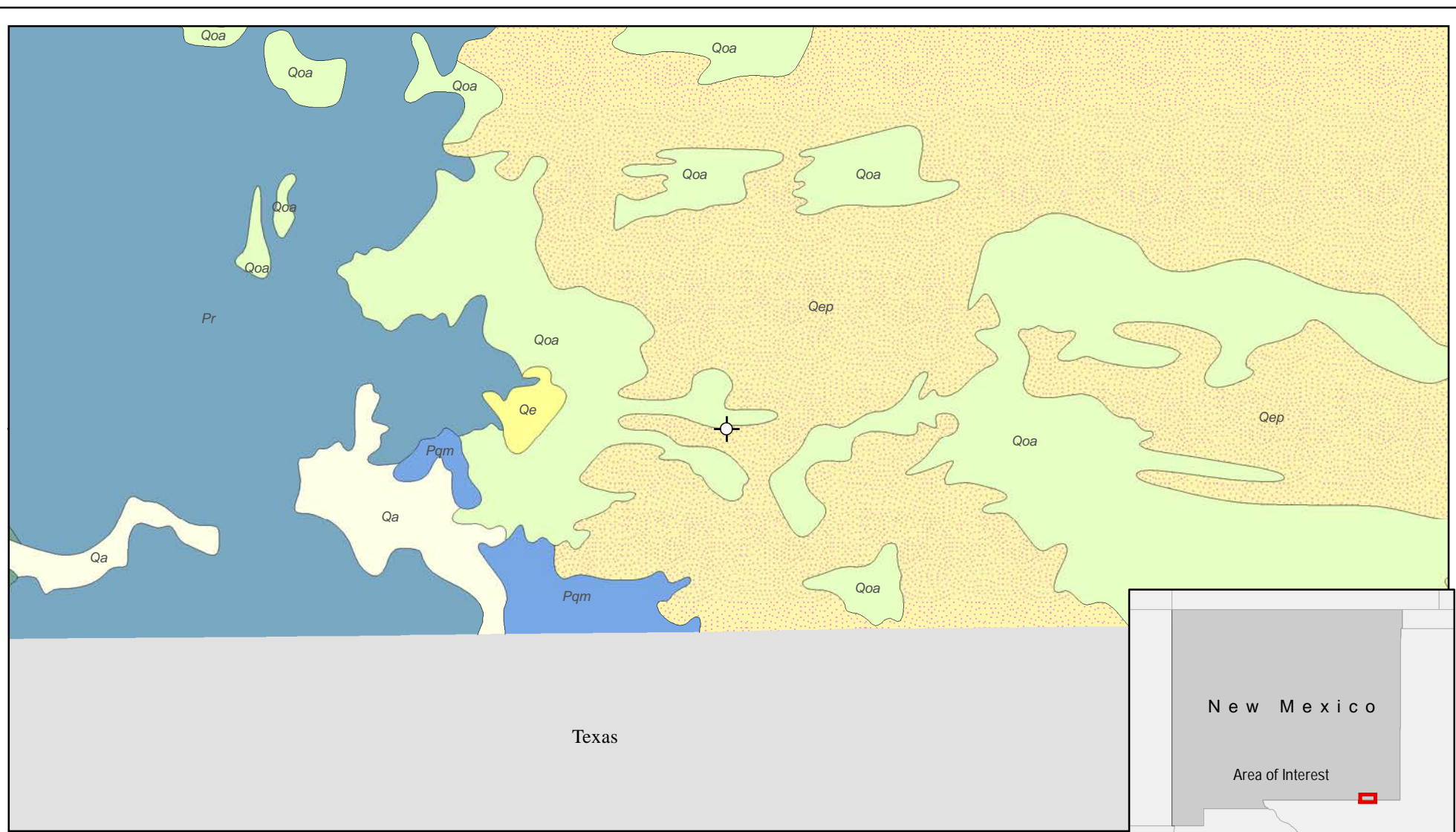
3. Number and height of erosional pedestals or terracettes:

4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):

5. **Number of gullies and erosion associated with gullies:**
-
6. **Extent of wind scoured, blowouts and/or depositional areas:**
-
7. **Amount of litter movement (describe size and distance expected to travel):**
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**
-
12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant:
- Sub-dominant:
- Other:
- Additional:
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
-
14. **Average percent litter cover (%) and depth (in):**
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**
-
16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if**

their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

17. Perennial plant reproductive capability:



NAD 1983 UTM Zone 13N
Date: May 17/22



New Mexico Geology
RDX Federal 17 #035

FIGURE:

Y



Geospatial data presented in this figure may be derived from external sources and Vertex does not assume any liability for inaccuracies. This figure is intended for reference use only and is not certified for legal, survey, or engineering purposes.

Note: Geology data sourced from New Mexico Bureau of Geology & Mineral Resources, Bureau of Land Management. Sit elocation from GPS point, Vertex Professional Services., 2022

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ATTACHMENT 4

Monica Peppin

From: Dhugal Hanton <vertexresourcegroupusa@gmail.com>
Sent: September 12, 2022 3:16 PM
To: Enviro, OCD, EMNRD; CFO_Spill, BLM_NM
Cc: Raley, Jim; Monica Peppin
Subject: Multiple Liner Inspections 48-HR Notification

All,

Please accept this email as 48-hr notification that Vertex Resource Services has scheduled multiple liner inspections to be conducted for the following releases:

nAPP2222130109 DOR: 8/8/2022 Site Name: RDX 17 Federal #035H

nAPP2222750606 DOR: 8/15/2022 Site Name: RDX 17 Federal #040H

nAPP2218938856 DOR: 7/7/2022 Site Name: RDX 17 Federal #010H

This work will be completed on behalf of WPX Energy Permian, LLC

On Friday, September 16, 2022 at approximately 8:00 a.m., Jacob Reta will be on site to conduct liner inspections. He can be reached at 505-506-0040. If you need directions to the site, please do not hesitate to contact him. If you have any questions or concerns regarding this notification, please give me a call at 575-361-9880.

Thank you,

Monica Peppin
Project Manager

Vertex Resource Services Inc.
3101 Boyd Drive,
Carlsbad, NM 88220

P 575.725.5001 Ext. 711
C 575.361.9880
F

www.vertex.ca

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Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

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

CONDITIONS

Action 146036

CONDITIONS

Operator: WPX Energy Permian, LLC Devon Energy - Regulatory Oklahoma City, OK 73102	OGRID: 246289
	Action Number: 146036
	Action Type: [C-141] Release Corrective Action (C-141)

CONDITIONS

Created By	Condition	Condition Date
rhamlet	We have received your closure report and final C-141 for Incident #NAPP2222130109 RDX FEDERAL 17 #035H, thank you. This closure is approved.	12/14/2022