

NM1-63

**Permit
Application
Vol 4
Part 1 of 3**

10/12/16

**APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC**

**VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA**

ATTACHMENT IV.1.A

**WATERCOURSES, FLOODPLAINS, AND WETLANDS INVESTIGATION
(ROCKY MOUNTAIN ECOLOGY, OCTOBER 2015)**

WATERCOURSES, FLOODPLAINS, AND WETLANDS INVESTIGATION

***FOR A SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN A PORTION
OF SECTION 23, TOWNSHIP 24 SOUTH, RANGE 33 EAST, LEA COUNTY, NM
FOR OILFIELD WATER LOGISTICS, LLC***

PREPARED FOR:

GORDON ENVIRONMENTAL, INC.
213 S. CAMINO DEL PUEBLO
BERNALILLO, NM 87004

PREPARED BY:

ROCKY MOUNTAIN ECOLOGY, LLC
P.O. Box 1441
BERNALILLO, NM 87004



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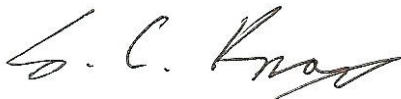
ROCKY MOUNTAIN ECOLOGY, LLC
P.O. BOX 1441
BERNALILLO, NM 87004

PREPARATION DATE:

OCTOBER 2015

INVESTIGATOR/S:

SHAWN C. KNOX, M.S., C.W.B
DIRECTOR, ROCKY MOUNTAIN ECOLOGY, LLC



Signature

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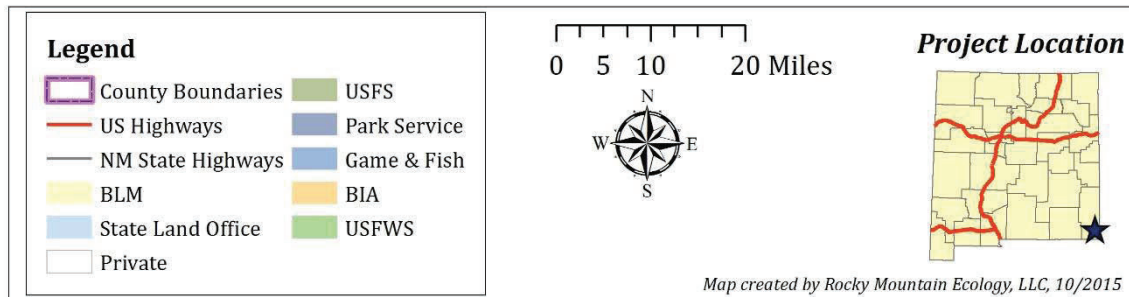
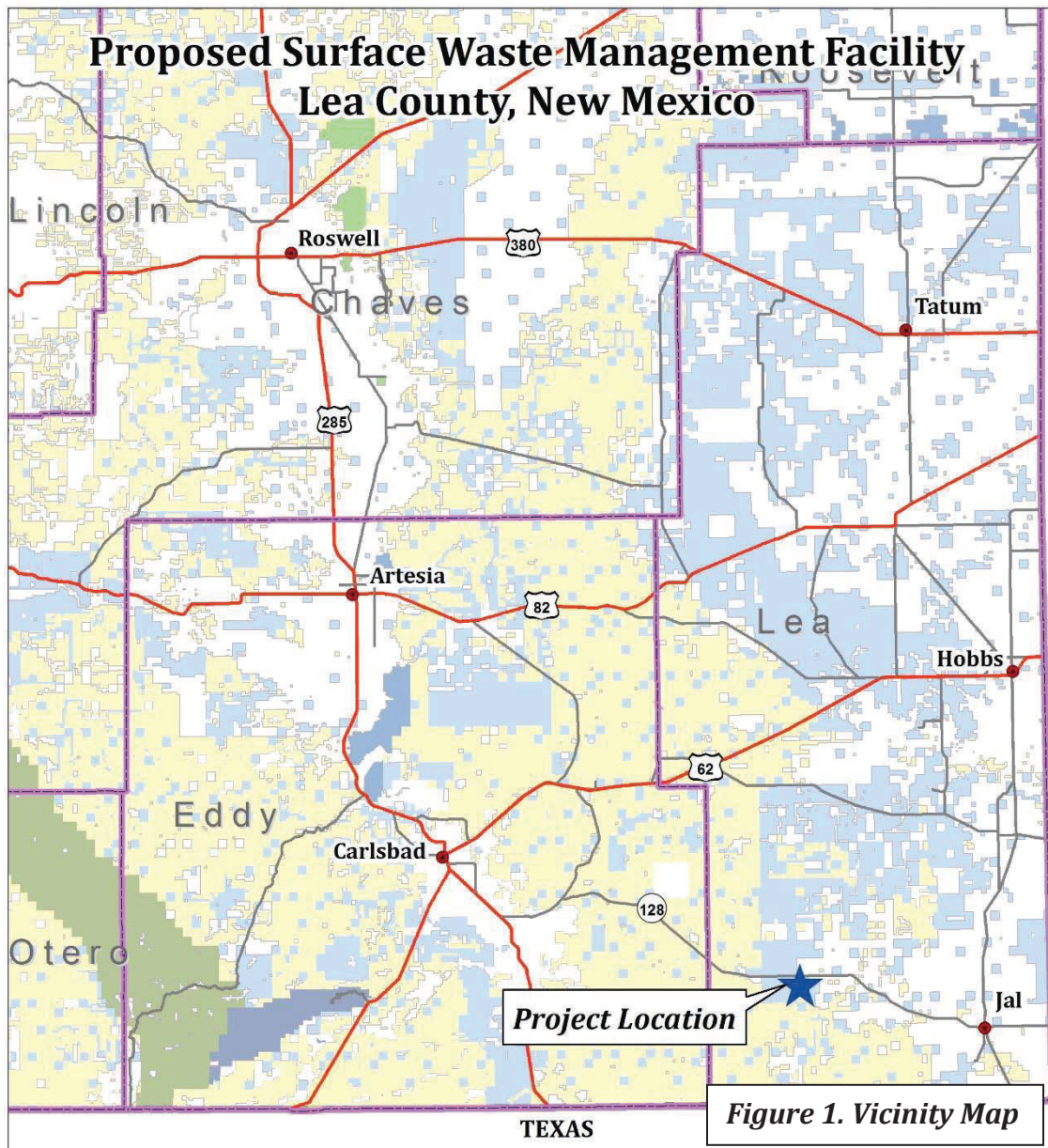
1.0. INTRODUCTION

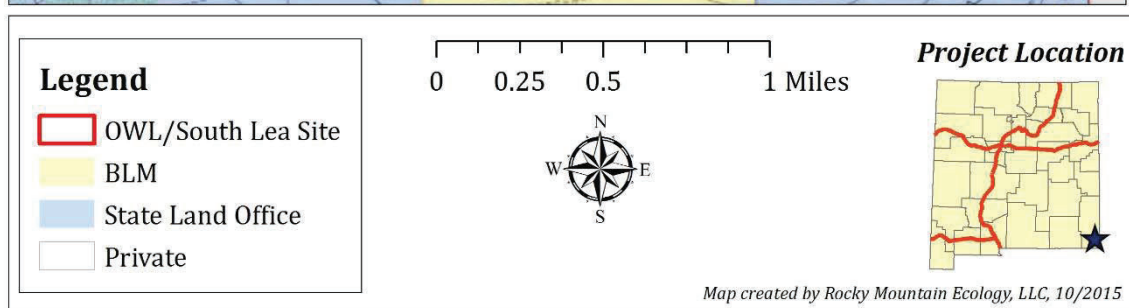
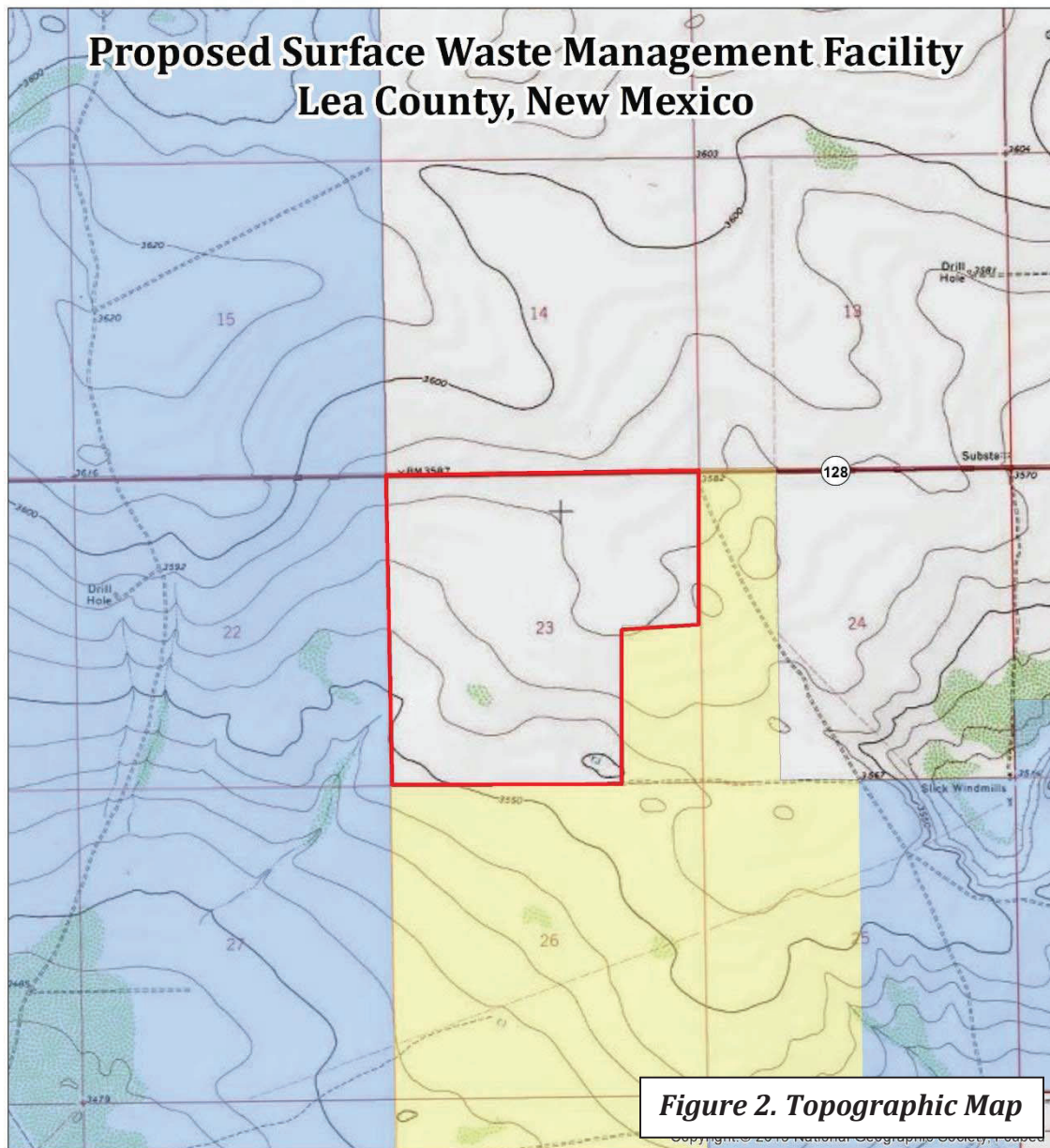
This document describes results of an investigation for presence and extent of watercourses, floodplains and wetlands on a ± 560-acre tract of land in Lea County, New Mexico (NM). Oilfield Water Logistics (OWL) is pursuing a Permit, issued by the Oil Conservation Division (OCD) of the New Mexico Energy, Minerals, and Natural Resources Department (EMNRD), for a “Surface Waste Management Facility” per 19.15.2.7.S(11) NMAC: “a facility that receives oil field waste for collection, disposal, evaporation, remediation, reclamation, treatment or storage...”. The proposed project is called the OWL/South Lea Site. In order to obtain a Permit for a Surface Waste Management Facility, OWL will submit an Application to the OCD that address the requirement of 19.15.36 NMAC, including siting requirements (19.15.36.13 NMAC) that require analyses of watercourses, floodplains, wetlands, etc. The project will serve the oilfield industry in southern Lea County and West Texas. This report specifically addresses those requirements in 19.15.36.13.B, excluding “existing wellhead protection areas.”

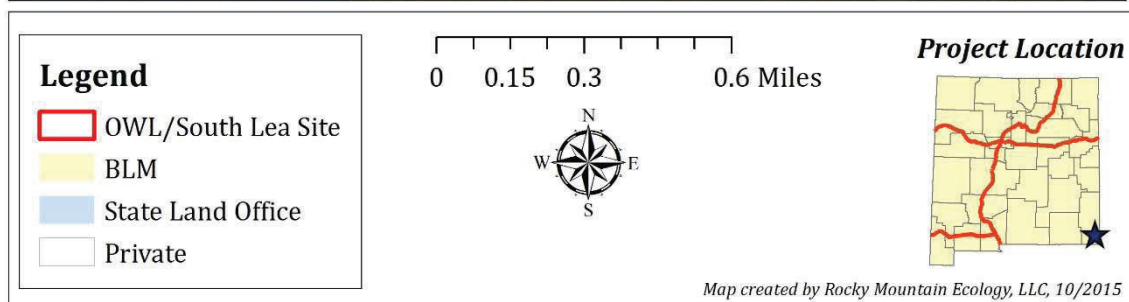
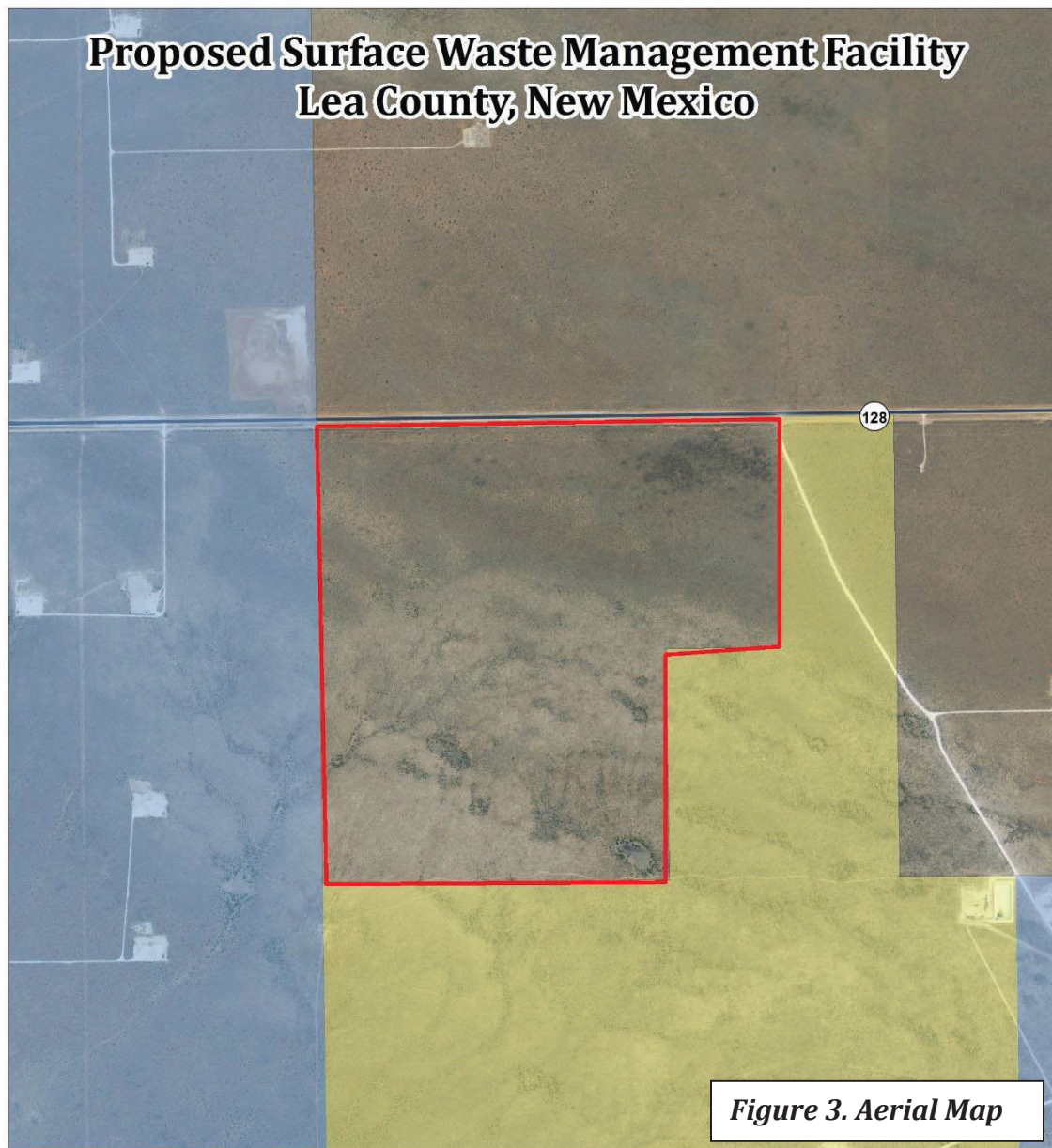
SITING AND OPERATIONAL REQUIREMENTS APPLICABLE TO ALL PERMITTED SURFACE WASTE MANAGEMENT FACILITIES: Except as otherwise provided in 19.15.36 NMAC.

- B. No surface waste management facility shall be located:*
- (1) within 200 feet of a watercourse, lakebed, sinkhole or playa lake;*
 - (2) within an existing wellhead protection area or 100-year floodplain;*
 - (3) within, or within 500 feet of, a wetland.*

The OWL/South Lea Site is located in a portion of Section 23, Township 24 South, Range 33 East. The project area occurs on the Bell Lake, NM U.S. Geological Survey (USGS) 7.5-minute quadrangle map (Figures 1-3).







2.0 METHODS

Clayton P. Bowers, from Rocky Mountain Ecology, LLC (RME) conducted a field survey of the OWL/South Lea Site on 29 September 2015. The entire property was surveyed via pedestrian gridding (Appendix A. Photographs). Prior to the field survey, topographic maps and U.S. Department of Agriculture (USDA) National Agricultural Imagery Program (NAIP) ortho-photography were evaluated to ascertain where depressions exist on the landform which could channel or pond water. Further, the National Wetland Inventory (NWI) (<http://www.fws.gov/wetlands/data>) and USDA Natural Resource Conservation Service Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov>) databases were queried to gather existing data on potential wetlands and wetland soils that could occur. Moreover, the National Hydrography Dataset (NHD) (USGS 1999) was assessed in a Geographical Information System (GIS) to gather data regarding watercourses in the project area. Finally, the Federal Emergency Management Agency (FEMA) Map Service Center database (<https://msc.fema.gov>) (FEMA 2015) was consulted for information regarding the 100-year floodplain. A search for watercourses, lakebeds, sinkholes, playa lakes, wetlands and floodplains was conducted in the field.

3.0 GENERAL ENVIRONMENTAL SETTING

The project area occurs within the Chihuahuan Desert Grasslands subregion of the Chihuahuan Deserts Ecoregion (Griffith, et. al 2006). “The grasslands occur in areas of somewhat higher annual precipitation (10 to 15 inches) than the Chihuahuan Basins and Playas, such as elevated basins between mountain ranges, low mountain benches and plateau tops, and north-facing mountain slopes. Grasslands were once more widespread, but heavy grazing in the late 19th and early 20th centuries was unsustainable, and desert shrubs invaded where the grass cover became fragmented. In grassland areas with lower rainfall, areal coverage of grasses may be sparse, 10% or less. Some areas are now mostly shrubs as grasslands continue to decline due to erosion, drought, and climatic change.” (Griffith et al 2006).

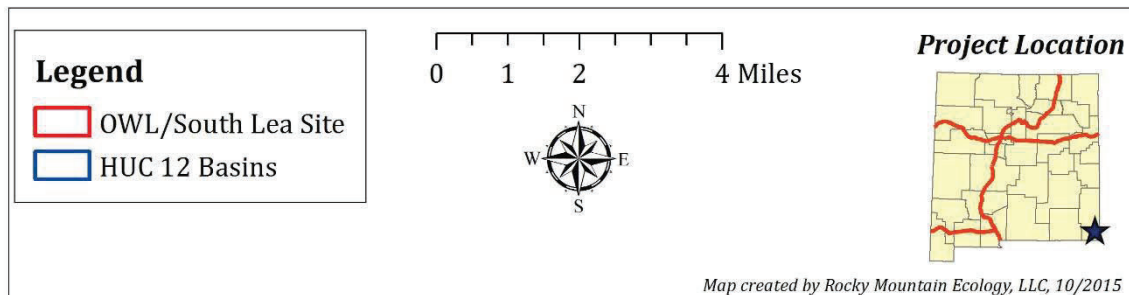
The project area is located within the Landreth-Monument Draws watershed, eight-digit Hydrologic Unit Code (HUC) #13070007 (USGS 1999). Two twelve-digit watersheds are encompassed within the Owl/South Lea Site; most of the Site occurs within the Double X Ranch sub-watershed (HUC # 130700070403), while 60 acres of the northeast portion of the Site occurs in the Woodley Flat sub-watershed (HUC # 130700070405). Neither of the sub-watersheds are closed basins according to the NHD (USGS 1999) (Figure 4). Water within these sub-watersheds generally flows south via surface runoff. Surface runoff through the OWL/South Lea Site flows in a southerly direction.

The OWL/South Lea Site is located within the Plains-Mesa Sand Scrub vegetation type as defined by Dick-Peddie (1993). Dominant plant species across the Site include honey mesquite (*Prosopis glandulosa*), thinleaf yucca (*Yucca glauca*) sand dropseed (*Sporobolus cryptandrus*), black grama (*Bouteloua eriopoda*) and Lehmann’s lovegrass (*Eragrostis lehmanniana*). Multiple isolated depressions (i.e. playas) were located across the Site (Figures 5 & 6). Within these features, dominant vegetation was comprised of more robust stands of honey mesquite, vine mesquite (*Panicum obtusum*), silverleaf nightshade (*Solanum elaeagnifolium*) and Canadian horsetweed (*Conyza canadensis*).

The project area is located on slopes ranging from 0 to 15 percent. Elevation within the project area ranges from 3,592 to 3,559 ft above sea level in the Northeast and Southeast portions, respectively. The warmest average maximum temperature in Ochoa, NM (located ~ 7 miles east of

the Site) occurs in June at 95.7 degrees Fahrenheit (°F); while the coldest average minimum temperature of 28.2 °F occurs in January. Annual precipitation averages 11.75 inches (in) (WRCC 2015).

The soil map units represented in the project area are the SR—Simona-Upton association (59% of the Site), BH—Berino-Cacique association, hummocky (23% of the Site), PU—Pyote and maljamar fine sands (17% of the Site), and BE—Berino-Cacique loamy fine sands (0.1% of the Site) (USDA-NRCS 2015). No hydric soils are present; nor is ponding probable on any of the soils in the project area (Appendix B). NRCS data in Appendix B indicate that 1-2% of soils may exhibit hydric characteristics; however soil pits were excavated in depressional feature areas (i.e., in the areas with highest likelihood of containing hydric soil properties) and no evidence of hydric soils was located. All soils within the project area are labeled as well drained. Moreover, depth to water table across the project area is greater than 200 centimeters (USDA-NRCS 2015). Detailed information regarding soil characteristics is located in Appendix B.



4.0 RESULTS

4.1 Watercourses

One unnamed ephemeral drainage was located in the southwestern portion of the OWL/South Lea Site (Figure 5). The drainage was observed to be approximately 0.13 miles in length before terminating in a man-made earthen tank (Appendix A. Photographs). No surface water was present in the features during the field survey. The Oil & Gas Rules define a "watercourse" as a "*river, creek, arroyo, canyon, draw or wash or other channel having definite banks and bed with visible evidence of the occasional flow of water*" (19.15.2.7.W(4) NMAC). Based on the field investigation, the unnamed ephemeral drainage identified within the Site may be defined as a watercourse, as it does have definite banks and a bed with visible evidence of occasional water flow.

Based on the USGS (1999), the subject drainage in the OWL/South Lea Site is located entirely within the Double X Ranch sub-watershed. As stated above, any water flowing down the drainage is captured by a man-made earthen tank (Appendix A. Photographs). It is highly unlikely water exits the earthen tank given the small drainage area that the channel provides for. Further, no defined channel can be found downstream of the tank. Should water ever exit the tank, it would flow out of the project boundary and be captured in another man-made earthen tank (Figure 6). Downstream and beyond this tank, no channel can be found and the flow path appears to percolate into the ground, with no connection to any other drainage or flow path (Figure 6).

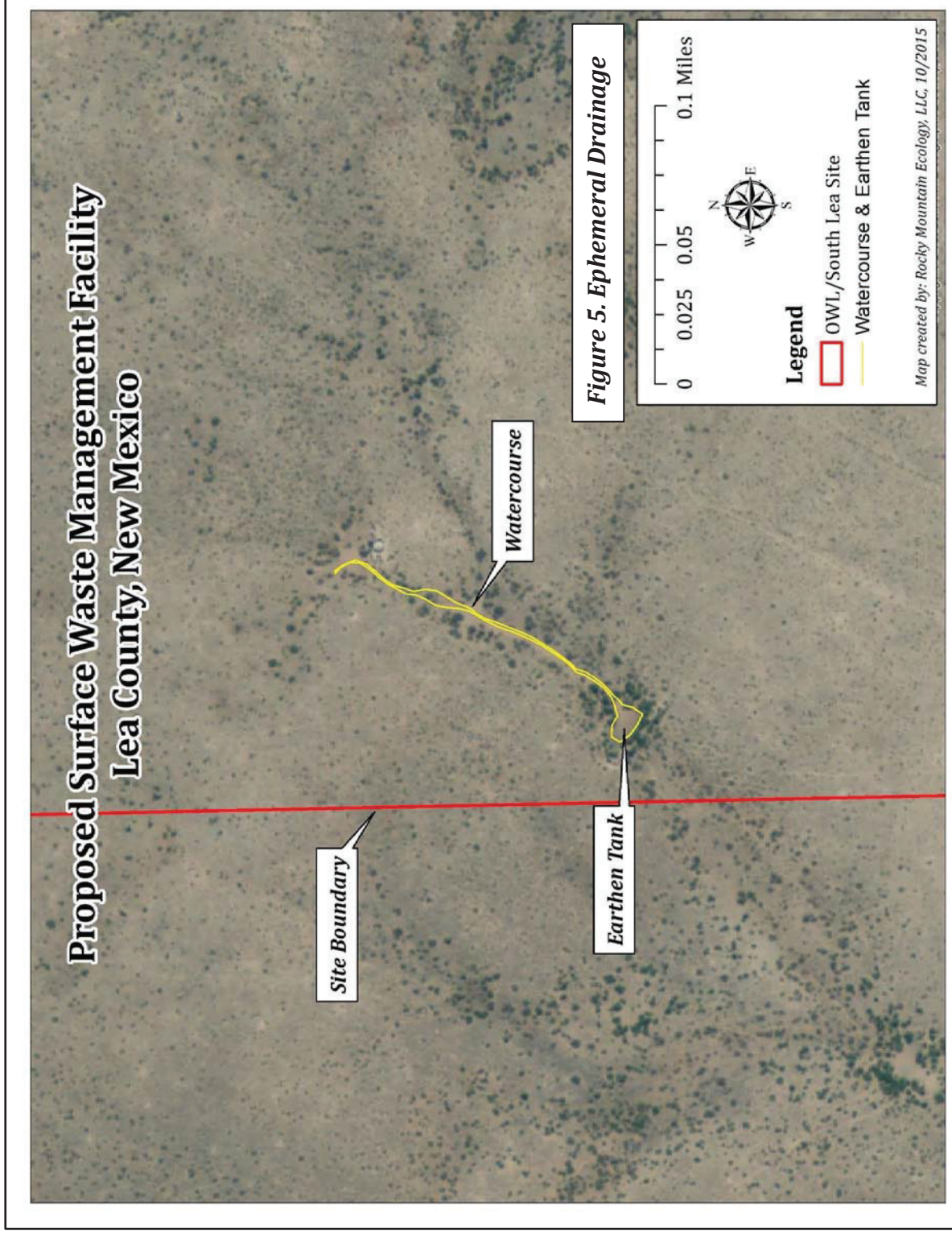
The U.S. Army Corps of Engineers (USACE) was not consulted regarding a preliminary jurisdictional determination (PJD) via this scope of work. However, it appears there is no possibility that any Waters of the U.S., as defined by the USACE, occur within the project boundary. There is no possibility that the subject drainage described above, could provide or contribute to "interstate commerce."

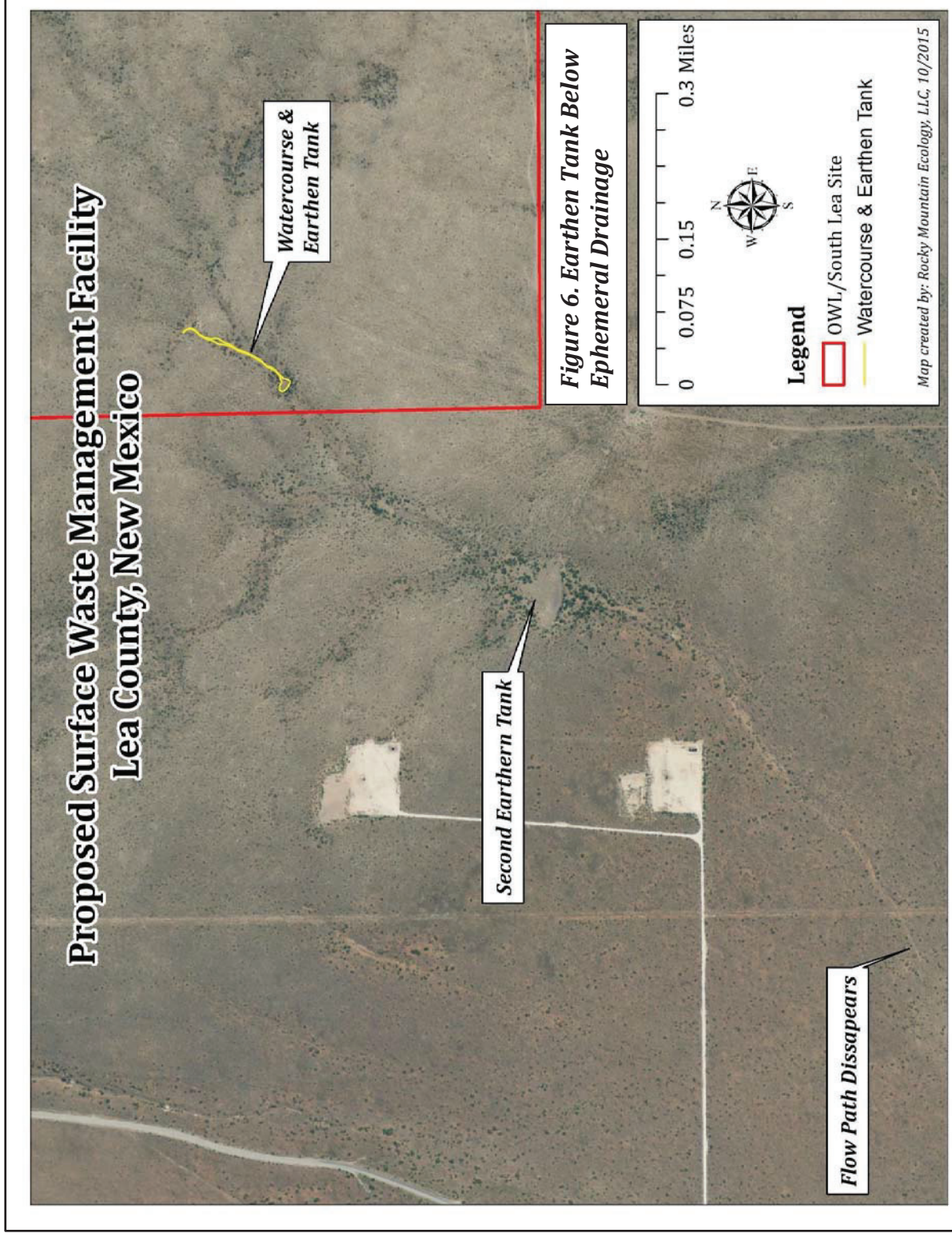
4.2 100-Year Floodplain

The FEMA Map Service Center database indicated that the project area has not been mapped for floodplain occurrence (Zone D) (Appendix C). Correspondence with the Lea County Floodplain Coordinator, Cassie Corley, indicated that "...there is no data that FEMA can provide since there has been no study done" (personal communication 10/2015).

4.3 Lakebeds

No lakebeds were observed on the property during the field survey.





4.4 Playa lakes

The Oil & Gas Rules define a “playa lake” as a “*level or nearly level area that occupies the lowest part of a completely closed basin and that is covered with water at irregular intervals, forming a temporary lake*” (19.15.2.7.P(4) NMAC). During the field investigation, numerous depressional features were found that exhibited signs of infrequent and irregular inundation (Appendix A. Photographs). These characteristics include a more robust vegetative community, depressional topography, and limited surface cracking of the soil. Overall, most of these features were very shallow (1 – 2 feet) and possessed limited water storage capability. One of the features appeared to have been excavated, likely for increased water storage capability for livestock. This feature is discussed in more detail in Section 4.6, below. All of the features were located within the Double X Ranch sub-watershed, which is not a closed basin. Therefore, these features are not considered playas.

4.5 Sinkholes

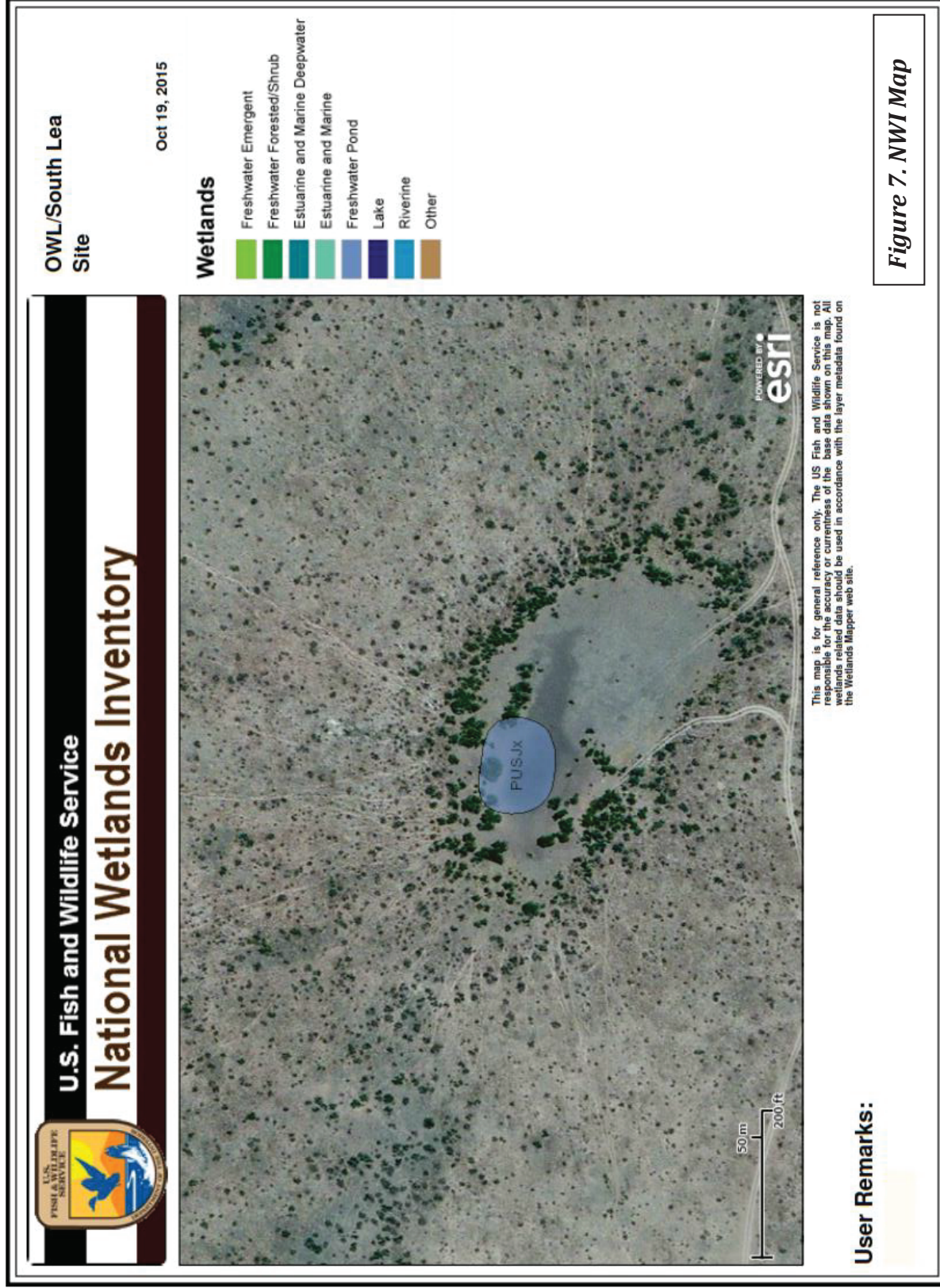
No sinkholes were observed on the property during the field survey.

4.6 Wetlands

The OWL/South Lea Site was evaluated in the field for the presence of wetland indicators (i.e., hydrophytic vegetation, hydric soil and wetland hydrology) by RME during the field survey. A formal wetland delineation was not conducted on the Site because it did not show signs of wetland occurrence, which could warrant a more detailed assessment. No indicators of hydrology, hydric soils, or hydrophytic vegetation exist within the majority of the depressional features. Three of the depressional features did harbor a hydrologic indicator, soil surface cracks, however this indicator by itself does not constitute wetland occurrence. No Obligate Wetland plant species, as defined by the Lichvar (2012), were observed during the field survey.

The NWI database, pre-survey review indicated that one of the depressional features in the very southeastern corner of the Site (described in Section 4.4) is classified as an “intermittently flooded palustrine wetland” (Figure 7) (USDI Fish and Wildlife Service 2015). However, at the time of the field survey, the feature did not harbor soils or vegetation indicative of wetlands. Soil surface cracks, a hydrologic indicator of wetlands, was present in the deepest portions of the feature (Appendix A. Photographs).

All of the depressional features contained some component of vine mesquite (*Panicum obtusum*), rated as a “Facultative” species, according to the 2012 National Wetland Plant List (Lichvar 2012). Three of the features contained sparse inland saltgrass (*Distichlis spicata*), a “Facultative Wetland” species (Lichvar 2012). However, neither of these species were vegetative dominants in the depressions, and therefore the features lacked the hydrophytic vegetation component. None of the depressional features are considered wetlands; it is likely they are inundated too infrequently to exhibit all necessary wetland characteristics.



5.0 DISCUSSION & RECOMMENDATIONS

The OWL/South Lea Site is located within two distinct sub-watersheds; most of the Site occurs in the Double X Ranch sub-watershed, while 60 acres of the northeast portion of the Site occurs in the Woodley Flat sub-watershed. Neither of the watersheds are considered closed basins according to the NHD (USGS 1999) (Figure 4). Surface runoff water within these sub-watersheds generally flows to the South, and has potential to directly exit the watershed boundaries. One ephemeral drainage flows in a southwesterly direction in the southwest portion of the Site (Figures 5 & 6). However, a man-made earthen tank captures any water that may flow down the drainage, preventing it from exiting the Site. To the best of my knowledge, based on field surveys and analysis of topographic maps and aerial photography, I (Clayton Bowers) believe that no Waters of the U.S., as defined by the USACE, are located within the OWL/South Lea Site. If a definitive determination is desired, it is recommended that the USACE be contacted regarding an official PJD or Approved Jurisdictional Determination (AJD).

Based on the definition of a "watercourse", as defined by the Oil & Gas Rules (19.15.2.7.W(4) NMAC), the un-named ephemeral drainage identified within the Site may be defined as a watercourse. This drainage does have definite banks and a bed with visible evidence of occasional water flow.

The project area has not been mapped for floodplain occurrence (Zone D) (Appendix C). Correspondence with the Lea County Floodplain Coordinator, Cassie Corley, indicated that "...there is no data that FEMA can provide since there has been no study done" (personal communication 10/2015).

The Oil & Gas Rules define a "playa lake" as a *"level or nearly level area that occupies the lowest part of a completely closed basin and that is covered with water at irregular intervals, forming a temporary lake"* (19.15.2.7.P(4) NMAC). During the field investigation, numerous depressional features were found that exhibited signs of infrequent and irregular inundation (Appendix A. Photographs). One of the features appeared to have been excavated, likely for increased water storage capability for livestock. All of the features were located within the Double X Ranch sub-watershed, which is not a closed basin. Therefore, these features are not considered playas based on the Oil and Gas Rules.

No lakebeds were observed within the OWL/South Lea Site boundary.

No sinkholes were observed on the property during the field survey.

No evidence of wetlands, as defined by the USACE, was observed during the field survey.

6.0 REFERENCES

Corley, Cassie. 2015. Personal Communication – Floodplain Coordinator, Lea County Floodplain Management, 10/2015.

Dick-Peddie, W.A. 1993. New Mexico Vegetation: Past, Present, and Future. UNM Press.

Griffith, G.E., Omernik, J.M., McGraw, M.M., Jacobi, G.Z., Canavan, C.M., Schrader, T.S., Mercer, D., Hill, R., and Moran, B.C., 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

Lichvar, R.W. 2012. The National Wetland Plant List. ERDC/CRREL TR-12-11. Hanover, NH: U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory.
[http://acwc.sdp.sirsi.net/client/search/asset:asset?t:ac=\\$N/1012381](http://acwc.sdp.sirsi.net/client/search/asset:asset?t:ac=$N/1012381)

USDHS-FEMA. 2015. Federal Emergency Management Agency Map Service Center. Database accessed October 2015.

USDA-NRCS. 2015. Natural Resource Conservation Service Web Soil Survey database. Accessed October 2015.

USDI-U.S. Fish & Wildlife Service. 2015. U.S. Fish and Wildlife Service National Wetland Inventory. Database accessed October 2015.

USGS 1999. National Hydrography Dataset. US Geological Survey.

[WRCC]. Western Regional Climate Center. 2015. Ochoa, New Mexico (296281). Accessed 16 October 2015. Available online: <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm6281>

APPENDICES
APPENDIX A - PHOTOGRAPHS

Photo 1. Representative view of northern half of Site, facing south.



Photo 2. Representative view of a depressional feature, facing north.



Photo 3. Looking south from midpoint of OWL/South Lea Site.



Photo 4. Excavated depressional feature, facing southeast.



Photo 5. Watercourse in southwest project area, facing southwest.

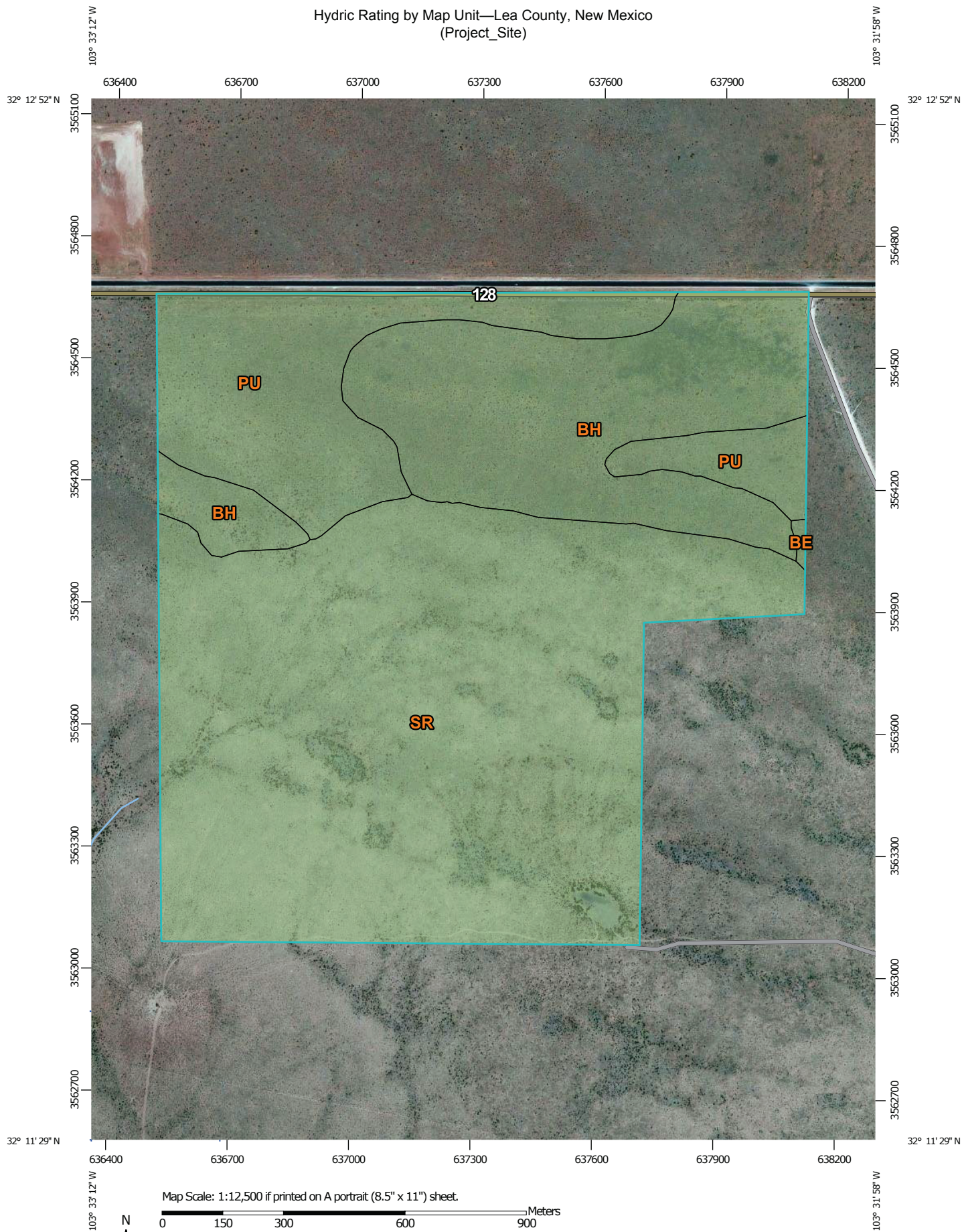


Photo 6. Man-made earthen tank that watercourse empties into, facing southwest.

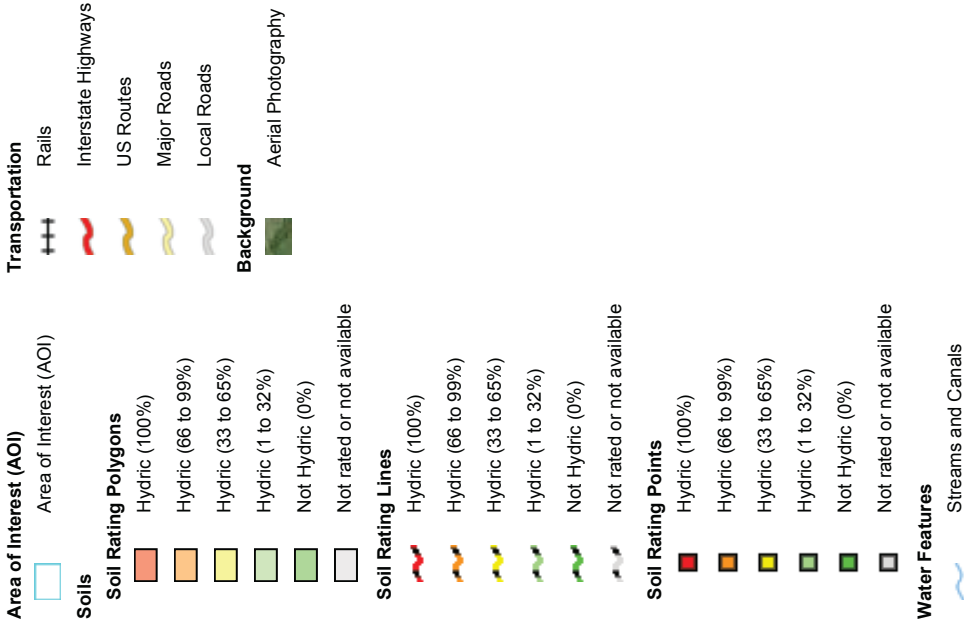


APPENDIX B – NRCS SOILS DATA

Hydric Rating by Map Unit—Lea County, New Mexico
(Project_Site)



MAP LEGEND



MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
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: Lea County, New Mexico
Survey Area Data: Version 11, Sep 30, 2014

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

Date(s) aerial images were photographed: Data not available.

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.

Hydric Rating by Map Unit

Hydric Rating by Map Unit— Summary by Map Unit — Lea County, New Mexico (NM025)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BE	Berino-Cacique loamy fine sands association	2	0.8	0.1%
BH	Berino-Cacique association, hummocky	1	130.2	23.5%
PU	Pyote and maljamar fine sands	1	98.3	17.7%
SR	Simona-Upton association	1	324.7	58.6%
Totals for Area of Interest			554.0	100.0%

Description

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric components, 1 to 32 percent hydric components, and less than one percent hydric components.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Rating Options

Aggregation Method: Percent Present

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

APPENDIX C – FEMA FIRMETTE



*35025C1575D 12/16/2008	*35025C1600D 12/16/2008	*35025C1625D 12/16/2008	12/16/2008 *35
*35025C1725D 12/16/2008	*35025C1750D 12/16/2008	*35025C1775D 12/16/2008	*35025C1800D 12/16/2008
<div>OWL/South Lea Site</div> <div>128</div> <div>35025C2 12/16/2008</div> <div>Flow Flow Flow *35</div>			
*35025C1875D 12/16/2008	*35025C1900D 12/16/2008	*35025C1925D 12/16/2008	*35025C1950D 12/16/2008
*35025C2025D 12/16/2008	*35025C2050D 12/16/2008	*35025C2075D 12/16/2008	*35025C2100D 12/16/2008

* PANEL NOT PRINTED - AREA IN ZONE D

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

MAP INDEX

FIRM

FLOOD INSURANCE RATE MAP

LEA COUNTY,

NEW MEXICO

AND INCORPORATED AREAS

MAP INDEX

PANELS PRINTED: 440, 445, 955,
965, 1165, 1170, 1200, 1335, 1345, 1355,
1365, 1670, 2102

MAP NUMBER
35025CIND0A

EFFECTIVE DATE
DECEMBER 16, 2008



Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

**APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC**

**VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA**

ATTACHMENT IV.1.B

**LETTER REPORT FOR SUMMARY OF CLASS I FILE SEARCH
(HAMMERSTONE ARCHAEOLOGICAL SERVICES, OCTOBER 2015)**

HAMMERSTONE ARCHAEOLOGICAL SERVICES

Dacia R. Tucholke
Project Manager
Gordon Environmental, Inc.
213 S. Camino Del Pueblo,
Bernalillo, NM 87004

RE: Letter Report for Summary of Class I File Search for a Proposed Surface Waste Management Facility in Lea County, NM.

Hammerstone Archaeological Services (HAS) is pleased to provide you with the following summary of a file search for a proposed surface waste management facility in Lea County, New Mexico per 19.15.2.7.S(11) NMAC: “a facility that receives oil field waste for collection, disposal, evaporation, remediation, reclamation, treatment or storage.” The project will serve the oilfield industry in southern Lea County and West Texas.

A Class I file search of the Archaeological Records Management Section (ARMS) Mapserver database was conducted on October 15, 2015 (please see the attached ARMS map). One previously recorded cultural resource site was identified within the proposed project area. Site LA 178420 is an historic surface manifestation originally recorded by Lone Mountain Archaeological Services in February of 2014. The site measures approximately 53 meters x 67 meters. It was officially determined not eligible by the Bruce Boeke of the Carlsbad Field Office, Bureau of Land Management on February 11, 2014. There has yet to be a formal determination of the site by the New Mexico State Historic Preservation Office; however it is unlikely that they would disagree with the agency determination by the BLM. That being said, a determination of “not eligible” would allow any ground disturbance associated with the proposed project undertaking to move forward without any regard for site LA 178420.

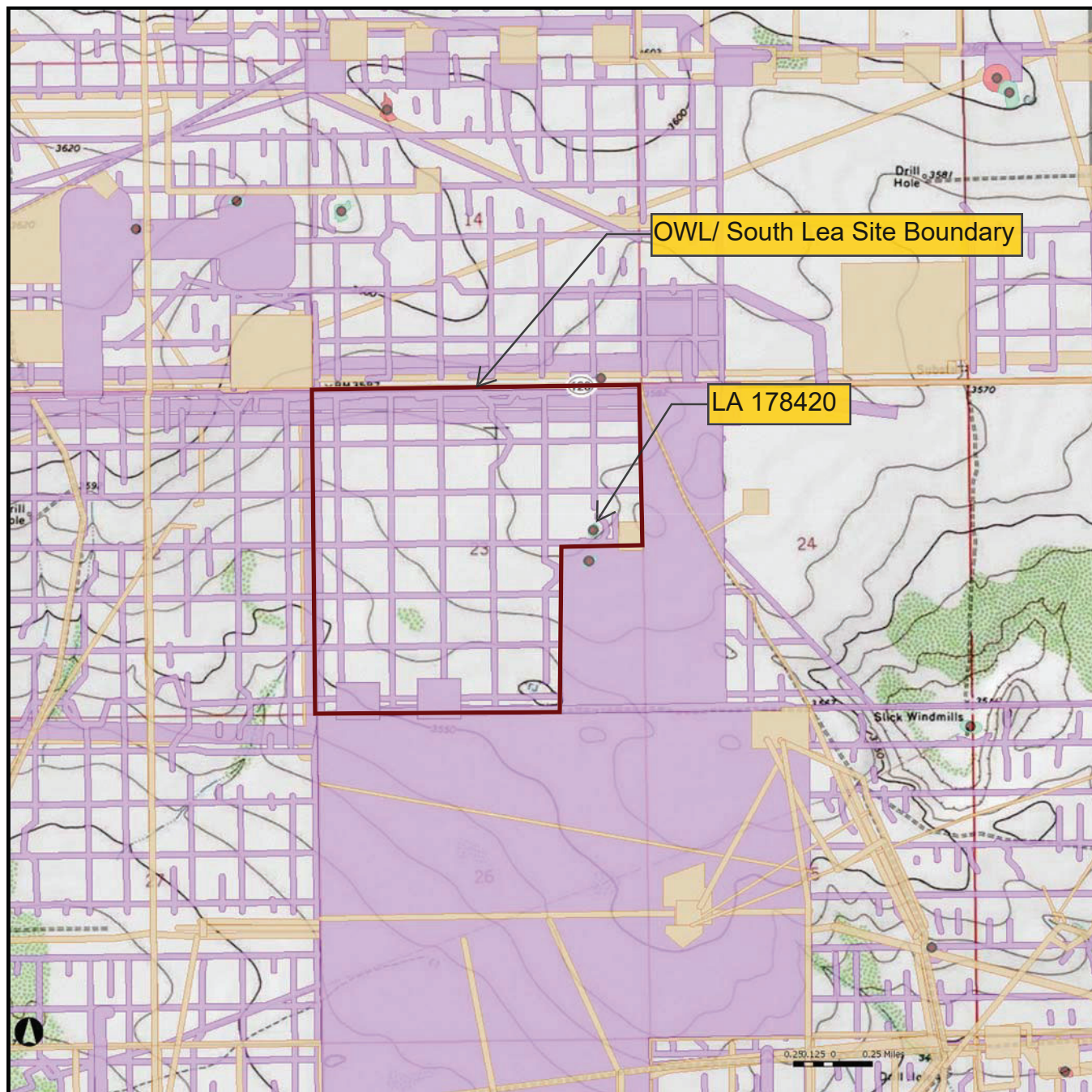
The pink and tan areas depicted on the ARMS map refer to previously conducted archaeological surveys. The legend states that the pink areas are “proposed” survey areas; however this is misleading. Those areas have been surveyed, but have not gone through the official ARMS verification process. If there are any questions concerning this summary, please do not hesitate to call me at any time.

Sincerely,

Richard Burleson Co-owner (Partner)
Hammerstone Archaeological Services



Map



PLSS

- Site Labels
- Site Boundaries (Edit)
- Site Boundaries
 - Not Defined
 - Proposed
 - Approved

Historic Structures

- Not Defined
- Proposed
- Approved
- Buildings
 - Not Defined
 - Proposed
 - Approved
- Objects
 - Not Defined

Register Properties

- Not Defined
- Proposed
- Approved
- Archaeological Surveys (Edit)
- Archaeological Surveys
 - Not Defined
 - Proposed
 - Approved

Building Labels

Object Labels

Linear Resource Labels

Historic Structure Labels

Historic Structures (Edit)

Buildings (Edit)

Objects (Edit)

Linear Resources (Edit)

Proposed

Approved

Linear Resources

Not Defined

Proposed

Approved

District Labels

Districts (Edit)

Districts

Not Defined

Proposed

Approved

Register Properties (Edit)

Highways

Primary Limited Access or Interstate

Primary US and State Highways

Secondary State and County

Local - Rural

Ramp, other

New Mexico

Counties

Towns

NGS USA Topographic Maps

NMCRIS

Background Reference Layers

DRGs: Copyright: © 2013 National Geographic Society

NGS USA Topographic Maps: Copyright: © 2013 National Geographic Society

Satellite Imagery

ESRI_Imagery_World_2D: Copyright:© 2013 ESRI, i-cubed, GeoEye

World Imagery: Copyright:© 2013 ESRI, i-cubed, GeoEye

**APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC**

**VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA**

ATTACHMENT IV.1.C

**THREATENED AND ENDANGERED SPECIES REVIEW
(ROCKY MOUNTAIN ECOLOGY, 10/20/2015)**



ROCKY MOUNTAIN ECOLOGY

ENVIRONMENTAL CONSULTING | APPLIED RESTORATION SERVICES

NEW MEXICO

P.O. Box 1441
Bernalillo, NM 87004
575.639.3883

COLORADO

306 Rosalie Drive
Durango, CO 81301
505.992.6150 | 970.259.2186

October 20th, 2015

Dacia R. Tucholke
Project Manager
Gordon Environmental, Inc.
213 S. Camino del Pueblo
Bernalillo, NM 87004

Threatened and Endangered Species Review for a Surface Waste Management Facility on 560 acres in a portion of Section 23, T 24S, R 33E, Lea County, NM

Dear Ms. Tucholke:

This letter report describes results of a review of potential Threatened and Endangered Species and their habitats that could occur within a \pm 560-acre tract of land in Lea County, New Mexico (NM) (Figures 1 – 3). Oilfield Water Logistics (OWL) is pursuing a Permit, issued by the Oil Conservation Division (OCD) of the New Mexico Energy, Minerals, and Natural Resources Department (EMNRD), for a “Surface Waste Management Facility” per 19.15.2.7.S(11) NMAC: “a facility that receives oil field waste for collection, disposal, evaporation, remediation, reclamation, treatment or storage...”. The proposed project is called the OWL/South Lea Site.

The OWL/South Lea Site is located in a portion of Section 23, Township 24 South, Range 33 East. The Project Area occurs on the Bell Lake, NM U.S. Geological Survey (USGS) 7.5-minute quadrangle map (Figures 2).

Rocky Mountain Ecology LLC (RME) was subcontracted to conduct a review of Threatened and Endangered Species resources that could occur within the Project Area. Below is a summary of that review:

METHODS

Clayton P. Bowers, from RME conducted a field survey of the OWL/South Lea Site on 29 September 2015. The entire property was surveyed via pedestrian gridding (Appendix A. Photographs). The Endangered Species Act of 1973 (ESA) requires the evaluation of potential impacts on federally-listed species and their critical habitat. The U.S. Fish and Wildlife Service (USFWS), the New Mexico Department of Game and Fish (NMDGF), and NM Rare Plant Technical Council (NMRPTC) databases were reviewed to determine potential

occurrence of state or federal Proposed, Threatened, Endangered, and Candidate species in the Project Area. Specifically, the USFWS New Mexico Ecological Services website (<http://ecos.fws.gov/>) was verified for federally-listed flora and fauna species (Consultation Tracking No. 02ENNM00-2015-SLI-0153 – See *USFWS IPAC Consultation Letter/ Species List* - attached). The BISON-M database (<http://www.bison-m.org/>) was searched for state-listed fauna species (BISON-M 2015). The NM Rare Plants website (<http://nmrareplants.unm.edu>) was searched for information on potential state Threatened or Endangered flora species, however none exist within Lea County, NM (NMRPTC 1999). Habitat associations and species descriptions for the targeted species were derived from these websites, and their habitat requirements were then compared to the habitat found in the Project Area to identify which species were likely to occur.

GENERAL PROJECT AREA DESCRIPTION

The project area occurs within the Chihuahuan Desert Grasslands subregion of the Chihuahuan Deserts Ecoregion (Griffith, et. al 2006). “The grasslands occur in areas of somewhat higher annual precipitation (10 to 15 inches) than the Chihuahuan Basins and Playas, such as elevated basins between mountain ranges, low mountain benches and plateau tops, and north-facing mountain slopes. Grasslands were once more widespread, but heavy grazing in the late 19th and early 20th centuries was unsustainable, and desert shrubs invaded where the grass cover became fragmented. In grassland areas with lower rainfall, areal coverage of grasses may be sparse, 10% or less. Some areas are now mostly shrubs as grasslands continue to decline due to erosion, drought, and climatic change.” (Griffith et al 2006).

The OWL/South Lea Site is located within the Plains-Mesa Sand Scrub vegetation type as defined by Dick-Peddie (1993). Dominant plant species across the Site include honey mesquite (*Prosopis glandulosa*), thinleaf yucca (*Yucca glauca*) sand dropseed (*Sporobolus cryptandrus*), black grama (*Bouteloua eriopoda*) and Lehmann’s lovegrass (*Eragrostis lehmanniana*). Multiple isolated depressions (i.e. playas) were located across the Site (Figures 5 & 6). Within these features, dominant vegetation was comprised of more robust stands of honey mesquite, vine mesquite (*Panicum obtusum*), silverleaf nightshade (*Solanum elaeagnifolium*) and Canadian horsetweed (*Conyza canadensis*).

The Project Area is located on slopes ranging from 0 to 15 percent. Elevation within the Project Area ranges from 3,592 to 3,559 ft above sea level in the Northeast and Southeast portions, respectively.

Proposed Surface Waste Management Facility Lea County, New Mexico

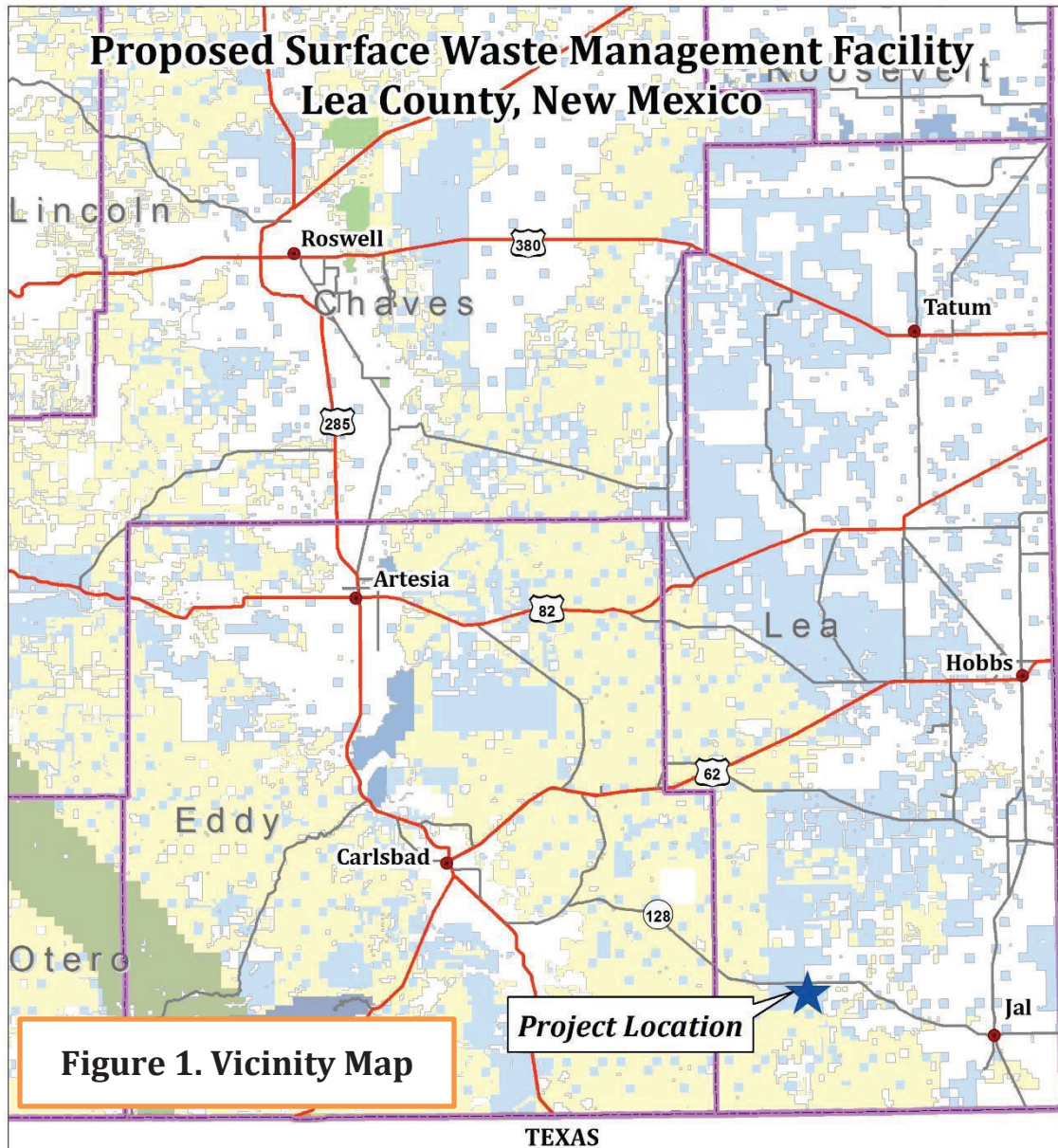


Figure 1. Vicinity Map

Legend

- | | |
|-------------------|--------------|
| County Boundaries | USFS |
| US Highways | Park Service |
| NM State Highways | Game & Fish |
| BLM | BIA |
| State Land Office | USFWS |
| Private | |

0 5 10 20 Miles

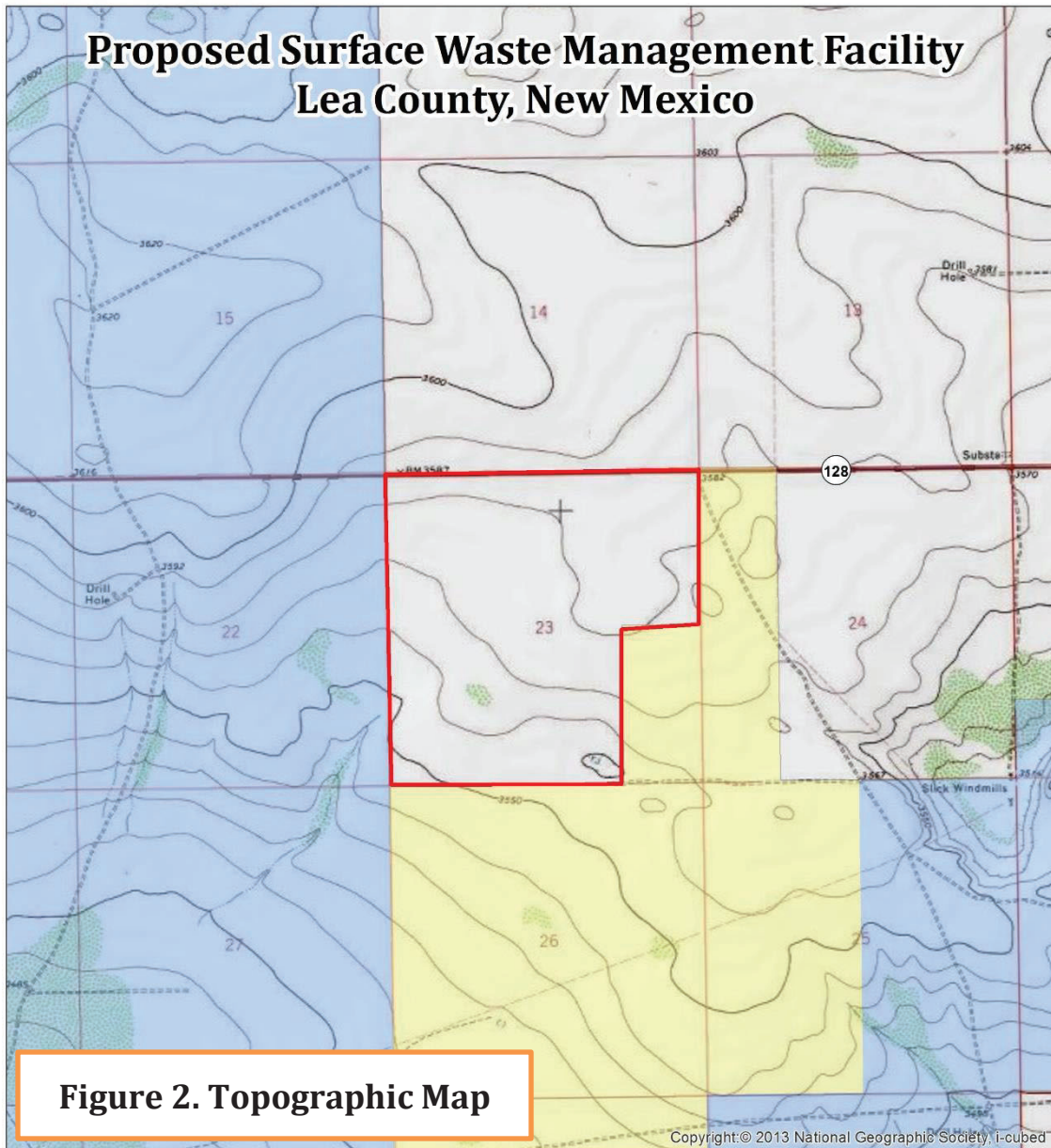


Project Location



Map created by Rocky Mountain Ecology, LLC, 10/2015

Proposed Surface Waste Management Facility Lea County, New Mexico



Legend

- OWL/South Lea Site
- BLM
- State Land Office
- Private

0 0.25 0.5 1 Miles



Project Location

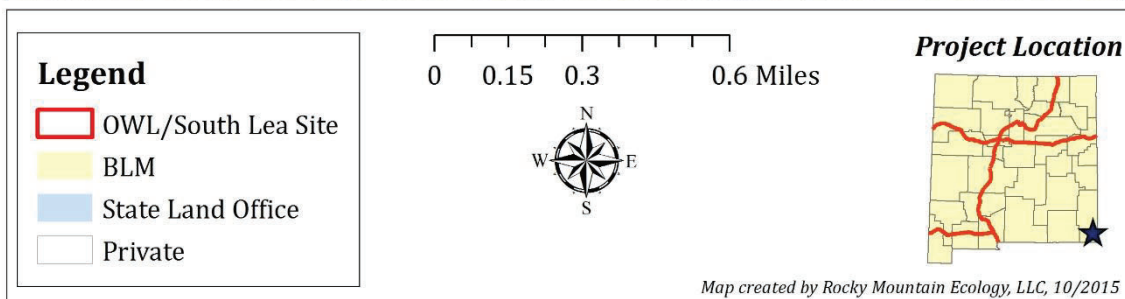


Map created by Rocky Mountain Ecology, LLC, 10/2015

Proposed Surface Waste Management Facility Lea County, New Mexico



Figure 3. Aerial Photograph



Below – Table 1 summarizes the Threatened and/or Endangered Species resources that occur in the region and within the habitat types in the Project Area, and assesses their potential to occur. Habitat descriptions were derived from the BISON-M (2015) and NM Rare Plants (NMRPTC 1999) websites.

Table 1 - Listed Species Within the Habitat Types Located in the Project Area

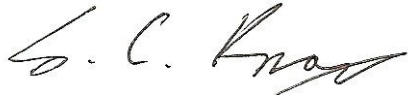
Species Category	Common Name	Scientific Name	Habitat	Habitat Present in Project Area?	Status	Determination
	USFWS Threatened, Endangered & Proposed, Candidate Species and Critical Habitat, Lea County, NM <i>Source: USFWS IPAC Species list Consultation Letter (attached)</i>					
BIRD	Northern Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	Associated with yucca-grasslands within proximity to lower elevation shrub habitats.	No yucca-grassland associations are present within the greater Project Area.	USFWS Experimental Population;	No Effect
BIRD	Lesser Prairie Chicken	<i>Tympanuchus pallidicinctus</i>	Mid-grass rangelands with components of shinnery oak, sand sagebrush and mixed grass communities.	No shinnery oak or sand-sagebrush communities exist within the Project Area.	USFWS Threatened	No Effect
BIRD	Sprague's Pipit	<i>Anthus spragueii</i>	Short grass prairie in the Great Plains Ecoregion	The Project Area is not characterized by short grass prairie habitat type.	USFWS Candidate	No Impact
	State-Listed Threatened and Endangered Species, Lea County, NM <i>Source: BISON-M database http://www.bison-m.org/reports.aspx?rtype=13&county='025'&gapveg='4000'&gapveg='5221'&habitat=&status='201'&status='202';; NM Rare Plants from Lea County, NM http://nmrareplants.unm.edu/county_result.php?output=html</i>					
BIRD	Bald Eagle	<i>Haliaeetus leucocephalus alascanus (NM)</i>	Impoundments, dam spillways, and lakes among other types; nests in forested areas.	No perennial waters occur and no forested areas exist within or adjacent to the Project Area.	State NM Threatened	No Impact
BIRD	Northern Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	Associated with yucca-grasslands within proximity to lower elevation shrub habitats.	No yucca-grassland associations are present within the greater Project Area.	USFWS Experimental Population;	See above

Species Category	Common Name	Scientific Name	Habitat	Habitat Present in Project Area?	Status	Determination
BIRD	Peregrine Falcon/ Arctic Peregrine Falcon	(<i>Falco peregrinus anatum/tundrius</i>)	Steep, sheer cliffs overlooking woodlands, riparian areas or other habitats supporting avian prey species in abundance are not located within or near the Project Area.	No steep, sheer cliffs overlooking woodlands, or riparian areas occur within the Project Area. However, incidental peregrine falcons could forage within the project area.	State NM: Threatened	No impact
BIRD	Baird's sparrow	<i>Ammodramus bairdii</i>	Desert grasslands, short-grass prairies. This grassland species winters in New Mexico and further south. It is considered rare to uncommon in New Mexico. The species has not been documented breeding in New Mexico (BISON-M 2015).	The species is very rare in NM, and the Project Area is unlikely to support this species based on the lack of high-quality grasslands, and/or short-grass prairie habitat.	State NM: Threatened	No impact

No (1) federally listed species protected under the ESA (e.g., Threatened, Endangered, Proposed); (2) federal Candidate species, which although not receiving protection under ESA are likely to become listed as a result of the USFWS settlement agreement with WildEarth Guardians dated September 9, 2011; (3) state listed species protected under the New Mexico Wildlife Conservation Act (e.g., Threatened and Endangered); or (4) state-listed New Mexico rare plants or their habitats are likely to occur within the Project Area.

Thanks again and do not hesitate to contact with questions.

Best Regards,

A handwritten signature in black ink, appearing to read "S. C. Knox", written in a cursive style.

Shawn Knox
Co-owner/Principal,
Rocky Mountain Ecology, LLC

REFERENCES

BISON-M Biota Information System of New Mexico. 2015. <http://www.bison-m.org/reports.aspx?rtype=13&county='025'&gapveg='4000','5221'&habitat=&status='201','202'>. (Accessed October 2015.)

Dick-Peddie, W.A. 1993. New Mexico Vegetation: Past, Present, and Future. UNM Press.

Griffith, G.E., Omernik, J.M., McGraw, M.M., Jacobi, G.Z., Canavan, C.M., Schrader, T.S., Mercer, D., Hill, R., and Moran, B.C., 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

New Mexico Rare Plant Technical Council (NMRPTC). 1999. New Mexico Rare Plants. Albuquerque, NM: New Mexico Rare Plants Home Page. <http://nmrareplants.unm.edu> (Accessed October 2015).

PHOTOGRAPHS

Photo 1. Representative view of northern half of Site, facing south.



Photo 2. Representative view of a depressional feature, facing north.



Photo 3. Looking south from midpoint of OWL/South Lea Site.



Photo 4. Excavated depressional feature, facing southeast.



Photo 5. Watercourse in southwest project area, facing southwest.



Photo 6. Man-made earthen tank that watercourse empties into, facing southwest.



USFWS IPAC Consultation Letter/ Species List



United States Department of the Interior



FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 OSUNA ROAD NE
ALBUQUERQUE, NM 87113
PHONE: (505)346-2525 FAX: (505)346-2542
URL: www.fws.gov/southwest/es/NewMexico/;
www.fws.gov/southwest/es/ES_Lists_Main2.html

Consultation Code: 02ENNM00-2016-SLI-0044

October 20, 2015

Event Code: 02ENNM00-2016-E-00047

Project Name: SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN LEA COUNTY

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

Thank you for your recent request for information on federally listed species and important wildlife habitats that may occur in your project area. The U.S. Fish and Wildlife Service (Service) has responsibility for certain species of New Mexico wildlife under the Endangered Species Act (ESA) of 1973 as amended (16 USC 1531 et seq.), the Migratory Bird Treaty Act (MBTA) as amended (16 USC 701-715), and the Bald and Golden Eagle Protection Act (BGEPA) as amended (16 USC 668-668c). We are providing the following guidance to assist you in determining which federally imperiled species may or may not occur within your project area and to recommend some conservation measures that can be included in your project design.

FEDERALLY-LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

Attached is a list of endangered, threatened, and proposed species that may occur in your project area. Your project area may not necessarily include all or any of these species. Under the ESA, it is the responsibility of the Federal action agency or its designated representative to determine if a proposed action "may affect" endangered, threatened, or proposed species, or designated critical habitat, and if so, to consult with the Service further. Similarly, it is the responsibility of the Federal action agency or project proponent, not the Service, to make "no effect" determinations. If you determine that your proposed action will have "no effect" on threatened or endangered species or their respective critical habitat, you do not need to seek concurrence with the Service. Nevertheless, it is a violation of Federal law to harm or harass any federally-listed threatened or endangered fish or wildlife species without the appropriate permit.

If you determine that your proposed action may affect federally-listed species, consultation with

the Service will be necessary. Through the consultation process, we will analyze information contained in a biological assessment that you provide. If your proposed action is associated with Federal funding or permitting, consultation will occur with the Federal agency under section 7(a)(2) of the ESA. Otherwise, an incidental take permit pursuant to section 10(a)(1)(B) of the ESA (also known as a habitat conservation plan) is necessary to harm or harass federally listed threatened or endangered fish or wildlife species. In either case, there is no mechanism for authorizing incidental take "after-the-fact." For more information regarding formal consultation and HCPs, please see the Service's Consultation Handbook and Habitat Conservation Plans at www.fws.gov/endangered/esa-library/index.html#consultations.

The scope of federally listed species compliance not only includes direct effects, but also any interrelated or interdependent project activities (e.g., equipment staging areas, offsite borrow material areas, or utility relocations) and any indirect or cumulative effects that may occur in the action area. The action area includes all areas to be affected, not merely the immediate area involved in the action. Large projects may have effects outside the immediate area to species not listed here that should be addressed. If your action area has suitable habitat for any of the attached species, we recommend that species-specific surveys be conducted during the flowering season for plants and at the appropriate time for wildlife to evaluate any possible project-related impacts.

Candidate Species and Other Sensitive Species

A list of candidate and other sensitive species in your area is also attached. Candidate species and other sensitive species are species that have no legal protection under the ESA, although we recommend that candidate and other sensitive species be included in your surveys and considered for planning purposes. The Service monitors the status of these species. If significant declines occur, these species could potentially be listed. Therefore, actions that may contribute to their decline should be avoided.

Lists of sensitive species including State-listed endangered and threatened species are compiled by New Mexico state agencies. These lists, along with species information, can be found at the following websites:

Biota Information System of New Mexico (BISON-M): www.bison-m.org

New Mexico State Forestry. The New Mexico Endangered Plant Program:
www.emnrd.state.nm.us/SFD/ForestMgt/Endangered.html

New Mexico Rare Plant Technical Council, New Mexico Rare Plants: nmrareplants.unm.edu

Natural Heritage New Mexico, online species database: nhnm.unm.edu

WETLANDS AND FLOODPLAINS

Under Executive Orders 11988 and 11990, Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and floodplains, and preserve and enhance their natural and beneficial values. These habitats should be conserved through avoidance, or mitigated to ensure that there would be no net loss of wetlands function and value.

We encourage you to use the National Wetland Inventory (NWI) maps in conjunction with ground-truthing to identify wetlands occurring in your project area. The Service's NWI program website, www.fws.gov/wetlands/Data/Mapper.html integrates digital map data with other resource information. We also recommend you contact the U.S. Army Corps of Engineers for permitting requirements under section 404 of the Clean Water Act if your proposed action could impact floodplains or wetlands.

MIGRATORY BIRDS

The MBTA prohibits the taking of migratory birds, nests, and eggs, except as permitted by the Service's Migratory Bird Office. To minimize the likelihood of adverse impacts to migratory birds, we recommend construction activities occur outside the general bird nesting season from March through August, or that areas proposed for construction during the nesting season be surveyed, and when occupied, avoided until the young have fledged.

We recommend review of Birds of Conservation Concern at website www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html to fully evaluate the effects to the birds at your site. This list identifies birds that are potentially threatened by disturbance and construction.

BALD AND GOLDEN EAGLES

The bald eagle (*Haliaeetus leucocephalus*) was delisted under the ESA on August 9, 2007. Both the bald eagle and golden eagle (*Aquila chrysaetos*) are still protected under the MBTA and BGEPA. The BGEPA affords both eagles protection in addition to that provided by the MBTA, in particular, by making it unlawful to "disturb" eagles. Under the BGEPA, the Service may issue limited permits to incidentally "take" eagles (e.g., injury, interfering with normal breeding, feeding, or sheltering behavior nest abandonment). For information on bald and golden eagle management guidelines, we recommend you review information provided at www.fws.gov/midwest/eagle/guidelines/bgepa.html.

On our web site www.fws.gov/southwest/es/NewMexico/SBC_intro.cfm, we have included conservation measures that can minimize impacts to federally listed and other sensitive species. These include measures for communication towers, power line safety for raptors, road and highway improvements, spring developments and livestock watering facilities, wastewater facilities, and trenching operations.

We also suggest you contact the New Mexico Department of Game and Fish, and the New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division for information regarding State fish, wildlife, and plants.

Thank you for your concern for endangered and threatened species and New Mexico's wildlife habitats. We appreciate your efforts to identify and avoid impacts to listed and sensitive species in your project area. For further consultation on your proposed activity, please call 505-346-2525 or email nmesfo@fws.gov and reference your Service Consultation Tracking Number.

Attachment



United States Department of Interior
Fish and Wildlife Service

Project name: SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN LEA COUNTY

Official Species List

Provided by:

New Mexico Ecological Services Field Office

2105 OSUNA ROAD NE

ALBUQUERQUE, NM 87113

(505) 346-2525

<http://www.fws.gov/southwest/es/NewMexico/>

http://www.fws.gov/southwest/es/ES_Lists_Main2.html

Consultation Code: 02ENNM00-2016-SLI-0044

Event Code: 02ENNM00-2016-E-00047

Project Type: Landfill

Project Name: SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN LEA COUNTY

Project Description: This project is evaluating potential for T&E resources on a potential future waste management facility.

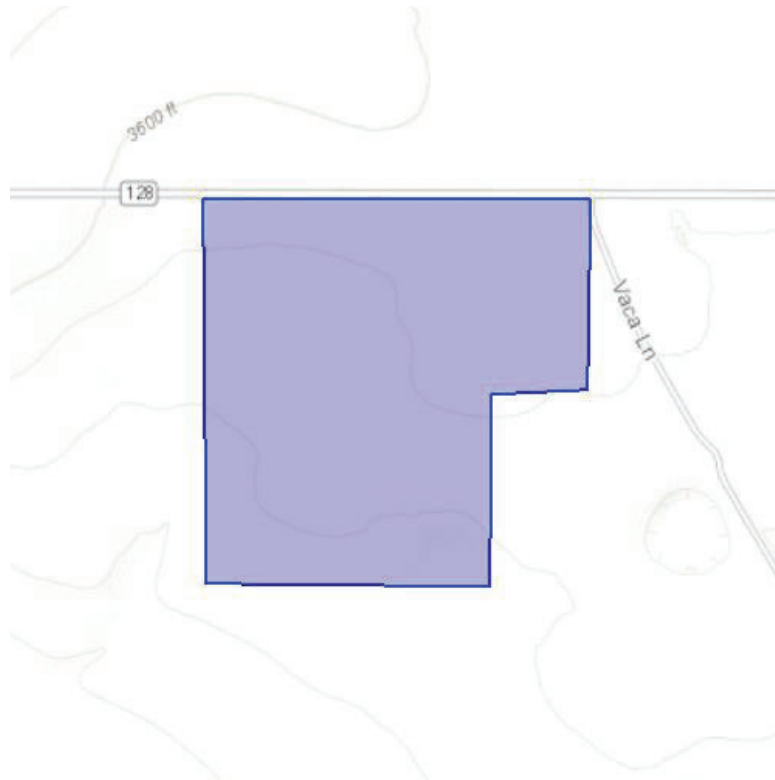
Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.



United States Department of Interior
Fish and Wildlife Service

Project name: SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN LEA COUNTY

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-103.53896259919381 32.19577455847815, -103.55152141584355 32.195859392967996, -103.55164437612655 32.21024017350828, -103.53451989587789 32.210281462827844, -103.53463469452775 32.20312296783665, -103.5388481720311 32.202933075657945, -103.53896259919381 32.19577455847815)))

Project Counties: Lea, NM



United States Department of Interior
Fish and Wildlife Service

Project name: SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN LEA COUNTY

Endangered Species Act Species List

There are a total of 3 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Birds	Status	Has Critical Habitat	Condition(s)
Lesser prairie-chicken (<i>Tympanuchus pallidicinctus</i>)	Threatened		
northern aplomado falcon (<i>Falco femoralis septentrionalis</i>) Population: U.S.A (AZ, NM)	Experimental Population, Non-Essential		
Sprague's Pipit (<i>Anthus spragueii</i>)	Candidate		



United States Department of Interior
Fish and Wildlife Service

Project name: SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN LEA
COUNTY

Critical habitats that lie within your project area

There are no critical habitats within your project area.



**APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC**

**VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 2: HYDROGEOLOGY**

**HYDROGEOLOGY REPORT
FOR THE
PROPOSED OWL LANDFILL SERVICES, LLC
SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO**

Prepared For: Gordon Environmental, Inc.
213 S. Camino del Pueblo
Bernalillo, NM 87004

OWL Landfill Services, LLC
8214 Westchester Drive, Suite 850
Dallas, TX 75225

Prepared By: Golder Associates Inc.
5200 Pasadena Avenue NE, Suite C
Albuquerque, NM 87113

Submitted To: Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

October 3, 2016

1530841





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- Attachment IV.2.C OWL site characterization boring logs
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1.0 REGIONAL GEOLOGY AND HYDROLOGY

The OWL Landfill Services, LLC (OWL) site is situated in a mature oil and gas producing province in the Permian Basin of southeastern New Mexico. The site is also in proximity to a mature potash mining and refining province, as well as to the Waste Isolation Pilot Project (WIPP) site. Pursuant to these activities, the regional geology and hydrogeology in the vicinity of the OWL site has been studied extensively by numerous professionals.

1.1 Physiographic Setting

The proposed OWL surface waste management facility is located near the boundary between the Southern High Plains Section (Llano Estacado) and the Pecos Valley Section of the Great Plains Physiographic Province (Hawley, 1993b). The Great Plains Physiographic Province is characterized by low relief and lightly deformed Permian and Triassic sedimentary bedrock units overlain by variable thicknesses of late Tertiary and Quaternary age unconsolidated to semiconsolidated deposits of sand, silt, clay, gravel and calcrete (caliche) of the Ogallala Formation and younger Quaternary deposits of unconsolidated or aeolian sands and silts. These conditions are confirmed by focused on-site drilling, as well as local subsurface studies conducted by Ochoa.

Physiography of the vicinity of the OWL site in southern Lea County and eastern Eddy County was described by Nicholson and Clebsch (1961) and Kelly (1979) and is summarized in the physiographic map in **Figure IV.2.1**. The site is situated in Landreth-Monument Draw watershed (USGS cataloging Unit 13070007), near the eastern boundary of the Lower Pecos-Red Bluff Reservoir watershed (USGS cataloging unit 13070001).

The OWL site is located on a broad, northwest to southeast-trending salient known as Antelope Ridge in the area between the High Plains (alternately, the Llano Estacado) to the northeast and the Pecos River to the southwest. Antelope Ridge is the southernmost of two broad northwest to southeast trending salients in southwestern Lea County; the northern salient is known as Grama Ridge. These salients are generally erosional remnants of Tertiary Ogallala Formation, which is a thick sequence of unconsolidated to semiconsolidated sand, silt and gravel which were deposited on an erosional surface incised into Triassic Chinle Formation in much of southeastern New Mexico. In the vicinity of Grama Ridge and Antelope Ridge, the Ogallala has been largely removed by erosion and a veneer (generally less than 100 feet) of Quaternary age unconsolidated Ogallala detritus and aeolian sands mantle shale and sandstone beds of the Triassic Chinle in this area. Salients are formed by resistant well-cemented sections (caliche) of the Ogallala Formation where ledge-forming units remain.

Numerous subsidence features are present in eastern Eddy County and Western Lea County. (**Figure IV.2.1**). The most notable of these are Nash Draw, Clayton Basin and several large playas, including



Laguna Plata, Laguna Gatuna, Laguna Tonto and Laguna Toston. These features are generally considered to be karst subsidence features associated with dissolution of evaporates in the Permian bedrock units in the Rustler and Salado Formations. A broad depression known as San Simon Swale is located approximately eight miles north of the OWL site; San Simon Swale encompasses approximately 100 square miles and is believed to have resulted from a combination of dissolution of deep-seated substrates (Rustler and Salado) and wind deflation (Nicholson and Clebsch, 1961).

1.2 Structural Setting

The OWL site is situated on the northeastern margin of a deep sedimentary basin known as the Delaware Basin. During most of the Permian period, the Delaware Basin was the site of a deep marine canyon that extended across southeastern New Mexico and west Texas. Major structural elements of the Delaware Basin area are shown in **Figure IV.2.2** (Powers, 1978). The major structures of the basin include the Guadalupe Mountains on the west side, the Central Basin Platform on the east side, and the Capitan Reef Complex on the west, north and east sides of the basin.

The Central Basin Platform forms an abrupt eastern terminus to the Delaware Basin; it is a steeply fault-bound uplift of basement rocks that grew through the early and middle Paleozoic Era such that most of the pre Permian sedimentary section is missing from its apex. Great thickness of organic-rich marine deposits in the Delaware Basin and the presence of abrupt structural thinning in the Capitan Reef Complex and against the Central Basin Platform combined to produce a prolific oil and gas producing province. These areas have been the focus of intense petroleum exploration and development activities since approximately 1920.

Surficial geology and generalized stratigraphy across the Delaware Basin in the region of the OWL site are depicted in the map and cross section in **Figure IV.2.3** (New Mexico Bureau of Geology and Minerals, 2003 and Duchene and Cunningham, 2006). Tectonic development of the Delaware Basin began by the late Pennsylvanian period and major basin subsidence took place during the late Pennsylvanian period and early Permian period. Basin development ended in the late Permian period (Brokaw, et. al., 1972). Thickness of sediments in the Delaware Basin exceeds 20,000 feet, and Permian strata alone account for more than 13,000 feet of basin fill materials (Oriel, et. al., 1967). During the Triassic period, the area was uplifted, resulting in deposition of clastic continental shales (redbeds). Continuing uplift resulted in erosion and/or non-deposition until the middle to late Cenozoic period, when regional eastward tilting completed structural development of the basin as it exists today (Stipp, 1954).

1.3 Surface Geology and Shallow Stratigraphy

Surface geologic mapping in Lea County and Eastern Eddy County was compiled by the Texas Bureau of Economic Geology and is depicted in available detail on the 1:250,000 Hobbs Sheet of the Geologic Atlas of Texas (1976). A portion of this map in the vicinity of the OWL site is shown in **Figure IV.2.4**.



Post-Pennsylvanian stratigraphic units of the Delaware Basin are summarized in the stratigraphic nomenclature chart in **Figure IV.2.5** (Hendrickson and Jones, 1952, Nicholson and Clebsch, 1961 and Hawley, et. al., 1993a). Geologic units that are present at land surface or in the shallow subsurface in the vicinity of the OWL site include unconsolidated Quaternary alluvial, aeolian and playa lacustrine deposits, semiconsolidated clastics of the Tertiary Ogallala Formation, and Triassic bedrock shale and sandstone units of the Chinle/Dockum Group. Shallow stratigraphic units in the vicinity of the OWL site as described by the Texas Bureau of Economic Geology for the Hobbs Sheet (1976) are listed below.

Windblown Sand (Qsu/Qs Quaternary) – Sand and silt in sheets, light brown to reddish, overlies windblown coversand; thickness 5-10 feet.

Playa Deposits (Qp Quaternary) – Playa deposits, clay and silt, sandy, light to dark gray, in shallow depressions.

Caliche (Qcc Quaternary) – Caliche, stripped of covering materials, mapped as a separate unit, up to 10 feet in thickness.

Colluvium (Qscg Quaternary) – Sand, silt and gravel deposited by slopewash, and talus from Ogallala, red to gray; in part calcified, caliche 1-20 feet thick; may include weathered Gatuna Formation; rests mainly on Triassic and Permian rocks.

Tahoka Formation Lacustrine Deposits (Qta Quaternary) – Lacustrine clay, silt, sand and gravel, locally calcareous and selenitic, indistinctly bedded to massive, weakly coherent, various shades of light gray, grades to gravel at playa margins, contains molluscan and vertebrate fossils.

Ogallala Formation (To Tertiary) – Fluvatile sand, silt, clay and gravel capped by caliche; various shades of gray and red; caliche is a sandy, hard, ledge former; up to 100 feet in thickness.

Chinle Formation/Dockum Group (Trc/Td Triassic) – upper is Chinle Formation consisting of Claystone, micaceous, greenish red with green reduction spots, interbedded with fine grained sandstone, thickness up to 300 feet; lower is Santa Rosa Sandstone; cross-bedded, conglomeratic with mixed lithology, thickness 50-70 feet.

1.4 Sources of Hydrogeologic Data

Available basic hydrogeologic data from wells in the area of the OWL site is summarized in **Table IV.2.1** in this submittal. Information in **Table IV.2.1** includes well locations, depths, water levels, water-bearing zones and available stratigraphic intercepts of hydrologically significant mappable units in the area.



1.4.1 Area Water Wells

Most of the water wells in the vicinity of the OWL site were drilled prior to the administrative declaration of the eastern extension of the Carlsbad Underground Water Basin (Carlsbad Basin) by the New Mexico Office of the State Engineer (NMOSE), in 1993. Lithologic logs and records of completions are generally not available for the “prebasin” wells. Copies of available NMOSE Well Records for water wells in the vicinity of the OWL site are included in **Attachment IV.2.A**. Prior to the declaration of the Carlsbad Basin, Alexander Nicholson conducted well canvassing in southern Lea County in 1953, 1954 and 1955, identifying well locations and variously documenting the well ownership, depths, water levels, casing diameters, pump types and well yields and water quality and other available information (Nicholson and Clebsch, 1961). Additional well canvass information is kept in unpublished files in the NMOSE District 2 office in Roswell, NM. Tim Kelly (Geohydrology Associates, Inc., 1978) captured the NMOSE file data and performed extensive additional well canvassing in the area in 1977, revisiting numerous wells that Nicholson had catalogued, as well as numerous additional wells in the area.

Several wells completed in the Santa Rosa Sandstone are present in the vicinity of the OWL site. One well (C-3662-1), located at the OWL tract in Section 23, T.24S. R.33E produces from intervals in the Santa Rosa Sandstone in the depth interval of 250-275 feet below grade. Another well (C-3666-1), located approximately one mile to the northeast in Section 13, T.24S. R.33E produces from Santa Rosa Sandstone beds in the interval 460-600 feet below grade. Three wells (C-2430, C-2431 and C-2432), located approximately three miles west of the OWL site in Sections 16 and 17, T.24S. R.33E. penetrate Santa Rosa Sandstone beds at depths exceeding 500 feet.

1.4.2 Potash Mine Borings

Intercontinental Potash Company (ICP) advanced numerous borings in the immediate vicinity of the OWL site pursuant to evaluating the feasibility of mining polyhalite potash ore from the Permian Rustler Formation, which is approximately 1600 feet below grade in the area. Information from this drilling has been included in numerous planning documents prepared for ICP’s proposed Ochoa Mine. Ochoa’s extensive subsurface investigation of the local area provides a wealth of data not typically available. Records for 30 of these borings in the vicinity of the OWL site were obtained from unpublished file data at the NMOSE were and reviewed during preparation of this document. Copies of these records are included in **Attachment IV.2.A**.

One of the borings (ICP Boring 92, C-3565-8), located approximately one half mile northwest of the OWL site in Section 15, T.24S R.33E was advanced at the anticipated location for the vertical shaft for the Ochoa Mine. Numerous drill stem tests (DSTs) were performed on this boring to evaluate potential groundwater inflows into the shaft (Intera 2014, Table 7.5, pg. 74). A summary of this boring and testing data provides



insight into the anticipated water-bearing properties of shallow stratigraphic units in the area of the OWL site and is included in **Attachment IV.2.B**.

1.4.3 OWL Site Borings

Five shallow borings were advanced on the proposed OWL disposal site in Section 23, T.24S. R.33E in November 2014. Copies of logs of these borings are included in **Attachment IV.2.C**. The OWL site borings were drilled with hollow-stem auger and air rotary methods. Each boring was advanced to refusal near the upper interface of the Chinle Formation bedrock using hollow-stem auger; air rotary methods were then used to further advance the borings into the Chinle to depths ranging from 150 to 200 feet below grade. During drilling of these wells, cuttings were inspected for lithology, color, degree of induration and moisture content; and samples were collected for laboratory analysis.

1.4.4 Oil and Gas Exploration and Development Wells

It has been mentioned that the OWL site is located in a prolific oil and gas producing province; many oil and gas exploration and development borings have been drilled in the area. Since the target reservoirs in the Delaware Basin are middle Permian and older units, most oil and gas drilling documentation does not identify stratigraphic information above the Delaware Mountain Group (Capitan Reef Facies); however many New Mexico Oil and Gas Conservation Division records do identify the depth of the uppermost anhydrite bed in the Rustler Formation, which is a laterally extensive marker bed and the shallowest mappable unit in the area. Nicholson and Clebsch (1961, Table IV.2.4) prepared lithologic descriptions of cuttings from the shallow stratigraphic section from an exploratory well (Continental Oil Company Bell Lake No. 2, API 25-08489), located approximately four miles northeast of the OWL site in Section 30 of T.23S. R.34E. A copy of this log is included in **Attachment IV.2.D**. This log identifies the thicknesses of Ogallala, Chinle, Santa Rosa Sandstone and pre-Santa Rosa Sandstone shale (Dewey Lake Redbeds), as well as the depth to the top of the uppermost anhydrite marker bed in the Rustler Formation.

1.4.5 Groundwater Sampling and Analyses

Groundwater sampling and analyses have been performed at the site and in the vicinity of the OWL Facility for numerous projects. Nicholson and Clebsch (1961) cited United States Geological Survey water quality data from water samples that were collected from several wells in southern Lea County, including one sample from a well completed in the Santa Rosa Sandstone in Section 31, T.23S. R.34E., approximately 3.5 miles north of the OWL site. Intera (2013) collected and analyzed water samples from ten wells on the Double M Ranch in the immediate vicinity of the OWL site. Gordon Environmental Inc. (2015) collected and analyzed a water sample from the “McCloy Well” (C-3662), located at the OWL site in Section 23 T. 24S.R.33E. A summary of available groundwater quality data from wells in the vicinity of the OWL site is included in **Table IV.2.2a** and **Table IV.2.2b**. Copies of analytical laboratory reports from the Intera and Gordon Environmental analyses are included in **Attachment IV.2.E**.



1.5 Water-Bearing Geologic Units

Potable water-bearing geologic units in southern Lea County and Eastern Eddy County include the Tertiary Ogallala Aquifer, shallow Quaternary alluvial aquifers, and the Santa Rosa Sandstone unit of the lower portion of the Triassic Chinle/Dockum Group.

The Ogallala Formation was deposited on an erosional surface incised into Triassic shale bedrock deposits of the Chinle Formation/Dockum Group. This shallow stratigraphy is present in the vicinity of the OWL site, and throughout much of southeastern New Mexico. In the vicinity of the OWL site, the Ogallala has been largely removed by erosion and localized outliers of Ogallala remain; a veneer (generally less than 100 feet) of Quaternary age unconsolidated Ogallala detritus and aeolian sands mantle the Triassic bedrock units elsewhere in this area. Well-cemented sections (i.e., caliche or calcrete) of remnant Ogallala Formation form gentle ridge-form salients. The Ogallala Aquifer is locally a prolific water-bearing unit in the Llano Estacado region northeast of the OWL site, but it is largely absent in the vicinity of the OWL site; where remnant Ogallala deposits are present, this unit is typically non water-bearing.

Thin, laterally discontinuous and often ephemeral groundwater saturations are occasionally present in the basal alluvium overlying the Triassic shale bedrock units, particularly in and around playas, where stormwater periodically recharges shallow sediments. Local saturations may also be present in basal alluvium in areas where the shale bedrock was deeply incised by drainages prior to deposition of the alluvium, forming buried paleochannels.

Saturated zones may be present in Triassic Chinle bedrock units at relatively shallow depths; however these saturated zones rarely yield useable quantities of water to wells.

The Santa Rosa Sandstone (lower Triassic Dockum Group) is laterally extensive in the vicinity of the OWL site and yields modest to moderate quantities of good quality groundwater to several wells in the area. The Santa Rosa Sandstone contains some porous and or conglomeratic beds and is a significant source of groundwater for domestic and livestock wells in those portions of Lea County (Leedshill-Herkenhoff, et. al., 1999) where drilling depths are feasible. Dutton and Simkins (1986), completed a regional investigation of lower Dockum Group aquifers (the Santa Rosa Sandstone) in southeastern New Mexico and West Texas; regional head mapping prepared by these professionals projected the potentiometric surface elevation of the Santa Rosa Sandstone in the vicinity of the OWL site to be approximately 3100 feet above mean sea level, or approximately 380 feet below land surface.

A paucity of published water quality data exists for wells completed in the Santa Rosa Sandstone in southern Lea County and eastern Eddy County. Nicholson and Clebsch (1961) reported total dissolved solids (TDS) values ranging from 635 to 1,950 milligrams per liter (mg/L) and sulfate concentrations ranging from 71 mg/L to 934 mg/L for water samples collected from wells completed in the Santa Rosa Sandstone



in southern Lea County. Dutton and Simkins (1986) prepared a regional projection of TDS of waters from the Lower Dockum Group (Santa Rosa Sandstone); this projection indicates that the TDS concentration of water in the Santa Rosa Sandstone in the vicinity of the OWL site is expected to be approximately 1,000 mg/L. Unpublished water quality data from samples collected from numerous deep wells completed in the Santa Rosa Sandstone in the vicinity of the OWL site indicate that water available from this zone is of good chemical quality, having low level of mineralization and meeting tested primary and secondary standards for public health parameters. A water sample was collected from well C-3662-1 (the McCloy Well) in May 2015 and analyzed for organic and inorganic analytes; laboratory results indicated that the water sample was of good overall quality (507 parts per million, ppm Total Dissolved Solids, TDS) and contained relatively low concentrations of chloride (32 ppm) and sulfate (99 ppm).

Based upon review of available water well and oil well information in the vicinity of the OWL site, as well as information obtained from site characterization borings performed on the OWL tract, only the Santa Rosa Sandstone is considered to be a potential aquifer at the site. The top of the Santa Rosa Sandstone at the OWL site is approximately 350 feet \pm below land surface. The shallowest fresh water bearing zones at site are present in Sandstone beds in the middle or lower Santa Rosa Sandstone at a projected depth of approximately 500 feet below land surface. The depth from the cell base grades (i.e., a maximum depth 60 feet \pm below land surface) to the top of the water-bearing zones in the Santa Rosa Sandstone is estimated to be approximately 440 ft.



2.0 SITE SPECIFIC GEOLOGY AND HYDROGEOLOGY

2.1 Site Investigation, Data Compilation and Interpretation

A map of the surficial geology in southern Lea County and in the vicinity of the OWL site was published the Texas Bureau of Economic Geology (Hobbs Sheet, 1976). A portion of this map depicting surface geology in the vicinity of the OWL site is shown in **Figure IV.2.4**.

Subsurface boring investigations were performed on the OWL property to characterize geologic and hydrogeologic conditions of the site pursuant to ultimate conformance with provisions set forth in 19.15.36.8.C.15 NMAC. Published and unpublished resources on shallow stratigraphy of the area have been supplemented with the results of five soil borings that were drilled on the OWL property in November 2014 to determine the presence or absence of shallow groundwater and potential water-bearing zones within 200 feet of land surface at the site. Subsurface investigations were performed at the OWL site using hollow-stem auger and air rotary drilling. Data that was accumulated during boring and testing at the OWL site, as well as published and agency file data on local geology and groundwater were compiled into this site-specific assessment of hydrogeologic conditions at the OWL site. Gordon Environmental, Inc. (GEI), on behalf of OWL, directed the site drilling operations. Enviro-Drill of Phoenix, Arizona was contracted by GEI to perform the drilling.

Five soil borings were advanced on the OWL property at locations shown on the map in **Figure IV.2.6**. Numerous other borings were drilled in the immediate vicinity of the OWL site by Intercontinental Potash Corporation (ICP); data from these borings are summarized in **Table IV.2.1** and was also used to prepare this hydrogeologic site characterization. Survey coordinates, depths, drill dates and Chinle Formation depths of the OWL site borings are presented in **Table IV.2.3**. Copies of logs associated with these borings are included in **Attachment IV.2.C**.

The five OWL site borings (BH-1 through BH-5) were drilled using a CME 75 drill rig capable of drilling with both hollow stem auger (HSA) and air rotary drilling methods. Generally, HSA methods were used to penetrate and sample unconsolidated alluvium to the top of the Triassic Chinle Formation bedrock, where auger refusal was encountered; air rotary drilling methods were then used complete borings into the Chinle Formation to final depths ranging from 150 feet to 200 feet. During auger drilling, split spoon samples were collected on five-foot intervals; during air rotary drilling, circulated cuttings and selected split spoon samples were collected. Depth-referenced formation samples collected during drilling were visually examined in the field to determine the lithology, texture color, degree of lithification, plasticity, and moisture content of penetrated materials. Borings were generally left overnight after penetrating the Chinle Formation bedrock and reaching total depth, then sounded the next morning for water. All of the borings except BH-2 found no evidence of groundwater saturation. A thin layer of saturated alluvium was found above the Chinle Formation in OWL Boring BH-2, which is situated adjacent to a small local depression of approximately 1.7



acres in area (**Figure IV.2.6**). During drilling of this borehole, water was noted in the hole immediately above the shale at a depth of 38 feet. The hole was advanced with hollow stem auger into the Chinle Formation to 80 feet and allowed to stand overnight; water had infiltrated the hole and risen to a depth of about 45 feet by the next morning. Drilling was switched to air rotary and the hole was advanced to 200 feet; after purging the accumulated water from the hole, no additional water was detected in circulated media during the drilling. Based upon these observations, we conclude that a laterally discontinuous body of groundwater saturation is present in the immediate vicinity of the small depression at the Chinle surface; the thickness and capacity of this saturation appears to be limited.

2.2 OWL Site Geotechnical Evaluation

Table IV.2.4 provides the summary results of site-specific soils laboratory testing, which demonstrate the dramatic change in soils characteristics between the near-surface (i.e., 0-50 feet) coarse-grained deposits; and the thick and dense impermeable redbed deposits below. This site-specific characterization of the onsite soils is entirely consistent with other focused site studies in the area; as well as the documented regional database.

The surface soils consist of aeolian sands and caliche materials, suited for specific environmental applications:

- PSL – protective soil layer.
- Vegetative layer – final cover establishment of erosion control.
- Caliche – ideal for temporary road base construction and permanent road subgrade.

The lower soils (Chinle shale and siltstone), horizons (i.e., 40-50 feet) are effective aquitards to vertical flow, and represent the selected positions for vadose monitoring points.

2.3 OWL Site Geology

The OWL site borings, as well as those drilled by ICP on adjacent tracts confirm that site conditions are consistent with understanding of shallow stratigraphy and hydrogeology in the area based upon information published by Nicholson and Clebsch (1961). **Table IV.2.1** contains summary information on OWL site vicinity borings, water wells, oil and gas wells and mineral exploration wells, along with available information on groundwater levels, stratigraphic intercepts and other significant information. **Figure IV.2.4** is a map showing surface exposures of geologic units in the area; the locations of selected wells having significant stratigraphic and or hydrogeologic information are also shown. A regional hydrogeologic cross section through the OWL site was prepared using this information and is presented in **Figure IV.2.7**.

It has been mentioned that lithologic logs and completion records for water wells in the vicinity of the OWL site are scant and very little information on the depth and thickness of the Santa Rosa Sandstone aquifer and other water-bearing units is available from water well logs. Oil and gas well records typically do not



contain stratigraphic information on Triassic and younger units, but many include intercepts for a laterally-extensive anhydrite bed that marks the upper extent of the Permian Rustler Formation. Nicholson and Clebsch (1961, Table 4) presented a detailed lithologic log of shallow sediments penetrated by the Conoco Bell Lake Unit 2 oil and gas well, located approximately 4 miles northeast of the OWL site in Section 30, T.23S.R34E. A copy of this log is included in **Attachment IV.2.D**. Using thicknesses of shallow stratigraphic units down to the upper Rustler Formation anhydrite bed from the Nicholson and Clebsch (1961) log, tops of the Santa Rosa Sandstone and Dewey Lake Redbeds were projected above the Rustler upper anhydrite bed at locations of other oil and gas wells in the area and used to prepare the regional cross section in **Figure IV.2.7**. This diagram illustrates available information on depths, screen intervals and the potentiometric surface of the Santa Rosa Sandstone aquifer at the OWL site, as well as the projected tops of the Santa Rosa Sandstone and Dewey Lake Redbeds, based upon the Rustler anhydrite bed intercepts of area oil and gas wells.

The five site borings penetrated various thicknesses of alluvial deposits above the Triassic Chinle Formation bedrock ranging from 35 feet to 60 feet. Shallow alluvium penetrated by the site borings was poorly graded fine sand with in-situ and detrital fragments of calcrete (caliche) and minor gravel. Based upon the lithologic logs, as well as drive blow counts for split spoon samples, the alluvium is moderately indurated and caliche zones were identified within the alluvium above the shale bedrock interface. The Chinle Formation penetrated by all site borings was grey and reddish brown, purple and green dense micaceous sandstone and shale.

2.4 OWL Site Hydrogeology

Known and potential water-bearing units at the OWL site include the Santa Rosa Sandstone, water-bearing sandstones or fractured shales in the Chinle Formation, and shallow saturations in unconsolidated basal alluvium on top of the Chinle Formation (i.e., CL and CH USCS classifications).

2.4.1 Santa Rosa Sandstone Aquifer

The Santa Rosa Sandstone is tapped by several wells in the vicinity of the OWL site. Well C3662-1, located at the OWL site in Section 23 T.24S.R.33E., and well C3666-1, located approximately one mile northeast of the OWL site in Section 13 T.24S.R.33E., each penetrated and was completed to produce from the Santa Rosa Sandstone. Using the projected intercepts of the top of the Santa Rosa Sandstone from oil well documentation as described above, a terrain map of the Santa Rosa Sandstone was prepared and is shown in **Figure IV.2.8**. This map indicates that the Santa Rosa Sandstone dips to the southeast at the OWL site and that the elevation of the top of the Santa Rosa Sandstone ranges from about 3250 feet above mean sea level in the northwest corner of Section 32 to about 3150 feet above mean sea level in the southeast corner of Section 23. Projected depth to the top of the Santa Rosa Sandstone ranges from about 337 feet in the northwest corner of Section 23 to 413 feet in the southeast corner of Section 23.



The potentiometric surface of water-bearing zones in the Santa Rosa Sandstone was mapped using historical water level data from Santa Rosa Sandstone wells obtained from Nicholson and Clebsch (1961), Tim Kelly (Geohydrology Associates, 1978), available water levels from NMOSE well logs and a water level made in the McCloy well at the OWL site (C3662-1) during pump installation. The resultant potentiometric surface map is shown in **Figure IV.2.9**. This map indicates that the depth to potentiometric surface at the OWL site is expected to range from 408 feet below grade in the northwest corner of Section 23 to 363 feet below grade in the southeast corner of Section 23.

Although the potentiometric head values for the map in **Figure IV.2.9** were not contemporaneous, they do potentially indicate that head values in the Santa Rosa Sandstone have been significantly impacted by pumping. Three wells (C2430, C2431 and C2432), located approximately 2.5 miles west of the OWL site in Sections 16 and 17 T.24SR.33E., appear to have created significant drawdown of the potentiometric surface in the area, resulting in a northwest gradient at the OWL site. These three wells are located in a small geographic area and according to NMOSE records, a combined 207 acre feet per year (AFY) of diversionary water rights are attached to these wells. The NMOSE files contain metering records for these wells that indicate active use; infrastructure at the site indicates that water is being used for oilfield services.

2.4.2 Water-Bearing Zones in the Chinle Formation

The most productive wells in the vicinity of the OWL site produce from coarser clastics in the Santa Rosa Sandstone; however limited water-bearing zones in the Chinle Formation may have been tapped by wells in the area. Available information on the geometry of water-bearing zones in the Chinle Formation and the Santa Rosa Sandstone in the vicinity of the OWL site is depicted in the local hydrogeologic cross section in **Figure IV.2.10**. The line of section and locations of identified wells for this cross section are shown on the map in **Figure IV.2.6**.

According to the NMOSE Well Record for the McCloy well on the OWL site (C3662-1) located in Section 23 T.24S.R33E., the well penetrated a water-bearing sandstone in the Chinle Formation in the depth interval from 250 feet to 275 feet below grade; however the well was advanced to a total depth of 550 feet and completed with screen in the intervals of 280-360 feet and 500-550 feet below grade. The NMOSE Well Record for this well indicated that the depth to water upon completion on 8/20/13 was 110 feet below grade; however information inscribed on the well casing (apparently by the pump installer) indicated that the depth to water was 393 feet on 8/24/13. Based upon available water level and screen placement information on this well, we conclude that well C3662-1 penetrated non-sustainable production in the shallow interval 250-275 feet, but that the shallow zone was depleted and production comes from intervals in the Santa Rosa Sandstone.

The NMOSE Well Record for well C-3666-1, located approximately one mile northeast of the OWL site in Section 13 T.24S.R33E., indicates that the well penetrated a water-bearing sandstone in the Santa Rosa



Sandstone in the depth interval from, 460 feet to 600 feet below grade. The well was advanced to a total depth of 650 feet and completed with screen in the intervals of 485-650 feet below grade. The NMOSE Well Record for this well indicates that the depth to water upon completion on 10/26/13 was 390 feet below grade. Based upon the water level and screen placements, we conclude that well C3666-1 produces from intervals in the Santa Rosa Sandstone.

Nicholson and Clebsch (1961) identified a well located on the OWL tract in Section 23 T.24S.R33E. that apparently tapped water-bearing zones in the Chinle Formation. No lithologic log or completion information exists for this well; however the total depth of the well was measured at 230 feet and the water level was sounded at a depth of 208.6 feet below grade on 11/27/53. This well was equipped with a tank and windmill, but was reported to be out of use in 1953. It was located by Golder personnel performing a site reconnaissance on 6/4/15 and observed to be caved or full of debris at a depth of approximately 8 feet below grade. Based upon the available information, it is possible that the well tapped locally stored ephemeral water in the Chinle Formation that was exhausted and the well taken out of use.

2.4.3 Water-Bearing Zones in Shallow Alluvium

It has been mentioned that thin and laterally discontinuous groundwater saturations are occasionally present in basal alluvium resting atop low permeability bedrock shales and dense sandstones of the Chinle Formation in the region of the OWL site.

Five on-site characterization borings were advanced through unconsolidated alluvium or semiconsolidated Ogallala deposits on the OWL site in November 2013. Summary data from these borings is included in **Table IV.2.1**. Logs of these borings are included in **Attachment IV.2 C**. Locations of these borings are shown on the boring and well location map in **Figure IV.2.6**. None of the borings except OWL BH-2 found evidence of groundwater saturation in basal alluvium. A thin layer of saturated alluvium was found above the Chinle Formation in OWL Boring BH-2, which is situated adjacent to a small local depression of approximately 1.7 acres in area (**Figure IV.2.6**). During drilling of this borehole, water was noted in the hole immediately above the shale at a depth of 38 feet below grade. The hole was advanced with hollow stem auger into the Chinle Formation to 80 feet and allowed to stand overnight; water had infiltrated the hole and had risen to a depth of about 45 feet by the next morning. Drilling was switched to air rotary and the hole was advanced to 200 feet; after purging the accumulated water from the hole, no additional water was detected in circulated media during the drilling. Based upon these observations, we conclude that a laterally discontinuous body of groundwater saturation is present in the immediate vicinity of the small depression; the thickness and capacity of this saturation appears to be nominal with ephemeral surface water recharge.

Numerous borings were advanced through shallow alluvium and into the Chinle Formation on sites adjacent to the OWL tract by Intercontinental Potash Company. Logs of these borings were obtained and examined by Golder Associates. Locations of the ICP borings are shown in **Figure IV.2.6**; summary data from the



borings is included in **Table IV.2.1** and copies of the logs are included in **Attachment IV.2.C**. Measured elevations of the top of the Chinle Formation in these borings were used to prepare a terrain map on top of the Chinle Formation that shown in **Figure IV.2.11**.

This map indicates several areas where laterally discontinuous bodies of saturated basal alluvium could potentially be present in buried drainages that were incised into the Chinle Formation bedrock units. The interpreted Chinle terrain comports with observed shallow alluvial saturation that was noted in OWL BH-2. A buried bedrock drainage could potentially be present approximately 2000 feet west of OWL BH-2 in Section 23.

2.4.4 Intercontinental Potash Company Borehole 092 Drill Stem Testing

Pursuant to testing to evaluate potential groundwater inflow and water management for a planned vertical mine shaft, Intercontinental Potash Company performed extensive local subsurface investigations, including a series of 10 drill stem tests (DSTs) of Boring ICP-092, located approximately 4500 feet northwest of the OWL tract in Section 15 T.24S.R33E (Intera, 2013). During drill stem testing, a DST tool is placed on the lower end of the evacuated drill pipe and a packer is placed some distance above the lower end of the drill pipe and the DST tool. The drill pipe is lowered into the open hole and placed on hole bottom, which expands the packer to make a seal against the hole at some depth above the bottom of the DST tool, which is the tested interval. The DST tool is then manipulated to allow fluids to flow from the tested interval into the drill pipe at the bottom of the hole and a transducer and data logger record the rate of fluid entry into the bottom of the drill pipe through the DST tool as a rise in fluid level within the tool and drill pipe. These records are then recovered and analyzed to assess the rate and volume of fluid flow into the hole across the tested interval.

Results of the DST testing of ICP-092 are summarized in **Attachment IV.2.B** and are illustrated in the local hydrogeologic cross section in **Figure IV.2.10**. Test data from the shallowest zone (40-53 feet below grade) indicated that the flow was only 0.02 gallons per minute (gpm). Deeper zones within the Chinle all found flows less than 0.50 gpm. Several intervals in the Santa Rosa Sandstone found flows exceeding 10 gpm; one zone in the interval 510-644 feet below grade tested at 112 gpm. This test data indicates that shallow zones in the Chinle Formation above a depth of 150 feet may have limited saturation, but have inadequate hydraulic conductance to yield useful quantities of water to a well and do not meet the definition of ground water per the Oil and Gas Rules (19.15.2.7.G(10) NMAC). It should be noted that the borings on the OWL site (with the exception of OWL BH-2 as discussed above) were drilled to depths ranging from 150 feet to 200 feet and found to be completely dry.



3.0 REGULATORY SITING REQUIREMENTS

This section addresses regulatory requirements for basic hydrogeologic site data, as well as for demonstration of compliance with siting requirements relative to minimum depth to groundwater, as follows:

19.15.36.8.C.15 NMAC

- (a) *a map showing names and locations of streams, springs and other watercourses and water wells within one mile of the site;*
- (b) *laboratory analyses, performed by an independent commercial laboratory, for major cations, and anions; BTEX; RCRA metals; and TDS of groundwater samples of the shallowest fresh water aquifer beneath the proposed site;*
- (c) *depth to, formation name, type and thickness of the shallowest fresh water aquifer;*
- (d) *soil types beneath the proposed surface waste management facility; including a lithologic description of soil and rock members from ground surface down to the top of the shallowest fresh water aquifer;*
- (e) *geologic cross sections;*
- (f) *potentiometric maps for the shallowest fresh water aquifer;*

and

19.15.36.13.A(1) NMAC

Depth to groundwater: no landfill shall be located where groundwater is less than 100 feet below the lowest elevation of the design depth at which the operator will place oil field waste.

3.1 Streams, Springs, Watercourses and Water Wells Within One Mile of the Site

The map in **Figure IV.2.12** shows terrain wells and drainages, as well as the region within a one mile radius of the OWL property. No perennial streams or springs are present within one mile of the proposed OWL site. One small local depression encompassing approximately 1.7 acres is present on the OWL tract. There are two water wells within one mile of the proposed OWL site. Locations of water wells in the vicinity of the OWL site are shown in **Figure IV.2.12**; a summary of vicinity wells is also included in **Table IV.2.1**.

3.2 Laboratory Analyses of Shallow Groundwater Samples

A groundwater sample was collected from the on-site McCloy well (C3662-1), completed in the Santa Rosa Sandstone aquifer at the OWL site on May 13, 2015. Laboratory analyses for analytes set forth in 19.15.36.8.C.15(b) indicates that the water is of good general quality, having a total dissolved solids of 507 parts per million and meeting all tested groundwater protection standards. Analytical data from this test is included in **Table IV.2.2a** and **Table IV.2.2.b**, along with summary data from other nearby wells tested in April 2013 (Intera, 2013). Copies of laboratory reports for tests listed in **Table IV.2.2a** and **Table IV.2.2b** are included in **Attachment IV.2.E**. The McCloy well produces from water-bearing zones in the Santa Rosa Sandstone that are approximately 500 feet below grade.



3.3 Depth, Formation Name, Type and Thickness of the Shallowest Fresh Water Aquifer

The shallowest fresh water bearing zones at the OWL site are present in sandstone beds within the Santa Rosa Sandstone. Several water wells in the region of the OWL site which were completed in Triassic bedrock were identified by Nicholson and Clebsch (1961) and Geohydrology Associates, Inc. (1978). Projected geometry of the Santa Rosa Sandstone, as well as the potentiometric surface of this unit are illustrated on the hydrogeologic cross section in **Figure IV.2.10**. Well locations and summary formation and water level data for these wells are listed in **Table IV.2.1**. The McCloy well (C-3662-1) penetrated the Santa Rosa Sandstone in the depth interval of 350 feet to 550 feet below land surface; principal water-bearing zones penetrated by the McCloy well appear to be approximately 500 feet below grade. Another water well located approximately one half mile northeast of the OWL site (C-3666-1) penetrated the Santa Rosa Sandstone at a projected depth of approximately 420 feet. Based upon projected Santa Rosa Sandstone data, it is anticipated that the Santa Rosa Sandstone is approximately 350 feet below land surface and is approximately 300 feet thick at the OWL site.

3.4 Lithology of Stratigraphic Units Above the Santa Rosa Sandstone at the OWL Site

Stratigraphic units which are above the Santa Rosa Sandstone in the vicinity of the OWL site include Quaternary alluvium piedmont deposits and upper Triassic Chinle Formation. Site characterization borings drilled on the OWL site penetrated predominantly fine silty sands with calcrete (caliche) zones in the alluvial section. The site borings penetrated dense red and green sandstone, siltstone and claystone in the upper Triassic bedrock section at depths ranging from 38 to 60 feet below land surface.

3.5 Geologic Cross Sections

A hydrogeologic cross section depicting stratigraphy and geometry of the Santa Rosa Sandstone and its potentiometric surface is included in **Figure IV.2.10**. This diagram indicates that the depth to the top of the Santa Rosa Sandstone at the OWL site is projected to be approximately 350 feet below land surface; the depth to the potentiometric surface in the Santa Rosa Sandstone is approximately 390 feet.

3.6 Potentiometric Map of the Santa Rosa Sandstone

A potentiometric surface map was prepared using water level data from vicinity wells that penetrate water-bearing zones in the Triassic bedrock section and is included in **Figure IV.2.9**. This map indicates that the depth of the water level in the Santa Rosa Sandstone is expected to be approximately 390 feet; the gradient direction is to the west.



3.7 Depth to Shallow Fresh Groundwater

Available well log and water level data from the vicinity of the OWL site indicates that the shallowest fresh water-bearing zones at the OWL site are present in sandstone beds in the middle or lower Santa Rosa Sandstone at projected depths of approximately 500 feet below grade at the site.

Data from the OWL site characterization borings indicates that thin accumulations of unconsolidated deposits of alluvial sand, silt, caliche and minor gravels ranging in thickness from 30 to 60 feet are present above shale and dense sandstone beds in the Triassic Chinle Formation. Site drilling indicates that the alluvial deposits are dry, with the exception thin, laterally discontinuous and likely ephemeral saturations of non-productible water.



4.0 CONCLUSIONS

Extensive regional, vicinity and site characterization boring and testing data indicates that the shallowest fresh groundwater bearing zones beneath the OWL site are within sandstone beds of the Santa Rosa Sandstone, which are approximately 500 feet below land surface. Water within these beds is under confined conditions. Small non-sustainable quantities and ephemeral saturations of groundwater in laterally and vertically discontinuous zones have been noted in lower Chinle Formation shales and upper Santa Rosa Sandstone beds at shallower depths in the vicinity; however these occurrences of groundwater are not regarded to be protectable as resources as defined by the Oil and Gas Rules (19.15.2.7.G(10) NMAC).

Due to the depth of water-bearing sandstone zones within the Santa Rosa Sandstone and the fact that they are generally under confined conditions, a potential release from the OWL site would not be expected to migrate readily into these confined groundwater zones through the dense Chinle deposits. Therefore, groundwater monitoring wells completed in the Santa Rosa Sandstone aquifer at the OWL site would not be expected to provide a high level of environmental protection as sentinel wells.

Based upon shallow stratigraphy at the site, as well as the geometry of the proposed waste disposal cells, we conclude that vadose zone monitoring wells completed to communicate with permeable basal alluvial sediments at the contact with underlying dense shale in the Chinle Formation and placed in strategic positions at the downgradient side of the OWL facility would provide the most effective early leak detection system and the greatest level of environmental protection for the site.

This site has the unique advantage that the local subsurface conditions have been extensively characterized during subsurface investigations conducted for the OWL Project, as well as the Ochoa Mine Project. No additional drilling is recommended to augment the hydrogeologic or geotechnical database; however we recommend that emergent subsurface data that is obtained during installations of proposed vadose zone monitoring wells be used to update subsurface mapping and adjust well locations as appropriate. Detailed logs will be prepared for the five proposed vadose zone monitoring wells (see **Volume II.8**, Vadose Zone Monitoring Plan) and will be provided to OCD. OCD will be notified of the proposed well installation program in advance, and invited to observe well installations.



5.0 REFERENCES

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TABLES

Records of Wells and Borings
Vicinity of the OWL Landfill Services, LLC Site
SW Lea County, NM

Table W.2.1

Borehole, Well ID or API No.	USE	Drill Date	Liho Log	Owner	Water Source	Location PLS South Range East	UTM X (NAD 83)	UTM Y (NAD 83)	Land Surf Elevation (ft) from USGS 7.5' Sheets (NAD-27)	Depth to Water (ft)	WL Elevation (ft) above MSL	WL Date (or Completion Date)	Flow Rate (gpm)	Aquifer	Water-Bearing Zone	Depth to Top of Rusler Anhydrite (ft)	Elev. Top of Rusler Anhydrite (ft)	Source of Data Comments
Permitted Carlsbad Underground Basin Water Wells																		
C-03628 POD1	Stock	3/12/2012	X	MARK MCCLOY (M&M RANCH)	Shallow	24-32.15.211	625948	3566099	3594	541	3461			Qal-Tr	133-152	75	3519	OSE Well Record
C-02308	Stock	6/30/1920		MCCLOY	Shallow	24-33.10.131	634963	3567364	3592	40	20		15	ToQal				Shomaker 10/2014; OSE POD Summary
C-03666 POD1		10/26/2013	X	Agave Energy Co	Shallow	24-33.13.432	639132	3565078	3588	650	3198		38	Tr	460-600	90	3498	OSE Well Record
C-02430	Comm	12/31/1982		PLAINS FEDERAL LAND BANK ASSOC	Shallow	24-33.16.333	633377	3564732	3573	643	3158		12	Tr				Shomaker 10/2014; OSE POD Summary
C-02431	Comm	12/31/1959		PLAINS FEDERAL LAND BANK ASSOC	Shallow	24-33.17.444	633175	3564728	3573	525	3158		20	Tr				Shomaker 10/2014; OSE POD Summary
C-02432	Comm	12/31/1980		MCCLOY	Shallow	24-33.17.444	633175	3564728	3573	640	3158		45	Tr				Shomaker 10/2014; OSE POD Summary
C-03662 POD1	Dom-Slk	8/20/2013	X	MARK MCCLOY (M&M RANCH)	Shallow	24-33.23.213	637342	3564428	3582	550	383		10	Tr	250-275	30	3552	OSE Well Record + Pump Set WL
C-03662 POD1				EOG RESOURCES	Shallow	24-33.23.213	637342	3564428	3582	550	3472			Tr				Shomaker 10/2014
C-02309	Dom-Slk	6/30/1912		PLAINS FEDERAL LAND BANK ASSOC	Shallow	24-33.25.222	639705	3562966	3518	60	30		40	ToQal				Shomaker 10/2014; OSE POD Summary
C-02310	Comm	12/31/1980		MCCLOY	Shallow	24-33.33.232	634437	3560918	3472	120	70		60	ToQal				Shomaker 10/2014; OSE POD Summary
C-02311	Dom-Slk	12/31/1980		MCCLOY	Shallow	24-33.33.232	634437	3560918	3472	120	70		60	ToQal				Shomaker 10/2014; OSE POD Summary
Pre-Basin Water Wells, NMBM GW Report 6, 1961 and Geohydrology Associates, 1978																		
Prebasin Well	Dom-Slk			Brinnabod		23-32.28.334	633966	3571164	3683	575	500		2.5	Tr				NMBM GW Report 6
Prebasin Well	Industrial	1953		Continental Oil		23-34.31.340	640952	3569745	3616	678			47	Tr				NMBM GW Report 6
Prebasin Well	Stock			Frank James		24-32.10.344	625927	3566147	3593	60	31.1		6.355					NMBM GW Report 6
Prebasin Well	Dom-Slk			Frank James		24-32.10.344	625927	3566147	3593	40	34.5		3559					GAI 1978 NMBM GW Report 6
Prebasin Well	Stock			Richard Ritz		24-32.33.422	625217	3568454	3661	550	196.3		3453	Tr				GAI 1978 NMBM GW Report 6
Prebasin Well	Stock			Carl Johnson		24-32.33.423	625217	3560349	3591	367	313.4		3188	Tr				Nicholson Ciesch 1961
Prebasin Well	Stock			Carl Johnson		24-32.33.423	625217	3560349	3591	334.2	314.09		3188	Tr				GAI 1978
Prebasin Well	Not Used					24-33.10.113	634979	357350	3592	36	24.6		3667	Tr				GAI 1978 NMBM GW Report 6
Prebasin Well	Stock					24-33.23.311	636675	3563632	3599	232	206.6		3350	Tr				GAI 1978 NMBM GW Report 6
Prebasin Well	Stock					24-33.23.311	636675	3563632	3599	232	206.6		3350	Tr				GAI 1978 NMBM GW Report 6
Prebasin Well	Dom-Slk					24-33.33.231	634400	3560918	3472		83.2		3379	Tr				GAI 1978
Prebasin Well	Dom-Slk					24-33.33.231	634400	3560918	3472		83.2		3379	Tr				GAI 1978
Prebasin Well	Dom-Slk					24-33.35.122	645843	3561348	3417	258	310.3		320.65	Tr				NMBM GW Report 6
Prebasin Well	Stock			Madara Ranch		24-34.34.111	642951	3563850	3459	51.3	3518		126.50	Tr				NMBM GW Report 6
Prebasin Well	Aug-Slk					24-34.4.113	642951	3563850	3459	70	51.88		126.50	Tr				GAI 1978 NMBM GW Report 6
Prebasin Well	Obs					24-34.4.114	645943	3569358	3457	56	3518		126.50	Tr				GAI 1978
Prebasin Well	Industrial					24-34.4.211	645943	3569358	3457	56	3518		126.50	Tr				GAI 1978
Prebasin Well	Stock					24-34.4.933	642913	3567659	3575	76	66.50		3508	Tr				GAI 1978 NMBM GW Report 6
Prebasin Well	Stock					24-34.7.222	641243	3567916	3598	72.19	3508		126.70	Tr				GAI 1978
Prebasin Well	Stock			Madara Ranch		24-35.30.341	650019	3551883	3343	140	150		3193	Tr				NMBM GW Report 6
Prebasin Well	Dom-Slk			Plains Prod Co		25-33.20.443	633053	3553407	3402	226	3177		1127.63	Tr				NMBM GW Report 6
Prebasin Well	Stock			Nick Ritz		25-33.31.244	631723	3551210	3408	320	288		3150	Tr				NMBM GW Report 6
Prebasin Well	Stock			Madara Ranch		25-34.1.132	648200	3563926	3369	300+	231		3158	Tr				NMBM GW Report 6
Prebasin Well	Not Used					25-34.15.242	646117	3566178	3335	168	164.9		3170	Tr				NMBM GW Report 6
Prebasin Well						26-34.6.213	641002	6549971	3321	300	141.9		3179	Tr				NMBM GW Report 6
OWL Landfill Services, LLC - Section 23 Site Borings																		
Borehole 1	Geotech	11/25/2014	X			24-33.23.222	638096	3564656	3585	150	dty		60					Gordon Environmental 2015
Borehole 2	Geotech	11/18/2014	X			24-33.23.434	637723	3563081	3552	200	39		3513					Gordon Environmental 2015
Borehole 3	Geotech	11/25/2014	X			24-33.23.311	636538	3563071	3561	175	dty		35					Gordon Environmental 2015
Borehole 4	Geotech	11/25/2014	X			24-33.23.111	636515	3564633	3588	200	dty		35					Gordon Environmental 2015
Borehole 5	Geotech	11/17/2014	X			24-33.23.233	637326	3563949	3579	165	dty		45					Gordon Environmental 2015
Transwestern Pipeline Facility Environmental Wells																		
TW PL SVE-13	Environ	12/15/1999		Transwestern Pipe	Shallow	24-33.1.42	639266	3568976	3639	99	90.4		3549					OSE Well Record
TW PL MW-13	Environ	12/14/1999		Transwestern Pipe	Shallow	24-33.1.42	639266	3568976	3639	90	83.4		3556					OSE Well Record

Records of Wells and Borings
Vicinity of the OWL Landfill Services, LLC Site
SW Lea County, NM

Table IV.2.1

MINOSE File No. or Well Name	Borehole, Well ID or API No.	USE	Drill Date	Litho Log	Owner	Water Source	Location PLS South Range East	UTM X (NAD 83)	UTM Y (NAD 83)	Land Surf Elevation (ft) from USGS 7.5' Sheets (NAD-27)	Depth to Water (ft)	WL Elevation (ft) above MSL	WL Date (or Completion Date)	Flow Rate (gpm)	Aquifer	Water-Bearing Zone	Depth to Top of Chert (ft)	Elev. Top of Chert (ft)	Depth to Top of Rustler Anhydrite (ft)	Elev. Top of Rustler Anhydrite (ft)	Source of Data Comments
Double M Ranch Wells included in Water Quality Investigation (Intera, 2013)																					
ICP-DHR-01	East	Stock			McCoy		24.33.17.444	633252	3564318	3573	540				Tr						Intera 5/2013
ICP-DHR-02	Tower	Stock			McCoy		24.33.17.444	633219.4	3564695	3573	unk										Intera 5/2013
ICP-DHR-03	North	Stock			McCoy		24.33.17.444	633278.6	3564685	3571	unk			26.3							Intera 5/2013
ICP-DHR-04	North XX	Stock			McCoy		24.33.17.444	633278.6	3454678	3571	unk										Intera 5/2013
ICP-DHR-05	House WM	Stock			McCoy		24.33.33.232	634398.6	3560920.9	3472	180			24.4							Intera 5/2013
ICP-DHR-06	South XX	Stock			McCoy		24.33.31.433	630409.4	3558829.5	3509	180			3.6							Intera 5/2013
ICP-DHR-07	Unknown	Stock			McCoy		24.34.32.141	641951	3560925	3454	540			28	Tr						Intera 5/2013
ICP-DHR-08	E House	Stock			McCoy		24.33.33.232	634401	3560929	3472	unk			13.3							Intera 5/2013
ICP-DHR-09	House	Domestic			McCoy		24.33.33.232	634401	3560834	3472	unk										Intera 5/2013
ICP-DHR-10	James East	Stock			McCoy		24.32.12.131	628576	3567331	3600	540				Tr						Intera 5/2013
Intercontinental Potash Ore Characterization Borings																					
C03565 POD1	ICP-083	Geotech			Intercontinental Potash Corp		24.33.6.42	630871	3568316	3633											OSE Waters Database POD Summary
C03565 POD2	ICP-084	Geotech			Intercontinental Potash Corp		24.33.7.43	631156	3568515	3581											OSE Waters Database POD Summary
C03565 POD4	ICP-086	Geotech			Intercontinental Potash Corp		24.33.9.14	633672	3567057	3611											OSE Waters Database POD Summary
C03565 POD5	ICP-087	Geotech			Intercontinental Potash Corp		24.33.9.43	634135	3566496	3610											OSE Waters Database POD Summary
C03565 POD6	ICP-089	Geotech			Intercontinental Potash Corp		24.33.10.33	635022	3566373	3617											OSE Waters Database POD Summary
C03565 POD7	ICP-090	Geotech			Intercontinental Potash Corp		24.33.6.22	631361	3569250	3650											OSE Waters Database POD Summary
C 03565 POD3	ICP-085	Geotech	10/21/2012	X	Intercontinental Potash Corp		24.33.8.433	632763	3566546	3601	1533	dry					55	3546	1227	2374	OSE Well Record
C 03565 POD8	ICP-092	Geotech	3/25/2013	X	Intercontinental Potash Corp		24.33.15.14	635485	3565610	3624	1665	dry					55	3569	1284	2340	OSE Well Record
C 03565 POD9	ICP-093	Geotech	2/19/2013	X	Intercontinental Potash Corp		24.33.15.44	636430	3565005	3599	1563	dry					55	3544	1238	2361	OSE Well Record

Records of Wells and Borings
Vicinity of the OWL Landfill Services, LLC Site
SW Lea County, NM

Table IV.2.1

NIMOSE File No. or Well Name	Borehole, Well ID or API No.	USE	Drill Date	Liho Log	Owner	Water Source	Location PLS South Range East	UTM X (NAD 83)	UTM Y (NAD 83)	Land Surf Elevation (ft) from USGS 7.5' Sheets (NAD-27)	Depth to Water (ft)	WL Elevation (ft) above MSL	WL Date (or Completion Date)	Flow Rate (gpm)	Aquifer	Water-Bearing Zone	Depth to Top of Rustler Anhydrite (ft)	Elev. Top of Rustler Anhydrite (ft)	Source of Data Comments
Intercontinental Potash Geotechnical Borings																			
C.03600 POD1	BH-16	Geotech	1/7/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.122	637275	3563023	3553	75	dry					37	3516	Shomaker 10/2014; OSE Well Record
C.03600 POD3	BH-19	Geotech	1/16/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.243	637784	3562340	3551	75	dry					28	3523	Shomaker 10/2014; OSE Well Record
C.03600 POD4	BH-20	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.133	636617	3562293	3522	75	dry					63	3459	Shomaker 10/2014; OSE Well Record
C.03600 POD6	BH-22	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.413	637382	3562026	3532	75	dry					42	3490	Shomaker 10/2014; OSE Well Record
C.03600 POD5	BH-21	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.423	637857	3562020	3548	75	dry					17	3531	Shomaker 10/2014; OSE Well Record
C.03600 POD2	BH-17	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.25.144	638824	3562329	3555	75	dry					24	3531	Shomaker 10/2014; OSE Well Record
C.03600 POD2	BH-18	Geotech	1/15/2013	X	Intercontinental Potash Corp	Shallow	24.33.25.144	638824	3562329	3555	75	dry					21	3534	Shomaker 10/2014; OSE Well Record
C.03600 POD7	BH-23	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.313	636726	3561988	3518	75	dry					66	3452	Shomaker 10/2014; OSE Well Record
C.03601 POD2	BH-9	Geotech	1/7/2013	X	Intercontinental Potash Corp	Shallow	24.33.23.423	637946	3563588	3575	75	dry					23	3552	Shomaker 10/2014; OSE Well Record
C.03601 POD6	BH-13	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.23.441	637833	3563338	3570	75	dry					24	3546	Shomaker 10/2014; OSE Well Record
C.03601 POD1	BH-8	Geotech	12/21/2012	X	Intercontinental Potash Corp	Shallow	24.33.24.113	638124	3563937	3582	100	dry					28	3554	Shomaker 10/2014; OSE Well Record
C.03601 POD5	BH-12	Geotech	1/6/2013	X	Intercontinental Potash Corp	Shallow	24.33.23.442	637988	3563334	3569	75	dry					31	3538	Shomaker 10/2014; OSE Well Record
C.03601 POD3	BH-10	Geotech	1/6/2013	X	Intercontinental Potash Corp	Shallow	24.33.24.331	638141	3563413	3571	75	dry					31	3540	Shomaker 10/2014; OSE Well Record
C.03601 POD7	BH-14	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.23.444	637946	3563170	3562	75	dry					27	3535	Shomaker 10/2014; OSE Well Record
C.03601 POD 4	BH-11	Geotech	1/4/2013	X	Intercontinental Potash Corp	Shallow	24.33.24.333	638156	3563222	3566	75	dry					35	3531	Shomaker 10/2014; OSE Well Record
C.03603	BH-24	Geotech	1/1/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	637759	3561237	3521	75	dry					23	3498	OSE Well Record
C.03603	BH-25	Geotech	1/11/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	637338	3561180	3514	75	dry					26	3488	OSE Well Record
C.03603	BH-26	Geotech	1/13/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	636847	3561108	3507	75	dry					23	3484	OSE Well Record
C.03603	BH-27	Geotech	1/14/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	637747	3560475	3511	75	dry					22	3489	OSE Well Record
C.03603	BH-28	Geotech	1/13/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	636896	3560784	3501	75	dry					31	3470	OSE Well Record
C.03603	BH-29	Geotech	1/13/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	636705	3560641	3502	75	dry					24	3478	OSE Well Record
USGS Observation Well																			
Oil and Gas Wells																			
USGS 32134R103340401		USGS Piezometer						634948	3568629	3601	36	22	3579						Shomaker 10/2014
Tomcat Federal 8	25-3897	Gas	1/1/2008	X	Reif Operating		23.32.8.441	623113	3576043	3626	8900						1047	2579	NIMCD Record
Chlorine Shale 1	25-26892	Oil	12/1/1980	X	RTA Oil Producers		23.34.14.112	646824	3575069	3375	12942						1395	1980	NIMCD Record
American Ridge 24	25-26547	SVD	8/7/1980	X	Nukoms N America		23.34.24.321	648224	3572478	3371	13900						905	2468	NIMCD Record
Ball Lake 2	25-08489	Oil	11/21/1954	X	Continental Oil Co		23.34.30.342	640209	3571352	3533	13868						1255	2378	NIMCD Record NIMB GW Report 6
Acqua Elman 1	25-08674	SVD	8/11/1955	X	Aper Oil Corp		23.35.1.222	658845	35719316	3508	3748						1620	1888	NIMCD Record
Red Hills BS 1	25-29008	Oil	1/3/1966	X	EOG Resources		24.33.24.411	639125	3563688	3565	15600						1250	2315	NIMCD Record
Bradley State 1	25-08248	SVD	12/23/1953	X	Fullerton Oil Co		25.32.36.331	628813	3550299	3345	4953						672	2673	NIMCD Record
Bass Federal 1	25-08385	Oil	7/25/1962	X	Curtis Hankamer		25.33.20.212	632816	3554795	3424	5074						1010	2414	NIMCD Record
Pitchblende Fed 2	25-27753	Oil	10/6/1996	X	EOG Resources		25.34.35.412	647853	3550937	3306	14091						934	2372	NIMCD Record

**Table IV.2.2.a--Organic Water Quality Data
OWL Landfill Services, LLC Site Well**

Analytes	8021B (Golder) 8260B (Intera)				
	Benzene	Ethylbenzene	Toluene	MTBE	Xylenes (Total)
G.W.P.S.	10	750	750		620
PQL (Golder)	1	1	1	2.5	2
PQL (Intera)	1	1	1	1	1.5
Well C-3662 POD 1					
5/13/15	<1	<1	<1	<2.5	<2

Table IV.2.2.b--Water Quality Data
Double M Ranch Wells and OWL Landfill Services, LLC Site Vicinity

		Inorganic Analytes														Organic Analytes									
		300.0				SM2540C MOD	EPA 6010B (Golder) EPA 200.7 (Intera)										7470 (Golder) 245.1 (Intera)	8021B (Golder) 8260B (Intera)	8260						
Well	Method	Chloride	Fluoride	Sulfate	Nitrate	Total Dissolved Solids	Aluminum	Barium	Cadmium	Calcium	Chromium	Iron	Lead	Magnesium	Potassium	Silver	Sodium	Arsenic	Selenium	Mercury	Benzene	Ethylbenzene	Toluene	MTBE	Xylenes (Total)
	G.W.P.S.	250	1.6	600	10	1,000	5	1	0.01	1.0	0.006	0.05	1	0.05	1	0.05	0.05	0.100	0.100	0.05	0.002	10	750	750	620
	PQL (Golder)	10.0	0.1	10.0	0.1	20	0.02	0.02	0.002	1.0	0.006	0.006	0.05	0.005	1	1	0.005	5	0.020	0.050	0.0002	1.0	1.0	1.0	2.5
	PQL (Intera)	10.0	0.1	10.0	0.1	20	0.02	0.002	0.002		0.006	0.006	0.02	0.001			0.005		0.001	0.001	0.0002	1.0	1.0	1.0	1.0
	Date																								
Wells Completed in Triassic Aquifers																									
323.34.31.340	12/4/53	52	1.4	219	0.70	635	--	--	--	--	--	--	--	26.0	--	--	--	--	--	--	--	--	--	--	--
2C-3662 POD 1	5/13/15	32	1.2	99	<0.10	507	<0.02	0.036	<0.002	17	<0.006	0.11	<0.005	19.0	3.9	<0.005	170	<0.02	<0.05	0.0002	<1.0	<1.0	<1.0	<2.5	<2.0
1ICP-DHR-01	4/11/13	26	1.2	130	0.54	513	<0.02	0.037	<0.002	--	<0.006	<0.02	<0.001	--	--	<0.005	--	<0.001	0.015	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-02	4/11/13	36	1.2	140	0.72	533	<0.02	0.05	<0.002	--	<0.006	<0.02	<0.001	--	--	<0.005	--	<0.001	0.017	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-03	4/11/13	26	1.1	120	0.65	482	<0.02	0.041	<0.002	--	<0.006	<0.02	<0.001	--	--	<0.005	--	<0.001	0.021	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-04	4/11/13	12	1.3	66	<0.10	416	<0.02	0.046	<0.002	--	<0.006	<0.02	<0.001	--	--	<0.005	--	<0.001	0.001	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-07	4/11/13	28	1.6	190	<0.10	640	<0.02	0.027	<0.002	--	<0.006	0.14	<0.001	--	--	<0.005	--	<0.001	<0.001	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
Wells Completed in Playa Deposits, Shallow, Multiple or Unknown Aquifers																									
1ICP-DHR-05	4/11/13	200	4.1	630	24	1560	<0.02	0.049	<0.002	--	<0.006	0.047	<0.001	--	--	<0.005	--	0.018	0.048	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-06	4/11/13	130	3.5	470	8.30	1110	<0.02	0.034	<0.002	--	<0.006	<0.02	<0.001	--	--	<0.005	--	0.014	0.023	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-08	4/11/13	110	3.9	660	8.40	1310	<0.02	0.015	<0.002	--	<0.006	<0.02	<0.001	--	--	<0.005	--	0.013	0.060	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-09	4/11/13	340	3.8	710	28	1920	<0.02	0.047	<0.002	--	<0.006	0.039	<0.001	--	--	<0.005	--	0.017	0.055	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-10	4/11/13	550	1.1	220	<0.10	1400	<0.02	0.026	<0.002	--	<0.006	0.170	<0.001	--	--	<0.005	--	0.0014	0.037	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1ICP-DHR-06	4/11/13	130	3.5	470	8.30	1110	<0.02	0.034	<0.002	--	<0.006	<0.02	<0.001	--	--	<0.005	--	0.014	0.023	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5

Notes:

Inorganic analytes: all units milligrams per liter

Organic analytes: all units micrograms per liter

Sources of Data:

¹Intera 2013 Double M Ranch Sampling Investigation²Gordon Environmental 2015 sample³Nicholson and Ciebsch 1961 prebasin well

**Table IV.2.3--Summary of OWL Landfill Services, LLC Site Boring Locations
Total Depths, Drill Dates, and Chinle Shale Depths**

Boring Number	B-1	B-2	B-3	B-4	B-5
Northing	441088.401	435985.091	435917.137	440977.229	438707.209
Easting	788080.396	786825.961	783182.1299	783171.1478	785946.616
*Latitude	32.21011167	32.19610998	32.19599657	32.20990526	32.20360995
*Longitude	103.5355444	103.5397218	103.5515022	103.5514187	103.5424996
Elevation (ft above MSL)	3584	3553	3546	3588	3579
Date	11/24/2014	11/18/2014	11/20/2014	11/22/2014	11/17/2014
Total Depth (ft)	150	200	150	200	140
Depth to top of Chinle	60	40	38	35	45
Elevation of top of Chinle	3524	3513	3508	3553	3534

Notes:

*coordinates in WGS-84

State plane coordinates in NAD83 and NAVD88

TABLE IV.2.4 (SUMMARY)
Soils Laboratory Analyses Summary
OWL Landfill Services, LLC site

Sample Number ¹	Sample Depth (ft bgs)	USCS Class ²	Grain Size Distribution				Atterberg Limits ³			Natural Moisture ⁴ (%)	Standard Proctor		Permeability (cm/sec)	Porosity (%)
			Pass #4 (%)	Pass #40 (%)	Pass #200 (%)		LL- PI	PI			Max Dry Density (PCF)	Optimum Moisture (%)		
BH1 - 3	15	SP-SM	82.1	39.7	8.3					5.99				38.39
BH1 - 12	82-85	SP-SM	99.0	70.6	6.0					3.68				37.13
BH-1 Bucket	100	CI	100.0	71.0	51.2		31-15	16		4.90	130.4	10.6	2.87 x 10 ⁻⁸	44.39
BH2 - 6	25	SP	92.0	72.2	3.1					6.67				43.18
BH-2 Bucket	50	SP	96.2	63.4	4.3						120.5	12.4		42.18
BH2 - 16	116-119	SC	100.0	55.5	30.8		37-20	17		17.52				40.75
BH3 - 5	20	SP-SM	100.0	97.9	6.6					8.38				33.15
BH-3 Bucket	45	SP-SM	84.8	44.6	9.9						115.5	12.6		36.15
BH3 - 16	128	SP-SM	99.8	55.0	9.6					6.49				38.97
BH4 - 3	15	SP-SM	87.0	72.4	10.3					9.28				43.9
BH5 - 9	35	SP	96.2	61.5	4.0					10.37				43.06

Notes:

Blank field indicates test not conducted

¹See **Figure IV.2.6** for locations of borings and **Attachment IV.2.A** for boring logs.

²Unified Soil Classification System: SM = silty sand; SP = poorly graded sand; SC = clayey sand; ML = low-plasticity silt; CL = low-plasticity clay; CH = high-plasticity clay

³LL = liquid limit; PI = plasticity index; NV = non viscous; NP = non plastic

⁴Gravimetric basis

Porosity = $(V_v/V) \times 100$

FIGURES



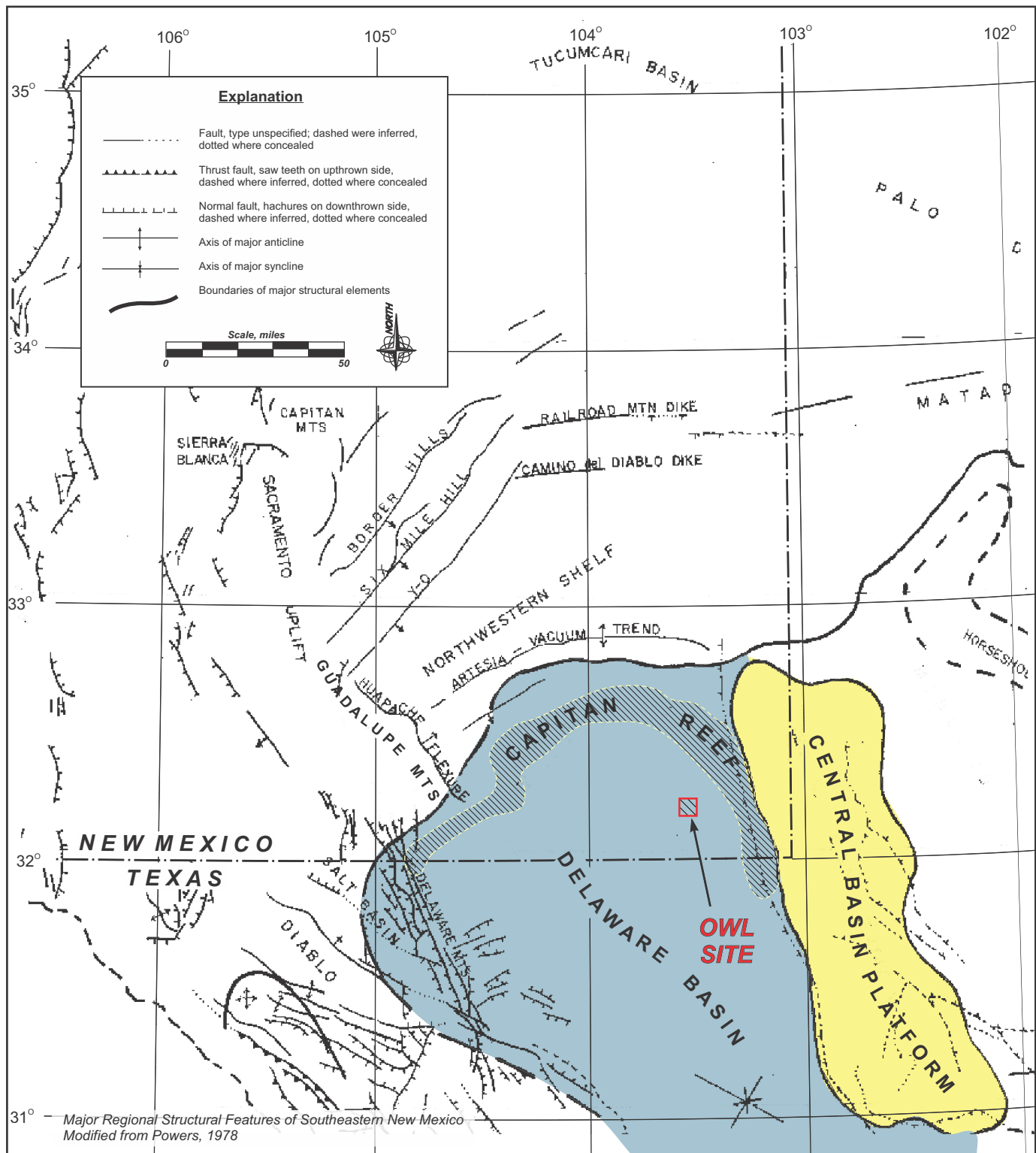
PROJECT

OWL Landfill Services, LLC Lea County Site

TITLE

**Figure IV.2.1.--Physiography of southern Lea County
and eastern Eddy County, New Mexico**





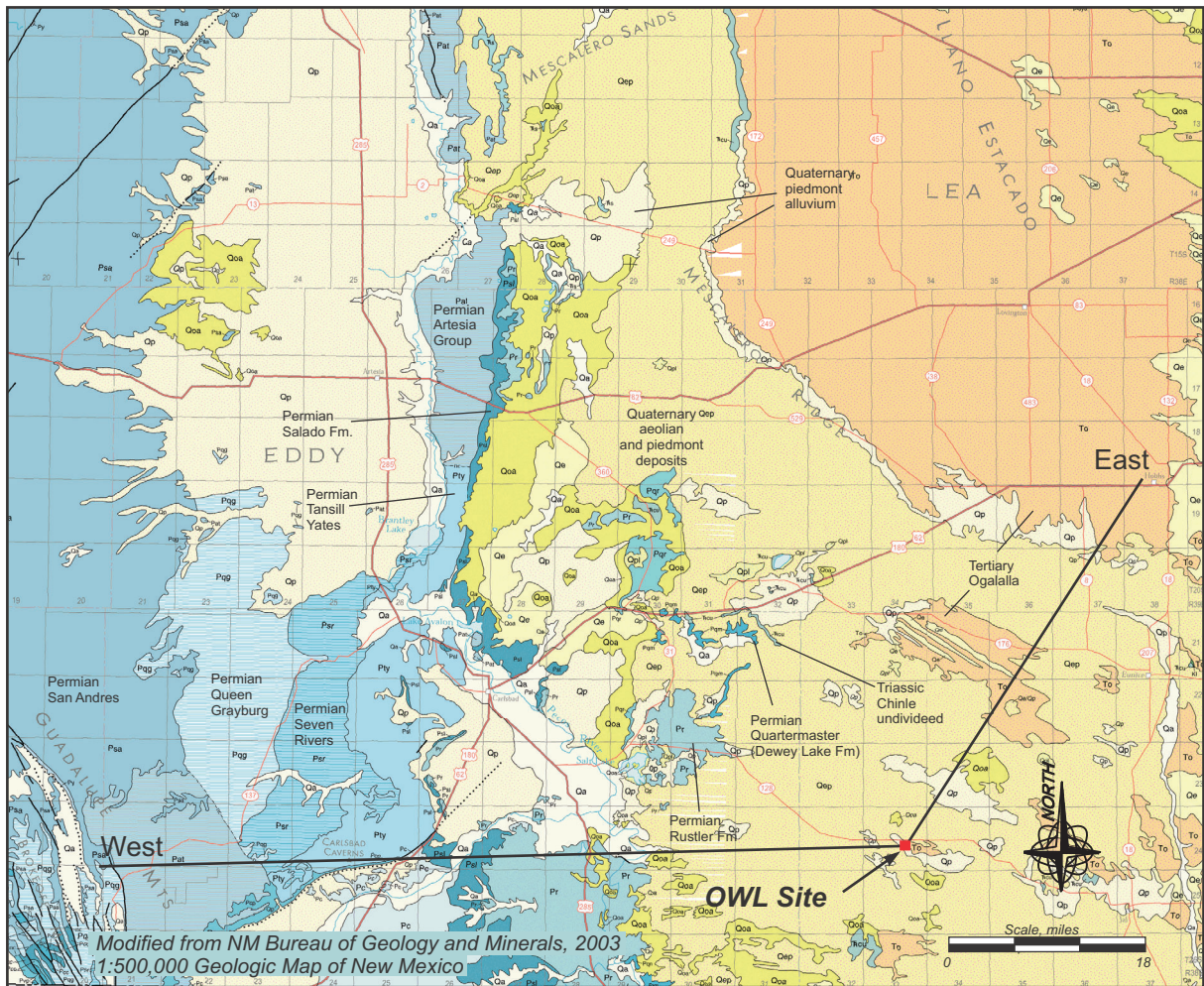
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OWL Landfill Services, LLC Lea County Site

TITLE

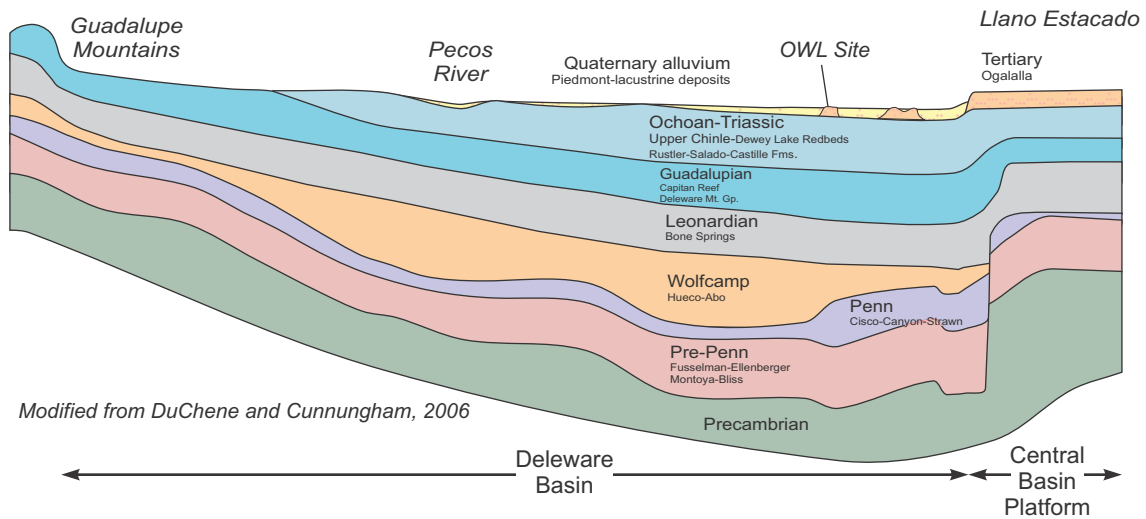
**Figure IV.2.2.--Structures of the Delaware Basin,
southeastern New Mexico and
west Texas**





West

East



Deleware Basin Central Basin Platform

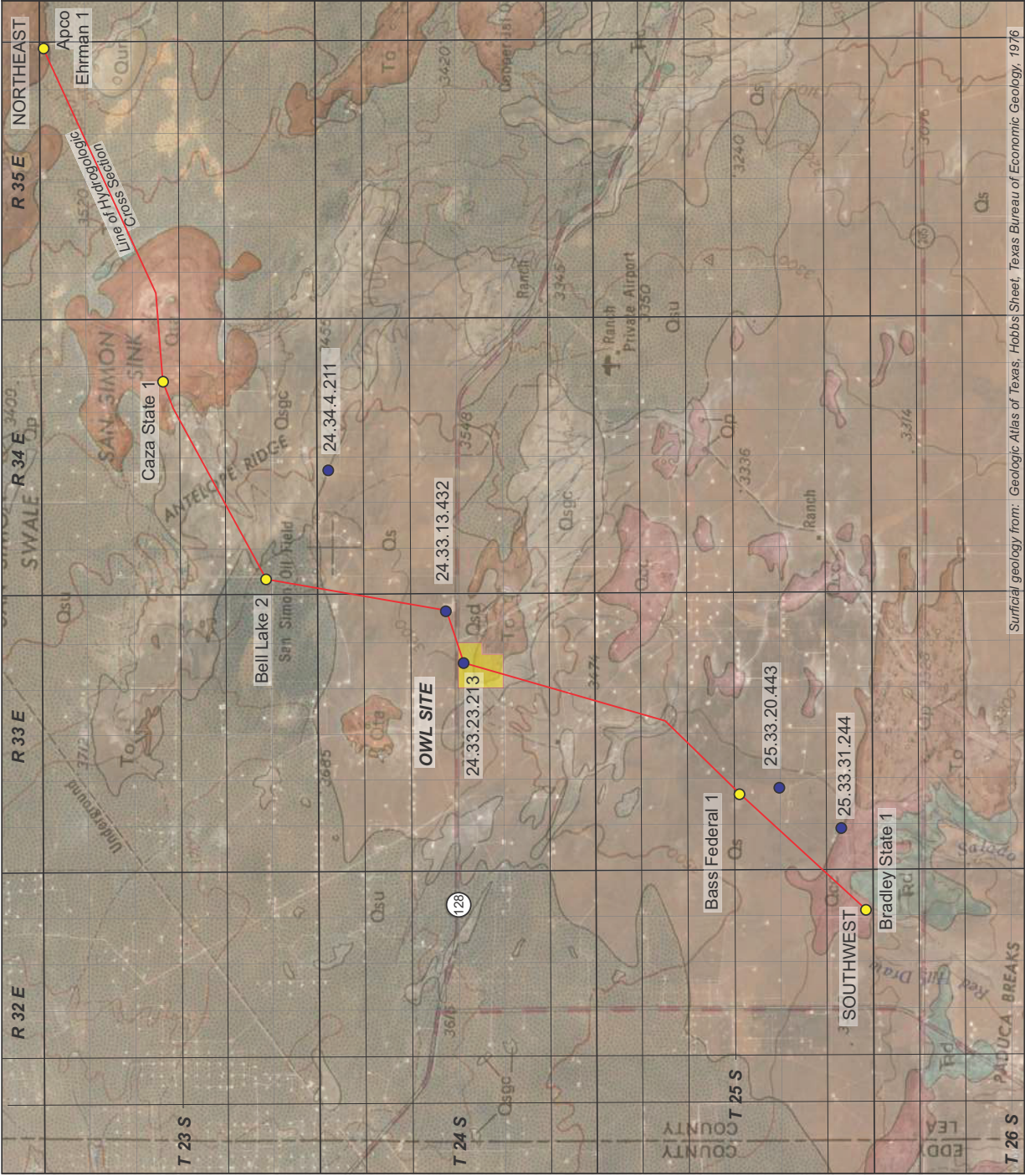
PROJECT

OWL Landfill Services, LLC Lea County Site

TITLE

Figure IV.2.3.--Regional Surface Geology and Generalized Stratigraphy, Southeastern New Mexico





EXPLANATION

Geologic Units

Qsu/Qs: Windblown sand

Sand and silt in sheets, light brown to reddish, overlies windblown cover sand; thickness 5-10 ft

Qp: Playa deposits

Playa deposits, clay and silt, sandy, light to dark gray, in shallow depressions

Qcc: Caliche

Caliche, stripped of covering materials mapped separately; thickness up to 10 ft

Qscg: Colluvial deposits

Sand, silt and gravel deposited by slopewash, and talus from Ogallala, red to gray; in part calcified, caliche 1-20 ft thick; may include weathered Gatluna Fm; rests mainly on Triassic and Permian rocks

Qta: Tahoka Formation

Lacustrine clay, silt, sand and gravel, locally calcareous, selenitic, indistinctly bedded to massive, weakly coherent, various shades of light gray, grades to gravel at margins. Contains molluscan and vertebrate fossils

To: Ogallala Formation

Fluvatile sand, silt, clay and gravel capped by caliche; various shades of gray and red; caliche, sandy, hard, ledge former; up to 100 ft thickness

Trc/Td: Chinle Formation/Dockum Group

Claystone, micaceous, greenish red with reduction spots, interbedded with fine grained sandstone; Dockum group includes Santa Rosa Sandstone; cross-bedded, conglomeratic with mixed lithology, combined thickness 300 feet

Water well showing PLS location

24.34.4.211

Oilgas well showing well name

Apocho 1



Scale, miles



PROJECT

OWL Landfill Services, LLC Lea County Site


TITLE

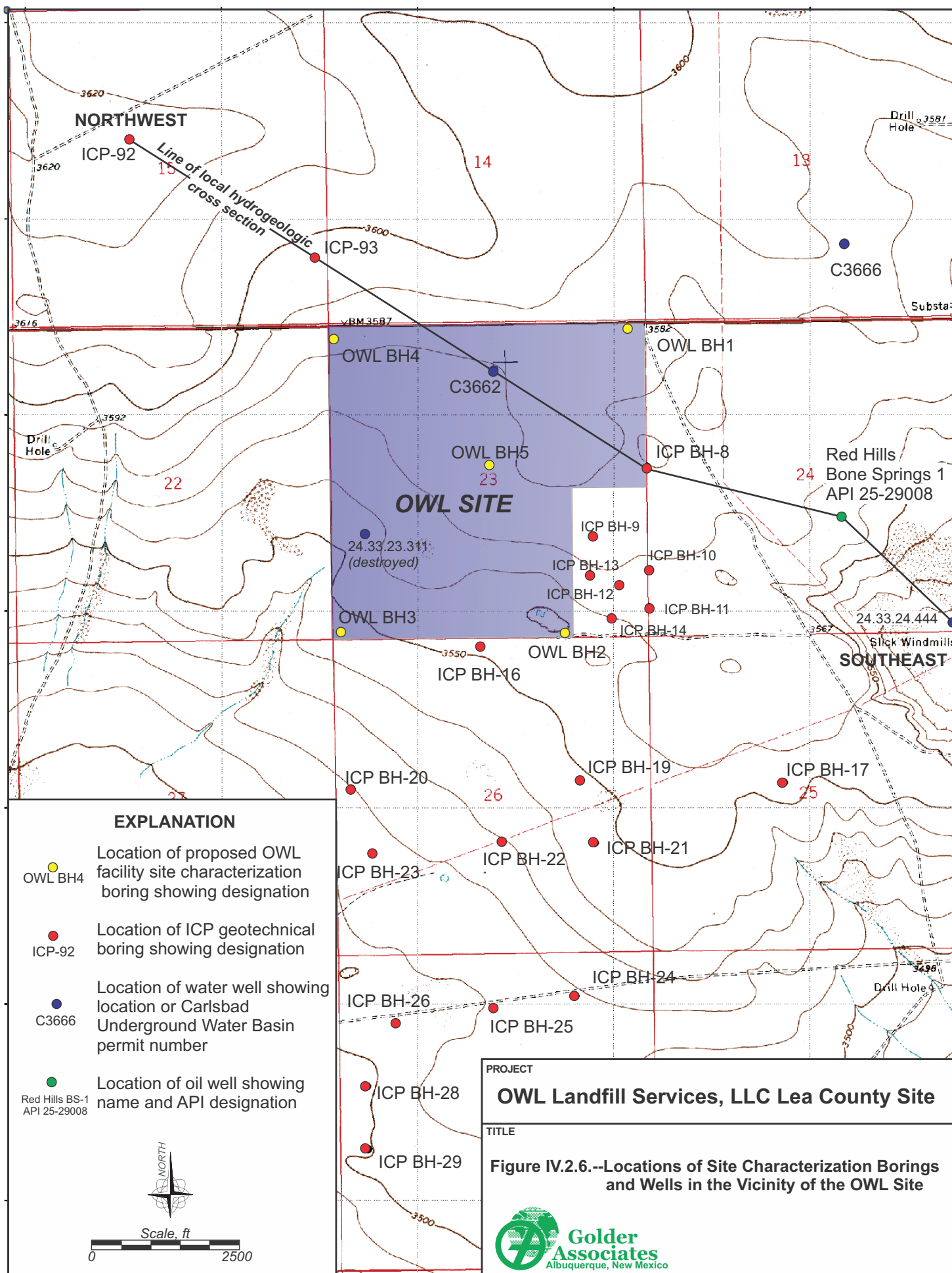
Figure IV.2.4--Surficial Geology in the Vicinity of the OWL Site



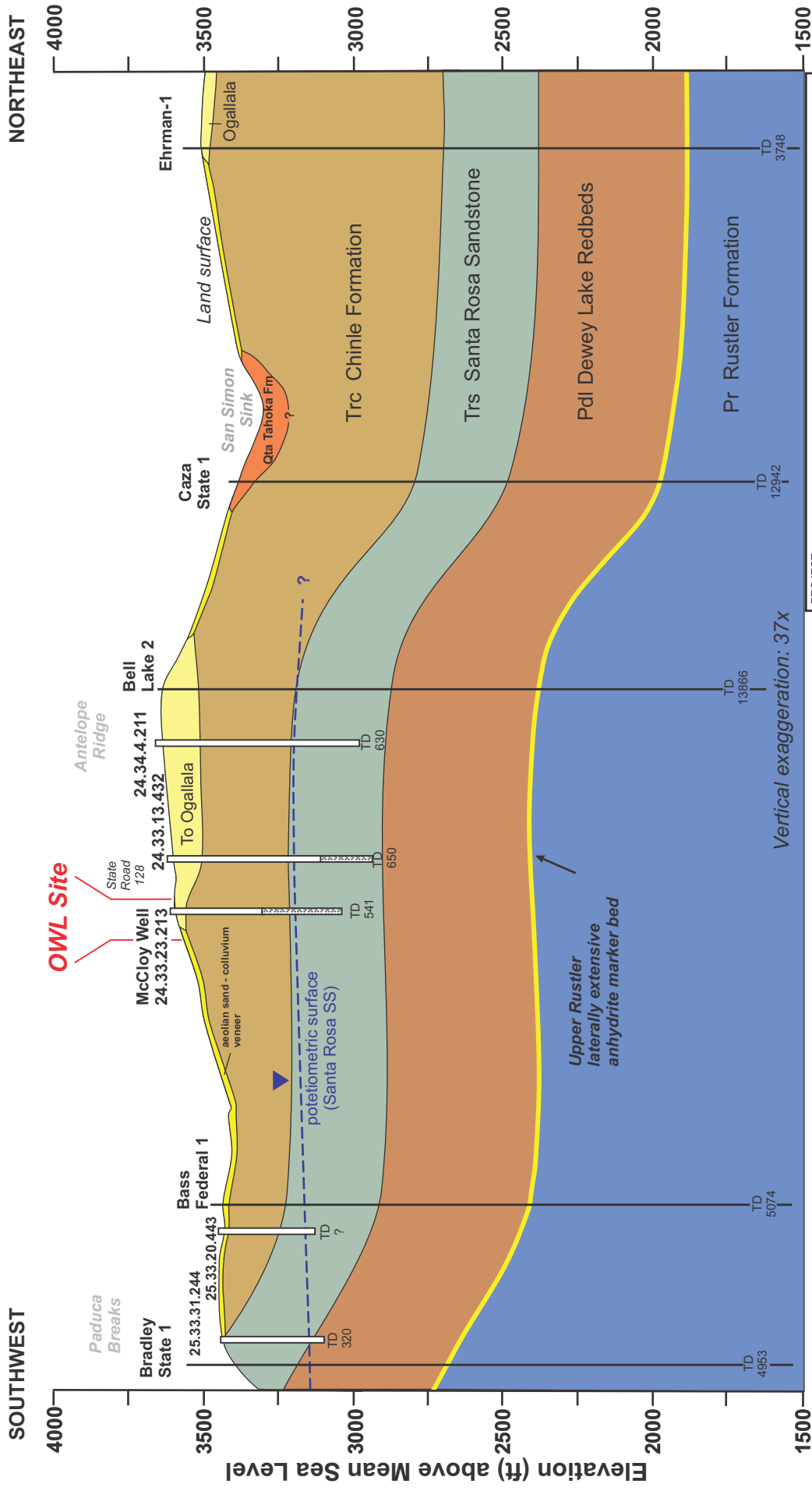
System	Series	<u>Delaware Basin Stratigraphy</u>	
Quaternary	Pediments, Valley Fills Upper Gatuna Fm.		
Tertiary	Lower Gatuna Formation Ogallala		
Triassic	Dockum Group Chinle Formation Santa Rosa Sandstone		
PERMIAN	Ochoa	Dewey Lake Redbeds Rustler Formation Salado Formation Castille Formation	
	Guadalupe	Delaware Mountain Group	Bell Canyon Formation Cherry Canyon Formation Brushy Canyon Formation Capitan Reef Facies
	Leonard	Bone Springs Limestone	Cutoff Shaly Member Black Limestone Beds Abo Reef Facies
	Wolfcamp	Hueco/Abo	

Post-Pennsylvanian stratigraphy of the Delaware Basin
from Hendrickson and Jones, 1952, Nicholson and Clebsch, 1961 and Hawley, et al., 1993

PROJECT
OWL Landfill Services, LLC Lea County Site
TITLE
Figure IV.2.5.--Post Pennsylvanian Stratigraphic Units of the Delaware Basin, Southeastern New Mexico
 Golder Associates Albuquerque, New Mexico



Regional Hydrogeologic Cross Section OWL Site, Lea County, NM



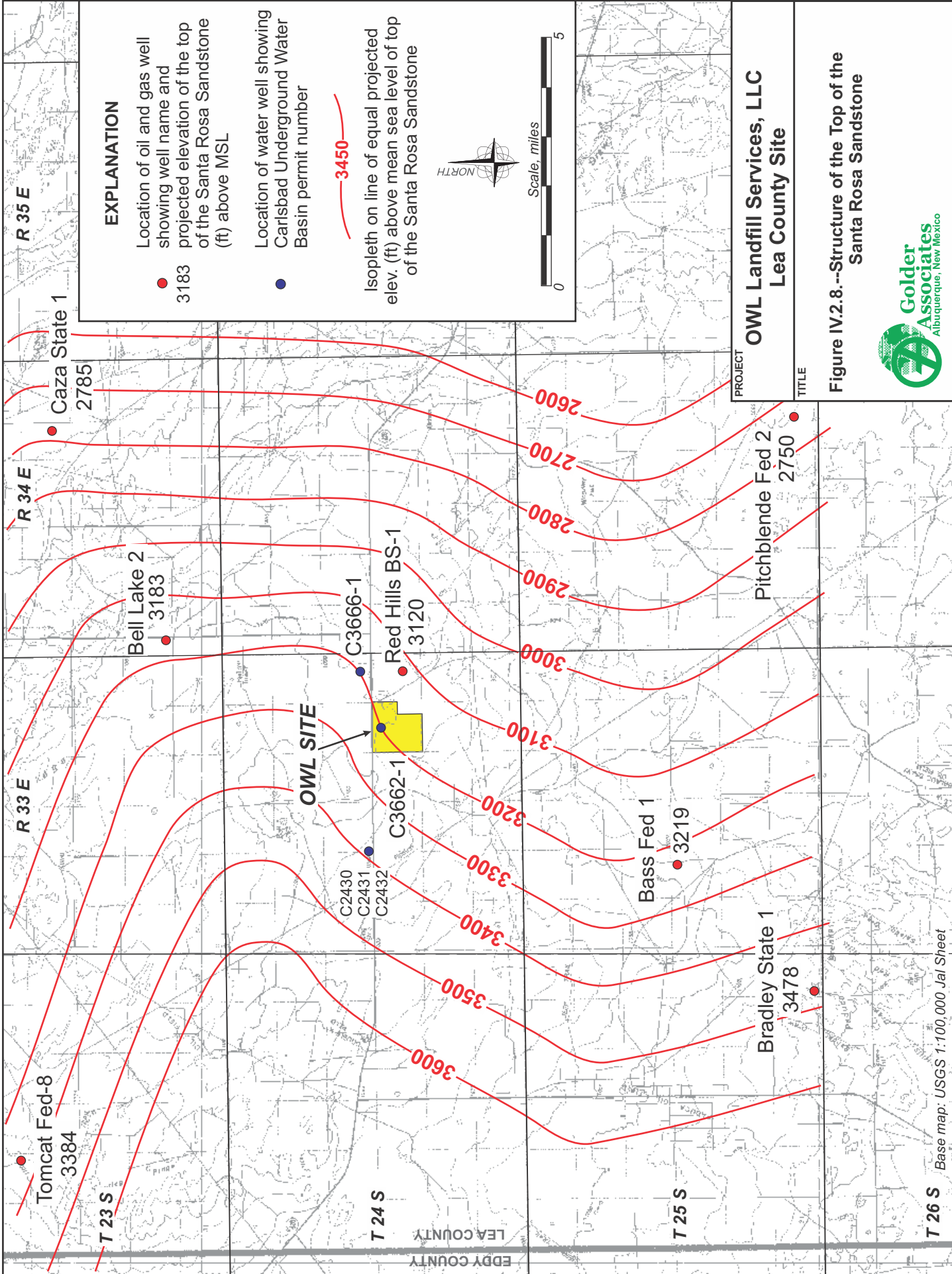
PROJECT

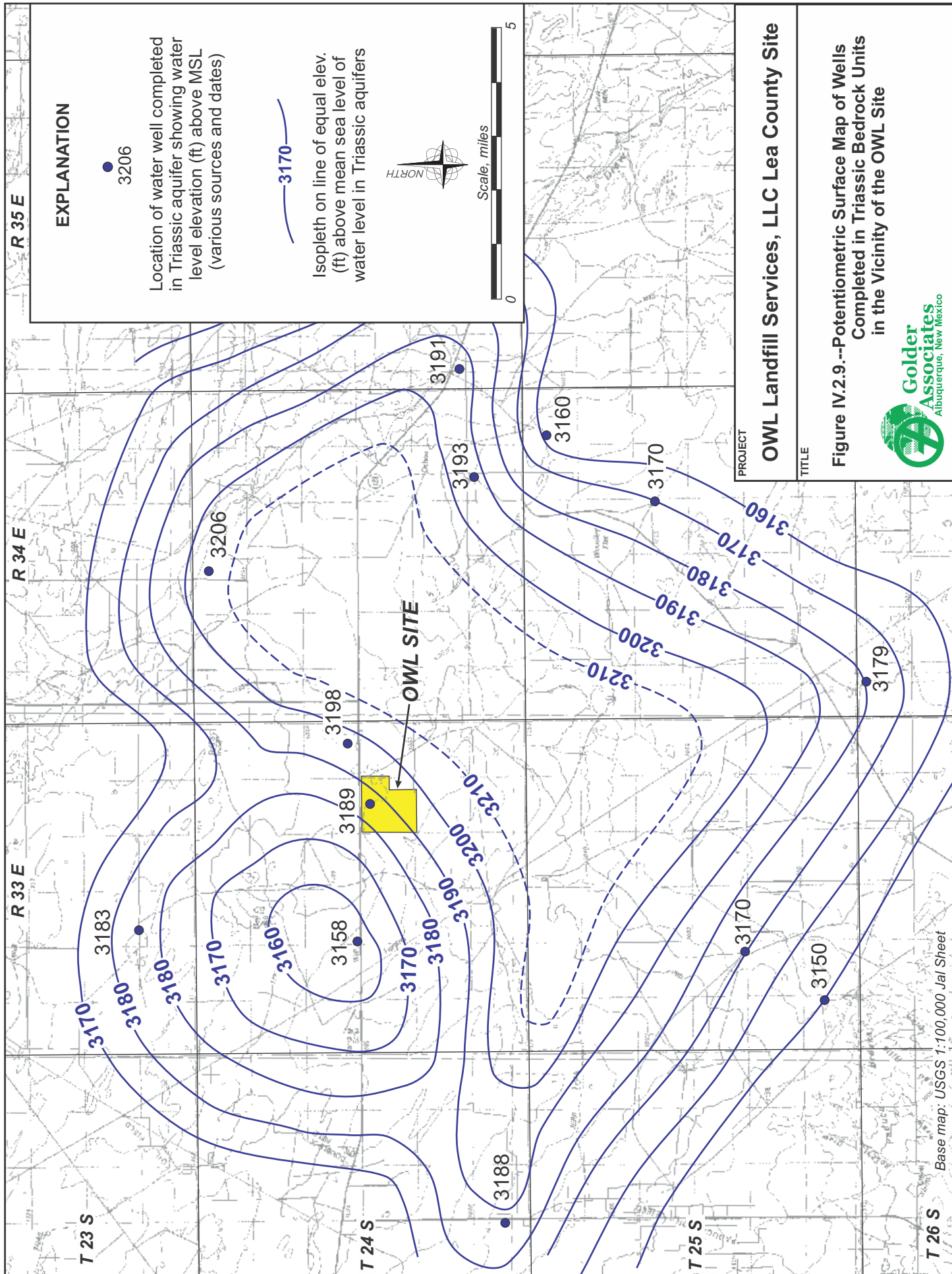
OWL Landfill Services, LLC Lea County Site

TITLE

Figure IV.2.7.--Regional Hydrogeologic Cross Section
OWL Site, Lea County New Mexico

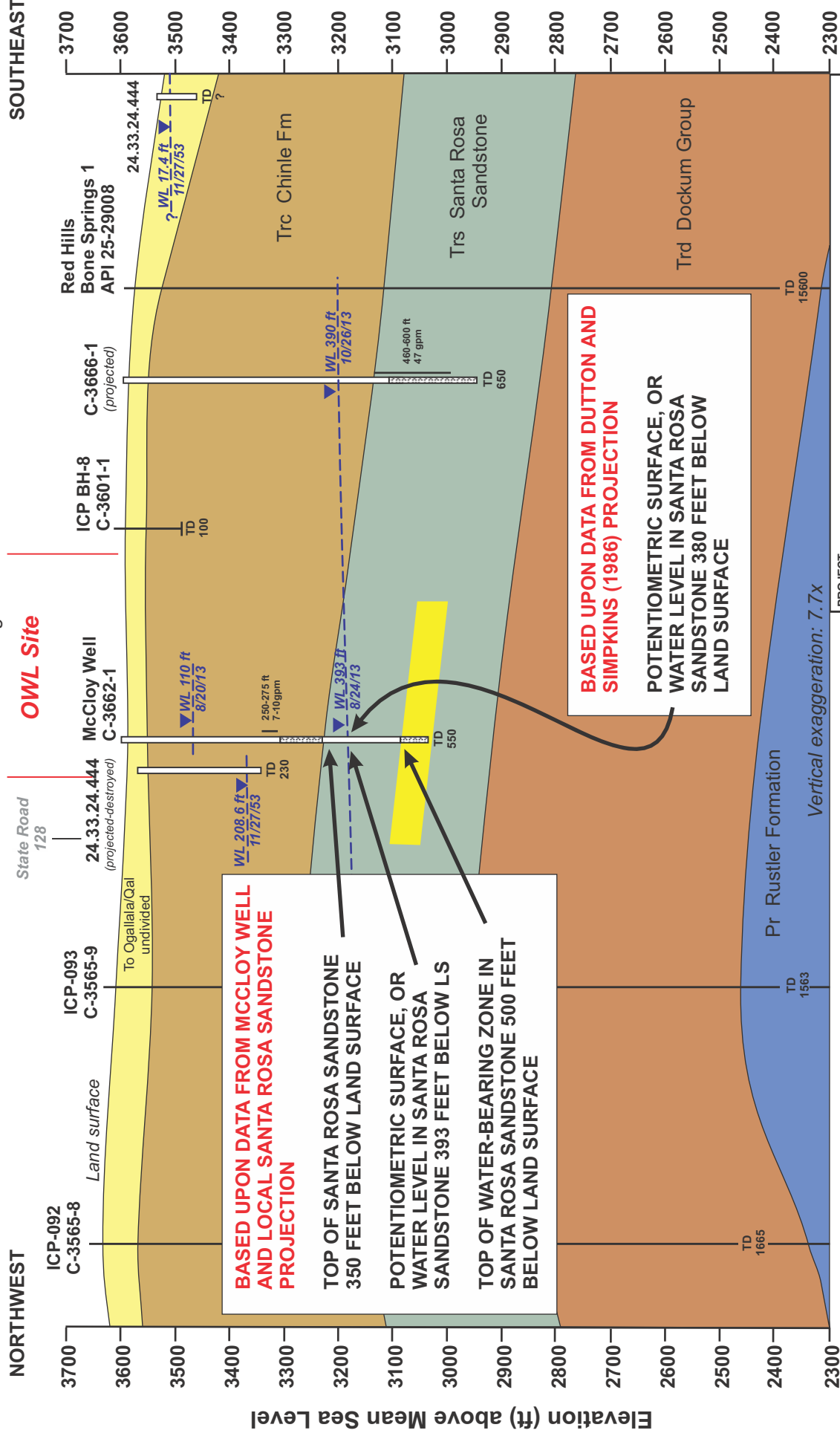





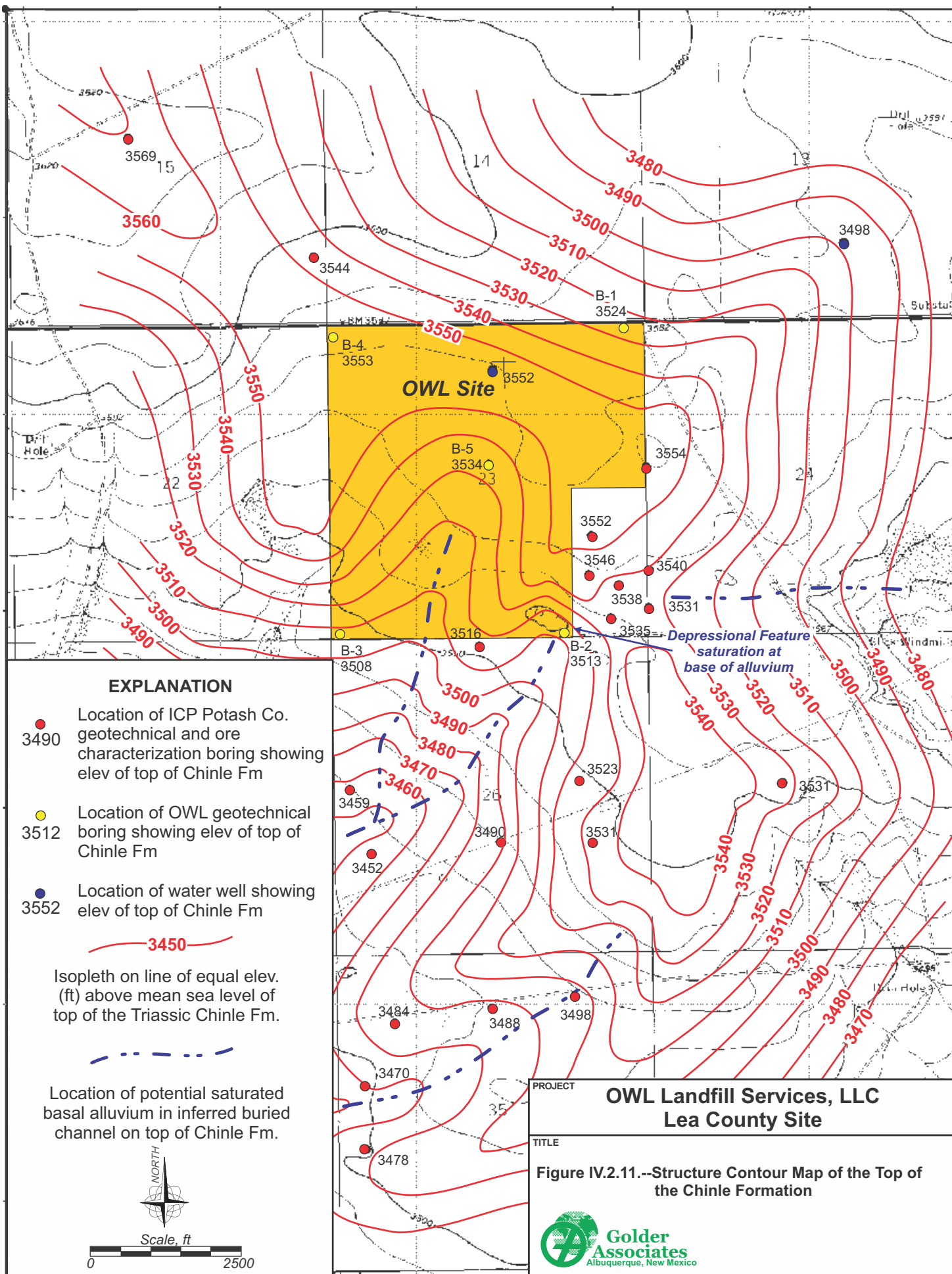


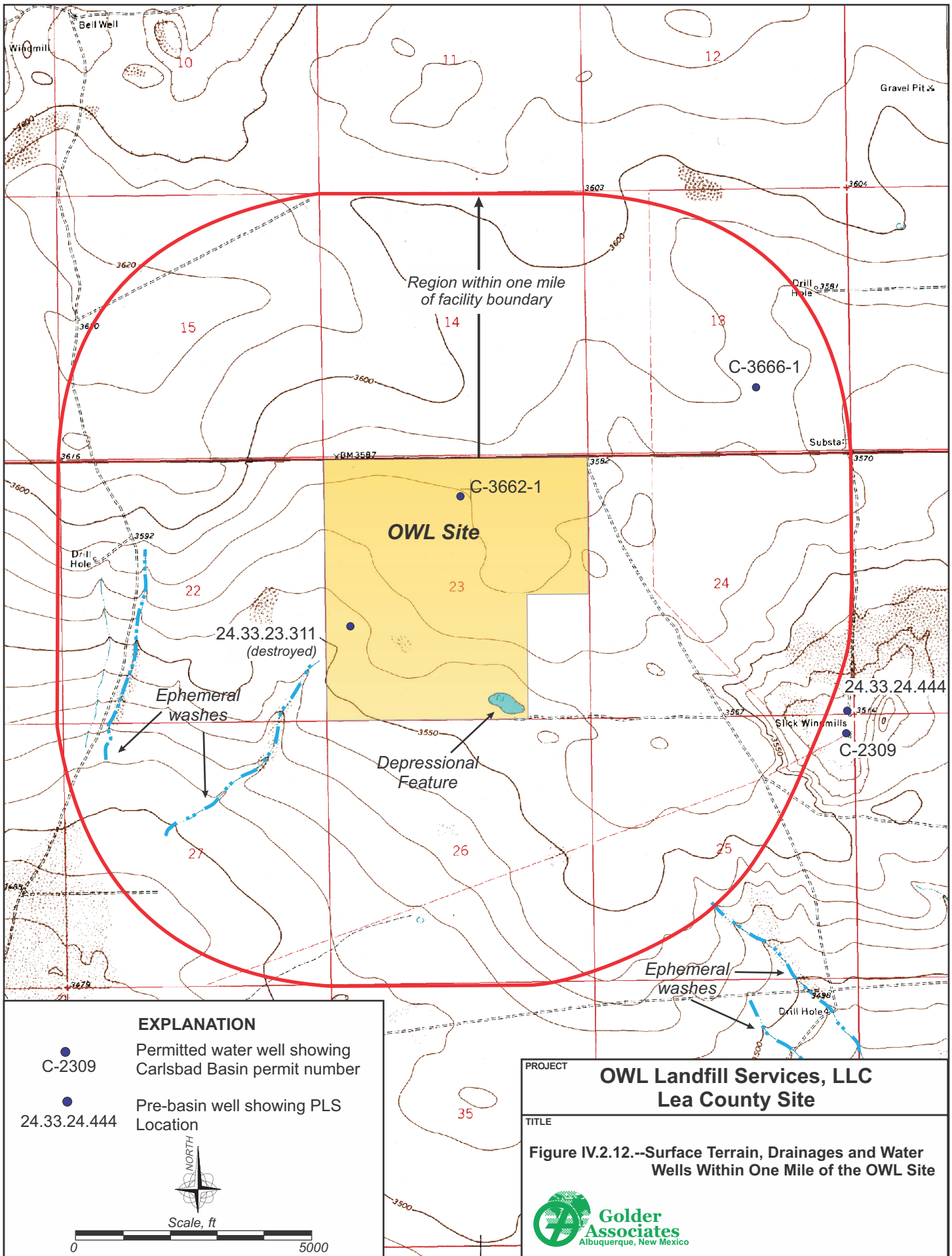
Local Hydrogeologic Cross Section OWL Site, Lea County, NM

Line of section shown in Figure IV.2.6



PROJECT	OWL Landfill Services, LLC Lea County Site
TITLE	Figure IV.2.10.--Local Hydrogeologic Cross Section OWL Site, Lea County New Mexico
 <p>Golder Associates Albuquerque, New Mexico</p>	





ATTACHMENT IV.2.A

NMOSE WELL LOGS FOR PERMITTED WELLS AND BORINGS



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

4-23-12

Corrected well log

1. GENERAL AND WELL LOCATION	POD NUMBER (WELL NUMBER) C-03528-POD1				OSE FILE NUMBER(S) C-03528-POD1				
	WELL OWNER NAME(S) MARK & ANNETTE MCCLOY				PHONE (OPTIONAL) 432-940-4459				
	WELL OWNER MAILING ADDRESS PO BOX 1076				CITY JAL		STATE NM	ZIP 88252	
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32	MINUTES 13	SECONDS 29.00 N	* ACCURACY REQUIRED ONE TENTH OF A SECOND * DATUM REQUIRED WGS 84				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS Coordinates Based on Map (Non-GPS)									
2. OPTIONAL	(2.5 ACRE) NW 1/4	(10 ACRE) NW 1/4	(40 ACRE) NW 1/4	(160 ACRE) NE 1/4	SECTION 25	TOWNSHIP 24	<input type="checkbox"/> NORTH <input checked="" type="checkbox"/> SOUTH	RANGE 32	<input checked="" type="checkbox"/> EAST <input type="checkbox"/> WEST
	SUBDIVISION NAME				LOT NUMBER	BLOCK NUMBER	UNIT/TRACT		
HYDROGRAPHIC SURVEY						MAP NUMBER		TRACT NUMBER	
3. DRILLING INFORMATION	LICENSE NUMBER WD1682		NAME OF LICENSED DRILLER JOHN NORRIS			NAME OF WELL DRILLING COMPANY HUNGRY HORSE, LLC			
	DRILLING STARTED 2-20-12		DRILLING ENDED 3-12-12		DEPTH OF COMPLETED WELL (FT) 541	BORE HOLE DEPTH (FT) 541	DEPTH WATER FIRST ENCOUNTERED (FT) 133		
	COMPLETED WELL IS: <input type="checkbox"/> ARTESIAN <input type="checkbox"/> DRY HOLE <input checked="" type="checkbox"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT)		
	DRILLING FLUID: <input type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY								
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY								
	DEPTH (FT) FROM TO		BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)	
	0 541		8 3/4	PVC	GLUED	6"	3/8	1/8	
4. WATER BEARING STRATA	DEPTH (FT) FROM TO		THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)			YIELD (GPM)		
	133 152		19	SAND			UK		
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA N/A							TOTAL ESTIMATED WELL YIELD (GPM)		

FOR OSE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER C-3528

POD NUMBER C-03528-POD1

TRN NUMBER 491386

LOCATION 24.32.15.211

PAGE 1 OF 2

5. SEAL AND PUMP	TYPE OF PUMP: <input type="checkbox"/> SUBMERSIBLE <input type="checkbox"/> JET <input type="checkbox"/> NO PUMP - WELL NOT EQUIPPED <input type="checkbox"/> TURBINE <input type="checkbox"/> CYLINDER <input type="checkbox"/> OTHER - SPECIFY: UNKNOWN						
	ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT)		BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
		FROM	TO				
		0	20				
				8 3/4	GROUT & CEMENT	8	TOP

6. GEOLOGIC LOG OF WELL	DEPTH (FT)		THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
	FROM	TO			
	0	3	3	TOPSOIL	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	3	18	15	CALICHE	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	18	26	8	SAND	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
	26	133	107	RED CLAY	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	133	152	19	SAND	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
	152	318	166	RED CLAY	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	318	345	27	SAND	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
	345	384	39	RED CLAY AND ROCK	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	384	418	34	SAND	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
	418	444	26	RED CLAY AND ROCK	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	444	468	24	SAND	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
	468	500	32	RED CLAY	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	500	508	8	SAND	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
	508	541	33	RED CLAY AND ROCK	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
					<input type="checkbox"/> YES <input type="checkbox"/> NO
					<input type="checkbox"/> YES <input type="checkbox"/> NO
				<input type="checkbox"/> YES <input type="checkbox"/> NO	

ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL.

7. TEST & ADDITIONAL INFO	WELL TEST	METHOD: <input type="checkbox"/> BAILER <input type="checkbox"/> PUMP <input type="checkbox"/> AIR LIFT <input type="checkbox"/> OTHER - SPECIFY N/A	
		TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD	
	ADDITIONAL STATEMENTS OR EXPLANATIONS		

8. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING	
	 SIGNATURE OF DRILLER	4-23-12 DATE

FOR OSE INTERNAL USE

FILE NUMBER C-3528

POD NUMBER C-03528-P001

WELL RECORD & LOG (Version 6/9/08)

TRN NUMBER 491386

LOCATION 24.32.15.2111

PAGE 2 OF 2



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 P 2: 20

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 16				OSE FILE NUMBER(S) C3600; 518382			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS			
					STATE NM			
				ZIP 88240				
WELL LOCATION (FROM GPS)	DEGREES		MINUTES		SECONDS			
	LATITUDE 32		11		43.4		N	
	LONGITUDE 103		32		37.1		W	
	* ACCURACY REQUIRED: ONE TENTH OF A SECOND							
* DATUM REQUIRED: WGS 84								
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE								
T24S; R 33E; SECTION 26								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.		
	DRILLING STARTED 01-07-13		DRILLING ENDED 01-07-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	
					DEPTH WATER FIRST ENCOUNTERED (FT) N/A			
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT)	
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	75	8"	N/A	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

FILE NUMBER

C-3600

POD NUMBER

BH

16

WR-20 WELL RECORD & LOG (Version 06/08/2012)

TRN NUMBER

518382

LOCATION

24S.33E.26

PAGE 1 OF 2

[illegible]

4. HYDROGEOLOGIC LOG OF WELL

FILE NUMBER 7-3600

POD NUMBER 34-16

TRN NUMBER 518382

PAGE 2 OF 2



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

1. GENERAL AND WELL LOCATION	POD NUMBER (WELL NUMBER) ICP-093				OSE FILE NUMBER(S) <i>13-193-2 P 1: 25</i> <i>C-3565-POD 9</i>														
	WELL OWNER NAME(S) Intercontinental Potash (USA)				PHONE (OPTIONAL) 575-942-2799														
	WELL OWNER MAILING ADDRESS 600 West Bender Boulevard				CITY Hobbs		STATE NM		ZIP 88240										
	WELL LOCATION (FROM GPS)		DEGREES LATITUDE 32		MINUTES 12		SECONDS 48.09 N		* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84										
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS																			
2. OPTIONAL	(2.5 ACRE) 1/4		(10 ACRE) 1/4		(40 ACRE) 1/4		(160 ACRE) 1/4		SECTION 15		TOWNSHIP 24		<input type="checkbox"/> NORTH <input checked="" type="checkbox"/> SOUTH		RANGE 33		<input checked="" type="checkbox"/> EAST <input type="checkbox"/> WEST		
	SUBDIVISION NAME				LOT NUMBER				BLOCK NUMBER				UNIT/TRACT						
	HYDROGRAPHIC SURVEY								MAP NUMBER				TRACT NUMBER						
3. DRILLING INFORMATION	LICENSE NUMBER WD #331		NAME OF LICENSED DRILLER Phillip Stewart						NAME OF WELL DRILLING COMPANY Stewart Brothers Drilling Co.										
	DRILLING STARTED 01/11/2013		DRILLING ENDED 02/19/2013		DEPTH OF COMPLETED WELL (FT) NA		BORE HOLE DEPTH (FT) 1562.80 FT		DEPTH WATER FIRST ENCOUNTERED (FT) NA										
	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)								
	DRILLING FLUID: <input type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,																		
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY: TACKLE, MYLOGEL, NaCl																		
	DEPTH (FT)		BORE HOLE DIA. (IN)		CASING MATERIAL		CONNECTION TYPE (CASING)		INSIDE DIA. CASING (IN)		CASING WALL THICKNESS (IN)		SLOT SIZE (IN)						
	FROM 0		TO 1245		12.25		J-55 #20 steel		theaded		6.456		0.272						
	1245		1562.80		NA														
4. WATER BEARING STRATA	DEPTH (FT)		THICKNESS (FT)		FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)								YIELD (GPM)						
	FROM NA		TO NA		NA		NA								NA				
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA Bypass flow										TOTAL ESTIMATED WELL YIELD (GPM) na									

FOR OSE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	<i>C-3565</i>	POD NUMBER	<i>9</i>	TRN NUMBER	<i>509298</i>
LOCATION	<i>T245 R33E Sec 15</i>				PAGE 1 OF 2

5. SEAL AND PUMP	TYPE OF PUMP: <input type="checkbox"/> SUBMERSIBLE <input type="checkbox"/> JET <input checked="" type="checkbox"/> NO PUMP - WELL NOT EQUIPPED <input type="checkbox"/> TURBINE <input type="checkbox"/> CYLINDER <input type="checkbox"/> OTHER - SPECIFY: STATE ENGINEER OFFICE						
	ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT)		BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT	METHOD OF PLACEMENT
		FROM	TO				
		NA	NA				

6. GEOLOGIC LOG OF WELL	DEPTH (FT)		THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
	FROM	TO			
	0	20	20	Caliche	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	20	55	35	Gutuna Fm. - red siltstones and sandstones	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	55	1238	1183	Dewey Lake Fm. Red siltstones and mudstones, gray/green mottling	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1138	1275	137	Rustler Fm./A-5, white anhydrite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1275	1306	31	H-4 sub-mbr. - milky white halite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1306	1320	14	A-4 sub-mbr. - white anhydrite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1320	1338	18	Magenta Dolomite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1338	1386	48	A-3 sub-mbr. white anhydrite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1386	1491	110	H-3 sub-mbr. - milky halite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1491	1501	10	Ore zone, anhydrite and white polyhalite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1501	1562	61	Halite and red mudstones	<input type="checkbox"/> YES <input type="checkbox"/> NO
ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL					

7. TEST & ADDITIONAL INFO	WELL TEST	METHOD: <input type="checkbox"/> BAILER <input type="checkbox"/> PUMP <input type="checkbox"/> AIR LIFT <input type="checkbox"/> OTHER - SPECIFY: NA	
		TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.	
	ADDITIONAL STATEMENTS OR EXPLANATIONS:		

8. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:	
	 SIGNATURE OF DRILLER	<u>3-27-13</u> DATE

FOR USE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER <u>C-3565</u>	POD NUMBER <u>9</u>	TRN NUMBER
LOCATION <u>T245 R33E Sect 15</u>		PAGE 2 OF 2



STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ROSWELL

Scott A. Verhines, P.E.
State Engineer

DISTRICT II
1900 West Second St.
Roswell, New Mexico 88201
Phone: (575) 622-6521
Fax: (575) 623-8559

April 18, 2013

Intercontinental Potash
Attn: Allen Hall
600 West Bender Boulevard
Hobbs, NM 88240

RE: *Well Logs* for C-3565 POD 8 and C-3565 POD 9

Greetings:

We have received and filed your Well Logs for the above referenced wells.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Goetz", is written over a horizontal line.

Catherine Goetz
Water Resource Specialist
District II Office of the State Engineer

Enclosures
cc: Office of State Engineer, Santa Fe

Goetz, Catherine, OSE

From: Allen Hall [ahall@icpotash.com]
Sent: Monday, April 15, 2013 11:27 AM
To: Goetz, Catherine, OSE
Subject: RE: ICP-092 and ICP-093

Hi Catherine,

The borehole diameters for ICP092 and ICP093 were 12.25", from surface to casing depth, below casing 6.25". DST's were conducted on the Magenta mbr., and the Culebra mbr. In borehole ICP092, but not in ICP093. ICP had INTERA run the tests on the hydrology of these two mbrs., our concern was water from these units impacting the mine shaft in the future. I need to contact Tim Dale at INTERA for the results of the Drill Stem Tests.

Thanks,

Allen

From: Goetz, Catherine, OSE [mailto:Catherine.Goetz@state.nm.us]
Sent: Monday, April 15, 2013 9:01 AM
To: Allen Hall
Subject: ICP-092 and ICP-093

Hi Mr. Hall,

Trying to get some items off the desk.

I received the Well Record and Log from the Stewart brothers for C-3565 POD 8 (ICP-092) and C-3565 POD9 (ICP-093).

Do you have the borehole diameters and if water bearing or not for the lower intervals for both wells?

ICP-092: 1245 to 1665 ft

ICP-093: 1245 to 1562.8 ft

Want to attach to well record so I can file these documents.

If you prefer, I'll contact Stewart Bros. for the info.

Thanks,

Cath Goetz



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2012 DEC 11 P 4: 02

1. GENERAL AND WELL LOCATION	POD NUMBER (WELL NUMBER)				OSE FILE NUMBER(S)					
	ICP-085				C-3565 POD 3					
	WELL OWNER NAME(S)				PHONE (OPTIONAL)					
	Intercontinental Potash (USA)				575-942-2799					
WELL OWNER MAILING ADDRESS				CITY		STATE		ZIP		
600 West Bender Boulevard				Hobbs		NM		88240		
WELL LOCATION (FROM GPS)		DEGREES		MINUTES		SECONDS		* ACCURACY REQUIRED: ONE TENTH OF A SECOND		
LATITUDE		32		13		39.75 N		* DATUM REQUIRED: WGS 84		
LONGITUDE		103		35		27.62 W				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS										
2. OPTIONAL	(2.5 ACRE)		(10 ACRE)		(40 ACRE)		(160 ACRE)		SECTION	
	1/4		1/4		1/4		1/4		8	
	SUBDIVISION NAME				LOT NUMBER		BLOCK NUMBER		UNIT/TRACT	
	HYDROGRAPHIC SURVEY				MAP NUMBER		TRACT NUMBER			
3. DRILLING INFORMATION	LICENSE NUMBER		NAME OF LICENSED DRILLER				NAME OF WELL DRILLING COMPANY			
	WD #331		Phillip Stewart				Stewart Brothers Drilling Co.			
	DRILLING STARTED		DRILLING ENDED		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT)		DEPTH WATER FIRST ENCOUNTERED (FT)	
	9/27/2012		10/21/2012		NA		1533 FT		NA	
	COMPLETED WELL IS:				STATIC WATER LEVEL IN COMPLETED WELL (FT)					
	<input type="checkbox"/> ARTESIAN <input checked="" type="checkbox"/> DRY HOLE <input type="checkbox"/> SHALLOW (UNCONFINED)				NA					
	DRILLING FLUID:				ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,					
	<input type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY									
	DRILLING METHOD:				TACKLE, MYLOGEL, NaCl					
	<input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY									
DEPTH (FT)		BORE HOLE DIA. (IN)		CASING MATERIAL		CONNECTION TYPE (CASING)		INSIDE DIA. CASING (IN)		
FROM		TO								
0		1250		12.625		J-55 #36 steel		8.921		
1250		1533		8.75		NA		0.302		
4. WATER BEARING STRATA	DEPTH (FT)		THICKNESS (FT)		FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)				YIELD (GPM)	
	FROM		TO							
	NA		NA		NA				NA	
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA							TOTAL ESTIMATED WELL YIELD (GPM)			
Bypass flow							na			

FOR OSE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION	PAGE 1 OF 2	

5. SEAL AND PUMP		STATE ENGINEER OFFICE ROSWELL, NEW MEXICO					
		TYPE OF PUMP: <input type="checkbox"/> SUBMERSIBLE <input type="checkbox"/> JET <input checked="" type="checkbox"/> NO PUMP - WELL NOT EQUIPPED					
		<input type="checkbox"/> TURBINE <input type="checkbox"/> CYLINDER <input type="checkbox"/> OTHER - SPECIFY:					
ANNULAR SEAL AND GRAVEL PACK		DEPTH (FT)		BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
		FROM	TO				
		NA					

6. GEOLOGIC LOG OF WELL		DEPTH (FT)		THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?		
		FROM	TO			<input type="checkbox"/> YES	<input type="checkbox"/> NO	
			0	20	20	Caliche	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
			20	55	35	Gutuna Fm. - red siltstones and sandstones	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	55	1227	1181	Dewey Lake Fm. Red siltstones and mudstones, gray/green mottling	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO		
	1227	1262	35	Rustler Fm./A-5, white anhydrite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO		
	1262	1295	33	H-4 sub-mbr. - milky white halite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO		
	1295	1310	15	A-4 sub-mbr. - white anhydrite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO		
	1310	1330	20	Magenta Dolomite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO		
	1330	1375	45	A-3 sub-mbr. white anhydrite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO		
	1375	1479	112	H-3 sub-mbr. - milky halite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO		
	1479	1489	10	Ore zone, anhydrite and white polyhalite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO		
	1489	1533	44	Halite, with some anhydrite	<input type="checkbox"/> YES	<input type="checkbox"/> NO		
					<input type="checkbox"/> YES	<input type="checkbox"/> NO		
					<input type="checkbox"/> YES	<input type="checkbox"/> NO		
					<input type="checkbox"/> YES	<input type="checkbox"/> NO		
					<input type="checkbox"/> YES	<input type="checkbox"/> NO		
					<input type="checkbox"/> YES	<input type="checkbox"/> NO		
					<input type="checkbox"/> YES	<input type="checkbox"/> NO		
ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL.								

7. TEST & ADDITIONAL INFO		WELL TEST	
		METHOD: <input type="checkbox"/> HAULER <input type="checkbox"/> PUMP <input type="checkbox"/> AIR LIFT <input type="checkbox"/> OTHER - SPECIFY: NA	
		TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.	
		ADDITIONAL STATEMENTS OR EXPLANATIONS:	

8. SIGNATURE	
<p>THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:</p> <div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="text-align: center;"> SIGNATURE OF DRILLER </div> <div style="text-align: center;"> 12-10-12 DATE </div> </div>	

FOR OSE INTERNAL USE		WELL RECORD & LOG (Version 6/9/08)	
FILE NUMBER	POD NUMBER	TRN NUMBER	
LOCATION			PAGE 2 OF 2



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2012 DEC 11 P 4: 02

1. GENERAL AND WELL LOCATION	POD NUMBER (WELL NUMBER) ICP-085				OSE FILE NUMBER(S) C-3565 POD 3			
	WELL OWNER NAME(S) Intercontinental Potash (USA)				PHONE (OPTIONAL) 575-942-2799			
	WELL OWNER MAILING ADDRESS 600 West Bender Boulevard				CITY Hobbs		STATE NM	ZIP 88240
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32	MINUTES 13	SECONDS 39.75 N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84			
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS								
2. OPTIONAL	(2.5 ACRE) 1/4	(10 ACRE) 1/4	(40 ACRE) 1/4	(160 ACRE) 1/4	SECTION 8	TOWNSHIP 24	RANGE 33	
	SUBDIVISION NAME				LOT NUMBER	BLOCK NUMBER	UNIT/TRACT	
	HYDROGRAPHIC SURVEY				MAP NUMBER		TRACT NUMBER	
3. DRILLING INFORMATION	LICENSE NUMBER WD #331		NAME OF LICENSED DRILLER Phillip Stewart			NAME OF WELL DRILLING COMPANY Stewart Brothers Drilling Co.		
	DRILLING STARTED 9/27/2012		DRILLING ENDED 10/21/2012		DEPTH OF COMPLETED WELL (FT) NA	BORE HOLE DEPTH (FT) 1533 FT	DEPTH WATER FIRST ENCOUNTERED (FT) NA	
	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) NA		
	DRILLING FLUID: <input type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,							
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY: TACKLE, MYLOGEL, NaCl							
	DEPTH (FT)		BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	
	FROM	TO						
	0	1250	12.625	J-55 #36 steel	threaded	8.921	0.302	
	1250	1533	8.75	NA				
4. WATER BEARING STRATA	DEPTH (FT)		THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)			YIELD (GPM)	
	FROM	TO						
	NA		NA	NA			NA	
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA Bypass flow					TOTAL ESTIMATED WELL YIELD (GPM) na			

FOR OSE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION	PAGE 1 OF 2	

3. SEAL AND PUMP	TYPE OF PUMP: <input type="checkbox"/> SUBMERSIBLE <input type="checkbox"/> JET <input checked="" type="checkbox"/> NO PUMP - WELL NOT EQUIPPED <input type="checkbox"/> TURBINE <input type="checkbox"/> CYLINDER <input type="checkbox"/> OTHER - SPECIFY:						
	ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT)		BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
		FROM	TO				
		NA	NA				

4. GEOLOGIC LOG OF WELL	DEPTH (FT)		THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
	FROM	TO			
	0	20	20	Caliche	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	20	55	35	Gutuna Fm. - red siltstones and sandstones	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	55	1227	1181	Dewey Lake Fm. Red siltstones and mudstones, gray/green mottling	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1227	1262	35	Rustler Fm./A-5, white anhydrite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1262	1295	33	H-4 sub-mbr. - milky white halite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1295	1310	15	A-4 sub-mbr. - white anhydrite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1310	1330	20	Magenta Dolomite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1330	1375	45	A-3 sub-mbr. white anhydrite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1375	1479	112	H-3 sub-mbr. - milky halite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1479	1489	10	Ore zone, anhydrite and white polyhalite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	1489	1533	44	Halite, with some anhydrite	<input type="checkbox"/> YES <input type="checkbox"/> NO
	ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL.				

7. TEST & ADDITIONAL INFO	WELL TEST	METHOD: <input type="checkbox"/> BAILER <input type="checkbox"/> PUMP <input type="checkbox"/> AIR LIFT <input type="checkbox"/> OTHER - SPECIFY: NA TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.
	ADDITIONAL STATEMENTS OR EXPLANATIONS:	

8. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:	
	 SIGNATURE OF DRILLER	<u>12-10-12</u> DATE

FOR OSE INTERNAL USE		WELL RECORD & LOG (Version 6/9/08)	
FILE NUMBER	POD NUMBER	TRN NUMBER	
LOCATION: <u>2017 DEC 11 P 4:00</u>	PAGE 2 OF 2		

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSARIO

2013 APR -2 P 1:25

1. GENERAL AND WELL LOCATION	POD NUMBER (WELL NUMBER) ICP-092				OSE FILE NUMBER(S) C - 03565 Pod 8					
	WELL OWNER NAME(S) Intercontinental Potash (USA)				PHONE (OPTIONAL) 575-942-2799					
	WELL OWNER MAILING ADDRESS 600 West Bender Boulevard				CITY Hobbs		STATE NM		ZIP 88240	
	WELL LOCATION (FROM GPS)		DEGREES LATITUDE 32		MINUTES 13		SECONDS 8.17 N		* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84	
		LONGITUDE 103		33		44.19 W				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS										
2. OPTIONAL	(2.5 ACRE) 1/4		(10 ACRE) 1/4		(40 ACRE) 1/4		(160 ACRE) 1/4		SECTION 15	
	SUBDIVISION NAME				LOT NUMBER		TOWNSHIP 24		RANGE 33	
							<input type="checkbox"/> NORTH <input checked="" type="checkbox"/> SOUTH		<input checked="" type="checkbox"/> EAST <input type="checkbox"/> WEST	
	HYDROGRAPHIC SURVEY				MAP NUMBER		BLOCK NUMBER		UNIT/TRACT	
3. DRILLING INFORMATION	LICENSE NUMBER WD #331		NAME OF LICENSED DRILLER Phillip Stewart				NAME OF WELL DRILLING COMPANY Stewart Brothers Drilling Co.			
	DRILLING STARTED 02/19/2013		DRILLING ENDED 03/25/2013		DEPTH OF COMPLETED WELL (FT) NA		BORE HOLE DEPTH (FT) 1665 FT		DEPTH WATER FIRST ENCOUNTERED (FT) NA	
	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)	
	DRILLING FLUID: <input type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,									
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY: TACKLE, MYLOGEL, NaCl									
	DEPTH (FT)		BORE HOLE DIA. (IN)		CASING MATERIAL		CONNECTION TYPE (CASING)		INSIDE DIA. CASING (IN)	
	FROM TO									
	0 1284		12.25		J-55 #20 steel		threaded		6.456	
	1245 1665				NA				0.272	
4. WATER BEARING STRATA	DEPTH (FT)		THICKNESS (FT)		FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)				YIELD (GPM)	
	FROM TO									
	NA		NA		NA				NA	
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA Bypass flow								TOTAL ESTIMATED WELL YIELD (GPM) na		

FOR OSE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	C - 3565	POD NUMBER	8	TRN NUMBER	509298
LOCATION	T24S - 15R24E Section 15				PAGE 1 OF 2

5. SEAL AND PUMP	TYPE OF PUMP: <input type="checkbox"/> SUBMERSIBLE <input type="checkbox"/> JET <input checked="" type="checkbox"/> NO PUMP - WELL NOT EQUIPPED <input type="checkbox"/> TURBINE <input type="checkbox"/> CYLINDER <input type="checkbox"/> OTHER - SPECIFY:						STATE ENGINEER OFFICE ROSWELL	
	ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT)		BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT	
		FROM	TO					
		NA	NA					

6. GEOLOGIC LOG OF WELL	DEPTH (FT)		THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?	
	FROM	TO			<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	0	20	20	Caliche	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	20	55	35	Gutuna Fm. - red siltstones and sandstones	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	55	1284	1229	Dewey Lake Fm. Red siltstones and mudstones, gray/green mottling	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	1284	1275	137	Rustler Fm./A-5, white anhydrite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	1275	1306	31	H-4 sub-mbr. - milky white halite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	1306	1320	14	A-4 sub-mbr. - white anhydrite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	1320	1338	18	Magenta Dolomite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	1338	1386	48	A-3 sub-mbr. white anhydrite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	1386	1516	110	H-3 sub-mbr. - milky halite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	1516	1526	10	Ore zone, anhydrite and white polyhalite	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
	1526	1563	61	Halite and red mudstones	<input type="checkbox"/> YES	<input type="checkbox"/> NO
	1563	1585	18	Anhydrite	<input type="checkbox"/> YES	<input type="checkbox"/> NO
	1585	1606	31	Dolomite - Culebra	<input type="checkbox"/> YES	<input type="checkbox"/> NO
	1606	1655	49	Halite, red mudstones H2/M2	<input type="checkbox"/> YES	<input type="checkbox"/> NO
					<input type="checkbox"/> YES	<input type="checkbox"/> NO
				<input type="checkbox"/> YES	<input type="checkbox"/> NO	
				<input type="checkbox"/> YES	<input type="checkbox"/> NO	
ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL						

7. TEST & ADDITIONAL INFO	WELL TEST	METHOD: <input type="checkbox"/> BAILER <input type="checkbox"/> PUMP <input type="checkbox"/> AIR LIFT <input type="checkbox"/> OTHER - SPECIFY: NA				
		TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.				
	ADDITIONAL STATEMENTS OR EXPLANATIONS:					

8. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:	
	 SIGNATURE OF DRILLER	_____ DATE

FOR USE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER <u>C-3565</u>	POD NUMBER <u>8</u>	TRN NUMBER
LOCATION <u>T245 - R24E Sect 15</u>		PAGE 2 OF 2



STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ROSWELL

Scott A. Verhines, P.E.
State Engineer

DISTRICT II
1900 West Second St.
Roswell, New Mexico 88201
Phone: (575) 622-6521
Fax: (575) 623-8559

April 18, 2013

Intercontinental Potash
Attn: Allen Hall
600 West Bender Boulevard
Hobbs, NM 88240

RE: *Well Logs* for C-3565 POD 8 and C-3565 POD 9

Greetings:

We have received and filed your Well Logs for the above referenced wells.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Goetz", written over a horizontal line.

Catherine Goetz
Water Resource Specialist
District II Office of the State Engineer

Enclosures

cc: Office of State Engineer, Santa Fe

Goetz, Catherine, OSE

From: Allen Hall [ahall@icpotash.com]
Sent: Monday, April 15, 2013 11:27 AM
To: Goetz, Catherine, OSE
Subject: RE: ICP-092 and ICP-093

Hi Catherine,

The borehole diameters for ICP092 and ICP093 were 12.25", from surface to casing depth, below casing 6.25". DST's were conducted on the Magenta mbr., and the Culebra mbr. In borehole ICP092, but not in ICP093. ICP had INTERA run the tests on the hydrology of these two mbrs., our concern was water from these units impacting the mine shaft in the future. I need to contact Tim Dale at INTERA for the results of the Drill Stem Tests.

Thanks,

Allen

From: Goetz, Catherine, OSE [mailto:Catherine.Goetz@state.nm.us]
Sent: Monday, April 15, 2013 9:01 AM
To: Allen Hall
Subject: ICP-092 and ICP-093

Hi Mr. Hall,

Trying to get some items off the desk.

I received the Well Record and Log from the Stewart brothers for C-3565 POD 8 (ICP-092) and C-3565 POD9 (ICP-093).

Do you have the borehole diameters and if water bearing or not for the lower intervals for both wells?

ICP-092: 1245 to 1665 ft

ICP-093: 1245 to 1562.8 ft

Want to attach to well record so I can file these documents.

If you prefer, I'll contact Stewart Bros. for the info.

Thanks,
Cath Goetz

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Transwestern Pipeline Owner's Well No. SVE-13
 Street or Post Office Address 6381 North Main Street
 City and State Albuquerque, New Mexico 88201

Well was drilled under Permit No. N/A and is located in the:

a. SE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 1 Township 24S Range 33E N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Geoprojects International License No. WD 1311
 Address 8834 Circle Drive Austin, TX 78736

Drilling Began 12/14/99 Completed 12/15/99 Type tools Air Rotary & HSA Size of hole 8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 99 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well 90.4 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
40	99	59	Red Sand	N/A

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Casing / Screen	Perforations	
			Top	Bottom			From	To
2	0.69	4	0	84	84	SCH 40 PVC Casing	N/A	N/A
2	2.1	4	84	99	15	SCH 40 PVC Screen	84	99

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
1	78	8"	13.2	25.4	Pumped through HSA
78	81	8"	1.5 Bentonite Hole Plug	1	Surface Drop through HSA
81	99	8"	8 1/10 Sand	6	Surface Drop through HSA

Section 5. PLUGGING RECORD

Plugging Contractor _____
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 01-31-2000


Quad _____ FWL _____ FSL _____

File No _____ Use _____ Location No. 24S, 33E, 1, 24

[illegible]

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

belief, the foregoing is a true and correct record of the above


Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. If this form is used as a plugging record, only Section 1(a) and Section 4 shall be completed.

**STATE ENGINEER OFFICE
WELL RECORD**

Section 1. GENERAL INFORMATION

(A) Owner of well Transwestern Pipeline Owner's Well No. MW-13
 Street or Post Office Address 6381 North Main Street
 City and State Roswell, New Mexico 88201

Well was drilled under Permit No. N/A and is located in the:

a. SE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 1 Township 24S Range 33E N.M.P.N.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor GeoProjects International License No. WD 1311

Address 8534 Circle Drive Austin TX 78736

Drilling Began 12/14/99 Completed 12/14/99 Type tools Air Rotary + HSA Size of hole 8" in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 90 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well 83.4 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
<u>80</u>	<u>90</u>	<u>10</u>	<u>Red Sandstone</u>	<u>N/A</u>
			<u>H₂O @ 83.4'</u>	

OD

Section 3. RECORD OF CASING

SSWB

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Casing / Screen	Perforations	
			Top	Bottom			From	To
<u>2</u>	<u>0.69</u>	<u>4</u>	<u>0</u>	<u>75</u>	<u>75</u>	<u>SCH 40 PVC</u>	<u>N/A</u>	<u>N/A</u>
<u>2</u>	<u>2.1</u>	<u>4</u>	<u>75</u>	<u>90</u>	<u>15</u>	<u>SCH 40 PVC</u>	<u>75</u>	<u>90</u>

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
<u>1</u>	<u>69</u>	<u>8"</u>	<u>11.5</u>	<u>22</u>	<u>Pumped through HSA</u>
<u>69</u>	<u>72</u>	<u>8"</u>	<u>Bentonite Hole Plug</u>	<u>1</u>	<u>Surface Drop through HSA</u>
<u>72</u>	<u>90</u>	<u>8"</u>	<u>8/16 Sand</u>	<u>6</u>	<u>Surface Drop through HSA</u>

Section 5. PLUGGING RECORD

Plugging Contractor _____
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
<u>1</u>			
<u>2</u>			
<u>3</u>			
<u>4</u>			

FOR USE OF STATE ENGINEER ONLY

Date Received 01-31-2000


Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. 24S.33E.1.24

[illegible]

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

belief, the foregoing is a true and correct record of the above


Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. If this form is used as a plugging record, only Section 1(a) and Section 4 shall be completed.



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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					OSE FILE NUMBER(S) C-3666		
WELL OWNER NAME(S) AGAVE ENERGY COMPANY					PHONE (OPTIONAL)		
WELL OWNER MAILING ADDRESS 105 SOUTH 4TH STREET					CITY ARTESIA	STATE NM	ZIP 88210
WELL LOCATION (FROM GPS)	DEGREES		MINUTES	SECONDS	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84		
	LATITUDE	32	12	49.3 N			
	LONGITUDE	103	31	25.1 W			
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE							

2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1058		NAME OF LICENSED DRILLER CASEY KEY			NAME OF WELL DRILLING COMPANY KEYS DRILLING & PUMP SERVICE INC.		
	DRILLING STARTED 10-18-2013		DRILLING ENDED 10-26-2013		DEPTH OF COMPLETED WELL (FT) 650	BORE HOLE DEPTH (FT) 650	DEPTH WATER FIRST ENCOUNTERED (FT) 460	
	COMPLETED WELL IS: <input type="checkbox"/> ARTESIAN <input type="checkbox"/> DRY HOLE <input checked="" type="checkbox"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT) 390	
	DRILLING FLUID: <input checked="" type="checkbox"/> AIR <input type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY:							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	21	17-1/2"	STEEL		13-3/8"	.375	
	-2.5	485	12-1/4"	STEEL	WELD	8"	.322	
	485	650	12-1/4"	STEEL	WELD	8"	.322	.1875

3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
	FROM	TO				
	0	20	17-1/2"	CEMENT		STATE ENGINEER'S OFFICE ROSA 2013 NOV 14
	0	325	12-1/4"	CEMENT		
	325	390	12-1/4"	BENTONITE HOLE PLUG		
	390	650	12-1/4"	5/8" GRAVEL		

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3666	POD NUMBER		TRN NUMBER	532991
LOCATION	24S. 33E. 13		4-3-2		PAGE 1 OF 2

	DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)
	FROM	TO				
4. HYDROGEOLOGIC LOG OF WELL	0	10	10	TOP SOIL	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	10	15	5	WHITE CALICHE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	15	50	35	RED SAND	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	50	65	15	RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	65	90	25	GREY SAND AND CLAY	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	90	97	7	DARK RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	97	100	3	GREY SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	100	108	8	DARK RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	108	117	9	GREY SAND AND CLAY	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	117	123	6	DARK RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	123	155	41	GREY SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	155	160	5	DARK RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	160	195	35	GREY CLAY AND SAND	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	195	210	15	DARK RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	210	230	20	GREY SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	230	300	70	RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	300	320	20	MULTI-COLOR SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	320	460	140	RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	460	465	5	MILT-COLER ROCK	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	2-GPM
	465	490	25	RED SANDSTONE	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
490	535	45	MULTI-COLORED CONGLOMERATE	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	20-GPM	
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input checked="" type="checkbox"/> PUMP <input type="checkbox"/> AIR LIFT <input type="checkbox"/> BAILER <input type="checkbox"/> OTHER - SPECIFY:					TOTAL ESTIMATED WELL YIELD (gpm): 38	
5. TEST; RIG SUPERVISION	WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.				
	MISCELLANEOUS INFORMATION: 535 TO 565 - 30 - RED SANDSTONE NO H2O 565 TO 600 - 35 - MULTI-COLORED CONGLOMERATE 25-GPM 600 TO 650 - 50 - RED SANDSTONE NO H2O					
	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE: CASEY KEY					
6. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING: <div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="text-align: center;"> SIGNATURE OF DRILLER / PRINT SIGNEE NAME </div> <div style="text-align: center;"> Gary Key DATE </div> </div>					

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) C-03662-POD1				OSE FILE NUMBER(S) C-03662									
	WELL OWNER NAME(S) MARK McCloy (Mt M Ranch)				PHONE (OPTIONAL)									
	WELL OWNER MAILING ADDRESS				CITY		STATE		ZIP					
	WELL LOCATION (FROM GPS)		DEGREES LATITUDE 32		MINUTES 12		SECONDS 29.00		N					
		LONGITUDE 103		32		33.81		W						
* ACCURACY REQUIRED: ONE TENTH OF A SECOND														
* DATUM REQUIRED: WGS 84														
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE Hwy 128 @ 30 min - 1/4 mile south														
2. DRILLING & CASING INFORMATION	LICENSE NUMBER 1654		NAME OF LICENSED DRILLER John Simon				NAME OF WELL DRILLING COMPANY Simon Drilling & Const							
	DRILLING STARTED 8/19/13		DRILLING ENDED 8/20/13		DEPTH OF COMPLETED WELL (FT) 550'-0		BORE HOLE DEPTH (FT) 550'-0		DEPTH WATER FIRST ENCOUNTERED (FT) 275'-0					
	COMPLETED WELL IS:		<input type="checkbox"/> ARTESIAN		<input type="checkbox"/> DRY HOLE		<input checked="" type="checkbox"/> SHALLOW (UNCONFINED)		STATIC WATER LEVEL IN COMPLETED WELL (FT) 110'-0					
	DRILLING FLUID:		<input checked="" type="checkbox"/> AIR		<input type="checkbox"/> MUD		<input type="checkbox"/> ADDITIVES - SPECIFY:							
	DRILLING METHOD:		<input checked="" type="checkbox"/> ROTARY		<input checked="" type="checkbox"/> HAMMER		<input type="checkbox"/> CABLE TOOL		<input type="checkbox"/> OTHER - SPECIFY:					
	DEPTH (feet bgl)		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)	
	FROM TO													
	0 280		10"		PVC		Certa-Lok		6"		DR-17		Blank	
	280 360		10"		PVC		Certa-Lok		6"		DR-17		032 ser	
	360 500		10		PVC		Certa-Lok		6"		DR-17		Blank	
500 550		10		PVC		Certa-Lok		6"		DR-17		Screen		
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)		LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL				AMOUNT (cubic feet)		METHOD OF PLACEMENT			
	FROM TO													
	0 20		10		3/8 hole plug - Bentonite				8 bags SD16s		gravity			
	20 550		10		3/8 pea gravel pack				5 yds		gravity			

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WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER

C-3662

POD NUMBER

TRN NUMBER

534516

Domestic/Stock

245.33E.23.2-1-3

DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)
FROM	TO				
0	3	3	Brown sand	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
3	30	27	caliche	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
30	40	10	Red sandstone	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
40	55	15	grey sandstone	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
55	65	10	Red shale	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
65	75	10	grey sandstone	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
75	250	175	Red shale	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
250	275	25	grey sandstone	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	7-10
275	550	275	Red shale	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
		550		<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
				<input type="checkbox"/> Y <input type="checkbox"/> N	
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input type="checkbox"/> PUMP				TOTAL ESTIMATED WELL YIELD (gpm):	
<input checked="" type="checkbox"/> AIR LIFT <input type="checkbox"/> BAILER <input type="checkbox"/> OTHER - SPECIFY:				7-10	

5. TEST; RIG SUPERVISION	WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.
	MISCELLANEOUS INFORMATION:	
	none	
6. SIGNATURE	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:	
	none	
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:		
Signature of Driller / Print Signee Name: <u>John Sieman</u>		Date: <u>8/21/13</u>

FOR OSE INTERNAL USE		WR-20 WELL RECORD & LOG (Version 06/08/2012)	
FILE NUMBER	C-3662	POD NUMBER	534516
		245.33E.23.2-1-3	



WELL RECORD & LOG

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ROSWELL

2013 JAN 29 10:20 AM

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 28				OSE FILE NUMBER(S) C3603; 518404			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS		STATE NM	ZIP 88240
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32	MINUTES 10	SECONDS 30.4	N	* ACCURACY REQUIRED ONE TENTH OF A SECOND		
	LONGITUDE 103	32	58.5	W	* DATUM REQUIRED WGS 84			
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 35								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.		
	DRILLING STARTED 01-12-13		DRILLING ENDED 01-13-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)							STATIC WATER LEVEL IN COMPLETED WELL (FT)
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	75	8"	N/A	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

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FILE NUMBER

C-3603

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TRN NUMBER

518404

LOCATION

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[illegible]

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input type="radio"/> PUMP		TOTAL ESTIMATED WELL YIELD (gpm)
<input type="radio"/> AIR LIFT	<input type="radio"/> BAILER <input type="radio"/> OTHER - SPECIFY:	

WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD
MISCELLANEOUS INFORMATION	
PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE	

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING

Rodney Hammer Rodney Hammer 1-23-13
SIGNATURE OF DRILLER / PRINT SIGNEE NAME DATE

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WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROCKY HOLLOW, NM

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 27				OSE FILE NUMBER(S) C3603; 518404				
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)				
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS		STATE NM	ZIP 88240	
	WELL LOCATION (FROM GPS)	DEGREES		MINUTES	SECONDS	* ACCURACY REQUIRED ONE TENTH OF A SECOND			
		LATITUDE	32	10	20.0	N	* DATUM REQUIRED WGS 84		
LONGITUDE		103	32	18.8	W				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 35									
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.			
	DRILLING STARTED 01-14-13		DRILLING ENDED 01-14-13		DEPTH OF COMPLETED WELL (FT) 75'		BORE HOLE DEPTH (FT) 75'		
	DEPTH WATER FIRST ENCOUNTERED (FT) N/A		STATIC WATER LEVEL IN COMPLETED WELL (FT)						
	COMPLETED WELL IS <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)								
	DRILLING FLUID <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY								
	DRILLING METHOD <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY AUGER								
	DEPTH (feet bgl)		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)	
	FROM	TO							
	0	75	8"	N/A	N/A	N/A	N/A	N/A	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT			
	FROM	TO							

FOR OSE INTERNAL USE

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WELL RECORD & LOG

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2013 JAN 29 AM 2:24

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 26				OSE FILE NUMBER(S) C3603; 518404			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS	STATE NM	ZIP 88240	
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32		MINUTES 10	SECONDS 40.9	N	* ACCURACY REQUIRED ONE TENTH OF A SECOND	
		LONGITUDE 103		32	52.8	W	* DATUM REQUIRED WGS 84	
	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 35							
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186	NAME OF LICENSED DRILLER RODNEY HAMMER				NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.		
	DRILLING STARTED 01-13-13	DRILLING ENDED 01-13-13	DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A		
	COMPLETED WELL IS <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)					STATIC WATER LEVEL IN COMPLETED WELL (FT)		
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
0	75	8"	N/A	N/A	N/A	N/A	N/A	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

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2013 JAN 29 A 2:20

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 25				OSE FILE NUMBER(S) C3603; 518404			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS		STATE NM	ZIP 88240
	WELL LOCATION (FROM GPS)	DEGREES		MINUTES	SECONDS	* ACCURACY REQUIRED ONE TENTH OF A SECOND * DATUM REQUIRED WGS 84		
		LATITUDE	32	10	43.1			
	LONGITUDE	103	32	33.9	W			
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 35								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.		
	DRILLING STARTED 01-11-13		DRILLING ENDED 01-11-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A
	COMPLETED WELL IS <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)							STATIC WATER LEVEL IN COMPLETED WELL (FT)
	DRILLING FLUID <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY							
	DRILLING METHOD <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	75	8"	N/A	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

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WELL RECORD & LOG

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ROOM 100

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1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 29			OSE FILE NUMBER(S) C3603; 518404				
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP			PHONE (OPTIONAL)				
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.			CITY HOBBS	STATE NM	ZIP 88240		
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32	MINUTES 10	SECONDS 20.0 N	* ACCURACY REQUIRED ONE TENTH OF A SECOND			
	LONGITUDE 103	32	58.5 W	* DATUM REQUIRED WGS 84				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 35								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER		NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.			
	DRILLING STARTED 01-13-13	DRILLING ENDED 01-13-13	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A			
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)				STATIC WATER LEVEL IN COMPLETED WELL (FT)			
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY AUGER							
	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	75	8"	N/A	N/A	N/A	N/A	N/A
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		
FOR OSE INTERNAL USE								
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ROOM 100

2013 JUN 29 AM 2:24

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 24				OSE FILE NUMBER(S) C3603; 518404				
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)				
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS		STATE NM	ZIP 88240	
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32	MINUTES 10	SECONDS 44.8 N	* ACCURACY REQUIRED ONE TENTH OF A SECOND * DATUM REQUIRED WGS 84				
		LONGITUDE 103	32	17.8 W					
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 35									
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.			
	DRILLING STARTED 01-10-13		DRILLING ENDED 01-10-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'		
					DEPTH WATER FIRST ENCOUNTERED (FT) N/A				
	COMPLETED WELL IS <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)							STATIC WATER LEVEL IN COMPLETED WELL (FT)	
	DRILLING FLUID <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY								
	DRILLING METHOD <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY AUGER								
	DEPTH (feet bgl)		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)	
	FROM	TO							
	0	75	8"	N/A	N/A	N/A	N/A	N/A	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT			
	FROM	TO							

FOR OSE INTERNAL USE

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FILE NUMBER	C-3603	POD NUMBER	TRN NUMBER	518404
LOCATION	24S. 33E. 35			PAGE 1 OF 2

REF ZONE

☐ AIR LIFT ☐ BAILER ☐ OTHER - SPECIFY _____MISCELLANEOUS INFORMATIONDATE _____

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WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 14				OSE FILE NUMBER(S) C3601; 518393				
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)				
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBES		STATE NM	ZIP 88240	
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32	MINUTES 11	SECONDS 47.9 N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 23									
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.			
	DRILLING STARTED 01-05-13		DRILLING ENDED 01-05-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A	
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)							STATIC WATER LEVEL IN COMPLETED WELL (FT)	
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:								
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER								
	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 75		8"	N/A		N/A	N/A	N/A	N/A
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	

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WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER

C-3601

POD NUMBER

7

TRN NUMBER

518393

LOCATION

T24S-R33E-Sec 23.441

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WR-20 WELL RECORD & LOG (Version 06/08/2012)

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WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 30 P 10:44

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 13			OSE FILE NUMBER(S) C3601; 518393				
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP			PHONE (OPTIONAL)				
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.			CITY HOBBS				
				STATE NM				
	ZIP 88240							
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32	MINUTES 11	SECONDS 53.4	N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND		
		LONGITUDE 103	32	15.6	W	* DATUM REQUIRED: WGS 84		
	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 23							
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER		NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.			
	DRILLING STARTED 01-05-13	DRILLING ENDED 01-05-13	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A			
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)				STATIC WATER LEVEL IN COMPLETED WELL (FT)			
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	75	8"	N/A	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3601	POD NUMBER 6	TRN NUMBER 518393
LOCATION T24S - R33E - Section 23.441		

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	DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)
	FROM	TO				
4. HYDROGEOLOGIC LOG OF WELL	0	2	2	BROWN SILTY SAND, LOOSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A
	2	24	22	CALICHE WHITE SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A
	24	46	22	RED SILTY SAND, DENSE TO VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A
	46	74	28	SHALE GREEN SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A
	74	75	1	SHALE RED SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input type="radio"/> PUMP <input type="radio"/> AIR LIFT <input type="radio"/> BAILER <input type="radio"/> OTHER - SPECIFY:					TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION	WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.
	MISCELLANEOUS INFORMATION:	
	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:	

6. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:	
	SIGNATURE OF DRILLER / PRINT SIGNEE NAME	1-23-13 DATE

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WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3601

POD NUMBER 6

TRN NUMBER

LOCATION T248-R33E-Section 23.441

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WELL RECORD & LOG

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 30 P 10: 44

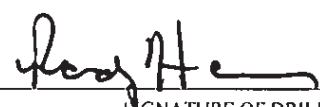
1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 12				OSE FILE NUMBER(S) C3601; S18393			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS		STATE NM	ZIP 88240
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32		MINUTES 11	SECONDS 53.2	N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND	
		LONGITUDE 103		32	9.7	W	* DATUM REQUIRED: WGS 84	
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 23								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.		
	DRILLING STARTED 01-06-13		DRILLING ENDED 01-06-13		DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A	
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT)	
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	75	8"	N/A	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	5	TRN NUMBER	518393
LOCATION	T245 - R33E - section 22. 442				PAGE 1 OF 2

PAGE 1 OF 2

	DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)	
	FROM	TO					
4. HYDROGEOLOGIC LOG OF WELL	0	1	2	BROWN SILTY SAND, LOOSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A	
	1	19	18	CALICHE WHITE SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A	
	19	31	12	RED SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A	
	31	38	7	SHALE GREEN SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A	
	38	75	37	SHALE RED SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A	
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
					<input type="radio"/> Y <input type="radio"/> N		
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input type="radio"/> PUMP					TOTAL ESTIMATED	
	<input type="radio"/> AIR LIFT <input type="radio"/> BAILER <input type="radio"/> OTHER - SPECIFY:					WELL YIELD (gpm):	
5. TEST; RIG SUPERVISION	WELL TEST TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.						
	MISCELLANEOUS INFORMATION:						
	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:						
6. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:						
	 SIGNATURE OF DRILLER / PRINT SIGNED NAME				1-23-13 DATE		

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FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3601	POD NUMBER 5	TRN NUMBER
LOCATION T24 S - R33 E - Section 23.442		PAGE 2 OF 2



WELL RECORD & LOG

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STATE ENGINEER OFFICE
ROSWEIL

2013 JAN 30 P 10:41

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 11			OSE FILE NUMBER(S) C3601;518393								
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP			PHONE (OPTIONAL)								
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.			CITY HOBBBS								
				STATE NM								
			ZIP 88240									
WELL LOCATION (FROM GPS)		DEGREES 32		MINUTES 10		SECONDS 49.5		N		* ACCURACY REQUIRED: ONE TENTH OF A SECOND		
		LONGITUDE 103		32		4.1		W		* DATUM REQUIRED: WGS 84		
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T245; R 33E; SECTION 24												
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER				NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.					
	DRILLING STARTED 01-03-13		DRILLING ENDED 01-04-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'		DEPTH WATER FIRST ENCOUNTERED (FT) N/A			
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT)					
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:											
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER											
	DEPTH (feet bgl)		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)	
	FROM TO											
	0 75'		8"		N/A		N/A		N/A		N/A	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)		LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL		AMOUNT (cubic feet)		METHOD OF PLACEMENT			
	FROM TO											

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	4	TRN NUMBER	518393
LOCATION	T 245 - R 33E - Section 24, 333				PAGE 1 OF 2

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WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 30 P 10:40

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 10				OSE FILE NUMBER(S) C3601; 518393									
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)									
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS									
					STATE NM									
				ZIP 88240										
WELL LOCATION (FROM GPS)		DEGREES LATITUDE 32		MINUTES 11		SECONDS 55.7		N						
		LONGITUDE 103		32		3.8		W						
* ACCURACY REQUIRED: ONE TENTH OF A SECOND														
* DATUM REQUIRED: WGS 84														
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T245; R 33E; SECTION 23														
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER				NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.							
	DRILLING STARTED 01-06-13		DRILLING ENDED 01-06-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'		DEPTH WATER FIRST ENCOUNTERED (FT) N/A					
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)													
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:													
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER													
	DEPTH (feet bgl)		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)	
	FROM TO													
	0 75		8"		N/A		N/A		N/A		N/A		N/A	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)		LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL				AMOUNT (cubic feet)		METHOD OF PLACEMENT			
	FROM TO													

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3601	POD NUMBER 3	TRN NUMBER 518393	PAGE 1 OF 2
LOCATION T245 - R33E - Section 24, 331			

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WELL RECORD & LOG

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 30 P 10:39

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 9				OSE FILE NUMBER(S) C3601; 518393			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS		STATE NM	ZIP 88240
	WELL LOCATION (FROM GPS)	DEGREES		MINUTES	SECONDS	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84		
		LATITUDE	32	12	1.5			
	LONGITUDE	103	32	15.0	W			
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T245; R 33E; SECTION 23								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.		
	DRILLING STARTED 01-06-13		DRILLING ENDED 01-07-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	
					DEPTH WATER FIRST ENCOUNTERED (FT) N/A			
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT)	
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
		0	75	8"	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3601

POD NUMBER 2

TRN NUMBER 518393

LOCATION T245-R33E-Sec 23.423

PAGE 1 OF 2

	DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)
	FROM	TO				
4. HYDROGEOLOGIC LOG OF WELL	0	1	1	BROWN SILTY SAND, LOOSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A
	1	23	22	CALICHE WHITE SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A
	23	75	52	SHALE GREEN SILTY SAND, VERY DENSE	<input type="radio"/> Y <input checked="" type="radio"/> N	N/A
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
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					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input type="radio"/> PUMP <input type="radio"/> AIR LIFT <input type="radio"/> BAILER <input type="radio"/> OTHER - SPECIFY: _____					TOTAL ESTIMATED WELL YIELD (gpm): _____
5. TEST; RIG SUPERVISION	WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.				
	MISCELLANEOUS INFORMATION: 					
PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE: 						
6. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:					
	Rodney Hammer					1-23-13 DATE

FOR USE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER <u>C-3601</u>	POD NUMBER <u>2</u>	TRN NUMBER
LOCATION <u>T24S-R33E-Sec 23.423</u>		PAGE 2 OF 2

4. HYDROGEOLOGIC LOG OF WELL

STATE ENGINEER OFFICE
ROSWELL, N.M.

2013 JAN - 8 A 11.55

LOCATION	24S-33E-24.1333
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WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 F 2: 21

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 23				OSE FILE NUMBER(S) C3600; 518382			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL) 			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBBS		STATE NM	ZIP 88240
	WELL LOCATION (FROM GPS)	DEGREES		MINUTES	SECONDS	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84		
		LATITUDE	32	11	9.4			
	LONGITUDE	103	32	58.6	W			
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 26								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER				NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.	
	DRILLING STARTED 01-08-13		DRILLING ENDED 01-09-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)							STATIC WATER LEVEL IN COMPLETED WELL (FT)
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	75	8"	N/A	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER 6-3600

POD NUMBER 64-23

TRN NUMBER 678382

LOCATION

PAGE 1 OF 2

ROSWELL

4. HYDROGEOLOGIC LOG OF WELL

5. TEST; RIG SUPERVISION

5. SIGNATURE

WR-20 WELL RECORD & LOG (Version 06/08/2012)



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 PM 2:21

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 22			OSE FILE NUMBER(S) C3600; 518382				
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP			PHONE (OPTIONAL)				
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.			CITY STATE ZIP HOBBBS NM 88240				
	WELL LOCATION (FROM GPS)			DEGREES MINUTES SECONDS LATITUDE 32 11 11.0 N LONGITUDE 103 32 33.5 W * ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 26								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.		
	DRILLING STARTED 01-09-13		DRILLING ENDED 01-09-13		DEPTH OF COMPLETED WELL (FT) 75'		BORE HOLE DEPTH (FT) N/A	
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)					DEPTH WATER FIRST ENCOUNTERED (FT) N/A		
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:						STATIC WATER LEVEL IN COMPLETED WELL (FT)	
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0 75		8"	N/A	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600

POD NUMBER BH-22

TRN NUMBER 518382

LOCATION

PAGE 1 OF 2

ROSVELL
COUNTERED -
FRACTURE ZONES
JAN 29
rib (all units)

4. HYDROGEOLOGIC LOG OF WELL

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 21				OSE FILE NUMBER(S) C3600; 518382			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBBS		STATE NM	ZIP 88240
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32		MINUTES 11	SECONDS 10.6	N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND	
		LONGITUDE 103		32	15.4	W	* DATUM REQUIRED: WGS 84	
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 26								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER				NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.	
	DRILLING STARTED 01-09-13		DRILLING ENDED 01-09-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)							STATIC WATER LEVEL IN COMPLETED WELL (FT)
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	75	8"	N/A	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-31600	POD NUMBER	BA-21	TRN NUMBER	518382
LOCATION					PAGE 1 OF 2

ROSWELL

4. HYDROGEOLOGIC LOG OF WELL

5. TEST; RIG SUPERVISION

5. SIGNATURE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER

-3600

POD NUMBER

3421

TRN NUMBER

R 518382

LOCATION

PAGE 2 OF 2



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 20				OSE FILE NUMBER(S) C3600; 518382							
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)							
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBBS							
					STATE NM							
				ZIP 88240								
WELL LOCATION (FROM GPS)		DEGREES 32		MINUTES 11		SECONDS 20.0		N		* ACCURACY REQUIRED: ONE TENTH OF A SECOND		
		LATITUDE								* DATUM REQUIRED: WGS 84		
		LONGITUDE		103		33		2.6		W		
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 26												
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER				NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.					
	DRILLING STARTED 01-08-13		DRILLING ENDED 01-08-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'		DEPTH WATER FIRST ENCOUNTERED (FT) N/A			
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)								STATIC WATER LEVEL IN COMPLETED WELL (FT)			
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:											
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER											
	DEPTH (feet bgl)		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)	
	FROM TO										SLOT SIZE (inches)	
	0 75		8"		N/A		N/A		N/A		N/A	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)		LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL				AMOUNT (cubic feet)		METHOD OF PLACEMENT	
	FROM TO											

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600

POD NUMBER BH-20

TRN NUMBER 518382

LOCATION

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FOR USE INTERNAL USE		WR-20 WELL RECORD & LOG (Version 06/08/2012)	
FILE NUMBER	C-3600	POD NUMBER	BH-20
LOCATION	TRN NUMBER		518382
			PAGE 2 OF 2

TRN NUMBER 518382

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WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 P 2:21

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) 8H 19				OSE FILE NUMBER(S) C3600; 518382							
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)							
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS							
					STATE NM							
				ZIP 88240								
WELL LOCATION (FROM GPS)		DEGREES 32		MINUTES 11		SECONDS 21.0		N		* ACCURACY REQUIRED: ONE TENTH OF A SECOND		
		LONGITUDE 103		32		18.0		W		* DATUM REQUIRED: WGS 84		
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 26												
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER				NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.					
	DRILLING STARTED 01-16-13		DRILLING ENDED 01-16-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'		DEPTH WATER FIRST ENCOUNTERED (FT) N/A			
	COMPLETED WELL IS:		<input type="radio"/> ARTESIAN		<input checked="" type="radio"/> DRY HOLE		<input type="radio"/> SHALLOW (UNCONFINED)		STATIC WATER LEVEL IN COMPLETED WELL (FT)			
	DRILLING FLUID:		<input type="radio"/> AIR		<input type="radio"/> MUD		ADDITIVES - SPECIFY:					
	DRILLING METHOD:		<input type="radio"/> ROTARY		<input type="radio"/> HAMMER		<input type="radio"/> CABLE TOOL		<input checked="" type="radio"/> OTHER - SPECIFY: AUGER			
	DEPTH (feet bgl)		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)	
	FROM TO											
	0 75		8"		N/A		N/A		N/A		N/A	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)		LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL				AMOUNT (cubic feet)		METHOD OF PLACEMENT	
	FROM TO											

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600

POD NUMBER BH-19

TRN NUMBER 518382

LOCATION

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WELL RECORD & LOG

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 P 2:21

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 18				OSE FILE NUMBER(S) C3682; 518347			
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.				CITY HOBBS		STATE NM	ZIP 88240
	WELL LOCATION (FROM GPS)		DEGREES 32		MINUTES 11		SECONDS 20.2 N	
		LONGITUDE 103		31		38.3 W		
* ACCURACY REQUIRED: ONE TENTH OF A SECOND								
* DATUM REQUIRED: WGS 84								
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 25								

2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER		NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.			
	DRILLING STARTED 01-15-13		DRILLING ENDED 01-15-13		DEPTH OF COMPLETED WELL (FT) 75'		DEPTH WATER FIRST ENCOUNTERED (FT) N/A	
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)					STATIC WATER LEVEL IN COMPLETED WELL (FT)		
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
	0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
	FROM	TO				

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER

C-3600

POD NUMBER

BH-18

TRN NUMBER

518382

LOCATION

PAGE 1 OF 2

	DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)
	FROM	TO				
4. HYDROGEOLOGIC LOG OF WELL	0	1	1	BROWN SILTY SAND, LOOSE	<input checked="" type="radio"/> Y <input checked="" type="radio"/> N	N/A
	1	21	20	CALICHE WHITE SILTY SAND, VERY DENSE	<input checked="" type="radio"/> Y <input checked="" type="radio"/> N	N/A
	21	47	76	SHALE GREEN SILTY SAND, VERY DENSE	<input checked="" type="radio"/> Y <input checked="" type="radio"/> N	N/A
	47	53	6	SHALE RED SILTY SAND, VERY DENSE	<input checked="" type="radio"/> Y <input checked="" type="radio"/> N	N/A
	53	75	22	SHALE GREEN SILTY SAND, VERY DENSE	<input checked="" type="radio"/> Y <input checked="" type="radio"/> N	N/A
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
					<input type="radio"/> Y <input type="radio"/> N	
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input type="radio"/> PUMP <input type="radio"/> AIR LIFT <input type="radio"/> BAILER <input type="radio"/> OTHER - SPECIFY:					TOTAL ESTIMATED WELL YIELD (gpm):

STATE ENGINEER OFFICE
 RDS WELL # 11-23-13

5. TEST; RIG SUPERVISION	WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.
	MISCELLANEOUS INFORMATION:	
	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:	

6. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:	
	 SIGNATURE OF DRILLER / PRINT SIGNEE NAME	1-23-13 DATE



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ROSWEIL, NEW MEXICO

2013 JAN 29 PM 2:20

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) BH 17			OSE FILE NUMBER(S) C3600; 518382				
	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP			PHONE (OPTIONAL)				
	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.			CITY HOBBBS STATE NM ZIP 88240				
	WELL LOCATION (FROM GPS)	DEGREES		MINUTES	SECONDS	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84		
		LATITUDE	32	11	20.2			N
	LONGITUDE	103	31	38.3	W			
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE T24S; R 33E; SECTION 26								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD-1186		NAME OF LICENSED DRILLER RODNEY HAMMER			NAME OF WELL DRILLING COMPANY ENVIRO-DRILL, INC.		
	DRILLING STARTED 01-07-13		DRILLING ENDED 01-08-13		DEPTH OF COMPLETED WELL (FT)		BORE HOLE DEPTH (FT) 75'	DEPTH WATER FIRST ENCOUNTERED (FT) N/A
	COMPLETED WELL IS: <input type="radio"/> ARTESIAN <input checked="" type="radio"/> DRY HOLE <input type="radio"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT)	
	DRILLING FLUID: <input type="radio"/> AIR <input type="radio"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input type="radio"/> ROTARY <input type="radio"/> HAMMER <input type="radio"/> CABLE TOOL <input checked="" type="radio"/> OTHER - SPECIFY: AUGER							
	DEPTH (feet bgl)		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)
	FROM	TO						
		0	75	8"	N/A	N/A	N/A	N/A
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600

POD NUMBER BH-17

TRN NUMBER 518382

LOCATION

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~~RO307~~
RO307

4. HYDROGEOLOGIC LOG OF WELL

5. TEST; RIG SUPERVISION

6. SIGNATURE

FOR USE INTERNAL USE		WR-20 WELL RECORD & LOG (Version 06/08/2012)	
FILE NUMBER	C-3600	POD NUMBER	BH-17
LOCATION			TRN NUMBER 518382
			PAGE 2 OF 2

ATTACHMENT IV.2.B


INTERCONTINENTAL POTASH DRILL STEM TEST DATA

ATTACHMENT IV.2.B
Drill Stem Test Data
ICP Boring 92, C-3665-8

Summary of Estimated Steady-State and Early-Time Interval-Specific Inflow Rates (INTERA 2014)

Interval Top (ft bgs)	Interval Bottom (ft bgs)	Interval Thickness (ft)	Lithologic Category	Interval-Specific Steady-State Inflow Rate (gpm)	Interval-Specific Early-Time Inflow Rate (gpm)
40	53	13	Sandstone	0.02	0.04
165	203	38	Sandstone	0.2	0.3
267	303	36	Sandstone	0.3	0.6
318	326	8	Sandstone	0.08	0.1
349	361	12	Sandstone	0.1	0.2
382	411	29	Sandstone	0.3	0.4
458	508	50	Sandstone	27	21
510	644	134	Sandstone	11	112
655	699	44	Sandstone	4.4	45.5
735	771	36	Sandstone	0.4	0.6
1,348	1,366	18	Dolomite	0.001	1.6
1,585	1,611	26	Dolomite	1.4	1.8

ATTACHMENT IV.2.C
OWL SITE BORING LOGS

DEPTH (FEET BGS)	SOIL DESCRIPTION	DEPTH (FEET BGS)	SPLIT SPOON SAMPLE NO.	AIR ROTARY CUTTINGS SAMPLE NO.	AUGER CUTTINGS SAMPLE NO.	BLOW COUNT PER 1/2FT	GEOLOGIC UNITS	NOTES
10	GRAVEL 3/8"-1/2" SILTY SAND SILTY SAND, CALICHE CALICHE, GRAVEL 1/2"-3/4"	10			1 2 3	NA NA NA	Qal ALUVIUM	
20	CALICHE, SILTY SAND, GRAVEL 1/4"-3/8"	20			4	NA		
30	SILTY SAND, GRAVEL 1/4"-3/8", SOME ROUND SILTY SAND, GRAVEL 1/4"-1/2"	30			5 6	NA NA		
40	SILTY SAND, GRAVEL 1/8"-1/4"	40			7	NA		
50	SILTY SAND	50			8	NA		
60	SILTY SAND, RED, DRY	60			9	NA		
70	RED, SILTY SAND	70			10 11	NA NA		HOLLOW STEM AUGER DRILLING CHANGED TO AIR ROTARY DRILLING AT 60'
80	GRAY SHALE (VISUAL) BROWN SANDSTONE RED SILTY SAND & BROWN SANDSTONE LAYERS OF 1' GREEN SHALE, RED AND GRAY	80			12	NA	TrC CHINLE SHALES & DENSE SANDSTONE	
90		90						
100	93'-94' RED, (VISUAL)	100				NA		BUCKET SAMPLE
110		110						
120		120						
130	GREEN SHALE, DRY	130			13	NA		
140		140						
150	GRAY SHALE PULVERIZED IN CLAY, PLUGGED ROTARY AIR DRILL BIT BROWN AND GRAY SHALE, SEMI-HARD, FIRM, MOIST TD = 150'	150				NA		AFTER REACHING TD, HOLE LEFT OPEN OVERNIGHT, HOLE CHECKED FOR WATER THE FOLLOWING MORNING (DRY)
160		160						
170		170						
180		180						
190		190						
200		200						
Project: OWL Site, Lea County, New Mexico Drilling Company: Enviro Drill Drilling Rig/Bit: CME-75: Hollow Stem Auger/Air Rotary Driller: Ryan O'Malley Sampling Method: Split Spoon/Auger Cuttings Location: North East Corner of Section 23 Coordinate: N 441088.401, E 788080.396 Elevation: 3584' Start Date: 11/24/2015 Completion Date: 11/25/2015 Boring Depth: 150 feet below ground surface Logged by: Carl King				OWL SITE LEA COUNTY, NEW MEXICO				
				SOIL BORING BOREHOLE #1				
								
SOURCE: CARL KING, GORDON ENVIRONMENTAL								

DEPTH (FEET BGS)	SOIL DESCRIPTION	DEPTH (FEET BGS)	SPLIT SPOON SAMPLE NO.	AIR ROTARY CUTTINGS SAMPLE NO.	AUGER CUTTINGS SAMPLE NO.	BLOW COUNT PER 1/2FT	GEOLOGIC UNITS	NOTES
0	ORGANIC SOIL ABOUT 40% FINE, 60% LOAM, SILTY SAND, MOIST						Qal ALUVIUM	
10	CALICHE AT 18" WITH GRAVEL 3/8"-1/2" SEMI-ROUNDED TO SEMI-ANGULAR, HARD	10	1			0.2FT/50		
	CALICHE, WHITE SILTY SAND, FINE, DRY		2			22/22/27		
	CALICHE WITH GRAVEL, ANGULAR 3/4"-1", WHITE SILTY SAND, LOOSE		3			34/54/5		
20	CALICHE WITH WHITE SILTY SAND, LOOSE	20	4			0.3FT/50		
	CALICHE WITH GRAVEL 3/8", SILTY SAND, LOOSE		5			18/20/26		
	CALICHE WITH WHITE SILTY SAND, FIRM, DRY		6			0.3FT/50		
30	CALICHE, WHITE WITH RED SILTY SAND, FIRM	30	7		6	7/10/19		
	RED SILTY SAND, LOOSE, SOME MOISTURE		8		9	29/0.5FT/50		
40	RED SILTY SAND, LOOSE, SOME MOISTURE	40	9			36/0.4FT/50		
	GREEN SHALE WITH SAND, SAMPLE MOISTURE BUT ACCUMULATED WATER, NEAT TO FRESH ACCUMULATED, (ANIMAL ENTERED HOLE)		10			0.5FT/50	TrC CHINLE SHALE & DENSE SANDSTONE	▼ WATER ENCOUNTERED AT 38'
	GREEN SHALE WITH RED SILTY SAND, WET TO MOIST		11			0.4FT/50		▼ WATER LEVEL 45' PRIOR TO PLUGGING
50	RED SHALE, SILTY SAND, MOIST	50	12		12	0.5FT/50		BUCKET SAMPLING
	RED/GREEN SHALE, SILTY SAND, MOIST, NO FREE WATER IN SAMPLE		13			0.4FT/50		58'-59'-PER DRILLER
	BROWN SILTY SAND, MOIST, FIRM		14			0.4FT/50		
60	BROWN SILTY SAND, VERY SOFT	60	15			0.4FT/50		
	GREEN SHALE WITH ROCKS, FIRM		16			35/0.4FT/50		
	GREEN SHALE, FIRM, (REMAINDER OF MOIST)		17			0.1FT/50		
70	GREEN SHALE TO GRAY SHALE, DENSE, DRY	70	18			0.1FT/50		
	TRANSITION TO AIR ROTARY CUTTINGS		19		19	0.3FT/50		
80	GREEN SHALE, VERY DENSE, DRY, WATER SATURATED FROM LAYERS ABOVE	80	20			0.1FT/50	PULLED AIR ROTARY TO CHECK FOR PLUGGING	HOLLOW STEM AUGER DRILLING AIR ROTARY DRILLING
90	AIR ROTARY, SLURRY CHANGED TO RED, SPLIT SPOON AT 100'	90	21			0.1FT/50		
100	GREEN SHALE, VERY DENSE, DRY, GRAY SAND STONE	100	22			0.2FT/50		
110		110						
120		120						
130		130						
140	GRAY SHALE PULVERIZED IN CLAY, PLUGGED ROTARY AIR DRILL BIT	140						
150	BROWN AND GRAY SHALE, SEMI-HARD, FIRM, MOIST	150						
160	GRAY SLURRY CUTTINGS	160						
170	RED SLURRY CUTTINGS	170						
180	GREEN SHALE, VERY HARD, DRY	180						
190		190						
200	GREEN SHALE, VERY HARD, DRY TD = 200'	200						

Project:

Drilling Company:

Drilling Rig/Bit:

Driller:

Sampling Method:

Location:

Coordinate:

Elevation:

Start Date:

Completion Date:

Boring Depth:

Logged by:

OWL Site, Lea County, New Mexico

Enviro Drill

CME-75: Hollow Stem Auger/Air Rotary

Ryan O'Malley

Split Spoon/Auger Cuttings

South East Corner of Section 23

N 435985.091, E 786825.961

3553'

11/18/2015

11/19/2015

200 feet below ground surface


Carl King

OWL SITE

LEA COUNTY, NEW MEXICO

SOIL BORING

BOREHOLE #2



SOURCE: CARL KING, GORDON ENVIRONMENTAL

DEPTH (FEET BGS)	SOIL DESCRIPTION	DEPTH (FEET BGS)	SPLIT SPOON SAMPLE NO.	AIR ROTARY CUTTINGS SAMPLE NO.	AUGER CUTTINGS SAMPLE NO.	BLOW COUNT PER 1/2FT	GEOLOGIC UNITS	NOTES
10	ORGANIC SOIL ABOUT 60% FINES, 40% SAND, REDDISH BROWN ML WITH GRAVEL, ABOUT 15% LOOSE, BROWN, SILTY SAND, 85% GRAVEL SUB-ROUND TO SUB-ANGULAR 1/2"-1" CALICHE WITH SILTY SAND, DRY	10	1			8/20/36	Qal ALUVIUM	
	CALICHE WITH GRAVEL 3/8" SUB-ANGULAR	10	2		3	30/2		
	CALICHE (PLUG SPLIT SPOON RESAMPLE) AND GRAVEL 3/8" SEMI-ANGULAR, FIRM, WHITE		4			15/22/34		
20	RED SILTY SAND, LOOSE, DRY	20	5			7/9/16		
	CALICHE, WHITE WITH SAND, SOME FIRM AT DEEP, MOIST, LOOSE		6			0.4FT/50		
30	CALICHE WITH GRAVEL 1" PLUS, LOOSE DRY	30	7	7R		0.1FT/50	TrC CHINLE SHALE & DENSE SANDSTONE	PLUG SPLIT SPOON RESAMPLE
	RED SILTY SAND, FIRM, OVER GRAY/GREEN SANDSTONE, VERY FIRM		8			20/34/ 0.4FT/50		
40	GRAY/GREEN SANDSTONE, VERY DENSE	40	9			0.5FT/50		
	GRAY/GREEN SANDSTONE, DENSE		10			0.4FT/50		
50	BROWN SANDSTONE, FIRM, DRY	50	11			0.2FT/50		
	BROWN SANDSTONE, SOFT, DRY		12			0.4FT/50		
60		60						
70		70				0.1FT/50		NO SAMPLE COLLECTED
	BROWN SANDSTONE WITH TRACE OF GREEN SHALE, FIRM AND LAYERED		13			0.1FT/50		
80		80						
90	91' - GREEN SHALE OBSERVED BY COLOR IN AIR ROTARY CUTTING	90						NOT SUFFICIENT TO COLLECTED
	BROWN SANDSTONE							OBSERVED BY COLOR AND AIR
100	96'-97' - GREEN SHALE OBSERVED IN EXTRACT	100		13S		0.1FT/50		ROTARY CUTTING AND NOT
	GREEN SHALE EXHAUST, GRAB HEAVIER PARTICLES							SUFFICIENT TO COLLECTED
110	BROWN SANDSTONE	110				0.05FT/50		NO SAMPLE COLLECTED
	MIXTURE OF GRAY SHALE AND BROWN SANDSTONE LAYERS		14					NO SAMPLE COLLECTED
120	GRAY SHALE	120	15					COLLECT SAMPLE FROM PALE
	RED/BROWN SHALE		16					AT AIR ROTARY DISCHARGE
130	GRAY SHALE	130						SAMPLE COLLECTED AT AIR
								ROTARY DISCHARGE
140	142' - GRAY SHALE, 6" THICK LAYERS	140						
	RED SHALE							
150	GREEN SHALE, WELL DEFINED, FIRM	150	21			0.3FT/50		
160		160						
170	GRAY SHALE	170	21					NO SAMPLE COLLECTED
	GRAY SHALE TD = 175'							SPLIT SPOON STUCK IN SHALE AT
180		180						SAMPLING, EXHAUSTED PULL
190		190						ATTEMPTS, APPLIED ROTARY
200		200						FORCE IN COMBINATION WITH
								LIFT, SPLIT SPOON SHEARED AT
								THREADS. ABANDON SAMPLE IN
								PLACE AT 175'-6" BELOW
								SURFACE.
								AFTER REACHING TD, HOLE LEFT
								OPEN OVERNIGHT, HOLE CHECKED
								FOR WATER THE FOLLOWING
								MORNING (DRY)

Project: OWL Site, Lea County, New Mexico

Drilling Company: Enviro Drill

Drilling Rig/Bit: CME-75: Hollow Stem Auger/Air Rotary

Driller: Ryan O'Malley

Sampling Method: Split Spoon/Auger Cuttings

Location: South West Corner of Section 23

Coordinate: N 435917.137, E 783182.1299

Elevation: 3546'

Start Date: 11/20/2015

Completion Date: 11/25/2015

Boring Depth: 175 feet below ground surface


Logged by: Carl King

OWL SITE

LEA COUNTY, NEW MEXICO


SOIL BORING

BOREHOLE #3



SOURCE: CARL KING, GORDON ENVIRONMENTAL

DEPTH (FEET BGS)	SOIL DESCRIPTION	DEPTH (FEET BGS)	SPLIT SPOON SAMPLE NO.	AIR ROTARY CUTTINGS SAMPLE NO.	AUGER CUTTINGS SAMPLE NO.	BLOW COUNT PER 1/2FT	GEOLOGIC UNITS	NOTES	
0	ORANGE, ORGANIC SOIL ABOUT 30% FINES, 70% REDDISH BROWN SILTY SAND, DRY ML WITH GRAVEL, ABOUT 15% LOOSE, BROWN, SILTY SAND, 85% GRAVEL SUB-ROUND TO SUB-ANGULAR 1/2"-1" CALICHE WITH SILTY SAND, LOOSE, WHITE OVER LAYER OF BROWN SILTY SAND	0	1			16/14/11	QaL ALUVIUM		
10	WHITE CALICHE WITH BROWN SILTY SAND, LOOSE	10	2			8/9/6			
	REDDISH BROWN SILTY SAND, LOOSE, OVER WHITE CALICHE, FIRM		3			5/7/18			
20	WHITE CALICHE, VERY FIRM 90% RED SILTY SAND, 105 SEMI-ROUND 3/8"-3/4" GRAVEL RED SILTY SAND, DRY, LOOSE	20	4		5	22/22/33			
			6			24/54/2			
30	RED SILTY SAND, FIRM, GRAVEL TRACE <3/8"	30	7			13/22/26			
	GRAY SILTY SANDSTONE, VERY FIRM		8			13/31/54	TrC CHINLE SHALES & DENSE SANDSTONE		
40	GRAY SILTY SANDSTONE TO RED SILTY SANDSTONE TRASITION	40	9			20/39/50			
	RED SILTY SAND AND RED SHALE, HARD, DRY		10			25/34/43			
50	RED SHALE STICKY, ALTERNATING RED SHALE AND GRAY SILTY SANDSTONE IN 3' LAYERS	50	11	12		25/5			CHANGED TO AIR ROTARY CUTTINGS AT 45' BUCKET SAMPLE SAMPLE 12 IS FROM AIR ROTARY DISCHARGE
60		60							
	GRAY RED SHALE, 1' THICK LAYERS			13		4.0IN/50		NO SAMPLE RECOVERED SAMPLE IS FROM AIR ROTARY DISCHARGE	
70	RED SILTY SAND AND GRAY SANDSTONE, VERY HARD, DRY	70	14			5.0IN/50			
80		80							
	GRAY SANDSTONE								
90		90							
100	GRAY SANDSTONE, VERY HARD	100	15			1.0IN/50			
110		110							
	GREEN SHALE FROM AIR ROTARY DISCHARGE			16					
120	GREEN SHALE WITH SANDSTONE, FIRM, DRY	120	17			1.0IN/50			
130		130							
140		140							
150	GRAY SHALE, MOISTURE FROM COMPRESSOR CONDENSATION	150	18			0.5IN/50			
160		160							
170	BROWN SHALE OBSERVED BY AIR ROTARY DISCHARGE	170		19		0.5IN/50		NO SAMPLE RECOVERED	
	BROWN SHALE COLLECTED IN AIR ROTARY DISCHARGE			20					
180	GRAY SHALE COLLECTED IN AIR ROTARY DISCHARGE	180							
190		190		21					
200	GRAY SHALE COLLECTED IN AIR ROTARY DISCHARGE GRAY SHALE, HARD, DRY TD = 200'	200				0.5IN/50		AFTER REACHING TD, HOLE LEFT OPEN OVERNIGHT, HOLE CHECKED FOR WATER THE FOLLOWING MORNING (DRY)	

Project: OWL Site, Lea County, New Mexico	OWL SITE LEA COUNTY, NEW MEXICO
Drilling Company: Enviro Drill	
Drilling Rig/Bit: CME-75: Hollow Stem Auger/Air Rotary	
Driller: Ryan O'Malley	
Sampling Method: Split Spoon/Auger Cuttings	
Location: North West Corner of Section 23	SOIL BORING BOREHOLE #4
Coordinate: N 440977.229, E 783171.1478	
Elevation: 3588'	
Start Date: 11/22/2015	
Completion Date: 11/25/2015	
Boring Depth: 200 feet below ground surface	
Logged by: Carl King	
SOURCE: CARL KING, GORDON ENVIRONMENTAL	

DEPTH (FEET BGS)	SOIL DESCRIPTION	DEPTH (FEET BGS)	SPLIT SPOON SAMPLE NO.	AIR ROTARY CUTTINGS SAMPLE NO.	AUGER CUTTINGS SAMPLE NO.	BLOW COUNT PER 1/2FT	GEOLOGIC UNITS	NOTES
	BLACK, ORGANIC SOIL (OL/OH) ABOUT 50% FINES, 50% SAND, BROWN TO REDDISH BROWN ML WITH GRAVEL, ABOUT 5% LOOSE, BROWN SILTY SAND, 15% GRAVEL SUB-ROUND TO SUB-ANGULAR GRAVEL CALICHE WITH SILTY SAND, LOOSE		2		1			
10	WHITE CALICHE SILTY SAND, HARD	10	3		4	6/10/27		
	CALICHE 85%, GRAVEL SUB-ANGULAR 15%, LOOSE		5			0.4FT/50		
20	CALICHE WHITE SILTY 50%, GRAVEL 50% 3/8"-1/2"	20	6		7	8/10/32	Qal	STONE PLUG, NO SAMPLE
	RED SILTY SAND, SOME MOISTURE, FIRM		8			0.4FT/50	ALUVIUM	
30	CALICHE WHITE	30				10/15/27		
	RED SILTY SAND, LOOSE		10		9	8/13/22		
40	CALICHE WHITE SILTY, HARD	40	12		11	0.4FT/50		
	BROWN SILTY SAND, DENSE		13			0.4FT/50		BOLT IN CUTTING PULL HOLLOW STEM AUGER REPLACE BOLT TO HOLLOW STEM AUGER
	BROWN SILTY SAND, VERY DENSE					0.4FT/50		CHANGED TO AIR ROTARY NO SAMPLE RECOVERED
50	WHITE SHALE	50				0.1FT/50	TrC	
	BROWN SILTY SAND AND SHALE, VERY DENSE						CHINLE	
60	RED SHALE SILTY SAND, VERY DENSE	60	14			0.2FT/50	SHALE	
							&	
70	GREEN SHALE WITH SILTY SAND, VERY DENSE	70					DENSE	
	GREEN SHALE WHITE SILTY SAND, VERY DENSE						SANDSTONE	
80	PURPLE	80		15				BOREHOLE #5 IS LOCATED 18' SOUTH OF THE ORIGINAL BOREHOLE #5. PLACED 40' OF HOLLOW STEM AUGER FOR AIR ROTARY CASING REFUSAL AT 83'
	GRAY SANDSTONE							
90	GREEN SHALE	90		16				
	GREEN SHALE FROM AIR ROTARY DISCHARGE							
100	GREEN SHALE, WITH SANDSTONE, HARD, DRY	100	17			3.0IN/50		
	RED SHALE AND SANDSTONE AT 103', GRAY SHALE AT 105'							
110		110		18				
	GREEN SHALE FROM AIR ROTARY DISCHARGE							
120	GRAY SHALE	120		19				
	GRAY SHALE FROM AIR ROTARY DISCHARGE							
130	RED SHALE	130		20				
	GRAY SHALE TO 165' AND STOPS, NO MOISTURE							
140		140						
150		150						
160	TD = 165'	160						
170		170						
180		180						
190		190						AFTER REACHING TD, HOLE LEFT OPEN OVERNIGHT, HOLE CHECKED FOR WATER THE FOLLOWING MORNING (DRY)
200		200						

Project: OWL Site, Lea County, New Mexico

Drilling Company: Enviro Drill

Drilling Rig/Bit: CME-75: Hollow Stem Auger/Air Rotary

Driller: Ryan O'Malley

Sampling Method: Split Spoon/Auger Cuttings

Location: Center of Section 23

Coordinate: N 438707.209, E 785946.616

Elevation: 3579'

Start Date: 11/17/2015

Completion Date: 11/??/2015

Boring Depth: 165 feet below ground surface


Logged by: Carl King

OWL SITE

LEA COUNTY, NEW MEXICO

SOIL BORING

BOREHOLE #5



SOURCE: CARL KING, GORDON ENVIRONMENTAL