# **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

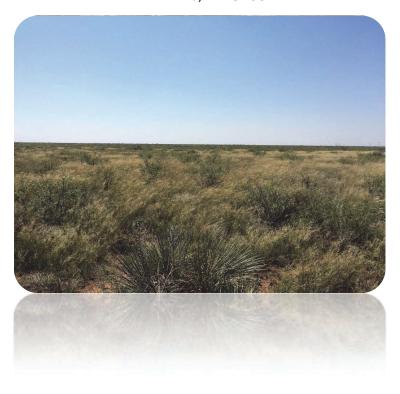
FOR A SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN A PORTION OF SECTION 23, TOWNSHIP 24 SOUTH, RANGE 33 EAST, LEA COUNTY, NM FOR OILFIELD WATER LOGISTICS, LLC

# 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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#### PREPARATION DATE:

OCTOBER 2015

# **INVESTIGATOR/S:**

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

Signature

# **Table of Contents**

1.0 Introduction	
2.0. Methods	5
3.0. General Environmental Setting	
4.0. Results	
5.0. Discussion and Recommendations	15
3.0. DISCUSSION AND RECOMMENDATIONS	13
6.0. References	14
Figures	
Figure 1. Vicinity Map	2
Figure 2. Topographic Map	
Figure 3. Aerial Map	
Figure 4. HUC 12 Watershed Map	
Figure 5. Ephemeral Drainage Map	
Figure 6. Earthen Tank Below Ephemeral Drainage Map	
Figure 7. National Wetland Inventory Map	12
Appendices	15
Appendix A. Photos	
Appendix B. NRCS Soils Data	
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Appendix C. FEMA Firmette

Appendix D. USFWS NWI Map

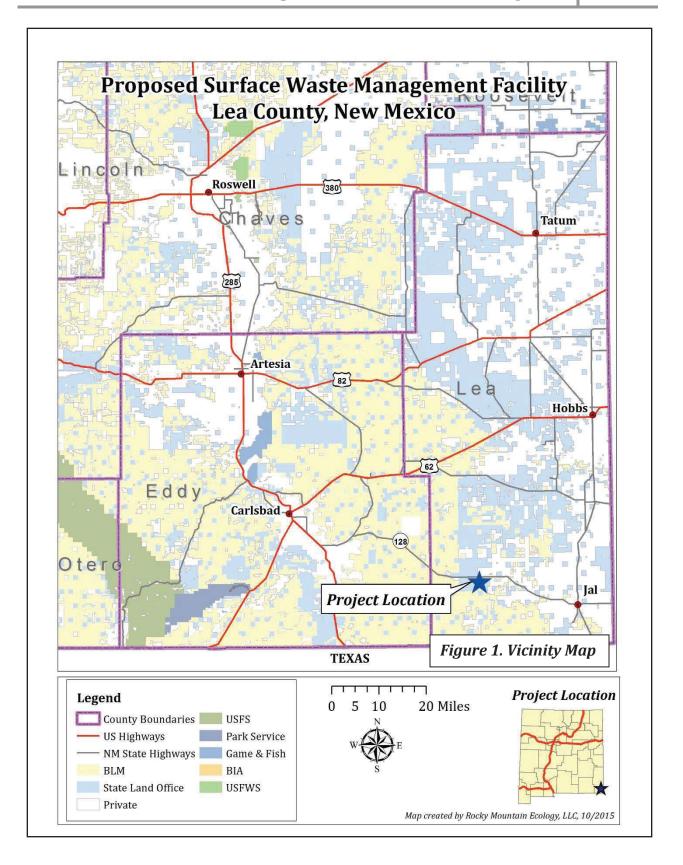
# 1.0. INTRODUCTION

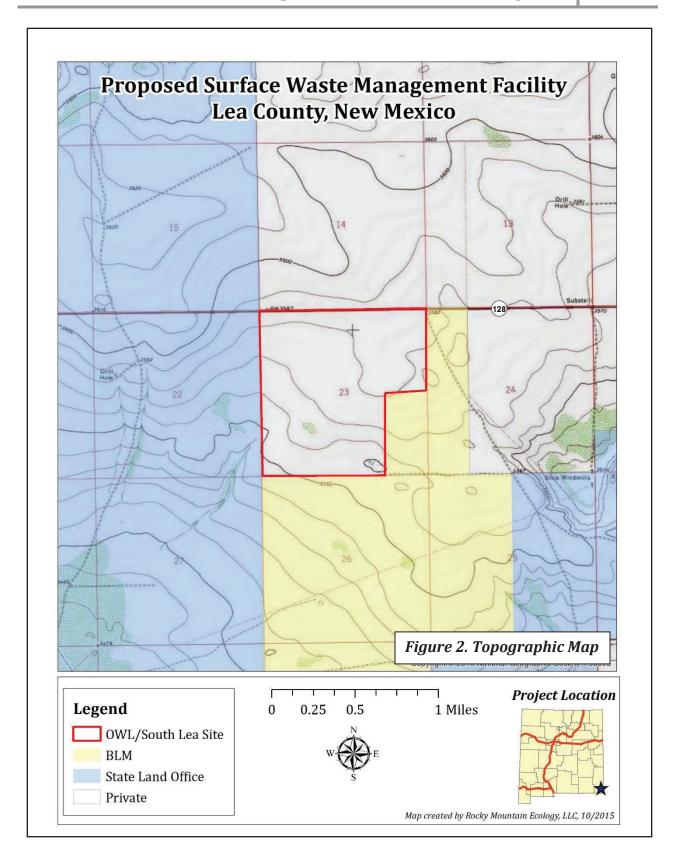
This document describes results of an investigation for presence and extent of watercourses, floodplains and wetlands on a ± 560-acre tract of land in Lea County, New Mexico (NM). Oilfield Water Logistics (OWL) is pursuing a Permit, issued by the Oil Conservation Division (OCD) of the New Mexico Energy, 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."

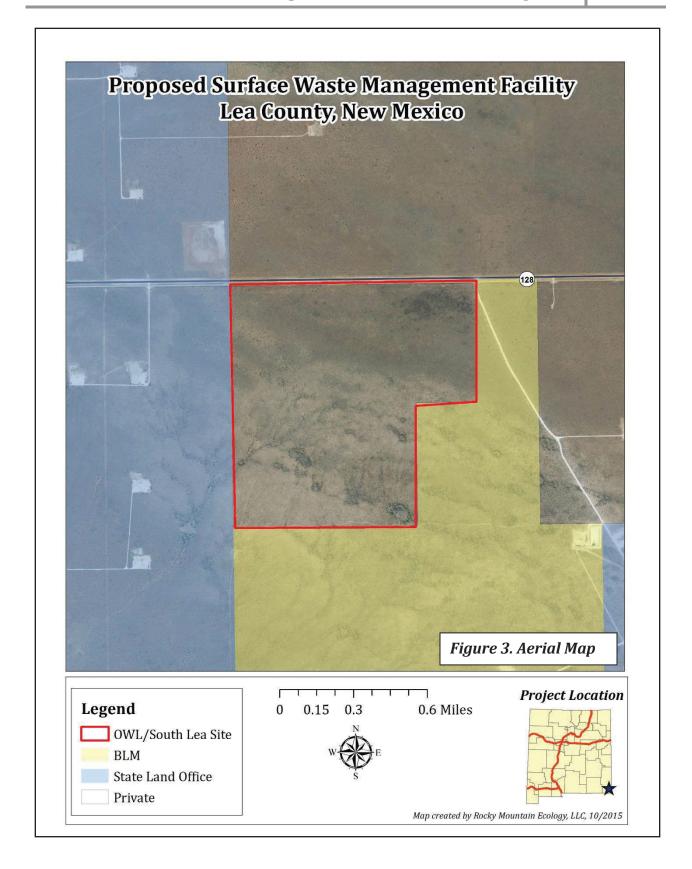
SITING AND OPERATIONAL REQUIREMENTS APPLICABLE TO ALL PERMITTED SURFACE WASTE MANAGEMENT FACILITIES: Except as otherwise provided in 19.15.36 NMAC.

- 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) orthophotography 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

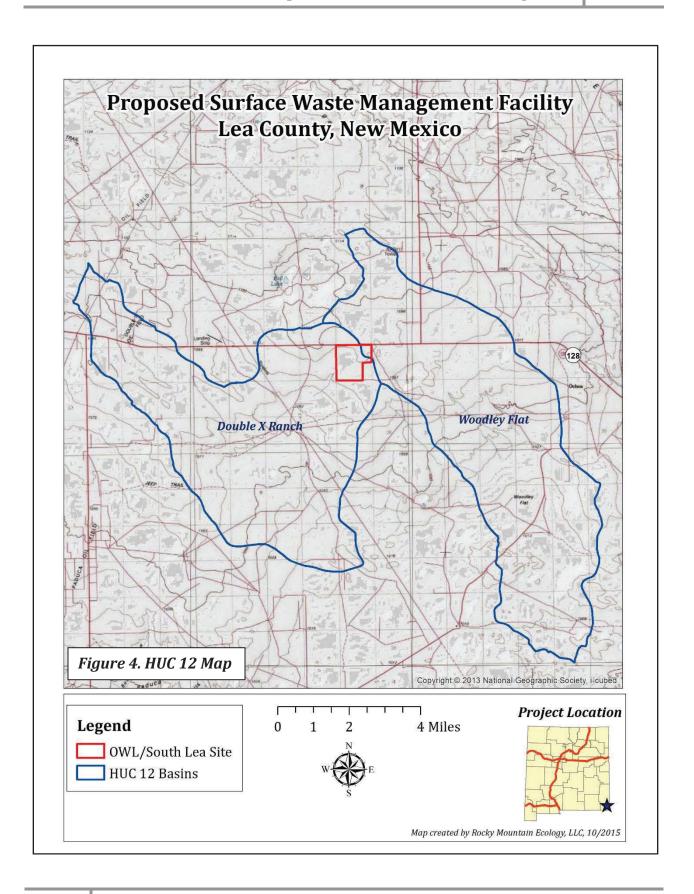
The project area occurs within the Chihuahuan Desert Grasslands subregion of the Chihuahuan Deserts Ecoregion (Griffith, et. al 2006). "The grasslands occur in areas of somewhat higher annual precipitation (10 to 15 inches) than the Chihuahuan Basins and Playas, such as elevated basins between mountain 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 subwatershed (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 runnoff 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 horseweed (Convza 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 a 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).

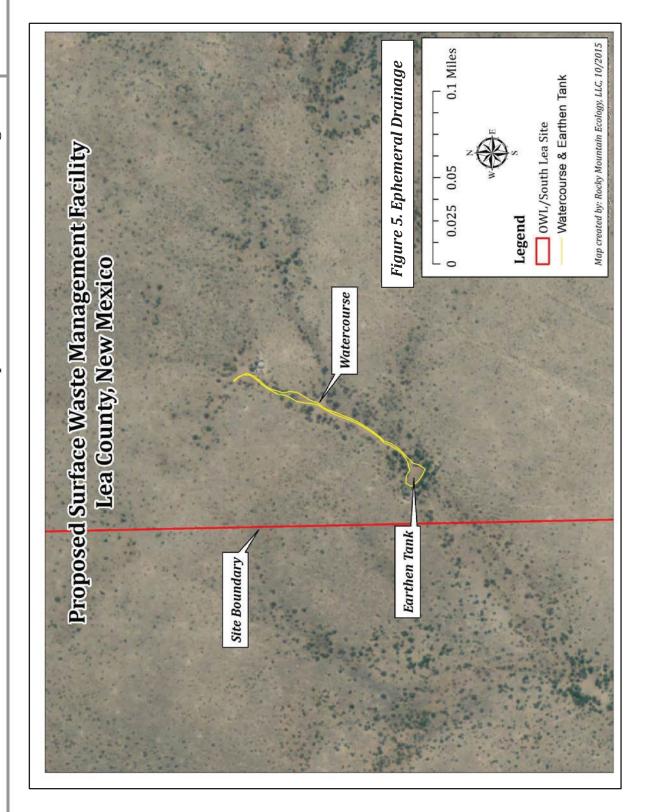
The U.S. Army Corps of Engineers (USACE) was not consulted regarding a preliminary jurisdictional determination (PJD) via this scope of work. However, it appears there is no possibility that any Waters of the U.S., as defined by the USACE, occur within the project boundary. There is no possibility that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

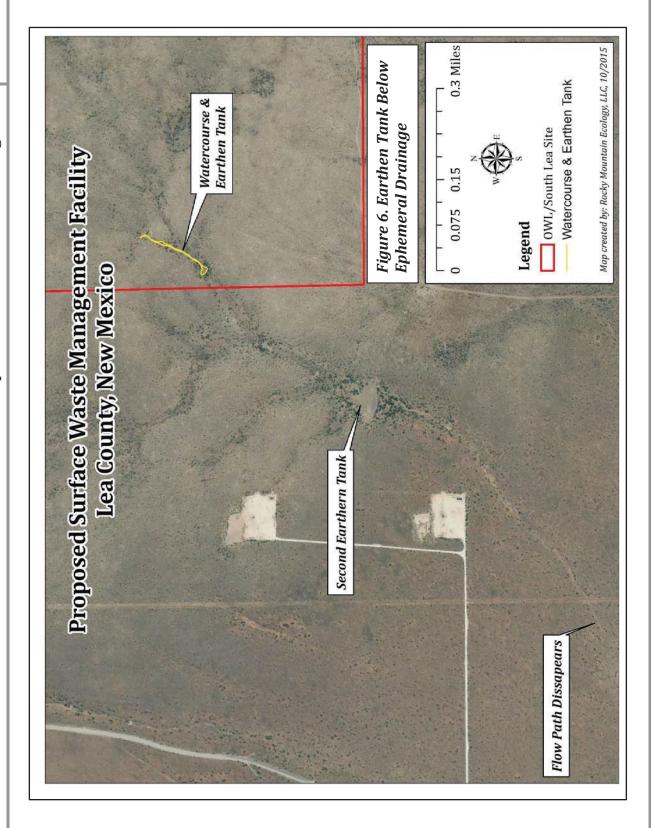
# 4.2 100-Year Floodplain

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

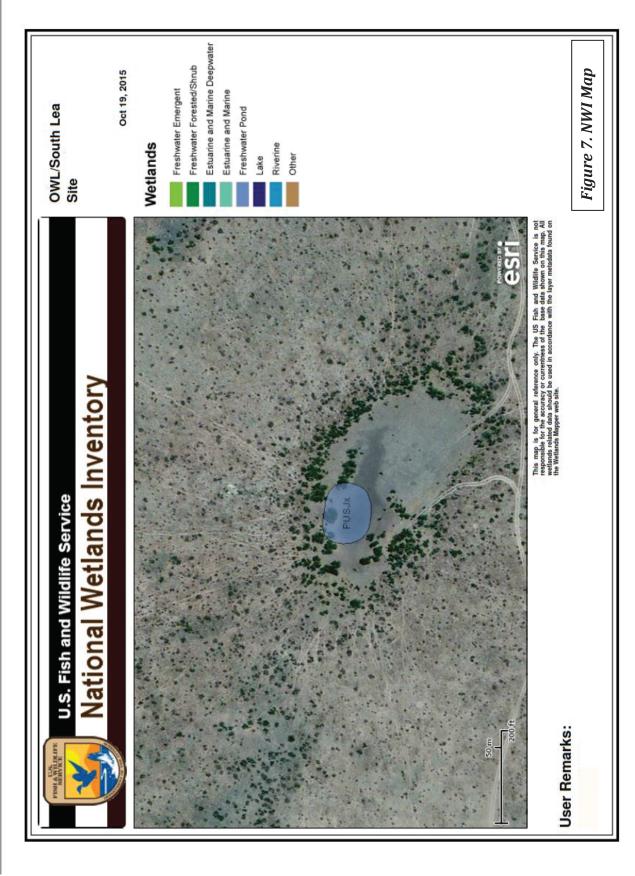
No sinkholes were observed on the property during the field survey.

#### 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 subwatershed, 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
- 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.

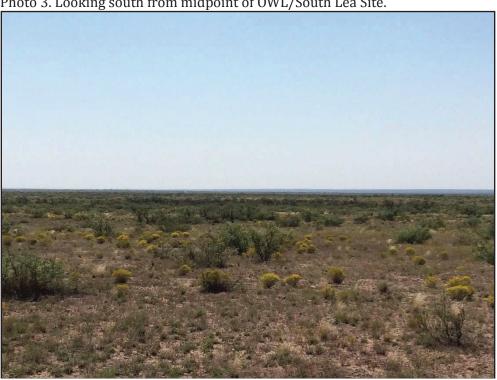


Photo 4. Excavated depressional feature, facing southeast.



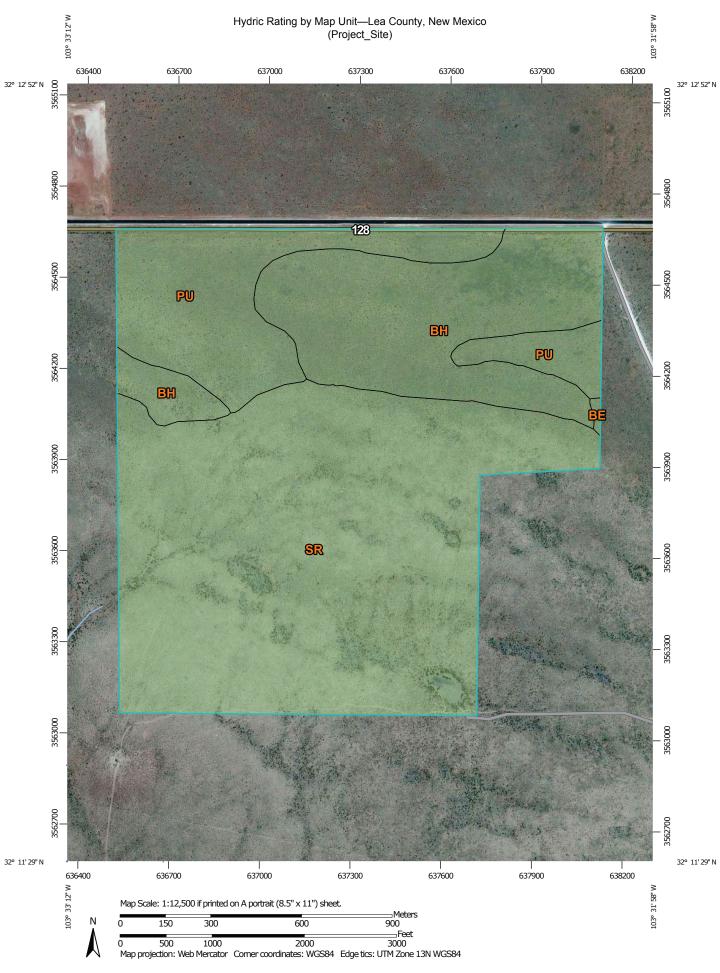
Photo 5. Watercourse in southwest project area, facing southwest.



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



# APPENDIX B - NRCS SOILS DATA



USDA

# MAP LEGEND

# Interstate Highways Aerial Photography Major Roads Local Roads US Routes Rails **Transportation** Background Not rated or not available Area of Interest (AOI) Hydric (66 to 99%) Hydric (33 to 65%) Hydric (1 to 32%) Not Hydric (0%) Hydric (100%) Soil Rating Polygons Area of Interest (AOI)

# 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.

Not rated or not available

Hydric (66 to 99%) Hydric (33 to 65%)

Hydric (100%)

Soil Rating Points

Hydric (1 to 32%)

Not Hydric (0%)

Hydric (66 to 99%) Hydric (33 to 65%)

Hydric (100%)

Soil Rating Lines

Hydric (1 to 32%)

Not Hydric (0%)

}

# Water Features

Not rated or not available

Streams and Canals

# **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	
ВЕ	Berino-Cacique loamy fine sands association	2	0.8	0.1%	
ВН	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 Inter	rest		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**

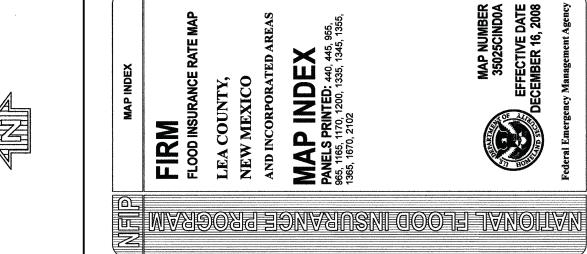
Aggregation Method: Percent Present

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

# APPENDIX C – FEMA FIRMETTE

*35025C1800D 12/16/2008	*35025C1950D 12/16/2008	Flowp Flowp *35 *35 12/16/2008
*35025C1775D	*35025C1925D	*35025C2075D 12/16/2008
*35025C1750D	*35025C1900D 12/16/2008	*35025C2025D *35025C2050D *35025C2075D *35025C2100D 12/16/2008 12/16/2008 12/16/2008
5025C1725D 12/16/2008	3025C1875D 12/16/2008	5025C2025D 12/16/2008
	3025C1725D *35025C1750D *35025C1775D *35025C1800D 12/16/2008 12/16/2008 12/16/2008	***55025C1750D **35025C1775D **35 12/16/2008 12/16/2008 ****55025C1900D **35025C1925D **35025C19008



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 mades 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

\* PANEL NOT PRINTED - AREA IN ZONE D

# 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.

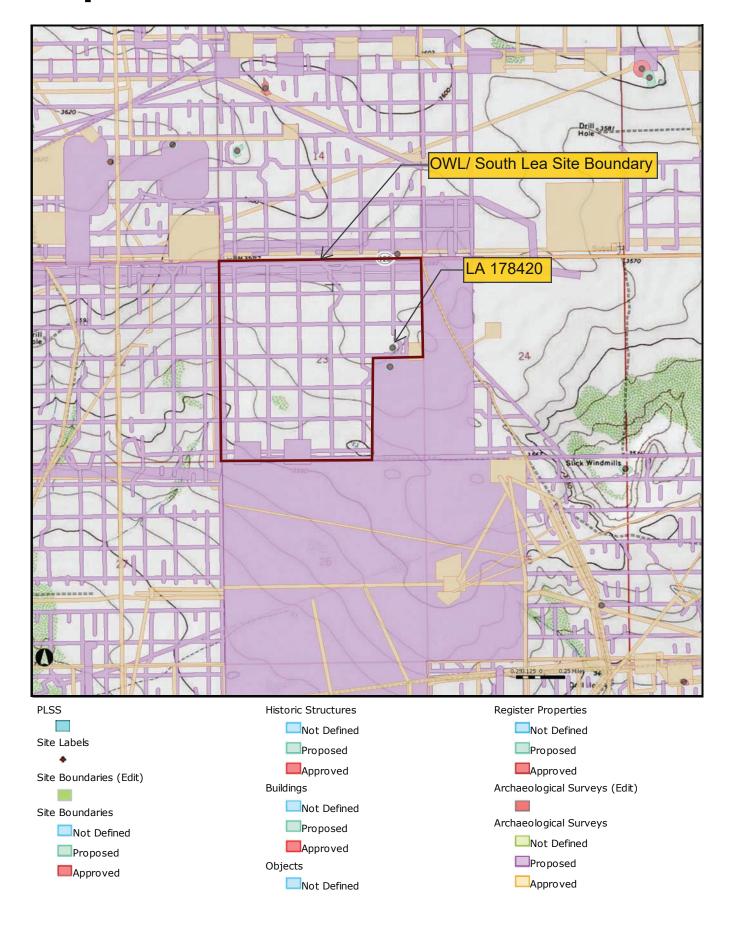
A Class I file search of the Archaeological Records Management Section (ARMS) Mapserver database was conducted on October 15, 2015 (please see the attached ARMS map). One previously recorded cultural resource site was identified within the proposed project area. Site LA 178420 is an historic surface 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.

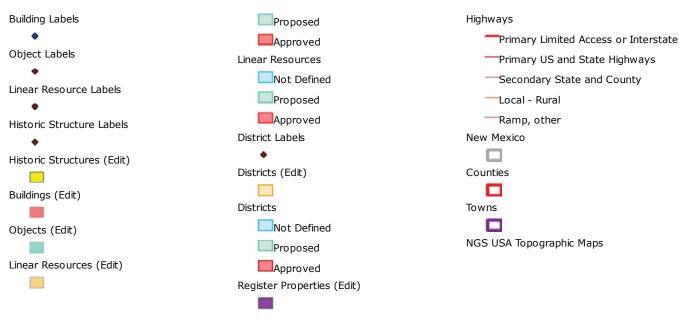
Sincerely,

Richard Burleson Co-owner (Partner) Hammerstone Archaeological Services

# Map



1 of 2



#### **NMCRIS**

## **Background Reference Layers**

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#### **Satellite Imagery**

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2 of 2

# 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)

**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 ± 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

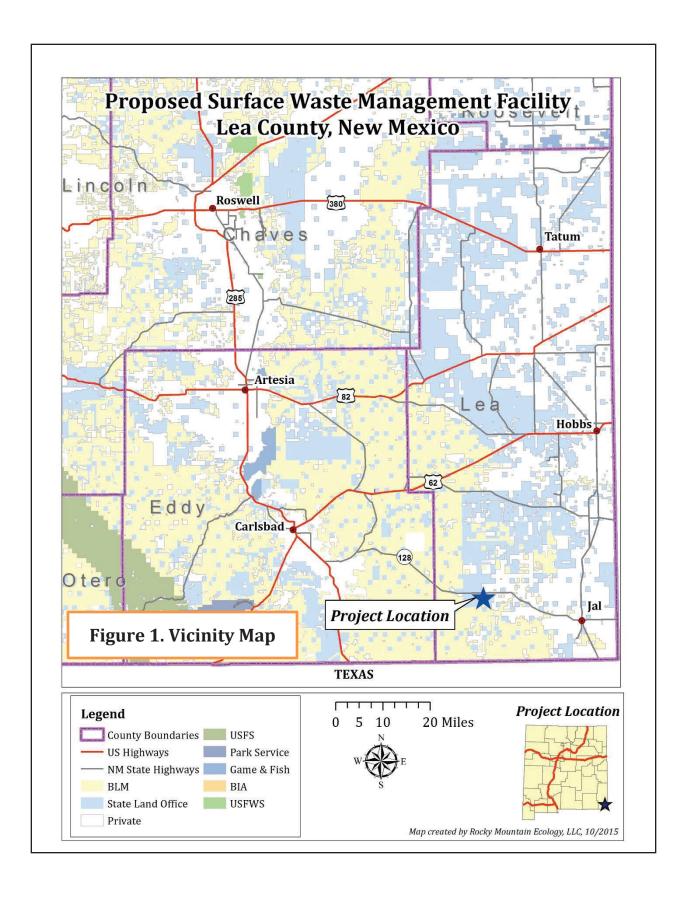
occurrence of state or federal Proposed, Threatened, Endangered, and Candidate species in the Project Area. Specifically, the USFWS New Mexico Ecological Services website (http://ecos.fws.gov/) was verified for federally-listed flora and fauna species (Consultation Tracking No. 02ENNM00-2015-SLI-0153 – 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.

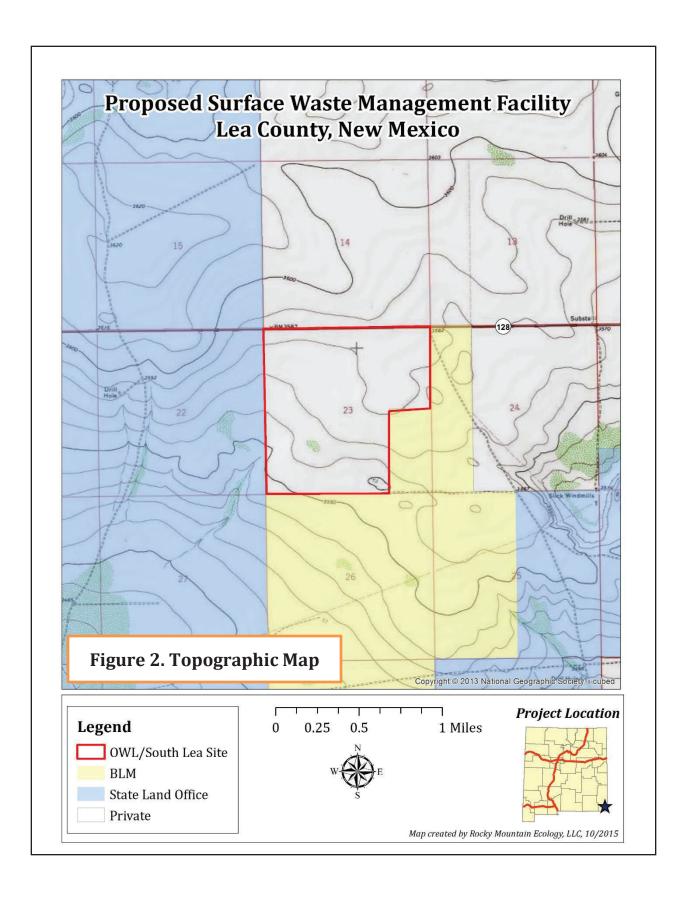
# **GENERAL PROJECT AREA DESCRIPTION**

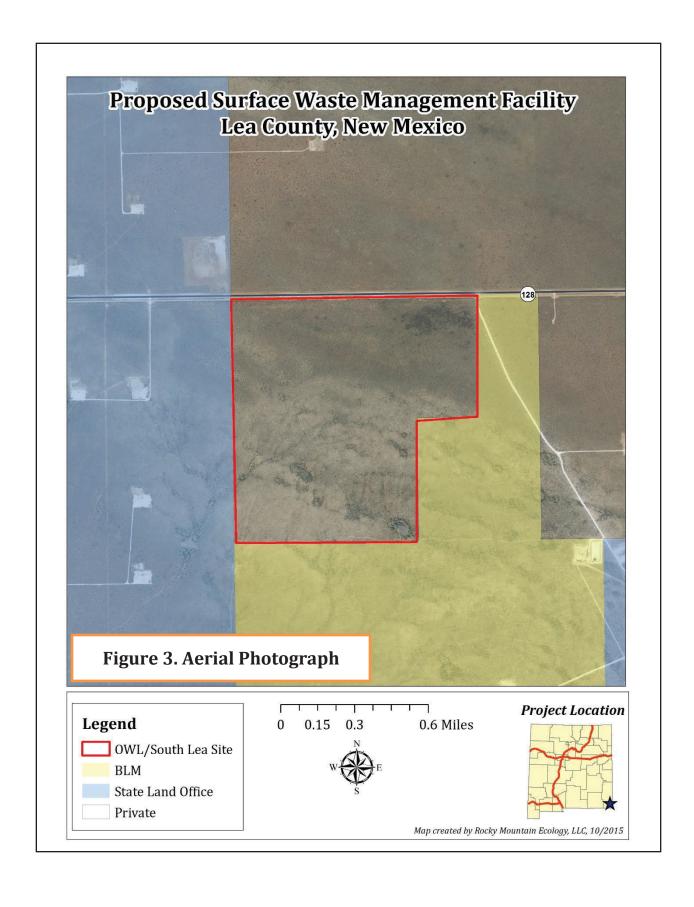
The project area occurs within the Chihuahuan Desert Grasslands subregion of the Chihuahuan Deserts Ecoregion (Griffith, et. al 2006). "The grasslands occur in areas of somewhat higher annual precipitation (10 to 15 inches) than the Chihuahuan Basins and Playas, such as elevated basins between mountain 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 horseweed (*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.







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.

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Table 1

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

Species Category	Common Name	Scientific Name	Habitat	Habitat Present in Project Area?	Status	Determination
BIRD	Peregrine Falcon/ Arctic Peregrine Falcon	(Falco peregrinus anatum/ tundrius)	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	Ammondramus bairdii	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 highquality 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) statelisted 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,

Shawn Knox

Co-owner/Principal,

Rocky Mountain Ecology, LLC

### **REFERENCES**

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.

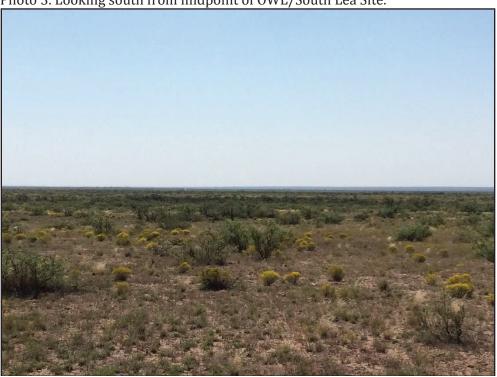


Photo 4. Excavated depressional feature, facing southeast.



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



October 20, 2015

Consultation Code: 02ENNM00-2016-SLI-0044

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





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

# **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.

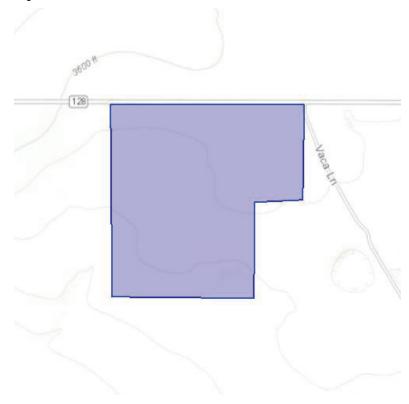
**Please Note:** The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your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





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

# **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





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

# **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 (Tympanuchus pallidicinctus)	Threatened		
northern aplomado falcon (Falco femoralis septentrionalis) Population: U.S.A (AZ, NM)	Experimental Population, Non- Essential		
Sprague's Pipit (Anthus spragueii)	Candidate		





Project name: SURFACE WASTE MANAGEMENT FACILITY ON 560 ACRES IN LEACOUNTY

# 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





# **Table of Contents**

1.0	RE	GIONAL GEOLOGY AND HYDROLOGY	1
1.1	F	Physiographic Setting	1
1.2	5	Structural Setting	2
1.3	5	Surface Geology and Shallow Stratigraphy	2
1.4	5	Sources of Hydrogeologic Data	3
1	.4.1	Area Water Wells	4
1	.4.2	Potash Mine Borings	4
1	.4.3	OWL Site Borings	5
1	.4.4	Oil and Gas Exploration and Development Wells	5
1	.4.5	Groundwater Sampling and Analyses	5
1.5	١	Nater-Bearing Geologic Units	6
2.0	SIT	E SPECIFIC GEOLOGY AND HYDROGEOLOGY	8
2.1	5	Site Investigation, Data Compilation and Interpretation	8
2.2	(	DWL Site Geotechnical Evaluation	9
2.3	(	DWL Site Geology	9
2.4	(	DWL Site Hydrogeology	10
2	.4.1	Santa Rosa Sandstone Aquifer	10
2	.4.2	Water-Bearing Zones in the Chinle Formation	11
2	.4.3	Water-Bearing Zones in Shallow Alluvium	12
2	.4.4	Intercontinental Potash Company Borehole 092 Drill Stem Testing	13
3.0	RE	GULATORY SITING REQUIREMENTS	14
3.1	5	Streams, Springs, Watercourses and Water Wells Within One Mile of the Site	14
3.2	L	aboratory Analyses of Shallow Groundwater Samples	14
3.3		Depth, Formation Name, Type and Thickness of the Shallowest Fresh Water Aquifer	15
3.4	L	ithology of Stratigraphic Units Above the Santa Rosa Sandstone at the OWL Site	15
3.5	(	Geologic Cross Sections	15
3.6	F	Potentiometric Map of the Santa Rosa Sandstone	15
3.7		Depth to Shallow Fresh Groundwater	16
4.0	CO	NCLUSIONS	17
5.0	RE	FERENCES	18

i

# **List of Tables**

Table IV.2.1	Records of wells and borings in the vicinity of the OWL Landfill Services, LLC site
Table IV.2.2a-b	Water quality data, the OWL Landfill Services, LLC site well and vicinity wells
Table IV.2.3	Summary of OWL Landfill Services, LLC site boring locations, depths, drill dates and
	Chinle Shale Depths
Table IV.2.4	Soil Laboratory Summary, OWL Landfill Services, LLC site





# **List of Figures**

Figure IV.2.1	Physiography of southern Lea County and Eastern Eddy County, New Mexico
Figure IV.2.2	Major structural features of Southeastern New Mexico
Figure IV.2.3	Regional surface geology and general stratigraphy, Southeastern New Mexico
Figure IV.2.4	Surface geology in the vicinity of the OWL site
Figure IV.2.5	Post-Pennsylvanian stratigraphy of the Delaware Basin
Figure IV.2.6	Locations of site characterization borings on the OWL site and adjacent tracts
Figure IV.2.7	Regional hydrogeologic cross section through the OWL site
Figure IV.2.8	Projected structure, top of the Santa Rosa Sandstone
Figure IV.2.9	Potentiometric surface of the Santa Rosa Sandstone Aquifer
Figure IV.2.10	Local hydrogeologic cross section through the OWL site
Figure IV.2.11	Terrain of the top of the Chinle Formation
Figure IV.2.12	

# **List of Attachments**

Attachment IV.2.A	Records of permitted wells in the vicinity of the OWL site
Attachment IV.2.B	Summary of Intercontinental Potash Company boring 092 drill stem test data
Attachment IV.2.C	OWL site characterization boring logs
Attachment IV.2.D	Lithologic log of the post-Rustler Fm. section, Conoco Bell Lake 2 (Nicholson and
	Clebsch 1961)
Attachment IV.2.E	Laboratory reports on water quality testing, OWL site well and Double M Ranch
	Well



1530841



### 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.

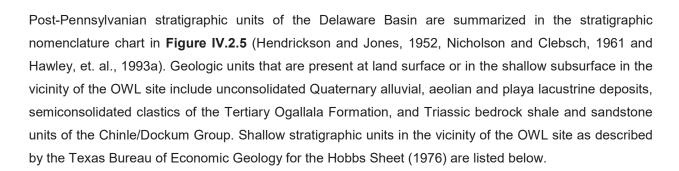
The Central Basin Platform forms an abrupt eastern terminus to the Delaware Basin; it is a steeply fault-bound uplift of basement rocks that grew through the early and middle Paleozoic Era such that most of the pre Permian sedimentary section is missing from its apex. Great thickness of organic-rich 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**.





**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, sant 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 Rose Sandstone at the OWL site is approximately 350 feet ± 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 ± 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 aguifer 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-producible water.



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#### 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.

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October 2016

Table IV.2.1

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

NMOSE File No. or Well Name	Borehole, Well ID or API No.	USE	Drill Date	Litho	Owner	Water Source	Location PLS Township South Range East	UTM X (NAD 83)	UTM Y (NAD 83)	Land Surf Elevation (ft) Estimated from USGS 7.5' Sheets (NAD-27)	Depth (ft)	Depth to Ele Water (ft)	WL Elevation Con (ft) above	WL Date (or F Completion R Date) (g	Flow Rate Aquifer (gpm)		Water. T Bearing C Zone	Depth to Elev Top Tr Top Tr Chinle Chinle (ft) (ft)	Tr Santa nie Rosa SS	Co Elev. Top Santa S Rosa SS (ft)	Depth to Top of Rustler S Anhydrite (ft)	Elev. Top of Rustler Anhydrite (ff)	Source of Data Comments
										Permitted Car	risbad Un	derground	Carlsbad Underground Basin Water Wells	Wells									
C 03528 POD1		Stock	3/12/2012	¥ ×	MARK MCCLOY (M&M RANCH)	Shallow 2	24.32.15.211 62	625948 35	3566099	3594	541	133	3461		Qa	Qal-Tr 13	133-152	75 3519	61				OSE Well Record
C 02308		Stock	6/30/1920	Ź	MCCLOY S	Shallow 2	24.33.10.131 60	634953 35	3567364	3592	40	20			15 To/	To/Qal							Shomaker 10/2014; OSE POD Summary
C 03666 POD1			10/26/2013	×		Shallow 2	24.33.13.432 6:	639132 35	3565078	3588	650	390	3198	H	38 T	Tr 46	460-600	90 3498	98				OSE Well Record
C 02430		Comm	12/31/1982	د ت		Shallow 2	24.33.16.333 63	633377 35	3564732	3573	643	415	3158		12 Tr	_							Shomaker 10/2014; OSE POD Summary
C 02431		Comm	12/31/1959	د ته		Shallow 2	24.33.17.444 60	633175 36	3564728	3573	525	415	3158		Z0 T	Ė							Shomaker 10/2014; OSE POD Summary
C 02432		Comm	12/31/1980	Ź		Shallow 2	24.33.17.444 60	633175 35	3564728	3573	640	415	3158		45 Tr	_							Shomaker 10/2014; OSE POD Summary
C 03662 POD1		Dom-Stk	8/20/2013	ž ≥ ×		Shallow 2	24.33.23.213 60	637342 35	3564428	3582	220	393	3189		T 01	Tr 25	250-275	30 3552	25				OSE Well Record + Pump Set WL
C 03662 POD1				≧ سُ	EOG RESOURCES S	Shallow 2	24.33.23.213 60	637342 35	3564428	3582	220	110	3472		_	ı=							Shomaker 10/2014
C 02309		Dom-Stk	6/30/1912	ے تھ	INS FEDERAL ID BANK ASSOC	Shallow 2	24.33.25.222 60	639705 35	3562966	3518	09	30			40 To/Qal	Qal							Shomaker 10/2014; OSE POD Summary
C 02310		Comm	12/31/1890	Ž	MCCLOY S	Shallow 2	24.33.33.232 60	634437 35	3560918	3472	120	02			60 To/Qal	Qal							Shomaker 10/2014; OSE POD Summary
C 02311		Dom-Stk	12/31/1890	Ź	МССГОУ	Shallow 2	24.33.33.232 60	634437 35	3560918	3472	120	20			60 To/Qal	Dal							Shomaker 10/2014; OSE POD Summary
								Pre	Basin Water	-Basin Water Wells, NMBM GW Report 6, 1961 and Geohydrology Associates, 1978	GW Repo	ırt 6, 1961 a	nd Geohydro	logy Associ	ates, 1978		ı	l					
Prebasin Well		Dom-Stk		ã	Brinninstool	CV I			3571164	3683	575	200	3183			_							NMBM GW Report 6
Prebasin Well		Stock	1953	0 1	Continental Oil Frank James	1416	23.34.31.340 62	640352 35	3569745	3593	678	31.1	3562 6	6/3/55	- Q	- Co							NMBM GW Report 6 NMBM GW Report 6
Prebasin Well		Stock		T		100	Т	Ţ	3566147	3593	40	╀	ŀ	11/18/77		-	t	H	_				GAI 1978 (NMBM GW Report 6)
Prebasin Well		Dom-Stk		ŭ	Frank James	CA	П		3568454	3661	Н	Н	H	_	Ц	L							GAI 1978 (NMBM GW Report 6)
Prebasin Well		Stock		œ	Richard Ritz	N	24.32.33.422 62	625217 38	3560349	3501	367	313.4	3188 2/	2/18/58 0.25	0.25 gpm Tr		$\dagger$	+	+				Nicholson Clebsch 1961
Prebasin Well		Stock		Ö	Carl Johnson	2 2	Т.		3567350	3592	+	+	-	1/27/53	0	Oal							GAI 1978 (NMBM GW Report 6)
Prebasin Well	É	Not Used				2	33.23.311	Γ	3563632	3559	232	H	t	1/27/53	T	T.	t	H					GAI 1978 (NMBM GW Report 6)
Prebasin Well		Stock		H		CA	24.444		3563114	3519		Н	Н	11/27/53		To							GAI 1978 (NMBM GW Report 6)
Prebasin Well		Dom-Stk	1	$\dagger$		N	33.33.231	634400 35	3560918	3472		93.2	3379 3/	3/17/54		Qal	1	+	+				GAI 1978
Prebasin Well		Stock		ž	Madera Ranch	2 2	24.34.35.122 6		3561348	3417	258	5 24	+	3/29/55		오뉴	t	H					NMBM GW Report 6
Prebasin Well		Stock		Н		ťΝ	П	642951 35	3569350	3569		Н	3518 6	6/3/55	_	To							NMBM GW Report 6
Prebasin Well		Abd-Stk		$\dagger$		N C	24.34.4.113 6		3569350	3567	Q 9	51.88	+	12/8/70		0							GAI 1978 (NMBM GW Report 6)
Prebasin Well	Ī	Industrial		t	İ	2 2	Т		169226	3549	+	L	+	12/8/70		F							GAI 1978
Prebasin Well		Stock		H		EN I	Ш	П	3567959	3575	78	Н	Ĥ	4/21/55		_O							GAI 1978 (NMBM GW Report 6)
Prebasin Well	1	Stock		12	Modern Doneh	. 4 C	24.34.7.222 68	641243	3567916	3598	140	150	3526	0/8/70	1	0		+	+	1			MMPM CW Boosts
Prebasin Well	Ī	Dom-Stk		≥ ₫	Plains Prod Co	410		T	3553407	3402	2	+	$^{+}$	11/27/53	<u> </u>	Ļ	t	t	+	1			NWBM GW Report 6
Prebasin Well		Stock		Ž	Nick Rtz	Ø	ш		551210	3408	320	258	3150 7/	7/26/54		_							NMBM GW Report 6
Prebasin Well		Stock		ž	adera Ranch	CA.	ı	Ш	3559326	3389	300+	Н	Н	/15/53	'-	Tr							NMBM GW Report 6
Prebasin Well		Not Used		+		N C	25.34.15.242 6	646117 35	3556178	3335	300	164.9	3170 7/	7/23/54	. [	<u>-</u>							NMBM GW Report 6
I COROLL A COL				1			1		1	ndfill	ď	II.S. Socti		Roringe		ł	l	ł	ł	ļ	ļ	l	O TIOODI AAO INGININ
Borehole 1	ľ	Geotech	11/25/2014	×		2	24.33.23.222 63	638096	3564656		150	dry		11/25/14	-	ŀ	ŀ	60 3525	52	L		L	Gordon Environmental 2015
Borehole 2	ĺ	۰	11/18/2014	×		2			3563081	3552	200	36	3513 11	11/25/14	Qal	a		H	12				Gordon Environmental 2015
Borehole 3		Geotech	11/25/2014	×		CA	24.33.23.311 63	Ĭ	3563071	3561	175	dry	7	/25/14		Н		38 3523	53				Gordon Environmental 2015
Borehole 4		-	11/25/2014	×		N C	т		3564633	3588	200	dry	= 3	11/25/14	+	+	1	+	23	1			Gordon Environmental 2015
Borehole 5		Geotech	11/1 //2014	×		, v	24.33.23.233	637326	3563949	35/9	165	dry	165 dry 11/1///	11/17/14	$\left\{ \right.$	1	1	45 3534	34	4	1		Gordon Environmental 2015
TW DI CVE 13			12/15/1000	F	Г	Chollow		Г	3569076	3630	oo oo	Pacinity Env	2540 42	12/15/00	ŀ	-	ŀ	r	35	L			OSE Wall Beauth
TW PL SVE-13		Finding	12/14/1999	1	Transwestern Pine		24 33 1.42 0.	639200	3568976	3630	8 8	+	3556 12	12/14/99	+	$\dagger$	t	34 3605	2 2	1			OSE Well Record
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Page 1 of 3

October 2016

Table IV.2.1

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

			_										_									
i i	Source of Data Comments		Intera 5/2013		OSE Waters Database POD Summary	OSE Well Record	OSE Well Record	OSE Well Record														
Elev. Top	of Rustler Anhydrite (ft)		_				Ī	Ī	Ī	Ī	Ī	Ī	ı		Ü	Ŭ			Ū	2374 (	2340	2361
Depth to Top of	Rustler Anhydrite (ft)												ı							1227	1284	1238
Elev. Top	Santa Rosa SS (ft)	١											ı									
Depth to Top	Chinle Chinle Rosa SS Rosa SS (ft) (ft) (ft) (ft) (ft)												ı									
Elev	Top Tr Chinle (ft)	l											ı							3546	3569	3544
Depth to	Top Tr Chinle (ft)												ı							22	22	22
Water-	Bearing Zone												ı									
	Aquifer		Ė						Ė			Ė	ı									
Flow		ra, 2013)			26.3		24.4	3.6		28	13.3		ı									
WL Date (or	Completion Date)	tigation (Inte											n Borings									
, WL	Water (ft) above (ft) MSL	Quality Inves											aracterizatio									
Depth to	Water (ft)	n Water C											Ore Cha							dry	dry	dry
	Depth (ft)	ncluded i	540	hun	hun	hun	180	180	540	hun	hun	540	tal Potas							1533	1665	1563
Land Surf Elevation (ft)	from USGS 7.5' Sheets (NAD-27)	Double M Ranch Wells Included in Water Quality Investigation (Intera, 2013)	3573	3573	3571	3571	3472	3509	3454	3472	3472	3600	Intecontinental Potash Ore Characterization Borings	3633	3581	3611	3610	3617	3650	3601	3624	3599
	(NAD 83)	Double M	3564318	3564695	3564685	3454678	3560920.9	3559829.5	3560925	3560929	3560834	3567331	ı	3568316	3566515	3567057	3566496	3566373	3569250	3566546	3565610	3565005
	(NAD 83)		633252	633219.4	633278.6	633278.6	634398.6	630409.4	641951	634401	634401	628576	ı	630871	631156	633672	634135	635022	631361	632763	635485	636430
Location PLS	Township South Range East		24.33.17.444	24.33.17.444	24.33.17.444	24.33.17.444	24.33.33.232	24.33.31.433	24.34.32.141	24.33.33.232	24.33.33.232	24.32.12.131	ı	24.33.6.42	24.33.7.43	24.33.9.14	24.33.9.43	24.33.10.33	24.33.6.22	24.33.8.433	24.33.15.14	24.33.15.44
	Source		2	CA	cv	2	2	Ø	2	2	2	2		C/V	N	N	CV.	C/V	N	N	N	N
	Owner		McCloy		Intercontinental Potash Corp	Intercontinental Potash Com																
	Log																			× ×	×	×
	Drill Date																			10/21/2012	3/25/2013	2/19/2013
	USE		Stock	Domestic	Stock		Geotech															
Borehole,			East	Tower	North	North XX	House WM	South XX	Unknown	E House	House	James East		ICP-083	ICP-084	ICP-086	ICP-087	ICP-089	ICP-090	ICP-085	ICP-092	ICP-093
i	NMOSE File No. or Well Name		ICP-DHR-01	ICP-DHR-02	ICP-DHR-03	ICP-DHR-04	ICP-DHR-05	ICP-DHR-06	ICP-DHR-07	ICP-DHR-08	ICP-DHR-09	ICP-DHR-10		C03565 POD1	C03565 POD2	C03565 POD4	C03565 POD5	C03565 POD6	C03565 POD7	C 03565 POD3	C 03565 POD8	C 03565 POD9



October 2016

Table IV.2.1

Records

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

																								П		T	Т	П	Т	Т	П
Source of Data Comments		Shomaker 10/2014; OSE Well Record	OSE Well Record	OSE Well Record	OSE Well Record	OSE Well Record	OSE Well Record	OSE Well Record		Shomaker 10/2014		NMOCD Record	NMOCD Record	NMOCD Record; NMBM GW Report 6	NMOCD Record	NMOCD Record	NMOCD Record														
Elev. Top of Rustler Anhydrite (ft)		0)	0)	0)	0)	0)	0)	0)	0)	0)	0)	0)	0)	0)	0)	0)		0	0		0	0		0,	H	1980	П	П	1888 N	Т	2414
Depth to Top of Rustler Anhydrite (ft)																										1395	902	1255	1620	672	1010
Depth to Elev. Top Top Santa Rosa SS Rosa SS (ft) (ft)																												3183			
																							l					450			L
Top Tr Chinle (ft)	ı	3516	3523	3459	3490	3531	3531	3534	3452	3552	3546	3554	3538	3540	3535	3531	3498	3488	3484	3489	3470	3478						3508	3458		L
Depth to Top Tr Chinle (ft)		37	28	63	45	17	54	21	99	23	24	78	31	31	27	32	23	56	23	22	31	54						125	20		
Water- Bearing Zone	l																														
Aquifer																															
Flow Rate (gpm)	l																									T	Ī				
WL Date (or Completion Date)	rings																														
WL Elevation (ft) above MSL	Intecontinental Potash Geotechnical Borings																						on Well	3579	ells		Ī				
Depth to Water (ft)	tash Geo	dry	dny	dny	dry	dry	dny	dny	dny	dny	dry	dny	dny	dny	dny	dny	dny	dry	dry	dny	dny	dny	<b>USGS Observation Well</b>	22	Oil and Gas Wells	T	Ī				l
Depth (ft)	nental Po	75	75	75	75	75	75	75	75	75	75	100	75	75	75	75	75	75	75	75	75	75	USGS	36	Oila	12942	13900	13866	3748	4953	1 200
Elevation (ft) Estimated from USGS 7.5' Sheets (NAD-27)	Intecontir	3553	3551	3522	3532	3548	3555	3555	3518	3575	3570	3582	3569	3571	3562	3566	3521	3514	3507	3511	3501	3502		3601		3626	3371	3633	3508	3345	, 0, 0
UTM Y (NAD 83)		3563023	3562340	3562293	3562026	3562020	3562329	3562329	3561968	3563588	3563338	3563937	3563334	3563413	3563170	3563222	3561237	3561180	3561108	3560475	3560784	3560641		3566829		3576043	3573478	3571352	3579316	3550299	1017110
UTM X (NAD 83)		637275	637784	636617	637382	637857	638824	638824	636726	637846	637833	638124	637988	638141	637946	638136	637759	637338	636847	637747	969969	636705	١	634948		623313			658645	Г	
Location PLS Township South Range East		24.33.26.122	24.33.26.243	24.33.26.133	24.33.26.413	24.33.26.423	24.33.25.144	24.33.25.144	24.33.26.313	24.33.23.423	24.33.23.441	24.33.24.113	24.33.23.442	24.33.24.331	24.33.23.444	24.33.24.333	24.33.35	24.33.35	24.33.35	24.33.35	24.33.35	24.33.35			lľ	23.32.8.441	23.34.24.321	23.34.30.342	23.35.1.222	25.32.36.331	0,000000
Water Source	١	Shallow 24	Shallow 24	Shallow 24	Shallow 24	Shallow 24	Shallow 24	Shallow 24	l			8 8	1 20	23	212	1 50	č														
Owner		Intercontinental S Potash Corp	tal		ıtal	tal			tal		tal	tal		ıtal	tal		ıtal	ıtal	Intercontinental S Potash Corp	tal	Intercontinental S Potash Corp	Intercontinental S Potash Corp				Roff Operating	Natomas N America	Continental Oil Co	Apco Oil Corp	Fullerton Oil Co	Custio Honkowork
Litho Log	l	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×			ı	××	т	П	××		
Drill Date		1/7/2013	1/16/2013	1/8/2013	1/9/2013	1/9/2013	1/8/2013	1/15/2013	1/9/2013	1/7/2013	1/5/2013	12/21/2012	1/6/2013	1/6/2013	1/5/2013	1/4/2013	1/1/2013	1/11/2013	1/13/2013	1/14/2013	1/13/2013	1/13/2013		ometer		17/4/1980	8/7/1980	11/2/1954	8/11/1955 1/3/1996	12/23/1953	
USE		Geotech	Geotech	Geotech	Geotech	Geotech	Geotech	Geotech		USGS Piezometer		Gas	SWD	io	SWD	SWD															
Borehole, Well ID or API No.		BH-16	BH-19	BH-20	BH-22	BH-21	BH-17	BH-18	BH-23	6-H8	BH-13	8H-8	BH-12	BH-10	BH-14	BH-11	BH-24	BH-25	BH-26	BH-27	BH-28	BH-29				25-38367	25-26547	25-08489	25-08674	25-08248	
NMOSE File No. or Well Name		C 03600 POD1	C 03600 POD3	C 03600 POD4	C 03600 POD6	C 03600 POD5	C 03600 POD2	C 03600 POD2	C 03600 POD7	C 03601 POD2	C 03601 POD6	C 03601 POD1	C 03601 POD5	C 03601 POD3	C 03601 POD7	C 03601 POD 4	C 03603	C 03603	C 03603	C 03603	C 03603	C 03603		JSGS 321348103340401	П	Tomcat Federal 8	Antelope Ridge 24		Apco Ehman 1	Bradley State 1	Door Fodorol 4



October 2016 1530841

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

			B (Go )B (In	older) tera)	
Analytes	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

										Inorc	Inorganic Analytes	alvtes									Organ	Organic Analytes	es	
	Method		300	300.0		SM2540C MOD					<u></u>	EPA 6010B (Golder) EPA 200.7 (Intera)	B (Gold	der) ra)					7470 (Golder) 245.1 (Intera)	8021B (Golder) 8260B (Intera)		8260	00	
Well	səlylisnA	Chloride	Flouride	Sulfate	Nitrate	Total Dissolved Solids	munimulA	muinsa	muimbsO	Calcium	Chromium	lron	реәд	muisənga Magnesium Muissaio	Silver	muiboS	Sirsenic	Selenium	Мегсигу	Benzene	Ethylbenzene	oluene	HTBE	Xylenes (Total)
	G.W.P.S.	250	1.6	009	10	1,000	2	Н	0.01	3	0.05	Н	0.05		0.05	2	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.	0.002	1.0 0.1	0.006	0.05 0.0	0.005	1 1	0.005	05 5	0.020	0.050	0.0002	1.0	1.0	1.0	2.5	2.0
	PQL (Intera)	10.0	0.1	10.0	0.1	20 (	0.02	0.002 0.	0.002	0	0.006 0.	0.02 0.0	0.001		0.005	35	0.001	0.001	0.0002	1.0	1.0	1.0	1.0	1.5
	Date																							
									Wells	Wells Completed in Triassic Aquifers	eted in 1	riassic	Aquife	rs										
<sup>3</sup> 23.34.31.340	12/4/53	25	1.4	219	0.70	635			-	:	-	-	26	26.0	-			:	:	:-	:	:	-	:
<sup>2</sup> C-3662 POD 1	5/13/15	32	1.2	66	<0.10	> 205	<0.02 0	0.036 <0	<0.002	17 <0	0 900.0>	0.11 <0.	<0.005 19	19.0 3.9	9 <0.005	005 170	0 <0.02	2 <0.05	0.0002	<1.0	<1.0	<1.0	<2.5	<2.0
<sup>1</sup> ICP-DHR-01	4/11/13	56	1.2	130	0.54	513	<0.02 0	0.037 <0	<0.002	0>	<0.006 <c< th=""><th>&lt;0.02 &lt;0.</th><th>&lt;0.001</th><th>:</th><th>- &lt;0.005</th><th> 500</th><th>- &lt;0.001</th><th>1 0.015</th><th>0.0002</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.5</th></c<>	<0.02 <0.	<0.001	:	- <0.005	500	- <0.001	1 0.015	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
<sup>1</sup> ICP-DHR-02	4/11/13	36	1.2	140	0.72	533	<0.02	0.05 <0	<0.002	0>	<0.006 <c< th=""><th>&lt;0.02 &lt;0.</th><th>&lt;0.001</th><th></th><th>- &lt;0.005</th><th> 500</th><th>- &lt;0.001</th><th>1 0.017</th><th>0.0002</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.5</th></c<>	<0.02 <0.	<0.001		- <0.005	500	- <0.001	1 0.017	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
<sup>1</sup> ICP-DHR-03	4/11/13	56	1.1	120	0.65	482	<0.02 0.041	Н	<0.002	0>	<0.006 <c< th=""><th>&lt;0.02 &lt;0.</th><th>&lt;0.001</th><th></th><th>- &lt;0.005</th><th> 500</th><th>- &lt;0.001</th><th>1 0.021</th><th>0.0002</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.5</th></c<>	<0.02 <0.	<0.001		- <0.005	500	- <0.001	1 0.021	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
<sup>1</sup> ICP-DHR-04	4/11/13	12	1.3	99	<0.10	416 <	<0.02 0	0.046 <0	<0.002	0>	<0.006 <c< th=""><th>&lt;0.02 &lt;0.</th><th>&lt;0.001</th><th></th><th>- &lt;0.005</th><th> 500</th><th>- &lt;0.001</th><th>1 0.001</th><th>0.0002</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.5</th></c<>	<0.02 <0.	<0.001		- <0.005	500	- <0.001	1 0.001	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
<sup>1</sup> ICP-DHR-07	4/11/13	28	1.6	190	<0.10	640	<0.02 0.027	Н	<0.002	0>	<0.006 0	0.14 <0.	<0.001	-	- <0.005	500	- <0.001	1 <0.001	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
						1	Wells Comple	ompletec	in Play	ted in Playa Deposits, Shallow, Multiple or Unknown Aquifers	its, Sha	How, Mr	ultiple (	or Unk	nown A	Aquifer	,,							
<sup>1</sup> ICP-DHR-05	4/11/13	200	4.1	630	24	1560	<0.02 0	0.049 <0	<0.002	0>	<0.006 0.	0.047 <0.	<0.001		- <0.005	500	0.018	3 0.048	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1CP-DHR-06	4/11/13	130	3.5	470	8.30	1110	<0.02 0.034	-	<0.002	0>	<0.006 <0	<0.02 <0.	<0.001		- <0.005	500	0.014	0.023	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1CP-DHR-08	4/11/13	110	3.9	099	8.40	1310	<0.02 0	0.015 <0	<0.002	0>	<0.006 <c< th=""><th>&lt;0.02 &lt;0.</th><th>&lt;0.001</th><th>-</th><th>- &lt;0.005</th><th> 500</th><th>0.013</th><th>3 0.060</th><th>0.0002</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.5</th></c<>	<0.02 <0.	<0.001	-	- <0.005	500	0.013	3 0.060	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
<sup>1</sup> ICP-DHR-09	4/11/13	340	3.8	710	28	1920	<0.02 0	0.047 <0	<0.002	0>	<0.006 0.	0.039 <0.	<0.001	-	- <0.005	500	. 0.017	0.055	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
<sup>1</sup> ICP-DHR-10	4/11/13	220	1.1	220	<0.10	1400	<0.02 0.026	Н	<0.002	0>	<0.006 0.170	_	<0.001	-	- <0.005	500	0.0014	4 0.037	0.0002	<1.0	<1.0	<1.0	<1.0	<1.5
1CP-DHR-06	4/11/13	130	3.5	470	8.30	1110	<0.02 0	0.034 <0	<0.002	0>	<0.006 <c< th=""><th>&lt;0.02 &lt;0.</th><th>&lt;0.001</th><th></th><th>- &lt;0.005</th><th> 500</th><th>0.014</th><th>1 0.023</th><th>0.0002</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.0</th><th>&lt;1.5</th></c<>	<0.02 <0.	<0.001		- <0.005	500	0.014	1 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**.

<sup>1</sup>Inter 2013 Doubte M Ranch Sampling Investigation <sup>2</sup>Gordon Environmental 2015 sample

<sup>3</sup>Nicholson and Clebsch 1961 prebasin well

Table IV.2.2a-b.--OWL Area Wells WQ.xlsx/Table 2b



Page 1 of 1

1530841 October 2016

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	09	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



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

S S S S S S S S S S S S S S S S S S S	Sample	0001	Grain S	Grain Size Distr	tribution	Atterberg	erg	Natural	Standar	Standard Proctor		4
Number <sup>1</sup>	Depth (ft bgs)	Class <sup>2</sup>	Pass #4	Pass	Pass #200	Limits <sup>3</sup>	ຶທ	Moisture <sup>4</sup> (%)	Max Dry Density	Optimum Moisture	(cm/sec)	rorosity (%)
			(%)	(0/)	(%)	LL-PI			(PCF)	(%)		
BH1 - 3	15	SP-SM	82.1	39.7	8.3			5.99				38.39
BH1 - 12	82-85	SP-SM	99.0	9.07	0.9			3.68				37.13
BH-1 Bucket	100	ਠ	100.0	71.0	51.2	31-15	16	4.90	130.4	10.6	$2.87 \times 10^{-8}$	44.39
BH2 - 6	25	SP	92.0	72.2	3.1			6.67				43.18
BH-2 Bucket	20	SP	96.2	63.4	4.3				120.5	12.4		42.18
BH2 - 16	116-119	SC	100.0	52.5	30.8	37-20	17	17.52				40.75
BH3 - 5	20	SP-SM	100.0	6.76	9.9			8.38				33.15
BH-3 Bucket	45	SP-SM	84.8	44.6	6.6				115.5	12.6		36.15
BH3 - 16	128	SP-SM	8.66	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

Blank field indicates test not conducted

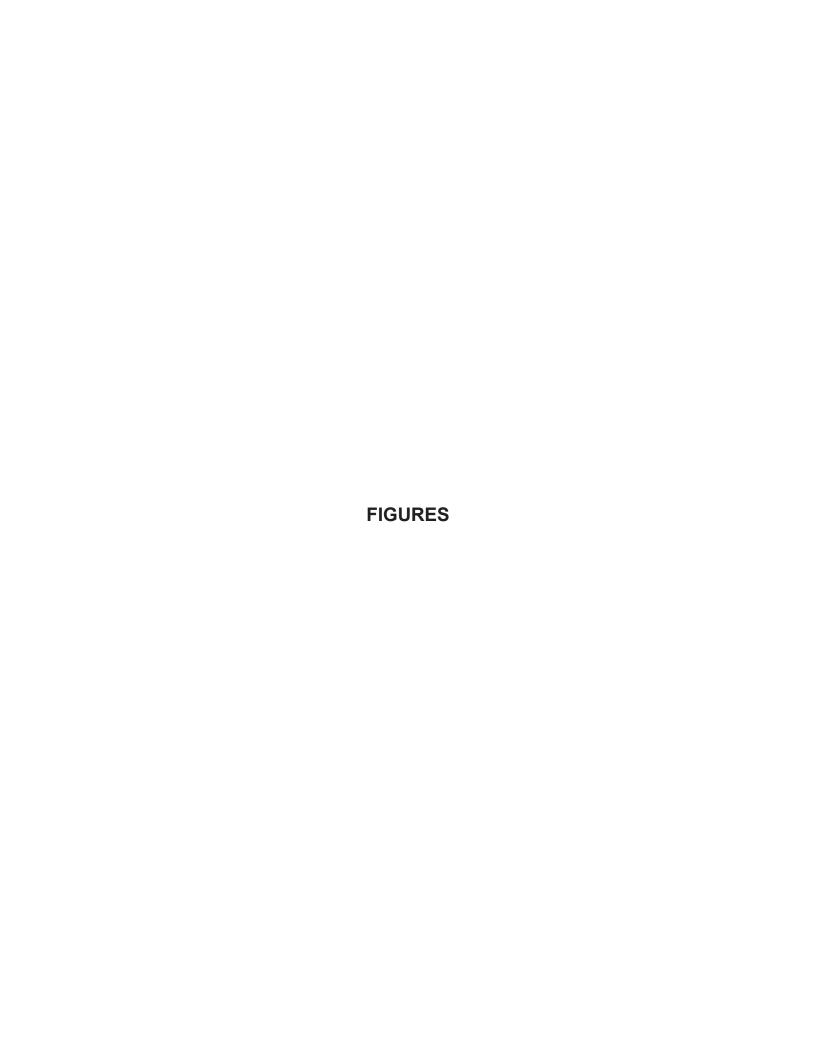
<sup>1</sup>See Figure IV.2.6 for locations of borings and Attachment IV.2.A for boring logs.

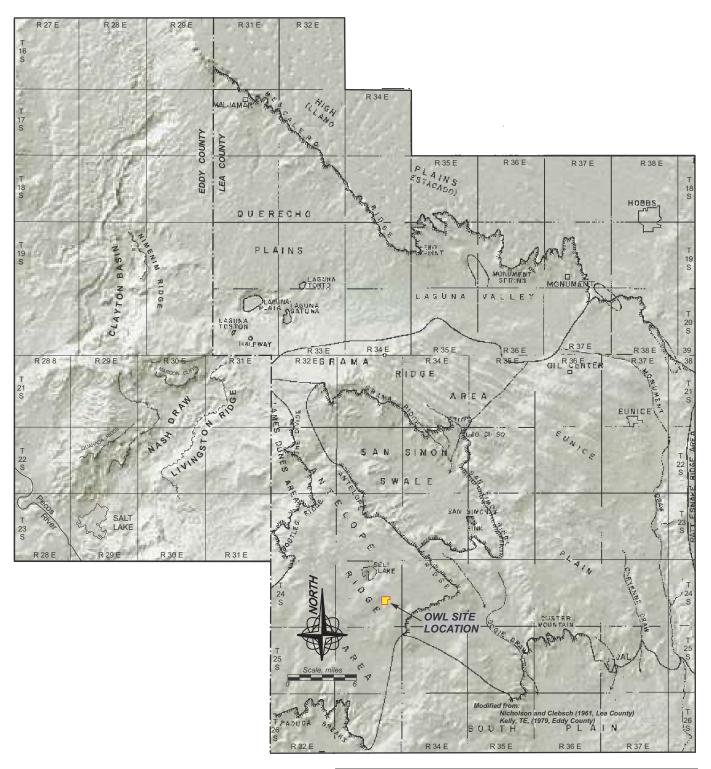
Porosity =  $(V_V/V)^*100$ 

<sup>&</sup>lt;sup>2</sup>Unified 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

 $<sup>^3</sup>$ LL = liquid limit; PI = plasticity index; NV = non viscous; NP = non plastic

<sup>&</sup>lt;sup>4</sup>Gravimetric basis





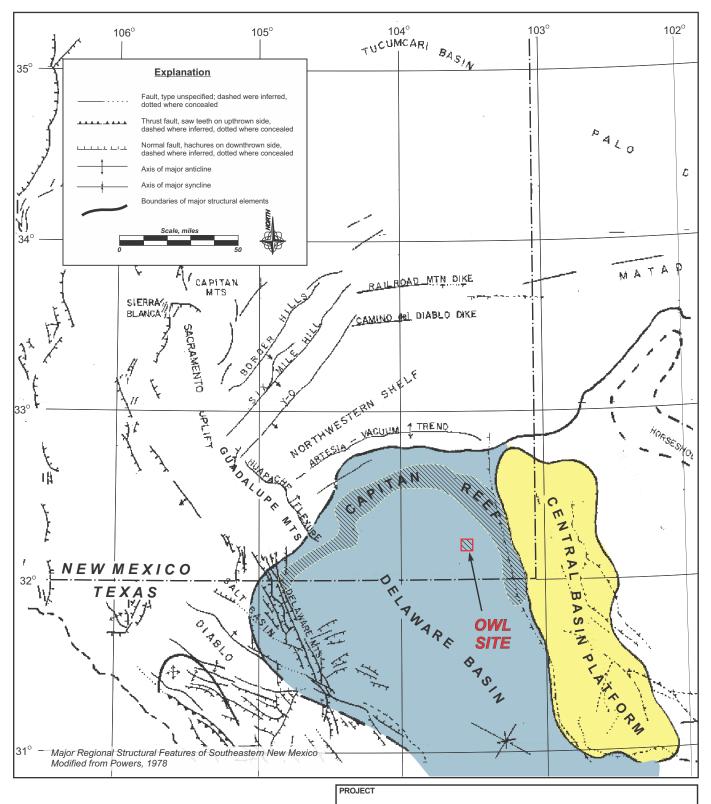
PROJECT

### **OWL Landfill Services, LLC Lea County Site**

TITLE

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



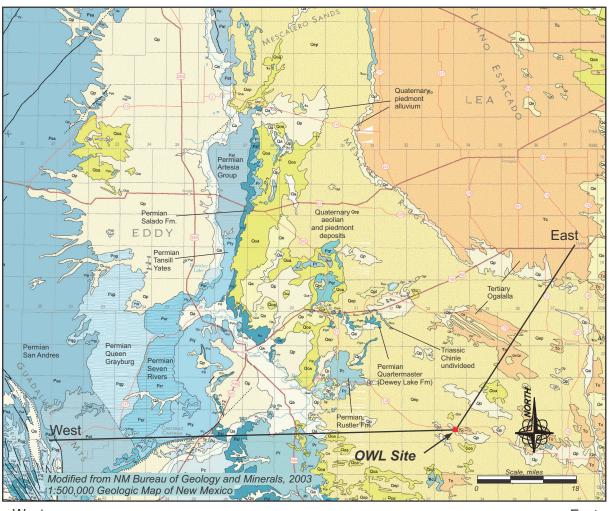


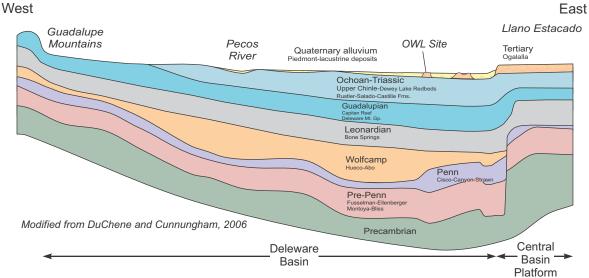
### **OWL Landfill Services, LLC Lea County Site**

TITLE

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







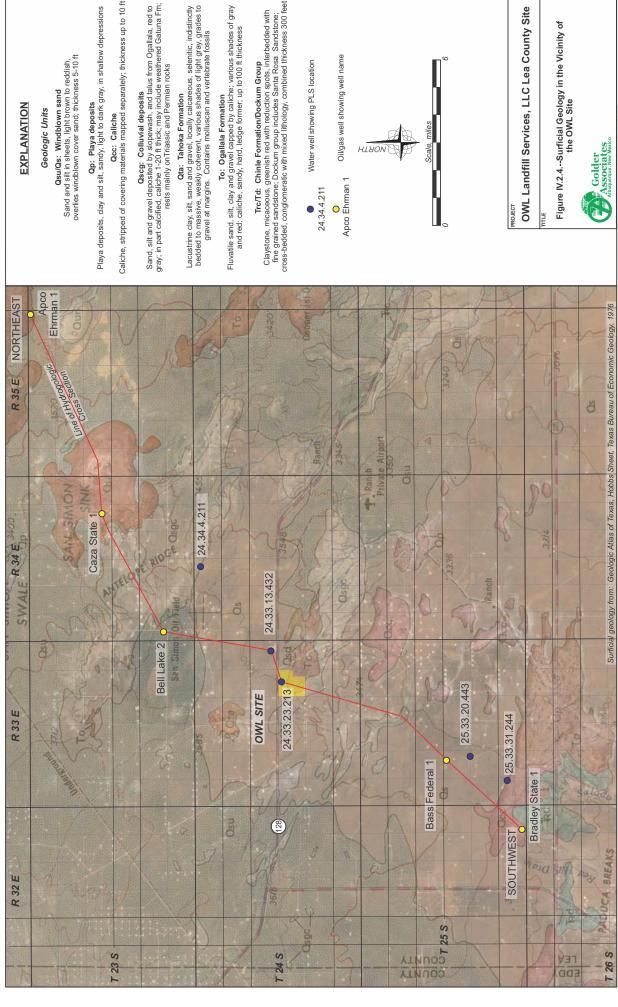
## **OWL Landfill Services, LLC Lea County Site**

TITLE

PROJECT

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

Qcc: Caliche Stripped of covering materials mapped separately; thickness up to 10 ft

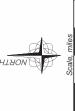
Qta: Tahoka Formation

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

Trc/Td: Chinle Formation/Dockum Group
Claystone, micaceous, greenish red with reducinor 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

Oil/gas well showing well name



OWL Landfill Services, LLC Lea County Site

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



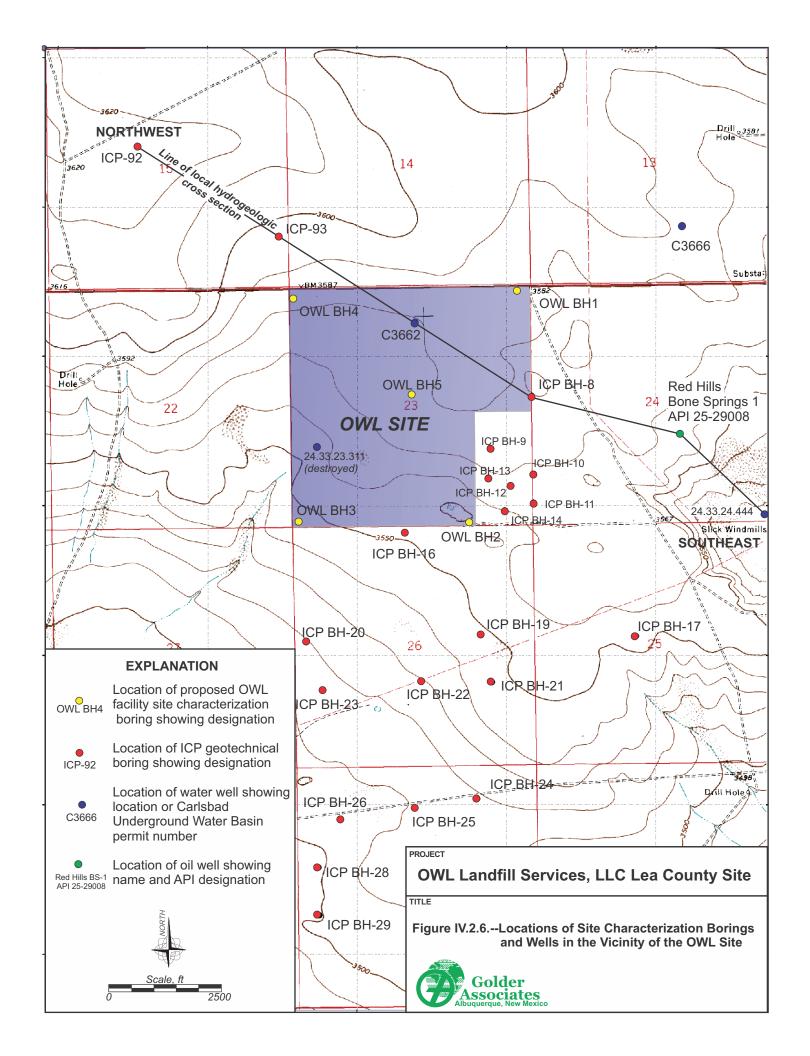
System	Series		Delaware Basin Stratigraphy
Quaternary			Pediments, Valley Fills Upper Gatuna Fm.
Tertiary			Lower Gatuna Formation Ogallala
Triassic		Dockum	n Group Chinle Formation Santa Rosa Sandstone
			Dewey Lake Redbeds
	Ochoa		Rustler Formation
			Salado Formation
			Castille Formation
PERMIAN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

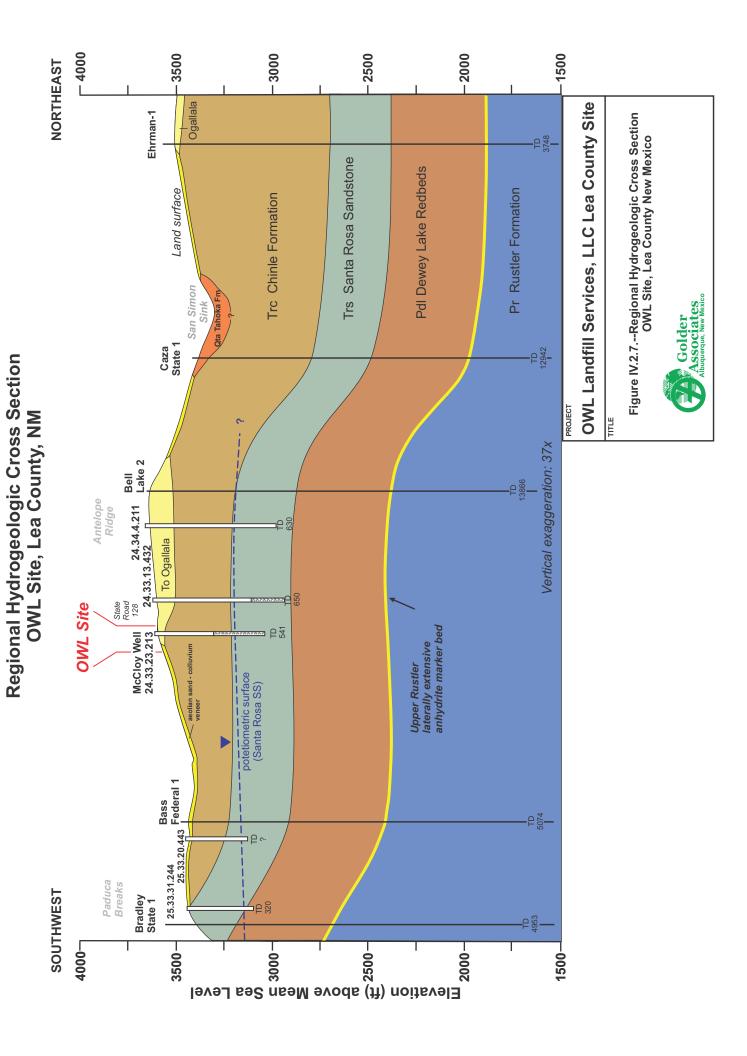
Post-Pennsylvanian stratigraphy of the Delaware Basin from Hendrickson and Jones, 1952, Nicholson and Clebsch, 1961 and Hawley, et al., 1993

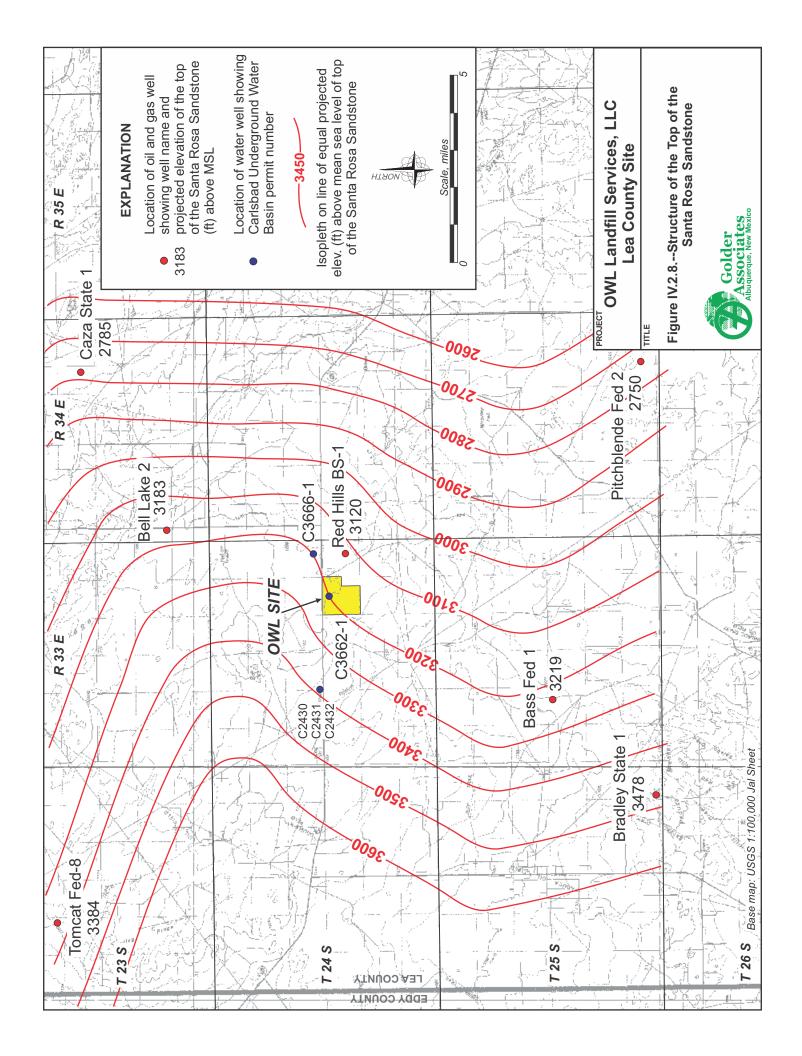
## PROJECT **OWL Landfill Services, LLC Lea County Site** TITLE **Figure IV.2.5.--Post Pennsylvanian Stratigraphic Units**

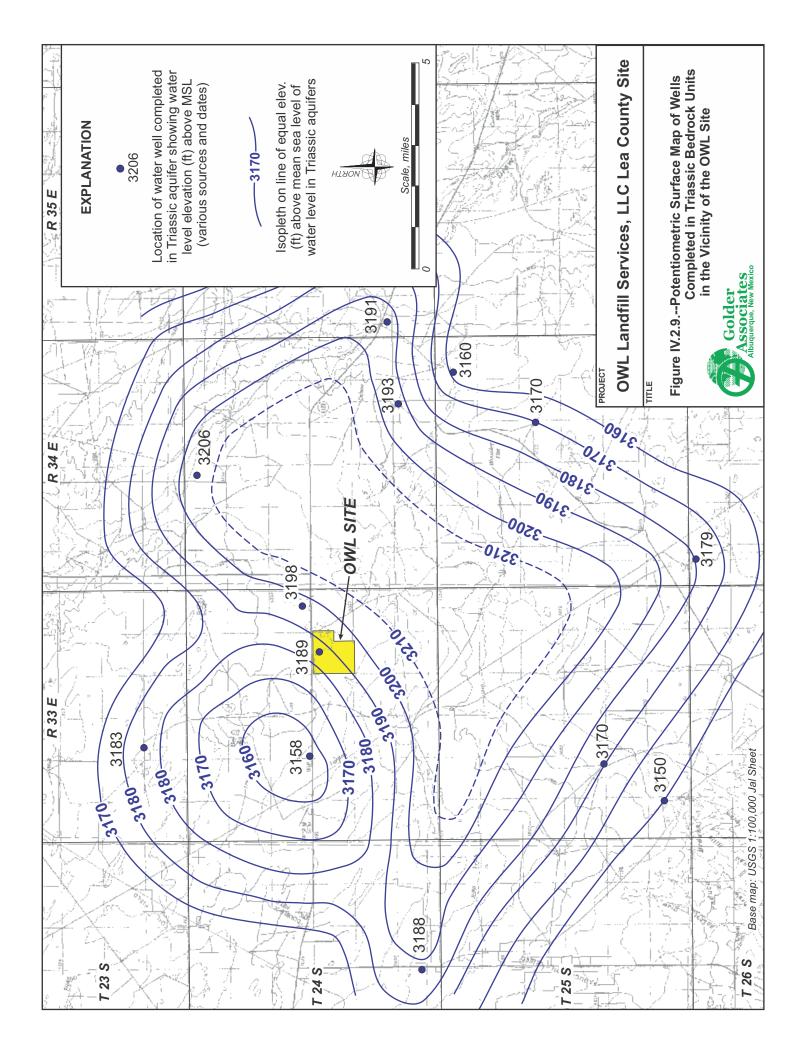
of the Delaware Basin, Southeastern **New Mexico** 

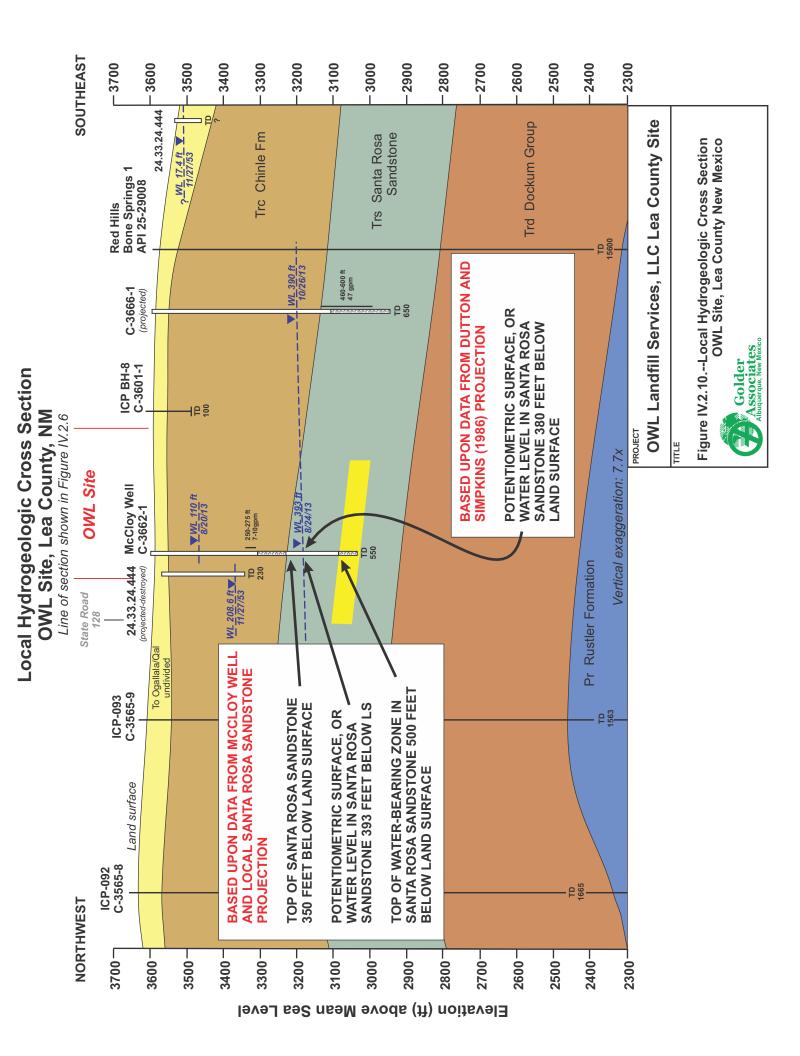
Golder Associates Albuquerque, New Mexico

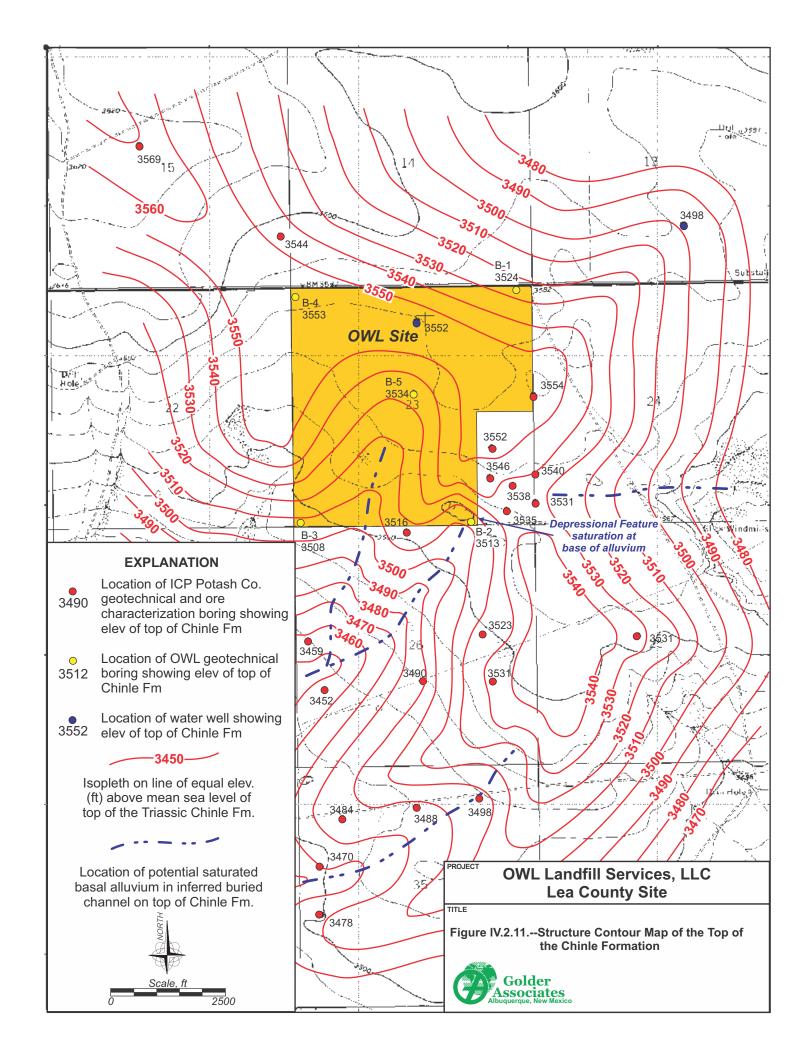


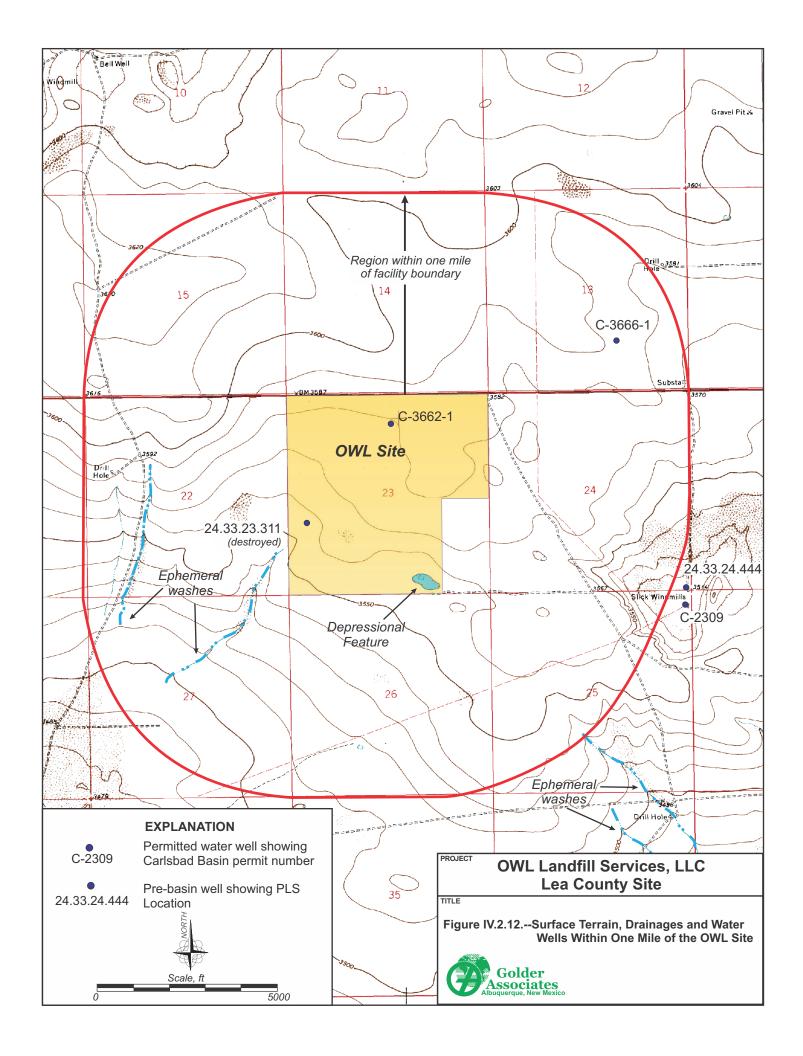












# ATTACHMENT IV.2.A NMOSE WELL LOGS FOR PERMITTED WELLS AND BORINGS



# WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER
4-23-12

	1912	03	www.ose.s	tate.nm.us	^ -	7 20	1				
					COV	rected	d iam	211 10a			
	POD NUN	ABER (WEL	L NUMBER)			100.00	OSE FILE NU	IMBER(S)	······································		
ON O	C-0352	28-POD	)1				C-03528				
ATI		VNER NAM					PHONE (OPT				
Š	MARK	& ANN	ETTE MCCLC	Υ			432-940				
LL	1		LING ADDRESS				CITY		STATE		ZIP
ΨE	PO BC	X 1076	6				JAL		NM	8	8252
S	WE			DEGREES	MINUTES	SECONDS	<u> </u>				
LA	LOCA"		LATITUDE	32	13	29.00 N	* ACCURAC	Y REQUIRED ONE TE	NTH OF A SE	COND	
EK.	(FROM	GPS)	LONGITUDE	103	39	44.60 W	* DATUM RE	QUIRED WGS 84			
GENERAL AND WELL LOCATION	DESCRIE	TION REL		ION TO STREET ADDR							
1. (	1										
	COO	rain		ed on M	ap CNON-	6PS)					
	(2.5 A)		(10 ACRE)	(40 ACRE)	(160 ACRE)	SECTION		TOWNSHIP	NORTH	RANGE	EAST
NAE	NW	<u> </u>	NW 1/4	NW 1/2	NE 14	13		24	SOUTH	32	WEST
100	SUBDIVIS	SION NAMI	Ē			LOT NUM	BER	BLOCK NUMBER		UNIT/TRA	ACT
2. OPTIONAL	HYDROG	RAPHIC SU	JRVEY					MAP NUMBER		TRACT N	DADED
7								MAF NOMBER		IRACIN	UNIBER
	LICENSE	NIIMBER	NAME OF LICE	NSED DRILLER				NILVE OF VELL DI		10.12.07	
	1	01682	JOHN NO					HUNGRY HO			
		STARTED			MPLETED WELL (FT)	BORE HOL	E DEPTH (FT)	DEPTH WATER FIR			
Z	2-2	20-12	3-12-12		541		541		133		
TIO					,	<u> </u>		STATIC WATER LE	VEL IN COM	PLETED WE	LL (FT)
SM.A	COMPLET	TED WELL	IS ARTESIAN	DRY HOLI	E ✓ SHALLOW (	(UNCONFINED)					
DRILLING INFORMATION	DRILLING	FLUID:	air	✓ MUD	ADDITIVES	- SPECIFY	•				
G	DRILLING	METHOD	✓ ROTARY	HAMMER	CABLE TOO	OL OTHE	R - SPECIFY				
I.I.	DEP	TH (FT)	BORE HOL	E	CASING	CONN	ECTION	INSIDE DIA.	CASING	G WALL	SLOT
KII	FROM	то	DIA. (IN)	N	MATERIAL		CASING)	CASING (IN)	1	ESS (IN)	SIZE (IN)
3.1	0	541	8 3/4		PVC	GL	.UED	6"	3	/8	1/8
	<u> </u>										
									-		
		H (FT)	THICKNES	S F				ATER-BEARING S			YIELD
ATA	FROM	TO	(FT)		(INCLUDE WA			R FRACTURE ZON	(ES)		(GPM)
STR	133	152	19			S	AND				UK
NG.											
ARI									**		
BE		<del></del>				~ I"	ast The	+	<del></del>		
4. WATER BEARING STRATA	- ATTUOD II	CED TO ES	TIMATE VIELD OF W	VATER-BEARING STR.	ATA 11	30 VIII	VICA O.	TOTAL ESTIMATED	WELL VIEL	D (CDAO)	
X X	метнов о <b>N/A</b>	SED IO ES	TIMATE TIELD OF W	VATER-BEARING STR.	uru [tt	••	30	C TOTAL ESTIMATEL	WELL TIEL	D (GPM)	
4	11//1				· · · · · · · · · · · · · · · · · · ·	1132033	1773 37X	<u> </u>			
	PAN 645	DECEMBER 1	AT HCC		à	11720.2	-	WELL RECO	017 & 170	(Varous - 1	(0/4)91
Γ	FOR OSE		-3528		POD NUI	MBER (-03	528-PAC				(7/06)
-	LOCATIO	N 20	1.32.15.	2/1/			-0 00	1	1 (1 ,	PAGE 1	OF 2
- 1		- /		- 1 - 1						L	

I MP	ТҮРЕ	OF PUMP:	□ SUBME. □ TURBIN		☐ JET ☐ CYLINDER	☐ NO PUMP – WELL NOT EQUIPPED☐ OTHER – SPECIFY: UNKNOWN			
SEAL AND PIMP	ANI	NULAR	DEPTI FROM	H (FT)	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)		HOD OF
5. SEA		L AND EL PACK	0	20	8 3/4	GROUT & CEMENT	8		OP OP
-									
		TH (FT)	THICK	NESS		COLOR AND TYPE OF MATERIAL ENCOUNT	TERED		
	FROM	ТО	(F)	T)	(INCLU	JDE WATER-BEARING CAVITIES OR FRACT	URE ZONES)		ATER RING?
	0	3	3			TOPSOIL		☐ YES	☑ NO
	3	18	1:	5		CALICHE		☐ YES	☑ NO
	18	26	8			SAND		✓ YES	□ NO
	26	133	10	7		RED CLAY		☐ YES	☑ NO
ELL	133	152	19	) 		SAND		✓ YES	□ NO
FW	152	318	160			RED CLAY		☐ YES	☑ NO
0 9	318	345	27			SAND		✓ YES	□ NO
07.7	345	384	39			RED CLAY AND ROCK		☐ YES	ON 🔽
DGI	384	418	34			SAND		☑ YES	□ NO
GEOLOGIC LOG OF WELL	418	444	26			RED CLAY AND ROCK		☐ YES	☑ NO
6. GF	444	468	24			SAND		✓ YES	□NO
	468	500	32		·	RED CLAY		YES	☑ NO
	500 508	508	8		<del></del>	SAND		✓ YES	□NO
	506	541	33			RED CLAY AND ROCK		☐ YES	☑ NO
								☐ YES	□ NO
								☐ YES	□ NO
		I	ATTACU A	DDITIONA	I DACEDO ACTURES			☐ YES	□ NO
						DED TO FULLY DESCRIBE THE GEOLOGIC I	LOG OF THE WELL		
IFO.	WELL			BAILER		☐ AIR LIFT ☐ OTHER – SPECIFY N/A			
7. TEST & ADDITIONAL INF		1	AND A TABL	rs - attac E showing	H A COPY OF DAT G DISCHARGE AN	TA COLLECTED DURING WELL TESTING, IN D DRAWDOWN OVER THE TESTING PERIOL	ICLUDING START TII D	ME, END TI	ME,
IO	ADDITIONA	L STATEME	NTS OR EXPLAN	ATIONS.					
Ido									
& Al									
EST									
7. TI									İ
RE	THE UNDE	ERSIGNED RECORD	HEREBY CER	TIFIES TH	AT, TO THE BEST	OF HIS OR HER KNOWLEDGE AND BELIEF	THE FOREGOING IS	A TRUE AN	D
						OF HIS OR HER KNOWLEDGE AND BELIEF. HAT HE OR SHE WILL FILE THIS WELL REC OF WELL DRILLING	ORD WITH THE STA	TE ENGINEI	ER AND
CN	/	1-6	$\mathcal{I}_{\mathcal{I}_{\mathcal{I}}}$			1/- 22 12			
8. SI		+OV	EIGNIATURE O	E DRILLER	,	4-23-12			
	-		SIGNATURE C	T DKILLER		DATE			

FOR OSE INTERNAL USE

FILE NUMBER (-3528

POD NUMBER (-03528-9001)

TRN NUMBER (49/386)

PAGE 2 OF 2



## WELL RECORD & LOG

## OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

## STATE ENGINEER OFFICE ROSWELL, NEW MEXICO

12913 JAN 29 F 2: 20

-	OSE POD N	UMBER	(WELL	NUMBER)				OSE FILE NU	* *		
) ĝ	BH 16	IPA STAR	46.65					C3600; 51			
LOCATION	INTERCO		• •	L POTASH COR	Þ			PHONE (OPT	IONAL)		
2	WELL OWN				, 			CITY	<u>-</u>	STATE	ZIP
GENERAL AND WELL	600 W. B							HOBBS		NM 8824	
è	WELL			DEGREE	S MINUTES	SECONI	OS				
LA	LOCATIO	- 1	LATT	TUDE 32	11	43.4	И	* ACCURACY	Y REQUIRED: ONE TEN	TH OF A SECOND	
ERA	(FROM G	PS)		ITUDE 103	32	37.1	· w	DATUM RE	QUIRED: WGS 84		
8	DESCRIPTIO	N RELAT	ING WE	LLLOCATION TO STREE	TADDRESS AND COMM	ON LANDMARKS - PL	S (SECTION, TO	OWNSHJIP, RANG	SE) WHERE AVAILABLE		
-	T245; R 3	3E; S8	CTIO	N 26							
	LICENSE N	JMBER		NAME OF LICENSED	DRILLER				NAME OF WELL DR	ILLING COMPANY	
	WD-1186	5	ľ	RODNEY HAMM	1ER				ENVIRO-DRILL,	INC.	
	DRILLING S		- 1	DRILLING ENDED	DEPTH OF COMPLET	ED WELL (FT)		LE DEPTH (FT)		ST ENCOUNTERED (FT	)
	01-07-13			1-07-13			75'		N/A		
	COMPLETE	D WELL	.ıs: (	ARTESIAN	@ DRY HOLE	SHALLOW (UNC	ONFINED)		STATIC WATER LEV	VEL IN COMPLETED WI	LL (FT)
DRILLING & CASING INFORMATION	DRILLING F	LUID:	(	AIR	C MUD	ADDITIVES - SPI	ECIFY:				
RMA	DRILLING N		): (		C HAMMER (			R - SPECIFY:	AUGER	·	
<u> </u>	DEPTH	(feet b	gl)	BORE HOLE	CASING MATI	ERIAL AND/OR	Ţ:		CASING	CACDIC WALL	T
5	FROM		0	DIAM	1	ADE		SING VECTION	INSIDE DIAM.	CASING WALL THICKNESS	SLOT
NIS				(inches)		asing string, and as of screen)		YPE	(inches)	(inches)	(inches)
S C	0	75		8"	N/A		N/A		N/A	N/A	N/A
S											
DRI					<u> </u>						
7.							<u> </u>				
											ļ. <u></u> .
1											<u> </u>
							<del>                                     </del>				<del> </del>
	DEPTH	(C b		<u> </u>	<u> </u>				<u> </u>	<u> </u>	
ا د	DEPTH			BORE HOLE DIAM. (inches)		NULAR SEAL MA ACK SIZE-RANG			AMOUNT (cubic feet)	METHO PLACEN	
RIA	FROM	T	<del></del>		- GIGTY SET				(cuoic icet)		
TE											
3				<u> </u>				-			
3						<del></del>					
ANNULAR MATERIAL								<del></del>			
			<del></del>	-							
ri									<u> </u>		
FOP	OSE INTER	NAI I			<u> </u>		3H.	עם מע	MEIT BECORD	LOG (Version 06/0	
	NUMBER	<u> </u>		400		POD NUMBER	<del>}</del>			8382	3/2012)
LOC.	ATION			000	01	15 331	- 137			PAGE	LOF 2

STATE ENGINEER OFFICE

					# <u>E4</u>	1				
	DEPTH (feet bgl)		THICKNESS	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE 2985	JAN BEARING? 2	2 WATER-				
	FROM	то	(feet)	(attach supplemental sheets to fully describe all units)	(YES/NO)	BEARING ZONES (gpm)				
	0	3	3	BROWN SILTY SAND, LOOSE	CYGN	N/A				
	3	18	15	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A				
	18	37	19	RED SILTY SAND, VERY DENSE	CYGN	N/A				
	37	75	38	SHALE GREEN SILTY SAND, VERY DENSE	Схеи	N/A				
	·				CYCN					
ہ (					CACN					
HYDROGEOLOGIC LOG OF WELL					$C^{Y}C^{N}$					
0.5					$C_A C_N$					
8					$C^{Y}C^{N}$					
2					OY ON					
8					CYCN					
EO					$C^{Y}C^{N}$					
200					CYCN					
HAD			_		CYCN					
4					$C^{Y}C^{N}$					
					CYCN					
					CYCN					
					CY CN					
					CYCN					
					CYCN	-				
	-				CYCN	<u> </u>				
	METHOD U	SED TO ES	TIMATE YIELD	OF WATER-BEARING STRATA: C PUMP	TOTAL ESTIMATED					
	C AIR LIFT	г С.	BAILER C	OTHER - SPECIFY:	WELL YIELD (gpm):					
_										
NO	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.									
ERVISION	MISCELLANEOUS INFORMATION:									
TEST; RIG SUP										
X										
EST	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:									
vi										
RE	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									
ATU	AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:									
SIGNATURE	Here Ac Rodney Hammer 1-23-13									
6. SI	- Per	14	1-23-13							
	SIGNATURE OF DRILLER / PRINT SIGNEE NAME DATE									
FOR	FOR OSE INTERNAL USE WR-20 WELL RECORD & LOG (Version 06/08/2012)									

FOR OSE INTERNAL USE	WR-20 WELL RECORD & LOG (Version 06/08/2012)	
FILE NUMBER ( -3600	POD NUMBERS - 16	TRN NUMBER 5/83X2
LOCATION		PAGE 2 OF 2



# STATE ENGINEER OFFICE ROSWELL

PAGE 1 OF 2

	DOD : ***	- D /		(DED)				====			OPP PH C	200 - 2	<del>-) 1</del>		
ž	POD NUMBER (WELL NUMBER)								OSE FILE NUMBERIS! R - 2 F 1: 25						
<u> </u>	ICP-093									C-3565-POD 9					
-5∥	WELL OWNER NAME(S) Intercontinental Potash (USA)									575-942-2	-				
3	WELL OWNER MAILING ADDRESS								CITY		Confin V chica		ZIP		
[달]	600 West Bender Boulevard										Hobbs				
. ≩. [		r Déli		Doulevaru							FIODUS		MM 		240
3	WELL				DEGRE		MINUTI		SECONI						
¥.	LOCATIO	L	LATI	TUDE		32	1	2	48.	.09 и		REQUIRED: ONE TEN	TH OF A SEC	COND	
. 現.	(FROM GI	PS)	LONG	SITUDE	10	03	3	3	8.	.31 W	* DATUM REC	UIRED: WGS 84			
ICP-093															
7															
							1							T	
	(2.5 ACR		(	IO ACRE)	(40 A	(CRE)	(10	50 ACRE)		SECTION	45	TOWNSHIP	NORTH	RANGE	✓ EAST
, ₹ L	1/4			1/4		<u>'4</u>		1/4			15	24	✓ south	33	☐ WEST
( <u>6</u>	SUBDIVISIO	MAM MC	Ė							LOT NUM	BER	BLOCK NUMBER		UNIT/TRAC	T
· -									<del></del>						
2 OPTIONAL	HYDROGRAPHIC SURVEY									MAP NUMBER		TRACT NUI	MBER		
N. C											<u> </u>			<u> </u>	
	LICENSE NUMBER NAME OF LICENSED DRILLER							NAME OF WELL DRILLING COMPANY							
3.5	WD #331 Phillip Stewart								Stewart Brothers Drilling Co.						
	DRILLING STARTED DRILLING ENDED								E DEPTH (FT) DEPTH WATER FIRST ENCOUNTERED (FT)						
Z	01/11/2013 02/19/2013 NA 1562.80 FT NA														
3, DRILLING INFORMATION	COMPLETED WELL IS: ARTESIAN DRY HOLE SHALLOW (UNCONFINED)									L (FT)					
Z							H GEL. PL	ATINUM PAC	. BI-CAR	B. SODA	ASH.				
Č	DRILLING METHOD: ROTARY HAMMER CABLE TOOL OTHER-SPECIFY: TACKLE, MYLOGEL, NaCl														
13	DEPTH (FT) BORE HOLE CASING CON				NECTION	INSIDE DIA.	CASIN	G WALL	SLOT						
E I	FROM					TYPE	(CASING)	CASING (IN)	THICK	NESS (IN)	SIZE (IN)				
. n	0	124	5	12.25		J-5	5 #20 s	teel		th	eaded	6.456	0.	272	
: if	1245	1562	.80				NA								
									]						
12.0	DEPT	H (FT)		THICKNE	SS		FORMA1	TON DES	CRIP	TION OF	PRINCIPAL W	ATER-BEARING	STRATA		YIELD
ĄTĄ								TER-BEARING CAVITIES OR FRACTURE ZONES)				(GPM)			
¥	NA			NA							NA				NA
เรย															
NI N		<u> </u>													
EAI															
×															
FROM TO (FT) (INCLUDE WATER-BEARING CAVITIES OR FRACT NA NA NA NA  METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA  Bypass flow								TOTAL ESTIMAT	ED WELL YII	ELD (GPM)					
≱	Bypass flow								na	3					
<u> </u>															
	FOR OSE INTERNAL USE WELL RECORD & LOG (Version 6/9/08),									/9/08)					
	FILE N			- 3565	-	<del></del>		POD N	UMBE	ER 9	<del></del>	TRN NUMI		3092	
			- 1	<u> </u>				1		'				<u> حر ر –                                   </u>	<u> </u>

Sect 15

T245 R33E

LOCATION

		. D. D. 4D	SUBMER	SIBLE	☐ JET	✓ NO PUMP - WELL NOT EQUIPPED				
¥ [	TYPEOR	TYPE OF PUMP: TURBINE		Ξ	CYLINDER OTHER - SPECIFY: STATE ENGINEER OFFICE					
S. SEAL AND PUMP	DEPTH (FT) ANNULAR FROM TO SEAL AND NA			BORE HOLE DIA. (IN)	METHOD OF PLACEMENT					
\ \{\frac{1}{2}}			NA NA		NA NA	MATERIAL TYPE AND SIZE 1711 APR - 2 (CUBIC FT) 25	NA NA			
SE	GRAVE				<u> </u>	7,1,2				
· .										
12.50	DEPTI	H (FT)	THICK	NESS		WAT	ΓER			
	FROM TO (FT)			n	(INCL	UDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	BEAR	ING?		
	0	20	20	)		Caliche	☐ YES	Ø NO		
	20	55	35	5	(	Gutuna Fm red siltstones and sandstones	☐ YES	ØИ 🖸		
٠ , [	55	1238	118	33	Dewey Lake	Fm.Red siltstones and mudstones, gray/green mottling	☐ YES	Ø №		
	1138	1275	13	7		Rustler Fm./A-5, white anhydrite	☐ YES	ØN ⊡		
<u> </u>	1275	1306	3′	1		H-4 sub-mbr milky white halite	☐ YES	ØИ 🖸		
OF WELL	1306	1320	14	1		A-4 sub-mbr white anhydrite	☐ YE\$	Ø NO		
	1320 1338 18					Magenta Dolomite	☐ YES	☑ NO		
ိုဝ	1338	1338 1386 48				☐ YES	☑ NO			
] []	1386	1386 1491 110			☐ YES	☑ NO				
CEOLOGIC LOG	1491 1501 10			0		☐ YES	☑ NO			
CEO	1501	1562	6	1		☐ YES	□ио			
9						☐ YES	□ NO			
							☐ YES	□ NO		
						☐ YES	□ №			
							☐ YEŞ	□ NO		
				_			☐ YES	□ NO		
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1							☐ YES	□ №		
		·	ATTACH	ADDITION	AL PAGES AS N	EEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL				
FO	METHOD: BAILER PUMP AIR LIFT OTHER - SPECIFY: NA									
VL INFO										
7. TEST & ADDITION										
. ₹										
T										
TE										
7										
re)		THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND								
SIGNATURE	1		_			ND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE ST TION OF WELL DRILLING:	ATE ENGIN	IEER AND		
GNA	-									
8.SI	_1	3-27-13								
	SIGNATURE OF DRILLER DATE									
<u> </u>	<del>'</del>									

FOR OSE INTERNAL USE	WELL RECORD & LOG (Version 6/9/08)	
FILE NUMBER C-3565	POD NUMBER 9	TRN NUMBER
LOCATION TZ45 R33E	Sect 15	PAGE 2 OF 2



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,

Catherine Goetz

Water Resource Specialist

District II Office of the State Engineer

Enclosures

cc: Office of State Engineer, Santa Fe

# Goetz, Catherine, OSE

Sent: ö From: Subject: Allen Hall [ahall@icpotash.com] Monday, April 15, 2013 11:27 AM Goetz, Catherine, OSE

RE: ICP-092 and ICP-093

Hi Catherine,

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 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  $\mathbf g$ nits impacting the mine shaft in the furture. 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).

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

ICP-093: 1245 to 1562.8 ft ICP-092: 1245 to 1665 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



#### OFFICE OF THE STATE ENGINEER

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1 2017 DEC 11 1P 4: 02 1

	POD NUM		LL N	IMBER)					OSE FULE (SUMBUR(S)				
NO.	ICP-08	5							C-3565 P	OD 3			
-	WELL OW	NER NAM	Hes	1					PHONE (OPT)	ONAL)			
00	Interco	ntinenl	tal F	Potash (USA	A)				575-942-2	2799			
1	WILLOW	NER MAI	HJING	ADDRESS					CHY		STATE	· · ·	ZIP
N.E.	600 We	est Ber	nde	r Boulevard					Hobbs NM 883			3240	
9	WEL				DEGREES	MISULE	S SECO	SDS					
1.2	LOCAT	- 1	LAT	TUDE	32	13	3 3	9.75 N	• ACCURACY	REQUIRED: ONE TE	VIH OF A SEC	COND	
GENERAL AND WELL LOCATION	(FROM	ļ			103	3				* DATUM REQUIRED; WGS 84			
EN	DESCRIP			VIANGE LOCATI	ON TO STREET ADDRE								
), G	Disckir	I IV. D. C. C. C.		AT WELL LOC AT	ON TO STREET NEADEL	NA MADE CO	MAION LAWY						
	(2.5 AC	RE)		(10 ACRE)	(40 ACRE)	(Jo	(ACRE)	SECTION	· <del></del>	TOWNSHIP	☐ sc#tift	RANGE	Ø IASI
÷	!	и		1/4	34		94	8		24	Sooni	33	□ WLSI
No.	SUIIDIVIS	ION NAM	IE					LOT NUM	IDER .	BLOCK NUMBER		UNIT/IRA	
: OPTIONAL												İ	
0,	HYDROGE	TAPING S	URVE	Y						MAP NUMBER		TRACT NU	JMBER
	LICENSE NUMBER NAME OF LICENSED DRILLER									NAME OF WELL DRILLING COMPANY			
	WD	#331		Phillip Stev	vart	t				Stewart Brothers Drilling Co.			
1	DRILLING	STARTE	t)	DRILLING END	HO DUPTH OF COM	1			JE DEPTH (FT)	DEPTH WATER FL	STESCOUS	TERED (FT)	
S. DRHLLING INFORMATION	9/27	/2012		10/21/201	2	NA		15	33 FT		NA		
				·						STATIC WATER LE	VEL IN COM	PLETED WEI	L (FT)
1	COMPLETED WELLIS ARTESIAN DRY HOLE SUALLOW (UNCONFINED)									•	NA		
ō.	DRILLING	FLUID.		□ AIR	✓ MUD	MUD ADDITIVES - SPECIFY, ETH GEL, PL					BI-CARI	B, SODA	ASH,
No.	DRILLING METHOD: PROTARY HAMMER CABLETO							OTHE	R = SPECIFY.	TACKLE, MYL	OGEL, N	aCI	
3		H (FT)		BORE HOL							1		
3	FROM	то		DIA. (IN)		CASING MATERIAL		CONNECTION TYPE (CASING)		INSIDE DIA. CASING (IN)	CASING	ESS (IN)	SLOT SIZE (IN)
=	0	125		12.625		J-55 #36 steel		ļ	aded	8.921	<del> </del>	302	<u> </u>
	1250	153		8.75		NA NA							
ŀ			_								<del> </del>		
ľ			_										
	IDIZET	H (FT)		2012	. 57/	THE LATE	M PRESCRIPTO	CIAN OF D	DINCIDAL M	ATER-BEARING S	THATA	<del></del>	
-	FROM	то		THICKNES (FT)	•					R FRACTURE ZOM		ŀ	YIELD (GPM)
4, WATER BEARING STRATA	NA			NA NA					NA				NA NA
2													
2													
- 5	-				<del>-   </del>	····· <u> </u>							
를							-	, <del>, , , , , , , , , , , , , , , , , , </del>					
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA TOTAL ESTIMATED WELL YIELD (GPM)												
3	Bypass					ra Total Estimated Well Yield (GPM)				}			
<u> </u>													
	EOI:			11017						411010 1 1011			
ſ	FOR OSL		NAL	USE		1 .	OD NUMBE	772	WELL RECORD & LOG (Version 6/9/08) TRN NUMBER				9/08)
}	FILE NU					1.	OD NORDE			TRIVINUMBE	.r.	DACE ! :	20.2
- 1	LOCATH	UN							PAGE 1 OF 2				Jt 2



-.[

							STATE ENCINE	FR 0F	-10-			
NP	TYPE O	F PUMP:	□ SUBMER □ TURBIN		DIET CYLINDER	☑ NO PUMP – WIELL NOT EQUIPPED ☐ OTHER – SPECIFY:						
SEAL AND PUMP			DEPTH	TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	(CUBIC FT)	PLAC	OBE !			
3		JLAR . AND	NA NA	10	NA NA	NA NA	NA NA	ļ <u>.</u>	IA .			
		L PACK	11/1		1	NA NA	144	<u> </u>				
wi			· · · · · · · · · · · · · · · · · · ·									
	DEPT	II (FT)	ТНІСК	NESS		COLOR AND TYPE OF MATERIAL ENCOUNT	FRED	W/A	TEO			
	FROM	то	(FT		1	JRE ZONES)	WATER BEARING?					
	0	20	20	)		Caliche						
'	20	55	35	5	(	Sutuna Fm red siltstones and sands	tones	□ YES	Ø NO			
	55	1227	118	31	Dewey Lake	Fm.Red siltstones and mudstones, g	ay/green mottling	☐ YES	Ø NO			
	1227	1262	35	35 Rustler Fm./A-5, white anhydrite					□ NO			
1	1262	1295	33	3		H-4 sub-mbr milky white halite		☐ YES	Ø NO			
WE	1295	1310	15	;		A-4 sub-mbr white anhydrite		☐ YES	Ø NO			
OF	1310	1330	20	)		Magenta Dolomite		☐ YES	Ø NO			
100	1330	1375	45	<u> </u>		A-3 sub-mbr. white anhydrite		□ YES	Ø NO			
CIC	1375	1479	112	2		☐ YES	Ø NO					
GEOLOGIC LOG OF WELL	1479	1489	10	)		Ore zone, anhydrite and white polyh	alite	☐ YES	☑ NO			
33	1489	1533	44			☐ YES	□ NO					
ف								☐ YES	□ NO			
								☐ YES	□ NO			
								□ YES	□ NO			
								☐ YES	□ NO			
1			ATTACH	ADDITION	AL PAGES AS NEI	EDED TO FULLY DESCRIBE THE GEOLOGIC	LOG OF THE WELL					
٥			METHOD:	BAILE	R 🔲 PUMP	☐ AIR LIFT ☐ OTHER - SPECIFY: NA						
& ADDITIONAL INFO	WELL.	TEST	TEST RESUL AND A TABI	TS - ATTAC LE SHOWIN	CH A COPY OF DA	ATA COLLECTED DURING WELL TESTING, I ND DRAWDOWN OVER THE TESTING PERIC	NCLUDING START TIA D.	4E, END 71.	ME,			
ő	ADDITION	AL STATEM	ENTS OR ENPLA	NATIONS:								
Ĕ												
Ą												
<b>₩</b>												
TEST												
7.												
,,,	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND											
SIGNATURE	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:											
LY.	1 2 2 2 4											
	Theligh Study 17-10-12											
æ	SIGNATURE OF DRILLER DATE											

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



LOCATION



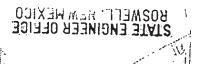
1 2012 DEC 11 1P 4: 02

PAGE 1 OF 2

	POD NUM	BER (WELL	NUMBER)			OSE FILE NUMBER(S)							
N.O	ICP-08	5						C-3565 POD 3					
(III	WELL OW	NER NAME(	S)				_	PHONE (OPT)	ONAL)				
I. GENERAL AND WELL LOCATION	Interco	ntinental	Potash (USA)					575-942-2	2799				
7.1	WELL OW	NER MAILI	NG ADDRESS	•		<u>.</u>		CITY	·	STATE		ZIP	
TEL.	600 We	st Bend	er Boulevard					Hobbs NM 88240					
W Q				DEGREES	MINUTES SECONDS								
VV	WEI.							• 400000 100	CURACY REQUIRED: ONE TENTH OF A SECOND				
Val.	LOCAT (FROM		ATITUDE	32	13	39.75	_	]	DATUM REQUIRED: WGS 84				
NEF	(FKOAI)	ursi Lu	ONGITUDE	103	35	27.62	w —	DATOMACA	QUIRED: WGS 84				
GE	DESCRIP	TON RELAT	ING WELL LOCATION	TO STREET ADDRESS	AND COMMON L	ANDMARKS							
-													
-	(2,5 AC	912	(10 ACRE)	(40 ACRE)	(160 ACRE)	CT/CT	SECTION		TOURIGIUS		5.1100		
						SECTI	UN	☐ NUR17t			f	<b>Ø</b> EAST	
Ž		ON NAME	1/4	1/4	1/4	107	8 24 🔽 sourn 33					□ WEST	
01	SOBDIVIS	ONNAME			LOT ?	UN	BEK	BLOCK NUMBER		UNIT/TRA	cr		
2. OPTIONAL	Ininhaar	APHIC SUR	V.										
4	nibkook	Armic Suk	ver						MAP NUMBER		TRACT NU	MBER	
	LICENSE		NAME OF LICENSI						Stewart Brothers Drilling Co.				
		#331	Phillip Stewa	rt					Stewart Broth	ers Drilli	ng Co.		
DRILLING INFORMATION	DRILLING		DRILLING ENDED	DEPTH OF COMPL		- 1		.E DEPTH (FT)	DEPTH WATER FIR				
	9/27	/2012	10/21/2012		NA		15	33 FT		NA			
	220 4 PA 17			[]a					STATIC WATER LE			.L (PT)	
R.M.	COMPLET	ED WELL IS:	ARTESIAN	✓ DRY HOLE		UNCONFINED				NA			
Ğ.	DRILLING	FLUID.	AIR	<b>☑</b> MUD	ADDITIVES	- SPECIFY: (	ETI	H GEL, PL	ATINUM PAC,	BI-CAR	B, SODA	ASH,	
<u>~</u>	DRILLING	METHOD:	<b>✓</b> ROTARY	HAMMER	CABLE TOO	اد ∐ه	THE	R - SPECIFY;	TACKLE, MYL	OGEL, N	laCi		
E E	DEPT	H (FT)	BORE HOLE	1			TECTION	INSIDE DIA.	CASINI	3 WALL	DI OT		
R E	FROM	то	DIA. (IN)	CASING MATERIAL			CONNECTION TYPE (CASING)		CASING (IN)		IESS (IN)	SLOT SIZE (IN)	
3.0	0	1250	12.625	J-55 #	#36 steel		the	eaded 8.921			302		
Ì	1250	1533	8.75		VA (Ties								
i							_			1			
				<del> </del>						1			
=	DEPT	H (FT)	TUICKNESS	ron	MATION DES	י ארויים פי	t, Di	DINCIDAL W	ATER-BEARING S	TDATA			
ا خ	FROM	TO	THICKNESS (FT)	1					a i ek-beaking s R fracture zon		ļ	YIELD (GPM)	
7.7.	NA		NA	<del>                                     </del>			_	NA		,		NA NA	
TS.	, , ,			<del> </del>									
N.				1					·				
3				1						-			
=							_						
4. WATER BEARING STRATA	METROD 1	METHOD USED TO ESTIMATE VIELD OF WATER-BEARING STRATA							TOTAL ESTIMATES	WELL MIN	D (CBM)		
\S_{\begin{subarray}{c} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Bypass flow							TOTAL ESTIMATED WELL YIELD (GPM)				ļ	
→i	-, pagg							na					
	FOR OSE	INTERNA	AL USE	· · · · · · · · · · · · · · · · · · ·		ADED			WELL RECO		(Version 6/	9/08)	
FILE NUMBER POD NUMBER TRN NUMBER													

178	JMP	TYPE O	F PUMP;	SUBME		☐ JET ☐ CYLINDER								
DEPTH (FT) THICKNESS (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)    DEPTH (FT)   THICKNESS (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)   BEARING?	AND PU	ANN	II.AR		<del></del>		MATERIAL TYPE AND SIZE							
DEPTH (FT)	EAL	SEAL	AND	NA		NA NA	NA NA	NA	N	A				
FROM   TO   (FT)   (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)   BEARING?		Old VC	LIACK											
FROM   TO   (FT)   (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)   BEARING?		DEPT	u (FT)	771100	NEGO.		COLOR AND THE OF MATERIAL ENCOUNT	nen.						
178   178				!		t .								
1227   1181   Dewey Lake Fm.Red siltstones and mudstones, gray/green mottling   YES   No.     1227   1262   35   Rustler Fm./A-5, white anhydrite   YES   No.     1262   1295   333   H-4 sub-mbr milky white halite   YES   No.     1295   1310   15   A-4 sub-mbr white anhydrite   YES   No.     1310   1330   20   Magenta Dolomite   YES   No.     1330   1375   45   A-3 sub-mbr. white anhydrite   YES   No.     1375   1479   1112   H-3 sub-mbr milky halite   YES   No.     1479   1489   10   Ore zone, anhydrite and white polyhalite   YES   No.     1489   1533   44   Halite, with some anhydrite   YES   No.     1489   1533   44   Halite, with some anhydrite   YES   No.     1489   1533   44   Halite, with some anhydrite   YES   No.     1489   1533   YES   No.     1489   1533   YES   No.     1489   No.   YES   No.     14		0						Ø NO						
1227   1262   35				<del></del>	·· · · · · · · · · · · · · · · · · · ·	<del></del>		Ø №						
1262   1295   33				i		Dewey Lake		Ø NO						
1295 1310 15 A-4 sub-mbr white anhydrite										Ø NO				
WELL TEST  METHOD: BAILER   PUMP   AIR LIFT   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.  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	1			<del></del>										
WELL TEST  METHOD: BAILER   PUMP   AIR LIFT   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.  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	W.						<del></del>	·						
WELL TEST  METHOD: BAILER   PUMP   AIR LIFT   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.  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	0									Ø NO				
WELL TEST  METHOD: BAILER   PUMP   AIR LIFT   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.  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	ğ							Ø №						
WELL TEST  METHOD: BAILER   PUMP   AIR LIFT   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.  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	SGIC													
WELL TEST  METHOD: BAILER   PUMP   AIR LIFT   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.  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	3													
WELL TEST  METHOD:   BAILER   PUMP   AIR LIFT   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.  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND		1489	1533	44	\$		Halite, with some anhydrite							
ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL    MSTHOD:   BAILER   PUMP   AIR LIFT   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:   THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	١													
ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL  METHOD:   BAILER   PUMP   AIR LIFT   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:  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	}													
ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL  METHOD: BAILER PUMP AIR LIFT 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:  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	}													
ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL    METHOD:   BAILER   PUMP   AIR LIFT   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:   THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	-													
ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL  METHOD: BAILER PUMP AIR LIFT 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:  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	ŀ													
WELL TEST  METHOD: BAILER PUMP AIR LIFT 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:  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	}													
WELL TEST  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:  THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND							<del></del>	OG OF THE WELL						
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	요	WC t	rcer											
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	N.	WCLL	1031						ME, END TI	ME,				
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	ž	ADDITION	AL STATEM	ENTS OR EXPL	ANATIONS:									
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	Ĕl													
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\													
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	48													
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND	- ⊦													
	-													
THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:	N.													
	Ę													
\$ 17-10-12	\text{S}	1 Thetu D. A. 12-10-12												
SIGNATURE OF DRILLER DATE														

FOR OSE INTERNAL USE	WELL RECORD & LOG (Version 6/9/08)			
FILE NUMBER	POD NUMBER	TRN NUMBER		
LOCATED TILL DECEMBER 1			PAGE 2 OF 2	





#### STATE ENGINEER OFFICE ROSWELL

120B APR -2 P 1: 25

PAGE 1 OF 2

POD NUMBER (WE	LL NUMBER)				OSE FILE NUM						
CP-092					C -	- 03565	Pol	>8			
VELL OWNER NAI	•				PHONE (OPTIONAL)						
	tal Potash (US	۹) 			575-942-2799						
VELL OWNER MA	iling address nder Boulevard	ı			Hobbs NM 88				ZIP		
OU West be	ider boulevard	<u></u>			Hobbs NM 88240						
WELL		DEGREES 32	MINUTES SECO	NDS 8.17 N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND						
LOCATION (FROM GPS)	LATITUDE			4.19 W	]	UIRED: WGS 84					
DESCRIPTION RE	LONGITUDE  ATING WELL LOCAT	103	33 4		=====			<u>-</u>	<del></del> -		
(2.5 ACRE)	(IO ACRE)	(40 ACRE)	(160 ACRE)	SECTION		TOWNSHIP	□ NORTH	RANGE	✓ BAS		
1/4	1/4	1/4	1/4		15	24	SOUTH	33	U we		
SUBDIVISION NAM	AE .	<del></del>	<u> </u>	LOT NUM	IBER	BLOCK NUMBER	<del></del>	UNIT/TRAC	T		
HYDROGRAPHIC:	TIRVEY					MAP NUMBER TRACT			MRFR		
II DROGIGGING	10W121					l l l l l l l l l l l l l l l l l l l		TRACT NUMBER			
ICENSE NUMBER	NAME OF LIC	ENSED DRILLER				NAME OF WELL DE	ULLING COM	MPANY			
WD #331	Phillip Ste	wart				Stewart Broth	ers Drilli	ng Co.			
DRILLING START	l l		1	LE DEPTH (FT)	DEPTH WATER FIR						
02/19/201	3 03/25/20	013	NA	16	65 FT		NA				
COMPLETED WEL	LIS: ARTESIA	N DRY HOLE	SHALLOW (UNC	STATIC WATER LEVEL IN COMPLETED WELL (I SHALLOW (UNCONFINED)							
DRILLING FLUID:	AIR	✓ MUD	ADDITIVES - SP	ECIFY: ET	H GEL, PL	ATINUM PAC	BI-CAR	B, SODA	ASH,		
DRILLING METHO	DD: ROTARY	HAMMER	CABLE TOOL	ОТН	ER - SPECIFY:	TACKLE, MYL	OGEL, N	laCI			
DEPTH (FT	BORE HO	LE	CASING		NECTION	INSIDE DIA.		G WALL	SLO		
FROM T	O DIA. (IN	D N	MATERIAL	ТҮРЕ	(CASING)	CASING (IN)	THICK	NESS (IN)	SIZE		
	84 12.25	J-5	55 #20 steel	th	eaded	6.456	0.	272			
1245 16	65		NA				ļ		<u>-</u> _		
1270											
DEPTH /FT	TUICE	200	FORMATION DESCRI	PTION OF	OF PRINCIPAL WATER-BEARING STRATA ING CAVITIES OR FRACTURE ZONES)				YIEI		
DEPTH (FT	) THICKNY O (FT)	ESS							`(GP		
	(1777)	ESS									
FROM T	O (FT)	ESS			G CAVITIES C						
FROM T	O (FT)	ESS			G CAVITIES C						
FROM T	O (FT)	ESS			G CAVITIES C						
FROM T	O (FT)		(INCLUDE WATE		G CAVITIES C	OR FRACTURE ZO	NES)		`(GP		
FROM T	O (FT) NA O ESTIMATE YIELD	DF WATER-BEARING ST	(INCLUDE WATE		G CAVITIES C		NES)	, ,			

LOCATION

3	TYPE OF	PUMP:	☐ SUBMER☐ TURBINI	_	☐ JET ☐ CYLINDER	☑ NO PUMP – WELL NOT EQUIPPED ☐ OTHER – SPECIFY:	STATE ENGINEER	OLLIOT			
ŧ											
£		ŀ	DEPTH	TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	2013 COBIC FT)	) METHO PLACE			
	ANNU SEAL		NA		NA	NA NA	NA NA	NA			
	GRAVEI				777	,,,,	- '''				
; ;											
7	DEPTH	I (FT)	THICK	NESS	(	COLOR AND TYPE OF MATERIAL ENCOU	NTERED	WA	TER -		
	FROM	то	(F)	n)	(INCLU	JDE WATER-BEARING CAVITIES OR FRAC	TURE ZONES)	BEAR	ING?		
<i>i</i> [	0	20	20	)		Caliche		☐ YES	☑ NO		
<b>,</b>	20	55	3	5	G	Sutuna Fm red siltstones and san	dstones	☐ YES	Ø NO		
	55	1284	122	29	Dewey Lake	Fm.Red siltstones and mudstones,	gray/green mottling	☐ YES	Ø NO		
	1284	1275	13	7		Rustler Fm./A-5, white anhydr		☐ YES	Ø NO		
1	1275	1306	3	<u> </u>		H-4 sub-mbr milky white hal	ite	☐ YES	Ø NO		
אבר אבר	1306	1320	14	4		A-4 sub-mbr white anhydrit	e	☐ YES	☑ NO		
Q.	1320 1338 18 Magenta Dolomite										
8	1338     1386     48     A-3 sub-mbr. white anhydrite       1386     1516     110     H-3 sub-mbr milky halite										
CEOLOGIC	1386	1516	<del></del>	☐ YES	☑ NO						
읽	1516	1526	1	0		Ore zone, anhydrite and white pol	yhalite	☐ YES	☑ NC		
8	1526	1563	6	1	<u> </u>	Halite and red mudstones		☐ YES	□ NO		
9	1563 1585 18 Anhydrite							☐ YES	□ NO		
	1585	1606	3	1		Dolomite - Culebra		☐ YES	□ NC		
n ok	1606	1655	4	9		Halite, red mudstones H2/M	2	YES	□ NO		
150								YES	□ NC		
								YES	NC		
			<u> </u>					☐ YES	_ □ N(		
15.3			ATTACI	ADDITION	VAL PAGES AS NI	EEDED TO FULLY DESCRIBE THE GEOLO	GIC LOG OF THE WELL				
	mer r	TEST	METHOD:	BAIL		☐ AIR LIFT ☐ OTHER – SPECIFY:					
AL INFO	WELL	LIESI				DATA COLLECTED DURING WELL TESTIN AND DRAWDOWN OVER THE TESTING PI		IME, END T	IME,		
	ADDITIO	NAL STATE	MENTS OR EXP	LANATIONS:			<del></del>	·			
TIO											
ADDIT											
ADDITIONAL STATEMENTS OR EXPLANATIONS:											
** # ** ** **											
Œ						EST OF HIS OR HER KNOWLEDGE AND B ID THAT HE OR SHE WILL FILE THIS WEL					
TO						ION OF WELL DRILLING:					
8. SIGNATURE	_	>.	00	- 1 c	~ F						
8. SI		Tr. Lu	CIGNATI	RE OF DRI	LLED	DATE					
	l		PIONATO	IVE OL DKI	UUSK	DATE					

FOR OSE INTERNAL USE		WELL RECORD & LOC	(Version 6/9/08)
FILE NUMBER C -3565	POD NUMBER 8	TRN NUMBER	
LOCATION 7245 - RZAE Sect 15			PAGE 2 OF 2
72		•	



#### 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,

Catherine Goetz

Water Resource Specialist

District II Office of the State Engineer

Enclosures

cc: Office of State Engineer, Santa Fe

# Goetz, Catherine, OSE

Allen Hall [ahall@icpotash.com] Monday, April 15, 2013 11:27 AM Goetz, Catherine, OSE RE: ICP-092 and ICP-093 From: Sent: <u>ا</u>ن

Hi Catherine,

Subject:

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 furture. 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.

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 o	f well	مرسع سعود	stem 3	Dies.	عدمنا		Оwn	er's W	II No.	<u>e-13</u>			
	Street or	Post Office A	idress	381 No	CHY	M	HZ COLL	heed						
	City and	State ho	Lesell, 10	ع۱۱) حيج	KILO		8 201							
Well		d under Permit												
	a56	2 × Ne ×	4 ¥ _	¼ of \$	ection	1	Township	245 R	inge	<u> 33e</u>	N.M.P.N			
	b. Tract	No	of Map N	0,		of the	·			· · · · · · · · · · · · · · · · · · ·				
	c. Lot N	lo ivision, recorde	of Block No.			of the	County.							
	d. X= _		_ feet, Y=		f	cet, N	.M. Coordina	ite System			Zone in			
			_					<del></del>	١ ،		Grant.			
				•				License No						
					•		•	7873			_			
								Air Rotary 4		_	_			
Eleva	ition of li	ind surface or _				at we	ll is	ft. Total depth	of we	11	19ft.			
Com	pleted we	ll is 🗆 s	hallow	artesian.			Depth to wa	iter upon completion	of we	<u> 90</u>	<u>&gt;.4</u> ft.			
			7	ction 2, PRIN	CIPAL V	VATE	R-BEARING	STRATA						
	Depth in Feet   Thickness   Description of Water-Bearing Formation   Estimated Yield (gallons per minute)													
40 99 B9 Deo Sano NIA														
									<del>                                     </del>					
								*						
	~~			Section	n 3 RFC	מפטי	OF CASING		· I — —					
Di	⊇ <u>O</u> ameter	Pounds	Threads		in Feet	OND	Length	CASING	 I	Perfo	rations			
-	nches)	per foot	per in.	Тор	Bott	om	(feet)	Sch 40P	en	From	То			
	<u>ス</u>	0.69	4	0			84	SCH 40 F		NA	N/A			
	2	2.	4	84	90	<u> </u>	15	Screen		84	99			
L				**										
	Denth	in Feet		ion 4. RECOI				MENTING						
F	rom	То	Hole Diameter	Sack of Mi			bic Feet Cement	Metho	od of l	lacement				
1	1	78	<b>8</b> "	13.2		2	5.4	Pomped th	ూల్వ	h ++5	A			
7	පි	81	_8"	1.5 Ber		1		Surface D	rop	through	RHSA			
8	31	वव	00	8/16 S	<i></i>	4	2	Surface I	كاماح	Loos	h-HSA			
				Sectio	n 5, P1, U	GGIN	G RECORD							
		ictor												
		d					No.	Depth in Top	Feet Botto		ubic Feet Cement			
	Velt Plugg ng approv	ed		*** ** ** ****************************						, m	Cement			
i idggil	ng approv		State bas	ineer Represe				1						
eren and	an aller der eine Sellsteinen Grein	يسيد ويوافده لدعم معاشم	State 1.11g	-	anthree situation (ii)	na ond <b>Ma</b> nha, wa	4	Miles in Parallel and Annual A						
Date R	ecessed	01-31-20	000	FOR USE	OF STAT	IF FN	GINEER ON	H Y		• .				
						Quad		son in FWI						
File	No		· · · · · · · · · · · · · · · · · · ·		. Use .			Location No	248.	33E.1.24				

Section 6. LOG OF HOLE

			Section 6, EOG OF ROLE
	in Feet	Thickness in Feet	Color and Type of Material Encountered
From	34.3	34.3	Samo, Tano. Brown to RED
34.3		2.3	
40	99	59	Red Janel, Med. grained
	- 1		Clay hit @ 99
<del></del>			
<del></del>			
		1	
	ļ		
		<u> </u>	L

Section 7. REMARKS AND ADDITIONAL INFORMATION

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.

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All secret Section 5, shall be answered as completely and accurately suble when any well is drilled, repaired or deepene this form is used as a plugging record, only Section 1(a) and Section 6.

# 4

# STATE ENGINEER OFFICE WELL RECORD

#### Section 1. GENERAL INFORMATION

Sti	reet or	r well	Idress 63	129 US	ath	Main	Shr	eet own	er's Wei	II No	Nu.13	
Well was	drille	d under Permit	No. ~1	4		an-	d is locat	ed in the:				
<b>a.</b>	<b>S</b>	. « ne	i ¼	¼ of Sc	ection	<u>1</u> 1	`ownship	245 R	nge _=	53e	N,M,P,N	
	Lot N		of Block No.			of the						
d.	X**						•	e System				
(8) 8			9_ ~		~						Grant.	
								License No.				
								7873				
Drilling Began 12/14/99 Completed 12/14/99 Type tools Aig Robary 4HSA Size of hole 8 in.  Elevation of land surface or 90 fe												
Elevation of land surface or at well is ft. Total depth of well ft.												
Completed well is ahallow artesian. Depth to water upon completion of well 83.4 ft.												
Section 2. PRINCIPAL WATER-BEARING STRATA  Depth in Feet Thickness Estimated Yield												
From To in Feet Description of Water-Bearing Formation (gallons per minute)												
80 90 10 Red Sand Stone NIA												
				H21	0 0	83	s.4°			·		
			<u></u>									
<u></u>												
	<u> </u>	D				ORD OF C		T			WRB.	
Diame (inch		Pounds per foot	Threads per in.	Тор	in Feet Botte		Length (feet)	Chaing /		Perfe From	To To	
_2	•	0.69	4	0	7.5	5 7	75	SCH 40 P	יעב	N 12	NIL	
2		2.1	4	75	90	)	15	SCH 40P	عد	75	90	
<del></del>			Section	on 4. RECOI	RD OF M	UDDING A	AND CE	MENTING			and the second second	
Fror		n Feet To	Hole Diameter	Sack of Mu		Cubic I of Cem		Metho	d of Pl	lacement		
١		69	ිස"	11.5		27		Pumped +	lions			
اوعا		72	8	Book	scite Scite	\	<	witau C	MOO.	JI	المدعل	
72	2	90	නී	8/165		9					I	
Plugging (	Section 5. PLUGGING RECORD											
Address .							No.	Depth in l			ubic Feet	
Date Well	lugging method Top Bottom of Cement lugging approved by:											
TORREST &	ippiov		State Engl	Bas Dansas	manation		3					
			State Engl	neer Represe		Control of the second	4					
Date Rece	ived	01-31-20	000	FOR USE					-			
					(	Quad		FWL	3000 - 100	ESI		
File No	). <u> </u>				_ Use		_	Location No. 245	s. 33F	1.1.24		

Section 6. LOG OF HOLE

Depth in Feet Thickness			Section 6, EOG OF ROLE
		Thickness in Feet	Color and Type of Material Encountered
From	34.3	34.3	Samo, Tano. Brown to RED
34.3		2.3	
40	99	59	Red Janel, Med. grained
	- 1		Clay hit @ 99
<del></del>			
<del></del>			
		1	
	ļ		
		<u> </u>	L

Section 7. REMARKS AND ADDITIONAL INFORMATION

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.

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All secret Section 5, shall be answered as completely and accurately suble when any well is drilled, repaired or deepene this form is used as a plugging record, only Section 1(a) and Section 6.



			_ <del></del>	<del></del>							
							OSE FILE NU	MBER(S)			
					·		C-3666				
	WELL OWN						PHONE (OPTI	ONAL)			
	AGAVE EN										
	WELL OWN						CITY		STATE	ZIP	
	105 SOUTH						ARTESIA		im 882		
	WELL		DI	GREES	MINUTES SECO	NDS		•			
	LOCATIO	N LA	TITUDE 32	12	49.3	N	* ACCURACY	REQUIRED: ONE TEN	TH OF A SECOND		
	(FROM GE	S) LOI	NGITUDE 10	31	25.1	W	* DATUM RE	QUIRED: WG\$ 84			
	DESCRIPTION	ON RELATIN	NG WELL LOCATION TO	STREET ADDRES	S AND COMMON LANDM	IARKS - PLS	S (SECTION, TO	WNSHJIP, RANGE) WH	ERE AVAILABLE		
										:	
	LICENSE NU	IMBER	NAME OF LICENSED	DRILLER				NAME OF WELL DRI			
	WD-1058		CASEY KEY				_	<u> </u>	PUMP SERVICE INC		
	DRILLING S		DRILLING ENDED		LETED WELL (FT)	t .	LE DEPTH (FT)	1	ST ENCOUNTERED (FT)		
	10-18-201	<u> </u>	10-26-2013	650 		650		460			
	COMPLETE	well ic	ARTESIAN	DRY HOLE	SHALLOW (UNCO	NEWERN	STATIC WATER LEVEL IN COMPLETED WEL			LL (FT)	
ON								390			
ΑTI	DRILLING F	LUID:	₩ AIR	MUD	ADDITIVES - SPE	CIFY:					
CASING INFORMATION	DRILLING M	IETHOD:	ROTARY	HAMMER	CABLE TOOL	ОТНЕ	R - SPECIFY:				
	DEPTH	(feet bgl)	BORE HOLE	CASING MA	ATERIAL AND/OR			CASING			
S	FROM	то	DIAM	1	GRADE		ASING NECTION	INSIDE DIAM.	CASING WALL THICKNESS	SLOT SIZE	
SIS	(inches)			h casing string, and tions of screen)		YPE	(inches)	(inches)	(inches)		
Š	0	21	17-1/2"	STEEL				13-3/8"	.375		
Ş	-2.5	485	12-1/4"		STEEL	WELD		8"	.322	<del>                                     </del>	
CLI)	485	650	12-1/4"		STEEL	WELD		8*	.322	.1875	
DRILLING											
2. [										1 7 7	
									2.7		
									STAL ROSS		
									NO THE		
•											
								-	- 42		
	DEPTH	(feet bgl)	BORE HOLE	LIST	ANNULAR SEAL MA	TERIAL A	ND	AMOUNT	> METHO	bos	
۸L	FROM	то	DIAM. (inches)	1	L PACK SIZE-RANG			(cubic feet)	→ METHQ PLACEN		
ERI	0	20	17-1/2"		CEMENT				<del>-   ••</del>	<u> </u>	
IAT	0	325	12-1/4*		CEMENT		_		<u>₩</u> 25		
ANNULAR MATERIAL	325	390	12-1/4"	<del>                                     </del>	BENTONITE HOLE	PLUG	<del></del>		= 711		
ULA	390	650	12-1/4"	<del>                                     </del>	5/8*GRAVEL						
Z			<del>                                     </del>			<del></del> •	·		-		
3. A			<del>                                     </del>	<del>                                     </del>							
		<del></del>	<del></del>				<del></del>				
	OSE INTER			<u></u>		-		1			

FOR OSE INTERNAL USE	WR-20 WELL RECORD & LOG (Version 06/08/2012)				
FILE NUMBER 1 - 30000	POD NUMBER	TRN NUMBER	53299	<u> </u>	
LOCATION 205. 338, 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	s	BEAF	TER RING?	ESTIMATED YIELD FOR WATER- BEARING				
				(attach supplemental sheets to fully describe all units)		(185	/ NO)	ZONES (gpm)				
	0	10	10	TOP SOIL		ΠY	<b>■</b> N					
İ	10	15	5	WHITE CALLCHE		ΠY	■ N					
	15	50	35	RED SAND		ΠY	ı N	·				
	50	65	15	RED SANDSTONE	T	□ Y	■ z					
	65	90	25	GREY SAND AND CLAY		ΠY	® N					
ا بر	90	97	7	DARK RED SANDSTONE		ΠY	■ N					
HYDROGEOLOGIC LOG OF WELL	97	100	3	GREY SANDSTONE		ΒY	■ N					
OF	100	108	8	DARK RED SANDSTONE		ΠY	■ N					
507	108	117	9	GREY SAND AND CLAY		ΠY	■ N					
125	117	123	6	DARK RED SANDSTONE		□ Y	■ N					
07	123	155	41	GREY SANDSTONE		□ Y	■ N					
3E0	155	160	5	DARK RED SANDSTONE		□ Y	■ N	·····				
80	160	195	35	GREY CLAY AND SAND		□ Y	■ N					
H	195	210	15	DARK RED SANDSTONE		□ Y	■ N					
4	210	230	20	GREY SANDSTONE		□ Y	■ N					
	230	300	70	RED SANDSTONE		□ Y	■ N					
	300	320	20	MULTI-COLOR SANDSTONE		ΟY	■ N					
	320	460	140	RED SANDSTONE		□ Y	■ N					
	460	465	5	MILTI-COLER ROCK		■ Y	Пи	2-GPM				
	465	490	25	RED SANDSTONE	$\neg$	□ Y		•				
	490	535	45	MULTI-COLORED CONGLOMERATE		<b>■</b> Y	Пи	20-GPM				
	METHOD U	SED TO ES	TOTA	AL ESTIMATED								
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ■ PUMP  TO  WI  AIR LIFT □ BAILER □ OTHER - SPECIFY:							. 38				
NO	WELL TES			ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INC ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVE								
RVISION	MISCELLA	NEOUS INF	ORMATION:									
<u>121</u>	,		э.		H2O GPM							
SUI	1	1	60	00 TO 650 - 50 - RED SANDSTONE NO	H2O							
TEST; RIG SUP	73 , <b>-</b>	· <u>-</u>										
ST;	PRINTE NA S											
S. TI		IE(S) OF DI	CILL KIG SUPER	(VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CON	STRUC	TION O	THER TH	IAN LICENSEE:				
	CASEY KEY											
	THE UNDE	RSIGNED H	EREBY CERTIF	IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELII	EF, THE	E FORE	GOING IS	A TRUE AND				
URE				ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RI O DAYS AFTER COMPLETION OF WELL DRILLING:	ECORD	) WITH	THE STA	TE ENGINEER				
Y	$\cap$	1/6										
SIGNATURE	7	DOVE		TAXI KON	11	1-1	3-1	7				
6.8		SIGNATI	IDC AC ADULE	R / PRINT SIGNEE NAME		- ( (	DATE					
Ш		SIGNATI	UNE OF DRILLE	A / FRINT SIGNEE NAME			DATE					

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



N.	OSE POD 1	O366	L NUMBER)	D i		OSE FILE NU	MBER(S)					
AND WELL LOCATION	1	NER NAME(S)				PHONE (OPT						
9	MAR	KN	CC/oy	[M+ M Ranch		CITY		STATE	ZIP			
ELL	WELL ON	NEK MAILING	MUDBASS ,			GII.		SIAIE				
Š	WEL	, 1	DE	BOREES MINUTES SECO	ONDS	<u> </u>						
LA	LOCATI		mune 3.	2 12 29.0	O N	* ACCURACY	( REQUIRED: ONE TE	NTH OF A SECOND	-			
GENERAL	(FROM (	IPS) LON	GITUDB: "- "-/C	3 32 33.		. DATUM RE	QUIRED: WGS 84					
CE	DESCRIPT	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE										
	1 Du	04 /	28 @	30 mm - 1/4 mil	e 50	th						
	LICENSE N	UMBER	NAME OF LICENSED					STITTING CONGANA	4			
	1654 John SIRMEN						SIRMAN DRIlling & CONST.					
	DRILLING	3/13	DRILLING ENDED	550-0		B DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)					
	011	7/13	8 20   3	DRY HOLE SHALLOW (UNC	550	)-0	STATIC WATER LE	VEL IN COMPLETED WI	IL (FT)			
z	COMPLETE	D WELL IS:	ARTESIAN		110-	<i>9</i>						
ATIC	DRILLING FLUID: MUD ADDITIVES - SPECIFY:											
OKM	DRELENG	METHOD:	ROTARY	HAMMER CABLE TOOL	OTHER	- SPBCIFY:						
DRILLING & CASING INFORMATION		(feet bgi)	BORE HOLE	CASING MATERIAL AND/OR GRADE	CA	SING	CASING	CASING WALL	SLOT			
NG NG	FROM TO		DIAM (inches)	(include each casing string, and		ECTION YPE	INSIDE DIAM. (inches)	THICKNESS (inches)	SIZE (inches)			
้์อื่	0	280	10"	note sections of screen)	Certa	- 1.4	[11	DO 17				
, Ç		000	10	770	CEITA	- ~ ~		DK-11	Blask			
CLD	280	360	10"	PVC	Ceita	lok	6"	DR-17	032501			
2. DR	015			0.45		1. 1. 1	110		20			
	360	500	10	PVC	Certa	LOK	6"	DKELTEN	Blove			
	500	550	10	PUC	Certa	Lok	6"	DRO17 m	Sereni			
				न् दीहरणि				- d-				
			·				<del></del>					
	DEPTH	(fast bai)	DODE WAY T	LIST ANNULAR SEAL MA	TEDIAL AN	<u></u>	AN COLDET	Ū a				
AL.	FROM	(feet bgl) TO	BORE HOLE DIAM. (inches)	GRAVEL PACK SIZE-RANGE			AMOUNT (cubic feet)	METHOI PLACEM				
ERS	0	20	10	3/8 hole plug - E	entoni	te	8 6995 3	DIAS OFA	, fr.			
MA [				7 . J				J .	,			
MA.	20 -	550	10	3/8 pri gravel	DACK			gravit	4			
ANNULAR MATERIAL						<del></del>			·			
3. A					1.4							
FOR	OSE INTER	NAL USE				WR-20	WELL RECORD 8	LOG (Version 06/08	/2012)			

100100	Domestic / Strck	2116	32 6 3 2 4 3	
FILE NUMBER	C-31662	POD NUMBER	TRN NUMBER 53US/10	
FOR OSE INTERN	VAL USE		WR-20 WELL RECORD & LOG (Version 06/	08/2012

	DEPTH (	feet bgl)		COLOR AND TYPE OF MATERIAL ENCOUNTERED -	W. TTD	ESTIMATED
	FROM	то	THICKNESS (feet)	INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	YIELD FOR WATER- BEARING ZONES (gpm)
	0	3	3	BROWN SANIC	□Y □×	
	3	30	27	taliche	□Y Dix	
	30	40	10	Red soudstone	□Y <del>□N</del>	
	40	55	15	Red gardsteve accy sendstone	□Y GN	
	\$5	65	10	Red Shake	□Y <del>□N</del>	
1 =	65	75	10	BIEW SANd Stone	□Y <del>□N</del>	
HYDROGEOLOGIC LOG OF WELL	75	250	175	Red Shela	□Y ⊡ <del>N</del>	
ō	250	275	25	aren sandstone	אם דפ	7-10
8	275	550	275	Red Liole		•
125					N □ Y □	
1 03					N Y	
02			550		אם אם	
NO.			•		OY ON	
12					□Y □N	
<b>+</b>					אם אם	
					N DY	
}					□Y: □N	
					ДΫ □и	
					N DY	
				·	и п	
					N DY	
,	WELLIOD O	SED TO ES	TIMATE YIELD		TOTAL ESTIMATED	
	AIR LIFE	Г	AILER 🗆	OTHER - SPECIFY:	WEIL YIELD (gpm):	7-10
NÖ	WELL TEST	TEST R	ESULTS - ATTA TIME, END TIM	CH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLU E, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER	UDING DISCHARGE M THE TESTING PERIO	ETHOD, D.
ervision	MISCELLA	NEOUS INFO	DRMATION:			ì
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	THE UNDER	SIGNED HE	EREBY CERTIFIE	ES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, SCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL REC	THE FOREGOING IS	A TRUZ AND
SIGNATURE	AND THE PE	RMIT HOL	DER WITHIN 20	DAYS AFIER COMPLETION OF WELL DRILLING:	<u> </u>	ICE
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, ,	71	SIGNATU	RE OF DRILLER	/ PRINT SIGNEE NAME	DATE	
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								7913 144 20	10, 7, 3			
	OSE POD NU	MBER (WELL	NUMBER)				OSE FILE NUM					
O	BH 28						C3603; 518	3404				
ATI	APT. 0'72						PHONE (OPTR	DNAL)				
Ö	INTERCO	NTINENTA	<b>VL POTASH CORP</b>									
1. GENERAL AND WELL LOCATION	600 W. BI	ENDER BL					HOBBS	١	STATE NM 8824	21P 0		
GNA.	WELL		DEGREES 32	MINUTES 10	SECOND 30.4	os N	* ACCURACY	REQUIRED ONE TENT	THOF A SECOND			
ERVI	(FROM GI	Linita	GITUDE 103	32	58.5	W	* DATUM REC	OURED WGS 84				
1. GEN	DESCRIPTION HELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE  T24S; R 33E; SECTION 35											
	LICENSE M	MEER	NAME OF LICENSED	ORILLER				NAME OF WELL DRI	LLING COMPANY			
	WD-1186	1	<b>RODNEY HAMM</b>	ER				ENVIRO-DRILL,	INC.			
	ORALINGS 01-12-13		DRILLING ENDED	DEPTH OF COMPLETE	D WELL (FT)	BORE HO	LE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT) N/A				
_	COMPLETE	D WELL IS:	Cartesian	ORY HOLE	SHALLOW (UNC	ONFINED)		STATIC WATER LEV	EL IN CONIPLETED W	FII (FT)		
Ö	DRILLING FLUID. C AIR C MUD ADDITIVES - SPECIFY											
Į.V.			-				ca carcury	AUGER				
OKA	DRILLING		ROTARY	C HAMMER C	CABLE TOOL	( OIR	ER - SPECIFY			-		
DRILLING & CASING INFORMATION	DEPTH (feet bgl) BORE HOLE FROM TO DIAM (inches)		CASING MATER GRAI (include each case note sections	DE ing string, and	CON	ASING NECTION TYPE	CASING INSIDE DIAM (inches)	CASING WALL THICKNESS (mches)	SLOT SIZE (inches)			
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,		(feet hgl)	BORE HOLE DIAM (inches)		NULAR SEAL M			AMOUNT (cubic feet)	t t	IOD OF FMENT		
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	OCC INTER	VALUEE					WR	20 WELL RECORI	) & LOG (Version 0	6.08/2012)		

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LOCATION		245.336.35	PAGE 1 OF 2

	DEPTH	(feet bgl)									
	FROM	то	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 <sup>o</sup> (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)					
	2	31		BROWN SILTY SAND, LOOSE	CYGN	N/A					
	31	58	29	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A					
	58	75		SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A					
		/3	17	SHALE RED SILTY SAND, VERY DENSE	CYGN	N/A					
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4. HYDROGEOLOGIC LOG OF WELL					C Y C - X						
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	METHOD US	SED TO EST	TIMATE YIELD (	OF WATER-BEARING STRATA PUMP TO	TAL ESTIMATED						
	_				ELL YIELD (gpm)						
		TEST P	ECHITC ATTA	CIL A CODY OF DATE							
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E	CORRECT RE	COKDOLI	HE ABOVE DES	CRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORDAYS AFTER COMPLETION OF WELL DRILLING	ED WITH THE STATE	E ENGINEER					
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6.5	اهما	4.11.	E OF DRU : E=	and the second s	-23-13						
		SIGNATURI	E OF DRILLER	/ PRINT SIGNEE NAME	DATE						
FOR (	OSE INTERNAL	L USE		WR-20 WFILER	CORD & LOG (Versi	on 06/08/2012)					
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PAGE 2 OF 2

LOCATION



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## STATE ENGINEER OFFICE

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NC	OSE POD NUM	MBER (WELL	NUMBER)				OSE FILE NU:	MBER(S) 8404 013 JAN 2	911/2:21	1
ATIC	WELL OWNER						PHONE (OPTI			
COC	1		L POTASH CORP							716
GENERAL AND WELL LOCATION	600 W. BEI						HOBBS	ľ	STATE NM 882	Z1P 40
Q.	WELL		DEGREES			)Š				
AL/	LOCATION			10	20.0	N	* ACCURACY REQUIRED ONE TENTH OF A SECOND  * DATUM REQUIRED WGS 84			
NER	(FROM GPS	LONG	GITUDE 103	32	18.8	W				
J. GE	T24S; R 33		ELLOCATION TO STREET  ON 35	ADDRESS AND COMM	ON LANDMARKS - PLS	S (SECTION, T	ÖWNSHJIP, RANC	SE) WHERE AVAILABLE		
	LICENSE NUN	MBER	NAME OF LICENSED	DRILLER				NAME OF WELL DRI		
	WD-1186		RODNEY HAMM	ER				ENVIRO-DRILL,		
	DRILLING ST. 01-14-13	1	DRILLING ENDED	DEPTH OF COMPLET	ED WELL (FT)	BORE HO	HOLE DEPTH (FT) DEPTH WATER FIRST ENCOUNTERED (FT)  N/A			
z	COMPLETED WELL IS C ARTESIAN O DRY HOLE C SHALLOW (UNCONFINED)									
OIT.	DRILLING FL	לוט (	Air	C MUD	ADDITIVES - SPI	ECIFY				
DRILLING & CASING INFORMATION	DRILLING ME	ETHOD (	ROTARY	C HAMMER C	CABLE TOOL	© OTHE	R - SPECIFY	AUGER		
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FOR	OSE INTERN	AL USE					WR-2	20 WELL RECORD	& LOG (Version 06	v08/2012)

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	I DEPART				
	FROM	(feet bgl)	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZOI (attach supplemental sheets to fully describe all units)	WATER NES BEARING' (YES / NO) WATER WATER WATER- BEARING ZONES (gpm)
	0	1	1	BROWN SILTY SAND, LOOSE	CY 6 N N/A
	1	22	21	CALICHE WHITE SILTY SAND, VERY DENSE	C Y @ N N/A
	22	31	9	SHALE GREEN SILTY SAND, VERY DENSE	C Y @ N N/A
	31	70	39	SHALE RED SILTY SAND, VERY DENSE	C Y © N N/A
	70	75	5	SHALE GRAY SILTY SAND, VERY DENSE	C Y G N N/A
ر ا				January VIII DENSE	CYCN
4. HYDROGEOLOGIC LOG OF WELL		<u> </u>			
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	C AIR LIF	r (	BAILER (	OTHER – SPECIFY:	WELL YIELD (gpm)
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5. TEST; RIG SUPERVISION					
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5. TE	PRINT NAM	E(S) OF DR	RILL RIG SUPER	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CO	ONSTRUCTION OTHER THAN EICENSEE.
SIGNATURE	CORRECTR	ECORD OF	THE ABOVE DI	ES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL DAYS AFTER COMPLETION OF WELL DRILLING:  Rodrey Hammer	LIEF, THE FOREGOING IS A TRUE AND RECORD WITH THE STATE ENGINEER
او		SIGNATU	RE OF DRILLER	PRINT SIGNEE NAME	DATE
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TRN NUMBER

PAGE 2 OF 2



LOCATION

# WELL RECORD & LOG

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# STATE ENGINEER OFFICE ROSY

PAGE 1 OF 2

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GENERAL AND WELL LOCATION	600 W. B	ENDER	NG ADDRESS BL.VD.				CITY HOBBS		STATE NM	8824	ZIP O
Ž	WELL		DEGREE	S MINUTES	SECON	D\$	<u> </u>				
KEA	LOCATIO	U NC	ATITUDE 32	10	40.9	N	* ACCURACY	REQUIRED, ONE TEN	TH OF A SECO	OND	
ER	(FROM G	PS) L	ONGITUDE 103	32	52.8	· W	* DATUM RE	QUIRED, WGS 84			
1. GEN	DESCRIPTION T24S; R 3	N RELATING	WELL LOCATION TO STREE	T ADDRESS AND COMMO	DN LANDMARKS - PL	SS (SECTION, TO	) Ownshjip, rang	SE) WHERE AVAILABLE			
	LICENSE N		NAME OF LICENSED	DRILLER				NAME OF WELL DR	ILLING COMP	12.0	
	WD-1186	5	RODNEY HAMA					ENVIRO-DRILL,		ANI	
	DRILLING S 01-13-13		DRILLING ENDED 01-13-13	DEPTH OF COMPLETE	D WELL (FT)	BORE HOL	LE DEPTH (FT)	DEPTH WATER FIR		ERED (FT)	
Z	COMPLETE	D WELL IS	C ARTESIAN	• DRY HOLE	SHALLOW (UNC	ONFINED)	<u> </u>	STATIC WATER LEV	VEL IN COMPL	ETED WE	LL (FT)
110	DRILLING F	LUID:	C AIR	Смир	ADDITIVES - SP	ECIEV					
RMA	DRILLING M		ROTARY	C HAMMER C	CABLE TOOL		R – SPECIFY	AUGER			
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ASING I	FROM	TO	DIAM (inches)	GRAI (include each cas note sections	ing string, and	CASING CONNECTION TYPE		INSIDE DIAM (inches)	CASING THICKI	NESS	SLOT SIZE (inches)
S C	0	75	8"	N/A		N/A		N/A	N/A		N/A
2. DRILLING & CASING INFORMATION											
TERIAL	DEPTH (I	feet bgl)	BORE HOLE DIAM. (inches)		ULAR SEAL M/ CK SIZE-RANG			AMOUNT (cubic feet)		METHO PLACEM	
3. ANNULAR MATERIAL											
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	DEPTH (I	bet hgl)			
	FROM	TO	THICKNESS (feet)	(attach supplemental sheets to fully describe all units)	(YES/NO) BEARING
	0	2	2	BROWN SILTY SAND, LOOSE	JAN 29 A ZONES (gpm)
:	2	23	21		C Y @ N N/A
	23	31	8	RED SILTY SAND, VERY DENSE	CY @ N N/A
	31	41	10		CY 6 N N/A
	41	75'	34	SHALE RED SILTY SAND, VERY DENSE	C Y @ N N/A
		/3	34	SHALE GREEN SILTY SAND, VERY DENSE	CY @ N N/A
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SIG	Kan	人。小	tan	Kodney Hammer	1-23-13
6.9		SIGNATU	RE OF DRILLER	/ PRINT SIGNEE NAME	DATE

FOR OSE INTERNAL USE WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER POD NUMBER TRN NUMBER

LOCATION PAGE 2 OF 2



FILE NUMBER

LOCATION

# WELL RECORD & LOG

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# STATE ENGINEER OFFICE ROSKITS

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PAGE 1 OF 2

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	WD-1186	5	1	RODNEY HAMM					ENVIRO-DRILL,		
	DRILLING S		7	DRILLING ENDED	DEPTH OF COMPLE	TED WELL (FT)	BORE HOL	E DEPTH (FT)	DEPTH WATER FIRS		ויני
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	FROM	то	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTE INCLLIDE WATER-BEARING CAVITIES OR FRACTI (attach supplemental sheets to fully describe all	LRE ZONES	WATER BEARING	YIELD FOR WATER-
	0	1	1	BROWN SILTY SAND, LOOSE		CYG	
	1	26	25	CALICHE WHITE SILTY SAND, VERY DENSE		CYG	
	26	38	12	SHALE GREEN SILTY SAND, VERY DENSE			
	38	46	8	• • • • • • • • • • • • • • • • • • •		CYG	
	46	75	19	SHALE RED SILTY SAND, VERY DENSE		CYE	
		-	13	SHALE BROWN SILTY SAND, VERY DENSE		CYG	
HYDROGEOLOGIC LOG OF WELL						C Y C	1
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N O	WELL TES	T TEST	RESULTS - ATT. ITTIME, END TO	ACH A COPY OF DATA COLLECTED DURING WELL TES (E, AND A TABLE SHOWING DISCHARGE AND DRAWD	TING, INCLUDING OWN OVER THE	NG DISCHARGE TESTING PE	GE METHOD. RIOD
N	MISCELLA	NEOUS INF	ORMATION				
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PAGE 1 OF 2

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ON O	BH 29						C3603; 51	18404		
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LOCATION	INTERC		NTAL POTASH CO	RP						
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THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE A CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINE AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING  ROSE INTERNAL USE  WR-20 WELL RECORD & LOG (Version 66-68)  WR-20 WELL RECORD & LOG (Version 66-68)  TRN NUMBER									
CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINE AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING  ROSE INTERNAL USE  WR-20 WELL RECORD & LOG (Version 66-08)  TRN NUMBER  POD NUMBER  TRN NUMBER									
SIGNATURE OF DRILLER / PRINT SIGNEE NAME  DATE  WR-20 WELL RECORD & LOG (Version 66-68  LE NUMBER  POD NUMBER  TRN NUMBER	- 1	CAMBRIANT B	ECORD OF	ETHE ABOVE D	DESCRIBED HOLE AN	ND THAT HE OR SHE WILL FILE IPLETION OF WELL DRILLING	E THIS WELL K	EF, THE FOREGOING ECORD WITH THE ST	IS A TRUE A TATE ENGINE
DR OSE INTERNAL USE  WR-20 WELL RECORD & LOG (Version 66:08 LE NUMBER  TRN NUMBER		Kor	44	-			<del></del>	•	
LE NUMBER POD NUMBER TRN NUMBER			SIGNATU	JRE OF DRILLE	ER / PRINT SIGNEE	NAME		DATE	
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LOCATION

# WELL RECORD & LOG

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# STATE ENDINGE OFFICE BOSHO

PAGE 1 OF 2

NAME OF LICENSE RODNEY HAM!  DRILLING ENDED 01-10-13	10 44 32 17 EET ADDRESS AND COMMON LANDMA	8 W	* DATUM RE	18404 TIONAL) Y REQUIRED ONE TE: QUIRED WGS \$4	STATE NM 882 NTH OF A SECOND	ZIP 40			
DEGRE 32 ONGITUDE 103 SWELL LOCATION TO STRI TION 35  NAME OF LICENSE RODNEY HAMI DRILLING ENDED 01-10-13	10 44 32 17 EET ADDRESS AND COMMON LANDMA D DRILLER MER	.8 N .8 W .PLSS (SECTION, T	C3603; 5° PHONE (OPT  CITY HOBBS  * ACCURAC* * DATUM RE	18404 TIONAL) Y REQUIRED ONE TE: QUIRED WGS \$4	NM 882				
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NAME OF LICENSE RODNEY HAM!  DRILLING ENDED 01-10-13	D DRILLER MER	77	OWNSHJIP, RANG						
NAME OF LICENSE RODNEY HAM!  DRILLING ENDED 01-10-13	D DRILLER MER	77							
DRILLING ENDED 01-10-13	MER	) BORE HOL		7 2 3 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5					
O1-10-13	DEPTH OF COMPLETED WELL (F	T) BORE HO!		ENVIRO-DRILL,	HLLING COMPANY INC.				
	01-10-13 01-10-13 DEPTH WATER FIRST ENCOUNTERED (FT) N/A								
C AIR	SHALLOW (UNCONFINED)								
ADDITIVES - SPECIFY									
CROTARY	C HAMMER C CABLE T	OOL ( OTHE	R - SPECIFY	AUGER					
BORE HOLE	CASING MATERIAL AND	/OR							
DIAM (inches)	GRADE (include each casing string, note sections of screen)	and CONN	SING ECTION YPE	CASING INSIDE DIAM (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (mehes)			
8"	N/A	N/A		N/A	N/A	N/A			
						ļ			
		-							
BORE HOLE	LIST ANNULAR SE	AL MATERIAL AT	ND	AMOUNT					
DIAM (inches)				(cubic feet)					
				DIAM (inches) GRAVEL PACK SIZE-RANGE BY INTERVAL	DIAM (inches) CRAVEL DACK SIZE DANCE DV DVEDOVA	DIAM (inches) CRAVEL DACY CIZE DANCE DV DYDDON			

	DEPTH	(feet bgl)		STATE	Haller or	THE S					
	FROM 0	то 2	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES 14 (attach supplemental sheets to fully describe all units)		ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)					
	2	+	2	BROWN SILTY SAND, LOOSE	CYGN	N/A					
	23	23	21	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	1					
		40	17	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A N/A					
	40	75	5	SHALE RED SILTY SAND, VERY DENSE	CYGN						
				TO THE STATE OF TH	$C \times C \times$	N/A					
E											
HYDROGEOLOGIC LOG OF WELL					$C \times C \times$						
OF					$C \times C \times$						
90					C $X$ $C$ $X$						
101					$C \times C \times$						
00.					CYCX						
E01					CYCN						
502					CYCX						
YDE			<u> </u>		$C_{\lambda}$						
4. H					$C^{Y} \subset S$						
					$C_{X}$						
					$C_X \subset X$						
					$C_{X}$						
					CYCX						
أ					CYCN						
					CYCX						
					CYCN						
	1		TIMATE YIELD	OF WATER-BEARING STRATA C PUMP TOT	'AL ESTIMATED						
	C AIR LIF	г ( 1	BAILER (	OTHER - SPECIFY. WE	LL YIELD (gpm)						
NO	WELL TES	T TEST	RESULTS - ATT/ Γ TIME, END TIM	ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDE ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER TH	ING DISCHARGE N IE TESTING PERIO	METHOD, D					
TEST; RIG SUPERVISIO	MISCELLA	NEOUS INF	ORMATION:								
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SO											
RIC											
ST;	PRINT NAM	E(S) OF DR	ILL RIG SUPERV	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRU	CTION OTHER TH						
5. T		2(0) 01 1511	ion mo oor an	THO MAY THAT THO TINED ONSTITE BUT LIKE 1310 A OF WELL CONSTRU	CHON OTHER TH	AN LICENSEE					
	THE UNDER	SIGNED HE	EREBY CERTIFII	ES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, TH	HE FOREGOING IS	A TRUE AND					
RE	CORRECT R.	ECORD OF	THE ABOVE DE	SCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECOR	D WITH THE STAT	LE ENGINEER					
ATL	AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING.										
SIGNATURE	1 1 N 2 1 1 1 2 1 2 2 2 2 2 2 2 2 2 2 2										
6. S	Kod He Kodney Hammer 1-23-13										
		SIGNATU	RE OF DRILLER	/ PRINT SIGNEE NAME	DATE						
FOR	OSE INTERNA	AL USE		WR-20 WELL RE	CORD & LOG (Ver	sion 06/08/2012)					

FOR OSE INTERNAL USE

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

FILE NUMBER

POD NUMBER

TRN NUMBER

PAGE 2 OF 2



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	OSE POD N	JMBER (	(WELL	NUMBER)				OSE FILE NU	MBER(S)		-	
NO	BH 14							C3601; 51	8393			
ΛTΙ	WELL OWN	ER NAM	iE(S)					PHONE (OPT)	ONAL)			
OC.	INTERCO	NTINE	ENTA	L POTASH CORI	P							
ΓΓ	WELL OWN	ER MAII	LING A	ADDRES\$				CITY		STATE		ŽĮP
'EL	600 W. B	ENDE	R BL\	/D.				HO8BS		NM	8824	.0
% Q				DEGREES	MINUTES	SECONO	\c'	1				
NV	WELL			32	11	47.9		A A COURT A CO	A DECLUDED. ONE TEN	THOE . C	tcovo	
ΑL	LOCATIO (FROM G	<b>⊢</b>	LATIT	TUDE			N	4	-	TH OF A SI	ECOND	
GENERAL AND WELL LOCATION	(PROM G	rs)	LONG	ITUDE 103	. 32	11.4	W	- DATUM RE	QUIRED: WGS 84			
<u> </u>	DESCRIPTIO	N RELATI	NG WE	LL LOCATION TO STREE	T ADDRESS AND COMM	ON LANDMARKS - PLS	S (SECTION, T	OWNSHJIP, RANG	E) WHERE AVAILABLE			
-	T24S; R 3	3E; SE	CTIO	N 23								
	LICENSE NU	JMBER		NAME OF LICENSED					NAME OF WELL DR	ILLING CO	MPANY	
	WD-1186 RODNEY HAM				IER				ENVIRO-DRILL,	TENTH OF A SECOND  TENTH OF A SECOND  TENTH OF A SECOND  TENTH OF A SECOND  TO A SE		
	DRILLING S		7	DRILLING ENDED	DEPTH OF COMPLET	ED WELL (FT)	BORE HOL	LE DEPTH (FT)	DEPTH WATER FIRE	ST ENCOU	M 88240  H OF A SECOND  LING COMPANY NC.  FENCOUNTERED (FT)  L IN COMPLETED WELL (FT)  L IN COMPLETED WELL (FT)  WAR STATE  N/A STAT	
	01-05-13		01	1-05-13			75'		N/A			
					•			-	STATIC WATER LEV	EL IN CON	TPLETED WE	LL (FT)
.,	COMPLETE	O WELL	ıs: (	ARTESIAN	ORY HOLE	SHALLOW (UNC	ONFINED)					
OI.												
[V]	Manual Steem											
DRILLING & CASING INFORMATION	DRILLING N	TETHOD	e (	ROTARY	C HAMMER C	CABLE TOOL	●, OTHE	R - SPECIFY:	AUGER			
N.E.	DEPTH	(feet bg	gl)	BORE HOLE	CASING MATE		CA	ASING	CASING	CASIN		SLOT
رِوَ	FROM	TO	5	DIAM	GRA (include each ca		CONN	RECTION	INSIDE DIAM.			SIZE
\SI	(inches)		(inches)	note section		T	YPE	(inches)	(in	iches)	¹(inches)	
Ü	0	75	8" N/A N/A		N/A	-N/A	70 <b>5</b>	N/A				
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L)							<u> </u>					<del>                                     </del>
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	DEPTH	(feet bg	(1)	BORE HOLE		NULAR SEAL MA			AMOUNT	- [		
<u> </u>	FROM	TC	)	DIAM. (inches)	GRAVEL PA	ACK SIZE-RANG	E BY INTE	RVAL	(cubic feet)		PLACEN	IENT
EE [												
4												
ANNULAR MATERIAL		•										
3												
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	005 1	.1	0.7									
	OSE INTER					DOD MULIDES	~~				ersion 06/08	3/2012)
	NUMBER	<u>C</u>		601		POD NUMBER	7	IKN	IUMBER 5/8	<u> </u>	<u> </u>	
LOC	ATION	Ti	24	<u>5-R33</u>	3E - Sei	2 23.4	41				PAGE	I OF 2

	DEPTH (feet bgl) ESTIMATED										
	DEPTH (	feet bgl)	THEVNESS	COLOR AND TYPE OF MATERIAL ENCOUNTERED -	WATER	ESTIMATED YIELD FOR					
	FROM	то	(feet)	INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	BEARING? (YES / NO)	WATER- BEARING ZONES (gpm)					
	0	2	2	BROWN SILTY SAND, LOOSE	CYEN	N/A					
	2	27	25	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A					
ĺ	27	47	20	SHALE RED SILTY SAND, VERY DENSE	CYGN	N/A					
	47	75'	28	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A					
					CYCN	-					
					CYCN						
WE					CYCN						
4. HYDROGEOLOGIC LOG OF WELL					$C \times C N$						
00					CYCN						
ii					$C_A C_N$						
707					$C^{Y}C^{N}$						
360					$C_A C_N$						
RO.	$C_{\Lambda}$										
HYD					$C^{Y}C^{N}$						
₩					CYCN						
					$C^{Y}$						
					CYCN						
					CY CN						
	-				CYCN						
			·		$C^{Y}$						
					$C^{Y}$						
	METHOD U	SED TO ES	OTAL ESTIMATED								
	C AIR LIF	г С	BAILER (	OTHER - SPECIFY:	WELL YIELD (gpm):						
		TECT	DECLUTE ATT	ACULA CONVOE DATA COLUMNETED DURING WELL TESTINO WOLL		AFTHOD.					
z	WELL TES	T START	results - ATT TTIME, END TI	ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLI ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER	THE TESTING PERIC	DD <b>Z</b>					
RVISION	MISCELLA	VEOLIS INF	ORMATION:			to i					
			0		JAK	<u></u>					
SUP	3 7 <u>6</u>										
RIG					0	- î					
TEST; RIG SUPE						゚ヹ					
5. TE	PRINT NAM	IE(S) OF DR	ULL RIG SUPER	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONST	RUCTION OTHER TH	- ≤-mi					
41	S 25.6										
	THE UNDER	RSIGNED H	EREBY CERTIF	IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF	, THE FOREGOING IS	A TRUE AND					
IRE				ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL REC 0 DAYS AFTER COMPLETION OF WELL DRILLING:	ORD WITH THE STA	TE ENGINEER					
ATL	n			•							
SIGNATURE	Ja	· Th		Labore Hammer	1 22 12						
6.8	100	TIGNAT!	INE OF DRILLE	Kodney Hammer  R / PRINT SIGNEE NAME	1-23-13						
		210NATE	JAE OF DRILLE	K / FRINT SIUNCE NAME	DATE						
EO B	FOR OSE INTERNAL USE. WR-20, WELL RECORD & LOG (Version 06/08/2012)										

TON OUR INTERNATIONAL CONTRACTOR & EDG									
FILE NUMBER	C-3601	POD NUMBER 7	TRN NUMBER						
LOCATION	T245-R33E-Se	c 23.441		PAGE 2 OF 2					



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# STATE ENGINEER OFFICE.

								VAL EIUS	30 P 10: 1	!!!-		
	OSE POD NUMBER (WELL NUMBER)							OSE FILE NUMBER(S)				
ŏ	BH 13						C3601; 518393					
E.	WELL OWNER N					PHONE (OPTI	ONAL)					
20	ļ		L POTASH CORF	,								
1. GENERAL AND WELL LOCATION	600 W. BEN						HOBBS		STATE NM 8824	ZIP 10		
ΥE	OUU TV. DEINE	JEN DEV					110003		002-			
2	WELL		DEGREES			OS						
Υ.	LOCATION	LATIT	rude 32	11	53.4	N	* ACCURACY	REQUIRED: ONE TEN	TH OF A SECOND			
ERA	(FROM GPS)	LONG	IITUDE 103	32	15.6	· w	* DATUM RE	QUIRED: WGS 84				
EN	DESCRIPTION RE	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHJIP, RANGE) WHERE AVAILABLE										
1.0	T24S; R 33E;	SECTIO	N 23									
	<u></u>							<del></del> .				
	LICENSE NUMB WD-1186		NAME OF LICENSED RODNEY HAMM					ENVIRO-DRILL,				
		- 1										
	DRILLING STAR 01-05-13		DRILLING ENDED	DEPTH OF COMPLET	red well (FT)	75'	LE DEPTH (FT)	N/A	ST ENCOUNTERED (FT	)		
			. 03 13						EL DUCOURLETTO N	er reservi		
	COMPLETED WELL IS: C ARTESIAN    ORY HOLE    SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT)					
Ö												
2. DRILLING & CASING INFORMATION	DRILLING FLUID: C AIR C: MUD ADDITIVES - SPECIFY:											
	DRILLING METHOD: C. ROTARY C HAMMER C CABLE TOOL G OTHER - S							R - SPECIFY: AUGER				
	DEPTH (fee	t bgl)	BORE HOLE		ERIAL AND/OR		ASING	CASING	CASING WALL	SLOT		
9	FROM TO DIAM		DIAM	GRADE (include each easing string, and		CONNECTION		INSIDE DIAM.	THICKNESS	SIZE		
(S)			(inches)	note sections of screen)		T	YPE	(inches)	(inches)	(inches)		
S. C.	0 7:	5	8"	N/A		N/A		N/A	N/A	N/A		
Ş												
3												
DRI												
7.												
						<u></u>		<u> </u>	<u> </u>			
	DEPTH (fee	t bgi)	BORE HOLE	LIST AN	NULAR SEAL MA	ATERIAL A	ND	AMOUNT	метно			
7	FROM	ТО	DIAM. (inches)	GRAVEL PACK SIZE-RANGE BY INTER		RVAL	(cubic feet)	PLACE	MENT			
3									<del></del>			
IAT												
ANNULAR MATERIAL												
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FOR	OSE INTERNA	LUSE					WR-20	WELL RECORD &	& LOG (Version 06/0	18/20121		

FILE NUMBER C-3601	POD NUMBER &	TRN NUMBER	518393
LOCATION T248 - R:	3E-Section 23,441		PAGE 1 OF 2

	DEPTH (feet bgl)			COLOR AND TYPE OF MATERIAL ENCOUNTERED -	WATER	ESTIMATED			
			THICKNESS	INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES	BEARING? WATER-				
	FROM	то	(feet)	(attach supplemental sheets to fully describe all units)	(YES/NO)	BEARING ZONES (gpm)			
	0	2	2	BROWN SILTY SAND, LOOSE	CYGN	N/A			
İ	2	24	22	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A			
	24	46	22	RED SILTY SAND, DENSE TO VERY DENSE	CYGN	N/A			
	46	74	28	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A			
	74	75	1	SHALE RED SILTY SAND, VERY DENSE	CYGN	N/A			
. ر					CYCN				
VEL					CYCN				
OF.V					CYCN				
90					CYCN				
ICT					CYCN				
507					$C^{Y}$				
03:					CYCN				
ROC					CY CN	STA			
4. HYDROGEOLOGIC LOG OF WELL					CYCE	SVE SVE			
4					CYCH	Tim.			
					CYCNE	-6			
					CY CND	-G			
					CYCNT	.3			
					CYCNE	28			
					CYCNE	. 56			
					CY CN-				
	METHOD L	ISED TO ES	TIMATE YIELD	OF WATER-BEARING STRATA: C PUMP TO	TAL ESTIMATED				
	C AIR LIF	т С	BAILER C	OTHER - SPECIFY:	ELL YIELD (gpm):				
	WELL TES			ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUI					
ERVISION		STAR	T TIME, END TI	ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER T	HE TESTING PERIC	)D.			
RVIS	MISCELLA	NEOUS INF	ORMATION:						
TEST; RIG SUP									
T; R									
TES	PRINT NAM	ME(S) OF DI	RILL RIG SUPER	(VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTR	JCTION OTHER TH	IAN LICENSEE:			
vr.	vî								
THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A 1									
3	CORRECT	RECORD O	F THE ABOVE D	ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECO	RD WITH THE STA	TE ENGINEER			
AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:									
SIGNATURE	. V.	. 1		2 , 11	22.12				
6. 51	Thom	7 14			-23-13				
		SIGNAT	URE OF DRILLE	R / PRINT SIGNEE NAME	DATE				

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FOR OSE INTERNAL USE	WK-20 WELL RECORD & LOG (Version 06/08/2012)		
FILE NUMBER C-3601	POD NUMBER 6	TRN NUMBER	
LOCATION T248- R33E - Section	n 23.441		PAGE 2 OF 2



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# STATE ENGINEER OFFICE ROSWELL

								2013 JAN :	30 · P 10: цг	<u> </u>	
		MBER (WELL	NUMBER)				OSE FILE NU	MBER(S)			
NO.	BH 12							C3601; 518393			
CAT	INTERCO			·	· <del></del>		PHONE (OPTI	ONAL)			
ŎŢ.	INTERCONTINENTAL POTASH CORP  WELL OWNER MAILING ADDRESS							<u>.</u>	STATE	ZIP	
I. GENERAL AND WELL LOCATION	i	ENDER BL\				HOBBS		NM 8824			
QN.	WELL DEGREES			MINUTES 11	SECOND 53.2	S					
NT.	LOCATIO (FROM GR	1,7,111		<del></del>		N	4	' REQUIRED: ONE TEN QUIRED: WGS 84	TH OF A SECOND		
NER	`	LONG	DITUDE 103	32	9.7	W					
I. GE	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHJIP, RANGE) WHERE AVAILABLE  T245; R 33E; SECTION 23										
_	LICENSE NU	JMBER	NAME OF LICENSED	DRILLER	<del></del>		<del></del>	NAME OF WELL DR	ILLING COMPANY		
	WD-1186	;	RODNEY HAMM	IER				ENVIRO-DRILL,	INC.		
	DRILLINGS 01-06-13	I .	DRILLING ENDED 1-06-13	DEPTH OF COMPLETED	WELL (FT)	воке ног 75'	LE DEPTH (FT)	DEPTH WATER FIRE	ST ENCOUNTERED (FT)		
								STATIC WATER LEV	VEL IN COMPLETED WE	LL (FT)	
DRILLING & CASING INFORMATION	COMPLETED WELL IS: ARTESIAN OF DRY HOLE SHALLOW (UNCONFINED)										
	DRILLING FLUID: C AIR C MUD ADDITIVES – SPECIFY:										
	DRILLING N	IETHOD: (	ROTARY	C HAMMER C	CABLE TOOL	● OTHE	R - SPECIFY:	AUGER			
	DEPTH (feet bgl) BORE HOLE FROM TO DIAM		CASING MATERIAL AND/OR GRADE			ASING NECTION	CASING INSIDE DIAM.	CASING WALL THICKNESS	SLOT SIZE		
ASIN			(inches)	(include each casing string, and note sections of screen)			YPE	(inches)	(inches)	(inches)	
8	0	75	8"	N/A		N/A		N/A	N/A	N/A	
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,	DEPTH	(feet bgl)	BORE HOLE	F	JLAR SEAL MA			AMOUNT	METHO! PLACEM		
ANNULAR MATERIAL	FROM	TO	DIAM, (inches)	GRAVEL PACK SIZE-RANGE BY INTE			ERVAL (cubic feet)		PLACEN	Half I	
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FOR	OSE INTER	NAL USE	<u></u>	l. <u> </u>		· · · · · · · ·	WR-20	0 WELL RECORD	& LOG (Version 06/0	8/2012)	
	NUNIOCO			<del></del>	DOD NILIS (DED		-	ULLADED ACCOUNT			

FILE NUMBER C-3601	POD NUMBER 5	TRN NUMBER	_5/839	3
LOCATION T245 - R33E- Sec	400 23.442			PAGE 1 OF 2

DEPTH (feet bgl)											
	FROM	TO	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)					
	0	1	2	BROWN SILTY SAND, LOOSE	CYGN	N/A					
	1	19	18	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A					
	19	31	12	RED SILTY SAND, VERY DENSE	CYGN	N/A					
	31	38	7	SHALE GREEN SILTY SAND, VERY DENSE	CYEN	N/A					
}	38	75	37	SHALE RED SILTY SAND, VERY DENSE	CYEN	N/A					
	<del></del>	1	3,	STATE RED SIETT SAND, VERT DENSE	CYCN	17/2					
HYDROGEOLOGIC LOG OF WELL					· · ·						
FW	·				V. V.						
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DRO		<u>.                                    </u>			CYCN	1					
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चं					CY C 門	OS					
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					CY CB	- <u>Z</u>					
					CY CN	- T					
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					CYCN	35					
	METHOD U	SED TO ES	TIMATE YIELD	OF WATER-BEARING STRATA: C PUMP T	OTAL ESTIMATED	<u> </u>					
	CAIRLIFT C BAILER C			· · · · · · · · · · · · · · · · · · ·	VELL YIELD (gpm);						
			JIII CONTRACTOR OF THE CONTRAC	OTTEN - SI BOILT,	<u></u>						
NC	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.										
ERVISION	MISCELLANEOUS INFORMATION:										
ER											
SUF											
TEST; RIG SUP											
ST;						····					
S. TE	PRINT NAM	IE(S) OF DR	IILL RIG SUPER	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONST	RUCTION OTHER TH	AN LICENSEE:					
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	THE LINDER	RSIGNED H	FRERY CERTIF	ES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF,	THE FOREGOING IS	A TRUE AND					
RE	CORRECT R	RECORD OF	THE ABOVE D	ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL REC DIDAYS AFTER COMPLETION OF WELL DRILLING:	ORD WITH THE STAT	E ENGINEER					
VTU	AND THE F	CKWIII FIOI	LDEK WITHIN 2	DIA 13 AFTER COMPLETION OF WELL DRILLING:							
SIGNATURE	.1/.	.nl		2 \ 11 =							
6. SI	year	グル	<u></u>	Kodney Hammer	1-23-13						
		SIGNATU	JRE OF DRILLE	R / PRINT SIGNEE NAME	DATE						
FOR	OSE INTERN	tal lise		WD 20 WELL	RECORD & LOG (Ven	-io- 06/08/2013)					

POD NUMBER 5

TRN NUMBER

PAGE 2 OF 2

C-3601 POD NUMBER 5 T245-R33E- Section 23.442

FILE NUMBER

LOCATION



LOCATION

## WELL RECORD & LOG

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STATE ENGINEER OFFICE ROSWELL

2017 JAN 30 P 10: 44

PAGE I OF 2

	2013 JAN 3U P 10: 44											
	OSE POD NUMBER (WELL NUMBER)							OSE FILE NUMBER(S)				
ίο <sub>ι</sub>	BH 11							C3601;518393				
CAT	WELL OWNER NAME(S) INTERCONTINENTAL POTASH CORP								ONAL)			
1.00					<b>-</b>	CITY		000 4000	210			
1. GENERAL AND WELL LOCATION	WELL OWNER MAILING ADDRESS 600 W. BENDER BLVD.								1	STATE NM 8824	ŽIР О	
Q.	WELL	Ī		DEGREES	MINU	TES SECON	D\$					
LA	LOCATIO	IN	LATIT	<sub>UDE</sub> 32	10	49.5	N	* ACCURACY	REQUIRED; ONE TENT	TH OF A SECOND		
ERA	(FROM GF	PS)	LONG	ITUDE 103	32	4.1	W	* DATUM RE	QUIRED: WGS 84			
EN	DESCRIPTIO	N RELAT			T ADDRESS AND CO	MMON LANDMARKS - PL	SS (SECTION, T	I OWNSHJIP, RANC	SE) WHERE AVAILABLE			
1.0	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHJIP, RANGE) WHERE AVAILABLE  T245; R 33E; SECTION 24											
	LIČENSÉ NU		- 1	NAME OF LICENSED					NAME OF WELL DRI			
	WD-1186	•	F	RODNEY HAMN	MER				ENVIRO-DRILL,			
2. DRILLING & CASING INFORMATION	DRILLING S 01-03-13			ORILLING ENDED -04-13	DEPTH OF COMP	CÉTEĎ WELL (FT)	75'	LE DEPTH (FT)	DEPTH WATER FIRS	ST ENCOUNTERED (FT)	1	
	COMPLETE	D WELL	. IS: (	ARTESIAN	ORY HOLE	C shallow (und	CONFINED)		STATIC WATER LEV	ZEL IN COMPLETED WE	LL (FT)	
	DRILLING F	T HID:		AIR	C MUD	ADDITIVES - SE	PECIFY:					
									R - SPECIFY: AUGER			
	DEPTH (feet hal) CASING MATERIAL AND/OR						<del></del>		CASING CASING WALL SI		T	
2	FROM TO		BORE HOLE DIAM	DIAM GRADE			ASING RECTION	INSIDE DIAM.	CASING WALL THICKNESS	SLOT SIZE		
SIN				(inches)	(include each casing string, and note sections of screen)			YPE	(inches)	(inches)	(inches)	
Ċ	0	75'		8"	N/A		N/A		N/A	N/A	N/A	
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,	DEPTH			BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AN				AMOUNT (cubic feet)	METHO PLACEN		
ANNULAR MATERIAL	FROM	Т	0	Direct (menes)	GKAVE	GRAVEL PACK SIZE-RANGE BY INTE			(cubic reet)	, , , , , ,		
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	OSE INTER			(		POD NUMBE	R 42			& LOG (Version 06/0	18/2012)	
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	DEPTH (	feet bgl)		COLOR AND TYPE OF MATERIAL ENCOUNT	TERED -	WATER	ESTIMATED
	FROM	то	THICKNESS (feet)	INCLUDE WATER-BEARING CAVITIES OR FRACT	TURE ZONES	BEARING? (YES/NO)	YIELD FOR WATER- BEARING
	0	3	3	LIGHT BROWN SILTY SAND. VERY LOOSE		CYGN	ZONES (gpm)
	3						N/A
	8"	35	5	LIGHT RED SILTY SAND, VERY DENSE		CYGN	N/A N/A
	35		40	LIGHT GREEN SILTY SAND, SHALE VERY DENSE			
		75	40	LIGHT GREEN SILTT SAND, SHALE VERT DENSE		$CY \bigcirc N$	N/A
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015						$C \times C \times$	
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DR(						C $X$ $C$ $N$	
4. HYDROGEOLOGIC LOG OF WELL			· · · · · · · · · · · · · · · · · · ·			$C_A \subset N$	
						$C_A \subset M$	
						$C_A \subset M$	
				· · · · · · · · · · · · · · · · · · ·		$C^{Y}$	
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		-				CY CN	
		255 <b>TO</b> 10			Lancan	CYCN	
	C AIR LIFT			OF WATER-BEARING STRATA: PUMP OTHER - SPECIFY:	"	AL ESTIMATED LL YIELD (gpm):	
NC	WELL TEST	r TEST	RESULTS - ATT. I TIME, END TI	ACH A COPY OF DATA COLLECTED DURING WELL TI ME, AND A TABLE SHOWING DISCHARGE AND DRAW	ESTING, INCLUDI DOWN OVER TH	NG DISCHARGE N E TESTING PERIO	METHOD,
ERVISION	MISCELLA	NEOUS INF	ORMATION:			-844	
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TEST; RIG SUP	DRINT NAM	E/S) OF DE	III DIC SUDED	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF	WELL CONSTRU	CTION OTHER TH	
S. TE	FRINT IVAN	ic(3) Or Dr	CILL KIG SOFEK	VISOR(3) THAT PROVIDED ONSITE SUPERVISION OF	WELL CONSTRO		TM 20
		· <u>-</u> -				<u>ד</u>	;0
	THE UNDER	RSIGNED H	EREBY CERTIF	IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE ESCRIBED HOLE AND THAT HE OR SHE WILL FILE TE	E AND BELIEF, TH	E FOREGOING IS	A TRUE AND
SIGNATURE				DAYS AFTER COMPLETION OF WELL DRILLING:	no wase necon	3	- In
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SIG	ye.	ᆚ		Kodney Hammer	1-	-23-13	
6.		SKINATI	JRE OF DRILLE	R / PRINT SIGNEE NAME	<b></b> _	DATE	
FOR	OCE INTERN	dat Dec			WE 30 WELL DE	CORD & LOG (Ver	nin= ()6(0)27() 7)
	OSE INTERN	_	601		TRN NUMBER	COND & LOG (Ver	31011 00/03/2012)
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#### STATE ENGINEER OFFICE ROSWELL NEW MEXICO

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00	INTERCO	NTIN	NTA	L POTASH CORF	•						
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K	WELL LOCATIO			32	11	55.7	N	* ACCURACY	REQUIRED: ONE TEN	TH OF A SECOND	
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GENERAL AND WELL LOCATION				ITUDE 103				<u> </u>	<u> </u>		
GE	DESCRIPTIO	N RELAT	ING WE	LL LOCATION TO STREE	T ADDRESS AND COMM	ON LANDMARKS - PLS	S (SECTION, T	OWNSHJIP, RANC	E) WHERE AVAILABLE		
-i	T245; R 3	3E; SE	CTIO	N 23							
	LICENSE NU	NIRER		NAME OF LICENSED	DDILLED			NAME OF WELL DR	ILLING COMPANY	===	
	WD-1186			RODNEY HAMM					ENVIRO-DRILL,		
	DRILLING STARTED   DRILLING ENDED   DEPTH OF COMPLETED WELL (FT)   BORE								1	ST ENCOUNTERED (FT)	
	01-06-13		·	-06-13	DETTION COMPLET	CO WEEL (11)	75'	cc oci iii(i i)	N/A	or Encountries (FT)	
			Щ.						STATIC WATER LEV	EL IN COMPLETED WE	T ÆTS
	COMPLETE	D WELL	ıs: (	ARTESIAN	PRY HOLE	SHALLOW (UNC	ONFINED)			CC IN COM LETED WE	(* 1)
NO								<u> </u>			
ATI	DRILLING FLUID: C AIR C: MUD ADDITIVES - SPECIFY:										
DRILLING & CASING INFORMATION	DRILLING	ETHO	): <i>(</i>	ROTARY	C HAMMER C	CABLE TOOL	( OTHE	R - SPECIFY:	AUGER		
	DEPTH	(feet b	gl)	BORE HOLE	CASING MATE	RIAL AND/OR			CASING	CASING WALL	SLOT
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	DEPTH	(feet b	gl)	BORE HOLE	1	NULAR SEAL MA			AMOUNT	метно	
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	DEPTH (	cet bgl)		COLOR AND TYPE OF MATERIAL ENCOUNTERED -	WATER	ESTIMATED			
			THICKNESS	INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES	BEARING?	YIELD FOR WATER-			
[	FROM	ТО	(feet)	(attach supplemental sheets to fully describe all units)	(YES / NO)	BEARING			
		3	3	PROVINCII TV CAND LOOSS	CYGN	ZONES (gpm)			
	0	3	16	BROWN SILTY SAND, LOOSE  CALICHE WHITE SILTY SAND, VERY DENSE	, ,,	N/A			
	3	19 31	CYGN	N/A					
	19	CYGN	N/A						
	31	42	11	SHALE GREEN SILTY SAND, VERY DENSE	C A G N	N/A			
	42	57	15	SHALE RED SILTY SAND, VERY DENSE	CYGN	N/A			
1	57	75	18	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A			
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4. HYDROGEOLOGIC LOG OF WELL					CYCN	1			
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	METHOD U	SED TO ES	TIMATE YIELD		AL ESTIMATED				
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TEST; RIG SU									
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뗥	CORRECT F	RECORD OF	F THE ABOVE D	ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECOR					
10.1	AND THE P	ERMIT HO	LDER WITHIN 2	0 DAYS AFTER COMPLETION OF WELL DRILLING:					
SIGNATURE	\begin{array}{c} \emptyset{\partial} \emptyset	Λl		2	_	1			
	Tree	グー	· C	Kodney Hammer 1	<u>- 2<b>:3</b>-13</u>				
ć,		GIGNAT	URE OF DRILLE	R / PRINT SIGNEE NAME	DATE				
FOR	OSE INTER	NAL USE		WR.20 WELL RE	CORD & LOG (Ver	rsion 06/08/2012)			
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LOCATION T245-R33E-Section 24.331 PAGE 2 OF 2

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LOCATION T245-R33E-Sec 23,423

# STATE ENGINEER OFFICE ROSWELL, TO WIE YOU

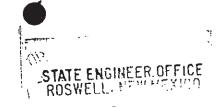
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LL			G ADDRESS							ŽIP	
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LA	LOCATIO	N L	TITUD <u>E</u> 32	12	1.5	N	• ACCURACY	REQUIRED: ONE TEN	TH OF A SECOND		
GENERAL AND WELL LOCATION	(FROM GF		ONGITUDE 103	32	15.0	· w	* DATUM RE	QUIRED: WGS 84			
S	DESCRIPTION			ET ADDRESS AND COMA	ON LANDMARKS - PLS	S (SECTION, T	OWNSHJIP, RANG	E) WHERE AVAILABLE			
1. G	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIJP, RANGE) WHERE AVAILABLE  T245; R 33E; SECTION 23										
	LICENSE NU		NAME OF LICENSE					NAME OF WELL DR		<del></del>	
	WD-1186	<b>5</b>	RODNEY HAM	MER				ENVIRO-DRILL,	INC.		
	DRILLING S 01-06-13		DRILLING ENDED 01-07-13	DEPTH OF COMPLE	TED WELL (FT)	75'	LE DEPTH (FT)	DEPTH WATER FIR	ST ENCOUNTERED (FT)		
~	COMPLETE	D WELL IS:	C ARTESIAN	ORYHOLE (	SHALLOW (UNC	ONFINED)		STATIC WATER LEV	EL IN COMPLETED WE	LL (FT)	
T10	DRILLING F	LUID:	C AIR	C. MUD	ADDITIVES - SPE	CIFY:		<u> </u>			
SMA	DRILLING METHOD: C ROTARY C HAMMER C CABLE TOOL  OTHER - SPECIFY: AUGER										
DRILLING & CASING INFORMATION		(feet bgl)			ERIAL AND/OR	1		I			
S	FROM	TO	BORE HOLE DIAM	GR	ADE		ASING NECTION	CASING INSIDE DIAM,	CASING WALL THICKNESS	SLOT	
VSIN		(inches)			asing string, and ns of screen)	Т	YPE	(inches)	(inches)	(inches)	
& C	0	75	8"	N/A		N/A		N/A	N/A	N/A	
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	DEPTH	(feet bgl)	BORE HOLE	LIST AN	NULAR SEAL MA	TERIAL A	ND ON	AMOUNT	метно	D OF	
ĬĽ.	FROM	ТО	DIAM. (inches)	1	PACK SIZE-RANG			(cubic feet)	PLACEM		
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FOR	OSE INTER	NAL USE	:				WR-20		& LOG (Version 06/0	8/2012)	
FILE	NUMBER	0-3	(0)		POD NUMBER	2.	TRN	NUMBER 5/	2393		

<u> </u>	DEPTH (	feet hal)				ESTIMATED	
	- DE: 111(	Teet ogi,	THICKNESS	COLOR AND TYPE OF MATERIAL ENCOUNTERED -	WATER	YIELD FOR	
	FROM	то	(feet)	INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES	BEARING? (YES / NO)	WATER- BEARING	
				(attach supplemental sheets to fully describe all units)	(123710)	ZONES (gpm)	
İ	0	1	1	BROWN SILTY SAND, LOOSE	CYGN	N/A	
	1	23	22	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A	
	23	75	52	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A	
			<del>                                     </del>		CYCN		
					CYCN		
_					CYCN		
/ELI					CYCN		
) F V			<del> </del>		CYCN		
300		-	-		CYCN		
CTC	\ <u></u>				CYCN		
150					CYCN		
EOL		-			CYCN	_0	
Soci					CY CEN	70.5A	
4. HYDROGEOLOGIC LOG OF WELL		-			CYCH	50	
<del>4</del>					CY CN	75	
					CYCNU	孟	
					CYCN		
			-		CYCN	· 유 연	
i					CYCN	3	
		_		·	CYCN	F 2m	
		-			CY CN	<u> </u>	
	METHODI	ISED TO ES	TIMATE VIELD	OF WATER-BEARING STRATA: PUMP 1	OTAL ESTIMATED	<u> </u>	
					WELL YIELD (gpm):		
	( AIR LIF		BAILER C	OTHER - SPECIFY:			
	WELL TES			ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCL			
ERVISION		STAR	T TIME, END TI	ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER	THE TESTING PERIC	)D, —	
IVIS	MISCELLA	NEOUS INF	ORMATION:				
PER							
TEST; RIG SUP							
2							
EST	PRINT NAM	ME(S) OF D	RILL RIG SUPER	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONST	RUCTION OTHER TH	IAN LICENSEE:	
. v							
			<u>.</u>				
5-1				TES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL REC			
SIGNATURE	AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:						
N.							
	there Hammer 1-23-13						
ý		SIGNAT	URE OF DRILLE	R / PRINT SIGNEE NAME	DATE		
	=				RECORD & LOC (Va		

FOR OSE INTERNAL USE		WR-20 WELL RECORD & LOG (Vers	sion 06/08/2012)
FILE NUMBER (1, -3601	POD NUMBER 2	TRN NUMBER	
LOCATION T245-R33E-Sec 2	3.423		PAGE 2 OF 2





- 2013 JAN -8 A 11-54

	OSE POD NU	MBER (WELL	. NUMBER)				OSE FILE NU				
NOI.	внв						C-03601 : :				
CA1	WELL OWN		AL POTASH CORF	<b>&gt;</b>			PHONE (OPT)	UNAL)			
07.7		ER MAILING					CITY		STATE		ZIP
VELJ	600 W. BE	NDER BL	VD.				HOBBS	h	M	88240	)
N ON	WELL	<u> </u>	DEGREES	MINUTES	SECON	os e	<u> </u>				
LA	LOCATIO	N LATI	TUDE 32	12	12.7	N	* ACCURACY	REQUIRED: ONE TENT	'H OF A SEC	OND	
GENERAL AND WELL LOCATION	(FROM GPS) LONGITUDE 103 32 4.2 W						* DATUM REG	QUIRED: WGS 84			
GEN	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHJIP, RANGE) WHERE AVAILABLE										
-	T245; R 3	3E; SECTIC	ON 24								
	LICENSE NU		NAME OF LICENSED					NAME OF WELL DRI		PANY	
	WD-1186		RODNEY HAMM					ENVIRO-DRILL, I			
	DRILLING ST 12-21-12		DRILLING ENDED   2-21-12	DEPTH OF COMPLETE	ED WELL (FT)	100'	LE DEPTH (FT)	N/A	T ENCOUN	rered (FT)	
							<u>.</u>	STATIC WATER LEV	EL IN COMP	LETED WE	.L (FT)
N.	COMPLETED WELL IS: C ARTESIAN ON DRY HOLE C SHALLOW (UNCONFINED										
DRILLING FLUID: C AIR C MUD ADDITIVES - SPECIFY:											
)RM	DRILLING M	IETHOD: (	ROTARY	C HAMMER C	CABLE TOOL	©, OTHE	R - SPECIFY:	AUGER			
INF		(feet bgl)	BORE HOLE	CASING MATE		C/	ASING	CASING	CASING		SLOT
DRILLING & CASING INFORMATION	FROM	то	DIAM (inches)	(include each cas	sing string, and	I	NECTION TYPE	INSIDE DIAM. (inches)	THICK (inc	(NESS hes)	SIZE (inches)
ر ر	0	100	8"	N/A		N/A		N/A	N/A		N/A
ING											
E.L.						<del></del>					
2. DI											
						ļ					
					<u> </u>	<del> </del>		<u> </u>			
	DEPTH	(feet bgl)	BORE HOLE	LIST AN	NULAR SEAL M	ATERIAL A	AND	AMOUNT		метно	
IAL	FROM	TO	DIAM. (inches)	GRAVEL PA	ACK SIZE-RANC	GE BY INTE	ERVAL	(cubic feet)		PLACEM	IENT
TER											
MA											
3. ANNULAR MATERIAL								-			
NN					<del> </del>						
3. A											

FOR OSE INTERNAL USE

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

FILE NUMBER C - 3601	POD NUMBER /	TRN NUMBER	51839	<u> 13</u>
LOCATION 249-33E-24. 1333				PAGE 1 OF 2

	DEPTH (f	cet bgl)		COLOR AND TYPE OF MATERIAL ENCOUNTERED	).	WATER	ESTIMATED
			THICKNESS	INCLUDE WATER-BEARING CAVITIES OR FRACTURE		BEARING?	YIELD FOR WATER-
	FROM	TO	(feet)	(attach supplemental sheets to fully describe all units	i)	(YES/NO)	BEARING ZONES (gpm)
	0	2	2	DARK BROWN SILTY SAND, LOOSE SLIGHTLY DAMP		CY ON	N/A
	2	28	26	CALICHE WHITE, VERY DENSE, SLIGHTLY DAMP		CYON	N/A
	28	46	18	CALICHE REDISH BROWN, VERY DENSE, SLIGHTLY DA	AMP	CIY ( N	N/A
	46	100	54	CALICHE GREENISH BROWN, VERY DENSE, SLIGHTLY	DAMP	CA @ M	N/A
						OY CN	
]						C $X$ $C$ $N$	
4. HYDROGEOLOGIC LOG OF WELL						$C_{\Lambda}$	
0.5						CACA	
007						$C^{Y}C^{N}$	
SIC						$C^{Y}C^{N}$	
100	, , <b>LL</b> ,	···				$O^{Y} \subset N$	
GEC	FIC	55				CYCN	
DRO	0F.	· <u>-</u>				$\bigcup_{X} \bigcup_{X} \bigcup_{X}$	
HYI	ER.	A				CYON	
4.	J.E	· <b>&amp;</b>				$C_A C_N$	
	5	1 I				$C_A C_N$	
	וח! הוד	JAR				$C_A$ $C_N$	
	MAT	[]				$C_A$	
	ÿo≃	37			<u> </u>	CACN	
	J (* )					$C^{Y}C^{N}$	
						$C^{Y}$	
				OF WATER-BEARING STRATA: C PUMP	ŀ	AL ESTIMATED LL YIELD (gpm):	
	C AIR LIF	r Cı	BAILER (	OTHER - SPECIFY:		(Bp.11).	
	WELL TES	TEST	RESULTS - ATT	ACH A COPY OF DATA COLLECTED DURING WELL TESTIN ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOW	G, INCLUD	ING DISCHARGE	METHOD,
S. TEST; RIG SUPERVISION			-	ALE, AND A TABLE SHOWING DISCHARGE AND DIGHT BOTT			
RVI	MISCELLA	NEOUS INF	ORMATION:				
UPE							
SOU							
H. H.						· · · · · · · · · · · · · · · · · · ·	
TES	PRINT NAN	IE(S) OF DI	RILL RIG SUPĒ	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WEL	L CONSTRU	ICTION OTHER T	HAN LICENSEE:
vs							
	THE UNDE	RSIGNED I	HEREBY CERTII	IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND	D BELIEF, T	HE FOREGOING I	S A TRUE AND
RE	CORRECT	RECORD OF	F THE ABOVE I	ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS W IO DAYS AFTER COMPLETION OF WELL DRILLING:	ELL RECOF	RD WITH THE STA	TE ENGINEER
VTV	AND THE	EKMIT HO	EDEK WITHIN	ODATS AT LEK COMPLETION OF WELL DIMELING.			
SIGNATURE	1).	. nl	•	2.1.	4.	-7-13	
6.8	THE	D'A	TIRE OF DRULL	Rodney Hammer  R / PRINT SIGNEE NAME		DATE	
	<u> </u>	ן אאוטונ	OKE OF DRILLI	A / TAINT SIGNEE NAME		DATE	
FOI	R OSE INTER	NAL USE				ECORD & LOG (Ve	ersion 06/08/2012)
	E NUMBER	C-3	601		NUMBER		T = . =
1.0	CATION	245	-33 E-	24.1333			PAGE 2 OF 2



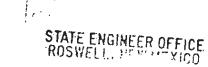
FILE NUMBER -3600

LOCATION

## WELL RECORD & LOG

#### OFFICE OF THE STATE ENGINEER

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								2013 JAN 29	P 2: 21 1	
-	OSE POD NUMI	BER (WELL	NUMBER)				OSE FILE NU	MBER(S)	<u> </u>	
NO	BH 23						C3600; 51			
:ATI	WELL OWNER						PHONE (OPTIONAL)			
Ŏ,			L POTASH CORF				CHEST		CT 1 TT	ZIP
GENERAL AND WELL LOCATION	600 W. BEN						HO8B\$		STATE NM 8824	
Q	WELL		DEGREES			is .				
NL A	LOCATION	LATTI		11	9.4	N	<b>⊣</b>			
ERV	(FROM GPS)	LONG	<sub>επυσε</sub> 103	32	58.6	w	• DATUM RE	QUIRED: WGS 84		
SE	DESCRIPTION R	ELATING WE	LL LOCATION TO STREE	TADDRESS AND COMA	ON LANDMARKS - PLS	S (SECTION, TO	OWNSHJIP, RANC	E) WHERE AVAILABLE		
	T245; R 33E									
	LICENSE NUMI WD-1186		NAME OF LICENSED RODNEY HAMM					ENVIRO-DRILL,		
					200 Pa ha 1254 C (1550)	I bone you	LE DÉPTH (FT)		ST ENCOUNTERED (FT)	
٠	DRILLING STA 01-08-13		DRILLING ENDED	DEPTH OF COMPLE	IED WELL (FT)	75'	LE DEPTH (FT)	N/A	ST ENCOUNTERED (FT)	
						l		STATIC WATER LEV	EL IN COMPLETED WE	LL (FT)
N.O	COMPLETED W	VELL IS:		O DRY HOLE	SHALLOW (UNC	ONFINED)				
ĬΤ	DRILLING FLU	ID: (	AIR	C MUD	ADDITIVES - SPE	CIFY:				
RM	DRILLING MET	нов: (	ROTARY	C HANIMER (	CABLE TOOL	( OTHE	R - SPECIFY:	AUGER		
NFC	DEPTH (fo	et bgl)	BORE HOLE		ERIAL AND/OR ADE	CA	SING	CASING	CASING WALL	SLOT
DRILLING & CASING INFORMATION	FROM TO		DIAM (inches)	(include each c	asing string, and		ECTION YPE	INSIDE DIAM.	THICKNESS (inches)	SIZE (inches)
CAS					ns of screen)	N1/A			N/A	N/A
<b>8</b>	0 7	75	8"	N/A		N/A		N/A	N/A	IN/A
Ž	<b></b>					:				
RIL							<del>.</del>			
2. D			<del> </del>							
			· ·			ļ				
			]		<del>.</del>	<u> </u>		[		
J	DEPTH (fe		BORE HOLE DIAM. (inches)		NULAR SEAL MA PACK SIZE-RANG			AMOUNT (cubic feet)	METHO: PLACEM	
RIA	FROM	то		0.01122				(022.0100)		
\TE					•					
N.								<u> </u>		
Y							-			
ANNULAR MATERIAL										
3. A				<u> </u>						
-										
FOR	OSE INTERNA	L USE	* · · · · · · · · · · · · · · · · · · ·				WR-20	WELL RECORD &	LOG (Version 06/08	8/2012)

POD NUMBER 34.23 TRN NUMBER 5/8382

STATE ENGINEER OFFICE

	DEPTH (I	ret hal)	<u> </u>	ROSWET		ESTIMATED		
	FROM	то	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTÈRED.  INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES  (attach supplemental sheets to fully describe all units).	WATER	2 YIELD FOR WATER- BEARING ZONES (gpm)		
1 1	0	2	2	BROWN SILTY SAND, LOOSE	CYGN	N/A		
	2	24	22	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A		
	24	66	42	RED SILTY SAND, VERY DENSE	CYGN	N/A		
	66	75	9	SHALE GREEN SILTY SAND	CYGN	N/A		
					CYCN			
[ → [	_				CYCN			
HYDROGEOLOGIC LOG OF WELL					CACN			
ō					$C_A \subset M$			
၂ ဗွ					C $Y$ $C$ $N$			
5 [					$C^{Y}C^{N}$			
[ ઙૢૻ [					C.Y C N			
25		•			$C_A C_N$			
Š [					$C^{Y}C^{N}$			
HXI [					$C^{Y}C^{N}$			
₹					$C_A \subset M$			
					OY ON			
					$C_A \subset M$			
					$C_A \subset M$			
[					$C_{\Lambda}$			
					$C_A \subset_N$			
					$C_A \subset N$			
	METHOD U	SED TO ES	TIMATE YIELD		AL ESTIMATED			
	C AIR LIFT	C E	BAILER C	OTHER - SPECIFY:	LL YIELD (gpm):			
z o	WELL TEST			ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUD ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER TH				
PERVISION	MISCELLAN	EOUS INF	ORMATION:					
PER								
ns :								
RIC								
S. TEST; RIG SUI	PRINT NAM	E(S) OF DR	ILL RIG SUPER	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRU	CTION OTHER TH	AN LICENSEE:		
5.7								
	_							
URE	CORRECT R	ECORD OF	THE ABOVE DI	ES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD DAYS AFTER COMPLETION OF WELL DRILLING:	IE FOREGOING IS D WITH THE STAT	A TRUE AND TE ENGINEER		
VAT	D	Δ١.						
SIGNATURE	Rodner Hammer 1-23-13							
ي ا								
	=				- DATE			
FOR	OSE INTERN	AL USE		WR-20 WELL RE	CORD & LOG (Vers	sion 06/08/2012)		

FOR OSE INTERNAL USE	WR-20 WELL RECORD & LOG (Version 06/08/2012)
FILE NUMBER ( -3600	POD NUMBER 4-23 TRN NUMBER 5/8382
LOCATION	PAGE 2 OF 2



#### OFFICE OF THE STATE ENGINEER

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2013 JAN 29 F) 2: 21

	l	MBER (WELL	, NUMBER)			1	OSE FILE NUMBER(S)				
Š	BH 22					C3600; 51					
I.Y	WELL OWN					PHONE (OPTIONAL)					
õ			L POTASH COR	·							
=======================================	1	ER MAILING / ENDER BL\				HOBBS	HOBBS NM 88240				
3	000 W. Bi	INDER BLY	VU.			HOBBS	'	14141 0024	0		
GENERAL AND WELL LOCATION	WELL	-	DEGREES	MINUTES SECON	DS	T					
LA	LOCATIO	N LATE	TUDE 32	11 11.0	11 11.0 <sub>N</sub>			ACCURACY REQUIRED: ONE TENTH OF A SECOND			
Z.	(FROM GP	S) LONG	SITUDE 103	32 33.5	·w	DATUM REQUIRED: WGS 84					
S	DESCRIPTION		<del></del>	T ADDRESS AND COMMON LANDMARKS - PL	S (SECTION, T	I OWNSHJIP, RANC	E) WHERE AVAILABLE				
1. G	T24S; R 3:										
	LICENSE NU	MBER	NAME OF LICENSED	DRILLER			NAME OF WELL DR	ILLING COMPANY			
	WD-1186	. [	RODNEY HAMM	IER			ENVIRO-DRILL,	INC.			
	DRILLING ST		DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HO	E DEPTH (FT)	DEPTH WATER FIR:	ST ENCOUNTERED (FT)	<del>)</del>		
	01-09-13	0.	1-09-13		75'		N/A				
					<u> </u>		STATIC WATER LEV	EL IN COMPLETED WE	LL (FT)		
Z	COMPLETED	WELL IS: (		The dry hole C shallow (UNC	ONFINED)						
ΨŢ	DRILLING F	LUID: (	AIR	C MUD ADDITIVES - SPI	ECIFY:						
RM	DRILLING M	ETHOD: (	ROTARY	C HAMMER C CABLE TOOL	( OTHE	R - SPECIFY:	AUGER				
DRILLING & CASING INFORMATION	DEPTH	(feet bgl)	BORE HOLE	CASING MATERIAL AND/OR		CINIC	CASING	CASING WALL	T SLOT		
	FROM	TO	DIAM	GRADE	1	SING IECTION	INSIDE DIAM.	THICKNESS	SLOT		
YSIN			(inches)	(include each casing string, and note sections of screen)	TYPE		(inches)	(inches)	(inches)		
3	0	75	8*	N/A	N/A		N/A	N/A	N/A		
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		_									
7.			<u> </u>								
			ļ		<u> </u>						
			<u> </u>		<u> </u>						
	DEPTH (	(feet bgl)	BORE HOLE	LIST ANNULAR SEAL MA		1	AMOUNT	метно			
IAL	FROM	то	DIAM. (inches)	GRAVEL PACK SIZE-RANG	E BY INTE	RVAL	(cubic feet)	PLACEM	IENT		
E											
ANNULAR MATERIAL											
ÅR.											
<u> </u>											
3											
3. A											
[											
FOR	OSE INTERN	VAL USE	<del></del>			WR.20	WELL RECORD &	LOG (Version 06/08	3/2012)		

FILE NUMBER C - 3600 POD N	NUMBER BH-22 TRN NUMBER 5/8382
LOCATION	PAGE I OF 2

STATE FHEINEER OFFICE

	DEPTH (	feet bgl)		COLOR AND TYPE OF MATERIAL ENCOUNTERED -	1	ESTIMATED			
	FROM	то	THICKNESS (feet)	INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONE (attach supplemental sheets to fully describe all units)	WATER DBEARING? (YES/NO)	YIELD FOR WATER- BEARING ZONES (gpm)			
	0	2	2	BROWN SILTY SAND, LOOSE	CYGN	N/A			
	2	27	25	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A			
	27	42	15	RED SILTY SAND, DENSE TO VERY DENSE	CYGN	N/A			
	42	75	33	SHALE RED SILTY SAND, VERY DENSE	CYGN	N/A			
					CYCN				
با					CYCN				
4. HYDROGEOLOGIC LOG OF WELL					$C^{Y}C^{N}$				
9		<u> </u>			CYON				
ટ્રિ	<del></del>			-	$C^{Y}C^{N}$				
<u> </u>					$C^{Y}C^{N}$				
<u>ĕ</u>					CYCN				
99					$C^{Y}C^{N}$				
N N					$C_A \subset M$	<del>,</del>			
H					$C_A \subset N$				
4					$C_A \subset M$				
					$C_A \subset N$				
					$C_A \subset M$				
					$C^{Y}C^{N}$				
					$C_A \subset M$				
,					$C_A \subset N$				
					C. Y C N				
	METHOD U		TOTAL ESTIMATED						
	C AIR LIF	r C	BAILER (	OTHER - SPECIFY:	WELL YIELD (gpm):				
z	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.								
ERVISION	MISCELLA	NEOUS INF	ORMATION:						
SUE									
RIC						{			
TEST; RIG SUP	PRINT NAM	IE(S) OF DE	RILL RIG SUPER	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CON	TRUCTION OTHER TH	ANTICENSEE			
S. T		, , -				, iii Bicai ibaa			
					·· <u>-</u> ·_				
SIGNATURE	CORRECT R	ECORD OF	F THE ABOVE D	IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIE ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RE DIDAYS AFTER COMPLETION OF WELL DRILLING:	EF, THE FOREGOING IS ECORD WITH THE STAT	A TRUE AND TE ENGINEER			
LY.	$\cap$								
	Ker	H'X		Kodney Hammer	1-23-13				
ن		SIGNATI	JRE OF DRILLE	R / PRINT SIGNEE NAME	DATE				
FOR	FOR OSE INTERNAL USE  WR-20 WELL RECORD & LOG (Version 06/08/2012)								

FOR OSE INTERNAL USE	WR-20 WELL RECORD & LOG (Version 06/08/2012)
FILE NUMBER ( -3 (000)	POD NUMBER SH-22 TRN NUMBER 514342
LOCATION	PAGE 2 OF 2



LOCATION

## WELL RECORD & LOG

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## STATE ENGINEER OFFICE ROSWELL, MEW MEXITS

SW.

2013 JAN 29 P 2: 21

	OSE POD N	UMBER (	WELL	. NUMBER)					OSE FILE NU	MBER(S)			<del></del> -
Z	BH 21								C3600; 51	8382			
Ĕ	WELL OWN	SER NAM	E(\$)						PHONE (OPTIONAL)				
OC.	INTERCO	BNITNO	NTA	L POTASH COR	P								
GENERAL AND WELL LOCATION	WELL OWN				<u> </u>	· ··—·		<del>- , · ,</del>	CITY		STATE NM	8824	ZIP
WE	000 11. 5			· · · · · · · · · · · · · · · · · · ·			110000		14141	0027			
S	WELL			DEGREE		JTES	SECONI	os					
AL.	LOCATIO	· -		TUDE 32	11	_	10.6	N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND				
ER	(FROM G	PS)	LONG	SITUDE 103	32		15.4	· w	DATUM RE	QUIRED: WGS 84			
GEN	DESCRIPTIO	N RELATI	NG WE	LL LOCATION TO STREE	TADDRESS AND CO	MMON LA	NDMARKS - PLS	SS (SECTION, TO	OWNSHJIP, RANC	E) WHERE AVAILABLE			
-	T24S; R 33E; SECTION 26												
	LICENSE NI		- 1	NAME OF LICENSED			<del>.</del>			NAME OF WELL DR	ILLING CON	IPANY	<del></del>
	WD-1186	5		RODNEY HAMM	1ER					ENVIRO-DRILL, INC.			
	DRILLING S 01-09-13			DRILLING ENDED 1-09-13	DEPTH OF COM	PLETED W	ELL (FT)	75'	LE DEPTH (FT) DEPTH WATER FIRST ENCOUNTERED (FT) N/A				
	STATIC WATER LEVEL IN COMPLETED WELL (FT)  COMPLETED WELL IS: ARTESIAN O DRY HOLE SHALLOW (UNCONFINED)						LL (FT)						
NOI													
MAT													
DRILLING & CASING INFORMATION		-	<del></del>	ROTARY				(● OTHE	R - SPECIFY:	AUGER			<u> </u>
	DEPTH			BORE HOLE	CASING M.	ATERIAL GRADE	. AND/OR		SING	CASING	CASINO	-	SLOT
ASING	FROM	TO	,	DIAM (inches)	(include eac	tions of s		1	IECTION YPE	INSIDE DIAM. (inches)	1	HICKNESS SIZE (inches)	
3	0	75		8"	N/A	•		N/A		N/A	N/A		N/A
N.				ļ		,							
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STATE ENGINEER OFFICE

	DEPTH (	feet hall)	1	T ROSWELL		ESTIMATED			
		Teer ogi/	THICKNESS	COLOR AND TYPE OF MATERIAL ENCOUNTERED -	WATER FEBERING?	YIELD FOR			
	FROM	то	(feet)	INCLUDE WATER-BEARING CAVITIES OR FRAGRURE FUNES		WATER-			
	PROM	'0	(1001)	(attach supplemental sheets to fully describe all units)	(YES/NO)	BEARING ZONES (gpm)			
	0	2	2	BROWN SILTY SAND, LOOSE	CYGN	N/A			
1	2	17	15	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A			
	17	28	11	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A			
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1	28	75	47	SHALE RED SILTY SAND, VERY DENSE	CYGN	N/A			
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20	WELL 1ES	STAR	T TIME, END TH	ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER	THE TESTING PERIC	DD.			
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ഥ				IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL REC					
E	AND THE P	ERMIT HO	LDER WITHIN 2	0 DAYS AFTER COMPLETION OF WELL DRILLING:					
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SIGNATURE	Ke.	チェ	· C	Kodney Hammer 1	-23-13				
ا تو		SIGNATI	URE OF DRILLE	R / PRINT SIGNEE NAME	DATE				
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FOR OSE INTERNAL USE		WR-20 WELL RECORD & LOG (Version 06/08/2012)
FILE NUMBER ( -3600	POD NUMBER 3	TRN NUMBER 5/8382
LOCATION		. PAGE 2 OF 2



LOCATION

## WELL RECORD & LOG

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	1	UMBER (WE	LL NUMBER)			OSE FILE NU	-					
ĝ	BH 20	ER W. P.				C3600; 51						
3		IER NAME(S MITINEMI	, TAL POTASH COR	p		PHONE (OPT	IUNAL)					
ļ Š		ER MAILING		<u> </u>		CITY	•	STATE	219			
GENERAL AND WELL LOCATION	600 W. B					HOBBS NM 88240						
Q.	WELL		DEGREE		DS .							
LA	LOCATIO	- 1	TITUDE 32	11 20.0	N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND						
ERA	(FROM G	PS) LO	NGITUDE 103	33 2.6	·w	• DATUM RE	QUIRED: WGS 84					
SEN	DESCRIPTIO			TADORESS AND COMMON LANDMARKS - PL	SS (SECTION, T	OWNSHJIP, RANG	SE) WHERE AVAILABLE					
=	T24S; R 33E; SECTION 26											
=	LICENSE N		NAME OF LICENSED				NAME OF WELL DR					
	WD-1186	5	RODNEY HAMM	MER			ENVIRO-DRILL,	INC.				
	O1-08-13	1	DRILLING ENDED 01-08-13	DEPTH OF COMPLETED WELL (FT)	75'	LE DEPTH (FT)	DEPTH WATER FIR	ST ENCOUNTERED (FT)	1			
		STATIC WATER LEVEL IN COMPLETED WELL (F						LL (FT)				
Z	COMPLETE	D WELL IS:	C ARTESIAN	DRY HOLE	ONFINED)							
ATIC	DRILLING F	LUID:	C AIR	MUD ADDITIVES - SP	ECIFY:							
RM	DRILLING	METHOD:	ROTARY	C HAMMER C CABLE TOOL	€ отне	R - SPECIFY:	AUGER					
NFC	DEPTH	(feet bgl)	BORE HOLE	CASING MATERIAL AND/OR	C	ASING	CASING	CASING WALL	SLOT			
Š	FROM	ТО	DIAM	GRADE (include each easing string, and	CON	VECTION	INSIDE DIAM.	THICKNESS	SIZE			
CASING INFORMATION			(inches)	note sections of screen)	en) TY		(inches)	(inches)	(inches)			
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DRILLING &	<u> </u>				ļ				ļ			
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	DEPTH	(feet bgl)	BORE HOLE	LIST ANNULAR SEAL MA	ATERIAL A	ND	AMOUNT	метно	D OF			
AL	FROM	TO	DIAM. (inches)	GRAVEL PACK SIZE-RANG			(cubic feet)	PLACEM				
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	OSE INTER	NAL USE				WR-20	WELL RECORD	LOG (Version 06/08	3/2012)			
FILE	NUMBER	-36	00	POD NUMBEL	341-20	O TRN N	IUMBER 5/8	382				

STATE ENGINEER OFFICE

	DEPTH (	eet bgl)			1	- ESTIMATED			
	FROM	то	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER JAFEZPRONG (YES/NO)	YIELD FOR 2: WHTER- BEARING ZONES (gpm)			
	0	2	· 2	BROWN SILTY SAND, LOOSE	CYGN	N/A			
	2	17	15	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A			
	17	63	46	RED SILTY SAND, DENSE TO VERY DENSE	CYGN	N/A			
	63	68	5	SHALE RED SILTY SAND, VERY DENSE	CYGN	N/A			
	68	75	7	RED SAND STONE	CYGN	N/A			
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	METHOD U	SED TO ES	TAL ESTIMATED						
	C AIR LIFT C BAILER C OTHER ~ SPECIFY: WELL YIELD (gpm):								
	west mean	. TEST I	RESULTS - ATT	ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLU	DING DISCHARGE N	METHOD.			
ő	WELL TEST			ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER T					
PERVISION	MISCELLAN	NEOUS INF	ORMATION:	-					
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TEST; RIG SUF	PRINT NAM	E(S) OF DR	ILL RIG SUPER	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTR	UCTION OTHER TH	AN LICENSEE:			
, v.									
SIGNATURE	CORRECT R	ECORD OF	THE ABOVE D	IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECO DOAYS AFTER COMPLETION OF WELL DRILLING:					
N.V.	n.	ام		2					
	Yes	アン		Kodney Hammer 1	-23-13				
6.		SIGNATU	IRE OF DRILLE	R / PRINT SIGNEE NAME	DATE				
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FOR OSE INTERN	AL USE	WR-20 WELL RECORD & LOG (Vers	WR-20 WELL RECORD & LOG (Version 06/08/2012)				
FILE NUMBER	-3600	POD NUMBER 3H-20 TRN NUMBER 518382					
LOCATION			PAGE 2 OF 2				



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## STATE ENGINEER OFFICE ROSWELL, NEW MEXICS

- 2013 JAN 29 FP 2: 21

	OSE POD NUN	MBER (WI	ELL NUMBER)				OSE FILE NU	MBER(S)	<del></del>			
NO O	8H 19						C3600; 51	8382				
ΑTI	WELL OWNER						PHONE (OPT)	ONAL)				
ò			TAL POTASH CORI	•								
GENERAL AND WELL LOCATION	600 W. BE						HOBBS					
Q.	WELL		DEGREES	1								
LA	LOCATION	۰ L	ATITUDE 32	11	21.0	N	* ACCURACY	REQUIRED: ONE TEN	TH OF A SECOND			
¥	(FROM GPS) LONGITUDE 103 32 18.0 W * DATUM REQUIRED: WGS 84											
EN	DESCRIPTION	_	WELL LOCATION TO STREE	T ADDRESS AND COMM	ON LANDMARKS - PL	S (SECTION, TO	L OWNSHJIP, RANC	E) WHERE AVAILABLE		·		
1.6	T24S; R 33	E; SECT	TION 26									
<b>—</b>	LICENSE NUM	MBER	NAME OF LICENSED	DRILLER				NAME OF WELL DR				
	WD-1186		RODNEY HAMM	IER				ENVIRO-DRILL,	INC.			
	DRILLING ST	ARTED	DRILLING ENDED 01-16-13	DEPTH OF COMPLET	ED WELL (FT)	75'	E DEPTH (FT)	DEPTH WATER FIRE	DEPTH WATER FIRST ENCOUNTERED (FT) N/A			
								STATIC WATER LEVEL IN COMPLETED WELL (FT)				
NO	COMPLETED WELL IS: C ARTESIAN  O DRY HOLE C SHALLOW (UNCONFINED)											
ΑŢΙ	DRILLING FL	UID:	C AIR	C· MUD	ADDITIVES - SPI	ECIFY:						
RM	DRILLING ME	ETHOD:	ROTARY	C HAMMER C	CABLE TOOL	● OTHE	R - SPECIFY:	AUGER				
CASING INFORMATION	DEPTH (	feet bgl)	BORE HOLE	CASING MATE		CA	SING	CASING	CASING WALL	SLOT		
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	0	75	8"	N/A		N/A		N/A	N/A	N/A		
DRILLING &												
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	DEPTH (f	fect bgl)	BORE HOLE		NULAR SEAL MA			AMOUNT	METHO			
IAL	FROM	TO	DIAM. (inches)	GRAVEL P.	ACK SIZE-RANG	E BY INTE	RVAL	(cubic feet)	PLACEN	MENT		
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FOR OSE INTERNAL USE

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

FILE NUMBER - 3660

POD NUMBER 4-19 TRN NUMBER 3/8383

LOCATION

PAGE 1 OF 2

	DEPTH (	(cet bgl)		COLOR AND TYPE OF MATERIAL ENCOUNTERED -	WATER	ESTIMATED					
			THICKNESS (feet)	INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES	WATER BEARING?	WATER-					
	FROM	ТО	(YES / NO)	BEARING ZONES (gam)							
	0	2	2	BROWN SILTY SAND, LOOSE	ZONES BEARING? (YES / NO) WATER-BEARING ZONES (gpm  C Y © N N/A  C Y © N N/A  C Y © N N/A  C Y © N N/A  C Y © N N/A  C Y © N N/A  C Y © N N/A						
	2	13	11	CALICHE WHITE SILTY SAND, VERY DENSE	<u> </u>	YIELD FOR WATER- BEARING ZONES (gpm) N/A N/A N/A					
	13	28	15	RED SILTY SAND. VERY DENSE	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \						
		38	1		<del>-</del>						
	28		10	SHALE RED SILTY SAND, VERY DENSE	(						
	38	75	37	SHALE GREEN SILTY SAND, VERY DENSE	, ,,	N/A					
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HYDROGEOLOGIC LOG OF WELL					CYCN						
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	METHODI	SED TO ES	TIMATE VIELD	OF WATER-BEARING STRATA: PUMP TO	( (						
	WELL VIELD (com)										
	C AIR LIF	Г ( I	BAILER (	OTHER - SPECIFY:	WELL YIELD (gpm):						
	WELL TES	TEST	RESULTS - ATT.	ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUE	ING DISCHARGE N	IETHOD.					
PERVISION		ļ		ME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER TI	HE TESTING PERIO	D.					
RVIS	MISCELLA	NEOUS INF	ORMATION:		-						
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5. TEST; RIG SU	PRINT NAM	IE(S) OF DR	IILL RIG SUPER	VISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRU	JCTION OTHER TH	AN LICENSEE:					
5. T											
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	THE UNDER	RSIGNED H	EREBY CERTIF	IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, T ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECOR	HE FOREGOING IS	A TRUE AND					
URE				D DAYS AFTER COMPLETION OF WELL DRILLING:	CD WITH THE STAT	E ENGINEER					
Y.A.T	$\cap$	. 1		3							
SIGNATURE	4/2	~ VI	.a	Rodney Hammer 1.	-23-13						
ن و	100	SIGNATI	RE OF DRILLE		DATE	<del></del>					
	-	DIGITAL C		A CHAIN SIGNED WANT	DATE						
FOR	FOR OSE INTERNAL USE WR-20 WELL RECORD & LOG (Version 06/08/2012)										

POD NUMBER BALL

TRN NUMBER 51

PAGE 2 OF 2

FILE NUMBER C-3600

LOCATION



LOCATION

## WELL RECORD & LOG

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## STATE ENGINEER OFFICE ROSWELL, HEW MEXICO

12913 JAN 29 FD 2: 21 '

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-,	OSE POD N	UMBER	(WELL	NUMBER) .				OSE FILE NU	•		
rio	8H 18 WELL OWNER NAME(S)					C3682; 518347  PHONE (OPTIONAL)					
GENERAL AND WELL LOCATION		INTERCONTINENTAL POTASH CORP					THORE (OF II	ioivat)			
777	WELL OWN							СПҮ		STATE	ZIP
VEL	600 W. BENDER BLVD.						}	HO8BS		NM 8824	0
Q.	WELL			DEGREE		SECOND	S		<u> </u>		
V T V	LOCATIO	-	<u>LATI</u>		11	20.2	N N	1	REQUIRED: ONE TEN	TH OF A SECOND	
SER	(FROM GI	PS)	LONG	SITUDE 103	31	38.3	· w	* DATUM RE	QUIRED: WGS 84		
	DESCRIPTIO	N RELAT	NG WE	LL LOCATION TO STREE	T ADDRESS AND COMMO	N LANDMARKS - PLS	S (SECTION, TO	OWNSHJIP, RANC	SE) WHERE AVAILABLE		
-	T24S; R 3	3E; SE	CTIO	N 25							
	LICENSE NU		- 1	NAME OF LICENSED				,	NAME OF WELL DR		
	WD-1186			RODNEY HAMM					ENVIRO-DRILL,		
	DRILLING S 01-15-13		- 1	DRILLING ENDED	DEPTH OF COMPLETE	D WELL (FT)	BORE HOL	LE DEPTH (FT)	DEPTH WATER FIR	ST ENCOUNTERED (FT)	
7	COMPLETE	D WELL	. IS: (	ARTESIAN	O DRY HOLE C	SHALLOW (UNC	ONFINED)		STATIC WATER LEV	VEL IN COMPLETED WE	LL (FT)
2. DRILLING & CASING INFORMATION	DRILLING F	LUID:	(	AIR	C: MUD	ADDITIVES - SPE	CIFY:		<u> </u>		
	DRILLING METHOD: C ROTARY C HAMMER C CABLE TOOL © OTHER - SPECIFY: AUGER										
	DEPTH	(feet b	gl)	BORE HOLE	CASING MATER	IIAL AND/OR	1		CASING	CASING WALL	CLOT
	FROM TO		0	DIAM (inches)	GRADE (include each casing string, and note sections of screen)		CONN	ISING VECTION YPE	INSIDE DIAM.	THICKNESS (inches)	SLOT SIZE (inches)
k CA	0	75		8"	N/A	· · · · · · · · · · · · · · · · · · ·	N/A		N/A	N/A	N/A
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	DEPTH	(feet bg	şl)	BORE HOLE				1	AMOUNT	METHOL	
IAI.	FROM	FROM TO DIAM. (inches)		GRAVEL PACK SIZE-RANGE BY INTERVAL		RVAL	(cubic feet)	PLACEMENT			
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ANNULAR MATERIAL											
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	OSE INTER	NAL U	SE	<del></del>				WR-20	WELL RECORD &	LOG (Version 06/08	/2012)
FILE	NUMBER	\	عاد	UO		POD NUMBER	BH-19	TRN N	TUMBER 5/X	382	

F	DEPTH (feet bgl) ESTIMATED									
	FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDÉ 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)				
1	0	1	1	BROWN SILTY SAND, LOOSE	CYGN	N/A				
	1	21	20	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A				
1	21	47	76	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A				
	47	53	6	SHALE RED SILTY SAND, VERY DENSE	CYGN	N/A				
	53	75	22	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A				
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HYDROGEOLOGIC LOG OF WELL					CYCN					
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	METHOD U		TAL ESTIMATED (gpm):	ĺ						
	C AIR LIF	r ( e	BAILER (	OTHER - SPECIFY:	(ap).					
2	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.									
ERVISION	voccii i									
RVI	MISCELLA	NEOUS INF	ORMATION:							
UP.										
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S. TEST; RIG SUP										
TES	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:									
vi										
	THE LINDS	DEICNED II	EDCOV CEDTIE	IES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF,	FUE CORECONIC IS	A TERLIC AND				
RE	CORRECT R	ECORD OF	THE ABOVE D	ESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECO  DAYS AFTER COMPLETION OF WELL DRILLING:						
SIGNATURE	$\cap$									
<u>5</u>	<i>Y</i> _	' U)		21 11-11-1	1 00 10					
6. 5	725	J.12.	100.00.00	Kodney Hammer	1-23-13	i				
		SIGNATU	JRE OF DRILLE	R / PRINT SIGNEE NAME	DATE					

FILE NUMBER (-3600) POD NUMBER SH - 18 TRN NUMBER 518382 LOCATION PAGE 2 OF 2	FOR OSE INTERNAL USE	WR-20 WELL RECORD & LOG (Version 06/08/2012)
LOCATION PAGE 2 OF 2	FILE NUMBER C-3600	POD NUMBER 34 - 18 TRN NUMBER 518382
	LOCATION	PAGE 2 OF 2



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#### STATE ENGINEER OFFICE ROSWELL, PEY MEXICO

12013 JAN 29 FP 2: 20

	OSE POD NUMBER (WELL NUMBER)						OSE FILE NUMBER(S)					
NO.	BH 17					C3600; 518382						
. Y	WELL OWN	•	•	•		PHONE (OPT)	IONAL)					
Š	1		TAL POTASH COR	P 								
GENERAL AND WELL LOCATION	600 W. BI					HOBBS		STATE NM 8824	ZIP IO			
3												
N N	WELL		DEGREE.		KDS							
۲,	LOCATIO	<u> </u>	TITUDE 32	11 20.2	N	{	/ REQUIRED: ONE TEN	TH OF A SECOND				
ER	(FROM GP	'S) Lo	NGITUDE 103	31 38.3	w	DATUM REQUIRED: WGS 84						
SEN	DESCRIPTION	N RELATING	WELL LOCATION TO STREE	T ADDRESS AND COMMON LANDMARKS - P	ESS (SECTION, T	OWNSHJIP, RANC	SE) WHERE AVAILABLE					
-	T245; R 3	3E; SECT	TON 26									
	LICENSE NU	MBER	NAME OF LICENSED	DRILLER			NAME OF WELL DR	ILLING COMPANY				
	WD-1186	•	RODNEY HAMA	MER			ENVIRO-DRILL,	INC.				
	DRILLING S	- 1	DUILLING ENDED	DEPTH OF COMPLETED WELL (FT)		LE DEPTH (FT)	1	ST ENCOUNTERED (FT	)			
	01-07-13		01-08-13		75'		N/A					
							STATIC WATER LEVEL IN COMPLETED WELL					
Z	COMPLETED	) WELL IS:	CARTESIAN	ORY HOLE C SHALLOW (UN	CONFINED)							
DRILLING & CASING INFORMATION	DRILLING FLUID: C AIR C MUD ADDITIVES - SPECIFY:											
)RM	DRILLING METHOD: C ROTARY C HAMMER C CABLE TOOL © OTHER - SPECIFY: AUGER						AUGER					
NFC	DEPTH	(feet bgl)	BORE HOLE	CASING MATERIAL AND/OR	CA	SING	CASING	CASING WALL	SLOT			
Š.	FROM TO		DIAM	GRADE (include each casing string, and	CONN	IECTION	INSIDE DIAM.	THICKNESS	SIZE			
\SI			(inches) note sections of screen)		Т	YPĖ	(inches)	(inches)	(inches)			
& C	0	75	8"	N/A	N/A		N/A	N/A	N/A			
NC.												
I.L.												
DRI												
7.												
ł		·- <del></del>					-					
	DESTU	feat h-IX	<u> </u>		1			<u> </u>				
ارا	DEPTH (feet bgl) BORE HOLE DIAM. (inches)			LIST ANNULAR SEAL MATERIAL AND			1		METHOD OF			
ANNULAR MATERIAL	FROM TO DIAM. (inches)			GRAVEL PACK SIZE-RANGE BY INTERVA			(caoic reet)	PLACEMENT				
			<u> </u>									
¥												
3			_									
5												
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				<u> </u>								

FOR OSE INTERNAL USE

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

FILE NUMBER 7 TRN NUMBER 5/1/3 X 2

LOCATION

PAGE 1 OF 2

STATE ENGINEER OFFICE

	DEPTH (	feet bgl)			9 L L 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	ESTIMATED					
	FROM	то	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER INBEARINED (YES/NO)	YIELD FOR  YATER- BEARING ZONES (gpm)					
	0	2	2	BROWN SILTY SAND, LOOSE	CYGN	N/A					
	2	18	16	CALICHE WHITE SILTY SAND, VERY DENSE	CYGN	N/A					
	18	24	6	RED SILTY SAND, DENSE TO VERY DENSE	CYGN	N/A					
HYDROGEOLOGIC LOG OF WELL	24	33	9	RED SAND STONE	CAGN	N/A ·					
	33	50	17	SHALE GREEN SILTY SAND, VERY DENSE	CYGN	N/A					
	50	75	25	SHALE RED SILTY SAND, VERY DENSE	CYEN	N/A					
					$C^{Y}C^{N}$						
OF					CACN						
၂ ဗို					$C_A \subset N$						
<u>[</u>					C $Y$ $C$ $N$						
50					CYCN						
035					$C_A \cup_N$						
&					$C_A \subset N$						
H.					CYCN						
4					$C^{Y} C^{N}$						
					$O_A O_N$						
					$C_A C_B$						
					$C^{Y}C^{N}$						
					$C^{Y}C^{N}$						
					$C^{Y}C^{N}$						
			<u> </u>		$C^{Y}C^{N}$						
				· · · · · · · · · · · · · · · · · · ·	TAL ESTIMATED						
	C AIR LIF	rCı	ELL YIELD (gpm):								
7	WELL TES	TEST	RESULTS - ATT	ACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER T	DING DISCHARGE N	METHOD,					
SIO											
ERV	MISCELLANEOUS INFORMATION:										
SUP											
RIG											
TEST; RIG SU											
5. TE	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:										
- T											
E	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										
Ž	AND THE PI	ERMIT HOL	DER WITHIN 20	DAYS AFTER COMPLETION OF WELL DRILLING:							
SIGNATURE	()	In,		2							
6. SIC	The	<u> </u>		Kodney Hammer	1-23-13						
		SYGNATU	JRE OF DRILLEI	R / PRINT SIGNEE NAME	DATE						
	FOR OSE INTERNALLISE										

FILE NUMBER - 3600 POD NUMBER 3H-17 TRN NUMBER 5/8382  LOCATION PAGE 2 OF 2	FOR OSE INTERNAL USE	WR-20 WELL RECORD & LOG (Version 06/08/2012)
LOCATION PAGE 2 OF 2	FILE NUMBER _ 3600	POD NUMBER 3H-17 TRN NUMBER 5/8382
	LOCATION	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	N	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" CALICHE, SILTY SAND, GRAVEL 1/4"-3/8"		10			2 3	NA NA NA		
	SILTY SAND, GRAVEL 1/4"-3/8", SOME ROUND SILTY SAND, GRAVEL 1/4"-1/2"		20			5	NA NA		
1 3	SILTY SAND, GRAVEL 1/8"-1/4" SILTY SAND		30			7	NA NA	QaL ALUVIUM	
40	SILTY SAND, RED, DRY		40			8	NΑ		
50	RED, SILTY SAND		50			9	ŊΑ		
60	GRAY SHALE (VISUAL)		60			10		TrC	HOLLOW STEM AUGER DRILLING CHANGED TO AIR ROTARY DRILLING AT 60'
1 70 <b>-1</b>	BROWN SANDSTONE RED SILTY SAND & BROWN SANDSTONE LAYERS OF 1' GREEN SHALE, RED AND GRAY		70			11	NA NA	CHINLE SHALE	
80			80			12	ŊA	& DENSE _SANDSTONE_	
90	93'-94' RED, (VISUAL)		90						
100			100				NA		BUCKET SAMPLE
110			110						
120			120			13			
130	GREEN SHALE, DRY		130				NA		
140	GRAY SHALE PULVERIZED IN CLAY, PLUGGED ROTARY AIR DRILL BIT		140						
150	BROWN AND GRAY SHALE, SEMI-HARD, FIRM, MOIST TD = 150'		150				ŊΑ		AFTER REACHING TD, HOLE LEFT OPEN OVERNIGHT, HOLE CHECKED FOR WATER THE FOLLOWING MORNING (DRY)
160			160						
170			170						
180			180						
190			190						
200 <b>-</b>	ect: OWL Site, Lea County, New Mexico		200					OWL SI	TE
Drilli Drilli Drille	ng Company: Enviro Drill ng Rig/Bit: CME-75: Hollow Stem Auger/Air Rota er: Ryan O'Malley	у				L		UNTY, NE	EW MEXICO
Loca Coo	pling Method: Split Spoon/Auger Cuttings stion: North East Corner of Section 23 rdinate: N 441088.401, E 788080.396 ation: 3584'							SOIL BOF BOREHOL	
Stari Com Borii	Elevation: 3584' Start Date: 11/24/2015 Completion Date: 11/25/2015 Boring Depth: 150 feet below ground surface Logged by: Carl King SOURCE: CARL KING, GORDON ENVIRONMENTAL							der ciates	

