# NM1 - 35

## Part 36

# MAJOR MODIFICATION Application

4 of 5

# July 30, 2019

# Permit Application

## FOR MODIFICATION

**Lea Land Landfill**
**OCD Facility Permit No.: NM-1-0035**
**Lea County, New Mexico**

# VOLUME IV:
# SITING AND HYDROGEOLOGY

**Submitted To:**

**New Mexico Energy, Minerals, and Natural Resources Department**
**Oil Conservation Division**
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Gordon/PSC Project #: 01041618.00

GORDON ENVIRONMENTAL PSC

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## 1.0 INTRODUCTION

Lea Land LLC (the Facility) is an existing Surface Waste Management Facility (SWMF) providing oil field waste solids (OFWS) disposal services. The existing Lea Land SWMF is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.9.711 and 19.15.36 NMAC, administered by the Oil Conservation Division (OCD) of the NM Energy, Minerals, and Natural Resources Department (NMEMNRD). This document is a component of the "Application for Permit Modification" that proposes continued operations of the existing approved waste disposal unit; lateral and vertical expansion of the landfill via the construction of new double-lined cells; and the addition of waste processing capabilities. The proposed Facility is designed in compliance with 19.15.36 NMAC, and will be constructed and operated in compliance with a Surface Waste Management Facility Permit issued by the OCD. The Facility is owned by, and will be constructed and operated by, Lea Land LLC.

The Lea Land SWMF is one of the most recently designed facilities to meet the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that Lea Land will provide needed resources to fill an existing void in the market for technologies that exceed current OCD requirements.

### 1.1 Purpose

This section provides compliance demonstrations for the Siting Criteria for Surface Waste Management Facilities specified in the NM Oil and Gas Rules, 19.15.36.13.A-C NMAC. These requirements include depth to groundwater; and proximity of watercourse, floodplains, wetlands, mines, residences/institutions, and unstable areas. The Lea Land site meets the Siting Requirements applicable to a Surface Waste Management Facility (i.e., 19.15.36.13.A-C NMAC).

### 1.2 Site Location

The Lea Land site is located approximately 27 miles northeast of Carlsbad, straddling US Highway 62-180 (Highway 62) in Lea County, NM. The Lea Land site is comprised of a 642-acre ± tract of land encompassing Section 32, Township 20 South, Range 32 East, Lea County, NM (**Figure IV.1.1**). Site access is currently provided on the south side of US Highway 62. The coordinates for the approximate center of the Lea Land site are Latitude 32°31'46.77" and Longitude -103°47'18.25".

### 1.3 Facility Description

The Lea Land SWMF comprises approximately 463 ± acres of the 642-acre ± site, and will include two main components: an oil field waste Processing Area and an oil field waste solids Landfill, as well as related infrastructure (i.e., access, waste receiving, stormwater management, etc.). Oil field wastes are delivered to the Lea Land SWMF from oil and gas exploration and production operations in southeastern NM and west Texas. The Site Plan provided as **Figure IV.1.2** identify the locations of the Processing Area and Landfill Disposal facilities, which are further detailed on the **Permit Plans** (**Volume III.1**). The proposed facilities are detailed in **Table II.1.2** (**Volume II.1**), and are anticipated to be developed in four primary phases as described in **Table II.1.3** (**Volume II.1**).

## 2.0 SITING CRITERIA FOR SURFACE WASTE MANAGEMENT FACILITIES

In order to re-confirm the suitability of the proposed Lea Land site for a Surface Waste Management Facility, an evaluation with respect to each of the Siting Requirements detailed in 19.15.36.13.A-C NMAC was performed and is presented herein. Based upon available information, the proposed Lea Land site satisfies the size restriction and each of the eight siting criteria. Following is a detailed description of the Lea Land Site's compliance with the siting criteria. Each siting criterion is defined, applied and discussed individually. The following sections provide the regulatory citation for each criterion in bold, followed by a narrative response. In most cases, a Figure or study is referenced to demonstrate compliance with applicable standard(s).

### 2.1 Depth to Groundwater

***No landfill shall be located where ground water is less than 100 feet below the lowest elevation of the design depth at which the operator will place oil field waste. (19.15.36.13.A(1) NMAC)***

***No other surface waste management facility shall be located where ground water is less than 50 feet below the lowest elevation at which the operator will place oil field waste. (19.15.36.13.A(5) NMAC)***

The Oil and Gas Rules define ground water as *"interstitial water that occurs in saturated earth material and is capable of entering a well in sufficient amounts to be used as a water supply"* per 19.15.2.7.G(10) NMAC. The maximum distance from the ground surface to the floor of the waste (i.e., cell basegrades) is 50 feet (ft) ±, i.e., landfill excavation extends 50 ft ± below ground surface (bgs). Therefore, for the purposes of this analysis, the minimum acceptable depth to groundwater is 150 ft bgs.

As described in **Volume IV.2** (Hydrogeology), saturation in shale beds in the Permian Dewey Lake Redbeds is the shallowest saturation beneath the Lea Land site. Information obtained from five groundwater monitoring wells at the Lea Land SWMF was used to determine the depth and character of shallow saturation zones at the Facility. **Figure IV.1.3** provides the potentiometric surface of water-bearing zones in the Dewey Lake Redbeds using available historic water level data from the above referenced wells.

A Local Hydrogeologic Cross Section through the Lea Land site is presented as **Figure IV.1.4**. As shown in **Figure IV.1.4**, the top of the Dewey Lake Redbeds at the Lea Land site is 50 ft bgs ±, and the shallowest saturated zones at site are present in zones ranging between 123 ft and 148 ft beneath the top of the Dewey Lake Redbeds at depths ranging between 173 ft to 198 ft bgs ±. The depth from the cell base grades (i.e., a maximum depth 50 ft bgs ±) to the top of the saturated zones in the Dewey Lake Redbeds is estimated to be between 122 ft and 149 ft.

In summary, information obtained from on-site borings that were advanced by air rotary drilling at the Lea Land site (**Volume IV.2**) provide adequate demonstration that the minimum depth to the shallowest saturated zone on the property approaches 200 ft bgs; and is more than 100 ft below projected landfill base grade levels. Therefore, the depth to saturation is greater than 100 ft below the lowest elevation of the design depth at which the operator will place oil field waste in the landfill, and greater than 50 ft below the processing area. Additionally, saturation zones penetrated by monitoring wells at the site do not produce enough water to be used as a water supply, therefore, water saturation in these zones does not meet the definition of "groundwater" as defined in 19.15.2.7.G(10) NMAC.

### 2.2 Watercourse, Lakebed, Sinkhole, or Playa Lake

***No surface waste management facility shall be located: within 200 feet of a watercourse, lakebed, sinkhole or playa lake. (19.15.36.13.B(1) NMAC)***

The Oil and Gas Rules specifically define watercourses and playa lakes as follows:

> ***"Watercourse" means 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)***
>
> ***"Playa lake" means 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)***

**Figure IV.1.5** is a United States Geological Survey 7.5-minute topographic map (contour interval 10 ft) that shows detailed terrain within one mile of the Lea Land SWMF. This map indicates that no watercourses are present within two hundred feet of the Lea Land SWMF. On-site photo documentation of the site can be found in **Attachment IV.1.C** (On-site Sheet Flow). Two ephemeral washes are present on the Livingston Ridge escarpment approximately one half mile southwest of the Lea Land SWMF. Drainage at the facility is northwest and surface grade is less than 5 feet per mile. A small closed depression comprising approximately 8 acres is present in the northeast corner of the Lea Land property. This feature is less than two feet in depth and does not appear to contain water; however, an area within the depression of approximately one-half acre has been excavated to promote stormwater capture. Another shallow closed depression comprising approximately 52 acres is located approximately 4,000 feet northwest of the Lea Land property. This depression is less than five feet deep and does not appear to contain ephemeral pooled water as a playa lake. Laguna Toston is a playa lake of approximately 713 acres and is located approximately 1950 feet northeast of the Lea Land SWMF. Laguna Toston receives brine from potash milling operations at the Intrepid mine and contains hypersaline water.

**Figure IV.1.6** shows that the Lea Land SWMF is not located within 200 feet of a watercourse, lakebed, sinkhole or playa lake, as those terms are defined by the Oil and Gas Rules. The June 4, 2015 United States Environmental Protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES) Multi-Sector General Permit (MSGP) regulations authorize stormwater discharges from certain industrial facilities (including landfills) to “waters of the United States” (WOTUS). Facilities that have the potential for stormwater discharges to WOTUS are required to obtain coverage under the 2015 MSGP through submission of a Notice of Intent (NOI) and development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). In accordance with the Oil Pollution Prevention regulation at 40 CFR Part 112, the USEPA requires non-transportation-related facilities (including landfills) to develop and implement a Spill Prevention, Control, and Countermeasures (SPCC) Plan if the facility “could reasonably be expected to discharge oil in quantities that may be harmful into navigable WOTUS”. The following evaluation of the potential to discharge to WOTUS has been performed to determine the applicability of both the MSGP and SPCC regulations for the Lea Land SWMF.

As shown on **Figure IV.1.6**, the Lea Land SWMF is located within a catchment encompassing approximately 45 square miles (115.65 $km^2$) of the Upper Pecos-Black Watershed (Hydrologic Unit Code (HUC) 13060011). The direction of local surface drainage in the vicinity of the Facility is to the north-northwest (NNW) toward the Williams Sink (Assessment Unit (AU) ID NM9000.B_109). The Williams Sink, located within the catchment approximately 3 miles NNW of the site, is a natural subsidence and deflation basin feature, and is the closest "receiving water" to the Facility.

The most recent USEPA Watershed Report (i.e., 2016) is included in **Attachment IV.1.A** (obtained through USEPA's online WATERS GeoViewer watershed delineation tool) for the area surrounding the Facility specifies that the 45-$mi^2$ catchment is a "sink catchment with no outflow, and that its catchment and watershed are the same". The Watershed Report characterizes the surficial lithology within the catchment and watershed as consisting of eolian and coarse-textured (sand dunes) soils with a mean permeability of 19.59 cm/hr (i.e., 5.4 X $10^{-3}$ cm/s). Potential sheet flows from the site would need to traverse approximately 3 miles of relatively flat terrain (~0.5 %) consisting of these highly pervious soils prior to reaching the Williams Sink.

The 2018-2020 State of New Mexico Clean Water Act Section 303(d)/Section 305(b) Integrated Report, Appendix A 303(d)/305(b) List identifies one of the uses for the Williams Sink as livestock watering (LW). However, the Integrated Report (**Attachment IV.1.B**) also states that "potash activities have led to hypersaline conditions which likely make livestock watering not attainable or existing". To-date, water quality standards (WQS) for the Williams Sink have not been assessed by NMED Surface Water Quality Bureau, and the US Army Corps of Engineers (USACE) has not rendered either a preliminary or an approved jurisdictional determination (PJD or AJD) for WOTUS applicability. The evaluation presented above shows that MSGP coverage is not required for the Lea Land SWMF; and the SPCC regulations do not apply to the site.

No lakebeds or sinkholes have been observed by Gordon/PSC on the Lea Land SWMF. The depressional feature located in the northeastern corner of the Lea Land site (**Figure IV.1.5**) has been excavated mechanically to serve as a cattle tank. The Lea Land SWMF is not located within 200 ft of any off-site playa lakes.

## 2.3 Wellhead Protection Area; 100-Year Floodplain

***No surface waste management facility shall be located: within an existing wellhead protection area or 100-year floodplain. (19.15.36.13.B(2) NMAC)***

The Oil and Gas Rules specifically define wellhead protection areas as follows:

> ***"Wellhead protection area" means the area within 200 horizontal feet of a private, domestic fresh water well or spring used by less than five households for domestic or stock watering purposes or within 1000 horizontal feet of any other fresh water well or spring. Wellhead protection areas does not include areas around water wells drilled after an existing oil or gas waste storage, treatment or disposal site was established. (19.15.2.7.W(8) NMAC)***

In addition, fresh water is defined as follows:

> ***"Fresh water" to be protected includes the water in lakes and playas (regardless of quality, unless the water exceeds 10,000 mg/l TDS and it can be shown that degradation of the particular water body will not adversely affect hydrologically connected fresh ground water), the surface waters of streams regardless of the water quality within a given reach, and underground waters containing 10,000 mg/l or less of TDS except for which, after notice and hearing, it is found there is no present or reasonably foreseeable beneficial use that contamination of such waters would impair. (19.15.2.7.F(3) NMAC)***

The New Mexico Office of the State Engineer (OSE) manages a database, the New Mexico Water Rights Reporting System (NMWRRS), which relates to wells and water rights. Based on NMWRRS data, the closest well is a "domestic one household" well (CP-368) located approximately 6626 ft west of the Lea Land site (**Figure IV.1.7**). The OSE Well Record for this well indicates that the well was drilled in 1966, was a dry hole and was not cased. Therefore, the Lea Land SWMF is not located within 200 ft of an existing wellhead protection area.

A review of potential floodplains was conducted. Flood Insurance Rate Maps are not available from the Federal Emergency Management Agency (FEMA) for this area. The Lea County Floodplain Coordinator was also contacted to inquire about the presence of mapped flood areas near the Lea Land SWMF. Lea County maintains no flood mapping in the vicinity of the Lea Land SWMF. Field reconnaissance of the Lea Land SWMF was conducted by Gordon/PSC personnel on February 25, 2018 to identify evidence of flooding or ponding on the property. No evidence of flood inundation was noted on the site, or in adjacent upgradient or downgradient areas near the facility. There are no apparent "rivers" or "streams" that would result in floodplain issues in the vicinity of the Lea Land site. Based on the field survey and communications with the Lea County Floodplain Coordinator, the Lea Land site is not located within a 100-year floodplain.

## 2.4 Wetlands

***No surface waste management facility shall be located: within, or within 500 feet of, a wetland. (19.15.36.13.B(3) NMAC)***

The Oil and Gas Rules specifically define wetlands as follows:

> ***"Wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions in New Mexico. This definition does not include constructed wetlands used for wastewater treatment purposes. (19.15.2.7.W(9) NMAC)***

The Lea Land SWMF area was evaluated for the presences of wetland indicators (i.e., hydrophytic vegetation, hydric soil, and wetland hydrology). The National Wetlands Inventory (NWI) identifies the depressional feature in the northeastern corner of the Lea Land site as an "intermittently flooded palustrine wetland" (**Figure IV.1.8**). This depressional feature is shallow, estimated to be less than 5 ft deep. The feature has been excavated and basal soils have been disrupted and removed. Inspection of the depressional feature during the site reconnaissance performed by Gordon/PSC personnel on February 25, 2019 indicated that no hydric soils or aquatic adapted vegetation are present. Therefore, the depressional feature does not qualify as a wetland, as defined in the Oil and Gas Rules [19.15.2.7.W(9) NMAC].

## 2.5 Subsurface Mines

***No surface waste management facility shall be located: within the area overlying a subsurface mine. (19.15.36.13.B(4) NMAC)***

The applicable section of the current NM Energy Minerals and Natural Resources Department (EMNRD) Mines, Mills and Quarries in New Mexico Map is provided as **Figure IV.1.9**. The closest mining operation is a potash mine and mill operated by Intrepid Potash Company, located in Eddy County and approximately 6100 feet south of the Lea Land Site. Therefore, the Lea Land SWMF is not located within an area overlying an existing subsurface mine.

Numerous underground potash mine works are present in the vicinity of the Lea Land SWMF. The Bureau of Land Management (BLM) owns the surface and mineral rights to much of the land in the eastern Eddy County and western Lea County and administers permitting for exploration and extraction of minerals on BLM land. Oil and gas exploration, development and production, along with underground potash mining, is ongoing in the vicinity of Lea Land. The BLM manages risks that oil and gas well drilling could pose to underground mine works by maintaining detailed maps of underground potash mine works and prohibiting drilling within safe setback distances to the existing

underground mine works. Map coverage obtained from BLM showing locations of existing underground mine works in the vicinity of the Lea Land site are shown on **Figure IV.1.10**. This map indicates that the nearest underground mine works to the Lea Land SWMF are located approximately 1350 feet west of the facility. The Intrepid Potash mine located to the east and south of the Facility does lease subsurface mineral rights from the Bureau of Land Management under a portion of the Lea Land site, where potential mineral resources are situated over 1,200 below ground surface.

### 2.6 Land Use Setbacks

***No surface waste management facility shall be located: within 500 feet from the nearest permanent residence, school, hospital, institution or church in existence at the time of initial application. (19.15.36.13.B(5) NMAC)***

Examination of land use surrounding the Facility, including a site reconnaissance and an aerial photo review (**Figure IV.1.11**), indicate that there are no permanent residences, schools, hospitals, institutions, or churches within 500 ft of the Lea Land site. No permanent structures are present within 500 ft of the Lea Land site, and there is no apparent trend for development of residential, institutional, or educational facilities in the general vicinity of the proposed Facility.

### 2.7 Unstable Areas

***No surface waste management facility shall be located: within an unstable area, unless the operator demonstrates that engineering measures have been incorporated into the surface waste management facility design to ensure that the surface waste management facility's integrity will not be compromised. (19.15.36.13.B(6) NMAC)***

The Oil and Gas Rules specifically define unstable area as follows:

> ***"Unstable area" means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of a division-approved facility's structural components. Examples of unstable areas are areas of poor foundation conditions, areas susceptible to mass earth movements and karst terrain areas where karst topography is developed as a result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features of karst terrain include sinkholes, sinking streams, caves, large springs or blind alleys. (19.15.2.7.U(6) NMAC)***

This section addresses regulatory requirements for defining site characteristics related to earth stability at the proposed facility.

### 2.7.1 Karst Potential

Gordon/PSC performed the following "unstable areas" analysis based on review of potential karst or other earth stability features within the vicinity of the Lea Land site. Numerous depressional features are present in western Lea County. Several of the larger depressional features are suspected to have formed, at least in part, by subsidence. Therefore, a thorough evaluation of the Lea Land site for potential karst conditions is warranted. The potential for unstable terrain or karst development at the Lea Land site was initially evaluated by review of published and unpublished information on the area, and then by detailed on-site reconnaissance to identify any evidence of potential karst or subsidence features in the area.

***Karst Environments and Features***

Thornbury (1969) identified several geologic and hydrologic conditions favorable to the development of karst terrain as follows:

**TABLE IV.1.1 - Karst Terrain Conditions**

- Presence of soluble rock such as limestone, gypsum, dolomite or halite at or near land surface
- Dense, highly jointed and/or thinly bedded soluble rock units
- Stream valleys deeply incised into soluble rock
- Moderate to high rainfall rates

Thornbury also identified numerous characteristic karst geomorphic landforms as follows:

**TABLE IV.1.2 - Karst Indicators**

- Sinkholes and associated forms, including solution sinks with broad shallow sinkhole ponds and collapse sinks, with steep rocky margins
- Karst plain, as a broad flat area with no laterally extensive drainages
- Sinking creeks, or creeks that end abruptly, typically in sinkholes
- Blind valleys, or ephemeral washes that end abruptly
- Rise and resurgence of streams
- Artesian springs
- Haystack hills or hums
- Caverns
- Voids and lost drilling circulation
- Tension cracks

***Lea Land Site File and Literature Review***

Comparison of conditions at the Lea Land site with those factors favorable to karst development identified in the literature indicates that conditions at the site are not conducive to karst development. No thick sections of soluble rock are present at or near land surface; the shallowest significant thickness of soluble bedrock materials are gypsum and halite beds in the Rustler Formation, which are located at least 1,200 ft bgs at the site. Additionally, rainfall rates in the area are low, and evapotranspiration rates are high (Section 2.9).

George Bachman (1980) identified laterally extensive pedogenic calcium carbonate (caliche) deposits in shallow soils of western Lea County and eastern Eddy County and proposed an informal stratigraphic unit and nomenclature for the caliche as the "Mescalero Caliche". The site characterization borings and monitoring wells drilled at the Lea Land site penetrated caliche in the upper 20 ft of the site soil profile. Copies of the boring logs and monitoring well logs are included in **Attachments IV.2.D** and **IV.2.E**. The Mescalero caliche can be soluble and is situated at or near land surface; however this unit is no more than 20 ft in thickness. Local dissolution of the Mescalero Caliche unit may have resulted in the development of a number of small shallow depressions in the area; however this is not regarded as a significant karst process at the Lea Land site. The design base grades for the landfill extend to 50 ft ± below ground surface, and the resulting earthmoving will penetrate through the caliche zone. The excavated caliche is planned for beneficial use (e.g., road surfacing, erosion control).

The nearest karst features in the vicinity of the Lea Land site are identified on the physiographic map in **Figure IV.1.12** (Nicholson and Clebsch, 1963 and Kelly, 1979). Nash Draw, located approximately 3 miles southwest of the Lea Land site, is the likely result of dissolution of shallow and exposed gypsum and halite beds in the Rustler Formation, as well as dissolution of halite beds in the Salado Formation below. Another feature known as San Simon Sink is located approximately 26 miles southeast of the Lea Land site. The origin of San Simon Sink is less well understood; and Nicholson and Clebsch (1963) concluded that San Simon Sink likely resulted from a combination of deep-seated collapse and wind deflation. Several playas, including Williams Sink, Laguna Plata, Laguna Gatuna and Laguna Toston, are located north and east of the Lea Land SWMF. These playas are shallow, ranging in depth from less than 10 feet (Laguna Toston) to about 50 feet (Laguna Plata). Large

downwind dune complexes are present at each of these playas except Laguna Toston, indicating that wind deflation was a significant contributor to development of these playas.

***Site Reconnaissance***

One of the common indicators of active karst and collapse is the presence of tension cracks in surface soil and rock on margins of actively subsiding areas. Other indicators of active karst processes may be tilting, offset and/or displacement of cultural features. Nicholson and Clebsch (1963) identified an array of large annular cracks in soils arrayed around San Simon Sink, which are clearly visible in aerial photographs. San Simon sink is approximately 25 miles southeast of the Lea Land site. Tension cracks are visible on the margins of many sinks and escarpments of the region where karst processes are active. Land and Love (2000) identified karst-related tension cracks in gypsum beds of the Seven Rivers Formation in the area of McMillan Escarpment on the east flank of the Pecos River near Lake McMillan (19 miles to the west).

During the Lea Land site reconnaissance conducted by Gordon/PSC on 02/25/2018, a detailed inspection of the Lea Land tract and surrounding properties was conducted to identify any tension cracks, disrupted soils, tilting or other evidence of earth displacement. No tension cracks, tilted or offset cultural features, or other evidence of displacement was observed during the reconnaissance.

A small depressional feature (approximately 1.7 acres) was identified on the Lea Land tract near the northeastern corner of Section 32. The location of the depressional feature is shown in **Figure IV.1.5**. The margins of the depressional feature were inspected and found to form gentle slopes with no evidence of off-set of soil horizons, tension cracks, accelerated erosion, or tilting. Maximum vertical relief from the depressional feature base to surfaces of adjacent slopes was estimated to be less than five ft ±.

Cultural features, including road grades, utility poles and fence posts in the vicinity of the Lea Land site were inspected to identify evidence of tilting, offset or displacement that could indicate recent land movement and none was observed. Based upon the referenced literature review (**Table IV.1.3**) and site reconnaissance, we conclude that no evidence of active karst or land subsidence was discovered during these investigations.

**TABLE IV.1.3 - Unstable Areas – References**

1. Bachman, G. O., 1980, Regional geology and Cenozoic history of Pecos region, southeastern New Mexico: U.S. Geological Survey, Open-file Report 80-1099, 120 pp., map in 12 over-size sheets, scale 1:250,000 and 1:125,000.
2. Thornbury, W.D., 1969, Principles of Geomorphology: John Wiley and Sons, New York, NY
3. Nicholson, A., Alfred Clebsch. "Geology and Ground-Water Conditions in Southern Lea County, New Mexico". Ground-Water Report 6. State Bureau of Mines and Minerals
4. Land, L. and Love., D, 2000, Gypsum Karst Processes in the Seven Rivers Formation, Thire Day Road Log, New Mexico Geological Society 57th Field Conference Guidebook, p. 88
5. Kelly, T.E., Geohydrology Associates, 1979, Water-resources study of the Carlsbad Potash area, New Mexico: Consultant report to the Bureau of Land Management, Denver Colorado, Contract No. YA-5112-CT8-195

### 2.7.2 Pleistocene Faults and Seismic Zones

The Lea Land site was evaluated for geologic faults that have experienced movement during the last 11,000 years (i.e., Holocene Period) and areas susceptible to potential seismic impacts to verify the physical stability of this location. The Quaternary Faults Map (**Figure IV.1.13**) is based on the United States Geological Survey (USGS) *Map of Quaternary faults and folds in New Mexico and adjacent areas*. The Lea Land site is located within an area that is described as an area of "no Quaternary Faults" or an area that is "unmapped". No faults are shown in the vicinity of the site.

The seismic impact zones map (**Figure IV.1.14**) is based on seismic data from the USGS National Seismic Hazard Mapping Project data. The seismic impact zone map indicates that the site is located within an area with no more than an 8% probability of peak horizontal ground acceleration of 0.10491 g in 250 years. A "seismic impact zone" is an area with a 10% or greater probability of peak horizontal ground acceleration of 0.10 g in 250 years. Therefore, the Lea Land site is not located within a seismic impact zone, as is most of the State of New Mexico.

## 2.8 Maximum Size

***No surface waste management facility shall exceed 500 acres. (19.15.36.13.C NMAC)***

The disposal and operational footprint (i.e., landfill and processing) of the selected site for a surface waste management facility must not exceed 500 acres. The Lea Land tract is comprised of 642 acres ±, and the SWMF operational footprint is comprised of 463 acres ± including basic

infrastructure (e.g., waste receiving, access, etc.). A description of the Lea Land SWMF components and corresponding acreages is provided in **Table IV.1.4**.

**TABLE IV.1.4 - Site Acreages**

| Description | Acres (±) |
|---|---|
| Lea Land Site: Total Tract | 642.10 |
| Municipal Solid Waste (MSW) Facility Footprint (Total) | 134.73 |
| Lea Land LLC Tract Size | 507.37 |
| Right-of-Way – US Highway 62/BNSF Rail Road | 44 |
| **Surface Waste Management Facility Footprint (Total)** | **463.37** |
| SWMF Landfill: Disposal Footprint | 100 |
| Processing Area: Operations Footprint (SE corner) | 82 |
| Infrastructure (Section 32 exclusive of MSW unit) | 118 |
| Additional Open Land | 163.37 |

## 2.9 Climatology

The Lea Land site enjoys an arid climate with ample sunshine and low precipitation. The US Climate Center database indicates an average annual precipitation of 13.43 inches with an evapotranspiration rate of approximately 34.00 inches per year. This balance results in a low potential for leachate generation, subsurface solubility, stormwater runoff, etc. The HELP Model (**Volume III.4**), however uses the maximum precipitation rate of approximately 30 inches per year in order to produce the most conservative results.

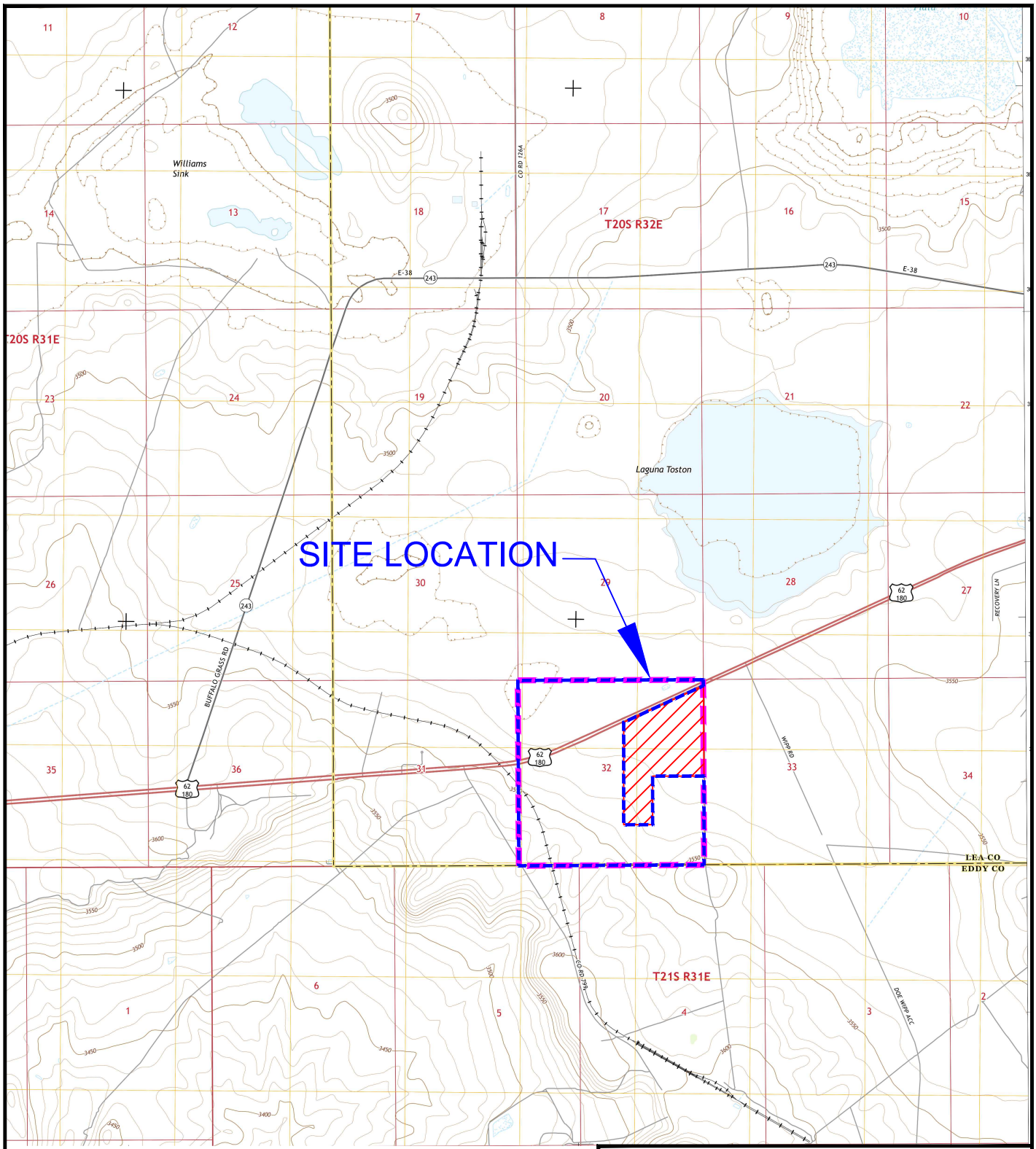
**Figure IV.1.15** is a "Wind Rose" for the site area (Western Regional Climate Center). The local wind rose indicates a prevailing wind direction from the south/southeast. This positions Lea Land tracts and facilities downwind of proposed landfill and waste processing facilities, further enhancing the buffer zone from uninhabited adjacent properties. Potential impacts that are sensitive to wind propagation, such as short-term odors, dust, etc., will not typically extend to the Lea Land property lines. The proposed OCD processing is visually shielded from the highway by prior waste disposal deposits (100 ft high) and a buffer zone > 1,500.

## 3.0 SUMMARY

In conclusion, the Lea Land LLC Facility meets and exceeds each of the Part 36 Surface Waste Management Siting Criteria; and has operated with no negative environmental consequences at the same site for over 20 years. Lea Land offers a long-term sustainable disposal alternative for growing E&P activities in southeast NM, by transitioning to the new double liner standards specified in Part 36.

Due to its unique remote location, Lea Land does not conflict with any of the regional land uses or cultural resources. Water beneath the site is not produced in useable quantities, and proposed vadose zone monitoring will provide enhanced environmental protection well above the shallowest saturation zone at the facility. Local climatology demonstrates that the Lea Land Facility is ideally located in an arid zone of low precipitation and high evapotranspiration (Section 2.9).

## FIGURES




## LEGEND

- PROPERTY BOUNDARY
- LEA LAND LLC FACILITY BOUNDARY
- INDUSTRIAL SOLID WASTE MANAGEMENT FACILITY

NORTH

0 2000' 4000'

NOTES:

1. GEOGRAPHIC CENTER 32° 31'46.77 -103° 47' 18.25 MAP REFERENCE: WILLIAMS SINK, NM. 2017 USGS 7.5 MIN QUAD

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\RAI1\SITE LOCATION.dwg
Date/Time:May. 31, 2019-06:21:21 ; LAYOUT: A (P)

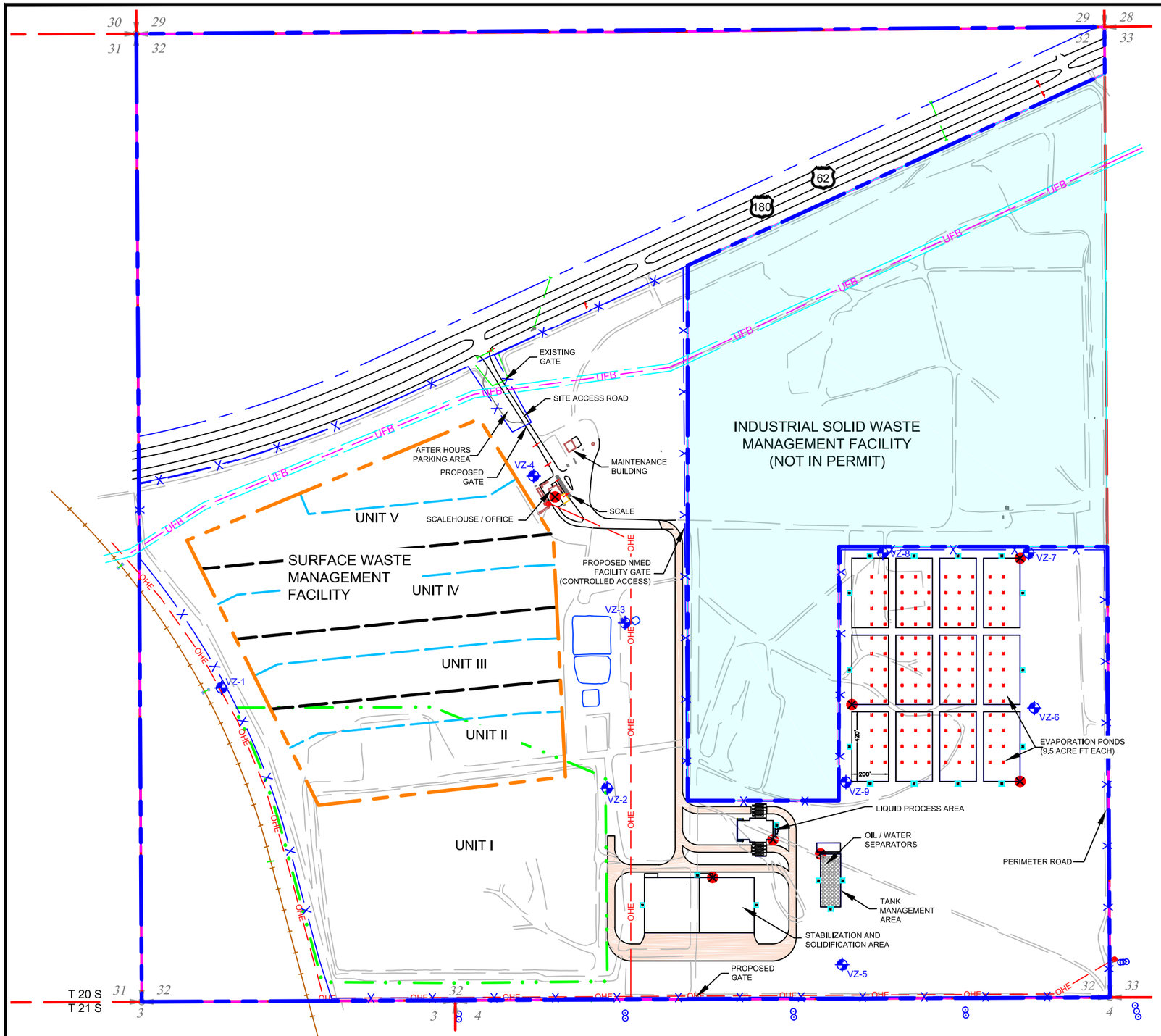


# SITE LOCATION

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/11/2019 | CAD: SITE LOCATION.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.1 |
| APPROVED BY: CWF | www.team-psc.com | |




## LEGEND

- SECTION BOUNDARY
- PROPERTY BOUNDARY
- SURFACE WASTE MANAGEMENT BOUNDARY
- EXISTING OCD PERMIT BOUNDARY
- PROPOSED SURFACE WASTE MANAGEMENT BOUNDARY
- INDUSTRIAL SOLID WASTE FACILITY BOUNDARY
- CELL BOUNDARY
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- PROPOSED FENCE
- EXISTING RAILROAD
- PROPOSED UNDERGROUND FIBER OPTIC
- PROPOSED OVERHEAD POWER LINE
- EXISTING CULVERT
- PROPOSED UNPAVED ROAD (GRAVEL)
- NOT IN OCD PERMIT
- EXISTING TRANSMISSION LINE
- $H_2S$ MONITORING LOCATION
- PROPOSED VADOSE ZONE MONITORING WELL
- PPE AND EMERGENCY EQUIPMENT

NORTH

0 300' 600'

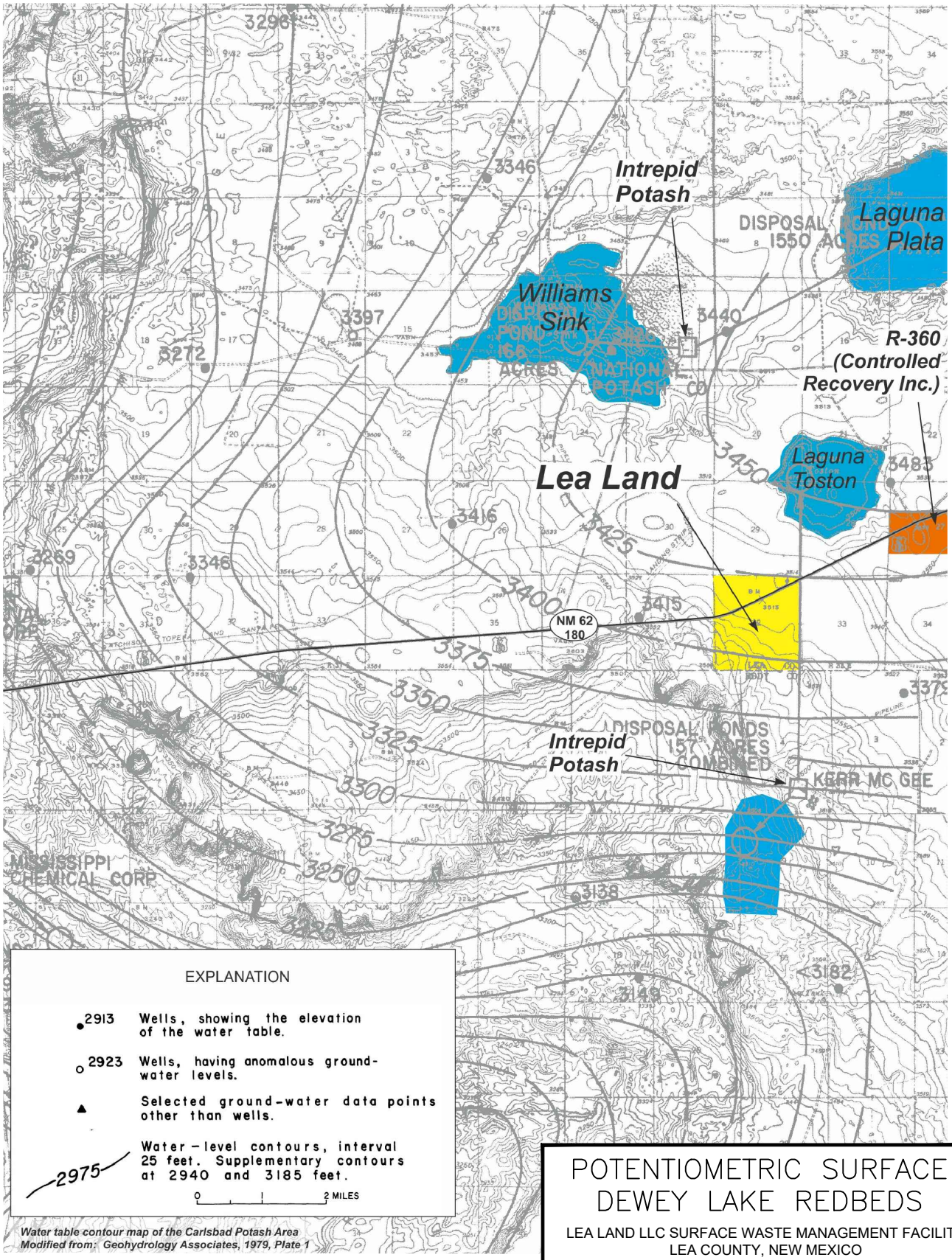
# SITE PLAN

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/27/2019 | CAD: SITE PLAN.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.2 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\RAI1\SITE PLAN.dwg
Date/Time:Jun. 27, 2019-09:24:41 ; LAYOUT: B (LS)




*Water table contour map of the Carlsbad Potash Area*
*Modified from: Geohydrology Associates, 1979, Plate 1*

# POTENTIOMETRIC SURFACE DEWEY LAKE REDBEDS

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

NOTES:

1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 N, -103° 47' 18.25 W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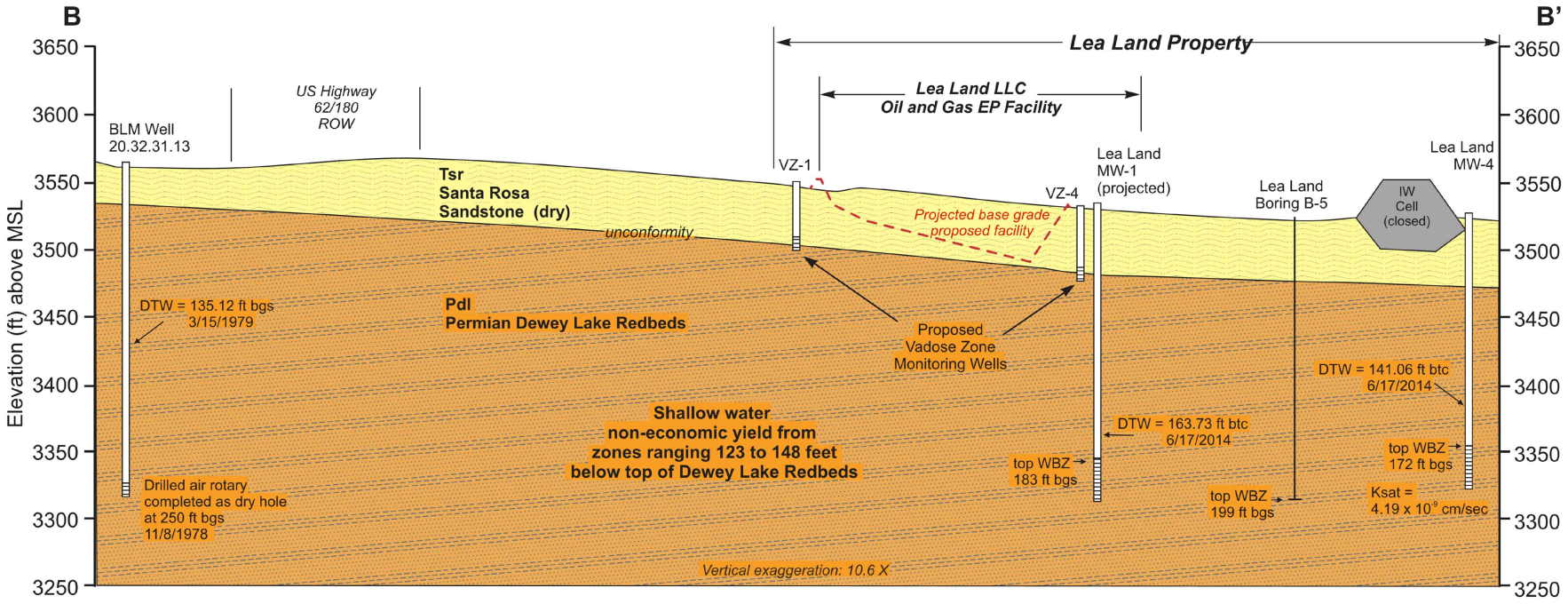
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991


| | | |
|---|---|---|
| DATE: 03/31/2019 | CAD: REDBEDS GEO.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.3 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\POTENTIOMETRIC SURFACE DEWEY LAKE REDBEDS.dwg
Date/Time:May. 31, 2019-07:17:37 ; LAYOUT: Layout A (P)

# SHALLOW LOCAL HYDROGEOLOGIC CROSS SECTION LEA LAND LLC FACILITY




## EXPLANATION

| | |
|---|---|
| Qun | Quaternary alluvium and lacustrine deposits, undifferentiated |
| Tsr | Triassic Santa Rosa Sandstone |
| Pdl | Permian Dewey Lake Redbeds |

Notes: btc: below top of casing
bgs: below ground surface

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\LOCAL HYDROGEOLOGIC CROSS-SECTION B B'.dwg
Date/Time:Mar. 25, 2019-13:01:48 ; LAYOUT: A (LS)


SHALLOW LOCAL HYDROGEOLOGIC CROSS-SECTION B-B'

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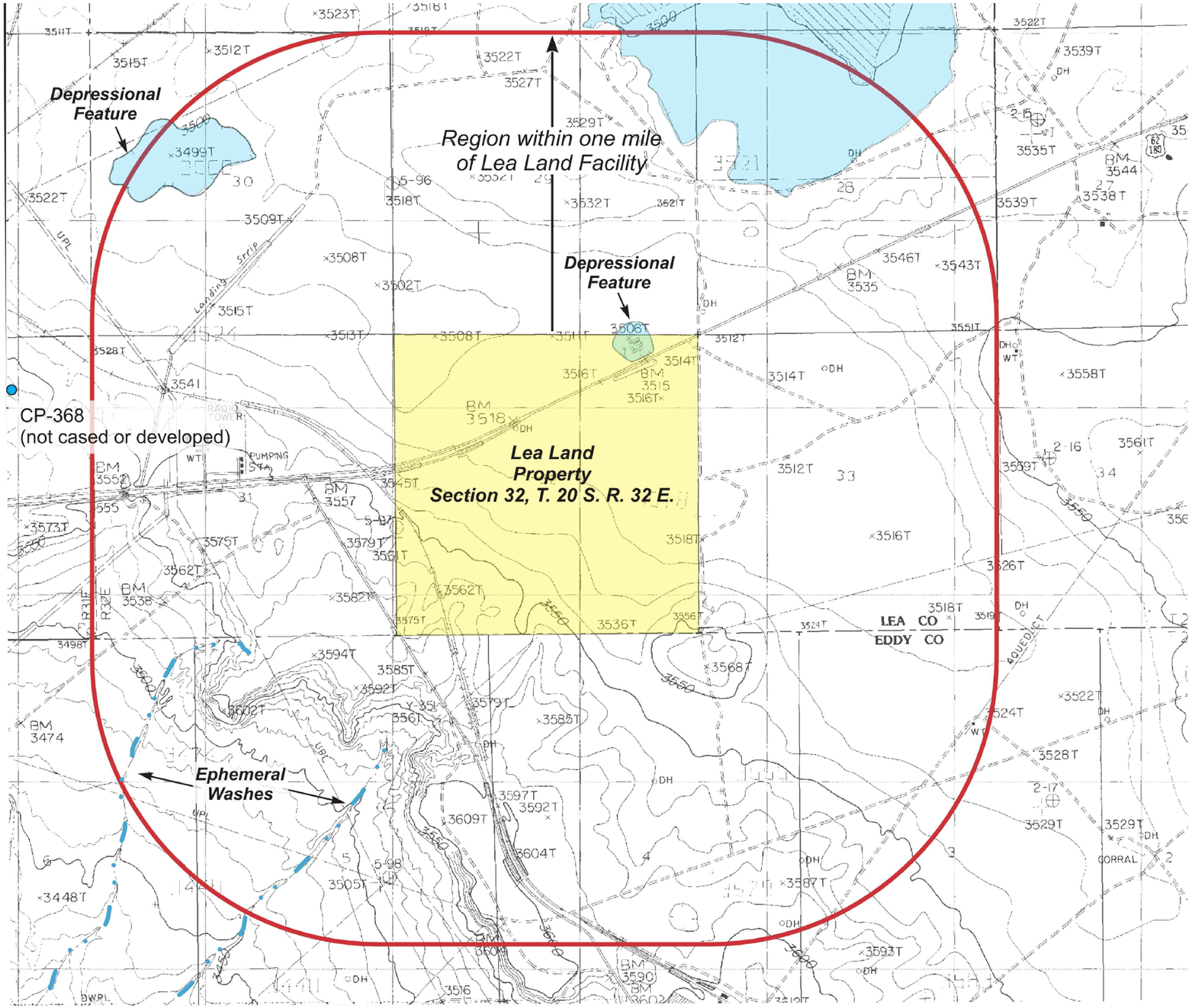
LEA COUNTY, NEW MEXICO

GORDON PSC ENVIRONMENTAL
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD:HYDRO GEO X-SEC.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.4 |
| APPROVED BY: CWF | www.team-psc.com | |




## EXPLANATION

Location of NMOSE permitted water well showing NMOSE Basin and permit number

**CP-368**

NORTH

Scale, miles

0 1/2 1.0

# SITE TOPOGRAPHY AND DRAINAGE

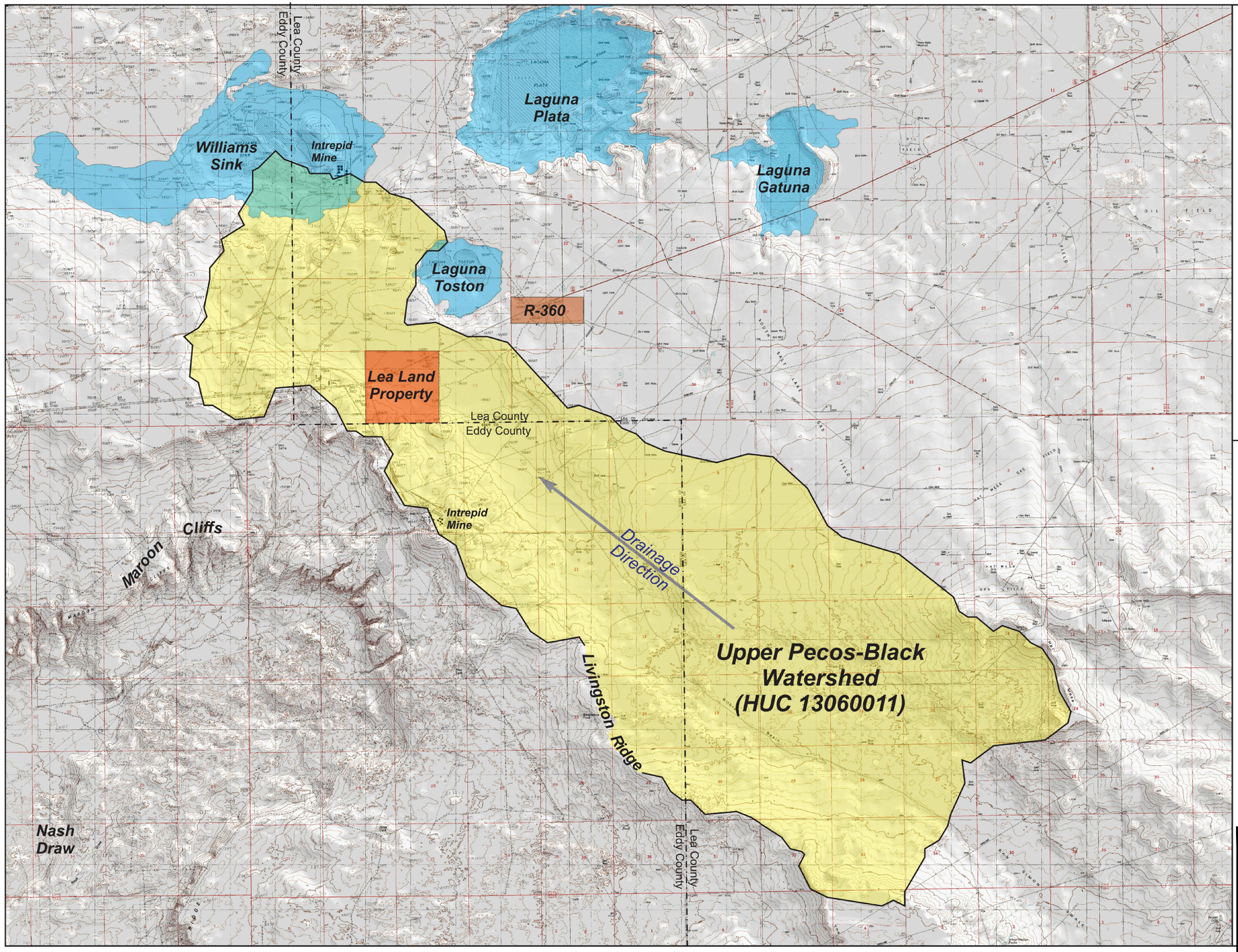
LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/11/2019 | CAD: SITE LOCATION.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.5 |
| APPROVED BY: CWF | www.team-psc.com | |

NOTES:
1. GEOGRAPHIC CENTER 32° 31' 46.77 -103° 47' 18.25

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\RAI1\SITE TOPO DRAINAGE.dwg
Date/Time:May. 30, 2019-13:29:19 ; LAYOUT: B (LS)




## EXPLANATION

- Limits of EPA delineated Upper Pecos-Black Watershed
- Limits of closed depression
- Lea Land property boundary
- R-360 property boundary

NORTH

Scale, miles
0 1/2 1.0 2.0

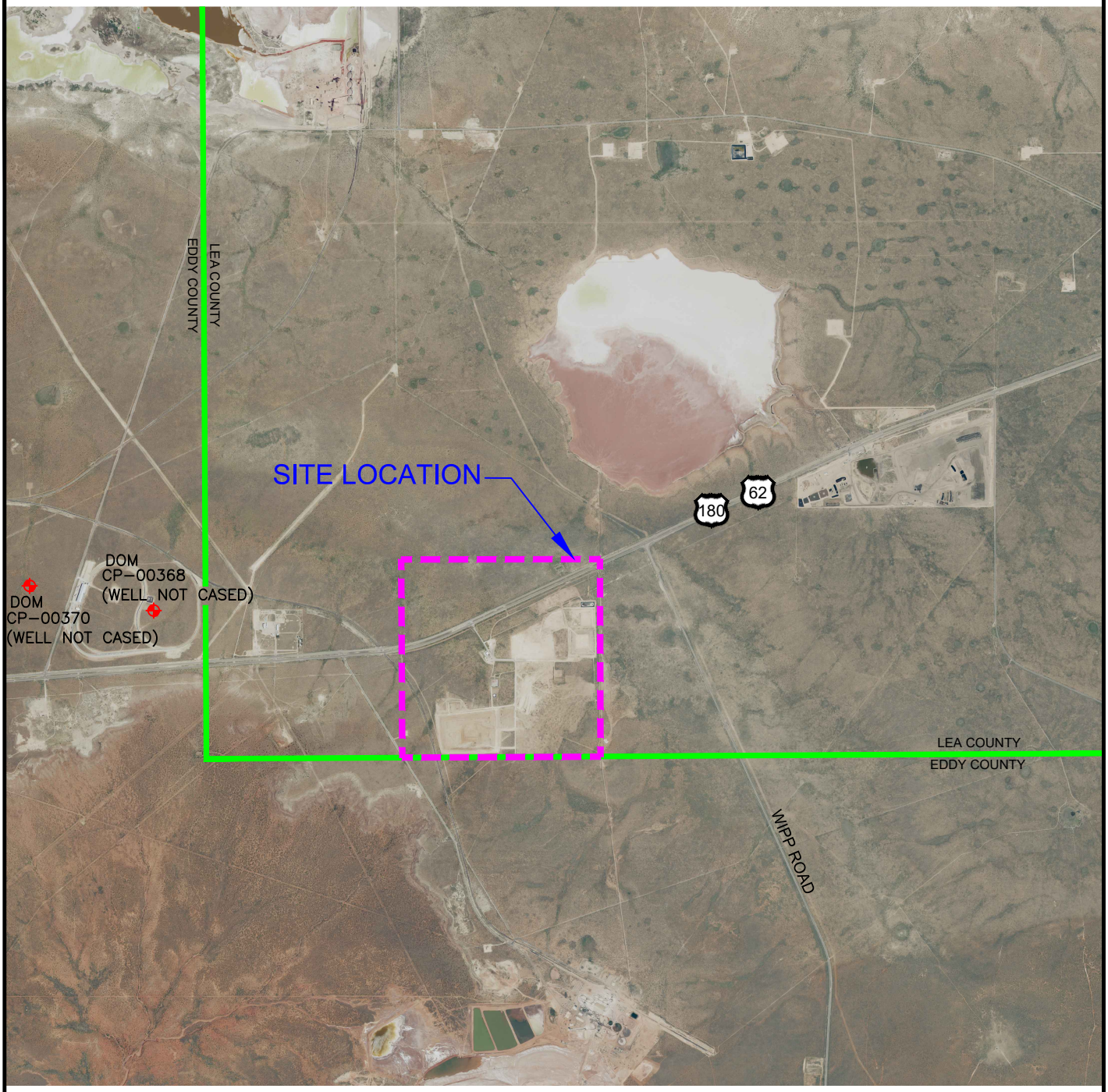
# SURFACE WATER FEATURES

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/11/2019 | CAD: WINDROSE.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CWF | FIGURE IV.I.6 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\SURFACE WATER FEATURES.dwg
Date/Time:Mar. 25, 2019-13:25:12




## LEGEND

SITE BOUNDARY

### WELL CLASSIFICATION

DOM DOMESTIC ONE HOUSEHOLD

NORTH

0 2000' 4000'

IMAGE REFERENCE: NAIP LEA COUNTY ORTHOPHOTO MOSAIC, 2016

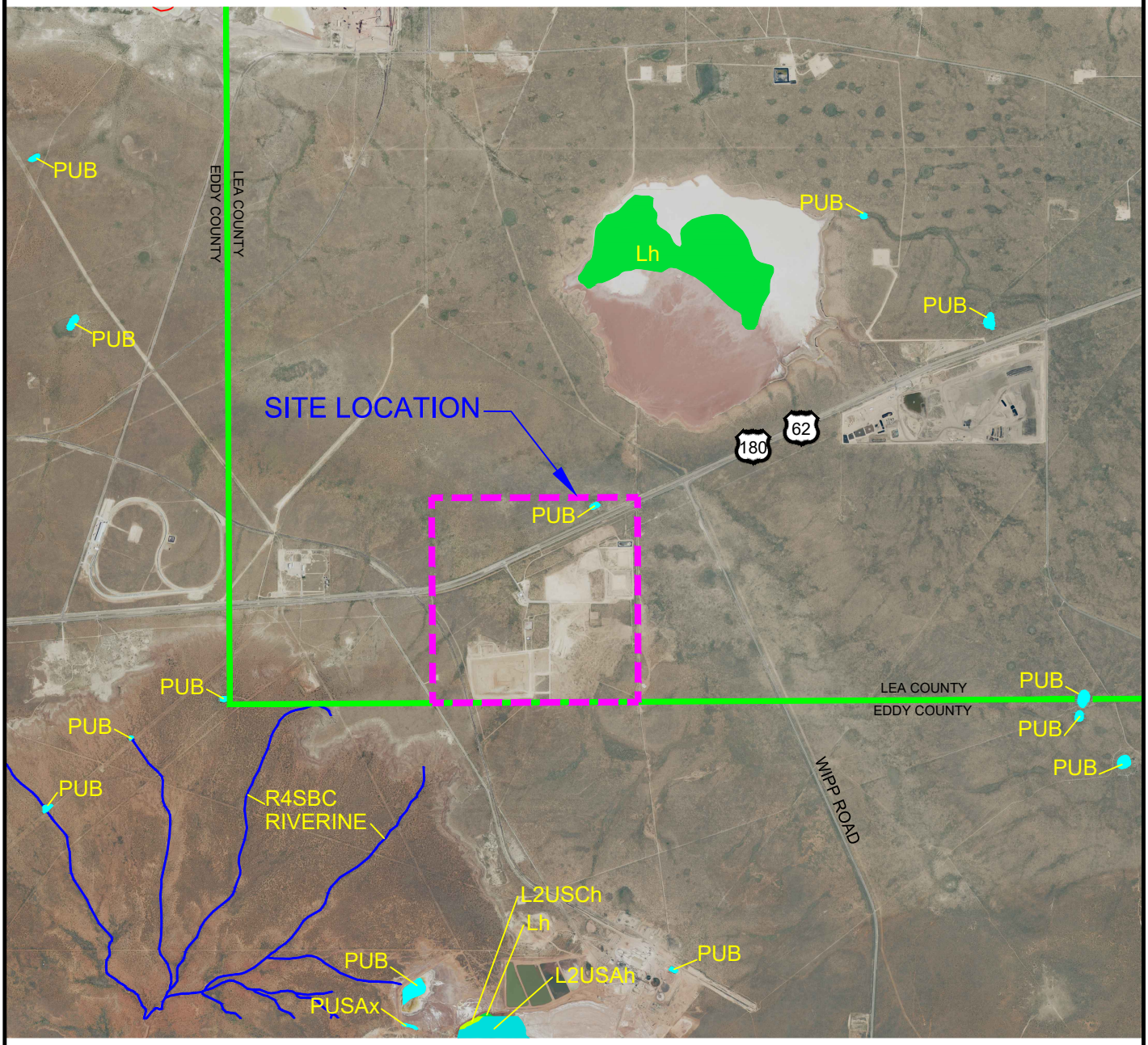
# WATER WELL LOCATION MAP

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/14/2019 | CAD: WELLHEAD.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.7 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\WELLHEAD.dwg
Date/Time:Mar. 25, 2019-07:45:03 ; LAYOUT: A (P)




## LEGEND

| | |
|---|---|
| SITE BOUNDARY | |
| PUSAx | PALUSTRINE UNCONSOLIDATED SHORE TEMPORARILY FLOODED EXCAVATED |
| PUB | PALUSTRINE FRESH WATER POND UNCONSOLIDATED BOTTOM |
| R4SBC | RIVERINE INTERMITTENT STREAM BED |
| Lh | LACUSTRINE DIKE IMPOUNDED |
| L2USCh | LACUSTRINE LITTORAL UNCONSOLIDATED SHORE SEASONLY FLOODED DIKE IMPOUNDED |
| L2USAh | LACUSTRINE LITTORAL UNCONSOLIDATED SHORE TEMPORARILY FLOODED DIKE IMPOUNDED |

NORTH

0 2000' 4000'

NOTES:

1. NAIP LEA COUNTY ORTHOPHOTO MOSAIC 2016
2. VECTOR REFERENCE:
   US FISH AND WILDLIFE SERVICE, NATIONAL WETLANDS INVENTORY
   DATA 2018.

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\WETLANDS.dwg
Date/Time:Mar. 25, 2019-08:37:04 ; LAYOUT: A (P)

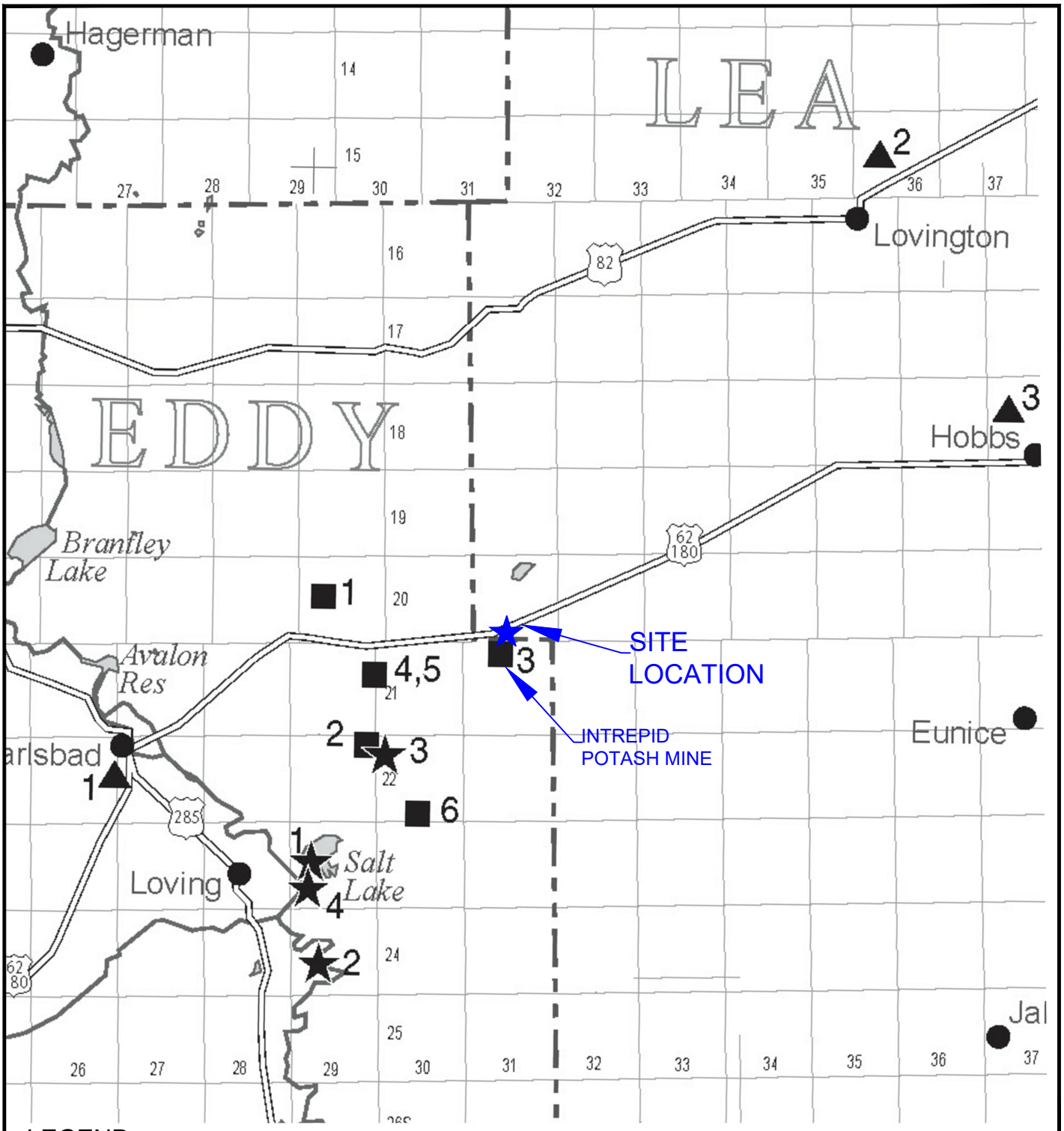


# WETLANDS MAP

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/14/2019 | CAD: WETLANDS.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.8 |
| APPROVED BY: CWF | www.team-psc.com | |




## LEGEND

- SITE LOCATION
- AGGREGATE AND STONE MINING
- INDUSTRIAL MINERALS, MINING AND MILLING
- POTASH MINING AND MILLING

NORTH

0 5 MILES 10 MILES

MAP REFERENCE:
WILKS et. al. 2001, MINES MILLS AND QUARRIES IN NEW MEXICO., MINING AND MINERALS DIVISION, NEW MEXICO ENERGY MINERALS AND NATURAL RESOURCES DEPARTMENT, NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES, AND THE NEW MEXICO BUREAU OF MINE INSPECTION.

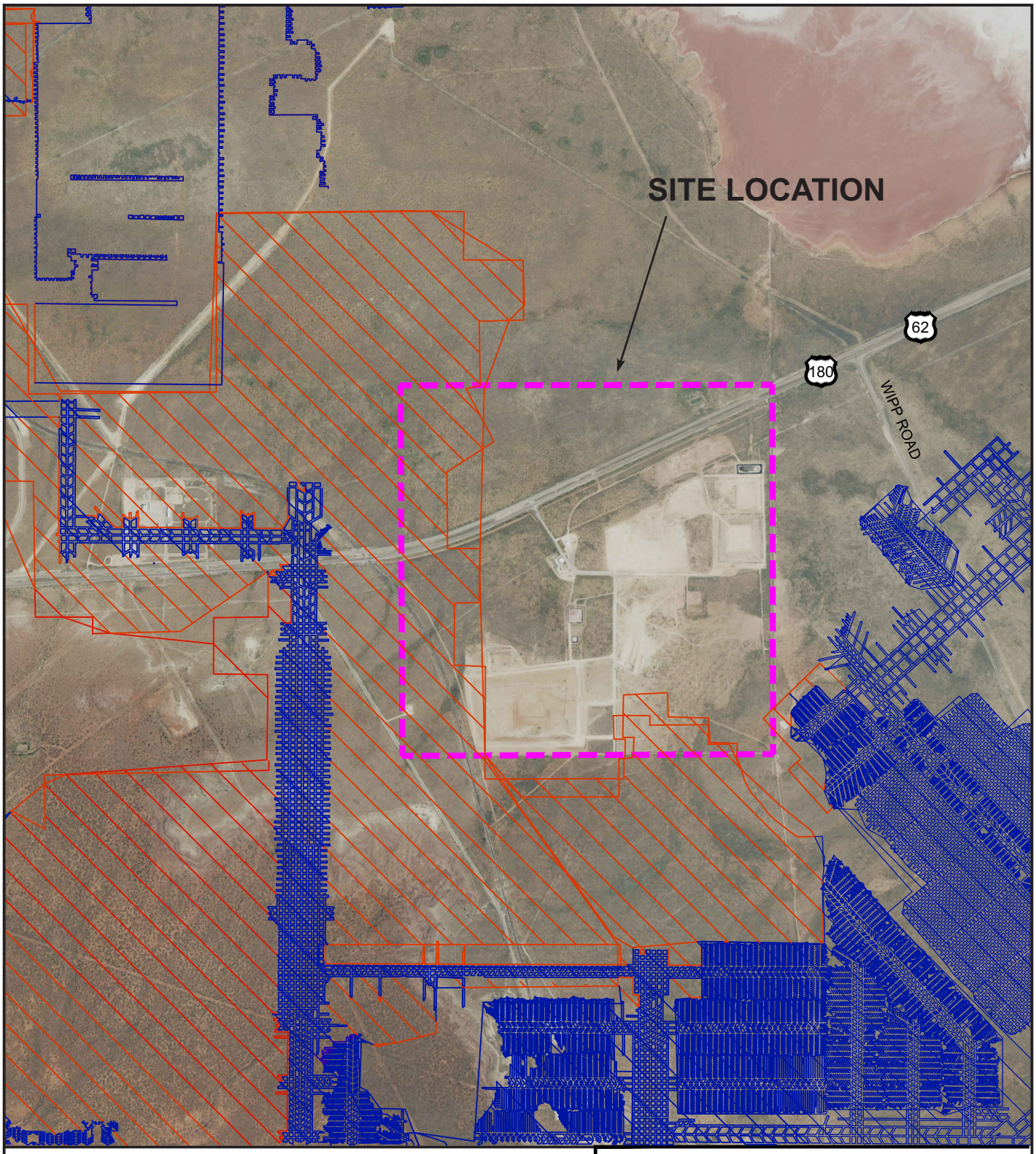
Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\MINES.dwg
Date/Time:Mar. 25, 2019-09:19:42 ; LAYOUT: A (P)


# MINES, MILLS, AND QUARRIES

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/14/2019 | CAD: MINES.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.9 |
| APPROVED BY: CWF | www.team-psc.com | |




## LEGEND

- SITE BOUNDARY
- EXISTING UNDERGROUND MINE WORKS
- MINERAL LEASE AREAS

NORTH

0 1000' 2000'

NOTES:
1. IMAGE REFERENCE: NAIP 2016
2. GEOGRAPHIC CENTER 32° 31' 46.77 -103° 47' 18.25

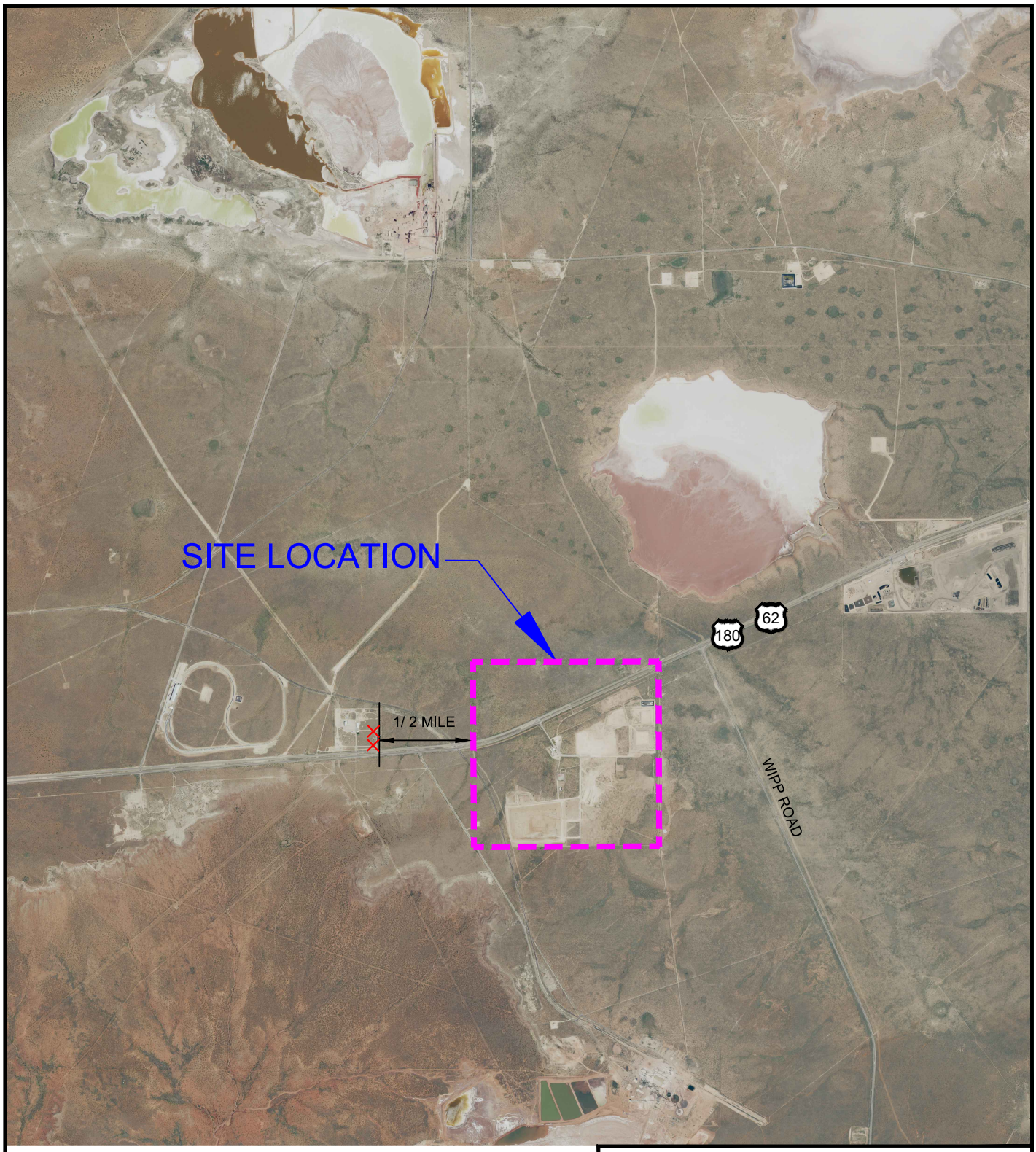
Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\AERIAL IMAGE POTASH.dwg
Date/Time:Mar. 29, 2019-09:43:58 ; LAYOUT: A (P)


# SUBSURFACE MINING ACTIVITY

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/14/2019 | CAD: POTASH IMAGE.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.10 |
| APPROVED BY: CWF | www.team-psc.com | |




## LEGEND

- SITE BOUNDARY
- RESIDENCE

NORTH

0 2000' 4000'

NOTES:
1. IMAGE REFERENCE: NAIP 2016
2. GEOGRAPHIC CENTER 32° 31' 56.77 -103° 47' 18.25

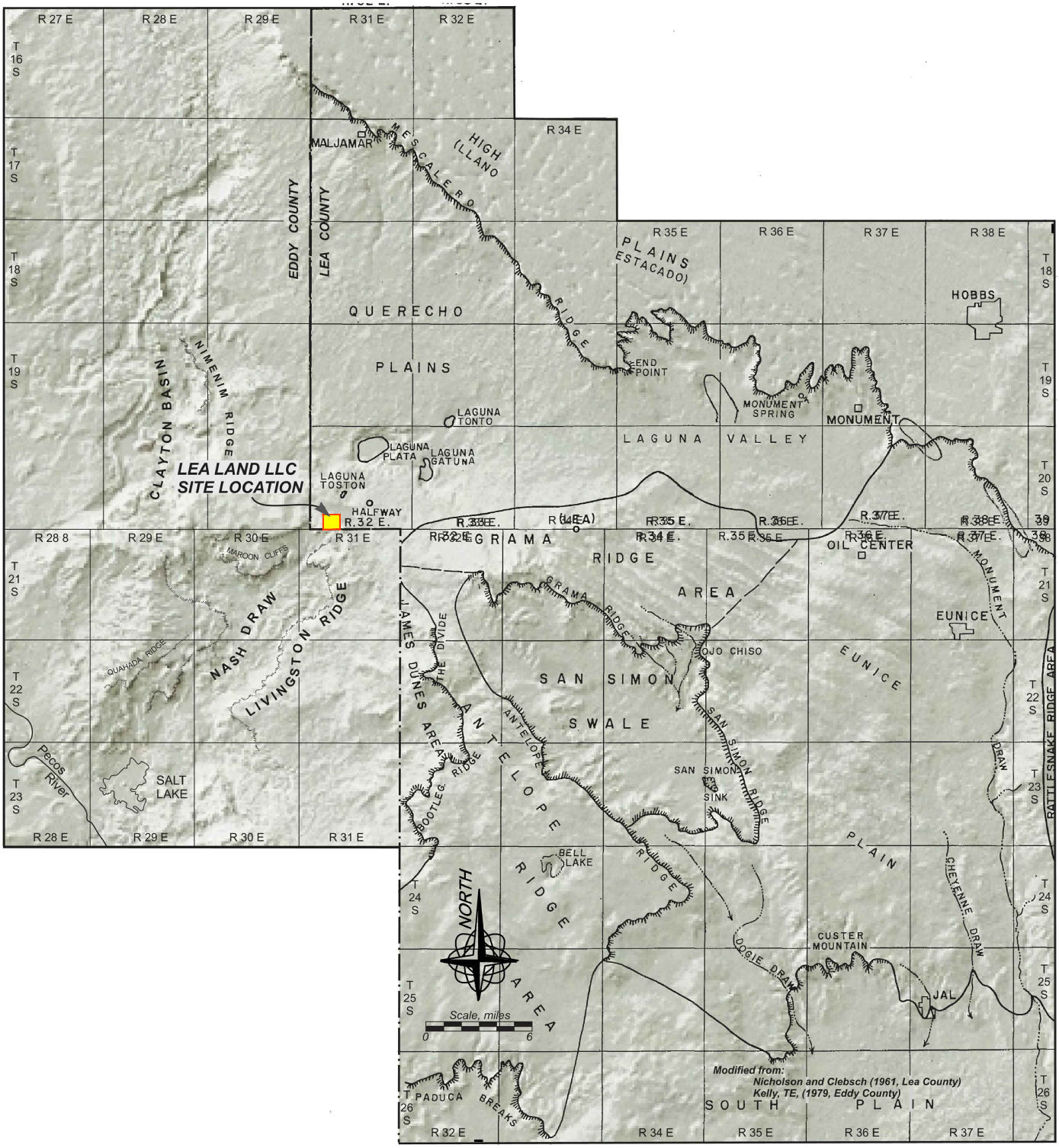
Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\RAI2\AERIAL IMAGE.dwg
Date/Time:Jul. 18, 2019-16:38:25 ; LAYOUT: A (P)


# AERIAL PHOTOGRAPH

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/14/2019 | CAD: AERIAL IMAGE.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.11 |
| APPROVED BY: CWF | www.team-psc.com | |




# REGIONAL PHYSIOGRAPHY

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

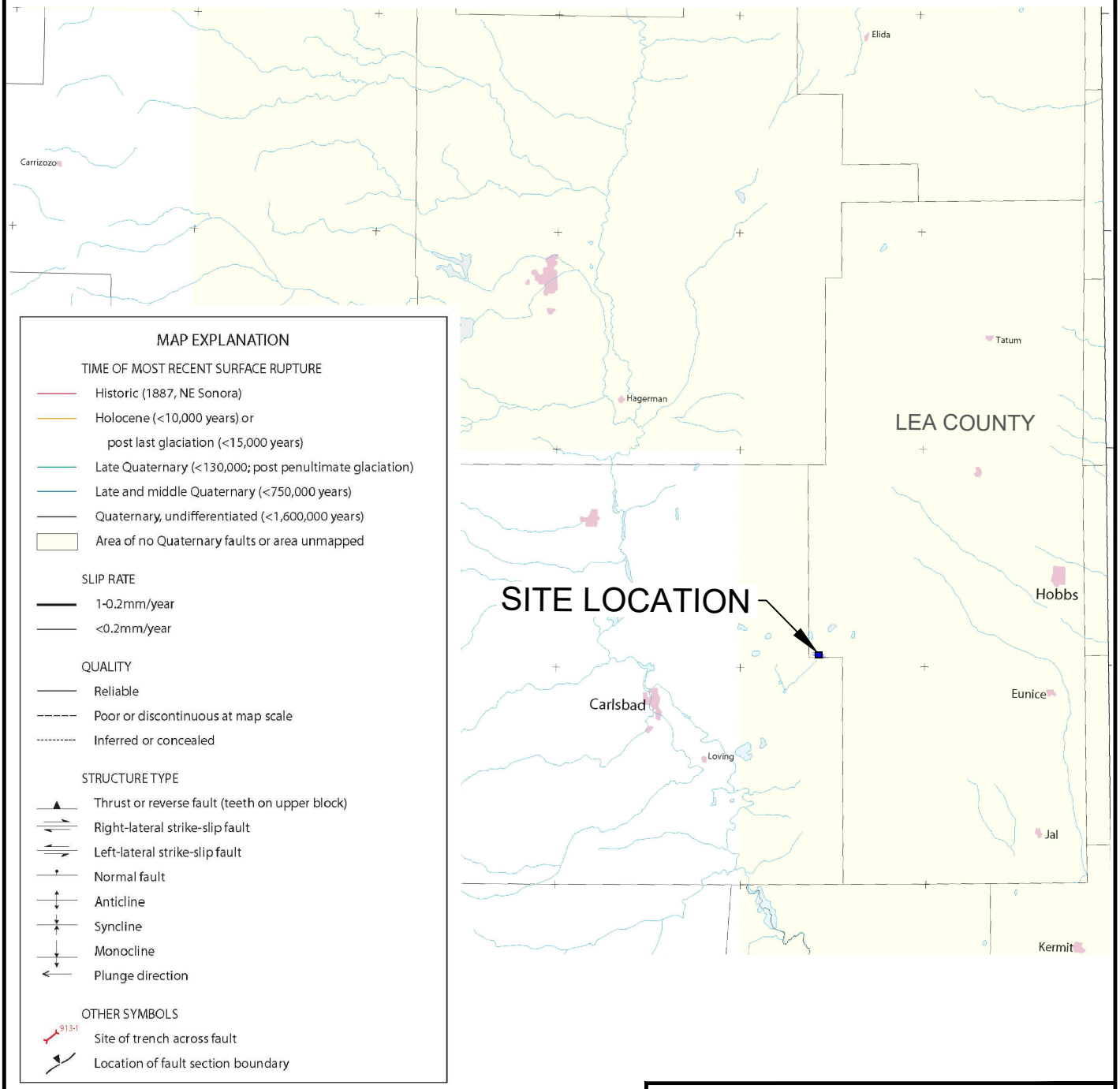
NOTES:

1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 N, -103° 47' 18.25 W


GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991


| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD: PHYSIOGRAPHY.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.12 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\PHYSIOGRAPHY.dwg
Date/Time:Mar. 25, 2019-13:14:34 ; LAYOUT: Layout A (P)




MAP EXPLANATION

TIME OF MOST RECENT SURFACE RUPTURE
- Historic (1887, NE Sonora)
- Holocene (<10,000 years) or post last glaciation (<15,000 years)
- Late Quaternary (<130,000; post penultimate glaciation)
- Late and middle Quaternary (<750,000 years)
- Quaternary, undifferentiated (<1,600,000 years)
- Area of no Quaternary faults or area unmapped

SLIP RATE
- 1-0.2mm/year
- <0.2mm/year

QUALITY
- Reliable
- Poor or discontinuous at map scale
- Inferred or concealed

STRUCTURE TYPE
- Thrust or reverse fault (teeth on upper block)
- Right-lateral strike-slip fault
- Left-lateral strike-slip fault
- Normal fault
- Anticline
- Syncline
- Monocline
- Plunge direction

OTHER SYMBOLS
- 913-1 Site of trench across fault
- Location of fault section boundary

FAULT DATA FROM:
USGS Open File Report OFR 98–521 (digital version)
Map of Quaternary faults and folds in New Mexico and adjacent areas, 1998, by Michael N. Machette, Stephen F. Personius, Keith I. Kelson. Kathleen M. Haller, and Richard L. Dart.

NORTH

0 12 24 MILES

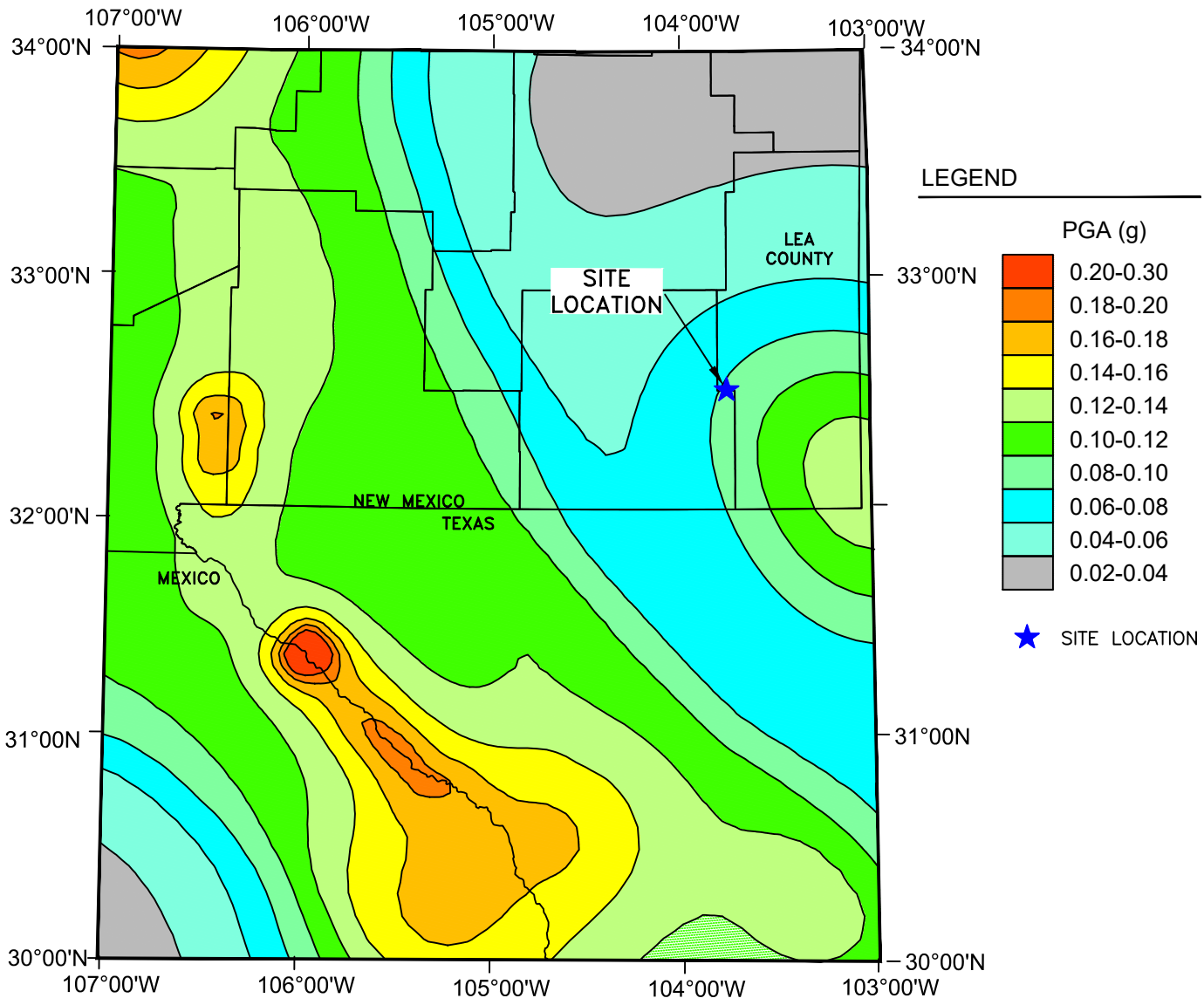
# QUATERNARY FAULTS MAP

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON PSC ENVIRONMENTAL
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/14/2019 | CAD: FAULTS.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.13 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\FAULTS.dwg
Date/Time:Mar. 25, 2019-09:43:20 ; LAYOUT: A (P)




Peak Horizontal Ground Acceleration (g) with 10% Probability of Exceedance in 250 Years

NOTES:

1.) SEISMIC DATA FROM: USGS NATIONAL HAZARD MAPPING PROJECT GIS DATA and Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008-1128, 61.

2.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 -103° 47' 18.25

3.) Peak Horizontal Ground Acceleration (g) with 10% Probability of Exceedance in 250 Years For the Site = 0.125(g)

NORTH

0 25 MILES 50 MILES

# SEISMIC IMPACT ZONES MAP

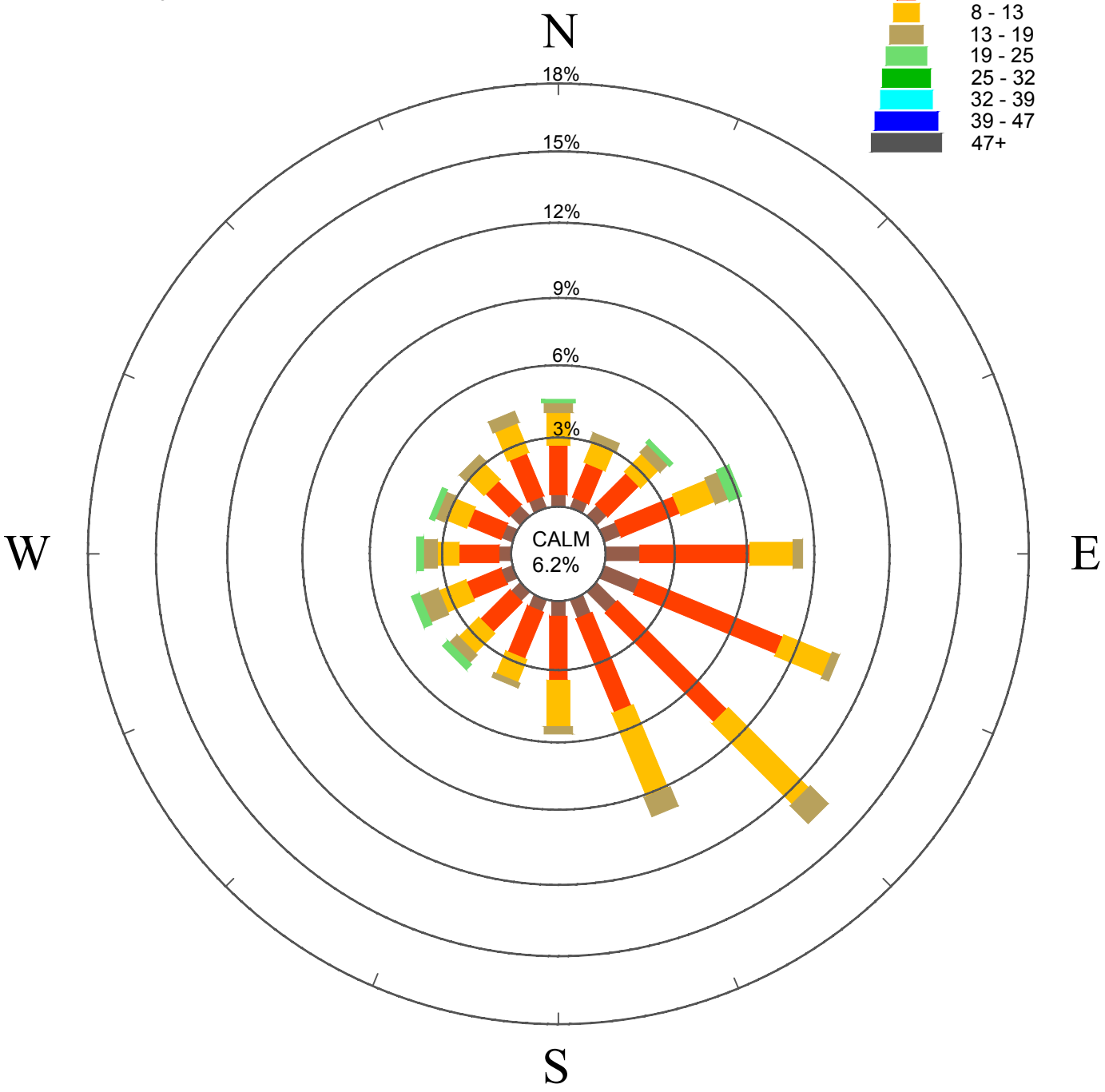
LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/14/2019 | CAD: SEISMIC FIGURE.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.14 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\SEISMIC FIGURE.dwg
Date/Time:Mar. 25, 2019-09:27:28 ; LAYOUT: Layout A (P)

STATION: PADUCA, NEW MEXICO
LATITUDE: 32° 10' 47" N
LONGITUDE: -103° 43' 18" W
ELEVATION: 3510 FT
ELEMENT: WIND SPEED




START DATE: DEC. 1, 2008
END DATE: DEC.31 2018
# OF DAYS: 3683 OF 3683
# OBS: Poss: 87196 of 88392
WESTERN REGIONAL CLIMATE CENTER

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\WINDROSE.dwg
Date/Time:Mar. 21, 2019-13:41:45 ; LAYOUT: A (P)


# WIND ROSE

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/14/2019 | CAD: WINDROSE.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.1.15 |
| APPROVED BY: CWF | www.team-psc.com | |

# ATTACHMENT IV.1.A

# WATERSHED REPORT OFFICE OF WATER USEPA

Lithologic Log, Completion and Hydrologic Data
Well 20.32.22.33 (BLM Potash Study, Geohydrology Associates, 1979)

Well 20.32.22.33; drilled November 8, 1978

| Top | Thickness | Description |
|---|---|---|
| 0 | 3 | sand, brownish-buff, medium-fine texture (aeolian) 6" organic profile |
| 3 | 9 | caliche, white, medium to strong formation |
| 12 | 18 | sand, pinkish buff, medium-fine texture, calcareous cement |
| 30 | 10 | shale, brown, clayey with laminae of greenish-gray medium crystalline, anhydrite |
| 40 | 20 | shale, brown, silty |
| 60 | 10 | shale, red-brown, silty, clayey, has minor amount thin laminae of green silty shale |
| 70 | 10 | as above, but no green shale |
| 80 | 20 | shale, red-brown, clayey with laminae of green clayey-silty shale |

Well 20.32.22.33 continued

| Top | Thickness | Description |
|---|---|---|
| 100 | 10 | as above, but no green shale |
| 110 | 30 | shale, brown, silty |
| 140 | 10 | shale, brown-silty, clayey, has laminae of gray silty shale |
| 150 | 10 | shale, brown, clayey, has laminae of greenish gray silty shale |
| 160 | 10 | shale, reddish brown, silty-clayey, has greenish gray inclusions, has small nodules of maroon limestone |

Total Depth - 170'

Driller encountered water at 35' (probably perched brine from Laguna Toston)
Casing perforated - 150-179' below LSD
Bailing results - estimates 12-15 gpm
Tastes fresh
Measurement: February 28, 1979: Water level - 30' below LSD

Gamma logs, continued.

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
ALBUQUERQUE, NEW MEXICO

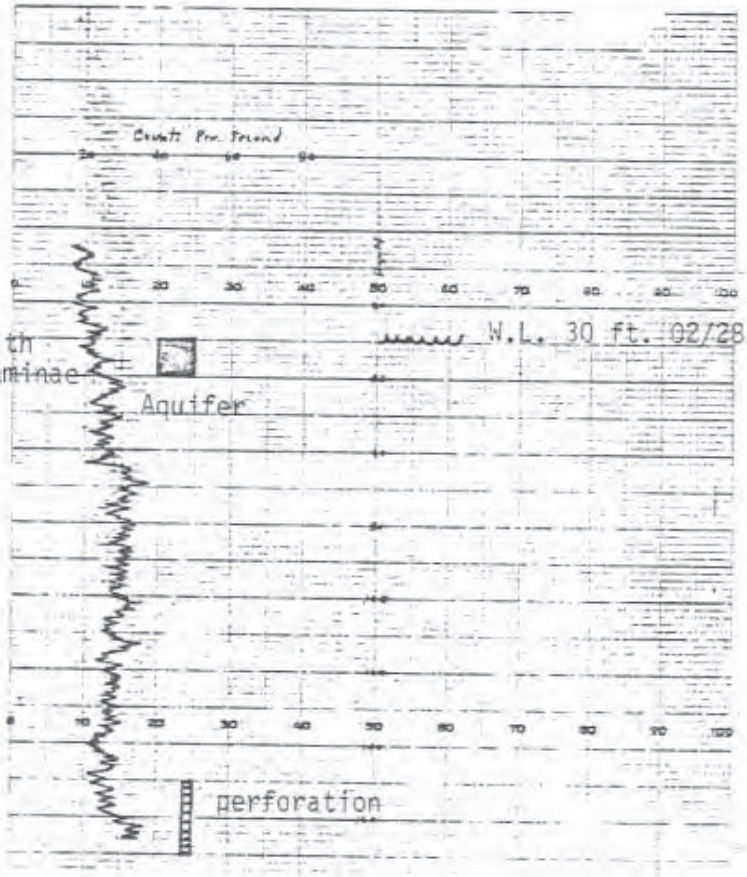
20.32.22.33

LOG HEADING

LOCATION NO. 20.34.12.230

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| OWNER | B.L.M. | SEC. 28 | TWP. 20S | RNG. 32E | OPERATOR(S) Hudson | | |
| PROJECT | WELL NO. | COUNTY Lea | STATE N. Mex. | DATE Feb 28 1979 | | | |
| DEPTH-DRILLER 170 | CASING | | THICKNESS | BORE SIZE | | | |
| DEPTH-LOGGER 166 | Diam. 3 in. ____ Ft. to ____ Ft. | | PVC | Diam. ____ in. ____ Ft. to ____ Ft. | | | |
| INTERVAL LOGGED Total | Diam. ____ in. ____ Ft. to ____ Ft. | | | Diam. ____ in. ____ Ft. to ____ Ft. | | | |
| LOG MEAS. FROM G.L. | ELEVATIONS KB. | DF. | GL. | TC. | PERFORATIONS | | |
| DRILLERS MEAS. FROM G.L. | TYPE FLUID | | LEVEL | DENSITY LB/Gal | ____ Ft. to ____ Ft. | | |

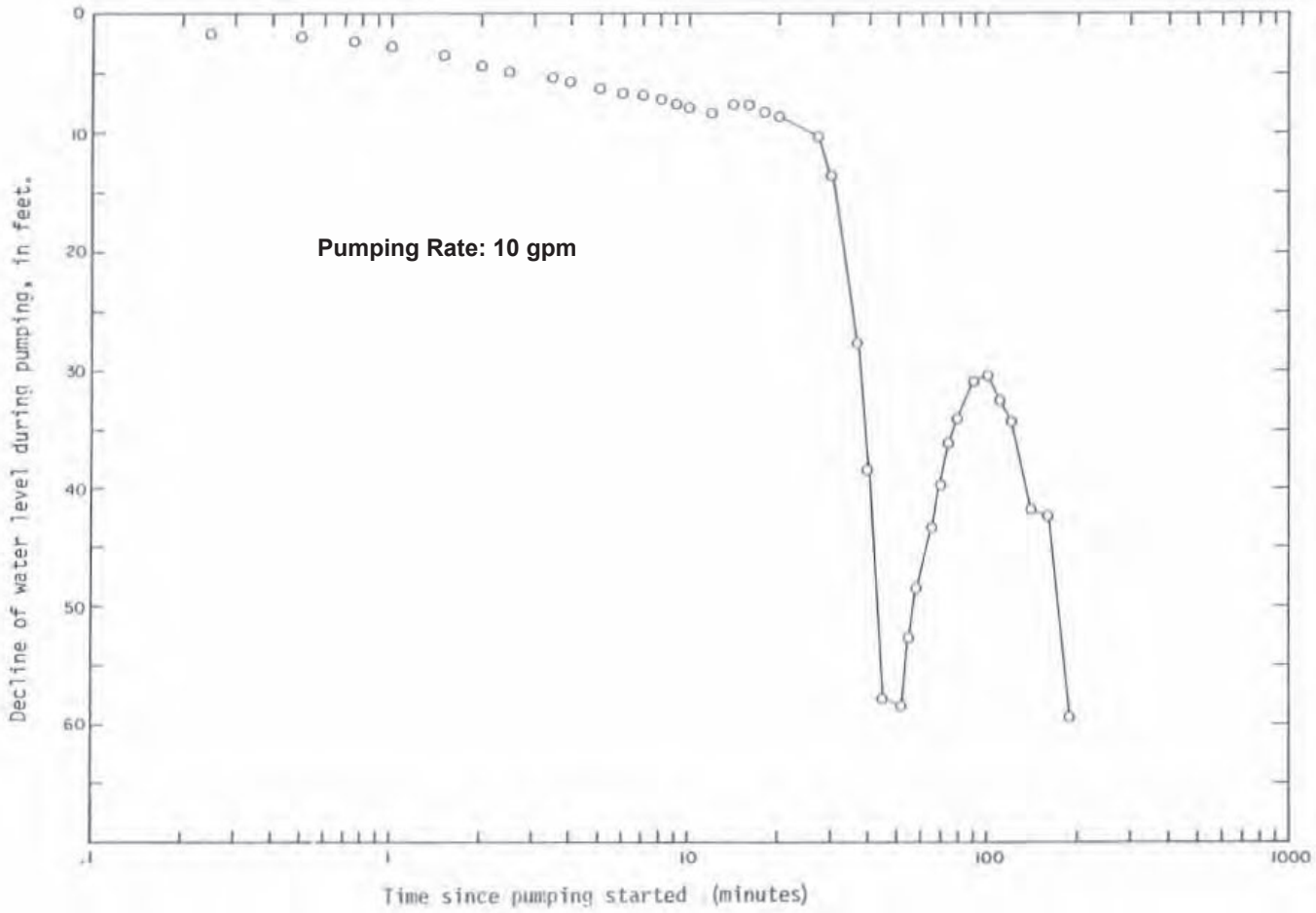
| NUCLEAR RADIATION | | | | | | ELECTRIC LOG | |
|---|---|---|---|---|---|---|---|
| CHANNEL NO. | 1 | 2 | 3 | 4 | REMARKS | DEPTH | Ft. |
| DEPTH | 166 | | | | | RESISTIVITY | Ohms |
| RANGE CPS 5 in. | 100 | | | | | S.P. PER MO. | MV |
| SPAN | 1.0 | | | | | VERTICAL SCALE | Ft/in |
| POSITION | 10.0 | | | | | CALIPER | |
| TIME CONSTANT Sec. | 2 | | | | | VERTICAL SCALE | Ft/in |
| LOGGING SPEED Ft/Min | 20 | | | | | HORIZONTAL SCALE | in/in |
| VERTICAL SCALE Ft/in | 20 | | | | | OTHER | |
| WATER LEVEL Ft. | 30 | | | | | DEPTH | Ft. |
| DIGITAL RECORD | | | | | | RANGE | |
| TYPE LOG | Gamma | | | | | | |




Aquifer Test

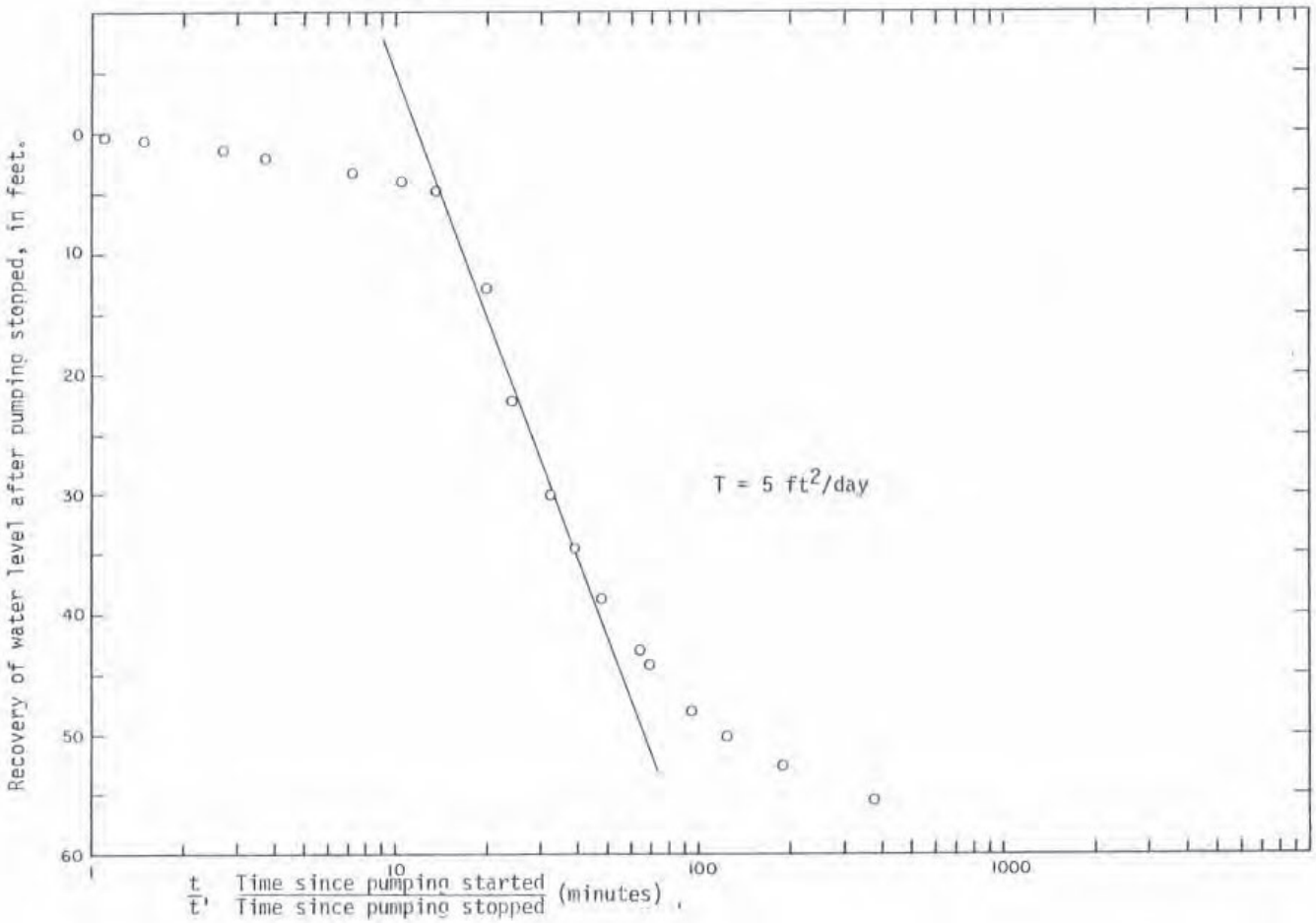
Transmissivity
5 $ft^2$/day

Drawdown and recovery curves.




Plot of drawdown data for well at 20.32.22.33.

Drawdown and recovery curves.




Plot of recovery data for well at 20,32.22.33.

# Albuquerque Analytical, Inc.

[505] 266-9106
[505] 294-6310 Nights

4115 Silver S.E.
Albuquerque, N.M. 87108


No. 8804

Rec'd. Feb. 2, 1979

## WATER ANALYSIS

Owner Geohydrology & Associates Address 3225 Candelaria Road NE

Appearance and Data 20.32.22.33 Chemist Joan M. Brown

| | mg/l | meq/l |
|---|---|---|
| Aluminum | | |
| Ammonium | | |
| Arsenic | | |
| Barium | | |
| Cadmium | | |
| Calcium | 105. | |
| Chromium (T) | <0.02 | |
| Cobalt | | |
| Copper | | |
| Gold | | |
| Iron | | |
| Lead | | |
| Lithium | | |
| Magnesium | 92. | |
| Manganese | | |
| Mercury | | |
| Nickel | | |
| Potassium | 33.5 | |
| Silver | | |
| Sodium | 325. | |
| Uranium ($U_3O_8$) | | |
| Zinc | | |

| | mg/l | meq/l |
|---|---|---|
| Beryllium ($BeO_3^-$) | | |
| Bicarbonate | 0.3 | |
| Boron ($BO_2^-$) | | |
| Bromide | | |
| Carbonate | | |
| Chloride | 75. | |
| Cyanide | | |
| Fluoride | | |
| Hydroxide | | |
| Iodide | | |
| Molybdenum ($MoO_4^-$) | | |
| Nitrate | | |
| Nitrite | | |
| Phosphate (Tot.) | | |
| Phosphate (Meta) | | |
| Phosphate (Ortho) | | |
| Selenium ($SeO_4^-$) | | |
| Sulfate | 550. | |
| Sulfite | | |
| Tellurium ($TeO_3^-$) | | |
| Vanadium | | |
| Chromium + 6 | <0.02 | |

| | | |
|---|---|---|
| Acidity | | ppm |
| Alkalinity | | ppm |
| BOD | | ppm |
| Chlorine | | ppm |
| COD | | ppm |
| Color | | PCU |
| Conductance | | µmho/cm |
| Dissolved $O_2$ | | ppm |
| Hardness | | ppm |
| $H_2S$ | | ppm |
| Hydrazine | | ppm |
| Odor | | T.O. |
| pH | | |
| Phenols | | ppm |
| Silica | | ppm |
| Solids (Tot.) | | ppm |
| Solids (Tot. Diss.) | 3136. | ppm |
| Solids (Tot. Susp.) | | ppm |
| Solids ( ) | | ppm |
| Surfactant | | ppm |
| Turbidity | | JTU |
| Volatile Acids | | ppm |

Lithologic Log, Completion and Hydrologic Data
Well 20.32.31.13 (BLM Potash Study, Geohydrology Associates, 1979)

Well 20.32.31.13; drilled November 8, 1978

| Top | Thickness | Description |
|---|---|---|
| 0 | 10 | sand, buff medium to fine texture, moderate caliche formation |
| 10 | 13 | sand, brown-buff, fine to medium texture, leached carbonate |
| 23 | 13 | shale, reddish brown, silty with clayey laminae |
| 36 | 4 | shale, greenish gray, silty, sandy |
| 40 | 30 | shale, brown, silty-clayey shale, reddish brown |
| 70 | 10 | silty-clayey, has a bed of greenish-gray siltstone |
| 80 | 20 | shale, brown, clayey |
| 100 | 20 | as above, but more silt |
| 120 | 30 | shale, brown, clayey, interbedded with limestone, brown, fine crystalline |
| 150 | 10 | shale, brown, clayey-silty |
| 160 | 10 | as above, but reddish brown |
| 170 | 10 | shale, brown, silty-clayey, has zones of superior cementation along bedding, probably calcite |
| 180 | 10 | shale, brown, clayey, fairly cohesive from cementation |
| 190 | 10 | shale, brown, varigated clayey to silty, has greenish gray inclusions |
| 200 | 20 | shale, greenish to gray, silty, interbedded with brown silty shale |
| 220 | 20 | shale, reddish brown silty zones of calcite cementation along bedding |
| 240 | 10 | shale, reddish brown, clayey |

Well 20.32.31.13 continued

Total Depth - 250'

Water level-drilled dry, never encountered moist sediments
Casing perforated - 230-250' below LSD
Bailing results - bailing showed about 8' water in hole (probably residual from drilling) - dry ; DTW 135.12' March 15, 1979

Gamma logs, continued.

**U.S. GEOLOGICAL SURVEY**
WATER RESOURCES DIVISION
ALBUQUERQUE, NEW MEXICO

20.32.31.13

**LOG HEADING**

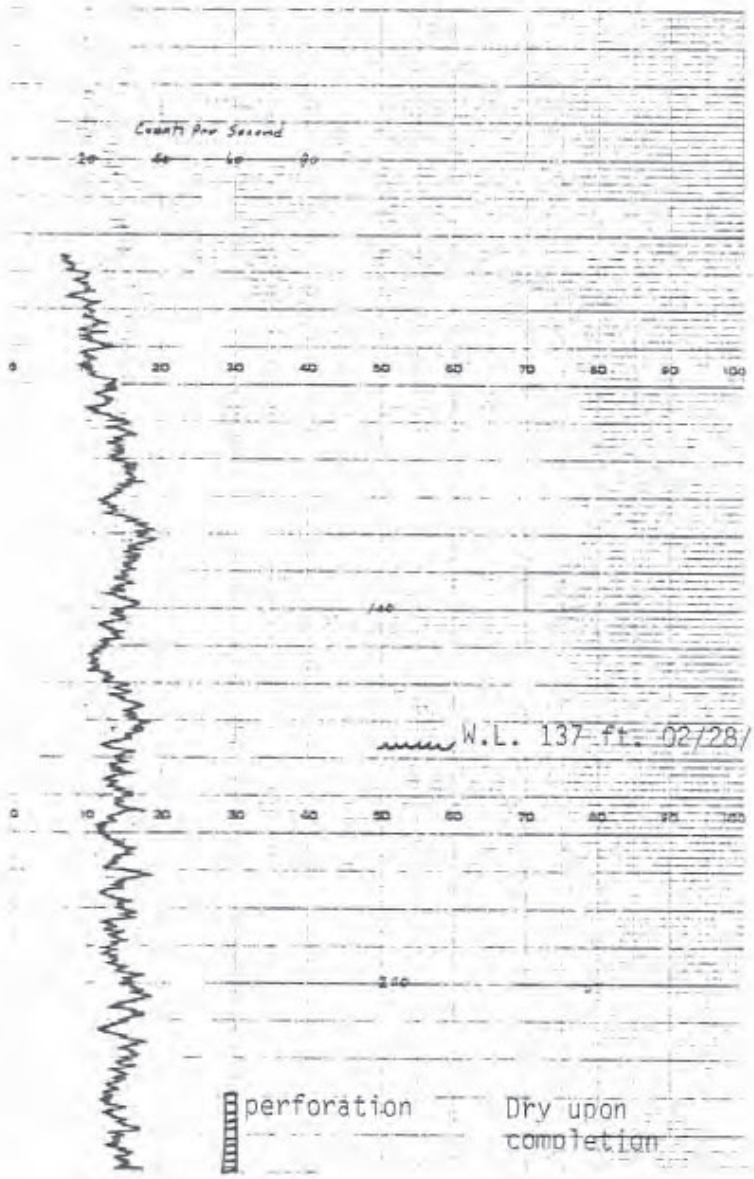
LOCATION NO. 20.32.31.130

| | | | | | |
|---|---|---|---|---|---|
| OWNER | D. L. H. | SEC. 31 | TWP. 20S | RNG. 32E | OPERATOR(S) Hudson |
| PROJECT | | HOLE NO. | COUNTY Lea | STATE N. Mex. | DATE Feb. 28, 79 |
| DEPTH-DRILLER | 250 | CASING | | THICKNESS | BORE SIZE |
| DEPTH-LOGGER | 249 | Diam. 3 in. ____ Ft. to ____ Ft. | | PVC | Diam. ____ in. ____ Ft. to ____ Ft. |
| INTERVAL LOGGED | Total | Diam. ____ in. ____ Ft. to ____ Ft. | | | Diam. ____ in. ____ Ft. to ____ Ft. |
| LOG MEAS. FROM | G. L. | ELEVATIONS KB. | DF. | GL. | TC. |
| DRILLERS MEAS. FROM | G. L. | TYPE FLUID | | LEVEL | DENSITY Lb/Gal |

PERFORATIONS
____ Ft. to ____ Ft.
____ Ft. to ____ Ft.

| NUCLEAR RADIATION | | | | | | ELECTRIC LOG | |
|---|---|---|---|---|---|---|---|
| CHANNEL NO. | 1 | 2 | 3 | 4 | REMARKS | DEPTH | Ft. |
| DEPTH | 244 | | | | | RESISTIVITY | Ohms |
| RANGE CPS 5 in. | 100 | | | | | S.P. PEN NO. | mv |
| SPAN | 1.0 | | | | | VERTICAL SCALE | Ft/in |
| POSITION | 10.0 | | | | | CALIPER | |
| TIME CONSTANT Sec. | 2 | | | | | VERTICAL SCALE | Ft/in |
| LOGGING SPEED Ft/min | 20 | | | | | HORIZONTAL SCALE | in/in |
| VERTICAL SCALE Ft/in | 20 | | | | | OTHER | |
| WATER LEVEL Ft. | 137 | | | | | DEPTH | Ft. |
| DIGITAL RECORD | | | | | | RANGE | |
| TYPE LOG | Gamma | | | | | | |

No Test



Lithologic Log, Completion and Hydrologic Data
Well 21.31.3.22 (BLM Potash Study, Geohydrology Associates, 1979)

Well 21.31. 3.22; drilled November 9, 1978

| Top | Thickness | Description |
|---|---|---|
| 0 | 18 | caliche, white, moderate to strong formation |
| 18 | 12 | sand, brown-buff, medium-fine texture, calcareous cement |
| 30 | 10 | shale, buff-red, silty, calcareous laminae |
| 40 | 10 | shale, red, clayey with some silt |
| 50 | 10 | shale, mottled red, greenish gray, has sandy laminae but mostly silt |
| 60 | 10 | shale, brown, silty, with clayey laminae, has greenish gray inclusions |
| 70 | 10 | shale, reddish, brown, silty, has good cement, some laminae (calcite) (these laminae are gray-red) |
| 80 | 10 | as above, but subequal amounts of silt and clay |
| 90 | 10 | shale, red, silty, ahs clayey laminae |
| 100 | 20 | shale, brownish red, silty, has laminae with calcite cement |
| 120 | 10 | as above, but more calcite zones (mineralized with crystalline calcite) |
| 130 | 10 | shale, brownish red, silty |
| 140 | 10 | as above, but has clayey laminae |
| 150 | 10 | shale, brownish red, silty, has calcite mineralized laminae |
| 160 | 10 | shale, red, clayey, has laminae of silty greenish gray shale |
| 170 | 10 | shale, reddish brown, silty |
| 180 | 10 | as above, but has laminae of greenish gray shale |
| 190 | 10 | shale, brownish red, subequal amounts of silt and clay, has greenish gray laminae, silty |

Total Depth - 200'

Driller encountered water at 150' below LSD
Casing perforated 140-160' below LSD
Bailing results - estimates 8 gpm
Water level on completion - 128' below LSD
Measurement: February 28, 1979: Water level - 142' below LSD

Gamma logs, continued.

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
ALBUQUERQUE, NEW MEXICO

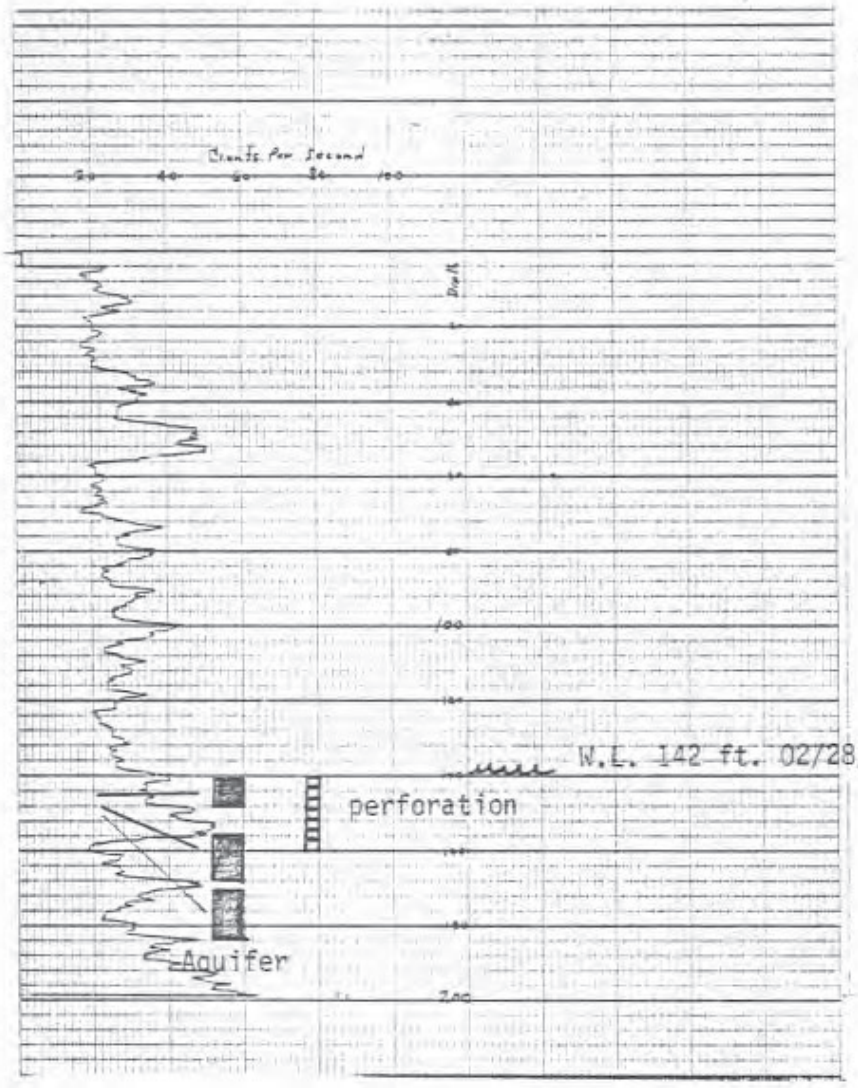
21.31.3.22

LOG HEADING

LOCATION NO. 21-31-3-[illegible]

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OWNER | BLM | SEC. 3 | TWP. 21S | RNG. 32E | OPERATOR(S) Pugh | | | | |
| PROJECT | HOLE NO. | COUNTY Lea | STATE N Mex | DATE Feb 28, 1979 | | | | | |
| DEPTH-DRILLER | 200 | CASING Diam. 2 in. ____ Ft. to ____ Ft. | THICKNESS PVC | BORE SIZE Diam. ____ in. ____ Ft. to ____ Ft. | | | | | |
| DEPTH-LOGGER | 199 | Diam. ____ in. ____ Ft. to ____ Ft. | | Diam. ____ in. ____ Ft. to ____ Ft. | | | | | |
| INTERVAL LOGGED | Total | Diam. ____ in. ____ Ft. to ____ Ft. | | Diam. ____ in. ____ Ft. to ____ Ft. | | | | | |
| LOG MEAS. FROM G.L. | ELEVATIONS KB. | DF. | GL. | TD. | PERFORATIONS ____ Ft. to ____ Ft. | | | | |
| DRILLERS MEAS. FROM G.L. | TYPE FLUID | | LEVEL | DENSITY Lb/Gal | ____ Ft. to ____ Ft. | | | | |

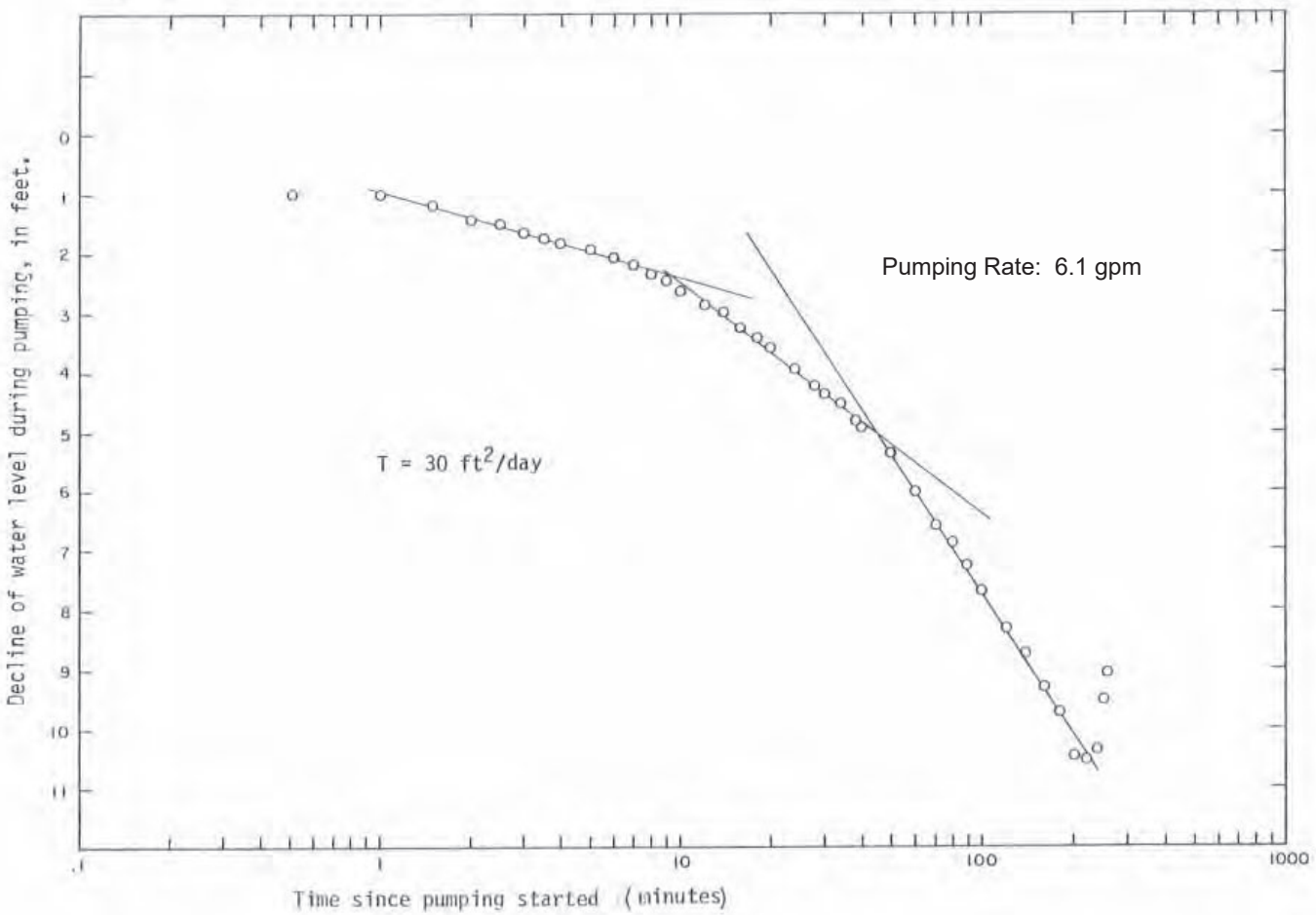
| NUCLEAR RADIATION | | | | | | ELECTRIC LOG | |
|---|---|---|---|---|---|---|---|
| CHANNEL NO. | 1 | 2 | 3 | 4 | REMARKS | DEPTH | Ft. |
| DEPTH | 199 | | | | | RESISTIVITY | Ohms |
| RANGE CPS 5 in. | 100 | | | | | S.P. PER MV. | MV |
| SPAN | 10 | | | | | VERTICAL SCALE | Ft/in |
| POSITION | 100 | | | | | CALIPER | |
| TIME CONSTANT Sec. | 2 | | | | | VERTICAL SCALE | Ft/in |
| LOGGING SPEED Ft/Min | 20 | | | | | HORIZONTAL SCALE | In/in |
| VERTICAL SCALE Ft/In | 20 | | | | | OTHER | |
| WATER LEVEL Ft. | 142 | | | | | DEPTH | Ft. |
| DIGITAL RECORD | | | | | | RANGE | |
| TYPE LOG | Gamma | | | | | | |




Aquifer Test
Transmissivity
35 $ft^2$/day

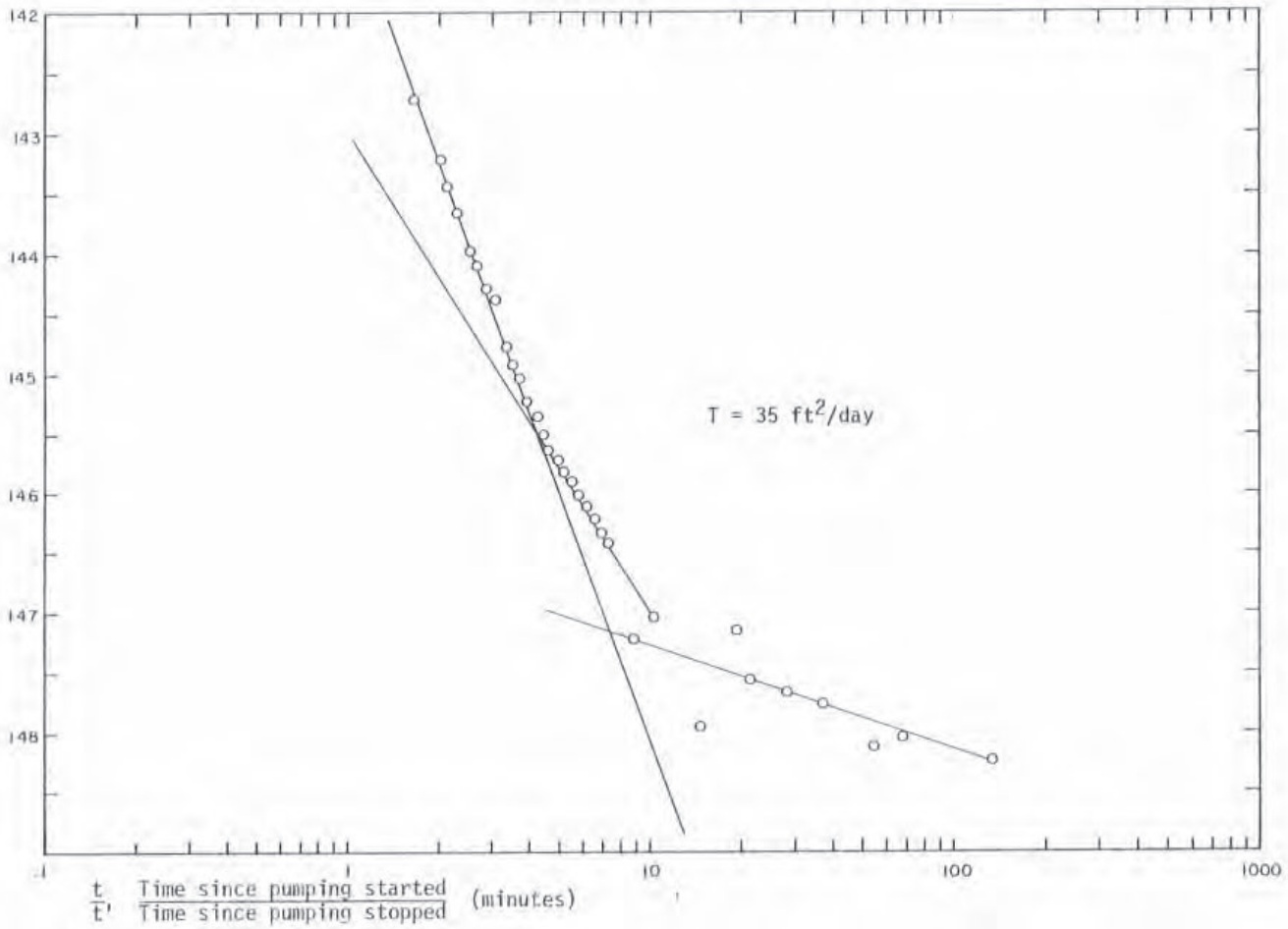
silty shale

Drawdown and recovery curves.




Plot of drawdown data for well at 21.31.3.22.

Drawdown and recovery curves.




Plot of recovery data for well at 21.31.3.22.

# Albuquerque Analytical, Inc.

[505] 266-9106
[505] 294-6310 Nights

4115 Silver S.E.
Albuquerque, N.M. 87108

No. 8804

Rec'd Feb. 2, 1979

## WATER ANALYSIS

Owner Geohydrology & Associates Address 3225 Candelaria Road NE

Appearance and Data 21.31.3.22 Chemist [signature]

| | mg/l | meq/l |
|---|---|---|
| Aluminum | | |
| Ammonium | | |
| Arsenic | | |
| Barium | | |
| Cadmium | | |
| Calcium | 19.9 | |
| Chromium (T) | <0.02 | |
| Cobalt | | |
| Copper | | |
| Gold | | |
| Iron | | |
| Lead | | |
| Lithium | | |
| Magnesium | 17.5 | |
| Manganese | | |
| Mercury | | |
| Nickel | | |
| Potassium | 3.55 | |
| Silver | | |
| Sodium | 19.6 | |
| Uranium ($U_3O_8$) | | |
| Zinc | | |

| | mg/l | meq/l |
|---|---|---|
| Beryllium ($BeO_3^=$) | | |
| Bicarbonate | | |
| Boron ($BO_2^-$) | <0.05 | |
| Bromide | | |
| Carbonate | | |
| Chloride | 18. | |
| Cyanide | | |
| Fluoride | | |
| Hydroxide | | |
| Iodide | | |
| Molybdenum ($MoO_4^=$) | | |
| Nitrate | | |
| Nitrite | | |
| Phosphate (Tot.) | | |
| Phosphate (Meta) | | |
| Phosphate (Ortho) | | |
| Selenium ($SeO_4^=$) | | |
| Sulfate | 20. | |
| Sulfite | | |
| Tellurium ($TeO_3^=$) | | |
| Vanadium | | |
| chromium + 6 | <0.02 | |

| | | |
|---|---|---|
| Acidity | | ppm |
| Alkalinity | | ppm |
| BOD | | ppm |
| Chlorine | | ppm |
| COD | | ppm |
| Color | | PCU |
| Conductance | | μmho/cm |
| Dissolved $O_2$ | | ppm |
| Hardness | | ppm |
| $H_2S$ | | ppm |
| Hydrazine | | ppm |
| Odor | | T.O. |
| pH | | |
| Phenols | | ppm |
| Silica | | ppm |
| Solids (Tot.) | | ppm |
| Solids (Tot. Diss.) | 424. | ppm |
| Solids (Tot. Susp.) | | ppm |
| Solids ( ) | | ppm |
| Surfactant | | ppm |
| Turbidity | | JTU |
| Volatile Acids | | ppm |

# ATTACHMENT IV.1.B

# INTERGRATED LIST, STATE OF NEW MEXICO CLEAN WATER ACT

# 2018-2020
# State of New Mexico
# Clean Water Act
# Section 303(d)/
# Section 305(b)
# Integrated Report

# Appendix A
# 303(d)/305(b) List

**Prepared by:**
New Mexico Environment Department
Surface Water Quality Bureau
1190 St. Francis Drive
Santa Fe, New Mexico 87505
https://www.env.nm.gov/surface-water-quality/

**III. Abbreviations in Assessment Unit Names**

The size of the assessment unit name is limited to 60 characters by the database. Therefore, the following abbreviations were used when necessary:

| | | |
|---|---|---|
| abv | = | above |
| AZ | = | Arizona |
| blw | = | below |
| bnd | = | boundary |
| BNSF | = | Burlington Northern – Santa Fe |
| Campgrd | = | Campground |
| Ck | = | Creek |
| Cny | = | Canyon |
| CO | = | Colorado |
| CR | = | County Road |
| confl | = | confluence |
| Div | = | Diversion |
| E | = | East |
| Fk | = | Fork |
| FS | = | Forest Service (usually road) |
| hdwtrs | = | headwaters |
| HWY | = | Highway |
| I | = | Interstate highway |
| Irr | = | irrigation |
| LANL | = | Los Alamos National Laboratory |
| M | = | Middle |
| mi | = | mile |
| N | = | North |
| NM | = | New Mexico |
| nr | = | near |
| NWR | = | National Wildlife Refuge |
| OK | = | Oklahoma |
| prt | = | Portion (i.e., reaches) |
| R | = | River or Rio |
| rd | = | road |
| RR | = | railroad |
| Rsvr | = | Reservoir |
| S | = | South |
| SFNF | = | Santa Fe National Forest |
| Spr | = | Spring |
| SR | = | state road |
| trib | = | tributary |
| TX | = | Texas |
| VCNP | = | Valles Caldera National Preserve |
| xing | = | crossing |
| USFS | = | United States Forest Service |
| W | = | West |
| WWTP | = | waste water treatment plant |

(Table of Contents of Category 5 waters on the following Integrated §303(d)/§305(b) List)

- Charette Lake (Upper)
- Wheaton Creek (Manuelas Creek to headwaters)

**HUC: 11080004 - Mora**

- Coyote Creek (Black Lake to headwaters)
- Coyote Creek (Mora River to Amola Ridge)
- Coyote Creek (Williams Canyon to Black Lake)
- Mora River (USGS gage east of Shoemaker to HWY 434)
- Rito Cebolla (Mora River to Rito Morphy)
- Sapello River (Mora River to Arroyo Jara)

**HUC: 11080005 - Conchas**

- Conchas Reservoir
- Conchas River (Conchas Reservoir to Salitre Creek)

**HUC: 11080006 - Upper Canadian-Ute Reservoir**

- Canadian River (TX border to Ute Reservoir)
- Canadian River (Ute Reservoir to Conchas Reservoir)
- Pajarito Creek (Perennial prt Canadian R to Vigil Canyon)
- Ute Reservoir

**HUC: 11080008 - Revuelto**

- Revuelto Creek (Canadian River to headwaters)

**HUC: 11100101 - Upper Beaver**

- Clayton Lake

**HUC: 13010005 - Conejos**

- Canada Tio Grande (Rio San Antonio to headwaters)
- Rio San Antonio (CO border to Montoya Canyon)
- Rio San Antonio (Montoya Canyon to headwaters)

**HUC: 13020101 - Upper Rio Grande**

- Acid Canyon (Pueblo Canyon to headwaters)
- Arroyo del Palacio (Rio Grande to headwaters)
- Bitter Creek (Red River to headwaters)
- Canada Agua (Arroyo La Mina to headwaters)
- DP Canyon (Grade control to upper LANL bnd)
- DP Canyon (Los Alamos Canyon to grade control)
- Embudo Creek (Canada de Ojo Sarco to Picuris Pueblo bnd)

- Embudo Creek (Rio Grande to Canada de Ojo Sarco)
- Graduation Canyon (Pueblo Canyon to headwaters)
- Grassy Creek (Comanche Creek to headwaters)
- Los Alamos Canyon (DP Canyon to upper LANL bnd)
- Los Alamos Canyon (NM-4 to DP Canyon)
- Pioneer Creek (Red River to headwaters)
- Pojoaque River (San Ildefonso bnd to Pojoaque bnd)
- Pueblo Canyon (Acid Canyon to headwaters)
- Pueblo Canyon (Los Alamos Canyon to Los Alamos WWTP)
- Pueblo Canyon (Los Alamos WWTP to Acid Canyon)
- Red River (Placer Creek to headwaters)
- Red River (Rio Grande to Placer Creek)
- Rio Fernando de Taos (R Pueblo d Taos to USFS bnd at canyon)
- Rio Grande (Embudo Creek to Rio Pueblo de Taos)
- Rio Grande (Ohkay Owingeh bnd to Embudo Creek)
- Rio Grande (Red River to CO border)
- Rio Grande (Santa Clara Pueblo bnd to Ohkay Owingeh bnd)
- Rio Grande del Rancho (R Pueblo de Taos to Rito de la Olla)
- Rio Pueblo (Picuris Pueblo bnd to headwaters)
- Rio Pueblo de Taos (Arroyo del Alamo to R Grande del Rancho)
- Rio Pueblo de Taos (Rio Grande to Arroyo del Alamo)
- Rio Santa Barbara (non-pueblo Embudo Ck to USFS bnd)
- Santa Cruz Lake
- Santa Cruz River (San Clara Pueblo bnd to Santa Cruz Dam)
- South Fork Acid Canyon (Acid Canyon to headwaters)
- Unnamed Arroyo (Rio Pueblo de Taos to Taos WWTP)
- Vidal Creek (Comanche Creek to headwaters)
- Walnut Canyon (Pueblo Canyon to headwaters)

**HUC: 13020102 - Rio Chama**

- Abiquiu Creek (Rio Chama to headwaters)
- Abiquiu Reservoir
- Arroyo del Toro (Rio Chama to headwaters)
- Burns Lake (Rio Arriba)
- Canada de Horno (Rio Chama to headwaters)
- Canjilon Ck (Perennial portions Abiquiu Rsrv to headwaters)
- Canones Creek (Abiquiu Rsvr to Chihuahuenos Ck)
- Canones Creek (Rio Chama to Jicarilla Apache bnd)
- Chihuahuenos Creek (Canones Creek to headwaters)

- Coyote Creek (Rio Puerco de Chama to headwaters)
- El Rito Creek (Perennial reaches above HWY 554)
- El Rito Creek (Perennial reaches below HWY 554)
- Heron Reservoir
- Hopewell Lake
- Placer Creek (Hopewell Lake to headwaters)
- Poleo Creek (Rio Puerco de Chama to headwaters)
- Rio Nutrias (Perennial prt Rio Chama to headwaters)
- Rio Ojo Caliente (Arroyo El Rito to Rio Vallecitos)
- Rio Puerco de Chama (Abiquiu Reservoir to HWY 96)
- Rio Tusas (Perennial prt Rio Vallecitos to headwaters)
- Rio Vallecitos (Rio Tusas to headwaters)
- Rio del Oso (Perennial prt Rio Chama to headwaters)
- Rito Encino (Rio Puerco de Chama to headwaters)
- Rito de Tierra Amarilla (HWY 64 to headwaters)
- Rito de Tierra Amarilla (Rio Chama to HWY 64)
- Sixto Creek (Rio Chamita to CO border)

**HUC: 13020201 - Rio Grande-Santa Fe**

- Ancho Canyon (North Fork to headwaters)
- Ancho Canyon (Rio Grande to North Fork Ancho)
- Arroyo de la Delfe (Pajarito Canyon to headwaters)
- Canada del Buey (within LANL)
- Canon de Valle (LANL gage E256 to Burning Ground Spr)
- Canon de Valle (below LANL gage E256)
- Canon de Valle (upper LANL bnd to headwaters)
- Chaquehui Canyon (within LANL)
- Mortandad Canyon (within LANL)
- North Fork Ancho Canyon (Ancho Canyon to headwaters)
- Pajarito Canyon (Lower LANL bnd to Two Mile Canyon)
- Pajarito Canyon (Two Mile Canyon to Arroyo de La Delfe)
- Pajarito Canyon (upper LANL bnd to headwaters)
- Pajarito Canyon (within LANL above Starmers Gulch)
- Potrillo Canyon (above Water Canyon)
- Rio Grande (Cochiti Reservoir to San Ildefonso bnd)
- Rio Grande (non-pueblo Angostura Div to Cochiti Rsrv)
- Rito de los Frijoles (Rio Grande to headwaters)
- Sandia Canyon (Sigma Canyon to NPDES outfall 001)
- Sandia Canyon (within LANL below Sigma Canyon)

- Santa Fe River (Cienega Creek to Santa Fe WWTP)
- Santa Fe River (Cochiti Pueblo bnd to Cienega Creek)
- Santa Fe River (Guadalupe St to Nichols Rsvr)
- Santa Fe River (Nichols Reservoir to headwaters)
- Santa Fe River (Santa Fe WWTP to Guadalupe St)
- Ten Site Canyon (Mortandad Canyon to headwaters)
- Three Mile Canyon (Pajarito Canyon to headwaters)
- Two Mile Canyon (Pajarito to headwaters)
- Water Canyon (upper LANL bnd to headwaters)
- Water Canyon (within LANL below Area-A Cyn)

**HUC: 13020202 - Jemez**

- Calaveras Creek (Rio Cebolla to headwaters)
- Clear Creek (Rio de las Vacas to San Gregorio Lake)
- Clear Creek (San Gregorio Lake to headwaters)
- East Fork Jemez (San Antonio Creek to VCNP bnd)
- East Fork Jemez (VCNP to headwaters)
- Fenton Lake
- Jaramillo Creek (East Fork Jemez to headwaters)
- Jemez River (Jemez Pueblo bnd to Rio Guadalupe)
- Jemez River (Soda Dam nr Jemez Springs to East Fork)
- Jemez River (Zia Pueblo bnd to Jemez Pueblo bnd)
- La Jara Creek (East Fork Jemez to headwaters)
- Redondo Creek (Sulphur Creek to headwaters)
- Rio Cebolla (Fenton Lake to headwaters)
- Rio Cebolla (Rio de las Vacas to Fenton Lake)
- Rio Guadalupe (Jemez River to confl with Rio Cebolla)
- Rio de las Vacas (Clear Creek to headwaters)
- Rito Penas Negras (Rio de las Vacas to headwaters)
- Rito de las Palomas (Rio de las Vacas to headwaters)
- Rito de los Indios (San Antonio Creek to headwaters)
- San Antonio Creek (East Fork Jemez to VCNP bnd)
- San Antonio Creek (VCNP bnd to headwaters)
- San Gregorio Lake
- Sulphur Creek (Redondo Creek to headwaters)
- Sulphur Creek (San Antonio Creek to Redondo Creek)
- Vallecito Ck (Jemez Pueblo bnd to Div abv Ponderosa)
- Vallecito Ck (Perennial Prt Div abv Ponderosa to headwaters)

**HUC: 13020203 - Rio Grande-Albuquerque**

- Rio Grande (Arroyo de las Canas to Rio Puerco)
- Rio Grande (Isleta Pueblo boundary to Tijeras Arroyo)
- Rio Grande (Rio Puerco to Isleta Pueblo bnd)
- Rio Grande (San Marcial at USGS gage to Arroyo de las Canas)
- Rio Grande (Tijeras Arroyo to Alameda Bridge)
- Rio Grande (non-pueblo Alameda Bridge to HWY 550 Bridge)

**HUC: 13020204 - Rio Puerco**

- Rio Puerco (Arroyo Chijuilla to northern bnd Cuba)
- Rio Puerco (non-pueblo Rio Grande to Arroyo Chico)

**HUC: 13020207 - Rio San Jose**

- Arroyo del Valle (Laguna Pueblo bnd to headwaters)
- Bluewater Lake

**HUC: 13020209 - Rio Salado**

- Rio Salado (Rio Grande to Alamo Navajo bnd)

**HUC: 13020211 - Elephant Butte Reservoir**

- Elephant Butte Reservoir
- Rio Grande (Elephant Butte Rsvr to San Marcial at USGS)

**HUC: 13030101 - Caballo**

- Caballo Reservoir
- Las Animas Ck (perennial prt Animas Gulch to headwaters)
- Rio Grande (Caballo Reservoir to Elephant Butte Reservoir)

**HUC: 13030102 - El Paso-Las Cruces**

- Rio Grande (International Mexico bnd to Anthony Bridge)

**HUC: 13030202 - Mimbres**

- Bear Canyon Reservoir
- Gallinas Creek (Mimbres River to headwaters)
- San Vicente Creek (Perennial prt Maudes Cny to Silva Creek)

**HUC: 13050003 - Tularosa Valley**

- Dog Canyon Creek (perennial portions)
- Fresnal Canyon (La Luz Creek to Salado Canyon)
- Karr Canyon (Fresnal Canyon to headwaters)

- Lake Holloman
- Nogal Creek (Tularosa Creek to Mescalero Apache bnd)

**HUC: 13050004 - Salt Basin**

- Sacramento R (Perennial prt Scott Able Canyon to headwaters)

**HUC: 13060001 - Pecos Headwaters**

- El Porvenir Creek (Gallinas River to SFNF bnd)
- El Rito (Pecos River to headwaters)
- Gallinas River (Pecos River to Aguilar Creek)
- Gallinas River (Perennial prt Aguilar Creek to Pecos Arroyo)
- Glorieta Ck (Perennial prt Pecos R to Glorieta CC WWTP)
- McAllister Lake
- Pecos River (Sumner Reservoir to Santa Rosa Reservoir)
- Pecos River (Tecolote Creek to Villanueva State Park)
- Santa Rosa Reservoir
- Storrie Lake
- Sumner Reservoir
- Tecolote Creek (I-25 to Blue Creek)
- Tres Lagunas (Northeast)

**HUC: 13060003 - Upper Pecos**

- Pecos River (Salt Creek to Crockett Draw)

**HUC: 13060007 - Upper Pecos-Long Arroyo**

- Figure Eight Lake
- Lake Van
- Pecos River (Eagle Creek to Rio Felix)
- Pecos River (Rio Felix to Rio Hondo)
- Pecos River (Rio Hondo to Salt Creek)
- Pecos River (Rio Penasco to Eagle Creek)

**HUC: 13060008 - Rio Hondo**

- Grindstone Canyon Reservoir
- Rio Bonito (Perennial prt NM 48 near Angus to headwaters)

**HUC: 13060010 - Rio Penasco**

- Agua Chiquita (perennial portions McEwan Cny to headwaters)

**HUC: 13060011 - Upper Pecos-Black**

- Brantley Reservoir
- Lower Tansil Lake/Lake Carlsbad (Carlsbad Municipal Lake)
- Pecos River (Avalon Reservoir to Brantley Reservoir)
- Pecos River (Black River to Six Mile Dam Lake )
- Pecos River (Brantley Reservoir to Rio Penasco)
- Pecos River (Six Mile Dam Lake to Lower Tansil Lake)
- Pecos River (TX border to Black River)
- Six Mile Dam Lake

**HUC: 14080101 - Upper San Juan**

- Navajo Reservoir
- Navajo River (Jicarilla Apache Nation to CO border)

**HUC: 14080104 - Animas**

- Animas River (Estes Arroyo to So. Ute Indian Tribe bnd)
- Lake Farmington (Beeline Reservoir)

**HUC: 14080105 - Middle San Juan**

- La Plata R (McDermott Arroyo to So. Ute Indian Tribe bnd)
- La Plata River (San Juan River to McDermott Arroyo)
- San Juan River (Navajo bnd at Hogback to Animas River)

**HUC: 15020003 - Carrizo Wash**

- Quemado Lake

**HUC: 15020004 - Zuni**

- McGaffey Lake
- Ramah Reservoir

**HUC: 15020006 - Upper Puerco**

- Puerco River (non-tribal AZ border to Gallup WWTP)

**HUC: 15040001 - Upper Gila**

- Beaver Creek (Perennial prt Taylor Ck to Mule Canyon)
- East Fork Gila River (Gila River to headwaters)
- Gila River (Mogollon Ck to East and West Forks of Gila R)
- Gilita Creek (Middle Fork Gila R to Willow Creek)
- Iron Creek (Middle Fork Gila R to headwaters)
- Lake Roberts
- Middle Fork Gila River (Canyon Creek to headwaters)

- Middle Fork Gila River (West Fork Gila R to Canyon Creek)
- Snow Lake
- Taylor Creek (Perennial reaches Beaver Creek to headwaters)
- Turkey Creek (Gila River to headwaters)
- West Fork Gila R (East Fork to Middle Fork)
- West Fork Gila R (Middle Fork to headwaters)
- Willow Creek (Gilita Creek to headwaters)

**HUC: 15040002 - Upper Gila-Mangas**

- Bill Evans Lake
- Gila River (AZ border to Red Rock)
- Gila River (Mangas Creek to Mogollon Creek)
- Gila River (Red Rock to Mangas Creek)
- Mangas Creek (Gila River to Mangas Springs)

**HUC: 15040004 - San Francisco**

- Centerfire Creek (San Francisco R to headwaters)
- Mule Creek (San Francisco R to Mule Springs)
- Negrito Creek (Tularosa River to confl of N and S forks)
- San Francisco River (Box Canyon to Whitewater Creek)
- San Francisco River (Centerfire Creek to AZ border)
- San Francisco River (NM 12 at Reserve to Centerfire Creek)
- San Francisco River (Whitewater Ck to Pueblo Ck)
- Trout Creek (Perennial prt San Francisco R to headwaters)
- Tularosa River (San Francisco R to Apache Creek)

| Uses Abbreviation Key | |
|---|---|
| ColdWAL | Coldwater Aquatic Life |
| CoolWAL | Coolwater Aquatic Life |
| DWS | Domestic Water Supply |
| FC | Fish Culture |
| HQColdWAL | High Quality Coldwater Aquatic Life |
| IW Storage | Industrial Water  Storage |
| IW Supply | Industrial Water Supply |
| IRR | Irrigation |
| IRR Storage | Irrigation Storage |
| LAL | Limited Aquatic Life |
| LW | Livestock Watering |
| MCWAL | Marginal Coldwater Aquatic Life |
| MWWAL | Marginal Warmwater Aquatic Life |
| MWS | Municipal Water Storage |
| PC | Primary Contact |
| PWS | Public Water Supply |
| SC | Secondary Contact |
| WWAL | Warmwater Aquatic Life |
| WH | Wildlife Habitat |

| Williams Sink (Eddy) | | | AU IR CATEGORY | LOCATION DESCRIPTION | |
|---|---|---|---|---|---|
| | | | 3/3A | HUC: 13060011 Upper Pecos-Black | |
| **AU ID** | **WQS REF** | **WATER TYPE** | **SIZE** | **ASSESSED** | **MONITORING SCHEDULE** |
| NM-9000.B_109 | 20.6.4.98 | LAKE, PLAYA | 210.11 ACRES | 1998 | 2021 |
| **USE** | **ATTAINMENT** | **CAUSE(S)** | **FIRST LISTED** | **TMDL DATE** | **PARAMETER IR CATEGORY** |
| LW | Not Assessed | | | | |
| MWWAL | Not Assessed | | | | |
| PC | Not Assessed | | | | |
| WH | Not Assessed | | | | |
| **AU Comment:** Potash activities have lead to hypersaline conditions which likely make livestock watering not attainable or existing. | | | | | |

## HUC: 13070002 Delaware

| Delaware River (Pecos River to TX border) | | | AU IR CATEGORY | LOCATION DESCRIPTION | |
|---|---|---|---|---|---|
| | | | 2 | HUC: 13070002 Delaware | |
| **AU ID** | **WQS REF** | **WATER TYPE** | **SIZE** | **ASSESSED** | **MONITORING SCHEDULE** |
| NM-2202.A_20 | 20.6.4.202 | STREAM, PERENNIAL | 8.43 MILES | 2006 | 2019 |
| **USE** | **ATTAINMENT** | **CAUSE(S)** | **FIRST LISTED** | **TMDL DATE** | **PARAMETER IR CATEGORY** |
| IW Supply | Not Assessed | | | | |
| IRR | Fully Supporting | | | | |
| LW | Fully Supporting | | | | |
| PC | Fully Supporting | | | | |
| WWAL | Fully Supporting | | | | |
| WH | Fully Supporting | | | | |
| **AU Comment:** No flow documented at US285 bridge. | | | | | |

# ATTACHMENT IV.1.C

# ON-SITE SHEET FLOW

## ATTACHMENT IV.1.C – On-site Sheet Flow

Site entry road looking east

## ATTACHMENT IV.1.C – On-site Sheet Flow

Looking west from NW quadrant and rail road

# ATTACHMENT IV.1.C – On-site Sheet Flow

Sheet flow looking north from NE quadrant

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## 1.0 INTRODUCTION

Lea Land LLC (the Facility) is an existing Surface Waste Management Facility (SWMF) providing oil field waste solids (OFWS) disposal services. The existing Lea Land SWMF is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.9.711 and 19.15.36 NMAC, administered by the Oil Conservation Division (OCD) of the NM Energy, Minerals, and Natural Resources Department (NMEMNRD). This document is a component of the "Application for Permit Modification" that proposes continued operations of the existing approved waste disposal unit; lateral and vertical expansion of the landfill via the construction of new double-lined cells; and the addition of waste processing capabilities. The proposed Facility is designed in compliance with 19.15.36 NMAC, and will be constructed and operated in compliance with a Surface Waste Management Facility Permit issued by the OCD. The Facility is owned by, and will be constructed and operated by, Lea Land LLC.

The Lea Land SWMF is one of the most recently designed facilities to meet the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that Lea Land will provide needed resources to fill an existing void in the market for technologies that exceed current OCD requirements.

### 1.1 Purpose

This section provides compliance demonstrations for the Siting Criteria for Surface Waste Management Facilities specified in the NM Oil and Gas Rules, 19.15.36.13.A-C NMAC. These requirements include depth to groundwater; and proximity of watercourse, floodplains, wetlands, mines, residences/institutions, and unstable areas. The proposed Facility site meets the Siting Requirements applicable to a Surface Waste Management Facility (i.e., 19.15.36.13.A-C NMAC). Supplemental studies were also conducted for ecological resources, with positive results.

### 1.2 Site Location

The Lea Land site is located approximately 27 miles northeast of Carlsbad, straddling US Highway 62-180 (Highway 62) in Lea County, NM. The Lea Land site is comprised of a 642-acre ± tract of land encompassing Section 32, Township 20 South, Range 32 East, Lea County, NM (**Figure II.1.1**). Site access is currently provided on the south side of US Highway 62. The coordinates for

the approximate center of the Lea Land site are Latitude 32°31'46.77" and Longitude -103°47'18.25".

### 1.3 Facility Description

The Lea Land SWMF comprises approximately 463 acres ± of the 642-acre ± site, and will include two main components: an oil field waste Processing Area and an oil field waste solids Landfill, as well as related infrastructure (i.e., access, waste receiving, stormwater management, etc.). Oil field wastes are delivered to the Lea Land SWMF from oil and gas exploration and production operations in southeastern NM and west Texas. The Permit Plans (**Attachment III.1.A**) identify the locations of the Processing Area and Landfill Disposal facilities. The proposed facilities are detailed in **Table II.1.2** (**Volume II.1**), and are anticipated to be developed in four primary phases as described in **Table II.1.3** (**Volume II.1**).

## 2.0 REGIONAL GEOLOGY AND HYDROLOGY

The Lea Land SWMF is situated in a mature oil and gas producing province in the Permian Basin of southeastern New Mexico. The site is also within a mature potash mining and refining province, and is located approximately 10.25 miles north of the Waste Isolation Pilot Project (WIPP) site. Pursuant to these activities, the regional geology and hydrogeology near the Lea Land SWMF has been studied extensively by numerous professionals (Figures, Tables, and Attachments).

### 2.1 Physiographic Setting

The proposed 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 semi-consolidated deposits. These strata consist 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.

Physiography of the vicinity of the Lea Land SWMF 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 the Upper Pecos-Black watershed (USGS cataloging Unit 1306011).

The Facility is located near the southwestern terminus of the Querecho Plains, which is a broad and relatively flat area that slopes gently from Mescalero Ridge at the western terminus of the Llano Estacado toward the Pecos River, approximately 80 miles to the west of Mescalero Ridge. The Querecho Plains are generally underlain by thin accumulations of unconsolidated sand, silt, gravel and caliche that mantle Triassic age redbeds and sandstones. The Tertiary Ogallala Formation, which is a thick sequence of unconsolidated to semi-consolidated sand, silt and gravel forms the caprock on Mescalero Ridge. Ogallala sediments were deposited on an erosional surface incised into the Triassic Chinle Formation in much of southeastern New Mexico. The Ogallala has been removed by erosion and is absent west of Mescalero Ridge

The Facility is situated east of the northernmost extension of Livingston Ridge, which, in the vicinity of the site, is a west-facing escarpment created by ledge-forming sandstone beds of the Triassic Santa Rosa Sandstone. The Facility rests on thinly alluvium-mantled gently east dipping beds of the Santa Rosa Sandstone.

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 Williams Sink, Laguna Plata, Laguna Gatuna, Laguna Tonto and Laguna Toston. These features are generally believed to have formed from a combination of dissolution of deep-seated soluble substrates (Rustler and Salado) and wind deflation (Nicholson and Clebsch, 1961). Wind deflation is evidenced by dunes on the downwind flank of the Lagunas.

## 2.2 Structural Setting

The Lea Land SWMF is situated on the northeastern margin of a deep sedimentary feature 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 Lea Land SWMF are depicted in the map and cross-section provided as **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 (i.e., 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).

## 2.3 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 detail on the 1:250,000 Hobbs Sheet of the Geologic Atlas of Texas (Eifler and Reeves, 1976). A portion of this map showing the vicinity of the Lea Land SWMF is shown as **Figure IV.2.4**.

Post-Pennsylvanian stratigraphic units of the Delaware Basin are summarized in the stratigraphic nomenclature chart in **Figure IV.2.5** (Hendrickson and Jones, 1952, Nicholson and Clebsch, 1961 and Hawley, et. al., 1993a). Geologic units that are present at land surface or in the shallow subsurface near the Lea Land SWMF include unconsolidated Quaternary alluvial, aeolian and playa

lacustrine deposits, semi-consolidated clastics of the Tertiary Ogallala Formation, Triassic bedrock shale and sandstone units of the Chinle/Dockum Group, and shale and evaporites, including gypsum and halite. Shallow stratigraphic units in the vicinity of the Lea Land SWMF as described by the Texas Bureau of Economic Geology for the Hobbs Sheet (1976) are listed below.

- ***Eolian Deposits (Qcd Quaternary) –*** *Sand, calcareous, primarily brown to grey, derived from and rests on lacustrine deposits.*
- ***Colluvium (Qscg Quaternary) –*** *Sand, silt and gravel deposited by slopewash, and talus from Ogallala, red to gray; in part calcified, caliche 1-20 feet thick; may include weathered Gatuna Formation; rests mainly on Triassic and Permian rocks.*
- ***Tahoka Formation Lacustrine Deposits (Qta Quaternary) –*** *Lacustrine clay, silt, sand and gravel, locally calcareous and selenitic, indistinctly bedded to massive, weakly coherent, various shades of light gray, grades to gravel at playa margins, contains molluscan and vertebrate fossils.*
- ***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.***
- ***Dewey Lake Redbeds (Pdl, Permian) –*** *Siltstone and fine grained quartz sandstone, laminated, locally crossbedded, reddish orange, reddish brown, brownish yellow, greenish grey reduction spots up to 1 inch common; thickness 200-250 feet.*
- ***Rustler Formation (Pru, Permian) –*** *Limestone, siltstone, sandstone, gypsum, marl, and clay. Upper part – limestone and dolomitic limestone; thickness 50+ feet. Middle part – siltstone and sandstone, yellowish grey; thickness 50 to 70 feet. Lower part – siltstone and fine-grained sandstone, thin to medium bedded, red, interbeds of earth to sparry red gypsum, a few beds of red and greenish grey marl and clay; thickness 50+ feet.*

The Lea Land site is situated on a gently northeast-dipping homocline. Shallow stratigraphy consists of a thin mantle of Quaternary alluvial sand and silt, which is underlain by a relatively complete section (i.e., 50 feet thick) of Triassic Santa Rosa Sandstone. The Santa Rosa Sandstone is underlain by Permian Dewey Lake Redbeds, then by Permian Rustler Formation,

## 2.4 Sources of Hydrogeologic Data

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

### *2.4.1 Permitted and Pre-basin Water Wells*

Numerous water wells in the general vicinity of the Lea Land SWMF were drilled prior to the administrative declaration of the Capitan Underground Water Basin (Capitan Basin) by the New Mexico Office of the State Engineer (NMOSE), in 1965. Lithologic logs and records of completions are generally not available for the "pre-basin" wells. 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 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 a number of additional wells in the area.

Review of NMOSE on-line files of permitted water wells (NMOSE WATERS DATABASE, 2019) indicates that there are no permitted water wells near the Lea Land SWMF. Two domestic wells were attempted at locations approximately 1.5 miles west of the Facility in 1966 (Wells C-368 and C-370 in Sec. 36, T. 20 S., R. 31 E.); however, these holes found no production and were not cased. Copies of records for wells C-368 and C-370 are included in **Attachment IV.2.F**. Several other permitted monitoring wells associated with the Waste Isolation Pilot Project were installed from 2.8 miles and greater distances south and southeast of the Lea Land SWMF. Summary water well information compiled by Nicholson and Clebsch (1961), as well as available information on the nearest NMOSE permitted wells are presented in **Table IV.2.1**.

### *2.4.2 Area Borings and Monitoring Wells*

Resource and environmental characterization projects have yielded information on subsurface stratigraphy and groundwater conditions in the vicinity of the Facility. Projects include:

- A water resources study of the Carlsbad Potash area (Geohydrology Associates 1979)
- An environmental hydrogeologic site characterization boring project for permitting the Controlled Recovery Inc. (CRI, now R-360) oil and gas waste disposal Facility (James Wright, 1990)
- Hydrogeologic update for the same Facility (Safety and Environmental Solutions, Inc., 2003)
- Potash mineral exploration drilling (United States Geological Survey, 1953),

Copies of boring logs and related information obtained from these investigations are included in **Attachments IV.2.A, IV.2.B** and **IV.2.C**, respectively.

### *2.4.3 Lea Land Site Boring and Groundwater Monitoring Well Installation*

Pursuant to site characterization of Lea Land site in Section 32 T. 20 S. R. 32 E., ten shallow borings were advanced in November 1993 (Standard Testing and Engineering Company, 1993). Copies of logs of the borings are included in **Attachment IV.2.D**. The Lea Land borings were drilled with air rotary methods and were advanced through alluvial veneer, 30 to 50 feet of Santa Rosa Sandstone and into the Dewey Lake Redbeds to depths ranging from 126 to 201 feet below grade. During drilling, cuttings were inspected for lithology, color, degree of induration and moisture content; and samples were collected for laboratory analysis of engineering properties. The borings found no groundwater in the Santa Rosa Sandstone in the site area. Saturated zones were found beneath the Santa Rosa Sandstone in the Dewey Lake Redbeds at 125 feet below grade (BH-1) and 201 feet below grade (BH-5).

Based upon information from the geotechnical borings, five shallow groundwater monitoring wells were installed in June 1996 and June 1997, and completed in shallow saturated zones in the Dewey Lake Redbeds at depths ranging from 203.5 to 215 feet below ground surface (bgs). Water was found in confined zones such that water levels in the completed wells rose between approximately 22 feet and 51 feet above the tops of the saturated zones (i.e., base of the aquitard) identified during drilling. Locations of the Lea Land borings and monitoring wells, as well as locations of other wells and borings in the vicinity of the Facility are shown on **Figure IV.2.6**. Completion details, water levels and water-bearing zones of the groundwater monitoring wells are summarized in **Table IV.2.1**. Copies of the lithologic logs of Lea Land Geotechnical Borings 1-10 and Monitoring Wells 1-5 are included in **Attachments IV.2.D** and **IV.2.E.**

### *2.4.4 Groundwater Sampling and Analyses*

Groundwater sampling and analyses have been performed on wells at the site and in the vicinity of the Lea Land SWMF for numerous projects. Groundwater sampling and analyses have been performed on Lea Land site monitoring wells MW-2, MW-4 and MW-5 since 1997. A copy and a summary of the laboratory analyses of water samples collected from the Lea Land site monitoring wells in March 2010 and June 2018 are included in **Attachment IV.2.G**. Water quality data was also obtained from two nearby wells installed during the BLM potash area groundwater investigation

(Geohydrology 1979). Copies of the laboratory analytical data sheets from the BLM wells are included with the information from these wells in **Attachment IV.2.A**. A summary of available groundwater quality data from the Lea Land site monitoring wells and the BLM potash investigation wells (Geohydrology 1979) is included in **Table IV.2.2**.

### 2.5 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. Insufficient quantities of water are locally present in the Permian Dewey Lake Redbeds and deeper bedrock units at the Lea Land Site to sustain sampling. The Ogallala Formation has been removed by erosion and is absent in the vicinity of the Facility. The Santa Rosa Sandstone is above saturation and is dry at the Lea Land SWMF.

Thin, laterally discontinuous and often ephemeral saturations are occasionally present in the basal alluvium overlying the Triassic and Permian 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.

The Santa Rosa Sandstone (lower Triassic Dockum Group) is laterally extensive east of Livingston Ridge in the vicinity of the Lea Land SWMF and yields modest to moderate quantities of good quality groundwater to wells further east in Lea County but is non water-bearing at the Lea Land SWMF. Based upon data from vicinity wells and on-site Facility borings and groundwater monitoring well installations, shallow saturation is present in limited and unusable quantities in hydraulically tight confined zones in the Dewey Lake Redbeds beneath the site at depths ranging from 171 feet to 188 feet.

## 3.0 SITE SPECIFIC GEOLOGY AND HYDROGEOLOGY

### 3.1 Site Investigation, Data Compilation and Interpretation

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

Subsurface boring investigations were performed on the Lea Land SWMF to characterize geologic and hydrogeologic conditions of the site to demonstrate 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 the ten soil borings and five groundwater monitoring wells that were drilled on the Lea Land site in 1993, 1996-1997 to determine the shallow geologic conditions and potential saturated zones beneath the site. Subsurface investigations were performed at the Lea Land site using air rotary drilling, the most appropriate technology for detecting the presence of water. Data that was accumulated during boring and testing at the Lea Land 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 Lea Land.

Ten soil borings were drilled, and five groundwater monitoring wells were installed on the Facility property at locations shown on the map in **Figure IV.2.6**. Numerous other shallow wells have been drilled in the vicinity of the Lea Land by the Bureau of Land Management and Controlled Recovery Inc. Locations, completions, stratigraphic and water level data on these wells is summarized in **Table IV.2.1**; this data was used to prepare this hydrogeologic site characterization. Copies of logs and other data associated with the BLM monitoring wells (Geohydrology, 1979) are included in **Attachment IV.2.A;** logs and completion data from the Controlled Recovery Inc. monitoring wells are included in **Attachment IV.2.B**; logs and completion data from the Lea Land borings and monitoring wells are included in **Attachments IV.2.D** and **IV.2.E.** A potash mineral exploration well was drilled to a depth of 1273 feet and logged by the USGS in 1953; a copy of the log is included in **Attachment IV.2.C**.

The Lea Land site borings (BH-1 through BH-10) and groundwater monitoring wells (MW-1 through MW-5) were installed using air rotary drilling methods. During air rotary drilling, circulated cuttings 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. None of the Lea Land borings or groundwater monitoring wells encountered water in the Santa Rosa Sandstone. Non-economic saturations were in the Dewey Lake Redbeds at depths ranging from 171 feet below grade to 188 feet below grade confirmed.

Saturation was noted in Dewey Lake Redbeds in Lea Land boring B-1 at a depth of 125 feet when it was drilled in November 1993. Monitoring well MW-3, which was drilled approximately 185 feet west of boring B-1 in June 1996 encountered no saturation at this depth and was completed in the first penetrated saturation zone at a depth of 214 feet below grade.

### 3.2 Facility Geotechnical Evaluation

**Table IV.2.3** provides summary results of site-specific surface and subsurface materials testing, which includes laboratory testing of depth-referenced soil boring samples as well as hydraulic tests of groundwater monitoring wells. The geotechnical testing data indicates that the Santa Rosa Sandstone is a fine-grained silty/sand unit, containing an average of 34% silt and finer particles. Available hydraulic tests of boring samples taken from the Santa Rosa Sandstone indicate a saturated hydraulic conductivity ranging from $1.4 \times 10^{-4}$ centimeters per second (cm/sec) to $3.4 \times 10^{-4}$ cm/sec.

Boring sample lab tests and well test data from Dewey Lake Redbed wells and borings indicate that the Dewey Lake Redbeds are significantly finer grained, containing an average of 49% silt and finer particles (i.e., 200 sieve). Hydraulic tests of monitoring wells completed in the Dewey Lake Redbeds indicate a saturated horizontal hydraulic conductivity ranging from $4.17 \times 10^{-9}$ cm/sec to $1.33 \times 10^{-6}$ cm/sec.

The site geotechnical boring and testing data indicates that an abrupt change in lithology occurs between the near-surface coarser-grained Santa Rosa Sandstone and the thick deposit of dense and relatively impermeable Dewey Lake Redbeds below. Prior to deposition of the Santa Rosa Sandstone, the Dewey Lake Redbeds were aerially exposed and incised by erosion. The Santa Rosa Sandstone was then deposited on top of the Dewey Lake Redbeds, forming an erosional unconformity. The unconformity between the Dewey Lake Redbeds and the Santa Rosa Sandstone is a significant impediment to vertical movement of water through the vadose zone and is an important hydrogeologic feature at the Facility.

Findings of the site-specific characterization of the onsite soils at the Facility are consistent with other studies in the area. The surface soils consist of colluvium and caliche materials, suited for specific environmental applications:

- Subgrade – compactible *in situ* materials at basegrade elevations
- PSL – protective soil layer
- Daily and intermediate cover in ample quantities

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

The lower soils (Permian Dewey Lake Redbed shale and siltstone), horizons are effective aquitards to vertical flow and represent the selected positions for vadose monitoring points.

### 3.3 Facility Geology

The Lea Land site borings, as well as those drilled by various entities 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** provides summary information on Lea Land SWMF and vicinity borings, water wells and mineral exploration wells, along with available information on water levels, stratigraphic intercepts and other pertinent information. **Figure IV.2.4** is a map showing surface exposures of geologic units in the area. A vicinity hydrogeologic cross-section (Cross-Section A-A') through the Lea Land SWMF was prepared using this information and is presented as **Figure IV.2.7**.

A potash mineral exploration boring was drilled approximately 1.5 miles northeast of the Facility, north of US 62-180 and east of Laguna Toston (Well, USGS 20-F, **Figure IV.2.6**). This well fully penetrated to the Permian Rustler Formation (depth 900 feet), the Permian Salado Formation (depth 1180 feet) and the potash-bearing section between 1239 feet and 1273 feet. This log, due to its lithologic description detail and depth, is an important deep stratigraphic reference for the vicinity of the Lea Land site. A copy of the log is included in **Attachment IV.2.C**.

The ten site borings and five groundwater monitoring wells penetrated various thicknesses of alluvium and Santa Rosa Sandstone above the Dewey Lake Redbeds, ranging from 30 feet to 50 feet. Shallow Santa Rosa Sandstone penetrated by the site borings was poorly graded fine and friable sandstone and intebedded shale. The Dewey Lake Redbed deposits penetrated by all site borings was reddish brown to pink, dense siltstone, shale, with fine grained silty sandstone stringers.

### 3.4 Facility Hydrogeology

Shallow saturation is present in hydraulically tight, artesian zones within the Dewey Lake Redbeds at depths ranging from 173 to 198 feet bgs at the Facility. The following is a summary of the stratigraphy beneath the Lea Land site.

### *3.4.1 Santa Rosa Sandstone*

The Santa Rosa Sandstone is thinly mantled by alluvium and laterally continuous across the Facility. Although this unit is a significant water-bearing zone further east in Lea County, the Santa Rosa Sandstone is dry and above saturation in the vicinity of the site.

### *3.4.2 Shallow Saturation in the Dewey Lake Redbeds*

The monitoring wells completed in the Dewey Lake Redbeds at the Facility communicate with saturated zones that range in depth between 171.5 feet below grade to 188 feet below grade; and between 123.5 feet and 148 feet below the top of the Dewey Lake Redbeds. The saturated zones are of low capacity, and are unable to sustain adequate water production for well purging prior to groundwater sample collection. "Hydra Sleeve" sampling methods have been necessary to obtain water samples for prior groundwater sampling at the Facility. Water levels in the completed monitoring wells at the Facility range from 22 feet to 51 feet above the levels where saturated conditions were noted during drilling, indicating confined conditions.

A hydraulic test of Monitoring well MW-4 at the Facility was performed in February 1997 (Intera, 1997). This test indicated a saturated horizontal hydraulic conductance of $4.17 \times 10^{-9}$ cm/sec and a storage coefficient of $3.71 \times 10^{-9}$.

A monitoring well installed by the BLM (BLM-21.31.3.22, Geohydrology, 1979) and located approximately one mile southeast of the Facility was completed in the Dewey Lake Redbeds and tested. This well is shown in **Figure IV.2.6** and information on the well is included in **Table IV.2.1** and **Attachment IV.2.A.** Well BLM-21.31.3.22 penetrated a saturated zone at a depth of 150 feet below grade; the water level in the completed well was 140.81, or about 9 feet above the top of the saturated zone. The well was pumped at a rate of 6.1 gallons per minute for approximately 120 minutes, producing approximately 732 gallons and a water level decline of about 10.5 feet. The water level recovered approximately 5 feet during the initial 240 minutes after pumping ceased. Although this well had some initial yield, water level recovery after pumping cessation was slow and incomplete, indicating that local storage had been depleted. Analysis of the test data indicated a saturated horizontal hydraulic conductance of $1.33 \times 10^{-6}$ cm/sec.

Another BLM monitoring well located approximately 1.5 miles west of the Facility (BLM-20.32.31.13, Geohydrology, 1979) was drilled with air rotary into the Dewey Lake Redbeds to a depth of 250 feet below grade, found no saturation, and was completed as a dry hole at the total drilled depth of 250 feet on 11/8/1978. A water level was sounded in the well at 135.12 feet below casing top on March 15, 1979, indicating that the well penetrated hydraulically tight saturated zones at this location. Summary data on this well is included in **Table IV.2.1** and a lithologic log of the well is included in **Attachment IV.2.A**.

### *3.4.3 Shallow Alluvium*

It has been noted that thin and laterally discontinuous saturations are occasionally present in basal alluvium resting atop low permeability bedrock shales and dense sandstones in the region of the Lea Land SWMF. None of the borings or monitoring wells drilled at the Lea Land site found evidence of saturation in basal alluvium, or in basal Santa Rosa Sandstone above the Dewey Lake Redbeds.

### *3.4.4 Groundwater Occurrence and Movement*

Relationships between terrain, subsurface geology and shallow saturations are summarized in Hydrogeologic Cross-Section A-A', presented as **Figure IV.2.7**. The line of this cross-section is shown on the vicinity well location map in **Figure IV.2.6**. Cross-Section A-A' shows the Lea Land site location on the east-dipping outcrop of the Santa Rosa Sandstone east of Livingston Ridge, which is a west-facing escarpment created by ledge-forming sandstone beds in the Santa Rosa Sandstone. Groundwater monitoring wells installed at Lea Land penetrated 40 to 50 feet of dry Santa Rosa Sandstone and 123 to 148 feet of Dewey Lake Redbeds, before reaching saturation in the redbeds. Saturation zones in the redbeds are confined, with water levels in completed wells rising between 19 and 48 feet above the observed saturation zones.

Based on the change from more permeable sediments in the Santa Rosa Sandstone to hydraulically tight shale in the Dewey Lake Redbeds below, impedance to vertical fluid flow and potential for perched saturation exists at this contact. No perched water was noted at the contact between the Dewey Lake Redbeds and the Santa Rosa Sandstone in any of the 10 soil borings or 5 groundwater monitoring wells that were drilled on the Lea Land site. Due to the propensity for perched conditions to exist atop the Dewey Lake Redbeds, terrain of the upper surface of the redbeds is an important feature to consider in plans for monitoring shallow horizons for potential fugitive liquids from the

proposed waste disposal and management facilities (i.e., Vadose Zone Monitoring Plan, **Volume II.9**). A map illustrating elevation of the upper surface of the Dewey Lake Redbeds, as well as the location and base grade elevations of the proposed facility expansion is presented in **Figure IV.2.8**. This map indicates that the upper redbed surface slopes east-northeasterly at the facility at a gradient of approximately 50 feet per mile. The excavation for the proposed facility expansion reaches a depth of approximately 50 feet in its northeastern extremity, having a minimum base grade elevation of 3490 feet above mean sea level (msl). This is within about 5 feet of the projected top of the redbed elevation of approximately 3485 feet above msl.

A regional gradient map was prepared pursuant to a groundwater study of the Carlsbad Potash Mining District commissioned by the BLM in 1979 (Geohydrology, 1979). A copy of this map is presented as **Figure IV.2.9**. This map indicates that the shallow gradient is toward the south-southwest at the Lea Land SWMF and has a gradient of approximately 30 feet per mile. A vicinity potentiometric gradient map, **Figure IV.2.10**, was prepared using water level data from the Lea Land monitoring wells, as well as monitoring wells at the R-360 facility located approximately one mile to the northeast, and two of the BLM potash study groundwater monitoring wells. This map indicates that gradient direction is southwest at a gradient of approximately 75 feet per mile. Relatively steep groundwater gradient at the Lea Land site is indicative of low hydraulic conductance in the shallow saturation zone beneath the site.

## 4.0 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;***

***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.***

### 4.1 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 Facility. No perennial or ephemeral streams or springs are present within one mile of the proposed Lea Land SWMF. There are no water wells within one mile of the proposed Lea Land SWMF. Locations of groundwater monitoring wells in the vicinity of the Lea Land SWMF are shown in **Figure IV.2.6**; a summary of vicinity wells is also included in **Table IV.2.1**.

### 4.2 Laboratory Analyses of Shallow Groundwater Samples

Groundwater samples were collected from Lea Land groundwater monitoring wells MW-2, MW-4 and MW-5, completed in the Dewey Lake Redbeds at the Lea Land SWMF on March 19, 2010 and on June 13, 2018. Laboratory analyses for analytes set forth in 19.15.36.8.C.15(b) indicate that the water is of moderately good quality, having a total dissolved solids (TDS) ranging from 778 milligrams per liter (mg/L) to 818 mg/L; and meeting all tested groundwater protection standards except selenium, which is regarded as a natural constituent, and was detected in upgradient and downgradient wells in similar concentrations. Available analytical data from all tests is included in **Table IV.2.2**, along with summary data from other nearby wells tested by BLM in 1979. Copies of laboratory reports for tests listed in **Table IV.2.2** are included in **Attachment IV.2.G**.

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

The shallowest fresh saturated zones at the Lea Land SWMF are present in hydraulically tight and confined zones within the Dewey Lake Redbeds. Several monitoring wells in the vicinity of the Facility were completed in the Dewey Lake Redbeds by the BLM (Geohydrology Associates, 1979). Depth to the shallowest saturated zones in the Dewey Lake Redbeds at the Facility is projected to range from 178 feet to 188 feet below grade. The shallow saturated zones are vertically limited to likely no more than a few feet or inches; similar zones are expected at deeper horizons within the Dewey Lake Redbeds. Hydraulic testing of monitoring wells completed in the Dewey Lake Redbeds at the Lea Land site and other nearby wells indicates that the Dewey Lake Redbed zones do not produce economically viable quantities of water.

### 4.4 Lithology of Stratigraphic Units Above the Dewey Lake Redbeds at the Facility

Stratigraphic units which are above the Dewey Lake Redbeds at the site include the Santa Rosa Sandstone and veneers of Quaternary colluvium deposits. Site characterization borings drilled on the Lea Land site penetrated fine silty sands with calcrete (caliche) zones in the alluvial section. The site borings penetrated interbedded fine grained dense red sandstone and siltstone bedrock in the Santa Rosa Sandstone section at depths ranging from 30 to 50 feet bgs.

### 4.5 Geologic Cross-Sections

A hydrogeologic cross-section depicting stratigraphy and geometry of the Alluvium, the Santa Rosa Sandstone, the Dewey Lake Redbeds potentiometric surface is included in **Figure IV.2.7**. This diagram indicates that the depth to the top of the Dewey Lake Redbeds at the Lea Land SWMF is projected to be 30 to 50 feet bgs; the depth to the saturated zones in the Dewey Lake Redbeds is approximately 175 feet.

### 4.6 Potentiometric Surface of Shallow Saturations

A regional potentiometric surface map was prepared using water level data from numerous wells completed in shallow geologic units in the Carlsbad potash mining district (Geohydrology, 1979) and is presented in **Figure IV.2.9**. This map indicates that regional gradient direction is southwesterly at a magnitude of about 30 feet per mile. A local vicinity potentiometric gradient map was prepared using combined water level data from the Lea Land onsite groundwater monitoring wells, as well as the CRI Facility monitoring wells, and the BLM wells and is shown in **Figure IV.2.10**. This map indicates that gradient direction is southwest at approximately 75 feet per mile.

### 4.7 Depth to Shallow Fresh Groundwater

Well logs and water level data from the onsite groundwater monitoring wells at the site indicate that the shallowest saturated zones at Lea Land are present in hydraulically tight and confined zones in the Dewey Lake Redbeds below the Santa Rosa Sandstone at projected depths of approximately 175 feet below-grade at the site.

Data from the Lea Land site characterization borings and monitoring wells indicates that no saturation is present in alluvial veneers, or in Santa Rosa Sandstone, which is laterally continuous across the site and varies in thicknesses from 30 ft to 50 ft.

## 5.0 CONCLUSIONS

Regional, vicinity and site characterization boring and testing data indicates that the shallowest saturated zones beneath the Lea Land SWMF are within hydraulically tight shale beds of the Dewey Lake Redbeds, at a depth are approximately 175 ft bgs and more than 100 ft below the projected base grade elevations. Water within these beds is under confined conditions. Small non-sustainable quantities of water are present in saturated zones penetrated by the groundwater monitoring wells at the Facility. These saturated zones are not regarded to be protectable as resources as defined by the Oil and Gas Rules.

***19.15.2.7.G.(10) NMAC***
***"Ground water" means interstitial water that occurs in saturated earth material and can enter a well in sufficient amounts to be used as a water supply.***

Due to the depth of the saturated zones within the Dewey Lake Redbeds and the fact that they are generally under confined conditions, a potential release from the Lea Land SWMF would not be expected to migrate readily into these confined saturated zones through the 124-148 feet of overlying Dewey Lake redbed deposits. Therefore, groundwater monitoring wells completed in the shallow saturated zones in the Dewey Lake Redbeds at the Lea Land SWMF 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, it is concluded that vadose zone monitoring wells completed to communicate with more permeable basal Santa Rosa Sandstone sediments at the contact with underlying dense shale in the Dewey Lake Redbeds would provide the most effective early leak detection system and the greatest level of environmental protection for the site. These wells would be placed strategically at the downgradient east side of the Facility to optimize detection of potentially fugitive fluids.

This site has the advantage that the local subsurface conditions have been significantly characterized during subsurface investigations conducted at the Facility, as well as the CRI site and the 1979 BLM potash study monitoring well installation and testing. No additional reconnaissance drilling is recommended to augment the hydrogeologic or geotechnical database; however 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 four proposed vadose zone monitoring wells (see **Volume II.9**, 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.

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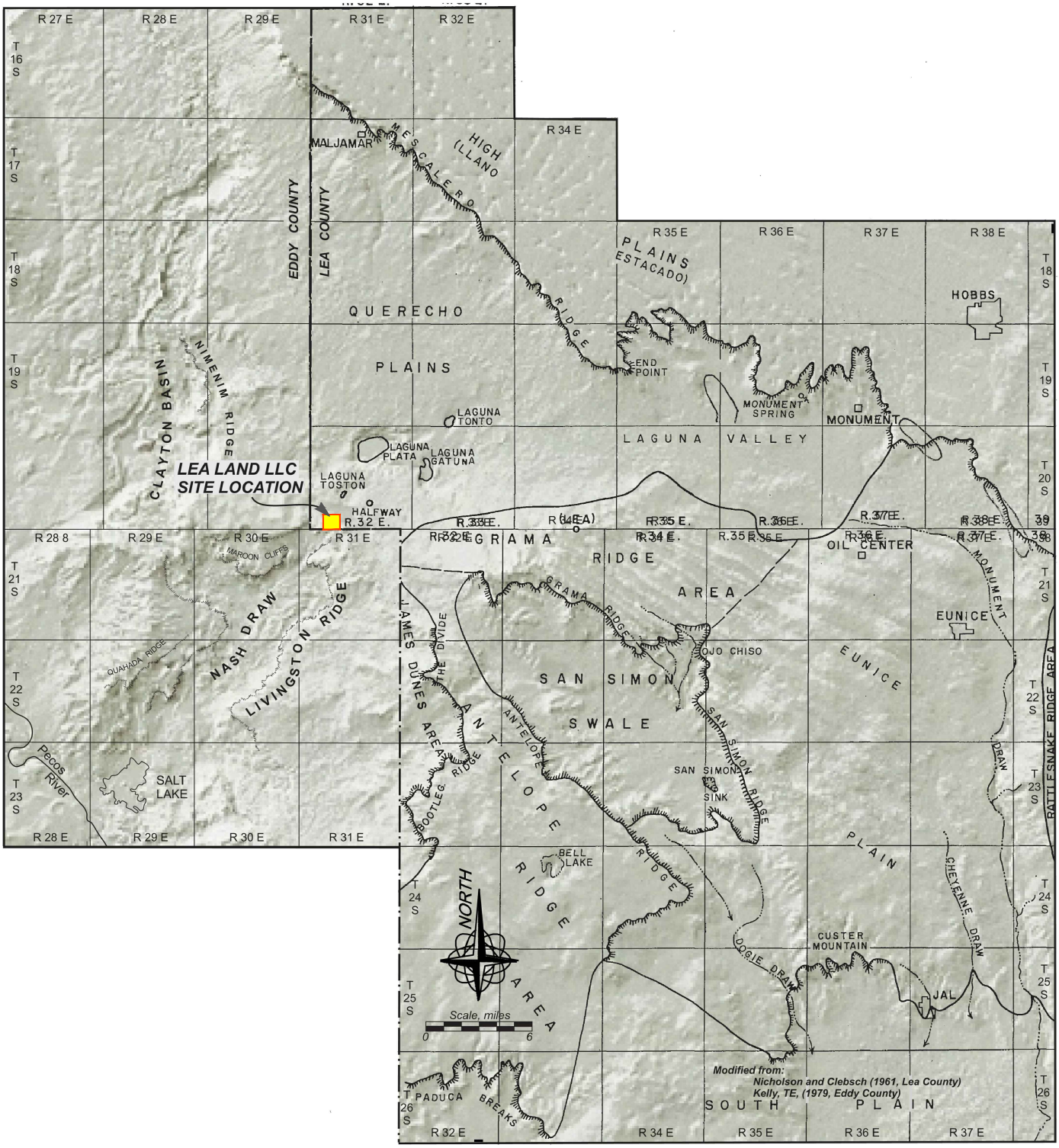
## FIGURES




# REGIONAL PHYSIOGRAPHY

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

NOTES:

1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 N, -103° 47' 18.25 W


GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991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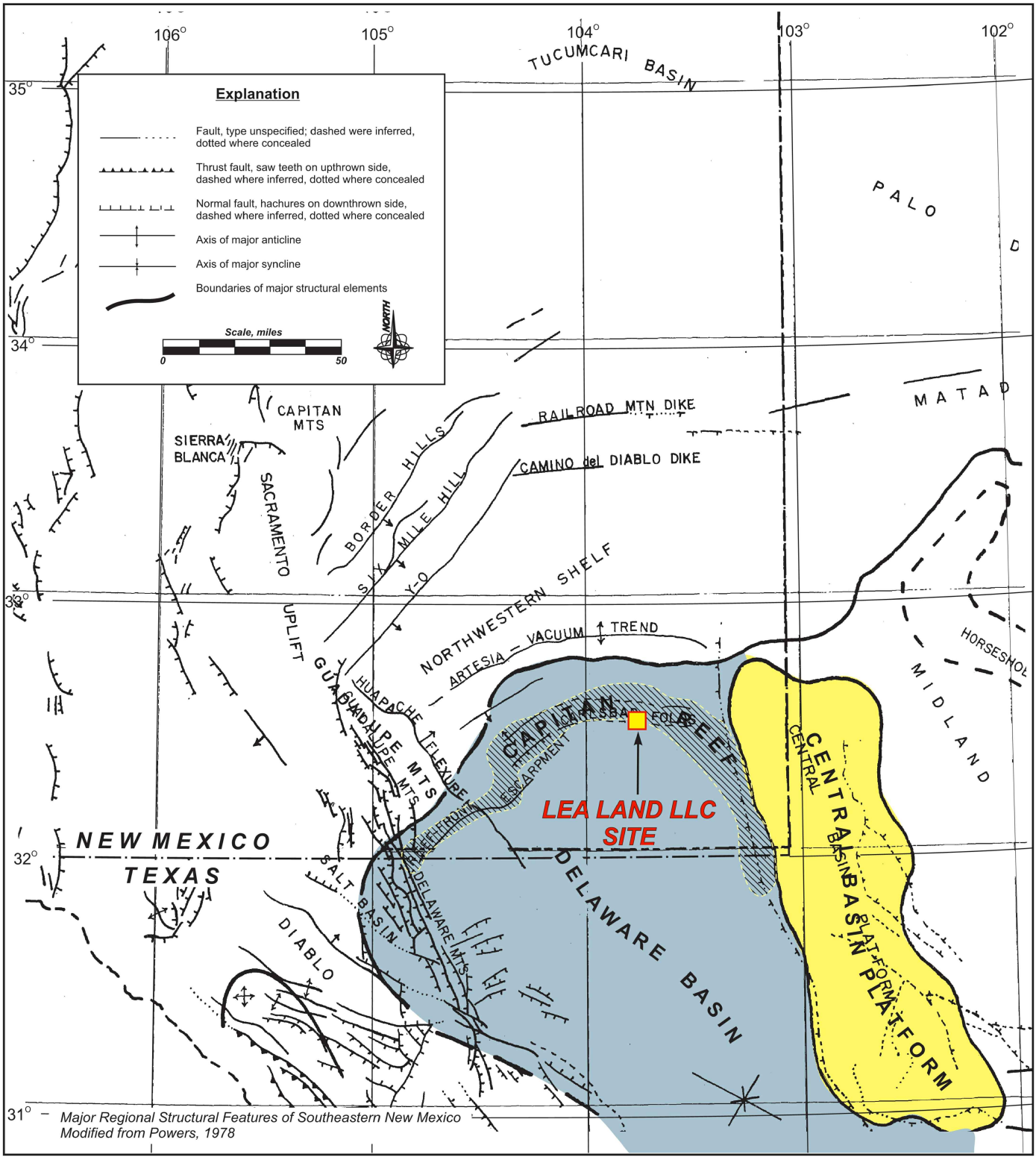


*Major Regional Structural Features of Southeastern New Mexico*
*Modified from Powers, 1978*

# MAJOR STRUCTURAL FEATURES

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

NOTES:

1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 N, -103°47' 18.25 W


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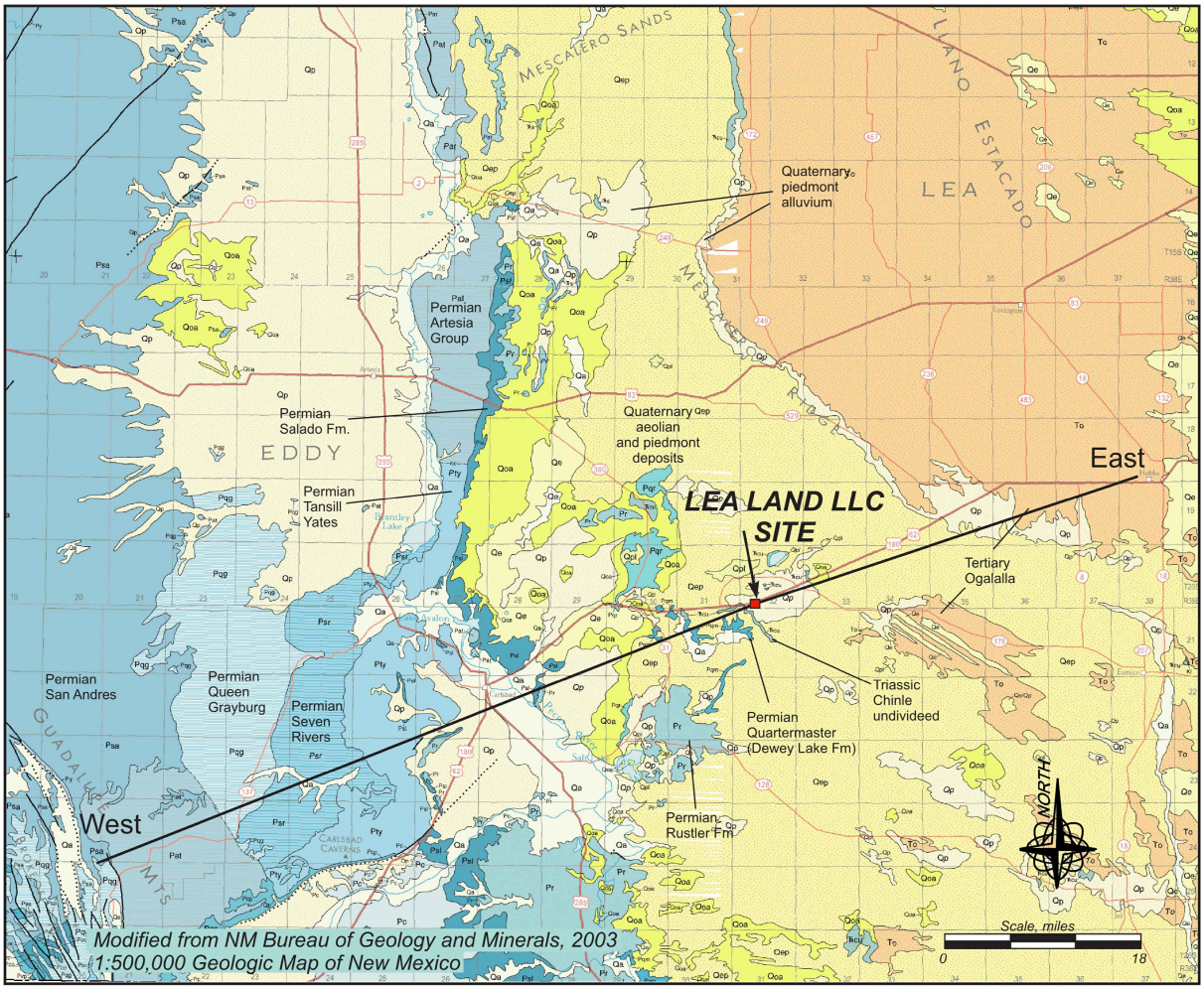
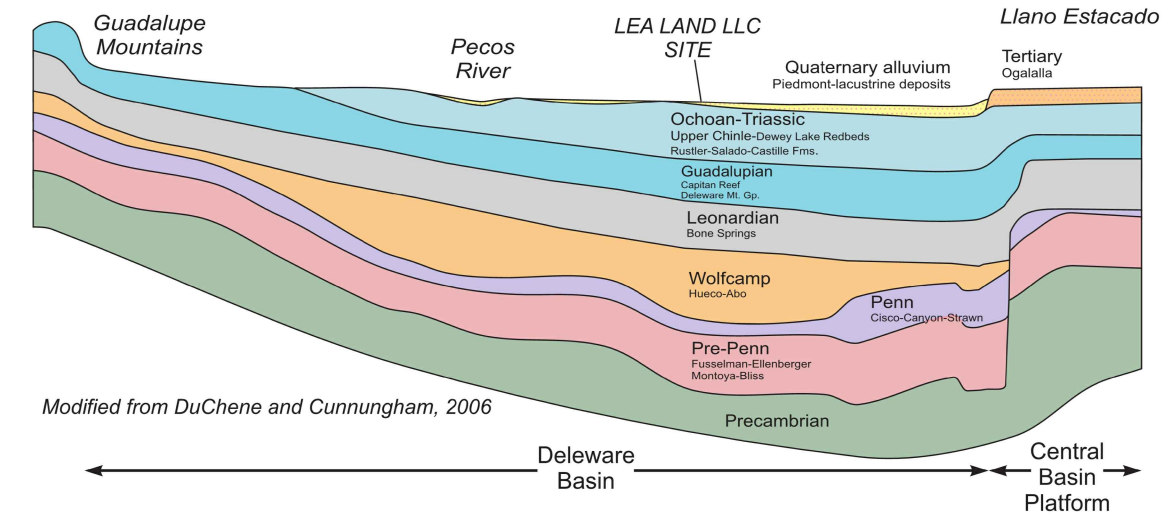



# REGIONAL SURFACE GEOLOGY AND GENERALIZED STRATIGRAPHY

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

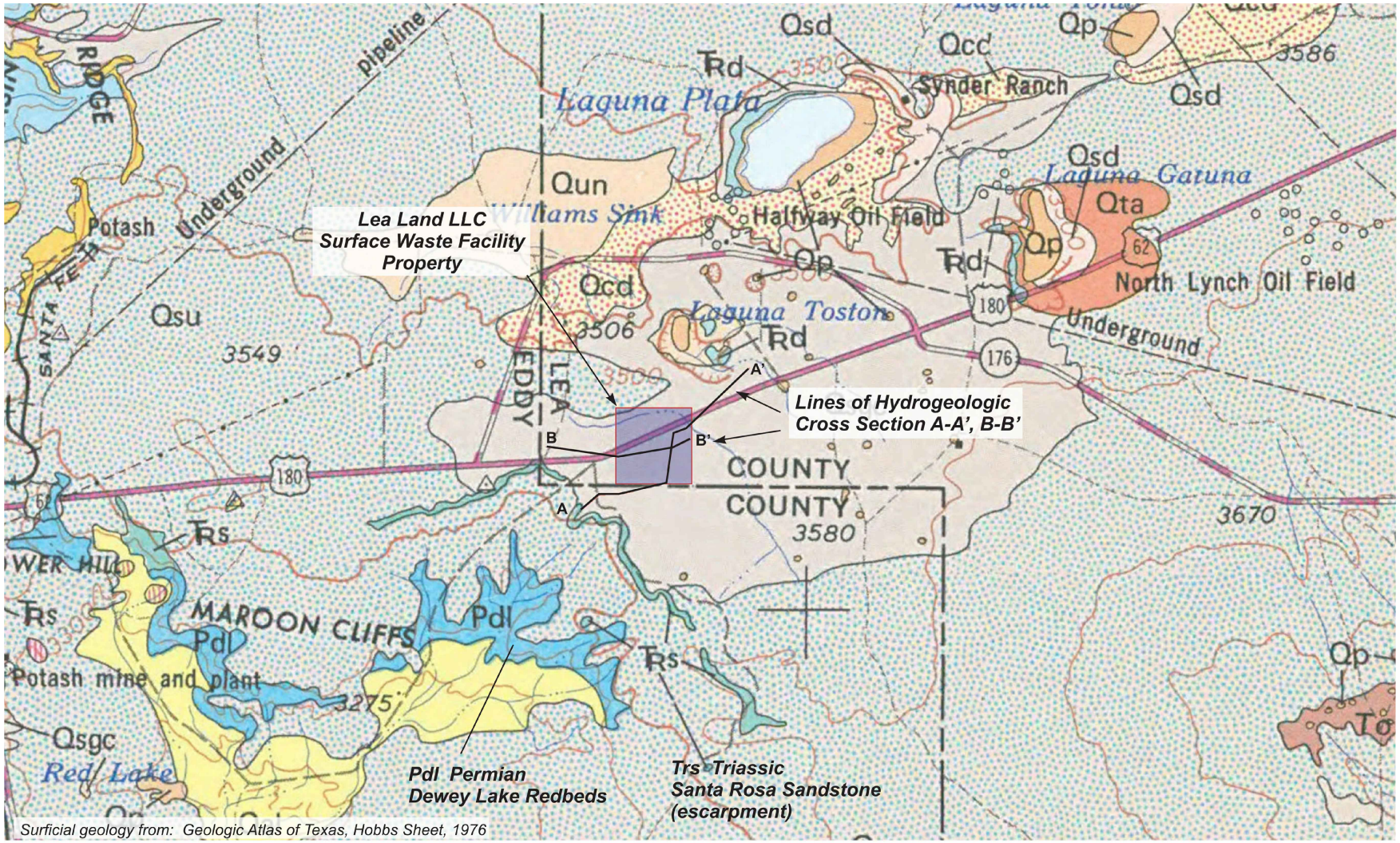
NOTES:

1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32°31' 46.77 N, -103° 47' 18.25 W


GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991


| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD:SURFACE GEOLOGY.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.3 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\REGIONAL SURFACE GEOLOGY.dwg
Date/Time:Mar. 25, 2019-10:51:10 ; LAYOUT: Layout A (P)




*Surficial geology from: Geologic Atlas of Texas, Hobbs Sheet, 1976*

NOTES:
1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 N, -103° 47' 18.25 W

NORTH

Scale, miles

0 2.0 4.0

# SURFACE GEOLOGY MAP

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

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Rio Rancho, NM 87124
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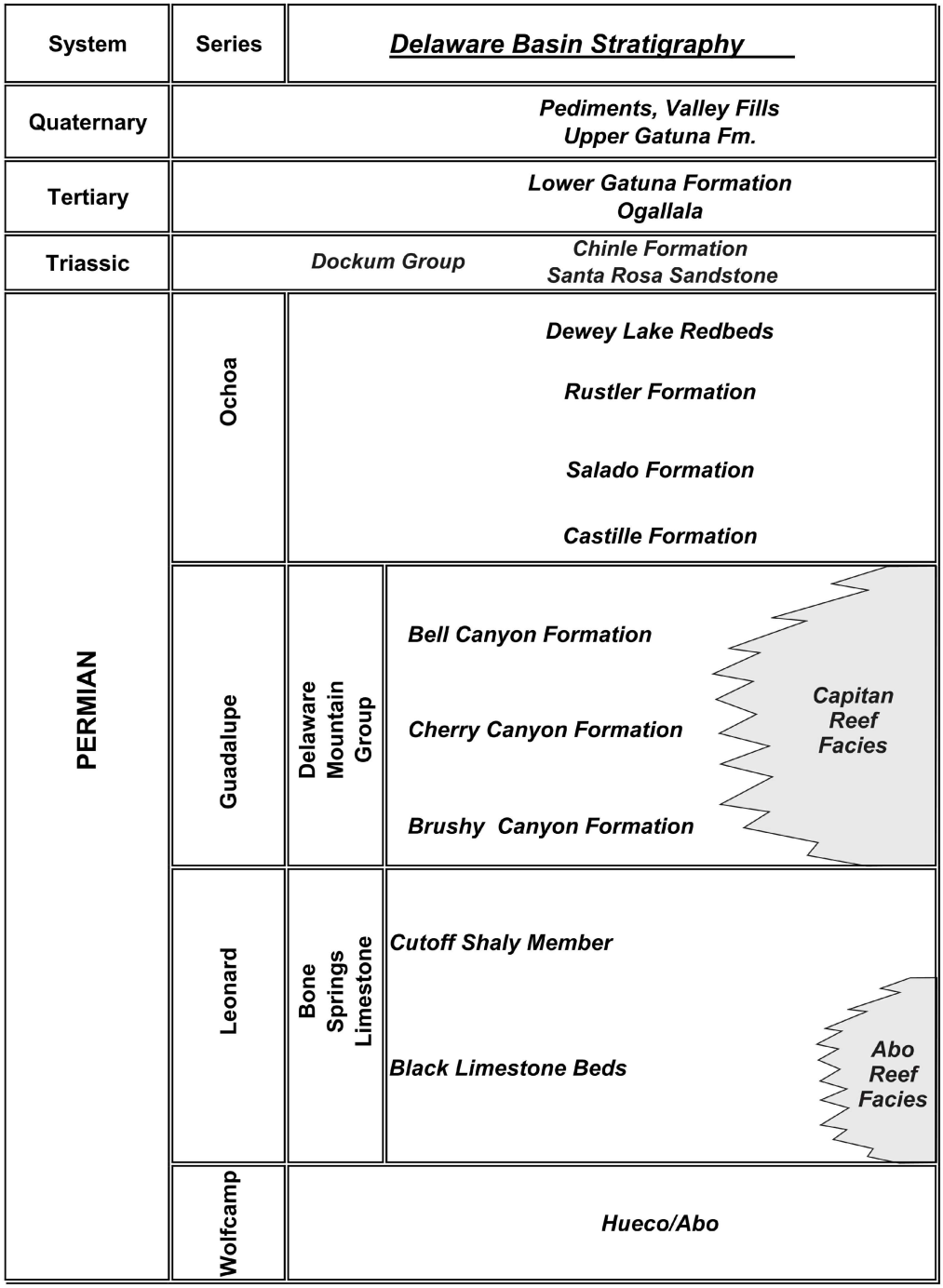
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD: SURF GEO.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.4 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\SITE GEOLOGY MAP.dwg
Date/Time:Mar. 25, 2019-11:58:12 ; LAYOUT: A (LS)




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

# POST–PENNSYLVANIAN STRATIGRAPHC UNITS

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Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD: POST-PENN GEO.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.5 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\POST PENNSYLVANIAN GEOLOGY.dwg
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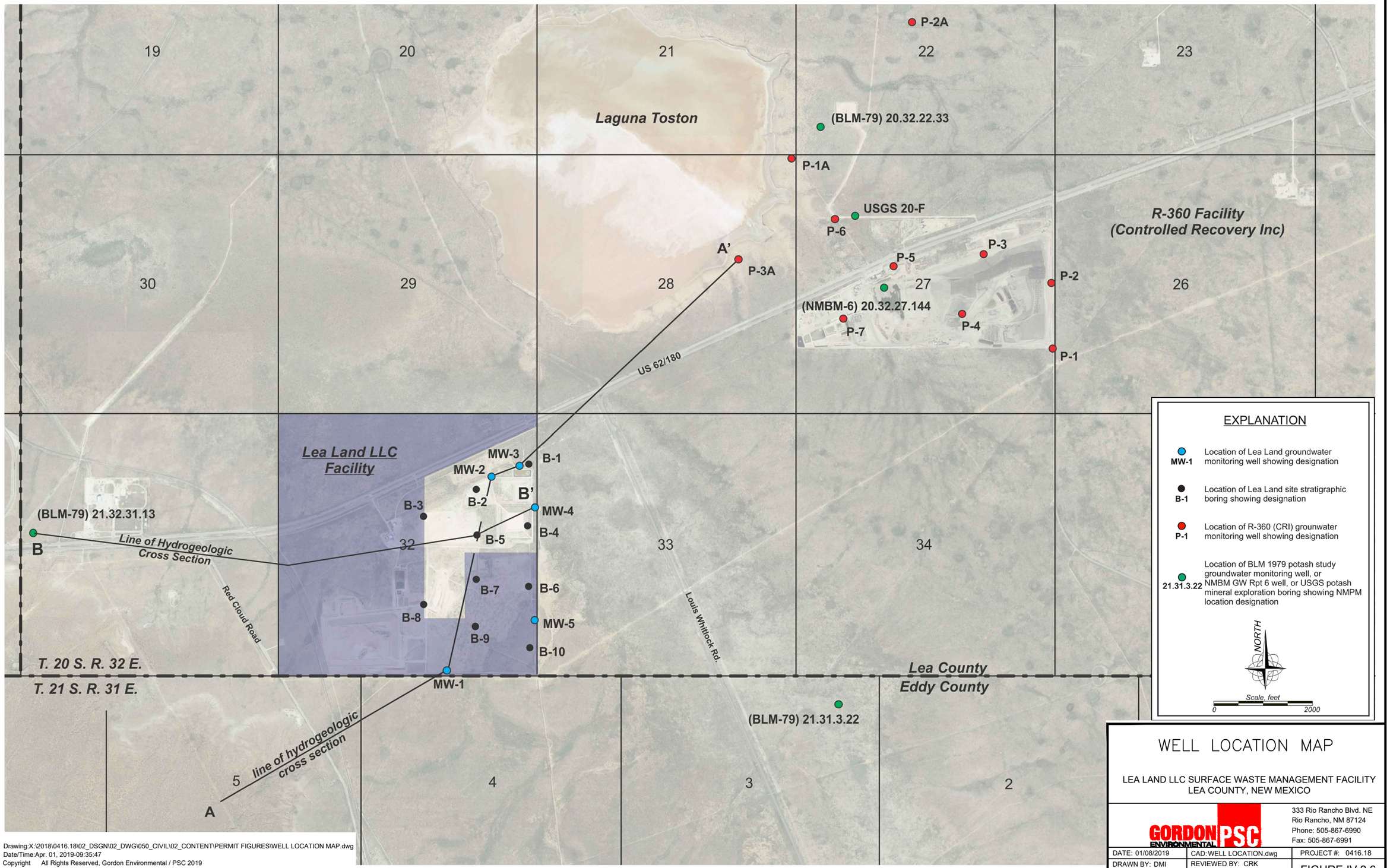


# WELL LOCATION MAP

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO


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Rio Rancho, NM 87124
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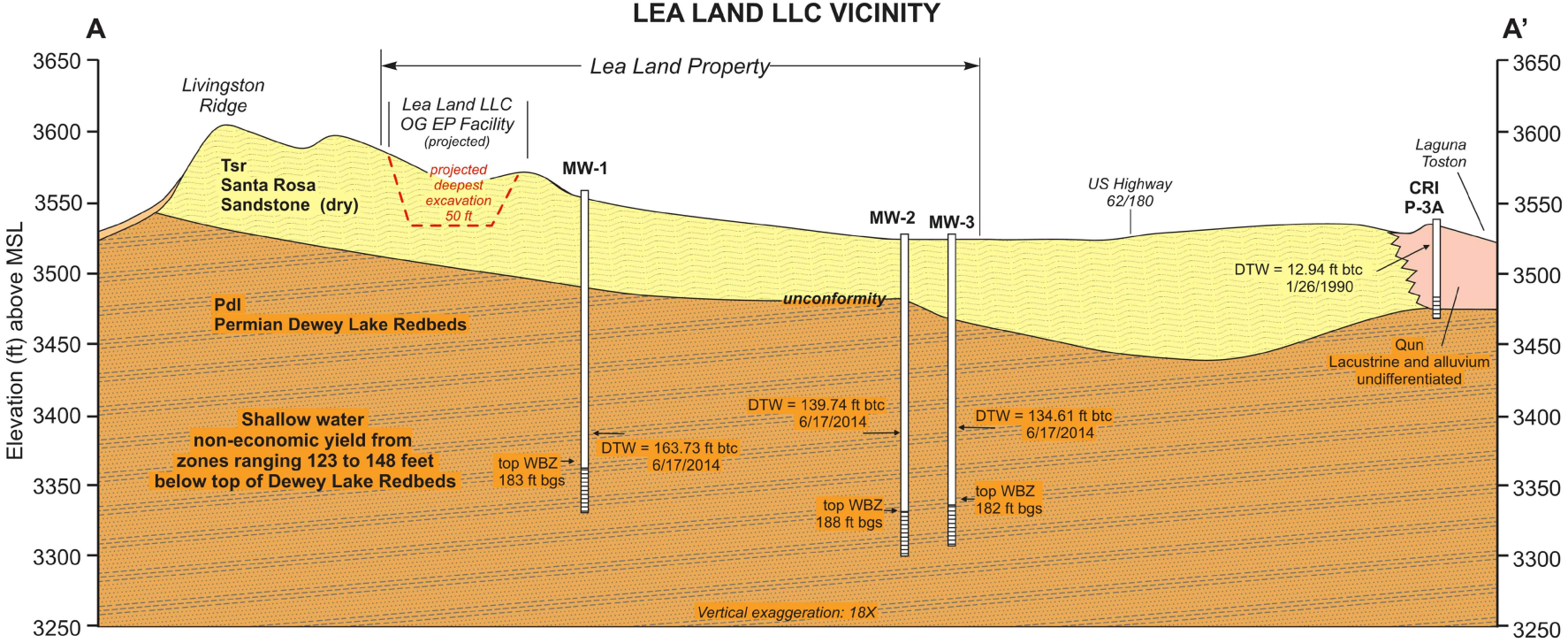
Fax: 505-867-6991


| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD:WELL LOCATION.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.6 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\WELL LOCATION MAP.dwg
Date/Time:Apr. 01, 2019-09:35:47

# HYDROGEOLOGIC CROSS SECTION
# LEA LAND LLC VICINITY




## EXPLANATION

- Qun — Quaternary alluvium and lacustrine deposits, undifferentiated
- Tsr — Triassic Santa Rosa Sandstone
- Pdl — Permian Dewey Lake Redbeds

Notes: btc: below top of casing
bgs: below ground surface

# HYDROGEOLOGIC CROSS–SECTION A–A'

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO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333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991


| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD: HYDRO GEO X-SEC.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.7 |
| APPROVED BY: CWF | www.team-psc.com | |


Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\HYDROGEOLOGIC CROSS-SECTION A A'.dwg
Date/Time:Mar. 25, 2019-12:33:57 ; LAYOUT: A (LS)

Eddy County

Lea County

General Slope Direction
Dewey Lake Redbeds

MW-3
3466.46

MW-2
3477.70

B-1

B-2
3471.6

MW-4
3469.71

B'

(BLM-79) 21.32.31.13
3530

B

31

Line of Hydrogeologic
Cross Section

B-3
3474.2

B-5
3474.5

B-4
3472.3

VZ-4

32

3520
3510
3500
3490

Evaporation
Ponds

VZ-8

VZ-7

VZ-1

VZ-3

B-7
3489.4

B-6
3490.9

Red Cloud Road

B-8

VZ-9

VZ-6

MW-5
3493.03

Jet Out Pit

VZ-2

B-9

Boiler

B-10
3498.2

Mechanical
Oil/Water
Separators

Stabilization and
Solidification Area

VZ-5

MW-1
3493.79

T. 20 S. R. 32 E.

T. 21 S. R. 31 E.

PROPOSED
FACILITY
EXPANSION
(basegrade elevations)

PROPOSED
LIQUIDS
MANAGEMENT
FACILITIES

5

4

## EXPLANATION

MW-1 3493.79 — Location of Lea Land groundwater monitoring well showing designation and elevation (ft above MSL) of the top of the Dewey Lake Redbeds

B-2 3471.6 — Location of Lea Land site stratigraphic boring showing designation and elevation (ft above MSL) of the top of the Dewey Lake Redbeds

21.31.3.22 3493 — Location of BLM 1979 potash study groundwater monitoring well, or NMBM GW Rpt 6 well, or USGS potash mineral exploration boring showing NMPM location designation and elevation (ft above MSL) of the top of the Dewey Lake Redbeds

VZ-1 — Location of proposed Vadoze Zone Monitoring well showing designation

Isopleth on line of equal elevation (ft) of base grade of proposed facility

3500

NORTH

Scale, feet

0 2000

NOTES:

1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 N, -103° 47' 18.25 W

# FACILITY BASEGRADES AND PROPOSED VADOSE WELLS

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/20/2019 | CAD:PROPOSED VADOSE.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.8 |
| APPROVED BY: CWF | www.team-psc.com | |

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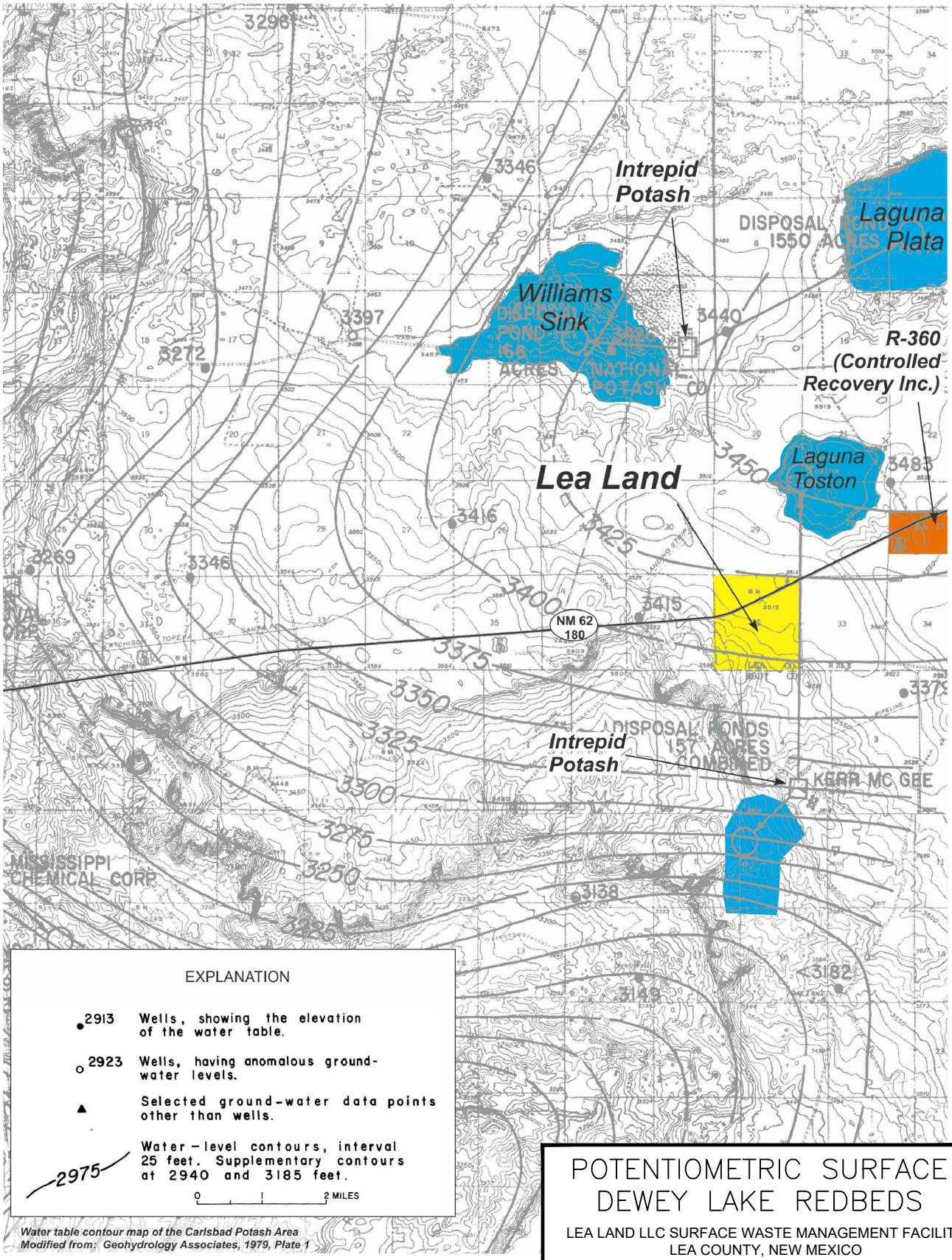
Date/Time:Apr. 01, 2019-07:01:20 ; LAYOUT: B (LS)




*Water table contour map of the Carlsbad Potash Area*
*Modified from: Geohydrology Associates, 1979, Plate 1*

NOTES:

1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 N, -103° 47' 18.25 W

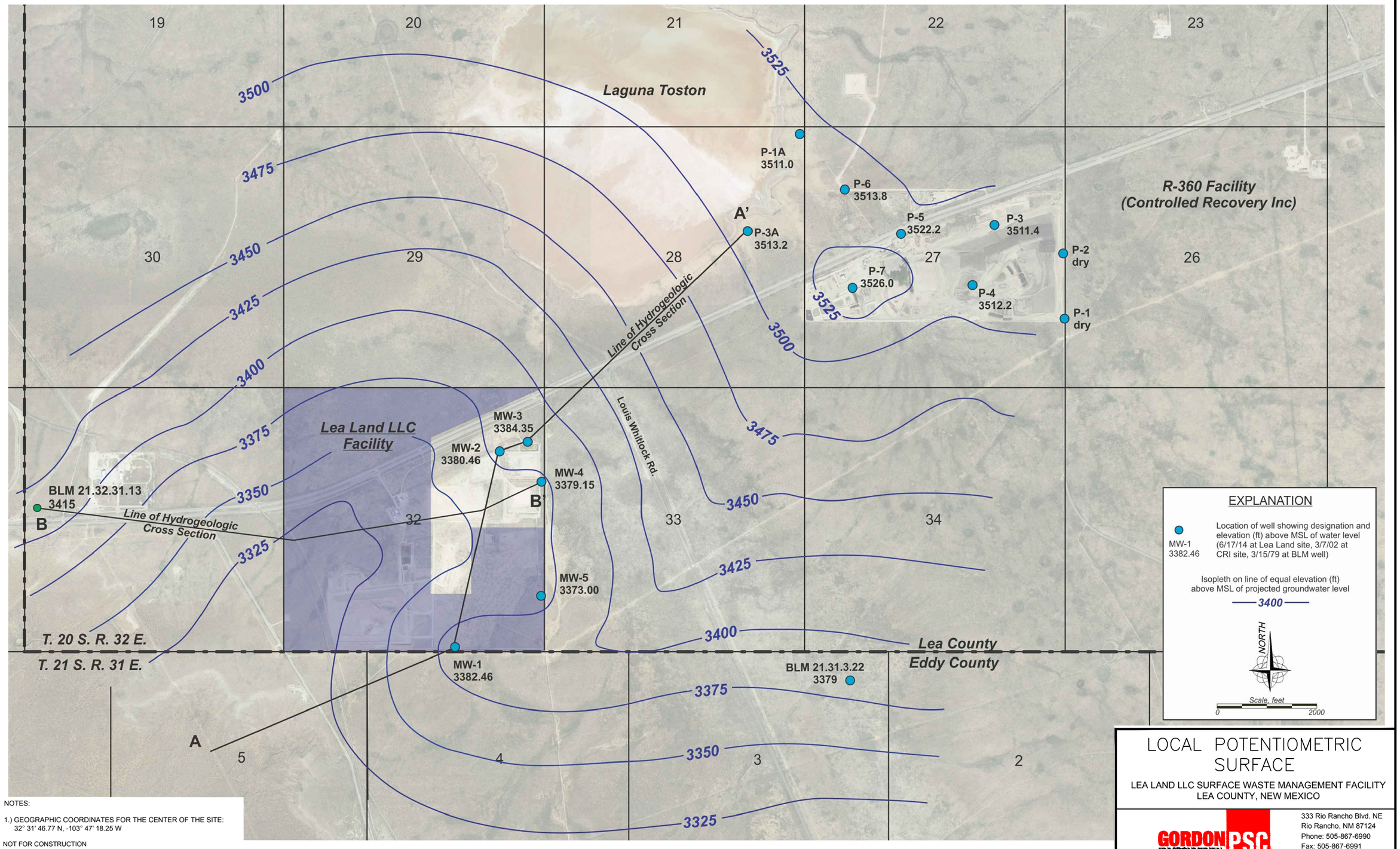
# POTENTIOMETRIC SURFACE DEWEY LAKE REDBEDS

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO


GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991


| | | |
|---|---|---|
| DATE: 03/31/2019 | CAD: REDBEDS GEO.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.9 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\POTENTIOMETRIC SURFACE DEWEY LAKE REDBEDS.dwg
Date/Time:May. 31, 2019-07:19:10 ; LAYOUT: Layout A (P)




# LOCAL POTENTIOMETRIC SURFACE

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

NOTES:

1.) GEOGRAPHIC COORDINATES FOR THE CENTER OF THE SITE:
32° 31' 46.77 N, -103° 47' 18.25 W

NOT FOR CONSTRUCTION

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\LOCAL POTENTIOMETRIC SURFACE.dwg
SIZE: ANSI-B Date/Time:Mar. 25, 2019-12:26:45 ; LAYOUT: B (LS)



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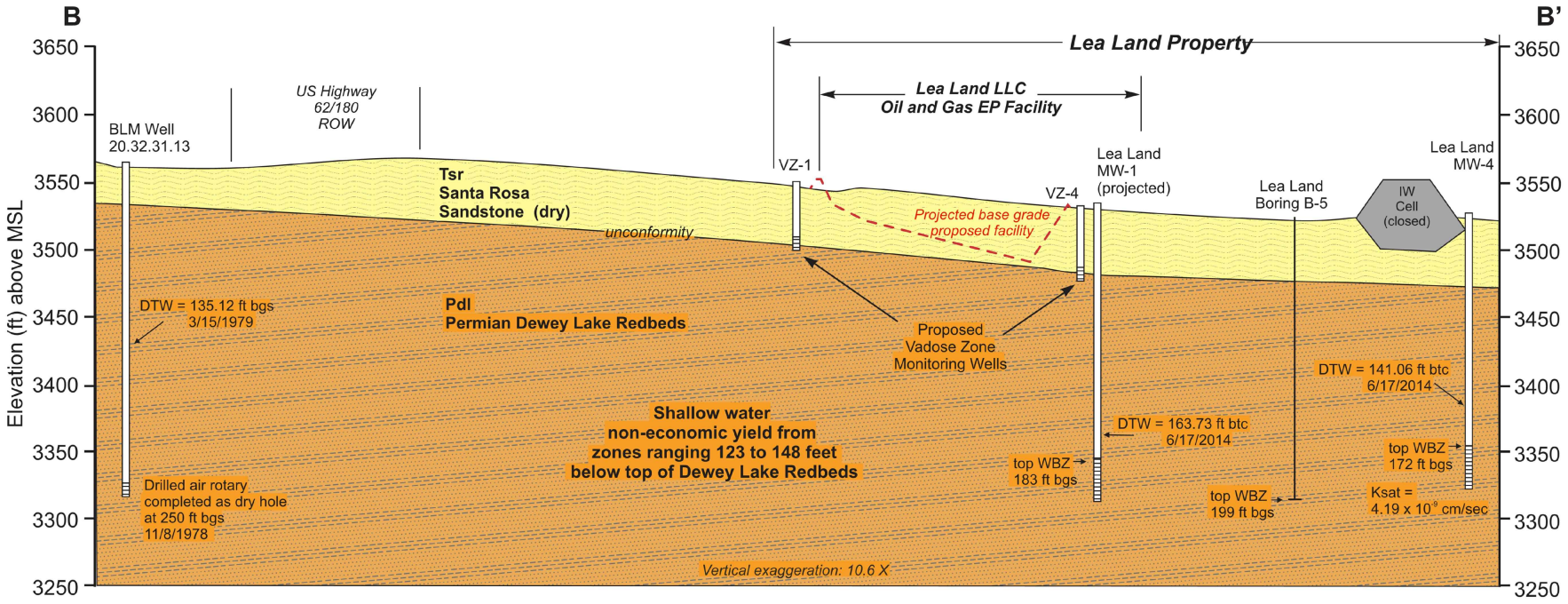
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD:LOCAL POTENT.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.10 |
| APPROVED BY: CWF | www.team-psc.com | |

# SHALLOW LOCAL HYDROGEOLOGIC CROSS SECTION LEA LAND LLC FACILITY




## EXPLANATION

| | |
|---|---|
| Qun | Quaternary alluvium and lacustrine deposits, undifferentiated |
| Tsr | Triassic Santa Rosa Sandstone |
| Pdl | Permian Dewey Lake Redbeds |

Notes: btc: below top of casing
bgs: below ground surface

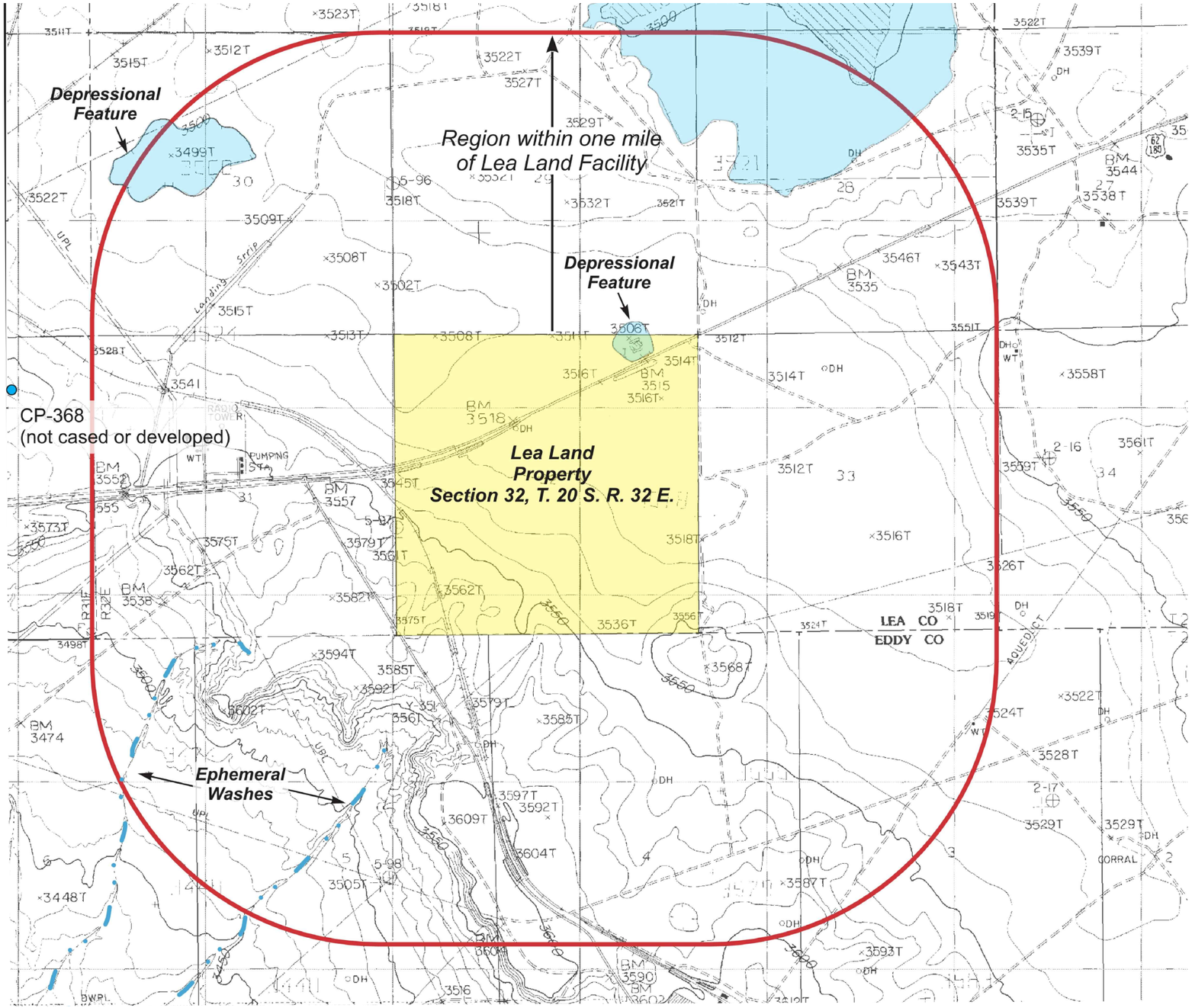
SHALLOW LOCAL HYDROGEOLOGIC CROSS–SECTION B–B'

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO


GORDON PSC ENVIRONMENTAL
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991


| | | |
|---|---|---|
| DATE: 01/08/2019 | CAD: HYDRO GEO X-SEC.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.11 |
| APPROVED BY: CWF | www.team-psc.com | |

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\LOCAL HYDROGEOLOGIC CROSS-SECTION B B'.dwg
Date/Time:Mar. 25, 2019-13:00:44 ; LAYOUT: A (LS)




## EXPLANATION

Location of NMOSE permitted water well showing NMOSE Basin and permit number

**CP-368**

NORTH

Scale, miles

0 1/2 1.0

NOTES:

1. GEOGRAPHIC CENTER 32° 31' 46.77 -103° 47' 18.25

Drawing:X:\2018\0416.18\02_DSGN\02_DWG\050_CIVIL\02_CONTENT\PERMIT FIGURES\RAI1\1 MILE RADIUS MAP.dwg
Date/Time:Jun. 03, 2019-09:48:06 ; LAYOUT: B (LS)



# 1 MILE RADIUS MAP

LEA LAND LLC SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

GORDON ENVIRONMENTAL PSC
333 Rio Rancho Blvd. NE
Rio Rancho, NM 87124
Phone: 505-867-6990
Fax: 505-867-6991

| | | |
|---|---|---|
| DATE: 03/11/2019 | CAD: SITE LOCATION.dwg | PROJECT #: 0416.18 |
| DRAWN BY: DMI | REVIEWED BY: CRK | FIGURE IV.2.12 |
| APPROVED BY: CWF | www.team-psc.com | |

## TABLES

## TABLE IV.2.1 - Summary Data from Wells and Borings in the Vicinity of the Lea Land SWMF

| Well or Boring | Latitude | Longitude | Owner | Completion Date | [1]LS Elev (ft) | Water Bearing Zone | Top Casing Elev (ft) | Depth (ft) | WL (ft) Below Top Casing | WL (ft) Below Land Surface | WL Date | WL Elev (ft) above MSL | Top Screen Elev (ft) Above MSL | Bottom Screen Elev (ft) Above MSL | Depth to Top of Water-Bearing Zone (ft) | Depth to Top of Pdl Dewey Lake Redbed (ft) | Elev Top of Pdl Dewey Lake Redbeds (ft) | Source of Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Lea Land Facility Groundwater Monitoring Wells*** | | | | | | | | | | | | | | | | | | |
| MW-1 | 32.522613 | -103.78581 | Lea Land | Jun-96 | 3543.79 | Pdl | 3546.29 | 215.0 | 163.73 | | 6/17/2014 | 3382.56 | 3361 | 3329 | 183 | 50 | 3493.79 | LL Permit Doc, GW Monitoring Reports |
| MW-2 | 32.533437 | -103.78285 | Lea Land | Jun-96 | 3517.70 | Pdl | 3520.20 | 220.0 | 139.74 | | 6/17/2014 | 3380.46 | 3330 | 3298 | 188 | 40 | 3477.70 | LL Permit Doc, GW Monitoring Reports |
| MW-3 | 32.533989 | -103.78099 | Lea Land | Jun-96 | 3516.46 | Pdl | 3518.96 | 214.0 | 134.61 | | 6/17/2014 | 3384.35 | 3335 | 3303 | 182 | 50 | 3466.46 | LL Permit Doc, GW Monitoring Reports |
| MW-4 | 32.531736 | -103.78001 | Lea Land | Jun-96 | 3517.71 | Pdl | 3520.21 | 203.5 | 141.06 | | 6/17/2014 | 3379.15 | 3347 | 3315 | 171.5 | 48 | 3469.71 | LL Permit Doc, GW Monitoring Reports |
| MW-5 | 32.525402 | -103.78000 | Lea Land | Jun-97 | 3523.03 | Pdl | 3525.53 | 210.0 | 152.53 | | 6/17/2014 | 3373.00 | 3346 | 3314 | 178 | 30 | 3493.03 | LL Permit Doc, GW Monitoring Reports |
| ***Lea Land Facility Soil Borings*** | | | | | | | | | | | | | | | | | | |
| B-1 | 32.535111 | -103.780339 | Lea Land | 11/8/1993 | 3515.5 | Pdl | not cased | 126 | | 125 | | 3390.50 | | | | 60 | 3455.5 | Lea Land Boring Logs-Permit Document |
| B-2 | 32.533001 | -103.783891 | Lea Land | 11/8/1993 | 3516.6 | dry | not cased | 155 | | dry | | | | | | 45 | 3471.6 | Lea Land Boring Logs-Permit Document |
| B-3 | 32.531446 | -103.787568 | Lea Land | 11/8/1993 | 3519.2 | dry | not cased | 150.0 | | dry | | | | | | 45 | 3474.2 | Lea Land Boring Logs-Permit Document |
| B-4 | 32.531098 | -103.780226 | Lea Land | 11/8/1993 | 3517.3 | dry | not cased | 148.0 | | dry | | | | | | 45 | 3472.3 | Lea Land Boring Logs-Permit Document |
| B-5 | 32.530447 | -103.783806 | Lea Land | 11/8/1993 | 3519.5 | Pdl | not cased | 201.0 | | 199 | | 3320.50 | | | | 45 | 3474.5 | Lea Land Boring Logs-Permit Document |
| B-6 | 32.527602 | -103.780036 | Lea Land | 11/8/1993 | 3520.9 | dry | not cased | 165.0 | | dry | | | | | | 30 | 3490.9 | Lea Land Boring Logs-Permit Document |
| B-7 | 32.527902 | -103.783752 | Lea Land | 11/8/1993 | 3524.4 | dry | not cased | 184 | | dry | | | | | | 35 | 3489.4 | Lea Land Boring Logs-Permit Document |
| B-8 | 32.526431 | -103.787421 | Lea Land | 11/8/1993 | 3536.4 | dry | not cased | 166 | | dry | | | | | | 95 | 3441.4 | Lea Land Boring Logs-Permit Document |
| B-9 | 32.525223 | -103.783718 | Lea Land | 11/8/1993 | 3530.1 | dry | not cased | 160 | | dry | | | | | | 75 | 3455.1 | Lea Land Boring Logs-Permit Document |
| B-10 | 32.524025 | -103.779907 | Lea Land | 11/8/1993 | 3548.2 | dry | not cased | 178 | | dry | | | | | | 50 | 3498.2 | Lea Land Boring Logs-Permit Document |
| ***Controlled Recovery Inc. Monitoring Wells*** | | | | | | | | | | | | | | | | | | |
| P-1 | 32.540629 | -103.745681 | CRI | 10/31/1989 | 3553 | dry | 3554.9 | 97.95 | dry | | 3/7/2002 | | | | | 45 | 3508 | Safety-Environmental Solutions 2003 |
| P-2 | 32.544247 | -103.745751 | CRI | 10/31/1989 | 3546 | dry | 3556.6 | 59.28 | dry | | 3/7/2002 | | | | | 40 | 3506 | Safety-Environmental Solutions 2003 |
| P-3 | 32.545867 | -103.750232 | CRI | 10/31/1989 | 3542 | Qal | 3543.4 | 46.8 | 31.98 | | 3/7/2002 | 3511.4 | | | | 40 | 3502 | Safety-Environmental Solutions 2003 |
| P-4 | 32.542550 | -103.751759 | CRI | 10/31/1989 | 3550 | Qal | 3551.2 | 58.6 | 39.01 | | 3/7/2002 | 3512.2 | | | | 50 | 3500 | Safety-Environmental Solutions 2003 |
| P-5 | 32.545331 | -103.756278 | CRI | 10/31/1989 | 3539 | Qal | 3541.0 | 48.57 | 18.85 | | 3/7/2002 | 3522.2 | | | | 50 | 3489 | Safety-Environmental Solutions 2003 |
| P-6 | 32.547877 | -103.760023 | CRI | 10/31/1989 | 3529 | Qal | 3531.8 | 50.21 | 18.00 | | 3/7/2002 | 3513.8 | | | | 40 | 3489 | Safety-Environmental Solutions 2003 |
| P-7 | 32.542377 | -103.759548 | CRI | 10/31/1989 | 3541 | Qal | 3543.7 | 42.04 | 17.74 | | 3/7/2002 | 3526.0 | | | | 35 | 3506 | Safety-Environmental Solutions 2003 |
| P-1A | 32.551305 | -103.762889 | CRI | 1/26/1990 | 3519 | Qal | 3522.9 | 31.26 | 11.86 | | 3/7/2002 | 3511.0 | | | | 30 | 3489 | Safety-Environmental Solutions 2003 |
| P-2A | 32.558896 | -103.75490 | CRI | 1/26/1990 | 3527 | Qal | 3529.3 | 47.41 | 37.14 | | 3/7/2002 | 3492.2 | | | | 45 | 3482 | Safety-Environmental Solutions 2003 |
| P-3A | 32.545635 | -103.76645 | CRI | 1/26/1990 | 3522 | Qal | 3526.1 | 55.45 | 12.94 | | 3/7/2002 | 3513.2 | 3482 | 3467 | | 50 | 3472 | Safety-Environmental Solutions 2003 |
| ***BLM 1978 Potash Environmental Study Wells*** | | | | | | | | | | | | | | | | | | |
| BLM 20.32.17.13 | 32.575143 | -103.79470 | BLM | 11/8/1978 | 3460.5 | Qplaya | 3450.35 | 100 | 9.90 | | 3/15/1979 | 3440.45 | 20 | 40 | 18 | 35 | 3425.5 | Geohydrology 1979 |
| BLM 20.32.22.33 | 32.553150 | -103.76076 | BLM | 11/8/1978 | 3527 | Tr undiff | 3512.52 | 170 | 29.65 | | 3/15/1979 | 3482.87 | 150 | 179 | 35 | 30 | 3497.0 | Geohydrology 1979 |
| BLM 20.32.31.13 | 32.531335 | -103.81209 | BLM | 11/8/1978 | 3553 | Pdl | 3549.95 | 250 | 135.12 | | 3/15/1979 | 3414.83 | 240 | 250 | unknown | 23 | 3530.0 | Geohydrology 1979 |
| BLM 21.31.3.22 | 32.520657 | -103.75978 | BLM | 11/9/1978 | 3523 | Pdl | 3519.59 | 200 | 140.81 | | 3/15/1979 | 3378.78 | 140 | 160 | 150 | 30 | 3493.0 | Geohydrology 1979 |
| ***NMBM GW-6*** | | | | | | | | | | | | | | | | | | |
| 20.32.18.233 | 32.573908 | -103.804859 | Freeport | 1954 | 3450 | Tr | | 400 | | 89.2 | 3/24/1954 | 3360.8 | WBZ 215-243 ft | | | | | Nicholson-Clebsch, 1961 |
| 20.32.27.144 | 32.544000 | -103.756733 | Joel Frey | | 3545 | Qal | | 25 | | 12.3 | 6/11/1954 | 3532.7 | | | | | | Nicholson-Clebsch, 1961 |
| 20.32.30.142 | 32.546506 | -103.806406 | | | 3530 | Pdl | | | | 9.9 | 6/11/1954 | 3520.1 | | | | | | Nicholson-Clebsch, 1961 |
| ***NMOSE Permitted Water Wells and Monitoring Wells*** | | | | | | | | | | | | | | | | | | |
| CP-00368 | 32.533577 | -103.81851 | Ballard-Bonfield | 6/9/1966 | 3573 | | not cased | 303 | | dry | | | not cased | | | 9 | 3564 | NMOSE WATERS DATABASE |
| CP-00370 | 32.535000 | -103.82900 | Ballard-Bonfield | 7/14/1966 | 3549 | | not cased | 120 | | 80 | 7/14/1966 | | not cased | | | 80 | 3469 | NMOSE WATERS DATABASE |
| C-02953 EXPL | 32.481000 | -103.79000 | DOE WIPP | 4/7/2004 | 3500 | | | | 630 | | | | | | | | | NMOSE WATERS DATABASE |
| C-03233 EXPLORE | 32.458000 | -103.79300 | DOE WIPP | 6/19/2006 | 3349 | | | 566 | | | | | | | | | | NMOSE WATERS DATABASE |
| C-03151 | 32.491000 | -103.71100 | DOE WIPP | 8/23/2005 | 3433 | | | 1352 | | | | | | | | | | NMOSE WATERS DATABASE |
| C-02727 | 32.440000 | -103.79000 | DOE WIPP | 8/27/2000 | 3440 | Pr | | 913 | | | | | | | | | | NMOSE WATERS DATABASE |
| ***Mineral Exploration Wells*** | | | | | | | | | | | | | | | | | | |
| USGS 20-F | 32.54044 | -103.758712 | FM Coop. | 3/6/1953 | 3532 | | not cased | 1273 | | | | | | | | 40 | 3492.0 | Mineral Expl Hole |

## TABLE IV.2.2 - Water Quality Data Summary

### Volatile Organic Compounds

| Lab Method | | EPA Method 8260B - (all units in micrograms per liter) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Chloromethane | Vinyl chloride | Bromomethane | Chloroethane | Trichlorofluoromethane | 1,1-Dichloroethene | Methylene chloride | trans-1,2-Dichloroethene | 1,1-Dichloroethane | cis-1,2-Dichloroethene | Chloroform | Carbon tetrachloride | 1,1,1-Trichloroethane | Benzene | 1,2-Dichloroethane | Trichloroethene | 1,2-Dichloropropane | Bromodichloromethane | cis-1,3-Dichloropropene | Tetrachloroethene | trans-1,3-Dichloropropene | 1,1,2-Trichloroethane | Dibromochloromethane | Chlorobenzene | Bromoform | 1,1,2,2-Tetrachloroethane | 1,4 Dichlorobenzene | 1,2-Dichlorobenzene |
| **NMWQCC Standard** | | 100 | 1.0 | -- | -- | -- | 25 | 5 | 100 | -- | 5 | 100 | -- | 100 | 5 | 5 | 5 | 5 | -- | -- | 5 | -- | 5 | -- | 100 | -- | 10 | 75 | 600 |
| ***Lea Land Monitoring Wells Completed in Dewey Lake Redbeds*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Well Location** | **Sample Date** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Lea Land MW-2** | **6/13/18** | <0.2 | <0.1 | <0.3 | <0.2 | <0.1 | <0.2 | <0.09 | <0.2 | <0.1 | <0.2 | <0.1 | <0.1 | <0.1 | <0.1 | <0.2 | <0.2 | <0.1 | <0.1 | <0.08 | <0.03 | <0.08 | <0.1 | <0.1 | <0.1 | <0.2 | <0.2 | <0.1 | <0.1 |
| **Lea Land MW-4** | **6/13/18** | <0.2 | <0.1 | <0.3 | <0.2 | <0.1 | <0.2 | <0.09 | <0.2 | <0.1 | <0.2 | <0.1 | <0.1 | <0.1 | <0.1 | <0.2 | <0.2 | <0.1 | <0.1 | <0.08 | <0.03 | <0.08 | <0.1 | <0.1 | <0.1 | <0.2 | <0.2 | <0.1 | <0.1 |
| **Lea Land MW-5** | **6/13/18** | <0.2 | <0.1 | <0.3 | <0.2 | <0.1 | <0.2 | <0.09 | <0.2 | <0.1 | <0.2 | <0.1 | <0.1 | <0.1 | <0.1 | <0.2 | <0.2 | <0.1 | <0.1 | <0.08 | <0.03 | <0.08 | <0.1 | <0.1 | <0.1 | <0.2 | <0.2 | <0.1 | <0.1 |

### Inorganic Compounds

| Lab Method | | All units are milligrams per liter (mg/L) except conductivity (micromhos/cm3) and pH (standard units). | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 300.0 | | | | | 350.1 | 160.1 | 200.7 | | | | | | 310.1 | | | 5310C | 120.1 | 150.1 | 6010B | | | | | | | | | 1 | 1 | 1 |
| | | Chloride | Nitrate as N | Nitrate+Nitrite as N by IC | Nitrite as N | Sulfate | Ammonia | Total Dissolved Solids | Calcium | Iron | Magnesium | Manganese | Potassium | Sodium | Alkalinity, Bicarbonate | Alkalinity, Carbonate | Alkalinity Total | Total Organic Carbon | Conductivity mS/cm | pH | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury | Selenium | Silver | Boron | Chromium, total | Chromium +6 |
| **NMWQCC Standard** | | 250 | 10.0 | -- | 10.0 | 600 | -- | 1,000 | -- | 1.0 | -- | 0.2 | -- | -- | -- | -- | -- | -- | -- | 6-9 | 0.01 | 1.0 | 0.01 | 0.05 | 0.05 | 0.0020 | 0.05 | 0.05 | | 0.05 | |
| ***Lea Land Monitoring Wells Completed in Dewey Lake Redbeds*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Well Location** | **Sample Date** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Lea Land MW-2** | **6/13/18** | 79.8 | 3.36 | 3.36 | <0.02 | 462 | 0.09 | 818 | 50.6 | <0.05 | 40.1 | <0.02 | 5.33 | 224 | 205 | <1.0 | 168 | 1.36 | 1510 | 7.72 | | | | | | | | | | | |
| | **3/19/10** | | | | | | | | | | | | | | | | | | | | <0.005 | 0.033 | <0.00209 | 0.0030 | <0.005 | <0.0002 | 0.069 | <0.005 | | | |
| **Lea Land MW-3** | **3/19/10** | | | | | | | | | | | | | | | | | | | | <0.005 | 0.017 | <0.00209 | <0.005 | <0.005 | <0.0002 | 0.075 | <0.005 | | | |
| **Lea Land MW-4** | **6/13/18** | 62.5 | 3.32 | 3.32 | <0.02 | 361 | 0.05 | 778 | 48.4 | <0.05 | 43.2 | <0.02 | 4.92 | 170 | 190 | <1.0 | 156 | <0.05 | 1280 | 7.74 | | | | | | | | | | | |
| | **3/19/10** | | | | | | | | | | | | | | | | | | | | <0.005 | 0.025 | <0.00209 | 0.004 | <0.005 | <0.0002 | 0.087 | <0.005 | | | |
| **Lea Land MW-5** | **6/13/18** | 54.0 | 3.15 | 3.15 | <0.02 | 412 | 0.07 | 886 | 58.6 | <0.05 | 42.0 | <0.02 | 4.14 | 176 | 224 | <1.0 | 184 | 0.501 | 886 | 7.70 | | | | | | | | | | | |
| | **3/19/10** | | | | | | | | | | | | | | | | | | | | <0.005 | 0.023 | <0.00209 | <0.005 | <0.005 | <0.0002 | 0.068 | <0.005 | | | |
| ***BLM 1979 Potash Area Groundwater Monitoring Wells Completed in Dewey Lake Redbeds*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **[1]BLM 20.32.22.33** | **Jan 1979** | 75.0 | | | | 550 | | 3136 | 105 | | | | | | | | | | | | | | | | | | | 0.3 | <0.02 | <0.02 |
| **[1]BLM 21.31.3.22** | **Jan 1979** | 18.0 | | | | 20.0 | | 424.0 | 19.9 | | | | | | | | | | | | | | | | | | | <0.05 | <0.02 | <0.02 |

*Notes:*

*All units are milligrams per liter (mg/L) except conductivity (micromhos/cm $^3$) and pH (standard units).*

*[1] Methods undetermined*

## TABLE IV.2.3 - Soil Laboratory Analysis Summary

(Page 1 of 3)

| Boring, Well or Source | Depth Top Sample (Top Tested Interval) | Depth Bottom Sample (Bottom Tested Interval) | Work Completed By | Date | USCS | Sieve - % Passing | | Atterberg Limits | | Carbonate % | [1]Permeability Range Based on Texture (cm/sec) | Ksat, (cm/sec) [Constant Head] | Ksat, (cm/sec) [Falling Head] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | No. 40 | No. 200 | Liquid Limit | Plasticity Index | | | | |
| ***Tests of Borehole Media from Santa Rosa Sandstone and Alluvial Veneers*** | | | | | | | | | | | | | |
| B-1 | 5 | 6 | STEC | 11/8/1993 | SM | 71.6% | 32.4% | NP | NP | 100 | 10-3 to 10-6 | | |
| B-1 | 35 | 36 | STEC | 11/8/1993 | SM | 67.8% | 23.4% | NP | NP | 100 | 10-3 to 10-6 | | |
| B-1 | 45 | 46 | STEC | 11/8/1993 | SM | 82.2% | 38.6% | NP | NP | 24 | 10-3 to 10-6 | | |
| B-2 | 10 | 11 | STEC | 11/8/1993 | SM | 90.9% | 30.4% | NP | NP | 17 | 10-3 to 10-6 | | |
| B-2 | 25 | 26 | STEC | 11/8/1993 | SM | 82.2% | 38.5% | NP | NP | 24 | 10-3 to 10-6 | | |
| B-3 | 15 | 16 | STEC | 11/8/1993 | SM | 93.6% | 30.5% | 28 | NP | 8 | 10-3 to 10-6 | | |
| B-4 | 40 | 41 | STEC | 11/8/1993 | SM | 90.2% | 38.0% | NP | NP | 18 | 10-3 to 10-6 | | |
| B-5 | 35 | 36 | STEC | 11/8/1993 | SM | 89.9% | 35.1% | NP | NP | 18 | 10-3 to 10-6 | | |
| B-7 | 25 | 26 | STEC | 11/8/1993 | SM | 59.0% | 19.1% | NP | NP | 77 | 10-3 to 10-6 | | |
| B-8 | 0 | 1 | STEC | 11/8/1993 | CL | 85.4% | 54.4% | NP | NP | 4 | 10-6 to 10-8 | | |
| B-8 | 5 | 6 | STEC | 11/8/1993 | SM | 69.7% | 33.4% | 29 | NP | 77 | 10-3 to 10-6 | | |
| B-8 | 15 | 16 | STEC | 11/8/1993 | SM | 59.0% | 19.1% | NP | NP | 77 | 10-3 to 10-6 | | |
| B-8 | 85 | 86 | STEC | 11/8/1993 | SM | 95.4% | 30.5% | NP | NP | 18 | 10-3 to 10-6 | | |
| B-9 | 0 | 1 | STEC | 11/8/1993 | ML | 97.8% | 53.9% | 24 | NP | 5 | 10-3 to 10-6 | | |
| B-9 | 30 | 31 | STEC | 11/8/1993 | SM | 71.6% | 32.4% | NP | NP | 100 | 10-3 to 10-6 | | |
| B-9 | 35 | 36 | STEC | 11/8/1993 | SM | 93.6% | 30.5% | 28 | NP | 8 | 10-3 to 10-6 | | |
| B-9 | 50 | 51 | STEC | 11/8/1993 | SM | 95.4% | 30.5% | NP | NP | 18 | 10-3 to 10-6 | | |
| B-10 | 10 | 11 | STEC | 11/8/1993 | SM | 69.7% | 33.4% | 29 | NP | 77 | 10-3 to 10-6 | | |
| B-10 | 15 | 16 | STEC | 11/8/1993 | SM | 83.3% | 37.8% | NP | NP | 40 | 10-3 to 10-6 | | |
| ***Tests of Borrow Material Samples (Santa Rosa Sandstone and Alluvial Materials)*** | | | | | | | | | | | | | |
| Onsite Stockpile Soil 1 | | | DBSA | 7/19/2016 | | | | | | | | 3.40E-04 | N/A |
| Onsite Stockpile Soil 2 | | | DBSA | 7/19/2016 | | | | | | | | 1.40E-04 | N/A |

*Note:*

*[1] Permeability range estimates from Engineering document FM-5-47/NAVFAC MO 330/AFJMAN 32-1221(1)*

## TABLE IV.2.3 - Soil Laboratory Analysis Summary

(Page 2 of 3)

| Boring, Well or Source | Depth Top Sample (Top Tested Interval) | Depth Bottom Sample (Bottom Tested Interval) | Work Completed By | Date | USCS | Sieve - % Passing | | Atterberg Limits | | Carbonate % | [1]Permeability Range Based on Texture (cm/sec) | Ksat (cm/sec) (Horizotal) | Coefficient of Storage (dimensoinless) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | No. 40 | No. 200 | Liquid Limit | Plasticity Index | | | | | |
| ***Tests of Borehole Media from Dewey Lake Redbeds*** | | | | | | | | | | | | | | |
| B-1 | 75 | 76 | STEC | 11/8/1993 | CL | 85.4% | 54.4% | 25 | 8 | 4 | 10-6 to 10-8 | | | |
| B-1 | 90 | 91 | STEC | 11/8/1993 | SC | 78.9% | 49.2% | 31 | 14 | 19 | 10-6 to 10-8 | | | |
| B-2 | 65 | 66 | STEC | 11/8/1993 | CL | 85.4% | 54.4% | 25 | 8 | 4 | 10-6 to 10-8 | | | |
| B-4 | 50 | 51 | STEC | 11/8/1993 | SM | 92.3% | 40.9% | NP | NP | 16 | 10-3 to 10-6 | | | |
| B-4 | 140 | 141 | STEC | 11/8/1993 | SC | 78.9% | 49.2% | 31 | 14 | 19 | 10-6 to 10-8 | | | |
| B-6 | 30 | 31 | STEC | 11/8/1993 | CL | 96.5% | 73.8% | 27 | 11 | 27 | 10-6 to 10-8 | | | |
| B-6 | 40 | 41 | STEC | 11/8/1993 | SM | 83.3% | 37.8% | NP | NP | 40 | 10-3 to 10-6 | | | |
| B-6 | 55 | 56 | STEC | 11/8/1993 | SM | 90.0% | 30.4% | NP | NP | 17 | 10-3 to 10-6 | | | |
| B-6 | 110 | 111 | STEC | 11/8/1993 | SM | 90.2% | 38.0% | NP | NP | 18 | 10-3 to 10-6 | | | |
| B-8 | 105 | 106 | STEC | 11/8/1993 | ML | 97.8% | 53.9% | 24 | NP | 5 | 10-3 to 10-6 | | | |
| B-8 | 120 | 121 | STEC | 11/8/1993 | ML | 97.8% | 53.9% | 24 | NP | 5 | 10-3 to 10-6 | | | |
| B-9 | 65 | 66 | STEC | 11/8/1993 | SM | 85.9% | 28.6% | NP | NP | 24 | 10-3 to 10-6 | | | |
| B-10 | 60 | 61 | STEC | 11/8/1993 | SM | 92.3% | 40.9% | NP | NP | 18 | 10-3 to 10-6 | | | |
| B-10 | 70 | 71 | STEC | 11/8/1993 | CL | 96.5% | 73.8% | 27 | 11 | 27 | 10-6 to 10-8 | | | |
| ***Insitu Tests of Wells Completed in the Dewey Lake Redbeds*** | | | | | | | | | | | | | | |
| Lea Land MW-4 | 170 | 203 | Intera | 2/27/1997 | | | | | | | | 4.17E-09 | 3.71E-09 | Slug test |
| BLM 20.32.22.33 | 150 | 179 | Geohydrology | 11/8/1978 | | | | | | | | 3.15E-07 | | Pump Test |
| BLM 21.31.3.22 | 140 | 160 | Geohydrology | 11/8/1978 | | | | | | | | 1.33E-06 | | Pump Test |

*Note:*

*[1] Permeability range estimates from Engineering document FM-5-47/NAVFAC MO 330/AFJMAN 32-1221(1)*

**TABLE IV.2.3 - Soil Laboratory Analysis Summary**
(Page 3 of 3)

| Boring, Well or Source | Work Completed By | Date | USCS | Sieve - % Passing | Max Density (pcf) | Optimum Moisture (%) | Atterberg Limits | | | ASTM D-2922 | | Ksat, (cm/sec) [Constant Head] | Ksat, (cm/sec) [Falling Head] | Ksat, (cm/sec) (Corrected) [Constant Head] | Ksat, (cm/sec) (Corrected) [Falling Head] | Cu | Cc | Calculated Porosity (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | No. 200 | | | Liquid Limit | Plastic Limit | Plasticity Index | Dry Density % Maximum | Moisture Content % | | | | | | | |
| *Tests of Proposed Cover Samples for Municipal Cell Closure (Santa Rosa Sandstone and Alluvial Materials)* | | | | | | | | | | | | | | | | | | |
| Sample 1.0 | DBS&A | 8/7/20014 | SC | 45.8% | 116.12 | 13.9 | 28 | 18 | 10 | 80.5% | 13.5% | 4.4E-03 | | 4.1E-03 | | 326 | 0.84 | 44.8 |
| Sample 1.1 | DBS&A | 8/7/20014 | SC | | 116.12 | 13.9 | | | | 95.2% | 17.4% | | 5.7E-07 | | 5.3E-07 | | | 34.7 |
| Sample 2.0 | DBS&A | 8/7/20014 | SC | 42.8% | 117.99 | 12.7 | 28 | 17 | 11 | 80.4% | 12.3% | 4.1E-03 | | 3.8E-03 | | 205 | 0.48 | 44.3 |
| Sample 2.0 | DBS&A | 8/7/20014 | SC | | 117.99 | 12.7 | | | | 95.3% | 15.7% | | 3.0E-06 | | 2.7E-06 | | | 33.9 |
| Sample 3.0 | DBS&A | 8/7/20014 | SC | 44.4% | 114.87 | 14.0 | 27 | 17 | 10 | 80.1% | 13.7% | 6.6E-03 | | 6.1E-03 | | 183 | 0.43 | 45.8 |
| Sample 3.1 | DBS&A | 8/7/20014 | SC | | 114.87 | 14.0 | | | | 94.8% | 17.4% | | 3.9E-06 | | 3.5E-06 | | | 35.9 |
| Sample 4.0 | DBS&A | 8/7/20014 | SC | 43.4% | 114.87 | 14.0 | 28 | 17 | 11 | 80.3% | 13.5% | 4.9E-03 | | 4.6E-03 | | 211 | 0.39 | 45.5 |
| Sample 4.1 | DBS&A | 8/7/20014 | SC | | 114.87 | 14.0 | | | | 95.1% | 17.0% | | 1.0E-06 | | 9.4E-07 | | | 35.5 |
| Sample 5.0 | DBS&A | 8/7/20014 | SC | 48.4% | 114.87 | 13.6 | 30 | 18 | 12 | 80.0% | 13.0% | 4.4E-03 | | 4.1E-03 | | 176 | 0.21 | 45.2 |
| Sample 5.1 | DBS&A | 8/7/20014 | SC | | 114.87 | 13.6 | | | | 95.2% | 16.3% | | 1.1E-06 | | 1.0E-06 | | | 34.8 |
| Sample 6.0 | DBS&A | 8/7/20014 | SC | 45.2% | 115.49 | 13.6 | 29 | 19 | 10 | 80.0% | 13.4% | 5.2E-03 | | 4.7E-03 | | 195 | 0.23 | 45.6 |
| Sample 6.1 | DBS&A | 8/7/20014 | SC | | 115.49 | 13.6 | | | | 94.9% | 16.8% | | 8.2E-07 | | 7.5E-07 | | | 35.4 |
| Sample 7.0 | DBS&A | 8/7/20014 | SC | 43.7% | 114.24 | 13.4 | 27 | 16 | 11 | 79.9% | 12.9% | 6.0E-03 | | 5.6E-03 | | 190 | 0.32 | 45.8 |
| Sample 7.1 | DBS&A | 8/7/20014 | SC | | 114.24 | 13.4 | | | | 95.1% | 16.4% | | 5.6E-06 | | 5.3E-06 | | | 35.4 |
| Sample 8.0 | DBS&A | 8/7/20014 | SC | 47.0% | 115.49 | 14.4 | 30 | 18 | 12 | 80.1% | 13.8% | 5.3E-03 | | 5.0E-03 | | 184 | 0.13 | 45.2 |
| Sample 8.1 | DBS&A | 8/7/20014 | SC | | 115.49 | 14.4 | | | | 95.3% | 17.1% | | 4.4E-07 | | 6.4E-07 | | | 34.8 |
| Sample 9.0 | DBS&A | 8/7/20014 | SC | 44.8% | 115.49 | 14.1 | 28 | 18 | 10 | 80.0% | 13.8% | 7.8E-03 | | 7.4E-03 | | 170 | 0.40 | 45.2 |
| Sample 9.1 | DBS&A | 8/7/20014 | SC | | 115.49 | 14.1 | | | | 95.2% | 16.8% | | 1.4E-06 | | 1.3E-06 | | | 34.9 |
| Sample 10.0 | DBS&A | 8/7/20014 | SC | 44.5% | 114.24 | 14.3 | 29 | 17 | 12 | 80.1% | 13.8% | 7.5E-03 | | 7.0E-03 | | 214 | 0.52 | 45.9 |
| Sample 10.1 | DBS&A | 8/7/20014 | SC | | 114.24 | 14.3 | | | | 94.9% | 17.2% | | 1.3E-06 | | 1.2E-06 | | | 35.8 |

*Note:*
[1] *Permeability range estimates from Engineering document FM-5-47/NAVFAC MO 330/AFJMAN 32-1221(1)*

# ATTACHMENT IV.2.A

# WELL LOGS AND INFORMATION ON BLM 1979 POTASH STUDY

Lithologic Log, Completion and Hydrologic Data
Well 20.32.22.33 (BLM Potash Study, Geohydrology Associates, 1979)

Well 20.32.22.33; drilled November 8, 1978

| Top | Thickness | Description |
|---|---|---|
| 0 | 3 | sand, brownish-buff, medium-fine texture (aeolian) 6" organic profile |
| 3 | 9 | caliche, white, medium to strong formation |
| 12 | 18 | sand, pinkish buff, medium-fine texture, calcareous cement |
| 30 | 10 | shale, brown, clayey with laminae of greenish-gray medium crystalline, anhydrite |
| 40 | 20 | shale, brown, silty |
| 60 | 10 | shale, red-brown, silty, clayey, has minor amount thin laminae of green silty shale |
| 70 | 10 | as above, but no green shale |
| 80 | 20 | shale, red-brown, clayey with laminae of green clayey-silty shale |

Well 20.32.22.33 continued

| Top | Thickness | Description |
|---|---|---|
| 100 | 10 | as above, but no green shale |
| 110 | 30 | shale, brown, silty |
| 140 | 10 | shale, brown-silty, clayey, has laminae of gray silty shale |
| 150 | 10 | shale, brown, clayey, has laminae of greenish gray silty shale |
| 160 | 10 | shale, reddish brown, silty-clayey, has greenish gray inclusions, has small nodules of maroon limestone |

Total Depth - 170'

Driller encountered water at 35' (probably perched brine from Laguna Toston)
Casing perforated - 150-179' below LSD
Bailing results - estimates 12-15 gpm
Tastes fresh
Measurement: February 28, 1979: Water level - 30' below LSD

Gamma logs, continued.

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
ALBUQUERQUE, NEW MEXICO

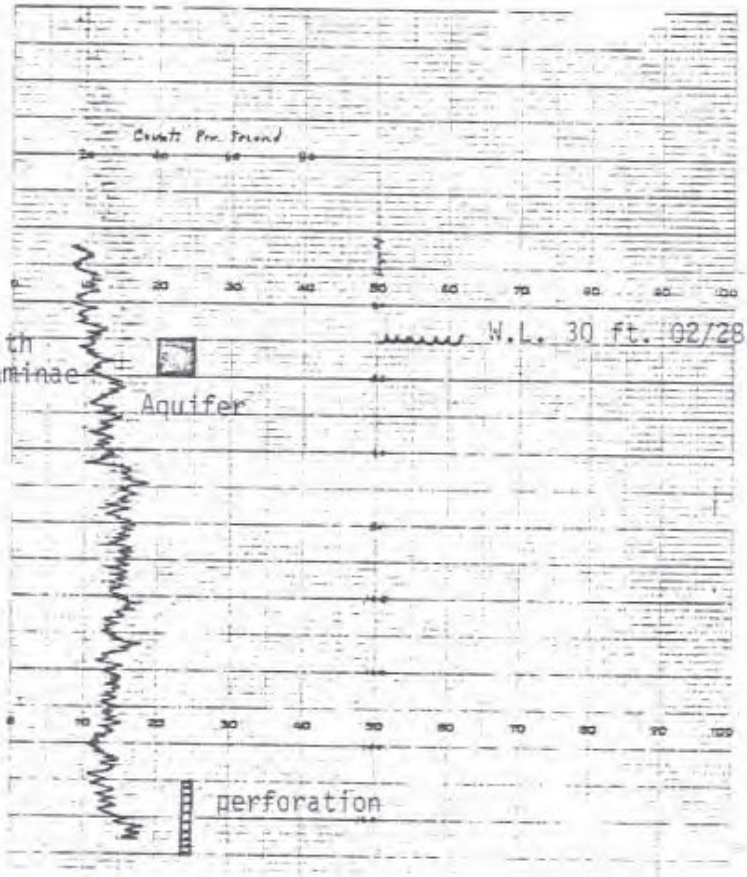
20.32.22.33

LOG HEADING

LOCATION NO. 20.34.12.230

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| OWNER | B.L.M. | SEC. 28 | TWP. 20S | RNG. 32E | OPERATOR(S) Hudson | | |
| PROJECT | WELL NO. | COUNTY Lea | STATE N. Mex. | DATE Feb 28 1979 | | | |
| DEPTH-DRILLER 170 | CASING | | THICKNESS | BORE SIZE | | | |
| DEPTH-LOGGER 166 | Diam. 3 in. ____ Ft. to ____ Ft. | | PVC | Diam. ____ in. ____ Ft. to ____ Ft. | | | |
| INTERVAL LOGGED Total | Diam. ____ in. ____ Ft. to ____ Ft. | | | Diam. ____ in. ____ Ft. to ____ Ft. | | | |
| LOG MEAS. FROM G.L. | ELEVATIONS KB. | DF. | GL. | TC. | PERFORATIONS | | |
| DRILLERS MEAS. FROM G.L. | TYPE FLUID | | LEVEL | DENSITY LB/Gal | ____ Ft. to ____ Ft. | | |

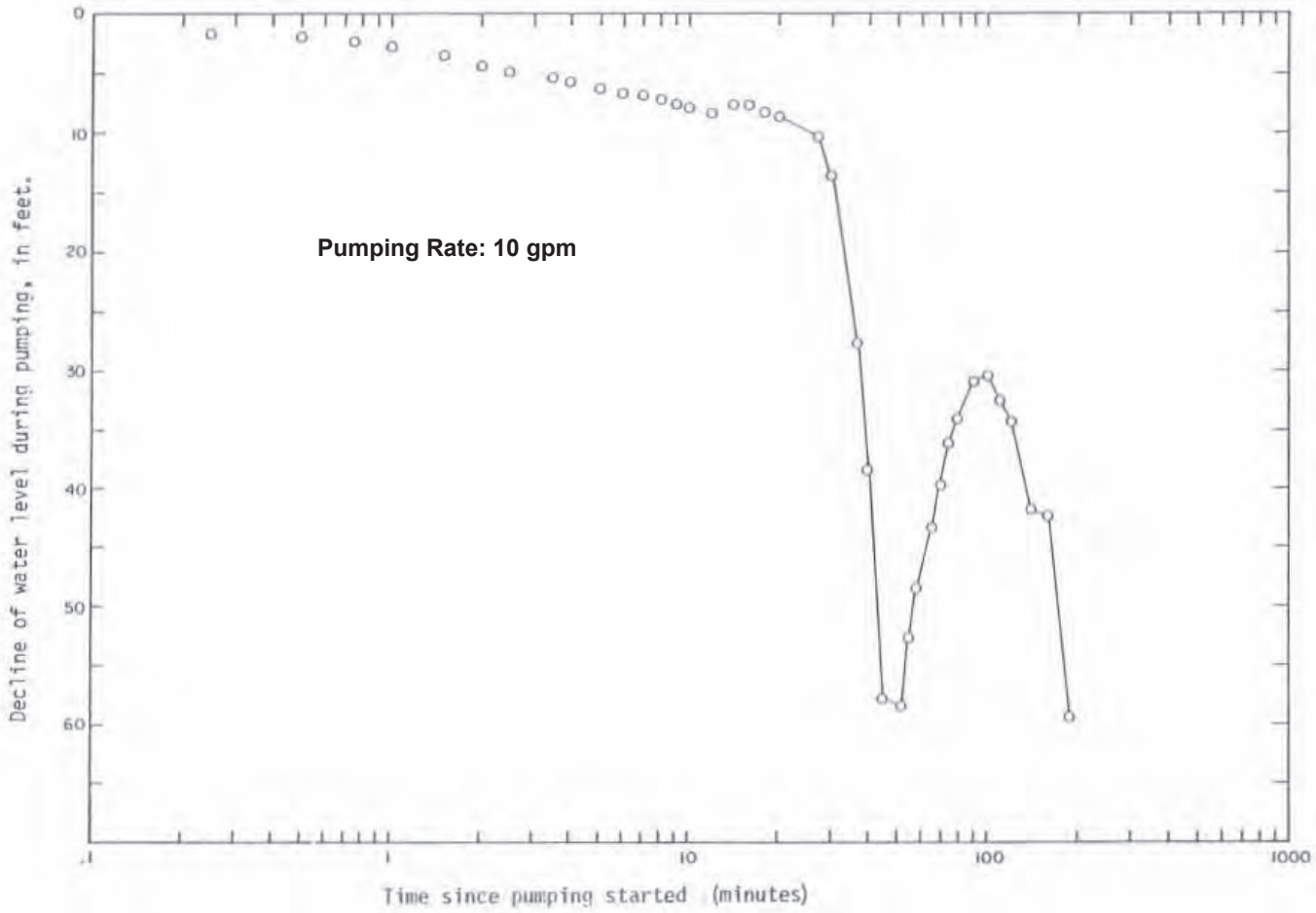
| NUCLEAR RADIATION | | | | | | ELECTRIC LOG | |
|---|---|---|---|---|---|---|---|
| CHANNEL NO. | 1 | 2 | 3 | 4 | REMARKS | DEPTH | Ft. |
| DEPTH | 166 | | | | | RESISTIVITY | Ohms |
| RANGE CPS 5 in. | 100 | | | | | S.P. PER MO. | MV |
| SPAN | 1.0 | | | | | VERTICAL SCALE | Ft/in |
| POSITION | 10.0 | | | | | CALIPER | |
| TIME CONSTANT Sec. | 2 | | | | | VERTICAL SCALE | Ft/in |
| LOGGING SPEED Ft/Min | 20 | | | | | HORIZONTAL SCALE | in/in |
| VERTICAL SCALE Ft/in | 20 | | | | | OTHER | |
| WATER LEVEL Ft. | 30 | | | | | DEPTH | Ft. |
| DIGITAL RECORD | | | | | | RANGE | |
| TYPE LOG | Gamma | | | | | | |




Aquifer Test

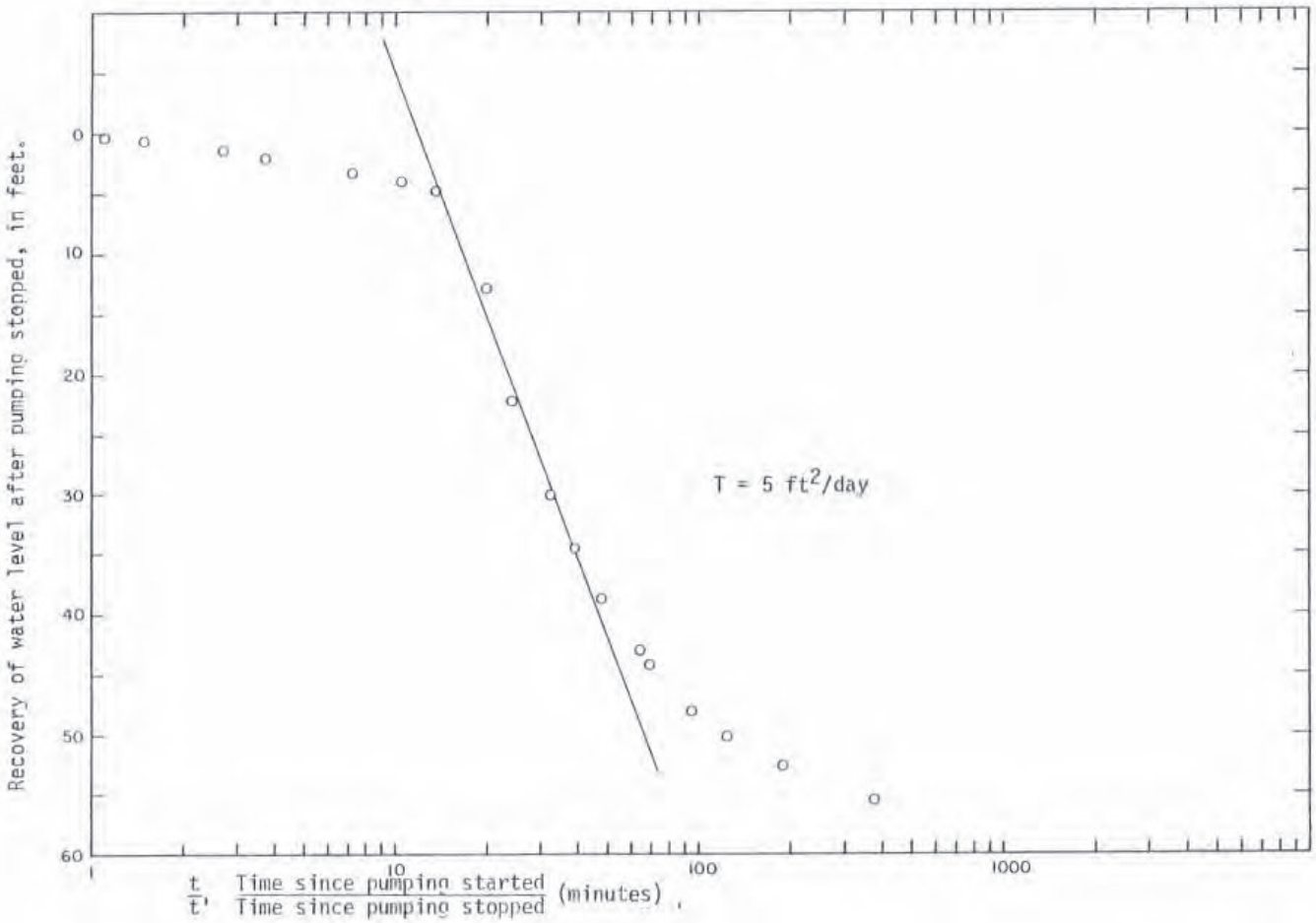
Transmissivity
5 $ft^2$/day

Drawdown and recovery curves.




Plot of drawdown data for well at 20.32.22.33.

Drawdown and recovery curves.




Plot of recovery data for well at 20,32.22.33.

# Albuquerque Analytical, Inc.

[505] 266-9106
[505] 294-6310 Nights

4115 Silver S.E.
Albuquerque, N.M. 87108


No. 8804

Rec'd. Feb. 2, 1979

## WATER ANALYSIS

Owner Geohydrology & Associates Address 3225 Candelaria Road NE

Appearance and Data 20.32.22.33 Chemist Joan M. Brown

| | mg/l | meq/l |
|---|---|---|
| Aluminum | | |
| Ammonium | | |
| Arsenic | | |
| Barium | | |
| Cadmium | | |
| Calcium | 105. | |
| Chromium (T) | <0.02 | |
| Cobalt | | |
| Copper | | |
| Gold | | |
| Iron | | |
| Lead | | |
| Lithium | | |
| Magnesium | 92. | |
| Manganese | | |
| Mercury | | |
| Nickel | | |
| Potassium | 33.5 | |
| Silver | | |
| Sodium | 325. | |
| Uranium ($U_3O_8$) | | |
| Zinc | | |

| | mg/l | meq/l |
|---|---|---|
| Beryllium ($BeO_3^-$) | | |
| Bicarbonate | 0.3 | |
| Boron ($BO_2^-$) | | |
| Bromide | | |
| Carbonate | | |
| Chloride | 75. | |
| Cyanide | | |
| Fluoride | | |
| Hydroxide | | |
| Iodide | | |
| Molybdenum ($MoO_4^-$) | | |
| Nitrate | | |
| Nitrite | | |
| Phosphate (Tot.) | | |
| Phosphate (Meta) | | |
| Phosphate (Ortho) | | |
| Selenium ($SeO_4^-$) | | |
| Sulfate | 550. | |
| Sulfite | | |
| Tellurium ($TeO_3^-$) | | |
| Vanadium | | |
| Chromium + 6 | <0.02 | |

| | | |
|---|---|---|
| Acidity | | ppm |
| Alkalinity | | ppm |
| BOD | | ppm |
| Chlorine | | ppm |
| COD | | ppm |
| Color | | PCU |
| Conductance | | µmho/cm |
| Dissolved $O_2$ | | ppm |
| Hardness | | ppm |
| $H_2S$ | | ppm |
| Hydrazine | | ppm |
| Odor | | T.O. |
| pH | | |
| Phenols | | ppm |
| Silica | | ppm |
| Solids (Tot.) | | ppm |
| Solids (Tot. Diss.) | 3136. | ppm |
| Solids (Tot. Susp.) | | ppm |
| Solids ( ) | | ppm |
| Surfactant | | ppm |
| Turbidity | | JTU |
| Volatile Acids | | ppm |

Lithologic Log, Completion and Hydrologic Data
Well 20.32.31.13 (BLM Potash Study, Geohydrology Associates, 1979)

Well 20.32.31.13; drilled November 8, 1978

| Top | Thickness | Description |
|---|---|---|
| 0 | 10 | sand, buff medium to fine texture, moderate caliche formation |
| 10 | 13 | sand, brown-buff, fine to medium texture, leached carbonate |
| 23 | 13 | shale, reddish brown, silty with clayey laminae |
| 36 | 4 | shale, greenish gray, silty, sandy |
| 40 | 30 | shale, brown, silty-clayey shale, reddish brown |
| 70 | 10 | silty-clayey, has a bed of greenish-gray siltstone |
| 80 | 20 | shale, brown, clayey |
| 100 | 20 | as above, but more silt |
| 120 | 30 | shale, brown, clayey, interbedded with limestone, brown, fine crystalline |
| 150 | 10 | shale, brown, clayey-silty |
| 160 | 10 | as above, but reddish brown |
| 170 | 10 | shale, brown, silty-clayey, has zones of superior cementation along bedding, probably calcite |
| 180 | 10 | shale, brown, clayey, fairly cohesive from cementation |
| 190 | 10 | shale, brown, varigated clayey to silty, has greenish gray inclusions |
| 200 | 20 | shale, greenish to gray, silty, interbedded with brown silty shale |
| 220 | 20 | shale, reddish brown silty zones of calcite cementation along bedding |
| 240 | 10 | shale, reddish brown, clayey |

Well 20.32.31.13 continued

Total Depth - 250'

Water level-drilled dry, never encountered moist sediments
Casing perforated - 230-250' below LSD
Bailing results - bailing showed about 8' water in hole (probably residual from drilling) - dry ; DTW 135.12' March 15, 1979

Gamma logs, continued.

**U.S. GEOLOGICAL SURVEY**
WATER RESOURCES DIVISION
ALBUQUERQUE, NEW MEXICO

20.32.31.13

**LOG HEADING**

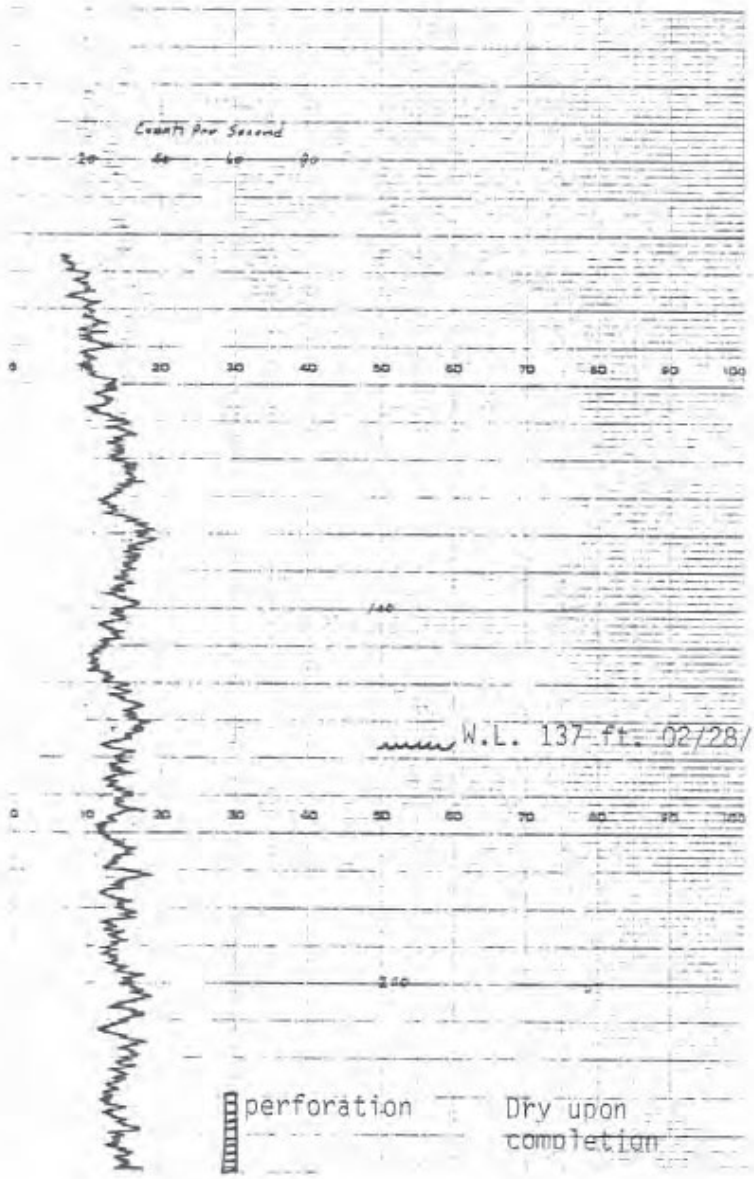
LOCATION NO. 20.32.31.130

| | | | | | |
|---|---|---|---|---|---|
| OWNER | D. L. H. | SEC. 31 | TWP. 20S | RNG. 32E | OPERATOR(S) Hudson |
| PROJECT | | HOLE NO. | COUNTY Lea | STATE N. Mex. | DATE Feb. 28, 79 |
| DEPTH-DRILLER | 250 | CASING | | THICKNESS | BORE SIZE |
| DEPTH-LOGGER | 249 | Diam. 3 in. ____ Ft. to ____ Ft. | | PVC | Diam. ____ in. ____ Ft. to ____ Ft. |
| INTERVAL LOGGED | Total | Diam. ____ in. ____ Ft. to ____ Ft. | | | Diam. ____ in. ____ Ft. to ____ Ft. |
| LOG MEAS. FROM | G. L. | ELEVATIONS KB. | DF. | GL. | TC. |
| DRILLERS MEAS. FROM | G. L. | TYPE FLUID | | LEVEL | DENSITY Lb/Gal |

PERFORATIONS
____ Ft. to ____ Ft.
____ Ft. to ____ Ft.

| NUCLEAR RADIATION | | | | | | ELECTRIC LOG | |
|---|---|---|---|---|---|---|---|
| CHANNEL NO. | 1 | 2 | 3 | 4 | REMARKS | DEPTH | Ft. |
| DEPTH | 244 | | | | | RESISTIVITY | Ohms |
| RANGE CPS 5 in. | 100 | | | | | S.P. PEN NO. | mv |
| SPAN | 1.0 | | | | | VERTICAL SCALE | Ft/in |
| POSITION | 10.0 | | | | | CALIPER | |
| TIME CONSTANT Sec. | 2 | | | | | VERTICAL SCALE | Ft/in |
| LOGGING SPEED Ft/min | 20 | | | | | HORIZONTAL SCALE | in/in |
| VERTICAL SCALE Ft/in | 20 | | | | | OTHER | |
| WATER LEVEL Ft. | 137 | | | | | DEPTH | Ft. |
| DIGITAL RECORD | | | | | | RANGE | |
| TYPE LOG | Gamma | | | | | | |

No Test



Lithologic Log, Completion and Hydrologic Data
Well 21.31.3.22 (BLM Potash Study, Geohydrology Associates, 1979)

Well 21.31. 3.22; drilled November 9, 1978

| Top | Thickness | Description |
|---|---|---|
| 0 | 18 | caliche, white, moderate to strong formation |
| 18 | 12 | sand, brown-buff, medium-fine texture, calcareous cement |
| 30 | 10 | shale, buff-red, silty, calcareous laminae |
| 40 | 10 | shale, red, clayey with some silt |
| 50 | 10 | shale, mottled red, greenish gray, has sandy laminae but mostly silt |
| 60 | 10 | shale, brown, silty, with clayey laminae, has greenish gray inclusions |
| 70 | 10 | shale, reddish, brown, silty, has good cement, some laminae (calcite) (these laminae are gray-red) |
| 80 | 10 | as above, but subequal amounts of silt and clay |
| 90 | 10 | shale, red, silty, ahs clayey laminae |
| 100 | 20 | shale, brownish red, silty, has laminae with calcite cement |
| 120 | 10 | as above, but more calcite zones (mineralized with crystalline calcite) |
| 130 | 10 | shale, brownish red, silty |
| 140 | 10 | as above, but has clayey laminae |
| 150 | 10 | shale, brownish red, silty, has calcite mineralized laminae |
| 160 | 10 | shale, red, clayey, has laminae of silty greenish gray shale |
| 170 | 10 | shale, reddish brown, silty |
| 180 | 10 | as above, but has laminae of greenish gray shale |
| 190 | 10 | shale, brownish red, subequal amounts of silt and clay, has greenish gray laminae, silty |

Total Depth - 200'

Driller encountered water at 150' below LSD
Casing perforated 140-160' below LSD
Bailing results - estimates 8 gpm
Water level on completion - 128' below LSD
Measurement: February 28, 1979: Water level - 142' below LSD

Gamma logs, continued.

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
ALBUQUERQUE, NEW MEXICO

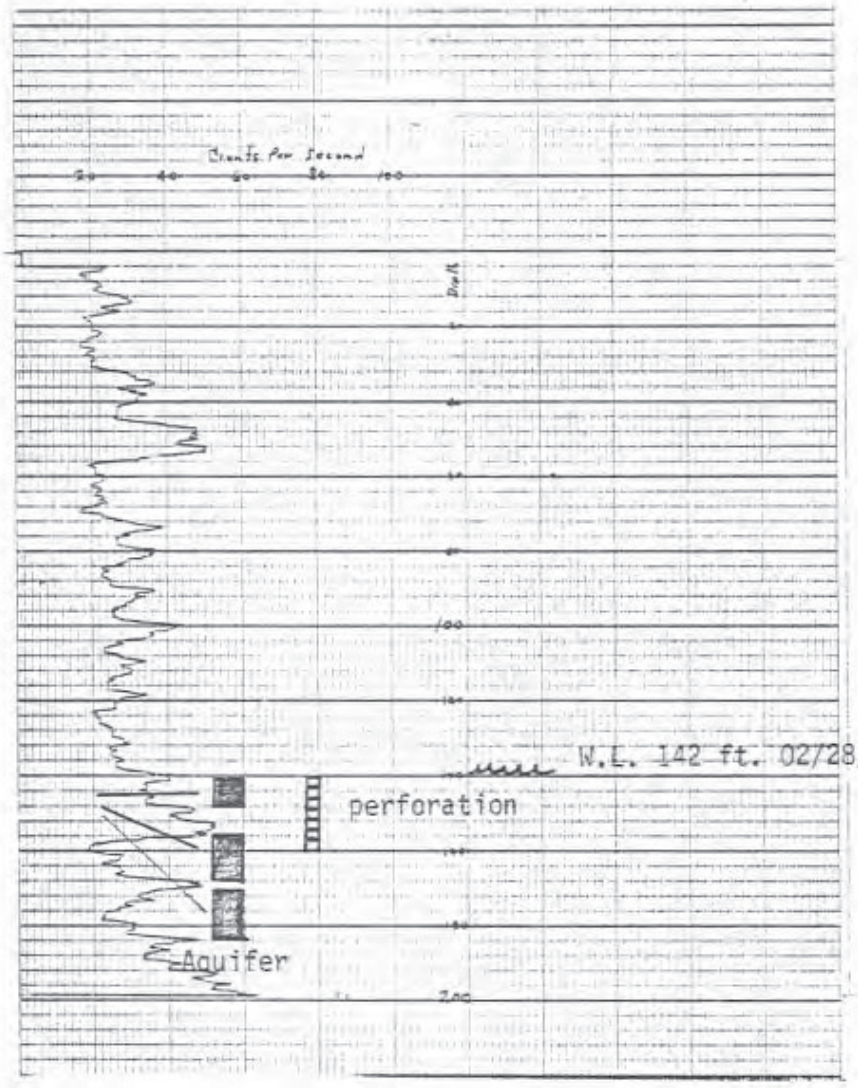
21.31.3.22

LOG HEADING

LOCATION NO. 21-31-3-[illegible]

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OWNER | BLM | SEC. 3 | TWP. 21S | RNG. 32E | OPERATOR(S) Pugh | | | | |
| PROJECT | HOLE NO. | COUNTY Lea | STATE N Mex | DATE Feb 28, 1979 | | | | | |
| DEPTH-DRILLER | 200 | CASING Diam. 2 in. ____ Ft. to ____ Ft. | THICKNESS PVC | BORE SIZE Diam. ____ in. ____ Ft. to ____ Ft. | | | | | |
| DEPTH-LOGGER | 199 | Diam. ____ in. ____ Ft. to ____ Ft. | | Diam. ____ in. ____ Ft. to ____ Ft. | | | | | |
| INTERVAL LOGGED | Total | Diam. ____ in. ____ Ft. to ____ Ft. | | Diam. ____ in. ____ Ft. to ____ Ft. | | | | | |
| LOG MEAS. FROM G.L. | ELEVATIONS KB. | DF. | GL. | TD. | PERFORATIONS ____ Ft. to ____ Ft. | | | | |
| DRILLERS MEAS. FROM G.L. | TYPE FLUID | | LEVEL | DENSITY Lb/Gal | ____ Ft. to ____ Ft. | | | | |

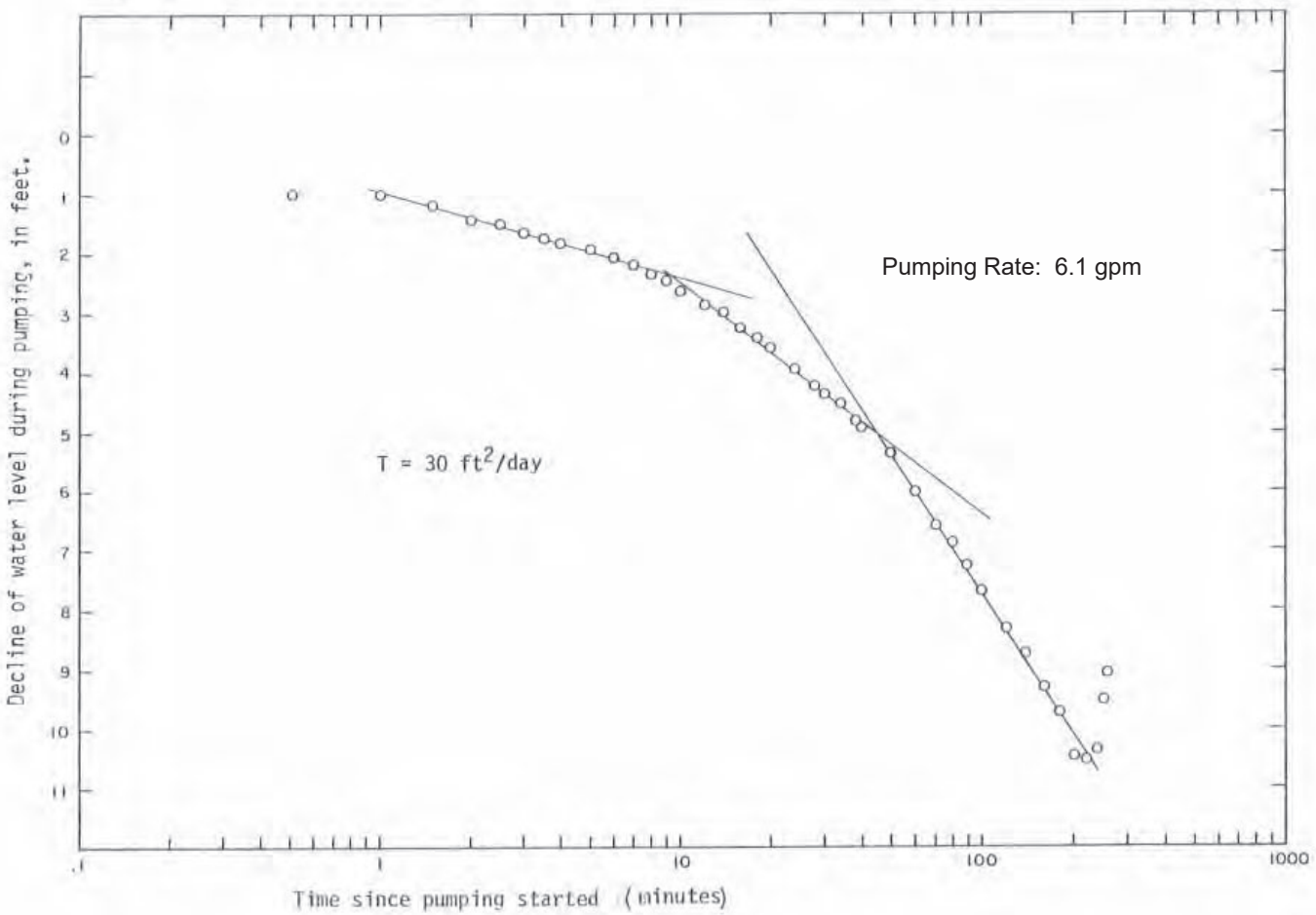
| NUCLEAR RADIATION | | | | | | ELECTRIC LOG | |
|---|---|---|---|---|---|---|---|
| CHANNEL NO. | 1 | 2 | 3 | 4 | REMARKS | DEPTH | Ft. |
| DEPTH | 199 | | | | | RESISTIVITY | Ohms |
| RANGE CPS 5 in. | 100 | | | | | S.P. PER MV. | MV |
| SPAN | 10 | | | | | VERTICAL SCALE | Ft/in |
| POSITION | 100 | | | | | CALIPER | |
| TIME CONSTANT Sec. | 2 | | | | | VERTICAL SCALE | Ft/in |
| LOGGING SPEED Ft/Min | 20 | | | | | HORIZONTAL SCALE | In/in |
| VERTICAL SCALE Ft/In | 20 | | | | | OTHER | |
| WATER LEVEL Ft. | 142 | | | | | DEPTH | Ft. |
| DIGITAL RECORD | | | | | | RANGE | |
| TYPE LOG | Gamma | | | | | | |




Aquifer Test
Transmissivity
35 $ft^2$/day

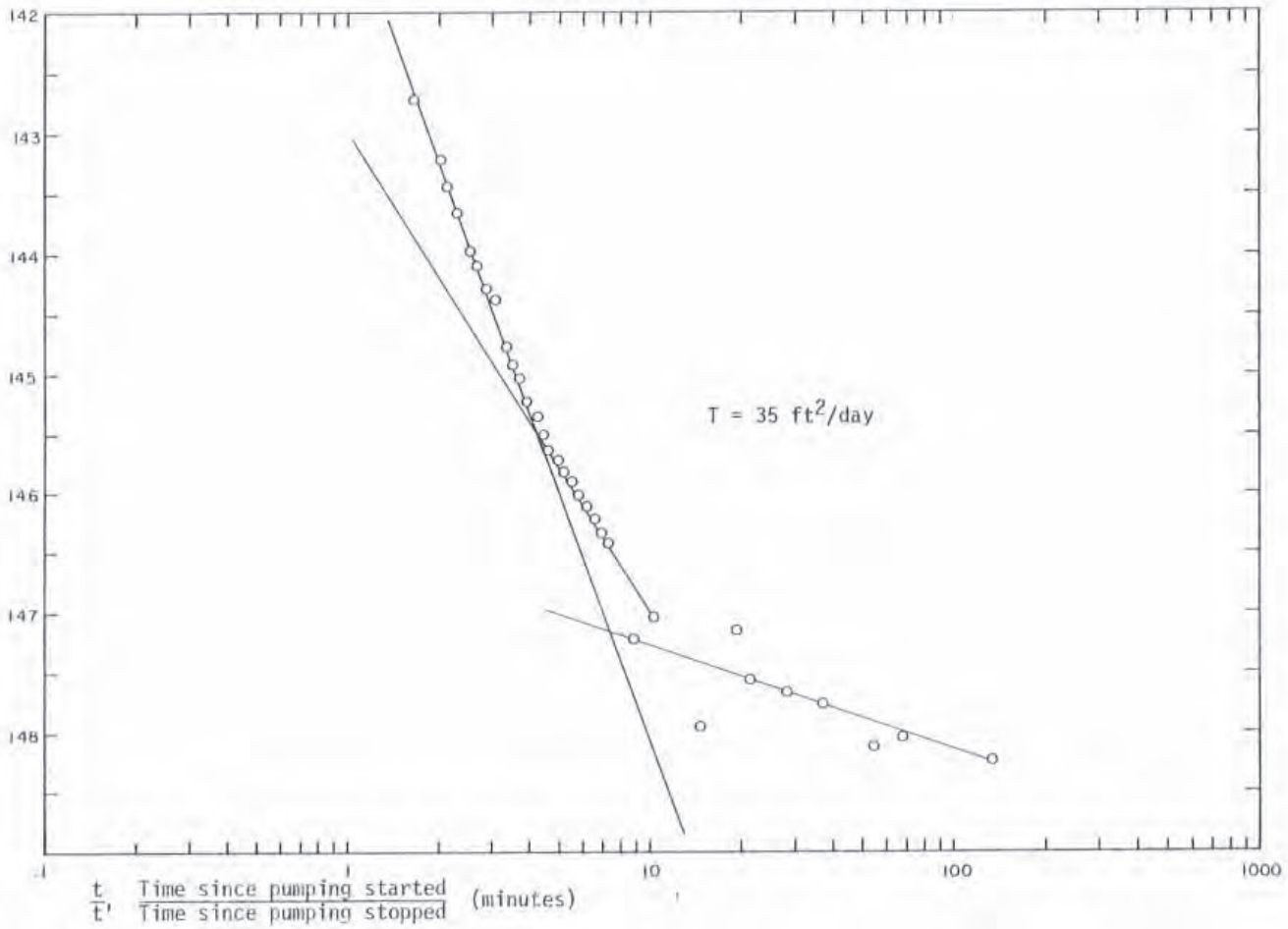
silty shale

Drawdown and recovery curves.




Plot of drawdown data for well at 21.31.3.22.

Drawdown and recovery curves.




Plot of recovery data for well at 21.31.3.22.

# Albuquerque Analytical, Inc.

[505] 266-9106
[505] 294-6310 Nights

4115 Silver S.E.
Albuquerque, N.M. 87108

No. 8804

Rec'd Feb. 2, 1979

## WATER ANALYSIS

Owner Geohydrology & Associates Address 3225 Candelaria Road NE

Appearance and Data 21.31.3.22 Chemist [signature]

| | mg/l | meq/l |
|---|---|---|
| Aluminum | | |
| Ammonium | | |
| Arsenic | | |
| Barium | | |
| Cadmium | | |
| Calcium | 19.9 | |
| Chromium (T) | <0.02 | |
| Cobalt | | |
| Copper | | |
| Gold | | |
| Iron | | |
| Lead | | |
| Lithium | | |
| Magnesium | 17.5 | |
| Manganese | | |
| Mercury | | |
| Nickel | | |
| Potassium | 3.55 | |
| Silver | | |
| Sodium | 19.6 | |
| Uranium ($U_3O_8$) | | |
| Zinc | | |

| | mg/l | meq/l |
|---|---|---|
| Beryllium ($BeO_3^=$) | | |
| Bicarbonate | | |
| Boron ($BO_2^-$) | <0.05 | |
| Bromide | | |
| Carbonate | | |
| Chloride | 18. | |
| Cyanide | | |
| Fluoride | | |
| Hydroxide | | |
| Iodide | | |
| Molybdenum ($MoO_4^=$) | | |
| Nitrate | | |
| Nitrite | | |
| Phosphate (Tot.) | | |
| Phosphate (Meta) | | |
| Phosphate (Ortho) | | |
| Selenium ($SeO_4^=$) | | |
| Sulfate | 20. | |
| Sulfite | | |
| Tellurium ($TeO_3^=$) | | |
| Vanadium | | |
| chromium + 6 | <0.02 | |

| | | |
|---|---|---|
| Acidity | | ppm |
| Alkalinity | | ppm |
| BOD | | ppm |
| Chlorine | | ppm |
| COD | | ppm |
| Color | | PCU |
| Conductance | | μmho/cm |
| Dissolved $O_2$ | | ppm |
| Hardness | | ppm |
| $H_2S$ | | ppm |
| Hydrazine | | ppm |
| Odor | | T.O. |
| pH | | |
| Phenols | | ppm |
| Silica | | ppm |
| Solids (Tot.) | | ppm |
| Solids (Tot. Diss.) | 424. | ppm |
| Solids (Tot. Susp.) | | ppm |
| Solids ( ) | | ppm |
| Surfactant | | ppm |
| Turbidity | | JTU |
| Volatile Acids | | ppm |

# ATTACHMENT IV.2.B

# WELL LOGS AND INFORMATION ON CRI FACILITY INVESTIGATIONS

**Lithologic logs from CRI wells, taken from James Wright 1990 facility permitting report**

LOGS OF EXPLORATORY HOLES
LARRY FELKINS, DRILLER

---

TEST HOLE #1
20.32.27.424443
LS ELEV. 3553
DRILLED: 10/31/89

| | |
|---|---|
| 0-12 | CALICHE |
| 12-24 | SAND COARSE |
| 24-28 | SAND & GRAVEL |
| 28-34 | SAND FINE |
| 34-39 | SAND LIGHT |
| 39-41 | RED BED |
| 41-44 | GRAY ROCK |
| 44-97 | THIN LAYERS SAND & GRAVEL RED SAND GRAY ROCK SANDY YELLOW GRAY & BROWN CLAY (DRY) |

TEST HOLE #2
20.32.27.422221
LS ELEV. 3546
DRILLED: 10/31/89

| | |
|---|---|
| 0- 8 | CALICHE |
| 8-28 | SAND |
| 28-32 | SAND & GRAVEL |
| 32-36 | GRAY ROCK |
| 36-38 | SAND & GRAVEL |
| 38-50 | RED BED (DRY) |

TEST HOLE #3
20.32.27.234210
LS ELEV. 3542
DRILLED: 10/31/89

| | |
|---|---|
| 0-12 | CALICHE |
| 12-34 | SAND THIN LAYERS GRAVEL |
| 34-50 | RED BED (DRY) |

TEST HOLE #4
20.32.27.412333
LS ELEV. 3550
DRILLED: 10/31/89

| | |
|---|---|
| 0- 8 | CALICHE |
| 8-39 | SAND & GRAVEL |
| 39-42 | RED BED |
| 42-60 | LAYERS RED, YELLOW, GRAY SANDY CLAY WITH SOME GRAVEL LAYER OF GRAY ROCK (DRY) |

TEST HOLE #5
20.32.27.144133
LS ELEV. 3539
DRILLED: 10/31/89

| | |
|---|---|
| 0- 2 | CALICHE |
| 2-24 | SAND DAMP AT 18 DOWN |
| 24-28 | SAND & GRAVEL |
| 28-34 | SAND |
| 34-36 | GREEN CLAY |
| 36-40 | RED SAND & RED BED DAMP |
| 40-44 | RED BED DRY |
| 44-46 | GRAY CLAY |
| 46-60 | LAYERS OF RED BED GRAY CLAY GREEN CLAY (WATER AT 21 FT.) |

TEST HOLE #6
20.32.27.132121
LS ELEV. 3529
DRILLED: 10/31/89

| | |
|---|---|
| 0-12 | CALICHE |
| 12-24 | SAND THIN GRAVEL |
| 24-32 | SAND & GRAVEL WET |
| 32-34 | GRAY CLAY |
| 34-36 | RED BED |
| 36-38 | GREEN & GRAY CLAY |
| 38-50 | RED BED (WATER AT 26 FT.) |

TEST HOLE #7
20.32.27.314122
LS ELEV. 3541
DRILLED: 10/31/89

| | |
|---|---|
| 0- 9 | CALICHE |
| 9-28 | SAND LIGHT |
| 28-35 | SAND DARK |
| 35-37 | RED BED |
| 37-38 | GRAY CLAY |
| 38-40 | SAND THIN LAYERS CLAY |
| 40-50 | RED BED THIN LAYERS GRAY & GREEN CLAY (WATER AT 47 FT.) |

TEST HOLE #1a
20.32.28.222224
LS ELEV. 3519
DRILLED: 01/26/90

| | |
|---|---|
| 0- 8 | CALICHE |
| 8-24 | SAND & CLAY |
| 24-28 | GRAVEL & SAND |
| 28-34 | CLAYS YELLOW & BROWN |
| 34-37 | RED BED |
| CASED | 37 FT. PERFS 29 FT. |

TEST HOLE #2a
20.32.22.322142
LS ELEV. 3527
DRILLED: 01/26/90

| | |
|---|---|
| 0- 6 | CALICHE |
| 6-10 | SAND |
| 10-20 | SAND CLAY ROCK |
| 20-35 | RED CLAY & SAND |
| 35-45 | RED CLAY & GRAVEL |
| 45-55 | RED BED |
| CASED | 50 FT. PERFS BOTTOM 30 FT. |

TEST HOLE #3a
20.32.28.243123
LS ELEV. 3522
DRILLED: 01/26/90

| | |
|---|---|
| 0- 8 | CALICHE |
| 8-20 | CALICHE SAND GRAVEL |
| 20-45 | DRY BROWN & RED CLAY |
| 45-55 | RED BED |
| CASED | 55 FT. PERFS 40 FT. |

LOGS OF EXPLORATORY HOLES
BASED ON INSPECTION OF DRILL CUTTINGS

TEST HOLE #1
20.32.27.424443
LS ELEV. 3553
DRILLED: 10/31/89

| | |
|---|---|
| 0- 5 | CALICHE |
| 5-10 | CALICHE |
| 10-15 | CALICHE-FINE SAND |
| 15-20 | SAND CALICHE |
| 20-25 | SAND |
| 25-30 | SAND |
| 30-35 | NO SAMPLE |
| 35-40 | SAND GRAVEL |
| 40-45 | RED CLAY |
| 45-50 | RED BED |
| 50-55 | VERY FINE SILTY SAND |
| 55-60 | SILTY SAND-GREY SHALE -TRACE OF GRAVEL |
| 60-65 | SAND |
| 65-70 | GREY SILTSTONE |
| 70-75 | RED CLAY W/TRACE OF GRAVEL |
| 75-80 | RED SHALE |
| 80-85 | RED CLAY W/SOME SAND |
| 85-90 | RED CLAY |
| 90-95 | RED CLAY |
| 95-99 | NO SAMPLE |

TEST HOLE #2
20.32.27.422221
LS ELEV. 3546
DRILLED: 10/31/89

| | |
|---|---|
| 0- 5 | CALICHE |
| 5-10 | CALICHE |
| 10-15 | FINE SAND |
| 15-20 | FINE SAND W/SMALL GRAVEL |
| 20-25 | FINE SAND |
| 25-30 | FINE SAND |
| 30-35 | GREY SILTY SANDSTONE |
| 35-40 | RED BED W/TRACE OF GRAVEL |
| 40-45 | RED BED |
| 45-50 | RED BED |

TEST HOLE #3
20.32.27.234210
LS ELEV. 3542
DRILLED: 10/31/89

| | |
|---|---|
| 0- 5 | SAND AND CALICHE |
| 5-10 | CALICHE W/SOME SAND |
| 10-15 | CALICHE |
| 15-20 | SAND |
| 20-25 | CALICHE AND VERY FINE SAND |
| 25-30 | SAND-GRAVEL |
| 30-35 | RED SHALE W/TRACE OF GRAVEL |
| 35-40 | RED BED W/SOME GRAVEL |
| 40-45 | RED BED |
| 45-50 | RED BED |

TEST HOLE #4
20.32.27.412333
LS ELEV. 3550
DRILLED: 10/31/89

| | |
|---|---|
| 0- 5 | CALICHE |
| 5-10 | CALICHE |
| 10-15 | SAND W/SOME CALICHE |
| 15-20 | SAND & GRAVEL W/SOME CALICHE |
| 20-25 | SAND |
| 25-30 | SAND AND GRAVEL |
| 30-35 | BROWN SAND AND GRAVEL |
| 35-40 | CLAY AND SAND |
| 40-45 | RED AND GREY CLAY |
| 45-50 | GREY CLAYEY SAND W/SOME GREY SHALE |
| 50-55 | RED BED W/SOME GRAVEL (SILTSTONE) |
| 55-60 | GREY CLAY AND SAND W/SOME CHERT |

TEST HOLE #5
20.32.27.144133
LS ELEV. 3539
DRILLED: 10/31/89

| | |
|---|---|
| 0-10 | SOIL-CALICHE |
| 10-20 | CALICHE AND SAND |
| 20-30 | SAND AND GRAVEL |
| 30-35 | GREY SILTY SAND |
| 35-40 | GREY CLAY |
| 40-45 | RED CLAY |
| 45-50 | RED AND GREY CLAY W/SOME GRAVEL |
| 50-55 | RED BED |
| 55-60 | RED BED |

TEST HOLE #6
20.32.27.132121
LS ELEV. 3529
DRILLED: 10/31/89

| | |
|---|---|
| 0-10 | CALICHE |
| 10-20 | CALICHE SAND W/SOME GRAVEL |
| 20-30 | VERY FINE SAND W/SOME GRAVEL |
| 30-40 | RED BED W/SOME FINE SAND & TRACE OF GRAVEL |
| 40-45 | RED BED |
| 45-50 | RED BED |

LOGS OF EXPLORATORY HOLES
BASED ON INSPECTION OF DRILL CUTTINGS CONTINUED

TEST HOLE #7
20.32.27.314122
LS ELEV. 3541
DRILLED: 10/31/89

| | |
|---|---|
| 0–10 | CALICHE |
| 10–20 | SAND |
| 20–30 | VERY FINE SAND W/SOME RED CLAY |
| 30–35 | NO SAMPLE |
| 35–40 | RED BED |
| 40–45 | RED BED |
| 45–50 | RED SILT (LIGHT COLORED) |

TEST HOLE #1a
20.32.28.222224
LS ELEV. 3519
DRILLED: 01/26/90

| | |
|---|---|
| 0– 5 | CALICHE |
| 5–10 | CALICHE W/SOME SAND |
| 10–15 | SAND & CLAY W/SOME SANDSTONE |
| 15–20 | SAND AND CLAY W/SOME GRAVEL |
| 20–25 | GREY & YELLOW CLAY |
| 25–30 | BROWN SAND AND GRAVEL |
| 30–35 | RED BED |
| 35–37 | RED BED |

TEST HOLE #2a
20.32.22.322142
LS ELEV. 3527
DRILLED: 01/26/90

| | |
|---|---|
| 0– 5 | CALICHE |
| 5–10 | CALICHE W/TRACE OF SAND |
| 10–15 | CALICHE W/SOME SAND |
| 15–20 | RED CLAY |
| 20–25 | RED CLAY – CALICHE |
| 25–30 | RED CLAY |
| 30–35 | RED CLAY W/SOME SAND |
| 35–40 | SAND AND CLAY |
| 40–45 | SAND-GRAVEL RED CLAY |
| 45–50 | RED BED – DARK RED |
| 50–55 | RED BED – DARK RED |

TEST HOLE #3a
20.32.28.243123
LS ELEV. 3522
DRILLED: 01/26/90

| | |
|---|---|
| 0– 5 | CALICHE |
| 5–10 | SAND AND CALICHE |
| 10–15 | SAND GRAVEL W/SOME CLAY |
| 15–20 | SAND GRAVEL W/SOME CLAY |
| 20–25 | RED CLAY |
| 25–30 | RED CLAY |
| 30–35 | RED CLAY |
| 35–40 | RED CLAY W/TRACE OF GRAVEL |
| 40–45 | RED CLAY |
| 45–50 | DARK RED CLAY |
| 50–55 | NO SAMPLE |

**Water level and water quality data, CRI Hydrogeologic Update Report (Safety & Environmental Solutions, Inc., 2003)**



Using depth to Red Bed data given in the Wright report and new elevation survey data for the top of casing at the existing piezometers, a Red Bed elevation contour map was prepared is shown as Figure 3. The map shows that in the area of the CRI facility, the slope of the Red Beds is to the northwest in the direction of Laguna Toston with a gradient of 0.0063 or 33 ft. per mile. Shallow groundwater in the area will flow on top of the red bed surface and therefore also move in the direction of Laguna Toston.

## Hydrologic Work

The existing piezometer network was used to collect information on current groundwater conditions. Table 1 shows the results of the water level survey and was used to prepare a groundwater contour map (Figure 4). Information from several of the piezometers was not available or not used in the construction of the map. Two of the original piezometers were dry, another has been impacted by a water line leak, and a fourth is located over a mile from the main fluid processing areas at the facility.

Table 1. Water Level Measurements and Groundwater Elevations, Controlled Recovery, Inc., Lea County, New Mexico

| Piezometer Number (ft.) | Date Measured | Casing Elevation (ft.) | Depth to Water (ft.) | Ground-water Elevation (ft.) | Total Depth (ft.) | Water Saturation (ft.) |
|---|---|---|---|---|---|---|
| P–1 | 03/07/02 | 3,554.9 | (dry) | - - | 97.95 | - - |
| P–2 | 03/07/02 | 3,556.6 | (dry) | - - | 59.28 | - - |
| P–3 | 03/07/02 | 3,543.4 | 31.98 | 3511.4 | 46.80 | 14.8 |
| P–4 | 03/07/02 | 3,551.2 | 39.01 | 3512.2 | 58.60 | 19.6 |
| P–5 | 03/07/02 | 3,541.0 | 18.85[a] | - - | 48.57 | - - |
| P–6 | 03/07/02 | 3,531.8 | 18.00 | 3513.8 | 50.21 | 32.2 |
| P–7 | 03/07/02 | 3,543.7 | 17.74 | 3526.0 | 42.04 | 24.3 |
| P–1A | 03/07/02 | 3,522.9 | 11.86 | 3511.0 | 31.26 | 19.4 |
| P–2A | 03/07/02 | 3,529.3 | 37.14[b] | - - | 47.41 | - - |
| P–3A | 03/07/02 | 3,526.1 | 12.94 | 3513.2 | 55.45 | 42.5 |

**Notes:**

a. Water in P-5 is from a nearby water-line leak and a water level was not calculated for use in preparing the map.

b. P-2A is more than a mile north of the main liquids processing area of the facility and the water level was not calculated for use in preparing the map.

The groundwater map shows a groundwater mound in the vicinity of P-7 with decreasing hydraulic head radially outward. Although there is likely some movement to the east, piezometers P-1 and P-2 are dry, and the saturated thickness range in P-3 and P-4 is between 15 and 20 ft. Because the Red Beds dip to the northwest, most movement will be in that direction also and groundwater moving in other directions due to the influence of the groundwater mound will eventually be redirected to move to the northwest, also. The groundwater gradient to the northwest is 0.006 or about 30 ft. per mile.

As the groundwater approaches Laguna Toston, the salt lake, the groundwater contours flatten. The gradient between P-6 and P-1A decreases to 0.002, or about 10 ft. per mile. At some point lateral groundwater movement ceases in the vicinity of the lake and additional groundwater influx causes a rise in groundwater levels around the perimeter of the lake. Given the thin saturated thickness of the sediments, the low volume of recharge to the saturated zone and the slow movement of the groundwater, it is very unlikely that a small increase in groundwater elevation upgradient of the lake will have any type of measurable impact on water levels in the lake.

## Water Quality

The current piezometers were not designed for the collection of water quality samples, and not much information is known about their construction. However they can be sampled and the results can be used to broadly characterize the groundwater in the area.

Samples were collected from several piezometers, Laguna Toston, and a borehole drilled beneath a pit closed for cleaning (Borehole 1, pit "D"). The results are tabulated in Table 2 and shown on Figure 5. The poorest overall water quality is in Laguna Toston which has a chloride concentration of 207,936 mg/L and a total dissolved solids (TDS) concentration of 446,900 mg/L. Samples from P-1A and P-3A show equally poor water quality, with a TDS of well over 100,000 mg/L at both locations. At a TDS of 103,900 mg/L, the borehole beneath pit D has less salt than the Laguna or these two piezometers. Piezometer 7 is located adjacent to pit D, and has a TDS of 39,300 mg/L, which is less than 10% of the TDS found in Laguna Toston. Piezometer P-6 has the "best" water quality. However, with a TDS of 15,200 mg/L, the groundwater at that location exceeds all state and federal standards for any use and is outside classification as an Underground Source of Drinking Water by state and federal water pollution control programs. (To be considered an Underground Source Of Drinking Water, the water must be less than 10,000 mg/L).

Table 2. Results of Water Quality Sampling for Chloride and TDS, Controlled Recovery, Inc., Lea County, New Mexico

| Sample Location | Date | Chloride (mg/L) | TDS (mg/L) |
|---|---|---|---|
| "A" Pit | 05/08/02 | 154,952 | 319,400 |
| Borehole 1 | 02/22/02 | 69,978 | 103,900 |
| P-1A | 02/14/02 | 198,000 | 361,900 |
| P-3A | 05/10/02 | 92,971 | 183,390 |
| P-6 | 02/14/02 | 9,600 | 15,200 |
| P-7 | 04/09/02 | 21,093 | 39,340 |
| Laguna Toston | 05/13/02 | 207,936 | 446,900 |

# ATTACHMENT IV.2.C

# WELL LOG ON 1953 USGS POTASH EXPLORATORY COREHOLE

1250 FNL 1250 FWL

P-1147

Copy mailed to Washington 4-3-53

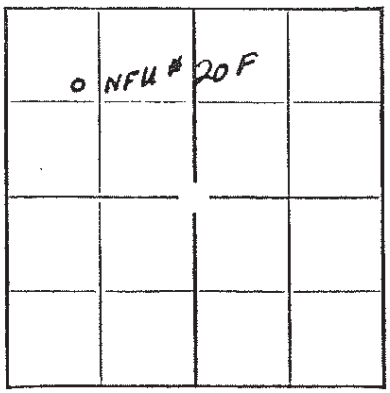
Budget Bureau No. 42-R352.2
Approval expires Dec. 31, 1954

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

U. S. Land Office New Mexico
Permit Number 04347
Date effective

# LOG OF PROSPECT BORE HOLE

Logs of prospect bore holes are to be transmitted in duplicate to the regional mining supervisor immediately upon completion of hole or shaft, or when work has been suspended indefinitely.




Locate hole correctly, giving distance in feet from N. or S. and E. or W. line of section; when hole is not vertical, give direction and angle.

Lessee or permittee Farmers Educational and Cooperative Union of America
Address 3502 East 46th Avenue, Denver, Colorado
Driller O. F. Featherstone
Commenced drilling 2-10-53 Finished 3-1-53
Hole No. F-20 Sec. 27 T. 20S R. 32E M. N.M.P. State N.M.
Method of drilling Rotary Logged by Charles Hicks

The information given herewith is a complete and correct record of the bore hole and all work done thereon, so far as can be determined from all available records.

RECEIVED
APR - 1 1953

(Signed) Charles W. Hicks

Date March 6, 1953 U. S. Geological Survey (Title) Geologist

Carlsbad, N.M.

Section 35(A) of the United States Criminal Code, 18 U.S.C. 80, makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

Elevation of top of hole relative to sea level 3539 ✓

## FORMATION RECORD

| DEPTH From— Feet | DEPTH From— Inches | DEPTH To— Feet | DEPTH To— Inches | Thickness of stratum Feet | Thickness of stratum Inches | Geologic formations; character of rock; oil, gas and water horizons; coal and other mineral occurrences |
|---|---|---|---|---|---|---|

Farmers 21-F

| From | To | Inter | Formation |
|---|---|---|---|
| 0' | 20' | 20' | Caliche - A little silty clay in the bottom 10'. |
| 20' | 40' | 20' | Sand - Fine grained. Approx. 30% red shale in the lower 10' |
| 40' | 70' | 30' | Shale - Brown and grey. |
| 70' | 160' | 90' | Shale - Reddish brown. |
| 160' | 200' | 40' | Siltstone - Red, some grey. |
| 200' | 220' | 20' | Siltstone - Red to magenta, a little grey. Approx. 40% sandstone. |
| 220' | 280' | 60' | Sandstone - Red. Approx. 20% red to magenta siltstone. |
| 280' | 300' | 20' | Shale - Red, a little magenta and grey. |
| 300' | 310' | 10' | Sandstone - Red. A little red and grey shale. |
| 310' | 330' | 20' | Clay - Red, silty. |
| 330' | 360' | 30' | Sandstone - Red. Approx. 15% red shale. |
| 360' | 380' | 20' | Shale - Red to magenta. |
| 380' | 400' | 20' | Clay - Red, silty. |
| 400' | 500' | 100' | Shale - Red to magenta. Broken caliche pebbles. |
| 500' | 550' | 50' | Shale - Brown, a little grey. Approx. 2% caliche. |
| 550' | 660' | 110' | Shale - Brown, very little grey. Traces of caliche. |
| 660' | 720' | 60' | Shale - Brown. Some red clay. Trace caliche. |
| 720' | 750' | 30' | Shale - Brown, little grey. Trace caliche. |
| 750' | 810' | 60' | Siltstone - Red. Some brown shale. Very little green shale. |
| 810' | 890' | 80' | Shale - Red and brown, silty. Trace of caliche and green shale. |
| 890' | 900' | 10' | Clay - Red, sandy. Trace of gypsum. |
| 900' | 960' | 60' | Anhydrite - Grey, some gypsum. Approx. 20% red clay. |
| 960' | 1010' | 50' | Anhydrite - Dark grey. A little brown and grey clay. |
| 1010' | 1080' | 70' | Shale - Red. Approx. 20% gypsum and anhydrite. |
| 1080' | 1100' | 20' | Shale - Red. Approx. 40% gypsum and anhydrite. |
| 1100' | 1110' | 10' | Shale - Red. Approx. 10% gypsum and anhydrite. |

Farmers 20-F

| From | To | Inter | Formation |
|---|---|---|---|
| 1110' | 1130' | 20' | Gypsum and anhydrite - Approx. 5% red shale. |
| 1130' | 1150' | 20' | Anhydrite - Grey. Set casing at 1132' 10". |
| 1150' | 1170' | 20' | Limestone - Tan. A little grey anhydrite. (Culebra). |
| 1170' | 1180' | 10' | Clay - Red and grey. |
| 1180' | 1200' | 20' | Halite - Approx. 20% brown clay. |
| 1200' | 1236' | 36' | Halite - Approx. 4% brown clay. |
| | 1236' | | Start coring - 2-23-53. |
| 1236' 0" | 1239' 4" | 3' 4" | Halite - Clear to faint orange. Occasional bleb of orange polyhalite. Approx. 2% brown clay. |
| 1239' 4" | 1240' 4" | 1' 0" | Clay - Red, silty. Approx. 15% halite. |
| 1240' 4" | 1247' 6" | 7' 2" | Halite - Clear, medium grained. Approx. 40% red siltstone. |
| 1247' 6" | 1251' 2" | 3' 8" | Siltstone - Red. Approx. 5% halite. |
| 1251' 2" | 1253' 1" | 1' 11" | Halite - Clear, medium grained. Approx. 40% red and grey siltstone. |
| 1253' 1" | 1257' 2" | 4' 1" | Siltstone - Red. A few halite crystals, more prominent in the top 2'. |
| 1257' 2" | 1264' 4" | 7' 2" | Clay - Red, silty. Occasional carnallite and halite bleb. |
| 1264' 4" | 1266' 4" | 2' 0" | Siltstone - Brown. Numerous small carnallite blebs. |
| 1266' 4" | 1267' 2" | 0' 10" | Anhydrite - Grey. A few small carnallite blebs. A few halite crystals. |
| 1267' 2" | 1268' 0" | 0' 10" | Siltstone - Red. Numerous small carnallite blebs. A few halite crystals. |
| 1268' 0" | 1271' 2" | 3' 2" | Anhydrite - Grey and grey clay. A few halite crystals. Red, silty clay seams at 1268' 4" and 1269' 8". |
| 1271' 2" | 1271' 6" | 0' 4" | Clay - Red, silty. A few halite and carnallite blebs. |
| 1271' 6" | 1272' 5" | 0' 11" | Clay - Brownish grey. Some grey anhydrite. A few halite and carnallite blebs. |
| 1272' 5" | 1272' 10" | 0' 5" | Halite - and brown clay. Scattered carnallite blebs. |
| 1272' 10" | 1273' 1" | 0' 3" | Clay - Green. A few halite and carnallite blebs. (12th ore zone). |

# ATTACHMENT IV.2.D

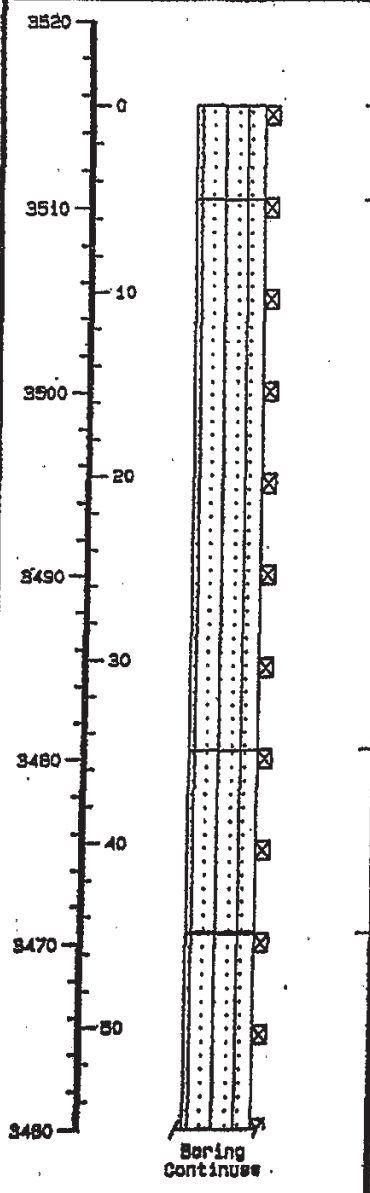
# GEOTECHNICAL BOREHOLE LOGS, LEA LAND SITE INVESTIGATION

# SOIL BORING LOG AND TEST RESULTS

BORING B-1

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3515.5 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 4220.0 ft. from S. Line; 160.5 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-1
Water Depth: 125 ft.




| ELEV/DEPTH Feet | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|
| | SM | Gray Silty Sand<br>Nonplastic | | | | | |
| | SM | Light Pink Silty Sand<br>Nonplastic<br>High Carbonate | NP | NP | 71.6 | 32.4 | 100 |
| | SM | Lt. Gray Silty Sand<br>Nonplastic<br>High Carbonate | NP | NP | 67.8 | 23.4 | 100 |
| | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | NP | NP | 82.2 | 38.6 | 24 |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 1

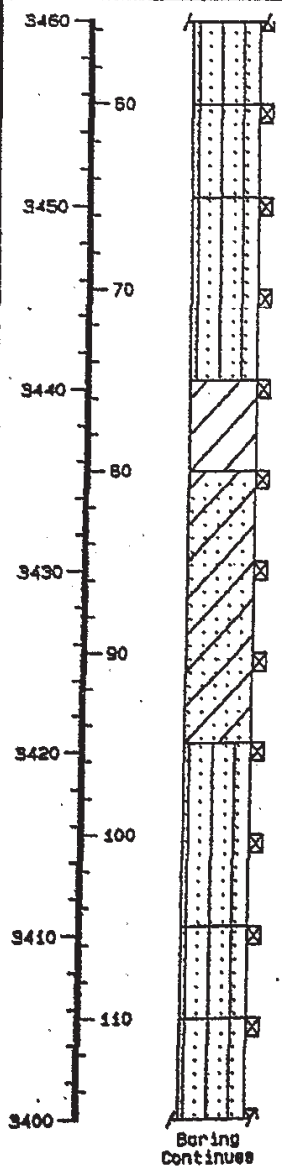
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-1

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3515.5 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 4220.0 ft. from S. Line; 160.5 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-1
Water Depth: 125 ft.




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Dark Pink Silty Sand<br>Nonplastic | | | | | |
| | | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Dark Brown V. Sandy Clay<br>Low Plasticity | 25 | 8 | 85.4 | 54.4 | 4 |
| | | SC | Dark Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | 31 | 14 | 78.9 | 49.2 | 19 |
| | | SM | Dark Pink Silty Sand<br>Nonplastic | | | | | |
| | | SM | Dark Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Dark Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 2

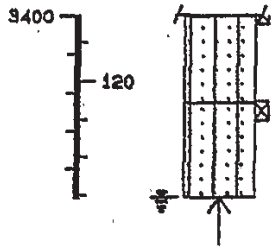
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-1

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3515.5 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 4220.0 ft. from S. Line; 160.5 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-1
Water Depth: 125 ft.

| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| 3400 |  | SM | Dk Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| 120 | | | | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 3

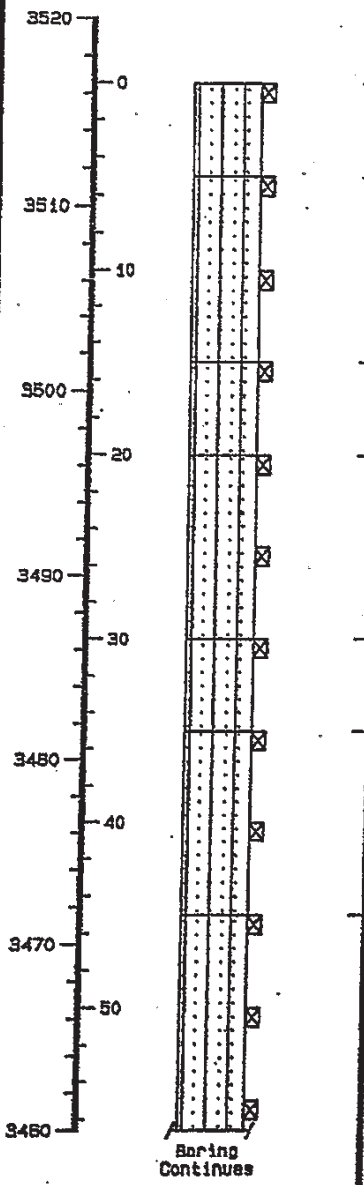
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-2

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3516.6 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 3699.9 ft. from S. Line; 1230.3 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-2
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Lt. Tan Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Lt. Pink Silty Sand<br>Nonplastic<br>Low Carbonate | NP | NP | 90.9 | 30.4 | 17 |
| | | SM | Lt. Pink Silty Sand<br>Nonplastic<br>High Carbonate | | | | | |
| | | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | NP | NP | 82.2 | 38.6 | 24 |
| | | SM | Dk Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Pink Silty Sand<br>Nonplastic | | | | | |
| | | SM | Dk Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 4

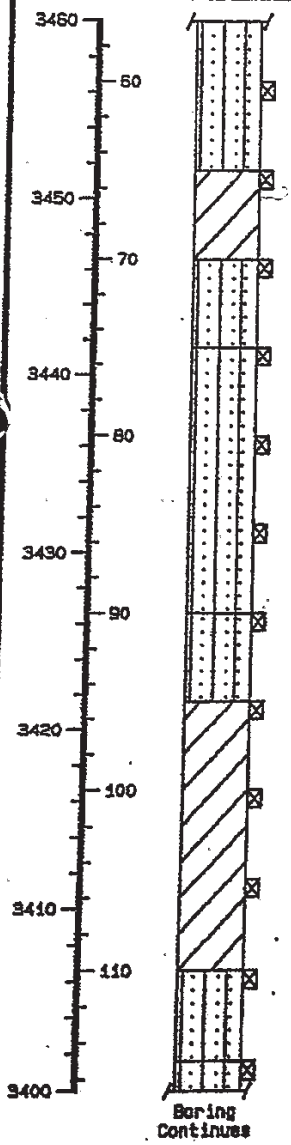
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-2

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3516.6 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 3699.9 ft. from S. Line; 1230.3 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-2
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | CL | Pink V Sandy Clay<br>Low Plasticity | 25 | 8 | 85.4 | 54.4 | 4 |
| | | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Dk Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Dk Pink V Sandy Clay<br>Low Plasticity | | | | | |
| | | SM | Dk Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Dk Pink Silty Sand<br>Nonplastic | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 5

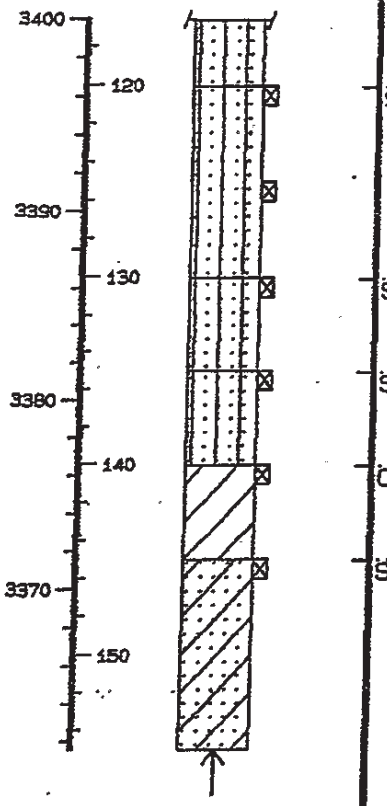
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-2

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3516.6 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 3699.9 ft. from S. Line; 1230.3 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-2
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Dk Brown V Sandy Clay<br>Low Plasticity | | | | | |
| | | SC | Dark Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

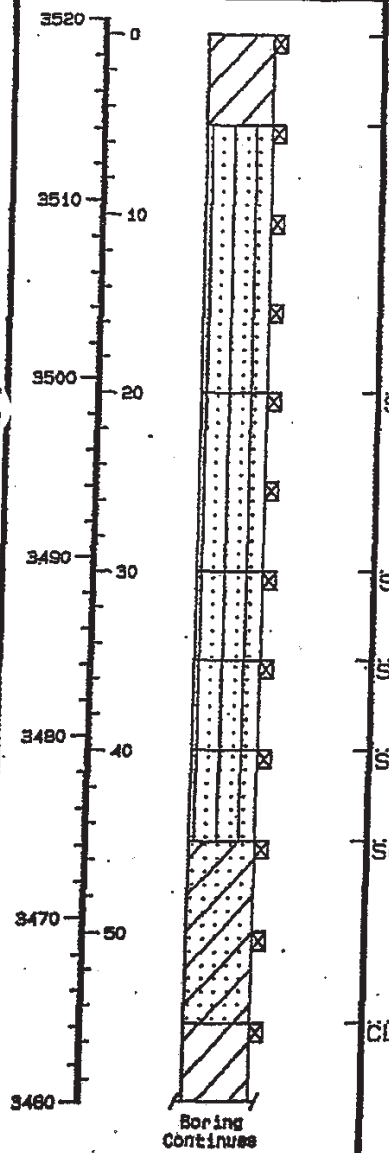
PLATE B-6

# SOIL BORING LOG AND TEST RESULTS

BORING B-3

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3519.2 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 3169.7 ft. from S. Line; 2300.2 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-3
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | CL | Lt Tan V Sandy Clay<br>Low Plasticity | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic | 28 | NP | 93.6 | 30.6 | 8 |
| | | SM | Gray Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Dk Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Dk Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SC | Dark Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| | | CL | Brown V Sandy Clay<br>Low Plasticity | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-7

# SOIL BORING LOG AND TEST RESULTS

BORING B-3

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3519.2 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 3169.7 ft. from S. Line; 2300.2 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-3
Water Depth: None

| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| 3460 – 60 | | SC | Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| 3450 – 70 | | | | | | | | |
| 3440 – 80 | | | | | | | | |
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| 3430 – 90 | | SC | Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| 3420 – 100 | | SM | Lt Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| 3410 – 110 | | | | | | | | |
| | | SC | Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| 3400 | Boring Continues | | | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-3

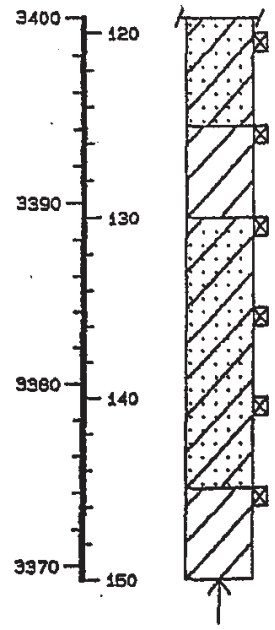
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-3

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3519.2 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 3169.7 ft. from S. Line; 2300.2 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-3
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | CL | V Dk Brown Sandy Clay<br>Low Plasticity | | | | | |
| | | SC | Lt Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| | | CL | Gray Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

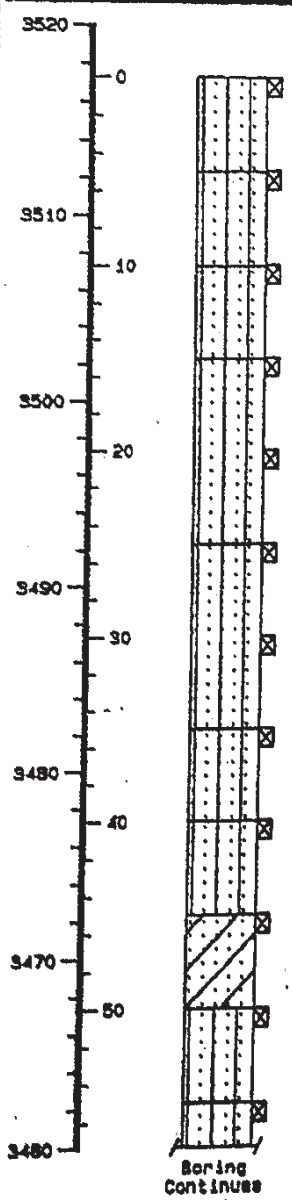
PLATE B-3

# SOIL BORING LOG AND TEST RESULTS

BORING B-4

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3517.3 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 2970.0 ft. from S. Line; 175.1 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-4
Water Depth: None




| ELEV/DEPTH Feet | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|
| | SM | Dk Tan Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | SM | Lt Gray Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | SM | Gray Silty Sand<br>Nonplastic<br>High Carbonate | | | | | |
| | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | SM | Lt Pink Silty Sand<br>Nonplastic<br>Moderate Carbonate | | | | | |
| | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | NP | NP | 90.2 | 38 | 18 |
| | SC | Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| | SM | Brown, Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | SM | Dk Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 10

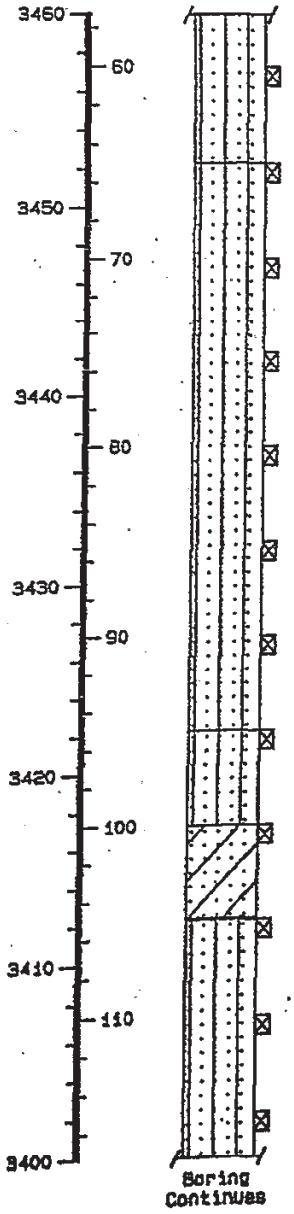
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-4

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3517.3 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 2970.0 ft. from S. Line; 175.1 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-4
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | | | NP | NP | 92.3 | 40.9 | 18 |
| | | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Dk Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SC | Dk Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| | | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE

# SOIL BORING LOG AND TEST RESULTS

BORING B-4

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3517.3 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 2970.0 ft. from S. Line; 1765.1 ft. from E. Line

Date: 11/8/01
Project No.: 0-070
Boring No.: B-4
Water Depth: None

| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | #40 % | #200 % | Calcite % |
|---|---|---|---|---|---|---|---|---|
| 3400 | | | | | | | | |
| 120 | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| 3390 | | SM | LT Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| 130 | | | | | | | | |
| 3380 | | | | | | | | |
| 140 | | SC | DK Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | 31 | 14 | 78.9 | 48.2 | 18 |
| 3370 | | CL | Reddish Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

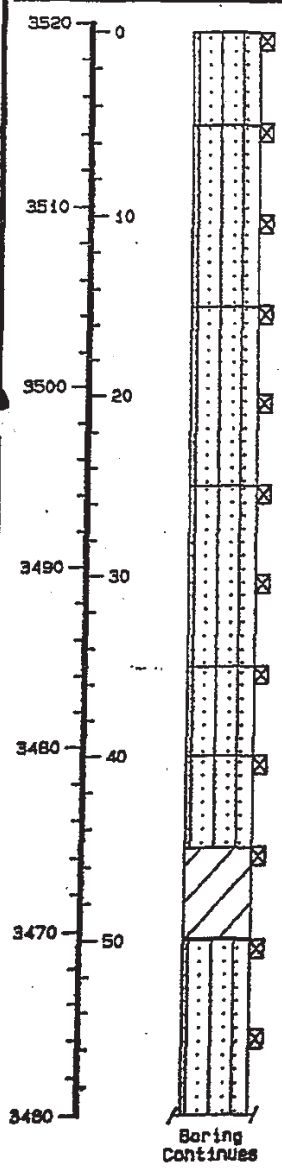
PLATE B- 18

# SOIL BORING LOG AND TEST RESULTS

BORING B-5

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3519.5 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 2789.9 ft. from S. Line; 1220.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-5
Water Depth: 199 ft.




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Dk Tan Silty Sand<br>Nonplastic | | | | | |
| | | SM | V Lt Pink Silty Sand<br>Nonplastic<br>High Carbonate | | | | | |
| | | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic | | | | | |
| | | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | NP | NP | 89.9 | 35.1 | 18 |
| | | SM | Brown Silty Sand<br>Nonplastic<br>Moderate Carbonate | | | | | |
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SM | Lt Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

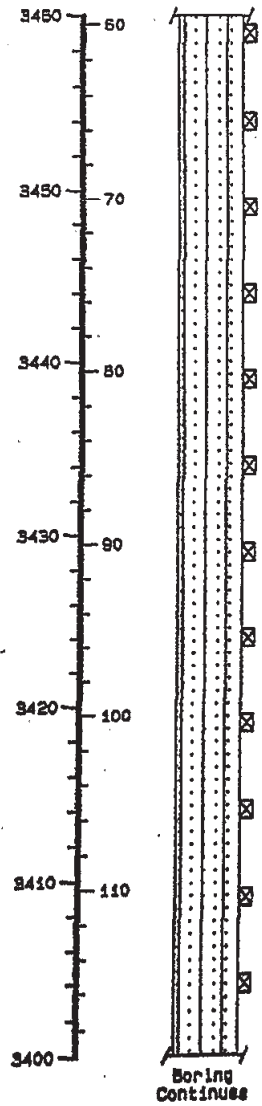
Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

# SOIL BORING LOG AND TEST RESULTS

BORING B-5

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3519.5 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 2789.9 ft. from S. Line; 1220.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-5
Water Depth: 199 ft.

| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| 3460 — 60 |  | | | | | | | |
| 3450 — 70 | | | | | | | | |
| 3440 — 80 | | | | | | | | |
| 3430 — 90 | | | | | | | | |
| 3420 — 100 | | | | | | | | |
| 3410 — 110 | | | | | | | | |
| 3400 | | | | | | | | |



Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 14

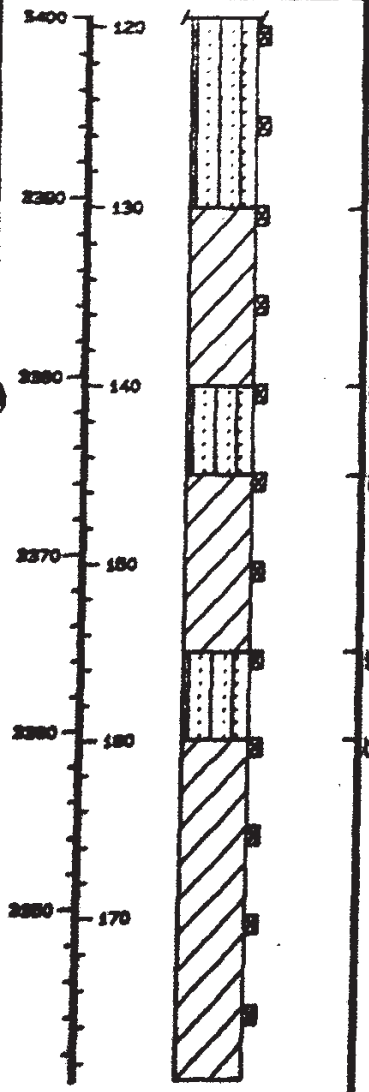
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-5

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3519.5 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 2789.9 ft. from S. Line; 1220.0 ft. from E. Line

Date: 11/8/93
Project No.: 6-979
Boring No.: B-5
Water Depth: 199 ft.




| USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|
| CL | Reddish Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| SM | Lt Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| CL | Dk Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE No. 10

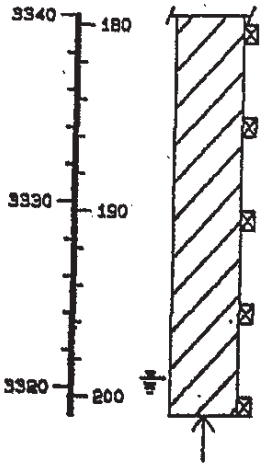
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-5

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3519.5 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 2789.9 ft. from S. Line; 1220.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-5a
Water Depth: 199 ft.

| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| 3340 — 180<br>3330 — 190<br>3320 — 200 |  | | | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 16

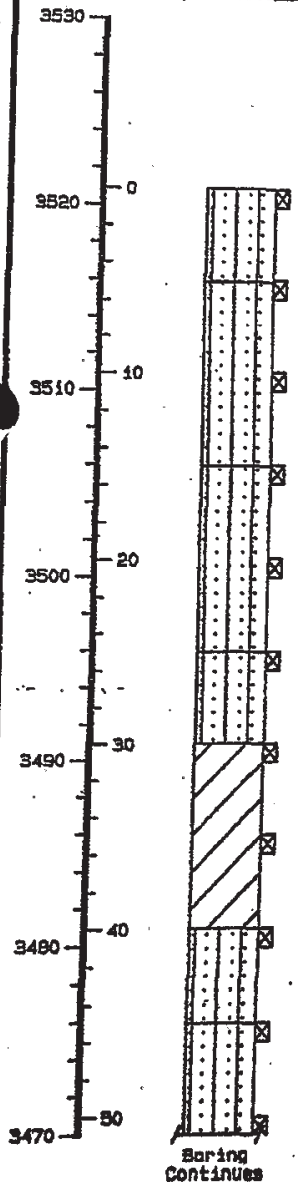
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-6

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3520.9 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1750.0 ft. from S. Line; 150.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-6
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Dk Tan Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | Lt Gray Silty Sand<br>Nonplastic<br>High Carbonate | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>High Carbonate | | | | | |
| | | SM | Pink Silty Sand<br>Nonplastic<br>High Carbonate | | | | | |
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | 27 | 11 | 96.5 | 73.8 | 27 |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Moderate Carbonate | NP | NP | 83.3 | 37.8 | 40 |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-

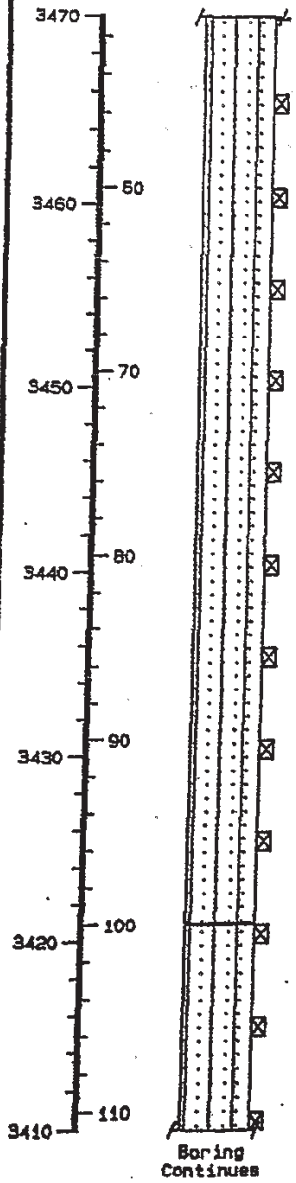
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-6

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3520.9 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1750.0 ft. from S. Line; 150.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-6
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | | | NP | NP | 90.0 | 30.4 | 17 |
| | | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | | | NP | NP | 90.2 | 38.0 | 18 |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-

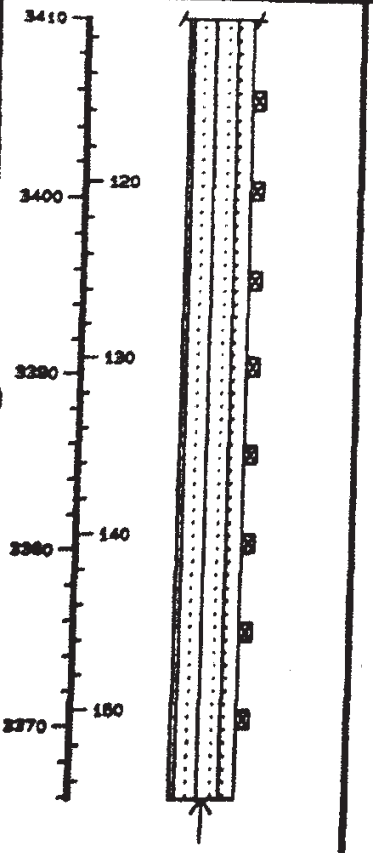
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-6

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3520.9 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1750.0 ft. from S. Line; 150.0 ft. from E. Line

Date: 11/8/93
Project No.: S-979
Boring No.: B-6
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-19

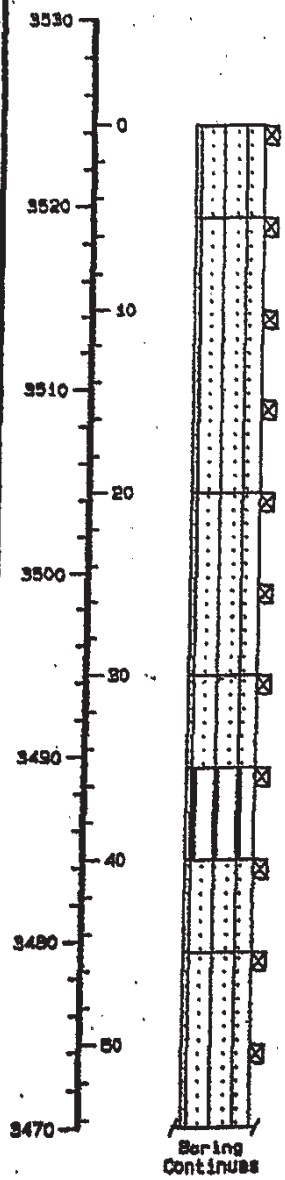
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-7

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3524.4 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1899.9 ft. from S. Line; 1230.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-7
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Dk Tan Silty Sand<br>Nonplastic | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | SM | White to Pink Silty Sand<br>Nonplastic<br>High Carbonate | NP | NP | 59.0 | 19.1 | 77 |
| | | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | ML | Brown Sandy Silt<br>Nonplastic | 24 | NP | 97.8 | 53.9 | 5 |
| | | SM | Pink Silty Sand<br>Nonplastic | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

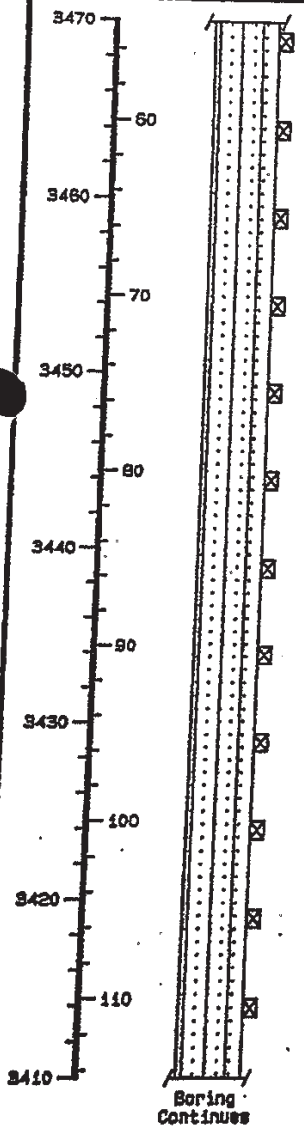
PLATE B-20

# SOIL BORING LOG AND TEST RESULTS

BORING B-7

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3524.4 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1899.9 ft. from S. Line; 1230.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-7
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | | | NP | NP | 85.9 | 28.6 | 24 |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-31

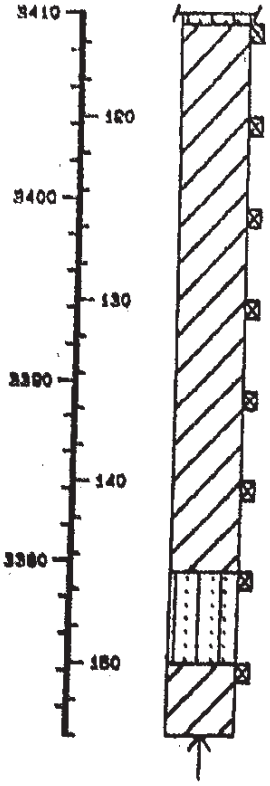
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-7

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3524.4 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1899.9 ft. from S. Line; 1230.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-7
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | CL | Dk Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SM | Lt Grey Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Dk Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 22

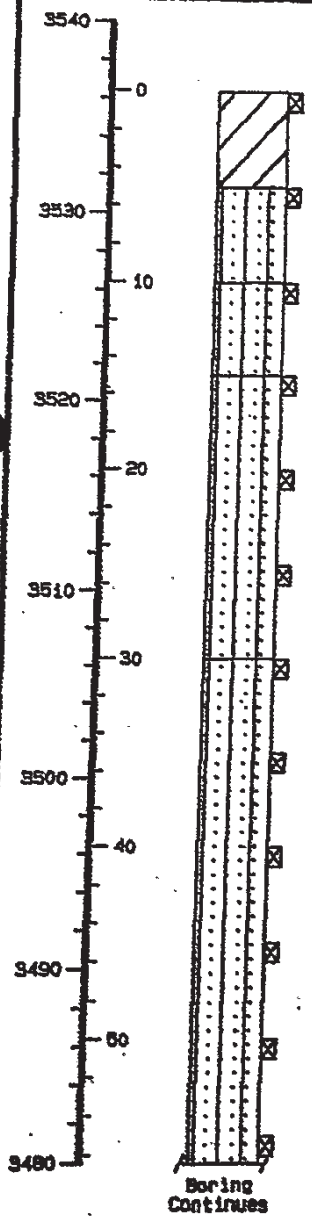
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-8

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3536.4 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1419.7 ft. from S. Line; 2300.0 ft. from E. Line

Date: 11/8/93
Project No.: 6-979
Boring No.: B-8
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | CL | Dk Tan Sandy Clay<br>Low Plasticity | 25 | 8 | 85.4 | 54.4 | 4 |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>High Carbonate | 29 | NP | 69.7 | 33.4 | 77 |
| | | SM | Lt Pink Silty Sand<br>Nonplastic | | | | | |
| | | SM | Lt Gray Silty Sand<br>Nonplastic<br>High Carbonate | NP | NP | 59.0 | 19.1 | 77 |
| | | SM | Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

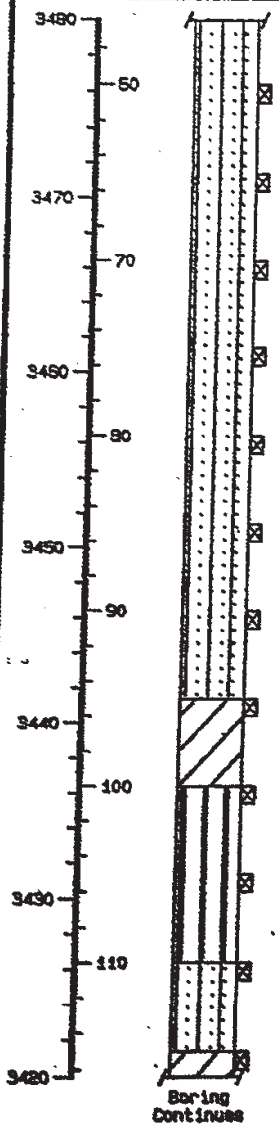
PLATE B-2

# SOIL BORING LOG AND TEST RESULTS

BORING B-8

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3536.4 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1419.7 ft. from S. Line; 2300.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-8
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | NP | NP | 95.4 | 30.5 | 18 |
| | | ML | Brown Sandy Silt<br>Nonplastic | 24 | NP | 97.8 | 53.9 | 5 |
| | | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Dk Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-24

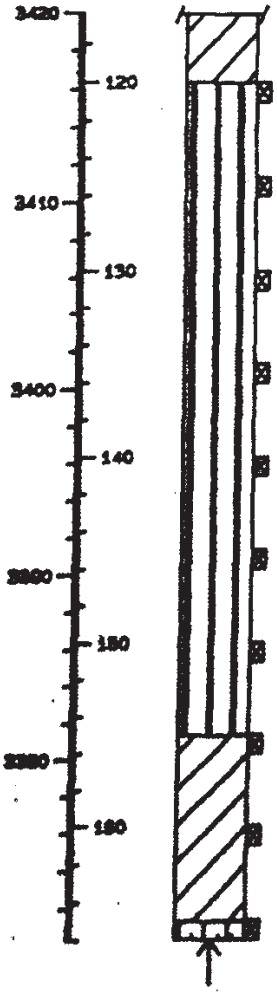
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-8

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3536.4 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 1419.7 ft. from S. Line; 2300.0 ft. from E. Line

Date: 11/8/93
Project No.: 6-979
Boring No.: B-8
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | ML | Brown Sandy Silt<br>Nonplastic | 24 | NP | 97.8 | 53.9 | 5 |
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SM | Gray Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

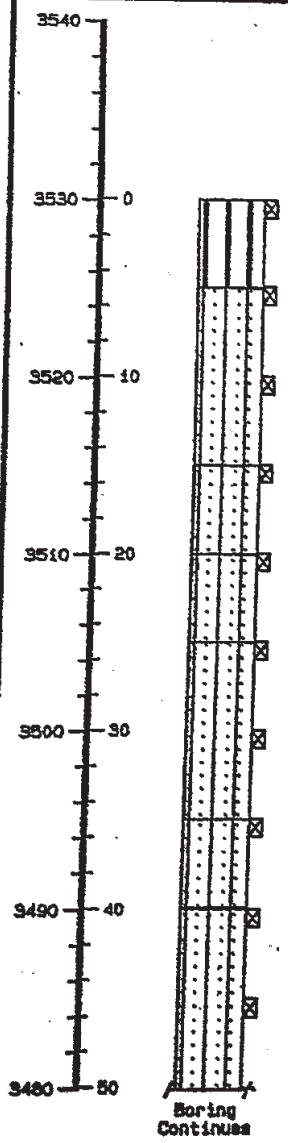
Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

# SOIL BORING LOG AND TEST RESULTS

BORING B-9

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3530.1 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 949.9 ft. from S. Line; 1250.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-9
Water Depth: None




| ELEV/DEPTH Feet | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|
| | ML | Dk Tan Sandy Silt<br>Nonplastic | 24 | NP | 97.8 | 53.9 | 5 |
| | SM | Lt Pink Silty Sand<br>Nonplastic<br>High Carbonate | | | | | |
| | SM | Lt Tan Silty Sand<br>Nonplastic<br>Moderate Carbonate | | | | | |
| | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | SM | Lt Pink Silty Sand<br>Nonplastic<br>High Carbonate | NP | NP | 71.6 | 32.4 | 100 |
| | SM | Pink Silty Sand<br>Nonplastic. | 28 | NP | 93.6 | 30.6 | 8 |
| | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | NP | NP | 96.4 | 30.5 | 18 |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-26

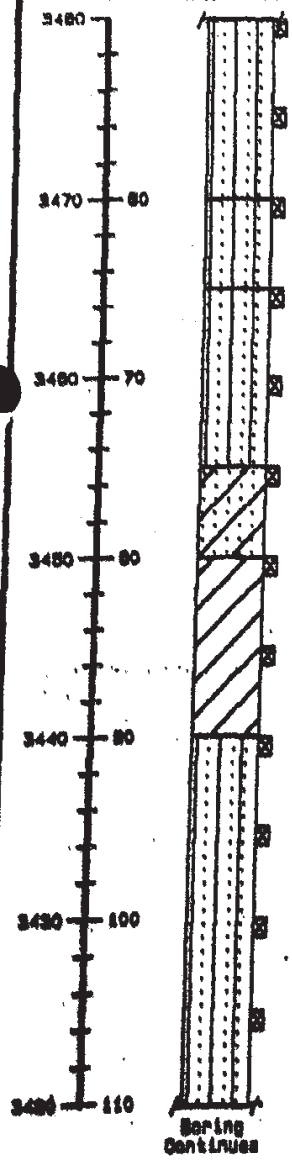
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-9

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3530.1 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 949.9 ft. from S. Line; 1250.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-9
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Moderate Carbonate | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | NP | NP | 85.9 | 28.6 | 24 |
| | | SC | Lt Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| | | CL | Lt Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SM | Lt Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 37

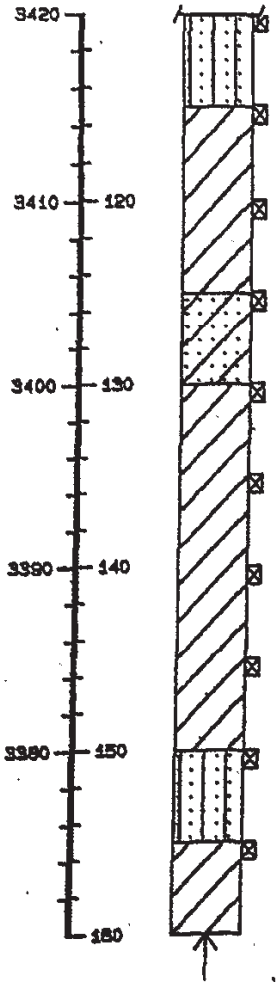
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-9

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3530.1 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 949.9 ft. from S. Line; 1250.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-9
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | CL | Dk Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SC | Dk Brown Clayey Sand<br>Medium Plasticity<br>Low Carbonate | | | | | |
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SM | Lt Gray Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Dk Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 20

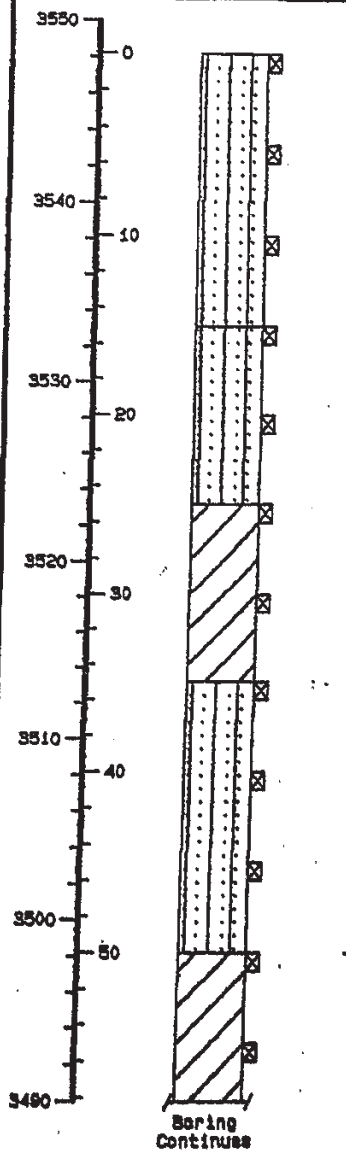
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-10

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3548.2 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 500.0 ft. from S. Line; 150.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-10
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Lt Gray Silty Sand<br>Nonplastic<br>High Carbonate | 29 | NP | 69.7 | 33.4 | 77 |
| | | SM | Dk Pink Silty Sand<br>Nonplastic<br>Moderate Carbonate | NP | NP | 83.3 | 37.8 | 40 |
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B- 29

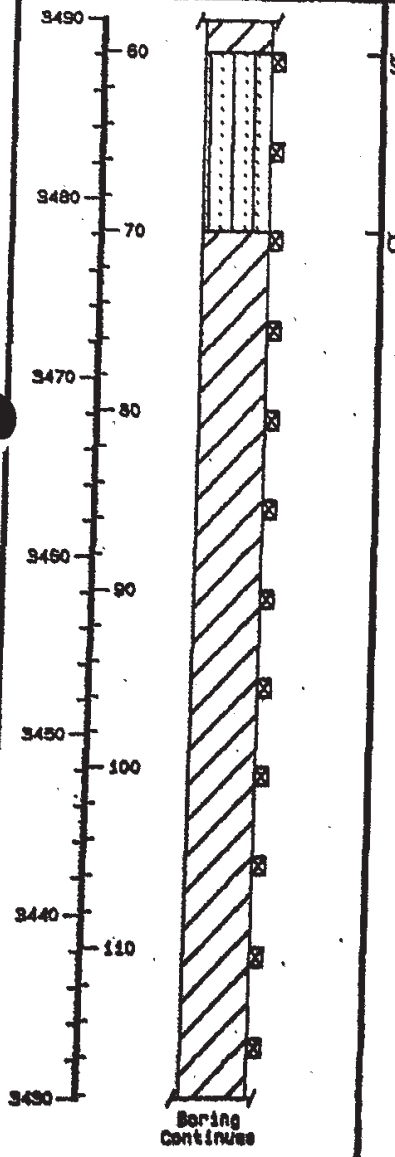
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-10

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3548.2 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 500.0 ft. from S. Line; 150.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-10
Water Depth: None




| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | NP | NP | 92.3 | 40.9 | 18 |
| | | CL | Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | | | 27 | 11 | 98.5 | 73.8 | 27 |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by client.

PLATE B- 10

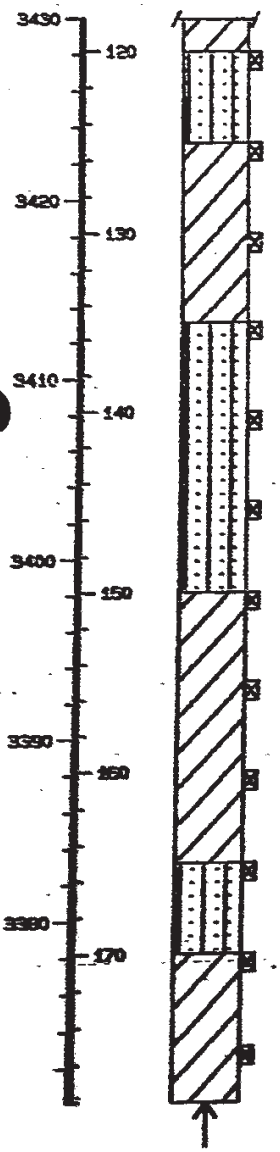
Standard Testing and Engineering Company

# SOIL BORING LOG AND TEST RESULTS

BORING B-10

Project: Lea Land, Inc.
Location: Lea County, New Mexico
Surface Elevation: 3548.2 ft.
Drill method: Air Rotary
Reported To: Bob Hall; Lea Land, Inc.
Remarks: 500.0 ft. from S. Line; 150.0 ft. from E. Line

Date: 11/8/93
Project No.: G-979
Boring No.: B-10
Water Depth: None



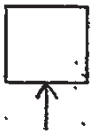

| ELEV/DEPTH Feet | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA | USCS | Soil Description | LL % | PI % | -#40 % | -#200 % | CaCO3 % |
|---|---|---|---|---|---|---|---|---|
| | | SM | Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Dk Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SM | Lt Brown Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Lt Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |
| | | SM | Lt Pink Silty Sand<br>Nonplastic<br>Low Carbonate | | | | | |
| | | CL | Dk Brown Sandy Clay<br>Low to Medium Plasticity<br>Moderate Carbonate | | | | | |

Boring logs are based on laboratory examination of air rotary drill cuttings sampled by Client.

PLATE B-10

Standard Testing and Engineering Company

Legend:

| Symbol: | Description: |
|---|---|
|  | Silty Sand |
|  | Clayey Sand |
|  | Bulk sample taken from air rotary cuttings |
|  | End of boring |

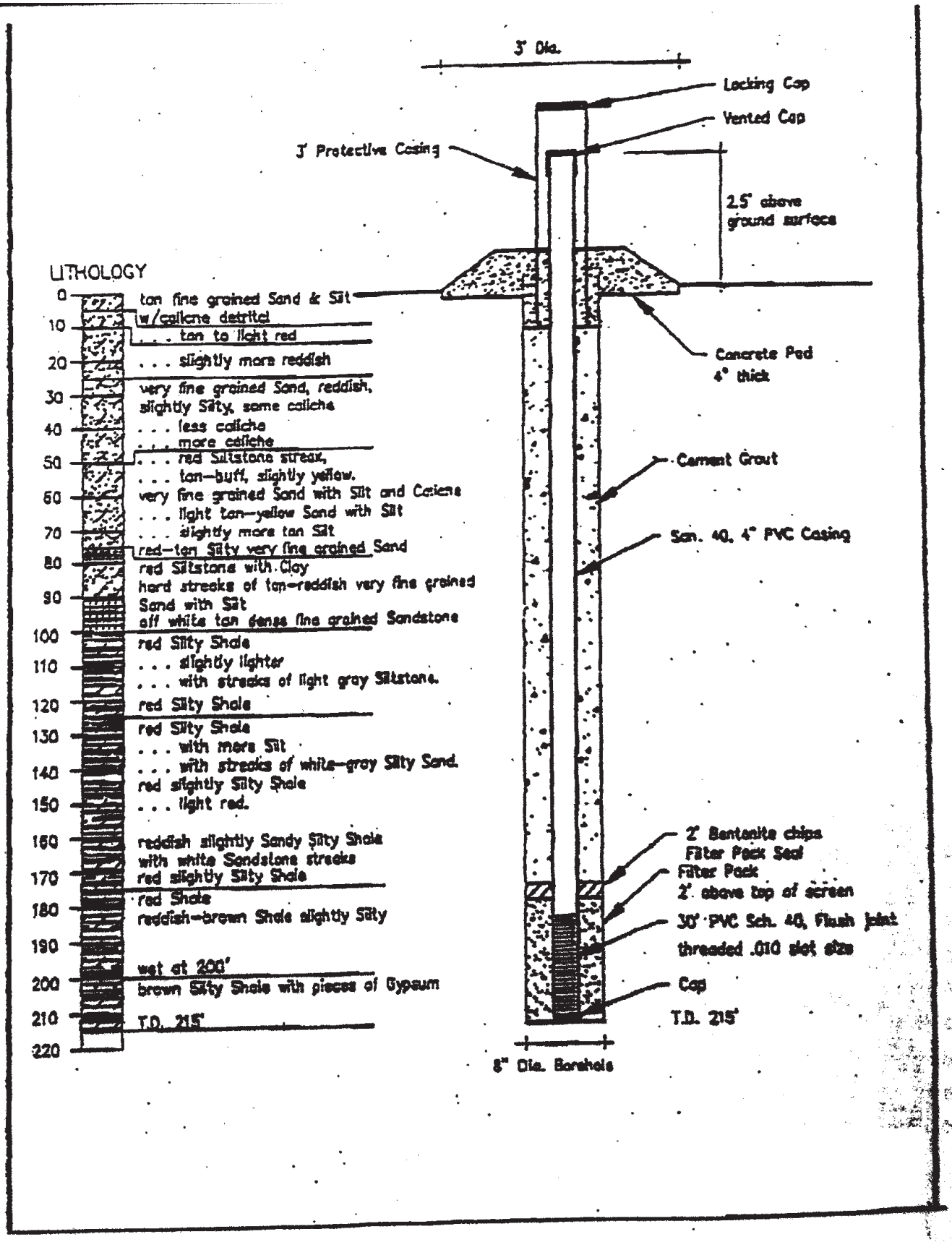
| Symbol: | Description: |
|---|---|
|  | Sandy Clay |
|  | Sandy Silt |
|  | |

Notes:

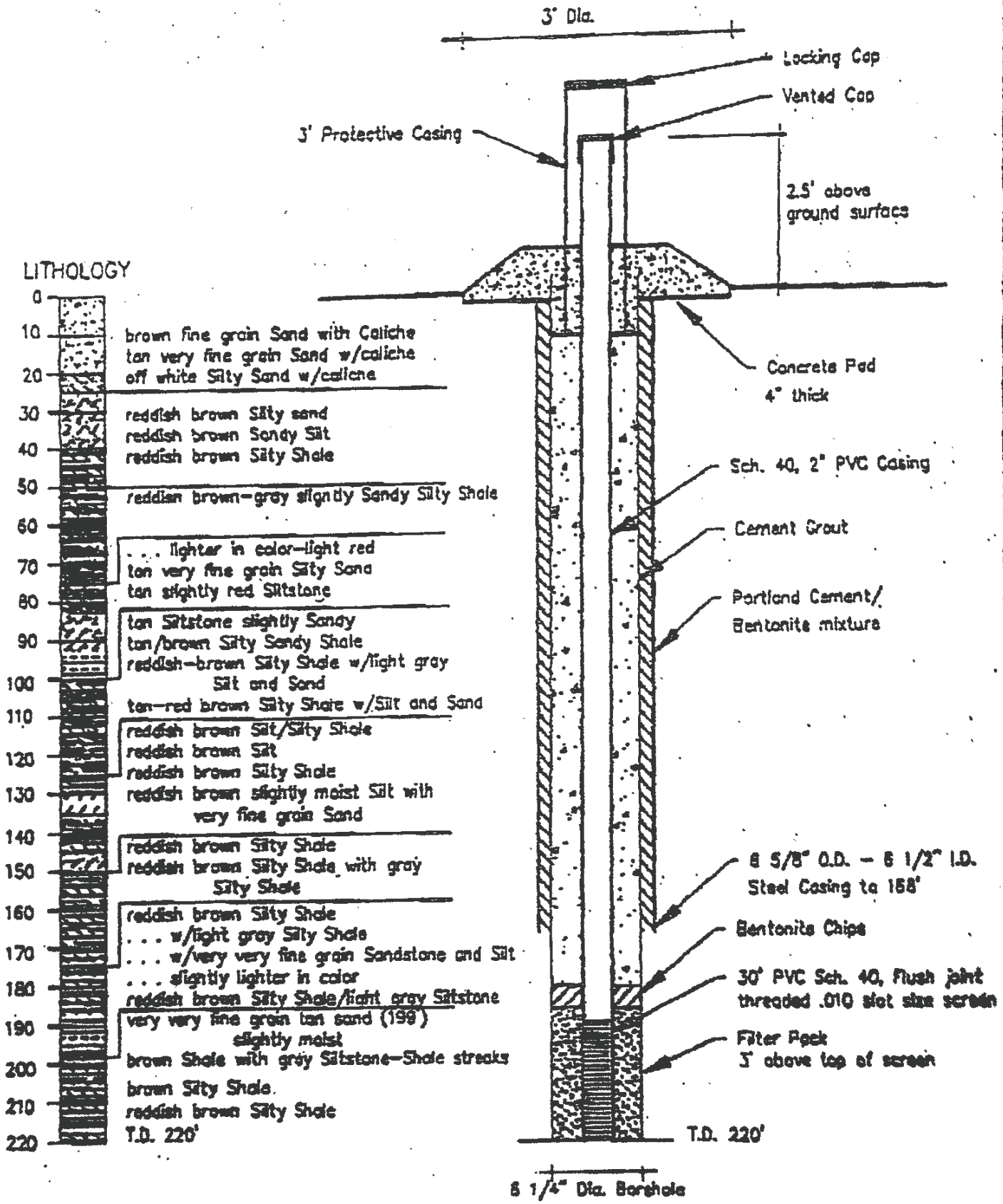
LL = Liquid limit
PI = Plasticity index
#40 = percent passing #40 U.S. Standard sieve
#200 = percent passing #200 U.S. Standard sieve
CaCO3 = percent Calcium Carbonate and/or Magnesium Carbonate

# ATTACHMENT IV.2.E

# GROUNDWATER MONITORING WELL LOGS, LEA LAND SITE




Well completion diagram with stratigraphy of MW #1




Well completion diagram with stratigraphy of MW #2

Form WR-23 STATE ENGINEER OFFICE

SANTA FE

# WELL RECORD

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

Section 1

(Plat of 640 acres)

(A) Owner of well Ballard & Bonfield

Street and Number 107 North Canal

City Carlsbad State New Mexico

Well was drilled under Permit No. C.P. 368 and is located in the ¼ ¼ NE ¼ of Section 36 Twp. 20 Rge. 31

(B) Drilling Contractor Emmett Barron License No. W.D.30

Street and Number 307 South 10th

City Carlsbad State New Mexico

Drilling was commenced June 2 19 66

Drilling was completed June 10 19 66

Elevation at top of casing in feet above sea level ____ Total depth of well 303

State whether well is shallow or artesian shallow Depth to water upon completion none

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| | | | | none |
| 1 | 0 | 303 | 303 | Silt, Stone & Red Bed |
| 2 | | | | |
| 3 | | | | Not used |
| 4 | | | | |
| 5 | | | | |

STATE ENGINEER OFFICE SANTA FE, N. M. OCT 25 AM 9:12 1966

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| | | | None | | | None | Used | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor ____ License No. ____

Street and Number ____ City ____ State ____

Tons of Clay used ____ Tons of Roughage used ____ Type of roughage ____

Plugging method used ____ Date Plugged ____ 19 ____

Plugging approved by: ____ Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received ✓ STATE ENGINEER OFFICE DISTRICT II ROSWELL, N. MEX. 1966 OCT 11 AM 8:34

File No. CP-368 Use Dom Location No. 20.31.36.200

Section 6

## LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 1 | 1 | Brown | Top Soil |
| 1 | 5 | 4 | White | Caliche |
| 4 | 303 | 299 | Red | Silt Stone & Red Bed |

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 well.

Emmett Bass
Well Driller

FORM WR-32

Form WR-23.

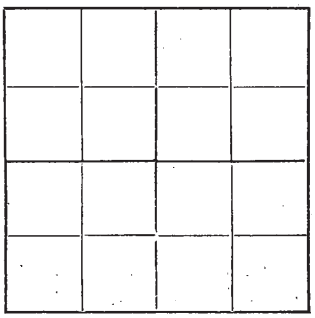
SANTA FE

STATE ENGINEER OFFICE

# WELL RECORD

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

Section 1



(Plat of 640 acres)

(A) Owner of well Ballard & Bonfield

Street and Number 1007 North Canal

City Carlsbad State New Mexico

Well was drilled under Permit No. C.P. 370 and is located in the NW ¼ NW ¼ NW ¼ of Section 36 Twp. 20 Rge. 31

(B) Drilling Contractor Emmett Barron License No. W.D. 30

Street and Number 307 South 10th

City Carlsbad State New Mexico

Drilling was commenced July 11, 19 66

Drilling was completed July 14 19 66

Elevation at top of casing in feet above sea level ..... Total depth of well 120'

State whether well is shallow or artesian shallow Depth to water upon completion 80'

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 75' | 80 | 5 | Brown sandstone and silt stone |
| 2 | | | | 6" Well |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

STATE ENGINEER OFFICE SANTA FE, N. M. 1966 OCT 25 AM 9:12

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| | | NONE | | | | NONE | USED | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor ..... License No. .....

Street and Number ..... City ..... State .....

Tons of Clay used ..... Tons of Roughage used ..... Type of roughage .....

Plugging method used ..... Date Plugged ..... 19 .....

Plugging approved by: Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

Basin Supervisor

DISTRICT II ROSWELL, N. MEX.

FOR USE OF STATE ENGINEER ONLY

STATE ENGINEER OFFICE

Date Received

1966 OCT 11 AM 8:34

File No. CP-370 Use Dom Location No. 20.31.36.111

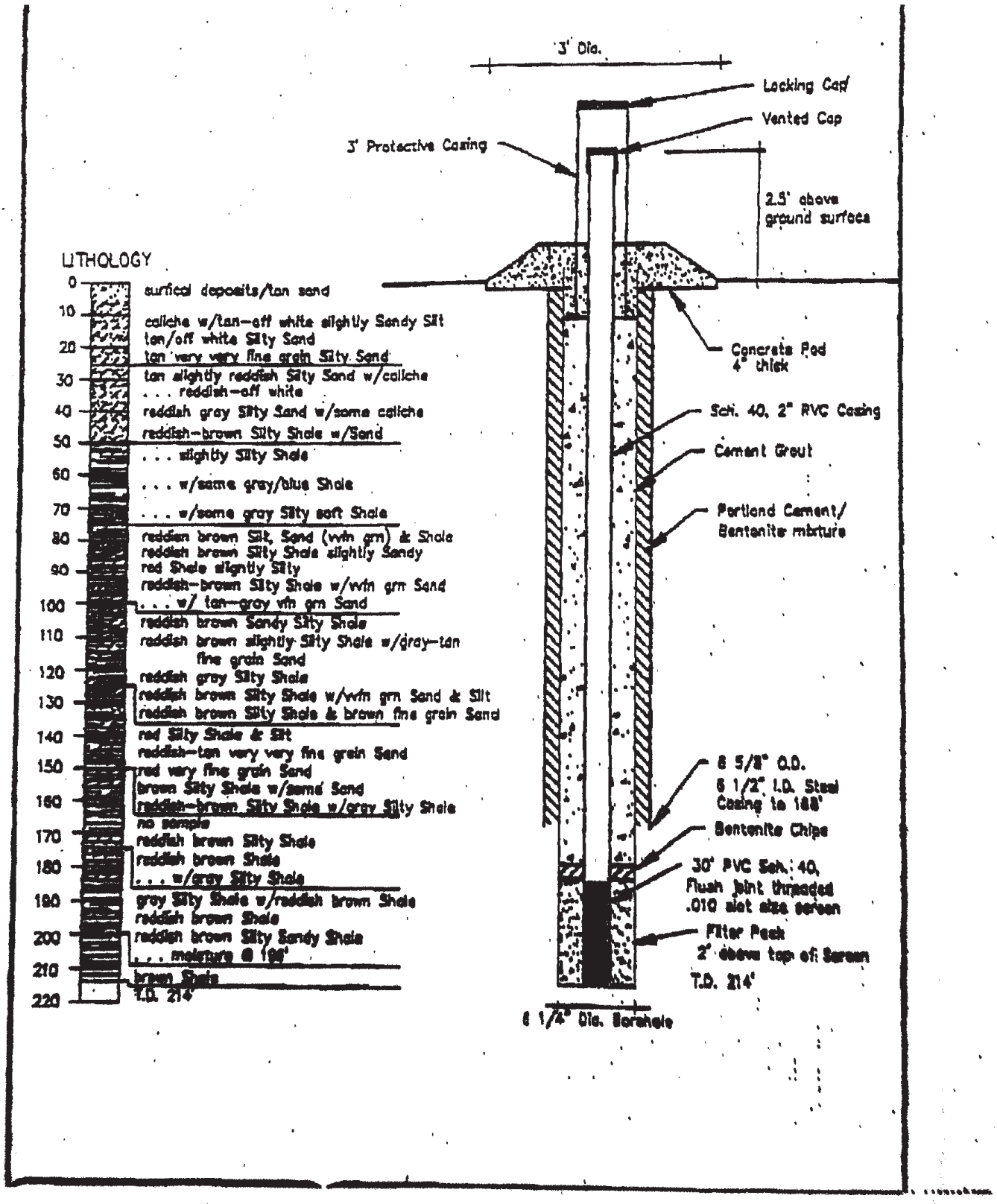
Section 6

## LOG OF WELL

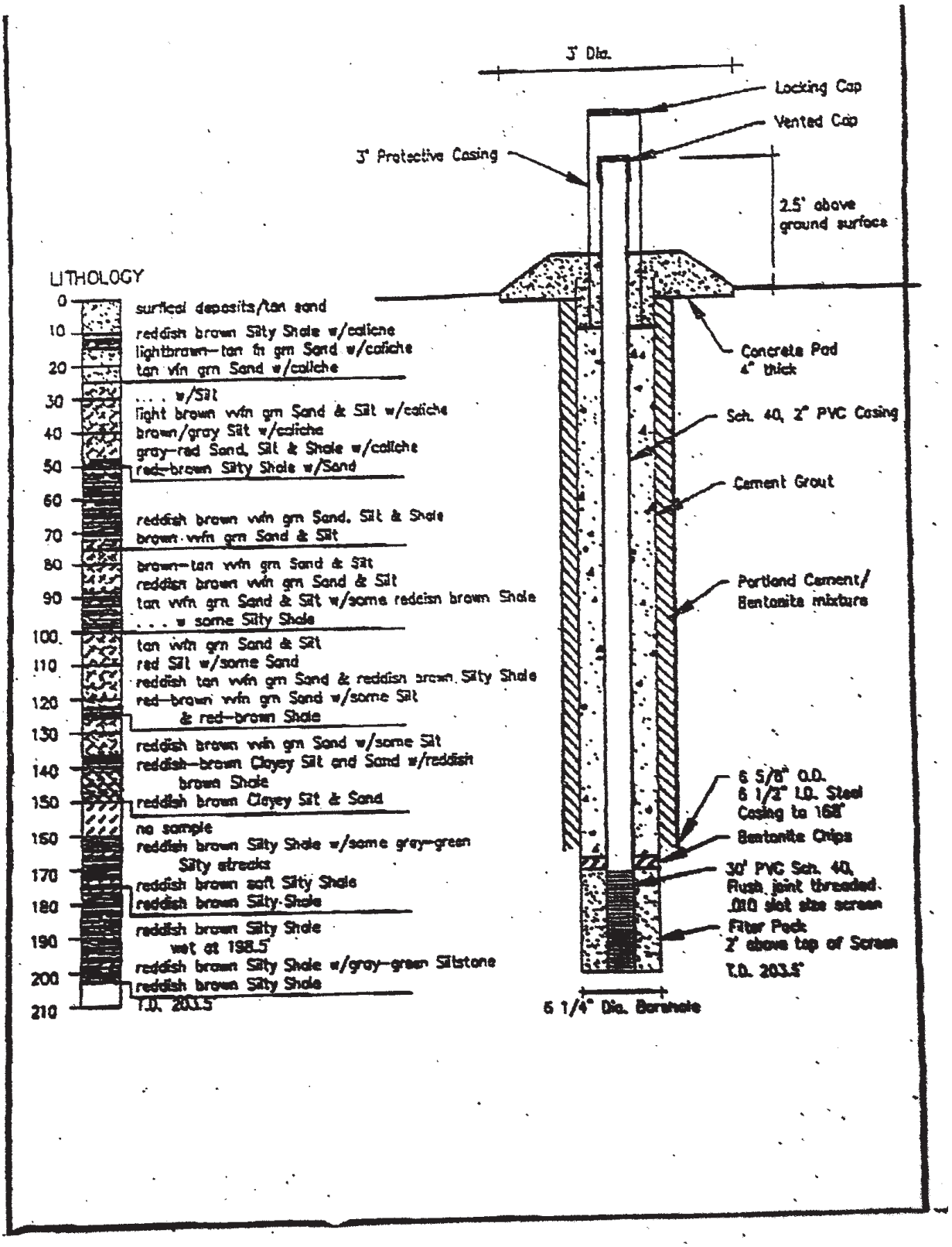
| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 2 | 2 | Brown | Top Soil |
| 2 | 75 | 73 | Red | Silt stone and red bed |
| 75 | 80 | 5 | Brown | Hard sand stone |
| 80 | 120 | 40 | Red | Silt stone and red bed |

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 well.

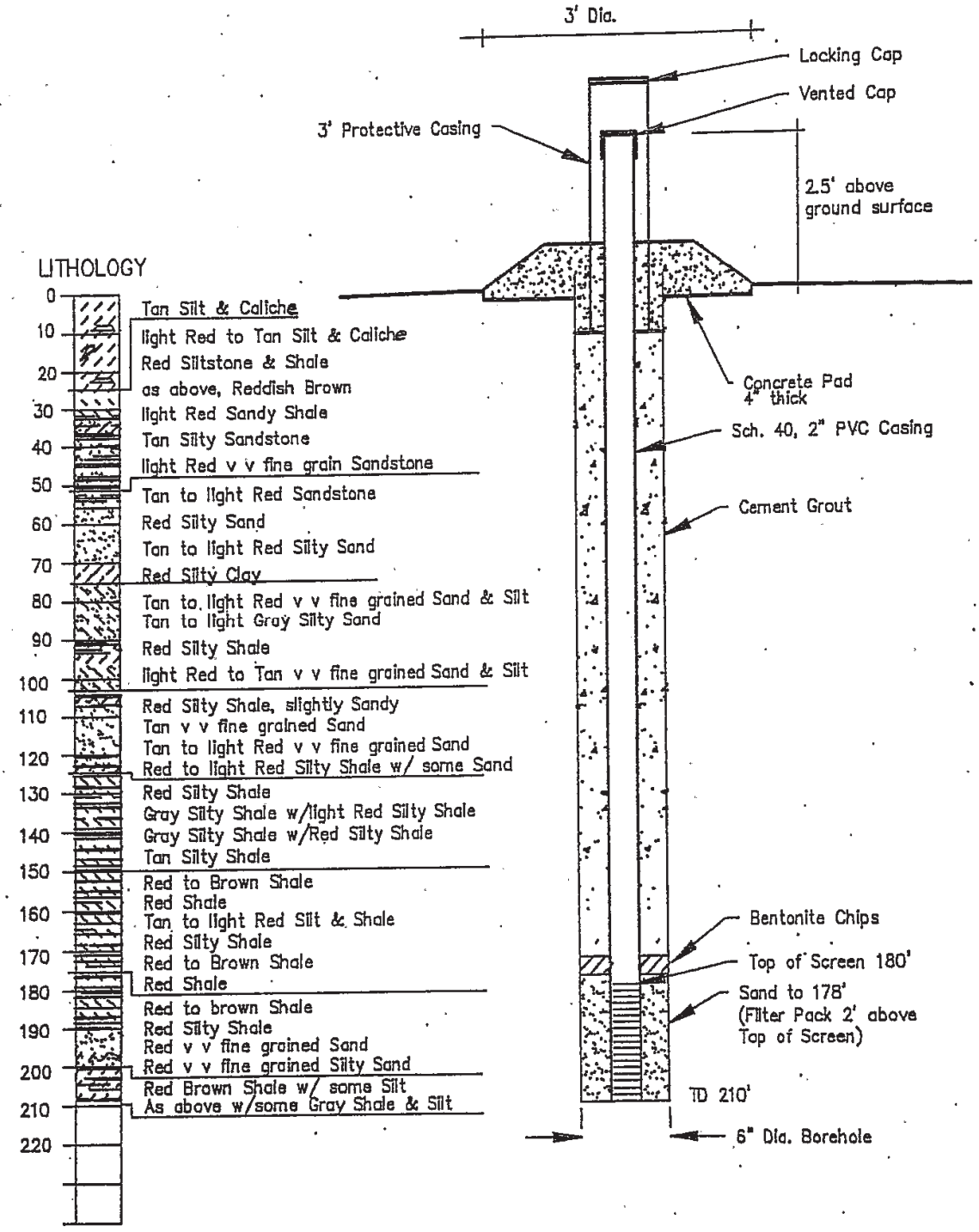
Emmett Barron
Well Driller




Well completion diagram with stratigraphy of MW #3




Well completion diagram with stratigraphy of MW #4




| | |
|---|---|
| PROJ.# 404.1 | DRAWN BY: BJF |
| SCALE: NOT TO SCALE | CHECKED BY: MG |
| FN: | |
| DATE: JUNE, 1997 | |

**GROUNDWATER MONITORING WELL MW-5**

LEA LAND, INC. LANDFILL
LEA COUNTY, NEW MEXICO

Cardinal ENVIRONMENTAL, INC.

# ATTACHMENT IV.2.F

# NMOSE WELL RECORDS FOR NEARBY PERMITTED WELLS

Form WR-23 STATE ENGINEER OFFICE

SANTA FE

# WELL RECORD

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

Section 1

(Plat of 640 acres)

(A) Owner of well Ballard & Bonfield

Street and Number 107 North Canal

City Carlsbad State New Mexico

Well was drilled under Permit No. C.P. 368 and is located in the ¼ ¼ NE ¼ of Section 36 Twp. 20 Rge. 31

(B) Drilling Contractor Emmett Barron License No. W.D.30

Street and Number 307 South 10th

City Carlsbad State New Mexico

Drilling was commenced June 2 19 66

Drilling was completed June 10 19 66

Elevation at top of casing in feet above sea level ..... Total depth of well 303

State whether well is shallow or artesian shallow Depth to water upon completion none

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation none |
|---|---|---|---|---|
| 1 | 0 | 303 | 303 | Silt, Stone & Red Bed |
| 2 | | | | |
| 3 | | | | None used |
| 4 | | | | |
| 5 | | | | |

STATE ENGINEER OFFICE SANTA FE, N.M. 1966 OCT 25 AM 9:12

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| | | | None | | | None | Used | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor ..... License No. .....

Street and Number ..... City ..... State .....

Tons of Clay used ..... Tons of Roughage used ..... Type of roughage .....

Plugging method used ..... Date Plugged ..... 19 .....

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

FOR USE OF STATE ENGINEER ONLY

Date Received 1966 OCT 11 AM 8:34

STATE ENGINEER OFFICE DISTRICT II ROSWELL, N. MEX.

File No. CP-368 Use Dom Location No. 20.31.36.200

Section 6

## LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 1 | 1 | Brown | Top Soil |
| 1 | 5 | 4 | White | Caliche |
| 4 | 303 | 299 | Red | Silt Stone & Red Bed |

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 well.

Emmett Bass
Well Driller

Form WR-23.

SANTA FE

STATE ENGINEER OFFICE

# WELL RECORD

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

Section 1

(Plat of 640 acres)

(A) Owner of well Ballard & Bonfield

Street and Number 1007 North Canal

City Carlsbad State New Mexico

Well was drilled under Permit No. C.P. 370 and is located in the NW ¼ NW ¼ NW ¼ of Section 36 Twp. 20 Rge. 31

(B) Drilling Contractor Emmett Barron License No. W.D. 30

Street and Number 307 South 10th

City Carlsbad State New Mexico

Drilling was commenced July 11, 19 66

Drilling was completed July 14 19 66

Elevation at top of casing in feet above sea level ..... Total depth of well 120'

State whether well is shallow or artesian shallow Depth to water upon completion 80'

Section 2 PRINCIPAL WATER-BEARING STRATA

| No. | Depth in Feet From | Depth in Feet To | Thickness in Feet | Description of Water-Bearing Formation |
|---|---|---|---|---|
| 1 | 75' | 80 | 5 | Brown sandstone and silt stone |
| 2 | | | | 6" Well |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

STATE ENGINEER OFFICE SANTA FE, N. M. 1966 OCT 25 AM 9:12

Section 3 RECORD OF CASING

| Dia in. | Pounds ft. | Threads in | Depth Top | Depth Bottom | Feet | Type Shoe | Perforations From | Perforations To |
|---|---|---|---|---|---|---|---|---|
| | | NONE | | | | NONE | USED | |
| | | | | | | | | |
| | | | | | | | | |

Section 4 RECORD OF MUDDING AND CEMENTING

| Depth in Feet From | Depth in Feet To | Diameter Hole in in. | Tons Clay | No. Sacks of Cement | Methods Used |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Section 5 PLUGGING RECORD

Name of Plugging Contractor ..... License No. .....

Street and Number ..... City ..... State .....

Tons of Clay used ..... Tons of Roughage used ..... Type of roughage .....

Plugging method used ..... Date Plugged ..... 19 .....

Plugging approved by: Cement Plugs were placed as follows:

| No. | Depth of Plug From | Depth of Plug To | No. of Sacks Used |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

Basin Supervisor

ROSWELL, N. MEX.

FOR USE OF STATE ENGINEER ONLY

DISTRICT II STATE ENGINEER OFFICE

Date Received 1966 OCT 11 AM 8:34

File No. CP-370 Use Dom Location No. 20.31.36.111

Section 6

## LOG OF WELL

| Depth in Feet From | Depth in Feet To | Thickness in Feet | Color | Type of Material Encountered |
|---|---|---|---|---|
| 0 | 2 | 2 | Brown | Top Soil |
| 2 | 75 | 73 | Red | Silt stone and red bed |
| 75 | 80 | 5 | Brown | Hard sand stone |
| 80 | 120 | 40 | Red | Silt stone and red bed |

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 well.

Emmett Barrow
Well Driller

# ATTACHMENT IV.2.G

# GROUNDWATER SAMPLE LAB ANALYTICAL REPORT, LEA LAND SITE

# 2010 AND 2018 MONITORING EVENTS

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

July 02, 2018

MIKE STEWART

LEA LAND INC

PO BOX 3247

CARLSBAD, NM 88220

RE: LEA LAND DISPOSAL FACILITY

Enclosed are the results of analyses for samples received by the laboratory on 06/13/18 14:38.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-17-10. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

Cardinal Laboratories is accreditated through the State of Colorado Department of Public Health and Environment for:

| | |
|---|---|
| Method EPA 552.2 | Total Haloacetic Acids (HAA-5) |
| Method EPA 524.2 | Total Trihalomethanes (TTHM) |
| Method EPA 524.4 | Regulated VOCs (V1, V2, V3) |

Cardinal Laboratories is accredited through the State of New Mexico Environment Department for:

| | |
|---|---|
| Method SM 9223-B | Total Coliform and E. coli (Colilert MMO-MUG) |
| Method EPA 524.2 | Regulated VOCs and Total Trihalomethanes (TTHM) |
| Method EPA 552.2 | Total Haloacetic Acids (HAA-5) |

Accreditation applies to public drinking water matrices for State of Colorado and New Mexico.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Celey D. Keene

Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| MONITOR WELL #2 | H801607-01 | Water | 13-Jun-18 09:30 | 13-Jun-18 14:38 |
| MONITOR WELL #4 | H801607-02 | Water | 13-Jun-18 10:30 | 13-Jun-18 14:38 |
| MONITOR WELL #5 | H801607-03 | Water | 13-Jun-18 11:40 | 13-Jun-18 14:38 |
| DUPLICATE SAMPLE | H801607-04 | Water | 13-Jun-18 00:00 | 13-Jun-18 14:38 |
| FIELD BLANK | H801607-05 | Water | 13-Jun-18 08:00 | 13-Jun-18 14:38 |
| TRIP BLANK | H801607-06 | Water | 13-Jun-18 00:00 | 13-Jun-18 14:38 |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### MONITOR WELL #2

**H801607-01 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **Inorganic Compounds** | | | | | | | | | | |
| **Ammonia** | **0.0900** | | 0.0500 | mg/L | 1 | 8061905 | AC | 19-Jun-18 | 350.1 | |
| **Alkalinity, Bicarbonate** | **205** | | 5.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| Alkalinity, Carbonate | <1.00 | | 1.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| **Conductivity*** | **1510** | | 1.00 | uS/cm | 1 | 8061401 | AC | 14-Jun-18 | 120.1 | |
| **pH*** | **7.72** | | 0.100 | pH Units | 1 | 8061401 | AC | 14-Jun-18 | 150.1 | |
| **TDS*** | **818** | | 5.00 | mg/L | 1 | 8061501 | AC | 18-Jun-18 | 160.1 | |
| **Alkalinity, Total*** | **168** | | 4.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| Chloromethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Vinyl chloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromomethane* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichlorofluoromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Methylene chloride* | <0.00009 | 0.00009 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| trans-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroform* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Carbon tetrachloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,1-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Benzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloropropane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromodichloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Tetrachloroethene* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### MONITOR WELL #2

**H801607-01 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| trans-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Dibromochloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromoform* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2,2-Tetrachloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,4 Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| *Surrogate: Dibromofluoromethane* | | | *98.4 %* | *86.5-122* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: Toluene-d8* | | | *98.3 %* | *85.7-112* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: 4-Bromofluorobenzene* | | | *96.2 %* | *86.3-117* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| **Green Analytical Laboratories** | | | | | | | | | | |
| **General Chemistry** | | | | | | | | | | |
| **Chloride*** | **79.8** | | 5.00 | mg/L | 5 | B806185 | AES | 21-Jun-18 | EPA300.0 | M5 |
| **Nitrate as N*** | **3.36** | | 0.100 | mg/L | 5 | B806128 | AES | 14-Jun-18 | EPA300.0 | |
| **Nitrate+Nitrite as N by IC** | **3.36** | | 0.120 | mg/L | 5 | [CALC] | AES | 14-Jun-18 | EPA300.0 | |
| Nitrite as N* | <0.020 | | 0.020 | mg/L | 1 | B806128 | AES | 14-Jun-18 | EPA300.0 | |
| **Sulfate*** | **462** | | 25.0 | mg/L | 25 | B806185 | AES | 22-Jun-18 | EPA300.0 | |
| **Total Organic Carbon*** | **1.36** | | 0.500 | mg/L | 1 | B806180 | aes | 21-Jun-18 | 5310C | |
| **Total Recoverable Metals by ICP (E200.7)** | | | | | | | | | | |
| **Calcium*** | **50.6** | | 0.100 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| Iron* | <0.050 | | 0.050 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Magnesium*** | **40.1** | | 0.100 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| Manganese* | <0.020 | | 0.020 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Potassium*** | **5.33** | | 1.00 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Sodium*** | **224** | | 1.00 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### MONITOR WELL #2

**H801607-01 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|





Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### MONITOR WELL #4

**H801607-02 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **Inorganic Compounds** | | | | | | | | | | |
| **Ammonia** | **0.0500** | | 0.0500 | mg/L | 1 | 8061905 | AC | 19-Jun-18 | 350.1 | |
| **Alkalinity, Bicarbonate** | **190** | | 5.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| Alkalinity, Carbonate | <1.00 | | 1.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| **Conductivity*** | **1280** | | 1.00 | uS/cm | 1 | 8061401 | AC | 14-Jun-18 | 120.1 | |
| **pH*** | **7.74** | | 0.100 | pH Units | 1 | 8061401 | AC | 14-Jun-18 | 150.1 | |
| **TDS*** | **778** | | 5.00 | mg/L | 1 | 8061501 | AC | 18-Jun-18 | 160.1 | |
| **Alkalinity, Total*** | **156** | | 4.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| Chloromethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Vinyl chloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromomethane* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichlorofluoromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Methylene chloride* | <0.00009 | 0.00009 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| trans-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroform* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Carbon tetrachloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,1-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Benzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloropropane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromodichloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Tetrachloroethene* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### MONITOR WELL #4

**H801607-02 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| trans-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Dibromochloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromoform* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2,2-Tetrachloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,4 Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| *Surrogate: Dibromofluoromethane* | | | *97.5 %* | *86.5-122* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: Toluene-d8* | | | *99.9 %* | *85.7-112* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: 4-Bromofluorobenzene* | | | *96.3 %* | *86.3-117* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| **Green Analytical Laboratories** | | | | | | | | | | |
| **General Chemistry** | | | | | | | | | | |
| **Chloride*** | **62.3** | | 5.00 | mg/L | 5 | B806185 | AES | 21-Jun-18 | EPA300.0 | |
| **Nitrate as N*** | **3.32** | | 0.100 | mg/L | 5 | B806128 | AES | 15-Jun-18 | EPA300.0 | |
| **Nitrate+Nitrite as N by IC** | **3.32** | | 0.120 | mg/L | 5 | [CALC] | AES | 15-Jun-18 | EPA300.0 | |
| Nitrite as N* | <0.020 | | 0.020 | mg/L | 1 | B806128 | AES | 14-Jun-18 | EPA300.0 | |
| **Sulfate*** | **361** | | 25.0 | mg/L | 25 | B806185 | AES | 22-Jun-18 | EPA300.0 | |
| Total Organic Carbon* | <0.500 | | 0.500 | mg/L | 1 | B806180 | aes | 21-Jun-18 | 5310C | |
| **Total Recoverable Metals by ICP (E200.7)** | | | | | | | | | | |
| **Calcium*** | **48.4** | | 0.100 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| Iron* | <0.050 | | 0.050 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Magnesium*** | **43.2** | | 0.100 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| Manganese* | <0.020 | | 0.020 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Potassium*** | **4.92** | | 1.00 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Sodium*** | **170** | | 1.00 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### MONITOR WELL #4

**H801607-02 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### MONITOR WELL #5

**H801607-03 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **Inorganic Compounds** | | | | | | | | | | |
| **Ammonia** | **0.0700** | | 0.0500 | mg/L | 1 | 8061905 | AC | 19-Jun-18 | 350.1 | |
| **Alkalinity, Bicarbonate** | **224** | | 5.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| Alkalinity, Carbonate | <1.00 | | 1.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| **Conductivity*** | **1370** | | 1.00 | uS/cm | 1 | 8061401 | AC | 14-Jun-18 | 120.1 | |
| **pH*** | **7.70** | | 0.100 | pH Units | 1 | 8061401 | AC | 14-Jun-18 | 150.1 | |
| **TDS*** | **886** | | 5.00 | mg/L | 1 | 8061501 | AC | 18-Jun-18 | 160.1 | |
| **Alkalinity, Total*** | **184** | | 4.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| Chloromethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Vinyl chloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromomethane* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichlorofluoromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Methylene chloride* | <0.00009 | 0.00009 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| trans-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroform* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Carbon tetrachloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,1-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Benzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloropropane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromodichloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Tetrachloroethene* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### MONITOR WELL #5

**H801607-03 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| trans-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Dibromochloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromoform* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2,2-Tetrachloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,4 Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| *Surrogate: Dibromofluoromethane* | | | *102 %* | *86.5-122* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: Toluene-d8* | | | *102 %* | *85.7-112* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: 4-Bromofluorobenzene* | | | *97.0 %* | *86.3-117* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| **Green Analytical Laboratories** | | | | | | | | | | |
| **General Chemistry** | | | | | | | | | | |
| **Chloride*** | **54.0** | | 5.00 | mg/L | 5 | B806185 | AES | 21-Jun-18 | EPA300.0 | |
| **Nitrate as N*** | **3.15** | | 0.100 | mg/L | 5 | B806128 | AES | 14-Jun-18 | EPA300.0 | |
| **Nitrate+Nitrite as N by IC** | **3.15** | | 0.120 | mg/L | 5 | [CALC] | AES | 14-Jun-18 | EPA300.0 | |
| Nitrite as N* | <0.020 | | 0.020 | mg/L | 1 | B806128 | AES | 14-Jun-18 | EPA300.0 | |
| **Sulfate*** | **412** | | 25.0 | mg/L | 25 | B806185 | AES | 22-Jun-18 | EPA300.0 | |
| **Total Organic Carbon*** | **0.501** | | 0.500 | mg/L | 1 | B806180 | aes | 21-Jun-18 | 5310C | |
| **Total Recoverable Metals by ICP (E200.7)** | | | | | | | | | | |
| **Calcium*** | **58.6** | | 0.100 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| Iron* | <0.050 | | 0.050 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Magnesium*** | **42.0** | | 0.100 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| Manganese* | <0.020 | | 0.020 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Potassium*** | **4.14** | | 1.00 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Sodium*** | **176** | | 1.00 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### MONITOR WELL #5

**H801607-03 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### DUPLICATE SAMPLE

**H801607-04 (Water)**

**Cardinal Laboratories**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic Compounds** | | | | | | | | | | |
| **Ammonia** | **0.0500** | | 0.0500 | mg/L | 1 | 8061905 | AC | 19-Jun-18 | 350.1 | |
| **Alkalinity, Bicarbonate** | **220** | | 5.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| Alkalinity, Carbonate | <1.00 | | 1.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| **Conductivity*** | **1360** | | 1.00 | uS/cm | 1 | 8061401 | AC | 14-Jun-18 | 120.1 | |
| **pH*** | **7.72** | | 0.100 | pH Units | 1 | 8061401 | AC | 14-Jun-18 | 150.1 | |
| **TDS*** | **874** | | 5.00 | mg/L | 1 | 8061501 | AC | 18-Jun-18 | 160.1 | |
| **Alkalinity, Total*** | **180** | | 4.00 | mg/L | 1 | 8060705 | AC | 18-Jun-18 | 310.1 | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| Chloromethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Vinyl chloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromomethane* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichlorofluoromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Methylene chloride* | <0.00009 | 0.00009 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| trans-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroform* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Carbon tetrachloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,1-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Benzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloropropane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromodichloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Tetrachloroethene* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### DUPLICATE SAMPLE

**H801607-04 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| trans-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Dibromochloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromoform* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2,2-Tetrachloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,4 Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| *Surrogate: Dibromofluoromethane* | | | *97.8 %* | *86.5-122* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: Toluene-d8* | | | *101 %* | *85.7-112* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: 4-Bromofluorobenzene* | | | *99.8 %* | *86.3-117* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| **Green Analytical Laboratories** | | | | | | | | | | |
| **General Chemistry** | | | | | | | | | | |
| **Chloride*** | **53.2** | | 5.00 | mg/L | 5 | B806185 | AES | 21-Jun-18 | EPA300.0 | |
| **Nitrate as N*** | **3.16** | | 0.100 | mg/L | 5 | B806128 | AES | 14-Jun-18 | EPA300.0 | |
| **Nitrate+Nitrite as N by IC** | **3.16** | | 0.120 | mg/L | 5 | [CALC] | AES | 14-Jun-18 | EPA300.0 | |
| Nitrite as N* | <0.020 | | 0.020 | mg/L | 1 | B806128 | AES | 14-Jun-18 | EPA300.0 | |
| **Sulfate*** | **408** | | 25.0 | mg/L | 25 | B806185 | AES | 22-Jun-18 | EPA300.0 | |
| **Total Organic Carbon*** | **0.595** | | 0.500 | mg/L | 1 | B806180 | aes | 21-Jun-18 | 5310C | |
| **Total Recoverable Metals by ICP (E200.7)** | | | | | | | | | | |
| **Calcium*** | **59.1** | | 0.100 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| Iron* | <0.050 | | 0.050 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Magnesium*** | **42.5** | | 0.100 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| Manganese* | <0.020 | | 0.020 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Potassium*** | **4.20** | | 1.00 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |
| **Sodium*** | **177** | | 1.00 | mg/L | 1 | B806156 | AES | 20-Jun-18 | EPA200.7 | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### DUPLICATE SAMPLE

**H801607-04 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|

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*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### FIELD BLANK

**H801607-05 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| Chloromethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Vinyl chloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromomethane* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichlorofluoromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Methylene chloride* | <0.00009 | 0.00009 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| trans-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroform* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Carbon tetrachloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,1-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Benzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloropropane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromodichloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Tetrachloroethene* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| trans-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Dibromochloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromoform* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2,2-Tetrachloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,4 Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| *Surrogate: Dibromofluoromethane* | | | *98.2 %* | *86.5-122* | | *8061904* | ms | *19-Jun-18* | *8260B* | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### FIELD BLANK

**H801607-05 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| *Surrogate: Toluene-d8* | | | *102 %* | *85.7-112* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: 4-Bromofluorobenzene* | | | *98.9 %* | *86.3-117* | | *8061904* | ms | *19-Jun-18* | *8260B* | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### TRIP BLANK

**H801607-06 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| Chloromethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Vinyl chloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromomethane* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichlorofluoromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Methylene chloride* | <0.00009 | 0.00009 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| trans-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1-Dichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,2-Dichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chloroform* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Carbon tetrachloride* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,1-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Benzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Trichloroethene* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichloropropane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromodichloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| cis-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Tetrachloroethene* | <0.0003 | 0.0003 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| trans-1,3-Dichloropropene* | <0.00008 | 0.00008 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2-Trichloroethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Dibromochloromethane* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Chlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| Bromoform* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,1,2,2-Tetrachloroethane* | <0.0002 | 0.0002 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,4 Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| 1,2-Dichlorobenzene* | <0.0001 | 0.0001 | 0.0005 | mg/L | 1 | 8061904 | ms | 19-Jun-18 | 8260B | |
| *Surrogate: Dibromofluoromethane* | | | *99.6 %* | *86.5-122* | | *8061904* | ms | *19-Jun-18* | *8260B* | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### TRIP BLANK

**H801607-06 (Water)**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Analyst | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cardinal Laboratories** | | | | | | | | | | |
| **VOLATILES BY GC/MS** | | | | | | | | | | |
| *Surrogate: Toluene-d8* | | | *98.1 %* | *85.7-112* | | *8061904* | ms | *19-Jun-18* | *8260B* | |
| *Surrogate: 4-Bromofluorobenzene* | | | *96.4 %* | *86.3-117* | | *8061904* | ms | *19-Jun-18* | *8260B* | |

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Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### Inorganic Compounds - Quality Control

### Cardinal Laboratories

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 8060705 - General Prep - Wet Chem** | | | | | | | | | | |
| **Blank (8060705-BLK1)** | | | | Prepared & Analyzed: 07-Jun-18 | | | | | | |
| Alkalinity, Carbonate | ND | 1.00 | mg/L | | | | | | | |
| Alkalinity, Bicarbonate | 5.00 | 5.00 | mg/L | | | | | | | |
| Alkalinity, Total | 4.00 | 4.00 | mg/L | | | | | | | |
| **LCS (8060705-BS1)** | | | | Prepared & Analyzed: 07-Jun-18 | | | | | | |
| Alkalinity, Carbonate | ND | 2.50 | mg/L | | | | 80-120 | | | |
| Alkalinity, Bicarbonate | 355 | 12.5 | mg/L | | | | 80-120 | | | |
| Alkalinity, Total | 290 | 10.0 | mg/L | 250 | | 116 | 80-120 | | | |
| **LCS Dup (8060705-BSD1)** | | | | Prepared & Analyzed: 07-Jun-18 | | | | | | |
| Alkalinity, Carbonate | ND | 2.50 | mg/L | | | | 80-120 | | 20 | |
| Alkalinity, Bicarbonate | 318 | 12.5 | mg/L | | | | 80-120 | 11.2 | 20 | |
| Alkalinity, Total | 260 | 10.0 | mg/L | 250 | | 104 | 80-120 | 10.9 | 20 | |
| **Batch 8061401 - General Prep - Wet Chem** | | | | | | | | | | |
| **LCS (8061401-BS1)** | | | | Prepared & Analyzed: 14-Jun-18 | | | | | | |
| Conductivity | 486 | | uS/cm | 500 | | 97.2 | 80-120 | | | |
| pH | 6.96 | | pH Units | 7.00 | | 99.4 | 90-110 | | | |
| **Duplicate (8061401-DUP1)** | **Source: H801607-01** | | | Prepared & Analyzed: 14-Jun-18 | | | | | | |
| Conductivity | 1520 | 1.00 | uS/cm | | 1510 | | | 0.925 | 20 | |
| pH | 7.78 | 0.100 | pH Units | | 7.72 | | | 0.774 | 20 | |
| **Batch 8061501 - Filtration** | | | | | | | | | | |
| **Blank (8061501-BLK1)** | | | | Prepared: 15-Jun-18 Analyzed: 18-Jun-18 | | | | | | |
| TDS | ND | 5.00 | mg/L | | | | | | | |

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CARDINAL Laboratories

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## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### Inorganic Compounds - Quality Control

### Cardinal Laboratories

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 8061501 - Filtration** | | | | | | | | | | |
| **LCS (8061501-BS1)** | | | | Prepared: 15-Jun-18 Analyzed: 18-Jun-18 | | | | | | |
| TDS | 512 | 5.00 | mg/L | 527 | | 97.2 | 80-120 | | | |
| **Duplicate (8061501-DUP1)** | | **Source: H801607-01** | | Prepared: 15-Jun-18 Analyzed: 18-Jun-18 | | | | | | |
| TDS | 872 | 5.00 | mg/L | | 818 | | | 6.39 | 20 | |
| **Batch 8061905 - General Prep - Wet Chem** | | | | | | | | | | |
| **Blank (8061905-BLK1)** | | | | Prepared & Analyzed: 19-Jun-18 | | | | | | |
| Ammonia | ND | 0.0500 | mg/L | | | | | | | |
| **LCS (8061905-BS1)** | | | | Prepared & Analyzed: 19-Jun-18 | | | | | | |
| Ammonia | 1.88 | 0.0500 | mg/L | 2.00 | | 94.0 | 80-120 | | | |
| **Duplicate (8061905-DUP1)** | | **Source: H801607-01** | | Prepared & Analyzed: 19-Jun-18 | | | | | | |
| Ammonia | 0.100 | 0.0500 | mg/L | | 0.0900 | | | 10.5 | 20 | |
| **Matrix Spike (8061905-MS1)** | | **Source: H801607-01** | | Prepared & Analyzed: 19-Jun-18 | | | | | | |
| Ammonia | 1.91 | 0.0500 | mg/L | 2.00 | 0.0900 | 91.0 | 70-130 | | | |

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## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### VOLATILES BY GC/MS - Quality Control

### Cardinal Laboratories

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 8061904 - Volatiles** | | | | | | | | | | |
| **Blank (8061904-BLK1)** | | | | Prepared & Analyzed: 19-Jun-18 | | | | | | |
| Chloromethane | ND | 0.0005 | mg/L | | | | | | | |
| Vinyl chloride | ND | 0.0005 | mg/L | | | | | | | |
| Bromomethane | ND | 0.0005 | mg/L | | | | | | | |
| Chloroethane | ND | 0.0005 | mg/L | | | | | | | |
| Trichlorofluoromethane | ND | 0.0005 | mg/L | | | | | | | |
| 1,1-Dichloroethene | ND | 0.0005 | mg/L | | | | | | | |
| Methylene chloride | ND | 0.0005 | mg/L | | | | | | | |
| trans-1,2-Dichloroethene | ND | 0.0005 | mg/L | | | | | | | |
| 1,1-Dichloroethane | ND | 0.0005 | mg/L | | | | | | | |
| cis-1,2-Dichloroethene | ND | 0.0005 | mg/L | | | | | | | |
| Chloroform | ND | 0.0005 | mg/L | | | | | | | |
| Carbon tetrachloride | ND | 0.0005 | mg/L | | | | | | | |
| 1,1,1-Trichloroethane | ND | 0.0005 | mg/L | | | | | | | |
| Benzene | ND | 0.0005 | mg/L | | | | | | | |
| 1,2-Dichloroethane | ND | 0.0005 | mg/L | | | | | | | |
| Trichloroethene | ND | 0.0005 | mg/L | | | | | | | |
| 1,2-Dichloropropane | ND | 0.0005 | mg/L | | | | | | | |
| Bromodichloromethane | ND | 0.0005 | mg/L | | | | | | | |
| cis-1,3-Dichloropropene | ND | 0.0005 | mg/L | | | | | | | |
| Tetrachloroethene | ND | 0.0005 | mg/L | | | | | | | |
| trans-1,3-Dichloropropene | ND | 0.0005 | mg/L | | | | | | | |
| 1,1,2-Trichloroethane | ND | 0.0005 | mg/L | | | | | | | |
| Dibromochloromethane | ND | 0.0005 | mg/L | | | | | | | |
| Chlorobenzene | ND | 0.0005 | mg/L | | | | | | | |
| Bromoform | ND | 0.0005 | mg/L | | | | | | | |
| 1,1,2,2-Tetrachloroethane | ND | 0.0005 | mg/L | | | | | | | |
| 1,4 Dichlorobenzene | ND | 0.0005 | mg/L | | | | | | | |
| 1,2-Dichlorobenzene | ND | 0.0005 | mg/L | | | | | | | |
| *Surrogate: Dibromofluoromethane* | *0.0100* | | mg/L | *0.0100* | | *100* | *86.5-122* | | | |
| *Surrogate: Toluene-d8* | *0.00980* | | mg/L | *0.0100* | | *98.0* | *85.7-112* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *0.00971* | | mg/L | *0.0100* | | *97.1* | *86.3-117* | | | |

Cardinal Laboratories

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Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### VOLATILES BY GC/MS - Quality Control

### Cardinal Laboratories

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 8061904 - Volatiles** | | | | | | | | | | |
| **LCS (8061904-BS1)** | | | | Prepared & Analyzed: 19-Jun-18 | | | | | | |
| Chloromethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 90.5 | 63.7-134 | | | |
| Vinyl chloride | 0.018 | 0.0005 | mg/L | 0.0200 | | 87.6 | 69.6-123 | | | |
| Bromomethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 90.4 | 57.9-133 | | | |
| Chloroethane | 0.019 | 0.0005 | mg/L | 0.0200 | | 93.8 | 62.4-134 | | | |
| Trichlorofluoromethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 87.6 | 62.6-142 | | | |
| 1,1-Dichloroethene | 0.017 | 0.0005 | mg/L | 0.0200 | | 85.8 | 65-126 | | | |
| Methylene chloride | 0.019 | 0.0005 | mg/L | 0.0200 | | 95.6 | 43.1-162 | | | |
| trans-1,2-Dichloroethene | 0.018 | 0.0005 | mg/L | 0.0200 | | 90.8 | 76.6-122 | | | |
| 1,1-Dichloroethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 90.2 | 80.9-121 | | | |
| cis-1,2-Dichloroethene | 0.019 | 0.0005 | mg/L | 0.0200 | | 97.1 | 76.8-126 | | | |
| Chloroform | 0.018 | 0.0005 | mg/L | 0.0200 | | 88.4 | 82.5-123 | | | |
| Carbon tetrachloride | 0.019 | 0.0005 | mg/L | 0.0200 | | 97.0 | 77.5-136 | | | |
| 1,1,1-Trichloroethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 90.9 | 88.3-127 | | | |
| Benzene | 0.018 | 0.0005 | mg/L | 0.0200 | | 88.0 | 84.9-121 | | | |
| 1,2-Dichloroethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 86.0 | 76.9-133 | | | |
| Trichloroethene | 0.017 | 0.0005 | mg/L | 0.0200 | | 86.6 | 82.8-120 | | | |
| 1,2-Dichloropropane | 0.019 | 0.0005 | mg/L | 0.0200 | | 96.4 | 80.2-126 | | | |
| Bromodichloromethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 87.6 | 84.1-130 | | | |
| cis-1,3-Dichloropropene | 0.017 | 0.0005 | mg/L | 0.0200 | | 86.4 | 76.8-130 | | | |
| Tetrachloroethene | 0.018 | 0.0005 | mg/L | 0.0200 | | 88.0 | 65.3-133 | | | |
| trans-1,3-Dichloropropene | 0.017 | 0.0005 | mg/L | 0.0200 | | 87.4 | 80.1-132 | | | |
| 1,1,2-Trichloroethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 85.0 | 82.3-117 | | | |
| Dibromochloromethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 88.3 | 75.2-137 | | | |
| Chlorobenzene | 0.018 | 0.0005 | mg/L | 0.0200 | | 88.2 | 76.8-125 | | | |
| Bromoform | 0.018 | 0.0005 | mg/L | 0.0200 | | 90.8 | 54.1-155 | | | |
| 1,1,2,2-Tetrachloroethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 85.4 | 72.8-123 | | | |
| 1,4 Dichlorobenzene | 0.018 | 0.0005 | mg/L | 0.0200 | | 90.4 | 71.5-122 | | | |
| 1,2-Dichlorobenzene | 0.017 | 0.0005 | mg/L | 0.0200 | | 85.2 | 73.9-123 | | | |
| *Surrogate: Dibromofluoromethane* | *0.00990* | | mg/L | *0.0100* | | *99.0* | *86.5-122* | | | |
| *Surrogate: Toluene-d8* | *0.0101* | | mg/L | *0.0100* | | *101* | *85.7-112* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *0.00988* | | mg/L | *0.0100* | | *98.8* | *86.3-117* | | | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### VOLATILES BY GC/MS - Quality Control

### Cardinal Laboratories

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 8061904 - Volatiles** | | | | | | | | | | |
| **LCS Dup (8061904-BSD1)** | | | | Prepared & Analyzed: 19-Jun-18 | | | | | | |
| Chloromethane | 0.019 | 0.0005 | mg/L | 0.0200 | | 94.8 | 63.7-134 | 4.64 | 20.9 | |
| Vinyl chloride | 0.018 | 0.0005 | mg/L | 0.0200 | | 87.8 | 69.6-123 | 0.228 | 16.7 | |
| Bromomethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 91.8 | 57.9-133 | 1.54 | 33.2 | |
| Chloroethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 92.4 | 62.4-134 | 1.50 | 29.5 | |
| Trichlorofluoromethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 87.4 | 62.6-142 | 0.228 | 24.9 | |
| 1,1-Dichloroethene | 0.018 | 0.0005 | mg/L | 0.0200 | | 88.3 | 65-126 | 2.87 | 15.4 | |
| Methylene chloride | 0.020 | 0.0005 | mg/L | 0.0200 | | 99.0 | 43.1-162 | 3.55 | 9.96 | |
| trans-1,2-Dichloroethene | 0.017 | 0.0005 | mg/L | 0.0200 | | 87.4 | 76.6-122 | 3.87 | 11.5 | |
| 1,1-Dichloroethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 87.4 | 80.9-121 | 3.10 | 7.62 | |
| cis-1,2-Dichloroethene | 0.019 | 0.0005 | mg/L | 0.0200 | | 93.9 | 76.8-126 | 3.35 | 8.74 | |
| Chloroform | 0.017 | 0.0005 | mg/L | 0.0200 | | 83.7 | 82.5-123 | 5.52 | 8.33 | |
| Carbon tetrachloride | 0.019 | 0.0005 | mg/L | 0.0200 | | 92.7 | 77.5-136 | 4.53 | 9.31 | |
| 1,1,1-Trichloroethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 87.0 | 88.3-127 | 4.38 | 7.44 | BS2 |
| Benzene | 0.017 | 0.0005 | mg/L | 0.0200 | | 86.6 | 84.9-121 | 1.55 | 7.79 | |
| 1,2-Dichloroethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 87.1 | 76.9-133 | 1.27 | 8.3 | |
| Trichloroethene | 0.017 | 0.0005 | mg/L | 0.0200 | | 85.8 | 82.8-120 | 0.986 | 6.6 | |
| 1,2-Dichloropropane | 0.019 | 0.0005 | mg/L | 0.0200 | | 95.4 | 80.2-126 | 1.15 | 6.21 | |
| Bromodichloromethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 84.8 | 84.1-130 | 3.25 | 7.88 | |
| cis-1,3-Dichloropropene | 0.017 | 0.0005 | mg/L | 0.0200 | | 83.2 | 76.8-130 | 3.78 | 10.6 | |
| Tetrachloroethene | 0.017 | 0.0005 | mg/L | 0.0200 | | 83.9 | 65.3-133 | 4.83 | 21.1 | |
| trans-1,3-Dichloropropene | 0.017 | 0.0005 | mg/L | 0.0200 | | 85.1 | 80.1-132 | 2.67 | 12.4 | |
| 1,1,2-Trichloroethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 85.9 | 82.3-117 | 1.05 | 12.7 | |
| Dibromochloromethane | 0.017 | 0.0005 | mg/L | 0.0200 | | 86.8 | 75.2-137 | 1.71 | 10.7 | |
| Chlorobenzene | 0.017 | 0.0005 | mg/L | 0.0200 | | 83.9 | 76.8-125 | 4.94 | 10.9 | |
| Bromoform | 0.018 | 0.0005 | mg/L | 0.0200 | | 89.4 | 54.1-155 | 1.61 | 23.6 | |
| 1,1,2,2-Tetrachloroethane | 0.018 | 0.0005 | mg/L | 0.0200 | | 88.4 | 72.8-123 | 3.34 | 26 | |
| 1,4 Dichlorobenzene | 0.018 | 0.0005 | mg/L | 0.0200 | | 88.0 | 71.5-122 | 2.80 | 7.03 | |
| 1,2-Dichlorobenzene | 0.017 | 0.0005 | mg/L | 0.0200 | | 85.1 | 73.9-123 | 0.0587 | 9.07 | |
| *Surrogate: Dibromofluoromethane* | *0.00979* | | mg/L | *0.0100* | | *97.9* | *86.5-122* | | | |
| *Surrogate: Toluene-d8* | *0.00975* | | mg/L | *0.0100* | | *97.5* | *85.7-112* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *0.00974* | | mg/L | *0.0100* | | *97.4* | *86.3-117* | | | |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### General Chemistry - Quality Control

### Green Analytical Laboratories

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B806128 - General Prep - Wet Chem** | | | | | | | | | | |
| **Blank (B806128-BLK1)** | | | | Prepared & Analyzed: 14-Jun-18 | | | | | | |
| Nitrite as N | ND | 0.020 | mg/L | | | | | | | |
| Nitrate as N | ND | 0.020 | mg/L | | | | | | | |
| **LCS (B806128-BS1)** | | | | Prepared & Analyzed: 14-Jun-18 | | | | | | |
| Nitrate as N | 1.06 | 0.020 | mg/L | 1.00 | | 106 | 90-110 | | | |
| Nitrite as N | 1.03 | 0.020 | mg/L | 1.00 | | 103 | 90-110 | | | |
| **LCS Dup (B806128-BSD1)** | | | | Prepared & Analyzed: 14-Jun-18 | | | | | | |
| Nitrite as N | 1.00 | 0.020 | mg/L | 1.00 | | 100 | 90-110 | 2.59 | 20 | |
| Nitrate as N | 1.01 | 0.020 | mg/L | 1.00 | | 101 | 90-110 | 4.52 | 20 | |
| **Batch B806180 - General Prep - Wet Chem** | | | | | | | | | | |
| **Blank (B806180-BLK1)** | | | | Prepared & Analyzed: 21-Jun-18 | | | | | | |
| Total Organic Carbon | ND | 0.500 | mg/L | | | | | | | |
| **LCS (B806180-BS1)** | | | | Prepared & Analyzed: 21-Jun-18 | | | | | | |
| Total Organic Carbon | 10.1 | 0.500 | mg/L | 10.0 | | 101 | 85-115 | | | |
| **LCS Dup (B806180-BSD1)** | | | | Prepared & Analyzed: 21-Jun-18 | | | | | | |
| Total Organic Carbon | 10.1 | 0.500 | mg/L | 10.0 | | 101 | 85-115 | 0.297 | 20 | |
| **Batch B806185 - General Prep - Wet Chem** | | | | | | | | | | |
| **Blank (B806185-BLK1)** | | | | Prepared & Analyzed: 21-Jun-18 | | | | | | |
| Chloride | ND | 1.00 | mg/L | | | | | | | |
| Sulfate | ND | 1.00 | mg/L | | | | | | | |

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*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

## *Analytical Results For:*

| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |
|---|---|---|

### General Chemistry - Quality Control

### Green Analytical Laboratories

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B806185 - General Prep - Wet Chem** | | | | | | | | | | |
| **LCS (B806185-BS1)** | | | | Prepared & Analyzed: 21-Jun-18 | | | | | | |
| Chloride | 23.5 | 1.00 | mg/L | 25.0 | | 93.9 | 90-110 | | | |
| Sulfate | 23.6 | 1.00 | mg/L | 25.0 | | 94.3 | 90-110 | | | |
| **LCS Dup (B806185-BSD1)** | | | | Prepared & Analyzed: 21-Jun-18 | | | | | | |
| Sulfate | 23.4 | 1.00 | mg/L | 25.0 | | 93.4 | 90-110 | 0.997 | 20 | |
| Chloride | 23.3 | 1.00 | mg/L | 25.0 | | 93.2 | 90-110 | 0.782 | 20 | |

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CARDINAL Laboratories

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## *Analytical Results For:*

| | | |
|---|---|---|
| LEA LAND INC<br>PO BOX 3247<br>CARLSBAD NM, 88220 | Project: LEA LAND DISPOSAL FACILITY<br>Project Number: ANNUAL GW MONITORING<br>Project Manager: MIKE STEWART<br>Fax To: NA | Reported:<br>02-Jul-18 16:23 |

### Total Recoverable Metals by ICP (E200.7) - Quality Control

### Green Analytical Laboratories

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B806156 - Total Rec. 200.7/200.8/200.2** | | | | | | | | | | |
| **Blank (B806156-BLK1)** | | | | Prepared: 19-Jun-18 Analyzed: 20-Jun-18 | | | | | | |
| Sodium | ND | 1.00 | mg/L | | | | | | | |
| Manganese | ND | 0.020 | mg/L | | | | | | | |
| Iron | ND | 0.050 | mg/L | | | | | | | |
| Potassium | ND | 1.00 | mg/L | | | | | | | |
| Calcium | ND | 0.100 | mg/L | | | | | | | |
| Magnesium | ND | 0.100 | mg/L | | | | | | | |
| **LCS (B806156-BS1)** | | | | Prepared: 19-Jun-18 Analyzed: 20-Jun-18 | | | | | | |
| Iron | 4.14 | 0.050 | mg/L | 4.00 | | 103 | 85-115 | | | |
| Sodium | 3.52 | 1.00 | mg/L | 3.24 | | 109 | 85-115 | | | |
| Manganese | 2.19 | 0.020 | mg/L | 2.00 | | 109 | 85-115 | | | |
| Magnesium | 21.1 | 0.100 | mg/L | 20.0 | | 105 | 85-115 | | | |
| Potassium | 8.54 | 1.00 | mg/L | 8.00 | | 107 | 85-115 | | | |
| Calcium | 4.27 | 0.100 | mg/L | 4.00 | | 107 | 85-115 | | | |
| **LCS Dup (B806156-BSD1)** | | | | Prepared: 19-Jun-18 Analyzed: 20-Jun-18 | | | | | | |
| Sodium | 3.52 | 1.00 | mg/L | 3.24 | | 109 | 85-115 | 0.0456 | 20 | |
| Calcium | 4.24 | 0.100 | mg/L | 4.00 | | 106 | 85-115 | 0.569 | 20 | |
| Iron | 4.17 | 0.050 | mg/L | 4.00 | | 104 | 85-115 | 0.702 | 20 | |
| Magnesium | 21.0 | 0.100 | mg/L | 20.0 | | 105 | 85-115 | 0.492 | 20 | |
| Potassium | 8.57 | 1.00 | mg/L | 8.00 | | 107 | 85-115 | 0.344 | 20 | |
| Manganese | 2.18 | 0.020 | mg/L | 2.00 | | 109 | 85-115 | 0.262 | 20 | |

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Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

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## Notes and Definitions

| | |
|---|---|
| M5 | Sample was chosen for matrix spike. Spike recovery did not meet laboratory acceptance criteria, possible matrix interference in sample. |
| BS2 | Blank spike recovery below laboratory acceptance criteria. Results for analyte potentially biased low. |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| RPD | Relative Percent Difference |
| ** | Samples not received at proper temperature of 6°C or below. |
| *** | Insufficient time to reach temperature. |
| - | Chloride by SM4500Cl-B does not require samples be received at or below 6°C |
| | Samples reported on an as received basis (wet) unless otherwise noted on report |

Cardinal Laboratories

*=Accredited Analyte



Celey D. Keene, Lab Director/Quality Manager

101 East Marland - Hobbs, NM 88240
Tel (575) 393-2326
Fax (575) 393-2476

# Cardinal Laboratories, Inc.

## CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

LAB Order ID # H 801607

| | |
|---|---|
| Company Name: Lea Land LLC | BILL TO Company: Lea Land, LLC — PO# |
| Project Manager: Mike Stewart | Address: (Street, City, Zip) P. O. Box 3247 Carlsbad, New Mexico 88221 |
| Address: (Street, City, Zip) P. O. Box 3247 Carlsbad, New Mexico 88221 | Phone#: (575) 887-4048 — Fax#: |
| Phone #: (575) 887-4048 — Fax #: | |
| Project #: — Project Name: Lea Land Disposal Facility | |
| Project Location: Highway 62/180E Mile Marker 64, New Mexico | Sampler Signature: Rozanne Johnson (575)631-9310 rozanne11@windstream.net |

| LAB # (LAB USE ONLY) H801607- | FIELD CODE | (G)rab or (C)omp | # CONTAINERS | MATRIX: WATER | SOIL | AIR | SLUDGE | | PRESERVATIVE METHOD: HCL (2 40ml VOA) | $HNO_3$ | $NaHSO_4$ | $H_2SO_4$ | ICE (1-1Liter HDPE) | NONE | SAMPLING: DATE (2018) | TIME | Volatile Organic Compounds on Table 3-2 Attached | See Attached List |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | Monitor Well #2 | G | | X | | | | | | | | | X | | 6/13 | 9:30 | | X |
| 02 | Monitor Well #4 | G | | X | | | | | | | | | X | | 6/13 | 10:30 | | X |
| 03 | Monitor Well #5 | G | | X | | | | | | | | | X | | 6/13 | 10:40 | | X |
| 04 | Duplicate Sample | G | | X | | | | | | | | | X | | 6/13 | 00:00 | | X |
| 05 | Field Blank | G | 3 | X | | | | | X | | | | X | | 6/13 | 8:00 | X | |
| 06 | Trip Blank | | 3 | X | | | | | | | | | X | | | | X | |

**ANALYSIS REQUEST**
(Circle or Specify Method No.)

Turn Around Time ~ 24 Hours

| | | | | |
|---|---|---|---|---|
| Relinquished by: Rozanne Johnson | Date: 6/13/18 | Time: 14:45 | Received by: | Date: 6/13/18 Time: 14:38 |
| Relinquished by: | Date: | Time: | Received By: (Laboratory Staff) | Date: Time: |

| | | | | |
|---|---|---|---|---|
| Phone Results | | Yes | | No |
| Fax Results | | Yes | | No — Additional Fax Number: |

REMARKS: Email Results to: mstewart@aecdenver.com rozanne11@windstream.net

| | | |
|---|---|---|
| Delivered By: (Circle One) Sampler - UPS - Bus - Other: | Sample Condition: Cool (Yes ✓ / No) Intact (Yes ✓ / No) | CHECKED BY: (Initials) CdL #75 |

-1.4°C corrected -1.45°C

- [ ] Dry Weight Basis Required
- [x] TRRP Report Required
- [ ] check if special reporting limits needed

**Table 3-2 NMED Approved Reduced Parameter List**

| Physical | Organic | | Inorganic |
|---|---|---|---|
| Specific Conductance | Bromodichloromethane | 1,2-Dichloroethane (EDC) | Ammonia-N |
| Temperature | Bromoform | 1,1-Dichloroethene | Bicarbonate |
| Water Elevation | Bromomethane | Cis-1,2-Dichloroethene | Calcium |
| pH | Carbon tetrachloride | Trans-1,2-dichloroethene | Carbonate |
| | Chlorobenzene | 1,2-dichloropropane | Chloride |
| | Chloroethane | Cis-1,3-dichloropropene | Iron |
| | Chloroform | Trans-1,3-dichloropropene | Magnesium |
| | Chloromethane | Methylene chloride | Manganese |
| | Dibromochloromethane | 1,1,2,2-tetrachloroethane | Nitrate-N |
| | 1,2-dichlorobenzene | Tetrachloroethene | Potassium |
| | 1,4-dichlorobenzene | 1,1,1-trichloroethane | Sodium |
| | 1,1-dichloroethane | 1,1,2-trichloroethane | Sulfate |
| | Vinyl Chloride | Trichloroethene | Total Dissolved Solids |
| | | Trichlorofluoromethane | |
| | | Total Organic Carbon | |
| | | Benzene | |

Note: Parameter list approved in NMED Solid Waste Bureau correspondence to Michael Stewart, American Environmental Consulting LLC, dated June 28, 2011. Deletion of 1,3-dichlorobenzene approved in NMED Solid Waste Bureau correspondence dated November 3, 2011. Deletion of 1,2-dibromoethane (EDB) approved in NMED Solid Waste Bureau correspondence dated July 19, 2012. Deletion of phosphate approved in NMED Solid Waste Bureau correspondence dated November 6, 2012. Most recent version of corrected Table 3-2 added to Groundwater Monitoring and Systems Plan on November 6, 2012.

# APPENDIX 2

# SUMMARY OF PARAMETER LIST CONSTITUENTS

**Notes:**

1. **Only the constituents are currently included in the required suite are included.**
2. **The volatile organic compounds are not included because there have only been a limited number of detects that are discussed in the text.**

# APPENDIX 2 - SUMMARY OF HISTORICAL GROUNDWATER DATA

## MW-2 SUMMARY OF APPLICABLE ANALYTICAL DATA

| | Ammonia-N | Calcium | Chloride | Carbonate | Bicarbonate | Iron | Magnesium | Manganese |
|---|---|---|---|---|---|---|---|---|
| 09/17/97 | <0.01 | 95 | 92 | <10 | 210 | 0.0092 | 87 | <0.005 |
| 03/23/98 | <0.05 | 80 | 89 | <10 | 150 | <0.005 | 90 | 0.008 |
| 03/15/00 | <0.5 | 101 | 120 | 0 | 134 | 0.1 | 77 | 0.1 |
| 07/11/01 | <0.1 | 99.2 | 132 | 0 | 146 | 0.412 | 75.6 | <0.05 |
| 12/04/01 | <0.1 | 54.6 | 135 | | 138 | <0.150 | 49 | <0.0125 |
| 04/19/04 | <0.10 | 99.6 | 134 | | 135 | <0.10 | 76.7 | 0.0326 |
| 01/14/10 | | | | <1 | 210 | | | |
| 03/19/10 | 0.868J | 110 | 135 | <1.00 | 160 | 1.07 | 80.7 | 0.044 |
| 12/20/10 | <1 | 88 | 113 | <1 | 120 | 0.147 | 68 | <0.005 |
| 06/29/11 | 1.54 | 84.4 | 130 | <1.00 | 110 | 0.135 | 64.1 | <0.00269 |
| 12/08/11 | 1.4 | 79.8 | 115 | 40 | 70 | 0.239 | 60.6 | <0.00269 |
| 06/25/12 | <1 | 92.4 | 109 J | <1 | 115 | 1.38 | 69.5 | 0.01 |
| 12/18/12 | <0.443 | 96.2 | 111 | <1.00 | 159 | 2.09 | 70.9 | 0.026 |
| 06/25/13 | 0.42 | 131 | <1 | 129 | 1.29 | 65.5 | 0.009 | |
| 06/17/14 | 12.6 | 73.4 | 102 | <20 | 115 | 0.0593 | 56.4 | <0.00201 |
| 06/17/15 | <1 | 63.7 | 71.4 | <20 | 148 | 0.148 | 45.2 | 0.008 |
| 06/13/16 | <0.535 | 68 | 101 | <20 | 160 | 0.011 | 53.5 | 0.003 |
| 06/27/17 | <0.0500 | 54.8 | 84.3 | <1.00 | 215 | <0.203 | 45.1 | <0.132 |
| 06/13/18 | 0.09 | 50.6 | 79.8 | <1.00 | 205 | <0.050 | 40.1 | <0.020 |

| | Nitrate | Potassium | Sodium | Sulfate | TDS | SC | pH |
|---|---|---|---|---|---|---|---|
| 09/17/97 | 0.84 | 5.2 | 300 | 950 | 1700 | 2300 | |
| 03/23/98 | 0.91 | 5.8 | 1900 | 1000 | 1700 | 2600 | |
| 03/15/00 | 2.6 | 6 | 275 | 870 | 1670 | 2390 | |
| 07/11/01 | 2.53 | 7.05 | 1018 | 521 | 1686 | 2036 | |
| 12/04/01 | 2.62 | 7.2 | 5630 | 935 | 1560 | | |
| 04/19/04 | 2.8 | 6.49 | 277 | 850 | 1600 | 2190 | |
| 01/14/10 | | | | | | | |
| 03/19/10 | 2.74 | 9.97 | 289 | 816 | 1590 | 1790 | 7.71 |
| 12/20/10 | 2.57 | 9 | 300 | 776 | 1626 | 2160 | 7.75 |
| 06/29/11 | 2.90 | 7.04 | 289 | 828 | 1524 | 2180 | 7.36 |
| 12/08/11 | 2.2 | 6.85 | 263 | 676 | 1568 | 2230 | 7.42 |
| 06/25/12 | 2.41 | 9.42 | 318 | 787 | 1488 | 2260 | 7.45 |
| 12/18/12 | 2.47 | 7.24 | 312 | 960 | 1472 | 2200 | 7.50 |
| 06/25/13 | 2.49 | 5.49 | 308 | 761 | 1352 | 2230 | 7.58 |
| 06/17/14 | 2.96 | 5.73 | 288 | 708 | 1380 | 2020 | 8.39 |
| 06/17/15 | 2.88 | 5.09 | 280 | 614 | 1290 | 1840 | 7.97 |
| 06/13/16 | 3.01 | 5.62 | 290 | 639 | 1220 | 1780 | 7.93 |
| 06/27/17 | 3.06 | 5.02 | 258 | 537 | 1110 | 1560 | 7.71 |
| 06/13/18 | 3.36 | 5.33 | 224 | 462 | 818 | 1510 | 7.72 |

All units mg/l except SC (umhos/cm) and pH (pH units) TDS = total dissolved solids; SC = specific conductance; NR = LLI no longer required to sample for this constituent; J = estimated value

# APPENDIX 2 - SUMMARY OF HISTORICAL GROUNDWATER DATA

## MW-4 SUMMARY OF APPLICABLE ANALYTICAL DATA

| | Ammonia-N | Calcium | Chloride | Carbonate | Bicarbonate | Iron | Magnesium | Manganese |
|---|---|---|---|---|---|---|---|---|
| 09/17/97 | 0.013 | 50 | 54 | <10 | 210 | 0.008 | 41 | <0.005 |
| 03/23/98 | <0.05 | 42 | 50 | <10 | 130 | 0.045 | 37 | <0.005 |
| 03/15/00 | <0.5 | 50 | 65 | 0 | 138 | <0.1 | 45 | <0.03 |
| 07/11/01 | <0.1 | 48.4 | 72 | 0 | 178 | 0.31 | 43.1 | <0.05 |
| 12/04/01 | <0.1 | 44.4 | 77 | | 152 | <0.150 | 44.5 | <0.0125 |
| 04/19/04 | <0.10 | 48.6 | 74.5 | | 147 | 0.518 | 43.3 | 0.0126 |
| 01/14/10 | | | | <1 | 133 | | | |
| 03/19/10 | 0.616J | 63.4 | 88.9 | <1.00 | 140 | 0.947 | 54.9 | 0.015 |
| 12/20/10 | <1 | 49 | 61 | <1 | 120 | 0 | 44 | <0.005 |
| 06/29/11 | 1.40 | 43.3 | 62.7 | <1.00 | 150 | 0.056 | 39.8 | <0.00269 |
| 12/08/11 | 0.84J | 40.3 | 62.1 | <1.00 | 220 | 0.041 | 35.9 | <0.00269 |
| 06/25/12 | <1 | 49.3 | 63.8 | <1 | 134 | 0.169 | 44.5 | <0.005 |
| 12/18/12 | 0.56 | 51 | 62.8 | <1.00 | 166 | 0.011 | 46.2 | <0.00290 |
| 06/25/13 | <1.00 | 50 | 60.2 | <1.0 | 124 | 0.024 | 46.1 | <0.005 |
| 06/17/14 | 4.06 | 49.2 | 64.2 | <20 | 121 | 0.0347 | 44.7 | <0.00201 |
| 06/17/15 | <1 | 49.2 | 61.9 | <20 | 137 | 0.019 | 44.3 | 0.001 |
| 06/13/16 | <0.535 | 50.3 | 63.4 | <20 | 144 | 0.011 | 45.2 | <0.000382 |
| 06/27/17 | 0.120 | 47.3 | 62.7 | <1.00 | 185 | <0.203 | 44.0 | <0.132 |
| 06/13/18 | 0.05 | 48.4 | 62.3 | <1.00 | 190 | <0.050 | 43.2 | <0.020 |

| | Nitrate | Potassium | Sodium | Sulfate | TDS | SC | pH |
|---|---|---|---|---|---|---|---|
| 09/17/97 | 2.3 | 6.5 | 190 | 480 | 970 | 1400 | 7.9 |
| 03/23/98 | 1.4 | 6.1 | 1200 | 430 | 880 | 1300 | 8.4 |
| 03/15/00 | 3.7 | 5 | 165 | 400 | 875 | 1292 | 8.07 |
| 07/11/01 | 3.37 | 5.95 | 267 | 574 | 906 | 1247 | 7.8 |
| 12/04/01 | 3.56 | 5.79 | 166 | 452 | 802 | | |
| 04/19/04 | 3.6 | 5.46 | 157 | 386 | 868 | 1290 | 7.9 |
| 01/14/10 | | | | | | | |
| 03/19/10 | 4.09 | 7.85 | 167 | 463 | 1020 | 1470 | 8.01 |
| 12/20/10 | 3 | 8 | 166 | 367 | 830 | 1290 | 7.90 |
| 06/29/11 | 3.17 | 5.25 | 159 | 423 | 862 | 1330 | 7.88 |
| 12/08/11 | 0.826 | 5.55 | 147 | 360 | 819 | 1510 | 7.83 |
| 06/25/12 | 3.11 | 6.81 | 173 | 424 | 978 | 1540 | 7.81 |
| 12/18/12 | 2.88 | 4.94 | 177 | 434 | 844 | 1510 | 7.56 |
| 06/25/13 | 3.1 | 4.92 | 174 | 406 | 792 | 1520 | 7.55 |
| 06/17/14 | 3.36 | 5.44 | 165 | 402 | 876 | 1330 | 8.33 |
| 06/17/15 | 3.1 | 4.51 | 170 | 366 | 864 | 1260 | 7.90 |
| 06/13/16 | 3.34 | 4.89 | 176 | 372 | 836 | 1250 | 7.87 |
| 06/27/17 | 3.41 | 4.27 | 175 | 413 | 862 | 1240 | 7.84 |
| 06/13/18 | 3.32 | 4.92 | 170 | 361 | 778 | 1280 | 7.74 |

All units mg/l except SC (umhos/cm) and pH (pH units) TDS = total dissolved solids; SC = specific conductance;
NR = LLI no longer required to sample for this constituent; J = estimated value

# APPENDIX 2 - SUMMARY OF HISTORICAL GROUNDWATER DATA

## MW-5 SUMMARY OF APPLICABLE ANALYTICAL DATA

| | Ammonia-N | Calcium | Chloride | Carbonate | Bicarbonate | Iron | Magnesium | Manganese |
|---|---|---|---|---|---|---|---|---|
| 09/17/97 | <0.01 | 60 | 48 | <10 | 210 | <0.005 | 38 | 0.032 |
| 03/23/98 | <0.05 | 51 | 52 | <10 | 170 | 0.029 | 46 | 0.029 |
| 03/15/00 | <0.5 | 65 | 58 | 0 | 172 | 0.1 | 46 | 0.07 |
| 07/11/01 | <0.1 | 61.5 | 62.5 | 0 | 232 | 0.378 | 43.8 | <0.05 |
| 12/04/01 | <0.1 | 57.7 | 68 | | 171 | <0.150 | 45.7 | <0.0125 |
| 04/19/04 | <0.10 | 63.2 | 64.5 | | 164 | 1.23 | 45.3 | 0.0732 |
| 01/14/10 | | | | <1 | 170 | | | |
| 03/19/10 | 0.616J | 68.6 | 55.8 | <1.00 | 200 | 0.794 | 47.6 | 0.019 |
| 12/20/10 | <1 | 60 | 54 | <1 | 150 | 0.372 | 44 | 0 |
| 06/29/11 | 1.60 | 56.4 | 54.8 | <1.00 | 160 | 0.126 | 41.4 | <0.00269 |
| 12/08/11 | 1.04/0.924J | 88.7/85.7 | 53.9/55.2 | <1.00/<1.00 | 160/140 | 0.072/0.068 | 64.5/61.8 | <0.00269/ <0.00269 |
| 06/25/12 | <1/<1 | 61.6/62 | 52.2/57.5 | <1/<1 | 147/149 | 0.328/0.686 | 44.9/45.2 | <0.005/0.006 |
| 12/18/12 | <0.443/<0.443 | 63.8/61.8 | 53.5/52.5 | <1.00/<1.00 | 176/186 | 0.053/0.1 | 46/44.7 | <0.00290/ <0.00290 |
| 06/25/13 | <1.00/2.1 | 63.2/63.3 | 52.1/56.5 | <1.00/<1.00 | 148/140 | 0.0220/0.047 | 46.2/45.5 | <0.005/<0.005 |
| 06/17/14 | 1.68/1.54 | 82.8/64.8 | 56.4/55.8 | <20/<20 | 125/134 | 3.95/0.457 | 49.3/45.1 | 0.119/0.0058 |
| 06/17/15 | <1/<1 | 63.3/63.7 | 78.2/71.4 | <20/<20 | 155/148 | 0.173/0.148 | 44.9/45.2 | 0.009/0.008 |
| 06/13/16 | <0.535/<0.535 | 64.8/64 | 57.8/60.5 | <20/<20 | 171/171 | 0.01/0.011 | 47.3/45.9 | 0.001/0.001 |
| 06/27/17 | <0.0500/<0.0500 | 58.2/58.0 | 55.0/54.9 | <1.00/<1.00 | 220/210 | <0.203/<0.203 | 43.4/43.8 | <0.132/<0.132 |
| 06/13/18 | 0.07/0.05 | 58.6/59.1 | 54/53.2 | <1.00/<1.00 | 224/220 | <0.050/<0.050 | 42/42.5 | <0.020/<0.020 |

| | Nitrate | Potassium | Sodium | Sulfate | TDS | SC | pH |
|---|---|---|---|---|---|---|---|
| 09/17/97 | 1.8 | 5 | 170 | 470 | 990 | 1300 | 7.8 |
| 03/23/98 | 2.4 | 4.3 | 1200 | 400 | 960 | 1200 | 8.5 |
| 03/15/00 | 3.3 | 5 | 179 | 450 | 962 | 1385 | 7.93 |
| 07/11/01 | 3.06 | 5.83 | 287 | 555 | 965 | 1324 | 7.93 |
| 12/04/01 | 3.35 | 5.68 | 176 | 500 | 939 | | |
| 04/19/04 | 3.37 | 5.42 | 193 | 440 | 1020 | 1380 | 7.8 |
| 01/14/10 | | | | | | | |
| 03/19/10 | 3.45 | 6.71 | 162 | 436 | 868 | 1380 | 7.92 |
| 12/20/10 | 3 | 7 | 173 | 408 | 890 | 1350 | 7.9 |
| 06/29/11 | 3.16 | 4.91 | 172 | 475 | 924 | 1410 | 7.75 |
| 12/08/11 | 2.68/2.69 | 10.50/9.51 | 148/149 | 412/419 | 910/872 | 1580 | 7.79 |
| 06/25/12 | 2.92/2.93 | 6.2/6.16 | 182/182 | 470/484 | 902/822 | 1610 | 7.68 |
| 12/18/12 | 2.51/2.46 | 4.29/4.53 | 186/180 | 459/455 | 898/930 | 1370 | 7.49 |
| 06/25/13 | 5.84/2.8 | 3.74/3.65 | 186/186 | 450/454 | 902/908 | 1480 | 7.51 |
| 06/17/14 | 3.23/3.18 | 6.42/4.95 | 181/168 | 456/453 | 888/944 | 1270/1410 | 8.3/8.29 |
| 06/17/15 | 2.98/2.82 | 4.08/4.07 | 180/180 | 694/455 | 908/968 | 1340/1390 | 7.84/7.85 |
| 06/13/16 | 3.01/3.08 | 4.34/4.42 | 195/192 | 424/415 | 928/916 | 1320/1290 | 7.79/7.77 |
| 06/27/17 | 3.10/3.13 | 3.83/3.95 | 183/182 | 468/470 | 894/906 | 1320/1330 | 7.85/7.78 |
| 06/13/18 | 3.15/3.16 | 4.14/4.2 | 176/177 | 412/408 | 886/874 | 1370/1360 | 7.7/7.72 |

All units mg/l except SC (umhos/cm) and pH (pH units) TDS = total dissolved solids; SC = specific conductance;
NR = LLI no longer required to sample for this constituent; J = estimated value

# GEOLOGIC/HYDROGEOLOGIC DESCRIPTION
# LEA LAND, INC. LANDFILL
# LEA COUNTY, NEW MEXICO

**Prepared for:**

**Lea Land Incorporated**
**1300 West Main Street**
**Oklahoma City, Oklahoma 73106**

**Prepared by:**

**American Environmental Consulting, LLC**
**6885 South Marshall, Suite 3**
**Littleton, Colorado 80128**
**(303)948-7733**

**December 2010**

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## Tables and Figures



## Appendicies

# APPENDIX E - GROUNDWATER DATA BASE

SUBSECTION A
MW-2
Sample Date

| INORGANIC CONSTITUENT | 9/17/1997 | 3/23/1998 | 3/15/2000 | 7/11/2001 | 12/4/2001 | 4/19/2004 | 1/14/2010 | 3/19/2010 | AML | PQL | Background |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony (Sb)(h) | <0.01 | <0.01 | <0.003 | <0.006 | <0.005 | <0.005 | -- | <0.0123 | 0.003 | 0.020 | PQL |
| Arsenic (h) | <0.005 | <0.005 | <0.01 | <0.05 | <0.005 | <0.010 | -- | <0.00540 | 0.005 | 0.005 | PQL |
| Barium (h) | 0.016 | 0.013 | <0.02 | <1 | 0.0288 | 0.0128 | -- | 0.033 | 0.5 | 0.001 | 0.0177 |
| Beryllium (h) | <0.005 | <0.001 | <0.002 | <0.002 | 0.00068 | <0.001 | -- | <0.002 | 0.002 | 0.002 | 0.0007 |
| Cadmium (h) | <0.005 | <0.005 | <0.002 | <0.005 | <0.001 | <0.002 | -- | <0.00209 | 0.0025 | 0.001 | PQL |
| Chromium (h) | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | -- | 0.003J | 0.025 | 0.001 | PQL |
| Cobalt (i) | <0.005 | <0.005 | <0.03 | <0.05 | <0.0125 | <0.010 | -- | <0.005 | 0.025 | 0.001 | PQL |
| Copper (a) | <0.005 | <0.005 | <0.05 | <0.5 | <0.005 | <0.005 | -- | <0.005 | 0.5 | 0.002 | PQL |
| Lead (h) | <0.005 | <0.005 | <0.01 | <0.00375 | <0.00375 | <0.006 | -- | <0.005 | 0.025 | 0.005 | PQL |
| Nickel (h) | <0.005 | <0.005 | <0.75 | 0.102 | 0.0133 | <0.005 | -- | <0.005 | 0.1 | 0.005 | 0.058 |
| Selenium (h) | 0.018 | 0.014 | 0.068 | <0.01 | 0.086 | 0.0417 | -- | 0.069 | 0.025 | 0.010 | 0.046 |
| Silver (h) | <0.005 | <0.005 | <0.01 | <0.05 | <0.005 | <0.005 | -- | <0.005 | 0.025 | 0.005 | PQL |
| Thallium (h) | <0.005 | <0.005 | <0.001 | <0.001 | <0.001 | <0.005 | -- | <0.00674 | 0.001 | 0.020 | PQL |
| Vanadium (h) | <0.005 | <0.005 | 0.08 | <0.005 | <0.025 | 0.0269 | -- | 0.03 | 0.00975* | 0.005 | 0.0535 |
| Zinc (a) | 0.029 | 0.02 | 0.07 | <1 | 0.0329 | 0.0109 | -- | <0.005 | 5 | 0.007 | 0.0326 |
| Aluminum (i) | <0.05 | <0.05 | <3.0 | <1 | <0.125 | <0.10 | -- | 1.19 | 3.75 | 0.005 | PQL |
| Boron (i) | -- | -- | 0.6 | 0.661 | 0.816 | 0.664 | 0.514 | 0.614 | 0.5625 | 0.050 | 0.6853 |
| Chloride (a) | 92 | 89 | 120 | 132 | 135 | 134 | -- | 135 | 187.5 | 2.500 | 117 |
| Cyanide (h) | <0.02 | <0.02 | <0.1 | <0.1 | <0.01 | <0.010 | -- | <0.015 | 0.1 | 0.010 | PQL |
| Fluoride (h) | <0.05 | 0.12 | <0.4 | 0.66 | 0.514 | 0.528 | -- | 0.42J | 0.8 | 0.980 | 0.456 |
| Iron (a) | 0.0092 | <0.005 | 0.1 | 0.412 | <0.150 | <0.10 | -- | 1.07 | 0.75 | 0.010 | 0.174 |
| Manganese (a) | <0.005 | 0.008 | 0.1 | <0.05 | <0.0125 | 0.0326 | -- | 0.044 | 0.15 | 0.003 | 0.047 |
| Mercury (h) | <0.0002 | <0.0002 | <0.001 | <0.002 | <0.0002 | <0.0002 | -- | <0.0002 | 0.001 | 0.000 | PQL |
| Molybdenum (i) | <0.005 | <0.005 | <0.05 | <0.5 | 0.0279 | 0.0255 | -- | 0.033 | 0.75 | 0.010 | 0.027 |
| Nitrate-N (h) | 0.84 | 0.91 | 2.6 | 2.53 | 2.62 | 2.8 | -- | 2.74 | 5 | 0.100 | 2.05 |
| Sulfate (a) | 950 | 1000 | 870 | 521 | 935 | 850 | -- | 816 | 450 | 25.000 | 854 |
| Uranium (h) | <0.01 | <0.01 | <2.5 | <0.20 | 0.0665±0.01 | 0.071±0.006 | -- | <0.0242 | 0.015 | 0.050 | PQL |
| Radium, combined 226/228 (h) | 2.7 | 1.6 | <5.0 | 0.59±0.23 | 0.45±0.21 | <0.5±0.4 | -- | 1.72 | 2.5 | | 2.15 |
| ORGANIC CONSTITUENT | | | | | | | | | | | |
| Acetone (h) | <0.020 | <0.020 | <0.100 | <0.010 | <0.020 | <0.020 | -- | <0.01 | 0.0195* | 0.010 | PQL |
| Acrylonitrile (h) | <0.020 | <0.020 | <0.20 | <0.010 | <0.020 | <0.020 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Benzene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | 0.35J | 0.0025 | 0.001 | PQL |
| Bromochloromethane (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Bromodichloromethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Bromoform (h) | <0.002 | <0.002 | <0.015 | <0.002 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Carbon disulfide (h) | <0.001 | <0.001 | <0.10 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Carbon tetrachloride (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Chlorobenzene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| Chloroethane (h) | <0.002 | <0.002 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Chloroform (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| Dibromochloromethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| 1,2-dichlorobenzene (h) | -- | -- | -- | -- | <0.001 | <0.001 | <0.001 | <0.001 | 0.3 | 0.001 | PQL |
| 1,4-dichlorobenzene (h) | <0.001 | <0.001 | <0.015 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0375 | 0.001 | PQL |
| trans-1,4-dichloro-2-butene (h) | <0.002 | <0.002 | <0.10 | <0.001 | -- | -- | <0.01 | <0.01 | 0.0195* | 0.010 | PQL |
| 1,1-dichloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0125 | 0.001 | PQL |
| 1,2-dichloroethane (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| 1,1-dichloroethylene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| cis-1,2-Dichloroethylene | -- | -- | <0.005 | -- | <0.001 | <0.001 | -- | <0.001 | 0.035 | 0.001 | PQL |
| trans-1,2-Dichloroethylene | -- | -- | <0.005 | -- | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| 1,2-dichloropropane (h) | <0.001 | <0.001 | <0.0005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| cis-1,3-dichloropropene (h) | <0.001 | <0.001 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| trans-1,3-dichloropropene (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Ethylbenzene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.35 | 0.001 | PQL |
| 2-hexanone (h) | <0.010 | <0.010 | <0.050 | <0.010 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl bromide (h) | <0.002 | <0.002 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl chloride (h) | <0.002 | <0.002 | <0.001 | <0.002 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Methylene bromide (h) | <0.001 | <0.001 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Methylene chloride (h) | <0.002 | <0.002 | <0.001 | <0.002 | <0.005 | <0.005 | -- | <0.005 | 0.0025 | 0.001 | PQL |
| Methyl ethyl ketone (h) | <0.020 | <0.020 | <0.010 | <0.010 | <0.020 | <0.020 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl iodide (h) | <0.002 | <0.002 | <0.040 | <0.001 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| 4-methyl-2-pentanone (h) | <0.001 | <0.001 | <0.015 | <0.010 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Styrene (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| 1,1,1,2-tetrachloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,1,2,2-tetrachloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.005 | 0.001 | PQL |
| Tetrachloroethylene (h) | <0.001 | <0.001 | <0.0005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Toluene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.002 | <0.002 | -- | <0.001 | 0.375 | 0.001 | PQL |
| 1,1,1-trichloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.03 | 0.001 | PQL |
| 1,1,2-trichloroethane (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Trichloroethylene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Trichlorofluoromethane (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| 1,2,3-trichloropropane (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Vinyl acetate (h) | <0.002 | <0.002 | <0.050 | <0.010 | <0.010 | <0.010 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Vinyl chloride (h) | <0.002 | <0.002 | <0.0004 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0005 | 0.001 | PQL |
| Xylenes, total (h) | <0.002 | <0.002 | <0.005 | <0.003 | <0.003 | <0.003 | -- | <0.001 | 0.31 | 0.001 | PQL |
| 1,2-Dibromoethane (EDB) | <0.00001 | <0.00001 | <0.000025 | <0.00026 | <0.00001 | <0.00001 | -- | <0.00014 | 0.000025 | 0.001 | PQL |
| 1,2-dibromo-3-chloropropane (h) | <0.00002 | <0.00002 | <0.00010 | <0.001 | <0.00001 | <0.00001 | -- | <0.00065 | 0.0001 | 0.005 | PQL |
| Phenols (a) | <0.005 | <0.005 | <0.003 | <0.005 | <0.005 | -- | -- | <0.000484 | 0.0025 | 0.00001 | PQL |
| Benzo(a)pyrene (h) | <0.0001 | <0.0001 | <0.0001 | <0.00009 | <0.00012 | <0.00012 | -- | <0.00159 | 0.0001 | 0.000 | PQL |
| Naphthalene (h) | <0.001 | <0.001 | <0.010 | <0.00009 | <0.0005 | <0.0005 | -- | <0.000466 | 0.015 | 0.000 | PQL |
| PCBs (h) | <0.00005 | <0.00005 | <0.00005 | <0.007 | <0.00005 | <0.000505 | -- | <0.000148 | 0.00025 | 0.000 | PQL |

| SUBSECTION A<br>MW-3<br>Sample Date<br>INORGANIC CONSTITUENT | 3/15/2000 | 7/11/2001 | 12/4/2001 | 4/19/2004 | 3/19/2010 | AML | PQL | Background |
|---|---|---|---|---|---|---|---|---|
| Antimony (Sb)(h) | <0.003 | <0.006 | <0.005 | <0.005 | <0.0123 | 0.003 | 0.020 | PQL |
| Arsenic (h) | <0.01 | <0.05 | <0.005 | <0.010 | <0.00540 | 0.005 | 0.005 | PQL |
| Barium (h) | 0.04 | <1 | 0.0261 | 0.0163 | 0.017 | 0.5 | 0.001 | 0.03 |
| Beryllium (h) | <0.002 | <0.002 | <0.0005 | <0.001 | <0.002 | 0.002 | 0.002 | PQL |
| Cadmium (h) | <0.002 | <0.005 | <0.001 | <0.002 | <0.00209 | 0.0025 | 0.001 | PQL |
| Chromium (h) | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | 0.025 | 0.001 | PQL |
| Cobalt (i) | <0.03 | <0.05 | <0.0125 | <0.010 | <0.005 | 0.025 | 0.001 | PQL |
| Copper (a) | <0.05 | <0.5 | <0.005 | <0.005 | <0.005 | 0.5 | 0.002 | PQL |
| Lead (h) | <0.01 | <0.00375 | <0.00375 | <0.006 | <0.005 | 0.025 | 0.005 | PQL |
| Nickel (h) | <0.75 | <0.1 | <0.010 | <0.005 | <0.005 | 0.1 | 0.005 | PQL |
| Selenium (h) | 0.07 | <0.01 | 0.087 | 0.0659 | 0.075 | 0.025 | 0.010 | 0.07 |
| Silver (h) | <0.01 | <0.05 | <0.005 | <0.005 | <0.005 | 0.025 | 0.005 | PQL |
| Thallium (h) | <0.001 | <0.001 | <0.001 | <0.005 | <0.00674 | 0.001 | 0.020 | PQL |
| Vanadium (h) | <0.08 | <0.005 | <0.025 | <0.010 | 0.013 | 0.00975* | 0.005 | PQL |
| Zinc (a) | 0.79 | <1 | 0.0732 | 0.0187 | <0.005 | 5 | 0.007 | 0.29 |
| Aluminum (i) | <3.0 | <1 | <0.125 | <0.10 | 0.271 | 3.75 | 0.005 | PQL |
| Boron (i) | <0.5 | 0.34 | 0.627 | 0.579 | 0.553 | 0.5625 | 0.050 | 0.52 |
| Chloride (a) | 88 | 104 | 110 | 109 | 89.3 | 187.5 | 2.500 | 102.75 |
| Cyanide (h) | <0.1 | <0.1 | <0.01 | <0.010 | <0.015 | 0.1 | 0.010 | PQL |
| Fluoride (h) | <0.4 | 0.42 | 0.54 | 0.55 | 0.412J | 0.8 | 0.980 | 0.50 |
| Iron (a) | 0.1 | 0.26 | <0.150 | <0.10 | 0.326 | 0.75 | 0.010 | 0.18 |
| Manganese (a) | <0.03 | <0.05 | <0.0125 | <0.010 | 0.007 | 0.15 | 0.003 | PQL |
| Mercury (h) | <0.001 | <0.002 | <0.0002 | <0.0002 | <0.0002 | 0.001 | 0.000 | PQL |
| Molybdenum (i) | <0.05 | <0.5 | 0.0227 | 0.0217 | 0.022 | 0.75 | 0.010 | 0.02 |
| Nitrate-N (h) | 4.3 | 3.53 | 3.71 | 3.71 | 3.94 | 5 | 0.100 | 3.81 |
| Sulfate (a) | 510 | 521 | 620 | 589 | 555 | 450 | 25.000 | 560 |
| Uranium (h) | <2.5 | <0.20 | 0.108±0.01 | 133±0.009 | <0.0242 | 0.015 | 0.050 | PQL |
| Radium, combined 226/228 (h) | <2.5 | 1.1±0.3 | <0.5 | 1.3±0.4 | 2.17 | 2.5 | | PQL |
| ORGANIC CONSTITUENT | | | | | | | | |
| Acetone (h) | <0.100 | <0.010 | <0.020 | <0.020 | <0.01 | 0.0195* | 0.010 | PQL |
| Acrylonitrile (h) | <0.20 | <0.010 | <0.020 | <0.020 | <0.001 | 0.00195* | 0.001 | PQL |
| Benzene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0025 | 0.001 | PQL |
| Bromochloromethane (h) | <0.002 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Bromodichloromethane (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Bromoform (h) | <0.015 | <0.002 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Carbon disulfide (h) | <0.10 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Carbon tetrachloride (h) | <0.002 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0025 | 0.001 | PQL |
| Chlorobenzene (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.05 | 0.001 | PQL |
| Chloroethane (h) | <0.010 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Chloroform (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.05 | 0.001 | PQL |
| Dibromochloromethane (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| 1,2-dichlorobenzene (h) | -- | -- | <0.001 | <0.001 | <0.001 | 0.3 | 0.001 | PQL |
| 1,4-dichlorobenzene (h) | <0.015 | 0.009 | <0.001 | <0.001 | <0.001 | 0.0375 | 0.001 | 0.009 |
| trans-1,4-dichloro-2-butene (h) | <0.10 | <0.001 | -- | -- | <0.01 | 0.0195* | 0.010 | PQL |
| 1,1-dichloroethane (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0125 | 0.001 | PQL |
| 1,2-dichloroethane (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0025 | 0.001 | PQL |
| 1,1-dichloroethylene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0025 | 0.001 | PQL |
| cis-1,2-Dichloroethylene | -- | -- | -- | -- | <0.001 | 0.035 | 0.001 | PQL |
| trans-1,2-Dichloroethylene | -- | -- | -- | -- | <0.001 | 0.05 | 0.001 | PQL |
| 1,2-dichloropropane (h) | <0.0005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0025 | 0.001 | PQL |
| cis-1,3-dichloropropene (h) | <0.020 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| trans-1,3-dichloropropene (h) | <0.010 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Ethylbenzene (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.35 | 0.001 | PQL |
| 2-hexanone (h) | <0.050 | <0.010 | <0.005 | <0.005 | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl bromide (h) | <0.020 | <0.001 | <0.001 | <0.001 | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl chloride (h) | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Methylene bromide (h) | <0.020 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Methylene chloride (h) | <0.001 | 0.008 | <0.005 | <0.005 | <0.005 | 0.0025 | 0.001 | 0.008 |
| Methyl ethyl ketone (h) | <0.010 | <0.010 | <0.020 | <0.020 | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl iodide (h) | <0.040 | <0.001 | <0.005 | <0.005 | <0.005 | 0.00975* | 0.005 | PQL |
| 4-methyl-2-pentanone (h) | <0.015 | <0.010 | <0.005 | <0.005 | <0.005 | 0.00975* | 0.005 | PQL |
| Styrene (h) | <0.010 | <0.001 | <0.001 | <0.001 | <0.001 | 0.05 | 0.001 | PQL |
| 1,1,1,2-tetrachloroethane (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1,1,2,2-tetrachloroethane (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.005 | 0.001 | PQL |
| Tetrachloroethylene (h) | <0.0005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0025 | 0.001 | PQL |
| Toluene (h) | <0.005 | <0.001 | <0.002 | <0.002 | <0.001 | 0.375 | 0.001 | PQL |
| 1,1,1-trichloroethane (h) | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 0.03 | 0.001 | PQL |
| 1,1,2-trichloroethane (h) | <0.002 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0025 | 0.001 | PQL |
| Trichloroethylene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0025 | 0.001 | PQL |
| Trichlorofluoromethane (h) | <0.010 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| 1,2,3-trichloropropane (h) | <0.010 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00195* | 0.001 | PQL |
| Vinyl acetate (h) | <0.050 | <0.010 | <0.010 | <0.010 | <0.005 | 0.00975* | 0.005 | PQL |
| Vinyl chloride (h) | <0.0004 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0005 | 0.001 | PQL |
| Xylenes, total (h) | <0.005 | <0.003 | <0.003 | <0.003 | <0.001 | 0.31 | 0.001 | PQL |
| 1,2-Dibromoethane (EDB) | <0.000025 | <0.00026 | <0.00001 | <0.00001 | <0.00014 | 2.5E-05 | 0.001 | PQL |
| 1,2-dibromo-3-chloropropane (h) | <0.00010 | <0.001 | <0.00001 | <0.00001 | <0.00065 | 0.0001 | 0.005 | PQL |
| Phenolics (a) | <0.003 | <0.005 | <0.005 | -- | <0.000478 | 0.0025 | 0.00001 | PQL |
| Benzo(a)pyrene (h) | <0.0001 | <0.00009 | <0.00012 | <0.00012 | <0.00157 | 0.0001 | 0.000 | PQL |
| Naphthalene (h) | <0.010 | <0.00009 | <0.0005 | <0.0005 | <0.000459 | 0.015 | 0.000 | PQL |
| PCBs (h) | <0.00005 | <0.001 | <0.00005 | <0.00005 | <0.000149 | 0.00025 | 0.000 | PQL |

SUBSECTION A

MW-4

| INORGANIC CONSTITUENT | Sample Date 9/17/1997 | 3/23/1998 | 3/15/2000 | 7/11/2001 | 12/4/2001 | 4/19/2004 | 1/14/2010 | 3/19/2010 | AML | PQL | Background |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony (Sb)(h) | <0.01 | <0.01 | <0.003 | <0.006 | <0.005 | <0.005 | -- | <0.0123 | 0.003 | 0.020 | PQL |
| Arsenic (h) | 0.022 | 0.015 | <0.01 | <0.05 | <0.005 | <0.010 | -- | <0.00540 | 0.005 | 0.005 | 0.019 |
| Barium (h) | 0.015 | 0.02 | <0.02 | <1 | <0.025 | 0.0189 | -- | 0.025 | 0.5 | 0.001 | 0.0180 |
| Beryllium (h) | <0.005 | <0.001 | <0.002 | <0.002 | <0.0005 | <0.001 | -- | <0.002 | 0.002 | 0.002 | PQL |
| Cadmium (h) | <0.005 | <0.005 | <0.002 | <0.005 | <0.001 | <0.002 | -- | <0.00209 | 0.0025 | 0.001 | PQL |
| Chromium (h) | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | -- | 0.004J | 0.025 | 0.001 | PQL |
| Cobalt (i) | <0.005 | <0.005 | <0.03 | <0.05 | <0.0125 | <0.010 | -- | <0.005 | 0.025 | 0.001 | PQL |
| Copper (a) | 0.018 | 0.03 | <0.05 | <0.5 | <0.005 | 0.0211 | -- | 0.006 | 0.5 | 0.002 | 0.0230 |
| Lead (h) | <0.005 | <0.005 | <0.01 | <0.00375 | <0.00375 | 0.00639 | -- | <0.005 | 0.025 | 0.005 | 0.00639 |
| Nickel (h) | <0.005 | <0.005 | <0.75 | 0.148 | <0.010 | <0.005 | -- | <0.005 | 0.1 | 0.005 | 0.148 |
| Selenium (h) | 0.0065 | 0.005 | 0.048 | <0.01 | 0.0445 | 0.0275 | -- | 0.087 | 0.025 | 0.010 | 0.026 |
| Silver (h) | <0.005 | <0.005 | <0.01 | <0.05 | <0.005 | <0.005 | -- | <0.005 | 0.025 | 0.005 | PQL |
| Thallium (h) | <0.005 | <0.005 | <0.001 | <0.001 | <0.001 | <0.005 | -- | <0.00674 | 0.001 | 0.020 | PQL |
| Vanadium (h) | <0.005 | <0.005 | <0.08 | <0.005 | <0.025 | 0.0209 | -- | 0.018 | 0.00975* | 0.005 | 0.021 |
| Zinc (a) | 0.0092 | 0.016 | <0.05 | <1 | 0.016 | 0.0233 | -- | <0.005 | 5 | 0.007 | 0.016 |
| Aluminum (i) | <0.05 | <0.05 | <3.0 | <1 | <0.125 | 0.531 | -- | 0.871 | 3.75 | 0.005 | 0.531 |
| Boron (i) | -- | -- | <0.5 | 0.502 | 0.525 | 0.538 | 0.456 | 0.543 | 0.5625 | 0.050 | 0.522 |
| Chloride (a) | 54 | 50 | 65 | 72 | 77 | 74.5 | -- | 88.9 | 187.5 | 2.500 | 65 |
| Cyanide (h) | <0.02 | <0.02 | <0.1 | <0.1 | <0.01 | <0.010 | -- | <0.015 | 0.1 | 0.010 | PQL |
| Fluoride (h) | <0.05 | 0.085 | 0.8 | 0.66 | 0.764 | 0.897 | -- | 0.443J | 0.8 | 0.980 | 0.6412 |
| Iron (a) | 0.008 | 0.045 | <0.1 | 0.31 | <0.150 | 0.518 | -- | 0.947 | 0.75 | 0.010 | 0.22025 |
| Manganese (a) | <0.005 | <0.005 | <0.03 | <0.05 | <0.0125 | 0.0126 | -- | 0.015 | 0.15 | 0.003 | 0.013 |
| Mercury (h) | <0.0002 | <0.0002 | <0.001 | <0.002 | <0.0002 | <0.0002 | -- | <0.0002 | 0.001 | 0.000 | PQL |
| Molybdenum (i) | <0.005 | <0.005 | <0.05 | <0.5 | 0.0173 | 0.0177 | -- | 0.023 | 0.75 | 0.010 | 0.0175 |
| Nitrate-N (h) | 2.3 | 1.4 | 3.7 | 3.37 | 3.56 | 3.6 | -- | 4.09 | 5 | 0.100 | 3.0 |
| Sulfate (a) | 480 | 430 | 400 | 574 | 452 | 386 | -- | 463 | 450 | 25.000 | 454 |
| Uranium (h) | <0.01 | <0.01 | <2.5 | <0.20 | 0.114±0.017 | 0.103±0.0079 | -- | <0.0242 | 0.015 | 0.050 | PQL |
| Radium, combined 226/228 (h) | 3.6 | 1.6 | <2.5 | 2.3±1.0 | 0.29±0.18 | <0.7±0.4 | -- | 0.83 | 2.5 | | 2.6 |
| ORGANIC CONSTITUENT | | | | | | | | | | | |
| Acetone (h) | <0.020 | <0.020 | <0.100 | <0.010 | <0.020 | <0.020 | -- | <0.01 | 0.0195* | 0.010 | PQL |
| Acrylonitrile (h) | <0.020 | <0.020 | <0.20 | <0.010 | <0.020 | <0.020 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Benzene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Bromochloromethane (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Bromodichloromethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Bromoform (h) | <0.002 | <0.002 | <0.015 | <0.002 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Carbon disulfide (h) | <0.001 | <0.001 | <0.10 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Carbon tetrachloride (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Chlorobenzene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| Chloroethane (h) | <0.002 | <0.002 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Chloroform (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| Dibromochloromethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| 1,2-dichlorobenzene (h) | -- | -- | -- | -- | <0.001 | <0.001 | <0.001 | <0.001 | 0.3 | 0.001 | PQL |
| 1,4-dichlorobenzene (h) | <0.001 | <0.001 | <0.015 | 0.01 | <0.001 | <0.001 | -- | <0.001 | 0.0375 | 0.001 | 0.01 |
| trans-1,4-dichloro-2-butene (h) | <0.002 | <0.002 | <0.10 | <0.001 | -- | -- | <0.01 | <0.01 | 0.0195* | 0.010 | PQL |
| 1,1-dichloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0125 | 0.001 | PQL |
| 1,2-dichloroethane (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| 1,1-dichloroethylene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| cis-1,2-Dichloroethylene | -- | -- | <0.005 | -- | <0.001 | <0.001 | -- | <0.001 | 0.035 | 0.001 | PQL |
| trans-1,2-Dichloroethylene | -- | -- | <0.005 | -- | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| 1,2-dichloropropane (h) | <0.001 | <0.001 | <0.0005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| cis-1,3-dichloropropene (h) | <0.001 | <0.001 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| trans-1,3-dichloropropene (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Ethylbenzene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.35 | 0.001 | PQL |
| 2-hexanone (h) | <0.010 | <0.010 | <0.050 | <0.010 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl bromide (h) | <0.002 | <0.002 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl chloride (h) | <0.002 | <0.002 | <0.001 | <0.002 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Methylene bromide (h) | <0.001 | <0.001 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Methylene chloride (h) | <0.002 | <0.002 | <0.001 | <0.001 | <0.005 | <0.005 | -- | <0.005 | 0.0025 | 0.001 | PQL |
| Methyl ethyl ketone (h) | <0.020 | <0.020 | <0.010 | <0.010 | <0.020 | <0.020 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl iodide (h) | <0.002 | <0.002 | <0.040 | <0.001 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| 4-methyl-2-pentanone (h) | <0.001 | <0.001 | <0.015 | <0.010 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Styrene (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| 1,1,1,2-tetrachloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| 1,1,2,2-tetrachloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.005 | 0.001 | PQL |
| Tetrachloroethylene (h) | <0.001 | <0.001 | <0.0005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Toluene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.002 | <0.002 | -- | <0.001 | 0.375 | 0.001 | PQL |
| 1,1,1-trichloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.03 | 0.001 | PQL |
| 1,1,2-trichloroethane (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trichloroethylene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Trichlorofluoromethane (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| 1,2,3-trichloropropane (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Vinyl acetate (h) | <0.002 | <0.002 | <0.050 | <0.010 | <0.010 | <0.010 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Vinyl chloride (h) | <0.002 | <0.002 | <0.0004 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0005 | 0.001 | PQL |
| Xylenes, total (h) | <0.002 | <0.002 | <0.005 | <0.003 | <0.003 | <0.003 | -- | <0.001 | 0.31 | 0.001 | PQL |
| 1,2-Dibromoethane (EDB) | <0.00001 | <0.00001 | <0.000025 | <0.00026 | <0.00001 | <0.00001 | -- | <0.00014 | 0.000025 | 0.001 | PQL |
| 1,2-dibromo-3-chloropropane (h) | <0.00002 | <0.00002 | <0.00010 | <0.001 | <0.00001 | <0.00001 | -- | <0.00065 | 0.0001 | 0.005 | PQL |
| Phenolics (a) | <0.005 | <0.005 | <0.003 | <0.005 | <0.005 | -- | -- | <0.000484 | 0.0025 | 0.00001 | PQL |
| Benzo(a)pyrene (h) | <0.0001 | <0.0001 | <0.0001 | <0.00009 | <0.00012 | <0.00012 | -- | <0.00159 | 0.0001 | 0.000 | PQL |
| Naphthalene (h) | <0.001 | <0.001 | 0.061 | <0.00009 | <0.0005 | <0.0005 | -- | <0.000466 | 0.015 | 0.000 | 0.061 |
| PCBs (h) | <0.00005 | <0.00005 | <0.00005 | <0.001 | <0.00005 | <0.00063 | -- | <0.000144 | 0.00025 | 0.000 | PQL |

| SUBSECTION A<br>MW-5<br>Sample Date<br>INORGANIC CONSTITUENT | 9/17/1997 | 3/23/1998 | 3/15/2000 | 7/11/2001 | 12/4/2001 | 4/19/2004 | 1/14/2010 | 3/19/2010 | AML | PQL | Background |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony (Sb)(h) | <0.01 | <0.01 | <0.003 | <0.006 | <0.005 | <0.005 | -- | <0.0123 | 0.003 | 0.020 | PQL |
| Arsenic (h) | <0.005 | <0.005 | <0.01 | <0.05 | <0.005 | <0.010 | -- | <0.00540 | 0.005 | 0.005 | PQL |
| Barium (h) | 0.019 | 0.016 | <0.02 | 1.086 | <0.025 | 0.0342 | -- | 0.023 | 0.5 | 0.001 | 0.289 |
| Beryllium (h) | <0.005 | <0.001 | <0.002 | <0.002 | <0.0005 | <0.001 | -- | <0.002 | 0.002 | 0.002 | PQL |
| Cadmium (h) | <0.005 | <0.005 | <0.002 | <0.005 | <0.001 | <0.002 | -- | <0.00209 | 0.0025 | 0.001 | PQL |
| Chromium (h) | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | -- | <0.005 | 0.025 | 0.001 | PQL |
| Cobalt (i) | <0.005 | <0.005 | <0.03 | <0.05 | <0.0125 | <0.010 | -- | <0.005 | 0.025 | 0.001 | PQL |
| Copper (a) | 0.0086 | 0.0098 | <0.05 | <0.5 | <0.005 | <0.005 | -- | <0.005 | 0.5 | 0.002 | 0.0092 |
| Lead (h) | <0.005 | <0.005 | <0.01 | <0.00375 | <0.00375 | <0.006 | -- | <0.005 | 0.025 | 0.005 | PQL |
| Nickel (h) | <0.005 | <0.005 | <0.75 | <0.1 | <0.010 | <0.005 | -- | <0.005 | 0.1 | 0.005 | PQL |
| Selenium (h) | 0.013 | 0.01 | 0.053 | <0.01 | 0.0545 | 0.0366 | -- | 0.068 | 0.025 | 0.010 | 0.03 |
| Silver (h) | <0.005 | <0.005 | <0.01 | <0.05 | <0.005 | <0.005 | -- | <0.005 | 0.025 | 0.005 | PQL |
| Thallium (h) | <0.005 | <0.005 | <0.001 | <0.001 | 0.00145 | <0.005 | -- | <0.00674 | 0.001 | 0.020 | 0.00145 |
| Vanadium (h) | <0.005 | <0.005 | <0.08 | <0.005 | 0.0308 | 0.0355 | -- | 0.031 | 0.00975* | 0.005 | 0.0332 |
| Zinc (a) | 0.038 | 0.023 | <0.05 | <1 | <0.0125 | 0.0109 | -- | <0.005 | 5 | 0.007 | 0.0240 |
| Aluminum (i) | <0.05 | <0.05 | <3.0 | <1 | <0.125 | 1.35 | -- | 0.715 | 3.75 | 0.005 | 1.35 |
| Boron (i) | -- | -- | 0.5 | 0.594 | 0.619 | 0.592 | 0.54 | 0.569 | 0.5625 | 0.050 | 0.6 |
| Chloride (a) | 48 | 52 | 58 | 62.5 | 68 | 64.5 | -- | 55.8 | 187.5 | 2.500 | 59 |
| Cyanide (h) | <0.02 | <0.02 | <0.1 | <0.1 | <0.01 | <0.010 | -- | <0.015 | 0.1 | 0.010 | PQL |
| Fluoride (h) | <0.05 | 0.16 | 0.4 | 0.51 | 0.659 | 0.606 | -- | 0.451J | 0.8 | 0.980 | 0.467 |
| Iron (a) | <0.005 | 0.029 | 0.1 | 0.378 | <0.150 | 1.23 | -- | 0.794 | 0.75 | 0.010 | 0.4 |
| Manganese (a) | 0.032 | 0.029 | 0.07 | <0.05 | <0.0125 | 0.0732 | -- | 0.019 | 0.15 | 0.003 | 0.05 |
| Mercury (h) | <0.0002 | <0.0002 | <0.001 | <0.002 | <0.0002 | <0.0002 | -- | <0.0002 | 0.001 | 0.000 | PQL |
| Molybdenum (i) | <0.005 | <0.005 | <0.05 | <0.5 | 0.0246 | 0.0232 | -- | 0.023 | 0.75 | 0.010 | 0.02 |
| Nitrate-N (h) | 1.8 | 2.4 | 3.3 | 3.06 | 3.35 | 3.37 | -- | 3.45 | 5 | 0.100 | 2.88 |
| Sulfate (a) | 470 | 400 | 450 | 555 | 500 | 440 | -- | 436 | 450 | 25.000 | 469 |
| Uranium (h) | <0.01 | <0.01 | <2.5 | <0.20 | 0.037±0.005 | 0.0517±0.005 | -- | <0.0242 | 0.015 | 0.050 | PQL |
| Radium, combined 226/228 (h) | 2.1 | 1.2 | <2.5 | 1.8±0.9 | 1.94±1.35 | 1.2±0.4 | -- | 1.48 | 2.5 | | 1.65 |
| ORGANIC CONSTITUENT | | | | | | | | | | | |
| Acetone (h) | <0.020 | <0.020 | <0.100 | <0.010 | <0.020 | <0.020 | -- | <0.01 | 0.0195* | 0.010 | PQL |
| Acrylonitrile (h) | <0.020 | <0.020 | <0.20 | <0.010 | <0.020 | <0.020 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Benzene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Bromochloromethane (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Bromodichloromethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Bromoform (h) | <0.002 | <0.002 | <0.015 | <0.002 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Carbon disulfide (h) | <0.001 | <0.001 | <0.10 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Carbon tetrachloride (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Chlorobenzene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| Chloroethane (h) | <0.002 | <0.002 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Chloroform (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| Dibromochloromethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| 1,2-dichlorobenzene (h) | -- | -- | -- | -- | <0.001 | <0.001 | <0.001 | <0.001 | 0.3 | 0.001 | PQL |
| 1,4-dichlorobenzene (h) | <0.001 | <0.001 | <0.015 | 0.011 | <0.001 | <0.001 | -- | <0.001 | 0.0375 | 0.001 | 0.011 |
| trans-1,4-dichloro-2-butene (h) | <0.002 | <0.002 | <0.10 | <0.001 | -- | -- | <0.01 | <0.01 | 0.0195* | 0.010 | PQL |
| 1,1-dichloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0125 | 0.001 | PQL |
| 1,2-dichloroethane (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| 1,1-dichloroethylene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| cis-1,2-Dichloroethylene | -- | -- | <0.005 | -- | <0.001 | <0.001 | -- | <0.001 | 0.035 | 0.001 | PQL |
| trans-1,2-Dichloroethylene | -- | -- | <0.005 | -- | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| 1,2-dichloropropane (h) | <0.001 | <0.001 | <0.0005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| cis-1,3-dichloropropene (h) | <0.001 | <0.001 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| trans-1,3-dichloropropene (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Ethylbenzene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.35 | 0.001 | PQL |
| 2-hexanone (h) | <0.010 | <0.010 | <0.050 | <0.010 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl bromide (h) | <0.002 | <0.002 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl chloride (h) | <0.002 | <0.002 | <0.001 | <0.002 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Methylene bromide (h) | <0.001 | <0.001 | <0.020 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Methylene chloride (h) | <0.002 | <0.002 | <0.001 | 0.002 | <0.005 | <0.005 | -- | <0.005 | 0.0025 | 0.001 | 0.002 |
| Methyl ethyl ketone (h) | <0.020 | <0.020 | <0.010 | <0.010 | <0.020 | <0.020 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Methyl iodide (h) | <0.002 | <0.002 | <0.040 | <0.001 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| 4-methyl-2-pentanone (h) | <0.001 | <0.001 | <0.015 | <0.010 | <0.005 | <0.005 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Styrene (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.05 | 0.001 | PQL |
| 1,1,1,2-tetrachloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| 1,1,2,2-tetrachloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.005 | 0.001 | PQL |
| Tetrachloroethylene (h) | <0.001 | <0.001 | <0.0005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Toluene (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.002 | <0.002 | -- | <0.001 | 0.375 | 0.001 | PQL |
| 1,1,1-trichloroethane (h) | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.03 | 0.001 | PQL |
| 1,1,2-trichloroethane (h) | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trichloroethylene (h) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0025 | 0.001 | PQL |
| Trichlorofluoromethane (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| 1,2,3-trichloropropane (h) | <0.001 | <0.001 | <0.010 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.00195* | 0.001 | PQL |
| Vinyl acetate (h) | <0.002 | <0.002 | <0.050 | <0.010 | <0.010 | <0.010 | -- | <0.005 | 0.00975* | 0.005 | PQL |
| Vinyl chloride (h) | <0.002 | <0.002 | <0.0004 | <0.001 | <0.001 | <0.001 | -- | <0.001 | 0.0005 | 0.001 | PQL |
| Xylenes, total (h) | <0.002 | <0.002 | <0.005 | <0.003 | <0.003 | <0.003 | -- | <0.001 | 0.31 | 0.001 | PQL |
| 1,2-Dibromoethane (EDB) | <0.00001 | <0.00001 | <0.000025 | <0.00026 | <0.00001 | <0.00001 | -- | <0.00014 | 0.000025 | 0.001 | PQL |
| 1,2-dibromo-3-chloropropane (h) | <0.00002 | <0.00002 | <0.00010 | <0.001 | <0.00001 | <0.00001 | -- | <0.00065 | 0.0001 | 0.005 | PQL |
| Phenolics (a) | <0.005 | <0.005 | <0.003 | <0.005 | <0.005 | -- | -- | <0.000484 | 0.0025 | 0.00001 | PQL |
| Benzo(a)pyrene (h) | <0.0001 | <0.0001 | <0.0001 | <0.00009 | <0.00012 | <0.00012 | -- | <0.00159 | 0.0001 | 0.000 | PQL |
| Naphthalene (h) | <0.001 | <0.001 | <0.010 | <0.00009 | <0.0005 | <0.0005 | -- | <0.000466 | 0.015 | 0.000 | PQL |
| PCBs (h) | <0.00005 | <0.00005 | <0.00005 | <0.001 | <0.00005 | <0.00055 | -- | <0.000144 | 0.00025 | 0.000 | PQL |

| SUBSECTION C<br>MW-2<br>Sample Date<br>CONSTITUENT | 9/17/1997 | 3/23/1998 | 3/15/2000 | 7/11/2001 | 12/4/2001 | 4/19/2004 | 1/14/2010 | 3/19/2010 | AML | PQL | Background |
|---|---|---|---|---|---|---|---|---|---|---|---|
| pH (a) | -- | -- | -- | -- | -- | -- | -- | 7.71 | 6 to 9 | | n/a |
| Total Dissolved Solids (a | 1700 | 1700 | 1670 | 1686 | 1560 | 1600 | -- | 1590 | 750 | 10.000 | 1643 |
| Ammonia-N | <0.01 | <0.05 | <0.5 | <0.1 | <0.1 | <0.10 | -- | 0.868J | 1.95* | 1.000 | PQL |
| Calcium | 95 | 80 | 101 | 99.2 | 54.6 | 99.6 | -- | 110 | 1.95* | 1.000 | 88 |
| Magnesium | 87 | 90 | 77 | 75.6 | 49 | 76.7 | -- | 80.7 | 1.95* | 1.000 | 76 |
| Phosphate | -- | -- | -- | -- | -- | -- | -- | <2.5 | | 2.503 | PQL |
| Potassium | 5.2 | 5.8 | 6 | 7.05 | 7.2 | 6.49 | -- | 9.97 | 1.95* | 1.000 | 6 |
| Sodium | 300 | 1900 | 275 | 1018 | 5630 | 277 | -- | 289 | 1.95* | 1.000 | 1567 |
| Kjeldahl-N | 0.053 | 0.14 | 9.8 | 3.69 | <0.5 | <0.50 | -- | 4.06J | 19.5* | 10.000 | 3.4 |
| Total Nitrogen (h) | 0.053 | 1.4 | 12.4 | 6.22 | 2.62 | 2.8 | -- | 6.8 | 5 | 1.000 | 4.2 |
| Total Organic Carbon | 3 | 1.7 | 2 | 5 | 1.48 | <1.0 | -- | 3.16 | 1.95* | 1.000 | 3 |
| Bicarbonate | 210 | 150 | 134 | 146 | 138 | 135 | 210 | 160 | 1.95* | 1.000 | 152 |
| Carbonate | <10 | <10 | 0 | 0 | -- | -- | <1 | <1.00 | 1.95* | 1.000 | 0 |
| Specific Conductance | 2300 | 2600 | 2390 | 2036 | -- | 2190 | -- | 1790 | | | 2303 |

| SUBSECTION C<br>MW-3<br>Sample Date<br>CONSTITUENT | 3/15/2000 | 7/11/2001 | 12/4/2001 | 4/19/2004 | 3/19/2010 | AML | PQL | Background |
|---|---|---|---|---|---|---|---|---|
| pH (a) | 7.69 | 7.6 | -- | 7.9 | 8.02 | 6 to 9 | | 7.7 |
| Total Dissolved Sc | 1080 | 1027 | 1120 | 1170 | 1030 | 750 | 10.000 | 1099 |
| Ammonia-N | <0.5 | <0.1 | <0.1 | <0.10 | 0.644J | 1.95* | 1.000 | PQL |
| Calcium | 59 | 34.8 | 61.1 | 64.1 | 64.8 | 1.95* | 1.000 | 55 |
| Magnesium | 48 | 28.7 | 57.1 | 54.6 | 55.7 | 1.95* | 1.000 | 47 |
| Phosphate | | | | | <2.5 | | 2.503 | PQL |
| Potassium | 5 | 4.22 | 7.13 | 6.28 | 8.06 | 1.95* | 1.000 | 6 |
| Sodium | 189 | 382 | 220 | 210 | 188 | 1.95* | 1.000 | 250 |
| Kjeldahl-N | 2.5 | 4.03 | <0.5 | 0.516 | 3.64J | 19.5* | 10.000 | 2.3 |
| Total Nitrogen (h) | 6.8 | 7.56 | 3.71 | 4.23 | 7.58 | 5 | 1.000 | 5.6 |
| Total Organic Car | 2 | 12 | <1.0 | <1.0 | 2.03 | 1.95* | 1.000 | 7 |
| Bicarbonate | 142 | 162 | 132 | 130 | 130 | 1.95* | 1.000 | 142 |
| Carbonate | 0 | 0 | -- | -- | <1.00 | 1.95* | 1.000 | 0 |
| Specific Conducta | 1545 | 1471 | -- | 1670 | 1560 | | | 1562 |

| SUBSECTION C<br>MW-4<br>Sample Date<br>CONSTITUENT | 9/17/1997 | 3/23/1998 | 3/15/2000 | 7/11/2001 | 12/4/2001 | 4/19/2004 | 1/14/2010 | 3/19/2010 | AML | PQL | Background |
|---|---|---|---|---|---|---|---|---|---|---|---|
| pH (a) | 7.9 | 8.4 | 8.07 | 7.8 | -- | 7.9 | -- | 8.01 | 6 to 9 | | 8.0 |
| Total Dissolved Solids (a) | 970 | 880 | 875 | 906 | 802 | 868 | -- | 1020 | 750 | 10.000 | 884 |
| Ammonia-N | 0.013 | <0.05 | <0.5 | <0.1 | <0.1 | <0.10 | -- | 0.616J | 1.95* | 1.000 | 0.013 |
| Calcium | 50 | 42 | 50 | 48.4 | 44.4 | 48.6 | -- | 63.4 | 1.95* | 1.000 | 47 |
| Magnesium | 41 | 37 | 45 | 43.1 | 44.5 | 43.3 | -- | 54.9 | 1.95* | 1.000 | 42 |
| Phosphate | | | | | | | -- | <2.5 | | 2.503 | PQL |
| Potassium | 6.5 | 6.1 | 5 | 5.95 | 5.79 | 5.46 | -- | 7.85 | 1.95* | 1.000 | 6 |
| Sodium | 190 | 1200 | 165 | 267 | 166 | 157 | -- | 167 | 1.95* | 1.000 | 358 |
| Kjeldahl-N | 0.067 | 0.22 | <1.0 | 4.19 | 0.557 | 0.63 | -- | 5.18J | 19.5* | 10.000 | 1.13 |
| Total Nitrogen (h) | 0.08 | 2.3 | 3.7 | 7.56 | 4.117 | 4.23 | -- | 9.27 | 5 | 1.000 | 3.7 |
| Total Organic Carbon | <1 | 1.9 | 2 | 6 | <1.0 | <1.0 | -- | 3.35 | 1.95* | 1.000 | 3 |
| Bicarbonate | 210 | 130 | 138 | 178 | 152 | 147 | 133 | 140 | 1.95* | 1.000 | 159 |
| Carbonate | <10 | <10 | 0 | 0 | -- | -- | <1 | <1.00 | 1.95* | 1.000 | 0 |
| Specific Conductance | 1400 | 1300 | 1292 | 1247 | -- | 1290 | -- | 1470 | | | 1306 |

| SUBSECTION C<br>MW-5<br>Sample Date<br>CONSTITUENT | 9/17/1997 | 3/23/1998 | 3/15/2000 | 7/11/2001 | 12/4/2001 | 4/19/2004 | 1/14/2010 | 3/19/2010 | AML | PQL | Background |
|---|---|---|---|---|---|---|---|---|---|---|---|
| pH (a) | 7.8 | 8.5 | 7.93 | 7.93 | -- | 7.8 | -- | 7.92 | 6 to 9 | | 8.0 |
| Total Dissolved Sc | 990 | 960 | 962 | 965 | 939 | 1020 | -- | 868 | 750 | 10.000 | 973 |
| Ammonia-N | <0.01 | <0.05 | <0.5 | <0.1 | <0.1 | <0.10 | -- | 0.616J | 1.95* | 1.000 | PQL |
| Calcium | 60 | 51 | 65 | 61.5 | 57.7 | 63.2 | -- | 68.6 | 1.95* | 1.000 | 60 |
| Magnesium | 38 | 46 | 46 | 43.8 | 45.7 | 45.3 | -- | 47.6 | 1.95* | 1.000 | 44 |
| Phosphate | | | | | | | -- | <2.5 | | 2.503 | PQL |
| Potassium | 5 | 4.3 | 5 | 5.83 | 5.68 | 5.42 | -- | 6.71 | 1.95* | 1.000 | 5 |
| Sodium | 170 | 1200 | 179 | 287 | 176 | 193 | -- | 162 | 1.95* | 1.000 | 368 |
| Kjeldahl-N | <0.05 | 0.13 | <1.0 | 5.19 | 1.52 | 0.616 | -- | 3.50J | 19.5* | 10.000 | 1.86 |
| Total Nitrogen (h) | <0.05 | 1.4 | 3.3 | 8.25 | 4.87 | 3.99 | -- | 6.95 | 5 | 1.000 | 4.4 |
| Total Organic Car | 2 | 2.2 | 2 | 8 | <1.0 | <1.0 | -- | 2.42 | 1.95* | 1.000 | 4 |
| Bicarbonate | 210 | 170 | 172 | 232 | 171 | 164 | 170 | 200 | 1.95* | 1.000 | 187 |
| Carbonate | <10 | <10 | 0 | 0 | -- | -- | <1 | <1.00 | 1.95* | 1.000 | 0 |
| Specific Conducta | 1300 | 1200 | 1385 | 1324 | -- | 1380 | -- | 1380 | | | 1318 |