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> The Physical Security Plan, Safeguards Contingency Plan, Guard Force Training and Qualification Plan, and the Standard Practice Procedure Plan for the Protection of Classified Matter are not included, as these documents contain or reference safeguards information.

Instructions for navigating within these files:

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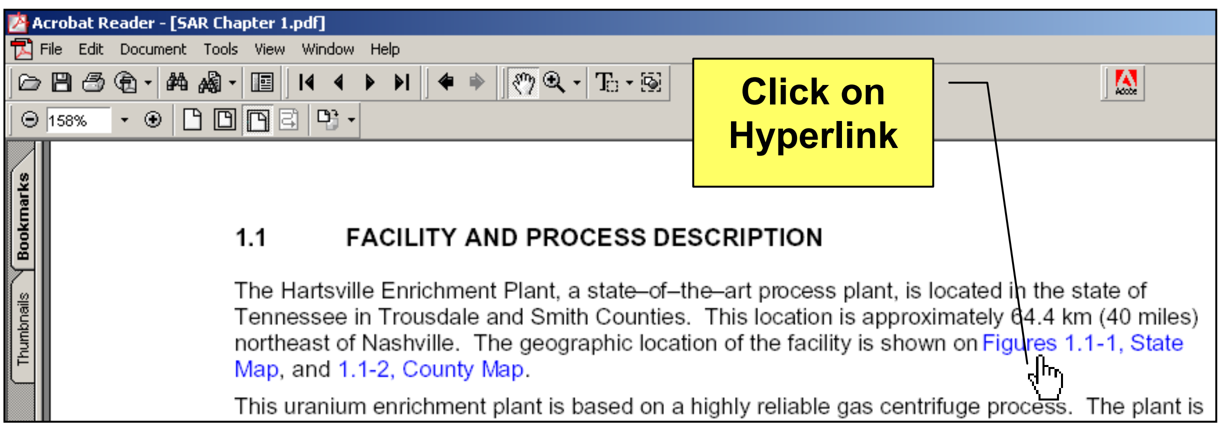

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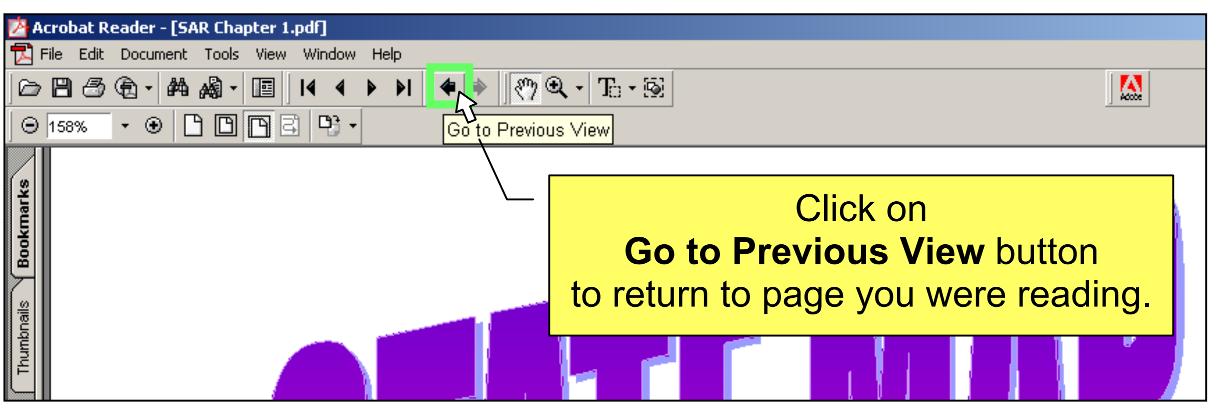

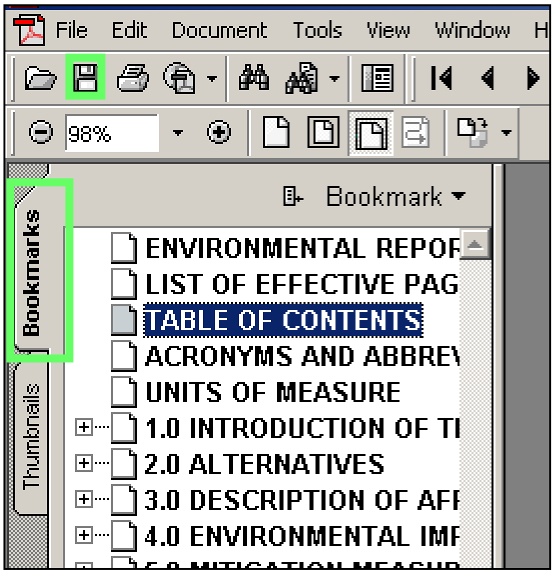

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5. Files are organized by **chapters** and **sections**.

Revision 1, February 2004

NATIONAL ENRICHMENT FACILITY

ENVIRONMENTAL REPORT

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3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

This chapter provides information and data for the affected environment at the proposed National Enrichment Facility (NEF) and surrounding vicinity. Topics include land use (3.1), transportation (3.2), and geology and soils (3.3), as well as various resources such as water (3.4), ecological (3.5), historic and cultural (3.8), and visual/scenic (3.9). Other topics included in this chapter are meteorology, climatology, and air pollution (3.6), environmental noise (3.7), socioeconomic information (3.10), public and occupational health (3.11), and waste management (3.12).

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3.1 LAND USE

This section describes land uses near the proposed NEF site. It also provides a discussion of off-site areas and the regional setting and includes a map of major land use areas. Major transportation corridors are identified in Section 3.2.

The proposed NEF site is situated within Lea County, on the north side of New Mexico Highway 234, about 0.8 km (0.5 mi) from the New Mexico/Texas state line. It is currently owned by the State of New Mexico and a 35-year easement has been granted to LES. Except for a gravel covered road which bisects the east and west halves of the property, it is undeveloped and utilized for domestic livestock grazing. A barbed wire fence runs along the east, south and west property lines. The fence along the north property line has been dismantled. An underground carbon dioxide pipeline, running southeast-northwest, traverses the site and an underground natural gas pipeline is located along the south property line.

Surrounding property consists of vacant land and industrial developments. A railroad spur borders the site to the north. Beyond is a sand/aggregate quarry. A vacant parcel of land is situated immediately to the east. Cattle grazing is not allowed on this vacant parcel. Cattle grazing on nearby sites occurs throughout the year. Further east, at the state line and within Andrews County, Texas is a hazardous waste treatment and disposal facility. A landfill is south/southeast of the site, across New Mexico Highway 234 and a petroleum contaminated soil treatment facility is adjacent to the west. Refer to ER Section 2.1.2, Proposed Action, for further discussion of these facilities. Land further north, south and west has been mostly developed by the oil and gas industry. Refer to Section 3.3, Geology and Soils, for further discussion on mineral resources in the site vicinity. Land further east is ranchland. The nearest residences are situated approximately 4.3 km (2.63 mi) west of the site. Beyond is the city of Eunice, which is approximately 8 km (5 mi) to the west. There are no known public recreational areas within 8 km (5 mi) of the site. There is a historical marker and picnic area approximately 3.2 km (2 mi) from the site at the intersection of New Mexico Highways 234 and 18. Transportation corridors are discussed in ER Section 3.2, Transportation. A discussion of schools and hospitals is included in ER Section 3.10, Socioeconmic.

The site and vicinity are located near the boundary between the Southern High Plains Section (Llano Estacado) of the Great Plains Province to the east and the Pecos Plains Section to the west. The boundary between the two sections is the Mescalero Escarpment, locally referred to as Mescalero Ridge. The Elliott Littman field is to the north, Drinkard field to the south and the Monument Jal field to the west. On-site soils are primarily of the Brownfield-Springer association and Kermit Soils and Dune Land. These soils consist of fine sand, loamy fine sand and loose sands surrounding large barren sand dunes. On-site soils are common to areas used for rangeland and wildlife habitat.

Referring to Table 3.1-1a, Land Use Within 8 km (5 mi) of the NEF Site Classification and Area, and Table 3.1-1b, Land Use Within 8 km (5 mi) of the NEF Site Classification Descriptions, and Figure 3.1-1, Land Use Map, rangeland comprises 98.5% of the area within an 8-km (5-mi) radius of the NEF site, encompassing 12,714 ha (31,415 acres) within Lea County, New Mexico and 7,213 ha (17,823 acres) in Andrews County, Texas. Rangeland is an extensive area of open land on which livestock wander and graze and includes herbaceous rangeland, shrub and brush rangeland and mixed rangeland. Built-up land and barren land constitute the other two land use classifications in the site vicinity, but at considerably smaller percentages. Land cover

due to built-up areas, which includes residential and industrial developments, makes up 1.2% of the land use. This equates to a combined total of 243 ha (601 acres) for Lea and Andrews Counties. The remaining 0.3% of land area is considered barren land which consists of bare exposed rock, transitional areas and sandy areas. The above, indicated land use classifications are identical to those used by the United States Geological Survey (USGS). No special land use classifications (i.e., Native American reservations, national parks, prime farmland) are within the vicinity of the site.

Wildlife observed on and near the subject site included quail, owls, turtles, white tail and jack rabbits, horny toads, and several javelinas. There are also coyotes, fox and mule deer in addition to emus and ostriches that have been released into the wild by local residents. Dove and quail hunting grounds are located north and west of the site. There are no known game harvests near the site. A nomination has been submitted (Stinnett, 2002) to the Bureau of Land Management (BLM) to designate two public land parcels within Lea County as an Area of Critical Environmental Concern (ACEC) for the lesser prairie chicken (*Tympanuchus pallidicinctur*). The nearest nominated ACEC is about 48 km (30 mi) northwest of the proposed NEF site. The other nominated ACEC is further north. Currently, the BLM is evaluating this nomination and expects to make a decision within the next several years. See ER Section 3.5, Ecological Resources, for a discussion of other unusual animals that may be found near the site.

Known sources of water in the site vicinity include the following: a manmade pond on the adjacent quarry property to the north which is stocked with fish for private use; Baker Spring, an intermittent surface water feature situated a little over 1.6 km (1 mi) northeast of the site which only contains water seasonally; several cattle watering holes where groundwater is pumped by windmill and stored in above ground tanks; a well by an abandoned home about 4 km (2.5 mi) to the east and Monument Draw, a natural, shallow drainageway situated several miles west of the site. Several longtime, local residents indicated that Monument Draw only contains water for a short period of time following a significant rainstorm. There are also three “produced water” lagoons for industrial purposes on the adjacent quarry property to the north and a manmade pond at the Eunice golf course approximately 15 km (9.5 mi) west of the site.

Although various crops are grown within Lea and Andrews Counties, local and county officials reported that there is no agricultural activity in the site vicinity, except for domestic livestock ranching (see Table 3.1-2, Agriculture Census, Crop and Livestock Information). The principal livestock for both Lea and Andrews Counties is cattle. Although milk cows comprise a significant number of cattle in Lea County, the nearest dairy farms are about 32 km (20 mi) north of the site, near the city of Hobbs, New Mexico. There are no milks cows in Andrews County, Texas. As Table 3.1-2 also shows, the number of farms and acres of farmland decreased slightly within Lea County between 1992 and 1997, whereas the number of farms in Andrews County increased during this same timeframe, but decreased in size (USDA, 2001a; USDA, 2001b; USDA, 2002a; USDA, 2002b). Note that the 1997 census data is the most current information presently available.

Except for the proposed construction of the NEF and the potential citing of a low-level radioactive waste disposal site in Andrews County, Texas, there are no other known current, future or proposed land use plans, including staged plans, for the site or immediate vicinity. Similarly, as the site is not subject to local or county zoning, land use planning or associated review process requirements, there are no known potential conflicts of land use plans, policies or controls.

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TABLES

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Table 3.1-1a Land Use Within 8 km (5 mi) of the NEF Site
Classification and Area
Page 1 of 1

Classification	Area (Hectares)			Area (Acres)			Percent
	New Mexico	Texas	Total	New Mexico	Texas	Total	
Built Up	243	0	243	601	0	601	1.2
Rangeland	12,714	7,213	19,927	31,415	17,823	49,238	98.5
Barren	69	0	69	170	0	170	0.3
Total	13,026	7,213	20,239	32,186	17,823	50,009	100.0

Table 3.1-1b Land Use Within 8 km (5 mi) of the NEF Site
Classification Descriptions

Classification	Description
Built Up	Residential; industrial; commercial services
Rangeland	Herbaceous rangeland; shrub and brush rangeland; mixed rangeland
Barren	Bare exposed rock; transitional areas; beaches; sandy areas other than beaches

Table 3.1-2 Agriculture Census, Crop, and Livestock Information

Information	County			
	Lea (New Mexico)		Andrews (Texas)	
Census Data (1992 & 1997)	1997	1992	1997	1992
Number of Farms	528	544	142	134
Total Land in Farms ha (acres)	810,161 (2,001,931)	869,861 (2,149,450)	335,431 (828,859)	389,545 (962,576)
Avg. Farm Size ha (acres)[1]	1,535 (3,792)	1,599 (3,951)	2,362 (5,837)	2,907 (7,183)
Crop Annual Average Yields (Most Current)	Area Harvested Hectares (Acres) in 2001	Yield per Hectare (Acre) in 2001	Area Harvested Hectares (Acres) in 2002	Yield per Unit Area in 2001
Chili Peppers	324 (800)	4.49 MT/ha (2.0 tons/acre)	0	0
Wheat	3,035 (7,500)	3.91 m^3/ha (45.0 bu/acre)	81 (200)	2.61 m^3/ha (30 bu/acre)
Grain Sorghum	688 (1,700)	3.66 m^3/ha (42.1 bu/acre)	688 (1,700)	1,384 kg/ha (1,235 lbs/acre)
Peanuts	5,828 (14,400)	3,182 kg/ha (2,840 lbs/acre)	2,266 (5,600)	4,521 kg/ha (4,035 lbs/acre)
All Hay	4,047 (10,000)	10.9 MT/ha (4.72 tons/acre)	0	0
Alfalfa Hay	2,428 (6,000)	13.6 MT/ha (6.0 tons/acre)	0	0
Pecans[2]	213 (526)	-		-
Upland Cotton	8,984 (22,200)	703 kg/ha (627 lbs/acre)	7,811 (19,300)	435 kg/ha (388 lbs/acre)

Table 3.1-2 Agriculture Census, Crop, and Livestock Information

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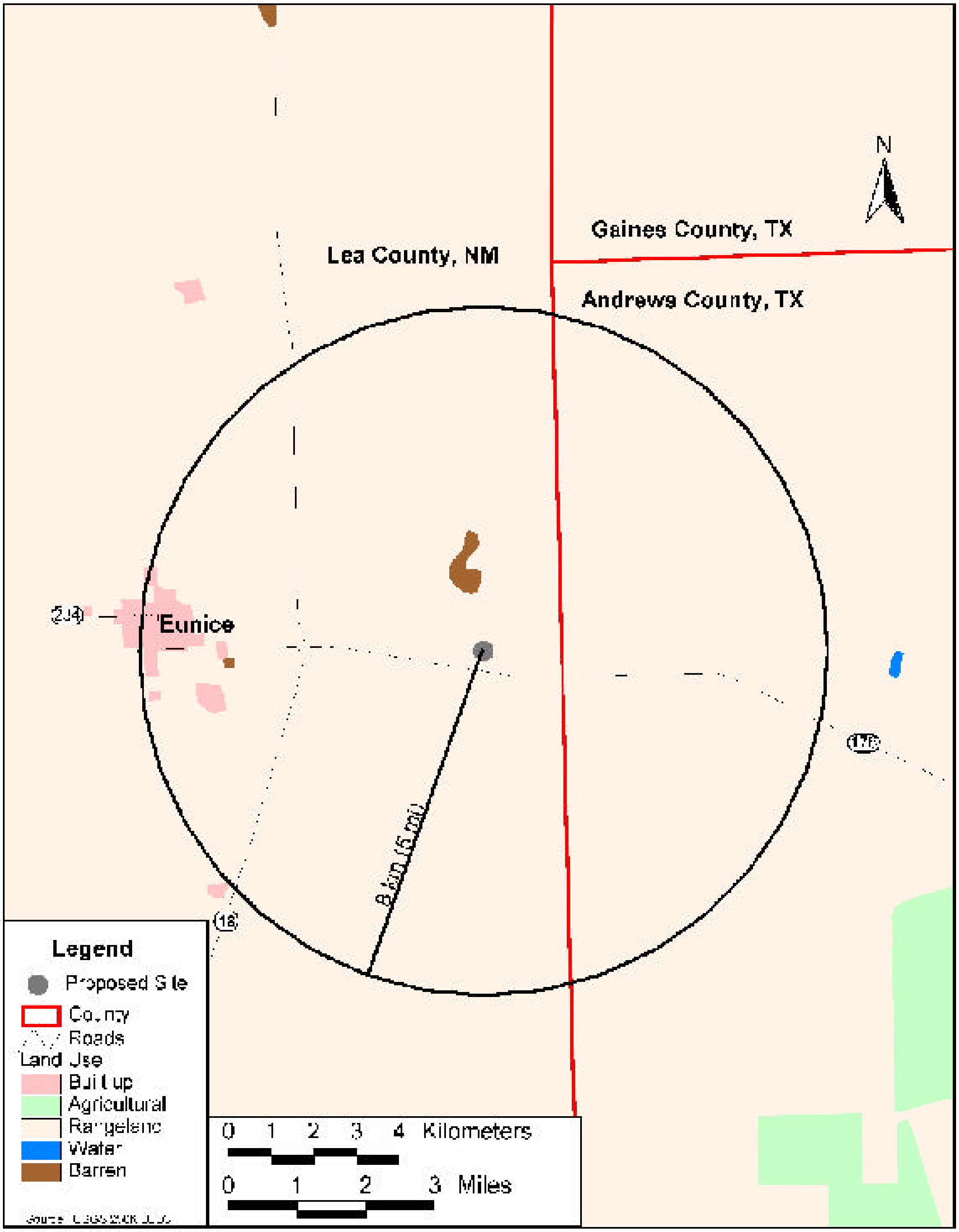
Information	County	
	Lea (New Mexico)	Andrews (Texas)
Livestock (Most Current)	Number in 2001	Number in 2002
All Cattle	82,000	13,000
Beef Cows	27,000	6,000
Milk Cows	25,000	0
Other Cattle (includes cattle on feed)	30,000	0
Sheep and Lambs	4,000	0

[1] Average value per ha (acre) [1998]: New Mexico $536 ($217) / Texas $1,465 ($593) (USDA, National Agricultural Statistical Service)

[2] 1997 Census Data

Source: (USDA, 2001a; USDA, 2001b; USDA, 2002a; USDA, 2002b)

FIGURES



SOURCE: (USGS, 1986)

FIGURE 3.1-1

LAND USE MAP

ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

REFERENCE NUMBER

Figure 3.1-1.doc

3.2 TRANSPORTATION

This section describes transportation facilities at or near the NEF site. The section provides input to various other sections such as 3.11, Public And Occupational Health and 3.12, Waste Management, and includes information on access to and from the plant, proposed transportation routes, and applicable restrictions.

3.2.1 Transportation of Access

The proposed NEF is located in southeastern New Mexico near the New Mexico/Texas state line in Lea County, New Mexico. The site lies along the north side of New Mexico Highway 234, which is a two-lane highway with 3.7-m (12-ft) driving lanes, 2.4-mm (8-ft) shoulders and a 61-m (200-ft) right-of-way easement on either side. New Mexico Highway 234 provides direct access to the site. To the north, U.S. Highway 62/180 intersects New Mexico Highway 18 providing access from the city of Hobbs south to New Mexico Highway 234. New Mexico Highway 18 is a four-lane divided highway which was rehabilitated within the last four to six years north of its intersection with New Mexico Highway 234. It was recently improved south of its intersection with New Mexico Highway 234. To the east in Texas, U.S. Highway 385 intersects Texas Highway 176 providing access from the town of Andrews west to New Mexico Highway 234. To the south in Texas, Interstate 20 intersects Texas Highway 18 which becomes New Mexico Highway 18. West of the site, New Mexico Highway 8 provides access from the city of Eunice east to New Mexico Highway 234. Refer to Figure 2.1-1, 80-Kilometer (50-Mile) Radius With Cities and Roads. Additional information regarding corridor dimensions, corridor uses, and traffic patterns and volumes is provided in ER Section 4.2, Transportation Impacts.

The nearest active rail transportation (the Texas-New Mexico Railroad) is in Eunice, New Mexico to the west about 5.8 km (3.6 mi) from the site. This rail line is used mainly by the local oil and gas industry for freight transport. A train may travel on the rail once a day. There is an active rail spur along the north property line of the site that is owned by the neighboring property to the east (Waste Control Specialists LLC). On average, a train consisting of five to six cars may travel on the rail spur once a week. The speed limit for the rail spur is 16 km (10 mi) per hour.

The nearest airport is in Eunice approximately 16 km (10 mi) west of the site. The airport is used by privately-owned planes.

3.2.2 Transportation Routes

3.2.2.1 Plant Construction Phase

The transportation route for conveying construction material to the site is New Mexico Highway 234, which leads directly into the site. The mode of transportation will consist of over-the-road trucks, ranging from heavy-duty 18-wheeled delivery trucks, concrete mixing trucks and dump trucks, to box and flatbed type light-duty delivery trucks.

3.2.2.2 Plant Operation Phase

All radioactive material shipments will be transported in packages that meet the requirements of 10 CFR 71 (CFR, 2003e) and 49 CFR 171-173 (CFR, 2003k; CFR, 2003l). Uranium feed,

product and associated low-level waste (LLW) will be transported to and from the NEF. The following distinguishes each of these conveyances and associated routes.

Uranium Feed

The uranium feed for the NEF is natural uranium in the form of uranium hexafluoride (UF_6). The UF_6 is transported to the facility in 48Y or 48X cylinders. These cylinders are designed, fabricated and shipped in accordance with American National Standard Institute N14.1, Uranium Hexafluoride - Packaging for Transport (ANSI, applicable version). Feed cylinders are transported to the site by 18-wheeled trucks, one per truck (48Y) or two per truck (48X). In the future, rail transport may also be used to bring uranium feed to the site. Since the NEF has an operational capacity of 690 feed cylinders per year (type 48Y and 48X), between 345 and 690 shipments of feed cylinders per year will arrive at the site.

Uranium Product

The product of the NEF is transported in 30B cylinders. These cylinders are designed, fabricated and shipped in accordance with ANSIN14.1, Uranium Hexafluoride - Packaging for Transport (ANSI, applicable version). Product cylinders are transported from the site to fuel fabrication facilities by modified flat bed truck - typically two per truck although up to five product cylinders could be transported on the same truck. In the future, rail transport may be used to ship product cylinders from the site. A maximum of 11,500 kg (25,353 lbs) (2,300 kg (5,071 lbs) per cylinder) of enriched uranium could be transported per shipment. There will be approximately 350 product cylinders shipped per year, which would typically result in a shipment frequency of one shipment per three days (122 shipments per year).

Uranium Wastes

Waste materials are transported in packages by truck via highway in accordance with 10 CFR 71 and 49 CFR 171-173 (CFR, 2003e; CFR, 2003k; CFR 2003l). Detailed descriptions of radioactive waste materials which will be shipped from the NEF facility for disposal are presented in ER Section 3.12, Waste Management. Table 3.12-1, Estimated Annual Radiological and Mixed Wastes, presents a summary of these waste materials.

Depleted Uranium

Depleted uranium in UBCs will be shipped to conversion or storage facilities via truck in 48Y cylinders similar to feed cylinders. These cylinders are designed, fabricated and shipped in accordance with ANSI N14.1, Uranium Hexafluoride – Packaging for Transport (ANSI, applicable version). UBCs will be transported from the site by 18-wheeled trucks, one per truck (48Y). In the future, rail transport may also be used for ship UBCs from the site. Since the NEF has an operational capacity of 627 UBCs per year (type 48Y), 627 shipments of UBCs per year will leave the site. At present, UBCs will be temporarily stored onsite until conversion or storage facilities are available.

3.2.3 Transportation Modes, Route, and Distances

Construction material would be transported by truck from areas north and south of the site via New Mexico Highway 18 to New Mexico Highway 234. From the east, the transportation route would be Texas Highway 176 which becomes New Mexico Highway 234. From the west, New Mexico Highway 8, which becomes New Mexico Highway 234 near the city of Eunice, would serve as the route of transportation. New Mexico Highway 234 provides direct access to the site.

The feed and product materials of the facility will be transported by truck via highway travel only, although use of rail is being considered. Most of the feed material is expected to be obtained from UF_6 conversion facilities near Port Hope, Ontario and Metropolis, IL, although a small amount could come from non-domestic sources. The product could be transported to fuel fabrication facilities near Hanford, WA, Columbia, SC, and Wilmington, NC. The designation of the supplier of UF_6 and the product receiver is the responsibility of the utility customer. Waste generated from the enrichment process may be shipped to a number of disposal sites or processors depending on the physical and chemical form of the waste. Potential disposal sites or processors are located near Barnwell, SC; Clive UT; Oak Ridge, TN; Paducah, KY; and Portsmouth, OH. Refer to ER Section 3.12.2.1, Radioactive and Mixed Wastes, for disposition options of other wastes.

The primary transportation route between the site and the conversion, fuel fabrication and disposal facilities is via New Mexico Highway 234 to northbound New Mexico Highway 18. These two highways intersect one another a short distance west of the site. New Mexico Highway 18 is accessible from eastbound and westbound highways in the city of Hobbs, approximately 32 km (20 mi) north of the site. Table 3.2-1, Possible Radioactive Material Transportation Routes, lists the approximate highway distances from the NEF site to the respective conversion facilities, fuel fabrication facilities, and radioactive waste disposal sites.

The highways in the vicinity of the site serve as trucking routes for the local area. Traffic volume on these highways varies greatly during the day. The condition and design basis for these roadways are adequate to meet current traffic flow requirements and future minor changes to traffic patterns brought about by the construction and operation of the NEF.

3.2.4 Land Use Transportation Restrictions

The proposed NEF site is on land currently owned by the State of New Mexico and LES has been granted a 35-year easement for the site. Highway easements associated with state trust land is for highway use only, although application for other uses (i.e., installation of utilities) may be submitted to the state. There are no known restrictions on the types of materials that may be transported along the important transportation corridors. This was confirmed with both the State of New Mexico and Texas officials.

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TABLES

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Table 3.2-1 Possible Radioactive Material Transportation Routes

Facility	Description	Estimated Distance, km (mi)
UF_6 Conversion Facility Port Hope, Ontario	Feed	2,869 (1,782)
UF_6 Conversion Facility Metropolis, IL	Feed	1,674 (1.040)
Fuel Fabrication Facility Hanford, WA	Product	2,574 (1,599)
Fuel Fabrication Facility Columbia, SC	Product	2,264 (1,406)
Fuel Fabrication Facility Wilmington, NC	Product	2,576 (1,600)
Barnwell Disposal Site Barnwell, SC	LLW Disposal	2,320 (1,441)
Envirocare of Utah Clive, UT	LLW and Mixed Disposal	1,636 (1,016)
GTS Duratek[1] Oak Ridge, TN	Waste Processor	1,993 (1,238)
Depleted UF_6 Conversion Facility[2] Paducah, KY	Depleted UF_6 Disposal	1,670 (1,037)
Depleted UF_6 Conversion Facility[2] Portsmouth, OH	Depleted UF_6 Disposal	2,243 (1,393)

[1]Other off-site waste processors may also be used.
[2]To be operational in approximately 3-5 years.

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3.3 GEOLOGY AND SOILS

This section identifies the geological, seismological, and geotechnical characteristics of the National Enrichment Facility (NEF) site and its vicinity. Some areas immediately adjacent to the site have been thoroughly studied in recent years in preparation for construction of other facilities including the Waste Control Specialists (WCS) site and the former Atomic Vapor Laser Isotope Separation (AVLIS) site. Data remain available from these investigations in the form of reports (WBG, 1998; TTU, 2000). These documents and related materials provide a significant description of geological conditions for the NEF site. In addition, Louisiana Energy Services (LES) performed field investigations, where necessary, to confirm site-specific conditions.

The NEF site is located in New Mexico west of the Texas border about 48 km (30 mi) from the southeast corner of the state and about 90 km (56 mi) east of the Pecos River. The east edge of the site is 0.8 km (0.5 mi) from the Lea County, New Mexico – Andrews County, Texas border. The site is contained in the Eunice New Mexico, Texas-New Mexico USGS topographic quadrangle (USGS, 1979).

Figure 3.3-1, Regional Physiography, (Raisz, 1957) shows the site is located near the boundary between the Southern High Plains Section (Llano Estacado) of the Great Plains Province to the east and the Pecos Plains Section to the west. The boundary between the two sections is the Mescalero Escarpment, locally referred to as Mescalero Ridge. That ridge abruptly terminates at the far eastern edge of the Pecos Plains. The ridge is an irregular erosional topographic feature in southern Lea County where it exhibits relief of about 9 to 15 m (30 to 50 ft) compared with a nearly vertical cliff and relief of approximately 45 m (150 ft) in northwestern Lea County. The lower relief of the ridge in southeastern Lea County is due to partial cover by wind deposited sand (WBG, 1998).

Locally, the proposed NEF site is located on the Eunice Plain just northwest of Rattlesnake Ridge in Section 32, Township 21 South, Range 38 East. The Eunice Plain gently slopes towards Monument Draw, a north to south traversing arroyo. Monument Draw being north of the city of Eunice following a southeasterly trend, and then turns southerly presumably diverted by Mescalero Ridge.

The dominant geologic feature of this region is the Permian Basin. The NEF site is located within the Central Basin Platform area (Figure 3.3-2, Regional Geology of the Permian Basin). This platform occurs between the Midland and Delaware Basins, which comprises the Permian Basin. The basin, a 250 million-year-old feature, is the source of the region's prolific oil and gas reserves. The late Cretaceous to the early Tertiary periods (65 to 70 million years ago) marked the beginning of the Laramide Orogeny, which formed the Cordilleran Range to the west of the Permian Basin. That orogeny uplifted the region to its present elevation.

The primary difference between the Pecos Plains and the Southern High Plains physiographic sections is a change in topography. The High Plains is a large flat mesa which uniformly slopes to the southeast. In contrast, the Pecos Plains section is characterized by its more irregular erosional topographic expression (WBG, 1998). Topographic relief on the site is generally subdued. NEF site elevations range between about +1,033 and +1,045 m (+3,390 and +3,430 ft), mean sea level (msl). Finished site grade will be about +1,041 m (+3,415 ft), msl (Figure 3.3-3, Site Topography). The NEF site itself encompasses approximately 220 ha (543 acres), of which approximately 73 ha (180 acres) will be developed. Small-scale topographic features within the boundary of the proposed NEF site include a closed depression evident at the

northern center of the site, the result of eolian processes, and a topographic high at the southwest corner of the site that was created by dune sand. In general the site slopes from northeast to southwest with a general overall slope of about 0.5%. Red Bed Ridge (TTU, 2000) is an escarpment of about 15 m (50 ft) in height that occurs just northwest of the NEF site.

Geologically the site is located in an area where surface exposures consist mainly of Quaternary-aged eolian and piedmont sediments along the far eastern margin of the Pecos River Valley (NMIMT, 2003). Figure 3.3-4, Surficial Geologic Map of the NEF Site Area is a portion of the Surficial Geologic Map of Southeast New Mexico (NMIMT, 1977), which includes the area of the NEF site. The surficial unit shown on this map at the NEF site is described as a sandy alluvium with subordinate amounts of gravel, silt and clay. Figure 3.3-4 also describes other surficial units in the site vicinity including caliche, a partly indurated zone of calcium carbonate accumulation formed in the upper layers of surficial deposits including tough slabby surface layers and subsurface nodules, fibers and veinlets; loose sand deposits, some gypsiferous, and subject to wind erosion. Other surficial deposits in the site area include floodplain channel deposits along dry channels and playa sands.

Recent deposits of dune sands are derived from Permian and Triassic rocks. These so-called Mescalero Sands (also known as the Blackwater Draw Formation) occur over 80% of Lea County and are generally described as fine to medium-grained and reddish brown in color. The USDA Soil Survey of Lea County identifies the dune sands at the site as the Brownsfield-Springer Association of reddish brown fine to loamy fine sands (USDA, 1974).

Figure 3.3-5, Site Boring Plan and Profile, includes the NEF site, adjacent site borings and a geologic profile from the immediately adjacent parcel to the east that provides a representation of site geology. The profile shows alluvial deposits about 9 to 15 m (30 to 60 ft) thick, cemented by a soft caliche layer of 1 to 4 m (3 to 13 ft) that occurs at the top of the alluvium. Locally on the site, dune sand overlies both these deposits. The alluvium rests on the red beds of the Chinle Formation, a silty clay with lenses of sandy clay or claystone and siltstone. Information from recent borings initiated by LES on the NEF site in September 2003 is consistent with the data shown on the profile in Figure 3.3-5 as discussed in ER Section 3.3.1, Stratigraphy and Structures.

Borings on the NEF site depicted on Figure 3.3-5 include:

- Three borings/monitoring wells (MW-1, MW-2, and MW-3)
- Nine site groundwater exploration borings (B-1 through B-9)
- Five geotechnical borings (B-1 through B-5).

Other borings depicted on Figure 3.3-5, not on the NEF site, were performed by others. See Safety Analysis Report (SAR) Section 3.2, Site Description, for additional information and boring logs.

The Southeast New Mexico-West Texas area presently is structurally stable. The Permian Basin has subsided slightly since the Laramide Orogeny. This is believed to be a result of dissolution of the Permian evaporite layers by groundwater infiltration and possibly from oil and gas extraction (WBG, 1998).

The NEF site lies within the Landreth-Monument Draws Watershed. Site drainage is to the southwest with runoff not able to reach any water body before it evaporates. The only major

regional drainage feature is Monument Draw, which is located just over 2.5 km (1.0 mi) west of the site, between the proposed NEF site and the city of Eunice, New Mexico (USDA, 1974). The draw begins with a southeasterly course to a point north of Eunice where it turns south and becomes a well defined cut approximately 9 m (30 ft) in depth and 550 to 610 m (1,800 to 2,000 ft) in width. The draw does not have through-going drainage and is partially filled with dune sand and alluvium.

Along Red Bed Ridge (TTU, 2000), approximately 1.6 km (1 mi) northeast of the NEF site is Baker Spring (Figure 3.3-5, Site Boring Plan and Profile). The depression contains water only intermittently (see ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems). No defined drainage features are present at the site. Rainfall on the site will be collected in detention/retention basins. Rainfall that is not collected is expected to infiltrate, or evaporate without creating any runoff that flows beyond site boundaries.

Within Lea County, New Mexico and Andrews County, Texas there are water-bearing strata used for water production. North and east of the NEF site, beneath the High Plains, the Ogallala Aquifer is the most productive of these regional aquifers. West of the site, in the alluvial deposits of Monument Draw, subsurface flow is also locally used as a minor aquifer. Lastly, the Santa Rosa Formation of the Lower Dockum Group and sandy lenses in the Upper Dockum Chinle formation are occasionally used as aquifers on a regional basis.

The most shallow strata to produce measurable quantities of water is an undifferentiated siltstone seam of the Chinle approximately 61 to 73 m (200 to 240 ft) below ground surface. The uppermost aquifer capable of producing significant volumes of water is the Santa Rosa Formation located approximately 244 m (800 ft) below ground surface (WBG, 1998).

With respect to the environment, geologic conditions at the NEF site will not be significantly affected by construction or operation of the NEF. (See ER Section 4.3, Geology and Soils Impact.)

3.3.1 Stratigraphy and Structures

The Permian Basin, a massive subsurface bedrock structure, is a downward flexure of a large thickness of originally flat-lying, bedded, sedimentary rock. It dominates the geologic structure of the region. It extends to 4,880 meters (16,000 feet) below msl. The NEF site is located above the Central Basin Platform that divides the Permian Basin into the Midland and Delaware sub-basins, as shown in Figure 3.3-2, Regional Geology of the Permian Basin. The base of the Permian basin sediments extends about 1,525 m (5,000 ft) deep beneath the NEF site.

The top of the Permian deposits are approximately 232 m (760 ft) below ground surface. Overlying the Permian are the sedimentary rocks of the Triassic Age Dockum Group. The upper formation of the Dockum Group is the Chinle. Locally, the Chinle Formation consists of red, purple and greenish micaceous claystone and siltstone with interbedded fine-grained sandstone. The Chinle is regionally extensive with outcrops as far away as the Grand Canyon region in Arizona (WBG, 1998). Locally overlying the Chinle Formation in the Permian Basin is either the Tertiary Ogallala, Gatuña or Antlers Formations, or Quaternary alluvium. The Tertiary Ogallala Formation underlies all of the High Plains (to the east) and mantles several ridges in Lea County. Unconsolidated sediments northeast of the NEF site are recognized as the Ogallala and deposits west of the NEF site are mapped as the Gatuña or Antlers Formations. This sediment is described as alluvium (WBG, 1998) and is mined as sand and gravel in the NEF site area.

As shown in Table 3.3-1, Geological Units Exposed At, Near, or Underlying the Site, the uppermost 367 m (1,200 ft) of the subsurface in the NEF site vicinity can include up to about 3 m (10 ft) of dune sand, 3.5 m (12 ft) of caliche, and 26 m (85 ft) of alluvium overlying the Chinle Formation of the Triassic Age Dockum Group. The Chinle Formation is predominately red to purple moderately indurated claystone, which is highly impermeable (WBG, 1998). Red Bed Ridge is a significant topographic feature in this regional plain that intersects the extreme northeast corner of the NEF site, and is capped by relatively resistant caliche. Ground surface elevation increases about 15 m (50 ft) from +1,045 m (+3,430 ft) to +1,059 m (+3,475 ft) across the ridge.

Recent deposits at the site and in the site area are primarily dune sands derived from Permian and Triassic rocks of the Permian Basin. These so-called Mescalero Sands cover approximately 80% of Lea County, locally as active sand dunes.

Information from recent borings done on the NEF site is consistent with the data shown on the profile in Figure 3.3-5, Site Boring Plan and Profile. This includes a thin layer of loose sand at the surface; about 12 m (40 ft) of high blow count alluvial silty sand and sand and gravel locally cemented with caliche; and the Chinle clay at a depth of about 12 m (40 ft) below the ground surface and extending to a depth of at least 30 m (100 ft). No sandy clay layers were reported in the clay.

The boring logs for the NEF site geotechnical borings (Borings B-1 through B-5) are provided in the Safety Analysis Report (SAR) Figures 3.2-10 through 3.2-15.

Two types of faulting were associated with early Permian deformation. Most of the faults were long, high-angle reverse faults with well over a hundred meters (several hundred feet) of vertical displacement that often involved the Precambrian basement rocks. The second type of faulting is found along the western margin of the platform where long strike-slip faults, with displacements of tens of kilometers (miles), are found. The closest fault to the site as defined by the New Mexico Bureau of Geology and Mineral Resources (NMIMT, 2003) and is over 161 km (100 mi) to the northwest associated with the deeper portions of the Permian Basin.

The large structural features of the Permian Basin are reflected only indirectly in the Mesozoic and Cenozoic rocks, as there has been virtually no tectonic movement within the basin since the Permian period. Figure 3.3-2, Regional Geology of the Permian Basin, shows the structure that causes the draping of the Permian sediments over the Central Basin Platform structure, located approximately 2,134 m (7,000 ft) beneath the present land surface. The faults that uplifted the platform do not appear to have displaced the younger Permian sediments.

In addition to the lack of regional information indicating the presence of post-Permian faulting, the local information does not indicate Holocene displacement of faults near the proposed NEF site. Site investigations carried out for the WCS site provide an indication that faulting is absent in the subsurface beneath that site. The majority of Quaternary age faults within New Mexico are mapped along the north-south trending Rio Grande Rift located approximately 290 km (180 mi) west of the site.

According to Machette et al. (Machette, 1998), Quaternary age faults are not identified in New Mexico within 161 km (100 mi) of the site. Quaternary age faults within 240 km (150 mi) of the site include the Guadalupe fault, located approximately 185 km (115 mi) west of the site in New Mexico, and in Texas, the West Delaware Mountains fault zone, East Sierra Diablo fault, East Flat Top Mountain fault, and the East Baylor Mountain-Carrizo Mountain fault located 180 km

(110 mi) southwest, 190 km (120 mi) southwest, 190 km (120 mi) west-southwest and 190 km (120 mi) southwest of the site, respectively.

3.3.1.1 Potential Mineral Resources at the Site

No significant non-petroleum mineral deposits are known to exist in the vicinity of the NEF site. The surface cover of silty sand and gravel overlies a claystone of no economic value. No mineral operations are noted in Lea County by the New Mexico Bureau of Mines Inspection (NMBMI, 2001). Mining and potential mining of potash, a commonly extracted mineral in New Mexico, is followed by the New Mexico Energy, Minerals and Natural Resources Department, which maintains a map of areas with potash mines and mining potential (NMEMNRD, 2003). Those data indicate neither mining nor potential for mining of potash in the site area.

The topographic quadrangle map that contains the site (USGS, 1979) contains 10 locations where sand and gravel have been mined from surface deposits, spread across the quadrangle, an area about 12 by 14 km (7.5 by 8.9 mi), suggesting that suitable surficial deposits for borrow material are widespread.

Exploratory drill holes for oil and gas are absent from the site area and its vicinity, but are common 8 km (5 mi) west in and around the city of Eunice, New Mexico. See ER Figure 3.4-7, Water and Oil Wells in the Vicinity of the NEF Site, for nearby well locations. That distribution and the time period of exploration since the inception of exploration for this area suggest that the potential for productive oil drilling at the NEF site is not significant.

3.3.1.2 Volcanism

No volcanic activity exists in the NEF site region.

3.3.2 Site Soils

Soil development in the region is generally limited due to its semi-arid climate. The site has a minor thickness of silty soil (generally less than 0.2 m (0.7 ft)) developed from subaerial weathering. Caliche deposits are common in the near-surface soils. A small deposit of active dune sand is present at the southwest corner of the site.

The U. S. Department of Agriculture soil survey for Lea County, New Mexico (USDA, 1974) categorizes site soils as hummocky loamy (silty) fine sand. Near-surface caliche deposits may locally limit (limiting soil porosity) or enhance (fractured caliche) surface drainage. Figure 3.3-6, Site Soils Map Per USDA Data, shows the soil map for the NEF site (USDA, 1974). The legend for that map lists each of the soils present at the NEF site, describing them and citing their Unified Soil Classification designations (ASTM, 1993).

3.3.2.1 Geotechnical Investigations

The granular soils in the uppermost 12 m (40 ft) of the subsurface provide potentially high-quality bearing materials for building and heavy machine foundations. For extremely heavy or settlement intolerant facilities, foundations can be founded in the Chinle Formation which has an unconfined compressive strength of over 195,000 kg/m^2 (20 ton/ft^2) (WBG, 1998).

Topsoil occurs as 0.3 m (1 ft) or less of brown organic silty sand that overlies a formation of white or tan caliche. The caliche consists of very hard to friable cemented sand, conglomerate

limestone rock, silty sand and gravel. A sand and gravel layer varying from 0 to 6 m (0 to 20 ft) in thickness occurs at the bottom of the caliche strata. Below the caliche is a reddish brown silt clay that extends to the termination of the borings, 30 to 91 m (100 to 300 ft) below grade. The red beds consist of a highly consolidated, impervious clay:

- mottled reddish brown-gray clay;
- purple-gray silty clay;
- yellowish brown-gray silty clay; and
- siltstones and sandstone layers found at various depths with varying thicknesses

The depth to the top of the red beds in borings done for engineering purposes ranged from about 3.6 to 9.1 m (12 to 30 ft).

The dry density of the clay ranges from 1.86 to 2.32 g/cm^3 (116 to 145 lbs/ft^3), averaging 2.11 g/cm^3 (132 lbs/ft^3). The red, reddish-brown or purple silty clays range in moisture content from 2.5% to 25%, averaging 8% to 12% for most samples. Liquid limits for the clays range from 35% to 55% with plasticity indices ranging from 24 to 38. Percent passing the #200 sieve for the clays ranges from 87% to 99.8%.

Permeabilities were measured for the reddish brown silty clays, sandstones and siltstones. Ranges were determined as shown in Table 3.3-2, Measured Permeabilities Near the NEF Site. The values for the clay indicate that it is highly impervious. Siltstones are slightly more permeable, but still having relatively poor permeability.

Unconfined compressive tests on the clay resulted in values from 136,000 kg/m^2 to 485,000 kg/m^2 (13.9 to 49.7 tons/ft^2) with an average value of 293,000 kg/m^2 (30 tons/ft^2).

Given a depth to groundwater of at least 61 to 67 m (200 to 220 ft), there is no potential for liquefaction at the site.

A geotechnical investigation of the site conducted in September 2003 consisted of 5 widely-spaced test borings that extended to depths of about 12 to 30.5 m (40 to 100 ft) using a hollow-stem auger and split-spoon sampling. Based on the boring results, up to 0.6 m (2 ft) of loose eolian sand underlain by dense to very dense, fine- to medium-grained sand and silty sand of the Gatuña Formation was encountered. These sands are locally cemented with caliche deposits. Beneath the Gatuña is the Chinle claystone, a very hard highly plastic clay, which was encountered at depths of about 10.7 to 12.2 m (35 to 40 ft). One boring extended to 30.5 m (100 ft) deep and ended in the Chinle Formation. Blow-count N-values for about the top 7.6 m (25 ft) of sand and gravel ranged from about 20 to 76. Beneath that horizon the unit becomes denser or contains gravel to the extent that useful blow counts are not obtained. Where caliche cements the sand and gravel, N-values of over 60 are typical. Standard N-values were not available for samples in the underlying clay due to its hardness causing blow counts to range upwards of 100.

For samples from the shallow sand and gravel unit, California Bearing Ratio values of 10.5 and 34.4 were obtained along with a maximum dry density value of 1.97 g/cm^3 (123 lbs/ft^3). Fines in this material were generally non-plastic with 17% to 31% of samples finer than 200 sieve size. Clay samples had relatively high liquid limits of 50% to 60% and plastic limits of 18% to 23%, suggesting high silt content.

Footings bearing in the firm and dense sandy soils below the upper loose eolian soils are estimated to have an allowable bearing pressure of 34,177 kg/m^2 (7,000 lbs/ft^3).

3.3.3 Seismology

The majority of earthquakes in the United States are located in the tectonically active western portion of the country. However, areas within New Mexico and the southwestern United States also experience earthquakes, although at a lower rate and at lower intensities. Earthquakes in the region around the NEF site include: isolated and small clusters of low to moderate size events toward the Rio Grande Valley of New Mexico and in Texas, southeast of the NEF site.

3.3.3.1 Seismic History of the Region and Vicinity

The NEF site is located within the Permian Basin as shown on Figure 3.3-7, Tectonic Subdivisions of the Permian Basin (Talley, 1997). Specifically, the site is located near the northern end of the Central Basin Platform (CBP). The CBP became a distinct dividing feature within the Permian Basin as a result of Pennsylvanian and early Permian compressional stresses. This tectonism resulted in a deeper Delaware Basin to the west and shallower Midland Basin to the east of the ridge-like CBP.

The last episode of tectonic activity centered on the late Cretaceous and early Tertiary Laramide Orogeny that formed the Cordilleran Range to the west of the Permian Basin. The Permian Basin region was uplifted to its present position during this orogenic event. There has not been any further tectonic activity since the early Tertiary. Structurally, the Permian Basin has subsided slightly since the Larmaide tectonic event. Dissolution of Permian evaporate layers by groundwater infiltration or possibly from oil and gas extraction is suggested as a possible cause for this observed subsidence.

The 250-million year old Permian Basin is the source of abundant gas and oil reserves that continue to be extracted. These oil fields in southeast New Mexico are characterized as “in a mature stage of secondary recovery effort” (Talley, 1997). Water flooding began in the late 1970’s followed by carbon dioxide (CO_2) flooding now being used to enhance recovery in some fields. Industry case studies describe hydraulic fracturing procedures used in the Queen and San Andres formations near the NEF site that produced fracture half-lengths from 170 to 259 m (560 to 850 ft) in these formations.

No Quaternary faults are mapped for the site locale. The nearest recent faulting is situated more than 161 km (100 mi) west of the site (Machette, 1998).

The study of historical seismicity includes earthquakes in the region of interest known from felt or damage records and from more recent instrumental records (since early 1960’s). Most earthquakes in the region have left no observable surface fault rupture.

Figure 3.3-8, Seismicity Map for 322-Kilometer (200-Mile) Radius of the NEF Site indicates the location of earthquakes which have occurred within a 322 km (200 mi) radius of the NEF site with magnitude greater than or equal to zero (≥ 0). The earthquakes are also listed in Table 3.3-3, Earthquakes Within a 322 Kilometer (200 Mile) Radius of the NEF Site. Figure 3.3-9, Seismicity in the Immediate Vicinity of the NEF Site, indicates the location of earthquakes within about 97 km (60 mi) of the NEF site. Earthquakes, which have occurred within a 322 km (200 mi) radius of the NEF site with a magnitude of 4.0 and greater, are listed in Table 3.3-4, Earthquakes of Magnitude 4.0 and Greater Within 322 Kilometers (200 Mile) of the NEF Site.

The data reflected in the above figures and tables are from earthquake catalogs from the University of Texas Institute for Geophysics (UTIG, 2002), New Mexico Tech Historical Catalog (NMIMT, 2002), Advanced National Seismic System (USGS, 2003a) and the New Mexico Tech Regional Catalog, exclusive of Socorro New Mexico events (NMIMT, 2002).

Earthquake data for a 322 km (200 mi) radius of the NEF site were acquired from public domain resources. Table 3.3-5, Earthquake Data Sources for New Mexico and West Texas, lists organizations and data sources that were identified and earthquake catalogs were obtained.

Earthquake parameters (e.g., date, time, location coordinates, magnitudes, etc.) from the data repositories listed in Table 3.3-5 were combined into a uniformly formatted database to allow statistical analyses and map display of the four catalogs. Through a process of comparison of earthquake entries among the four catalogs, duplicate events were purged to achieve a composite catalog. In addition, aftershocks and aftershock sequences were purged from one version of the catalog for computation of earthquake recurrence statistical models, which describe recurrence rates of earthquake main shocks. The composite list of earthquakes, with aftershocks and aftershock sequences purged, for the 322 km (200 mi) radius of the NEF site is provided in Table 3.3-3, Earthquakes Within a 322 Kilometer (200 Mile) Radius of the Site. The regional seismicity map is shown on Figure 3.3-8, Seismicity Map for 322-Kilometer (200-Mile) Radius of the NEF Site. Local seismicity is shown on Figure 3.3-9, Seismicity in the Immediate Vicinity of the NEF Site. The large majority of events (i.e., 82%) in the composite catalog originate from the Earthquake Catalogs for New Mexico (exclusive of the Socorro New Mexico immediate area) (NMIMT, 2002) as observed in the event counts in Table 3.3-5, Earthquake Data Sources for New Mexico and West Texas. Earthquake magnitudes in these catalogs (NMIMT, 2002) are tied to the New Mexico duration magnitude scale, M_d, that in turn approximate Local Magnitude, M_L. All events in the composite catalog are specified to have an undifferentiated local magnitude.

Table 3.3-4, Earthquakes of Magnitude 4.0 and Greater Within 322 Kilometer (200 Mile) of the NEF Site, shows all earthquake main shocks of magnitude 4.0 and larger within a 322 km (200 mi) radius of the NEF site. The largest earthquake within 322 km (200 mi) of the NEF is the August 16, 1931 earthquake located near Valentine, Texas. This earthquake has an estimated magnitude of 6.0 to 6.4 and produced a maximum epicentral intensity of VIII on the Modified Mercalli Intensity (MMI) Scale. The intensity observed at the NEF site is IV on the MMI scale (NMGS, 1976). A copy of the MMI scale is provided in Table 3.3-6, Modified Mercalli Intensity Scale.The closest of these moderate earthquakes occurred about 16 km (10 mi) southwest of the site on January 2, 1992.

It is noted that the University of Texas Geophysics Institute Catalog of West Texas Earthquakes reports a smaller magnitude of 4.6 and a more easterly epicenter location in Texas for the January 2, 1992 earthquake. Table 3.3-7, Comparison of Parameters for the January 2, 1992 Eunice, New Mexico Earthquake, shows the location and size parameters for the January 2, 1992 earthquake. Parameters given by the New Mexico Tech Regional Catalog were adopted for the seismic hazard assessment of the NEF site.

3.3.3.2 Correlation of Seismicity with Tectonic Features

Earthquake epicenters scaled to magnitude for the site region are plotted over Permian Basin tectonic elements on Figure 3.3-10, Regional Seismicity and Tectonic Elements of the Permian Basin. Most epicenters lie within the Central Basin Platform, however, earthquake clusters also occur within the Delaware and Midland Basins. Although events local to the NEF site are likely

induced by gas/oil recovery methods, the resulting ground motions are transmitted similar to earthquakes on tectonic faults and impacts at the NEF site are analyzed using standard seismic hazard methods. In addition, the January 2, 1992 event is attributed to a tectonic origin due to its determined focal depth of about 12 km (7.5 mi) (DOE, 2003d).

Analysis of the spatial density of earthquakes in the composite catalog is shown on Figure 3.3-11, Earthquake Frequency Contours and Tectonic Elements of the Permian Basin. This form of spatial analysis has historically been used to define the geometry of seismic source zones for seismic hazard investigations (USGS, 1997; USGS, 1976). Seismic source areas for the NEF site region are determined on the basis of the earthquake frequency pattern shown on Figure 3.3-11. The NEF site is located near the northern end of the region of highest observed earthquake frequency within the Central Basin Platform of the Permian Basin.

The Waste Isolation Pilot Project (WIPP) Safety Analysis Report (SAR) (DOE, 2003d) suggests that the cluster of small events located along the Central Basin Platform (Figure 3.3-10, Regional Seismicity and Tectonic Elements of the Permian Basin) are not tectonic in origin, but are instead related to water injection and withdrawal for secondary recovery operations in oil fields in the Central Basin Platform area. Such a mechanism for the Central Basin Platform seismic activity could provide a reason why the Central Basin Platform is separable from the rest of the Permian Basin on the basis of seismicity data but not by using other common indicators of tectonic character. Both the spatial and temporal association of Central Basin Platform seismicity with secondary recovery projects at oil fields in the area are suggestive of some cause and effect relationship of this type.

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TABLES

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Table 3.3-1 Geological Units Exposed At, Near, or Underlying the Site

Formation	Geologic Age	Descriptions	Estimates for the NEF Site Area	
			Depths: m (ft)	Thickness: m (ft)
Topsoils	Recent	Residual silty topsoil	0.2 (0.7)	0.2 (0.7)
Mescalero Sands/ Blackwater Draw Formation	Quaternary	Dune or dune-related sands	0 to 3.0 (0 to 10)	0 to 3.0 (0 to 10)
Mescalero Caliche	Quaternary	Soft to hard calcium carbonate deposits	0 to 6.1 (0 to 20)	0 to 6.1 (0 to 20)
Gatuña/ Antlers Formation	Pleistocene/mid-Pliocene	Pecos Valley alluvium: Sand and silty sand with interbedded caliche near the surface and a sand and gravel base layer	12 to 38 (40 to 125)	26 (85)
Chinle Formation	Triassic	Claystone and silty clay: red beds	38 to 137 (125 to 450)	99 (325)
Santa Rosa Formation	Triassic	Sandy red beds, conglomerates and shales	137 to 232 (450 to 760)	95 (310)
Dewey Lake	Permian	Muddy sandstone and shale red beds	232 to 383 (760 to 1255)	151 (495)

Sources: (BLM, 2003; TTU, 2000; DOE 1997b)

Table 3.3-2 Measured Permeabilities Near the NEF Site

Permeability Direction	Sediment Type	Permeability, cm/s (ft/s)
Vertical	Clays	1.00×10^{-9} to 1.76×10^{-8} (3.28×10^{-11} to 5.77×10^{-10})
Horizontal	Clays	1.63×10^{-9} to 1.10×10^{-8} (5.35×10^{-11} to 3.61×10^{-10})
Vertical	Siltstones and sandstones within 18 to 27 m (56 to 90 ft) depth	2.58×10^{-8} to 1.93×10^{-6} (8.46×10^{-10} to 6.33×10^{-8})
Horizontal	Siltstones and sandstones within 18 to 27 m (56 to 90 ft) depth	Average: 6.53×10^{-7} (2.14×10^{-8})
Vertical	Siltstone at 63 m (208 ft) depth	2.06×10^{-8} (6.76×10^{-10})

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1931	8	16	-104.60	30.70	6.00	UTIG
1949	5	23	-105.20	34.60	4.50	NMTH
1955	1	27	-104.50	30.60	3.30	UTIG
1962	1	3	-103.75	34.85	2.90	NMTR
1962	3	6	-104.80	31.20	3.50	UTIG
1963	12	19	-104.27	34.82	3.40	NMTR
1964	2	11	-103.94	34.23	2.10	NMTR
1964	3	3	-103.60	34.84	2.90	NMTR
1964	6	19	-105.77	32.95	1.90	NMTR
1964	8	14	-102.94	31.97	1.90	NMTR
1964	9	7	-102.92	31.94	1.60	NMTR
1964	11	8	-103.10	31.90	3.00	UTIG
1964	11	21	-103.10	31.90	3.10	UTIG
1964	11	27	-102.97	31.89	1.90	NMTR
1965	1	21	-102.85	32.02	1.30	NMTR
1965	2	3	-103.10	31.90	3.30	UTIG
1965	8	30	-103.00	31.90	3.50	UTIG
1966	8	14	-103.00	31.90	3.40	UTIG
1966	9	17	-103.98	34.89	2.70	NMTR
1966	10	6	-104.12	35.13	2.90	NMTR
1966	11	26	-105.44	30.95	3.50	NMTR
1968	3	23	-105.91	32.67	2.60	NMTR
1968	5	2	-105.24	33.10	2.60	NMTR
1969	6	1	-105.21	34.20	1.90	NMTR
1969	6	8	-105.19	34.15	2.60	NMTR
1971	7	30	-103.00	31.72	3.00	ANSS
1971	7	31	-103.06	31.70	3.40	ANSS
1971	9	24	-103.20	31.60	3.20	UTIG
1972	7	26	-104.01	32.57	3.10	NMTR
1973	3	17	-102.36	31.59	2.50	NMTR
1973	8	2	-105.56	31.04	3.60	NMTR
1973	8	4	-103.22	35.11	3.00	NMTR
1974	7	31	-104.19	33.11	0.00	NMTR
1974	10	2	-100.86	31.87	0.00	NMTR
1974	10	27	-104.83	30.63	0.00	NMTR
1974	11	12	-102.67	32.14	0.00	NMTR
1974	11	21	-102.75	32.07	0.00	NMTR

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1974	11	22	-101.26	32.94	0.00	NMTR
1974	11	22	-105.21	33.78	0.00	NMTR
1974	11	28	-103.94	32.58	0.00	NMTR
1974	11	28	-104.14	32.31	3.90	ANSS
1974	12	30	-103.10	30.90	3.70	UTIG
1975	1	30	-103.08	30.95	2.10	NMTR
1975	2	2	-103.19	35.05	3.00	NMTR
1975	4	8	-101.69	32.18	0.00	NMTR
1975	7	25	-102.62	29.82	0.00	NMTR
1975	8	1	-104.60	30.49	0.00	NMTR
1975	8	1	-104.00	31.40	3.00	UTIG
1975	8	3	-104.45	30.71	0.00	NMTR
1975	10	10	-105.02	33.36	0.00	NMTR
1975	12	12	-102.31	31.61	3.00	NMTR
1976	1	10	-102.76	31.79	0.00	NMTR
1976	1	15	-102.32	30.98	0.00	NMTR
1976	1	19	-103.09	31.90	3.50	UTIG
1976	1	21	-102.29	30.95	0.00	NMTR
1976	1	22	-103.07	31.90	2.80	ANSS
1976	1	25	-103.08	31.90	3.90	ANSS
1976	1	28	-100.89	31.99	0.00	NMTR
1976	2	4	-103.53	31.68	0.00	NMTR
1976	2	14	-102.47	31.63	0.00	NMTR
1976	3	5	-102.25	31.66	0.00	NMTR
1976	3	15	-102.58	32.50	0.00	NMTR
1976	3	18	-102.96	32.33	0.00	NMTR
1976	3	20	-104.94	31.27	0.00	NMTR
1976	3	20	-103.06	32.22	0.00	NMTR
1976	3	27	-103.07	32.22	0.00	NMTR
1976	4	3	-103.10	31.24	0.00	NMTR
1976	4	12	-103.00	32.27	0.00	NMTR
1976	4	21	-102.89	32.25	0.00	NMTR
1976	4	30	-103.09	31.98	0.00	NMTR
1976	4	30	-103.11	31.92	0.00	NMTR
1976	5	1	-103.06	32.37	0.00	NMTR
1976	5	3	-105.66	32.41	0.00	NMTR
1976	5	3	-103.20	32.03	0.00	NMTR
1976	5	3	-103.03	32.03	0.00	NMTR
1976	5	4	-103.23	31.86	0.00	NMTR
1976	5	6	-103.18	31.97	0.00	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1976	5	6	-103.16	31.87	0.00	NMTR
1976	5	11	-102.92	32.29	0.00	NMTR
1976	5	21	-105.59	32.49	0.00	NMTR
1976	6	14	-102.49	31.52	0.00	NMTR
1976	6	15	-102.34	31.56	0.00	NMTR
1976	6	15	-102.37	31.60	0.00	NMTR
1976	7	28	-102.29	33.02	0.00	NMTR
1976	8	5	-101.73	30.87	0.00	NMTR
1976	8	5	-103.00	31.60	3.00	UTIG
1976	8	6	-102.59	31.78	2.10	NMTR
1976	8	10	-102.03	31.77	0.00	NMTR
1976	8	10	-102.06	31.79	0.00	NMTR
1976	8	25	-101.94	31.55	0.00	NMTR
1976	8	26	-102.01	31.84	0.00	NMTR
1976	8	30	-101.98	31.57	0.00	NMTR
1976	8	31	-102.18	31.46	0.00	NMTR
1976	9	3	-103.48	31.55	2.00	NMTR
1976	9	5	-102.74	32.23	0.00	NMTR
1976	9	17	-103.06	32.24	0.00	NMTR
1976	9	17	-102.50	31.40	3.10	UTIG
1976	9	19	-104.57	30.47	0.00	NMTR
1976	10	22	-102.16	31.55	0.00	NMTR
1976	10	23	-102.38	31.62	0.00	NMTR
1976	10	25	-102.53	31.84	0.00	NMTR
1976	10	26	-103.28	31.33	2.40	NMTR
1976	11	3	-102.27	30.92	0.00	NMTR
1976	12	12	-102.46	31.57	2.80	NMTR
1976	12	12	-102.49	31.61	1.90	NMTR
1976	12	15	-102.22	31.59	1.40	NMTR
1976	12	18	-103.02	31.62	1.80	NMTR
1976	12	19	-102.45	31.87	2.20	NMTR
1976	12	19	-103.14	32.25	1.80	NMTR
1976	12	19	-103.08	32.27	2.70	NMTR
1977	1	29	-104.59	30.58	0.00	NMTR
1977	2	4	-104.70	30.59	0.00	NMTR
1977	2	18	-103.05	32.24	0.00	NMTR
1977	3	5	-102.66	31.16	0.00	NMTR
1977	3	14	-101.01	33.04	0.00	NMTR
1977	3	20	-103.10	32.21	0.00	NMTR
1977	3	29	-103.28	31.60	0.00	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1977	4	3	-103.17	31.49	1.90	NMTR
1977	4	3	-103.20	31.47	0.00	NMTR
1977	4	4	-103.36	31.00	0.00	NMTR
1977	4	7	-103.05	32.19	0.00	NMTR
1977	4	7	-102.70	31.32	0.00	NMTR
1977	4	7	-102.94	31.35	0.00	NMTR
1977	4	12	-102.55	31.28	0.00	NMTR
1977	4	17	-102.35	31.50	0.00	NMTR
1977	4	18	-103.25	31.60	0.00	NMTR
1977	4	22	-103.02	32.18	0.00	NMTR
1977	4	25	-102.81	32.07	0.00	NMTR
1977	4	26	-103.08	31.90	3.30	ANSS
1977	4	28	-102.52	31.83	0.00	NMTR
1977	4	28	-101.99	31.87	0.00	NMTR
1977	4	29	-102.65	31.77	0.00	NMTR
1977	6	7	-100.75	33.06	4.00	ANSS
1977	6	8	-100.83	32.83	0.00	NMTR
1977	6	8	-100.82	32.92	0.00	NMTR
1977	6	8	-101.04	32.87	0.00	NMTR
1977	6	17	-100.95	32.90	2.70	NMTR
1977	6	28	-103.30	31.54	2.30	NMTR
1977	7	1	-103.34	31.50	2.00	NMTR
1977	7	11	-102.62	31.80	0.00	NMTR
1977	7	11	-102.68	31.79	0.00	NMTR
1977	7	12	-102.64	31.77	0.00	NMTR
1977	7	18	-102.70	31.78	0.00	NMTR
1977	7	22	-102.72	31.80	0.00	NMTR
1977	7	22	-102.70	31.80	3.00	UTIG
1977	7	24	-102.70	31.79	0.00	NMTR
1977	8	20	-103.33	31.60	1.90	NMTR
1977	8	21	-104.91	30.54	0.00	NMTR
1977	10	13	-100.81	32.91	2.20	NMTR
1977	10	17	-102.46	31.57	1.80	NMTR
1977	11	14	-104.96	31.52	0.00	NMTR
1977	11	27	-101.14	33.02	0.00	NMTR
1977	11	28	-100.84	32.95	3.50	ANSS
1977	12	16	-102.40	31.52	0.00	NMTR
1977	12	21	-102.41	31.52	0.00	NMTR
1977	12	31	-102.46	31.60	2.10	NMTR
1978	1	2	-102.53	31.60	2.20	NMTR

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1978	1	12	-102.30	31.49	0.00	NMTR
1978	1	15	-101.70	31.36	0.00	NMTR
1978	1	18	-103.23	31.61	0.00	NMTR
1978	1	19	-103.71	32.56	0.00	NMTR
1978	2	5	-102.60	31.89	0.00	NMTR
1978	2	5	-104.55	31.41	0.00	NMTR
1978	2	18	-104.69	31.21	2.30	NMTR
1978	3	2	-103.06	32.82	1.50	NMTR
1978	3	2	-102.38	31.58	3.30	NMTR
1978	3	2	-102.61	31.59	2.10	NMTR
1978	3	2	-102.56	31.55	3.50	UTIG
1978	3	19	-102.49	31.47	1.60	NMTR
1978	6	16	-100.80	33.00	3.40	UTIG
1978	6	16	-100.77	33.03	5.30	ANSS
1978	6	29	-102.42	31.08	3.20	NMTR
1978	7	5	-102.20	31.61	0.00	NMTR
1978	7	18	-104.36	30.36	0.00	NMTR
1978	7	21	-102.77	31.34	0.00	NMTR
1978	8	14	-102.18	31.58	2.20	NMTR
1978	9	29	-102.42	31.52	0.00	NMTR
1978	9	30	-102.17	31.36	0.00	NMTR
1978	10	2	-102.43	31.53	0.00	NMTR
1978	10	2	-102.19	31.51	0.00	NMTR
1978	10	2	-102.36	31.48	0.00	NMTR
1978	10	3	-102.99	31.90	0.00	NMTR
1978	10	6	-102.36	31.55	0.00	NMTR
1979	4	28	-104.72	30.47	0.00	NMTR
1979	7	17	-103.73	32.65	2.00	NMTR
1979	8	3	-100.81	32.87	2.40	NMTR
1980	1	21	-105.00	34.20	1.30	NMTR
1980	3	21	-102.34	31.57	1.60	NMTR
1981	8	13	-102.70	31.90	2.20	NMTR
1981	9	16	-105.23	33.72	1.80	NMTR
1982	1	4	-102.49	31.18	3.90	ANSS
1982	4	26	-100.84	33.02	2.80	ANSS
1982	5	1	-103.04	32.33	2.10	NMTR
1982	10	17	-102.71	30.90	2.00	NMTR
1982	10	26	-103.59	33.67	1.50	NMTR
1982	10	26	-103.61	33.63	1.50	NMTR
1982	11	25	-100.78	32.89	2.30	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site
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YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1982	11	28	-100.84	33.00	3.30	ANSS
1983	1	9	-104.19	30.65	1.90	NMTR
1983	1	12	-105.19	34.32	1.50	NMTR
1983	1	29	-102.08	31.75	2.20	NMTR
1983	3	3	-104.35	29.96	2.80	NMTR
1983	6	5	-105.35	32.52	1.30	NMTR
1983	6	21	-103.58	33.63	1.60	NMTR
1983	7	21	-105.14	30.97	1.60	NMTR
1983	8	4	-105.14	32.57	1.30	NMTR
1983	8	19	-102.23	31.31	1.80	NMTR
1983	8	22	-105.08	34.06	1.30	NMTR
1983	8	23	-105.52	31.17	2.10	NMTR
1983	8	26	-102.53	33.62	1.60	NMTR
1983	8	29	-100.62	31.80	2.60	NMTR
1983	9	15	-104.43	34.92	3.10	NMTR
1983	9	29	-104.45	34.89	2.70	NMTR
1983	9	30	-103.97	30.57	1.70	NMTR
1983	12	1	-101.99	31.86	1.40	NMTR
1983	12	3	-103.32	30.97	2.10	NMTR
1983	12	26	-102.88	30.77	1.70	NMTR
1984	1	2	-102.12	31.81	1.80	NMTR
1984	1	3	-102.69	31.21	1.70	NMTR
1984	1	3	-103.04	30.76	2.00	NMTR
1984	1	16	-102.20	31.56	1.40	NMTR
1984	3	2	-104.84	30.81	1.90	NMTR
1984	3	23	-100.78	32.45	1.50	NMTR
1984	5	21	-102.59	31.14	1.30	NMTR
1984	5	21	-102.23	35.07	3.10	ANSS
1984	6	27	-102.48	31.22	2.00	NMTR
1984	7	17	-105.77	32.85	1.30	NMTR
1984	8	18	-103.56	30.78	1.80	NMTR
1984	8	24	-104.48	30.67	1.30	NMTR
1984	8	26	-104.27	30.38	2.10	NMTR
1984	9	11	-100.70	31.99	3.20	ANSS
1984	9	19	-100.69	32.03	3.00	ANSS
1984	9	27	-103.42	32.59	1.60	NMTR
1984	10	4	-102.70	33.58	1.30	NMTR
1984	10	4	-102.24	31.65	1.30	NMTR
1984	10	11	-100.56	31.95	2.40	NMTR
1984	10	27	-104.56	30.62	1.70	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1984	11	27	-105.41	33.57	1.60	NMTR
1984	12	4	-101.93	30.10	2.30	NMTR
1984	12	4	-103.21	32.64	2.10	NMTR
1984	12	4	-103.56	32.27	2.90	ANSS
1984	12	12	-105.61	33.36	1.50	NMTR
1985	2	21	-100.75	32.88	1.40	NMTR
1985	2	21	-100.81	32.72	1.50	NMTR
1985	3	9	-105.12	33.97	1.30	NMTR
1985	5	3	-104.95	31.04	1.90	NMTR
1985	6	1	-102.83	31.06	1.50	NMTR
1985	6	2	-102.28	31.18	1.60	NMTR
1985	6	12	-103.90	34.64	1.60	NMTR
1985	8	2	-104.34	32.48	1.40	NMTR
1985	9	5	-103.77	33.66	1.80	NMTR
1985	9	18	-103.42	30.90	2.00	NMTR
1985	10	21	-101.88	32.04	1.30	NMTR
1985	11	13	-103.08	32.10	1.80	NMTR
1985	11	28	-101.99	31.61	1.80	NMTR
1985	12	5	-102.94	32.42	1.60	NMTR
1986	1	25	-100.73	32.06	2.90	ANSS
1986	1	30	-104.01	33.54	1.90	NMTR
1986	1	30	-100.69	32.07	3.30	ANSS
1986	2	7	-105.44	32.54	1.40	NMTR
1986	2	14	-100.76	31.53	2.60	NMTR
1986	3	1	-102.57	31.16	1.70	NMTR
1986	3	11	-105.08	32.11	2.00	NMTR
1986	3	21	-105.64	33.43	1.60	NMTR
1986	5	28	-105.12	31.76	1.60	NMTR
1986	6	12	-102.22	31.77	1.80	NMTR
1986	6	27	-102.01	32.06	2.20	NMTR
1986	7	9	-102.48	31.55	1.60	NMTR
1986	7	20	-105.00	33.47	1.50	NMTR
1986	8	2	-103.79	33.68	1.70	NMTR
1986	8	6	-103.03	33.86	2.40	NMTR
1986	8	14	-104.66	32.53	1.30	NMTR
1986	8	15	-103.43	33.14	1.70	NMTR
1986	8	29	-102.41	31.31	1.40	NMTR
1986	9	18	-102.37	31.51	1.80	NMTR
1986	10	18	-102.69	30.07	1.60	NMTR
1986	10	25	-102.13	31.60	1.70	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1986	11	3	-104.64	31.09	2.00	NMTR
1986	11	6	-104.58	32.55	1.60	NMTR
1986	11	17	-100.73	33.08	2.00	NMTR
1986	11	24	-102.16	31.68	2.00	NMTR
1986	12	6	-102.16	31.59	2.40	NMTR
1986	12	6	-102.23	31.47	2.10	NMTR
1986	12	6	-102.17	31.65	1.70	NMTR
1986	12	6	-102.09	31.72	2.20	NMTR
1986	12	15	-103.19	35.07	1.50	NMTR
1986	12	15	-102.02	31.76	1.50	NMTR
1987	1	25	-104.86	31.74	1.70	NMTR
1987	2	9	-103.45	30.69	2.30	NMTR
1987	2	9	-101.96	31.86	1.60	NMTR
1987	2	12	-101.94	31.66	1.60	NMTR
1987	2	17	-104.52	30.60	2.10	NMTR
1987	3	2	-105.08	30.78	1.80	NMTR
1987	3	3	-105.44	31.17	1.50	NMTR
1987	3	10	-105.66	31.13	1.50	NMTR
1987	3	26	-103.28	30.96	2.60	NMTR
1987	3	31	-104.95	31.52	2.80	NMTR
1987	4	23	-105.02	32.03	1.60	NMTR
1987	4	25	-105.22	33.97	1.90	NMTR
1987	4	29	-105.92	32.67	2.30	NMTR
1987	7	5	-104.77	30.85	2.00	NMTR
1987	7	23	-103.03	35.29	1.90	NMTR
1987	7	30	-103.87	34.54	1.50	NMTR
1987	8	4	-102.12	31.87	1.70	NMTR
1987	9	11	-103.62	33.61	2.00	NMTR
1987	9	21	-103.74	33.68	1.80	NMTR
1987	10	1	-105.16	30.47	1.60	NMTR
1987	10	1	-103.76	33.66	1.50	NMTR
1987	10	9	-104.59	31.07	1.40	NMTR
1987	10	31	-105.31	32.86	1.30	NMTR
1987	11	3	-103.71	33.70	1.30	NMTR
1987	11	17	-101.97	32.06	1.60	NMTR
1987	12	6	-102.76	31.83	1.60	NMTR
1987	12	20	-103.07	32.29	2.20	NMTR
1987	12	28	-102.25	31.47	2.10	NMTR
1987	12	29	-102.11	31.58	1.50	NMTR
1988	1	26	-102.42	31.24	2.30	NMTR

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1988	2	14	-102.06	31.78	1.40	NMTR
1988	2	21	-103.02	30.45	1.40	NMTR
1988	2	27	-103.75	33.67	1.80	NMTR
1988	3	9	-102.44	31.24	1.70	NMTR
1988	3	15	-105.52	31.72	1.30	NMTR
1988	3	17	-102.20	31.66	1.60	NMTR
1988	4	5	-102.33	31.44	2.10	NMTR
1988	4	6	-102.09	31.94	1.30	NMTR
1988	5	3	-104.39	30.52	1.30	NMTR
1988	5	10	-105.20	30.96	1.40	NMTR
1988	5	27	-102.12	31.78	1.30	NMTR
1988	5	27	-102.02	32.06	1.30	NMTR
1988	7	4	-100.74	33.74	2.00	NMTR
1988	7	11	-103.25	35.28	1.90	NMTR
1988	7	20	-102.43	29.77	2.20	NMTR
1988	7	25	-104.91	31.98	1.50	NMTR
1988	7	26	-105.14	30.94	1.50	NMTR
1988	8	23	-102.02	32.26	1.50	NMTR
1988	9	15	-103.32	31.68	1.50	NMTR
1988	9	19	-102.45	32.46	2.00	NMTR
1988	10	2	-103.79	33.63	1.30	NMTR
1988	11	10	-102.40	31.55	1.90	NMTR
1989	1	9	-102.59	31.44	1.80	NMTR
1989	1	9	-102.12	31.78	1.30	NMTR
1989	1	20	-101.97	32.08	1.90	NMTR
1989	2	21	-103.39	35.29	2.30	NMTR
1989	3	19	-103.55	31.19	1.50	NMTR
1989	3	21	-102.33	31.42	1.50	NMTR
1989	3	30	-102.86	33.24	1.40	NMTR
1989	6	5	-102.09	32.10	2.10	NMTR
1989	6	23	-102.23	31.59	1.60	NMTR
1989	6	28	-105.08	30.93	2.30	NMTR
1989	7	13	-105.27	33.53	1.50	NMTR
1989	7	24	-100.93	32.92	1.60	NMTR
1989	7	25	-101.76	30.90	2.10	NMTR
1989	8	8	-102.70	31.30	2.30	NMTR
1989	8	16	-101.96	31.70	1.60	NMTR
1989	9	5	-102.50	34.25	2.50	NMTR
1989	11	2	-100.94	33.02	2.00	NMTR
1989	11	16	-103.12	35.11	2.60	NMTR

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1989	12	7	-103.67	34.58	1.40	NMTR
1989	12	28	-101.06	31.70	2.10	NMTR
1989	12	28	-100.96	32.04	1.70	NMTR
1990	1	16	-105.32	31.74	1.80	NMTR
1990	3	4	-103.92	30.53	1.70	NMTR
1990	3	30	-100.53	32.96	2.30	NMTR
1990	3	30	-100.56	32.99	2.20	NMTR
1990	4	6	-103.36	31.51	1.90	NMTR
1990	5	10	-102.37	31.14	2.20	NMTR
1990	5	10	-101.96	32.13	1.60	NMTR
1990	5	16	-102.04	31.86	2.40	NMTR
1990	5	22	-102.09	30.24	2.20	NMTR
1990	6	22	-100.76	32.58	2.20	NMTR
1990	7	3	-102.22	31.44	1.50	NMTR
1990	7	13	-101.81	34.86	2.70	NMTR
1990	8	3	-100.69	32.21	3.40	NMTR
1990	8	9	-102.67	31.21	1.90	NMTR
1990	8	14	-102.26	31.39	1.80	NMTR
1990	8	25	-102.01	31.91	1.80	NMTR
1990	10	8	-105.12	30.94	1.30	NMTR
1990	12	20	-103.14	35.27	2.50	NMTR
1991	1	1	-105.27	32.44	1.60	NMTR
1991	1	29	-103.04	32.89	1.40	NMTR
1991	2	3	-104.49	32.81	1.30	NMTR
1991	2	3	-103.96	35.00	2.10	NMTR
1991	3	10	-103.97	30.47	2.10	NMTR
1991	3	10	-103.33	33.58	2.00	NMTR
1991	4	8	-103.13	34.98	2.10	NMTR
1991	5	16	-103.75	33.67	2.00	NMTR
1991	6	4	-102.31	32.05	2.00	NMTR
1991	7	16	-101.12	33.09	2.10	NMTR
1991	8	1	-104.02	34.59	2.70	NMTR
1991	8	7	-104.81	31.62	1.80	NMTR
1991	8	17	-100.99	32.09	2.00	NMTR
1991	9	22	-101.30	31.32	2.10	NMTR
1991	9	28	-103.77	33.63	1.70	NMTR
1991	9	30	-100.73	31.85	2.20	NMTR
1991	10	5	-105.41	31.38	2.20	NMTR
1992	1	2	-103.19	32.30	5.00	NMTR
1992	1	2	-103.19	32.30	1.80	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1992	1	2	-103.19	32.30	1.50	NMTR
1992	1	2	-103.19	32.30	2.40	NMTR
1992	1	2	-103.19	32.30	1.80	NMTR
1992	1	3	-103.19	32.30	1.90	NMTR
1992	1	4	-103.19	32.30	1.50	NMTR
1992	1	7	-103.19	32.30	2.40	NMTR
1992	1	9	-103.19	32.30	2.80	NMTR
1992	1	11	-103.19	32.30	2.00	NMTR
1992	1	23	-102.29	31.84	1.90	NMTR
1992	2	2	-102.86	32.17	1.90	NMTR
1992	3	15	-104.12	34.92	1.70	NMTR
1992	3	28	-105.39	33.45	1.80	NMTR
1992	4	3	-103.03	32.26	2.10	NMTR
1992	4	6	-102.61	31.86	1.70	NMTR
1992	4	7	-102.29	31.56	1.60	NMTR
1992	4	7	-102.29	31.56	2.30	NMTR
1992	4	7	-102.29	31.56	1.70	NMTR
1992	4	8	-104.86	32.41	1.60	NMTR
1992	4	30	-104.31	30.66	1.70	NMTR
1992	5	9	-104.34	30.49	1.60	NMTR
1992	5	15	-103.08	32.28	1.60	NMTR
1992	5	16	-102.34	31.75	1.70	NMTR
1992	6	14	-103.10	32.30	2.30	NMTR
1992	6	20	-102.42	31.43	1.60	NMTR
1992	6	20	-102.42	31.43	1.50	NMTR
1992	6	29	-102.47	31.42	1.40	NMTR
1992	6	29	-102.47	31.42	1.40	NMTR
1992	6	29	-102.47	31.42	2.00	NMTR
1992	7	5	-102.39	31.88	1.50	NMTR
1992	7	5	-102.39	31.88	1.30	NMTR
1992	7	21	-103.13	32.28	1.90	NMTR
1992	8	12	-102.41	31.39	1.50	NMTR
1992	8	18	-102.45	31.46	1.90	NMTR
1992	8	19	-100.92	33.11	2.20	NMTR
1992	8	26	-102.71	32.17	3.00	ANSS
1992	8	28	-100.98	32.38	1.70	NMTR
1992	9	4	-102.26	31.42	1.90	NMTR
1992	9	15	-103.02	32.16	2.20	NMTR
1992	10	8	-102.81	32.25	1.60	NMTR
1992	10	10	-102.41	31.71	1.60	NMTR

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1992	10	27	-101.93	34.12	1.30	NMTR
1992	11	22	-103.16	32.29	1.70	NMTR
1992	11	27	-102.49	31.44	1.30	NMTR
1992	12	2	-102.35	31.42	2.40	NMTR
1992	12	3	-103.74	33.66	1.90	NMTR
1992	12	5	-102.51	31.87	1.40	NMTR
1993	1	4	-105.27	31.06	1.30	NMTR
1993	1	28	-102.58	31.85	1.80	NMTR
1993	1	31	-104.64	30.60	1.50	NMTR
1993	2	11	-105.23	31.12	2.00	NMTR
1993	2	28	-102.43	31.21	1.30	NMTR
1993	2	28	-102.41	31.22	1.50	NMTR
1993	3	8	-103.33	30.87	1.60	NMTR
1993	3	21	-102.37	31.43	1.50	NMTR
1993	4	23	-102.47	31.21	1.70	NMTR
1993	5	5	-105.16	32.29	2.10	NMTR
1993	5	16	-105.06	30.44	2.20	NMTR
1993	5	17	-102.33	31.42	2.30	NMTR
1993	5	23	-102.42	31.42	1.60	NMTR
1993	5	28	-103.12	32.75	2.50	NMTR
1993	6	17	-102.56	31.80	1.70	NMTR
1993	6	23	-102.44	31.51	1.40	NMTR
1993	6	23	-102.54	31.43	2.50	NMTR
1993	6	23	-102.52	31.43	2.80	NMTR
1993	6	23	-102.52	31.43	2.10	NMTR
1993	6	23	-102.54	29.66	1.90	NMTR
1993	6	23	-102.51	31.35	2.80	ANSS
1993	6	24	-102.45	31.48	2.10	NMTR
1993	7	3	-102.43	31.44	1.50	NMTR
1993	7	3	-102.34	31.50	2.20	NMTR
1993	7	3	-102.38	31.54	1.60	NMTR
1993	8	13	-102.52	31.89	1.30	NMTR
1993	8	29	-102.91	32.35	2.50	NMTR
1993	9	5	-100.96	32.28	2.00	NMTR
1993	9	6	-100.91	32.48	1.80	NMTR
1993	9	11	-103.76	34.72	1.50	NMTR
1993	9	26	-103.52	35.08	1.50	NMTR
1993	9	30	-103.80	33.64	1.90	NMTR
1993	10	3	-103.84	33.61	1.70	NMTR
1993	11	6	-102.19	31.75	1.50	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1993	11	24	-104.74	32.34	1.30	NMTR
1993	11	25	-102.10	34.27	2.60	NMTR
1993	11	25	-104.38	30.49	1.30	NMTR
1993	12	2	-102.34	31.27	1.30	NMTR
1993	12	3	-102.23	31.68	1.60	NMTR
1993	12	10	-102.29	31.74	1.60	NMTR
1993	12	18	-103.41	30.21	1.80	NMTR
1993	12	22	-105.68	33.33	3.20	ANSS
1994	1	6	-105.09	31.95	2.40	NMTR
1994	1	7	-102.32	31.24	1.70	NMTR
1994	3	15	-103.56	30.11	2.00	NMTR
1994	4	21	-103.12	32.31	1.40	NMTR
1994	4	25	-104.62	30.60	1.90	NMTR
1994	5	23	-102.64	32.11	1.60	NMTR
1994	6	30	-102.33	31.36	1.30	NMTR
1994	8	22	-102.21	33.34	1.60	NMTR
1994	8	30	-102.32	31.38	1.40	NMTR
1994	8	30	-102.32	31.34	1.50	NMTR
1994	8	30	-102.30	31.42	1.30	NMTR
1994	9	24	-102.36	31.43	2.00	NMTR
1994	11	24	-100.80	32.39	2.70	NMTR
1995	1	1	-102.45	31.77	1.40	NMTR
1995	1	4	-102.38	31.48	1.30	NMTR
1995	2	1	-104.09	34.51	1.80	NMTR
1995	3	19	-104.21	35.00	3.30	ANSS
1995	4	14	-103.35	30.28	5.70	UTIG
1995	4	18	-102.27	31.44	1.90	NMTR
1995	4	18	-105.34	31.10	1.60	NMTR
1995	4	21	-103.35	30.30	2.90	ANSS
1995	5	11	-105.20	32.71	2.40	NMTR
1995	5	15	-102.42	31.40	1.80	NMTR
1995	5	27	-102.34	31.34	2.30	NMTR
1995	5	30	-105.21	32.71	2.10	NMTR
1995	7	11	-105.06	30.87	1.80	NMTR
1995	7	17	-104.94	31.15	1.40	NMTR
1995	8	1	-105.27	33.14	1.30	NMTR
1995	8	2	-103.36	30.31	1.80	NMTR
1995	8	12	-103.07	30.79	1.90	NMTR
1995	8	14	-102.96	30.41	1.50	NMTR
1995	10	19	-104.84	32.05	2.00	NMTR

Table 3.3-3 Earthquakes Within a 322-Kilometer (200-Mile) Radius of the NEF Site
Page 14 of 14

YEAR	MONTH	DAY	LONGITUDE	LATITUDE	MAGNITUDE	DATA SOURCE[1]
1995	10	25	-103.42	30.35	2.20	NMTR
1995	11	12	-103.35	30.30	3.60	ANSS
1995	12	3	-104.90	31.93	1.50	NMTR
1995	12	4	-104.90	31.93	1.40	NMTR
1995	12	4	-104.90	31.93	1.30	NMTR
1996	3	15	-105.69	33.59	2.90	ANSS
1998	4	15	-103.30	30.19	3.60	ANSS
1999	3	1	-104.66	32.57	2.90	ANSS
1999	3	14	-104.63	32.59	4.00	ANSS
1999	3	17	-104.67	32.58	3.50	ANSS
1999	5	30	-104.66	32.58	3.90	ANSS
1999	8	9	-104.59	32.57	2.90	ANSS
2000	2	2	-104.63	32.58	2.70	ANSS
2000	2	26	-103.61	30.24	2.80	ANSS
2001	6	2	-103.14	32.33	3.30	ANSS
2001	11	22	-102.63	31.79	3.10	ANSS
2002	9	17	-104.63	32.58	3.50	ANSS
2002	9	17	-104.63	32.58	3.30	ANSS
2003	6	21	-104.51	32.67	3.60	ANSS

[1]Data Sources:

UTIG, University of Texas Institute for Geophysics (UTIG, 2002)
NMTH, New Mexico Tech Historical Catalog (NMIMT, 2002)
ANSS, Advanced National Seismic System (USGS, 2003a)
NMTR, New Mexico Tech Regional Catalog, Exclusive of Socorro, New Mexico Events (NMIMT, 2002)

Table 3.3-4 Earthquakes of Magnitude 4.0 and Greater Within
322 Kilometers (200 Miles) of the NEF Site

No.	Year	Month	Day	Longitude	Latitude	Magnitude	Data Source[1]	Distance km (mi) to NEF Site
507	1931	8	16	-104.6000	30.7000	6.0	UTIG	237 (147)
547	1949	5	23	-105.2000	34.6000	4.5	NMTH	314 (195)
559	1977	6	7	-100.7490	33.0580	4.0	ANSS	229 (142)
562	1978	6	16	-100.7660	33.0300	5.3	ANSS	225 (140)
382	1992	1	2	-103.1863	32.3025	5.0	NMTR	16 (10)
541	1995	4	14	-103.3500	30.2800	5.7	UTIG	238 (148)
602	1999	3	14	-104.6300	32.5910	4.0	ANSS	146 (91)

[1]Data Sources:

UTIG, University of Texas Institute for Geophysics (UTIG, 2002)
NMTH, New Mexico Tech Historical Catalog (NMIMT, 2002)
ANSS, Advanced National Seismic System (USGS, 2003a)
NMTR, New Mexico Tech Regional Catalog, Exclusive of Socorro, New Mexico Events (NMIMT, 2002)

Table 3.3-5 Earthquake Data Sources for New Mexico and West Texas

Data Source	Time Span	Number of Events Within a 322-Kilometer (200-Mile) Radius
New Mexico Tech, Regional Catalog (NMIMT, 2002)	1962 - 1995	504
New Mexico Tech, Historical Catalog (NMIMT, 2002)	1869 - 1992	2
Univ. of Texas Institute of Geophysics (UTIG, 2002)	1931 - 1998	42
Advanced National Seismic System (USGS, 2003a)	1962 - 2003	64

Table 3.3-6 Modified Mercalli Intensity Scale

Intensity Value	Description
I	Not felt except by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibration like passing of truck.
IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing automobiles rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes, windows, and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster and damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown in the air.

Table 3.3-7 Comparison of Parameters for the January 2, 1992, Eunice, New Mexico Earthquake

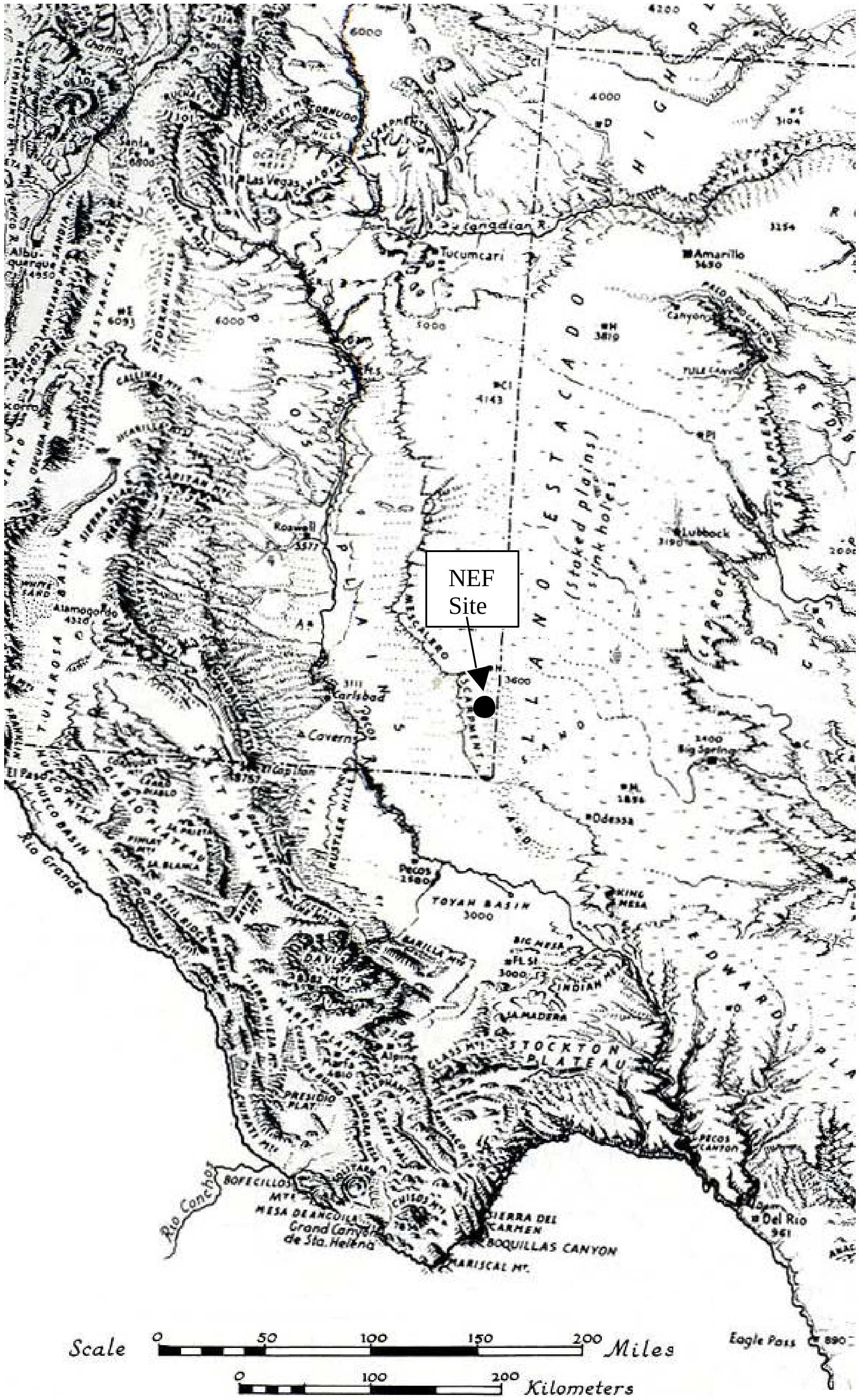
Page 1 of 1

Year	Month	Day	Longitude	Latitude	Magnitude	Data Source[1]
1992	1	2	-103.1863	32.3025	5.0	NMTR
1992	1	2	-102.97	32.36	4.6	UTIG
1992	1	2	-103.2	32.3	5.0	NMTH
1992	1	2	-103.101	32.336	5.0	ANSS

[1]Data Sources:

UTIG, University of Texas Institute for Geophysics (UTIG, 2002)
NMTH, New Mexico Tech Historical Catalog (NMIMT, 2002)
ANSS, Advanced National Seismic System (USGS, 2003a)
NMTR, New Mexico Tech Regional Catalog, Exclusive of Socorro, New Mexico Events (NMIMT, 2002)

FIGURES



REFERENCE:
(RAISZ, 1957)

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FIGURE 3.3-1
REGIONAL PHYSIOGRAPHY
ENVIRONMENTAL REPORT
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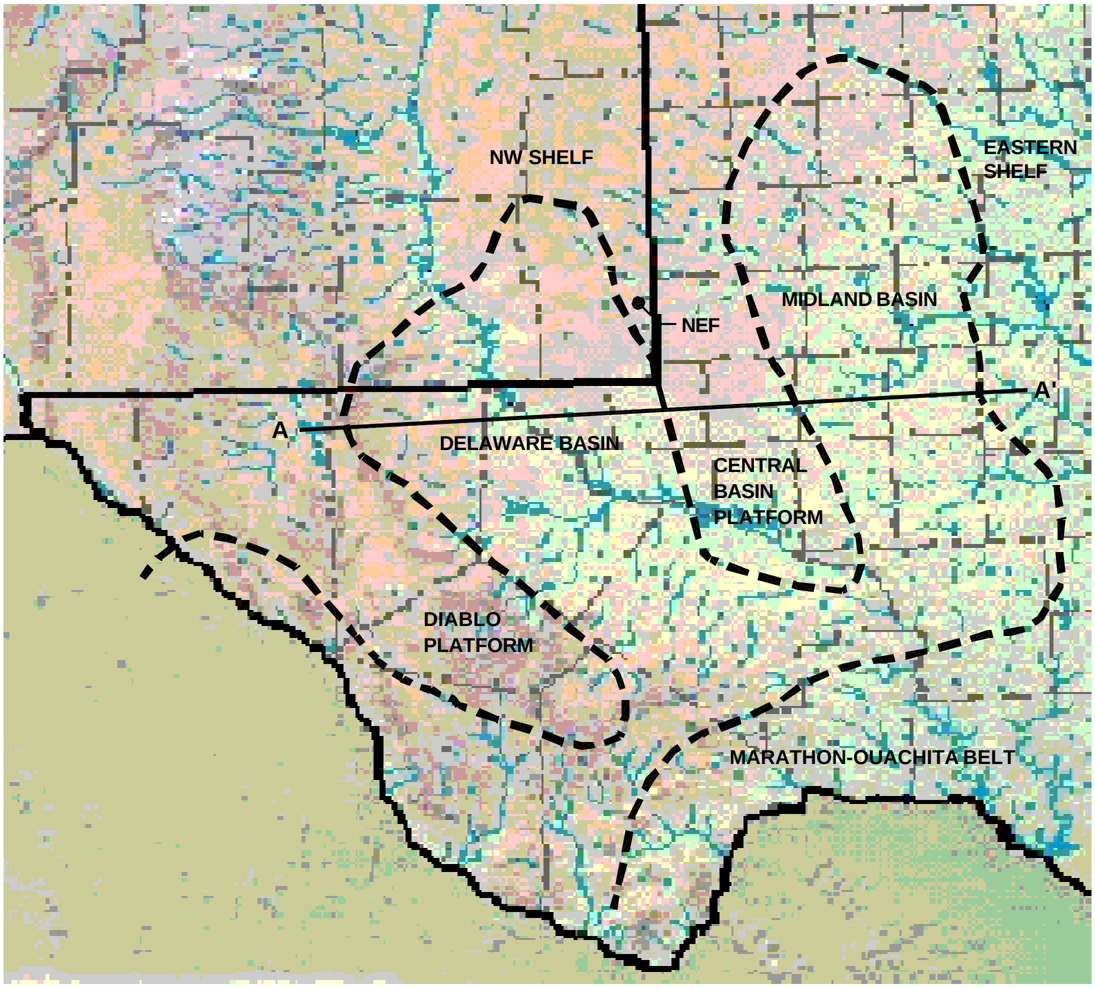
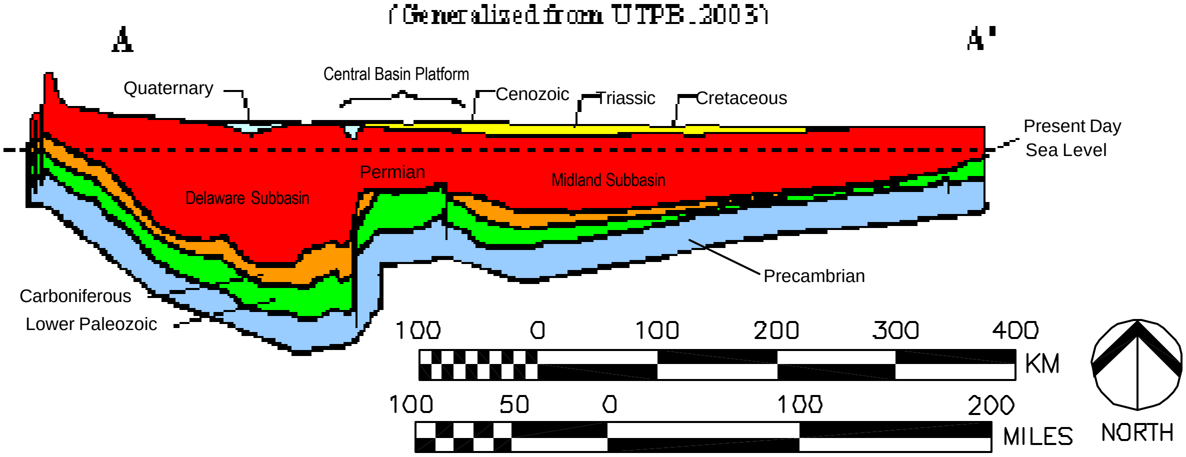


Permian Basin Geologic Profile

(Generalized from UTPB, 2003)



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Section 3.3 Figures.dwg

FIGURE 3.3-2

REGIONAL GEOLOGY OF THE PERMIAN BASIN

ENVIRONMENTAL REPORT

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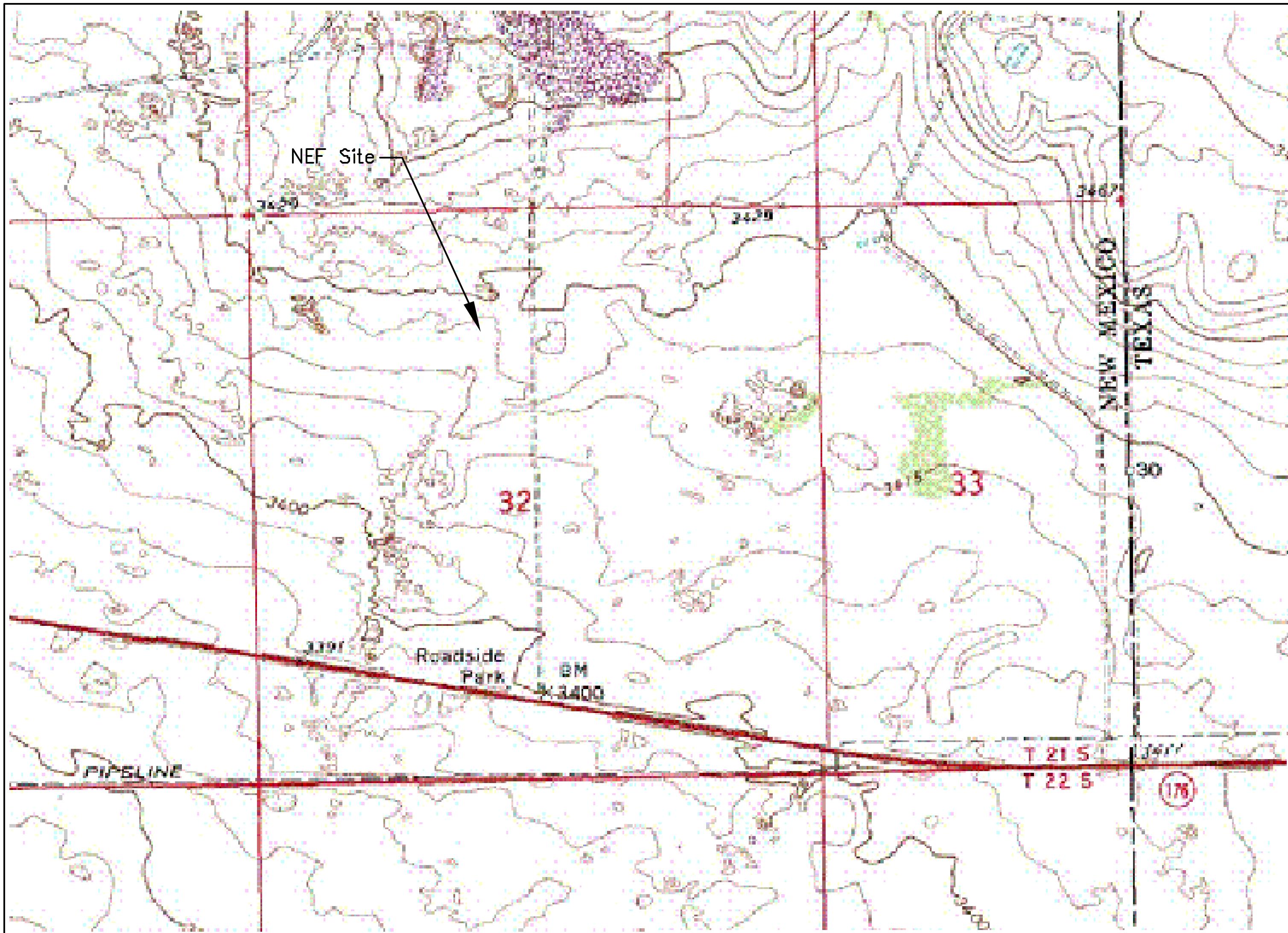

FROM USGS EUNICE NE TEX–NM TOPOGRAPHIC QUADRANGLE, PHOTO–REVISED JULY, 1979

CONTOUR INTERVAL: 5 FEET

NORTH

0.25 0 0.25 0.5 0.75 1 MILES

Modified from: http://mrdata.usgs.gov.

REFERENCE NUMBER
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FIGURE 3.3-3

SITE TOPOGRAPHY

ENVIRONMENTAL REPORT

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LEGEND

ca — CALICHE — *Partly indurated zone of calcium carbonate accumulation formed in upper layers of surficial deposits; 2 to 10 ft thick; commonly overlain by windblown sand. Much caliche shown on the map consists of tough, slabby surface layers underlain by calcium carbonate nodules that grade downward to fibers and veinlets. Especially well developed in Basin and Range and Great Plains parts of the state. Thick caliches (locally >20 ft) associated with undissected High Plains surfaces of the Great Plains commonly comprise an upper sequence of several carbonate-cemented zones interlayered with reddish loamy paleosol horizons over a basal caprock zone developed on Ogallala (To) sediments. Forms on various types of parent formations, indicated by subscripts. The extensive caliche along Rio Salado northwest of Socorro is partly a travertine deposit. Where buried by sand, the caliche is identified by subscript ca. A distinctive unit; boundaries are well defined where the caliche forms rimrock and approximate where exposed in deflation hollows. Where thick and well indurated, caliche is quarried for road metal and other aggregate, subject to minimal erosion*

al$_2$ — FLOODPLAIN AND CHANNEL DEPOSITS ALONG GENERALLY DRY ARROYOS AND WASHES — *Includes deposits along some perennial mountain streams. Extent exaggerated to emphasize drainage patterns. Sandier than* al$_1$*, gradients 5 to 15 percent. Arroyos 10 ft deep common. Surface flat where deposit was formed by stream overflowing its banks; hummocky where built of coalescing fans at mouths of tributaries that crowd the main stream against its far bank; or V-shaped where alluvium grades laterally into fan sand washed from adjoining hillsides. Ephemeral perched water tables under some deposits. Width of deposits represented has been exaggerated but total area probably about right because small deposits had to be omitted*

fs — SAND FACIES — *Sandy alluvium with subordinate amounts of fine gravel, silt, and clay. Forms at least four kinds of ground: 1) On short, steep fans sloping from the mountains of granitic or gneissic rock (e.g., parts of the Florida Mountains), this facies may form a smooth sandy layer a few feet thick covering gravel below; slopes 5 to 20 percent; washes 1 to 10 ft deep may expose underlying gravel. 2) On other short fans, sand facies may form arcuate belt at toe of fan with slopes averaging 10 percent, commonly reworked into coppice dunes 3 to 7 ft high* (sm)*. 3) Other belts of smooth sandy ground commonly slope 5 percent or less and consist of sand mounds approximately 1 ft high over caliche* (fs$_2$)*. 4) Gypsiferous sand* (fs$_3$)*, especially in the Jornada del Muerto, Tularosa Valley and east side of the Pecos Valley. Sand facies absent on the broad Las Palomas surface. Thin fan sand covering pediments is denoted by* fs *over subscript that identifies underlying formation. Boundary with residual sand, fan gravel, and fan silt is approximate*

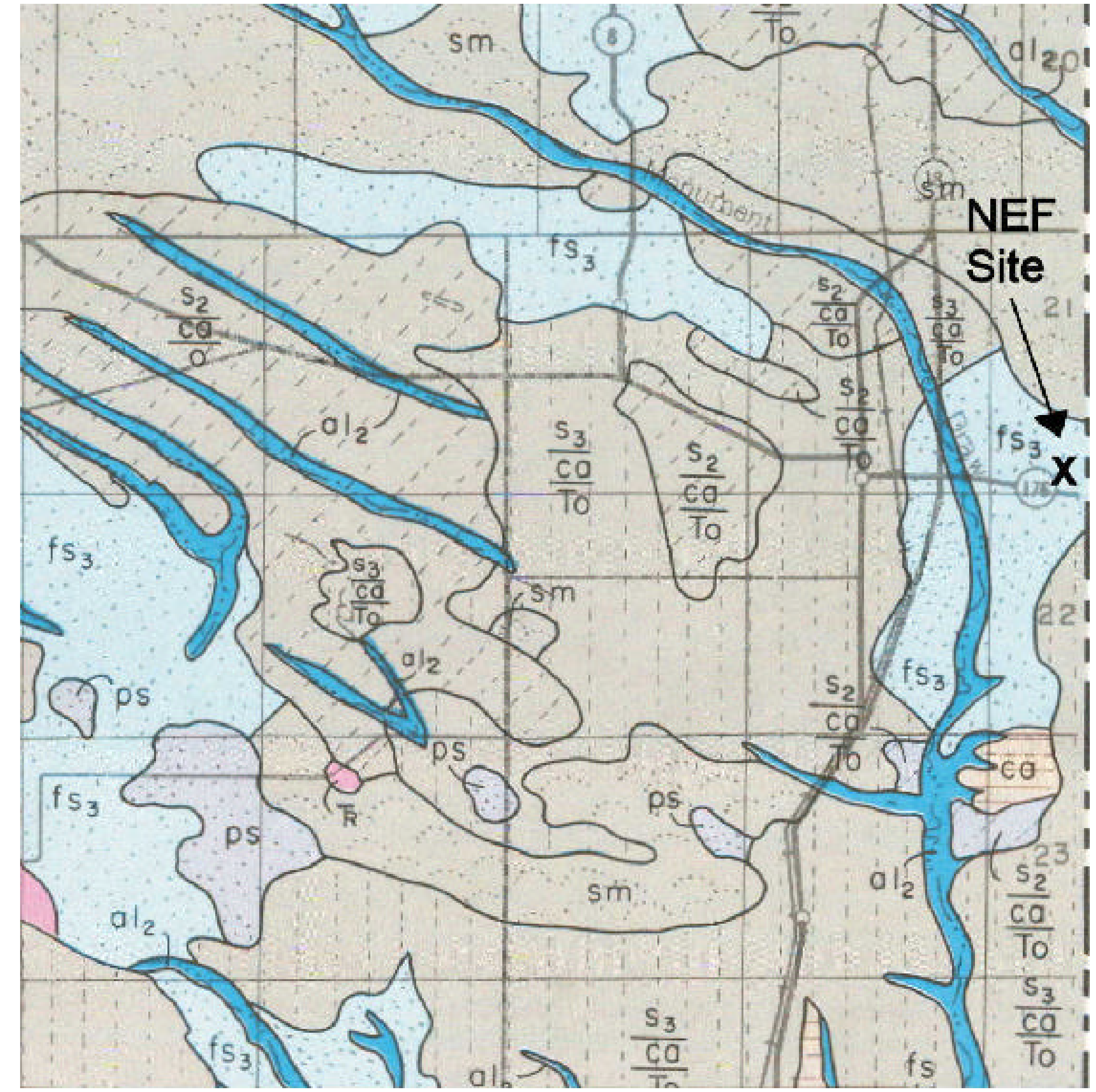
s$_2$/ca/To — MODERATELY THICK SAND ON CALICHE ON OGALLALA FORMATION — *Sand 1 to 3 ft thick. Surface layers noncalcareous over reddish loam. Local sand mounds. Ground favored for farming. Boundaries approximate*

s$_3$/ca/To — THICK SAND ON CALICHE ON OGALLALA FORMATION — *Sand 3 to 5 ft thick. Local mounds. Brownish-red, fine sandy loam over reddish-brown, sandy clay loam; noncalcareous to depths of 3 ft; calcareous subsoil contains filaments of lime carbonate. Where farmed, ground is subject to wind erosion. Boundaries approximate*

sm — LOOSE SAND IN MOUNDS — *Coppice dunes, commonly 3 to 7 ft high and 25 to 50 ft in diameter; generally elongated north of east but a local exception lies east of Columbus where elongation is south of east. Age is Holocene. Boundaries fairly accurate*

ps — SANDY LAKE OR PLAYA DEPOSITS — *Gypsiferous deposits labeled* ps$_2$

₨ — OTHER BEDROCK — *Colluvium or other cover amounts to less than half the area. Only extensive areas are shown; age and rock type keyed by symbol to State geologic map (e.g.,* Kd*, Cretaceous Dakota Sandstone,* ₨s*, Triassic Santa Rosa Sandstone). Many small areas omitted; indicated boundaries are approximate.* ₨ – *Triassic, undifferentiated*



REFERENCE: (NMIMT, 1977)

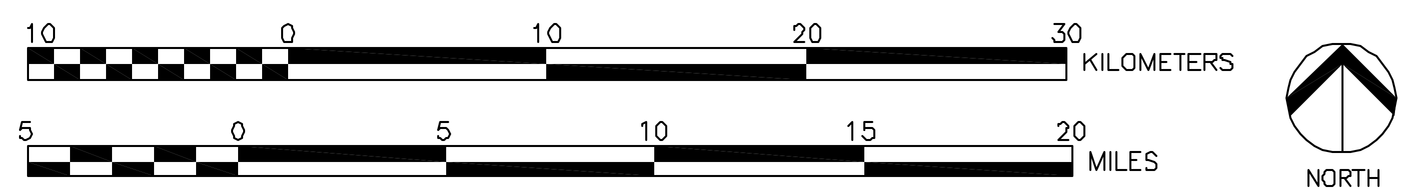


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Figure 3.3-4.dwg

FIGURE 3.3-4
SURFICIAL GEOLOGIC MAP
OF THE NEF SITE AREA
ENVIRONMENTAL REPORT

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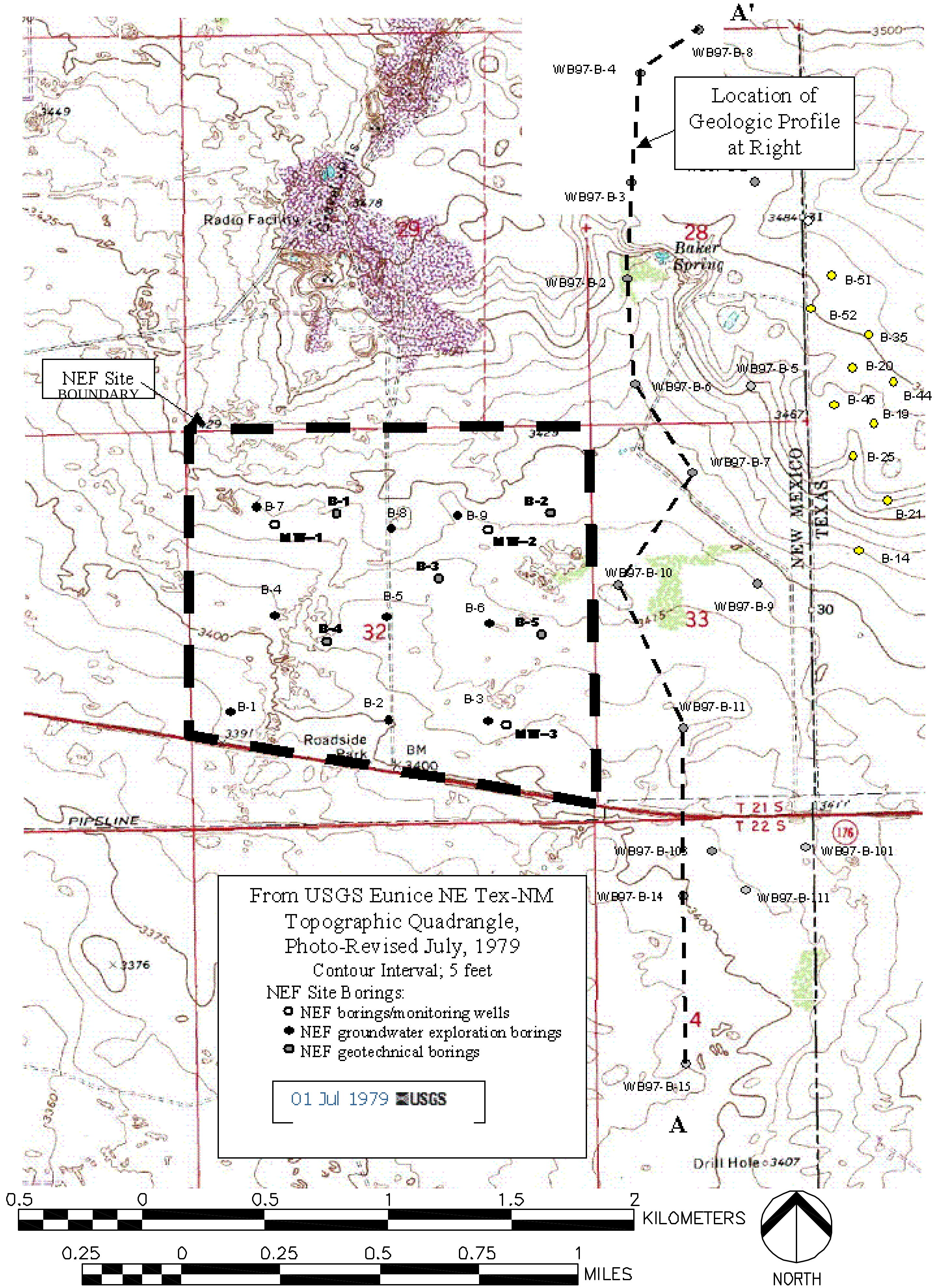

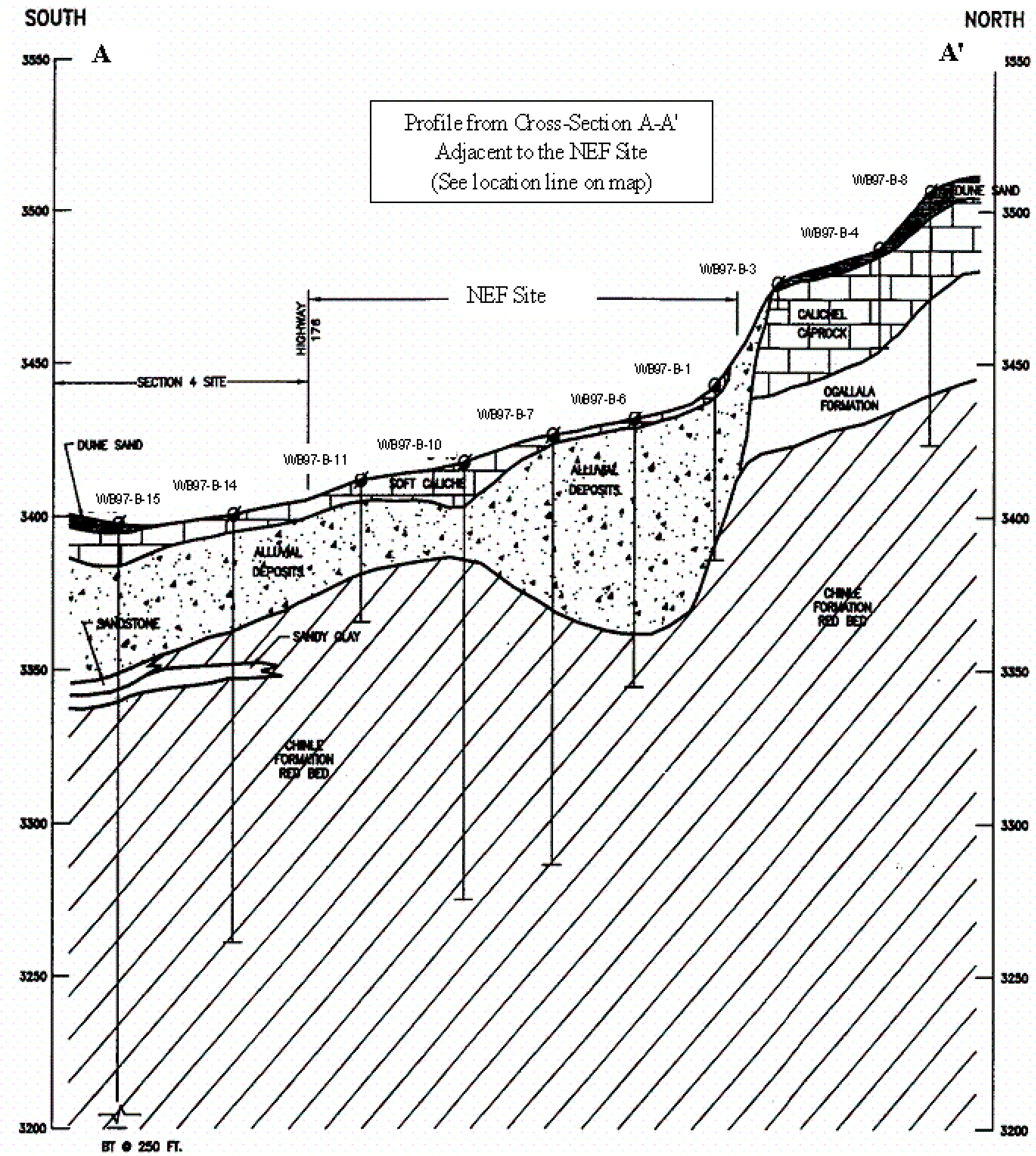

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Figure 3.3-5.dwg

FIGURE 3.3-5
SITE BORING PLAN AND PROFILE
ENVIRONMENTAL REPORT
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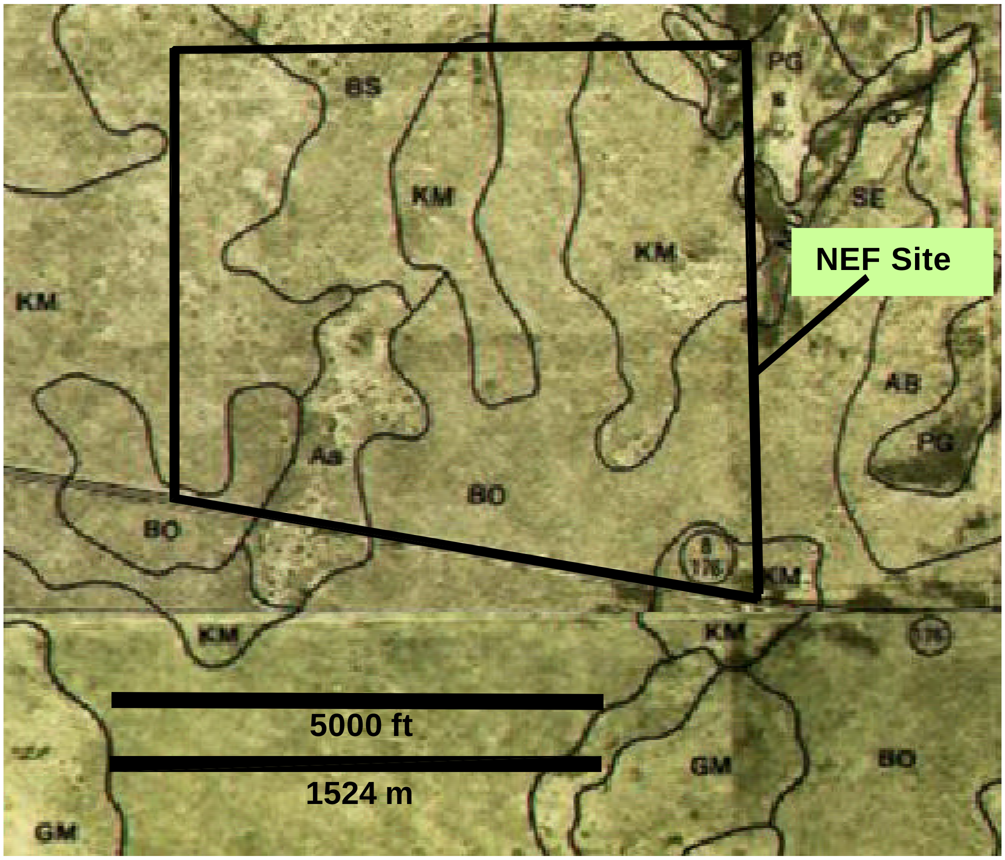

USDA SOIL DESIGNATION	SOIL NAME/DESCRIPTION	UNIFIED SOIL CLASSIFICATION DESIGNATION(S)
Aa	ACTIVE (SAND) DUNE LAND.	SP
BO	BROWNFIELD-SPRINGER ASSOCIATION: MOSTLY FINE SAND WITH LOAM FINE SAND; LEVEL TO UNDULATING TOPOGRAPHY; MODERATELY RAPID PERMEABLILITY AND SLOW RUNOFF.	SM
BS	BROWNFIELD-SPRINGER ASSOCIATION: MOSTLY FINE SAND WITH LOAM FINE SAND; DUNES AND HUMMOCKS FOR CONCAVE AND CONVEX ROLLING TERRAIN; DRAINAGE SIMILAR TO BO.	SM
KM	KERMIT SOILS AND DUNE LAND: EXCESSIVELY-DRAINED NON-CALCAREOUS SOILS; HUMMOCKY AND UNDULATING TOPOGRAPHY DUE TO EOLIAN PROCESSES.	SP-SM OR SM
MU	MIXED ALLUVIAL LANDS: UNCONSOLIDATED, STRATIFIED ALLUVIUM WITH VARIED TEXTURES OCCURRING INTERMITTENTLY IN DRAINAGE-WAYS A FEW FEET IN THICKNESS; MODERATE TO RAPID PERMEABILITY WITH SLOW RUNOFF.	VARIABLE
PG	PORTALES AND GOMEZ FINE SANDY LOAMS: LIGHT CLAY LOAM, WELL-DRAINED.	VARIABLE

SOURCE: (USDA, 1974)

NORTH

REFERENCE NUMBER
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FIGURE 3.3-6
SITE SOILS MAP PER USDA DATA

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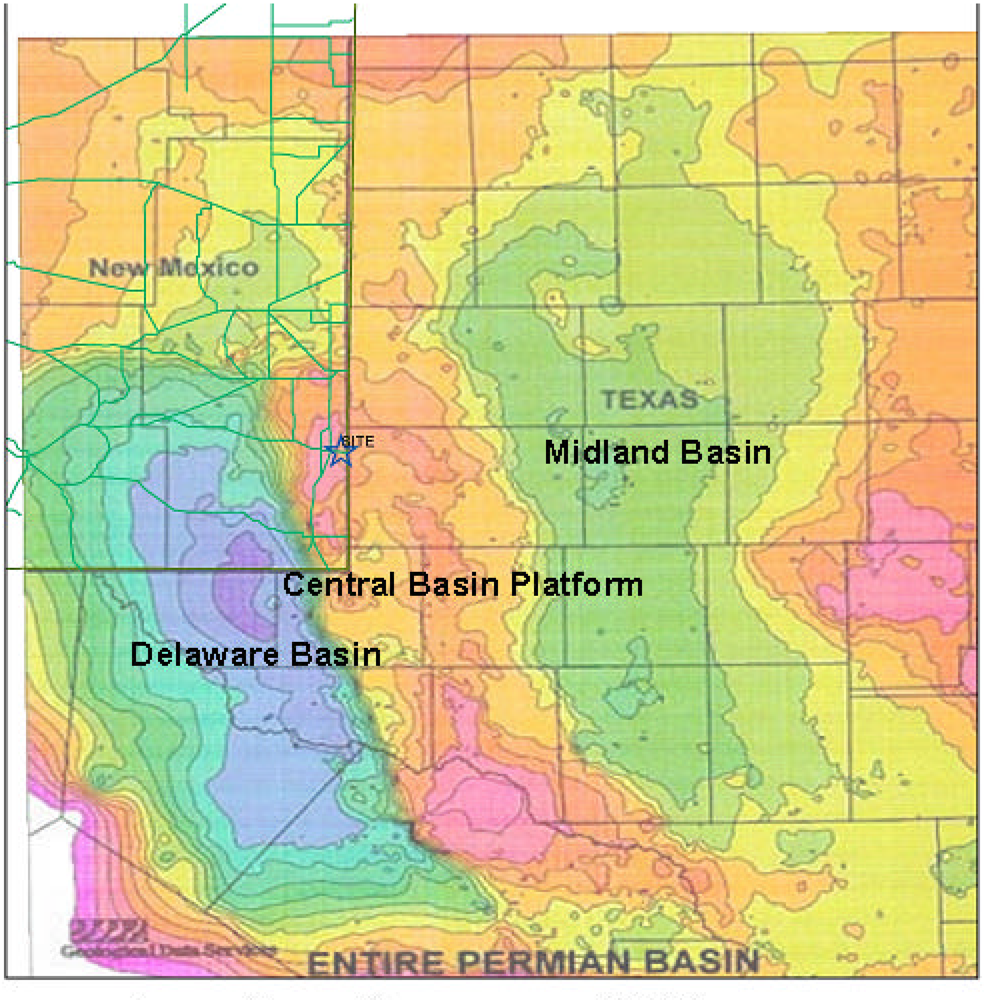

LEGEND

☆ NEF SITE

REFERENCE: (TALLEY, 1997)

NORTH

60 0 60 120 180 KM

30 0 30 60 90 120 MILES

REFERENCE NUMBER
Section 3.3 Figures.dwg

FIGURE 3.3-7

TECTONIC SUBDIVISIONS OF THE PERMIAN BASIN
ENVIRONMENTAL REPORT

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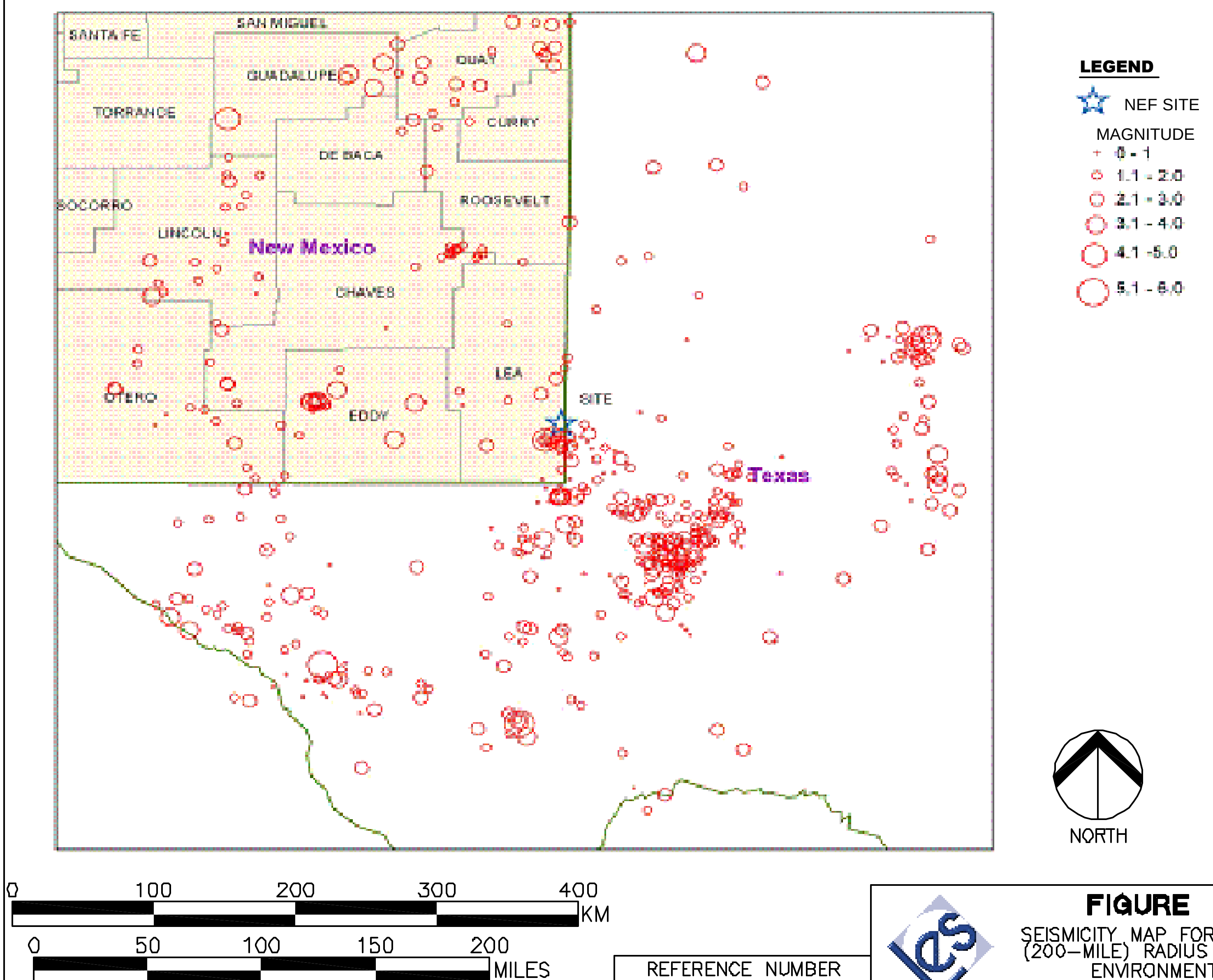
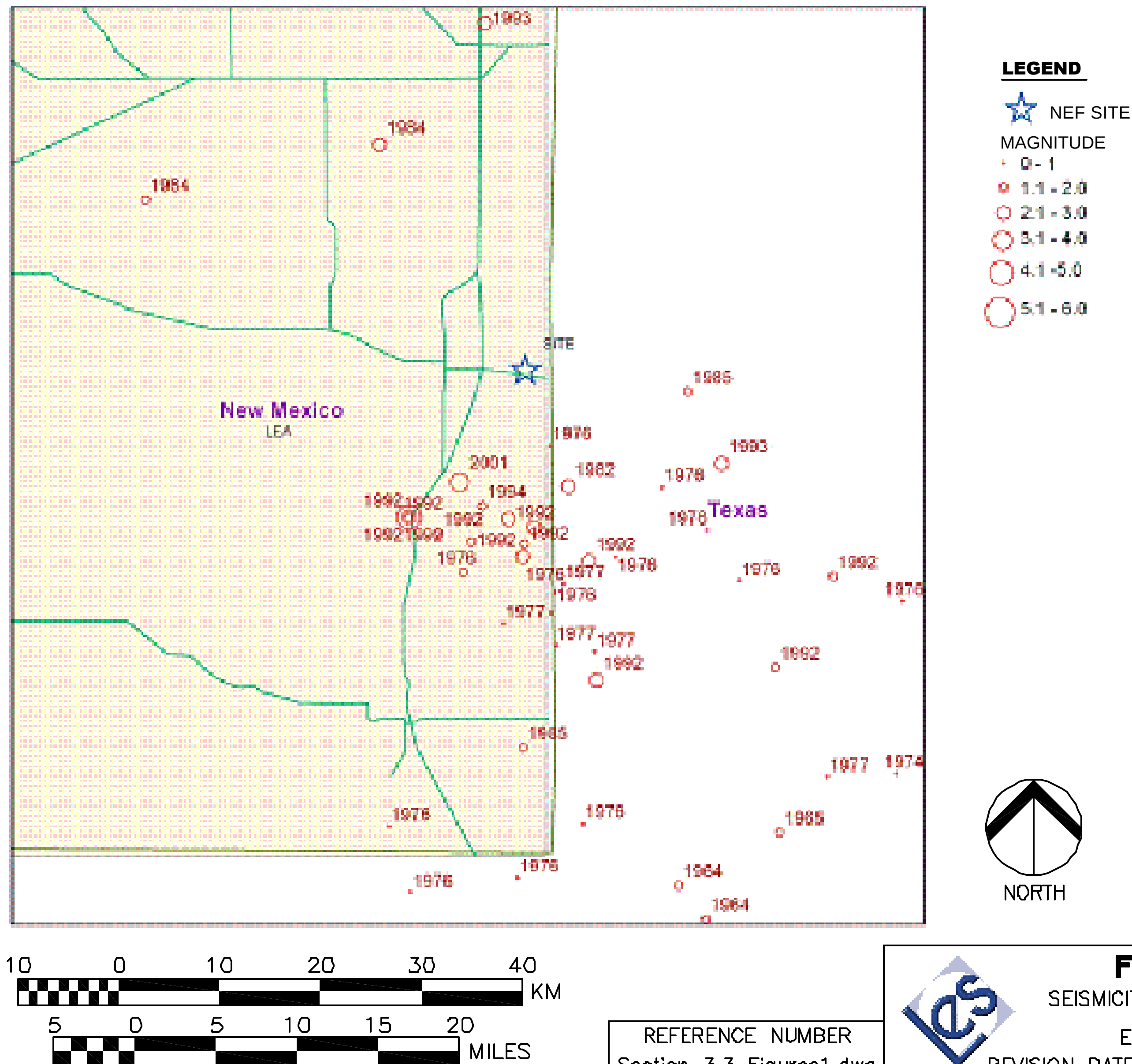


REFERENCE NUMBER
Section 3.3 Figures.dwg

FIGURE 3.3-8

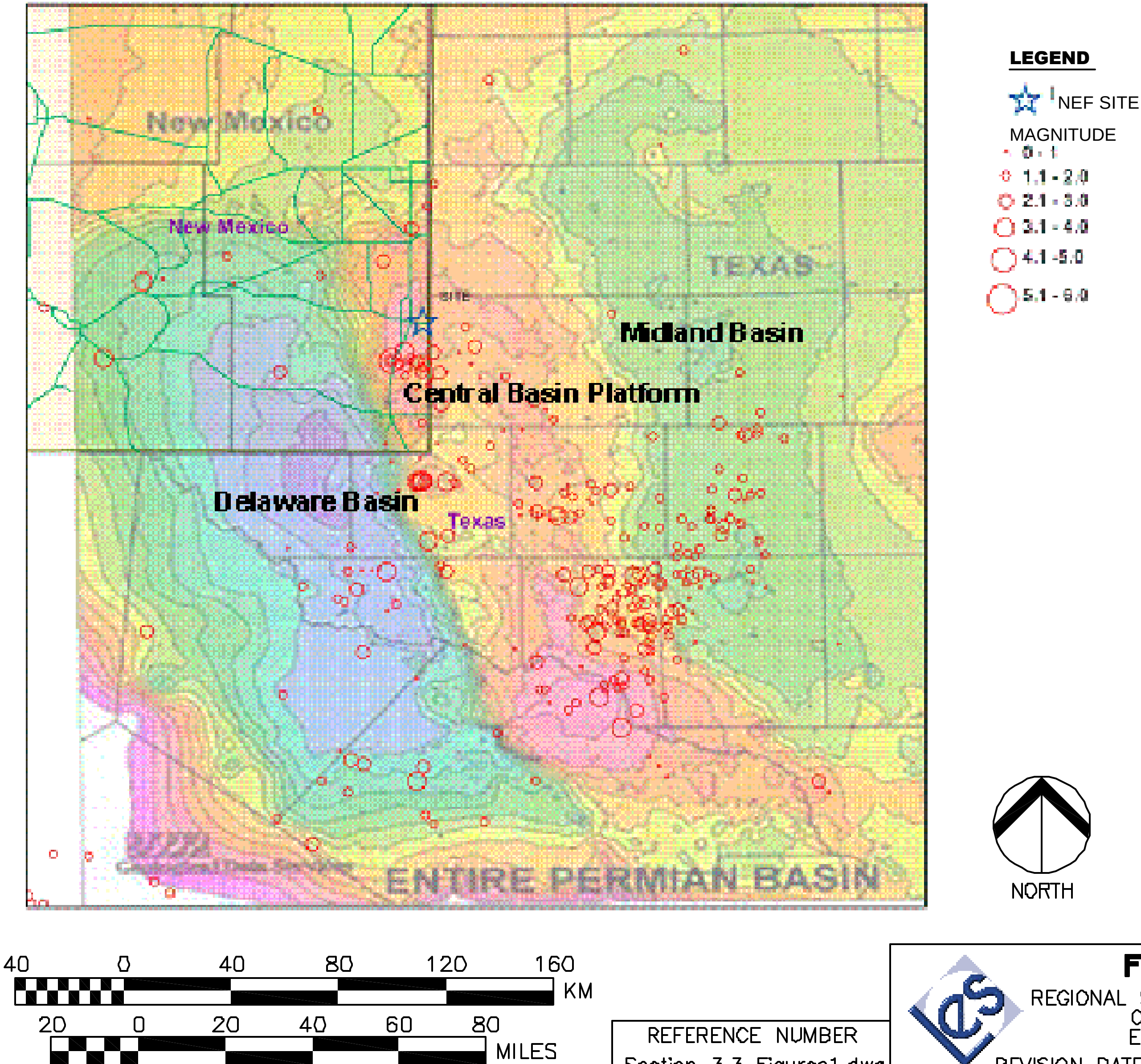
SEISMICITY MAP FOR 322-KILOMETERS (200-MILE) RADIUS OF THE NEF SITE
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003



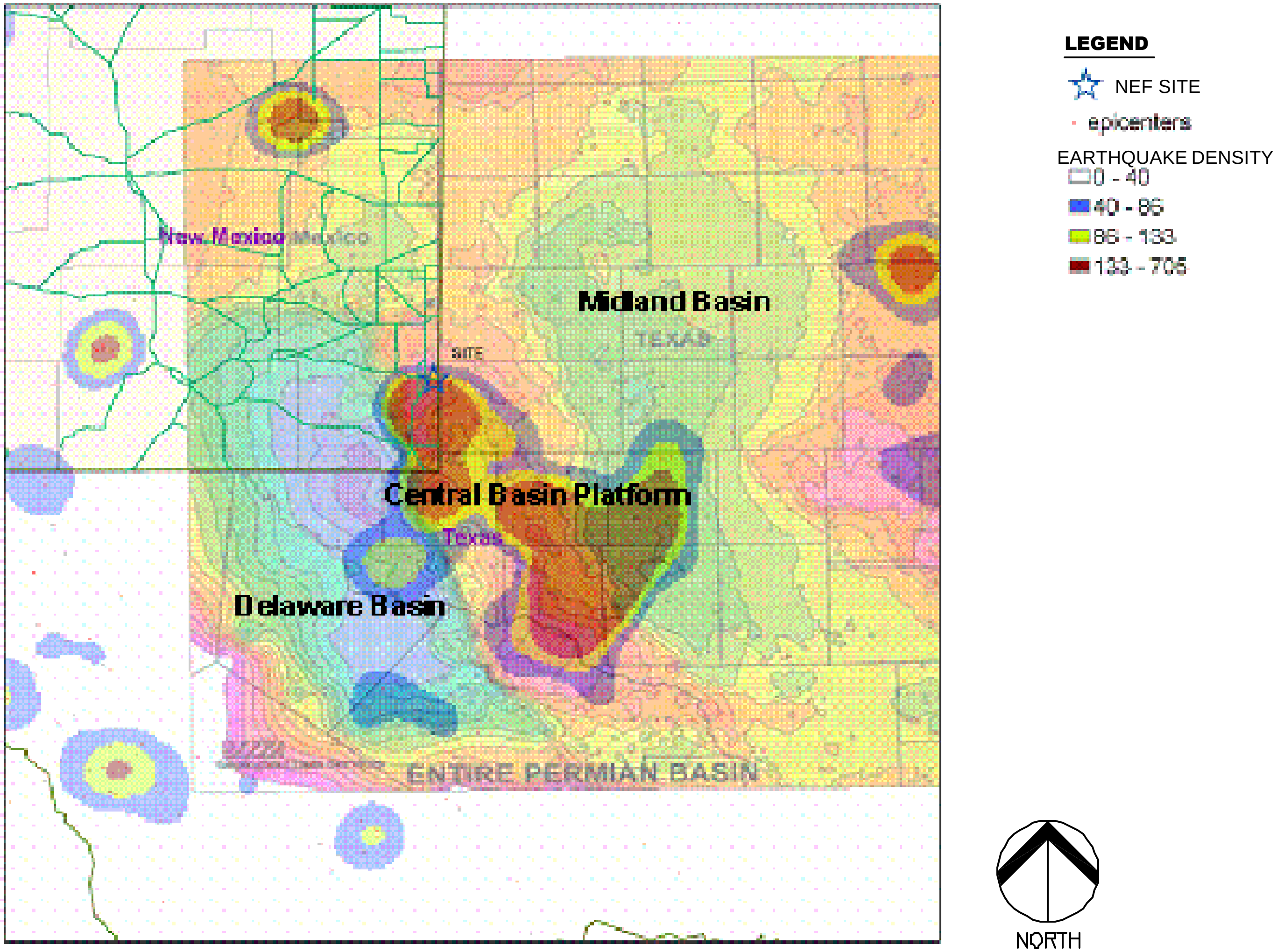
REFERENCE NUMBER
Section 3.3 Figures1.dwg

FIGURE 3.3-9
SEISMICITY IN THE IMMEDIATE VICINITY
OF THE NEF SITE
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



REFERENCE NUMBER
Section 3.3 Figures1.dwg

FIGURE 3.3-10
REGIONAL SEISMICITY AND TECTONIC ELEMENTS OF THE PERMIAN BASIN
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



REFERENCE NUMBER
Section 3.3 Figures1.dwg

FIGURE 3.3-11
EARTHQUAKE FREQUENCY CONTOURS AND TECTONIC ELEMENTS OF THE PERMIAN BASIN
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3.4 WATER RESOURCES

This section describes the National Enrichment Facility (NEF) site's surface water and groundwater resources. Data are provided for the NEF site and its general area, and the regional associations of those natural water systems are described. This information provides the basis for evaluation of any potential facility impacts on surface water, groundwaters, aquifiers, water use and water quality. Subsections address surface hydrology, water quality, pre-existing environmental conditions, water rights and resources, water use, contamination sources, and groundwater characteristics.

The information included in this section was largely obtained from prior site studies including extensive subsurface investigations for a nearby facility, Waste Control Specialists (WCS) located about 1.6 km (1 mi) to the east of the NEF site. In addition, literature searches were conducted to obtain additional reference material. Some of the WCS data has been collected on Section 33 located immediately east of the NEF site. These data are being supplemented by a groundwater exploration and sampling program on Section 32 initiated by LES in September 2003.

The NEF will make no use of either surface water or groundwater from the site. The collection and storage of runoff from specific site areas will be controlled. No significant adverse changes are expected in site hydrology as a result of construction or operation of the NEF. ER Section 4.4.7, Control of Impacts to Water Quality, addresses potential for impacts onsite water resources as a result of activities on the NEF site including runoff and infiltration changes due to plant construction and fill placement.

3.4.1 Surface Hydrology

The NEF site itself contains no surface water bodies or surface drainage features. Essentially all the precipitation that occurs at the site is subject to infiltration and/or evapotranspiration. More information on the movement and fate of surface water and groundwater at the site is provided in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems. Regional and local hydrologic features are shown on Figure 3.4-1, Local Hydrologic Features and Figure 3.4-2, Regional Hydrologic Features, respectively. These features are discussed in the following sections. These features include Baker Spring, Monument Draw and several ponds on the adjacent Wallach Concrete, Inc. property. There are also several intermittent surface features in the vicinity of the NEF site that may collect water for short periods of times following heavy rainfall events.

3.4.1.1 Major Surface and Subsurface Hydrological Systems

The climate in southeast New Mexico is semi-arid. Precipitation in the NEF area averages only 33 to 38 cm/yr (13 to 15 in/yr). Evaporation and transpiration rates are high. This results in minimal, if any, surface water occurrence or groundwater recharge.

The NEF site contains no surface drainage features. The site topography is relatively flat, with the average slope only 0.0064 m/m (0.0064 ft/ft). Some localized depressions exist, due to eolian processes, but the size of these features is too small to be of significance with respect to surface water collection.

Most precipitation is contained onsite due to infiltration and/or evapotranspiration. The vegetation on the site is primarily shrubs and native grasses. The surface soils are

predominantly of an alluvial or eolian origin. The texture of the surface soils is generally silt to silty sands. Therefore, the surface soils are relatively low in permeability, and would tend to hold moisture in storage rather than allow rapid infiltration to depth. Water held in storage in the soil is subsequently subject to evapotranspiration. Nine subsurface borings were drilled at the site during September 2003, all of which produced cuttings at residual moisture contents from land surface to 10 to 15 m (33 to 49 ft) deep. Evapotranspiration processes are significant enough to short-circuit any potential groundwater recharge.

There is some evidence for shallow (near-surface groundwater occurrence in areas to the north and east of the site. These conditions are intermittent and limited. A quarry operated by Wallach Concrete, Inc. is located just north of the NEF site. Wallach has extensively mined sand and gravel from the quarry. The typical geologic cross section at that site consists of a layer of caliche at the surface, referred to as the "caprock," underlain by a sand and gravel deposit, which in turn overlies a thick clay unit of the Dockum Group, referred to as red beds, and part of the Chinle Formation. Table 3.3-1, Geological Units Exposed At, Near, or Underlying the Site and Figure 3.3-5, Site Boring Plan and Profile depict this stratigraphy. Figure 3.4-3, View of a Pit Wall in a Wallach Sand & Gravel Excavation to the North of the NEF Site, shows a pit wall in one of Wallach's excavations, where the caprock (caliche) overlies sand and gravel, with the red bed clay Chinle Formation at the base of the pit. In some areas the caprock is missing and the sand and gravel is exposed at the surface. The caprock is generally fractured and, following precipitation events may allow infiltration that quickly bypasses any roots from surface vegetation. In addition, the areas where the sand and gravel outcrop may allow rapid infiltration of precipitation. These conditions have led to instances of minor amounts of perched groundwater at the base of the sand and gravel unit, atop the red bed Chinle Formation. The Chinle red bed clay has a very low permeability, about 1x 10^{-8} cm/s (4 x 10^{-9} in/s) (Rainwater, 1996), and serves as a confining unit arresting downward percolation of localized recharge.

Figure 3.4-4, Groundwater Seep at the Base of a Wallach Sand & Gravel Excavation to the North of the NEF Site, shows a shallow surface depression filled with water in the base of one of Wallach's gravel pits. The water is present perennially due to a seep at the base of the sand and gravel unit at the top of the Chinle clay. Occasionally the water is pumped out of this depression for use on site. The rate of replenishment has not been quantified, but it is relatively slow. The amount of water in the pit is insufficient to fully supply the quarry operations. This shallow perched zone is not likely to be pervasive throughout the area; not all of Wallach's excavations encounter this horizon. It is not considered to be an aquifer.

Conditions at the NEF site are different than at the Wallach site. Two conditions are of particular importance. First, the caprock is not present at the NEF site. Therefore, rapid infiltration through fractured caliche does not contribute to localized recharge at the NEF site. Second, the surface soils at the NEF site are finer-grained than the sand and gravel at the Wallach site. There is a thin layer of sand and gravel just above the red bed Chinle clay unit on the NEF site, but based on recent investigations, it is not saturated. Further, that horizon at the NEF site is at a residual saturation level based on information from the nine recent soil borings.

Another instance of saturation above the Chinle clay may be seen at Baker Spring, just to the northeast of the NEF site. Baker Spring is located at the edge of an escarpment, where the caprock ends. The location of the spring is shown on Figure 3.4-1, Local Hydrologic Features. A photograph of the spring is provided in Figure 3.4-5, View of Baker Spring Area to the Northeast of the NEF Site. The surface water feature is intermittent. Water typically flows into

Baker Spring after precipitation events. There may be some water seeping from the sand and gravel unit beneath the caprock into Baker Spring. The area where Baker Spring is located is underlain by the Chinle clay. Deep infiltration of water is impeded by the low permeability of the clay. Therefore, seepage and/or precipitation/runoff into the Baker Spring area appear to be responsible for the intermittent localized flow and ponding of water in this area. Flows from this feature are intermittent, unlike those supplying the Wallach's pits. This condition does not exist at the NEF site due to the absence of the caprock and the low permeability surface soils.

A pedestrian survey, personal interviews, and a search of historical aerial photographs were used to investigate the origin of the area identified as Baker Spring on USGS topographic maps.

During the pedestrian survey, a surface engineering control or diversion berm, was identified just north of Baker Spring and it is believed that the berm had been constructed to divert surface water from the north and cause it to flow to the east of the Baker Spring area. Stockpiles of the overburdened slit and very fine sand material, which are typically not suitable for sand or gravel use were identified in the area south of Baker Spring. In addition, the area around Baker Spring is littered with debris such as thick cable and scrap metal components that appear to be parts of excavation equipment. The Baker Spring area appears to have been excavated to the top of the redbed through the removal of the overlying sand and gravel reserves. The area is at a lower elevation than the natural drainage features that flow from the northwest and the northeast, and merge in the area of Baker Spring and formerly ran to the south. Both of these drainage features now allow surface water to flow into Baker Spring. Ground surface at Baker Spring is several feet below the outlet that would otherwise flow to the south. Therefore, the results of past quarrying activities allow surface water that formerly flowed through the natural drainage features to be diverted and now pond in Baker Spring.

Based on personal interviews, it appears that mining operations of the sand and gravel materials above the redbed began in the 1940s and continued into the 1950s. An aerial photograph from 1949 shows what appears to be a clean fresh face of the excavation. In the area of the excavation, a network of roads are visible in the aerial, including a main road which leads south towards New Mexico Highway 234. Based on enlargements of the aerial, the quarry floor appears to have regularly shaped excavation patterns on the top of the redbed material.

Based on the investigation of the Baker Spring area, it is concluded that the feature is man-made and results from the historical excavation of gravel and caprock materials that are present above the redbed clay. As a result of the excavation, Baker Spring is topographically lower than the surrounding area. Following rainfall events, ponding on the excavation floor occurs. Because the excavation floor consists of very low permeability clay of the redbed, limited vertical migration of the ponded water occurs. Shading from the high wall and trees that have flourished in the excavated area retard the natural evaporation rates and water stands in the pond for sometime. It is also suspected that during periods of ponding, surface water infiltrates into the sands at the base of the excavated wall and is retained as bank storage. As the surface water level declines, the bank storage is discharged back to the excavation floor.

A third instance of localized shallow groundwater occurrence exists to the east of the NEF site where several windmills on the WCS property were used to supply water for stock tanks; they are no longer in use. These windmills tap small saturated lenses above the Chinle Formation red beds. The amount of groundwater in these zones is limited. The source of recharge for these localized perched zones is likely to be "buffalo wallows," (playas) depressions located near the windmills. The buffalo wallows are substantial surface depressions that collect surface

water runoff. Water collecting in these depressions is inferred to infiltrate below the root zone due to the ponding conditions. WCS has drilled monitoring wells in these areas to characterize the nature and extent of the saturated conditions. Some of these wells are dry, owing to the localized nature of the perched conditions. When water is encountered in the sand and gravel above the Chinle Formation red beds its level is slow to recover following sampling events, due to the low permeability of the perched saturated zones. The discontinuity of this saturated zone and its low permeability argue against its definition an aquifer. No buffalo wallows or related groundwater conditions occur on or near the NEF site.

The NEF is located in an area with little to no surface water or runoff. Monument Draw is an intermittent stream and the closest surface water conveyance feature. Flow data are presented in ER Section 3.4.12.9, Design-Basis Flood Elevation.

Walvoord et al,. 2002 (Walvoord, 2002) best describes the hydrologic conditions that occur in the shallow surface regime at the NEF site. This reference uses field investigations including geochemical and soil-physics based techniques, as well as computer modeling, to show that there is no recharge occurring in thick, desert vadose zones with desert vegetation. Precipitation that infiltrates into the subsurface is efficiently transpired by the native vegetation. Vapor-phase movement of soil-moisture may occur, but it is also intercepted by the vegetation. In a thick vadose zone, such as at the NEF site, the deeper part of that zone has a natural thermal gradient that induces upward vapor diffusion. As a result, a small flux of water vapor rises from depth to the base of the root zone, and any infiltration coming from the land surface is captured by the roots of the plants within the top several meters (feet) of the profile. Effectively there is a maximum negative pressure potential at the base of the root zone that acts like a sink, where water is taken up by the plants and transpired. These deep desert soil systems have functioned in this manner for thousands of years, essentially since the time of the last glacial period when precipitation rates fell dramatically. It is expected that these conditions will remain for several thousand more years (until the next glacial period), unless the hydrology and vegetation is altered dramatically.

3.4.1.1.1 Site Groundwater Investigations

A subsurface investigation was initiated at the NEF site in September 2003 to delineate specific hydrologic conditions. Figure 3.3-5, Site Boring Plan and Profile and Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour, show the locations of subsurface borings and monitoring wells.

The WCS facility is located directly to the east of the NEF site in Texas. It has had numerous subsurface investigations performed for the purpose of delineating and monitoring site subsurface hydrogeologic conditions. Much of this information is directly pertinent to the NEF site. The WCS hydrogeologic data was used in planning the recent NEF site investigations. A recent evaluation of potential groundwater impacts in the area provides a good overview of the investigations performed for the WCS facility (Rainwater, 1996).

The NEF site investigation initiated in September 2003 had two main objectives: 1) delineate the depth to the top of the Chinle Formation red beds to assess the potential for saturated conditions above the red beds, and 2) complete three monitoring wells in the siltstone layer beneath the red beds to monitor water level and water quality within this thin horizon of perched intermittent saturation.

Nine boreholes oriented on a three-by-three grid were drilled to the top of the Chinle red beds (Figure 3.4-6). Well depths ranged up to approximately 76 m (250 ft) below the ground surface. Left open for at least a day, no groundwater was observed to enter any of these holes. Cuttings from the boreholes all appeared to be dry or at residual saturation. No elevated moisture contents were observed. No samples could be collected for water quality analysis at the time of well construction. One groundwater sample has since been collected due to limited water occurrence, as discussed in ER Section 3.4.15.6, Interactions Among Different Aquifers.

The land surface elevation was surveyed at each of the nine borehole locations and the elevation of the top of the red beds was computed. This information was combined with similar information from the WCS facility to produce an elevation map of the top of the red beds (see Figure 3.4-6). The dry nature of the soils from each of these borings supports a conclusion that there is no recharge from the ground surface at the site (Walvoord, 2002).

The three monitoring wells were installed at the end of September 2003 (Figures 3.3-5 and 3.4-6). Through the first month of monitoring only one well, MW-2, located at the northeast corner of the site, produced water. Several water samples have been taken from that well. It is anticipated that the other two wells may provide water over lengthy time periods, based on information from the WCS site. Groundwater quality is discussed in ER Section 3.4.2, Water Quality Characteristics.

Another factor to consider relative to hydrologic conditions at the NEF site is the presence of the Triassic Chinle Formation red bed clay. This clay unit is approximately 46 to 61 m (150 to 200 ft) thick beneath the site. With an estimated hydraulic conductivity on the order of $2x10^{-8}$ cm/s ($7.9x10^{-9}$ in/s), the unit is very tight (Table 3.3-2, Measured Permeabilities on the NEF Site). This permeability is of the same order prescribed for engineered landfill liner materials. One would expect vertical travel times through this clay unit to be on the order of thousands of years, based on this permeability and the thickness of the unit.

The first presence of saturated porous media beneath the site appears to be at the base of the Chinle red bed clay where there exists a low-permeability silty sandstone or siltstone. Borings and monitor wells at the WCS facility directly to the east of the NEF site have encountered this zone approximately 61 to 91 m (200 to 300 ft) below land surface. Wells completed in this unit are very slow to produce water. This makes sampling quite difficult. It is arguable whether this zone constitutes an aquifer, given the low permeability of the unit. As discussed above, three monitoring wells were installed on the NEF site in September 2003 with screened intervals within this siltstone unit. These wells are approximately 61 to 76 m (200 to 250 ft) deep.

The first occurrence of a well-defined aquifer is approximately 244 m (800 ft) below land surface, within the Santa Rosa formation. Because of the depth below land surface to this unit, and the fact that the thick Chinle clay unit would limit any potential migration to depth, this aquifer has not been investigated. No impacts are expected to the Santa Rosa aquifer.

Figure 3.4-7, Water and Oil Wells in the Vicinity of the NEF Site, is a map of wells and surface water features in the vicinity of the NEF plant site. The figure also includes oil wells. No water wells are located within 1.6 km (1 mi) of the site boundary.

3.4.1.2 Facility Withdrawals and/or Discharges to Hydrologic Systems

The NEF plant will receive its water supply from one or more municipal water systems and thus no water will be drawn from either surface water or groundwater sources at the NEF site.

Supply of nearby groundwater users will thus not be affected by operation of the NEF. NEF water supply requirements are discussed in ER Section 4.4, Water Resources Impact.

The NEF design precludes operational process discharges from the plant to surface or groundwater at the site other than into engineered basins. Discharge of routine plant liquid effluents will be to the Treated Effluent Evaporative Basin on the site. The Treated Effluent Evaporative Basin is utilized for the collection and containment of waste water discharge from the Liquid Effluent Collection and Treatment System. The ultimate disposal of waste water will be through evaporation of water and impoundment of the residual dry solids byproduct of evaporation. Total annual discharge to that basin will be approximately 2,535 m^3 per year (669,844 gal/yr). The location of the basin is shown in Figure 4.12-2, Site Layout for NEF. Evaporation will provide the only means of liquid disposal from this basin. The Treated Effluent Evaporative Basin will include a double membrane liner and a leak detection system. A summary of liquid wastes volumes accumulated at the NEF is provided in Table 3.4-1, Summary of Potentially Contaminated Liquid Wastes for the NEF. Of the wastes listed in Table 3.4-1, only uncontaminated liquid wastes are released to the Treated Effluent Evaporative Basin for evaporation without treatment. Contaminated liquid waste is neutralized and treated for removal of uranium, as required. Effluents unsuitable for the evaporative disposal will be removed off-site by a licensed contractor in accordance with regulatory requirements.

Stormwater from parts of the site will be collected in a retention or detention basin. The design for this system includes two basins as shown in Figure 4.12-2, Site Layout for NEF. The Site Stormwater Detention Basin at the south side of the site will collect runoff from various developed parts of the site including roads, parking areas and building roofs. It is unlined and will have an outlet structure to control discharges above the design level. The normal discharge will be through evaporation/infiltration into the ground. The basin is designed to contain runoff for a volume equal to that for the 24-hour, 100-year return frequency storm, a 15.2 cm (6.0 in) rainfall. The basin will have approximately 23,350 m^3 (100 acre-ft) of storage capacity. Area served includes about 39 ha (96 acres) with the majority of that area being the developed portion of the 220 ha (543 acres) NEF site.

The Uranium Byproduct Cylinder (UBC) Storage Pad Stormwater Retention Basin is utilized for the collection and containment of water discharges from two sources: (1) cooling tower blowdown discharges and (2) stormwater runoff from the UBC Storage Pad. The ultimate disposal of basin water will be through evaporation of water and impoundment of the residual dry solids after evaporation. It is designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency storm, a 15.2-cm (6.0-in) rainfall plus an allowance for cooling tower blowdown water. The UBC Storage Pad Stormwater Retention Basin is designed to contain a volume of approximately 77,700 m^3 (63 acre-ft). Area served by the basin includes 9.2 ha (22.8 acres), the total area of the UBC Storage Pad. This basin is designed with a membrane lining to minimize any infiltration into the ground.

A standard septic system is planned to dispose of sanitary wastes at the site, as described in ER Section 4.1.2, Utilities Impacts.

3.4.2 Water Quality Characteristics

As discussed in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems, water resources in the area of the NEF site are minimal. Runoff from precipitation at the site is

effectively collected and contained by detention/retention basins and through evapotranspiration. It is highly unlikely that any groundwater recharge occurs at the site.

The first occurrence of groundwater beneath the NEF site is in a silty sandstone or siltstone horizon in the Chinle Formation, approximately 67 m (220 ft) below the surface. This unit is low in permeability and does not yield water readily. Groundwater quality in monitoring wells in the Chinle Formation, the most shallow saturated zone, is poor due to natural conditions. Samples from monitoring wells within this horizon on the WCS facility have routinely been analyzed with Total Dissolved Solids (TDS) concentrations between about 2,880 and 6,650 mgL. Table 3.4-2, Groundwater Chemistry, contains a summary of metal analyses from four background monitoring wells at the WCS site for 1997-2000. Essentially all results are below maximum contaminant limits (MCL) for EPA drinking water standards. The tightness of the formation, the limited thickness of saturation, and the poor water quality, support the argument that this zone does not constitute an aquifer.

Three monitoring wells have been drilled and installed on the NEF site, i.e., MW-1, MW-2, and MW-3 shown on Figure 3.3-5, Site Boring Plan and Profile and Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour, and yield several water quality samples. The results of the water quality analyses are summarized in Table 3.4-3, Chemical Analyses of NEF Site Groundwater. Water quality characteristics are similar to those for WCS site samples. No local groundwater well sites and, as a result, groundwater data are available with the exception of groundwater well sites on the WCS site and those that have been installed on the NEF site. Additional groundwater sampling and analysis of the onsite monitoring wells will be conducted on a frequency needed to establish a baseline.

Table 3.4-3 presents a summary of results from analyses of a groundwater sample from NEF monitoring well MW-2 which is adjacent to the location of NEF groundwater exploration of boring B-9 on the NEF site (Figure 3.4-6). Standard protocols (ASTM, 1992) were used for sampling.

Groundwater analyses included routine groundwater including: standard inorganic components, Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SOCs), pesticides, PCB and radiological constituents. The table includes the parameter, NEF sample result, and two regulatory limits. The first limit is the New Mexico Water Quality Control Commission (NMWQCC) standard for discharges to surface and groundwater (NMWQCC, 2002). The second limit is the EPA Safe Drinking Water Act (SDWA) maximum contaminate levels (MCLs) for potable water supplies. These MCLs include both the Primary and Secondary Drinking Water Standards (CFR, 2003h). In general, the water is of low quality compared to drinking water standards. Total dissolved solids are 2,500 mg/L, higher than the New Mexico and EPA limits of 1,000 and 500 mg/L, respectively. Also high are chlorides at 1,600 mg/L compared to regulatory limits of 250 mg/L, and sulfate at 2,200 mg/L compared to regulatory limits of 250 to 600 mg/L. A very minor level of a pesticide was detected in the sample, likely due to field or laboratory contamination. Gross alpha activity was detected at a level just slightly above the screening level of 0.6 Bq/L (15 pCi/L).

3.4.3 Pre-Existing Environmental Conditions

There is no documented history of manufacturing, storage or significant use of hazardous chemicals on the NEF property. Historically the site has been used to graze cattle.

The WCS facility is a nearly 541-ha (1,338-acre) property located in Texas. WCS possesses a radioactive materials license from Texas, an NRC agreement state. The facility is licensed to treat and temporarily store low-level and mixed low-level radioactive waste. WCS is also permitted to treat and dispose of hazardous, toxic waste in landfills. While a potential source for release, this disposal site is also a well-monitored facility.

The DD Landfarm, a petroleum contaminated soil treatment facility is adjacent to the west. To the south, across New Mexico Highway 234, is the Lea County Landfill.

To the north of the NEF site about 0.5 km (0.3 mi) a series of man-made ponds contain water and sludge used by petroleum industry contractors to assist with oil and gas drilling and extraction. Unlined, these ponds have some potential for input of hydrocarbon chemicals to the subsurface, but due to the considerable depth to groundwater and the great thickness of the underlying and highly impermeable red bed clay of the Chinle Formation, this arrangement is not likely to impact any natural water systems. Analytes expected from such activities have not been detected during the analysis of groundwater samples taken from monitoring wells at the WCS facility or at the NEF.

3.4.4 Historical and Current Hydrological Data

The NEF is located in an area with little to no surface water or runoff. There are no rivers or streams in the area that would be impacted by the facility. The occurrence of groundwater is also limited at the site. Flow data for Monument Draw, an intermittent stream and the closest surface water conveyance feature are presented in ER Section 3.4.12.9.

3.4.5 Statistical Inferences

No statistical parameters are used to provide or interpret hydrologic data for the NEF.

3.4.6 Water Rights and Resources

The NEF site will obtain water for operational purposes from one or more municipal water systems. Any water rights potentially required for this arrangement will be negotiated with the municipalities. A description of the available municipal water supply systems, the source of plant water, is provided in ER Section 4.1.2.

3.4.7 Quantitative Description of Water Use

No subsurface or surface water, such as withdrawals and consumption are made at the site by the NEF. All water used at the facility will be provided through the Eunice and Hobbs Municipal Water Supply Systems, as described in ER Section 4.1.2. Those systems obtain water from groundwater sources in or near the city of Hobbs, approximately 32 km (20 mi) north of the site. Water use by the facility is shown in Table 3.4-4, Anticipated Normal Plant Water Consumption and Table 3.4-5, Anticipated Peak Plant Water Consumption. Water supply is sufficient for operation and maintenance of the NEF. See ER Section 4.4.5, Ground and Surface Water Use, for detailed information concerning the capacities of the Hobbs and Eunice, New Mexico water supply systems and the expected NEF average and peak usage.

3.4.8 Non-Consumptive Water Use

The NEF makes no non-consumptive use of water. Non-consumptive water use is water that is used and returned to its source and made available for other uses. An example is a once-through cooling system.

3.4.9 Contaminant Sources

There will be no discharges to natural surface waters or groundwaters from the NEF. The EPA reports (EPA, 2003a) that no Superfund (CERCLA) sites exist in the area near the NEF site in either Lea County, New Mexico or Andrews County, Texas.

Water intake for the NEF plant will be made from one or more municipal supply systems. There is sufficient capacity available to provide water supply for the NEF, as discussed in ER Section 4.4.

Stormwater runoff from the NEF site will be controlled during construction and operation. Appropriate stormwater construction runoff permits for construction activities will be obtained before construction begins. Design of stormwater run-off controls for the operating plant are described in Section 4.4. Appropriate routine erosion control measures best management practices (BMPs), will be implemented, as is normally required by such permits.

During operation stormwater will be collected from appropriate site areas and routed to detention/retention basins. These basins and the site stormwater system are described in ER Section 3.4.1.2.

3.4.10 Description of Wetlands

An evaluation of the site and of available wetlands information has been used to determine that the site does not contain jurisdictional wetlands.

3.4.11 Federal and State Regulations

ER Section 1.3 describes all applicable regulatory requirements and permits. ER Section 4.4 describes potential site impacts as they relate to environmental permits regarding water use by the facility.

Applicable regulations for water resources include:

- NPDES: A General Permit for Industrial Stormwater Discharge is required for point source discharge of stormwater runoff from industrial or commercial facilities to the waters of the state. The New Mexico Water Quality Bureau administers this activity. An individual NPDES permit will be pursued because of the surface water runoff into the detention basins.
- NPDES: General Permit for Construction Stormwater Discharge is required because construction of the NEF will involve the grubbing, clearing, grading or excavation of five or more acres of land. This permit is administered by the EPA Region 6 with oversight review by the New Mexico Water Quality Bureau. Various land clearing activities such as offsite borrow pits for fill material have also been covered under this general permit. LES construction contractors will be clearing approximately 73 ha (180 acres) during the construction phase of the project.

- Groundwater Discharge Permit/Plan is required by the New Mexico Water Quality Bureau for facilities that discharge an aggregate waste water volume of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems. This requirement is based on the assumption that these discharges have the potential of affecting groundwater. NEF will discharge treated process water, stormwater and cooling tower blowdown water to surface impoundments, as well as domestic septic wastes.

3.4.12 Surface Water Characteristics for Relevant Water Bodies

No offsite surface water runoff will occur from the NEF site. There are no drainage features that would transport surface water offsite. Precipitation onsite is either subject to infiltration, natural evapotranspiration, or facility system collection and evaporation.

3.4.12.1 Freshwater Streams, Lakes, Impoundments

The NEF site includes no freshwater streams or lakes. Impoundments to contain stormwater runoff and process water will be constructed as part of the facility. These components are described in ER Section 3.4.1.2 Facility Withdrawals and/or Discharges to Hydrologic Systems.

3.4.12.2 Flood Frequency Distributions, Including Levee Failures

Site grade will be above the elevation of the 100-year and the 500-year flood elevations (WBG, 1998; FEMA, 1978).

3.4.12.3 Flood Control Measures (Reservoirs, Levees, Flood Forecasting)

No flood control measures are proposed for the NEF. Site grade will be above the elevation of the 100-year and the 500-year flood elevations, as discussed in ER Section 3.4.12.2.

3.4.12.4 Location, Size, and Elevation of Outfall

The NEF includes no direct outfall to a surface water body.

3.4.12.5 Outfall Water Body

The NEF includes no direct outfall to a surface water body. Runoff volume will not change from present levels due to site development or facility operation.

3.4.12.6 Bathymetry Near any Outfall

The NEF includes no outfall to a surface water body.

3.4.12.7 Erosion Characteristics and Sediment Transport

The NEF includes no outfall to a surface water body.

3.4.12.8 Floodplain Description

The NEF site is located above the 100-year or 500-year flood elevation (WBG, 1998; FEMA, 1978). There are no detailed floodplain maps available for the site since the site is not located near any floodplains.

3.4.12.9 Design-Basis Flood Elevation

Flooding for the NEF site is not a credible event. The NEF site is contained within the Landreth-Monument Draw Watershed. The closest water conveyance is Monument Draw, a typically dry, intermittent stream located about 3.2 km (2.0 mi) west of the site. The location of Monument Draw is shown on Figure 3.4-1, Local Hydrologic Features. The maximum historical flow for Monument Draw is 36.2 m^3/s (1,280 cfs) measured on June 10, 1972. All other historical maximum measurements are below 2.0 m^3/s (70 cfs) (USGS, 2003c). Therefore, no special design considerations, other than those described in SAR Sections 3.2.4.3, Floods, and 3.3, Facility Description, for local intense precipitation, are needed for flooding at the site.

3.4.13 Freshwater Streams for the Watershed Containing the Site

The NEF includes no perennial freshwater streams in its watershed.

3.4.13.1 Drainage Areas

There are no major drainage areas associated with the NEF.

3.4.13.2 Historical Maximum and Minimum River Flows

The NEF includes no rivers within the site or its watershed.

3.4.13.3 Historical Drought River Flows

The NEF includes no rivers within the site or its watershed.

3.4.13.4 Important Short Duration Flows

The NEF includes no rivers within the site or its watershed.

3.4.14 Water Impoundments

Impoundments to contain stormwater runoff and process water will be constructed as part of the facility. These features are described in ER Section 3.4.1.2.

3.4.14.1 Elevation-Area-Capacity Curves

Impoundments to contain stormwater runoff and process water will be constructed as part of the facility. These features are described in ER Section 3.4.1.2.

3.4.14.2 Reservoir Operating Rules

The NEF will not make use of any reservoir.

3.4.14.3 Annual Yield and Dependability

The NEF will not take or discharge process water from any local water body; thus it will not affect water availability for any water body.

3.4.14.4 Inflow/Outflow/Storage Variations

The NEF will not take or discharge process water to any local water body; thus it will not affect water storage in any water body.

3.4.14.5 Net Loss, Including Evaporation and Seepage

The NEF will not take or discharge process water from any local water body; thus it will not affect water flow or storage in any water body.

3.4.14.6 Current Patterns

The NEF will not take or discharge process water to any local water body; thus it will not affect current patterns in any water body.

3.4.14.7 Temperature Distribution

The NEF will not take or discharge process wastewater or non-contact cooling water to any local water body; thus it will not affect temperature in any water body.

3.4.15 Groundwater Characteristics

Groundwater resources at the proposed NEF site are limited. There are no major water-producing units beneath the site. The site is not located within the recharge area of any sole-source or major aquifer. In the near subsurface, the soils are dry due to low rainfall rates and a very effective evapotranspiration process by the native vegetation. Natural recharge to groundwater is not inferred to be taking place at the site. In the upper 10 to 15 m (33 to 49 ft) the soils are relatively fine grained, silts to silty sands. At the bottom of this section the material becomes a bit more coarse, grading to a sand and gravel. The sand and gravel horizon is on the order of a few meters (feet) thick and overlays a thick clay formation. In areas to the north and east of the site, this sand and gravel layer has some localized saturation. The processes that lead to these localized saturated areas are not present at the NEF site (see discussion in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems). The soils above the Chinle Formation clay horizon are dry, and, under natural conditions, and contain no saturated horizons.

The Chinle Formation consists of a thick expanse of clay beneath the site. It is part of the Triassic Dockum Group, and is 46 to 61 m (150 to 200 ft) thick. The hydraulic conductivity of the clay is on the order of $1x10^{-8}$ cm/s ($3.9x10^{-9}$ in/s). Clay with this permeability is typically specified for engineered landfill liners. Ground-water travel times through a unit with this permeability and thickness would be on the order of thousands of years. It provides hydraulic isolation for groundwater at depth.

Beneath the Chinle at a depth of about 67 to 73 m (220 to 240 ft) below the surface is a small siltstone or silty sandstone unit that has some local saturation. This unit is the shallowest occurrence of groundwater beneath the site. The permeability of this unit is fairly low, and monitor wells completed in this unit at the NEF and at the WCS facilities to the east of the NEF site are slow to produce water. The water quality in this unit is poor, based on the sampling and analysis performed. TDS values typically range from 2,880 to 6,650 mg/L. Three monitor wells have been installed on the NEF site to monitor this unit. One well has been sampled and analyzed and the results are provided in Table 3.4-3, Chemical Analyses of NEF Site Groundwater. Due to the low permeability of this unit, and its limited ability to yield water, it is not considered to be an aquifer. This siltstone layer is hydraulically isolated from the near surface hydrologic conditions due to the presence of a thick clay sequence above it.

The first occurrence of a defined aquifer beneath the site is the Triassic-aged Santa Rosa Formation, almost 244 m (800 ft) below the land surface at the NEF site. Given the depth to this

formation, and the fact that the Chinle Formation clay separates it hydraulically from surface discharges at the site, and no potential for recharge from site basins, the Santa Rosa will not be investigated.

Recent NEF site groundwater investigations included nine soil borings and the installation of three monitoring wells. These have confirmed anticipated site stratigraphy and groundwater conditions. Borings done in the near-surface alluvial sand and gravel, above the red beds of the Chinle clay showed that no shallow groundwater occurs in that unit. The top of the clay in site borings was found at depths from 7 to 17 m (23 to 55 ft) below the ground surface.

Three monitoring wells were installed at the site (Figure 3.4-6). These three monitoring wells are designated MW-1 through MW-3. Screens for those wells were placed in a siltstone layer within the Chinle clay based on resistivity logs at depths of about 70 m (230 ft) below the ground surface. The water bearing zone, referred to as the 230-zone, is approximately 4.6 m (15 ft) thick and is encountered at depths ranging from 65 to 68 m (214 to 212 ft) below ground level. Only one well, MW-2, adjacent to B-9 and near the northeast corner of the site, has produced water. Measured head for groundwater in the well is at an approximate elevation of 1,009 m (3,311 ft). Results of chemical and radiological analyses of water samples from that well are provided in Table 3.4-3, Chemical Analyses of NEF Site Groundwater.

Based on groundwater levels in MW-2 and data from the adjacent WCS site, a groundwater gradient of 0.011 m/m (ft/ft) was determined, generally sloping towards the south. Hydraulic conductivity of the saturated layer, based on slug tests is estimated to be approximately 3.7 x 10^{-6} cm/s (3.8 ft/yr). Based on the data collected at the NEF and WCS, the groundwater gradient in the siltstone unit at NEF is estimated to range from approximately 0.011 to 0.017 m/m (0.011 to 0.017 ft/ft).

3.4.15.1 Groundwater Elevation Trends

Three monitoring wells were recently installed at the NEF site, i.e., MW-1, MW-2 and MW-3 shown on Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour. They are being monitored for inflow of groundwater. The well screens are located at the first occurrence of groundwater beneath the site, some 67 m (220 feet) below land surface. They are set in a siltstone or silty sandstone that has very low permeability. Monitor wells tapping the same unit to the east of the site on the WCS property are also slow to recover after drilling and sampling operations. Some of the wells never appear to equilibrate between sampling events

Groundwater levels in the 70-m (230-ft) zone siltstone unit at the NEF is approximately at an elevation of 1,009 m (3,311 ft) msl which is consistent with data from the nearby WCS site. Levels do not fluctuate much over time.

3.4.15.2 Water Table Contours

Information relative to water table gradients in the siltstone at the base of the Chinle Formation unit is available from the WCS site to the east and NEF . Based on the data collected at the NEF and WCS, the groundwater gradient in the siltstone unit at the NEF is estimated to range from approximately 0.011 to 0.017 m/m (0.011 to 0.017 ft/ft). The groundwater gradient was estimated based on interpretation of data collected at the NEF and WCS in the 70 m (230-ft) groundwater zone. The groundwater gradient generally slopes south beneath the NEF site. Water table contour maps will be produced for the NEF site as the data from the three monitoring wells becomes available to supplement the contour maps for the nearby WCS site.

3.4.15.3 Depth to Water Table for Unconfined Aquifer Systems

The depth to the first occurrence of groundwater beneath the site is on the order of 61 m (200 ft). This same geologic unit has been investigated beneath the WCS facility to the east of the NEF site. The information available from the WCS site suggests that this saturated unit, which is just below the red bed clay, may be under confined or semi-confined conditions. The unit is low in permeability, however, and does not produce water very quickly. It is not formally considered an aquifer, as discussed in ER Section 3.4.15.6, Interactions Among Different Aquifers.

3.4.15.4 Soil Hydrologic Properties

The top 10 to 15 m (33 to 49 ft) of soil is comprised of a silty sand, grading to a sand and gravel just above the red bed clay unit. Based on this characterization, the porosity of the surface soils is on the order of 25% to 50% (Freeze, 1979). The saturated hydraulic conductivity of the surface soils is likely to range from 10^{-5} to 10^{-1} cm/s (3.9 x 10^{-6} to 3.9 x 10^{-2} in/s) (Freeze, 1979). Estimates of the hydraulic conductivity of the Chinle clays are on the order of 10^{-8} cm/s (3.9 x 10^{-9} in/s) (Rainwater, 1996). Given the low permeability of the underlying red bed clay, this unit serves as a barrier for any hydraulic connection between the surficial hydrologic processes and any subsurface occurrence of groundwater beneath the Chinle clay.

3.4.15.5 Flow Travel Time: Groundwater Velocity

Groundwater flow velocities are dependent on the groundwater gradient and soil or bedrock permeabilities. WCS and NEF have wells in the saturated unit that constitutes the first occurrence of groundwater beneath the site. The groundwater velocity in this unit has been estimated to be very low, on the order of 0.002 m/yr (0.007 ft/yr). Based on the data collected at the NEF and WCS, the groundwater velocity at the NEF is estimated to range from approximately 0.002 to 0.09 m/yr (0.007 to 0.3 ft/yr).

3.4.15.6 Interactions Among Different Aquifers

As discussed in ER Section 3.4.1.1, there are occurrences of shallow groundwater in a thin saturated stratum just above the Chinle Formation red bed clays in various locations to the north and east of the NEF site. These localized zones of saturation are due to local infiltration mechanisms, such as fractures in the caprock caliche leading to underlying sand and gravel deposits, and infiltration through "buffalo wallow" depressions that pond surface water runoff. None of these shallow saturated unit occurrences are laterally continuous and none extend to the NEF site. Conditions at the NEF site are markedly different. It is probable that no recharge is actively occurring at the NEF site due to infiltration of precipitation. The native vegetation is quite efficient with evapotranspiration processes to intercept all infiltration before it gets to depth, a process that has probably been in progress for thousands of years. Therefore, no interaction exists between the shallow saturated units to the north and east of the site and the site itself.

The presence of the thick Chinle clay beneath the site essentially isolates the deep and shallow hydrologic systems. Groundwater occurring beneath the red bed clay occurs at two distinct and distant elevations. Approximately 67 m (220 ft) beneath the land surface, just below the red bed unit, is a siltstone or silty sandstone unit with some saturation. It is a low permeability formation that does not yield groundwater very readily. It is not considered an aquifer. ER Figure 3.3-5, Site Boring Plan and Profile shows the locations of three monitoring wells (MW-1, MW-2 and

MW-3) installed at the NEF site in September 2003 with screens at the depth of this horizon. Two of these wells have yielded no water. Well MW-2 produced a minimal amount of water suitable for sampling purposes several weeks after installation. Based on this information and the lack of groundwater encountered in other site borings, this unit is not interpreted to meet the definition of an aquifier (Freeze, 1979) which requires that the unit be able to transmit "significant quantities of water under ordinary hydraulic gradients."

The next water bearing unit below the saturated siltstone horizon is the Santa Rosa formation, which is located about 244 m (800 ft) below land surface. Between the siltstone saturated horizon and the Santa Rosa formation lie a number of layers of sandstones, siltstones, and shales. Hydraulic connection between the siltstone saturated horizon and the Santa Rosa formation is non-existent.

No withdrawals or injection of groundwater will be made as a result of operation of the NEF facility. Thus there will be no affect on any inter-aquifer water flow.

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TABLES

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Table 3.4-1 Summary of Potentially Contaminated Liquid Wastes for the NEF

Page 1 of 1

Source/System	**Annual Volume: L (gal)**
Treated Plant Effluent[1]	29,570 (7,811)
Showers and Handwash	2,100,000 (554,820)
Laundry	405,800 (107,213)
Total Liquid Effluents	2,535,370 (669,844)

[1]Floor washings, laboratory effluent, miscellaneous condensates, degreaser water, and spent citric acid

Table 3.4-2 Groundwater Chemistry

Page 1 of 1

Constituent	Maximum Result	MCL (EPA)
Arsenic	0.007 mg/L or < Detection Limit	0.05 mg/L
Barium	0.018 mg/L or < Detection Limit	2.0 mg/L
Cadmium	0.005 mg/L or < Detection Limit	0.005 mg/L
Chromium	0.011 mg/L or < Detection Limit	0.1 mg/L
Cobalt	0.0022 mg/L or < Detection Limit	-
Copper	0.02 mg/L or < Detection Limit	1.3 mg/L
Lead	0.054 mg/L or < Detection Limit	0.015 mg/L
Mercury	< Detection Limit	0.002 mg/L
Nickel	0.006 mg/L or < Detection Limit	-
Selenium	0.021 mg/L or < Detection Limit	0.05 mg/L
Silver	0.0026 mg/L or < Detection Limit	0.05 mg/L
Vanadium	0.07 mg/L or < Detection Limit	-
Zinc	0.014 mg/L or < Detection Limit	5 mg/L
*Action level **Secondary standard		

Notes:

MCL – Maximum Contaminant Level

Data are derived from four background monitoring wells at the WCS site: MW-3A, MW-3B, MW-4A, and MW-4B. These wells produce samples from the siltstone layer within the Chinle Formation at depths of about 61 to 73 m (200 to 240 ft).

Data are from unfiltered samples (required by the state of Texas) and include some qualified data due to sample sediment and low volume samples.

Results for organic components generally include no detectable analytes except for isolated samples with concentrations of analytes consistent with sampling or laboratory contamination.

Table 3.4-3 Chemical Analyses of NEF Site Groundwater

Page 1 of 3

		Existing Regulatory Standards	
PARAMETER	**NEF Sample (mg/L, or as noted)**	**NEW MEXICO (mg/L, or as noted)**	**EPA MCL (mg/L, or as noted)**
General Properties			
Total Dissolved Solids (TDS)	**2500**	1000	500 (a)
Total Suspended Solids	6.2	NS	NS
Specific Conductivity	6800 (µmhos/L)	NS	NS
Inorganic Constituents			
Aluminum	0.480 (c)	5.0 (i)	0.05 – 0.2 (a)
Antimony	<0.0036	NS	0.006
Arsenic	<0.0049	0.1	0.05
Barium	0.021	1	2
Beryllium	<0.00041	NS	0.004
Boron	**1.6**	0.75 (i)	NS
Cadmium	<0.00027	0.01	0.005
Chloride	**1600**	250	250 (a)
Chromium	0.043	0.05	0.1
Cobalt	<0.00067	0.05 (i)	NS
Copper	0.0086	NS	1.3 (al)
Cyanide	<0.0039	0.2	0.2
Fluoride	<0.5	1.6	4
Iron	0.51	1	0.3 (a)
Lead	<0.0021	0.05	0.015 (al)
Manganese	**1.0**	0.2	0.05 (a)
Mercury	<0.000054	0.002	0.002
Molybdenum	0.04	1.0 (i)	NS
Nickel	0.034	0.2 (i)	0.1
Nitrate	<0.25	10	10
Nitrite	<1	NS	1
Selenium	<0.0046	0.05	0.05
Silver	<0.0007	0.05	0.05
Sulfate	**2200**	600 (a)	250 (a)
Thallium	<0.0081	NS	0.002
Zinc	0.016	10	5 (a)
Radioactive Constituents			
Gross Alpha (pCi/L)*	**0.6 Bq/L (15.1 pCi/L)**	NS	0.6 Bq/L (15 pCi/L)

Table 3.4-3 Chemical Analyses of NEF Site Groundwater
Page 2 of 3

		Existing Regulatory Standards	
PARAMETER	**NEF Sample (mg/L, or as noted)**	**NEW MEXICO (mg/L, or as noted)**	**EPA MCL (mg/L, or as noted)**
Gross beta	1.2 Bq/L (31.4 pCi/L)	NS	4 (mrem/yr)
Radium 224	<4.88 Bq/L (<130 pCi/L)	NS	NS
Radium 226**	0.24 Bq/L (6.5 pCi/L)	NS	0.2 Bq/L (5 pCi/L)
Uranium		0.005	0.030
U-234	4.75 pCi/L (0.00695 mg/L	0.005	0.030
U-235	0.158 pCi/L (0.000231 mg/L	0.005	0.030
U-238	1.06 pCi/L (0.001551 mg/L	0.005	0.030
Ag-108m	-1.20 (-0.044)	NS	***
Ag-110m	-0.8 (-0.03	NS	***
Ba-140	2.5 (0.093)	NS	***
Be-7	6 (0.2)	NS	***
Ce-141	3.3 (0.12)	NS	***
Ce-144	-3.3 (-0.12)	NS	***
Co-57	1 (0.04)	NS	***
Co-58	-0.1 (-0.004)	NS	***
Co-60	-0.1 (-0.004)	NS	***
Cr-51	-34 (-1.3)	NS	***
Cs-134	0.6 (0.02)	NS	***
Cs-137	0.8 (0.03)	NS	***
Fe-59	1.1 (0.041)	NS	***
I-131	1.7 (0.063)	NS	***
K-40	44 (1.6)	NS	***
La-140	2.9 (0.11)	NS	***
Mn-54	0.1 (0.004)	NS	***
Nb-95	-0.7 (-0.03	NS	***
Ra-228	5.9 (0.22)	NS	***
Ru-103	-1.2 (-0.044)	NS	***
Ru-106	9 (0.3)	NS	***
Sb-124	-5.6 (-0.21)	NS	***
Sb-125	-2.7 (-0.10)	NS	***
Se-75	-0.1 (-0.0037)	NS	***
Zn-65	-1.4 s(-0.052)	NS	***
Zr-95	-1.5 (-0.056)	NS	***

Table 3.4-3 Chemical Analyses of NEF Site Groundwater

		Existing Regulatory Standards	
PARAMETER	**NEF Sample (mg/L, or as noted)**	**NEW MEXICO (mg/L, or as noted)**	**EPA MCL (mg/L, or as noted)**
Miscellaneous Constituents			
Other VOCs and Pesticides	<MDLs	Various	Various
Semi-Volatile Organic Compounds (SOCs)	<MDLs	Various	Various
Polychlorinated biphenyls, PCBs	<MDLs	0.001	0.0005

Notes:

Highlighted values exceed a regulatory standard

(a): EPA Secondary Drinking Water Standard

(al): Action Level requiring treatment

(c): Results of lab or field-contaminated sample

(i): Crop irrigation standard

* The proposed standard excludes ^{222}Rn, ^{226}Ra and uranium activity

** This standard excludes ^{228}Ra activity. Units for the existing standard are mrem/yr. U.S.

*** EPA MCL Goal (mg/L, or as noted) 0.04 mSv/yr (4 mrem/yr). EPA has proposed to change the units to mrem Effective Dose Equivalent per year

**** Minimum Detection Level

NS: No standard or goal has been defined

MCL: Maximum Contaminant Level

MDL: Minimum Detection Limit

Table 3.4-4 Anticipated Normal Plant Water Consumption

Page 1 of 1

Potable Water/Sewer Average Consumption	**L/Day**	**Gal/Day**
All Shifts – 210 People	19,873	5,250
Cooling Tower Water		
Process Cooler Drift	5,924	1,565
Process Cooler Evaporation	59,677	15,765
Process Cooler Blowdown	22,379	5,912
HVAC Cooler Drift	6,768	1,788
HVAC Cooler Evaporation	80,035	21,143
HVAC Cooler Blowdown	30,015	7,929
Humidification	8,464	2,236
Total Cooling Water	213,263	56,338
Summation of Liquid Effluents (excluding utilities)		
Floor Washings, Misc. Condensates and Lab Effluent	64	17
Degreaser Washer	11	3
Citric Acid	8	2
Laundry	1,113	294
Hand Wash and Shower Water	5,754	1,520
Total Liquid Effluents	6,950	1,836
Total City Water Consumption	240,086	63,423

Table 3.4-5 Anticipated Peak Plant Water Consumption
Page 1 of 1

Peak Potable Water Consumption	No. of Fixtures	Fixture Units	Total Fixtures	Flow Rate gpm	Flow Rate L/s
TSB Sinks	10	3	30		
TSB WC	10	4	40		
TSB Urinals	3	2	6		
TSB Showers	4	2	8		
TSB JC	1	3	3		
Admin Sinks	6	3	18		
Admin WC	7	4	28		
Admin Urinals	2	2	4		
Admin JC	1	3	3		
CAB Sinks	9	3	27		
CAB Urinals	2	2	4		
CAB JC	1	3	3		
CAB WC	8	4	32		
Fixture Subtotal			206	93	5.9
Safety Showers (estimated)				30	1.9
Total			206	123	8
Peak Process Water Consumption					
DI Water Makeup				30	1.9
Boiler Make-up				20	1.3
CH Water Make-up				20	1.3
Tower Water Make-Up				175	11.0
Laundry	1	3	3	10	0.6
HVAC Humidifiers				0	0
Total				255	16.1
Two 474 m^3 (125,000-Gal) Fire Water Tanks				520.8	32.9

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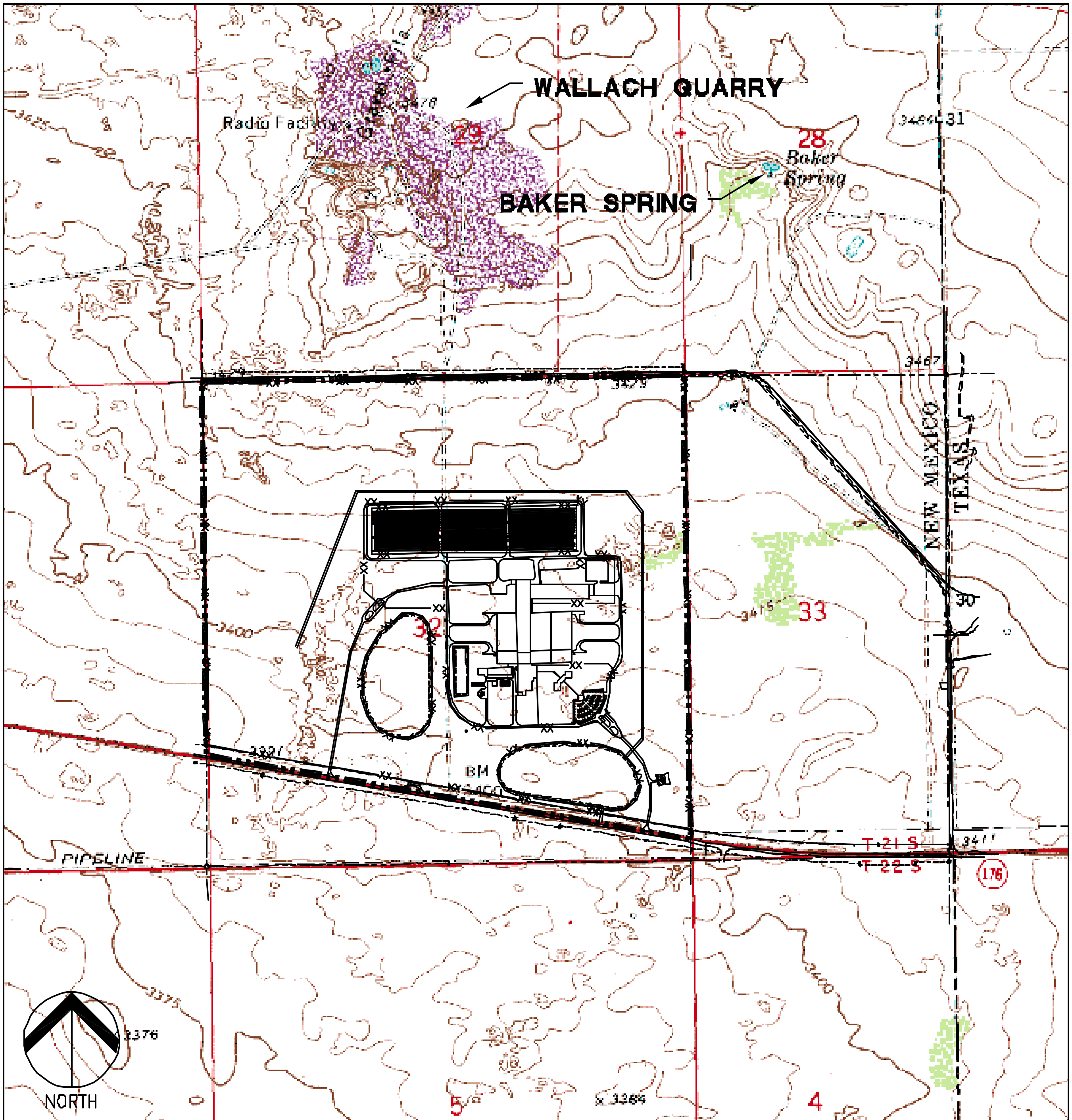
FIGURES



1000 0 1000 2000 3000 FEET

300 0 300 600 900 METERS

MAP SOURCE:
USGS 7.5 MINUTE
EUNICE NE QUADRANGLE
TEX.–N. MEX. 1:24000

CONTOUR INTERVAL:
5 FEET

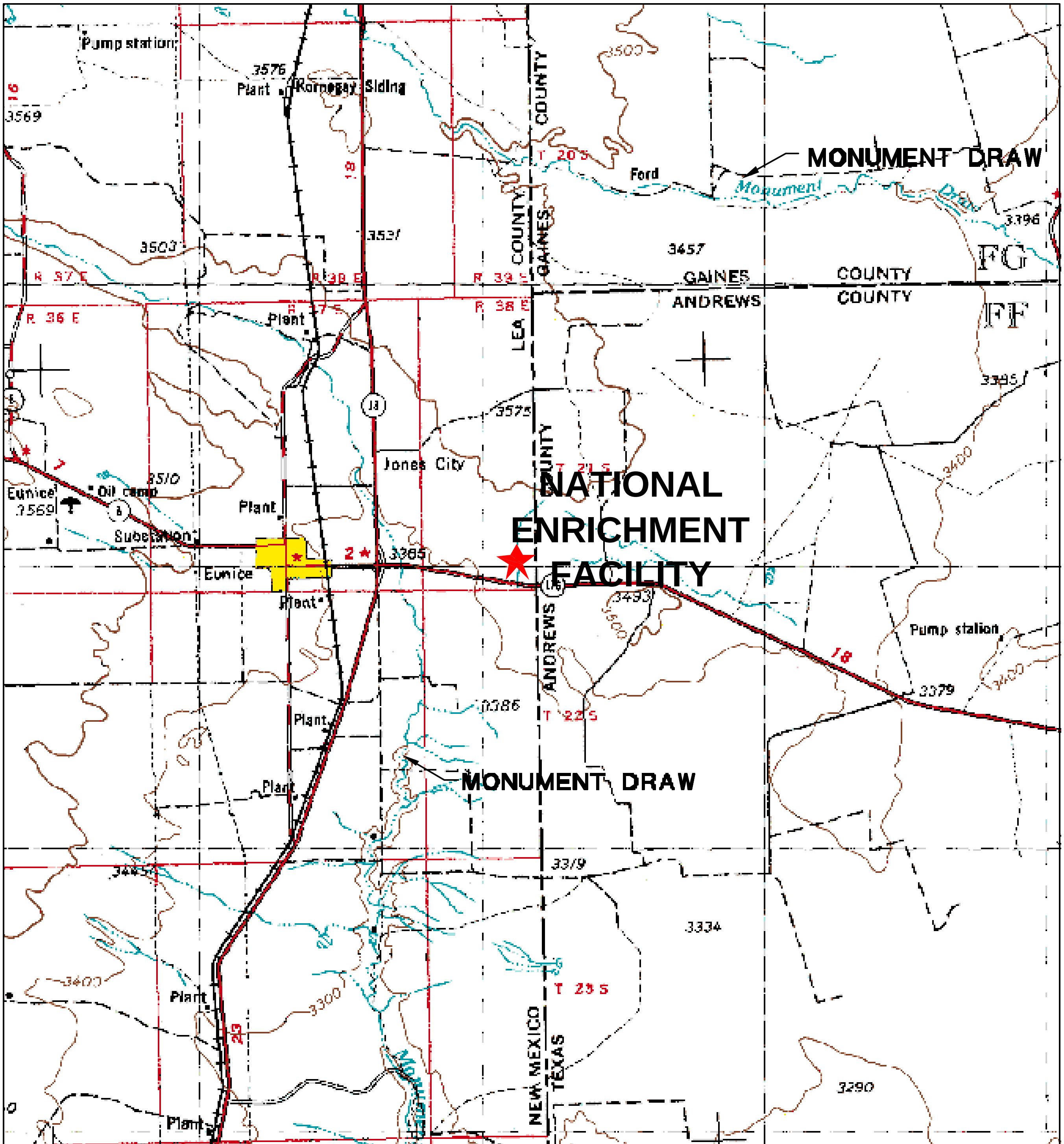
LOCKWOOD GREENE
ENGINEERING & CONSTRUCTION

REFERENCE NUMBER
Figure 3.4–1.dwg

FIGURE 3.4–1
LOCAL HYDROLOGIC FEATURES

ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003



1 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

1 0 1 2 3 4 5 6 MILES

NORTH

CONTOUR INTERVAL: 100 FT

REFERENCE NUMBER
Figure 3.4–2.dwg

MAP SOURCE:
USGS 1:100,000 30 MIN. X 60 MIN. MAPS
HOBBS, NEW MEXICO – TEXAS
AND EUNICE NE,TEX. – N. MEX.

FIGURE 3.4-2
REGIONAL HYDROLOGIC FEATURES

ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

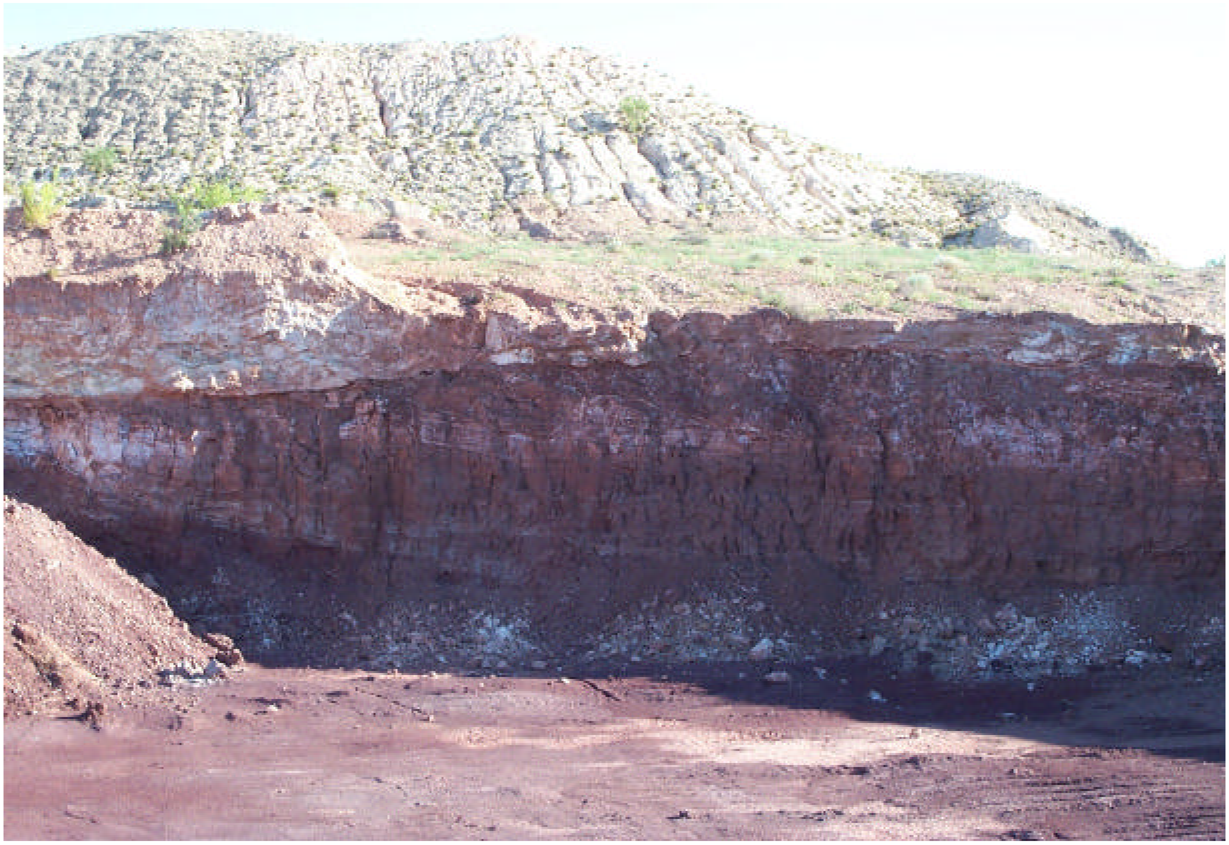


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FIGURE 3.4-3

VIEW OF A PIT WALL IN A WALLACH SAND & GRAVEL EXCAVATION TO THE NORTH OF THE NEF SITE
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003

REFERENCE NUMBER
MSWord Figures.dwg

FIGURE 3.4-4

GROUNDWATER SEEP AT THE BASE OF A WALLACH SAND & GRAVEL EXCAVATION TO THE NORTH OF THE NEF SITE
ENVIRONMENTAL REPORT

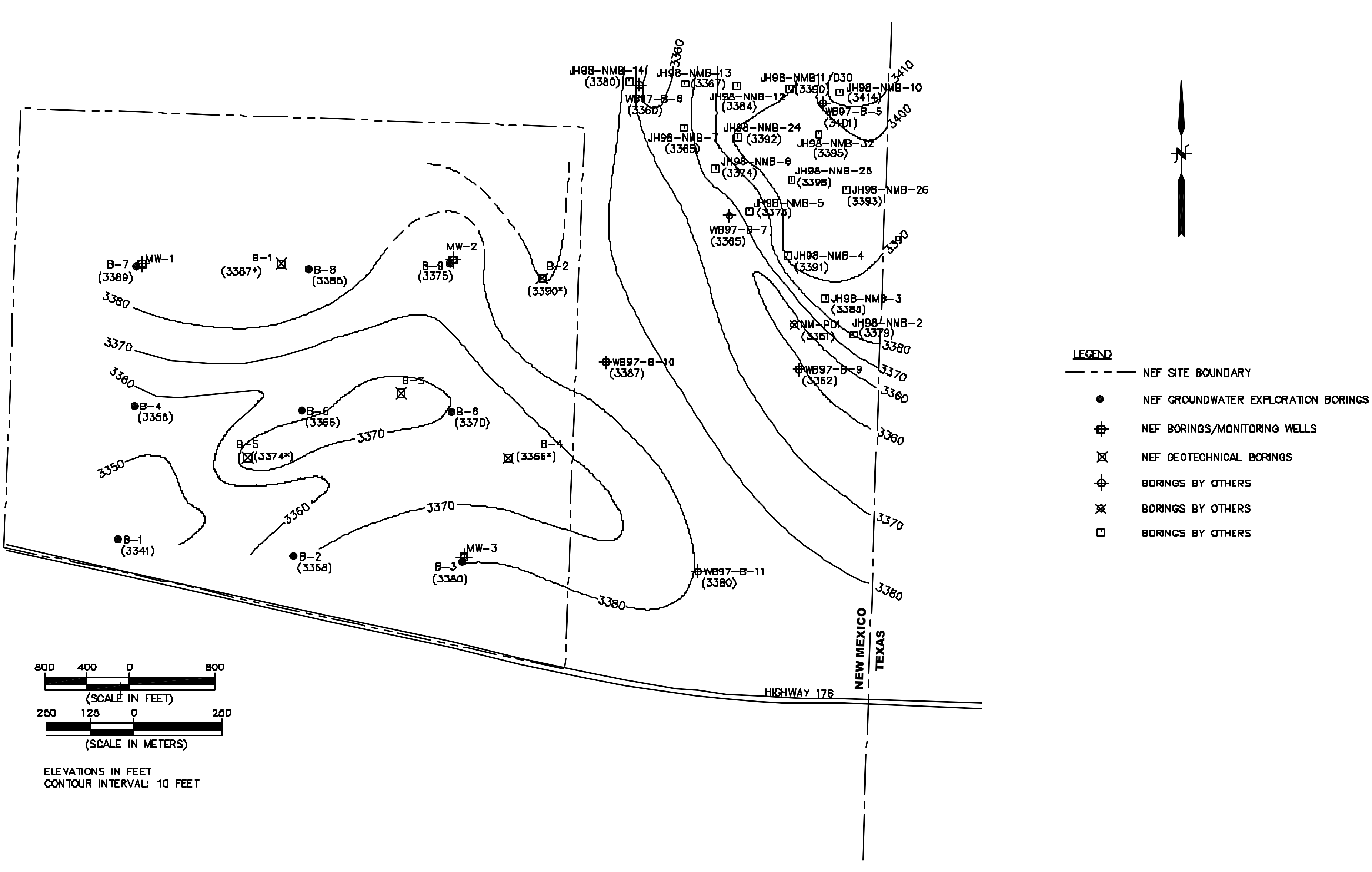
REVISION DATE: DECEMBER 2003

REFERENCE NUMBER
MSWord Figures.dwg

FIGURE 3.4-5

VIEW OF BAKER SPRING AREA
TO THE NORTHEAST OF THE NEF SITE
ENVIRONMENTAL REPORT

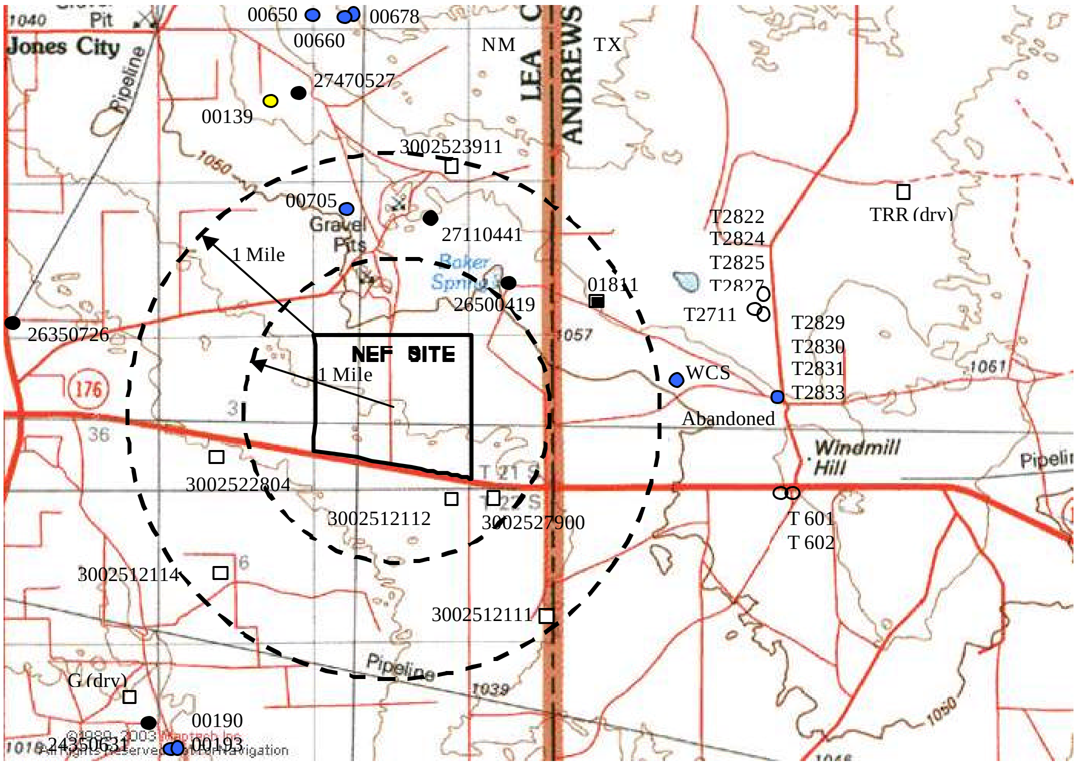
REVISION DATE: DECEMBER 2003



LOCKWOOD GREENE
A J.A. Jones Company
ENGINEERING & CONSTRUCTION

REFERENCE NUMBER
BORINGS 3.4-6.DWG

FIGURE 3.4-6
DOCKUM GROUP (CHINLE FORMATION)
SURFACE CONTOUR
ENVIRONMENTAL REPORT
REVISION DATE: DECEMBER 2003



Water Wells

○ Undetermined

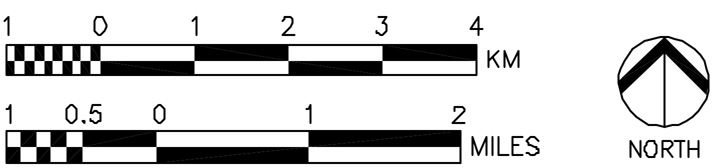
● Observation wells: USGS

● Livestock well

● Domestic Well

Oil Wells

■ □ Open symbol represents dry, plugged and/or abandoned hole



SOURCES: (NMSE, 2003; TWDB, 2003; USGS, 2003b; TRC, 2003; GOTECH, 2003; ESRI, 2001)

REFERENCE NUMBER
Figure 3.4-7.dwg

FIGURE 3.4-7

WATER AND OIL WELLS
IN THE VICINITY OF THE NEF SITE
ENVIRONMENTAL REPORT

REVISION DATE: DECEMBER 2003