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1.3 PROPOSED PROJECT SCHEDULE

It is anticipated that the PFSF will be issued a specific license to receive, transfer and possess spent fuel in accordance with the requirements of 10 CFR 72 prior to June 2002 in order to commence operation of the PFSF. Construction of the PFSF is scheduled to start in September 2000, with completion by December 31, 2001. If determined to be necessary, an exemption request will be submitted in compliance with 10 CFR 72.7 in order to allow the initiation of construction activities prior to the issuance of the license. The construction and preoperational testing will be completed in time to support operation of the facility in 2002.

Chapter 3 provides a more detailed description of the facility construction. The areas of construction consist of the following components:

AREA OF CONSTRUCTION	SCHEDULED START DATE
Access Road	September 2000
Storage Facility	September 2000
Canister Transfer Building	
Security and Health Physics Building	
Storage Pads	
Site infrastructure	

Installation of pads in the southwest quadrant and the northern half of the site is expected to continue beyond the initial commercial operation date while pads in the southeast quadrant are being loaded. Chapter 3 provides a detailed discussion on the installation sequence of the pads.

Balance of Facility	June 1, 2001
Operations and Maintenance Building	
Administration Building	
Intermodal Transfer Point	January 1, 2001
Railroad siding	
Gantry Crane	
Crane enclosure	
Low Corridor Rail Line	September 2000

Testing and startup is scheduled to start on January 1, 2002, and commercial operation is scheduled for June 1, 2002.

CHAPTER 2

THE SITE AND ENVIRONMENTAL INTERFACES

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FIGURE **TITLE**

Land use within the Skull Valley Indian Reservation boundary consists of residential uses (approximately 30 persons living on the Reservation), and the Tekoi Rocket Engine Test Facility operated by Alliant Techsystems on leased Reservation lands. This facility, located approximately 2.5 miles south-southeast of the PFSF on the south side of Hickman Knolls, has been operated at this location since 1975. The current lease agreement for this facility will expire in 1998 (Quintanna, 1995). Skull Valley Road (designated as Federal Aid Secondary Road (FAS) 108) is located to the east of the PFSF and traverses Skull Valley from Interstate 80 south to the intersection with State Route 199.

2.1.2 Transportation Corridors

Two modes of transporting the shipping casks to the PFSF are presented. The preferred approach is by direct rail from the Union Pacific mainline to PFSF via a new rail line that originates at Low Junction, Utah. Alternatively, the shipping casks will be transferred from the rail mainline at an intermodal transfer point and transported by heavy haul tractor/trailer to the PFSF along Skull Valley Road.

For the direct rail approach, the portion of the Skull Valley that would be affected, due to the construction of the new rail line, is approximately 32 miles of undeveloped public rangeland administered by the BLM. The new line will be approximately 40-ft wide and will originate from the mainline on the south side of Interstate 80 at Low Junction and will proceed southeast, parallel to Interstate 80, for approximately 3 miles, turn south for approximately 26 miles, and then east for about 3 miles to the PFSF.

For the intermodal transfer point, a portion of the frontage road on the north side of Interstate 80 (from the intersection of Interstate highway 80 and the Skull Valley Road to a point 1.8 miles west) would be affected by the transportation of shipping casks to and from the PFSF. The frontage road is a 20-foot wide asphalt roadway with 0 to 3-foot wide aggregate shoulders. The portion of the Skull Valley Road that would be affected is approximately 24 miles long, beginning at Timpie and continuing south to the PFSF access road. The existing road is a 22 to 24-foot wide asphalt roadway with 0 to 3-foot wide aggregate shoulders.

2.2 GEOGRAPHY, LAND USE, AND DEMOGRAPHY

2.2.1 Geography

Skull Valley is an inter-mountain basin oriented in a north-south direction between the Stansbury Mountains to the east and the Cedar Mountains to the west. From the mouth of the valley at Interstate 80, the valley floor gently rises from an elevation of about 4,300 ft to an elevation of about 4,800 ft, 36 miles south at Route 199. The Stansbury Mountains extend from Interstate 80 to the north for about 25 miles south to Johnson Pass at Route 199. The highest point is Deseret Peak (elevation 11,031 ft) which is located approximately 9.5 miles east-northeast of the PFSF. The Cedar Mountains flank the western side of the valley and separate it from the Great Salt Lake Desert. The central portion of the Cedar Mountain range reaches elevations of about 7,600 ft (see Section 2.5.1). Tabby's Peak, the highest point in the south-central portion of the range, located just over 10.5 miles west-northwest of the PFSF, reaches an elevation of 6,921 ft. The southern extent of the range bends to the southeast and drops to elevations of between 5,500 and 6,000 ft (see Figure 2.1-1).

The PFSF is located in the south-central portion of Skull Valley at an average elevation of 4,465 ft, and slopes gently from south to north. Hickman Knolls, located about 1.5 miles south of the PFSF, is the most prominent geographic feature within a 5-mile radius of the PFSF site, rising steeply to a peak elevation of 4,873 ft. A more gently sloped ridge is located about 1.5 miles northeast of the PFSF, which reaches an elevation of approximately 4,621 ft . The toe of the Stansbury Mountains, at an elevation of approximately 5,500 ft, is located approximately 5-miles east of the PFSF (Figure 2.1-1).

2.2.2 Land Use

The principal land use in Skull Valley is rangeland for livestock grazing. Cattle and sheep are grazed, especially in winter when the livestock is brought down from the higher mountain elevations. Except for the land adjacent to the mainline, all of the property required by the Low Corridor rail line or intermodal transfer point and the majority of land (55 percent) within a 5-mile radius of the PFSF is public land administered by the BLM as part of the Pony Express Resource Area (PERA). The land adjacent to the mainline is owned by Union Pacific Railroad (UP), with the right-of-way currently zoned for industrial uses. The addition of rail sidings at Low for the rail line or at the intermodal transfer point that are within the UP right-of-way are allowed by the zone designation.The remainder of the land is split almost evenly between the Skull Valley Indian Reservation property and private ownership (Figure 2.2-1). Based on applicable State of Utah laws, the Tooele County Zoning Ordinance does not apply to federal lands such as the land administered by the BLM and therefore does not apply.

BLM land within the 5-mile radius is part of the Skull Valley and South Skull Valley grazing allotments.[1] Most of the rangeland within the Skull Valley allotment (85 percent) is considered to be of fair to poor condition with the overall conditions in decline (BLM, 1988). The allotment is divided into three pastures: West Cedar, Eightmile, and Black Knoll. The Low Corridor rail line would cross the Eightmile and Black Knoll Pastures. The southeast corner of the Black Knoll Pasture is within the 5-mile radius. Two operators are authorized to graze up to 5,000 sheep and 2,300 cattle within the Skull Valley allotment from November 1 to April 30. Sheep graze in alternate

[1] An allotment is an area of land where one or more permit holders may graze livestock.

years. Cattle graze following a 3-year cycle: in year one they graze from November 1 to April 30th; in year two they graze from November 1 to February 28th; and in three they graze from November 1 to February 28, and April 1 to April 30th (BLM, 1985).[2] Portions of two pastures in the South Skull Valley allotment are within the 5mile radius: the east end of the Cochrane Pasture and the northern edge of the Post Hollow Pasture. The permit holder for these pastures is authorized to graze a maximum of 700 cattle and 3,800 sheep from November 1 to April 30th in alternating years (BLM, 1986).[3]

In addition to grazing, recreation use is also allowed on some BLM land within the PERA. Off-highway vehicle (OHV) use, dispersed camping, and hunting are principal uses of BLM property within the PERA (BLM, 1988). There are no designated camping areas or OHV trails or roads within the 5-mile radius, though the BLM land within the radius is given an OHV designation category "A," meaning that it is open to all types of motor vehicle use (BLM, 1992).

The closest developed BLM recreation facility is Horseshoe Springs, which is located 15 miles north on the Skull Valley Road. Horseshoe Springs is accessed via a short (~1,100 ft) gravel road. The site consists of a 10 to 20 space parking area, an information kiosk, and a short, unmarked hiking trail that winds around the two ponds that are the central feature of the area. There is a wooden boardwalk and footbridge on the trail. Recreation activity in the area consists of OHV use, nature study, bird watching, fishing, and waterfowl hunting. BLM reports visitor use of the area at 500 to 1,000 visits per year (Personal communication between S. Conant, SWEC and L. Kirkman, BLM, May 22, 1997).

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[2] 5,000 sheep and 2,300 cattle are the maximum authorized for the three pastures in the 271,000-acre Skull Valley allotment.

[3] The permit holder is allowed to graze livestock at two other pastures within the South Skull Valley allotment outside the 5-mile radius, so we would expect considerably fewer sheep or cattle grazing within the 5-mile radius.

Although area is posted as "No Swimming", BLM reports that some limited unauthorized swimming does occur (BLM, 1992).

Land use outside the boundaries of the Skull Valley Indian Reservation is regulated by Tooele County zoning. BLM property and most of the privately owned property is zoned as a Multiple Use District. The minimum lot size in a Multiple Use District is 40 acres. Multiple Use Districts are established in open, generally undeveloped areas where human habitation would be limited in order to protect land and open space resources. The remainder of the privately owned land is zoned Agricultural, which has a minimum lot size of 20 acres. The purpose of an Agricultural District is "to promote and preserve in appropriate areas conditions favorable to agricultural uses and to maintain greenbelt open spaces" (Tooele County 1996). Permitted uses in Multiple Use and Agricultural Districts include grazing of livestock, agricultural uses, construction of single and two-family homes, development of public park and recreation facilities, and the storage and disposal of agricultural equipment (Tooele County, 1995 and 1996).

2.2.3 Demographics

2.2.3.1 Population Distribution and Trends

Populations in this section are discussed from four viewpoints: (1) "regional population" consisting of a three-county area comprised of Tooele, Salt Lake, and Utah counties, which contain nearly 60 percent of the total state population, (2) a 50-mile circle centered on the PFSF to show population densities relative to the site location, and (3) the population within a 5-mile radius of the PFSF, for the purpose of identifying whether disproportionately high and adverse impacts might exist to minority or low income populations (see Section 2.7.3, Environmental Justice).

2.2.3.2 Regional Population

Utah had a population of 1,980,000 persons in 1994. Among the 50 states and the District of Columbia, the State ranked as 34th most populous (BEA, 1996). From 1970 to 1990, the Tooele County regional population approximated State-wide growth levels. During this period, the Tooele County region's population increased at an average annual rate of approximately 2.55 percent, while the growth rate for the State was 2.8 percent. Between 1980 and 1990, Tooele County regional population growth slowed to an average annual growth rate of 1.3 percent, compared to 3.8 percent during the previous decade. Utah is expected to remain the 34th most populous state, with 2.2 million people expected for the year 2000 and 2.9 million people expected for the year 2025 (Campbell, 1996).

The 1990 population for the three county area around the PFSF (Tooele, Salt Lake, and Utah Counties) was 1,016,147, which comprised nearly 60 percent of the state's total 1990 population of 1,722,850. The most populous county was Salt Lake, which contained over 71 percent of the three county total. Tooele was the least populous county in the region (Census, 1983, 1988, and 1993). Population in this three county area is projected to reach 1,804,519 persons by 2020, based on a projected annual average population growth of 2.0 percent.

2.2.3.3 Population Within 50 Miles

Skull Valley is a remote region with populations found in the unincorporated residential community of Terra, the Town of Dugway, the Skull Valley Band of Goshute Village, and ranches located in the valley along Skull Valley Road. According to county utility records, there are approximately 30 households in Terra and 11 others scattered in Skull Valley. Utilizing the persons per household value of 3.06 (Census, 1993), we estimate that an additional 119 persons live in Skull Valley (excluding the two ranches accounted for in the 5-mile radius). In addition, the nearest sizable population area to the PFSF is the Town of Dugway, with a population of about 1,761 (Census, 1993), located approximately 12 miles to the southwest of the PFSF. Therefore, the total population estimate for Skull Valley is 1,916. Using an area of 600 square miles for Skull Valley, the population density equals approximately 3.2 persons per square mile.

Figures 2.2-2 and 2.2-3 show estimated population figures, based on the 1990 Census, for the years 1990 through 2020 for the 50-mile radius around the PFSF. Also shown are the relative locations of the major towns. The population between 5 and 50 miles of the PFSF is about 276,577 (Figure 2.2-2). The two largest population centers within the 50-mile radius include Tooele City and a portion of western Salt Lake City, with 1990 populations of approximately 13,887 and 246,981, respectively. Expected population growth by the year 2020 (based on state-wide growth levels) is depicted in Figure 2.2-3. The age distribution within this area, from the 1990 Census, is shown in Table 2.2-1.

2.2.3.4 Population Within 5 Miles

The population within a 5-mile radius of the PFSF has been characterized for the purposes of identifying whether any disproportionately high and adverse impacts might exist to minority or low-income populations. The definitions of minority and low-income and the analysis approach are presented in Section 2.7 on Environmental Justice (Census, 1993).

Population within a 5-mile radius of the PFSF consists of approximately 30 residents of the Skull Valley Indian Reservation and two private ranches (each assumed to have 3 residents) on Skull Valley Road, approximately 2.75 and 4.0 miles northeast of the

PFSF. The closest residences to the PFSF are two homes on the Skull Valley Indian Reservation, located approximately 2 miles southeast of the PFSF. There are no cities, towns or census designated places (CDP) located within a 5-mile radius of the PFSF (see Figure 2.2-4). There are no residences located near the Low Corridor.

The estimated population within a 5-mile radius of the PFSF is about 36 persons. Because of the remoteness of the Skull Valley location, it is unlikely that the permanent population within a 5-mile radius of the PFSF would change significantly during the license period.

2.2.3.5 Transient and Institutional Population

No transient or institutional populations are present within 5 miles of the PFSF. The Skull Valley Road passes through the Reservation approximately 1.5 miles from the PFSF. Traffic on this roadway is primarily related to local resident travel and travel between Interstate 80 and the Dugway Proving Ground. During October 1996, a survey was conducted to identify existing and planned public facilities and institutions, within a 5-mile radius of the facility. Due to the remoteness and extreme low population density of the area (36 persons within 5-mile radius), no public facilities such as hospitals, prisons, parks or recreational areas are located or planned within 5-miles of the PFSF.

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2.3 ECOLOGY

Within a 5-mile radius around the PFSF, there are approximately 28,000 acres of public land administered by the BLM, 9,000 acres of privately owned land and 13,000 acres of land which is part of the Skull Valley Indian Reservation. The area is nearly flat, sloping gently downward to the north with small, local elevation changes of about 1 foot per 100 ft.

The heavy-haul of transportation casks will begin at the intermodal transfer point, 1.8 miles west of the intersection of I-80 and Skull Valley Road at Timpie, and continue south approximately 24 miles along Skull Valley Road to the access road for the PFSF. The Low Corridor rail line will cross BLM land beginning at Low Junction on the south side of I-80, Section 18, Township 1 North, Range 9 West, and proceed southeast along I-80 about 3 miles, turning south for about 26 miles, and finally east for 3 miles to the west side of the PFSF (about 32 miles total). Assuming a 200 foot construction right-of-way for the rail line, about 776 total acres would be disturbed. Resources were evaluated and are described in this section for a 0.5-mile zone along both sides of the existing Skull Valley Road and 0.5-mile zone along both sides of the Low Corridor rail line. Transportation of casks on Skull Valley Road would occur by heavy haul tractor/trailer; a rail line would be used to transport casks along the Low Corridor.

Skull Valley is within the area identified by Bailey (1978) as the Bonneville Saltbush-Greasewood section of the Intermountain Sagebrush Province. This is a high desert environment with desert shrub species dominating the valley floors and a coniferous forest (pinyon/juniper) creeping down the adjacent mountain slopes. In addition to sagebrush (*Artemisia tridentata*), other important plants found in this community include shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), rubber rabbitbrush (*Chrysothamnus nauseosus*) , spiny hopsage (*Grayia spinosa*), and horsebrush (*Tetradymia sp.*) (Bailey, 1978). This vegetative community results from the low precipitation and highly alkaline soils. Soils which encompass the PFSF site and transportation corridors are poor in terms of supporting vegetation that would provide diverse wildlife habitats (USDA-SCS, undated).

The BLM identifies seven vegetation zones within the Pony Express Resource Area (PERA), which includes most of Tooele and some of Utah Counties. They are as follows: desert shrub/saltbush, greasewood, sagebrush, mountain shrub, juniper/pinyon woodland, riparian /wetland habitats and conifer/aspen. Additional vegetation types found in the area include barren/rock outcrops, perennial grass, and annuals. Cheatgrass (*Bromus tactorum*), an introduced annual grass, has invaded disturbed areas within the desert shrub/saltbush zone (BLM, 1988).

A study of the ecological history of Tooele and Rush Valleys (located to the east of Skull Valley) indicates that the original vegetation over the more accessible parts of the area may have been destroyed by overgrazing and fires prior to 1880 (Christensen and Hutchinson, 1965, as cited in BLM, 1990). Range conditions continued to decline until 1929 when parts of the valleys became a major "dust bowl." These areas are relatively stable today; however, fire has played a major part in the diversity of vegetation (Christensen and Hutchinson, 1965, as cited in BLM, 1990). According to Sparks, et. al (1990), massive conversions to cheatgrass and other annuals of former sagebrush and shadscale-dominated vegetation were triggered by wildfires and unrestricted grazing.

Table 2.3-1 classifies the major vegetation types found within the project area including those areas within a 5-mile radius of the PFSF and the proposed transportation corridors, along with common plants, and elevations and locations where the vegetation types are normally found.

greasewood/shadscale, and juniper vegetation types near steep, rocky slopes. Although the PFSF site and access road are not in chukar range, the easternmost portion of the 5-mile radius is (BLM, 1990). Chukars are an exotic game species that occur in the easternmost portion of a 5-mile radius from the PFSF (see Figure 2.3-4) (UDWR, 1997a).

Sage grouse are an endemic game species that the UDWR identified as potentially occurring within a 5-mile radius of the PFSF and the transportation corridors. Local sage grouse habitat is generally associated with the benches and upper valley floors of the Stansbury Mountains. Figure 2.3-5 shows the mapped sage grouse habitat in Skull Valley where their general range extends to the northern part of Skull Valley Road, just south of I-80 (BLM, 1990). UDWR has not identified any leks or strutting grounds (courtship areas where male sage grouse congregate to attract mates) within the PFSF project's 5-mile radius. Leks are usually associated with wet meadows (UDWR, 1997a), and these mesic areas are concentrated on the northern end of Skull Valley. No crucial winter range or nesting habitat type has been located within the project's 5-mile radius.

The ring-necked pheasant and the Hungarian partridge are exotic game species that could be found within a 5-mile radius of the PFSF and within 0.5 miles of the Skull Valley Road Corridor. No pheasants or partridges are expected nor have any been observed within 0.5 miles of the Low Corridor rail line. Agricultural areas that produce small grain crops are critically valued areas to both species (UDWR, 1997a). There are no agricultural areas within any areas that will be disturbed by the project. Figure 2.3-6 shows the locations of ring-necked pheasant use within the project area. Hungarian partridge once existed within the project area but are not known to exist there today (UDWR, 1997a).

According to the UDWR (1997a), all raptor species in the area are endemic, and are classified as state protected wildlife in Utah. There are no identified nests within a 5-mile radius of the PFSF, as shown in Figure 2.3-7, however UDWR expects many nests are unidentified throughout Skull Valley. Raptors that inhabit the area include golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), burrowing owl (*Speoyoto cunicularia*) short-eared owl (*Asio flammeus*), northern harrier (*Circus cyanneus*), rough-legged hawk (*Buteo lagopus*), Swainson's hawk (*Buteo swainsoni*), ferruginous hawk (*Buteo regalis*), and red-tailed hawk (*Buteo jamaicensis*). There is extremely limited nesting habitat available within the 5-mile radius of the PFSF because most of these species require trees or cliffs to nest. However, there is some potential nesting habitat available at Hickman Knolls about 1.5 miles south-southwest of the PFSF and within 1 to 2 miles west of the Low Corridor. Observations made during the 1998 wildlife survey indicate that suitable raptor nesting habitat is used and available within 0.5 mile of the Skull Valley Road transportation corridor. In addition, short-eared owls and the northern harrier (marsh hawk) (*Circus cyaneus*) nest on the ground or in short bushes. Ferruginous hawks may also select rock outcrops low to the ground for nesting. State and BLM requirements place a 0.5-mile buffer zone around active raptor nests where disturbing activities are not permitted during specified nesting periods.

2.3.1.3 Aquatic Resources

There are no aquatic resources within Section 6 and there are no wetlands or ponds within a 5-mile radius of the PFSF. However, there are approximately 20 stream channels identified on the U.S. Geological Survey (USGS) quadrangles within a 5-mile radius of the PFSF. These stream channels are ephemeral or, at best, intermittent and have no features that can be considered aquatic. They are essentially dry washes that probably have short-term flow following local storm events or perhaps during a period of snowmelt. The infrequency and small magnitude of these flows precludes the development of wetlands and prevents the streams from providing aquatic or riparian habitat.

this study, a ventilation or dilution factor was calculated as the product of mixing height (meters) and layer average wind speed (meters/second) for 62 upper air stations throughout the United States for the period 1960-1964. A low value of this factor indicates slower dilution. The Salt Lake City upper air station was found to have 1-, 2-, 3-, 4-, and 5-day episode ventilation factors of 99.9, 236.3, 322.1, 357.2, and 463.5 m^2/sec, respectively, compared to those of the worst case station in Lander, Wyoming, of 14, 17, 34, 57, and 55 m^2/sec. Salt Lake City ranked 9th, 18th, 13th, 12th, and 16th out of 62 stations in 1-, 2-, 3-, 4-, and 5-day episode ventilation factors.

2.4.2 Local Meteorology

The meteorology of the PFSF site can be partially characterized using long-term meteorological data collected by the National Weather Service at the SLCIA (NOAA, 1992). This climatological data set is the most comprehensive available for this area. The SLCIA is located approximately 50 miles northeast of the PFSF at an elevation of approximately 4,220 ft. With the PFSF located at an elevation of approximately 4,465 ft, meteorological data collected at SLCIA can be considered representative of the general climate of the PFSF but needs to be supplemented with data more representative of local conditions.

The valley location of the PFSF has an influence on the local meteorology relative to that of SLCIA, with the Stansbury and Oquirrh Mountains rising to elevations of above 10,000 ft between the two locations. The location of the Great Salt Lake to the north of Skull Valley as opposed to west and northwest of SLCIA also probably causes some meteorological differences between the two locations. Therefore, meteorological data collected in Skull Valley are also needed to characterize the local conditions. Monthly average temperature and precipitation data collected at various locations in Skull Valley are available from a book published by the Utah Climate Center (Ashcroft et al., 1992).

The data collected at Dugway, located approximately 12 miles south of the PFSF at an elevation of 4,340 ft, have the longest period of record (1950 - 1992) and appear to be the most reliable. Other useful data were collected at Iosepa South Ranch, which is located about 12 miles north of the PFSF at an elevation of 4,415 ft, during the period from 1951 - 1958.

The on-site Meteorological Monitoring Measurement Program, described in detail in Section 6.1.1, provides hourly average data on wind speed, wind direction, temperature, relative humidity, precipitation, barometric pressure, and solar radiation for characterization of the local meteorology because many of these parameters are not available from other sources. The on-site data were collected for the period December 19, 1996 through December 29, 1998 and are summarized in Table 6.1-2.

Although the tower is located approximately 3 miles southeast of the PFSF at the Pony Express convenience store, where power and a telephone line are available, this location is judged to be suitably representative for "on site" meteorological data collection. The tower location is in the same topographic setting as the PFSF with the Stansbury Mountains to the east and northeast being sufficiently distant from both locations as to cause insignificant differences in meteorological observations between the two locations. Both sites are essentially the same distance from the Great Salt Lake and the Wasatch Mountains to the east. Given that the intent of the meteorological data collection program is to characterize the local meteorology, this location provides representative local data.

2.4.2.1 Precipitation

Normal monthly precipitation tends to be concentrated in the winter and spring months with the larger amounts occurring between December and May and the least amounts in the summer and early fall. The annual average rainfall rate at Salt Lake City is 15.3

inches per year with a record 24-hour rainfall of 2.4 inches. Precipitation occurs an average of 90 days per year (0.01 inch or more). Precipitation data collected in Skull Valley indicate a range of annual precipitation of from 7 to 12 inches per year with increasing amounts at higher elevations in the Stansbury Mountains, maximizing at Deseret Peak with approximately 40 inches per year (Hood and Waddell, 1968). A 43-year record (1950 - 1992) of precipitation data at Dugway indicates a normal annual precipitation rate of 8.2 inches per year. An 8-year record (1951 - 1958) at Iosepa South Ranch indicates an average annual precipitation rate of 9.6 inches per year. The PFSF site data indicate annual precipitation amounts of 9.5 and 10.8 inches respectively for the years 1997 and 1998. Therefore, the valley location of the PFSF tends toward the lowest precipitation amounts in the area. Table 2.4-3 summarizes monthly precipitation amounts for Salt Lake City and Skull Valley locations.

The long-term average annual snowfall (1963 - 1992) at Salt Lake City is 57.6 inches per year occurring mostly between November and April and ranging from a low of 30.2 inches in 1979 - 1980 to 110.8 inches in 1973 - 1974. The maximum recorded monthly snowfall is 41.9 inches in March 1977 along with a maximum 24-hour snowfall of 18.4 inches in October 1984. Information on snowfall amounts at Dugway and Iosepa South Ranch indicate normal annual snowfalls of 16.0 and 21.3 inches, respectively, with maximum monthly amounts of 21.2 and 17.7 inches. The record daily snowfalls at Dugway and Iosepa South Ranch are 9.0 and 8.0 inches, each.

2.4.2.2 Temperature

The range of temperatures in the area is rather large from winter to summer. Summers are relatively hot with temperatures reaching 90°F or higher approximately 56 days per year on average at Salt Lake City. The average daily maximum temperature at Salt Lake City in July is 93.2°F, and mean maximum temperatures at Dugway and Iosepa South

Ranch exceed 90°F during July and August. The record high temperature at Salt Lake City is 107°F occurring in July, 1960 with record high temperatures ranging from 105 to 109°F in Skull Valley. Winters are moderately cold with an average monthly temperature of 28.6°F in January at Salt Lake City and a daily minimum temperature of 19.7°F. The lowest recorded temperature at Salt Lake City is -30°F occurring in February, 1933. Similar winter temperatures are experienced in Skull Valley with average monthly values near 30°F in December and January and record low temperatures from -11 to -29°F. The average number of days with temperatures reaching 32°F or below at Salt Lake City is 125 days with the first freeze normally occurring in October and the last freeze occurring in April. The annual average temperature at Salt Lake City is approximately 52°F for the period 1951 - 1980 with Skull Valley average temperatures ranging from 49 to 51°F. Table 2.4-4 provides daily maximum, daily minimum, and average temperatures by month for the period 1951 to 1980 for Salt Lake City, 1950 to 1992 for Dugway, and 1951 to 1958 for Iosepa South Ranch. Average monthly temperatures are also provided for the 2-year PFSF site database.

2.4.2.3 Wind Direction and Speed

Winds at Salt Lake City are moderate and are fairly uniform over the year with the highest average speed (9.7 mph) occurring in August and the lightest average wind speed (7.4 mph) occurring in December. The long-term mean wind speed for the year is 8.8 mph. The prevailing wind direction at Salt Lake City is from the southeast or south-southeast throughout the year. The winds at the PFSF site based on the 2-year monitoring program are very similar to those of Salt Lake City. They are fairly uniform over the year with the highest monthly average speed (9.6 mph) occurring in April and the lightest monthly average wind speed (7.4 mph) occurring in November and December. The 2-year average wind speed at the PFSF site is 8.7 mph.

Table 2.4-5 provides mean wind speeds by month for a 62-year period of record and prevailing wind directions by month for Salt Lake City, along with the 2-year average values for the PFSF site. Long-term wind information is not available specifically for the Skull Valley.

2.4.2.4 Humidity, Fog, Thunderstorms

PSFS site relative humidity values are summarized on a monthly average basis along with those for Salt Lake City in Table 2.4-6. The Salt Lake City data are the averages of four time-of-day values from NOAA, 1992, while the PFSF site values are based on hourly averages for a 2-year period. The table indicates that the relative humidity values, although for different time periods, are fairly similar to each other with the PFSF site values being somewhat higher during the spring and summer months.

Heavy fog (visibility below 0.25 mile) is not a frequently occurring phenomenon with an average annual frequency of 11.6 days per year at Salt Lake City, occurring mostly during the winter months.

Salt Lake City also has a mean of 36.7 thunderstorm days per year and approximately 5 to 8 thunderstorm days per month from May through August.

2.4.2.5 Atmospheric Stability and Mixing Heights

The dispersion of an air contaminant by atmospheric turbulence and diffusion can be characterized by the stability of the atmosphere. Pasquill (1961) has developed an atmospheric stability classification scheme that divides atmospheric diffusion levels into six classes labeled A through F. Stability Class A represents the most "unstable" and diffusive category representative of conditions during warm sunny afternoons, while F is the most "stable" and least diffusive class generally occurring during the night and early morning hours under light or calm winds. The intermediate stability class D represents "neutral" atmospheric stability and is typified by cloudy, windy conditions. These stability classes are generally determined from National Weather Service meteorological data using a combination of wind speed and cloud cover observations, coupled with solar insolation as a function of latitude, time of day, and day of year.

Table 2.4-7 presents the frequency of occurrence of each Pasquill stability class as determined for Salt Lake City based on 5 years (1988 - 1992) of meteorological data collected at the airport. This table indicates that the dispersion environment of the area is dominated by "neutral" (stability class D) stability (moderate dispersion) with stable atmospheric conditions (poor dispersion) being approximately 60 percent more frequent than unstable conditions (strong dispersion).

Table 2.4-8 presents seasonal average mixing heights for Salt Lake City (Holzworth, 1972). The morning and afternoon mixing heights in Table 2.4-7 were approximated by the National Climatic Data Center from vertical temperature measurements taken by the National Weather Service twice daily for the period 1960 to 1964. The mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs (Holzworth, 1972). As such, the mixing height defines the vertical layer of the atmosphere through which pollutants can be mixed. Low mixing heights, which are characteristic of the nighttime dispersion environment, generally result in higher pollutant concentrations at the surface for low level sources (below the mixing height). The higher mixing heights occurring during midday are conducive to greater dispersion and lower ground level pollutant concentrations.

2.4.2.6 Air Quality

The air quality in the PFSF area is generally very good. The U.S. Environmental Protection Agency (EPA) has adopted National Ambient Air Quality Standards (NAAQS) for six criteria pollutants. The primary NAAQS are designed to protect public health while the secondary standards are designed to protect public welfare (includes protection of economic interests, vegetation, and visibility). The Utah Department of Environmental Quality (DEQ) has adopted the federal NAAQS as the state ambient air quality standards; Table 2.4-9 shows these standards.

Ambient air monitoring data collected by the DEQ at several monitoring stations throughout the state are used to determine whether or not these NAAQS are being met. Areas where the standards are attained are referred to as "attainment" areas and those areas not attaining the standards are called "nonattainment" areas. This project is located in the Wasatch Front Intrastate Air Quality Control Region (AQCR) which is in attainment for nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter with aerodynamic diameter less than 10 microns (PM_{10}), lead (Pb), and ozone (O_3) based on monitoring data collected in the AQCR. A portion of eastern Tooele County is currently non-attainment for the primary and secondary sulfur dioxide (SO_2) standard.

The attainment status of the Wasatch Front Intrastate AQCR is supported by the three most recent years (1995 - 1997) of available ambient air quality monitoring data collected by the DEQ in the AQCR. Table 2.4-10 summarizes these data showing the highest annual average and second highest short-term (1-, 3-, 8-, 24-hour) monitored values in the county for each pollutant and averaging time. These data demonstrate that ambient criteria pollutant concentrations are well below the NAAQS. Given that all of Tooele County, except for the highest elevation areas in the far eastern part of the county, is currently in attainment of the NAAQS for all criteria pollutants and the available monitoring data indicate air pollutant concentrations generally well below the NAAQS, air quality is not expected to be a resource of concern for development of the PFSF.

ranches or farms along the east side of the valley, are wells drilled into the unconsolidated or semi-consolidated sediments that form the alluvial fan along the base of the Stansbury Mountains. Consequently, there is no potable surface water supply that could be subject to normal or accidental effluents from the facility.

Water, including potable supplies, will be required during construction and operation of the PFSF. Water requirements will be modest and similar to a light industrial facility with a 24 hour-per-day work force. The highest water demand will occur during construction for dust control and operation of the concrete batch plant. Source water may come from several water wells drilled and developed at the PFSF or from offsite sources. Wells would be located so that they have no impact on any existing wells in the vicinity of the PFSF.

The land surface at the PFSF is nearly flat and slopes gently downward to the north, from approximate elevation 4,470 ft at the south end to 4,460 ft at the north end. A few shallow, dry washes and former beach or lake bottom features provide slight relief to the PFSF site area. Desert shrubs and grasses form a thin vegetative cover.

No streams that would even be considered intermittent cross the facility area. The closest stream with a significant channel crosses the northeast corner of Section 6 and the center of Section 5, about 1,500 ft from the northeast corner of the facility (Figure 2.5-1). The channel is up to 3 ft deep and 6 to 8 ft wide in some areas. It carried no water during the observation period between June 1996, and February 1997.

Watersheds contributing runoff to the areas of the access road and the 3-mile-long rail road adjacent to the PFSF site are shown in Figure 2.5-1. Watershed runoff contributing to the access road area is primarily from the east mountain range of the valley, and is designated as Basin A in Figure 2.5-1. Basin A is a watershed comprising an area of approximately 270 square miles. Watershed runoff contributing to the 3-mile-long rail road adjacent to the PFSF site is from the west mountain range on the west of the valley, and is designated as Basin B in Figure 2.5-1. Basin B is a watershed comprising an area of approximately 64 square miles (40,960 acres). The PFSF is separated from Basin A and Basin B by an earthern berm proposed for construction to keep out runoff from the two basins. The topography and approximate sheet flow direction in the PFSF vicinity are also shown in Figure 2.5-1.

A major portion of Basin A runoff originates in the east upland upland extending from the lower Stansbury Mountains to the Lookout mountain in the south.. Flood runoff is drained into the valley by a number of intermittent streams (see Figure 2.5-1). The flow from the mountain front, after crossing the alluvial fans at the foothills of the mountain, is quickly lost to the pervious sublayer and evapotranspiration to become an intermittent stream. Stream flow would be produced only by very heavy rainfall or during snowmelt conditions.

Basin B runoff is primarily from the upland in the Lower Cedar Mountains on the west of PFSF. The runoff converges to the 3-mile-long rail road through many small streams. Similar to Basin A, these small streams are normally dried, stream flows can only be seen after a heavy thunder storm.

During PFSF site visits conducted between June 1996 and February 1997, several hydrologic observations were made. No perennial streams were observed to cross Skull Valley road from the uplands to the east, nor were any perennial streams observed west of the PFSF to the base of the Cedar Mountains. There are no upstream or downstream flow control structures whose failure could conceivably affect the PFSF or its access road. The only structures located within 5 miles of the PFSF are very small reservoirs in the foothills used as stock ponds or for collection of water for irrigation purposes.

2.5.2 Floods

The PFSF is located in an area of western Utah with a semi-arid climate, receiving average annual precipitation of 7 to 12 inches (Hood and Waddell, 1968). There are no perennial water courses within 4 miles of the PFSF. The nearest streams are high gradient streams that drain the slopes of the Stansbury Mountains through steep-walled canyons. This flow is quickly lost to the unconsolidated sediments comprising the alluvial apron at the foot of the mountains and becomes part of the groundwater system. No perennial surface flow makes its way across Skull Valley road which runs north-south approximately 1.5 miles east of the PFSF.

There are no active streams in the PFSF vicinity and no average or maximum annual flow rates are available. There are no perennial streams in the PFSF vicinity and no dry stream channels that show evidence of flash flooding. There is no evidence of past flooding in the PFSF site area and only minor development of drainage channels created by infrequent thunderstorms (<1 to 2 ft deep). There is no evidence of flash-flooding in the area, such as flood deposits, nor are there channels that could affect the PFSF if they were subject to a flash flood.

The PFSF location has not experienced any flooding in the past, since it is not located within any flood plain. Storm-induced runoff will provide sheet flow toward the PFSF, which will easily be controlled by construction of short diversion berms near the southern portions of the PFSF.

Analyses of the probable maximum precipitation (PMP) were made to determine a probable maximum flood (PMF) from drainage Basins A and B (SWEC, 1999a, 1999c). As discussed in the PFSF Safety Analysis Report (SAR) Sections 2.4.2.2 and 2.4.2.3, hypothetical PMP events were analyzed to determine maximum flooding elevation at the PFSF site due to flood flows from Basin A and Basin B. The analyses included the general storm and the local storm events..

Based on the computer output, the results of the PMF are summarized in the following:

	Basin A	Basin B
$Q_{Local\ PMF}$=	40,237 cfs	68,500 cfs
$Q_{General\ PMF}$=	52,983 cfs	20,972 cfs

The larger peak discharge is selected as the PMF for the basin:

Q_{PMF}=	53,000 cfs	68,500 cfs

An extremely conservative case that is unlikely to happen in the Skull Valley drainage basin was also analyzed. In Basin A, assuming CN = 96 and Tc = 11 hours, the calculated PMF = 85,000 cfs. In Basin B, assuming CN=96, and Tc = 4.17 hours, the calculated PMF = 102,000 cfs. A CN = 96 is equivalent to an impervious surface or a saturated ground condition.

Results of hydraulic analysis indicate that maximum water surface elevation near the PFSF site is predicted to be 4,506.4 ft (upstream of the access road) in the east floodway with runoff from Basin A, and 4,478.0 ft (upstream of the rail line) in the west floodway from Basin B. Both of the predicted flood elevations are below the designed top elevations of an earthen berm (PMF berm, to be built) at 4,507.5, and 4,480 ft, respectively. Consequently, all Structures, Systems, and Components (SSCs) classified as being Important to Safety are located above the PMF flood plains.

The PFSF site drainage systems (both offsite and onsite) are designed for the 100-yr storm event. Offsite drainage system design for the Hickman Knolls runoff is conveyed around the south and west sides of the PFSF. This flow is then discharged at a permissible velocity to the natural Skull Valley drainage system. Flows resulting from a storm event more severe than a 100-year event from Hickman Knolls are also diverted into the Skull Valley drainage system. Local runoff is conveyed by a surface flow system utilizing swales channeled to a stormwater collection and detention basin where it can evaporate and seep into the soil.

The PFSF access road and the rail road drainage systems are designed to safely convey the surface water under the roadway during a 100-yr storm event. During a PMP, the excess runoff will overtop the access road and the rail road embankments. The flood overflow will be contained with a north-south berm tied into Hickman Knolls to prevent flows from approaching the PFSF. Downstream of the access road and the rail road, the PMF returns to the natural flow conditions. Access to the PFSF site by normal vehicular traffic, as well as emergency vehicles, will be provided at all times except during a storm that is more severe than a 100-yr storm event.

2.5.3 Flood Protection Requirements

As discussed in Section 2.5.2, the PFSF is not subject to flooding. Stormwater which flows toward and/or past the PFSF site area is diverted around the PFSF by newly constructed earthen berms. All structures, systems and components (SSCs) which are classified as important to safety are not subject to flooding. The earthen berms will be protected with rip rap to withstand erosion due to stormwater discharge velocities.

2.5.4 Environmental Acceptance of Effluents

There are no planned liquid releases as a result of PFSF operation. The PFSF septic system will be designed to meet state requirements. No impact to local resources will result.

2.5.5 Groundwater Hydrology

Skull Valley is a north-trending valley extending 50 miles from Lookout Pass in the Onaqui Mountains, to the southwest shore of the Great Salt Lake. It is one of many linear valleys of the Basin and Range bordered by relatively young fault-block mountains. These blocks are composed mainly of limestone and dolomite with a few beds of quartzite, sandstone, and shale, ranging in age from Early Cambrian to Tertiary. Primary permeability of these rocks is generally low; secondary permeability exists as joints, fractures, faults, and bedding plane separations.

A large portion of the precipitation that falls in the uplands runs off the steep hillsides as spring snowmelt in short, high-gradient streams, with little infiltration into the mountain blocks. Another portion drains eastward, becoming part of the hydrologic system of the adjacent Tooele and Rush valleys, while some is discharged as springs in the foothills along the edges of the valley.

Another portion enters the valley-fill aquifers through an extensive recharge area consisting of alluvial fans at the base of the ranges. Hood and Waddell (1968) estimated the long-term average annual runoff from the uplands is about 32,000 acre-ft with only a small part of this actually flowing out of Skull Valley. They estimated the average annual groundwater discharge and recharge is between 30,000 to 50,000 acre-ft with evapotranspiration accounting for 80 to 90 percent of the total discharge.

The valley-fill deposits are unconsolidated and semi-consolidated rocks of Tertiary and Quaternary age. They consist of inter-stratified colluvium, alluvium, lacustrine, and fluvial deposits with minor basalt and ash, and some eolian material. These sediments are derived almost entirely from the surrounding uplands and constitute the main groundwater reservoir.

In general, the coarser deposits are near the perimeter of the valley, grading into well-sorted sand and gravel, and interlayered with lacustrine silt and clay towards the center of the valley. Thick beds of clay exist in some areas and may create local, confined aquifers where they interfinger with sand and gravel along the alluvial fans.

The Salt Lake Group of Tertiary age comprises the majority of the valley fill ranging in thickness from 2,000 ft to over 6,000 ft (Arabasz et al., 1987). The younger Quaternary rocks deposited in Lake Bonneville are mainly silt and clay, and may be up to 1,000 ft thick in the central portion of the valley. Sack (1993) has recently mapped and described the various Quaternary and Holocene surficial deposits in Skull Valley.

The Tertiary and oldest Quaternary deposits are slightly to highly permeable, depending upon grain size and degree of cementation. The deeper, more consolidated deposits contain some volcanic deposits that may reduce the permeability. The Tertiary and Quaternary deposits probably contain most of the groundwater of usable quality in storage in this part of Utah.

The younger Quaternary and Holocene sediments in the valley bottom have generally low permeability except for areas of windblown sand and old beach and bar deposits. Precipitation on, or surface runoff to the valley bottom remains ponded until it evaporates. The precipitation that is absorbed does not reach the water table in the southern and central parts of the valley because of the depth of the water table, the low permeability of the soil materials, and the low amount of precipitation. Most of this water is captured by plants and transpired; a small portion evaporates directly through capillary action and contributes to the development of a high alkali content in the surface soils.

Groundwater flow is generally northward toward the Great Salt Lake. Hood and Waddell (1968) calculated that with a transmissivity of 2,675 ft^2/day, the annual volume of underflow out of the valley is about 800 acre-ft per year. Pumpage from wells for all purposes was estimated at 5,000 acre-ft per year in Skull Valley and is not believed to have changed significantly in the last 30 years.

Domestic water wells are developed almost exclusively in the unconsolidated alluvial fan deposits along the east side of Skull Valley. This same area serves as the main recharge area for the valley. Water quality is also the highest in this area. Discrete sand and gravel lenses are sufficiently interconnected so that water moves from bed to bed as a single hydrologic unit. Groundwater is commonly between 110 and 160 ft below ground in this area.

Farther out in the valley where lake clays have been deposited between granular layers, some degree of confinement occurs and, as a result, many irrigation and stock wells are under artesian conditions. These wells are commonly drilled to depths between 250 to 500 ft but maintain static water depth of 100 ft or less (Figure 2.5-2). Some well records indicate artesian flow at the ground surface from wells just south of the Skull Valley Indian Reservation. This information dates from the 1940's to 1960's (Arabasz et al., 1987).

Groundwater quality varies significantly in Skull Valley, dependent mainly on proximity to the bordering ranges. The alluvial apron along the base of the Stansbury Mountains contains the lowest total dissolved solids (TDS) in the valley, with concentrations from 100 to 800 mg/l. In the southernmost part of the valley, TDS concentrations range from

700 to about 900 mg/l with a few isolated wells above 1,000 mg/l TDS. A well south of the Skull Valley Indian Reservation yielded a TDS concentration of greater than 2,500 mg/l (Arabasz et al., 1987). Sodium and chloride are the major ions found in these waters.

Toward the center part of the valley, away from the alluvial apron, unconsolidated lacustrine materials are interstratified with clastic material. Wells in this area tend to have lower yields and poorer quality water (TDS >1,000 mg/l) and are used mainly for irrigation and stock watering. The north end of the valley has generally high TDS concentrations, in the range of 1,600 to 7,900 mg/l with sodium and chloride again being the main constituents (Arabasz et al., 1987).

Based on boring data obtained at the PFSF site, the uppermost soil layer consists of interbedded silt, silty clay, and clayey silt with a thickness of approximately 30 ft. This layer is underlain by very dense fine sand and silt. The groundwater table was encountered in the borings at a depth of 125 ft (approximate elevation 4,350 ft).

Limited hydraulic characteristics of the soil in the PFSF vicinity are available from the on-site boring program (SWEC, 1999b).

The hydraulic gradient was estimated to be approximately $9.5x10^{-4}$. (Hood and Waddell, 1968). Groundwater flows in a south to north direction toward the Great Salt Lake.

Soil interpretations prepared by USDA (undated) indicate that the permeability of a silt soil in Skull Valley ranges from 0.2 to 0.6 inch/hr. The average groundwater velocity was estimated to be approximately $2.8x10^{-3}$ to $8.5x10^{-3}$ gallons/day/sq ft.

The source of groundwater flow at the PFSF is mainly derived from precipitation that falls at the higher elevations of the Stansbury and Cedar Mountains. As a result of the low permeability deposits and high evapotranspiration at the PFSF, rainfall at the PFSF is unlikely to contribute to groundwater flow.

Preliminary testing of the onsite groundwater monitoring well indicates that development of the PFSF will have no measurable offsite effects on existing groundwater quality or levels of a water supply well at the site (SWEC, 1999b).

2.5.6 Contaminant Transport Analysis

The nature and form of the material stored (spent fuel rod assemblies) and the method of storage (dry casks) preclude the possibility of a liquid contaminant spill. Discussion of potential contamination of groundwater is not applicable.

2.6 GEOLOGY AND SEISMOLOGY

2.6.1 Geologic and Physiographic Setting

The PFSF is situated in western Utah near the eastern boundary of the Basin and Range Physiographic Province with the Middle Rocky Mountain Province (Figure 2.6-1). This area is characterized by a series of roughly north-south trending, tilted fault-block ranges separated by down-faulted linear basins. The PFSF is located near the middle of the Skull Valley basin, at approximate elevation 4,460 to 4,470 ft, between the Stansbury Mountain range on the east and the Cedar Mountains on the west. Surficial soils at the PFSF are mainly lacustrine marly silts and clays deposited by Lake Bonneville during the Late Pleistocene. As shown on the boring logs, below about 25 to 35 ft is a very dense fine sand with minor gravel and silt layers to at least the 100 foot depth (see PFSF SAR, Appendix 2A). The base of the Bonneville deposits is believed to be at a depth of 45 to 50 ft. in the site area where the Promontory Soil was identified (Geomatrix Consultants, Inc., 1999a) and the soil blow-counts increase dramatically (Appendix 2A). The base of the Quaternary section is not well-constrained but the Tertiary “Walcott ash” is known in several borings at a depth of about 85 ft. Bedrock was not encountered in the borings but is believed to occur at a depth of between 520 and 820 ft, based on seismic survey results (see PFSF SAR, Appendix 2B). Bedrock outcroppings, about 1.25 miles south of the PFSF at Hickman Knolls, have been mapped as the Fish Haven Dolomite of Late Ordovician age (Moore and Sorensen, 1979; Geomatrix Consultants, Inc., 1999a). Based on seismic refraction surveys and onsite monitoring well data, the groundwater table is believed to occur beneath the PFSF at a depth of about 125 ft.

The Stansbury fault, exposed along the base of the western escarpment of the Stansbury Mountains about 6 miles east of the PFSF, is considered to be "capable" as defined in 10 CFR 100, Appendix A. The fault dips to the west and is projected beneath the PFSF at a depth of 4.4 miles (55° dip assumed). Arabasz et al. (1987) consider the Stansbury fault capable of generating an earthquake with a maximum magnitude 7.3. Wells and Coppersmith (1994) using surface rupture length criteria suggest the maximum earthquake magnitude on the Stansbury fault is 7.0 ± 0.28 (moment mag.). Helm (1995) has calculated that the next seismic event on the fault should be a 6.8-6.9 ± 0.04 M_S, based on strain accumulation rates of previous events. Geomatrix Consultants, Inc. (1999a) calculate an expected value (mean) of **M** 7.0 for the maximum magnitude on the Stansbury Fault.

Two unnamed faults were identified in the PFSF area, and are informally named the East and West faults (Geomatrix Consultants Inc., 1999a). Late Pleistocene activity is indicated for both of these faults, based on geophysical and geomorphological studies. The East fault lies 0.9 km east of the site and the West is 2 km to the west. Mean maximum magnitudes for the East and West faults were calculated to be **M** 6.5 and **M** 6.4, respectively. The Stansbury, East, and West faults are the most important structures with respect to the assessment of seismic hazard in the PFSF vicinity. A transition zone or zone of distributive fault offset between the East and West faults was identified and evaluated as a surface displacement hazard beneath the PFSF. Results are discussed in Geomatrix Consultants Inc., (1999a). The maximum "random" earthquake for this region has been defined by Pechmann and Arabasz (1995) as M_L = 6.5.

Geomatrix Consultants, Inc. (1999a and 1999b) performed a probabilistic hazard analysis to assess vibratory ground motion and fault displacement hazards at the PFSF site. Peak accelerations for design bases were calculated to be 0.40 g horizontal and 0.39 g vertical for a return period of 1000 years. Ground surface displacements associated with faults believed to exist beneath the site were determined to be less than 0.1 cm for the same return period.

2.6.2 Site Geomorphology

Figure 2.6-2 shows PFSF topography, and Figures 2.1-1 and 2.6-4 show topography in the PFSF vicinity. The PFSF lies near the center of Skull Valley about mid-way between the Stansbury Mountains and the Cedar Mountains. Skull Valley is in a part of the Great Basin that was once occupied by Lake Bonneville, a large lake that developed in the Late Pleistocene (30,000 to 25,000 years before present (B.P.)). As the climate became warmer in the latest Pleistocene, the lake shrank in size and outlets for the lake were abandoned; the water gradually became saline. The gently north-sloping floor of Skull Valley is the former bottom of the lake and the unconsolidated deposits at the PFSF are sediments laid down in and by Lake Bonneville. About 2 miles east of the PFSF, the valley bottom meets the toe of an alluvial apron built up from a series of coalescing alluvial fans along the base of the Stansbury Mountains. The apron slopes at about 200 ft/mile in the vicinity of the Skull Valley Indian Reservation village. A wave-cut bench or terrace can be seen near the head of the apron representing the maximum level of Lake Bonneville about 15,300 years B.P. at elevation 5,240 ft. A scarp and small graben in Quaternary deposits reflecting Quaternary movement on the Stansbury fault (Barnhard and Dodge, 1988; Geomatrix Consultants, Inc., 1999a) are also present.

The apron is only slightly dissected by streams originating in the steep bedrock terrain of the Stansbury Mountains. Stream and spring flow are rapidly absorbed into the coarse granular fan deposits resulting in very little water reaching the valley bottom as surface runoff in this area.

The valley floor is relatively smooth, being interrupted in only a few locations by bedrock outcrops, such as Hickman Knolls rising about 400 ft above the valley bottom near the PFSF. Relief on the valley bottom is slight consisting of a few shallow (1 to 3 ft) north-trending dry washes and low (1 to 3 ft) linear soil ridges. The washes are marked by more dense desert shrub vegetation, whereas the ridges tend to be grass covered. The washes carry water for very short periods during spring snowmelt and infrequent, local thunderstorms. A few shallow depressions appear to pond water at times until they evaporate. This network of shallow washes eventually leads offsite to the north where it joins the central valley drainage system leading to the Great Salt Lake. Perennial surface water is found about 10 miles north of the PFSF in a large mudflat fed mainly by springs along the base of the Stansbury Mountains.

Other features recognized on the valley bottom near the PFSF include beach ridges and shoreline deposits associated with Lake Bonneville and eolian dune deposits in various forms, mainly parabolic or shrub-coppice dunes (Sack, 1993).

There is no evidence of flash flooding near the PFSF site area nor any deposits indicative of mudflows or recent landslides. The great depth to bedrock and the very dense condition of most subsurface soils preclude the development of collapse or uplift features associated with karst terrains or tectonic depressions. There is no history of mineral extraction or injection in the area and little likelihood of future development. Withdrawal of water in the area is widely scattered and consists of a few domestic supply wells, irrigation wells, and stock watering wells. There is no potential for subsidence from water withdrawal because of the distance from these sources and the present depth to water at the PFSF (125 ft).

In summary, the geomorphology of the PFSF is typical of a semi-arid to arid desert setting. The adjacent ranges are affected by mass-wasting processes and stream erosion that deliver their load of sediments to a complex of alluvial fans at the edge of the ranges. Most of the sediment load is dropped here as the water infiltrates or evaporates. The central part of the valley is relatively unaffected by fluvial processes. Mechanical and chemical weathering of rock and soil proceeds very slowly in this flat dry environment.

Essentially, the only geomorphic processes to affect the PFSF are microprocesses wherein soil moisture from occasional precipitation is drawn upward by capillary action and evaporates near the ground surface. This results in a gradual buildup of calcium carbonate, alkali, and sulfate in the near-surface soils. Soils at the PFSF are described in the County soil report (USDA, undated) as being calcareous and saline.

2.6.3 Site Area Structure and Geologic History

2.6.3.1 Bedrock

The PFSF lies above a sediment-filled, structural basin that is bounded on the east and west by uplifted range blocks, the Stansbury-Onaqui Mountains and the Cedar Mountains, respectively. This pattern is repeated throughout western Utah and Nevada and elsewhere and is so characteristic that the name Basin and Range is applied to the physiographic area containing this structural arrangement (Figure 2.6-1). The eastern border of this province is generally drawn along the north-south trending Wasatch Front about 55 miles east of the PFSF. The western boundary of the Front is known to be a major, active normal fault, the Wasatch fault, along which the Front has been uplifted and the Salt Lake basin is down-dropped. This major structural element is believed to have persisted since at least Late Precambrian time. The Uinta arch, which includes the present Uinta Mountains east of the Wasatch Front, is an east-west trending, anticlinal structure with a similarly long history of uplift. It intersects the Wasatch line at right angles and is believed to have influenced sedimentation patterns, as well as provided a stable buttress during tectonic episodes. Evidence of the Uinta arch has been traced as far west as central Nevada (Roberts et al., 1965) and is postulated to have affected sedimentation patterns in the rocks of the Stansbury Mountains and patterns of faulting and mineralization (Zoback, 1983; Helm, 1995; Stokes, 1986). The regional bedrock geology is depicted on Figure 2.6-3.

The Stansbury Mountains are but one of numerous mountain ranges in the Great Basin with similar origins and characteristics. The ranges are oriented roughly north-south, are commonly 9 to 12 miles wide, and are separated by valleys or basins filled with alluvium and colluvium derived from the ranges. The thickness of sediment in the valleys ranges from 1,000 ft to as much as 12,000 ft. Elevation of the ranges (and subsidence of adjacent basins) occurs by movement along major faults on one or both sides of the uplifted range blocks. It is generally believed that the faulting is distributed along several range-front faults, many of which are buried beneath the valley-fill deposits. Many of the mountain blocks show significant tilt; in the eastern Great Basin, most blocks are tilted to the east (Stewart, 1978).

Latest movement is known to be Quaternary or younger on many of the range front faults. Offset of Quaternary sediments or Holocene alluvial fans is well documented in numerous studies, particularly along the Wasatch fault. The Stansbury fault has been considered to be active at least since the work of Rigby (1958). More recent analyses suggest the fault may be segmented with movement on the southern segment occurring less than 18,000 years B.P. (latest Pleistocene) (Helm, 1995; Geomatrix Consultants, Inc., 1999a). The most recent events on the Stansbury fault displace late Pleistocene shorelines that are estimated to be about 18,000 years old. Detailed discussion of the Stansbury fault and the seismic implications are found in the PFSF SAR, Section 2.6.2.3, and Sections 5 and 6 of Geomatrix Consultants, Inc. (1999a).

Other Tertiary normal faults in Skull Valley have been proposed by various authors (Cook et al., 1989; Helm, 1995; Zoback, 1983). Recent work for the PFSF has identified two additional west-dipping normal faults and one east-dipping normal fault in the vicinity of the PFSF, based mainly on geophysical data and subtle geomorphic expression (Bay Geophysical Associates, 1999; Geomatrix Consultants, Inc., 1999a). These faults are informally named the "East", "West" and "F" faults and are discussed in detail in

Geomatrix Consultants, Inc. (1999a), Sections 2, 5, and 6. As shown on the cross sections, Figures 2-1 and 2-2 in Geomatrix Consultants, Inc. (1999a), the East fault is interpreted to form the east margin of the Tertiary basin that underlies Skull Valley whereas the West fault lies within the basin, west of the PFSF location. The East and West faults are interpreted to merge together about 9 miles southeast of the site. The PFSF appears to be located in the stepover zone between the East and West faults where the slip is transferred from the East to the West fault. The west boundary of the Tertiary Skull Valley basin is believed to be the East Cedar Mountains fault.

Interpretation of the high resolution seismic reflection survey (Bay Geophysical Associates, 1999) performed across the PFSF site indicates the East fault displaces a subsurface reflector believed to be the unconformity at the base of the Bonneville alloformation on the Promontory soil. The Bonneville sediments are 30,000 years old or younger. Therefore, the East fault is considered to be capable as defined in 10 CFR 100 Appendix A. The West fault is also considered to be capable based on apparent changes in elevation along a geomorphic feature, the late Pleistocene Stansbury gravel bar, southwest of the PFSF. The evidence for the fault and an analysis of its slip rate are discussed in Section 2 and 5 of Geomatrix Consultants, Inc. (1999a). The zone of distributed faulting, where slip is transferred from the East fault to the West fault, was also interpreted from the high resolution reflection survey. Small normal faults, both east-and west-dipping, were imaged; some were interpreted to offset the base of the Bonneville alloformation whereas others clearly do not (Bay Geophysical Associates, 1999). Displacement on individual faults within the zone of distributed faulting is small (Geomatrix Consultants, Inc., 1999a, Table 5-1). A drilling program conducted across this zone confirmed the presence and nature of this zone of faulting, as shown on Figure 5-4 in Geomatrix Consultants, Inc. (1999a).

2.6.3.2 Surficial (Basin-fill deposits)

The surficial geology of Skull Valley is predominantly unconsolidated material of Quaternary age deposited by Lake Bonneville (~ 30,000 to 12,000 years B.P.). Pre-Lake Bonneville lacustrine deposits have been found in other valleys in the region indicating numerous lakes occupied the Salt Lake basin prior to Lake Bonneville. These deposits date from at least 600,000 B.P. to 30,000 B.P. (Lund et al., 1990). Pre-Lake Bonneville sediments were encountered in borings, test pits, and trenches in the site vicinity, as discussed by Geomatrix Consultants, Inc. (1999a).

Gilbert (cited in Sack, 1993) believed that the extensive pre-Bonneville alluvial fans were an indication of a long period of hot, dry climate prior to the transgression of Lake Bonneville. Most investigators believe that the Bonneville lake cycle began between 30,000 and 25,000 years B.P., coinciding with the final glacial maximum in the Rocky Mountains (Scott, 1988). Lake levels continued to rise until about 21,000 to 20,000 years B.P. when the level remained somewhat stable for an extended period of time. The Stansbury shoreline developed at this time and has been identified throughout the Bonneville Basin (Oviatt et al., 1990), near elevation 4,468 ft. Sack (1993) and Geomatrix Consultants, Inc. (1999a) have also mapped this shoreline through the southern part of Section 6, T5S, R8W near the PFSF, based on aerial photographs (Figure 2.6-4). Geomatrix Consultants, Inc. (1999a) mapped numerous additional shoreline features in the area shown on their Figure 1-3.

Continued filling of the basin after 20,000 years B.P. caused the lake to rise to its maximum elevation of about 5,240 ft approximately 15,300 years B.P. At that time, an outlet for the lake into the Snake River drainage was reached. The Bonneville shoreline was created at this time and can be seen as a bench on the alluvial fan east of the PFSF. At about 14,500 years B.P., unconsolidated deposits in the lake outlet channel were rapidly eroded. The lake dropped more than 300 ft in a matter of a few weeks, and resulted in the Bonneville flood. The outlet stabilized at about elevation 4,740 ft, and the Provo level developed (Malde, 1968). Sack (1993) has also mapped this shoreline east of the PFSF on the alluvial fan (Figure 2.6-4).

Climatic change beginning about 14,000 years B.P. caused the gradual shrinkage of Lake Bonneville to at least the lowest level of the present Great Salt Lake by about 12,000 years B.P. (Currey, 1990). A brief transgression of the lake occurred between about 10,900 and 10,300 years B.P. to about elevation 4,250 ft (Currey, 1990). This level is known as the Gilbert level of the Great Salt Lake and has been mapped about 11 miles north of the PFSF (Sack, 1993). Since that time the lake has receded and fluctuates within about 20 ft elevation of its historic average (Lund et al., 1990). Only once in the past 10,000 years has the level of the lake been as high as 4,220 ft (Atwood and Mabey, 1995). The PFSF is at approximate elevation of 4,465 ft, well above any recorded maximum level of the Great Salt Lake.

2.6.4 Site Stratigraphy

The PFSF site geology was investigated in 1996 by a subsurface drilling program totaling 24 borings to a maximum depth of 100 ft, and a seismic refraction and reflection program. Logs of borings are included in the PFSF SAR, Appendix 2A, and the results of the seismic surveys are found in the PFSF SAR, Appendix 2B. Section 2.6.5 includes a description of the generalized subsurface profile and engineering characteristics of the subsurface materials.

Additional investigations were conducted in 1998 and included surficial and bedrock mapping, excavation and mapping of numerous test pits and trenches, drilling of more than 40 additional boreholes to a maximum depth of 225 ft, and completion of 6 kilometers of high-resolution seismic shear-wave reflection lines. A summary of these efforts is included below. Additional detail and discussion are found in the original reports of this work (Geomatrix Consultants, Inc., 1999a; Bay Geophysical Associates, 1999).

The PFSF site is situated near the center of Skull Valley where Quaternary lacustrine and geomorphic features dominate the topography. The stratigraphy beneath the site consists of approximately 500 to 800 ft of Quaternary and Tertiary basin fill overlying Paleozoic bedrock. The nature of the deepest Tertiary deposits is unknown at this time but is believed to include sediments of the Salt Lake Formation, mainly sand, silt, marl and tuff in varying states of consolidation. The Salt Lake Formation extends up to a depth of about 85 ft in the central part of the PFSF. A volcanic ash at that level has been correlated with the Walcott tuff, known to be late Miocene in age (approximately 6 m.y.; SAR Appendix 2E). This boundary was also identified as a prominent reflector the high-resolution shear wave profiles (Bay Geophysical Associates, 1999; Geomatrix Consultants, Inc., 1999a, Plate 4).

There is evidence for four major lake cycles in the Bonneville basin during the past 700,000 years (Machette and Scott, 1988; Oviatt et al., 1997). Evidence for the three oldest is not well preserved regionally and was found only sporadically in the PFSF vicinity. The most recent cycle, the Lake Bonneville cycle, occurred between about 30,000 and 12,000 years ago and is well documented in Skull Valley. Several transgressions and recessions of the lake occurred during this time, each leaving an identifiable characteristic in the geomorpholoy of the valley or in the stratigraphic record. This evidence is presented in detail in Geomatrix Consultants, Inc. (1999a, Section 3.2). Near-surface Pleistocene deposits at the PFSF consist mainly of fine sand, silt, clay and marl. In general, the finer grained materials, such as silt, clay and marl were deposited during the deeper water portions of the lake cycle and the sand represents shallower, near-shore beach or deltaic fan environments. The engineering properties of those materials are discussed in Section 2.6.1.6. Locally, Holocene eolian and fluvial activities have reworked the surface soils to some extent (Sack, 1993). Eastward from the PFSF, along the proposed access road to Skull Valley Road, the influence of the proximity to the range-front alluvial fans is apparent as an increase in gravel content at shallow depths (SAR Appendix 2A).

Bedrock is not exposed at the PFSF but is found about 1.5 miles to the south at Hickman Knolls, and about 1.5 miles northeast in a series of unnamed low hills. Hickman Knolls has been mapped as Fish Haven Dolomite of Ordovician age (Moore and Sorensen, 1979; Geomatrix Consultants, Inc., 1999a). At this location the formation is a medium to dark gray dolomite and limestone breccia. Bedding is massive to indistinct, and breccia pebbles are angular to sub-round and appear to be the same composition as the enclosing matrix. Bedding strikes northerly to northeasterly and dips to the east at moderate to steep angles. Bedrock fracturing consists mainly of two sets of high angle fractures, one trends east-west and the other north-south. These fractures tend to coincide with more silicified zones that form prominent scarps on the Knolls that are strongly expressed in the morphology and are associated with many of the aerial-photo lineaments (See Plate 1, Geomatrix Consultants, Inc., 1999a).

Several faults and ductile shear zones were identified at Hickman Knolls during the recent investigations. Geomatrix Consultants, Inc. (1999a) presents evidence that indicates the faults developed prior to the dolomitization process and the shear zones are likely penecontemporaneous with the process of brecciation. No large, through-going faults are believed to exist on Hickman Knolls.

There has been some enlargement of a few joints from dissolution, and a few small caves or openings (1 to 4 ft deep) can be seen on some of the steeper rock faces. Karst conditions do not exist at Hickman Knolls nor are they likely to develop because of the near-desert environment and the depth to ground water (~125 ft). The outcrop mapped northeast of the PFSF has been identified as Deseret Limestone of Mississippian age (Moore and Sorensen, 1979).

Areas of bedrock outcrop are indicated on Figure 2.6-4, in addition to the surficial deposits. Scarps in soil near the PFSF identified on the map have been investigated by Dr. Donald Currey for this project (see PFSF SAR, Appendix 2C). Currey concluded the features were related to lacustrine processes of Lake Bonneville and are not of tectonic origin.

2.6.5 Engineering Characteristics of Site Materials

The subsurface profile at the PFSF was investigated by drilling a series of exploratory borings up to 100 ft deep (see PFSF SAR, Appendix 2A), as well as by performing seismic refraction (P- and S-wave) and reflection surveys (see PFSF SAR, Appendix 2B). Figure 2.6-2 presents the locations of these investigations superimposed on the plot plan of the facilities. Standard Penetration Test (SPT) samples were obtained at 5 ft intervals in these borings. Based on these borings, the generalized subsurface profile consists of three layers, as shown in Figure 2.6-5. The uppermost layer extends to a depth of between 25 and 35 ft below existing grade and is mainly interlayered silt, silty clay, and clayey silt. SPT N-values for this layer are mostly between 8 and 20 blows per ft, with an average value of 16 blows per ft and a median value of 14 blows per ft, indicating that these are "stiff" or "medium dense" materials.

This layer is underlain by 25 to 30 ft of very dense, dry, fine sand with occasional thin layers of fine gravel and coarse sand. SPT N-values often are greater than 100 blows per 6 inches. A few clayey zones were encountered, but they had no apparent effect on the blow counts. The two borings that were drilled to a depth of 100 ft (Borings A-1 and D-4) indicate that this second layer of dense, dry, fine sand is underlain by very dense silt, silty sand, and sandy silt with occasional layers of clayey silt.

The groundwater table was encountered in the borings at a depth of 125 ft in the area of the Canister Transfer Building. Seismic refraction results indicate the compression wave (P-wave) velocity changes from approximately 2,800 fps to approximately 5,525 fps at about 100 to 130 ft depth, which is believed to represent the water table (see PFSF SAR, Appendix 2B).

Borings AR-1 through AR-5 were drilled along the corridor for the access road, which extends easterly from the PFSF in the vicinity of the Administration Building to Skull Valley Road. These borings indicate that the near-surface soils are similar to the uppermost layer described above; i.e., silt, silty clay, and clayey silt, although somewhat thinner. Sands were encountered at depths of 5 and 10 ft in Boring AR-1 and from a depth of 5 ft to 20 ft in Boring AR-2. Silty or sandy gravels were encountered at depths of 30 ft in Boring AR-3, 20 ft in Boring AR-4, and 6 ft in Boring AR-5.

None of these borings encountered bedrock. Interpretation of the seismic reflection survey data indicates that the depth to bedrock is between 520 ft and 820 ft below the surface in the vicinity of the PFSF and that it drops off towards the east, dipping from an estimated depth of 740 ft at Station 700 on Seismic Line 3 to approximately 1,020 ft at the eastern end of this seismic line.

Geotechnical laboratory tests were performed on samples of the upper layer of silt, silty clay, and clayey silt obtained from these borings. The results of these tests are as follows:

- Water content: $28\% < \omega < 47\%$, ω_{avg} 36%,

- Liquid Limit: 29% < LL < 61%, LL_{avg} = ~42%
- Plastic Limit: 20% < PL < 44%, PL_{avg} = ~29%
- Plasticity Index: 5% < PI < 23%, Pi_{avg} = ~13%
- Specific gravity: 2.72
- Saturation: 51%
- Initial void ratio: 1.9
- Unit weight:

  Dry 59 pcf

  Moist 80 pcf

  Saturated 100 to 105 pcf
- Consolidation parameters:

  Maximum past pressure: 6 ksf

  Virgin compression ratio, CR: 0.294

  Recompression ratio, RR: 0.014

  Rate of secondary compression: As shown by dashed curve in Fig. 2.6-6.

Effective-stress strength parameters for drained analyses are estimated to be $\phi = 30°$ and c = 0 ksf, based on the plasticity index of this material.

Total-stress strength parameters for undrained analyses (e.g., earthquake loadings) are estimated to be $\phi = 0°$ and c = 2.2 ksf, based on unconsolidated-undrained triaxial tests.

The recommended coefficients of earth pressure for this material are as follows:

- At-rest, K_o, is 0.5
- Active, K_a, is 0.33
- Passive, K_p, is 3.0

The recommended coefficient of friction between concrete placed on the in situ soils is 0.58 for long-term loadings, and a cohesion of 2.2 ksf (i.e., the undrained shear strength) should be used to resist sliding for short-term (e.g., earthquake) loadings.

The recommended value of the coefficient of vertical subgrade reaction of the silt, silty clay and clayey silt for a 1-ft x 1-ft square is 120 kips/ft^3. This value should be reduced for footing widths greater than 1 ft by applying a reduction factor, RF, calculated as follows:

$$RF = [(B+1) / 2B]^2$$, where B is the effective width of the footing.

The recommended value of the coefficient of vertical subgrade reaction of the in situ soils for use in design of the storage pads is 20 kips/ft^3.

The recommended value of the coefficient of horizontal subgrade reaction of the in situ soils for use in the design of drilled caissons is $20 \cdot z / B$ kips/ft^3, where z is the depth below finished grade and B is the effective width of the caisson.

The dynamic foundation parameters in support of the soil-structure interaction analysis were derived by Geomatrix Consultants, Inc. (1997) from the results of a one-dimensional site response analysis. Figures 2.6-7 and 2.6-8 present the strain-compatible shear-wave velocity and damping ratio profiles.

Strain-compatible soil properties of the upper layer of silt, silty clay, and clayey silt, developed based on the weighted average of the values within 30 ft below the foundation, include:

- Shear-wave velocity: 515 ft/sec

- Shear-wave damping: 11%
- Compressional-wave velocity: 1,500 ft/ sec
- Shear modulus: 668 ksf
- Young's modulus: 1,915 ksf
- Poisson's ratio: 0.433

Table 2.6-1 presents the equivalent dynamic soil parameters for the storage pad.

2.6.6 Earthquake History

The historic record of earthquakes in Utah began in 1850 with the publication of the region's first newspapers in Salt Lake City. Prior to mid-1962 when a scattered, state-wide network of seismographic stations became operational, most records were based upon felt reports. A few larger events were recorded instrumentally at regional stations beginning in the 1950's, including seismograph stations at Salt Lake City and Logan since 1955. Since 1974, a network of modern stations (presently > 85 stations) has provided data to the University of Utah's Seismograph Station (Arabasz et al., 1980). Coverage in the PFSF site area has been provided since 1968 by a station at Dugway, about 14 miles to the south; at Fish Springs, about 50 miles southwest; and on Stansbury Island, about 30 miles north-northeast. Arabasz et al. (1980) estimated the historical catalog for the Wasatch Front region to be complete for Modified Mercalli (MM) intensity greater than VIII since 1850; greater than VII since 1880; greater than VI since 1940; and greater than V since 1950. They judged that instrumental monitoring has provided a complete record down to magnitude (M_L) 2.3 since mid-1962. (For explanation of various magnitude designations, see Stover and Coffman, 1993, p. 2-3.)

Figure 2.6-9 is a map of all earthquakes within 160 km (100 miles) of the PFSF of magnitude 3.0 or greater from the University of Utah Seismograph Station catalog. Table

2.6-2 is a chronological listing and description of those events. Only one earthquake greater than magnitude 3.0 has been reported within 50 km of the PFSF. This event occurred on August 11, 1915 at an assumed location north of Deseret Peak in the Stansbury Mountains. It was reported at Iosepa, a settlement on the western foothill of the Stansbury Mountains. The University of Utah catalog indicates a magnitude 4.3, based on conversion of MM intensity V from the felt report (Arabasz et al., 1987). Stover et al. (1986) list an intensity VI for this event. However, Stover and Coffman (1993) do not list this event in their catalog which has a threshold magnitude of 4.5. The earthquake was not reported in Tooele, less than 20 miles from Iosepa (Everitt and Kaliser, 1980), nor in Salt Lake City, about 43 miles away to the east (Arabasz et al., 1987).

The largest historic earthquakes to occur within 160 km (100 mi) of the PFSF occurred in the Hansel Valley at the northern end of the Great Salt Lake. A magnitude 6.6 earthquake occurred on March 12, 1934 and produced the only surface offset associated with an historic earthquake in Utah. The event occurred beneath an alluvium-filled valley and resulted in 50 cm of vertical ground surface displacement in a zone 12 km long. Some lateral displacement may also have occurred. Liquefaction and land subsidence occurred locally (Smith, 1978). Slight damage was reported in Grantsville and Tooele with MM intensity V experienced at Tooele (Everitt and Kaliser, 1980). Oaks (1987) reports MM intensity VIII in Salt Lake City caused buildings to sway and a 2-ton clock mechanism fell from the tower of the Salt Lake County Building. Chimneys were toppled and structures were shifted on their foundations. The location of the earthquake is about 90 miles north of the PFSF and appears to be associated with northerly-trending faults along the base of the Hansel Mountains (dePolo et al., 1989). Four aftershocks occurred within the following 2 months ranging in size from magnitude 4.8 to 6.1. It is not known what effects, if any, these events had in the PFSF site area. An isoseismal map indicates the PFSF would have been subject to MM intensity V effects from the original event (Stover and Coffman, 1993).

The Hansel Valley was the site of a prior moderate event of intensity VII (6.3 magnitude) on October 6, 1909. Everitt and Kaliser (1980) indicate an MM intensity VII in the epicentral area; the event received no mention in the Tooele paper. The Salt Lake City paper indicated some buildings at the Saltair Resort on the southern shore of the Great Salt Lake were knocked out of plumb. Waves reportedly rolled over the boathouse pier and windows were cracked in Salt Lake City.

The closest magnitude 5.0 or greater earthquakes to the PFSF occurred near Magna, UT, about 42 miles to the northeast. A magnitude 5.0 event on February 22, 1943 and a magnitude 5.2 event on September 5, 1962 were felt locally in Tooele but no damage was reported (Everitt and Kaliser, 1980). Other sources (Coffman and von Hake, 1973; Stover and Coffman, 1993) report cracked plaster and windows in Salt Lake City and damage to chimneys at Magna from both of these events. Wong et al. (1995) speculate this activity is occurring on the "Saltair structure" and estimate a maximum magnitude 6 for this feature.

Another historic earthquake worthy of mention occurred on August 1, 1900 near the towns of Eureka and Goshen. This magnitude 5.7 event damaged chimneys and plaster in the epicentral area and caused a mine shaft nearby to be thrown out of alignment (Stover and Coffman, 1993). The epicenter is about 48 miles southeast of the PFSF.

There is no evidence of any effects from any historic earthquake in the PFSF vicinity.

2.6.7 Vibratory Ground Motion

The PFSF is situated near the eastern margin of the Basin and Range province in an area known as the Great Basin. It has long been recognized that the pattern of north-south trending ranges and valleys in the Basin and Range is the result of periodic movement on normal faults that border the ranges on one or both sides. This activity is believed to be related to east-west horizontal extension starting in the late Cenozoic (Zoback and Zoback, 1989) and continues today, as evidenced by historic seismicity patterns, ground surface ruptures associated with infrequent, large magnitude, historic seismic events (6.5 M to 7.5 M), and deformation of late Quaternary and Holocene sediments across range-bounding faults.

The eastern boundary of the Basin and Range with the Middle Rocky Mountains province is commonly placed along the Wasatch Front, the north-south trending and west-facing escarpment that follows the Wasatch fault zone. This boundary is much less distinct than it appears physiographically, however. A transition zone up to 60 miles wide occurs east of the fault zone, in which block faulting overprints compressional features of the Sevier orogeny. Historic seismicity is actually higher east of the Wasatch fault than along it and geophysical data indicate the crustal boundary between the provinces occurs here as well (Smith, 1978). When examined on a regional scale, this belt of seismicity can be seen to be part of a larger zone that extends in a curvilinear pattern from northern Arizona and southern Nevada to northwestern Montana (Figure 2.6-10). This zone was first recognized in 1970 and is known as the Intermountain Seismic Belt (ISB) (Smith and Sbar, 1970; Sbar and Barazangi, 1970). Since that time, numerous investigators have discussed the origin and history of the ISB and have attempted to define the seismicity in a plate tectonic setting. Notable among these are the following: Smith and Sbar (1974), Anderson (1989), Stickney and Bartholomew (1987), Smith (1978), Smith et al. (1989), and Smith and Arabasz (1991).

The PFSF is interpreted to lie within the ISB near its western boundary (Arabasz et al., 1987) although it should be noted the boundary is somewhat arbitrary because of the diffuse, low level of seismic activity in this area. At least 16 earthquakes of magnitude 6.0 or greater have occurred in the ISB since settlement of the area began in the late 1840's (Figure 2.6-10). Ground surface faulting has been documented for three of these events: 1959 Hebgen Lake, MT (M_s 7.5); 1983 Borah Peak, ID (M_s 7.3); and 1934 Hansel Valley, UT (M_s 6.6). Surface faulting has also occurred elsewhere in the Basin and Range, in central and western Nevada and eastern California (Slemmons, 1980). The largest of these were the 1915 Pleasant Valley, NV (7.75 magnitude) and the 1872 Owens Valley, CA (8.0 magnitude) events. Arabasz et al. (1987) discuss these events in relation to determining a maximum size for Wasatch Front earthquakes. They concur with studies by Youngs et al. (1987) that the maximum probable event is M_s 7.5 and could have up to 6 meters of vertical displacement.

Other studies, summarized by Arabasz et al. (1987), indicate there is a threshold magnitude value below which surface faulting is not likely in the Basin and Range. This value is approximately magnitude 6.0 to 6.5. More recent studies also suggest an estimated maximum magnitude of $M_L \sim 6.5$ (Arabasz et al., 1992; dePolo, 1994). This value represents the hypothetical maximum "background" or "random" earthquake for this area, one of several seismic sources evaluated to determine peak ground accelerations at the PFSF. Geomatrix Consultants, Inc. (1999a) considers the maximum magnitude for the "random" event to be between M 5.5 and 6.5, with a mean value of 6.0.

Probabilistic analysis of capable faults and seismic zones in the region is summarized in Section 2.6.8 and detailed in Geomatrix Consultants, Inc. (1999a). Peak acceleration levels of 0.40 g for horizontal ground motion and 0.39 g for the vertical ground motion were determined as the design bases of the PFSF.

2.6.8 Design Basis Ground Motions

Federal regulations governing the requirements for siting an ISFSI are contained in 10 CFR 72. These regulations require that seismicity at an ISFSI located west of the Rocky Mountain Front, such as the PFSF, be evaluated using the criteria for determining the safe shutdown earthquake at a nuclear power plant (10 CFR 100 Appendix A) in the same area. Vibratory ground motion design bases were determined by using a "deterministic" approach based upon a single set of earthquake sources. The regulations for siting nuclear power plants (10 CFR 100.23) were amended in 1997 in order to recognize the many uncertainties in geologic and seismologic parameters that must be addressed in determining the seismic hazard at a nuclear power plant site. One of the ways to address these uncertainties is through a probabilistic seismic hazard analysis (PSHA). In response to the Part 100 changes and anticipated changes to Part 72 (SECY-98-126), a probabilistic seismic hazard assessment has been performed for the PFSF for vibratory ground motions and surface fault displacement. Methodologies used and the results thereof are detailed in Sections 6 and 7 and Appendix F of Geomatrix Consultants, Inc. (1999a). The hazards results are presented as mean hazard curves that incorporate the uncertainty in input data and interpretations. The seismic source model used 16 capable fault sources and 4 seismic source zones within 100 km.

The NRC staff has recommended a risk-informed graded approach in their proposed changes to 10 CFR 72 when determining the appropriate hazard frequency or return period. It was determined that an appropriate design probability level for the PFSF is 1×10^{-3} per year or a 1000-year return period (PFS letter April 1999).

Seismic sources include all structures that have some potential for causing strong ground motion at the PFSF ($\geq$ magnitude 5). Seismic sources modeled in the probabilistic seismic hazard analysis (PSHA) are of two types: fault-specific sources and seismic source zones. Fault-specific sources include mapped late Quaternary faults. Seismic source zones are areas that have similar geological or seismologic characteristics that are assumed to have uniform earthquake potential. Seismic source zones are used to model the occurrence of seismicity that cannot be attributed to any mapped late Quaternary faults.

A total of sixteen fault-specific sources were analyzed and included in the PSHA as well as four separate seismic source zones. Fault sources are listed in Table 6-1, Geomatrix Consultants, Inc. (1999a). The key parameters used to characterize these sources are as follows:

- Total fault length and plan-view geometry
- Probability of activity
- Maximum earthquake magnitude
- Slip rate
- Recurrence

The values for these key parameters and the weighting factors assigned to each parameter for all seismic sources used in the PSHA are given in Table 6-2, Geomatrix Consultants, Inc. (1999a).

Figure 6-12 in Geomatrix Consultants, Inc. (1999a) shows the contributions of the various fault sources to the total hazard for horizontal motion at the Canister Transfer Building location. The largest contributors to the hazard are the Stansbury and East-Springline faults. For long period ground motions the contribution due to the Stansbury fault increases due to the potential for larger earthquakes on the Stansbury than on the mid-Valley faults. The contribution of various earthquake magnitude intervals to the mean hazard for horizontal motion at the CTB location is shown on Figure 6-13 (Geomatrix Consultants, Inc., 1999a). It is evident the hazard is dominated by ground motions from nearby **M** 6 to 7 events, consistent with the proximity of the Stansbury and East-Springline faults to the CTB. Figure 6-20 (Geomatrix Consultants, Inc., 1999a) shows the contributions of the various seismic sources to the total hazard for vertical motions. Again, the Stansbury and East-Springline faults are the dominant sources. The effects of using various models of attenuation, fault segmentation, and fault independence are documented in the report.

Geomatrix Consultants, Inc. (1999a) divided the Stansbury fault into four segments and analyzed five rupture combination scenarios. Based on empirical relationships between magnitude and rupture length, magnitude and rupture area, magnitude and single event displacement, and a relationship between magnitude, rupture length, and slip rate, Geomatrix Consultants, Inc. determined the maximum magnitude distribution for the Stansbury fault is M 6.5 to 7.5 with a mean of 7.0.

Similarly, they also determined mean maximum magnitudes for the recently identified East fault (**M** 6.5) and the West fault (**M** 6.4). These values for the individual faults were utilized in the probabilistic seismic hazard assessment of the PFSF site.

The site investigations document the presence of capable faults in the immediate PFSF vicinity. In order to determine the potential hazard of coseismic displacement on these faults, a probabilistic fault displacement hazard analysis was also performed and is described in Geomatrix Consultants, Inc., 1999a, Section 7. Fault displacement hazard analysis is based on methodology developed for the Yucca Mountain repository. Three separate categories of faults that appear to underlie the site were evaluated for displacement hazard: faults that appear to displace the Promontory/Bonneville unconformity (Faults D and F), faults that appear to displace the Tertiary/Quaternary unconformity but not the Promontory/Bonneville (Fault C), and, the zone of distributive faulting between the East and West faults.

Two separate approaches were utilized, an "earthquake approach" and a "displacement approach". Figure 7-8 in Geomatrix Consultants, Inc. (1999a) shows the contribution of the various seismic sources to the displacement hazard using the earthquake approach. The East fault dominates the hazard due to the potential for distributive faulting from a large event near the site. Figure 7-9 compares the mean hazard results for both approaches at the three fault locations beneath the site. The earthquake approach produces similar hazard as the displacement approach at Fault C and lower hazards at the other two locations.

As the consequences of failure of the cask storage system due to fault displacement are comparable to those due to ground motions, the probability level of interest for displacement is also judged to be 1 x 10^{-3} per year or a 1000-yr return period. At these probability levels, the displacements associated with faulting on Faults C, D, and F were determined to be less than 0.1cm (Geomatrix Consultants, Inc. 1999a, Figure 7-7).

Design basis ground motions were determined by this probabilistic seismic hazard analysis and are defined as having a peak horizontal ground acceleration of 0.40 g and a peak vertical ground acceleration of 0.39 g.

2.6.9 Stability of Subsurface Materials

Dolomite or limestone bedrock is believed to underlie the PFSF at depths between 520 to 820 ft. Examination of outcrops in the area indicates no evidence of cavernous or karst conditions in these rocks and there is no history of karst development in the region. The near-desert conditions make the development of karst very unlikely and the great depth to bedrock precludes effects at the ground surface. There is no evidence of any significant soluble mineral deposits in the unconsolidated materials beneath the PFSF to at least a depth of 225 ft, and water well records in the valley do not indicate the presence of similar material at greater depths. Evaporites associated with the waning stages of Lake Bonneville and the Great Salt Lake were not deposited here as the area remained above the extent of saline stages of these lakes.

There is no history of oil or gas development or subsurface mining in the Skull Valley and little potential for development in the future. There are no injection wells in the area and no evidence of past activities affecting the ground surface. Groundwater is withdrawn at a few scattered locations in the valley bottom for irrigation and stock watering but not to such an extent to cause surface subsidence or ground cracking. The nearest wells of this type are located 2.5 miles northeast and 3 miles southeast of the PFSF.

Bedrock is not exposed at the PFSF and will not be encountered by excavation or foundations. As a result, problems associated with alteration, deformation, or weathering of bedrock or anomalous in situ stresses are not a consideration for the PFSF foundations.

2.6.9.1 Dynamic Settlements

Dynamic settlements due to Design Basis Ground Motions are not expected to occur at the PFSF because of the nature of the subsurface materials. Dynamic settlements, as reported in the geotechnical literature, are based on two different mechanisms, depending on whether the soils are above or below the groundwater table. Silver and Seed (1971) developed a technique for estimating dynamic settlements of dry cohesionless sands above the groundwater table. For such soils, the dynamic settlement mechanism is compaction from soil grain slip, and it is a function of the magnitude of the cyclic shear strain developed due to the earthquake, the applied number of cycles of this shear strain, and the relative density of the soils.

Groundwater is about 125 ft deep at the PFSF. Approximately the top 30 ft of the profile consists of silt, silty clay, and clayey silt. The median blow count for this material is about 14 blows per ft, indicating that it is "stiff". In addition, it appears to be weakly cemented and unconsolidated-undrained triaxial tests on this material indicate that it has a cohesion of greater than 2,000 psf. Therefore, the technique for estimating dynamic settlements of soils above the groundwater table is not applicable for these materials, since they are not expected to compact because of soil grain slip.

This layer is underlain by about 30 ft of very dense, fine sands, which have uncorrected blow counts that commonly exceed 100 blows per ft and which are underlain by silts that have even higher blow counts. Because of their very dense nature, these materials are not susceptible to settlement from the dynamic settlement mechanism applicable for soils above the groundwater table; i.e., compaction due to grain slip.

The underlying soils that are below the groundwater table, are greater than 120 ft below grade. The P-wave velocities (5,100 fps to 5,900 fps), reported by Geosphere Midwest, Inc (PFSF SAR, Appendix 2B), indicate that these soils are also very dense. Further, these soil are too far removed from the surface to cause problems if they were to experience dynamic settlement.

2.6.9.2 Liquefaction

The soils underlying the PFSF are not susceptible to liquefaction from the Design Basis Ground Motions because they are essentially dry from grade down to a depth greater than 100 ft. Figure 2.6-5 presents a generalized subsurface profile, which was developed based on the borings that were drilled in late 1996. The groundwater table was not encountered in these borings, the deepest of which were drilled to depths of 100 ft.

However, borings completed in 1998 indicate that the groundwater table is about 125 ft below grade at the PFSF.

Figure 2.6-5 illustrates that from a depth of about 30 ft down to 100 ft, the soils are very dense, as the standard penetration test N-values for these soils typically exceed 100 blows per ft, and they increase with depth. The presence of this greater than 60-ft-thick, very dense layer is expected to preclude any surface manifestation of liquefaction (e.g., sand boils) of soils below the groundwater table, even if it were possible for the soils to liquefy. Liquefaction is considered unlikely, however, because the density of the soils encountered in the borings increases with depth, and the P-wave velocities below the groundwater table (5,100 fps to 5,900 fps) indicate that these soils are also very dense (see PFSF SAR, Appendix 2B).

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Ambient levels of traffic generated noise on Skull Valley Road is a function of vehicle type, traffic volume, and traffic speed. In the absence of hourly data, we assumed that the maximum vehicle per hour (v/h) volume is one-sixth of the total ADT. This is equivalent to 1/3 of the ADT occurring during the morning 2-hour commute period, and 1/3 during the evening 2-hour commute. For traffic between Iosepa and I-80, this approach gives a maximum volume of 94 v/h. We assumed that 50 percent of the vehicles will be automobiles, 35 percent medium trucks, and 15 percent heavy. Based on these assumptions, we predict the noise from existing traffic traveling at 62 miles per hour to have an equivalent sound level of 68 dBA at a distance of 50 ft. The equivalent sound level, Leq, is the hourly energy level. For traffic between Iosepa and Route 199, we estimated a maximum volume of 54 v/h and assumed the same vehicle type distribution as that north of Iosepa. Based on these assumptions, we predict the noise from existing peak hour traffic traveling at 62 miles per hour to have an equivalent sound level of 67 dBA at a distance of 50 ft.

For non-peak traffic-generated noise, it is assumed that the remaining third of the non-peak traffic will be evenly distributed over a 12-hour, non-rush hour period (it is assumed that there is no traffic between the hours of 10 p.m. and 6 a.m.) resulting in a non-peak, average daytime traffic volume of 16 v/h north of Iosepa and 9 v/h south of Iosepa. The equivalent sound levels at 50 ft generated by this volume of traffic north and south of Iosepa will be 63 dBA and 62 dBA, respectively.

The traffic noise predictions will be used for assessing the impact of the construction and operation traffic noise. The ambient noise survey residual sound levels will be used to assess the noise impact (audibility) of the onsite facility operation and the rail line operation.

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2.9 REGIONAL HISTORIC, SCENIC, CULTURAL, AND NATURAL FEATURES

2.9.1 Cultural Resources

Section 106 of the National Historic Preservation Act requires that projects receiving federal licenses and permits take into account how these undertakings could affect historic properties. Historic properties are defined as properties listed on or eligible for listing on the National Register of Historic Places (NRHP). For this review process, SWEC contacted the Utah State Historic Preservation Officer (SHPO) by letters dated January 3, 1997, and March 11, 1997, and contacted the Skull Valley Band of Goshute Indians to aid in the identification of historic properties in the project study area.

The PFSF is located within the Skull Valley Indian Reservation. The Skull Valley Band of Goshute Indians historically lived in the region around the Great Salt Lake in Northern Utah. The Skull Valley Reservation was established in 1917 and is home to approximately 30 members of the Skull Valley Band of Goshute Indians. The Band indicates that the portion of the Reservation designated as project area does not contain any cultural or historic resources, or areas of religious significance to the Band (letter dated October 28, 1996, from L. D. Bear, Band Chairman, to J. Donnell, SWEC). However, the Band requests that if any artifacts that may be of cultural value are discovered during construction on the Reservation, construction should stop and the Band contacted immediately to investigate the artifacts.

By letter dated January 14, 1997, the Utah SHPO concurs with the determination of the Band that there are no known historic or religious properties in the project area as defined by the National Historic Preservation Act or the American Religious Freedom Act.

Skull Valley is sparsely settled. White explorers first traversed the area in the 1820's looking for routes across the Great Salt Lake Desert. An abandoned trail, through Skull Valley and extending beyond the Silver Mountains to the west, marks the route taken by the ill-fated Donner Party in 1846. The trail crosses Skull Valley Road just north of Iosepa.

The Iosepa Cemetery is listed in the National Register of Historic Places and is significant as surviving evidence of the settlement of Mormon converts from Hawaii in 1889. An outbreak of leprosy in 1896, combined with the poor climate for farming, led to the abandonment of the Iosepa settlement by 1917. The Iosepa Cemetery is situated well away from the PFSF and the transportation corridor.

Approximately 20 miles south of the Skull Valley Indian Reservation, remnants of the legendary Pony Express Trail, which operated from 1860-1861, survive and are maintained for public visitation by the BLM.

The Pony Express Trail is one of 5 "Scenic Backways" designated by the BLM in Tooele County. The 133-mile-long Pony Express Trail retains the ruins of 14 Pony Express Station sites (Tooele County Chamber of Commerce and Tourism, 3/21/97). There are no National Natural Landmarks within a 5-mile or a 50-mile radius of the PFSF (U. S. Department of Interior, 1996).

The Class I cultural resource inventory for the ITP area and the Low Corridor rail line conducted in May 1998 included a study area of one-quarter mile radius around the ITP area, and a half mile wide corridor on either side of the proposed rail line. A Class I inventory is designed to locate previously inventoried areas and previously recorded sites in the area to help assess the effect of project development on cultural resources. Archeological surveys were conducted along Skull Valley Road in the early 1980's.

Besides the two historic trails (Hastings and Donner-Reed) that cross the proposed Low Corridor, no other recorded archeological or historical sites were located within the study area. These trails are part of the California Historic Trail. While both trails are significant and eligible to be on the NRHP, given the proximity to Interstate 80, the Hastings Trail has already been severely impacted in the area of the proposed rail line corridor. The Donner-Reed Trail, however, may have been less impacted in the area where it crosses the proposed corridor. No sites were located in the intermodal transfer point study area.

The Class I Survey concluded that there is only a low probability of encountering archeological or historical sites in the proposed rail line corridor or ITP area. A complete Class III inventory is expected to be completed prior to construction in all areas that will be subject to ground disturbing activities.

2.9.2 Visual and Scenic Resources

The overall scenic character of Skull Valley is one of vast openness and isolation. There are long views across the flat desert valley toward the distant serrated peaks of the Stansbury Mountains to the east or the Cedar Mountains to the west. The scenic quality is marked by variations in landforms and color. There is dispersed evidence of human development, such as farmhouses, fences, overhead transmission lines, and roads. The two-lane Skull Valley Road is the most prominent manmade feature in the valley. A wooden-pole, single overhead power transmission line extends from Interstate 80 south to Dugway. Sections of the transmission line parallel the Skull Valley Road corridor, with slight variances through the open valley to provide service to area ranches.

The BLM has established visual resource management (VRM) classes for lands under its management control. Three VRM classifications are established for the Pony Express Resource Area (PERA) - Classes II, III, and IV. BLM land near the Intermodal Transfer Point, along the Low Corridor, and within the 5-mile radius of the PFSF is within VRM Class IV, which has a management objective that provides for activities that may result in major modifications to the existing character of the landscape. Class IV designated areas allow activities that may dominate the view and be a major focal point for the viewer. The designation anticipates high levels of change in the visual character of the landscape, yet calls for efforts to control the impact of activities through repetition of visual elements, sensitive siting, and minimization of disturbances (BLM, 1988). The facility has been designed to minimize visual impacts by siting structures in a remote location approximately 1.5 miles west of Skull Valley Road where the natural topography provides some screening for viewers. The design of buildings, with the exception of the canister transfer building, is typical of other structures in the area.

Regional scenic features include the Stansbury Mountains that encompass the Stansbury Mountain unit of the Wasatch National Forest. Deseret Peak is located about 9.5 miles east-northeast of the facility and is the central feature of the 25,000-acre Deseret Peak Wilderness Area. The boundary of the wilderness area is about 6 miles east of the PFSF. The Cedar Mountains are located on the opposite side of Skull Valley, about 10 miles distant.

2.11 REFERENCES

ANSI (American National Standards Institute), 1982, American national standard minimum design loads for buildings and other structures: ANSI A58.1-1982, published by the American National Standards Institute, Inc., New York, New York.

Anderson, J.G., Wesnousky, S.G., and Stirlilng, M.W., 1996, Earthquake size as a function of fault slip rate: Bulletin of the Seismological Society of America, v. 86, No. 3, p. 683-690.

Anderson, R.E., 1989, Tectonic evolution of the Intermontane system; Basin and Range, Colorado Plateau, and High Lava Plains, in Pakiser, L.C., and Mooney, W.D., eds., Geophysical framework of the continental United States: Geological Society of America Memoir 172, pp. 163-176.

Arabasz, W.J., Smith, R.B., and Richins, W.D., 1980, Earthquake studies along the Wasatch Front, Utah: Network monitoring, seismicity, and seismic hazards: Bulletin of Seismological Society of America, vol. 70, pp. 1479-1499.

Arabasz, W.J., Pechmann, J.C., and Brown, E.D., 1987, Evaluation of seismicity relevant to the siting of a Superconducting Supercollider (SSC) in Tooele County, Utah: Technical report for the Dames and Moore Utah SSC Proposal Team, June 1987, 107 pp.

Arabasz, W.J., Pechmann, J.C., and Brown, E.D., 1992, Observational seismology and the evaluation of earthquake hazards and risk in the Wasatch Front area, Utah, in Gori, P.L., and Hays, W.W., eds., Assessment of regional earthquake hazards and risk along the Wasatch Front, Utah: U.S. Geological Survey Professional Paper 1500-A-J, pp. D1-D36.

Ashcroft, G.L., D.T. Jensen and J. L. Brown, 1992, Utah climate: Logan, UT, Utah Climate Center, Utah State University, 127 p.

Atwood, G., and Mabey, D.R., 1995, Flooding hazards associated with Great Salt Lake, in Lund, W.R., ed., Environmental and engineering geology of the Wasatch Front Region: Utah Geological Assoc. Pub. 24, pp. 483-493.

Bailey, R.G., 1978, Description of the ecoregions of the United States, USDA Forest Service, Ogden, UT, p. 77.

Barnhard, T.P. and Dodge, R.L., 1988, Map of fault scarps formed on unconsolidated sediments, Tooele 1° x 2° quadrangle, northwestern Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1990, scale 1:250,000.

Bay Geophysical Associates, Inc. 1999, High-resolution seismic shear-wave reflection profiling for the identification of faults at the Private Fuel Storage Facility, Skull Valley, Utah,-final report, prepared for Stone and Webster Engineering Corp., Denver, CO, 16 pp.

BEA (Bureau of Economic Analysis), 1996, U.S. Bureau of the Census, BEA Regional Facts. Utah 1984-1994. BEA updated October 23, 1996.

BLM (Bureau of Land Management), 1985, Skull Valley Allotment Management Plan. Salt Lake District, BLM, U.S. Department of the Interior, Salt Lake City, UT. August, 1985.

BLM (Bureau of Land Management), 1986, South Skull Valley Allotment Management Plan. Salt Lake District, BLM, U.S. Department of the Interior, Salt Lake City, UT. January, 1986.

BLM (Bureau of Land Management), 1988, Draft Pony Express Resource Management Plan and Environmental Impact Statement. Salt Lake District, BLM, U.S. Department of the Interior, Salt Lake City, UT. May 1988.

BLM (Bureau of Land Management), 1990, Stansbury Mountains Habitat Management Plan. Salt Lake District, BLM, U.S. Department of the Interior, Salt Lake City, UT. May 1, 1990.

BLM (Bureau of Land Management), 1992, Horseshoe Springs Habitat Management Plan. UT-020-WHA-T-7. Salt Lake District, BLM, U.S. Department of the Interior, Salt Lake City, UT. February 26, 1992.

Campbell, P. R., 1996, Population projections for states, by age, sex, race and hispanic origin: 1995 to 2025, Report PPL-47, U.S. Bureau of the Census, Population Division.

Census, 1983, U.S. Bureau of the Census. County and City Data Book, 1983.

Census, 1988, U.S. Bureau of the Census. County and City Data Book, 1989.

Census, 1993, U.S. Bureau of the Census. 1990 Census of Population and Housing. Population and housing Characteristics for Census Tracts and Block Numbering Areas. May 1993.

Chow, V.T., 1964, Handbook of applied hydrology, McGraw-Hill Book Company, New York.

Coffman, J.L. and von Hake, C.A., 1973, Earthquake history of the United States, revised edition (through 1970): U.S. Dept. of Commerce - NOAA Publication 41-1, 208 pp.

Cook, K.L., Bankey, V., Mabey, D.R., and DePangher, M., 1989, Complete Bougher gravity map of Utah: Utah Geological and Mineral Survey Map 122, scale 1:500,000.

Currey, D.R., 1990, Quaternary paleolakes in the evolution of semi-desert basins, with special emphasis on Lake Bonneville and the Great Basin, U.S.A.: Paleogeography, Paleoclimatology, and Paleoecology, vol. 76, pp. 189-214.

dePolo, C.M., 1994, The maximum background earthquake for the Basin and Range Province, western North America: Bulletin of the Seismological Society of America, v. 84, pp. 466-472.

dePolo, C.M., Clark, D.G., Slemmons, D.B., and Aymard, W.G., 1989, Historical Basin and Range Province surface faulting and fault segmentation, in Schwartz, D.P., and Sibson, R.H., editors, Fault segmentation and controls of rupture initiation and termination--proceedings of conference XLV: U.S. Geological Survey Open-file Report 89-315, pp. 131-162.

Economic Report to the Governor, 1997, Governor's Office of Planning and Budget's Economic Report to the Governor, 1997; demographic and Economic Analysis. http://www.governor.state.ut.us/gopb.

EPA (Environmental Protection Agency), 1971, Community Noise, Report NTID300.3. December 31, 1971.

Everitt, B.L. and Kaliser, B.N., 1980, Geology for assessment of seismic risk in the Tooele and Rush Valleys, Tooele County, Utah: Utah Geological and Mineral Survey Special Study 51, 33 pp.

Geomatrix Consultants, Inc., 1997, PFSF Calculation 05996.01-G(PO5)-1, "Development of Soil and Foundation Parameters in Support of Dynamic Soil-Structure Interaction Analyses," San Francisco, CA, March 1997 (73 pp.).

Geomatrix Consultants, Inc., 1999a, Fault evaluation study and seismic hazard assessment study-final report, prepared for Stone and Webster Engineering Corp., Denver, CO, 3 volumes.

Geomatrix Consultants, Inc., 1999b, Development of design ground motions for the Private Fuel Storage Facility, prepared for Stone and Webster Engineering Corp., Denver, CO. 19 pp.

Gilbert, G.K., 1890, Lake Bonneville, U.S. Geological Survey Monograph 1, 428 pp.

Goter, S.K., compiler, 1990, Earthquakes in Utah, 1884-1989: U.S. Geological Survey, National Earthquake Information Center, scale 1:500,000.

Grazulis, T. P., 1993, Significant tornadoes 1680 - 1991: Published by The Tornado Project of Environmental Films, St. Johnsbury, Vermont.

Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, Salt Lake City, UT, 156 pp.

Helm, J.M., 1994, Structure and tectonic geomorphology of the Stansbury fault zone, Tooele County, Utah, and the effect of crustal structure on Cenozoic faulting patterns, M.S. thesis, Univ. of Utah, Salt Lake City, Utah, 128 pp.

Helm, J.M., 1995, Quaternary faulting in the Stansbury fault zone, Tooele County, Utah, in Lund, W.R., editor, Environmental and engineering geology of the Wasatch Front Region: Utah Geological Association Publication 24, pp. 31-44.

Holzworth, G.C., 1972, Mixing heights, wind speeds, and potential for urban air pollution throughout the contiguous United States: Environmental Protection Agency, Office of Air Programs, Research Triangle Park, North Carolina.

Holzworth, G.C., 1974, Meteorological episodes of slowest dilution in contiguous United States: National Environmental Research Center, Research Triangle Park, North Carolina, Report No. EPA-650/4-74-002.

Hood, J. W. and Waddell, K. M., 1968, Hydrologic reconnaissance of Skull Valley, Tooele County, UT: Technical Publication No. 18, 57 pp.

Hosler, C. R., 1961, Low-level inversion frequency in the contiguous United States: Monthly Weather Review, pp. 319-339.

Huschke, R. E., ed., 1959, Glossary of meteorology. Published by the American Meteorological Society, Boston, Massachusetts.

Kass, R. J., 1998a, Private Fuel Storage Facility Rare Plant Inventory, Skull Valley, Utah. Unpublished report prepared by Intermountain Ecosystems L.L.C. for Stone & Webster, May 20, 1998.

Kass, R. J., 1998b, Private Fuel Storage Facility Rare Plant Inventory, Skull Valley, Utah. Unpublished report prepared by Intermountain Ecosystems L.L.C. for Stone & Webster, June 22, 1998.

Lund, W.R., Christenson, G.E., Harty, K.M., Hecker, S., Atwood, G., Case, W.F., Gill, H.E., Gwynn, J.W., Klauk, R.H., Mabey, D.R., Mulvey, W.E., Sprinkel, D.A., Tripp, B.T., Black, W.D., and Nelson, C.V., 1990, Geology of Salt Lake City, Utah, U.S.A.: Assoc. of Engrg. Geologists Bulletin, vol. XXVII, pp. 391-478.

Machette, M.N., and Scott, W.E., 1988, Field trip introduction-A brief review of research on lake cycles and neotectonics of the Basin and Range province: Utah Geological and Mineral Survey Misc. Pub. 88-1, p. 7-14.

Malde, H.E., 1968, The catastrophic late Pleistocene Bonneville flood in the Snake River plain, Idaho: U.S. Geological Survey Professional Paper 596, 52 pp.

Moore, W.J., and Sorensen, M.L., 1979, Geologic map of the Tooele 1° x 2° quadrangle: U.S. Geological Survey Miscellaneous Investigations Series Map I-1132, scale 1:250,000.

NOAA (National Oceanic and Atmospheric Administration), 1960, Climatography of the United States No. 60, Climate of Utah National Environmental Satellite, Data, and Information Service, National Climatic Data Center.

NOAA (National Oceanic and Atmospheric Administration), 1992, Local climatological data, annual summary with comparative data for 1991: Salt Lake City, Utah National Environmental Satellite, Data, and Information Service, National Climatic Data Center.

NOAA (National Oceanic and Atmospheric Administration), 1975-1995, Storm data and unusual weather phenomena with late reports and corrections, National Environmental Satellite, Data, and Information Service, National Climatic Data Center.

Newmark, N. M., and Rosenblueth, E., 1971, Fundamentals of Earthquake Engineering, Prentice-Hall, Englewood Cliffs, NJ (pp. 92-101).

NUREG-1531, Reclamation of the Uranium Mill Tailings at the Atlas Site, Moab, Utah, U.S. Nuclear Regulatory Commission, January 1996.

Nussbaum, R.A., E.D. Brodie, Jr., and R.M. Storm, 1983, Amphibians and Reptiles of the Pacific Northwest, University Press of Idaho, Moscow, Idaho, (pp.332)

Oaks, S.D., 1987, Effects of six damaging earthquakes in Salt Lake City, Utah, in Gori. P.L., and Hays, W.W., editors, Assessment of regional earthquake hazards and risk along the Wasatch Front, Utah: U.S. Geological Survey Open-file Report 87-585, vol. 2, pp. P-1-95.

Oviatt, C.G., Currey, D.R., and Miller, D.M., 1990, Age and paleoclimatic significance of the Stansbury shoreline of Lake Bonneville, northwestern Great Basin: Quaternary Research, vol. 33, pp. 291-305.

Oviatt, C.G., and Miller, D.M., 1997, New explorations along the northern shores of Lake Bonneville: Brigham Young University Geology Studies 1997, v. 42, Part 2, p. 345-360.

P-III Associates, 1998, Class I Cultural Resource Inventory of the Private Fuel Storage Facility Railroad Spur and Intermodal Transfer Point , Skull Valley, Tooele County, Utah. P-III Associates, Inc., Salt Lake City, Utah, May, 1998.

Pasquill, F., 1961, The estimation of the dispersion of windborne material: Meteorol. Mag., 90, 1063, 33-49.

Pechmann, J.C. and Arabasz, W.J., 1995, The problem of the random earthquake in seismic hazard analysis: Wasatch Front region, Utah, in Lund, W.R., editor, Environmental and engineering geology of the Wasatch Front region: Utah Geological Association Publication 24, pp. 77-93.

Peterson, R.T., 1961, A field guide to western birds. Houghton Mifflin Co., Boston.

PFS Letter, Parkyn to Delligatti (NRC), Request for Exemption to 10 CFR 72.102(f)(1), dated April 2, 1999.

Quintana, 1995. Letter from D. Quintana & Associates to S. Northard, dated March 9, 1995. Subject: Private Spent Fuel Storage Facility on the Skull Valley Goshute Reservation.

Ramsdell, J. V. and G. L. Andrews, 1986, Tornado climatology of the contiguous United States: Prepared by Pacific Northwest Laboratory for the U.S. Nuclear Regulatory Commission, NUREG/CR-4461, PNL-5697.

Rigby, J.K., 1958, Geology of the Stansbury Mountains, Tooele County, Utah: Utah Geological Society Guidebook 13, 168 pp.

Roberts, R.J., Crittenden, M.D., Jr., Tooker, E.W., Morris, H.T., Hose, R.K., and Cheney, T.M., 1965, Pennsylvanian and Permian basins in northwestern Utah, northeastern Nevada and south-central Idaho: Amer. Assoc. Petrol. Geologists Bulletin, vol. 49, pp. 1926-1956.

Ryser Jr., F.A. 1985, Birds of the Great Basin, A Natural History. University of Nevada Press, Reno, Nevada.

Sack, D., 1993, Quaternary geologic map of Skull Valley, Tooele County, Utah, Utah Geological Survey map 150, scale 1:100,000, 16 pp.

Sbar, M.L., and Barazangi, M., 1970, Tectonics of the intermountain seismic belt, western United States, Part I, microearthquake seismicity and composite fault plane solutions: Geological Society of America Abst. with Programs, vol. 2, p. 675.

Scott, W.E., 1988, Temporal relations of lacustrine and glacial events at Little Cottonwood Canyon and Bells Canyon, Utah, in Machette, M.N. and Currey, D.E., editors: In the footsteps of G.K. Gilbert - Lake Bonneville and neotectonics of the eastern Basin and Range Province, guidebook for field trip twelve, Utah Geological and Mineral Survey Misc. Publ. 88-1, pp. 78-82.

Sheviak, C.J. 1984. Spiranthes diluvialis (Orchidacae), a new species from the western United States. Brittonia 36(1): 8-14.

Silver, M. and Seed, H. B., 1971, Volume changes in sands during cyclic loading, Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics and Foundations Division, Vol. 97, SM9, (pp. 1171-1182).

Simiu, E., Changery, M. J., and Filliben, J. J., 1979, Extreme wind speeds at 129 stations in the contiguous United States, NBS building science series 118: U.S. Department of Commerce, National Bureau of Standards.

Slack, 1997, Fascimile transmittal to J. Donnell, SWEC, from B. Slack, Skull Valley Band Of Goshute Indians, Tapai Project Office, May 23. 1997.

Slemmons, D.B., 1980, Design earthquake magnitudes for the western Great Basin, in Proc. of Conference X, Earthquake hazards along the Wasatch-Sierra Nevada frontal fault zones: U.S. Geological Survey Open-file Report 80-801, pp. 62-85.

Smith, R.B., and Arabasz, W.J., 1991, Seismicity of the intermountain seismic belt, in Slemmons, D.B., Engdahl, E.R., Zoback, M.D., and Blackwell, D.C., eds., Neotectonics of North America: Geological Society of America, Decade Map Volume 1, pp. 185-228.

Smith, R.B., 1978, Seismicity, crustal structure, and intraplate tectonics of the interior of the western Cordillera, in Smith, R.B., and Eaton, G.P., editors, Cenozoic tectonics and regional geophysics of the western Cordillera: Geological Society of America Memoir 152, pp. 111-144.

Smith, R.B., and Sbar, M.L., 1970, Seismicity and tectonics of the intermountain seismic belt, western United States, Part II, Focal mechanism of major earthquakes: Geological Society of America Abst. with Programs, vol. 2, p. 657.

Smith, R.B., and Sbar, M.L., 1974, Contemporary tectonics and seismicity of the western United States with emphasis on the intermountain seismic belt: Geological Society of America Bulletin, vol. 85, pp. 1205-1218.

Smith, R.B., Nagy, W.C., Julander, D.R., Viveiros, J.J., Baker, C.A., and Gants, D.G., 1989, Geophysical and tectonic framework of the eastern Basin and Range-Colorado Plateau-Rocky Mountain transition, in Pakiser, L.C., and Mooney, W.D., eds., Geophysical framework of the continental United States: Geological Society of America Memoir 172, pp. 205-233.

Sparks, S.R., N.E. West, and E.B. Allen, 1990, Changes in Vegetation and Land Use at Two Townships in Skull Valley, Western Utah, in Proceeding- Symposium on Cheatgrass Invasion, Shrub Die-Off, and Other Aspects of Shrub Biology and Management, Las Vegas, NV, April 5-7, 1989. USDA-Forest Service Intermountain Research Station, Ogden, UT. General Technical Report INT-276

Stebbins, R. C., 1985. Western Reptiles and Amphibians. Houghton Mifflin Co., Boston.

Stewart, J.H., 1978, Basin-range structure in western North America: A review, in Smith, R.B. and Eaton, G.P., editors, Cenozoic tectonics and regional geophysics of the western Cordillera: Geological Society of America Memoir 152, pp. 1-31.

Stickney, M.C., and Bartholomew, M.J., 1987, Seismicity and late Quaternary faulting of the northern Basin and Range province, Montana and Idaho: Seismological Society of America Bulletin, vol. 77, pp. 1602-1625.

Stokes, W.L., 1986, Geology of Utah, Utah Museum of Natural History and Utah Geological and Mineral Survey, Salt Lake City, UT, 280 pp.

Stone & Webster Engineering Corporation (SWEC), 1999a, Calc. No. 0599602-G(B)-12, Rev. 1, Flood Analysis with a Larger Drainage Basin.

Stone & Webster Engineering Corporation (SWEC), 1999b, Calc. No. 0599602-G(B)-15, Rev. 0, Determination of Aquifer Permeability from Constant Head Test and Estimation of Radius of Influence for the Proposed Water Well.

Stone & Webster Engineering Corporation (SWEC), 1999c, Calc. No. 0599602-G(B)-16, Rev. 1, Flood Analysis at 3-mile-long Portion of Rail Spur.

Stone & Webster Site Visits. Project site visits including visual inspection, photographs, and video tape. June 1996, October 1996, and February 1997.

Stone & Webster Engineering Corporation (SWEC), 1999d, Calc. No. 0599602-G(B)-16, Rev. 1, Flood Analysis with Proposed Access Road and Rail Road.

Stover, C.W. and J.L. Coffman, 1993, Seismicity of the United States, 1568-1989 (Revised): U.S. Geological Survey Professional Paper 1527, 418 pp.

Stover, C.W., Reagor, B.G., and S.T. Algermissen, 1986, Seismicity map of the State of Utah, U.S. Geological Survey Miscellaneous Field Studies Map MF-1856, scale 1:1,000,000.

Thom, H. C. S., 1963, Tornado probabilities: Monthly Weather Review 91, pp. 730-736.

Tooele, 1995. Tooele County General Plan. Gillies Stansky Brems Smith Architects, et. al. November 1995.

Tooele, 1996. Tooele County Zoning Ordinance. Uniform Zoning Ordinance of Tooele County. Tooele, Utah 1994 Edition. Modified by Table of Changes, August 13, 1996.

Tooele County Chamber of Commerce and Tourism: Tooele County Scenic Backways. http://www.trilobyte.net/chamber/backways.html 3/21/97.

Turner, F.B., 1958, Life history of the western spotted frog in Yellowstone National Park. Herpetologica 14:96-100.

U.S. Army Corps of Engineers, Office of the Chief of Engineers, 1990, Flood hydrograph package, HEC-1, Hydrologic Engineering Center, 283 pp.

U.S. Army Corps of Engineers, Hydrologic Center, 1995, River analysis system, HEC-RAS, Davis, CA.

U.S. Department of Agriculture, Soil Conservation Service, 1986, Urban hydrology for small watersheds, TR-55.

U.S. Department of Agriculture, Soil Conservation Service, Engineering Division, 1973, Precipitation-frequencyatlas of the western United States, Volume IV, Utah, NOAA Atlas 2, 67 pp.

U.S. Department of Agriculture, Soil Conservation Service, 1985, National engineering handbook, Sect. 4, Hydrology, Washington, DC, 665 pp.

U.S. Department of Agriculture, undated, Soil survey of Tooele County, Utah, unpublished maps and data, Natural Resource Conservation Service, Tooele, UT.

U.S. Department of the Army, 1952, Standard project flood determinations, Civil Engineer Bulletin, No. 52-8, Washington DC, 19 pp.

U.S. Department of Commerce, Weather Bureau, 1955, Rainfall intensity-duration-frequency curves for selected stations in the United States, Alaska, Hawaiian Islands, and Puerto Rico: Technical Paper No. 25.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1977, Probable maximum precipitation estimates, Colorado River and Great Basin drainage, HydrometeorologicalReport No. 49 (HMR 49), 161 pp.

UDES (Utah Department of Economic Security), 1997, News release, April 4,1997.

UDWR (Utah Division of Wildlife Resources), 1997a, Biological Assessment, Private Radionuclide Storage Facility, Goshute Indian's Skull Valley Reservation, Tooele County, Utah. March 27, 1997.

UDWR (Utah Division of Wildlife Resources), 1997b, Utah Sensitive Species List. March 1997.

USGS (U.S. Geological Survey), 1994, Methods for estimating magnitude and frequency of floods in the southwestern United States, Open-File Report 93-419, 211 pp.

USNRC (U.S. Nuclear Regulatory Commission), 1993, Final Environmental Impact Statement to Construct and Operate a Facility to Receive, Store, and Dispose of 11e.(2) Byproduct Material Near Clive, UT. Docket No. 40-8989, NUREG-1476. Washington, D.C.

Wells, D.L., and Coppersmith, K.J., 1994, Analysis of empirical relationships among magnitude, rupture length, rupture area, and surface displacement: Seismological Society of America Bulletin, vol. 84, pp. 974-1002.

Whitaker, J.O., 1980, National Audubon Society Field Guide to North American Mammals, Alfred A. Knopf, New York.

Wong, I., Olig, S., Green, R., Moriwaki, Y., Abrahamson, N., Baures, D., Silva, W., Somerville, P., Davidson, D., Pilz, J., and Dunne, B., 1995, Seismic hazard analysis of the Magna tailings impoundment, in Lund, W.R., ed., Environmental and engineering geology of the Wastach Front Region: 1995 Symposium and Field Conference, Utah Geological Association Publication 24, pp. 95-110.

Youngs, R.R., Swan, F.H., III, Power, M.S., Schwartz, D.P., and Green, R.K., 1987, Probabilistic analysis of earthquake ground shaking hazard along the Wasatch Front, Utah, in Gori. P.L. and Hays, W.W., editors, Assessment of regional earthquake hazards and risk along the Wasatch Front, Utah: U.S. Geological Survey Open-File Report 87-585, Vol. 2, pp. M-1-110.

Zoback, M.L., 1983, Structure and Cenozoic tectonism along the Wasatch fault zone, in Miller, D.M., Todd, V.R., and Howard, K.A., editors, Tectonic and stratigraphic studies in the eastern Great Basin: Geological Society of America Memoir 157, pp. 3-27.

Zoback, M.L., and Zoback, M.D., 1989, Tectonic stress field of the continental United States, in Pakiser, L.C., and Mooney, W.D., eds., Geophysical framework of the continental United States: Geological Society of America Memoir 172, pp. 523-539.

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TABLE 2.3-2 (SHEET 1 OF 5)

SPECIES OF CONCERN THAT OCCUR IN SKULL VALLEY, UTAH, AS IDENTIFIED BY THE AGENCIES (Letter from A. Stephenson, Salt Lake Field Office, BLM, February 20, 1997; Letter from Keith Clapier, Klamas Field Office, USFS, January 27, 1997; UDWR 1997a; Letter from R. Williams, Utah Field Office, USFWS, February 27, 1997, Letter from R. Harris, Utah Field Office, USFWS, July 31, 1998)

Name of Species Commented on by Agencies common (scientific)	BLM	FS	UDWR	USFWS	Likely to Occur in Riparian/ Wetland Areas Only	Preferred Habitat
PLANTS						
Big saltbush (Atriplex lentiformis)			G5/S2			Washes, stream and canal banks, and roadsides.
Pohl's milkvetch (*Astragalus lentiginosus var. pohlii*)	BLM2		G5T1, S1			Dry areas, high elevation [1]
Small Spring-Parsley *(Cymopterus acaulis var. parvus)*			G5T1T3, S1S3			Desert shrub, sagebrush, and juniper communities, often on aeolian sand [1]
Ute Ladies-Tresses *(Spiranthes diluvialis)*	BLME			Threatened	X	Low elevation in mesic or wet meadows along permanent streams and major desert lakes
FISH						
Least Chub *(Iotichthys plegethontis)*	BLM1			Proposed Endangered	X	Desert springs, pools, marshes, and stream habitats

TABLE 2.3-2 (SHEET 2 OF 5)

Name of Species Commented on by Agencies common (scientific)	BLM	FS	UDWR	USFWS	Likely to Occur in Riparian/ Wetland Areas Only	Preferred Habitat
INVERTEBRATES						
Swamp Lymnaea (*Lymnaea stagnalis*)			G5, S1S2		X	Reliable aquatic environments [1]
AMPHIBIANS						
Great Basin Spadefoot (*Spea intermontanus*)			G5, S4		X	Sagebrush flats, semi-desert shrublands, pinon-juniper woodland, high-elevation spruce and fir with available water [2]
Spotted Frog (*Rana luteiventris*)	BLM1	Sensitive species	G5, S4	Candidate	X	Sagebrush flats, semi-desert shrublands, pinon-juniper woodland, high-elevation spruce and fir with available water [2]
MAMMALS						
Desert Kangaroo Rat (*Dipodomys deserti*)	BLM1					Areas of soft sand, such as dunes; creosote bush or shadscale scrub [3]
Fringed Myotis (*Myotis thysanodes*)		Sensitive species				Inhabits caves, mines, rock crevices, and buildings at higher elevations [4]
Kit Fox (*Vulpes macrotis*)	BLM1					Shortgrass prairies, other arid areas [3]

TABLE 2.3-2 (SHEET 3 OF 5)

Name of Species Commented on by Agencies common (scientific)	BLM	FS	UDWR	USFWS	Likely to Occur in Riparian/ Wetland Areas Only	Preferred Habitat
Merriam's Kangaroo Rat (*Dipodomys merriami*)	BLM1					Sagebrush, shadscale, creosote bush, desert scrubs, on a great variety of soil types [3]
Skull Valley Pocket Gopher (*Thomomys bottae robustus*)	BLM1		G5T2, S2			Deserts to mountain meadows, in soils from sand to clay, with loam preferred [3]
Spotted Bat (*Euderma maculata*)		Sensitive species				Found throughout the West - specific habitat unknown [4]
Western Big-eared Bat (*Plecotus townsendi*)		Sensitive species				Communal roosts in caves and mines [3]
BIRDS						
American Peregrine Falcon (*Falco peregrinus anatum*)	BLME	Sensitive species		Endangered	X	Mainly open country (mountains to coast) [5]
Bald Eagle (*Haliaeetus leucocephalus*)		Sensitive species		Threatened		Riparian habitat, overwinter in low elevation forest and deserts [5]
Black-crowned Night-heron (*Nycticorax nycticorax*)	BLM3					Marshes, lake margins, shores [5]
Burrowing Owl (*Speotyto cunicularia*)	BLM1					Open grasslands, prairies, dikes, desert, farms [5]
Ferruginous Hawk (*Buteo regalis*)	BLM1					Arid plains, open rangeland [5]
Golden Eagle (*Aquila chrysaetos*)		Sensitive species				Open mountains, foothills, canyons, and plains [5]

TABLE 2.3-2 (SHEET 4 OF 5)

Name of Species Commented on by Agencies common (scientific)	BLM	FS	UDWR	USFWS	Likely to Occur in Riparian/ Wetland Areas Only	Preferred Habitat
Great Blue Heron (*Ardea herodias*)	BLM3					Marshes, swamps, streams, shores, tideflats, kelpbeds, irrigation ditches[5]
Logggerhead Shrike (*Lanius ludovicianus*)	BLM1					Open country with lookout posts, wires, scattered trees, low scrub, deserts [5]
Long-billed Curlew (*Numenius americanus*)	BLM1		S1S2		X	High plains, rangeland; in winter also cultivated land, tideflats, beaches, salt marshes [5]
Mountain Bluebird (*Sialia currucoides*)	BLM3					Open terrain with scattered trees; in winter, also treeless terrain [5]
Mountain Plover *(Charadrius montanus)*	BLM1			Candidate	X	Semiarid grassland, shortgrass prairie plains, plateaus [5]
Short-eared Owl (*Asio flammeus*)	BLM1		S1			Prairies, marshes (fresh and salt), irrigated land, dunes, tundra [5]
Snowy Plover (*Charadrius alexandrinus*)	BLM1				X	Beaches, alkali flats, sand flats [5]
Swainson's Hawk *(Buteo swainsoni)*	BLM1		S1S2			Dry plains, open foothills, alpine meadows, rangeland, open forest, sparse trees [5]
White-faced Ibis (*Plegadis chihi)*	BLM1				X	Fresh marshes, irrigated land, tules [5]

TABLE 2.4-3

NORMAL MONTHLY PRECIPITATION FOR SALT LAKE CITY, DUGWAY, IOSEPA SOUTH RANCH, AND PFSF

	PRECIPITATION (inches)			
MONTH	SALT LAKE CITY[1]	DUGWAY[2]	IOSEPA RANCH[3]	PSFS Site[4]
January	1.35	0.46	0.97	0.42
February	1.33	0.57	0.59	0.48
March	1.72	0.84	1.05	0.37
April	2.21	0.81	1.44	0.93
May	1.47	1.06	1.26	0.72
June	0.97	0.53	0.64	3.16
July	0.72	0.57	0.47	1.23
August	0.92	0.61	0.63	0.60
September	0.89	0.72	0.15	0.96
October	1.14	0.81	0.65	0.74
November	1.22	0.58	0.82	0.20
December	1.37	0.59	0.98	0.38
Annual	15.31	8.15	9.64	10.16

1. Period of record for Salt Lake City is 1951 - 1980.
2. Period of record for Dugway is 1950 - 1992.
3. Period of record for Iosepa South Ranch is 1951 - 1958.
4. Period of record for PFSF Site is 12/96 – 12-98.

TABLE 2.4-4

NORMAL MONTHLY TEMPERATURES (°F) FOR SALT LAKE CITY[1], DUGWAY[2], IOSEPA SOUTH RANCH,[3] AND PFSF[4]

MONTH	DAILY MAXIMUM			DAILY MINIMUM			AVERAGE			
	SLC	DUGWAY	IOSEPA	SLC	DUGWAY	IOSEPA	SLC	DUGWAY	IOSEPA	PFSF
January	37	37	42	20	15	17	28.5	25.7	29.2	30.7
February	44	45	46	24	23	20	34.0	34.0	33.3	31.8
March	52	53	53	30	29	25	41.0	40.9	38.9	39.0
April	61	63	64	37	35	31	49.0	49.0	47.8	43.4
May	72	73	76	45	44	38	58.5	58.6	56.9	56.3
June	83	85	86	53	53	45	68.0	69.0	65.5	63.3
July	93	94	95	62	62	52	77.5	78.2	73.5	73.7
August	90	91	93	60	59	53	75.0	75.3	72.9	74.7
September	80	80	86	50	48	41	65.0	64.1	63.5	63.4
October	67	66	71	39	36	32	53.0	51.0	51.6	47.0
November	50	51	52	29	27	22	39.5	38.6	36.9	38.0
December	39	38	43	22	17	17	30.5	27.7	30.2	22.7

1. Period of record for Salt Lake City is 1951 - 1980.
2. Period of record for Dugway is 1950 - 1992.
3. Period of record for Iosepa South Ranch is 1951 - 1958.
4. Preriod of record for PFSF is 12/96 – 12/98.

TABLE 2.4-5

MEAN WIND SPEEDS AND PREVAILING DIRECTIONS FOR SALT LAKE CITY[1] AND PFSF[2]

MONTH	WIND SPEED (MPH)		PREVAILING DIRECTION	
	Salt Lake City	PFSF Site	Salt Lake City	PFSF Site
January	7.6	8.8	SSE	SE
February	8.2	9.1	SE	ESE
March	9.4	8.9	SSE	SE
April	9.6	9.6	SE	ESE
May	9.5	9.2	SE	SE
June	9.4	9.3	SSE	SE
July	9.6	8.5	SSE	SSE
August	9.7	9.1	SSE	SSE
September	9.1	8.2	SE	SSE
October	8.5	8.6	SE	SE
November	8.0	7.4	SSE	SE
December	7.4	7.4	SSE	SE

1. Period of record is 1951 - 1980.

2. Period of record is 12/96 – 12/98

Table 2.4-6

AVERAGE RELATIVE HUMIDITY FOR SALT LAKE CITY[1] AND PFSF[2]

Month	Relative Humidity (percent)	
	Salt Lake City	PFSF Site
January	74.3	74.2
February	69.3	74.3
March	59.0	61.3
April	52.8	61.5
May	48.5	52.4
June	41.3	51.7
July	35.8	40.0
August	38.0	39.5
September	44.8	56.7
October	54.0	60.1
November	66.0	67.5
December	74.5	75.5

1. Average of the four time-of-day relative humidity values for a 32-year period of record
2. Period of record is 12/96 – 12/98

TABLE 2.4-7

FREQUENCY OF OCCURRENCE OF ATMOSPHERIC STABILITY CLASSES FOR SALT LAKE CITY[1]

STABILITY CLASS	FREQUENCY OF OCCURRENCE (percent)
A	0.70
B	6.34
C	14.94
D	43.05
E	17.93
F	17.04

1. Period of record is 1988 - 1992.

TABLE 2.4-8

MEAN SEASONAL MORNING AND AFTERNOON MIXING HEIGHTS FOR SALT LAKE CITY[1]

SEASON	MEAN MIXING HEIGHT (meters)	
	MORNING	AFTERNOON
Winter	329	944
Spring	419	2,675
Summer	216	3,737
Fall	238	1,933
Annual	300	2,322

1. Period of record is 1960 - 1964.

TABLE 2.4-9

NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING INTERVAL	PRIMARY STANDARD		SECONDARY STANDARD	
		µg/m³	ppmv	µg/m³	ppmv
SO_2	Annual	80	0.03	-	-
	24-hr	365	0.14	-	-
	3-hr	-	-	1,300	0.50
PM10	Annual	50	-	50	-
	24-hr	150	-	150	-
CO	8-hr	10[1]	9	10[1]	9
	1-hr	40[1]	35	40[1]	35
O_3	1-hr	235	0.12	235	0.12
NO_2	Annual	100	0.053	100	0.053
Pb	3 months	1.5	-	1.5	-

1. mg/m³ (Milligrams per cubic meter)

Table 2.4-10

Ambient Air Quality Monitoring Data for
Wasatch Front Intrastate AQCR

Pollutant	Averaging Interval	Second Highest Observed Value (ppmv) 1995	1996	1997	AAQS
SO_2[1]	Annual	0.001	0.001	0.001	0.03
	24-hr	0.003	0.002	0.003	0.14
	3-hr	0.008	0.004	0.005	0.50
PM-10[2]	Annual	23.0	21.0	17.0	50
	24-hr	49.0	50.0	32.0	150
CO[3]	8-hr	5.0	6.0	5.4	9.0
	1-hr	9.0	9.0	8.5	35.0
O_3[4]	1-hr	0.096	0.112	0.097	0.12
NO_2[5]	Annual	0.023	0.025	0.025	0.053

Notes:

1. SO_2 data are from Grantsville, Tooele County
2. PM-10 data are from Grantsville, Tooele County. Concentrations are in units of $\mu g/m^3$
3. CO monitoring data from Cottonwood, Salt Lake County
4. Ozone monitoring data from Herriman, Salt Lake County
5. NO_2 monitoring data from Salt Lake, Salt Lake County

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TABLE 2.6-1

DYNAMIC SOIL PARAMETERS FOR SPRING, DASHPOT, AND MASS MODEL

Vertical Vibration Mode:

- Distributed Mass per Area = 30.0 pcf-sec^2
- Distributed Vertical Dashpot Constant per Area = 1.94 kcf-sec
- Distributed Vertical Spring Constant per Area = 59 kcf

Horizontal Vibration Mode:

- Distributed Mass per Area = 5.5 pcf-sec^2
- Distributed Vertical Dashpot Constant per Area = 0.97 kcf-sec
- Distributed Vertical Spring Constant per Area = 40 kcf

Rocking Vibration Mode:

- Distributed Mass per Area = 38.6 pcf-sec^2
- Distributed Vertical Dashpot Constant per Area = 1.39 kcf-sec
- Distributed Vertical Spring Constant per Area = 138 kcf

SOURCE: Geomatrix Consultants, Inc, 1997

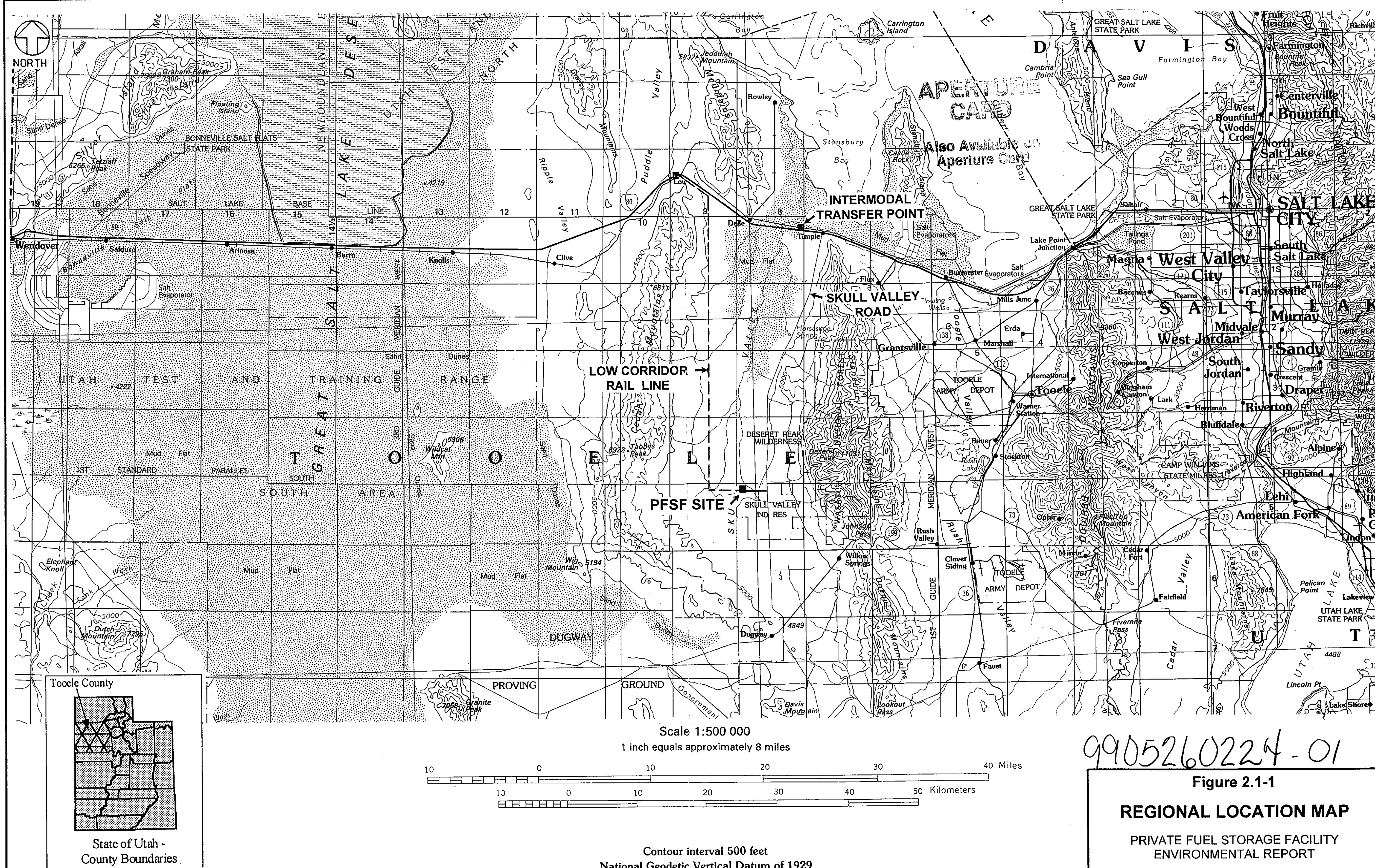

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Figure 2.1-1

REGIONAL LOCATION MAP

PRIVATE FUEL STORAGE FACILITY
ENVIRONMENTAL REPORT

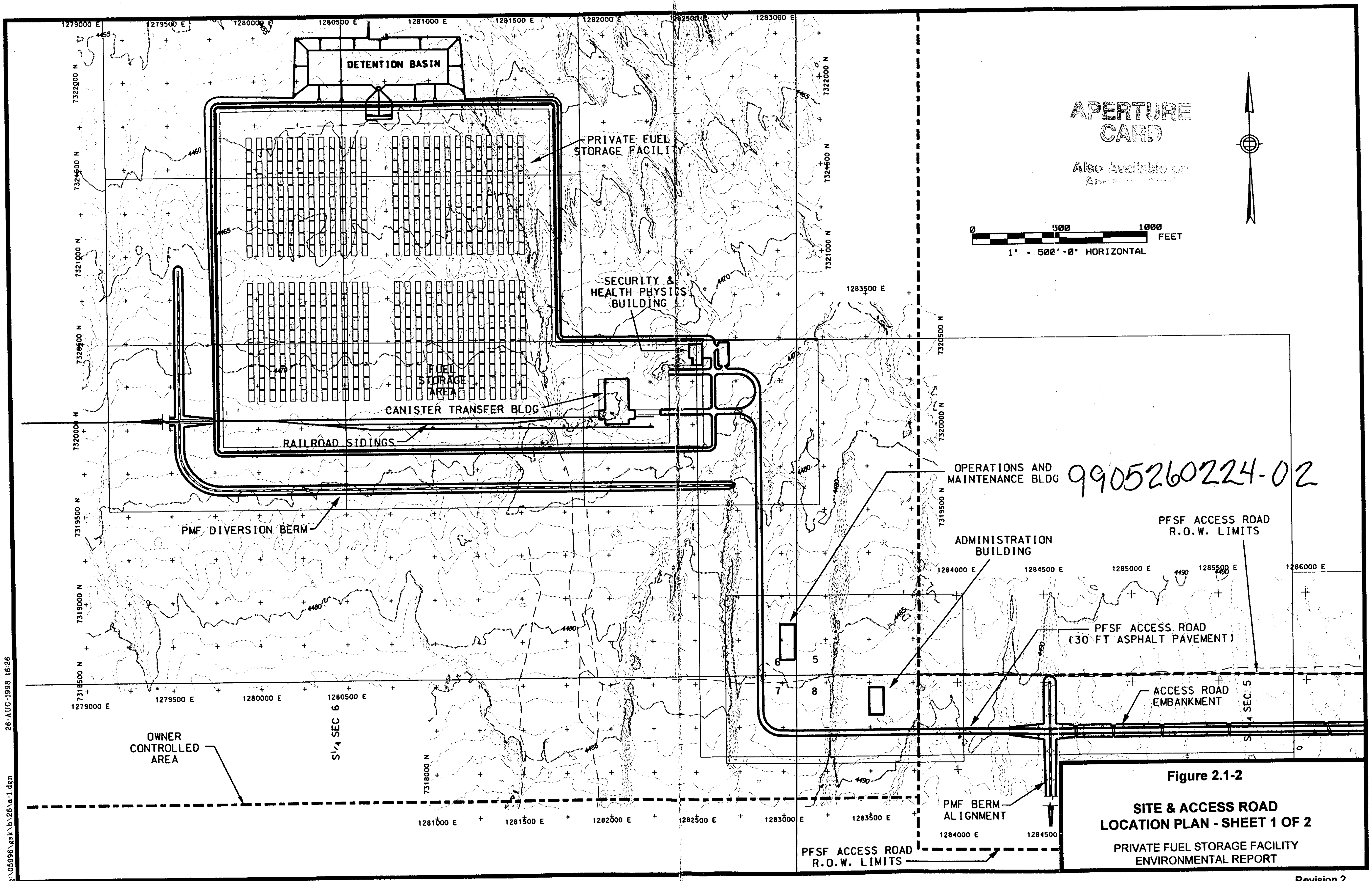

Figure 2.1-2

SITE & ACCESS ROAD LOCATION PLAN - SHEET 1 OF 2

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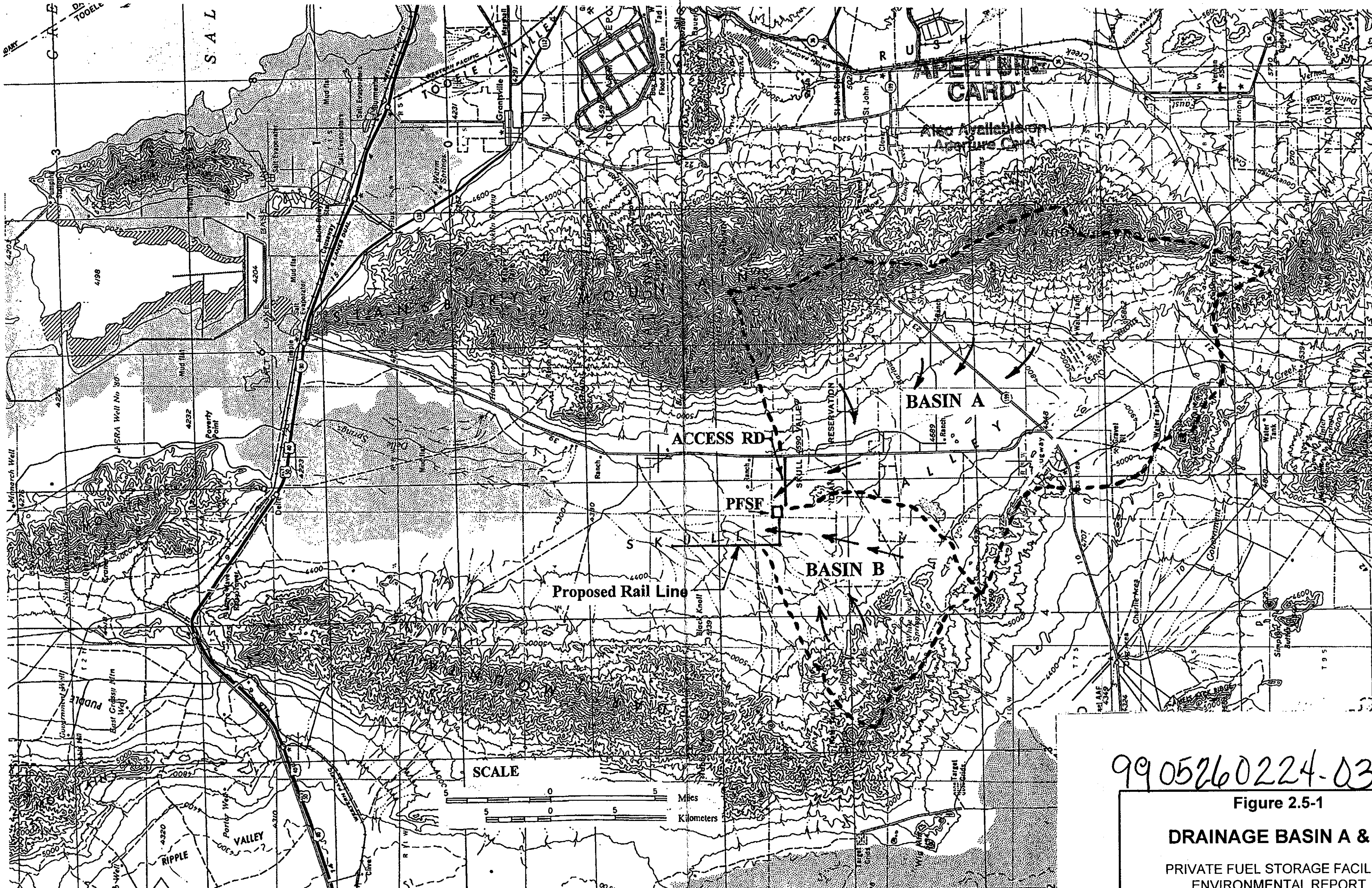

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Figure 2.5-1

DRAINAGE BASIN A & B

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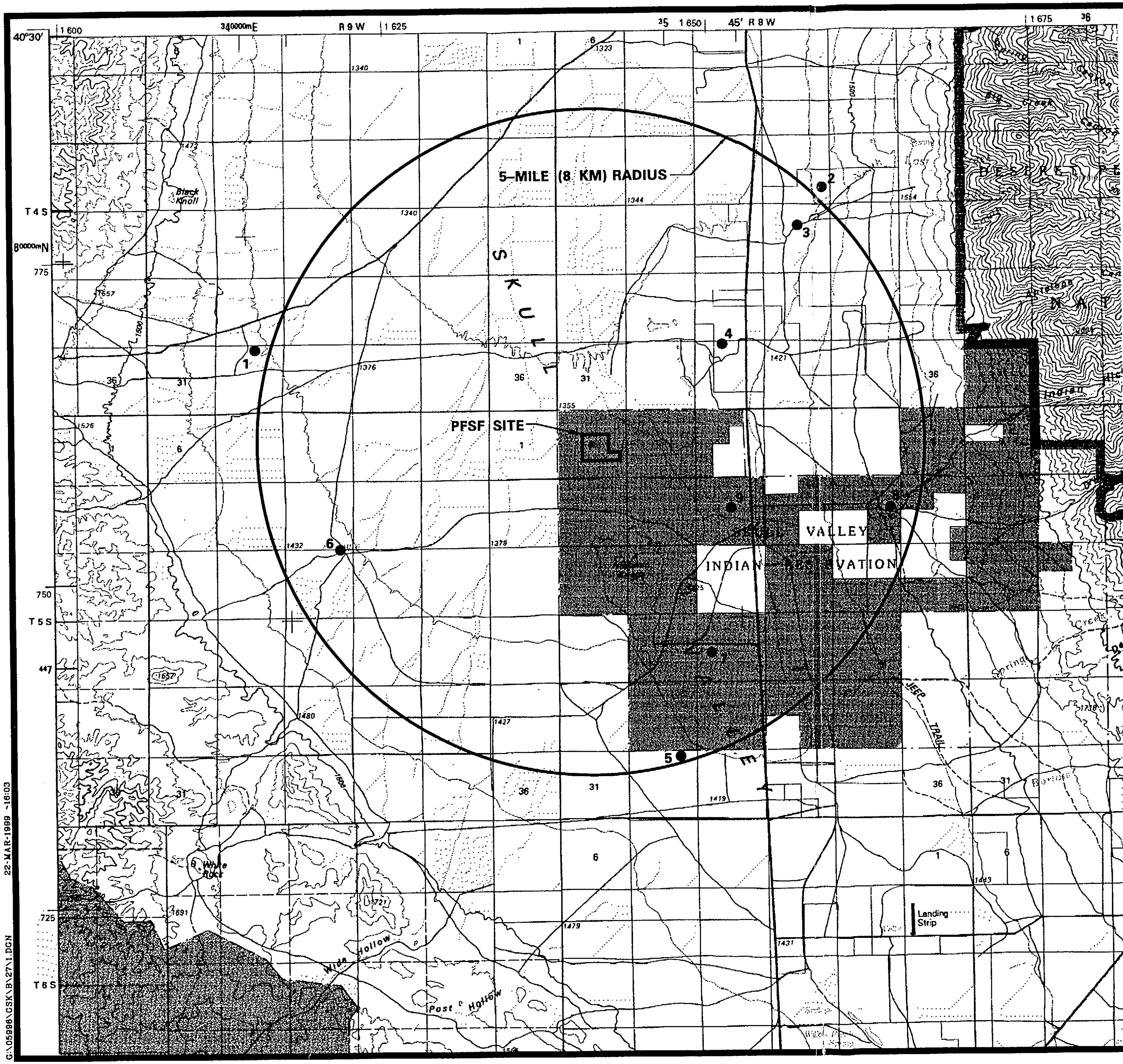

WELL MAP NO.	OWNER	TOTAL DEPTH	DATE DRILLED	USE	DEPTH TO WATER	YIELD	CURRENT WATER RIGHT
1	SKULL VALLEY CO., LTD.	340'	1956	STOCK WATERING	295'	35 gpm	YES (1955) 0.015 cfs
2	ISLAND RANCHING CO., INC.	325'	NO INFO.	IRRIGATION, STOCK	NO DATA	NO DATA	YES (1959) 2.180 cfs
3	ISLAND RANCHING CO., INC.	347'	1954	IRRIGATION, STOCK	90'	NO DATA	YES (1954) 1.226 cfs
4	ANSCHUTZ LAND CO., LTD.	408'	NO INFO.	IRRIGATION, STOCK	NO DATA	NO DATA	YES (1960) 0.7487 cfs
5	ANSCHUTZ LAND CO., LTD.	209'	1948	STOCK WATERING	150'	20 gpm	YES (1948) 0.015 cfs
6	ANSCHUTZ LAND CO., LTD.	292'	1940	STOCK WATERING	280'	12 gpm	YES (1940) 0.015 cfs
7	SKULL VALLEY INDIAN RESERV.	401'	1975	DOMESTIC, INDUSTRIAL	77.5'	15 gpm	NOT REQUIRED
8	SKULL VALLEY INDIAN RESERV.	651'	1976	DOMESTIC	519.5'	60 gpm	NOT REQUIRED
9	SKULL VALLEY INDIAN RESERV.	NO DATA	NO DATA	DOMESTIC	NO DATA	NO DATA	NOT REQUIRED

SOURCES: BASE MAP IS RUSH VALLEY, UT, BUREAU OF LAND MANAGEMENT SPECIAL EDITION, SURFACE MANAGEMENT STATUS, 1:100,000 SCALE METRIC, 1981. WELL DATA ARE FROM STATE OF UTAH, DIVISION OF WATER RIGHTS AND HOOD AND WADDELL (1968).

LEGEND:

● WATER WELL LOCATION

SCALE 1 : 100,000

CONTOUR INTERVAL IS 50 METERS

KILOMETERS 0 1 2 3 4 5 6

MILES 0 1 2 3 4

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Figure 2.5-2

WATER WELLS WITHIN 5 MILES (8 KM) OF PFSF SITE

PRIVATE FUEL STORAGE FACILITY ENVIRONMENTAL REPORT

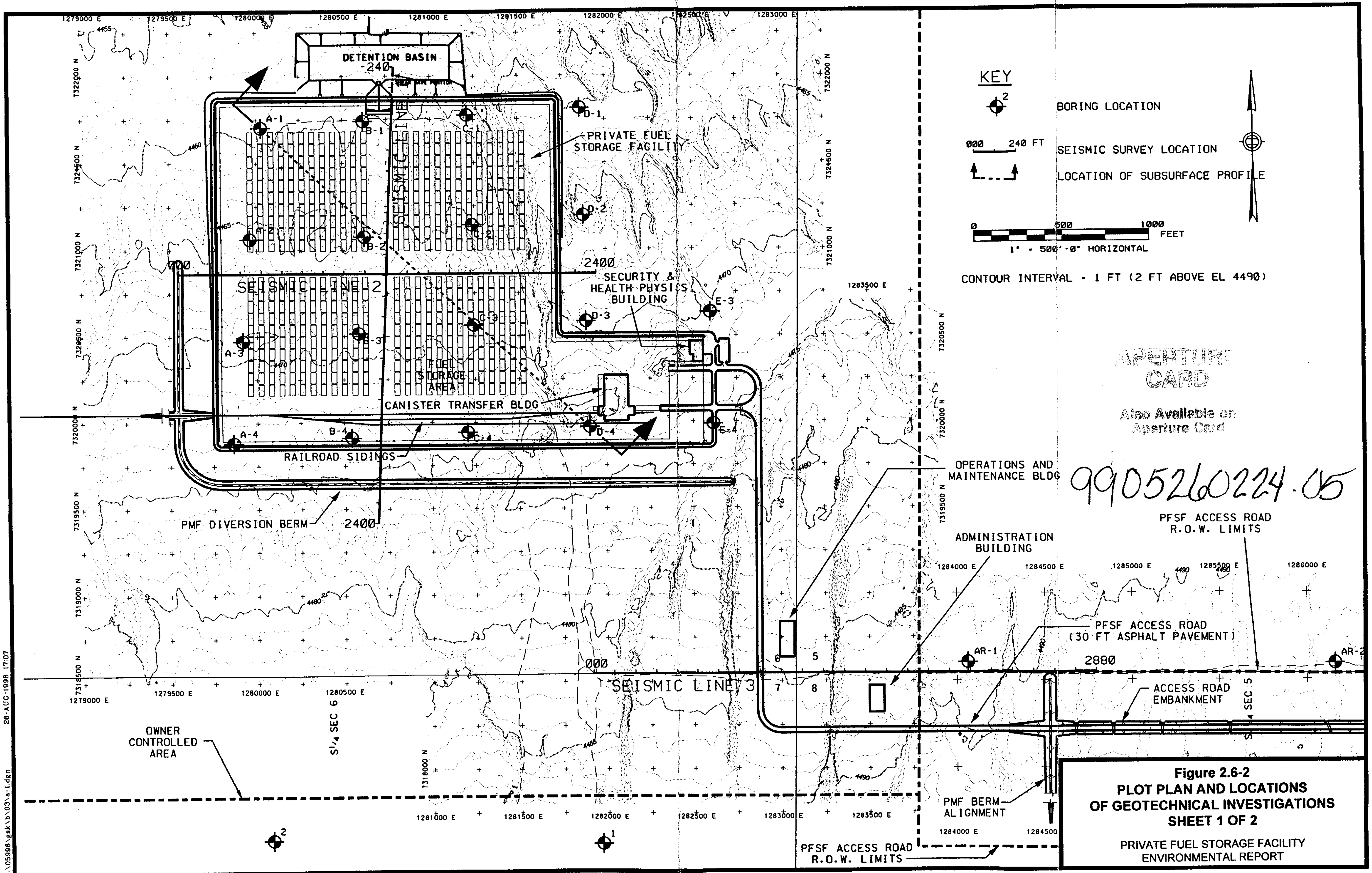

Figure 2.6-2
PLOT PLAN AND LOCATIONS OF GEOTECHNICAL INVESTIGATIONS
SHEET 1 OF 2

PRIVATE FUEL STORAGE FACILITY
ENVIRONMENTAL REPORT

Revision 2

CHAPTER 3

THE FACILITY

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CHAPTER 3

THE FACILITY

3.1 EXTERNAL APPEARANCE

The dominant external features of the Private Fuel Storage Facility (PFSF) are the access road and the storage facility itself. The noticeable features of the storage facility include the storage casks and pads, the Canister Transfer Building, the Administration Building, the Operations and Maintenance Building, the Security and Health Physics Building, light poles, security and access road fences, a storm water detention basin, and earthen berms for flood and storm water diversion. The overall site or owner controlled area (OCA) is approximately 820 acres with the actual storage area or Restricted Area (RA) occupying approximately 99 acres. Figure 2.1-2 shows the overall layout of the PFSF. The general arrangement of the proposed facility is shown in Figure 3.1-1.

The spent nuclear fuel will be stored in cylindrical shaped concrete casks which are approximately 11 ft in diameter and 19 ft tall. The casks will be stored on concrete storage pads which are arranged in a rectilinear grid pattern within the facility. Each storage pad is 30 feet wide and 64 feet long and can accommodate up to eight casks. At full capacity the facility will store 4000 casks. The surface of the concrete storage pads are 3.5 inches above grade elevation. The area around the storage pads is surfaced with compacted crushed rock with a gentle slope toward the north to facilitate drainage.

The Administration Building, located at the entrance to the OCA, is a single story steel frame building and is approximately 80 feet wide, 150 feet long, and 17 feet tall. The Operations and Maintenance Building located between the Administration Building and the storage area is a single story steel frame building and is approximately 80 feet wide, 200 feet long and 26 feet tall. The Security and Health Physics Building located at the entrance to the RA, is a single story concrete masonry building and is approximately 76 feet wide, 120 feet long, and 18 feet tall. The Canister Transfer Building is located within the RA and is a reinforced concrete high bay structure and is approximately 200 feet wide, 260 feet long, and 92 feet tall. A general arrangement of the buildings is shown in Figures 3.1-2 through 3.1-5.

The RA is surrounded by an eight foot chain link security fence (w/ barbed wire), a 20 foot isolation zone and an eight foot chain link nuisance fence. A 20 foot wide compacted gravel perimeter road surrounds the RA. The boundary of the OCA is surrounded by a typical range fence, consisting of wood posts and 3 horizontal strands of barbed wire.

The site access road is approximately 2.5 miles long and connects the PFSF with the Skull Valley Road located 1.5 miles from the OCA boundary. The access road is provided with multiple culverts beneath the road to accommodate storm runoff under the road. The access road will be designed with two 15 foot paved lanes to facilitate the potential use of heavy haul tractor/trailer for shipment by highway of spent fuel from the intermodal transfer point to the PFSF. The preferred shipping method is by means of a new rail line. The new rail line will be constructed to connect the PFSF directly to the Union Pacific mainline to facilitate shipment by rail from the mainline railroad to the PFSF. These shipment routes are discussed in more detail in section 3.2.

An earthen berm is located on the west and south sides of the RA to divert runoff from the Hickman Knolls Probable Maximum Flood (PMF) event. The berm is five feet high, 50 feet wide and 4300 feet long. Another earthen berm is located perpendicular to the access road approximately 750 feet east of the OCA to divert runoff from the Stansbury Mountains PMF event. The berm is a maximum of nine feet high where it meets the access road and tapers down to meet the Hickman Knolls. The berm is a maximum of 64 feet wide at the base, and is 1900 feet long. The RA is provided with a gentle slope toward the north such that onsite storm runoff will flow into the storm water detention basin north of the RA.

As part of construction, the driveways and parking areas around the facility buildings will be paved with asphalt or concrete. Native vegetation will be provided at the main entrance to the Administration Building. The facility, located more than 1.5 miles from the nearest public road, will have the appearance of a light industrial park. The lighting luminaries are selected to shine downward to minimize nighttime glare.

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3.2 FACILITY CONSTRUCTION

The facility will require the removal of vegetation and soil excavation and backfill for construction of the site and access road. Approximately 140 acres of desert shrub/saltbush vegetation will be cleared. This includes the site, which is made up of the cask storage area and buildings within the RA, the storm water detention basin located north of the RA, and the earthen berm located on the west and south sides of the RA. The area for the access road that must be cleared of vegetation is 2.5 miles long and 80 feet wide (approximately 22 acres).

An additional 24 acres (approximately) will be temporarily disturbed during construction, which includes 5 acres for a construction laydown area located south of the site, 2 acres for the installation of the facility septic system, and 17 acres for construction of the access road.

3.2.1 Construction Plan

It is anticipated that the PFSF will be issued a specific license to receive, transfer and possess spent fuel in accordance with the requirements of 10 CFR 72 prior to June 2002 in order to commence operation of the PFSF. Construction of the PFSF is scheduled to start in September 2000, with completion by December 31, 2001. The construction and preoperational testing will be completed in time to support operation of the facility in 2002.

The following describes the conceptual plan and schedule for construction of the PFSF and includes the following components:

- Access Road
- Restricted Area (Storage Area)

- Balance of Facility
- Intermodal Transfer Point
- Rail Line

PFSF construction will start in September 2000. The access road, Restricted Area (initially a quarter of the total number of storage pads), intermodal transfer point, and the new rail line will be completed by December 31, 2001 (Phase 1). Testing and start-up will commence January 1, 2002, and facility operation will begin about June 1, 2002.

The project will be constructed in three phases. This approach will optimize the resources and schedule required to expedite facility operation and will provide continuous local employment for construction of concrete pads and casks. Phase 1 construction will include all the buildings (Administration Building, Operations and Maintenance (O&M) Building, Security and Health Physics Building, and Canister Transfer Building), the access road, the intermodal transfer point, the new rail line, and the complete southeast quadrant of the Restricted Area.

The remainder of the Restricted Area will be constructed in Phases 2 and 3. Phase 2 will include construction of the pads in the SW quadrant, and Phase 3 will include construction of the pads in the northern half of the Restricted Area. Completion of Phase 2 and 3 will be scheduled to meet the spent fuel storage needs of the nuclear power plants.

A portable, concrete batch plant will be located at the PFSF through the completion of Phase 3 to provide concrete for construction of the storage pads and casks.

3.2.1.1 Access Road

The access road is approximately 2.5 miles long and connects the PFSF with the existing Skull Valley Road located 1.5 miles from the OCA boundary. The access road will be constructed early in the first year of construction to facilitate access to the site for construction equipment, materials, and personnel. Road grading will be performed, large concrete box culverts will be installed, and the PMF diversion berm will be constructed. To minimize damage from the heavy construction equipment required to perform the major site excavation and grading, the roadway will initially be constructed with a gravel surface. After completion of the major site earthwork, the access road will be paved with asphalt.

3.2.1.2 Restricted Area

The RA includes the Canister Transfer Building, the Security and Health Physics Building, and the cask storage pads. The Canister Transfer Building is a large, concrete structure and the Security and Health Physics Building is a one-story, concrete-block building. The RA occupies approximately 99 acres and provides for a total of 500 concrete cask storage pads which are capable of supporting a total of 4000 storage casks.

As described previously, construction of the RA will be performed in 3 phases. The phases are further described below:

The objective of Phase 1 is to provide an operational facility with a portion (25%) of the storage pads completed. Phase 1 construction will include completion of the Canister Transfer Building, the Security and Health Physics Building, one quarter of the storage pads (130 total) located in the southeast quadrant of the RA. Phase 1 construction also includes the Administration Building and the Operations and Maintenance (O&M)

Building. The southwest quadrant will be rough graded. The storm water detention basin and PMF diversion berm on the south and west sides of the RA will also be constructed. The site drainage from the southeast and southwest quadrants will be channeled to the detention basin by means of a rockfill ditch. Yard lighting, duct banks, grounding, security fences, perimeter intrusion detection system and perimeter road will be completed for the southeast quadrant. Phase 1 construction will be completed by December 31, 2001 with the exception of the Administration Building, and the O&M Building, which will be completed by March 1, 2002. (These buildings are not required to support the initial testing and startup of the storage facility).

The objective of Phase 2 is to provide additional storage capacity to the operating facility by adding the second 25 percent of the storage pads. Construction in the southwest quadrant (Phase 2) will be performed while the storage pads in the southeast quadrant are being loaded with casks, and will be completed before all of the Phase 1 casks are in-place. When all of the pads are constructed in the southwest quadrant, the Phase 1 security fence, perimeter road, and perimeter intrusion detection systems will be extended to include the Phase 2 area. Phase 2 construction is tentatively planned for completion by November 30, 2011.

The objective of Phase 3 is to provide additional storage capacity to the operating facility by completing the remaining 50 percent of the storage pads. Construction of the northern half of the RA (Phase 3) will be performed while the Phase 2 (southwest quadrant) pads are being loaded with casks, and will be completed before all of the Phase 2 casks are in-place. When all of the pads are constructed in the northern half of the RA, the security fence, perimeter road, and perimeter intrusion detection systems will be extended to include this area. Phase 3 construction is tentatively planned for completion by November 30, 2021.

3.2.1.3 Balance of Facility

The Balance of Facility is made up of the O&M Building and the Administration Building, both of which are single story steel frame buildings with pre-fabricated (insulated) metal siding and roofing panels. Construction of these two buildings will start on June 1, 2001 and will be completed by March 1, 2002 as part of Phase 1. Parking areas around the O&M Building and the Administration Building are surfaced with asphalt or concrete pavement.

3.2.1.4 Intermodal Transfer Point/Skull Valley Road

The intermodal transfer point will be located 1.8 miles west of the intersection of Interstate highway 80 and Skull Valley Road at the mainline Union Pacific Railroad approximately 24 miles north of the PFSF (Figure 3.2-1). At the intermodal transfer point there will be a short rail siding and a pre-engineered metal building, which will house a gantry crane for cask transfer. An access road will be provided to connect the intermodal transfer point to the frontage road which runs along the north side of Interstate highway 80.

Although the site is nearly level, rough grading will be required to level the site. Excavation will be required for installation of the mat foundation for the gantry crane and enclosure. The enclosure will be a pre-engineered metal building approximately 80-ft. wide by 100-ft. long and 54-ft. high. The access road will be an asphalt-paved private road approximately 30-ft wide and 400-ft. long.

The equipment at the intermodal transfer point will be constructed between January 1 and December 31, 2001 to support testing and startup of the PFSF.

3.2.1.5 Low Corridor Rail Line

A new rail line, the preferred transportation method, will be constructed by the PFSLLC to connect the PFSF directly to the Union Pacific mainline railroad at Low. The rail line will be approximately 32 miles long and will originate from the mainline on the south side of Interstate highway 80 at Low (Figure 3.2-2). From the mainline at Low, the rail line will proceed southeast parallel to Interstate highway 80 for approximately 3 miles, then turn south along the western side of Skull Valley for approximately 26 miles, and then turn east for approximately 3 miles to the PFSF. The rail line will consist of a single track installed on undeveloped public rangeland administered by the BLM.

Construction activities will begin at Low Junction where excavation will be required to connect the new line to the existing mainline railroad and to provide the required sidings. The existing grades are elevated where the railroad and interstate highway cross the north end of the Cedar Mountains. The mainline is depressed beneath the two Interstate highway 80 overpasses at Low Junction. The excavated soils will be stockpiled for use as fill for rail line construction in Skull Valley.

Construction of the rail line beyond the Low Junction will on the relatively flat terrain of Skull Valley. Approximately 56 dry arroyos cross the transportation corridor. Each will require installation of a culvert or small bridge. Construction will begin with clearing and grubbing activities for a width of approximately 50-ft. (25-ft. on both sides of rail line centerline). The upper 6-in. of soil (topsoil) will then be excavated for a width of approximately 10-ft. (5-ft. on both sides of rail line centerline) and stockpiled for later use. The roadbed will be proof-rolled and backfilled with 1-ft. of compacted fill material (excavated or imported). Six inches of sub-ballast will be placed on the prepared surface. The ties and rail will be laid on top of the sub-ballast and a rail construction machine will travel along the previously laid track and install the remaining 6-in. of crushed gravel or rock ballast beneath and around the wooden ties. The construction machine will also attach the rails to the ties using spikes and tie plates. The rail will be spliced with bolts for ease of assembly.

Construction of the new rail line will begin in September 2000 and will be completed by December 31, 2001 to support testing and startup of the PFSF.

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The PFSF is expected to receive 100 to 200 shipments of loaded spent fuel canisters annually.

Due to the proximity between the PFSF and the railroad mainline, the shipping casks will be transported by rail on a new rail line that will connect the PFSF directly to the Union Pacific mainline at Low. Alternatively, the shipping casks will be off-loaded at an intermodal transfer point located 1.8 miles west of the intersection of Interstate highway 80 and the Skull Valley Road, approximately 24 miles north of the PFSF and loaded onto a heavy haul tractor/trailer for transporting to the PFSF.

When received at the PFSF, the shipping cask will be inspected and monitored to ensure dose rates are in compliance with PFSF requirements. The shipping cask will be moved into the Canister Transfer Building where the impact limiters will be removed. The shipping cask will be uprighted, lifted off the heavy haul tractor/trailer or rail car, and moved into one of the canister transfer cells using the canister transfer overhead bridge crane. The canister transfer cells will provide a shielded work space during the transfer process. After the shipping cask is moved into the cell, the transfer cask will be mounted on top of the shipping cask. Canister transfer operations are depicted in Figures 3.3-3 and 3.3-4.

The transfer cask is constructed of steel and is used to provide radiation shielding, canister cooling, physical protection for the canister, and a means to lift the canister during transfer operations. When the transfer cask is secure on top of the shipping cask, the canister will be lifted up into the transfer cask from the shipping cask. The transfer cask will then be moved from the shipping cask, placed on top of the concrete storage cask, and the canister lowered from the transfer cask into the storage cask.

The storage cask is constructed of concrete and steel and provides physical protection, canister cooling, and radiation shielding for the canister during the storage period. The storage cask is constructed with vents to facilitate cooling air flow paths for natural convective cooling of the canister. After the canister has been loaded into the concrete storage cask, and the lid installed, the cask will then be moved to the storage area using a cask transporter and placed on a concrete pad for storage.

The facility will operate under a "Start Clean / Stay Clean" philosophy. The design of the canister system and the loading procedures minimizes the potential for contamination of the canister at the originating nuclear power plant. Health physics surveys will be conducted at the power plant to ensure unacceptable levels of contamination are removed from the outer surfaces of the canister at the power plant prior to shipping. Consequently, negligible radioactive waste is anticipated to be generated at the PFSF. However, provisions will be available at the PFSF for packaging and storing health physics survey material and dry wipes used to remove contamination in the event some minor contamination is found.

While the canisters are in storage in the storage casks on the pads, a temperature monitoring system will provide a means to track and ensure heat generated by the spent fuel is transferred to the atmosphere. When the PFSF begins to ship spent fuel offsite, the storage casks will be returned to the Canister Transfer Building to transfer the canisters back into the shipping casks for offsite shipment.

The major auxiliary systems required to support operation of the PFSF will include fire protection, potable water, sanitary waste, compressed air, heating, ventilating, and air conditioning (HVAC), electrical distribution and lighting, and communication and alarms. A fire detection system is provided in all the buildings. A fire suppression system is provided in the Canister Transfer Building to mitigate potential fires. The suppression system is fed by fire pumps and a water tank. A potable water supply system is provided at the PFSF for normal facility services and operation and maintenance functions. Potable water needs are expected to be minimal, providing only that

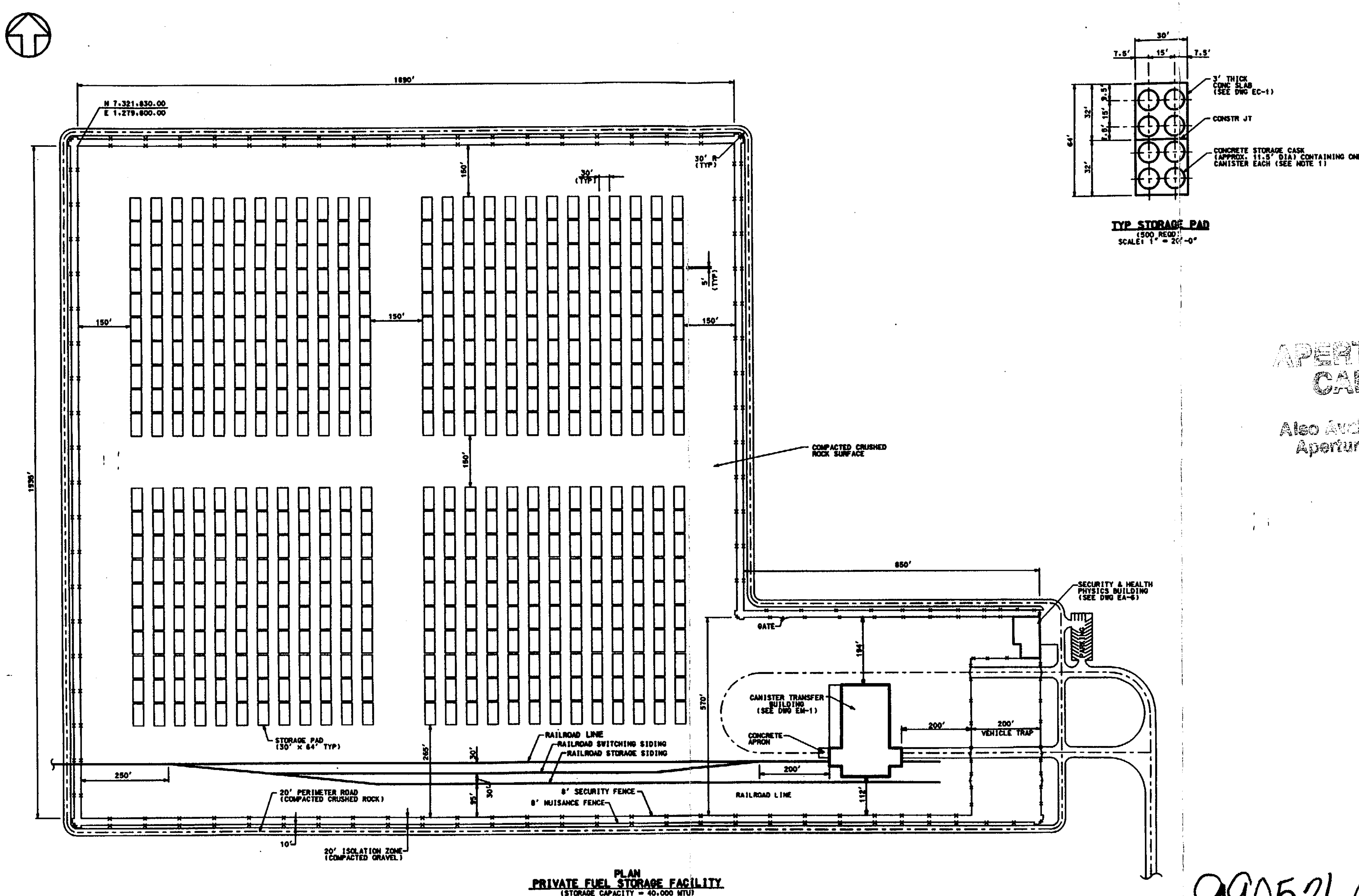
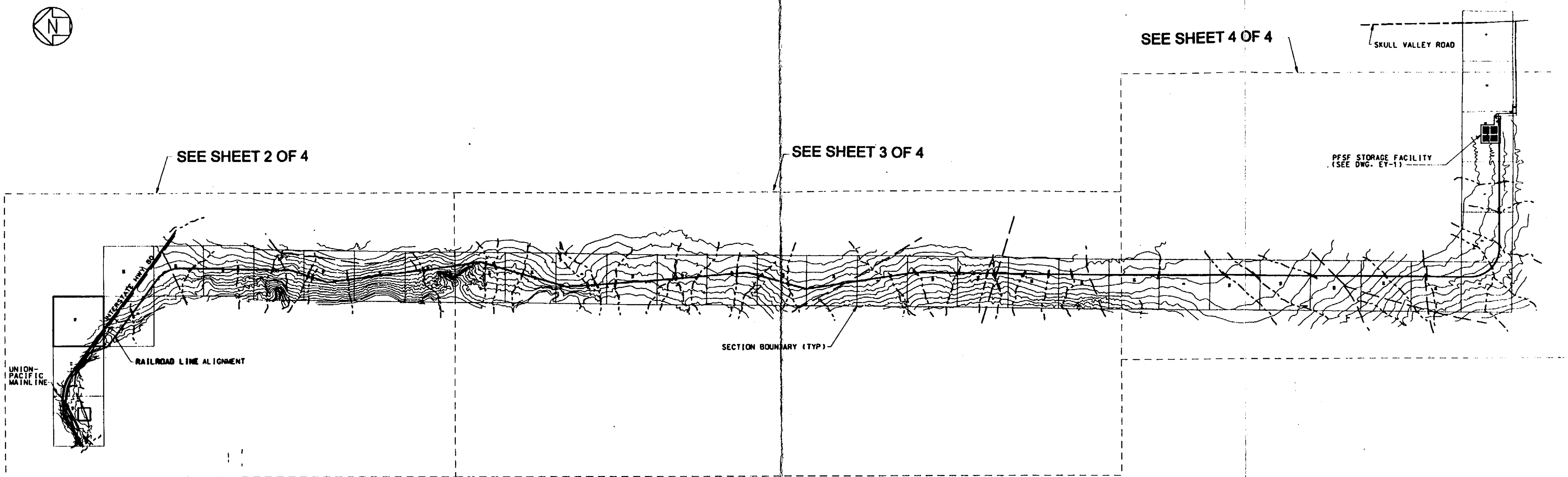


Figure 3.1-1

PFSF GENERAL ARRANGEMENT

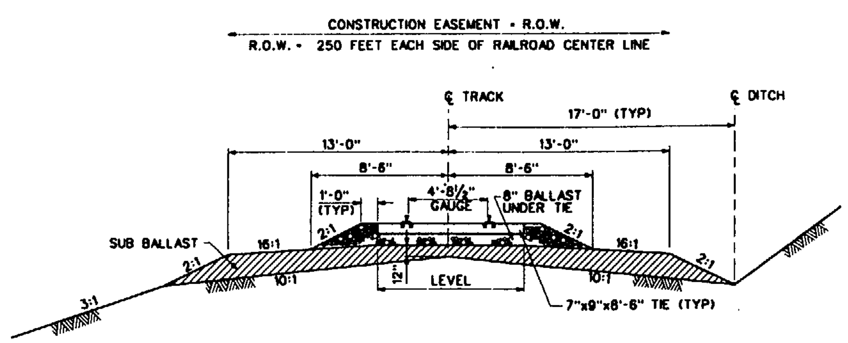
PRIVATE FUEL STORAGE FACILITY
ENVIRONMENTAL REPORT



KEY PLAN

LEGEND:

- DRAINAGE PATH
- EXISTING CONTOUR
- EXISTING DIRT ROAD



LOW RAILROAD LINE
TYPICAL SECTION
NOT TO SCALE

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Figure 3.2-2

LOW CORRIDOR RAIL LINE
Sheet 1 of 4

PRIVATE FUEL STORAGE FACILITY
ENVIRONMENTAL REPORT

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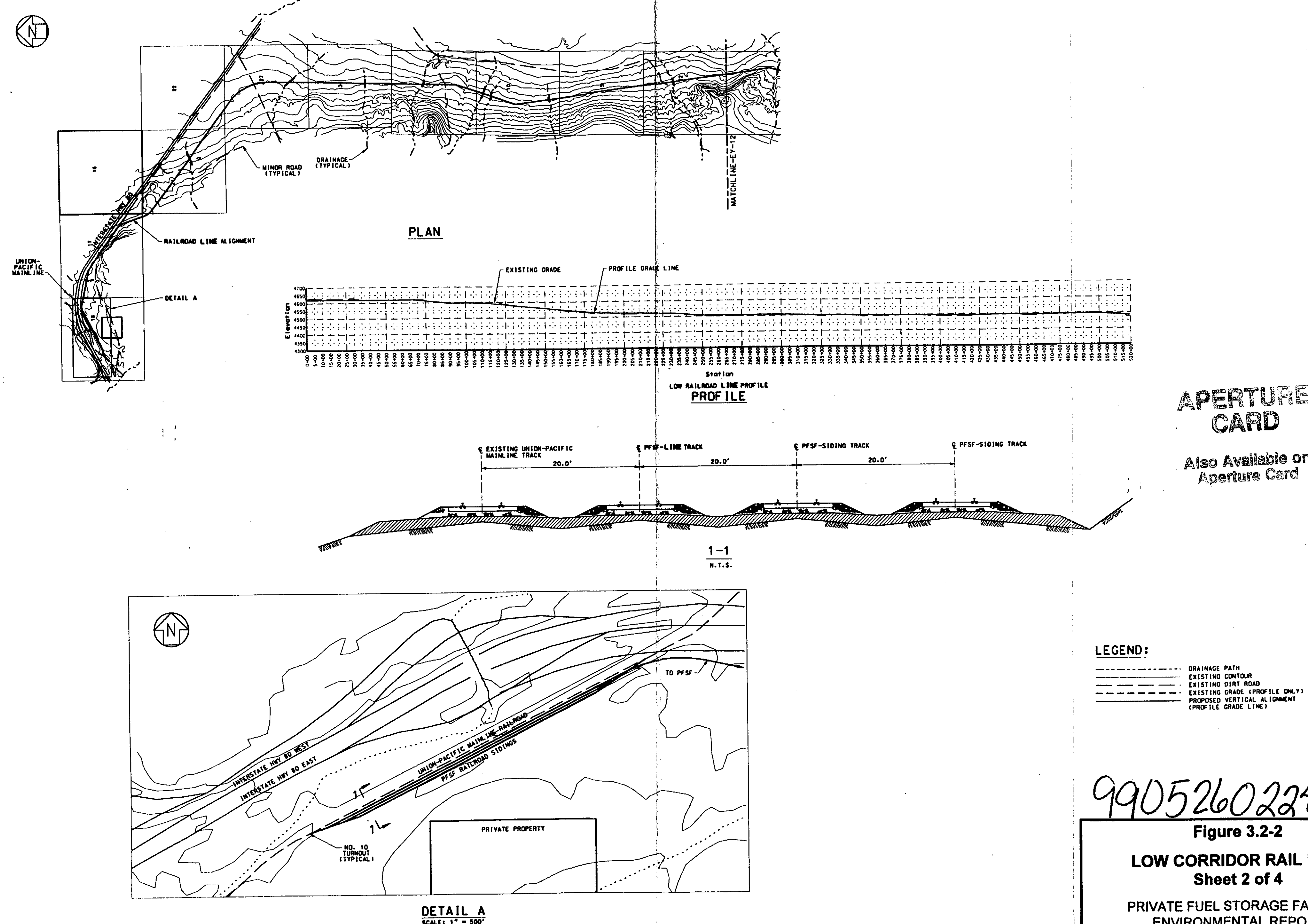
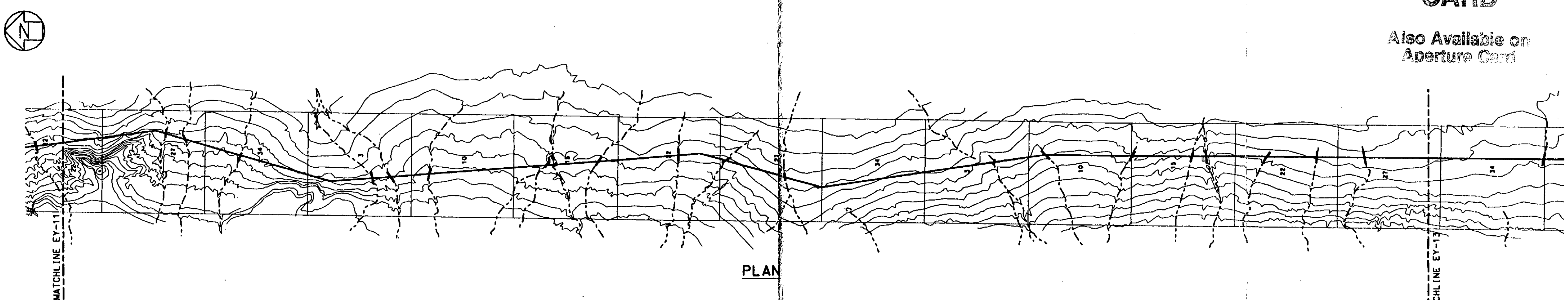


Figure 3.2-2

LOW CORRIDOR RAIL LINE
Sheet 2 of 4

PRIVATE FUEL STORAGE FACILITY
ENVIRONMENTAL REPORT



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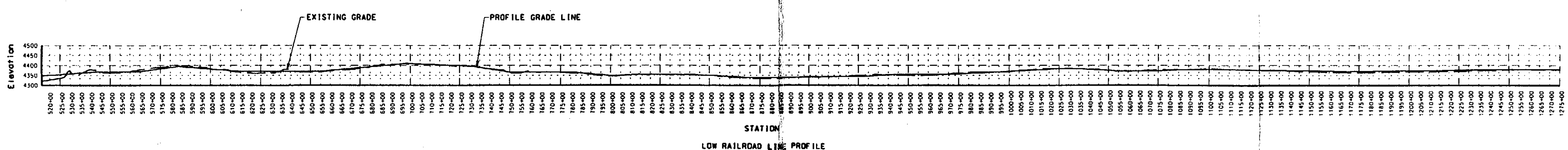

PROFILE

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Figure 3.2-2

LOW CORRIDOR RAIL LINE
Sheet 3 of 4

PRIVATE FUEL STORAGE FACILITY
ENVIRONMENTAL REPORT

Revision 2

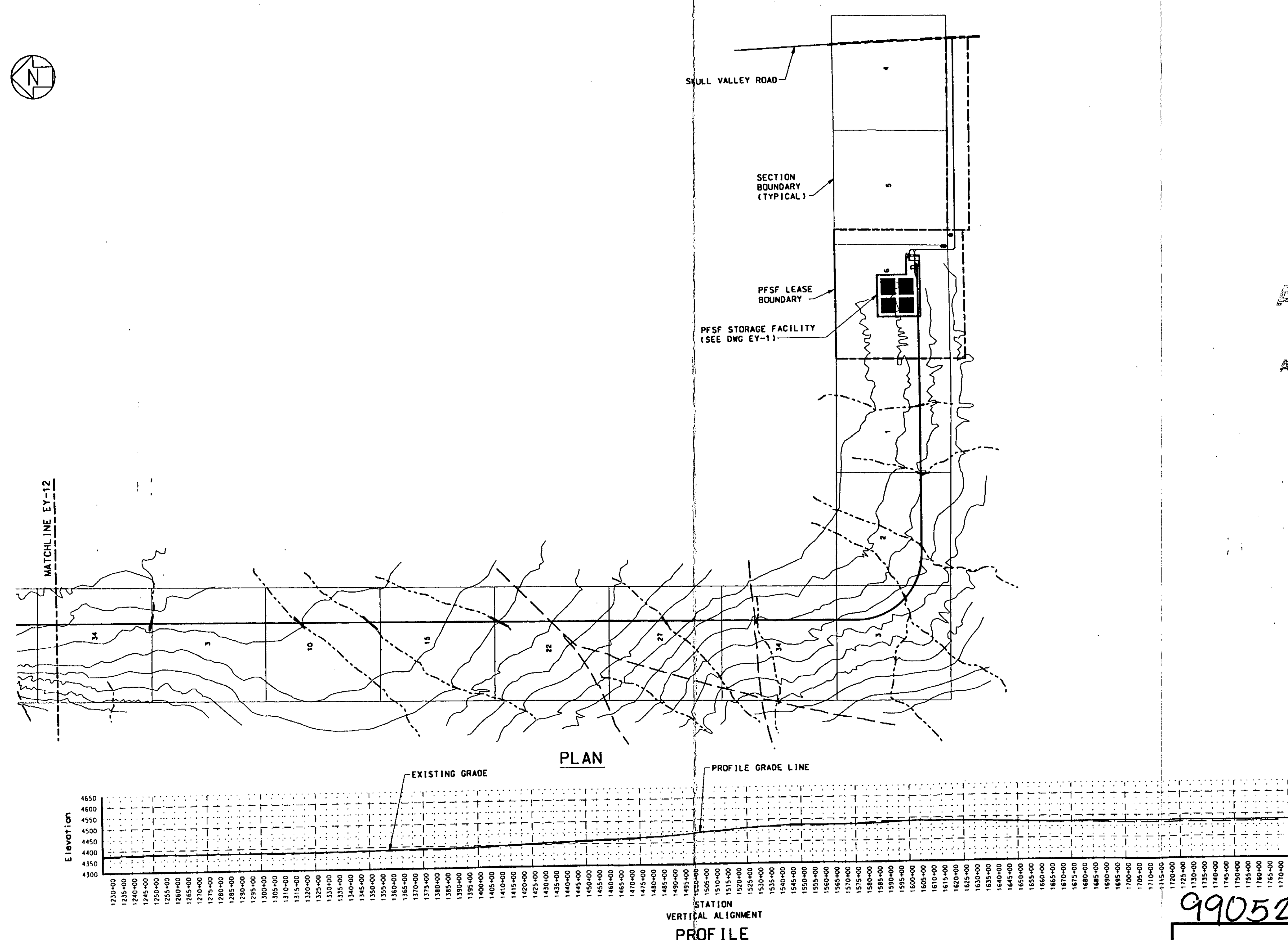

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Figure 3.2-2

LOW CORRIDOR RAIL LINE
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CHAPTER 4

ENVIRONMENTAL EFFECTS OF SITE AND TRANSPORTATION CORRIDOR CONSTRUCTION AND OPERATION

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CHAPTER 4

ENVIRONMENTAL EFFECTS OF SITE AND TRANSPORTATION CORRIDOR CONSTRUCTION AND OPERATION

This chapter discusses impacts to the existing environmental baseline, described in Chapter 2, associated with the construction and operation of the Private Fuel Storage Facility (PFSF). It also discusses the impacts resulting from construction and operation of the Intermodal Transfer Point/Skull Valley Road and the Low Corridor rail line.

4.1 SITE PREPARATION AND FACILITY CONSTRUCTION

Impacts discussed in this section are based on the construction activities and scheduling described in Section 3.2, Facility Construction.

4.1.1 Effects on Geography, Land Use, and Demography

Development of the proposed PFSF on the Skull Valley Indian Reservation will not adversely affect any existing land uses, either on the Reservation or on adjacent properties. The proposed location for the PFSF, approximately 1.5 miles west of Skull Valley Road, is currently an undeveloped tract of land, inaccessible to the general public. The overall Owner Controlled Area (OCA) required for development of the facility is approximately 820 acres, with the actual cask transfer and storage area or Restricted Area (RA) occupying 99 acres.

Development of the proposed facility will not result in the displacement of any residences, commercial operations, or industrial facilities or impact the existing Tekoi Rocket Engine testing facility, located 2.5 miles S-SE of the site. Nor will the construction of the PFSF preclude the future development of residential, commercial, or industrial facilities outside of the OCA.

Site preparation and facility construction will remove the OCA and access road corridor from potential rangeland use. However, the Skull Valley Band of Goshute Indians (Band) do not currently utilize this portion of the Reservation for grazing, or any other activity. Further, because the existing rangeland in Skull Valley is of fair to poor quality, the removal of 820 acres of potential rangeland (which also represents less than 0.5 percent of the 271,000 total acres of rangeland in Skull Valley) will not have a significant effect on grazing activity in the Skull Valley area.

During the initial construction phase, an estimated 130 workers will be required for various tasks related to project development. During later construction phases, an estimated work force of 43 persons will be required to continue activities associated with site earth work and concrete finishing as the remaining portions of the facility are developed. This construction work force is expected to be drawn from Tooele County and the Salt Lake City metropolitan area. It is anticipated that these workers will be current residents of these communities who will commute daily to the project site. Consequently, project construction will not induce the in-migration of families with school-age children, and there will be no impact on housing availability, levels of local government services, or other demographic variables.

Construction of the PFSF will result in an average of approximately 51 construction-related jobs per year during the extended 21-year construction period. This increase in employment will help to reduce the Tooele County unemployment rate of 4.4 percent (February 1997) (personal communication between D. Johnson, Tooele County Economic Development Corporation and J.H. Rumpp of SWEC, May 15, 1997).

4.1.2 Effects on Ecological Resources

Ecological resources potentially affected by construction of the facility and local access road include terrestrial vegetation and wildlife. Construction procedures for the proposed project facility will require the removal of vegetation for the site and access road. Overall, approximately 140 acres of desert shrub/saltbush vegetation community will need to be cleared for the life of the facility, unless the Band chooses to retain non-radiological portions of the facility after termination of the NRC license. This assumes approximately 99 acres for the RA, 22 acres for the access road, 6 acres for the PMF berms located near the access road and the site, and 8 acres for a storm water detention basin located outside of the RA but within the OCA. The site clearing includes the entire area within the RA. The access road clearing is 2.5 miles long and 80 feet wide.

Another 24 acres will be temporarily cleared of vegetation. This includes a 5-acre construction laydown area south of the site, a 2 acre area used for installation of the septic system and leach field, and an additional 17 acres of temporary vegetation disturbance. This 17 acres is contiguous and adjacent to the proposed access road location. Following construction, these three areas will be actively revegetated, even though this small amount of vegetation removal is minor compared to the over 1 million acres of desert shrub/saltbush community within Tooele County alone. Further, there are no unique habitat features in areas proposed for permanent or temporary vegetation removal (BLM, 1988). Following decommissioning, the concrete pads will be removed or covered with topsoil and the site will be actively revegetated with appropriate naturally occurring species.

No federal or state-listed threatened or endangered plant species are known to occur within the site or access road areas (letters from USFWS, Utah Field Office, dated February 10, 1997, February 27, 1997, and July 31, 1998 and UDWR, 1997).

Construction of the proposed facility will not impact vegetation or habitats located outside of the site area and access road. Although Pohl's milkvetch is not protected, surveys for this species will be conducted again shortly before construction within the areas identified for earthwork to prevent impacts on any sensitive plant species.

Construction activities will temporarily disturb resident wildlife species. The proposed site and access road are located within a common desert shrub/saltbrush vegetation community with minimal wildlife habitat value. However, for resident wildlife species, these habitats provide meaningful area of cover for breeding, foraging, and avoidance of predators. Small, less mobile wildlife such as rodents and reptiles could be displaced or lost as a direct result of construction activity and/or destruction of suitable habitat. Impacts on local populations will be minimal because of the relatively small area of impact, the commonness of this habitat type in surrounding areas, and the high reproductive potential for many of these resident species. Larger mammals, birds, and some mobile reptiles will likely be disturbed by construction activities and will move to other nearby suitable habitats. Prior to construction, a comprehensive wildlife survey should be conducted to assure that no sensitive or endangered species are nesting (or denning) within 0.5 mile of the PFSF site. If any animals are located, mitigation plans such as construction timing restrictions should be implemented and alternative nest (or den) site locations should be established in consultation with the BLM, UDWR, and FWS to offset the loss of these sites due to construction.

The proposed construction activities that will be likely to cause the most disturbance to wildlife (due to noise, land disturbance, and general human activity) will occur mostly in the first construction phase. These activities include grading the first portion of the RA, installing yard lighting, duct banks and grounding, and constructing all buildings, the access road, PMF berms, detention basin, perimeter road, security fence, and all of the southeast quadrant storage pads. As a result, most of the construction impacts on wildlife discussed above will occur in the first construction phase. Subsequent numbers shown are averages, and that some days will have higher traffic volumes while others will have less depending on the actual timing of specific activities.

A concrete batch plant will be located onsite to provide concrete to the project and allow for a reduction in the number of concrete trucks that will have to use public roads. However, because the onsite materials are not suitable for concrete aggregate, these materials will be brought to the site from a quarrying operation located in Tooele County. The material volumes estimated below for traffic level purposes include both structural fill and concrete aggregate for a total constructed material volume.

4.1.7.1 Construction Phase 1

The initial construction period of this phase will include construction of the site access road, the access road flood diversion berm, and initial grading and excavation for the Administration Building and the Operation and Maintenance Building. These activities will begin about September 1, 2000, and be completed about October 31, 2000 (approximately 40 working days). These construction activities will require the transport of approximately 108,600 CY of material. Including a 10 percent material expansion factor, these activities will require an estimated average of 299 truck trips per day or 30 vehicles per hour to transport the required volumes for construction of these project elements over this 40 day period.[1]

During the second period of this phase (November 1, 2000 to May 31, 2001), the storage facility will be leveled to final grade. Additional construction activities will include construction of the first half of the concrete storage pads in the south-east quadrant, the site flood diversion berm and storm detention basin, the Canister Transfer Building, and the Security and Health Physics Building. These activities will require the

[1] A truck trip, or vehicle trip, is defined as a single or one direction vehicle movement. Therefore, a vehicle arriving and departing the site constitutes 2 vehicle trips.

transport of approximately 207,200 CY of material. During the 7 month construction period, including the material expansion factor, this will equate to an additional 154 truck trips per day, or an increase of about 16 truck trips per hour.

During the third period of this first construction phase (June 1, 2001 to March 1, 2002), the Administration Building and the Operation and Maintenance Building will be completed as well as the remaining concrete storage pads in the south-east quadrant. These activities will require the transport of approximately 93,000 CY of material. Including the material expansion factor, these activities will require an estimated average of 54 truck trips per day or 5 vehicles per hour over the 9 month construction period to transport the required volumes for construction of these project elements.

Site preparation and facility construction will affect traffic and noise levels along Skull Valley Road. In addition to material and equipment deliveries, a peak construction labor force of 130 workers is projected. It is anticipated that workers will commute to and from the construction site on a daily basis utilizing individual passenger vehicles and light trucks. These workers will increase the ADT on Skull Valley Road south of the settlement of Iosepa from 325 to 585 trips. Trucks carrying fill material will add another 299 trips during the first period of Phase 1, increasing the ADT to 884 trips. This anticipated additional traffic volume will lower the level of service (LOS) on Skull Valley Road from A to B.[2] This reduction in LOS results from delivery trucks moving at a slower rate of speed (estimated at 40 mph) than the posted limit of 55 miles per hour, requiring other traffic to reduce travel speed or make additional passing maneuvers. The LOS change is not significant and will not affect emergency response time for

[2] Level of service (LOS) is defined as a qualitative measure that represents the collective factors of speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs provided by a highway facility under a particular volume condition. There are six levels of services, A through F. Level A is the highest quality of service. There is little or no restriction on maneuverability or speed caused by other traffic. Level F is the lowest. Level B is a zone of stable flow where operating speed is beginning to be affected by other traffic.

4.2 EFFECTS OF FACILITY OPERATION

This section of the report discusses impacts on the existing environmental baseline, described in Chapter 2, associated with the operation of the PFSF. Details of PFSF operation are discussed in Section 3.3, Facility Operation.

4.2.1 Effects on Geography, Land Use, and Demography

Because of the PFSF's remote location on an unpopulated, undeveloped parcel of Reservation-controlled land, operation of the PFSF will have no impact on area land use or demographics. No impacts on the Tekoi Rocket Engine testing facility, located on the south side of Hickman Knolls, will result from operation at the PFSF site.

Operation of the facility will remove 820 acres from potential use as livestock grazing lands. This reduction in area will not result in a significant loss of valuable grazing land. It represents less than 0.5 percent of the 271,000 acres of rangeland in Skull Valley, the majority of which is characterized as of fair to poor quality.

4.2.2 Effects on Ecological Resources

Large mammals such as pronghorn antelope, mule deer, and coyote that may normally forage or travel through the site area will be excluded from the RA by the two 8-foot high chain link fences around the perimeter. These animals could continue to graze or inhabit the other areas within the OCA, although they might be discouraged by the barbed wire range fence installed around the OCA perimeter. Although these fences could alter some travel patterns for some species it is not likely to be a significant impact because the site is not located in a major wildlife travel corridor and there is an abundance of similar habitat in the areas surrounding the site that will not be impacted.

Runoff from precipitation will be collected in the detention basin. Surface runoff is uncontaminated and will not adversely affect vegetation or wildlife. A septic system with two leach fields will be installed near the buildings. In the immediate area of the detention basin and leach fields, the vegetative species composition could change to include species that occur in areas with greater root zone water availability. No adverse impacts to area vegetation would result from operation of the PFSF.

During operation, there could be a limited effect to wildlife near the project site because of the increase in night light levels. Individuals of some species might alter their behavioral patterns, including breeding and resting times and selection of breeding sites, to avoid the illuminated area. Any effect should be minimal and should only occur where the light is brightest. It is likely to affect only the 99 acre RA, since all lighting will be installed and oriented to minimize the amount of illumination that extends offsite.

Operational noise resulting from the human activity/traffic and operation of the concrete batch plant and other equipment could also have a limited effect on wildlife. Some individuals that are particularly intolerant of human presence are likely to avoid the immediate area. Operational noise is likely to be minimal (see Section 4.2.7) with most of the additional noise occurring during the day when wildlife is more accustomed to human activity.

A small amount of heat will be emitted from the storage casks. This could potentially affect the behavior of the wildlife in the area, especially birds. In the colder months, certain species (e.g., mourning doves, small mammals, sparrows and associated predetors) could be attracted to the heat dissipated and congregate near or on the casks. Security systems will be installed, however, to prevent the intrusion of larger wildlife. Appropriate control programs, such as sound devices or physical barriers, will be implemented if the flocking, perching, and/or loafing of wildlife species on casks, lights, or other project features interferes with operation of the PFSF.

Increased traffic along Skull Valley Road and the access road from the daily workforce is not likely to have an impact on wildlife since the percent increase in traffic is small. Operation of the PFSF will require an estimated 42 persons per day. At night and on weekends the workforce will be reduced to security personnel only. This will result in a maximum increase of 84 operational vehicle trips on Skull Valley Road, increasing the current ADT of 325 vehicle trips to 409 vehicle trips.

4.2.3 Effects on Air Quality

The operation of the PFSF is not expected to have any measurable impact on the local meteorology or air quality. The heat given off from the surface of the casks will only have a trivial effect on the temperature of the air in the immediate vicinity of the casks and should have no discernable off-site impact on the atmosphere.

Precipitation events could result in some very localized fogging as water is evaporated from the surface of the casks but will only occur under high ambient humidity conditions during which time natural fogging events will be likely. The downwind extent of any such fogging will be very limited and the frequency of occurrence will be very small as the site area receives very little rainfall throughout the year (approximately 8 inches per year).

There are no significant air pollution sources associated with the operation of the PFSF. The only fuel burning equipment to be operated on-site will be small space heating furnaces, the infrequent use of a small emergency generator for testing purposes, and the storage cask transporter. Small space heating sources of air pollutants (less than one million Btu per hour heat input) are exempt from the Utah air quality regulations. Operation of the emergency diesel generator will be so infrequent as to have trivial emissions. The storage cask transporter is powered by a 220 horsepower diesel engine and is considered to be a mobile source which is not regulated by the DEQ.

The air pollutant emissions from the private vehicles driven by the operational labor force of approximately 42 workers are not regulated under EPA or state regulations as they are mobile sources which are regulated at the manufacturer level.

4.2.4 Effects on Hydrological Resources

Potable water needs during operation of the PFSF are minimal (approximately 1500 gallons per day), similar to a light industrial facility with a 24-hour-a-day contingent of security personnel. Highest water demand is associated with a larger daytime work-force as well as operation of the concrete batching plant. It is anticipated that surface storage tanks will be erected for potable water, emergency fire water, and for the batching plant, as it is unlikely that water wells drilled into the main valley aquifer will yield adequate quantities of water for these purposes on demand. Several wells on the site may be required to meet demand. In the event that onsite water quality or quantity are inadequate, potable water will be obtained directly from the Reservation's existing supply or an additional well or wells will be drilled east of the site and outside of the OCA, where water supplies are likely to be more satisfactory.

Localized drawdown of the valley aquifer will occur in the vicinity of the wells, the extent of which cannot be estimated until the wells are drilled, developed, and pump-tested. Future site water wells will be located and developed such that its drawdown influence will have no impact on any public, domestic, or irrigation water supply wells in Skull Valley. A few isolated stock watering wells may exist several miles downgradient of the site, but are not likely to be affected due to the distances involved and the large size of the aquifer.

The RA will be constructed to collect and drain storm-water to a detention pond at the north edge of the RA. The pond is free-draining and sized to accommodate a 100-year storm event. Water that may collect here will dissipate by evaporation and percolation into the subsoils. Operation of the detention pond will have a very local, sporadic effect on the subsurface hydrology. This water will slowly migrate northward and will most likely be transpired by vegetation at the ground surface or will be brought to the surface by capillary action and evaporated.

Drainage ditches around the perimeter of the storage area lead to rip-rap flow spreaders that return the collected water to the natural drainage. No significant changes to the surface hydrology are anticipated from these structures. Earthen berms constructed along the southern and western sides of the storage area, as well as east of the site (perpendicular to the access road), serve to divert probable maximum flood (PMF) flows away from the site. These berms will function only during this highly unlikely event and have little effect on the natural surface hydrology.

4.2.5 Effects on Mineral Resources

No mineral resources have been identified at or near the PFSF site. Therefore, no impact to this resource is expected from operation of the facility.

4.2.6 Effects on Socioeconomics

During the operational life of the proposed PFSF, 42 full-time positions will be required to staff activities. Table 4.2-1 provides an anticipated personnel breakdown for each position required during operation of this project.

The operational workforce will be drawn from labor pools in Tooele County and the Salt Lake City metropolitan area. These employees will be current residents who will commute daily to the project site. Consequently, project operation will not induce the in-migration of families with school-age children, and there will be no impact on housing availability or levels of government services (eg, police, fire, schools). The earnings of operational personnel and the spending of related salaries at local retail and service establishments in the Tooele County area will benefit the local economy.

Operation of the proposed PFSF will result in a significant benefit to Tooele County. Although the PFSF is on Reservation lands and consequently is not subject to County taxes, the PFSF will provide a fee to the County in consideration of increased county resources needed to support the PFSF activities. In addition, taxes will accrue to the County from the 1.25 percent local option sales tax on local purchases. This increase in revenue could benefit local populations by reducing current tax rates, funding improvements to local infrastructure, or other initiatives identified by local government.

Because the project's socioeconomic impacts will be predominantly beneficial, no mitigation measures are required.

4.2.7 Effects of Noise and Traffic

Because of the overlapping construction and operational phases of this project, noise and traffic impacts are jointly discussed in Section 4.1.7. Due to the remoteness of the facility from sensitive receptors, there will be no noise impacts from facility operation. As previously discussed, minor noise impacts may result from the combination of construction and operational traffic along Skull Valley Road. However, these impacts will be minor because activities generating excess noise will occur on weekdays during daylight hours.

4.3 EFFECTS OF CONSTRUCTION AND OPERATION OF THE SKULL VALLEY ROAD TRANSPORTATION CORRIDOR

This section of the report discusses impacts on the existing environmental baseline, described in Chapter 2, associated with utilizing the Skull Valley corridor to transport casks from the Intermodal Transfer Point (ITP) to the PFSF.

Two means of cask transport from the railroad mainline to the PFSF are under consideration, heavy haul tractor/trailer via Skull Valley Road or rail transport via a new rail line. This section describes the heavy haul transportation alternative via Skull Valley Road. Section 4.4 describes the new rail line which is the preferred means of cask transport to the PFSF.

4.3.1 Effects on Geography, Land Use, and Demography

The Intermodal Transfer Point will require alteration of approximately 11 acres of land for the building, access road, and rail sidings. This estimate assumes that conventional construction practices will occur and that no additional land acquisition will be required. A 500 ft access road will be constructed connecting the ITP to the existing frontage road. The proposed ITP is located on previously disturbed public land administered by the BLM that is currently not in use. No relocation of residential, commercial, or industrial structures is anticipated under this alternative. There are no known wetlands or other environmentally sensitive areas near the ITP and access road. Demographic impacts will also be minimal.

The portion of the existing Skull Valley Road that will accommodate transportation of storage casks is approximately 24 miles long, beginning at Interstate 80 near Timpie nd continuing south to the PFSF site. An additional 1.8 miles of frontage road between the intermodal transfer point and Skull Valley Road will also be utilized.

Utilization of heavy haul equipment for cask transportation will result in the transportation vehicle passing within approximately 50 ft of 2 two story residences located along Skull Valley Road. Additional survey work will be performed to identify and mitigate any potential impacts to these residences.

4.3.2 Effects on Ecological Resources

Heavy haul transportation of storage casks from the intermodal transfer point to the PFSF (approximately 26 miles) will not require any land disturbance or widening of the existing frontage or Skull Valley Roads to accommodate the specialized heavy haul tractor/trailer. About 11 acres of land will be disturbed at the intermodal transfer point for the building, access road, and rail sidings. In general, the small amount of vegetation lost will be a minor impact as much of this land is composed of common habitat types, such as desert shrub/saltbush.

No federal or state-listed threatened or endangered plant species are known to occur within the ITP and Skull Valley Road transportation areas (letters from USFWS, Utah Field Office, dated February 10, 1997, February 27, 1997, and July 31, 1998 and UDWR, 1997).

Increased traffic on Skull Valley Road during construction and project operations could result in temporary minor impacts on wildlife that frequent the road area by altering individual behavioral patterns for some species (including mule deer, black-tailed jack rabbits, and pronghorn antelope) and increasing rates of carrion. Section 4.1.7 discussed the anticipated increase in traffic volume.

The Horseshoe Springs Wildlife Management Area (WMA), located approximately 9.5 miles south of Timpie, is a wetland/riparian area that has been designated an Area of

Critical Environmental Concern (ACEC) by the Bureau of Land Management (BLM). Because the wetland/riparian habitat at Horseshoe Springs is located approximately 1100 ft west of the road, transportation activities are unlikely to affect any species located at the springs, other than a temporary disturbance. Therefore, the Horseshoe Springs area should not be adversely impacted by transportation corridor activity.

The proposed intermodal transfer point is at a previously disturbed site on public land administered by the BLM. Potential mitigation or protection measures will be developed in consultation with UDWR to ensure that no further adverse affects will result from project activities at this location.

According to the BLM (personal communication with K. Gardner, Wildlife Biologist, Salt Lake City District Office, BLM, February 25, 1997) raptor nests may be located in trees along the Skull Valley Road, primarily at ranch sites. Many raptors are sensitive species and may be afforded some level of protection by the Endangered Species Act,Migratory Bird Act, Bald and Golden Eagle Protection Act, BLM, and/or UDWR (Utah Code 23-13-2(43)) restrictions. BLM and UDWR restrictions prohibit construction activities within 0.5 miles of an active raptor nest during nesting activities. No impacts on protected raptor nests are anticipated since no construction activities will occur within 0.5 miles of current nesting locations.

The peregrine falcon and occasional transient bald eagles are the only federally or state listed endangered or threatened species occurring in the transportation corridor (letters from USFWS, Utah Field Office, February 10, 1997, February 27, 1997, and July 31, 1998 and UDWR, 1997). Peregrine falcons nesting at Timpie Springs hunt only within the northern 10 miles of the transportation corridor. Construction activities at the intermodal transfer point area are unlikely to affect the falcon's forage base of small mammals and birds because of the small amount of land to be altered in this area. Protection measures will be developed in consultation with UDWR and USFWS prior to initiation of construction, to ensure that there are no adverse impacts on falcons nesting at Timpie Springs.

4.3.3 Effects on Air Quality

There will be minor construction impacts on air quality resulting from the alteration of 11 acres of land for the Intermodal Transfer Building, which involves moving approximately 10,000 cubic yards of earth. Emissions of particulate matter with an aerodynamic diameter less than or equal to a nominal 10 microns (PM-10) are estimated for construction activities including: clearing/excavation; vehicular traffic on unpaved roads; wind erosion from temporary topsoil piles; material handling; bulldozing; compacting; and grading. Emissions of PM-10, nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC) are also estimated from construction vehicle operation. Calculations of concentrations of these pollutants in ambient air are not meaningful as there are no sensitive receptors in the vicinity of the facility that can be impacted by these emissions.

Estimates of air pollutant emissions due to construction activities are determined on the basis of estimated material handling (e.g., cubic yards of topsoil moved) and reasonable assumptions regarding construction equipment mileage and hours of operation during the construction period. Emissions estimates are provided for fugitive dust (PM-10) caused by clearing/ excavation; vehicular traffic on unpaved roads; wind erosion from temporary topsoil piles; material handling; bulldozing; compacting; and grading. Applicable gaseous criteria pollutant emissions from equipment use (i.e., NO_x, CO, PM, and VOC) are also provided. Most of the construction activities are assumed to be occurring simultaneously during any given construction month for purposes of ensuring conservatism in these emissions estimates.

The emission factors used in the estimates for construction activities are taken from the 5th edition of EPA's AP-42 document (EPA, 1998) assuming reasonable levels of emissions control as needed to satisfy DEQ requirements. On-road truck exhaust emissions are based on emission factors taken from the pending 5th edition of EPA's AP-42 document (EPA, 1998a). These factors apply to heavy duty diesel powered vehicles (HDDV) operated at high altitudes (~5,550 ft MSL) for model year 1996 or later at the federal test method speed of 19.6 mph. Non-road construction equipment exhaust emission factors are taken from EPA's Nonroad Emissions Model (EPA, 1998b).

The construction equipment exhaust emission factors used in this calculation are as follows:

On-Road Dump Truck Exhaust (grams/mile @ 19.6 mph):

$E(NO_x)$ = 6.5
E(CO) = 17.2
E(VOC) = 4.7
E(PM) = N/A

Non-Road Construction Equipment Exhaust (grams/bhp-hr):

Bulldozers: $E(NO_x)$ = 10.4
E(CO) = 1.8
E(VOC) = 0.56
E(PM) = 0.50

Roller: $E(NO_x)$ = 9.2
E(CO) = 3.9
E(VOC) = 0.74
E(PM) = 0.94

Loader : $E(NO_x)$ = 10.4
E(CO) =7.9
E(VOC) = 2.2
E(PM) = 1.35

The estimated air pollutant emissions associated with the construction of the Intermodal Transfer Building are summarized in Table 4.3-1.

The effects on air quality of cask transport between the ITP and the PFSF for heavy haul transportation have been quantified relative to annual air pollutant emissions and impacts on sensitive receptors. The assessment considers the number and types of vehicles used over the course of a year along with the total mileage covered, vehicle speed and appropriate air pollutant emission factors. Sensitive receptor impacts are determined in a conservative manner based on the few residences located along Skull Valley Road. There are no residences along the access road.

It is expected that 2-4 round trips per week will be required for the Skull Valley Road heavy haul option. Each trip would bring one full cask from the ITP to the storage facility and return one empty cask to the ITP. However, it is possible that the truck dropping off a full cask will return without the empty cask resulting in an empty truck being sent to deliver the empty cask to the ITP requiring an additional round trip. This should occur no more than half the time for a maximum of two additional rounds trips per week to pick up the empty casks left behind at the storage facility. This would result in a maximum of six round trips per week or 312 round trips per year. With a one way mileage of approximately 26 miles, the worst case truck mileage would be about 20,000 miles per year. The estimated truck speed is expected to be 20 miles per hour (mph).

The annual air pollutant emissions potential resulting from the heavy haul alternative are estimated on the basis of the vehicle miles traveled per year and the EPA standards that apply to heavy duty vehicles (HDV). The EPA HDV standards vary by model year of vehicle. For purposes of these estimates, the 1994 standards are assumed for the heavy duty diesel trucks that would be used for cask transport.

The air pollutants for which emissions estimates are provided include HC, CO, NO_x and PM. The emission factors used in this assessment are expressed as grams per brake horsepower per hour (g/bhp-hr) and are summarized below for heavy duty trucks:

Pollutant	Emission Rate, g/bhp-hr
HC	1.3
CO	15.5
NO_x	5.0
PM	0.1

The annual hours of operation can be calculated based on an annual mileage of 20,000 miles and the maximum speed of 20 mph to be 1,000 hours. Therefore, assuming a 450 bhp heavy duty diesel truck engine, the worst case annual air pollutant emissions potential in tons per year are:

Pollutant	Emissions, tons/yr
HC	0.6
CO	7.7
NO_x	2.5
PM	0.05

It can be concluded that the emissions from diesel truck operations are minimal when compared to existing (1994) Tooele County emissions that are 3-4 orders of magnitude higher.

The localized impacts of the truck traffic on residences along Skull Valley Road were examined using the EPA CAL3QHC, Version 2.0 dispersion model dated 95221 (EPA 1995c). This is the EPA recommended method for such analyses (EPA 1992). This model is based on the California Line Source (CALINE3) dispersion model with the inclusion of algorithms to estimate the length of vehicle queues at signalized intersections. This model calculates CO concentrations at sensitive receptors near highways and arteries due to free flow traffic, as well as for idling vehicles at intersections. CO is the pollutant emitted in the greatest amounts from most vehicles.

The input data to the model consist of vehicular emission rates, roadway geometries (i.e., number, width, and length of lanes), meteorological conditions, traffic volumes, signal timings, and receptor locations. In the case of cask transport, free flow conditions with no intersection idling were assumed. The receptors (i.e., residences) were conservatively assumed to be located on both the east and west sides of the road with a separation distance of 50 feet between the road and residences. The CO emission rate for heavy duty trucks discussed earlier was used in this analysis along with an assumed maximum speed of 20 mph. A conservative one truck per hour was assumed as a peak traffic volume. A meteorological condition of E-stability class and a wind speed of 1.0 meter per second was also employed in the analysis, considering 36 different wind direction 10-degree azimuth ranges.

The CAL3QHC model results were negligible for a 1-hour ground level concentration due to the very infrequent passage of the cask truck. Much more traffic volume per hour is needed for quantifiable concentrations to occur.

Therefore it can be concluded that insignificant impacts of criteria pollutants are expected as a result of the cask transport along Skull Valley Road corridor.

4.3.4 Effects on Hydrological Resources

Hydrologic features along the existing Skull Valley Road corridor consist of shallow, intermittent drainages that head in the steep canyons of the Stansbury Mountains, east of the road. These drainages lead to shallow roadside ditches, and culverts convey any runoff beneath the road to the west. Running water or water standing in the ditches has not been observed at any location between the PFSF and the ITP area between June 1996 and May 1998.

Springs occur at several locations along Skull Valley Road, surfacing at various distances west of the highway. Utilizing the ITP frontage and Skull Valley Roads to accommodate heavy haul vehicles is judged to have no additional impact on the existing hydrological resources along the road right-of-way.

4.3.5 Effects on Mineral Resources

No mineral resources have been identified at the ITP and along the ITP frontage and Skull Valley Roads. Therefore, no impact to this resource is expected.

4.3.6 Effects on Socioeconomic Resources

Minor short-term employment will result from construction activities associated with the intermodal transfer point. These activities will utilize a small local labor force commuting daily to the project area and will not require relocation. Therefore it is anticipated that no adverse impacts on socioeconomic resources will result from these activities. Operationally, the infrequent transport of casks along Skull Valley Road will have no adverse socioeconomic impacts.

4.3.7 Effects of Noise and Traffic

It is expected that 2-4 round trips per week will be required for the heavy haul transportation of casks along the 26-mile segment of the existing ITP frontage and Skull Valley Roads. The heavy haul tractor/trailer will travel at an estimated 20 mph resulting in a brief maximum sound level, 50 feet from Skull Valley Road, of 85 dBA. This is similar to a conventional tractor trailer at normal highway speeds, however, the duration of the noise will be longer due to the slower speed. Due to the infrequency of these trips and because of the undeveloped nature of Skull Valley (only 2 residences within 50 ft of the roadway) no significant noise impacts are anticipated from this minor increase in sound levels. Since each occasional pass by is an isolated event, the maximum sound levels, rather than the hourly energy average sound level, which is much lower, is reported here.

As discussed in section 4.1.7.1, the current level of service (LOS) on Skull Valley Road is level A. The heavy haul tractor/trailers will be moving at a slower rate of speed (estimated at 20 mph) than the posted limit of 55 miles per hour, requiring other traffic to reduce travel speed or make additional passing maneuvers. Due to the infrequent number of round trips per week (2-4) and the ample opportunity for passing maneuvers afforded along Skull Valley Road, the heavy haul transportation of casks along the 26-mile segment of the existing ITP frontage and Skull Valley Roads will have minimal impact on traffic and will not lower the LOS. There will be no affect on emergency response time for public safety vehicles.

4.3.8 Effects on Regional Historical, Cultural, Scenic, and Natural Features

The heavy haul transportation of casks involves utilizing a 26-mile segment of the existing ITP frontage and Skull Valley Roads. The ITP, including access road and new rail siding will occupy approximately 11 acres of previously disturbed land.

Section 106 of the National Historic Preservation Act, as amended, requires that federal agencies take into account the effects of undertakings on properties listed or eligible for listing in the National Register of Historic Places. The Advisory Council on Historic Preservation (ACHP) regulations (36 CFR 800) set forth a consultation process among the federal agency, the SHPO, and the ACHP. For the purposes of compliance with Section 106, the area of potential effect means the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if such properties exist (36 CFR 800.2(c)).

A Class III cultural resource survey in the area of potential effect at the intermodal transfer point will be performed prior to the start of construction activities. In Utah, a Class III survey includes a literature search of prior surveys, a walkover of the project area, and sufficient subsurface testing to determine whether any potentially significant sites meet the criteria for listing in the National Register of Historic Places. The survey will be conducted in consultation with the SHPO in a manner consistent with SHPO and BLM guidelines and regulations. The survey will be conducted by an archeological firm holding an active joint permit issued by these two agencies. Based on the Class I survey performed (P-III Associates, 1998), no significant sites are expected to be found, but if cultural resources are identified, a mitigation plan will be developed in consultation with the SHPO and BLM and submitted for their approval.

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4.4 EFFECTS OF CONSTRUCTION AND OPERATION OF THE LOW CORRIDOR RAIL LINE

A new rail line will be constructed to connect the PFSF directly to the Union Pacific mainline railroad at Low. The single track rail line will be approximately 32 miles long and will originate from the mainline on the south side of Interstate 80 at Low. From the mainline at Low, the rail line will proceed southeast parallel to Interstate 80 for approximately 3 miles, then turn south along the western side of Skull Valley for approximately 26 miles, and then turn east for approximately 3 miles to the PFSF. Associated sidings will be located either at the PFSF or near Low Junction.

A 200 foot wide right-of-way for construction of the Low Corridor would temporarily remove or disturb about 776 acres of greasewood and desert shrub salt/brush habitat. A 40 foot wide rail line width is necessary to operate the rail line to the PFSF site; therefore approximately 155 acres would be permanently altered, and about 621 acres would be actively revegetated with appropriate naturally occurring species and restored to previous conditions following construction.

4.4.1 Effects on Geography, Land Use, and Demography

Construction of a new rail line will require the alteration of approximately 776 acres of land along the rail line. This estimate assumes that conventional construction practices will occur and that no additional land acquisition will be required. The rail line will result in the permanent alteration of approximately 155 acres.

The railroad turnout would be located on public land administered by the BLM, with right-of-way granted for the railroad. The full length of the rail line would require the granting of Right-of-Way from the BLM.

The Low Corridor rail line would cross the Eightmile and Black Knoll Pastures which are part of the Skull Valley grazing allotment. Construction activities related to the Low Corridor will temporarily disturb resident livestock and cause them to avoid the construction area. Impacts from the removal of habitat (776 acres temporarily and 155 acres permanently) is minimal when compared to the 271,00 acres of rangeland in Skull Valley. Operation of the rail line is not expected to adversely affect the use of the area for livestock grazing. Livestock will be able to freely cross the rail line tracks accessing rangeland on either side. Due to the infrequent number of trips (1-2 round trips/week) and the slow train speed (20 mph), collisions with livestock are not anticipated. Further consultation with BLM will be conducted to determine if any additional measures are required to insure livestock access and safety.

Recreational use for the land on either side of the rail line will be maintained by providing crossings where the rail line intersects off-highway vehicle trails or dirt roads.

There are no known wetlands or other environmentally sensitive areas along the entire 32-mile rail line. Horseshoe Springs and other local Skull Valley wetlands are well outside of the Low Corridor. The rail line will cross approximately 56 small and large dry arroyos. Small, medium, and large culverts; as well as short bridge crossings, will be constructed over these arroyos.

There are no demographic impacts along the entire rail corridor since the route does not encounter any private ranches or other members of the public. State inholdings along the route and a small piece of private land near Low Junction will be avoided. Therefore, relocation of residential structures, or realignment of fencing, driveways, and roadside utilities will not be required. In addition, all construction activity is south of Interstate 80 which eliminates any conflicts associated with the highway, such as overpass/underpass construction.

4.4.2 Effects on Ecological Resources

The Low Corridor rail line will require alteration of 155 acres of public land administered by the BLM for the life of the PFSF. Generally, the ecological resources in the vicinity of the Low transportation corridor are similar to those found in the Skull Valley transportation corridor and at the PFSF site. No federal or state-listed threatened or endangered plant species are known to occur within the Low Corridor transportation area (letters from USFWS, Utah Field Office, dated February 10, 1997, February 27, 1997, and July 31, 1998 and UDWR, 1997).

Ecological resources potentially affected by construction of the Low Corridor rail line include both terrestrial vegetation and wildlife. Within the 200-foot right-of-way, construction activities would temporarily remove 776 acres of greasewood and desert shrub/saltbrush habitat. The 40-foot wide permanent rail line width required for operation will result in the permanent loss of approximately 155 acres while approximately 621 acres would be restored to previous conditions after construction. This small amount of vegetation is minor compared to the over 1 million acres of desert shrub/saltbrush within Tooele County. There are also no unique vegetation habitat features in areas proposed for vegetation removal.

Construction activities related to the Low Corridor will temporarily disturb resident wildlife species. Larger mammals would temporarily avoid the construction area, but likely return following the completion of construction. Prior to construction, a comprehensive wildlife survey should be conducted to assure that no kit fox, burrowing owls, northern harriers, or ferruginous hawks are nesting (or denning) within 0.5 mile of the rail line. If any animals are located, mitigation plans such as construction timing restrictions should be implemented and alternative nest (or den) site locations should be established in consultation with the BLM, UDWR, and FWS to offset the loss of these sites due to construction and improve habitat for local populations.

Impacts to wild horses, mule deer and pronghorn antelope could occur if rail cars traveling the corridor collide with these animals. In addition, the rail corridor has the potential to divide natural wildlife travel corridors between the west and east sides of Skull Valley during construction. Because most of the water resources are concentrated on the east side of Skull Valley, construction and operation of the rail line could cause some wild horses, mule deer, and pronghorn antelope to avoid the area. Other animals may habituate to the noise of new construction and continue to cross the rail corridor. The level of impact to the local population of these species from construction and operation is expected to be minimal.

All other ecological resources identified in Section 2.3.3, such as migratory peregrine falcons, should not be adversely affected by construction activities, since these activities are temporary in nature. Additional consultation relative to threatened and endangered species may be required with the BLM and USFWS.

4.4.3 Effects on Air Quality

Although the construction of the Low Corridor rail line will require a significant amount of alteration of public land administered by the BLM, the overall impacts on air quality from construction and operation will be minor and limited to the general vicinity of the corridor. Any impacts will mainly be associated with emissions of fugitive dust from construction activities and from locomotive emissions during cask transport operations. No long-term impacts on the local meteorology/climatology will result from these activities.

Emissions of particulate matter with an aerodynamic diameter less than or equal to a nominal 10 microns (PM-10) are estimated for activities related to the construction of the Low Corridor Railroad Line including: clearing/grubbing; vehicular traffic on unpaved roads; wind erosion from temporary topsoil piles; material handling; bulldozing;

compacting; scraping and grading. Emissions of total particulate matter (PM), nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC) are also estimated from construction vehicle operation and locomotive use. Calculations of concentrations of these pollutants in ambient air are not meaningful as there are no sensitive receptors in the vicinity of the rail corridor that can be impacted by these emissions.

Estimates of air pollutant emissions due to construction activities are determined on the basis of estimated material handling (e.g., cubic yards of topsoil and cut moved) and reasonable assumptions regarding construction equipment mileage and hours of operation during the construction period. PM-10 emissions estimates are provided for fugitive dust caused by clearing/grubbing; vehicular traffic on unpaved roads; wind erosion from temporary topsoil piles; material handling; bulldozing; compacting; scraping and grading. Applicable gaseous criteria pollutant emissions from equipment use (i.e., NO_x, CO,, PM, and VOC) are also provided. Most of the construction activities are assumed to be occurring simultaneously during any given construction month for purposes of ensuring conservatism in these emissions estimates.

The emission factors used in the estimates for construction activities are taken from the 5th edition of EPA's AP-42 document (EPA, 1998) assuming reasonable levels of emissions control as needed to satisfy DEQ requirements.

On-road dump truck exhaust emissions are based on emission factors taken from the pending 5th edition of EPA's AP-42 document (EPA, 1998a). These factors apply to heavy duty diesel powered vehicles (HDDV) operated at high altitudes (~5,550 ft MSL) for model year 1996 or later at the federal test method speed of 19.6 mph. Non-road construction equipment exhaust emission factors are taken from EPA's Nonroad Emissions Model (EPA, 1998b). The locomotive emission factors used are conservatively based on 1997 estimates provided by the Internet Web site DieselNet (http://www.dieselnet.com). The construction equipment exhaust emission factors (E) used in this calculation are as follows:

On-Road Dump Truck Exhaust (grams/mile @ 19.6 mph):

$E(NO_x) = 6.5$

E(CO) = 17.2

E(VOC) = 4.7

E(PM) = N/A

Non-Road Construction Equipment Exhaust (grams/bhp-hr):

Graders:
$E(NO_x) = 9.5$
E(CO) = 2.4
E(VOC) = 1.0
E(PM) = 0.76

Scrapers:
$E(NO_x) = 8.6$
E(CO) = 3.9
E(VOC) = 0.47
E(PM) = 0.96

Bulldozers:
$E(NO_x) = 10.4$
E(CO) = 1.8
E(VOC) = 0.56
E(PM) = 0.50

Roller:
$E(NO_x) = 9.2$
E(CO) = 3.9
E(VOC) = 0.74
E(PM) = 0.94

Locomotive Operation (grams/bhp-hr):

$E(NO_x) = 13.5$
E(CO) = 1.5
E(VOC) = 0.5
E(PM) = 0.34

The estimated air pollutant emissions associated with the construction of the Low Corridor Rail Line are summarized in Table 4.3-2.

Similarly, the effects on air quality of the Low Corridor rail line cask transport between Low and the PFSF were assessed relative to annual air pollutant emissions since there are no residences to be impacted along the entire corridor. This assessment considers the total locomotive mileage, vehicle speed, and appropriate locomotive air pollutant emission factors. Generally, there will be 1-2 locomotive round trips per week; with each trip transporting full casks to PFSF, and returning back to Low Junction with empty casks. It is also possible that additional trips would be required to deliver empty casks to the mainline rail siding for pickup by the mainline train. The additional 2 round trips results in a bounding case of a maximum of 4 round trips per week, yielding 13,312 vehicle miles of rail travel per year. The largest train is expected to consist of 2 1500-horsepower locomotives with 6 cars containing casks, 7 empty cars, and a security car. The maximum train speed is expected to be 20 miles per hour.

The annual air pollutant emissions potential are estimated on the basis of annual vehicle miles traveled and emissions of current model diesel locomotive engines. The latter were based on current estimates (1997) from the Internet web site DieselNet. EPA standards were not applicable since they only apply to remanufactured engines, which may not be the case for the Low Corridor rail system. The criteria air pollutants for which emissions are provided include HC, CO, NO_x, and PM, expressed as grams per brake horsepower per hour and are summarized below for line haul locomotives:

Pollutant	Emission Rate, g/bhp-hr
HC	0.5
CO	1.5

NO_x	13.5
PM	0.34

At an average speed of 20 mph, the annual hours of locomotive operation, for 13,312 miles traveled, is 665.6 hours. Therefore, assuming a 3,000 bhp locomotive, the annual air pollutant emissions potential in tons/year is:

Pollutant	Emissions, tons/yr
HC	1.1
CO	3.3
NO_x	29.7
PM	0.7

It can be concluded that the emissions from the rail transport operations are trivial, when compared to existing (1994) Tooele County emissions that are 3-4 orders of magnitude higher.

4.4.4 Effects on Hydrological Resources

Because there are no existing surface water bodies and ground water is over 100 ft below the surface, it is unlikely that the rail line will have any impact on hydrological resources.

4.4.5 Effects on Mineral Resources

No mineral resources have been identified along the rail line corridor. Therefore, no impact to this resource is expected from the construction of a rail line.

4.4.6 Effects on Socioeconomics

No adverse impacts on socioeconomic resources are anticipated as a result of the new rail line. Minor short-term employment will result from construction activities associated with the rail line. These activities will utilize a local labor force commuting daily to the project area and will therefore not induce relocation of families and associated impacts on local government services.

4.4.7 Effects of Noise and Traffic

The distances between the proposed rail line and the residences along Skull Valley Road are on the order of 5 to 10 miles. The construction noise is not expected to be audible along Skull Valley Road.

Sound level predictions were made for the locomotive and rail cars delivering the casks to the site. The train noise predictions were based upon methodologies outlined in C.M. Harris's Handbook of Noise Control. The propagation calculations were made using atmospheric absorption at standard conditions. No credit was taken for ground absorption or wind and thermal gradients. The levels predicted are maximum levels which could occur with the receptor down wind. During calm clear days or receptor upwind conditions, the levels would be at least 20 dBA less than indicated.

There are some ranches and residences along Skull Valley Road between I-80 and the PFSF site. The proposed rail line parallels Skull Valley Road from the site northward to Low Junction. The distance between the rail alignment and Skull Valley Road in this region is approximately 5 miles. The maximum locomotive and rail car noise would be 31 dBA at Skull Valley Road, which may occasionally be just audible if the ambient sound level drops into the 20s dBA. Where the alignment turns east to the site, the levels may occasional reach 45 dBA and be audible.

North of 8 Mile Spring Road, Skull Valley Road veers north-northeast and the distance from the rail line increases to 7 miles at Horseshoe Springs, and to 10 miles where Skull Valley road intersects I-80. The predicted maximum rail noise to receptors along Skull Valley Road (near Eight Mile Spring Road) is 26 dBA, and 19 dBA at the intersection of I-80 and Skull Valley Road. The train is not expected to be generally audible in this area.

Traffic on east-west roads is not expected to be affected or public safety threatened. The proposed new rail line will cross several roads. Most of the roads are little more than dirt jeep trails that are subject to little, if any, use. Eight Mile Spring Road, however, is graded. It appears that ranchers use the road to access the interior of Skull Valley, and that hunters and other recreationists travel the road on an infrequent basis to gain access to the southern end of the Cedar Mountains. Because of the unimproved nature of the roads, traffic usually proceeds at a reduced speed. The new rail line will be used only once or twice a week, with the trains traveling at approximately 20 miles per hour. Because the area is flat, unoccupied and unwooded, users of both the roads and rail line will have a virtually unlimited field of vision. Based on these factors, it is unlikely that the rail line will have any impact on traffic or vehicular safety.

4.4.8 Effects on Regional Historical, Cultural, Scenic, and Natural Features

The Class I cultural resource inventory for the Low Corridor rail line conducted in May 1998 included a study area of a mile wide corridor centered over the proposed rail line. The Class I Survey concluded that there is only a low probability of encountering archeological or historical sites in the proposed rail line corridor or ITP area.

A Class III cultural resource survey will be performed in the area potentially affected by the Low Corridor rail line. In Utah, a Class III survey includes a literature search of prior surveys, a walkover of the project area, and sufficient subsurface testing to determine whether any potentially significant sites meet the criteria for listing in the National Register of Historic Places. The survey will be conducted in consultation with the SHPO in a manner consistent with SHPO and BLM guidelines and regulations. The survey will be conducted by an archaeological firm holding an active joint archeological survey permit issued by these two agencies.

There is the potential for impacts to historic trails that may cross the Low Corridor rail line. A Comprehensive Management Plan (CMP) for Historic Trails is currently being prepared by the National Park Service. The Low Corridor rail line will be reviewed for consistency with the CMP, how the rail line would fit into the limits of acceptable change for the trails, and implement any mitigation measures as needed.

The Low Corridor rail line will add a visual element to Skull Valley. However, due to the variations in the rolling topography and the low profile of the rail line (essentially at grade level), the rail line will not be obviously visible from most locations in the valley. The Low Corridor rail line will be an apparent change in the visual landscape only in the developed areas near I-80 and from high elevations in the Cedar Mountains. Although the rail line represents a change in the landscape, it will be consistent with the visual resource management classification (VRM Class IV) established by BLM for the Low Corridor and with other developments in the area, such as I-80, the mainline railroad along I-80, and the Skull Valley Road. Because of the low level of recreational use of the area and lack of nearby residences, the Low Corridor is not expected to be a significant impact to the scenic environment.

To reduce the potential for increased range fires that may be caused by rail transport, the 40 ft wide rail line corridor will be cleared of vegetation to provide a buffer zone in preventing fires. Also the elevation of the rail line will be constructed close to grade to allow emergency fire vehicles access over the rail bed.

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4.5 RESOURCES COMMITTED

Several resources will be permanently committed as a result of construction and operation of the PFSF. Development of the PFSF and access road will require the permanent commitment of raw materials used in the concrete storage casks, storage pads, and road building materials. These include cement, sand, aggregate, steel, and other building materials. These commodities are in abundant supply in the region and the quantities of each utilized here are considered to be insignificant.

Development of this facility will also require the commitment of approximately 22 acres of land for the access road corridor. The new rail line will require an additional 155 acres of land. It is planned at this time to return the PFSF land area to its original habitat following decommissioning. Some additional acreage will be lost if the facility buildings are retained. These modifications will permanently alter the vegetation and wildlife habitat within the affected area.

Water needs during construction and operation of the PFSF are very modest. Beginning the third year of construction and subsequently during operation, the estimated water needs average approximately 3600 gallons/day. The highest water demand is associated with the larger daytime work force as well as operation of the concrete batch plant which is estimated at 8500 gallons/day during the first year of construction and about 5300 gallons/day during the second year of construction. It is anticipated that no more than two water wells drilled into the valley aquifer will be required to satisfy the project demands. It is also anticipated that some surface storage capacity will be erected at the site for potable water, emergency fire water, and for the concrete batch plant. Wells drilled into the valley aquifer will yield more than the demands for the site construction and operation. Localized drawdown of the valley aquifer caused by the site water wells is not expected to have any effects on adjacent water well users. Similarly operation of the site will have no effects on existing groundwater quality. At present, groundwater quality at the site has not been determined and will be tested when and if water wells are constructed at the site. Since the water demands at the site during construction and operation are very modest and there are no ground water users within or immediately adjacent to the site, there will not be any impacts caused by groundwater withdrawal at the site.

high berm east of the storage area could be used to cover the former cask storage area, or, alternatively, soil could be trucked in from outside the PFSF.

After the PFSF cask storage area is resurfaced with topsoil suitable for supporting native vegetation, the land is essentially returned to its original condition. There is no irreversible commitment of natural resources associated with the long term plans for the PFSF land, unless the Band chooses to keep some of the buildings or other structures intact for their own use.

At the intermodal transfer point the rail siding, pre-engineered metal building and foundation, and access road will be dismantled and removed. The area will be covered with topsoil and replanted with native vegetation. There is no irreversible commitment of natural resources associated with the intermodal transfer point.

It is anticipated that the low corridor rail line will be utilized by others in the Skull Valley and will not be dismantled and removed. This would result in a permanent commitment of about 155 acres of public land administered by the BLM associated with the rail line.

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PFSF, or transported via a new rail line connecting the PFSF directly to the Union Pacific mainline at Low. Doses due to the new rail line are included in Table S-4 values described above. The following discussion estimates doses to the public and nearby workers due to the use of the intermodal transfer point alternative.

Shipping casks will arrive on the railroad siding at the intermodal transfer point, where the shipping casks will be transferred from the rail car to a heavy haul tractor/trailer for transport to the PFSF. For purposes of estimating the dose to the general public from these activities, it was assumed that one shipping cask containing design fuel (as identified in the vendors' shipping cask SARs) is continuously staged at the intermodal transfer point throughout a year. The PFSF is expected to receive 100 to 200 fuel shipments (rail shipping casks) per year, so the assumption of one cask being present 365 days a year is conservative.

The distance from the intermodal transfer point to the north side of I-80 is approximately 500 ft. An integrated dose was calculated from the side of a cask to a vehicle on I-80 passing by the intermodal transfer point. The average number of vehicles traveling I-80 is 9,000 per day, and the average number of occupants is 2 per vehicle (UDOT, 1997). Assuming the vehicles travel at an average speed of 60 mph results in an estimated total dose to travelers along I-80 of 0.19 person-rem per year. Assuming 3 shipping casks staged at the intermodal transfer point at any given time, the maximum dose to an individual traveling past the intermodal transfer point on I-80 will be less than 9.8 E-5 mrem.

An estimate was made of the dose to an individual with a disabled vehicle on the I-80 frontage road in the vicinity of the intermodal transfer point. Assuming the person parks the disabled vehicle along the frontage road at the nearest point from 3 shipping casks that contain design fuel staged at the intermodal transfer point, and remains at the location for 4 hours, a maximum dose of 0.20 mrem is calculated.

An estimate was also made of the annual collective dose to people traveling past the intermodal transfer point by rail (the rail mainline runs near the proposed intermodal transfer point). Assuming a shipping cask containing design fuel is continuously staged on the closest intermodal transfer point rail siding and based on 167,000 people traveling by rail (AMTRAK, 1997) at a speed of 50 mph past the intermodal transfer point over the course of a year, the annual collective dose to rail travelers is calculated to be 0.16 person-rem. If 3 shipping casks were staged on the rail siding of the intermodal transfer point at any one time, the maximum dose to a passenger on a railroad train traveling past the intermodal transfer point will be less than 3.07 E-3 mrem.

An estimate was made of the dose to a railroad employee assumed to perform switching operations on the rail siding adjacent to the intermodal transfer point. Assuming the individual spends one hour at the highest dose point in the vicinity of 3 shipping casks containing design fuel staged on the intermodal transfer point rail siding, a maximum dose to the railroad employee of 4.8 mrem is calculated.

The dose rate to persons working at the nearby industrial salt plant from the intermodal transfer point was also considered. The main building of the salt plant is located approximately 7,000 ft from the intermodal transfer point railroad siding cask staging area. A maximum dose rate of 5.4 E-8 rem/hr was calculated at this distance from a shipping cask, which is insignificant when compared to background. The maximum dose to an individual worker at the nearby salt plant from shipping casks staged at the intermodal transfer point is not expected to exceed 1 mrem per year.

4.8 REFERENCES

BLM (Bureau of Land Management), 1988, Draft Pony Express Resource Management Plan and Environmental Impact Statement. Salt Lake district, BLM, U.S. Department of the Interior, Salt Lake City, UT, May 1988

BLM (Bureau of Land Management), 1990, Stansbury Mountains Habitat Management Plan. Salt Lake district, BLM, U.S. Department of the Interior, Salt Lake City, UT, May 1990

Census (U.S. Bureau of the Census), 1993, 1990 Census of Population and Housing, Population and Housing Characteristics for Census Tracts and Block Numbering Areas, May 1993

DEQ (The Utah Department of Environmental Qualty), Regulations for Fugitive Dust Generated by Construction Activities, DEQ R307-12.3

DOE (U.S. Department of Energy), 1986, Environmental Assessment, Yucca Mountain Site, Nevada Research And Development Area, DOE/RW-0073, May 1986

DOE (U.S. Department of Energy), 1996, Record of Decision On A Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel, issued by the DOE May 13, 1996.

EPA 1992. U.S. Environmental Protection Agency. Office of Air Quality Planning and Standards. Guideline for Modeling Carbon Monoxide from Roadway Intersections. Research Triangle Park, NC. Report no. EPA-454/R-92-005. November, 1992.

EPA 1998. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources", 5th Edition, AP-42, 1995 (Sections 11.1, 11.9, 11.12, 13.2.2).

EPA 1995b. Environmental Protection Agency, "SCREEN3 User's Guide". EPA Publication No. EPA-454/B-95-004, October 1995.

EPA 1995c. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. User's Guide to CAL3QHC, Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections. Research Triangle Park, NC. Report no. EPA-454/2-92-006 (Revised), September, 1995.

EPA 1996. Environmental Protection Agency, "User's Guide to MOBILE5 (Mobile Source Emissions Factor Model)". Office of Air Quality and Radiation, Office of Mobile Sources, Emission Planning and Strategies Division, Ann Arbor, MI., Report no. EPA-AA-AQAB-94-01, revised September, 1996.

EPA 1998a. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources", pending 5th Edition, AP-42, (Appendix H), April, 1998.

EPA 1998b. U. S. Environmental Protection Agency, "Draft User's Guide for the National Nonroad Emissions Model, Draft Version". Prepared by ENVIRON International Corporation for U. S. Environmental Protection Agency, National Vehicle and Fuel Emissions Laboratory, Ann Arbor, MI, June, 1998.

NUREG-0170, Final Environmental Statement On The Transportation Of Radioactive Material By Air And Other Modes, December, 1977

NUREG-1437, Generic Environmental Impact Statement For License Renewal of Nuclear Plants, May 1996.

P-III Associates, 1998, Class I Cultural Resource Inventory of the Private Fuel Storage Facility Railroad Spur and Intermodal Transfer Point , Skull Valley, Tooele County, Utah. P-III Associates, Inc., Salt Lake City, Utah, May, 1998.

SWEC Calculation No. 0599601-P-001, Rev. 0, PFSF Transportation Impacts, May 12, 1997

UDOT, 1997. Telephone conversation between J.R. Johns (SWEC) and J. Reaveley (Utah Department of Transportation), dated April 25, 1997.

UDWR (Utah Division of Wildlife Resources), 1997, Biological Assessment, Private Radionuclide Storage , Goshute Indian's Skull Valley Reservation, Tooele County, UT, March 27, 1997

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TABLE 4.1-3

SKULL VALLEY ROAD TRAFFIC/NOISE
SOUTH OF IOSEPA

	ADT	PEAK VOLUME (V/H)	SOUND LEVEL (@50')
Existing Traffic	325	54	67 dBA
Construction Phase 1 Period I (Sept. 1 to Oct. 30, 2000)	884	150	72 dBA
Construction Phase 1 Period II (Nov. 1, 2000 to May 31, 2001)	739	135	71 dBA
Construction Phase 1 Period III (June 1, 2001 to Mar. 1,2002)	639	124	71 dBA
Construction Phase 2 (March 1, 2002 to November 30, 2011)	503[4]	104	69 dBA
Construction Phase 3 (March 1, 2012 to November 30, 2021)	515	105	69 dBA
Operation (After November 30, 2021)	409	81	68 dBA

[4] ADTs and peak volume figures include traffic generated by Facility operation which begins June 1, 2002.

Table 4.1-4

ESTIMATED CONSTRUCTION RELATED POLLUTANT EMISSIONS

Activity	Pollutant	Emission Rate (tons/month)	Basis
Clearing/Excavation • vehicular traffic on unpaved and paved roads • wind erosion • material handling • bulldozing • scraping • grading	PM10	15.4	Assumes 330,000 total construction vehicle miles traveled in one year
Concrete Batch Plant	PM10	0.6	Assumes 125,300 cubic yards of concrete used in one year
Asphalt Batch Plant	NO_x CO SO_2 PM10 VOC	0.08 0.03 0.1 0.03 0.02	Assumes 11,500 cubic yards of asphalt used in one year
Vehicle Operation	NO_x CO VOC	0.4 0.5 0.1	Assumes 350,000 total vehicle miles traveled in one year

Table 4.1-5

ESTIMATED CONSTRUCTION AIR QUALITY IMPACTS

Source	Pollutant	Estimated Impact ($\mu g/m^3$)		Standard ($\mu g/m^3$)
		Skull Valley Rd	Residences	
Fugitive Dust Sources	PM10			
	24-hour	27.2	16.4	150
	Annual Avg	3.4	2.1	50
Concrete Batch Plant	PM10			
	24-hour	37	20	150
	Annual Avg	5	3	50
Asphalt Batch Plant	NO_x			
	Annual Avg	0.5	0.3	100
	CO			
	1-hour	4.1	2.3	40,000
	8-hour	2.8	1.6	10,000
	SO_2			
	3-hour	12.6	7.2	1,300
	24-hour	5.6	3.2	365
	Annual Avg	0.7	0.4	80
	PM10			
	24-hour	1.6	0.9	150
	Annual Avg	0.2	0.1	50

TABLE 4.2-1

ESTIMATED OPERATION LABOR FORCE (PFSLLC FINANCIAL PLAN 1997).

POSITION	NUMBER OF STAFF
PFSF Manager	1
Secretary	2
Mechanical Technicians	3
General Plant Workers	2
Elec./Inst. Technicians	3
Transportation Specialist	1
Nuclear Engineer	3
Licensing Engineer	1
HP Manager	1
HP Technicians	2
QA Lead	1
QA Technicians	2
Emergency Response Leader	1
Public Relations Coordinator	1
Security Captain	1
Security Force	15
Finance & Purchasing Specialist	1
Administrative Assistant	1
Total	**42**

TABLE 4.3-1

ESTIMATED CONSTRUCTION RELATED POLLUTANT EMISSIONS FOR INTERMODAL TRANSFER BUILDING

Activity	Pollutant	Emission Rate (tons/year)	Annual Basis
Clearing/Excavation • clearing/excavation • vehicular traffic on unpaved roads • material handling/topsoil • wind erosion from piles • bulldozing/compacting • grading	PM-10	1.70	172 dump truck miles 70 concrete truck miles 28 asphalt truck miles 1,500 front end loader miles 600 hours bulldozer operation 300 hours of compacting 10,000 tons soil handled 17,000 tons backfill handled
Construction Vehicle Operation	NO_x CO VOC PM	4.01 1.53 0.40 0.33	Assumes 6,270 total construction vehicle miles traveled in one year

TABLE 4.3-2

ESTIMATED CONSTRUCTION RELATED POLLUTANT EMISSIONS FOR LOW CORRIDOR RAIL LINE

Activity	Pollutant	Emission Rate (tons/month)	Annual Basis
Clearing/Excavation • clearing/grubbing • vehicular traffic on unpaved roads • material handling • wind erosion from piles • bulldozing/compacting • grading • scraping	PM-10	22.3	340,704 dump truck miles 108,000 scraper miles 1,000 grader miles 1,500 front end loader miles 4,032 hours bulldozer operation 4,032 hours of compacting 1,103,200 tons of cut handled 85,000 tons topsoil handled
Construction Vehicle Operation	NO_x CO VOC PM	5.03 2.37 1.73 0.46	Assumes 462,664 total construction vehicle miles traveled in one year
Locomotive Operation	NO_x CO HC PM	3.75 0.42 0.14 0.09	Assumes 2,016 hours of locomotive operation in one year

CHAPTER 5

ENVIRONMENTAL EFFECTS OF ACCIDENTS

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CHAPTER 5

ENVIRONMENTAL EFFECTS OF ACCIDENTS

5.1 ISFSI ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

Postulated accidents at the PFSF are addressed in Chapter 8 of the PFSF SAR. The SAR discusses the spectrum of accidents analyzed and identifies certain accidents as the bounding cases involving release of radioactive materials.

5.1.1 Normal Operations and Operational Occurrences

Section 4.2 of this ER addresses the radiological impact from routine operation of the PFSF. Section 8.1 of the PFSF SAR analyzes the following postulated off-normal events:

- Loss of external electrical power
- Off-normal ambient temperatures
- Partial blockage of storage cask air inlet ducts
- Operator error
- Off-normal contamination release

The spent fuel storage canister conforms to requirements of the ASME Boiler and Pressure Vessel code (BPVC) Section III and provides substantial assurance that radioactive materials will not leak from the canister over the life of the PFSF. The canister retains its pressure boundary integrity in all of the above postulated events, and there is no release to the environment of radioactive fission products or activation products from inside the canister. In addition, the concrete storage casks protecting the canister would remain intact, with no loss of shielding capability, so there are no abnormal radiation levels associated with these off-normal events. The only dose consequence arises from the postulated release of surface contamination from the canister exterior, as discussed in Section 8.1.5 of the PFSF SAR. This evaluation conservatively assumes that the entire outer surface of a canister is covered with contamination at the maximum concentration permitted by the PFSF Technical Specifications, and that 100 percent of this radioactive material is somehow removed from the canister and becomes airborne in respirable size particles. Dose consequences were calculated at the OCA boundary using a dispersion factor (χ/Q) of 1.94 E-3 seconds/cu. meter, which was calculated in accordance with Regulatory Guide 1.145 assuming a minimum distance of 500 meters from the Canister Transfer Building to the Owner Controlled Area (OCA) boundary, a wind speed of 1 meter/sec, atmospheric stability class F, with no consideration for plume meander. These conditions result in a conservatively high χ/Q for purposes of assessing maximum possible doses. The total effective dose equivalent (TEDE) to an individual at the OCA boundary from this worst case scenario is calculated to be 4.4 E-3 mrem, and the total dose to the lungs (maximally exposed organ) is calculated to be 2.6 E-2 mrem. These doses are well below the 10 CFR 72.106 criteria for accidents. Assuming an off-normal condition resulting in release of contamination to the atmosphere occurs on the order of once per year, total annual dose consequences at the OCA boundary from this event and radiation emanating from storage casks (Section 4.2.9) will not exceed the 10 CFR 72.104 limit of 25 mrem/yr. The radiological impacts to the environment from normal operations at the PFSF (including off-normal conditions) are negligible.

5.1.2 Postulated Accidents

Section 8.2 of the PFSF SAR presents a range of postulated accident scenarios, including hypothetical, non-credible events, to establish a conservative design basis for confinement systems. Design events of the third and fourth types as defined in

ANSI/ANS-57.9 were considered in that section. A Design Event III is associated with infrequent events that could be reasonably expected to occur during the lifetime of the PFSF. A Design Event IV consists of natural phenomena or a man-induced low probability event postulated because its consequences may result in the maximum potential impact on the immediate environs. Their consideration establishes a conservative design basis for systems with important confinement features. The following accidents are analyzed in Section 8.2 of the PFSF SAR:

- Earthquake
- Extreme wind
- Flood
- Explosion
- Fire
- Hypothetical storage cask drop / tip-over
- Canister leakage under hypothetical accident conditions
- 100% blockage of air inlet ducts
- Lightning
- Hypothetical accident pressurization

It was determined that the canister would retain its confinement integrity for each of these accidents (with the exception of leakage postulated in the canister leakage under hypothetical accident conditions). In addition, the canister would remain inside the storage cask, so that shielding would continue to be provided. Some localized reduction in shielding was considered possible in cases of a design basis tornado-generated missile striking a storage cask, but this would have no significant effect on the radiation levels at the PFSF OCA boundary, as discussed in PFSF SAR Chapter 8. The storage cask shields the canister from direct impact by missiles so that none of the design basis missiles can strike the canister. The only accident evaluated that involves a release of radioactive material to the environment is the canister leakage postulated under hypothetical accident conditions in which 100% of the fuel rod cladding is assumed to have ruptured.

The canister leakage under hypothetical accident conditions is evaluated in Section 8.2.7 of the PFSF SAR. In this accident analysis, it is postulated that a canister leaks at the maximum rate permitted by the acceptance criteria of the helium leakage test of the closure welds. Such a leak would require a defect in each of two redundant closure welds. In this hypothetical accident condition, it is assumed that cladding of 100% of the fuel rods stored in the canister has ruptured. Failure of the cladding of all the rods in a canister is not a credible scenario. The spent fuel is stored in a dry, inert (helium gas) environment at temperatures that do not cause fuel cladding degradation. The results of analyses concerning the accidents and off-normal events identified above indicate that spent fuel cladding temperatures remain within allowables under analyzed conditions, including high ambient temperatures and partial blockage of the natural convection air inlet ducts. Even if all fuel cladding were postulated to fail and release fuel rod fill gas and fission product gases into the canister, canister internal pressures would remain within design allowables and the canister would retain its leak-tight integrity (PFSF SAR Section 8.2.10). This postulated cladding rupture results in the escape of rod fill gas and fission product gases from the rods to the canister innerspace, with consequent pressure increase of the canister innerspace. In addition, it is conservatively assumed that the canister is at an abnormally high temperature, thus maximizing the canister internal pressure and the flow rate of gas through the leak path to the atmosphere.

Conservative fractions of fission product gases, volatiles, fuel fines and activation products are assumed to be released from the fuel rods into the canister, and available for release to the environment via the canister leak (PFSF SAR Section 8.2.7). Dose consequences were projected using a dispersion factor of 1.94 E-3 seconds/cu. meter, which was calculated in accordance with Regulatory Guide 1.145 assuming the minimum distance of 500 meters from the Canister Transfer Building to the OCA boundary, a wind speed of 1 meter/sec, atmospheric stability class F, with no consideration for plume meander. These conditions result in a conservatively high χ/Q for purposes of assessing maximum possible doses. It is assumed that the canister leakage lasts for 30 days and an individual is located within the plume at the nearest point of the OCA boundary to the Canister Transfer Building for the duration of the release. It is calculated that the individual would receive a maximum total effective dose equivalent (TEDE) of 75.9 mrem, and a total dose to the bone surface, the maximally exposed organ, of 824 mrem. 10 CFR 72.106(b) requires that any individual located on or beyond the nearest boundary of the controlled area may not receive from any design basis accident the more limiting of a total effective dose equivalent of 5 rem, or the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue (other than the lens of the eye) of 50 rem. The lens dose equivalent shall not exceed 15 rem and the shallow dose equivalent to skin or to any extremity shall not exceed 50 rem. Based on the above TEDE and organ doses, the bounding canister leakage accident does not exceed the limits specified in 10 CFR 72.106(b).

As an evaluation of the potential doses from environmental pathways following deposition of material in the plume, a pathway analysis using the RESRAD computer code (RESRAD) was next conducted. The first step of this evaluation was to estimate the amount of material deposited on the ground from the plume. This estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (1977). Using a straight-line trajectory model, this approach requires that the relative deposition rate should be divided by the arc length of the sector at the given downwind distance being considered to estimate deposition. The value of relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111, with the resulting value of 8.0 E-5 m^{-1} at 500 meters downwind. Deposition estimates were made for each of the radionuclides in the source term. These values, in units of pCi/m^2, were next modified to units of pCi/g to match the input requirements of the RESRAD code, by assuming a soil density of 1.5 E+6 g/m^3 and uniform contamination of the soil to a depth of 1 cm.

The exposure scenario considered in the RESRAD analysis includes direct exposure to contaminated ground, inhalation of resuspended radioactive material, ingestion of milk and beef following grazing, and ingestion of soil. This scenario is considered to be a conservative representation of the land use conditions and environment of the land surrounding the PFSF. 2,000 hours/year occupancy time was assumed at the 500 meter distance along the owner controlled area fence. Although natural vegetation is quite sparse, it is conservatively assumed that the RESRAD default values for fodder intake are met both for the dairy and beef cattle. Default values for human consumption provided in RESRAD for air, milk, beef, and soil were assumed (with the inhalation value reduced from the default value by a factor of 0.228 (2000 hrs / 8760 hrs) to account for partial occupancy). The default values include inhalation of 1,918 m^3 of air with a mass loading factor for air of 2.0 E-4 g/m^3, ingestion of 92 liters of milk, ingestion of 63 kg of beef, and ingestion of 36.5 g soil. The resulting TEDE for the accident case was 2.70 mrem/yr at 500 meters downwind. This dose is a small fraction of the inhalation plus submersion doses identified above, and well below the 5 rem TEDE accident limit imposed by 10 CFR 72.106(b). The dominant exposure pathway was determined to be external exposure to contaminated land and the radionuclide with the largest contribution to the dose was Co-60.

5.1.3 Impacts of Accidents on the Surrounding Population

There are only about 36 residents within a 5 mile radius of the PFSF. The nearest residence is located approximately 2 miles east-southeast of the PFSF. The site is located a substantial distance from population centers. The distance to the nearest town, Dugway, is over 10 miles. Dugway is a military town on the Dugway Proving

Grounds, with a population of approximately 1,700, located about 12 miles south of the PFSF. Terra, a small residential community of about 120 people, is located 10 miles east-southeast of the PFSF.

Doses from the off-normal contamination release event discussed in Section 5.1.1 were below 0.1 mrem at the OCA fence and would be negligible at the greater distance to the nearest residence (3,219 meters vs. 500 meters). Worst case doses to offsite individuals from the non-credible canister leakage accident under hypothetical accident conditions (discussed in Section 5.1.2) are assessed as follows at the distance to the nearest residence: A χ/Q of 9.42 E-5 sec/cu meter was calculated in accordance with Regulatory Guide 1.145, based on a distance of 2 miles (3,219 meters) from the release source to the dose receptor, a wind speed of 1 meter/sec, atmospheric stability class F, with no consideration for plume meander. Assuming the same quantity of radionuclides released from the hypothesized leaking canister as assumed in Section 8.2.7 of the PFSF SAR, and assuming the wind direction directs the release plume toward the nearest residence, it is calculated that an individual at 2 miles from the release point who remains in the plume for the duration of the release would receive a maximum TEDE of 3.68 mrem, and a total dose to the bone surface, the maximally exposed organ, of 40.0 mrem. This represents a maximum dose to a member of the surrounding population from a worst case hypothetical accident. These doses are well below 10 CFR 72.106 (b) limits, identified above.

As an evaluation of the potential doses from environmental pathways following deposition of material in the plume, a pathway analysis using the RESRAD computer code (RESRAD) was next conducted. The first step of this evaluation was to estimate the amount of material deposited on the ground from the plume. This estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (1977). Using a straight-line trajectory model, this approach requires that the relative deposition rate should be divided by the arc length of the sector at the given downwind distance being considered to estimate deposition. The value of relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111, with the resulting value of 2.3E-5 m^{-1} at 3,219 meters downwind. Deposition estimates were made for each of the radionuclides in the source term. These values, in units of pCi/m^2, were next modified to units of pCi/g to match the input requirements of the RESRAD code, by assuming a soil density of 1.5 E+6 g/m^3 and uniform contamination of the soil to a depth of 1 cm.

The exposure scenario considered in the RESRAD analysis includes direct exposure to contaminated ground, inhalation of resuspended radioactive material, ingestion of milk and beef following grazing, and ingestion of soil. This scenario is considered to be a conservative representation of the land use conditions and environment of the land surrounding the PFSF. Continuous exposure, 8,760 hours/yr, was conservatively assumed at the nearest residence. Although natural vegetation is quite sparse, it is conservatively assumed that the RESRAD default values for fodder intake are met both for the dairy and beef cattle. Default values for human consumption provided in RESRAD for air, milk, beef, and soil were assumed. The default values include inhalation of 8,400 m^3 of air with a mass loading factor for air of 2.0 E-4 g/m^3, ingestion of 92 liters of milk, ingestion of 63 kg of beef, and ingestion of 36.5 g soil.. The resulting TEDE for the accident case was 0.527 mrem/yr at 3,219 meters downwind. This dose is a small fraction of the inhalation plus submersion doses identified above, and well below the 5 rem TEDE accident limit imposed by 10 CFR 72.106(b). The dominant exposure pathway was determined to be external exposure to contaminated land and the radionuclide with the largest contribution to the dose was Co-60.

5.3 REFERENCES

ANSI/ANS-57.9,1992, Design Criteria for an Independent Spent Fuel Storage Installation (Dry Storage Type).

DOE/RW-0073, Environmental Assessment, Yucca Mountain Site, Nevada Research And Development Area, May 1986

NUREG-0170, Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, December, 1977

NUREG/CR-4829, Shipping Container Response to Severe Highway and Railway Accident Conditions, February, 1987

Private Fuel Storage Facility Safety Analysis Report.

Regulatory Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, Revision 1, July 1977.

Regulatory Guide 1.145, Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants, February 1983.

RESRAD Computer Code, Version 5.82 for Windows.

SWEC (Stone & Webster Engineering Corporation) 1997, Calculation No. 0599601-P-001, Rev. 0, PFSF Transportation Impacts.

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7.2.2 Indirect Benefits

The indirect benefits of the PFSF over its operating life include payments to Tooele County as cask surcharges, tax revenues to the State of Utah from sales taxes, a short term increase in regional employment due to the facility construction and a long term increase in employment during its operation, as described in Section 9.1 of the Safety Analysis Report. Other indirect benefits include local procurement of materials and supplies for the construction and operation of the facility from the surrounding region. Procurement of casks and other goods, as well as possible local fabrication of canisters will have a large impact on the local area. Each dollar earned which is spent in the local economy has a multiplier effect, further increasing the positive spending impact on the local area.

It is estimated that U.S. operating nuclear plants reduce the emission of 86 million metric tons of carbon into the air each year (NEI, 1997). Likewise, a significant amount of nitrogen oxide and sulfur dioxide emissions are also prevented. Plants which are shut down or not relicensed due to lack of spent fuel storage availability will likely be replaced with fossil generation. In the U.S. Clean Air Act and the Global Climate Action Plan, aggressive goals for reduced emissions have been established. Compliance and attainment of these goals would be jeopardized by plants idled due to lack of spent fuel storage capability.

The indirect benefits for the Band include increased traffic and business at their convenience store during construction and operation, and an increased profile for the Band in the Utah business economy, potentially bringing new economic development initiatives to the Band. Other indirect benefits will include construction of a rail line to the site which will provide opportunities for further Band economic development projects. In addition, the project will provide improved access to the western portion of the reservation and improved electric and phone services through upgraded distribution and communications lines to the reservation area.

TABLE 8.1-1

POTENTIAL HOST SITES

No.	Host Site	No.	Host Site
01	Mescalero (LTR)	21	Ponca Tribe
02	Mescalero (RH)	22	Prairie Island Sioux
03	Goshute Tribe	23	Sac & Fox Nation
04	Santee Sioux	24	San Juan County
05	Absentee Shawanee	25	Tetlin Tribe
06	Akhoik Kaguyak Tribe	26	Tonkawa Tribe
07	Alabama-Quassarte Tribe	27	Ute Tribe
08	Apache County	28	Yakima Tribe
09	Apache Development Authority	29	Caliente/Lincoln City
10	New Corporation	30	Pacific Atoll
11	United Nuclear Corporation	31	Barnwell
12	Caddo Tribe	32	Hanford
13	Chickasaw Nation	33	Fort Wingate
14	Eastern Shawnee	34	AECL Whiteshell Lab
15	Fifield Development Corporation	35	TGM, Inc.
16	Fort McDermitt Tribe	36	Area 25 Test Site
17	Grant County	37	LADO Ranch
18	Lower Brule Sioux	38	Andrews County
19	Miami Tribe		
20	Northern Arapho		

TABLE 8.1-2
(Sheet 1 of 5)

SITE SELECTION QUESTIONNAIRE

I. LOCATION
1. Specify location of proposed site.
   a. State, County, or other political jurisdiction
   b. Tribal reservation
2. Specify size and site configuration.
3. Provide maps of site and area showing location, size, configuration, and transportation corridor(s), together with jurisdictional boundaries.

II. HOST JURISDICTION ACCEPTANCE
1. Identify the jurisdiction or jurisdictions in which the site is located.
2. Would there be any change in jurisdiction prior to licensing, construction, or operation of the ISFSI? If so, identify other jurisdiction involved, and describe how and when such change would be accomplished.
3. Describe basis for concluding that applicable jurisdiction (state/local; tribal) is a willing host.
4. Provide information on any surveys or opinion polls on views of residents in vicinity of proposed site to ISFSI.
5. Identify (and provide copes of) any jurisdictional restrictions, including applicable state, local or tribal laws or regulations, which could prohibit or significantly restrict construction or operation of an ISFSI.
6. Describe positions taken by local, regional and state-wide media on location of an ISFSI at proposed site or other locations.

III. SITE OWNERSHIP
1. Identify the individual or entity that currently holds title to the proposed site, and to the railroad transportation corridor.
2. Would title be transferred to another entity in connection with development of the ISFSI? If so, identify the other entity and describe when and how title would be transferred.
3. If you do not currently own the site, provide the estimated cost to acquire. It.

IV. TRANSPORTATION ACCESS
1. Describe the accessibility of the proposed site by railroad.
   a. Identify the railroad mainline(s) and their distance from the proposed site.
   b. Does a rail line exist to the proposed site or close thereto? If so identify and describe. Is it capable of handling spent fuel shipments?
   c. If no rail line exists to the proposed site, describe the terrain between the mainline(s) and the site, identify the jurisdiction through which such a rail line to the site, including cost, ownership and availability of right-of-way, environmental impacts of construction and operation, etc.

CHAPTER 9

ENVIRONMENTAL APPROVALS AND CONSULTATION

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CHAPTER 9

ENVIRONMENTAL APPROVALS AND CONSULTATION

There are several environmentally related permits and plans required by federal and state agencies that need to be developed and approved in order to construct and operate the PFSF, the Low Corridor rail line, and the intermodal transfer point. In addition, under National Environmental Policy Act (NEPA) rules and the Council on Environmental Quality (CEQ) (40 CFR 1500 - 1508) enabling regulations, consultations may be required with other federal agencies including the Department of Interior (DOI), U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and the Bureau of Indian Affairs (BIA). Comments and recommendations made by these agencies are made part of the review process for NRC project approvals.

9.1 UNITED STATES GOVERNMENT

The following is a summary of federal agencies that will be involved in the environmental approvals and consultation process for PFSF project construction and operation activities.

9.1.1 Nuclear Regulatory Commission (NRC)

The NRC is responsible for the review and licensing of spent nuclear fuel storage facilities. The federal guidelines for an independent spent fuel storage installation (ISFSI) are identified in 10 CFR 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High Level Radioactive Wastes". Submittal of a comprehensive License Application (LA), which includes a Safety Analysis Report (SAR) and Environmental Report (ER) that address environmental issues, is required by 10 CFR 72. This ER is being submitted to the NRC with other LA documents for its review and approval.

The transportation of spent fuel from the originating nuclear power plants to the PFSF requires a transportation container that is approved and certified under the requirements of 10 CFR 71. The certification in part ensures that the shipping containers are designed to maintain confinement of the fuel during shipping and preclude any accident scenarios with adverse effects to the environment.

The storage/transportation system vendors, who are providing the storage and transportation systems (i.e., Holtec and Sierra Nuclear Corp.) are required to submit applications to the NRC for approval of a storage system under 10 CFR 72 and a transportation cask under 10 CFR 71. Upon approval of these applications, the NRC will issue Certificates of Compliance for the specific designs.

9.1.2 Department of the Interior (DOI)

9.1.2.1 U.S. Fish and Wildlife Service (USFWS)

The USFWS furnishes lists of threatened and endangered species located near or at a proposed project site. Information from the USFWS has indicated that, there are two threatened (i.e., Bald Eagle and Ute Ladies-tresses), one endangered (i.e., Peregrine Falcon), one proposed endangered (i.e., Least Chub), and two candidate (i.e., Mountain Plover and Spotted Frog) species are found in Tooele County and may occur in the project area. Baseline ecological surveys indicate that none of the listed species, except for transient, infrequent occurrences by Bald Eagles and Peregrine Falcons, are within the proposed PFSF site or transportation corridors. Therefore, there are no expected impacts to rare or endangered species resulting from construction or operation of the PFSF, Low Corridor, or the intermodal transfer point.

9.1.2.2 Bureau of Land Management (BLM)

The Low Corridor rail line and the intermodal transfer point (ITP) will both be located on public lands administered by BLM. The BLM's granting of right of way will be necessary to utilize public lands for siting these facilities. Applications for right of way will be submitted to the BLM for both areas. Granting of right of way will require consultation with the BLM and may require development of a mitigation plan to be reviewed by BLM.

9.1.2.3 Bureau of Indian Affairs (BIA)

Under federal laws and regulations governing business leases with Indian Tribes, the Secretary of Interior, or his authorized representative, acting pursuant to delegated authority ("Secretary of Interior"), must approve the lease between the PFSLLC and the Skull Valley Band of Goshute Indians (Band) (25 U.S.C. § 415 and 25 CFR 162). This is a federal approval process, which requires compliance with NEPA, and mitigation of any environmental effects identified. Since NRC approval also requires compliance with NEPA, the two agencies will work together on an EIS with the BIA and DOI, acting as cooperating agencies with the NRC. The BIA and the parties to the lease have agreed that this will include an EIS. The lease with the Band has been approved subject to the successful completion of the environmental analysis, issuance of the EIS, modification of the lease to incorporate mitigation measures, if any, and the issuance of the NRC License.

9.1.3 Environmental Protection Agency (EPA)

The permitting of the PFSF, which is located on the Skull Valley Indian Reservation, is governed by federal and tribal law. The following is a summary of environmental permitting activities, virtually all to be undertaken with EPA Region VIII in Denver, Colorado.

Surface Water Protection

In order to protect jurisdictional waters from pollutants that could be conveyed in construction-related storm water runoff, EPA enabling regulations require construction projects disturbing 5 or more acres of soil to secure coverage under a National Pollutant Discharge Elimination System (NPDES) permit authorizing the construction-related storm water discharges. EPA regulates the proper disposition of stormwater from these larger construction sites through a NPDES permit program (40 CFR 122.26(b)(14)) pursuant to Section 402 of the Clean Water Act (CWA). With respect to all construction activity on the Band of Goshute Indian Reservation, a NPDES General Permit is available from EPA Region VIII to cover construction projects disturbing 5 or more acres of soil on all Indian lands in Utah.

Coverage under this particular EPA Storm Water General Permit will be secured by filing an application form with EPA Region VIII (i.e., Notice of Intent (NOI)), at least 48 hours prior to initiating construction activity. The scope of construction will need to comply with all applicable terms and conditions identified in the EPA Region VIII Storm Water General Permit.

Soil disturbing activities associated with the construction of the PFSF include:

- 99 acres for the restricted area;
- 6 acres for the PMF berms that will function as diversion ditches;
- 8 acres for the stormwater detention basin located outside the RA, but within the Owner Controlled Area (OCA);
- 22 acres for the construction of the 2.5-mile site access road;
- 5 acres for a construction lay down area south of the site;
- 2 acres for the installation of a septic system and leach field systems; and,

- 17 additional acres (e.g., security) of soil contiguous and adjacent to the proposed road.

Thus, approximately 164 acres of soil will be disturbed during the construction of the PFSF and ancillary facilities on the Skull Valley Indian Reservation.

Once the storm water permit application NOIis filed with EPA Region VIII, coverage under the General Permit is received by default 48 hours after filing. However, several activities must be conducted prior to filing an NOI. These activities include an endangered species assessment, the preparation of a Stormwater Management Pollution Prevention Plan (SWPPP), and a verification of the existence and/or absence of applicable local, county, State, or Tribal environmental programs.

The NOI will provide general information about the site such as name, location, dates, and other general information relevant to the nature of the construction activities. The extensive information that has been gathered on endangered species (see Chapter 2) has been reviewed relative to General Permit requirements and it has been determined that it is sufficient to satisfy Part 1.B.3.e.(2)(b) of the General Permit. Within the SWPPP, there will be provisions outlining erosion and sediment controls, soil stabilization practices, structural controls, and other best management practices that will be employed during construction to protect offsite waters from adverse impacts from construction-related storm water runoff. The SWPPP will also outline maintenance and inspection requirements and identify Best Management Practices (BMP's) for the effective management of storm water runoff from the concrete and asphalt batch plants. The detention basin will also be appropriately sized to meet the applicable criteria in the EPA Region VIII General Permit.

The SWPPP will be maintained onsite throughout the construction process and will be updated as appropriate. This document will also be made available for review, upon request, to the EPA Region VIII Director, the Band, and other authorized individuals.

Once construction has been completed, a separate NPDES permit is not required for the operation of the PFSF since facility operations will not result in the discharge of process wastewater. In addition, facility operations are not subject to storm water permit regulations.

A Spill Prevention, Control and Countermeasures Plan (SPCC Plan) may need to be developed since all diesel fuel storage tanks at the PFSF will be placed above the ground. This fuel tank orientation may lead to the exceedance of the 40 CFR 112 SPCC permitting threshold, which will simply require the preparation of a SPCC plan that will be stamped by a Professional Engineer and maintained onsite.

Drinking Water and Groundwater Protection

Drinking water needs for PFSF construction and operation activities are expected to be met by using the drinking water from the Band's reservoir, with a secondary option to purchase offsite drinking water supplies. In the unlikely event that well drilling is selected, all applicable Safe Drinking Water Act (SDWA) enabling regulations associated with treatment to ensure meeting National Primary Drinking Water Standards for non-transient, non-community drinking water systems will be met.

Sanitary wastewater from PFSF construction and operation activities will be disposed of using two (2) septic tank/leach field systems, each with a design capacity to serve 20 or more people. All PFSF floor drains will be designed to ensure that inadvertent spills of oil, antifreeze, and other chemicals, will not enter the sanitary waste leach field system. The size of these septic tank/leach field systems will require an Underground Injection

Control (UIC) registration with EPA Region VIII since septic tank/leach fields with a design capacity to serve 20 or more people are classified as Class V injection wells per 40 CFR 144.26(a). This enabling regulation identifies the need to provide information on nature and type of injection wells and their operating status before injection of fluids can begin. This information must be filed with EPA shortly before placing the sanitary systems into service.

Preservation of Air Quality

Construction and operation activities at the PFSF are not expected to have any measurable impact on the local air quality since no significant criteria or hazardous air pollution emissions will occur. Gaseous criteria pollutant emissions at the PFSF are limited to small propane space heating furnaces, a standby emergency diesel generator, a fire pump diesel, heavy haul trucks, cask transporters, and worker's private vehicles.

Small space heating sources of air pollutants less than one million per Btu per hour heat input are exempt from applicable air quality regulations. The emergency and fire pump diesels, which are non-construction stationary sources of air pollutants smaller than 150kW, and not operating more than 250 hours per year, will not trigger any 40 CFR 60 New Source Performance Standards (NSPS) nor 40 CFR 52 Prevention of Significant Deterioration (PSD) levels. Moreover, the heavy haul trucks, transporters, and private vehicles are considered mobile sources, which are not regulated by the EPA. Finally, the quantity of criteria and hazardous air pollutants expected to be emitted during PFSF operations are not of sufficient magnitude to trigger Clean Air Act (CAA) Title V (40CFR 71) compliance regulations.

Any potential air quality-related impacts associated with the construction of the PFSF will result from gaseous pollutant emissions from diesel-powered construction equipment, and from fugitive dust emissions from excavation activities and construction equipment. In addition, concrete and asphalt batch plants will also be sources of fugitive dust emissions, and the asphalt batch plant will be a source of small amounts of gaseous criteria pollutants from its dryer burner. There are no regulations governing the generation of fugitive dust resulting from construction activities. However, for a project of this size, steps need to be taken to minimize fugitive dust emissions. Accordingly, a BMP Emissions Control Plan will be developed to provide assurance that fugitive dust emissions will be effectively managed and minimized throughout all of the construction phases of the project. This Plan, which will be integrated into the SWPPP, will include dust control techniques, such as watering and/or chemical stabilization of potential dust sources.

There are no expected airborne effluents of radionuclides from normal PFSF operation. Accordingly, the 40 CFR 191.03(a) offsite dose limit of 25 mrem is not exceeded and airborne effluent monitoring will not be required.

The diesel tanks for the standby emergency diesel generator and the diesel fire pump will be located above ground.The small levels of Volatile Organic Compound (VOC) emissions will be well within 40 CFR 52 and 40 CFR 60 compliance levels.

Refrigerants used for air conditioning at the PFSF will consist of Class II refrigerants (i.e., non-ozone depleting substances). Therefore, Permitting for Clean Air Act Title VI, Stratospheric Ozone Protection, relative to the usage and storage of refrigerants will not be required.

Propane tanks used as fuel for the heating units in the PFSF buildings will be less than 10,000 pounds. Therefore, the quantity of this chemical will be less than the threshold levels that would invoke compliance with 40 CFR 68, the Risk Management Rule, which determines the consequences from various hazardous and toxic chemicals and demonstration of Process Safety Management techniques. The PFSF will fall under Program 1, which involves minimal compliance activities.

Pollution Prevention and Waste Management

The PFSF project is committed to pollution prevention practices and will incorporate all Resource Conservation and Recovery Act (RCRA) pollution prevention goals, as identified in 40 CFR 261. Non-hazardous RCRA wastes from construction activities will be appropriately disposed. Throughout operations, the small quantities of waste generated in the health physics lab. (40 CFR 262), and the potential 40 CFR 261 RCRA materials, such as lead, dye-penetrant materials (i.e., phosphorescent materials), hydraulic fluids, and miscellaneous lubricants used at the PFSF, will be appropriately handled and disposed. The small quantities of hazardous wastes that would be generated is expected to be much less than 100 kg/month. Thus, PFSF will qualify as a Conditionally Exempt Small Quantity hazardous waste Generator (CESQG). Since UDEQ has jurisdiction over issuing RCRA hazardous waste ID numbers on Tribal lands, a "Notification of Regulated Waste Activity" will be filed with that agency. All hazardous wastes that are generated will then be identified, stored, and disposed of in accordance with RCRA requirements applicable to CESQG's.

Since the PFSF design does not include Underground Storage Tanks (UST's), no UST registration with EPA Region VIII will be required.

9.1.4 Army Corps of Engineers (ACE)

An individual or general 404 Permit (and 401 Water Quality Certification) may be required from the ACE and the Utah DEQ for the Low Corridor rail line, which will use bridges and culverts to cross numerous arroyos and intermittent streams. The need for an individual permit would be enhanced if these crossings would impact endangered species, affect historic properties, or otherwise be unable to satisfy the special conditions under ACE General Permit #40. At this time, it is anticipated that a Joint Application for a Stream Alteration Permit will be filed with the Utah State Engineer to satisfy CWA Section 401 Water Quality certification. Additionally, it is also anticipated that requirements necessary to obtain coverage under ACE General Permit #40 (i.e., CWA Section 404 Permit) for dredge and fill activities associated with crossing numerous arroyos and intermittent streams with the Low Corridor rail line will be also be satisfied.

9.1.5 Department of Transportation (DOT)

Transportation of spent fuel is regulated under 49 CFR 173, "Shippers - General Requirements for Shipments and Packagings", specifically Subpart I addressing radioactive materials. Other regulations pertaining to the transportation of material to the PFSF are: 49 CFR 171, "General Information, Regulations and Definitions"; 49 CFR 172, "Hazardous Materials Tables, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements"; 49 CFR 174, "Carriage by Rail," 49 CFR 177, "Carriage by Public Highway", and 49 CFR 107 Subpart G (registration/fee to DOT as a person who offers or transports hazardous materials).

9.2 STATE OF UTAH

The permitting of the Low Corridor rail line and intermodal transfer point (ITP), both of which are on land administered by the BLM, are under jurisdiction of Utah State agencies. The following is a summary of environmental permitting activities to be undertaken with the appropriate State agencies.

9.2.1 Utah Department of Environmental Quality (UDEQ)

Surface Water Protection

In order to protect surface water from construction-related storm water runoff on BLM lands, the UDEQ regulates the proper disposition of storm water through a Utah Pollutant Discharge Elimination System (UPDES) General Permit (i.e., UAC R317-8-3.8). The UPDES General Permit criteria follow very closely to the criteria within the scope of the USEPA Region VIII NPDES General Permit available for construction activity on Indian lands in Utah.

Soil disturbing activities associated with the construction of the Low Corridor rail line include approximately 200 acres, and the ITP construction will disturb approximately 11 acres of soil. Since this common plan of development will exceed the UDEQ's 5-acre permitting threshold, a single UPDES storm water general permit application will be filed to the combined construction activities of the Low Corridor and ITP.

In order to secure coverage under the UDEQ General Permit for storm water discharges associated with construction activity, an NOI will be filed with UDEQ at least 48 hours prior to the initiation of construction activities. This NOI is similar to the one that will be filed with EPA Region VIII for the PFSF construction, and default coverage should be granted 48 hours after the NOI submittal. Before filing the NOI with the

UDEQ, a SWPPP will also be prepared whose requirements are also very similar to EPA's, and all other applicable pre-permit application requirements will also be met.

Once construction is complete, a UPDES Permit will not be required for operational activities at the Low Corridor and ITP since there will be no process wastewater generated or discharged to surface waters as part of the ITP or rail corridor operation... Similarly, a SPCC Plan is also not required at the Low Corridor and ITP locations due to the absence of any above ground or underground diesel fuels or gasoline storage tanks.

A Joint Application for a Stream Alteration Permit from the Utah State Engineer,to satisfy 401 water quality certification, and the ACE,to satisfy Clean Water Act Section 404 permitting statutes, will be required for dredge and fill activities associated with crossing numerous arroyos with the Low Corridor rail line. The scope of work will satisfy the special and general conditions outlined in COE General Permit #40.

Drinking Water and Groundwater Protection

Drinking water needs for Low Corridor and ITP construction and operation activities is expected to be met using the drinking water from the Tribe's reservoir, with a secondary option to purchase offsite drinking water supplies.

Sanitary wastewater disposal from ITP construction and operation activities is still under evaluation. The use of portable toilets and/or obtaining permission to use the nearby Cargill Salt's rest rooms are being considered in lieu of installing a holding tank. The size of any of these alternatives will not require a UIC registration with UDEQ.

Preservation of Air Quality

Similar to the PFSF, construction and operation activities at Low Corridor rail line and ITP are not expected to have any measurable impact on the local air quality.

Since air pollution emissions generated from the operation and construction of the Low Corridor rail line and the ITP will be either mobile sources, or below regulated levels for stationary sources, no Utah Regulation R307-15 approvals should be required from the State of Utah, which administers the Clean Air Act Title V regulations.

Any potential air quality-related impacts associated with the construction of the Low Corridor rail line and ITP will result from gaseous pollutant emissions from diesel-powered construction equipment, and from fugitive dust emissions from excavation activities and construction equipment. In addition, concrete and asphalt batch plants will also be sources of fugitive dust emissions, and the asphalt batch plant will be a source of small amounts of gaseous criteria pollutants from its dryer burner. Fugitive dust generated by construction activities of the rail line and ITP will be minimized as prescribed by Utah Regulation R307-12. A Construction Emissions Control Plan (CECP), will be developed to provide assurance that fugitive dust emissions will be effectively managed and minimized throughout all of the construction phases of the project. This Plan, will also be integrated into the SWPPP, and submitted to UDEQ.

Pollution Prevention and Waste Management

Pollution prevention practices will be encouraged at the ITP. No RCRA wastes will be generated during operations. However, should operational activities result in the generation of minor quantities of hazardous wastes, they will be identified, stored, and disposed of in accordance with CESQG requirements.

9.2.2 Utah State Historic Preservation Office (USHPO)

Construction activities that do not take place on the reservation require compliance with applicable Utah State Historic Preservation Office (USHPO) requirements, as part of the NRC NEPA review.

9.3 SKULL VALLEY BAND OF GOSHUTE INDIANS

The PFSF is located on tribal trust lands within the Reservation of the Skull Valley Band of Goshute Indians. The lands are leased to the PFSLLC by the Band with approval from the Secretary of Interior. The Band is in the process of developing a Tribal Environmental Code and being authorized by EPA to be the permitting agency for the environmental protection of the reservation. Until these actions become approved, the Band has the right to comment on any of the environmental documentation as an independent review agency. Any comments and recommendations will become part of the NRC's NEPA review and approval.

The Band has assumed the functions of the USHPO for cultural resources issues with respect to Skull Valley Indian Reservation lands, and has indicated that no cultural, sacred or religious sites are present that could be affected by the project. However, a Class 3 evaluation of historical preservation impacts at the PFSF site may need to be conducted to meet Band of Goshute requirements.

The Band will provide drinking water from its reservoir for the construction and operation activities of PFSF, Low Corridor rail line, and the ITP.

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9.4 TOOELE COUNTY

Tooele County may review the SWPPP for the portions of the project that are not on the Reservation to ensure that soil erosion and sediment control ordinances are being met. In addition, there is also a County Zoning Ordinance and General Development Plan. However, based on applicable State of Utah laws, the Tooele County Zoning Ordinance does not apply to federal lands, such as the land administered by the BLM, and therefore does not apply to development of the Low Corridor rail line, intermodal transfer point, or the PFSF.

The following permits may need to be obtained from Tooele County:

- Drinking water permit for the 40 – 60 full-time employees (should Tribe reservoir water not be used for drinking water needs); and,
- Construction Permit for a septic system less than 5,000 gallons per day.

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9.5 PERMIT AND APPROVAL STATUS AND CONSULTATIONS

9.5.1 Permit and Approval Status

An Environmental Permitting Plan has been developed to determine Federal, State, Tribe, and local requirements for obtaining various permits and approvals, and towards the development of various environmental plans. This includes obtaining pertinent data including developing a meteorological monitoring plan for the facility and obtaining engineering data on material and waste stream flows.

Applications are in various stages of preparation but have not as yet been formally filed.

9.5.2 Agency and Public Consultations

Preliminary consultations have been initiated with federal and state agencies. A productive meeting with EPA Region VIII Was conducted on February 9, 1999. Resource agencies have been contacted to obtain information on resources that may be impacted by the project.

Since 10 CFR 51.45 requires a discussion of alternatives, an alternative PFSF site analysis, described in Section 8.1, has been reviewed and accepted by the Band. USHPO has been contacted to discuss information needs for development of facilities off the Skull Valley Indian Reservation.

More specific discussions will be held with review agencies and local citizens groups as the project progresses.

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9.6 REFERENCES

Federal Laws

25 U.S.C. § 415, Leases of Restricted Lands.

33 U.S.C. § 1342, Clean Water Act, Section 402, National Pollutant Discharge Elimination System (NPDES), 1972 with Amendments of 1987.

33 U.S.C. § 1342, Clean Water Act, Section 404, Permits for Dredged or Fill Material, 1972 with Amendments of 1987.

42 U.S.C. § 4321 et seq., National Environmental Policy Act, 1970 with Amendments.

42 U.S.C. § 300f et seq., Safe Drinking Water Act, 1974 with Amendments.

42 U.S.C. § 6901 et seq., Resource Conservation and Recovery Act (RCRA), 1976 with Amendments.

42 U.S.C. § 7661, Clean Air Act, Section 501, Title V - Permits, Amendment of 1990.

42 U.S.C. § 4321 et seq., National Environmental Policy Act, 1970 with Amendments.

42 U.S.C. § 300f et seq., Safe Drinking Water Act, 1974 with Amendments.

42 U.S.C. § 6901 et seq., Resource Conservation and Recovery Act (RCRA), 1976 with Amendments.

Code of Federal Regulations

10 CFR 51.45, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions, Environmental Reports, NRC.

10 CFR 71, Packaging and Transportation of Radioactive Material, NRC.

10 CFR 72, Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste, NRC.

25 CFR 162, Leasing and Permitting, BIA.

40 CFR 51, Requirements for Preparation, adoption, and Submittal of Implementation Plans, EPA.

40 CFR 52, Approval and Promulgation of Implementation Plans, EPA.

40 CFR 60, Standards of Performance for New Stationary Sources, EPA.

40 CFR 68, Chemical Accident Prevention Provisions, EPA.

40 CFR 71, Title V Operating Permits, EPA.

40 CFR 112, Oil Pollution Prevention, EPA.

40 CFR 122, EPA Administered Permit Programs: The National Pollution Discharge Elimination System, EPA.

40 CFR 141, National Primary Drinking Water Regulations, EPA.

40 CFR 144, Underground Injection Control Program, EPA.

40 CFR 191, Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes, EPA.

40 CFR 261, Hazardous Waste Management System; Identification and Listing of Hazardous Waste, EPA.

40 CFR 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks, EPA.

40 CFR 1500 - 1508, Council on Environmental Quality (CEQ) Regulations, EPA.

49 CFR 107, Hazardous Materials Program Procedures

49 CFR 171, General Information, Regulations, and Definitions for Hazardous Materials Regulations, DOT.

49 CFR 172, Hazardous Materials Tables and Communications Regulations, DOT.

49 CFR 173, Shippers - General Requirements for Shipments and Packages, DOT.

49 CFR 174, Carriage by Rail, DOT.

49 CFR 177, Carriage by Public Highway, DOT.

Utah State Regulations

Utah Environmental Rules, Section 307-1, Utah Air Conservation Rules, UDEQ.

Utah Environmental Rules, Section 307-12, Fugitive Emissions and Fugitive Dust, UDEQ.

Utah Environmental Rules, Section 307-15, Operating Permit Requirements, UDEQ.

Utah Environmental Rules, Section 317-8, Utah Pollutant Discharge Elimination System (UPDES), UDEQ.

Utah Environmental Rules, Section 401, Water Quality Certification, UDEQ.

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