CONTENTS

TABLES

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FIGURES

2. SITE CHARACTERISTICS

2.1. Geography And Demography

2.1.1. Site Location

The FSV ISFSI is located next to the former FSV Nuclear Generating Station site. The site is located about three and one-half miles northwest of the center of the town of Platteville in Weld County, Colorado, and about 35 miles north of Denver. By far the majority of the land within thirty miles of the site is agricultural. The area within a few miles of the site is characterized by irrigated farm land and pasture land with gently rolling hills. The grade elevation at the ISFSI is approximately 4,781 feet above sea level. By traveling approximately 20 miles directly west one can reach the base of the Rocky Mountain Range. These "foothills" have an elevation of approximately 6,000 feet above sea level. By going an additional 20 miles directly west one would reach the Continental Divide with an approximate elevation of 13,000 feet above sea level. Elevation changes in all other directions, north, east, and south are typified by changes of only tens of feet within 30 miles surrounding the site.

The site is located approximately one mile south of the confluence of the South Platte River and the St. Vrain Creek, 1/2 mile west of the South Platte River, and 3/4 of a mile east of the St. Vrain Creek.

The ISFSI general location is shown on Figure 2.1-1. The plot plan of the FSV power generating plant and the ISFSI is shown on Figure 2.1-2. The ISFSI's general arrangement is shown on Figure 2.1-3. The local road network is described in Section 2.2.3.

The ISFSI administration building has been constructed, it was reviewed and licensed by the NRC in the original license application. The administration building contains office space for ISFSI operations.

Six 230 Kv transmission lines originate from the FSV switchyard. Their routes are shown on Figure 2.1-5. The nearest 230 Kv transmission line route is about 1,500 feet west of the ISFSI facility. A 13 Kv distribution line serves the ISFSI facility from the east. The distribution line is shown on Figure 2.1-2.

2.1.2. Site Description

The ISFSI facility is located inside an independent controlled area. The minimum distance from the MVDS outer concrete surfaces to the Controlled Area Boundary is approximately 331 feet (101 meters). The ISFSI is inside an 8 foot high chain link fence with outriggers. The FSV ISFSI Security Program establishes and maintains physical security for the ISFSI facility (see Section 9.6).

A FSV ISFSI Emergency Response Plan (ERP) (Ref.) is used should a radiological or non-radiological emergency arise (see Section 9.5).

The natural topography of the ISFSI facility site is generally flat, with slight slope to the northeast toward the Platte River (see Figure 2.1-4). The general surface drainage pattern is not altered by the addition of the ISFSI facility.

The area immediately surrounding the MVDS is surfaced with either asphalt or a gravel road base material and is maintained essentially vegetation free. The ground surfaces surrounding the exterior of the MVDS structure and the access trailer are sloped away for drainage. Where potential for erosion exists, provisions are made to prevent such occurrence.

Other than ISFSI operation, no other activity is conducted inside the ISFSI controlled area.

The areas north and east of the ISFSI site continue to be used for farming. This activity does not affect the operation of the ISFSI.

2.1.3. Population Distribution and Trends

The population density in the rural area surrounding the site is relatively low. The nearest town is Platteville which is located between three and four miles from the ISFSI location. The population of Platteville was ~~estimated~~reported by the 2000 Census to be 2,370 and the population within a 5-mile radius was ~~estimated~~reported to be 5,172.

The nearest population centers with a population over 25,000 are Greeley, Longmont and Loveland. Greeley, which had a 1960 population of 26,314, increased to a population of 53,006 in 1980 and 76,930 according to the 2000 Census. The nearest boundary of Greeley is about 14 miles from the ISFSI location. Longmont, with a population of 11,489 in 1960, 42,942 in 1980 increased to 71,093 in 2000. Loveland, with a 1960 population of 9,734,30,244 in 1980 increased to 50,608 in 2000. The population center boundaries nearest the ISFSI for Longmont and Loveland are within approximately 12 and 14 miles respectively.

2.1.3.1. Present Population Distribution

Population distribution of permanent residents within five miles of the ISFSI location is displayed in Figure 2.1-4. The population is shown in each of the 16 sectors at one-mile increments. The nearest permanent residence is located approximately one-half mile north of the ISFSI facility. The population figures shown in Figure 2.1-4 were computed, based on the 2000 census.

The 2000 US Census Bureau block group data was used to generate Figure 2.1-4. Block groups generally contain populations between 600 to 3,000 people and do not cross state or county boundaries. To generate the Fort St Vrain population sector the number of people per square meter was calculated. This was done by dividing the total population by the area of each block group. Once this was completed the sector/rings were generated and centered on the facility. The coordinates for the center of the facility were obtained from Google Earth. The sector/rings were then intersected with the block groups which divided up each block group into individual sectors grids. The population for each sector grid was then recalculated by multiplying the population per square meter by the area to obtain the total population per sector grid. There is some seasonal fluctuation in the population in agricultural areas surrounding the site due to migrant farm workers. The usual length of stay for these workers is about four months during the summer. The number of migrant and seasonal farm workers in the Greeley area for two previous growing seasons averaged only about 500 persons. These farm workers, combined with all other visitors and transients within five miles of the ISFSI location during the summer, would probably amount to no more than a 20% increase over the number of permanent rural residents.

2.1.3.2. Future Population Growth

Most of the land within a five-mile radius of the ISFSI location is agricultural. Changes will occur in population density and land use mainly in and around the cities and towns and along the major highways through this region. The future population trend is projected to the year 2041, through the remainder of the license of the ISFSI facility. The population growth rate from 1980 to 2000 is assumed to continue for the licensed period. The population within the five-mile radius of the ISFSI is projected to be 16,959, with 7,773 residing in Platteville. The projected population distribution is shown in Table 2.1-2.

2.1.4. Uses of Nearby Land and Water

The site is located in the southwest corner of Weld County, Colorado, which is a large county with an area of 4,033 square miles. The climate is dry and generally mild with long, warm summers, open winters and a growing season of 138 days. The surface is level or rolling prairies with low hills near the western border and elevations ranging from 4,400 to 5,000 ft. (Ref. 2).

Weld County is Colorado's leading producer of cattle, grain and sugar beets, and is the richest agricultural county in the United States east of the Rocky Mountains. It is also becoming more important as a ~~milk~~ milk-producing county, with close to half of the state's cattle.

The leading industries in Weld County were livestock, food processing, and electronics. Currently the major employers ~~in~~ are education, government, electronics, trade, livestock, and irrigated agriculture, in that order.

Weld County production of various minerals, petroleum, natural gas and coal constitutes significant portions of the overall production within the State of Colorado. Coal mining is a major activity in the area beginning about ten miles southwest of the ISFSI near the towns of Frederick and Firestone, and extending to the southwest.

Land use within a five-mile radius of the ISFSI facility is predominantly agriculture. The major farm products include feed corn, sugar beets, vegetables, beef cattle, sheep and turkeys. There also is a limited amount of dairy farming in the area.

The industrial facilities within a few miles of the ISFSI site are primarily located in the town of Platteville, about 3 1/2 miles Southeast of the ISFSI (see Section 2.2.1). Table 2.2-1 provides a list of the manufacturing and related products within a five-mile radius.

The oil/gas wells and associated gas pipelines within approximately a one-mile radius of the ISFSI are shown in Figure 2.2-1.

Combustion turbines and heat recovery steam generators for the FSV repower project have been approved for installation on the east side of the Turbine Building, 1,200 – 1,400 feet south of the ISFSI. The first combustion turbine was installed and placed into commercial operation in April, 1996. The repowering facilities are fueled by natural gas, and are further described in Sections 2.2.1 and 3.3.6.

Numerous permanent residences are dispersed within a five-mile radius, with the only municipal population at the town of Platteville. The balance of the population is rural. The population distribution is addressed in Section 2.1.3. During the summer, migrant farm workers increase the rural population by about 20%.

Because the majority of the land within a five-mile radius is privately owned and zoned agricultural, no public recreation facilities exist in the area. The St. Vrain Creek and South Platte River, the major natural waterways in the area, are not large enough to be used for water transportation, boating or water skiing (Ref. 3). These two waterways, via diversion ditches, supply the majority of the irrigation water for the farm lands.

Table 2.1-1. ~~Estimated~~ 2000 Population as a Function of Distance and Direction from the FSV ISFSI.

Compass Segment Center	0-1 Mile	1-2 Miles	2-3 Miles	3-4 Miles	4-5 Miles
N	3	19	37	38	130
NNE	3	31	69	44	47
NE	3	30	96	102	126
ENE	3	10	66	92	103
E	3	8	19	20	26
ESE	3	8	424	99	26
E	3	8	682	953	26
SSE	3	8	19	20	26
S	3	8	19	21	26
SSW	3	8	22	37	45
SW	3	10	100	129	162
WSW	3	16	119	130	164
W	4	18	73	83	104
WNW	3	15	36	38	49
NW	4	15	36	39	49
NNW	3	15	36	39	49
Totals	50	227	1853	1884	1158

* All population is rural except that shown for Platteville, totaling 2,370. Total population within 5 mile radius is 5,172.

Table 2.1-2. ~~For the Year 2041~~ Population as a Function of Distance and Direction from the FSV ISFSI for the Year 2041.

Compass Segment Center	0-1 Mile	1-2 Mile	2-3 Mile	3-4 Mile	4-5 Mile
N	10	62	121	125	426
NNE	10	102	226	144	154
NE	10	98	315	335	413
ENE	10	33	216	302	338
E	10	26	62	66	85
ESE	10	26	1,391	325	85
SE	10	26	2,237	3,126	85
SSE	10	26	62	66	85
S	10	26	62	69	85
SSW	10	26	72	121	148
SW	10	33	328	423	531
WSW	10	52	390	426	538
W	13	59	239	272	341
WNW	10	49	118	125	161
NW	13	49	118	128	161
NNW	10	49	118	128	161
Totals	164	742	6,075	6,181	3,797

* All population is rural except that shown for Platteville, totaling 7,773. Total population within 5 mile radius is 16,959.

~~Total population within 5 mile radius is 16,959.~~

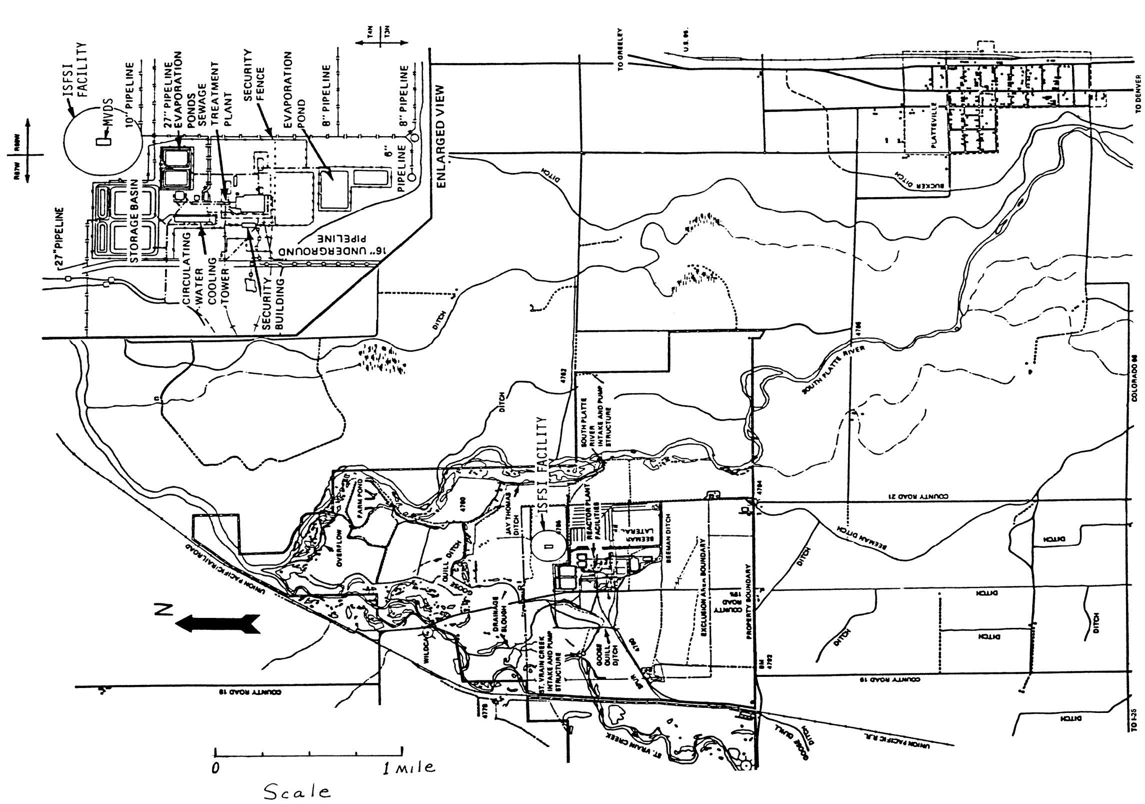

Figure 2.1-1. General Location of the ISFSI.

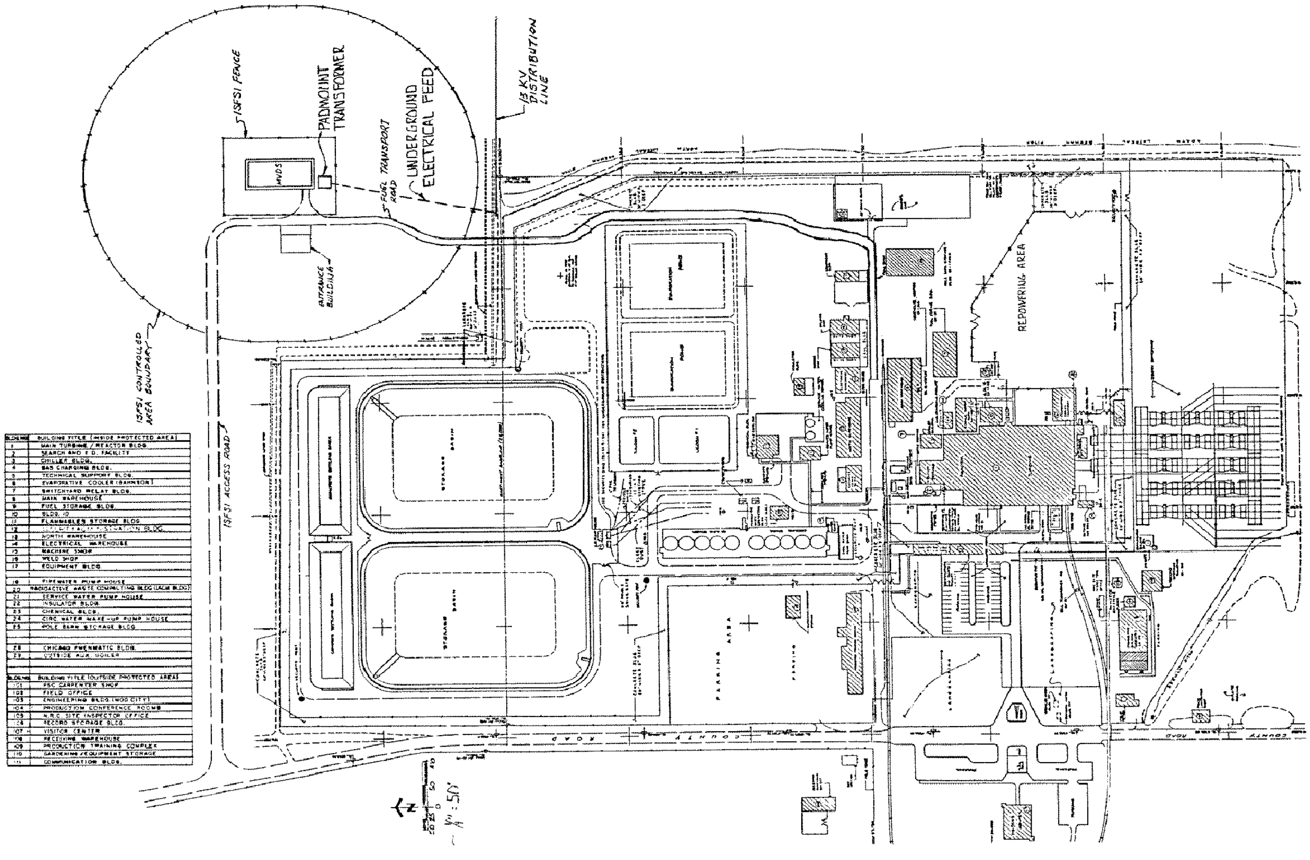

Figure 2.1-2. Fort St. Vrain - ISFSI Plot Plan.

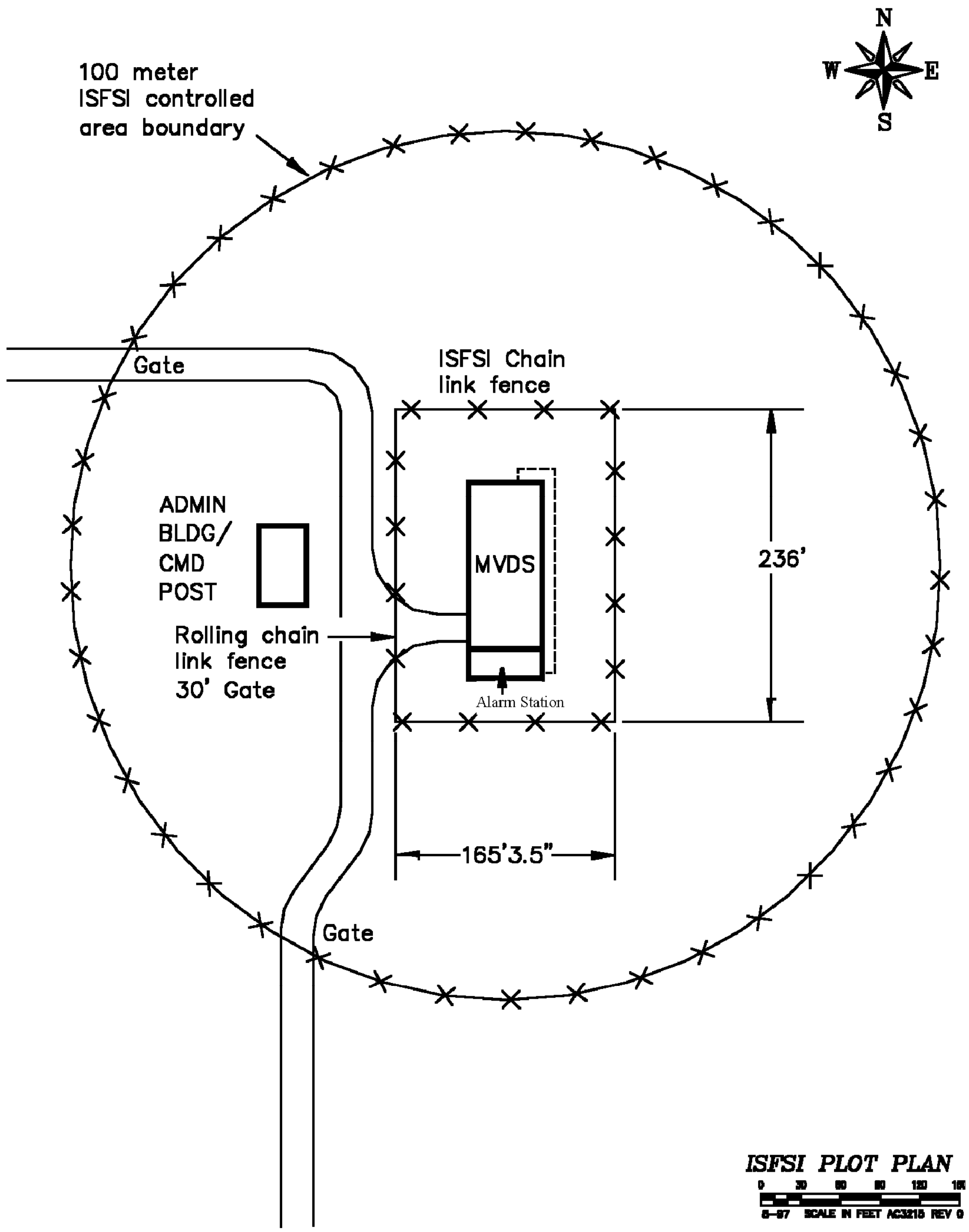

Figure 2.1-3. ISFSI General Arrangement

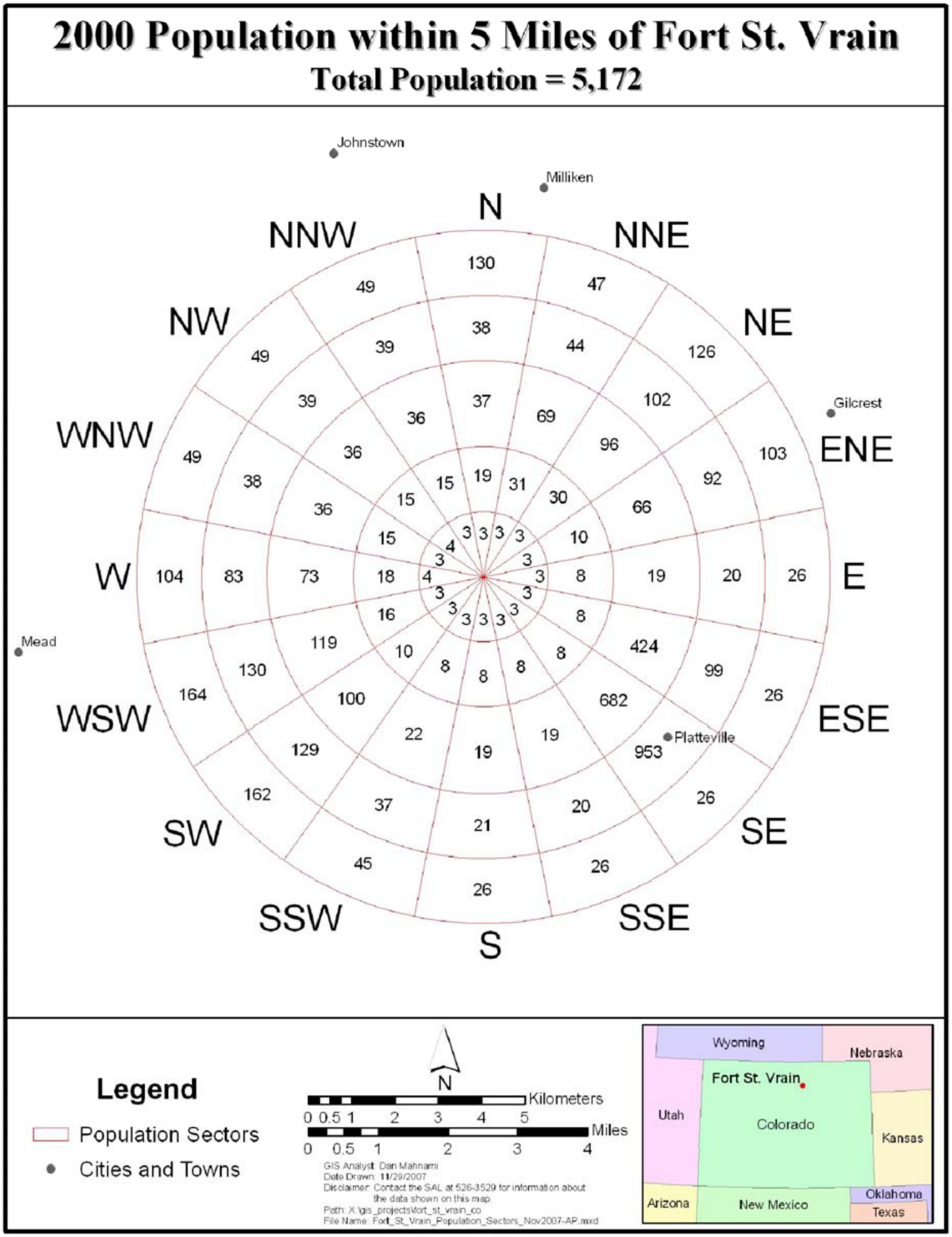

Figure 2.1-4 Resident Population Distribution 0 to 5 Miles at 1-Mile Intervals from the FSV ISFSI.

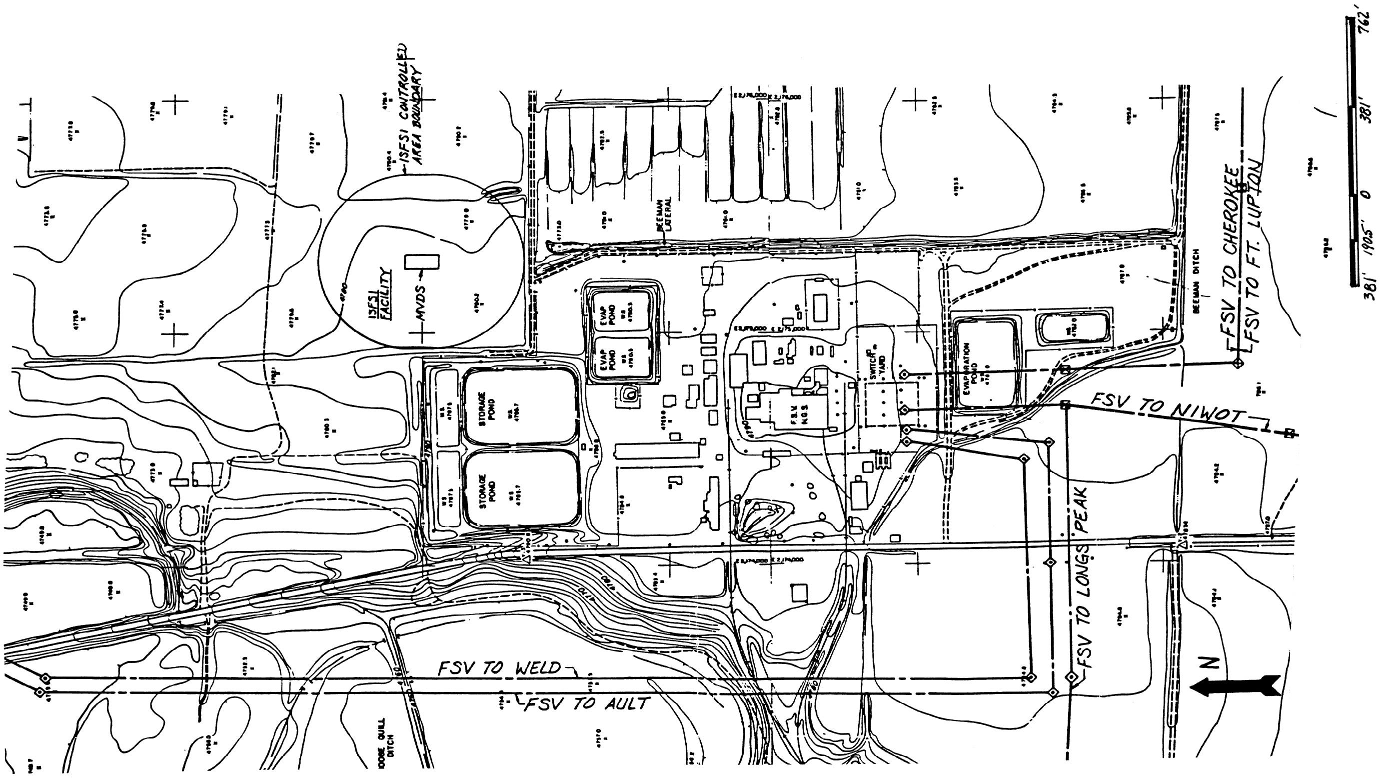

Figure 2.1-5. Fort St. Vrain Transmission Line Arrangement.

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2.2. Nearby Industrial, Transportation, And Military Facilities

This section describes the industrial, transportation, and military installations and operations located within a five-mile radius of the ISFSI facility.

2.2.1. Industrial Installations and Operations

The industrial installations are primarily located in the City of Platteville (located approximately 3 1/2 miles from the ISFSI). Table 2.2-1 provides a list of the manufacturers and related products within a five-mile radius (Ref. 4). The farm feed/fertilizers may be stored in tall grain elevator type structures. The failure (fire, explosion, collapse) of these tall structures, as well as the other industrial facilities, would only impact the immediate surrounding area and not pose a threat to the ISFSI facility.

The area surrounding the site is characterized as irrigated farm land and pasture land. Major farm crops in this area are feed corn, sugar beets, and vegetables. The raising of beef cattle and turkeys are other major activities in this area.

There are no tall structures located in proximity to the site whose collapse could impose damage to the ISFSI MVDS. Exhaust stacks are installed along with the combustion turbines and heat recovery steam generators in the FSV ~~repowering~~plant, located ~~at least 1200~~ approximately 1,500 feet south of the ISFSI MVDS (See Section 2.2.4). However, this consideration was taken into account when selecting the ISFSI location. Therefore, no hazard exists.

There are up to 16 oil/gas wells per square mile in the area around the site. There are also associated oil production equipment and gas gathering pipelines (see Figure 2.2-1). Impact of gas/oil well (including storage) and pipe line failure is addressed in SAR Section 3.3.6.

PSCo decided to repower the FSV plant, located approximately 1,500 ft. south of the ISFSI, with combustion turbines and heat recovery steam generators. The Colorado Public Utilities Commission granted approval by issuing the application for the Certificate of Public Convenience and Necessity for phased installation of two combustion turbines and two associated heat recovery steam generators, on July 1, 1994. The first combustion turbine was installed and placed into commercial operation in April, 1996. The first heat recovery steam generator for the first combustion turbine was put in service in May, 1998. The second combustion turbine and its associated heat recovery system were put in service in 1999~~,~~. ~~and t~~The third combustion turbine and its associated heat recovery system were put in service in 2001. The fourth and fifth combustion turbines were put into service in 2009.

The combustion turbines and heat recovery steam generators are located on the east side of the FSV Turbine Building (site of the decommissioned FSV Nuclear Generating Station). The repowering facilities are fueled by natural gas. Natural gas is piped to the FSV power plant site using a 24 inch diameter pipeline from a hub near Cheyenne, Wyoming that enters a metering station near the intersection of Weld County Roads 19 1/2 and 34, approximately 5,700 ft. south-southwest of the ISFSI. From the metering station, a 12-inch pipeline feeds natural gas to the combustion turbine(s). The 12-inch pipeline does not approach closer than 1,400 ft. to the ISFSI.

PSCo submitted to the NRC a description of plans for repowering the FSV plant, along with an analysis of the effects of postulated worst-case natural gas pipeline ruptures at the ISFSI, as described in Section 3.3.6. The NRC approved PSCo's proposed natural gas pipeline installation plans, concluding that the installation of natural gas pipelines and repower facilities is acceptable and does not pose a threat to nuclear safety at the ISFSI.

Farm field burning for weed control is occasionally utilized in the surrounding agricultural area. The land immediately surrounding the ISFSI MVDS will be maintained vegetation free such that the threat of a wild field fire impacting the MVDS is precluded. Smoke from such a field burning fire would not adversely impact the MVDS ventilation system (see Section 3.3.2.2).

Chemical type fertilizers/machinery fuel may be stored at nearby farms within a 5 mile radius. There are no stone quarries or mines within a 5 mile radius which are permitted to use and/or store explosives.

2.2.2. Military Installations and Operations

There are no military installations or munitions depots located within a five-mile radius of the site.

2.2.3. Transportation and Aircraft

In addition to the commercial aircraft activity, the agricultural industry in the surrounding areas employs the use of small single engine aircraft for "crop dusting/spraying." These aircraft fly at relatively low speeds and at low elevation directly over the crop field. There are no local municipal or private airports within afive-mile radius of the ISFSI facility.

Denver International Airport (DIA) is located 24 miles south-southeast of the site. There are two low altitude Federal airways which pass overhead within a five-mile radius, (Ref. 5). Victor 575, which goes northwest from DIA toward Laramie, Wyoming, passes within approximately 4.8 miles southwest of the ISFSI; and Victor 220, which is directed southwest from Greeley, Colorado, passes within approximately 4.1 miles to the northwest of the ISFSI (Ref. 1). There also is a high altitude jet route passing within a five-mile radius of the ISFSI, designated J-13, directed north from DIA towards Cheyenne, Wyoming. The ISFSI is located approximately 21 miles north and 9 miles west of the nearest DIA runway. A conservative assessment of the annual probability of an aircraft impacting the ISFSI MVDS was made based on the following information using the guidelines in NUREG 0800 (Ref. 6):

1. For the first six months after its opening on February 28, 1995, DIA had a total of 245,538 flight operations, an average of 1,334 operations per day. The Federal Aviation Administration (FAA) at DIA indicated that flight paths of aircraft departing DIA vary constantly depending on the departing and arriving runways in operation. Arrival flight paths are more consistent, and the ISFSI is located outside the area where arriving aircraft normally begin their final descent below 6,000 feet above ground level into DIA. Aircraft arriving and departing DIA will normally be at least 6,000 feet above ground level in the vicinity of the ISFSI (Ref. 7). In

response to PSCo's request for information, FAA personnel at DIA estimated that 66,000 flights per year pass through the airspace above a horizontal circle on the ground, centered at the ISFSI, with a radius of 5 nautical miles (Ref. 8). This estimate includes flights operating out of airports other than DIA, such as Loveland, Fort Collins, Greeley and Jefferson County.

2. A traffic volume near the FSV site of 240 flights per day (15%) based on a DIA daily traffic volume of 1,600 operations was conservatively assumed. Relative to the major population centers throughout the continental United States, the majority of the DIA operations would involve east-west destinations rather than north/south over the ISFSI site. This volume includes general aviation (including crop dusting and spray aircraft), air carrier and military.

3. The enroute accident rate was assumed to be 4E-10 per mile (Ref. 6). This value is conservative (for the data presented in Ref. 6) since the ISFSI site is greater than 10 miles from the end of DIA's runways.

4. Although the legal width of Federal VOR airways is 9.2 statute miles, the effective width of the Federal airways is 7 miles at the ISFSI site. Federal Aviation Regulations (14 CFR 91.123(a)) require aircraft operating under IFR to fly along the centerline of the Federal airway. The regulations (14 CFR 171~~91.25~~) permit a maximum error of ± 6 degrees in the aircraft equipment used to determine the location of the airway. Since the ISFSI site is within 30 miles from 5 VOR transmitters, the effective width of the airway at the ISFSI site would be 7 miles.

5. An impact angle of 45 degrees to the MVDS was assumed. This angle will result in calculating the largest effective target area. The effective area of the MVDS would be the (MVDS base area) + (MVDS elevation area x cot 45 degrees) = .0005 square miles. An effective target area of .002 square miles, which includes the area within the ISFSI fence, was conservatively assumed.

6. The annual probability of flight accident (PFA) of an aircraft traveling on an airway or initial approach segment impacting on the ISFSI MVDS is given by Ref. 6:

where: PFA = CNA/W

C = Probability of aircraft accident per mile of flight = 4E-10 per mile

N = Number of aircraft/year traveling on airway = 87,600

A = Effective area of plant = 0.002 square miles

W = Effective width of airway in miles = 7 miles

PFA = 1.0 E-08 per year

NUREG-0800, Section 3.5.1.6, Acceptance Criteria states that "aircraft accidents which could lead to radiological consequences in excess of the exposure guidelines of 10 CFR Part 100 with a probability of occurrence greater than about 1E-7 per year should be considered in the design..."

It is conservatively concluded that the risk of an aircraft impacting upon the ISFSI MVDS and causing radiological consequences exceeding 10 CFR Part 100 guidelines is below 1E-7 per year. Such accidents are therefore not considered design basis events, and design for aircraft impact or ensuing fire hazard is not necessary.

The nearest public roadway (Weld County Road 19 1/2) is located approximately 1,300 feet west of the ISFSI. Travel on this road is typically local farm machinery, vehicles associated with oil/gas well operations, local residents and employees at the FSV site. Interstate Highway 25 (U.S. 87) between Denver and Cheyenne passes about six miles west of the ISFSI facility, and U.S. 85 between Denver and Greeley is about three miles to the east. Colorado State Highway 66, a two-lane, paved, principal through highway which connects Interstate 25 and U.S. 85, passes about three miles south of the ISFSI facility. The FSV site is readily accessible by paved roads, maintained by Weld County.

A railway system also is located within a 5-mile radius. A Union Pacific Railroad north-south freight line runs through the City of Platteville to the east of the site. To the north (approximately 6-7 miles) an east-west Union Pacific Line runs near the town of Milliken. From this east-west railway, the Dent Line (5 miles owned by XCEL) is routed south to the former FSV reactor site.

None of the public highway or railway systems poses a threat to the safe operation of the ISFSI.

2.2.4. FSV Power Generating Facility

With the FSV power generating facility located immediately adjacent to the ISFSI facility, several industrial associated aspects and activities need to be addressed.

XCEL strategies have resulted in the conversion of the FSV reactor site to a fossil fueled power plant, as discussed in Sections 2.2.1 and 3.3.6. One exhaust stack services each combustion turbine and its associated heat recovery steam generator. The exhaust stacks are less than 180 feet high, and located a distance of at least 1,1501,200 feet from the ISFSI MVDS structure. A restriction in the site selection process (see Section 10.2 of Ref. 9) was that the FSV conversion would be limited to using natural gas.

Diesel fuel oil (minimum of 1,000 gallons) is stored in an above-ground storage tankDiesel fuel oil (minimum of 10,000 gallons) is stored in underground tanks for operation of the standby diesel generators at the FSV power generating facility site. Smaller above ground tanks (approximately 1,000 gallons) also exist for other equipment operation.

There are hazardous chemicals and flammable materials at the FSV power generating facility site, including ammonia, chlorine, sulfuric acid, and hydrogen. None of these materials affect the design of the MVDS.

Table 2.2-1. Manufacturers Located Within a Five-Mile Radius of the Site.

Distance Miles	Company Name	Product
3-4	PLATTEVILLE	
	Colorado Wire Cloth	Screen wire cloth and bolts, tack-lag
	Farley's Machine	Air duct systems and wood planing machines
	MCO, Inc.	Mobile home chassis
	Morning Fresh Farms	Protein supplement for cattle feed; Richlawn Turf Food
	Platteville Elevator, Inc.	Manufactured, processed feed
	Platteville Herald	Newspapers
	Longmont Foods	Feedmill

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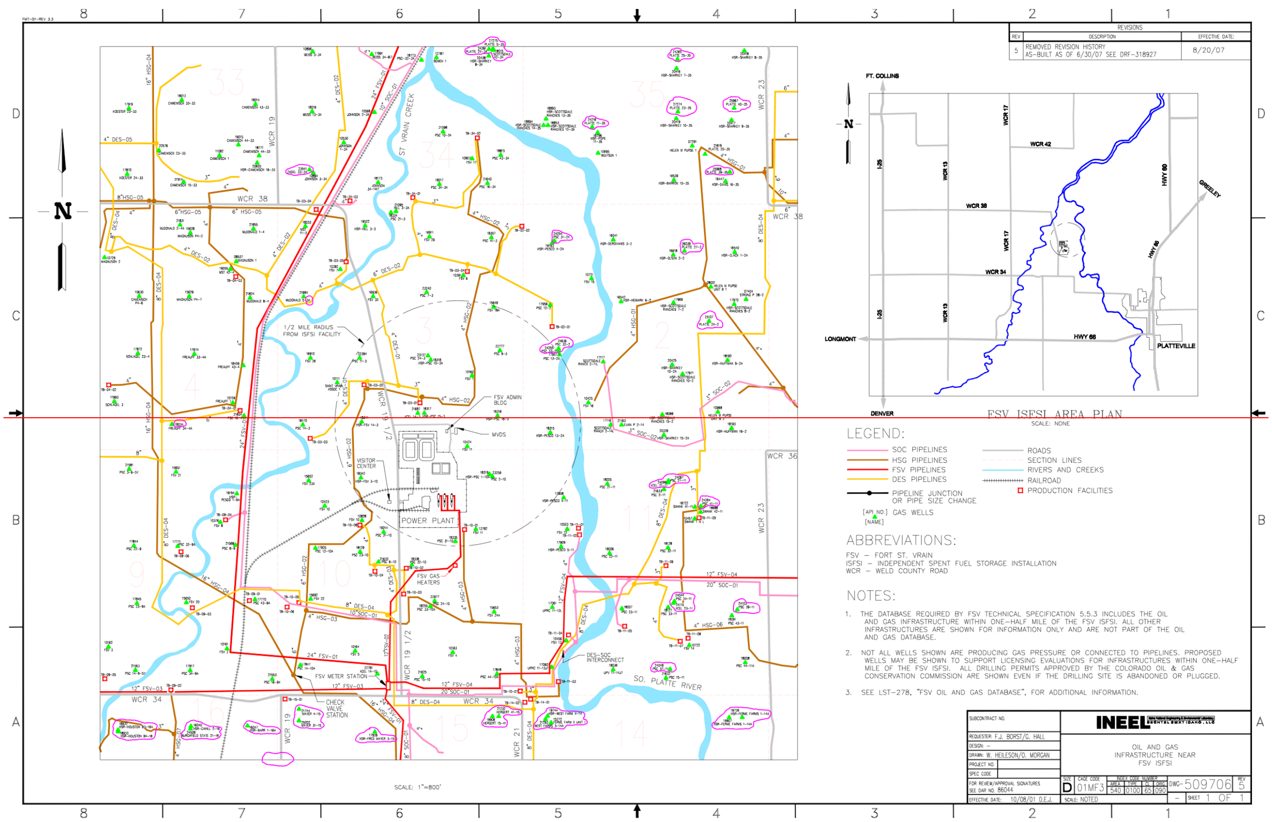
REVISIONS
REV 5 REMOVED REVISION HISTORY AS-BUILT AS OF 6/30/07 SEE DRF-318927 EFFECTIVE DATE: 8/20/07
WCR 38
WCR 34
WCR 36
WCR 19
WCR 19 1/2
WCR 21
WCR 23
ST VRAIN CREEK
SO. PLATTE RIVER
1/2 MILE RADIUS FROM ISFSI FACILITY
FSV ADMIN BLDG
MVDS
VISITOR CENTER
POWER PLANT
FSV GAS HEATERS
FSV METER STATION
CHECK VALVE STATION
DES-SOC INTERCONNECT
SCALE: 1"=800'
FT. COLLINS
GREELEY
LONGMONT
DENVER
PLATTEVILLE
I-25
HWY 66
HWY 85
WCR 42
FSV ISFSI AREA PLAN
SCALE: NONE
LEGEND:
SOC PIPELINES
HSG PIPELINES
FSV PIPELINES
DES PIPELINES
PIPELINE JUNCTION OR PIPE SIZE CHANGE
[API NO.] [NAME] GAS WELLS
ROADS
SECTION LINES
RIVERS AND CREEKS
RAILROAD
PRODUCTION FACILITIES
ABBREVIATIONS:
FSV – FORT ST. VRAIN
ISFSI – INDEPENDENT SPENT FUEL STORAGE INSTALLATION
WCR – WELD COUNTY ROAD
NOTES:
1. THE DATABASE REQUIRED BY FSV TECHNICAL SPECIFICATION 5.5.3 INCLUDES THE OIL AND GAS INFRASTRUCTURE WITHIN ONE–HALF MILE OF THE FSV ISFSI. ALL OTHER INFRASTRUCTURES ARE SHOWN FOR INFORMATION ONLY AND ARE NOT PART OF THE OIL AND GAS DATABASE.
2. NOT ALL WELLS SHOWN ARE PRODUCING GAS PRESSURE OR CONNECTED TO PIPELINES. PROPOSED WELLS MAY BE SHOWN TO SUPPORT LICENSING EVALUATIONS FOR INFRASTRUCTURES WITHIN ONE–HALF MILE OF THE FSV ISFSI. ALL DRILLING PERMITS APPROVED BY THE COLORADO OIL & GAS CONSERVATION COMMISSION ARE SHOWN EVEN IF THE DRILLING SITE IS ABANDONED OR PLUGGED.
3. SEE LST–278, "FSV OIL AND GAS DATABASE", FOR ADDITIONAL INFORMATION.
SUBCONTRACT NO.
REQUESTER: F.J. BORST/G. HALL
DESIGN: –
DRAWN: W. HEILESON/O. MORGAN
PROJECT NO.
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO. 86044
EFFECTIVE DATE: 10/08/01 D.E.J.
INEEL
BECHTEL BWXT IDAHO, LLC
OIL AND GAS INFRASTRUCTURE NEAR FSV ISFSI
SIZE D
CAGE CODE 01MF3
INDEX CODE NUMBER AREA 540 TYPE 0100 CL 65 ORIG 090
DWG-509706
REV 5
SCALE: NOTED
SHEET 1 OF 1

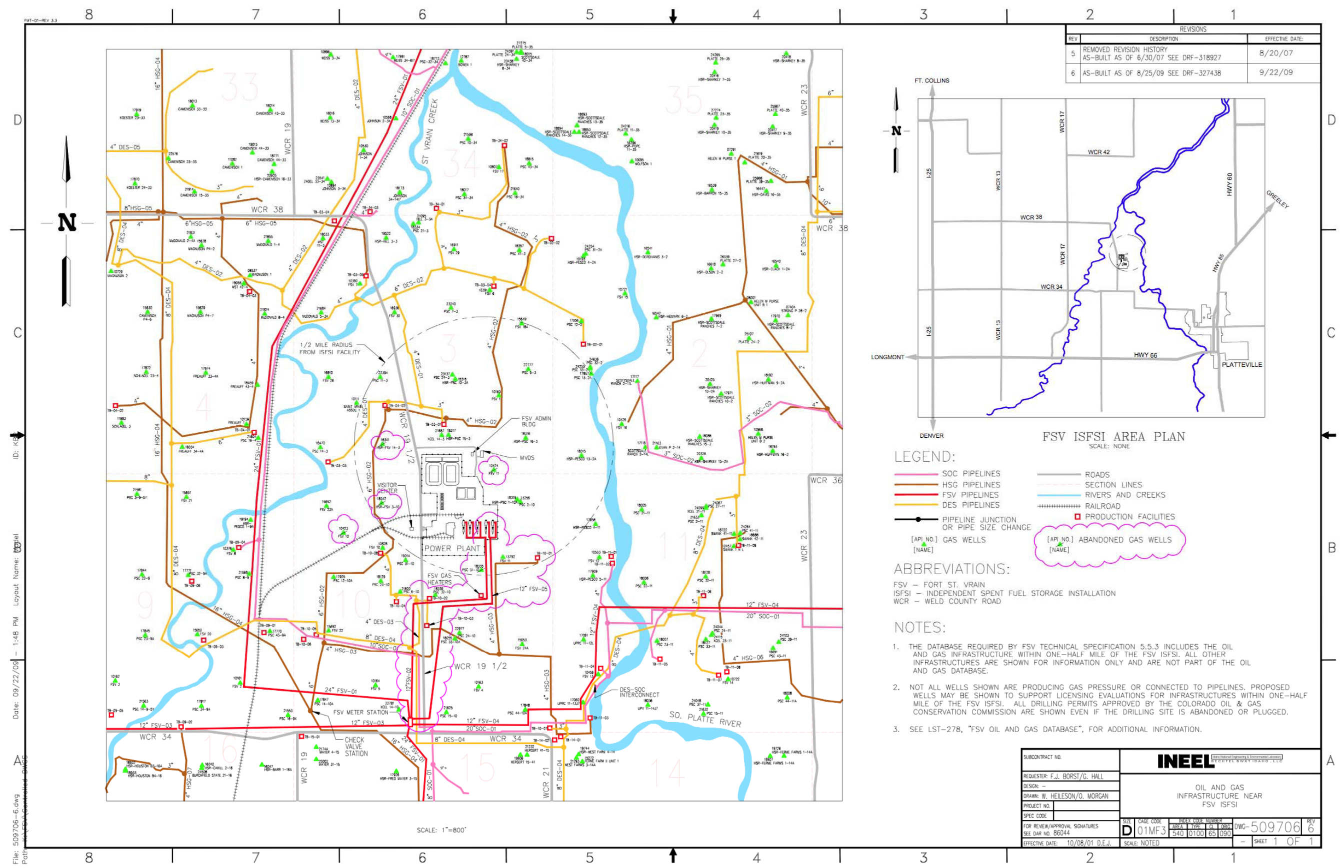

Figure 2.2-1. Natural Gas Facilities Near FSV.

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2.3. Meteorology

2.3.1. Regional Climatology

2.3.1.1. Data Sources

The regional climatology is described by data acquired from various sources at several locations as described below. Figure 2.3-1 shows these cities, which are mentioned throughout Section 2.3, in relation to the FSV ISFSI.

Weather data for Brighton, Longmont, and Greeley (Tables 2.3-1, 2.3-2, and 2.3-3) were collected by the Colorado Climate Center at Colorado State University. Information on extreme winds in Section 2.3.1.3 is a summary of the work performed by Dr. Elmar Reiter, Professor of Atmospheric Science, CSU. A complete report of Dr. Reiter's work is contained in References 10, 11, and 12. The tornado and thunderstorm data of Section 2.3.1.3 was extracted from References 13 and 14, respectively.

Information regarding the Onsite Meteorological Measurement Program was obtained from the Environmental Services Group of the National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colorado.

2.3.1.2. General Climate

The general climate around the FSV ISFSI is typical of the Colorado eastern-slope plains region. In this semi-arid region the precipitation averages 10 to 15 inches a year, mostly from thunderstorms in late spring and summer.

The wind records show no dominant direction, although winds out of the north by northeast segment do occur with the greatest frequency. The winds are generally light (10 mph), with higher velocities occurring during various atmospheric disturbances.

The weather is generally mild. Most seasons are characterized by low humidity and sunny days, with occasional, short-lived storms bringing precipitation into the area. Relative humidity averages about 40 percent during the day and 65 percent at night. Thermal radiation losses resulting from lack of cloud cover provide considerable variation in temperature from night to day. Although snowfall is significant, the snow cover is usually melted in a few days.

2.3.1.3. Severe Weather

2.3.1.3.1. Temperature and Precipitation

Tabulated below are temperature and precipitation records for three cities within 20 miles of FSV (see Figure 2.3-1). The recording periods were 1973-1988 (Brighton), 1931-1988 (Longmont), and 1967-1988 (Greeley).

	Brighton	Longmont	Greeley
Max. Temp. (degrees F)	101	106	103
Min. Temp. (degrees F)	-23	-36	-25
Max. Precip. - Day (in.)	2.73	4.04	3.20
Max. Snowfall - Month (in.)	22.1	32.4	37.3

Complete summaries of monthly climatic data for these locations are given in Tables 2.3-1, 2.3-2 and 2.3-3.

Actual on-site measurements at Fort St. Vrain for the period 1986 through 1989 yield the following weather extremes:

Maximum Temperature	=	103.8 degrees F
Minimum Temperature	=	-26.3 degrees F
Maximum Wind Velocity	=	48 mph

at Wind Direction 6.5 degrees (NNE)

This information was extracted from archived weather data collected from FSV's previous 60 meter meteorological tower. Meteorological data acquisition during the operation of FSV is explained in Reference 1.

The MVDS design temperatures are 120 degrees F and -32 degrees F as discussed in Section 3.3.2.2.2. The Thermal-Hydraulic Analysis of the MVDS (Appendix A3-1) has numerous conservative assumptions and results in fuel temperatures significantly lower than allowable.

2.3.1.3.2. Extreme Winds

Seasonally, winds tend to be strongest in the late winter and spring, the season with high chinook frequency, and again in the summer, when thunderstorms occur frequently.

Strong winds, especially under chinook conditions, have been observed on various occasions in eastern Colorado. The chinook winds are strongest immediately to the east of the mountain ridge and diminish rapidly over the plains with increasing distance from the mountains, as shown by measurements from the National Center for Atmospheric Research (NCAR) wind network near Boulder, Colorado on January 15, 1967:

Location	Peak Gusts	3-Hour Mean Speed 9PM -12AM	Direction
NCAR Building	125 MPH	52 MPH	--
Bottom of Table Mesa, 3/4 miles northeast of NCAR Building	80 MPH	26 MPH	WNW
Boulder, Downtown	82 MPH	34 MPH	--
Boulder, 76th Street	70 MPH	28 MPH	WNW
Lafayette, Colorado	58 MPH	18 MPH	WNW

At Stapleton International Airport, Denver, the "fastest mile" measured on January 15, 1967 was equivalent to a wind velocity of 23 mph and the peak gust was 43 mph from the west.

This evidence suggests that the Denver gust data, taken at a comparable distance from the mountains, would be more representative for the FSV site than the Boulder data. The Denver "peak gust" for 20 years preceding 1967 was 70 mph, therefore, it appears that under non-tornadic conditions 100 mph winds should provide maximum wind forces to be expected at the FSV ISFSI (Ref. 12).

Figures 2.3-2 and 2.3-3 show the wind rose diagrams for Denver and Ft. Collins, Colorado. This information was taken from Reference 11, which gives a complete description of the wind characteristics near Fort St. Vrain.

The measurement records at the site reveal a strong prevalence of northerly and southerly winds caused by the shallow depression of the St. Vrain Creek and the South Platte River and by the proximity of the Rocky Mountains (see Figure 2.3-9).

2.3.1.3.3. Tornadoes

A study of tornadoes in the area surrounding the FSV site was conducted in March, 1967. The results of the study are reported in Reference 12.

Since that report, several tornadoes have touched down in the Denver area. The following information, from the National Center for Atmospheric Research, describes an event in which three separate tornadoes hit Denver on June 3, 1981 (Ref. 15).

An aerial survey (see Figure 2.3-5) was conducted for the National Center for Atmospheric Research in Boulder, Colorado, by Dr. Roger Wakimoto, of the University of Chicago, who has done similar surveys for many of the more devastating tornadoes in the United States.

Wakimoto used a tornado damage scale with a range of 0 to 5 that has been developed by Dr. Theodore Fujita, Professor of Meteorology at the University of Chicago's Department of Geophysical Sciences.

As the map indicates, the Fujita tornado damage scale is expressed in terms of wind speeds: 0 on the scale equals winds of 40 to 72 miles per hour; 1 equals winds of 73 to 112 miles per hour; and 2 equals wind velocities of 113 to 157 miles per hour. The tornado strengths were estimated from the types of damage viewed in the aerial survey.

The 1981 tornado outbreak was the largest ever recorded in the Denver metropolitan area in the 75 to 80 years that the National Weather Service has been keeping records.

The FSV ISFSI is located in a region that typically experiences 5 tornadoes per year per 10,000 square miles (see Figure 2.3-4). The peak tornado activity occurs in the month of June (Ref. 13). According to the National Weather Service, Weld County has had 117 tornadoes during the period 1950-1987.

Maximum wind velocities in severe tornadoes of the FSV region should be less than their midwestern counterparts. However, for design purposes the most severe tornado of Regulatory Guide 1.76 (Ref. 16) was assumed (see Section 3.2.1).

2.3.1.3.4. Thunderstorms and Lightning

Northeastern Colorado has moderate thunderstorm activity. As shown in Figure 2.3-6 (Ref. 14), the region near Fort St. Vrain averages 50 days/year in which thunder and lightning occur. The majority of these thunderstorms are present from late spring through the summer.

2.3.2. Local Meteorology

2.3.2.1. Data Sources

The meteorological data base for the accident analysis is described in a report dated June, 1967, and revised in November, 1970, by Dr. Elmar R. Reiter (Reference 10 and 12). These reports include tables of wind speed, wind direction, and dilution factors for Fort St. Vrain.

2.3.2.2. Topography

The land near the ISFSI location is generally flat with the only significant features being the South Platte River and the St. Vrain Creek. Detailed topographic features in the region surrounding the ISFSI are shown in Figure 2.1-5.

2.3.3. Onsite Meteorological Measurement Program

The NOAA no longer maintains the on-site meteorological tower.

PSCo performed an evaluation (Reference 17) of its capability to comply with regulatory requirements, particularly those involving emergency response, assuming NOAA ~~discontinues~~ discontinued maintenance of their FSV meteorological tower. This evaluation determined that operability of the NOAA meteorological tower on the FSV site is not required, and DOE can fully comply with applicable regulations without reliance on data from this tower. It was determined that meteorological monitoring is not required to protect the public from the effects of potential releases of radioactivity from the ISFSI due to the extremely low dose consequences projected to occur at the ISFSI emergency planning zone (EPZ) from worst case credible accidents, with whole body doses of approximately 1 mrem. The ISFSI EPZ is located approximately 100 meters from the ISFSI MVDS structure. In the event of an accident at the ISFSI involving radioactive release, dose consequences at the EPZ are conservatively assigned by identifying the type of accident and using previous calculations of dose consequences at the EPZ for the worst case scenario of that type of accident. Field monitoring data can be utilized to validate these assigned doses. On-site meteorological monitoring also is not required to protect emergency response personnel during an emergency. Personal observations by individuals responding to an emergency may be used to assess wind direction and determine appropriate access routes. Wind speeds associated with such tornadoes would be estimated based on information obtained by the National Weather Service.

On site meteorological monitoring is as described in the FSV ISFSI Emergency Response Plan.

2.3.4. Diffusion Estimates

2.3.4.1. Basis

The design two-hour relative concentration (X/Q) at the controlled area boundary (CAB) for an accidental release at the ISFSI is based on a Pasquill F type stability with a wind speed of 1.0 m/sec. The following equation for calculating (X/Q) is referenced in NRC Regulatory Guide 1.4 (Ref. 18) for these conditions.

$$X/Q = 1/[\bar{\mu}\ \Pi \sum y\ \sigma_z] = 3.3E\text{-}3\ \text{sec/m}^3$$

Meteorological conditions resulting in a higher value will occur less than five percent of the time annually.

There are no long-term (routine) airborne releases associated with the operation of the facility; therefore, no long-term diffusion estimate was made.

2.3.4.2. Calculations

Calculations of doses resulting from a potential accidental release from the ISFSI have been performed based on the recommendations of NRC Regulatory Guide 1.4 (Ref. 18) using the computer code MARC-1 (Ref. 19). MARC-1 calculates X/Q values assuming a Gaussian plume model consistent with the recommendations of Reference 18.

The results of the calculations are presented in Section 8.1.

Table 2.3-1. Climatic Data.

SUMMARY OF MONTHLY CLIMATIC DATA FOR BRIGHTON 1 NE COLORADO FOR YEARS 1973-1988 SUBSTATION NO. 5095[illegible] DIVISION [illegible]

LATITUDE - 40 0 LONGITUDE - 104 48 ELEVATION - 4980 FEET

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MONTHLY PRECIPITATION (IN)	AVE.	0.37	0.40	1.09	1.72	3.12	1.79	1.49	1.37	0.73	0.83	0.81	0.67	14.34
	MAX.	0.81	1.48	3.46	4.01	5.70	3.48	4.76	3.24	2.12	3.35	1.96	2.09	19.75
	YEAR	1974	1987	1983	1986	1987	1983	1977	1979	1985	1984	1983	1973	1983
	MIN.	0.10	0.10	0.22	0.32	0.14	0.76	0.31	0.16	0.01	0.02	0.10	0.08	9.97
	YEAR	1983	1982	1982	1982	1974	1975	1988	1985	1978	1988	1984	1980	1988
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	16.	16.	14.
GREATEST DAILY PRECIP (IN)	AMOUNT	0.58	0.60	1.32	2.26	2.73	2.27	2.25	1.26	0.68	1.18	0.77	1.37	
	YEAR AND DAY	198819	198720	198306	198603	198213	197908	197721	197513	198529	197822	198715	197324	
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	
MONTHLY SNOWFALL (IN)	AVE.	5.2	4.4	9.3	6.9	2.0	0.	0.	0.	0.7	1.9	7.0	7.5	47.2
	MAX.	11.9	8.0	22.1	17.0	11.1	0.	0.	0.	6.4	8.7	19.6	20.7	78.3
	YEAR	1987	1987	1983	1974	1979	1974	1974	1974	1985	1984	1979	1973	1979
	MIN.	1.0	1.2	1.1	0.	0.	0.	0.	0.	0.	0.	0.9	0.3	32.4
	YEAR	1983	1982	1986	1985	1988+	1988+	1988+	1988+	1988+	1988+	1982	1980	1988
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	14.	16.	12.
GRTST DEPTH SNOW ON GRND IN MON (IN)		15	5	7	13	4	0	0	0	6	5	18	16	
	YEAR AND DAY	198301	198715+	198831+	198604	198317+	0	0	0	198529	198416	198328	198227	
	YEARS OF RECORD	15.	14.	12.	13.	13.	13.	14.	15.	13.	13.	13.	15.	
NO DAYS PRECIP GTR OR EQ 0.1 IN	AVE.	1.4	1.5	3.5	4.1	5.1	3.8	3.2	2.9	2.4	2.1	3.0	1.8	35.2
	MAX.	4	3	7	6	8	6	5	7	6	5	7	4	44
	YEAR	1985	1987+	1983	1983+	1982+	1977	1983+	1984	1985	1974	1983	1973	1983
	MIN.	0	0	1	1	1	2	1	1	0	0	0	0	26
	YEAR	1983	1982+	1982+	1988+	1974	1980+	1987	1985+	1978+	1988+	1976	1980+	1988
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
NO DAYS PRECIP GTR OR EQ 0.5 IN	AVE.	0.1	0.1	0.5	1.1	2.1	1.1	0.6	0.7	0.2	0.6	0.3	0.3	7.9
	MAX.	1	1	2	2	5	3	2	3	1	4	1	2	14
	YEAR	1988	1987	1983	1986+	1987	1987	1985+	1979	1988+	1984	1987+	1982	1987
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	4
	YEAR	1987+	1988+	1987+	1988+	1984+	1978+	1988+	1988+	1986+	1988+	1988+	1988+	1976
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
NO DAYS PRECIP GTR OR EQ 1.0 IN	AVE.	0.	0.	0.1	0.1	0.8	0.4	0.4	0.3	0.	0.1	0.	0.1	2.3
	MAX.	0	0	1	2	2	2	2	1	0	1	0	1	5
	YEAR	1974	1974	1983	1986	1988+	1983	1983+	1987+	1974	1984+	1973	1973	1983
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	0
	YEAR	1988+	1988+	1988+	1988+	1986+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1980
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
NUMBER OF DAYS WITH HAIL	AVE.	0.	0.	0.	0.	0.1	0.1	0.1	0.3	0.	0.	0.	0.	0.5
	MAX.	0	0	0	0	1	1	1	2	0	0	0	0	3
	YEAR	1974	1974	1974	1974	1980	1980	1980	1981	1974	1973	1973	1973	1980
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	0
	YEAR	1981+	1981+	1981+	1981+	1979+	1979+	1981+	1980+	1981+	1981+	1981+	1981+	1979+
	YEARS OF RECORD	8.	8.	8.	8.	7.	7.	8.	8.	8.	9.	8.	9.	6.
NO. OF DAYS WITH SNOW ON GROUND (GTR OR EQ 1 INCH ON GROUND)	AVE.	15.6	6.7	4.6	2.7	0.4	0.	0.	0.	0.1	0.7	6.3	11.2	[illegible]
	MAX.	31	14	11	7	2	0	0	0	1	4	22	3[illegible]	92
	YEAR	1988+	1988	1983	1974	1983+	1974	1974	1974	1985	1984	1985	1983	1983
	MIN.	1	0	0	0	0	0	0	0	0	0	0	[illegible]	25
	YEAR	1977	1982	1982	1985+	1988+	1988+	1988+	1988+	1988+	1988+	1982+	1980	[illegible]
	YEARS OF RECORD	15.	15.	14.	15.	15.	14.	14.	15.	14.	15.	15.	[illegible]5	[illegible]

** NOTE : MANY WEATHER STATIONS DO NOT RECORD ALL HAIL OCCURRENCES. THEREFORE THESE DATA MAY NOT BE REPRESENTATIVE.

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Table 2.3-1. Climatic Data.

SUMMARY OF MONTHLY CLIMATIC DATA FOR BRIGHTON 1 NE COLORADO FOR YEARS 1973-1988 SUBSTATION NO. 50950 DIVISION -

LATITUDE - 40 0 LONGITUDE - 104 48 ELEVATION - 4980 FEET

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MONTHLY MEAN MAXIMUM TEMP (F)	AVE.	41.1	48.3	55.3	64.1	72.2	84.2	89.4	86.5	79.3	68.1	51.5	44.2	65.1
	MAX.	54.1	55.7	63.7	72.5	78.4	89.0	91.6	90.4	83.9	72.5	59.7	55.7	67.6
	YEAR	1986	1976	1986	1981	1974	1980	1980	1985	1977	1975	1981	1980	1981
	MIN.	30.6	40.2	49.0	55.2	66.9	77.5	88.1	84.1	75.0	58.2	40.5	28.5	62.4
	YEAR	1979	1978	1983	1983	1983	1983	1985	1981	1985	1984	1985	1983	1983
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
MONTHLY MEAN MINIMUM TEMP (F)	AVE.	13.0	19.2	25.4	33.2	42.5	51.6	56.7	54.4	45.4	34.6	22.8	15.9	34.6
	MAX.	23.5	24.5	32.0	38.3	46.4	56.3	58.7	58.5	48.5	37.0	26.3	24.8	37.2
	YEAR	1986	1987	1986	1981	1987	1988	1985	1983	1981	1988	1981	1980	1986
	MIN.	3.0	12.7	21.3	28.3	39.1	47.7	54.9	50.2	40.7	30.6	16.7	3.4	32.7
	YEAR	1979	1985	1976	1975	1983	1975	1979	1974	1974	1976	1979	1983	1975
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
MONTHLY MEAN AVERAGE TEMP (F)	AVE.	27.1	33.8	40.4	48.7	57.4	68.0	73.1	70.5	62.4	51.4	37.2	30.0	49.9
	MAX.	38.8	39.3	47.9	55.4	61.2	71.7	74.9	73.8	65.4	53.7	43.0	40.3	52.1
	YEAR	1986	1976	1986	1981	1974	1988	1980	1983	1981	1988	1981	1980	1986
	MIN.	16.8	27.6	36.5	42.5	53.0	63.4	71.9	67.3	58.2	45.7	29.5	16.0	48.4
	YEAR	1979	1985	1980	1984	1983	1983	1975	1974	1974	1984	1985	1983	1979
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
DEGREE DAYS (BASE 65F)	AVE.	1168.8	874.6	756.4	483.1	240.3	41.1	1.1	6.7	121.9	416.5	828.2	1076.8	6053.2
	MAX.	1486	1043	881	668	369	110	5	21	215	594	1057	1519	6612
	YEAR	1979	1985	1980	1984	1983	1983	1987	1987	1974	1984	1985	1983	1983
	MIN.	806	740	526	287	141	0	0	0	37	343	654	761	5241
	YEAR	1986	1976	1986	1981	1977	1977	1988+	1986+	1981	1988	1981	1980	1986
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
NO DAYS MAX TEMP GTR OR EQ 90F	AVE.	0.	0.	0.	0.	0.4	9.2	16.6	10.5	3.8	0.	0.	0.	40.5
	MAX.	0	0	0	0	2	16	23	19	9	0	0	0	61
	YEAR	1974	1974	1974	1974	1988+	1980	1980	1985	1978	1973	1973	1973	1980
	MIN.	0	0	0	0	0	4	12	5	0	0	0	0	30
	YEAR	1988+	1988+	1988+	1988+	1987+	1983	1986	1976+	1986	1988+	1988+	1988+	1986
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
NO DAYS MAX TEMP LESS OR EQ 32F	AVE.	8.0	3.8	1.3	0.3	0.	0.	0.	0.	0.	0.1	2.8	5.4	23.2
	MAX.	19	7	4	3	0	0	0	0	0	1	10	15	37
	YEAR	1979	1986	1983	1983	1974	1974	1974	1974	1974	1984	1985	1983	1978
	MIN.	0	0	0	0	0	0	0	0	0	0	0	1	9
	YEAR	1986	1977	1986+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1976	1986
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
NO DAYS MIN TEMP LESS OR EQ 32F	AVE.	30.5	26.6	26.2	13.0	1.9	0.	0.	0.	1.7	12.3	26.1	30.1	168.9
	MAX.	31	29	31	24	7	0	0	0	6	18	30	31	194
	YEAR	1988+	1984+	1984	1984	1979	1974	1974	1974	1985	1980+	1979	1988+	1984
	MIN.	29	20	18	5	0	0	0	0	0	8	22	27	142
	YEAR	1975+	1986	1986	1985+	1987+	1988+	1988+	1988+	1988+	1988+	1987	1980	1986
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
NO DAYS MIN TEMP LESS OR EQ 0 F	AVE.	5.2	1.8	0.5	0.1	0.	0.	0.	0.	0.	0.	0.7	3.3	11.7
	MAX.	15	7	3	1	0	0	0	0	0	0	3	12	26
	YEAR	1979	1985	1976	1975	1974	1974	1974	1974	1974	1973	1979	1983	1979
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	2
	YEAR	1986+	1987+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1984+	1986
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	13.
HIGHEST TEMPERATURE (F)	TEMP	74	77	82	86	91	100	100	101	96	87	80	74	
	YEAR AND DAY	198226	198625	198630	198126	198816+	198508	198121+	198006	197909+	197801+	197808	198017	
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	
LOWEST TEMPERATURE (F)	TEMP	-22	-20	-8	-8	22	35	46	41	19	15	-7	-23	
	YEAR AND DAY	198418	198505+	197606+	197502	197807	197511	198713	197819	198529	197619	197627	198321	
	YEARS OF RECORD	15.	15.	15.	15.	15.	14.	14.	15.	14.	15.	15.	16.	

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Table 2.3-2. Climatic Data.

SUMMARY OF MONTHLY CLIMATIC DATA FOR LONGMONT 2 ESE   COLORADO   FOR YEARS 1931-1988   SUBSTATION NO. 55116 DIVISION -

LATITUDE - 40 10 LONGITUDE - 105 4 ELEVATION - 4950 FEET

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MONTHLY PRECIPITATION (IN)	AVE.	0.36	0.41	0.93	1.70	2.52	1.66	1.12	1.01	1.18	0.90	0.58	0.45	12.84
	MAX.	1.13	1.45	4.69	4.84	6.88	6.23	3.74	3.99	6.06	4.81	2.46	1.73	20.91
	YEAR	1980	1987	1983	1957	1957	1947	1946	1979	1938	1969	1983	1987	1983
	MIN.	0.	0.	0.10	0.01	0.08	0.01	0.	0.	0.	0.	0.	0.	6.42
	YEAR	1952+	1954+	1966	1963+	1974	1971	1939	1971	1956+	1934	1949+	1957+	1939
	YEARS OF RECORD	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.
GREATEST DAILY PRECIP (IN)	AMOUNT	0.75	0.78	1.45	2.70	4.04	2.38	1.52	1.74	1.60	1.84	0.84	0.72	
	YEAR AND DAY	197320	195728	195221	196714	195709	197206	198311	195103	197619	197822	198715+	197324	
	YEARS OF RECORD	40.	41.	41.	41.	40.	41.	41.	41.	41.	41.	41.	40.	
MONTHLY SNOWFALL (IN)	AVE.	5.6	5.4	7.9	5.5	0.6	0.	0.	0.	0.6	1.6	5.3	5.3	37.3
	MAX.	18.0	15.5	26.0	25.5	8.0	0.	0.	0.	10.0	22.5	32.4	32.0	67.5
	YEAR	1962	1955	1970	1944	1979	1931	1931	1931	1971	1969	1946	1982	1973
	MIN.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	15.6
	YEAR	1983+	1970+	1966+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1978+	1980+	1943
	YEARS OF RECORD	55.	51.	52.	53.	56.	58.	58.	58.	58.	56.	57.	55.	36.
GRTST DEPTH SNOW ON GRND IN MON (IN)		12	8	14	16	3	0	0	0	9	11	9	14	
	YEAR AND DAY	0	197121+	195221	195703	197301+	0	0	0	197118	196912	0	198510	
	YEARS OF RECORD	34.	27.	33.	28.	38.	40.	40.	40.	38.	34.	33.	31.	
NO DAYS PRECIP GTR OR EQ 0.1 IN	AVE.	1.8	1.7	3.5	4.4	5.9	4.8	3.9	3.5	3.0	2.5	2.2	1.7	38.6
	MAX.	7	5	10	10	13	16	10	13	9	8	7	4	83
	YEAR	1949	1987+	1949	1957+	1952+	1949	1965	1952	1976+	1969	1952	1982+	1951
	MIN.	0	0	0	0	0	0	1	0	0	0	0	0	21
	YEAR	1986+	1982+	1966	1982+	1974	1980+	1968+	1985+	1978+	1988+	1978+	1977+	1964+
	YEARS OF RECORD	41.	40.	41.	40.	41.	41.	41.	41.	41.	41.	40.	41.	38.
NO DAYS PRECIP GTR OR EQ 0.5 IN	AVE.	0.1	0.1	0.5	1.0	1.4	1.0	0.5	0.6	0.6	0.5	0.2	0.3	6.6
	MAX.	1	1	4	3	4	5	3	4	3	3	2	2	15
	YEAR	1973+	1975+	1983	1974+	1978+	1949	1967	1979	1971+	1969+	1985+	1985+	1983
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	2
	YEAR	1988+	1988+	1987+	1988+	1985+	1988+	1988+	1987+	1987+	1988+	1988+	1987+	1966+
	YEARS OF RECORD	40.	40.	40.	40.	39.	40.	40.	40.	40.	40.	40.	40.	39.
NO DAYS PRECIP GTR OR EQ 1.0 IN	AVE.	0.	0.	0.1	0.2	0.6	0.3	0.1	0.1	0.2	0.2	0.	0.	1.9
	MAX.	0	0	3	2	3	3	1	1	2	2	0	0	7
	YEAR	1948	1948	1983	1973+	1978	1949	1983+	1988+	1970	1969	1948	1948	1983
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	0
	YEAR	1988+	1988+	1988+	1988+	1987+	1988+	1988+	1987+	1988+	1988+	1988+	1988+	1987+
	YEARS OF RECORD	40.	40.	40.	41.	40.	40.	40.	40.	40.	40.	40.	40.	40.
NUMBER OF DAYS WITH HAIL	AVE.	0.	0.	0.	0.0	0.2	0.2	0.1	0.1	0.	0.	0.	0.	0.7
	MAX.	0	0	0	1	2	2	1	1	0	0	0	0	2
	YEAR	1956	1956	1956	1964	1971	1969	1976+	1965+	1956	1956	1956	1956	1972+
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	0
	YEAR	1981+	1981+	1981+	1981+	1981+	1981+	1981+	1981+	1981+	1981+	1981+	1981+	1981+
	YEARS OF RECORD	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.	26.
NO. OF DAYS WITH SNOW ON GROUND (GTR OR EQ 1 INCH ON GROUND)	AVE.	8.7	5.9	4.8	1.6	0.1	0.	0.	0.	0.2	0.8	3.4	7.1	31.0
	MAX.	20	16	13	6	1	0	0	0	3	11	18	31	40
	YEAR	1974+	1966	1965	1975+	1979+	1963	1963	1963	1985+	1969	1985	1985	1963
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	24
	YEAR	1987+	1983+	1982+	1985+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1986+	1976
	YEARS OF RECORD	19.	16.	20.	21.	25.	26.	26.	26.	26.	25.	22.	14.	6

** NOTE : MANY WEATHER STATIONS DO NOT RECORD ALL HAIL OCCURRENCES. THEREFORE THESE DATA MAY NOT BE REPRESENTATIVE.

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Table 2.3.2 Climatic Data

SUMMARY OF MONTHLY CLIMATIC DATA FOR LONGMONT 2 ESE COLORADO FOR YEARS 1931-1988 SUBSTATION NO. 55[illegible] DIVISION [illegible]

LATITUDE - 40 10 LONGITUDE - 105 4 ELEVATION - 4950 FEET

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MONTHLY MEAN MAXIMUM TEMP (F)	AVE.	42.0	45.9	52.0	62.1	71.1	81.8	88.7	86.6	78.2	67.1	52.2	44.7	64.4
	MAX.	53.1	61.9	63.1	71.2	79.7	89.9	93.0	92.1	84.0	75.6	67.0	54.9	69.1
	YEAR	1953	1954	1986	1946	1934	1956	1936	1937	1953	1950	1949	1957	1934
	MIN.	27.5	32.5	39.8	51.8	59.5	72.4	84.4	82.5	66.1	51.0	40.2	27.8	61.7
	YEAR	1937	1942	1965	1957	1935	1967	1972	1979	1965	1969	1985	1983	1985
	YEARS OF RECORD	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.
MONTHLY MEAN MINIMUM TEMP (F)	AVE.	11.4	16.3	22.9	32.5	42.2	50.1	55.3	53.6	44.2	33.4	21.9	14.7	33.2
	MAX.	21.2	24.0	31.1	39.3	46.0	55.6	58.8	58.5	50.1	39.4	27.2	23.3	36.6
	YEAR	1986+	1976	1986	1981	1958	1977	1954	1983	1940	1963	1949	1980	1981
	MIN.	-3.2	4.8	14.5	27.0	38.4	45.6	52.5	48.0	38.8	27.8	15.8	0.5	30.4
	YEAR	1937	1942	1965	1945	1983+	1945	1959+	1950	1988	1969	1952	1932	1988
	YEARS OF RECORD	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.
MONTHLY MEAN AVERAGE TEMP (F)	AVE.	26.7	31.1	37.4	47.3	56.7	66.0	72.0	70.1	61.2	50.3	37.0	29.7	48.8
	MAX.	37.2	41.8	47.1	54.5	62.4	71.6	75.9	74.7	66.0	56.8	47.1	38.8	51.9
	YEAR	1953	1954	1986	1981	1934	1977	1954	1983	1981	1963	1949	1980+	1934
	MIN.	12.2	18.6	27.2	39.9	49.6	59.8	68.5	66.8	53.1	39.4	28.3	16.2	46.9
	YEAR	1937	1942	1965	1945	1935	1945	1950	1950	1965	1969	1985	1983	1942
	YEARS OF RECORD	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.
DEGREE DAYS (BASE 65F)	AVE.	1194.4	947.2	842.1	527.6	248.6	62.3	6.0	13.4	157.9	457.1	838.7	1100.0	6395.4
	MAX.	1544	1214	1167	726	400	161	52	49	357	785	1095	1511	6884
	YEAR	1962	1955	1965	1957	1983	1969	1972	1968	1965	1969	1985	1983	1984
	MIN.	869	745	549	317	126	0	0	0	38	248	642	806	5423
	YEAR	1986	1976	1986	1981	1977	1977	1986+	1986+	1981	1963	1981	1980	1981
	YEARS OF RECORD	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
NO DAYS MAX TEMP GTR OR EQ 90F	AVE.	0.	0.	0.	0.	0.8	7.7	15.4	11.5	3.5	0.0	0.	0.	39.0
	MAX.	0	0	0	0	5	16	24	23	11	1	0	0	61
	YEAR	1948	1948	1948	1948	1964	1980+	1954	1983	1978	1980	1948	1948	1980
	MIN.	0	0	0	0	0	0	5	3	0	0	0	0	17
	YEAR	1988+	1988+	1988+	1988+	1987+	1967+	1958	1963	1986+	1988+	1988+	1988+	1967
	YEARS OF RECORD	40.	40.	40.	40.	40.	41.	41.	41.	41.	40.	40.	40.	40.
NO DAYS MAX TEMP LESS OR EQ 32F	AVE.	8.1	4.7	2.7	0.5	0.	0.	0.	0.	0.	0.2	3.1	5.3	24.9
	MAX.	20	11	11	4	0	0	0	0	0	2	10	17	43
	YEAR	1979	1955	1965	1959	1948	1948	1948	1948	1948	1971+	1985+	1983	1978
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	12
	YEAR	1986	1977+	1986+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1959+	1986+
	YEARS OF RECORD	41.	41.	41.	40.	40.	40.	40.	40.	40.	40.	41.	41.	40.
NO DAYS MIN TEMP LESS OR EQ 32F	AVE.	30.4	27.3	27.9	13.9	1.8	0.0	0.	0.	1.3	14.1	27.7	30.4	175.0
	MAX.	31	29	31	23	6	1	0	0	7	23	30	31	198
	YEAR	1987+	1988+	1984+	1984+	1979+	1951	1948	1948	1988+	1948	1984+	1988+	1984
	MIN.	26	23	20	5	0	0	0	0	0	3	23	26	154
	YEAR	1971	1986	1986	1981	1987+	1988+	1988+	1988+	1987+	1963	1981	1977	1986+
	YEARS OF RECORD	41.	41.	41.	41.	41.	40.	40.	40.	40.	40.	41.	41.	39.
NO DAYS MIN TEMP LESS OR EQ 0 F	AVE.	6.1	2.5	1.1	0.1	0.	0.	0.	0.	0.	0.0	0.6	3.2	13.6
	MAX.	16	10	7	2	0	0	0	0	0	1	5	13	30
	YEAR	1979+	1955	1948	1975+	1948	1948	1948	1948	1948	1969	1952	1972	1948
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	3
	YEAR	1986+	1987+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1980+	1986
	YEARS OF RECORD	41.	40.	41.	40.	40.	40.	40.	40.	40.	40.	41.	41.	40.
HIGHEST TEMPERATURE (F)	TEMP	75	79	82	87	94	105	106	103	99	91	83	78	
	YEAR AND DAY	198227	193227	197127+	198127	196928+	195424	197307	194703	196001	193407	193102	193911	
	YEARS OF RECORD	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	
LOWEST TEMPERATURE (F)	TEMP	-34	-36	-26	-10	24	31	40	38	18	0	-22	-29	
	YEAR AND DAY	196313+	195101	193208	194504	198803+	194713	195209	196428	198530	196913	195010	19321[illegible]	
	YEARS OF RECORD	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58.	58	

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Table 2.3-3. Climatic Data.

SUMMARY OF MONTHLY CLIMATIC DATA FOR GREELEY UNC COLORADO FOR YEARS 1967-1988 SUBSTATION NO. 53553 DIVISION -

LATITUDE - 40 25 LONGITUDE - 104 42 ELEVATION - 4650 FEET

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MONTHLY PRECIPITATION (IN)	AVE.	0.45	0.35	1.08	1.80	2.82	1.86	1.34	1.03	1.07	1.01	0.85	0.53	14.18
	MAX.	1.44	1.52	2.90	3.41	5.36	3.68	2.74	3.89	3.36	4.46	2.29	1.11	22.17
	YEAR	1980	1987	1979	1983	1981	1983	1981	1979	1971	1969	1983	1979	1979
	MIN.	0.02	0.	0.09	0.18	0.10	0.43	0.28	0.12	0.	0.03	0.02	0.	8.44
	YEAR	1975	1977	1978	1982	1974	1973	1972	1973	1978	1988	1971	1974	1968
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
GREATEST DAILY PRECIP (IN)	AMOUNT	0.65	0.79	1.08	1.74	2.94	3.20	1.45	1.65	1.68	1.93	1.22	0.75	
	YEAR AND DAY	197320	198726	197922	197122	197529	197408	198126	197910	197117	197822	197920	197927	
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	
MONTHLY SNOWFALL (IN)	AVE.	5.3	3.8	8.1	6.8	1.1	0.	0.	0.	0.7	3.5	8.4	7.0	42.9
	MAX.	16.3	13.2	17.0	16.5	6.0	0.	0.	0.	9.0	37.3	23.5	13.8	68.7
	YEAR	1980	1987	1988	1984	1983+	1967	1967	1967	1971	1969	1983	1975	1983
	MIN.	0.3	0.	0.3	0.	0.	0.	0.	0.	0.	0.	0.5	0.	17.4
	YEAR	1968	1977	1978	1976+	1987+	1988+	1988+	1988+	1988+	1988+	1984	1974	1976
	YEARS OF RECORD	20.	20.	20.	18.	22.	22.	22.	22.	22.	19.	20.	18.	15.
GRTST DEPTH SNOW ON GRND IN MON (IN)		12	9	30	9	6	0	0	0	5	17	16	13	
	YEAR AND DAY	197103	0	197423	198420	197806	0	0	0	198529	196912	198327	0	
	YEARS OF RECORD	19.	19.	20.	21.	21.	22.	22.	22.	21.	20.	18.	16.	
NO DAYS PRECIP GTR OR EQ 0.1 IN	AVE.	1.5	1.1	3.2	4.0	6.0	4.5	3.4	2.6	2.7	2.5	2.5	1.9	35.4
	MAX.	6	5	7	8	12	11	6	6	6	8	6	4	49
	YEAR	1980	1984	1980	1973	1987	1967	1982+	1979	1985+	1969	1987+	1988+	1987
	MIN.	0	0	0	1	0	1	1	0	0	0	0	0	23
	YEAR	1983+	1985+	1986+	1982	1974	1973	1979+	1973	1984+	1988+	1984+	1976+	1974
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
NO DAYS PRECIP GTR OR EQ 0.5 IN	AVE.	0.1	0.1	0.5	1.4	1.8	1.0	0.7	0.5	0.6	0.5	0.3	0.2	7.7
	MAX.	2	2	2	3	5	3	2	2	2	4	2	1	13
	YEAR	1973	1987	1983+	1975	1981	1983	1985+	1979	1971+	1969	1972	1985+	1969
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	2
	YEAR	1987+	1988+	1986+	1988+	1985+	1988+	1987+	1987+	1987+	1988+	1988+	1988+	1968
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
NO DAYS PRECIP GTR OR EQ 1.0 IN	AVE.	0.	0.	0.1	0.2	0.6	0.4	0.2	0.1	0.2	0.2	0.1	0.	2.1
	MAX.	0	0	1	1	2	2	1	2	1	2	1	0	7
	YEAR	1968	1968	1983+	1984+	1983+	1983	1985+	1979	1982+	1969	1983+	1967	1983
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	0
	YEAR	1988+	1988+	1988+	1988+	1987+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1987+
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
NUMBER OF DAYS WITH HAIL	AVE.	0.	0.	0.1	0.3	1.3	1.1	0.5	0.1	0.1	0.1	0.	0.	3.4
	MAX.	0	0	1	2	3	4	2	1	1	1	0	0	5
	YEAR	1968	1968	1975	1968	1972+	1967	1976	1979+	1976	1971	1967	1967	1981+
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	1
	YEAR	1981+	1981+	1981+	1981+	1979+	1980+	1980+	1981+	1981+	1981+	1981+	1981+	1974+
	YEARS OF RECORD	14.	14.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	14.
NO. OF DAYS WITH SNOW ON GROUND (GTR OR EQ 1 INCH ON GROUND)	AVE.	14.9	7.0	4.6	1.8	0.3	0.	0.	0.	0.2	1.1	6.1	14.4	54.2
	MAX.	31	22	10	9	3	0	0	0	3	9	21	31	92
	YEAR	1988	1980	1979	1983	1979	1967	1967	1967	1985	1969	1985	1985+	1985
	MIN.	0	0	0	0	0	0	0	0	0	0	1	0	[illegible]
	YEAR	1983+	1983+	1978	1985+	1988+	1988+	1988+	1988+	1988+	1988+	1981	1976+	[illegible]
	YEARS OF RECORD	20.	18.	19.	19.	22.	22.	22.	22.	21.	20.	17.	18.	[illegible]

** NOTE : MANY WEATHER STATIONS DO NOT RECORD ALL HAIL OCCURRENCES. THEREFORE THESE DATA MAY NOT BE REPRESENTATIVE.

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Table 2.3-3. Climatic Data.

SUMMARY OF MONTHLY CLIMATIC DATA FOR GREELEY UNC COLORADO FOR YEARS 1967-1988 SUBSTATION NO. 53553 DIVISION -

LATITUDE - 40 25 LONGITUDE - 104 42 ELEVATION - 4650 FEET

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MONTHLY MEAN MAXIMUM TEMP (F)	AVE.	40.1	47.4	54.6	63.8	72.2	83.3	89.2	87.1	78.4	66.2	50.4	41.8	64.6
	MAX.	48.8	57.2	63.6	70.6	79.3	89.6	92.0	90.7	85.1	72.9	58.3	53.9	68.2
	YEAR	1981	1970	1972	1981	1974	1977	1980	1969	1977	1975	1981	1980	1977
	MIN.	27.1	37.4	47.4	54.9	66.3	75.9	86.1	83.6	72.4	53.7	38.7	26.3	61.9
	YEAR	1979	1978	1980	1984+	1983	1967	1967	1981	1985	1969	1985	1983	1985
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
MONTHLY MEAN MINIMUM TEMP (F)	AVE.	13.3	19.5	25.8	34.0	43.4	52.4	57.7	55.4	45.7	34.7	23.7	15.6	35.2
	MAX.	19.8	24.5	30.8	39.2	47.1	56.7	60.0	59.5	49.4	38.8	27.8	23.0	37.3
	YEAR	1983	1987	1986	1981	1977	1988	1980	1983	1981	1973	1981	1980	1981
	MIN.	4.6	12.4	20.2	27.4	39.8	49.1	56.0	50.7	42.0	29.7	15.8	6.0	33.0
	YEAR	1979	1985	1969	1968	1968	1982	1967	1967	1971	1969	1985	1983	1985
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
MONTHLY MEAN AVERAGE TEMP (F)	AVE.	26.7	33.5	40.2	48.9	57.8	67.9	73.5	71.3	62.0	50.5	37.1	28.7	49.9
	MAX.	33.7	39.3	47.1	54.9	62.9	73.1	76.0	75.1	66.7	55.2	43.1	38.5	52.4
	YEAR	1981	1970	1986	1981	1974	1977	1980	1983	1977	1973	1981	1980	1977
	MIN.	15.9	25.6	34.6	42.5	53.2	62.6	71.1	67.5	58.1	41.7	27.3	16.2	47.5
	YEAR	1979	1985	1969	1983	1983	1967	1967	1967	1971	1969	1985	1983	1985
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
DEGREE DAYS (BASE 65F)	AVE.	1180.2	885.5	759.7	476.8	230.7	45.4	3.7	6.9	124.9	443.7	831.2	1118.9	6103.0
	MAX.	1514	1097	935	669	366	113	25	26	244	716	1125	1509	6870
	YEAR	1979	1985	1969	1983	1983	1983	1972	1979	1985	1969	1985	1983	1985
	MIN.	964	714	545	304	97	0	0	0	22	297	651	816	5356
	YEAR	1981	1970	1986	1981	1977	1977	1986+	1986+	1969	1973	1981	1980	1981
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
NO DAYS MAX TEMP GTR OR EQ 90F	AVE.	0.	0.	0.	0.	0.6	8.7	16.2	12.5	2.6	0.	0.	0.	42.3
	MAX.	0	0	0	0	4	18	24	25	8	0	0	0	59
	YEAR	1968	1968	1967	1967	1969	1977	1980	1983	1983	1967	1967	1967	1980
	MIN.	0	0	0	0	0	0	10	5	0	0	0	0	31
	YEAR	1988+	1988+	1988+	1988+	1987+	1967	1971	1974+	1986+	1988+	1988+	1988+	1968
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	21.	22.	22.	22.	22.	22.	20.
NO DAYS MAX TEMP LESS OR EQ 32F	AVE.	8.5	3.3	1.5	0.2	0.	0.	0.	0.	0.0	0.2	2.8	6.5	22.9
	MAX.	22	10	5	2	0	0	0	0	1	2	12	18	46
	YEAR	1979	1978	1983	1973	1967	1967	1967	1967	1985	1969	1985	1983	1978
	MIN.	1	0	0	0	0	0	0	0	0	0	0	1	9
	YEAR	1986	1983+	1986+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1976	1977
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
NO DAYS MIN TEMP LESS OR EQ 32F	AVE.	30.5	27.1	25.9	12.2	1.5	0.	0.	0.	1.4	12.0	25.8	30.2	166.3
	MAX.	31	29	30	24	5	0	0	0	7	20	30	31	183
	YEAR	1988+	1984+	1980+	1968	1967	1967	1967	1967	1985	1969	1979	1988+	1984
	MIN.	28	24	19	3	0	0	0	0	0	3	19	28	146
	YEAR	1970	1971	1986	1969	1987+	1988+	1988+	1988+	1988+	1974+	1987	1987+	1974
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
NO DAYS MIN TEMP LESS OR EQ 0 F	AVE.	4.6	1.1	0.2	0.0	0.	0.	0.	0.	0.	0.	0.4	2.7	9.1
	MAX.	12	7	2	1	0	0	0	0	0	0	2	13	21
	YEAR	1979	1985	1976	1975	1967	1967	1967	1967	1967	1967	1985+	1983	1979
	MIN.	0	0	0	0	0	0	0	0	0	0	0	0	2
	YEAR	1983+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1988+	1984+	[illegible]
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	21.
HIGHEST TEMPERATURE (F)	TEMP	74	76	81	87	93	101	103	102	97	89	79	75	
	YEAR AND DAY	198226	198625	198630	198125	197428	198824	197609+	197506	197707	197907	198007	198017	
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22.	
LOWEST TEMPERATURE (F)	TEMP	-25	-19	-4	-3	25	35	42	41	17	5	-7	-22	
	YEAR AND DAY	198418	198502	197606	197502	198312	197511	197130	196831	198530	196914	197229	197206	
	YEARS OF RECORD	21.	21.	22.	22.	22.	22.	22.	22.	22.	22.	22.	22	

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DEPARMENT OF ATMOSPERIC SCIENCE
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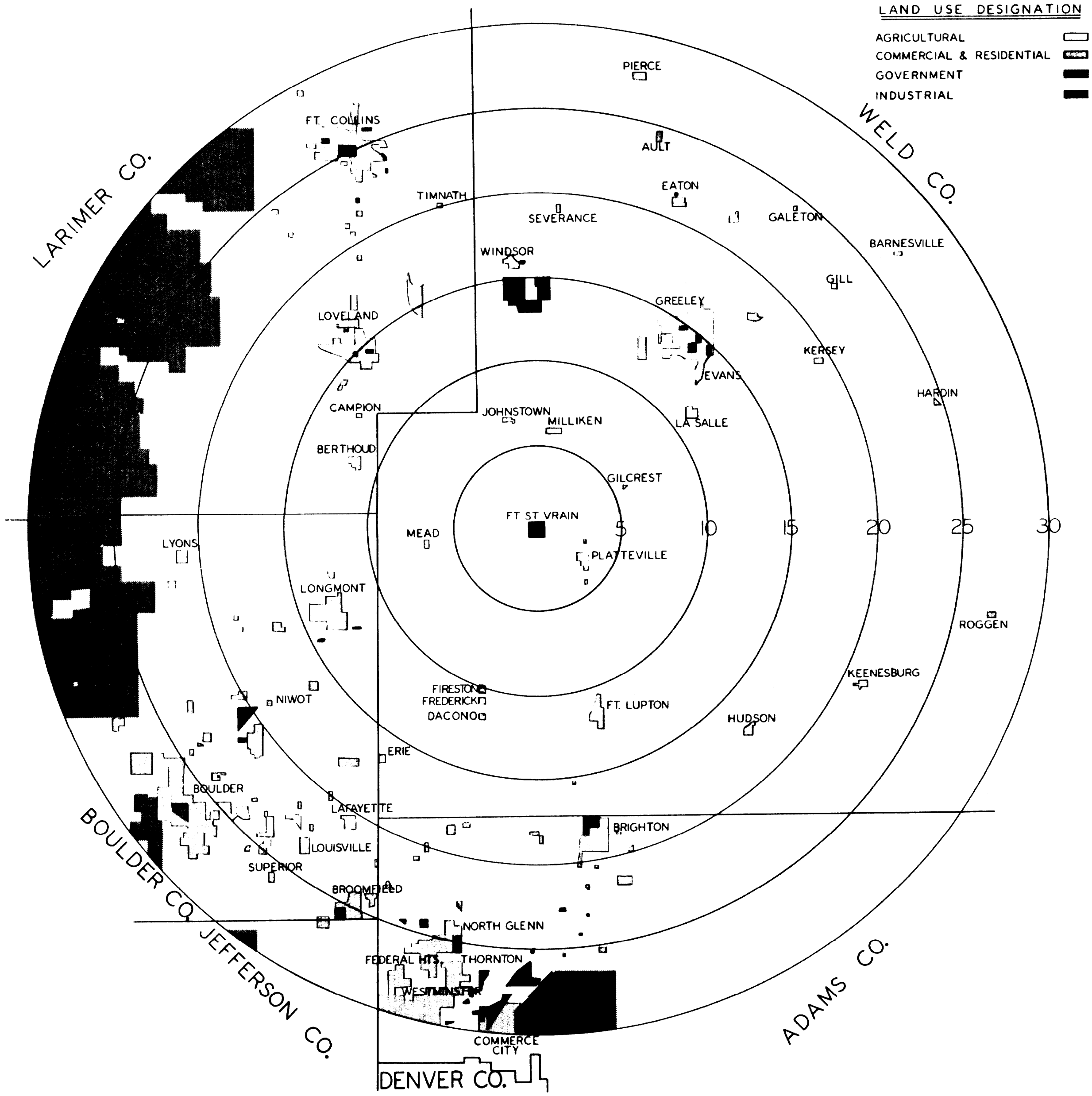
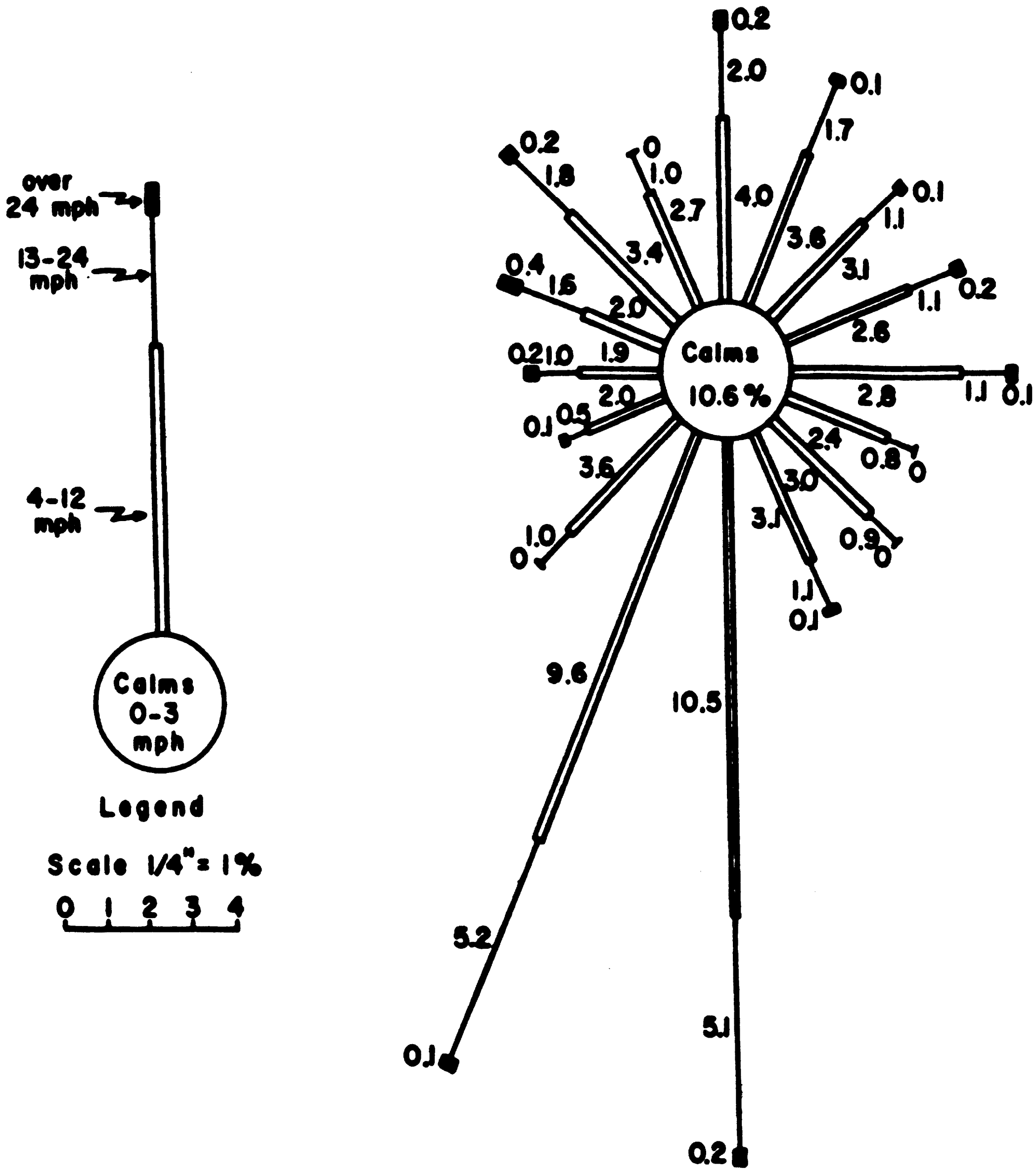
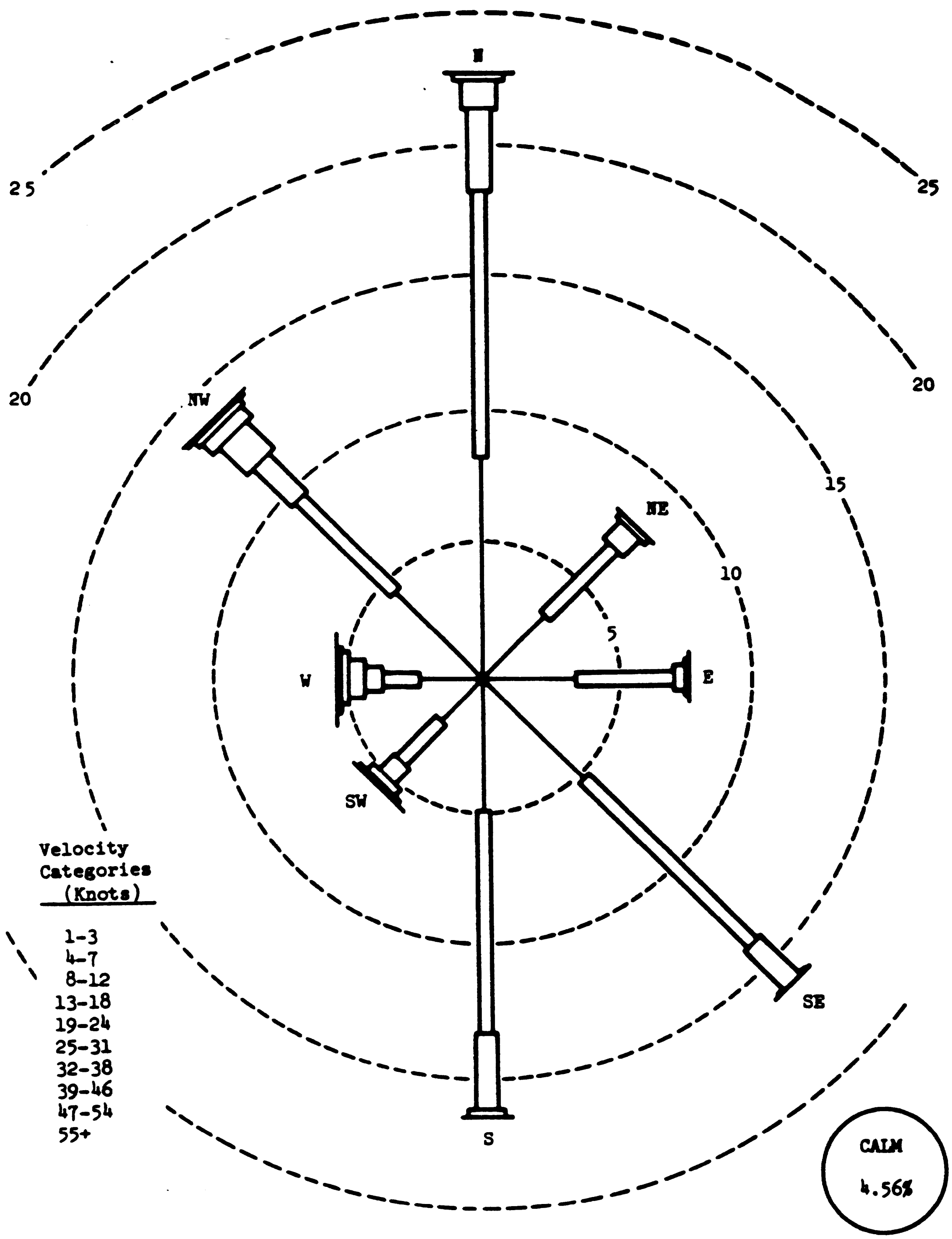


Figure 2.3-1. 30 Mile Radius From Fort St. Vrain.



Wind Rose from Stapleton International Airport, Denver, Colorado, Based on Ten Years of Data, 1951–1960. Numbers Plotted Along the Radial Arms of the Wind Rose are Percentage Frequencies of Winds at Class Intervals 4–12, 13–24 and Over 24 mph (Courtesy: U.S. Weather Bureau, Denver).

Figure 2.3-2. Wind Rose Diagram, Denver.



Annual Wind Rose, Fort Collins, Colorado, 1954–1963 (42,510 Observations). Wind Speed Classes as Indicated in the Diagram (Samson, 1965).

Figure 2.3-3. Wind Rose Diagram, Fort Collins.

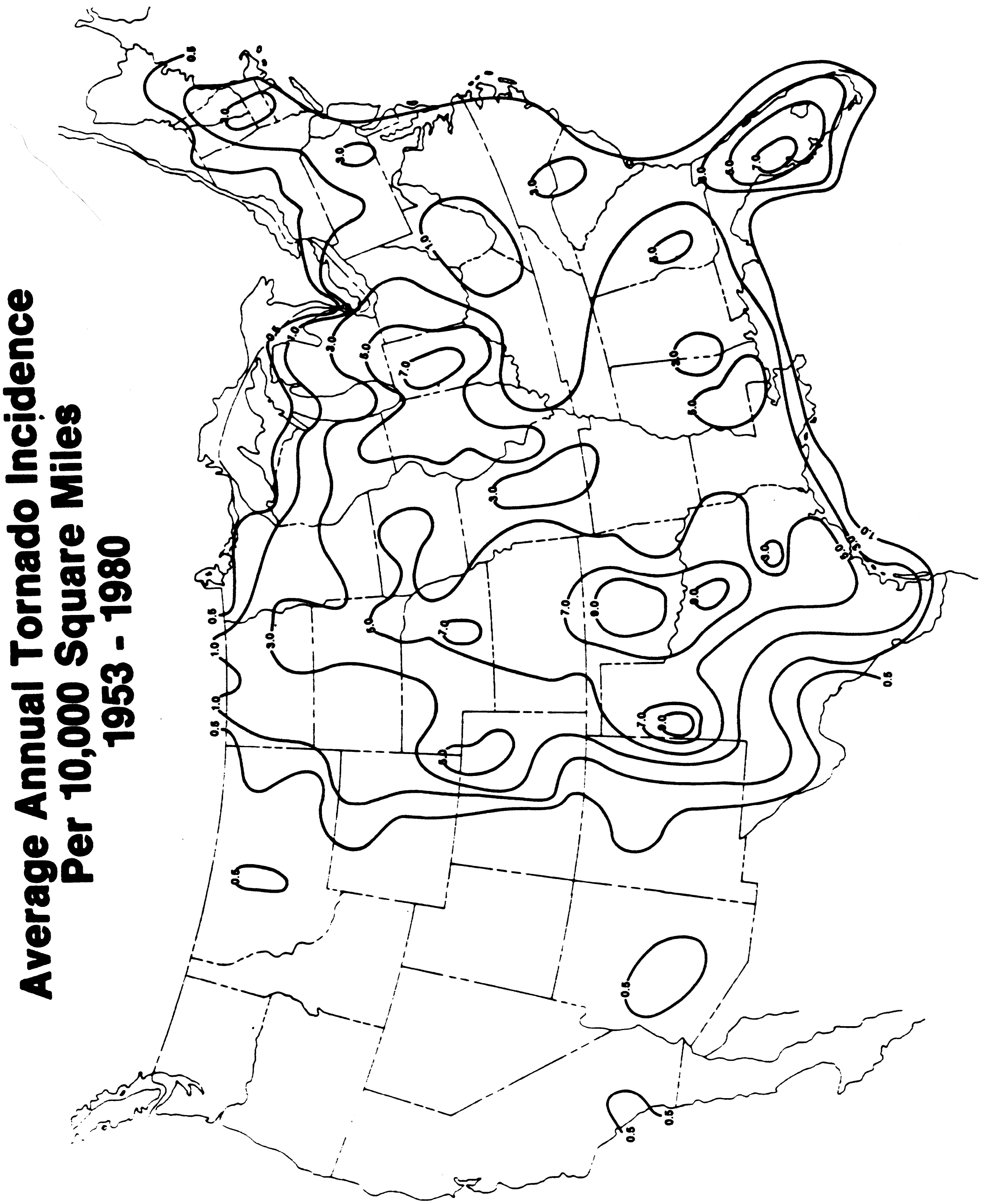


Figure 2.3-4. Average Annual Tornado Incidence.

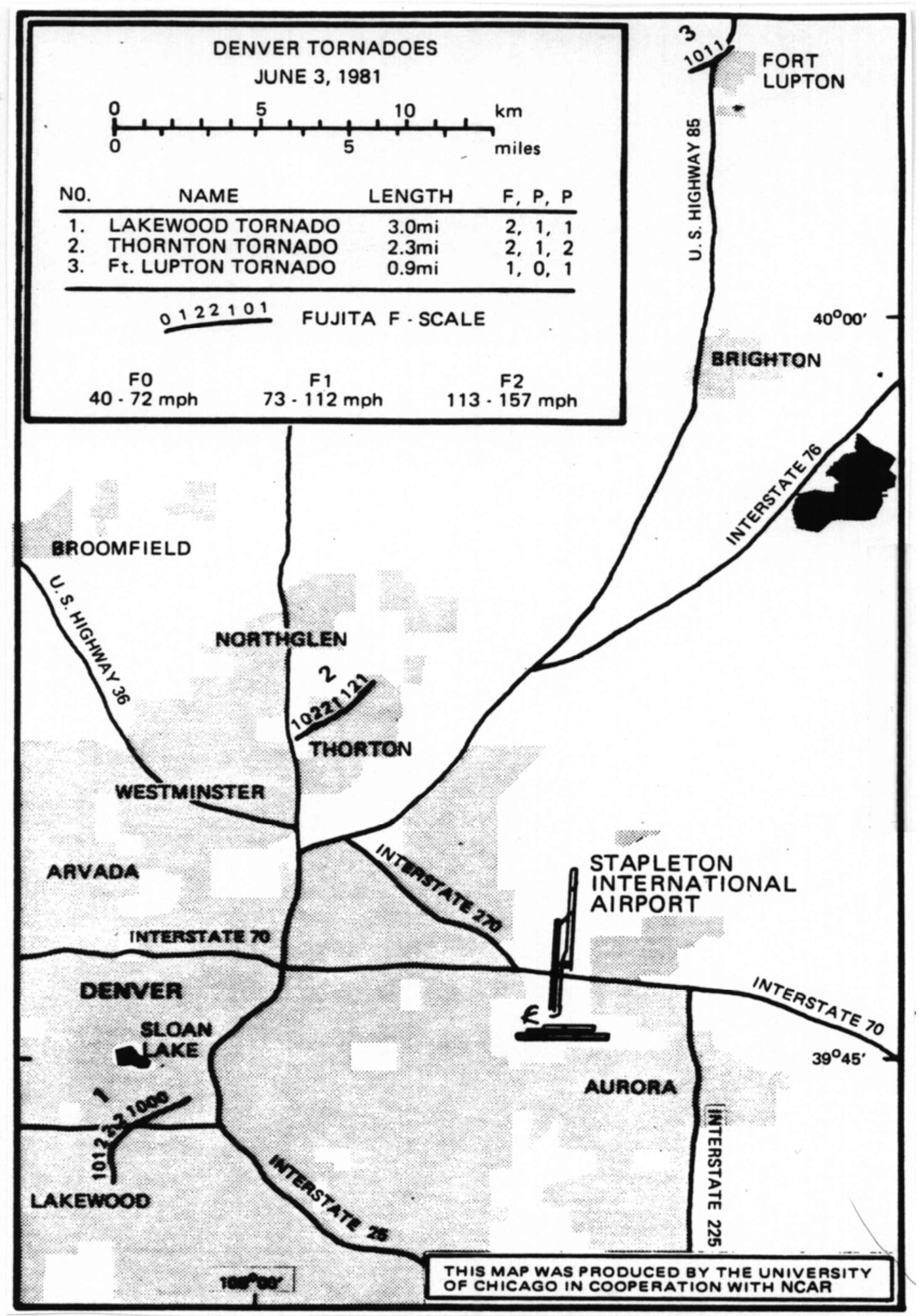
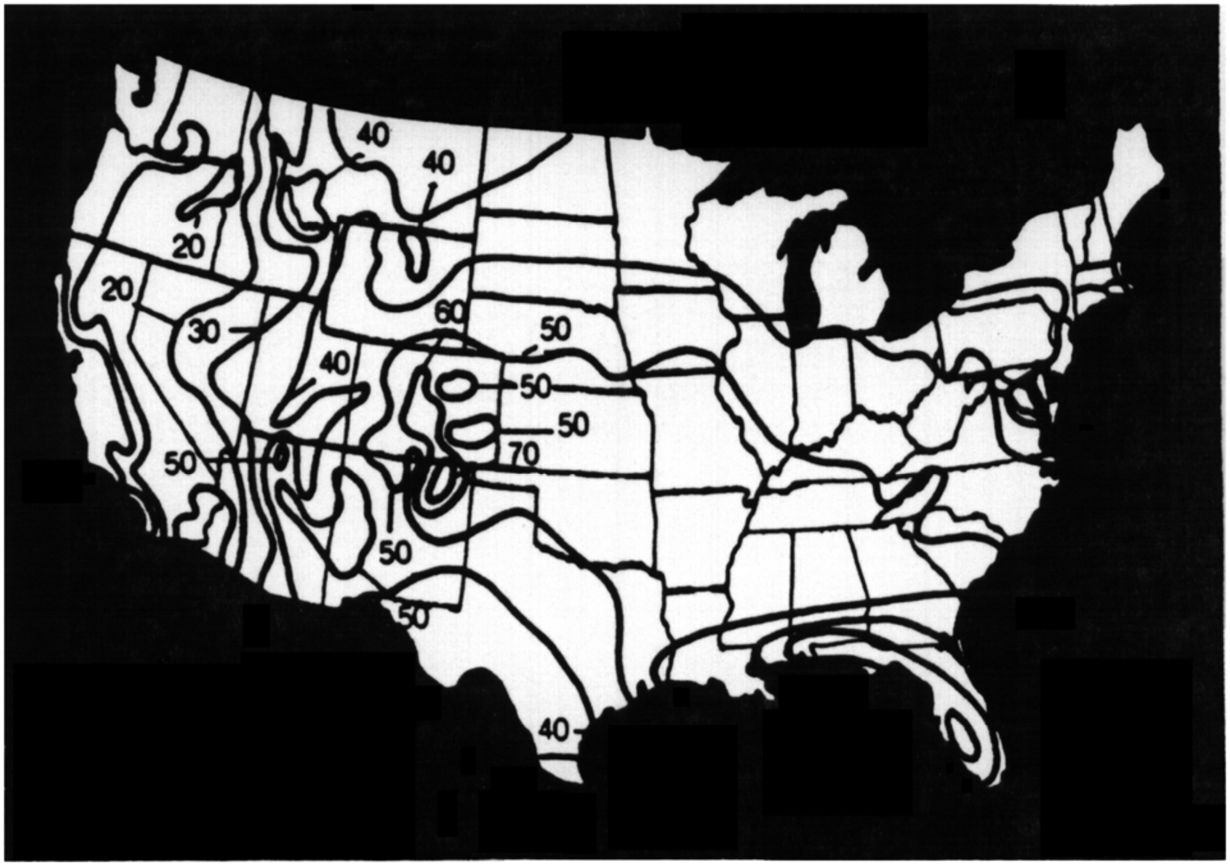


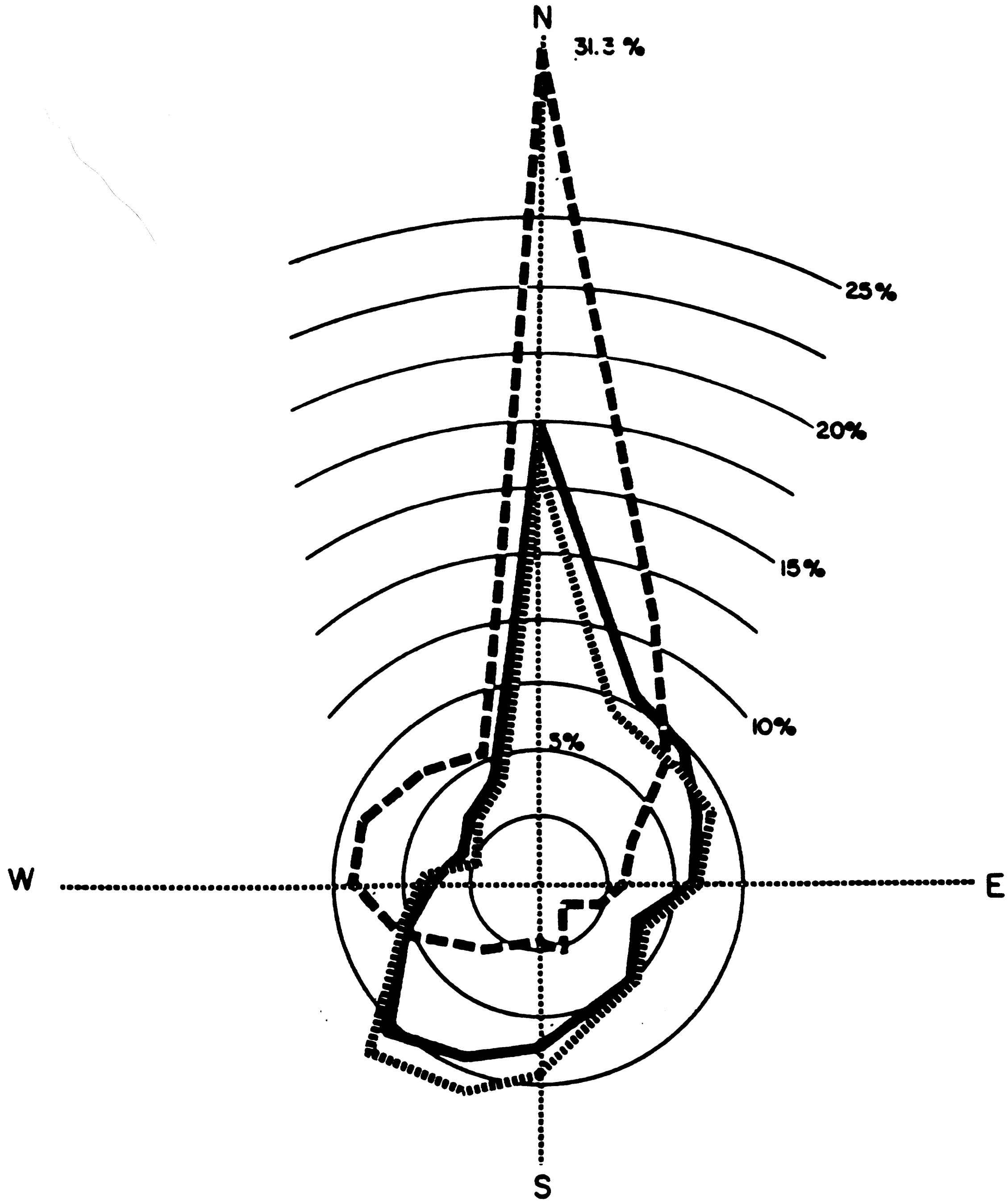
Figure 2.3-5. Denver Tornadoes, June 3, 1981.



Contourlike lines show average number of days per year thunder is heard in various parts of U.S. Florida leads by a wide margin.

Source: Weisel, Edwin P. "Lightning: The Underrated Killer." NOAA Reprint, Vol. 6 No. 2, April 1976.

Figure 2.3-6. Average Frequency (Days) of Thunder Heard.



Percent Frequency of Occurrence of Wind Directions, Fort St. Vrain. Full Line: All Wind Speeds; Dotted Line: Speeds ≤ 4 mph; Dashed Line: Speeds > 13mph. (Calm: 1.01 % with Speeds < 0.1 mph; 2.81 % with Speeds < 0.2 mph).

Figure 2.3-7. Frequency of Occurrence of Wind Direction, Fort St. Vrain.

2.4. Hydrology

This section describes the surface and subsurface hydrology of the FSV ISFSI facility and surrounding vicinity. The ISFSI location is between the South Platte River and St. Vrain Creek about two miles south of the confluence of these two streams. Four ditches traverse portions of the XCEL owned, FSV power generating facility property and the surface water rights are owned by them. No ditches cross the FSV ISFSI property owned by DOE. In addition, nineteen shallow wells are located on the FSV power generating facility site. One monitoring well has been drilled on the FSV ISFSI site.

Flow of ground water on the site is toward the alluvial deposits of both the South Platte River and St. Vrain Creek. This is illustrated by Figure 2.4-1 which shows the contours of bedrock on the site. The contours of the water table shown in Figure 2.4-2 indicate that the flow of ground water is predominately toward the South Platte River Valley.

The presence of the ISFSI facility does not change the hydrology of the FSV site. No water is diverted from the South Platte River or St. Vrain Creek for use at the ISFSI. Surface runoff at the ISFSI due to precipitation is not noticeably altered as the runoff continues to flow toward the South Platte River Valley once outside the FSV ISFSI site, following the natural contour of the land.

2.4.1. ISFSI Facility Water Supply

No cooling water is required for the operation of the ISFSI because the MVDS structure is designed to provide a passive self-regulating cooling system that induces buoyancy driven ambient air to flow across the exterior of the fuel storage containers.

Domestic water for the administration building is supplied via a ~~new~~ line tapped into the existing Weld County water distribution system. The total annual water usage will be minimal with the majority used for sewage disposal and personal hygiene.

2.4.2. Plant Effluent

By design, there is no effluent from the MVDS structure since there is no active source of water inside the MVDS. As a precaution, provisions have been made in the MVDS design to discharge any water that may accumulate inside the vaults. The floors of the vaults are sloped to cause any accumulated water to flow into a drainage trench which in turn discharges the water into a pipe that protrudes from the exterior of the MVDS. The pipe has a valve that is normally closed, and the end of the pipe is capped. Routine surveillances check for water buildup inside the pipe. The water is tested for contamination prior to its disposal.

The effluent from domestic water used at the administration building is discharged into the septic system.

2.4.3. Floods

The largest floods ever recorded in the South Platte River Valley in the vicinity of the site occurred June 16-17, 1965 and May 6, 1973.

The 1965 flood was a result of torrential rains in the drainage area of tributary streams upstream from Denver. The reported maximum discharge of 40,300 cfs in the South Platte River at

Denver on June 17, 1965, exceeded the previous recorded maximum of 22,000 cfs in 1938. Discharge of the South Platte River at Henderson was calculated to be 29,600 cfs, compared to the previous maximum of 14,800 cfs. The recorded gage height of 12.93 ft. was higher than the previous recorded maximum of 11.35 ft. in 1957. However, damage at the FSV site was relatively minor, and was confined primarily to the area around the small reservoir at the north end of the site. The crest was about 7 ft. below the elevation at the ISFSI location, and due to the wide low area east of the river, it is inconceivable that the ISFSI location could ever be flooded by the South Platte River.

The 1973 flood was caused mainly by rainfall, amounting to as much as 6 inches, which had begun on May 5. The rainfall runoff was augmented by mountain snowmelt runoff which also was increasing during this period. Discharge of the South Platte River at Henderson reached 33,000 cfs, which exceeded the maximum flow rate measured during the 1965 flood, although the 1973 gage height reached 11.67 ft., which was more than a foot below the 1965 level. In the immediate vicinity of the FSV site, the high water mark reached an elevation of 4,734.3 ft., which was well below the ISFSI grade elevation of 4,781 ft. and below the foundation elevation of 4,781. No significant damage occurred at the site as a result of this flood.

Discharge in St. Vrain Creek at the mouth reached a maximum during the period of the 1965 flood, of 2,800 cfs, on June 18, 1965; and reached a maximum, during the period of the 1973 flood, of 5,620 cfs, on May 7, 1973. These flow rates were not abnormal for high flow conditions, and were considerably below the maximum recorded discharge of 11,300 cfs in 1938. Information obtained from the local office of the United States Geological Survey (USGS) indicated that the flood discharge for a flood recurrence interval of 50 years on St. Vrain Creek would be 27,000 cfs. Extrapolation would incident a discharge of 34,400 cfs for a recurrence interval of 100 years.

The simultaneous occurrence of the maximum recorded discharges in the South Platte River and St. Vrain Creek would not cause damage at the ISFSI location. However, floods of the same or larger magnitude as the 1965 and 1973 floods could occur in the future. To determine the flood hazard posed by the South Platte River in Weld County, 10-year, 50-year, 100-year, and 500-year floods were analyzed by the Omaha District of the Corps of Engineers. The evaluation - discharge curve for these floods is shown in Figures 2.4-3a and 2.4-3b (Ref. 20). The 500-year flood is not the largest flood that can occur, but the probability of larger floods is remote. In the immediate vicinity of the FSV site, the higher water mark corresponding to the 500-year flood is approximately 4,773 ft. (Ref. 21).

Additionally, the Omaha District Office of the Corps of engineers was requested to provide an estimate of the maximum probable flood discharge that might develop in the south Platte River basin between the Chatfield reservoir, which was completed in 1973, and the plant site. The following paragraph (taken from Ref. 20) summarizes the reply received from the Omaha District Office:

> The peak discharge of the probable maximum inflow hydrograph computed for Chatfield reservoir was 548,000 cfs. The uncontrolled drainage area between Littleton and Fort Lupton is 1,556 sq. miles. It is estimated that a maximum discharge of about 500,000 cfs would occur as a result of centering a probable maximum storm over the basin between Chatfield dam and the plant site. Hydraulic computations indicate that the stage for this discharge would be from 12 to 15 ft. above the flood plain in the vicinity of the plant.

The elevation of the flood plain was not specified by the Omaha Office. If a flood plain elevation of 4,765 is assumed, the estimated water level would be 4,777 to 4,780 ft. Thus the ISFSI facility, at grade elevation of 4,781 ft., would be between zero and four feet above the high water mark of the maximum flood discharge of the South Platte River. Due to the flat topography of the area, the depth of water at the ISFSI facility would only be on the order of a few inches, and thus would not have any significant velocity or force associated with it.

To check the estimated water level for a maximum discharge of 500,000 cfs, calculations were made using the slope-area method (Ref. 22). Two cross-sections were selected in the South Platte River Valley east of the plant as a basis for the calculations. One section was taken about 1,800 ft. north of the south boundary of Section 11, Township 3N, Range 67W; the other was taken about 150 ft. south of the north boundary of Section 11, Township 3N, Range 67W. The distance between the two reaches was 3,300 ft. Elevations within the site boundary were determined from topographic site survey maps. These topographic survey maps were prepared by the photogrammetric method as part of preliminary site investigation work. The maps were plotted to a contour interval of one foot west of the South Platte River, and a contour interval of two feet east of the river. It was specified that plotting accuracy would be such that 90% of the contours would be within one-half of the basic contour interval. For the area to the east of the property boundary, elevations were inferred from standard USGS topographic maps in the 7-1/2 minute series. Contours on these maps were found to correlate very well with those determined by the photogrammetric survey in the area east of the river.

Discharge for a reach between two cross-sections may be computed directly by the following equation if the water level at the two sections is known:

$$Q = \sqrt{\frac{\Delta h}{\frac{L}{K_1 K_2} + \frac{1-k}{2gA_2^2}\left[1 - \left(\frac{A_2}{A_1}\right)^2\right]}}$$

where :

Q = discharge, cfs

K = 1.486 $AR^{2/3}$ x 1/n, cfs

n = roughness coefficient, $ft^{1/6}$

A = cross-sectional area, sq. ft.

R = hydraulic radius, ft.

Δh = difference in water level surface at two sections, ft.

L = length of reach, ft.

k = coefficient, zero for contracting reach, 0.5 for expanding reach.

To determine water elevations versus discharge by this equation, water levels were arbitrarily selected at the first cross-section and a trial and error solution was used to determine the elevation at the second cross-section which would result in the maximum calculated discharge. Velocity head at each of the two sections was taken into account in checking the calculated discharge.

The river stage calculated at a cross-section directly east of the plant for the maximum probable flood discharge of 500,000 cfs was 4,777.75. This is about 3 ft. below the facility grade elevation of 4,781, and compares very well with the Corps of Engineers computations. Thus it may be safely concluded that, even for the maximum probable flood discharge in the South Platte River, the plant would not be subjected to direct flooding by the flood discharge in the river valley.

However, while no direct flooding of the plant would occur in the maximum portable flood, covered or damaged roadways could isolate the plant. In the event of such a flood, helicopters or small water craft would be utilized to transport necessary personnel, equipment and supplies to the site.

The MVDS structure is located about 500 feet east of the FSV generating station storage ponds. An analysis has been performed to determine the bounding depth and velocity of water flowing from a breach of the FSV storage ponds. The conservative analysis resulted in a bounding water depth of 6 feet and velocity of less than 10 ft/sec. The MVDS structure has been designed to withstand the forces developed by the bounding case, as well as the partial blockage of the cooling air intake (see Section 3.2.2).

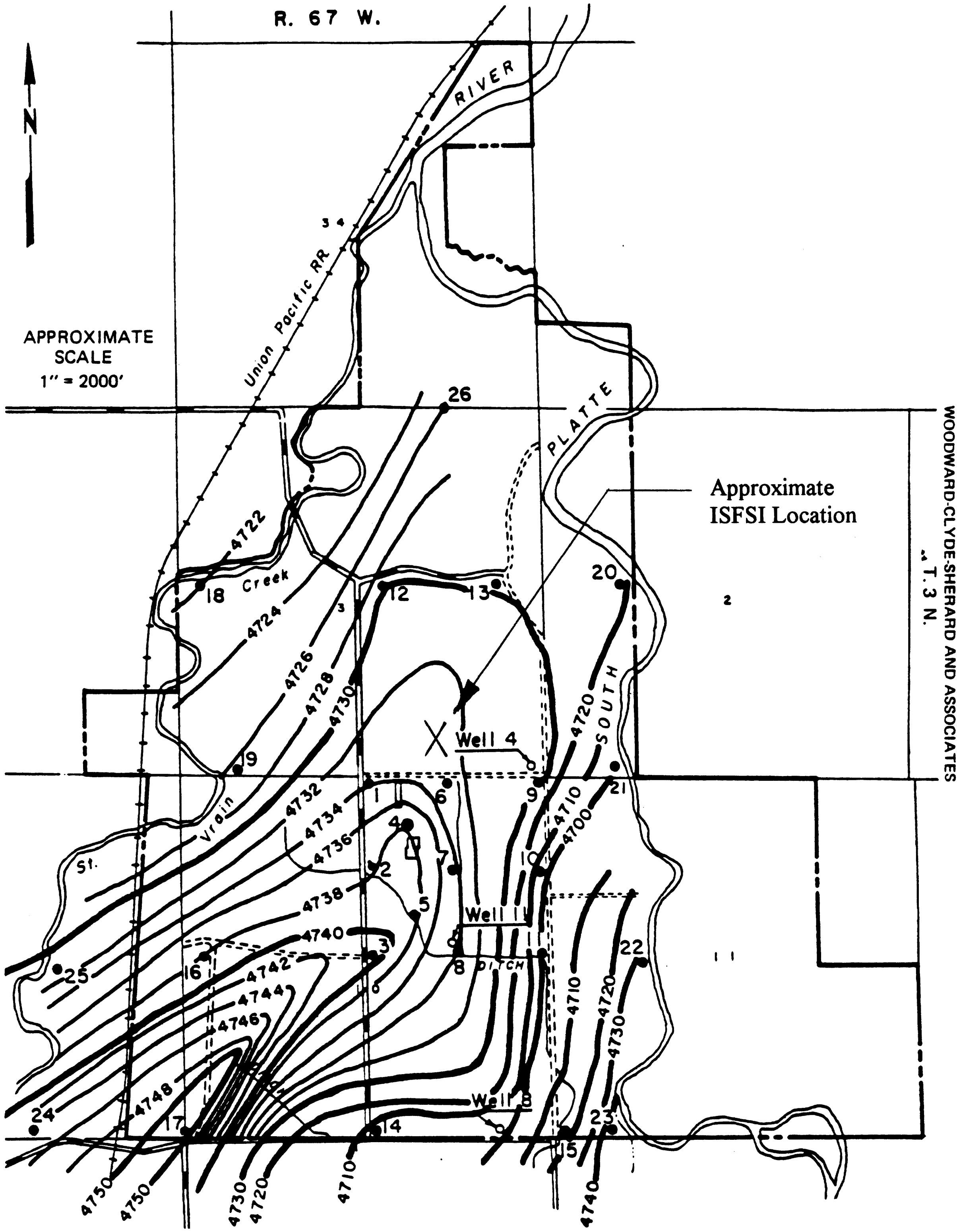


Figure 2.4-1. Estimated Bedrock Contours Surrounding the FSV ISFSI.

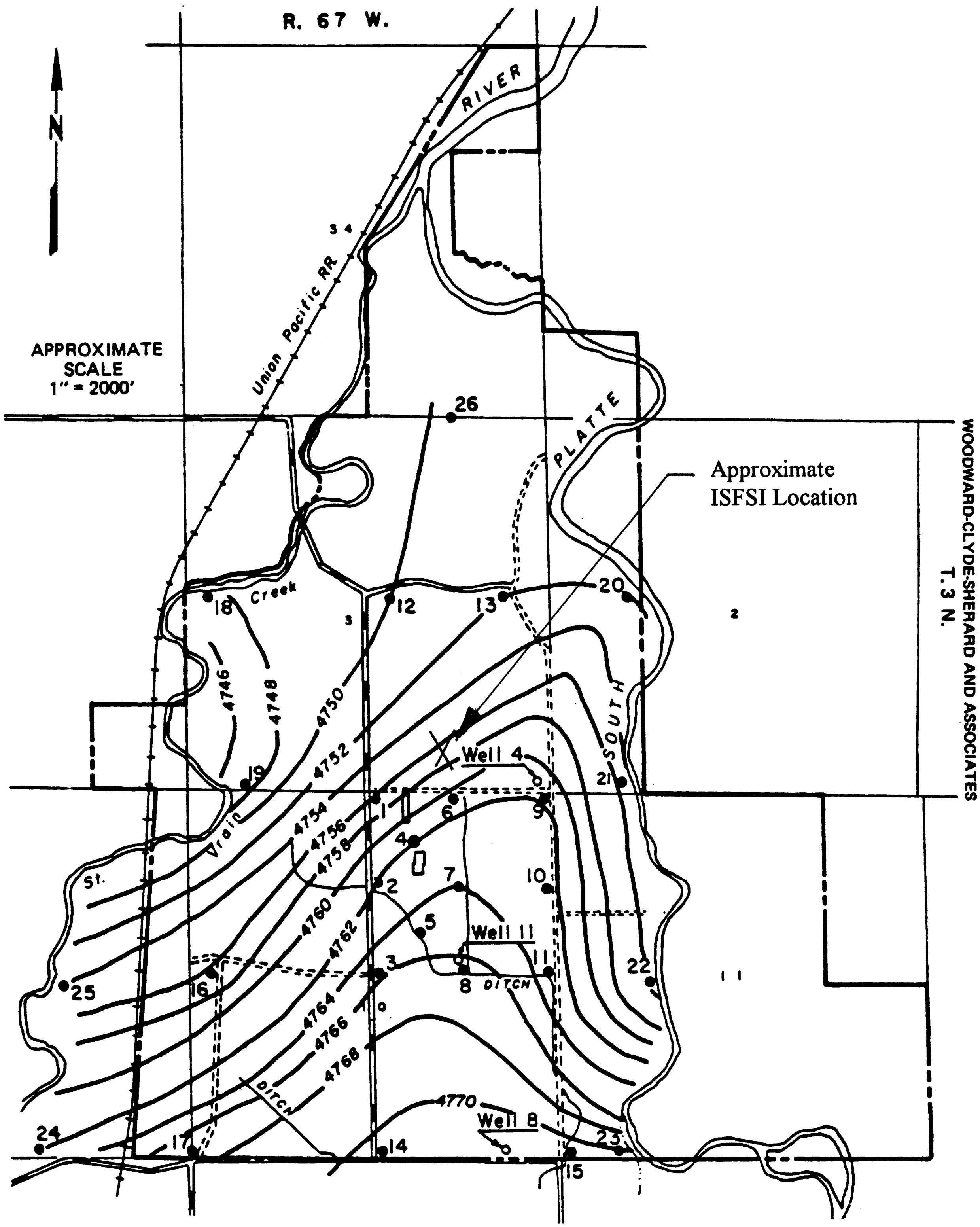


Figure 2.4-2. Estimated Water Table Contours Surrounding the FSV ISFSI.

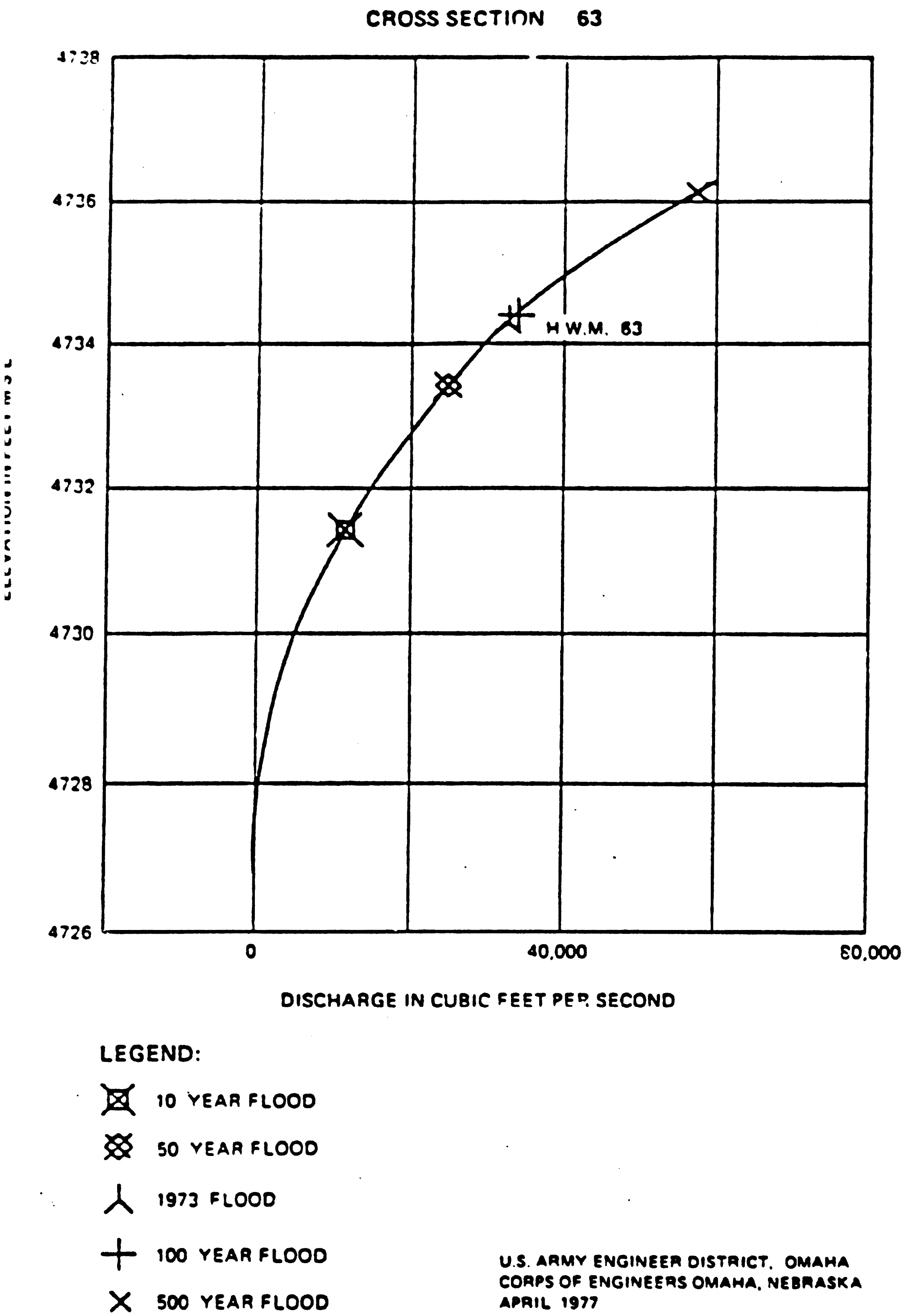


Figure 2.4-3a. Elevation - Discharge Curve, South Platte River Basin.

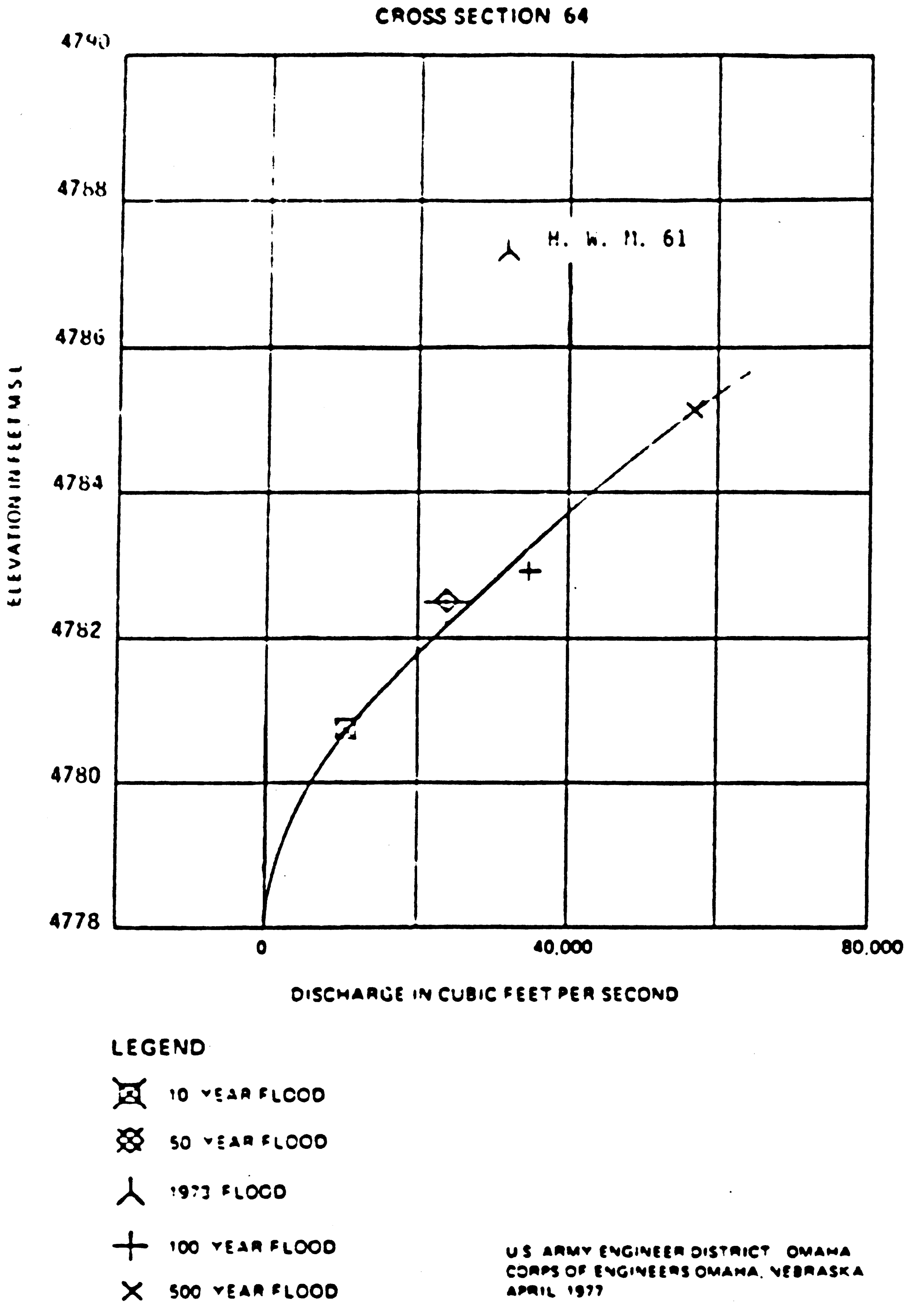


Figure 2.4-3b. Elevation - Discharge Curve, South Platte River Basin.

2.5. Geology And Seismology

The original surficial geology and seismology of the former FSV reactor site was investigated by the Colorado School of Mines Foundation. The results of the investigation are described in the final report, "Geology and Seismology, Fort St. Vrain Nuclear Generating Station Near Platteville, Colorado," Colorado School of Mines Foundation, May 1967 (Reference 23). Site specific soils investigation for the ISFSI facility was performed to determine the geotechnical criteria for design of the MVDS structure and administration building.

2.5.1. Regional Geology

The geologic structure of the general area in which the ISFSI site is located is shown in Figure 2.5-1.

The geologic map in Figure 2.5-2 covers about 20 square miles around the ISFSI site and was prepared from field investigations, photogeologic interpretation and analyses of core samples from drill holes. The field and photogeologic information was compiled on a base map constructed from portions of U.S.G.S. topographic maps of the Gowanda, Johnstown, Milliken, and Platteville Quadrangles.

The area contains the confluence of St. Vrain Creek with the South Platte River. The most striking topographic feature of the area is the abrupt northeast-southwest trending escarpment along the northwest side of St. Vrain Creek and the South Platte River. Over most of the area, the topography is characteristically the near flat, stepped topography formed by several terrace levels along the major drainage.

The area of Figure 2.5-2 lies mainly in the valley of the South Platte River. Rocks of Cretaceous and Quaternary ages that have been identified in the area are listed on Table 2.5-1. No rocks of Tertiary age have been recognized in this vicinity. The valley of the South Platte was cut in rocks of Cretaceous age and has undergone repeated filling and cutting by streams during the Quaternary with the result that the modern valley of the South Platte is developed primarily of Quaternary alluvial deposits.

See Reference 23 for a detailed description of the Cretaceous rocks and Quaternary alluvial deposits.

2.5.1.1. Storage Site Geomorphology

The early stages in the geomorphic development of the area must be inferred from areas outside that shown on Figure 2.5-2. The surficial sediments and the present topography reflect primarily changes in the South Platte River and its tributaries during the late Quaternary.

During the Tertiary period, sediments were deposited and then removed by streams which were probably ancestral to the modern South Platte River. The earliest stage of topographic development evident in this area is the sedimentation in the early Pleistocene which produced the Verdos Alluvium, suggesting that the South Platte may have been as much as 150 feet higher than at present.

Subsequent to the development of the pediment beneath the Verdos, the streams began deepening their channels in the Cretaceous rocks. Aggradation in the channels of the major streams led to the deposition of the "Older Quaternary Valley Deposits." Most probably these deposits represent not a single episode of deposition but rather a relatively long period of repeated deposition and removal of material. The present topography and surficial deposits represent only the latter phases in the cutting-filling of the valley deposits.

By late Wisconsin time, the Valley had been filled to approximately the level of the top of the terrace formed by the Broadway Alluvium, which represents the channel-flood plain deposits of the late-Wisconsin South Platte River.

During recent time, the river cut through the Broadway Alluvium to develop a lower flood plain on which the Piney Creek Alluvium was deposited. Most recently, the river again lowered its channel to about the present level and the Post-Piney Creek Alluvium began to accumulate.

The repeated history of post-Tertiary erosion and deposition in the valley of the South Platte River reflects climatic changes in the mountains to the west. Episodes of glaciation and deglaciation altered both the flow characteristics of the streams and the availability of sediment. The topography and Quaternary sediments of the valley suggest a Quaternary history of climatic changes rather than changes in the base level induced by uplift.

2.5.1.2. Storage Site Structural Geology

Although exposures of the pre-Quaternary rocks are very limited in the mapped area, the information available indicates that the structural geology of the area is relatively uncomplicated. The area lies within the Denver Basin and is relatively close to the axis of the basin. In the area of the map, the Cretaceous rocks are nearly flat-lying. In the northwest part of the map where Cretaceous rocks are exposed, the beds dip gently to the east. Maximum dip of the Cretaceous beds is 1-1/2 to 2 degrees. Outside the area to the east, the dip is to the west.

A soil and foundation investigation of the site area was performed by CTL/Thompson, Inc. Test holes were drilled for the MVDS structure and the administration building, and soil samples were retrieved. During the sampling process, the relative density, stiffness or hardness of the soils and bedrock layers were estimated by penetration tests. The samples from the test holes were returned to the laboratory for classification and testing. Laboratory testing included natural moisture content and dry density, gradation, Atterberg limits, water soluble sulfate, compaction and R value (Hveem stabilometer) tests. The results of the tests, including the static and dynamic engineering soil properties, are documented in Reference 24. Figure 2.5-3 shows the test bore hole locations.

Based on the soils investigation results, the maximum allowable soil bearing capacities were determined. A minimum safety factor of 2 is provided for the ultimate bearing capacity of the foundation material.

The subsoils at the ISFSI facility site are St. Vrain - Platte River alluvial sands and gravel overlying Pierre claystone/shale bedrock. Generally, there is up to 5 feet of loose, slightly clayey sand overlying 4 to 7 feet of loose and medium dense, clean to silty sand underlain in turn by medium dense to dense, silty and slightly silty sand and then very dense, gravelly sand overlying hard claystone/shale bedrock at 47 to 49 feet. The claystone/shale changed to very hard claystone/shale at 49 to 51 feet. Free water was measured in the test holes at the time of drilling at 16 and 19 feet. Logs of the test holes are presented in Figure 2.5-4.

The loose sands have moderate strength but will consolidate considerably if subjected to high soil bearing pressures. If saturated loose sands are subjected to a Design Basis Earthquake

(DBE), they are at risk of liquefaction. The medium dense and dense sands are stronger than the shallower sands and much less susceptible to consolidation even under higher soil bearing pressures. The deeper sands should not liquefy during a DBE because of their depth and higher density even though they are below the water table. The hard and very hard claystone/shale bedrock are an excellent foundation strata.

The MVDS foundation is a shallow reinforced concrete slab with its top surface at elevation 4781'. The general thickness of the slab is 3'-0" but local thicker sections are provided as required by the design. Approximately 12'-0" of loose in situ sand is excavated in the foundation area as the soils investigation has shown that this soil could be subject to liquefaction during the DBE. A compacted structural fill is replaced in the excavation in accordance with specification 362F0229, which supersedes SP1.5 (Reference 5 to Appendix A4.1.2.1), to suit the required profile of the foundation slab. Figure 2.5-6 shows the extent of excavation and backfill at the MVDS structure.

2.5.1.3. Ground Water

Flow of ground water on the site is toward the alluvial deposits of both the South Platte River and St. Vrain Creek. This is illustrated by Figure 2.4-1 which shows the contours of bedrock on the site. The contours of the water table shown in Figure 2.4-2 indicate that the flow of ground water is predominately toward the South Platte River Valley. Much of the ground water comes from the South Platte River and St. Vrain Creek, such that the water table changes with the flow rate (elevation) in the two streams. Total precipitation, mostly in the form of rain, in the South Platte Valley is small and contributes relatively little to the ground water (Ref. 3).

2.5.2. Vibratory Ground Motion

The seismic history and characteristics of the FSV site were investigated by the Colorado School of Mines Foundation. A copy of the final report, entitled "Geology and Seismology Fort St. Vrain Nuclear Generating Station near Platteville, Colorado," which presents the results of this investigation, is included in Reference23.

The following determinations were made by this report:

1. No evidence of recent faulting was discovered in this area.

2. The vast majority of Colorado earthquakes occur west of the continental divide and, like most earthquakes in the world, appear to be associated with late Tertiary and Quaternary volcanism.

3. In the last one hundred years, only two Colorado earthquakes have had an observed maximum modified Mercalli intensity of VII. The first, November 7, 1882, frightened people in Golden and Denver and caused minor damage in Louisville and Boulder, but was apparently not felt in Longmont. Taken as a whole the newspaper reports are inconsistent. The second earthquake, April 10, 1967, was well recorded. Its epicenter was between Thornton and Irondale, about twenty-five miles from the St. Vrain Valley site.

4. The Magnitude 5 earthquake of April 10, 1967 produced ground accelerations at St. Vrain Valley of .002g plus or minus .001g.

5. Based on history, it is estimated that the facility will be subjected to horizontal accelerations no larger than .02 g during its lifetime.

6. Competent bedrock (Pierre Shale) exists whose bulk and shear moduli are 1.4E+06 and 1.0E+05 psi respectively.

7. No velocity contrast exists between the water saturated overburden and the bedrock, thus precluding refraction seismic mapping of the bedrock surface.

8. No unforeseen factors appeared during the investigation that would adversely affect the choice of the site.

9. No earthquakes have ever been observed in the vicinity of Platteville. The closest active area is in northeast Denver, about 25 miles south of the FSV ISFSI site. Based on history, the maximum intensity likely to be experienced by the ISFSI facility during its lifetime will be associated with an earthquake originating in the Denver area.

Seismic occurrence data subsequent to 1967 shows that there have not been earthquakes of comparable magnitude as evaluated in References 23 and 25. These supplemental earthquake data are tabulated in Reference 26.

The procedures used to determine the design earthquake for the ISFSI site are documented in References 23 and 25.

The dynamic soil properties used in the seismic wave propagation and soil-structure interaction analyses are shown in Table 2.5-2. These property values were derived from the laboratory test results discussed in Section 2.5.1.2.

Based on the seismic history, it appears unlikely the ISFSI site will experience a significant earthquake ground motion during the life of the installation. The MVDS structure was conservatively designed to horizontal earthquake ground acceleration of 0.1g and vertical earthquake ground acceleration of 0.07g without loss of function. It is unlikely that this level of ground motion will be exceeded during an earthquake similar to any historical event.

Figure 2.5-5 shows the FSV ISFSI earthquake acceleration response spectra. The spectra have been normalized to a horizontal ground acceleration of 0.1g for the DBE.

2.5.3. Surface Faulting

The FSV site lies on the east flank of the Colorado Front Range which is a complexly faulted anticlinal arch and on which are superimposed numerous smaller folds and faults. The rocks of the core of the anticlinal arch are Precambrian crystallines, including gneisses, schists, and quartzites which have been intruded by granitic rocks that range in age from Precambrian to Tertiary. On the east flank of the arch are Paleozoic and Mesozoic sedimentary rocks.

The regional structure of this part of Colorado is characterized by sedimentary rocks dipping eastward into the Denver Basin. Along the mountain front the regional structural pattern is interrupted by relatively small, en echelon anticlines that plunge to the southeast. In addition to the fold axes, two groups of faults have been recognized. The most notable occurs along the mountain front and includes a series of faults extending in a generally northwest-southeast direction from the Precambrian into the Paleozoic-Mesozoic sediments. The second group of faults has been recognized primarily in coal mines, located generally east of Boulder. These faults have a northeast-southwest orientation. Both groups of faults are relatively high angle faults. There are no known active faults at the ISFSI facility site (Refs. 27 and 28).

The faults and the minor folds are related to the uplift of the Front Range which began in Late Cretaceous and continued into the Tertiary. The field examination and photo interpretation of the area surrounding the site location failed to indicate any evidence of recent movement along any of the known faults.

2.5.4. Stability of Subsurface Materials

As discussed in Section 2.5.1.2, up to about 12 feet of natural sand materials at the MVDS structure is excavated and reused as structural backfill material. The sands are placed in 8-inch maximum loose lifts at 4 percent below to optimum moisture content and compacted to at least 98 percent of modified Proctor maximum dry density (Ref. 29). See Figure 2.5-6 for limits of excavation and backfill. The compacted backfill and the underlying natural soil are not susceptible to liquefaction during a DBE event.

The MVDS structure's reinforced concrete mat foundation is designed to bear on soil with allowable soil bearing pressure of 2,000 psf. The estimated total settlement of the MVDS structure is on the order of 1 inch. The settlement due to dead load ~~will~~ occurred during construction and that due to live load upon first application of the live load due to the granular nature of the soil~~s~~.

The administration building is founded on continuous footings bearing on loose natural sand with maximum allowable soil bearing pressure of 2,000 psf. The estimated total settlement of the administration building is in the order of 1 inch and differential settlement~~s~~ between footings ~~will be~~is 1/2 of the total that occurred. The settlement due to dead load ~~will~~ occurred during construction and that due to live load upon first application of the live load due to the granular nature of the soil.

The loose sands underlying the administration building foundation are at risk to liquefaction if saturated and subjected to a DBE event. The administration building is not required to function subsequent to a DBE event, therefore, improvement of the soil conditions to prevent liquefaction is not necessary.

Backfill around foundations are well compacted. Backfill consisting of the onsite sands placed in thin lifts at 4 percent below to optimum moisture content and compacted to at least 95 percent of standard Proctor maximum dry density (Ref. 30).

2.5.5. Slope Stability

The ISFSI facility site is generally flat. The ground floors of the MVDS structure and administration building are situated essentially at the existing natural grade elevation. The bottom of their respective mat and spread footing foundations are founded on the alluvium soil stratum below the natural ground surface (see Figure 2.5-6). Therefore, slope stability is not a concern.

Table 2.5-1. Stratigraphic Units Identifiedi n the Area Covered by Figure 2.5-2

ERA	SYSTEM	SERIES	SUBDIVISION
Mesozoic	Cretaceous	Upper	Pierre Formation
			Fox Hills Sandstone
			Laramie Formation
Cenozoic	Quaternary (1)	Pleistocene	Verdos Alluvium
			Broadway Alluvium
		Recent	Upland Deposits
			Piney Creek Alluvium
			Post-Piney Creek Alluvium

1. In the area of Figure 2.5-2, drilling indicates that a maximum thickness of 85 feet of alluvial sand and gravel of Quaternary age overlies the Cretaceous rocks.

Table 2.5-2. Summary of In-Situ Estimated Dynamic Soil Properties for Naturally Occurring Strata at MVDS Site.

Soil Layer	Description	Density Kg/m^3	SPT 'N' Value	Relative Density %	Shear Modulus Kn/m^2	Poissons Ration	Shear Wave Velocity m/s
1	Loose Sands	1,666	5	40	28,587	0.38	131
2	Medium Dense Sands	1,858	6	50	70,260	0.35	195
3	Dense Sands	2,018	20	70	155,730	0.35	278
4	Dense Gravel	2,098	40	80	206,921	0.35	314
Rock	Hard Sandstone	2,323	>40	Not Estimated	1,792,700	0.15	878

SOURCE: Reference 31

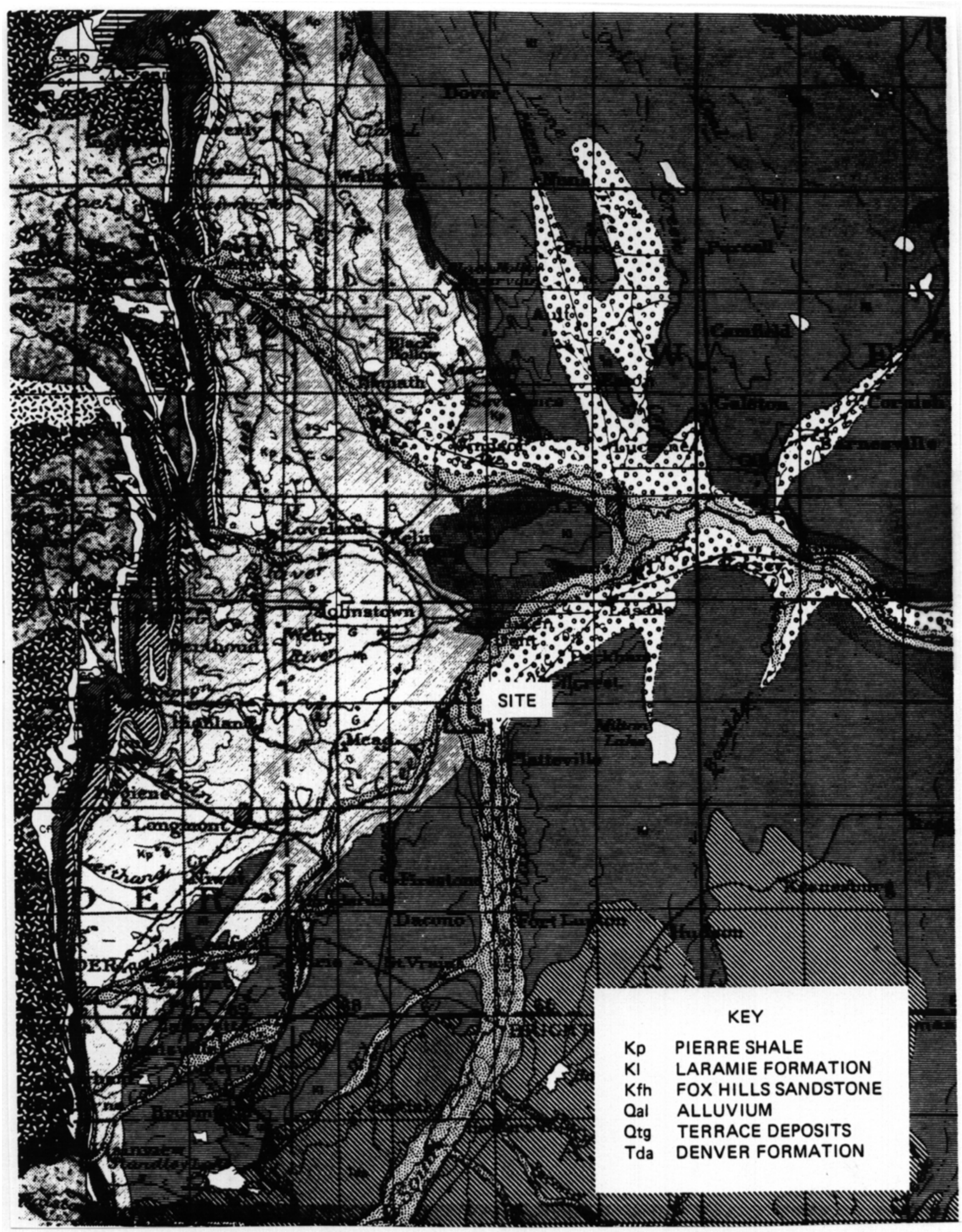


Figure 2.5-1. Subsurface Geology of the Area Surrounding the Site.

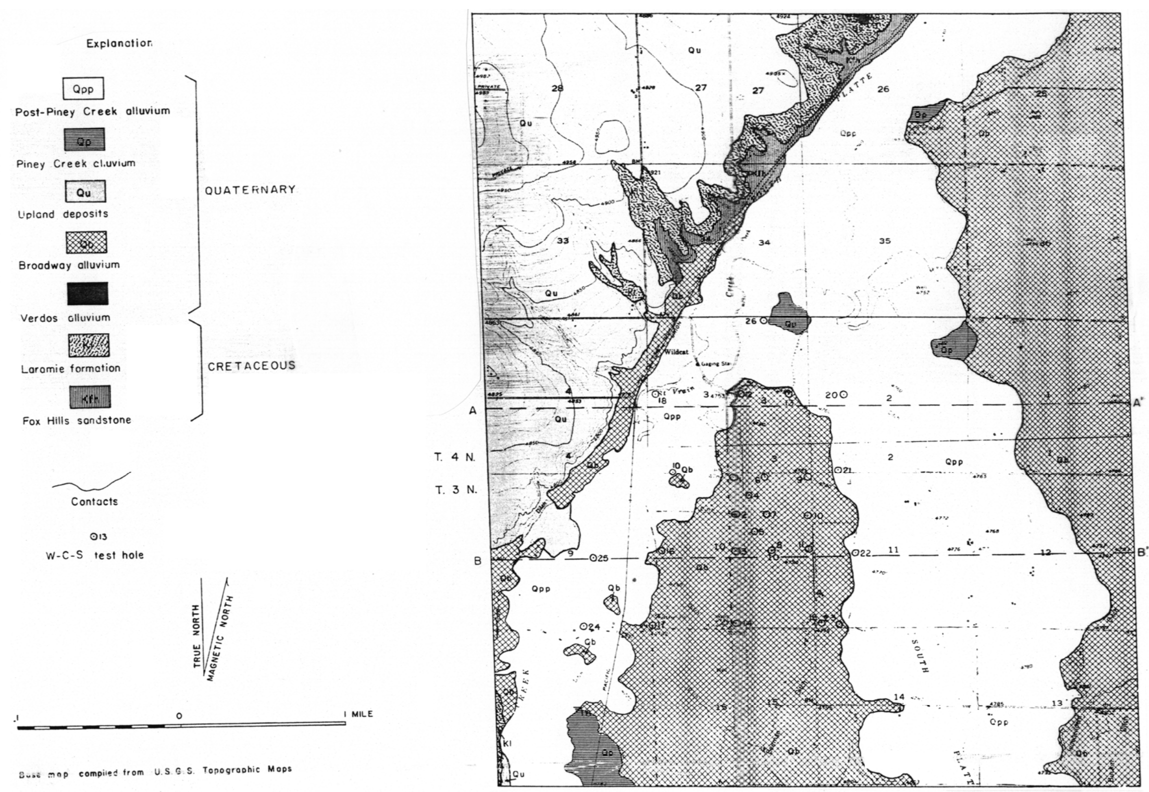


Figure 2.5-2. Geologic Map of the Fort St. Vrain Site, Weld County, Colorado.

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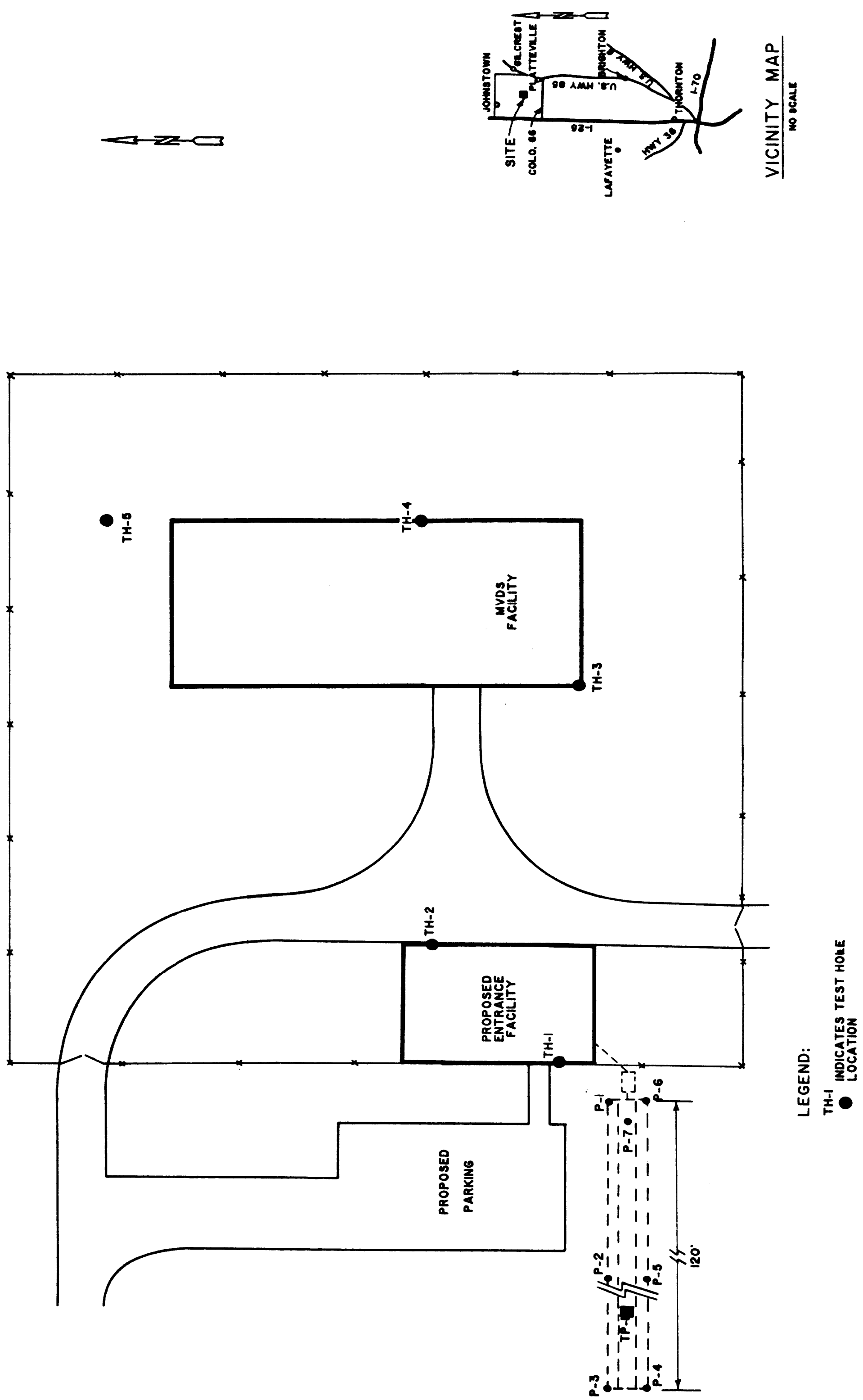

Figure 2.5-3. ISFSI Facility Test Bore Hole Location Plan.

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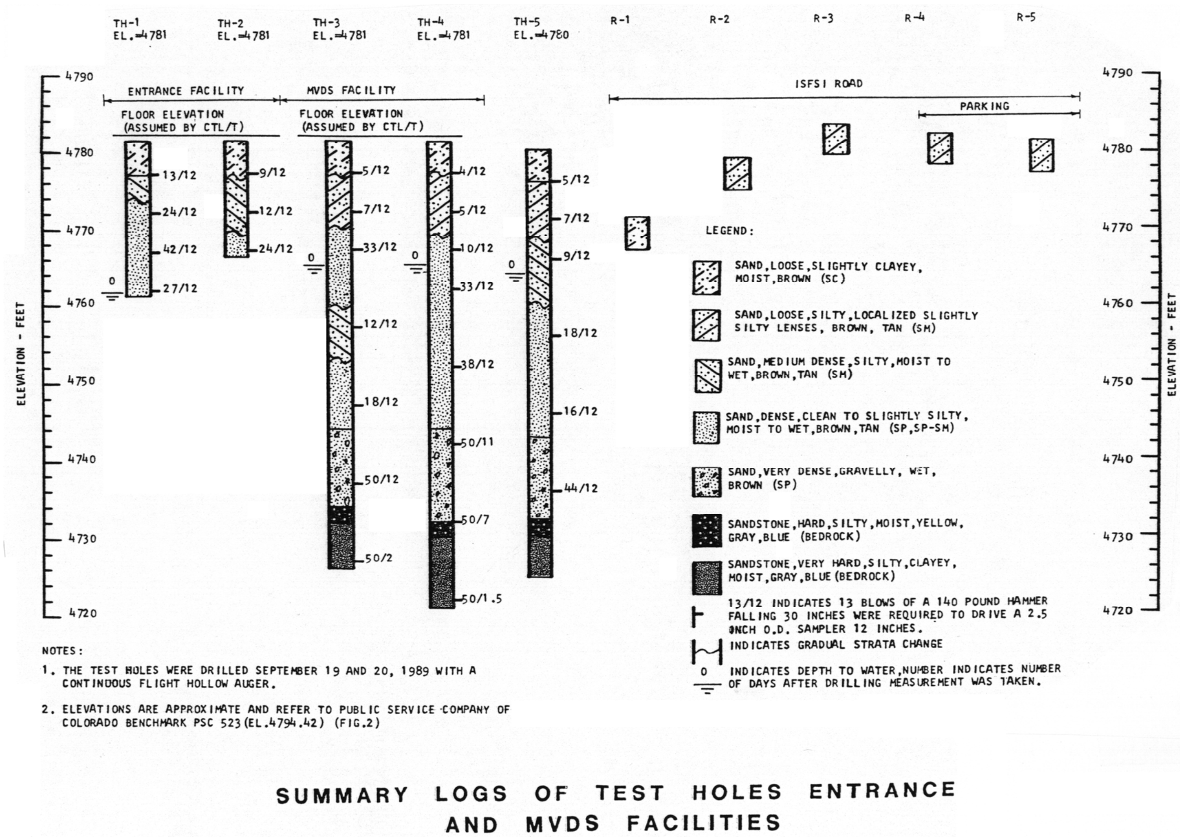

Figure 2.5-4. Summary of Logs of Test Holes.

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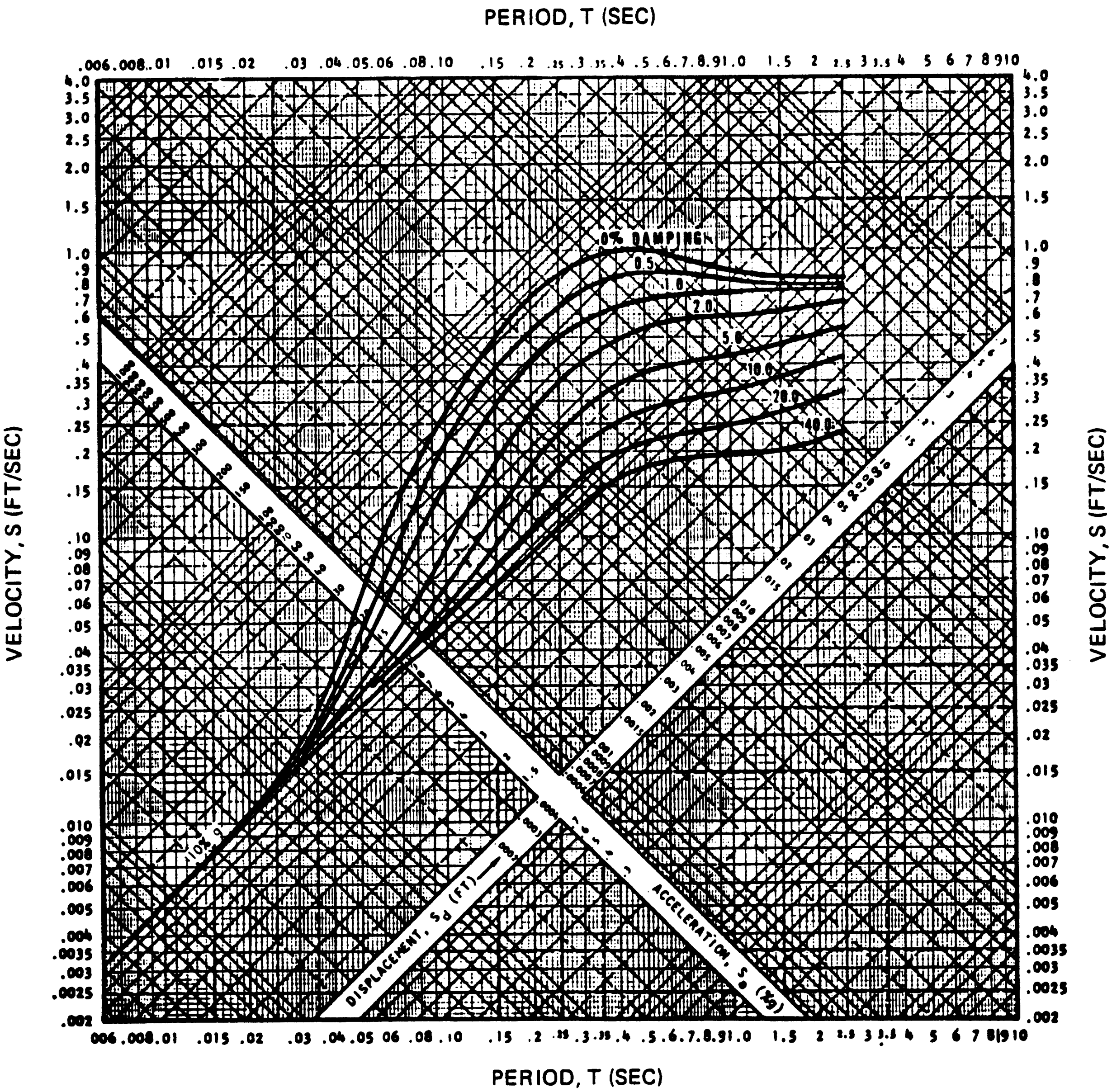

Figure 2.5-5. Earthquake Acceleration Response Spectra.

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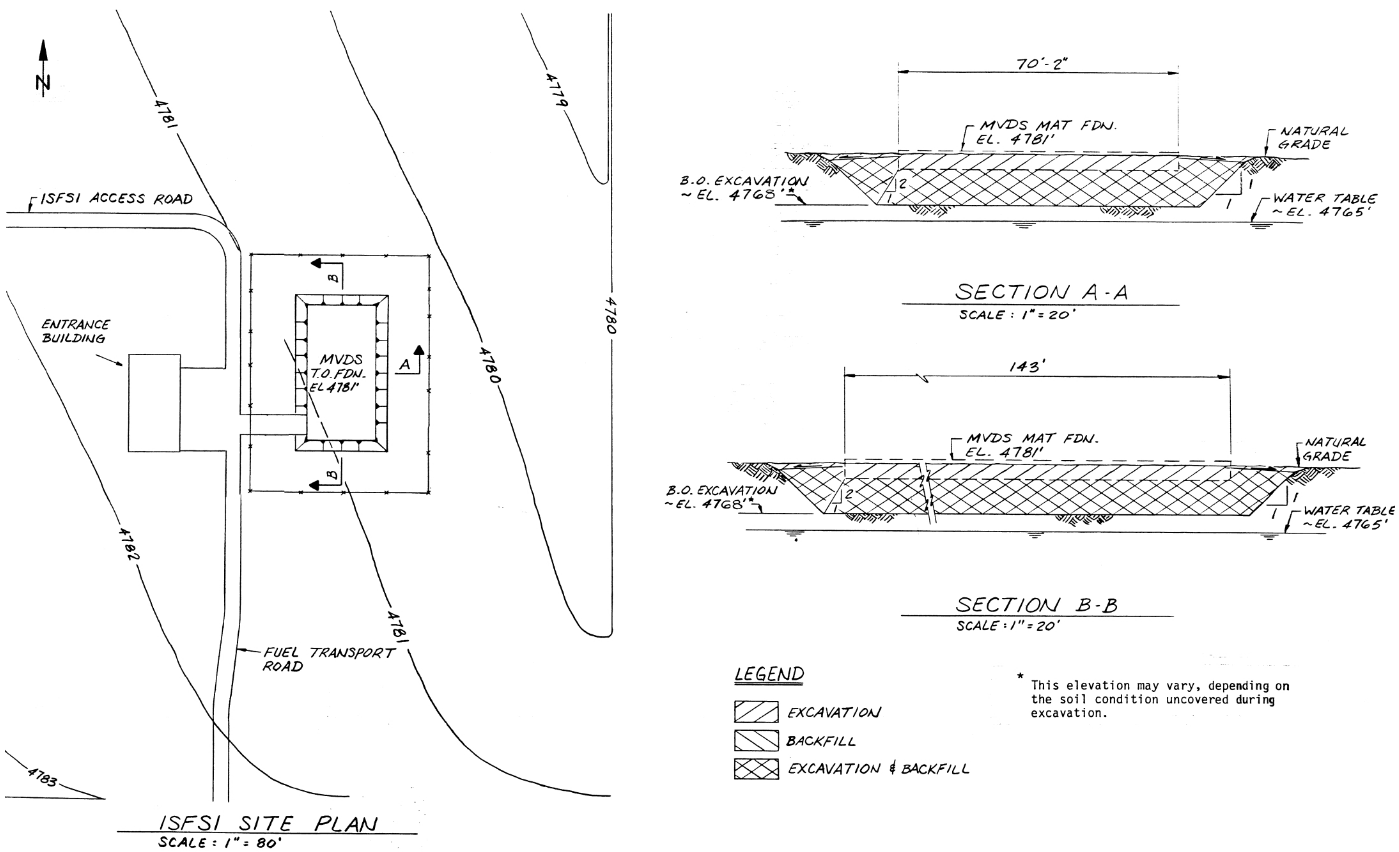

Figure 2.5-6. MVDS Excavation and Backfill Plan and Sections.

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