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INSTALLATION RESTORATION PROGRAM

PHASE I - RECORDS SEARCH

AIR FORCE PLANT 78

BRIGHAM CITY, UTAH

PREPARED FOR

UNITED STATES AIR FORCE
HQ AFESC/DEV
Tyndall AFB, Florida
and
HQ ASD/PMD
Wright-Patterson AFB, Ohio

ES ENGINEERING-SCIENCE

MARCH 1984

PII Redacted

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Wright-Patterson AFB, Ohio

March 1984

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This report provides the Installation Restoration Program (IRP) Phase I-Records Search for Air Force Plant 78, Morton-Thiokol, Brigham City, Utah. This is a report of a study conducted to identify past potentially hazardous material disposal sites. Interviews and document searches were conducted to determine sites that were potentially contaminated. (Keywords)

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EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Confirmation/Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Air Force Plant 78 under Contract No. F08637-80-G0009-5011.

FACILITY DESCRIPTION

Air Force Plant 78 is located in Box Elder County, Utah, approximately 35 miles west of Brigham City. The plant site is part of a complex of facilities operated by Morton Thiokol, Inc. The area surrounding the plant is mostly ranchland and natural terrain. The plant site encompasses 1,550 acres. The plant site is characterized by open areas between the production buildings with the greatest concentration of facilities located around Building M-508 and Building E-517.

The Thiokol Corporation (presently Morton Thiokol, Inc.) constructed a complex of solid propellant technology development facilities in 1957. Air Force Plant 78 was constructed in 1962 to augment the solid propellant rocket motor production already in progress. Plant 78 is separated from the Morton Thiokol facilities by appoximately five miles. From 1962 to 1979, Plant 78 was engaged in the mixing, casting and final assembly of solid propellant chemicals into rocket motors for the Minuteman I missile program. Beginning in 1972, rocket motor production activities were expanded to include the first stage of the Trident-I (C-4) missile. In 1980, full scale development of the first stage rocket motor for the Peacekeeper missile began. As a part of the solid propellant rocket motor production, components such as nozzles and motor housings have been fabricated at Plant 78.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicate the following major points that are relevant to the evaluation of past hazardous waste management practices at Air Force Plant 78:

- The mean annual precipitation is 15.68 inches; the net precipitation is -26.32 inches and the 1-year, 24-hour rainfall event is estimated to be 1.25 inches. These data indicate that there is little or no potential for precipitation to infiltrate the surface soils on the plant. Also, there is a moderate potential for runoff and erosion.
- The natural soils on the plant are typically silty loam with combinations of clayey, cobbly and gravelly loam. Relatively low permeabilities exist in a majority of the plant soils, but moderate permeabilities exist in the southeastern and southern portions of the plant where sand, cobbles and gravel are more prevalent. These data indicate that recharge by precipitation, surface-water runoff and plant discharges will be relatively slow except in the southeastern and southern portions where recharge may be moderate.
- Surface-water drainage on the plant is controlled by open ditches, the Faust Valley Drainage Course and a major interceptor ditch. All drainage flows to Blue Creek.
- Ammonium perchlorate has been found in Blue Creek water samples. The exact source of the contaminant is unknown.
- Ground water exists under the plant in possibly perched aquifers, in the Valley-Fill Deposits (primary aquifer) and in faulted and fractured rock. The ground water in the Valley-Fill Deposits and faulted/fractured rock is abundant but quite saline and usable. The depth to the water table in the Valley-Fill Deposits is 150 feet below ground level.

- The direction of ground-water flow in possibly perched aquifers and the Valley Fill-Deposits is west towards Blue Creek. The general direction of ground-water flow in faulted and fractured rock is along the connecting faults and fractures.
- There are no Federally- or state- listed endangered or threatened species which inhabit the plant.

METHODOLOGY

During the course of this project, interviews were conducted with plant personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with local, state and Federal agencies; and a field reconnaissance inspection was conducted at past hazardous waste activity sites. Several sites were identified as containing potentially hazardous contaminants resulting from past activities (Figure 1). These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure are presented in Appendix G and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-on action.

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team's field inspection, review of plant records and files and interviews with plant personnel.

The areas determined to have a sufficient potential to create environmental contamination are as follows:

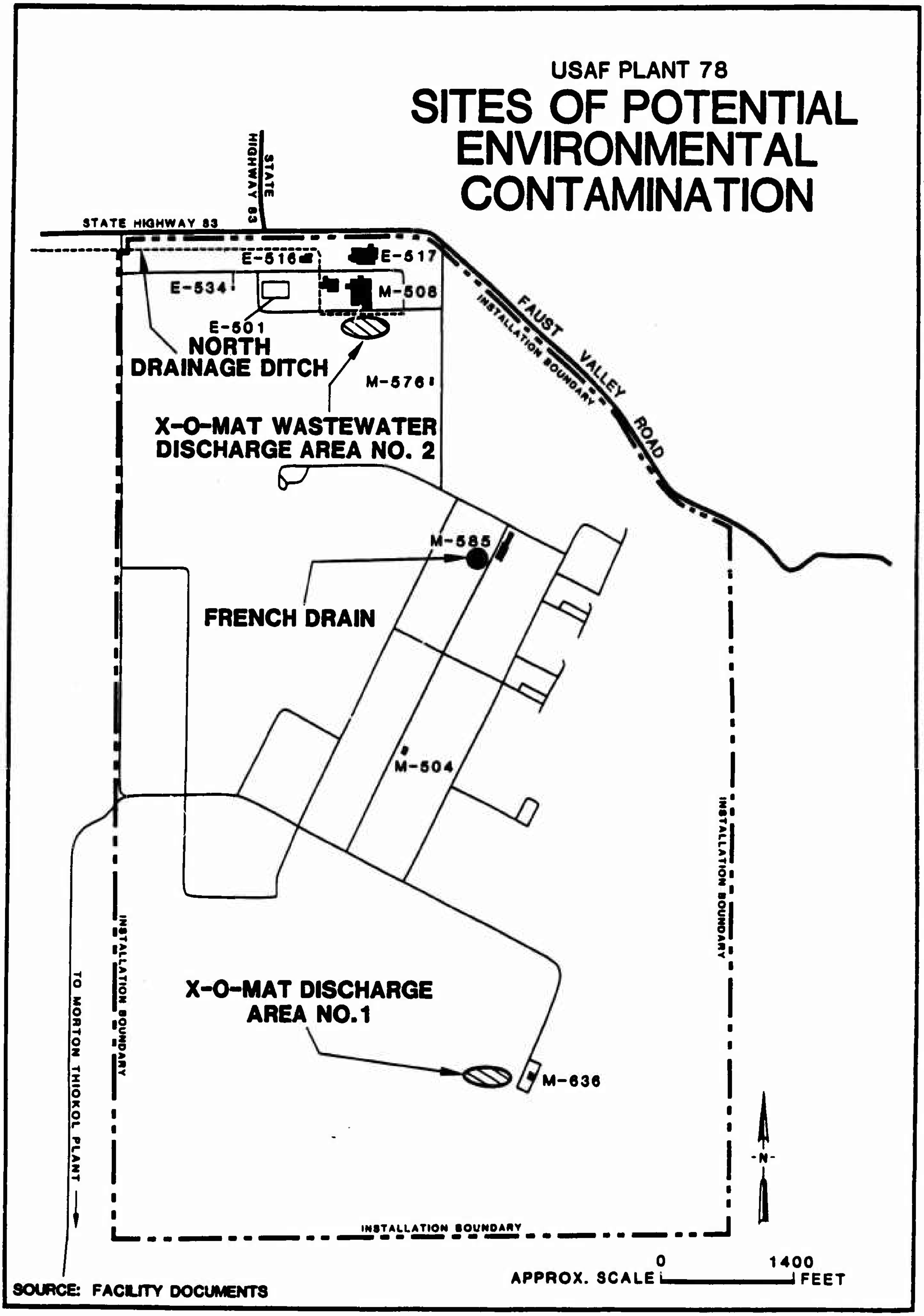
North Drainage Ditch
French Drain
X-O-Mat Wastewater Discharge Area No. 2
X-O-Mat Wastewater Discharge Are No. 1

Follow-on investigations for these areas is warranted.

TABLE 1

SITES ASSESSED USING THE HAZARD ASSESSMENT RATING METHODOLOGY
AIR FORCE PLANT 78

Rank	Site Name and Number	Building Number	Occurrence	Final Score
1	North Drainage Ditch	E-516	1962-Present	66
2	French Drain	M-585	1962-Present	48
3	X-O-Mat Wastewater Discharge Area No. 2	M-508	1976-Present	46
4	X-O-Mat Wastewater Discharge Area No. 1	M-636	1962-1982	43



SOURCE: FACILITY DOCUMENTS

RECOMMENDATIONS

The detailed recommendations developed for further assessment of areas of environmental concern at Air Force Plant 78 are also presented in Chapter 6. These recommendations are summarized as follows:

o North Drainage Ditch	Collect stream sediment samples near Building E-516. Initiate additional sampling stations further upstream from Station No. 4. Implement expanded list of parameters at Station No. 4 and additional sampling locations.
o French Drain	Collect one soil core boring sample at a depth of six feet.
o X-O-Mat Wastewater Discharge Area No. 2	Collect two soil core boring samples in the drainage field.
o X-O-Mat Wastewater Discharge Area No. 1	Collect one soil core sample to a depth of 18 inches.

SECTION 1

INTRODUCTION

BACKGROUND

The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of past disposal sites and take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites and make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP will be the basis for response actions on Air Force facilities under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and clarified by Executive Order 12316. CERCLA is the primary federal legislation governing remedial actions at past hazardous waste disposal sites.

PURPOSE AND SCOPE

The Installation Restoration Program has been developed as a four-phased program as follows:

Phase I - Initial Assessment/Records Search
Phase II - Confirmation/Quantification
Phase III - Technology Development
Phase IV - Operations/Remedial Actions

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at Air Force Plant 78 under Contract No. F08637-80-G0009-5011. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommendations for follow-on actions.

The objective of the first phase of the program was to identify the potential for environmental contamination from past waste disposal practices at Air Force Plant 78, and to assess the potential for contaminant migration. The activities that were performed in the Phase I study included the following:

- Review site records
- Interview personnel familiar with past generation and disposal activities
- Inventory the generation of wastes in the past
- Estimate quantities and locations of current and past hazardous waste treatment, storage, and disposal activities
- Define the environmental setting at the plant
- Review past disposal practices and methods
- Conduct field reconnaissance
- Gather pertinent information from Federal, state, and local agencies
- Assess the potential for contaminant migration
- Develop follow-on recommendations.

ES performed the on-site portion of the records search during December 1983. The following team of professionals was involved:

- R. M. Reynolds, Chemical Engineer and Project Manager, BChE, 10 years of professional experience
- H. D. Harman, Hydrologist, 8 years of professional experience
- B. D. Moreth, Environmental Scientist, 12 years of professional experience

More detailed information on these three individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the Air Force Plant 78 Records Search began with a review of past and present industrial operations conducted at the plant. Information was obtained from available records and files, as well as interviews with past and present plant employees from the various operating areas. Those interviewed included current and past personnel associated with Morton Thiokol, Inc. and the Air Force Plant Representative Office (AFPRO). A listing of the plant interviewee positions with approximate years of service is presented in Appendix B.

Concurrent with the plant interviews, the applicable Federal, state, and local agencies were contacted for pertinent plant related environmental data. The agencies contacted and interviewed are listed below and additional information is included in Appendix B.

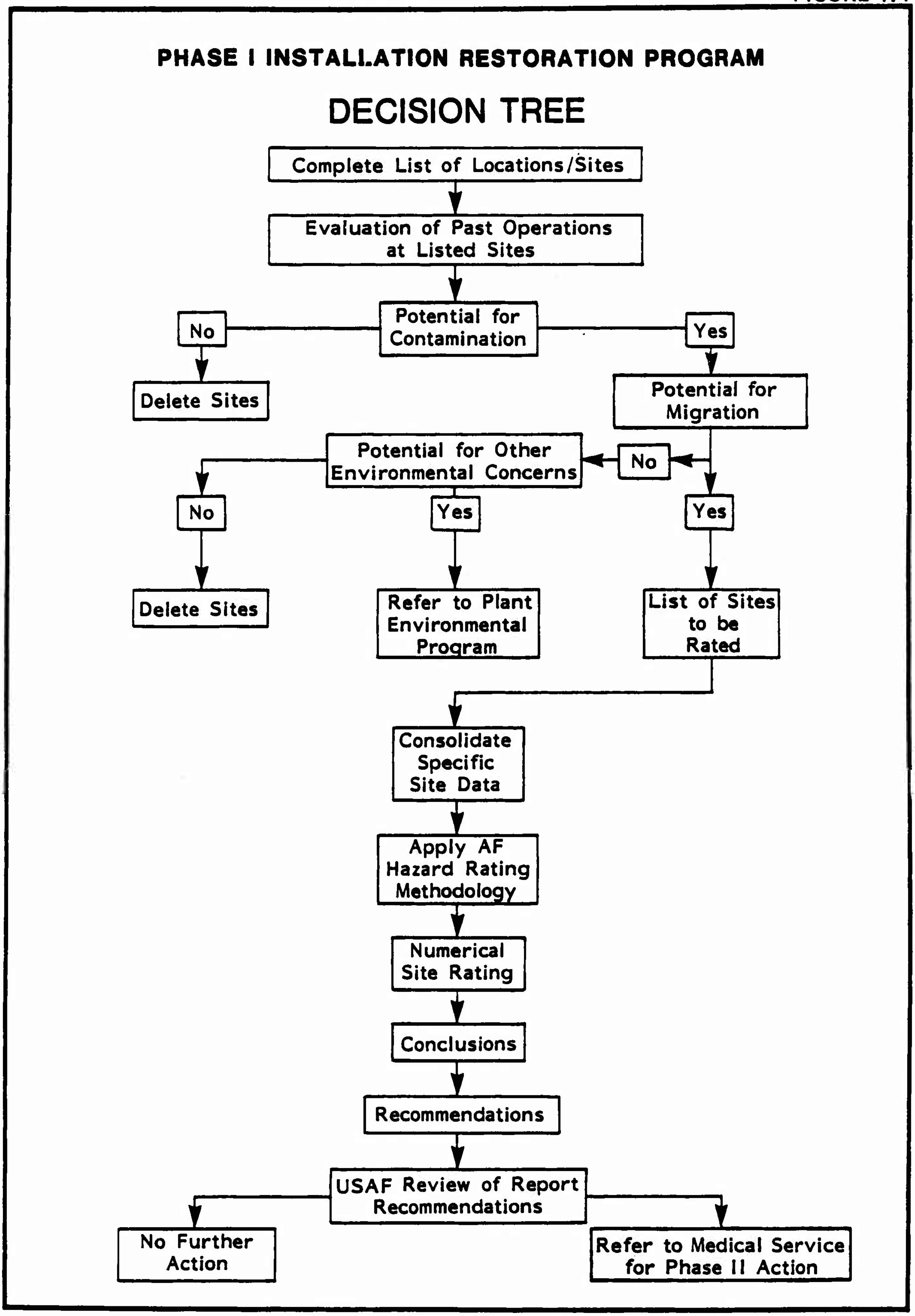
- o Box Elder County Health Department
- o University of Utah Seismic Station
- o U.S. Army, Corps of Engineers
- o U.S.D.A., Soil Conservation Service
- o U.S. EPA, Region VIII
- o U.S. Fish and Wildlife Service
- o U.S. Geological Survey, Water Resources Division
- o Utah Department of Natural Resources and Energy, Division of Wildlife Resources
- o Utah Department of Health, Bureaus of Solid and Hazardous Waste Management, Water Pollution Control and Public Water Supplies
- o Utah Geological and Mineral Survey

The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources at the plant. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

A general ground tour of the identified sites was then made by the ES Project Team to gather site-specific information including: (1) general characteristics of waste management practices; (2) visual evidence of environmental stress; (3) the presence of nearby drainage ditches or surface water bodies; and (4) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential existed for hazardous material contamination at any of the identified sites using the decision tree shown in Figure 1.1. If no potential existed, the site was deleted from further consideration. For those sites where a potential for contamination was identified, a determination of the potential for migration of the contamination was made by considering site-specific conditions. If there were no further environmental concerns, then the site was deleted from further IRP consideration. If the potential for contaminant migration was considered significant, then the site was evaluated and prioritized using the Hazard Assessment Rating Methodology (HARM). If there are other environmental concerns then these are referred to the plant environmental program. A discussion of the HARM system is presented in Appendix G. Potential land use restrictions will be addressed in subsequent IRP phases.

FIGURE 1.1


PHASE I INSTALLATION RESTORATION PROGRAM
DECISION TREE
Complete List of Locations/Sites
Evaluation of Past Operations at Listed Sites
Potential for Contamination
No
Yes
Delete Sites
Potential for Migration
Potential for Other Environmental Concerns
No
No
Yes
Yes
Delete Sites
Refer to Plant Environmental Program
List of Sites to be Rated
Consolidate Specific Site Data
Apply AF Hazard Rating Methodology
Numerical Site Rating
Conclusions
Recommendations
USAF Review of Report Recommendations
No Further Action
Refer to Medical Service for Phase II Action

SECTION 2

FACILITY DESCRIPTION

LOCATION, SIZE AND BOUNDARIES

Air Force Plant 78 is located in Box Elder County, Utah, approximately 35 miles northwest of Brigham City (Figures 2.1 and 2.2). The plant site is part of a complex of facilities operated by Morton Thiokol, Inc. The area surrounding the plant is mostly ranchland and natural terrain. The plant site is owned by the Air Force and encompasses 1,550 acres. The facility site plan is shown in Figure 2.3. The plant site is characterized by open areas between the production buildings with the greatest concentration of facilities located around Building M-508 and Building E-517.

HISTORY

The Thiokol Corporation (presently Morton Thiokol, Inc.) constructed a complex of solid propellant technology development facilities in 1957. Air Force Plant 78 was constructed in 1962 to augment the solid propellant rocket motor production already in progress. Plant 78 is separated from the Morton Thiokol facilities by appoximately five miles. From 1962 to 1979, Plant 78 was engaged in the mixing, casting and final assembly of solid propellant chemicals into rocket motors for the Minuteman I missile program. Beginning in 1972, rocket motor production activities were expanded to include the first stage of the Trident-I (C-4) missile. In 1980, full scale production of the first stage rocket motor for the Peacekeeper missile began. As a part of the solid propellant rocket motor production, components such as nozzles and motor housings have been fabricated at Plant 78.

ORGANIZATION AND MISSION

The host organization at Air Force Plant 78 is the Wasatch Division of the Aerospace Group of Morton Thiokol, Inc. The primary mission of Morton Thiokol at Plant 78 is to assemble solid propellant rocket motors

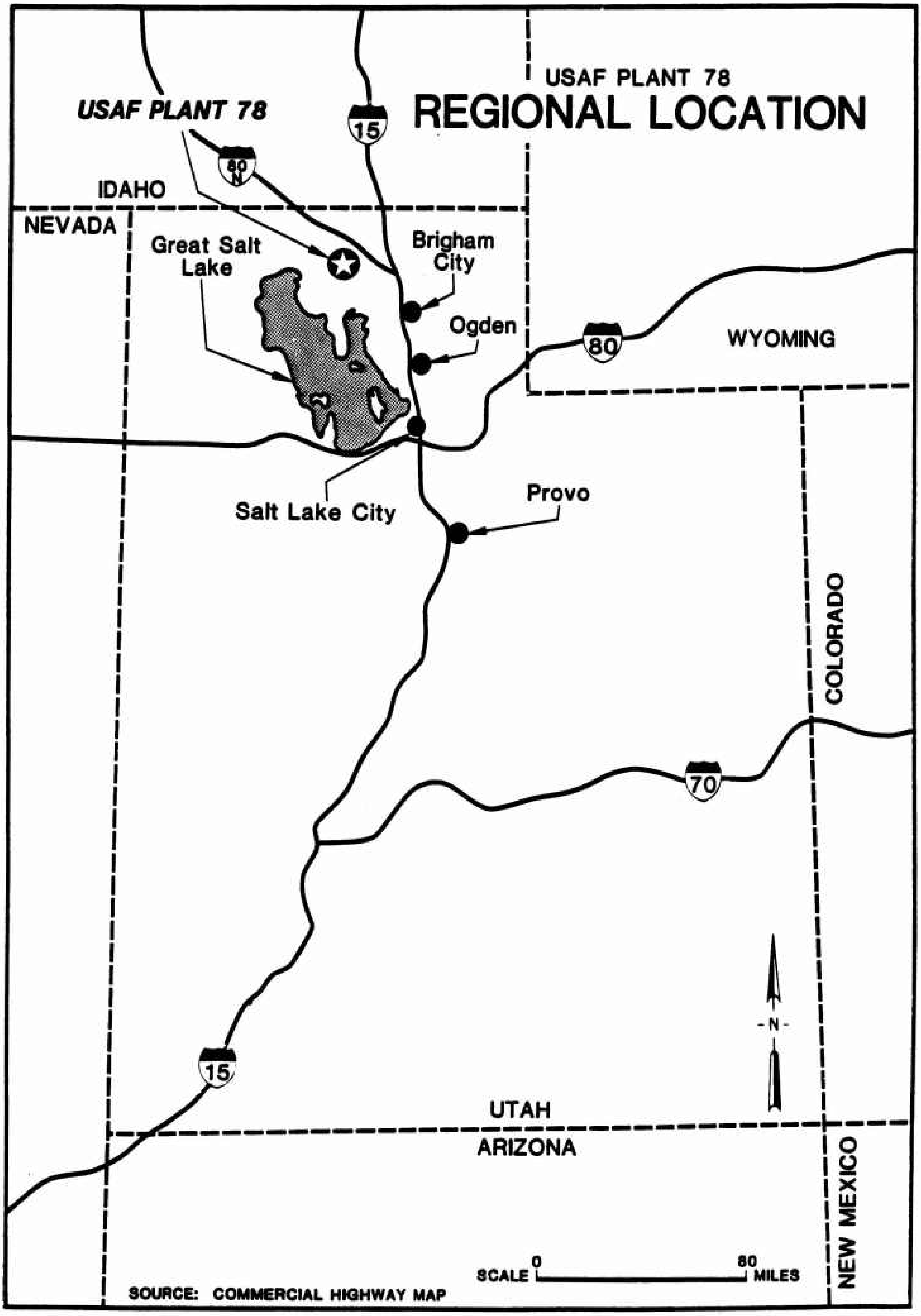
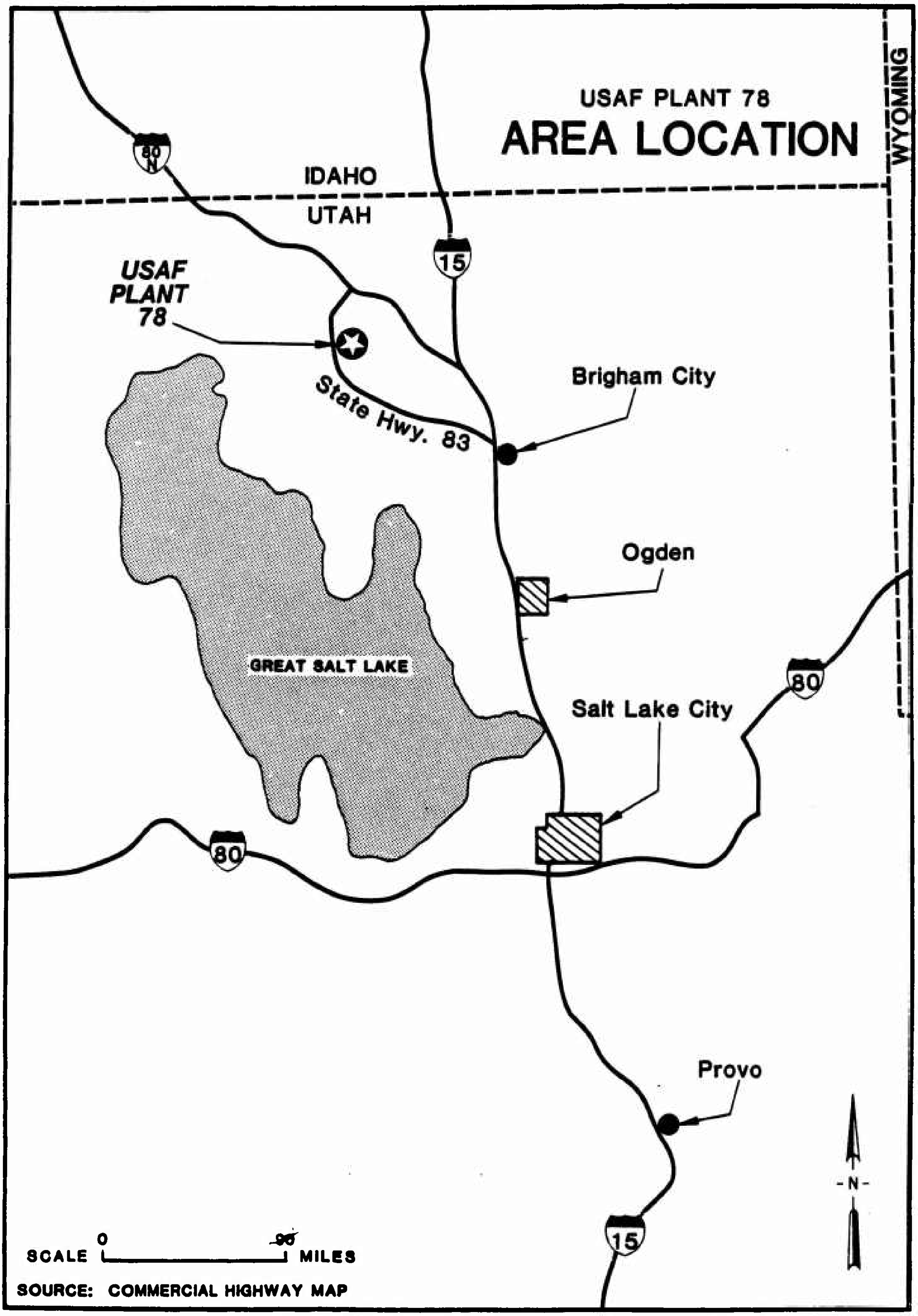
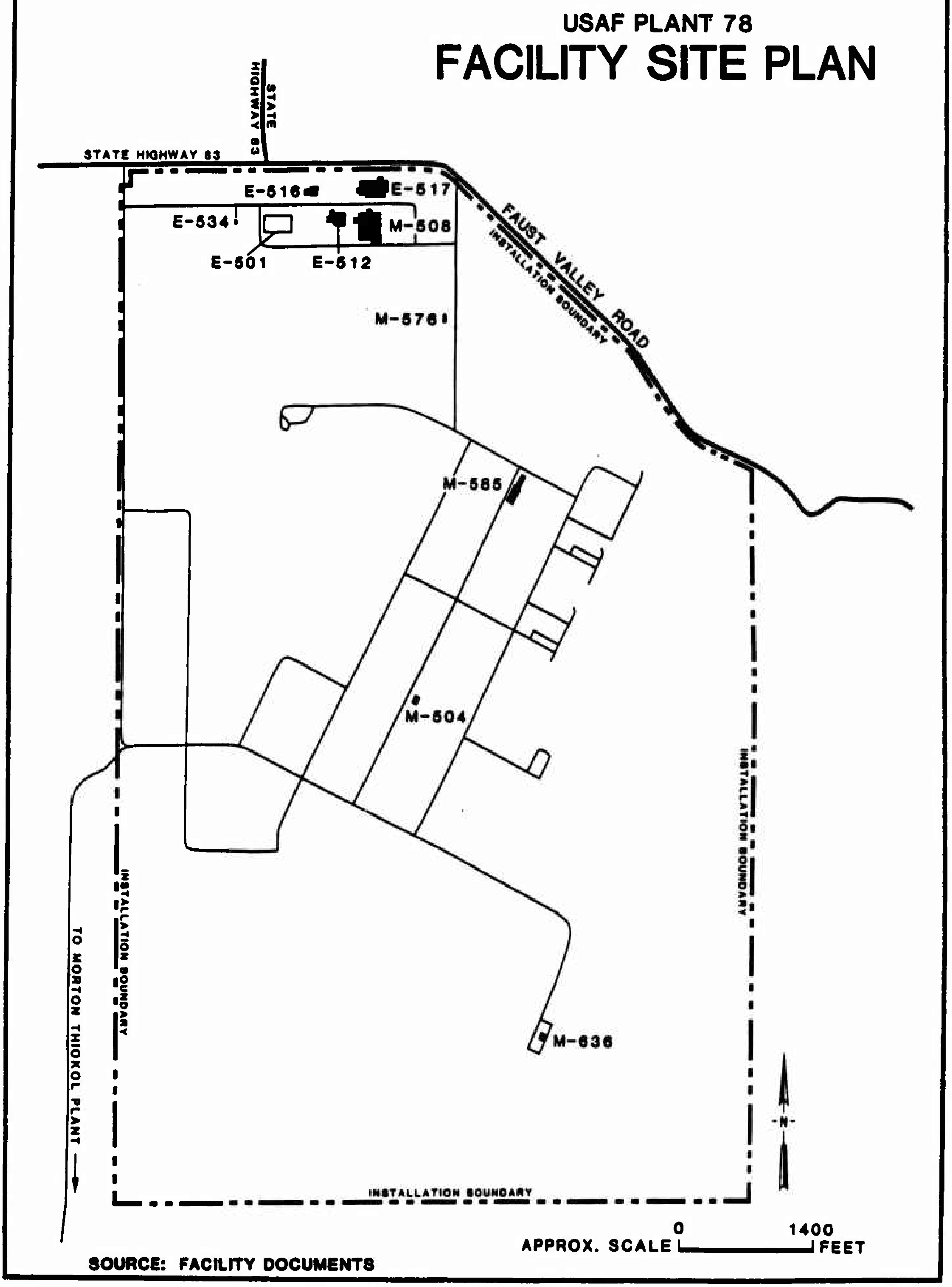

USAF PLANT 78
REGIONAL LOCATION
USAF PLANT 78
15
80 N
IDAHO
NEVADA
Great Salt Lake
Brigham City
Ogden
80
WYOMING
Salt Lake City
Provo
COLORADO
70
15
N
UTAH
ARIZONA
NEW MEXICO
SCALE 0 80 MILES
SOURCE: COMMERCIAL HIGHWAY MAP

FIGURE 2.2


USAF PLANT 78
AREA LOCATION
WYOMING
IDAHO
UTAH
80 N
15
USAF PLANT 78
State Hwy. 83
Brigham City
Ogden
GREAT SALT LAKE
Salt Lake City
80
80
Provo
15
-N-
SCALE 0 MILES
SOURCE: COMMERCIAL HIGHWAY MAP



SOURCE: FACILITY DOCUMENTS

for Trident-I (C-4) missile and the Peacekeeper missile. The Air Force Plant Representative Office (AFPRO) serves as the administrator for the Aeronautical Systems Division (ASD) contract with Morton Thiokol. Lockheed Corporation maintains several personnel at Plant 78 to inspect contract rocket motor assembly work performed for the Navy by Morton Thiokol.

SECTION 3
ENVIRONMENTAL SETTING

The environmental setting of Air Force Plant 78 is described in this chapter with an emphasis on the identification of natural features that may promote the movement of hazardous waste contaminants. Environmental conditions pertinent to this study are summarized at the conclusion of this chapter.

METEOROLOGY

The climate of Plant 78 is characterized by hot, dry summers and cold, snowy winters. Temperatures range from over 100°F in the summer to -30°F in the winter. The semi-arid climate of the plant area has a mean annual precipitation of 15.68 inches and a mean annual snowfall of 58.1 inches (National Oceanic and Atmospheric Administration (NOAA), 1983). The mean annual lake evaporation for the area is 42 inches (NOAA, 1979). Selected meterological data for Plant 78 are summarized in Table 3.1.

Two climatic features of interest in determining the potential for movement of contaminants are net precipitation and rainfall intensity. Net precipitation is an indicator of the potential for leachate generation and is equal to the difference between precipitation and evaporation. Rainfall intensity is an indicator of the potential for excessive runoff and erosion. The one-year, 24-hour rainfall event is used to gauge the potential for runoff and erosion. Net precipitation at Plant 78 is -26.32 inches as determined from meteorological data. The negative value of net precipitation indicates that there is little or no potential for precipitation to infiltrate the surface soils on the plant. The one-year, 24-hour rainfall event in the area is estimated to be 1.25 inches (NOAA, 1963). This value indicates that there is a moderate potential for runoff and erosion.

TABLE 3.1

CLIMATIC DATA FOR USAF PLANT 78

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TEMPERATURE(°F)												
Mean Average	28.1	33.3	40.8	49.2	58.3	68.2	77.3	75.4	65.2	53.1	40.6	31.5
PRECIPITATION (IN)												
Mean	1.29	1.35	1.85	1.98	1.76	0.89	0.62	0.86	0.94	1.42	1.35	1.37
SNOWFALL (IN)												
Mean	13.4	9.5	10.4	4.9	0.6	T	0.0	0.0	0.1	1.1	6.2	11.9

Period of Record: 1943 - 1982 T = Trace

Source: NOAA, 1983

GEOGRAPHY

Plant 78 is located within the Basin and Range Physiographic Province of northern Utah (Figure 3.1). This province is characterized by broad valleys trending north and south with relatively low mountains on either side of the valleys. Two major physiographic features of the general area are the Great Salt Lake located south of the plant and the Wasatch Front Valleys east of the plant.

Topography

The topography of Plant 78 is typical of the general province topography. The plant is on the eastern side of Blue Creek Valley. The North Promontory Mountains are located on the western side of Blue Creek Valley and the Blue Spring Hills are located on the eastern side of the valley (Figure 3.2). Engineer Mountain, located southwest of the plant, has elevations approximately 600 feet above the valley floor. The highest peak on Engineer Mountain is 5,263 feet above the National Geodetic Vertical Datum of 1929 (NGVD). In the lower elevations of Blue Creek Valley, Blue Creek, which flows south through the valley, has cut a relatively deep (40 feet) meandering path through the soil and the Valley-Fill Deposits. Blue Creek flows near the western property boundary of Plant 78, and empties into the northern section of the Great Salt Lake.

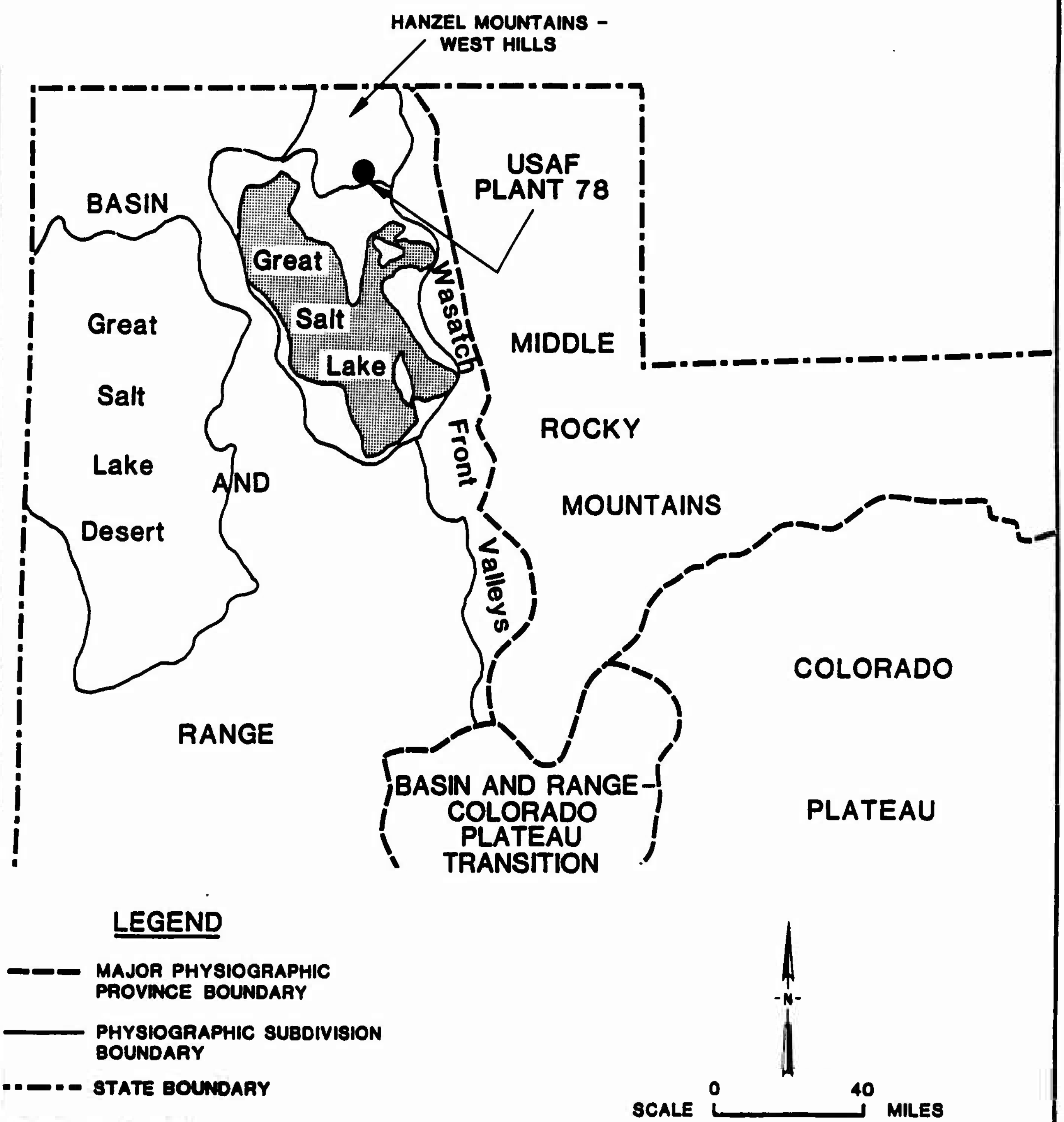
Elevations on the plant vary from a high of 5,020 feet NGVD on the western edge of the Blue Spring Hills to a low of 4,444 feet NGVD near Blue Creek. The plant relief is low to moderate with slopes of approximately 2 percent in the northern section of the plant and approximately 13 percent in the southeastern section of the plant.

The areas immediately surrounding Plant 78 include agricultural lands to the north and west, mountains to the east and industrial development (Morton Thiokol Plant) to the south.

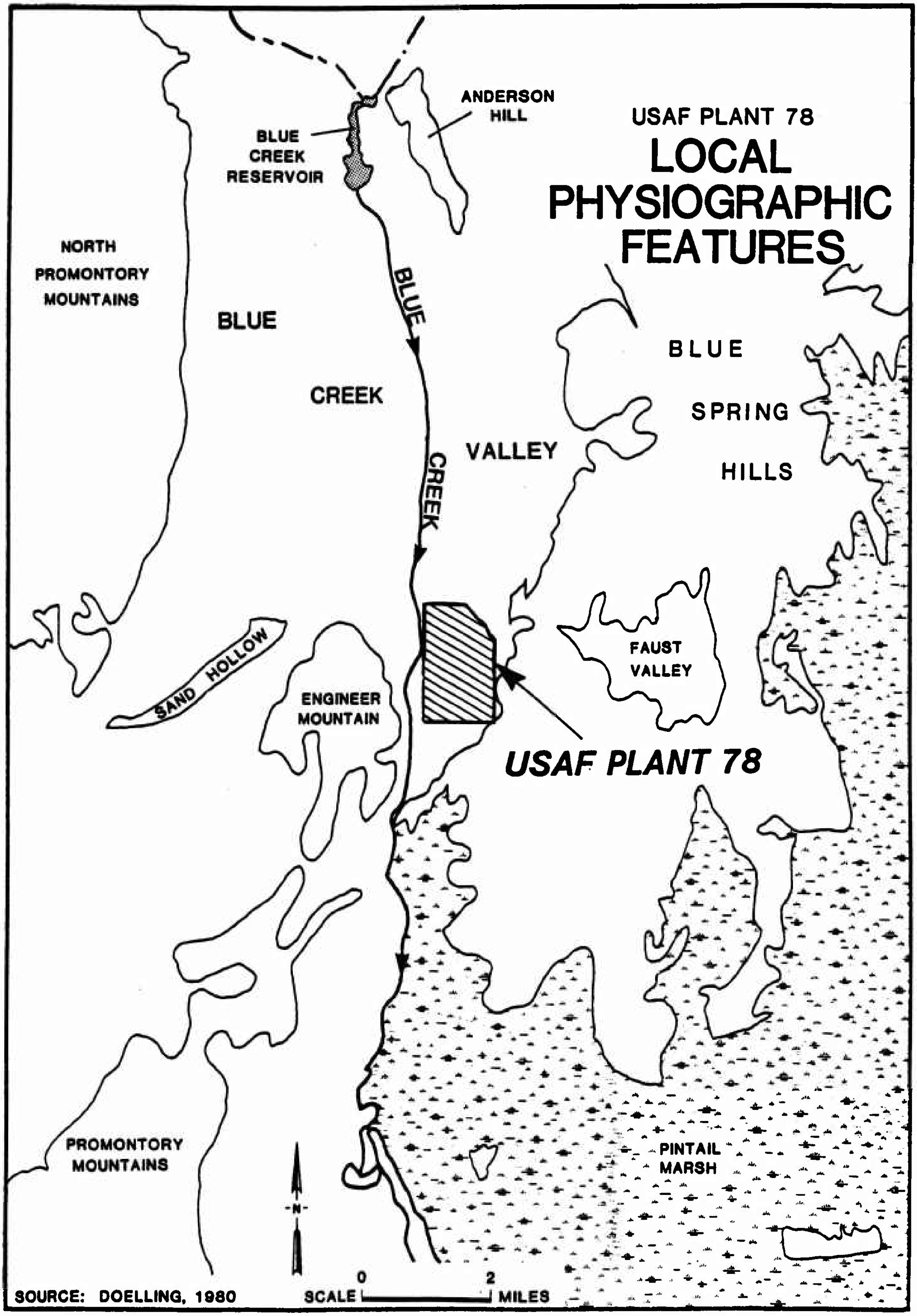
Soils

The soils of Plant 78 are typically silty loam with combinations of clayey, cobbly and gravelly loam. Loam is a soil with varying proportions of sand, clay and organic matter. The three most extensive soil types are Hansel silt loam, Hupp gravelly silt loam and Thiokol silt loam. Hansel and Thiokol soil types developed as a result of the deposition of silty material on lake terraces that once existed along

USAF PLANT 78
REGIONAL PHYSIOGRAPHIC FEATURES



SOURCE: STOKES, 1977


USAF PLANT 78
LOCAL PHYSIOGRAPHIC FEATURES
ANDERSON HILL
BLUE CREEK RESERVOIR
NORTH PROMONTORY MOUNTAINS
BLUE CREEK VALLEY
BLUE CREEK
BLUE SPRING HILLS
SAND HOLLOW
ENGINEER MOUNTAIN
FAUST VALLEY
USAF PLANT 78
PROMONTORY MOUNTAINS
PINTAIL MARSH
N
SOURCE: DOELLING, 1980
SCALE 0 2 MILES

the shoreline of ancient Lake Bonneville, a prehistoric inland lake of Pleistocene geologic age (Chadwick, et al., 1975). Hupp soil types developed as a result of the deposition of cobbly and gravelly material in alluvial fans on the slopes of foothills. The soils occurring on Plant 78 are shown in Figure 3.3. Soil descriptions and the engineering properties for all soil types on Plant 78 are summarized in Table 3.2.

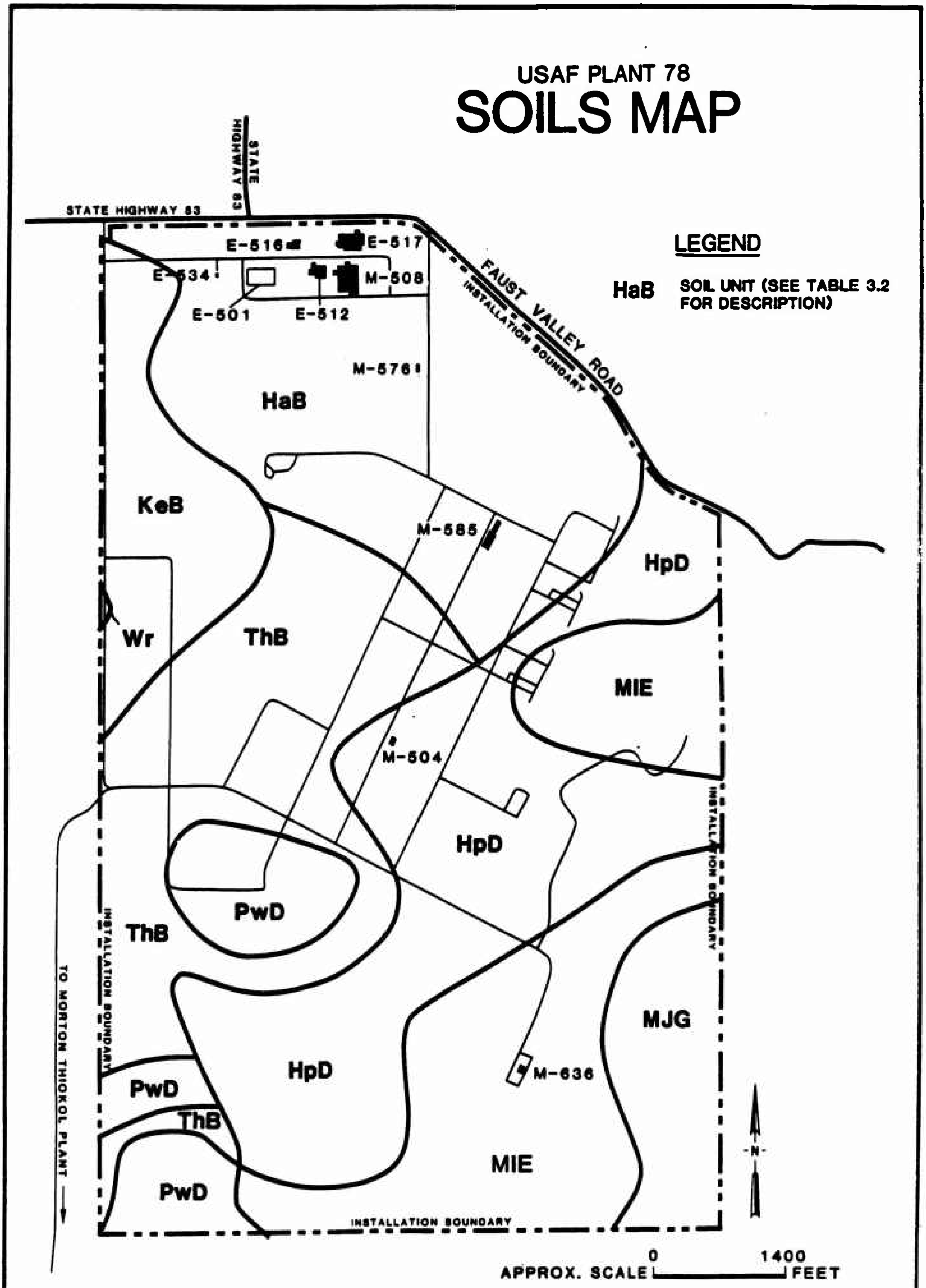
The soil property of concern in assessing the potential for surface-water infiltration is permeability. The permeability values for the soils on the plant range from 4.2×10^{-5} centimeters per second (cm/sec) to 1.4×10^{-3} cm/sec (Chadwick, et al., 1975). These values indicate that surface water will infiltrate slowly to moderately. The Soil Conservation Service (SCS) has ranked the soil types on the plant as having slight, moderate and severe use limitations for septic tank absorption fields. Hupp and Thiokol soil types have slight to moderate use limitations while all other soil types have moderate to severe use limitations. The SCS has noted slow permeability, land slopes and shallow bedrock as reasons for the use limitations. The SCS use limitations are defined in Table 3.2.

SURFACE-WATER RESOURCES

USAF Plant 78 is located in the Blue Creek Valley drainage basin. Blue Creek is the only perennial stream in the valley. North of the plant Blue Creek waters are used for irrigation purposes, while south of the plant Blue Creek waters flow into the northern section of the Great Salt Lake which includes the Bear River Migratory Bird Refuge. The SCS administers the Blue Creek - Howell Watershed Project within the valley (Brown, 1983). Major problems such as sheet and gully erosion have been decreased by the installation of diversion canals within the valley.

Drainage

Drainage on Plant 78 is controlled by open ditches, the Faust Valley Drainage Course and a major interceptor ditch (Figure 3.4). Open ditches exist on both sides of most plant roads. The Faust Valley Drainage Course in the northern section of the plant channels surface-water runoff through the plant as the runoff enters the plant property along Faust Valley Road. The major interceptor ditch located on the eastern side of the plant intercepts and diverts surface-water runoff



SOURCE: CHADWICK, et al, 1975

TABLE 3.2

USAF PLANT 78 SOILS

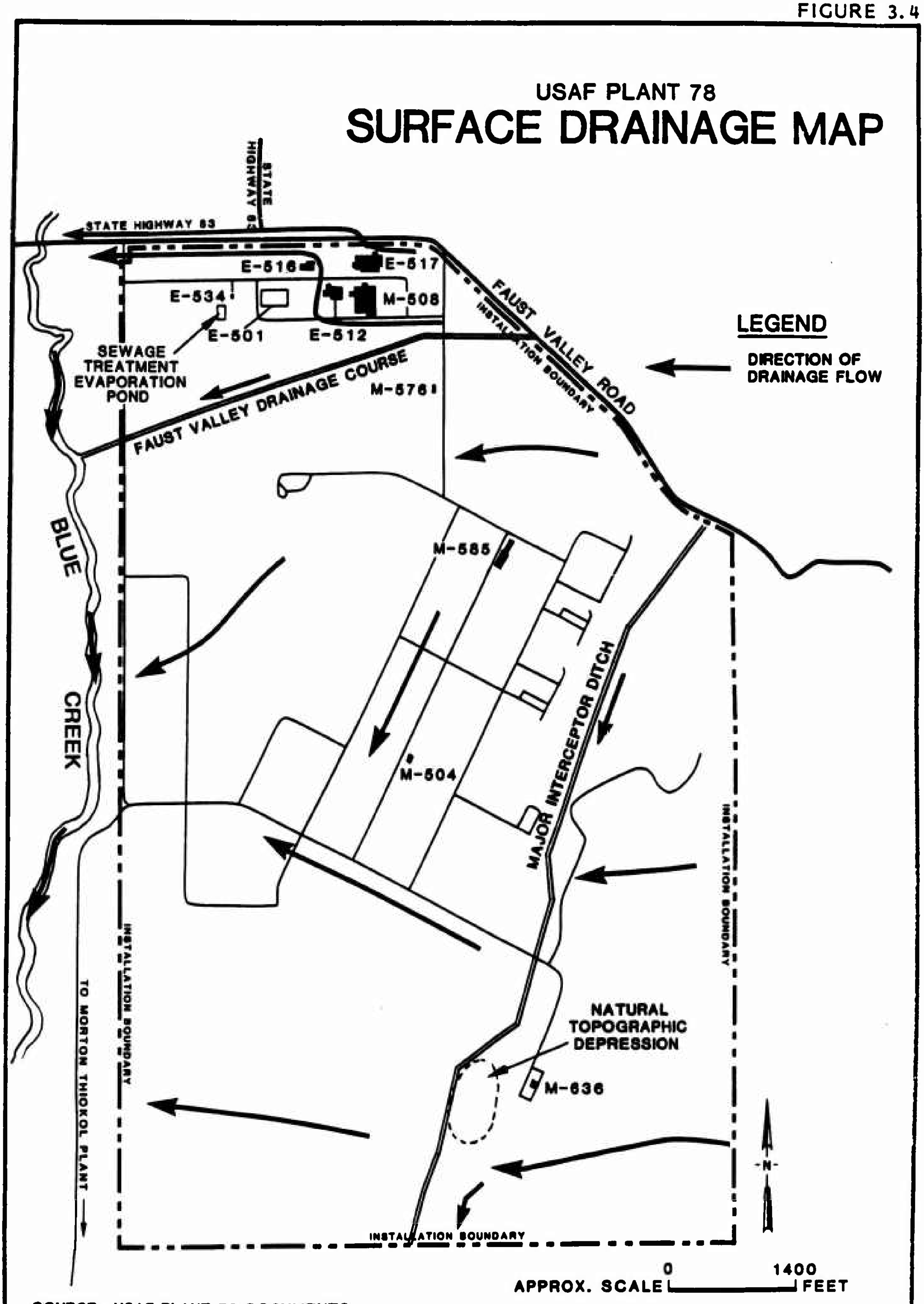
Symbol on Figure 3.2	Unit Description	Depth (inches)	Permeability (Centimeters/Second)	Septic Tank Absorption Field Use Limitation[1]
HaB	Hansel silt loam, 1 to 6 percent slopes	0-62	1.4×10^{-4} to 4.2×10^{-4}	Severe: moderately slow permeability.
HpD	Hupp gravelly silt loam, 6 to 10 percent slopes	0-18 18-60	1.4×10^{-3} to 4.2×10^{-3} 1.4×10^{-3} to 4.2×10^{-3}	Slight to moderate: slopes of 1 to 10 percent.
KeB	Kearns silt loam, 1 to 3 percent slopes	0-76	4.2×10^{-4} to 1.4×10^{-3}	Moderate to severe: moderate permeability; slopes of 1 to 20 percent.
MIE	Middle cobbly silt 10 to 30 percent slopes.	0-12 12-28 (28-Fractured limestone)	4.2×10^{-4} to 1.4×10^{-3} 4.2×10^{-4} to 1.4×10^{-3}	Severe: slopes of 10 to 70 percent; moderate permeability; bedrock at depth of 24 to 38 inches.
MJG	Middle-Broad association, steep (cobbly silt loam)	0-12 12-28 (28-Fractured limestone)	4.2×10^{-4} to 1.4×10^{-3} 4.2×10^{-4} to 1.4×10^{-3}	Severe: slopes of 10 to 70 percent; moderate permeability; bedrock at depth of 24 to 38 inches.
PwD	Pomat silt loam, 6 to 10 percent slopes	0-56 56-65	4.2×10^{-4} to 1.4×10^{-3} 1.4×10^{-3} to 4.2×10^{-3}	Moderate to severe: slopes of 6 to 40 percent.
ThB	Thiokol silt loam, 1 to 6 percent slopes.	0-60	4.2×10^{-4} to 1.4×10^{-3}	Slight to moderate: moderate permeability
Wr	Woods Cross silty clay loam, moderately saline	0-60	4.2×10^{-5} to 1.4×10^{-4} (Jointing and fine sandy loam lenses may increase permeability)	Severe: slow permeability.

Notes: 1. Slight - soil properties are generally favorable for use; limitations are minor and easily overcome.

Moderate - soil properties are unfavorable but can be overcome or modified by special planning and design.

Severe - soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special designs.

Source: Chadwick, et al., 1975.



SOURCE: USAF PLANT 78 DOCUMENTS

from flowing through the main sections of the plant. A natural topographic depression exists southwest of Building M-636 and acts as a catch basin for precipitation and for surface water within the interceptor ditch. Another topographic depression west of Building E-534 is manmade and acts as a sewage treatment evaporation pond for the plant. There is no discharge from the pond to surface streams.

Major surface-water drainage from the plant exits at eight locations. Minor surface-water drainage leaves the plant at numerous locations between Building M-628 and M-586 on the western side of the plant. The north drainage ditch between Buildings E-516 and E-537 on the north side of the plant was observed to contain a sheen on the water surface and a petroleum-like smell in the stream sediment during the plant visit (December, 1983). The drainage ditch south of Building E-512 was also observed during the plant visit to contain a sheen. Surface-water drainage from the plant infiltrates the soil, evaporates to the atmosphere, or enters Blue Creek. Blue Creek empties into the northern section of the Great Salt Lake approximately 7 miles from the plant.

Prior to 1975, Blue Creek was an intermittent stream flowing significantly only after rainfall events and snow melts. As a result of an earthquake in March, 1975, Blue Creek became a perennial stream with significant flow year round. Major changes in surface-water as well as in ground-water flow and quality are common in northern Utah after earthquakes (Richens, 1984).

<u>Surface-Water Quality</u>

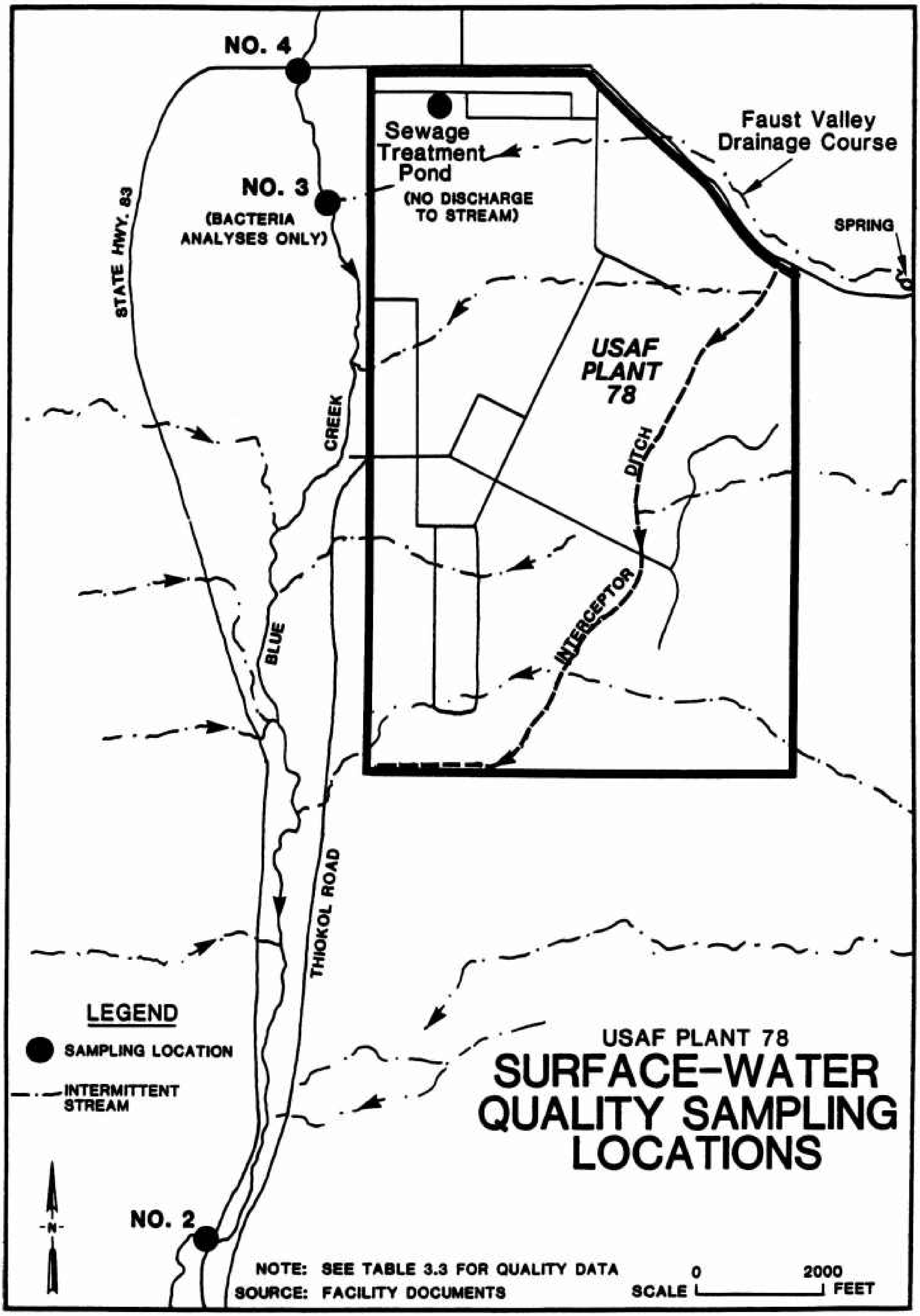
The surface-water quality in Blue Creek is water-quality poor due to excessive concentrations of chloride and total dissolved solids (Bolke and Price, 1972). The quality of the water is affected by irrigation return flow, surface-water runoff and surplus flow from Blue Creek Reservoir approximately 6 miles north of the plant. The quality may also be affected by the naturally occurring minerals in the Blue Creek Valley through which the creek flows and by naturally occurring cold- and hot-water springs which discharge into Blue Creek. The Promontory Mining District located near the southern end of the Promontory Mountain Range has produced gold, silver, copper, lead and zinc (Doelling, 1980).

Surface-water sampling near Plant 78 is conducted at two main locations (Figure 3.5). Sampling Point No. 2 on Blue Creek is located near Highway 83 approximately 1.5 miles downstream of the plant. Sampling Point No. 2 is a downstream sampling location for Plant 78, but the stream quality at this location may be affected by potential surface-water discharges or perched ground-water seepage from the Morton Thiokol burning grounds area south of Plant 78 property. Sampling Point No. 4 on Blue Creek is located near Highway 83 just west of the northwest corner of the plant. Selected surface-water quality analyses are summarized in Table 3.3 and additional surface-water quality analyses are summarized in Table E.1, Appendix E.

The surface-water analyses for Plant 78 were compared to the Utah surface-water quality standards for Class 3D. Class 3D waters are protected for waterfowl, shorebirds and other water-oriented wildlife including the necessary aquatic organisms in their food chain (Utah Department of Social Services, Division of Health, 1978). The only listed parameter which can be compared to the standards is iron. The standard of 1.0 milligram per liter (mg/l) was exceeded on numerous occasions at both Blue Creek No. 2 and No. 4 sampling stations due to the effects of naturally occurring minerals in the vicinity. The only unnatural parameter of which analyses are available is ammonium perchlorate. Ammonium perchlorate is used as a propellant ingredient at Plant 78. Ammonium percholate concentrations found in samples from Blue Creek No. 4 ranged from 0.64 mg/l to 7.2 mg/l. Ammonium perchlorate concentrations found in samples from Blue Creek No. 2 ranged from 0.30 mg/l to 5.3 mg/l. Of interest is the fact that relatively high concentrations (>3.0 mg/l) of ammonium perchlorate were found at both sampling stations in April and August, 1975. Relatively high concentrations of ammonium perchlorate were also found at both sampling stations in 1972.

Surface-Water Use

Surface-water one to three miles north of Plant 78 is used for irrigation of approximately 3,000 acres of cropland (SCS, 1960). Blue



USAF PLANT 78
SURFACE-WATER QUALITY SAMPLING LOCATIONS

ES ENGINEERING-SCIENCE

TABLE 3.3

SELECTED SURFACE-WATER QUALITY DATA FOR USAF PLANT 78 AND VICINITY
(Analyses are in milligrams per liter)

Station Identification on Blue Creek[1]	Date (Year)	Iron (1.0)	Copper (No Standard)	Ammonium Perchlorate (No Standard)	Station Identification Blue Creek[1]	Iron (1.0)	Copper (No Standard)	Ammonium Perchlorate (No Standard)
	Reported Maximum Values of Selected Parameters and Applicable Utah Water Quality Standards[2]							
No. 2	1967	1.70	0.26	NA	No. 4	0.72	0.22	NA
	1968	1.16	1.14	NA		2.56	0.25	NA
	1969	0.79	0.14	NA		1.36	0.16	NA
	1970	1.53	0.22	2.0		1.81	0.23	>1.0
	1971	5.80	0.79	2.7		3.84	0.43	3.0
	1972	1.46	0.29	3.9		1.60	0.67	4.2
	1973	6.45	0.27	2.9		3.20	0.27	2.3
	1974	1.13	0.45	1.7		1.47	0.38	3.8
	1975	3.15	0.43	5.3		3.01	0.35	7.2
	1976	2.47	0.30	0.69		2.19	0.20	0.55
	1977	1.74	0.53	0.30		1.80	0.34	0.57
	1978	1.62	0.22	0.41		2.33	0.34	0.70
	1979	1.69	0.58	1.1		1.71	0.25	1.0
	1980	2.37	0.13	1.85		2.50	0.14	2.1
	1981	1.68	0.19	1.05		3.51	0.14	1.4
	1982	3.64	0.20	0.68		1.59	0.42	0.64
	1983 (Through July)	4.65	0.18	NA		6.13	0.11	NA

Notes: 1. See Figure 3.5 for station locations.

NA = Not Analyzed

2. Utah Department of Social Services, Division of Health, Standards of Quality for Class 3D Waters of the State, 1978.

Source: USAF Plant 78 Documents.

Creek Irrigation Company, Howell, Utah, regulates surface water in Blue Creek Reservoir, Blue Creek and local canals in Blue Creek Valley. South of Plant 78 surface water in Blue Creek flows into the northern section of the Great Salt Lake which includes the Bear River Migratory Bird Refuge. There are no public water supply intakes on Blue Creek.

GROUND-WATER RESOURCES

The ground-water resources in the immediate vicinity of Plant 78 are not useable due to the total dissolved solids and chloride contents of the ground water. Useable ground water is available several miles both north and south of the plant. Reports by Carpenter (1913), Holman (1963), Bolke and Price (1972), Eakin, et al. (1976), Hood (1976), Doelling (1980) and Battelle (1983) describe the ground-water resources of the area.

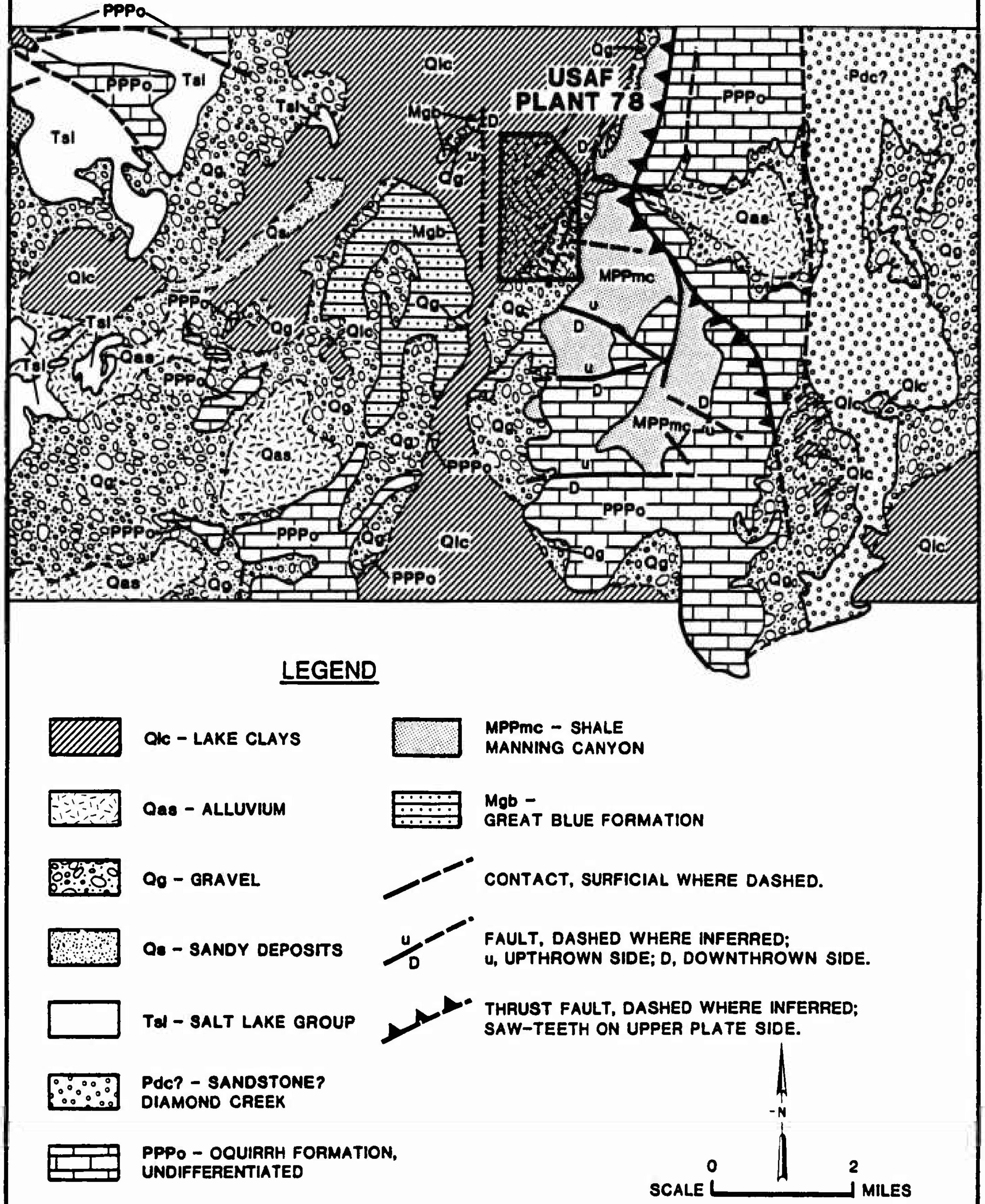
Hydrogeologic Units

Geologically Plant 78 is located in the outcrop areas of the Lake Clays and Gravel units of Quaternary Age (Figure 3.6). The Lake Clays are composed of clay and silt while the gravel is composed of gravel with minor amounts of sand, silt and clay. Table 3.4 summarizes the local hydrogeologic units and their water-bearing characteristics. The geology in the area of the plant is complex with both unconsolidated sediments and consolidated rocks as well as numerous faults.

The sediments on the plant have been penetrated by numerous test borings. One of the deepest test borings (No. M-46) was 70 feet deep (Figure 3.7). This test boring encountered numerous layers of silt with varying compositions of clay, sand and gravel. This sequence of varying compositions is typical of sediments deposited in the Lake Clays. These sediments were deposited while ancient Lake Bonneville covered the valley. Cross-section locations on Figure 3.8 and cross sections shown on Figures 3.9, 3.10, 3.11 and 3.12 illustrate the shallow and deep stratigraphy underlying the plant. Cross-sections A-A' and B-B' shown on Figures 3.9 and 3.10, respectively, illustrate the shallow stratigraphy in the northern and central sections of the plant. Sandy silt is dominant in the northern section whereas clayey silt is dominant in the central section. Cross-section C-C' shown on Figure 3.11 illustrates the stratigraphy in the southern section of the plant.

USAF PLANT 78

GEOLOGIC MAP



SOURCE: DOELLING, 1980; HOLMAN, 1963; AND BOLKE AND PRICE, 1972.

TABLE 3.4

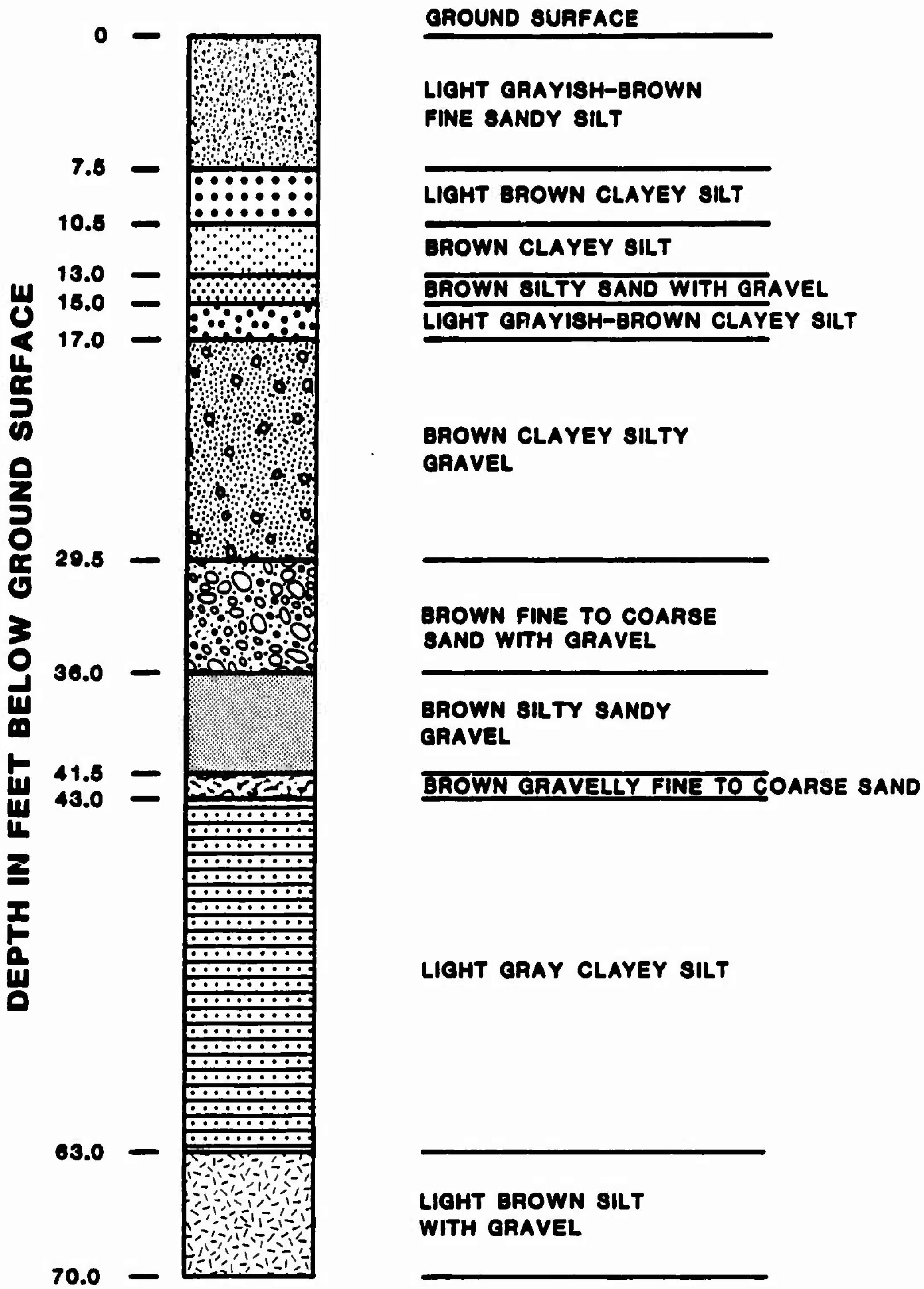
HYDROGEOLOGIC UNITS AND THEIR WATER-BEARING CHARACTERISTICS IN THE VICINITY OF USAF PLANT 78

System	Hydrogeologic Unit	Hydrogeologic Classification	Approximate Thickness (Feet)	Dominant Lithology	Water-Bearing Characteristics
Quaternary	Lake Clays	Possibly Perched Aquifer	50	Clay and silt	Above water table; transmit water slowly.
	Alluvium	Possibly Perched Aquifer	50	Clay, silt, sand and gravel	Above water table, transmits water slowly.
	Gravel	Possibly Perched Aquifer	50	Gravel; minor sand, silt and clay	Above water table; transmits water readily.
	Sandy Deposits	Possibly Perched Aquifer	50	Sand	Above water table; transmits water readily.
Quaternary and Tertiary	Valley-Fill Deposits	Aquifer (most permeable aquifer in Blue Creek Valley)	200 to 450	Clay, sand and gravel	Within Blue Creek Valley ground-water reservoir; most deposits transmit water slowly, but sand and gravel deposits transmit water readily; properly constructed wells may yield several hundred gallons per minute; water may be saline.
Teritary	Salt Lake Group	Limited Aquifer	150	Tuffaceous sandstone, conglomerate, limestone and volcanic debris	Generally transmits water slowly; well yields are variable; yields dependent on fractures and solution cavities.
Permian	Diamond Creek Sandstone?	Limited Aquifer	Unknown	Calcareous sandstone and orthoquartzite	Generally transmits water slowly; well yields are variable; yields dependent on fractures and solution cavities.
Pennsylvanian	Oquirrh Formation, Undifferentiated	Limited Aquifer	Unknown	Interbedded limestone, siltstone, and orthoquartzite	Generally transmits water slowly; well yields are variable; yields dependent on fractures and solution cavities.
Mississippian	Manning Canyon Shale	Limited Aquifer	Unknown	Shale and siltstone	Generally transmits water slowly; well yields are variable; yields dependent on fractures and solution cavities.
	Great Blue Formation	Limited Aquifer	Unknown	Massive limestone	Generally transmits water slowly; well yields are variable; yields dependent on fractures and solution cavities.

Source: Doelling, 1980 and Bolke and Price, 1972.

USAF PLANT 78

TEST BORING LOG M-46



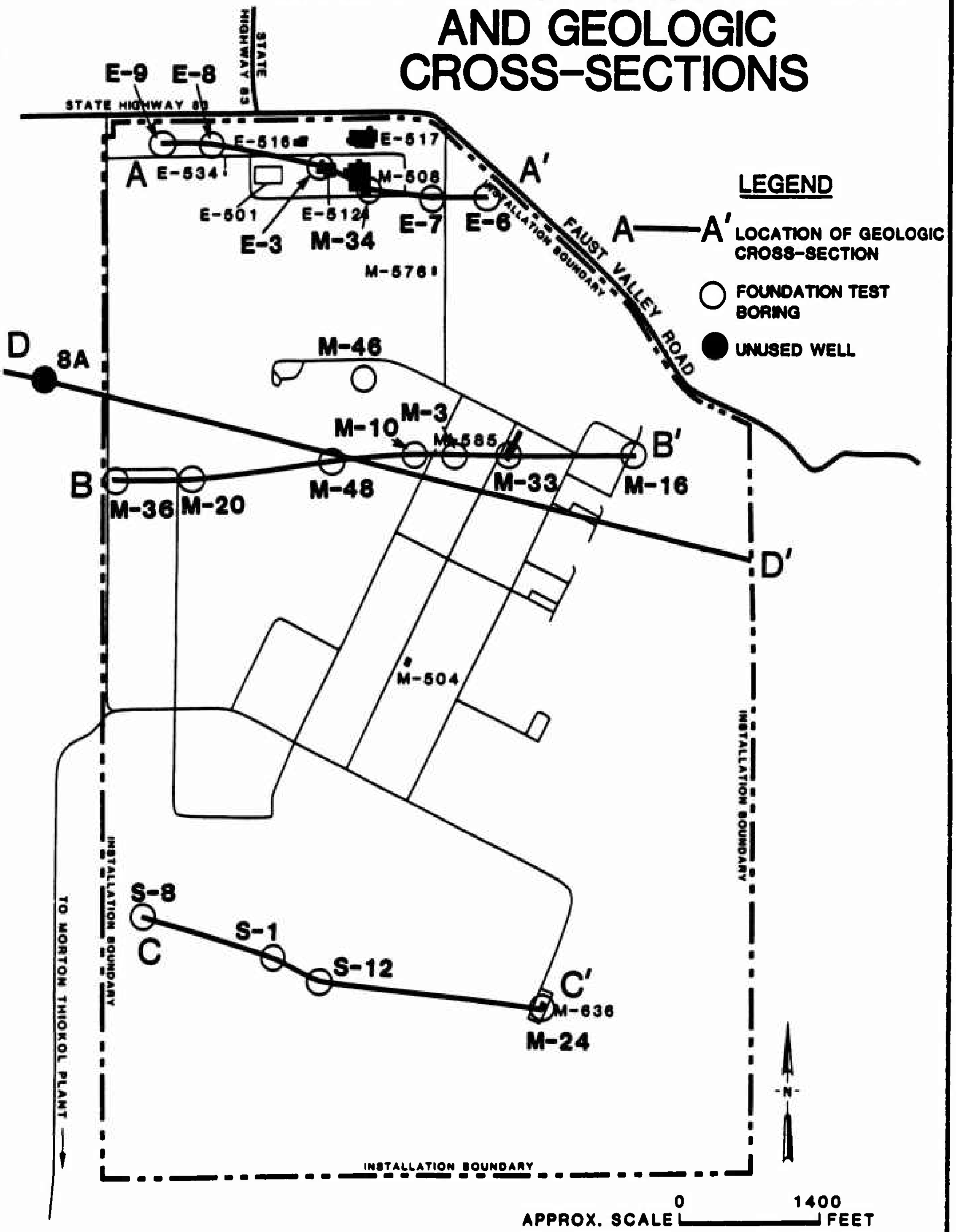
NO WATER ENCOUNTERED

NOTE: SEE FIGURE 3.8 FOR BORING LOCATION

SOURCE: USAF PLANT 78 DOCUMENTS

FIGURE 3.8

USAF PLANT 78
LOCATION OF TEST BORINGS AND GEOLOGIC CROSS-SECTIONS



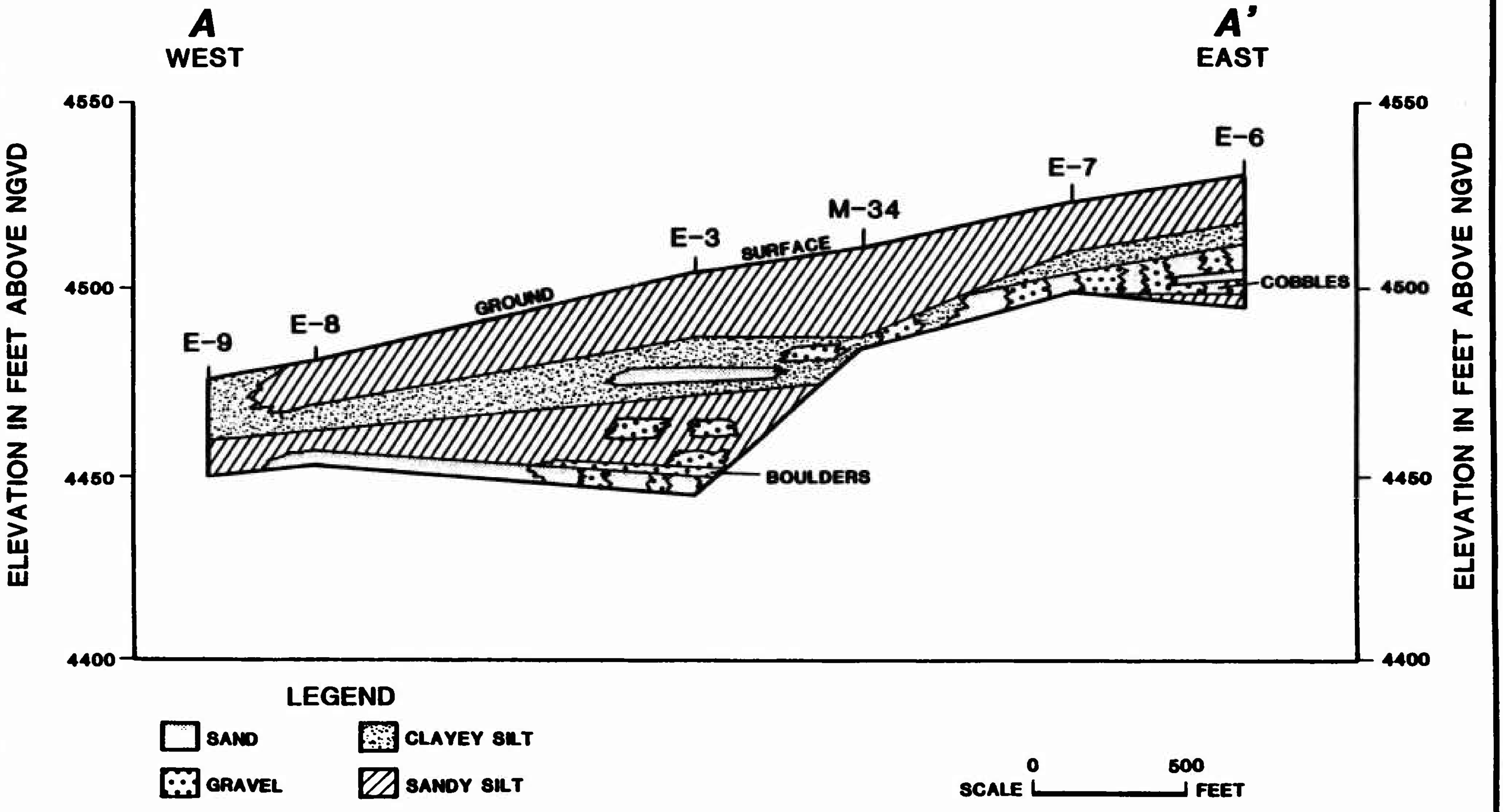
NOTE: SEE FIGURES 3.9, 3.10, 3.11 AND 3.12 FOR CROSS-SECTIONS

SOURCE: FACILITY DOCUMENTS AND HOLMAN, 1963

FIGURE 3.9

USAF PLANT 78

GEOLOGIC CROSS-SECTION A–A′

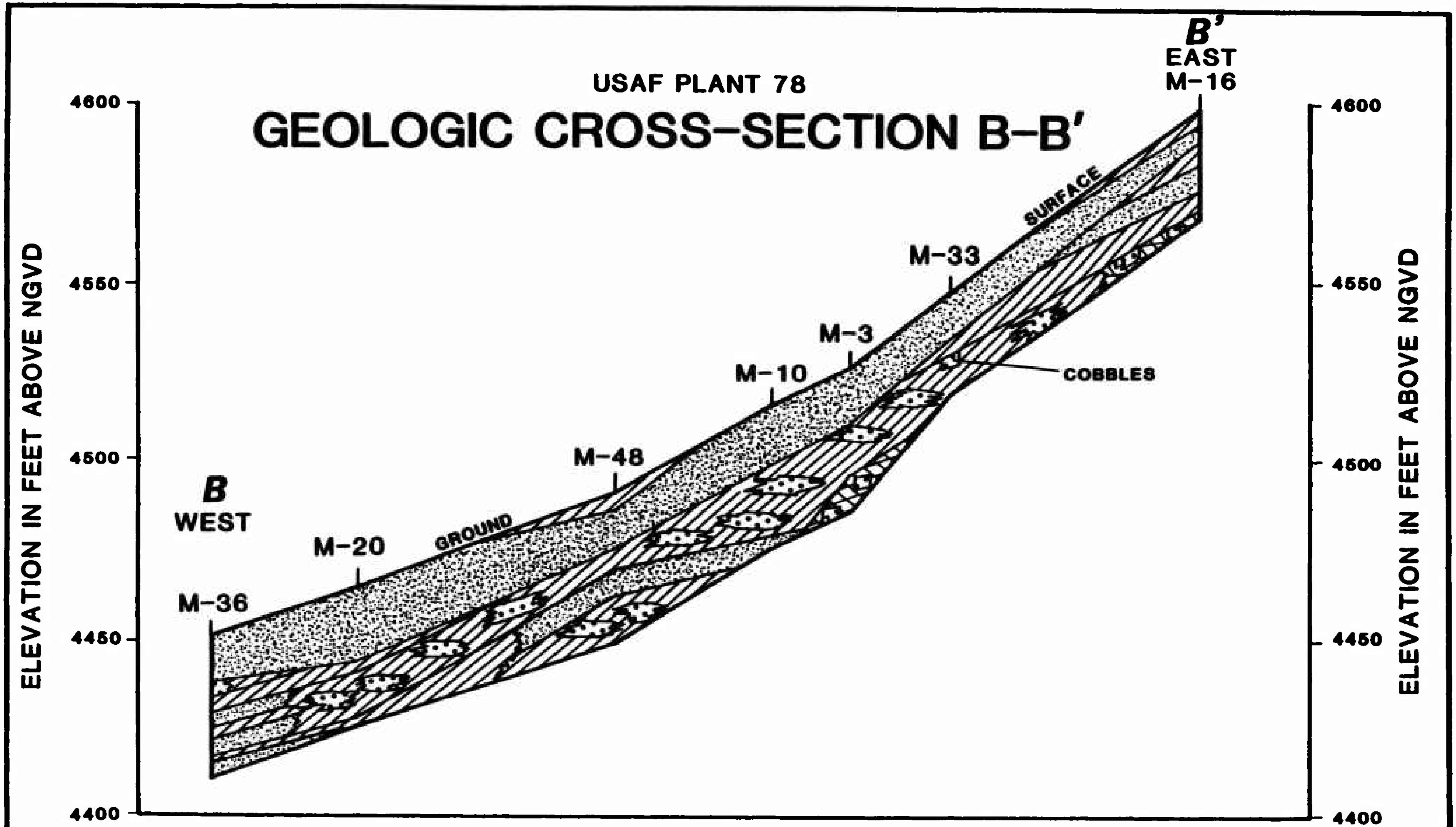


NOTE: SEE FIGURE 3.8 FOR CROSS-SECTION LOCATION
SOURCE: USAF PLANT 78 DOCUMENTS

FIGURE 3.10

USAF PLANT 78

GEOLOGIC CROSS-SECTION B-B′



LEGEND

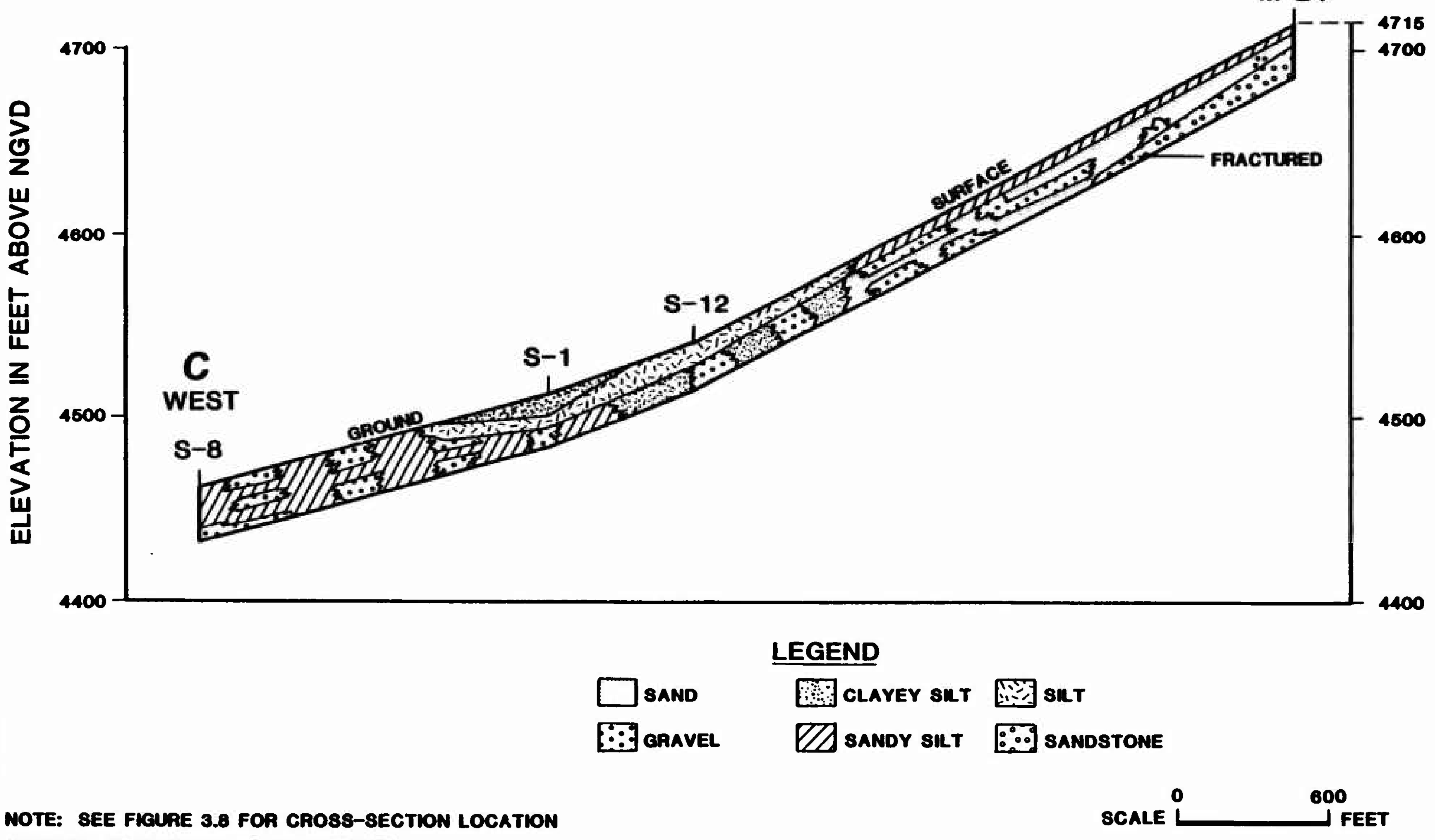
SANDY CLAY
CLAYEY SILT
GRAVEL
SANDY SILT

SCALE 0 800 FEET

NOTE: SEE FIGURE 3.8 FOR CROSS-SECTION LOCATION
SOURCE: USAF PLANT 78 DOCUMENTS

USAF PLANT 78

GEOLOGIC CROSS-SECTION C–C′

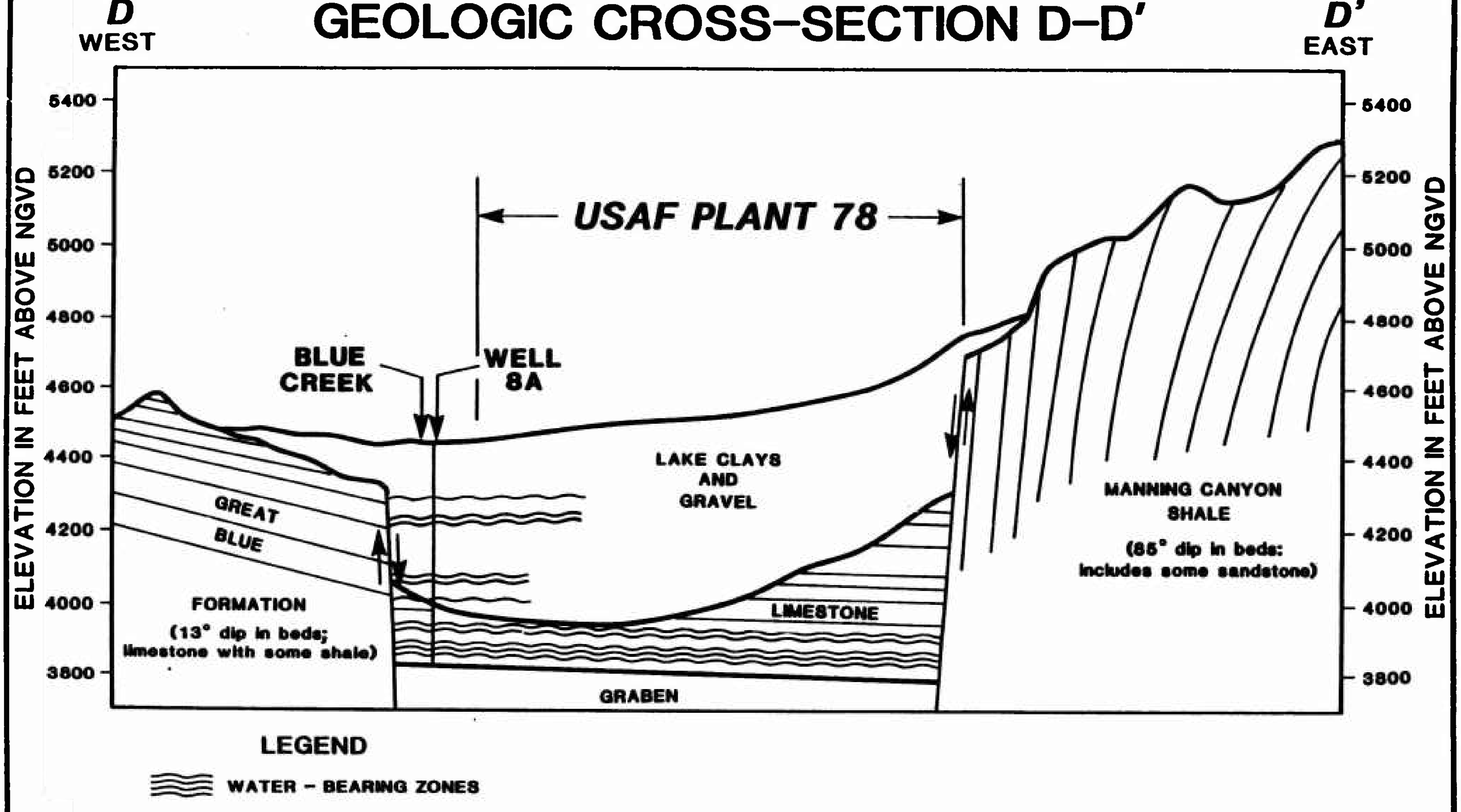


NOTE: SEE FIGURE 3.8 FOR CROSS-SECTION LOCATION
SOURCE: USAF PLANT 78 DOCUMENTS

FIGURE 3.12

USAF PLANT 78

GEOLOGIC CROSS-SECTION D–D′



NOTE: SEE FIGURE 3.8 FOR CROSS-SECTION LOCATION

SOURCE: HOLMAN, 1963 and DOELLING, 1980

Sandy silt with some gravel is dominant in the western portion of this cross section, but sand with gravel and fractured sandstone is most abundant in the eastern portion of the cross section. This eastern portion is in the same area identified by the SCS as having cobbly silt loam soils with shallow fractured rock. This portion is also in the same area identified by Doelling (1980) as having gravel outcrops. Cross-section D-D' shown on Figure 3.12 illustrates the deep stratigraphy in the vicinity of the plant. The plant is located in a structural graben which is a fault block that has been lowered relative to the blocks on either side. The graben contains Lake Clays, Gravel, Valley-Fill Deposits and limestone. Well 8A, drilled as a water supply test well for Morton Thiokol, encountered 445 feet of unconsolidated sediments and 165 feet of partially fractured and faulted limestone. The graben is bordered on the west by limestone and shale of the Great Blue Formation and on the east by shale and minor sandstone of the Manning Canyon Shale.

Plant 78 has been affected by two earthquakes in recent years. On March 28, 1975, an earthquake ranked 6.0 on the Richter Scale was felt by employees of the plant. The epicenter of this earthquake was in Pocatello Valley, Idaho, approximately 30 miles north of the plant (Richens, 1984). According to the Richter Scale, an earthquake ranked between 6.0 and 7.0 is potentially destructive. As a result of this earthquake, Blue Creek changed from an intermittent stream to a perennial stream. A second earthquake also felt by plant employees, occurred on October 28, 1983, and was ranked 7.3 on the Richter Scale. The epicenter of this earthquake was in Mackay, Idaho, approximately 175 miles north of the plant. According to the Richter Scale, an earthquake ranked between 7.0 and 7.7 is a major earthquake. There have been no observable effects from either earthquake on the plant. Numerous smaller earthquakes, ranked between 2.0 and 3.0 on the Richter Scale, have occurred within 50 miles of Blue Creek Valley over geologic time (Richens, 1984).

Hydrologically, Plant 78 is located in an area of relatively abundant but unuseable ground water. Figure 3.12 illustrates the location of water-bearing zones within Well 8A underlying the plant vicinity. These zones exist at 150, 200, 400, 430, 500 and 540 to 585 feet below ground.

Ground water in Blue Creek Valley occurs under unconfined (water table) and confined (artesian) conditions. These two conditions may exist in both the Valley-Fill Deposits and in fractured and faulted consolidated rocks. Perched water tables may exist in shallow deposits (Lake Clays, alluvium, gravel and sandy deposits) within the vicinity of the plant (Bolke and Price, 1972). Precipitation, surface-water infiltration and plant discharges which infiltrate into the plant sediments may migrate slowly vertically and/or horizontally to form perched water tables. The discharge of possible perched ground water may be vertically to the first water-bearing zone at 150 feet deep or horizontally to Blue Creek. Blue Creek may recharge shallow deposits in the center of the valley. Shallow ground water may migrate faster in the gravel and faulted and fractured rocks of the plant's southeast corner. The direction of movement within the gravel may be vertically to the 150-foot zone or horizontally toward Blue Creek. The direction of movement within the faulted and fractured rocks will be controlled by the connection of faults and fractures. Figure 3.13 shows the potentiometric surface map of Blue Creek Valley in 1970. The general direction of ground-water flow in the valley is north to south. The direction of ground-water flow on Plant 78 is generally west from the Blue Spring Hills to Blue Creek.

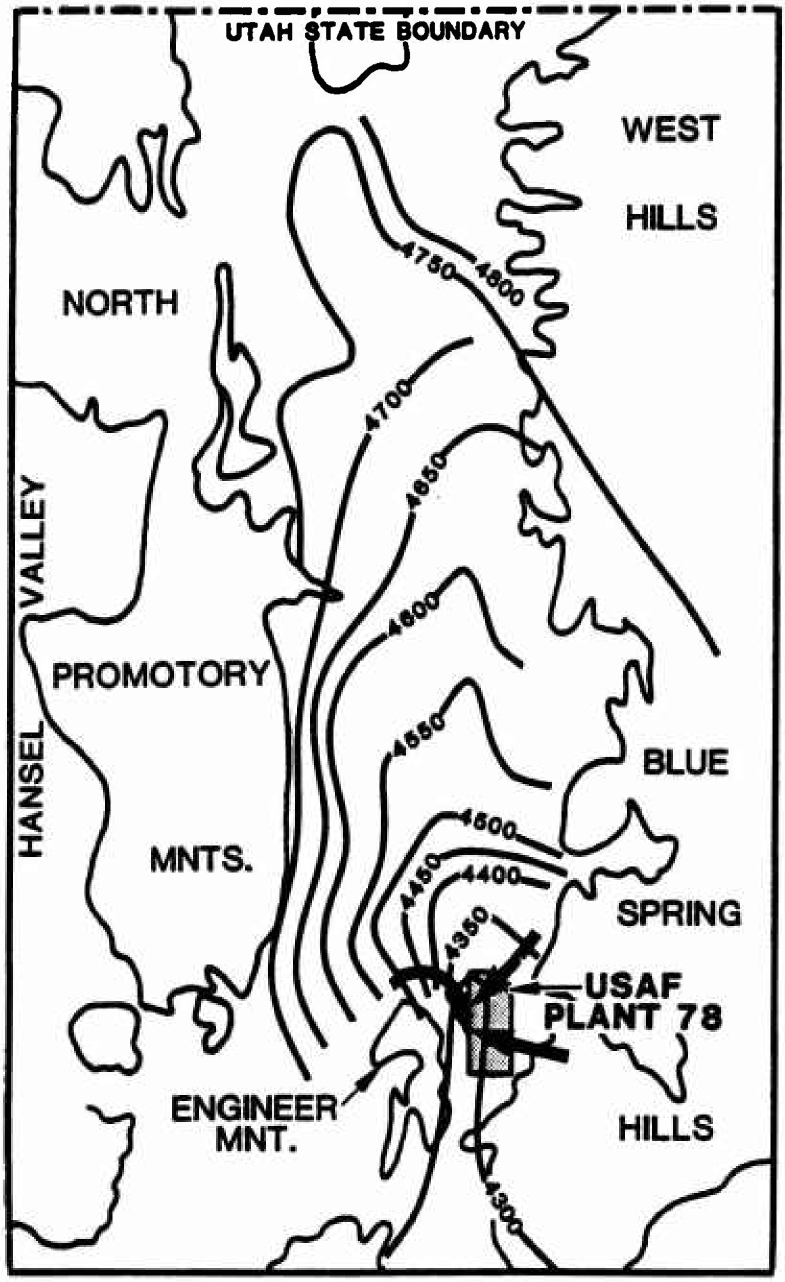
Ground-Water Quality

Ground-water quality in the immediate vicinity of the plant is poor due to the salinity of the water. Both water supply test wells drilled near the plant (No. 8A and No. 4) encountered saline water. The dissolved solids of both wells exceeded the drinking water standard of 1,000 mg/l. Munk Well No. 2, approximately 3 miles northwest of the plant, encountered fresher water with a dissolved solids content of 644 mg/l. Figure 3.14 identifies local wells and one spring where ground-water samples have been obtained. Table 3.5 summarizes the water quality analyses for these sampling stations.

Ground-water quality several miles both north and south of Plant 78 is good. The wells and springs used as water supply sources provide

USAF PLANT 78

POTENTIOMETRIC SURFACE MAP OF BLUE CREEK VALLEY AREA, 1970



LEGEND

—4600— POTENTIOMETRIC CONTOUR; DATUM IS NGVD.

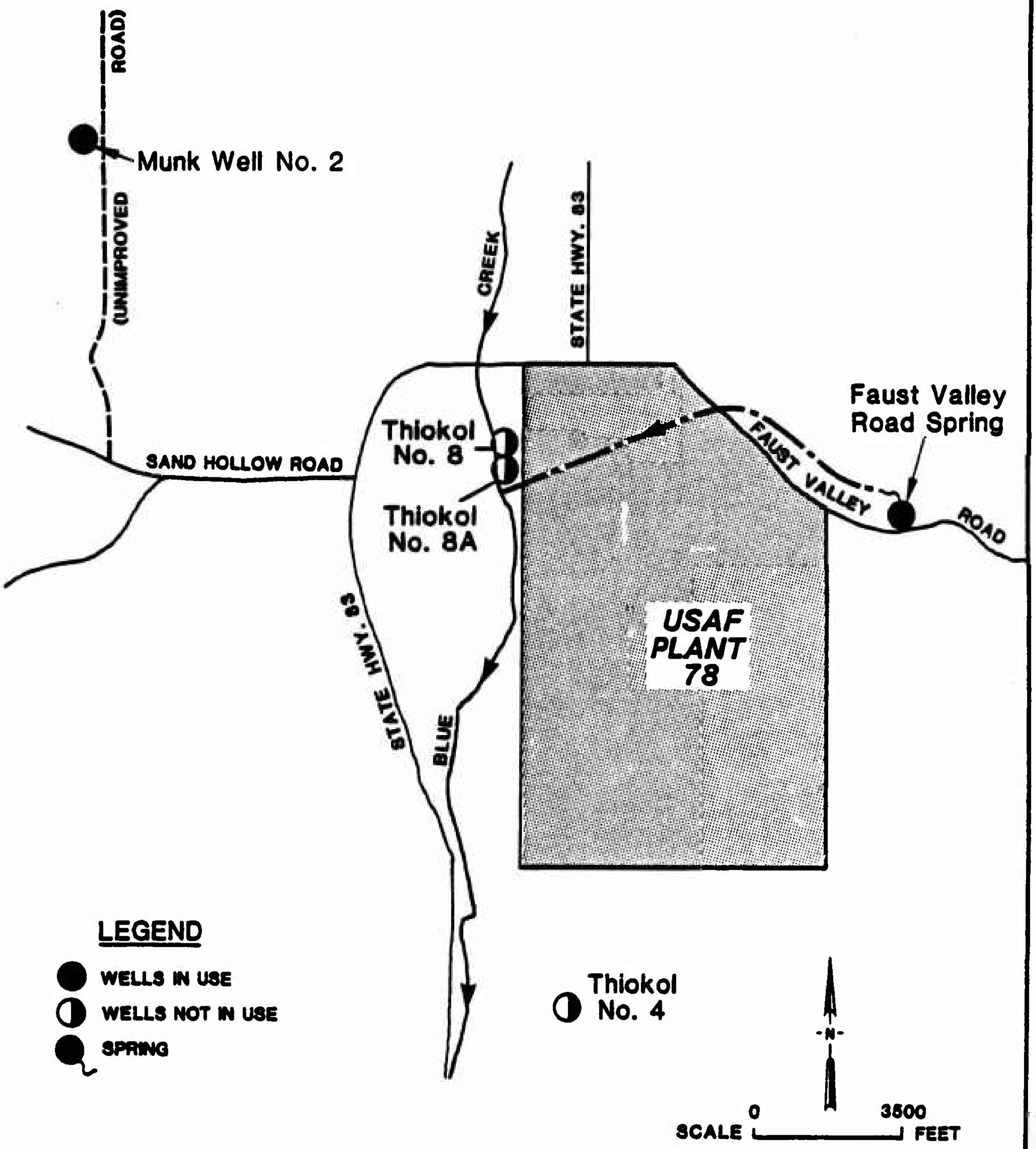
⟶ DIRECTION OF GROUND-WATER MOVEMENT.

-N-

SCALE 0 4 MILES

SOURCE: BOLKE AND PRICE, 1972

USAF PLANT 78
GROUND-WATER QUALITY SAMPLING LOCATIONS



NOTE: SEE TABLE 3.5 FOR QUALITY DATA
SOURCE: FACILITY DOCUMENTS AND BOLKE AND PRICE, 1972

TABLE 3.5

SELECTED GROUND-WATER QUALITY DATA FOR USAF PLANT 78 VICINITY
(Analyses are in milligrams per liter)

		Selected Parameters and Applicable Utah Water Quality Standards[2]					
Station Identification[1]	Date	pH (su)	Specific Conductance (umhos/cm)	Dissolved Solids (1000)	Chloride	Iron	Salinity
Faust Valley Road Spring	7-14-70	NA	765	NA	NA	NA	NA
Munk Well No. 2	7-14-70	8.2	1,100	644	230	NA	NA
Thiokol Well No. 4 (original sample)	Summer, 1958	NA	NA	NA	NA	NA	2,500
Thiokol Well No. 4	12-62	NA	NA	NA	NA	NA	245-256
Thiokol Well No. 4	6-63	NA	NA	NA	NA	NA	1,200
Thiokol Well No. 4 (sample No. 1)	7-2-63	8.0	NA	994	236	0.076	NA
Thiokol Well No. 4 (sample No. 4)	7-2-63	6.7	NA	2,845	1,360	0.165	NA
Thiokol Well No. 4 (sample No. 7)	7-2-63	6.7	NA	2,711	1,264	0.104	NA
Thiokol Well No. 4 (sample No. 8)	7-2-63	6.0	NA	2,580	1,210	0.08	NA
Thiokol Well No. 8A (bottom sample)	10-2-62	7.85	NA	NA	1,338	NA	NA
Thiokol Well No. 8A (pump setting at 550 ft.)	10-17-62	NA	4,340 (avg. value)	NA	1,243 (avg. value)	NA	NA
Thiokol Well No. 8A (pump setting at 500 ft.)	10-18-62	NA	4,183 (avg. value)	NA	1,249 (avg. value)	NA	NA
Thiokol Well No 8A (pump setting at 440 ft.)	10-19-62	NA	4,192 (avg. value)	NA	1,275 (avg. value)	NA	NA
Thiokol Well No. 8A (pump setting at 405 ft.)	10-22-62	NA	4,260 (avg. value)	NA	1,232 (avg. value)	NA	NA
Thiokol Well No. 8A	12-63	NA	NA	NA	NA	NA	1,300-1,400

NA = Not Analyzed   SU = Standard Unit   umhos/cm = micromhos per centimeter

Note: 1. See Figure 3.14 for station locations.

2. Utah Department of Health, Bureau of Public Water Supplies, Primary Drinking Water Standards, 1983.

Source: USAF Plant 78 Documents; Holman, 1963; Bolke and Price, 1972.

good quality water. Representative well supply water quality data is presented in Table E.2, Appendix E.

Ground-Water Use

Ground water is not used on Plant 78 due to poor water quality. Ground water use within the vicinity of the plant is limited to one stock well (Douglas Well) and one domestic water supply well (Munk No. 2 Well). Figure 3.15 shows the location of wells and one spring in the vicinity of the plant. Table 3.6 summarizes the well data for each well. One 1963 oil test well southwest of the plant encountered high pressure saline water and traces of oil at 8,463 and 8,485 feet below ground (Doelling, 1980).

Ground water from Morton Thiokol wells in Howell, approximately 8 miles north of Plant 78, Well 3A approximately 6 miles southeast of the plant and the Promontory wells approximately 10 miles south of the plant provide water to Plant 78. Water is also obtained from Railwood Springs approximately 3 miles southeast of the plant and Maple Springs approximately 10 miles south of the plant. During 1981 and 1982, Plant 78 used an average of 4 million gallons of water per month.

BIOTIC ENVIRONMENT

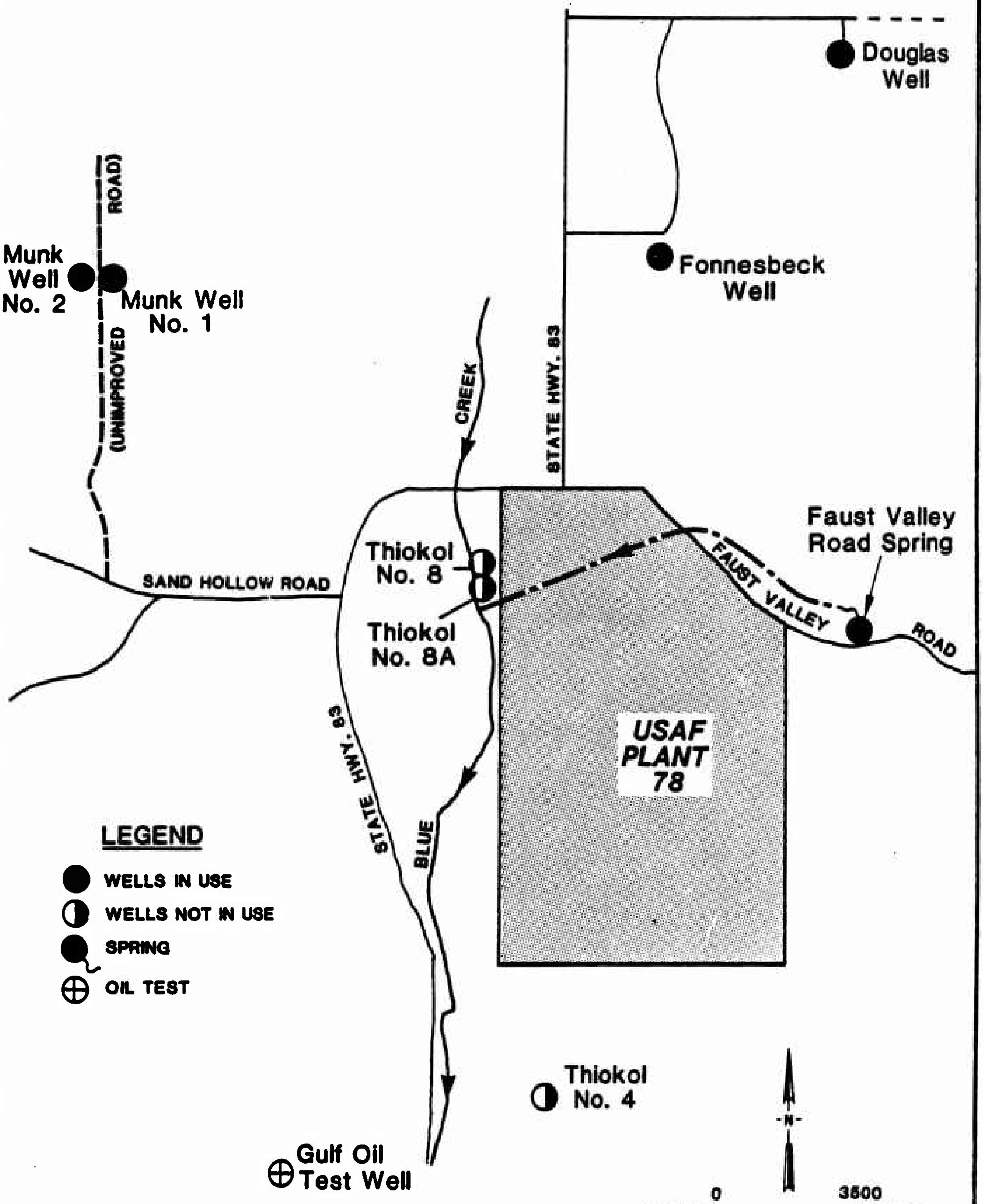
Within Blue Creek Valley, including Plant 78, common vegetation includes bunchgrass, sagebrush and juniper. Common animals in the valley include pheasant, deer and a variety of rodents. The only fish which would be expected to inhabit Blue Creek is the Western Speckled Dace (Battelle, 1983). During the plant visit in December pheasant and golden eagles were observed on the plant.

Within the regional vicinity of Plant 78 two species of birds have been listed as endangered by the U.S. Fish and Wildlife Service (England, 1983). These are the American peregrine falcon and the Bald eagle. Both on occasion may temporarily inhabit the Bear River Migratory Bird Refuge. There are no endangered or threatened species on Plant 78.

FIGURE 3.15

USAF PLANT 78

LOCATION OF WELLS AND SPRINGS



NOTE: SEE TABLE 3.6 FOR WELL AND SPRING DATA.

SOURCE: FACILITY DOCUMENTS AND BOLKE AND PRICE, 1972

TABLE 3.6

WELL DATA FOR USAF PLANT 78 VICINITY

Well Identification on Figure 3.15	Well Owner	Depth (Feet) Casing	Depth (Feet) Screen	Depth (Feet) Total	Hydrogeologic Unit(s) Tapped by Well	Water Level (Feet) Below Land Surface	Water Level (Feet) Date	Use
Douglas	L.P. Douglas	256	19	275	Valley-Fill Deposits	256	4-54	Stock
Munk No. 1	J.O. Munk	NR	(open end)	180	Valley-Fill Deposits	144	7-70	Unused
Munk No. 2	J.O. Munk	NR	NR	212	Valley-Fill Deposits	156	9-69	Domestic
Fonnesbeck	H. Fonnesbeck	200	NR	200	Valley-Fill Deposits	NR	NR	Unused
Gulf Oil Test Well	Gulf Oil Company	2,389	NR	8,966	Deposits of Silurian Age	NR	NR	Oil Test
Thiokol Well No. 4	Morton Thiokol, Inc., Wasatch Division	NR	NR	395	Great Blue Formation?	254	12-62	Unused
Thiokol Well No. 8	Morton Thiokol, Inc., Wasatch	0	0	458	Great Blue Formation? and Valley-Fill Deposits	NR	NR	Dry Hole/ Abandoned
Thiokol Well No. 8A	Morton Thiokol, Inc., Wasatch Division	400	400-410 430-450 480-510 530-590	610	Great Blue Formation? and Valley-Fill Deposits	150	12-62	Unused/ Capped

NR = No Record

Source: USAF Plant 78 Documents; Holman, 1963; Bolke and Price, 1972.

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data for Plant 78 indicate the following observations are important when evaluating past hazardous waste disposal practices.

- o The mean annual precipitation is 15.68 inches; the net precipitation is -26.32 inches and the 1-year, 24-hour rainfall event is estimated to be 1.25 inches. These data indicate that there is little or no potential for precipitation to infiltrate the surface soils on the plant. Also, there is a moderate potential for runoff and erosion.
- o The natural soils on the plant are typically silty loam with combinations of clayey, cobbly and gravelly loam. Relatively low permeabilities exist in a majority of the plant soils, but moderate permeabilities exist in the southeastern and southern portions of the plant where sand, cobbles and gravel are more prevalent. These data indicate that recharge by precipitation, surface-water runoff and plant discharges will be relatively slow except in the southeastern and southern portions where recharge may be moderate.
- o Surface-water drainage on the plant is controlled by open ditches, the Faust Valley Drainage Course and a major interceptor ditch. All drainage flows to Blue Creek.
- o Ammonium perchlorate has been found in Blue Creek water samples. The exact source of the contaminant is unknown.
- o Ground water exists under the plant in possibly perched aquifers, in the Valley-Fill Deposits (primary aquifer) and in faulted and fractured rock. The ground water in the Valley Fill Deposits and faulted/fractured rock is abundant but quite saline and usable. The depth to the water table in the Valley Fill-Deposits is 150 feet below ground level.
- o The direction of ground-water flow in possibly perched aquifers and the Valley Fill-Deposits is west towards Blue Creek. The general direction of ground-water flow in faulted and fractured rock is along the connecting faults and fractures.

- There are no Federally- or state-listed endangered or threatened species which inhabit the plant.

SECTION 4

FINDINGS

This chapter summarizes the industrial wastes that have been generated on Plant 78, describes past waste management and disposal methods, identifies the waste sites located at the plant, and evaluates the potential for environmental contamination from those sites.

PAST SHOP AND PLANT ACTIVITY REVIEW

A review was conducted of current and past waste generation and management methods in order to identify those activities that resulted in the generation of hazardous waste. This activity consisted of a review of files and records, interviews with current and former plant employees and site inspections.

The sources of hazardous waste at Air Force Plant 78 can be associated with one of the following activities:

- Industrial Operations (Shops)
- Fire Protection Training
- Fuels Management
- Pesticide Utilization
- Waste Storage Areas
- Spills

The following discussion emphasizes those wastes generated at Air Force Plant 78 which are either hazardous or potentially hazardous. In this discussion a hazardous substance is defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and a potentially hazardous waste is one which is suspected of being hazardous, although insufficient data are available to fully characterize the waste material.

Industrial Operations (Shops)

Industrial operations at Air Force Plant 78 have been conducted by Morton Thiokol, Inc. or its acquisitions since 1962. Plant 78 has been involved in providing rocket motors for various systems such as the Minuteman, Trident, Peacekeeper, and Space Shuttle. Operations at the plant have involved producing rocket motor nozzles, preparing and casting the propellants, and analyzing the casts for imperfections since 1962. The fabrication process involves mixing, casting, curing, tooling, and painting. The specific processes performed on site include:

- Machining aluminum, plastics, and titanium
- Degreasing
- Anodizing
- Plastics molding
- Casting/curing
- Cast cleaning
- Painting
- Propellant mixing
- Ingredient preparation (drying and grinding)

Additionally, rocket motors are radiographically inspected on-site. Motors are test-fired on Morton Thiokol property.

The wastes generated from the present industrial operations were used as a starting point for defining the past waste generation and waste management practices at the plant which have had minor changes over the plant life. Past waste generation quantities are commensurate with present levels. Morton Thiokol does not separate waste by Plant 78/Morton Thiokol property, making separate estimation of Plant 78/Morton Thiokol waste generation difficult. The plants are contiguous and work is shared (i.e., sometimes a process is performed at one plant that may be done later at the other plant, depending upon schedule restraints). From this review a list was developed that contains the facility name and number, the location, hazardous material handlers, hazardous waste generators, and typical treatment, storage, and disposal methods. This list is presented in Appendix D.

Those shops which were determined to be generators of hazardous waste were selected for further investigation and evaluation. During the site visit, interviews were conducted with personnel specifically familiar with these shop operations and waste generation. These interviews focused on hazardous waste generation, waste quantities, and methods of storage, treatment, and disposal of hazardous waste. Historical information was obtained primarily from interviews with various employees. Table 4.1 summarizes the information obtained from the detailed shop reviews including information on shop location, identification of hazardous or potentially hazardous wastes, present waste quantities, and treatment, storage, and disposal timelines. Changes in the treatment, storage and disposal methods are noted on the table.

Wastes generated have included chlorinated and non-chlorinated organic solvents, waste propellants and oxidizers. Waste management practices at Plant 78 include drum storage, drum treatment, tank treatment, and resource recovery. Wastes generally have been taken off of Plant 78 property to Morton Thiokol property for ultimate disposal since its construction in 1962. Exceptions to the usual practice are the disposal of X-O-Mat process fluids in leach fields and disposal of lab sink water in the Building M-585 french drain. Waste management practices carried out on Morton Thiokol property include open burning of waste propellant solutions and materials, or evaporation of anodizing solutions and industrial wastes. Waste materials not disposed of through treatment or burning are disposed of through outside contractors.

Temporary accumulation points for hazardous wastes are located throughout the industrial areas. Waste materials are containerized and no known spills have been noted.

Sumps and tanks are used to collect contaminated washwater which is pumped into a tank truck by Morton Thiokol and disposed of at their facilities off of Plant 78 property.

Fire Protection Training

Plant 78 has maintained a Fire Department on plant property since 1962. All fire training exercises using large fire fighting units have been conducted off the plant property in an area owned by Morton Thiokol. Training exercises using small fire fighting equipment such as fire extinguishers are conducted at the Fire Station on plant. These exercises generate little or no wastes. The fire extinguishing agents used now and in the past are water, carbon dioxide, Halon and AFFF.

TABLE 4.1
INDUSTRIAL OPERATIONS (Shops)
Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	WASTE MANAGEMENT PRACTICES 1960 1970 1980
MANUFACTURING AND FABRICATION				
PLASTIC AND NOZZLE FABRICATION	E-512	MEK	10 GALS./MO.	1962 MTI DISPOSAL
		METHYL CHLOROFORM	5 GALS./MO.	MTI DISPOSAL
		PAINT BOOTH WATER	500 GALS./MO.	FAUST VALLEY DRAINAGE TRIB; 1980 MTI DISPOSAL
		CHROMATED RUST INHIBITOR	10 GALS./YR.	FAUST VALLEY DRAINAGE TRIB; 1980 DISCONTINUED
MACHINE SHOP	E-517	WASTE SOLVENTS	<1 GAL./MO.	NORTH DITCH; 1976 MTI DISPOSAL
		WASTE MACHINE COOLANT	100 GALS./MO.	NORTH DITCH; 1971 MTI DISPOSAL
		WASTE OILS	15 GALS./MO.	MTI DISPOSAL
		ANODIZING RINSATE	3,000 GALS./WK.	MTI DISPOSAL
		ANODIZING BATHS	400 GALS./AS REQUIRED	NEUTRALIZED AND MTI DISPOSAL; 1982
INERT PARTS BUILDING	M-508	TRICHLOROETHYLENE	165 GALS./MO.	MTI DISPOSAL; 1973 DISCONTINUED USE OF TCE
		METHYL CHLOROFORM	165 GALS./MO.	MTI DISPOSAL
		TOLUENE WIPES	2 DRUMS/MO.	MTI DISPOSAL
		ACID ETCH/ALCOHOL	2 GALS./MO.	MTI DISPOSAL
		PHOTOGRAPHIC FIXER	120 GALS./WK.	1976 X-O-MAT #2 FIELD; 1982 SILVER RECOVERY TO FIELD

MTI - MORTON THIOKOL INC.

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	WASTE MANAGEMENT PRACTICES (1960 – 1970 – 1980)
INERT PARTS BUILDING (CONT'D)	M-508	PHOTOGRAPHIC PROCESS WATER	10,000 GALS./WK.	1976 X-O-MAT #2 FIELD →
		CONTAMINATED DYE PENETRANT WATER	300 GALS./WK.	1962 X-O-MAT #2 FIELD → 1974 MTI DISPOSAL →
CASTING AND MIXING				
CAST/CURE BUILDINGS	M-591 THROUGH M-603	PROPELLANTS, RAGS, GLOVES, SOLVENT WIPES	4,100 GALS./WK.	MTI DISPOSAL →
TOOLING ASSEMBLY	M-638	SOLVENT WIPES	2 DRUMS/MO.	MTI DISPOSAL →
CLEANING BUILDING	M-504	TRICHLOROETHYLENE	35 GALS./MO.	MTI DISPOSAL → 1973 DISCONTINUED USE OF TCE
		METHYL CHLOROFORM	35 GALS./MO.	MTI DISPOSAL →
		PROPELLANT, RAGS, GLOVES	2,100 LBS./MO.	MTI DISPOSAL →
		RINSEWATER (PROPELLANT CONTAMINATED)	2,500 GALS./WK.	MTI DISPOSAL →
MIXER BUILDINGS	M-519, 523, 524, 528	PROPELLANT, RAGS, GLOVES, SOLVENT WIPES	900 LBS./MO.	MTI DISPOSAL →
		RINSEWATER (PROPELLANT CONTAMINATED)	1,200 GALS./WK.	MTI DISPOSAL →

MTI - MORTON THIOKOL INC.

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	WASTE MANAGEMENT PRACTICES 1960 – 1970 – 1980
HMX PROCESSING	M-570, 571, 572, 573	PROPELLANT, RAGS, GLOVES, SOLVENT WIPES	700 LBS./MO.	1962 MTI DISPOSAL →
		RINSEWATER (CONTAMINATED)	4,800 GALS./WK.	MTI DISPOSAL →
		LAUNDRY WATER	1,200 GALS./DAY	MTI DISPOSAL →
SUBSCALE MFG.	M-605	PROPELLANT, RAGS, SOLVENT WIPES	1,000 LBS./MO.	MTI DISPOSAL →
ASSEMBLY				
PREFINAL ASSEMBLY	M-621	PROPELLANT, RAGS, WIPES	700 LBS./MO.	MTI DISPOSAL →
		PROPELLANT CONTAMINATED WATER	200 GALS./MO.	MTI DISPOSAL →
PREFINAL ASSEMBLY	M-622	PROPELLANT, RAGS, WIPES	300 LBS./MO.	MTI DISPOSAL →
CORE INSPECTION	M-623	SOLVENT, RAGS, WIPES	1 DRUM/MO.	MTI DISPOSAL →
FINAL ASSEMBLY	M-627, 628, 689	PROPELLANT, RAGS, WIPES	300 LBS./MO.	MTI DISPOSAL →
OXIDIZER PREPARATION AND GRINDING	M-606, 629	AMMONIUM PERCHLORATE	250 LBS./MO.	MTI DISPOSAL →
		CONTAMINATED SUMP WATER	650 GALS./WK.	MTI DISPOSAL →
BINDER PREMIX	M-693	CONTAMINATED SUMP WATER	700 GALS./MO.	MTI DISPOSAL →
		BINDER CONTAMINATED TRASH	200 LBS./MO.	MTI DISPOSAL →

MTI - MORTON THIOKOL INC.

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	WASTE MANAGEMENT PRACTICES (1960 – 1970 – 1980)
INSPECTION AND SAMPLING				
RADIOGRAPHIC INSPECTION	M-636	PHOTOGRAPHIC PROCESS WATER	10,000 GALS./WK.	1962 X-O-MAT #1 DRAINAGE →
		PHOTOGRAPHIC FIXER	120 GALS./WK.	X-O-MAT #1 DRAINAGE → 1982 SILVER RECOVERY TO X-O-MAT #2 FIELD AT M-508 →
QUALITY CONTROL LAB AND PROPELLANT MILLING	M-585,687	WASTE SOLVENTS AND STRIPPERS	55 GALS./MO.	MTI DISPOSAL →
		REACTIVE WASTES	150 LBS./WK.	MTI DISPOSAL →
		PROPELLANT	4,200 LBS./MO.	MTI DISPOSAL →
		CONTAMINATED CLOTHES, GLOVES	50 LBS./WK.	MTI DISPOSAL →
		WASTE SAMPLES, SOLVENTS	30 GALS./MO.	FRENCH DRAIN → 1973 MTI DISPOSAL →
		LAB WASH WATER	500 GALS./DAY	FRENCH DRAIN →
MAINTENANCE				
VEHICLE MAINTENANCE/PRESERVATION	E-516	WASTE OILS & SOLVENTS	5 DRUMS/MO.	MTI DISPOSAL →
		ANTIFREEZE	30 GALS./YR.	FLOOR DRAIN TO NORTH DITCH →
MATERIALS STORAGE	E-502	CONTAMINATED SUMP WATER	500 GALS./DAY	MTI DISPOSAL →

MTI - MORTON THIOKOL INC.

Fuels Management

The fuels used at Air Force Plant 78 consist of gasoline and diesel fuel to service the plant vehicles. The fuel is stored at Building E-516 in three 5,000 gallon underground tanks (gasoline) and one 3,200 gallon above ground tank (diesel fuel). The tanks were pressure tested in 1979 and gave no indications of leakage. Stick inventory testing occurs on a continual basis and has not shown any discrepancies. There have been no known spills over 5 gallons in conjunction with refueling activities.

The boiler house (M-576) is supplied from two 181,000 gallon aboveground tanks. The tanks hold #5 fuel oil and #6 fuel oil which is burned for steam production. There is an auxiliary 3,000 gallon underground tank which holds #2 fuel oil. The underground tank is stick inventoried and the aboveground tanks are monitored. No known spills over 10 gallons have occurred during unloading or normal operations at this facility.

Pesticide Utilization

The pesticide utilization program for Plant 78 has been managed by Thiokol personnel since 1962. All chemical mixing and equipment cleaning is done off of Plant 78 property. The types and approximate quantities of pesticides used on Plant 78 are shown in Table 4.2. Pesticides are utilized primarily for mosquito control (spring, summer, fall) and vegetation control (spring, fall).

Waste Storage Areas

Since 1980, storage of hazardous wastes at Plant 78 has occurred at one location as shown in Figure 4.1. This facility serves as a storage area for several items and is used to store recoverable methyl chloroform waste solvent. The recoverable solvent is sold to a contractor for reuse. Prior to 1980, the recoverable methyl chloroform was stored off of Plant 78 property awaiting sale to a contractor. All non-recoverable hazardous chemical wastes have been taken off-plant for Morton Thiokol disposal.

Spills

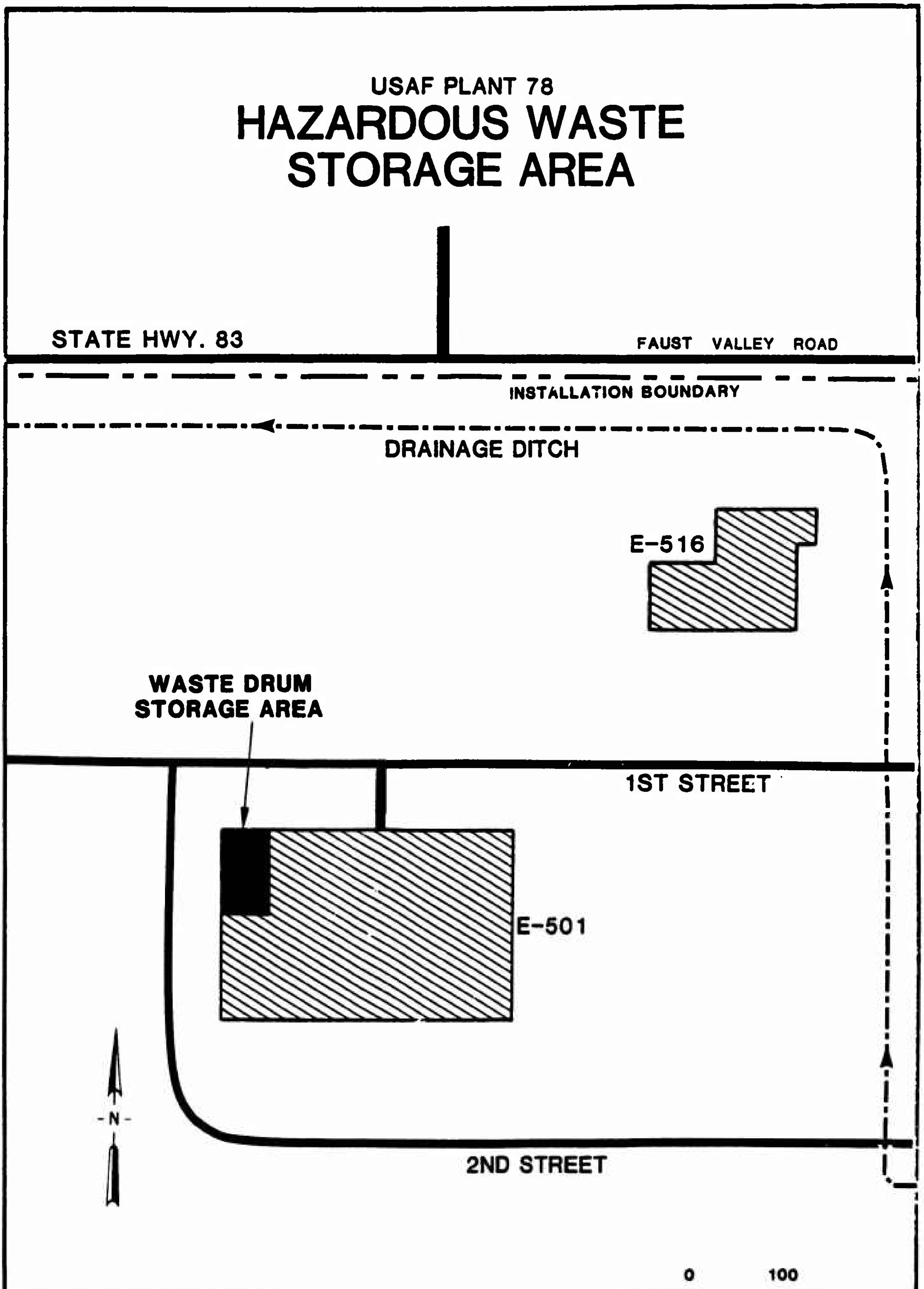
There have been no major spill incidents on Plant 78 since operations began in 1962. Minor spillage of fuel oil may occur on the ground area at the boiler house (M-576) during unloading operations.

TABLE 4.2

PRINCIPLE PESTICIDES USED ON AIR FORCE PLANT 78

Name	Approximate Quantity
Malathion 91%	100 gals/yr
Atrazine[1]	1200 lbs/yr
Krovar II	1000 lbs/yr
Oust	500 lbs/yr
Round-up	5 gals/yr

[1] Discontinued in 1981.



SOURCE: FACILITY DOCUMENTS

DESCRIPTION OF PAST TREATMENT AND DISPOSAL METHODS

The facilities on Air Force Plant 78 which have been used for treatment and disposal of wastes are limited to the following:

- o French Drain
- o Sanitary Sewer System
- o Surface Drainage System

No on-plant land treatment or disposal facilities existed at Plant 78 due to the availability of off-plant Morton Thiokol disposal facilities including evaporation ponds, burn pits and outside contractor disposal.

French Drain

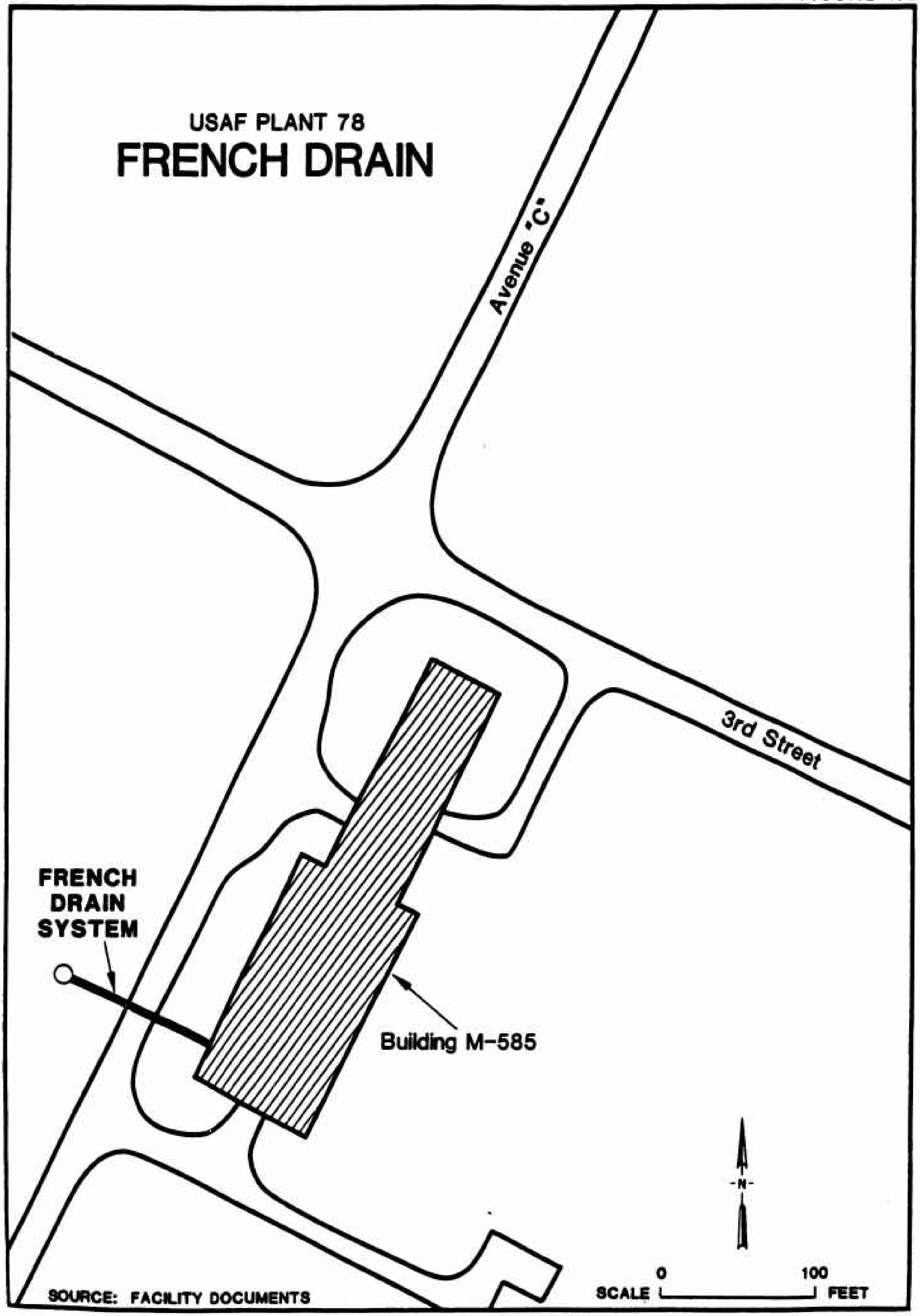
A french drain is located at Building M-585 as shown in Figure 4.2. The french drain consists of a 4-inch diameter gravity-flow line from the southwest end of Building M-585 leading to a large diameter sub-surface pit which allow water to seep into the soil. In the past, this french drain has received quantities of sink rinsewater contaminated with acids, alkalies and various solvents including acetone, MEK and benzene. Since 1980, disposal of solvents in the french drain has been eliminated and acids and alkalies are neutralized and/or diluted prior to disposal in the french drain. Waste solvents are presently segregated for off-plant disposal.

Sanitary Sewer System

Domestic sewage from the mixing, casting and finishing areas is treated and disposed of by septic tanks and drain field systems at the individual buildings. Domestic sewage from the administrative and manufacturing buildings at the north end of the plant is collected and treated in a package treatment plant. The treatment plant consists of primary clarification, aeration and settling followed by chlorination. Since 1976, the treated effluent has been discharged to an evaporation pond with no discharge to surface waters. Prior to 1976, the treated effluent was discharged to Blue Creek.

Surface Drainage System

The surface drainage system at Plant 78 includes open drainage ditches which discharge to Blue Creek. The general drainage patterns on


USAF PLANT 78
FRENCH DRAIN
Avenue "C"
3rd Street
FRENCH DRAIN SYSTEM
Building M-585
N
0
100
SCALE
FEET
SOURCE: FACILITY DOCUMENTS

the plant are shown in Figure 3.4. Blue Creek empties into the Great Salt Lake.

Evidence of contamination exists at several locations within the surface drainage system as a result of the shop activities. Two locations where silver contaminated photographic solutions were discharged and one location where oil and ammonium perchlorate contamination exists are present on Plant 78. Each of these areas are described below.

X-O-Mat Wastewater Discharge Area No. 1 (Bldg. M-636)

Photographic waste solutions containing silver and possibly cadmium were discharged from Building M-636 from the 1960's through 1982. The discharge area is shown in Figure 4.3. The area is a drainage path whereby the effluent from X-ray processing equipment was allowed to run onto the ground after some silver recovery. It would then evaporate or seep into the ground. In 1982, the fixer solution which contains the silver has been separated from the waste streams and collected for high efficiency silver recovery at Building M-508. The discharge of non-silver bearing photographic wastes was diverted to a separate drainage area and some attempts to recover the silver contaminated soil have been made.

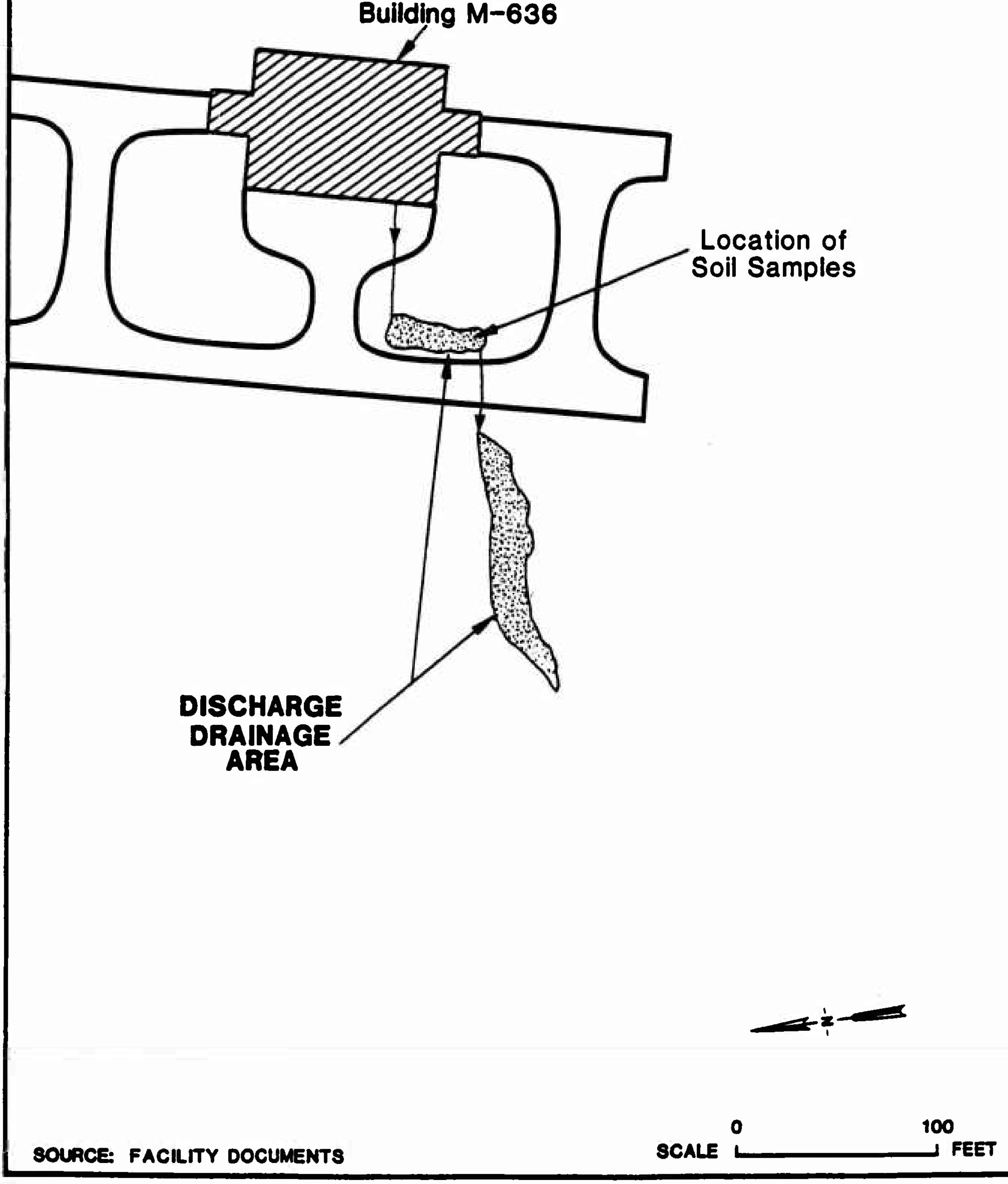
Soil samples were taken from the locations shown in Figure 4.3 to determine the total silver content and the potential leaching properties of the silver in the soil. The results of the sampling are shown in Table 4.3. The data indicates that the total silver content of the soil is approximately 25 percent by weight; however, the EP toxicity values indicated a range of 2.48 ppm near Building M-636 and 0.30 ppm away from Building M-636.

X-O-Mat Wastewater Discharge Area No. 2 (Bldg. M-508)

In 1976, X-ray processes were initiated at Building M-508 and photographic wastes were discharged to a subsurface drainage area as shown in Figure 4.4. Some silver recovery was practiced prior to discharging the photographic solutions. In 1982, a high efficiency silver recovery unit was installed at Building M-508 and the fixer from Buildings M-636 and M-508 is collected and treated. The treated fixer effluent from both buildings was then discharged to the M-508 drainage field. This recovery system is presently in operation. No soil sample data is available for the M-508 drainage area.

USAF PLANT 78

X-O-MAT WASTEWATER DISCHARGE AREA NO. 1

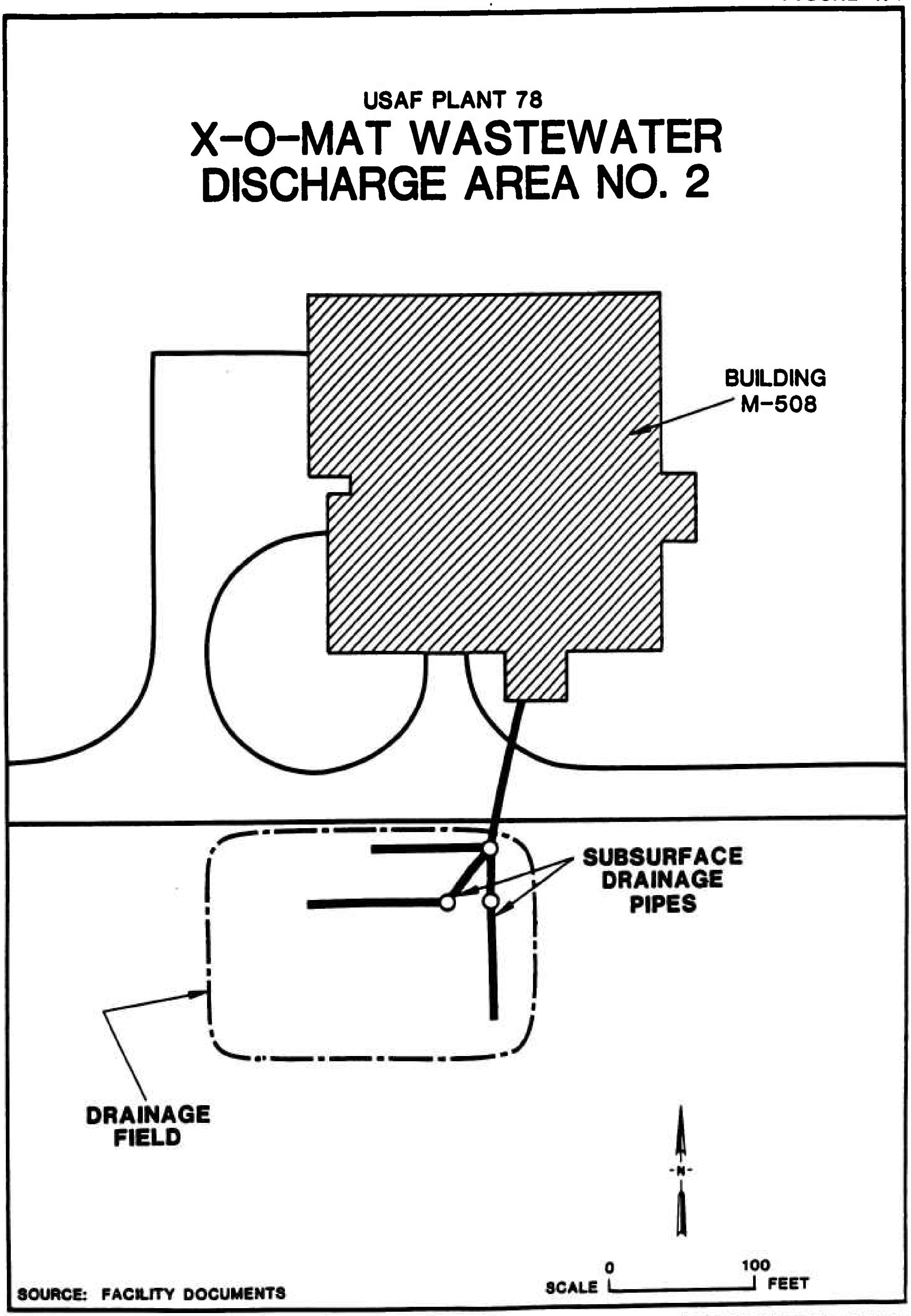


SOURCE: FACILITY DOCUMENTS

TABLE 4.3

SOIL SAMPLE DATA
BUILDING M-636
AIR FORCE PLANT 78

Sample Date	Sample Number	Building Number	EP Toxicity (ppm)	Total Silver Content (wt. percent)
2-16-83	1	M-636	2.48	No Data
2-16-83	2	M-636	0.44	No Data
2-16-83	3	M-636	0.30	No Data
3-24-83	Composite	M-636	0.70	25.5
3-24-83	Composite	M-636	0.40	25.4


USAF PLANT 78
X-O-MAT WASTEWATER
DISCHARGE AREA NO. 2
BUILDING
M-508
SUBSURFACE
DRAINAGE
PIPES
DRAINAGE
FIELD
-N-
0
100
SCALE
FEET
SOURCE: FACILITY DOCUMENTS

North Drainage Ditch

Since the 1960's, quantities of petroleum wastes, some industrial wastes and washwater has been discharged to the surface drainage area surrounding Buildings E-512, E-516, and M-508 as shown in Figure 4.5. During an investigation of the drainage ditches north of Building E-516, portions of the embankments were disturbed and sheens of oily material developed indicating that oily wastes may have been present in the past in the ditches. Also, surface water quality sampling data for Station No. 4 indicates elevated levels of ammonium perchlorate in the stream. Since 1972, the sampling results indicate the levels of ammonium perchlorate at Station No. 4 have ranged from 0.55 mg/l to 7.2 mg/l (see Table 3.3).

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

The review of past production functions and past waste management practices at Air Force Plant 78 has resulted in the identification of six sites which were considered as areas of concern with regard to the potential for contamination, as well as the potential for the migration of contaminants. These sites were evaluated using the Decision Tree Methodology referred to in Figure 1.1. The sites were further evaluated using the Hazard Assessment Rating Methodology (HARM). Table 4.4 identifies the decision tree logic used for each of the areas of initial concern. Photographs of some of the key disposal sites are included in Appendix F.

Based on the Decision Tree Logic, the sanitary treatment plant and the plant septic tanks did not warrant evaluation using the HARM system. These areas were eliminated due to the non-hazardous nature of the domestic waste treatment. Also, no evidence indicated that hazardous wastes were disposed of in these facilities.

The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. The details of the rating procedures are presented in Appendix G. Results of the assessment for the sites, based on a worst-case value of 100, are summarized in Table 4.5. The HARM system is designed to indicate the relative need for follow-on action. The information presented in Table

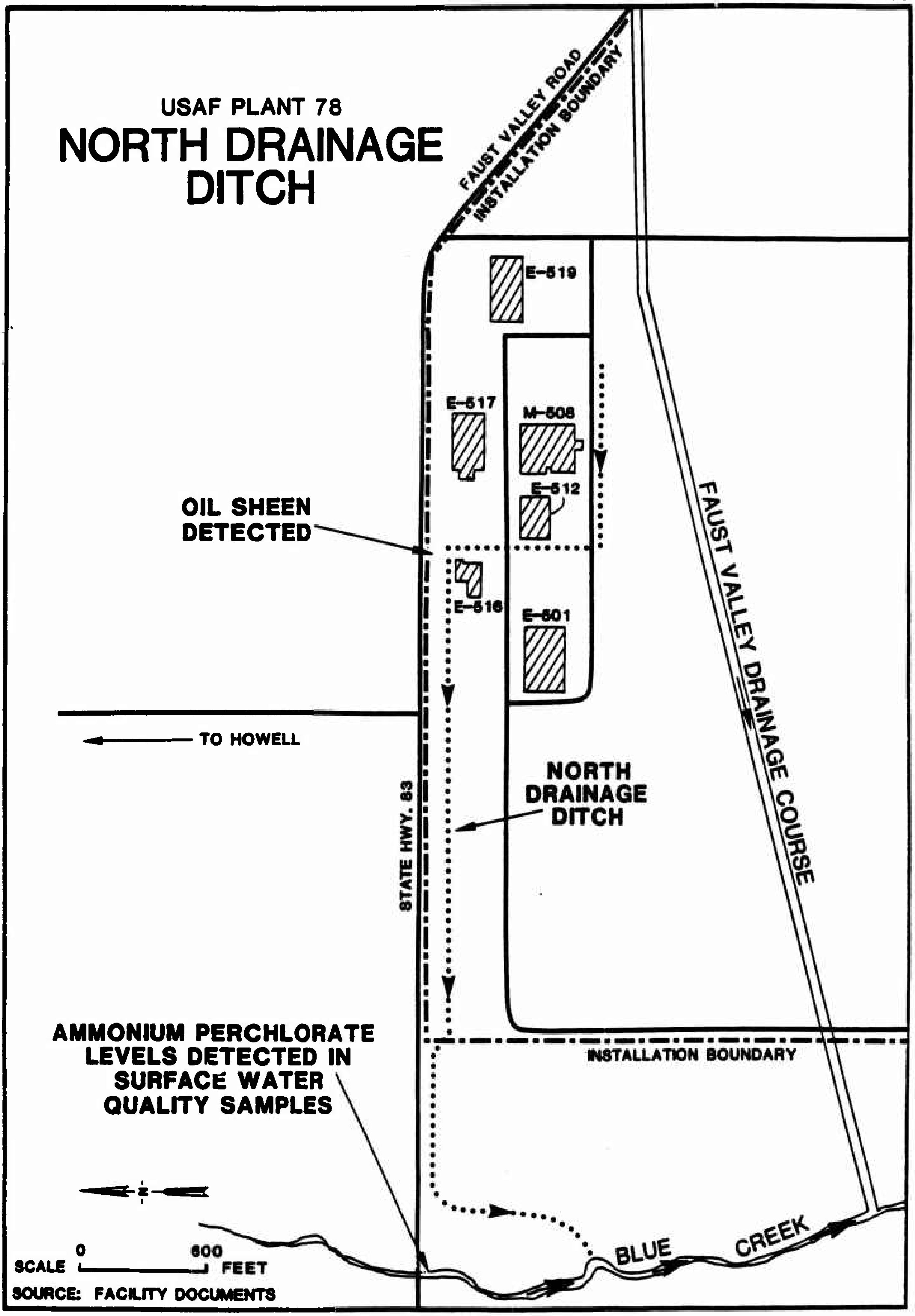

USAF PLANT 78
NORTH DRAINAGE DITCH
FAUST VALLEY ROAD
INSTALLATION BOUNDARY
E-519
E-517
M-508
E-512
OIL SHEEN DETECTED
E-516
E-501
FAUST VALLEY DRAINAGE COURSE
TO HOWELL
NORTH DRAINAGE DITCH
STATE HWY. 83
AMMONIUM PERCHLORATE LEVELS DETECTED IN SURFACE WATER QUALITY SAMPLES
INSTALLATION BOUNDARY
N
BLUE CREEK
SCALE 0 600 FEET
SOURCE: FACILITY DOCUMENTS

TABLE 4.4

SUMMARY OF DECISION TREE LOGIC FOR AREAS OF INITIAL ENVIRONMENTAL CONCERN AT AIR FORCE PLANT 78

Site	Potential for Contamination	Potential for Contaminant Migration	Potential for Other Environmental Concern	HARM Rating
French Drain	Yes	Yes	NA	Yes
Sanitary Treatment Plant	No	No	No	No
Plant Septic Tanks	No	No	No	No
X-O-Mat Wastewater Discharge Area No. 1	Yes	Yes	NA	Yes
X-O-Mat Wastewater Discharge Area No. 2	Yes	Yes	NA	Yes
North Drainage Ditch	Yes	Yes	NA	Yes

TABLE 4.5
SUMMARY OF HARM SCORES FOR POTENTIAL
CONTAMINATION SOURCES
AIR FORCE PLANT 78

Rank	Site	Receptor Subscore	Waste Characteristics Subscore	Pathways Subscore	Waste Management Factor	Overall Total Score
1	French Drain	43	54	48	1.0	48
2	X-O-Mat Wastewater Discharge Area No. 2	47	50	41	1.0	46
3	X-O-Mat Wastewater Discharge Area No. 1	37	50	43	1.0	43
4	North Drainage Ditch	47	50	24	1.0	40

4.5 is intended for assigning priorities for further evaluation of the Air Force Plant 78 disposal areas (Chapter 5, Conclusions, and Chapter 6, Recommendations). The rating forms for the individual waste disposal sites at Air Force Plant 78 are presented in Appendix H.

SECTION 5

CONCLUSIONS

The objective of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on field inspections, review of records and files, review of the environmental setting, and interviews with plant personnel, past employees, and state and local government employees. Table 5.1 contains a list of the potential contamination sources identified at Air Force Plant 78 and a summary of the HARM scores for those sites.

NORTH DRAINAGE DITCH

The north drainage ditch has a sufficient potential to create environmental contamination and follow-on investigation is warranted. Sheens of oily materials were visible in this ditch north of Building E-516 during an inspection of the area. Also, surface water monitoring data at Station No. 4 have indicated ammonium perchlorate levels since 1972 ranging from 0.55 mg/l to 7.2 mg/l. Natural soils in this area are composed of silty loam with moderately slow permeabilities. Ground water is usually present at 150 feet below ground, but there is a possibility of isolated perched water tables in the area. A nearby test boring (E-3) encountered sandy silt and silty clay to a depth of approximately 26 feet below ground. A thin lens of fine sand from 26 to 28 feet deep was encountered below which was clayey silt. The north drainage ditch received a HARM score of 66.

FRENCH DRAIN

The french drain located at Building M-585 has a sufficient potential to create environmental contamination and follow-on investigation is warranted. From 1962 to 1980, quantities of sink rinse water con-

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TABLE 5.1

SITES ASSESSED USING THE HAZARD ASSESSMENT RATING METHODOLOGY
AIR FORCE PLANT 78

Rank	Site Name and Number	Building Number	Occurrence	Final Score
1	North Drainage Ditch	E-516	1962-Present	66
2	French Drain	M-585	1962-Present	48
3	X-O-Mat Wastewater Discharge Area No. 2	M-508	1976-Present	46
4	X-O-Mat Wastewater Discharge Area No. 1	M-636	1962-1982	43

taminated with acids, alkalies and various solvents were disposed of in the french drain. From 1980 to the present, no solvents and only neutralized acids or bases have been disposed of in the french drain. Natural soils in this area are composed of silty loam with moderately slow permeabilities. Ground water is usually present at 150 feet below ground, but there is the possibility of isolated perched water tables in the area. A nearby test boring (M-33) encountered silt and clayey silt to a depth of approximately 15 feet below ground. Silty and clayey sand with cobbles and gravel was encountered from 15 to 25 feet below ground. Surface-water drainage from this site flows southwest along the open ditch near Building M-585. Water of sufficient volume could reach Blue Creek. The french drain received a HARM score of 48.

X-O-MAT WASTEWATER DISCHARGE AREA NO. 2 (BLDG. M-508)

The X-O-Mat Wastewater Discharge Area No. 2 has a sufficient potential to create environmental contamination and follow-on investigation Table 5.1 is warranted. From 1976 to 1982, photographic waste solutions containing silver and possibly cadmium were discharged to a subsurface drain field south of Building M-508. In 1980, a high efficiency silver recovery system was installed. The treated effluent is discharged to the drain field at present. Natural soils in this area are composed of silty loam with moderately slow permeabilities. Ground water is usually present at 150 feet below ground, but there is a possibility of isolated perched water tables in the area. A nearby test boring (M-34) encountered fine sandy silt to a depth of approximately 23 feet below ground. Silty clay with gravel was encountered from approximately 23 to 26 feet below ground. Surface-water drainage from this site flows west along the adjacent road then southwest to Blue Creek. This site received a HARM score of 46.

X-O-MAT WASTEWATER DISCHARGE AREA NO. 1 (BLDG. M-636)

The X-O-Mat Wastewater Discharge Area No. 1 has a sufficient potential to create environmental contamination and follow-on investigation is warranted. Photographic waste solutions containing silver and possibly cadmium were discharged to drainage pathway near Building M-636 from 1962 through 1982. Silver contamination in the soils of the drainage pathway has been quantified at levels of approximately 25 percent by weight. Natural soils in this area are composed of cobbly silt loam with relatively moderate permeability. Ground water is usually present at 150 feet below ground, but ground water may be present in fractured bedrock at less than 25 feet below ground. A nearby est boring (M-24) encountered fractured sandstone at approximately 8 feet below ground. Surface-water drainage from this site either infiltrates the soil or flows southwest towards the natural topographic depression in the immediate vicinity. This site received a HARM score of 43.

SECTION 6

RECOMMENDATIONS

Four sites were identified as having the potential for environmental contamination. These sites have been evaluated using the HARM system which assessed their relative potential for contamination. Each of the sites were determined to have sufficient evidence to indicate potential for environmental contamination. Additional data concerning these sites will be required in order to clearly ascertain whether or not these sites have contributed toward environmental contamination. Therefore, the following recommendations have been developed for each of these sites.

PHASE II MONITORING RECOMMENDATIONS

The following recommendations are made to further assess the potential for environmental contamination from waste disposal areas at Air Force Plant 78. The recommended actions are a one-time sampling program to determine if contamination does exist at the site. If contamination is confirmed, the sampling program may need to be expanded to further quantify the extent of contamination. The recommended monitoring program for Phase II is summarized in Table 6.1.

North Drainage Ditch

Stream sediment samples should be collected in the drainage ditch north of Building E-516. Each sediment sample should be taken at a depth of between 6 and 12 inches. Analysis should be performed for the parameters in Table 6.2.

Surface water monitoring points upstream from Station No. 4 in Blue Creek should be established. On a one time basis, the samples collected upstream of Station No. 4 should be analyzed for the parameters listed in Table 6.2, in addition to the parameters currently monitored at Station No. 4.

TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR PHASE II
AIR FORCE PLANT 78

Site Name	Rating Score	Recommended Monitoring	Comments
North Drainage Ditch	66	a. Collect series of stream sediment samples near Bldg. E-516. Samples should be analyzed for the parameters in Table 6.2.	Collect additional soil samples if contamination is found to quantify the extent of contamination.
		b. On a one time basis, collect surface water samples upstream from Station No. 4. Add parameters in Table 6.2, to routine analysis parameters.	
		c. Initiate surface water monitoring in the North Drainage Ditch near Blue Creek. Analyze water samples for the parameters in Table 6.2 on a one time basis.	Continue additional sampling if contamination is found to quantify the extent of the contamination and identify the source.
French Drain	48	Collect one soil core boring sample to a depth of six feet. Water extraction samples should be analyzed for the parameters in Table 6.2.	Collect additional soil core boring samples if contamination is found to quantify the extent of contamination.
X-O-Mat Wastewater Discharge Area No. 2	46	Collect two soil core boring samples in drain field. Water extraction analyses should be performed on the soil samples for the parameters in Table 6.2.	Collect additional soil core boring samples if contamination is found to quantify the extent of contamination.
X-O-Mat Wastewater Discharge Area No. 1	43	Collect one soil core boring sample to a depth of 18 inches. Water extraction samples from the soil sample should be analyzed for the parameters in Table 6.2.	Collect additional soil core boring samples if contamiantion is found to quantify the extent of contamination.

TABLE 6.2

RECOMMENDED LIST OF ANALYTICAL PARAMETERS
AIR FORCE PLANT 78

Silver	Oil and Greese
Ammonium Perchlorate	pH
Total Organic Carbon	Lead
Total Organic Halogens	Mercury
Phenols	
Cadmium	
Chromium	

An additional surface water monitoring point should be activated in the North Drainage Ditch near Blue Creek. On a one time basis, samples collected from this monitoring point should be analyzed to the parameters in Table 6.2.

French Drain

One soil core boring sample should be collected near the french drain to a depth of six feet. Water extraction samples from the soil samples should be analyzed for the parameters in Table 6.2.

X-O-Mat Wastewater Discharge Area No. 2 (Bldg. M-508)

Two soil core boring samples should be taken in the area of the drainage field near Building M-508 at a depth of at least one foot below the depth of the existing drain tile. Water extraction analyses should be performed on each soil sample for the parameters in Table 6.2.

X-O-Mat Wastewater Discharge Area No. 1 (Bldg. M-636)

One soil core boring sample should be collected in the contaminated soil to a depth of 18 inches. Water extraction samples from the soil samples should be analyzed for the parameters in Table 6.2.

APPENDIX A

PROJECT TEAM BIOGRAPHICAL DATA

Biographical Data

RANDAL M. REYNOLDS

Senior Engineer

[redacted] PII Redacted

Education

BChE (Chemical Engineering), 1973, Georgia Institute of Technology, Atlanta, Georgia

Professional Affiliations

Registered Professional Engineer, Georgia #13023
Air Pollution Control Association
American Institute of Chemical Engineers (Local Section Chairman, 1982-1983

Experience Record

1973-1975 U.S. Environmental Protection Agency, Water Enforcement Branch, Atlanta, Georgia. Chemical Engineer. Responsible for developing draft NPDES limitations for industrial discharges, issuing public notices and final NPDES permits and participating in public hearings concerning NPDES permits.

1975-1981 Gold Kist Inc., Corporate Engineering, Atlanta, Georgia. Environmental Process Engineer. Responsible for reviewing and implementing new air quality, NPDES, RCRA and TSCA regulations. Supervised preparation and submittal of air quality, water quality and hazardous waste permit applications. Kept management informed of impact of regulations on existing and future projects.

Served as staff engineer responsible for preparing preliminary designs for air pollution control systems and detailed cost estimates for air system capital projects. Major projects included the preliminary selection of alternatives for a particulate emission control system for a 60,000 lbs/hr industrial steam boiler (peanut hull/wood fired).

1981-Date Engineering-Science, Inc., Atlanta, Georgia. Senior Engineer. Responsible for developing environmental studies and alternative evaluations for clients in the areas of solid/hazardous waste management, spill control and containment and process/energy system design.

Randal M. Reynolds (Continued)

Lead Project Engineer for a U.S. Department of Energy project concerning the disposal of coal wastes from industrial facilities using RCRA nonhazardous and hazardous design conditions. Performed 19 industrial plant site visits to obtain specific coal ash handling and disposal costs. Coordinated the preparation of 20 plant reports describing the individual cost estimates to comply with RCRA regulations.

Project Manager for an evaluation of laboratory waste solvent generation from an industrial facility. Worked with client's lab personnel to accurately determine waste types and quantities. Established lab procedures to segregate waste solvents for contractor disposal.

Project Manager for a Phase I Installation Restoration Program (IRP) project for the Department of Defense. Conducted interviews of past and present employees, examined records, and performed site investigations to determine hazardous chemical usage, waste generation and waste disposal practices for industrial operations at Air Force facilities.

Through environmental audit procedures, identified industrial operation disposal practices which could result in waste migration and recommended priority disposal practices requiring further investigation. Project Engineer for Phase I IRP projects for 10 other Air Force bases.

Project Engineer assisting in a comprehensive study of the solid waste management program for the City of Roswell, Georgia. Developed conceptual cost estimates for a city operated sanitary landfill and incinerator disposal alternatives.

Project Manager for development of a Spill Prevention Control and Countermeasures (SPCC) Plan for an industrial facility. Coordinated the design of spill containment structures and recommended essential spill control and clean-up equipment.

<u>Publications and Presentations</u>

R. M. Reynolds, C. M. Mangan and B. D. Moreth, "Projected RCRA Disposal Costs for Ash and Related Wastes from Coal-Fired Industrial Facilities," presented at the 76th Annual Meeting of the Air Pollution Control Association, Atlanta, Georgia, June 20, 1983.

Randal M. Reynolds (Continued)

R. M. Reynolds, "Practical Tips - Bagging Sludge?", Pollution Engineering, Vol. 12, No. 17, July 1980, pg. 28.

R. M. Reynolds, "Pulse-Type Fabric Filters in a Soybean Processing Facility," Operation and Maintenance of Air Particulate Control Equipment, R. A. Young, F. L. Cross, Jr., editors, Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, July 1980, pp. 121-123.

"Operation, Maintenance and Design of Fabric Filters for a Soybean Processing Facility," a slide presentation for an EPA technology transfer seminar, "Operation and Maintenance of Air Pollution Equipment for Particulate Control," April 12, 1979, Atlanta, Georgia.

Biographical Data

H. DAN HARMAN, JR.
Hydrogeologist

[redacted] PII Redacted

Education

B.S., Geology, 1970, University of Tennessee, Knoxville, TN

Professional Affiliations

Registered Professional Geologist (Georgia NO.569)
National Water Well Association (Certified Water Well Driller No. 2664)
Georgia Ground-Water Association

Experience Record

1975-1977 Northwest Florida Water Management District, Havana, Florida. Hydrogeologist. Responsible for borehole geophysical logger operation and log interpretation. Also reviewed permit applications for new water wells.

1977-1978 Dixie Well Boring Company, Inc., LaGrange, Georgia. Hydrogeologist/Well Driller. Responsible for borehole geophysical logger operation and log interpretation. Also conducted earth resistivity surveys in Georgia and Alabama Piedmont Provinces for locations of water-bearing fractures. Additional responsibilities included drilling with mud and air rotary drilling rigs as well as bucket auger rigs.

1978-1980 Law Engineering Testing Company, Inc., Marietta, Georgia. Hydrogeologist. Responsible for ground-water resource evaluations and hydrogeological field operations for government and industrial clients. A major responsibility was as the Mississippi Field Hydrologist during the installation of both fresh and saline water wells for a regional aquifer evaluation related to the possible storage of high level radioactive waste in the Gulf Coast Salt Domes.

1980-1982 Ecology and Environment, Inc., Decatur, Georgia. Hydrogeologist. Responsible for project management of hydrogeological and geophysical investigations at uncontrolled hazardous waste sites. Also prepared Emergency Action Plans and Remedial Approach Plans for U.S. Environmental Protection Agency. Additional

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responsibilities included use of the MITRE hazardous ranking system to rank sites on the National Superfund List.

1982-1983 NUS Corporation, Tucker, Georgia. Hydrogeologist. Responsible for project management of hydrogeological and geophysical investigations at uncontrolled hazardous waste sites.

1983-Date Engineering-Science, Inc., Atlanta, Georgia. Hydrogeologist. Responsible for hydrogeological as well as geophysical evaluations at hazardous waste sites.

Publications and Presentations

"Geophysical Well Logging: An Aid in Georgia Ground-Water Projects," 1977, coauthor: D. Watson, The Georgia Operator, Georgia Water and Pollution Control Association.

"Use of Surface Geophysical Methods Prior to Monitor Well Drilling," 1981. Presented to Fifth Southeastern Ground-Water Conference, Americus, Georgia.

"Cost-Effective Preliminary Leachate Monitoring at an Uncontrolled Hazardous Waste Site," 1982, coauthor: S. Hitchcock. Presented to Third National Conference on Management of Uncontrolled Hazardous Waste Sites, Washington, D.C.

"Application of Geophysical Techniques as a Site Screening Procedure at Hazardous Waste Sites," 1983, coauthor: S. Hitchcock. Proceedings of the Third National Symposion and Exposition on Aquifer Restoration and Ground-Water Monitoring, Columbus, Ohio.

"Developing Ground-Water Supplies on the Georgia Piedmont: Applied Technology Versus the 'Dry Hole' Syndrome," 1983, coauthors: D. Watson and T. Duffey. Presentation at the Water Resources of Georgia and Adjacent Areas Conference, Atlanta, Georgia.

"Georgia's Piedmont Ground Water: Proper Well Location is Crucial to Effective Management," 1983, coauthors: D. Watson and T. Duffey. Presentation at National Water Well Association Eastern Regional Conference on Ground-Water Management, Orlando, Florida.

Biographical Data

BRIAN D. MORETH

Environmental Scientist

[redacted] PII Redacted

Education

B.S. in Forest Science and Zoology, 1971, Pennsylvania State University, University Park
Wildlife Management, Pennsylvania State University, University Park

Professional Affiliations

American Fisheries Society
Society of American Foresters
Wildlife Society

Honorary Affiliations

Phi Epsilon Phi
Phi Sigma
Xi Sigma Phi

Experience Record

1971-1973 Pennsylvania Cooperative Wildlife Unit. Research Assistant. Participated in wildlife research studies and design and implementation of public land use surveys. Cover mapped a parcel of state game lands by means of aerial photography and prepared suggestions for land management. Conducted research on the vegetative preferences of the ruffed grouse. Delivered public lectures to organized groups and schools.

1973-1980 Buchart-Horn, Inc., Environmental Division, York, Pennsylvania. Project Scientist. Researched, prepared, and supervised aspects of environmental studies dealing with wildlife, fishery, forestry, and land use. Coordinated preparation of various environmental impact statements. Prepared natural resource inventories for proposed sewer and highway construction areas and assessed possible impacts. Participated in evaluation of alternative sewage disposal systems. Coauthored a trout hatchery feasibility study of present facilities for the State of New Jersey, and prepared revegetation plans for reservoir and strip mined lands.

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Brian D. Moreth (Continued)

Task Force Leader. Prepared an inventory of all natural resources and environmentally sensitive and degraded areas for the environmental quality segment of the Comprehensive Water Quality Management Plan for a seven-county area in northeast Pennsylvania.

1974-1980 Pennsylvania Game Commission, York County, Pennsylvania (concurrent position). Deputy Game Protector. Responsible for enforcement of game, fish, forestry, and park laws of the Commonwealth of Pennsylvania. Assisted in public presentations including instruction of hunter safety courses.

1980-Date Engineering-Science. Scientist. Involved in the development of environmental studies, inventories, and evaluations for municipal, industrial, and federal government projects. Served as deputy project manager for preparation of a third-party EIS addressing multiple impacts from construction and operation of a phosphate mine in Florida. Involved in site and records searches of hazardous waste disposal activities and associated biological effects at several Air Force Bases. Assisted in development of a peat mining and restoration plan for a private concern in North Carolina.

APPENDIX B

LIST OF INTERVIEWEES

TABLE B.1

LIST OF INTERVIEWEES

Position	Years of Service
1. USAF Safety Manager	6
2. Senior Safety Engineer	22
3. Support Facilities Engineer Inert	10
4. Industrial Hygiene Associate	<1
5. Industrial Hygiene Section Supervisor	6
6. Supervisor, Machine Shop	21
7. Lead Machinist	22
8. Supervisor, Plastic Operations	9
9. Foreman, Plastic Operations	10
10. Foreman, NDT	22
11. Lab Manager	18
12. Senior Quality Control Analyst	19
13. Senior Chemist	21
14. Foreman, Casting	22
15. Station Engineer	21
16. Manager, Motor Manufacturing	21
17. Planning Specialist	5
18. Lead Operator	9
19. Foreman, Motor Manufacturing	19
20. Manufacturing Shift Supervisor	21
21. Foreman, Refurbishment	12
22. Manager, Maintenance & Construction	22
23. Industrial Engineer, AFPRO/PD	14
24. Foreman, Prevent. Maint. Roads & Grounds	24
25. Foreman, Burning Grounds	13
26. Fire Chief	23
27. Fire Chief, Retired	26
28. Manager, Products & Methods Development	22
29. Supervisor, Industrial Engineering, AFPRO/PD	10
30. Associate Scientist, Analytical Methods	15

TABLE B.1

(Continued)

LIST OF INTERVIEWEES

Position	Years of Service
31. Supervisor, Filament Winding	22
32. Supervisor, Excess Property	21
33. Supervisor, Property Management	21
34. Supervisor, Process Engineering	25
35. Director, Works Engineering	24
36. Senior Engineer, Process Engineering	5

TABLE B.2

OUTSIDE AGENCY CONTACTS

Name	Position
Lee Malmberg	Box Elder County Health Department, Brigham City, UT; Sanitarian (801) 257-3318
William Richens	University of Utah Seismic Station, Salt Lake City, UT; Seismologist (801) 581-6274
Lee McQuivey, P.E.	U.S. Corps of Engineers, Salt Lake City, UT; Project Planner (801) 524-6015
Harold T. Brown	U.S. Department of Agriculture, Soil Conservation Service, Salt Lake City, UT; Water Shed Project Manager (801) 524-5051
Victor Parslow	U.S. Department of Agriculture, Soil Conservation Service, Tremonton, UT; Soil Scientist (801) 257-5403
Jim Harvey	U.S. Department of Commerce Federal Emergency Management Agency, Salt Lake City, UT; State Coordinator (801) 533-5271
Elmer Schnalt	U.S. Environmental Protection Agency, Region VIII; Denver, CO; Federal Facilities Coordinator (303) 837-3826
Larry England	U.S. Fish and Wildlife Service, Endangered Species Office, Salt Lake City, UT; Staff Botanist (801) 524-5630
Joe Gates	U.S. Geological Survey, Water Resources Division, Salt Lake City, UT; Geologist (801) 524-5654

TABLE B.2
(Continued)
OUTSIDE AGENCY CONTACTS

Name	Position
Bob Walters	Utah Department of Natural Resources and Energy, Division of wildlife Resources, Salt Lake City, UT; Resource Analyst (801) 533-9333
Kurt M. Nelson	Utah Department of Health, Bureau of Solid Waste Management, Division Of Environmental Health, Salt Lake City, UT; Closure Expert (801) 533-4145
Reed Oberndorfer Richard Denton Steve McNeal	Utah Department of Health, Bureau of Water Pollution Control, Public Health Engineers, Salt Lake City, UT; (801) 533-6146
Fred Peherson	Utah Department of Health, Bureau of Water Pollution Control, Salt Lake City, UT; Chief of Permits and Compliance Section (801) 533-6146
Ken Bouchfield	Utah Department of Health, Bureau of Public Water Supplies, Salt Lake City, UT; Public Health Engineer (801) 533-4207
Gene Bigler, P.E.	Utah Division of Water Resources, Salt Lake City, UT; Engineer (801) 533-5401
(Publications Clerk)	Utah Geological and Mineral Survey, Salt Lake City, UT; (801) 524-5652

APPENDIX C

REFERENCES

APPENDIX C

REFERENCES

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England, L., 1983. Staff Botanist, U.S. Fish and Wildlife Service, Endangered Species Office, Salt Lake City, Utah (801) 524-5630, December 13, 1983.

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Hood, J.W., 1976. Hydrologic Reconnaissance of the Promontory Mountains Area, Box Elder County, Utah. Utah Department of Natural Resources Technical Publication No. 38.

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Richens, W., 1984. University of Utah Seismic Station, Salt Lake City, Utah (801) 581-6274, January 3, 1984.

Stokes, W.L., 1977. Physiographic Provinces of Utah, Map 43 of Subdivisions of the Major Physiographic Provinces in Utah. Utah Geology, Spring 1977. Vol. 4, No. 1.

U.S. Department of Agriculture, Soil Conservation Service, 1960. Watershed Work Plan, Blue Creek-Howell Watershed Project, Box Elder County, Utah. Northern Utah Soil Conservation District, Salt Lake City, Utah.

APPENDIX D

MASTER LIST OF INDUSTRIAL FACILITIES

APPENDIX D

MASTER LIST OF INDUSTRIAL FACILITIES

Location No.	Description	Hazardous Materials	Hazardous Wastes	Typical Treatment or Disposal Methods
E-502	Materials Storage	Yes	Yes	MTI Disposal
E-504	Oxidizer Storage	Yes	No	
E-506	Storage Shed	No	No	
E-510	Chemical Storage	Yes	No	
E-512	Plastics and Nozzle Fabrication	Yes	Yes	MTI Disposal
E-515	Standards Laboratory	Yes	No	MTI Disposal
E-516	Vehicle Maint/Preserv	Yes	Yes	MTI Disposal
E-517	Machine Shop	Yes	Yes	MTI Disposal
E-521	Nozzle Assembly	No	No	
E-522	Fire Station	No	No	
E-529	Flex Seal Fabrication	No	No	
E-532	Gas Cyl Storage	No	No	
E-533	Gas Cyl Storage	No	No	
E-534	Sewage Disposal Plant	No	No	
E-535	Electric Sub-Station	Yes	No	
E-537	Inflatable Storage	No	No	
M-504	Cleaning Bldg	Yes	Yes	MTI Disposal
M-508	Inert Parts Bldg	Yes	Yes	Silver Recycle MTI Disposal
M-512	Premix Bldg	No	No	
M-512A	Storage Farm (Polymer)	No	No	

APPENDIX D (Continued)

MASTER LIST OF INDUSTRIAL FACILITIES

Location No.	Description	Hazardous Materials	Hazardous Wastes	Typical Treatment or Disposal Methods
M-514	Mixer Surge Bldg (STDS)	Yes	No	
M-515	Mixer Surge Bldg	Yes	No	
M-516	Mixer Surge Bldg	Yes	No	
M-519	Mixer Bldg (Vert 600 Gal)	Yes	Yes	MTI Disposal
M-520	Mixer Bldg (ABM 300 Gal)	Yes	Yes	Not Presently in Use
M-521	Mixer Bldg (ABM 300 Gal)	Yes	Yes	Not Presently in Use
M-522	Mixer Bldg (ABM 300 Gal)	Yes	Yes	Not Presently in Use
M-523	Mixer Bldg (VERT 600 Gal)	Yes	Yes	MTI Disposal
M-524	Mixer Bldg (Vert 600 Gal)	Yes	Yes	MTI Disposal
M-528	STDS Mixer Bldg	Yes	Yes	MTI Disposal
M-570	HMX Change House	Yes	Yes	MTI Disposal
M-570A	HMX Control Bunker	No	No	
M-571	HMX Drying	Yes	Yes	MTI Disposal
M-572	HMX Grinding	Yes	Yes	MTI Disposal
M-573	HMX Dryer Bldg	Yes	Yes	MTI Disposal
M-574	Mixer Control Bldg	No	No	
M-576	Boilerhouse	Yes	No	
M-580	Storage	No	No	
M-581	STDS Mixer Control	No	No	

APPENDIX D (Continued)

MASTER LIST OF INDUSTRIAL FACILITIES

Location No.	Description	Hazardous Materials	Hazardous Wastes	Typical Treatment or Disposal Methods
M-583	Prefinal Assy Control	No	No	
M-585	Chemical Lab	Yes	Yes	MTI Disposal French Drain
M-586	Pump House	No	No	
M-587	Water Storage Tank	No	No	
M-588	Lab Solvent Storage	Yes	No	
M-589	C-4 AP Storage	Yes	No	
M-590	AFT Closure, Igniter Assy	Yes	No	
M-591	Cast/Cure Bldg	Yes	Yes	MTI Disposal
M-592	Cast/Cure Bldg	Yes	Yes	MTI Disposal
M-593	Cast/Cure Bldg	Yes	Yes	MTI Disposal
M-594	Cast-Cure Bldg (C-4)	Yes	Yes	MTI Disposal
M-595	Cast/Cure Bldg (C-4)	Yes	Yes	MTI Disposal
M-596	Cast/Cure Bldg (C-4)	Yes	Yes	MTI Disposal
M-597	Sample Cast/Cure Bldg	Yes	Yes	MTI Disposal
M-598	Cast/Cure Bldg (C-4 Aging)	Yes	Yes	MTI Disposal
M-599	Cast/Cure Bldg (C-4 Aging)	Yes	Yes	MTI Disposal
M-600	Cast/Cure Bldg	Yes	Yes	MTI Disposal
M-601	Cast/Cure Bldg (C-4)	Yes	Yes	MTI Disposal
M-602	Cast/Cure Bldg (C-4)	Yes	Yes	MTI Disposal
M-603	Cast/Cure Bldg (C-4)	Yes	Yes	MTI Disposal

APPENDIX D (Continued)

MASTER LIST OF INDUSTRIAL FACILITIES

Location No.	Description	Hazardous Materials	Hazardous Wastes	Typical Treatment or Disposal Methods
M-604	Cast/Cure Bldg (C-4)	Yes	Yes	MTI Disposal
M-605	Subscale Mfg	Yes	Yes	MTI Disposal
M-606	Oxidizer Prep	Yes	Yes	MTI Disposal
M-621	Prefinal Assy	Yes	Yes	MTI Disposal
M-622	Prefinal Assy	Yes	Yes	MTI Disposal
M-623	Core Inspection Fac	Yes	Yes	MTI Disposal
M-627	Final Assy	Yes	Yes	MTI Disposal
M-628	Final Assy (Mtr Weighing)	Yes	Yes	MTI Disposal
M-629	AP Grinder	Yes	Yes	MTI Disposal
M-636	Radiographic Insp	Yes	Yes	Silver Recovery
M-638	Tooling Assy	Yes	Yes	MTI Disposal
M-639	Vacuum Pump and Generator Bldg	No	No	
M-640	Vacuum Pump and Generator Bldg	No	No	
M-640A	Break Trailer	No	No	
M-641	Vacuum Pump and Generator Bldg	No	No	
M-642	Vacuum Pump and Generator Bldg	No	No	
M-643	Cast Clean Control	No	No	
M-687	Prop Sample Milling	Yes	Yes	MTI Disposal
M-689	Assembly Bldg	Yes	Yes	MTI Disposal

APPENDIX D (Continued)

MASTER LIST OF INDUSTRIAL FACILITIES

Location No.	Description	Hazardous Materials	Hazardous Wastes	Typical Treatment or Disposal Methods
M-690	Waste Shed	Yes	No	
M-693	Binder Premix	Yes	Yes	MTI Disposal
M-698	C-4 Turn Around Dock	No	No	
S-501	Propellant Sample Storage	Yes	No	
S-502	Oxidizer Sampling Bldg	Yes	No	
S-503	Scrap AP Packaging	Yes	No	
S-546	Pyrogen Magazine	Yes	No	
S-547	In-Process Ordnance	Yes	No	
S-548	Lab Sample Magazine	Yes	No	
S-549	Finishing Ordnance Mag.	Yes	No	
S-550	Aluminum Powder Storage	Yes	No	
S-551	Aluminum Powder Storage	Yes	No	
S-554	Oxidizer Storage	Yes	No	
S-555	Oxidizer Storage	Yes	No	
S-556	Oxidizer Storage	Yes	No	
S-560	Motor Storage Magazine	Yes	No	
S-561	Motor Storage Magazine	Yes	No	
S-562	Motor Storage Magazine	Yes	No	
S-563	Motor Storage Magazine	Yes	No	
S-564	Motor Storage Magazine	Yes	No	
S-565	Motor Storage Magazine	Yes	No	

APPENDIX D (Continued)

MASTER LIST OF INDUSTRIAL FACILITIES

Location No.	Description	Hazardous Materials	Hazardous Wastes	Typical Treatment or Disposal Methods
S-566	Motor Storage Magazine	Yes	No	
S-567	Motor Storage Magazine	Yes	No	
S-568	HMX Storage Magazine	Yes	No	
S-569	HMX Storage Magazine	Yes	No	
S-570	Motor Storage Magazine	Yes	No	
S-571	Motor Storage Magazine	Yes	No	
S-572	Motor Storage Magazine	Yes	No	
S-573	Motor Storage Magazine	Yes	No	
S-574	Premix Storage Magazine	Yes	No	
S-575	HMX Storage Magazine	Yes	No	
S-576	Mix Bowl Storage	Yes	No	
S-577	HMX Storage Magazine	Yes	No	
S-578	HMX Storage Magazine	Yes	No	
S-579	HMX Storage Magazine	Yes	No	
S-580	HMX Storage Magazine	Yes	No	
S-581	HMX Storage Magazine	Yes	No	
S-604A,B,C,D	Oxidizer Storage Pads	Yes	No	
S-605	Aluminum Storage Pad	Yes	No	
S-606	AP Storage Pad	Yes	No	
S-607	AP Storage Pad	Yes	No	

Note: MTI - Morton Thiokol, Inc.

APPENDIX E

SUPPLEMENT PLANT ENVIRONMENTAL DATA

TABLE E.2

SUPPLY WELL WATER QUALITY DATA
FOR AIR FORCE PLANT 78
(Analyses are in milligrams per liter)

Well Designation	Sample Date	Conductivity (umhos/cm)	Total Iron	Ammonia	Chloride	Copper	Silver	pH (Std.units)	Dissolved Solids
Sandall Well	1-14-83	840	0.17	0.06	144.5	0.01	<0.001	7.4	548
Toombs Well (No. 11)	1-14-83	710	0.04	0.06	133.5	0.01	<0.001	7.2	468
Well No. 9	1-14-83	650	0.17	0.1	105.7	<0.001	<0.001	7.3	420
Well No. 12	1-14-83	640	0.95	0.08	89.3	0.01	<0.001	7.4	420
Well 3A (Plant III)	1-14-83	1120	0.32	0.05	297	0.01	<0.001	7.6	733
Howell Well Booster Station (M-696)	1-14-83	730	0.15	0.07	106.4	0.01	<0.001	7.4	477

TABLE E.1

ADDITIONAL SURFACE-WATER QUALITY DATA FOR USAF PLANT 78 AND VICINITY
(Analyses are in milligrams per liter)

Station[1] Identification on Blue Creek	Year	Analyses[2]	Chloride (NS)	Iron (1.0)	Copper (NS)	Ammonium Perchlorate (NS)	Total Solids (NS)	Conductivity (umhos/cm) (NS)
			Selected Parameters and Applicable Utah Water Quality Standards[3]					
No. 2	1967	Min.	1,185	0.19	0.02	NA	2,277	4,130
		Mean	2,794	0.49	0.10	NA	5,792	9,278
		Max.	3,963	1.70	0.26	NA	8,101	13,000
No. 2	1968	Min.	1,925	0.09	0.05	NA	4,111	6,300
		Mean	3,188	0.49	0.21	NA	7,033	10,066
		Max.	4,566	1.16	1.14	NA	11,600	13,200
No. 2	1969	Min.	985	0.27	0.01	NA	2,305	5,600
		Mean	2,454	0.42	0.09	NA	5,453	8,300
		Max.	3,335	0.79	0.14	NA	7,082	10,750
No. 2	1970	Min.	1,590	0.18	0.02	<1	3,361	5,350
		Mean	2,704	0.47	0.14	1.0	5,702	8,865
		Max.	3,978	1.53	0.22	2.0	7,884	11,900
No. 2	1971	Min.	624	0.25	0.02	0.2	1,586	2,360
		Mean	1,928	1.11	0.23	1.7	4,233	6,333
		Max.	2,876	5.80	0.79	2.7	6,052	9,050
No. 2	1972	Min.	516	0.30	0.07	0.67	1,330	5,550
		Mean	2,016	0.83	0.26	2.28	4,402	7,770
		Max.	3,871	1.46	0.29	3.90	8,044	11,150
No. 2	1973	Min.	1,420	0.22	0.09	1.0	3,189	5,000
		Mean	2,368	2.00	0.17	1.6	4,986	7,638
		Max.	3,713	6.45	0.27	2.9	7,756	11,300
No. 2	1974	Min.	1,688	0.21	0.08	0.28	3,903	5,900
		Mean	2,577	0.57	0.22	0.96	5,573	8,305
		Max.	4,383	1.13	0.45	1.7	9,047	13,700
No. 2	1975	Min.	1,288	0.09	0.03	0.20	3,100	5,170
		Mean	1,939	1.02	0.12	1.60	4,202	6,680
		Max.	2,706	3.15	0.43	5.3	5,611	8,850
No. 2	1976	Min.	1,359	0.32	0.01	<0.1	2,820	4,650
		Mean	1,894	1.23	0.10	0.29	4,024	6,394
		Max.	2,730	2.47	0.30	0.69	5,964	9,250
No. 2	1977	Min.	1,264	0.19	0.05	0.018	2,644	4,450
		Mean	2,279	0.76	0.18	0.18	4,723	8,159
		Max.	3,341	1.74	0.53	0.30	6,350	12,200
No. 2	1978	Min.	1,346	0.21	0.04	0.10	2,866	3,590
		Mean	1,839	0.64	0.11	0.15	3,867	6,387
		Max.	2,520	1.62	0.22	0.41	5,338	8,700
No. 2	1979	Min.	1,004	0.27	0.08	<0.1	1,983	3,630
		Mean	1,916	0.70	0.20	0.5	3,722	6,416
		Max.	2,928	1.69	0.58	1.1	5,804	8,950
No. 2	1980	Min.	1,087	0.26	0.02	<0.1	2,123	3,330
		Mean	1,364	0.92	0.09	0.85	2,881	4,148
		Max.	1,655	2.37	0.13	1.85	3,554	5,600

Notes:

1. See Figure 3.5 for station locations.
2. Analyses as minimum, mean and maximum values.
3. Utah Department of Social Services, Division of Health, Standards of Quality for Class 3D Waters of the State, 1978.

NS = No Standard; NA = Not Analyzed

umhos = micromhos per centimeter

TABLE E.1
(Continued)
ADDITIONAL SURFACE-WATER QUALITY DATA FOR USAF PLANT 78 AND VICINITY
(Analyses are in milligrams per liter)

Station Identification on Blue Creek[1]	Year	Analyses[2]	Chloride (NS)	Iron (1.0)	Copper (NS)	Ammonium Perchlorate (NS)	Total Solids (NS)	Conductivity (umhos/cm) (NS)
			Selected Parameters and Applicable Utah Water Quality Standards[3]					
No. 2	1981	Min.	1,222	0.18	.03	0.76	2,846	4,500
		Mean	1,887	0.74	0.10	0.92	4,110	6,734
		Max.	3,095	1.68	0.19	1.05	6,645	10,650
No. 2	1982	Min.	1,388	0.22	0.02	0.37	2,798	2,930
		Mean	1,742	1.13	0.09	0.53	3,736	4,970
		Max.	2,936	3.64	0.20	0.68	6,413	9,450
No. 2	1983	Min.	1,462	0.08	0.02	NA	2,907	2,986
	(thru	Mean	1,599	1.72	0.10	NA	3,317	5,163
	July)	Max.	1,821	4.65	0.18	NA	3,906	6,380
No. 4	1967	Min.	1,158	0.13	0.01	NA	2,378	4,050
		Mean	2,681	0.35	0.09	NA	5,524	8,995
		Max.	3,621	0.72	0.22	NA	7,172	12,200
No. 4	1968	Min.	4,429	0.09	0.06	NA	3,941	5,700
		Mean	3,110	0.68	0.16	NA	6,407	10,177
		Max.	1,856	2.56	0.25	NA	9,058	14,700
No. 4	1969	Min.	1,125	0.20	0.01	NA	2,696	3,500
		Mean	2,468	0.58	0.10	NA	5,416	8,228
		Max.	3,360	1.36	0.16	NA	6,910	10,750
No. 4	1970	Min.	2,190	0.12	0.02	<1.0	4,407	7,000
		Mean	2,789	0.49	0.12	1.0	5,854	9,070
		Max.	3,634	1.81	0.23	>1.0	7,188	12,050
No. 4	1971	Min.	603	0.32	0.02	1.0	1,557	2,250
		Mean	1,978	1.55	0.20	1.9	4,259	6,531
		Max.	2,928	3.84	0.43	3.0	6,124	9,300
No. 4	1972	Min.	822	0.53	0.05	0.21	2,006	5,450
		Mean	2,051	1.01	0.25	2.49	4,465	7,680
		Max.	3,652	1.60	0.67	4.2	7,893	11,700
No. 4	1973	Min.	1,501	0.33	0.07	0.68	3,146	5,150
		Mean	2,453	1.26	0.17	1.45	5,123	7,585
		Max.	3,720	3.20	0.27	2.3	7,859	10,150
No. 4	1974	Min.	1,557	0.27	0.06	0.1	3,464	5,350
		Mean	2,622	0.65	0.18	1.39	5,690	8,657
		Max.	4,076	1.47	0.38	3.8	9,043	13,600
No. 4	1975	Min.	1,300	0.12	0.03	0.24	2,769	4,500
		Mean	1,825	1.08	0.16	1.69	3,949	6,222
		Max.	2,356	3.01	0.35	7.2	5,187	7,900
No. 4	1976	Min.	1,372	0.29	0.01	0.10	2,999	4,200
		Mean	1,870	1.06	0.11	0.29	4,103	6,188
		Max.	2,629	2.19	0.20	0.55	5,742	8,950

Notes:

1. See Figure 3.5 for station locations.
2. Analyses as minimum, mean and maximum values.
3. Utah Department of Social Services, Division of Health, Standards of Quality for Class 3D Waters of the State, 1978.

NS = No Standard; NA = Not Analyzed

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TABLE E.1
(Continued)
ADDITIONAL SURFACE-WATER QUALITY DATA FOR USAF PLANT 78 AND VICINITY
(Analyses are in milligrams per liter)

Station[1] Identification on Blue Creek	Year	Analyses[2]	Selected Parameters and Applicable Utah Water Quality Standards[3]					
			Chloride (NS)	Iron (1.0)	Copper (NS)	Amonium Perchlorate (NS)	Total Solids (NS)	Conductivity (umhos/cm) (NS)
No. 4	1977	Min.	1,258	0.20	0.05	0.017	2,767	4,250
		Mean	2,197	0.93	0.21	0.19	4,860	7,962
		Max.	3,213	1.80	0.34	0.57	7,020	12,200
No. 4	1978	Min.	1,459	0.15	0.03	0.10	2,928	4,850
		Mean	1,905	0.68	0.12	0.21	3,883	6,413
		Max.	2,156	2.33	0.34	0.70	5,730	8,500
No. 4	1979	Min.	1,248	0.06	0.03	<0.1	2,469	4,450
		Mean	2,023	0.68	0.11	0.45	3,980	6,468
		Max.	2,826	1.71	0.25	1.0	5,567	8,450
No. 4	1980	Min.	384	0.10	0.05	<0.1	2,276	1,605
		Mean	1,243	0.65	0.08	0.80	2,550	3,808
		Min.	1,613	2.50	0.14	2.1	3,554	5,350
No. 4	1981	Min.	1,211	0.29	0.05	0.58	2,649	4,450
		Mean	1,956	1.07	0.09	0.96	4,295	6,965
		Max.	2,988	3.51	0.14	1.4	6,342	10,200
No. 4	1982	Min.	1,418	0.57	0.05	0.30	2,938	3,000
		Mean	1,844	0.74	0.12	0.47	3,957	5,051
		Max.	3,098	1.59	0.42	0.64	6,611	9,800
No. 4	1983	Min.	1,457	0.42	0.03	NA	2,912	2,973
	(through	Mean	1,802	2.04	0.08	NA	3,785	5,809
	July)	Max.	2,855	6.13	0.11	NA	6,041	8,450

Notes:

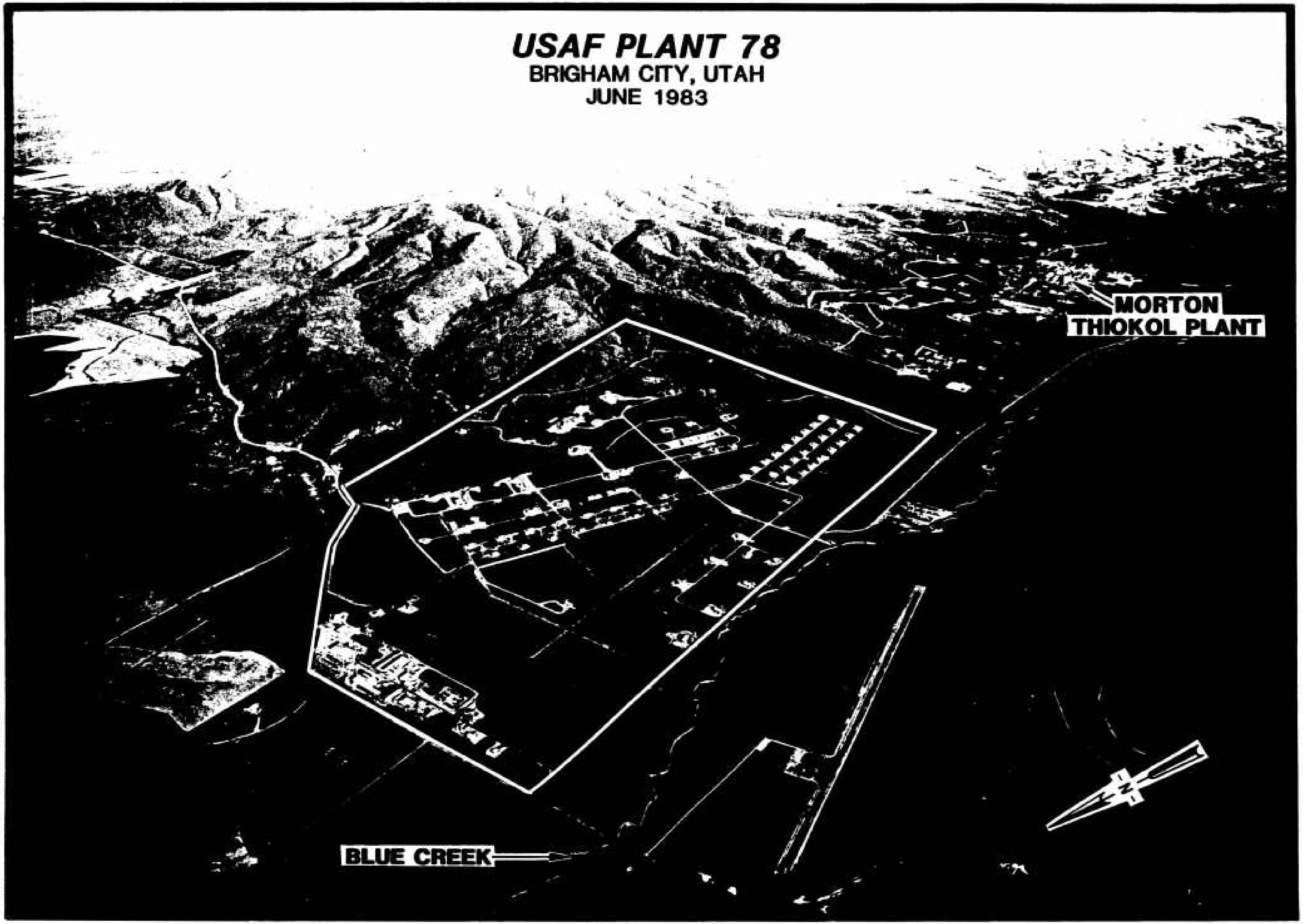
1. See Figure 3.5 for station locations.
2. Analyses as minimum, mean and maximum values.
3. Utah Department of Social Services, Division of Health, Standards of Quality for Class 3D Waters of the State, 1978.

NS = No Standard; NA = Not Analyzed

umhos = micromhos per centimeter

APPENDIX F

SITE PHOTOGRAPHS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BRIGHAM CITY, UTAH
JUNE 1983
MORTON THIOKOL PLANT
BLUE CREEK
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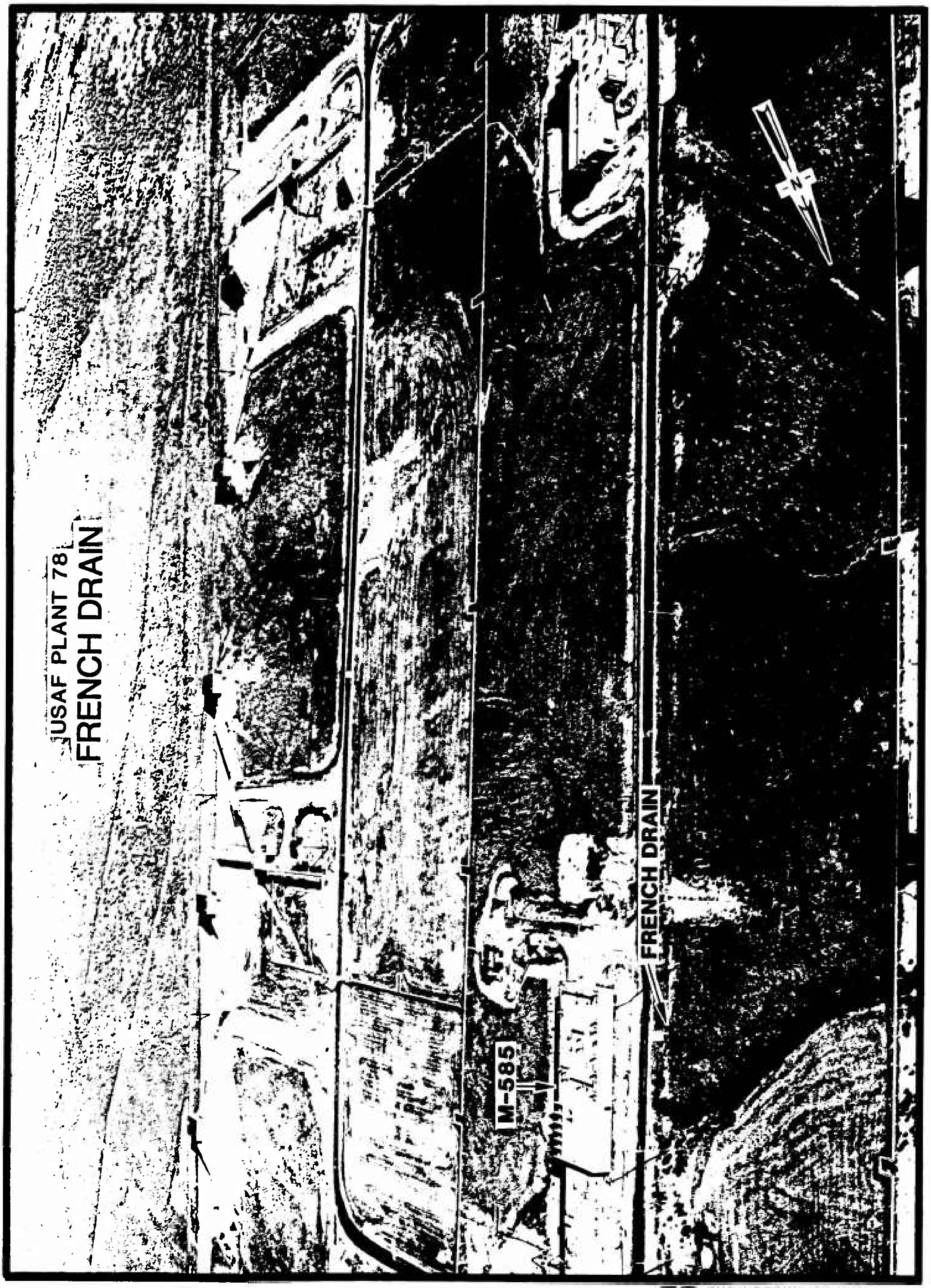
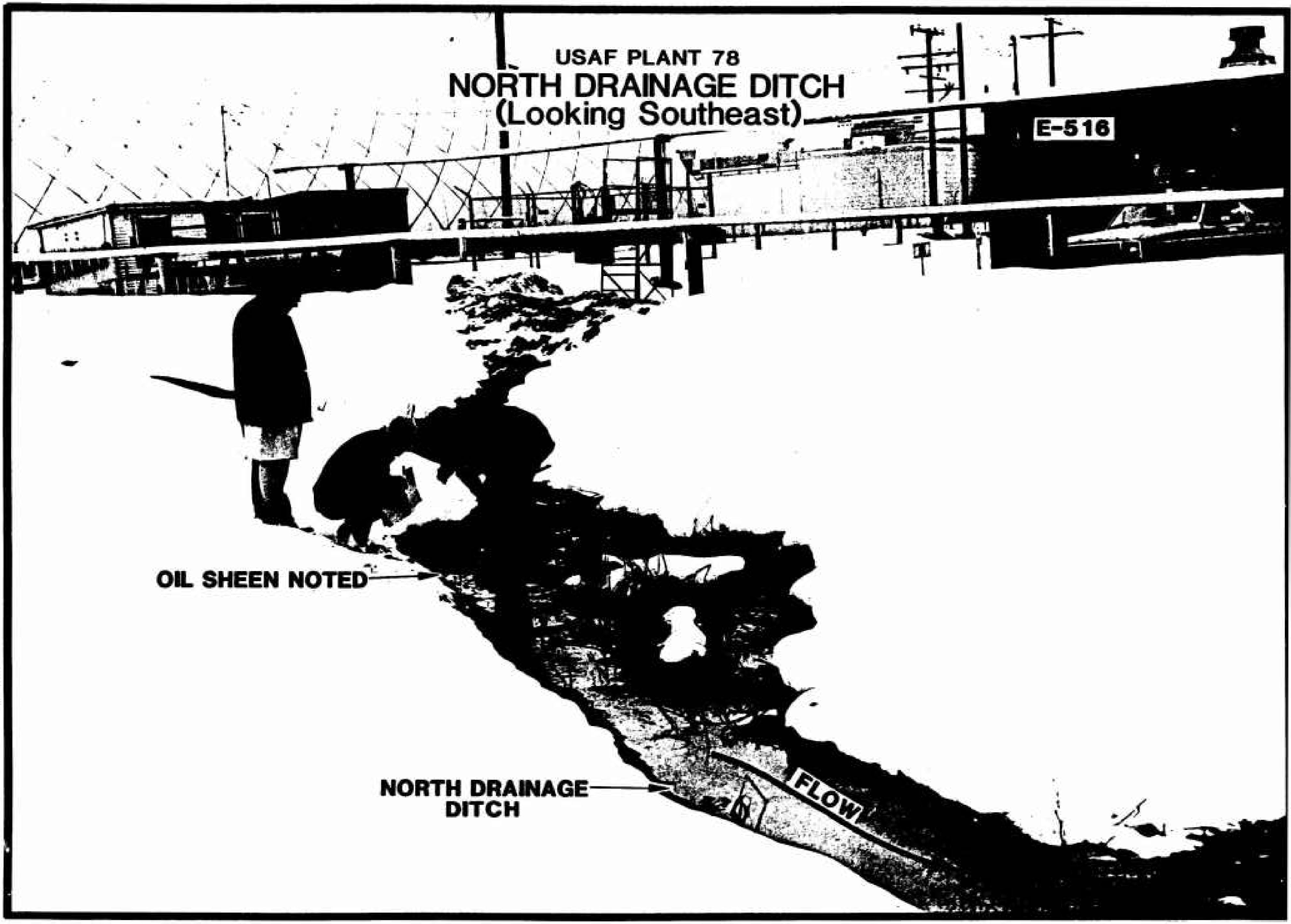

USAF PLANT 78
FRENCH DRAIN
FRENCH DRAIN
M-585
N

USAF PLANT 78

X-O-MAT WASTEWATER DISCHARGE AREA NO. 1 (Looking Southwest)

ES ENGINEERING-SCIENCE

ES ENGINEERING-SCIENCE



ES ENGINEERING-SCIENCE

APPENDIX G

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of the IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

FIGURE 1

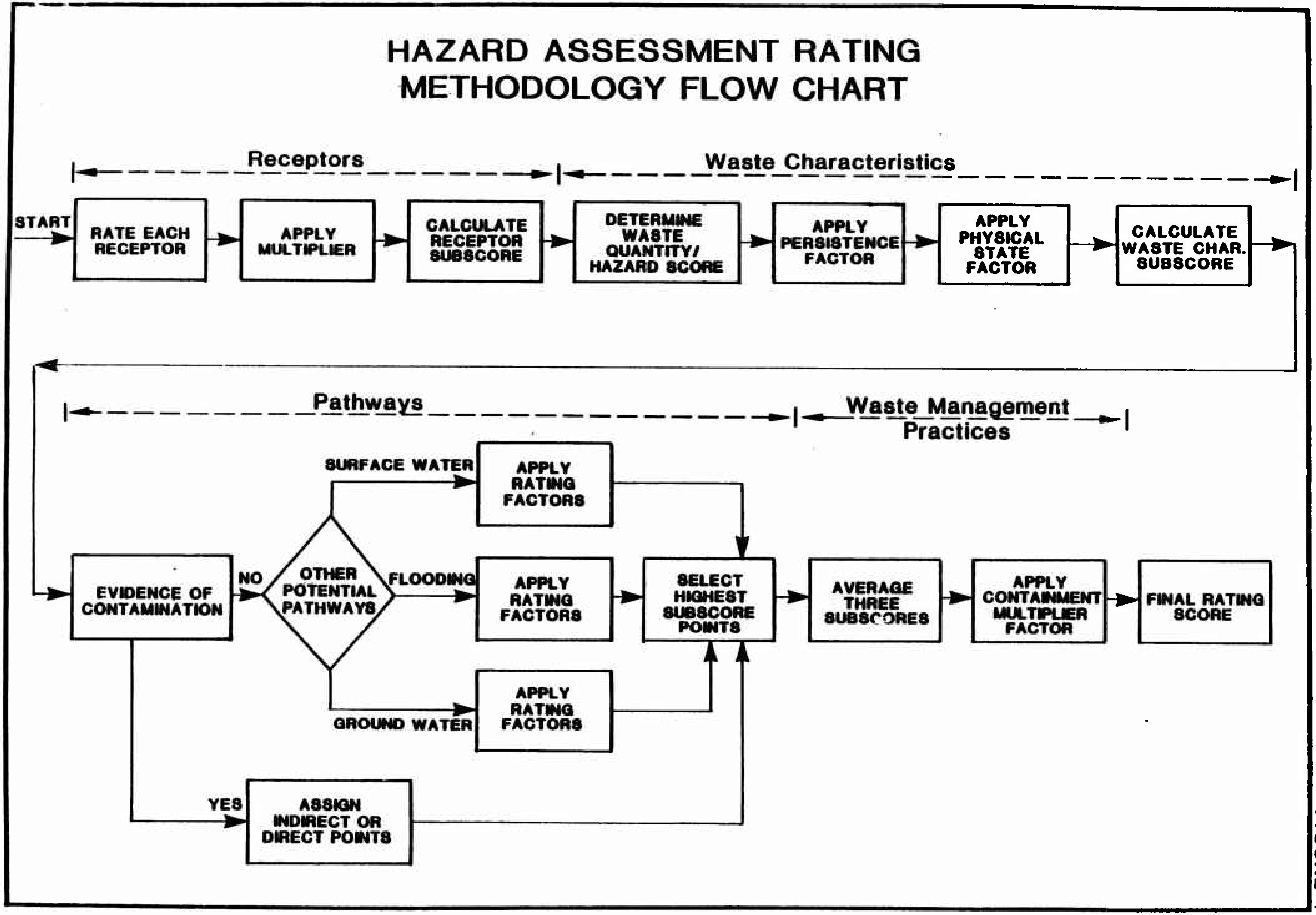

HAZARD ASSESSMENT RATING
METHODOLOGY FLOW CHART
Receptors
Waste Characteristics
START
RATE EACH RECEPTOR
APPLY MULTIPLIER
CALCULATE RECEPTOR SUBSCORE
DETERMINE WASTE QUANTITY/ HAZARD SCORE
APPLY PERSISTENCE FACTOR
APPLY PHYSICAL STATE FACTOR
CALCULATE WASTE CHAR. SUBSCORE
Pathways
Waste Management Practices
EVIDENCE OF CONTAMINATION
NO
YES
OTHER POTENTIAL PATHWAYS
SURFACE WATER
FLOODING
GROUND WATER
APPLY RATING FACTORS
APPLY RATING FACTORS
APPLY RATING FACTORS
ASSIGN INDIRECT OR DIRECT POINTS
SELECT HIGHEST SUBSCORE POINTS
AVERAGE THREE SUBSCORES
APPLY CONTAINMENT MULTIPLIER FACTOR
FINAL RATING SCORE

FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______

LOCATION ______

DATE OF OPERATION OR OCCURRENCE ______

OWNER/OPERATOR ______

COMMENTS/DESCRIPTION ______

SITE RATED BY ______

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
Subtotals			______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals	______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals	______	______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = [ ]

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8
B-2 POTENTIAL FOR FLOODING					
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1
B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION					
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. **WASTE MANAGEMENT PRACTICES CATEGORY**

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. **WASTE MANAGEMENT PRACTICES FACTOR**

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

SITE ASSESSMENT RATING FORMS

APPENDIX H

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HAZARD ASSESSMENT RATING METHODOLOGY
AIR FORCE PLANT 78

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: NORTH DRAINAGE DITCH
Location: NORTH OF BUILDING E-516
Date of Operation or Occurrence: 1962-PRESENT
Owner/Operator: AIR FORCE PLANT 78
Comments/Description: POSSIBLE OIL, AMMONIUM PERCHLORATE CONTAMINATION

Site Rated by: R.M. REYNOLDS

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundry	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			84	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 47

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 2

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 1.00 = 50

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

50 x 1.00 = 50

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 80

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	0
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			38	84
Subscore (100 x factor score subtotal/maximum score subtotal)				45
2. Flooding	3	1	3	3
Subscore (100 x factor score/3)				100
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		47	
Waste Characteristics		50	
Pathways		100	
Total	197 divided by 3 =		66 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

66 x 1.00 = 66

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: FRENCH DRAIN
Location: BUILDING M-585
Date of Operation or Occurrence: 1962-PRESENT
Owner/Operator: AIR FORCE PLANT 78
Comments/Description: LAB WASTE DISPOSAL

Site Rated by: R.M. REYNOLDS

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundry	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			78	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 43

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 2
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 2

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.90 = 54

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

54 x 1.00 = 54

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
Subtotals			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		43	
Waste Characteristics		54	
Pathways		48	
Total	145 divided by 3 =		48 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

48 x 1.00 = 48

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: X-O-MAT WASTEWATER DISCHARGE AREA NO. 2
Location: BUILDING M-508
Date of Operation or Occurrence: 1976-PRESENT
Owner/Operator: AIR FORCE PLANT 78
Comments/Description: SILVER CONTAMINATION

Site Rated by: R.M. REYNOLDS

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundry	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			84	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 47

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 2

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 1.00 = 50

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

50 x 1.00 = 50

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	1	8	8	24
Subtotals			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		47
Waste Characteristics		50
Pathways		41
Total	138 divided by 3 =	46 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

46 x 1.00 = 46

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: X-O-MAT WASTEWATER DISCHARGE AREA NO. 1
Location: BUILDING M-636
Date of Operation or Occurrence: 1962-1982
Owner/Operator: AIR FORCE PLANT 78
Comments/Description: SILVER CONTAMINATION

Site Rated by: R.M. REYNOLDS

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to reservation boundry	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			67	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 37

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 2

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 1.00 = 50

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

50 x 1.00 = 50

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		37
Waste Characteristics		50
Pathways		43
Total	130 divided by 3 =	43 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

43 x 1.00 = 43

APPENDIX I
GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

AF: Air Force.

AFESC: Air Force Engineering and Services Center.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent.

AFPRO: Air Force Plant Representative Office

AFR: Air Force Regulation.

AFRCE: Air Force Regional Civil Engineer.

AFS: Air Force Station.

AFSC: Air Force Systems Command.

Ag: Chemical symbol for silver.

Al: Chemical symbol for aluminum.

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

AP: Ammonium Perchlorate.

AQUICLUDE: Poorly permeable formation that impedes ground-water movement and does not yield to a well or spring.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AQUITARD: A geologic unit which impedes ground-water flow.

ARTESIAN: Ground water contained under hydrostatic pressure.

ASD: Aeronautical Systems Division

Ba: Chemical symbol for barium.

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals.

Cd: Chemical symbol for cadmium.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CIRCA: About; used to indicate an approximate date.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

CN: Chemical symbol for cyanide.

COBBLE: A specific grain size classification of geologic sediments from 2.5 to 10 inches in diameter.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of ground water.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

CPM: Counts per minute (alpha radiation measurement).

Cr: Chemical symbol for chromium.

Cu: Chemical symbol for copper.

DIP: The angle at which a stratum is inclined from the horizontal.

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency.

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally.

EPICENTER: The earth's surface directly above the focus of an earthquake.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

FACILITY: Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient.

FPTA: Fire Protection Training Area.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown compounds.

GLACIAL TILL: Unsorted and unstratified drift consisting of clay, sand, gravel and boulders which is deposited by or underneath a glacier.

GLAUCOMITIC SAND AND GRAVEL: A mixture of sand, gravel and glaucomite, an iron-potassium silicate mineral which imparts a green color to the mixture. Glaucomite is geologically significant because it indicates slow sedimentation.

GLIDE-BLOCK: A large section of a geologic unit that has separated from the main portion of the unit due to earthquake/landslide-induced lateral movement.

GRAVEL: A general grain size classification of geologic sediments from 0.08 to greater than 10 inches in diameter.

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUND WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water.

HARM: Hazard Assessment Rating Methodology.

HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg: Chemical symbol for mercury.

HWMF: Hazardous Waste Management Facility.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program.

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LINER: A continous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable and buff to gray in color.

MEK: Methyl Ethyl Ketone.

METHYL CHLOROFORM: 1,1,1, Trichloroethane.

MGD: Million Gallons per Day.

Mn: Chemical symbol for manganese.

MODIFIED MERCALLI INTENSITY: A number describing the effects of an earthquake on man, structures and the earth's surface. A Modified Mercalli Intensity of I is not felt. An intensity of VI is felt indoors and outdoors and for an intensity of VII it becomes difficult for a man to remain standing. Intensities of Ix to XII involve increasing levels of destruction with destruction being nearly total at an intensity of XII.

MONITORING WELL: A well used to measure ground-water levels and to obtain samples.

MORAINE: An accumulation of glacial drift deposited cheifly by direct glacial action and possessing initial constructional form independent of the floor beneath it.

MSL: Mean Sea Level.

MTI: Morton Thiokol, Inc.

NDT: Non-destructive Testing.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929.

Ni: Chemical symbol for nickel.

NON-CALCAREOUS: Not bearing calcium carbonate ($CaCO_3$) a characteristic mineral of marine paleoenvironment.

NPDES: National Pollutant Discharge Elimination System.

OEHL: Occupational and Environmental Health Laboratory.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

O&G: Symbols for oil and grease.

Pb: Chemical symbol for lead.

PERCHED WATER TABLE: The top of a zone of saturation that bottoms on an impermeable horizon above the level of the general water table in an area.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERENNIAL: A stream which flows continuously.

PERMEABILITY: The capacity of a porous rock, soil or sediment for transmitting a fluid without damage to the structure of the medium.

pH: Negative logarithm of hydrogen ion concentration.

PL: Public Law.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POTENTIALLY ACTIVE FAULT: A fault along which movement has occurred within the last 25-million years.

POTENTIOMETRIC SURFACE: The imaginery surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

PPB: Parts per billion by weight.

PPM: Parts per million by weight.

PRECIPITATION: Rainfall.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

RCRA: Resource Conservation and Recovery Act.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RICHTER SCALE: An earthquake magnitude scale devised by C.F. Richter in 1935. The scale is an index of an earthquake's energy at its source.

RIPARIAN: Living or located on a riverbank.

SALINE: Water having a dissolved solids content greater than 1,000 milligrams per liter.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SEISMICITY: Pertaining to earthquakes or earth vibrations.

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage Treatment Plant.

TCE: Trichloroethylene.

TDS: Total Dissolved Solid, a water quality parameter.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TSD: Treatment, storage or disposal.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground-water.

USAF: United States Air Force.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Zn: Chemical symbol for zinc.

APPENDIX J

INDEX TO REFERENCES OF POTENTIAL CONTAMINATION SOURCES
AT AIR FORCE PLANT 78

APPENDIX J

INDEX OF REFERENCES TO POTENTIAL CONTAMINATION SOURCES FOR AIR FORCE PLANT 78

Site Name	Reference (Page Numbers)
North Drainage Ditch	3,4,5,6,4-14,4-17,4-18,4-20,5-1,5-2,6-1, 6-2,6-4
French Drain	3,4,5,6,4-8,4-11,4-12,4-20,5-1,5-2,6-2, 6-4
X-O-Mat Wastewater Discharge Area No. 1	3,4,5,6,4-13,4-14,4-20,5-2,5-3,6-2,6-4
X-O-Mat Wastewater Discharge	3,4,5,6,4-13,4-15,4-20,5-2,5-3,6-2,6-4