Administrative Record

FORT WINGATE DEPOT ACTIVITY, GALLUP, NEW MEXICO

Document No. 80-3

Final Report Environmental Survey of Ft. Wingate Depot Activity, Gallup, New Mexico

Environmental Science and Engineering, Inc.

September 1981

INQUIRIES REGARDING THIS DOCUMENT AND/OR THE ADMINISTRATIVE RECORD FOR FORT WINGATE DEPOT ACTIVITY SHOULD BE MADE TO:
COMMANDER, TOOELE ARMY DEPOT, TOOELE, UTAH 84074

Contract DAAK11-80-C-0096

ENVIRONMENTAL SURVEY OF FT. WINGATE DEPOT ACTIVITY Gallup, New Mexico 87301

FINAL REPORT

Authors:
L.S. Wiese, J.B. Sosebee, R.G. Gregory, J.J. Mousa,
J.G. Morse, M.A. Keirn, E.A. Knauft

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
Post Office Box ESE
Gainesville, Florida 32602

19 September 1981

APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

Prepared for:
Ft. Wingate Depot Activity
Gallup, New Mexico 87301

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
Aberdeen Proving Ground, Maryland 21010

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) Environmental Survey of Fort Wingate Depot Activity	5. TYPE OF REPORT & PERIOD COVERED Final Report September 1980-September 1981
	6. PERFORMING ORG. REPORT NUMBER 80-606-260
7. AUTHOR(s) L.S. Wiese, J.B. Sosebee, R.G. Gregory, J.J. Mousa, J.G. Morse, M.A. Keirn, E.A. Knauft	8. CONTRACT OR GRANT NUMBER(s) DAAK-11-80-C-0096
9. PERFORMING ORGANIZATION NAME AND ADDRESS Environmental Science and Engineering, Inc. P.O. Box ESE Gainesville, Florida 32602	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Commander Ft. Wingate Depot Activity Gallup, New Mexico 87301	12. REPORT DATE 19 September 1981
	13. NUMBER OF PAGES 181
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) U.S. Army Toxic and Hazardous Materials Agency Aberdeen Proving Ground, Maryland 21010	15. SECURITY CLASS. (of this report) Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Explosives, propellants, Fort Wingate Army Depot Activity, 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, 2,6-dinitrotoluene, 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, nitrobenzene, tetryl, white phosphorus, cyclotrimethylenetrinitramine, Environmental Survey

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

An Environmental Survey of Fort Wingate Depot Activity was performed to determine the extent of contamination caused by activities related to munitions storage, recycling, and treatment. Sample sites were selected based on site history and potential for contamination. Monitor wells were installed. Four ground water, 5 surface water, 9 sediment, and 15 soil sites were sampled and analyzed for nitroaromatics, tetryl, white phosphorus, cyclotrimethylenetri-nitramine, priority pollutant metals, organics, pesticides and PCBs, and

20. (Cont'd)

nutrients. Soil contamination, consisting of nitroaromatic compounds, was found in the Ammunition Workshop Area and in the Demolition Area. One sediment site in the Demolition Area contained nitroaromatic compounds. Ground water and surface water were free of munitions-related compound contamination.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued, Page 2 of 2)

LIST OF TABLES

LIST OF TABLES
(Continued, Page 2 of 2)

LIST OF FIGURES

1.0 INTRODUCTION

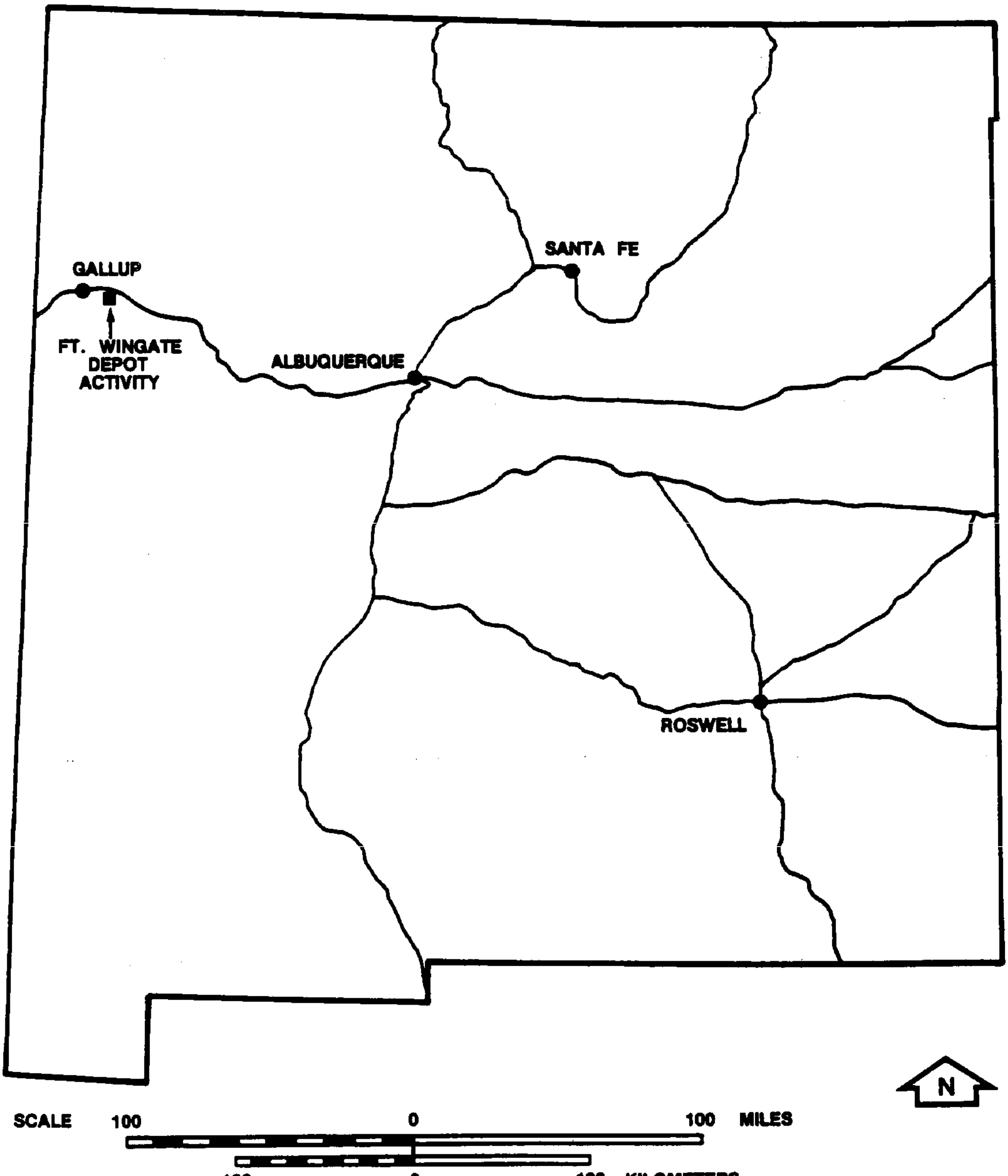
An Environmental Survey of the Ft. Wingate Depot Activity (FWDA), Gallup, New Mexico, (Figure 1-1) was conducted by Environmental Science and Engineering, Inc. (ESE), Gainesville, Florida. The objective of the Environmental Survey was to determine if hazardous materials from past depot activities are migrating beyond depot boundaries or threatening potable groundwater supplies. Since both surface and subsurface pathways offer potential migration routes, the survey included sampling of ground water, surface water and sediment, and soils. These samples were analyzed under stringent quality control conditions for selected organic and inorganic chemicals.

Sampling sites were selected using information from the records search (Record Evaluation Report No. 136), the preliminary site survey, interviews with the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) and FWDA personnel, and a review of U.S. Geological Survey (USGS) reports and other related material. Areas identified as likely to contain some degree of contamination are shown on the site map for FWDA (Figure 1-2). Thirty-eight individual sampling sites were selected at FWDA. Of these, 10 were for collecting upgradient and downgradient data for the base, and 28 were for detecting possible contaminants. The individual sampling sites included 14 groundwater sites, 15 soil sites, and 9 surface water and sediment sites.

1.1 STATEMENT OF WORK

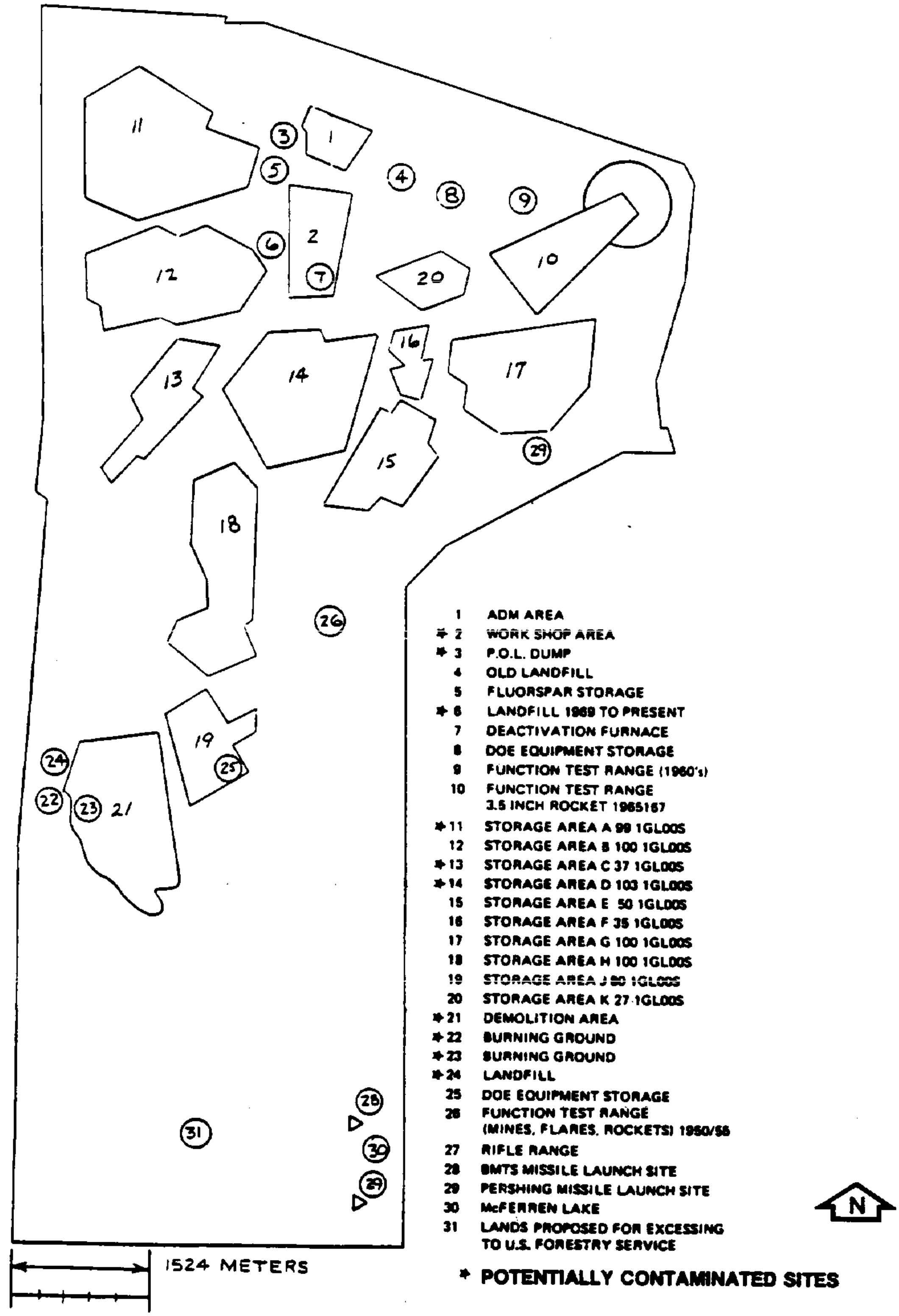
The survey consisted of the following seven activities:

1. Preparation and submission to the government for approval of the Detailed Sampling and Analysis Plan, Accident Prevention Safety Program, Quality Control Plan, and Data Management Plan. These reports incorporated the USATHAMA Quality Assurance and Minimum Well Drilling Requirements and included discussions of operations in all areas of potential contamination.



SOURCE: ESE, 1980.

Figure 1-1 SITE MAP--FWDA	ENVIRONMENTAL SURVEY Ft. Wingate Depot Activity Gallup, New Mexico
	U.S. Army Toxic and Hazardous Materials Agency Aberdeen Proving Ground, Maryland



SOURCE: ESE, 1981.

Figure 1-2
GENERAL LAYOUT AND AREAS OF POTENTIAL CONTAMINATION

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

2. Construction, installation, protection, development, and survey of groundwater monitoring wells as determined necessary.
3. Collection and analysis of geohydrological data from the monitoring wells.
4. Collection and chemical analysis of subsurface and surface water, sediment, and soil samples.
5. Maintenance and operation of a field and laboratory quality control program to ensure reliability, precision, and accuracy of all generated data at a level compatible with the environmental study programs of USATHAMA.
6. Maintenance and reporting of all field and laboratory data in a format compatible with the data management system and minimum requirements for boring logs and well sketches established by USATHAMA.
7. Technical evaluation of all generated data and presentation of an assessment of current and potential contaminant migration from the boundaries of FWDA.

1.2 DEPOT HISTORY

Fort Wingate was established in 1850 as a military outpost. In 1862, the fort received the name Fort Wingate and was garrisoned by units of the New Mexico Volunteers, the 37th U.S. Infantry, and the 3rd Cavalry.

At the beginning of World War I, the installation was designated as the Fort Wingate General Ordnance Depot, with the mission to store trinitrotoluene. The depot was the largest storage depot of high explosives in the world.

The current FWDA dates back to February 25, 1941, when construction was started on a new depot several miles west of the original Fort Wingate. FWDA is located 11 miles east of Gallup, New Mexico, and occupies an area of 34 square miles.

In 1941, as the United States entered World War II, the installation became highly active with incoming and outbound shipments of high explosives. Storage of ammunition other than trinitrotoluene began in 1942. Operations declined at the termination of World War II, but increased again during the Korean and Southeast Asian conflicts. Currently, FWDA operates under the Command of Tooele Army Depot, Utah. FWDA operates as an active storage facility for care, preservation, and maintenance of assigned commodities. Military tenant activities include the U.S. Army Reserve and National Guard. More detailed information on FWDA activities is included in the Installation Assessment of Fort Wingate Army Depot Activity, Record Evaluation Report No. 136 (USATHAMA, 1980).

1.3 ENVIRONMENTAL SETTING

1.3.1 METEOROLOGICAL DATA

The climate of this area of New Mexico is generally dry with seasonal changes, consistent with the classification of semi-desert biotic zone assigned to the region. Annual precipitation in the area varies from about 8 inches (in.) in the lower elevations to 20 in. in the Zuni Mountains. Records at FWDA indicate that the average yearly rainfall is 11 in. Thunderstorms during the months of July, August, and September account for most of this amount. Snowfall during the period from December to March accounts for the remainder of the precipitation at the site. The temperature ranges from an average winter value of -2.8°C to an average summer value of 20.6°C. Daily temperature fluctuations of 17°C to 22°C are common.

1.3.2 TOPOGRAPHY AND DRAWAGE

FWDA is situated both in the Puerco River Valley and in the foothills of the Zuni Mountains. FWDA is bounded on the west by a ridge of steeply dipping sedimentary rocks called the Hogback. The southern boundary is formed by the Zuni Mountains. To the east of FWDA, there is a small valley which terminates at the base of the Zuni Mountains. The Puerco merge and reach alluvium-filled canyons and valley floors, deep, steep-walled channels develop in the alluvium. These arroyos have low to moderate gradients and can be quite wide. As these deeply cut channels approach the flat valley floor, within which the Ammunition Workshop and Administrative Areas of FWDA are located, they become broad, shallow, and poorly defined. During periods of high surface water flow, sheet flow becomes an important means of drainage in the northern portions of the depot.

Nearly all drainage features were dry during November 1980 and January 1981, when the field operations associated with the current study were undertaken. Several components, however, were active. The main arroyo which drains the eastern side of the Hogback (i.e., the Demolition Area) contained flowing water until it reached the culvert at the Demolition Area gate. At this point, the rate of infiltration into the ground exceeded the surface flow. The arroyo draining Fenced-Up Horse Valley, a tributary of the main arroyo, was completely dry. From the culvert north, the main arroyo was dry until it merged with another arroyo which drained Igloo Areas H and J. Surface flows were noted from this point north until infiltration exceeded flow in the vicinity of Igloo Area C.

The C-Area Pond, a small impoundment on another tributary of the main arroyo, contained water, but inflow and outfall channels were dry.

D-Area Pond 425, selected as a background surface water sampling site during the initial visit to FWDA (November 1980), was completely dry during subsequent trips (January 1981).

Lake Knudson, located near the northern boundary of FWDA, did have water, although the level was quite low. Inflow and outflow channels were dry.

With the exception of a small stock-watering pond (fed by well) located on Eastern Patrol Road and the metal stock tanks in Igloo Area H, all remaining surface water features were devoid of water.

1.3.3 GEOLOGY

Potable drinking water, in the vicinity of FWDA, is primarily from the San Andres-Glorieta Aquifer. The San Andres Limestone and the Glorieta Sandstone, both of Permian age, are exposed at an elevation of approximately 8,100 ft above MSL in the Zuni Mountains in the southeast region of FWDA (Figures 1-3, 1-4, 1-5). From this location, these formations dip steeply to the west and to the north. To the west, the San Andres and the Glorieta are buried beneath a thick sequence of younger sedimentary rocks composed of 10 different formations. From bottom to top, these formations are:

1. Moenkopi Formation (claystone, siltstone, sandstone);
2. Chinle Formation (claystone, siltstone, sandstone, limestone);
3. Wingate Sandstone;
4. Entrada Sandstone;
5. Todilto Limestone;
6. Cow Springs Sandstone;
7. Morrison Formation (sandstone, conglomerate);
8. Dakota Sandstone;
9. Mancos Shale; and
10. Crevasse Canyon Formation (Gallup Sandstone, shale, claystone).

Within FWDA property boundaries, only the Moenkopi Formation, the Chinle Formation, and Quaternary alluvium overlie the San Andres-Glorieta (Figures 1-4 and 1-5). Most of the remainder of the stratigraphic column observed to the west is also present north of the Puerco River. However, it appears that the Mancos Shale, Gallup Sandstone, and the Crevasse Canyon Formation have been removed by erosion, leaving the Dakota Sandstone as the top of the mesas in this area.

FWDA lies in an erosional basin formed by the Zuni Uplift, of which the Zuni Mountains form the core. The steeply dipping rocks which form the Hogback are the result of the draping of sediments over an assumed fault in the Precambrian basement rocks underlying this region. The draping

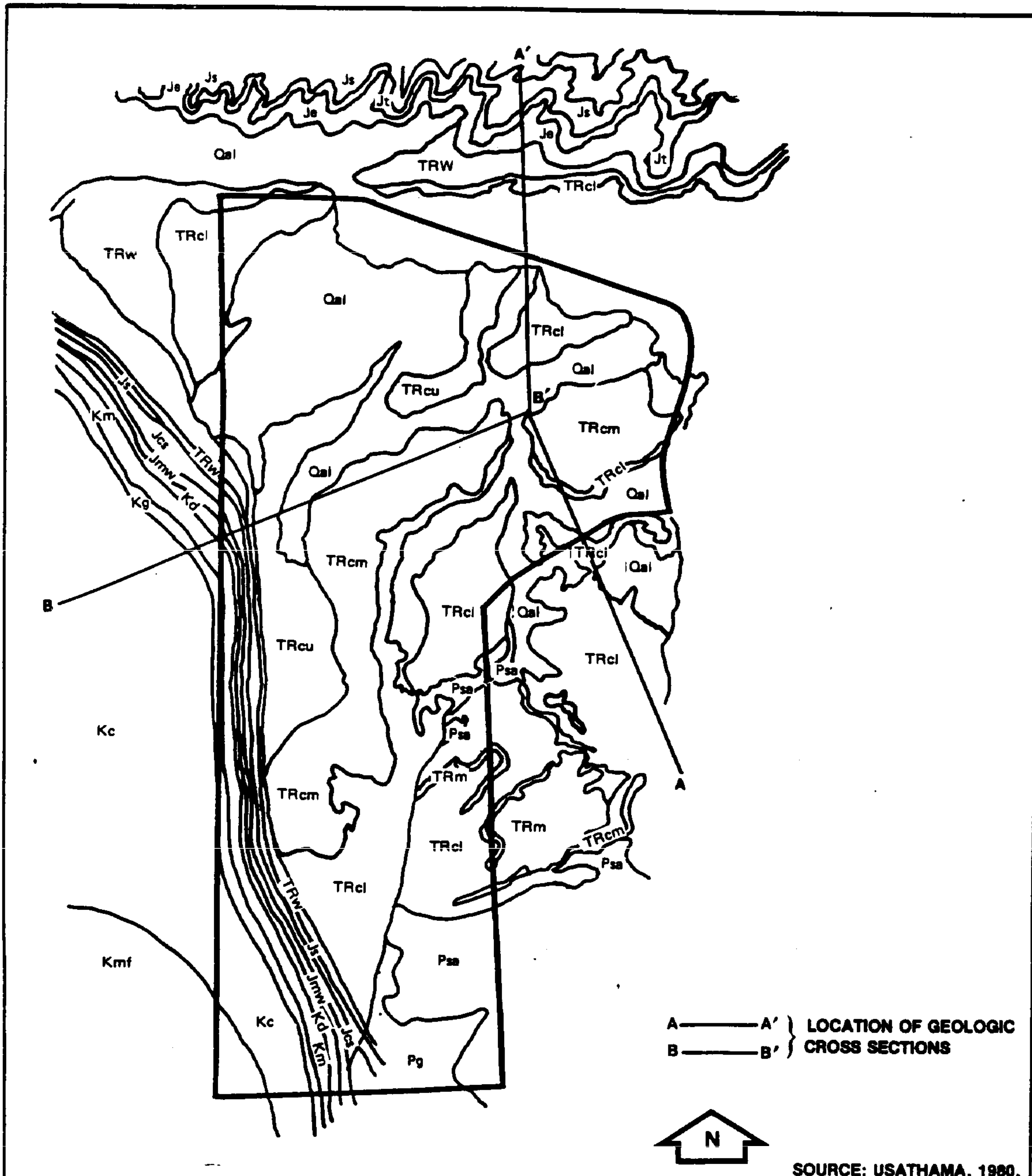


Figure 1-4
GEOLOGY MAP
(CONTINUED, PAGE 1 OF 2)

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Quaternary	Qal	-	Veneer (Alluvium)
	Qal	-	Alluvium
Cretaceous	Kmf	-	Menefee Fm - Sandstone, Claystone, Shale
	Kc	-	Crevasse Canyon Fm - Sandstone, Shale, Claystone
	Kg	-	Gallup Sandstone
	Km	-	Mancos Shale
	Kd	-	Dakota Sandstone
Jurassic	Jmw	-	Morrison Fm - West Water Canyon Member - Sandstone Conglomerate
	Jcs	-	Cow Springs - Sandstone
	Js	-	Summerville Sandstone
	Jt	-	Todilto Limestone
	Je	-	Entrada Sandstone
Triassic	TRw	-	Wingate Sandstone
	TRcu, TRcm, TRcl	-	Chinle Formation - Claystone, Siltstone, Sandstone, Limestone
	TRcs	-	Shinarump Conglomerate
	TRm	-	Moenkopi Fm - Claystone, Siltstone, Sandstone
Permian	Psa	-	San Andreas Limestone
	Pg	-	Glorieta Sandstone

SOURCE: USATHAMA, 1980.

Figure 1-4
GEOLOGY MAP
(CONTINUED, PAGE 2 OF 2)

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

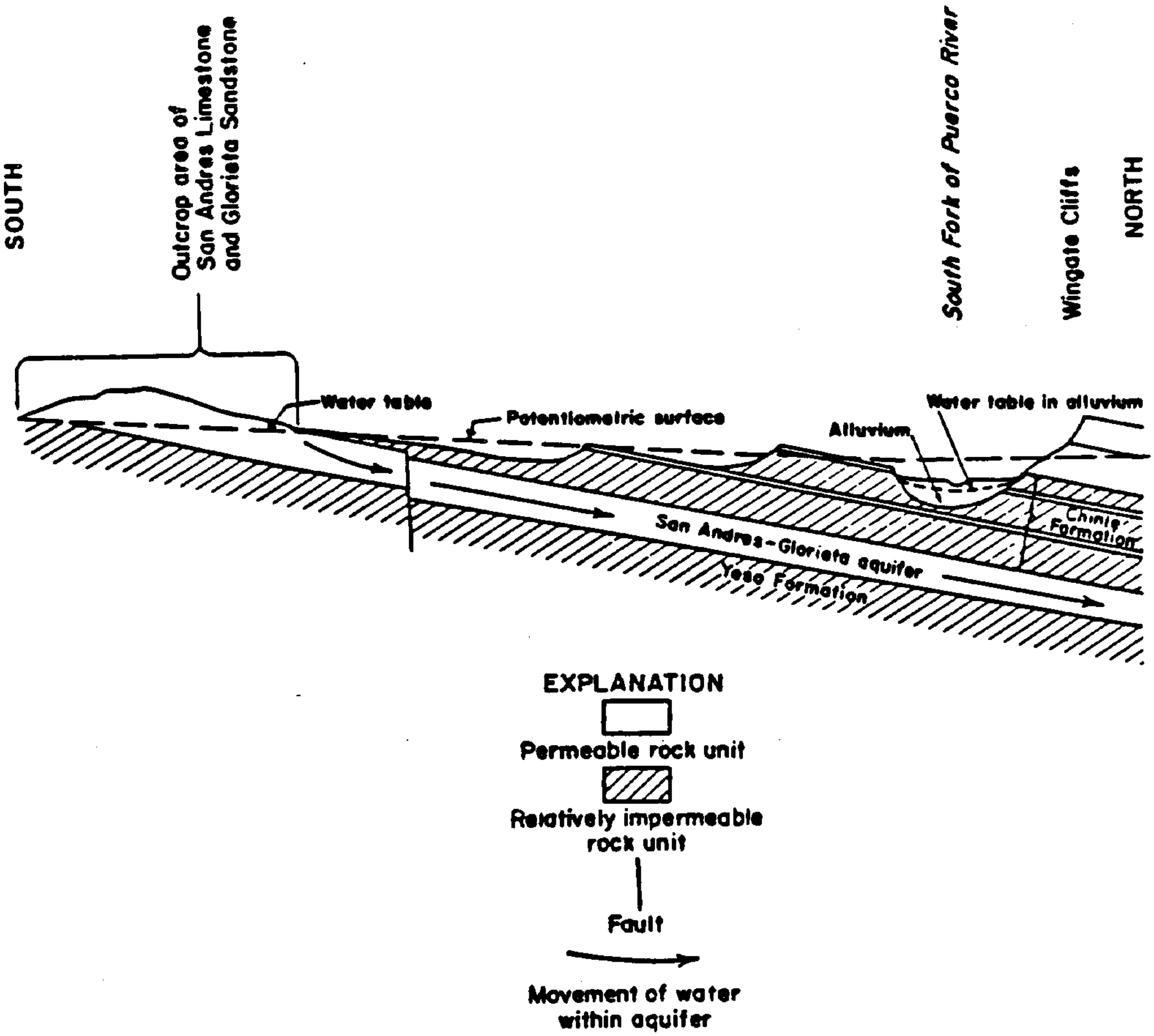


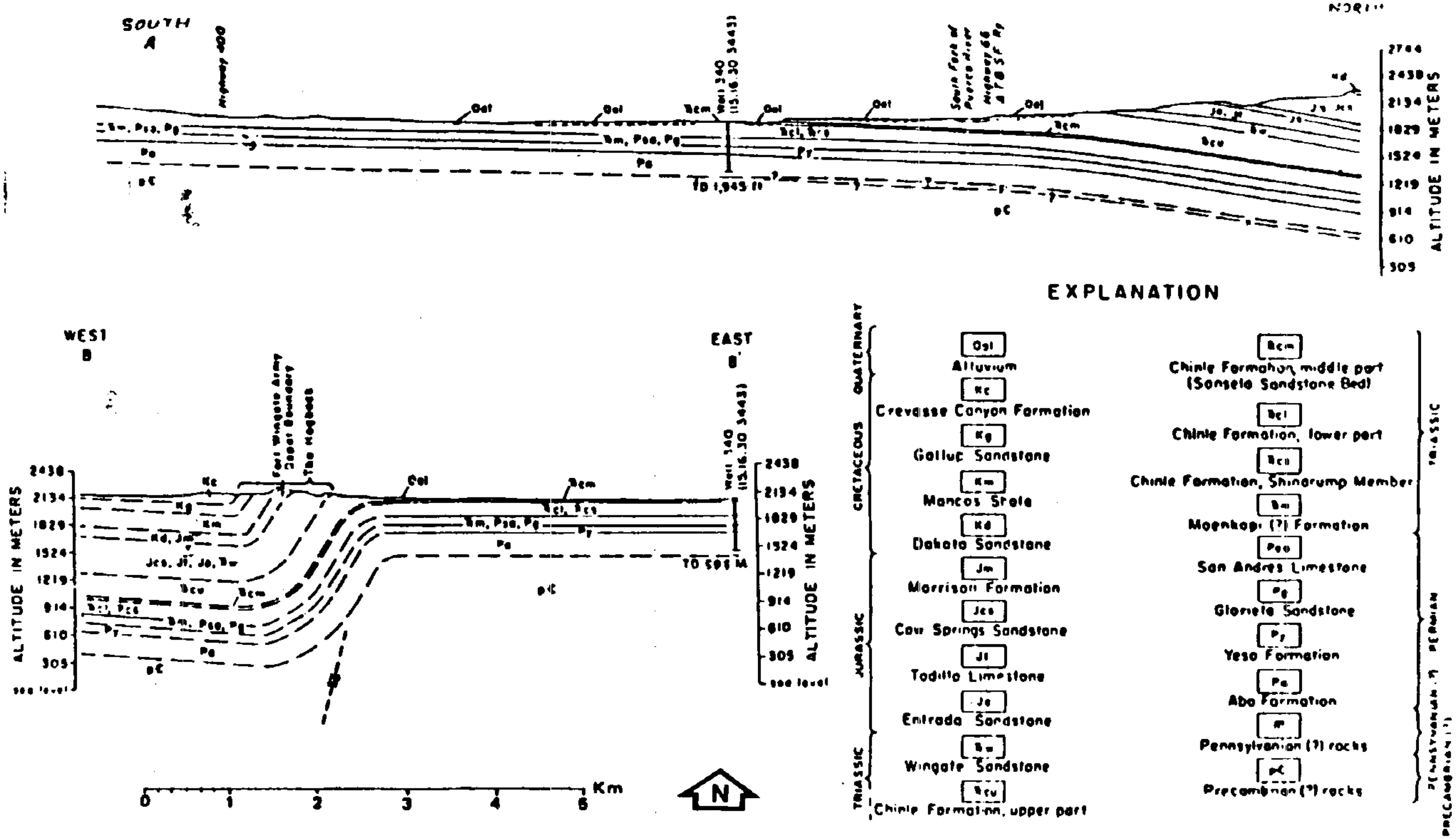
Figure 1-5 **MOVEMENT OF GROUND WATER** **(Not to scale)**	**ENVIRONMENTAL SURVEY** **Ft. Wingate Depot Activity** **Gallup, New Mexico** **U.S. Army** **Toxic and Hazardous Materials Agency** **Aberdeen Proving Ground, Maryland**

of sediments over this fault produced a fold in the sedimentary rocks which is known as the Nutria Monocline.

At one point in the geologic past, the sedimentary rocks exposed in the Hogback probably were continuous with the rocks exposed in the cliffs north of the Puerco River. The Zuni Uplift forced the upward movement of a large mass of material, and the area currently occupied by FWDA was subjected to extreme tensional stresses. The rocks were evidently extensively fractured and subsequently removed by erosion, leaving the present-day basin. This is easily seen in the geologic cross-sections presented in Figure 1-6. There is an upward bowing of bedrock beneath FWDA, and some rock units, continuous in the area around FWDA, are missing at the site. The numerous ridges and hills distributed throughout FWDA are formed by portions of the Chinle Formation which have resisted erosion (Figure 1-5).

Surface exposures of several rock units described earlier constitute the recharge areas for several aquifers. The San Andres Limestone and the Glorieta Sandstone function hydrologically as a single aquifer unit and provide water to FWDA via a single deep well (Figure 1-3). Recharge for the aquifer occurs in the outcrop areas in the Zuni Mountains, where water enters the San Andres-Glorieta aquifer and flows downgradient (northward). The production well at FWDA taps the San Andres-Glorieta aquifer at a depth below land surface of 1,352 ft (equivalent to an elevation of approximately 5,330 ft above MSL), almost 3,000 ft lower in elevation than the outcrop areas in the southern region of FWDA.

The City of Gallup draws a major portion of its potable water supply from the Gallup Sandstone aquifer, which receives part of its total recharge from outcrops along the Hogback. The outcrop of the Gallup Sandstone aquifer on the Hogback is approximately 7,500 ft above MSL. Near the City of Gallup (elevation 6,500 ft), the Gallup Sandstone aquifer is at a shallow depth. The 1,000-ft difference in altitude is indicative of the steepness of the dipping sandstone.



SOURCE: USATHAMA, 1980.

Figure 1-6
GEOLOGIC CROSS SECTIONS A—A' AND B—B' (FIGURE 1-4) ON AND NEAR FWDA, McKINLEY COUNTY, NEW MEXICO

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

The water table aquifer in the Puerco River area, north of FWDA, can locally produce significant amounts of water as documented in studies by USGS (1971, 1975). The alluvial gravels of the Puerco River are capable of producing approximately 100 gallons per minute (gpm) from a depth of 125 ft. This alluvial gravel would provide a rapid transport medium for potentially contaminated ground water and/or surface runoff, if present on FWDA.

Groundwater flow within the water table aquifer would only be possible during wet portions of the year, specifically with the snowmelt in spring. This flow would be expected to be at shallow depth (less than 50 ft) and would move from areas of high elevation (e.g., the Zuni Mountains at the southern boundary of FWDA) to areas of lower elevation (e.g., the Puerco River Valley, north of FWDA).

1.3.4 RATIONALE FOR SAMPLE AREA SELECTION

Ammunition Workshop Area

Beginning in 1949, munitions washout operations were conducted in the 500 series buildings area. Munitions were received in Building 500 where they were unpacked, broken down, and transported to Building 503. There, a hot water [redacted] operation was conducted for munitions containing trinitrotoluene, cyclotrimethylenetrinitramine, and Tritonal.

Red water from the trinitrotoluene washout was disposed of by draining it into three settling tanks outside of Building 503 (Area 2, Figure 1-2), from which it overflowed into [redacted] bed immediately north of the building. This leaching bed was used in the late 1940's and was deactivated when the building was renovated to accommodate washout of larger munitions. The [redacted] in this bed were removed to the Demolition Area for [redacted]g. The renovated [redacted]ut operations used [redacted] northeast of Building 503. These beds were used until washout operations ceased [redacted] During operation of the washout facility, the settling tanks were cleaned once a week, and the residue was taken to the burning ground at the Demolition Area where it was burned.

Building 515 housed the ammunition painting facility, and contained acid tanks used for [redacted] prior to painting. The diluted acid wastes from the pickling tanks were routed into an [redacted]est of Building 515. The material in this pond was disposed of by [redacted]

Currently, an agreement exists between FWDA and the City of Gallup, New Mexico, whereby all garbage from FWDA is collected by the city and hauled to a city-owned landfill for disposal. Trash from other activities on the installation is buried within a landfill (Area 6 on Figure 1-2) located just east of Storage Area B on the installation. Waste material at this landfill is covered once a month. In addition, the old landfill and burning area (Area 4 on Figure 1-2) was located just north of the water storage tanks off North Patrol Road. Activity in this area ceased in 1968. Surface runoff from these areas generally is low and dissipates either through evaporation or infiltration. Any runoff from the landfills is to the north into the Puerco River Valley.

The potentially contaminated areas within the Ammunition Workshop Area, the acid disposal pit, trinitrotoluene washout leaching pits, triangular leaching pit, and current sanitary landfill, are situated on unconsolidated alluvial sediments (sand, silt, and clay). Previously existing data indicate that these sediments would be expected to be approximately 30 ft deep and rest upon the consolidated rocks of the Chinle Formation. Ground water was expected to exist as a perched water table within the alluvial sediments. If significant contamination exists in the area, the contaminants could possibly move both horizontally and vertically toward potable water supplies. Of principal concern would be the ability of contaminants to reach the highly permeable and shallow gravels of the Puerco River.

Demolition and Burning Ground Areas

The Demolition Area (Area 21 in Figure 1-2) has been used as a disposal ground for explosives-contaminated material. Old equipment from the trinitrotoluene drying and flaking operations was removed from Building 503 during the renovation of the building and was disposed of in the Demolition Area.

Two burning ground areas were located at FWDA. The first area (Area 22 in Figure 1-2) was used to burn explosives and explosive-contaminated material from 1948 to 1955. This burning ground was certified clean and closed in 1955. The second area (Area 23 in Figure 1-2) is the current area used for burning, and was started in 1955.

The geological setting of this area indicated that it was unlikely that shallow ground water would be present during the dry season, but the spring snowmelt would probably cause a short-term shallow groundwater supply. Aquifer recharge areas exist nearby, but at a much higher altitude. The determination of the degree of contamination present and the potential effects upon the recharge areas was considered important. Major drainage features originate in this area and drain to the north toward the Puerco River valley. Potential contaminants could possibly travel via this route.

Administration Area

The two potential contaminant sources within this area are the sewage lagoon and the oil disposal/fluorspar sites. The main sewage treatment plant (STP) is located on a flat, low area just west of the Administration Area. The STP consists of a bar screen, lift station, Imhoff tank, sludge beds, three stabilization ponds in series, and an evaporation-infiltration lagoon. The evaporation-infiltration rates generally equal or exceed flow into the system. However, discharge from the system (during periods of low evaporation, heavy rainstorm, or snowfalls) is into an open drainage ditch north of the installation which drains eventually into the South Fork of the Puerco River. Both of these sources are in the alluvium-filled valley of the South Fork of the Puerco River. Although there was the possibility that no shallow ground water existed during the dry season, monitor wells were constructed to intercept any existing perched water tables. Potential contaminants from this area could possibly reach the Puerco River via subsurface flow, or by surface runoff.

Property Boundary Area

The northern property boundary of FWDA was selected as a sampling area because it is the area toward which all ground and surface water flows. The adjacent Puerco River is the ultimate receiving water for both stormwater and wastewater treatment plant effluent, if any.

Background Areas

Background areas were selected to determine naturally occurring concentrations of analytes for all sampled mediums. These areas were distributed throughout FWDA.

1.4 TECHNICAL APPROACH

An initial survey of FWDA was made by key members of the ESE project team in conjunction with USATHAMA and FWDA personnel who defined, on site, the approach to the Environmental Survey. In addition, Army personnel provided essential background information which affected the determination of sample points and analyses required.

As a result of the visit to FWDA and a search of the available literature (see Section 6.0), including the USATHAMA Records Search, ESE's project team identified the proposed sampling points and analytical requirements for determining the extent of munition and other pollutant contamination. The Detailed Sampling and Analysis Plan, Accident Prevention Safety Program, Quality Control Plan, and Data Management Plan, presenting in detail the approach that ESE was taking in performing the Environmental Survey, were submitted to USATHAMA in November 1980 and finalized by December 1980.

Field efforts began in November 1980. A survey of the well locations was conducted by Stitzer and Associates in November. Well drilling began in early November and was completed within 2 weeks.

FWDA was sampled from January 22 to 26, 1981. Samples were shipped by air, arriving in Gainesville within 24 hours of sample collection. The samples were processed and stored at ESE's laboratories in keeping with the chain-of-custody procedures practiced at ESE. Analyses occurred within holding times, subject to procedures outlined in the August 1980 Quality Control Plan.

Data were evaluated and presented to USATHAMA in April 1981. Final data validation and entry to the USATHAMA Installation Restoration Data Management System were completed in May 1981.

2.0 FIELD STUDIES

The field sampling program included those activities necessary to obtain groundwater, soil, and surface water and sediment samples at selected sites at FWDA. The program consisted of both geotechnical and sample collection activities.

A total of 38 sampling sites was selected based on information from the FWDA records search, ESE's on-site survey, interviews with USATHAMA and FWDA personnel, and a review of USGS reports and other related material. Most of these sample sites were located in the Ammunition Workshop Area, the Administration Area, Igloo Areas A and C, and the Demolition Area. Background samples were collected at upgradient and downgradient sites near the base perimeter and at selected springs and tanks.

The individual sites included 14 groundwater sites, 15 soil sites, and 9 surface water and sediment sites. At surface water sites, both a water and sediment sample were collected, if possible. The dry condition of many of the watercourses allowed only a sediment sample to be collected. The sampling site selection rationale, number of samples, and procedure for the geotechnical and sampling activities are presented in the following sections.

2.1 RATIONALE FOR SAMPLING SITE SELECTION

2.1.1 AMMUNITION WORKSHOP AREA

The Ammunition Workshop Area contains the remains of an acid disposal pit and two trinitrotoluene washout leaching pits. Because of the nature of the activities conducted here, this site was considered to be a potentially contaminated area. Seven soil sites, one surface water and sediment site, and seven monitor well sites were selected for contamination assessment. Table 2-1 describes well locations and

Table 2-1. Ammunition Workshop Area Soil Siting Rationale

Site Number	Siting Rationale
FW01	—Downgradient (north) of current sanitary landfill to detect potential contamination.
FW06	—Within acid disposal pit to quantify amount of contamination.
FW09	—Within triangular leaching pit to quantify amount of contamination.
FW14	—Within leaching pit (eastern) to quantify amount of contamination.
FW15	—Within leaching pit (western) to quantify amount of contamination.
FW16	—In overflow ditch west of leaching pits to detect downgradient migration of contaminants via surface runoff.
FW17	—To detect downgradient migration of potential contamination from triangular pit via this ditch.

Source: ESE, 1981.

rationale for siting; Table 2-2 lists soil sampling sites and siting rationale; and Table 2-3 lists surface water and sediment sampling sites and rationale. These sites are mapped in Figure 2-1.

The geologic environment of the Ammunition Workshop Area indicated that shallow perched ground water may be present during times of high surface water activity (e.g., snowmelt in spring). The sandy alluvium in the area would be capable of transporting quantities of ground water down-gradient toward the property boundary to the north. The sampling program was designed to determine the level of contamination within washout leaching beds, and then to determine if contaminants have migrated downgradient via surface water runoff or shallow groundwater flow.

2.1.2 DEMOLITION AND BURNING GROUND AREA

The primary activity in this area has been the destruction of a wide variety of ordnance materials. One well, four soil sites, and four surface water and sediment sites were sampled. Table 2-4 lists soil sampling sites and siting rationale; Table 2-5 lists surface water and sediment sampling sites and rationale; and Table 2-6 describes well locations and rationale for siting. These sites are shown on Figure 2-2.

This area is located in the topographically higher regions of FWDA. Recharge to major aquifers occurs near this area, and the sampling program was developed with attention to the spatial relationships of contaminated areas and recharge areas. Bedrock is either exposed or at very shallow depths in this area, except in the narrow alluvium-filled arroyos. The sampling sites were, therefore, concentrated within the major drainageways or within known burning and demolition grounds.

2.1.3 ADMINISTRATION AREA

The Administration Area contains two locations which are potentially contaminated, the sewage lagoon area and the area containing the oil

Table 2-2. Ammunition Workshop Area Surface Water and Sediment Siting Rationale

Site Number	Siting Rationale
FW30	—To determine whether impounded surface runoff from Ammunition storage areas to the south has contaminated lake and sediments.

Source: ESE, 1981.

Table 2-3. Ammunition Workshop Area Monitor Well Siting Rationale

Site Number	Siting Rationale
FW07	—Downgradient (north) of acid disposal pit to detect potential contaminants.
FW08	—Upgradient (south) of acid disposal pit and Ammunition Workshop Area to define incoming groundwater quality and to determine depth to bedrock in this area.
FW10	—Upgradient (southeast) of leaching pits and Ammunition Workshop Area, to define incoming groundwater quality and to determine depth to bedrock.
FW11	—Downgradient (northeast) of leaching pits to detect potential contaminants.
FW12	—Downgradient (north) of leaching pits to detect potential contaminants.
FW13	—Downgradient (northwest) of leaching pits to detect potential contaminants.
FW35	—Downgradient of Lake Knudson to determine if impounded surface runoff in lake is allowing contaminants to migrate toward northern property boundary (downgradient) via shallow groundwater system.

Source: ESE, 1981.

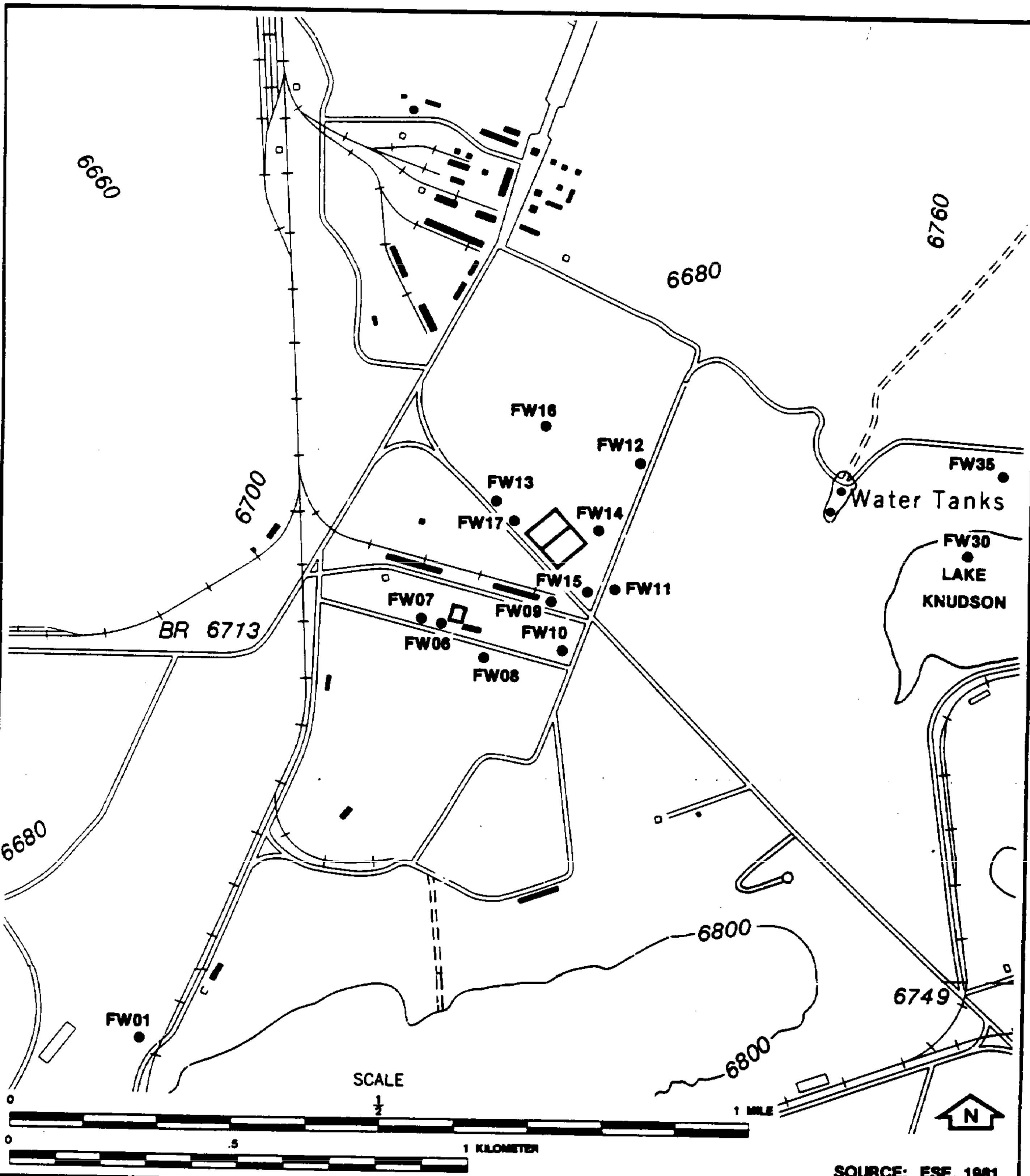


Figure 2-1
AMMUNITION WORKSHOP AREA SAMPLE SITES

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 2-4. Demolition Area Soil Siting Rationale

Site Number	Siting Rationale
FW19	—Within old demolition ground to quantify amount of contamination.
FW20	—Within old burning ground to quantify amount of contamination.
FW21	—Within old burning ground to quantify amount of contamination.
FW32	—Within the drywash leading from the old burning ground to detect potential contaminants migrating via surface runoff.

Source: ESE, 1981.

Table 2-5. Demolition Area Surface Water and Sediment Siting Rationale

Site Number	Siting Rationale
FW18	—Within active demolition ground to quantify level of contamination present.
FW22	—At intersection of arroyos draining old and new Demolition Areas to quantify existing contamination.
FW23	—From arroyo, further downgradient (north) than FW22.
FW24	—From arroyo, further downgradient (north) than FW23.

Source: ESE, 1981.

Table 2-6. Demolition Area Monitor Well Siting Rationale

Site Number	Siting Rationale
FW24	—Downgradient of Demolition Area, next to arroyo draining the same areas to detect potential contamination moving downgradient (north).

Source: ESE, 1981.

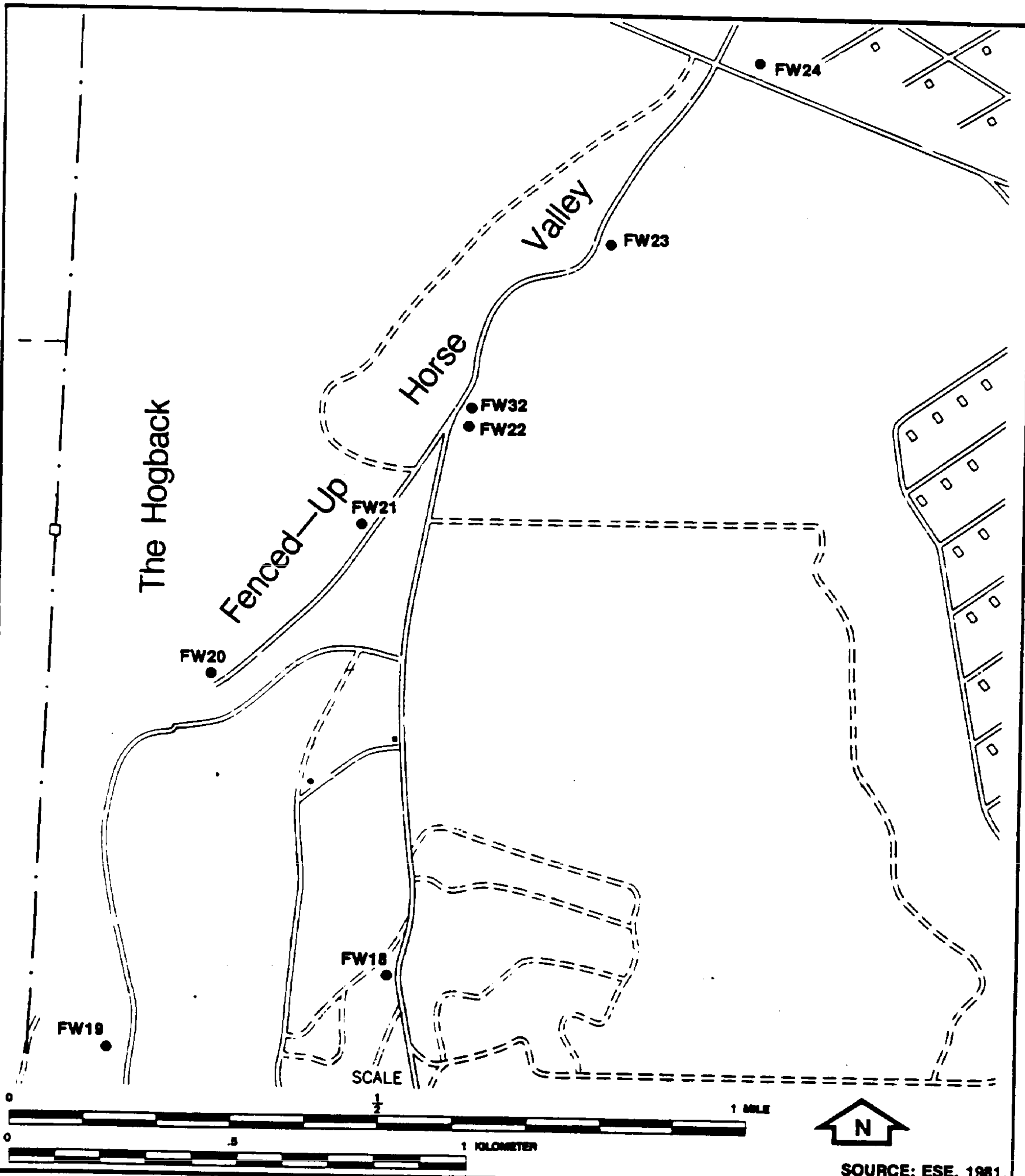


Figure 2-2
DEMOLITION AREA SAMPLE SITES

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

disposal and fluorspar sites. Both of these locations are in the alluvium-filled valley of the South Fork of the Puerco River. Two monitor wells were sampled in this area. Table 2-7 describes the location and rationale for siting of these wells. The geologic setting of this area is nearly identical to that of the Ammunition Workshop Area. Sandy alluvium appeared to be capable of transporting shallow ground water downgradient (to the north). The monitor wells in this area were sited downgradient of the potential contaminant sources. The STP lagoons provide an artificial source of shallow ground water, and the monitor well downgradient of the lagoons was intended to also determine the alluvium's ability to transmit ground water.

2.1.4 OTHER AREAS

Property boundaries and background sites were sampled to determine if potential contaminants were migrating off property to the north, and to determine natural background levels of all analytes. Tables 2-8, 2-9, and 2-10 describe site locations and siting rationale for wells, soil sampling sites, surface water and sediment sites, and well sampling sites, respectively (see Figure 2-3).

The geologic environment of FWDA strongly favors water movement along relatively narrow and well-defined watercourses. As a result, sampling sites were concentrated within or near these features. Monitor wells were sited to detect perched water tables near these drainageways.

2.2 WELL INSTALLATION/GROUNDWATER SAMPLING

The geotechnical activities at FWDA included the drilling, logging, and construction of 14 water quality sampling wells. The sample site number, location, and depth of these wells are listed in Table 2-11. Locations of the wells are shown in Figure 2-4. Dry holes which were drilled were constructed as wells to make them available for sampling during spring high water.

Table 2-7. Administration Area Monitor Well Siting Rationale

Site Number	Siting Rationale
FW26	—Downgradient (north) of oil disposal area and fluorspar storage pile to detect potential contaminants.
FW29	—Downgradient (north) of STP ponds to detect potential contaminants.

Source: ESE, 1981.

Table 2-8. Other Area Soil Siting Rationale

Site Number	Siting Rationale
FW04	—In dry ravine containing munitions container refuse to detect potential contaminants.
FW33	—In drainageway near Well FW27 to detect potential contaminants at property boundary.
FW34	—In drainageway near Well FW28 to detect potential contaminants at property boundary.

Source: ESE, 1981.

Table 2-9. Other Areas Surface Water and Sediment Siting Rationale

Site Number	Siting Rationale
FW02	—D-Area Pond 425, to detect potential contamination from munitions storage activities.
FW03	—C-Area Pond, to detect potential contamination from munitions storage activities.
FW05	—Opposite Igloo C-1119, to detect potential contamination from munition storage activities.
FW37	—East of the Demolition Area, to detect migration potential of demolition activities contamination.

Source: ESE, 1981.

Table 2-10. Other Areas Monitor Well Siting Rationale

Site Number	Siting Rationale
FW27	—Located next to a drainageway (eastern half) leading off property (north) to detect potential contamination from FWDA activities.
FW28	—Located next to drainageway (western half) leading off property (north) to detect potential contamination in the shallow ground water as it flows off property.
FW31	—Background well (upgradient) located on East Patrol Road near Ft. Wingate School to define incoming groundwater quality.
FW36	—Deep well in Administration Area used for quality control samples and well drilling fluid.

Source: ESE, 1981.

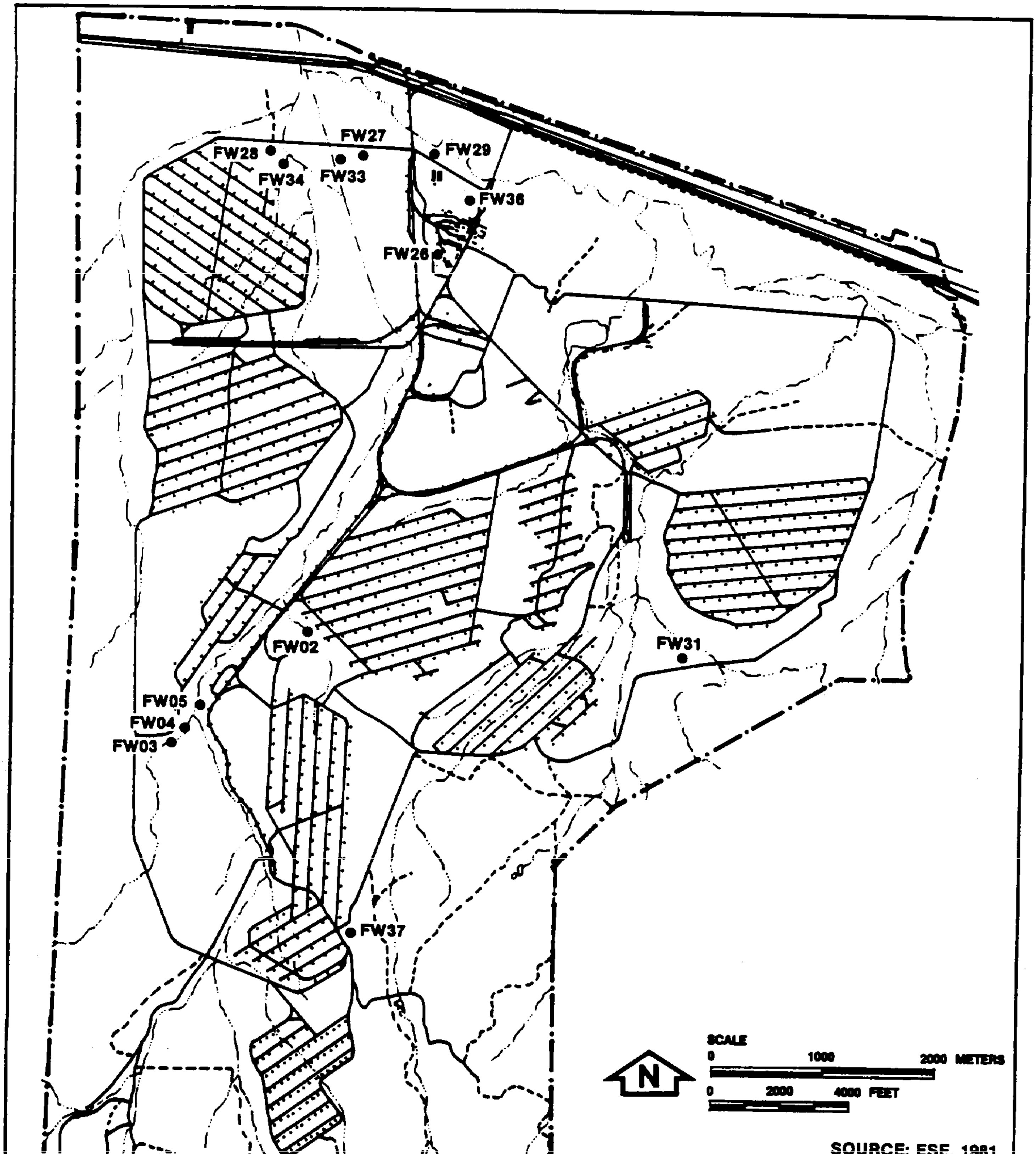


Figure 2-3
ADMINISTRATION, IGLOO, AND BACKGROUND AREAS SAMPLE SITES

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 2-11. FWDA Groundwater Sampling Sites

Site Number	Location	Depth (feet)
Ammunition Workshop Area		
FW07	North of Acid Pit	26
FW08	Upgradient of Acid Pit	49
FW10	Upgradient of Leaching Pits	49
FW11	Northeast of Leaching Pits	28
FW12	North of Leaching Pits	29
FW13	West of Leaching Pits	30.5
FW35	Lake Knudson Downgradient	30
Demolition Area		
FW24	North of Demolition Area Entrance and Building 601	23
Administration Area		
FW26	North of Oil Disposal and Fluorspar Pile	31
FW29	North of Sewage Ponds	30
FW36 (FW00GW)	Deep Well (Drill Water Source)	1,650
Igloo Area A		
FW27	North Boundary Road, East Drainage	30
FW28	North Boundary Road, West Drainage	33
Other Areas		
FW31	East Patrol Road, Upgradient Well	50

Source: ESE, 1981.

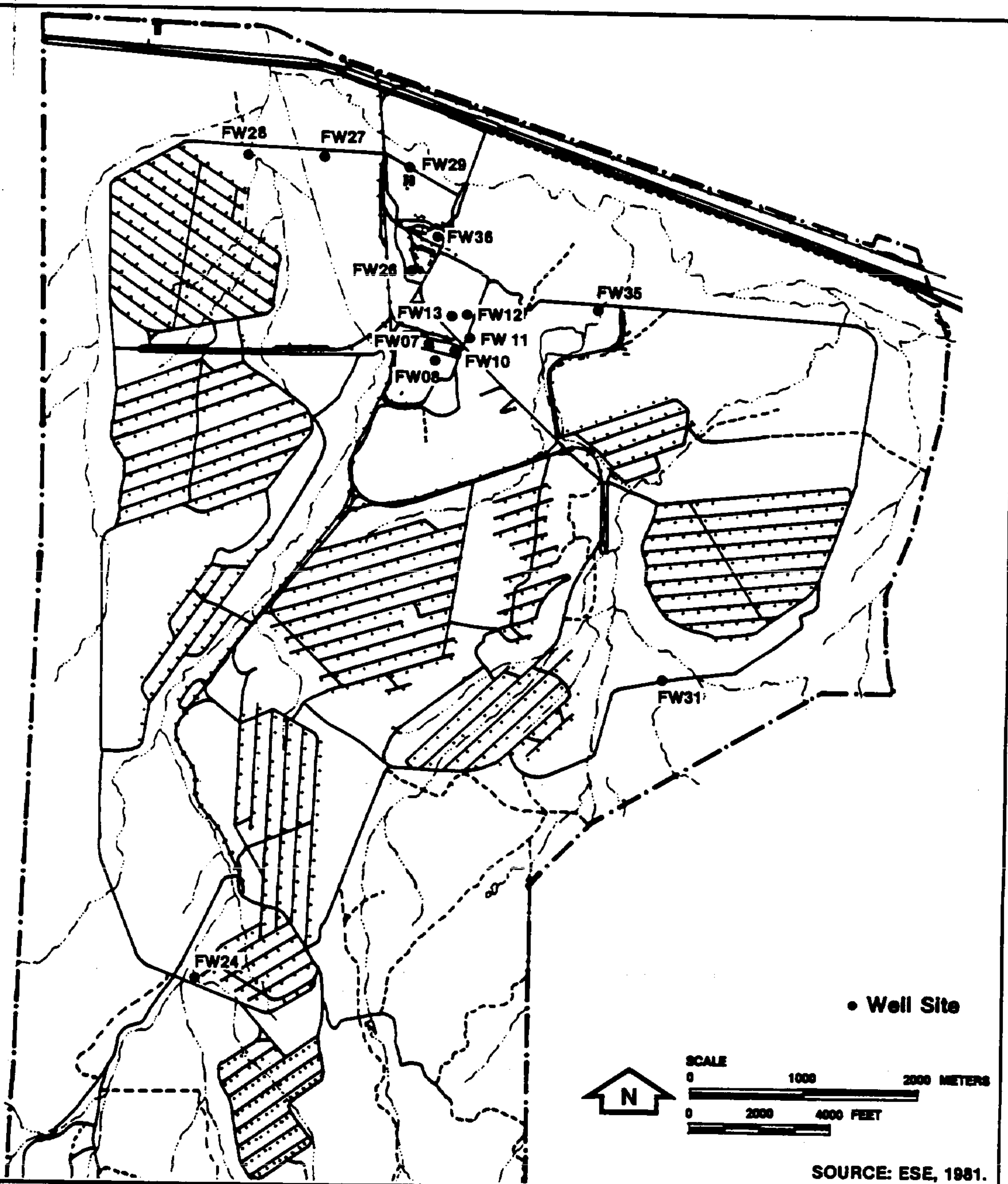


Figure 2-4
LOCATION OF WELL SITES

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

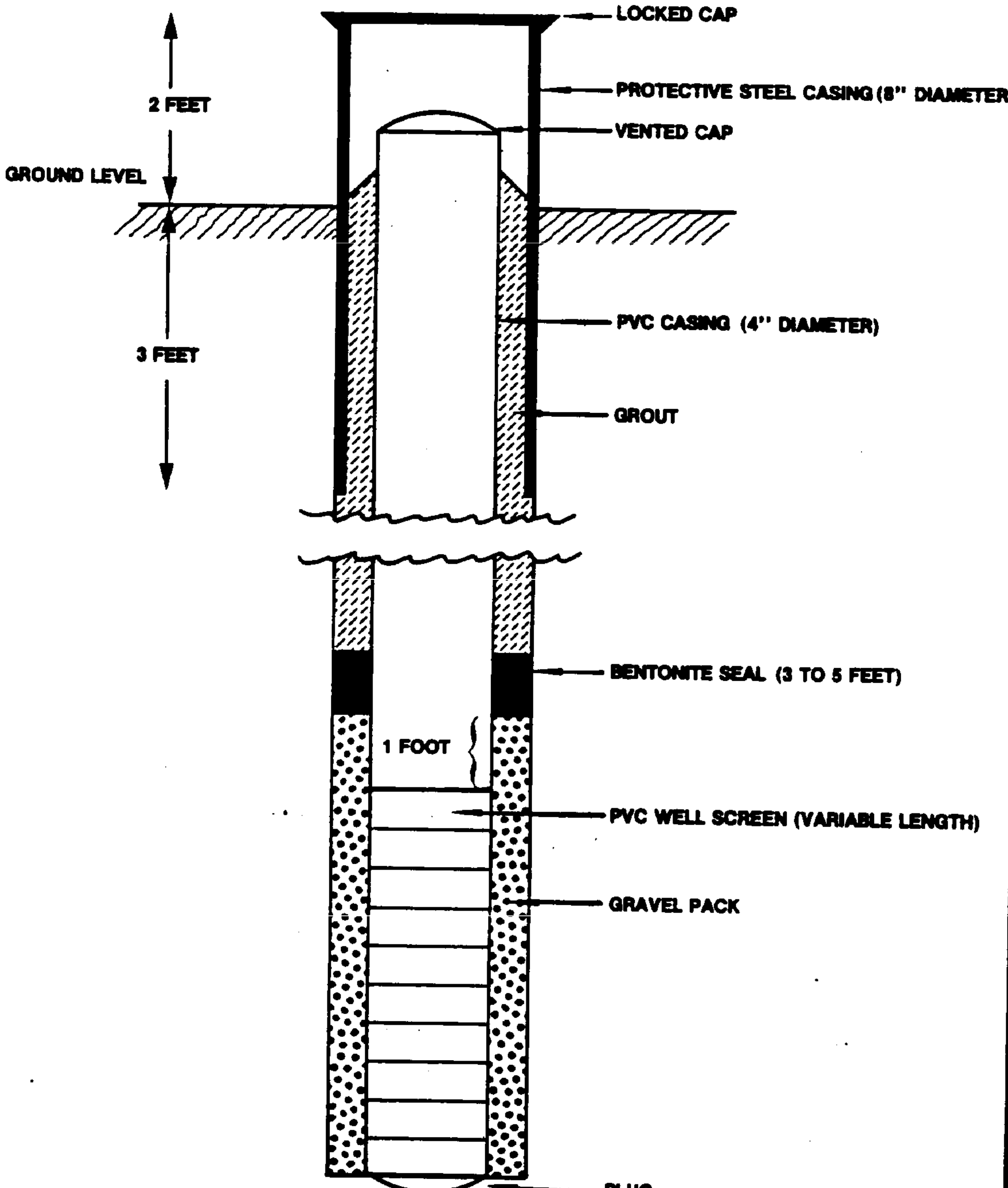
All wells were drilled, logged, and constructed as specified in the following section. All drilling sites were surveyed by Stitzer & Associates surveying and engineering company. The surveyor obtained all the necessary benchmark information from the Corps of Engineers and installed a reference marker at each drilling site prior to drilling.

2.2.1 WELL DESIGN AND CONSTRUCTION

Sampling wells constructed at FWDA were used to investigate both near surface stratigraphy and ground water. The monitor wells were constructed to maximize the probability of obtaining a representative sample of shallow ground water (if available) and intercepting any leachate plume. Construction of the wells follows the design shown in Figure 2-5. Wells constructed in the Ammunition Workshop Area were constructed with a 4-ft riser to prevent flooding of the wells during peak spring runoff. Each well was constructed in an 8-in. diameter hole drilled to the depth presented in Table 2-11. This table shows actual, not intended, depths resulting from these considerations. Bedrock was not encountered in the drilling of any of the FWDA monitor wells.

An ESE geologist supervised the drilling of the wells, maintained detailed drilling logs, and collected appropriate samples. The drilling was performed by a subcontractor and proceeded as follows:

1. Unchlorinated water for drilling and well installations was obtained from the deep well, Site 1948.
2. An 8-in. hole was drilled using hollow-stem augers. This allowed the collection of soil samples through the barrel of the auger.
3. During the drilling of each hole, soil samples were collected continuously for the first 10 ft and at every 5 ft or at each major stratigraphic change following, whichever occurred first.
4. The soil samples were collected by using driven samplers of the split barrel types. Weight of hammer, diameter of sampler, number of blows, drop distance, penetration distance, and length of sample recovered were recorded.



SOURCE: ESE, 1980.

Figure 2-5
MONITOR WELL CONSTRUCTION

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

5. Between borings, the drilling tools were thoroughly cleaned with unchlorinated water from the approved source to prevent cross-contamination.

Sample Description and Logging Procedures

Each boring was fully described on the boring log (shown in Figure 2-6) as it was being drilled. Well profiles which show lithology and Unified Soil Classification System (USCS) abbreviations plotted by elevation are provided in Appendix A. Original well logs were provided to USATHAMA. Data which were included in the logs, when applicable, are listed below. These requirements and procedures conform to the USATHAMA minimal requirements for boring logs.

1. Depths were recorded in ft and decimal fractions thereof. Metric measurements only were entered on the data entry forms.
2. Soil descriptions were in accordance with the USCS. These descriptions were prepared in the field by the ESE geologist.
3. Soil samples were fully described on the log. The description included:
   a. Classification;
   b. USCS symbol;
   c. Secondary components and estimated percentage;
   d. Color (using Munsell Soil Color Chart);
   e. Plasticity;
   f. Consistency (cohesive soil) and density (noncohesive soil);
   g. Moisture content;
   h. Texture/fabric/bedding; and
   i. Depositional environment.
4. Numerical, visual estimates were made of secondary soil constituents. If such terms as "trace," "some," or "several," were used, their quantitative meaning was defined on each log or with a general legend.
5. The length of sample recovered for each sampled interval was recorded.

Boring No. ______ Location Coordinates N ______

Hole Size ______ Slot ______ E ______

Screen Length ______ Mat'l ______ Filter Materials ______

Diameter ______ Mat'l ______ Grout Type ______

Casing Length ______ Mat'l ______ Development ______

Diameter ______ Static Water Level ______

Date Start ______ Finish ______ Top of Well Elevation ______

Ground Elevation ______ Depth to Water ______

Depth (feet)	Sample	Lithology, Color	Sketch of Construction	Standard Penetration Blow Count

SOURCE: ESE, 1990.

Figure 2-6
SAMPLE BORING LOG FOR FWDA GEOTECHNICAL STUDY (REDUCED) (PAGE 1 OF 2)

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Boring No.__________ Sheet ___ of ___

Date

Signed

SOURCE: ESE, 1980.

Figure 2-6
SAMPLE BORING LOG FOR FWDA GEOTECHNICAL STUDY (REDUCED)
(CONTINUED, PAGE 2 OF 2)

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

6. Blow counts, hammer weight, and length of fall for split spoon were recorded.
7. Minimum information on the sample container included the boring and sample number.
8. The estimated interval for each sample was specified.
9. Depth to water was indicated along with the method of determination, as first encountered during drilling. Any distinct water-bearing zones below this first one also were noted.
10. The drilling equipment used was generally described either on each log or in a general legend including such information as rod size, bit type, pump type, rig manufacturer, and model.
11. Each log recorded the drilling sequence.
12. All special problems were recorded.
13. The dates for the start and completion of any boring were recorded on the log.
14. Lithologic boundaries were noted on the boring log.
15. The boring logs were submitted directly from the field to the Contracting Officer's Representative (COR) within 3 working days after the boring was completed.
16. Only the original log and sketch(es) were submitted to COR to fulfill this requirement.

A sketch of the well installation was included on the boring log and showed, by depth, the bottom of the boring, screen location, coupling location, granular backfill, seals, grout, cave-in, and height of riser above ground surface. The actual composition of the grout, seals, and granular backfill was also recorded on each sketch. Well sketches also included the protective casing detail.

Well Installation

When the boring was complete, the ESE geologist inspected the hole to ensure plumbness and cleanliness. The well screen and casing were carefully cleaned with unchlorinated water from the deep well prior to installation in the hole. The specifics of length of screen versus solid casing were field determined (generally, however, the gravel/sand pack was placed around the screen to at least 1 ft above the estimated seasonally high water table).

As the 3-ft bentonite seal was placed on top of the filter material, unchlorinated water from the deep well was added, if necessary, to ensure that the pellets expanded to form a tight seal.

The gel-cement grout seal extended from the top of the bentonite seal to the land surface. Grouting was completed as a continuous operation in the presence of the ESE geologist. The grout was placed into the annular space to ensure that there was a continuous grout seal. The protective casing was sealed in the grout, as shown in Figure 2-5. Three 6-ft steel posts were driven 2 ft into the ground, 4 ft from the well, and strung with barbed wire to enclose the well against livestock grazing in the vicinity.

The following materials were used in well construction:

1. Casing used in the well was PVC Schedule 40 with solvent-welded joints. The well screen was factory slotted. Slot width was 0.01 in.
2. Grout was composed by weight of six parts cement to one part bentonite, with just enough approved unchlorinated water for a pumpable mix.
3. Bentonite pellets used in the seal were a commercially available product designed for well sealing purposes.
4. The well graded silica sand used in the filter envelope around the well screen was selected to be compatible with both the screen slot size and the natural subsurface materials and was approved by USATHAMA. At least one sample (1/2 to 1 pint in volume) of the granular backfill used as part of a well installation was taken from each shipment of granular material, and stored with the soil samples.

The well site was surveyed and marked prior to drilling, with the finished well tied into the mark by a hand level and measurement adjustment. Vertical control for the ground surface and top of each well casing (not protective casing) at each boring/monitor well was established within ± 0.1 ft.

Well Development

Since water was not encountered during the drilling operations, well development activities were not performed.

2.2.2 SAMPLING TECHNIQUES

Groundwater sampling began approximately 6 weeks after installation of the monitor wells. The groundwater sampling program produced five samples. One well was sampled in duplicate to provide data concerning the variability in the data associated with field sampling.

The following subsurface water sampling procedures were followed:

1. The depth to water was measured.
2. Samples were taken after the fluid in the screen and well casing had been exchanged a number of times (preferably five times). However, due to the soil types, some wells had slow recovery rates. These wells had the fluid exchanged at least twice. Sampling was accomplished by a bailer constructed of PVC.
3. To protect the wells from contamination during sampling procedures, a separate bailer was supplied for, and attached to, each well. This bailer remained in place in the well during the monitoring phases. The sample was collected in a manner which minimized its aeration and prevented oxidation of reduced compounds in the sample. The container was filled to the top without air bubbles and tightly stoppered. The metals fraction was vacuum filtered through a 0.45-micron filter, chilled to 4°C, appropriately preserved (Table 2-12), and immediately transported to the laboratory.

4. On-site measurements of water quality included conductivity and depth of wells from the topographical surface to the surface of the well water.

Essentially inert PVC well casings were used in this program since stainless steel casings would have been prohibitively expensive. However, three potential problems may be associated with the use of PVC for sampling organic parameters. First, adsorption of certain compounds in the plastic could affect the apparent groundwater concentration. Second, phthalate plasticizers could be introduced into the samples. Third, compounds present in the PVC cleaner or cement could contaminate the samples. To minimize the effect of these potential problems, each well was pumped and then sampled as soon as sufficient water returned (typically less than 5 minutes). The contact time between the water sample and the PVC well casing was kept to the shortest possible period.

Each sample fraction was carefully labeled so that it could be identified by laboratory personnel. The sample label included the project number, sample number, time and date, and sampler's initials. All samples were identified with a standard preprinted and prenumbered label immediately after collection. Information concerning preservation methods, matrix, and sample location was included on the label. As a further precaution, each sample container was marked with water-insoluble ink.

For data to be valid, samples had to arrive at the laboratory unaltered. To accomplish this objective, several fractions were collected at each site and preserved. Table 2-12 lists the containers, volumes, and preservative techniques employed for water samples. Samples were shipped in styrofoam ice chests and were kept at 4°C from time of sample collection until analysis.

Table 2-12. Water Sample Preservation Techniques

Analysis/ Parameter	Container Type	Volume	Preservation*	Holding Time (days)
GC/MS and HPLC Screen Picric Acid	Amber Glass Bottle	2x1 gal	Chill to 4°C	7
Volatile Organics	Septum Vials	2x60 ml	Chill to 4°C	7
GC/HPLC Analyses Pesticides PCB Nitroaromatics Tetryl RDX	Amber Glass Bottle	1 gal	Chill to 4°C	7
White Phosphorus	Amber Glass Bottle	1 gal	Chill to 4°C	7
Metals	Plastic Cubitainer	250 ml	Acidify with concentrated HNO_3 to pH<2	180
Acid Anions				
Phosphate, Total	Plastic Cubitainer	1 liter	Acidify with concentrated H_2SO_4 to pH<2	1
Nitrate + Nitrite	Plastic Cubitainer	1 liter	Chill to 4°C	1
Sulfate	Plastic Cubitainer	1 liter	Chill to 4°C	7

* All samples were chilled to 4°C at time of collection and kept at or below that temperature.

Source: ESE, 1981.

2.3 SURFACE WATER AND SEDIMENT SAMPLING

Surface water and sediment samples were both taken at each location where water was available. Bottom sediment samples were taken at stations which were dry. Sample station locations are identified in Table 2-13 and Figure 2-7. Surface water was collected as grab samples, directly filling containers at the sample points.

Sediment samples were collected at all stations with a Ponar sampler. When sediments encountered were composed of gravel and small rocks, post hole diggers were used for sampling. Sediment samples were placed in 1-quart glass containers with Teflon®-lined lids, shipped under ice, and stored at 4°C.

Samples were labeled, preserved, and shipped in the same manner as were groundwater samples.

2.4 SOIL SAMPLING

Soil samples were taken at representative locations at each site (Table 2-14 and Figure 2-8). Surface vegetation, rocks, leaves, and debris were removed prior to sampling. Each sample was taken from the surface to a depth of 2 ft with a post hole digger, quartered to approximately 1-pound size, and placed in glass containers with Teflon®-lined lids. These containers were labeled with a preprinted label, chilled to 4°C, and shipped to the laboratory for analysis.

Soil Sample Number 1934 was obtained using a soil auger. A 6-ft-deep sample was obtained and composited. Sampling equipment was thoroughly cleaned, with water from the deep well, between sampling locations.

Table 2-13. Surface Water and Sediment Sampling Sites

Site Number	Location
Ammunition Workshop Area	
FW30	Lake Knudson
Igloo Areas C and D	
FW03	C-Area Pond
FW05	Opposite C-1119
FW02 (FW00SW and FW00SE, Background)	D-Area Pond 425
Demolition Area	
FW18	Pond Near Active Area
FW22	Old and New Demolition Area Drainage
FW23	Masonry Dam
FW24	Near Well FW25
FW37	Metal Stock Tank

Source: ESE, 1981.

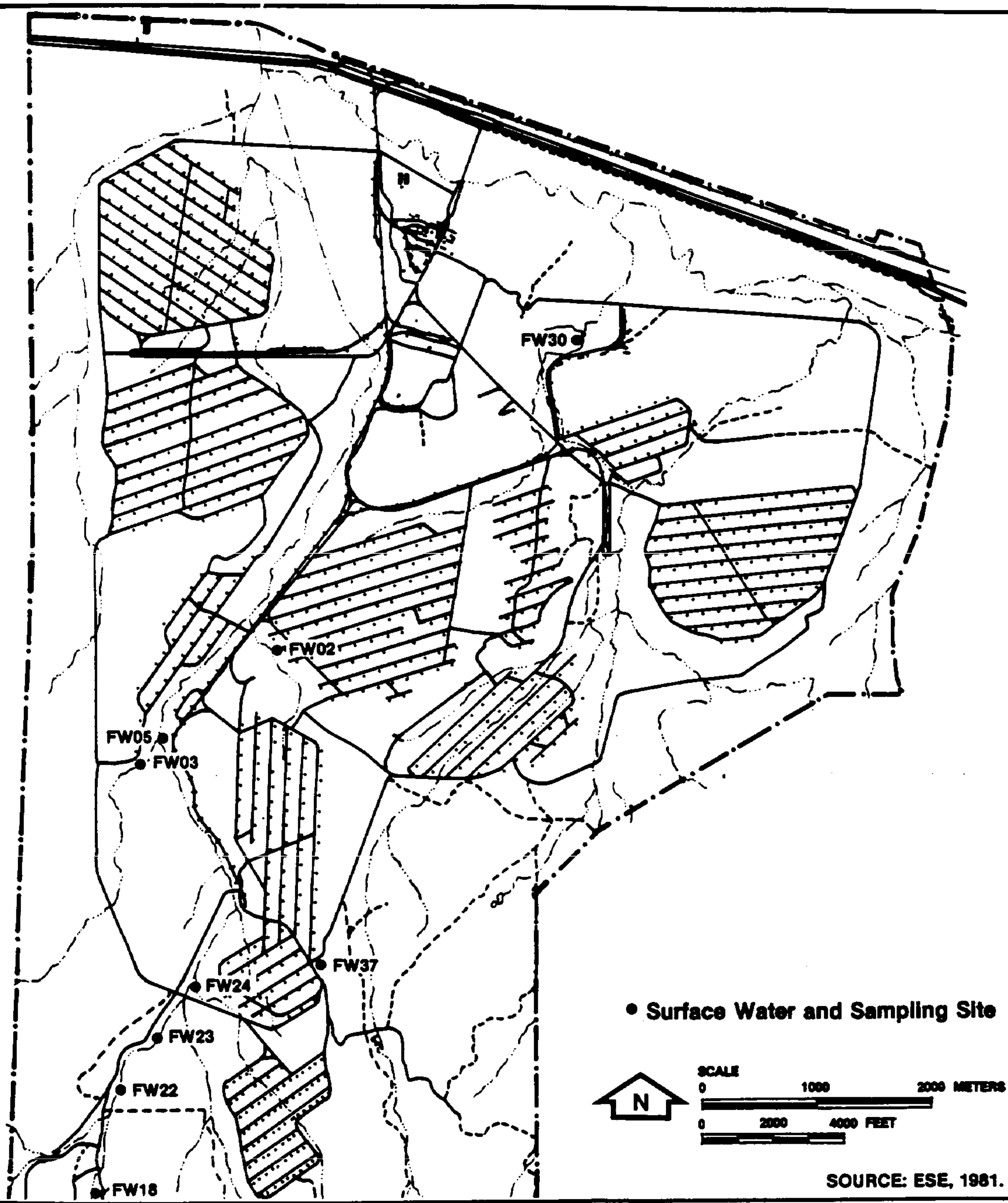


Figure 2-7
SURFACE WATER AND SEDIMENT SAMPLING SITES

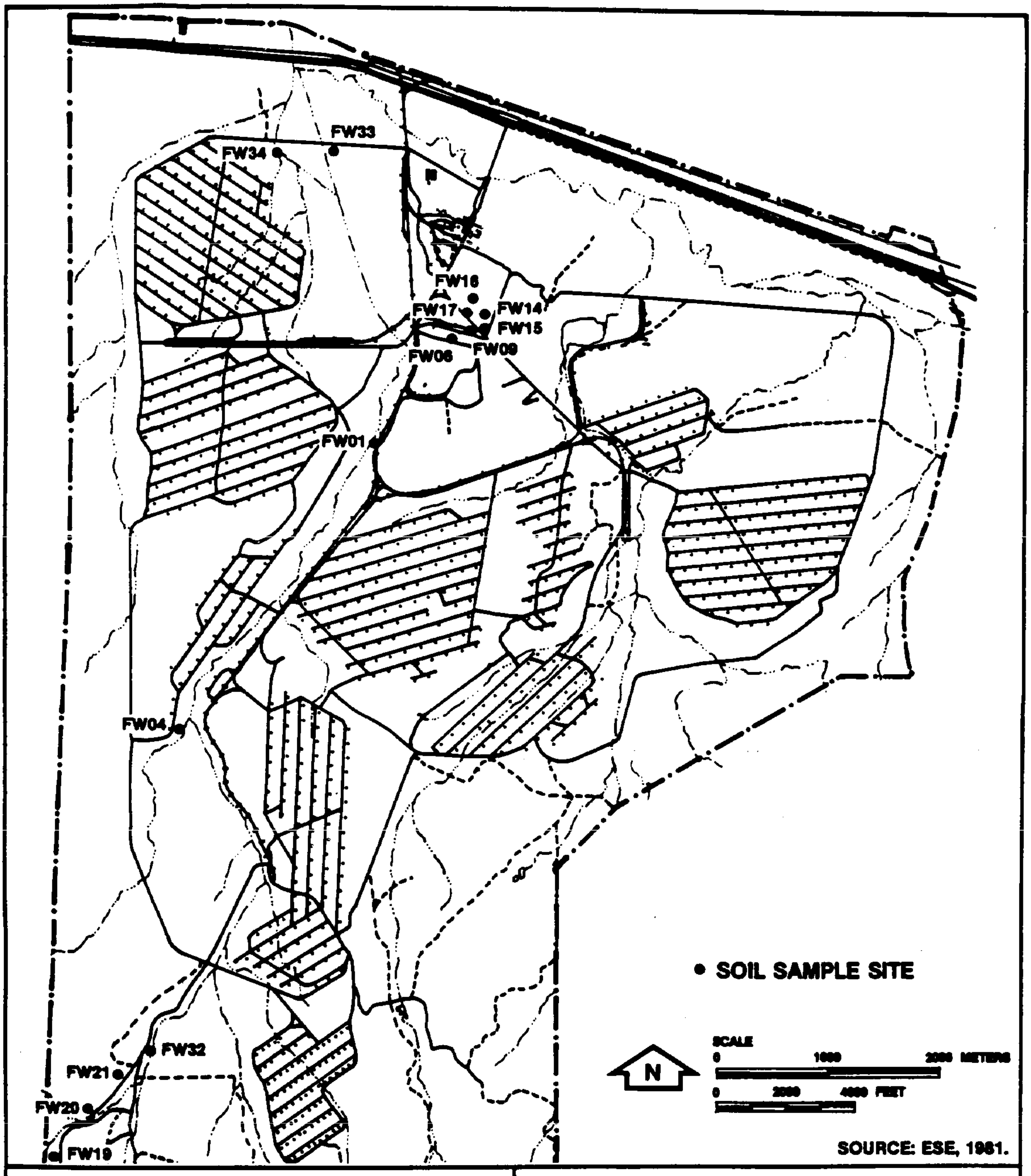
ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 2-14. Soil Sampling Sites

Site Number	Location	Depth (feet)
Ammunition Workshop Area		
FW00SO (Background)	Near FW10	2
FW01	Current Sanitary Landfill	2
FW06	Center of Acid Pit	2
FW09	Center of Triangle Pit	2
FW14	Center of Leaching Bed	6
FW15	Center of Leaching Bed	6
FW16	Ditch West of Leaching Bed	2
FW17	Drainageway of Triangle Pit	2
Demolition Area		
FW19	Old Demolition Area	2
FW20	Old Burning Ground	4
FW21	Old Burning Ground	4
FW32	Drywash From Old Burning Ground	2
Igloo Area A		
FW33	Ditch Near Well FW27	2
FW34	Ditch Near Well FW28	2
Igloo Area C		
FW04	Dry Ravine Containing Munitions Container Refuse	2

Source: ESE, 1981.



SOURCE: ESE, 1981.

Figure 2-8
SOIL SAMPLING SITES

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

3.0 LABORATORY STUDIES

3.1 CHEMICAL ANALYSIS

3.1.1 CERTIFICATION OF METHODS

For semi-quantitative methods, spiked samples of standard media (standard water or soil) were analyzed at concentrations of 0.5X, X, 2X, 5X, and 10X, where X was the desired/required detection limit. A blank was also run. The detection limit was calculated by the method of Hubaux and Vos (1970) from the results of these analyses. The reported detection limit was not less than the lowest spiked standard sample.

For quantitative methods, precision and accuracy data were generated by analyzing spikes of standard samples at concentrations of 0.5X, X, 2X, 5X, and 10X, where X was the desired/required detection limit. A blank was also run. One replicate at each concentration was analyzed on each of 4 separate days. The collective data were subjected to the Hubaux and Vos detection limit program. The reported detection limit was not less than the lowest spiked standard sample. Precision and accuracy were calculated from the standard error and slope of the best-fit linear regression line.

A summary of analyses performed and certification status are presented in Tables 3-1 and 3-2.

In the gas chromatography/mass spectroscopy (GC/MS) semi-quantitative screening certification, the detection limit for the various priority pollutants and other specific compounds was calculated by analysis of standard matrices spiked with solutions containing at least five of the priority pollutant acid compounds, five of the base/neutral compounds, and five of the volatile compounds. The munitions-related priority pollutant compounds 2,6-dinitrotoluene and 4,6-dinitro-o-cresol were

Table 3-1. Analyses for which ESE has been Certified by USATHAMA--Quantitative Methods

Compound	Medium	Test Name	Number	Detection Limit (ppb)
Nitrobenzene	WA (Water)	NB	1K	17
	SO (Soil)	NB	1L	1,640
2,4-Dinitrotoluene	WA	24DNT	1K	3.0
	SO	24DNT	1L	223
2,6-Dinitrotoluene	WA	26DNT	1K	3.8
	SO	26DNT	1L	419
1,3-Dinitrobenzene	WA	13DNB	1K	4.8
	SO	13DNB	1L	317
1,3,5-Trinitrobenzene	WA	135TNB	1K	9.7
	SO	135TNB	1L	1,080
2,4,6-Trinitrotoluene	WA	246TNT	1K	1.4
	SO	246TNT	1L	194
Tetryl	WA	Tetryl	1K	23.9
	SO	Tetryl	1L	1,500
RDX	WA	RDX	2B	10.5
(cyclotrimethylenetrinitramine)	SO	RDX	2C	288
Silver	WA	AG	1B	6.3
Arsenic	WA	AS	1B	10.0
Beryllium	WA	BE	1B	9.5
Cadmium	WA	CD	1B	3.7
Chromium	WA	CR	1B	7.3
Copper	WA	CU	1B	29
Mercury	WA	HG	1D	0.4
Nickel	WA	NI	1B	7.6
Lead	WA	PB	1B	11
Antimony	WA	SB	1B	39
Selenium	WA	SE	1B	8.6
Thallium	WA	TL	1B	7.1
Zinc	WA	ZN	1M	34
Nitrate	WA	NO3	1U	0.01
	SO	NO3	1T	300
Total Phosphates	WA	TPO4	2G	0.02
	SO	TPO4	2H	790
Sulfate	WA	SO4	1W	4.0
	SO	SO4	IV	259,000

Source: USATHAMA, 1981.

Table 3-2. Analyses for which ESE has been Certified by USATHAMA—Semi-Quantitative Methods

Compound	Medium	Test Name	Number	Detection Limit (ppb)
Acid Fraction				
2,4-Dimethylphenol	WA (Water)	24DMPN	1X	9.0
	SO (Soil)	24DMPN	1Y	600
3-Methyl-4-chlorophenol	WA	4CL3C	1X	8.0
	SO	4CL3C	1Y	600
2-Methyl-4,6-dinitrophenol	WA	46DN2C	1X	20
	SO	46DN2C	1Y	500
Pentachlorophenol	WA	PCP	1X	9.0
	SO	PCP	1Y	400
Phenol	WA	PHENOL	1X	20
	SO	PHENOL	1Y	200
2,4,6-Trichlorophenol	WA	246TCP	1X	8.0
	SO	246TCP	1Y	100
Base/Neutral Fraction				
Naphthalene	WA	NAP	1Z	2.0
	SO	NAP	2A	400
1,2,4-Trichlorobenzene	WA	124TCB	1Z	4.0
	SO	124TCB	2A	1,000
2-Amino-4,6-dinitrotoluene	WA	2A46DT	1Z	20
	SO	2A46DT	2A	4,000
3-Nitrotoluene	WA	3NT	1Z	20
	SO	3NT	2A	4,000
2,6-Dinitrotoluene	WA	26DNT	1Z	4.0
	SO	26DNT	2A	419
3,5-Dinitroaniline	WA	35DNA	1Z	20
	SO	35DNA	2A	3,000
Fluoranthene	WA	FANT	1Z	1.0
	SO	FANT	2A	400
Acenaphthylene	WA	ANAPYL	1Z	3.0
	SO	ANAPYL	2A	400
Diethylphthalate	WA	DEP	1Z	2.0
	SO	DEP	2A	400
Chrysene	WA	CHRY	1Z	1.0
	SO	CHRY	2A	1,000
Nitrobenzene	WA	NB	1Z	5.0
	SO	NB	2A	1,000
Benzo(g,h,i)perylene	WA	BGHIPY	1Z	1.0
	SO	BGHIPY	2A	4,000
Fluorene	WA	FLRENE	1Z	1.0
	SO	FLRENE	2A	2,000
Volatile Organic Fraction				
Benzene	WA	C6H6	2J	0.5
Bromodichloromethane	WA	BRDCLM	2J	0.5
Chlorobenzene	WA	CLC6H5	2J	0.5
Dibromochloromethane	WA	DBRCLM	2J	1.0

Table 3-2. Analyses for which ESE has been Certified by USATHAMA--
Semi-Quantitative Methods (Continued, Page 2 of 3)

Compound	Medium	Test Name	Number	Detection Limit (ppb)
1,2-Dichloroethane	WA	12DCLE	2J	0.9
Trans-1,2-dichloroethene	WA	T12DCE	2J	0.5
1,2-Dichloropropane	WA	12DCLP	2J	0.6
Ethylbenzene	WA	ETC6H5	2J	2.0
1,1,2,2-Tetrachloroethane	WA	TCLEA	2J	0.9
1,1,1-Trichloroethane	WA	111TCE	2J	0.6
1,1,2-Trichloroethane	WA	112TCE	2J	0.7
Trichloroethene	WA	TRCLE	2J	0.7
Organochlorine Pesticides and PCBs (EPA 608)				
Aldrin	WA	ALDRN	2F	2.0
	SO	ALDRN	2M	0.7
Alpha-BHC	WA	ABHC	2F	2.0
	SO	ABHC	2M	1.0
Beta-BHC	WA	BBHC	2F	1.0
	SO	BBHC	2M	2.0
Delta-BHC	WA	DBHC	2F	2.0
	SO	DBHC	2M	5.0
Lindane	WA	LIN	2F	2.0
	SO	LIN	2M	2.0
Chlordane	WA	CLDAN	2F	0.7
	SO	CLDAN	2M	20
4,4'-DDD	WA	PPDDD	2F	2.0
	SO	PPDDD	2M	6.0
4,4'-DDE	WA	PPDDE	2F	2.0
	SO	PPDDE	2M	3.0
4,4'-DDT	WA	PPDDT	2F	3.0
	SO	PPDDT	2M	6.0
Dieldrin	WA	DLDRN	2F	1.0
	SO	DLDRN	2M	0.8
Endosulfan I	WA	AENSLF	2F	3.0
	SO	AENSLF	2M	3.0
Endosulfan II	WA	BENSLF	2F	4.0
	SO	BENSLF	2M	5.0
Endosulfan Sulfate	WA	ESFSO4	2F	3.0
	SO	ESFSO4	2M	3.0

Table 3-2. Analyses for which ESE has been Certified by USATHAMA--Semi-Quantitative Methods (Continued, Page 3 of 3)

Compound	Medium	Test Name	Number	Detection Limit (ppb)
Endrin	WA	ENDRN	2F	1.0
	SO	ENDRN	2M	0.7
Heptachlor	WA	HPCL	2F	2.0
	SO	HPCL	2M	2.0
Heptachlor Epoxide	WA	HPCLE	2F	2.0
	SO	HPCLE	2M	3.0
Toxaphene	WA	TXPHEN	2F	9.0
	SO	TXPHEN	2M	50
PCB-1016	WA	PCB016	2F	4.0
	SO	PCB016	2M	20
PCB-1260	WA	PCB260	2F	0.9
	SO	PCB260	2M	20
<u>Others</u>				
Oil and Grease	SO	OILGR	2E	5,000
White Phosphorus	WA	WP	2K	0.7
	SO	WP	2L	70
Picric Acid	WA	246TNP	2B	6.0
	SO	246TNP	2C	500

Source: ESE, 1981.

included in the spiking compounds for the base/neutral and acid fractions, respectively. Specific munitions-related compounds found to be chromatographable under the same conditions used for the priority pollutants were also included in the spiking mixture. These compounds included nitrotoluene, 2-amino-4,6-dinitrotoluene, and 3,5-dinitroaniline. For those compounds not included in the detection limit study, a detection limit was assumed to be that of the most chemically similar compound involved in the study.

3.1.2 DEVELOPMENT OF NEW METHODS

Several analyses required the development of new analytical techniques or major modifications of existing approaches. Method development and subsequent semi-quantitative certification were required for white phosphorus and for the high pressure liquid chromatography (HPLC) screen for organic compounds (including picric acid). Method development and quantitative certification were required for cyclotrimethylenetrinitramine (RDX).

The method developed for white phosphorus in water and soil involved extraction using toluene followed by gas chromatographic (GC) analysis on a non-polar column with a 526-nanometer (nm) flame photometric detector. Sediment samples were extracted with 50 percent toluene/50 percent acetone solvent and analyzed by GC with detection limits attainable in the microgram-per-liter (ug/l) range. An interim Standard Analytical Reference Material (SARM) was obtained in the form of yellow phosphorus (i.e., white phosphorus with small impurities of the other allomers, red and black phosphorus). This method was qualitatively certified for standard water and soil.

HPLC was used to screen for those specific munitions compounds and degradation products which are unstable and/or are nonvolatile and cannot be satisfactorily analyzed by GC/MS. Specifically, this screen was limited to acidic and neutral organic compounds. Picric acid specifically was analyzed semi-quantitatively by this screen. Spiked standard samples containing picric acid were tested with an extraction scheme similar to that used for the GC/MS screen for United States Environmental Protection Agency (EPA) acidic priority pollutants (Method 625). Picric acid was extracted from acidified media using methylene chloride.

The RDX analysis included an acidic neutral extraction from water samples with methylene chloride followed by concentration, solvent exchange, and analysis by HPLC. Soil samples were extracted with methylene chloride, and the solvent was exchanged and analyzed by HPLC.

3.1.3 METHODS OF ANALYSIS

Upon arrival at ESE, samples were checked in and placed in the cold room (4°C) until they were analyzed.

Groundwater samples were filtered on 0.45-micron membrane filters in the laboratory for all parameters except metals, which were filtered in the field. The groundwater samples were then transferred to clean containers and analyzed within required holding times.

All soil samples were air-dried and passed through a 30-mesh sieve before analysis. Percent moisture was determined for soil and sediment samples according to ASTM Method D2216-71.

A general organic screening procedure was carried out using GC/MS and HPLC to look for specific munitions and hazardous chemical pollutants in the low parts-per-billion (ppb) range in the waters and the low parts-per-million (ppm) range in soils and sediments. A GC/MS screen for EPA organic priority pollutants (Table 3-3) was conducted on samples from selected sites. Volatile priority pollutants were analyzed using the EPA purge and trap procedure (Federal Register EPA Method 624). The priority pollutant base/neutral and acid compounds were analyzed by Federal Register EPA Method 625. In the GC/MS screen, an attempt was

Table 3-3. EPA Priority Pollutants

Volatile Fraction

Acrolein	1,2-Dichloropropane
Acrylonitrile	1,3-Dichloropropene
Benzene	Methylene chloride
Toluene	Methyl chloride chloromethane
Ethylbenzene	Methyl bromide
Carbon tetrachloride	Bromoform
Chlorobenzene	Dichlorobromomethane
1,2-Dichloroethane	Trichlorofluoromethane
1,1,1-Trichloroethane	Dichlorodifluoromethane
1,1-Dichloroethane	Chlorodibromomethane
1,1-Dichloroethylene	Tetrachloroethylene
1,1,2-Trichloroethane	Trichloroethylene
1,1,2,2,-Tetrachloroethane	Vinyl chloride
Chloroethane	1,2,-trans-Dichloroethylene
2-Chloroethyl vinyl ether	
Chloroform	

Acid Fraction

Phenol	p-Chloro-m-cresol
2-Nitrophenol	2-Chlorophenol
4-Nitrophenol	2,4-Dichlorophenol
2,4-Dinitrophenol	2,4,6-Trichlorophenol
4,6-Dinitro-o-cresol	2,4-Dimethylphenol
Pentachlorophenol	

Base/Neutral Fraction

1,2-Dichlorobenzene	Fluorene
1,3-Dichlorobenzene	Fluoranthene
1,4-Dichlorobenzene	Chrysene
Hexachloroethane	Pyrene
Hexachlorobutadiene	Phenanthrene
Hexachlorobenzene	Anthracene
1,2,4-Trichlorobenzene	Benzo(a)anthracene
bis(2-Chloroethoxy) methane	Benzo(b)fluoranthene
Naphthalene	Benzo(k)fluoranthene
2-Chloronaphthalene	Benzo(a)pyrene
Isophorone	Indeno(1,2,3-c,d)pyrene
Nitrobenzene	Dibenzo(a,h)anthracene
2,4-Dinitrotoluene	Benzo(g,h,i)perylene
2,6-Dinitrotoluene	4-Chlorophenyl phenyl ether

Table 3-3. EPA Priority Pollutants (Continued, page 2 of 2)

Base/Neutral Fraction (continued)	
4-Bromophenyl phenyl ether	3,3'-Dichlorobenzidine
bis(2-Ethylhexyl) phthalate	Benzidine
Di-n-octyl phthalate	bis(2-Chloroethyl) ether
Dimethyl phthalate	1,2-Diphenylhydrazine
Diethyl phthalate	Hexachlorocyclopentadiene
Di-n-butyl phthalate	N-Nitrosodiphenylamine
Acenaphthylene	N-Nitrosodimethylamine
Acenaphthene	N-Nitrosodi-n-propylamine
Butyl benzyl phthalate	bis(2-Chloroisopropyl) ether
2,3,7,8-Tetrachloro-dibenzo-p-dioxin (TCDD)	
Pesticides	
alpha-Endosulfan	Dieldrin
beta-Endosulfan	Heptachlor
Endosulfan sulfate	Heptachlor epoxide
alpha-BHC	Chlordane
beta-BHC	Toxaphene
gamma-BHC	Aldrin
delta-BHC	4,4'-DDE
Endrin	4,4'-DDD
Endrin aldehyde	4,4'-DDT
Metals	
Antimony	Mercury
Arsenic	Nickel
Beryllium	Selenium
Cadmium	Silver
Chromium	Thallium
Copper	Zinc
Lead	

Source: EPA, 1980.

also made to identify other major chromatographic peaks which represented a significant portion (greater than 10 percent) of the total ion current. The identification was accomplished with the aid of National Bureau of Standards (NBS) library reference spectra.

A slightly modified version of the Federal Register EPA Method 608 was used to qualitatively determine organochlorine pesticides and polychlorinated biphenyls (PCBs) as part of the initial screen.

A flow chart of the analyses scheme for water samples for organic analytes is presented in Figure 3-1. Inorganic analytes were analyzed by standard methods described in the Technical Report Quality Control Part I and Supplement (ESE, 1980). The scheme for soil samples is similar with the introduction of cleanup procedures if warranted by sample interferences. Gel permeation chromatography was employed for cleanup of GC/MS samples. A flow chart for the soils analyses is shown in Figure 3-2.

Tables 3-4, 3-5, 3-6, and 3-7 summarize the analyses performed for each sample in each matrix. The combination of parameters selected for each sample was based on patterns of potential contamination deduced from the records search, discussions with FWDA personnel, and the preliminary site visit.

3.2 QUALITY ASSURANCE

Successful accomplishment of the USATHAMA Environmental Survey objectives required the addition of USATHAMA-specific requirements to ESE's own QA program and the complete integration of all phases of the survey: geotechnical, sampling, analysis, data management, and reporting.

The detailed procedures used by ESE included all USATHAMA QA Program requirements. ESE followed the procedures described in the ESE Quality Control Plan developed for this project with appropriate modifications. This plan was approved by USATHAMA for use in the Environmental Survey

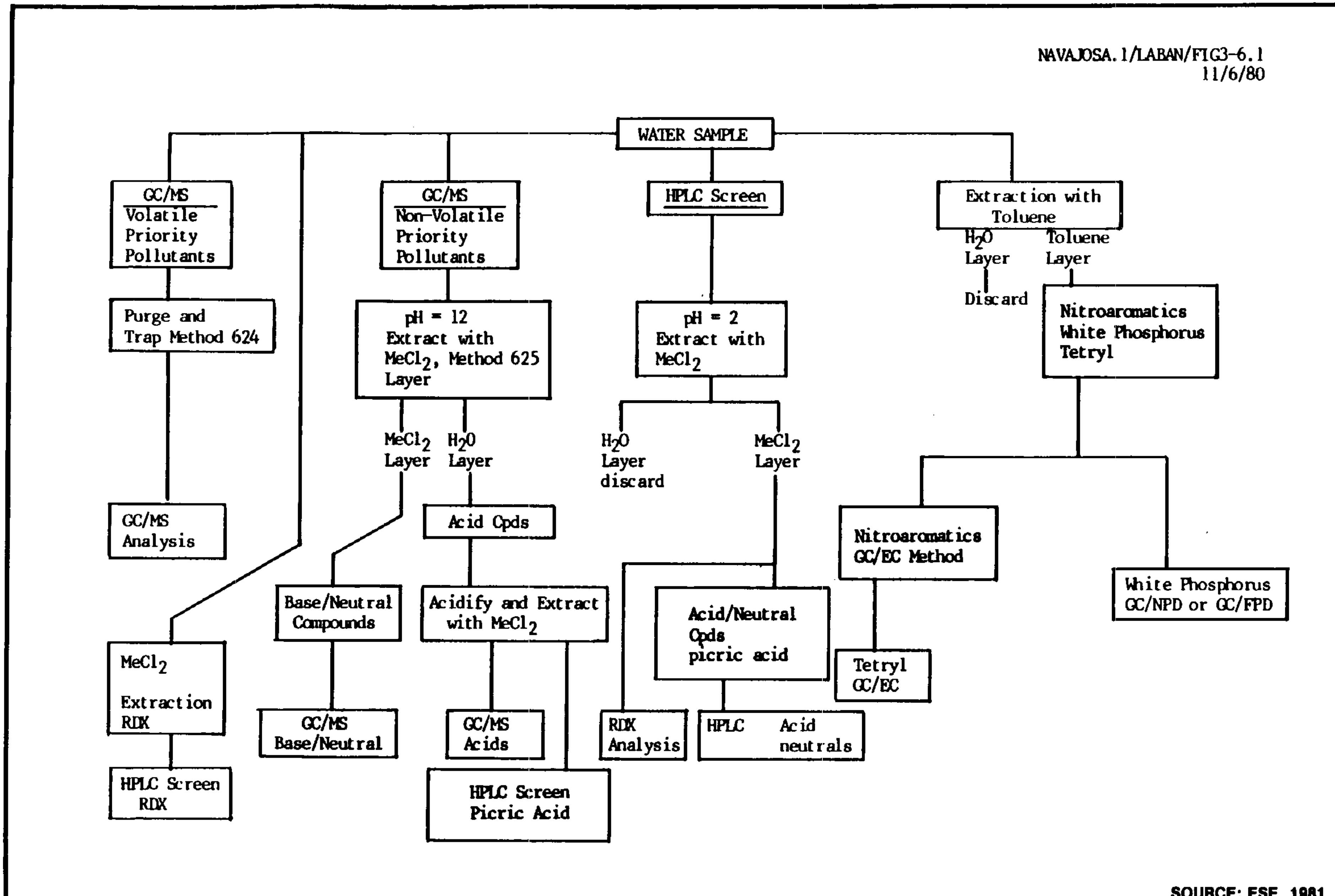
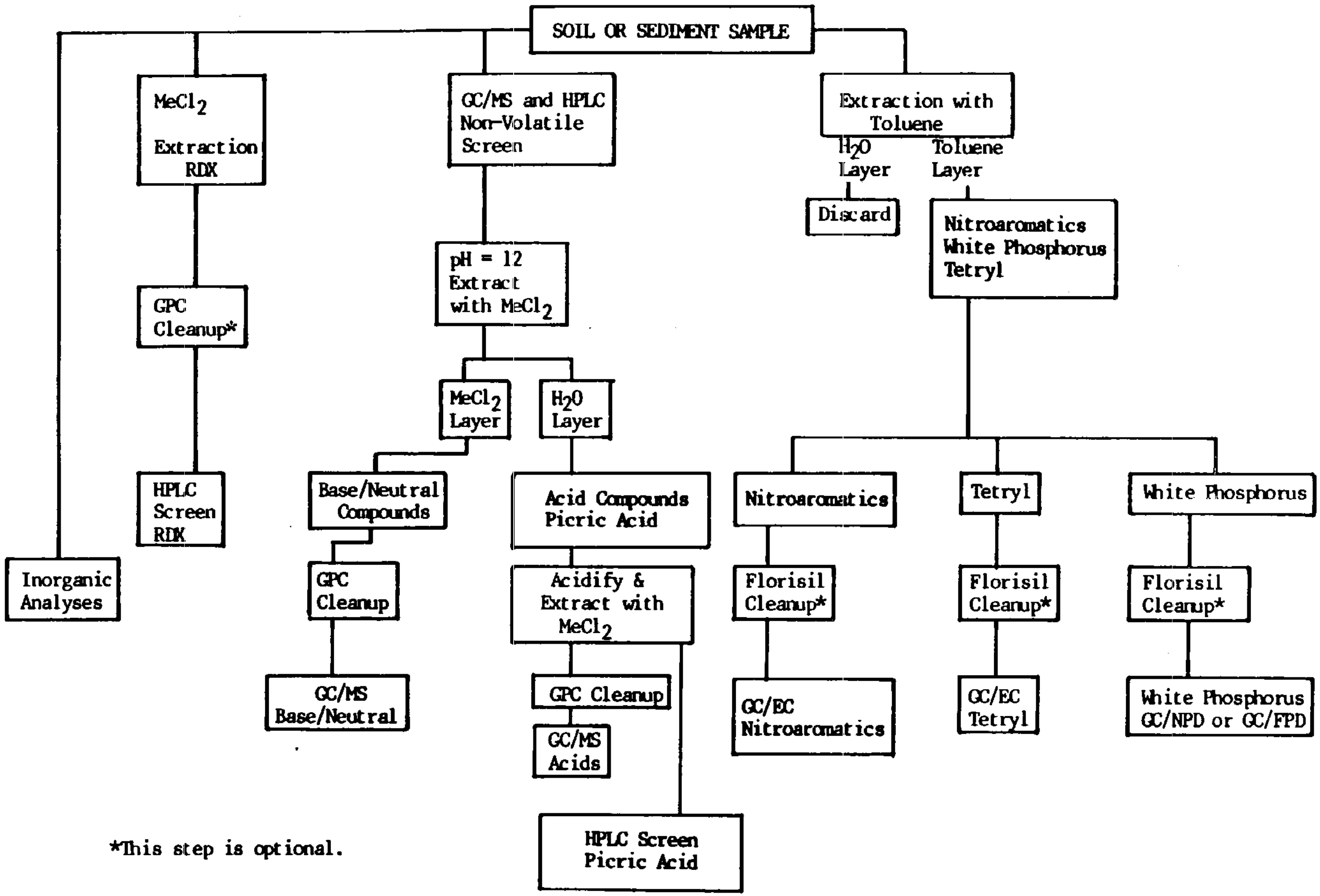


Figure 3-1
FLOW CHART FOR WATER SAMPLE ORGANIC ANALYSES

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

NAVAJOSA.1/LABAN/FIG3-7.1
11/6/80



SOURCE: ESE, 1981.

Figure 3-2 FLOW CHART FOR SOIL AND SEDIMENT ORGANIC ANALYSES	ENVIRONMENTAL SURVEY Ft. Wingate Depot Activity Gallup, New Mexico	U.S. Army Toxic and Hazardous Materials Agency Aberdeen Proving Ground, Maryland

Table 3-4. Groundwater Analyses, FWDA Environmental Survey

Site Number	Type of Chemical Analysis												
FW-00GW*	A	B	C	D	E	F	G	H	I	J	K	L	M
FW-35	A	B	C	D	E	F	G	H	I	J	K	L	M
FW-36-1	A	B	C	D	E	F	G	H	I	J	K	L	M
FW-36-2	A	B	C	D	E	F	G	H	I	J	K	L	M
FW-31	A	B	C	D	E	F	G	H	I	J	K	L	M

Key:
- A = Priority pollutant volatile fraction
- B = Priority pollutant acid fraction
- C = Priority pollutant base/neutral fraction
- D = Priority pollutant pesticides
- E = Priority pollutant metals
- F = PCBs
- G = Nitroaromatics
- H = HPLC Screen
- I = Tetryl
- J = RDX
- K = White Phosphorus
- L = Oil and grease
- M = Anions

* Quality control background sample used as natural media for spiking analytical parameters.

Source: ESE, 1981.

Table 3-5. Surface Water Analyses, FWDA Environmental Survey

Site Number	Type of Chemical Analysis												
FW30-1	A	B	C	D	E	F	G	H	--	J	K	L	M
FW30-2	A	B	C	D	E	F	G	H	--	J	K	L	M
FW03	--	--	--	--	E	--	G	H	--	J	--	--	M
FW18	A	B	C	--	E	--	G	H	I	J	K	--	M
FW23	A	B	C	--	E	--	G	H	--	J	K	--	M
FW37	A	B	C	--	E	--	G	H	--	J	K	--	M

Key: A = Priority pollutant volatile fraction
B = Priority pollutant acid fraction
C = Priority pollutant base/neutral fraction
D = Priority pollutant pesticides
E = Priority pollutant metals
F = PCBs
G = Nitroaromatics
H = HPLC Screen
I = Tetryl
J = RDX
K = White Phosphorus
L = Oil and grease
M = Anions

Source: ESE, 1981.

Table 3-6. Sediment Analyses, FWDA Environmental Survey

Site Number	Type of Chemical Analysis												
FWOOSE*	—	B	C	D	—	F	G	H	—	J	K	L	—
FW30-1	—	B	C	D	—	F	G	H	—	J	K	L	—
FW30-2	—	B	C	D	—	F	G	H	—	J	K	L	—
FW03	—	—	—	—	—	—	G	H	—	J	—	—	—
FW05	—	—	—	—	—	—	G	H	—	J	—	—	—
FW02	—	—	—	D	—	F	G	H	—	J	—	—	—
FW18	—	B	C	—	—	—	G	H	I	J	K	—	—
FW22	—	B	C	—	—	—	G	H	I	J	K	—	—
FW23	—	B	C	—	—	—	G	H	—	J	K	—	—
FW24	—	B	C	—	—	—	G	H	I	J	K	—	—

Key:
A = Priority pollutant volatile fraction
B = Priority pollutant acid fraction
C = Priority pollutant base/neutral fraction
D = Priority pollutant pesticides
E = Priority pollutant metals
F = PCBs
G = Nitroaromatics
H = HPLC Screen
I = Tetryl
J = RDX
K = White Phosphorus
L = Oil and grease
M = Anions

* Quality control background sample used as natural media for spiking analytical parameters.

Source: ESE, 1981.

Table 3-7. Soil Analyses, FWDA Environmental Survey

Site Number	Type of Chemical Analysis											
FW00SO*	—	B	C	D	—	F	G	H	I	J	—	—	M
FW01	—	B	C	D	—	F	G	H	—	J	—	—	M
FW06	—	—	—	D	—	F	G	H	—	J	—	—	M
FW09	—	—	—	—	—	—	G	H	—	J	—	—	M
FW14	—	B	C	—	—	—	G	H	—	J	—	—	M
FW15	—	—	—	—	—	—	G	H	—	J	—	—	M
FW16	—	—	—	—	—	—	G	H	—	J	—	—	M
FW17	—	—	—	—	—	—	G	H	—	J	—	—	M
FW19	—	B	C	—	—	—	G	H	I	J	K	—	M
FW20	—	B	C	—	—	—	G	H	I	J	K	—	M
FW21	—	B	C	—	—	—	G	H	I	J	K	—	M
FW32	—	B	C	D	—	F	G	H	I	J	K	—	M
FW33-1	—	—	—	—	—	—	G	H	—	J	—	—	M
FW33-2	—	—	—	—	—	—	G	H	—	J	—	—	M
FW34	—	—	—	—	—	—	G	H	—	J	—	—	M
FW04	—	B	C	—	—	—	G	H	—	J	—	—	M

Key:
- A = Priority pollutant volatile fraction
- B = Priority pollutant acid fraction
- C = Priority pollutant base/neutral fraction
- D = Priority pollutant pesticides
- E = Priority pollutant metals
- F = PCBs
- G = Nitroaromatics
- H = HPLC Screen
- I = Tetryl
- J = RDX
- K = White Phosphorus
- L = Oil and grease
- M = Anions

* Quality control background sample used as natural media for spiking analytical parameters.

Source: ESE, 1981.

of FWDA. The following sections highlight the major topics of the QA program for the FWDA Environmental Survey.

3.2.1 ORGANIZATION AND RESPONSIBILITIES

The Quality Control (QC) Program was based on the USATHAMA central-laboratory/field-laboratory concept. ESE acted as the field laboratory which was monitored by the USATHAMA Central Laboratory QA Coordinator. The overall Quality Assurance/Quality Control (QA/QC) organization to provide valid data to USATHAMA followed the requirements of the August 1980 Quality Assurance Program developed by USATHAMA.

3.2.2 TRAINING AND CERTIFICATION

Analysts were trained in the methods documented for the FWDA Environmental Survey. They were also certified for these methods, based on their analytical performance.

3.2.3 METHOD CERTIFICATION

Two different types of analyses recognized by the USATHAMA QA program, semi-quantitative and quantitative, were conducted during this project. Each type of analysis required a different level of documentation including precision and accuracy data and a different set of daily or batch-related QC criteria, as described in Section 3.1.

3.2.4 SAMPLE COLLECTION

The QA/QC Supervisor monitored the receipt of samples, audited the field sampling procedures, and ensured compliance with preservation and holding time specifications. One site visit was performed by the QA/QC Supervisor to audit sampling performance.

3.2.5 ANALYTICAL SYSTEMS CONTROL

Detailed procedures for controlling analytical systems were followed for the FWDA Environmental Survey. Instrument logbooks were maintained for all analytical equipment, and laboratory notebooks documented all sample handling and analysis. Copies of applicable pages of these notebooks were submitted to the QA/QC Supervisor weekly during the analytical phase of the survey.

The application of the USATHAMA QA Plan to the analysis of FWDA environmental samples was accomplished by the QA/QC Supervisor, who assigned spiking levels, samples to be spiked, and sample batches.

The number of samples per batch depended on the number of samples which could be conveniently and efficiently analyzed as a group. The factors which were taken into consideration in establishing batch size included: (1) the type of analysis, (2) the complexity, (3) the time required for a particular analysis, and (4) the holding time for the sample. The batch size was optimized to provide efficient analysis while meeting the holding time criteria for the samples.

Each quantitative analysis batch included three spikes and one blank, and each semi-quantitative batch included one spike (at the detection limit) and one blank.

3.2.6 DATA VALIDATION

Before submittal of data to USATHAMA, all chemical and field data were thoroughly reviewed by the QA/QC Supervisor. Validation of data was accomplished by investigation of randomly selected individual lines of USATHAMA-formatted data. These data were checked through all channels, validating the data management, sample handling, and analytical aspects of the reported results. Data validated in this manner were elevated to Level 2.

3.2.7 CONTAMINATION SAFEGUARDS

In the process of collecting and handling samples, contamination may be accrued which is independent of the environmental setting at FWDA. Routine practices which delineate real and artifactual pollutants were used in field and laboratory procedures.

To provide adequate blanks for volatile organics analyses, "trip blanks" were shipped to the sampling site and returned with samples. These blanks were prepared in the laboratory and consisted of organic-free water purged with high purity helium (Air Products, Grade 6) while heating at 75°C. The blank water was placed in a 60-ml amber bottle and capped with a Teflon®-lined septum, identical to vessels used for collecting water samples for volatile organics analysis. Like actual sample vessels, these blanks were packed in glass Mason® jars with a packet of activated charcoal to adsorb contaminating organics. The analysis of trip blanks shows contamination which is a result of sample vessel preparation, packing, handling, and shipping.

Care was taken to wash sampling devices between sample sites to eliminate cross contamination. Likewise, in the laboratory, sample processing equipment such as soil sieves and water filtration devices were washed and solvent rinsed between samples. Field and laboratory duplicates and natural background samples were used to detect cross contamination from sample handling. All such controls showed that the integrity of samples was maintained through sampling, processing, and analysis.

Finally, laboratory contamination from glassware, solvents, and other sources could be detected in reagent blanks which were run daily with sample batches. These blanks consisted of the reagents required for a specific analysis, run through the appropriate glassware. Contaminants most frequently found by these blanks are phthalates in low concentrations.

3.3 DATA MANAGEMENT

Each of the steps required to control the flow of data from field trip preparation, sample collection, and field note recording through data reduction, validation, and assembly in the required format for storage in the Installation Restoration Data Management System (IR-DMS) was incorporated in ESE's Data Management System. This system included:

1. Data logging and chain-of-custody recording procedures such as:
    a. Field notebook requirements,
    b. Sample labeling procedures,
    c. Sample transmittal forms, and
    d. Analysis report forms.
2. Details of the procedures for interfacing ESE computerized quality control data handling methods with IR-DMS.
3. Data coding and tape generation procedures. This format conformed to requirements specified in the IR Data Management User's Guide.
4. Procedures for transfer of data from ESE to USATHAMA.

ESE's chain-of-custody protocol, used in the FWDA survey, allowed precise accounting for the location and status of samples through the sampling and analysis process by a computer-controlled management program. Automated data handling at ESE facilitated the coordination of the laboratory and field portions of a program and provided easy monitoring for QC.

Sample kits were prepared and labeled prior to field sampling. Acquisition of labels was part of the Pre-Field Setup procedure, in which sample stations, sample fractions, sample trip itinerary, personnel, and analyses to be performed were entered in the data system and printed on labels. Each sample container was marked with labels obtained in this manner.

The field team, having collected samples according to applicable protocols, shipped samples by guaranteed air freight to ESE laboratories. Package registration and other shipping documents were kept to record shipping processes and to serve as tracers.

Each package shipped contained a logsheet which recorded the sample numbers included in the package, the date and time each sample was collected, the site sampled, and the field team member responsible for sample handling. Upon arrival at ESE, the samples were received by the Assistant Laboratory Coordinator. The logsheets were checked against the contents of the package, the coordinator's records of the sampling trip itinerary, and projected sample arrivals. Samples were unpacked and their appearance noted. If samples were broken or damaged, these facts were recorded.

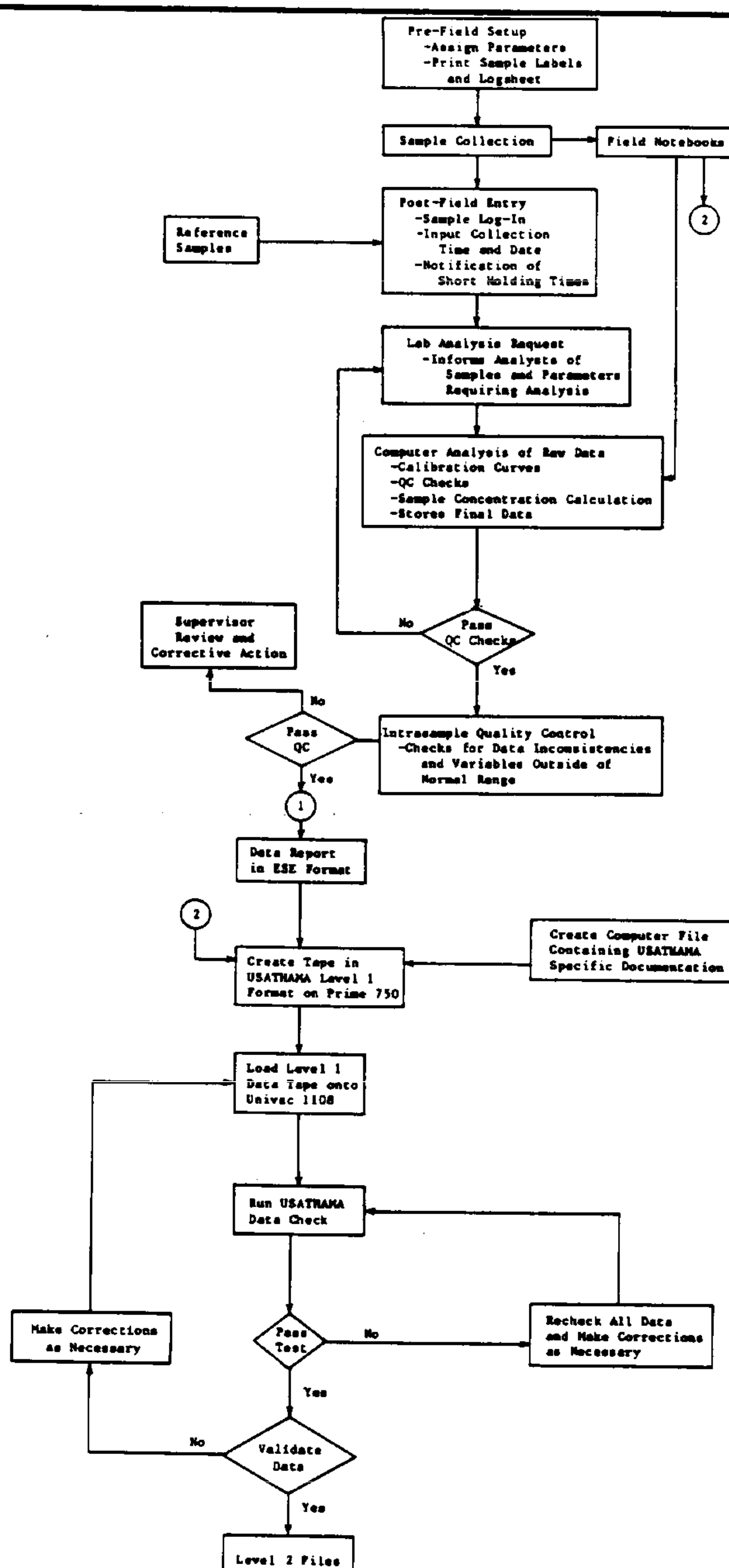
The arrival of samples was followed by notification of the Data Management Coordinator, who logged into the computer the samples received and the date they were collected. Also, samples which were originally projected to be received, but were not, were deleted. The samples were forwarded to the Laboratory Storage Coordinator, who received the samples, stored them appropriately, and recorded the location of storage.

Samples were signed out when taken from their storage places and signed in when they were replaced. Upon completion of analyses, data reported to the computer were filed with the historical data which described sampling, sample handling, and quality assurance.

Field data, the field drilling file, the groundwater stabilized file, and the map file were submitted to the Data Management Coordinator on IR-DMS forms. After data entry, the files were checked for accuracy by field team members and resubmitted. The field data and chemical data were passed through quality assurance reviews before being submitted to USATHAMA.

Data were subjected to QC checks in the ESE data system and were reviewed by the appropriate discipline manager. Once this review was complete, the data were transferred to the USATHAMA data system using the Tektronix terminal as an intermediary between ESE's Prime computer and USATHAMA's Univac computer. Data were also sent to USATHAMA on 9-track magnetic tape. The data were originally loaded in as Level 1 data. Field drilling data were checked using USATHAMA's GEOTEST program. The ESE QA Supervisor performed a data validation check at appropriate intervals, and if the data passed, they were upgraded to Level 2 files.

The data handling process for this survey is shown in more detail in Figure 3-3. All of the FWDA field and chemical data are available as computer printouts and remain permanently stored for reference. Data files are listed in Table 3-8.



SOURCE: ESE, 1981.

Figure 3-3
OVERVIEW OF DATA MANAGEMENT PLAN

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Table 3-8. FWDA Level 2 Data Files

File	USATHAMA File Name
Field Drilling	FWSAGFD81125
Map	FWSAGMA81136 FWSAGMA81105 FWSAGMA81128
Groundwater Stabilized	FWSAGGS81125
Chemical	FWSACGW81141 FWSACSW81141 FWSACSE81141 FWSACSO81141

Source: ESE, 1981.

4.0 RESULTS

4.1 RESULTS OF CHEMICAL ANALYSES

Presented in this section is a summary of the results obtained from the chemical analysis of FWDA groundwater, surface water, sediment, and soil samples. A complete tabulation of all data is provided in Appendix C.

The occurrence of several compounds in the reported data is attributed to sample contamination rather than actual presence in the environment. Phthalates, used as plasticizers, are common contaminants of the GC/MS base/neutral fraction. Methylene chloride and toluene are used in the extraction of several analytical fractions (see Figures 3-1 and 3-2) and are frequent laboratory contaminants of the GC/MS volatile fraction. Groundwater samples typically contained compounds found in the PVC adhesive and cleaner used to join sections of well casing. These compounds included tetrahydrofuran, methylethyl ketone, and acetone.

4.1.1 AMMUNITION WORKSHOP AREA

Samples collected from the Ammunition Workshop Area consisted of the soil samples described in Table 2-1, a Lake Knudson surface water and sediment sample, and a groundwater sample taken from a well downgradient of Lake Knudson. The other wells in the Ammunition Workshop Area were dry at the time samples were collected.

Table 4-1 summarizes the results of analysis of samples collected in the Ammunition Workshop Area. Detectable levels of GC/MS volatiles, GC/MS acids, GC/MS base/neutrals, picric acid, tetryl, and white phosphorus were not found in any samples.

Pesticides and PCBs were identified in samples from the sanitary landfill (FW01) and the acid pit (FW06). FW01 contained trace amounts

Table 4-1. Summary of Analytical Results at the Ammunition Workshop Area

Parameters	Ground Water	Surface Water	Sediment	Soil
GC/MS Volatiles	NA*	<DL†	NA	NA
GC/MS Acids	<DL	<DL	<DL	<DL
GC/MS Base/Neutrals	<DL	<DL	<DL	<DL
Pesticides	<DL	<DL	<DL	See text
PCBs	<DL	<DL	<DL	See text
Metals	NA	NA	NA	NA
Antimony	47 ug/l			
Chromium		8.9 ug/l		
Nitroaromatics	<DL	<DL	<DL	See text
Picric Acid	<DL	<DL	<DL	<DL
RDX	<DL	<DL	<DL	<2.88-10.2 mg/kg
Tetryl	<DL	NA	NA	NA
White Phosphorus	<DL	<DL	<DL	NA
Oil and Grease	<DL	<DL	750 mg/kg	NA
Nitrate + Nitrite	8 mg/l	0.011 mg/l	NA	<3-31 mg/kg
Sulfate	2,460 mg/l	308 mg/l	NA	<259-270 mg/kg
Total Phosphate	<DL	0.13 mg/l	NA	222-452 mg/kg

* NA = Not analyzed.
† DL = Detection limit.

Source: ESE, 1981.

of DDD, dieldrin, endosulfan sulfate, endrin, and Aroclor 1016. FW06 contained higher concentrations of beta-BHC, chlordane, DDD, DDE, DDT, dieldrin, alpha-endosulfan, endosulfan sulfate, endrin, and Aroclor 1260. Trace amounts of Aroclor 1016 were also detected in soil sample FW00.

Dinitrotoluene was found in the triangle pit [FW09, 0.30 milligram per kilogram (mg/kg)] and one of the leaching beds (FW15, 0.265 mg/kg). FW15 also contained trinitrobenzene at a concentration of 1.08 mg/kg. RDX was found in FW09 at 2.88 mg/kg. The measured concentrations of nitroaromatic compounds and RDX and their spatial distributions are shown in Figure 4-1.

The Lake Knudson surface water sample contained 8.9 micrograms per liter (ug/l) chromium, and the groundwater sample contained antimony at 47 ug/l. Oil and grease was detected in the sediment at 750 mg/kg.

The groundwater sample contained elevated levels of nitrate plus nitrite [8 milligrams per liter (mg/l)] and sulfate (2,460 mg/l) relative to the upgradient surface water (nitrate plus nitrite = 0.011 mg/l; sulfate = 308 mg/l).

4.1.2 DEMOLITION AREA

Samples taken at the Demolition Area consisted of three surface water samples (FW18, FW23, and FW37), four sediment samples (FW18, FW22, FW23, and FW24), and the four soil samples. The remaining surface water sites and the single well were dry.

The samples were free of measurable levels of GC/MS volatiles, GC/MS acids, GC/MS base/neutrals, picric acid, RDX, tetryl, white phosphorus, and oil and grease.

Surface water Sample FW37 was collected from a metal storage tank and contained high levels (2,000 ug/l) of zinc.

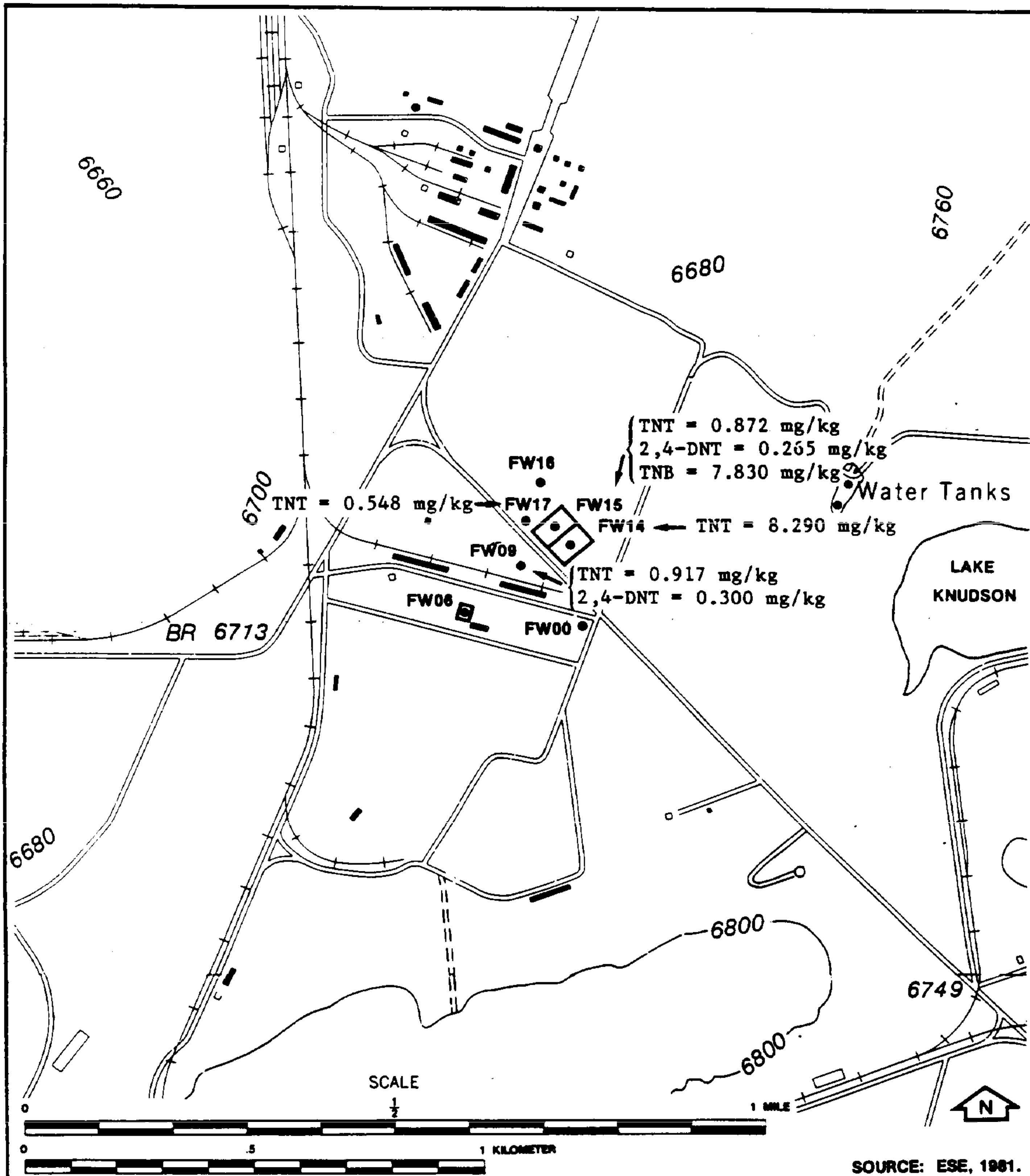


Figure 4-1
DETAIL MAP OF ADMINISTRATION AND AMMUNITION WORKSHOP AREA CONTAMINATION

ENVIRONMENTAL SURVEY
Ft. Wingate Depot Activity
Gallup, New Mexico

U.S. Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Endosulfan sulfate and Arocolor 1016 were detected in soil sample FW32 at concentrations of 3 micrograms per kilogram (ug/kg) and 30 ug/kg, respectively.

Nitroaromatic compounds were found in three of the four soil samples. The spatial arrangement of the sample sites and their respective concentrations are shown in Figure 4-2. In addition, sediment Sample FW20 contained trinitrotoluene at a concentration of 1.94 mg/kg.

Soil Sample FW20 contained nitrate plus nitrite and total phosphate levels that were significantly higher than other soil samples taken in the Demolition Area.

4.1.3 OTHER AREAS

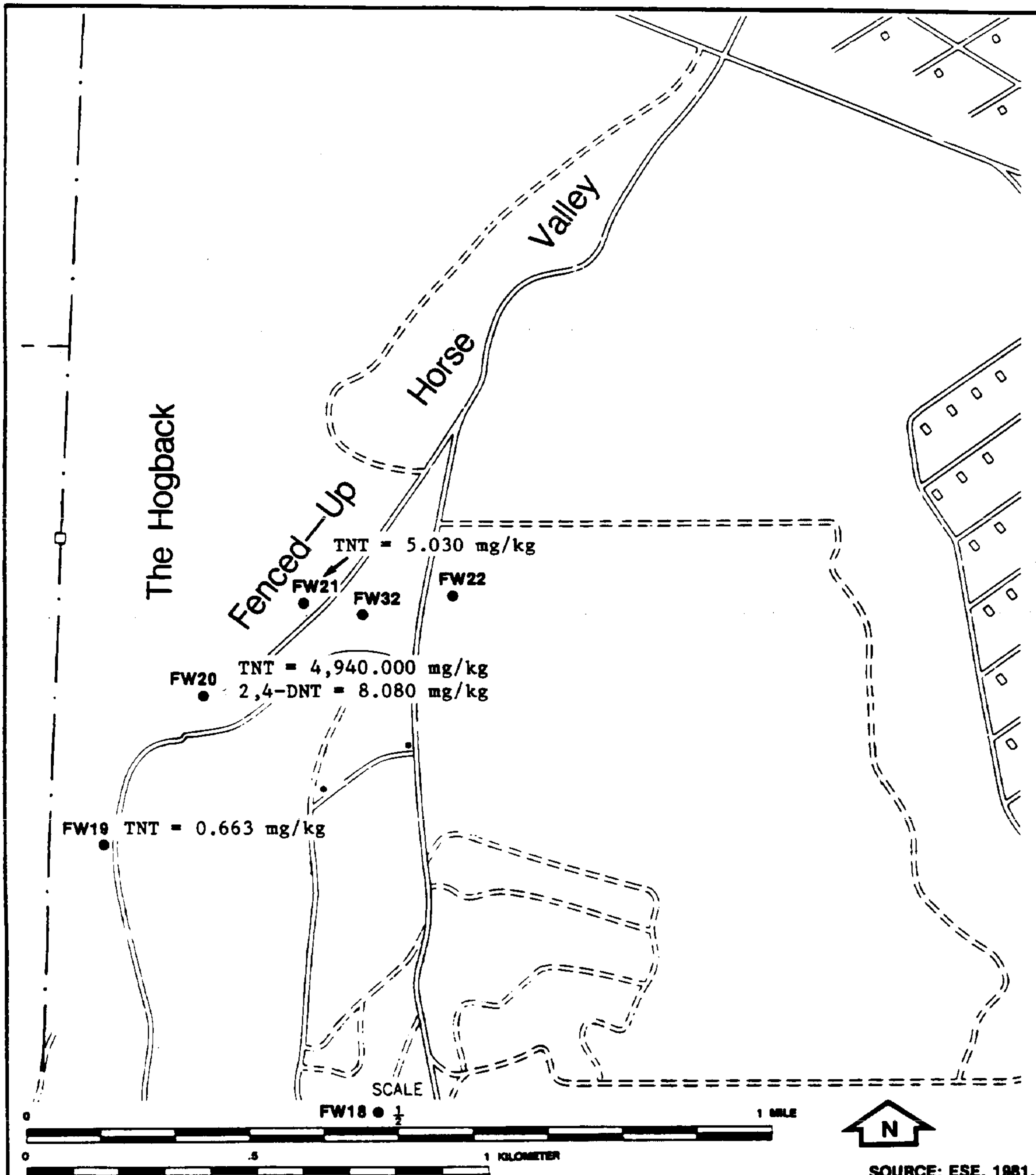
The deep well, used as a source of water for drilling operations, was free of all measured parameters except sulfate, which was present at 688 mg/l.

Samples collected in the background areas contained less than detectable levels of GC/MS volatiles, GC/MS acids, GC/MS base/neutrals, metals, nitroaromatics, picric acid, tetryl, RDX, white phosphorus, and oil and grease.

Sediment Sample FW02 contained dieldrin and Aroclor 1016 at concentrations of 1 ug/kg and 20 ug/kg, respectively.

4.2 GEOHYDROLOGY

The water resources report for FWDA (USGS, 1971) indicated that unconsolidated alluvial sediments (sand, silt, and clay) would be expected to a depth of approximately 30 ft. Bedrock beneath this alluvium consists of rocks of the Chinle Formation. Ground water could possibly have been present as a perched water table within the alluvial sediments.



SOURCE: ESE, 1981.

Figure 4-2 **DEMOLITION AREA CONTAMINATION**	**ENVIRONMENTAL SURVEY** **Ft. Wingate Depot Activity** **Gallup, New Mexico**
	U.S. Army **Toxic and Hazardous Materials Agency** **Aberdeen Proving Ground, Maryland**

Ground water was not encountered in the majority of the borings/wells at FWDA. Many borings penetrated material that appears capable of transmitting ground water if and when it is present. As a result, it is difficult to make definitive statements about the geohydrology of FWDA as a whole.

4.2.1 AMMUNITION WORKSHOP AREA

Two wells (FW08 and FW10) were drilled to a depth of 50 ft upgradient of the Ammunition Workshop Area. Both wells were dry, and bedrock was not encountered. The clay materials encountered in Well FW08 below a depth of 39 ft required water rotary drilling techniques rather than hollow-stem auger because of their hardness. The well casing was filled with drilling water upon completion, but by the time of sampling (January 1981), only 1 ft of water remained in the well, the rest having been absorbed by the subsurface materials or lost to the atmosphere through evaporation. It is not believed that any ground water exists at this site.

Wells FW08 and FW10, presumed to be upgradient of the Ammunition Workshop Area, and Well FW07 contained silty, very fine sand in the first 20 to 30 ft of drilling. Below this depth, dry to slightly moist massive clays dominated the subsurface.

Wells FW11, FW12, and FW13, which surround the leaching beds, exhibited subsurface profiles consisting of silty, very fine sand to 20 or 30 ft, underlain by massive clays. It appears that the silty, very fine sands would be capable of transmitting water laterally during wet seasons; however, all of these wells were dry during the drilling (November 1980) and sampling (January 1981) phases of this study.

Monitor Well FW35, the only well where significant amounts of ground water were encountered during drilling, exemplifies the water-bearing capabilities of the silty and/or clayey very fine sands which are common at the northern end of FWDA. Located downgradient of Lake Knudson, Well FW35 receives ground water from the lake bed via a sandy clay zone encountered in the boring at a depth of approximately 15 ft. The soils immediately above and below this zone were only slightly moist, indicating that the thin bed at the 15-ft depth may be the source of the ground water. It should be noted that at this site, the subsurface materials are predominately clays. The existence of a small sand component to the clay, in combination with the driving head of Lake Knudson, allowed ground water to flow downgradient.

At the time of drilling (November 1980), there was 2 ft of mud at the bottom of the hole upon completion of the boring. The casing was filled with water during the sampling trip in January 1981.

4.2.2 DEMOLITION AREA

Within the Demolition Area itself, no wells were installed; however, Well FW24 was installed just downgradient of the area boundary to collect a groundwater sample adjacent to the wash which drains the area. The wash was slightly damp, but no water was encountered during well installation. During the sampling phase, less than 1 ft of water was present in the well.

Silt and weathered rock fragments were encountered in the upper 10 ft of the boring, followed by dense clay until bedrock was reached at 23 ft. The relative coarseness of the materials at this site reflects the proximity of unweathered source materials.

A clay-rich weathered bedrock surface was encountered during drilling at a depth of approximately 21.5 ft. The water in the well could possibly represent the potentiometric level of the shallow bedrock aquifer. In addition, the source of this water may be the subsurface downgradient flow of water which infiltrates the ground in the Demolition Area arroyo. Surface water flows in this arroyo disappear underground several hundred yards upgradient of Well FW24. The clayey soils at this well site appeared slightly moist in contrast to the extremely dry soils encountered in the Ammunition Workshop Area, indicating that some subsurface movement of water may occur in this area.

4.2.3 ADMINISTRATION AREA

During the drilling of Wells FW26 and FW29 (November 1980), materials similar to those found in the subsurface at the Ammunition Workshop Area were encountered. The vertical distribution was distinctly different, however, with beds of clay and silty, fine sands alternating continuously from the surface to the bottom of the borings. These borings record the effects of sheetwash, anastomosing, and/or braided stream channels which spread out over the flat basin floor during times of heavy rainfall, depositing mostly fine-grained materials with occasional coarse-grained pockets developed during infrequent high-intensity events.

All subsurface materials encountered during drilling appeared to be dry. During the sampling period, less than 1 ft of water was present in Well FW29, located downgradient of STP. The clay-rich weathered bedrock surface (predominately sandstone, with a few limestone fragments) probably acts as a confining layer. The construction of the well partially penetrated this confining zone, allowing water to seep upward into the well during the 2 months between well construction and sampling. No water quality samples were taken from this well because of the lack of a sufficient quantity of ground water. A weathered bedrock surface was reached during drilling at the 20-ft depth. The water level in the well is probably the result of ground water in the bedrock because all materials above the bedrock showed no signs of significant moisture. The bedrock is recharged by outcrops in the Zuni Mountains or in the ridges present throughout FWDA and possibly by downward percolation of water from the STP evaporation-infiltration lagoon.

4.2.4 OTHER AREAS

The upgradient well on the East Patrol Road near Ft. Wingate School, FW31, was partially filled with water during the sampling trip in January 1981. Water was not expected in Well FW31 because only slightly moist massive clay to a depth of 50 ft was encountered during well drilling operations. The source of this water, though not known specifically, is most probably a thin, slightly permeable zone within the clay, hydraulically connected to a water-bearing rock unit at the base of the Zuni Mountains. Review of the boring log of this site indicates that the materials at a depth of 30 to 40 ft are the most likely source of the water. Small, discrete pockets of water were present in the clay samples. The fact that there was water in the well during January 1981 suggests that these pockets may be interconnected. The rate of groundwater movement and, therefore, potential contaminant movement in this type of material, would be very low.

Wells FW27 and FW28, located along the northern boundary of FWDA, exhibited subsurface profiles very similar to Wells FW26 and FW29. All samples collected at these sites appeared to be dry.

5.0 CONCLUSIONS

Wells installed at FWDA suggest that the water table aquifer at FWDA is discontinuous and low-yield at best. It is also evident that the discontinuity is temporal as well as spatial. In areas near the recharge areas of the major confined aquifers, the water table aquifer is more pronounced, being fed by both precipitation and infiltration from surface runoff. The Demolition Area and several igloo areas of FWDA are located in this type of geohydrologic setting.

With the exception of Well FW31, the water table is almost nonexistent in the broad valley areas, which contain igloo areas, the Ammunition Workshop Area, and the Administration Area. The study documented the existence of the water table only in two areas which had surface water impoundments in proximity. These two examples indicate that the fine-grained clay-rich soils of FWDA can transmit minor amounts of ground water if a source is available.

Considering the low permeability of the natural subsurface materials, dry climate, and location of sources of potential contamination within FWDA, it is unlikely that significant groundwater contamination is possible via the water table aquifer.

The four potentially contaminated media--ground water, surface water, sediment, and soil--were sampled and analyzed for suspect compounds. The sampling was concentrated in three main areas of FWDA:

1. Ammunition Workshop Area,
2. Demolition Area, and
3. Northern property boundary.

Groundwater samples were obtained from three wells at FWDA: FW31, FW35, and the deep production well (FW36, FW00GW). The samples were essentially free of contaminants.

The analytical results also indicate that there is no significant contamination of the surface water of FWDA.

With the exception of Sample FW22, all sediment samples were free of contaminants. FW22, located in the Demolition Area, contained trinitrotoluene at a concentration of 1.94 mg/kg. Two sediment sampling sites immediately downgradient of FW22 did not show trinitrotoluene contamination. This contaminant seems to be contained within a small area close to its source.

Analysis of soil samples collected at FWDA revealed elevated levels of contamination in proximity to the source areas.

A series of samples was collected in Fenced-Up Horse Valley. Samples FW19, FW20, and FW21 had high concentrations of trinitrotoluene, with FW20 having the highest value (4.94 mg/kg). In addition, FW20 had a high concentration of 2,4-dinitrotoluene (8.08 mg/kg). The high trinitrotoluene levels recorded at sediment site FW22 may be the result of runoff from the burning ground in the vicinity of site FW20.

The soil obtained immediately downgradient of the sanitary landfill, FW01, contained a suite of pesticides at low to moderate concentrations.

The Ammunition Workshop Area has several specific sites which have been found to be contaminated (Figure 4-1). The acid disposal pit, FW06, contained low to moderate concentrations of a variety of pesticides and PCB-1260. It appears that this pit has been used to dispose of small quantities of these organic chemicals.

Samples taken from the washout leaching system contain moderately high levels of trinitrotoluene (range 0.548 mg/kg to 8.29 mg/kg). In addition, FW09 contained 2,4-dinitrotoluene (0.3 mg/kg) and RDX (10.2 mg/kg), and FW15 contained 2,4-dinitrotoluene (0.265 mg/kg) and 1,3,5-trinitrobenzene (7.83 mg/kg). FW16, located in a ditch which receives overflow from the leaching system, had no detectable contamination. This site is within 50 yards of the highly contaminated leaching beds and indicates the restricted distribution of existing contamination.

FW00, the background soil station, was located less than 100 yards upgradient of the contaminated area and did not contain detectable contamination.

Soil samples FW33 and FW34, located at the northern property boundary of FWDA, did not contain detectable levels of any of the compounds selected for analysis.

6.0 REFERENCES

Hubaux and Vos. 1970. Analytical Chemistry, Volume 42.

United States Environmental Protection Agency. 1980. Part 122: Consolidated Permit Regulations. Federal Register, 45(98):33418-33455.

U.S. Army Toxic and Hazardous Materials Agency. 1980. Record Evaluation Report No. 136, Installation Assessment of Ft. Wingate Army Depot Activity. Aberdeen Proving Ground, Maryland.

U.S. Army Toxic and Hazardous Materials Agency. 1980. Quality Assurance Program for Field Laboratories. Aberdeen Proving Ground, Maryland.

U.S. Geological Survey, Water Resources Division. 1971. Water Resources of Fort Wingate Army Depot and Adjacent Areas, McKinley County, New Mexico. Albuquerque, New Mexico.

U.S. Geological Survey. 1975. Evaluation and Proposed Study of Potential Ground-Water Supplies, Gallup Area, New Mexico. Report 75-522. Albuquerque, New Mexico.

7.0 APPENDICES

APPENDIX A--WELL PROFILES

APPENDIX A
WELL PROFILES

Well profiles mapped by the Installation Restoration Data Management System (USATHAMA) Profile program are included. Each well is plotted for USCS soil classification and lithology. The profiles are grouped by each plot type.

LITHOLOGY--LEGEND

ALVM	Alluvium
BSLT	Basalt
GLCL	Glacial--undifferentiated
LMSN	Limestone
SDGL	Sand and gravel
SDSL	Sandstone and shale
SNDS	Sandstone
VLCC	Volcanic--undifferentiated
WSNDS	Weathered sandstone
∇	Water level

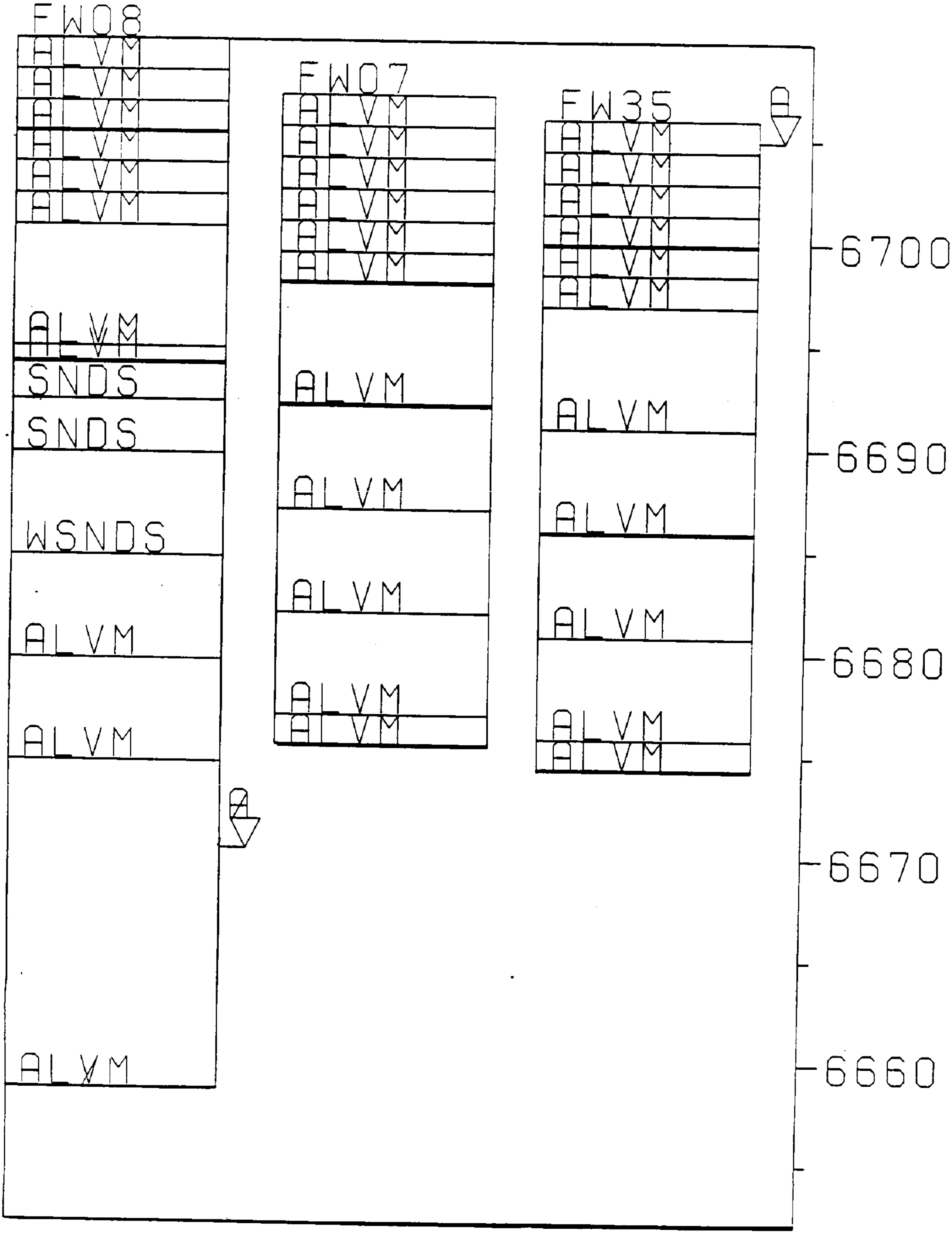


Figure A-1. Schematic presentation of FW08, FW07, and FW35 well profiles with lithology plotted vs. elevation above MSL in feet.

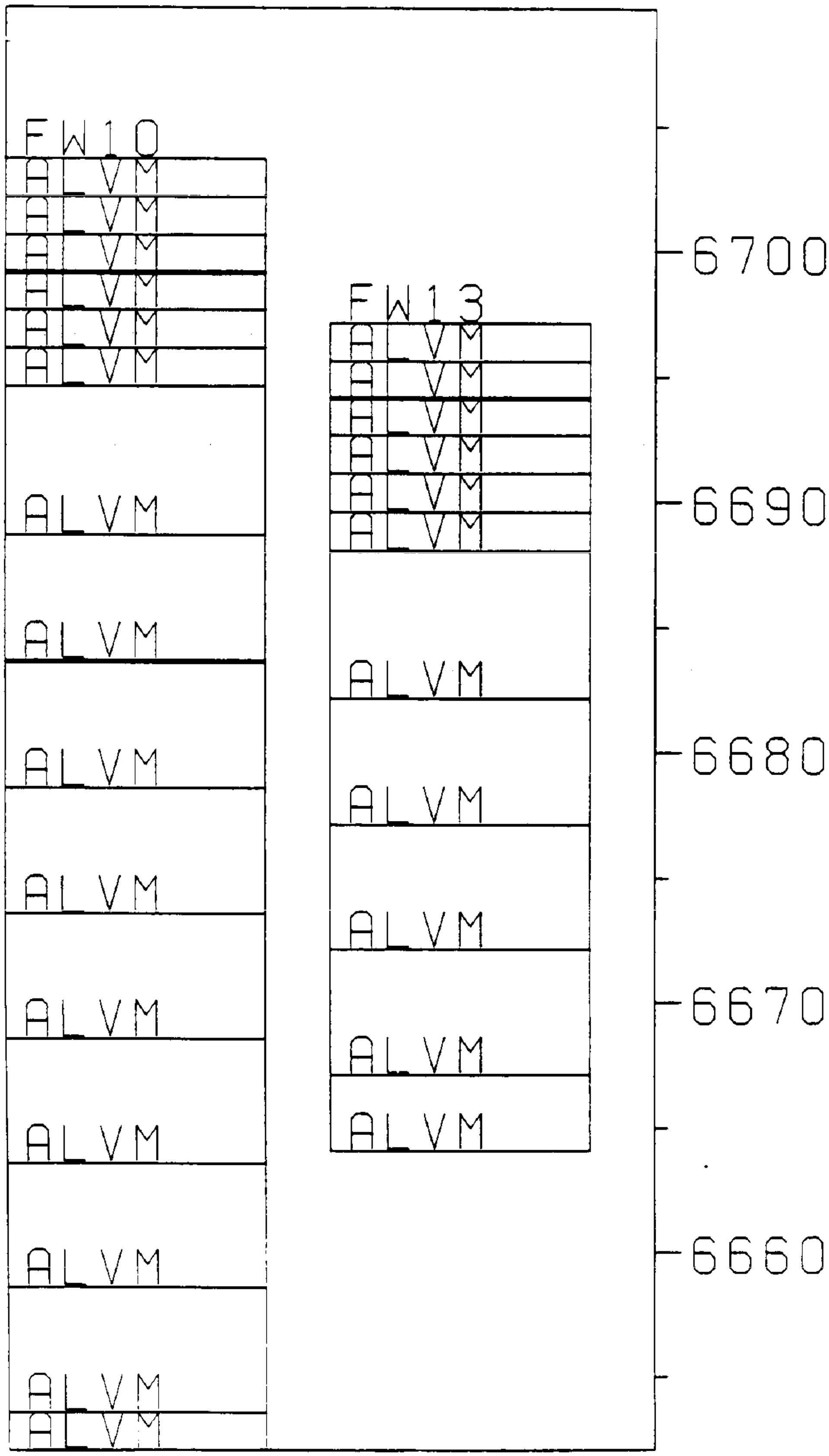


Figure A-2. Schematic presentation of FW10 and FW13 well profiles with lithology plotted vs. elevation above MSL in feet.

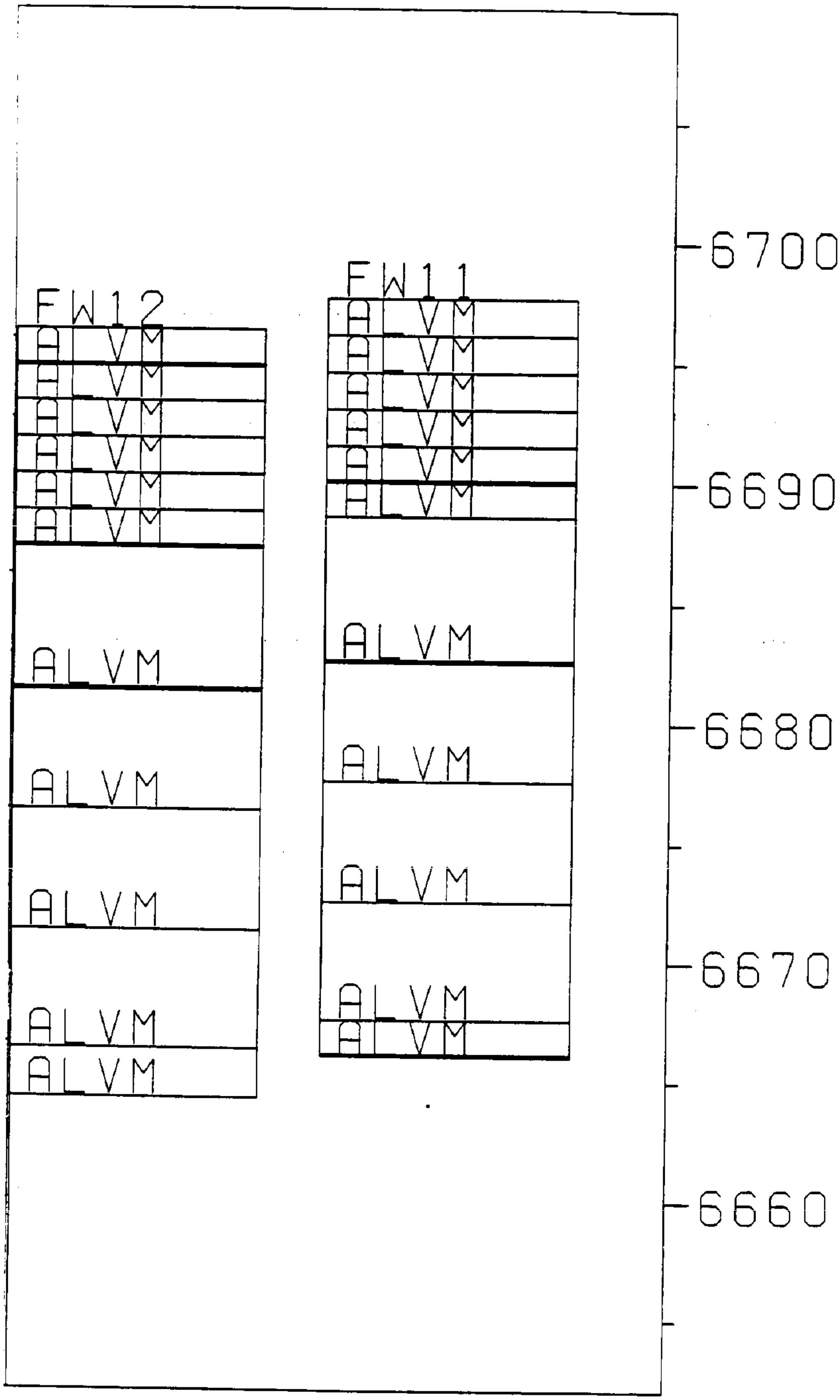


Figure A-3. Schematic presentation of FW12 and FW11 well profiles with lithology plotted vs. elevation above MSL in feet.

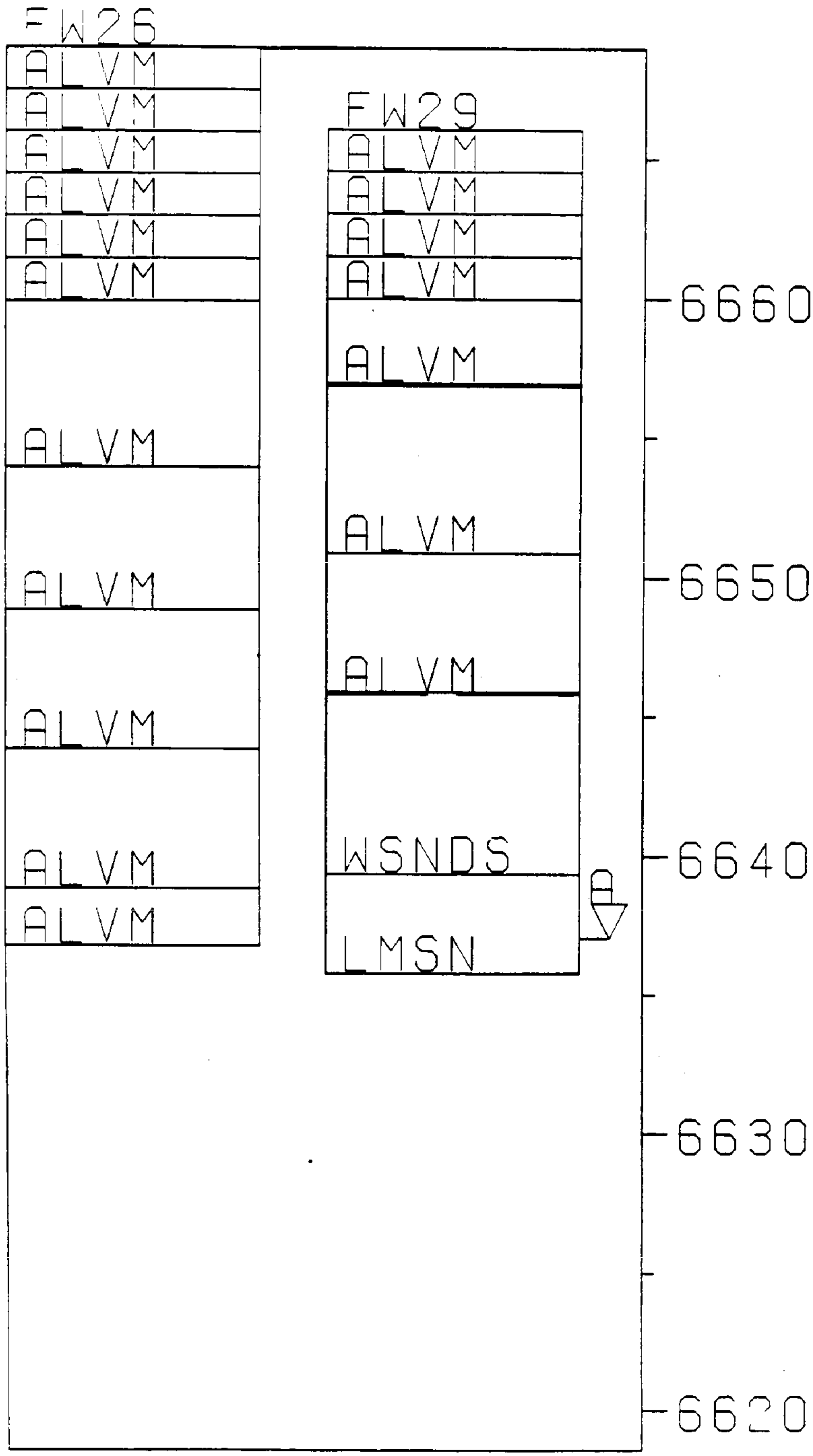


Figure A-4. Schematic presentation of FW26 and FW29 well profiles with lithology plotted vs. elevation above MSL in feet.

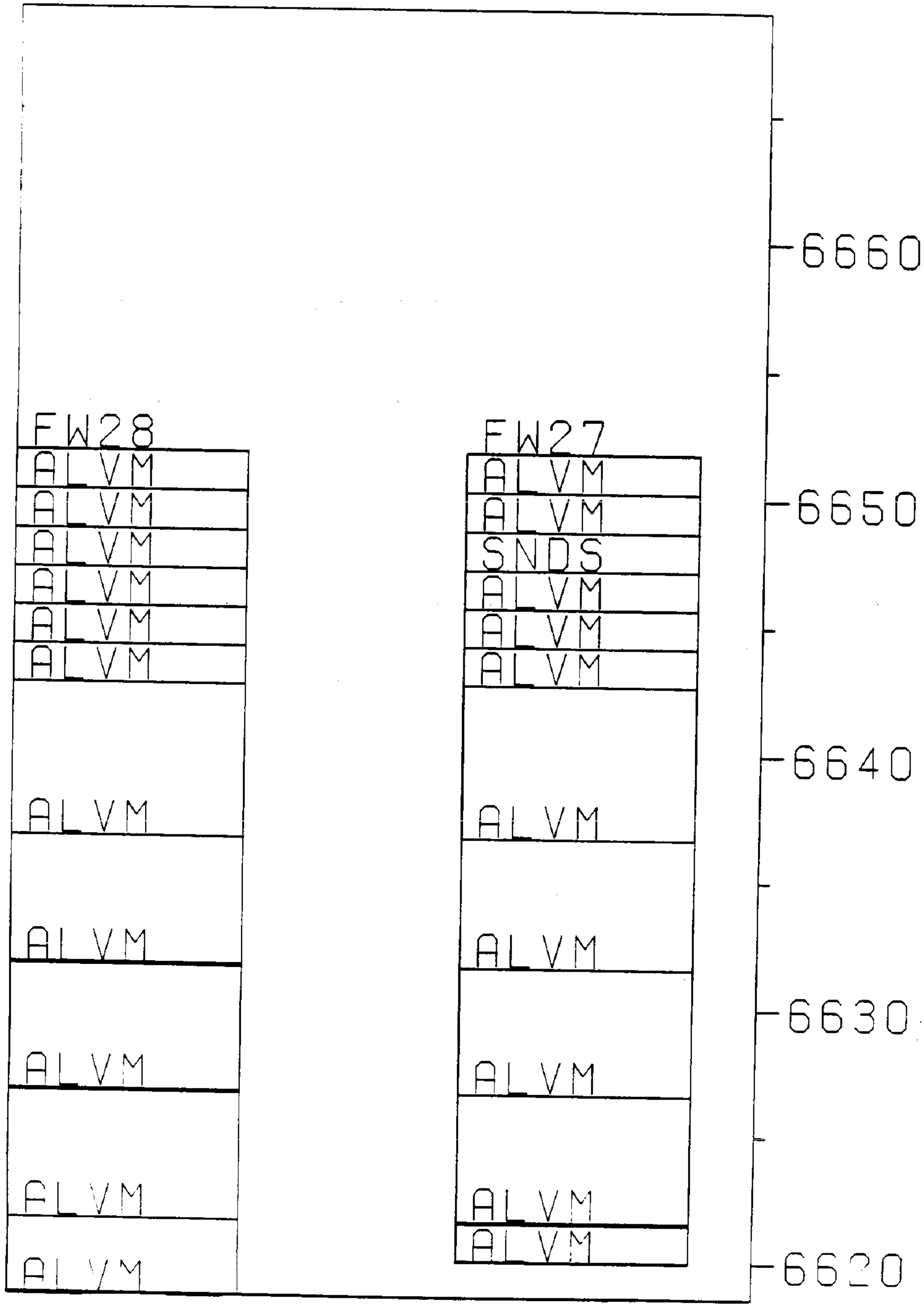


Figure A-5. Schematic presentation of FW28 and FW27 well profiles with lithology plotted vs. elevation above MSL in feet.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)--LEGEND

CH	Fat clay, inorganic clay of high plasticity
CL	Lean clay, sandy clay, silty clay, of low to medium plasticity
GC	Clayey gravel, gravel-sand-clay mixtures
GM	Silty gravel, gravel-sand-silt mixtures
ML	Silt and very fine sand, silty or clayey fine sand or clayey silt with slight plasticity
OH	Organic clays of medium to high plasticity, organic silts
SC	Clayey sand, sand-clay mixtures
SM	Silty-sand, sand-silt mixtures
SP	Sand, poorly-graded, gravelly sands
▽	Water level

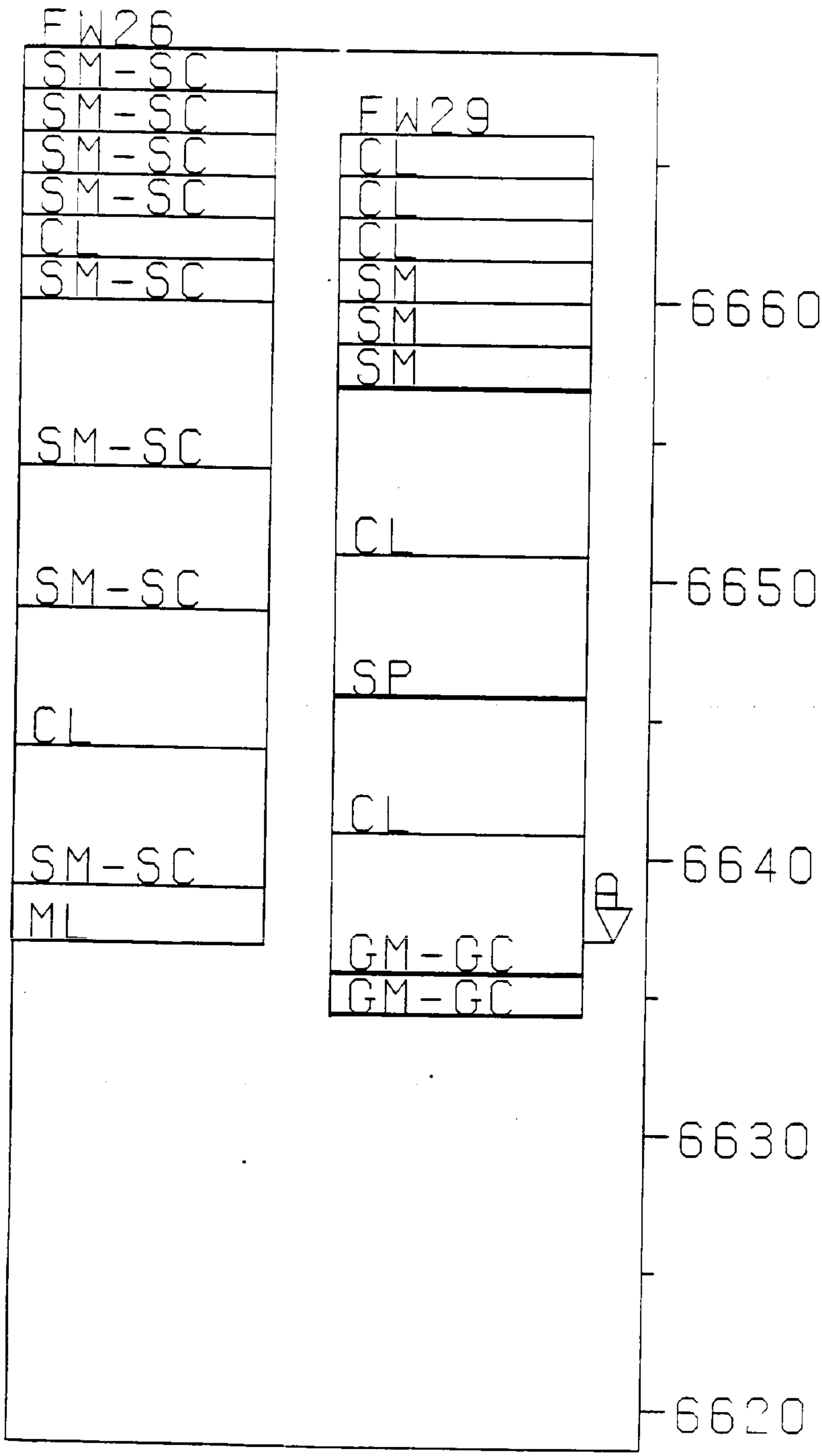


Figure A-6. Schematic presentation of FW26 and FW29 well profiles with USCS codes plotted vs. elevation above MSL in feet.

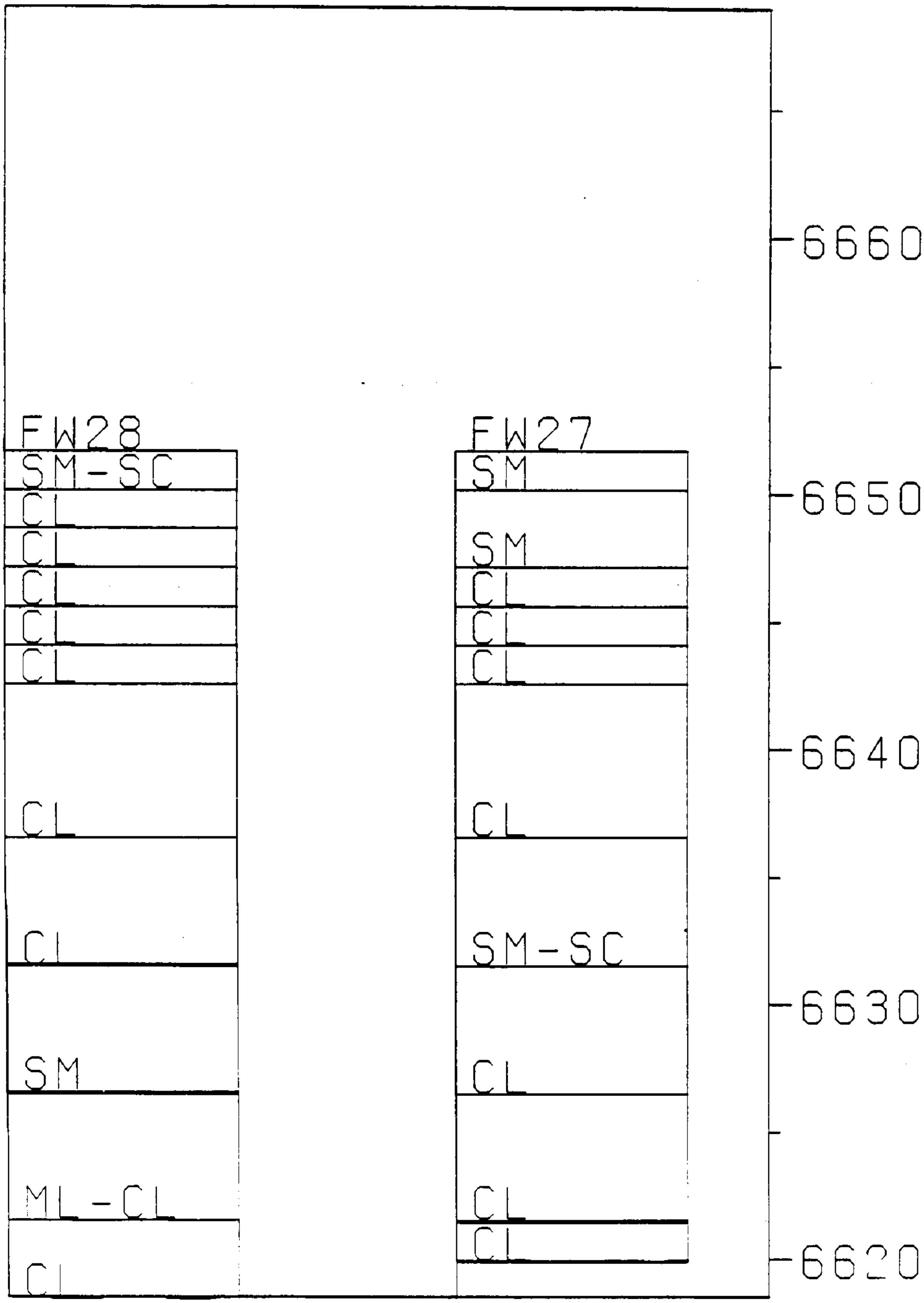


Figure A-7. Schematic presentation of FW28 and FW27 well profiles with USCS codes plotted vs elevation above MSL in feet.

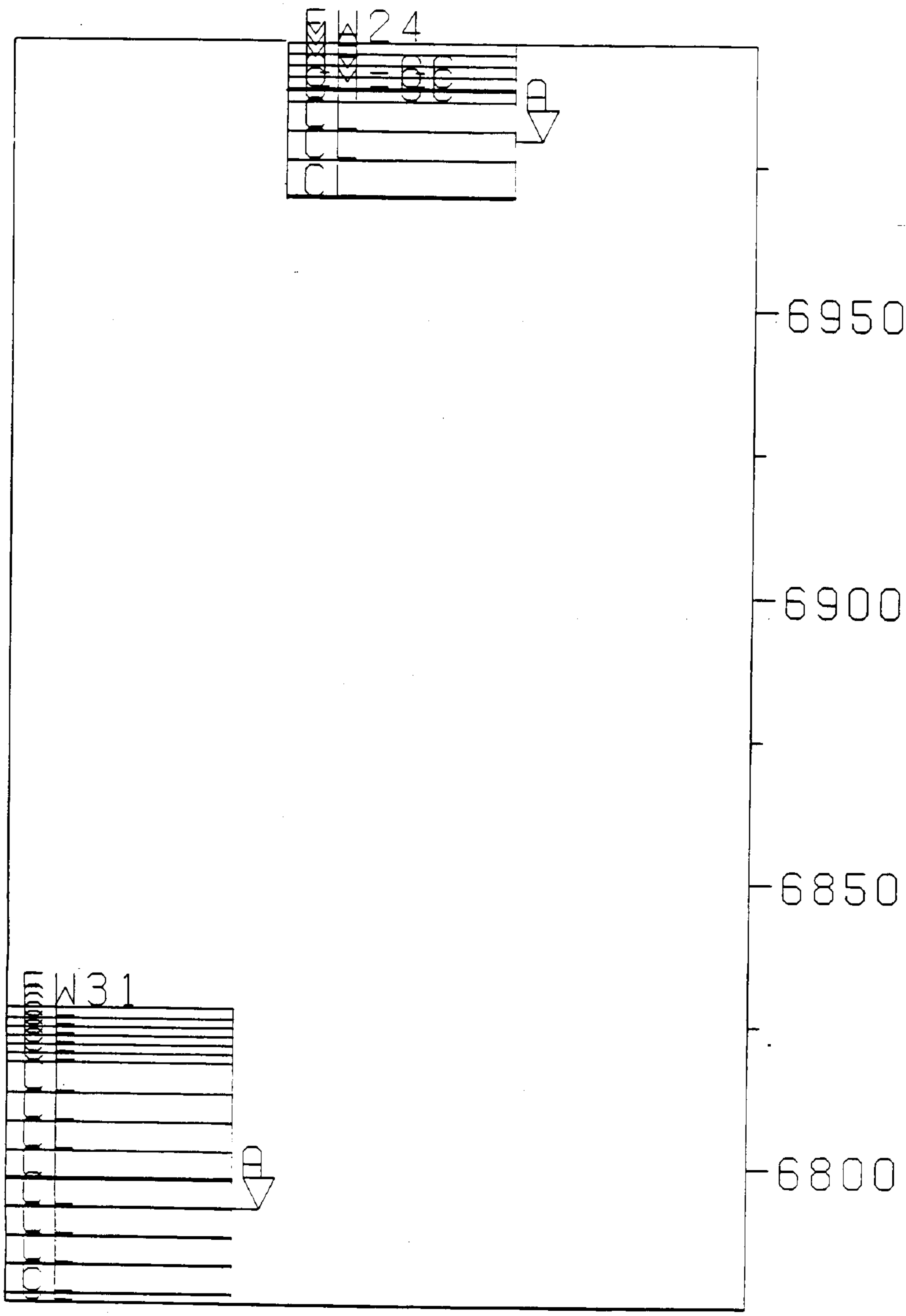


Figure A-8. Schematic presentation of FW31 and FW24 well profiles with USCS codes plotted vs. elevation above MSL in feet.

APPENDIX B—SURVEY REPORT

REPORT OF SURVEY

FORT WINGATE DEPOT ACTIVITY

GALLUP, NEW MEXICO

FOR

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.

By agreement with John Morse and for lack of specific instructions from the army it was decided to use the State Plane Coordinate System as the basis of survey. It has been our experience that the Army Corps of Engineers have usually worked from these values.

The State Plane Coordinate grid reduces survey bearings and distances to a plane cutting the surface of the earth at such a position that the maxiumum error due to the curvature will not exceed one in ten thousand parts. Sea level is the basis of elevations and any survey readings taken are reduced by proportioning to sea level values. This sea level factor combined with the scale factor provides a total reduction of the measured values to the plane grid intersecting the earth's surface. By this means, surveys made at great differences in elevation can be mathametically closed and the positions obtained at maximum precision.

U.S. National Ocean and Atmospeheric Survey Department published control points were rather scarce in this area and our contacts with the Geological Survey yielded little additional information. However, the triangulation station ERIC had been established in 1966 near the water tank. A telephone call to Washington produced the needed information and this data is recorded in the field notes. The single reference point was used as the point from which the surveys were done.

Most of the drill hole locations were located directly from this station. The balance of the holes, namely FW 31 and FW 24 were located by open traverse. Meaning that a closure was not made back upon either the starting point or a point of known coordinate values. An Askania Theodolite Model 2 E was used for angular values, this instrument reads directly to one second of arc. Distances were obtained by a Model 6 A geodimeter manufactured by the Swedish firm of AGA. Angles were turned direct and inverse with three sets and the values averaged for the final result.

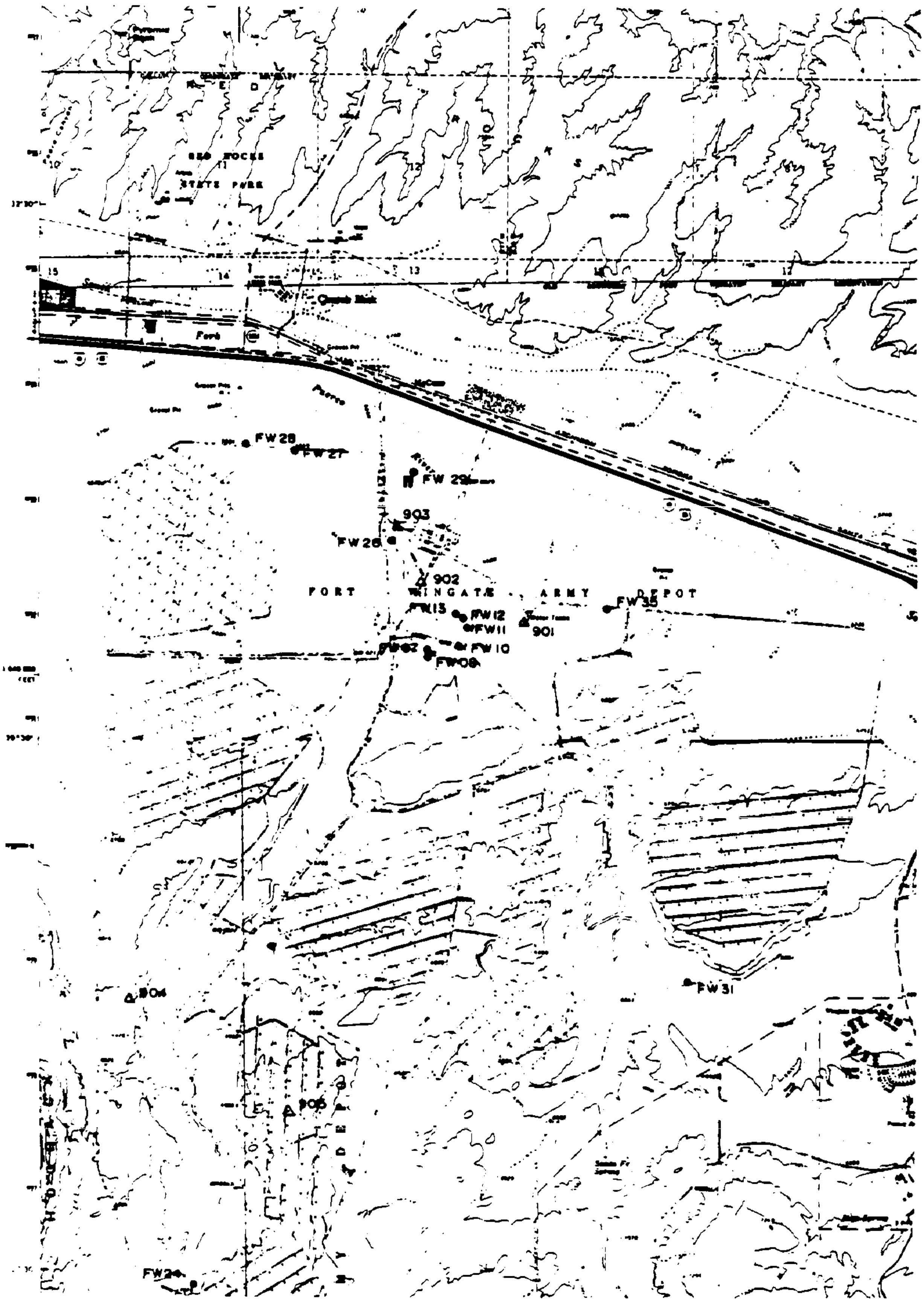
Duplicate sets of readings were taken with the distance measuring device to ensure against errors of reading and calculation. Care was taken in checking the original notes against the computer input. The information thus obtained was fed into our in-house computer program called CAINAD which accepts first the coordinates values and the elevations of the starting point, then the bearing, slope distance and vertical angle of the initial course. Following this, the right horizontal angle, slope distance and vertical angle of the succeeding course and courses are given. The scale factor is introduced as the first card and with the use of the vertical angles an average elevation is computed for each course of the traverse, the scale factor together with the computed elevation of the line is used by the program to determine the horizontal grid distance. This value together with the bearings developed by the program from the right horizontal angle values determines the coordinate values of the points established. As noted on the computer printout which is made a part of this report, the average sea level value is given and the correction to convert from the grid distances given to ground distance is also reported.

In conjunction and at the direction of Mr. John Morse it was decided to set permanent control points in the form of 5/8" X 18" reinforcing bars close to where the drill holes would be eventually put. Coordinates given for the various numbered control points are to these 5/8" steel bars. And also elevations are given to the tops of these bars. The drill holes were generally set by ESE personnel by taking a compass bearing from the survey point and by means of a string level the elevation of the collar of the drill hole was also determined by the ESE people. The elevations given on the computer printout are not to be accepted as the elevations of the point, the printout states that these elevations are only for the purpose for determining the sea level correction.

Elevation values were based on a series of bench marks as depicted on a map provided to us by Fort Wingate personnel. The source of this level information is not given but values seemed reliable when checks were made between adjacent stations.

Level circuits were run with a wild model N - 3 precise level and a Philadelphia type level rod. As a field checking procedure against error of reading, each reading was taken with the rod erect and then a reading with the rod inverted, the rod being either fully extended or fully retracted. The sum of the erect and inverted readings is always a constant value which is the total length of the rod. The instrument man can immediately make a mental addition and if the two readings do not form this constant total he can reject his readings to obtain a more satisfactory result, this method is also valuable in clarifying an unclear notation such as a two being mistaken for a seven or some other coincidence of similarity. No standards were established for closure errors however all level circuits were closed back either upon themselves or some other point of known elevation to guarantee against major blunders. If these circuits were to be described they would be third order precision which seemed to be of sufficient accuracy for this project and could be accomplished within the cost projections.

The recipient of this report may wonder at the purpose of our establishing two bench marks close together, this is done so that a level circuit can be started at one of the bench marks and closed back upon the other. This removes the possibility of error from causes such as transposing figures in copying the values of one of the bench marks, taking off from the wrong bench mark, and other possible confusion that could result from using one bench mark and closing back upon that same bench mark. The TBM is a station of some value that can be identified by this particular field crew in checking back upon themselves or in the event the level circuit does not close and must be rerun, it is then possible to segment the level circuit in order to isolate the error.


RED ROCKS
STATE PARK
FW 28
FW 27
FW 29
903
FW 26
902
FORT WINGATE ARMY DEPOT
FW13
FW12
FW11
901
FW35
FW02
FW10
FW08
FW 31
904
905
FW24

STITZER & ASSOCIATES

JOB 5912
12-5-80

DRILL HOLE LOCATIONS & ELEVATIONS

FORT WINGATE ARMY DEPOT

STATION	EAST COORD	NORTH COORD	ELEV
FW 07	275,162.83	1,640,776.24	6706.86
FW 08	275,228.51	1,640,508.03	6710.02
FW 10	276,028.14	1,640,786.02	6704.10
FW 11	276,214.51	1,641,268.66	6697.84
FW 12	276,127.03	1,641,546.40	6696.90
FW 13	275,928.64	1,641,628.50	6697.56
FW 24	268,556.84	1,622,656.64	6993.91
FW 26	274,159.90	1,643,789.70	6669.05
FW 27	271,491.94	1,646,401.25	6652.70
FW 28	270,149.29	1,646,522.74	6652.55
FW 29	274,775.35	1,645,744.05	6666.16
FW 31	282,298.39	1,631,132.34	6827.71
FW 35	280,113.91	1,641,829.19	6706.46

TRAVERSE ADJUSTMENT PROGRAM CORRECTED TO SCALE FACTOR OF .9999565 AND TO SEA LEVEL FROM ELEVATION.

BS PT	OCC PT	FS PT	HORIZONTAL ANGLE	FORESITE BEARING	SLOPE DISTANCE	VERTICAL ANGLE	H I FROM	H I TO	HORIZ DISTANCE	COORDINATES EAST	COORDINATES NORTH	ELEV'N	TEMP	PT
										277936.41	1641592.47	6810.00		900
	900	902		N 75 54 0W	3056.77	-2. 14. 16.	.01	.01	3063.31	275041.71	1642594.76	6896.25	70.00	902
900	902	901	1.40.24.	S 69 5 37E	3014.45	2. 15. 6.	.01	.01	3011.05	277854.53	1641520.28	6808.60	70.00	901
902	901	7	323.36.30.	S 71 32 22W	2795.53	-2. 2. 30.	.01	.01	2792.05	275162.63	1640776.24	6706.47	70.00	7
902	901	8	316. 0.48.	S 88 55 10W	2817.11	-2. 0. 6.	.01	.01	2814.36	275220.51	1640508.03	6710.29	70.00	8
902	901	10	317.11.31.	S 69 [illegible] 13W	1472.39	-3. 6. 30.	.01	.01	1468.47	275026.14	1640796.02	6701.67	70.00	10
902	901	11	330.22.15.	S 81 16 37W	1663.67	-3. 53. 52.	.01	.01	1659.21	276214.51	1641268.65	6695.51	70.00	11
902	901	12	337.57.35.	N 89 0 2W	1732.10	-3. 40. 20.	.01	.01	1727.69	275127.03	1641546.40	6694.33	70.00	12
902	901	13	342.18.35.	N 86 47 2W	1932.96	-3. 21. 45.	.01	.01	1928.93	275928.64	1641626.50	6695.23	70.00	13
902	901	27	10.35.12.	N 52 30 25W	6023.55	-1. 8. 46.	.01	.01	6019.13	271991.94	1646461.25	6648.03	70.00	27
902	901	28	12. 5.11.	N 57 0 20W	9125.19	0. 58. 46.	.01	.01	9106.69	273147.29	1646522.74	6651.49	70.00	28
902	901	903	13.41.44.	N 53 23 53W	4477.59	-1. 43. 36.	.01	.01	4474.62	274262.63	1644167.93	6673.68	70.00	903
901	903	26	67.55.10.	S 14 29 16W	411.36	-1. 7. 34.	.01	.01	411.31	274159.90	1643785.70	6665.59	70.00	26
901	903	29	251.37.44.	N 14 13 50E	1639.30	0. 24. 41.	.01	.01	1636.36	274775.35	1645744.05	6661.91	70.00	29
902	901	906	225.52.29.	S 20 13 [illegible]E	11172.22	0. 6. 25.	.01	.01	11168.60	281714.30	1631640.40	6829.45	70.00	906
902	901	904	271.41.31.	S 45 32 53W	15421.79	0. 31. 56.	.01	.01	15415.56	265643.83	1630734.25	6952.00	70.00	904
902	901	35	151.16.30.	N 82 12 52E	2283.60	-2. 36. 37.	.01	.01	2280.40	280113.91	1641829.19	6704.60	70.00	35
901	904	905	[illegible].9.50.	S 54 4 10E	5433.31	1. 3. 50.	.01	.01	5430.32	271237.92	1627547.71	7052.89	70.00	905
904	905	24	202.47.57.	S 20 43 40W	5580.10	0. 30. 15.	.01	.01	5577.70	260556.84	1622650.64	6990.80	70.00	24
901	903	31	101.10.29.	N 81 5 13E	591.30	0. 26. 26.	.01	.01	591.26	262246.39	1631132.34	6626.34	70.00	31

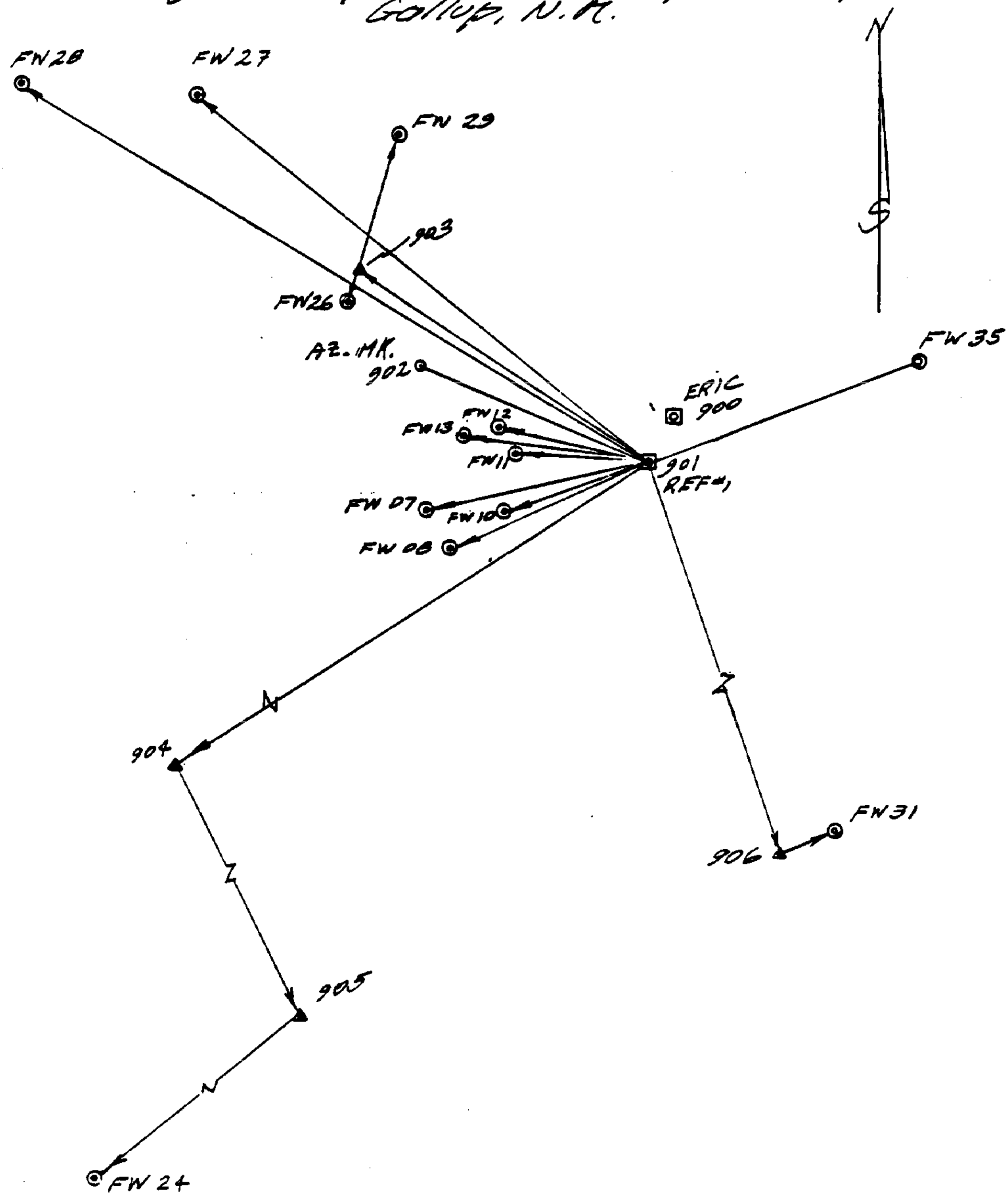
SURVEY FIELD NOTES STITZER & ASSOCIATES, INC.

Client *ESE* Date *11/11/80* Job no. *5912*

Party chief *JHS* Instrument *JHS* Helper *BA*

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

Sketch of survey at Fort Wingate Depot Act. Gallup, N.M.



SURVEY FIELD NOTES — STITZER & ASSOCIATES, INC.

Client: ESE — Date: 11/10/80 — Job no. 5912

Party chief: JHS — Instrument: — Helper:

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

NOTES

Found USC&GS Station ERIC, Ref. mark No. 1 & Azimuth Mark

Obtained following information from NOS information dept. in Washington D.C. #301-443-8631

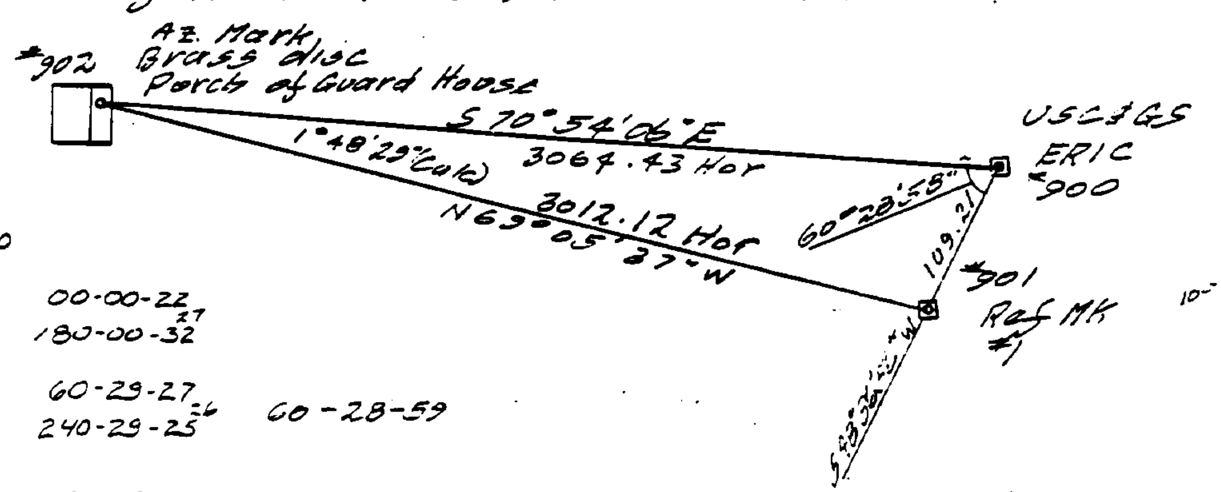
ERIC x = 277,936.41
y = 1,641,592.47 } Western Zone N.M.

Plane Az. to Az. Mark = 109°05'54"
Δa angle = -0°26'00"

Azimuth mark is a brass disc in porch of guard house @ gate #109 - Fort Wingate Army Depot. -

---

Determine Coord. of Ref. Mark #1 & Azimuth from Ref. Mark #1 to Az mark ERIC.



⊼@ 900

901	00-00-22 27 180-00-32				
902	60-29-27 26 240-29-25	60-28-59			
901	227-19-42 36 47-19-30	92-14-05 267-45-10	3066.77 934.255	-2°14'26"	
902	287-48-35 32 107-48-30	60-28-56		60°28'58"	

SURVEY FIELD NOTES STITZER & ASSOCIATES, INC.

Client ESE Date 11/10/80 Job no. 5912

Party chief ______ Instrument ______ Helper ______

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

Scale factor determination

x value station ERIC = 277,936

500,000
− 277,936
222 064

From tables 220,000 − 0.9999554
225,000 − 0.9999580
Diff = .0000026

$Incr = \frac{2064}{5000} \times .0000026 = .0000011$

Scale factor = 0.9999554 + .0000011
= 0.9999565

SURVEY FIELD NOTES — STITZER & ASSOCIATES, INC.

Client ESE — Date 11·11·80 — Job no. 5912

Party chief JHS — Instrument JHS — Helper BA (NOTES)

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
⊼@901						
902	00-00-25 180-00-31 (28)					
10	317-11-53 137-11-53 (57)	93-06-44 266-53-45	1972.09' 601.093 M	317-11-25	-3°06'30"	317°11'31"
08	318-01-07 138-01-20 (13)	92-00-00 268-00-35	2817.11 858.657 M	318-00-45	-2°00'00"	318°00'48"
07	323-38-47 143-38-52 (50)	92-05-47 267-54-35	2795.53' 852.080 M	323-38-22	-2°05'36"	323°38'30"
11	330-22-38 150-22-38 (38)	93-54-05 266-06-20	1663.67' 507.086 M	330-22-10	-3°53'52"	330°22'15"
12	339-58-02 159-57-37 (60)	93-47-12 266-13-15	1732.10' 527.944 M	339-57-32	-3°46'58"	339°57'35"
13	342-19-00 162-18-58 (59)	93-22-00 266-38-30	1932.96' 589.168	342-18-31	-3°21'45"	342°18'35"
28	12-05-30 192-05-41 (35)	90-59-00 269-01-27	9191.39' 2801.54 M	12-05-07	-0°58'46"	12°05'11"
903	15-42-10 195-42-11 (10)	91-43-40 268-16-27	4477.63' 1364.804 M	15-41-42	-1°43'36"	15°41'44"
27	16-35-36 196-35-32 (34)	91-08-36 268-51-54	8023.66' 2445.616 M	16-35-06	-1°08'48"	16°35'12"

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client ESE Date 11·11·80 Job no. 5912

Party chief JHS Instrument JHS Helper BA (NOTES)

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
⊼ @ 901						
902	74-59-44 / 254-59-45 (44)					
10	32-11-16 / 212-11-18 (17)			317-11-33		
08	33-00-29 / 213-00-30 (29)			318-00-45		
07	38-38-13 / 218-38-10 (12)			323-38-29		
11	45-22-02 / 225-21-57 (00)			330-22-16		
12	54-57-23 / 234-57-09 (16)			339-57-32		
13	57-18-20 / 237-18-15 (17)			342-18-33		
28	37-04-52 / 267-04-48 (50)			12-05-06		
903	90-41-30 / 270-41-30 (30)			15-41-46		
27	91-34-53 / 271-34-51 (52)			16-35-08		

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client ESE Date 11·11·80 Job no. 5912

Party chief JHS Instrument JHS Helper BA (NOTES)

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
π@ 901						
902	214-43-35 34-43-40 (37)					
10	171-55-08 351-55-16 (12)			317-11-35		
08	172-44-30 352-44-30 (30)			318-00-53		
07	178-22-03 358-22-11 (07)			323-38-30		
11	185-05-50 5-06-00 (55)			330-22-18		
12	194-41-10 14-41-26 (18)			339-57-41		
13	197-02-13 17-02-25 (19)			342-18-42		
28	226-48-53 46-48-59 (56)			12-05-19		
903	230-25-24 50-25-31 (27)			15-41-50		
27	231-18-58 51-19-03 (00)			16-35-23		

SURVEY FIELD NOTES — STITZER & ASSOCIATES, INC.

Client: ESE Date: 11·11·80 Job no.: 5312

Party chief: JHS Instrument: JHS Helper: BA (NOTES)

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
⊼@ 303						
301	00-00-37 48 180-01-00					
26	67-54-05 58 247-53-51	91-07-45 268-52-37		67-53-10	-1°07'34"	
29	251-38-23 25 71-38-26	90-24-30 269-35-08		251-37-37	-0°24'41"	
301	217-51-06 06 37-51-06					
26	285-44-13 18 105-44-24		411.54' 125.439 M	67-53-12		
29	109-29-05 56 289-28-48		1639.00' 499.569 M	251-37-50		
301	79-45-27 32 259-45-37					
26	147-38-55 44 327-38-33			67-53-09		67°53'10"
29	331-23-15 16 151-23-17			251-37-44		251°37'44"

SURVEY FIELD NOTES — STITZER & ASSOCIATES, INC.

Client ESE — Date 11·11·80 — Job no. 5312

Party chief JHS — Instrument JHS — Helper BA (NOTES)

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
⊼@905	TOP BLDG. H-1463					
904	00-00-04 03	91-03-15	5433.31		−1°03′50″	
	180-00-02	268-55-35	1656.076			
24	262-47-55 55	90-37-42	5580.16	262-47-52	−0°38′15″	
	82-47-55	269-21-12	1700.836			
904	219-56-32 32					
	39-56-33					
24	122-44-29 28			262-47-56		
	302-44-28					
904	88-08-11 12					
	268-08-13					
24	350-56-11 14			262-48-02		262°47′57″
	170-56-17					

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client ESE Date 11·11·80 Job no. 5912

Party chief JHS Instrument JHS Helper BA (NOTES)

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
⊼@ 904						
901	00-00-42 180-00-46 (44)					
905	80-20-30 260-20-38 (34)			80-19-50		
901	207-45-37 27-45-15 (26)					
905	288-05-38 108-05-13 (26)			80-20-00		
901	61-30-38 241-30-36 (37)					
905	141-50-30 321-50-36 (33)			80-19-56		80°19′56″

SURVEY FIELD NOTES — STITZER & ASSOCIATES, INC.

Client: ESE — Date: 11·11·80 — Job no. 5912

Party chief: JHS — Instrument: JHS — Helper: BA (NOTES)

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
π@ 901						
902	00-00-53 50 180-00-48					
35	151-19-29 22 331-19-16	92-36-05 267-22-50	2283.60 696.042	151-18-32	−2°36'37"	
906	228-53-26 23 48-53-21	89-53-05 270-05-55	11172.22 3405.299	228-52-33	+0°06'25"	
904	294-42-21 24 114-42-27	89-27-33 270-31-30	15421.99 4700.631	294-41-34	+0°31'58"	
902	217-04-50 48 37-04-47					
35	8-23-22 22 188-23-21			151-18-34		
906	85-57-30 22 265-57-14			228-52-34		
904	151-46-29 22 331-46-16			294-41-34		
902	83-03-41 35 263-03-30					
35	234-22-13 06 54-22-00			151-18-25		151°18'30"
906	311-56-08 10 131-56-12			228-52-29		228°52'29"
904	17-45-00 07 197-45-14			294-41-26		294°41'31"

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client ESE Date 11-12-80 Job no. 5912

Party chief JHS Instrument JHS Helper BA (NOTES)

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
⊼@ 906						
901	00-00-48 (43) 180-00-39					
31	101-17-00 281-16-47 (53)	90-53-03 269-06-00	591.50 180.289	101-16-10	-0°06'28"	
901	227-54-25 47-54-05 (15)					
31	329-10-34 149-10-41 (37)			101-16-22		
901	94-04-09 274-04-45 (25)					
31	195-21-11 15-21-00 (05)			101-16-40		101°16'24"

FW1

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client: ESE Date: 11/12/80 Job no. 5912

Party chief ______ Instrument ______ Helper ______

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

1/3 11/12/80

Job No. 5912

⊼ 4127-JHS † BA

BM BL-4 - Brass cap in concrete west edge of road to demolition area 5000 ft ± southeast of gate #209
El. 7126.23

TBM A-12 Disturbed base of BL4 (Top was destroyed) leaning to south - Record elev. 7086.76

③

1/3 Level circuit CE BL 4 to gate 209 & return to TBM A-12

Station			Elev.
BM BL-4	1.645 / 11.730		7126.23
TP	0.190 / 13.175	12.190 / 1.185	
TP	0.600 / 12.765	12.095 / 1.280	
TP	1.125 / 12.250	12.185 / 1.185	
	9.000 / 4.375	6.265 [illegible] / 7.110	
TBM A	3.800 / 9.575	9.150 / 3.925	7086.60
	1.660 / 12.710	10.325 / 3.050	
	0.075 / 13.290	13.060 / 0.305	
	5.535	23.385	

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client________________ Date________ Job no.______

Party chief______________ Instrument______________ Helper__________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

2/3 11/12/80

Cont. Job #5912

TBM B - Top of bent angle iron North of east hinge - gate #209.

TBM C - Top of plate on bottom member of west hinge - gate #209

③

2/3 Level Circuit C.E. BL-4 to gate 209 & return to TBM A-12

TP	3.335 / 10.040	10.009 / 8.370	
TP	9.775 / 13.600 [?]	8.015 / 5.355	
TP	1.300 / 12.065	13.255 / ~~8.160~~ 0.110	
TP	0.255 / 13.114	12.970 / 0.395	
TP	2.270 / 13.100	12.960 / 0.405	
	4.580 / 8.79[illegible]	8.180 / 5.195	
TBM B	4.410 / 8.930	4.570 / 8.810	7018.72
TBM C	4.660 / 8.710	4.060 / 9.205	7018.70

FW-3

SURVEY FIELD NOTES — STITZER & ASSOCIATES, INC.

Client________ Date________ Job no.________

Party chief________ Instrument________ Helper________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

3/3 Cont. Job #5912 11/12/80

TBM A Top conc. see descript. page 1

3/3 Level circuit C.L. to gate 209 & return to TBM A-12

Station			
TP	10.795 / 2.580	0.285 / 13.080	
TP	8.890 / 4.485	2.315 / 11.056	
TP	12.155 / 1.210	0.095 / 13.270	
TP	11.360 / 2.010	0.200 / 13.160	
TP	7.965 / 5.410	9.805 / 3.565	
TP	12.290 / 1.090	0.000 / 13.370	
TP	11.440 / 1.930	1.115 / 12.255	
TP	7.130 / 6.245	0.690 / 12.680	
TBM A		4.290 / 9.080	7086.60

③

FW4

SURVEY FIELD NOTES — STITZER & ASSOCIATES, INC.

Client______ Date______ Job no.______

Party chief______ Instrument______ Helper______

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

1/1

DH FW-24 — Top 1/2" rebar @ drill site - east bank of wash 200' ± north of demolition area fence

③

1/1 Level Circuit TBMs @ Gate #209 to DH FW 24 & return

Station			Elev	Adj Elev
TBM B				7018.32
TP	2.348 / 11.030	11.225 / 2.150		
TP	1.660 / 11.715	12.760 / 0.610		
DH FW24	2.590 / 10.780	7.000 / 6.370	6993.93	6993.91
TP	12.610 / 0.770	0.515 / 12.850		
TP	12.085 / 1.290	2.380 / 10.[illegible]		
TBM C	6.310 / 7.0[illegible]	3.300 / 3.130 / 10.070	7018.74	7018.70

FW5

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client_____ Date_____ Job no._____

Party chief_____ Instrument_____ Helper_____

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

1/3 Level Circuit B.M. 33-57 thru DH FW-29 & DH FW-26 to BM 35-57

Station			Elev	Adj Elev
BM 33-57	0.950 / 6.410			6678.20
TP	3.290 / 3.329 / 10.080	8.850 / 9.850 / 4.510		
DH FW29	4.00 / 9.37	7.450 / 5.920	6666.14	6666.16
	8.940 / 4.450	6.57 / 6.83		
BM A13	10.33 / 3.04	8.510 / 4.860	6664.03	6664.08
BM B13	5.34 / 2.03	4.810 / 8.555	6669.55	6669.61
TP	4.585 / 2.790	4.81 / 2.56		
TP	5.13 / 5.19 / 2.24	4.97 / 2.40		

③

Job #5112 11/13/80 1/3

⊼ & [illegible] JHS ⌖ B.A.

BM 33-57 Corps of eng. brass disc. N.E. Cor West walk bldg. #18. Elev 6678.20

DH FW29 Top 5/8" rebar near NE cor of sewage treatment pond fence

BM "A" High point conc fe post base at fe. corner south of gate 21[illegible]

BM B South spike in south switch throw lat[illegible]-2nd switch south of road.

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client________________ Date________ Job no.______

Party chief____________ Instrument____________ Helper____________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

2/3 Job 5912 11/3/80

③

DH FN-26 Top 5/8" Rebar

AZIM MK. ERIC – Brass disc near NE Corner concrete porch of guard building at gate #103

2/3 Level Circuit BM 33-57 to BM 35-57 (Cont)

DH FN 26		5.88 / 1.49	6669.05 / 6668.945
	1.11 / 0.26		
TP		0.150 / 1.210	
	12.46 / 0.91		
TP		0.175 / 1.19	
	11.950 / 1.420		
TP		2.525 / 4.840	
	4.750 / 2.620		
TP		1.065 / 0.300	
	4.93 / 4.95 / 2.44		
		6.97 / 0.40	
	6.145 / 1.220		
AZ MK ERIC		4.620 / 2.150	6694.95 / 6694.785
	3.040 / 3.40 / 4.330		
		1.02 / 0.345	
	2.32 / 5.05		

FW 7

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client ______ Date ______ Job no. ______

Party chief ______ Instrument ______ Helper ______

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

3/3

11/13/80

Job #5912

B.M. 35-57 – Corps of Engineers Brass disc NE Cor. of concrete structure SW Cor. of Navajo & Hopi Maso streets Elev. 6685.65

Level Circuit BM 33-57 to BM 35-57 (cont.)

3/3			
		Elev.	Adj. Elev.
TP	3.645 / 3.5[illegible] / 3.750	6.77 / 0.60	
BM 35-57	4.915 / 1.850	6685.85	6685.65

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client________ Date________ Job no.________

Party chief________ Instrument________ Helper________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

1/2 Job #5912 11/13/80 1/2

[illegible] - B.A.

BM 50-57 — Corps of Engineers brass disc in boulder 75' west of road. Elev. 6825.40

DH FW31 — Top 5/8" rebar south of wash, west of bridge #14

1/2 Level Circuit B.M. 50-57 To DH FW 31 & Return

Station			Elev	Adj Elev.
BM CE 50-57				6825.40
	3.100 / 10.225			
TP		13.065 / 0.800		
	3.00 / 10.38			
TP		0.72 / 12.64		
	8.67 / 4.70			
TP		10.52 / 2.86		
	5.52 / 7.85			
TP		3.41 / 9.96		
	9.61 / 3.76			
TP		4.80 / 8.57		
	8.41 / 4.96			
TP		2.08 / 11.29		
	6.17 / 7.20			
DH FW 31		7.55 / 5.82	6827.73	6827.71
	6.21 / 7.16			

FW9

SURVEY FIELD NOTES | STITZER & ASSOCIATES, INC.

Client________________ Date________ Job no.______

Party chief______________ Instrument____________ Helper____________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

2/2 11/13/80

Job #5912

BM 50-57 Corps of Engineer brass disc (see page 1)

2/2 Level Circuit BM 50-57 to DH FW31 (Cont)

			Elev	Adj. Elev.
		6.51 / 6.86		
	3.13 / 10.24	7.825 / 5.55		
	4.705 / 8.670	9.19 / 4.18		
	5.70 / 7.67	4.935 / 8.44		
	6.275 / 7.035	3.96 / 9.405		
	0.145 / 13.22	10.170 / 3.190		
	11.130 / 2.24	1.675 / 11.695		
BM 50-57	7.555 / 5.82	2.88 / 10.49	6825.44	6825.40

FW'10

SURVEY FIELD NOTES **STITZER & ASSOCIATES, INC.**

Client________ Date________ Job no.________

Party chief________ Instrument________ Helper________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

Job No. 5912 11/14/80 1/5

⊼ JHS & BA

AZIM ERIC — USC&GS Brass Disc MKD AZIM ERIC 1980 near N.E. corn. of conc. porch guard house @ gate #109

③

1/5 LEVEL CIRCUIT AZIM MK ERIC thru D.S. 35-1-8 & return to 13 BM

Station			Elev	Adj Elev
AZIM ERIC	3.15			6694.95
TP	4.22 / 7.10	5.35		
TP	0.27 / 5.96	2.02 / 2.60		
DH FW-13	1.40 / 4.71	4.77 / 5.64	6697.57	6697.56
DH FW-12	2.699 / 5.33	1.725 / 5.36	6696.92	6696.90
DH FW-11	2.03 / 5.95	2.05 / 4.39	6697.86	6697.84
TP	1.41 / 8.31	2.97 / 5.01		
	5.06	2.36		

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client__________ Date__________ Job no.__________

Party chief__________ Instrument__________ Helper__________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

2/5 Job #5912 11/12/80

TBM Top 6" steel water valve cover at base of H_2O tank hill (south)

TBM B ~NW cor conc. loading dock Bldg. G306

Station			Elev	Adj Elev
2/5				
TBM A	13.240 / 0.125	2.96 / 10.41	6704.15	6704.12
TP	11.635 / 1.730	1.22 / 12.143		
TP	12.93 / 0.4[illegible]	1.530 / 11.840		
TP	6.57 / 6.8[illegible]	0.64 / 12.72		
TP	5.73 / 5.78 / 7.68 / 7.64	12.46 / 0.91		
TBM B	2.29 / 11.08	2.62 / 10.17	6735.725	6735.71
TP	5.06 / 8.31	5.96 / 7.41		
TP	1.03 / 12.335	9.55 / 3.92		

FW 12

SURVEY FIELD NOTES STITZER & ASSOCIATES, INC.

Client________________ Date__________ Job no.________

Party chief______________ Instrument______________ Helper______________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

3/5 11/4/80 Job #5912

Top 1/2" rebar south of road, west of west

DH FW 35

TBM B

Station				Elevation
3/5				
TP	1.595 / 11.77	12.59 / 3.78		
DH FW 35	6.84 / 6.53	11.11 / 2.25		6706.19 / 6706.46
TP	11.51 / 1.80	4.075 / 9.290		
TP	12.70 / 9.665	3.195 / 10.170		
TP	10.40 / 2.97	3.125 / 10.145		
TP	5.205 / 8.160	5.28 / 8.09		
TBM B	2.195 / 11.180	1.675 / 11.685		6735.705 / 6735.71
TP	8.60 / 4.78	1.52 / 11.85		

SURVEY FIELD NOTES STITZER & ASSOCIATES, INC.

Client ______ Date ______ Job no. ______

Party chief ______ Instrument ______ Helper ______

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
4/5						

DH FW-10 — Top 5/8" rebar 200' E of ... edge ...

DH FW 08 — Top 5/8" rebar 100' S.E. of ... S/S

Station				
4/5	2.39	11.975	8.93	4.47
TP	2.945	10.425	12.63	0.74
TP	1.905	11.265	13.21	0.15
TP	2.255	10.615	11.495	1.870
TWIT A	2.160	-5.710	4.56	8.815
TP	6.59	0.78	5.00	2.37
DH FW10	11.32	1.98	3.83	3.54
DH FW 08	4.??	3.34	6.47	7.90

6704.12 — 6704.22 (TWIT A)

6704.10 — 6704.14 (DH FW10)

6710.02 — 6710.00 (DH FW08)

FW-14

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client ______ Date ______ Job no. ______

Party chief ______ Instrument ______ Helper ______

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values
5/5						
	Top 5/8" rebar 200'± NW Bldg 515		Corps of Engineers brass cap in west wing wall of bldg 507 EL 6712.91			
	DH FW-07		BM 36-57			

	Adj. Elev	6706.86		6712.91
	Elev	6706.905		6712.96
		7.185 / 0.11	3.52 / 3.64	2.71 / 4.66
		5.48 / 1.80	6.81 / 0.56	
5/5		DH FW07	TP	BM 36-57

SURVEY FIELD NOTES

STITZER & ASSOCIATES, INC.

Client______ Date______ Job no.______

Party chief______ Instrument______ Helper______

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

1/2

Job #5312 11/14/80

⊼ # ꟷ JHS § BA

BM A-13	High point conc base of cor. fence post south of gate 216.
BM A14	Top Concrete NE cor frame for Scale Bldg #37
DH FW-27	Top 5/8" Rebar So. of paved road & west of wash.
DH FW 28	Top 5/8" Rebar No. of paved road & west of wash

③

1/2 Level circuit BM A13 to DH's FW-27 & FW.28 & return to BM A13

Sta	B.S.	F.S.	Elev.	Adj Elev
BM A13	8.37 / 5.00			6664.08
BM A14	2.850 / 1.82 / 4.52	9.34 / 4.03	6663.11	6663.10
TP	3.38 / 3.98	6.83 / 0.54		
DH FW-27	8.48 / 4.89	9.78 / 3.60	6652.73	6652.70
TP	4.72 / 2.65	5.705 / 1.66		
DH FW 28	6.88 / 0.49	7.62 / 5.75	6652.61	6652.55
TP	4.28 / 3.09	3.85 / 3.52		

FW 16

SURVEY FIELD NOTES | **STITZER & ASSOCIATES, INC.**

Client________________ Date________ Job no.______

Party chief____________ Instrument__________ Helper__________

Station	Hor. angle	Vert. angle	Slope dist.	Difference Hor. angle	Reduced Vert. angle	Mean values

2/2

South spike in south switch throw patch 2nd switch south of road

BM B13

6669.61

6669.73

2/2	CHK BH 27	TP	TP	TP	BM B13
	7.18 / 0.18	2.169 / 5.20	3.52 / 3.85	4.050 / 3.320	2.54 / 4.829
		7.61 / 5.76	6.64 / 0.73	7.36 / 0.01	7.65 / 5.72

APPENDIX C—CHEMICAL DATA

APPENDIX C

The chemical data for the FWDA survey are presented in ESE report format. The data are also stored in USATHAMA format.

ESE Report of FWDA Chemical Data Ground Water

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINGW MAP# 700

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW31 84905	FW35 84902	FW36-1 84900	FW36-2 84901	FW00GW 84903
DATE		1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0
ACROLEIN (UG/L)	34210	<0.9	NA	<0.9	<0.9	NA
ACRYLONITRILE (UG/L)	34215	<0.9	NA	<0.9	<0.9	NA
BENZENE (UG/L)	99932	<0.5	NA	<0.5	<0.5	NA
BROMOMETHANE (UG/L)	34413	<1	NA	<1	<1	NA
BROMODICHLOROMETHANE (UG/L)	32101	<0.5	NA	<0.5	<0.5	NA
BROMOFORM (UG/L)	32104	<1	NA	<1	<1	NA
CARBON TETRACHLORIDE (UG/L)	32102	<1	NA	<1	<1	NA
CHLOROBENZENE (UG/L)	34301	<0.5	NA	<0.5	<0.5	NA
CHLOROETHANE (UG/L)	34311	<0.9	NA	<0.9	<0.9	NA
CHLOROFORM (UG/L)	32106	<0.5	NA	<0.5	<0.5	NA
CHLOROMETHANE (UG/L)	34418	<0.9	NA	<0.9	<0.9	NA
DIBROMOCHLOROMETHANE (UG/L)	34306	<1	NA	<1	<1	NA
DICHLORODIFLUOROMETHANE(UG/L)	34668	<0.9	NA	<0.9	<0.9	NA
1,1-DICHLOROETHANE (UG/L)	34496	<0.7	NA	<0.7	<0.7	NA
1,2-DICHLOROETHANE (UG/L)	34531	<0.9	NA	<0.9	<0.9	NA
1,1-DICHLOROETHENE (UG/L)	34501	<0.9	NA	<0.9	<0.9	NA
T-1,2-DICHLOROETHENE (UG/L)	34546	<0.5	NA	<0.5	<0.5	NA
1,2-DICHLOROPROPANE (UG/L)	34541	<0.6	NA	<0.6	<0.6	NA
CIS-1,3-DICHLOROPROPENE (UG/L)	34704	<0.9	NA	<0.9	<0.9	NA
T-1,3-DICHLOROPROPENE (UG/L)	34699	<0.6	NA	<0.6	<0.6	NA

PROJECT NUMBER 80606223

PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA

FIELD GROUP LEADER

PARAMETERS	STORET #	FW31 84905	FW35 84902	FW36-1 84900	FW36-2 84901	FW00GW 84903
DATE		1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0
ETHYLBENZENE (UG/L)	34371	<2	NA	<2	<2	NA
METHYLENE CHLORIDE (UG/L)	34423	10	NA	4	3	NA
1,1,2,2-TETRACHLOROETHANE(UG/L	34516	<0.9	NA	<0.9	<0.9	NA
TETRACHLORETHENE (UG/L)	34475	<0.9	NA	<0.9	<0.9	NA
1,1,1-TRICHLOROETHANE (UG/L)	34506	<0.6	NA	<0.6	<0.6	NA
1,1,2-TRICHLOROETHANE (UG/L)	34511	<0.7	NA	<0.7	<0.7	NA
TRICHLOROETHENE (UG/L)	39180	<0.7	NA	<0.7	<0.7	NA
TRICHLOROFLUOROMETHANE (UG/L)	34488	<1	NA	<1	<1	NA
TOLUENE (UG/L)	34010	<0.5	NA	<0.5	<0.5	NA
VINYL CHLORIDE (UG/L)	39175	<0.9	NA	<0.9	<0.9	NA
4-CHLORO-3-METHYLPHENOL (UG/L)	34452	<8	<8	<8	<8	<8
2-CHLOROPHENOL (UG/L)	34586	<8	<8	<8	<8	<8
2,4-DICHLOROPHENOL (UG/L)	34601	<8	<8	<8	<8	<8
2,4-DIMETHYLPHENOL (UG/L)	34606	<9	<9	<9	<9	<9
2,4-DINITROPHENOL (UG/L)	34616	<20	<20	<20	<20	<20
2-METHYL-4,6-DINITROPHENOL(UG/	34657	<20	<20	<20	<20	<20
2-NITROPHENOL (UG/L)	34591	<20	<20	<20	<20	<20
4-NITROPHENOL (UG/L)	34646	<9	<9	<9	<9	<9
PENTACHLOROPHENOL (UG/L)	39032	<9	<9	<9	<9	<9
PHENOL (UG/L)	34694	<20	<20	<20	<20	<20

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINGW MAF# 700

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW31 84905	FW35 84902	FW36-1 84900	FW36-2 84901	FW00GW 84903
		SAMPLE NUMBERS				
DATE		1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0
2,4,6-TRICHLOROPHENOL (UG/L)	34621	<8	<8	<8	<8	<8
ACENAPHTHENE (UG/L)	34205	<1	<1	<1	<1	<1
ACENAPHTHYLENE (UG/L)	34200	<3	<3	<3	<3	<3
ANTHRACENE (UG/L)	34220	<2	<2	<2	<2	<2
BENZO(A)ANTHRACENE (UG/L)	34526	<2	<2	<2	<2	<2
BENZO(B)FLUORANTHENE (UG/L)	34230	<1	<1	<1	<1	<1
BENZO(K)FLUORANTHENE (UG/L)	34242	<1	<1	<1	<1	<1
BENZO(A)PYRENE (UG/L)	34247	<1	<1	<1	<1	<1
BENZO(GHI)PERYLENE (UG/L)	34521	<1	<1	<1	<1	<1
BENZIDINE (UG/L)	39120	<4	<4	<4	<4	<4
BIS(2-CHLOROETHYL)ETHER (UG/L)	34273	<5	<5	<5	<5	<5
BIS(2-CHLOROETHOXY)METHANE(UG/	34278	<4	<4	<4	<4	<4
BIS(2-ETHYLHEXYL)PHTH.(UG/L)	39100	10	<2	<2	<2	20
BIS(2-CHLOROISOPROPYL)ETHER(UG	34283	<20	<20	<20	<20	<20
4-BROMOPHENYL PHENYL ETHER(UG/	34636	<20	<20	<20	<20	<20
BUTYL BENZYL PHTHALATE (UG/L)	34292	<2	<2	<2	<2	<2
2-CHLORONAPHTHALENE (UG/L)	34581	<2	<2	<2	<2	<2
4-CHLOROPHENYLPHENYL ETHER(UG/L	34641	<4	<4	<4	<4	<4
CHRYSENE (UG/L)	34320	<2	<2	<2	<2	<2
DIBENZO(A,H)ANTHRACENE (UG/L)	34556	<2	<2	<2	<2	<2

ENVIRONMENTAL SCIENCE $ ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINGW MAP# 700

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

SAMPLE NUMBERS

PARAMETERS	STORET #	FW31 84905	FW35 84902	FW36-1 84900	FW36-2 84901	FW00GW 84903
DATE		1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0
DI-N-BUTYLPHTHALATE (UG/L)	39110	<2	<2	<2	<2	<2
1,3,DICHLOROBENZENE (UG/L)	34566	<4	<4	<4	<4	<4
1,4-DICHLOROBENZENE (UG/L)	34571	<4	<4	<4	<4	<4
1,2-DICHLOROBENZENE (UG/L)	34536	<4	<4	<4	<4	<4
3,3'-DICHLOROBENZIDINE (UG/L)	34631	<4	<4	<4	<4	<4
DIETHYLPHTHALATE (UG/L)	34336	<2	<2	<2	<2	<2
DIMETHYLPHTHALATE (UG/L)	34341	<2	<2	<2	<2	<2
DIOCTYLPHTHALATE (UG/L)	34596	<2	<2	<2	<2	<2
1,2-DIPHENYLHYDRAZINE (UG/L)	34346	<2	<2	<2	<2	<2
FLUORANTHENE (UG/L)	34376	<1	<1	<1	<1	<1
FLUORENE (UG/L)	34381	<1	<1	<1	<1	<1
HEXACHLOROBENZENE (UG/L)	39700	<4	<4	<4	<4	<4
HEXACHLOROBUTADIENE (UG/L)	34391	<4	<4	<4	<4	<4
HEXACHLOROETHANE (UG/L)	34396	<4	<4	<4	<4	<4
HEXACHLOROCYCLOPENTADIENE(UG/L	34386	<4	<4	<4	<4	<4
INDENO(1,2,3-CD)PYRENE (UG/L)	34403	<2	<2	<2	<2	<2
ISOPHORONE (UG/L)	34408	<2	<2	<2	<2	<2
NAPHTHALENE (UG/L)	34696	<2	<2	<2	<2	<2
NITROBENZENE (UG/L)	34447	<5	<5	<5	<5	<5
N-NITROSODIMETHYLAMINE (UG/L)	34438	<2	<2	<2	<2	<2

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINGW MAP# 700

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW31 84905	FW35 84902	FW36-1 84900	FW36-2 84901	FW00GW 84903
		SAMPLE NUMBERS				
DATE		1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0
N-NITROSODIPROPYLAMINE (UG/L)	34428	<20	<20	<20	<20	<20
N-NITROSODIPHENYLAMINE (UG/L)	34433	<1	<1	<1	<1	<1
PHENANTHRENE (UG/L)	34461	<2	<2	<2	<2	<2
PYRENE (UG/L)	34469	<3	<3	<3	<3	<3
2,3,7,8-TCDD(UG/L)	34675	<2	<2	<2	<2	<2
1,2,4-TRICHLOROBENZENE (UG/L)	34551	<4	<4	<4	<4	<4
3-NITROTOLUENE(UG/L)	99793	<20	<20	<20	<20	<20
3,5 DINITROANILINE,TOTAL(UG/L)	99608	<20	<20	<20	<20	<20
2 AMINO-4,6-DNT,TOTAL(UG/L)	99612	<20	<20	<20	<20	<20
2-CHLOROETHYLVINYL ETHER(UG/L)	34576	<20	<20	<20	<20	<20
ALDRIN (UG/L)	39330	<2.0	<2.0	<2.0	<2.0	<2.0
A-BHC (UG/L)	39337	<2.0	<2.0	<2.0	<2.0	<2.0
B-BHC (UG/L)	39338	<1.0	<1.0	<1.0	<1.0	<1.0
D-BHC (UG/L)	39259	<2.0	<2.0	<2.0	<2.0	<2.0
G-BHC (UG/L)	39340	<2.0	<2.0	<2.0	<2.0	<2.0
CHLORDANE (UG/L)	39350	<0.70	<0.70	<0.70	<0.70	<0.70
4,4'-DDD (UG/L)	39310	<2.0	<2.0	<2.0	<2.0	<2.0
4,4'-DDE (UG/L)	39320	<2.0	<2.0	<2.0	<2.0	<2.0
4,4'-DDT (UG/L)	39300	<3.0	<3.0	<3.0	<3.0	<3.0
DIELDRIN (UG/L)	39380	<1.0	<1.0	<1.0	<1.0	<1.0

ENVIRONMENTAL SCIENCE & ENGINEERING   06/29/81   COMPUTER ANALYSIS REPORT   WINGW   MAP# 700

PROJECT NUMBER 80606223   PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA   FIELD GROUP LEADER

PARAMETERS	STORET #	FW31 84905	FW35 84902	FW36-1 84900	FW36-2 84901	FW00GW 84903
DATE		1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0
A-ENDOSULFAN (UG/L)	34361	<3.0	<3.0	<3.0	<3.0	<3.0
B-ENDOSULFAN (UG/L)	34356	<4.0	<4.0	<4.0	<4.0	<4.0
ENDOSULFAN SULFATE (UG/L)	34351	<3.0	<3.0	<3.0	<3.0	<3.0
ENDRIN (UG/L)	39390	<1.0	<1.0	<1.0	<1.0	<1.0
ENDRIN ALDEHYDE(UG/L)	34366	<1.0	<1.0	<1.0	<1.0	<1.0
HEPTACHLOR (UG/L)	39410	<2.0	<2.0	<2.0	<2.0	<2.0
HEPTACHLOR EPOXIDE (UG/L)	39420	<2.0	<2.0	<2.0	<2.0	<2.0
TOXAPHENE (UG/L)	39400	<9.0	<9.0	<9.0	<9.0	<9.0
ANTIMONY (UG/L)	1097	<39	47	<39	<39	<39
ARSENIC (UG/L)	1002	<10.0	<10.0	<10.0	<10.0	<10.0
BERYLLIUM (UG/L)	1012	<9.5	<9.5	<9.5	<9.5	<9.5
CADMIUM (UG/L)	1027	<3.7	<3.7	<3.7	<3.7	<3.7
CHROMIUM (UG/L)	1034	<7.3	<7.3	<7.3	<7.3	<7.3
COPPER (UG/L)	1042	<29	<29	<29	<29	<29
LEAD (UG/L)	1051	<11	<11	<11	<11	<11
MERCURY (UG/L)	71900	<0.4	<0.4	<0.4	<0.4	<0.4
NICKEL (UG/L)	1067	<7.6	<7.6	<7.6	<7.6	<7.6
SELENIUM (UG/L)	1147	<8.6	<8.6	<8.6	<8.6	<8.6
SILVER (UG/L)	1077	<6.3	<6.3	<6.3	<6.3	<6.3
THALLIUM (UG/L)	1059	<8.8	<8.8	<8.8	<8.8	<8.8

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINGW MAP# 700

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW31 84905	FW35 84902	FW36-1 84900	FW36-2 84901	FWOOGW 84903
		SAMPLE NUMBERS				
DATE		1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0
ZINC (UG/L)	1092	<34	<34	<34	<34	<34
PCB-1016 (UG/L)	34671	<4.0	<4.0	<4.0	<4.0	<4.0
PCB-1260 (UG/L)	39508	<0.90	<0.90	<0.90	<0.90	<0.90
TRINITROTOLUENE,TOTAL(UG/L)	81360	<1.4	<1.4	<1.4	<1.4	<1.4
2,4-DINITROTOLUENE,DISS(UG/L)	99725	<3.0	<3.0	<3.0	<3.0	<3.0
2,6-DINITROTOLUENE,TOTAL(UG/L)	99973	<3.8	<3.8	<3.8	<3.8	<3.8
TRINITROBENZENE,TOTAL(UG/L)	99735	<9.7	<9.7	<9.7	<9.7	<9.7
NITROBENZENE (UG/L)	99984	<17	<17	<17	<17	<17
1,3 DINITROBENZENE,DISS(UG/L)	99724	<4.8	<4.8	<4.8	<4.8	<4.8
PICRIC ACID (UG/L)	99792	<6.0	<6.0	<6.0	<6.0	<6.0
TETRYL,TOTAL(UG/L)	99733	<23.9	<23.9	<23.9	<23.9	<23.9
RDX (UG/L)	81364	<10.5	<10.5	<10.5	<10.5	<10.5
WHITE PHOSPHORUS (UG/L)	99790	<0.7	<0.7	<0.7	<0.7	<0.7
OIL & GREASE (MG/L)	556	<5	<5	<5	<5	<5
NO3 + NO2 (MG/L-N)	630	<0.010	8.00	<0.010	<0.010	<0.010
SULFATE (MG/L)	945	872	2460	744	684	663
T. PHOSPHORUS (MG/L)	665	0.04	<0.02	<0.02	<0.02	<0.02

ESE Report of FWDA Chemical Data Surface Water

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSH MAP# 699

PROJECT NUMBER 80606223

PROJECT MANAGER JOHN MOUSA

PROJECT NAME WINGATE DEPOT

FIELD GROUP LEADER

PARAMETERS	STORET #	SAMPLE NUMBERS FW30-1 84806	FW30-2 84807	FW03 84804	FW18 84800	FW23 84801	FW37 84803
DATE		1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0
ACROLEIN (UG/L)	34210	<0.9	<0.9	NA	<0.9	<0.9	<0.9
ACRYLONITRILE (UG/L)	34215	<0.9	<0.9	NA	<0.9	<0.9	<0.9
BENZENE (UG/L)	99932	<0.5	<0.5	NA	<0.5	<0.5	<0.5
BROMOMETHANE (UG/L)	34413	<1	<1	NA	<1	<1	<1
BROMODICHLOROMETHANE (UG/L)	32101	<0.5	<0.5	NA	<0.5	<0.5	<0.5
BROMOFORM (UG/L)	32104	<1	<1	NA	<1	<1	<1
CARBON TETRACHLORIDE (UG/L)	32102	<1	<1	NA	<1	<1	<1
CHLOROBENZENE (UG/L)	34301	<0.5	<0.5	NA	<0.5	<0.5	<0.5
CHLOROETHANE (UG/L)	34311	<0.9	<0.9	NA	<0.9	<0.9	<0.9
CHLOROFORM (UG/L)	32106	<0.5	<0.5	NA	<0.5	<0.5	<0.5
CHLOROMETHANE (UG/L)	34418	<0.9	<0.9	NA	<0.9	<0.9	<0.9
DIBROMOCHLOROMETHANE (UG/L)	34306	<1	<1	NA	<1	<1	<1
DICHLORODIFLUOROMETHANE(UG/L)	34668	<0.9	<0.9	NA	<0.9	<0.9	<0.9
1,1-DICHLOROETHANE (UG/L)	34496	<0.7	<0.7	NA	<0.7	<0.7	<0.7
1,2-DICHLOROETHANE (UG/L)	34531	<0.9	<0.9	NA	<0.9	<0.9	<0.9
1,1-DICHLOROETHENE (UG/L)	34501	<0.9	<0.9	NA	<0.9	<0.9	<0.9
T-1,2-DICHLOROETHENE (UG/L)	34546	<0.5	<0.5	NA	<0.5	<0.5	<0.5
1,2-DICHLOROPROPANE (UG/L)	34541	<0.6	<0.6	NA	<0.6	<0.6	<0.6
CIS-1,3-DICHLOROPROPENE (UG/L)	34704	<0.9	<0.9	NA	<0.9	<0.9	<0.9
T-1,3-DICHLOROPROPENE (UG/L)	34699	<0.6	<0.6	NA	<0.6	<0.6	<0.6

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINGW MAF# 699

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN HOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW30-1 84806	FW30-2 84807	FW03 84804	FW18 84800	FW23 84801	FW37 84803
DATE		1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0
ETHYLBENZENE (UG/L)	34371	<2	<2	NA	<2	<2	<2
METHYLENE CHLORIDE (UG/L)	34423	4	4	NA	3	3	2
1,1,2,2-TETRACHLOROETHANE(UG/L	34516	<0.9	<0.9	NA	<0.9	<0.9	<0.9
TETRACHLORETHENE (UG/L)	34475	<0.9	<0.9	NA	<0.9	<0.9	<0.9
1,1,1-TRICHLOROETHANE (UG/L)	34506	<0.6	<0.6	NA	<0.6	<0.6	<0.6
1,1,2-TRICHLOROETHANE (UG/L)	34511	<0.7	<0.7	NA	<0.7	<0.7	<0.7
TRICHLOROETHENE (UG/L)	39180	<0.7	<0.7	NA	<0.7	<0.7	<0.7
TRICHLOROFLUOROMETHANE (UG/L)	34488	<1	<1	NA	<1	<1	<1
TOLUENE (UG/L)	34010	<0.5	<0.5	NA	10	<0.5	<0.5
VINYL CHLORIDE (UG/L)	39175	<0.9	<0.9	NA	<0.9	<0.9	<0.9
4-CHLORO-3-METHYLPHENOL (UG/L)	34452	<8	<8	NA	<8	<8	<8
2-CHLOROPHENOL (UG/L)	34586	<8	<8	NA	<8	<8	<8
2,4-DICHLOROPHENOL (UG/L)	34601	<8	<8	NA	<8	<8	<8
2,4-DIMETHYLPHENOL (UG/L)	34606	<9	<9	NA	<9	<9	<9
2,4-DINITROPHENOL (UG/L)	34616	<20	<20	NA	<20	<20	<20
2-METHYL-4,6-DINITROPHENOL(UG/	34657	<20	<20	NA	<20	<20	<20
2-NITROPHENOL (UG/L)	34591	<20	<20	NA	<20	<20	<20
4-NITROPHENOL (UG/L)	34646	<9	<9	NA	<9	<9	<9
PENTACHLOROPHENOL (UG/L)	39032	<9	<9	NA	<9	<9	<9
PHENOL (UG/L)	34694	<20	<20	NA	<20	<20	<20

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSW MAP# 699

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW30-1 84806	FW30-2 84807	FW03 84804	FW18 84800	FW23 84801	FW37 84803
		SAMPLE NUMBERS					
DATE		1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0
2,4,6-TRICHLOROPHENOL (UG/L)	34621	<8	<8	NA	<8	<8	<8
ACENAPHTHENE (UG/L)	34205	<1	<1	NA	<1	<1	<1
ACENAPHTHYLENE (UG/L)	34200	<3	<3	NA	<3	<3	<3
ANTHRACENE (UG/L)	34220	<2	<2	NA	<2	<2	<2
BENZO(A)ANTHRACENE (UG/L)	34526	<2	<2	NA	<2	<2	<2
BENZO(B)FLUORANTHENE (UG/L)	34230	<1	<1	NA	<1	<1	<1
BENZO(K)FLUORANTHENE (UG/L)	34242	<1	<1	NA	<1	<1	<1
BENZO(A)PYRENE (UG/L)	34247	<1	<1	NA	<1	<1	<1
BENZO(GHI)PERYLENE (UG/L)	34521	<1	<1	NA	<1	<1	<1
BENZIDINE (UG/L)	39120	<4	<4	NA	<4	<4	<4
BIS(2-CHLOROETHYL)ETHER (UG/L)	34273	<5	<5	NA	<5	<5	<5
BIS(2-CHLOROETHOXY)METHANE(UG/	34278	<4	<4	NA	<4	<4	<4
BIS(2-ETHYLHEXYL)PHTH.(UG/L)	39100	<2	<2	NA	<2	<2	<2
BIS(2-CHLOROISOPROPYL)ETHER(UG	34283	<20	<20	NA	<20	<20	<20
4-BROMOPHENYL PHENYL ETHER(UG/	34636	<20	<20	NA	<20	<20	<20
BUTYL BENZYL PHTHALATE (UG/L)	34292	<2	<2	NA	<2	<2	<2
2-CHLORONAPHTHALENE (UG/L)	34581	<2	<2	NA	<2	<2	<2
4-CHLOROPHENYLPHENYL ETHER(UG/L	34641	<4	<4	NA	<4	<4	<4
CHRYSENE (UG/L)	34320	<2	<2	NA	<2	<2	<2
DIBENZO(A,H)ANTHRACENE (UG/L)	34556	<2	<2	NA	<2	<2	<2

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

		SAMPLE NUMBERS					
PARAMETERS	STORET #	FW30-1 84806	FW30-2 84807	FW03 84804	FW18 84800	FW23 84801	FW37 84803
DATE		1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0
DI-N-BUTYLPHTHALATE (UG/L)	39110	<2	<2	NA	<2	<2	<2
1,3,DICHLOROBENZENE (UG/L)	34566	<4	<4	NA	<4	<4	<4
1,4-DICHLOROBENZENE (UG/L)	34571	<4	<4	NA	<4	<4	<4
1,2-DICHLOROBENZENE (UG/L)	34536	<4	<4	NA	<4	<4	<4
3,3'-DICHLOROBENZIDINE (UG/L)	34631	<4	<4	NA	<4	<4	<4
DIETHYLPHTHALATE (UG/L)	34336	<2	<2	NA	<2	<2	<2
DIMETHYLPHTHALATE (UG/L)	34341	<2	<2	NA	<2	<2	<2
DIOCTYLPHTHALATE (UG/L)	34596	<2	<2	NA	<2	<2	<2
1,2-DIPHENYLHYDRAZINE (UG/L)	34346	<2	<2	NA	<2	<2	<2
FLUORANTHENE (UG/L)	34376	<1	<1	NA	<1	<1	<1
FLUORENE (UG/L)	34381	<1	<1	NA	<1	<1	<1
HEXACHLOROBENZENE (UG/L)	39700	<4	<4	NA	<4	<4	<4
HEXACHLOROBUTADIENE (UG/L)	34391	<4	<4	NA	<4	<4	<4
HEXACHLOROETHANE (UG/L)	34396	<4	<4	NA	<4	<4	<4
HEXACHLOROCYCLOPENTADIENE(UG/L	34386	<4	<4	NA	<4	<4	<4
INDENO(1,2,3-CD)PYRENE (UG/L)	34403	<2	<2	NA	<2	<2	<2
ISOPHORONE (UG/L)	34408	<2	<2	NA	<2	<2	<2
NAPHTHALENE (UG/L)	34696	<2	<2	NA	<2	<2	<2
NITROBENZENE (UG/L)	34447	<5	<5	NA	<5	<5	<5
N-NITROSODIMETHYLAMINE (UG/L)	34438	<2	<2	NA	<2	<2	<2

PROJECT NUMBER 80606223

PROJECT MANAGER JOHN MOUSA

PROJECT NAME WINGATE DEPOT

FIELD GROUP LEADER

PARAMETERS	STORET #	FW30-1 84806	FW30-2 84807	FW03 84804	FW18 84800	FW23 84801	FW37 84803
		SAMPLE NUMBERS					
DATE		1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0
N-NITROSODIPROPYLAMINE (UG/L)	34428	<20	<20	NA	<20	<20	<20
N-NITROSODIPHENYLAMINE (UG/L)	34433	<1	<1	NA	<1	<1	<1
PHENANTHRENE (UG/L)	34461	<2	<2	NA	<2	<2	<2
PYRENE (UG/L)	34469	<3	<3	NA	<3	<3	<3
2,3,7,8-TCDD(UG/L)	34675	<2	<2	NA	<2	<2	<2
1,2,4-TRICHLOROBENZENE (UG/L)	34551	<4	<4	NA	<4	<4	<4
3-NITROTOLUENE(UG/L)	99793	<20	<20	NA	<20	<20	<20
3,5 DINITROANILINE,TOTAL(UG/L)	99608	<20	<20	NA	<20	<20	<20
2 AMINO-4,6-DNT,TOTAL(UG/L)	99612	<20	<20	NA	<20	<20	<20
2-CHLOROETHYLVINYL ETHER(UG/L)	34576	<20	<20	NA	<20	<20	<20
ALDRIN (UG/L)	39330	<2.0	<2.0	NA	NA	NA	NA
A-BHC (UG/L)	39337	<2.0	<2.0	NA	NA	NA	NA
B-BHC (UG/L)	39338	<1.0	<1.0	NA	NA	NA	NA
D-BHC (UG/L)	39259	<2.0	<2.0	NA	NA	NA	NA
G-BHC (UG/L)	39340	<2.0	<2.0	NA	NA	NA	NA
CHLORDANE (UG/L)	39350	<0.70	<0.70	NA	NA	NA	NA
4,4'-DDD (UG/L)	39310	<2.0	<2.0	NA	NA	NA	NA
4,4'-DDE (UG/L)	39320	<2.0	<2.0	NA	NA	NA	NA
4,4'-DDT (UG/L)	39300	<3.0	<3.0	NA	NA	NA	NA
DIELDRIN (UG/L)	39380	<1.0	<1.0	NA	NA	NA	NA

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINEW MAF# 699

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW30-1 84806	FW30-2 84807	FW03 84804	FW18 84800	FW23 84801	FW37 84803
		SAMPLE NUMBERS					
DATE		1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0
A-ENDOSULFAN (UG/L)	34361	<3.0	<3.0	NA	NA	NA	NA
B-ENDOSULFAN (UG/L)	34356	<4.0	<4.0	NA	NA	NA	NA
ENDOSULFAN SULFATE (UG/L)	34351	<3.0	<3.0	NA	NA	NA	NA
ENDRIN (UG/L)	39390	<1.0	<1.0	NA	NA	NA	NA
ENDRIN ALDEHYDE(UG/L)	34366	<1.0	<1.0	NA	NA	NA	NA
HEPTACHLOR (UG/L)	39410	<2.0	<2.0	NA	NA	NA	NA
HEPTACHLOR EPOXIDE (UG/L)	39420	<2.0	<2.0	NA	NA	NA	NA
TOXAPHENE (UG/L)	39400	<9.0	<9.0	NA	NA	NA	NA
ANTIMONY (UG/L)	1097	<39	<39	<39	<39	<39	<39
ARSENIC (UG/L)	1002	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
BERYLLIUM (UG/L)	1012	<9.5	<9.5	<9.5	<9.5	<9.5	<9.5
CADMIUM (UG/L)	1027	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7
CHROMIUM (UG/L)	1034	7.8	10	<7.3	<7.3	<7.3	<7.3
COPPER (UG/L)	1042	<29	<29	<29	<29	<29	<29
LEAD (UG/L)	1051	<11	<11	<11	<11	<11	<11
MERCURY (UG/L)	71900	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
NICKEL (UG/L)	1067	<7.6	<7.6	<7.6	<7.6	<7.6	<7.6
SELENIUM (UG/L)	1147	<8.6	<8.6	<8.6	<8.6	<8.6	<8.6
SILVER (UG/L)	1077	<6.3	<6.3	<6.3	<6.3	<6.3	<6.3
THALLIUM (UG/L)	1059	<8.8	<8.8	<8.8	<8.8	<8.8	<8.8

PROJECT NUMBER 80606223

PROJECT MANAGER JOHN HOUSA

PROJECT NAME WINGATE DEPOT

FIELD GROUP LEADER

PARAMETERS	STORET #	FW30-1 84806	FW30-2 84807	FW03 84804	FW18 84800	FW23 84801	FW37 84803
		SAMPLE NUMBERS					
DATE		1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0
ZINC (UG/L)	1092	<34	<34	<34	<34	<34	2000
PCB-1016 (UG/L)	34671	<4.0	<4.0	NA	NA	NA	NA
PCB-1260 (UG/L)	39508	<0.90	<0.90	NA	NA	NA	NA
TRINITROTOLUENE,TOTAL(UG/L)	81360	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
2,4-DINITROTOLUENE,DISS(UG/L)	99725	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
2,6-DINITROTOLUENE,TOTAL(UG/L)	99973	<3.8	<3.8	<3.8	<3.8	<3.8	<3.8
TRINITROBENZENE,TOTAL(UG/L)	99735	<9.7	<9.7	<9.7	<9.7	<9.7	<9.7
NITROBENZENE (UG/L)	99984	<17	<17	<17	<17	<17	<17
1,3 DINITROBENZENE,DISS(UG/L)	99724	<4.8	<4.8	<4.8	<4.8	<4.8	<4.8
PICRIC ACID (UG/L)	99792	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
TETRYL,TOTAL(UG/L)	99733	NA	NA	NA	<23.9	NA	NA
RDX (UG/L)	81364	<10.5	<10.5	<10.5	<10.5	<10.5	<10.5
WHITE PHOSPHORUS (UG/L)	99790	<0.7	<0.7	NA	<0.7	<0.7	<0.7
OIL & GREASE (MG/L)	556	<5	<5	NA	NA	NA	NA
NO3 + NO2 (MG/L-N)	630	<0.010	0.012	<0.010	<0.010	<0.010	0.513
SULFATE (MG/L)	945	302	315	179	50	140	72
T. PHOSPHORUS (MG/L)	665	0.13	0.13	0.18	0.04	<0.02	<0.02

ESE Report of FWDA Chemical Data Sediments

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSE MAP# 698

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	SAMPLE NUMBERS FW30-1 84707	FW30-2 84708	FW03 84704	FW05 84705	FW02 84706	FW18 84700	FW22 84701	FW23 84702	FW24 84703	FWOOSE 84709
DATE		1/25/81	1/24/81	1/24/81	1/25/81	1/25/81	1/24/81	1/25/81	1/24/81	1/25/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0	0
4-CHLORO-M-CRESOL,SOIL (MG/KG)	99683	<0.5	<0.5	NA	NA	NA	<0.5	<0.5	<0.5	<0.5	NA
2-CHLOROPHENOL,SOIL(MG/KG)	99497	<0.5	<0.5	NA	NA	NA	<0.5	<0.5	<0.5	<0.5	NA
2,4-DICHLOROPHENOL,SOIL(MG/KG)	99498	<0.1	<0.1	NA	NA	NA	<0.1	<0.1	<0.1	<0.1	NA
2,4-DIMETHYPHENOL,SOIL(MG/KG)	99499	<0.5	<0.5	NA	NA	NA	<0.5	<0.5	<0.5	<0.5	NA
2,4-DINITROPHENOL,SOIL(MG/KG)	99695	<0.5	<0.5	NA	NA	NA	<0.5	<0.5	<0.5	<0.5	NA
4,6-DINITRO-O-CRESOL,SOIL (MG/	99686	<0.5	<0.5	NA	NA	NA	<0.5	<0.5	<0.5	<0.5	NA
2-NITROPHENOL,SOIL(MG/KG)	99495	<0.5	<0.5	NA	NA	NA	<0.5	<0.5	<0.5	<0.5	NA
4-NITROPHENOL,SOIL(MG/KG)	99496	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
PENTACHLOROPHENOL,SOIL (MG/KG)	99682	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
PHENOL,SOIL (MG/KG)	99685	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
2,4,6-TRICHLOROPHENOL,SOIL(MG/	99684	<0.1	<0.1	NA	NA	NA	<0.1	<0.1	<0.1	<0.1	NA
ACENAPHTHENE,SOIL(MG/KG)	99450	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
ACENAPHTHYLENE,SOIL(MG/KG)	99451	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
ANTHRACENE,SOIL(MG/KG)	99452	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
BENZO(A)ANTHRACENE,SOIL(MG/KG)	99453	<1	<1	NA	NA	NA	<1	<1	<1	<1	NA
BENZO(B)FLUORANTHENE,SOIL(MG/K	99454	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
BENZO(K)FLUORANTHENE,SOIL(MG/K	99455	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
BENZO(A)PYRENE,SOIL(MG/KG)	99456	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
BENZO (GHI)PERYLENE,SOIL(MG/K	99691	<2.0	<2.0	NA	NA	NA	<2.0	<2.0	<2.0	<2.0	NA
BENZIDINE,SOIL(MG/KG)	99457	<3	<3	NA	NA	NA	<3	<3	<3	<3	NA

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSE MAF# 698

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW30-1 84707	FW30-2 84708	FW03 84704	FW05 84705	FW02 84706	FW18 84700	FW22 84701	FW23 84702	FW24 84703	FWOOSE 84709
		SAMPLE NUMBERS									
DATE		1/25/81	1/24/81	1/24/81	1/25/81	1/25/81	1/24/81	1/25/81	1/24/81	1/25/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0	0
BIS(2-CHLRETH)ETHER, SOIL(MG/KG	99458	<1	<1	NA	NA	NA	<1	<1	<1	<1	NA
BIS(2-CHLETHOXY)METH ,SOIL(MG/K	99459	<3	<3	NA	NA	NA	<3	<3	<3	<3	NA
BIS(2-E-E)PHTHALATE, SOIL(MG/KG	99460	0.6	40	NA	NA	NA	3	<0.4	<0.4	0.5	NA
BIS(2-CHLISOP)ETHER, SOIL(MG/KG	99461	<4.0	<4.0	NA	NA	NA	<4.0	<4.0	<4.0	<4.0	NA
4-BROMOPHPHETHER,SOIL(MG/KG)	99462	<4.0	<4.0	NA	NA	NA	<4.0	<4.0	<4.0	<4.0	NA
BUTBPHTHALATE,SOIL(MG/KG)	99463	<2.0	<2.0	NA	NA	NA	<2.0	<2.0	<2.0	<2.0	NA
2-CHLRNAPHTHALENE,SOIL(MG/KG)	99464	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
4-CHLRPHPHETHER,SOIL (MG/KG)	99465	<3	<3	NA	NA	NA	<3	<3	<3	<3	NA
CHRYSENE, SOIL (MG/KG)	99690	<1	<1	NA	NA	NA	<1	<1	<1	<1	NA
DIBENZO(A,H)ANTHRA,SOIL(MG/KG)	99466	<1	<1	NA	NA	NA	<1	<1	<1	<1	NA
DI-N-BUTYLPHTH,SOIL(MG/KG)	99467	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
1,3DICHLRBENZENE,SOIL(MG/KG)	99468	<2.0	<2.0	NA	NA	NA	<2.0	<2.0	<2.0	<2.0	NA
1,4-DICHLRBENZ ,SOIL(MG/KG)	99469	<2.0	<2.0	NA	NA	NA	<2.0	<2.0	<2.0	<2.0	NA
1,2-DICHLRBENZENE,SOIL(MG/KG)	99470	<2.0	<2.0	NA	NA	NA	<2.0	<2.0	<2.0	<2.0	NA
3,3-DICHLRBENZIDINE, SOIL(MG/KG	99471	<3	<3	NA	NA	NA	<3	<3	<3	<3	NA
DIETHYLPHTHALATE,SOIL(MG/KG)	99472	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
DIMETHYLPHTHALATE,SOIL(MG/KG)	99473	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
DIOCTYPHTHALATE,SOIL (MG/KG)	99476	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
1,2-DIPHENYLHYDRAZINE,SOIL(MG/	99477	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
FLUORANTHENE,SOIL (MG/KG)	99689	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSE MAP# 698

PROJECT NUMBER 80406223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW30-1 84707	FW30-2 84708	FW03 84704	FW05 84705	FW02 84706	FW18 84700	FW22 84701	FW23 84702	FW24 84703	FWODSE 84709
		SAMPLE NUMBERS									
DATE		1/25/81	1/24/81	1/24/81	1/25/81	1/25/81	1/24/81	1/25/81	1/24/81	1/25/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0	0
FLUORENE, SOIL (MG/KG)	99692	<2.0	<2.0	NA	NA	NA	<2.0	<2.0	<2.0	<2.0	NA
HEXACHLOROBENZENE,SOIL(MG/KG)	99478	<3	<3	NA	NA	NA	<3	<3	<3	<3	NA
HEXACHLOROBUTADIENE, SOIL(MG/KG	99479	<3	<3	NA	NA	NA	<3	<3	<3	<3	NA
HEXACHLOROETHANE,SOIL(MG/KG)	99480	<3	<3	NA	NA	NA	<3	<3	<3	<3	NA
HEXACHLRCYCLPENTADIENE,SOIL(MG	99481	<3	<3	NA	NA	NA	<3	<3	<3	<3	NA
INDENO(1,2,3-CD)PYRENE,SOIL(MG	99482	<1	<1	NA	NA	NA	<1	<1	<1	<1	NA
ISOPHORONE,SOIL(MG/KG)	99483	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
NAPHTHALENE,SOIL(MG/KG)	99696	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
NITROBENZENE,SOIL(MG/KG)	99485	<1.0	<1.0	NA	NA	NA	<1.0	<1.0	<1.0	<1.0	NA
N-MEHTYLAMINE,SOIL(MG/KG)	99486	<3.0	<3.0	NA	NA	NA	<3.0	<3.0	<3.0	<3.0	NA
N-PROPYLAMINE,SOIL(MG/KG)	99487	<4.0	<4.0	NA	NA	NA	<4.0	<4.0	<4.0	<4.0	NA
N-SODIPHENYLAMINE,SOIL(MG/KG)	99488	<1	<1	NA	NA	NA	<1	<1	<1	<1	NA
PHENATHRENE,SOIL(MG/KG)	99489	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
PYRENE,SOIL(MG/KG)	99490	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
2,3,7,8-TCDD,SOIL(MG/KG)	99491	<0.4	<0.4	NA	NA	NA	<0.4	<0.4	<0.4	<0.4	NA
1,2,4-TRICHLOROBENZENE,SOIL(MG	99492	<1	<1	NA	NA	NA	<1	<1	<1	<1	NA
3-NITROTOLVENE,SOIL(MG/KG)	99679	<3.0	<3.0	NA	NA	NA	<3.0	<3.0	<3.0	<3.0	NA
3,5-DINITROANILINE,SOIL (MG/KG	99688	<3.0	<3.0	NA	NA	NA	<3.0	<3.0	<3.0	<3.0	NA
2,AMINO-4,6-DNT,SOIL (MG/KG)	99687	<4.0	<4.0	NA	NA	NA	<4.0	<4.0	<4.0	<4.0	NA
ALDRIN,SED(UG/KG)	39333	<0.7	<0.7	NA	NA	<0.7	NA	NA	NA	NA	NA

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSE MAP# 698

PROJECT NUMBER 80606223

PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA

FIELD GROUP LEADER

PARAMETERS	STORET #	FW30-1 84707	FW30-2 84708	FW03 84704	FW05 84705	FW02 84706	FW18 84700	FW22 84701	FW23 84702	FW24 84703	FWOOSE 84709
DATE		1/25/81	1/24/81	1/24/81	1/25/81	1/25/81	1/24/81	1/25/81	1/24/81	1/25/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0	0
A-BHC,SED(UG/KG)	99681	<1.0	<1.0	NA	NA	<1.0	NA	NA	NA	NA	NA
B-BHC,SED(UG/KG)	99680	<2.0	<2.0	NA	NA	<2.0	NA	NA	NA	NA	NA
D-BHC,SED(UG/KG)	34262	<5.00	<5.00	NA	NA	<5.00	NA	NA	NA	NA	NA
LINDANE,SED(UG/KG)	39783	<2.0	<2.0	NA	NA	<2.0	NA	NA	NA	NA	NA
CHLORDANE,SED(UG/KG)	39351	<20	<20	NA	NA	<20	NA	NA	NA	NA	NA
DDD,SED(UG/KG)	39311	<6.0	<6.0	NA	NA	<6.0	NA	NA	NA	NA	NA
DDE,SED(UG/KG)	39321	<3.0	<3.0	NA	NA	<3.0	NA	NA	NA	NA	NA
DDT,SED(UG/KG)	39301	<6.0	<6.0	NA	NA	<6.0	NA	NA	NA	NA	NA
DIELDRIN,SED(UG/KG)	39383	<0.8	<0.8	NA	NA	1.0	NA	NA	NA	NA	NA
A-ENDOSULFAN,SED(UG/KG)	34364	<3.0	<3.0	NA	NA	<3.0	NA	NA	NA	NA	NA
B-ENDOSULFAN,SED(UG/KG)	34359	<5.0	<5.0	NA	NA	<5.0	NA	NA	NA	NA	NA
ENDOSULFAN SULFATE,SED(UG/KG)	34354	<3.0	<3.0	NA	NA	<3.0	NA	NA	NA	NA	NA
ENDRIN,SED(UG/KG)	39393	<0.7	<0.7	NA	NA	<0.7	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE,SED(UG/KG)	34369	<0.7	<0.7	NA	NA	<0.7	NA	NA	NA	NA	NA
HEPTACHLOR,SED(UG/KG)	39413	<2.0	<2.0	NA	NA	<2.0	NA	NA	NA	NA	NA
HEPTACHLOR EPOXIDE,SED(UG/KG)	39423	<3.0	<3.0	NA	NA	<3.0	NA	NA	NA	NA	NA
TOXAPHENE,SED(UG/KG)	39403	<50	<50	NA	NA	<50	NA	NA	NA	NA	NA
PCB-1016,SOIL(UG/KG)	99693	<20	<20	NA	NA	20	NA	NA	NA	NA	NA
PCB-1260,SOIL(UG/KG)	99694	<20	<20	NA	NA	<20	NA	NA	NA	NA	NA
2,4,6 TNT,SOIL(UG/KG)	99567	<194	<194	<194	<194	<194	<194	1940	<194	<194	NA

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSE MAP# 698

PROJECT NUMBER 80606223

PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA

FIELD GROUP LEADER

PARAMETERS	STORET #	SAMPLE NUMBERS FW30-1 84707	FW30-2 84708	FW03 84704	FW05 84705	FW02 84706	FW18 84700	FW22 84701	FW23 84702	FW24 84703	FWDOSE 84709
DATE		1/25/81	1/24/81	1/24/81	1/25/81	1/25/81	1/24/81	1/25/81	1/24/81	1/25/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0	0
2,4-DNT,SOIL(UG/KG)	99568	<223	<223	<223	<223	<223	<223	<223	<223	<223	NA
2,6-DNT,SOIL(UG/KG)	99524	<419	<419	<419	<419	<419	<419	<419	<419	<419	NA
1,3,5-TNB,SOIL(UG/KG)	99570	<1080	<1080	<1080	<1080	<1080	<1080	<1080	<1080	<1080	NA
NITROBENZENE,SOIL(UG/KG)	99535	<1640	<1640	<1640	<1640	<1640	<1640	<1640	<1640	<1640	NA
1,3-DNB,SOIL(UG/KG)	99571	<317	<317	<317	<317	<317	<317	<317	<317	<317	NA
PICRIC ACID,SOIL(MG/KG)	99678	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TETRYL,SOIL(UG/KG)	99573	NA	NA	NA	NA	NA	<1500	<1500	NA	<1500	NA
RDX,SOIL(MG/KG)	99795	<2.61	<2.61	<2.61	<2.61	<2.61	<2.61	<2.61	<2.61	<2.61	<2.61
WHITE PHOSPHORUS,SED.(MG/KG)	99799	<0.07	<0.07	NA	NA	NA	<0.07	<0.07	<0.07	<0.07	NA
O&G,MUD(MG/KG-DRY)	557	900	600	NA	NA	NA	NA	NA	NA	NA	<300

ESE Report of FWDA Chemical Data Soil

PROJECT NUMBER 80606223

PROJECT MANAGER JOHN MOUSA

PROJECT NAME WINGATE DEPOT

FIELD GROUP LEADER

PARAMETERS	STORET #	FW01 84605	FW06 84611	FW09 84614	FW17 84610	FW14 84612	FW15 84613	FW16 84609
DATE		1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0	0
4-CHLORO-M-CRESOL,SOIL (MG/KG)	99683	<0.5	NA	NA	NA	<0.5	NA	NA
2-CHLOROPHENOL,SOIL(MG/KG)	99497	<0.5	NA	NA	NA	<0.5	NA	NA
2,4-DICHLOROPHENOL,SOIL(MG/KG)	99498	<0.1	NA	NA	NA	<0.1	NA	NA
2,4-DIMETHYPHENOL,SOIL(MG/KG)	99499	<0.5	NA	NA	NA	<0.5	NA	NA
2,4-DINITROPHENOL,SOIL(MG/KG)	99695	<0.5	NA	NA	NA	<0.5	NA	NA
4,6-DINITRO-O-CRESOL,SOIL (MG/	99686	<0.5	NA	NA	NA	<0.5	NA	NA
2-NITROPHENOL,SOIL(MG/KG)	99495	<0.5	NA	NA	NA	<0.5	NA	NA
4-NITROPHENOL,SOIL(MG/KG)	99496	<0.4	NA	NA	NA	<0.4	NA	NA
PENTACHLOROPHENOL,SOIL (MG/KG)	99682	<0.4	NA	NA	NA	<0.4	NA	NA
PHENOL,SOIL (MG/KG)	99685	<0.4	NA	NA	NA	<0.4	NA	NA
2,4,6-TRICHLOROPHENOL,SOIL(MG/	99684	<0.1	NA	NA	NA	<0.1	NA	NA
ACENAPHTHENE,SOIL(MG/KG)	99450	<0.4	NA	NA	NA	<0.4	NA	NA
ACENAPHTHYLENE,SOIL(MG/KG)	99451	<0.4	NA	NA	NA	<0.4	NA	NA
ANTHRACENE,SOIL(MG/KG)	99452	<0.4	NA	NA	NA	<0.4	NA	NA
BENZO(A)ANTHRACENE,SOIL(MG/KG)	99453	<1	NA	NA	NA	<1	NA	NA
BENZO(B)FLUORANTHENE,SOIL(MG/K	99454	<0.4	NA	NA	NA	<0.4	NA	NA
BENZO(K)FLUORANTHENE,SOIL(MG/K	99455	<0.4	NA	NA	NA	<0.4	NA	NA
BENZO(A)PYRENE,SOIL(MG/KG)	99456	<0.4	NA	NA	NA	<0.4	NA	NA
BENZO (GHI)PERYLENE,SOIL(MG/K	99691	<2.0	NA	NA	NA	<2.0	NA	NA
BENZIDINE,SOIL(MG/KG)	99457	<3	NA	NA	NA	<3	NA	NA

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW01 84605	FW06 84611	FW09 84614	FW17 84610	FW14 84612	FW15 84613	FW16 84609
		SAMPLE NUMBERS						
DATE	.	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0	0
BIS(2-CHLRETH)ETHER, SOIL(MG/KG	99458	<1	NA	NA	NA	<1	NA	NA
BIS(2-CHLETHOXY)METH ,SOIL(MG/K	99459	<3	NA	NA	NA	<3	NA	NA
BIS(2-E-E)PHTHALATE, SOIL(MG/KG	99460	>30	NA	NA	NA	0.8	NA	NA
BIS(2-CHLISOP)ETHER, SOIL(MG/KG	99461	<4.0	NA	NA	NA	<4.0	NA	NA
4-BROMOPHPHETHER,SOIL(MG/KG)	99462	<4.0	NA	NA	NA	<4.0	NA	NA
BUTBPHTHALATE,SOIL(MG/KG)	99463	<2.0	NA	NA	NA	<2.0	NA	NA
2-CHLRNAPHTHALENE,SOIL(MG/KG)	99464	<0.4	NA	NA	NA	<0.4	NA	NA
4-CHLRPHPHETHER,SOIL (MG/KG)	99465	<3	NA	NA	NA	<3	NA	NA
CHRYSENE, SOIL (MG/KG)	99690	<1	NA	NA	NA	<1	NA	NA
DIBENZO(A,H)ANTHRA,SOIL(MG/KG)	99466	<1	NA	NA	NA	<1	NA	NA
DI-N-BUTYLPHTH,SOIL(MG/KG)	99467	<0.4	NA	NA	NA	<0.4	NA	NA
1,3DICHLRBENZENE,SOIL(MG/KG)	99468	<2.0	NA	NA	NA	<2.0	NA	NA
1,4-DICHLRBENZ ,SOIL(MG/KG)	99469	<2.0	NA	NA	NA	<2.0	NA	NA
1,2-DICHLRBENZENE,SOIL(MG/KG)	99470	<2.0	NA	NA	NA	<2.0	NA	NA
3,3-DICHLRBENZIDINE, SOIL(MG/KG	99471	<3	NA	NA	NA	<3	NA	NA
DIETHYLPHTHALATE,SOIL(MG/KG)	99472	<0.4	NA	NA	NA	<0.4	NA	NA
DIMETHYLPHTHALATE,SOIL(MG/KG)	99473	<0.4	NA	NA	NA	<0.4	NA	NA
DIOCTYPHTHALATE,SOIL (MG/KG)	99476	<0.4	NA	NA	NA	<0.4	NA	NA
1,2-DIPHENYLHYDRAZINE,SOIL(MG/	99477	<0.4	NA	NA	NA	<0.4	NA	NA
FLUORANTHENE,SOIL (MG/KG)	99689	<0.4	NA	NA	NA	<0.4	NA	NA

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINGO MAP# 697

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW01 84605	FW06 84611	FW09 84614	FW17 84610	FW14 84612	FW15 84613	FW16 84609
		SAMPLE NUMBERS						
DATE		1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0	0
FLUORENE, SOIL (MG/KG)	99692	<2.0	NA	NA	NA	<2.0	NA	NA
HEXACHLOROBENZENE,SOIL(MG/KG)	99478	<3	NA	NA	NA	<3	NA	NA
HEXACHLOROBUTADIENE,SOIL(MG/KG	99479	<3	NA	NA	NA	<3	NA	NA
HEXACHLOROETHANE,SOIL(MG/KG)	99480	<3	NA	NA	NA	<3	NA	NA
HEXACHLRCYCLPENTADIENE,SOIL(MG	99481	<3	NA	NA	NA	<3	NA	NA
INDENO(1,2,3-CD)PYRENE,SOIL(MG	99482	<1	NA	NA	NA	<1	NA	NA
ISOPHORONE,SOIL(MG/KG)	99483	<0.4	NA	NA	NA	<0.4	NA	NA
NAPHTHALENE,SOIL(MG/KG)	99696	<0.4	NA	NA	NA	<0.4	NA	NA
NITROBENZENE,SOIL(MG/KG)	99485	<1.0	NA	NA	NA	<1.0	NA	NA
N-MEHTYLAMINE,SOIL(MG/KG)	99486	<3.0	NA	NA	NA	<3.0	NA	NA
N-PROPYLAMINE,SOIL(MG/KG)	99487	<4.0	NA	NA	NA	<4.0	NA	NA
N-SODIPHENYLAMINE,SOIL(MG/KG)	99488	<1	NA	NA	NA	<1	NA	NA
PHENATHRENE,SOIL(MG/KG)	99489	<0.4	NA	NA	NA	<0.4	NA	NA
PYRENE,SOIL(MG/KG)	99490	<0.4	NA	NA	NA	<0.4	NA	NA
2,3,7,8-TCDD,SOIL(MG/KG)	99491	<0.4	NA	NA	NA	<0.4	NA	NA
1,2,4-TRICHLOROBENZENE,SOIL(MG	99492	<1	NA	NA	NA	<1	NA	NA
3-NITROTOLVENE,SOIL(MG/KG)	99679	<3.0	NA	NA	NA	<3.0	NA	NA
3,5-DINITROANILINE,SOIL (MG/KG	99688	<3.0	NA	NA	NA	<3.0	NA	NA
2,AMINO-4,6-DNT,SOIL (MG/KG)	99687	<4.0	NA	NA	NA	<4.0	NA	NA
ALDRIN,SED(UG/KG)	39333	<0.7	<0.7	NA	NA	NA	NA	NA

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW01 84605	FW06 84611	FW09 84614	FW17 84610	FW14 84612	FW15 84613	FW16 84609
DATE		1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0	0
A-BHC,SED(UG/KG)	99681	<1.0	<1.0	NA	NA	NA	NA	NA
B-BHC,SED(UG/KG)	99680	<2.0	3.0	NA	NA	NA	NA	NA
D-BHC,SED(UG/KG)	34262	<5.00	<5.00	NA	NA	NA	NA	NA
LINDANE,SED(UG/KG)	39783	<2.0	<2.0	NA	NA	NA	NA	NA
CHLORDANE,SED(UG/KG)	39351	<20	90	NA	NA	NA	NA	NA
DDD,SED(UG/KG)	39311	7.0	8.0	NA	NA	NA	NA	NA
DDE,SED(UG/KG)	39321	<3.0	20	NA	NA	NA	NA	NA
DDT,SED(UG/KG)	39301	<6.0	20	NA	NA	NA	NA	NA
DIELDRIN,SED(UG/KG)	39383	2.0	2.0	NA	NA	NA	NA	NA
A-ENDOSULFAN,SED(UG/KG)	34364	<3.0	4.0	NA	NA	NA	NA	NA
B-ENDOSULFAN,SED(UG/KG)	34359	<5.0	<5.0	NA	NA	NA	NA	NA
ENDOSULFAN SULFATE,SED(UG/KG)	34354	4.0	6.0	NA	NA	NA	NA	NA
ENDRIN,SED(UG/KG)	39393	2.0	9.0	NA	NA	NA	NA	NA
ENDRIN ALDEHYDE,SED(UG/KG)	34369	<0.7	<0.7	NA	NA	NA	NA	NA
HEPTACHLOR,SED(UG/KG)	39413	<2.0	<2.0	NA	NA	NA	NA	NA
HEPTACHLOR EPOXIDE,SED(UG/KG)	39423	<3.0	<3.0	NA	NA	NA	NA	NA
TOXAPHENE,SED(UG/KG)	39403	<50	<50	NA	NA	NA	NA	NA
PCB-1016,SOIL(UG/KG)	99693	20	<20	NA	NA	NA	NA	NA
PCB-1260,SOIL(UG/KG)	99694	<20	100	NA	NA	NA	NA	NA
2,4,6 TNT,SOIL(UG/KG)	99567	<194	<194	917	548	8290	872	<194

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSO MAF# 697

PROJECT NUMBER 80606223

PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA

FIELD GROUP LEADER

PARAMETERS	STORET #	SAMPLE NUMBERS FW01 84605	FW06 84611	FW09 84614	FW17 84610	FW14 84612	FW15 84613	FW16 84609
DATE		1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81	1/24/81
TIME		0	0	0	0	0	0	0
2,4-DNT,SOIL(UG/KG)	99568	<223	<223	300	<223	<223	265	<223
2,6-DNT,SOIL(UG/KG)	99524	<419	<419	<419	<419	<419	<419	<419
1,3,5-TNB,SOIL(UG/KG)	99570	<1080	<1080	<1080	<1080	<1080	7830	<1080
NITROBENZENE,SOIL(UG/KG)	99535	<1640	<1640	<1640	<1640	<1640	<1640	<1640
1,3-DNB,SOIL(UG/KG)	99571	<317	<317	<317	<317	<317	<317	<317
PICRIC ACID,SOIL(MG/KG)	99678	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TETRYL,SOIL(UG/KG)	99573	NA	NA	NA	NA	NA	NA	NA
RDX,SOIL(MG/KG)	99795	<2.88	<2.88	10.2	<2.88	<2.88	<2.88	<2.88
WHITE PHOSPHORUS,SED,(MG/KG)	99799	NA	NA	NA	NA	NA	NA	NA
NO2+NO3-N,SED(MG/KG)	633	<3	11	31	25	<3	<3	5
T.PO4,SED(MG/KG-DRY)	668	308	363	280	290	452	222	264
SO4,SED(MG/KG)	81612	<259	<259	<259	<259	<259	<259	<259

ENVIRONMENTAL SCIENCE & ENGINEERING   06/29/81   COMPUTER ANALYSIS REPORT   WINGO   MAP# 597

PROJECT NUMBER 80606223   PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA   FIELD GROUP LEADER

PARAMETERS	STORET #	FW19 84600	FW20 84601	FW21 84602	FW32 84603	FW33-1 84607	FW33-2 84608	FW34 84606	FW00S0 84615	FW04 84604
		SAMPLE NUMBERS								
DATE		1/25/81	1/25/81	1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0
4-CHLORO-M-CRESOL,SOIL (MG/KG)	99683	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<0.5	<0.5
2-CHLOROPHENOL,SOIL(MG/KG)	99497	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<0.5	<0.5
2,4-DICHLOROPHENOL,SOIL(MG/KG)	99498	<0.1	<0.1	<0.1	<0.1	NA	NA	NA	<0.1	<0.1
2,4-DIMETHYPHENOL,SOIL(MG/KG)	99499	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<0.5	<0.5
2,4-DINITROPHENOL,SOIL(MG/KG)	99695	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<0.5	<0.5
4,6-DINITRO-O-CRESOL,SOIL (MG/	99684	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<0.5	<0.5
2-NITROPHENOL,SOIL(MG/KG)	99495	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	<0.5	<0.5
4-NITROPHENOL,SOIL(MG/KG)	99496	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
PENTACHLOROPHENOL,SOIL (MG/KG)	99682	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
PHENOL,SOIL (MG/KG)	99685	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
2,4,6-TRICHLOROPHENOL,SOIL(MG/	99684	<0.1	<0.1	<0.1	<0.1	NA	NA	NA	<0.1	<0.1
ACENAPHTHENE,SOIL(MG/KG)	99450	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
ACENAPHTHYLENE,SOIL(MG/KG)	99451	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
ANTHRACENE,SOIL(MG/KG)	99452	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
BENZO(A)ANTHRACENE,SOIL(MG/KG)	99453	<1	<1	<1	<1	NA	NA	NA	<1	<1
BENZO(B)FLUORANTHENE,SOIL(MG/K	99454	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
BENZO(K)FLUORANTHENE,SOIL(MG/K	99455	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
BENZO(A)PYRENE,SOIL(MG/KG)	99456	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
BENZO (GHI)PERYLENE,SOIL(MG/K	99691	<2.0	<2.0	<2.0	<2.0	NA	NA	NA	<2.0	<2.0
BENZIDINE,SOIL(MG/KG)	99457	<3	<3	<3	<3	NA	NA	NA	<3	<3

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSO MAF# 697

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW19 84600	FW20 84601	FW21 84602	FW32 84603	FW33-1 84607	FW33-2 84608	FW34 84606	FW0060 84615	FW04 84604
		SAMPLE NUMBERS								
DATE		1/25/81	1/25/81	1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0
BIS(2-CHLRETH)ETHER, SOIL(MG/KG	99458	<1	<1	<1	<1	NA	NA	NA	<1	<1
BIS(2-CHLETHOXY)METH ,SOIL(MG/K	99459	<3	<3	<3	<3	NA	NA	NA	<3	<3
BIS(2-E-E)PHTHALATE, SOIL(MG/KG	99460	0.6	0.6	1	<0.4	NA	NA	NA	<0.4	1
BIS(2-CHLISOP)ETHER, SOIL(MG/KG	99461	<4.0	<4.0	<4.0	<4.0	NA	NA	NA	<4.0	<4.0
4-BROMOPHPHETHER,SOIL(MG/KG)	99462	<4.0	<4.0	<4.0	<4.0	NA	NA	NA	<4.0	<4.0
BUTBPHTHALATE,SOIL(MG/KG)	99463	<2.0	<2.0	<2.0	<2.0	NA	NA	NA	<2.0	<2.0
2-CHLRNAPHTHALENE,SOIL(MG/KG)	99464	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
4-CHLRPHPHETHER,SOIL (MG/KG)	99465	<3	<3	<3	<3	NA	NA	NA	<3	<3
CHRYSENE, SOIL (MG/KG)	99690	<1	<1	<1	<1	NA	NA	NA	<1	<1
DIBENZO(A,H)ANTHRA,SOIL(MG/KG)	99466	<1	<1	<1	<1	NA	NA	NA	<1	<1
DI-N-BUTYLPHTH,SOIL(MG/KG)	99467	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
1,3DICHLRBENZENE,SOIL(MG/KG)	99468	<2.0	<2.0	<2.0	<2.0	NA	NA	NA	<2.0	<2.0
1,4-DICHLRBENZ ,SOIL(MG/KG)	99469	<2.0	<2.0	<2.0	<2.0	NA	NA	NA	<2.0	<2.0
1,2-DICHLRBENZENE,SOIL(MG/KG)	99470	<2.0	<2.0	<2.0	<2.0	NA	NA	NA	<2.0	<2.0
3,3-DICHLRBENZIDINE, SOIL(MG/KG	99471	<3	<3	<3	<3	NA	NA	NA	<3	<3
DIETHYLPHTHALATE,SOIL(MG/KG)	99472	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
DIMETHYLPHTHALATE,SOIL(MG/KG)	99473	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
DIOCTYPHTHALATE,SOIL (MG/KG)	99476	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
1,2-DIPHENYLHYDRAZINE,SOIL(MG/	99477	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
FLUORANTHENE,SOIL (MG/KG)	99689	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSO MAP# 697

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW19 84600	FW20 84601	FW21 84602	FW32 84603	FW33-1 84607	FW33-2 84608	FW34 84606	FW00SO 84615	FW04 84604
		SAMPLE NUMBERS								
DATE		1/25/81	1/25/81	1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0
FLUORENE, SOIL (MG/KG)	99692	<2.0	<2.0	<2.0	<2.0	NA	NA	NA	<2.0	<2.0
HEXACHLOROBENZENE,SOIL(MG/KG)	99478	<3	<3	<3	<3	NA	NA	NA	<3	<3
HEXACHLOROBUTADIENE, SOIL(MG/KG	99479	<3	<3	<3	<3	NA	NA	NA	<3	<3
HEXACHLOROETHANE,SOIL(MG/KG)	99480	<3	<3	<3	<3	NA	NA	NA	<3	<3
HEXACHLRCYCLPENTADIENE,SOIL(MG	99481	<3	<3	<3	<3	NA	NA	NA	<3	<3
INDENO(1,2,3-CD)PYRENE,SOIL(MG	99482	<1	<1	<1	<1	NA	NA	NA	<1	<1
ISOPHORONE,SOIL(MG/KG)	99483	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
NAPHTHALENE,SOIL(MG/KG)	99696	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
NITROBENZENE,SOIL(MG/KG)	99485	<1.0	<1.0	<1.0	<1.0	NA	NA	NA	<1.0	<1.0
N-MEHTYLAMINE,SOIL(MG/KG)	99486	<3.0	<3.0	<3.0	<3.0	NA	NA	NA	<3.0	<3.0
N-PROPYLAMINE,SOIL(MG/KG)	99487	<4.0	<4.0	<4.0	<4.0	NA	NA	NA	<4.0	<4.0
N-SODIPHENYLAMINE,SOIL(MG/KG)	99488	<1	<1	<1	<1	NA	NA	NA	<1	<1
PHENATHRENE,SOIL(MG/KG)	99489	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
PYRENE,SOIL(MG/KG)	99490	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
2,3,7,8-TCDD,SOIL(MG/KG)	99491	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<0.4	<0.4
1,2,4-TRICHLOROBENZENE,SOIL(MG	99492	<1	<1	<1	<1	NA	NA	NA	<1	<1
3-NITROTOLVENE,SOIL(MG/KG)	99679	<3.0	<3.0	<3.0	<3.0	NA	NA	NA	<3.0	<3.0
3,5-DINITROANILINE,SOIL (MG/KG	99688	<3.0	<3.0	<3.0	<3.0	NA	NA	NA	<3.0	<3.0
2,AMINO-4,6-DNT,SOIL (MG/KG)	99687	<4.0	<4.0	<4.0	<4.0	NA	NA	NA	<4.0	<4.0
ALDRIN,SED(UG/KG)	39333	NA	NA	NA	<0.7	NA	NA	NA	<0.7	NA

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSO MAP# 697

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW19 84600	FW20 84601	FW21 84602	FW32 84603	FW33-1 84607	FW33-2 84608	FW34 84606	FW00SO 84615	FW04 84604
DATE		1/25/81	1/25/81	1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0
A-BHC,SED(UG/KG)	99681	NA	NA	NA	<1.0	NA	NA	NA	<1.0	NA
B-BHC,SED(UG/KG)	99680	NA	NA	NA	<2.0	NA	NA	NA	<2.0	NA
D-BHC,SED(UG/KG)	34262	NA	NA	NA	<5.00	NA	NA	NA	7.00	NA
LINDANE,SED(UG/KG)	39783	NA	NA	NA	<2.0	NA	NA	NA	<2.0	NA
CHLORDANE,SED(UG/KG)	39351	NA	NA	NA	<20	NA	NA	NA	<20	NA
DDD,SED(UG/KG)	39311	NA	NA	NA	<6.0	NA	NA	NA	<6.0	NA
DDE,SED(UG/KG)	39321	NA	NA	NA	<3.0	NA	NA	NA	<3.0	NA
DDT,SED(UG/KG)	39301	NA	NA	NA	<6.0	NA	NA	NA	<6.0	NA
DIELDRIN,SED(UG/KG)	39383	NA	NA	NA	<0.8	NA	NA	NA	<0.8	NA
A-ENDOSULFAN,SED(UG/KG)	34364	NA	NA	NA	<3.0	NA	NA	NA	<3.0	NA
B-ENDOSULFAN,SED(UG/KG)	34359	NA	NA	NA	<5.0	NA	NA	NA	<5.0	NA
ENDOSULFAN SULFATE,SED(UG/KG)	34354	NA	NA	NA	3.0	NA	NA	NA	<3.0	NA
ENDRIN,SED(UG/KG)	39393	NA	NA	NA	<0.7	NA	NA	NA	<0.7	NA
ENDRIN ALDEHYDE,SED(UG/KG)	34369	NA	NA	NA	<0.7	NA	NA	NA	<0.7	NA
HEPTACHLOR,SED(UG/KG)	39413	NA	NA	NA	<2.0	NA	NA	NA	<2.0	NA
HEPTACHLOR EPOXIDE,SED(UG/KG)	39423	NA	NA	NA	<3.0	NA	NA	NA	<3.0	NA
TOXAPHENE,SED(UG/KG)	39403	NA	NA	NA	<50	NA	NA	NA	<50	NA
PCB-1016,SOIL(UG/KG)	99693	NA	NA	NA	30	NA	NA	NA	20	NA
PCB-1260,SOIL(UG/KG)	99694	NA	NA	NA	<20	NA	NA	NA	<20	NA
2,4,6 TNT,SOIL(UG/KG)	99567	663	4940000	5030	<194	<194	<194	<194	<194	<194

ENVIRONMENTAL SCIENCE & ENGINEERING 06/29/81 COMPUTER ANALYSIS REPORT WINSD MAF# 697

PROJECT NUMBER 80606223 PROJECT NAME WINGATE DEPOT

PROJECT MANAGER JOHN MOUSA FIELD GROUP LEADER

PARAMETERS	STORET #	FW19 84600	FW20 84601	FW21 84602	FW32 84603	FW33-1 84607	FW33-2 84608	FW34 84606	FWOOSO 84615	FW04 84604
DATE		1/25/81	1/25/81	1/25/81	1/25/81	1/24/81	1/24/81	1/24/81	1/24/81	1/25/81
TIME		0	0	0	0	0	0	0	0	0
2,4-DNT,SOIL(UG/KG)	99568	<223	<22300	<223	<223	<223	<223	<223	<223	<223
2,6-DNT,SOIL(UG/KG)	99524	<419	<41900	<419	<419	<419	<419	<419	<419	<419
1,3,5-TNB,SOIL(UG/KG)	99570	<1080	<1080000	<1080	<1080	<1080	<1080	<1080	<1080	<1080
NITROBENZENE,SOIL(UG/KG)	99535	<1640	<164000	<1640	<1640	<1640	<1640	<1640	<1640	<1640
1,3-DNB,SOIL(UG/KG)	99571	<317	<31700	<317	<317	<317	<317	<317	<317	<317
PICRIC ACID,SOIL(MG/KG)	99678	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TETRYL,SOIL(UG/KG)	99573	<1500	<1500	<1500	<1500	NA	NA	NA	<1500	NA
RDX,SOIL(MG/KG)	99795	<2.88	<2.88	<2.88	<2.88	<2.88	<2.88	<2.88	<2.88	<2.88
WHITE PHOSPHORUS,SED,(MG/KG)	99799	<0.07	<0.07	<0.07	<0.07	NA	NA	NA	<0.07	NA
NO2+NO3-N,SED(MG/KG)	633	<3	58	<3	<3	<3	3	9	7	<3
T.PO4,SED(MG/KG-DRY)	668	307	496	72.7	147	195	213	310	NA	250
SO4,SED(MG/KG)	81612	<259	<259	<259	<259	<259	<259	<259	270	<259

APPENDIX D—SUPPORTING REPORTS AND DOCUMENTS

APPENDIX D

SUPPORTING REPORTS AND DOCUMENTS

The following reports were each submitted to USATHAMA by ESE in partial fulfillment of Contract DAAK 11-80-C-0096 for the Ft. Wingate Depot Activity (FWDA).

1. Volume 1: Detailed Sampling and Analysis Plan
   10 November 1980

   This plan defined and integrated the tasks required to conduct an Environmental Survey of FWDA by ESE. The objective of the Environmental Survey was to determine if hazardous materials from past depot activities were migrating beyond depot boundaries or threatening groundwater supplies.

2. Volume 2: Data Management Plan
   10 November 1980

   This plan described the integration of the ESE and the Installation Restoration Data Management System (IR-DMS) and the data acquisition and control activities associated with sample collection, laboratory analysis, quality control, and data reduction.

3. Volume 3: Quality Control Plan
   10 November 1980

   This plan described Project Quality Control required for sampling and analysis in this Environmental Survey. The specific objectives of the plan were to describe in detail the process for controlling the validity of the data generated in the sampling and analysis effort, the methods and criteria for detection of out-of-control situations, what steps would be taken to provide timely corrective action, and how such actions would be reported and documented. This plan also supported the Data Management Plan.

4. Volume 4: Accident Prevention Safety Program
   10 November 1980

   The primary purposes of this program were to ensure the personal safety of all ESE personnel and persons retained by ESE who were involved in the project and to prevent any activities which might create adverse environmental impact. The secondary purpose was to monitor the labeling, shipping, and control of hazardous or potentially hazardous samples.

5. Technical Report Quality Control Part I
8 December 1980

This document presented the analytical methods and corresponding certification data for analyses to be conducted in the exploratory phase of the Environmental Survey.

6. Technical Report Quality Control Part I (Supplement 1)
16 December 1980

This document presented three additional analytical methods and corresponding certification data for analyses to be conducted in the exploratory phase of the Environmental Survey.

7. Letter to Contract Officer's Representative (COR) Dr. Robert York
from Jack Sosebee 24 December 1980

This letter included three attachments:

1. Responses to USATHAMA comments on the Quality Control Plans for both FWDA and NDA,
2. Responses to USATHAMA comments on the NDA Detailed Sampling and Analysis Plan, and
3. Responses to USATHAMA comments on the FWDA Detailed Sampling and Analysis Plan.

8. Well logs submitted to COR in November 1980.