RCRA FACILITY INVESTIGATION WORK PLAN FOR SOLID WASTE MANAGEMENT UNIT 62 NAS FORT WORTH TX

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CARSWELL AIR FORCE BASE

RCRA FACILITY INVESTIGATION (RFI) WORK PLAN

for

SOLID WASTE MANAGEMENT UNIT (SWMU) NO. 62

PREPARED BY:

U.S. ARMY CORPS OF ENGINEERS
Fort Worth District

AUGUST 1994

PREPARED FOR:

AIR FORCE BASE CONVERSION AGENCY
OPERATING LOCATION H
TEXAS

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1.0 Introduction.

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan is intended to define the framework for the verification and characterization of suspected hazardous waste releases to the environment at Carswell Air Force Base (CAFB) Solid Waste Management Unit (SWMU) No. 62, which encompasses the area commonly known as Landfill 6. During the past, Landfill 6 has been used as a gravel pit and as a burial site for construction debris and possibly for the disposal of hazardous wastes generated from base activities. In order to determine whether corrective measures are warranted, the specific activities required to verify and characterize releases to the environment from hazardous materials interred at SWMU No. 62 are presented in this RFI Work Plan.

2.0 Description of Current Conditions.

Carswell Air Force Base (CAFB) is located in Tarrant County, 6 miles west of downtown Fort Worth, Texas. The installation is bordered to the north by Lake Worth, to the east and southeast by the West Fork of the Trinity River and the community of Westworth Village, to the south and southwest by the community of White Settlement, and to the west by Air Force Plant 4 (AFP4). The location of CAFB is shown on Figure 1. Solid Waste Management Unit No. 62 is located in the south-central section of CAFB immediately northeast of the installation's golf course, approximately 1.4 miles due south of Lake Worth and approximately 0.6 miles due west of the West Fork of the Trinity River. The location of SWMU No. 62 is shown on Figure 2. The SWMU containing Landfill 6 was originally defined to be an area approximately 1 acre in size

located between the golf course and the flightline perimeter road and was thought to be the previous location of a gravel pit. Due to the visible presence of fill material and debris of an uncertain nature outside the perimeter of the original SWMU, the decision was made by the Air Force Base Conversion Agency (AFBCA) in late 1993 to enlarge the boundaries of the SWMU, which is now defined as the triangular-shaped area bordered on the southwest by Roaring Springs Road, on the east by Haile Drive, and on the north by Hobby Shop Drive (Figure 3). For the purposes of this RFI, SWMU No. 62 is considered to encompass the entire area bordered by these three roads, extending to the interior edge of pavement for each roadway. Photographs illustrating the current conditions at SWMU No. 62 are located in Appendix A.

The area north and northeast of the site contains facilities used for industrial aircraft support and maintenance operations, including an extensive hydrant fueling system which is currently inactive and scheduled for removal. The facility golf course and some base housing border the southern boundaries of the site across Roaring Springs Road and Haile Drive. Generally, the areas north of the site are used for support and maintenance of military aircraft while the areas south of the site are used for recreation and housing for base personnel. Traffic and usage in the areas surrounding the site are substantially reduced now that CAFB is no longer an active Strategic Air Command (SAC) base.

Most of the information concerning Landfill 6 and SWMU No. 62 has been obtained from the Installation Restoration Program (IRP) Records Search for CAFB performed by CH2M Hill in 1984 and a Corps of Engineers (COE) field investigation

conducted in 1993. No other field investigations specifically focused on SWMU No. 62 have been performed; however, previous investigations of trichloroethene (TCE) groundwater contamination at CAFB, possibly originating from AFP4, have shown SWMU No. 62 to be located in an area of elevated groundwater TCE concentrations.

Landfill 6 was operated from about 1975 until 1978. The site was originally a gravel pit used for base construction activities. After the gravel had been removed, the site was used for the burial of construction rubble, trees, and miscellaneous trash. Several drums of hydraulic fluid were reportedly buried in a centrally located pit used for the collection of groundwater. The locations and depths of buried drums are not known at the present time. The gravel pit is believed to be located in the relatively small (approximately one acre) area bordered by a chain link fence in the north central portion of SWMU No. 62. The presence of a gravel pit on an active military base prior to enactment of most major federal legislation regarding the disposal of hazardous wastes suggests that the pit could have been used as a convenient interment point for wastes from construction, operations, and aircraft maintenance and repair activities across the base. Due to the presence of fill material and unclassified types of debris beyond the gravel pit boundaries, the limits of SWMU No. 62 were increased to encompass the entire area between Roaring Springs Road, Haile Drive, and the flightline fence. For purposes of clarity, SWMU No. 62 will be used in this RFI Work Plan to reference the entire area bordered by the two roads and the flightline fence mentioned previously. Landfill 6 will be used to specifically reference the area of the

original gravel pit now surrounded by a chain link fence in the north central portion of SWMU No. 62.

The ground surface of SWMU No. 62 is mildly sloping and covered with grasses over most of the area, although there are patches of gravel and asphalt parking areas on the site. A large mound exists at the southwest corner of the fenced Landfill 6 area (see Figure 3 and Photo 5). The mound rises several feet above the surrounding terrain with the crest immediately adjacent to, but outside of, the Landfill 6 fence. The mound is covered with grasses and vegetation with the slopes of the mound extending into the Landfill 6 area. Due to the proximity of the mound to the landfill area and the uniqueness of the mound when compared with the rest of the SWMU, it is possible that the mound represents a waste burial site. A large soil stockpile, covered in plastic, also resides at the SWMU near the northwest corner of the site and is shown in Figure 3 and Photo 2. The stockpile is the result of recent petroleum storage tank (PST) excavations at CAFB and is scheduled for removal from SWMU No. 62.

Buildings 243 and 244 are located in the southeast portion of the site and have been used as a residence and storage shed, respectively. Building 243 was constructed in 1947 and Building 244 was constructed in 1954. The buildings were last occupied in 1993. Also located on the site, immediately east of Landfill 6, are Buildings 1021 and 1026. These buildings are actually sheet-metal covers for aboveground oxygen and nitrogen tanks and the attendant appurtenances. The tanks and ancillary structures have been in place since the 1964. Chain link fences are

located on the site and limit access to the gravel pit area and the tank area. The surface of Landfill 6 has been used as a private vehicle parking compound and was designated as Facility 1025 in 1990. Several utilities are located on the site, including electric power lines, underground water lines, and underground natural gas lines.

In addition to the buildings located on the site, a number of structures are located near SWMU No. 62. The following paragraphs summarize the historical use of structures located within 500 feet of the SWMU boundaries. The location of each structure is shown on the SWMU site drawing, Figure 3. Due to base realignment, many of the facilities and structures are currently not used, or are used infrequently. Future use of the facilities and structures is undefined at present.

Several unoccupied buildings used for base housing are located east-southeast of the site.

Building 237 is a residence constructed in 1947 and is located on the golf course southwest of the site across Roaring Springs Road. The building is currently unoccupied.

Buildings 240 and 241 were constructed in 1956 and are part of a military working dog compound located south of SWMU No. 62 across Roaring Springs Road. The area is currently inactive.

Building 247 is a residence located on Haile Drive east of SWMU No. 62. The building was constructed in 1954 and is currently unoccupied.

Building 248 is a garage and storage facility for the Building 247 residence and was also built in 1954.

Building 1000 was constructed in 1975 and houses communications receivers/transmitters. The building is located northwest of the site.

Building 1002 is a water pump station located west-northwest of the site and was constructed in 1984.

Building 1015 is an engine test cell facility for support of engine inspection and repair. The building was constructed in 1968 and is located near the northwest corner of the site.

Building 1020 is a security checkpoint at the flightline perimeter fence on Haile Drive and was constructed in 1951. Building 1020 is currently not active and is boarded up.

Building 1022 is an engineering and materials testing lab constructed in 1988. Building 1022 is located northeast of the site.

Building 1027 is a corrosion control facility located north of the site and was built in 1986.

Building 1039 is an elevated water storage tank constructed in 1955. The water tank is located northeast of the site.

Building 1040 was also constructed in 1955 and is a water pumping station which boosts domestic water system pressure and flow to meet fire protection flow requirements.

Building 1050 is an aircraft maintenance hangar located north-northeast of the site. The hangar was constructed in 1955.

Building 1054 is a miscellaneous outdoor recreational facility constructed in 1989 and located northeast of the site.

Building 1055 is located northeast of the site and is an avionics maintenance shop constructed in 1956.

Building 1101 was constructed in 1971 and is the petroleum operations building which is a centralized facility for handling all base functions related to the use of petroleum products. The building includes a lab, ready room, and administrative offices. The building is located east-northeast of SWMU No. 62.

3.0 RFI Strategy.

The primary objective of the RFI is to identify contaminants, verify and characterize releases to the environment, and determine the extent of contamination from hazardous materials resident at SWMU No. 62 in such a manner that corrective measures can be identified and selected. A secondary objective is to verify or

eliminate SWMU No. 62 as a contributing source to the TCE plume which occurs in the CAFB and AFP4 areas. To achieve these goals, sufficient information about the contaminants and the environmental context at the SWMU must be obtained. The following paragraphs outline the general strategy to be employed for the generation and collection of the necessary information.

3.1 Environmental Setting.

3.1.1 Regional Geology and Hydrogeology.

The regional stratigraphic, structural, and hydrogeologic information presented in this section was compiled from several previous and ongoing environmental investigations at AFP4 and CAFB.

3.1.1.1 Soils.

The U.S. Department of Agriculture Soil Conservation Service has identified four soil associations at CAFB. The soils are described in Table 1, and their occurrences on base are shown on Figure 4. The surficial soils of the installation area are primarily nearly level to gently sloping clayey soils of the Sanger-Purves-Slidell and Aledo-Bolar-Sanger Associations. In addition to the above, the clayey soil of the Frio-Trinity Association and the loamy soil of the Bastsil-Silawa Association occur on the floodplain and stream terraces of the West Fork of the Trinity River.

3.1.1.2 Stratigraphy.

Carswell AFB is situated on a sedimentary sequence of Cretaceous age geologic units unconformably overlying tightly cemented undifferentiated Paleozoic

rocks 6,000 to 7,000 feet thick. This sequence is illustrated on Figure 6. Descriptions and properties of the geologic units are summarized in Table 2.

The basal unit of this Cretaceous age sequence of rocks is the Twin Mountains Formation, formerly known as the Travis Peak Formation. The Twin Mountains Formation grades upward from a basal conglomerate of chert and quartz to a fine- to coarse-grained sand interbedded with shale and clay. The Twin Mountains Formation is not exposed in Tarrant County. It is approximately 250 feet thick at Lake Worth and is encountered at approximately 550 feet below ground surface.

The Twin Mountains Formation is overlain by the Glen Rose Formation. The Glen Rose Formation consists of limestone with some sand, clay, sandy clay, and anhydrite. Reported thickness of the Glen Rose Formation in the area of Lake Worth is 250 feet. Depths at which the Glen Rose Formation has been encountered range from 130 to 1,050 feet below the ground surface in Tarrant County.

The Paluxy Formation conformably overlies the Glen Rose Formation. It crops out over large areas northwest of Fort Worth and forms the bed of Lake Worth. The Paluxy Formation consists primarily of fine- to coarse-grained quartz sandstone varying from almost uncemented sand to moderately cemented sand interbedded with varying thicknesses of shale and clay. The average thickness of the Paluxy Formation in Tarrant County is approximately 160 feet.

Unconformably overlying the Paluxy Formation is the Walnut Formation, the basal unit of the Fredericksburg Group. This formation consists of a shell agglomerate limestone containing varying thicknesses of interbedded clay and shale.

Above the Walnut Formation is the Goodland Formation, also of the Fredericksburg Group. The Goodland Formation is a chalky-white, fossiliferous limestone containing a few thin shale beds. The formation is extensively fractured and weathered. Its thickness increases southward, ranging from 70 to 130 feet in Tarrant County.

Unconformably overlying the Goodland Formation is overburden consisting predominantly of alluvium deposited by the Trinity River. The alluvium is composed of gravel, sand, silt, and clay of varying thicknesses and lateral extents.

3.1.1.3 Major Structural Features.

Carswell AFB is located on the relatively stable Texas craton, west of the faults associated with the Ouachita Structural Belt. No major faults or fracture zones have been mapped on or near the base. The Cretaceous sequence of stratigraphic units occurring in the area of northwestern Tarrant County forms a broad homocline which dips gently southeastward toward the East Texas structural basin at a rate of 35 to 40 feet per mile. The Cretaceous sequence is wedge-shaped in cross section and increases in thickness down-dip from the outcrop areas.

3.1.1.4 Aquifer Characteristics.

The geologic units of northwestern Tarrant County can be divided based on their water-bearing properties into three water-bearing units separated by two aquitards. These hydrogeologic units are illustrated on Figure 6.

The lowermost water-bearing unit and major water supply in Tarrant County for both municipal and industrial purposes is the Twin Mountains Formation. Recharge of

this aquifer occurs west of CAFB where it crops out. Water movement is eastward in the down-dip direction. Under natural conditions, groundwater in the Twin Mountains Formation is confined; however, extensive pumping of the Twin Mountains in the Fort Worth area has lowered the potentiometric surface below the top of the formation, resulting in unconfined conditions in the vicinity of CAFB. Groundwater becomes confined as it moves further down dip. Transmissivities average 8,450 gpd/ft and permeabilities average 68 gpd/ft^2 in Tarrant County.

The fine-grained limestone, shale, marl, and sandstone beds of the Glen Rose Formation together act as a relatively impermeable aquitard restricting water movement between the Twin Mountains aquifer and the overlying Paluxy aquifer. The Paluxy aquifer is the most shallow aquifer underlying northwestern Tarrant County. It is an important source of potable groundwater in the Fort Worth area and to the community of White Settlement southwest of CAFB. Groundwater in the Paluxy occurs under water table conditions in its recharge area, then becomes confined as it moves eastward down dip. However, extensive pumping of the Paluxy in the area of CAFB has lowered the potentiometric surface below the top of the formation, resulting in unconfined conditions occurring beneath the base.

Recharge to the Paluxy aquifer occurs where the formation crops out west of CAFB and north of CAFB in the bed of Lake Worth. The lake is a significant recharge point for the aquifer and creates a potentiometric high in that area. Transmissivities in the Paluxy aquifer range from 1,263 to 13,808 gpd/ft, and average 3,700 gpd/ft. Permeabilities range from 13 to 140 gpd/ft^2, with an average well yield of 100 gpm.

Most wells completed in the Paluxy are completed in the lower coarser-grained section of the formation.

As a result of its extensive use as a water supply, water levels in the Paluxy aquifer have declined significantly over the years. However, because CAFB does not tap the Paluxy for a water supply, and because the installation is adjacent to the Lake Worth recharge area, the decline in the water level is not as significant in the vicinity of the installation.

The Paluxy aquifer is separated from the uppermost water-bearing zones by the low permeability limestones and shales of the Goodland and Walnut Formations. The aquitard is composed of moist clay and shale layers interbedded with dry limestone beds. The thickness of the Goodland/Walnut aquitard is approximately 25 feet or greater beneath most of CAFB; however, the top of this unit is an erosional surface, possibly reducing the thickness in some areas. If eroded completely, the absence of this aquitard allows overlying perched groundwater to come in contact with the Paluxy aquifer. This condition occurs west of CAFB in the east parking area of AFP4; it is not known to occur within the limits of CAFB.

The uppermost water-bearing unit in northwestern Tarrant County is groundwater occurring in the coarse sand and gravel alluvial deposits of the Trinity River, often referred to as the Upper Zone. These deposits are usually limited in areal extent and are isolated by surrounding low-permeability clays and silts. Recharge occurs locally from rainfall and infiltration from stream channels and drainage ditches. Groundwater flow in the Upper Zone is typically eastward across CAFB towards the

West Fork of the Trinity River. Groundwater occurring close to the Trinity River is sometimes developed for irrigation and residential use, but in most cases it is not economical for development because of the limited distribution of alluvium and its susceptibility to surface and storm water pollution.

3.1.1.5 Climatology/Air.

Carswell AFB is located near 33° north latitude in north central Texas. The climate is humid subtropical with hot summers and dry winters. Tropical maritime air masses control the weather during much of the year; however, the passage of polar cold fronts and continental air masses create large variations in winter temperatures. Meteorological data summarizing the period 1946 through 1978 are presented in Table 3 and are discussed briefly below.

The average annual temperature for CAFB is 66°F and monthly mean temperatures vary from 45°F in January to 86°F in July. The average daily minimum temperature in January is 35°F and the lowest recorded temperature is 2°F. The average daily maximum temperature in July and August is 95°F and the highest temperature recorded at the base was 111°F in the month of June. On the average, freezing temperatures occur at CAFB on 33 days per year.

Mean annual precipitation recorded at CAFB is 32 inches. The wettest month is May with a secondary maximum in September. The period from November to March is generally dry with a secondary minimum in August. Snowfall accounts for a small percentage of the total precipitation between November and March. On the average, measurable snowfall occurs on 2 days per year. Lake evaporation at CAFB

is estimated to be approximately 57 inches per year. Evapotranspiration over land areas may be greater or less than lake evaporation depending on vegetative cover type and moisture availability. Average net precipitation is expected to be equal to the difference between average total precipitation and average lake evaporation or approximately minus 25 inches per year.

Thunderstorm activity occurs at CAFB an average of 45 days per year. The greatest number of these storms occurs between April and June. Hail may fall on 2 to 3 days per year, and the maximum precipitation recorded in a 24-hour period is 5.9 inches.

Mean cloud cover averages 50 percent at CAFB with clear weather occurring frequently during all months. Some fog is present on an average of 83 days per year. Wind speed averages 7 knots; however, a maximum of 80 knots has been recorded. Wind direction is predominantly from the south during all months.

3.1.2 Site-Specific Geology and Hydrogeology.

3.1.2.1 Stratigraphy.

Stratigraphic and groundwater information at SWMU No. 62 relies primarily on a COE investigation of the Landfill 6 area in early 1993, supplemented by data from a CAFB TCE investigation performed during the summer of 1993. The Landfill 6 investigation consisted of five soil borings taken at the locations shown on Figure 7. Each boring was drilled to a depth where groundwater was encountered. Borings drilled outside of the borders of the former gravel pit generally indicated clays and gravel overlying limestone or shale. The clays were of low to high plasticity, stiff to

very stiff, and were encountered from the surface or near the surface and extended from 4.7 feet to 15 feet below grade. The gravels were coarse to fine, moist, with clays and sand mixed in, and were found from 4.7 down to 18 feet below grade. Underlying the gravels were weathered limestone and shale. Borings drilled inside the borders of the former gravel pit, LF06-3 and LF06-4, identified gravel and clay fill containing concrete, asphalt, cinders, bricks, and mulch debris from the surface to a depth of 14.1 feet to 19.5 feet below grade. Clay and gravel were found below the fill material. Caving gravel presented sample collection problems from the boring locations within the Landfill 6 perimeter. Boring logs from the COE investigation can be found in Appendix B.

Data from the TCE investigation were collected using a dual cone penetrometer. Cone penetrometer plots from the TCE investigation are presented in Appendix C. Stratigraphic data from the TCE sampling points in SWMU No. 62 or near the perimeter generally agree with the boring data.

3.1.2.2 Uppermost Water-Bearing Zone Characteristics.

Groundwater at the site occurs within alluvial deposits under generally unconfined conditions. This hydrogeologic unit is locally termed the Upper Zone and is not tapped as a water supply on CAFB. Groundwater was encountered during the COE investigation at depths of 10 to 19.5 feet below grade. The TCE investigation recorded depths to groundwater of 11.3 to 20.63 feet below grade in the vicinity of SWMU No. 62. Data from the TCE investigation indicated groundwater flow in the area was generally east-southeast. Groundwater contours based on the Phase II TCE

data are depicted on Figure 8. It is possible that groundwater from SWMU No. 62 discharges to Farmers Branch south of the SWMU.

3.1.2.3 Surface Water.

Carswell AFB is located within the Trinity River Basin just south of Lake Worth, a man-made reservoir on that river. Most of the CAFB surface drainage is intercepted by a series of storm drains and culverts, is directed to oil/water separators, and is discharged to the West Fork of the Trinity River downstream of Lake Worth. A small portion of the north end of the base drains into Lake Worth. Part of the base is drained by Farmers Branch which discharges into the West Fork Trinity River just south of the cantonment area. Farmers Branch begins within the community of White Settlement and flows eastward, south of SWMU No. 62, approaching to within approximately 400 feet of the site. Surface elevations at SWMU No. 62 range from approximately 609 feet above mean sea level (msl) along the northern boundary of the site to approximately 583 feet msl near the intersection of Roaring Springs Road and Haile Drive at the southern apex of the site. The gradient suggests that runoff from SWMU No. 62 collects in Farmers Branch and is subsequently carried to the West Fork of the Trinity River. Farmers Branch and its unnamed tributaries are believed to be points of groundwater discharge. Surface water flow paths for SWMU No. 62 are illustrated on Figure 3.

3.1.3 Soil and Water Quality Information.

Information regarding soil and water quality for this area of CAFB has been generated predominantly from the COE investigation at Landfill 6 and the groundwater

investigation, both Phase I and Phase II, of a TCE groundwater contaminant plume originating from AFP4 west of CAFB and extending eastward in the downgradient direction for an unknown distance under CAFB. The contamination occurs within the uppermost water-bearing zone beneath CAFB.

Soil samples collected during the COE investigation of Landfill 6 were tested for benzene, toluene, ethyl benzene, and total xylenes (BTEX); total recoverable petroleum hydrocarbons (TRPH); and total halogens (TOX). One sample from each boring was also analyzed for lead toxicity characteristic leaching potential (TCLP) and benzene TCLP. Sample results are summarized in Table 4. TRPH was detected within the Landfill 6 perimeter in borings LF06-3 and LF06-4 with a maximum concentration of 5160 mg/kg in LF06-3 at 7.5 - 8.0 feet below grade. Toluene was detected in borings LF06-3 and LF06-4 with a maximum concentration of 0.006 mg/kg in LF06-4 at 4.0 - 4.5 feet below grade. Xylenes were also found in LF06-3 and LF06-4 with a maximum concentration of 0.0042 mg/kg in LF06-3 at 15.0 - 15.5 feet below grade. Interestingly, the boring selected for background sampling, LF06-1, located on the golf course southwest of the site near Roaring Springs Road, also showed evidence of TRPH soil contamination with concentrations of 23 - 40 mg/kg at 1.0 - 9.5 feet below the surface. The remaining soil samples showed no evidence of contamination from the analytes tested. Soil samples were not collected as part of the TCE investigation.

During the COE investigation at Landfill 6, caving gravel problems prevented collection of groundwater samples at several locations. Groundwater samples were

collected from borings LF06-1, LF06-2, and LF06-4 and were analyzed for BTEX, TRPH, total dissolved solids (TDS), and lead. Results from the groundwater analyses are presented in Table 5. From the analyses, lead was found in boring LF06-2, near the Landfill 6 perimeter, at 0.068 mg/l. The background sample, boring LF06-1, exhibited TRPH at 0.3 mg/l and lead at 0.361 mg/l. Total dissolved solids (TDS) ranged from 356 mg/l (LF06-1) to 736 mg/l (LF06-4).

The TCE investigation utilized EPA methods 8010 during Phase I and 8021 during Phase II to test groundwater at CAFB for BTEX, TCE, and TCE degradation products. Sample locations for Phase I and Phase II of the TCE investigation are presented on Figures 9 and 10, respectively. Summaries of the corresponding groundwater analytical results for Phase I and Phase II samples taken within 500 feet of the SWMU No. 62 perimeter can be found in Tables 6 and 7, respectively. Groundwater contaminants found during the Phase I and Phase II investigations consisted of trichloroethene (TCE), dichloroethene (DCE), tetrachlroethene (PCE), and dichloropentene (DCP). The Phase I TCE data ranges from 12000 µg/l near the western edge of the SWMU (location 060) to non-detection near the eastern edge (locations 077 and 088). The elevated TCE concentrations at or near SWMU No. 62 could indicate that TCE release sources are present in the SWMU. Isoconcentration lines extrapolated and drawn from the Phase II TCE investigation data, shown on Figure 10, indicate that TCE is present in the groundwater at SWMU No. 62 at concentrations of approximately 400 µg/l at the westernmost edges of the SWMU near the intersection of Roaring Springs Road and Hobby Shop Road to approximately 20

µg/l in the east and south portions of the SWMU. The isoconcentration lines were drawn using distribution data for positive values of TCE and the TCE degradation products 1,2-DCE, both cis- and trans- forms. There was no BTEX detected within the vicinity of SWMU No. 62.

3.2 Contaminant Source Characterization.

The first task in executing the SWMU No. 62 RFI will focus on characterization of contaminant sources at the site. The primary suspected source of contaminants at SWMU No. 62 are the materials which have possibly been interred in the Landfill 6 gravel pit and in the fill material covering much of the SWMU's surface. The relative ease of access to SWMU No. 62 suggests that wastes from operations, maintenance, repair, and construction/demolition activities across the base could have been dumped and buried at the SWMU.

There is no specific information regarding the quantities or locations of hazardous wastes buried in Landfill 6 or in the remainder of SWMU No. 62. In an initial effort to determine if drums are present at SWMU No. 62 and to identify their number and specific location, a magnetometer survey will be performed. The survey will not be limited to the Landfill 6 area, but will encompass the entire surface area of the SWMU bordered by Hobby Shop Drive, Haile Drive, and Roaring Springs Road. In addition to locating any large, metallic contaminant sources such as buried drums, the magnetometer survey can help define the limits of fill areas within the SWMU. The survey will utilize an EM-31 unit or equivalent, capable of detecting magnetic anomalies to a depth of approximately 15 feet. Results of the survey will be marked

on a 1-foot contour topographic map of the SWMU accurate to within 0.1 feet. The survey data will be evaluated by personnel experienced in the interpretation of magnetometer data in order to differentiate between magnetic anomalies caused by normal interferences such as pipelines, fences, or power lines and those caused by buried drums.

Results of the magnetometer survey will be used to tailor the release characterization efforts to obtain the best possible information regarding subsurface contaminants at SWMU No. 62. Since contamination at the SWMU could have occurred in a number of different ways such as open dumping/pouring, burial in non-metallic containers, or burial in containers too small for detection, inconclusive magnetometer results cannot be interpreted as indicating that contaminants are absent from the SWMU. Instead, the RFI will assume that unknown contaminants are present and will proceed with release characterization.

3.3 Release Characterization.

After obtaining the results of the magnetometer survey, monitoring and data collection will be initiated to characterize any release to the environment which has occurred at SWMU No. 62. Although results of the magnetometer survey may affect the final configuration of the monitoring plan, the following paragraphs describe the general approach to monitoring and data collection anticipated at SWMU No. 62.

Since the suspected contaminant sources at SWMU No. 62 are buried materials, airborne releases are not considered to be a factor in the RFI; therefore, the work plan will focus on characterizing releases to subsurface media. In order to

quantify the local subsurface conditions, lithologic and hydrogeologic assessments will be performed.

The purpose of the lithologic and hydrogeologic assessments is to develop a complete understanding of the groundwater system on- and off-base by integrating the available data from earlier investigations and by conducting additional field studies to fill data gaps or provide additional detail where necessary. Specific purposes of this evaluation include: developing a better understanding of on- and off-base groundwater flow; relationships between saturated zones; extent and migration of contamination plumes; and seasonal changes in water levels and flow. Results of this study will form the framework for the evaluation of groundwater affects, risk assessment, and identification of remedial action alternatives. The information developed in the detailed site characterization of individual contamination areas will form an integral part of the data used in this task. The assessments will draw on the results of all previous groundwater investigations conducted at CAFB. In addition to those sources, previous studies will be updated with any regional and area studies by federal, state, and local agencies and other published and unpublished information will be used.

Although the surface area of SWMU No. 62 has been increased from the original Landfill 6 area to encompass the entire site bordered by the three roads, the landfill remains the most likely source of hazardous wastes within the SWMU. In order to better characterize the Landfill 6 subsurface, four soil borings will be drilled at the locations indicated on Figure 11. Three of the boreholes, SB-1, SB-2, and SB-3,

will be positioned along a north-south orientation within the Landfill 6 perimeter and will be used to characterize the contents of the landfill and to generate a profile of the Landfill 6 excavation and backfill. A relatively shallow boring at SB-4, outside of the Landfill 6 fence, will be used to investigate the mound located near the southwest corner of the landfill and to eliminate or verify it as a contaminant source. From the borings, data regarding hazardous waste constituents, depth to groundwater, depth of fill, and physical composition of the subsurface will be collected to supplement data obtained in previous investigations. The boreholes will provide valuable geologic and chemical data of subsurface conditions in order to define the lateral and vertical extent of releases to the environment.

The three boreholes within the Landfill 6 fence (SB-1,SB-2, and SB-3) will be drilled through any fill material to approximately 2 feet below the point where undisturbed gravel is encountered or until bedrock is reached, whichever occurs first. Using this criteria, the borings are expected to range from approximately 17 feet to 22 feet below ground surface. Boring SB-4 is intended to explore the contents of the mound located near the southwest corner of Landfill 6 and identify potential hazardous wastes buried beneath the mound. Accordingly, SB-4 will be drilled to a depth of approximately 10 feet below the crest of the mound. If fill material is encountered at a depth of 10 feet, the boring will be continued until undisturbed gravel or bedrock is encountered. All of the borings will be sampled continuously, collecting samples from each 5-foot interval. Samples will be collected from the worst-contaminated soil within the interval based on field screening with a photo-ionization detector (PID) or similar

instrument. If field screening is unable to identify a worst-case sample, the most representative sample within the 5-foot interval will be collected. Soil samples will be collected from each borehole using stainless steel or teflon equipment, removing enough soils from the desired sample location to fill the required containers. The volatile organic samples will be collected first with as little mixing and disturbance to the soil as possible. The remaining soil will be placed in a stainless steel bowl and thoroughly mixed with stainless steel instruments and divided among the sample containers. The necessary quality assurance (QA) and quality control (QC) samples will be the best possible duplication of the other samples. Sample preservation will be in accordance with the test methods used for parameter analysis. Each boring sample will be analyzed for the constituents listed in Appendix D.

During drilling of the boreholes, the geologic conditions encountered will be fully described and thorough field notes will be taken. The depth at which groundwater is encountered will be recorded. If possible, a groundwater grab sample will be collected for analysis of the Appendix D constituents from the borehole using a disposable bailer. Since the objective of the groundwater grab sample is to obtain an instantaneous representation of groundwater constituents present at the time of the boring, the groundwater sample will be collected as soon as the boring is completed. Borings SB-1, SB-2, and SB-3 will be temporarily kept open using a PVC or stainless steel casing and the water levels will be measured 24 hours later in order to determine water rise in the hole. After water level measurements are completed, or, for SB-4,

after sampling is completed, the casing will be removed and the hole will be pressure filled with cement from the bottom to the land surface.

All equipment used to drill the borehole and to collect samples will be decontaminated prior to initiating work at another location in order to prevent cross-contamination between boreholes and between samples. All wastes generated during construction of the boreholes will be drummed, labelled and dated, representatively sampled and tested for hazardous wastes, and appropriately disposed of.

Due to the relatively shallow depths to groundwater in the Upper Zone at CAFB and the depths at which landfilled material has been found in the Landfill 6 area, it is a good possibility that any releases from contaminant sources have migrated into groundwater at the site. Approximately seven monitor wells penetrating the Upper Zone will be drilled at SWMU No. 62 at the locations indicated on Figure 11. Three of the wells will be located near the downgradient edges of the SWMU to provide compliance monitoring for groundwater moving off-site. These three wells will be located in the best position to intercept possible releases from contaminant sources and to provide reliable hydrogeologic data about the area. Two background wells will be located upgradient from SWMU No. 62 and will provide soil and water quality data for subsurface media geographically near the SWMU but physically isolated from and unaffected by any contaminants which may be resident at SWMU No. 62. Obtaining reliable, high quality background soil and groundwater chemical data is critical in identifying contaminants originating from a source other than SWMU No. 62 and in determining SWMU No. 62's contribution to groundwater contaminants at CAFB.

Since Landfill 6 is the most suspect area for contaminant sources at SWMU No. 62, two monitor wells will be drilled near the landfill perimeter at downgradient locations most likely to intercept contaminants migrating from the landfill. These two monitor wells will serve to confirm or eliminate the eastern portion of the SWMU, the area between Landfill 6 and the three compliance monitor wells, as a contaminant source. In addition to providing initial information about releases to the environment and isolating the source, the two wells near the landfill, through regular and periodic sampling, can provide an "early warning system," alerting personnel to the migration of previously undetected contaminants.

Each monitor well will be drilled from the land surface until bedrock is encountered. No water or drilling mud will be used in the borings. Using the procedures described for the soil borings, soil samples will be collected from the unsaturated zone for each 5-foot interval within the well boring and analyzed for the constituents listed in Appendix D. Continuous soil sampling will be performed using field screening to identify the most contaminated soil within each 5-foot interval for subsequent sample collection. If field screening is unable to identify the most contaminated soil, a sample representative of the 5-foot interval will be selected. Detailed lithologic logs will be kept for each well noting any zones of higher or lesser permeability, changes in lithology, correlations between field screening results and particular lithologic zones, depth to groundwater, times of sampling and measurements, and any obvious areas of contaminant discoloration or odors. The field screening instrument readings and depths monitored will also be recorded.

Following the completion of well drilling, a 2-inch diameter monitor well will be installed based upon the well construction diagrams presented on Figures 12a and 12b. Prior to setting the well screen, the water level will be allowed to stabilize for at least 24 hours and water level measurements will be made. The well screen will then be set, with the screen extending from the bottom of the well to at least 2 feet above the highest expected water table, based upon the measured water table and nearby water level data from prior investigations. Well screens are anticipated to range from 10 - 15 feet in length. Each monitor well will be developed as soon as possible after completion. The wells will be developed by pumping or hand bailing until the water is clear and free of sediment. Careful field notes will be taken during each well installation and a State of Texas Well Report (Form ID No. WWD-012) will be prepared and submitted for each well.

Well screens and casings will be constructed of Schedule 80 poly-vinyl chloride (PVC) materials. The casing will be capped at the bottom and all connections will be flush jointed and threaded. To preserve the integrity of the groundwater samples, no glues, solvents, or thread compounds will be employed during construction and installation. To prevent infiltration or contamination between strata, each well will have a sand or gravel pack between the screen and boring wall extending above the top of the well screen, a bentonite seal above the sand pack, and cement grout above the bentonite to the land surface. Depending upon CAFB requirements, the wells may be completed either flush with the land surface or as an aboveground structure. Flush-mounted completion is unobtrusive, provides flexibility for land use, and protects the

well from vehicular traffic but is more difficult to label, can be hard to find, is more difficult to purge and sample, and is more easily corrupted with surface water. Protective structures will be installed aboveground to protect the well head. When not in use, the wells will be capped and locked to protect the well and prevent corruption of groundwater. Following completion, each well shall be surveyed for top of well casing, top of protective casing, and ground surface elevations and for location coordinates. The survey will provide elevations accurate to within 0.01 feet and locations accurate to within 1 foot.

Equipment used to install and develop each well and collect samples will be decontaminated prior to initiating installation of another well. All investigative-derived waste (IDW), including well cuttings, decontamination water, and development water, will be drummed, labelled and dated, representatively tested, and appropriately disposed of.

After development of the wells, slug tests will be performed to define aquifer characteristics such as hydraulic conductivity, the storage coefficient, transmissivity, and linear velocity. Before each sampling event, groundwater level measurements will be recorded for each well. Each well will be checked for free product. Prior to sampling, the wells will be purged by removing at least three wetted well casing volumes from the well. To minimize the possibility of cross-contamination, all sampling equipment which comes in contact with groundwater will be thoroughly decontaminated between wells. Additionally, the wells will be sampled sequentially from the well suspected of being the least contaminated to the well suspected of being

most contaminated. Groundwater temperature, Ph, dissolved oxygen (DO), and specific conductivity will be measured at the time of sampling for each well and, if possible, will be measured in situ. When collecting the samples, the containers designated for volatile organics analysis will be collected first, allowing no headspace, no bubbles, and with as little disturbance to the sample as possible. Preservatives will be added to the samples as required by the individual test methods, taking care not to overfill the containers.

In order to prevent cross-contamination, purging and sampling equipment will be either dedicated to an individual well, disposable, or thoroughly decontaminated prior to sampling another well. Wastewater generated during sampling and decontamination will be drummed, labelled with the well location and dated, and, based upon test results, appropriately disposed of.

All samples collected for analysis from SWMU No. 62, soil or water, will be handled, containerized, packaged, and transported in a manner compatible with the matrix, expected constituents, regulations, and analytical test methods employed. Generally, glass jars or plastic bottles will be used to collect the sample. The samples will then be bagged and placed on ice. The coolers containing the samples will be sealed and transported to the laboratory the day that the samples were taken. Labelling and manifesting of samples will be in accordance with all guidelines to ensure accurate sample identification, safety, and exchange of custody.

Since the contaminants at SWMU No. 62 could have originated from any location or any process on CAFB, soil and groundwater samples from the monitor

wells will be analyzed for total metals, volatile organics, semi-volatile organics, TRPH, and pesticides. The individual constituents to be analyzed are listed in Appendix D. The analysis list represents the range of wastes historically encountered at active military installations and is consistent with usage data for SWMU No. 62. The analytes listed in Appendix D form a substantial subset of the 40 CFR 264 Appendix IX list and constitute a broad spectrum of potential contaminants at the site. The initial Appendix D analyte list is a tool which will be used to focus the investigation and indicate whether additional parameters are required. Although TRPH was detected during prior investigations at Landfill 6, a specific analysis for TRPH is not going to be performed during this RFI. Instead, the investigation will search for hazardous components of TRPH which will be detected during analysis for volatile and semi-volatile organics. As the RFI progresses, the list of analytes may be modified and tailored to the actual conditions encountered.

In addition to the chemical analysis, certain geotechnical parameters will also be obtained for the site. Undisturbed soil samples will be collected from each soil boring and well boring for laboratory analysis to determine the following soil characteristics: bulk density; effective porosity; fraction organic carbon; intrinsic permeability; and volumetric water content. Sampling intervals for these physical parameters will be selected to best represent the materials through which contaminants could migrate. Based on information from prior investigations, it is expected that up to three samples per boring will be collected for the geotechnical

analysis - a sample from the clay stratum, a sample from the sand stratum, and a sample from the gravel stratum.

4.0 RFI Activity Schedule.

The following schedule shows the estimated time frame for execution of activities at SWMU No. 62 as part of the efforts described in this RFI Work Plan. Final approval of the RFI Work Plan is assumed to be the schedule start date. Activities, and therefore the schedule, may be adjusted or modified based upon information garnered during preceding activities.

Activity/Event	Date
Final approval of RFI work plan	Start date
Magnetometer survey	1 month from start date
Drill soil borings & sample	3 months from start date
Install monitor wells	5 months from start date
1st Groundwater sampling event	6 months from start date
2nd Groundwater sampling event	8 months from start date
3rd Groundwater sampling event	10 months from start date
Draft final RFI report	13 months from start date
Final RFI report	15 months from start date

5.0 QA/QC Procedures.

Data quality is a paramount requirement during RFI efforts. Procedures such as utilizing validated laboratories, precise sample documentation, and careful sample handling techniques will be implemented at SWMU No. 62 in order to ensure high sample data quality. Additionally, quality assurance and quality control (QA/QC) procedures will be employed during sampling events at SWMU No. 62 to guarantee the quality of the sampling effort and of the analytical data. Field sample replicates,

rinsate blanks, trip blanks, and background samples will be utilized to fulfill QA/QC objectives. Quality control samples will be used by the laboratory to identify and diagnose problems related to sampling and analysis. Quality assurance samples will be used to independently verify the performance of the primary laboratory. Rinsate blanks will identify decontamination and cross-contamination problems, and equipment blanks will confirm sample integrity during transportation. Quality assurance and quality control samples will be prepared as replicates of the same sample at a frequency of 1 QA and 1 QC sample for every 10 samples collected. Equipment blanks (rinsates) will be prepared prior to taking the QA/QC samples at a frequency of 1 equipment blank per 20 samples collected. Travel blanks will be prepared at the beginning of each day in which samples will be collected and sent off-site for analysis.

6.0 Data Management and Reporting.

The RFI has the potential to generate large amounts of hydrogeological and chemical data about SWMU No. 62. Computer software applications will be used to manage the collected data and convert it into a usable form. The software applications will therefore be required to support the following activities:

Archive, analyze, and manipulate physical, chemical, biological, and geological data collected.

Analyze data with respect to trends.

Produce subsets of data to form summary reports and data files which can be analyzed by environmental models and statistical algorithms.

Interpret relationships between contaminant migration and biogeochemical relationships existing at a particular site.

Results of the RFI will be provided in a final report prepared by CAFB and provided to Texas Natural Resource Conservation Commission (TNRCC). The report will integrate the important elements of all information obtained during the investigative efforts described in this work plan and the information derived from previous investigations relating to environmental conditions at SWMU No. 62. Generally, the report will contain a site map, or multiple maps if required for clarity, of the SWMU depicting surface contours, roads, utilities, structures, important physical features on or near SWMU No. 62, the Landfill 6 area, the location of all soil borings and monitor wells, geologic cross-sections, and the location of buried drums, if encountered. Also included in the report will be contours of the groundwater potentiometric surface and gradient direction; geologic cross-sections illustrating the near-surface stratigraphy; logs of all soil borings, well borings, and analyses results; well construction details and well reports; and isoconcentration contours and plume delineation of each groundwater contaminant at the SWMU. Report text will summarize all known information about the site, including historical usage and investigative results, and will draw objective conclusions based upon data obtained during the RFI and all previous investigations.

7.0 Identification of Potential Receptors.

The cities of Fort Worth, White Settlement, Westworth Village, and River Oaks surround CAFB. Fort Worth had a population of 469,500 based on a 1994 estimate by the North Central Texas Council of Governments (NCTCOG) and a population density of 1592 people per square mile. From the NCTCOG estimates, the satellite cities adjacent to CAFB have 1994 populations as follows:

White Settlement - 15,350
Westworth Village - 2350
River Oaks - 6600

The base is surrounded by residential, commercial, recreational, and industrial land. Residential land lies southwest, southeast and east of the base. Commercial property is south and recreational areas (Lake Worth and the West Fork of the Trinity River) are north and east of the base. Air Force Plant 4 is an industrial facility directly west of CAFB.

Land use within a 500-foot radius of SWMU No. 62 consists of military airfield support and maintenance operations north of the site, some base residential areas southeast of the site, and recreational use at the golf course southwest of the site.

The resident and work force population of CAFB has declined significantly in recent years due to deactivation of the facility as a SAC base. Although the base is not scheduled for closure, future plans for use of the base are currently not finalized. It is anticipated that the base will be utilized by several different government agencies and organizations, including the Air National Guard, Navy Air Reserve, and Marine Corps. As a result of the transition, future land use plans at or near SWMU No. 62 and work force population estimates are speculative.

There are no suspected contaminants at SWMU No. 62 which are believed to pose an airborne threat to normal foot traffic at the site or at the golf course and residential areas nearby.

The surface gradient at SWMU No. 62 generally extends from north to south. Two concrete pipes beneath Hobby Shop Drive transport surface water collected north

of the site onto SWMU No. 62. The surface water then flows generally south, collecting in ditches along both Roaring Springs Road and Haile Drive. Another concrete pipe located near the intersection of Roaring Springs Road and Haile Drive carries surface water from the site to a drainage ditch on the east side of Haile Drive. Surface waters are then routed to Farmers Branch approximately 600 feet southeast of the site. Water from Farmers Branch subsequently discharges into the West Fork of the Trinity River approximately 0.6 miles east of the site.

There are several subsurface utility lines crossing SWMU No. 62. A 16-inch water line parallels Hobby Shop Road along the north boundary of the SWMU. Several smaller water lines branch from the main line and traverse the SWMU to the south. One of the smaller lines, a 2-inch line, passes through the Landfill 6 area near its eastern edge, supplying water to Building 243, an enclosed building located on the site. Several natural gas lines also cross SWMU No. 62. Similar to the water lines, a 12-inch Lone Star Gas line crosses the site along the northern boundary parallel to Hobby Shop Road. Smaller branch lines cross the SWMU in a generally southern direction, and a 2-inch line passes near the eastern boundary of the Landfill 6 area, eventually servicing Building 243. Any of the subsurface utility lines could provide a conduit for vapor migration from contaminated soil at SWMU No. 62. The highest risk lines are estimated to be the water and gas lines passing through or near the Landfill 6 area and servicing Building 243. Vapor migrating along these utility lines would have to travel approximately 600 feet along the water line or 540 feet along the gas line to Building 243, which is the first human exposure point along the utility line route.

There are no records of fuel odors noted by any inhabitants or workers within this building to indicate that vapor migration along the utility lines has occurred.

According to previous investigations, the shallow Upper Zone of groundwater at SWMU No. 62 is contaminated, primarily with TCE and TCE degradation products. Groundwater is not tapped as a resource within a 1/2-mile radius of the site. The most shallow aquifer in which water supply wells are developed in this area of Tarrant County is the Paluxy aquifer. There are no water supply wells within a 1/2-mile radius of the site. The depth to the top of the Paluxy in this area of CAFB has not been determined, but may be as shallow as 40 feet.

Prior investigations have indicated that groundwater does discharge to Farmers Branch and its unnamed tributaries near the site. Farmers Branch flows into the West Fork of the Trinity River approximately 0.6 miles east of the site. The West Fork of the Trinity River experiences some recreational usage near CAFB. Although Farmers Branch approaches to within approximately 400 feet of the southwest border of the site, the TCE investigation concluded that the groundwater gradient in the vicinity of SWMU No. 62 was generally east-southeast, indicating that groundwater from the site would intercept Farmers Branch a considerable distance downstream. Lensing of alluvial deposits, the occurrence of low-permeability clays and silts within these deposits, and the distance to be traveled prior to discharge tend to reduce the likelihood of contaminant discharge from SWMU No. 62 to the river.

Lake Worth, approximately 1.4 miles north of the site, is upgradient of the site and acts as a recharge to the Paluxy Formation. Therefore, no migration pathway exists from SWMU No. 62 to Lake Worth.

8.0 Health and Safety Procedures.

During execution of the tasks outlined in this RFI Work Plan, work environments will be provided which will safeguard workers, CAFB personnel, equipment, and the public exposed to the operations and activities at SWMU No. 62. All personnel working at the site will be required to comply with the latest standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910. Drillers and sampling personnel will have received safety and health training and certification for operations at hazardous waste sites. At a minimum, it is expected that workers will utilize Level D modified personal protective equipment (PPE), including boots, hard hat, safety glasses, and impervious gloves. A Safety and Health Plan (SHP) will be generated prior to actual work at the site and will provide the safety and health guidance for all work performed at SWMU No. 62.

TAB

Tables

TABLES

TABLE 1. SOIL ASSOCIATIONS FOR CARSWELL AFB, TX

Association	Description	Thickness (inches)	Permeability (cm/sec)
Sanger-Purves-Slidell: Clayey soils of nearly level to gently sloping uplands.	Clay loam Clay over bedrock Silty clay	8 - 80	$<4.2 \times 10^{-5}$ to 3×10^{-4}
Aledo-Bolar-Sanger: Loamy and clayey soils of gently sloping to moderately steep uplands.	Clay loam over bedrock Clay loam	8 - 70	$<4.2 \times 10^{-5}$ to 9×10^{-4}
Frio-Trinity: Clayey soil on nearly level flood plains.	Silty clay loam Clay	25 - 75	$<4.2 \times 10^{-5}$ to 3×10^{-4}
Bastsil-Silawa: Loamy soils on nearly level to sloping stream terraces.	Sandy clay loam	40 - 80	9×10^{-4} to 3×10^{-3}

Source: U.S. Department of Agriculture, 1981, Soil Survey of Tarrant County: Soil Conservation Service, 218 pp.

TABLE 2. GEOLOGIC FORMATIONS BENEATH CARSWELL AFB, TX

System	Series and Group	Formation and Member	Thickness (ft)	Character of Rocks	Topographic Expression	Water-Bearing Properties
Quaternary	Recent and Pleistocene	Alluvium	0 - 45	Sand, gravel, clay, and silt.	Terrace and flood-plain deposits.	Small to moderate yields. Water unsatisfactory for use unless treated.
Cretaceous	Comanche Series Washita Group	Duck Creek Formation	0 - 80	Impure limestone and marl, which is blue when fresh and straw-colored when weathered. Fossiliferous with distinctive ammonites.	Bench topography produced by lower limestone unit. Upper marl forms slope separating the Duck Creek from Fort Worth limestone.	Small to moderate yields. Water unsatisfactory for use unless treated.
	Comanche Series Fredricksburg Group	Kiamichi Formation	0 - 40	Blue and brownish-yellow marl, thin limestone and sandstone flags.	Grassy slope separating scarps of Goodland and Duck Creek formations.	Small to moderate yields. Water unsatisfactory for use unless treated.
		Goodland Limestone	0 - 130	Chalky-white fossiliferous limestone, and blue to yellowish brown marl.	Prominent glaring-white escarpment along streams.	Small to moderate yields. Water unsatisfactory for use unless treated.
		Walnut Clay	0 - 30	Shell agglomerate fossiliferous clay and limestone, sandy clay, and black shale.	Forms conspicuous escarpment and waterfalls in western Cross Timbers belt.	Not known to yield water to wells in Tarrant County.
				UNCONFORMITY		
Cretaceous	Comanche Series Trinity Group	Paluxy Sand	140 - 190	Fine-grained sand, shale, sandy shale, lignite and pyrite.	Sandy soil, hummocky topography, heavily wooded with oaks.	Source of supply for most households, smaller cities, and some industries.
		Glen Rose Limestone	250 - 430	Fine-grained limestone, shale, marl, and sandstone.	Not exposed in Tarrant County.	Sands yield small supplies to wells in Fort Worth and western Tarrant County. Water too highly mineralized east of Fort Worth.
		Twin Mountains Formation (formerly Travis Peak Formation)	250 - 450	Coarse to fine-grained sandstone, red shale, red and yellow clay at base.	Not exposed in Tarrant County.	Principal aquifer in Tarrant County. Yields large supplies for municipal and industrial purposes. Water in upper sands east of Fort Worth may be highly mineralized.
				MAJOR UNCONFORMITY		
Pennsylvanian	Undifferentiated		3000 - 7000	Gray, sandy shale, tight quartzitic sandstone, black limestone. Probably represents stream formation.	Not exposed in Tarrant County.	Not tested. Probably would not yield fresh water.

TABLE 3. METEOROLOGICAL DATA SUMMARY FOR CARSWELL AFB, TX

	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Temperature (°F)													
Mean	45	50	57	66	74	82	86	85	78	68	56	49	66
Average daily maximum	55	60	67	76	83	91	95	95	88	78	66	59	76
Average daily minimum	35	39	46	56	64	72	75	75	68	57	46	38	56
Highest recorded	88	88	85	89	100	111	109	110	107	105	89	91	110
Lowest recorded	2	6	11	31	42	55	61	60	46	46	17	11	2
Precipitation (inches)													
Mean	1.7	1.9	2.1	3.9	4.2	3.1	2.5	2.1	3.6	3.1	1.8	1.9	31.9
Maximum monthly	5.9	4.7	6.5	14.2	15.2	8.8	9.0	6.0	9.6	10.7	7.4	6.7	15.2
Minimum monthly	0.1	0.1	a	0.8	0.8	0.1	a	a	a	a	a	a	a
Maximum in 24 hours	2.8	3.2	3.4	3.3	5.7	3.5	5.9	3.1	4.0	3.2	2.8	2.9	5.9
Days with thunderstorms	1	2	3	6	8	6	5	5	4	3	1	1	45
Snowfall (inches)													
Mean	2	1	6	0	0	0	0	0	0	0	b	b	3
Maximum monthly	8	12	7	0	0	0	0	0	0	0	4	3	8
Maximum in 24 hours	5	8	7	0	0	0	0	0	0	0	4	3	8
Relative Humidity (%)													
Mean	62	61	61	64	68	64	58	60	65	65	63	62	63
Surface Winds (knots)													
Mean	8	8	9	9	7	8	6	5	6	6	8	8	7
Maximum	50	63	69	64	68	65	56	54	80	45	54	58	80
Prevailing direction	S	S	S	S	S	S	S	S	S	S	S	S	S

Source: United States Air Force, Carswell AFB, Texas. Period of record: 1946 - 1978.

[a]Less than one-tenth inch.

[b]Less than one inch.

TABLE 4. SOIL ANALYSIS RESULTS FOR COE LANDFILL 6 INVESTIGATION

Boring No.	Sample Depth (feet)	Parameter Concentration							
		Benzene (mg/kg)	Toluene (mg/kg)	Ethyl benzene (mg/kg)	Xylenes (mg/kg)	TRPH (mg/kg)	TOX (mg/kg)	TCLP lead (mg/l)	TCLP benzene (mg/l)
LF06-1	1.0 - 1.5	<0.002	<0.002	<0.002	<0.002	**23**	<10	na	na
	3.0 - 3.5	<0.002	<0.002	<0.002	<0.002	<10	<10	na	na
	5.0 - 5.5	<0.002	<0.002	<0.002	<0.002	<10	<10	na	na
	7.0 - 7.5	<0.002	<0.002	<0.002	<0.002	**30**	<10	na	na
	9.0 - 9.5	<0.002	<0.002	<0.002	<0.002	**40**	<10	na	na
	11.0 - 11.5	<0.002	<0.002	<0.002	<0.002	<10	<10	<0.2	<0.005
LF06-2	2.8 - 3.3	<0.002	<0.002	<0.002	<0.002	<20	<10	na	na
	5.0 - 6.0	<0.002	<0.002	<0.002	<0.002	<10	<10	na	na
	QC	<0.002	<0.002	<0.002	<0.002	<10	<10	na	na
	QA	<0.001	<0.001	<0.001	<0.001	<20	<5	na	na
	7.0 - 7.5	<0.002	<0.002	<0.002	<0.002	<10	<10	na	na
	10.0 - 10.5	<0.002	<0.002	<0.002	<0.002	<10	<10	<0.2	<0.005
LF06-3	1.0 - 2.5	<0.002	<0.002	<0.002	<0.002	**23**	<10	na	na
	7.5 - 8.0	<0.002	<0.002	<0.002	<0.002	**5160**	<10	na	na
	15.0 - 15.5	<0.002	**0.0023**	<0.002	**0.0042**	**34**	<10	na	na
LF06-4	1.0 - 1.5	<0.002	<0.002	<0.002	<0.002	**401**	<10	na	na
	4.0 - 4.5	<0.002	**0.006**	<0.002	**0.002**	<10	<10	na	na
	6.0 - 6.5	<0.002	<0.002	<0.002	<0.002	**86**	<10	na	na
	9.0 - 9.5	<0.002	<0.002	<0.002	<0.002	<20	<10	<0.2	<0.005
	14.5 - 15.0	<0.002	<0.002	<0.002	<0.002	**225**	<10	na	na
LF06-5	1.0 - 1.5	<0.002	<0.002	<0.002	<0.002	<20	<10	na	na
	4.5 - 5.0	<0.002	<0.002	<0.002	<0.002	<20	<10	na	na
	6.5 - 7.0	<0.002	<0.002	<0.002	<0.002	<20	<10	na	na
	QC	<0.002	<0.002	<0.002	<0.002	<20	<10	na	na
	QA	<0.001	<0.001	<0.001	<0.001	<20	<5	na	na
	8.5 - 9.0	<0.002	<0.002	<0.002	<0.002	<20	<10	<0.2	<0.005
	10.5 - 11.0	<0.002	<0.002	<0.002	<0.002	<20	<10	na	na
	12.5 - 13.0	<0.002	<0.002	<0.002	<0.002	<20	<10	na	na
	14.5 - 15.0	<0.002	<0.002	<0.002	<0.002	<20	<10	na	na

Notes:

1. na = Sample not taken and analysis not performed. See Note 2.
2. Only one TCLP sample was taken from each boring.

TABLE 5. GROUNDWATER ANALYSIS RESULTS FOR COE LANDFILL 6 INVESTIGATION

Boring No.	Parameter Concentration (mg/l)						
	Benzene	Toluene	Ethyl benzene	Xylenes	TRPH	TDS	Lead
LF06-1	<0.001	<0.001	<0.001	<0.001	0.3	356	0.361
LF06-2	<0.001	<0.001	<0.001	<0.001	<0.2	474	0.068
LF06-4	<0.001	<0.001	<0.001	<0.001	<0.2	736	na

Notes:

1. Borings LF06-3 and LF06-5 were not sampled due to borings caving.
2. na = Sample not taken and analysis not performed.

TABLE 6. GROUNDWATER ANALYSIS RESULTS FOR TCE PHASE I INVESTIGATION

Sample No.	Parameter Concentration* (µg/l)					
	1,1-DCE	c-1,2-DCE	t-1,2-DCE	TCE	PCE	t-1,3-DCP
060	<200	1300	<100	12000	1900	<200
063	<20	71	<10	780	18	<20
067	<20	33	<10	230	16	<20
071	<20	<10	<10	66	17	170
074	28	41	5.4	270	1.9	<2.0
079	<20	230	<10	<10	18	<20
080	21	470	11	690	104	<20
081	61	55	<1.0	460	120	<2.0
083	28	28	<10	260	52	<20
087	<2.0	5.8	2.6	3.1	1.7	<2.0
088	<2.0	2.7	<1.0	<1.0	1.9	<2.0

*For these sample numbers, all other EPA Method 8010 analytes were below detection limits.

Source: Geo-Marine, Inc., November 1992, Groundwater Sampling Report - Phase I, U.S. Air Force Plant No. 4, Carswell Air Force Base, Fort Worth, TX

TABLE 7. GROUNDWATER ANALYSIS RESULTS FOR TCE PHASE II INVESTIGATION

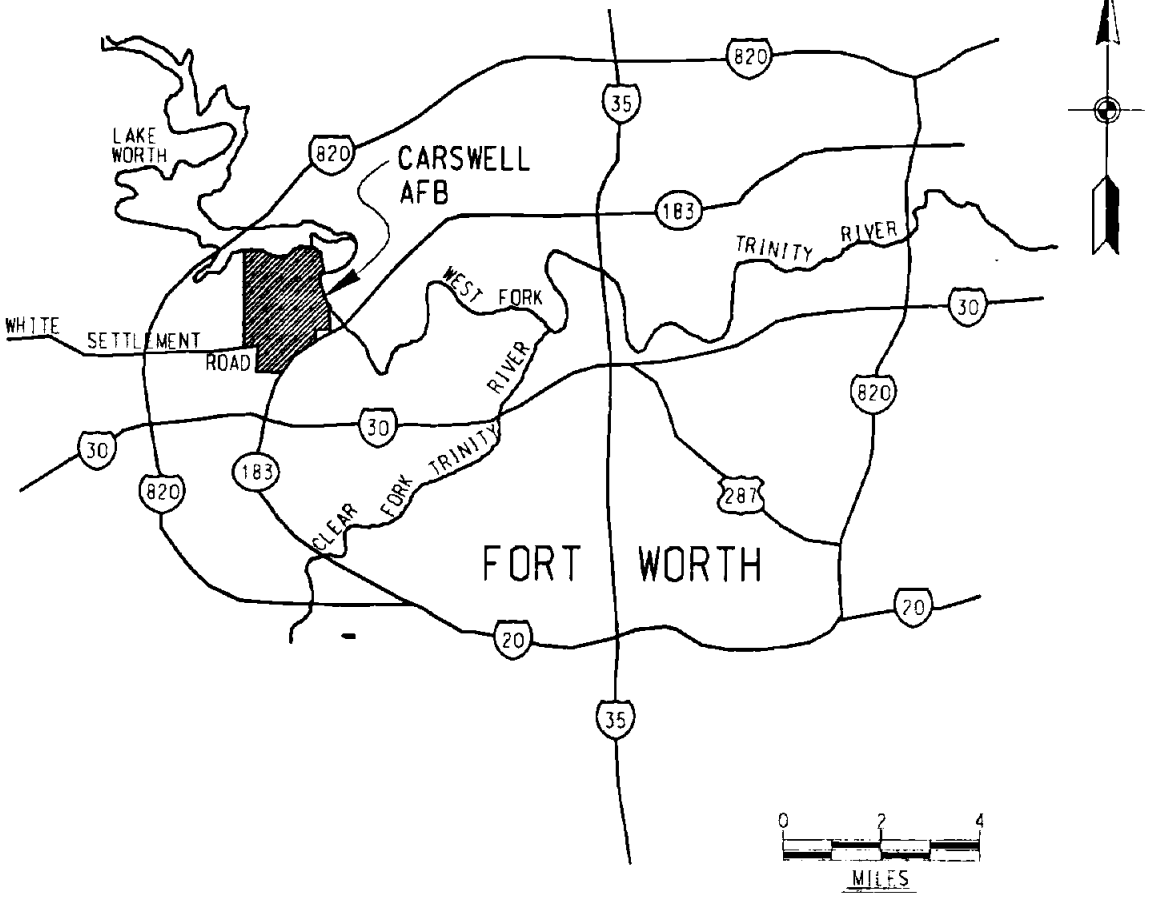
Sample No.	Groundwater Level Elevation (feet)	Parameter Concentration* (µg/l)		
		TCE	c-1,2-DCE	t-1,2-DCE
GMI-1S	595.0	492	73	<4
GMI-2S	590.97	278	32	<4
GMI-4S	593.1	99	14	<4
GMI-5S	na	438	66	<4
GMI-6S	589.37	7	<5	<4
GMI-9S	588.75	42	7	<4
GMI-12S	584.25	54	10	<4
GMI-14S	588.35	66	15	<4
GMI-18S	584.0	44	60	<4
GMI-20S	587.6	16	14	<4
GMI-25S	na	29	37	<4
GMI-26S	583.85	50	12	<4
GMI-27S	585.6	29	30	19
GMI-28S	589.65	<2	<5	<4
GMI-34S	585.0	<2	<5	<4
GMI-36S	587.96	3	<5	<4
GMI-42S	584.4	<2	<5	<4

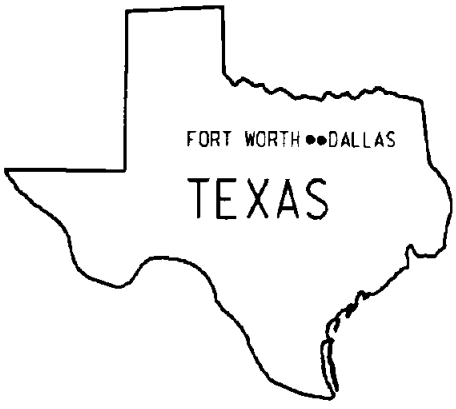
*For these sample numbers, all other EPA Method 8021 analytes were below detection limits.
na = Groundwater was sampled, but groundwater level was not obtained.
Source: Geo-Marine, Inc., December 1993, Phase II Report - Groundwater Sampling and Subsurface Soil Delineation, U.S. Air Force Plant No. 4, Carswell Air Force Base, Fort Worth, TX

TAB

Figures

FIGURES





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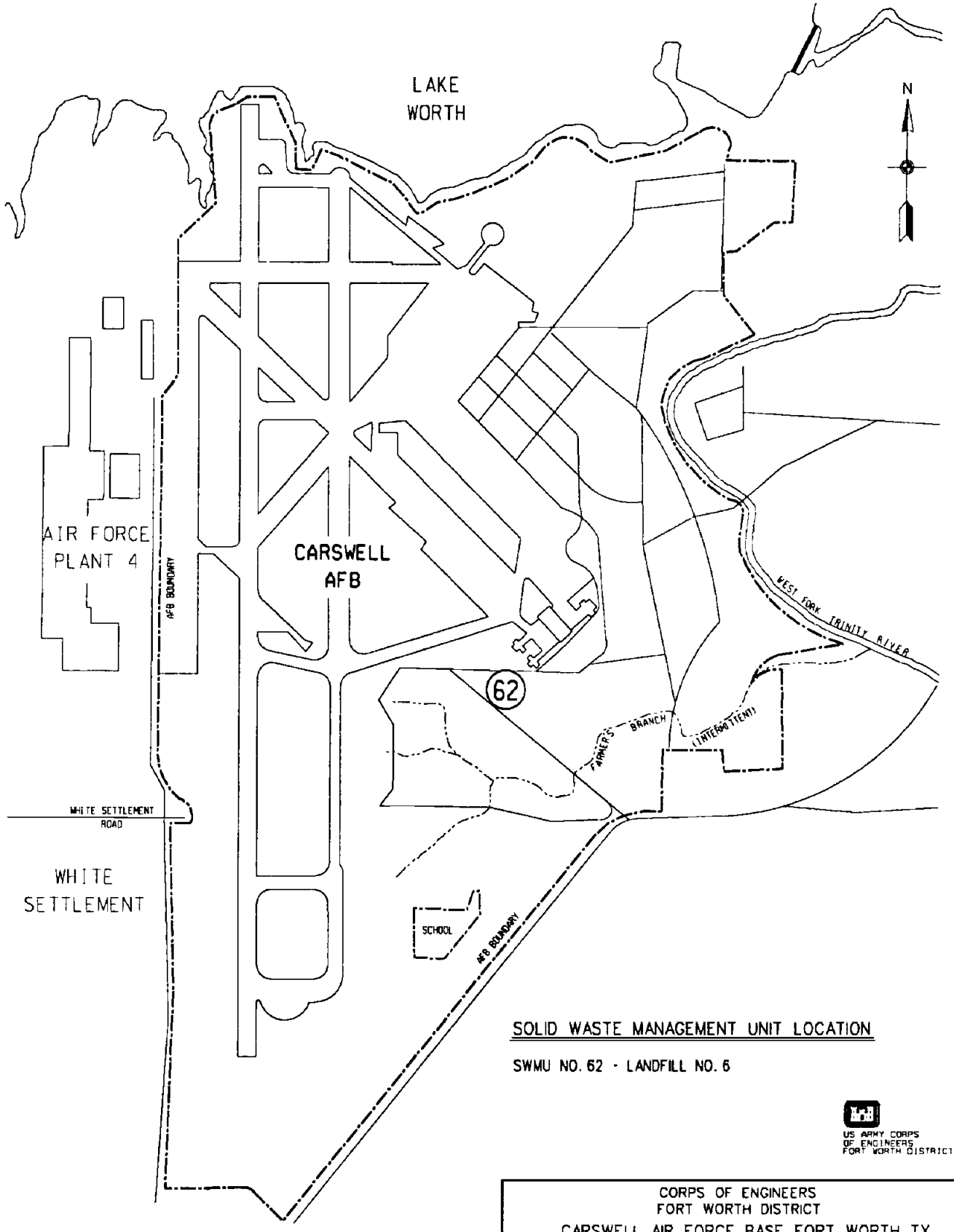
CARSWELL AIR FORCE BASE, FORT WORTH, TX

RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

REGIONAL SETTING

DATE: JULY 1994	FIGURE 1



SOLID WASTE MANAGEMENT UNIT LOCATION

SWMU NO. 62 - LANDFILL NO. 6

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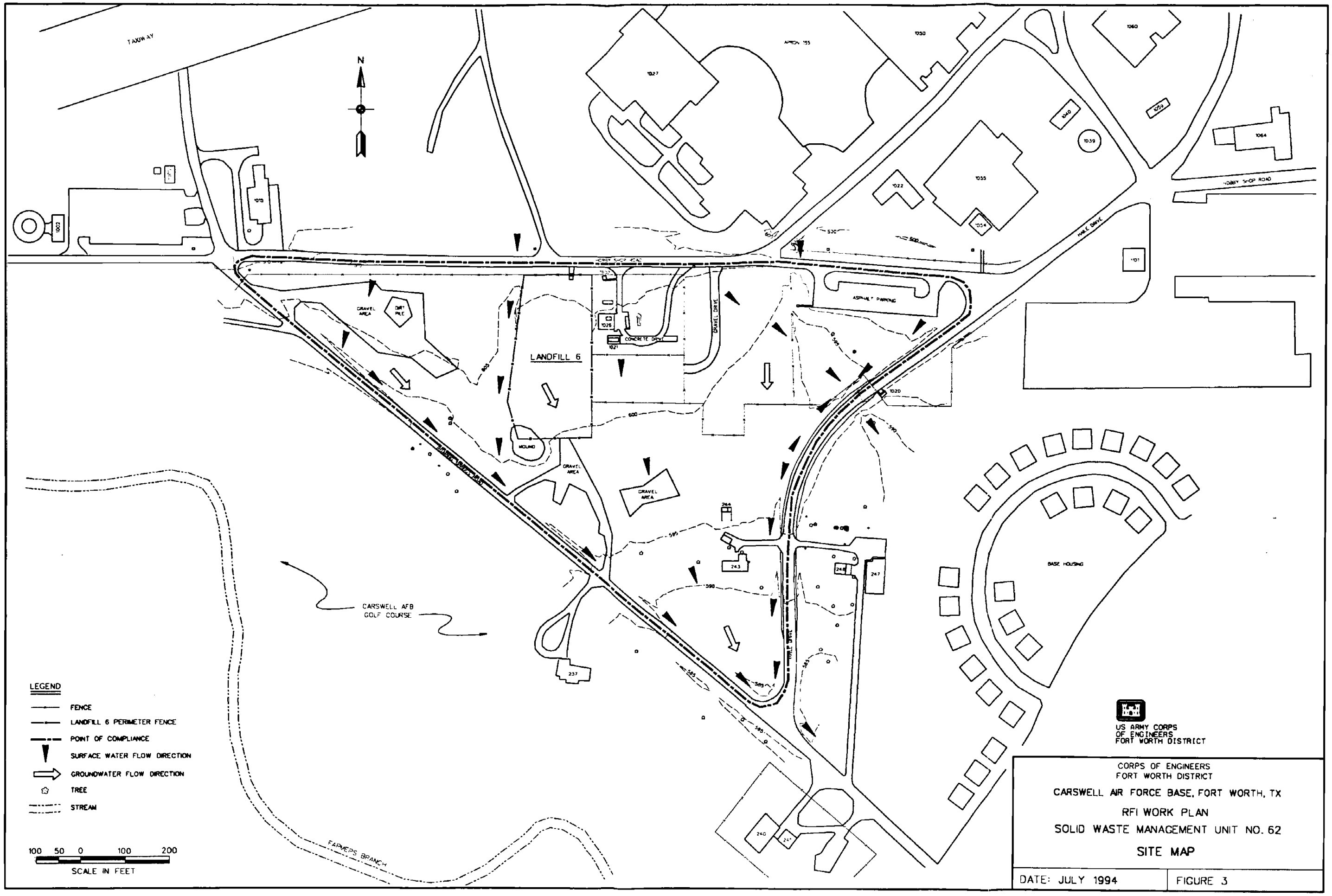
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

SOLID WASTE MANAGEMENT UNIT LOCATION

DATE: JULY 1994	FIGURE 2


TAXIWAY
N
APRON 155
1027
1050
1060
1040
1039
1059
1064
1055
1022
1054
1003
1018
HOBBY SHOP ROAD
HALE DRIVE
1101
ASPHALT PARKING
GRAVEL AREA
DIRT PILE
1026
CONCRETE DECK
1021
GRAVEL DRIVE
LANDFILL 6
1020
MOUND
GRAVEL AREA
GRAVEL AREA
264
243
248
247
240
241
237
BASE HOUSING
CARSWELL AFB GOLF COURSE
FARMERS BRANCH
LEGEND
FENCE
LANDFILL 6 PERIMETER FENCE
POINT OF COMPLIANCE
SURFACE WATER FLOW DIRECTION
GROUNDWATER FLOW DIRECTION
TREE
STREAM
100 50 0 100 200
SCALE IN FEET
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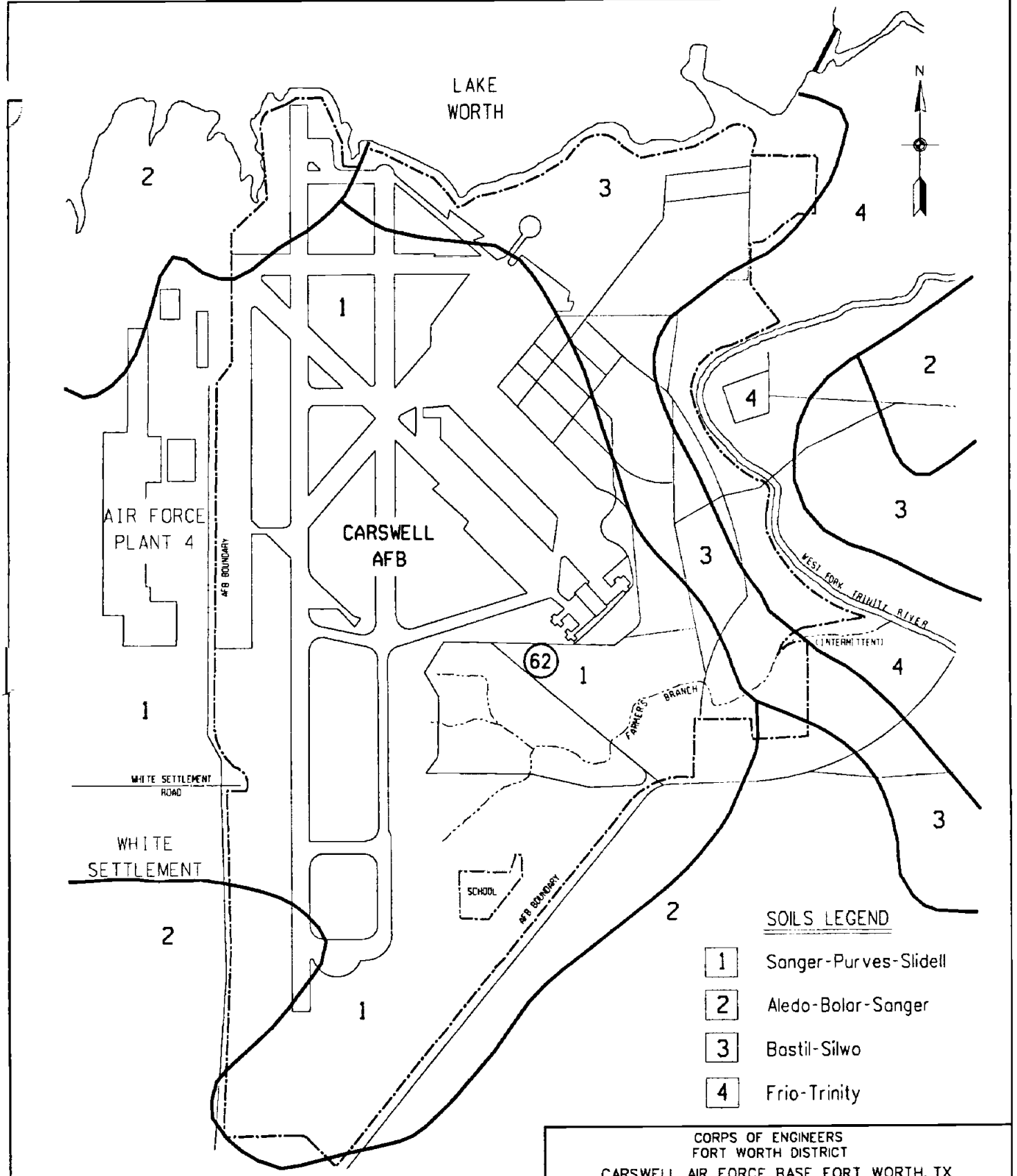
CORPS OF ENGINEERS
FORT WORTH DISTRICT
CARSWELL AIR FORCE BASE, FORT WORTH, TX
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62
SITE MAP
DATE: JULY 1994
FIGURE 3



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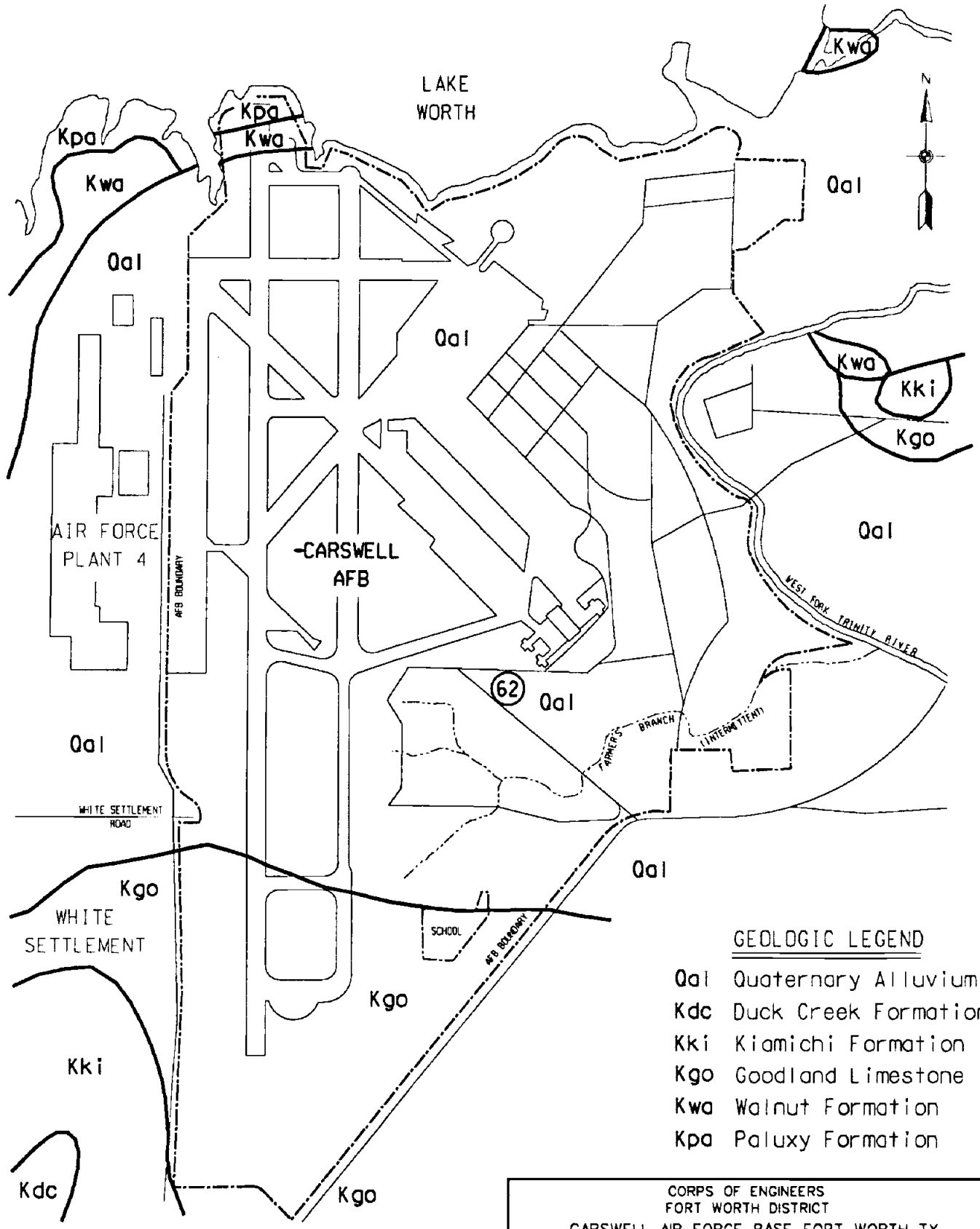
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

SOILS ASSOCIATION MAP

DATE: JULY 1994 | FIGURE 4



GEOLOGIC LEGEND

Qal	Quaternary Alluvium
Kdc	Duck Creek Formation
Kki	Kiamichi Formation
Kgo	Goodland Limestone
Kwa	Walnut Formation
Kpa	Paluxy Formation

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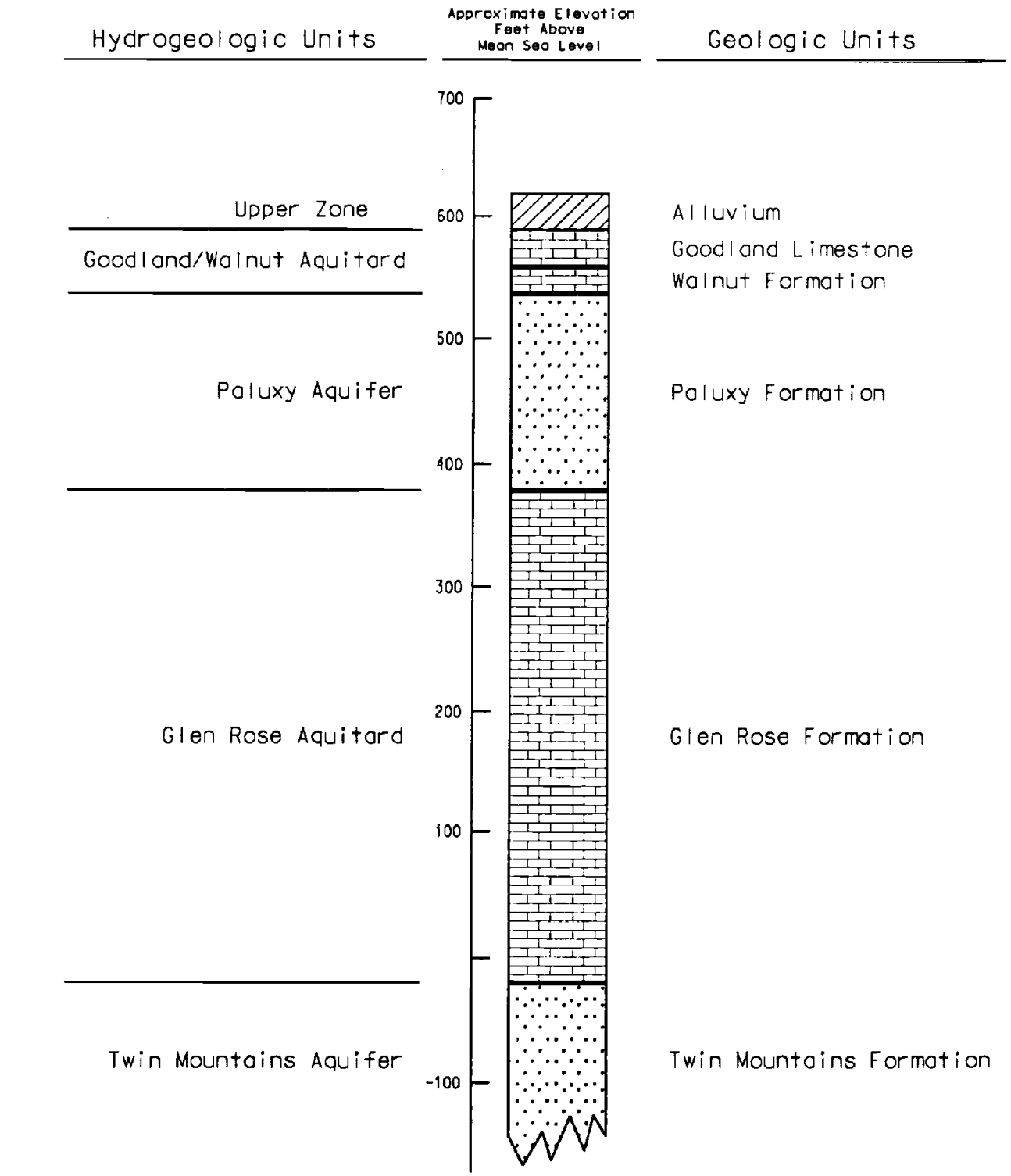
CARSWELL AIR FORCE BASE, FORT WORTH, TX

RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

GEOLOGIC MAP

DATE: JULY 1994 | FIGURE 5



Legend

- Alluvium
- Limestone
- Sandstone

US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT

SOURCE: RADIAN CORPORATION, OCT 1986.

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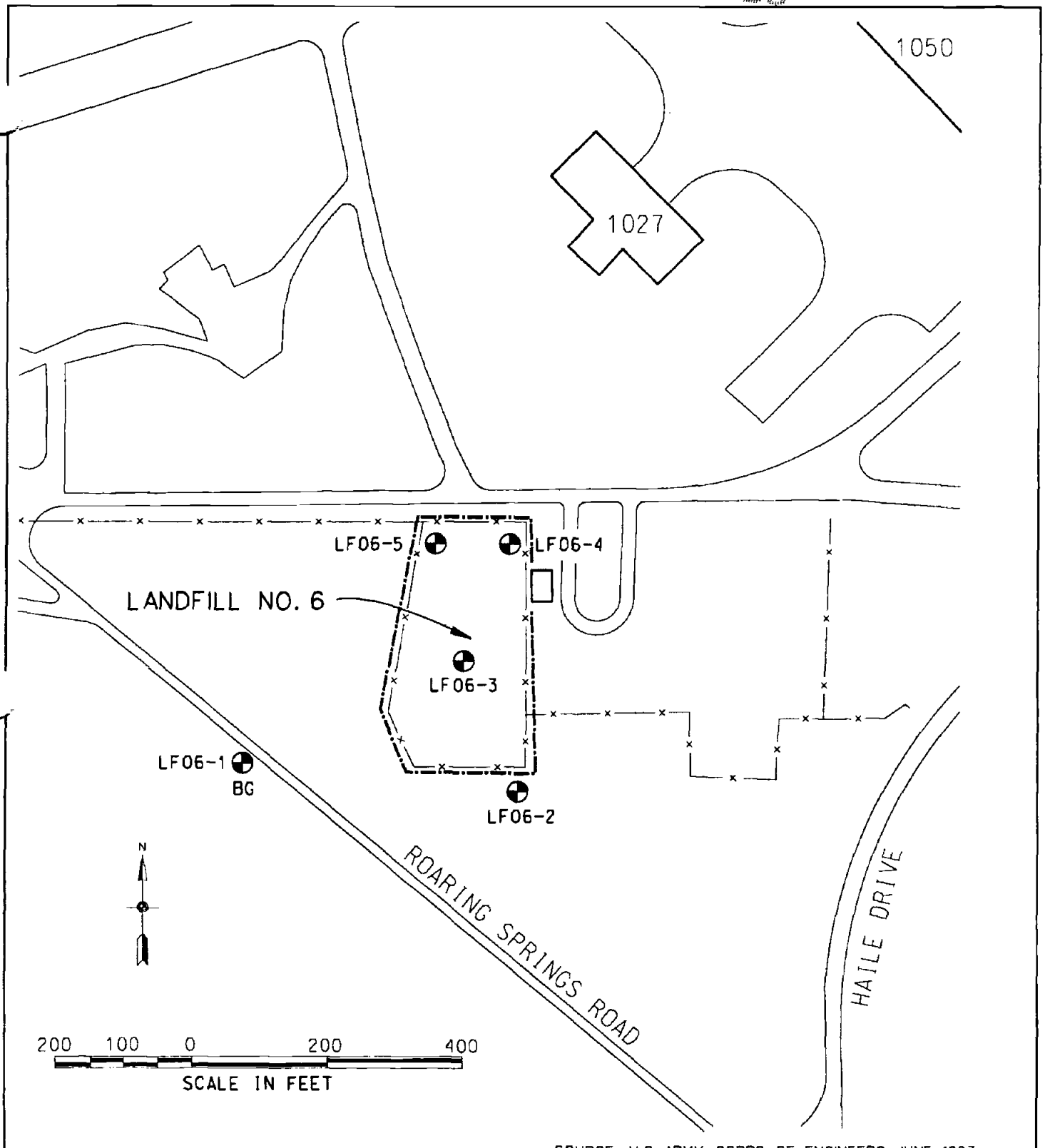
CARSWELL AIR FORCE BASE, FORT WORTH, TX
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

GENERAL HYDROGEOLOGIC COLUMN FOR CARSWELL AFB

DATE: JULY 1994 | FIGURE 6



LEGEND

LF06-1 SOIL BORING LOCATION

BG BACKGROUND SAMPLING LOCATION

LIMITS OF LANDFILL

US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT

SOURCE: U.S. ARMY CORPS OF ENGINEERS, JUNE 1993

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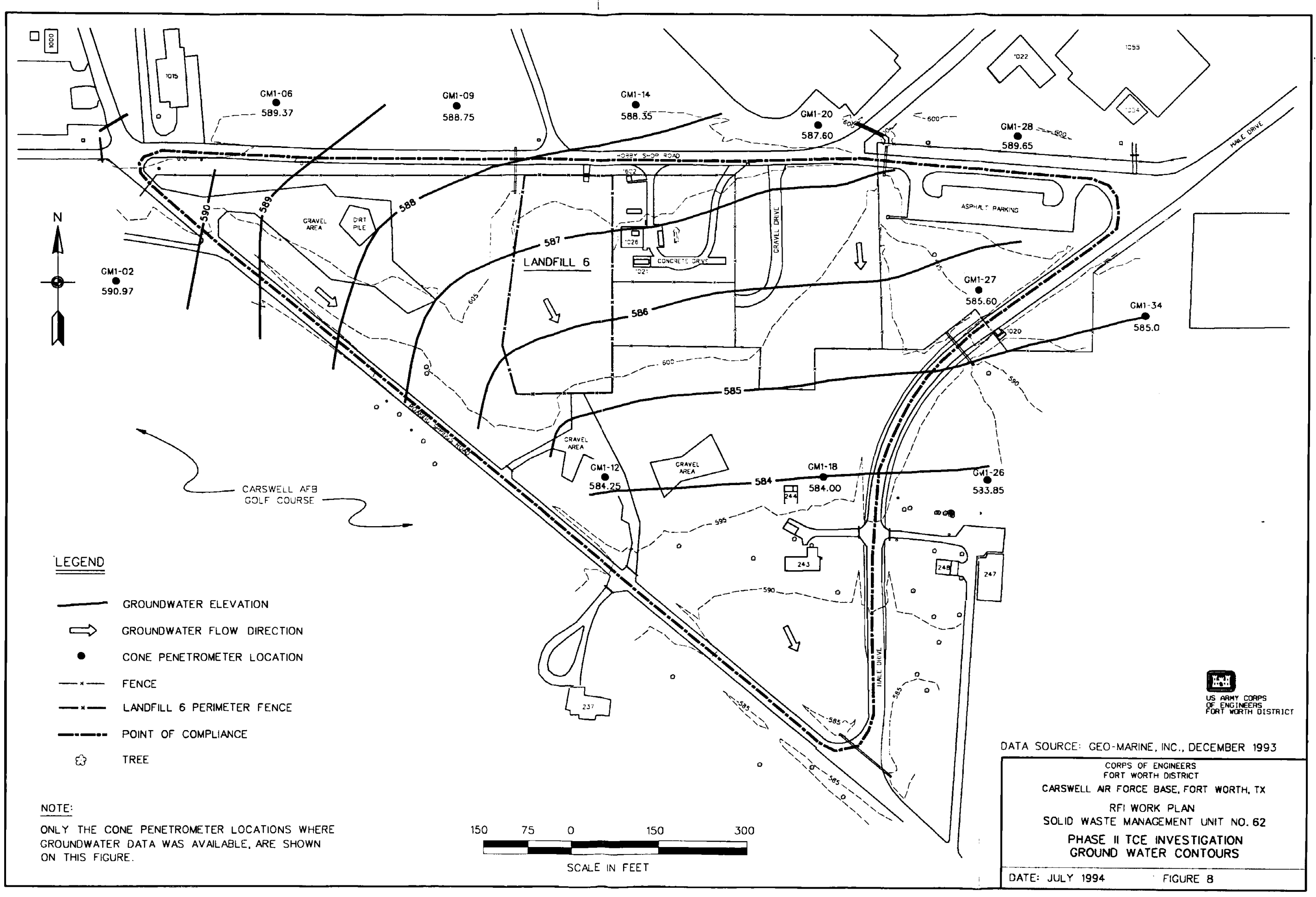
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

LANDFILL NO. 6
SOIL BORING LOCATION MAP

DATE: JULY 1994 | FIGURE 7



LEGEND

- GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION
- CONE PENETROMETER LOCATION
- FENCE
- LANDFILL 6 PERIMETER FENCE
- POINT OF COMPLIANCE
- TREE

NOTE:

ONLY THE CONE PENETROMETER LOCATIONS WHERE GROUNDWATER DATA WAS AVAILABLE, ARE SHOWN ON THIS FIGURE.

150 75 0 150 300

SCALE IN FEET

US ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

DATA SOURCE: GEO-MARINE, INC., DECEMBER 1993

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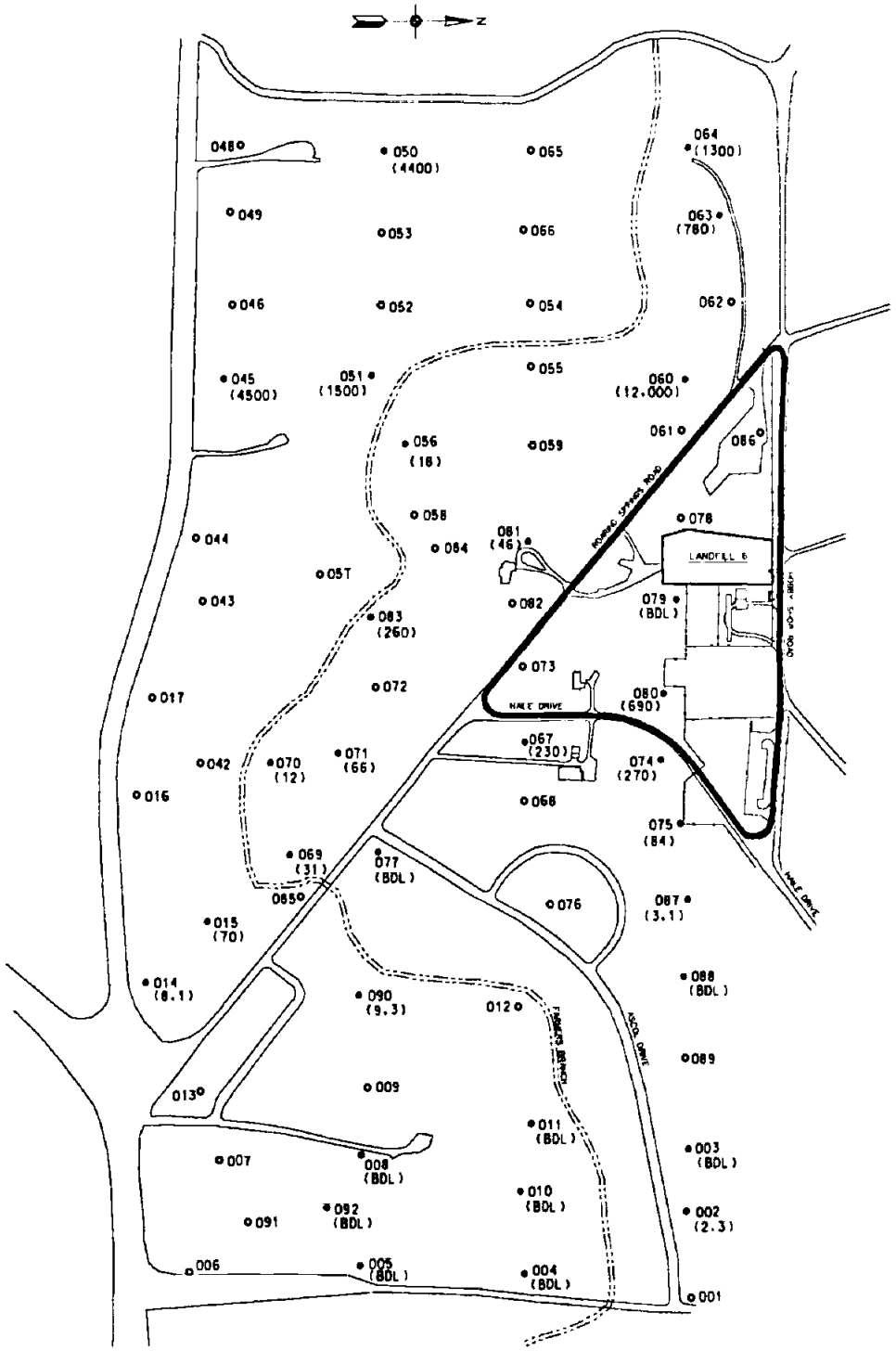
FORT WORTH DISTRICT
CARSWELL AIR FORCE BASE, FORT WORTH, TX
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62
PHASE II TCE INVESTIGATION
GROUND WATER CONTOURS

DATE: JULY 1994 FIGURE 8



APPROXIMATE SCALE: 1" = 600'

LEGEND

- • PENETROMETER SAMPLE LOCATION
- o PENETROMETER - DRY HOLE
- (2.3) TRICHLOROETHENE CONCENTRATION IN MICROGRAMS PER LITER
- (BDL) BELOW DETECTION LIMIT
- ▬▬ SWMU NO. 62 POINT OF COMPLIANCE

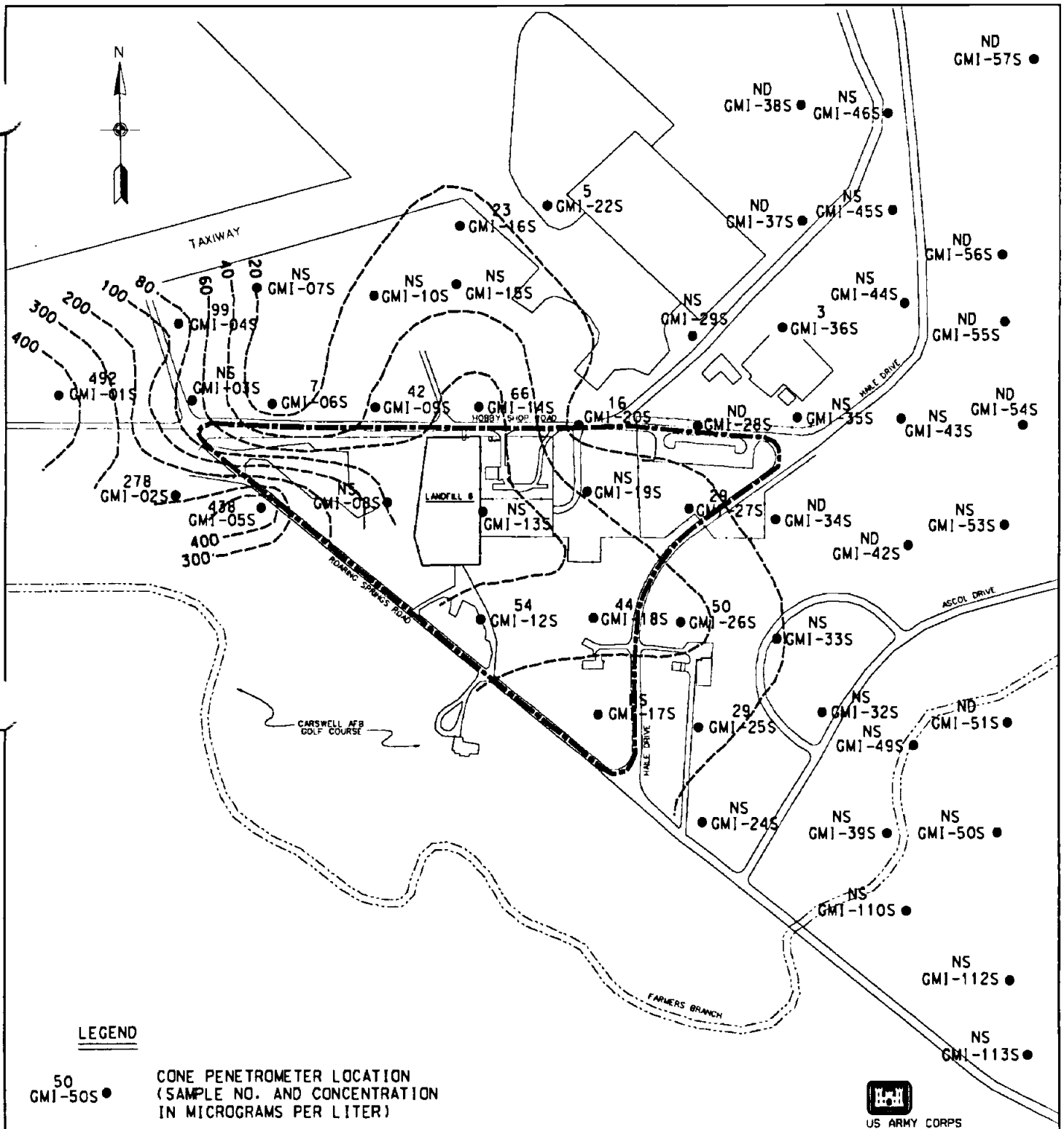
US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT

DATA SOURCE: GEO-MARINE, INC., NOVEMBER 1992

CORPS OF ENGINEERS
FORT WORTH DISTRICT
CARSWELL AIR FORCE BASE, FORT WORTH, TX
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

PHASE I TCE INVESTIGATION GROUNDWATER SAMPLING RESULTS

DATE: JULY 1994 | FIGURE 9



DATA SOURCE: GEO-MARINE, INC., DECEMBER 1993

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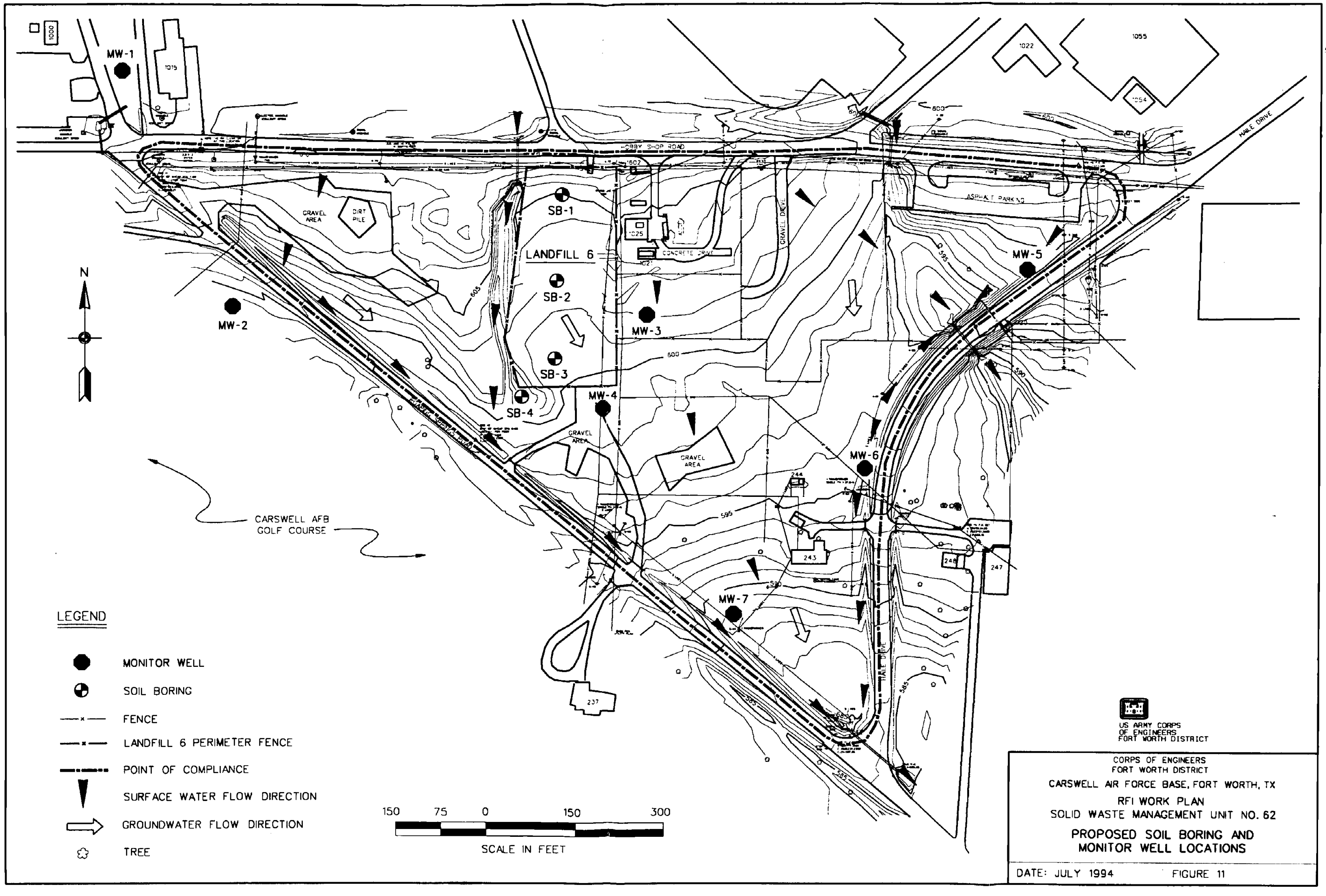
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

PHASE II TCE INVESTIGATION GROUNDWATER SAMPLING RESULTS

DATE: JULY 1994 | FIGURE 10



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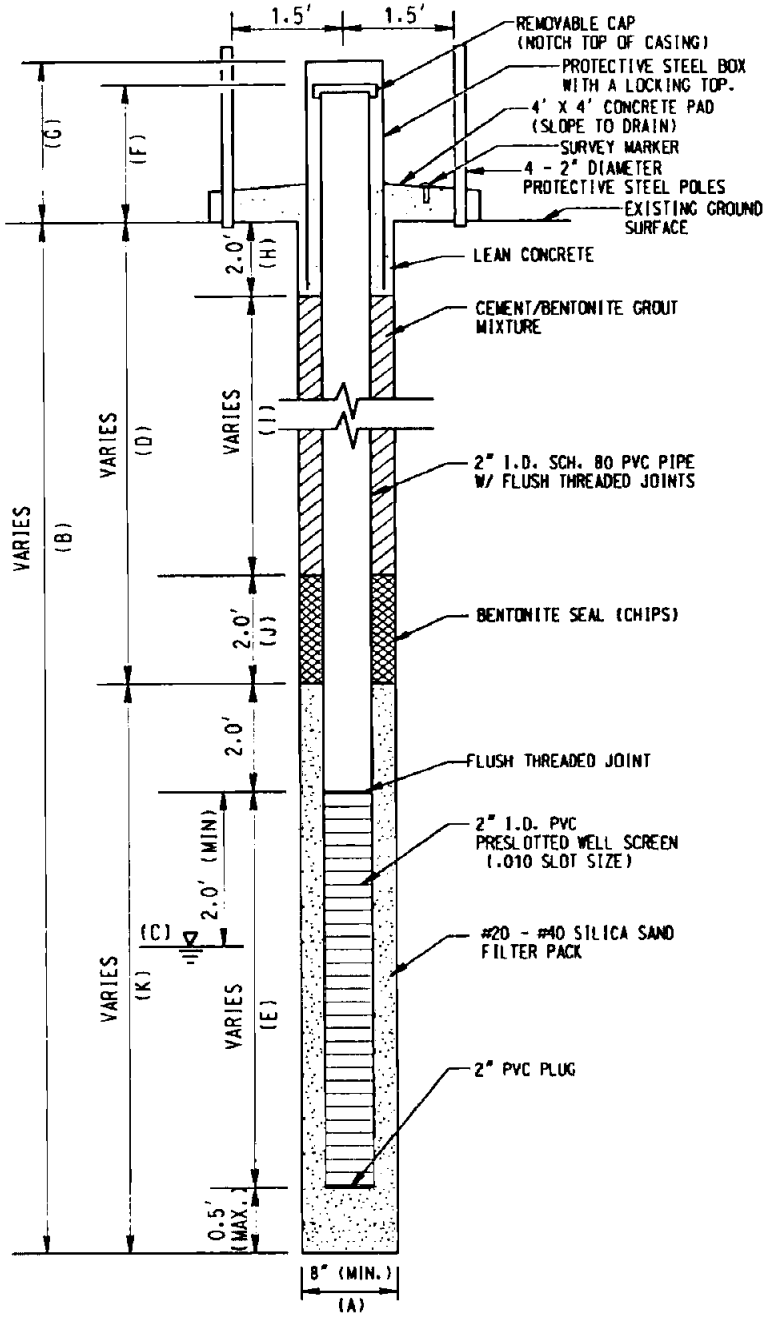
CARSWELL AIR FORCE BASE, FORT WORTH, TX

RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

PROPOSED SOIL BORING AND MONITOR WELL LOCATIONS

DATE: JULY 1994 FIGURE 11



WELL NUMBER:			
PROJECT:			
DATE INSTALLED:		SETTING	
INSTALLED BY:		From*	To
A	Diameter of boring (in)	———	
B	Depth of boring (ft)	0	
C	Depth to groundwater (ft) ▽	0	
D	Blank pipe (ft)	0	
E	Well Screen (ft)		
F	Well casing stick-up (ft)	0	
G	Protective casing stick-up (ft)	0	
H	Lean concrete (ft)	0	
I	Grout mix (ft)		
J	Bentonite seal (ft)		
K	Filter pack (ft)		

* Measured from ground surface (0 feet)

SURVEY FEATURE	MEASUREMENT
X Coordinate (Easting)	
Y Coordinate (Northing)	
Ground Elevation	
Well Casing Notch Elevation	

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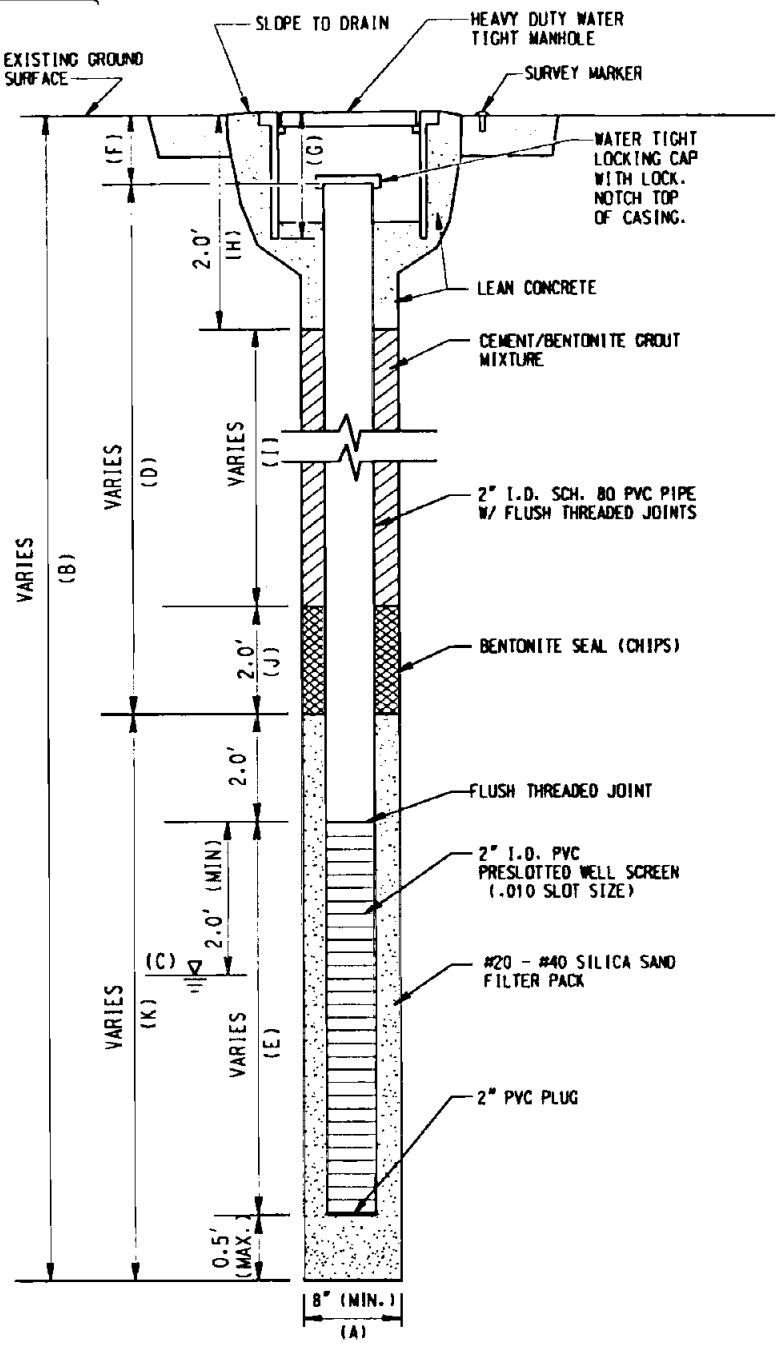
RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

WELL CONSTRUCTION DETAIL I

DATE: JULY 1994 | FIGURE 12a



WELL NUMBER:			
PROJECT:			
DATE INSTALLED:		SETTING	
INSTALLED BY:		From*	To
A	Diameter of boring (in)	———	
B	Depth of boring (ft)	0	
C	Depth to groundwater (ft) ▽	0	
D	Blank pipe (ft)		
E	Well Screen (ft)		
F	Depth to Top of Well (ft)	0	
G	Protective casing (ft)	0	
H	Lean concrete (ft)	0	
I	Grout mix (ft)		
J	Bentonite seal (ft)		
K	Filter pack (ft)		

* Measured from ground surface (0 feet)

SURVEY FEATURE	MEASUREMENT
X Coordinate (Easting)	
Y Coordinate (Northing)	
Ground Elevation	
Well Casing Notch Elevation	

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CARSWELL AIR FORCE BASE, FORT WORTH, TX

RFI WORK PLAN
SOLID WASTE MANAGEMENT UNIT NO. 62

WELL CONSTRUCTION DETAIL II

DATE: JULY 1994 | FIGURE 12b

TAB

Appendix A

APPENDIX A

Solid Waste Management Unit No. 62

Photographs

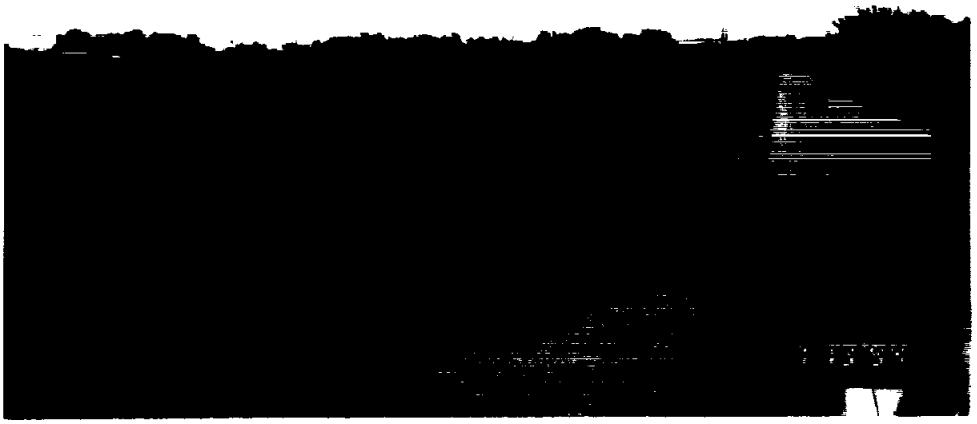


Photo 1. Southwest boundary of SWMU No. 62 along Roaring Springs Road. Photo taken from northwest corner of site, facing southeast.

Photo 2. Flightline permimeter fence near north boundary. Soil stockpile in center of photo. Photo taken from northwest corner of site, facing east.

Photo 3. East boundary of SWMU No. 62 along Haile Drive. Building 243 at left. Photo taken from south corner of site, facing northeast.

Photo 4. Southeast portion of SWMU No. 62. Buildings 243 and 244 at center and left. Photo taken from center of site, facing southeast.

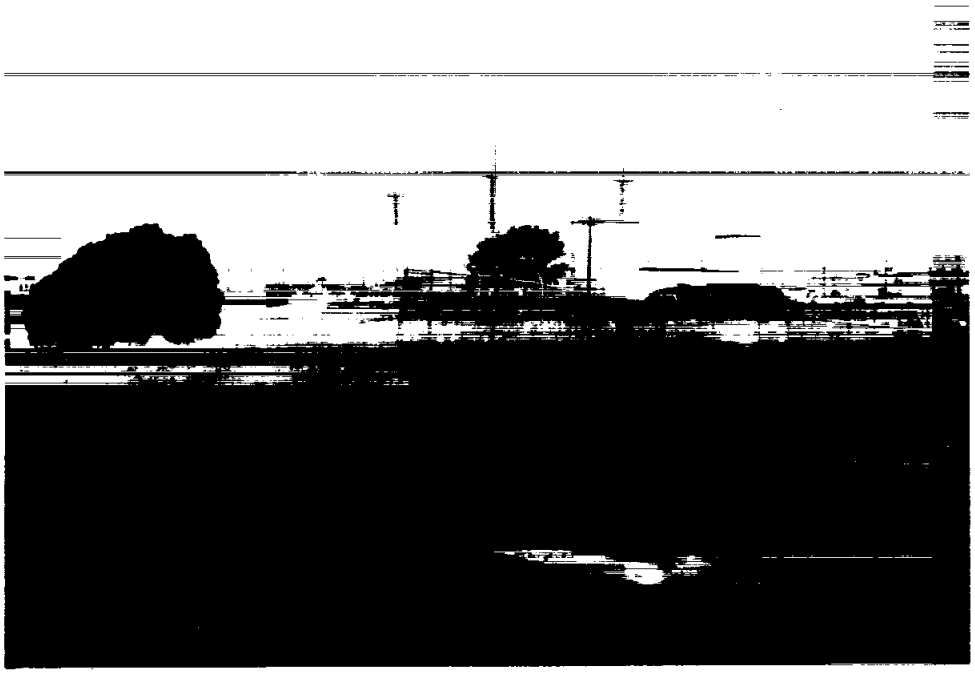


Photo 5. Northwest portion of SWMU No. 62. Southwest corner of Landfill 6 at center. Building 1015 in background. Photo taken from center of site, facing northwest.

Photo 6. Northeast portion of site. Buildings 1022 and 1055 in background at left. Photo taken from center of site, facing northeast.

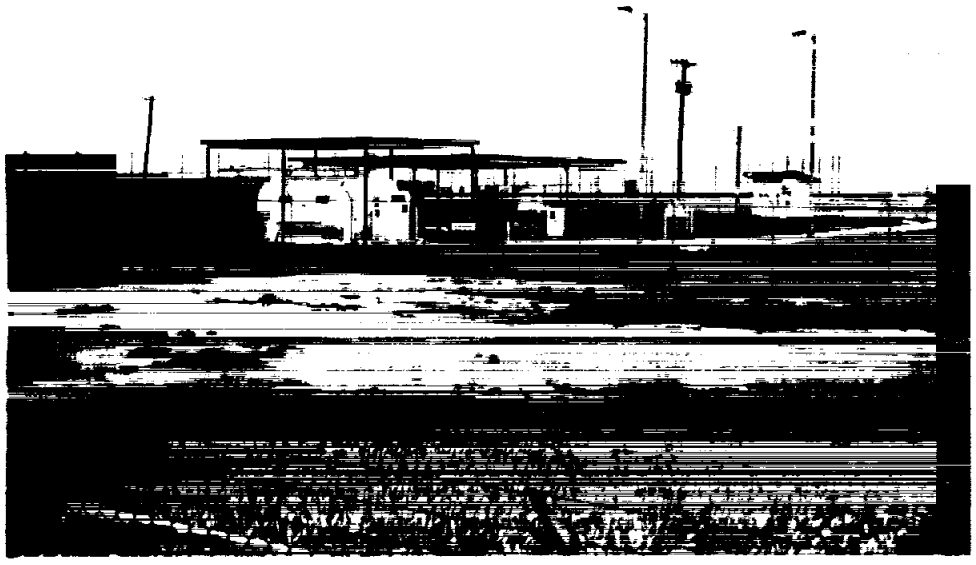


Photo 7. Buildings 1021 and 1026 with liquid oxygen and nitrogen storage tanks in north portion of SWMU No. 62. Photo taken from center of site, facing north.

Photo 8. Landfill 6 (former gravel pit) within fence enclosure in north-central portion of SWMU No. 62. Building 1027 in background. Photo taken from center of site, facing north.

Photo 9. Golf course southwest of SWMU No. 62. Embankment for Farmers Branch at center of photo. Photo taken from northwest portion of site, facing southwest.

Photo 10. Building 237 across Roaring Springs Road. Photo taken from south portion of site, facing southwest.

Photo 11. Building 240, military working dog area, south of SWMU No. 62. Photo taken from Roaring Springs Road, facing south.

Photo 12. Buildings 247 and 248 across Haile Drive from SWMU No. 62. Photo taken from Haile Drive, facing northeast.

Photo 13. Residential housing southeast of SWMU No. 62. Photo taken from Haile Drive, facing southeast.

Photo 14. Buildings 1050, 1055, and 1022 northeast of SWMU No. 62. Photo taken from Haile Drive, facing northeast.

TAB

Appendix B

APPENDIX B

COE Landfill 6 Investigation Boring Logs

Hole No. LF06-1

DRILLING LOG	DIVISION SWD	INSTALLATION FT WORTH	SHEET 1 OF 1 SHEETS
1. PROJECT LANDFILL, CARSWELL AFB		10. SIZE AND TYPE OF BIT 8" auger & 6" bbl.	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY	USCE	12. MANUFACTURER'S DESIGNATION OF DRILL Nitco	
4. HOLE NO. (As shown on drawing title and file number)	LF06-1	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 25	UNDISTURBED 0
5. NAME OF DRILLER	WILLIAMS	14. TOTAL NUMBER CORE BOXES	0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 24 hr check @10.01	
7. THICKNESS OF OVERBURDEN	12.6	16. DATE HOLE: STARTED 4 Feb 93	COMPLETED 4 Feb 93
8. DEPTH DRILLED INTO ROCK	.4	17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE	13'	18. TOTAL CORE RECOVERY FOR BORING	%
		19. SIGNATURE OF INSPECTOR Bob McVey	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0 to 0.8 GRAVEL - fill? moist, very sandy, brown.	No Loss	1	No chemical odor noted. All drilled up material was placed in obl's and moved to Fed Center, Ft Worth.
			0.8 to 11 CLAY	N.L.	2 3	4" slotted pvc put in hole and bailed for water samples-pipe removed for hole to be grouted.
	10		0.8 to 8.5 - high plasticity, stiff/very stiff, moist, dark brown, scattered gravels, slightly sandy.	N.L.	4 5	
			8.5 to 11 - high plast., stiff/very stiff, moist, red yellow, very sandy with gravel zones(lime nodules), calc.	Refusal	6, TCLP	Soil Samples four per group 1. 1.0 to 1.5 2. 3.0 to 3.5 3. 5.0 to 5.5 4. 7.0 to 7.5 5. 9.0 to 9.5 6. 11.0 to 11.5 plus TCLP.
			11 to 12.6 GRAVEL - coarse to fine, moist, brown, very sandy and clayey, calc.			Water Samples five for grab samples.
			12.6 to 13.0 LIMESTONE - argillaceous, weathered, well cemented seams, fossiliferous, moderately hard to hard(rock classification), shale seams.			All drilling and sampling for whole project is in accordance with ER 1110-1-263, '90.

Hole No. LF06-2

DRILLING LOG	DIVISION SWD	INSTALLATION FT WORTH	SHEET 1 OF SHEETS
1. PROJECT LANDFILL, CARSWELL AFB		10. SIZE AND TYPE OF BIT 8" aug & 6" inner bbl	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL UNITCO	
4. HOLE NO. (As shown on drawing title and file number) LF06-2		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23	UNDISTURBED 0
5. NAME OF DRILLER WILLIAMS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 24 hr check @15.09'	
		16. DATE HOLE: STARTED 2 Feb 93	COMPLETED 2 Feb 93
7. THICKNESS OF OVERBURDEN 18'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK .3		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE 18.3'		19. SIGNATURE OF INSPECTOR Bob McVey	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0 to 4.7 CLAY - high plasticity stiff, moist, dark brown, slightly sandy & gravelly, calc.	N.L. — —	1	No chemical odor detected in hole. Hole located 30' S68°W from SE corner of fenced area.
			4.7 to 10.5 GRAVEL - coarse to fine moist, various browns (mottled) to yellow, very sandy/clayey, sand and clay seams scattered throughout, cobbles to 3", calc.	N.L. — —	2 QA, QC 3	Soil Samples four per group 1. 2.8 to 3.3 2. 5.0 to 6.0 QA. 5.0 to 6.0 QC. 5.0 to 6.0 3. 7.0 to 7.5 4. 10.0 to 10.5 plus TCLP
	10'			L 2.8'	4+TCLP	
			10.5 to 18.0 SAND - coarse to fine, moist, red yellow to yellow brown, silty, scattered gravels and shells, calc.	— — L 3'		4" slotted pvc pipe placed in hole for water collection, then removed and hole grouted up.
			18.0 to 18.3 SHALE - very limy with cementation, weathered grey, yellow brown and white, fine bedded, moderately hard (rock classification).	— —		

Hole No. LF06-3

DRILLING LOG	DIVISION SWD	INSTALLATION FT WORTH	SHEET 1 OF 1 SHEETS
1. PROJECT LANDFILL, CARSWELL AFB		10. SIZE AND TYPE OF BIT 8" auger & 3" spoons	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500	
4. HOLE NO. (As shown on drawing title and file number) LF06-3		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12	UNDISTURBED 0
5. NAME OF DRILLER WILLIAMS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 24 hr check @19.72	
7. THICKNESS OF OVERBURDEN -		16. DATE HOLE STARTED 2 Feb 93	COMPLETED 2 Feb 93
8. DEPTH DRILLED INTO ROCK 0		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE 22'		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR Bob McVey	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0 to 14.1 GRAVEL - fill, coarse to fine, moist to very moist, browns to gray, very clayey with clay zones, sandy, cobbles, very dense after 9.5', concrete, brick and mulch debris, sewer odor scattered.		1	HNU reads; zero @ 3', 4', 6', 3'. Meter went dead. No chemical odor apparent to TD. 3" pushes; 15 to 15.5, 17 to 17.5-empty. No water samples from hole due to caving gravels. Attempts to push 2" slotted pipe into hole failed to collect enough water to fill one liter within 15 minutes.
	10'		14.1 to 16.8 CLAY - high plasticity, medium stiff, moist, dark brown, sandy and gravelly, calc.		2	
			16.8 to 22.0 GRAVEL - coarse to fine, dark brown, very clayey, sandy, calc.		3	Soil Samples four per group 1. 2.5 to 3.0 2. 7.5 to 8.0 3. 15.0 to 15.5 TCLP not collected because of lack of contamination indication and sample collected.
	20'					

Hole No. LF06-4

DRILLING LOG	DIVISION SWD	INSTALLATION FT WORTH	SHEET 1 OF 1 SHEETS
1. PROJECT LANDFILL, CARSWELL AFB		10. SIZE AND TYPE OF BIT *	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500/Nitco	
4. HOLE NO. (As shown on drawing title and file number) LF06-4		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 21	UNDISTURBED 0
5. NAME OF DRILLER WILLIAMS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 24 hr check @17.69'	
7. THICKNESS OF OVERBURDEN -		16. DATE HOLE STARTED 28 Jan 93	COMPLETED 1 Feb 93
8. DEPTH DRILLED INTO ROCK 0		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE 19'		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR Bob McVey	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0 to 3 GRAVEL-fill, coarse to fine, dry, gray to strong brown, very sandy, cobbles to 5", clayey. 3 to 19.5 GRAVEL & CLAY FILL clay is usually a high plasticity, dark brown to gray, moist, soft, gravels as above, mixed in is concrete, asphalt, cinder material. 19.5 to 22 GRAVEL - coarse to fine, yellow brown, very clayey and sandy, calc.		1 2 3 4 TCLP 5	*Drilling 0 to 10.3' - Nitco & 6" inner bbl-refusal. Failing from 10.3' to 19' with 8" auger. Caving gravels-4" slotted pipe dropped in hole-not bailed. Hole located: 42' S39°W from NE corner of fenced area. HNU reads all zero throuout section of recovered sample. Soil Sample four per group 1. 1.0 to 1.5 2. 4.0 to 4.5 3. 6.0 to 6.5 4. 9.0 to 9.5 TCLP 9.0 to 9.5 5. 14.5 to 15.0 Water Samples five group of grab samples-none preserved due to neutralizing sediments within sample. Grab sample.

3449 . 80 Hole No. LF06-5

DRILLING LOG	DIVISION SWD	INSTALLATION FT WORTH	SHEET 1 OF 1 SHEETS
1. PROJECT LANDFILL, CARSWELL AFB		10. SIZE AND TYPE OF BIT 8" auger	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500	
4. HOLE NO. (As shown on drawing title and file number) LF06-5		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 37	UNDISTURBED 0
5. NAME OF DRILLER BREWER		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 24 hr check @18.51'	
		16. DATE HOLE STARTED 1 Feb 93	COMPLETED 1 Feb 93
7. THICKNESS OF OVERBURDEN -		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK 0		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE 22'		19. SIGNATURE OF INSPECTOR Bob McVey	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10		0.0 to 15.0 CLAY 0-to 3.3 - high plasticity, medium stiff, dark red brown, sandy & gravelly lime, calc. 3.3 to 14 - high to medium, medium stiff, moist, red yellow with yellow brown and light gray, very sandy and gravelly lime nodules, sand/silt, calc, sand seams after 11'. 14 to 15 - medium to low plast, soft, moist, red yellow, very sandy & gravelly, calc.		1 2 3.QA,QC 4-TCLP 5 6 7	Located 23' S12°E of NW corner of fence. Note: Above site was 4th site attempted after three failed attempts through concrete rubble-all to the SE at least 25' to 35'. Caving gravels - could not bail hole, could not get pipe into hole-no water samples due to block off. Soil Samples 1. 1.5 to 2.0 2. 4.5 to 5.0 3. 6.5 to 7.0 QA. 6.5 to 7.0 QC. 6.5 to 7.0 4. 8.5 to 9.0 5. 10.5 to 11.0 6. 12.5 to 13.0 7. 14.5 to 15.0 TCLP @ 8.5 to 9.0 Note: HNU reads; @1', 3', 5'= 0 peaks of 6ppm @ 7', 9' peaks of 5.6ppm @ 11', 13', & 15'.
	20		15.0 to 22 GRAVEL - coarse to fine, very moist, yellowish brown, very sandy and clayey, calc.			

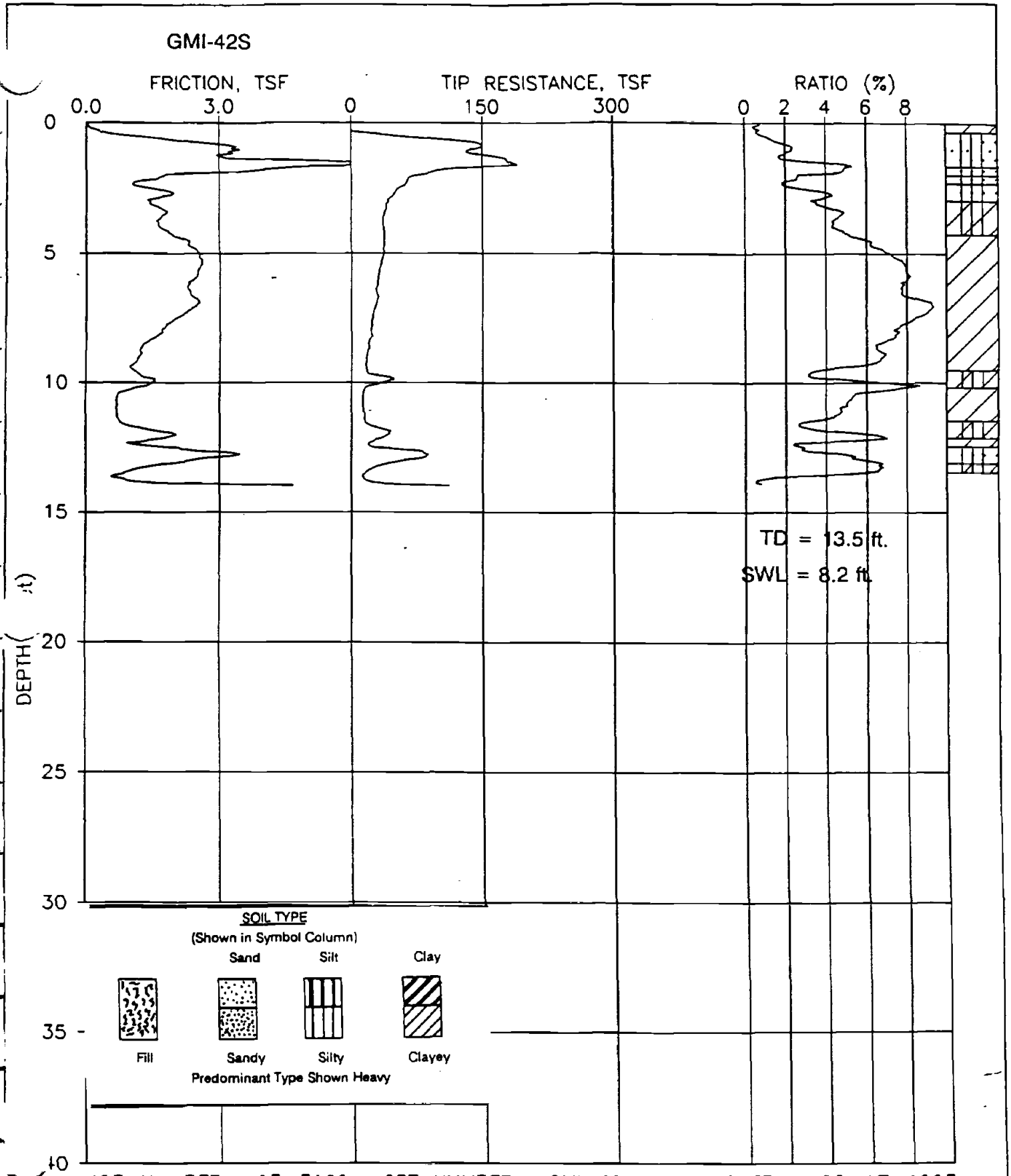
TAB

Appendix C

APPENDIX C

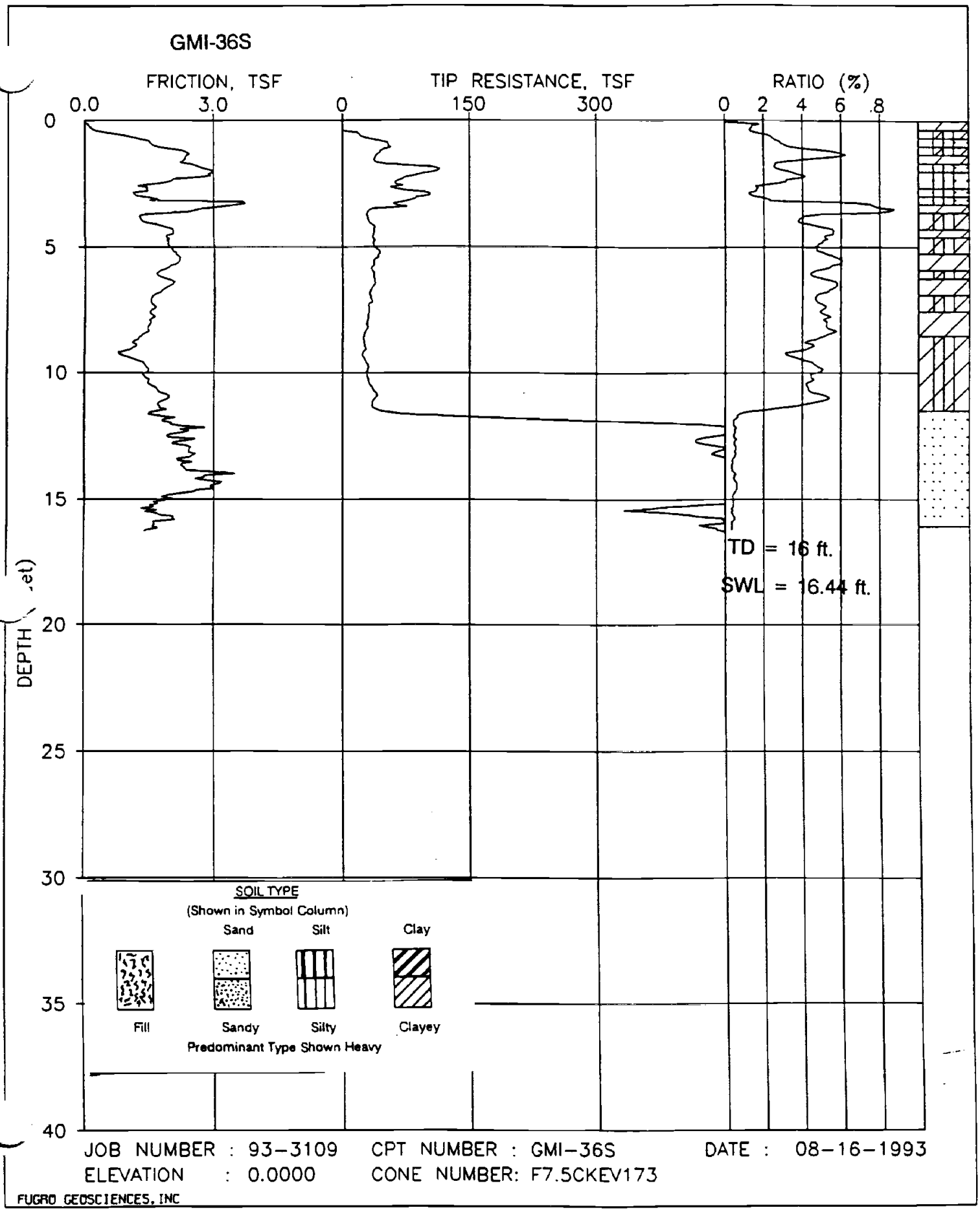
TCE Investigation Cone Penetrometer Stratigraphy Plots

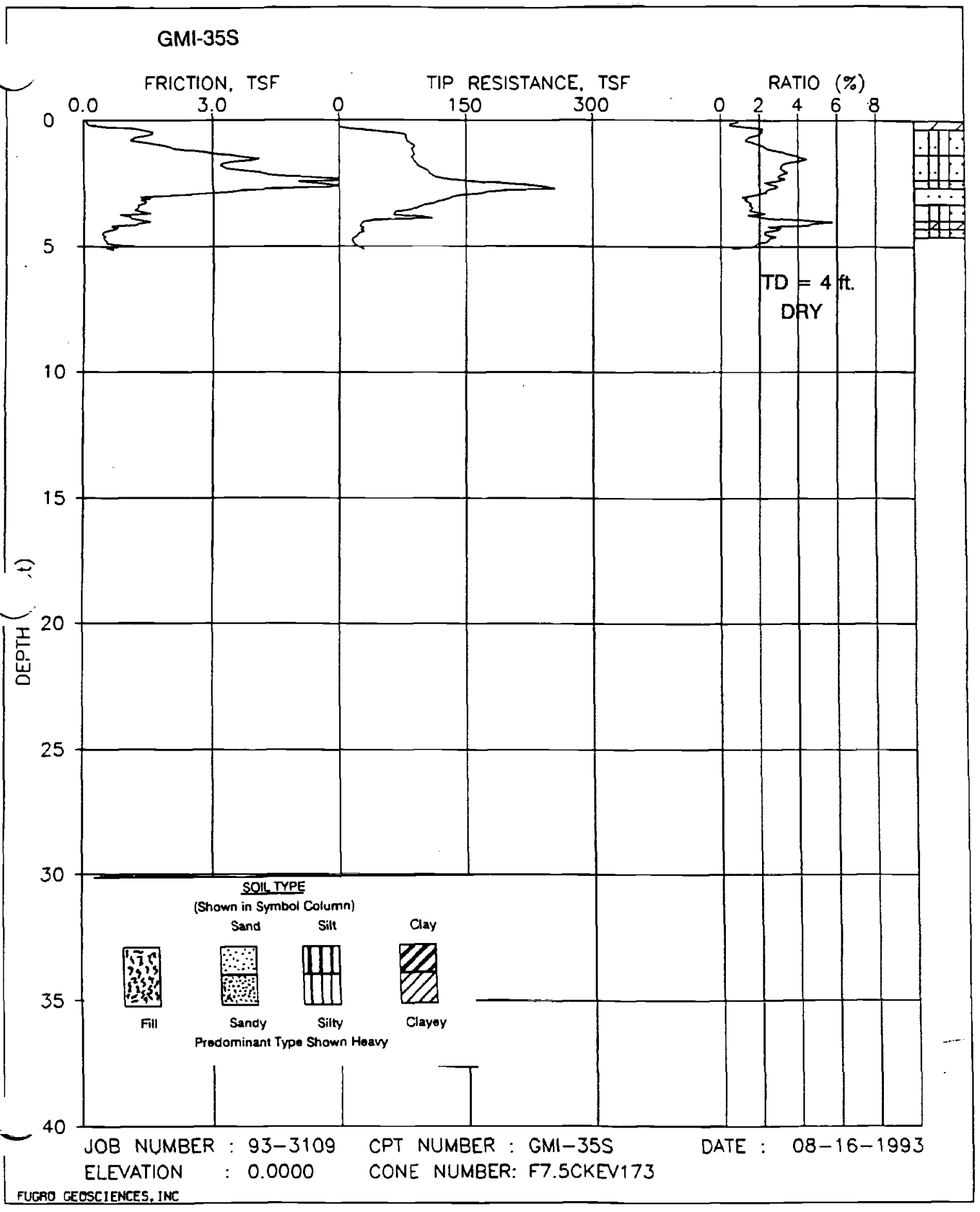
GMI-42S

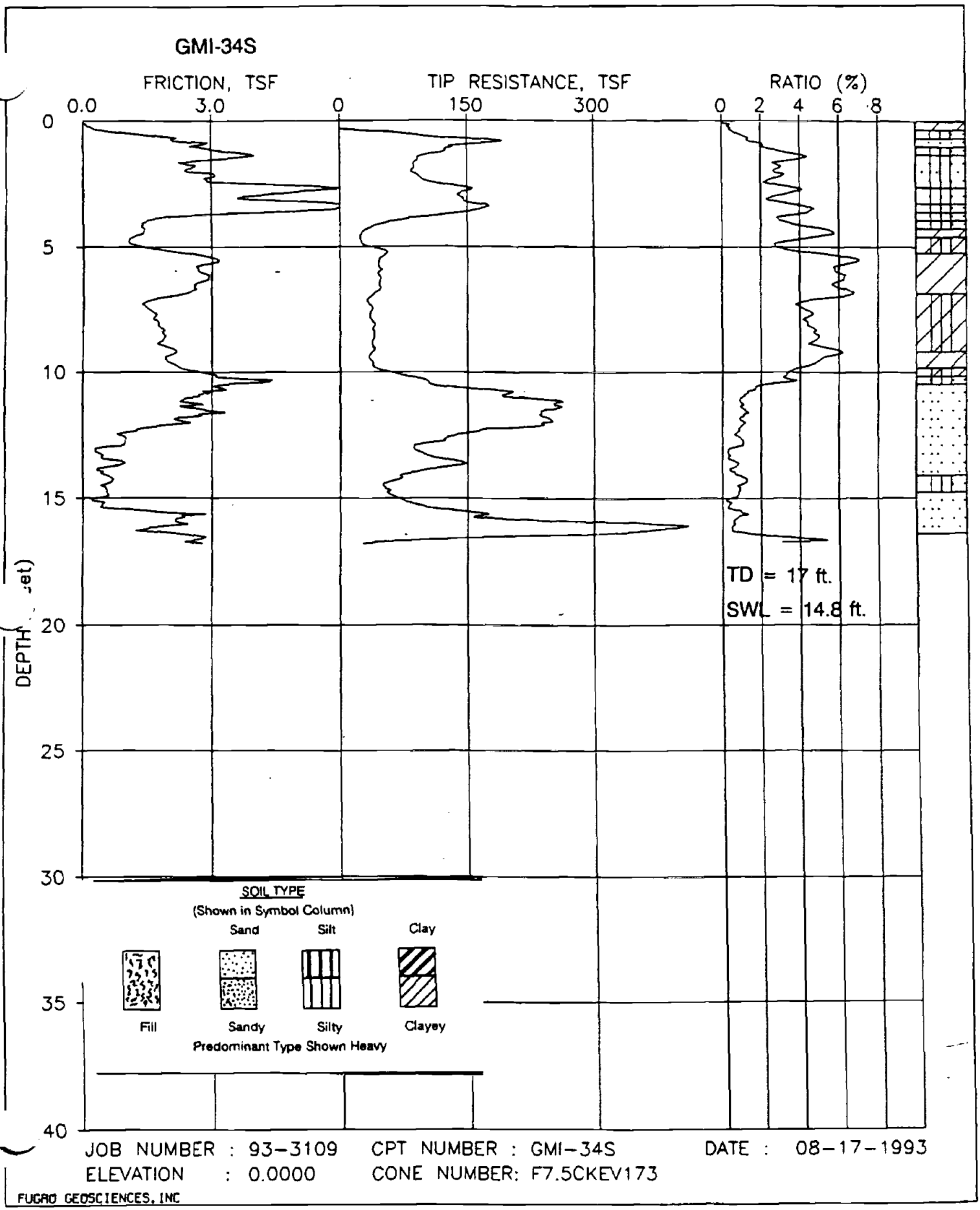


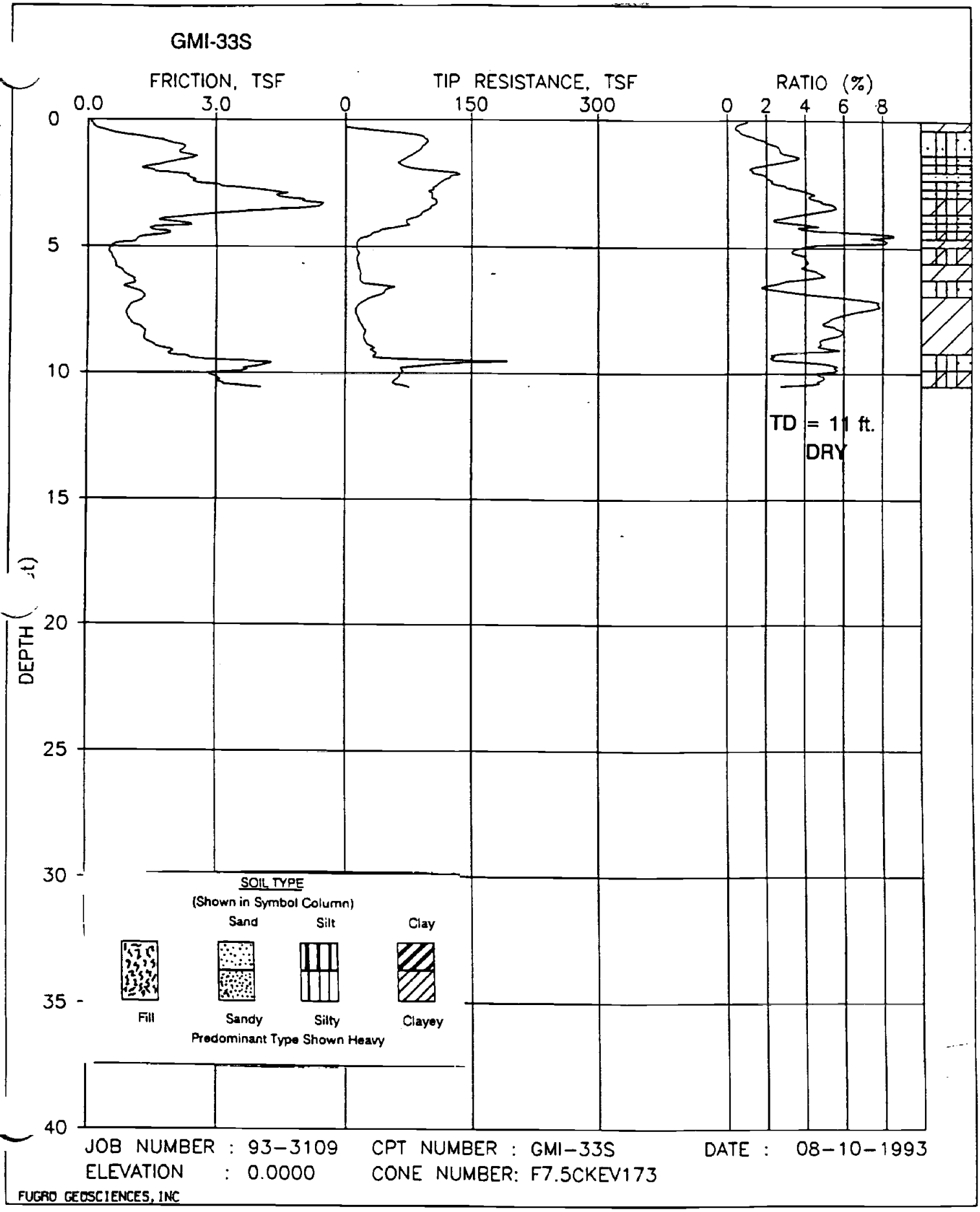
JOB NUMBER : 93-3109 CPT NUMBER : GMI-42S DATE : 08-17-1993
ELEVATION : 0.0000 CONE NUMBER: F7.5CKEV173

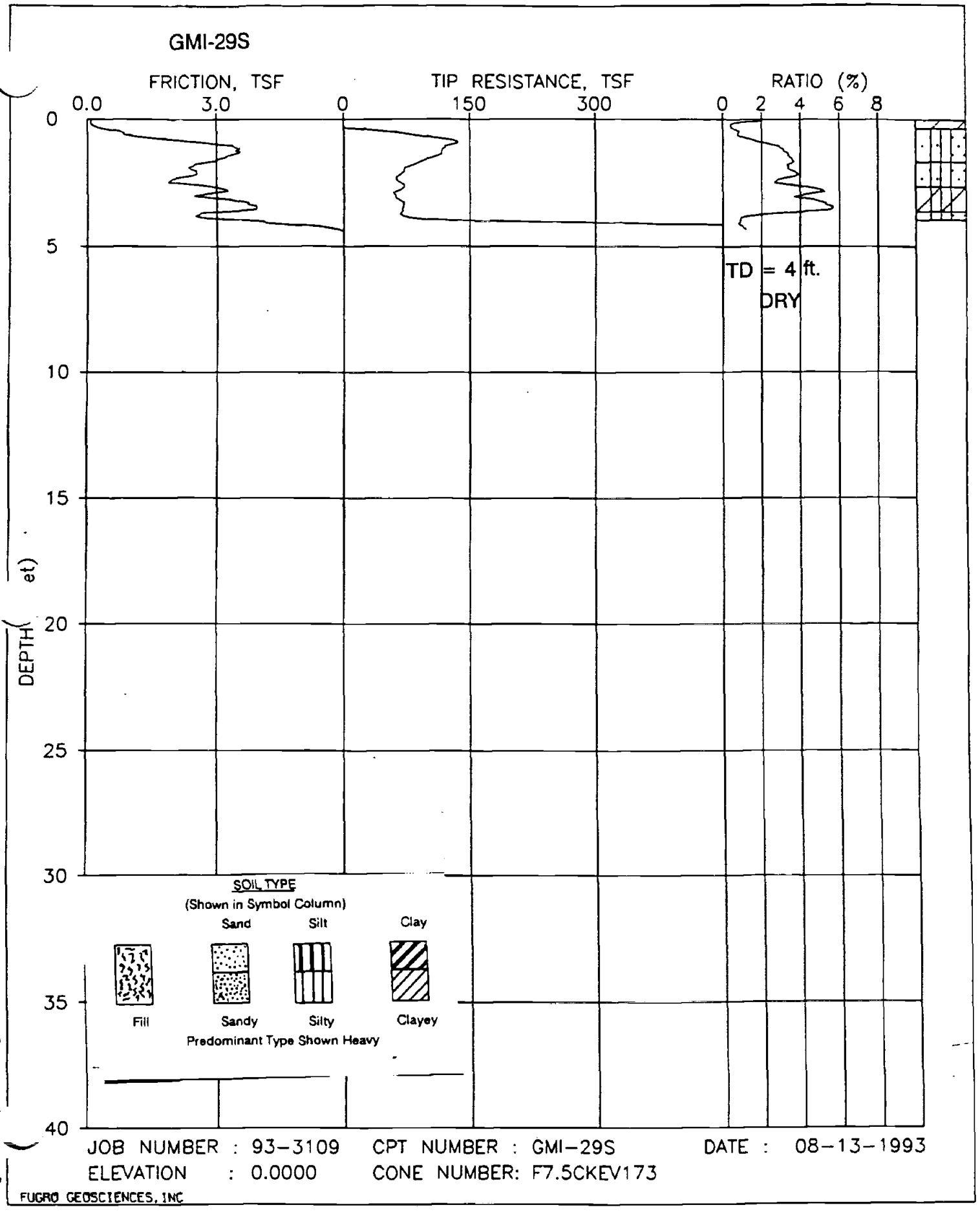
FUGRO GEOSCIENCES, INC

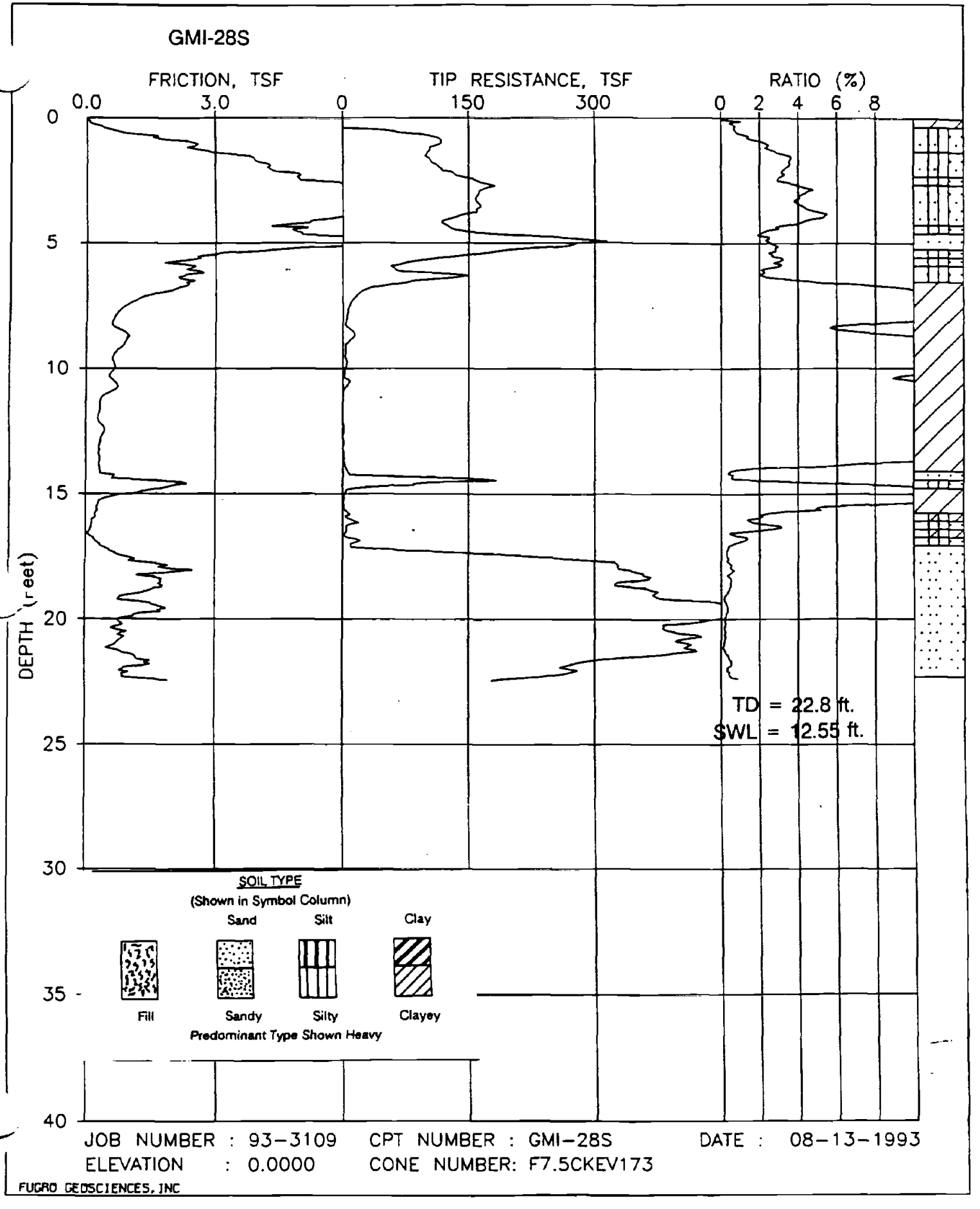

GMI-36S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (ft)
0
5
10
15
20
25
30
35
40
TD = 16 ft.
SWL = 16.44 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-36S
DATE : 08-16-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

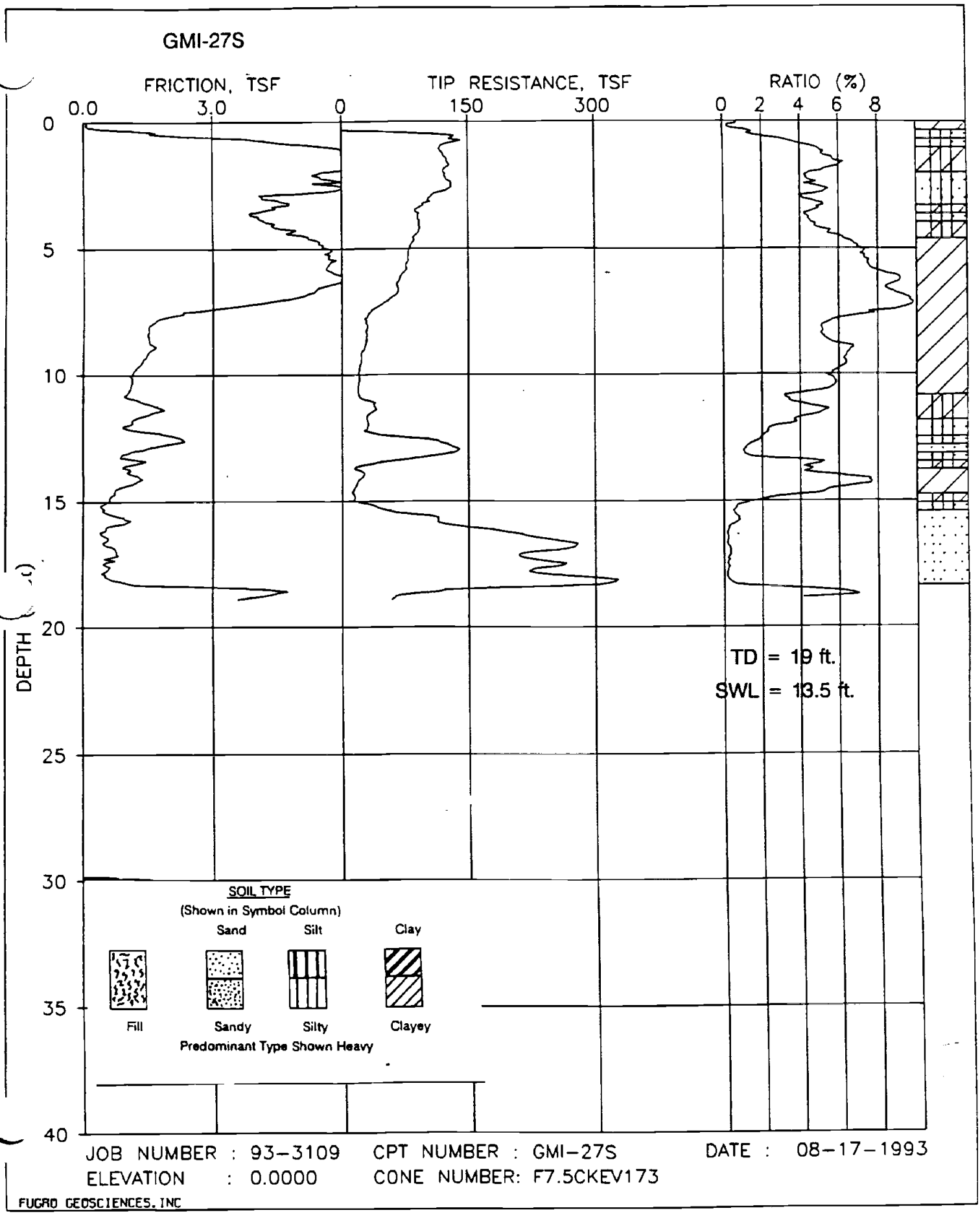

GMI-35S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (ft)
TD = 4 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-35S
DATE : 08-16-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

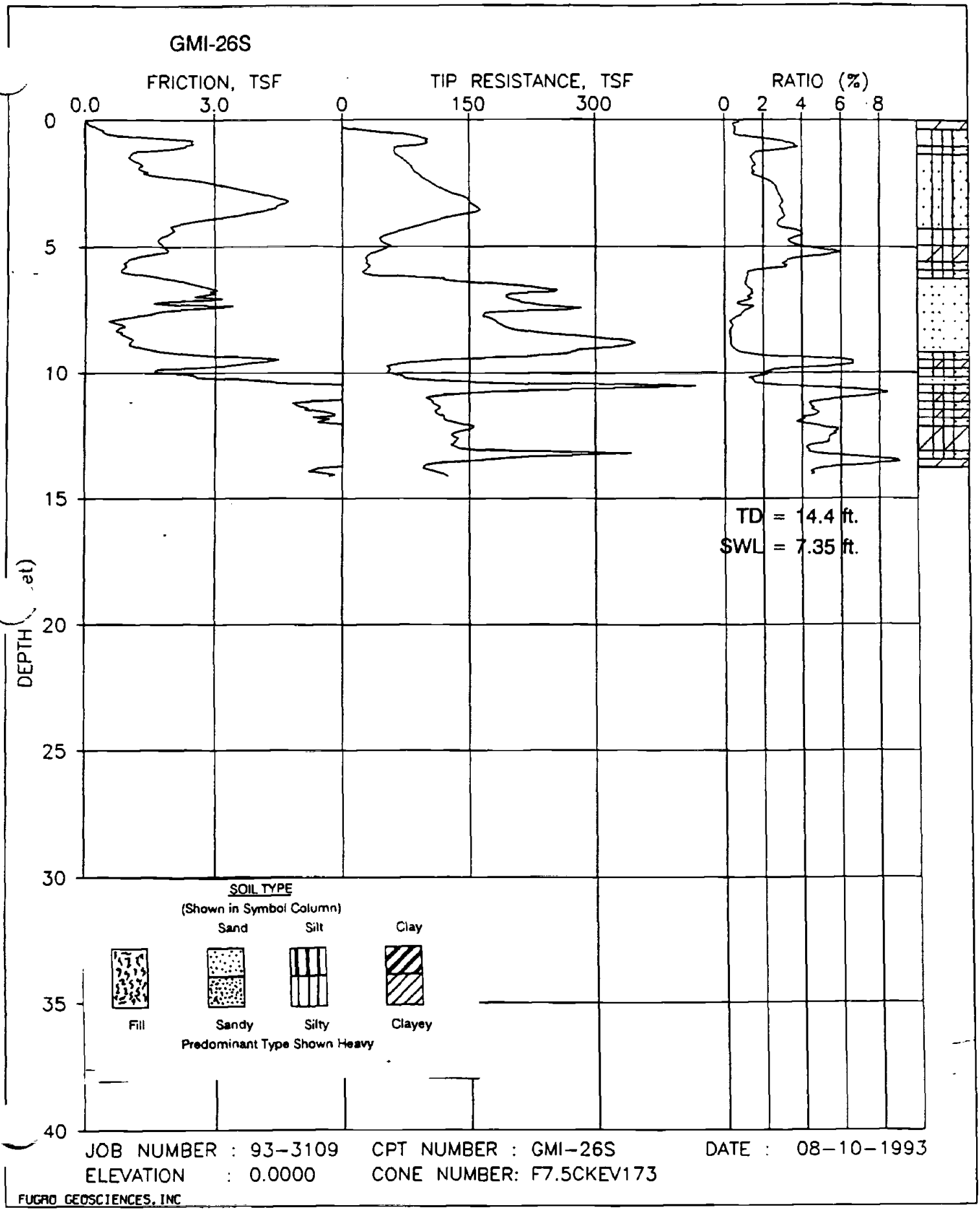

GMI-34S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (feet)
TD = 17 ft.
SWL = 14.8 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-34S
DATE : 08-17-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC


GMI-33S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (ft)
TD = 11 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-33S
DATE : 08-10-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC


GMI-29S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (ft)
TD = 4 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-29S
DATE : 08-13-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

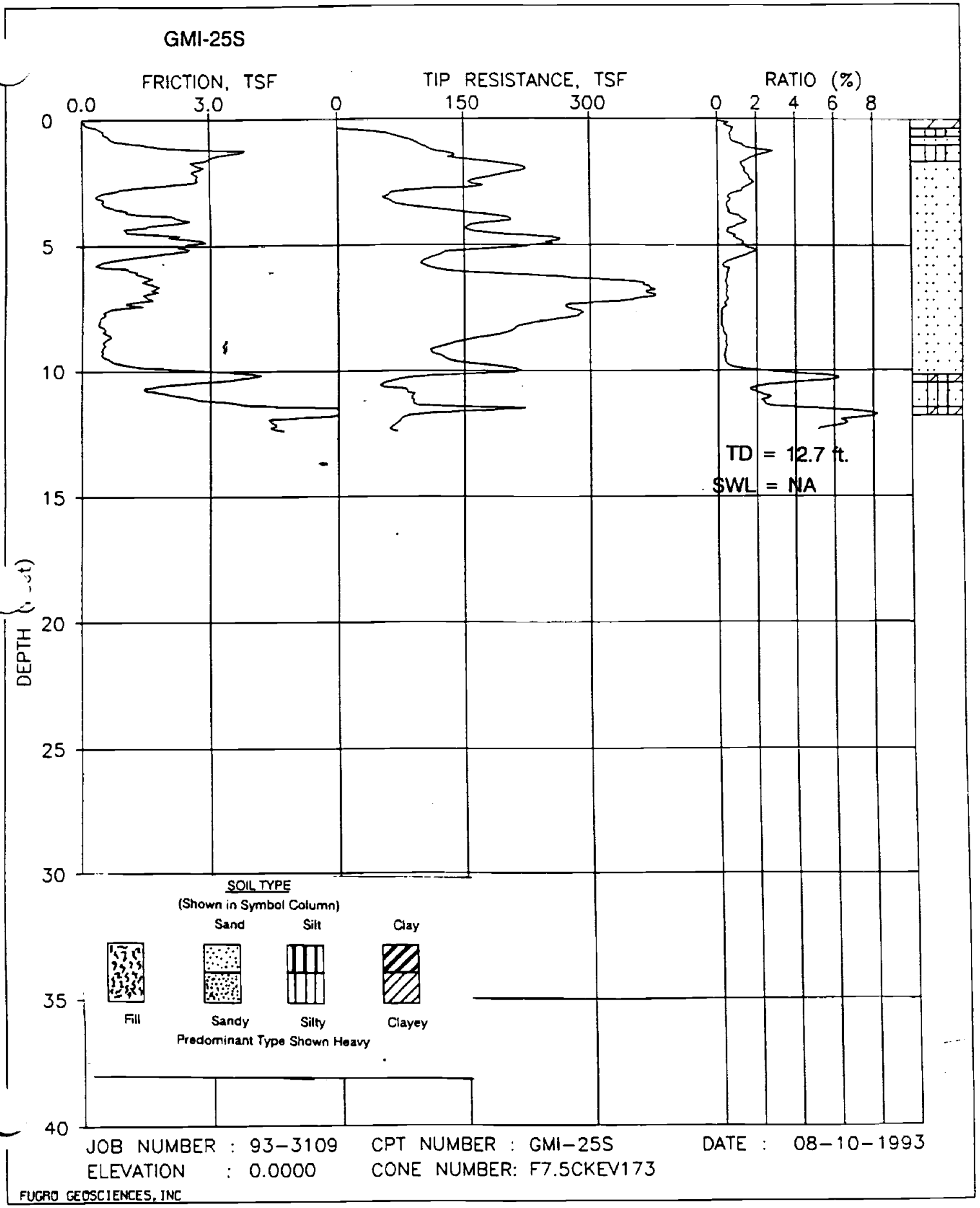

GMI-28S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (Feet)
TD = 22.8 ft.
SWL = 12.55 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-28S
DATE : 08-13-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

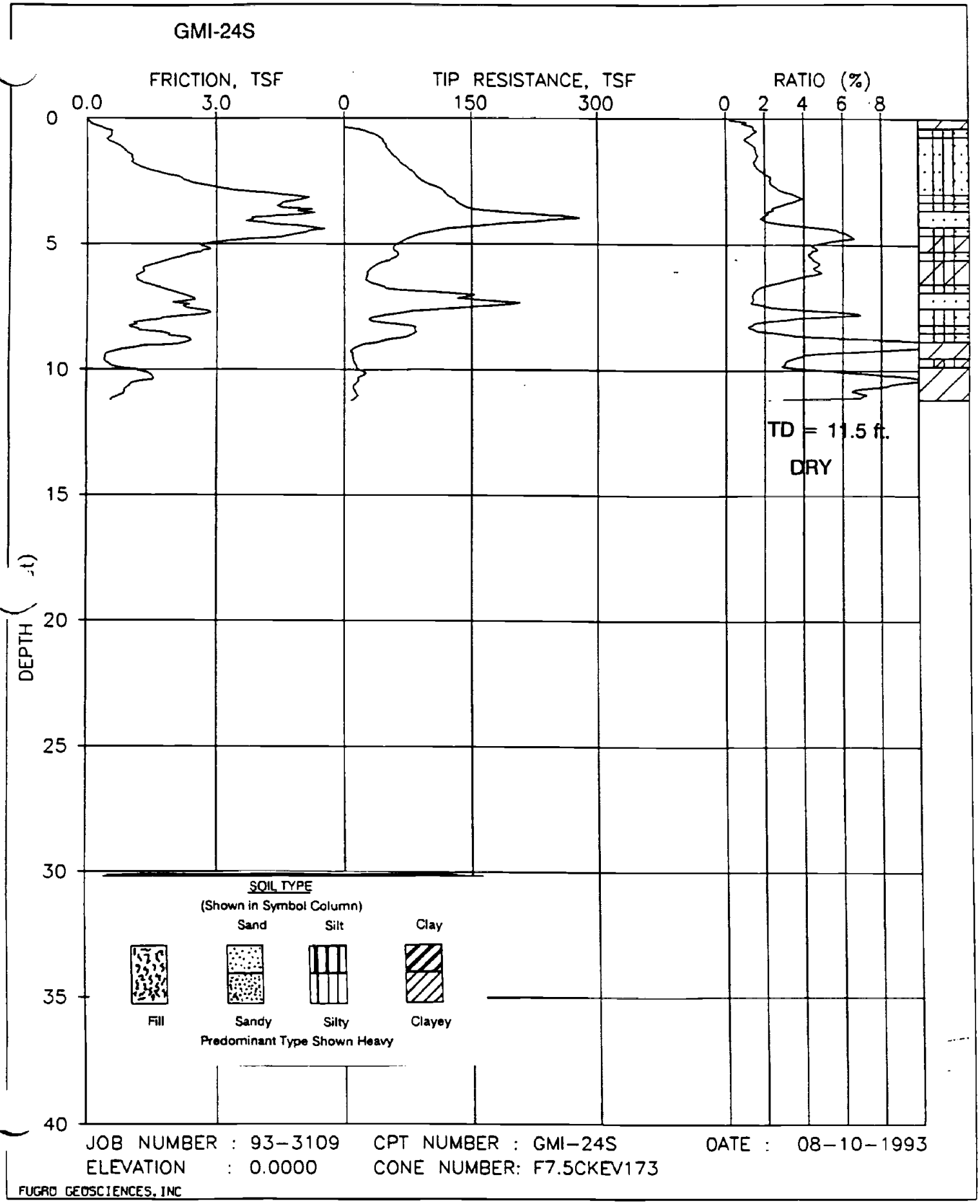

GMI-27S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (ft)
0
5
10
15
20
25
30
35
40
TD = 19 ft.
SWL = 13.5 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-27S
DATE : 08-17-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

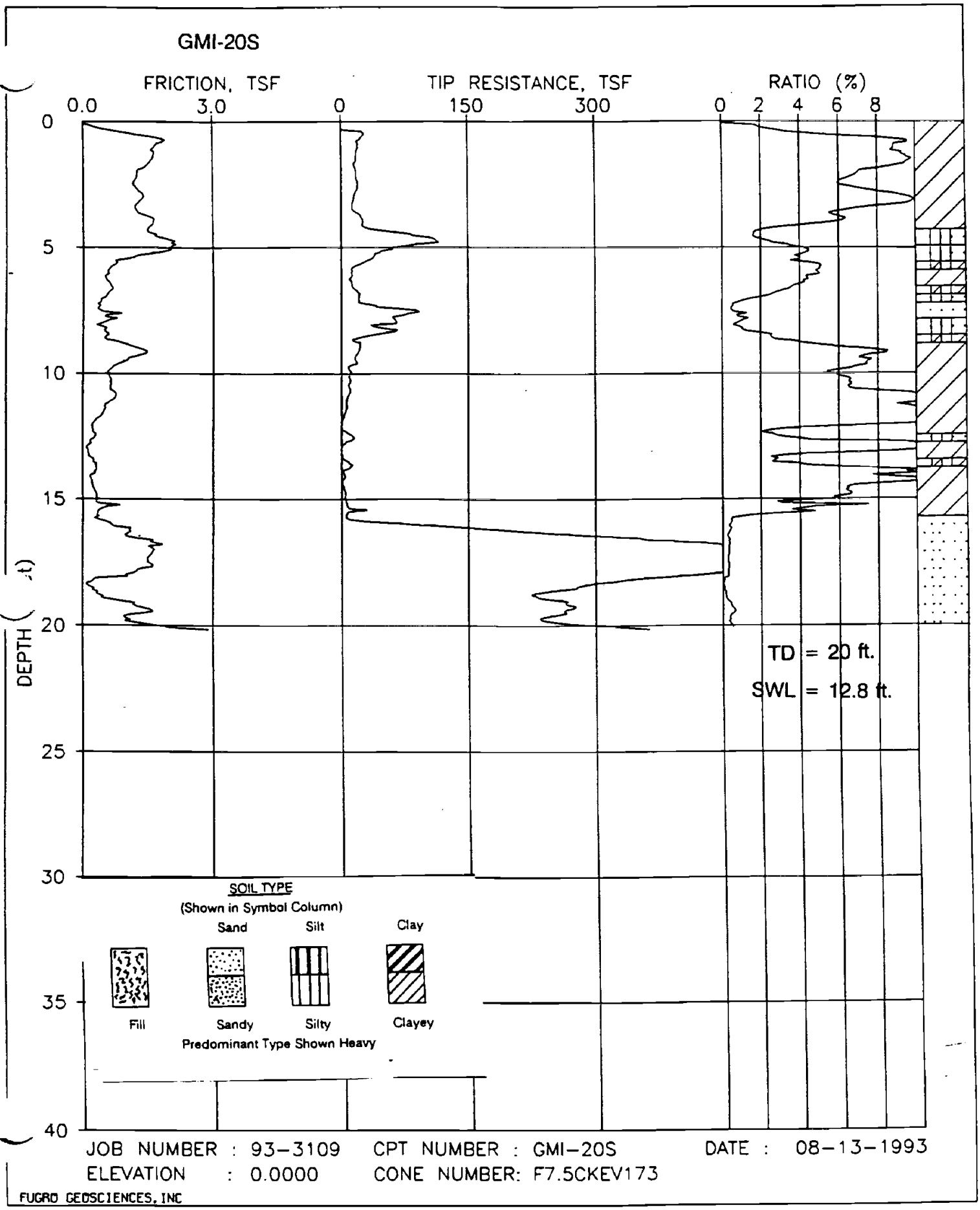


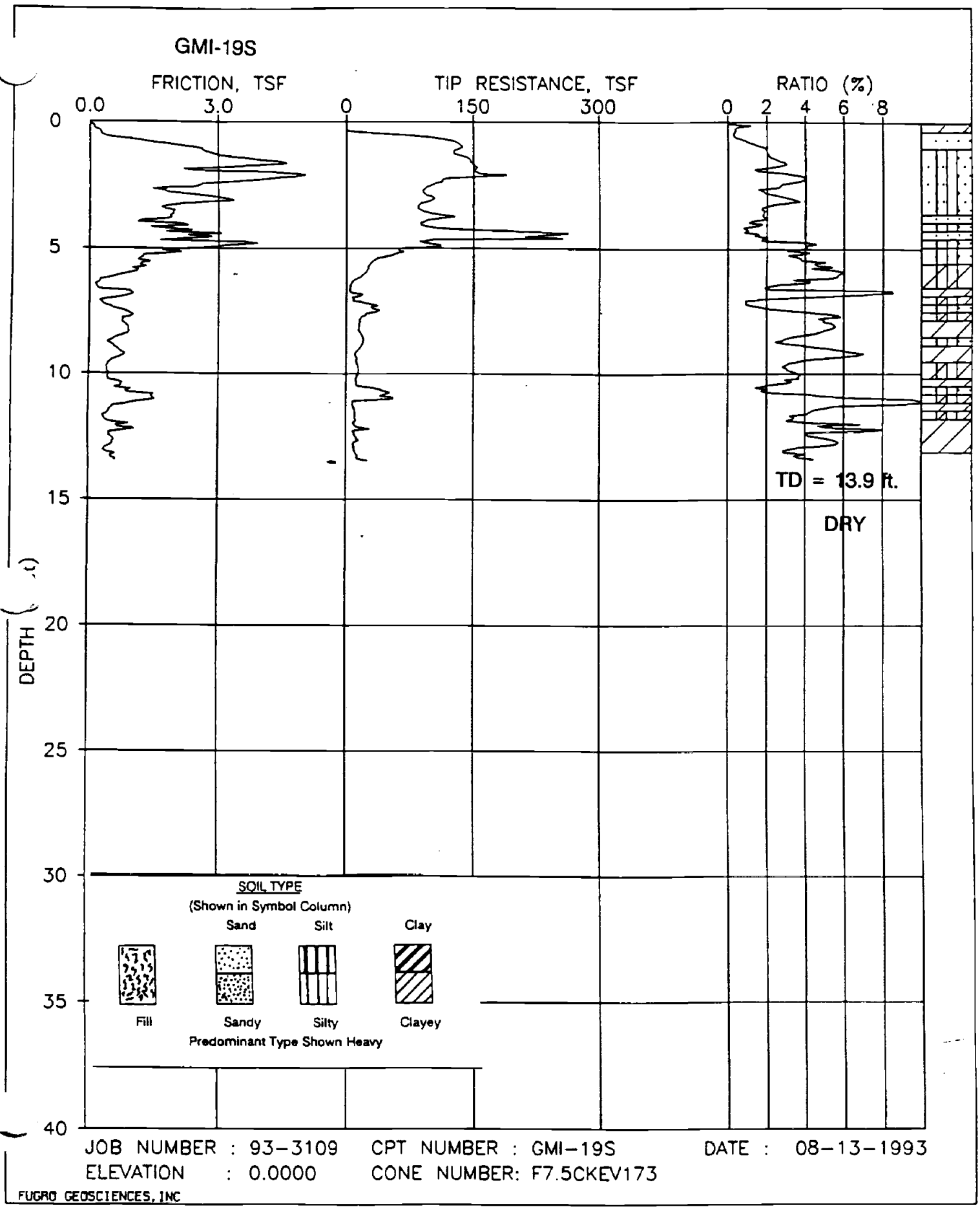
JOB NUMBER : 93-3109 CPT NUMBER : GMI-26S DATE : 08-10-1993
ELEVATION : 0.0000 CONE NUMBER: F7.5CKEV173

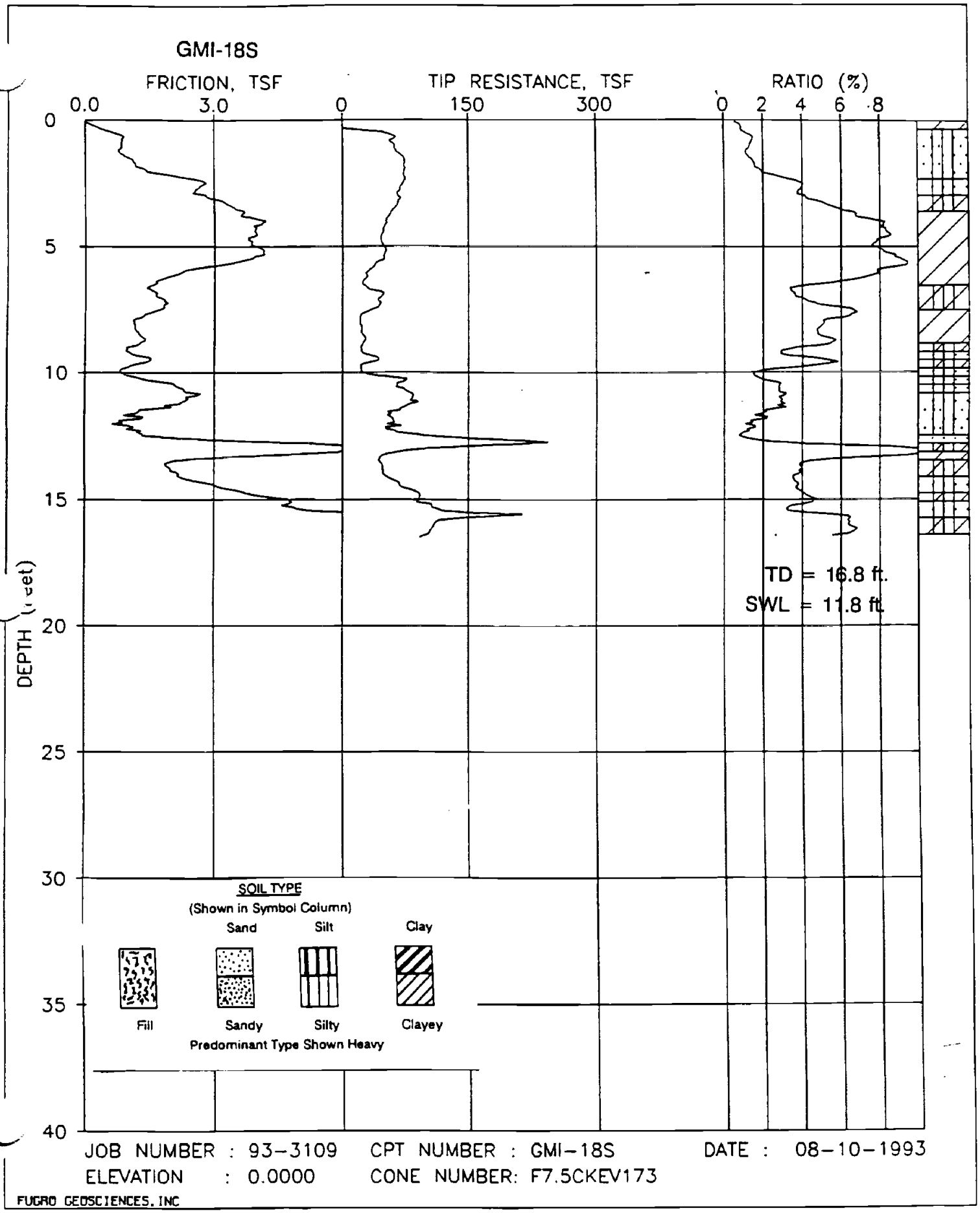
FUGRO GEOSCIENCES, INC

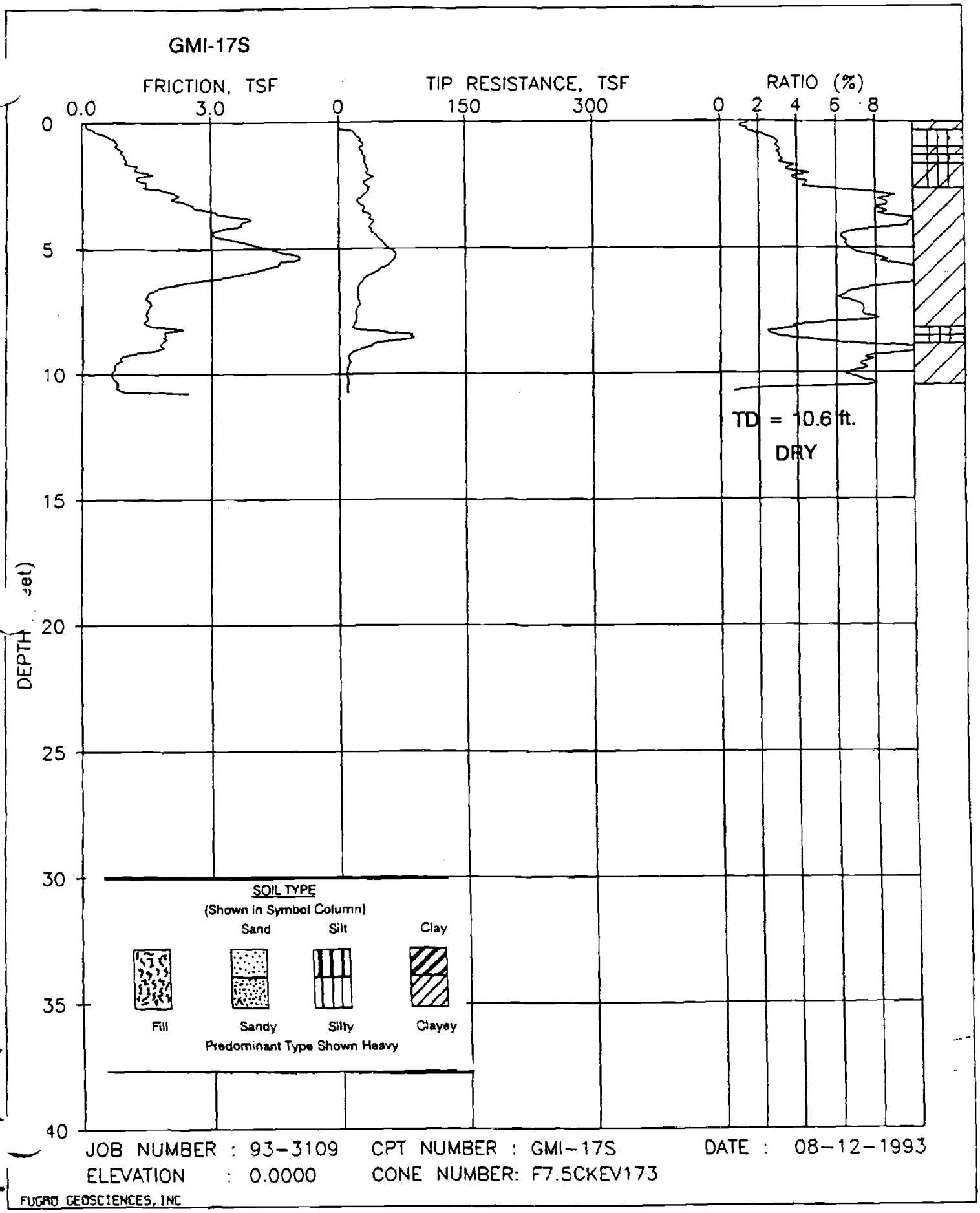

GMI-25S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (feet)
TD = 12.7 ft.
SWL = NA
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-25S
DATE : 08-10-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

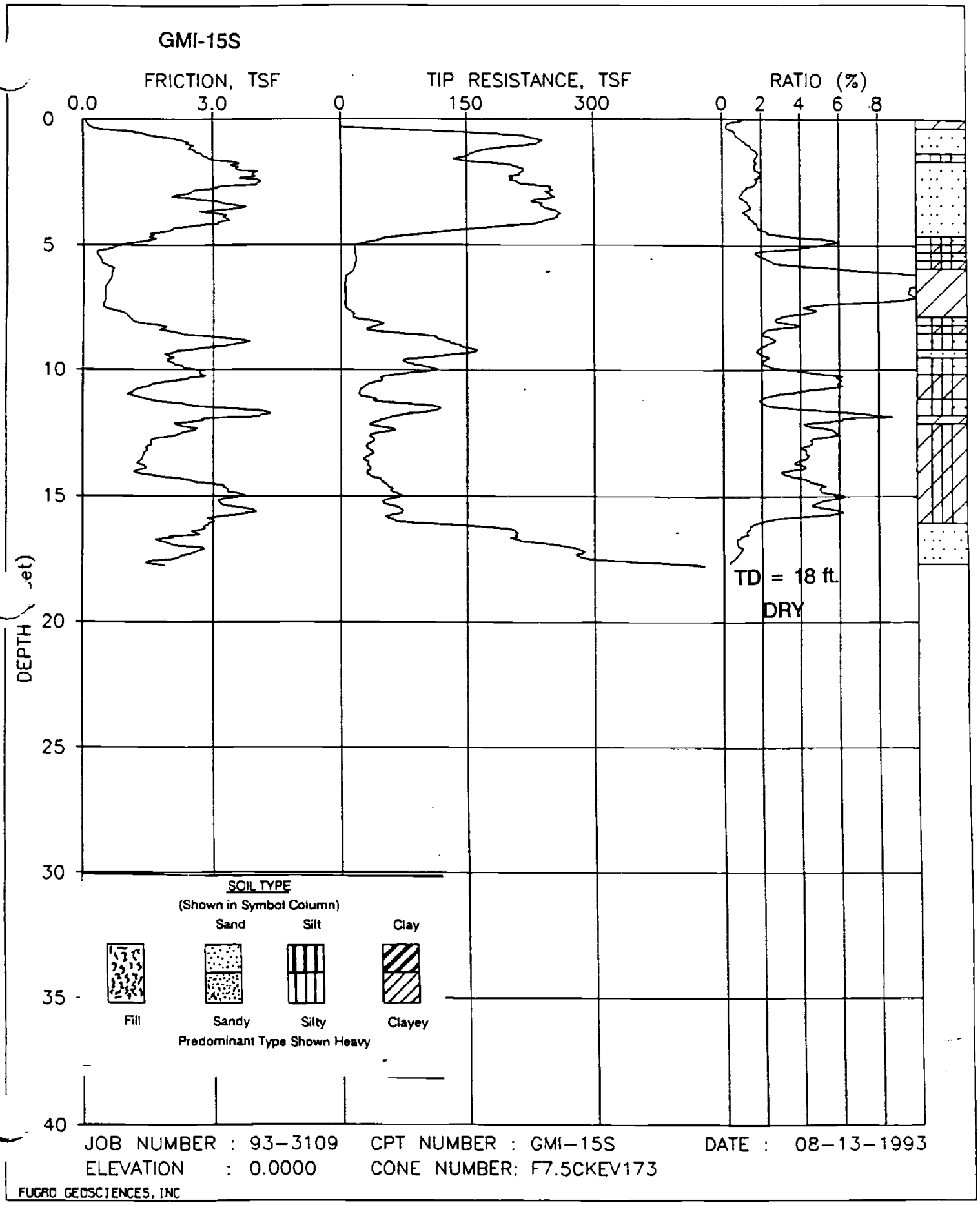

GMI-24S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (ft)
TD = 11.5 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-24S
DATE : 08-10-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

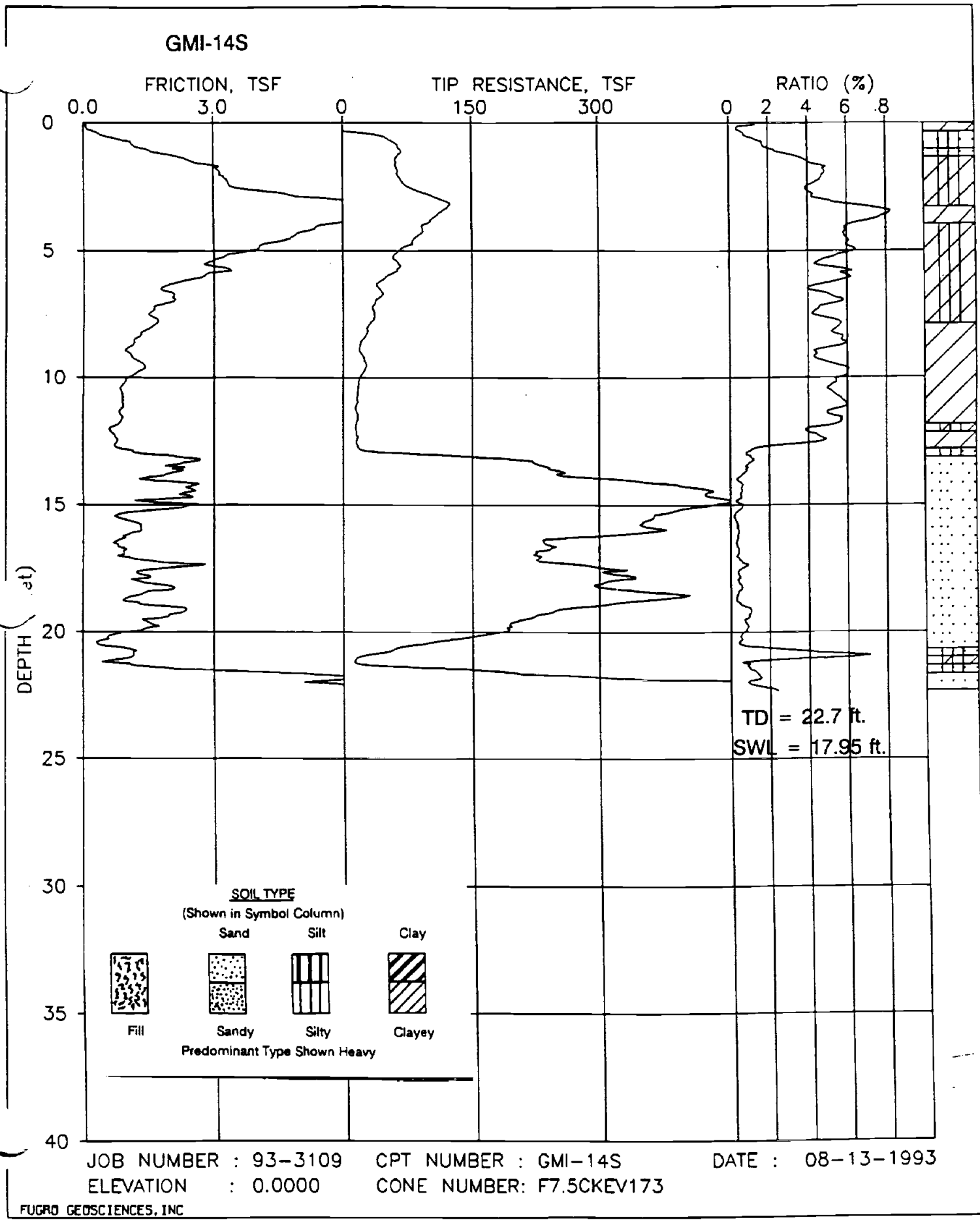

GMI-20S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (ft)
0
5
10
15
20
25
30
35
40
TD = 20 ft.
SWL = 12.8 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-20S
DATE : 08-13-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

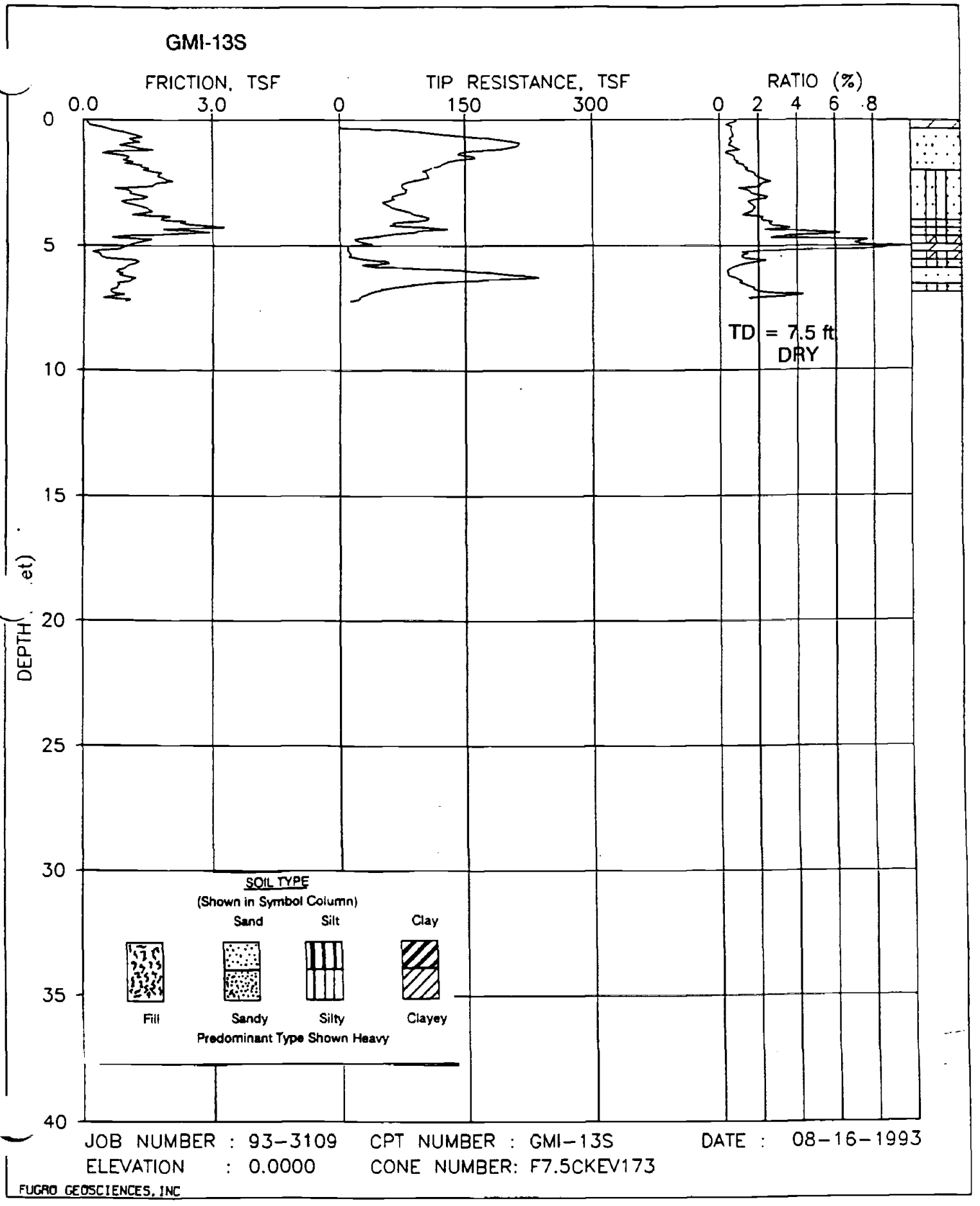

GMI-19S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (ft)
TD = 13.9 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-19S
DATE : 08-13-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

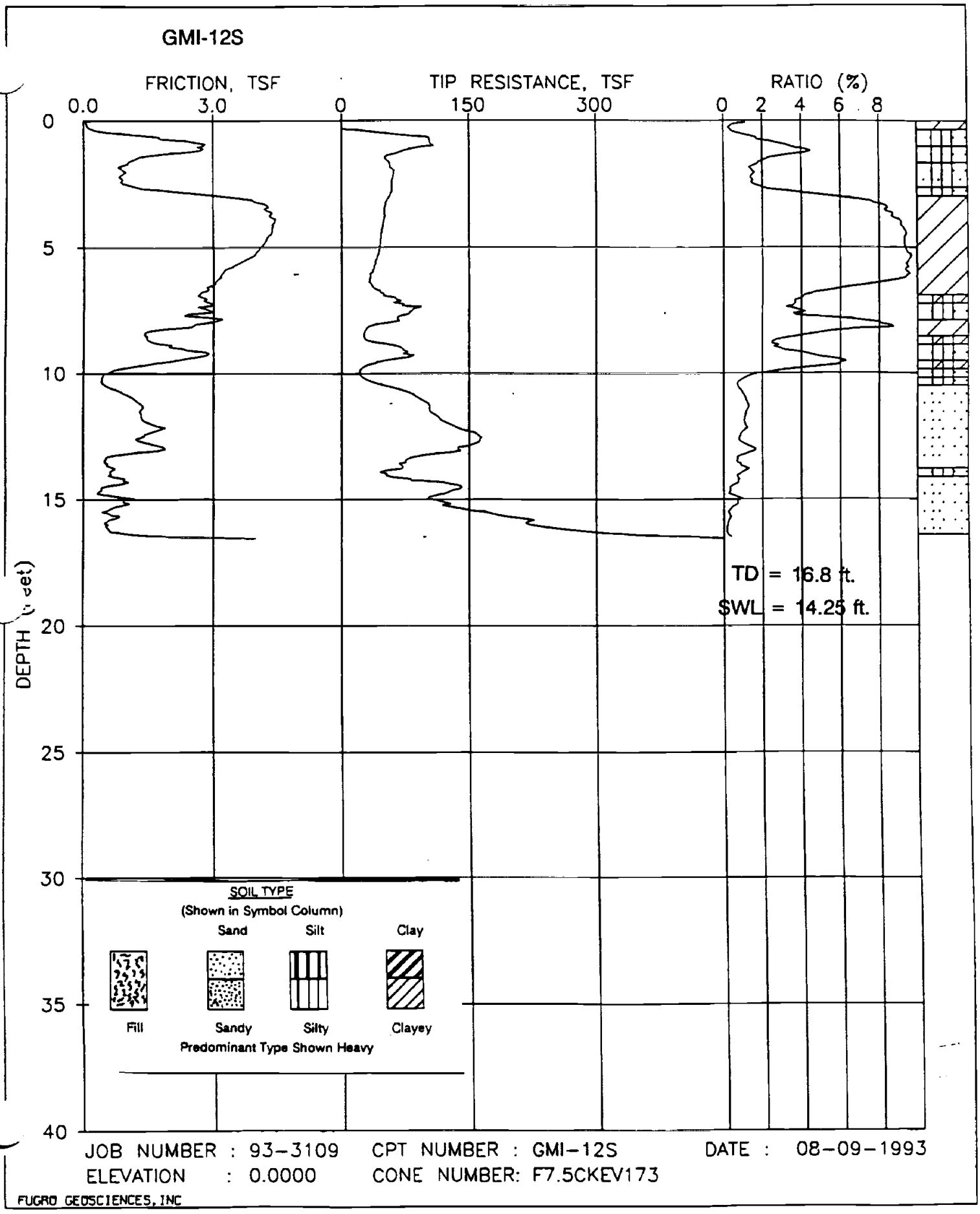

GMI-18S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (feet)
TD = 16.8 ft.
SWL = 11.8 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-18S
DATE : 08-10-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

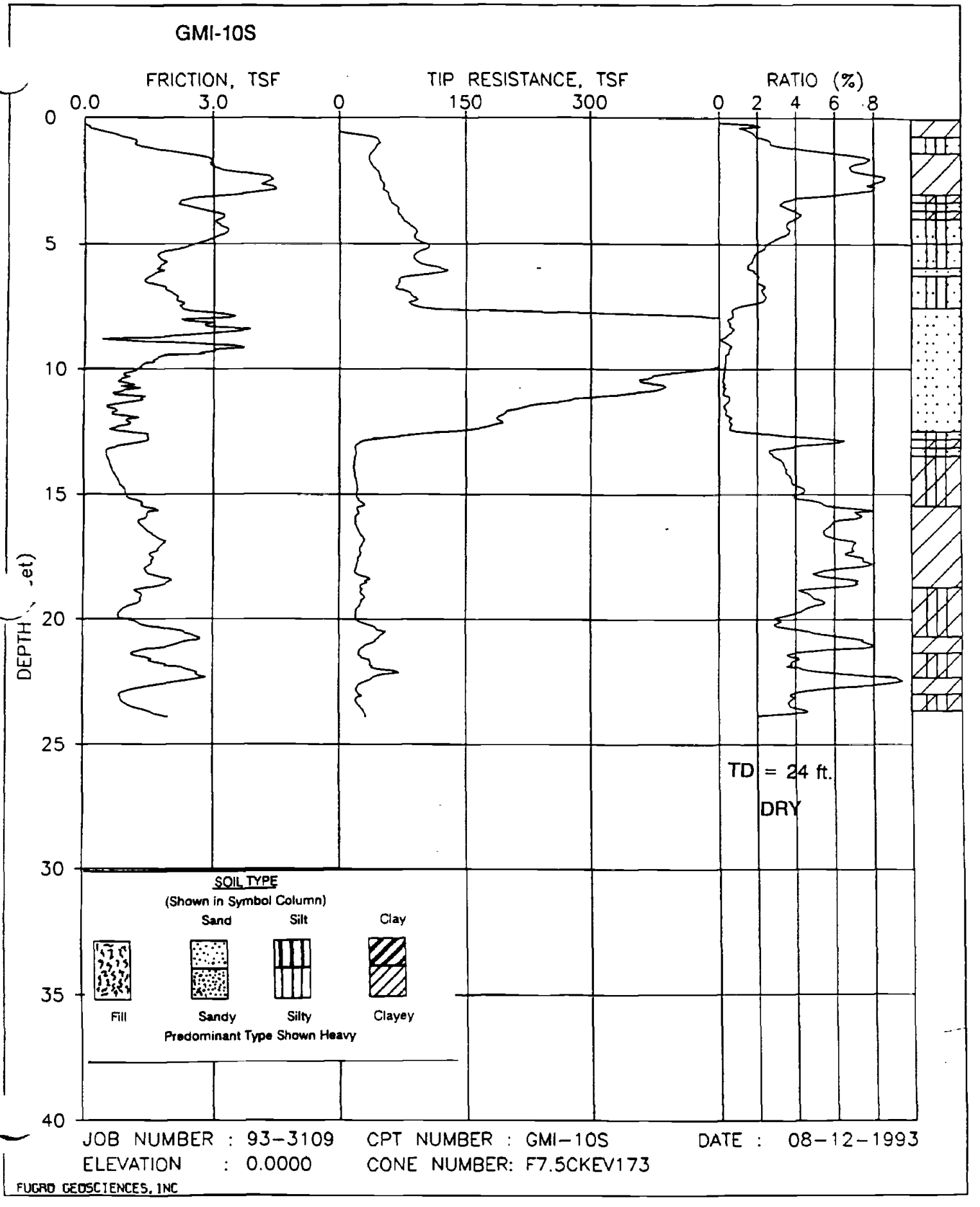

GMI-17S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (feet)
TD = 10.6 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-17S
DATE : 08-12-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

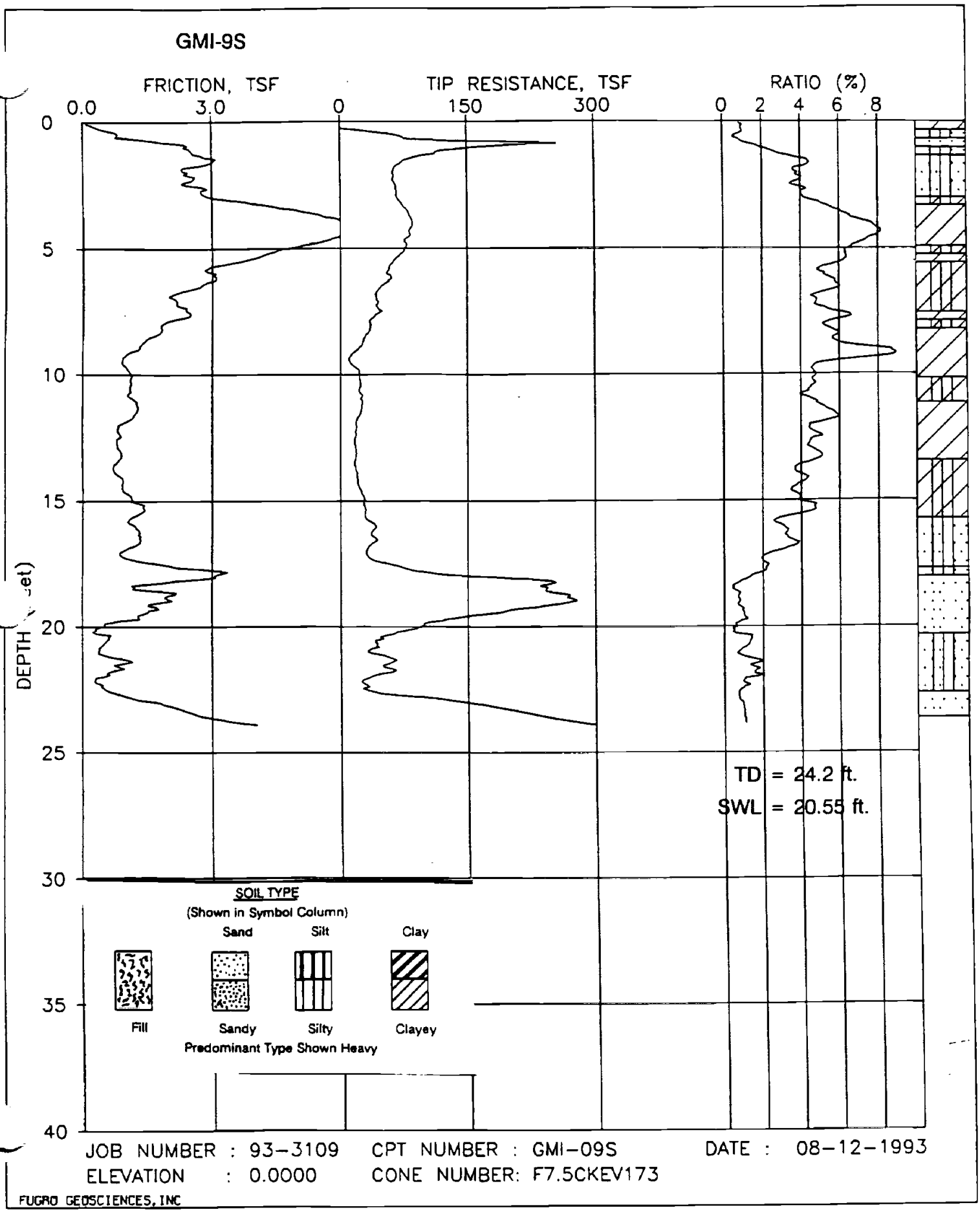

GMI-15S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (feet)
0
5
10
15
20
25
30
35
40
TD = 18 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-15S
DATE : 08-13-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

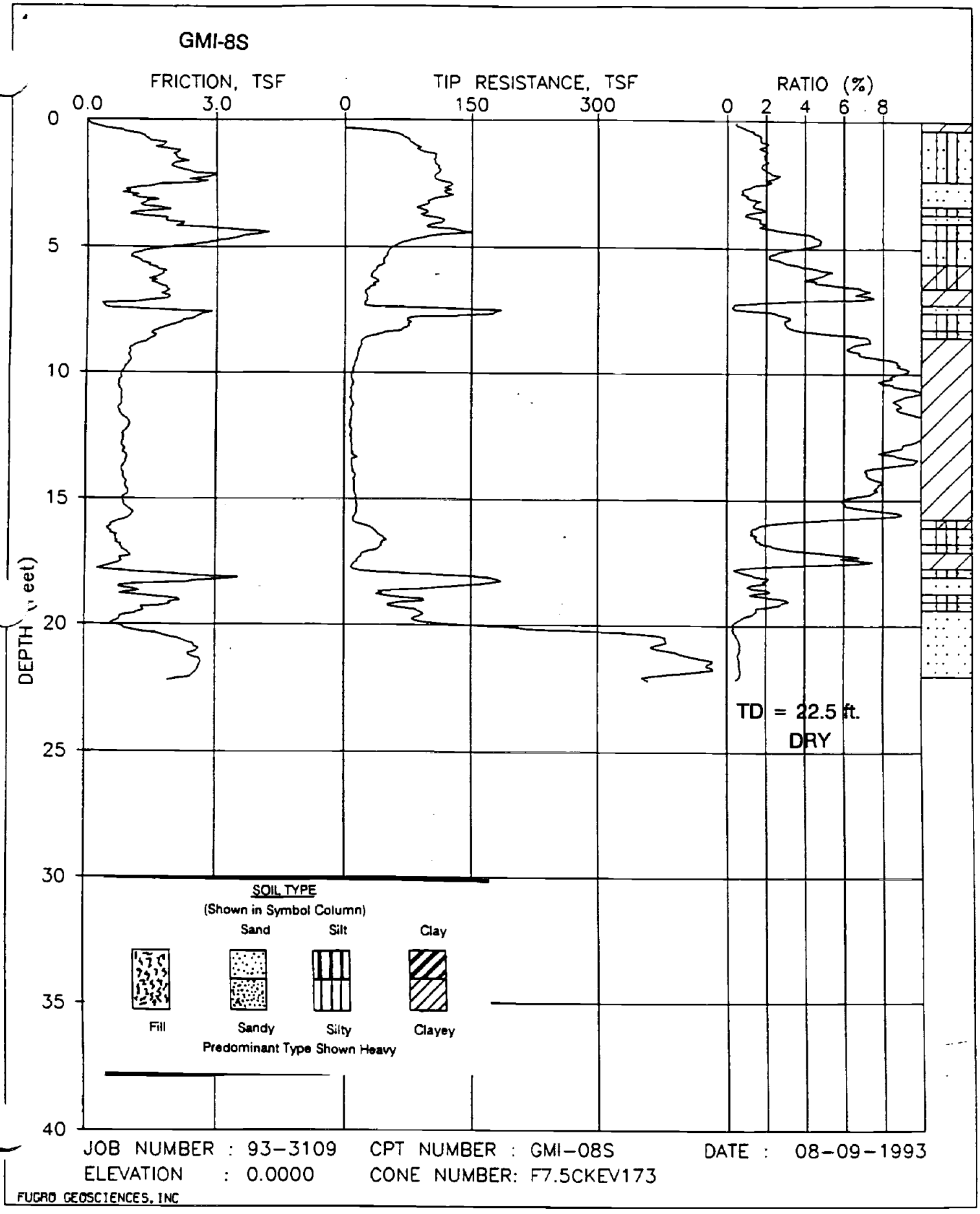

GMI-14S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (ft)
0
5
10
15
20
25
30
35
40
TD = 22.7 ft.
SWL = 17.95 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-14S
DATE : 08-13-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

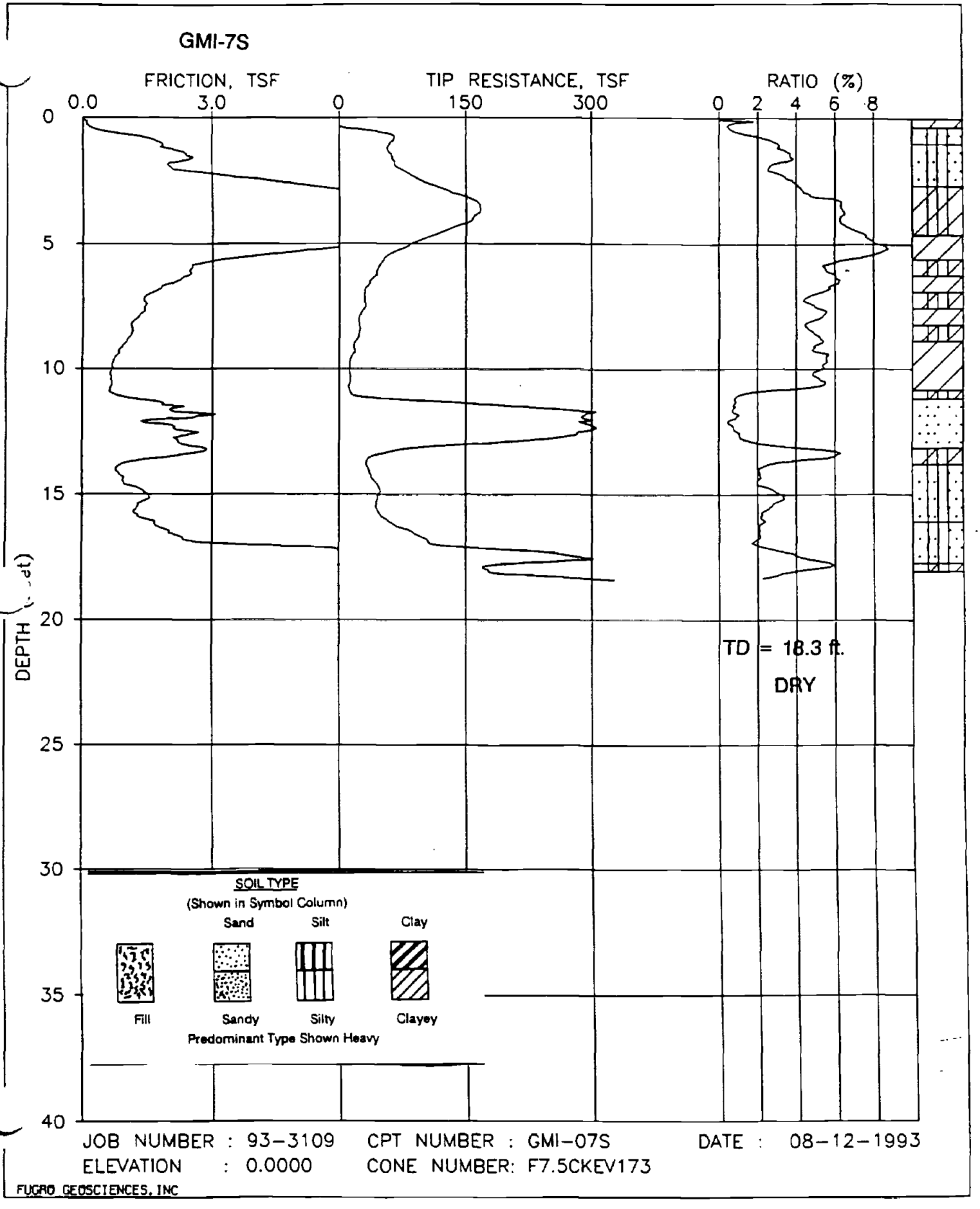

GMI-13S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (feet)
TD = 7.5 ft
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-13S
DATE : 08-16-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

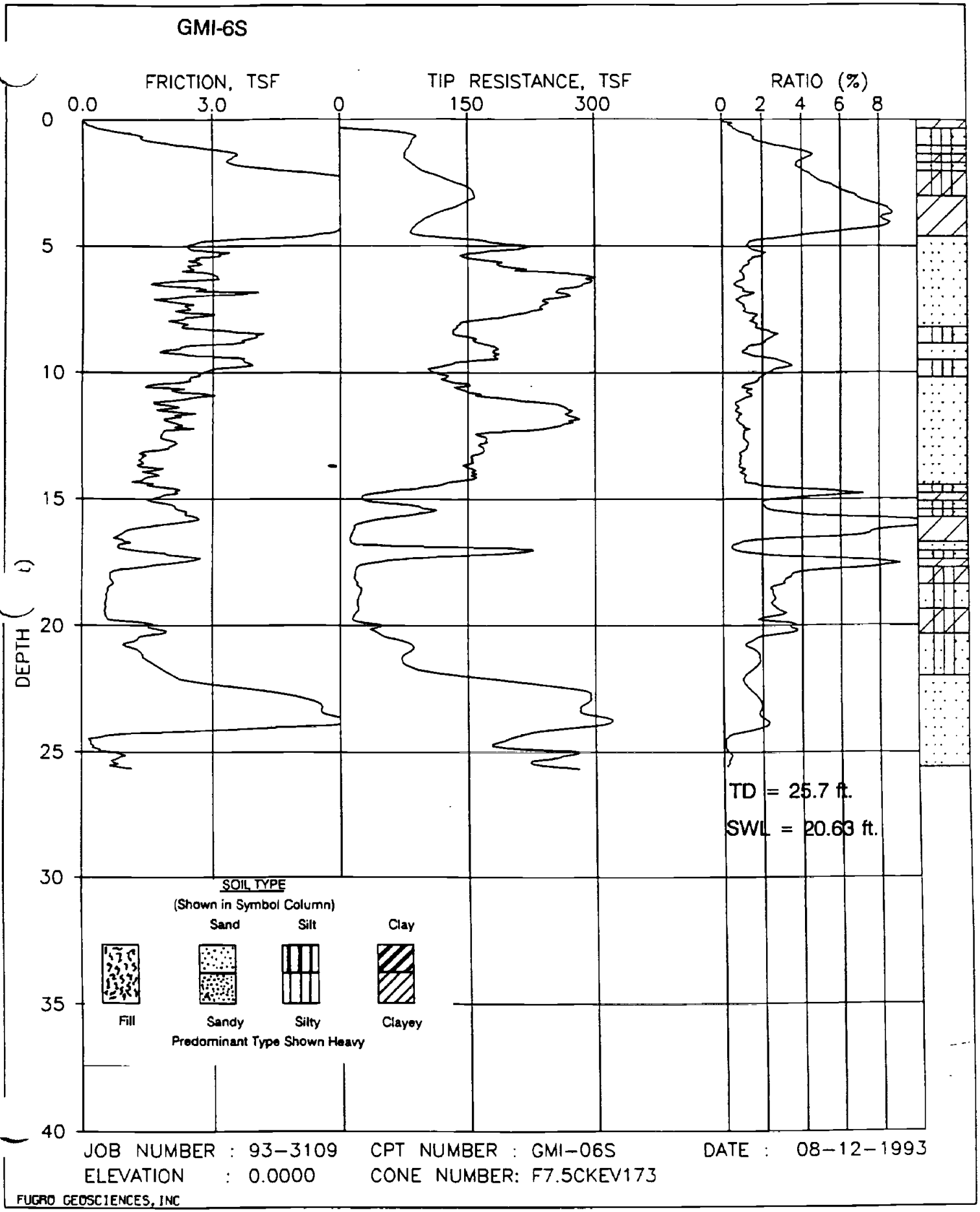

GMI-12S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (feet)
TD = 16.8 ft.
SWL = 14.25 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-12S
DATE : 08-09-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

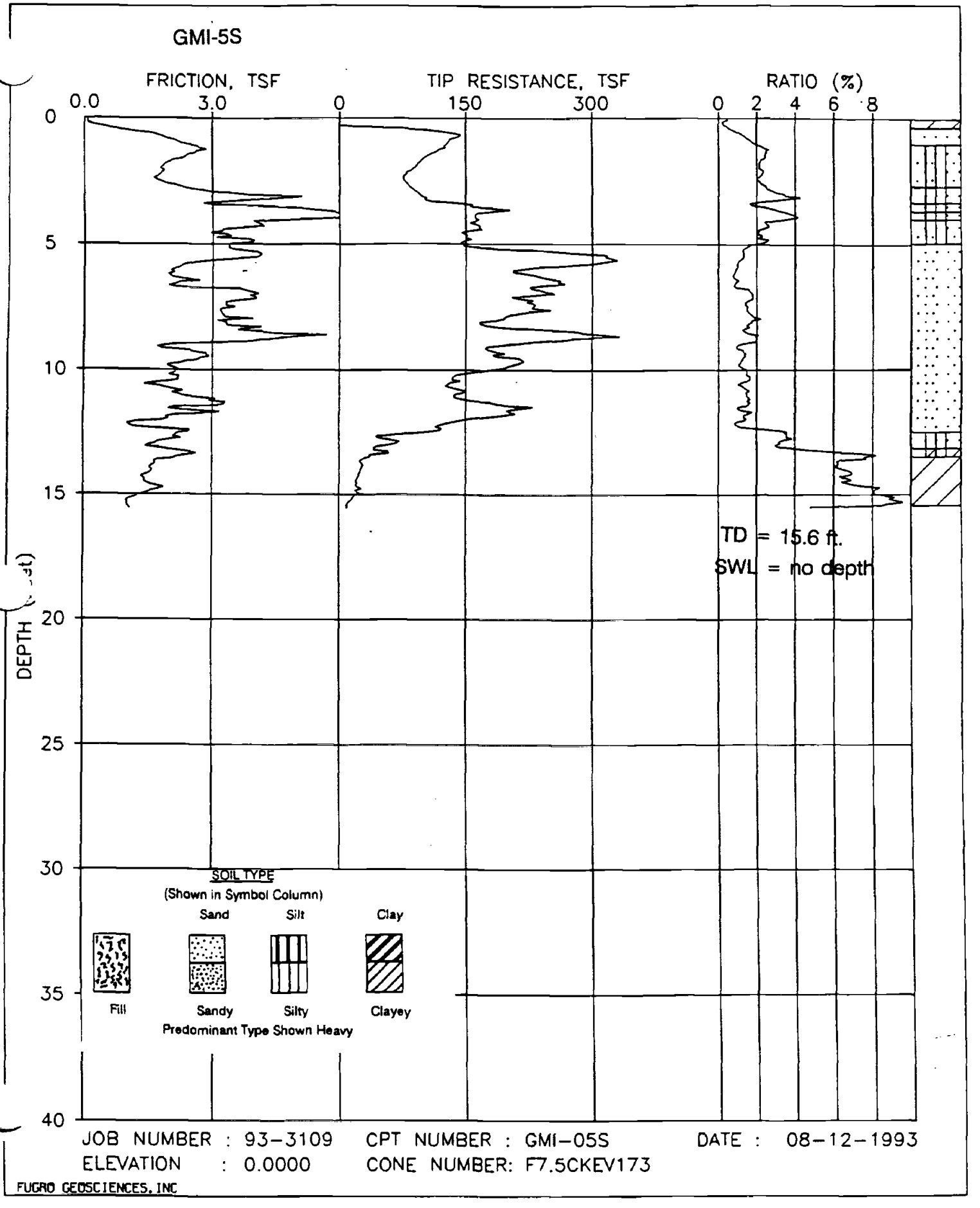

GMI-10S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (ft)
0
5
10
15
20
25
30
35
40
TD = 24 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-10S
DATE : 08-12-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

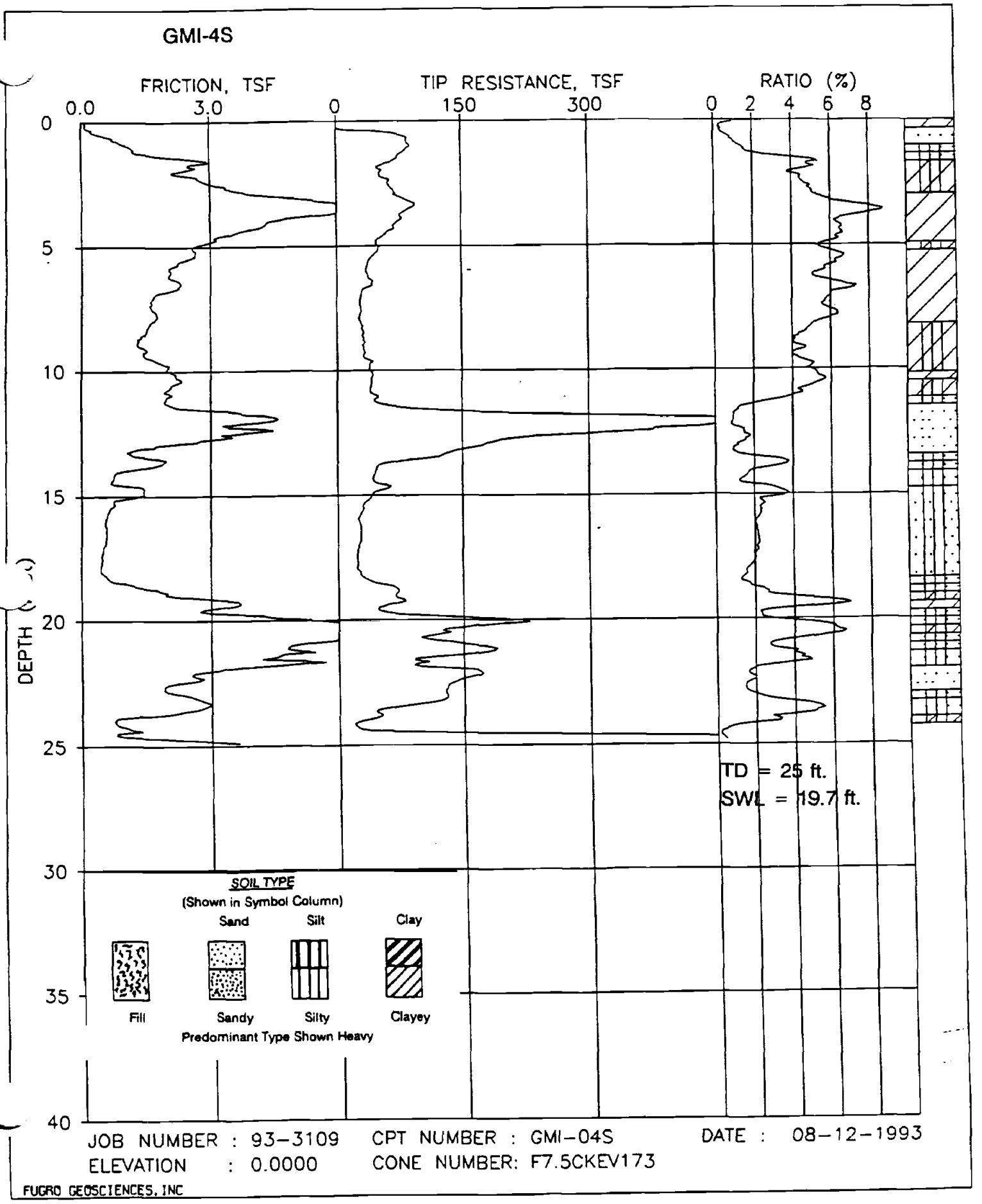

GMI-9S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (feet)
0
5
10
15
20
25
30
35
40
TD = 24.2 ft.
SWL = 20.55 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-09S
DATE : 08-12-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

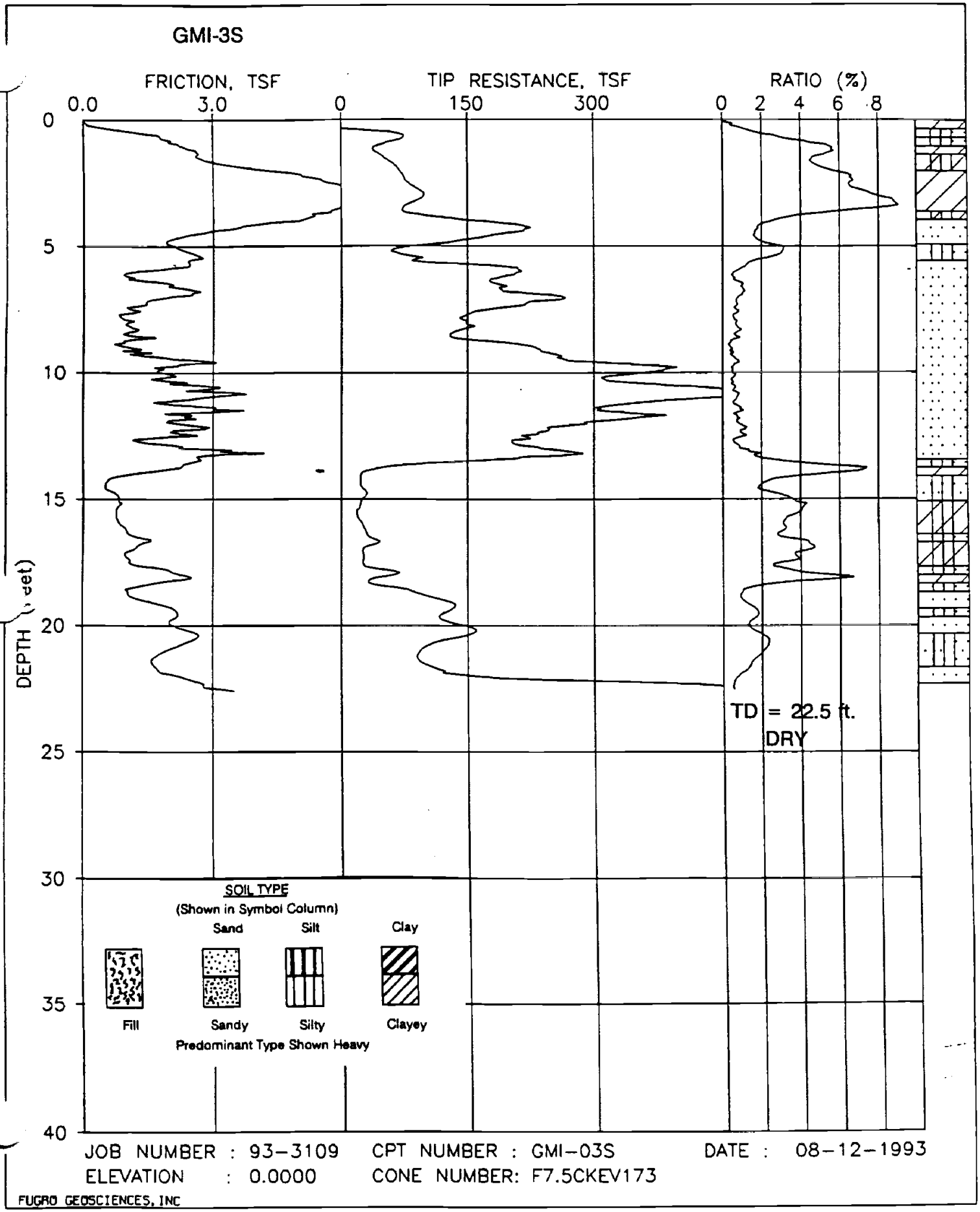

GMI-8S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (Feet)
TD = 22.5 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-08S
DATE : 08-09-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

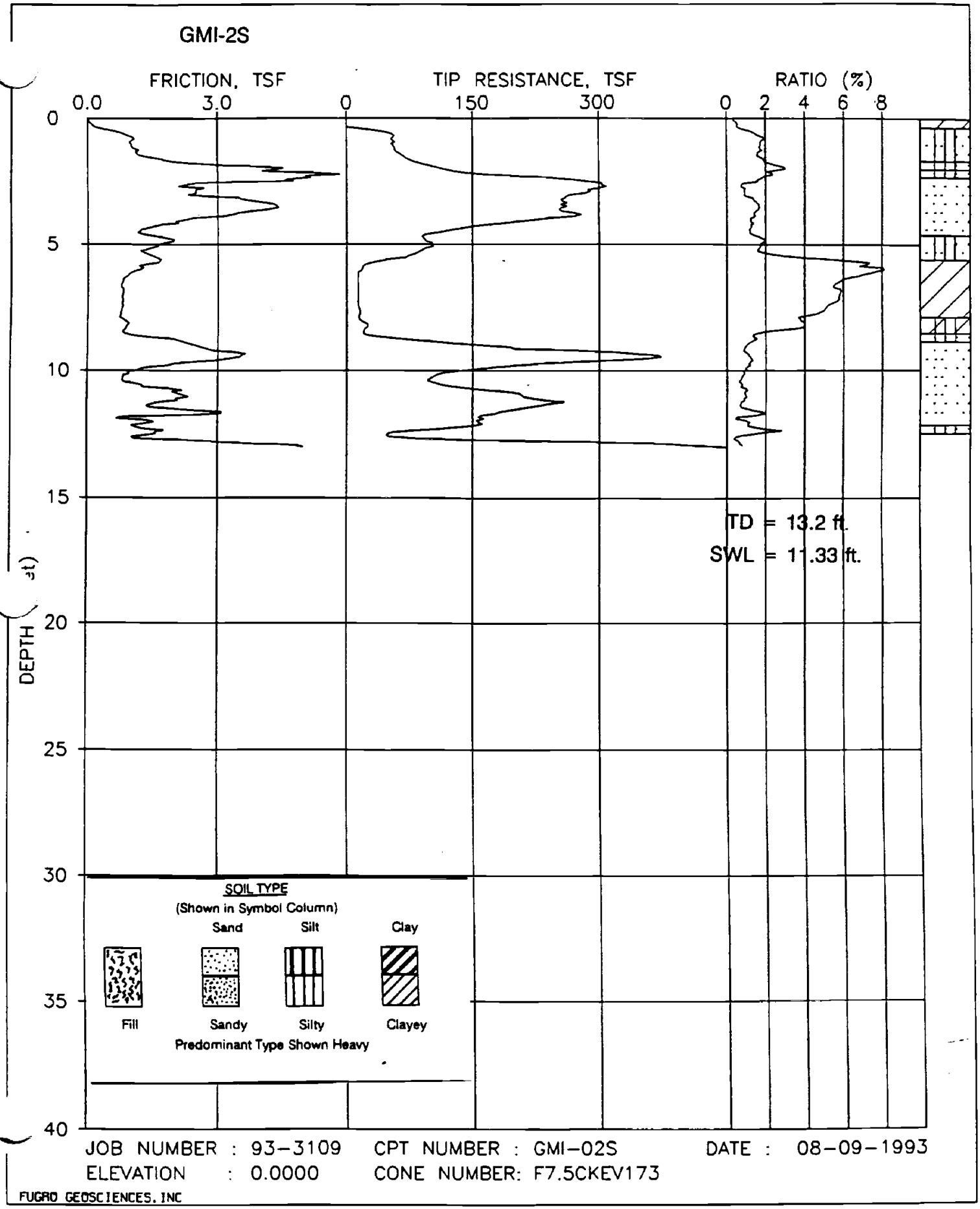

GMI-7S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
0
5
10
15
20
25
30
35
40
DEPTH (ft)
TD = 18.3 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-07S
DATE : 08-12-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC

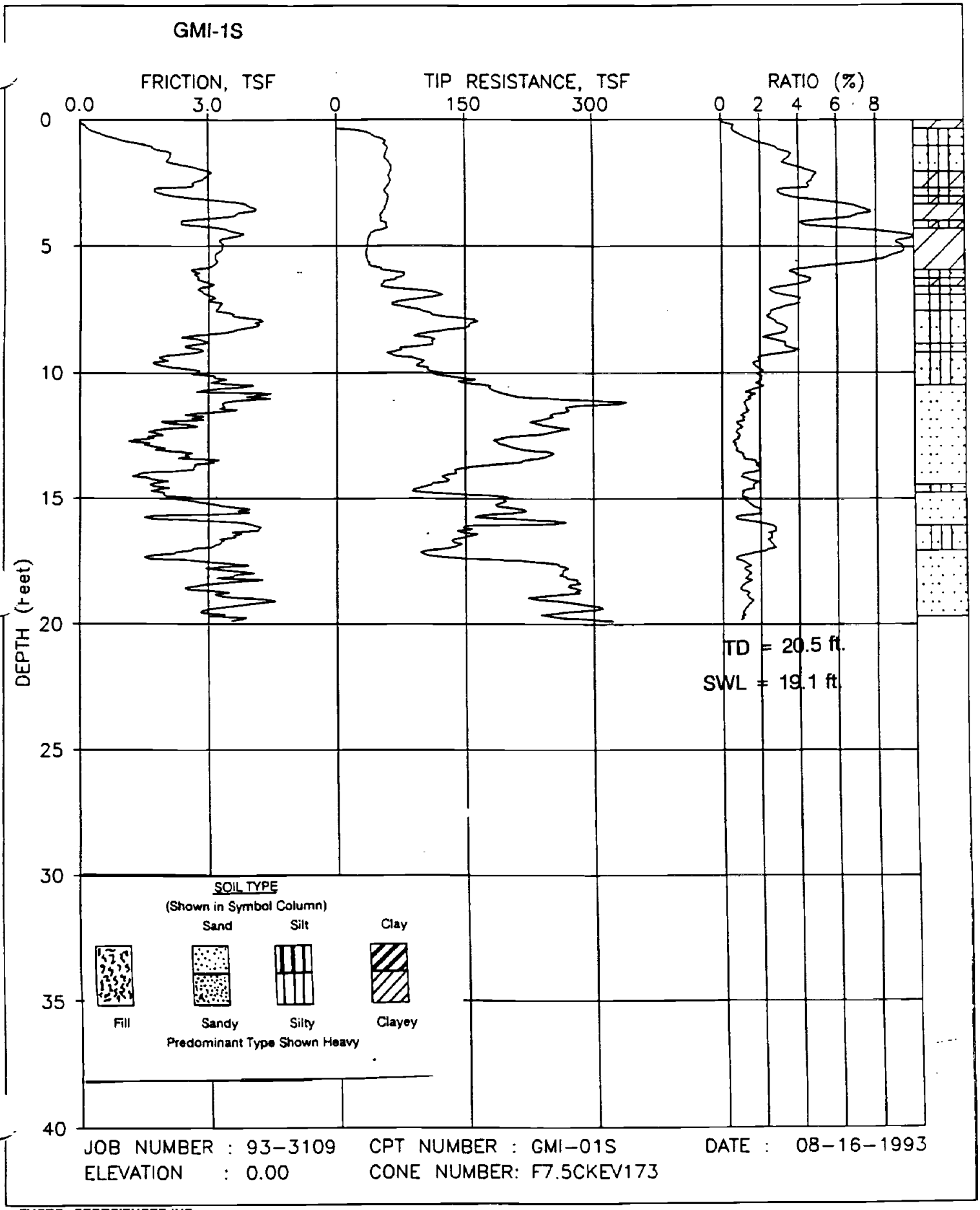

GMI-6S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (ft)
0
5
10
15
20
25
30
35
40
TD = 25.7 ft.
SWL = 20.63 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-06S
DATE : 08-12-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC


GMI-5S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (feet)
0
5
10
15
20
25
30
35
40
TD = 15.6 ft.
SWL = no depth
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-05S
DATE : 08-12-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC


GMI-4S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (ft)
0
5
10
15
20
25
30
35
40
TD = 25 ft.
SWL = 19.7 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-04S
DATE : 08-12-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC


GMI-3S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (feet)
0
5
10
15
20
25
30
35
40
TD = 22.5 ft.
DRY
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-03S
DATE : 08-12-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC


GMI-2S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (ft)
0
5
10
15
20
25
30
35
40
TD = 13.2 ft.
SWL = 11.33 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-02S
DATE : 08-09-1993
ELEVATION : 0.0000
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES, INC


GMI-1S
FRICTION, TSF
0.0
3.0
TIP RESISTANCE, TSF
0
150
300
RATIO (%)
0
2
4
6
8
DEPTH (Feet)
0
5
10
15
20
25
30
35
40
TD = 20.5 ft.
SWL = 19.1 ft.
SOIL TYPE
(Shown in Symbol Column)
Sand
Silt
Clay
Fill
Sandy
Silty
Clayey
Predominant Type Shown Heavy
JOB NUMBER : 93-3109
CPT NUMBER : GMI-01S
DATE : 08-16-1993
ELEVATION : 0.00
CONE NUMBER: F7.5CKEV173
FUGRO GEOSCIENCES,INC

TAB

Appendix D

APPENDIX D

Soil and Groundwater Analysis Constituents of Interest

for

Solid Waste Management Unit No. 62

Volatile Organics Analysis

Constituent	40 CFR 264 Appendix IX List*	Anticipated EPA Test Method
Benzene	x	8021
Bromobenzene		"
Bromochloromethane		"
Bromodichloromethane	x	"
Bromoform	x	"
Bromomethane		"
n-Butylbenzene		"
sec-Butylbenzene		"
tert-Butylbenzene		"
Carbon tetrachloride	x	"
Chlorobenzene	x	"
Chloroethane	x	"
Chloroform	x	"
Chloromethane		"
2-Chlorotoluene		"
4-Chlorotoluene		"
Dibromochloromethane	x	"
1,2-Dibromo-3-chloropropane	x	"
1,2-Dibromoethane	x	"
Dibromomethane		"
1,2-Dichlorobenzene	x	"
1,3-Dichlorobenzene	x	"
1,4-Dichlorobenzene	x	"
Dichlorodifluoromethane	x	"
1,1-Dichloroethane	x	"
1,2-Dichloroethane	x	"
1,1-Dichloroethene	x	"
cis-1,2-Dichloroethene		"
trans-1,2-Dichloroethene	x	"

Constituent	40 CFR 264 Appendix IX List*	Anticipated EPA Test Method
Benzene	x	8021
1,2-Dichloropropane	x	"
1,3-Dichloropropane		"
2,2-Dichloropropane		"
1,1-Dichloropropene		"
Ethylbenzene	x	"
Hexachlorobutadiene	x	"
Isopropylbenzene		"
4-Isopropyltoluene		"
Methylene chloride	x	"
Napthalene	x	"
Propylbenzene		"
Styrene	x	"
1,1,1,2-Tetrachloroethane	x	"
1,1,2,2-Tetrachloroethane	x	"
Tetrachloroethene	x	"
Toluene	x	"
1,2,3-Trichlorobenzene		"
1,2,4-Trichlorobenzene	x	"
1,1,1-Trichloroethane	x	"
1,1,2-Trichloroethane	x	"
Trichloroethene	x	"
Trichlorofluoromethane	x	"
1,2,3-Trichloropropane	x	"
1,2,4-Trimethylbenzene		"
1,3,5-Trimethylbenzene		"
Vinyl chloride	x	"
o-Xylene	x	"
m,p-Xylene	x	"

* constituents marked with "x" are included in Appendix IX list

Semi-volatile Organics Analysis

Constituent	40 CFR 264 Appendix IX List*	Anticipated EPA Test Method
Phenol	x	8270
Bis(2-chloroethyl)ether	x	"
2-Chlorophenol	x	"
1,3-Dichlorobenzene	x	"
1,4-Dichlorobenzene	x	"
Benzyl alcohol	x	"
1,2-Dichlorobenzene	x	"
2-Methylphenol		"
Bis(2-chloroisopropyl)ether		"
4-Methylphenol		"
N-Nitroso-di-n-dipropylamine		"
Hexachloroethane	x	"
Nitrobenzene	x	"
Isophorone	x	"
2-Nitrophenol	x	"
2,4-Dimethylphenol	x	"
Benzoic acid		"
Bis(2-chloroethoxy)methane	x	"
2,4-Dichlorophenol	x	"
1,2,4-Trichlorobenzene	x	"
Naphthalene	x	"
4-Chloroaniline	x	"
Hexachlorobutadiene	x	"
4-Chloro-3-methylphenol	x	"
2-Methylnaphthalene	x	"
Hexachlorocyclopentadiene	x	"
2,4,6-Trichlorophenol	x	"
2,4,5-Trichlorophenol	x	"
2-Chloronaphthalene	x	"

Constituent	40 CFR 264 Appendix IX List*	Anticipated EPA Test Method
Phenol	x	8270
2-Nitroaniline	x	"
Dimethylphthalate	x	"
Acenaphthylene	x	"
2,6-Dinitrotoluene	x	"
3-Nitroaniline	x	"
Acenaphthene	x	"
2,4-Dinitrophenol	x	"
4-Nitrophenol	x	"
Dibenzofuran	x	"
2,4-Dinitrotoluene	x	"
Diethylphthalate	x	"
4-Chlorophenyl phenyl ether	x	"
Fluorene	x	"
4-Nitroaniline	x	"
4,6-Dinitro-2-methylphenol	x	"
N-Nitrosodiphenylamine	x	"
4-Bromophenyl phenyl ether	x	"
Hexachlorobenzene	x	"
Pentachlorophenol	x	"
Phenanthrene	x	"
Anthracene	x	"
Di-n-butylphthalate	x	"
Fluoranthene	x	"
Pyrene	x	"
Butylbenzylphthalate	x	"
3,3'-Dichlorobenzidine	x	"
Benzo(a)anthracene	x	"
Chrysene	x	"
Bis(2-ethylhexyl)phthalate	x	"
Di-n-octylphthalate	x	"

Constituent	40 CFR 264 Appendix IX List*	Anticipated EPA Test Method
Phenol	x	8270
Benzo(b)fluoranthene	x	"
Benzo(k)fluoranthene	x	"
Benzo(a)pyrene	x	"
Indeno(1,2,3-cd)pyrene	x	"
Dibenzo(a,h)anthracene	x	"
Benzo(g,h,i)perylene	x	"

* constituents marked with "x" are included in Appendix IX list

Pesticides Analysis

Constituent	40 CFR 264 Appendix IX List*	Anticipated EPA Test Method
Alpha-BHC	x	8080
Beta-BHC	x	"
Delta-BHC	x	"
Gamma-BHC (Lindane)	x	"
Heptachlor	x	"
Aldrin	x	"
Heptachlor Epoxide	x	"
Endosulfan I	x	"
Dieldrin	x	"
4,4'-DDE	x	"
Endrin	x	"
Endosulfan II	x	"
4,4'-DDD	x	"
Endosulfan Sulfate	x	"
4,4'-DDT	x	"
Endrin Aldehyde	x	"
Methoxychlor	x	"
Chlordane	x	"
Toxaphene	x	"
PCB-1016	x	"
PCB-1221	x	"
PCB-1232	x	"
PCB-1242	x	"
PCB-1248	x	"
PCB-1254	x	"
PCB-1260	x	"

* constituents marked with "x" are included in Appendix IX list

Metals Analysis

Constituent	40 CFR 264 Appendix IX List*	Anticipated EPA Test Method
Arsenic	x	7060
Barium	x	6010
Cadmium	x	7131
Chromium	x	6010
Copper	x	6010
Lead	x	7421
Mercury	x	7471
Nickel	x	6010
Selenium	x	7740
Silver	x	6010

* constituents marked with "x" are included in Appendix IX list

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE