INSTALLATION RESTORATION PROGRAM

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SITE INVESTIGATION REPORT

**147TH FIGHTER INTERCEPTOR GROUP
TEXAS AIR NATIONAL GUARD
ELLINGTON FIELD
HOUSTON, TEXAS**

JANUARY 4, 1991

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Site Investigation Report for sites suspected to contain hazardous waste contamination. The report describes the site and the testing performed. The results are analyzed and conclusions stated as to the extent of contamination. Future work is proposed according to the data collected. The study was conducted under the Air National Guard's Installation Restoration Program.

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147TH FIGHTER INTERCEPTOR GROUP
TEXAS AIR NATIONAL GUARD
ELLINGTON FIELD
HOUSTON, TEXAS

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G REGULATORY AGENCY CORRESPONDENCE REGARDING ELLINGTON FIELD (ANG) SITE INVESTIGATION

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EXECUTIVE SUMMARY

As part of the Air National Guard (ANG) Installation Restoration Program (IRP), NUS conducted a Site Investigation (SI) at the Ellington Field (ANG) facility in Houston, Texas. Work was performed under Task Order Y-04 of the Martin Marietta Energy Systems Inc. Hazardous Waste Remedial Actions Program (HAZWRAP). This document presents the findings of all activities undertaken during the SI.

The purpose of the investigation was to determine whether soils or ground water at two sites had been attected a result of past waste management practices. The two sites evaluated as part of the SI were the Former Base Landfill and the Petroleum, Oils and Lubricants (POL) Storage Area. Field activities were performed in accordance with procedures outlined in the SI Sampling and Analysis Plan (SAP) issued on October 26, 1989.

Specific elements of the SI included the following:

- A geophysical survey - Magnetometry and electromagnetic conductivity techniques were employed at the Former Base Landfill to aid in characterizing the shallow subsurface prior to drilling and sampling activities.

- Installation of soil borings, piezometers and monitoring wells - A total of three piezometers, four soil borings and nine monitoring wells were installed at the two sites to characterize geologic and hydrogeologic conditions and provide locations for the collection of environmental samples.

- Collection of environmental samples - A total of three surface soil samples, 32 subsurface soil samples and nine ground-water samples were collected at the two sites.

- Water level measurements and slug testing - Ground-water elevations in piezometers and wells were determined in order to establish ground-water flow direction and hydraulic gradient at the two sites. Slug test data were used to calculate estimations of aquifer parameters.

- Chemical laboratory analysis - Samples were sent to a fixed-base laboratory for chemical analysis to determine whether soil and ground water at the sites had been affected.

- Risk Assessment - Based on the results of field activities and laboratory analysis, an evaluation was performed to determine actual or potential threats to public health and the environment.

- Data evaluation and report preparation - This report was prepared to present the findings of all SI activities.

Tables ES-1 and ES-2 show the maximum soil and ground-water concentrations detected at both sites. The tables also indicate the sample number and; for soils, the sample source. Standards for soils that are enforceable in Texas are indicated in Table ES-1 notes. Federal drinking water standards are given in Table ES-2, where available. For risk assessment purposes, soil sample concentrations are compared to background data. The location of samples are indicated by sample number on Figures ES-1 and ES-2. A brief discussion of the contaminants detected during the SI, information about ground water at each site, and conclusions from the risk assessment are provided in the following sections.

FORMER BASE LANDFILL

Soil

A number of Base Neutral compounds and several pesticides were detected in surface soil samples collected from the central and eastern portion of the landfill surface. Several inorganics were detected in surface soil samples at concentrations higher than literature background values. Heptachlor and phenol were detected in only one subsurface soil sample. Mercury was detected in several samples at concentrations higher than literature background concentration.

Ground Water

Ground water was encountered at depths varying from 10 feet below land surface at the southern end of the site to 20 feet below land surface in the northeastern corner of the site. Ground-water direction is to the east-northeast. The ground-water flow gradient appears to be strongly influenced by the presence of a large commercial sand pit east of the landfill.

Two pesticides, alpha-BHC and methoxychlor, were detected at very low concentrations in two ground-water samples. These compounds are not chemicals of concern for the following reasons. These compounds are relatively insoluble, and, based on available data, their source cannot be tied to the landfill. Aluminum was detected at a concentration approximately three times literature background in one sample. Aluminum is not considered a toxic chemical and is not currently regulated. Iron was detected in one ground-water sample at a concentration 10 times greater than the Federal drinking water standard. However, the concentration of iron detected is well within the range of background concentrations indicated in the reference literature (Dragen, 1988).

The risk assessment concludes that no significant risks to human health appear to exist at the Former Base Landfill based on the available data and the exposure scenarios considered. It is recommended that no further action be undertaken at the site and that a Decision Document be prepared in support of this recommendation.

POL STORAGE AREA

Soil

Several volatiles organic compounds were detected in subsurface soil samples beneath the diked area and adjacent to the railroad spur. The highest concentration was 13,000 µg/kg ethylbenzene in a sample collected at 4-6 feet beneath the dike. Two base neutrals were also detected in low concentrations in subsurface soil samples. All compounds detected in soils at the POL Storage Area, except 4-methyl-2-pentanone (MIBK), are considered in the risk assessment. MIBK, a noncarcinogenic chemical, was detected at a maximum concentration of 4 µg/kg, and was not found in any of the ground-water samples. Petroleum hydrocarbons were detected at

132 mg/kg in one subsurface soil sample, which is above the Texas Water Commission (TWC) criteria for clean closure. TWC clean closure criteria is 100 ppm for total petroleum hydrocarbons.

Ground Water

Ground water was encountered at depths ranging from 10 feet below grade at the western edge of the site to 16 feet below grade in the southeastern portion of the site. Ground water flows to the east, and aquifer recharge appears to occur in portions of the drainage ditch west of the site.

Several volatiles organics were detected at extremely low concentrations in ground-water samples collected at the site. No contaminants were detected in ground water at the POL Storage Area that exceed final Maximum Contaminant Levels or Drinking Water Health Advisories.

The risk assessment concludes that no significant risks to human health appear to exist at the POL Storage Area. However, the extent of soil contamination at the site has not been determined. It is therefore recommended that a soil boring program be implemented at the POL Storage Area to delineate the extent of contaminated soils east of the railroad spur.

TABLE ES-1

MAXIMUM SOIL CONCENTRATIONS

Chemical	Concentration (µg/kg)	Sample Source	Sample Number
Former Base Landfill			
Butylbenzylphthalate	290*	Surface	01-FD05-A
Acenaphthene	400*	Surface	01-FD05-A
Anthracene	810*	Surface	01-FD05-A
Benzo(a)anthracene	2,350*	Surface	01-FD05-A
Benzo(b)fluoranthene	1,800*	Surface	01-FD05-A
Benzo(k)fluoranthene	1,850*	Surface	01-FD05-A
Benzo(a)pyrene	2,000*	Surface	01-FD05-A
Chrysene	2,250*	Surface	01-FD05-A
Fluoranthene	4,350*	Surface	01-FD05-A
Fluorene	410*	Surface	01-FD05-A
Indeno(1,2,3-cd)pyrene	930*	Surface	01-FD05-A
Phenanthrene	3,250*	Surface	01-FD05-A
Pyrene	3,550*	Surface	01-FD05-A
Dibenzofuran	200*	Surface	01-FD05-A
Phenol	22J	Subsurface	01-FD02-A
4,4'-DDT	10J	Surface	01-SS03-A
4,4'-DDD	11J	Surface	01-FD05-A
4,4'-DDE	12J	Surface	01-FD05-A

ND Not detected.
NA Not analyzed.
J - Lab qualifier indicating estimated value.
[ ] - Data validation qualifier indicating estimated value.
\+ Texas clean closure standard for total petroleum hydrocarbons is 100 parts per million.
* Average of two duplicate samples using one-half the detection limit for non-detects.
** Texas clean closure standard is 30 parts per million for the sum total of benzene, toluene, ethylbenzene, and xylene.

TABLE ES-1 (CONTINUED)
MAXIMUM SOIL CONCENTRATIONS
PAGE TWO OF THREE

Chemical	Concentration (µg/kg)	Sample Source	Sample Number
Heptachlor	21	Subsurface	01-SB03B-A
Aluminum	11,000*	Surface	01-SS03-A
Arsenic/	32*	Surface	01-FD05-A
Barium	302J	Surface	01-SS01-A
Beryllium	0.9	Subsurface	01-SB04A-A
Calcium	39,900	Surface	01-SS02-A
Chromium	16	Surface	01-SS02-A
Cobalt	22	Subsurface	01-SB04A-A
Copper	8.9	Subsurface	01-SB01A-A
Iron	16,000	Subsurface	01-SB01A-A
Lead	141	Surface	01-SS02-A
Magnesium	3,460	Subsurface	01-SB01A-A
Manganese	540	Subsurface	01-SB04A-A
Mercury	0.34	Subsurface	01-SB05A-A
Nickel	16.2	Subsurface	01-SB04A-A
Potassium	1,400	Subsurface	01-SB01A-A
Sodium	[253]	Surface	01-SS03-A
Vanadium	20.9	Subsurface	01-SB04A-A
Zinc/	180J	Surface	01-SS03-A

ND Not detected.
NA Not analyzed.
J - Lab qualifier indicating estimated value.
[ ] - Data validation qualifier indicating estimated value.
\+ Texas clean closure standard for total petroleum hydrocarbons is 100 parts per million.
* Average of two duplicate samples using one-half the detection limit for non-detects.
** Texas clean closure standard is 30 parts per million for the sum total of benzene, toluene, ethylbenzene, and xylene.

TABLE ES-1 (CONTINUED)
MAXIMUM SOIL CONCENTRATIONS
PAGE THREE OF THREE

Chemical/Site(A)	Concentration (µg/kg)	Sample Source	Sample Number
Pol Storage Area			
Naphthalene	180*	Subsurface (>2')	02-SB13B-A
2-Methylnaphthalene	640	Subsurface (>2')	02-SB13B-A
Benzene**	180J	Subsurface (<2')	02-SB13A-A
Ethylbenzene**	13,000J	Subsurface (>2')	02-SB13B-A
Total xylenes**	240J	Subsurface (<2')	02-SB13A-A
Styrene	5J	Subsurface (>2')	02-SB13C-A
Chlorobenzene	1J	Subsurface (>2')	02-SB13C-A
Methylene chloride	6,100J	Subsurface (>2')	02-SB13B-A
1,2-Dichloropropane	1J	Subsurface (>2')	02-SB13C-A
Petroleum Hydrocarbons +	132,000	Subsurface (<2')	02-SB13A-A
Acetone	250J	Subsurface (<2')	02-SB14A-A
2-Butanone	41J	Subsurface (<2')	02-SB14A-A
4-Methyl-2-pentanone	4J	Subsurface (>2')	02-SB13C-A

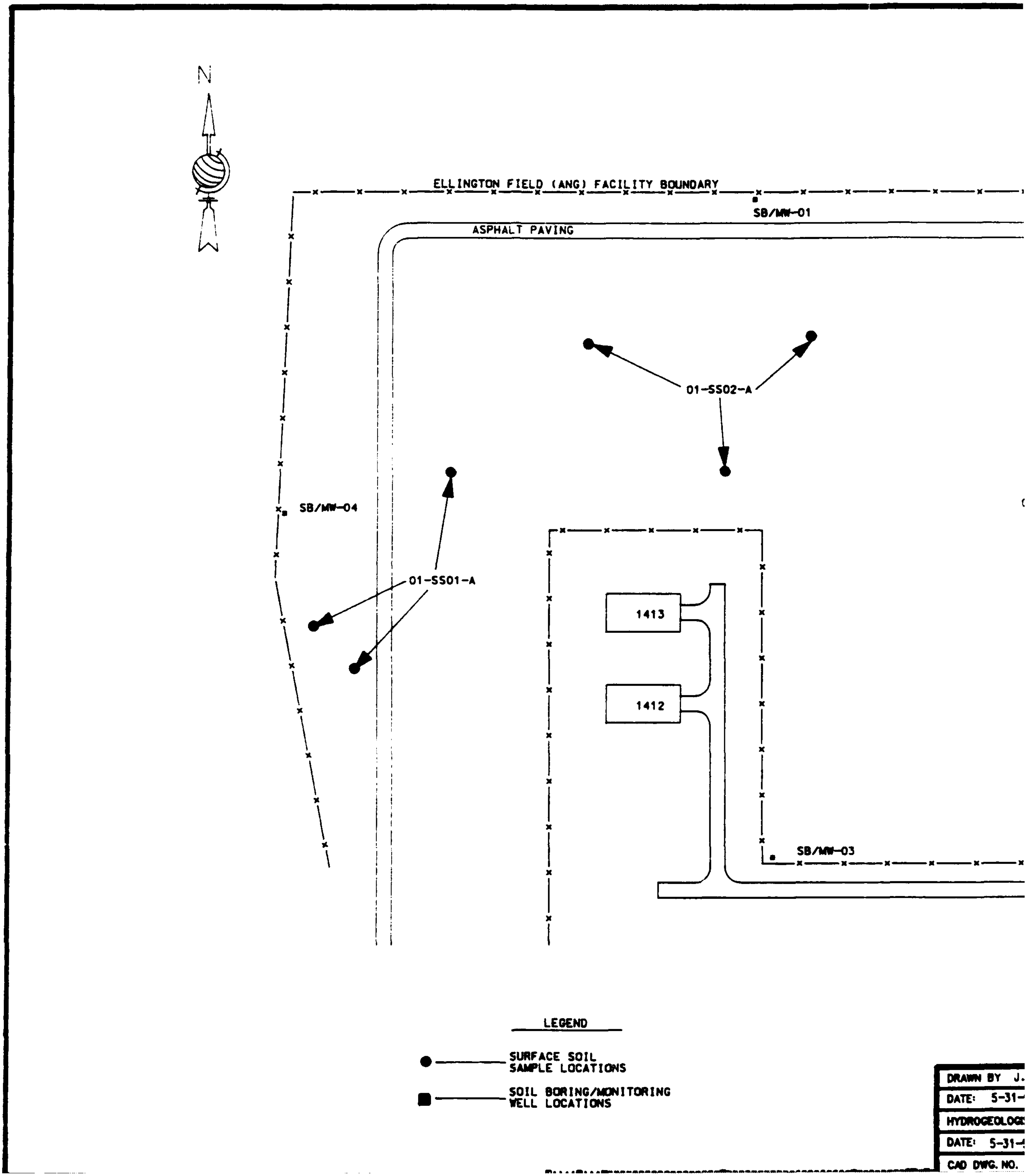
ND Not detected.
NA Not analyzed.
J - Lab qualifier indicating estimated value.
[ ] - Data validation qualifier indicating estimated value.
\+ Texas clean closure standard for total petroleum hydrocarbons is 100 parts per million (mg/kg).
* Average of two duplicate samples using one-half the detection limit for non-detects.
** Texas clean closure standard is 30 parts per million for the sum total of benzene, toluene, ethylbenzene, and xylene.

TABLE ES-2

MAXIMUM GROUND-WATER CONCENTRATIONS

Chemical	Concentration (µg/L)	Sample Number	Primary or Secondary Drinking Water Regulations(A) (µg/L)
Former Base Landfill			
Alpha-BHC	0.037J	01-MW01-A	NA
Methoxychlor	0.022	01-MW-05-A	NA
Aluminum	2,910	01-MW04-A	NA
Barium	517	01-MW03-A	1,000
Beryllium	[1.3]	01-MW04-A	NA
Calcium	176,000	01-MW01-A	NA
Chromium	[7.9]	01-MW04-A	50
Iron	3,710	01-MW04-A	300
Lead	10.6	01-MW02-A	50/5(B)
Manganese	498	01-MW04-A	NA
Nickel	[12.1]	01-MW04-A	NA
Vanadium	[10.8]	01-MW04-A	NA
Petroleum Hydrocarbon (mg/L)	0.9J	01-MW05-A	NA
POL Storage Area			
Ethylbenzene	6J	02-MW10-A	700/700(B)
Chlorobenzene	6J	02-MW10-A	100/100(B)
Total Xylenes	23J	02-MW10-A	10,000/10,000(B)
Styrene	10	02-MW10-A	5-10/10(B)

Notes:
(A) 40 CFR 141 and 143
(B) Proposed maximum contaminant level (MCL/maximum contaminant level goal (MCLG).
J - Lab qualifier indicating estimated value.
[ ] - Data validation qualifier indicating estimated value.
NA - Not Available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ASPHALT PAVING
01-SS02-A
SB/MW-04
01-SS01-A
1413
1412
SB/MW-03
LEGEND
SURFACE SOIL SAMPLE LOCATIONS
SOIL BORING/MONITORING WELL LOCATIONS
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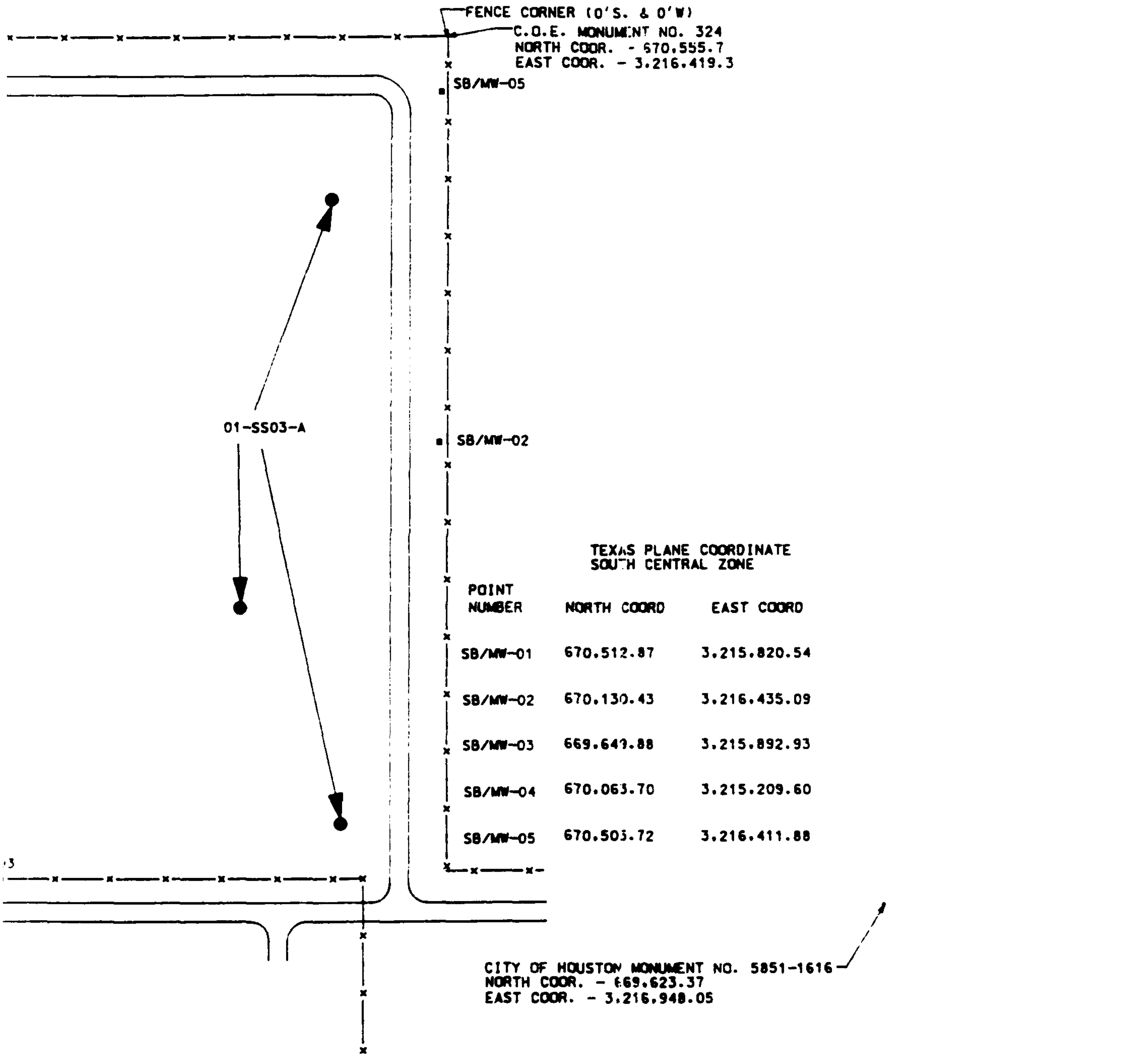
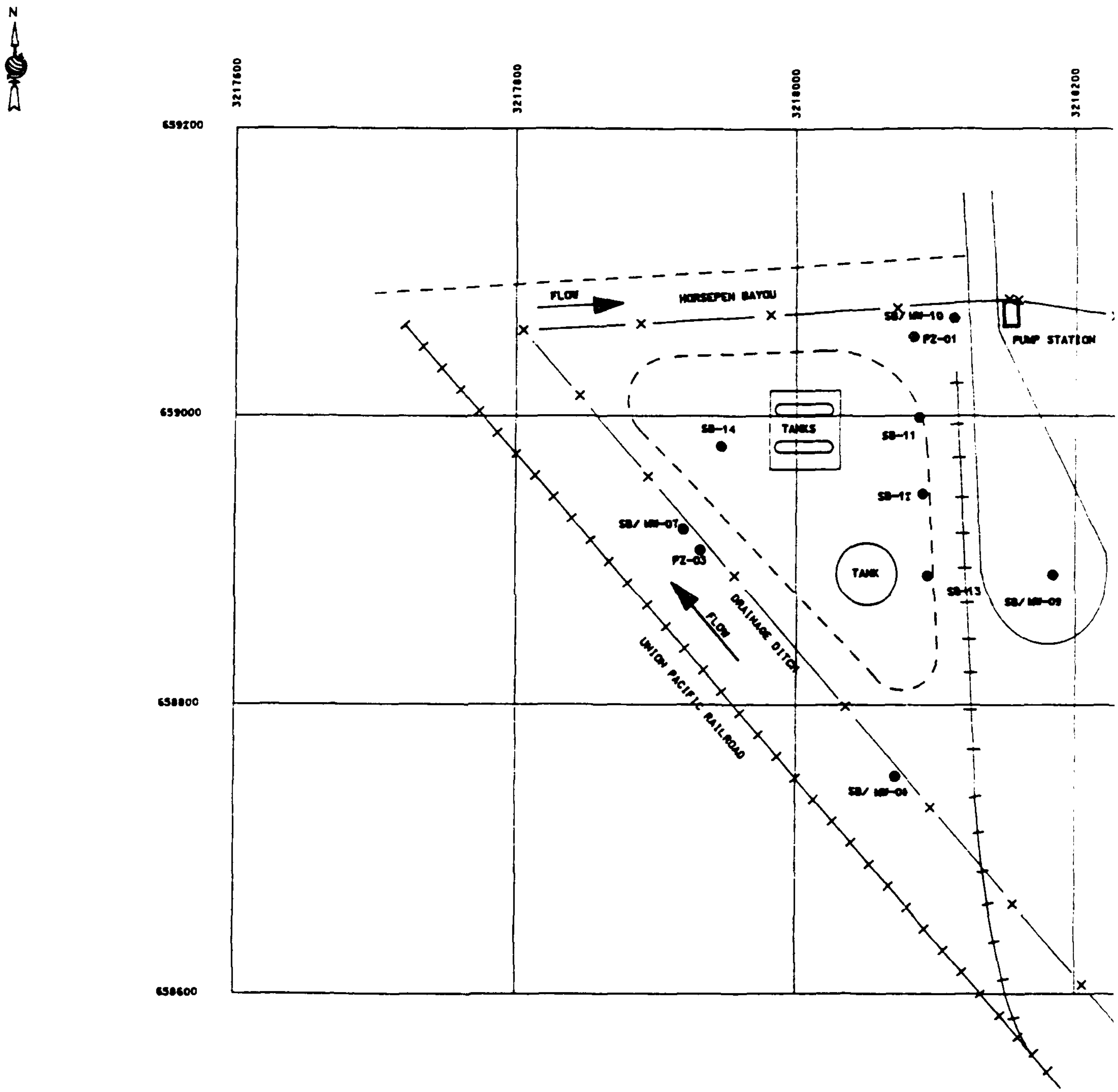
DATE: 5-31-
CAD DWG. NO.



TEXAS PLANE COORDINATE
SOUTH CENTRAL ZONE

POINT NUMBER	NORTH COORD	EAST COORD
SB/MW-01	670.512.87	3.215.820.54
SB/MW-02	670.130.43	3.216.435.09
SB/MW-03	669.649.88	3.215.892.93
SB/MW-04	670.063.70	3.215.209.60
SB/MW-05	670.503.72	3.216.411.88

DRAWN BY J. ATKINSON	FIGURE ES-1 SAMPLE LOCATION MAP FORMER BASE LANDFILL ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE: 5-31-90		
HYDROGEOLOGIST D. UPTHEGROVE		
DATE: 5-31-90		
CAD DWG. NO. 363M2801.DGN	SCALE: 1" = 180' NUS DWG. NO. 363M-2801 REV. 1	



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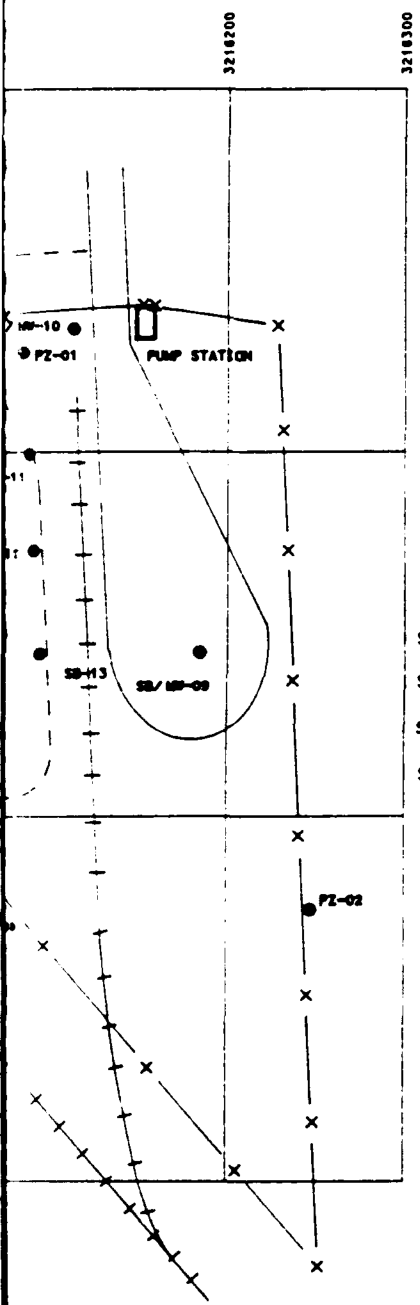
DATE:
HYDROGEOLOGIST
DATE:
CAD DWG. NO.



LEGEND

MW = MONITOR WELL

PZ = PIEZOMETER

SB = SOIL BORING

POINT NUMBER	TEXAS PLANE COORDINATE SOUTH CENTRAL ZONE	
	NORTH COORD.	EAST COORD.
SB/MW-07	658.931.22	3.217.921.70
SB/MW-08	658.757.71	3.218.072.43
SB/MW-09	658.895.21	3.218.182.34
SB/MW-10	659.073.15	3.218.110.76
PZ-01	659.060.17	3.218.081.47
PZ-02	658.753.85	3.218.241.40
PZ-03	(A)	(A)
SB-11	659.004.16	3.218.085.49
SB-12	658.951.06	3.218.087.97
SB-13	658.894.38	3.218.091.83
SB-14	658.984.11	3.217.944.55

(A) NOT SURVEYED. APPROXIMATE LOCATION SHOWN.

DRAWN BY	J. ATKINSON
DATE:	6-1-90
HYDROGEOLOGIST	D. UPTHEGROVE
DATE:	6-1-90
CAD DWG. NO.	363M2802.DGN

FIGURE ES-2
SAMPLE LOCATION MAP
POL STORAGE AREA
ELLINGTON FIELD (ANG) HOUSTON, TEXAS

SCALE: 1" = 100' | NUS DWG. NO. 363M-2802 | REV. 1

NUS CORPORATION
A Halliburton Company

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

The purpose of this report is to present the findings of all activities conducted as part of the Site Investigation (SI). Field activities undertaken during the SI included the characterization of site-specific geologic and hydrogeologic conditions, as well as the collection of environmental samples for laboratory analysis. Results of laboratory analysis have aided in the determination of contaminant occurrence and distribution at the two sites investigated. Utilizing the results of sampling and analytical activities, a preliminary risk assessment was performed to evaluate actual or potential exposure risks to public health and the environment. Finally, the combined results of all SI activities were evaluated to determine what, if any, further actions are warranted at each site.

1.2 REPORT ORGANIZATION

The introduction (Section 1) presents background information and outlines the purpose and scope of the investigation. Section 2 describes field activities performed by NUS. The results of field investigations and laboratory analyses are presented in Section 3. Section 4 contains the preliminary risk assessment, and Section 5 presents summaries, conclusions and recommendations. A list of acronyms is provided in Section 6.

The appendices contain the following material: regulatory correspondence, field data, slug test calculations, the geophysical survey report, the analytical data base, data validation reports, and risk assessment data.

1.3 FACILITY BACKGROUND

1.3.1 <u>Ellington Field Air National Guard (ANG)</u>

Ellington Field (ANG) construction began September 14, 1917. The first contingent of air service personnel (the 120th Aero Squadron) arrived on November 10, 1917. A variety of military aircraft have used the facility throughout its history, including the T-33, F-4C, C-131, Curtis JN-4 and "Super Guppy" aircraft. Ellington Field (ANG) is now operated by the 147th Fighter Interceptor Group (FIG) of the Texas Air National Guard, which moved onto the property in 1955. The facility also operated as a United States Air Force Base from 1917 through 1976.

Ellington Field (ANG) occupies 209 acres of essentially flat coastal plain approximately 15 miles south of downtown Houston in Harris County, Texas. The extent of Ellington Field (ANG) property is shown in Figure 1-1. The area within a 1-mile radius of Ellington Field (ANG) is sparsely populated, however densely populated suburbs of Houston (Pasadena, Friendswood, Clear Lake City, South Houston, etc.) are located within 5 miles of the facility. The Ellington Field (ANG) property at the north and and south ends of the facility is separated by Ellington Field property owned and operated by the City of Houston. Ellington Field (ANG) property is bordered to the west by a golf course and undeveloped land, to the east by open fields and a large commercial sand pit and to the north and south by undeveloped land.

1.3.2 Former Base Landfill

The Former Base Landfill is located at the northern end of Ellington Field (ANG) property. Site features are shown in Figure 1-2. The landfill site is approximately 30 acres in size and is bordered by a golf course to the west, an undeveloped wooded area to the north, a commercial sand pit to the east and additional ANG property to the south. Two munitions storage igloos (Buildings 1412 and 1413) were constructed on the south central portion of the site and are secured by a chain-link fence. A chain-link fence coincidental with the Ellington Field (ANG) property line also surrounds the site on the north, east and west sides. A shallow surface water drainage ditch is present just outside the asphalt perimeter road on the north and east sides of the landfill. However, the landfill's irregular surface promotes the pooling of water, and it appears that most precipitation evaporates or infiltrates into the shallow soils rather than running off site.

The landfill was used by the United States Air Force from 1942 or 1943 until 1974. Although no documentation exists regarding the types and amounts of wastes landfilled, verbal reports by past and present facility personnel indicate that the landfill was used only for the disposal of municipal solid waste generated on the facility property. Modern containment methods were not employed at the landfill (i.e., the landfill is not capped or lined, and no leachate collection system is in place). Concrete rubble, one rusty drum, and some uncovered domestic garbage were noted on the surface of the landfill during site visits.

1.3.3 Petroleum, Oils, and Lubricants (POL) Storage Area

The POL Storage Area is isolated from the main portion of Ellington Field (ANG), at the south end of the City of Houston property. The site is surrounded by a chain-link fence which approximates the ANG property line. The POL Storage Area is bordered by Union Pacific Railroad right-of-way property on the southwest side, Horsepen Bayou on the north side and undeveloped land on the east side. A drainage ditch on the railroad right-of-way flows northwest into Horsepen Bayou, which subsequently flows eastward into Armand Bayou, Pasadena and Mud Lakes, Clear Lake and, finally, Galveston Bay.

Three above-ground JP-4 fuel tanks (Tanks 39, 164, and 165) and a fuel pump station (Building 180) are located at the site. The fuel tanks are within a concrete diked area. A cul-de-sac driveway, which allows passageway for refueling tanker trucks, runs north-south between the diked area and the pump station. A railroad spur used for the delivery of JP-4 to the site is situated between the driveway and the diked area. Six fuel feed standpipes are located just east of the railroad spur, with an underground 8-inch diameter fuel loading pipeline leading to the storage tanks. The layout of the site is depicted in Figure 1-3.

A 1973 incident at the POL Storage Area resulted in the release of 8,000 gallons of JP-4 into the shallow drainage ditch over the period of one weekend. Water that had collected in the storage tank sump was being pumped into the drainage ditch. The pump was inadvertently left on and fuel was allowed to discharge into the ditch. Although attempts were made to contain the spill, most of the fuel reached Horsepen Bayou. No documentation of regulatory involvement in spill reporting, containment or countermeasure activities has been found regarding this incident.

Other spill incidents, including one in August 1989 which resulted in an immediate response action (see Section 1.4.2), are known to have occurred at the POL Storage

Area in the past. Due to the evidence of fuel-contaminated soils at the site, a decision was made to investigate the entire POL Storage Area, not just the 1973 spill site.

1.4 PREVIOUS PROGRAM ACTIVITIES

A Preliminary Assessment (PA) Records Search conducted by the Hazardous Materials Technical Center between December 1985 and October 1987 identified three sites at Ellington Field (ANG) which were potentially contaminated with hazardous materials. Although three sites were identified, only two, the Former Base Landfill and the POL Storage Area, were investigated as part of the SI. It was determined that any potential contamination at the third site, the Fuel System Repair Shop, would be the result of activities occurring after January 1984 and, therefore, not subject to IRP investigation.

SI activities at the POL were expanded to address the entire area as one site, as a result of an earlier study which concluded that contaminated soil was the result of past spills. A report on these activities (Report on POL Remediation Activities at Ellington Field Air National Guard Base, NUS Report Number R-34-10-9-002H) was issued to the ANG and the Texas Water Commission (TWC) in November 1989.

In summary, on August 19, 1989, JP-4 was found to be seeping into Horsepen Bayou through and over its south bank, adjacent to the railroad spur at the site. Fuel was collected from the bayou with absorbent booms and disposed of in a Class 2 landfill. Approximately 1700 cubic yards of fill and ballast were removed before interim remedial activities were suspended. Although the vast majority of the contaminated materials was removed, remedial efforts required to excavate all materials contaminated above TWC guidelines were not completed. TWC requirements to achieve clean closure are excavation and removal of all soils containing concentrations of petroleum hydrocarbons greater than 100 ppm or the sum total of benzene, toluene, ethylbenzene, and xylene (BTEX) greater than 30 ppm. Figure 1-4 depicts areas where laboratory results indicate the presence of petroleum hydrocarbons in soils at concentrations greater than 100 ppm. Once the remedial efforts were halted, the trench was backfilled and compacted and the railroad tracks replaced.

1.5 REGIONAL INVESTIGATION AREA

The following sections contain information on the regional environmental setting, geology and hydrogeology.

1.5.1 Environmental Setting

Meteorology

Mean annual precipitation in the vicinity of Ellington (ANG) is approximately 46 inches, while mean annual lake evaporation is approximately 53 inches. The 1-year 24-hour rainfall intensity is approximately 2.75 inches. Normal daily minimum temperature in January is 42° Fahrenheit (F); normal daily maximum temperature in July and August is 92°F (U.S. Dept. of Commerce, 1968).

Topography and Drainage

The topography of Ellington Field (ANG) is typical of the Gulf Coastal Plain, which is characterized by gently gulfward sloping land. The Pleistocene Beaumont Formation, which crops out at the facility, has an average erosional surface slope of 1.65 feet per mile from its landward extent to the shoreline. Surface elevations at Ellington Field (ANG) range from 40 feet above mean sea level (MSL) in the northwest corner to 25 feet above msl in the southeast corner (U.S.G.S., 1982).

The only major surface water body is Horsepen Bayou. This bayou flows eastward approximately 10 miles, where it flows into Armand Bayou, Pasadena and Mud Lakes, Clear Lake and, finally, Galveston Bay. Horsepen Bayou and its tributaries receive some overland drainage and runoff from drainage ditches on the Ellington Field (ANG) property. However, due to the relatively flat site topography, a great deal of surface water pools on site and either evaporates or percolates slowly to the ground water through semi-permeable surficial clays.

1.5.2 Regional Geology and Hydrogeology

Geology

Ellington Field (ANG) is located within the West Gulf Coastal Plain physiographic province. The formations underlying the site are comprised of consolidated and unconsolidated sediments of the Miocene, Pliocene and Pleistocene ages. These formations crop out in belts parallel to the coast and dip gently to the southeast. Younger formations crop out nearer the Gulf, older formations further inland. Due to the downdip thickening of the coastal sediments, the older formations dip more steeply than the younger ones (Texas State Board of Water Engineers, 1950).

The sediments comprising these strata were derived largely from the weathering of older Tertiary and Cretaceous formations, and were deposited in fluvial, deltaic, lagoonal and shallow marine environments. Owing to the differing modes of deposition, lithologies are diverse and complexly interbedded, and, therefore, individual beds can rarely be traced over long distances. Layers and lenses of clay grade laterally and vertically into sand zones; sands and gravels likewise grade into clay zones. Characteristic geologic and geomorphic features of the Gulf Coastal Plain include salt domes, down-to-the-gulf growth faults, scarps, pimple mounds and undrained depressions.

Hydrogeology

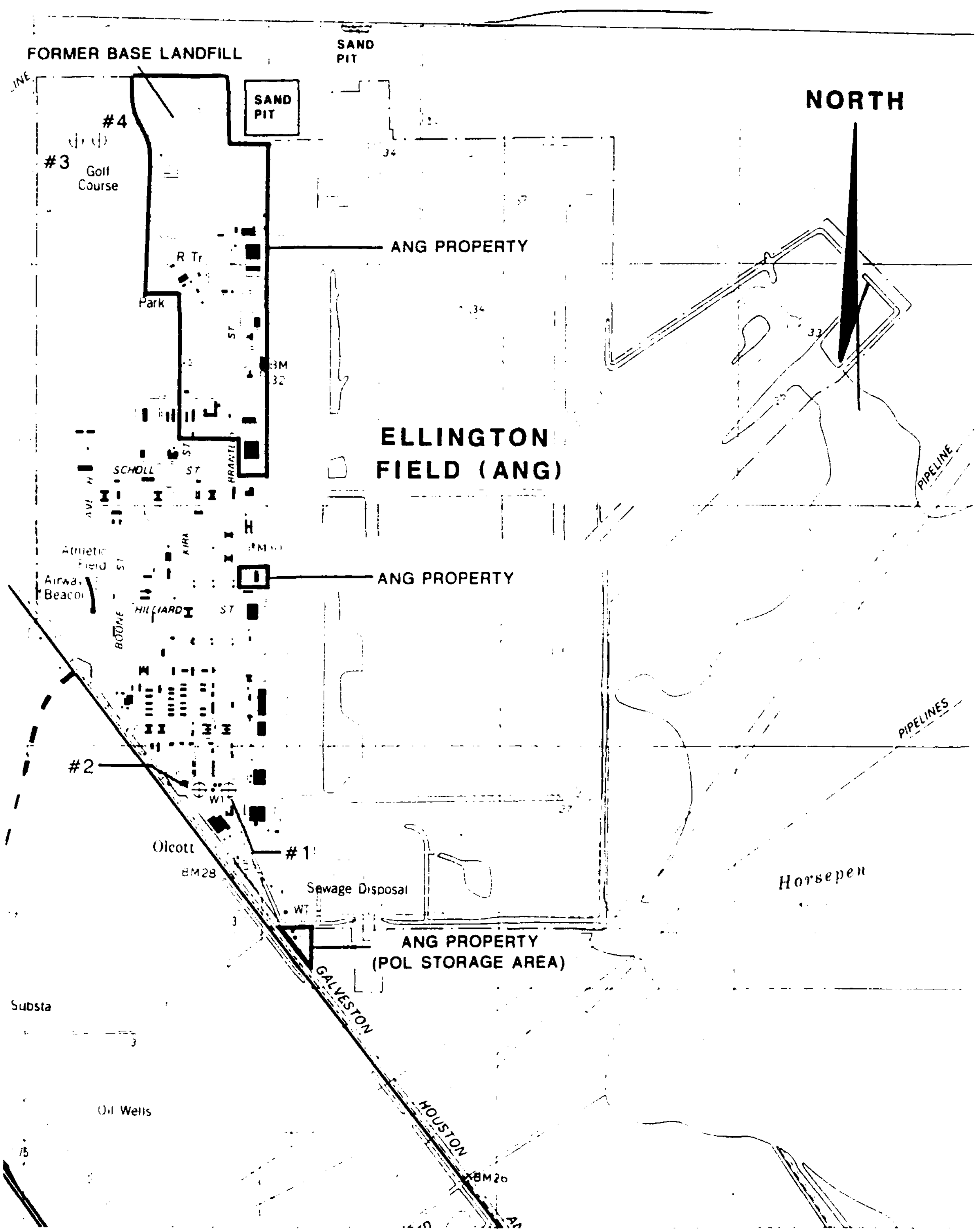
The geologic formations from which potable water is available in the site area are the Pleistocene formations, whose water-bearing units comprise the Chicot Aquifer, and the Pliocene-aged Goliad Sand, whose sand beds comprise the Evangeline Aquifer. The Chicot has a maximum thickness of 700 feet in the site vicinity; the Evangeline a maximum thickness of 2000 feet. Both aquifer systems consist predominantly of complexly interbedded sands and clays (Texas Water Development Board, 1975).

No continuous confining layers overlie the Chicot, and where the Beaumont Formation crops out, the aquifer extends to the ground surface, suggesting that the aquifer is under water table conditions. Although electric logs do not show any definite confining unit above the Evangeline, artesian conditions do exist within the aquifer. This, along with the difference in water level elevations between the two aquifers, suggests that the hydraulic connection between them is minimal. Recharge to the Chicot is via direct infiltration of precipitation from the ground surface; recharge to the Evangeline is probably by slow percolation of ground water through the overlying Pleistocene formations.

Available information indicates four municipal wells are located on City of Houston or City of Pasadena property in the vicinity of Ellington Field (ANG). The location of these wells is indicated on Figure 1-1. Well 1, located one block west of Cockran and Brantly was removed 6 months ago by the City of Houston. Use of well 2 was discontinued by the City of Houston on July 15, 1990. Wells 3 and 4 are owned by the City of Pasadena and are used by the golf course located west of the Former Base Landfill. These wells all produce water from the lower unit of the Chicot aquifer, a massive sand section known as the Alto Loma Sand. Screened intervals in these wells range from 390 to 570 feet below land surface (Texas Water Development Board, 1972).

1.5.3 Background

To characterize contamination at the site, it was first necessary to determine background inorganic concentrations in soil and ground water. TCL organic compounds are not naturally occurring, therefore background levels are considered zero. Background inorganic concentrations in soil and ground water were derived from reference literature (Shacklette and Boergen, 1984; Dragen 1988). For more information on background levels and a comparison of background levels to maximum site concentrations, see Section 4.2.2, Hazard Identification.

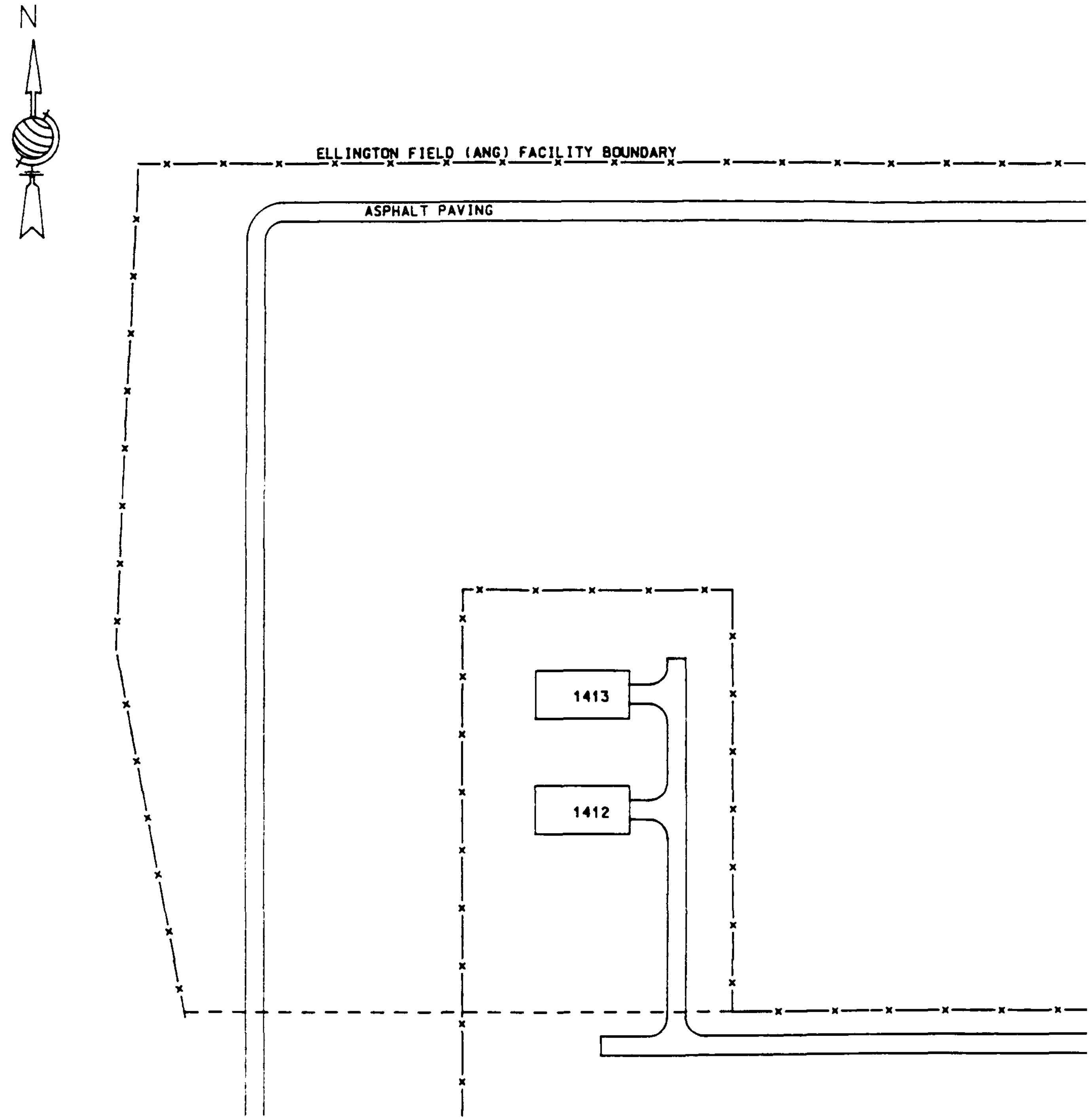


LEGEND

⊕ MUNICIPAL GROUNDWATER WELLS

SCALE 1" = 2000'

SITE LOCATION MAP ELLINGTON FIELD (ANG) HOUSTON, TEXAS		NUS CORPORATION
DATE JUNE 90	FIGURE 1-1	



NOTE: APPROXIMATE LIMITS OF LANDFILL COINCIDENTAL WITH FENCE EXCEPT WHERE DASHED LINE INDICATES OTHERWISE. — — — —

DRAWN BY J. A
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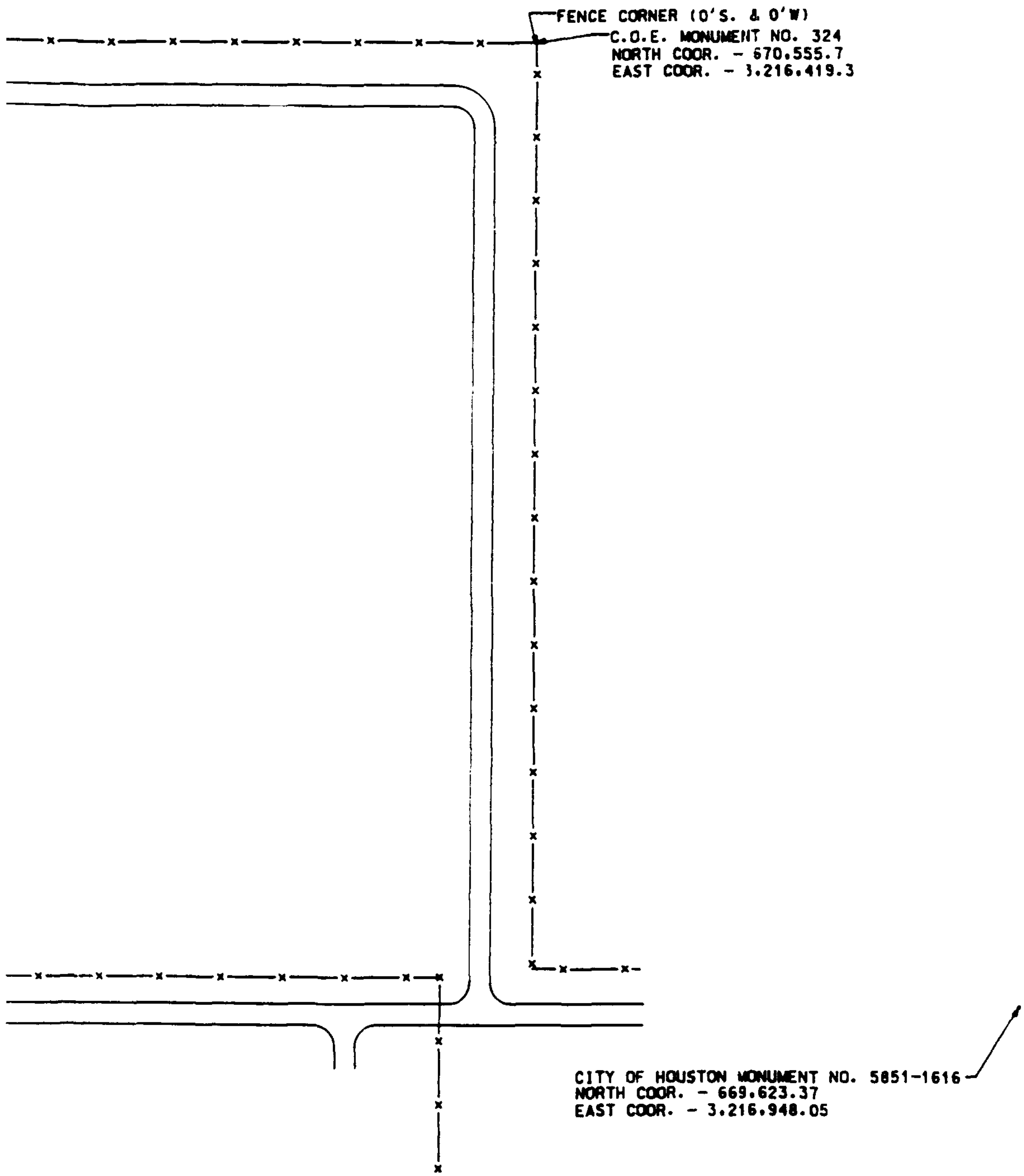
HYDROGEOLOGIST
DATE: 5-31-90
CAD DWG. NO. 36



DRAWN BY J. ATKINSON	FIGURE 1-2 SITE MAP FORMER BASE LANDFILL ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE: 5-31-90		
HYDROGEOLOGIST D. UPTHEGROVE		
DATE: 5-31-90		
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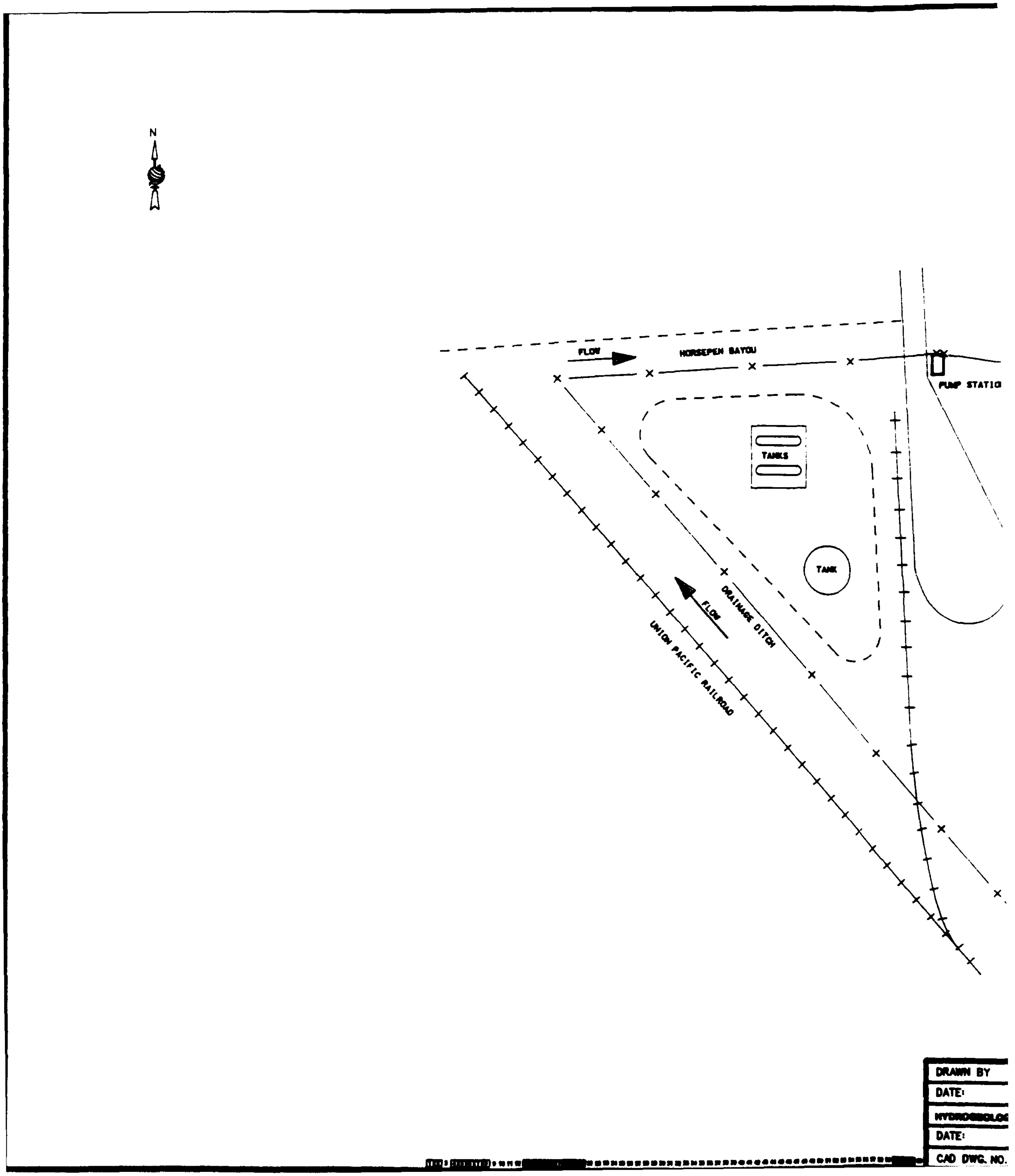
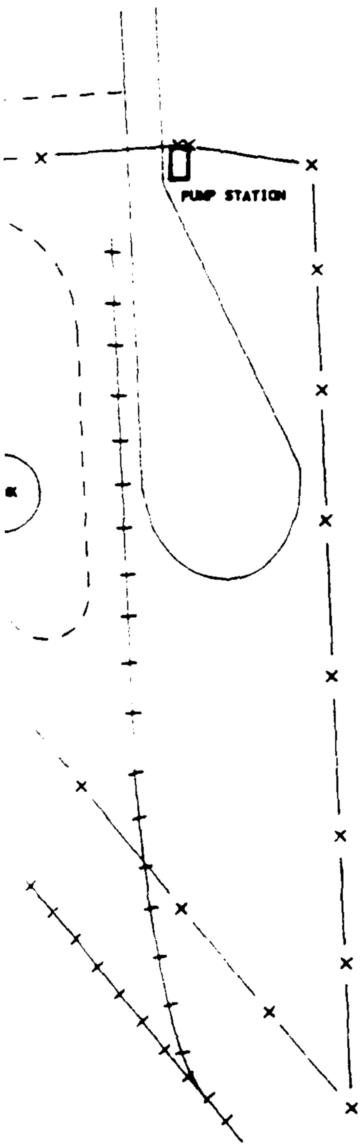
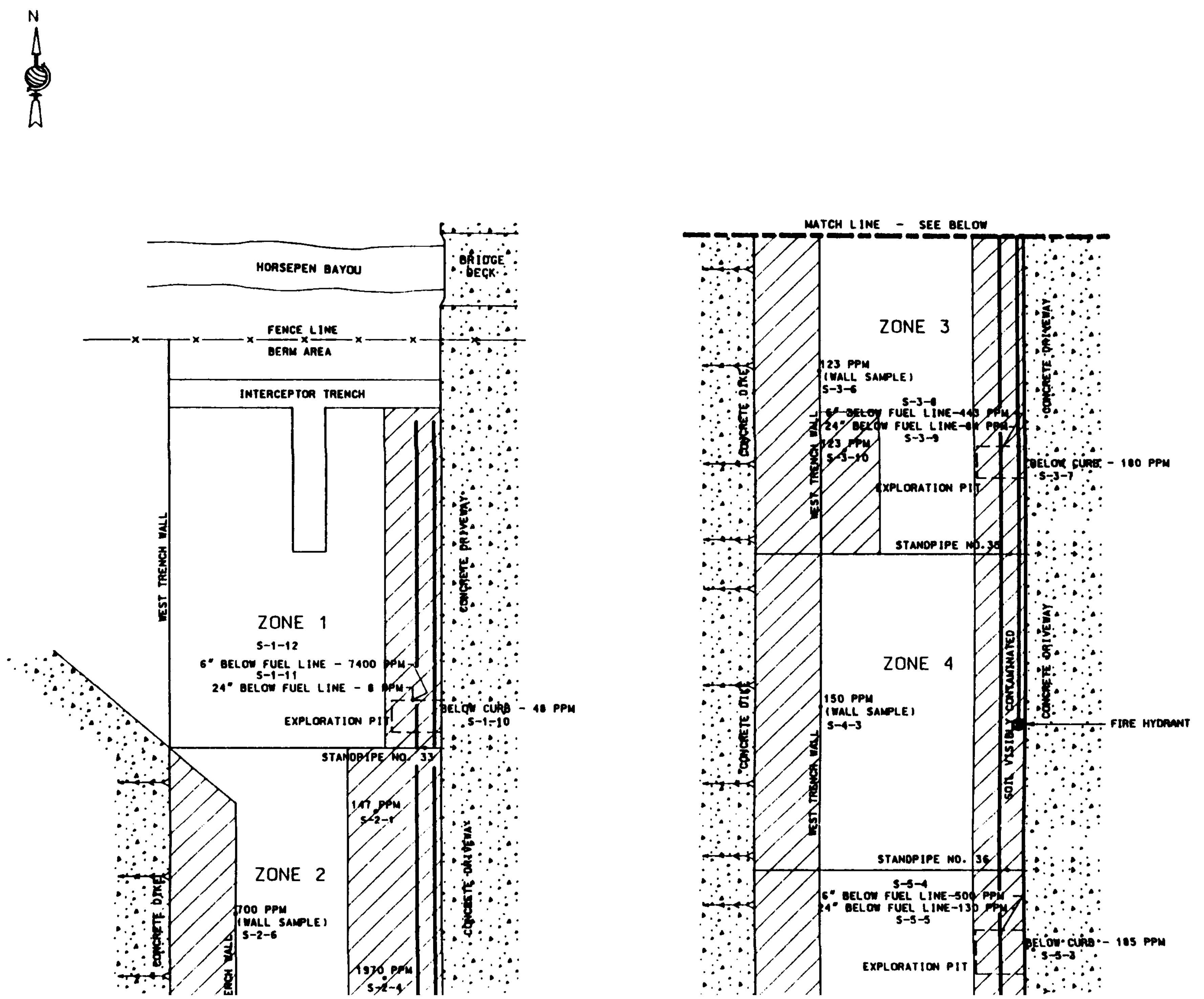
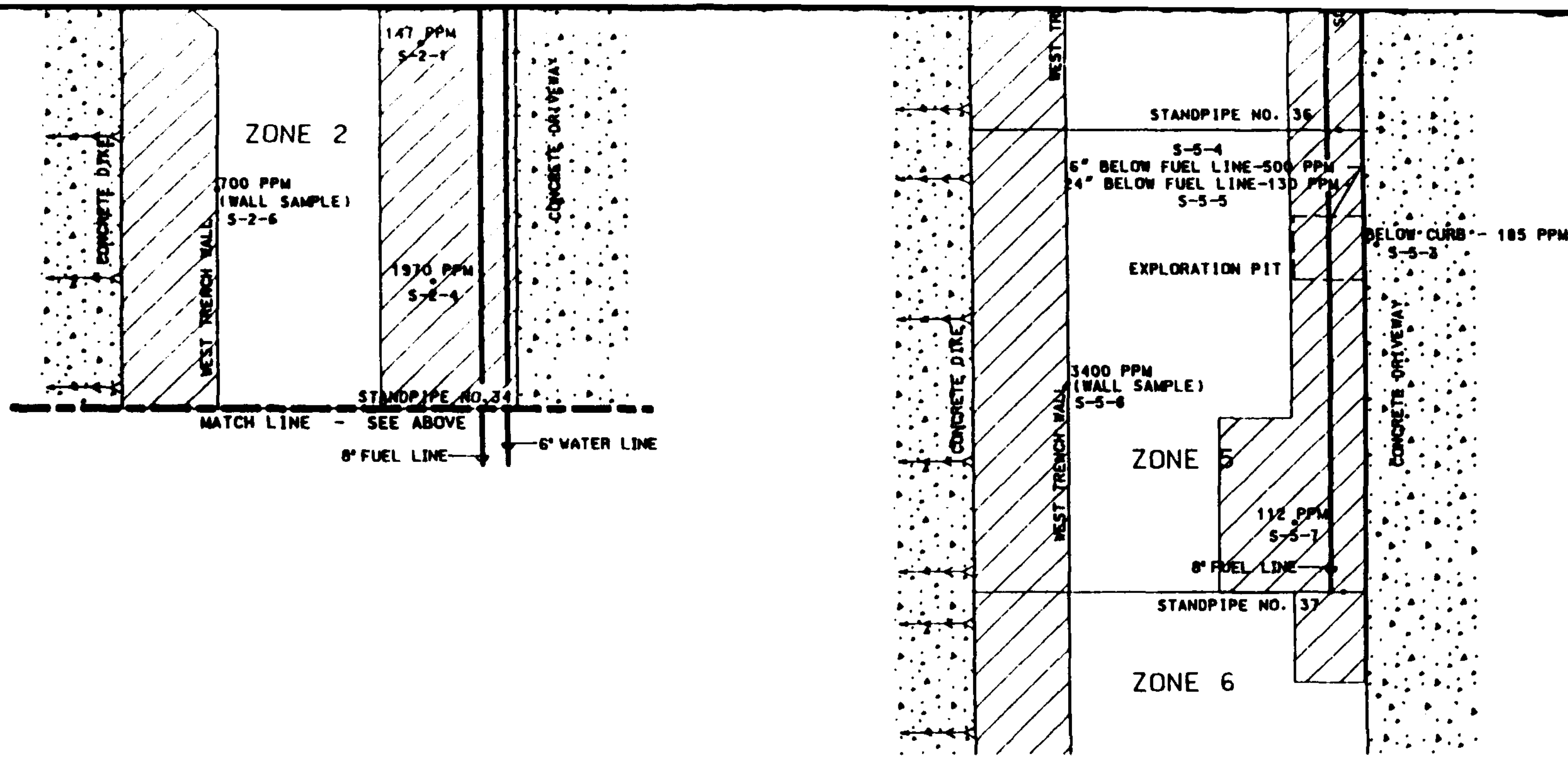

N
FLOW
HORSEPEN BAYOU
PUMP STATIO
TANKS
TANK
FLOW
DRAINAGE DITCH
UNION PACIFIC RAILROAD
DRAWN BY
DATE:
DATE:
CAD DWG. NO.



DRAWN BY	J. ATKINSON	FIGURE 1-3 SITE MAP POL STORAGE AREA ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE:	6-1-90		
HYDROGEOLOGIST	D. UPTHEGROVE		
DATE:	6-1-90		
CAD DWG NO.	363M2802.DGN	SCALE: 1" = 100' NUS DWG NO. 363M-2802 REV 1	


N
HORSEPEN BAYOU
BRIDGE DECK
FENCE LINE
BERM AREA
INTERCEPTOR TRENCH
WEST TRENCH WALL
CONCRETE DRIVEWAY
ZONE 1
S-1-12
6" BELOW FUEL LINE - 7400 PPM
S-1-11
24" BELOW FUEL LINE - 8 PPM
EXPLORATION PIT
BELOW CURB - 48 PPM
S-1-10
STANDPIPE NO. 33
147 PPM
S-2-1
ZONE 2
700 PPM
(WALL SAMPLE)
S-2-6
1970 PPM
S-2-4
CONCRETE DIKE
MATCH LINE - SEE BELOW
ZONE 3
123 PPM
(WALL SAMPLE)
S-3-6
S-3-8
6" BELOW FUEL LINE-443 PPM
24" BELOW FUEL LINE-64 PPM
S-3-9
123 PPM
S-3-10
BELOW CURB - 180 PPM
S-3-7
EXPLORATION PIT
STANDPIPE NO.35
ZONE 4
150 PPM
(WALL SAMPLE)
S-4-3
SOIL VISIBLY CONTAMINATED
FIRE HYDRANT
STANDPIPE NO. 36
S-5-4
6" BELOW FUEL LINE-500 PPM
24" BELOW FUEL LINE-130 PPM
S-5-5
BELOW CURB - 185 PPM
S-5-3
EXPLORATION PIT



- SIGNIFIES AREAS IN WHICH ANALYTICAL RESULTS INDICATE TPH CONCENTRATIONS AT >100 PPM.

DRAWN BY M. GREEN	FIGURE 1-4	NUS CORPORATION
DATE: NOV. 1989	AREAS WITHIN REMEDIATION TRENCH WITH	
HYDROGEOLOGIST D. UPTHEGROVE	TPH >100 PPM-POL STORAGE AREA	
DATE: NOV. 1989	ELLINGTON FIELD (ANG) HOUSTON, TEXAS	
CAD DWG. NO. 890M2A01.DGN	SCALE: 1" = 15'-0"	NUS DWG. NO. 890-2B1	REV. 0	

2.0 FIELD PROGRAM

2.1 FIELD PROCEDURES

2.1.1 Geophysical Investigation

A geophysical survey was conducted at the Former Base Landfill to aid in the characterization of shallow subsurface conditions before undertaking drilling and sampling activities at the site. Magnetometry and electromagnetic conductivity techniques were utilized during the survey. Instruments used were an EDA OMNI-IV PLUS Magnetometer/Gradiometer and a Geonics Limited EM-31 DL Electromagnetic Recording System. Readings were taken with both instruments at 25-foot intervals along mutually perpendicular lines, and more frequently where subsurface conditions caused anomalous readings.

2.1.2 Drilling

All drilling activities conducted as part of the SI were performed using truck-mounted drilling rigs. Borings were advanced by the hollow stem auger method. Soil samples were continuously collected from each boring to determine lithology beneath the site and for chemical laboratory analysis (where appropriate). A portion of each recovered sample was placed in a zip-loc bag and the headspace scanned for organic vapors using a photoionization detector (PID) and flame ionization detector (FID). An explosimeter was utilized during drilling activities to detect the presence of potentially flammable/explosive atmospheres.

Borings not completed as monitoring wells or piezometers were backfilled to ground surface with a cement/bentonite grout. Drill cuttings from borings for monitoring wells were drummed and stored on site pending results of laboratory analyses of soil samples collected from the borings. Cuttings from borings for piezometers were used as backfill material. Boring logs depicting site lithology are included in Appendix A.

2.1.3 Subsurface Soil Sampling

Subsurface soil samples were collected by pushing an oversized split-spoon sampler in advance of the hollow stem augers. Brass liners were utilized for the collection of volatile organic samples. Shelby tubes were used only for the collection of samples on which no chemical analyses were to be performed. Once a sample was brought to the surface, it was described then immediately placed in the appropriate sample container (if selected for chemical analysis) and iced to 4 degrees Centigrade(°C). All samples were delivered to the NUS Laboratory in Clear Lake City, Texas for chemical analysis. Field data is presented on soil sample log sheets which are contained in Appendix A. Soil profiles are shown in cross-sections contained in Section 3 (Figures 3-3, 3-4, 3-8, and 3-9).

2.1.4 Surface Soil Sampling

Composite surface soil samples were collected using stainless steel spoons and glass mixing bowls. Subsamples were collected from the interval between 0 and 6 inches below ground surface. Equal portions of subsamples were mixed thoroughly, then placed in the appropriate sample containers.

2.1.5 Monitoring Well/Piezometer Installation

All monitoring wells and piezometers installed during the SI were screened in the shallowest zone of saturated, permeable sediments beneath the facility. Borings used for the installation of monitoring wells/piezometers were advanced to a depth 3 feet below the base of the selected screened interval to accommodate a sediment trap and bottom cap. A silica sand filter pack was installed through the augers to extend approximately 2 feet above the top of the screen. A 2-foot thick bentonite seal was then placed above the sand pack. The remainder of the borehole was backfilled with cement/bentonite grout for monitoring wells and with natural backfill (drill cuttings) for piezometers. Most monitoring wells were surface completed with stainless steel locking casings, concrete pads and steel guard posts. Several wells, however, due to their locations, were flush-mounted and completed with locking caps, christy boxes, manhole covers and concrete pads. Typical piezometer construction is illustrated in Figure 2-1, while Figure 2-2 depicts typical monitoring well construction. As-built diagrams for all piezometers and monitoring wells are contained in Appendix A.

Upon completion, monitoring wells were developed through a combination of surging and bailing and air lifting sediment until water was essentially sediment free. The volume of water developed from wells was recorded on well development forms, which are contained in Appendix A. Development water was only drummed when field evidence of contamination was detected. Several well volumes of water were removed from each piezometer to ensure the accuracy of water level measurements. Piezometers were not utilized for the collection of ground-water samples. Once a preliminary determination of ground-water flow direction had been made, piezometers were abandoned according to TWC regulations.

2.1.6 Ground-Water Sampling

Ground-water samples were collected from all monitoring wells installed as part of the SI. Each monitoring well was purged (approximately three well volumes were removed) prior to the collection of samples. Samples were collected using bottom-loading stainless steel bailers and were transferred directly to the appropriate sample container (with the exception of samples collected for metals analysis, which were filtered prior to being containerized). Pertinent data were recorded on monitoring well sample log sheets which are contained in Appendix A.

2.1.7 Aquifer Testing

The aquifer testing program consisted of performing slug tests at all monitoring wells installed as part of the SI. A pressure transducer, a Hermit datalogger and a PVC slug of known volume were utilized for the tests. Data generated were used to calculate approximate hydraulic conductivities of the water-bearing sediments beneath the facility. Slug test calculations are presented in Appendix B.

2.1.8 Site Investigation Derived Waste Management

All cuttings generated by the drilling of soil borings were drummed and stored at their respective drill sites pending chemical analysis of soil samples. At boring locations where no significant soil contamination was detected through laboratory analysis, cuttings will be spread on the ground surface and raked level. Cuttings from boring SB-13 at the POL Storage Area will be disposed of in a Class II landfill. This is due to the presence of total petroleum hydrocarbons in one sample from the boring at a concentration (132 ppm) above TWC guidelines.

Development water from one well was drummed based on field evidence of contamination. However, no contamination was detected through laboratory analysis of ground water from that well. The drummed water will therefore be discharged onto the ground surface and allowed to evaporate or infiltrate into the shallow soils.

2.2 FORMER BASE LANDFILL

2.2.1 Summary

The field investigation at the Former Base Landfill was conducted to characterize shallow subsurface conditions and to determine whether soils and ground water had been affected by waste disposal activities at the site. Activities included the following:

- A geophysical survey utilizing magnetometry and electromagnetic conductivity techniques.
- Installation of five ground-water monitoring wells.
- Collection of three surface soil samples, nine subsurface soil samples, and five ground-water samples for fixed-base laboratory analysis.
- Measurement of water levels in all monitoring wells.
- Slug testing in all monitoring wells.

2.2.2 Deviations From the Work Plan

Deviations from the Sampling and Analysis Plan (SAP) during the field investigation of the landfill were as follows:

- To better define anomalous areas during the geophysical survey, readings were sometimes taken at intervals less than 25 feet.

- The laboratory informed field personnel of hexane contamination in rinseate blanks. An additional methanol rinse was added during decontamination to help air dry sampling equipment (per HAZWRAP Quality Control Requirements for Field Methods, HZ/RAP-102-2).

2.2.3 Geophysical Investigation

Before conducting the geophysical survey at the landfill, a grid system was surveyed at the site with stations at 100-foot intervals on mutually perpendicular lines. The grid was then filled in at 25-foot intervals using a measuring tape and pin flags. Readings were taken at each station with both the magnetometer and electromagnetic conductivity meter. As previously mentioned, more detailed surveying was conducted in anomalous zones.

The magnetometer has its own data recording system, while readings taken with the EM-31 were manually recorded in a logbook. The EM-31 displays a continuous readout, while the magnetometer must be triggered to record data at a sample point. A total of 1998 magnetic data points and 1537 electromagnetic conductivity data points were collected during the survey. In anomalous areas where more detailed surveying was performed, additional magnetic data points were always recorded. The EM-31 was monitored for variability in the readings, and only those readings where significant change was noted were recorded. This resulted in the disparity in sample data points between the two methods.

2.2.4 Soils Investigation

Five soil borings were drilled along the perimeter of the Former Base Landfill during the SI (SB-01 through SB-05). All five were completed as monitoring wells (MW-01 through MW-05). Lithologic samples were continuously collected from the borings.

A total of nine subsurface soil samples were collected from the borings for chemical laboratory analysis. One sample was collected at the top of the saturated zone from each boring, while the remaining four were collected at various depths based on field evidence of contamination. Subsurface soil samples were analyzed for target compound list (TCL) volatiles, TCL Base Neutrals/Acid Extractables (BNAs), TCL pesticides, target analyte list (TAL) inorganics and petroleum hydrocarbons.

Three composite surface soil samples (01-SS01-A, 01-SS02-A and 01-SS03-A) were collected at the landfill during the SI. For the purpose of sampling, the landfill was divided into thirds, with one composite sample being collected from each third. Each sample was a composite of three subsamples collected from areas with surficial evidence of subsurface fill (e.g., concrete rubble, uncovered domestic garbage, etc.). Surface soil samples were analyzed for TCL BNAs, TCL pesticides, TAL inorganics and petroleum hydrocarbons.

Sample locations at the Former Base Landfill are shown in Figure 2-3. Table 2-1 presents a summary of laboratory analysis of soil samples from the landfill.

2.2.5 Hydrogeologic Investigation

Water levels in the five wells installed at the site were measured and top of well casing elevations were surveyed. The resulting water level elevations were used to establish ground-water flow direction and hydraulic gradient across the site. Ground-water samples were collected from all five wells for chemical laboratory analysis to determine whether ground-water quality has been adversely affected by wastes disposed of in the landfill. Ground-water samples were analyzed for TCL volatiles, TCL BNAs, TCL pesticides, TAL inorganics and petroleum hydrocarbons. Finally, slug tests were performed at the wells to estimate aquifer parameters of the water-bearing sediments beneath the site.

Table 2-2 presents a summary of laboratory analysis of ground-water samples from the Former Base Landfill.

2.3 POL STORAGE AREA

2.3.1 Summary

The field investigation at the POL Storage Area was conducted to characterize shallow subsurface conditions and to determine whether soils and ground water had been affected as a result of fuel handling operations at the site. Activities included the following:

- The installation of three piezometers, four soil borings and four ground-water monitoring wells.
- Collection of 23 subsurface soil samples and four ground-water samples for fixed-base laboratory analysis.
- Measurement of water levels in all piezometers and monitoring wells.
- Slug testing in all monitoring wells.

2.3.2 Deviation from the Work Plan

Deviations from the SAP during the field investigation of the POL Storage Area are as follows:

- Sediment traps were added below the screen in the three piezometers due to the extremely silty nature of the shallow aquifer beneath the site.
- Three of the four wells installed at the site were changed to flush-mounted completions due to their locations.
- Again, a second methanol rinse was added during decontamination to help air dry sampling equipment.

- A field duplicate was inadvertently marked for BNA analysis resulting in one too many BNA duplicate samples.

2.3.3 Soils Investigation

A total of eleven borings were drilled at the POL storage area as part of the SI. All borings were continuously sampled for the collection of lithologic data. Borings PZ-01 through PZ-03 were completed as piezometers. No soil samples for chemical analysis were collected from these borings. Borings SB-11 through SB-14 were drilled inside the diked area. Samples for chemical analysis were collected from 0-2 feet below the diked area, at the top of the saturated zone and at an intermediate depth dependent on field evidence of contamination. Borings SB-07 through SB-10 were drilled for the installation of monitoring wells MW-07 through MW-10. Again, samples were collected from 0-2 feet below grade and at the top of the saturated zone, except in SB-10, which was drilled through fill material at the north end of the railroad spur. In this boring, one sample was collected at 0-2 feet below the filled material (8-10 feet below grade) and one at the top of ground water. Intermediate samples from SB-07 through SB-09 were collected due to the depth to ground water. A total of 23 subsurface soil samples were collected at the POL Storage Area for chemical analysis. All samples were analyzed for TCL volatiles and petroleum hydrocarbons. One sample from each of eight borings (SB-07 through SB-14) was analyzed for TCL BNAs based on field evidence of contamination. In the absence of field evidence of contamination, the sample was collected at the top of ground water.

Sample locations at the POL Storage Area are shown in Figure 2-4. Table 2-3 summarizes laboratory analysis of soil samples from the site.

2.3.4 Hydrogeologic Investigation

Water level measurements taken in the three piezometers were used to establish ground-water elevations and preliminary flow direction at the POL Storage Area. No ground-water samples were collected from piezometers. All piezometers were abandoned subsequent to determining preliminary flow direction. Water level data were also obtained from the four wells installed at the site. Ground-water sampling was conducted at all four wells to determine whether ground-water quality has been affected by fuel management operations at the site. Samples were analyzed for TCL volatiles, TCL BNAs and petroleum hydrocarbons. Slug tests were performed at the wells to determine hydraulic properties of the shallow aquifer beneath the site.

Table 2-4 summarizes laboratory analysis of ground-water samples from the POL Storage Area.

TABLE 2-1

SUMMARY OF LABORATORY ANALYSIS OF SOIL SAMPLES
FORMER BASE LANDFILL

Parameter	Analytical Method	QC Level	Number Environmental Samples	Number Field Duplicates	Number Trip Blanks	Number of Field/Rinsate Blanks	Total Number Environmental and QA/QC	Laboratory Duplicates MS/MSD[a]	Total Lab (QA/QC)	Grand Total
TCL Volatiles[b]	CLP[c]	C	9	1	3	4/2	19	3/3	6	25
TCL BNA	CLP	C	12	2	--	4/2	20	3/3	6	26
TAL Inorganics[d]	CLP 200 Series	C	12	2	--	4/2	20	3/3	6	26
TCL Pesticides	CLP	C	12	2	--	4/2	20	3/3	6	26
Petroleum Hydrocarbons	EPA 418.1[e]	C	12	2	--	4/2	20	3/3	6	26

(a) MS/MSD - Matrix Spike/Matrix Spike Duplicate
(b) TCL - Target Compound List
(c) CLP - Contract Laboratory Program, February 1988 for organic parameters, July 1987 for metals
(d) TAL - Target Analyte List
(e) Soils are prepared by Method 3550 using freon as the extraction solvent and treating the extract with silca gel.

TABLE 2-2

SUMMARY OF LABORATORY ANALYSIS OF GROUND-WATER SAMPLES
FORMER BASE LANDFILL

Parameter	Analytical Method	QC Level	Number Environmental Samples	Number Field Duplicates	Number Trip Blanks	Number of Field/Rinsate Blanks	Total Number Environmental and QA/QC	Laboratory Duplicates MS/MSD[a]	Total Lab (QA/QC)	Grand Total
TCL Volatiles[b]	CLP[c]	C	5	1	1	2/1	10	1/1	2	12
TCL BNA	CLP	C	5	1	--	2/1	9	1/1	2	11
TAL Inorganics[d]	CLP 200 Series	C	5	1	--	2/1	9	1/1	2	11
TCL Pesticides	CLP	C	5	1	--	2/1	9	1/1	2	11
Petroleum Hydrocarbons	EPA 418.1	C	5	1	--	2/1	9	1/1	2	11

(a) MS/MSD - Matrix Spike/Matrix Spike Duplicate
(b) TCL - Target Compound List
(c) CLP - Contract Laboratory Program, February 1988 for organic parameters, July 1987 for metals
(d) TAL - Target Analyte List

TABLE 2-3

SUMMARY OF LABORATORY ANALYSIS OF SOIL SAMPLES
POL STORAGE AREA

Parameter	Analytical Method	QC Level	Number Environmental Samples	Number Field Duplicates	Number Trip Blanks	Number of Field/Rinsate Blanks	Total Number Environmental and QA/QC	Laboratory Duplicates MS/MSD[a]	Total Lab (QA/QC)	Grand Total
TCL Volatiles[b]	CLP[c]	C	23	3	3	4/3	36	1/1	2	38
TCL BNA	CLP	C	8	2	--	4/3	17	1/1	2	19
Petroleum Hydrocarbons	EPA 418.1	C	23	3	--	4/3	33	1/1	2	35

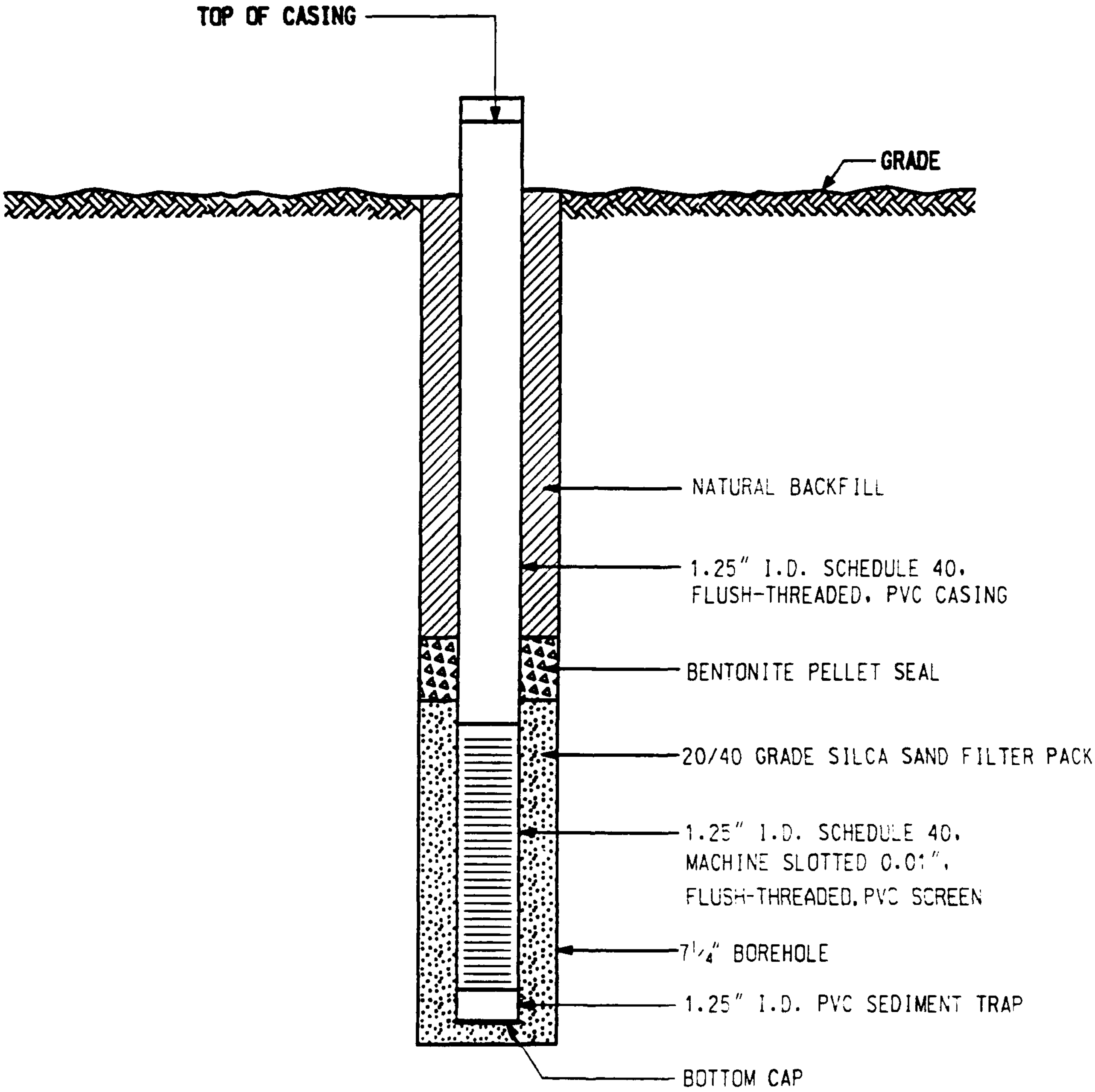
(a) MS/MSD - Matrix Spike/Matrix Spike Duplicate
(b) TCL - Target Compound List
(c) CLP - Contract Laboratory Program, February 1988 for organic parameters, July 1987 for metals

TABLE 2-4

SUMMARY OF LABORATORY ANALYSIS OF GROUND-WATER SAMPLES
POL STORAGE AREA

Parameter	Analytical Method	QC Level	Number Environmental Samples	Number Field Duplicates	Number Trip Blanks	Number of Field/Rinsate Blanks	Total Number Environmental and QA/QC	Laboratory Duplicates MS/MSD[a]	Total Lab (QA/QC)	Grand Total
TCL Volatiles[b]	CLP[c]	C	4	--	2	1/1	8	--	0	8
TCL BNA	CLP	C	4	--	--	1/1	6	--	0	6
Petroleum Hydrocarbons	EPA 418.1	C	4	--	--	1/1	6	--	0	6

(a) MS/MSD - Matrix Spike/Matrix Spike Duplicate
(b) TCL - Target Compound List
(c) CLP - Contract Laboratory Program, February 1988 for organic parameters, July 1987 for metals

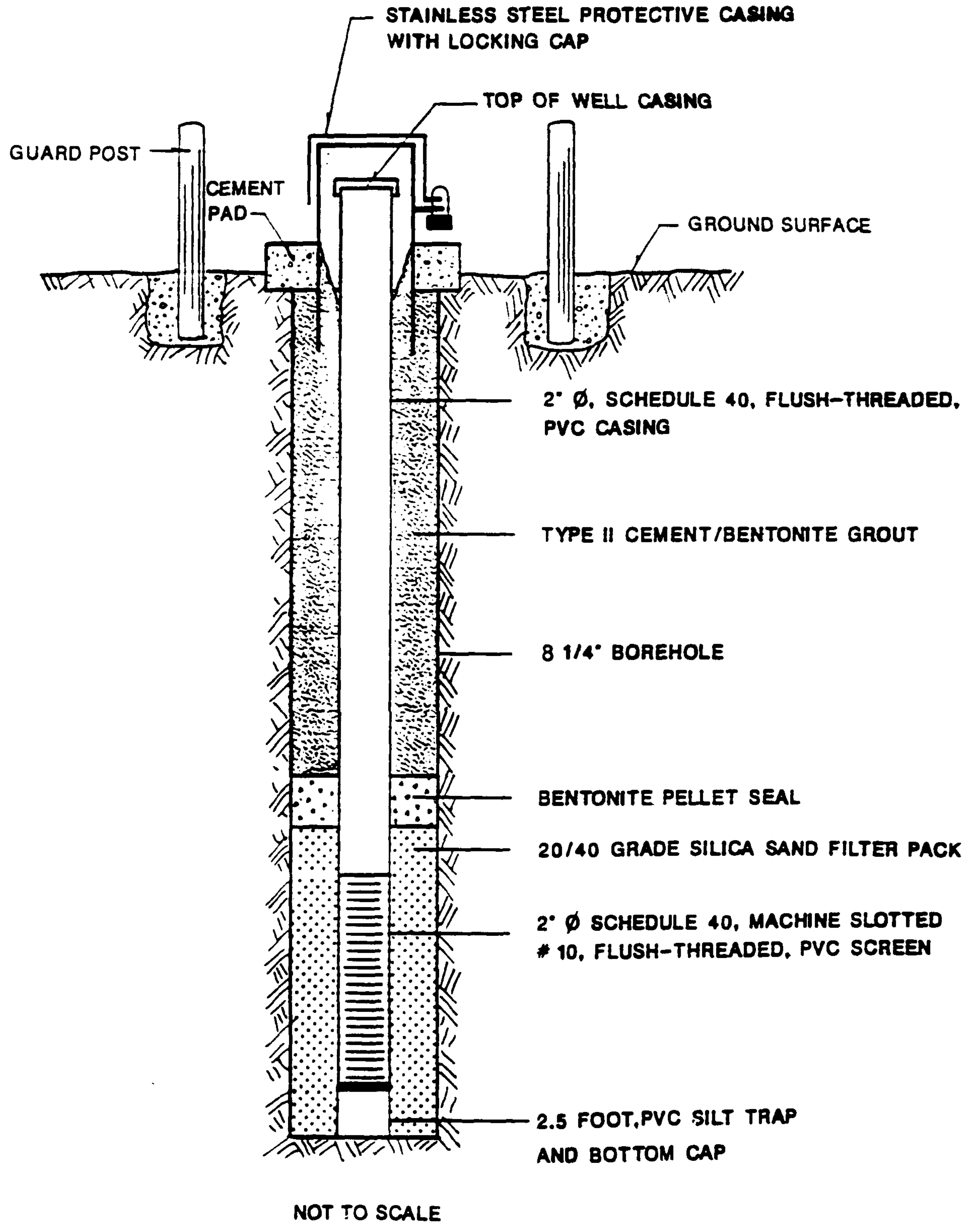


NOT TO SCALE

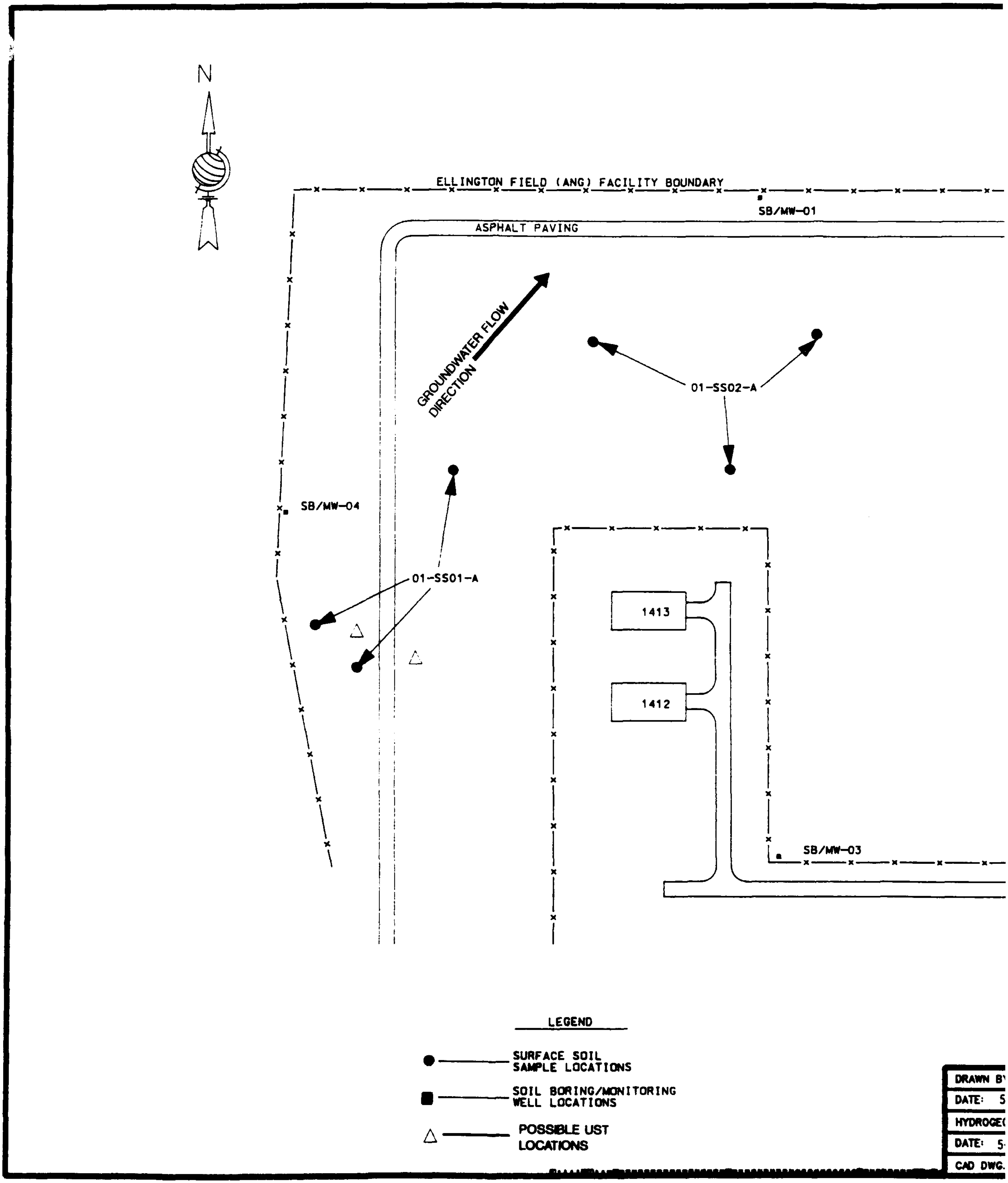
FIGURE 2-1
TYPICAL PIEZOMETER
CONSTRUCTION DIAGRAM
ELLINGTON FIELD (ANG) HOUSTON, TEXAS

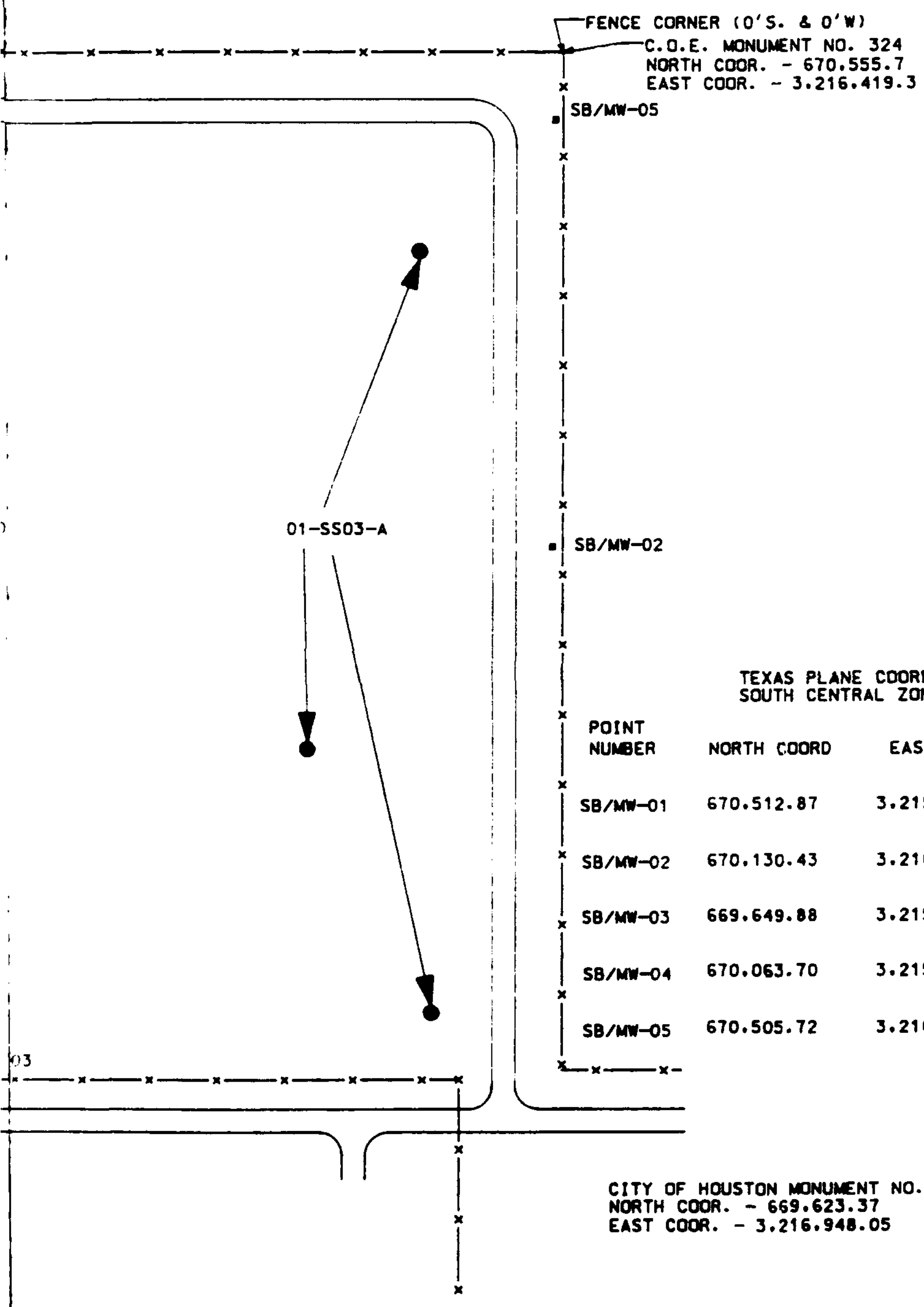
DATE: JUNE 90	NUS DWG. NO. 363M-4A01	REV. 0

NUS CORPORATION



TYPICAL WELL CONSTRUCTION DIAGRAM **ELLINGTON FIELD (ANG), HOUSTON, TEXAS**	NUS CORPORATION
DATE JUNE 90 **FIGURE** 2-2	


N
ELLINGTON FIELD (ANG) FACILITY BOUNDARY
SB/MW-01
ASPHALT PAVING
GROUNDWATER FLOW DIRECTION
01-SS02-A
SB/MW-04
01-SS01-A
1413
1412
SB/MW-03
LEGEND
SURFACE SOIL SAMPLE LOCATIONS
SOIL BORING/MONITORING WELL LOCATIONS
POSSIBLE UST LOCATIONS
DRAWN B
DATE: 5
HYDROGE
DATE: 5
CAD DWG.



TEXAS PLANE COORDINATE
SOUTH CENTRAL ZONE

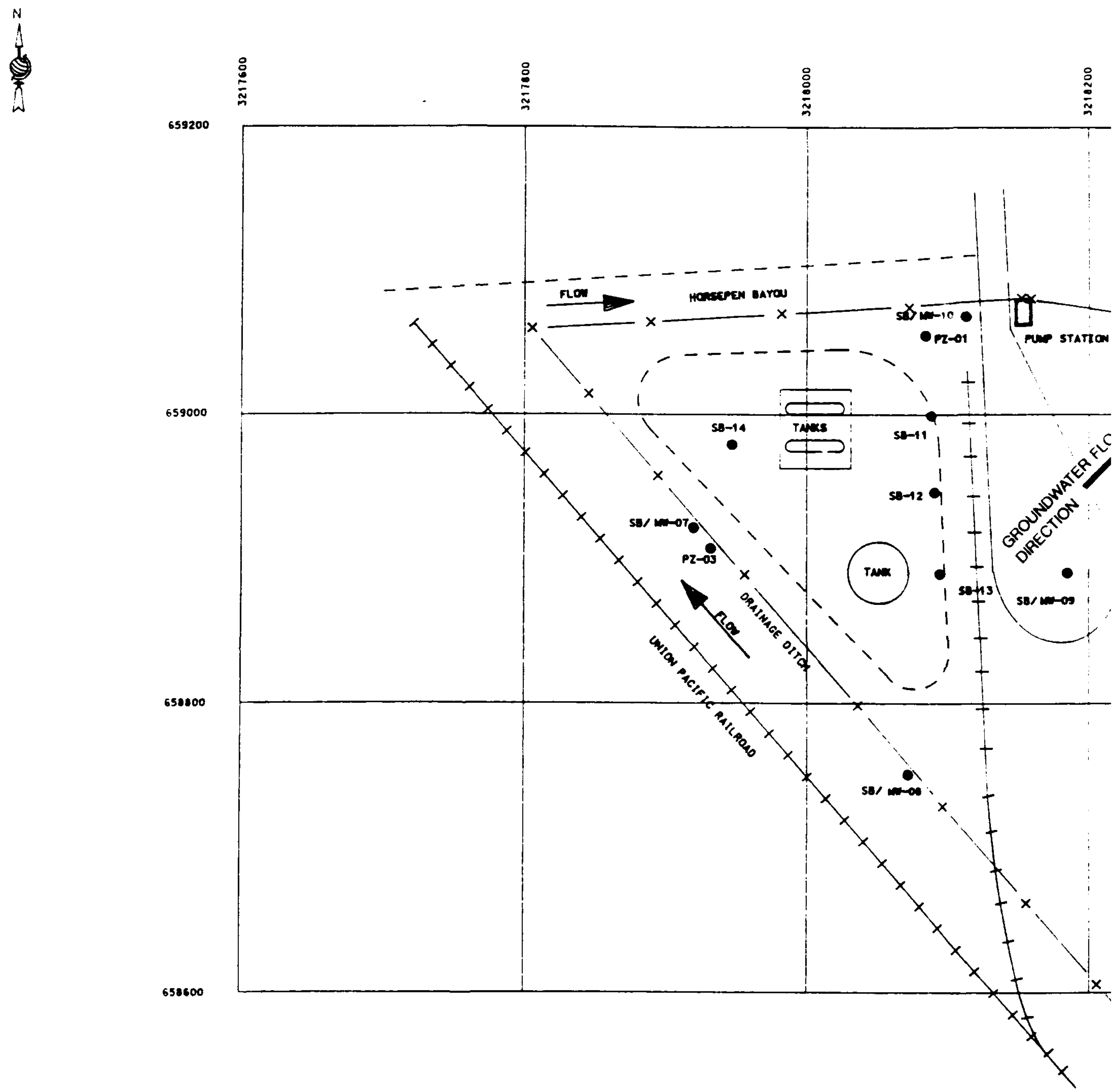
POINT NUMBER	NORTH COORD	EAST COORD	ELEVATIONS TOP OF CASING	ELEVATIONS TOP OF NATURAL GROUND
SB/MW-01	670.512.87	3.215.820.54	37.68	35.90
SB/MW-02	670.130.43	3.216.435.09	36.87	34.78
SB/MW-03	669.649.88	3.215.892.93	37.80	36.15
SB/MW-04	670.063.70	3.215.209.60	39.35	36.98
SB/MW-05	670.505.72	3.216.411.88	36.64	34.71

DRAWN BY J. ATKINSON	
DATE: 5-31-90	
HYDROGEOLOGIST D. UPTHEGROVE	
DATE: 5-31-90	
CAD DWG. NO. 363M2B01.DGN	

FIGURE 2-3
SAMPLE LOCATION MAP
FORMER BASE LANDFILL
ELLINGTON FIELD (ANG) HOUSTON, TEXAS

SCALE: 1" - 150' | NUS DWG. NO. 363M-2B01 | REV. 2

NUS CORPORATION
A Halliburton Company



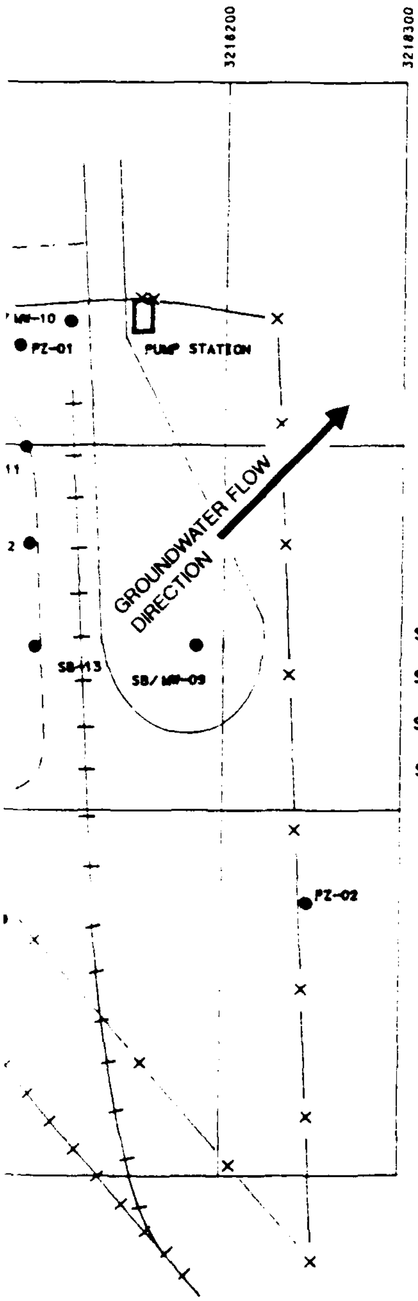
DRAWN BY

DATE:

HYDROGEOLOG

DATE:

CAD DWG. NO.



LEGEND

MW = MONITOR WELL

PZ = PIEZOMETER

SB = SOIL BORING

MAP SHOWING

LOCATIONS AND ELEVATIONS OF MONITORING WELLS, PIEZOMETERS, AND SOIL BORINGS AT THE POL STORAGE AREA ELLINGTON FIELD (ANG) HOUSTON, TEXAS

POINT NUMBER	TEXAS PLANE COORDINATE SOUTH CENTRAL ZONE		ELEVATIONS TOP OF CASINGS	TOP OF CONCRETE/NATURAL GROUND ELEVATION
	NORTH COORD.	EAST COORD.		
SB/MW-07	658,931.22	3,217,921.70	23.16	23.23 (NG)
SB/MW-08	658,757.71	3,218,072.43	23.31	23.55 (NG)
SB/MW-09	658,895.2[illegible]	3,218,182.34	25.27	25.65 (CONC)
SB/MW-10	659,073.15	3,218,110.76	27.59	25.82 (CONC)
PZ-01	659,060.17	3,218,081.47	28.73	26.65 (NG)
PZ-02	658,753.85	3,218,241.40	26.78	24.85 (NG)
PZ-03	(A)	(A)	25.10	23.45 (NG)
SB-11	659,004.16	3,218,085.49		23.71 (CONC)
SB-12	658,951.06	3,218,087.97		23.89 (CONC)
SB-13	658,894.38	3,218,091.83		24.00 (CONC)
SB-14	658,984.11	3,217,944.55		23.73 (CONC)

(A) NOT SURVEYED, APPROXIMATE LOCATION SHOWN.

ELEVATIONS SHOWN HEREON ARE BASED ON N.G.S. MONUMENT M-1276 (1987 ADJ)

DRAWN BY	J. ATKINSON
DATE:	6-1-90
HYDROGEOLOGIST	D. UPTHEGROVE
DATE:	6-1-90

FIGURE 2-4
SAMPLE LOCATION MAP
POL STORAGE AREA
ELLINGTON FIELD (ANG) HOUSTON, TEXAS

NUS CORPORATION
A Halliburton Company

3.0 SIGNIFICANCE OF RESULTS

3.1 FORMER BASE LANDFILL

The following sections summarize the results of field investigations and laboratory analysis at the Former Base Landfill.

3.1.1 Geophysical Survey

The geophysical survey was most effective in determining locations of buried ferrous materials at the landfill. During the interpretation of geophysical data, it was observed that, more often than not, zones exhibiting anomalously high magnetic field values exhibited high electromagnetic conductivity values as well. These are typical responses for both instruments in disturbed zones where ferrous objects are at or near the surface.

The Geophysical Survey Report (Appendix C) identified 36 detailed anomalous zones. Although in some cases these zones are isolated from what appear to be major fill areas, they are, for the most part, considered to be part of a depositional trend of ferromagnetic materials across the landfill. The grid system utilized to conduct the geophysical survey and locations of the detailed anomalous zones are shown in Figure 3-1.

In areas relatively free of disturbed zones, an attempt was made to correlate electromagnetic conductivity values with soil types at the landfill. The only relatively undisturbed areas at the landfill are found in the southeast quadrant of the site, in the eastern half of the southwest quadrant, in the southern portion of the northeast quadrant and along portions of the fenceline. In general, the survey indicated that the landfill area consists of saturated sands and sandy clays to the north grading south into predominantly clays.

The location of the underground storage tank at the former incinerator site in the southwest quadrant of the landfill was not positively identified. However, magnetic field signatures centered at Line 1135, Position 585 and Line 1075, Position 600 suggest these to be the most likely UST Locations (see Figure 3-1).

3.1.2 Soils Investigation

The five borings installed at the Former Base Landfill ranged in depth from 24 feet (SB-03 and SB-04)) to 30 feet (SB-01 and SB-05). Three distinct stratigraphic zones were identified during the investigation. Descriptions of the three zones, in descending order, are as follows:

- **Zone 1**

  Zone 1 is a brown and green-gray clay which changes to rust and light gray in color with depth. The clay contains varying amounts of silt and some very fine grained sand. The amount of silt and sand present in Zone 1 tends to increase with depth, with the bottom several feet becoming very silty and moist, apparently grading into the clayey silt and silty sand of Zone 2. The clay is soft to hard, plastic, and contains calcareous zones with gravel up to 1 inch in diameter. Iron staining and small iron nodules are common throughout, and abundant roots and organic material are present in the top two feet. Zone 1 ranges in thickness from 6 feet in SB-04 to 12.5 feet in SB-02.

- **Zone 2**

  Zone 2 is a layer of dense, brown and tan clayey silt and silty sand. It is the first zone of saturated sediments with sufficient permeability to allow observable ground water to enter a borehole during drilling. Zone 2 contains some interbedded silty clay and small amounts of semi-consolidated sand/siltstone. This relatively thick sand/silt body is typically fining-upward and probably represents point bar deposition in an ancestral stream bed. The thickness of Zone 2 in the vicinity of the landfill ranges from 2.5 feet in SB-02 to greater than 20 feet in SB-05.

- **Zone 3**

  Zone 3 is a gray-green and rust clay. The clay is very stiff to hard and contains minor amounts of sand and silt. SB-01, SB-02 and SB-03 were terminated in Zone 3, while SB-04 and SB-05 were terminated in Zone 2. The thickness of Zone 3 was not determined, as none of the borings drilled at the landfill fully penetrated the clay bed.

Two cross-sections were constructed using logs of soil borings advanced at the landfill. Figure 3-2 depicts the location of these profiles, which are shown in Figures 3-3 and 3-4.

3.1.3 Hydrogeologic Investigation

A network of five ground-water monitoring wells was installed at the landfill as part of the SI. Pertinent monitoring well data is presented in Table 3-1. Initially, four monitoring wells, MW-01 through MW-04, were installed at the approximate midpoints of the north, east, south and west sides of the landfill, respectively. Water levels in these wells were measured and, using surveyed elevations of tops of casings, converted to elevations with respect to mean sea level. This allowed for the construction of a ground-water elevation contour map (Figure 3-5), which gives a preliminary indication of ground-water flow direction in the shallow sediments beneath the site.

Figure 3-5 depicts ground-water flow on December 19-20, 1989 as being to the north-northeast in the southwestern portion of the landfill and changing to an east-northeast direction in the northeastern portion of the site. In order to fulfill TWC minimum requirements (one upgradient and three downgradient wells), it was decided to install a fifth well, MW-05, in the northeastern corner of the landfill. Figure 3-6 is a ground-water elevation contour map constructed using elevations derived from measurements taken in all five wells on January 25-26, 1990. This map shows the anticipated direction of ground-water flow (east-northeast) in the northeastern corner of the landfill to be accurate.

The hydraulic gradients estimated from ground-water contours across the site are much larger than average for shallow Gulf Coast sediments. Hydraulic gradients in the Upper Chicot aquifer normally range from 2 to 20 feet/mile. The hydraulic gradient along line A-A' on Figure 3-5 is 0.011 feet/feet (60 feet/mile); along line B-B' the gradient is 0.008 feet/feet (42 feet/mile). On Figure 3-6 the hydraulic gradient along A-A' is 0.015 feet/feet (80 feet/mile); along B-B' the gradient is 0.0084 feet/feet

(44 feet/mile). As would be expected, the expansive commercial sand pit just east of the landfill apparently has a profound effect on shallow ground-water flow at the Former Base Landfill. At the time of field activities, excavation of sand was occurring in an area 200-300 feet northeast of MW-05, to a depth of approximately 30 feet. The sand excavations indicated that no water was being pumped from the excavation pit.

Slug tests were performed at each of the five wells installed at the landfill to estimate hydraulic conductivities of the Zone 2 sediments. Hydraulic conductivities were calculated using the Bouwer and Rice method for partially or completely penetrating wells in unconfined aquifers. Several general and site-specific assumptions were made in the evaluation of slug test data. These assumptions are as follows:

General Assumptions:

- The aquifer is homogeneous and isotropic
- Head losses as water enters the well are negligible
- Flow above the water table is typically ignored, as it does not significantly affect slug test data evaluation
- Drawdown of the water table is negligible (Bouwer and Rice, 1976)

Site-Specific Assumptions:

- The effective length is the length of the screen (10 feet) in the wells unless there was open screen above the water level. In those instances, the effective length is the portion of the screened interval below static water level.
- Soils above and below Zone 2 contribute negligibly to equalization of the head in the well during the test.
- Time and "head" translational data, rather than theoretical estimates of head change with time, were utilized in performing slug test calculations to avoid instrument "noise" at the beginning of each test (i.e., the first consistent time/head values were used as H(0) (Pandit, et.al., 1986).

- If there was any question as to which straight line on a graph was more indicative of flow from the undisturbed aquifer, the steeper line was used in calculations as it yields a higher (more conservative) hydraulic conductivity.

Table 3-2 presents calculated hydraulic conductivity and transmissivity values. Values from rising head tests range from 4.15×10^{-3} cm/sec to 2.67×10^{-4} cm/sec. Generally wells in areas where the aquifer was comprised of a relatively thick, clean, sand body exhibited higher hydraulic conductivity values. Rising head tests are assumed to be more accurate than falling head tests for the following reasons. Rising head tests are not influenced by gravity, and, falling head tests involve wetting soils which may have previously been dry. Values from falling head tests were used for comparative purposes and were observed to be equal or similar to rising head values. Transmissivity values were estimated based on the thickness of the saturated permeable sediments. Values range from 774.59 gallons/day/foot to 14.21 gallons/day/foot due to the variability in hydraulic conductivity values and aquifer thickness. Hydraulic conductivity and transmissivity values appear to be high for clayey silt and silty sand; however, slug tests do not typically provide data as accurate as that from pump tests or laboratory tests.

Using the equation for Darcian seepage velocity, estimates of horizontal ground-water flow velocities were calculated for variable hydraulic conductivities and effective porosity estimates. Table 3-3 presents seepage velocity estimates for Zone 2 at the landfill. Estimates range from 377.41 feet/year to 16.64 feet/year. The high end of the range was calculated using the highest hydraulic conductivity and steepest gradient, while the low end was calculated using the lowest hydraulic conductivity and gentlest gradient.

3.1.4 Background Samples

The objective of the SI was to determine whether soils or ground water have been affected by past waste management practices and did not provide for collection of background samples. Naturally occurring levels of inorganics identified in published literature, as referenced in Section 4.2.2 of this report, were used as actual background data. Upgradient ground-water and soil samples were collected from areas not believed to have been affected by past waste management practices. Therefore, sample 01-MW03-A may be designated the background ground-water sample at the Former Base Landfill because it is hydraulically upgradient of the other four wells at the site. The sample contained no TCL volatiles, BNAs, pesticides, or petroleum hydrocarbons. TAL inorganics were present in concentrations comparable to those found in other ground-water samples collected from the site.

Similarly, sample 01-SB03A-A may be designated the background soil sample at the landfill. It was collected from a seemingly undisturbed area and contained no TCL volatiles, BNAs, pesticides, or petroleum hydrocarbons. TAL inorganics were detected in concentrations comparable to those found in other soil samples collected from the site.

3.1.5 Contaminant Occurrence and Distribution

This section summarizes information on the nature and extent of contamination at the Former Base Landfill. More complete information on laboratory analysis is contained in Appendix D, the Analytical Data Base. Additional laboratory data supporting data validation is contained in Appendix D, Data Validation Reports.

Surface Soil

Three composite surface soil samples were collected at the Former Base Landfill as part of the SI. The samples were sent to a fixed-base laboratory and analyzed for TCL BNAs, TCL pesticides, TAL inorganics and petroleum hydrocarbons. Quantitative results are summarized in Table 3-4. A number of Polynuclear Aromatic Hydrocarbons (PAHs) were detected in the landfill surface soil samples at relatively low concentrations. Surface soils also contained butylbenzylphthalate, dibenzofuran and DDT and its metabolites. The concentrations of inorganics in surface soil samples does not appear indicative of a widespread problem. Arsenic, lead, mercury, and zinc were, however, detected at average concentrations higher than the literature background values.

Subsurface Soil

Five soil borings were advanced at the Former Base Landfill. A sample was collected at the top of ground water from each boring. An additional sample was collected from four of the borings based on field evidence of contamination. The samples were sent to a fixed-base laboratory and analyzed for TCL volatiles, TCL BNAs, TCL pesticides, TAL inorganics and petroleum hydrocarbons. Table 3-5 presents a summary of quantitative results.

Heptachlor was detected in two subsurface soil samples and phenol in one sample at the landfill. No other organic compounds were detected in subsurface soils. Mercury was the only inorganic constituent detected at concentrations higher than reported background levels.

Ground Water

All five soil borings were converted to ground-water monitor wells. Ground-water samples were collected from each of the five monitoring wells installed at the Former Base Landfill. The samples were sent to a fixed-base laboratory and analyzed for TCL volatiles, TCL BNAs, TCL pesticides, TAL inorganics, and petroleum hydrocarbons. A summary of quantitative results is presented in Table 3-6.

No volatile organics were detected in ground water at the landfill. Two pesticides, alpha-BHC and methoxychlor, were detected at very low concentrations in samples collected from MW-01 and MW-05, respectively. Petroleum hydrocarbons were also detected in MW-05 at extremely low levels.

Aluminum was the only inorganic constituent detected at a concentration significantly higher than literature background (in the sample from MW-04). Barium, calcium, chromium, and vanadium were detected in one or more wells at concentrations slightly above reported background levels.

Quality Assurance / Quality Control (QA / QC)

Table 3-7 shows QA/QC sample concentrations for the Former Base Landfill. The presence of blank contamination lends a degree bias to the data, that is, is the compound there because it is in the sample or is it there because of blank contamination? To compensate for this bias, the detection limits of the affected compounds are elevated to negate the influence of blank contamination. First, the maximum concentration of the compound occurring in the blank is determined. Using that value, an action-level of five or ten times the blank concentration is set. Five times is used for uncommon contaminants, and ten times is used for methylene chloride, acetone, toluene, and methylethylketone. All positive values below the action level are qualified with a "B" (Blank contamination), and the data are not used in defining the nature and extent of contamination or in the risk assessment. Matrix spikes (MS) and matrix spike duplicates (MSD) are checked to ensure they are within a specific range. All sample results for which the MS/MSD data are not within the specified range are considered as non-detected data.This data is flagged during data validation.

3.1.6 Data Gaps

The only significant gap in data from the investigation of the Former Base Landfill is the lack of information on the sub-regional ground-water system and ground-water quality and usage in the area. Although a broad discussion of the regional ground-water system (regional aquifers, etc.) is presented in Section 1.5.2, it is difficult to determine how the results of a small scale investigation like the one conducted at the landfill fit into the overall "big picture". More information on ground-water quality and usage in the vicinity of the landfill would be helpful in performing the risk assessment presented in Section 4 of this report.

3.1.7 Conclusions

The following conclusion can be drawn from the Site Investigation at the Former Base Landfill:

- The results of the geophysical survey correlate well with historical aerial photographs which indicate that the majority of disposal activities occurred in the southwest, north central and northeast portions of the landfill.

- The water-bearing sediments of Zone 2 thicken substantially from the south end of the site northward. This was anticipated because the Geophysical Survey Report identified the shallow soils in the northern portion of the landfill as being predominantly sandy grading into clays at the southern end of the site.

- Ground-water flow direction is to the east-northeast, probably at a higher gradient than normal due to the sand pit east of the landfill. The water level in MW-03 is observed at depths which correlate with the clays of Zone 1, while unsaturated portions of Zone 2 are present above the water level in the remaining wells.

- No volatile organic compounds were detected in soil or ground-water samples collected at the landfill. Although low concentrations of pesticides were detected in soil and ground-water samples, and several BNAs and metals were present in surface soil samples, there does not appear to be a concern at the landfill.

3.2 POL STORAGE AREA

3.2.1 Soils Investigation

The borings drilled at the POL Storage Area ranged in depth from 20 feet (SB-14) to 33.5 feet (SB-10). The same three zones which are present beneath the landfill were encountered during drilling activities at the POL site. However, due to variations in the soil profile, the clays of Zone 1 were further divided into two subzones (designated as Zone 1A and Zone 1B). Descriptions of the units are as follows:

- **Zone 1A**

  Zone 1A consists of soft to stiff, dark brown, black and gray-green clays. Some fill material and abundant roots are present in the top 2-3 feet. Iron staining and nodules are common, as are calcareous zones. Minor amounts of silt and sand are contained within Zone 1A, especially in its lower portions. In several of the borings drilled through the diked area (SB-11 through SB-13), strong hydrocarbon odors and some staining were present in the top 6-8 feet. Zone 1A ranged in thickness from 12 feet in SB-12 and the boring for PZ-02 to 6 feet in SB-08.

- **Zone 1B**

  Zone 1B is a medium stiff to very stiff gray and rust silty clay. Iron staining and nodules are common throughout, as is abundant calcareous material. Silt content increases with depth, with the color of the clay changing to brown with increasing silt content. No hydrocarbon odor was present within this zone in any of the borings. The thickness of Zone 1B ranged from 12 feet in the boring for PZ-01 to 5 feet in SB-07.

- **Zone 2**

  Zone 2 is a layer of dense, brown clayey silt and silty sand. As at the landfill, this is the first zone of sediments beneath the site transmissive enough to allow ground water to enter a borehole during drilling. The sand is very fine to fine grained, with iron staining common throughout. Some semi-consolidated sandstone and siltstone are present within the silt/sand layer, as are some silty clay seams. Only SB-08, SB-09 and SB-10 fully penetrated Zone 2; the remainder of the borings were terminated within the zone. Zone 2 ranges from 9.5 feet in SB-07 to greater than 14 feet in SB-09.

- **Zone 3**

  Zone 3 is a brown sandy and silty clay. The clay is very stiff to hard, and contains some sandy seams. None of the borings drilled at the site fully penetrated Zone 3. However, an engineering study conducted for the city of Houston in March 1988 indicates that in borings in the vicinity of the POL Storage Area, Zone 3 is between 15 and 25 feet in thickness. This clay is, in turn, underlain by another water-bearing silty sand zone.

Two cross sections were constructed using logs of borings advanced at the POL Storage Area. Figure 3-7 depicts the locations of these cross-sections, which are shown in Figures 3-8 and 3-9.

3.2.2 Hydrogeologic Investigation

Three piezometers and four ground-water monitoring wells were installed at the POL Storage Area as part of the SI. Pertinent piezometer and monitoring well data are presented in Table 3-8. Initially, three piezometers, PZ-01 through PZ-03, were installed at the site. Ground-water elevations derived from January 12, 1990 water level measurements and surveyed top of casing elevations allowed for the construction of a ground-water contour map (Figure 3-10). This map depicts ground-water flow direction as being to the east-northeast. The cross sections presented in Figures 3-8 and 3-9 for the POL Storage Area show the water table for all monitor wells above the sand layer. This could be indicative of artesian conditions or it could mean that the clays above the aquifer are saturated but do not readily yield ground water to a borehole during drilling.

HAZWRAP was notified of the flow direction, and it was decided that monitoring wells would be installed at the locations proposed in the SAP. Four wells, MW-07 through MW-10, were installed at the POL Storage Area. A ground-water contour map was constructed using measurements taken in the four wells on January 19, 1990. This map (Figure 3-11) confirmed that ground-water flow direction was generally in an easterly direction. The hydraulic gradient calculated using the contours from Figure 3-10 is 0.014 feet/feet (73.92 feet/mile); the gradient using contours from Figure 3-11 is 0.015 feet/feet (79.2 feet/mile). As at the landfill, these gradients were significantly higher than normal (20 feet/mile) for shallow Gulf Coast sediments. This is likely due to the location of MW-07 within a probable recharge area.

Slug tests were performed at all four wells at the site. The assumptions made in evaluating the slug test data were identical to those used in evaluating data from the landfill wells (see pages 3-4 and 3-5). Estimated hydraulic conductivity and transmissivity values are presented in Table 3-9. Values from rising head tests range from 1.46×10^{-3} cm/sec to 9.29×10^{-4} cm/sec. Again, falling head tests were used for comparative purposes and were equal or similar to those for rising head tests. Transmissivity estimates ranged from 402.57 gallons/day/foot to 226.79 gallons/day/foot.

Estimates of horizontal ground-water flow velocities were calculated for variable hydraulic conductivities and effective porosities and are shown in Table 3-10. Estimates range from a maximum of 452.6 feet/year to 57.6 feet/year.

3.2.3 Background Samples

Upgradient background ground-water and soil samples were collected from areas not believed to have been affected by past waste management practices. Samples

02-MW07-A and 02-SB07C-A are designated background ground-water and soil samples, respectively, at the POL Storage Area. The well is hydraulically upgradient of the other wells at the site, and neither of the two samples contained any TCL volatiles, BNAs or petroleum hydrocarbons.

3.2.4 Contaminant Occurrence and Distribution

This section summarizes information on the nature and extent of contamination at the POL Storage Area.

Subsurface Soil

Subsurface soil samples for laboratory analysis were collected from eight borings advanced in the POL Storage Area. A total of 23 samples were sent to a fixed-base laboratory. All samples were analyzed for TCL volatiles and petroleum hydrocarbons. One sample from each boring was analyzed for TCL BNAs based on field evidence of contamination. In the absence of field evidence, the sample collected at the top of ground water was analyzed for BNAs. Table 3-11 presents a summary of the quantitative results.

Several volatile organic compounds were detected in subsurface soil samples. Ethylbenzene was detected in four samples from two different borings in concentrations ranging from 3 to 13,000 µg/kg. Several volatile compounds were detected in one deep (top of ground water) sample, 02-SB13C-A. The concentrations of these compounds in ground water, however, were extremely low.

Two BNAs, naphthalene and 2-methylnaphthalene, were detected in samples from both SB-10 and SB-13, as were petroleum hydrocarbons.

Ground Water

Ground-water samples were collected from the four wells installed at the POL Storage Area as part of the SI. Samples were sent to a fixed-base laboratory and analyzed for TCL volatiles, TCL BNAs and petroleum hydrocarbons. Table 3-12 presents a summary of the quantitative results. Some samples were reported to have no quantitative results, and therefore, are not indicated in Table 3-12.

Volatile organics were detected only in the ground-water sample from MW-10. Ethylbenzene, total xylenes, styrene, and chlorobenzene were all detected in extremely low levels in that sample. No BNAs or petroleum hydrocarbons were detected in ground water at the site.

QA/QC

Table 3-13 shows QA/QC sample concentrations for the POL Storage Area. These concentrations were used in conjunction with environmental sample concentrations in the manner described in Section 3.1.4, QA/QC, for the Former Base Landfill.

3.2.5 Data Gaps

The most significant gap in data at the POL Storage Area is that the soil and ground-water contamination in the immediate vicinity of the former remediation trench may not have been adequately characterized. Also, there is a lack of ground-water quality and usage information for the uppermost permeable sediments encountered at Ellington Field (ANG). The underlying (>350 ft below grade) Chicot and Evangeline aquifers are a major source of potable water for the Houston metroplex. Extensive literature references exist for these specific aquifers and the larger Coastal Lowlands aquifer system of which they are a part. At the present time the State of Texas considers all aquifers to be possible sources of potable water. A classification of the States aquifers is currently underway. There are no downgradient wells within one mile of the site. There are four municipal wells located on City of Houston and City of Pasadena property in the vicinity of Ellington Field (ANG). These wells were discussed in Section 1.5.2 of this report.

A survey of wells in the vicinity of Ellington Field (ANG) was not conducted as part of the SI activities. This will be done during the follow on remedial investigation tasks planned. The well survey will determine:

- If there are any wells within a 2-mile radius of Ellington Field (ANG)
- The depth of each well, if any
- Which wells are currently in use as water supply wells, if any

3.2.6 Conclusions

The following conclusions can be drawn from the investigations and interim remedial action at the POL Storage Area.

- Although the thickness of the soil zones varies from boring to boring, the soil profile is relatively uniform across the site. Shallow soils beneath the diked area exhibited some field evidence of fuel contamination.

- The direction of ground-water flow is generally east across the site. The substantially higher water level in MW-07 is probably due to the well's location in the drainage ditch.

- Water levels in all wells are observed at depths which correlate with the silty clays of Zone 1B, indicating that these sediments are probably saturated, but do not readily transmit water to a borehole during drilling, or, the aquifer is semi-confined.

- Several volatile organic compounds and petroleum hydrocarbons were detected in subsurface soil samples from borings within the diked area. Petroleum hydrocarbons were detected in a soil sample from 0-2 feet below the concrete in SB-13 at a concentration of 132 ppm, above the TWC criterion for clean closure (100 ppm). Several samples collected from the walls and flow of the remediation trench contained petroleum hydrocarbons at levels significantly above 100 ppm. The extent of soil contamination east of the remediation trench has not been determined.

TABLE 3-1

MONITORING WELL DATA
FORMER BASE LANDFILL

Monitoring Well	North Coordinate	East Coordinate	Top of Casing Elevation(a)	Natural Ground Elevation	Depth Below Top of Casing	Depth Below Grade	Screened Interval Below Grade	Filter Pack Below Grade	Bottom of Well Elevation
MW-01	670,512.87	3,215,820.54	37.68	35.90	30.87	29	16-26	13-29	6.81
MW-02	670,130.43	3,216,435.09	36.87	34.78	30.18	28.5	15.5-25.5	13-28.5	6.69
MW-03	669,649.88	3,215,892.93	37.80	36.15	25.03	23.5	10.5-20.5	8.5-23.5	12.77
MW-04	670,063.70	3,215,209.60	39.35	36.98	26.70	25	12-22	10-25	12.65
MW-05	670,505.72	3,216,411.88	36.64	34.71	30.68	29	16.5-26.5	13.5-29	5.96

(a) All elevations in feet with respect to mean sea level.

TABLE 3-2

ESTIMATES OF IN-SITU HYDRAULIC CONDUCTIVITY AND TRANSMISSIVITY
FORMER BASE LANDFILL
AIR TRANSMISSIVITY

Well	Thickness of Unit (feet)	Hydraulic Conductivity				Transmissivity(a)	
		Rising Head		Falling Head			
		cm/sec	ft/day	cm/sec	ft/day	ft/day	gallons/day/ft
MW-01	13	3.06×10^{-4}	0.87	3.62×10^{-4}	1.03	11.31	84.60
MW-02	9.51	2.43×10^{-3} 2.46×10^{-3}	6.90 6.97	(b)	(a)	66.28	495.81
MW-03	2.5	2.67×10^{-4}	0.76	3.05×10^{-4}	0.86	1.90	14.21
MW-04	10.72	3.18×10^{-3} 3.41×10^{-3}	9.03 9.66	(a)	(a)	103.55	774.59
MW-05	8.8	4.08×10^{-3} 4.15×10^{-3}	11.58 11.75	(a)	(a)	103.40	773.43

(a) Hydraulic conductivities from rising head tests were used to calculate transmissivities. In instances where two rising head tests were performed, the higher hydraulic conductivity was used.
(b) Did not conduct falling head tests due to open screen above water level in wells. Two rising head tests were performed.

TABLE 3-3

ESTIMATES OF DARCIAN SEEPAGE VELOCITY
FORMER BASE LANDFILL

Hydraulic Gradient (ft/ft)	Effective Porosity[a]		Hydraulic Conductivity (ft/day)[b]		Darcian Seepage Velocity (ft/day)		Darcian Seepage Velocity (ft/year)	
	Low	High	Low	High	Low	High	Low	High
.015	0.05	0.25	0.76	--	0.046	0.066	16.64	24.4
.015	0.05	0.25	--	11.75	0.705	1.03	257.36	377.41

(a) Effective porosity estimates based on estimates of specific yield for similar soil types from Fetter, 1979, Applied Hydrogeology.
(b) Hydraulic conductivity estimates based on range of hydraulic conductivities for rising head tests presented in Table 3-2.

TABLE 3-4

SURFACE SOIL CONCENTRATIONS(a)(b)
FORMER BASE LANDFILL

Sample Number Sample Depth Sample Date	01-SS01-A 0"-6" 1/17/90	01-SS02-A 0"-6" 1/17/90	01-SS03-A 0"-6" 1/17/90	01-FD05-A Duplicate of 01-SS03-A
Base/Neutrals (µg/kg)				
Butylbenzylphthalate				420 J
Acenaphthene			250 J	560 J
Anthracene			520 J	1,100 J
Benzo (A) Anthracene		800	1,500 J	3,200 J
Benzo (B) Fluoranthene		880	1,300	2,300
Benzo (K) Fluoranthene		930	1,100 J	2,600 J
Benzo (A) Pyrene		1,000	1,300 J	2,700 J
Chrysene		860	1,500	3,000
Flouranthene		1,500	3,300	5,400
Flourene			270 J	560 J
Indene (1,2,3-CD) Pyrene				1,700 J
Napthalene				190 J
Phenanthrene		510 J	2,300	4,200
Pyrene		1,200	2,500	4,600
Dibenzofuran				240 J
Pesticides (µg/kg)				
4,4'-DDT			10 J	
4,4'-DDD				11 J
4,4'-DDE				12 J

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit
(b) J - lab qualifier indicating estimated value.
[ ] - data validation qualifier indicating estimated value.

TABLE 3-4 (CONTINUED)
SURFACE SOIL CONCENTRATIONS(a)(b)
FORMER BASE LANDFILL
PAGE TWO OF TWO

Sample Number Sample Depth Sample Date	01-SS01-A 0"- 6" 1/17/90	01-SS02-A 0"- 6" 1/17/90	01-SS03-A 0"- 6" 1/17/90	01-FD05-A Duplicate of 01-SS03-A
Inorganics (mg/kg)				
Aluminum	7,250 J	6,010 J	13,500 J	8,500 J
Arsenic	4.4	3.5 J	2.9 J	62.0 J
Barium	302 J	141 J	115 J	125 J
Calcium	29,600	39,900	6,460 J	13,300 J
Chromium	13.4	16.0	12.2	10.4
Iron	7,410	6,700 J	10,600	7,330
Lead	125	141	18.9	26.1
Magnesium	2,720	1,480	2,000	1,860
Manganese	152	111 J	91.8	116
Mercury	[0.10]	[0.19]	[0.06]	[0.08]
Potassium	[678]	[492]	[934]	[566]
Sodium	[233]	[253]	[125]	[109]
Zinc	150	180 J		

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit
(b) J - lab qualifier indicating estimated value.
[ ] - data validation qualifier indicating estimated value.

TABLE 3-5

SUBSURFACE SOIL CONCENTRATIONS(a)(b)
FORMER BASE LANDFILL

Sample Number Sample Depth Sample Date	01-SB01A-A 16'-18' 12/13/89	01-SB01B-A 26'-28' 12/13/89	01-SB02A-A 16'-18' 12/14/89	01-SB03A-A 8'-10' 12/13/89	01-SB03B-A 12'-14' 12/13/89	01-SB04A-A 4'-6' 12/12/89	01-SB04B-A 12'-14' 12/12/89	01-SB05A-A 10'-12' 12/21/89	01-SB05B-A 18'-22' 12/21/89	01-FD02-A Duplicate of 01-SB05B-A
Acid Extractables (µg/kg)										
Phenol										22 J
Pesticides (µg/kg)										
Heptachlor					21					13 J
Inorganics (mg/kg)										
Aluminum	9,080	1,960	849	5,780	3,530	9,590	3,060	6,370	948	1,840
Arsenic	3 9	[0 66]	[0 51]		[1 8]	5 0	[0 36]			1.9
Barium	97 9	[22 3]	[11 3]	74 4	136	106	[23 5]	35.1	6 8	7.4
Beryllium	[0 82]			[0 55]	[0 32]	[0 90]				
Calcium	38,000	20,000		1,240				831		358
Chromium	10 1 J							7.0		2.4
Cobalt	[4 9]					22 0		2.6		1.9
Copper	8 9	[1 7]		[2.6]	[2.1]	[5 6]		4 8	2.0	
Iron	16,000	2,920	1,430	3,800	4,010	130	3,400	6,360	1,600	3,400
Lead	8 2	2 5	1 8	3 6	2 8	15 8	3 4	4 2	2 0	2 4
Magnesium	3,460	[1,030]		1,150	1,250	1,470	[852]			

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit
(b) J - lab qualifier indicates estimated result
[ ] - data validation qualifier indicating estimated value

TABLE 3-5 (CONTINUED)
SUBSURFACE SOIL CONCENTRATIONS(a)(b)
FORMER BASE LANDFILL
PAGE TWO OF TWO

Sample Number Sample Depth Sample Date	01-SB01A-A 16'-18' 12/13/89	01-SB01B-A 26'-28' 12/13/89	01-SB02A-A 16'-18' 12/14/89	01-SB03A-A 8'-10' 12/13/89	01-SB03B-A 12'-14' 12/13/89	01-SB04A-A 4'-6' 12/12/89	01-SB04B-A 12'-14' 12/12/89	01-SB05A-A 10'-12' 12/21/89	01-SB05B-A 18'-22' 12/21/89	01-FD02-A Duplicate of 01-SB-5B-A
Manganese	474	108	57.3	12.4	452	540	57.4	38.6	16.3	41.7
Mercury	[0.14]	[0.15]	[0.19]	[0.18]	[0.19]	0.20	0.28	0.34	0.21	0.33
Nickel	12.3	[4.3]	[3.6]	[5.5]	[5.5]	16.2	[5.6]	11.1	2.9	
Potassium	1,400	[210]	[45.6]	320	[407]	[687]	[251]	874	156	
Vanadium	20.1	[3.8]	[3.5]	[3.9]	[7.5]	20.9	[5.3]	6.5	2.2	5.2
Zinc	29.0 J			12.1 J		15.6 J				

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit
(b) J - lab qualifier indicates estimated result
[ ] - data validation qualifier indicating estimated value

TABLE 3-6

GROUND-WATER CONCENTRATIONS(a)(b)
FORMER BASE LANDFILL

Sample Number Sample Date	01-MW01-A 1/25/90	01-MW02-A 1/25/90	01-MW03-A 1/23/90	01-MW04-A 1/23/90	01-MW05-A 1/25/90	01-FD06-A Duplicate of 01-MW05-A
Pesticides (µg/L)						
Alpha BHC	0.037 J					
Methoxychlor					0.022 J	
Inorganics (µg/L)						
Aluminum				2910		
Barium			517			
Beryllium				[1.3]		
Calcium	176,000	78,400	90,700	153,000	104,000	101,000
Chromium				[7.9]		
Iron				3,710		
Lead		10.6				
Manganese	255			498		
Nickel				[12.1]		
Vanadium				[10.8]		
Geochemical Parameters (mg/L)						
Petroleum Hydrocarbons					0.9 J	

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit
(b) J - lab qualifier indicating estimated value.
[ ] - data validation qualifier indicating estimate value.

TABLE 3-7

BLANK SAMPLE CONCENTRATIONS (a)(b)
FORMER BASE LANDFILL

	HPLC Water			Municipal Water		
Sample Number Sample Date Description	01-FB01-A 12/14/89 Field Blank	01-FB03-A 12/21/89 Field Blank	01-FB10-A 1/24/90 Field Blank	01-FB02-A 12/14/89 Field Blank	01-FB04-A 12/21/89 Field Blank	01-FB11-A 1/24/90 Field Blank Landfill Hydrant
Volatiles (µg/L)						
Acetone				85		
2-Butanone						110
2-Hexanone						
Benzene			8			
Chloroform						33
Methylene Chloride			14			21
Bromoform				30		21
Bromodichloromethane				15	16	41
Chlorodibromomethane				36	33	44
Carbon Disulfide						
Base Neutrals (µg/L)						
Bis(2-ethylhexyl)phthalate			1			
Pyrene		99				
Acid Extractables (µg/L)						
Pentachlorophenol		230				
Pesticides (µg/L)						
Delta BHC						
Gamma BHC						
Heptachlor						
Inorganics (µg/L)						
Aluminum						
Arsenic		0.18				
Barium						[93.4]
Beryllium		0.44			0.35	
Calcium	[93]		[711]	[85.9]		14,400
Chromium	[1.3]			[1.6]		
Cobalt			[6.9]			[9.8]
Iron			[29.0]			106
Lead				[0.14]	0.33	[1.7]
Magnesium	[75.7]					[4,230]
Manganese			-			16.5
Mercury			0.21			0.25
Potassium						[1,110]
Silver						
Sodium	[139]			[198]	96.3	100,000
Vandium		1.1				
Zinc	[2.3]			[2.0]	1.0	195

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit.
(b) [ ] data validation qualifier indicating estimated value.
NA - Not analyzed.

TABLE 3-7 (CONTINUED)
QA/QC SAMPLE CONCENTRATIONS (a)(b)
FORMER BASE LANDFILL
PAGE TWO OF TWO

Sample Number Sample Date Description	01-RB01-A 12/12/89 Rinsate Blank	01-RB03-A 12/14/89 Rinsate Blank	01-RB13-A 1/25/90 Rinsate Blank	01-TB01-A 12/13/89 Trip Blank	01-TB03-A 12/14/89 Trip Blank	01-TB04-A 12/21/89 Trip Blank	01-TB09-A 1/25/90 Trip Blank
Volatiles (µg/L)							
Acetone							
2-Butanone	76						
2-Hexanone	27						
Benzene			10				10
Chloroform				33	36	40	53
Methylene Chloride			13	19	19		22
Bromoform							
Bromodichloromethane							
Chlorodibromomethane							
Carbon Disulfide			67				
Base Neutrals (µg/L)							
Bis(2-ethylhexyl)phthalate				NA	NA	NA	NA
Pyrene				NA	NA	NA	NA
Acid Extractables (µg/L)							
Pentachlorophenol				NA	NA	NA	NA
Pesticides (µg/L)							
Delta BHC			0.072	NA	NA	NA	NA
Gamma BHC			0.14	NA	NA	NA	NA
Heptachlor			0.18	NA	NA	NA	NA
Inorganics (µg/L)							
Aluminum	[8.8]			NA	NA	NA	NA
Arsenic				NA	NA	NA	NA
Barium				NA	NA	NA	NA
Beryllium				NA	NA	NA	NA
Calcium	[198]	[83.9]	[1,770]	NA	NA	NA	NA
Chromium	[1.1]	[1.1]		NA	NA	NA	NA
Cobalt			[8.4]	NA	NA	NA	NA
Iron	[2.2]		[52.0]	NA	NA	NA	NA
Lead			[0.80]	NA	NA	NA	NA
Magnesium	74.0	[0.14]		NA	NA	NA	NA
Manganese				NA	NA	NA	NA
Mercury				NA	NA	NA	NA
Potassium				NA	NA	NA	NA
Silver			[6.9]	NA	NA	NA	NA
Sodium	[100]		[540]	NA	NA	NA	NA
Vandium	[1.8]			NA	NA	NA	NA
Zinc		[2.4]	898	NA	NA	NA	NA

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit.
(b) [ ] data validation qualifier indicating estimated value.
NA - Not analyzed.

TABLE 3-8

PIEZOMETER/MONITORING WELL DATA
POL STORAGE AREA

Station Location	North Coordinate	East Coordinate	Top of Casing Elevation(a)	Natural Ground/Concrete Elevation	Depth Below Top of Casing	Depth Below Grade	Screened Interval Below Grade	Filter Pack Below Grade	Bottom of Well Elevation
MW-07	658,931.22	3,217,921.70	23.16	23.23	27.96	28	15-25	12.5-28	-4.80
MW-08	658,757.71	3,218,072.43	23.31	23.55	27.35	28	15-25	13-28	-4.04
MW-09	658,895.21	3,218,182.34	25.27	25.65	32.53	33	20-30	17.5-33	-7.26
MW-10	659,073.15	3,218,081.15	27.59	25.82	34.84	33.5	20.5-30.5	18-33.5	-7.25
PZ-01	659,060.17	3,218,081.47	28.73	26.65	29.52	29	24-26.5	22-29	-2.87
PZ-02	658,753.85	3,218,241.40	26.78	24.85	26.25	28	22.5-25	19-28	-1.40
PZ-03	(b)	(b)	25.10	23.45	(c)	23.5	18.5-21	15.5-23.5	(c)

(a) All elevations are with respect to mean sea level.
(b) The horizontal location of PZ-03 was not surveyed.
(c) Total depth of PZ-03 was not measured.

TABLE 3-9

ESTIMATES OF IN-SITU HYDRAULIC CONDUCTIVITY AND TRANSMISSIVITY POL STORAGE AREA

Well	Thickness of Unit (feet)	Rising Head		Falling Head		Transmissivity[a]	
		cm/sec	ft/day	cm/sec	ft/day	ft^2/day	gallons/day/ft
MW-07	8.0	1.33×10^{-3}	3.79	1.38×10^{-3}	3.92	30.32	226.29
MW-08	13.0	1.46×10^{-3}	4.14	1.07×10^{-3}	3.02	53.82	402.57
MW-09	14.0	9.29×10^{-4}	2.63	8.85×10^{-4}	2.51	36.82	275.41
MW-10	13.5	9.45×10^{-4}	2.68	9.50×10^{-4}	2.69	36.18	270.63

(a) Transmissivities calculated using hydraulic conductivities from rising head tests.

TABLE 3-10

ESTIMATES OF DARCIAN SEEPAGE VELOCITY
POL STORAGE AREA

Hydraulic Gradient (ft/ft)	Effective Porosity[a]		Hydraulic Conductivity[b]		Darcian Seepage Velocity (ft/day)		Darcian Seepage Velocity (ft/year)	
	Low	High	Low	High	Low	High	Low	High
.015	0.05	0.25	2.63	-	0.158	0.789	57.60	287.99
.015	0.05	0.25	-	4.14	0.248	1.24	90.67	452.60

(a) Effective porosity estimates based on estimates of specific yield for similar soil types from Fetter, 1979, Applied Hydrogeology.

(b) Hydraulic conductivity estimates based on range of hydraulic conductivities for rising head tests presented in Table 3-9.

TABLE 3-11

SUBSURFACE SOIL CONCENTRATIONS(a)
POL STORAGE AREA

Sample Number Sample Depth Sample Date	02-SB10A-A 8'-10' 1/16/90	02-FD04-A Duplicate of 02-SB10A-A	02-SB13A-A 0'-2' 12/19/89	02-SB13B-A 4'-6' 12/19/89	02-SB13C-A 20'-22' 12/19/89	02-SB14A-A 0'-2' 12/19/89
Volatiles (µg/kg)						
Acetone			160			250 J
2-Butanone						41 J
4-Methyl-2-Pentanone					4 J	
Benzene			180 J			
Ethylbenzene	66 J		210 J	13,000 J	3 J	
Total Xylenes			240 J		12 J	
Styrene					5 J	
Chlorobenzene					1 J	
Methylene Chloride				6,100 J		
1,2 Dichloropropane					1 J	
Base/Neutrals (µg/kg)						
Naphthalene		110 J		200 J		
2-Methylnaphthalene	150 J	340 J		640		
Geochemical Parameters (mg/kg)						
Petroleum Hydrocarbons	99	99	132			

(a) No entry indicates parameter not detected abc ve Contract Required Quantitation Limit
(b) J lab qualifier indicating estimated value.

TABLE 3-12

GROUND-WATER CONCENTRATIONS[a]
POL STORAGE AREA

Sample Number Sample Date	02-MW10-A 1/22/90
Volatiles (µg/L)	
Ethylbenzene	6 J
Total Xylenes	23 J
Styrene	10 J
Chlorobenzene	6 J

(a) J qualifier indicates estimated result.

TABLE 3-13

BLANK SAMPLE CONCENTRATIONS (a)
POL STORAGE AREA

Sample Number Sample Date Description	02-FB05-A 1/13/90 Field Blank HPLC Water	02-FB06-A 1/13/90 Field Blank Municipal Water	02-FD08-A 1/16/90 Field Blank Municipal Water	02-FD09-A 1/24/90 Field Blank POL Spigot
Volatiles (µg/L)				
Acetone	24			
2-Butanone				
2-Hexanone				
Benzene	15			10
Toluene				16
Ethylbenzene				5
Total Xylenes				37
Chlorobenzene		18		
1,1-Dichloroethene				
Chloroform		20	24	36
Methylene Chloride	12			23
Bromoform		15	22	14
Bromodichloromethane			21	9
Chlorodibromomethane		32	34	15
Carbon Disulfide				
Vinyl Acetate		23		
Base Neutrals (µg/L)				
Bis (2-ethylhexyl) phthalate				1
Naphthalene				1
Geochemical Parameters				
Petroleum Hydrocarbons				

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit.
NA - Not analyzed.

TABLE 3-13
BLANK SAMPLE CONCENTRATIONS (a)
POL STORAGE AREA
PAGE TWO OF THREE

Sample Number Sample Date Description	02-RB05-A 12/19/89 Rinsate Blank	02-RB07-A 1/12/90 Rinsate Blank	02-RB11-A 1/22/90 Rinsate Blank	02-TB03-A 12/19/89 Trip Blank
Volatiles (µg/L)				
Acetone				
2-Butanone				
2-Hexanone		17		
Benzene			8	
Toluene				
Ethylbenzene				
Total Xylenes				
Chlorobenzene				
1,1-Dichloroethene				
Chloroform				20
Methylene Chloride			14	
Bromoform				
Bromodichloromethane				
Chlorodibromomethane				
Carbon Disulfide			85	
Vinyl Acetate				
Base Neutrals (µg/L)				
Bis (2-ethylhexyl)phthalate	8		2	NA
Naphthalene				NA
Geochemical Parameters				
Petroleum Hydrocarbons	23			NA

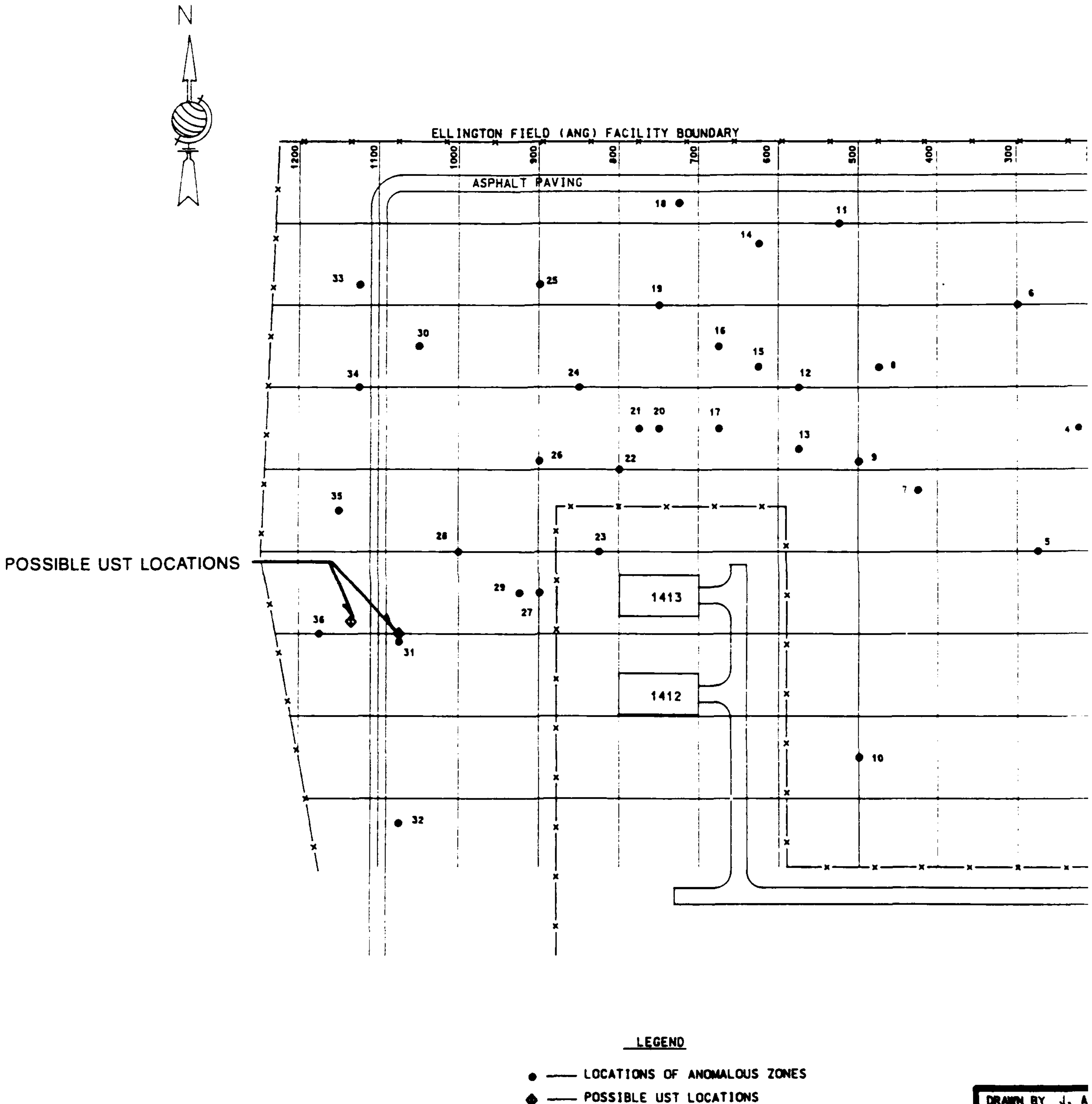
(a) No entry indicates parameter not detected above Contract Required Quantitation Limit.

NA - Not analyzed.

TABLE 3-13
BLANK SAMPLE CONCENTRATIONS (a)
POL STORAGE AREA
PAGE THREE OF THREE

Sample Number Sample Date Description	**02-TB05-A 1/12/90 Trip Blank**	**02-TB06-A 1/16/90 Trip Blank**	**02-TB07-A 1/22/90 Trip Blank**	**02-TB08-A 1/24/90 Trip Blank**
Volatiles (µg/L)				
Acetone			23	
2-Butanone			6	
2-Hexanone				19
Benzene			9	9
Toluene			8	
Ethylbenzene				5
Total Xylenes				
Chlorobenzene				
1,1-Dichloroethene			9	
Chloroform	40	51	30	31
Methylene Chloride			18	18
Bromoform				
Bromodichloromethane				
Chlorodibromomethane				
Carbon Disulfide				15
Vinyl Acetate				
Base Neutrals (µg/L)				
Bis (2-ethylhexyl)phthalate	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA
Geochemical Parameters				
Petroleum Hydrocarbons	NA	NA	NA	NA

(a) No entry indicates parameter not detected above Contract Required Quantitation Limit.
NA - Not analyzed.



DRAWN BY J. A
DATE: 5-31-90
HYDROGEOLOGIST
DATE: 5-31-90
CAD DWG. NO. 3

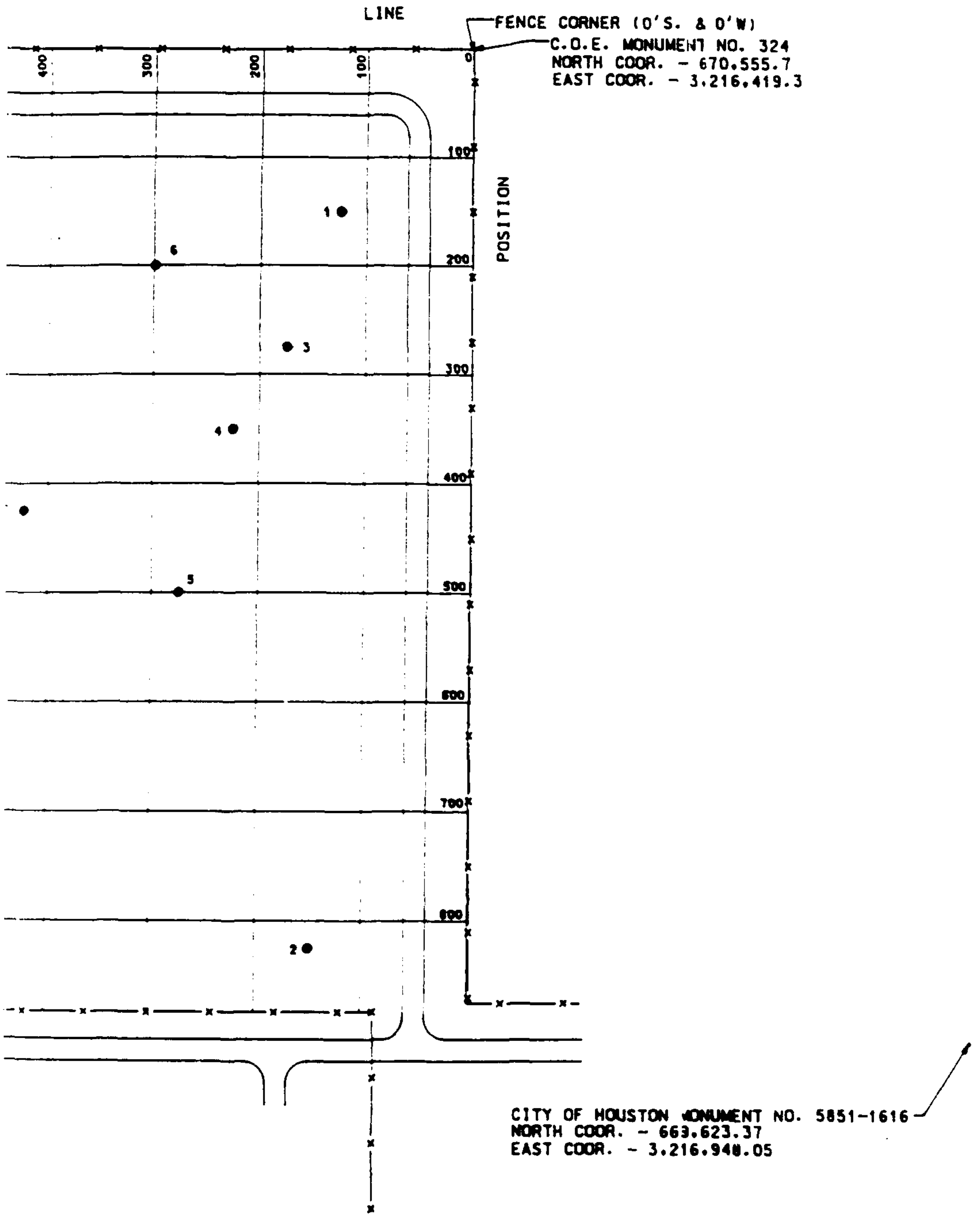
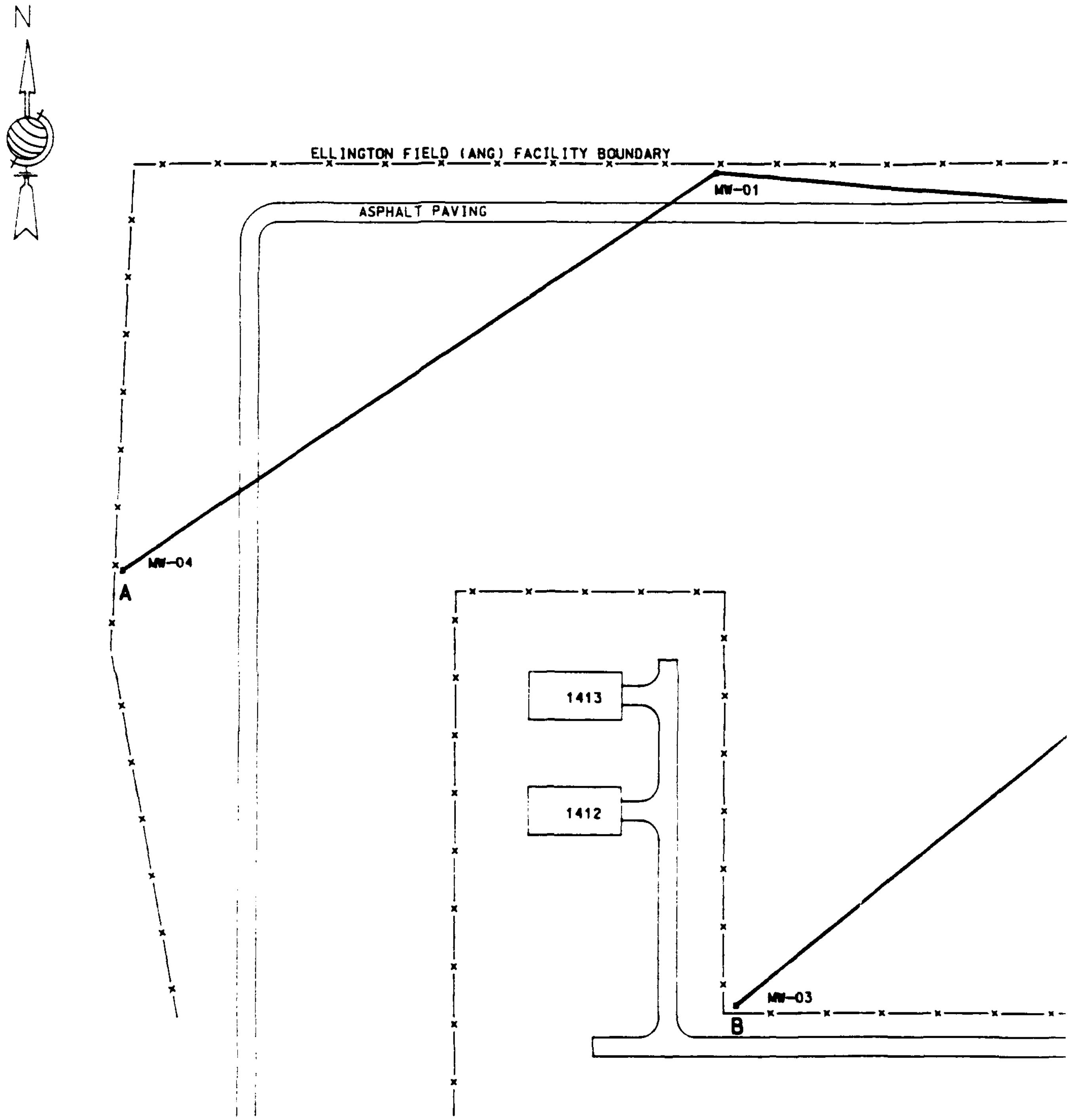
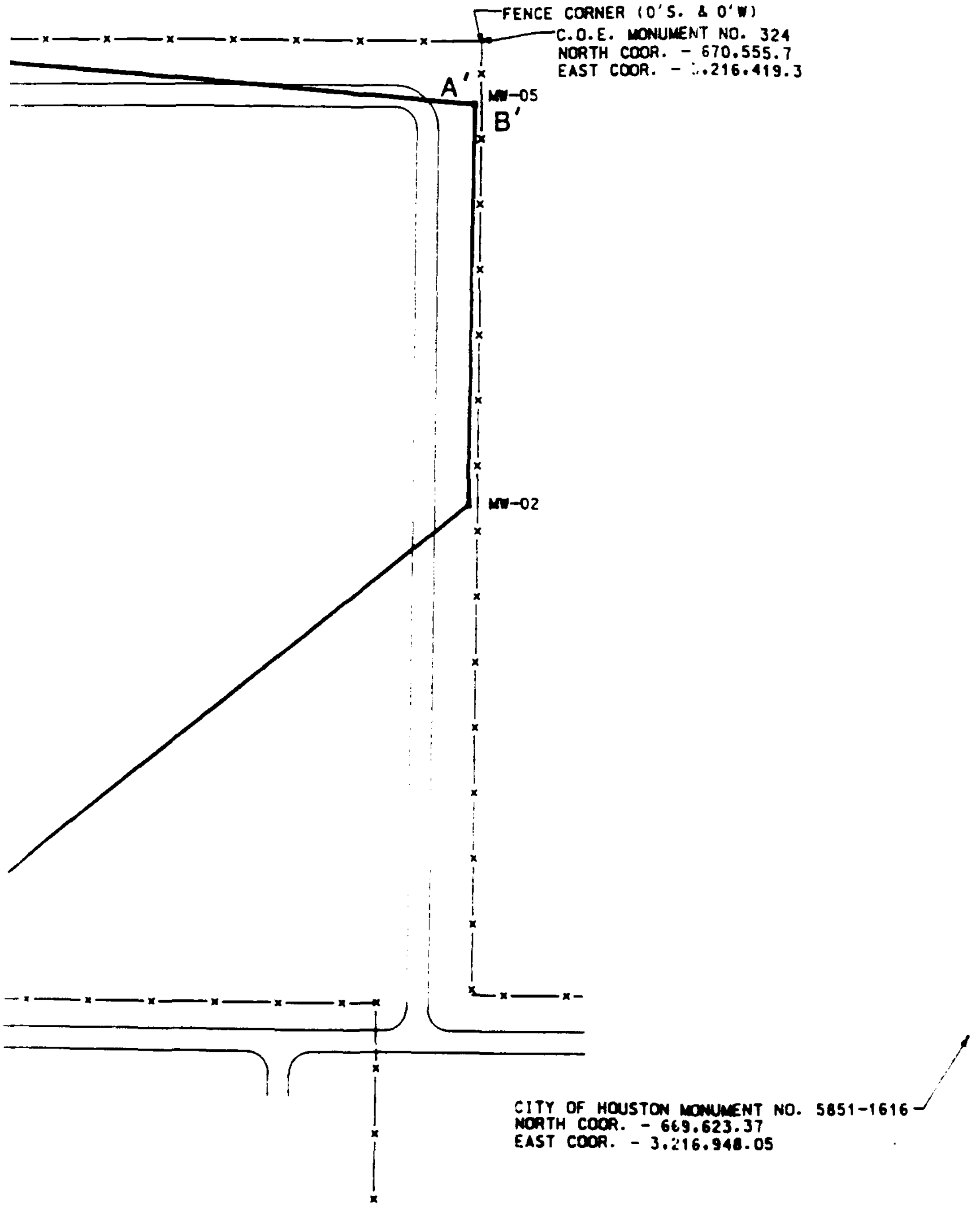


FIGURE 3-1

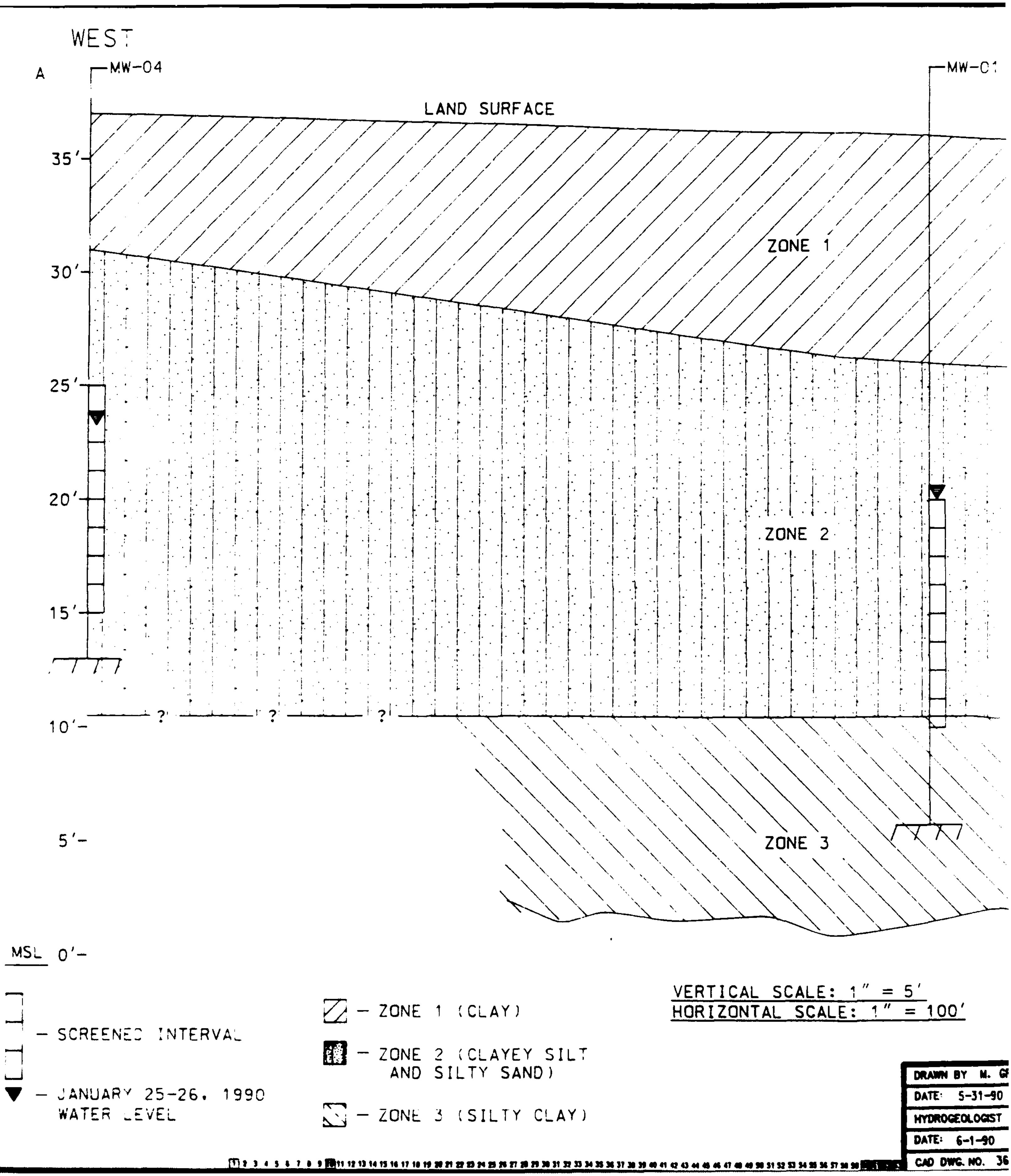
DRAWN BY J. ATKINSON	LOCATIONS OF ANOMALOUS ZONES AS DETECTED BY GEOPHYSICS FORMER BASE LANDFILL ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION
DATE: 5-31-90		
HYDROGEOLOGIST D. UPTHEGROVE		
DATE: 5-31-90		
CAD DWG. NO. 363M2B01.DGN	SCALE: 1" - 100' NUS DWG. NO. 363M-2B01 REV. 0	A Halliburton Company

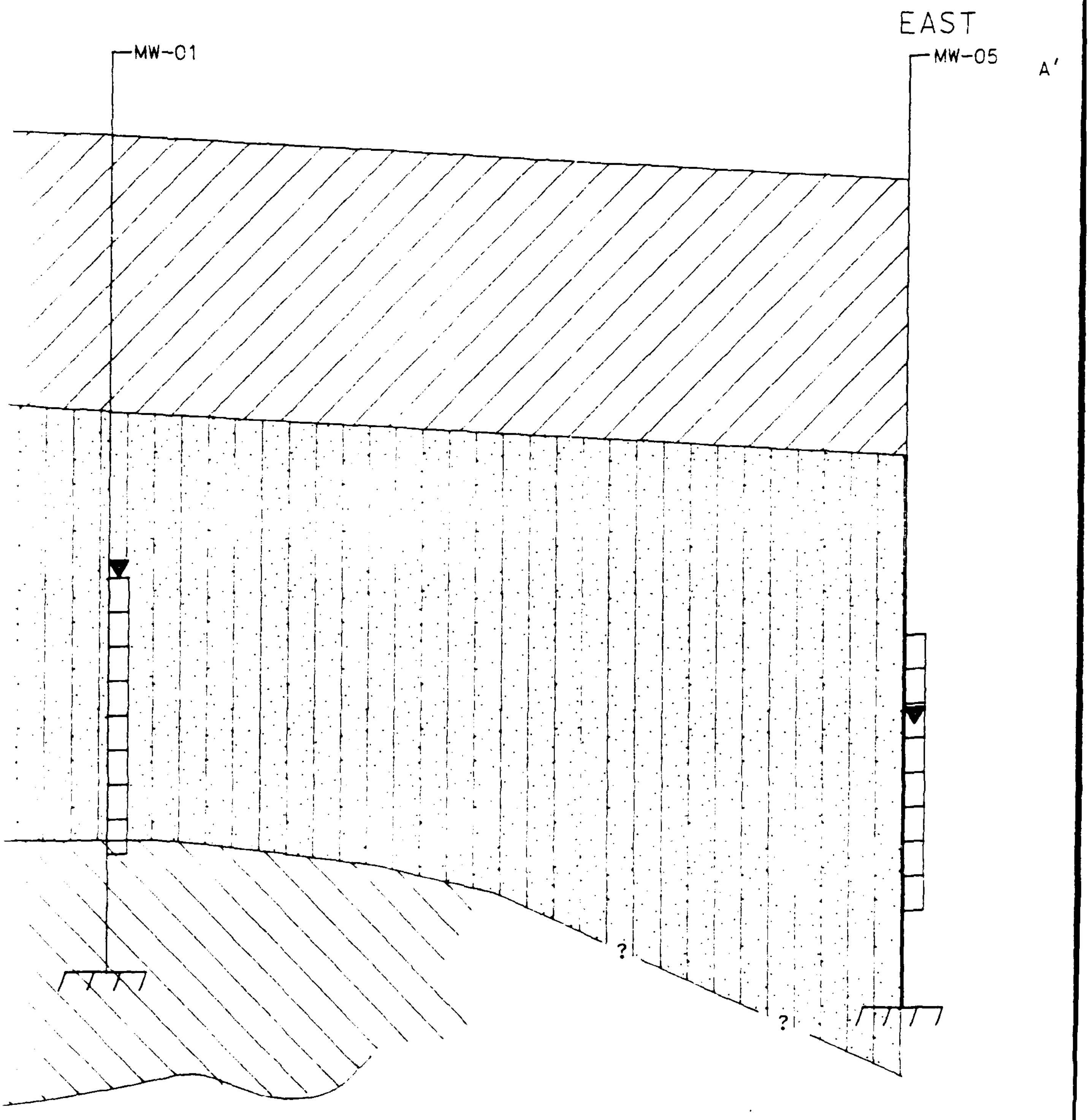


DRAWN BY J.
DATE: 5-31-9
HYDROGEOLOGIS
DATE: 5-31-9
CAD DWG. NO.



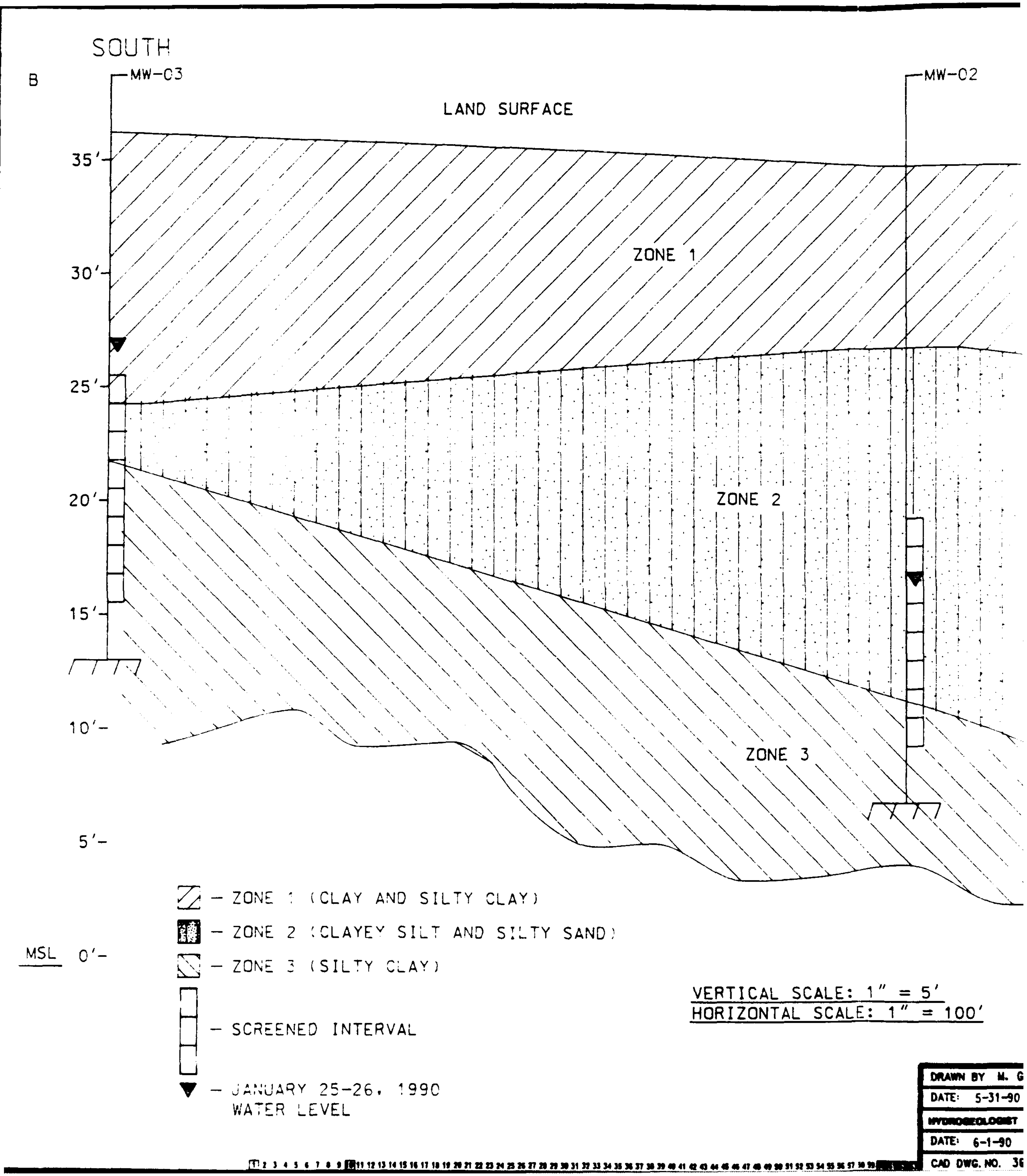
DRAWN BY J. ATKINSON	FIGURE 3-2 CROSS-SECTION LOCATION MAP FORMER BASE LANDFILL ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE: 5-31-90		
HYDROGEOLOGIST D. UPTHEGROVE		
DATE: 5-31-90		
CAD DWG. NO. 363M2B01.DGN	SCALE: 1" - 180' NUS DWG. NO. 363M-2B01 REV. 0	

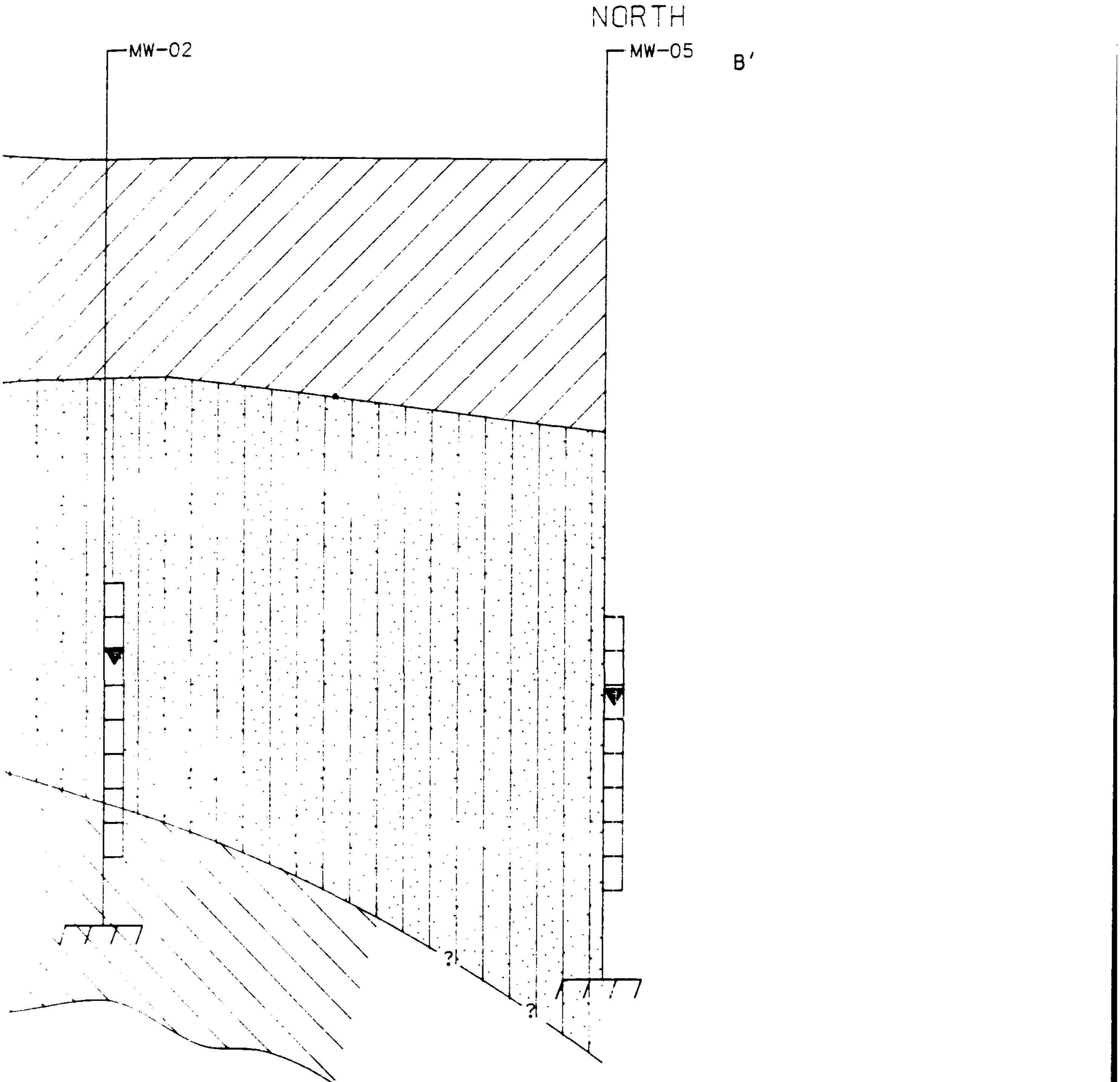

WEST
A
MW-04
MW-C1
LAND SURFACE
35'
30'
25'
20'
15'
10'
5'
MSL 0'
ZONE 1
ZONE 2
ZONE 3
? ? ?
- SCREENED INTERVAL
- JANUARY 25-26, 1990 WATER LEVEL
- ZONE 1 (CLAY)
- ZONE 2 (CLAYEY SILT AND SILTY SAND)
- ZONE 3 (SILTY CLAY)
VERTICAL SCALE: 1" = 5'
HORIZONTAL SCALE: 1" = 100'
DRAWN BY M. G
DATE: 5-31-90
HYDROGEOLOGIST
DATE: 6-1-90
CAD DWG. NO. 36



″ = 5′
: 1″ = 100′

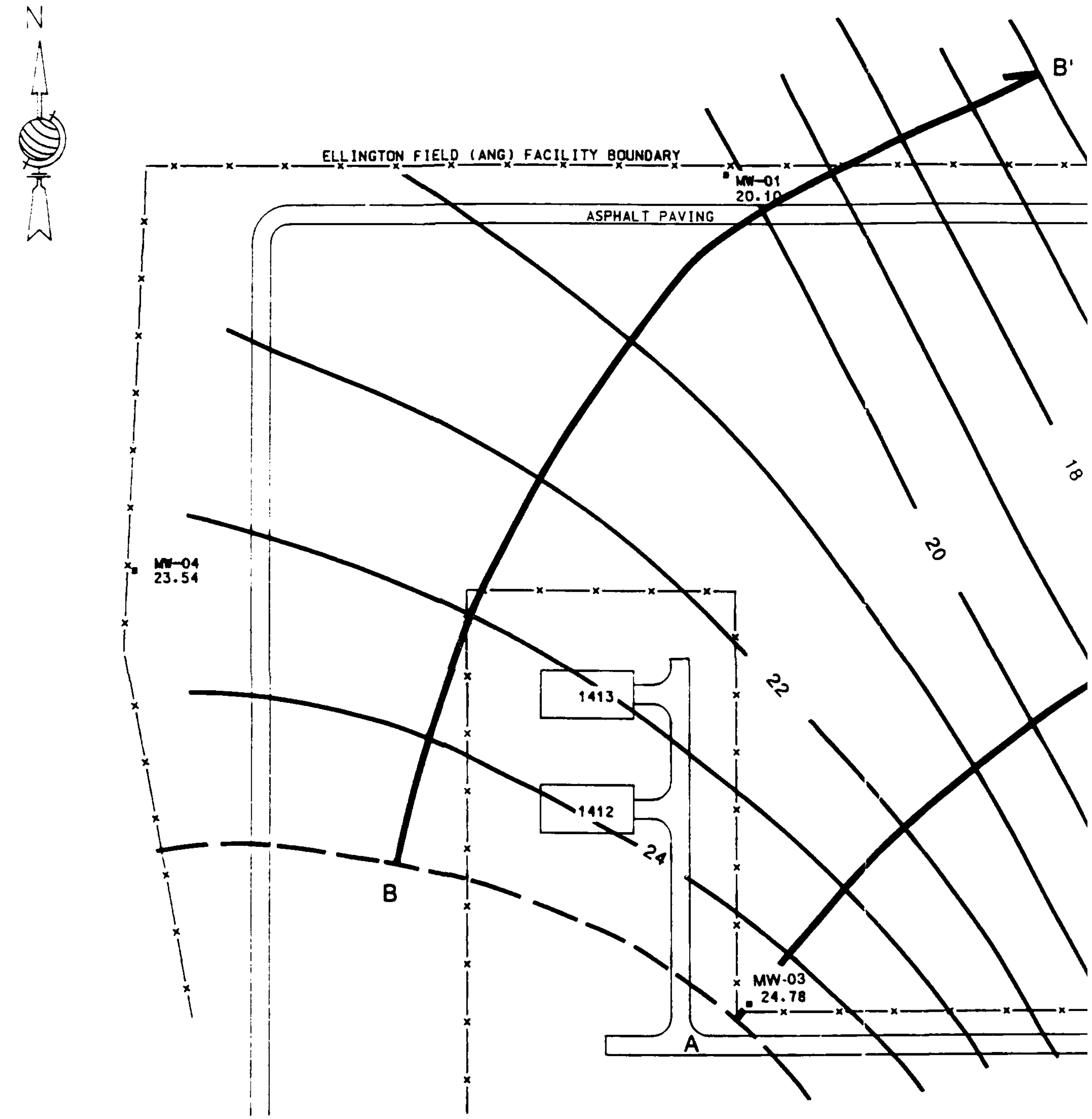
DRAWN BY M. GREEN	FIGURE 3-3 CROSS-SECTION A-A′ FORMER BASE LANDFILL ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE: 5-31-90		
HYDROGEOLOGIST D. UPTHEGROVE		
DATE: 6-1-90		
CAD DWG. NO. 363M1801.DGN	SCALE: AS NOTED | NUS DWG. NO. 363M-181 | REV. 0	


SOUTH
B
MW-03
MW-02
LAND SURFACE
ZONE 1
ZONE 2
ZONE 3
35'
30'
25'
20'
15'
10'
5'
MSL 0'
- ZONE 1 (CLAY AND SILTY CLAY)
- ZONE 2 (CLAYEY SILT AND SILTY SAND)
- ZONE 3 (SILTY CLAY)
- SCREENED INTERVAL
- JANUARY 25-26, 1990 WATER LEVEL
VERTICAL SCALE: 1" = 5'
HORIZONTAL SCALE: 1" = 100'
DRAWN BY M. G
DATE: 5-31-90
HYDROGEOLOGIST
DATE: 6-1-90
CAD DWG. NO. 36



LE: 1" = 5'
CALE: 1" = 100'

DRAWN BY M. GREEN	FIGURE 3-4 CROSS-SECTION B-B' FORMER BASE LANDFILL ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE: 5-31-90		
HYDROGEOLOGIST D. UPTHEGROVE		
DATE: 6-1-90		
CAD DWG. NO. 363M1802.DGN	SCALE: AS NOTED | NUS DWG. NO. 363M-1B2 | REV. 0	

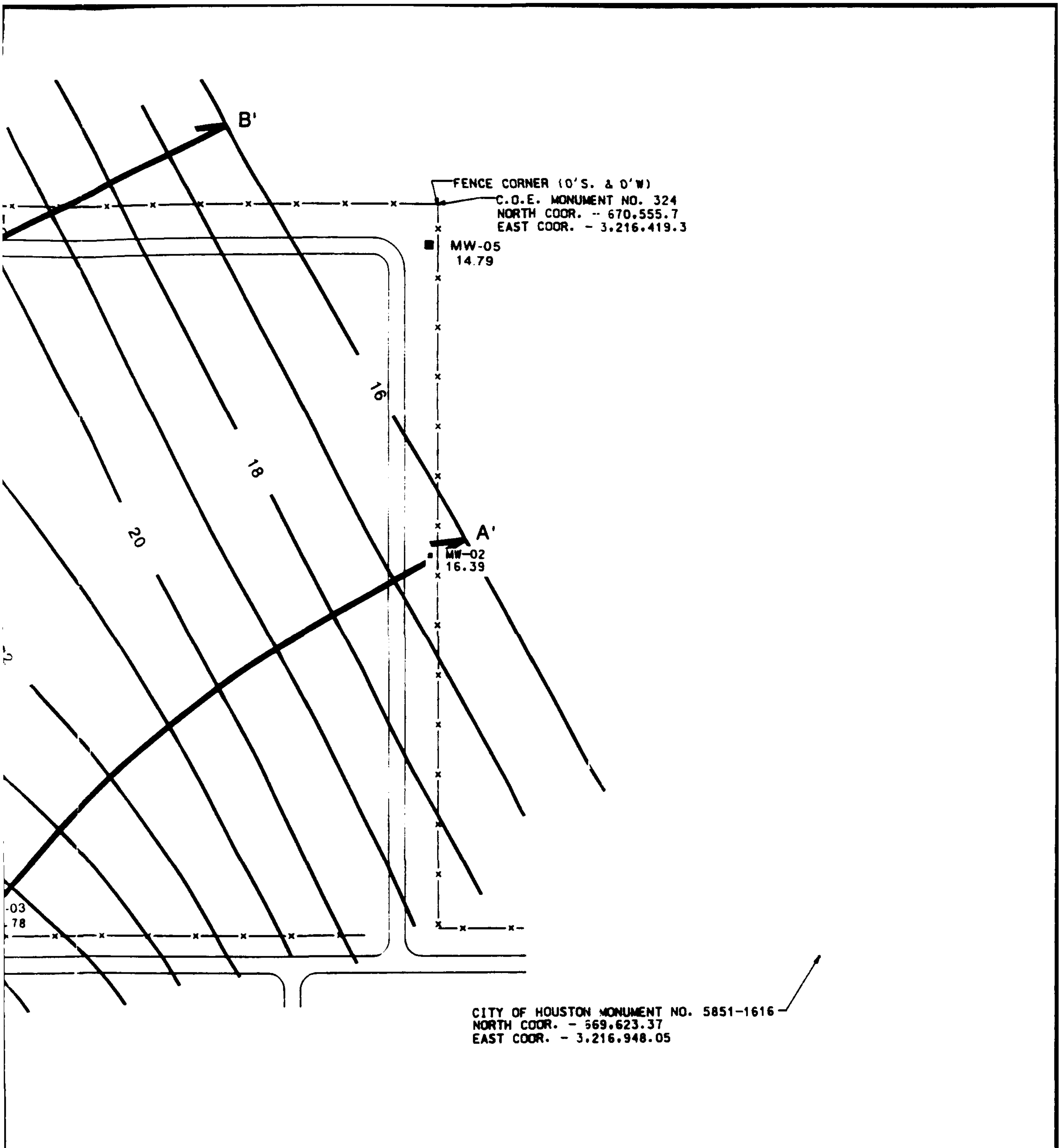


LEGEND

—— 8 —— GROUND-WATER ELEVATION CONTOUR (MSL)

A ⟶ A' HYDRAULIC GRADENT LINE

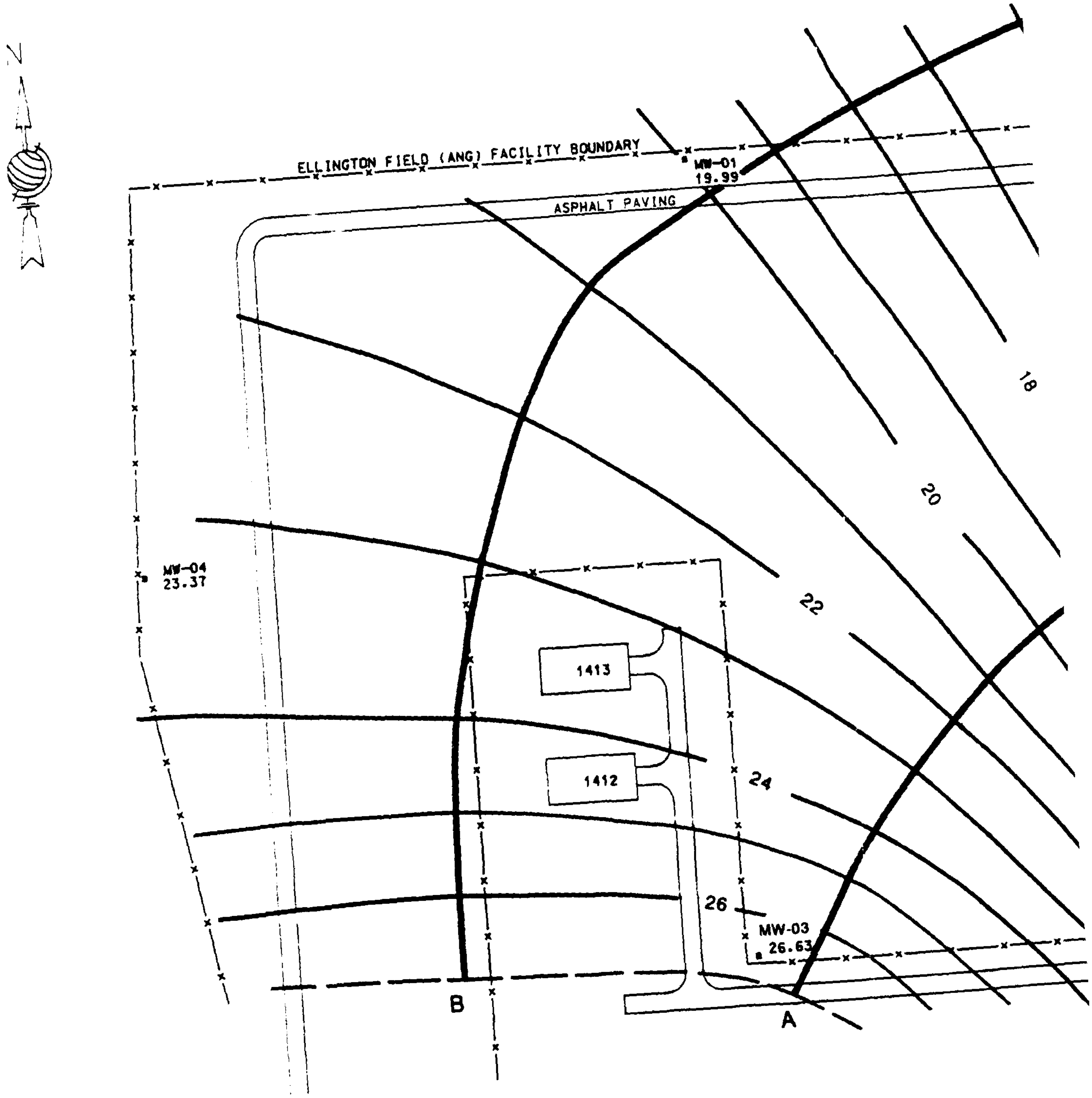
DRAWN BY	J. A
DATE:	5-31-90
HYDROGEOLOGIST	
DATE:	5-31-90
CAD DWG. NO.	36



DRAWN BY J. ATKINSON	
DATE: 5-31-90	
HYDROGEOLOGIST D. UPTHEGROVE	
DATE: 5-31-90	

FIGURE 3-5
GROUND-WATER ELEVATION CONTOUR MAP
DEC. 19-20, 1989 FORMER BASE LANDFILL
ELLINGTON FIELD (ANG) HOUSTON, TEXAS

NUS CORPORATION
A Halliburton Company

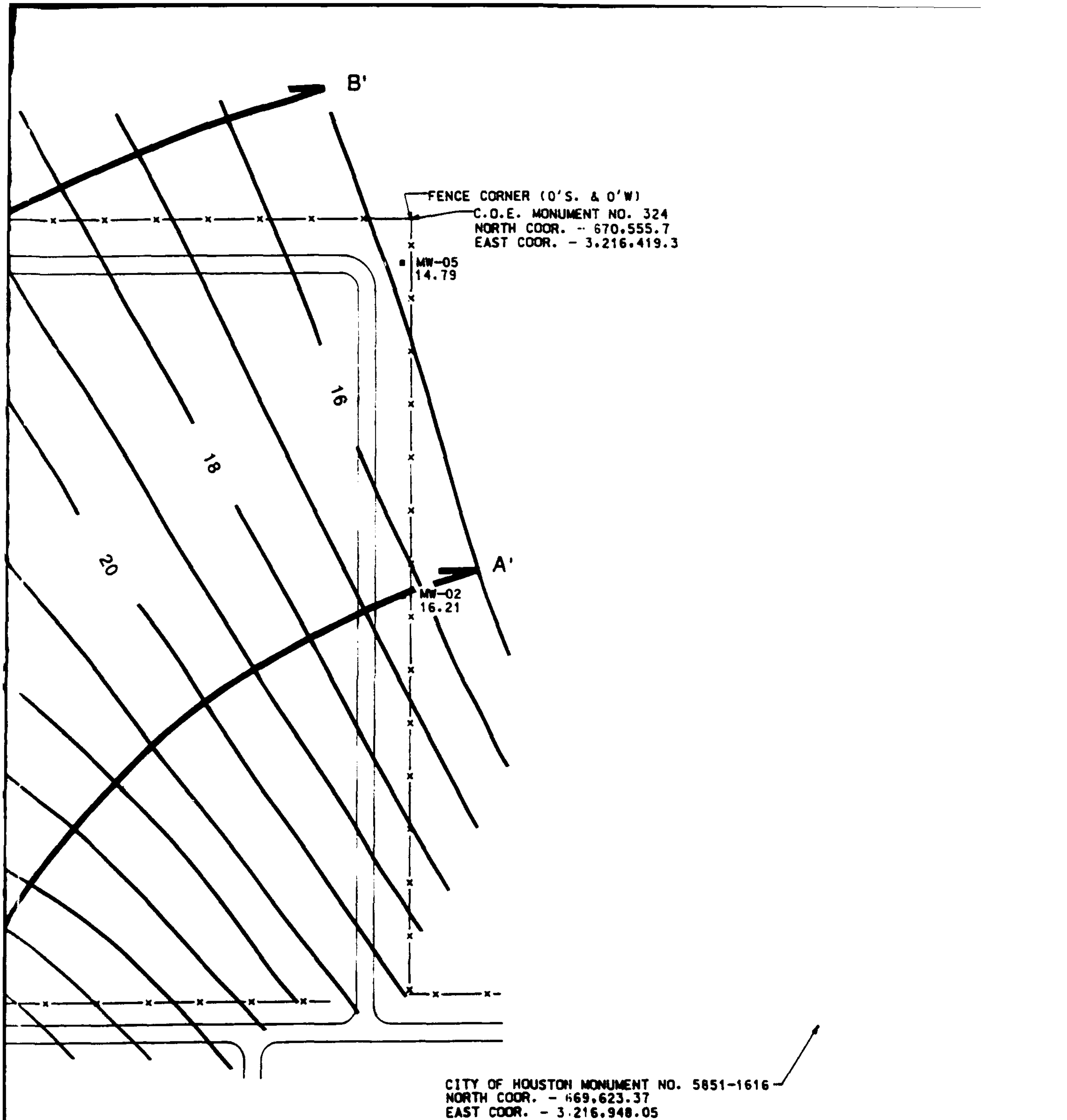


LEGEND

— 8 — GROUND-WATER ELEVATION CONTOUR (MSL)

A → A' HYDRAULIC GRADENT LINE

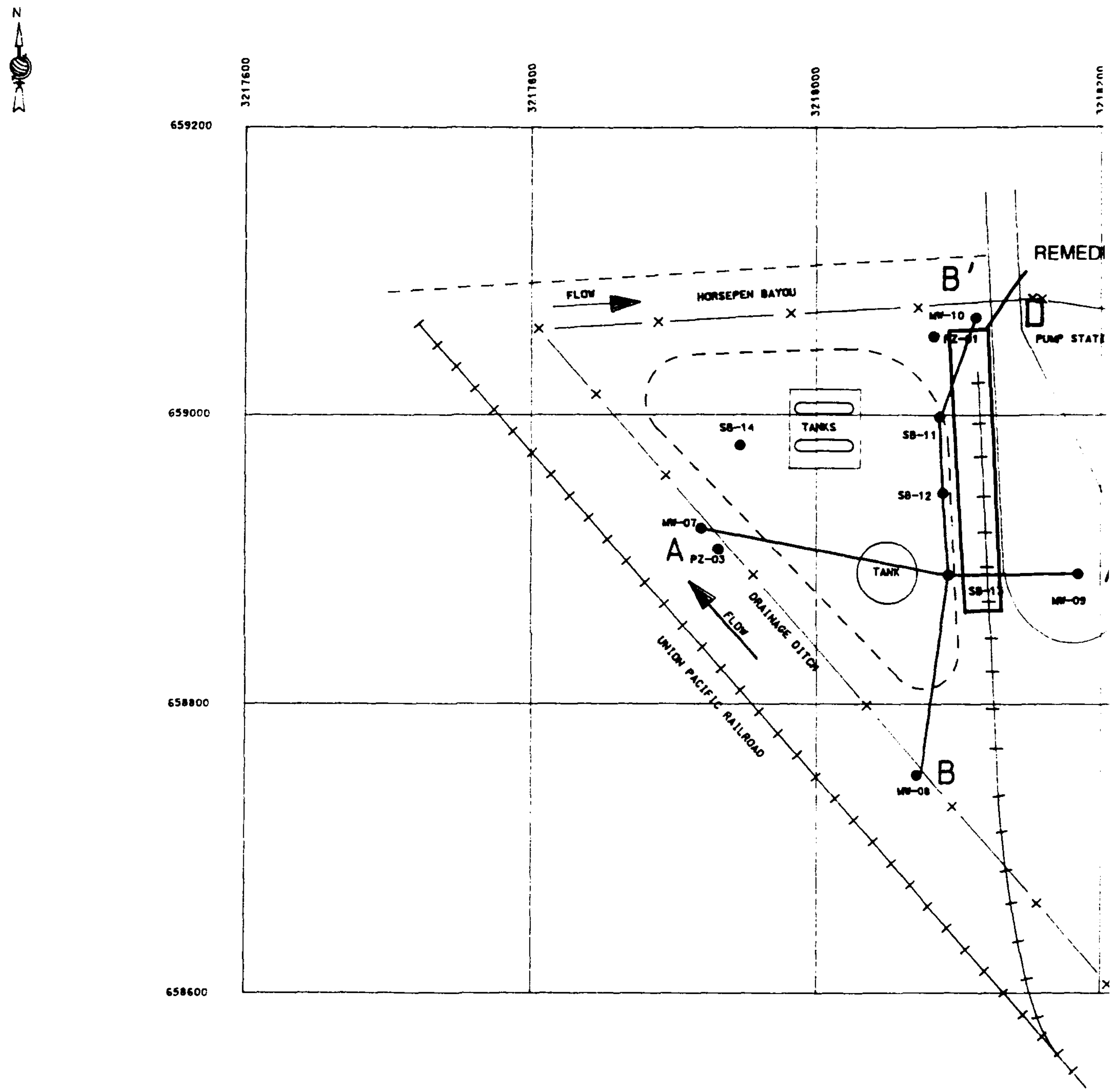
DRAWN BY	J. A
DATE:	5-31-90
HYDROGEOLOGIST	
DATE:	5-31-90
CAD DWG. NO.	36



DRAWN BY J. ATKINSON	
DATE: 5-31-90	
HYDROGEOLOGIST D. UPTHEGROVE	
DATE: 5-31-90	

FIGURE 3-6
GROUND-WATER ELEVATION CONTOUR MAP
JAN. 25-26, 1990 FORMER BASE LANDFILL
ELLINGTON FIELD (ANG) HOUSTON, TEXAS

NUS CORPORATION
A Halliburton Company



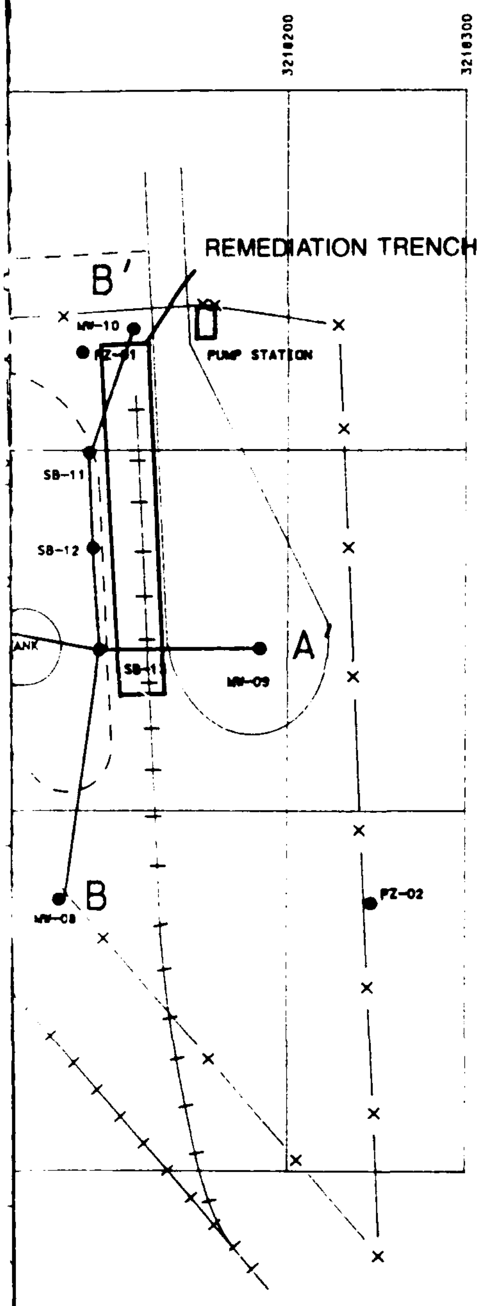
DRAWN BY

DATE:

HYDROGEOLO

DATE:

CAD DWG. NO



LEGEND

MW = MONITOR WELL

PZ = PIEZOMETER

SB = SOIL BORING

MAP SHOWING

LOCATIONS AND ELEVATIONS OF MONITORING WELLS, PIEZOMETERS, AND SOIL BORINGS AT THE POL STORAGE AREA ELLINGTON FIELD (ANG) HOUSTON, TEXAS

POINT NUMBER	TEXAS PLANE COORDINATE SOUTH CENTRAL ZONE NORTH COORD.	EAST COORD.	ELEVATIONS TOP OF CASINGS	TOP OF CONCRETE/NATURAL GROUND ELEVATION
MW-07	658,931.22	3,217,921.70	23.16	23.23 (NG)
MW-08	658,757.71	3,218,072.43	23.31	23.55 (NG)
MW-09	658,895.21	3,218,182.34	25.27	25.65 (CONC)
MW-10	659,073.15	3,218,110.76	27.59	25.82 (CONC)
PZ-01	659,060.17	3,218,081.47	28.73	26.65 (NG)
PZ-02	658,753.85	3,218,241.40	26.78	24.85 (NG)
PZ-03	(A)	(A)	25.10	23.45 (NG)
SB-11	659,004.16	3,218,085.49		23.71 (CONC)
SB-12	658,951.06	3,218,087.97		23.89 (CONC)
SB-13	658,894.38	3,218,091.83		24.00 (CONC)
SB-14	658,984.11	3,217,944.55		23.73 (CONC)

(A) NOT SURVEYED. APPROXIMATE LOCATION SHOWN.

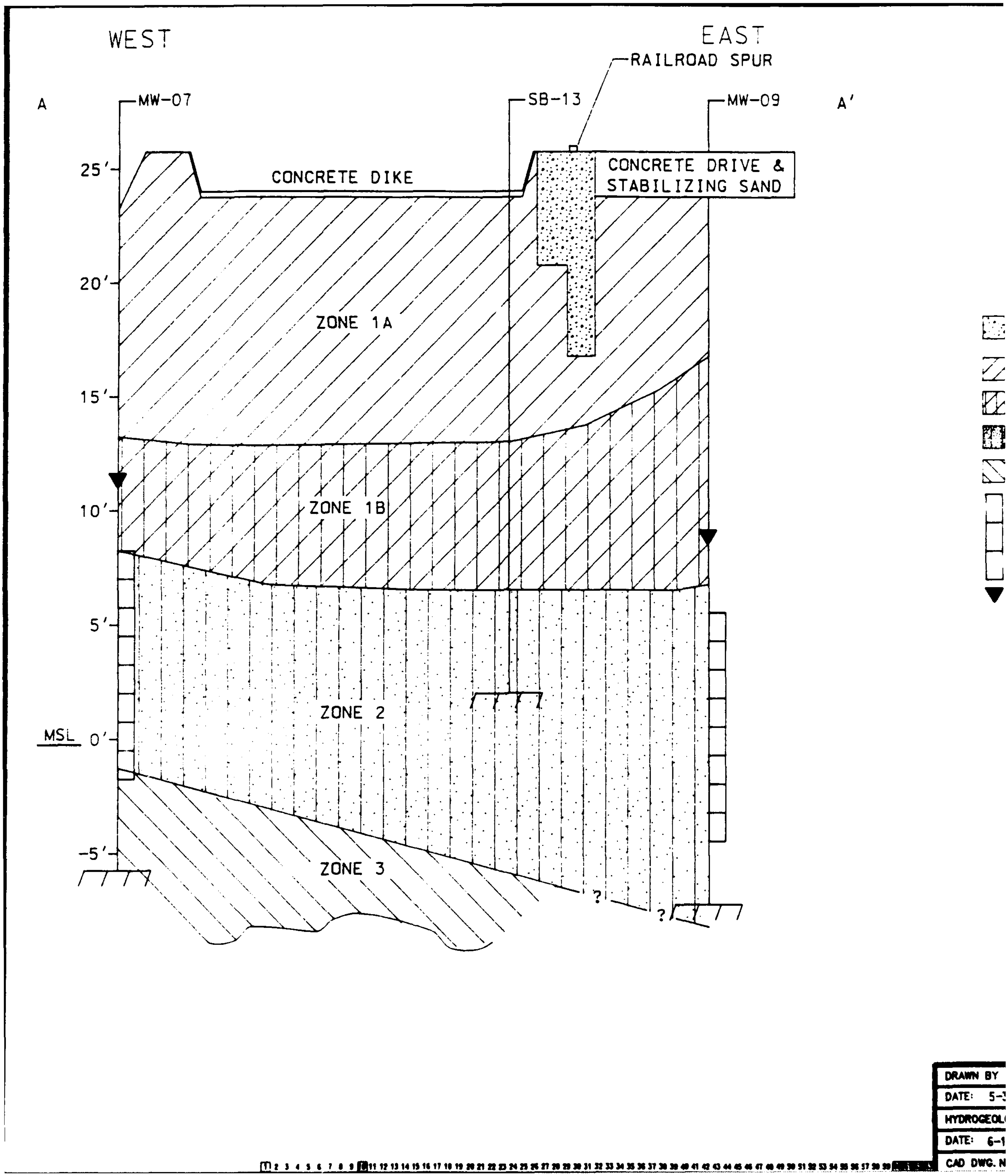
ELEVATIONS SHOWN HEREON ARE BASED ON N.G.S. MONUMENT M-1276 (1987 ADJ)

DRAWN BY	J. ATKINSON
DATE:	6-1-90
HYDROGEOLOGIST	D. UPTHEGROVE
DATE:	6-1-90
CAD DWG. NO.	363M2B02.DGN

FIGURE 3-7
CROSS-SECTION LOCATION MAP
POL STORAGE AREA
ELLINGTON FIELD (ANG) HOUSTON, TEXAS

SCALE: 1" = 100' | NUS DWG NO. 363M-2B02 | REV. 1

NUS CORPORATION
A Halliburton Company


WEST
EAST
RAILROAD SPUR
A
MW-07
SB-13
MW-09
A'
25'
20'
15'
10'
5'
MSL
0'
-5'
CONCRETE DIKE
CONCRETE DRIVE &
STABILIZING SAND
ZONE 1A
ZONE 1B
ZONE 2
ZONE 3
?
?
DRAWN BY
DATE: 5-
HYDROGEOL
DATE: 6-1
CAD DWG. N

A'

— RAILROAD BALLAST AND EXCAVATION BACKFILL

— ZONE 1A (CLAY)

— ZONE 1B (SILTY CLAY)

— ZONE 2 (CLAYEY SILT AND SILTY SAND)

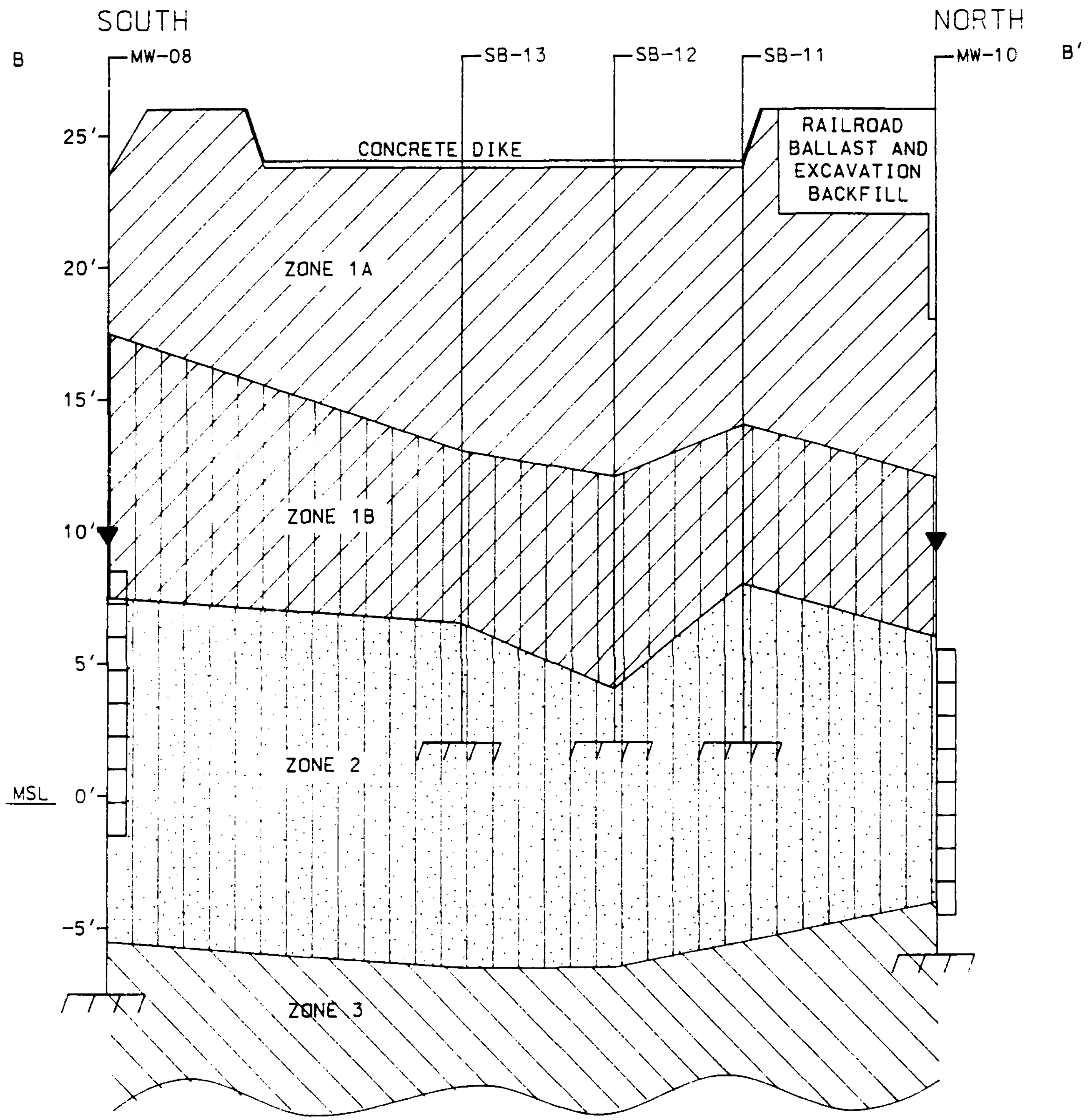
— ZONE 3 (SILTY CLAY)

— SCREENED INTERVAL

▼ — JANUARY 25-26, 1990
WATER LEVEL

VERTICAL SCALE: 1" = 5'
HORIZONTAL SCALE: 1" = 50'

DRAWN BY M. GREEN	FIGURE 3-8 CROSS-SECTION A-A' POL STORAGE AREA ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE: 5-31-90		
HYDROGEOLOGIST D. UPTHEGROVE		
DATE: 6-1-90		
CAD DWG. NO. 363M1803.DGN	SCALE: AS NOTED | NUS DWG. NO. 363M-183 | REV. 0	



DRAWN BY
DATE: 5-31
HYDROGEOLO
DATE: 6-1-
CAD DWG. NO.

ORTH

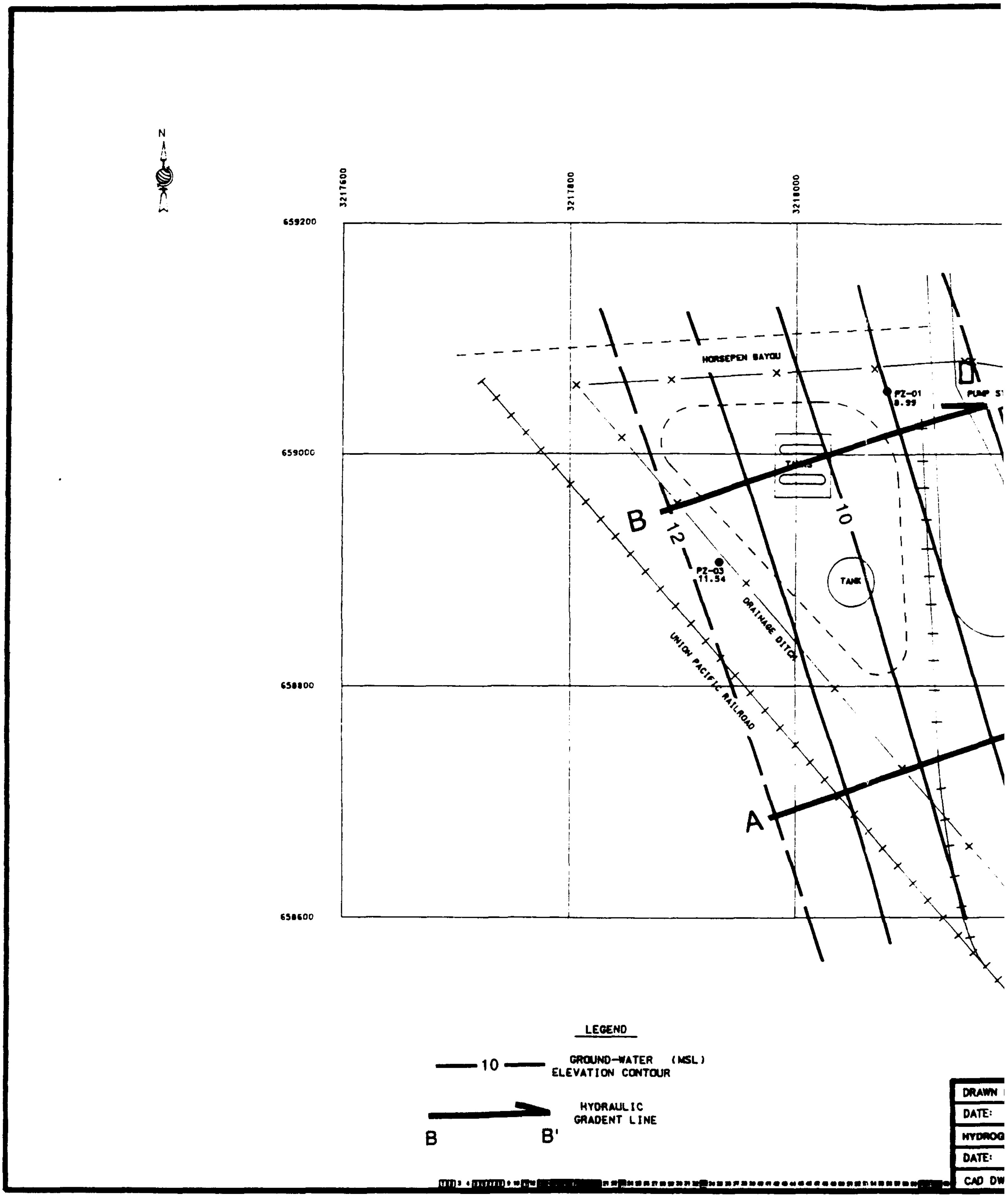
MW-1C B'

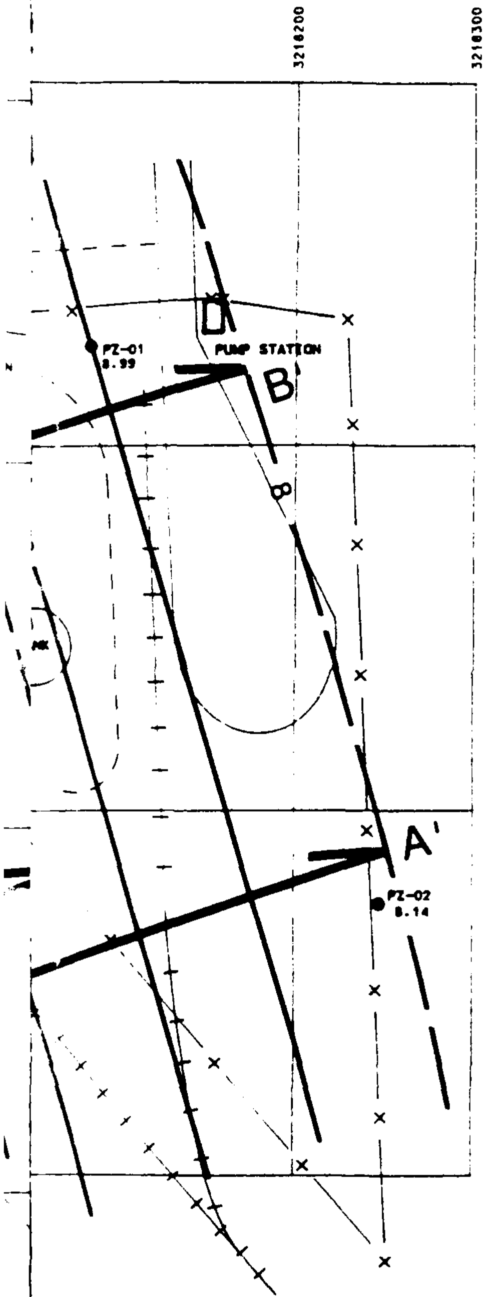
- ZONE 1A (CLAY)
- ZONE 1B (SILTY CLAY)
- ZONE 2 (CLAYEY SILT AND SILTY SAND)
- ZONE 3 (SILTY CLAY)
- SCREENED INTERVAL
- JANUARY 25-26, 1990 WATER LEVEL

VERTICAL SCALE: 1" = 5'

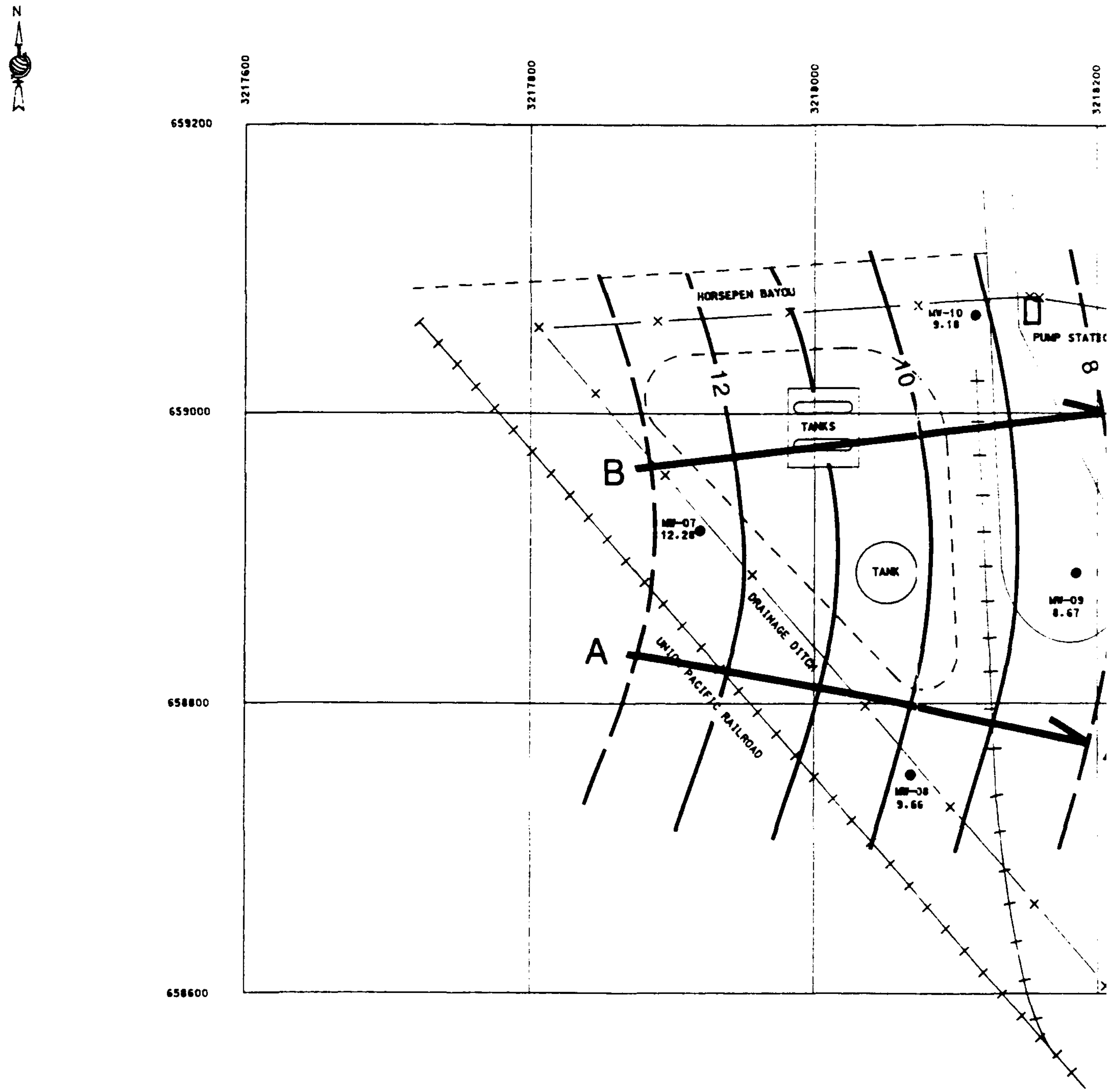
HORIZONTAL SCALE: 1" = 50'

DRAWN BY M. GREEN	FIGURE 3-9 CROSS-SECTION B-B' POL STORAGE AREA ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE: 5-31-90		
HYDROGEOLOGIST D. UPTHEGROVE		
DATE: 6-1-90		
CAD DWG. NO. 363M1804.DGN	SCALE: AS NOTED	NUS DWG. NO. 363M-184	REV. 0	


N
3217600
3217800
3218000
659200
659000
658800
658600
HORSEPEN BAYOU
PZ-01
8.99
PUMP ST
TANKS
TANK
PZ-03
11.54
DRAINAGE DITCH
UNION PACIFIC RAILROAD
B
A
12
10
LEGEND
10 GROUND-WATER (MSL)
ELEVATION CONTOUR
HYDRAULIC
GRADENT LINE
B
B'
DRAWN
DATE:
HYDROG
DATE:
CAD DW



DRAWN BY	J. ATKINSON	FIGURE 3-10 GROUND-WATER ELEVATION CONTOUR MAP JANUARY 12, 1990 POL STORAGE AREA ELLINGTON FIELD (ANG) HOUSTON, TEXAS		NUS CORPORATION A Halliburton Company
DATE:	6-1-90			
HYDROGEOLOGIST	D. UPTHEGROVE			
DATE:	6-1-90			
CAD DWG. NO.	363M2802.DGN	SCALE: 1" = 100'	NUS DWG. NO. 363M-2802	REV. 1

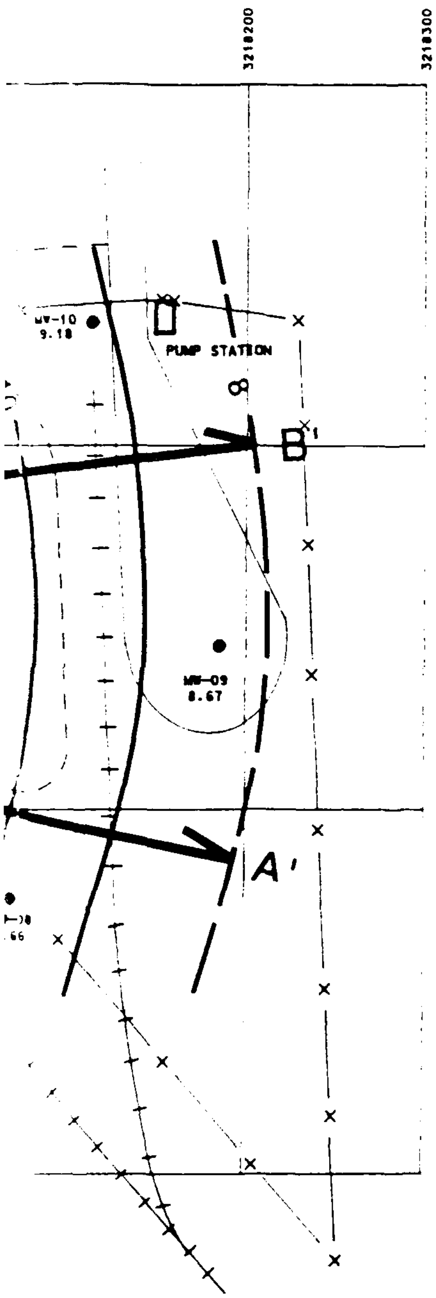


LEGEND

8 — GROUND-WATER (MSL) ELEVATION CONTOUR

A — A' HYDRAULIC GRADENT LINE

DRAWN BY
DATE:
HYDROGEOL
DATE:
CAD DWG. N



DRAWN BY	J. ATKINSON
DATE:	6-1-90
HYDROGEOLOGIST	D. UPTHEGROVE
DATE:	6-1-90

FIGURE 3-11
GROUND-WATER ELEVATION CONTOUR MAP
JANUARY 29, 1990 POL STORAGE AREA
ELLINGTON FIELD (ANG) HOUSTON, TEXAS

NUS CORPORATION
A Halliburton Company

4.0 PRELIMINARY RISK ASSESSMENT

A number of hypothetical exposure scenarios are evaluated in this section. In summary, the risk assessment shows that, even under these conservative scenarios, the sites at Ellington ANG present minimal risks to receptors. A summary of the methods used to determine the potential public health and environmental risks posed by contamination at Ellington Field (ANG) are presented in Sections 4.1 through 4.4. Section 4.1 summarizes data evaluation methods. Section 4.2 discusses contaminant mobility and presents a toxicity assessment including hazard identification, toxicological profiles for chemicals of concern, dose-response parameters and selected regulatory standards and guidelines. Section 4.3 identifies potential receptors that may be exposed to site-related contamination. Section 4.4 presents information on contaminant fate and transport and the methods used to characterize human exposures. The results of the preliminary public health risk assessment are provided in Section 4.5.

4.1 EVALUATION OF SITE INFORMATION

The preliminary risk assessment was completed based on the analytical results for samples collected during the NUS field investigation. At the Former Base Landfill, NUS collected three composite surface soil samples (and one duplicate) from the landfill surface, drilled five soil borings and collected a total of nine subsurface soil samples (and one duplicate). NUS also installed five monitoring wells at the landfill and collected one sample from each well and a single duplicate sample.

At the POL Storage Area, eight soil borings were drilled for the collection of environmental samples and 23 subsurface soil samples (and three duplicates) were collected. The grc und-water sampling investigation consisted of the installation of four monitoring wells and the collection of a single sample from each well.

All samples were analyzed in fixed-base laboratories and were validated in accordance with guidance provided by:

- Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses, EPA, February 1989.

- Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, EPA, February 1989.

The validation process involves such tasks as review chain-of-custody forms and proceeds through checks of initial and continuing instrument calibration to calculations of parameters such as percent matrix spike recover. Data which do not meet prescribed QA/QC requirements are qualified, or "flagged", by the following symbols:

- J. The associated numerical value is an estimated quantity.

- [ ] The analyte was detected at a concentration below the Contract Required Detection Limit (CRDL).

Examples of qualified data may be found throughout the data base (Appendix D).

Additional aspects of data evaluation are discussed in subsequent portions of the preliminary risk assessment. Analytes that were not detected in any environmental samples were treated as absent from site matrices. Averages presented are arithmetic averages calculated using one-half the method detection limit for analytes that were not detected in certain samples of a particular matrix.

Organic and inorganic soil concentrations are compared with reported background concentrations during the selection of chemicals of concern in Section 4.2.2 (Hazard Identification). Ground-water concentrations of naturally-occurring inorganic constituents are also compared with reported background levels in Section 4.2.2.

4.2 PROPERTIES OF CONTAMINANTS OF CONCERN

Information on various chemical and physical properties of site contaminants that affect contaminant mobility is presented in Section 4.2.1. Section 4.2.2 identifies contaminants of concern for the risk assessment. Section 4.2.3 includes a discussion of the toxicity of each of the contaminants of concern and identification of appropriate dose-response parameters.

4.2.1 Chemical and Physical Properties of Contaminants

This section provides a qualitative indication of the potential migration of the organic contaminants found at Ellington Field (ANG). The physical and chemical properties of the organic chemicals found in site soils and ground water are presented in Table 4-1. These parameters were used to assess the behavior of these compounds in the environment.

Empirically determined literature values of water solubility, the octanol/water partition coefficient, vapor pressure, the Henry's law constant, bioconcentration factor and specific gravity are provided in Table 4-1 (as available). Calculated values, which were determined using approximation methods, are presented where literature values could not be found. A discussion of the environmental significance of each of these parameters follows:

Water Solubility - The rate at which a chemical is leached from waste materials or soils by infiltrating precipitation is proportional to its water solubility. More soluble chemicals are expected to reach the water table much more readily and rapidly than less soluble chemicals. The water solubilities presented in Table 4-1 indicate that the volatile organic compounds detected in site media are generally several orders of magnitude more soluble than the base/neutral-extractable compounds (phthalate esters and polynuclear aromatic hydrocarbons) and pesticides. The nature and extent of contamination at the sites is consistent with the anticipated environmental behavior of the various classes of compounds. Volatile organic chemicals were detected in ground water at the POL Storage Area. Relatively water-insoluble compounds, such as phthalate esters, polynuclear aromatic hydrocarbons (PAHs), and pesticides, have not been detected at high concentrations in ground water and appear to be bound to the soil matrix.

Octanol-Water Partition Coefficient - The octanol-water partition coefficient (K_{ow}) is a measure of the equilibrium partitioning of a chemical between a two-phase octanol and water mixture. Polynuclear aromatic hydrocarbons (PAHs), phthalate esters, and pesticides have K_{ow} values several orders of magnitude greater than the various volatile organics detected in site media. The octanol-water partition coefficient is used to estimate bioconcentration factors in aquatic organisms. A linear relationship between the octanol-water partition coefficient and the uptake of chemicals by the lipid (fatty) tissue of animal and human receptors has been determined (Lyman et al., 1982). PAHs, phthalate esters and pesticides are more likely to accumulate in the tissues of receptors. The octanol-water partition coefficient is also useful for assessing the sorption of compounds by soils containing organic matter where experimental partitioning values are not available.

Soil/Sediment Adsorption Coefficient - The soil/sediment adsorption coefficient is related to the water solubility and the octanol-water partition coefficient. This parameter indicates the tendency of an organic chemical to bind to soil particles containing organic carbon. Chemicals with high soil/sediment adsorption coefficients generally have low water solubilities and vice versa. Chemicals such as PAHs, phthalate esters, and pesticides are relatively immobile in the subsurface environment and are preferentially bound to the soil phase. These compounds are not subject to ground-water transport to the same extent as compounds with high water solubilities and low adsorption coefficients. The analytical results for soil and ground-water samples obtained at the two sites are consistent with the anticipated partitioning of the various compounds detected. The soil-adsorptive PAHs, phthalate esters, and pesticides remain bound in the soil matrix whereas the soluble volatile organics are present in the ground water. The soil/sediment adsorption coefficient may also be used to infer the rates at which contaminants move in ground water using the retardation factor as follows (Javandel et al., 1984):

$$R = 1 + \frac{\rho}{n} K_d$$

Where:

R is the retardation factor (dimensionless)
ρ is the soil bulk density (kg/L)
n is the effective porosity of the soil (decimal fraction)
K_d is the distribution coefficient (µg/kg/µg/L)

$$K_d = f_{oc} \times K_{oc}$$

Where:

K_d is the distribution coefficient (µg/kg/µg/L)
f_{oc} is the soil organic carbon content (kg/kg)
K_{oc} is the soil/sediment adsorption coefficient (µg/kg organic carbon/µg/L)

The concept of the retardation factor is used in Section 4.4.1 to determine travel times for the primary potential ground-water contaminants at the site (i.e., monocyclic aromatics).

Vapor Pressure - Vapor pressure provides an indication of the rate at which a chemical evaporates from both soil and water. It is of primary significance where environmental interfaces such as surface soil/air or surface water/air are important. Vapor pressures for volatiles are generally many times higher than vapor pressures for pesticides and PAHs. As a result of the combined effects of vapor pressure and water solubility, concentrations of volatile organics in surface soils at the landfill were expected to be very low, and were therefore not analyzed.

Henry's Law Constant - The vapor pressure and the water solubility are of use in determining volatilization rates from surface water bodies. The ratio of these two parameters is used to calculate the equilibrium concentrations of a chemical in air versus water for the dilute solutions commonly encountered in environmental settings. The Henry's law constant is also useful for estimating volatile releases of ground-water contaminants as a result of potable use.

Bioconcentration Factor - The bioconcentration factor (BCF) represents the ratio of concentrations of water contaminants in aquatic species to the concentration in the water body in which they reside. The BCF is both contaminant- and species-specific. When site-specific values are not measured, literature values may be used, or the BCF may be derived from the octanol-water partition coefficient. Several of the classes of compounds detected at the sites are bioaccumulative in nature, particularly the PAHs, pesticides, and phthalate esters, as shown by the relative magnitude of the BCFs presented in Table 4-1.

Specific Gravity - Specific gravity is the ratio of the weight of a given volume of a pure chemical to the same volume of water at a specified temperature. It is of primary utility in determining whether a chemical will "float" or "sink" in surface water bodies or in ground water. Generally, organic chemicals must be present at concentrations approaching their water solubility for density effects to be important. Based on the minimal observed ground-water contaminant concentrations at the two sites, it is not anticipated that density stratification has had a significant effect on contaminant movement in the subsurface. For example, the most concentrated ground-water contaminant at the POL Storage Area (total xylenes) is present at a maximum concentration of 23 μg/L, which is only 0.01 percent of its water solubility (187,000 μg/L).

4.2.2 Hazard Identification

The primary purpose of Hazard Identification is to select organic and inorganic chemicals that will adequately represent the risks posed by site-specific contamination. Tables 4-2 and 4-3 present a complete listing of the chemicals of concern for soil and ground water at Ellington Field (ANG). Chemicals of concern have been identified based on their frequency of occurrence and distribution, concentrations, and toxicity, as well as through comparison with background concentrations (inorganic chemicals). For the purpose of hazard identification, estimated values are treated as real results and are therefore not flagged. All data qualifiers are presented on data tables in Section 3 and Appendix D. Sample concentration data presented throughout Section 4 does not contain the J and [ ] qualifiers as indicated in analytical data base provided in Appendix D. The risk assessment is based on a conservative approach where all estimated data (J and [ ] qualified) are assumed to be actual quantitative concentrations. Methods for selecting chemicals of concern are detailed in the following sections.

Chemicals of Concern - Ground Water

A summary of the maximum concentrations of organic and inorganic chemicals detected in ground-water samples collected in the vicinity of the two sites is provided in Table 4-4. No volatile organic chemicals were detected in ground water at the Former Base Landfill. However, two pesticides (alpha-BHC and methoxychlor) were present at very low concentrations in wells MW-01 and MW-05, respectively. Neither of these chemicals was detected in either the surface or subsurface soil samples collected at the landfill. They are relatively insoluble chemicals (similar to many of the PAHs, DDT, and heptachlor, which were detected in the site soils and not in the ground water). The source of the alpha-BHC and methoxychlor in the ground water cannot be tied to the landfill and therefore they were not selected as indicator chemicals.

Ground water at the POL Storage Area contained low concentrations of several monocyclic aromatics (e.g., ethylbenzene and styrene). These chemicals were also detected in several subsurface soil samples from the site and were therefore selected as indicator chemicals.

Table 4-5 presents a summary of inorganic chemical concentrations in site ground water versus naturally occurring levels identified in the literature and Primary/Secondary Drinking Water Standards. As shown by Table 4-5, only aluminum was detected at a concentration significantly above that reported as background. Aluminum is not considered a toxic chemical and is not currently regulated. Other inorganics such as calcium, barium, chromium and vanadium are present at concentrations slightly above the maximum reported background concentrations. However, these inorganics were either present at concentrations below the Drinking Water Standards (barium and chromium) or are not known to be either toxic (at the low concentrations detected) or carcinogenic. Iron, which is present at a maximum concentration of 3,710 µg/L, exceeds the Secondary Drinking Water Standard, but is within the range of naturally-occurring concentrations. The standard is based on aesthetic reasons (staining) rather than health reasons, and therefore, iron is not of concern at these sites. No inorganics were selected as chemicals of concern in ground water.

Chemicals of Concern - Soil

A summary of the maximum observed organic chemical concentrations in surface and subsurface soil at the two sites is provided in Table 4-6. As shown in Table 4-6 and as discussed in Sections 3.1.4 and 3.2.3 (Contaminant Occurrence and Distribution), soils contain relatively low levels of organic compounds such as monocyclic aromatics, chlorinated aliphatics, polynuclear aromatics and/or pesticides.

The various polynuclear aromatic hydrocarbons (PAHs) detected in the landfill surface soil samples were found at relatively low concentrations. The presence of low concentrations of these compounds is not considered a threat to human health. For comparative purposes, background total PAH concentrations in the vicinity of highways range from 6,000 µg/kg to 300,000 µg/kg (Santodonato, et al., 1982) and urban soils are reported to contain between 25,000 and 580,000 µg/kg total PAHs (ATSDR, October 1989). Site-specific surface soil results are well within this range of soil PAH concentrations. The Former Base Landfill is located in the vicinity of roads, railroads and airstrips, all of which are sources of contaminants derived from the burning of fossil fuels. However, since no other contamination has been identified, all potentially carcinogenic PAHs will be retained as indicator chemicals. The USEPA has officially revoked the Cancer Slope Factors for PAHs (benzo(a)pyrene); however, several articles have proposed the use of relative potency estimates (based on the slope factor for benzo(a)pyrene). In addition, naphthalene was retained as an indicator chemical because it is known to cause noncarcinogenic health effects.

Surface soils at the landfill also contained butylbenzylphthalate, dibenzofuran and DDT and its metabolites. No health-based standards or dose-response parameters are available for either dibenzofuran or the metabolites of DDT. Furthermore, these substances were detected at concentrations two to three orders of magnitude less than the PAHs. Therefore, these compounds were not selected as chemicals of concern in soil at the landfill. Compounds found only in single subsurface soil samples at the landfill (phenol and heptachlor) were not selected as chemicals of concern for the following reasons: (1) there is no route of direct human or environmental exposure to subsurface soil contaminants, and (2) they are either not highly soluble (heptachlor) or are not highly toxic (phenol).

At the POL Storage Area, several volatile organic chemicals were detected in subsurface soil samples. Several of these compounds have potential carcinogenic effects, whereas most of the remaining volatile organics may cause threshold (noncarcinogenic) effects in human receptors. One compound (1,2-dichloropropane) is a suspected human carcinogen, but it was detected in only one subsurface soil sample at a concentration of 1 µg/kg. This compound was not selected as a chemical of concern. Of the noncarcinogenic chemicals detected at the POL Storage Area, only 4-methyl-2-pentanone (MIBK) was not selected. It was detected at a maximum concentration of 4 µg/kg and was not found in any of the ground-water samples.

Table 4-7 presents a summary of metals concentrations in the landfill surface soils and also includes a summary of literature background values. Soil samples at the POL Storage Area were not analyzed for metals. Comparison of the maximum and average concentrations of metals in landfill surface soils to the reported background concentrations shows that arsenic, lead, mercury and zinc are present at concentrations above background. Therefore, they have been selected as chemicals of concern. Although lead has been classified as a possible human carcinogen, a Cancer Slope Factor has not been developed for this chemical as of this date. The Reference Dose for lead is currently undergoing review by the EPA, but will be used to characterize potential noncarcinogenic effects associated with lead exposures. Arsenic is a known human carcinogen via inhalation, and zinc and mercury are toxic via ingestion.

Tables 4-2 and 4-3 present a complete listing of the chemicals of concern for soil and ground water at Ellington Field (ANG). Toxicological profiles for each of the chemicals of concern are provided in Appendix F.

4.2.3 Dose-Response Evaluation

An important component of the risk assessment process is the relationship between the dose of a compound (amount to which an individual or population is exposed) and the potential for adverse health effects resulting from such exposure. Dose-response relationships provide a means by which potential public health impacts may be evaluated. Noncarcinogenic risks may be quantitatively assessed by comparing estimated doses with Reference Doses. Carcinogenic risks may be quantitatively assessed using the Cancer Slope Factor. These parameters, as well as uncertainty factors and weight-of-evidence for carcinogenicity, are discussed below.

Reference Dose (RfD) - The Reference Dose applies to prolonged human exposure to hazardous chemicals (i.e., chronic exposure) and is based solely on the noncarcinogenic effects of chemical substances. The RfD is usually expressed as an "acceptable" dose (mg) per unit body weight (kg) per unit time (day). It is generally derived by dividing a No- Observed-(Adverse)-Effect-Level (NOAEL or NOEL) or a

Lowest- Observed-Adverse-Effect-Level by an appropriate uncertainty factor. NOAELs, etc. are determined from laboratory or epidemiological toxicity studies. The uncertainty factor (10,100, or 1,000) is based on the availability of toxicity data: 10 is used if appropriate chronic human data are available; 100 is used if sufficient chronic animal data are available; and 1,000 is used if only subchronic animal data can be obtained. An additional uncertainty factor (ranging from 1 to 10) may also be included, depending on the severity of the observed effect, if a LOAEL is used to develop the Reference Dose. Dividing the effect level by an uncertainty factor results in an RfD that is protective of even the most sensitive members of an exposed human population.

RfDs are route-specific and have been developed for both ingestional and inhalational exposures. The United States Environmental Protection Agency (USEPA) has not developed RfDs for dermal exposure routes. Dermal RfDs may be derived from oral RfDs if the absorption efficiency for oral administration is known (USEPA, December 1989). Absorption efficiencies could not be determined for the chemicals of concern identified in the preceding section. It was assumed that 100 percent absorption occurred after ingestional administration, and oral RfDs were used to characterize noncarcinogenic risks associated with dermal contact.

Cancer Slope Factor (CSF) - The Cancer Slope Factor (formerly the Cancer Potency Factor) is developed by the USEPA's Cancer Assessment Group and is applicable for estimating the lifetime probability of human receptors developing cancer as a result of exposure to known or suspected carcinogens. The CSF is generally expressed in units of $(mg/kg/day)^{-1}$ and is derived through an assumed low-dosage linear relationship and an extrapolation from high to low dose-responses determined from animal studies. The CSF is the upper 95 percent confidence limit of the slope of the linearized dose-response curve. The USEPA weight-of-evidence classification describes the preponderance of evidence regarding carcinogenic effects in humans and animals. The categories are defined as follows:

EPA Category	Description of Group	Description of Evidence
Group A	Human carcinogen	Sufficient evidence from epidemiologic studies to support a casual association between exposure and cancer.
Group B1	Probable human carcinogen	Limited evidence of carcinogenicity in humans from epidemiologic studies.
Group B2	Probable human carcinogen	Sufficient evidence of carcinogenicity in animals; inadequate evidence of carcinogenicity in humans.
Group C	Possible human carcinogen	Limited evidence of carcinogenicity in animals.
Group D	Not classified	Inadequate evidence of carcinogenicity in animals.
Group E	No evidence of carcinogenicity in humans	No evidence of carcinogenicity in at least two adequate animal tests or in both epidemiologic and animal studies.

Values of the noncarcinogenic and carcinogenic dose-response parameters for site chemicals of concern are provided in Table 4-8. In addition, appropriate regulatory standards and guidelines such as Maximum Contaminant Levels, Maximum Contaminant Level Goals, Ambient Water Quality Criteria and USEPA Drinking Water Health Advisories are also presented. The dose-response parameters were used to generate quantitative risk estimates. Site-specific ground-water concentrations were also contrasted with appropriate standards and guidelines to provide an indication of the quality of site ground water.

Appendix F contains brief toxicological profiles for each chemical of concern. The profiles present a summary of available published information on both human health and environmental effects.

4.3 IDENTIFICATION OF RECEPTORS

Based on a review of existing site conditions, current land and water use and site-specific chemical contamination, potential routes by which human receptors may be exposed to contaminants at the sites have been identified. Exposures may occur directly at the site or as a result of contaminant migration to offsite receptor locations. Potential receptors include local residents as well as military and civilian base personnel.

4.3.1 Land Use

Discussions with Ellington Field (ANG) personnel indicate that the facility will continue in use as a government facility and will not be developed for any residential or commercial purposes. Furthermore, Ellington Field (ANG) personnel indicate that the two sites investigated at the facility (i.e., the Former Base Landfill and the POL Storage Area) will not be developed as either domicile areas (i.e., barracks, officer housing, etc.) or for other uses that will result in increased contact or disturbance of the subsurface.

Based on reported water use in the vicinity of the base, it has been assumed that shallow ground water may be used a potable water source. Although production wells are reported to exist at the base, these wells are believed to be installed in an aquifer that is not threatened by the minimal contamination observed at either site.

4.3.2 Potential Receptors

Potential receptors at Ellington Field (ANG) include both military and civilian base personnel as well as offbase residents. Base personnel could be exposed to residual contamination in soils during activities such as landscape maintenance (lawnmowing at the landfill) or as a result of routine maintenance at the POL (e.g., pump repair, filling/decanting operations). Offbase personnel may be exposed as a result of contaminant migration (fugitive dust emissions or advective transport of dissolved species in ground water). However, the results of the risk assessment indicate that no significant noncarcinogenic or carcinogenic risk are likely to occur during activities such as landscape maintenance, based on the available data.

Potential receptors consisting of base personnel include only adults. Offbase receptors include adults, adolescents, and children.

4.3.3 Exposure Routes

The following exposure routes will be considered for onbase and offbase receptors:

- Incidental ingestion of surface soils (base personnel)
- Dermal contact (absorption) with surface soil (base personnel)
- Ground water use (offbase receptors)
- Inhalation of fugitive dust (offbase receptors)

Ground water use exposure routes include ingestion, inhalation of volatiles during showering and dermal contact during showering or bathing. Inhalation of fugitive dust by offbase receptors includes intake as a result of both respiratory and gastrointestinal tract deposition of respirable particulates.

Several additional exposure routes were not considered as significant mechanisms for human exposure. Such routes included inhalation of volatile emissions from the site surface soils and exposures associated with erosional transport of surficial contaminants.

Sampling and analysis activities at the landfill did not reveal the presence of volatile organics in the shallow subsurface soils. Shallow subsurface soil samples (0 to 2 feet deep) in the drainage swale at the POL Storage Area did not contain volatile organics. The maximum concentration of volatiles (19,100 µg/kg) was found at a sample depth of 4 to 6 feet in one boring, (SB-13), which is an area covered with concrete, as is most of the site. Therefore, emission of volatiles is not considered a significant contaminant release mechanism for either site.

Erosion of surface soils and transport to offsite locations via surface water runoff is not considered a significant contaminant release mechanism. The landfill is currently vegetated, and the POL Storage Area is covered by concrete. The presence of cover impedes erosional releases. Furthermore, topographic relief is not particularly pronounced, and infiltration and evapotranspiration are probably the primary mechanisms for loss of precipitation in unpaved portions of the landfill. At the POL Storage Area, samples were collected in a drainage swale that leaves the site (samples 01-SB07A-A and 01-SB08A-A). These samples contained no volatile organics, a fact that indicates that contamination may have left the site in the past as releases of materials stored in the tanks. However, because the tanks had secondary containment and because there is little relief, releases of fuel products have probably not migrated far from the site. Continued offsite migration of these contaminated subsurface soils is unlikely. Therefore, erosion is not considered a significant contaminant release mechanism, and exposures associated with such releases will not be considered.

4.4 POTENTIAL MIGRATION PATHWAYS

Various aspects of contaminant fate and transport and exposure assessment at Ellington Field (ANG) are discussed in this section. Potential contaminant migration routes are identified and discussed in Section 4.4.1. Section 4.4.2 presents a brief discussion of contaminant persistence. The methods used to estimate human exposures to the identified contaminants are presented in Section 4.4.3.

4.4.1 Potential Migration Routes

This section identifies the primary contaminant migration pathway(s) for the two sites investigated. Contaminant release/migration mechanisms were identified through a review of the site-specific analytical data base, various site features and hydrogeologic conditions.

Neither site exhibits a significant amount of contamination. At both sites, subsurface soils exhibit some contamination with volatile organics, base/neutral- or acid-extractables and/or pesticides. The primary release mechanism acting at these sites is the slow downward migration of contaminants through the soil column. Neither site exhibited a major ground-water contamination problem, which is to be expected considering the relatively low concentrations of organic chemicals in the soils.

The potential impact of soil contamination may be estimated using the USEPA's Organic Leachate Model (OLM) (USEPA, November 13, 1986):

$$C_{leachate} = 2.21 \times 10^{-3} \times C_{soil}^{0.678} \times S^{0.373}$$

Where:

$C_{leachate}$	is the estimated leachate concentration (mg/L)
C_{soil}	is the soil concentration (mg/kg)
S	is the water solubility (mg/L)

This equation is used to calculate the leachate concentrations in the unsaturated zone. This leachate will eventually enter the saturated zone and be diluted. Dilution is calculated as follows, using a model proposed by Donigian et al. (November 1983):

$$Cgw = \frac{C_l \times q \times L}{Vd \times m}$$

Where:

Cgw	is the contaminant concentration in the saturated zone (mg/L)
C_l	is the contaminant concentration in leachate, as calculated by the OLM (mg/L)
q	is the estimated recharge rate (cm/yr)
L	is the length of the source area perpendicular to ground-water flow direction (m)
Vd	is the Darcy ground-water velocity (cm/yr)
m	is the effective aquifer thickness in the mixing zone (m)

The most concentrated contaminant found in any soil sample was at the POL Storage Area where ethylbenzene was detected at 13 mg/kg. With a solubility of 152 mg/L, $C_{leachate}$ is determined to be 8.1×10^{-2} mg/L. Assuming a recharge rate of 12 cm/yr, a length of 150 m, a Darcy velocity of 3,600 cm/yr and a thickness of 3.5 m, the ground-water concentration is estimated to be 1.2×10^{-2} mg/L. Considering that the maximum concentration of ethylbenzene detected in the ground water is 6 µg/L and using this process (which assumes that the entire site contains ethylbenzene at 13 mg/kg) results in a concentration of 12 µg/L, it is unlikely that the site soils are a significant source of future ground-water contamination.

An additional aspect of contaminant migration is related to the concept of the retardation factor defined in Section 4.2.1. This factor can be used to estimate contaminant velocities. Based on the following assumptions

- foc = 0.01 kg/kg
- ρ = 2.7 kg/L
- n = 0.35

Taking into account contaminant retardation, contaminant velocities range from 0.28 ft/day (acetone and methylene chloride) to 1.6×10^{-6} ft/day (4,4'-DDT). Assuming the nearest receptor well is one mile downgradient of either site, the most mobile contaminants (acetone and methylene chloride) could reach the receptor well in 52 years.

Another potential contaminant release mechanism at the landfill is the atmospheric transport of contaminated particulates as fugitive dust. Although most of the site is currently covered with grass, fugitive dust emissions are considered possible. Surficial soil samples at the site contain low concentrations of various semivolatile organics, pesticides, and various inorganic constituents. These compounds may be released from the site via fugitive dust emissions. Based on the available data, the results of the risk assessment indicated no significant noncarcinogenic or carcinogenic risks appear to exist in light of these release mechanisms.

Overland transport of contaminated soils is not considered a significant migration pathway at either site. The presence of vegetation and various cover materials, as well as the relatively flat topography, will impede erosion of surficial materials.

Volatilization of organic chemicals from either site is also considered a relatively insignificant release mechanism. Surface soil samples at the landfill were not analyzed for volatile organics and would not be expected to contain any because of high ambient temperature and the unconsolidated nature of the surficial material. In addition, only low concentrations of volatile organics were detected in the subsurface soils. The surface soil at the landfill contains a number of semivolatile compounds probably as a result of vehicular traffic at the landfill. The pesticides found in low concentrations at this site are also unlikely to volatilize (see

Section 4.2.1). Shallow subsurface soils at the POL Storage Area contained only low concentrations of volatile organics.

4.4.2 Contaminant Persistence

The persistence of various classes of site contaminants is discussed in this section. The following general classes of compounds are discussed:

- Ketones
- Monocyclic aromatic volatiles
- Chlorinated aliphatic volatiles
- Phthalate esters
- Polynuclear aromatic hydrocarbons (PAHs)
- Pesticides

Ketones are volatile and if they are released to the ground, they will both evaporate and leach into the subsurface unsaturated and saturated soil. Acetone is susceptible to aerobic biodegradation. Ketones are generally very soluble and lipophobic, and, therefore, adsorption to soil or sediment (in aquatic systems) or bioconcentration are not significant fate processes (Howard, 1990).

Monocyclic aromatic compounds, such as benzene and ethylbenzene, are not considered persistent environmental contaminants in comparison to PAHs, pesticides and metals. Such compounds are subject to degradation via the action of both soil and aquatic microorganisms. The biodegradation of these compounds in the soil matrix is dependent on the abundance of microflora, macronutrient availability, soil reaction (pH), temperature, etc. Increasing chlorination of aromatic compounds makes them more resistant to biodegradation. Hence, chlorobenzene is not expected to degrade as readily as nonhalogenated compounds. For example, a reported first-order biodegradation rate constant for benzene in aquatic systems is 0.11 day^{-1}, whereas the corresponding rate constant for chlorobenzene is 0.0045 day^{-1} (Lyman et al., 1982). Half-lives for these compounds are, therefore, 6 days and 150 days, respectively.

Based on the current extent of contamination at the two sites, it is not expected that significant degradation of the various aromatic compounds will occur.

Contamination is primarily confined to the subsurface soils where limited macronutrient availability and anaerobic conditions are expected to impede such processes. Other potential environmental degradation mechanisms, such as hydrolysis and photolysis, are considered insignificant for monocyclic aromatic compounds (USEPA, December 1982). The aromatic volatiles at the sites are primarily confined to the subsurface soils. Hence, photolytic degradation cannot occur.

Chlorinated aliphatic hydrocarbons, such as methylene chloride, are subject to reductive dehalogenation via the action of anaerobic bacteria. Photolytic degradation is not considered a significant fate process for these types of compounds (USEPA, December 1982). Methylene chloride is contained in the subsurface matrix, which prevents photolytic degradation from occurring. Hydrolysis may occur for saturated aliphatics (i.e., alkanes), but does not appear to be a significant degradation mechanism for unsaturated species (i.e., alkenes [USEPA, December 1982]).

Phthalate esters are considered relatively persistent environmental contaminants. Although numerous studies have demonstrated that such compounds undergo biodegradation, it appears that this is a very slow process in soils. While biodegradation of phthalate esters is an important fate mechanism over the long-term, rapid degradation of such compounds is not expected under existing site conditions. Hydrolysis is not expected to be a significant degradation mechanism for phthalate esters. For example, a reported alkaline hydrolysis half-life for bis(2-ethylhexyl)phthalate in aquatic systems is 2,000 years (USEPA, December 1979). Similarly, photolysis is considered an insignificant degradation mechanism (USEPA, December 1979).

Polynuclear aromatic hydrocarbons (PAHs) are constituents of oil and grease. Landfarming applications have indicated that PAHs are amenable to microbial degradation and studies have demonstrated that PAHs are more readily degraded in soil matrices than aquatic systems (USEPA, December 1979). It is considered possible that degradation of PAHs in site soils has occurred to some extent. PAHs do not contain functional groups susceptible to hydrolytic actions, and therefore, hydrolysis is considered an insignificant degradation mechanism. Photolysis may be a major degradation path in aquatic systems but is probably insignificant in surface soils at the landfill.

When pesticides and herbicides are used, a large proportion reaches the soil or sediment where they are strongly adsorbed. Bioconcentration of pesticides in the food chain is a potential fate mechanism although this is generally most important in aquatic environments. Hydrolysis, volatilization, oxidation, and photolysis are not generally important fate mechanisms for pesticides in either soil or water (EPA, December 1979).

In conclusion, it is not expected that environmental transformation or degradation of the primary contaminants at Ellington Field (ANG) will occur to any great extent.

4.4.3 Exposure Assessment Methods and Assumptions

The methods and models used to assess human intakes via each of the potential exposure routes are summarized in this section. For the most part, United States Environmental Protection Agency (USEPA) risk assessment guidance outlined in Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A) was employed to assess exposures (USEPA, December 1989).

Ground-Water Exposure Concentrations

Exposure estimates associated with potable use of ground water were generated using the analytical results from the field investigation. Maximum observed ground-water concentrations were used for one scenario, and a second exposure scenario examines the potential effects of leachate generated from subsurface soils at each site. Each scenario assumes there is no attenuation or degradation of contaminants prior to reaching an offsite well, or conversely, that wells are installed at the site boundaries.

Exposure estimates developed using field-generated data should be considered worst-case estimates, since drinking water wells do not exist in the shallow aquifer in the immediate vicinity of the base. Risk assessment results based on these data provide an overall indication of the quality of ground water in the vicinity of the site, but do not reflect realistic risks under current site conditions.

Because a potable water supply well may draw water from discrete locations within the aquifer in the vicinity of the site, maximum concentrations of the various chemicals detected were employed for each of the preceding scenarios. Table 4-4 summarizes the ground-water concentrations used under the ground-water exposure scenarios.

The leaching scenario examined for each site is based on the maximum contaminant concentrations in the subsurface soils. Again, this provides a conservative estimate of risk posed under the hypothetical ground water use scenario.

Soil Exposure Concentrations

Exposure estimates for dermal contact and accidental ingestion of soils at each site were generated using site-specific surface soil concentrations (Former Base Landfill) or shallow subsurface concentrations (POL Storage Area). Because the POL Storage Area is covered with concrete, soil samples collected at depths of 0 to 2 feet were used to assess these exposure routes. This approach was used because even though it is unlikely that potential receptors will come into contact with only discrete portions of the site, a conservative approach ensures protection of public health.

Maximum soil concentrations at the landfill also were used to characterize potential exposures as a result of fugitive dust emissions. This approach was used in an effort to be conservative within the defined exposure scenarios. Soil samples collected at depths of 0 to 2 feet will be used to evaluate potential fugitive dust exposures from the POL Storage Area. Table 4-6 summarizes the maximum soil concentrations that were considered to characterize exposures through dermal contact, incidental ingestion, and inhalation of fugitive dust.

Intake Estimation Method

Chronic (longer-term) Reference Doses were ultimately used to characterize potential noncarcinogenic risks. To account for the sporadic nature of the majority of the potential exposures, human intakes through most exposure routes were based on exposure frequency time-weighted concentrations. Furthermore, lifetime incremental cancer risks were generated using Cancer Slope Factors. Exposure duration and lifetime terms were used to characterize incremental cancer risks, since they are lifetime probability estimates.

Ground-Water Use

Three specific exposure routes associated with ground water use were assessed: ingestion, inhalation of volatiles while showering, and dermal contact. The methods used to assess these exposures are discussed in the following text.

Ingestional exposure was characterized using the following expression (USEPA, December 1989):

$$IEX = C \times IR \times EF \times ED / BW / LT / 365$$

Where:

IEX is the ingestional exposure dose (mg/kg/day)
C is the estimated ground-water concentration at the receptor point (mg/L)
IR is the water ingestion rate (L/day)
EF is the exposure frequency (days/yr)
ED is the exposure duration (yrs)
BW is the receptor body weight (kg)
LT is the lifetime of the receptor (yrs)
365 is a conversion factor (days/yr)

Ingestion rates (IR) were specified as 2 liters/day, 1.5 liters/day, and 1 liter/day for adult, adolescent, and child receptors, respectively. Since exposures associated with ground water use could occur on virtually a daily basis, the exposure frequency (EF) was specified as 365 days/year. The exposure duration (ED) and lifetime (LT) were specified as 70 years for adult receptors. These terms are used only for characterization of long-term (carcinogenic) risks in this and all subsequent exposure routes. Body weights were set as follows: adults--70 kg, adolescents--35 kg, children--10 kg.

Inhalational exposure during showering was estimated using a mass transfer model developed for this specific exposure route and a dose estimate model. The method employed is as follows (USEPA, December 1989; Foster and Chrostowski, 1987):

$$IEX = S \times IR \times K \times EF \times ED / BW / LT / R_a / 10^6$$
$$K = D_s + \exp(-R_a D_t)/R_a - \exp(R_a(D_s - D_t))]/R_a$$

Where:

IEX	is the inhalational exposure dose (mg/kg/day)
S	is the volatile chemical generation rate (μg/m3/min)
IR	is the inhalation rate (L/min)
EF	is the exposure frequency (days-1)
ED	is the exposure duration (yrs)
BW	is the receptor body weight (kg)
LT	is the receptor lifetime (yrs)
R_a	is the air exchange rate (min-1)
10^6	is a conversion factor (mg/μg/m3/L)
D_s	is the shower duration (min)
D_t	is the total duration in the bathroom (min)

The volatile chemical generation rate was estimated using the Foster and Chrostowski mass transfer model, which is based on a two-phase film theory. The model employs contaminant-specific mass transfer coefficients, Henry's law constants, droplet diameter, drop time, viscosity and temperature, etc. Specific details regarding the application of the mass transfer model, as well as sample calculations, are included in Appendix F.

Inhalation rates were specified as 14 liters/min and 11 liters/min for adult and adolescent receptors, respectively. Young children are not expected to shower, and therefore, child exposures were not considered through this route. The exposure frequency was specified as 1 day-1 (i.e., 1 shower per day) for both adult and adolescent receptors. The exposure duration and lifetime terms were set as 70 years for adult receptors. Body weights were specified as follows: adults -- 70 kg; adolescents--35 kg.

The air exchange rate (R_a) was specified as 0.0083 min^{-1} for all receptors. The shower duration (D_s) and total duration in the bathroom (D_t) were set as 15 minutes and 20 minutes, respectively.

Dermal exposure during bathing or showering was estimated as follows (USEPA, December 1989):

$$DEX = C \times PC \times AV \times ET \times EF \times ED / BW / LT / 10^3 / 365$$

Where:

DEX	is the dermal exposure dose (mg/kg/day)
C	is the estimated water concentration at the receptor point (mg/L)
PC	is the permeability constant of water (cm/hr)
AV	is the skin surface area available for contact (cm^2)
ET	is the exposure time (hrs/day)
EF	is the exposure frequency (days/year)
ED	is the exposure duration (years)
BW	is the receptor body weight (kg)
LT	is the lifetime of the receptor (years)
10^3	is a conversion factor (L/cm^3)
365	is a conversion factor (days/year)

This approach is based on the assumption that ground-water contaminants are present in dilute form and that percutaneous penetration is controlled by the absorption of water through the skin. The permeability constant was specified as 0.0008 cm/hr (USEPA, December 1989). Skin surface areas available for contact was set as 19,400 cm^2, 14,900 cm^2, and 7,280 cm^2, for male adults, adolescents, and children, respectively (USEPA, December 1989). The exposure time was specified as 0.2 hr/day for all three receptor groups. Exposure frequencies were set as 365 days/year. The exposure duration and lifetime were specified as 70 years for adult receptors. Body weights were set as follows: adults--70 kg; adolescents--35 kg; children--10 kg.

Incidental Ingestion of Surface Soil

It is remotely possible that base personnel may be exposed through incidental ingestion of surface soil. Exposures through this route are expected to occur on an infrequent basis, but could arise as a result of hand-to-mouth contact during activities such as landscaping or mowing. Intakes through this route were estimated using the following expression (USEPA, December 1989):

$$IEX = C \times IR \times EF \times ED / BW / LT / 365 / 10^6$$

Where:

IEX	is the ingestional exposure dose (mg/kg/day)
C	is the concentration of the contaminant in soil (mg/kg)
IR	is the soil ingestion rate (mg/event)
EF	is the exposure frequency (events/yr)
ED	is the exposure duration (yrs)
BW	is the receptor body weight (kg)
LT	is the receptor lifetime (yrs)
365	is a conversion factor (days/yr)
10^6	is a conversion factor (mg/kg)

An ingestion rate of 10 mg/event was assumed for adult receptors. This value is one-tenth of the daily ingestion rate reported by the USEPA (USEPA, December 1989) and has been used, since such exposures are expected to occur over brief time intervals. An exposure frequency of 12 events/year (i.e., once per month) was specified. An exposure duration of 40 years was assumed for civilian base personnel. A body weight of 70 kg was be used.

Dermal Contact With Surface Soil

Direct dermal contact with surface soil could occur in the same manner as previously discussed with respect to incidental ingestion. Exposures through this route will be characterized as follows:

$$DEX = C \times SA \times AF \times ABS \times EF \times ED / BW / AT / LT / 10^6$$

Where:

DEX is the absorbed dose (mg/kg/day)
C is the concentration of the contaminant in soil (mg/kg)
SA is the exposed skin area (cm^2/day)
AF is the soil to skin adherence factor (mg/cm^2)
ABS is the absorption factor (dimensionless)
EF is the exposure frequency (days/yr)
ED is the exposure duration (yrs)
BW is the receptor body weight (kg)
AT is the averaging time (days/year)
LT is the lifetime (yrs)
10^6 is a conversion factor (mg/kg)

The exposed skin area was set as 2,948 cm^2/day (Schaum, November 1984). This is the exposed surface area of adults wearing short-sleeved, open-necked shirts, pants, shoes, and no gloves or hat. The soil adherence factor was set as 1.45 mg/cm^2 (EPA, December 1989). Absorption factors were set as follows: volatiles--0.10, semivolatiles and pesticides--0.05, metals--0.0. These factors account for resistance to mass transfer from the soil to the skin surface as well as to transport through the skin. These are considered reasonable estimates, since studies have shown that less than 10 percent of most chemical substances are percutaneously absorbed even upon topical administration (Feldman and Mailbach, 1970; USEPA, May 1986).

The exposure frequency was set as 12 days/year. The exposure duration was set as 40 years (working lifetime at the facility). The receptor body weight was set as 70 kg; the averaging time, 365 days; and the receptor lifetime, 70 years.

Inhalation of Fugitive Dust

Although the emission of fugitive dust is impeded by the presence of cover materials (i.e, concrete and asphalt) and vegetation, this is considered a potential contaminant release mechanism and exposure pathway. Fugitive dust emissions, dispersion, and downwind concentrations were characterized using a particulate emission model developed by the USEPA (Cowherd et al.,1984). The model output is contingent upon input parameters including the area of the source, the quantity of erodible material, mean wind speed, vegetative cover factors and Thornthwaite's precipitation/evaporation index, etc. Details regarding the emission model are included in Appendix F. Values of the various input parameters were determined from the literature (Cowherd et al., 1984). Inhalational exposures were characterized using the following expression (USEPA, December 1989):

$$IEX = C \times IR \times ET \times EF \times ED / BW / LT / 365$$

Where:

IEX	is the inhalational dose (mg/kg/day)
C	is the concentration of the contaminant in air (mg/m^3)
IR	is the inhalation rate (m^3/hr)
ET	is the exposure time (hrs/day)
EF	is the exposure frequency (days/yr)
ED	is the exposure duration (yrs)
BW	is the receptor body weight (kg)
LT	is the lifetime (yrs)
365	is a conversion factor (days/yr)

Potential receptors through this route include persons residing just beyond the perimeter of the base. It was assumed that such individuals could be exposed on a frequent basis and adult, adolescent, and child exposures were considered. Inhalation rates were specified as 20 m^3/day (0.83 m^3/hr), 10 m^3/day (0.42 m^3/hr), and 3 m^3/day (0.12 m^3/hr), for adults, adolescents, and children, respectively. The exposure time was specified as 24 hours/day, since it was assumed that dust was present both inside and outside domiciles. The exposure frequency was set as 312 days/year (6 days/week) to account for times when receptors are outside the exposure zone. The exposure duration was specified as 70 years (worst-case). Receptor body weights were set as follows: adults--70 kg, adolescents--35 kg, children--10 kg. Lifetimes were assumed to be 70 years. Additional input parameters specific to the emission modeling effort are provided in Appendix E.

4.4.4 Exposure Assessment Summary

Exposures through potable use of ground water, dermal contact with surface soil, incidental ingestion of surface soil, and inhalation of fugitive dust were considered. Two distinct receptor groups have been identified: onsite receptors (base personnel) and offsite receptors (local residents). Adults constitute the primary onsite receptors. Offsite exposures were considered for adults, adolescents, and children. Table 4-9 provides a synopsis of the various exposure routes and pertinent assumptions identified in the preceding text.

4.5 RISK CHARACTERIZATION

Potential human health risks resulting from the exposure routes outlined in Section 4.4.3 (Exposure Assessment) are characterized on a quantitative basis in this section. Quantitative risk estimates are generated based on risk assessment methods outlined in USEPA guidance (USEPA, December 1989). Noncarcinogenic risk estimates are presented in the form of Hazard Quotients and Hazard Indices that are determined through comparison of estimated doses with published Reference Doses. Incremental cancer risk estimates are provided in the form of dimensionless probabilities based on published Cancer Slope Factors and time-weighted average doses. Section 4.5.1 summarizes the estimated human intakes (doses) for each of the exposure routes. Section 4.5.2 summarizes the results of the noncarcinogenic risk assessment. Carcinogenic risk estimates are provided in Section 4.5.3. Section 4.5.4 contrasts observed ground-water concentrations with applicable standards or guidelines.

4.5.1 Dose Estimates

Estimated intakes were developed for each of the specific exposure routes discussed previously. Complete calculations and methods are provided in Appendix F. Table 4-10 summarizes the estimated intakes (doses) for the routine domestic use of onsite ground water by local residents. Table 4-11 summarizes the doses based on a scenario that includes leachate generation from contaminated soil with subsequent dilution in the water table aquifer.

Table 4-12 presents the estimated doses associated with inhalation of fugitive dust by offsite receptors. Estimated doses from dermal contact and incidental ingestion of surface soils by onsite receptors are provided in Table 4-13.

Each table presents the average annual doses for each receptor. The average annual doses are used to calculate noncarcinogenic health risks. To calculate lifetime incremental cancer risks, a time weighting factor is used, as explained in Section 4.4.3. The time weighting factor consists of an exposure duration as part of a lifetime. For onsite receptors this factor is 40 yr/70 yr, which is a conservative assumption for a career employee. For offsite receptors, this is 70 yr/70 yr, or alternatively 1.0 (an entire lifetime).

4.5.2 Noncarcinogenic Risk Assessment

Noncarcinogenic risk is assessed using the concept of Hazard Quotients and Hazard Indices. The Hazard Quotient is the ratio of the estimated dose and the Reference Dose for a selected indicator chemical, as follows:

Hazard Quotient = Dose/Reference Dose

A Hazard Index is generated by summing the individual Hazard Quotients for the chemicals of concern. If the value of the Hazard Index exceeds unity (1.0), there is a potential noncarcinogenic health risk associated with exposure to that particular chemical mixture (USEPA, September 1986). The Hazard Index is not a mathematical prediction of the severity of toxic effects; it is simply a numerical indicator of the possibility of the occurrence of noncarcinogenic (threshold) effects. If the ratio of the dose and the Reference Dose for a selected chemical exceeds unity, it is likely that noncarcinogenic effects would occur as a result of the exposure.

Tables 4-14 and 4-15 summarize the Hazard Quotients associated with domestic use of onsite ground water and ground water affected by leachate, respectively. The results presented in these tables may be considered to be conservative estimates, for the following reasons:

- The Hazard Quotients are based on the maximum detected or predicted ground-water concentrations.

- The exposure scenario assumes that the contaminant concentrations observed on site will migrate to an offsite/offbase receptor location with no further dilution or attenuation.

Even under these conservative assumptions, no Hazard Index exceeds unity. The maximum estimated Hazard Index (0.10) is for small children under the leaching scenario. Under current site conditions, therefore, potential receptors are not expected to incur an unacceptable noncarcinogenic health risk as a result of the routine domestic use of ground water (even if a potable water well were installed in close proximity to the sites).

Table 4-16 presents a summary of Hazard Quotients and Hazard Indices for exposure of offsite residents to fugitive dust emissions. The maximum Hazard Indices for the landfill (2.8×10^{-4}) and the POL Storage Area (7.5×10^{-9}) are well below unity, indicating that fugitive dust emissions would be unlikely to cause any adverse noncarcinogenic health effects under a relatively steady exposure scenario.

Table 4-17 presents Hazard Quotients and Hazard Indices for periodic exposures to surface soils by base personnel (adults only). Incidental ingestion of site soils under the scenario defined in Sections 4.3 and 4.4 results in a Hazard Index of 1.1×10^{-3} at the landfill and 4.5×10^{-8} at the POL Storage Area. Dermal contact results in Hazard Indices of 6.7×10^{-6} (the Former Base Landfill) and 1.1×10^{-6} (the POL Storage Area). This shows that there is little possibility of base personnel suffering adverse health impacts after periodic exposure.

4.5.3 Carcinogenic Risk Assessment

Incremental cancer risk estimates were generated for each of the exposure pathways using the estimated doses and published Cancer Slope Factors, as follows:

Risk = Dose x CSF

The risk determined using this expression is a unitless expression of an individual's likelihood of developing cancer as a result of exposure to carcinogenic chemicals. An incremental cancer risk of 1×10^{-6} indicates that the exposed receptor has a

1 in 1 million chance of developing cancer after a lifetime of exposure. Alternately, such a risk may be interpreted as representing one additional case of cancer in an exposed population of 1 million people. Cancer risks based on Cancer Slope Factors should be recognized as upper-limit estimates. Cancer Slope Factors (CSFs) are the upper 95 percent confidence limit of a dose-response curve generally derived from animal studies. Actual human risk, while not identifiable, is not expected to exceed the upper limit based on CSFs, and, in fact, may be much lower.

Based on the revised National Contingency Plan [40 CFR 300.430 (e)], the range of excess individual lifetime cancer risk used as cleanup goals for Superfund Sites is between 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1,000,000). Site-specific cleanup standards are based on reasonable worst-case exposure scenarios.

Table 4-18 presents a summary of the incremental cancer risks for the potential domestic use of contaminated ground water affected by leachate (no carcinogens were detected in actual ground-water samples at either site). The risk at the Former Base Landfill is 3.2×10^{-5}, for oral, dermal and inhalational exposures combined, and at the POL Storage Area the risk is estimated to be 6.8×10^{-6}, based on the conservative assumptions discussed earlier. The primary contributors to these risks are benzo(a)pyrene at the landfill and methylene chloride at the POL Storage Area. However, considering that at least 50 years will elapse before the first contaminant could reach a receptor well 1 mile downgradient of the base, the risks presented above are currently of little concern. Furthermore, since attenuation mechanisms such as adsorption, molecular diffusion, and hydrodynamic dispersion will act between the source and potential receptor wells, it is considered unlikely that either site poses a threat to downgradient wells.

Table 4-19 presents a summary of incremental cancer risks from potential exposure to fugitive dust emissions. The lifetime incremental cancer risks resulting from exposure to fugitive dust emissions from the landfill is 7.2×10^{-7}, which is primarily attributable to the presence of arsenic and benzo(a)pyrene in the surface soil of the eastern portion of the landfill. However, it should be noted that, at the present time, USEPA considers it inappropriate to perform a quantitative carcinogenic risk assessment on benzo(a)pyrene or other PAHs. In addition, the concentrations of PAHs found in these surface soils are well within the range of concentrations reported in developed areas.

Table 4-20 summarizes estimated incremental cancer risks associated with periodic employee exposure to onsite surface soils. The risks at the Former Base Landfill, again, are primarily associated with the presence of benzo(a)pyrene in the eastern portion of the landfill. However, the total risk for both the ingestion and dermal contact scenarios is 1.5×10^{-6}. These scenarios used the maximum contaminant concentrations in an effort to be conservative, and this resulted in a risk well within the "acceptable" risk range (10^{-4} to 10^{-6}). The potential carcinogenic risk associated with onsite exposures to soils at the POL Storage Area are much lower (6.1×10^{-10}), and is attributable to the presence of benzene.

In conclusion, no significant noncarcinogenic or carcinogenic risks appear to exist based on the available data and the exposure scenarios considered. All risks, even under the relatively conservative scenarios used, fall within or below the USEPA range of acceptable risks (10^{-4} to 10^{-6}).

4.5.4 Comparison of Ground-Water Data with Standards/Guidelines

Comparison of the maximum observed ground-water concentrations (Table 4-2) with the final Maximum Contaminant Levels (MCLs) presented in Table 4-8 reveals that no constituents exceed applicable regulatory criteria. However, lead, which was detected at a maximum concentration of 10.6 µg/L, exceeds the proposed MCL of 5 µg/L, and styrene, which was detected at a maximum concentration of 10 µg/L, exceeds a proposed MCL of 5 µg/L. However, the 5 µg/L standard for styrene is based on a carcinogenicity classification of B2, while a standard of 100 µg/L has been proposed if styrene is a Class C carcinogen. This issue has not yet been resolved by the USEPA. No metals were detected at concentrations that exceed Primary Drinking Water Standards (Table 4-5).

No contaminants were detected in ground water at the POL Storage Area that exceeded Drinking Water Health Advisories (Table 4-8).

TABLE 4-1

MOBILITY PARAMETERS FOR ORGANIC CHEMICALS

CAS Number	Chemical	Molecular Weight(1)	Water Solubility (1) (mg/L @ 20°C)	Octanol/Water Partition Coefficient(1)	Soil/Sediment Adsorption Coefficient(1)	Vapor Pressure(1) (mm Hg @ 20°C)	Henry's Law Constant(1) (atm-m³/mol)	Bioconcentration Factor(1) (μg/kg/ μg/L)-1	Specific Gravity(2) (20°C/4°C)
KETONES									
67-64-1	Acetone	58.08(2)	600,000(7)	-0.24(2)	9.2	270(30°C)(2)	3.43×10^{-5}(4)	0.19(5)	0.791
78-93-3	2-Butanone	72.1(2)	353,000(10°C)(2)	1.82(2)	17	77.5(2)	2.08×10^{-5}(4)	0.93(5)	0.805
108-10-1	4-Methyl-2-pentanone	100.2(2)	19,000(2)	1.68(8)	113	6(2)	4.16×10^{-5}(4)	11(5)	0.8017
MONOCYCLIC AROMATICS									
71-43-2	Benzene	78.12	1,780(25°C)	135	65	95.2(25°C)	5.5×10^{-3}	37	0.879
100-41-4	Ethylbenzene	106.16	152	2,200	1,100	7	6.6×10^{-3}	470	0.867
	Total xylenes(6)	106.17(2)	187(2)	1,195(2)	248(7)	5.8(2)	4.33×10^{-3}(4)	128(5)	0.868
108-90-7	Chlorobenzene	112.56	488(25°C)	690	330	11.7	3.58×10^{-3}	164	1.107
100-42-5	Styrene	104.14(2)	300(2)	490	417	5(2)	2.3×10^{-3}(4)	100(5)	0.9045 (25°C)

(1) USEPA, December 1982 except as otherwise noted.
(2) Verschueren, 1983.
(3) Lyman et al., 1982; Eq 4-10 and 4-8, respectively.
(4) Lyman; Eq 15-8.
(5) Lyman; Eq 5-2.
(6) Average values for ortho-, meta-, and para-xylene.
(7) Lyman; Eq 2-6.
(8) Lyman; fragment analysis, Chapter 1. $\log Kow_{MIBK} = \log Kow_{MEK} - f_H + 2 f_{CH3} + f_{CB}$
(9) Weast, 1982.
(10) Value provided for similar compound 1-methylnaphthalene.
(11) Lyman; fragment analysis, Chapter 1. $\log Kow_{2\text{-methylnaphthalene}} = \log Kow_{naphthalene} + f^{\phi}_{CH_3}$.
(12) No data available; assumed same vapor pressure as naphthalene.

TABLE 4-1 (CONTINUED)
MOBILITY PARAMETERS FOR ORGANIC CHEMICALS
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CAS Number	Chemical	Molecular Weight(1)	Water Solubility (1) (mg/L @ 20°C)	Octanol/Water Partition Coefficient(1)	Soil/Sediment Adsorption Coefficient(1)	Vapor Pressure(1) (mm Hg @ 20°C)	Henry's Law Constant(1) (atm-m³/mol)	Bioconcentration Factor(1) (µg/kg/ µg/L)-1	Specific Gravity(2) (20°C/4°C)
CHLORINATED ALIPHATICS									
75-09-2	Methylene chloride	84 94	20,000	18.2	8 8	362.4	2.03×10^{-3}	6.0	1.327(9)
78-87-5	1,2-Dichloropropane	112 99	2,700	105	51	42	2.31×10^{-3}	30	1.16(20/20°C)
PHTHALATE ESTERS									
85-68-7	Butylbenzylphthalate	312	2 9	3.6×10^{5}	1.7×10^{5}	6×10^{-5}	8.3×10^{-6}	47,000	1.1(25/25°C)
PHENOLS									
108-95-2	Phenol	94 11	93,000(25°C)	30	14 2	0.431(25°C)	4.54×10^{-7}	9.4	1.07

(1) USEPA, December 1982 except as otherwise noted.
(2) Verschueren, 1983.
(3) Lyman et al., 1982; Eq 4-10 and 4-8, respectively
(4) Lyman; Eq 15-8.
(5) Lyman; Eq 5-2.
(6) Average values for ortho-, meta-, and para-xylene.
(7) Lyman; Eq 2-6.
(8) Lyman; fragment analysis, Chapter 1. $\log Kow_{MIBK} = \log Kow_{MEK} - f_H + 2 f_{CH3} + f_{CB}$
(9) Weast, 1982.
(10) Value provided for similar compound 1-methylnaphthalene.
(11) Lyman; fragment analysis, Chapter 1. $\log Kow_{2\text{-methylnaphthalene}} = \log Kow_{naphthalene} + f^{\phi}_{CH_3}$.
(12) No data available; assumed same vapor pressure as naphthalene.

TABLE 4-1 (CONTINUED)
MOBILITY PARAMETERS FOR ORGANIC CHEMICALS
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CAS Number	Chemical	Molecular Weight(1)	Water Solubility (1) (mg/L @ 20°C)	Octanol/Water Partition Coefficient(1)	Soil/Sediment Adsorption Coefficient(1)	Vapor Pressure(1) (mm Hg @ 20°C)	Henry's Law Constant(1) (atm-m³/mol)	Bioconcentration Factor(1) (µg/kg/µg/L)-1	Specific Gravity(2) (20°C/4°C)
POLYNUCLEAR AROMATICS									
83-32-9	Acenaphthene	154.4	3.42(25°C)	9,600	4,600	1.55×10^{-3}(25°C)	9.1×10^{-5}	1,800	
120-12-7	Anthracene	178.2	0.045 (25°C)	28,000	14,000	1.7×10^{-5} (25°C)	8.6×10^{-5}	4,700	1.25
56-55-3	Benzo(a)anthracene	228.28	0.0057	410,000	200,000	2.2×10^{-8}	1×10^{-6}	53,000	
205-99-2	Benzo(b)fluoranthene	252.3	0.014 (25°C)	1.15×10^{6}	550,000	5×10^{-7}	1.22×10^{-5}	140,000	
207-08-9	Benzo(k)fluoranthene	252.3	0.0043(25°C)	1.15×10^{6}	550,000	5×10^{-7}	3.87×10^{-5}	140,000	
50-32-8	Benzo(a)pyrene	252	0.0038 (25°C)	1.15×10^{6}	550,000	5.6×10^{-9} (25°C)	4.9×10^{-7}	140,000	
218-01-9	Chrysene	228.3	0.0018 (25°C)	410,000	200,000	6.3×10^{-9} (25°C)	1.05×10^{-6}	53,000	1.274
206-44-0	Fluoranthene	202.3	0.26 (25°C)	79,000	38,000	5×10^{-6} (25°C)	6.5×10^{-6}	12,000	
86-73-7	Fluorene	116.2	1.69(2°C)	15,000	7,300	7.1×10^{-4}	6.4×10^{-5}	3,800	
193-39-5	Indeno(1,2,3-cd)pyrene	276.3	5.3×10^{-4} (25°C)	3.2×10^{6}	1.6×10^{6}	1×10^{-10}	6.95×10^{-8}	350,000	
91-20-3	Naphthalene	128.2	31.7 (25°C)	1,950	940	0.087(25°C)	4.6×10^{-4}	420	1.152
91-57-6	2-Methylnaphthalene	142.19(2)	26-28 (25°C)(2)(10)	18,200(11)	5,750(7)	0.087 (25°C)(12)	6.02×10^{-4}(4)	1,020(5)	0.994
85-01-8	Phenanthrene	178.2	1.00 (25°C)	28,000	14,000	9.6×10^{-4} (25°C)	2.26×10^{-4}	4,700	1.025
129-00-0	Pyrene	202.3	0.13 (25°C)	80,000	38,000	2.5×10^{-6} (25°C)	5.1×10^{-6}	12,000	

(1) USEPA, December 1982 except as otherwise noted.
(2) Verschueren, 1983.
(3) Lyman et al., 1982; Eq 4-10 and 4-8, respectively.
(4) Lyman; Eq 15-8.
(5) Lyman; Eq 5-2.
(6) Average values for ortho-, meta-, and para-xylene.
(7) Lyman; Eq 2-6.
(8) Lyman; fragment analysis, Chapter 1. $\log Kow_{MIBK} = \log Kow_{MEK} - f_H + 2 f_{CH3} + f_{CB}$
(9) Weast, 1982.
(10) Value provided for similar compound 1-methylnaphthalene.
(11) Lyman; fragment analysis, Chapter 1. $\log Kow_{2\text{-methylnaphthalene}} = \log Kow_{naphthalene} + f^{\phi}_{CH_3}$.
(12) No data available; assumed same vapor pressure as naphthalene.

TABLE 4-1 (CONTINUED)
MOBILITY PARAMETERS FOR ORGANIC CHEMICALS
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CAS Number	Chemical	Molecular Weight(1)	Water Solubility (1) (mg/L @ 20°C)	Octanol/Water Partition Coefficient(1)	Soil/Sediment Adsorption Coefficient(1)	Vapor Pressure(1) (mm Hg @ 20°C)	Henry's Law Constant(1) (atm-m³/mol)	Bioconcentration Factor(1) (µg/kg/ µg/L)-1	Specific Gravity(2) (20°C/4°C)
PESTICIDES									
50-29-3	4,4'-DDT	354.5	0.0055(25°C)	8.1×10^{6}	3.9×10^{6}	1.9×10^{-7}(25°C)	1.58×10^{-5}	8.0×10^{6}	
72-55-9	4,4'-DDE	318	0.04	9.1×10^{6}	4.4×10^{6}	6.5×10^{-6}	6.8×10^{-5}	8.9×10^{5}	
72-54-8	4,4'-DDD	320	0.06(25°C)	1.6×10^{6}	7.7×10^{5}	1.02×10^{-6}(30°C)	2.2×10^{-8}	1.8×10^{5}	
76-44-8	Heptachlor	373.5	0.18(25°C)	26,000	12,000	3.0×10^{-4}(25°C)	4.0×10^{-3}	4,400	1.58
319-84-6	Alpha-BHC	291	1.63(25°C)	7,800	3,800	2.5×10^{-5}	6.0×10^{-6}	1,500	
	Methoxychlor		0.04(24°C)(2)						1.41(25/25°C)

(1) USEPA, December 1982 except as otherwise noted.
(2) Verschueren, 1983.
(3) Lyman et al., 1982; Eq 4 10 and 4-8, respectively.
(4) Lyman; Eq 15-8.
(5) Lyman; Eq 5-2.
(6) Average values for ortho-, meta-, and para-xylene.
(7) Lyman; Eq 2-6.
(8) Lyman; fragment analysis, Chapter 1. $\log Kow_{MIBK} = \log Kow_{MEK} - f_H + 2 f_{CH3} + f_{CB}$
(9) Weast, 1982.
(10) Value provided for similar compound 1-methylnaphthalene.
(11) Lyman; fragment analysis, Chapter 1. $\log Kow_{2\text{-methylnaphthalene}} = \log Kow_{naphthalene} + f^{\phi}_{CH_3}$.
(12) No data available; assumed same vapor pressure as naphthalene.

TABLE 4-2

CHEMICALS OF CONCERN
FORMER BASE LANDFILL
ELLINGTON FIELD (ANG)
HOUSTON, TEXAS

Medium	Chemicals of Concern
Soil	• Butylbenzylphthalate • Benzo(a)anthracene • Benzo(b)fluoranthene • Benzo(k)fluoranthene • Benzo(a)pyrene • Indeno(1,2,3-cd)pyrene • Naphthalene • 4,4'-DDT • Arsenic • Lead • Mercury • Zinc

TABLE 4-3

CHEMICALS OF CONCERN
POL STORAGE AREA
ELLINGTON FIELD (ANG)
HOUSTON, TEXAS

Medium	Chemicals of Concern
Soil	• Acetone • 2-Butanone • Benzene • Ethylbenzene • Total xylenes • Styrene • Chlorobenzene • Methylene chloride
Ground Water	• Ethylbenzene • Chlorobenzene • Total xylenes • Styrene

TABLE 4-4

MAXIMUM GROUND-WATER CONCENTRATIONS

Chemical	Former Base Landfill (µg/L)*	POL Storage Area (µg/L)
Ethylbenzene	ND *(5)*	6
Chlorobenzene	ND *(5)*	6
Total Xylenes	ND *(5)*	23
Styrene	ND *(5)*	10
Alpha-BHC	0.037	NA
Methoxychlor	0.022	NA
Aluminum	2,910	NA
Barium	517	NA
Beryllium	1.3	NA
Calcium	176,000	NA
Chromium	7.9	NA
Iron	3,710	NA
Lead	10.6	NA
Manganese	498	NA
Nickel	12.1	NA
Vanadium	10.8	NA
Petroleum Hydrocarbons (mg/L)	0.9	ND *(0.2)*

ND Not detected.
NA Not analyzed.
* Where not detected, method detection limit shown in parentheses.

TABLE 4-5

SITE GROUND-WATER AND BACKGROUND INORGANIC CONCENTRATIONS FORMER BASE LANDFILL

Chemical	Maximum Site Ground-Water Concentrations(2) (µg/L)	Background Ground-Water Concentrations(3) (µg/L)	Primary or Secondary Drinking Water Regulations(4) (µg/L)
Aluminum	2,910	<5.0-1,000	NA
Arsenic	ND (1.1)	<1.0-30	50
Barium	517	10-500	1,000
Beryllium	1.3	<10	NA
Cadmium	ND (3.3)	<1.0	10
Calcium	176,000	1,000-150,000	NA
Chromium	7.9	<1-5.0	50
Cobalt	ND (6.5)	<10	NA
Copper	ND (6.9)	<1.0-30	1,000/1,300(5)
Iron	3,710	10-10,000	300
Lead	10.6	<15	50/5(5)
Magnesium	ND (270)	1,000-50,000	NA
Manganese	498	<1.0-1,000	50
Mercury	ND (0.1)	<1.0	2
Nickel	12.1	<10-50	NA
Potassium	ND (94.2)	1,000-10,000	NA
Selenium	ND (1.7)	<1.0-10	10
Silver	ND (6.9)	<5.0	50
Sodium	ND (500)	500-120,000	NA
Vanadium	10.8	<1.0-10	NA
Zinc	ND (2.0)	<10-2,000	5,000

(1) Ground-water samples at the POL Storage Area were not analyzed for metals.
(2) Maximum concentration detected in all samples obtained in January 1990.
(3) Dragun, 1988.
(4) 40 CFR 141 and 143.
(5) Proposed Maximum Contaminant Level (EPA, August 18, 1988).
ND Not detected above the detection limit shown.
NA Not available.

TABLE 4-6

MAXIMUM SOIL CONCENTRATIONS

Chemical	Former Base Landfill		POL Storage Area	
	Surface (µg/kg)	Subsurface (µg/kg)	Subsurface (0-2 feet) (µg/kg)	Subsurface (>2 feet) (µg/kg)
Acetone	ND	ND	250	ND
2-Butanone	ND	ND	41	ND
4-Methyl-2-pentanone	ND	ND	ND	4
Benzene	ND	ND	180	ND
Ethylbenzene	ND	ND	210	13,000
Total xylenes	ND	ND	240	12
Styrene	ND	ND	ND	5
Chlorobenzene	ND	ND	ND	1
Methylene chloride	ND	ND	ND	6,100
1,2-Dichloropropane	ND	ND	ND	1
Butylbenzylphthalate	290*	ND	ND	ND
Acenaphthene	400*	ND	ND	ND
Anthracene	810*	ND	ND	ND
Benzo(a)anthracene	2,350*	ND	ND	ND
Benzo(b)fluoranthene	1,800*	ND	ND	ND
Benzo(k)fluoranthene	1,850*	ND	ND	ND
Benzo(a)pyrene	2,000*	ND	ND	ND
Chrysene	2,250*	ND	ND	ND
Fluoranthene	4,350*	ND	ND	ND
Fluorene	410*	ND	ND	ND

ND Not detected.
NA Not analyzed.
* Average of two duplicate samples using one-half the detection limit for non-detects.

TABLE 4-6 (CONTINUED)
MAXIMUM SOIL CONCENTRATIONS
PAGE TWO OF THREE

Chemical	Former Base Landfill		POL Storage Area	
	Surface (µg/kg)	Subsurface (µg/kg)	Subsurface (0-2 feet) (µg/kg)	Subsurface (>2 feet) (µg/kg)
Indeno(1,2,3-cd)pyrene	930*	ND	ND	ND
Naphthalene	180*	ND	ND	200
2-Methylnaphthalene	ND	ND	ND	640
Phenanthrene	3,250*	ND	ND	ND
Pyrene	3,550*	ND	ND	ND
Dibenzofuran	200*	ND	ND	ND
Phenol	ND	22	ND	ND
4,4'-DDT	10	ND	NA	NA
4,4'-DDD	11	ND	NA	NA
4,4'-DDE	12	ND	NA	NA
Heptachlor	ND	21	NA	NA
Aluminum	11,000*	9,590	NA	NA
Arsenic	32.4*	5.0	NA	NA
Barium	302	136	NA	NA
Beryllium	ND	0.90	NA	NA
Calcium	39,900	38,000	NA	NA
Chromium	16.0	10.1	NA	NA
Cobalt	ND	22.0	NA	NA
Copper	ND	8.9	NA	NA
Iron	8,960*	16,000	NA	NA

ND Not detected.
NA Not analyzed.
* Average of two duplicate samples using one-half the detection limit for non-detects.

TABLE 4-6 (CONTINUED)
MAXIMUM SOIL CONCENTRATIONS
PAGE THREE OF THREE

Chemical	Former Base Landfill		POL Storage Area	
	Surface (µg/kg)	Subsurface (µg/kg)	Subsurface (0-2 feet) (µg/kg)	Subsurface (>2 feet) (µg/kg)
Lead	141	15.8	NA	NA
Magnesium	2,720	3,460	NA	NA
Manganese	152	540	NA	NA
Mercury	0.19	0.34	NA	NA
Nickel	ND	16.2	NA	NA
Potassium	750	1,400	NA	NA
Sodium	253	ND	NA	NA
Vanadium	ND	20.9	NA	NA
Zinc	180	2[illegible].0	NA	NA
Petroleum Hydrocarbons	ND	ND	132	99

ND Not detected.
NA Not analyzed.
* Average of two duplicate samples using one-half the detection limit for non-detects.

TABLE 4-7

**ONSITE SURFACE SOIL AND BACKGROUND INORGANIC CONCENTRATIONS
FORMER BASE LANDFILL**

Chemical	Former Base Landfill Surface Soil Concentrations			Literature Background Surface Soil Concentrations(2)	
	Number of Positive Detections/Number of Samples	Range of Positive Detections (mg/kg)	Average Concentration (1) (mg/kg)	Range of Positive Detections (mg/kg)	Average Concentration (mg/kg)
Aluminum	3/3	6,010-11,000	8,090	5,000-100,000	74,000
Arsenic	3/3	3.5-32.4	13.4	<0.1-97	7.0
Barium	3/3	120-302	188	70-5,000	670
Calcium	3/3	9,880-39,900	26,500	600-320,000	33,000
Chromium	3/3	11.3-16.0	13.6	3-2,000	56
Iron	3/3	6,700-8,960	7,690	1,000-100,000	26,000
Lead	3/3	22.5-141	96.2	<10-700	20
Magnesium	3/3	1,480-2,720	2,040	300-100,000	10,000
Manganese	3/3	104-152	122	30-5,000	480
Mercury	3/3	0.07-0.19	0.12	<0.01-4.6	0.065
Potassium	3/3	492-750	640	1,900-63,000	NR
Sodium	3/3	117-253	201	500-100,000	12,000
Zinc	2/3	2.5-180(3)	111	10-2,100	65

(1) Arithmetic average of concentrations in samples 01-SS01-A, 01-SS02-A, and 01-SS03-A. The result for sample 01-SS03-A is the average of it and its duplicate 01-FD05-"A.
(2) Shacklette and Boerngen, 1984.
(3) For nondetected values, the concentration of the analyte was assumed to be half the method detection limit (5 mg/kg).
NR Not Reported.
ND Not Detected.
NA Not Analyzed.

TABLE 4-8

REGULATORY REQUIREMENTS AND DOSE-RESPONSE PARAMETERS FOR CHEMICALS OF CONCERN

Chemical	Safe Drinking Water Act(1)(2)(3)		Reference Dose(4) (mg/kg/day)		Ambient Water Quality Criteria(5) (µg/L)		Health Advisory(6) (mg/L)	Cancer Slope Factor(4)(7) (mg/kg/day)-1		EPA Weight of Evidence (4)(7)
	MCL (mg/L)	MCLG (mg/L)	Oral	Inhalation	Drinking Water Only	10^{-6} Risk		Oral	Inhalation	
Acetone			1×10^{-1}							
2-Butanone			5×10^{-2}	9×10^{-2}			1-Day/Child: 80 10-Day/Child: 8 Longer-term/Child: 3 Longer-term/Adult: 9 Lifetime/Adult: 0.2			D
Benzene	0.005	0			0	0.67	1-Day/Child: 0.200 10-Day/Child: 0.200	2.9×10^{-2}	2.9×10^{-2}	A
Ethylbenzene	0.7(d)	0.7(d)	1×10^{-1}		2,400		1-Day/Child: 30 10-Day/Child: 3 Longer-term/Child: 1 Longer-term/Adult: 3 Lifetime/Adult: 0.7			

(1) USEPA, July 8, 1987
(2) USEPA, August 18, 1988
(3) USEPA, May 22, 1989
(4) USEPA, October 1989
(5) USEPA, October 1986
(6) USEPA, April 5, 1989
(7) Chu and Chen, 1984

(a) 0.1 mg/L standard based on Class C weight-of-evidence
(b) Primary Drinking Water Standard
(c) Revoked by USEPA
(d) Proposed MCL/MCLG

EPA Weight of Evidence classification System for Carcinogenicity:
- A Human carcinogen
- B1 or B2 Probable human carcinogen
  - B1 indicates that limited human data are available
  - B2 indicates sufficient evidence in animals and inadequate or no evidence in humans
- C Possible human carcinogen
- D Not classifiable as to human carcinogenicity
- E Evidence of noncarcinogenicity for humans

TABLE 4-8 (CONTINUED)
REGULATORY REQUIREMENTS AND DOSE-RESPONSE PARAMETERS FOR CHEMICALS OF CONCERN
PAGE TWO OF THREE

Chemical	Safe Drinking Water Act(1)(2)(3)		Reference Dose(4) (mg/kg/day)		Ambient Water Quality Criteria(5) (µg/L)		Health Advisory(6) (mg/L)	Cancer Slope Factor(4)(7) (mg/kg/day)-1		EPA Weight of Evidence (4)(7)
	MCL (mg/L)	MCLG (mg/L)	Oral	Inhalation	Drinking Water Only	10^{-6} Risk		Oral	Inhalation	
Chlorobenzene	0.1(d)	0.1(d)	2×10^{-2}	5×10^{-3}	488		1-Day/Child: 2 10-Day/Child: 2 Longer-term/Child: 2 Longer-term/Adult: 7 Lifetime/Adult: 0.1			
Total Xylenes	10(d)	10(d)	2.0	7×10^{-2}			1-Day/Child: 40 10-Day/Child: 40 Longer-term/Child: 40 Longer-term/Adult: 100 Lifetime/Adult: 10			
Styrene	0.005/0.1(a)(d)	0/0.1(a)(d)	20				1-Day/Child: 20 10-Day/Child: 2 Longer-term/Child: 2 Longer-term/Adult: 7 Lifetime/Adult: 0/0.1(a)			B2/C
Methylene chloride			6×10^{-2}	9×10^{-1}	0	0.19	1-Day/Child: 10 10-Day/Child: 2	7.5×10^{-3}	1.2×10^{-7}	B2

(1) USEPA, July 8, 1987
(2) USEPA, August 18, 1988
(3) USEPA, May 22, 1989
(4) USEPA, October 1989
(5) USEPA, October 1986
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(a) 0.1 mg/L standard based on Class C weight-of-evidence
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TABLE 4-8 (CONTINUED)
REGULATORY REQUIREMENTS AND DOSE-RESPONSE PARAMETERS FOR CHEMICALS OF CONCERN
PAGE THREE OF THREE

Chemical	Safe Drinking Water Act(1)(2)(3)		Reference Dose(4) (mg/kg/day)		Ambient Water Quality Criteria(5) (µg/L)		Health Advisory(6) (mg/L)	Cancer Slope Factor(4)(7) (mg/kg/day)-1		EPA Weight of Evidence (4)(7)
	MCL (mg/L)	MCLG (mg/L)	Oral	Inhalation	Drinking Water Only	10^{-6} Risk		Oral	Inhalation	
Butylbenzylphthalate			2×10^{-1}							
Benzo(a)anthracene					0	3.1×10^{-3}		1.5×10^{1}	8.2×10^{-2}	B2
Benzo(b)fluoranthene					0	3.1×10^{-3}		9.2×10^{-1}	4.9×10^{-1}	B2
Benzo(k)floranthene					0	3.1×10^{-3}		5.1×10^{-2}	2.7×10^{-2}	B2
Benzo(a)pyrene					0	3.1×10^{-3}		11.5	6.1	B2
Indeno(1,2,3-cd)pyrene					0	3.1×10^{-3}		2.0×10^{-1}	1.0×10^{-1}	B2
Naphthalene			4×10^{-3}							
4,4'-DDT			5×10^{-4}					3.4×10^{-1}	3.4×10^{-1}	B2
Arsenic	0.05(b)	0.05(b)	1×10^{-3}		0	0.025			5.0×10^{-1}	A
Lead	0.05(b) 0.005(d)	0(d)	1.4×10^{-3}(c)		50					B2
Mercury	0.002(b)	0.002(b)	3×10^{-4}		10		Longer-term/Adult: 0.002 Lifetime/Adult: 0.002			D
Zinc			2×10^{-1}		5,000					

(1) USEPA, July 8, 1987
(2) USEPA, August 18, 1988
(3) USEPA, May 22, 1989
(4) USEPA, October 1989
(5) USEPA, October 1986
(6) USEPA, April 5, 1989
(7) Chu and Chen, 1984

(a) 0.1 mg/L standard based on Class C weight-of-evidence
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- C Possible human carcinogen
- D Not classifiable as to human carcinogenicity
- E Evidence of noncarcinogenicity for humans

TABLE 4-9

EXPOSURE ASSESSMENT SUMMARY(1)

Exposure Route	Input Parameters		
POTABLE USE OF GROUND WATER - OFFSITE (LOCAL RESIDENTS)			
Ingestion	Ingestion Rate:	Adults: Adolescents: Children:	2 L/day 1.5 L/day 1.0 L/day
	Exposure Frequency:	365 days/year	
	Exposure Duration:(2)	Adults:	70 years
	Lifetime:(2)	Adults:	70 years
	Body Weight:	Adults: Adolescents: Children:	70 kg 35 kg 10 kg
Inhalation(3)	Inhalation Rate:	Adults: Adolescents:	14 L/min 11 L/min
	Exposure Frequency:	1/day	
	Exposure Duration:	Adults:	70 years
	Lifetime:	Adults:	70 years
	Body Weight:	Adults: Adolescents:	70 kg 35 kg
Dermal Absorption	Permeability Constant:	0.0008 cm/hr	
	Skin Surface Area:	Adults: Adolescents: Children:	19,400 cm^2 14,900 cm^2 7,280 cm^2
	Exposure Time:	0.25 hr/day	
	Exposure Frequency:	365 days/year	
	Exposure Duration:	Adults:	70 years
	Lifetime:	Adults:	70 years
	Body Weight:	Adults: Adolescents: Children:	70 kg 35 kg 10 kg

(1) See text for parameter references.
(2) Exposure and lifetime terms for long-term (lifetime or working lifetime) risk estimates only (adults) for all exposure routes.
(3) Children not exposed through shower/inhalation route.

TABLE 4-9 (CONTINUED)
EXPOSURE ASSESSMENT SUMMARY(1)
PAGE TWO OF TWO

Exposure Route	Input Parameters		

SURFACE SOIL - OFFSITE (LOCAL RESIDENTS)

Exposure Route	Input Parameters		
Inhalation of Fugitive Dust	Inhalation Rate:	Adults: Adolescents: Children:	$0.83\ m^3/hr$ $0.43\ m^3/hr$ $0.12\ m^3/hr$
	Exposure Time:	24 hours/day	
	Exposure Frequency:	312 days/year	
	Exposure Duration:	70 years	
	Lifetime:	70 years	
	Body Weight:	Adults: Adolescent: Children:	70 kg 35 kg 10 kg

SURFACE SOIL - ONSITE (BASE PERSONNEL)

Exposure Route	Input Parameters		
Incidental Ingestion of Surface Soil	Ingestion Rate:	10 mg/event	
	Exposure Frequency:	12 events/year	
	Exposure Duration:	40 years	
	Lifetime:	70 years	
	Body Weight:	70 kg	
Dermal Contact With Surface Soil	Skin Surface Area:	$2{,}948\ cm^2$	
	Soil Adherence Factor:	$1.45\ mg/cm^2$	
	Absorption Factor:	Volatiles: Semivolatiles: Pesticides: Metals	0.10 0.05 0.05 0
	Exposure Frequency:	12 days/year	
	Exposure Duration:	40 years	
	Lifetime:	70 years	
	Body Weight:	70 kg	

(1) See text for parameter references.
(2) Exposure and lifetime terms for long-term (lifetime or working lifetime) risk estimates only (adults) for all exposure routes.
(3) Children not exposed through shower/inhalation route.

TABLE 4-10

DOSE ESTIMATES-OFFSITE RECEPTORS
DOMESTIC USE OF GROUND WATER
POL STORAGE AREA

Chemical	Dose Estimate (mg/kg/day)(1)				
	Ingestion and Dermal Absorption			Inhalation	
	Adult	Youth	Child	Adult	Youth
Ethylbenzene	1.7×10^{-4}	2.6×10^{-4}	6.0×10^{-4}	7.4×10^{-5}	1.2×10^{-4}
Xylenes	6.6×10^{-4}	9.9×10^{-4}	2.3×10^{-3}	2.8×10^{-4}	4.4×10^{-4}
Styrene	2.9×10^{-4}	4.3×10^{-4}	1.0×10^{-3}	1.2×10^{-4}	1.9×10^{-4}
Chlorobenzene	1.7×10^{-4}	2.6×10^{-4}	6.0×10^{-4}	7.1×10^{-5}	1.1×10^{-4}

(1) Calculations provided in Appendix E.

TABLE 4-11

DOSE ESTIMATES - OFFSITE RECEPTORS(2)
DOMESTIC USE OF GROUND WATER (BASED ON SOIL CONTAMINATION)

Chemical	Former Base Landfill Dose Estimates (mg/kg/day)(1)					POL Storage Area Dose Estimates (mg/kg/day)(1)				
	Ingestion and Dermal Absorption			Inhalation		Ingestion and Dermal Absorption			Inhalation	
	Adult	Youth	Child	Adult	Youth	Adult	Youth	Child	Adult	Youth
Acetone	NA	NA	NA	NA	NA	5.3×10^{-4}	7.9×10^{-4}	1.8×10^{-3}	4.8×10^{-5}	7.5×10^{-5}
2-Butanone	NA	NA	NA	NA	NA	1.2×10^{-4}	1.8×10^{-4}	4.2×10^{-4}	6.4×10^{-6}	1.0×10^{-5}
Benzene	NA	NA	NA	NA	NA	3.5×10^{-6}	5.2×10^{-6}	1.2×10^{-5}	1.7×10^{-6}	2.6×10^{-6}
Ethylbenzene	NA	NA	NA	NA	NA	3.4×10^{-4}	5.0×10^{-4}	1.2×10^{-3}	1.4×10^{-4}	2.3×10^{-4}
Xylenes	NA	NA	NA	NA	NA	2.4×10^{-5}	3.6×10^{-5}	8.4×10^{-5}	1.0×10^{-5}	1.6×10^{-5}
Styrene	NA	NA	NA	NA	NA	2.1×10^{-6}	3.1×10^{-6}	7.3×10^{-6}	8.6×10^{-7}	1.4×10^{-6}
Chlorobenzene	NA	NA	NA	NA	NA	8.5×10^{-7}	1.3×10^{-6}	3.0×10^{-6}	3.5×10^{-7}	5.5×10^{-7}
Methylene Chloride	NA	NA	NA	NA	NA	8.9×10^{-4}	1.3×10^{-3}	3.1×10^{-3}	3.9×10^{-4}	6.2×10^{-4}
Butylbenzylphthalate	7.5×10^{-5}	1.1×10^{-5}	2.5×10^{-5}	8.1×10^{-8}	1.2×10^{-7}	ND	ND	ND	ND	ND
Benzo(a)anthracene	3.0×10^{-6}	4.5×10^{-5}	1.0×10^{-5}	4.8×10^{-9}	7.5×10^{-9}	ND	ND	ND	ND	ND

(1) Calculations provided in Appendix E.
(2) Based on maximum soil concentrations.
ND Not detected.
NA Not analyzed.

TABLE 4-11 (CONTINUED)
DOSE ESTIMATES - OFFSITE RECEPTORS(2)
DOMESTIC USE OF GROUND WATER (BASED ON SOIL CONTAMINATION)
PAGE TWO OF TWO

Chemical	Former Base Landfill Dose Estimates (mg/kg/day)(1)					POL Storage Area Dose Estimates (mg/kg/day)(1)				
	Ingestion and Dermal Absorption			Inhalation		Ingestion and Dermal Absorption			Inhalation	
	Adult	Youth	Child	Adult	Youth	Adult	Youth	Child	Adult	Youth
Benzo(b)fluoranthene	3.5×10^{-6}	5.3×10^{-6}	1.2×10^{-5}	6.1×10^{-8}	9.6×10^{-8}	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	2.3×10^{-6}	3.5×10^{-6}	7.7×10^{-5}	1.1×10^{-7}	1.8×10^{-7}	ND	ND	ND	ND	ND
Benzo(a)pyrene	2.3×10^{-6}	3.5×10^{-6}	7.7×10^{-6}	1.7×10^{-9}	2.7×10^{-9}	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	6.6×10^{-7}	9.9×10^{-7}	2.2×10^{-6}	6.6×10^{-11}	1.0×10^{-10}	ND	ND	ND	ND	ND
Naphthalene	1.3×10^{-5}	2.0×10^{-5}	4.4×10^{-4}	3.8×10^{-6}	6.0×10^{-6}	1.1×10^{-5}	1.6×10^{-5}	3.8×10^{-5}	3.2×10^{-6}	5.0×10^{-6}
4,4'-DDT	7.3×10^{-8}	1.1×10^{-7}	2.5×10^{-7}	1.4×10^{-9}	2.2×10^{-9}	NA	NA	NA	NA	NA

(1) Calculations provided in Appendix E.
(2) Based on maximum soil concentrations.
ND Not detected.
NA Not analyzed.

TABLE 4-12

DOSE ESTIMATES - OFFSITE RECEPTORS(2)
FUGITIVE DUST EMISSIONS

Chemical	Former Base Landfill Dose Estimates (mg/kg/day)(1)			POL Storage Area Dose Estimates (mg/kg/day)(1)		
	Adult	Youth	Child	Adult	Youth	Child
Acetone	NA	NA	NA	5.1×10^{-10}	5.3×10^{-10}	5.1×10^{-10}
2-Butanone	NA	NA	NA	8.3×10^{-11}	8.6×10^{-11}	8.4×10^{-11}
Benzene	NA	NA	NA	3.6×10^{-10}	3.8×10^{-10}	3.7×10^{-10}
Ethylbenzene	NA	NA	NA	4.3×10^{-10}	4.4×10^{-10}	4.3×10^{-10}
Xylenes	NA	NA	NA	4.9×10^{-10}	5.0×10^{-10}	4.9×10^{-10}
Styrene	NA	NA	NA	ND	ND	ND
Chlorobenzene	NA	NA	NA	ND	ND	ND
Methylene Chloride	NA	NA	NA	ND	ND	ND
Butylbenzylphthalate	9.4×10^{-10}	9.8×10^{-10}	9.6×10^{-10}	ND	ND	ND
Benzo(a)anthracene	7.6×10^{-9}	7.9×10^{-9}	7.7×10^{-9}	ND	ND	ND
Benzo(b)fluoranthene	5.9×10^{-9}	6.1×10^{-9}	5.9×10^{-9}	ND	ND	ND
Benzo(k)fluoranthene	6.0×10^{-9}	6.2×10^{-9}	6.1×10^{-9}	ND	ND	ND

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
ND Not detected.
NA Not analyzed.

TABLE 4-12 (CONTINUED)
DOSE ESTIMATES - OFFSITE RECEPTORS(2)
FUGITIVE DUST EMISSIONS
PAGE TWO OF TWO

Chemical	Former Base Landfill Dose Estimates (mg/kg/day)(1)			POL Storage Area Dose Estimates (mg/kg/day)(1)		
	Adult	Youth	Child	Adult	Youth	Child
Benzo(a)pyrene	6.5×10^{-9}	6.7×10^{-9}	6.6×10^{-9}	ND	ND	ND
Indeno(1,2,3-cd)pyrene	3.0×10^{-9}	3.1×10^{-9}	3.1×10^{-9}	ND	ND	ND
Naphthalene	5.9×10^{-10}	6.1×10^{-10}	5.9×10^{-10}	ND	ND	ND
4,4'-DDT	3.2×10^{-11}	3.4×10^{-11}	3.3×10^{-11}	NA	NA	NA
Arsenic	1.0×10^{-7}	1.1×10^{-7}	1.1×10^{-7}	NA	NA	NA
Lead	4.6×10^{-6}	4.7×10^{-7}	4.6×10^{-7}	NA	NA	NA
Mercury	6.2×10^{-10}	6.4×10^{-10}	6.3×10^{-10}	NA	NA	NA
Zinc	5.8×10^{-7}	6.1×10^{-7}	5.9×10^{-7}	NA	NA	NA

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
ND Not detected.
NA Not analyzed.

TABLE 4-13

DOSE ESTIMATES - ONSITE RECEPTORS(2)
SURFACE SOIL EXPOSURES

Chemical	Former Base Landfill Dose Estimates (mg/kg/day)(1)		POL Storage Area Dose Estimates (mg/kg/day)(1)	
	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils
Acetone	NA	NA	1.2×10^{-9}	5.0×10^{-8}
2-Butanone	NA	NA	1.9×10^{-10}	8.2×10^{-9}
Benzene	NA	NA	8.4×10^{-10}	3.6×10^{-8}
Ethylbenzene	NA	NA	9.9×10^{-10}	4.2×10^{-8}
Xylenes	NA	NA	1.1×10^{-9}	4.8×10^{-8}
Styrene	NA	NA	ND	ND
Chlorobenzene	NA	NA	ND	ND
Methylene Chloride	NA	NA	ND	ND
Butylbenzylphthalate	1.3×10^{-9}	2.9×10^{-8}	ND	ND
Benzo(a)anthracene	1.1×10^{-8}	2.4×10^{-7}	ND	ND
Benzo(b)fluoranthene	8.4×10^{-9}	1.8×10^{-7}	ND	ND
Benzo(k)fluoranthene	8.7×10^{-9}	1.9×10^{-7}	ND	ND

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
(3) Metals in soil are not dermally absorbed.
ND Not detected.
NA Not analyzed.

TABLE 4-13 (CONTINUED)
DOSE ESTIMATES - ONSITE RECEPTORS(2)
SURFACE SOIL EXPOSURES
PAGE TWO OF TWO

Chemical	Former Base Landfill Dose Estimates (mg/kg/day)(1)		POL Storage Area Dose Estimates (mg/kg/day)(1)	
	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils
Benzo(a)pyrene	9.4×10^{-9}	2.0×10^{-7}	ND	ND
Indeno(1,2,3-cd)pyrene	4.4×10^{-9}	9.3×10^{-8}	ND	ND
Naphthalene	8.4×10^{-10}	1.8×10^{-8}	ND	ND
4,4'-DDT	4.7×10^{-11}	1.0×10^{-9}	NA	NA
Arsenic	1.5×10^{-7}	(3)	NA	NA
Lead	6.6×10^{-7}	(3)	NA	NA
Mercury	8.9×10^{-10}	(3)	NA	NA
Zinc	8.4×10^{-7}	(3)	NA	NA

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
(3) Metals in soil are not dermally absorbed.
ND Not detected.
NA Not analyzed.

TABLE 4-14

HAZARD QUOTIENTS-OFFSITE RECEPTORS
DOMESTIC USE OF GROUND WATER
POL STORAGE AREA

Chemical	Hazard Quotient(1)				
	Ingestion and Dermal Absorption			Inhalation	
	Adult	Youth	Child	Adult	Youth
Ethylbenzene	1.7×10^{-3}	2.6×10^{-3}	6.0×10^{-3}	--	--
Xylenes	3.3×10^{-4}	4.9×10^{-4}	1.1×10^{-3}	7.0×10^{-4}	1.1 x 10-3
Styrene	1.4×10^{-3}	2.1×10^{-3}	5.0×10^{-3}	--	--
Chlorobenzene	5.7×10^{-3}	8.6×10^{-3}	2.0×10^{-2}	1.4×10^{-2}	2.2×10^{-2}
Total (Hazard Index)	9.2×10^{-3}	1.4×10^{-2}	3.2×10^{-2}	1.5×10^{-2}	2.3×10^{-2}

(1) Calculations provided in Appendix E.

-- No reference dose available for this route of exposure.

TABLE 4-15

HAZARD QUOTIENTS - OFFSITE RECEPTORS(2)
DOMESTIC USE OF GROUND WATER (BASED ON SOIL CONTAMINATION)

Chemical	Former Base Landfill Hazard Quotient(1)					POL Storage Area Hazard Quotient(1)				
	Ingestion and Dermal Absorption			Inhalation		Ingestion and Dermal Absorption			Inhalation	
	Adult	Youth	Child	Adult	Youth	Adult	Youth	Child	Adult	Youth
Acetone	NA	NA	NA	NA	NA	$5.3x10^{-3}$	$7.9x10^{-3}$	$1.8x10^{-2}$	--	--
2-Butanone	NA	NA	NA	NA	NA	$2.4x10^{-3}$	$3.6x10^{-3}$	$8.5x10^{-3}$	$7.1x10^{-5}$	$1.1x10^{-4}$
Benzene	NA	NA	NA	NA	NA	--	--	--	--	--
Ethylbenzene	NA	NA	NA	NA	NA	$3.4x10^{-3}$	$5.0x10^{-3}$	$1.2x10^{-2}$	--	--
Xylenes	NA	NA	NA	NA	NA	$1.2x10^{-5}$	$1.8x10^{-5}$	$4.2x10^{-5}$	$2.6x10^{-5}$	$4.0x10^{-5}$
Styrene	NA	NA	NA	NA	NA	$1.0x10^{-7}$	$1.6x10^{-7}$	$3.6x10^{-7}$	--	--
Chlorobenzene	NA	NA	NA	NA	NA	$4.2x10^{-5}$	$6.4x10^{-5}$	$1.5x10^{-4}$	$7.0x10^{-5}$	$1.1x10^{-4}$
Methylene Chloride	NA	NA	NA	NA	NA	$1.5x10^{-2}$	$2.2x10^{-2}$	$5.2x10^{-2}$	$4.4x10^{-4}$	$6.9x10^{-4}$
Butylbenzylphthalate	$3.7x10^{-5}$	$5.6x10^{-4}$	$1.2x10^{-4}$	--	--	ND	ND	ND	ND	ND
Benzo(a)anthracene	--	--	--	--	--	ND	ND	ND	ND	ND

(1) Calculations provided in Appendix E.
(2) Based on maximum soil concentrations.
ND Not detected.
NA Not analyzed.
-- No reference dose available for this route of exposure.

TABLE 4-15 (CONTINUED)
HAZARD QUOTIENTS - OFFSITE RECEPTORS(2)
DOMESTIC USE OF GROUND WATER (BASED ON SOIL CONTAMINATION)
PAGE TWO OF TWO

Chemical	Former Base Landfill Hazard Quotient(1)					POL Storage Area Hazard Quotient(1)				
	Ingestion and Dermal Absorption			Inhalation		Ingestion and Dermal Absorption			Inhalation	
	Adult	Youth	Child	Adult	Youth	Adult	Youth	Child	Adult	Youth
Benzo(b)fluoranthene	--	--	--	--	--	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	--	--	--	--	--	ND	ND	ND	ND	ND
Benzo(a)pyrene	--	--	--	--	--	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	ND	ND	ND	ND	ND
Naphthalene	$3.3x10^{-3}$	$4.9x10^{-3}$	$1.1x10^{-2}$	--	--	$2.7x10^{-3}$	$4.1x10^{-3}$	$9.6x10^{-3}$	--	--
4,4'-DDT	$1.5x10^{-4}$	$2.2x10^{-4}$	$4.9x10^{-4}$	--	--	NA	NA	NA	NA	NA
Total (Hazard Index)	$3.5x10^{-3}$	$5.2x10^{-3}$	$1.2x10^{-2}$	--	--	$2.9x10^{-2}$	$4.3x10^{-2}$	$1.0x10^{-1}$	$6.0x10^{-4}$	$9.5x10^{-4}$

(1) Calculations provided in Appendix E.
(2) Based on maximum soil concentrations.
ND Not detected.
NA Not analyzed.
-- No reference dose available for this route of exposure.

TABLE 4-16

HAZARD QUOTIENTS - OFFSITE RECEPTORS(2)
FUGITIVE DUST EMISSIONS

Chemical	Former Base Landfill Hazard Quotient(1)			POL Storage Area Hazard Quotient(1)		
	Adult	Youth	Child	Adult	Youth	Child
Acetone	NA	NA	NA	3.2×10^{-9}	3.3×10^{-9}	3.2×10^{-9}
2-Butanone	NA	NA	NA	1.2×10^{-9}	1.2×10^{-9}	1.2×10^{-9}
Benzene	NA	NA	NA	--	--	--
Ethylbenzene	NA	NA	NA	2.7×10^{-9}	2.8×10^{-9}	2.7×10^{-9}
Xylenes	NA	NA	NA	3.0×10^{-10}	3.2×10^{-10}	3.1×10^{-10}
Styrene	NA	NA	NA	ND	ND	ND
Chlorobenzene	NA	NA	NA	ND	ND	ND
Methylene Chloride	NA	NA	NA	ND	ND	ND
Butylbenzylphthalate	2.9×10^{-9}	3.0×10^{-9}	3.0×10^{-9}	ND	ND	ND
Benzo(a)anthracene	--	--	--	ND	ND	ND

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
ND Not detected.
NA Not analyzed.
-- No reference dose available for this route of exposure.

TABLE 4-16 (CONTINUED)
HAZARD QUOTIENTS - OFFSITE RECEPTORS(2)
FUGITIVE DUST EMISSIONS
PAGE TWO OF TWO

Chemical	Former Base Landfill Hazard Quotient(1)			POL Storage Area Hazard Quotient(1)		
	Adult	Youth	Child	Adult	Youth	Child
Benzo(b)fluoranthene	--	--	--	ND	ND	ND
Benzo(k)fluoranthene	--	--	--	ND	ND	ND
Benzo(a)pyrene	--	--	--	ND	ND	ND
Indeno(1,2,3-cd)pyrene	--	--	--	ND	ND	ND
Naphthalene	9.1×10^{-8}	9.5×10^{-8}	9.3×10^{-8}	ND	ND	ND
4,4'-DDT	4.1×10^{-8}	4.2×10^{-8}	4.1×10^{-8}	NA	NA	NA
Arsenic	6.6×10^{-5}	6.8×10^{-5}	6.7×10^{-5}	NA	NA	NA
Lead	2.0×10^{-4}	2.1×10^{-4}	2.1×10^{-4}	NA	NA	NA
Mercury	1.3×10^{-6}	1.3×10^{-6}	1.3×10^{-6}	NA	NA	NA
Zinc	1.8×10^{-6}	1.9×10^{-6}	1.8×10^{-6}	NA	NA	NA
Total (Hazard Index)	2.7×10^{-4}	2.8×10^{-4}	2.8×10^{-4}	7.3×10^{-9}	7.6×10^{-9}	7.4×10^{-9}

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
ND Not detected.
NA Not analyzed.
-- No reference dose available for this route of exposure.

TABLE 4-17

HAZARD QUOTIENTS - ONSITE RECEPTORS(2) SURFACE SOIL EXPOSURES

Chemical	Former Base Landfill Hazard Quotient(1)		POL Storage Area Hazard Quotient(1)	
	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils
Acetone	NA	NA	1.2×10^{-8}	5.0×10^{-7}
2-Butanone	NA	NA	3.8×10^{-9}	1.6×10^{-7}
Benzene	NA	NA	--	--
Ethylbenzene	NA	NA	9.9×10^{-9}	4.2×10^{-7}
Xylenes	NA	NA	5.6×10^{-10}	2.4×10^{-8}
Styrene	NA	NA	ND	ND
Chlorobenzene	NA	NA	ND	ND
Methylene Chloride	NA	NA	ND	ND
Butylbenzylphthalate	6.8×10^{-9}	1.4×10^{-7}	ND	ND
Benzo(a)anthracene	--	--	ND	ND

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
(3) Metals in soil are not dermally absorbed.
ND Not detected.
NA Not analyzed.
-- No reference dose available for this route of exposure.

TABLE 4-17 (CONTINUED)
HAZARD QUOTIENTS - ONSITE RECEPTORS(2)
SURFACE SOIL EXPOSURES
PAGE TWO OF TWO

Chemical	Former Base Landfill Hazard Quotient(1)		POL Storage Area Hazard Quotient(1)	
	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils
Benzo(b)fluoranthene	--	--	ND	ND
Benzo(k)fluoranthene	--	--	ND	ND
Benzo(a)pyrene	--	--	ND	ND
Indeno(1,2,3-cd)pyrene	--	--	ND	ND
Naphthalene	2.1×10^{-7}	4.5×10^{-6}	ND	ND
4,4'-DDT	9.4×10^{-8}	2.0×10^{-6}	NA	NA
Arsenic	1.5×10^{-4}	(3)	NA	NA
Lead	4.7×10^{-4}	(3)	NA	NA
Mercury	3.0×10^{-6}	(3)	NA	NA
Zinc	4.2×10^{-6}	(3)	NA	NA
Total (Hazard Index)	6.3×10^{-4}	6.7×10^{-6}	2.6×10^{-8}	1.1×10^{-6}

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
(3) Metals in soil are not dermally absorbed.
ND Not detected.
NA Not analyzed.
-- No reference dose available for this route of exposure.

TABLE 4-18

INCREMENTAL CANCER RISKS-OFFSITE RECEPTORS (ADULTS) DOMESTIC USE OF GROUND WATER (BASED ON SOIL CONCENTRATIONS) POL STORAGE AREA

Chemical	Former Base Landfill Incremental Cancer Risk(1)		POL Storage Area Incremental Cancer Risk(1)	
	Ingestion and Dermal Absorption	Inhalation	Ingestion and Dermal Absorption	Inhalation
Acetone	NA	NA	--	--
2-Butanone	NA	NA	--	--
Benzene	NA	NA	$1.0x10^{-7}$	$4.9x10^{-8}$
Ethylbenzene	NA	NA	--	--
Xylenes	NA	NA	--	--
Styrene	NA	NA	--	--
Chlorobenzene	NA	NA	--	--
Methylene Chloride	NA	NA	$6.7x10^{-6}$	$4.7x10^{-11}$
Butylbenzylphthalate	--	--	ND	ND
Benzo(a)anthracene	$4.5x10^{-7}$	$3.9x10^{-10}$	ND	ND
Benzo(b)fluoranthene	$3.2x10^{-6}$	$3.0x10^{-8}$	ND	ND
Benzo(k)fluoranthene	$1.8x10^{-6}$	$4.6x10^{-8}$	ND	ND
Benzo(a)pyrene	$2.7x10^{-5}$	$1.0x10^{-8}$	ND	ND
Indeno(1,2,3-cd)pyrene	$1.3x10^{-7}$	$6.6x10^{-12}$	ND	ND
Naphthalene	--	--	--	--
4,4'-DDT	$2.5x10^{-8}$	$4.7x10^{-10}$	NA	NA
Total Risk	$3.2x10^{-5}$	$8.7x10^{-8}$	$6.8x10^{-6}$	$4.9x10^{-8}$

(1) Calculations provided in Appendix E.
ND Not detected.
NA Not analyzed
-- No cancer slope factor available for this route of exposure.

TABLE 4-19

INCREMENTAL CANCER RISKS - OFFSITE RECEPTORS(2)
FUGITIVE DUST EMISSIONS

Chemical	Former Base Landfill Incremental Cancer Risk(1)	POL Storage Area Incremental Cancer Risk(1)
	Adult	Adult
Acetone	NA	--
2-Butanone	NA	--
Benzene	NA	7.9×10^{-12}
Ethylbenzene	NA	--
Xylenes	NA	--
Styrene	NA	ND
Chlorobenzene	NA	ND
Methylene Chloride	NA	ND
Butylbenzylphthalate	--	ND
Benzo(a)anthracene	8.0×10^{-10}	ND
Benzo(b)fluoranthene	3.7×10^{-9}	ND
Benzo(k)fluoranthene	3.2×10^{-9}	ND
Benzo(a)pyrene	5.2×10^{-8}	ND
Indeno(1,2,3-cd)pyrene	4.2×10^{-10}	ND
Naphthalene	--	ND
4,4'-DDT	8.3×10^{-12}	NA
Arsenic	6.6×10^{-7}	NA
Lead	--	NA
Mercury	--	NA
Zinc	--	NA
Total Risk	7.2×10^{-7}	7.9×10^{-12}

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
ND Not detected.
NA Not analyzed
-- No cancer slope factor available for this route of exposure.

TABLE 4-20

INCREMENTAL CANCER RISKS - ONSITE RECEPTORS
SURFACE SOIL EXPOSURES

Chemical	Former Base Landfill Incremental Cancer Risk(1)		POL Storage Area Incremental Cancer Risk(1)	
	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils
Acetone	NA	NA	--	--
2-Butanone	NA	NA	--	--
Benzene	NA	NA	1.4×10^{-11}	6.0×10^{-10}
Ethylbenzene	NA	NA	--	--
Xylenes	NA	NA	--	--
Styrene	NA	NA	ND	ND
Chlorobenzene	NA	NA	ND	ND
Methylene Chloride	NA	NA	ND	ND
Butylbenzylphthalate	--	--	ND	ND
Benzo(a)anthracene	9.5×10^{-10}	2.0×10^{-8}	ND	ND

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
(3) Metals in soil are not dermally absorbed.
ND Not detected.
NA Not analyzed
-- No cancer slope factor available for this route of exposure.

TABLE 4-20 (CONTINUED)
INCREMENTAL CANCER RISKS - ONSITE RECEPTORS
SURFACE SOIL EXPOSURES
PAGE TWO OF TWO

Chemical	Former Base Landfill Incremental Cancer Risk(1)		POL Storage Area Incremental Cancer Risk(1)	
	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils	Incidental Ingestion of Onsite Surface Soils	Dermal Contact with Onsite Surface Soils
Benzo(b)fluoranthene	$4.4x10^{-9}$	$9.5x10^{-8}$	ND	ND
Benzo(k)fluoranthene	$3.8x10^{-9}$	$8.1x10^{-8}$	ND	ND
Benzo(a)pyrene	$6.2x10^{-8}$	$1.3x10^{-6}$	ND	ND
Indeno(1,2,3-cd)pyrene	$5.0x10^{-10}$	$1.1x10^{-8}$	ND	ND
Naphthalene	--	--	ND	ND
4,4'-DDT	$9.1x10^{-12}$	$1.9x10^{-10}$	NA	NA
Arsenic	--	(3)	NA	NA
Lead	--	(3)	NA	NA
Mercury	--	(3)	NA	NA
Zinc	--	(3)	NA	NA
Total Risk	$7.1x10^{-8}$	$1.5x10^{-6}$	$1.4x10^{-11}$	$6.0x10^{-10}$

(1) Calculations provided in Appendix E.
(2) Based on maximum surface or near-surface soil concentrations.
(3) Metals in soil are not dermally absorbed.
ND Not detected.
NA Not analyzed
-- No cancer slope factor available for this route of exposure.

5.0 SUMMARY AND CONCLUSIONS

The following sections summarize the results of the SI and present conclusions and recommendations for further actions. A meeting was held at Ellington Field (ANG) on October 3, 1990 to review comments on the draft SI Report from regulatory agencies involved with the SI activities. Minutes from the meeting are provided in Appendix G. Also contained in Appendix G is a letter from the National Guard Bureau to the Texas Water Commission (TWC) advising them of the meeting outcome and requesting comments on the SI Report, as a TWC representative was not present at the review meeting.

5.1 FORMER BASE LANDFILL

5.1.1 Summary

A geophysical survey utilizing magnetometry and electromagnetic conductivity techniques was conducted at the Former Base Landfill. The resulting data allowed for the characterization of shallow subsurface soils and the identification of areas where waste disposal activities had occurred. Two possible locations for the UST at the former incinerator site were also determined.

Three distinct stratigraphic zones were identified through the soils investigation conducted at the landfill. Zone 2, a layer of brown clayey silt and silty sand, was the first zone of saturated sediments beneath the site with sufficient permeability to yield ground water to a borehole during drilling. Nine subsurface soil samples and three surface soil samples were collected during the investigation and sent to a fixed-base laboratory for chemical analysis.

It was determined through water level measurements that the direction of ground-water flow in shallow sediments beneath the landfill is generally to the east-northeast, or toward the commercial sand pit adjacent to the site. Slug tests performed at the wells installed at the site allowed for the estimation of hydraulic conductivities of the Zone 2 sediments. Five ground-water samples were collected and sent to a fixed-base laboratory for chemical analysis.

No volatile organic compounds were identified through laboratory analysis in soil or ground-water samples collected from the site. Several pesticides were detected in soils and ground water at low concentrations, and several BNAs were present in surface soil samples. However, the analytical data does not appear to indicate a gross contamination problem associated with disposal of wastes at the Former Base Landfill.

5.1.2 Conclusions

A preliminary risk assessment was performed and concluded that there did not appear to be any significant risks to human health based on the available data and the exposure scenarios considered.

5.1.3 Recommendations

Based on the findings of the SI activities, it is recommended that a Decision Document be prepared substantiating that no further action is necessary at the Former Base Landfill.

5.2 POL STORAGE AREA

5.2.1 Summary

A soils investigation conducted at the POL Storage Area indicated that the soil profile beneath the site was extremely similar to the profile beneath the Former Base Landfill. As at the landfill, Zone 2 was the first zone to yield ground water to a borehole during drilling. However, water level data suggest that the overlying silty clays of Zone 1B may be saturated, but are not permeable enough to rapidly transmit water. Twenty-three subsurface soil samples were collected and sent to a fixed-base laboratory for chemical analysis.

Ground-water flow direction in shallow sediments beneath the site is predominantly to the east. Estimates of hydraulic conductivity, transmissivity and seepage velocity were calculated based on slug test results and site-specific hydrogeologic data. Four ground-water samples were collected and sent to a fixed-base laboratory for chemical analysis.

Contamination was detected in soil samples collected from three of the borings drilled at the POL Storage Area. The most contaminated boring, SB-13, is located within the diked area, just west of the railroad spur. It is adjacent to a portion of the former remediation trench in which petroleum hydrocarbons are known to exist in remaining soils at levels above TWC criteria for clean closure. Another of these borings, SB-10, was drilled through the trench backfill at the north end of the spur. The well installed at that location (MW-10) yielded the only ground-water sample in which contamination was detected. Gross contamination at the POL Storage Area is not apparent based on the results of the SI. However, samples collected from the walls and floor of the former remediation trench prior to backfilling indicate that petroleum hydrocarbons are present in remaining soils and fill material at concentrations above 100 ppm (TWC criteria for clean closure).

5.2.2 Conclusions

A preliminary risk assessment was performed and concluded that there did not appear to be any significant risks to human health based on data generated during the SI and the exposure scenarios considered. However, the extent of soil contamination in the immediate vicinity of the former remediation trench should be further delineated prior to reaching a decision regarding further action at the site. Also, there is a lack of ground-water quality and usage information for the uppermost permeable sediments encountered at Ellington Field (ANG).

5.2.3 Recommendations

To further delineate the extent of soil contamination adjacent to the former remediation trench, a series of soil borings should be installed along the western edge of the concrete driveway at the POL Storage Area. If substantial contamination exists in soils at or near the top of ground water, monitoring wells should be installed to determine whether ground-water quality has been affected by the vertical migration of fuel through soils. A ground-water well survey should be conducted as part of the follow on remedial investigation tasks planned at the POL Storage Area.

6.0 ACRONYMS

ANG	-	Air National Guard
BCF	-	Bioconcentration Factor
BHC	-	Benzene Hexachloride
BNA	-	Base Neutrals/Acid Extractables
BTEX	-	Benzene, Toluene, Ethylbenzene, and Xylene
CLP	-	Contract Laboratory Program
DDD	-	Dichlorodiphenyldichlorothane
DDE	-	Dichlorodiphenyldichloroethylene
DDT	-	Dichlorodiphenyltrichloroethane
DOE	-	Department of Energy
FID	-	Flame Ionization Detector
FIG	-	Fighter Interceptor Group
HAZWRAP	-	Hazardous Waste Remedial Actions Program
IRP	-	Installation Restoration Program
JP-4	-	Jet Petroleum Number 4 Fuel
MS/MSD	-	Matrix Spike/Matrix Spike Duplicate
MSL	-	Mean Sea Level
NUS	-	NUS Corporation
PA	-	Preliminary Assessment
PAHs	-	Polynuclear Aromatic Hydrocarbons
PID	-	Photoionization Detector
POL	-	Petroleum, Oils, and Lubricants
QA/QC	-	Quality Assurance/Quality Control
RfD	-	Reference Dose
SAP	-	Sampling and Analysis Plan
SI	-	Site Investigation
TAL	-	Target Analyte List
TCL	-	Target Compound List
TPH	-	Total Petroleum Hydrocarbons
TWC	-	Texas Water Commission
UST	-	Underground Storage Tank

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APPENDIX A

FIELD DATA

BORING LOGS

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 3

LOCATION OF BORING: North side of landfill, approximately 10' from boundary fence, position 6/0	**PROJECT:** Ellington Field Site Investigation
	BORING NO. MW-61
	TOTAL DEPTH: 29.5
	JOB NO.: 363M
	LOGGED BY: D. Untherrove
	PROJ. MGR.: L. Steekler
	EDITED BY:
	DRILLING CONTRACTOR: Custom Coring, Inc.
	DRILL RIG TYPE: ATV (Buggy) Rig
	DRILLERS NAME: Zane Griffin
	SAMPLING METHODS: Hollow Stem Augers, Split Spoon (SS) / Shelby Tube (ST)
	STARTED, TIME: 1500 / **DATE:** 12-12-89
	COMPLETED, TIME: 1130 / **DATE:** 12-13-89
	BORING DEPTH (ft.) 29.5
	WATER DEPTH (ft.) 16.12'
	TIME: 950
	DATE: 12-13-89
	BACKFILLED, TIME: 1300 / **DATE:** 12-13 / **BY:** Coring
	SURFACE ELEV.: 35.90 / **DATUM:** Natural ground
	CONDITIONS:

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
0-2	SS	N	24	24	4	NA			CL	0-2		GREEN GRAY CLAY, stiff, slightly silty, iron staining, roots, some calcareous matter @ base
2-4	SS	N	24	22	1	NA			CL	2-4		Same as above, hard, iron nodules, abundant calc. matter @ base
4-6	SS	N	24	22	2	NA			CL	4-6		Top 14" same as above; then a 4" zone of calcareous matter, then 4" of RUST SILTY CLAY, med stiff
6-8	SS	N	24	20	2	NA			CL	6-8		RUST V. SILTY CLAY, soft-med. stiff, iron staining abundant calcareous matter (up to 1" in diameter)
8-10	SS	N	24	20	0	NA			CL	8-10		RUST AND BROWN V. SILTY CLAY, soft, damp, some v. fine sand @ base

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT: Ellington SI | NO 363W1 | BORING NO MW-01

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU			USCS	DESCRIPTION
10-12	SS	N	24	20	0	NA			CL-ML	BROWN CLAYEY SILT, damp, contains some fine grained sand
12-14	SS	N	24	22	0	NA			CL-ML	BROWN AND RUST VERY SILTY CLAY, wet, sandy at base
14-16	SS	N	24	22	0	NA			SC	BROWN CLAYEY FINE-GRAINED SAND, wet, some semi-consolidated sandstone @ base (had to drive, not push sampler)
16-18	SS	Y	24	24	0	0			CL-ML	BROWN SILTY CLAY/CLAYEY SILT, saturated, some v. fine sand. Collected 01-SB01A-A @ 950
18-20	SS	N	24	10	0	0			CL-ML	Same as above
20-22	SS	N	24	24	20	2			CL-ML	Same as above
22-24	SS	N	24	24	0	0			SM	BROWN SILTY FINE-GRAINED SAND, saturated, minor amts. of clay
24-26	SS	N	24	24	0	0			SM	Same as above
26-28	SS	Y	24	24	20	2			SM-ML / CL	12" same as above; 6" GRAY-GREEN CLAY, hard, minor amts of sand. Apparently the contact between the first aquifer and a confining layer below. Collect 01-SB01B-A @ 1055
28-30	SS	N	18	18	0	0			CL	GREEN-GRAY AND RUST MOTTLED CLAY, v. hard.

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 3

LOCATION OF BORING: East side of landfill, 10' from eastern boundary fence, position 425

PROJECT: Ellington Field Site Investigation	BORING NO. MW-07
	TOTAL DEPTH: 28.5
JOB NO.: 3634	LOGGED BY: D. Unthermore
PROJ. MGR: L. Steakley	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: ATV (Buggy) Rig	
DRILLERS NAME: Zane Ruffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED, TIME: 12:50	DATE: 12-14-89
COMPLETED, TIME: 1500	DATE: 12-14-89
BORING DEPTH (ft): 28.5	
WATER DEPTH (ft.): 16-18'	
TIME: 1410	
DATE: 12-14-89	
BACKFILLED, TIME: 1545	DATE: 12-14 BY: Pouring
SURFACE ELEV.: 34.78	DATUM: Natural Ground
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
0-2	SS	N	24	14	3	NA			CL	0-2		BROWN SILTY CLAY, stiff, moist, abundant roots, small amts of sand
2-4	SS	N	24	24	1	NA			CL	2-4		GRAY AND ORANGE MOTTLED CLAY, stiff, bottom 6" silty, contains sand fissure
4-6	SS	N	24	18	0	NA			CL	4-6		GRAY SILTY CLAY, ~~Fe~~ iron staining and nodules, v. stiff, small amts. of v. fine sand
6-8	SS	N	24	18	0	NA			CL	6-8		Same as above, sandier @ base
8-10	SS	N	24	~~14~~ 20	3	NA			SM	8-10		~~tan~~ TAN SLIGHTLY SILTY SAND, v. fine to fine, iron staining, moist

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 3 OF 3

PROJECT Ellington SI | NO 363 W1 | BORING NO MW-07

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
10-12	SS	N	24	22	1	NA			SM			Same as above, minor amts of clay
12-14	SS	N	24	24	1.5	NA			SM	2		Same as above, turning orange in color, damper
~~12-14~~										3		
14-16	SS	N	24	22	2	NA			SM	4		Same as above
										5		
16-18	SS	Y	24	24	1	NA			SP	6		TAN FINE TO MEDIUM SAND, wet; Collect 01-SB02A-A @ 1410
										7		
18-20	SS	N	24	8	0	NA			SP	8		Same as above, saturated
										9		
20-22	SS	N	24	10	1	NA			SP	0		Same as above
22-24	SS	N	24	24	1	NA			SP	2		Same as above; rust clay laminae in bottom 6"
										3		
24-26	SS	N	24	24	1	NA			CL	4		GRAY AND RUST CLAY, hard, iron staining, ~~hard~~ small amts of silt
										5		
26-28	SS	N	24	24	NA	NA			CL	6		Same as above
										7		
										8		
										9		
										0		

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: South side of landfill, 10' north of southern boundary fence, 10' east of fence around munitions iglos

PROJECT: Ellington Field Site Investigation

BORING NO: MW-03

TOTAL DEPTH: 24'

JOB NO.: 363M

LOGGED BY: D. Unthermve

PROJ. MGR.: L. Steakley

EDITED BY:

DRILLING CONTRACTOR: Custom Coring, Inc.

DRILL RIG TYPE: ATV (buggy) Rig

DRILLERS NAME: Zane Ruffin

SAMPLING METHODS: Hollow Stem Augers, Split Spoon (SS) | Shelby Tube (ST)

STARTED, TIME: 1515 | **DATE:** 12-13-89

COMPLETED, TIME: 0900 | **DATE:** 12-14-89

BORING DEPTH (ft.) 24'

WATER DEPTH (ft.) 12-14'

TIME: 1615

DATE: 12-13-89

BACKFILLED, TIME: 1050 **DATE:** 12-14 **BY:** Pouring

SURFACE ELEV.: 36.15 | **DATUM:** Natural Ground

CONDITIONS:

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	CONDITIONS
0-2	SS	N	24	22	0	NA			CH-CL			6" DARK BROWN CLAY, soft, roots 16" GREEN-GRAY CLAY, stiff, iron staining, abundant calcareous zones, friable
										1		
2-4	SS	N	24	18	1	NA			CH-CL	2		Same as above
									~~CH-CL~~	3		
4-6	SS	N	24	20	NA	NA			CH-CL	4		Same as above w/ large calc. gravel (up to 1½" in diameter)
										5		
6-8	SS	N	24	16	7	NA			CH-CL	6		Same as above, iron staining, moist
										7		
8-10	SS	Y	24	20	30	NA			CL	8		BROWN AND GRAY SILTY CLAY, iron staining, collect 01-SB03A-A @ 1600
										9		
										10		

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT: Ellington SI | NO 363W | BORING NO MW-013

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU			USCS
10-12	SS	N	24	8	6	NA			CL
12-14	SS	Y	24	22	1	NA			SM
14-16	SS	N	24	20	4	NA			SM-ML CL
16-18	SS	N	24	22	1	NA			CL
18-20	SS	N	24	22	1	NA			CL
20-22	SS	N	24	20	10	NA			CL
22-24	SS	N	24	20	NA	NA			CL

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: West side of landfill, approximately 10' from boundary fence, position 425'

PROJECT: Ellington Field Site Investigation	BORING NO. MW-04
	TOTAL DEPTH: 25'
JOB NO.: 363M	LOGGED BY: D. Uptherove
PROJ. MGR.: L. Steakley	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: Buggy (ATV) Rig	
DRILLERS NAME: Zane Ruffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED, TIME: 940	DATE: 12-12-89
COMPLETED, TIME: 1215	DATE: 12-12-89
BORING DEPTH (ft.)	25'
WATER DEPTH (ft.)	12-14'
TIME:	1050
DATE:	12-12-89
BACKFILLED, TIME: 1400	DATE: 12-12 BY: Boring
SURFACE ELEV.: 36.98	DATUM: Natural Ground
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	CONDITIONS
0-2	SS	N	24	24	0	NA			CL	0–2		BROWN SILTY CLAY, soft to med. stiff; iron staining, abundant roots, some v. fine grained tan sand
2-4	SS	N	24	24	0	NA			CL	2–4		Same as above, fewer roots, more sand and some iron nodules
4-6	SS	Y	24	22	6	NA			CL	4–6		BROWN AND ORANGE VERY SILTY CLAY, med. stiff calcareous matter, some v. fine gr. sand. Collect 01-SB04-A @ 1010
6-8	SS	N	24	20	0	NA			SC	6–8		TAN AND ORANGE CLAYEY V. FINE GR. SAND
8-10	SS	N	24	22	0	NA			SC	8–10		Same as above

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 3 OF 3

PROJECT: Ellington SI | NO 363 W1 | BORING NO MW-04

DEPTH	TYPE	LAB	PUSHED	REC'D	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
										1		Same as above, moist
10-12	SS	N	24	16	0	NA			SC	2		
12-14	SS	Y	24	18	0	NA			SC	3		BROWN CLAYEY FINE SAND, wet (top of gw) Collect 01-SB04B-A @ 1050
										4		
14-16	SS	N	24	8	0	NA			SC	5		Same as above
										6		
16-18	SS	N	24	8	0	NA			SM	7		~~Brown silty fine~~ BROWN SILTY FINE SAND, saturated
										8		
18-20	SS	N	24	0	NA	NA			?	9		No Recovery - even w/ catcher, sample would not remain in split spoon
										0		
20-22	SS	N	24	0	NA	NA			?	1		No Recovery
										2		
22-24	SS	N	24	0	NA	NA			?	3		No Recovery
										4		
										5		
										6		
										7		
										8		
										9		
										0		

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: 10' from east boundary fence, 50' from north boundary fence, former base landfill

PROJECT: Ellington Field Site Investigation	BORING NO: MW-05
	TOTAL DEPTH: 30
JOB NO.: 3634	LOGGED BY: D. Unthercove
PROJ. MGR: L. Steckler	EDITED BY:
DRILLING CONTRACTOR: Custom Boring, Inc.	
DRILL RIG TYPE: ATV (Buggy) Rig	
DRILLERS NAME: Zane Ruffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED, TIME: 930	DATE: 12-21-89
COMPLETED, TIME: 1:15	DATE: 12-21-89
BORING DEPTH (ft.)	30
WATER DEPTH (ft.)	18-20
TIME:	1015
DATE:	12-21-86
BACKFILLED, TIME: 1230	DATE: 12-21 BY: Pouring
SURFACE ELEV.: 34.71	DATUM: Nat. Ground
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	CONDITIONS
0-2	SS	N	24	10	0	0			CL	1		GRAY-BLACK SILTY CLAY, hard, roots, iron staining
2-4	SS	N	24	12	2	0			CL	2, 3		V. SILTY LIGHT GRAY CLAY, hard, seams of v. fine grained sand, iron staining
4-6	SS	N	24	20	2	0			CL	4, 5		Same as above, more iron staining
6-8	SS	N	24	20	0	0			CL	6, 7		Same as above, friable
8-10	SS	N	24	18	0	0			CL	8, 9, 10		Top 4" same as above; next 8" GRAY SANDY & SILTY CLAY; bottom 6" RUST SILTY CLAY, moist, soft to stiff

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT: Ellington SI | NO 363 W1 | BORING NO MW-6S

DEPTH	TYPE	LAB	PUSHED	REC'V'D	OVA	HNU			USCS	DESCRIPTION
10-12	SS	~~N~~ Y	24	16	100	3			SC-CL	RUST AND TAN CLAYEY FINE GRAINED SAND, some SANDY CLAY. Collect 01-SB05A-A @ 950
12-14	SS	N	24	24	100	0			SM	BROWN & RUST SILTY FINE GRAINED SAND
14-16	SS	N	24	0	7	0			SM	Same as above
16-18	SS	N	24	6	3	0			CL	RUST AND GRAY SILTY CLAY, soft, moist, sandy seams
18-20	SS	Y	24	12	3	0			SM	BROWN SILTY SAND, wet, fine grained. Collect VOAs for 02-SB05B-A and 02-FD02A
20-22	SS	~~N~~ Y	24	10	0	0			SM	Same as above, fine to med. Collect samples for remaining parameters
22-24	SS	N	24	12	0	0			SP	BROWN MED GRAINED SAND, slightly silty
24-26	SS	N	24	14	0	0			SP	Same as above
26-28	SS	N	24	10	0	0			SP	Same as above
28-30	SS	N	24	10	0	0			SP	Same as above

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 3

LOCATION OF BORING: North end of RR spur/diked area POL storage area	
PROJECT: Ellington Field Site Investigation	BORING NO. PZ-01
	TOTAL DEPTH: 29'
JOB NO.: 363M	LOGGED BY: D. Upthegrove
PROJ. MGR.: L. Stankler	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: Diesel Engine Mobil Rig B-53	
DRILLERS NAME: Zane Ruffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED. TIME: 1315	DATE: 12-15-89
COMPLETED. TIME: 1430	DATE: 12-15-89
BORING DEPTH (ft.): 29'	
WATER DEPTH (ft.): 23-24'	
TIME: 1410	
DATE: 12-15-89	
BACKFILLED. TIME: 1530	DATE: 12-15 BY: Natural Backfill
SURFACE ELEV.: NA	DATUM:
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
0-2	ST	N	18	18	0	NA			CL	1		DARK BROWN CLAY slightly silty, v. stiff, abundant fill material (gravel & shell), roots
2-4	ST	N	18	18	0	NA			CL	2, 3		Same as above
4-6	ST	N	18	18	0	NA			CH	4, 5		BLACK CLAY, med stiff to stiff, iron nodules
												Top 9" same as above, bottom 9" GRAY CLAY, med stiff, iron staining
6-8	ST	N	18	18	0	NA			CH	6, 7		
8-10	ST	N	18	18	0	NA			CH	8, 9, 10		GRAY GREEN CLAY, med stiff, iron staining

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT: Ellington SI | NO 363 W1 | BORING NO PZ-01

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU	USCS	DESCRIPTION
10-12	ST	N	18	18	0	NA	CL	GRAY AND RUST MOTTLED CLAY, stiff, abundant calcareous gravel
12-14	SS	N	18	9	0	NA	CL	No recovery w/ ST, push SS. Same as above, predominantly rust
14-16	ST	N	18	18	4	NA	CL	Same as above, no calcareous matter
16-18	ST	N	18	18	20	NA	CL	Same as above, becoming silty
18-20	ST	N	18	18	7	NA	CL	RUST CLAY, v stiff, iron nodules and calc. matter, siltier
20-22	ST	N	18	18	0	NA	CL	Same as above, siltier, friable, iron staining
22-24	ST	N	18	18	1	NA	ML	6" same as above; 12" ~~RUST~~ BROWN V. CLAYEY SILT, wet
24-26	SS	N	18	~~18~~ 19	1	NA	ML	Same as above, saturated, less clay
26-28	SS	N	18	~~18~~ 17	1	NA	ML	Same as above

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: Southeast of cul-de-sac @ POL Storage Area	PROJECT: Ellington Field Site Investigation
BORING NO. PZ-02	TOTAL DEPTH: 28'
JOB NO.: 363M	LOGGED BY: D. Unthermore
PROJ. MGR.: L. Steckler	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: Diesel Engine Mobile Drill B-53	
DRILLERS NAME: Zane Riffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED, TIME: 0945	DATE: 12-20-89
COMPLETED, TIME: 1110	DATE: 12-20-89
BORING DEPTH (ft.)	28'
WATER DEPTH (ft.)	20'
TIME:	1030
DATE:	12-20-89
BACKFILLED, TIME: 1530	DATE: 12-20-89 BY: Nat. backfill
SURFACE ELEV.: NA	DATUM:
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
0-2	ST	N	18	14	0	0			CH	0-2		DARK BROWN CLAY, stiff to hard, abundant roots and fill materials (shell, gravel, etc). ~~Collect as SP~~
2-4	ST	N	18	18	0	0			CH	2-4		Same as above less fill
4-6	ST	N	18	18	0	0			CH	4-6		GRAY CLAY, soft to med stiff; iron nodules and staining
6-8	ST	N	18	18	2	1			CH	6-8		Top 14" same as above; bottom 4" RUST AND GRAY CLAY, stiff v. calc. zone, iron staining and nodules
8-10	ST	N	18	18	4	0			CH	8-10		Top 4" same as above; bottom 14" ~~RUST A~~ same, much less calc matter.

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT: Ellington SI | NO 363 W | BORING NO 202

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
										1		Same as above
10-12	ST	N	18	18	9	0			CH			
12-14	ST	N	18	18	19	0			CL	2		RUST CLAY, v stiff to hard, iron staining, some calc. gravel becoming slightly silty
										3		
14-16	ST	N	18	18	34	20			CL	4		Same as above, siltier toward base
										5		
16-18	ST	N	18	18	36	0			CL	6		BROWN V. SILTY CLAY, bottom 4" moist
										7		
18-20	ST	N	18	18	13	0			CL-ML	8		Top 9" same as above, bottom 9" V. CLAYEY SILT, wet ~~v. moist~~, some v. fine sand
										9		
20-22	SS	N	18	18	1	0			ML	0		Same as above, saturated
										1		
22-24	SS	N	18	10	0	0			ML	2		Same as above, some ~~sa~~ semi-consolidated sand/silt stone
										3		
24-26	SS	N	18	10	0	0			ML-CL	4		Same as above, bottom 4" silty clay
										5		
26-28	SS	N	18	16	0	0			SM	6		BROWN SILTY SAND, saturated, minor amts of clay
										7		
										8		
										9		
										0		

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: In UPRR right-of-way drainage ditch, & approx. location of 1973 spill

PROJECT: Ellington Field Site Investigation

BORING NO. PZ-03

TOTAL DEPTH: 23

JOB NO.: 3634

LOGGED BY: D. Upthegrove

PROJ. MGR.: L. Steakley

EDITED BY:

DRILLING CONTRACTOR: Custom Coring, Inc.

DRILL RIG TYPE: ATV (Buggy) Rig

DRILLERS NAME: Zane Ruffin

SAMPLING METHODS: Hollow Stem Augers

Split Spoon (SS) | Shelby Tube (ST)

STARTED. TIME: ~~1015~~ 1230 | DATE: 1-11-90

COMPLETED. TIME: 1400 | DATE: 1-11-90

BORING DEPTH (ft.): 23

WATER DEPTH (ft.): 18

TIME: 1330

DATE: 1-11-90

BACKFILLED. TIME: 1445 DATE: BY:

SURFACE ELEV.: DATUM:

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)		USCS	DEPTH IN FEET	GRAPHIC LOG	CONDITIONS:
0-2	ST	N	18	10	0	0		CH			GRAY-BLACK CLAY soft, iron staining and nodules, roots
									1		
2-4	ST	N	18	12	0	0		CH	2		Same as above, soft to med stiff
									3		
4-6	ST	N	18	14	0	0		CH	4		GRAY-GREEN & TAN CLAY mod stiff, iron staining & nodules
									5		
6-8	ST	N	18	12	0	0		CH	6		GRAY CLAY med stiff to stiff calc. matter
									7		
8-10	ST	N	18	12	0	0		CH	8		RUST AND GRAY CLAY med stiff to stiff, calc gravel up to 1" in diameter
									9		
									10		

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT: Ellington SI | NO 363 W1 | BORING NO P2-3

DEPTH	TYPE	LAB	PUSHED	REC'V'D	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
												RUST AND GRAY CLAY, soft to
10-12	ST	N	18	18	0	0			CL	1		stiff, silty @ base
12-14	ST	N	18	16	0	0			CL	2		RUST SILTY CLAY, stiff to
										3		v. stiff, iron staining, minor
												amts. v. fine sand
14-16	ST	N	18	17	0	0			CL	4		Same as above, soft - stiff
										5		
16-18	ST	N	18	18	0	0			CL-ML	6		RUST AND BROWN SILTY CLAY,
										7		soft to med stiff, moist, clayey
												silt toward base
18-20	ST	N	18	18	0	0			SM	8		BROWN CLAYEY AND SILTY V.
										9		FINE SAND, wet
20-22	ST	N	18	16	0	0			SM-CL	0		~~R~~ BROWN SILTY SAND, saturated.
										1		bottom 6" GRAY AND RUST
												V. SILTY CLAY, hard
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: Northeastern corner of diked area, POL Storage Area.

PROJECT: Ellington Field Site Investigation	BORING NO. SB-11
	TOTAL DEPTH: 22'
JOB NO.: 363M	LOGGED BY: D. Utterson
PROJ. MGR.: L. Steckler	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: Diesel Engine Mobil Rig B-53	
DRILLERS NAME: Zane Ruppin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED. TIME: 945	DATE: 12-18-89
COMPLETED. TIME: 1200	DATE: 12-18-89
BORING DEPTH (ft.): 22'	
WATER DEPTH (ft.): 18'	
TIME: 1200	
DATE: 12-18-89	
BACKFILLED. TIME: 1315	DATE: 12-18 BY: Coring
SURFACE ELEV.: NA	DATUM:
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	CONDITIONS
0-2	SS	Y	24	24	80	NA			CH	1		GRAY-BROWN CLAY, soft to med stiff, iron nodules, hydrocarbon odor, moist. Collect 02-SB11A-A @ 1050
2-4	SS	N	24	14	60	NA			CH	2, 3		GRAY-GREEN CLAY, soft to med. stiff, iron staining and nodules, slight hydrocarbon odor
4-6	SS	Y	24	14	280	NA			CH	4, 5		Same as above stronger odor. Collect 02-SB11B-A @ 1105.
6-8	SS	N	24	18	110	NA			CH	6, 7		Same as above
8-10	SS	N	24	18	110	NA			CH	8, 9, 10		~~Rust and~~ RUST and GRAY CLAY, soft to med. stiff, rust staining, some calc. matter, moist

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT Ellington SI | NO 363WA | BORING NO SB-11

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU			USCS	DESCRIPTION
10-12	SS	N	24	18	100	NA			CL	BROWN AND GRAY CLAY, soft to stiff, iron staining, some silt
12-14	SS	N	24	20	100	NA			CL	RUST AND GRAY CLAY stiff, iron staining, minor amts of calc. matter
14-16	ST	N	18	18	260	NA			CL	Top 8" same as above; Bottom 8" BROWN SILTY CLAY, friable
16-18	ST	N	18	18	15	NA			CL-ML	BROWN V. CLAYEY SILT, iron staining
18-20	SS	Y	24	16	12	NA			ML	BROWN CLAYEY SILT, saturated, some v. fine sand. Collect 02-SB11C-AA @ 1200 and 02-FD01-A
20-22	SS	Y	24	16	10	NA			ML	Same as above. This sample also used for 02-SB11C-A and 02-FD01-A

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 3

LOCATION OF BORING: Midpoint of the eastern side of the diked area at the POL storage area

PROJECT: Ellington Field Site Investigation	BORING NO. SB-12
	TOTAL DEPTH: 22'
JOB NO.: 363M	LOGGED BY: D. Untheroune
PROJ. MGR.: L. Steckler	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: Diesel Engine Mobil Rig B-53	
DRILLERS NAME: Zane Ruffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED, TIME: 1430	DATE: 12-18-89
COMPLETED, TIME: 1645	DATE: 12-18-89
BORING DEPTH (ft.): 22'	
WATER DEPTH (ft.): 20'	
TIME: 1645	
DATE: 12-18-89	
BACKFILLED, TIME: 1705	DATE: 12-18 BY: Boring
SURFACE ELEV.: NA	DATUM:
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
0-2	SS	Y	24	20	1000+	NA			CH	1		BLACK CLAY soft to med stiff, iron nodules, strong hydrocarbon odor. Collect 02-SB12A-A @ 1545
2-4	SS	N	24	18	130	NA			CH	2, 3		Same as above
4-6	SS	N	24	16	190	NA			CH	4, 5		GRAY-GREEN CLAY, soft to med stiff, iron nodules, hydrocarbon odor
6-8	SS	Y	24	15	100	NA			CH	6, 7		RUST AND GRAY-GREEN CLAY, abundant calc. gravel (up to 1" in diameter), med stiff to stiff, iron staining and nodules. Collect 02-SB12B-A @ 1610
8-10	ST	N	18	18	50	NA			CH	8, 9, 10		~~RU~~ Same as above, less calc.

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT Ellington SI | NO 363W1 | BORING NO SB-12

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
										1		Same as above
10-12	ST	N	24/18	18	55	NA			CH			
										2		RUST AND GRAY CLAY, v. stiff
12-14	ST	N	24/18	18	90	NA			CL			to hard, calc matter, iron staining,
										3		some silt
										4		Same as above, siltier @ base
14-16	ST	N	24/18	18	40	NA			CL			
										5		
										6		RUST v. SILTY CLAY, v stiff
16-18	ST	N	24/18	18	12	NA			CL			to hard, iron staining
										7		
										8		Same as above
18-20	SS	N	24	6	5	NA			CL			
										9		
										0		RUST v. CLAYEY SILT saturated
20-22	SS	Y	24	24	6	NA			ML			Collect 02-SB12C-A @ 1645
										1		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: Southeast corner of diked area @ POL Storage Area

PROJECT: Ellington Field Site Investigation	BORING NO. SB-13
	TOTAL DEPTH: 22'
JOB NO.: 363M	LOGGED BY: D. Uptherove
PROJ. MGR.: L. Steakley	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: Diesel Engine Mobil Rig B-53	
DRILLERS NAME: Zane Ruffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED. TIME: 940	DATE: 12-19-89
COMPLETED. TIME: 1130	DATE: 12-19-89
BORING DEPTH (ft.): 22'	
WATER DEPTH (ft.): 20'	
TIME: 1130	
DATE: 12-19-89	
BACKFILLED. TIME: 1200	DATE: 12-19 BY: Pouring
SURFACE ELEV.: NA	DATUM:

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	CONDITIONS:
0-2	SS	Y	24	18	100	NA			CH	1		BLACK CLAY soft to med stiff, iron nodules, strong hydrocarbon odor. collect 02-SB13A-A @ 940
2-4	SS	N	24	6	350	NA			CH	2, 3		Same as above, little recovery
4-6	SS	Y	24	16	1000	NA			CH	4, 5		GRAY AND BLACK CLAY, soft to med stiff, iron stained, strong hydrocarbon odor. Collect 02-SB13A-A @ 1000
6-8	SS	N	24	16	190	NA			CH	6, 7		Top 4" same as above then 12" GRAY CLAY med stiff, with a seam of coarse brown sand, abundant calc matter, iron staining
8-10	ST	N	18	18	100	NA			CH	8, 9, 10		Top 4" GRAY-GREEN CLAY, med stiff, then RUST AND GRAY CLAY soft to stiff, calc zone, iron nodules.

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT Ellington SI | NO 367W1 | BORING NO SB-13

DEPTH	TYPE	LAB	PUSHED	REC'D	OVA	HNU			USCS	DESCRIPTION
10-12	ST	N	18	18	140	NA			CH-CL	RUST AND GRAY CLAY, soft to ~~med~~, stiff; top 4" soft to med stiff w/ odor, bottom 14" slightly silty, iron staining (no odor)
12-14	ST	N	18	18	140	NA			CL	Same as above, v. stiff to hard, some calc matter
14-16	ST	N	18	18	120	NA			CL	Same as above
16-18	ST	N	18	18	280	NA			CL-ML	Top 15" Same as above, soft, v. silty. Bottom 3" ~~clayey silt, some~~ BROWN CLAYEY SILT, some very fine sand
18-20	SS	N	24	18	4	NA			ML	BROWN V. CLAYEY SILT, wet, some calc. matter, wet
20-22	SS	Y	24	18	6	NA			ML	BROWN V. CLAYEY FINE SAND AND SILT, saturated. Collect 02-SB13C-A @ 130

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FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: Northwestern quarter of diked area @ POL Storage area

PROJECT: Ellington Field Site Investigation
BORING NO. SB-14
TOTAL DEPTH:
JOB NO.: 363M
LOGGED BY: D. Uptheroue
PROJ. MGR.: L. Steckler
EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.
DRILL RIG TYPE: Diesel Engine Mobil Drill B-53
DRILLERS NAME: Zane Ruffin
SAMPLING METHODS: Hollow Stem Augers Split Spoon (SS) | Shelby Tube (ST)
STARTED. TIME 1330 **DATE:** 12-19-90
COMPLETED. TIME: 1510 **DATE:** 12-19-90
BORING DEPTH (ft.) 20'
WATER DEPTH (ft.) 18'
TIME: 1510
DATE: 12-19-90
BACKFILLED. TIME: 1545 **DATE:** 12-19-90 **BY:** Fleming
SURFACE ELEV.: NA **DATUM:**
CONDITIONS:

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	CONDITIONS
0-2	SS	Y	24	20	80	2			CH			BLACK CLAY, med stiff, iron nodules. Collect 02-SB14A-A @ 1410
										1		
2-4	SS	N	24	16	24	2			CH	2		Same as above
										3		
4-6	SS	N	24	16	30	1			CH	4		GRAY GREEN CLAY, med stiff to stiff, iron staining & nodules
										5		
6-8	SS	Y	24	16	10	1			CH	6		TAN AND GRAY CLAY, soft to med stiff, iron nodules and staining, abundant calcareous matter. Collect 02-SB14B-A @ 1425
										7		
8-10	ST	N	18	18	5	2			CH-CL	8		RUST AND GRAY CLAY, stiff, iron staining and nodules, some silt and calc. matter
										9		
										10		

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

PROJECT: Ellington SI | NO 363 W1 | BORING NO SB-14

DEPTH	TYPE	LAB	PUSHED	REC'V'D	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
										1		Same as above, no calc. matter
10-12	ST	N	18	18	2	NA			CH-CL			
12-14	ST	N	18	18	2	NA			CL	2		Same as above, siltier
										3		
										4		
14-16	ST	N	18	18	1	NA			CL			RUST SILTY CLAY, stiff to soft, abundant calc matter, iron staining
										5		
										6		
16-18	ST	N	18	18	1	NA			CL-ML ~~SM~~			RUST v. SILTY CLAY, grading into CLAYEY SILT, moist
										7		
										8		
18-20	SS	Y	24	19	1	NA			ML SM			BROWN V. CLAYEY SILT, saturated, some v. fine sand. Collect 03-SB14C-A @ 1510
										9		
										0		
										1		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING: In drainage ditch on UPRR right-of-way, downstream of point-of-entry for 1973 spill

PROJECT: Ellington Field Site Investigation	BORING NO. MW-07
	TOTAL DEPTH: 28'
JOB NO.: 3634	LOGGED BY: D. Uptheroove
PROJ. MGR.: L. Stackles	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: ATV (Buggy) Rig	
DRILLERS NAME: Zane Ruffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED. TIME 940	DATE 1-12-90
COMPLETED. TIME: 1130	DATE 1-12-90
BORING DEPTH (ft.)	28'
WATER DEPTH (ft.)	16'
TIME:	1050
DATE:	1-12-90
BACKFILLED. TIME: 1300	DATE: 1-12 BY: Pouring
SURFACE ELEV.: 23.23	DATUM: Nat. Ground
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	CONDITIONS
0-2	SS	Y	24	18	NA	0			CH			DARK GRAY CLAY, soft, moist roots and iron nodules Collect Sample 02-SB07A-A @ 945
										1		
2-4	SS	N	24	20	NA	0			CH	2		Same as above, iron staining
										3		
4-6	SS	N	24	16	NA	0			CH	4		GREEN-GRAY CLAY, soft to med. stiff iron staining and nodules
										5		
6-8	SS	N	24	16	NA	0			CH	6		RUST AND GRAY CLAY, soft to med stiff, iron staining & nodules, some calc. matter
										7		
8-10	SS	Y	24	18	NA	0			CH	8		RUST AND GRAY CLAY, med stiff to stiff, iron nodules, Collect 02-SB07B-A @ 1010
										9		
										10		

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 3 OF 3

PROJECT: Ellington SI | NO 363 W | BORING NO MW-07

DEPTH	TYPE	LAB	PUSHED	REC'V'D	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	DESCRIPTION
10-12	ST	N	18	18	NA ∅	0			CL	1		RUST AND GRAY CLAY, stiff to hard, iron staining, becoming silty @ base
12-14	ST	N	18	18	NA ∅	0			CL	2		RUST SILTY CLAY, v stiff to hard, v. silty @ base
										3		
14-16	ST	N	18	18	NA ∅	0			CL-ML	4		RUST SILTY CLAY/CLAYEY SILT, turns brown in color w/ increasing silt content, iron staining, calc matter, friable, wet
										5		
16-18	SS	Y	24	22	NA ∅	0			ML	6		BROWN AND GRAY V. CLAYEY SILT, saturated. Collect 02-SB07C-A @ 1050
										7		
18-20	ST	N	18	18	NA	0			SM	8		BROWN CLAYEY AND SILTY SAND, saturated
										9		
20-22	SS	N	24	18	NA	0			SM	0		BROWN SILTY SAND, fine grained, saturated
										1		
22-24	ST	N	18	18	NA	0			SM	2		Same as above
										3		
24-26	SS	N	24	24	NA	0			SM-CL	4		4" same as above; 20" ~~brown silty and sandy~~ clk BROWN SILTY AND SANDY CLAY, v. stiff to hard, iron staining, sandy seams
										5		
26-28	ST	N	18	18	NA	0			CL	6		Same as above
										7		
										8		
										9		
										0		

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 3

LOCATION OF BORING: JPRR right-of-way drainage ditch, upstream of 1973 spill site.

PROJECT: Ellington Field Site Investigation	BORING NO. MW-08
	TOTAL DEPTH: 28.71
JOB NO.: 3634	LOGGED BY: D. Unthercone
PROJ. MGR.: L. Steeklea	EDITED BY:
DRILLING CONTRACTOR: Custom Coring, Inc.	
DRILL RIG TYPE: ATU (buggy) rig	
DRILLERS NAME: Z. Ruffin	
SAMPLING METHODS: Hollow Stem Augers	
Split Spoon (SS)	Shelby Tube (ST)
STARTED. TIME: 0945	DATE: 1-13-90
COMPLETED. TIME: 1130	DATE: 1-13-90
BORING DEPTH (ft.): ~~28~~ 71	
WATER DEPTH (ft.): 16-18'	
TIME: 1045	
DATE: 1-13-90	
BACKFILLED. TIME: 1230	DATE: 1-13 BY: Paving
SURFACE ELEV.: 23.55	DATUM: Nat. Ground
CONDITIONS:	

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
0-2	SS	Y	24	12	NA	0			CH	1		DARK GRAY CLAY, soft, moist, iron staining and nodules, roots. Collect 02-SB08A-A @ 945
2-4	SS	N	24	12	NA	0			CH	2, 3		Same as above, some calc. matter
4-6	SS	N	24	14	NA	0			CH	4, 5		GRAY AND TAN CLAY, med stiff, iron staining and nodules, some calc matter, minor amts of silt.
6-8	SS	N	24	16	NA	0			CL-CH	6, 7		RUST AND GRAY MOTTLED CLAY, stiff, iron staining, v. slightly silty.
8-10	SS	Y	24	16	NA	0			CL-CH	8, 9, 10		RUST CLAY, stiff to v. stiff, iron staining, siltier @ base. Collect 02-SB08B-A @ 1010

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 3 OF 3

PROJECT Ellington SI | NO 363 W | BORING NO MV-04

DEPTH	TYPE	LAB	PUSHED	REC'D	OVA	HNU			USCS	DESCRIPTION
10-12	ST	N	18	18	NA	0			CL	Same as above, siltier AND GRAY
12-14	ST	N	18	18	NA	0			CL	RUSTY SILTY CLAY, v. stiff to hard, iron staining and nodules, calc matter
14-16	ST	N	18	18	NA	0			CL	Same as above, v. ~~#~~ silty @ base, turning brown in color w/ increasing silt content
16-18	SS	Y	24	20	NA	0			ML-SM	BROWN (CLAYEY SILT AND SAND), wet, iron staining, some semi-consolidated sand/siltstone. Collect 02-SB08C-A @ 1045
18-20	SS	Y	24	20	NA	0			SM	BROWN SILTY SAND saturated. This also used to achieve required vol. and E02-FD02-A
20-22	ST	N	18	18	NA	0			SM	Same as above, fine to v. fine grained
22-24	SS	N	24	20	NA	0			SS SM	Same as above
24-26	SS	N	24	18	NA	0			SM	Same as above, some clay
26-28	SS	N	24	18	NA	0			SM	Same as above
29-31	SS	N	24	16	NA	0			CL	BROWN V. SANDY CLAY, hard, iron stained

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 33

LOCATION OF BORING: middle of cul-de-sac @ the POL Storage Area	PROJECT: Ellington Field Site Investigation
	BORING NO. MW-09
	TOTAL DEPTH: 33'
	JOB NO.: 363M
	LOGGED BY: D. Unthermore
	PROJ. MGR.: L. Steakley
	EDITED BY:
	DRILLING CONTRACTOR: Custom Coring, Inc.
	DRILL RIG TYPE: Diesel Engine Mobil Rig B-53
	DRILLERS NAME: Roland Valdez
	SAMPLING METHODS: Hollow Stem Augers
	Split Spoon (SS) / Shelby Tube (ST)
	STARTED, TIME: 1030 / DATE: 1-15-90
	COMPLETED, TIME: 1400 / DATE: 1-15-90
	BORING DEPTH (ft.): 33'
	WATER DEPTH (ft.): 21'
	TIME: 1700
	DATE: 1-15-90
	BACKFILLED, TIME: 1530 / DATE: 1-15 / BY: Pouring
	SURFACE ELEV.: 75.65 / DATUM: Natural Ground
	CONDITIONS:

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
												CONCRETE, 10-12" thick
1-3	SS	Y	24	6	0	NA				1		Top 6-8" fill material/stabilizing sand
									CH	2		6" DARK GRAY CLAY, med stiff, iron staining and nodules
3-5	SS	Y	24	16	0	NA			CH	3		Same as above collect 07-SB09A-A from 1-3' and 3-5' samples @ 1030
										4		
5-7	SS	N	24	18	0	NA			CH	5		Top 14" same as above Bottom 4" GRAY-GREEN CLAY, med stiff, rust staining
										6		
7-9	SS	N	24	18	0	NA			CH	7		GRAY GREEN CLAY, soft to stiff, iron staining and nodules, sandy seams, calcareous gravel (up to 1" in diameter)
										8		
9-11	SS	N	24	18	0	NA			CH-CL	9		GRAY AND RUST CLAY, soft to v. stiff, iron staining, calc matter, becoming silty @ base. Collect
										10		

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

PROJECT Ellington SI | NO 363 W1 | BORING NO. MW09

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
11-13	ST	N	18	18	0	NA			CL	1		Same as above, siltier
										2		
13-15	ST	N	18	18	0	NA			CL	3		RUST AND GRAY SILTY CLAY, iron staining and nodules, v. stiff, calc. gravel, some sandy zones (iron stained)
										4		
15-17	ST	N	18	18	0	NA			CL	5		Same as above, v stiff to hard
										6		
17-19	ST	N	18	18	0	NA			CL	7		Same as above, bottom 4" semi-consolidated sand/siltstone, calc zone just above
										8		
19-21	ST	N	18	18	0	NA			ML	9		RUST AND GRAY V. CLAYEY SILT AND FINE SAND, becoming brown w/ increasing silt content, iron staining, calc. matter, v. moist
										0		
21-23	SS	Y	24	14	0	NA			SM	1		BROWN SILTY TO CLAYEY V. FINE SAND, saturated iron stained. Collect 02-SB09C-A @ 1300
										2		
23-25	ST	N	18	18	0	NA			SM	3		Same as above, some sandy and silty clay ~~layers~~ laminae
										4		
25-27	SS	N	~~18~~ 24	18	0	NA			SM	5		BROWN SILTY SAND, v. fine to fine, saturated
										6		
27-29	SS	N	24	14	0	NA			SM	7		Same as above
										8		
29-31	SS	N	24	12	0	NA			SM	9		Same as above w/ gray & brown v sandy clay laminae, hard

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 33 OF 33

PROJECT: Ellington SI | NO 363 W1 | BORING NO MW-9

DEPTH	TYPE	LAB	PUSHED	REC'V'D	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
										1		
31-33	SS	N	24	12	0	NA			SM	2		BROWN SILTY SAND, saturated, fine grained
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		
										1		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		

NUS CORPORATION

FIELD LOG OF BORING

SHEET 1 OF 3

LOCATION OF BORING: Between north end of RR spur and Horsepen Bayou, POL. storage area

PROJECT: Ellington Field Site Investigation

BORING NO. MW-10

TOTAL DEPTH: 37.5

JOB NO.: 363[illegible]

LOGGED BY: D. Uptherove

PROJ. MGR.: L. Stenkler

EDITED BY:

DRILLING CONTRACTOR: Custom Coring, Inc.

DRILL RIG TYPE: Diesel Engine Mobile Drill B-53

DRILLERS NAME: Roland Valdez

SAMPLING METHODS: Hollow Stem Augers, Split Spoon (SS), Shelby Tube (ST)

STARTED, TIME: 0915 DATE: 1-16-90

COMPLETED, TIME: 1105 DATE: 1-16-90

BORING DEPTH (ft.): 37.5'

WATER DEPTH (ft.): 20'

TIME: 1015

DATE: 1-16-90

BACKFILLED, TIME: 1330 DATE: 1-16 BY: [illegible]

SURFACE ELEV.: 25.82 DATUM:

CONDITIONS:

SAMPLE DEPTH	SAMPLER TYPE	LAB. ANALYSIS (Y/N)	INCHES DRIVEN/PUSHED	INCHES RECOVERED	OVA HEADSPACE (PPM)	HNU HEADSPACE (PPM)			USCS	DEPTH IN FEET	GRAPHIC LOG	DESCRIPTION
0-2	ST	N	18	6	9	0				1		BACKFILL - SANDY AND SILTY CLAY, compacted, contains shell fragments and gravel
2-4	ST	N	18	8	2	0				2, 3		Same as above
4-6	ST	N	18	6	0	0				4, 5		Same as above
6-8	ST	N	18	10	20	20				6, 7		Same as above, hydrocarbon odor @ base
8-10	SS	Y	24	16	22	NA			CH	8, 9, 10		RUST AND GRAY CLAY, stiff to very stiff, ~~xxx~~ iron staining, hydrocarbon odor. Collect 02-SB10-A and 02-FD04-A @ 940

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 3 OF 3

PROJECT: Ellington SI | NO 363W | BORING NO MW-10

DEPTH	TYPE	LAB	PUSHED	REC'VD	OVA	HNU			USCS	DESCRIPTION
10-12	SS	Y	24	16	9	NA			CH	Same as above, some calc. matter. Collect VOA portion of 02-FD04-A
12-14	ST	N	18	14	2	NA			CH-CL	Same as above becoming silty @ base. Hydrocarbon odor @ top, not @ base
14-16	ST	N	18	16	3	NA			CL	RUST AND GRAY SILTY CLAY, stiff, iron staining and nodules, calc. matter
16-18	ST	N	18	16	2	NA			CL	Same as above
18-20	ST	N	18	16	0	NA			CL	Same as above w/ abundant calc matter, v. silty and moist @ base
20-22	SS	Y	24	20	2	NA			ML-SM	BROWN V. CLAYEY SILT AND SAND, saturated. Collect 02-SB10B-A @ 1015
22-24	SS	N	~~18~~ 24	22	0	NA			SM	BROWN CLAYEY AND SILTY SAND, v. fine, saturated
24-26	ST	N	18	18	0	NA			SM	Same as above
26-28	ST	N	18	18	0	NA			SM	BROWN SILTY SAND, saturated, v. fine becoming fine @ base
28-30	ST	N	18	18	0	NA			SM-CL	Same as above w/ layers of BROWN SANDY CLAY, hard

NUS CORPORATION

FIELD LOG OF BORING (CONTINUED)

SHEET 33 OF 33

PROJECT Ellington SI | NO 363W1 | BORING NO MW-10

DEPTH	TYPE	LAB	PUSHED	REC'V'D	OVA	HNU			USCS	DEPTH	GRAPHIC LOG	
										1		Same as above
30-32	ST	N	18	18	0	NA			SM-CL	2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		

SAMPLE LOG SHEETS

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ____

Page 1 of 1

Case # NA

By NUS Corp

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 01-SB02A-A Source Location Boring for MW-02, landfill

Sample Method:
Oversized Split Spoon Sampler

Depth Sampled:
16-18'

Sample Date & Time:
~~1410~~ 12-14-89 / 1410

Sampled By:
D. Upthegrove / L. Basilio

Signature(s):
D. [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Tan	Fine to med. grained sand, ~~saturated~~ wet

Analysis:
- TCL Volatiles
- TCL BNAs
- TCL Pesticides
- TPH
- TAL Inorganics

Observations / Notes
Headspace reading of 1 ppm w/ OVA

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar	

NUS CORPORATION

SOILS SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ sample No. 01-SB01A-A Source Location Boring for MW-01, landfill

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 16-18'

Sample Date & Time: 12-13-89 / 915

Sampled By: D. Uptegrove / L. Basilio

Signature(s): D. [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color: Brown

Description: (Sand, Clay, Dry, Moist, Wet, etc.): Very silty clay, saturated

Observations / Notes: Some very fine sand

Analysis:

TCL Volatile
TCL BNAs
TCL Pesticides
TPH
TAL Inorganics

Lab	NUS
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar

SOILS SAMPLE LOG SHEET

NUS CORPORATION

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Page 1 of 1

Case # NA

By NUS Corp

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 01-SB01B-A Source Location Boring for MW-01, landfill

Sample Method:
Oversized Split Spoon Sampler

Depth Sampled:
26-28'

Sample Date & Time:
12-13-89/1055

Sampled By:
D. Uptegrove / L. Basilio

Signature(s):
D. [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown	Silty fine-grained sand

Analysis:
TCL Volatiles
TCL BNAs
TCL Pesticides
TPH
TAL Inorganics

Observations / Notes
Minor amounts of clay, headspace reading of 20 ppm w/ OVA

Lab	NUS
Volume	1 6" liner, 1 4oz jar, 1 16 oz jar

SOILS

NUS CORPORATION

SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 01-SB07AA Source Location Boring for MW-07, landfill

Sample Method:	Composite Sample Data		
Oversized Split Spoon Sampler	Sample	Time	Color / Description
Depth Sampled: 8-10			
Sample Date & Time: 12-13-89 / 1600			
Sampled By: D. Usthegrove / L. Basilio			
Signature(s): D. [signature]			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown, gray	Silty Clay

Observations / Notes:

Iron-staining, headspace reading of 30 ppm w/ OVA

Analysis:

TCL Volatiles
TCL BNAs
TCL Pesticides
TPH
TAL Inorganics

Lab	NUS
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 01-SB03B-A Source Location Boring for MW-03, landfill

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 12-14'			
Sample Date & Time: 12-13-90/1615			
Sampled By: D. Usthegrove / L. Basilio			
Signature(s):			
Type of Sample: [x] Low Concentration [ ] High Concentration [x] Grab [ ] Composite [ ] Grab - Composite			

Sample Data

Color: Brown

Description: (Sand, Clay, Dry, Moist, Wet, etc.): Silty very fine grained sand, saturated

Observations / Notes: Headspace reading of 1 ppm w/ OVA

Analysis:
- TCL Volatiles
- TCL BNAs
- TCL Pesticides
- TPH
- TAL Inorganics

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar	

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 01-SB04A-A Source Location Boring for MW-04, landfill

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 4-6'

Sample Date & Time: 12-12-89 / ~~940~~ 1010

Sampled By: D. Usthegrove / L. Basilio

Signature(s): D. [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis:

TCL Volatiles
TCL BNAs
TCL Pesticides
TPH
TAL Inorganics

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown, orange	Dry, very silty clay

Observations / Notes

Med stiff, some calcareous gravel and very fine sand. Headspace reading of 6 ppm w/ ~~OAO~~ ;

Lab	NUS
Volume	1 6" liner, 1 4oz jar, 1 16 oz jar

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Page 1 of 1

Case # NA

By NUS Corp

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ sample No. 01-SB04B-A Source Location Boring for MW-04, landfill

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 12-14'			
Sample Date & Time: 12-12-89 / 1050			
Sampled By: D. Upthegrove / L. Basilio			
Signature(s): D. [signature]			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown	Wet clayey fine sand

Analysis:

TCL Volatiles
TCL BNAs
TCL Pesticides
TPH
TAL Inorganics

Observations / Notes

0 ppm at headspace reading w/ OVA

Lab	NUS
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 01-SB05A-A Source Location Boring for MW-05, landfill

Sample Method:
Oversized Split Spoon Sampler

Depth Sampled:
10-12'

Sample Date & Time:
12-21-89 / 950

Sampled By:
D. Uptegrove / L. Basilio

Signature(s):

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Rust & Tan	Clayey fine grained sand

Analysis:
TCL Volatiles
TCL BNAs
TCL Pesticides
TPH
TAL Inorganics

Observations / Notes:
Some sandy clay, headspace reading of 100 ppm w/ OVA, 3 ppm w/ HNU.

Lab	NUS
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other

Case # NA

By NUS Corp

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 01-SB05B-A/01-FD02-A Source Location Boring for MW-05, landfill

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 18-22'

Sample Date & Time: 12-21-89/1015

Sampled By: D. Uptlegrove / L. Basilio

Signature(s): D. [signature]

Composite Sample Data

Sample	Time	Color / Description

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown	Silty fine grained sand

Analysis:

TCL Volatiles
TCL BNAs
TCL Pesticides
TPH
TAL Inorganics

Observations / Notes

Headspace reading of 3 ppm w/ OVA

Lab	NUS
Volume	32 6" liners, 2 4 oz jars, 2 16 oz jars

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB11A-A Source Location SB-11, POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 0-2'

Sample Date & Time: 12-18-89 / 1050

Sampled By: D. Uptegrove / L. Basilio

Signature(s):

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Gray-brown	Clay, soft to med stiff.

Analysis:
TCL volatiles
TPH

Observations / Notes
Iron nodules, hydrocarbon odor, moist, headspace reading of 80 ppm w/ ~~HNU~~. OVA.

Lab	NUS
Volume	1 6" liner, 1 4 oz jar

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 22-SB11B-A Source Location SB-11, POL

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 4-6'			
Sample Date & Time: 12-18-89 / 1105			
Sampled By: D. Uzzlegrove / L. Basilio			
Signature(s):			

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Green-gray	Clay, soft to med stiff

Observations / Notes

Iron staining & nodules, moist, strong hydrocarbon odor, headspace reading of 280 ppm w OVA

Analysis:
- TCL Volatiles
- TCL BNAs
- ~~TCL Pesticides~~ DCV
- TPH
- ~~TAL Inorganics~~ DCV

Lab	NUS
Volume	~~4" liner~~, 2 4oz jars, 16 oz jar

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 02-SB11C-A / 02-FD01-A Source Location SB-11, POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 18-22'

Sample Date & Time: 12-18-89 / 1200

Sampled By: D. Uttlegrove / L. Basilio

Signature(s): D. U[illegible]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color: Brown

Description: (Sand, Clay, Dry, Moist, Wet, etc.) Clayey silt, some v. fine sand, saturated

Observations / Notes: Head space reading of 12 ppm w/ OVA

Analysis:

TCL Volatiles

TPH

Lab	NUS	
Volume	2 6" liner, 2 4 oz jar	

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source No.~~ Sample 02-SB12A-A Source Location SB-12, POL

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 0-2'			
Sample Date & Time: 12-18-89 / 1545			
Sampled By: D. Uttergrove / L. Basilio			
Signature(s): [signature]			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Black	Clay, soft to med stiff

Analysis:
TCL Volatiles
TCL BNAs
TPH

Observations / Notes:
Iron nodules, strong hydrocarbon odor, headspace reading of 1000+ ppm w/ OVA

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar	

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Page 1 of 1

Case # NA

By NUS Corp

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 02-SB12B-A Source Location SB-12, POL

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 6-8'			
Sample Date & Time: 12-18-94 / 1610			
Sampled By: D. Usthegrove / L. Basilio			
Signature(s):			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Rust, gray-green	Clay, med stiff to stiff

Analysis:

TCL Volatiles

TPH

Observations / Notes

Abundant calcareous matter, iron staining & nodules, headspace reading of 100 ppm w/ OV.

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar	

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ____

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ sample No. 02-SB12C-A Source Location SB-12, POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 20-22'

Sample Date & Time: 12-18-89 / 1645

Sampled By: D. Usthegrove / L. Basilio

Signature(s): [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis:

TCL volatiles
TPH

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Rust	V. clayey silt

Observations / Notes

Headspace reading of 6 ppm w/ OVA

Lab	NUS
Volume	1 6" liner, 1 4 oz jar

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 07-SB13A-A Source Location SB-13, POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 0-2

Sample Date & Time: 12-19-89/940

Sampled By: D. Usthegrove / L. Basilio

Signature(s):

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis:
TCL Volatiles
TPH

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Black	Clay, soft to med stiff

Observations / Notes:
Iron nodules, strong hydrocarbon odor, headspace reading of 160 ppm w/OVA

Lab	NUS
Volume	~~+ 6" liner~~ 2 4 oz jars

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB13B-A Source Location SB-13, POL

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 4-6'			
Sample Date & Time: 12-19-89/1000			
Sampled By: D. Uttergrove / L. Basilio			
Signature(s):			
Type of Sample: [x] Low Concentration [ ] High Concentration [x] Grab [ ] Composite [ ] Grab - Composite	Sample Data		
	Color: Gray-black	Description: (Sand, Clay, Dry, Moist, Wet, etc.): Clay, soft to med stiff	
Analysis: TCL Volatiles, TCL BNAs, TPH	Observations / Notes: Iron-staining, strong hydrocarbon odor. headspace reading of 1000+ ppm w/ OVA		

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar	

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB13C-A Source Location SB-13, POL

Sample Method:			
Oversized Split Spoon Sampler			
Depth Sampled:			
20-22'			
Sample Date & Time:			
12-19-89/1130			
Sampled By:			
D. Usthegrove / L. Basilio			
Signature(s):			

Composite Sample Data		
Sample	Time	Color / Description

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown	V. Clayey fine sand and silt, saturated

Analysis:

TCL Volatiles

TPH

Observations / Notes

Headspace reading of 6 ppm w/ OVA

Lab	NUS
Volume	1 6" liner, 1 4 oz jar

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB14A-A Source Location SB-14, POL

Sample Method:
Oversized Split Spoon Sampler

Depth Sampled:
0-2'

Sample Date & Time:
12-14-89/1410

Sampled By:
D. Uttergrove / L. Basilio

Signature(s):
D. [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Black	Clay, med stiff

Analysis:
TCL Volatiles
TCL BNAs
TPH

Observations / Notes
Iron nodules, headspace reading of 20 ppm w/ OVA, 2 ppm w/ HNU

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar	

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case = NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB14B-A Source Location SB-14, POL

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 6-8'			
Sample Date & Time: 12-19-89 / 1425			
Sampled By: D. Umthegrove / L. Basilio			
Signature(s):			
Type of Sample: [x] Low Concentration [ ] High Concentration [x] Grab [ ] Composite [ ] Grab - Composite			

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Tan & gray	Clay, soft to med stiff

Analysis:
TCL Volatiles
TPH

Observations / Notes:
Iron nodules & staining, abundant calcareous matter, headspace reading of 5 ppm w/ OVA, HNU malfunctioning

Lab	NUS	
Volume	1 8" liner, 1 4 oz jar	

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 07-SB14CA Source Location SB-14, POL

Sample Method: Oversized Split Spoon Sampler	
Depth Sampled: 18-20'	
Sample Date & Time: 12-14-89/1510	
Sampled By: D. Uptegrove / L. Basilio	
Signature(s): [signature]	

Composite Sample Data

Sample	Time	Color / Description

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown	V. clayey silt, some v. fine sand, saturated

Observations / Notes: Headspace reading of 1 ppm w/OVA

Analysis:
TCL Volatiles
TPH

Lab	NUS
Volume	1 6" liner, 1 4 oz jar

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Case # NA

By NUS Corp

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 02-SB07A-A Source Location Boring for MW-07, POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 0-2'

Sample Date & Time: 1-17-90/945

Sampled By: D. Ustheegrove / L. Basilio

Signature(s): D. [signature]

Composite Sample Data

Sample	Time	Color / Description

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Dark grey	Clay, soft, moist

Analysis:
TCL Volatiles
TPH

Observations / Notes
Roots and iron nodules.

Lab	NUS
Volume	1 6" liner, 1 4 oz jar

SOILS SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ____

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB07B-A Source Location Boring for MW-07, EPOL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 8-10'

Sample Date & Time: 1-12-90/1010

Sampled By: D. Usherwood / L. Basilio

Signature(s): [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Rust & grey	Clay, med stiff to stiff

Observations / Notes

Iron nodules

Analysis:

TCL Volatiles

TPH

Lab	NUS
Volume	1 6" liner, 1 4 oz jar

NUS CORPORATION

SOILS

SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 02-SB07C-A Source Location Boring for MW-07, POL

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 16-18'			
Sample Date & Time: 1-12-90/1050			
Sampled By: D. Usthegrove / L. Basilio			
Signature(s): [signature]			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown, gray	Clayey silt, saturated

Analysis:

TCL Volatiles

TCL BNAs

TPH

Observations / Notes

Lab	NUS
Volume	1 6" liner, 1 4 oz jar, 1 16 oz jar

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS Source Sample No. 02-SB08A-A Source Location Boring for MW-08, POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 0-2

Sample Date & Time: 1/13-90 / 945

Sampled By: D. Ustlegrove / L. Basilio

Signature(s): [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Dark gray	Clay, soft, moist

Analysis:

TCL Volatiles
TPH

Observations / Notes

Iron staining and nodules, roots

Lab	NUS	
Volume	2 4 oz jars	

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB08B-A Source Location Boring for MW-08, POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 8-10'

Sample Date & Time: 1-13-90 / 1010

Sampled By: D. Usthegrove / L. Basilio

Signature(s): D. [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis:
TCL Volatiles
TPH

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color: Rust & gray

Description: (Sand, Clay, Dry, Moist, Wet, etc.) Clay, silty, stiff to v. stiff, iron-staining

Observations / Notes

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar	

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ____

Project Site Name: Ellington Field Site Investigation
Project Site Number: 363W
NUS ~~Source~~ Sample No. 02-SB08C-A / 02-FD03-A
Source Location: Boring for MW-02, POL

Sample Method: Oversized Split Spoon Sampler	
Depth Sampled: 16-20'	
Sample Date & Time: 1-13-90 / 1045	
Sampled By: D. Usherwood / L. Basilio	
Signature(s): [signature]	

Composite Sample Data

Sample	Time	Color / Description

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown	Clayey silt & v fine sand, wet

Analysis:

TCL Volatiles
TCL BNAs
TPH

Observations / Notes:

Iron staining; some semi-consolidated sandstone & siltstone

Lab	NUS
Volume	2 6" liners, 2 4 oz jars, 2 16 oz jars

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ____________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB09A-A Source Location Boring for MW-09, POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 0-2

Sample Date & Time: 1-15-90 / 1030

Sampled By: D. Usthegrove / L. Basilio

Signature(s):

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis:

TCL Volatiles

TPH

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Dark gray	Clay, med stiff, iron staining & nodul[illegible]

Observations / Notes

Lab	NUS
Volume	1 6" liner, 1 4 oz jar

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name: Ellington Field Site Investigation
Project Site Number: 363W

NUS ~~Source~~ sample No.: 02-SB09TS-A
Source Location: Boring for MW-09, POL

Sample Method: Oversized Split Spoon Sampler	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 9-11'			
Sample Date & Time: 1-15-90 / 1100			
Sampled By: D. Usthegrove / L. Basilio			
Signature(s):			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Rust & grey	Silty Clay, soft to v. stiff

Observations / Notes

Iron staining and calcareous matter

Analysis:

TCL Volatiles
TPH

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar	

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 07-SB09C-A Source Location Boring E- MW-09, POL

Sample Method: Oversized Split Spoon Sampler	
Depth Sampled: 21-23'	
Sample Date & Time: 1-15-90 / 1300	
Sampled By: D. Uptegrove / L. Basilio	
Signature(s):	

Composite Sample Data

Sample	Time	Color / Description

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown	Silty to clayey v. fine sand, saturated

Analysis:
- TCL Volatiles
- TCL BNAs
- TPH

Observations / Notes

Iron stained

Lab	NUS	
Volume	1 6" liner, 1 4oz jar, 1 16 oz jar	

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Page 1 of 1

Case # NA

By NUS Corp

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 02-SB10A-A / 02-FD04-A Source Location Boring for MW-10, POL

Sample Method: Oversized Split Spoon Sampler	**Composite Sample Data**		
	Sample	Time	Color / Description
Depth Sampled: 8-10'			
Sample Date & Time: 1-16-90 / 940			
Sampled By: D. Upthegrove / L. Basilio			
Signature(s): D. [signature]			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Rust & grey	clay, stiff to v. stiff.

Analysis:

TCL Volatiles
TCL BNAs
TPH

Observations / Notes

Iron staining, hydrocarbon odor, headspace reading of 22 ppm w/ OVA.
VOA portion for 02-FD04-A (field dup) collected in 10-12' interval

Lab	NUS	
Volume	2 6" liners, 2 4 oz jars, 2 16 oz jars	

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 02-SB10B-A Source Location Boring for MW-10, 20-22 POL

Sample Method: Oversized Split Spoon Sampler

Depth Sampled: 20-22'

Sample Date & Time: 1-16-91 / 1015

Sampled By: D. Vsthegrove / L. Basilio

Signature(s): D. [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Brown	Clayey v. fine sand and silt, saturate

Analysis:

TCL Volatiles
TPH

Observations / Notes

Headspace reading of 2 ppm w/ OVA

Lab	NUS	
Volume	1 6" liner, 1 4 oz jar	

NUS CORPORATION

SOILS
SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [x] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other

Project Site Name Ellington Field Site Investigation Project Site Number 363M

NUS ~~Source~~ Sample No. 01-5501-A Source Location Western 1/3 of landfill

Sample Method: Stainless Steel Spoon / ~~Oversized Split Spoon Sampler~~ Glass Bowl	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: 0-6"	01-5501A-A	915	Dry, brown, sandy and silty
	01-5501B-A	930	Clay, collected in areas
Sample Date & Time: 1-17-90/940	01-5501C-A	940	showing surficial evidence
			of fill material (trash
Sampled By: D. Usthegrove/L. Basilio			rubble, etc)
Signature(s): [signatures]			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [x] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis:

TCL BNAs

TCL Pesticides

~~TE~~ TPH

TAL Inorganics

Observations / Notes

See above; locations noted in logbook

Lab	NUS
Volume	1 4 oz jar, 1 16 oz jar

SOILS

SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [x] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS ~~Source~~ Sample No. 01-5502-A Source Location Central 1/4 of landfill

Sample Method: Stainless Steel Spoon/Glass Bowl ~~Dedicated Split~~ Spoon Sampler

Depth Sampled: 0-6"

Sample Date & Time: 1-17-90/1005

Sampled By: D. Uptlegrove / L. Basilio

Signature(s):

Composite Sample Data

Sample	Time	Color / Description
01-5502A-A	945	Dry, brown & Fine sandy
01-5502B-A	955	& silty clay, collected
01-5502C-A	1005	in areas showing surficial
		evidence of fill
		material

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [x] Grab - Composite

Sample Data

Color | Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis:

TCL BNAs

TCL Pesticides

TPH

TAL Inorganics

Observations / Notes

See above, locations noted in logbook

Lab	NUS	
Volume	1 4 oz jar, 1 16 oz jar	

SOILS
SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [x] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ______

Project Site Name Ellington Field Site Investigation Project Site Number 363W

NUS Source No. ~~02~~ 01-SS03-A / 01-FD05-A Source Location Eastern 1/3 of landfill

Sample Method: Stainless Steel Spoon, Glass Bowl, ~~Oversized Split Spoon Sampler~~

Depth Sampled: 0-6"

Sample Date & Time: 1-17-90 / 10:30

Sampled By: D. Upthegrove / L. Basilio

Signature(s):

Composite Sample Data

Sample	Time	Color / Description
01-SS03A-A	1010	Collected in location of rusty drums & rubble, one
01-SS03B-A	1020	location where water pools
01-SS03C-A	1030	during heavy rains,
		and a location
		coincident w/ a
		cut & fill trench in
		old aerial photos.

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [x] Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis:

TCL BNAs
TCL Pesticides
~~TCL~~ TPH
TAL Inorganics

Observations / Notes

See above; locations noted in logbook

Lab	NUS	
Volume	2 4 oz jars, 2 16 oz jars	

NUS CORPORATION

MONITORING WELL SAMPLE LOG SHEET

[x] Monitoring Well Data
[ ] Domestic Well Data
[ ] Other ________

Page 1 of 1
Case # NA
By NUS Corp

Project Site Name Ellington Field SI   Project Site Number 363un CA
NUS Source No. MW-01   Source Location Former Base Landfill

	Purge Data				
Total Well Depth: ± ~~30.87~~ 31.17 BTOC	Volume	pH	S.C.	Temp. (°C)	DO Color & Turbidity
Well Casing Size & Depth: 2", well set @ ± 29'	1	6.70	1200	18.0	23.4
Static Water Level: 17.70	2	6.75	1200	17.9	20.1
One Casing Volume: ~~8.474~~ ~~8.47~~ 9.63					
Start Purge (hrs.): 915					
End Purge (hrs.): 1015					
Total Purge Time (min.): 60					
Total Amount Purged (gal.): 25 77					
Monitor Reading: HNU 0, OVA 0					
Purge Method: SS bailer					
Sample Method: SS bailer					
Depth Sampled: Top of water					

Sample Date & Time: 1/25/90 1015	Sample Data			
	pH	S.C.	Temp. (°C)	DO Color & Turbidity
Sampled By: D. Upthegrove L. Basilio	6.75	1250	18.3	17.3 Clear

Signature(s): D. U

Observations / Notes: Sample data was collected after purging completed and prior to sample collection.

Type of Sample
[x] Low Concentration
[ ] High Concentration
[x] Grab
[ ] Composite
[ ] Grab - Composite

Analysis:	Preservative		Organic	Inorganic
TCL VOAs	HCL	Traffic Report #	NA	NA
TCL BNAs		Tag #	NA	NA
TCL Pesticides				
TPH		AB #	NA	NA
TAL Inorganics	Nitric	Date Shipped	NA	NA
		Time Shipped	NA	NA
		Lab	NUS	NUS
		Volume	2 40 ml vials 3 gals	1 liter

NUS CORPORATION

MONITORING WELL SAMPLE LOG SHEET

☑ Monitoring Well Data
☐ Domestic Well Data
☐ Other ________

Page 1 of 1

Case # NA

By NUS Corp

Project Site Name Ellington Field SI   Project Site Number 363m CA

NUS Source No. MW-02   Source Location Former Base Landfill

	Purge Data					
Total Well Depth: ~~30.0~~ 30.18						
Well Casing Size & Depth: 28.5'	Volume	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
2", set well @ ± ~~24~~ bw	1	6.90	640	22.0	18.0	
Static Water Level: 20.66	3	6.90	640	20.4	16.0	
One Casing Volume: ~~5.53~~ ~~5.30~~ 5.41						
Start Purge (hrs.): 1140						
End Purge (hrs.): 1240						
Total Purge Time (min.): 60						
Total Amount Purged (gal.): 27						
Monitor Reading: HNU 0, OVA 0						
Purge Method: SS bailer						
Sample Method: SS bailer						
Depth Sampled: Top of water						

Sample Date & Time:	Sample Data				
1/25/90 1240	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Sampled By: D. Upthegrove L. Basilio	690	630	20.0	20.4	Clear

Signature(s): D. U[signature]

Observations / Notes:
Sample data collected after purging complete and prior to sample collection

Type of Sample
☑ Low Concentration
☐ High Concentration
☑ Grab
☐ Composite
☐ Grab - Composite

Analysis:	Preservative		Organic	Inorganic
TCL VOAs	HCL	Traffic Report #	NA	NA
TCL BNAs		Tag #	NA	NA
TCL Pesticides				
TPH		AB #	NA	NA
TAL Inorganics	Nitric	Date Shipped	NA	NA
		Time Shipped	NA	NA
		Lab	NUS	NUS
		Volume	2 40 ml vial 3 gals	1 liter

NUS CORPORATION

MONITORING WELL SAMPLE LOG SHEET

Case # NA

By NUS Corp

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ________

Project Site Name: Ellington Field ST   Project Site Number: 367M

NUS Source No.: MW-03   Source Location: Former Base Landfill

	Purge Data					
Total Well Depth: ?5.03	Volume	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Well Casing Size & Depth: 2", 2" well set @ ±23.5'	1	9.00	600	26.5	121.7	
Static Water Level: 11.87 9.61	2	7.24	625	25.0	121.1	
One Casing Volume: ~~8.47~~ gals						
Start Purge (hrs.): 1355						
End Purge (hrs.): 1450						
Total Purge Time (min.): 55						
Total Amount Purged (gal.): 27						
Monitor Reading: HNU 0, OVA 0						
Purge Method: SS Bailer						
Sample Method: SS Bailer						
Depth Sampled: Top of water						

Sample Date & Time: 1/23/90 1450	Sample Data				
	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Sampled By: D. Upthegrove L. Basilio	7.05	625	25.5	24.8	Clear, v. slightly turbid

Signature(s): D. [signature]

Observations / Notes:
Sample data was collected after purging completed and prior to sample collection

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [x] Composite
- [ ] Grab - Composite

Analysis:	Preservative		Organic	Inorganic
TCL VOAs	HCL	Traffic Report #	NA	NA
TCL BNAs		Tag #	NA	NA
TCL Pesticides				
TPH		AB #	NA	NA
TAL Inorganics	Nitric	Date Shipped	NA	NA
		Time Shipped	NA	NA
		Lab	NUS	NUS
		Volume	2 40 ml vials, 3 gals	1 liter

NUS CORPORATION

MONITORING WELL SAMPLE LOG SHEET

☑ Monitoring Well Data
☐ Domestic Well Data
☐ Other ________

Page 1 of 1
Case # NA
By NUS Corp

Project Site Name: Ellington Field SI   Project Site Number: 363M CA
NUS Source No.: MW-04   Source Location: Former Base Landfill

	Purge Data				
Total Well Depth: ~~25.85~~ 26.7 LTOC	Volume	pH	S.C.	Temp. (°C)	DO Color & Turbidity
Well Casing Size & Depth: 2", well set @ ± 25'	1	8.59	1100	23.5	18.8
Static Water Level: 15.97 LTOC	2	8.10	1050	23.8	16.2
One Casing Volume: ~~5.~~ 1.8 gals					
Start Purge (hrs.): 920 6.51					
End Purge (hrs.): 1015					
Total Purge Time (min.): 55					
Total Amount Purged (gal.): 22					
Monitor Reading: HNU 0, OVA 0					
Purge Method: S.S. bailer					
Sample Method: S.S bailer					
Depth Sampled: Top of water					

	Sample Data				
Sample Date & Time: 1/23/90 1015	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Sampled By: D. Upthegrove L Basilio	8.12	1050	23.8	17.7	Clear, v. slightly turbid

Signature(s): D. [signature]

Observations / Notes:
Sample data was collected after purging completed and prior to sample collection.

Type of Sample
☑ Low Concentration
☐ High Concentration
☑ Grab
☐ Composite
☐ Grab - Composite

Analysis:	Preservative		Organic	Inorganic
TCL VOAs	HCL	Traffic Report #	NA	NA
TCL BNAs		Tag #	NA	NA
TCL Pesticides				
TPH		AB #	NA	NA
TAL Inorganics	Nitric	Date Shipped	NA	NA
		Time Shipped	NA	NA
		Lab	NUS	NUS
		Volume	2 40 ml vials, 3 gals	1 liter

NUS CORPORATION

MONITORING WELL SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ________

Page 1 of 1

Case # NA

By NUS Corp

Project Site Name: Ellington Field ST

Project Site Number: 363m CA

NUS Source No.: MW-05

Source Location: Former Base Landfill

Total Well Depth: ~~30.63~~ 30.68

Well Casing Size & Depth: 2", set well @ ±29'

Static Water Level: 21.85

One Casing Volume: ~~4.01~~ 5.47

Start Purge (hrs.): 1515

End Purge (hrs.): 1600

Total Purge Time (min.): 45

Total Amount Purged (gal.): 15

Monitor Reading: HNU 0, OVA 0

Purge Method: SS bailer

Sample Method: SS bailer

Depth Sampled: Top of water

Sample Date & Time: 1/25/90 1600

Sampled By: D. Upthegrove L. Basilio

Signature(s):

Purge Data

Volume	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
1	6.70	660	21.6	23.0	
2	6.70	660	21.2	24.9	

Sample Data

pH	S.C.	Temp. (°C)	DO	Color & Turbidity
6.70	660	21.0	26.5	Clear

Observations / Notes:

Sample data collected after purging complete and prior to sample collection

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis:	Preservative
TCL Volatiles	HCL
TCL BNAs	
TCL Pesticides	
TPH	
TAL Inorganics	Nitric

	Organic	Inorganic
Traffic Report #	NA	NA
Tag #	NA	NA
AB #	NA	NA
Date Shipped	NA	NA
Time Shipped	NA	NA
Lab	NUS	NUS
Volume	2 40 ml vials, 3 gals	1 liter

MONITORING WELL SAMPLE LOG SHEET

NUS CORPORATION

Page 1 of 1

Case # NA

By NUS Corp

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ________

Project Site Name: Ellington Field SI
Project Site Number: 363m CA
NUS Source No.: MW-07N
Source Location: POL Storage Area

	Purge Data					
Total Well Depth: ~~27.83~~ 27.96 bTOC	Volume	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Well Casing Size & Depth: 2" well set @ ± 28'	1	6.90	1300	24.5	16.1	
Static Water Level: 11.27	2	6.87	1250	23.9	14.9	
One Casing Volume: ~~10.54~~ 1 gals						
Start Purge (hrs.): 1545 12.00						
End Purge (hrs.): 1645						
Total Purge Time (min.): 60						
Total Amount Purged (gal.): 32						
Monitor Reading: HNU ~~2~~ bkg, OVA 2						
Purge Method: S.S. bailer						
Sample Method: S.S bailer						
Depth Sampled: Top of water						

Sample Date & Time: 1/27/90 1650	Sample Data				
	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Sampled By: D. Upthegrove L. Basilio	6.85	1250	23.6	17.3	Lt brown, turbid

Signature(s): [signature]

Observations / Notes: Sample data collected after purging completed and prior to sample collection

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis:	Preservative		Organic	Inorganic
TCL VOAs	HCL	Traffic Report #	NA	NA
TCL BNAs		Tag #	NA	NA
TPH				
		AB #	NA	NA
		Date Shipped	NA	NA
		Time Shipped	NA	NA
		Lab	NUS	NA
		Volume	2 40 ml vials, 2 gals	NA

NUS CORPORATION

MONITORING WELL SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ________

Project Site Name Ellington Field ST   Project Site Number 363m CA

NUS Source No. MW-08   Source Location POL Storage Area

	Purge Data					
Total Well Depth: ~~26.90~~ 27.35 bTOC	Volume	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Well Casing Size & Depth: 2" well set @ ±25'	1	7.10	1200	24.6	20.1	
Static Water Level: 14.78 bTOC	2	7.05	1200	24.4	17.5	
One Casing Volume: ~~8.37~~ 9.10 gals					~~22.2~~ DCV	
Start Purge (hrs.): 1030						
End Purge (hrs.): 1125						
Total Purge Time (min.): 55						
Total Amount Purged (gal.): 30						
Monitor Reading: HNU 0, OVA 20						
Purge Method: S.S. Bailer						
Sample Method: "						
Depth Sampled: Top of H_2O						

	Sample Data				
Sample Date & Time: 1/22/90 1130	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Sampled By: D. Upthegrove / L. Basilio	7.00	1200	24.4	22.2	Turbid, lt. brown

Signature(s):

Observations / Notes: Sample data collected after purging ~~3 volumes +~~ DCV completed and prior to sample collection

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis:	Preservative		Organic	Inorganic
~~VOA~~ DCV		Traffic Report #	NA	NA
TCL VOAs	HCL	Tag #	NA	NA
TCL BNAs				
TPH		AB #	NA	NA
		Date Shipped	NA	NA
		Time Shipped	NA	NA
		Lab	NUS	~~NUS~~ DCV NA
		Volume	2 40 ml vials, 2 gals	NA

NUS CORPORATION

MONITORING WELL SAMPLE LOG SHEET

Page 1 of 1

Case # NA

By NUS Corp

☑ Monitoring Well Data
☐ Domestic Well Data
☐ Other ______

Project Site Name Ellington Field ST   Project Site Number 363m CA

NUS Source No. MW-04   Source Location POL Storage Area

	Purge Data					
Total Well Depth: PVC ~~24.42~~ ~~32.44~~ 32.53 TOC	Volume	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Well Casing Size & Depth: 2", set well @ ± 33'	1		1200	23.3	17.9	
Static Water Level: 17.05	2		1150	23.3	15.7	
One Casing Volume: ~~10.30~~ gals						
Start Purge (hrs.): 930 1130						
End Purge (hrs.): 1045						
Total Purge Time (min.): 1:15						
Total Amount Purged (gal.): 31						
Monitor Reading: OVA 45, HNU 5						
Purge Method: SS bailer						
Sample Method: SS bailer						
Depth Sampled: Top of water						

	Sample Data				
Sample Date & Time: 1/24/90 1045	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Sampled By: D. Upthegrove L. Basilio	~~1150~~ 710	1150	23.3	17.3	Clear

Signature(s): D. Upthegrove

Observations / Notes:
Sample data collected after purging complete and prior to sample collection

pH meter malfunctioning; Authorized by HAZWRAP (S. Goldberg) to sample without.

Type of Sample
☑ Low Concentration
☐ High Concentration
☑ Grab
☐ Composite
☐ Grab - Composite

Analysis:	Preservative		Organic	Inorganic
TCL VOAs	HCL	Traffic Report #	NA	NA
TCL BNAs		Tag #	NA	NA
TPH				
		AB #	NA	NA
		Date Shipped	NA	NA
		Time Shipped	NA	NA
		Lab	NUS	NA
		Volume	2 40 ml vials 2 gals	NA

NUS CORPORATION

MONITORING WELL SAMPLE LOG SHEET

☑ Monitoring Well Data
☐ Domestic Well Data
☐ Other ________

Case # NA

By NUS Corp

Project Site Name: Ellington Field SI   Project Site Number: 363m CA

NUS Source No.: MW-10   Source Location: POL Storage Area

	Purge Data					
	Volume	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Total Well Depth: ~~34.60~~ 34.84 bTOC						
Well Casing Size & Depth: 2", well set @ ± ~~29~~ 33.5'	1	7.05	1250	25.3	15.5	
Static Water Level: 18.76 bTOC	2	7.01	1270	25.6	22.3	
One Casing Volume: ~~10.72~~ 4 gals						
Start Purge (hrs.): 1330 12:22						
End Purge (hrs.): 1440						
Total Purge Time (min.): 1:10						
Total Amount Purged (gal.): 33						
Monitor Reading: HNU 0, OVA 22						
Purge Method: S.S. Bailer						
Sample Method: "						
Depth Sampled: Top of water						

	Sample Data				
Sample Date & Time: 1/22/90 1445	pH	S.C.	Temp. (°C)	DO	Color & Turbidity
Sampled By: D. Upthegrove / L Basilio	7.11	1200	25.2		Clear, v. slightly turbid

Signature(s): [signature]

Observations / Notes: Sample data collected after ~~com~~ per purging completed and prior to sampling

Type of Sample
☑ Low Concentration
☐ High Concentration
☑ Grab
☐ Composite
☐ Grab - Composite

Analysis:	Preservative		Organic	Inorganic
TCL VOAs	HCL	Traffic Report #	NA	NA
TCL BNAs		Tag #	NA	NA
TPH				
		AB #	NA	NA.
		Date Shipped	NA	NA
		Time Shipped	NA	NA
		Lab	NUS	NA
		Volume	2 40 ml vials, 2 gals	NA

WELL COMPLETION FORMS

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 363M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: MW-01 | DATE: 12-13-89

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER | DRILLER: Z. Ruffin

☐ ____ INCH ROTARY WASH | HOURS DRILLED: ~~2.25~~ 3.4 (sic)

GALLONS OF WATER USED DURING DRILLING: ~~±4~~ 38 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME:	DATE:
GPM	FROM TO	
GPM	FROM TO	
GPM	FROM TO	
GPM	FROM TO	

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5.5 SACKS OF 20/40 grade silica SAND

3 SACKS OF Type II Portland CEMENT

±30 GALLONS OF GROUT USED

7.5 ~~SACKS~~ LBS OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

22.5 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

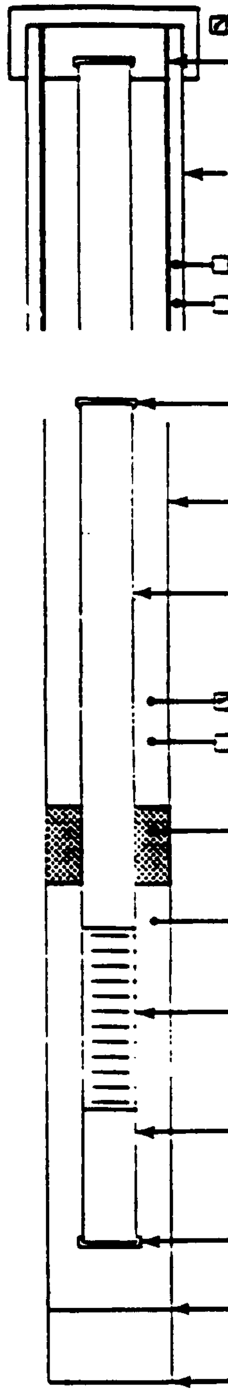
NA YARD³ CEMENT-SAND (REDI-MIX) ORDERED

7 ~~YARD~~ Sacks CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☑ LOCKING STEEL COVER ☐ CHRISTY BOX



☐ CHRISTY BOX

☑ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

TOP OF CASING AT ±2 FEET ABOVE/AT/BELOW GROUND LEVEL

8.25 INCH DIAMETER BOREHOLE 0 to 29.5 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING +2 to -16 feet

☑ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to 10 feet

BENTONITE PELLET SEAL 10 to 13 feet

20/40 grade silica (NAME) (NUMBER) SAND PACK 13 to 29.5 feet

2 INCH DIAMETER SLOTTED #10 SCREEN 16 to 26 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 26 to 28.5 feet

BOTTOM WELL CAP 29 feet

HOLE CLEANED OUT TO ____ feet

BOTTOM OF BOREHOLE 29.5 feet

NOT TO SCALE

ADDITIONAL INFORMATION:

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 363M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: MW-02 | DATE: 2-14-89

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER | DRILLER: C. Ruffin

☐ ____ INCH ROTARY WASH | HOURS DRILLED: 2.75

GALLONS OF WATER USED DURING DRILLING: 0 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME:	DATE:
GPM	FROM TO	
GPM	FROM TO	
GPM	FROM TO	
GPM	FROM TO	

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5 SACKS OF 20/40 grade silica SAND

3 SACKS OF Type II Portland CEMENT

130 GALLONS OF GROUT USED

7.5 LBS OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

20 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF ____ INCH PVC SLOTTED SCREEN

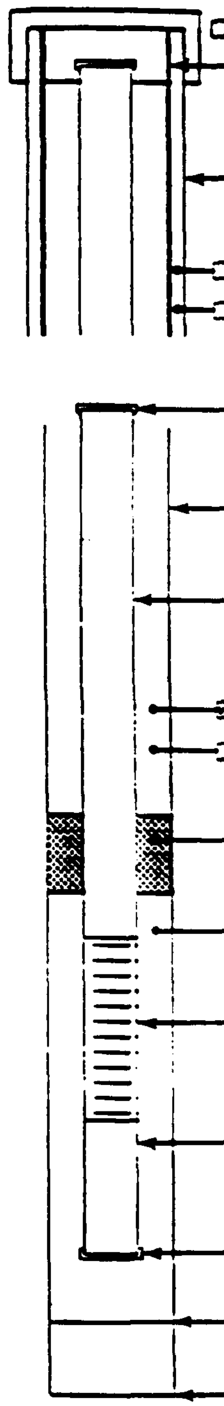
____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

7 SACKS CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☑ LOCKING STEEL COVER ☐ CHRISTY BOX



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

TOP OF CASING AT ±2 FEET ABOVE / BELOW GROUND LEVEL

8.25 INCH DIAMETER BOREHOLE 0 to -28.5 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING 0 to -15.5 feet

☑ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to 11' feet

BENTONITE PELLET SEAL -11 to -13 feet

20/40 grade silica (NAME) (NUMBER) SAND PACK -13 to -28.5 feet

2 INCH DIAMETER SLOTTED #10 SCREEN -15.5 to -25.5 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 25.5 to 28 feet

BOTTOM WELL CAP 28.5 feet

HOLE CLEANED OUT TO ____ feet

BOTTOM OF BOREHOLE 28.5 feet

NOT TO SCALE

ADDITIONAL INFORMATION:

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 368M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: MW-03 | DATE: 12-14-89

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER | DRILLER: Z. Ruffin

☐ ____ INCH ROTARY WASH | HOURS DRILLED: 2.25

GALLONS OF WATER USED DURING DRILLING: 0 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5.5 SACKS OF 20/40 grade silica SAND

2 SACKS OF Type II Portland CEMENT

120 GALLONS OF GROUT USED

5 LBS OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

~~12.5~~ 15 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

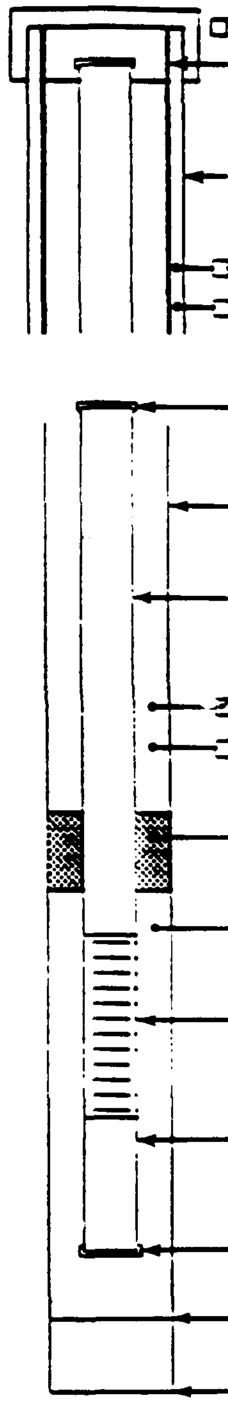
____ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

2 SACKS CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☑ LOCKING STEEL COVER ☐ CHRISTY BOX



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

TOP OF CASING AT ±2 FEET ABOVE AT BELOW GROUND LEVEL

8.25 INCH DIAMETER BOREHOLE 0 to -24 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING +2 to -10.5 feet

☑ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to -6.5 feet

BENTONITE PELLET SEAL -6.5 to -8.5 feet

20/40 grade silica (NAME) (NUMBER) SAND PACK -8.5 to -24 feet

2 INCH DIAMETER SLOTTED : #10 (SIZE) SCREEN 10.5 to 20.5 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 20.5 to ~~23.5~~ 23 feet

BOTTOM WELL CAP 23.5 feet

HOLE CLEANED OUT TO ____ feet

BOTTOM OF BOREHOLE 24 feet

NOT TO SCALE

ADDITIONAL INFORMATION:

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation
JOB NUMBER: 363M | PROJECT MANAGER: Linda Steakley
LOGGED BY: David Upthegrove | EDITED BY:
WELL NAME: MW-04 | DATE: 12-12-89
DRILLING COMPANY: Custom Coring, Inc.
EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER | DRILLER: Z. Ruffin
☐ ____ INCH ROTARY WASH | HOURS DRILLED: 2.5
GALLONS OF WATER USED DURING DRILLING: ~~135~~ 3449 DCU DCU GALLONS
METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:
DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME:		DATE:
GPM	FROM	TO	
GPM	FROM	TO	
GPM	FROM	TO	
GPM	FROM	TO	

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

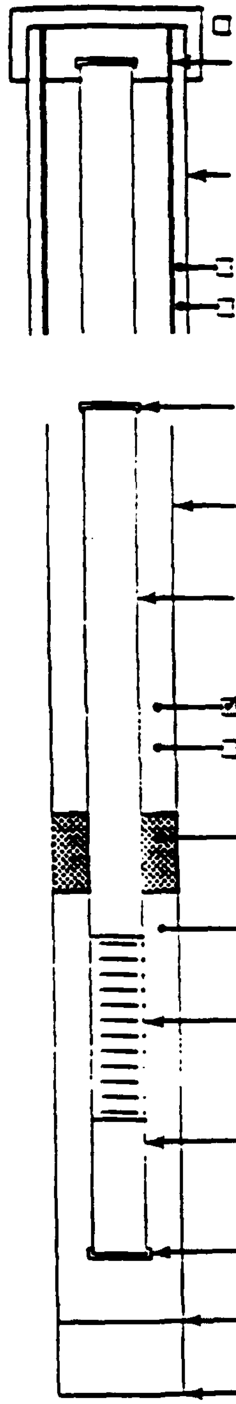
DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

4.5 SACKS OF 20/40 grade silica SAND
2 SACKS OF Type II Portland CEMENT
±20 GALLONS OF GROUT USED
5 LBS. ~~SACKS~~ OF POWDERED BENTONITE
50 POUNDS OF BENTONITE PELLETS
+517.5 FEET OF 2 INCH PVC BLANK CASING
10 FEET OF 2 INCH PVC SLOTTED SCREEN

____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED
7 SACKS ~~YARD³~~ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES
NAME NA
WELL COVER USED: ☑ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER



☐ CHRISTY BOX
☐ LOCKING STEEL COVER
____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet
____ INCH DIAMETER BOREHOLE ____ to ____ feet
☐ BENTONITE-CEMENT SEAL OR ☐ 6-SACK CEMENT-SAND SEAL ____ to ____ feet

TOP OF CASING AT +2 FEET ABOVE/BELOW GROUND LEVEL
8.25 INCH DIAMETER BOREHOLE 0 to 25 feet
2 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING +2 to -12 feet
☑ BENTONITE-CEMENT SEAL OR ☐ 6-SACK CEMENT-SAND SEAL 0 to ~~-10~~ -8 DCU feet
BENTONITE PELLET SEAL -8 to -10 feet
20/40 grade silica (NUMBER) SAND PACK -10 to -25 feet
2 INCH DIAMETER SLOTTED: #10 SCREEN -12 to -22 feet
2 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP -22 to -24.5 feet
BOTTOM WELL CAP -25 feet
HOLE CLEANED OUT TO ____ feet
BOTTOM OF BOREHOLE -25 feet

NOT TO SCALE

ADDITIONAL INFORMATION:

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 368M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: MW-05 | DATE: 12-21-89

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER | DRILLER: Z. Kuhn

☐ ____ INCH ROTARY WASH | HOURS DRILLED: 1.475

GALLONS OF WATER USED DURING DRILLING: 44 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME:		DATE:
GPM	FROM	TO	
GPM	FROM	TO	
GPM	FROM	TO	
GPM	FROM	TO	

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5 SACKS OF 20/40 grade silica SAND

3 SACKS OF Type II Portland CEMENT

±30 GALLONS OF GROUT USED

7.5 ~~SACKS~~ LBS OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

22.5 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

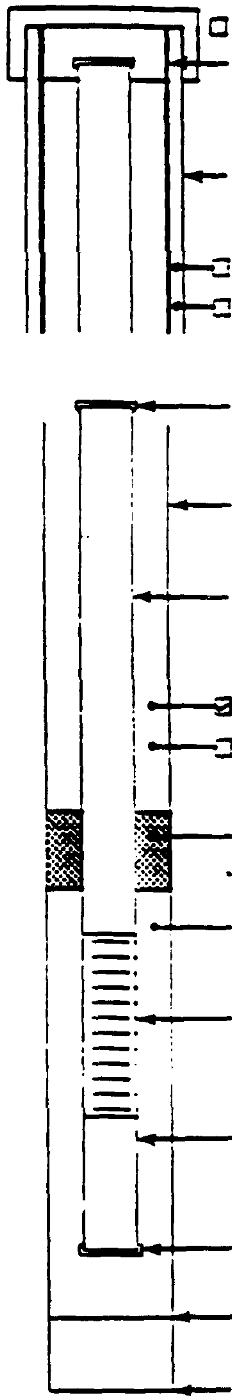
____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

2 ~~YARD³~~ SACKS CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☑ LOCKING STEEL COVER



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

TOP OF CASING AT ± 2 FEET ABOVE / BELOW GROUND LEVEL

8.25 INCH DIAMETER BOREHOLE 0 to 30 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING 0 to 16.5 feet

☑ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to 11.5 feet

BENTONITE PELLET SEAL 11.5 to 13.5 feet

20/40 grade silica SAND PACK 13.5 to 30 feet

2 INCH DIAMETER SLOTTED #10 SCREEN 16.5 to 26.5 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 26.5 to 29 feet

BOTTOM WELL CAP 29.5 feet

HOLE CLEANED OUT TO ____ feet

BOTTOM OF BOREHOLE 29.5 feet

NOT TO SCALE

ADDITIONAL INFORMATION: ____

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 363M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: ~~MW~~ PZ-01 | DATE: 12-15-89

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: 3.25 ☑ ~~4.25~~ INCH HOLLOW STEM AUGER | DRILLER: Z. Ruffin

☐ ______ INCH ROTARY WASH | HOURS DRILLED: 1.5

GALLONS OF WATER USED DURING DRILLING: 0 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT ~~See Well Development Form~~ NA

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ______

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

3 SACKS OF 20/40 grade silica SAND

NA SACKS OF ______ CEMENT

NA GALLONS OF GROUT USED

NA SACKS OF POWDERED BENTONITE

38 POUNDS OF BENTONITE PELLETS

27.5 FEET OF 1.25 INCH PVC BLANK CASING

2.5 FEET OF 1.25 INCH PVC SLOTTED SCREEN

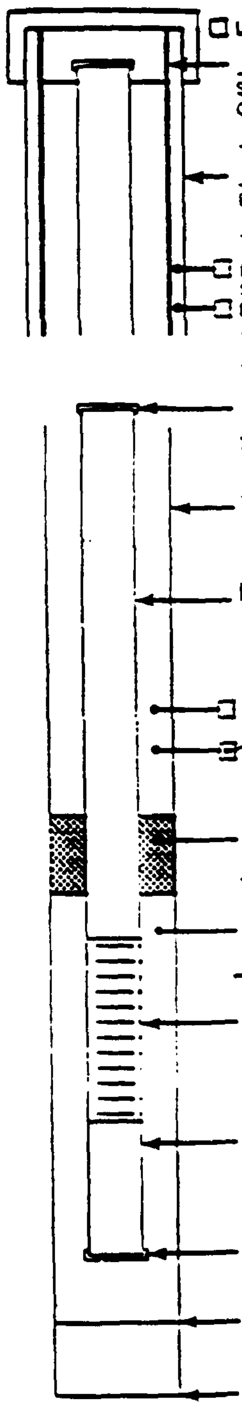
______ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

NA YARD³ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☑ OTHER Nail



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

______ INCH DIAMETER STEEL CONDUCTOR CASING ______ to ______ feet

______ INCH DIAMETER BOREHOLE ______ to ______ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ______ to ______ feet

TOP OF CASING AT ±3 FEET ABOVE AT BELOW GROUND LEVEL

7.25 INCH DIAMETER BOREHOLE 0 to 29 feet

1.25 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING +3 to -24 feet

☐ BENTONITE-CEMENT SEAL OR ☐ ~~8-SACK CEMENT-SAND SEAL~~ NATURAL BACKFILL 0 to ~~22~~ 20 feet

BENTONITE PELLET SEAL 20 to 22 feet

20/40 grade silica (NAME) (NUMBER) SAND PACK -22 to -29 feet

1.25 INCH DIAMETER SLOTTED #10 SCREEN -24 to 26.5 feet

1.25 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 26.5 to 29 feet

BOTTOM WELL CAP 29 feet

HOLE CLEANED OUT TO ______ feet

BOTTOM OF BOREHOLE 29 feet

NOT TO SCALE

ADDITIONAL INFORMATION:

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 363M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: ~~MW~~ 7202 | DATE: 12-20-90

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: 3.75 ☑ ~~4.25~~ INCH HOLLOW STEM AUGER | DRILLER: R. Ruffin

☐ ______ INCH ROTARY WASH | HOURS DRILLED: 1.25

GALLONS OF WATER USED DURING DRILLING: ~~250~~ 265 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT ~~See Well Development Form~~ NA

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME:		DATE:
GPM	FROM	TO	
GPM	FROM	TO	
GPM	FROM	TO	
GPM	FROM	TO	

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ______

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5 SACKS OF 20/40 grade silica SAND

NA SACKS OF ______ CEMENT

NA GALLONS OF GROUT USED

NA SACKS OF POWDERED BENTONITE

38 POUNDS OF BENTONITE PELLETS

27.5 FEET OF 1.25 INCH PVC BLANK CASING

2.5 FEET OF 1.25 INCH PVC SLOTTED SCREEN

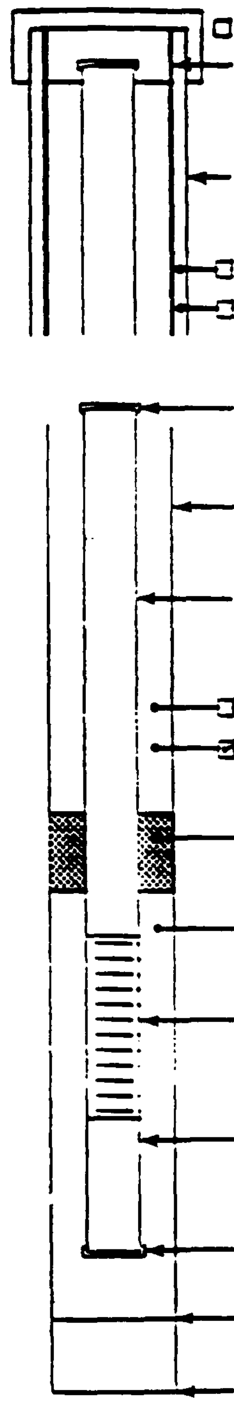
______ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

NA YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

______ INCH DIAMETER STEEL CONDUCTOR CASING ______ to ______ feet

______ INCH DIAMETER BOREHOLE ______ to ______ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ______ to ______ feet

TOP OF CASING AT ±2 FEET (ABOVE) AT BELOW GROUND LEVEL

7.25 INCH DIAMETER BOREHOLE 0 to 28 feet

1.25 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING +2 to 22.5 feet

☐ BENTONITE-CEMENT SEAL OR ☑ ~~8-SACK CEMENT-SAND SEAL~~ NATURAL BACKFILL 0 to 16.5 feet

BENTONITE PELLET SEAL 16.5 to 19 feet

20/40 grade silica (NAME) (NUMBER) SAND PACK 19 to 28 feet

1.25 INCH DIAMETER SLOTTED (#10 SLOT) SCREEN 22.5 to 25 feet

1.25 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 25 to 27.5 feet

BOTTOM WELL CAP 27.5 feet

HOLE CLEANED OUT TO ______ feet

BOTTOM OF BOREHOLE 27.5 feet

NOT TO SCALE

ADDITIONAL INFORMATION: ______

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 363M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Uptheqrove | EDITED BY:

WELL NAME: ~~MW~~ P2-03 | DATE: 1-11-90

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: 7.25 ☒ ~~4.25~~ INCH HOLLOW STEM AUGER | DRILLER: Z. Ruffin

☐ ______ INCH ROTARY WASH | HOURS DRILLED: 1.5

GALLONS OF WATER USED DURING DRILLING: 0 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT ~~See Well Development Form~~ NA

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ______

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

3 SACKS OF 20/40 grade silica SAND

NA SACKS OF ______ CEMENT

NA GALLONS OF GROUT USED

NA SACKS OF POWDERED BENTONITE

38 POUNDS OF BENTONITE PELLETS

22.5 FEET OF 1.25 INCH PVC BLANK CASING

2.5 FEET OF 1.25 INCH PVC SLOTTED SCREEN

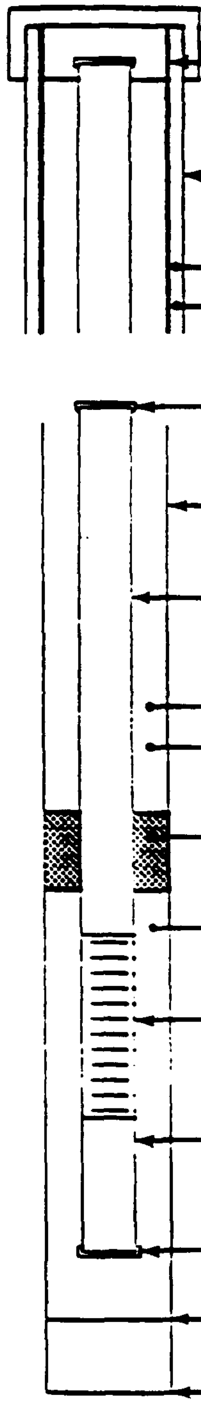
~~4~~ ~~sacks~~ ~~YARD^3~~ CEMENT-SAND (REDI-MIX) ORDERED

NA YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☒ NO ☐ YES

NAME NA

WELL COVER USED: ☐ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ ... [illegible]



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

TOP OF CASING AT 1.2 FEET ABOVE AT BELOW GROUND LEVEL

7.25 INCH DIAMETER BOREHOLE 0 to 23.5 feet

1.25 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING 0 to 18.5 feet

☐ BENTONITE-CEMENT SEAL OR ☐ ~~8-SACK CEMENT-SAND SEAL~~ NATURAL BACKFILL 0 to 13 feet

BENTONITE PELLET SEAL 13 to 15.5 feet

20/40 grade silica SAND PACK 15.5 to 23.5 feet

1.25 INCH DIAMETER SLOTTED: #10 SCREEN ~~21~~ 18.5 to ~~23.5~~ 21 feet

1.25 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 21 to 23.5 feet

BOTTOM WELL CAP 23.5 feet

HOLE CLEANED OUT TO ____ feet

BOTTOM OF BOREHOLE 23.5 feet

NOT TO SCALE

ADDITIONAL INFORMATION:

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation	
JOB NUMBER: 368M	PROJECT MANAGER: Linda Steakley
LOGGED BY: David Upthegrove	EDITED BY:
WELL NAME: MW-07	DATE: 1-17-90
DRILLING COMPANY: Custom Coring, Inc.	
EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER ☐ ____ INCH ROTARY WASH	DRILLER: Z. Ruffin HOURS DRILLED: 2
GALLONS OF WATER USED DURING DRILLING: 0 GALLONS	
METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning	

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:		
DEVELOPMENT BEGAN DATE:	TIME:	
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
YIELD: GPM	TIME: FROM TO	DATE:
TOTAL WATER REMOVED DURING DEVELOPMENT:	GALLONS	
DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT:	☐ CLEAR ☐ MOD. TURBID	☐ SLIGHTLY CLOUDY ☐ VERY MUDDY
ODOR OF WATER:		
WATER DISCHARGED TO:	☐ GROUND SURFACE ☐ STORM SEWERS ☐ DRUMS	☐ TANK TRUCK ☐ STORAGE TANK ☐ OTHER ____
DEPTH TO WATER AFTER DEVELOPMENT:	FEET	

MATERIALS USED

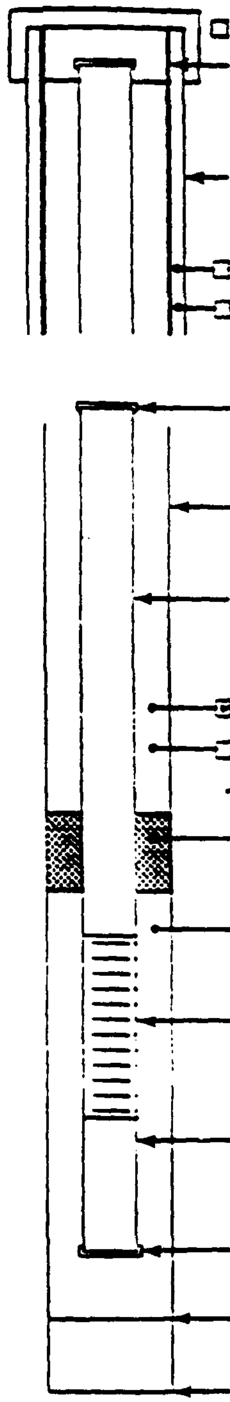
5 SACKS OF 20/40 grade silica SAND
32 SACKS OF Type II Portland CEMENT
320 GALLONS OF GROUT USED
5 LBS OF POWDERED BENTONITE
50 POUNDS OF BENTONITE PELLETS
17.5 FEET OF 2 INCH PVC BLANK CASING
10 FEET OF 2 INCH PVC SLOTTED SCREEN

7 SACKS CEMENT-SAND (REDI-MIX) ORDERED
2 7/8 SACKS CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☐ LOCKING STEEL COVER
☑ CHRISTY BOX



☐ CHRISTY BOX
☐ LOCKING STEEL COVER
____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet
____ INCH DIAMETER BOREHOLE ____ to ____ feet
☐ BENTONITE-CEMENT SEAL OR
☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet
TOP OF CASING AT ____ FEET ABOVE/AT BELOW GROUND LEVEL
8.25 INCH DIAMETER BOREHOLE 0 to 28 feet
2 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING 0 to 15 feet
☑ BENTONITE-CEMENT SEAL OR
☐ 8-SACK CEMENT-SAND SEAL ~~10.5~~ 0 to ~~17.5~~ 10.5 feet
BENTONITE PELLET SEAL 10.5 to 12.5 feet
20/40 grade silica (range) (number) SAND PACK 12.5 to 28 feet
2 INCH DIAMETER SLOTTED #10 (inch) SCREEN 15 to 25 feet
2 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 25 to 27.5 feet
BOTTOM WELL CAP 28 feet
HOLE CLEANED OUT TO ____ feet
BOTTOM OF BOREHOLE 28 feet

NOT TO SCALE

ADDITIONAL INFORMATION: ____

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 363M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: MW-08 | DATE: 1-13-90

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER | DRILLER: T. Ruffin

☐ ____ INCH ROTARY WASH | HOURS DRILLED: 1.75

GALLONS OF WATER USED DURING DRILLING: ± 50 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME:	DATE:
GPM	FROM TO	
GPM	FROM TO	
GPM	FROM TO	
GPM	FROM TO	

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5 SACKS OF 20/40 grade silica SAND

3 SACKS OF Type II Portland CEMENT

±30 GALLONS OF GROUT USED

7.5 ~~SACKS~~ LBS OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

17.5 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

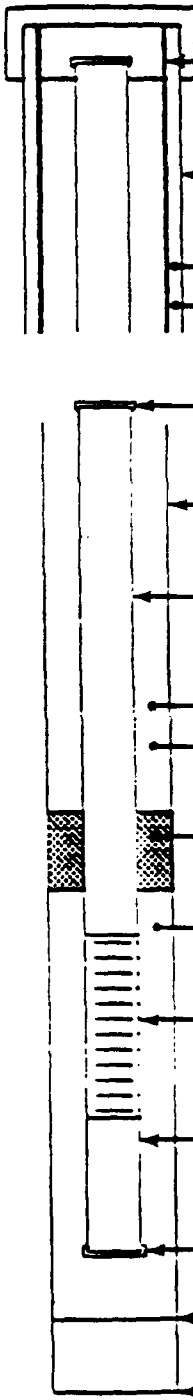
~~4~~ 8 ~~YARD~~[3] CEMENT-SAND (REDI-MIX) ORDERED

32 SACKS ~~YARD~~[3] CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☐ LOCKING STEEL COVER ☑ CHRISTY BOX



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

TOP OF CASING AT ____ FEET ABOVE AT BELOW GROUND LEVEL

8.25 INCH DIAMETER BOREHOLE 0 to 29 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING 0 to 15 feet

☑ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to 11 feet

BENTONITE PELLET SEAL 11 to 13 feet

20/40 grade silica (name) (number) SAND PACK 13 to 29 feet

2 INCH DIAMETER SLOTTED #10 (slot) SCREEN 15 to 25 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 25 to 27.5 feet

BOTTOM WELL CAP 28 feet

HOLE CLEANED OUT TO ____ feet

BOTTOM OF BOREHOLE 29 feet

NOT TO SCALE

ADDITIONAL INFORMATION: ____

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 363M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: MW-09 | DATE: 1-15-90

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER | DRILLER: R. Valdez

☐ ____ INCH ROTARY WASH | HOURS DRILLED: 7.5

GALLONS OF WATER USED DURING DRILLING: ~~48~~ 44 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME:		DATE:
GPM	FROM	TO	
GPM	FROM	TO	
GPM	FROM	TO	
GPM	FROM	TO	

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5 SACKS OF 20/40 grade silica SAND

4 SACKS OF Type II Portland CEMENT

±40 GALLONS OF GROUT USED

10 LBS ~~SACKS~~ OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

22.5 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

____ YARD³ CEMENT-SAND (REDI-MIX) ORDERED

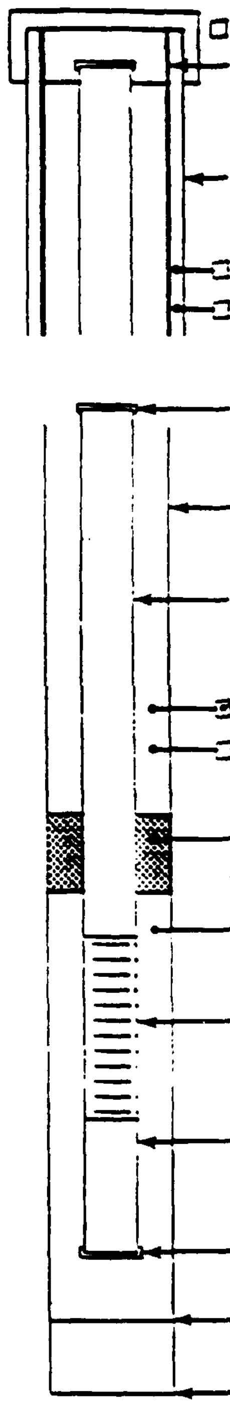
32 sacks ~~YARD³~~ CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME NA

WELL COVER USED: ☐ LOCKING STEEL COVER

☑ CHRISTY BOX



NOT TO SCALE

ADDITIONAL INFORMATION:

NUS CORPORATION

FIELD WELL COMPLETION FORM

JOB NAME: Ellington Field Site Investigation

JOB NUMBER: 368M | PROJECT MANAGER: Linda Steakley

LOGGED BY: David Upthegrove | EDITED BY:

WELL NAME: MW-10 | DATE: 1-16-90

DRILLING COMPANY: Custom Coring, Inc.

EQUIPMENT: ☑ 4.25 INCH HOLLOW STEM AUGER | DRILLER: R. Valdez

☐ ____ INCH ROTARY WASH | HOURS DRILLED: 2

GALLONS OF WATER USED DURING DRILLING: 0 GALLONS

METHOD OF DECONTAMINATION PRIOR TO DRILLING: Steam Cleaning

DEVELOPMENT See Well Development Form

METHOD OF DEVELOPMENT:

DEVELOPMENT BEGAN DATE: TIME:

YIELD:	TIME:	DATE:
GPM	FROM TO	
GPM	FROM TO	
GPM	FROM TO	
GPM	FROM TO	

TOTAL WATER REMOVED DURING DEVELOPMENT: GALLONS

DESCRIPTION OF TURBIDITY AT END OF DEVELOPMENT: ☐ CLEAR ☐ SLIGHTLY CLOUDY ☐ MOD. TURBID ☐ VERY MUDDY

ODOR OF WATER:

WATER DISCHARGED TO: ☐ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANK ☐ DRUMS ☐ OTHER ____

DEPTH TO WATER AFTER DEVELOPMENT: FEET

MATERIALS USED

5.5 SACKS OF 20/40 grade silica SAND

4 SACKS OF Type II Portland CEMENT

±40 GALLONS OF GROUT USED

10 ~~SACKS~~ LBS OF POWDERED BENTONITE

50 POUNDS OF BENTONITE PELLETS

25 FEET OF 2 INCH PVC BLANK CASING

10 FEET OF 2 INCH PVC SLOTTED SCREEN

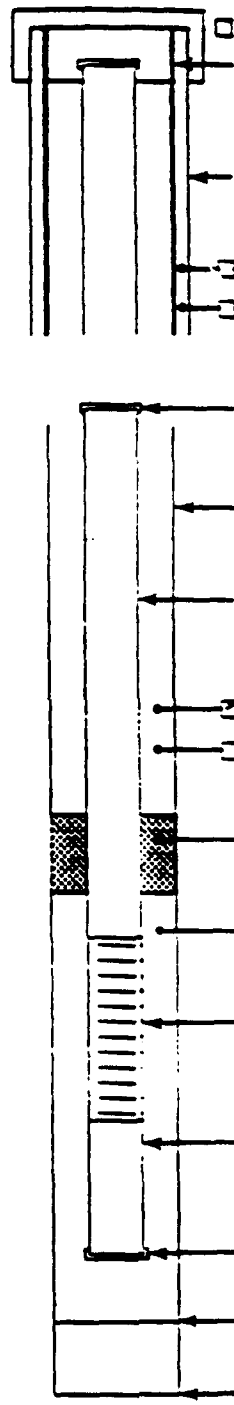
____ YARD^3 CEMENT-SAND (REDI-MIX) ORDERED

7 YARD^3 CEMENT-SAND (REDI-MIX) USED

CONCRETE PUMPER USED? ☑ NO ☐ YES

NAME

WELL COVER USED: ☑ LOCKING STEEL COVER ☐ CHRISTY BOX ☐ OTHER



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

TOP OF CASING AT ____ FEET ABOVE / AT / BELOW GROUND LEVEL

8.25 INCH DIAMETER BOREHOLE 0 to 33.5 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK CASING 0 to 20.5 feet

☑ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to 16 feet

BENTONITE PELLET SEAL 16 to 19 feet

20/40 grade silica (NAME) (NUMBER) SAND PACK 19 to 33.5 feet

2 INCH DIAMETER SLOTTED: #10 INCH SCREEN 20.5 to 30.5 feet

2 INCH DIAMETER SCHEDULE 40 PVC BLANK SILT TRAP 30.5 to 33 feet

BOTTOM WELL CAP 33.5 feet

HOLE CLEANED OUT TO ____ feet

BOTTOM OF BOREHOLE 33.5 feet

NOT TO SCALE

ADDITIONAL INFORMATION:

WELL DEVELOPMENT FORMS

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)

MW-01

	12-19	1-5	1-8
Total Depth of Well (bTOC*)	30.60	30.58	30.87
Static Water Level (bTOC)	17.58	17.77	17.42
h - Height of Water Column (feet)	13.02	12.81	13.45
r - Inside Diameter of Well (feet)	.083		
R - Diameter of Boring (feet)	.344		
Volume of Well and Filter Pack $v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	12.33	12.13	12.74

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	12-19	1-5	1-8
Time	1005	800	1045
Volume Removed	10 gals	20 gals	25 gals
Development Method	SS bailer	SS bailer	air lift
Developed By	R. Rexroad	D. Upthegrove	D. Upthegrove

Comments:

After removing a total of 55 gals, well produces water containing little or no sediment. Still slightly turbid

*below top of casing

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)
MW-02

	12-19	1-4	1-8
Total Depth of Well (bTOC*)	30.18	30.02	29.56
Static Water Level (bTOC)	20.48	20.60	20.57
h - Height of Water Column (feet)	9.70	9.42	8.99
r - Inside Diameter of Well (feet)	.083		
R - Diameter of Boring (feet)	.344		
Volume of Well and Filter Pack			
$v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	9.19	8.92	8.51

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	12-19	1-4	1-8
Time	1110	1230	1300
Volume Removed	8 gals	22 gals	23 gals
Development Method	SS bailer	SS bailer	air lift
Developed By	R. Rexroad	D. Upthegrove	D. Upthegrove

Comments:
53 gals total removed. Very little sediment, slightly turbid

*below top of casing

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)
MW-03

	12-19	1-8
Total Depth of Well (bTOC*)	25.02	25.03
Static Water Level (bTOC)	13.10 → ?	9.76
h - Height of Water Column (feet)	11.92	15.27
r - Inside Diameter of Well (feet)	.083	
R - Diameter of Boring (feet)	.344	
Volume of Well and Filter Pack $v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	11.29	14.46

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	12-19	1-8
Time	1150	1415
Volume Removed	10 gals	41 gal
Development Method	SS Bailer	air lift
Developed By	R. Rexroad	D. Upthegrove

Comments:
51 gals total removed. Relatively turbid, but only a small amount of sediment. Water level seems to fluctuate more in this well than others.

*below top of casing

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)
MW-04

	12-19	1-4	1-9
Total Depth of Well (bTOC*)	27.05	26.70	25.85
Static Water Level (bTOC)	16.75	15.95	15.93
h - Height of Water Column (feet)	10.30	10.75	
r - Inside Diameter of Well (feet)	.083		
R - Diameter of Boring (feet)	.344		
Volume of Well and Filter Pack $v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	9.75	10.18	9.39

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	12-19	1-4	1-9
Time	9:00	1445	800
Volume Removed	8 gals	22 gals	32 gal
Development Method	SS bailer	SS bailer	air lift
Developed By	R. Rexroad	D. Upthegrove	D. Upthegrove

Comments:
62 gals total removed. Very little sediment, slightly turbid

*below top of casing

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)

MW-05

	1-4	1-9
Total Depth of Well (bTOC*)	30.68	30.63
Static Water Level (bTOC)	21.75	21.70
h - Height of Water Column (feet)	8.93	8.93
r - Inside Diameter of Well (feet)	.083	
R - Diameter of Boring (feet)	.344	
Volume of Well and Filter Pack $v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	8.46	8.46

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	1-4	1-9
Time	9:00	9:50
Volume Removed	30 gals	14 gals
Development Method	SS bailer	air lift
Developed By	D. Upthegrove	D. Upthegrove

Comments:

44 gals total removed. Little or no sediment, very slightly turbid.

*below top of casing

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)
MW-07

	1-19
Total Depth of Well (bTOC*)	27.83
Static Water Level (bTOC)	11.35
h - Height of Water Column (feet)	16.48
r - Inside Diameter of Well (feet)	.083
R - Diameter of Boring (feet)	.344
Volume of Well and Filter Pack	
$v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	15.60

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	-19	1-19
Time	1120	1245
Volume Removed	15	60
Development Method	SS bailer	air lift
Developed By	D. Upthegrove	L. Basilio

Comments:
Total of 75 gals removed. Slightly turbid, little or no sediment

*below top of casing

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)
MW-08

	1-18
Total Depth of Well (bTOC*)	26.90
Static Water Level (bTOC)	14.20
h - Height of Water Column (feet)	12.70
r - Inside Diameter of Well (feet)	.083
R - Diameter of Boring (feet)	.344
Volume of Well and Filter Pack	
$v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	12.03

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	~~1-14~~ 1-19	1-19
Time	915	1120
Volume Removed	15 gals	65 gals
Development Method	SS bailer	air lift
Developed By	D. Upthegrove	L. Basilio

Comments:
80 gals removed. Slightly turbid, little sediment

*below top of casing

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)
MW-09

	1-17	1-18
Total Depth of Well (bTOC*)	32.22	32.42
Static Water Level (bTOC)	17.18	17.25
h - Height of Water Column (feet)	15.04	15.17
r - Inside Diameter of Well (feet)	.083	
R - Diameter of Boring (feet)	.344	
Volume of Well and Filter Pack $v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	14.24	14.37

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	1-17	1-18
Time	1330	1200
Volume Removed	20 gals	40 gals
Development Method	SS bailer	air lift
Developed By	D. Upthegrove	L. Basilio

Comments:
Total of 60 gals removed. Slightly turbid, little or no sediment

*below top of casing

FIGURE 6-7

WELL DEVELOPMENT FORM
ELLINGTON FIELD (ANG)
MW-10

	1-18
Total Depth of Well (bTOC*)	34.68
Static Water Level (bTOC)	18.80
h - Height of Water Column (feet)	15.88
r - Inside Diameter of Well (feet)	.083
R - Diameter of Boring (feet)	.344
Volume of Well and Filter Pack	
$v = [\pi r^2 h + (\pi R^2 h - \pi r^2 h)0.30]7.48$	15.04

where:

0.30 = 30% porosity of filter pack

7.48 = gallons per cubic foot

Date	1-18	1-18	1-19
Time	1430	1645	0915
Volume Removed	15 gals	35 gals	40 gals
Development Method	SS bailer	air lift	air lift
Developed By	D. Upthegrove	L. Basilio	L. Basilio

Comments:
Total of ~~80~~ 90 gals removed. V. slightly turbid. After 60 gals removed, doesn't appear to clear up further

*below top of casing

APPENDIX B

SLUG TEST CALCULATIONS

SLUG IN TEST

MONITOR WELL NUMBER:	MW-01
ELEVATION TOP OF CASING:	37.68
ELEVATION WATER (IN):	19.99 ELEVATION WATER (OUT):
DEPTH OF WELL (TOC):	31.13 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET, 16.0 TO 26.0 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	CLAYEY SILT AND SILTY SAND, 14 TO 27 FEET BELOW GRADE
H(O) TRANSLATION:	1.25 H(O) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	21.24 TRANS. METH. (SLUG IN) T(O): .0667
FINAL TRANSDUCER VALUE:	19.99

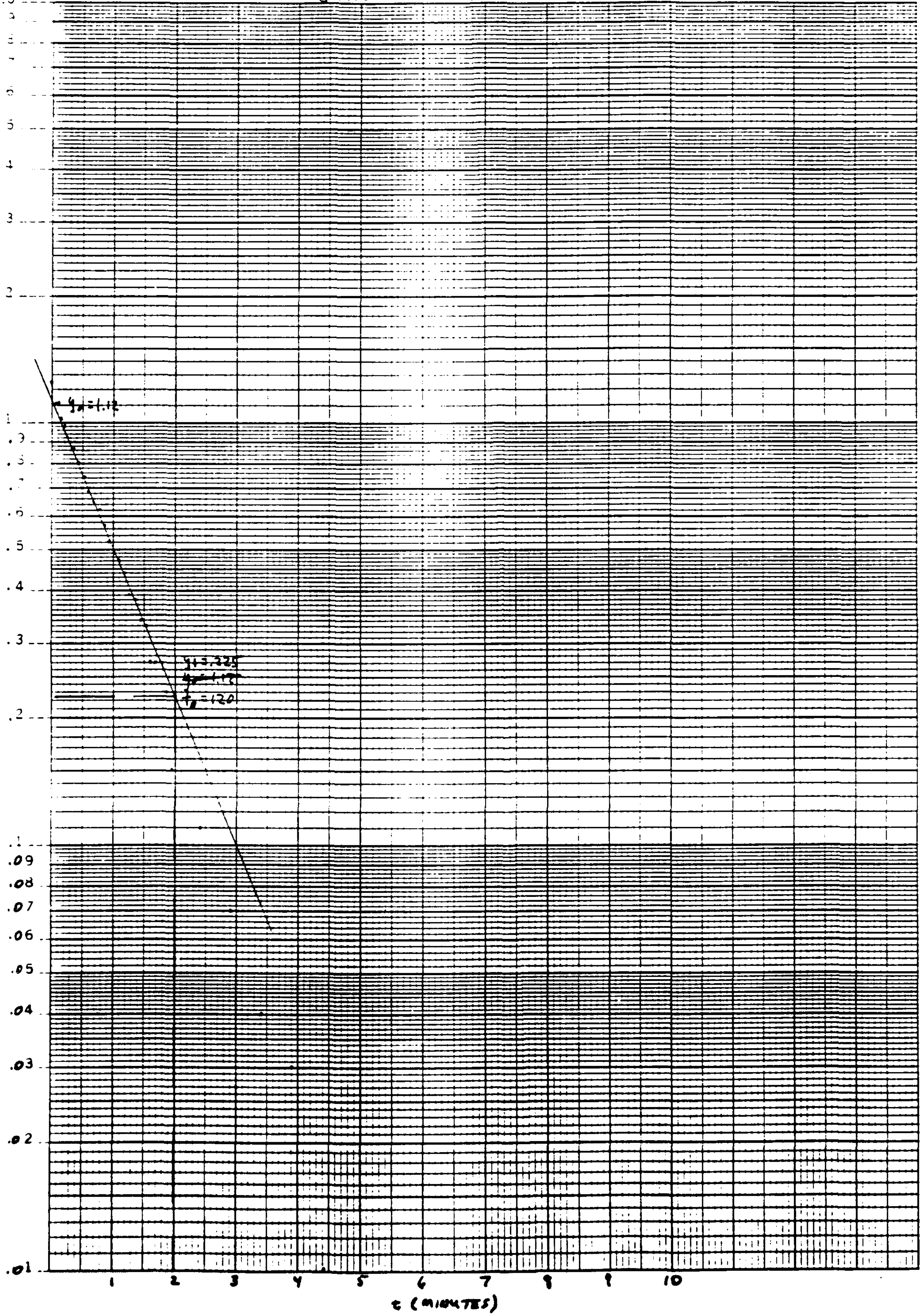
UG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(O) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(O) TRANS.	H/H(O) THEOR.
000	0	0	-.0667	17.25	3.99	-2.74	-2.192	-1.7908
001	.0033	.198	-.0634	20.72	.52	.73	.584	.4771
002	.0067	.402	-.06	24.69	3.45	-2.2	-1.76	-1.4379
003	.01	.6	-.0567	21.26	.02	1.23	.984	.8039
004	.0133	.798	-.0534	19.38	1.86	-.61	-.488	-.3987
005	.0167	1.002	-.05	21.59	.35	.9	.72	.5882
006	.02	1.2	-.0467	22.48	1.24	.01	.008	.0065
007	.0233	1.398	-.0434	21.19	.05	1.2	.96	.7843
008	.0267	1.602	-.04	20.92	.32	.93	.744	.6078
009	.03	1.8	-.0367	21.67	.43	.82	.656	.5359
010	.0333	1.998	-.0334	21.15	.09	1.16	.928	.7582
011	.05	3	-.0167	20.99	.25	1	.8	.6536
012	.0667	4.002	0	21.24	0	1.25	1	.817
013	.0833	4.998	.0166	21.16	.08	1.17	.936	.7647
014	.1	6	.0333	21.15	.09	1.16	.928	.7582
015	.1167	7.002	.05	21.10	.14	1.11	.888	.7255
016	.1333	7.998	.0666	21.10	.14	1.11	.888	.7255
017	.15	9	.0833	21.08	.16	1.09	.872	.7124
018	.1667	10.002	.1	21.10	.14	1.11	.888	.7255
019	.1833	10.998	.1166	21.03	.21	1.04	.832	.6797
020	.2	12	.1333	21.03	.21	1.04	.832	.6797
021	.2167	13.002	.15	21.02	.22	1.03	.824	.6732
022	.2333	13.998	.1666	20.99	.25	1	.8	.6536
023	.25	15	.1833	20.99	.25	1	.8	.6536
024	.2667	16.002	.2	20.97	.27	.98	.784	.6405
025	.2833	16.998	.2166	20.95	.29	.96	.768	.6275
026	.3	18	.2333	20.94	.3	.95	.76	.6209
027	.3167	19.002	.25	20.92	.32	.93	.744	.6078
028	.3333	19.998	.2666	20.92	.32	.93	.744	.6078
029	.4167	25.002	.35	20.86	.38	.87	.696	.5686
030	.5	30	.4333	20.80	.44	.81	.648	.5294
031	.5833	34.998	.5166	20.73	.51	.74	.592	.4837
032	.6667	40.002	.6	20.68	.56	.69	.552	.451
033	.75	45	.6833	20.64	.6	.65	.52	.4248
034	.8333	49.998	.7666	20.61	.63	.62	.496	.4052
035	.9167	55.002	.85	20.56	.68	.57	.456	.3725
036	1	60	.9333	20.51	.73	.52	.416	.3399
037	1.0833	64.998	1.0166	20.48	.76	.49	.392	.3203
038	1.1667	70.002	1.1	20.46	.78	.47	.376	.3072
039	1.25	75	1.1833	20.43	.81	.44	.352	.2876
040	1.3333	79.998	1.2666	20.38	.86	.39	.312	.2549
041	1.4167	85.002	1.35	20.37	.87	.38	.304	.2484
042	1.5	90	1.4333	20.33	.91	.34	.272	.2222
043	1.583	94.98	1.5163	20.32	.92	.33	.264	.2157
044	1.6667	100.002	1.6	20.26	.98	.27	.216	.1765

SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.6833	20.27	.98	.27	.216	.1765
046	1.833	109.98	1.7663	20.26	5	-3.75	-3	-2.451
047	1.9167	115.002	1.85	26.24	1.02	.23	.184	.1503
048	2	120	1.9333	20.22	1.1	.15	.12	.098
049	2.5	150	2.4333	20.14	1.14	.11	.088	.0719
050	3	180	2.9333	20.10	1.18	.07	.056	.0458
051	3.5	210	3.4333	20.06	1.21	.04	.032	.0261
052	4	240	3.9333	20.03	1.22	.03	.024	.0196
053	4.5	270	4.4333	20.02	1.24	.01	.008	.0065
054	5	300	4.9333	20.00	1.24	.01	.008	.0065
055	5.5	330	5.4333	20.00	1.24	.01	.008	.0065
056	6	360	5.9333	20.00	1.25	0	0	0
057	6.5	390	6.4333	19.99	1.24	.01	.008	.0065
058	7	420	6.9333	20.00	1.24	.01	.008	.0065
059	7.5	450	7.4333	20.00	1.25	0	0	0
060	8	480	7.9333	19.99	1.24	.01	.008	.0065
061	8.5	510	8.4333	20.00	1.25	0	0	0
062	9	540	8.9333	19.99	1.25	0	0	0
063	9.5	570	9.4333	19.99	1.25	0	0	0
064	10	600	9.9333	19.99	0	0	0	0
065	12	720	11.9333		0	0	0	0
066	14	840	13.9333		0	0	0	0
067	16	960	15.9333		0	0	0	0
068	18	1080	17.9333		0	0	0	0
069	20	1200	19.9333		0	0	0	0
070	22	1320	21.9333		0	0	0	0
071	24	1440	23.9333		0	0	0	0
072	26	1560	25.9333		0	0	0	0
073	28	1680	27.9333		0	0	0	0
074	30	1800	29.9333		0	0	0	0
075	32	1920	31.9333		0	0	0	0
076	34	2040	33.9333		0	0	0	0
077	36	2160	35.9333		0	0	0	0
078	38	2280	37.9333		0	0	0	0
079	40	2400	39.9333		0	0	0	0
080	42	2520	41.9333		0	0	0	0
081	44	2640	43.9333		0	0	0	0
082	46	2760	45.9333		0	0	0	0
083	48	2880	47.9333		0	0	0	0
084	50	3000	49.9333		0	0	0	0
085	52	3120	51.9333		0	0	0	0
086	54	3240	53.9333		0	0	0	0
087	56	3360	55.9333		0	0	0	0
088	58	3480	57.9333		0	0	0	0
089	60	3600	59.9333		0	0	0	0

SLUG IN MW-01



46 5810
K+E SEMI-LOGARITHMIC 3 CYCLES x 140 DIVISIONS
KEUFFEL & ESSER CO.

SLUG- IN
Well No. MW-01

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 10.44 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 13 ft.
C = 1.9
y_o = 1.12 y_t = 0.225   t = 120 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(10.44/.344)} + \frac{1.9}{(10/.344)} \right]^{-1}$$

$$= 2.58$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2\ (2.58)}{2(10)} \times \frac{1}{120} \times \ln\ (1.12/.225)$$

$K = 1.19 \times 10^{-5}$ ft./sec.

K = 1.03 ft./da.

$K = 3.62 \times 10^{-4}$ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (1.03) (13) (7.48)

T = 100.18 gpd/ft

BEST AVAILABLE COPY

SLUG OUT TEST

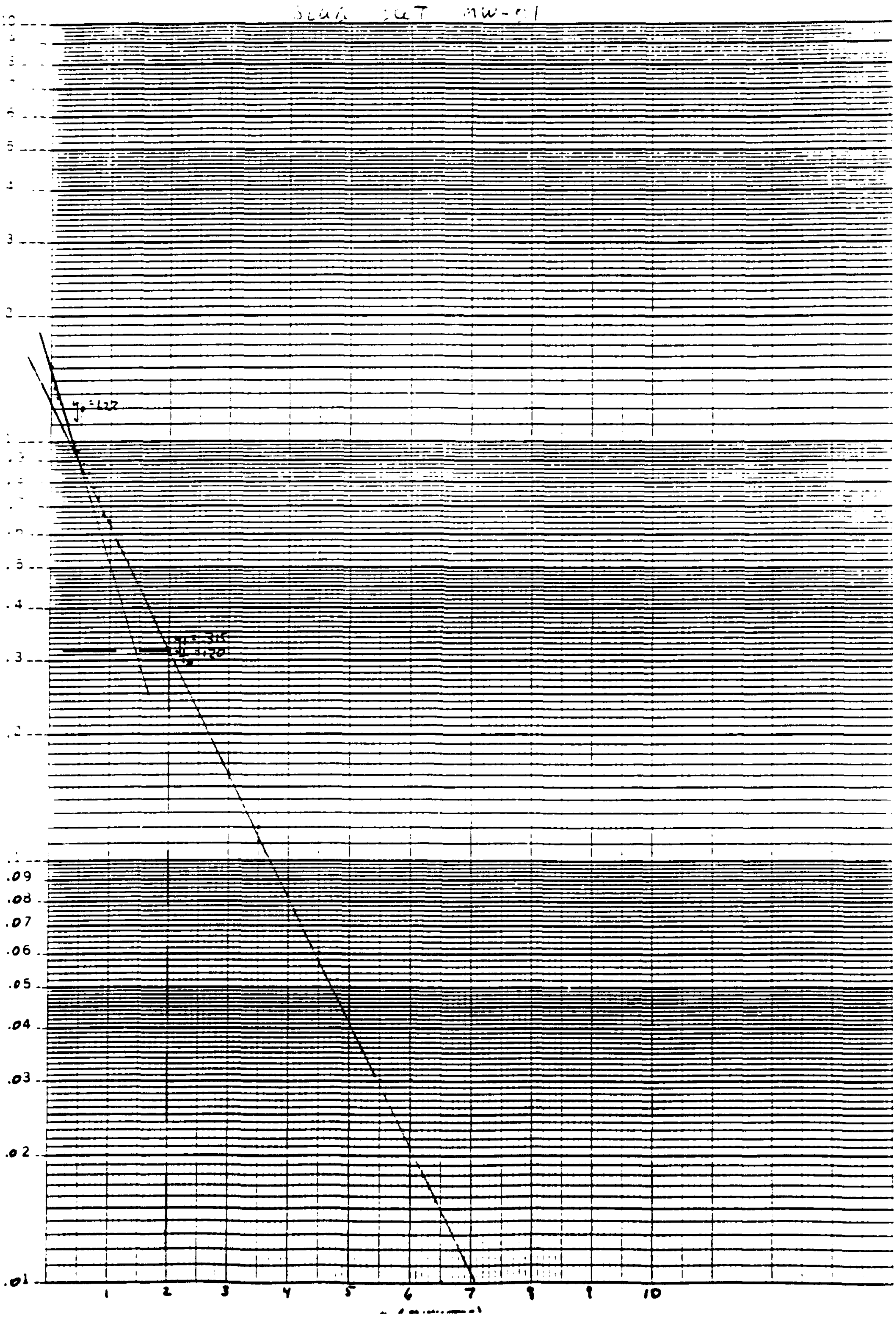
MONITOR WELL NUMBER:	MW-01
ELEVATION TOP OF CASING:	37.68
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 19.99
DEPTH OF WELL (TOC):	31.13 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET, 16.0 TO 26.0 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	CLAYEY SILT AND SILTY SAND, 14 TO 27 FEET BELOW GRADE
H(0) TRANSLATION:	1.51 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	18.49 TRANS. METH. (SLUG OUT) T(0): .03
FINAL TRANSDUCER VALUE:	20

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.03	18.14	-.35	1.86	1.2318	1.2157
001	.0033	.198	-.0267	18.55	.06	1.45	.9603	.9477
002	.0067	.402	-.0233	18.22	-.27	1.78	1.1788	1.1634
003	.01	.6	-.02	18.71	.22	1.29	.8543	.8431
004	.0133	.798	-.0167	18.35	-.14	1.65	1.0927	1.0784
005	.0167	1.002	-.0133	18.57	.08	1.43	.947	.9346
006	.02	1.2	-.01	18.49	0	1.51	1	.9869
007	.0233	1.398	-.0067	18.49	0	1.51	1	.9869
008	.0267	1.602	-.0033	18.57	.08	1.43	.947	.9346
009	.03	1.8	0	18.49	0	1.51	1	.9869
010	.0333	1.998	.0033	18.57	.08	1.43	.947	.9346
011	.05	3	.02	18.59	.1	1.41	.9338	.9216
012	.0667	4.002	.0367	18.60	.11	1.4	.9272	.915
013	.0833	4.998	.0533	18.65	.16	1.35	.894	.8824
014	.1	6	.07	18.67	.18	1.33	.8808	.8693
015	.1167	7.002	.0867	18.68	.19	1.32	.8742	.8627
016	.1333	7.998	.1033	18.71	.22	1.29	.8543	.8431
017	.15	9	.12	18.73	.24	1.27	.8411	.8301
018	.1667	10.002	.1367	18.75	.26	1.25	.8278	.817
019	.1833	10.998	.1533	18.76	.27	1.24	.8212	.8105
020	.2	12	.17	18.79	.3	1.21	.8013	.7908
021	.2167	13.002	.1867	18.79	.3	1.21	.8013	.7908
022	.2333	13.998	.2033	18.82	.33	1.18	.7815	.7712
023	.25	15	.22	18.84	.35	1.16	.7682	.7582
024	.2667	16.002	.2367	18.86	.37	1.14	.755	.7451
025	.2833	16.998	.2533	18.87	.38	1.13	.7483	.7386
026	.3	18	.27	18.89	.4	1.11	.7351	.7255
027	.3167	19.002	.2867	18.90	.41	1.1	.7285	.719
028	.3333	19.998	.3033	18.92	.43	1.08	.7152	.7059
029	.4167	25.002	.3867	19.00	.51	1	.6623	.6536
030	.5	30	.47	19.05	.56	.95	.6291	.6209
031	.5833	34.998	.5533	19.11	.62	.89	.5894	.5817
032	.6667	40.002	.6367	19.16	.67	.84	.5563	.549
033	.75	45	.72	19.22	.73	.78	.5166	.5098
034	.8333	49.998	.8033	19.27	.78	.73	.4834	.4771
035	.9167	55.002	.8867	19.32	.83	.68	.4503	.4444
036	1	60	.97	19.35	.86	.65	.4305	.4248
037	1.0833	64.998	1.0533	19.38	.89	.62	.4106	.4052
038	1.1667	70.002	1.1367	19.43	.94	.57	.3775	.3725
039	1.25	75	1.22	19.46	.97	.54	.3576	.3529
040	1.3333	79.998	1.3033	19.49	1	.51	.3377	.3333
041	1.4167	85.002	1.3867	19.52	1.03	.48	.3179	.3137
042	1.5	90	1.47	19.54	1.05	.46	.3046	.3007
043	1.583	94.98	1.553	19.57	1.08	.43	.2848	.281
044	1.6667	100.002	1.6367	19.60	1.11	.4	.2649	.2614

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H( ) THEO.
045	1.75	105	1.72	19.62	1.13	.38	.2517	.24[illegible]
046	1.833	109.98	1.803	19.65	1.16	.35	.2318	.228[illegible]
047	1.9167	115.002	1.8867	19.65	1.16	.35	.2318	.2288
048	2	120	1.97	19.68	1.19	.32	.2119	.20[illegible]
049	2.5	150	2.47	19.78	1.29	.22	.1457	.14[illegible]
050	3	180	2.97	19.84	1.35	.16	.106	.1046
051	3.5	210	3.47	19.89	1.4	.11	.0728	.071
052	4	240	3.97	19.91	1.42	.09	.0596	.05[illegible]
053	4.5	270	4.47	19.94	1.45	.06	.0397	.0392
054	5	300	4.97	19.95	1.46	.05	.0331	.0327
055	5.5	330	5.47	19.97	1.48	.03	.0199	.01[illegible]
056	6	360	5.97	19.97	1.48	.03	.0199	.0196
057	6.5	390	6.47	19.99	1.5	.01	.0066	.0065
058	7	420	6.97	19.99	1.5	.01	.0066	.006
059	7.5	450	7.47	19.99	1.5	.01	.0066	.006[illegible]
060	8	480	7.97	19.99	1.5	.01	.0066	.0065
061	8.5	510	8.47	19.99	1.5	.01	.0066	.006
062	9	540	8.97	19.99	1.5	.01	.0066	.006
063	9.5	570	9.47	19.99	1.5	.01	.0066	.0065
064	10	600	9.97	20.00	1.51	0	0	0
065	12	720	11.97		0	0	0	0
066	14	840	13.97		0	0	0	0
067	16	960	15.97		0	0	0	0
068	18	1080	17.97		0	0	0	0
069	20	1200	19.97		0	0	0	0
070	22	1320	21.97		0	0	0	0
071	24	1440	23.97		0	0	0	0
072	26	1560	25.97		0	0	0	0
073	28	1680	27.97		0	0	0	0
074	30	1800	29.97		0	0	0	0
075	32	1920	31.97		0	0	0	0
076	34	2040	33.97		0	0	0	0
077	36	2160	35.97		0	0	0	0
078	38	2280	37.97		0	0	0	0
079	40	2400	39.97		0	0	0	0
080	42	2520	41.97		0	0	0	0
081	44	2640	43.97		0	0	0	0
082	46	2760	45.97		0	0	0	0
083	48	2880	47.97		0	0	0	0
084	50	3000	49.97		0	0	0	0
085	52	3120	51.97		0	0	0	0
086	54	3240	53.97		0	0	0	0
087	56	3360	55.97		0	0	0	0
088	58	3480	57.97		0	0	0	0
089	60	3600	59.97		0	0	0	0
							0	



46 5810

K•E SEMI-LOGARITHMIC 3 CYCLES X 140 DIVISIONS
KEUFFEL & ESSER CO.

SLUG- OUT

Well No. RW-01

Casing Diameter = 2 in. = .167 ft.

Casing radius (r_c) = .083 ft.

Length of screen (L) = 10.0 ft.

Height of water from base of screen (H) = 10.44 ft.

Radius of borehole (r_w) = .344 ft.

Thickness of Aquifer (D) = 13.0 ft.

C = 1.9

y_o = 1.22 y_t = 0.315 t = 120 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(10.44/.344)} + \frac{1.9}{(10.0/.344)} \right]^{-1}$$

$$= 2.58$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.58)}{2(10.0)} \times \frac{1}{120} \times \ln(1.12/.315)$$

$$K = 1.00 \times 10^{-5} \text{ ft./sec.}$$

$$K = 0.87 \text{ ft./da.}$$

$$K = 3.06 \times 10^{-4} \text{ cm./sec.}$$

T = TRANSMISSIVITY

$$T = (K)(D)(7.48 \text{ gpd/ft})$$

$$T = (0.87)(13.0)(7.48)$$

$$T = 84.60 \text{ gpd/ft}$$

SLUG OUT TEST

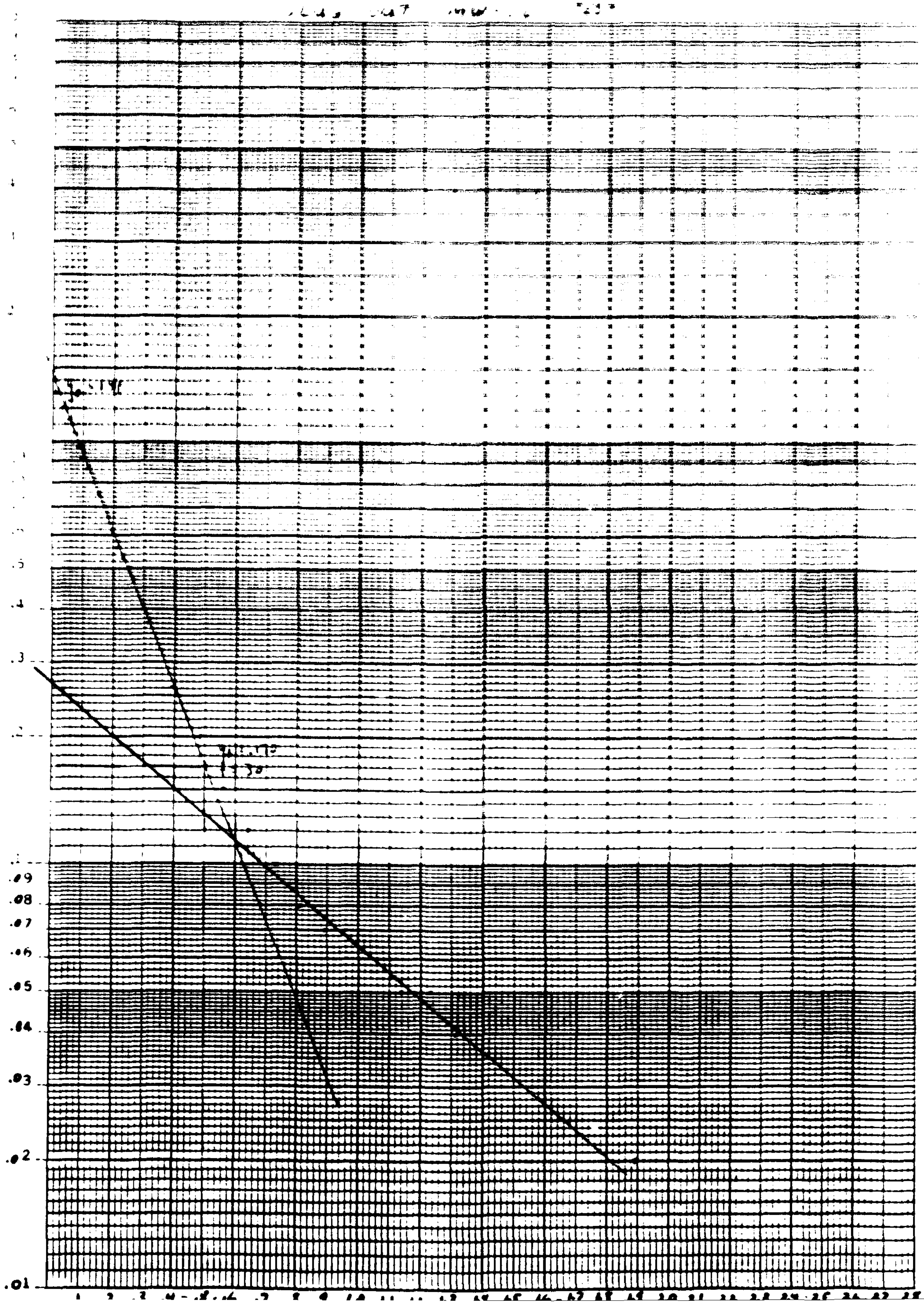
MONITOR WELL NUMBER:	MW-02 TEST 1
ELEVATION TOP OF CASING:	36.87
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 16.2
DEPTH OF WELL (TOC):	30.18 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. 15.5 TO 25.5 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	SILTY SAND AND SAND. 13 TO ? FEET BELOW GRADE
H(0) TRANSLATION:	1.4 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	14.8 TRANS. METH. (SLUG OUT) T(0): .02
FINAL TRANSDUCER VALUE:	16.2

LUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.02	14.64	-.16	1.56	1.1143	1.0196
001	.0033	.198	-.0167	16.12	1.32	.08	.0571	.052
002	.0067	.402	-.0133	14.86	.06	1.34	.9571	.875
003	.01	.6	-.01	15.35	.55	.85	.6071	.5556
004	.0133	.798	-.0067	14.83	.03	1.37	.9786	.895
005	.0167	1.002	-.0033	14.94	.14	1.26	.9	.823
006	.02	1.2	0	14.80	0	1.4	1	.915
007	.0233	1.398	.0033	14.84	.04	1.36	.9714	.888
008	.0267	1.602	.0067	14.88	.08	1.32	.9429	.862
009	.03	1.8	.01	14.89	.09	1.31	.9357	.8562
010	.0333	1.998	.0133	14.91	.11	1.29	.9214	.8431
011	.05	3	.03	15.00	.2	1.2	.8571	.784
012	.0667	4.002	.0467	15.08	.28	1.12	.8	.732
013	.0833	4.998	.0633	15.16	.36	1.04	.7429	.6797
014	.1	6	.08	15.23	.43	.97	.6929	.63
015	.1167	7.002	.0967	15.29	.49	.91	.65	.594
016	.1333	7.998	.1133	15.34	.54	.86	.6143	.5621
017	.15	9	.13	15.40	.6	.8	.5714	.522
018	.1667	10.002	.1467	15.45	.65	.75	.5357	.490
019	.1833	10.998	.1633	15.50	.7	.7	.5	.4575
020	.2	12	.18	15.54	.74	.66	.4714	.4314
021	.2167	13.002	.1967	15.59	.79	.61	.4357	.398
022	.2333	13.998	.2133	15.64	.84	.56	.4	.366
023	.25	15	.23	15.67	.87	.53	.3786	.3464
024	.2667	16.002	.2467	15.70	.9	.5	.3571	.326
025	.2833	16.998	.2633	15.73	.93	.47	.3357	.307
026	.3	18	.28	15.77	.97	.43	.3071	.281
027	.3167	19.002	.2967	15.80	1	.4	.2857	.261
028	.3333	19.998	.3133	15.83	1.03	.37	.2643	.241
029	.4167	25.002	.3967	15.94	1.14	.26	.1857	.1699
030	.5	30	.48	16.00	1.2	.2	.1429	.1307
031	.5833	34.998	.5633	16.05	1.25	.15	.1071	.098
032	.6667	40.002	.6467	16.08	1.28	.12	.0857	.0784
033	.75	45	.73	16.10	1.3	.1	.0714	.0654
034	.8333	49.998	.8133	16.12	1.32	.08	.0571	.0523
035	.9167	55.002	.8967	16.13	1.33	.07	.05	.0458
036	1	60	.98	16.13	1.33	.07	.05	.0458
037	1.0833	64.998	1.0633	16.13	1.33	.07	.05	.0458
038	1.1667	70.002	1.1467	16.15	1.35	.05	.0357	.0327
039	1.25	75	1.23	16.15	1.35	.05	.0357	.0327
040	1.3333	79.998	1.3133	16.16	1.36	.04	.0286	.0261
041	1.4167	85.002	1.3967	16.16	1.36	.04	.0286	.0261
042	1.5	90	1.48	16.16	1.36	.04	.0286	.0261
043	1.583	94.98	1.563	16.16	1.36	.04	.0286	.0261
044	1.6667	100.002	1.6467	16.16	1.36	.04	.0286	.0261

.UG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.73	16.16	1.36	.04	.0286	.0261
046	1.833	109.98	1.813	16.16	1.36	.04	.0286	.0261
047	1.9167	115.002	1.8967	16.18	1.38	.02	.0143	.0131
048	2	120	1.98	16.18	1.38	.02	.0143	.0131
049	2.5	150	2.48	16.18	1.38	.02	.0143	.0131
050	3	180	2.98	16.18	1.38	.02	.0143	.0131
051	3.5	210	3.48	16.20	1.4	1.3323e-15	0	0
052	4	240	3.98	16.20	1.4	1.3323e-15	0	0
053	4.5	270	4.48	16.20	1.4	1.3323e-15	0	0
054	5	300	4.98	16.20	1.4	1.3323e-15	0	0
055	5.5	330	5.48	16.20	1.4	1.3323e-15	0	0
056	6	360	5.98	16.20	1.4	1.3323e-15	0	0
057	6.5	390	6.48	16.20	1.4	1.3323e-15	0	0
058	7	420	6.98	16.20	1.4	1.3323e-15	0	0
059	7.5	450	7.48	16.20	1.4	1.3323e-15	0	0
060	8	480	7.98	16.20	1.4	1.3323e-15	0	0
061	8.5	510	8.48	16.20	1.4	1.3323e-15	0	0
062	9	540	8.98	16.20	1.4	1.3323e-15	0	0
063	9.5	570	9.48	16.20	1.4	1.3323e-15	0	0
064	10	600	9.98	16.20	1.4	0	0	0
065	12	720	11.98		0	0	0	0
066	14	840	13.98		0	0	0	0
067	16	960	15.98		0	0	0	0
068	18	1080	17.98		0	0	0	0
069	20	1200	19.98		0	0	0	0
070	22	1320	21.98		0	0	0	0
071	24	1440	23.98		0	0	0	0
072	26	1560	25.98		0	0	0	0
073	28	1680	27.98		0	0	0	0
074	30	1800	29.98		0	0	0	0
075	32	1920	31.98		0	0	0	0
076	34	2040	33.98		0	0	0	0
077	36	2160	35.98		0	0	0	0
078	38	2280	37.98		0	0	0	0
079	40	2400	39.98		0	0	0	0
080	42	2520	41.98		0	0	0	0
081	44	2640	43.98		0	0	0	0
082	46	2760	45.98		0	0	0	0
083	48	2880	47.98		0	0	0	0
084	50	3000	49.98		0	0	0	0
085	52	3120	51.98		0	0	0	0
086	54	3240	53.98		0	0	0	0
087	56	3360	55.98		0	0	0	0
088	58	3480	57.98		0	0	0	0
089	60	3600	59.98		0	0	0	0
							0	



46 5810
K·E SEMI-LOGARITHMIC 3 CYCLES × 140 DIVISIONS
KEUFFEL & ESSER CO.

SLUG- OUT TEST 1
Well No. MW-02

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 6.51 ft.
Height of water from base of screen (H) = 6.51 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 9.51 ft.
C = 1.75
y_o = 1.41 y_t = 0.170 t = 30 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(6.51/.344)} + \frac{1.75}{(6.51/.344)} \right]^{-1}$$

$$= 2.14$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.14)}{2(6.51)} \times \frac{1}{30} \times \ln(1.41/.170)$$

K = 7.98 x 10^{-5} ft./sec.

K = 6.90 ft./da.

K = 2.43 x 10^{-3} cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (6.90) (9.51) (7.48)

T = 490.83 gpd/ft

SLUG OUT TEST

MONITOR WELL NUMBER:	MW-02 TEST 2
ELEVATION TOP OF CASING:	36.87
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 16.2
DEPTH OF WELL (TOC):	30.18 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. 15.5 TO 25.5 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	SILTY SAND AND SAND. 18 TO ? FEET BELOW GRADE
H(0) TRANSLATION:	1.38 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	14.8 TRANS. METH. (SLUG OUT) T(0): .0233
FINAL TRANSDUCER VALUE:	16.18

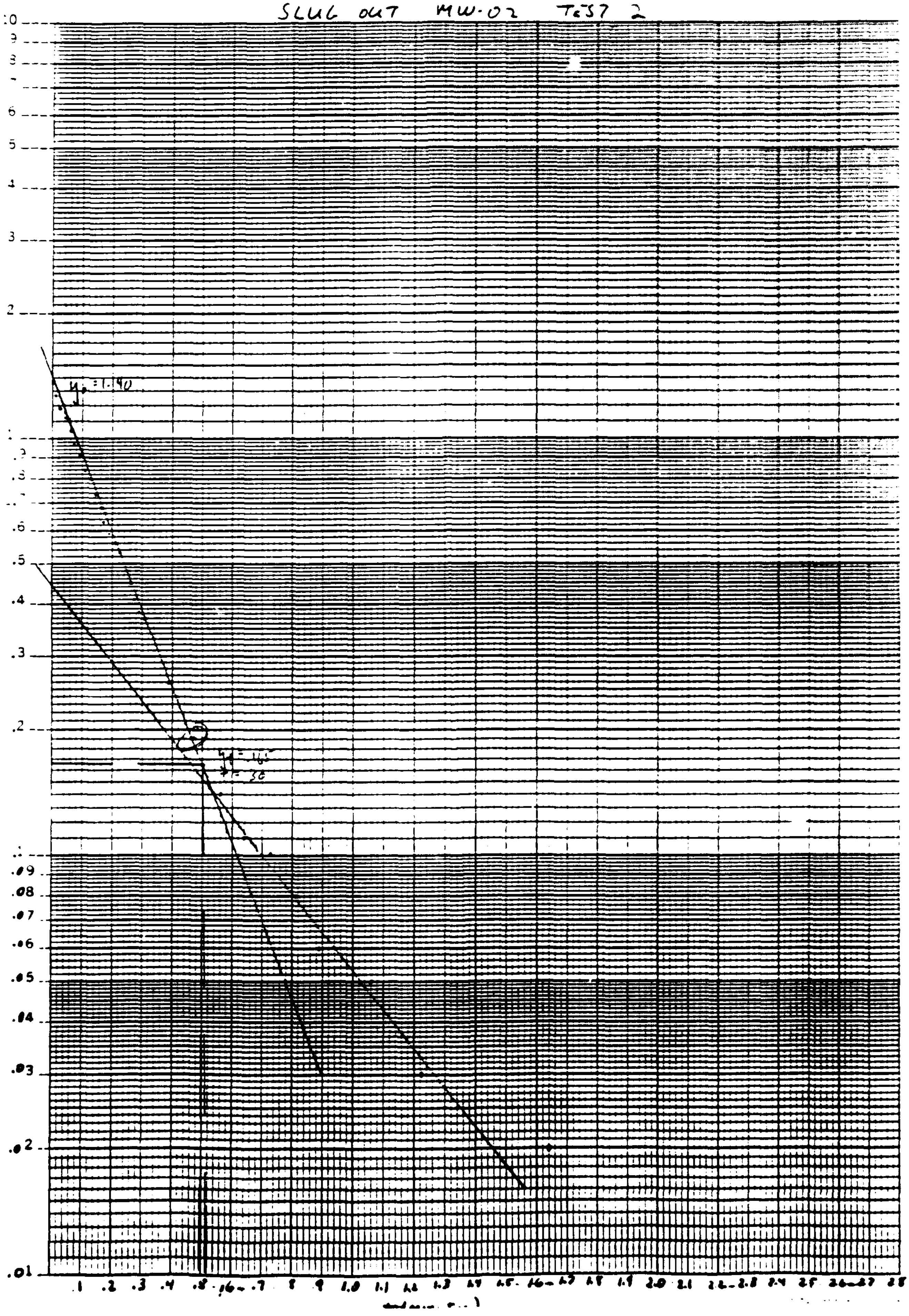
SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.0233	16.40	1.6	-.22	-.1594	-.1438
001	.0033	.198	-.02	14.84	.04	1.34	.971	.8758
002	.0067	.402	-.0166	15.69	.89	.49	.3551	.3203
003	.01	.6	-.0133	15.10	.3	1.08	.7826	.7059
004	.0133	.798	-.01	15.07	.27	1.11	.8043	.7255
005	.0167	1.002	-.0066	15.03	.23	1.15	.8333	.7516
006	.02	1.2	-.0033	14.83	.03	1.35	.9783	.8824
007	.0233	1.398	0	14.80	0	1.38	1	.902
008	.0267	1.602	.0034	14.86	.06	1.32	.9565	.8627
009	.03	1.8	.0067	14.88	.08	1.3	.942	.8497
010	.0333	1.998	.01	14.91	.11	1.27	.9203	.8301
011	.05	3	.0267	14.99	.19	1.19	.8623	.7778
012	.0667	4.002	.0434	15.07	.27	1.11	.8043	.7255
013	.0833	4.998	.06	15.15	.35	1.03	.7464	.6732
014	.1	6	.0767	15.21	.41	.97	.7029	.634
015	.1167	7.002	.0934	15.27	.47	.91	.6594	.5948
016	.1333	7.998	.11	15.34	.54	.84	.6087	.549
017	.15	9	.1267	15.38	.58	.8	.5797	.5229
018	.1667	10.002	.1434	15.45	.65	.73	.529	.4771
019	.1833	10.998	.16	15.50	.7	.68	.4928	.4444
020	.2	12	.1767	15.55	.75	.63	.4565	.4118
021	.2167	13.002	.1934	15.59	.79	.59	.4275	.3856
022	.2333	13.998	.21	15.62	.82	.56	.4058	.366
023	.25	15	.2267	15.65	.85	.53	.3841	.3464
024	.2667	16.002	.2434	15.70	.9	.48	.3478	.3137
025	.2833	16.998	.26	15.73	.93	.45	.3261	.2941
026	.3	18	.2767	15.77	.97	.41	.2971	.268
027	.3167	19.002	.2934	15.80	1	.38	.2754	.2484
028	.3333	19.998	.31	15.81	1.01	.37	.2681	.2418
029	.4167	25.002	.3934	15.92	1.12	.26	.1884	.1699
030	.5	30	.4767	15.99	1.19	.19	.1377	.1242
031	.5833	34.998	.56	16.04	1.24	.14	.1014	.0915
032	.6667	40.002	.6434	16.07	1.27	.11	.0797	.0719
033	.75	45	.7267	16.08	1.28	.1	.0725	.0654
034	.8333	49.998	.81	16.10	1.3	.08	.058	.0523
035	.9167	55.002	.8934	16.12	1.32	.06	.0435	.0392
036	1	60	.9767	16.12	1.32	.06	.0435	.0392
037	1.0833	64.998	1.06	16.13	1.33	.05	.0362	.0327
038	1.1667	70.002	1.1434	16.13	1.33	.05	.0362	.0327
039	1.25	75	1.2267	16.15	1.35	.03	.0217	.0196
040	1.3333	79.998	1.31	16.15	1.35	.03	.0217	.0196
041	1.4167	85.002	1.3934	16.15	1.35	.03	.0217	.0196
042	1.5	90	1.4767	16.15	1.35	.03	.0217	.0196
043	1.583	94.98	1.5597	16.15	1.35	.03	.0217	.0196
044	1.6667	100.002	1.6434	16.16	1.36	.02	.0145	.0131

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(^) THE(.
045	1.75	105	1.7267	16.16	1.36	.02	.0145	.013
046	1.833	109.98	1.8097	16.16	1.36	.02	.0145	.0131
047	1.9167	115.002	1.8934	16.16	1.36	.02	.0145	.0131
048	2	120	1.9767	16.16	1.36	.02	.0145	.013
049	2.5	150	2.4767	16.18	1.38	8.8818e-16	0	0
050	3	180	2.9767	16.18	1.38	8.8818e-16	0	0
051	3.5	210	3.4767	16.18	1.38	8.8818e-16	0	0
052	4	240	3.9767	16.18	1.38	8.8818e-16	0	0
053	4.5	270	4.4767	16.18	1.38	8.8818e-16	0	0
054	5	300	4.9767	16.18	1.38	8.8818e-16	0	0
055	5.5	330	5.4767	16.18	1.38	8.8818e-16	0	0
056	6	360	5.9767	16.18	1.38	8.8818e-16	0	0
057	6.5	390	6.4767	16.18	1.38	8.8818e-16	0	0
058	7	420	6.9767	16.18	1.38	8.8818e-16	0	0
059	7.5	450	7.4767	16.18	1.38	8.8818e-16	0	0
060	8	480	7.9767	16.18	1.38	8.8818e-16	0	0
061	8.5	510	8.4767	16.18	1.38	8.8818e-16	0	0
062	9	540	8.9767	16.18	1.38	8.8818e-16	0	0
063	9.5	570	9.4767	16.18	1.38	8.8818e-16	0	0
064	10	600	9.9767	16.18	1.38	0	0	0
065	12	720	11.9767		0	0	0	0
066	14	840	13.9767		0	0	0	0
067	16	960	15.9767		0	0	0	0
068	18	1080	17.9767		0	0	0	0
069	20	1200	19.9767		0	0	0	0
070	22	1320	21.9767		0	0	0	0
071	24	1440	23.9767		0	0	0	0
072	26	1560	25.9767		0	0	0	0
073	28	1680	27.9767		0	0	0	0
074	30	1800	29.9767		0	0	0	0
075	32	1920	31.9767		0	0	0	0
076	34	2040	33.9767		0	0	0	0
077	36	2160	35.9767		0	0	0	0
078	38	2280	37.9767		0	0	0	0
079	40	2400	39.9767		0	0	0	0
080	42	2520	41.9767		0	0	0	0
081	44	2640	43.9767		0	0	0	0
082	46	2760	45.9767		0	0	0	0
083	48	2880	47.9767		0	0	0	0
084	50	3000	49.9767		0	0	0	0
085	52	3120	51.9767		0	0	0	0
086	54	3240	53.9767		0	0	0	0
087	56	3360	55.9767		0	0	0	0
088	58	3480	57.9767		0	0	0	0
089	60	3600	59.9767		0	0	0	0
							0	

SLUG OUT MW-02 TEST 2



SLUG- OUT
Well No. MW-02

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 6.51 ft.
Height of water from base of screen (H) = 6.51 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 9.51 ft.
C = 1.75
y_o = 1.40 y_t = 0.165 t = 30 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(6.51/.344)} + \frac{1.75}{(6.51/.344)} \right]^{-1}$$

$$= 2.14$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.14)}{2(6.51)} \times \frac{1}{30} \times \ln(1.40/.165)$$

$K = 8.07 \times 10^{-5}$ ft./sec.

K = 6.97 ft./da.

$K = 2.46 \times 10^{-3}$ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (6.97) (9.51) (7.48)

T = 495.81 gpd/ft

SLUG IN TEST

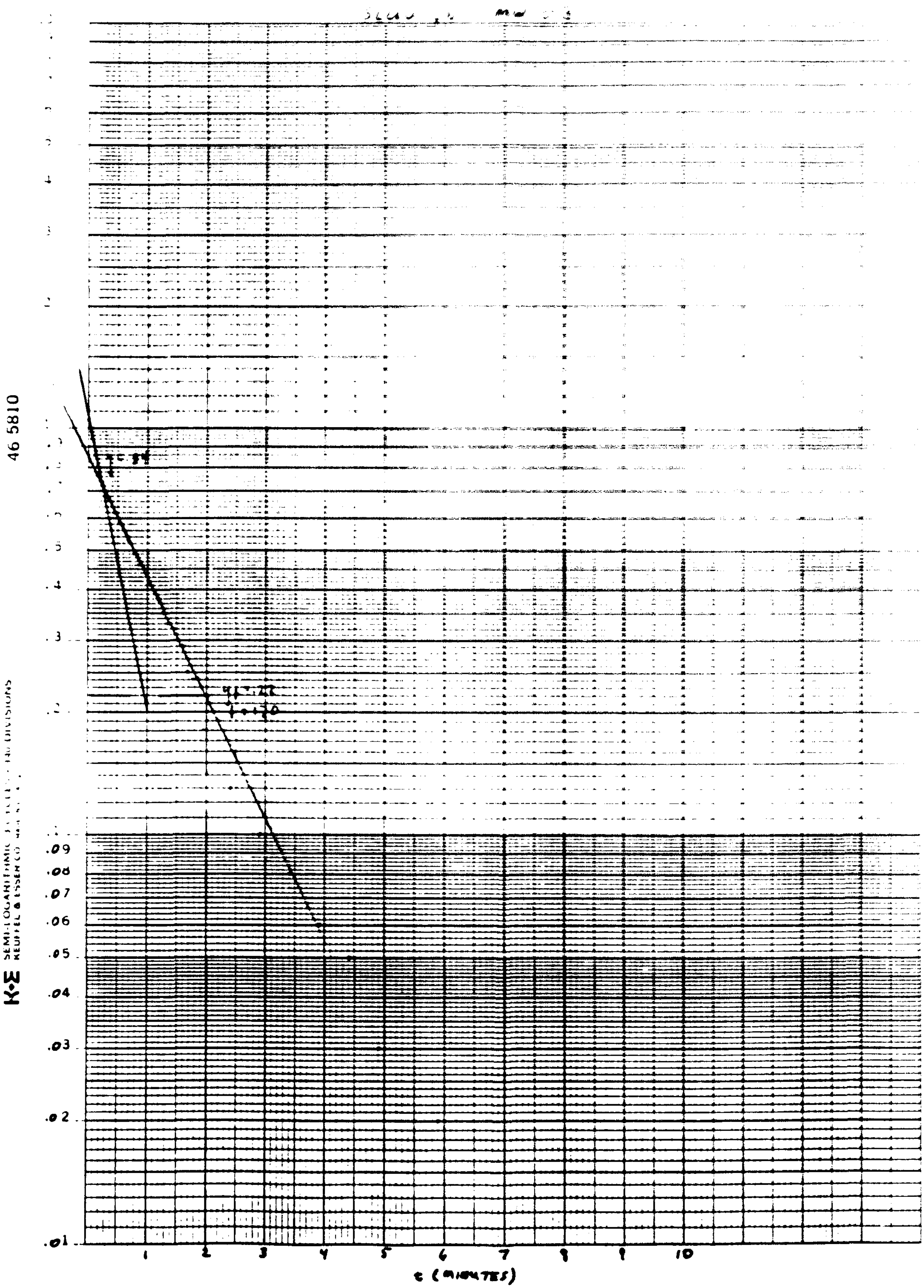
MONITOR WELL NUMBER:	MW-03
ELEVATION TOP OF CASING:	37.8
ELEVATION WATER (IN):	26.03 ELEVATION WATER (OUT):
DEPTH OF WELL (TOC):	25.03 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. 10.5 TO 20.5 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 FULLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	SILTY SAND AND CLAYEY SILT. 12 TO 14.5 FEET BELOW GRADE
H(0) TRANSLATION:	1.05 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	27.77 TRANS. METH. (SLUG IN) T(0): .0667
FINAL TRANSDUCER VALUE:	26.72

SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.0667	28.07	.3	.75	.7143	.4902
001	.0033	.198	-.0634	27.75	.02	1.03	.981	.6732
002	.0067	.402	-.06	28.18	.41	.64	.6095	.4183
003	.01	.6	-.0567	29.06	1.29	-.24	-.2286	-.1569
004	.0133	.798	-.0534	27.58	.19	.86	.819	.5621
005	.0167	1.002	-.05	27.59	.18	.87	.8286	.5686
006	.02	1.2	-.0467	28.39	.62	.43	.4095	.281
007	.0233	1.398	-.0434	28.80	1.03	.02	.019	.0131
008	.0267	1.602	-.04	28.26	.49	.56	.5333	.366
009	.03	1.8	-.0367	28.15	.38	.67	.6381	.4379
010	.0333	1.998	-.0334	28.25	.48	.57	.5429	.3725
011	.05	3	-.0167	28.52	.75	.3	.2857	.1961
012	.0667	4.002	0	27.77	0	1.05	1	.6863
013	.0833	4.998	.0166	27.72	.05	1	.9524	.6536
014	.1	6	.0333	27.71	.06	.99	.9429	.6471
015	.1167	7.002	.05	27.66	.11	.94	.8952	.6144
016	.1333	7.998	.0666	27.64	.13	.92	.8762	.6013
017	.15	9	.0833	27.61	.16	.89	.8476	.5817
018	.1667	10.002	.1	27.58	.19	.86	.819	.5621
019	.1833	10.998	.1166	27.56	.21	.84	.8	.549
020	.2	12	.1333	27.53	.24	.81	.7714	.5294
021	.2167	13.002	.15	27.53	.24	.81	.7714	.5294
022	.2333	13.998	.1666	27.52	.25	.8	.7619	.5229
023	.25	15	.1833	27.50	.27	.78	.7429	.5098
024	.2667	16.002	.2	27.48	.29	.76	.7238	.4967
025	.2833	16.998	.2166	27.47	.3	.75	.7143	.4902
026	.3	18	.2333	27.47	.3	.75	.7143	.4902
027	.3167	19.002	.25	27.45	.32	.73	.6952	.4771
028	.3333	19.998	.2666	27.44	.33	.72	.6857	.4706
029	.4167	25.002	.35	27.39	.38	.67	.6381	.4379
030	.5	30	.4333	27.34	.43	.62	.5905	.4052
031	.5833	34.998	.5166	27.31	.46	.59	.5619	.3856
032	.6667	40.002	.6	27.28	.49	.56	.5333	.366
033	.75	45	.6833	27.25	.52	.53	.5048	.3464
034	.8333	49.998	.7666	27.21	.56	.49	.4667	.3203
035	.9167	55.002	.85	27.18	.59	.46	.4381	.3007
036	1	60	.9333	27.17	.6	.45	.4286	.2941
037	1.0833	64.998	1.0166	27.13	.64	.41	.3905	.268
038	1.1667	70.002	1.1	27.12	.65	.4	.381	.2614
039	1.25	75	1.1833	27.10	.67	.38	.3619	.2484
040	1.3333	79.998	1.2666	27.07	.7	.35	.3333	.2288
041	1.4167	85.002	1.35	27.05	.72	.33	.3143	.2157
042	1.5	90	1.4333	27.04	.73	.32	.3048	.2092
043	1.583	94.98	1.5163	27.02	.75	.3	.2857	.1961
044	1.6667	100.002	1.6	27.01	.76	.29	.2762	.1895

SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.6833	26.99	.8	.25	.2381	.1634
046	1.833	109.98	1.7663	26.97	.81	.24	.2286	.1569
047	1.9167	115.002	1.85	26.96	.81	.24	.2286	.1569
048	2	120	1.9333	26.96	.87	.18	.1714	.1176
049	2.5	150	2.4333	26.90	.92	.13	.1238	.085
050	3	180	2.9333	26.85	.95	.1	.0952	.0654
051	3.5	210	3.4333	26.82	.97	.08	.0762	.0523
052	4	240	3.9333	26.80	.99	.06	.0571	.0392
053	4.5	270	4.4333	26.78	1	.05	.0476	.0327
054	5	300	4.9333	26.77	1.02	.03	.0286	.0196
055	5.5	330	5.4333	26.75	1.02	.03	.0286	.0196
056	6	360	5.9333	26.75	1.03	.02	.019	.0131
057	6.5	390	6.4333	26.74	1.03	.02	.019	.0131
058	7	420	6.9333	26.74	1.03	.02	.019	.0131
059	7.5	450	7.4333	26.74	1.03	.02	.019	.0131
060	8	480	7.9333	26.74	1.05	-6.661e-16	0	0
061	8.5	510	8.4333	26.72	1.05	-6.661e-16	0	0
062	9	540	8.9333	26.72	1.05	-6.661e-16	0	0
063	9.5	570	9.4333	26.72	1.05	-6.661e-16	0	0
064	10	600	9.9333	26.72	0	0	0	0
065	12	720	11.9333		0	0	0	0
066	14	840	13.9333		0	0	0	0
067	16	960	15.9333		0	0	0	0
068	18	1080	17.9333		0	0	0	0
069	20	1200	19.9333		0	0	0	0
070	22	1320	21.9333		0	0	0	0
071	24	1440	23.9333		0	0	0	0
072	26	1560	25.9333		0	0	0	0
073	28	1680	27.9333		0	0	0	0
074	30	1800	29.9333		0	0	0	0
075	32	1920	31.9333		0	0	0	0
076	34	2040	33.9333		0	0	0	0
077	36	2160	35.9333		0	0	0	0
078	38	2280	37.9333		0	0	0	0
079	40	2400	39.9333		0	0	0	0
080	42	2520	41.9333		0	0	0	0
081	44	2640	43.9333		0	0	0	0
082	46	2760	45.9333		0	0	0	0
083	48	2880	47.9333		0	0	0	0
084	50	3000	49.9333		0	0	0	0
085	52	3120	51.9333		0	0	0	0
086	54	3240	53.9333		0	0	0	0
087	56	3360	55.9333		0	0	0	0
088	58	3480	57.9333		0	0	0	0
089	60	3600	59.9333		0	0	0	0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t (MINUTES)

SLUG- IN
Well No. MW-03

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 10.86 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 2.5 ft.
C = 1.90
y_o = 0.84 y_t = 0.220 t = 120 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(10.86/.344)} + \frac{1.90}{(10.0/.344)} \right]^{-1}$$

$$= 2.60$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.60)}{2(10.0)} \times \frac{1}{120} \times \ln(0.84/.220)$$

$K = 1.00 \times 10^{-5}$ ft./sec.

$K = 0.86$ ft./da.

$K = 3.05 \times 10^{-4}$ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (0.86) (2.5) (7.48)

T = 16.08 gpd/ft

SLUG OUT TEST

MONITOR WELL NUMBER:	MW-03
ELEVATION TOP OF CASING:	37.8
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 26.63
DEPTH OF WELL (TOC):	25.03 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET, 10.5 TO 20.5 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 FULLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	SILTY SAND AND CLAYEY SILT, 12 TO 14.5 FEET BELOW GRADE
H(0) TRANSLATION:	1.37 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	25.32 TRANS. METH. (SLUG OUT) T(0): .0233
FINAL TRANSDUCER VALUE:	26.69

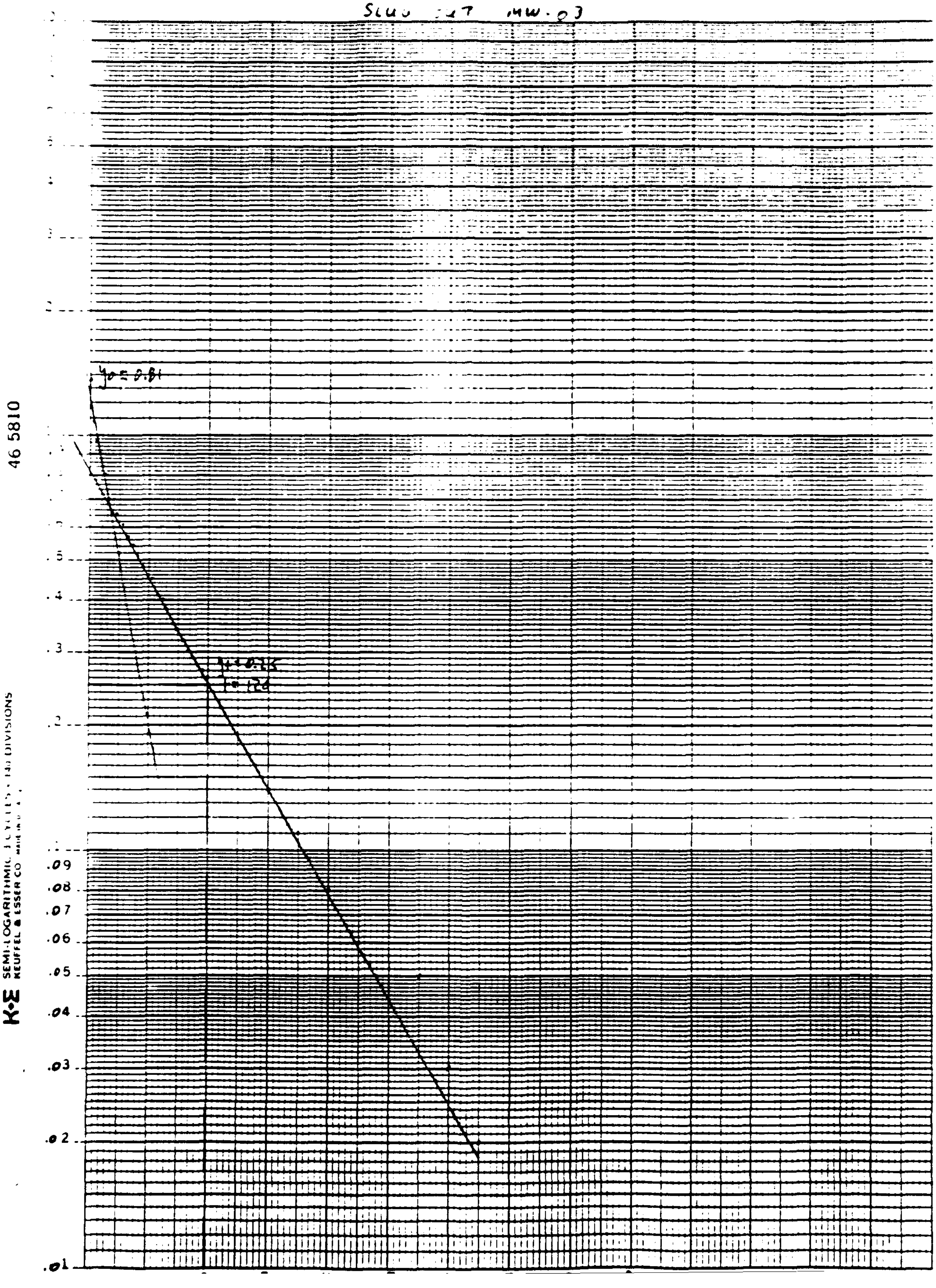
SLUG TEST OUT:

SAMPLE NUMBER	TIME MINUTES)	TIME (SECONDS)	T(O) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(O) TRANS.	H/H(O) THEOR.
000	0	0	-.0233	26.96	1.64	-.27	-.1971	-.1765
001	.0033	.198	-.02	26.34	1.02	.35	.2555	.2288
002	.0067	.402	-.0166	25.81	.49	.88	.6423	.5752
003	.01	.6	-.0133	25.45	.13	1.24	.9051	.8105
004	.0133	.798	-.01	25.62	.3	1.07	.781	.6993
005	.0167	1.002	-.0066	25.13	-.19	1.56	1.1387	1.0196
006	.02	1.2	-.0033	25.46	.14	1.23	.8978	.8039
007	.0233	1.398	0	25.32	0	1.37	1	.8954
008	.0267	1.602	.0034	25.39	.07	1.3	.9489	.8497
009	.03	1.8	.0067	25.42	.1	1.27	.927	.8301
010	.0333	1.998	.01	25.43	.11	1.26	.9197	.8235
011	.05	3	.0267	25.50	.18	1.19	.8686	.7778
012	.0667	4.002	.0434	25.56	.24	1.13	.8248	.7386
013	.0833	4.998	.06	25.61	[illegible]	1.08	.7883	.7059
014	.1	6	.0767	25.66	.34	1.03	.7518	.6732
015	.1167	7.002	.0934	25.69	.37	1	.7299	.6536
016	.1333	7.998	.11	25.72	.4	.97	.708	.634
017	.15	9	.1267	25.75	.43	.94	.6861	.6144
018	.1667	10.002	.1434	25.77	.45	.92	.6715	.6013
019	.1833	10.998	.16	25.78	.46	.91	.6642	.5948
020	.2	12	.1767	25.81	.49	.88	.6423	.5752
021	.2167	13.002	.1934	25.83	.51	.86	.6277	.5621
022	.2333	13.998	.21	25.85	.53	.84	.6131	.549
023	.25	15	.2267	25.86	.54	.83	.6058	.5425
024	.2667	16.002	.2434	25.88	.56	.81	.5912	.5294
025	.2833	16.998	.26	25.89	.57	.8	.5839	.5229
026	.3	18	.2767	25.91	.59	.78	.5693	.5098
027	.3167	19.002	.2934	25.93	.61	.76	.5547	.4967
028	.3333	19.998	.31	25.99	.67	.7	.5109	.4575
029	.4167	25.002	.3934	25.99	.67	.7	.5109	.4575
030	.5	30	.4767	26.04	.72	.65	.4745	.4248
031	.5833	34.998	.56	26.08	.76	.61	.4453	.3987
032	.6667	40.002	.6434	26.12	.8	.57	.4161	.3725
033	.75	45	.7267	26.15	.83	.54	.3942	.3529
034	.8333	49.998	.81	26.18	.86	.51	.3723	.3333
035	.9167	55.002	.8934	26.21	.89	.48	.3504	.3137
036	1	60	.9767	26.23	.91	.46	.3358	.3007
037	1.0833	64.998	1.06	26.24	.92	.45	.3285	.2941
038	1.1667	70.002	1.1434	26.28	.96	.41	.2993	.268
039	1.25	75	1.2267	26.29	.97	.4	.292	.2614
040	1.3333	79.998	1.31	26.31	.99	.38	.2774	.2484
041	1.4167	85.002	1.3934	26.34	1.02	.35	.2555	.2288
042	1.5	90	1.4767	26.35	1.03	.34	.2482	.2222
043	1.583	94.98	1.5597	26.37	1.05	.32	.2336	.2092
044	1.6667	100.002	1.6434	26.39	1.07	.3	.219	.1961

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.7267	26.40	1.08	.29	.2117	.18[illegible]
046	1.833	109.98	1.8097	26.40	1.08	.29	.2117	.1895
047	1.9167	115.002	1.8934	26.42	1.1	.27	.1971	.1765
048	2	120	1.9767	26.43	1.11	.26	.1898	.16[illegible]
049	2.5	150	2.4767	26.50	1.18	.19	.1387	.1242
050	3	180	2.9767	26.55	1.23	.14	.1022	.0915
051	3.5	210	3.4767	26.58	1.26	.11	.0803	.07[illegible]
052	4	240	3.9767	26.61	1.29	.08	.0584	.05[illegible]
053	4.5	270	4.4767	26.63	1.31	.06	.0438	.0392
054	5	300	4.9767	26.63	1.31	.06	.0438	.03[illegible]
055	5.5	330	5.4767	26.64	1.32	.05	.0365	.03[illegible]
056	6	360	5.9767	26.66	1.34	.03	.0219	.0196
057	6.5	390	6.4767	26.67	1.35	.02	.0146	.01[illegible]
058	7	420	6.9767	26.67	1.35	.02	.0146	.01
059	7.5	450	7.4767	26.67	1.35	.02	.0146	.0131
060	8	480	7.9767	26.67	1.35	.02	.0146	.0131
061	8.5	510	8.4767	26.69	1.37	-8.882e-16	0	0
062	9	540	8.9767	26.69	1.37	-8.882e-16	0	0
063	9.5	570	9.4767	26.69	1.37	-8.882e-16	0	0
064	10	600	9.9767	26.69	1.37	0	0	0
065	12	720	11.9767		0	0	0	0
066	14	840	13.9767		0	0	0	0
067	16	960	15.9767		0	0	0	0
068	18	1080	17.9767		0	0	0	0
069	20	1200	19.9767		0	0	0	0
070	22	1320	21.9767		0	0	0	0
071	24	1440	23.9767		0	0	0	0
072	26	1560	25.9767		0	0	0	0
073	28	1680	27.9767		0	0	0	0
074	30	1800	29.9767		0	0	0	0
075	32	1920	31.9767		0	0	0	0
076	34	2040	33.9767		0	0	0	0
077	36	2160	35.9767		0	0	0	0
078	38	2280	37.9767		0	0	0	0
079	40	2400	39.9767		0	0	0	0
080	42	2520	41.9767		0	0	0	0
081	44	2640	43.9767		0	0	0	0
082	46	2760	45.9767		0	0	0	0
083	48	2880	47.9767		0	0	0	0
084	50	3000	49.9767		0	0	0	0
085	52	3120	51.9767		0	0	0	0
086	54	3240	53.9767		0	0	0	0
087	56	3360	55.9767		0	0	0	0
088	58	3480	57.9767		0	0	0	0
089	60	3600	59.9767		0	0	0	0
							0	

SLUG TEST MW-03



SLUG- OUT
Well No. MW-03

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 10.86 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 2.5 ft.
C = 1.90
y_o = 0.81 y_t = 0.25   t = 120 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(10.86/.344)} + \frac{1.90}{(10.0/.344)} \right]^{-1}$$

$$= 2.60$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2\ (2.60)}{2(10.0)} \times \frac{1}{120} \times \ln\ (0.81/.25\ )$$

K = 8.77 x 10⁻⁴ ft./sec.

K = 0.76 ft./da.

K = 2.67 x 10⁻⁴ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (0.76) (2.5) (7.48)

T = 14.21 gpd/ft

SLUG OUT TEST

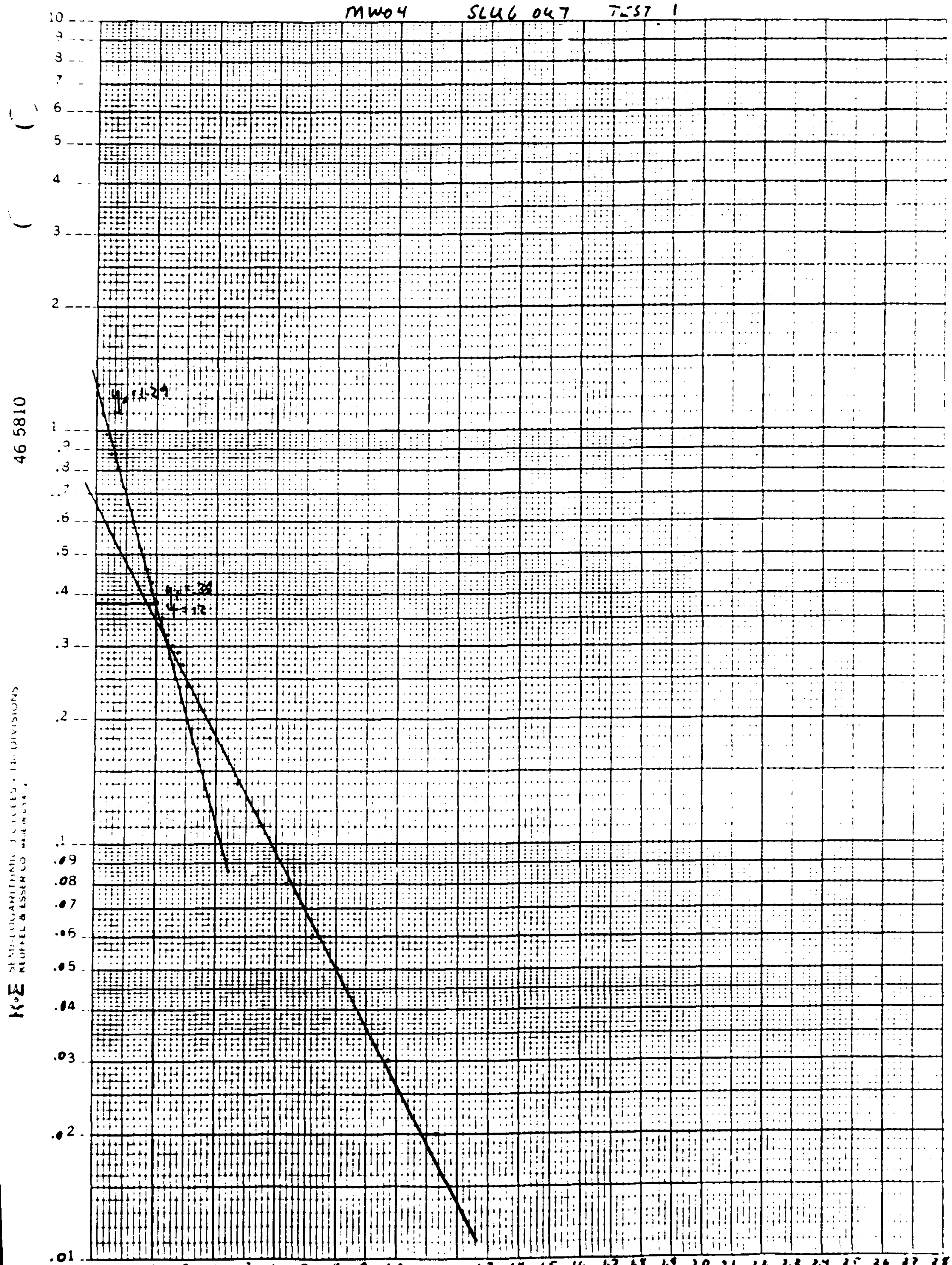
MONITOR WELL NUMBER:	MW-04 TEST 1
ELEVATION TOP OF CASING:	[illegible]9.[illegible]
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 23.[illegible]
DEPTH OF WELL (TOC):	[illegible]6.[illegible] DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. [illegible] TO [illegible] FEET BELOW GRADE
SCREEN/FILTER [illegible]PE:	[illegible] 10 [illegible] FULLY PENETRATING/ [illegible]/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	CLAYEY AND SILTY SAND, 12 TO ? FEET BELOW GRADE
H(0) TRANSLATION:	1.29 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	21.96 TRANS. METH. (SLUG OUT) T(0): .03
FINAL TRANSDUCER VALUE:	23.25

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THE[illegible]
000	0	0	-.03	22.87	.91	.38	.2946	.248[illegible]
001	.0033	.198	-.0267	21.56	-.4	1.69	1.3101	1.1[illegible]6
002	.0067	.402	-.0233	21.66	-.3	1.59	1.2326	1.0[illegible]2
003	.01	.6	-.02	21.80	-.16	1.45	1.124	.9477
004	.0133	.798	-.0167	21.85	-.11	1.4	1.0853	.9[illegible]
005	.0167	1.002	-.0133	21.87	-.09	1.38	1.0698	.90[illegible]
006	.02	1.2	-.01	21.91	-.05	1.34	1.0388	.8758
007	.0233	1.398	-.0067	21.95	-.01	1.3	1.0078	.84[illegible]
008	.0267	1.602	-.0033	21.99	.03	1.26	.9767	.82[illegible]
009	.03	1.8	0	21.96	0	1.29	1	.8431
010	.0333	1.998	.0033	22.03	.07	1.22	.9457	.797[illegible]
011	.05	3	.02	22.15	.19	1.1	.8527	.7[illegible]
012	.0667	4.002	.0367	22.26	.3	.99	.7674	.6471
013	.0833	4.998	.0533	22.36	.4	.89	.6899	.5817
014	.1	6	.07	22.44	.48	.81	.6279	.52[illegible]
015	.1167	7.002	.0867	22.52	.56	.73	.5659	.47[illegible]
016	.1333	7.998	.1033	22.58	.62	.67	.5194	.4379
017	.15	9	.12	22.65	.69	.6	.4651	.39[illegible]
018	.1667	10.002	.1367	22.69	.73	.56	.4341	.3[illegible]
019	.1833	10.998	.1533	22.74	.78	.51	.3953	.3333
020	.2	12	.17	22.79	.83	.46	.3566	.30[illegible]
021	.2167	13.002	.1867	22.82	.86	.43	.3333	.2[illegible]
022	.2333	13.998	.2033	22.87	.91	.38	.2946	.2484
023	.25	15	.22	22.90	.94	.35	.2713	.228[illegible]
024	.2667	16.002	.2367	22.93	.97	.32	.2481	.20[illegible]
025	.2833	16.998	.2533	22.95	.99	.3	.2326	.196[illegible]
026	.3	18	.27	22.96	1	.29	.2248	.1895
027	.3167	19.002	.2867	22.98	1.02	.27	.2093	.17[illegible]
028	.3333	19.998	.3033	23.01	1.05	.24	.186	.15[illegible]
029	.4167	25.002	.3867	23.07	1.11	.18	.1395	.1176
030	.5	30	.47	23.11	1.15	.14	.1085	.091[illegible]
031	.5833	34.998	.5533	23.14	1.18	.11	.0853	.071
032	.6667	40.002	.6367	23.17	1.21	.08	.062	.0523
033	.75	45	.72	23.19	1.23	.06	.0465	.039[illegible]
034	.8333	49.998	.8033	23.20	1.24	.05	.0388	.032
035	.9167	55.002	.8867	23.20	1.24	.05	.0388	.032[illegible]
036	1	60	.97	23.22	1.26	.03	.0233	.0196
037	1.0833	64.998	1.0533	23.22	1.26	.03	.0233	.019
038	1.1667	70.002	1.1367	23.23	1.27	.02	.0155	.013[illegible]
039	1.25	75	1.22	23.23	1.27	.02	.0155	.0131
040	1.3333	79.998	1.3033	23.23	1.27	.02	.0155	.013
041	1.4167	85.002	1.3867	23.23	1.27	.02	.0155	.013
042	1.5	90	1.47	23.25	1.29	8.8818e-16	0	0
043	1.583	94.98	1.553	23.25	1.29	8.8818e-16	0	0
044	1.6667	100.002	1.6367	23.25	1.29	8.8818e-16	0	0

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.72	23.25	1.29	8.8818e-16	0	0
046	1.833	109.98	1.803	23.25	1.29	8.8818e-16	0	0
047	1.9167	115.002	1.8867	23.25	1.29	8.8818e-16	0	0
048	2	120	1.97	23.25	1.29	8.8818e-16	0	0
049	2.5	150	2.47	23.27	1.31	-.02	-.0155	-.0131
050	3	180	2.97	23.27	1.31	-.02	-.0155	-.0131
051	3.5	210	3.47	23.27	1.31	-.02	-.0155	-.0131
052	4	240	3.97	23.25	1.29	8.8818e-16	0	0
053	4.5	270	4.47	23.25	1.29	8.8818e-16	0	0
054	5	300	4.97	23.25	1.29	8.8818e-16	0	0
055	5.5	330	5.47	23.27	1.31	-.02	-.0155	-.0131
056	6	360	5.97	23.27	1.31	-.02	-.0155	-.0131
057	6.5	390	6.47	23.27	1.31	-.02	-.0155	-.0131
058	7	420	6.97	23.27	1.31	-.02	-.0155	-.0131
059	7.5	450	7.47	23.25	1.29	8.8818e-16	0	0
060	8	480	7.97	23.25	1.29	0	0	0
061	8.5	510	8.47		0	0	0	0
062	9	540	8.97		0	0	0	0
063	9.5	570	9.47		0	0	0	0
064	10	600	9.97		0	0	0	0
065	12	720	11.97		0	0	0	0
066	14	840	13.97		0	0	0	0
067	16	960	15.97		0	0	0	0
068	18	1080	17.97		0	0	0	0
069	20	1200	19.97		0	0	0	0
070	22	1320	21.97		0	0	0	0
071	24	1440	23.97		0	0	0	0
072	26	1560	25.97		0	0	0	0
073	28	1680	27.97		0	0	0	0
074	30	1800	29.97		0	0	0	0
075	32	1920	31.97		0	0	0	0
076	34	2040	33.97		0	0	0	0
077	36	2160	35.97		0	0	0	0
078	38	2280	37.97		0	0	0	0
079	40	2400	39.97		0	0	0	0
080	42	2520	41.97		0	0	0	0
081	44	2640	43.97		0	0	0	0
082	46	2760	45.97		0	0	0	0
083	48	2880	47.97		0	0	0	0
084	50	3000	49.97		0	0	0	0
085	52	3120	51.97		0	0	0	0
086	54	3240	53.97		0	0	0	0
087	56	3360	55.97		0	0	0	0
088	58	3480	57.97		0	0	0	0
089	60	3600	59.97		0	0	0	0
							0	


MW04 SLUG OUT TEST 1
46 5810
K&E SEMI-LOGARITHMIC 3 CYCLES × 140 DIVISIONS KEUFFEL & ESSER CO. MADE IN U.S.A.
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.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8

SLUG- OUT TEST 1
Well No. MW-04

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 7.72 ft.
Height of water from base of screen (H) = 7.72 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 10.72 ft.
C = 1.8
y_o = 1.29 y_t = 0.38 t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w}\right]^{-1}$$

$$= \left[\frac{1.1}{\ln(7.72/.344)} + \frac{1.8}{(7.72/.344)}\right]^{-1}$$

$$= 2.30$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.30)}{2(7.72)} \times \frac{1}{12} \times \ln(1.29/.38)$$

K = 1.05×10^{-4} ft./sec.

K = 9.03 ft./da.

K = 3.18×10^{-3} cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (9.03) (10.72) (7.48)

T = 724.08 gpd/ft

SLUG OUT TEST

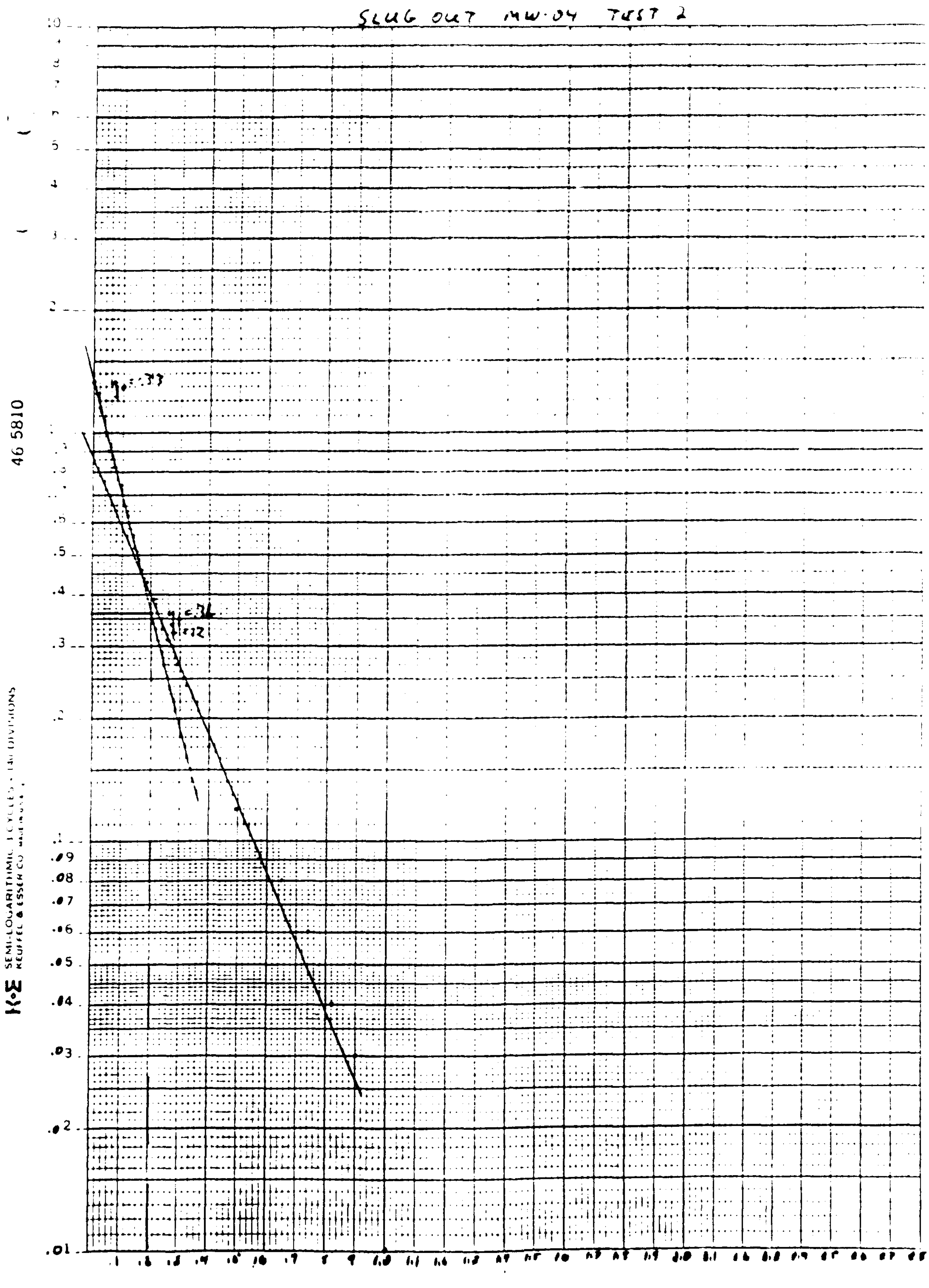
MONITOR WELL NUMBER:	MW-04 2ND EVENT
ELEVATION TOP OF CASING:	39.63
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 23.37
DEPTH OF WELL (TOC):	26.7 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET, [illegible] TO 22.0 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	CLAYEY AND SILTY SAND, 12 TO [illegible] FEET BELOW GRADE
H(0) TRANSLATION:	1.33 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	21.9 TRANS. METH. (SLUG OUT) T(0): .01
FINAL TRANSDUCER VALUE:	23.23

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.01	23.20	1.3	.03	.0226	.0196
001	.0033	.198	-.0067	21.45	-.45	1.78	1.3383	1.1634
002	.0067	.402	-.0033	21.91	.01	1.32	.9925	.8627
003	.01	.6	0	21.90	0	1.33	1	.8693
004	.0133	.798	.0033	21.95	.05	1.28	.9624	.8366
005	.0167	1.002	.0067	21.96	.06	1.27	.9549	.8301
006	.02	1.2	.01	21.99	.09	1.24	.9323	.8105
007	.0233	1.398	.0133	22.04	.14	1.19	.8947	.7778
008	.0267	1.602	.0167	22.06	.16	1.17	.8797	.7647
009	.03	1.8	.02	22.09	.19	1.14	.8571	.7451
010	.0333	1.998	.0233	22.10	.2	1.13	.8496	.7386
011	.05	3	[illegible]	22.23	.33	1	.7519	.6536
012	.0667	4.002	[illegible]	22.33	.43	.9	.6767	.5882
013	.0833	4.998	.0733	22.41	.51	.82	.6165	.5359
014	.1	6	.09	22.49	.59	.74	.5564	.4837
015	.1167	7.002	.1067	22.57	.67	.66	.4962	.4314
016	.1333	7.998	.1233	22.61	.71	.62	.4662	.4052
017	.15	9	.14	22.68	.78	.55	.4135	.3595
018	.1667	10.002	.1567	22.72	.82	.51	.3835	.3333
019	.1833	10.998	.1733	22.77	.87	.46	.3459	.3007
020	.2	12	.19	22.80	.9	.43	.3233	.281
021	.2167	13.002	.2067	22.84	.94	.39	.2932	.2549
022	.2333	13.998	.2233	22.87	.97	.36	.2707	.2353
023	.25	15	.24	22.90	1	.33	.2481	.2157
024	.2667	16.002	.2567	22.92	1.02	.31	.2331	.2026
025	.2833	16.998	.2733	22.93	1.03	.3	.2256	.1961
026	.3	18	.29	22.96	1.06	.27	.203	.1765
027	.3167	19.002	.3067	22.98	1.08	.25	.188	.1634
028	.3333	19.998	.3233	22.99	1.09	.24	.1805	.1569
029	.4167	25.002	.4067	23.06	1.16	.17	.1278	.1111
030	.5	30	.49	23.11	1.21	.12	.0902	.0784
031	.5833	34.998	.5733	23.14	1.24	.09	.0677	.0588
032	.6667	40.002	.6567	23.15	1.25	.08	.0602	.0523
033	.75	45	.74	23.17	1.27	.06	.0451	.0392
034	.8333	49.998	.8233	23.19	1.29	.04	.0301	.0261
035	.9167	55.002	.9067	23.20	1.3	.03	.0226	.0196
036	1	60	.99	23.22	1.32	.01	.0075	.0065
037	1.0833	64.998	1.0733	23.22	1.32	.01	.0075	.0065
038	1.1667	70.002	1.1567	23.22	1.32	.01	.0075	.0065
039	1.25	75	1.24	23.23	1.33	-1.776e-15	0	0
040	1.3333	79.998	1.3233	23.23	1.33	-1.776e-15	0	0
041	1.4167	85.002	1.4067	23.23	1.33	-1.776e-15	0	0
042	1.5	90	1.49	23.23	1.33	-1.776e-15	0	0
043	1.583	94.98	1.573	23.23	1.33	-1.776e-15	0	0
044	1.6667	100.002	1.6567	23.23	1.33	-1.776e-15	0	0

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(O) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEO.
045	1.75	105	1.74	23.23	1.33	-1.776e-15	0	0
046	1.833	109.98	1.823	23.23	1.33	-1.776e-15	0	0
047	1.9167	115.002	1.9067	23.23	1.33	-1.776e-15	0	0
048	2	120	1.99	23.23	1.33	-1.776e-15	0	0
049	2.5	150	2.49	23.23	1.33	-1.776e-15	0	0
050	3	180	2.99	23.25	1.35	-.02	-.015	-.0131
051	3.5	210	3.49	23.25	1.35	-.02	-.015	-.0[illegible]1
052	4	240	3.99	23.25	1.35	-.02	-.015	-.0[illegible]1
053	4.5	270	4.49	23.23	1.33	-1.776e-15	0	0
054	5	300	4.99	23.23	1.33	-1.776e-15	0	0
055	5.5	330	5.49	23.23	1.33	-1.776e-15	0	0
056	6	360	5.99	23.23	1.33	-1.776e-15	0	0
057	6.5	390	6.49	23.23	1.33	-1.776e-15	0	0
058	7	420	6.99	23.23	1.33	-1.776e-15	0	0
059	7.5	450	7.49	23.23	1.33	-1.776e-15	0	0
060	8	480	7.99	23.23	1.33	-1.776e-15	0	0
061	8.5	510	8.49	23.23	1.33	-1.776e-15	0	0
062	9	540	8.99	23.23	1.33	-1.776e-15	0	0
063	9.5	570	9.49	23.23	1.33	-1.776e-15	0	0
064	10	600	9.99	23.23	1.33	0	0	0
065	12	720	11.99		0	0	0	0
066	14	840	13.99		0	0	0	0
067	16	960	15.99		0	0	0	0
068	18	1080	17.99		0	0	0	0
069	20	1200	19.99		0	0	0	0
070	22	1320	21.99		0	0	0	0
071	24	1440	23.99		0	0	0	0
072	26	1560	25.99		0	0	0	0
073	28	1680	27.99		0	0	0	0
074	30	1800	29.99		0	0	0	0
075	32	1920	31.99		0	0	0	0
076	34	2040	33.99		0	0	0	0
077	36	2160	35.99		0	0	0	0
078	38	2280	37.99		0	0	0	0
079	40	2400	39.99		0	0	0	0
080	42	2520	41.99		0	0	0	0
081	44	2640	43.99		0	0	0	0
082	46	2760	45.99		0	0	0	0
083	48	2880	47.99		0	0	0	0
084	50	3000	49.99		0	0	0	0
085	52	3120	51.99		0	0	0	0
086	54	3240	53.99		0	0	0	0
087	56	3360	55.99		0	0	0	0
088	58	3480	57.99		0	0	0	0
089	60	3600	59.99		0	0	0	0
							0	


SLUG OUT MW-04 TEST 2
K·E SEMI-LOGARITHMIC 2 CYCLES × 140 DIVISIONS
KEUFFEL & ESSER CO.
46 5810

SLUG [illegible]
Well [illegible] [illegible]

Casing diameter = [illegible] in. = .157 [illegible].
Casing radius (r_c) = .083 [illegible].
Length of screen (L) = [illegible].72 [illegible].
Height of water from base of screen [illegible] = [illegible].72 ft.
Radius of borehole (r_w) = [illegible].44 [illegible]
Thickness of Aquifer (D) = 10.72 [illegible].
C = 1.[illegible]
y_o = 1.33 y_t = 0.36 t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln(H/r_w)} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln([illegible].72/.344)} + \frac{[illegible]}{[illegible].72/.344} \right]^{-1}$$

$$= 2.30$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.30)}{2(7.72)} \times \frac{1}{12} \times \ln(1.33/.36)$$

$K = 1.12 \times 10^{-4}$ ft./sec.

$K = 9.66$ ft./da.

$K = 3.41 \times 10^{-3}$ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (9.66) (10.72) (7.48)

T = 774.59 gpd/ft

SLUG OUT TEST

MONITOR WELL NUMBER:	MW-[illegible] TEST [illegible]
ELEVATION TOP OF CASING:	3[illegible].[illegible]4
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 14.7[illegible]
DEPTH OF WELL (TOC):	[illegible]0.6[illegible] DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. [illegible] TO 2[illegible].5 FEET BELOW GRADE
SCREEN/FILTER TYPE:	[illegible] PARTIALLY PENETRATING, [illegible] GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	SILTY SAND AND SAND. 13 TO [illegible] FEET BELOW GRADE
H(0) TRANSLATION:	1.47 H(0) THEORETICAL: 1.5[illegible]
INITIAL CONSISTENT VALUE:	13.21 TRANS. METH. (SLUG OUT) T(0): .01
FINAL TRANSDUCER VALUE:	14.68

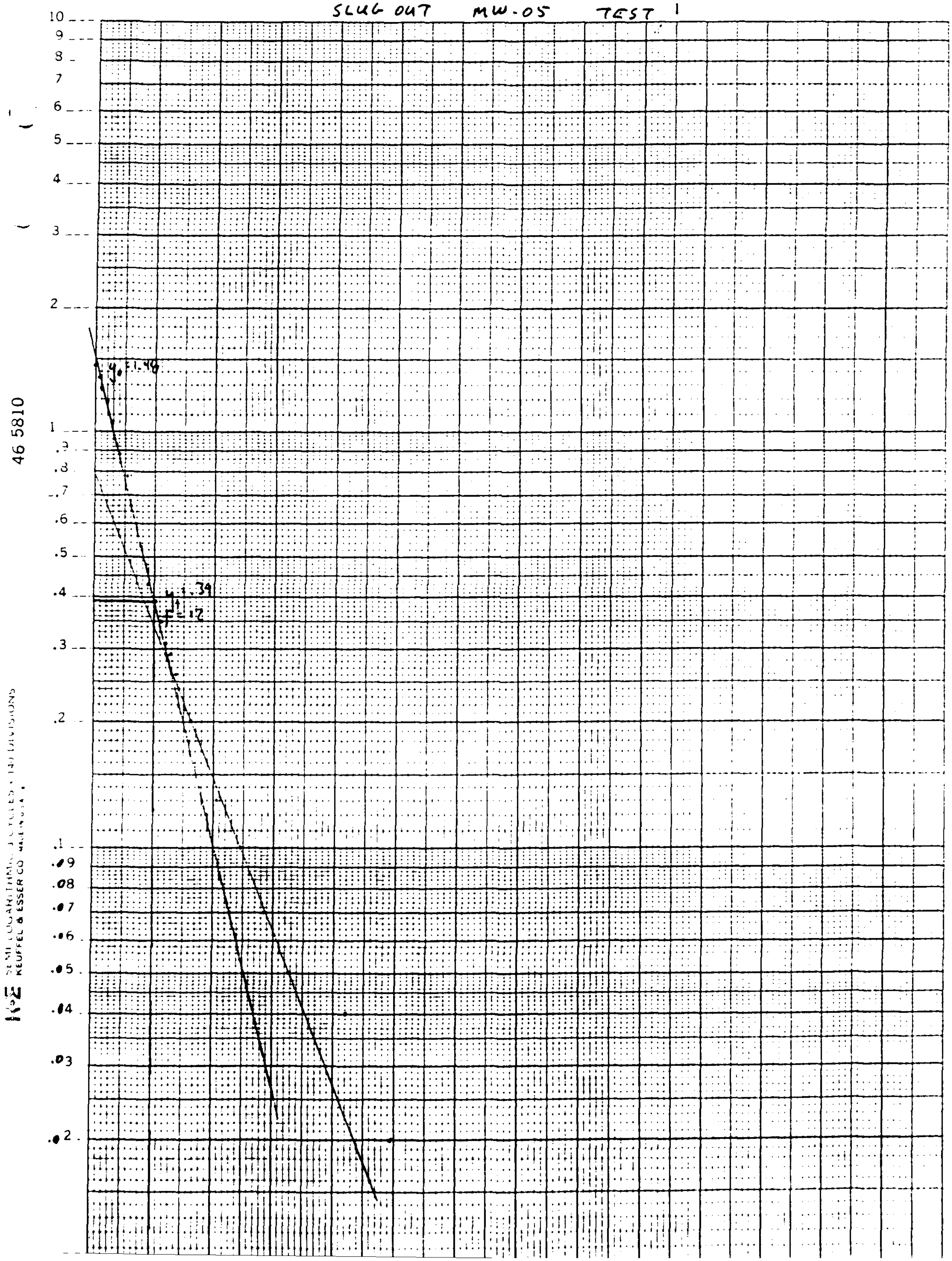
SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEO.
000	0	0	-.01	13.75	.54	.93	.6327	.6077
001	.0033	.198	-.0067	13.23	.02	1.45	.9864	.947
002	.0067	.402	-.0033	13.13	-.08	1.55	1.0544	1.0131
003	.01	.6	0	13.21	0	1.47	1	.9609
004	.0133	.798	.0033	13.24	.03	1.44	.9796	.941
005	.0167	1.002	.0067	13.28	.07	1.4	.9524	.915
006	.02	1.2	.01	13.31	.1	1.37	.932	.8954
007	.0233	1.398	.0133	13.34	.13	1.34	.9116	.875
008	.0267	1.602	.0167	13.36	.15	1.32	.898	.862[illegible]
009	.03	1.8	.02	13.40	.19	1.28	.8707	.8366
010	.0333	1.998	.0233	13.44	.23	1.24	.8435	.810
011	.05	3	.04	13.50	.29	1.18	.8027	.771
012	.0667	4.002	.0567	13.63	.42	1.05	.7143	.6863
013	.0833	4.998	.0733	13.72	.51	.96	.6531	.6275
014	.1	6	.09	13.80	.59	.88	.5986	.575
015	.1167	7.002	.1067	13.90	.69	.78	.5306	.5098
016	.1333	7.998	.1233	14.02	.81	.66	.449	.4314
017	.15	9	.14	14.09	.88	.59	.4014	.3851
018	.1667	10.002	.1567	14.15	.94	.53	.3605	.3464
019	.1833	10.998	.1733	14.20	.99	.48	.3265	.3137
020	.2	12	.19	14.25	1.04	.43	.2925	.28
021	.2167	13.002	.2067	14.29	1.08	.39	.2653	.2549
022	.2333	13.998	.2233	14.33	1.12	.35	.2381	.2288
023	.25	15	.24	14.37	1.16	.31	.2109	.2020
024	.2667	16.002	.2567	14.39	1.18	.29	.1973	.1899
025	.2833	16.998	.2733	14.42	1.21	.26	.1769	.1699
026	.3	18	.29	14.44	1.23	.24	.1633	.1569
027	.3167	19.002	.3067	14.47	1.26	.21	.1429	.1373
028	.3333	19.998	.3233	14.48	1.27	.2	.1361	.1307
029	.4167	25.002	.4067	14.55	1.34	.13	.0884	.085
030	.5	30	.49	14.58	1.37	.1	.068	.0654
031	.5833	34.998	.5733	14.61	1.4	.07	.0476	.0458
032	.6667	40.002	.6567	14.63	1.42	.05	.034	.0327
033	.75	45	.74	14.63	1.42	.05	.034	.0327
034	.8333	49.998	.8233	14.64	1.43	.04	.0272	.0261
035	.9167	55.002	.9067	14.64	1.43	.04	.0272	.0261
036	1	60	.99	14.66	1.45	.02	.0136	.0131
037	1.0833	64.998	1.0733	14.66	1.45	.02	.0136	.0131
038	1.1667	70.002	1.1567	14.66	1.45	.02	.0136	.0131
039	1.25	75	1.24	14.66	1.45	.02	.0136	.0131
040	1.3333	79.998	1.3233	14.66	1.45	.02	.0136	.0131
041	1.4167	85.002	1.4067	14.66	1.45	.02	.0136	.0131
042	1.5	90	1.49	14.66	1.45	.02	.0136	.0131
043	1.583	94.98	1.573	14.68	1.47	1.1102e-15	0	0
044	1.6667	100.002	1.6567	14.68	1.47	1.1102e-15	0	0

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.74	14.68	1.47	1.1102e-15	0	0
046	1.833	109.98	1.823	14.68	1.47	1.1102e-15	0	0
047	1.9167	115.002	1.9067	14.68	1.47	1.1102e-15	0	0
048	2	120	1.99	14.68	1.47	1.1102e-15	0	0
049	2.5	150	2.49	14.68	1.47	1.1102e-15	0	0
050	3	180	2.99	14.68	1.47	1.1102e-15	0	0
051	3.5	210	3.49	14.68	1.47	1.1102e-15	0	0
052	4	240	3.99	14.69	1.48	-.01	-.0068	-.0065
053	4.5	270	4.49	14.69	1.48	-.01	-.0068	-.0065
054	5	300	4.99	14.69	1.48	-.01	-.0068	-.0065
055	5.5	330	5.49	14.69	1.48	-.01	-.0068	-.0065
056	6	360	5.99	14.69	1.48	-.01	-.0068	-.0065
057	6.5	390	6.49	14.68	1.47	1.1102e-15	0	0
058	7	420	6.99	14.69	1.48	-.01	-.0068	-.0065
059	7.5	450	7.49	14.68	1.47	1.1102e-15	0	0
060	8	480	7.99	14.69	1.48	-.01	-.0068	-.0065
061	8.5	510	8.49	14.69	1.48	-.01	-.0068	-.0065
062	9	540	8.99	14.69	1.48	-.01	-.0068	-.0065
063	9.5	570	9.49	14.69	1.48	-.01	-.0068	-.0065
064	10	600	9.99	14.69	1.48	-.01	-.0068	-.0065
065	12	720	11.99	14.68	1.47	0	0	0
066	14	840	13.99		0	0	0	0
067	16	960	15.99		0	0	0	0
068	18	1080	17.99		0	0	0	0
069	20	1200	19.99		0	0	0	0
070	22	1320	21.99		0	0	0	0
071	24	1440	23.99		0	0	0	0
072	26	1560	25.99		0	0	0	0
073	28	1680	27.99		0	0	0	0
074	30	1800	29.99		0	0	0	0
075	32	1920	31.99		0	0	0	0
076	34	2040	33.99		0	0	0	0
077	36	2160	35.99		0	0	0	0
078	38	2280	37.99		0	0	0	0
079	40	2400	39.99		0	0	0	0
080	42	2520	41.99		0	0	0	0
081	44	2640	43.99		0	0	0	0
082	46	2760	45.99		0	0	0	0
083	48	2880	47.99		0	0	0	0
084	50	3000	49.99		0	0	0	0
085	52	3120	51.99		0	0	0	0
086	54	3240	53.99		0	0	0	0
087	56	3360	55.99		0	0	0	0
088	58	3480	57.99		0	0	0	0
089	60	3600	59.99		0	0	0	0
							0	

SLUG OUT MW-05 TEST 1



SLUG-OUT TEST 1
Well No. MW-05

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 5.80 ft.
Height of water from base of screen (H) = 5.80 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 5.80 ft.
C = 1.73
y_o = 1.48 y_t = 0.37 t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(5.80/.344)} + \frac{1.75}{(5.80/.344)} \right]^{-1}$$

$$= 2.03$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.03)}{2(5.80)} \times \frac{1}{12} \times \ln(1.48/.39)$$

$K = 1.34 \times 10^{-4}$ ft./sec.

$K = 11.58$ ft./da.

$K = 4.08 \times 10^{-3}$ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (11.58) (8.80) (7.48)

T = 762.24 gpd/ft

SLUG OUT TEST

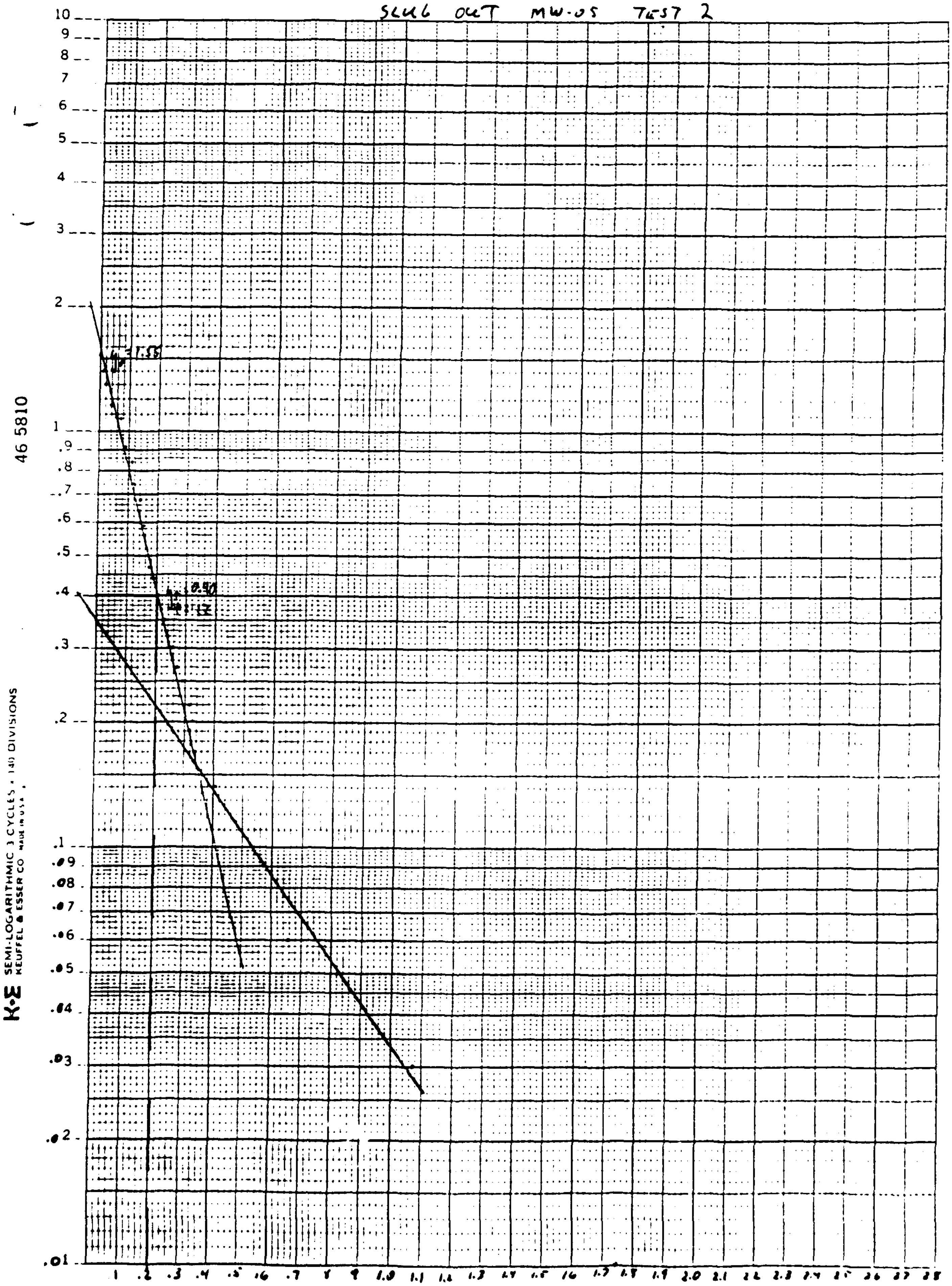
MONITOR WELL NUMBER:	MW-05 2ND EVENT
ELEVATION TOP OF CASING:	36.64
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 14.76
DEPTH OF WELL (TOC):	30.68 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET, 16.5 TO 26.5 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING, 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	SILTY SAND AND SAND, 13 TO [illegible] FEET BELOW GRADE
H(0) TRANSLATION:	1.52 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	13.16 TRANS. METH. (SLUG OUT) T(0): .01
FINAL TRANSDUCER VALUE:	14.68

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H´ A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.01	14.13	.97	.55	.3618	.3595
001	.0033	.198	-.0067	13.03	-.13	1.65	1.0855	1.0784
002	.0067	.402	-.0033	13.16	0	1.52	1	.9935
003	.01	.6	0	13.16	0	1.52	1	.9935
004	.0133	.798	.0033	13.22	.06	1.46	.9605	.9542
005	.0167	1.002	.0067	13.25	.09	1.43	.9408	.9346
006	.02	1.2	.01	13.28	.12	1.4	.9211	.915
007	.0233	1.398	.0133	13.33	.17	1.35	.8882	.8824
008	.0267	1.602	.0167	13.35	.19	1.33	.875	.8693
009	.03	1.8	.02	13.38	.22	1.3	.8553	.8497
010	.0333	1.998	.0233	13.41	.25	1.27	.8355	.8301
011	.05	3	.04	13.52	.36	1.16	.7632	.7582
012	.0667	4.002	.0567	13.59	.43	1.09	.7171	.7124
013	.0833	4.998	.0733	13.60	.44	1.08	.7105	.7059
014	.1	6	.09	13.76	.6	.92	.6053	.6013
015	.1167	7.002	.1067	13.84	.68	.84	.5526	.549
016	.1333	7.998	.1233	13.94	.78	.74	.4868	.4837
017	.15	9	.14	14.00	.84	.68	.4474	.4444
018	.1667	10.002	.1567	14.09	.93	.59	.3882	.3856
019	.1833	10.998	.1733	14.21	1.05	.47	.3092	.3072
020	.2	12	.19	14.24	1.08	.44	.2895	.2876
021	.2167	13.002	.2067	14.28	1.12	.4	.2632	.2614
022	.2333	13.998	.2233	14.33	1.17	.35	.2303	.2288
023	.25	15	.24	14.36	1.2	.32	.2105	.2092
024	.2667	16.002	.2567	14.38	1.22	.3	.1974	.1961
025	.2833	16.998	.2733	14.41	1.25	.27	.1776	.1765
026	.3	18	.29	14.43	1.27	.25	.1645	.1634
027	.3167	19.002	.3067	14.46	1.3	.22	.1447	.1438
028	.3333	19.998	.3233	14.48	1.32	.2	.1316	.1307
029	.4167	25.002	.4067	14.54	1.38	.14	.0921	.0915
030	.5	30	.49	14.57	1.41	.11	.0724	.0719
031	.5833	34.998	.5733	14.59	1.43	.09	.0592	.0588
032	.6667	40.002	.6567	14.62	1.46	.06	.0395	.0392
033	.75	45	.74	14.62	1.46	.06	.0395	.0392
034	.8333	49.998	.8233	14.63	1.47	.05	.0329	.0327
035	.9167	55.002	.9067	14.63	1.47	.05	.0329	.0327
036	1	60	.99	14.63	1.47	.05	.0329	.0327
037	1.0833	64.998	1.0733	14.65	1.49	.03	.0197	.0196
038	1.1667	70.002	1.1567	14.65	1.49	.03	.0197	.0196
039	1.25	75	1.24	14.65	1.49	.03	.0197	.0196
040	1.3333	79.998	1.3233	14.65	1.49	.03	.0197	.0196
041	1.4167	85.002	1.4067	14.65	1.49	.03	.0197	.0196
042	1.5	90	1.49	14.65	1.49	.03	.0197	.0196
043	1.583	94.98	1.573	14.65	1.49	.03	.0197	.0196
044	1.6667	100.002	1.6567	14.65	1.49	.03	.0197	.0196

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THE[illegible]
045	1.75	105	1.74	14.67	1.51	.01	.0066	.006[illegible]
046	1.833	109.98	1.823	14.67	1.51	.01	.0066	.00[illegible]
047	1.9167	115.002	1.9067	14.67	1.51	.01	.0066	.0065
048	2	120	1.99	14.67	1.51	.01	.0066	.0065
049	2.5	150	2.49	14.67	1.51	.01	.0066	.00[illegible]
050	3	180	2.99	14.67	1.51	.01	.0066	.0065
051	3.5	210	3.49	14.67	1.51	.01	.0066	.0065
052	4	240	3.99	14.67	1.51	.01	.0066	.00[illegible]
053	4.5	270	4.49	14.67	1.51	.01	.0066	.006[illegible]
054	5	300	4.99	14.67	1.51	.01	.0066	.0065
055	5.5	330	5.49	14.67	1.51	.01	.0066	.006[illegible]
056	6	360	5.99	14.68	1.52	4.4409e-16	0	0
057	6.5	390	6.49	14.68	1.52	4.4409e-16	0	0
058	7	420	6.99	14.68	1.52	4.4409e-16	0	0
059	7.5	450	7.49	14.67	1.51	.01	.0066	.006[illegible]
060	8	480	7.99	14.68	1.52	4.4409e-16	0	0
061	8.5	510	8.49	14.68	1.52	4.4409e-16	0	0
062	9	540	8.99	14.68	1.52	4.4409e-16	0	0
063	9.5	570	9.49	14.68	1.52	4.4409e-16	0	0
064	10	600	9.99	14.68	1.52	0	0	0
065	12	720	11.99		0	0	0	0
066	14	840	13.99		0	0	0	0
067	16	960	15.99		0	0	0	0
068	18	1080	17.99		0	0	0	0
069	20	1200	19.99		0	0	0	0
070	22	1320	21.99		0	0	0	0
071	24	1440	23.99		0	0	0	0
072	26	1560	25.99		0	0	0	0
073	28	1680	27.99		0	0	0	0
074	30	1800	29.99		0	0	0	0
075	32	1920	31.99		0	0	0	0
076	34	2040	33.99		0	0	0	0
077	36	2160	35.99		0	0	0	0
078	38	2280	37.99		0	0	0	0
079	40	2400	39.99		0	0	0	0
080	42	2520	41.99		0	0	0	0
081	44	2640	43.99		0	0	0	0
082	46	2760	45.99		0	0	0	0
083	48	2880	47.99		0	0	0	0
084	50	3000	49.99		0	0	0	0
085	52	3120	51.99		0	0	0	0
086	54	3240	53.99		0	0	0	0
087	56	3360	55.99		0	0	0	0
088	58	3480	57.99		0	0	0	0
089	60	3600	59.99		0	0	0	0
							0	



SLUG OUT MW-05 TEST 2
46 5810
K-E SEMI-LOGARITHMIC 3 CYCLES x 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
10
9
8
7
6
5
4
3
2
1
.9
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.1
.09
.08
.07
.06
.05
.04
.03
.02
.01

SLUG-OUT TEST
Well no. MW-0[illegible]

Casing diameter = [illegible] in. = .1[illegible] ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = [illegible].80 ft.
Height of water from base of screen (H) = 5.80 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = [illegible].80 ft.
C = 1.75
y_o = 1.55 y_t = 0.40   t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(5.80/.344)} + \frac{1.75}{(5.80/.344)} \right]^{-1}$$

$$= 2.03$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.03)}{2(5.80)} \times \frac{1}{12} \times \ln(1.55/.40)$$

K = 1.36×10^{-4} ft./sec.

K = 11.75 ft./da.

K = 4.15×10^{-3} cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (11.75) (8.80) (7.48)

T = 773.43 gpd/ft

SLUG IN TEST

MONITOR WELL NUMBER:	MW-[illegible]		
ELEVATION TOP OF CASING:	[illegible]		
ELEVATION WATER (IN):	12.28	ELEVATION WATER (OUT):	
DEPTH OF WELL (TOC):	27.96	DIAMETER OF CASING:	.167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. 15.0 TO 25.0 FEET BELOW GRADE		
SCREEN FILTER TYPE:	# 10 FULL PENETRATING/ 20/40 GRADE SILICA SAND		
AQUIFER TYPE AND THICKNESS:	CLAYEY SILT AND SILTY SAND. [illegible] TO 24 FEET BELOW GRADE		
H(0) TRANSLATION:	1.1	H(0) THEORETICAL:	1.53
INITIAL CONSISTENT VALUE:	13.42	TRANS. METH. (SLUG IN) T(0):	.0667
FINAL TRANSDUCER VALUE:	12.32		

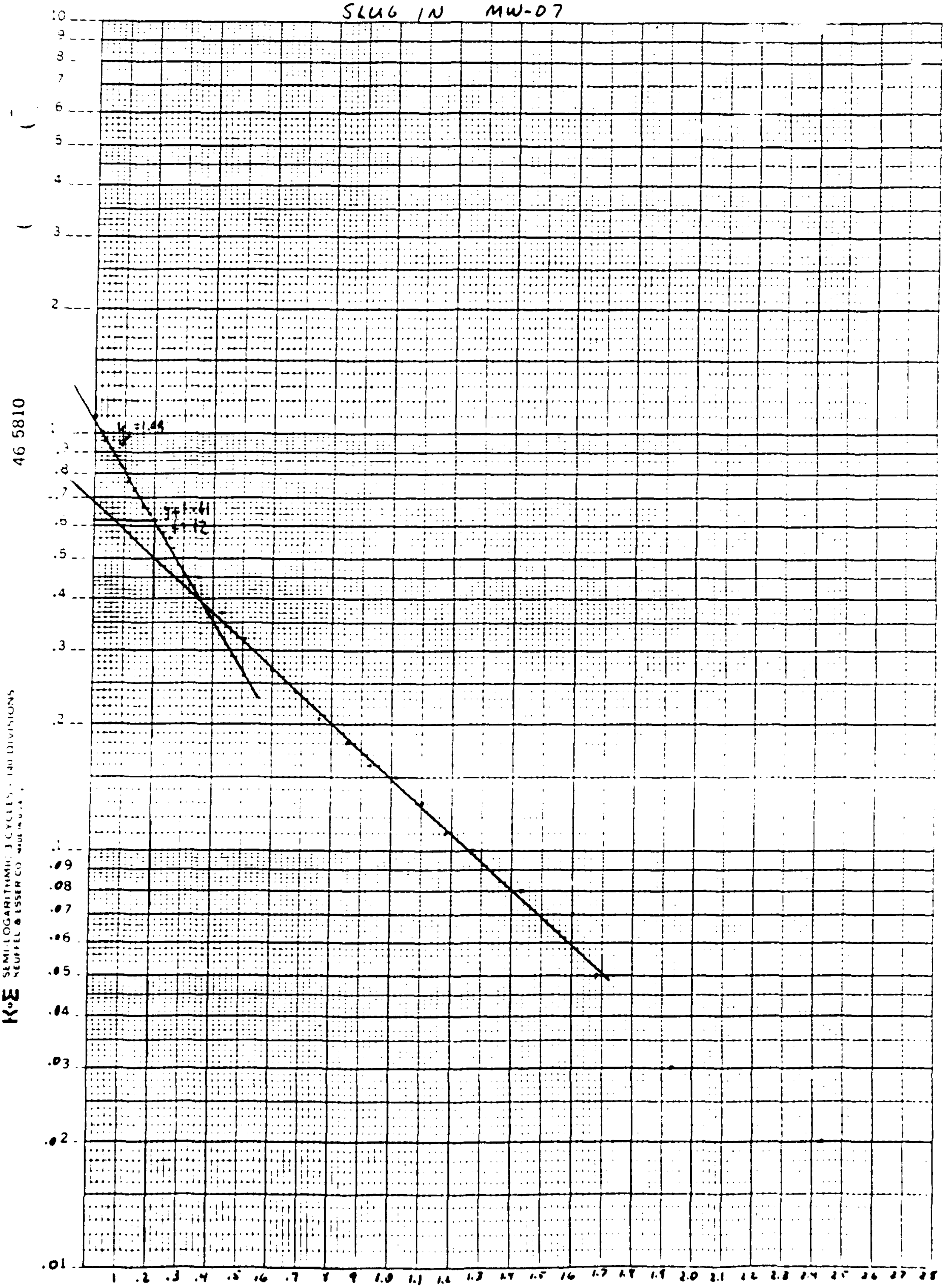
SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.0667	14.56	1.14	-.04	-.0364	-.0261
001	.0033	.198	-.0634	13.80	.38	.72	.6545	.4706
002	.0067	.402	-.06	14.28	.86	.24	.2182	.1569
003	.01	.6	-.0567	13.69	.27	.83	.7545	.5425
004	.0133	.798	-.0534	13.88	.46	.64	.5818	.4183
005	.0167	1.002	-.05	14.14	.72	.38	.3455	.2484
006	.02	1.2	-.0467	13.82	.4	.7	.6364	.4575
007	.0233	1.398	-.0434	13.69	.27	.83	.7545	.5425
008	.0267	1.602	-.04	14.15	.73	.37	.3364	.2418
009	.03	1.8	-.0367	13.45	.03	1.07	.9727	.6993
010	.0333	1.998	-.0334	14.18	.76	.34	.3091	.2222
011	.05	3	-.0167	13.32	.1	1	.9091	.6536
012	.0667	4.002	0	13.42	0	1.1	1	.719
013	.0833	4.998	.0166	13.32	.1	1	.9091	.6536
014	.1	6	.0333	13.28	.14	.96	.8727	.6275
015	.1167	7.002	.05	13.23	.19	.91	.8273	.5948
016	.1333	7.998	.0666	13.20	.22	.88	.8	.5752
017	.15	9	.0833	13.15	.27	.83	.7545	.5425
018	.1667	10.002	.1	13.12	.3	.8	.7273	.5229
019	.1833	10.998	.1166	13.09	.33	.77	.7	.5033
020	.2	12	.1333	13.05	.37	.73	.6636	.4771
021	.2167	13.002	.15	13.02	.4	.7	.6364	.4575
022	.2333	13.998	.1666	12.99	.43	.67	.6091	.4379
023	.25	15	.1833	12.96	.46	.64	.5818	.4183
024	.2667	16.002	.2	12.94	.48	.62	.5636	.4052
025	.2833	16.998	.2166	12.91	.51	.59	.5364	.3856
026	.3	18	.2333	12.90	.52	.58	.5273	.3791
027	.3167	19.002	.25	12.88	.54	.56	.5091	.366
028	.3333	19.998	.2666	12.85	.57	.53	.4818	.3464
029	.4167	25.002	.35	12.77	.65	.45	.4091	.2941
030	.5	30	.4333	12.69	.73	.37	.3364	.2418
031	.5833	34.998	.5166	12.64	.78	.32	.2909	.2092
032	.6667	40.002	.6	12.59	.83	.27	.2455	.1765
033	.75	45	.6833	12.56	.86	.24	.2182	.1569
034	.8333	49.998	.7666	12.53	.89	.21	.1909	.1373
035	.9167	55.002	.85	12.50	.92	.18	.1636	.1176
036	1	60	.9333	12.48	.94	.16	.1455	.1046
037	1.0833	64.998	1.0166	12.47	.95	.15	.1364	.098
038	1.1667	70.002	1.1	12.45	.97	.13	.1182	.085
039	1.25	75	1.1833	12.43	.99	.11	.1	.0719
040	1.3333	79.998	1.2666	12.42	1	.1	.0909	.0654
041	1.4167	85.002	1.35	12.42	1	.1	.0909	.0654
042	1.5	90	1.4333	12.40	1.02	.08	.0727	.0523
043	1.583	94.98	1.5163	12.40	1.02	.08	.0727	.0523
044	1.6667	100.002	1.6	12.39	1.03	.07	.0636	.0458

SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.6833	12.39	1.05	.05	.0455	.0327
046	1.833	109.98	1.7663	12.37	1.05	.05	.0455	.0327
047	1.9167	115.002	1.85	12.37	1.05	.05	.0455	.0327
048	2	120	1.9333	12.37	1.07	.03	.0273	.0196
049	2.5	150	2.4333	12.35	1.08	.02	.0182	.0131
050	3	180	2.9333	12.34	1.08	.02	.0182	.0131
051	3.5	210	3.4333	12.34	1.08	.02	.0182	.0131
052	4	240	3.9333	12.34	1.08	.02	.0182	.0131
053	4.5	270	4.4333	12.34	1.08	.02	.0182	.0131
054	5	300	4.9333	12.34	1.1	4.4409e-16	0	0
055	5.5	330	5.4333	12.32	1.1	4.4409e-16	0	0
056	6	360	5.9333	12.32	1.1	4.4409e-16	0	0
057	6.5	390	6.4333	12.32	1.1	4.4409e-16	0	0
058	7	420	6.9333	12.32	1.1	4.4409e-16	0	0
059	7.5	450	7.4333	12.32	1.1	4.4409e-16	0	0
060	8	480	7.9333	12.32	1.1	4.4409e-16	0	0
061	8.5	510	8.4333	12.32	1.1	4.4409e-16	0	0
062	9	540	8.9333	12.32	1.1	4.4409e-16	0	0
063	9.5	570	9.4333	12.32	1.1	4.4409e-16	0	0
064	10	600	9.9333	12.32	0	0	0	0
065	12	720	11.9333		0	0	0	0
066	14	840	13.9333		0	0	0	0
067	16	960	15.9333		0	0	0	0
068	18	1080	17.9333		0	0	0	0
069	20	1200	19.9333		0	0	0	0
070	22	1320	21.9333		0	0	0	0
071	24	1440	23.9333		0	0	0	0
072	26	1560	25.9333		0	0	0	0
073	28	1680	27.9333		0	0	0	0
074	30	1800	29.9333		0	0	0	0
075	32	1920	31.9333		0	0	0	0
076	34	2040	33.9333		0	0	0	0
077	36	2160	35.9333		0	0	0	0
078	38	2280	37.9333		0	0	0	0
079	40	2400	39.9333		0	0	0	0
080	42	2520	41.9333		0	0	0	0
081	44	2640	43.9333		0	0	0	0
082	46	2760	45.9333		0	0	0	0
083	48	2880	47.9333		0	0	0	0
084	50	3000	49.9333		0	0	0	0
085	52	3120	51.9333		0	0	0	0
086	54	3240	53.9333		0	0	0	0
087	56	3360	55.9333		0	0	0	0
088	58	3480	57.9333		0	0	0	0
089	60	3600	59.9333		0	0	0	0

SLUG IN MW-07



46 5810
K+E SEMI-LOGARITHMIC 3 CYCLES × 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

SLUG- IN
Well No. MW-07

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 14.08 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 8.0 ft.
C = 1.9
y_o = 1.08 y_t = 0.61   t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(14.08/.344)} + \frac{1.9}{(10.0/.344)} \right]^{-1}$$

$$= 2.77$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.77)}{2(10.0)} \times \frac{1}{12} \times \ln(1.08/.61)$$

K = 4.54×10^{-5} ft./sec.

K = 3.92 ft./da.

K = 1.38×10^{-3} cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (3.92) (8.0) (7.48)

T = 234.57 gpd/ft

SLUG OUT TEST

MONITOR WELL NUMBER:	MW-07
ELEVATION TOP OF CASING:	23.16
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 12.28
DEPTH OF WELL (TOC):	27.96 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. 15.0 TO 25.0 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 FULLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	CLAYEY SILT AND SILTY SAND. 16 TO 24 FEET BELOW GRADE
H(0) TRANSLATION:	1.35 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	10.97 TRANS. METH. (SLUG OUT) T(0): .0667
FINAL TRANSDUCER VALUE:	12.32

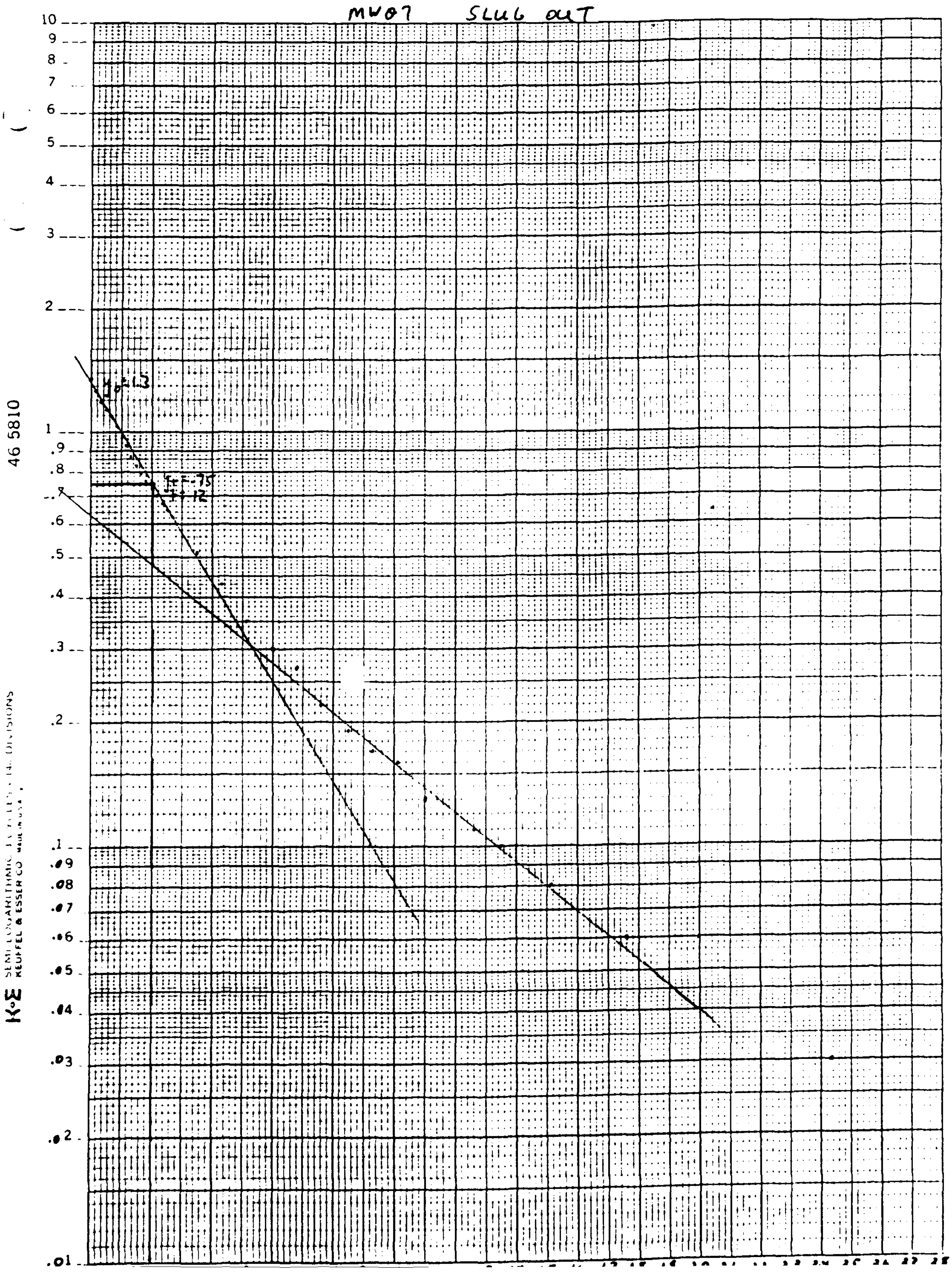
SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEO.
000	0	0	-.0667	11.94	.97	.38	.2815	.248
001	.0033	.198	-.0634	11.70	.73	.62	.4593	.405
002	.0067	.402	-.06	11.62	.65	.7	.5185	.4575
003	.01	.6	-.0567	11.22	.25	1.1	.8148	.719
004	.0133	.798	-.0534	11.35	.38	.97	.7185	.63
005	.0167	1.002	-.05	11.75	.78	.57	.4222	.3725
006	.02	1.2	-.0467	12.75	1.78	-.43	-.3185	-.281
007	.0233	1.398	-.0434	11.25	.28	1.07	.7926	.699
008	.0267	1.602	-.04	11.99	1.02	.33	.2444	.215
009	.03	1.8	-.0367	12.48	1.51	-.16	-.1185	-.1046
010	.0333	1.998	-.0334	11.40	.43	.92	.6815	.601
011	.05	3	-.0167	10.73	-.24	1.59	1.1778	1.03[illegible]2
012	.0667	4.002	0	10.97	0	1.35	1	.8824
013	.0833	4.998	.0166	11.05	.08	1.27	.9407	.830
014	.1	6	.0333	11.13	.16	1.19	.8815	.777
015	.1167	7.002	.05	11.19	.22	1.13	.837	.7386
016	.1333	7.998	.0666	11.25	.28	1.07	.7926	.6993
017	.15	9	.0833	11.30	.33	1.02	.7556	.666
018	.1667	10.002	.1	11.35	.38	.97	.7185	.63
019	.1833	10.998	.1166	11.40	.43	.92	.6815	.6013
020	.2	12	.1333	11.45	.48	.87	.6444	.568
021	.2167	13.002	.15	11.49	.52	.83	.6148	.542
022	.2333	13.998	.1666	11.53	.56	.79	.5852	.5163
023	.25	15	.1833	11.56	.59	.76	.563	.496
024	.2667	16.002	.2	11.59	.62	.73	.5407	.477
025	.2833	16.998	.2166	11.62	.65	.7	.5185	.4575
026	.3	18	.2333	11.65	.68	.67	.4963	.4379
027	.3167	19.002	.25	11.67	.7	.65	.4815	.424
028	.3333	19.998	.2666	11.70	.73	.62	.4593	.405
029	.4167	25.002	.35	11.81	.84	.51	.3778	.3333
030	.5	30	.4333	11.89	.92	.43	.3185	.28
031	.5833	34.998	.5166	11.97	1	.35	.2593	.228
032	.6667	40.002	.6	12.02	1.05	.3	.2222	.1961
033	.75	45	.6833	12.05	1.08	.27	.2	.176
034	.8333	49.998	.7666	12.10	1.13	.22	.163	.143
035	.9167	55.002	.85	12.13	1.16	.19	.1407	.1242
036	1	60	.9333	12.15	1.18	.17	.1259	.111
037	1.0833	64.998	1.0166	12.16	1.19	.16	.1185	.104
038	1.1667	70.002	1.1	12.19	1.22	.13	.0963	.08
039	1.25	75	1.1833	12.19	1.22	.13	.0963	.085
040	1.3333	79.998	1.2666	12.21	1.24	.11	.0815	.071
041	1.4167	85.002	1.35	12.22	1.25	.1	.0741	.065
042	1.5	90	1.4333	12.22	1.25	.1	.0741	.0654
043	1.583	94.98	1.5163	12.24	1.27	.08	.0593	.052
044	1.6667	100.002	1 6	12.24	1.27	.08	.0593	.052

0

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.6833	12.24	1.27	.08	.0593	.0523
046	1.833	109.98	1.7663	12.26	1.29	.06	.0444	.0392
047	1.9167	115.002	1.85	12.26	1.29	.06	.0444	.0392
048	2	120	1.9333	12.26	1.29	.06	.0444	.0392
049	2.5	150	2.4333	12.29	1.32	.03	.0222	.0196
050	3	180	2.9333	12.30	1.33	.02	.0148	.0131
051	3.5	210	3.4333	12.30	1.33	.02	.0148	.0131
052	4	240	3.9333	12.30	1.33	.02	.0148	.0131
053	4.5	270	4.4333	12.30	1.33	.02	.0148	.0131
054	5	300	4.9333	12.30	1.33	.02	.0148	.0131
055	5.5	330	5.4333	12.30	1.33	.02	.0148	.0131
056	6	360	5.9333	12.32	1.35	4.4409e-16	0	0
057	6.5	390	6.4333	12.32	1.35	4.4409e-16	0	0
058	7	420	6.9333	12.32	1.35	4.4409e-16	0	0
059	7.5	450	7.4333	12.32	1.35	4.4409e-16	0	0
060	8	480	7.9333	12.32	1.35	4.4409e-16	0	0
061	8.5	510	8.4333	12.32	1.35	4.4409e-16	0	0
062	9	540	8.9333	12.32	1.35	4.4409e-16	0	0
063	9.5	570	9.4333	12.32	1.35	4.4409e-16	0	0
064	10	600	9.9333	12.32	1.35	0	0	0
065	12	720	11.9333		0	0	0	0
066	14	840	13.9333		0	0	0	0
067	16	960	15.9333		0	0	0	0
068	18	1080	17.9333		0	0	0	0
069	20	1200	19.9333		0	0	0	0
070	22	1320	21.9333		0	0	0	0
071	24	1440	23.9333		0	0	0	0
072	26	1560	25.9333		0	0	0	0
073	28	1680	27.9333		0	0	0	0
074	30	1800	29.9333		0	0	0	0
075	32	1920	31.9333		0	0	0	0
076	34	2040	33.9333		0	0	0	0
077	36	2160	35.9333		0	0	0	0
078	38	2280	37.9333		0	0	0	0
079	40	2400	39.9333		0	0	0	0
080	42	2520	41.9333		0	0	0	0
081	44	2640	43.9333		0	0	0	0
082	46	2760	45.9333		0	0	0	0
083	48	2880	47.9333		0	0	0	0
084	50	3000	49.9333		0	0	0	0
085	52	3120	51.9333		0	0	0	0
086	54	3240	53.9333		0	0	0	0
087	56	3360	55.9333		0	0	0	0
088	58	3480	57.9333		0	0	0	0
089	60	3600	59.9333		0	0	0	0
					0		0	


MW07 SLUG OUT
H_0=1.3
H=.75
T=12
10
9
8
7
6
5
4
3
2
1
.9
.8
.7
.6
.5
.4
.3
.2
.1
.09
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.04
.03
.02
.01
46 5810
K&E SEMI-LOGARITHMIC
KEUFFEL & ESSER CO.

SLUG- OUT
Well No. 84-07

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 14.08 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 8.0 ft.
C = 1.9
y_o = 1.30 y_t = 0.75   t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(14.08/.344)} + \frac{1.9}{(10.0/.344)} \right]^{-1}$$

$$= 2.77$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.77)}{2(10.0)} \times \frac{1}{12} \times \ln(1.30/.75)$$

$$K = 4.37 \times 10^{-5} \text{ ft./sec.}$$

$$K = 3.79 \text{ ft./da.}$$

$$K = 1.33 \times 10^{-3} \text{ cm./sec.}$$

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (3.79) (8.0) (7.48)

T = 226.79 gpd/ft

SLUG IN TEST

MONITOR WELL NUMBER:	MW-0[illegible]		
ELEVATION TOP OF CASING:	23.3[illegible]		
ELEVATION WATER (IN):	9.66	ELEVATION WATER (OUT):	
DEPTH OF WELL (TOC):	[illegible]7.35	DIAMETER OF CASING:	.167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET, 1[illegible].0 TO 25.0 FEET BELOW GRADE		
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND		
AQUIFER TYPE AND THICKNESS:	WATER SILT AND SILTY SAND, 16 TO 29 FEET BELOW GRADE		
H(0) TRANSLATION:	1.05	H(0) THEORETICAL:	1.53
INITIAL CONSISTENT VALUE:	10.72	TRANS. METH. (SLUG IN) T(0):	.03
FINAL TRANSDUCER VALUE:	9.67		

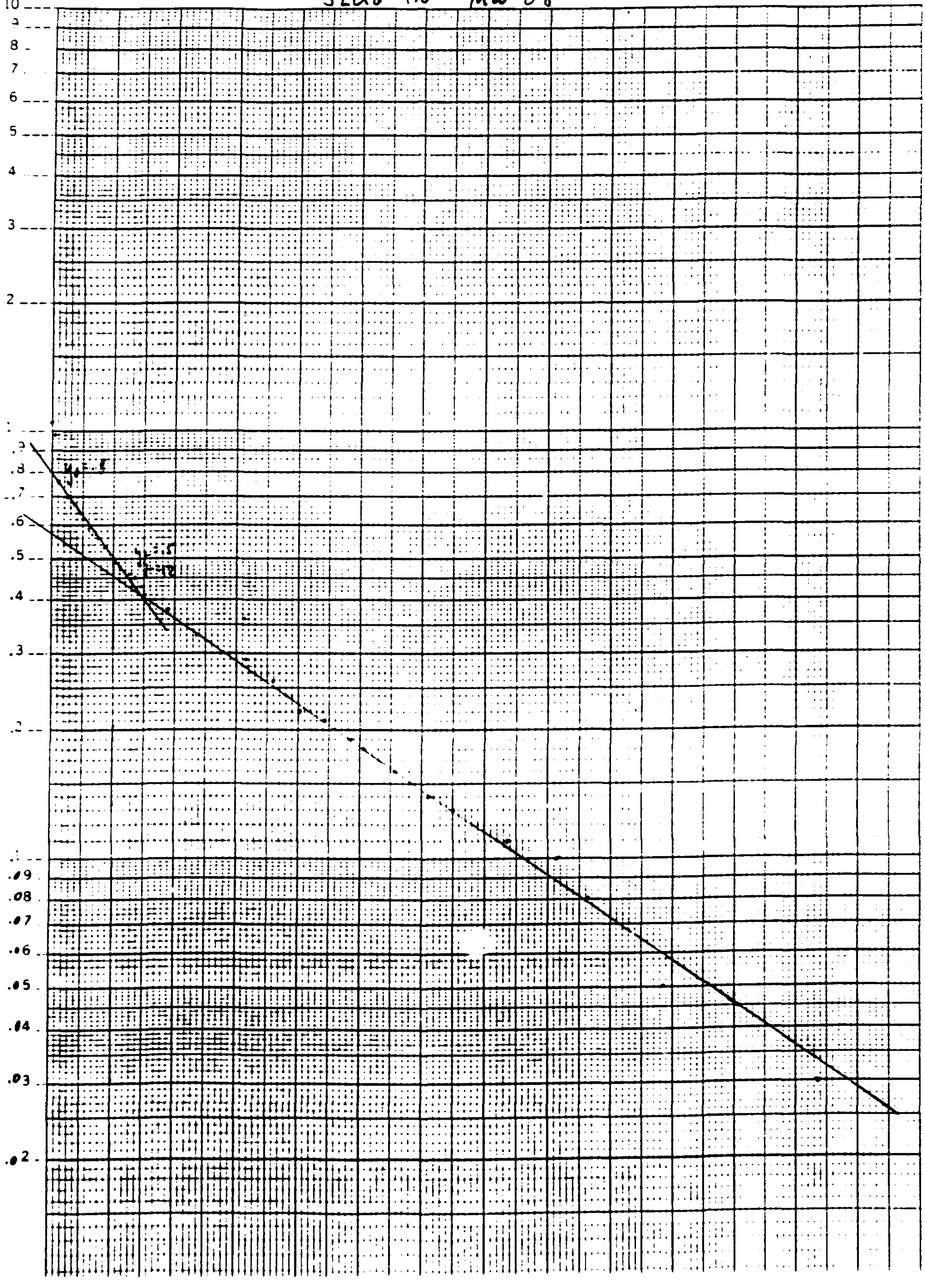
SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(O) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(O) TRANS.	H/H(O) THEOR.
000	0	0	-.03	10.80	.08	.97	.9238	.634
001	.0033	.198	-.0267	13.34	2.62	-1.57	-1.4952	-1.0261
002	.0067	.402	-.0233	12.55	1.83	-.78	-.7429	-.5098
003	.01	.6	-.02	10.61	.11	.94	.8952	.6144
004	.0133	.798	-.0167	9.70	1.02	.03	.0286	.0196
005	.0167	1.002	-.0133	11.01	.29	.76	.7238	.4967
006	.02	1.2	-.01	11.52	.8	.25	.2381	.1634
007	.0233	1.398	-.0067	10.80	.08	.97	.9238	.634
008	.0267	1.602	-.0033	10.58	.14	.91	.8667	.5948
009	.03	1.8	0	10.72	0	1.05	1	.6863
010	.0333	1.998	.0033	10.66	.06	.99	.9429	.6471
011	.05	3	.02	10.43	.29	.76	.7238	.4967
012	.0667	4.002	.0367	10.42	.3	.75	.7143	.4902
013	.0833	4.998	.0533	10.37	.35	.7	.6667	.4575
014	.1	6	.07	10.34	.38	.67	.6381	.4379
015	.1167	7.002	.0867	10.31	.41	.64	.6095	.4183
016	.1333	7.998	.1033	10.29	.43	.62	.5905	.4052
017	.15	9	.12	10.26	.46	.59	.5619	.3856
018	.1667	10.002	.1367	10.24	.48	.57	.5429	.3725
019	.1833	10.998	.1533	10.23	.49	.56	.5333	.366
020	.2	12	.17	10.20	.52	.53	.5048	.3464
021	.2167	13.002	.1867	10.18	.54	.51	.4857	.3333
022	.2333	13.998	.2033	10.16	.56	.49	.4667	.3203
023	.25	15	.22	10.15	.57	.48	.4571	.3137
024	.2667	16.002	.2367	10.15	.57	.48	.4571	.3137
025	.2833	16.998	.2533	10.13	.59	.46	.4381	.3007
026	.3	18	.27	10.12	.6	.45	.4286	.2941
027	.3167	19.002	.2867	10.10	.62	.43	.4095	.281
028	.3333	19.998	.3033	10.08	.64	.41	.3905	.268
029	.4167	25.002	.3867	10.05	.67	.38	.3619	.2484
030	.5	30	.47	10.00	.72	.33	.3143	.2157
031	.5833	34.998	.5533	9.97	.75	.3	.2857	.1961
032	.6667	40.002	.6367	9.96	.76	.29	.2762	.1895
033	.75	45	.72	9.93	.79	.26	.2476	.1699
034	.8333	49.998	.8033	9.89	.83	.22	.2095	.1438
035	.9167	55.002	.8867	9.88	.84	.21	.2	.1373
036	1	60	.97	9.86	.86	.19	.181	.1242
037	1.0833	64.998	1.0533	9.85	.87	.18	.1714	.1176
038	1.1667	70.002	1.1367	9.83	.89	.16	.1524	.1046
039	1.25	75	1.22	9.81	.91	.14	.1333	.0915
040	1.3333	79.998	1.3033	9.80	.92	.13	.1238	.085
041	1.4167	85.002	1.3867	9.80	.92	.13	.1238	.085
042	1.5	90	1.47	9.78	.94	.11	.1048	.0719
043	1.583	94.98	1.553	9.78	.94	.11	.1048	.0719
044	1.6667	100.002	1.6367	9.77	.95	.1	.0952	.0654

SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H´ A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.72	9.77	.97	.08	.0762	.0523
046	1.833	109.98	1.803	9.75	.97	.08	.0762	.0523
047	1.9167	115.002	1.8867	9.75	.97	.08	.0762	.0523
048	2	120	1.97	9.75	1	.05	.0476	.0327
049	2.5	150	2.47	9.72	1.02	.03	.0286	.0196
050	3	180	2.97	9.70	1.03	.02	.019	.0131
051	3.5	210	3.47	9.69	1.03	.02	.019	.0131
052	4	240	3.97	9.69	1.05	-6.661e-16	0	0
053	4.5	270	4.47	9.67	1.05	-6.661e-16	0	0
054	5	300	4.97	9.67	1.05	-6.661e-16	0	0
055	5.5	330	5.47	9.67	1.05	-6.661e-16	0	0
056	6	360	5.97	9.67	1.05	-6.661e-16	0	0
057	6.5	390	6.47	9.67	1.05	-6.661e-16	0	0
058	7	420	6.97	9.67	1.05	-6.661e-16	0	0
059	7.5	450	7.47	9.67	1.05	-6.661e-16	0	0
060	8	480	7.97	9.67	1.05	-6.661e-16	0	0
061	8.5	510	8.47	9.67	1.05	-6.661e-16	0	0
062	9	540	8.97	9.67	1.05	-6.661e-16	0	0
063	9.5	570	9.47	9.67	1.05	-6.661e-16	0	0
064	10	600	9.97	9.67	0	0	0	0
065	12	720	11.97		0	0	0	0
066	14	840	13.97		0	0	0	0
067	16	960	15.97		0	0	0	0
068	18	1080	17.97		0	0	0	0
069	20	1200	19.97		0	0	0	0
070	22	1320	21.97		0	0	0	0
071	24	1440	23.97		0	0	0	0
072	26	1560	25.97		0	0	0	0
073	28	1680	27.97		0	0	0	0
074	30	1800	29.97		0	0	0	0
075	32	1920	31.97		0	0	0	0
076	34	2040	33.97		0	0	0	0
077	36	2160	35.97		0	0	0	0
078	38	2280	37.97		0	0	0	0
079	40	2400	39.97		0	0	0	0
080	42	2520	41.97		0	0	0	0
081	44	2640	43.97		0	0	0	0
082	46	2760	45.97		0	0	0	0
083	48	2880	47.97		0	0	0	0
084	50	3000	49.97		0	0	0	0
085	52	3120	51.97		0	0	0	0
086	54	3240	53.97		0	0	0	0
087	56	3360	55.97		0	0	0	0
088	58	3480	57.97		0	0	0	0
089	60	3600	59.97		0	0	0	0

SLUG IN MW-08



46 5810
K•E SEMI-LOGARITHMIC 3 CYCLES × 140 DIVISIONS
KEUFFEL & ESSER CO.

SLUG- IN
Well No. MW-06

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 10.79 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 13.0 ft.
C = 1.9
Y_o = 0.80 Y_t = 0.50 t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w}\right]^{-1}$$

$$= \left[\frac{1.1}{\ln(10.79/.344)} + \frac{1.9}{(10.0/.344)}\right]^{-1}$$

$$= 2.59$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(Y_o/Y_t)$$

$$K = \frac{(.083)^2\ (2.59)}{2(10.0)} \times \frac{1}{12} \times \ln\ (0.80/.50)$$

K = 3.49×10^{-5} ft./sec.

K = 3.02 ft./da.

K = 1.07×10^{-3} cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (3.02) (13.0) (7.48)

T = 293.66 gpd/ft

SLUG OUT TEST

MONITOR WELL NUMBER:	MW-05
ELEVATION TOP OF CASING:	[illegible]
ELEVATION WATER (IN):	ELEVATION WATER (OUT): [illegible].66
DEPTH OF WELL (TOC):	27.35 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. 15.0 TO [illegible]5.0 FEET BELOW GRADE
SCREEN FILTER TYPE:	# 10 PARTIALL[illegible] PENETRATING, [illegible]/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	[illegible] SILT AND SILTY SAND. 15 TO 29 FEET BELOW GRADE
H(0) TRANSLATION:	1.18 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	8.49 TRANS. METH. (SLUG OUT) T(0): .05
FINAL TRANSDUCER VALUE:	9.67

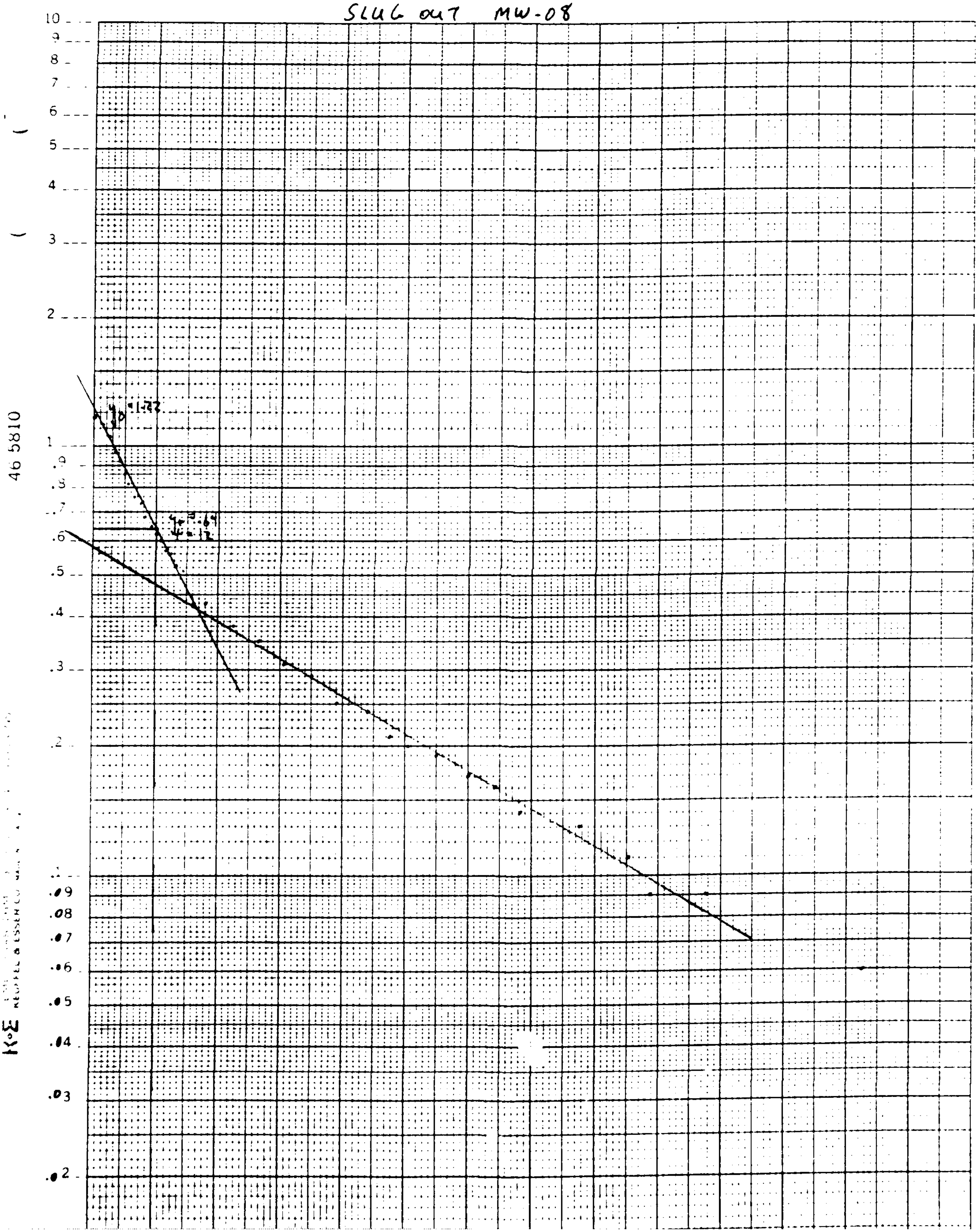
SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THE(.
000	0	0	-.05	9.64	1.15	.03	.0254	.019
001	.0033	.198	-.0467	8.97	.48	.7	.5932	.457
002	.0067	.402	-.0433	8.94	.45	.73	.6186	.4771
003	.01	.6	-.04	9.05	.56	.62	.5254	.405
004	.0133	.798	-.0367	8.91	.42	.76	.6441	.496
005	.0167	1.002	-.0333	9.29	.8	.38	.322	.2464
006	.02	1.2	-.03	9.85	1.36	-.18	-.1525	-.1176
007	.0233	1.398	-.0267	8.92	.43	.75	.6356	.490
008	.0267	1.602	-.0233	8.78	.29	.89	.7542	.581
009	.03	1.8	-.02	10.07	1.58	-.4	-.339	-.2614
010	.0333	1.998	-.0167	9.08	.59	.59	.5	.385
011	.05	3	0	8.49	0	1.18	1	.771
012	.0667	4.002	.0167	8.45	-.04	1.22	1.0339	.7974
013	.0833	4.998	.0333	8.54	.05	1.13	.9576	.738
014	.1	6	.05	8.62	.13	1.05	.8898	.686
015	.1167	7.002	.0667	8.70	.21	.97	.822	.634
016	.1333	7.998	.0833	8.76	.27	.91	.7712	.5948
017	.15	9	.1	8.81	.32	.86	.7288	.562
018	.1667	10.002	.1167	8.86	.37	.81	.6864	.529
019	.1833	10.998	.1333	8.91	.42	.76	.6441	.4967
020	.2	12	.15	8.94	.45	.73	.6186	.477
021	.2167	13.002	.1667	8.99	.5	.68	.5763	.444
022	.2333	13.998	.1833	9.02	.53	.65	.5508	.4248
023	.25	15	.2	9.05	.56	.62	.5254	.405
024	.2667	16.002	.2167	9.07	.58	.6	.5085	.392
025	.2833	16.998	.2333	9.10	.61	.57	.4831	.3725
026	.3	18	.25	9.11	.62	.56	.4746	.366
027	.3167	19.002	.2667	9.15	.66	.52	.4407	.339
028	.3333	19.998	.2833	9.16	.67	.51	.4322	.333
029	.4167	25.002	.3667	9.24	.75	.43	.3644	.281
030	.5	30	.45	9.29	.8	.38	.322	.248
031	.5833	34.998	.5333	9.32	.83	.35	.2966	.228
032	.6667	40.002	.6167	9.35	.86	.32	.2712	.2092
033	.75	45	.7	9.38	.89	.29	.2458	.189
034	.8333	49.998	.7833	9.42	.93	.25	.2119	.163
035	.9167	55.002	.8667	9.43	.94	.24	.2034	.1569
036	1	60	.95	9.45	.96	.22	.1864	.1439
037	1.0833	64.998	1.0333	9.46	.97	.21	.178	.137
038	1.1667	70.002	1.1167	9.48	.99	.19	.161	.1242
039	1.25	75	1.2	9.50	1.01	.17	.1441	.1111
040	1.3333	79.998	1.2833	9.51	1.02	.16	.1356	.104
041	1.4167	85.002	1.3667	9.53	1.04	.14	.1186	.091
042	1.5	90	1.45	9.53	1.04	.14	.1186	.0915
043	1.583	94.98	1.533	9.54	1.05	.13	.1102	.085
044	1.6667	100.002	1.6167	9.54	1.05	.13	.1102	.085

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.7	9.56	1.07	.11	.0932	.0719
046	1.833	109.98	1.783	9.58	1.09	.09	.0763	.0588
047	1.9167	115.002	1.8667	9.58	1.09	.09	.0763	.0588
048	2	120	1.95	9.58	1.09	.09	.0763	.0588
049	2.5	150	2.45	9.61	1.12	.06	.0508	.0392
050	3	180	2.95	9.62	1.13	.05	.0424	.0327
051	3.5	210	3.45	9.64	1.15	.03	.0254	.0196
052	4	240	3.95	9.64	1.15	.03	.0254	.0196
053	4.5	270	4.45	9.65	1.16	.02	.0169	.0131
054	5	300	4.95	9.65	1.16	.02	.0169	.0131
055	5.5	330	5.45	9.65	1.16	.02	.0169	.0131
056	6	360	5.95	9.67	1.18	2.2204e-16	0	0
057	6.5	390	6.45	9.67	1.18	2.2204e-16	0	0
058	7	420	6.95	9.67	1.18	2.2204e-16	0	0
059	7.5	450	7.45	9.67	1.18	2.2204e-16	0	0
060	8	480	7.95	9.67	1.18	2.2204e-16	0	0
061	8.5	510	8.45	9.67	1.18	2.2204e-16	0	0
062	9	540	8.95	9.67	1.18	2.2204e-16	0	0
063	9.5	570	9.45	9.67	1.18	2.2204e-16	0	0
064	10	600	9.95	9.67	1.18	0	0	0
065	12	720	11.95		0	0	0	0
066	14	840	13.95		0	0	0	0
067	16	960	15.95		0	0	0	0
068	18	1080	17.95		0	0	0	0
069	20	1200	19.95		0	0	0	0
070	22	1320	21.95		0	0	0	0
071	24	1440	23.95		0	0	0	0
072	26	1560	25.95		0	0	0	0
073	28	1680	27.95		0	0	0	0
074	30	1800	29.95		0	0	0	0
075	32	1920	31.95		0	0	0	0
076	34	2040	33.95		0	0	0	0
077	36	2160	35.95		0	0	0	0
078	38	2280	37.95		0	0	0	0
079	40	2400	39.95		0	0	0	0
080	42	2520	41.95		0	0	0	0
081	44	2640	43.95		0	0	0	0
082	46	2760	45.95		0	0	0	0
083	48	2880	47.95		0	0	0	0
084	50	3000	49.95		0	0	0	0
085	52	3120	51.95		0	0	0	0
086	54	3240	53.95		0	0	0	0
087	56	3360	55.95		0	0	0	0
088	58	3480	57.95		0	0	0	0
089	60	3600	59.95		0	0	0	0
							0	

SLUG OUT MW-08



SLUG-OUT
Well No. [illegible]

Casing diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 10.70 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 13.0 ft.
C = 1.7
y_o = 1.22 y_t = 0.64   t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln(H/r_w)} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(10.70/.344)} + \frac{1.7}{(10.0/.344)} \right]^{-1}$$

$$= 2.59$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.59)}{2(10.0)} \times \frac{1}{12} \times \ln(1.22/.64)$$

$K = 4.80 \times 10^{-5}$ ft./sec.

K = 4.14 ft./da.

$K = 1.46 \times 10^{-3}$ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (4.14) (13.0) (7.48)

SLUG IN TEST

MONITOR WELL NUMBER:	MW-09		
ELEVATION TOP OF CASING:	25.27		
ELEVATION WATER (IN):	8.67	ELEVATION WATER (OUT):	
DEPTH OF WELL (TOC):	32.53	DIAMETER OF CASING:	.167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET, 20.0 TO 30.0 FEET BELOW GRADE		
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND		
AQUIFER TYPE AND THICKNESS:	CLAYEY SILT AND SILTY SAND, 19 TO ? FEET BELOW GRADE		
H(0) TRANSLATION:	1.24	H(0) THEORETICAL:	1.53
INITIAL CONSISTENT VALUE:	9.89	TRANS. METH. (SLUG IN) T(0):	.05
FINAL TRANSDUCER VALUE:	8.65		

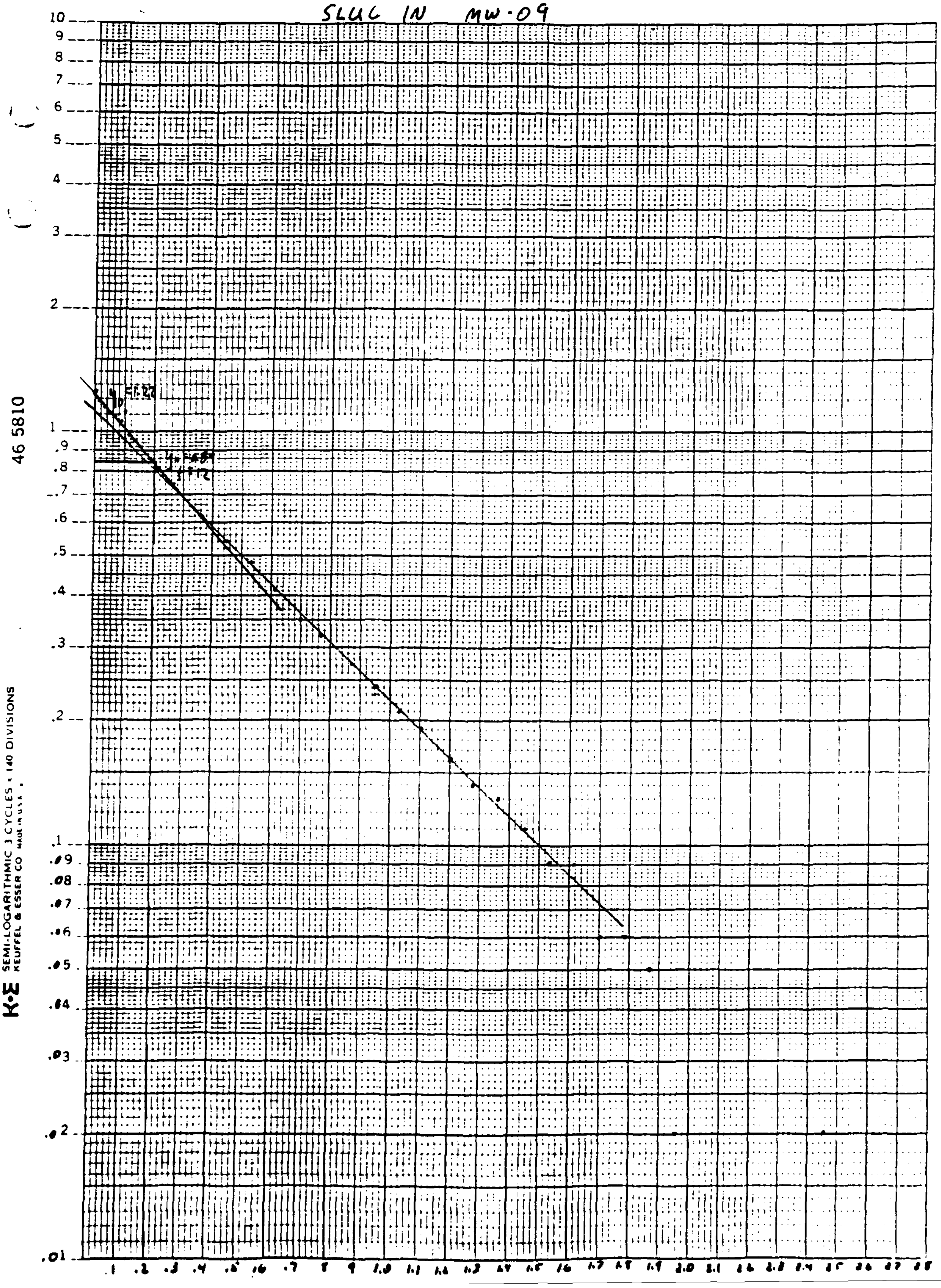
SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.05	11.51	1.62	-.38	-.3065	-.2484
001	.0033	.198	-.0467	11.30	1.41	-.17	-.1371	-.1111
002	.0067	.402	-.0433	10.99	1.1	.14	.1129	.0915
003	.01	.6	-.04	9.00	.89	.35	.2823	.2288
004	.0133	.798	-.0367	10.25	.36	.88	.7097	.5752
005	.0167	1.002	-.0333	10.35	.46	.78	.629	.5098
006	.02	1.2	-.03	8.81	1.08	.16	.129	.1046
007	.0233	1.398	-.0267	9.76	.13	1.11	.8952	.7255
008	.0267	1.602	-.0233	10.53	.64	.6	.4839	.3922
009	.03	1.8	-.02	9.67	.22	1.02	.8226	.6667
010	.0333	1.998	-.0167	9.79	.1	1.14	.9194	.7451
011	.05	3	0	9.89	0	1.24	1	.8105
012	.0667	4.002	.0167	9.84	.05	1.19	.9597	.7778
013	.0833	4.998	.0333	9.81	.08	1.16	.9355	.7582
014	.1	6	.05	9.76	.13	1.11	.8952	.7255
015	.1167	7.002	.0667	9.73	.16	1.08	.871	.7059
016	.1333	7.998	.0833	9.70	.19	1.05	.8468	.6863
017	.15	9	.1	9.67	.13	1.11	.8952	.7255
018	.1667	10.002	.1167	9.63	.26	.98	.7903	.6405
019	.1833	10.998	.1333	9.60	.29	.95	.7661	.6209
020	.2	12	.15	9.57	.32	.92	.7419	.6013
021	.2167	13.002	.1667	9.54	.35	.89	.7177	.5817
022	.2333	13.998	.1833	9.51	.38	.86	.6935	.5621
023	.25	15	.2	9.49	.4	.84	.6774	.549
024	.2667	16.002	.2167	9.46	.43	.81	.6532	.5294
025	.2833	16.998	.2333	9.44	.45	.79	.6371	.5163
026	.3	18	.25	9.41	.48	.76	.6129	.4967
027	.3167	19.002	.2667	9.40	.49	.75	.6048	.4902
028	.3333	19.998	.2833	9.36	.53	.71	.5726	.4641
029	.4167	25.002	.3667	9.27	.62	.62	.5	.4052
030	.5	30	.45	9.19	.7	.54	.4355	.3529
031	.5833	34.998	.5333	9.13	.76	.48	.3871	.3137
032	.6667	40.002	.6167	9.06	.83	.41	.3306	.268
033	.75	45	.7	9.00	.89	.35	.2823	.2288
034	.8333	49.998	.7833	8.97	.92	.32	.2581	.2092
035	.9167	55.002	.8667	8.92	.97	.27	.2177	.1765
036	1	60	.95	8.89	1	.24	.1935	.1569
037	1.0833	64.998	1.0333	8.86	1.03	.21	.1694	.1373
038	1.1667	70.002	1.1167	8.84	1.05	.19	.1532	.1242
039	1.25	75	1.2	8.81	1.08	.16	.129	.1046
040	1.3333	79.998	1.2833	8.79	1.1	.14	.1129	.0915
041	1.4167	85.002	1.3667	8.78	1.11	.13	.1048	.085
042	1.5	90	1.45	8.76	1.13	.11	.0887	.0719
043	1.583	94.98	1.533	8.74	1.15	.09	.0726	.0588
044	1.6667	100.002	1.6167	8.74	1.15	.09	.0726	.0588

SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H´ A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.7	8.73	1.18	.06	.0484	.0392
046	1.833	109.98	1.783	8.71	1.18	.06	.0484	.0392
047	1.9167	115.002	1.8667	8.71	1.19	.05	.0403	.0327
048	2	120	1.95	8.70	1.22	.02	.0161	.0131
049	2.5	150	2.45	8.67	1.22	.02	.0161	.0131
050	3	180	2.95	8.67	1.24	-2.220e-16	0	0
051	3.5	210	3.45	8.65	1.24	-2.220e-16	0	0
052	4	240	3.95	8.65	1.24	-2.220e-16	0	0
053	4.5	270	4.45	8.65	1.24	-2.220e-16	0	0
054	5	300	4.95	8.65	1.24	-2.220e-16	0	0
055	5.5	330	5.45	8.65	1.24	-2.220e-16	0	0
056	6	360	5.95	8.65	1.24	-2.220e-16	0	0
057	6.5	390	6.45	8.65	1.24	-2.220e-16	0	0
058	7	420	6.95	8.65	1.24	-2.220e-16	0	0
059	7.5	450	7.45	8.65	1.24	-2.220e-16	0	0
060	8	480	7.95	8.65	1.24	-2.220e-16	0	0
061	8.5	510	8.45	8.65	1.24	-2.220e-16	0	0
062	9	540	8.95	8.65	1.24	-2.220e-16	0	0
063	9.5	570	9.45	8.65	1.24	-2.220e-16	0	0
064	10	600	9.95	8.65	0	0	0	0
065	12	720	11.95		0	0	0	0
066	14	840	13.95		0	0	0	0
067	16	960	15.95		0	0	0	0
068	18	1080	17.95		0	0	0	0
069	20	1200	19.95		0	0	0	0
070	22	1320	21.95		0	0	0	0
071	24	1440	23.95		0	0	0	0
072	26	1560	25.95		0	0	0	0
073	28	1680	27.95		0	0	0	0
074	30	1800	29.95		0	0	0	0
075	32	1920	31.95		0	0	0	0
076	34	2040	33.95		0	0	0	0
077	36	2160	35.95		0	0	0	0
078	38	2280	37.95		0	0	0	0
079	40	2400	39.95		0	0	0	0
080	42	2520	41.95		0	0	0	0
081	44	2640	43.95		0	0	0	0
082	46	2760	45.95		0	0	0	0
083	48	2880	47.95		0	0	0	0
084	50	3000	49.95		0	0	0	0
085	52	3120	51.95		0	0	0	0
086	54	3240	53.95		0	0	0	0
087	56	3360	55.95		0	0	0	0
088	58	3480	57.95		0	0	0	0
089	60	3600	59.95		0	0	0	0

SLUG IN MW-09


46 5810
K•E SEMI-LOGARITHMIC 3 CYCLES × 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

SLUG- IN
Well No. MW-09

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 12.93 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 14.0 ft.
C = 1.9
y_o = 1.22 y_t = 0.84 t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(12.93/.344)} + \frac{1.9}{(10.0/.344)} \right]^{-1}$$

$$= 2.71$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.71)}{2(10.0)} \times \frac{1}{12} \times \ln(1.22/.84)$$

K = 2.90×10^{-5} ft./sec.

K = 2.51 ft./da.

K = 8.85×10^{-4} cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (2.51) (14.0) (7.48)

T = 262.85 gpd/ft

SLUG OUT TEST

MONITOR WELL NUMBER:	MW-09
ELEVATION TOP OF CASING:	25.27
ELEVATION WATER (IN):	ELEVATION WATER (OUT): 8.67
DEPTH OF WELL (TOC):	32.53 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET, 20.0 TO 30.0 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	CLAYEY SILT AND SILTY SAND, 19 TO ? FEET BELOW GRADE
H(0) TRANSLATION:	1.47 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	7.2 TRANS. METH. (SLUG OUT) T(0): .0233
FINAL TRANSDUCER VALUE:	8.67

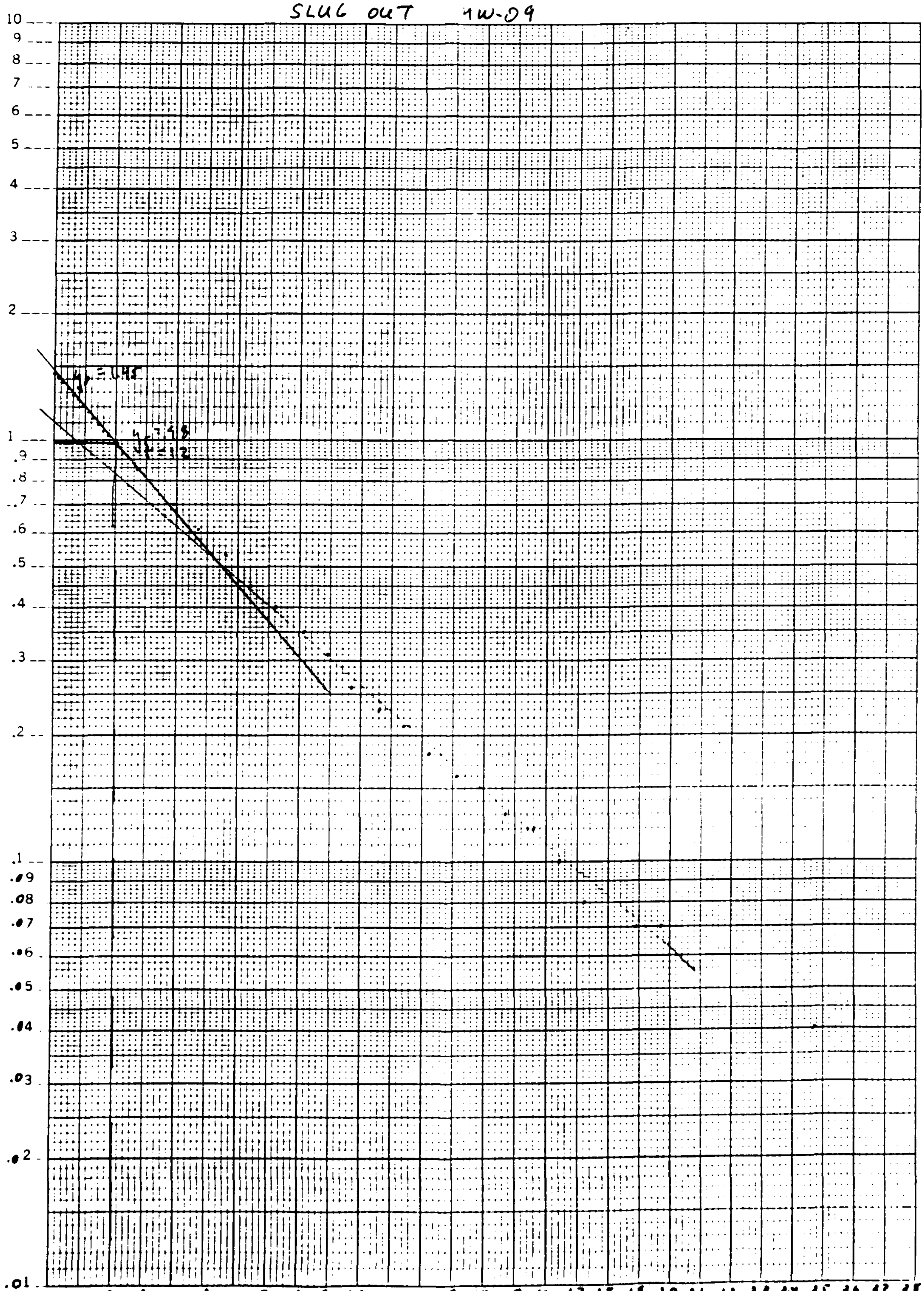
SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H´ A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.0233	8.06	.86	.61	.415	.3987
001	.0033	.198	-.02	7.41	.21	1.26	.8571	.82[illegible]5
002	.0067	.402	-.0166	7.06	-.14	1.61	1.0952	1.0[illegible]23
003	.01	.6	-.0133	7.39	.19	1.28	.8707	.8366
004	.0133	.798	-.01	7.08	-.12	1.59	1.0816	1.0392
005	.0167	1.002	-.0066	7.19	-.01	1.48	1.0068	.96[illegible]3
006	.02	1.2	-.00[illegible]3	7.20	0	1.47	1	.96[illegible]8
007	.0233	1.398	0	7.20	0	1.47	1	.9608
008	.0267	1.602	.0034	7.22	.02	1.45	.9864	.94[illegible]7
009	.03	1.8	.0067	7.23	.03	1.44	.9796	.94[illegible]2
010	.0333	1.998	.01	7.25	.05	1.42	.966	.9281
011	.05	3	.0267	7.30	.1	1.37	.932	.89[illegible]1
012	.0667	4.002	.0434	7.35	.15	1.32	.898	.86[illegible]7
013	.0833	4.998	.06	7.39	.19	1.28	.8707	.8366
014	.1	6	.0767	7.42	.22	1.25	.8503	.8[illegible]7
015	.1167	7.002	.0934	7.47	.27	1.2	.8163	.78[illegible]3
016	.1333	7.998	.11	7.50	.3	1.17	.7959	.76[illegible]7
017	.15	9	.1267	7.55	.35	1.12	.7619	.732
018	.1667	10.002	.1434	7.58	.38	1.09	.7415	.71[illegible]
019	.1833	10.998	.16	7.62	.42	1.05	.7143	.68[illegible]3
020	.2	12	.1767	7.65	.45	1.02	.6939	.6667
021	.2167	13.002	.1934	7.68	.48	.99	.6735	.64[illegible]
022	.2333	13.998	.21	7.71	.51	.96	.6531	.62[illegible]
023	.25	15	.2267	7.74	.54	.93	.6327	.6078
024	.2667	16.002	.2434	7.76	.56	.91	.619	.59[illegible]9
025	.2833	16.998	.26	7.79	.59	.88	.5986	.57[illegible]
026	.3	18	.2767	7.82	.62	.85	.5782	.55[illegible]6
027	.3167	19.002	.2934	7.84	.64	.83	.5646	.5425
028	.3333	19.998	.31	7.87	.67	.8	.5442	.52[illegible]
029	.4167	25.002	.3934	7.97	.77	.7	.4762	.45[illegible]
030	.5	30	.4767	8.06	.86	.61	.415	.3987
031	.5833	34.998	.56	8.14	.94	.53	.3605	.34[illegible]
032	.6667	40.002	.6434	8.22	1.02	.45	.3061	.29[illegible]
033	.75	45	.7267	8.27	1.07	.4	.2721	.2614
034	.8333	49.998	.81	8.32	1.12	.35	.2381	.22[illegible]
035	.9167	55.002	.8934	8.36	1.16	.31	.2109	.20[illegible]
036	1	60	.9767	8.41	1.21	.26	.1769	.1699
037	1.0833	64.998	1.06	8.44	1.24	.23	.1565	.1503
038	1.1667	70.002	1.1434	8.46	1.26	.21	.1429	.13[illegible]
039	1.25	75	1.2267	8.49	1.29	.18	.1224	.11[illegible]
040	1.3333	79.998	1.31	8.51	1.31	.16	.1088	.1046
041	1.4167	85.002	1.3934	8.52	1.32	.15	.102	.0[illegible]
042	1.5	90	1.4767	8.54	1.34	.13	.0884	.0[illegible]
043	1.583	94.98	1.5597	8.55	1.35	.12	.0816	.0784
044	1.6667	100.002	1.6434	8.57	1.37	.1	.068	.06[illegible]

SLUG TEST OUT:

SAMPLE NUMBER	TIME MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.7267	8.59	1.39	.08	.0544	.0523
046	1.833	109.98	1.8097	8.59	1.39	.08	.0544	.0523
047	1.9167	115.002	1.8934	8.60	1.4	.07	.0476	.0458
048	2	120	1.9767	8.60	1.4	.07	.0476	.0458
049	2.5	150	2.4767	8.63	1.43	.04	.0272	.0261
050	3	180	2.9767	8.65	1.45	.02	.0136	.0131
051	3.5	210	3.4767	8.65	1.45	.02	.0136	.0131
052	4	240	3.9767	8.67	1.47	2.2204e-16	0	0
053	4.5	270	4.4767	8.67	1.47	2.2204e-16	0	0
054	5	300	4.9767	8.67	1.47	2.2204e-16	0	0
055	5.5	330	5.4767	8.67	1.47	2.2204e-16	0	0
056	6	360	5.9767	8.67	1.47	2.2204e-16	0	0
057	6.5	390	6.4767	8.67	1.47	2.2204e-16	0	0
058	7	420	6.9767	8.67	1.47	2.2204e-16	0	0
059	7.5	450	7.4767	8.67	1.47	2.2204e-16	0	0
060	8	480	7.9767	8.67	1.47	2.2204e-16	0	0
061	8.5	510	8.4767	8.67	1.47	2.2204e-16	0	0
062	9	540	8.9767	8.67	1.47	2.2204e-16	0	0
063	9.5	570	9.4767	8.67	1.47	2.2204e-16	0	0
064	10	600	9.9767	8.67	1.47	0	0	0
065	12	720	11.9767		0	0	0	0
066	14	840	13.9767		0	0	0	0
067	16	960	15.9767		0	0	0	0
068	18	1080	17.9767		0	0	0	0
069	20	1200	19.9767		0	0	0	0
070	22	1320	21.9767		0	0	0	0
071	24	1440	23.9767		0	0	0	0
072	26	1560	25.9767		0	0	0	0
073	28	1680	27.9767		0	0	0	0
074	30	1800	29.9767		0	0	0	0
075	32	1920	31.9767		0	0	0	0
076	34	2040	33.9767		0	0	0	0
077	36	2160	35.9767		0	0	0	0
078	38	2280	37.9767		0	0	0	0
079	40	2400	39.9767		0	0	0	0
080	42	2520	41.9767		0	0	0	0
081	44	2640	43.9767		0	0	0	0
082	46	2760	45.9767		0	0	0	0
083	48	2880	47.9767		0	0	0	0
084	50	3000	49.9767		0	0	0	0
085	52	3120	51.9767		0	0	0	0
086	54	3240	53.9767		0	0	0	0
087	56	3360	55.9767		0	0	0	0
088	58	3480	57.9767		0	0	0	0
089	60	3600	59.9767		0	0	0	0
							0	

SLUG OUT 4W-09



46 5810
K&E SEMI-LOGARITHMIC 3 CYCLES × 140 DIVISIONS KEUFFEL & ESSER CO. MADE IN U.S.A.

SLUG-OUT
Well No. MW-0[illegible]

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 12.93 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 14.0 ft.
C = 1.7
y_o = 1.45 y_t = 0.98 t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(12.93/.344)} + \frac{1.7}{(10.0/.344)} \right]^{-1}$$

$$= 2.71$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.71)}{2(10.0)} \times \frac{1}{12} \times \ln(1.45/.98)$$

$K = 3.05 \times 10^{-5}$ ft./sec.

$K = 2.63$ ft./da.

$K = 9.29 \times 10^{-4}$ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (2.63) (14.0) (7.48)

T = 275.41 gpd/ft

SLUG IN TEST

MONITOR WELL NUMBER:	MW-1[illegible]
ELEVATION TOP OF CASING:	[illegible]7.59
ELEVATION WATER (IN):	9.18 ELEVATION WATER (OUT):
DEPTH OF WELL (TOC):	34.84 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. [illegible] TO [illegible].5 FEET BELOW GRADE
SCREEN/FILTER TYPE:	4 10 [illegible] PENETRATING/ [illegible]/40 GRADE [illegible] SILICA SAND
AQUIFER TYPE AND THICKNESS:	LAYER [illegible] AND SILTY SAND. [illegible] TO 7 FEET BELOW GRADE
H(0) TRANSLATION:	1.06 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	10.3 TRANS. METH. (SLUG IN) T(0): .05
FINAL TRANSDUCER VALUE:	9.22

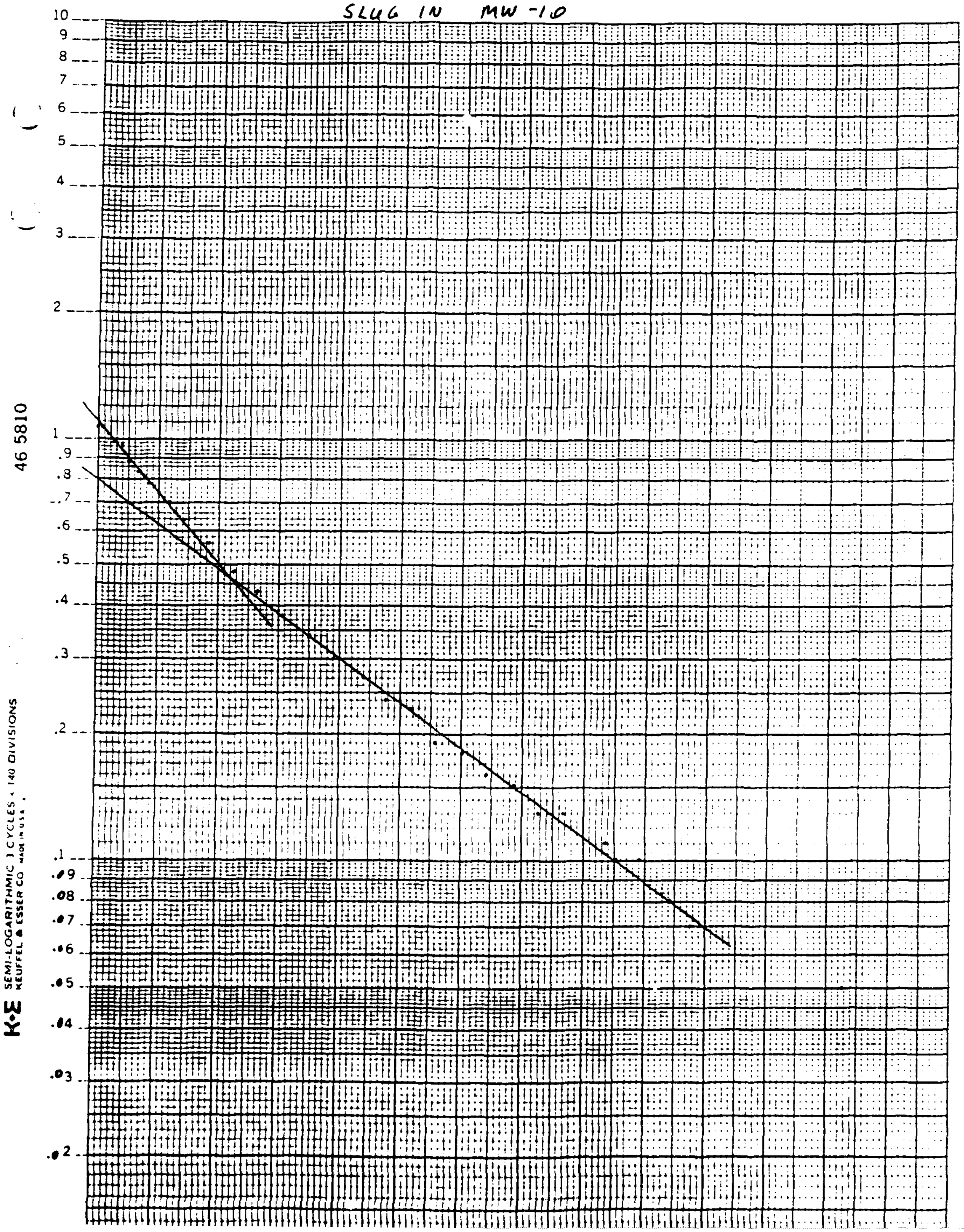
SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
000	0	0	-.05	15.44	5.14	-4.06	-3.7593	-2.6536
001	.0033	.198	-.0467	13.34	3.04	-1.96	-1.8148	-1.281
002	.0067	.402	-.0433	9.99	.31	.77	.713	.5033
003	.01	.6	-.04	10.24	.06	1.02	.9444	.6667
004	.0133	.798	-.0367	11.29	.99	.09	.0833	.0588
005	.0167	1.002	-.0333	10.69	.39	.69	.6389	.451
006	.02	1.2	-.03	10.73	.43	.65	.6019	.4248
007	.0233	1.398	-.0267	10.59	.29	.79	.7315	.5163
008	.0267	1.602	-.0233	10.56	.26	.82	.7593	.5359
009	.03	1.8	-.02	10.30	0	1.08	1	.7059
010	.0333	1.998	-.0167	10.46	.16	.92	.8519	.6013
011	.05	3	0	10.30	0	1.08	1	.7059
012	.0667	4.002	.0167	10.29	.01	1.07	.9907	.6993
013	.0833	4.998	.0333	10.24	.06	1.02	.9444	.6667
014	.1	6	.05	10.21	.09	.99	.9167	.6471
015	.1167	7.002	.0667	10.18	.12	.96	.8889	.6275
016	.1333	7.998	.0833	10.14	.16	.92	.8519	.6013
017	.15	9	.1	10.11	.19	.89	.8241	.5817
018	.1667	10.002	.1167	10.08	.22	.86	.7963	.5621
019	.1833	10.998	.1333	10.05	.25	.83	.7685	.5425
020	.2	12	.15	10.03	.27	.81	.75	.5294
021	.2167	13.002	.1667	10.00	.3	.78	.7222	.5098
022	.2333	13.998	.1833	9.99	.31	.77	.713	.5033
023	.25	15	.2	9.95	.35	.73	.6759	.4771
024	.2667	16.002	.2167	9.94	.36	.72	.6667	.4706
025	.2833	16.998	.2333	9.92	.38	.7	.6481	.4575
026	.3	18	.25	9.89	.41	.67	.6204	.4379
027	.3167	19.002	.2667	9.87	.43	.65	.6019	.4248
028	.3333	19.998	.2833	9.86	.44	.64	.5926	.4183
029	.4167	25.002	.3667	9.78	.52	.56	.5185	.366
030	.5	30	.45	9.70	.6	.48	.4444	.3137
031	.5833	34.998	.5333	9.65	.65	.43	.3981	.281
032	.6667	40.002	.6167	9.60	.7	.38	.3519	.2484
033	.75	45	.7	9.56	.74	.34	.3148	.2222
034	.8333	49.998	.7833	9.52	.78	.3	.2778	.1961
035	.9167	55.002	.8667	9.49	.81	.27	.25	.1765
036	1	60	.95	9.46	.84	.24	.2222	.1569
037	1.0833	64.998	1.0333	9.45	.85	.23	.213	.1503
038	1.1667	70.002	1.1167	9.41	.89	.19	.1759	.1242
039	1.25	75	1.2	9.40	.9	.18	.1667	.1176
040	1.3333	79.998	1.2833	9.38	.92	.16	.1481	.1046
041	1.4167	85.002	1.3667	9.37	.93	.15	.1389	.098
042	1.5	90	1.45	9.35	.95	.13	.1204	.085
043	1.583	94.98	1.533	9.35	.95	.13	.1204	.085
044	1.6667	100.002	1.6167	9.33	.97	.11	.1019	.0719

SLUG TEST IN:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.7	9.32	.98	.1	.0926	.0654
046	1.833	109.98	1.783	9.32	.98	.1	.0926	.0654
047	1.9167	115.002	1.8667	9.32	1	.08	.0741	.0523
048	2	120	1.95	9.30	1.01	.07	.0648	.0458
049	2.5	150	2.45	9.29	1.03	.05	.0463	.0327
050	3	180	2.95	9.27	1.05	.03	.0278	.0196
051	3.5	210	3.45	9.25	1.05	.03	.0278	.0196
052	4	240	3.95	9.25	1.06	.02	.0185	.0131
053	4.5	270	4.45	9.24	1.06	.02	.0185	.0131
054	5	300	4.95	9.24	1.06	.02	.0185	.0131
055	5.5	330	5.45	9.24	1.06	.02	.0185	.0131
056	6	360	5.95	9.24	1.08	0	0	0
057	6.5	390	6.45	9.22	1.08	0	0	0
058	7	420	6.95	9.22	1.08	0	0	0
059	7.5	450	7.45	9.22	1.08	0	0	0
060	8	480	7.95	9.22	1.08	0	0	0
061	8.5	510	8.45	9.22	1.08	0	0	0
062	9	540	8.95	9.22	1.08	0	0	0
063	9.5	570	9.45	9.22	1.08	0	0	0
064	10	600	9.95	9.22	0	0	0	0
065	12	720	11.95		0	0	0	0
066	14	840	13.95		0	0	0	0
067	16	960	15.95		0	0	0	0
068	18	1080	17.95		0	0	0	0
069	20	1200	19.95		0	0	0	0
070	22	1320	21.95		0	0	0	0
071	24	1440	23.95		0	0	0	0
072	26	1560	25.95		0	0	0	0
073	28	1680	27.95		0	0	0	0
074	30	1800	29.95		0	0	0	0
075	32	1920	31.95		0	0	0	0
076	34	2040	33.95		0	0	0	0
077	36	2160	35.95		0	0	0	0
078	38	2280	37.95		0	0	0	0
079	40	2400	39.95		0	0	0	0
080	42	2520	41.95		0	0	0	0
081	44	2640	43.95		0	0	0	0
082	46	2760	45.95		0	0	0	0
083	48	2880	47.95		0	0	0	0
084	50	3000	49.95		0	0	0	0
085	52	3120	51.95		0	0	0	0
086	54	3240	53.95		0	0	0	0
087	56	3360	55.95		0	0	0	0
088	58	3480	57.95		0	0	0	0

SLUG IN MW-10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K·E SEMI-LOGARITHMIC 3 CYCLES × 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

SLUG- IN
Well No. MW-10

Casing Diameter - 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 13.43 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 13.5 ft.
C = 1.9
y_o = 1.10 y_t = 0.74 t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln H/r_w} + \frac{C}{L/r_w}\right]^{-1}$$

$$= \left[\frac{1.1}{\ln(13.43/.344)} + \frac{1.9}{(10.0/.344)}\right]^{-1}$$

$$= 2.74$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.74)}{2(10.0)} \times \frac{1}{12} \times \ln(1.10/.74)$$

$K = 3.12 \times 10^{-5}$ ft./sec.

$K = 2.69$ ft./da.

$K = 9.50 \times 10^{-4}$ cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (2.69) (13.5) (7.48)

T = 271.64 gpd/ft

SLUG OUT TEST

MONITOR WELL NUMBER:	MW-10
ELEVATION TOP OF CASING:	[illegible]7.59
ELEVATION WATER (IN):	ELEVATION WATER (OUT): [illegible].18
DEPTH OF WELL (TOC):	34.84 DIAMETER OF CASING: .167 FEET
SCREEN LENGTH AND INTERVAL:	10 FEET. 20.5 TO 30.5 FEET BELOW GRADE
SCREEN/FILTER TYPE:	# 10 PARTIALLY PENETRATING/ 20/40 GRADE SILICA SAND
AQUIFER TYPE AND THICKNESS:	CLAYEY SILT AND SILTY SAND. 20 TO ? FEET BELOW GRADE
H(0) TRANSLATION:	1.45 H(0) THEORETICAL: 1.53
INITIAL CONSISTENT VALUE:	7.75 TRANS. METH. (SLUG OUT) T(0): .05
FINAL TRANSDUCER VALUE:	9.2

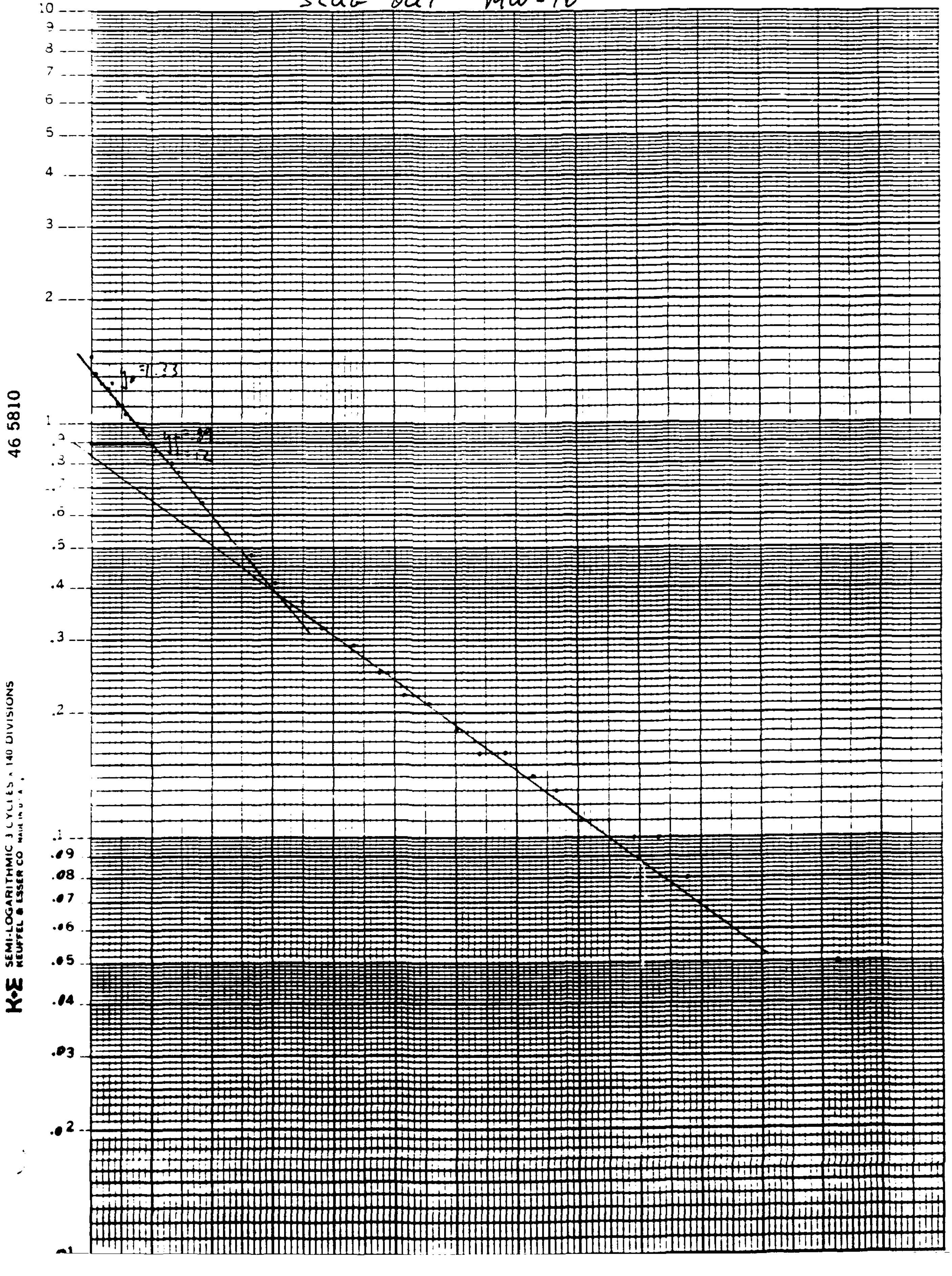
SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H' A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THE[illegible]
000	0	0	-.05	9.63	1.88	-.43	-.2966	-.2[illegible]
001	.0033	.198	-.0467	8.55	.8	.65	.4483	.42[illegible]
002	.0067	.402	-.0433	8.77	1.02	.43	.2966	.281
003	.01	.6	-.04	9.15	1.4	.05	.0345	.0327
004	.0133	.798	-.0367	9.09	1.34	.11	.0759	.07[illegible]
005	.0167	1.002	-.0333	7.86	.11	1.34	.9241	.8758
006	.02	1.2	-.03	9.63	1.88	-.43	-.2966	-.281
007	.0233	1.398	-.0267	9.09	1.34	.11	.0759	.07[illegible]
008	.0267	1.602	-.0233	8.95	1.2	.25	.1724	.16[illegible]
009	.03	1.8	-.02	7.72	-.03	1.48	1.0207	.9673
010	.0333	1.998	-.0167	8.72	.97	.48	.331	.31[illegible]
011	.05	3	0	7.75	0	1.45	1	.94[illegible]
012	.0667	4.002	.0167	7.88	.13	1.32	.9103	.8627
013	.0833	4.998	.0333	7.93	.18	1.27	.8759	.830[illegible]
014	.1	6	.05	7.98	.23	1.22	.8414	.79[illegible]
015	.1167	7.002	.0667	7.94	.19	1.26	.869	.8235
016	.1333	7.998	.0833	8.09	.34	1.11	.7655	.7255
017	.15	9	.1	8.10	.35	1.1	.7586	.71[illegible]
018	.1667	10.002	.1167	8.15	.4	1.05	.7241	.686[illegible]
019	.1833	10.998	.1333	8.17	.42	1.03	.7103	.6732
020	.2	12	.15	8.20	.45	1	.6897	.653
021	.2167	13.002	.1667	8.23	.48	.97	.669	.63[illegible]
022	.2333	13.998	.1833	8.26	.51	.94	.6483	.6144
023	.25	15	.2	8.31	.56	.89	.6138	.5817
024	.2667	16.002	.2167	8.34	.59	.86	.5931	.562
025	.2833	16.998	.2333	8.36	.61	.84	.5793	.549
026	.3	18	.25	8.39	.64	.81	.5586	.5294
027	.3167	19.002	.2667	8.40	.65	.8	.5517	.522
028	.3333	19.998	.2833	8.44	.69	.76	.5241	.496[illegible]
029	.4167	25.002	.3667	8.56	.81	.64	.4414	.4183
030	.5	30	.45	8.66	.91	.54	.3724	.352
031	.5833	34.998	.5333	8.72	.97	.48	.331	.313
032	.6667	40.002	.6167	8.79	1.04	.41	.2828	.268
033	.75	45	.7	8.83	1.08	.37	.2552	.2417
034	.8333	49.998	.7833	8.88	1.13	.32	.2207	.209
035	.9167	55.002	.8667	8.91	1.16	.29	.2	.1895
036	1	60	.95	8.95	1.2	.25	.1724	.1634
037	1.0833	64.998	1.0333	8.98	1.23	.22	.1517	.143
038	1.1667	70.002	1.1167	8.99	1.24	.21	.1448	.1373
039	1.25	75	1.2	9.02	1.27	.18	.1241	.1176
040	1.3333	79.998	1.2833	9.04	1.29	.16	.1103	.104
041	1.4167	85.002	1.3667	9.04	1.29	.16	.1103	.1043
042	1.5	90	1.45	9.06	1.31	.14	.0966	.0915
043	1.583	94.98	1.533	9.07	1.32	.13	.0897	.08[illegible]
044	1.6667	100.002	1.6167	9.09	1.34	.11	.0759	.071[illegible]

SLUG TEST OUT:

SAMPLE NUMBER	TIME (MINUTES)	TIME (SECONDS)	T(0) TRANS.	XD READING	H´ A/B DATUM TRANS.	H TRANS.	H/H(0) TRANS.	H/H(0) THEOR.
045	1.75	105	1.7	9.09	1.34	.11	.0759	.0719
046	1.833	109.98	1.783	9.10	1.35	.1	.069	.0654
047	1.9167	115.002	1.8667	9.10	1.35	.1	.069	.0654
048	2	120	1.95	9.12	1.37	.08	.0552	.0523
049	2.5	150	2.45	9.15	1.4	.05	.0345	.0327
050	3	180	2.95	9.17	1.42	.03	.0207	.0196
051	3.5	210	3.45	9.17	1.42	.03	.0207	.0196
052	4	240	3.95	9.18	1.43	.02	.0138	.0131
053	4.5	270	4.45	9.18	1.43	.02	.0138	.0131
054	5	300	4.95	9.20	1.45	6.6613e-16	0	0
055	5.5	330	5.45	9.20	1.45	6.6613e-16	0	0
056	6	360	5.95	9.20	1.45	6.6613e-16	0	0
057	6.5	390	6.45	9.20	1.45	6.6613e-16	0	0
058	7	420	6.95	9.20	1.45	6.6613e-16	0	0
059	7.5	450	7.45	9.20	1.45	6.6613e-16	0	0
060	8	480	7.95	9.20	1.45	6.6613e-16	0	0
061	8.5	510	8.45	9.20	1.45	6.6613e-16	0	0
062	9	540	8.95	9.20	1.45	6.6613e-16	0	0
063	9.5	570	9.45	9.20	1.45	6.6613e-16	0	0
064	10	600	9.95	9.20	1.45	0	0	0
065	12	720	11.95		0	0	0	0
066	14	840	13.95		0	0	0	0
067	16	960	15.95		0	0	0	0
068	18	1080	17.95		0	0	0	0
069	20	1200	19.95		0	0	0	0
070	22	1320	21.95		0	0	0	0
071	24	1440	23.95		0	0	0	0
072	26	1560	25.95		0	0	0	0
073	28	1680	27.95		0	0	0	0
074	30	1800	29.95		0	0	0	0
075	32	1920	31.95		0	0	0	0
076	34	2040	33.95		0	0	0	0
077	36	2160	35.95		0	0	0	0
078	38	2280	37.95		0	0	0	0
079	40	2400	39.95		0	0	0	0
080	42	2520	41.95		0	0	0	0
081	44	2640	43.95		0	0	0	0
082	46	2760	45.95		0	0	0	0
083	48	2880	47.95		0	0	0	0
084	50	3000	49.95		0	0	0	0
085	52	3120	51.95		0	0	0	0
086	54	3240	53.95		0	0	0	0
087	56	3360	55.95		0	0	0	0
088	58	3480	57.95		0	0	0	0
089	60	3600	59.95		0	0	0	0
							0	

SLUG OUT MW-10



SLUG-[illegible]T
Well No. MW-[illegible]

Casing Diameter = 2 in. = .167 ft.
Casing radius (r_c) = .083 ft.
Length of screen (L) = 10.0 ft.
Height of water from base of screen (H) = 13.45 ft.
Radius of borehole (r_w) = .344 ft.
Thickness of Aquifer (D) = 13.5 ft.
C = 1.9
y_o = 1.[illegible] y_t = 0.8[illegible] t = 12 sec.

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln(H/r_w)} + \frac{C}{L/r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(13.45/.344)} + \frac{1.9}{(10.0/.344)} \right]^{-1}$$

$$= 2.74$$

K = HYDRAULIC CONDUCTIVITY

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \times \frac{1}{t} \times \ln(y_o/y_t)$$

$$K = \frac{(.083)^2 (2.74)}{2(10.0)} \times \frac{1}{12} \times \ln(1.[illegible]/.[illegible])$$

K = 3.10 x 10^{-5} ft./sec.

K = 2.68 ft./da.

K = 9.45 x 10^{-4} cm./sec.

T = TRANSMISSIVITY

T = (K) (D) (7.48 gpd/ft)

T = (2.68) (13.5) (7.48)

T = 270.63 gpd/ft

APPENDIX C

GEOPHYSICAL SURVEY REPORT

GEOPHYSICAL SURVEY REPORT
OF
ELLINGTON FIELD LANDFILL PROJECT

SUBMITTED
TO

NUS CORPORATION
16360 PARK TEN PLACE, SUITE 300
HOUSTON, TEXAS 77084

BY
H. NEAL REEVES, GEOPHYSICAL CONSULTANT

NOVEMBER 27, 1989

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INTRODUCTION

This report is submitted to NUS CORPORATION(Client) of Houston, Texas, by H. Neal Reeves(Consultant) as a record of events, conclusions, and recommendations offered by Consultant to Client resulting from the geophysical survey conducted at a landfill site on the northwestern perimeter of Ellington Field south of Houston, Texas, between the dates of November 8-13, 1989.

STATEMENT OF WORK

Geophysical techniques were chosen to assist Client in obtaining a refined site assessment/site characterization of near surface conditions prior to embarking on the next phase of their work program, which could include such items as the installation of monitoring wells, determining groundwater gradient, obtaining soil and water samples for analysis, and to obtain a more precise location of an underground storage tank generally located in the southwest quadrant of the site. Results obtained from the geophysical phase will be used by Client to avoid drilling hazards and to assist in insuring that all zones, disturbed or otherwise, are adequately characterized.

Specifically, Consultant was charged with the responsibility of acquiring, processing, and interpreting a combined Magnetometer/Gradiometer Survey as well as to process and interpret an Electromagnetic Survey conducted by Client representative, Mr. David Upthegrove, during the same period referenced above. Results of both surveys, which are complementary techniques, will be integrated with each other and with site historical data in order for very precise and specific conclusions and recommendations to be presented to Client by Consultant.

SITE CONDITIONS AND ADVANCE PREPARATION

The site can be generally described as a rectangle having an approximate 1250 ft(E/W) X 900 ft(N/S) dimension. The area is bounded for the most part on all sides by an 8 foot tall chain link fence and has a storage facility behind an inside fence located roughly in the E 1/2 of the SW Quadrant. A blacktop road parallels the fenced boundaries on all but the south side of the site. Access is excellent, elevation relief is negligible, and the area has been kept free of thick vegetation which might impede progress of the survey. Although the site had been used as a landfill periodically over a period of years, backfilling, leveling, and the growth of grass and small trees had removed all but the scattered evidence of its former use. For example, pieces of concrete with rebars sticking out of the ground could be observed in a few locations across the site. There is, however, little current expression of the depth and aerial extent of any materials currently buried at the site.

Prior to Consultant becoming directly involved, Client contracted with the survey company of Washburn & Company to lay out a 100 ft X 100 ft control survey grid across the area This grid was marked by wooden stakes at each 100 X 100 ft corner. Line and Position convention adopted had the initial (X,Y) position (000.0,000.0) located at the northeast corner of the site. Line numbers increased to the west and Position numbers increased to the south. N''S representatives, including Mr. David Upthegrove, further refined the survey grid to a 25 ft X 25 ft interval by chaining between control survey stakes and placing pin flags at 25 ft intervals. This advance survey was in the process of being completed at the time of my arrival in the field on November 8, 1989.

As a result of preliminary discussions with Client, Consultant was requested to secure geophysical instrumentation from reputable vendors and check out the instruments prior to taking delivery on them from the vendor. Consultant arranged for this and did so on his own time.

The net result was that due to the efforts and forethought of all involved parties, the survey proceeded with all due haste and was completed essentially without delay.

GENERAL INTRODUCTION TO GEOPHYSICAL SYSTEMS UTILIZED

The geophysical systems deemed appropriate by Client and Consultant were, with ample precedent, suited to achieving the survey objectives referenced above. A brief non-rigorous discussion of both will now be presented to establish the relationship between site conditions, survey objectives, and the geophysical tools and techniques utilized.

Magnetometer/Gradiometer-The presence of buried ferrous materials which have in effect become magnets due to exposure to the earth's magnetic field(induced magnetization) over a period of time will commonly cause the total field reading as measured by a magnetometer to be anomalous by as much as several hundred or even several thousands of gammas; depending on size, volume, orientation, depth of burial, etc., of the buried object. A magnetometer survey in essence measures and maps variations in the total field caused by the presence of magnetic materials in the earth.

The gradiometer is effectively no more than two total field magnetometers mounted on the same staff and whose sensors are separated vertically by a known distance. By measuring the total field at the same location at two different heights, one is able to better detect the presence of where smaller(higher frequency)metallic concentrations begin and end and the rate at which this occurs in gammas/meter. This principal is analagous to the relationship between velocity and acceleration wherein both gradient and acceleration measure the rate of change of the fundamental unit in operation. One might intuitively see that a deeply buried broad (low frequency) geologic feature would not lend itself to the gradiometer approach. It is peculiarly applicable to environmental, engineering, archaeological, and other shallow investigations.

Electromagnetics-Electromagnetic instruments such as the one used in this survey are designed to measure variations in the conductivity of the subsurface volume sampled by the signal being transmitted and recorded. Conductivity variations within the earth are caused by factors including changes in porosity, permeability, moisture content, salinity, acidity, and presence of colloids/leachate in solution. This application is particularly useful in going from native(undisturbed)soil conditions outside a landfill area to the landfill itself; although internal as well as boundary changes are quite often hydrogeologically significant. Additionally, the Electromagnetic(EM) method as utilized in this survey will detect ferromagnetic materials with good resolution to a generally adequate depth in the mode used for conductivity cortrast mapping.

From the above discussion it should be obvious, when considering survey objectives, that the two systems employed do complement each other, overlap in some features, and are, when properly applied, applicable to surveys such as the one under discussion.

ACQUISITION PHASE DISCUSSION

Magnetometer/Gradiometer Survey

The instrument used was an EDA OMNI-IV PLUS Magnetometer/

Gradiometer which measures and records in protected memory the total magnetic field(top sensor) in gammas and the magnetic gradient of the total field(top sensor reading less bottom sensor reading divided by the distance between the two) in gammas per meter.

At the start of each recording day, the recording system would be powered up, put through a series of internal self-checking tests, programmed for initial lines to be surveyed, and put into the magnetometer/gradiometer recording mode for the days operations.

Additional to recording the values at each (Line,Position) location, a base station reading was taken at the start of each survey day which revealed an average regional total field value of 49,920 gammas for the survey area. This observed value tied very well with published value expected at the geographic coordinates and magnetic latitude of the survey site. Also, a magnetic datum value of 50,000 gammas was programmed into the system memory for the entire survey. Magnetic values for the total field recorded are thus net of datum. Such a practice is standard in order to avoid working with large numbers in the processing and interpretive stage.

At the end of each day the microprocessor controlled recording section of the instrument was linked to a microcomputer via RS-232 interface and the data were downloaded onto a floppy disk. Data were printed out and studied as a further refinement to the same values observed being recorded during the course of the day. Additional to this, system batteries were put on charge overnight at the end of each day.

A study of the data acquired during the previous day allowed the planning of additional detail data point locations in areas exhibiting rapid lateral magnetic response changes.

The instrument performance was trouble free. No magnetic storms were experienced during the course of the survey. Statistical information provided later in this report will give greater information as to total points acquired, production rate, etc.

Electromagnetic Survey

The instrument used was a Geonics Limited EM-31 DL Electromagnetic Recording System which is used in a continuous profiling manner to record the quadrature-phase component of the induced magnetic field; which is linearly related to the ground conductivity in native soils(undisturbed zones) and will detect and be influenced by the presence of buried metallic objects in fill areas(disturbed zones). The quantity measured is in millimhos per meter, which is the reciprocal of resistivity. Depth of detection of conductivity through native soils in the vertical coil configuration utilized is nominally down to 6 meters in depth. Detection depth of buried metallic objects is nominally in the range of 2-3 meters.

At the start of each recording day the instrument was checked for battery level and for zero reading at the least sensitive setting to insure the system was in calibriation. These checks were repeated during the course of the day on a periodic basis. NUS representative, Mr. David Upthegrove, operated the EM-31 throughout the survey.

The survey progressed routinely in a north-to-south direction with frequent right angle orientations recorded to determine if lateral changes were occuring. Readings were recorded manually in a log book. Readings were taken at every 25 ft interval in all cases and more frequently where subsurface influences were causing the readings to change rapidly.

Operating mode allowed the continuous recording of anomalous zones during one pass as compared to the Magnetometer survey which required obtaining needed detail on subsequent days.

The system performed in a trouble-free manner throughout the survey. As referenced above, production statistics will be provided in greater detail later in this report.

DATA PROCESSING DISCUSSION

In geophysical surveys, as in most scientific endeavors, there is a direct connection between acquisition, processing, and interpretation. The process is an iterative one which requires editing values that are anomalous not because of subsurface conditions but by cultural interferences such as powerlines, metal fences, automobiles, buried utilities, etc. In this regard a short discussion of cultural influences will precede any discussion of data processing and interpretation.

Cultural Influences

During the course of the survey it was observed that any magnetometer readings closer to metal fences than 25 ft resulted in anomalously high readings. In the case of the Electromagnetic system, anomalously high readings were recorded inside 35 ft for coil orientation perpendicular to

the fence and 25 feet for coil orientation parallel to the fence. In both cases the recorded values within this negative cultural influence zone were edited out during the data processing stage in order for subsurface conditions to be characterized without including extraneous influences. The same is true of well marked underground utilities encountered on the east side of the storage facility located in the southwest quadrant of the survey area.

Data Processing Procedures

Input data consisted primarily of data sets for the following:

Set 1-Electromagnetic recording(Z) for each surveyed Line and Position Number(X,Y).

Set 2-Total Field Magnetometer recording(Z) for each surveyed Line and Position Number(X,Y).

Set 3-Magnetic Gradient of Total Field Magnetometer recording(Z) for each surveyed Line and Position Number(X,Y).

Data processing was performed on a microcomputer utilizing a software package which takes data sets containing (X,Y,Z) information, creates a grid file, and outputs the data in either two(2) or three(3) dimensions. Two dimensional data are displayed as topographic contour maps, or simply as map values posted to the appropriate (X,Y) location, or in two dimensional(X,Z) crossection form. Three dimensional data were displayed with surface relief projected orthogonally and options utilized to rotate the 3-D displays at specified angles of rotation around the Z-Axis and tilt.

For all three data sets mentioned above, Consultant generated a topographic map(2-D) and four orthogonal projections which displayed the data in 3-D image at 45 degree angles to each corner of the survey grid. Additional to this, numerous other displays were computer generated which were of assistance in interpreting and reporting results of the survey. In all there were 35 displays generated during the data processing/interpretation phases of this project. **Each one of the displays generated are made a part of this report and will be discussed individually, where appropriate, in the interpretation section of this report.**

As mentioned earlier, interpretation is an iterative process which requires inspection of selected map values which may be anomalous not because of subsurface conditions but rather as a result of cultural interference. Many of the final maps included in this report are a result of at least two processing/interpretive iterations. This process will be understood as not unusual to those familiar with interpreting data sets of virtually any type.

DISCUSSION OF INTERPRETATION

Establishing Patterns in an Integrated Interpretation

During the course of this survey and subsequent data processing phase, a determination was made interactively as to which data points were of value in the interpretation of the Total Field, Gradient, and Electromagnetic Data Sets. As mentioned previously, data points were edited out only if the values were anomalous due to known cultural interference sources. Hidden cultural sources may still exist but Consultant made no assumptions in this matter in order to maintain the integrity of the data.

As a matter of record, the following data points were retained included in the final interpretation:

*Electromagnetic(EM)...............1537 Points
Total Field Magnetic..............1998 Points
Gradient of Total Field...........1998 Points

*Magnetic Data Includes Additional Detailing Points

Following the completion of the acquisition phase, Consultant was provided the use of site historical data including:

*Aerial Photograph of Site Dated 1965
*Aerial Photograph of Site Dated 1969
*Aerial Photograph of Site Dated 1975
*Drawing Entitled "Former Base Landfill Test Pit/Boring Location Ellington ANG"

Consultant utilized all available information acquired during the course of this survey up to the interpretation phase to establish certain patterns which may be significant to the interpretation of the data.

During the course of discussing the interpretation of the data the term "anomaly" will be used on a recurring basis. In the interest of being understood, Consultant will now offer a general definition and a discussion of this recurring term.

Anomaly-This term will geneally mean any measurement which does not conform to the normal or expected. In the case of the Total Magnetic Field values being discussed, any value or set of values which varies materially from the regional magnetic field, has a positive/negative swing in observed values across the zone, and can be contoured with closure will be considered anomalous.

In the case of the Gradient to the Magnetic Field, any value or set of values that vary much beyond the low tens in value, exhibit a positive/negative swing in observed values across the zone, and can be contoured with closure will be considered anomalous.

In the case of the Electromagnetic Conductivity reading, any value that varies upward or downward from the expected reading in undisturbed(native soils) zones, considering soil types, moisture content, etc. will be considered anomalous. In zones where the quadrature phase signal is being influenced by the presence of ferromagnetic materials buried in the near surface, which results in anomalously high readings, closure around this zone, and good correlation to the general patterns obtained by the magnetometer survey, such an EM conductivity situation will be considered anomalous.

During the course of the processing and preliminary interpretation, it was observed that anomalous conditions observed on the Total Field Map were consistently observed, as expected in a landfill situation, on the Gradient map. It was also observed that in zones exhibiting anomalously high Total and Gradient values, the Electromagnetic survey exhibited high values of conductivity more often than not. Historical information provided to Consultant and referenced above provides additional insight into the interpretation of the geophysical data; not an unexpected development.

In any event, Consultant will now develop a data set which will hopefully reveal patterns helpful to the understanding of the geophysical data and site characterization.

GENERAL LOCATION PLAT

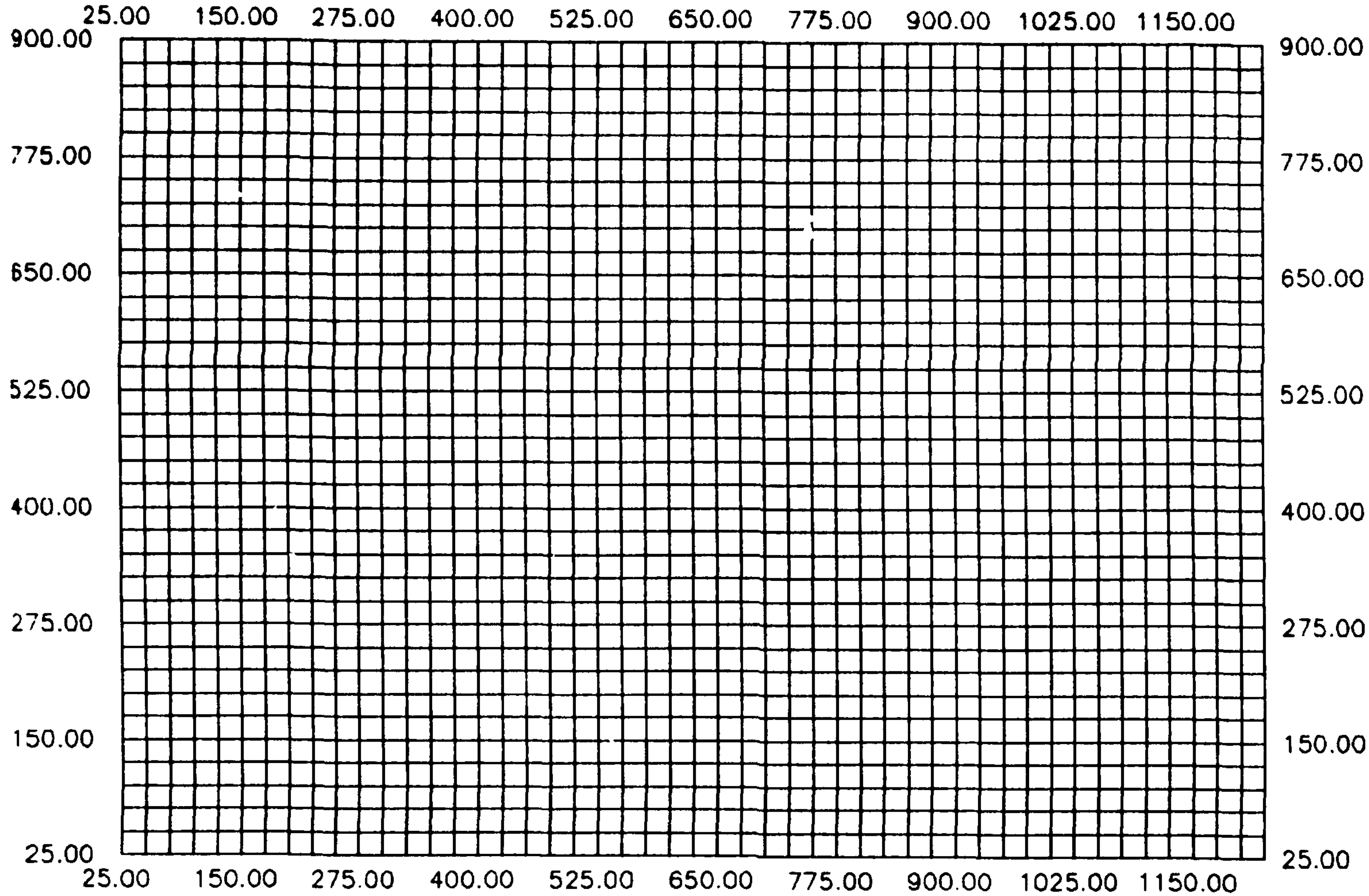

TABLE OF ANOMALOUS ZONES

ZONE CENTER	TOTAL FIELD RANGE			CONDUCTIVITY RANGE	
# 1 (125,150)	(P-100 -388	P-150 430	P-175) -333	P-100 72	P-125 48
# 2 (150,825)	(P-800 -257	P-825 154	P-850) -101	P-800 89	P-825 78
# 3 (175,275)	(P-225 -627	P-275 787	P-375) -397	P-225 50	P-250 48
# 4 (225,350)	(P-325 -1287	P-350 836	P-425) -26	P-325 62	P-360 0
# 5 (275,500)	(P-475 -282	P-500 177	P-525) 73	P-475 49	P-500 48
# 6 (300,200)	(P-180 -2158	P-200 1683	P-260) -35	P-175 62	P-195 12
# 7 (425,425)	(P-400 -1441	P-425 909	P-475) 32	P-400 48	P-410 18
# 8 (475,275)	(P-250 -426	P-275 731	P-300) -418	P-250 88	P-275 96
# 9 (500,390)	(P-330 -1269	P-390 1774	P-500) -25	P-370 290	P-400 115
# 10 (500,750)	(P-700 -1532	P-750 331	P-775) 3	P-725 80	P-750 68
# 11 (525,100)	(P-50 -898	P-100 -358	P-175) -252	P-65 120	P-75 85

# 12 (575,300)	(P-275 -1252	P-300 547	P-325) -440	P-275 110	P-300 92
# 13 (575,375)	(P-350 -589	P-375 1073	P-450) -120	P-350 120	P-375 200
# 14 (625,125)	(P-75 -753	P-125 636	P-175) -277	P-100 100	P-125 84
# 15 (625,275)	(P-275 -710	P-325 548	P-350) -275	P-275 95	P-300 82
# 16 (675,250)	(P-200 -368	P-250 828	P-275) -343	P-225 110	P-250 110
# 17 (675,350)	(P-300 -536	P-350 597	P-400) -6	P-305 100	P-325 92
# 18 (725,75)	(P-50 -643	P-75 314	P-125) -285	P-60 120	P-75 70
# 19 (750,200)	(P-175 -443	P-200 102	P-210) -18	P-175 120	P-200 125
# 20 (750,350)	(P-320 -281	P-350 1414	P-390) 33	P-325 115	P-350 87
# 21 (775,350)	(P-325 -525	P-350 806	P-425) 78	P-325 120	P-350 105
# 22 (800,400)	(P-370 -251	P-400 1387	P-420) 227	P-375 105	P-400 100
# 23 (825,500)	(P-375 -551	P-400 1166	P-500) -1105	P-375 115	P-400 105
# 24 (850,300)	(P-250 -985	P-300 295	P-310) -388	P-275 100	P-300 88
# 25 (900,175)	(P-125 -574	P-175 99	P-200) -229	P-125 85	P-150 46
# 26 (900.390)	(P-360 -1604	P-390 1846	P-420) 13	P-375 115	P-390 60

TABLE OF ANOMALOUS ZONES(CONTINUED)

ZONE CENTER	TOTAL FIELD RANGE			CONDUCTIVITY RANGE	
# 27 (900,550)	(P-525 -735	P-550 627	P-625) -346	P-525 80	P-550 40
# 28 (1000,500)	(P-475 -607	P-500 608	P-575) -140	P-475 74	P-500 90
# 29 (925,550)	(P-525 -657	P-550 492	P-600) -137	P-525 92	P-550 110
# 30 (1050,250)	(P-225 -600	P-250 405	P-300) -434	P-225 90	P-250 82
# 31 (1075,610)	(P-580 -2271	P-610 1834	P-640) -46	P-575 42	P-600 20
# 32 (1075,830)	(P-800 -1069	P-830 472	P-850) -110	P-800 27	P-805 140
# 33 (1125,175)	(P-150 -927	P-175 518	P-225) -30	P-150 80	P-175 67
# 34 (1125,300)	(P-275 -811	P-300 668	P-350) -250	P-275 84	P-300 90
# 35 (1150,450)	(P-425 -623	P-450 1125	P-500) -29	P-435 46	P-450 105
# 36 (1175,600)	(P-550 -310	P-575 410	P-625) -332	P-550 62	P-575 58

The definition of "anomalous" should be kept in mind when looking at the zones listed above.

Factoring In Site Historical Data

Aerial photographs and plat map referenced earlier were used by Consultant to prepare a map across the site which gives at least a partial picture of the land usage which contributed to the anomalous conditions observed on the geophysical data(See Fig. 1). General locations of trenches have been helpful in confirming the reasonableness of some of the geophysical results. Additional help was derived from the plat referenced earlier in having a record which gives a ballpark location of the underground storage tank which requires locating more precisely as well as old site facilities, such as the location of incenerator, buildings, tracks, etc. which are no longer in evidence.

One should always be careful in forming strong conclusions based on incomplete information. The composite historical picture shown in Figure 1 does not show, for instance, the evidence in the 1965 aerial photograph of older closed out fill areas in the northwestern quadrant of the site. There are undoubtedly other gaps in available historical information but the data provided fits the overall picture very well.

One additional factor will be thrown in the hopper before returning to the interpretation and beginning to state some conclusions which may be drawn from the geophysical data bank. While it will be observed that there is a strong correlation between the response of the magnetometer and the electromagnetic system in disturbed zones where ferrous metals are at or near the surface, the EM system will have a differing response to varying soil types and soil conditions in undisturbed zones. A few common ones typical to this area and present on this particular site include:

SOIL TYPE	EM RESPONSE RANGE
Clay	50-100 Millimhos/Meter
Topsoil	10
Unsaturated Sand	0-1
Moist Sand	5-20
Saturated Sand	50

These responses will vary depending primarily on the nature of particulates in solution and their susceptibility to the conductivity of electrical and electromagnetic components.

Discussion of Anomalous Zones

Magnetic response signatures recorded across the area were classic dipole wherein the response going from south to north would go slightly negative as the buried object was approached, swing dramatically to the positive, and then dramatically to a negative(minimum) value before becoming regional again. Objects buried within landfills generally can be modeled as horizontal cylinders, spheres, dikes, or the like of high frequency(short wavelength) duration. Geomagnetic inclination at the survey site is approximately 60 degrees, which means the force field coming from the buried object is located at a 60 degree angle from horizontal and as measured from the zero crossing northward; which would place the buried object just to the south of the minimum(largest negative number and typically the largest absolute value number in the signature resulting from the induced magnetic effects of the earth's magnetic field on the object being detected).

Electromagnetic response signatures which are under the influence of the induced magnetic field of buried ferromagnetic materials will record their highest reading at or near a point immediately above the object; certainly within a 10 foot radius of the object.

In both cases, readings off to the side of the object and in cases where insufficient spatial sampling is used, the field from the buried object may be ambiguous or be missed entirely. This caution applies to both data sets. These considerations should be kept in mind when interpreting results from these type surveys.

The anomalous zones tabulated above will now be discussed in greater detail individually. Tabular values for Total Field Magnetics are for Positions where the signature onset occurs, where its maximum positive value occurs, and where its maximum negative value occurs. Tabular values for the Electromagnetic Survey are maximum and minimum values recorded in the zone of influence of the buried object with Positions being noted above the reading in each case.

Zone #1-This zone is interpreted to contain a small amount of ferrous materials which requires closer sampling to locate with pinpoint precision. Both data sets agree that a close approximation of the location is between Position 100-110.

Zone #2-This zone can be characterized as containing a small amount of ferrous materials located between Positions 800-810. Good agreement is achieved between both methods. Closer sampling could further refine.

Zone #3-This zone exhibits good closure and indicates a ferrous concentration between Positions 225-235. There is good agreement between both methods.

Zone #4-This is a very well defined anomaly on both data sets which indictes the presence of ferrous materials between Positions 325-335.

Zone #5-A weak but coherent anomaly detected on both systems. Could be resolved better with finer sampling. Indicated location of ferrous materials is between Positions 475-485.

Zone #6-A very strong response contrast on both systems with indicated location of buried ferrous materials between Positions 180-190.

Zone #7-A very strong response contrast on both systems with indicated location of buried ferrous materials between Positions 400-405.

Zone #8-A moderate response on both systems which indicates that the area sampled is part of a northeast trending nose off a larger anomaly to the southwest. Indicated location of buried materials is between Positions 260-265.

Zone #9-A very strong anomaly that is well defined on both systems. Detail obtained on both systems indicates concentrations of ferrous materials between Positions 350-370.

Zone #10-This is an isolated anomaly centered at P-700. This anomaly was detected slightly by the EM system but stands out significantly on the Magnetometer reading. The signature is unusual in that there is very little positive swing but significant negative reading. The most likely explanation is that inadequate spatial sampling did not pick up the positive component on the magnetometer survey and that the EM sampling was inadequate as well. In any event the indicated location is between Positions 700-710.

Zone #11-A narrow anomaly which is detected by both systems but detail obtained on the EM survey places the location of ferrous materials at Position 65.

Zone #12-A well defined anomaly on both systems located between Positions 275-285.

Zone #13-A very strong anomaly detected by both systems but which would benefit from finer spatial sampling as the maximum magnetic minimum and probably the strongest EM reading is skipped. Probable location is between Positions 365-375.

Zone #14-A small anomalous feature detected reliably by both systems. Location is between Positions 85-95.

Zone #15-A mildly disturbed zone detected by both systems with probable location between Positions 275-285.

Zone #16-A mildly developed anomaly detected by both systems. Symmetric signature on both systems indicate the position not to be located immediately over a severely disturbed zone. Location is between Positions 240-250.

Zone #17-A well developed anomaly which is detected by both systems with detail acquired with the EM system locating the ferrous materials at Position 305; a location which is consistent with the Magnetics.

Zone #18-A well developed anomaly detected by both systems and located off the flank of a larger anomaly. Location is between Positions 50-60.

Zone #19-A mildly disturbed zone detected by both systems. The zone between 175-200 could benefit from greater detailed gridding. Ferrous materials are located between Positions 175-185.

Zone #20-A well defined zone that is located more precisely by the EM system due to greater detailing. Anomaly is located between Positions 325-335.

Zone #21- A well developed anomaly detected by both systems. Located on the southeast flank of a trend running northwest-southeast. Anomaly location is between Positions 330-340.

Zone #22-A well developed anomaly detected by both systems and following the same trend as Zone #21. Anomaly location is between Positions 375-385.

Zone #23-A well developed anomaly which could benefit from more magnetic detail between Position 375-400. Detail on EM survey places location of this ferrous concentration between Positions 380-390.

Zone #24-A mildly anomalous zone detected by both systems and located between Positions 260-270.

Zone #25-A well defined anomaly on both systems and located between Positions 130-140.

Zone #26-A very strong anomaly detected by both systems and located between Positions 370-380.

Zone #27-A well defined anomaly detected by both systems but probably would be stronger with finer spatial sampling. Location of this anomaly is between Positions 530-540.

Zone #28-A mild anomaly which is detected by both systems but which is not well defined probably due to inadequate spatial sampling. Location of this deposit is between Positions 490-500.

Zone #29-An ill defined anomaly due to inadequate sampling which is located between 540-550. Another cause for ambiguity is that it is located on the northeast flank of a major disturbance growing off to the southwest.

Zone #30-A mild anomaly detected by both systems and located between Positions 230-240.

Zone #31-A very strong anomaly detected by both systems and located between positions 580-590.

Zone #32-A well defined anomaly on both systems with detailed measurements on the EM survey placing the location between Positions 805-815.

Zone #33-A mild anomaly detected by both systems and located between Positions 160-170.

Zone #34-A mild anomaly detected by both systems. Increased spatial sampling required to refine but indications are that location is between Positions 290-300.

Zone #35-A well defined anomaly by both systems which would benefit from greater spatial detail but which, due to some detailed information on th EM survey indicates a location between Positions 440-450.

Zone #36-A poorly defined anomaly which is on the flank on a more pronounced expression but which could benefit from finer spatial sampling. Indicated location of buried target is between Positions 560-570.

The above detailed anomalous zones are in some cases isolated from the major pit areas but for the most part are to be considered as part of a depositional trend of ferromagnetic materials across the landfill area. The trends are obvious from plotting the zones discussed and from a review of the orthogonal projections of the three quantities measured. There is good agreement between results obtained by the Total Field Magnetics, Gradient of the Total Field, and the

Electromagnetic method. The data presented above in zone form is deemed suitable for the selection of a representative number of locations to collect soil samples, which is one of the stated objectives of the survey.

There is one area of interest outside the area most disturbed which is deemed worthy of mention when considering locations to collect soil and water samples as well as for possible location of monitoring wells. From a review of the aerial photographs it appears that there is a zone in the southeast quadrant where there were at one time tanks or perhaps natural ponding. The location of this zone appears to be be on a trend between Lines 100-400 and between Positions 700-800. One such site is near Zone #2 discussed above.

Electromagnetic Conductivity Response in Undisturbed Zones

As can be seen in the discussion of the various Zones above, much of the area has been disturbed and as a result the EM readings are influenced by the presence of ferrous materials which have induced magnetic properties. A cursory glance of the topographic and orthogonal projections, particularly the Gradient of the Total Field projections, will graphically present those high amplitude disturbed zones which dominate the northeast, northwest, and southwest quadrants and, to a lesser extent the southeast quadrant. Nevertheless, Consultant attempted to determine if any significant patterns could be observed in the relatively undisturbed zones. As a part of this investigation, topographic maps of the Electromagnetic Data were generated which limited the signal being contoured over a set of panels. These displays are made a part of this report and are identified as Figures 14-18. These Figures, when coupled with orthographic displays of all data sets, which complement and agree with each other, were used to investigate those relatively undisturbed areas to see if any useful geological and hydrogeological information could be inferred.

The only areas that are even relatively free of disturbed zones are to be found in areas generally to include:

* Southeast Quadrant of Site,
* East 1/2 of Southwest Quadrant,
* Central Portion of South 1/2 of Northeast Quadrant.

There are others of course such as just up against the fences in the Northeast corner and along portions of the western fence. However, for the purposes of this discussion the three areas referenced above will be analyzed.

Only one zone was observed in the area of investigation which had concentrated areas where Electromagnetic readings between 0-20 mmohs/meter and that was in and around Line 450, Position 400(See Fig. 14). This reading range would be typical of moist to saturated sand.

Opening the window to include readings between 0-50 mmhos/m, revealed that a trianguiar wedge with corners at (L-125, P-150) southwestward to (L-575,P-600) eastward to (L-200, P-575) and back to the starting point to the northeast had significant power in the 20-50 mmohs/m range. This range would infer a reasonable concentration of saturated sand or very sandy clay to be present(See Fig. 15).

Opening the window further revealed that the values in the 50-70 mmohs/m are increasing to the south and southeast(See Fig. 16).

The window from 70+ mmohs/meter upward reveals that there is a gentle trend with some areas of closure in the southeast quadrant and eastern 1/2 of the southwest quadrant where this higher reading begins to express itself. This reading would be typical of soils which are predominantly clays(See Fig. 17).

The window including 90+ mmohs/m reveals that no coherent contours are present in the relatively undisturbed areas under consideration(See Fig. 18).

Thus one could conclude that this area consists of saturated sands and sandy clays to the north grading to the south and southwest to primarily clays.

The area to the south where clays dominate do not exhibit any significant closure which might indicate a significant change in the hydrogeological environment which could in turn indicate an increase in conductive materials in the groundwater.

This analysis does not speak to organics which are, except where in very heavy concentration, difficult to detect. In any event, the readers are invited to form their own conclusion on matters discussed in this section.

Underground Storage Tank(UST) Location

Historical information provided at the end of the field phase plus discussions with NUS representative David Upthegrove indicates that the approximate location of this tank to be on the west side of the north-south road running along the west side of the landfill area. Specifically, the tank is reported to be west of the old cul-de-sac which circled the incenerator which has long since been torn down. This would place the tank at an approximate location of L-1125, P-600. The area is in a very disturbed zone, both culturally and subsurface wise. Culturally from the fence just to the west of the road and subsurface wise due to the amount of remnants from past facilities. Without some historical information it would be easy to get lost in this exercise of trying to find one particular bolt in a bucket of bolts. For instance, the Total Field Signature derived at L-1075, P-600 is a classic response of what one might expect to see when crossing an underground storage tank(See Fig. 28).

In order to investigate the most probable site, several detailed displays were generated at the site. Specifically, topographic and orthogonal projections were generated for the Total Field, Gradient of Total Field, and Electromagnetic survey data(See Figures 29-36).

Total Field detailed topographic display revealed a maximum area centered at (L-1175,P-585) with minimum components to the east; with the strongest minimum being to the east at approximately (L-1125,P-600).

Gradient of Total Field detailed topographic display revealed a gradient positive peak at (L-1200,P-575) and a gradient negative(mininum) trough at (L-1175,P-600).

Electromagnetic detailed topographic display revealed a high closed area at (L-1200,P600) and a northwest-southeast saddle with a maximum reading of 75 mmohs/m centered at approximately (L-1150,P-600). A close analysis of this data led to the personal conclusion that the closure at L-1200, P-600 is due to cultural interference from the nearby cyclone fence.

Overall, readings from the two systems are not nearly as high as one might expect from crossing an underground storage tank. Assuming the tank is in the proximity suggested by historical data, one can only conclude that adequate spatial sampling was not used in either survey to obtain the high amplitude signature characteristic of this type feature. Again, Figure 28 would be typical. A study of this figure will reveal that in the course of 30 feet the signature went from maximum positive to maximum negative value.

Based on what we have and not what we might like to have, the Total Field and Gradient of the Total Field would indicate a tank location of (L-1135,P-585). The approximate location based on Electromagnetic data is not at all clear to me. It may be that the depth of burial or insufficient sampling or the presence of sand backfilling around and over the tank or some combination of the above creates this inconclusive evidence.

For a location on the west side of the road, Consultant would have to recommend the above location as a good place to probe---Line 1135, Position 585.

Initial Monitoring Well Locations

Based on discussions with Client representative, Consultant is under the impression that an initial well program to obtain water samples for analysis and to determine gradient will consist of a four well program, with one well being placed on each side of the site.

Potential candidate locations for the east side of the site would likely include (L-50,P-50) and/or (L-50,P-600), assuming the criteria is to drill near but not into disturbed zones.

For a location on the south end of the site there are numerous undisturbed locations to choose from. Recalling the reference earlier of historical evidence suggesting that at one time there appears to have been ponding or a manmade tank complex across the area bounded by Lines 100-400 and Positions 700-800. Perhaps at least one site along this trend is to be recommended.

On the north side of the site, undisturbed zones are confined to the eastern and western extremities for the most part, with possible locations at (L-825,P-50) or, if a more central location is chosen on the east side, I would reccomend the northeast corner as another possibility; as for example (L-75, P-25) or perhaps the northern most site on the east side referenced earlier.

Locations on the west side will have to be tight against the fence at any location but two candidates would include (L-1175,P-750) or (L-1175,P-850).

CONCLUDING REMARKS

Issues addressed during the course of this report have included the following:

* Detailing the site to identify all anomalous zones for planning a soil sampling program.

* Characterizing the geologic and hydrogeologic conditions across undisturbed zones.

* Locating undisturbed sites on each side of the landfill area to consider for the initial monitoring well program.

* Deriving a more precise estimate of the location of underground storage tank.

Consultant feels that the quality of the data acquired and the consistency of results within each technique and between techniques, considering the complexity of the area, has resulted in a quality product which extracted the maximum available information which should allow Client to enter the next phases of the work program with a higher level of understanding of site conditions and the confidence which this brings to the decision making process.

ACKNOWLEDGEMENTS

I would like to express appreciation to NUS CORPORATION for the opportunity to have been chosen to participate with them in this very interesting and challenging survey. A personal word of thanks goes to Mr. David Upthegrove for his enthusiastic support and professionalism.

Respectfully submitted,

H. Neal Reeves

H. Neal Reeves
Geophysical Consultant

November 27, 1989

FIGURE 1

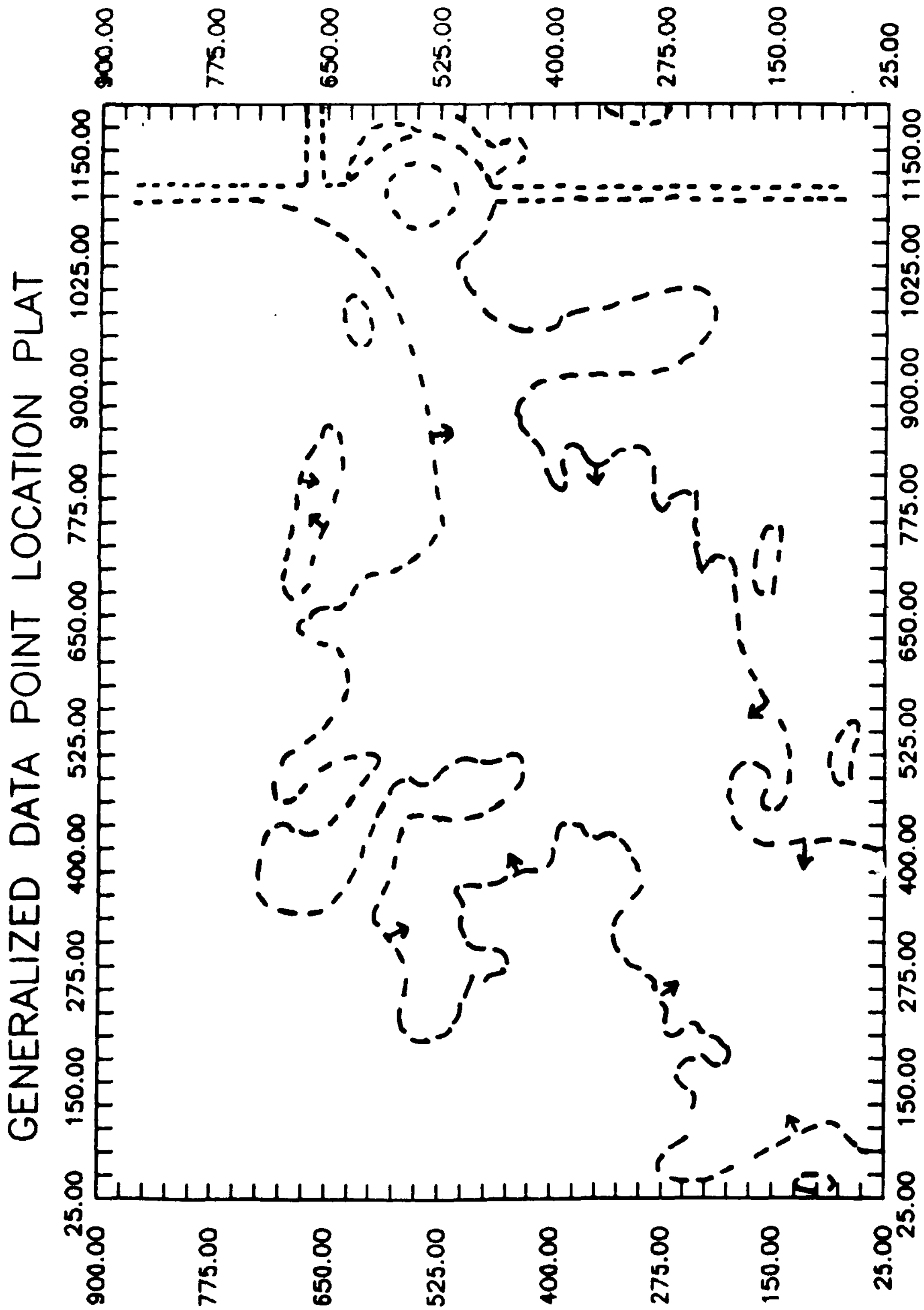
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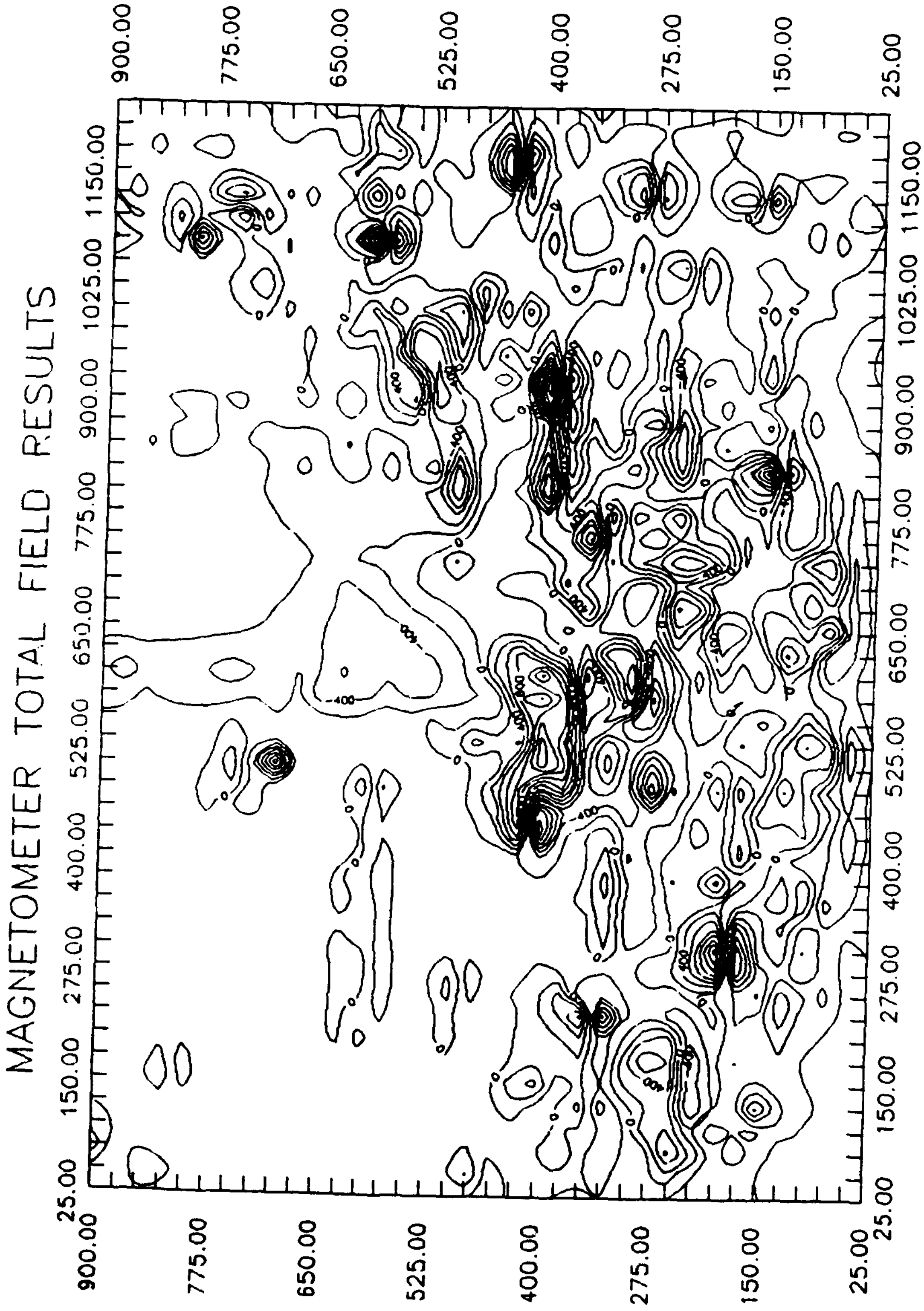
FIGURE 2



MAGNETOMETER TOTAL FIELD RESULTS
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150.00
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525.00
650.00
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FIGURE 3

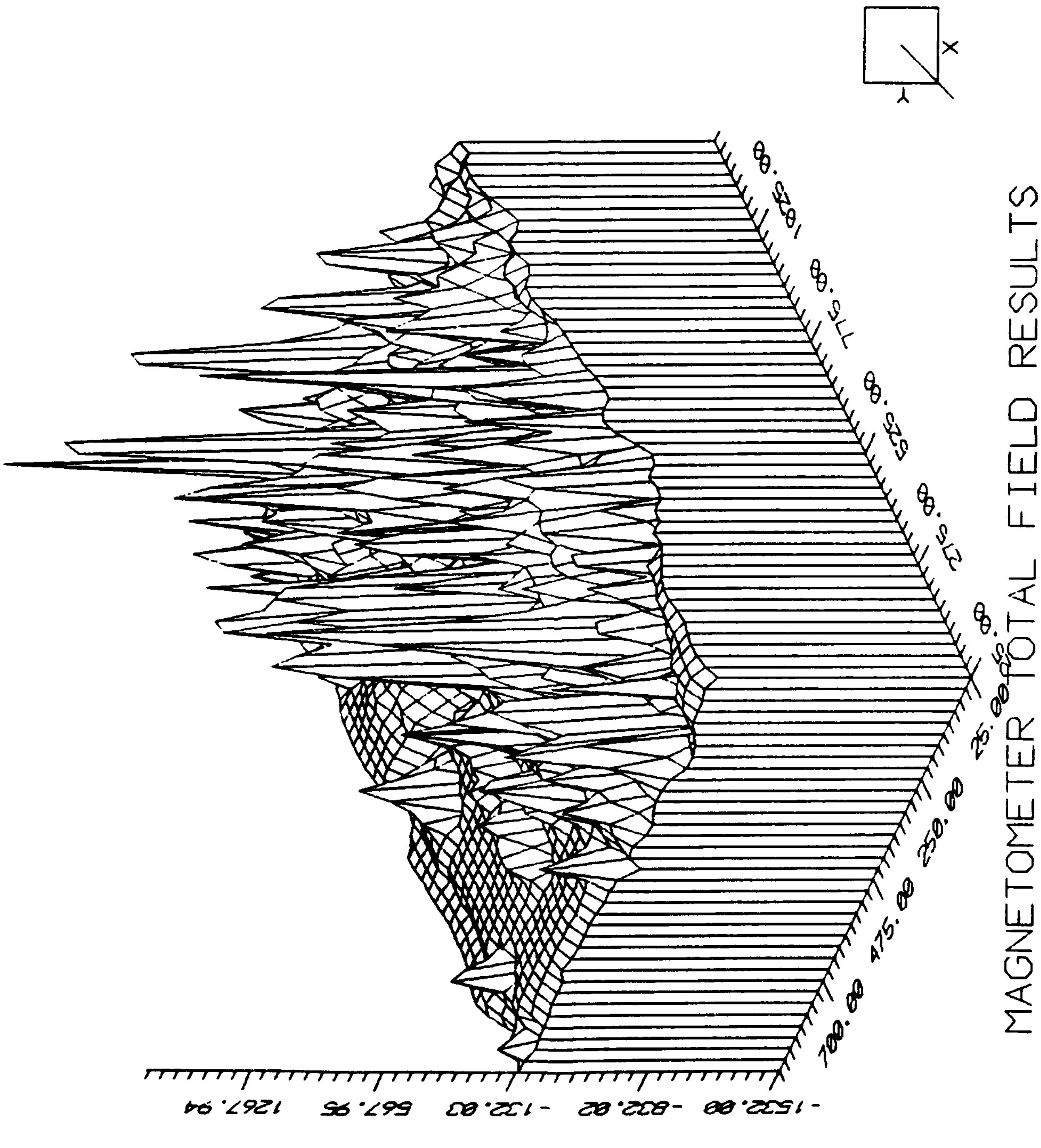
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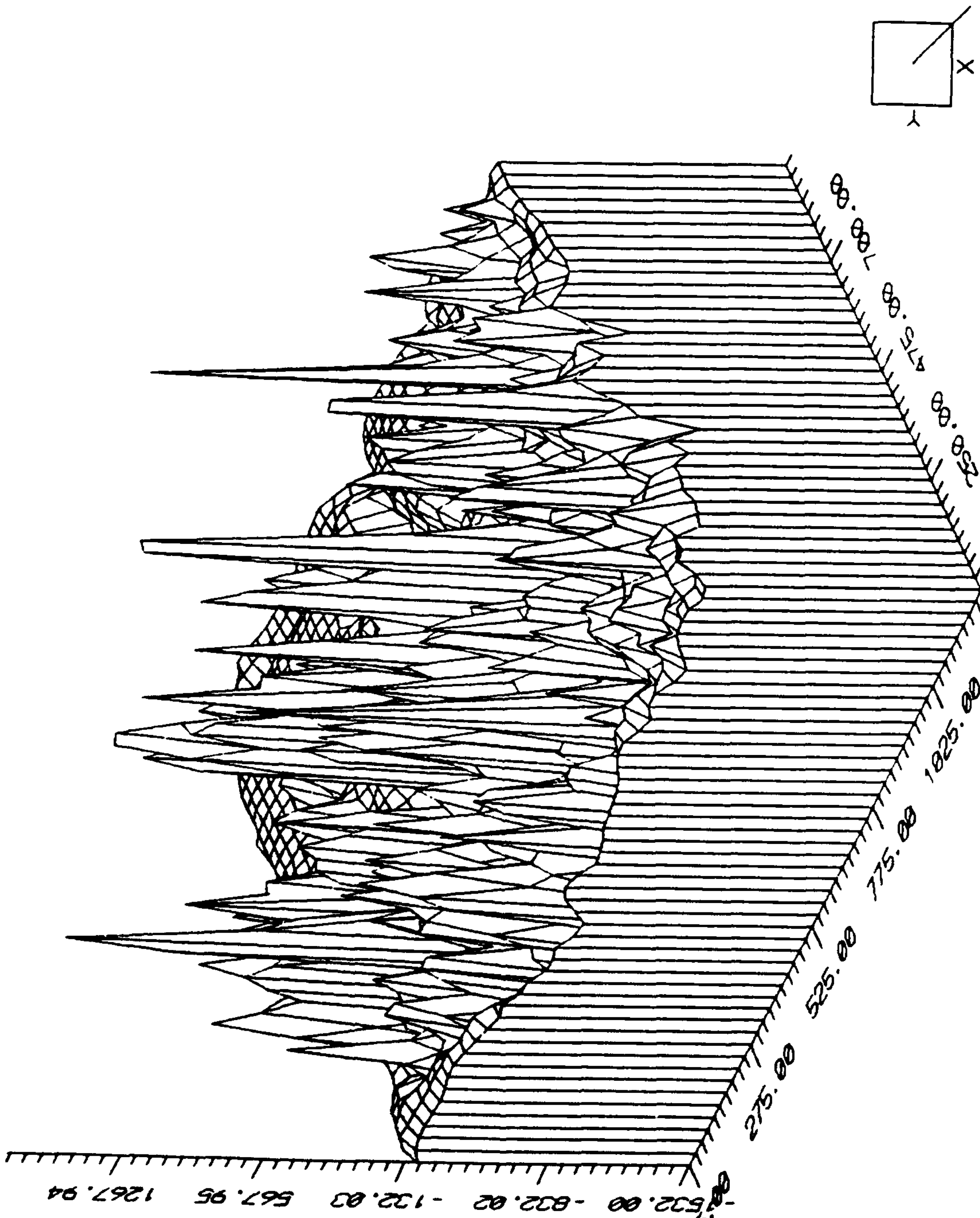
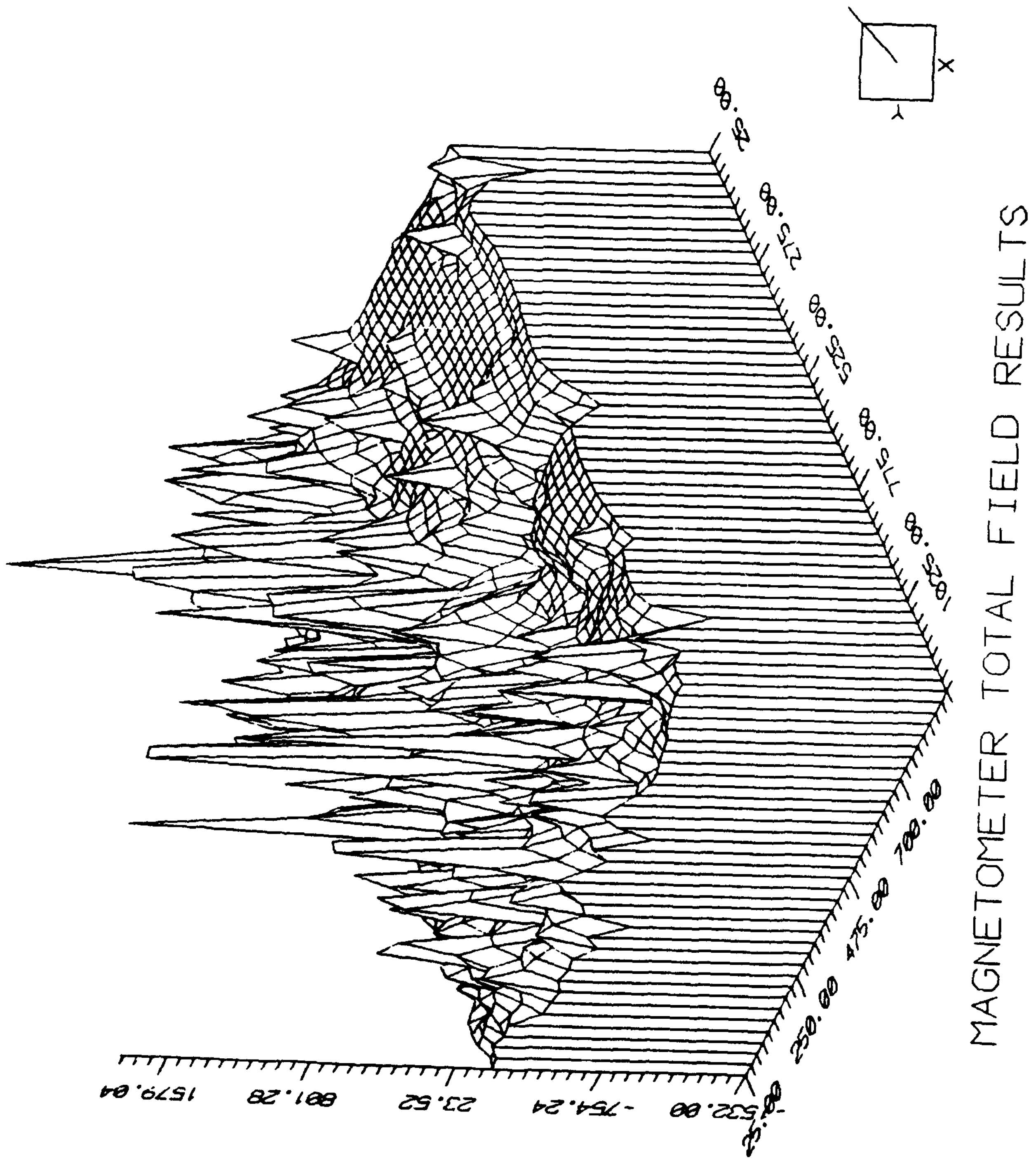
FIGURE 4



MAGNETOMETER TOTAL FIELD RESULTS

FIGURE 5



MAGNETOMETER TOTAL FIELD RESULTS
X
Y
1579.04
801.28
23.52
-754.24
250.00
475.00
700.00
275.00
525.00
775.00
1025.00

FIGURE 6

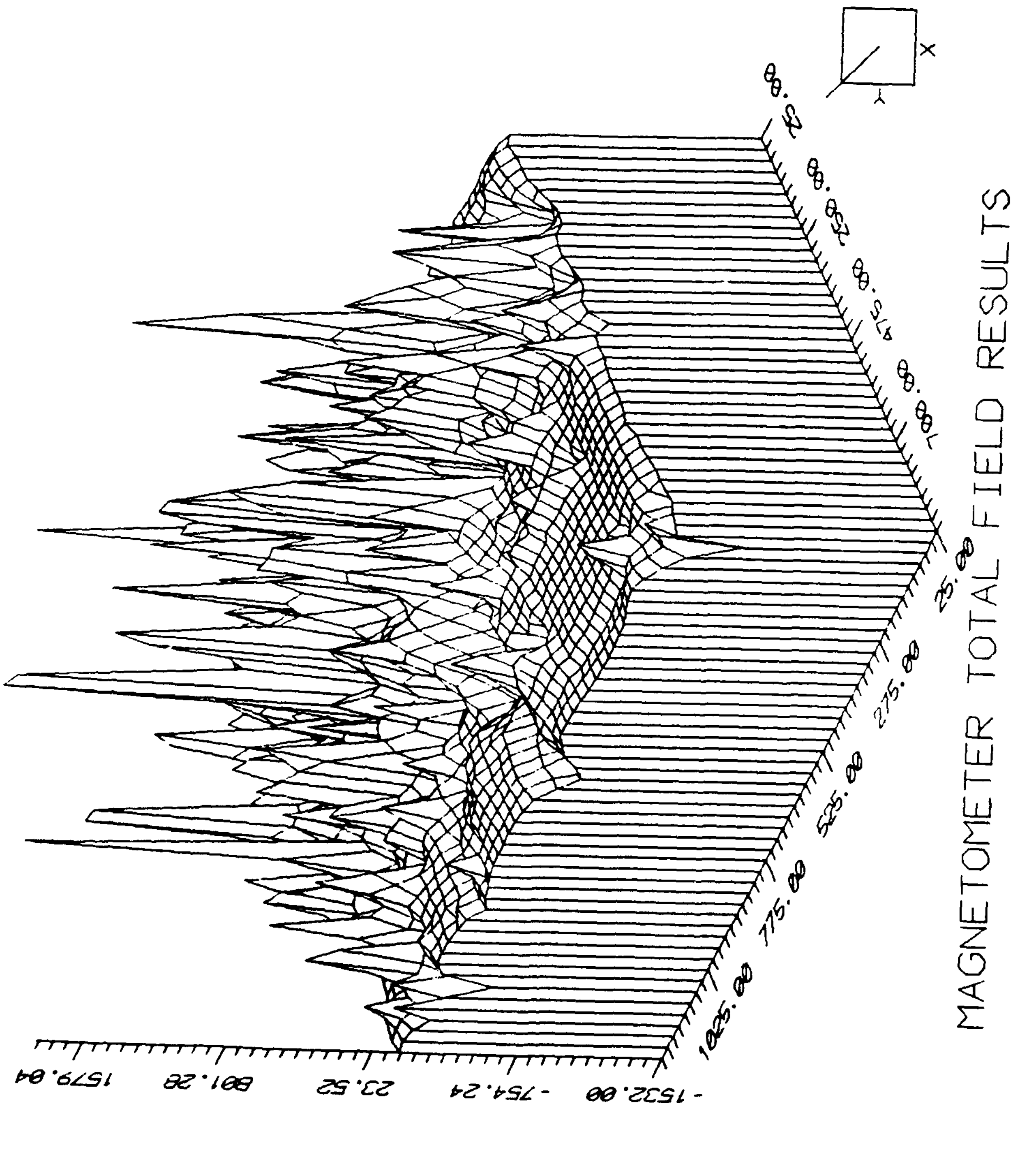

MAGNETOMETER TOTAL FIELD RESULTS
X
Y
25.00
250.00
475.00
700.00
25.00
275.00
525.00
775.00
1025.00
-1532.00
-754.24
23.52
801.28
1579.04

FIGURE 7

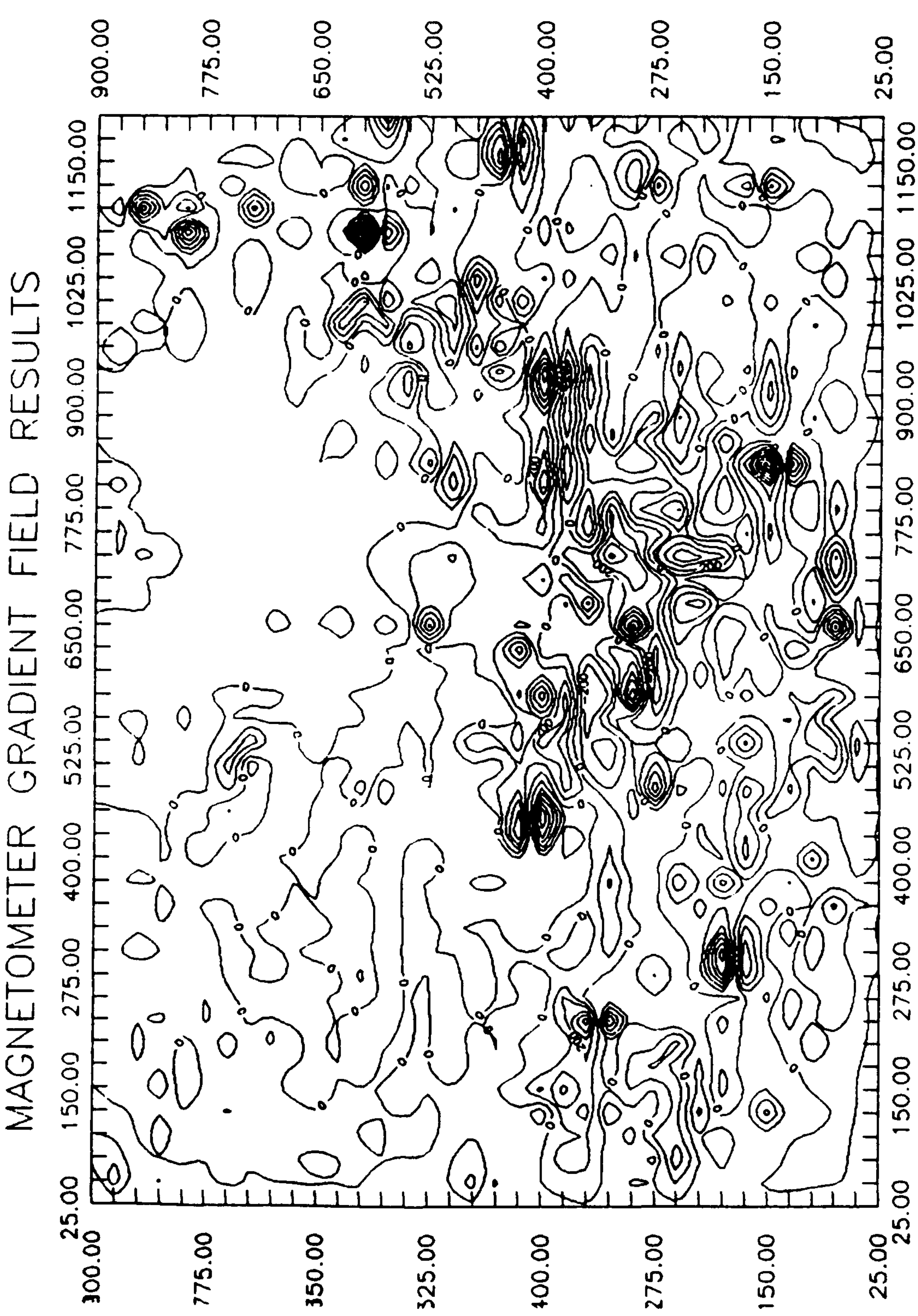

MAGNETOMETER GRADIENT FIELD RESULTS
25.00
150.00
275.00
400.00
525.00
650.00
775.00
900.00
1025.00
1150.00
900.00
775.00
650.00
525.00
400.00
275.00
150.00
25.00

FIGURE 8

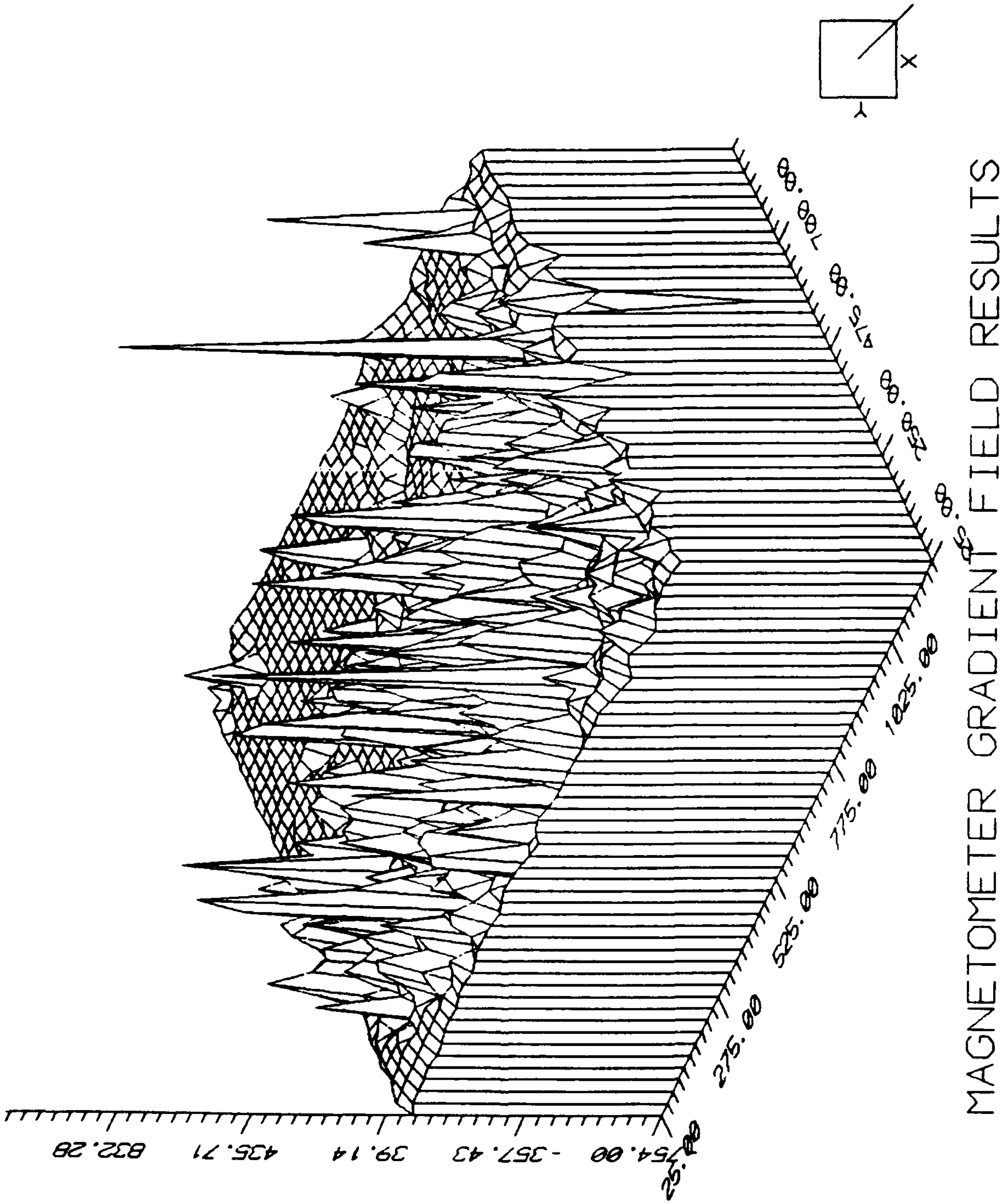

MAGNETOMETER GRADIENT FIELD RESULTS
X
Y
25.00
275.00
525.00
775.00
1025.00
25.00
250.00
475.00
700.00
-754.00
-357.43
39.14
435.71
832.28

FIGURE 9

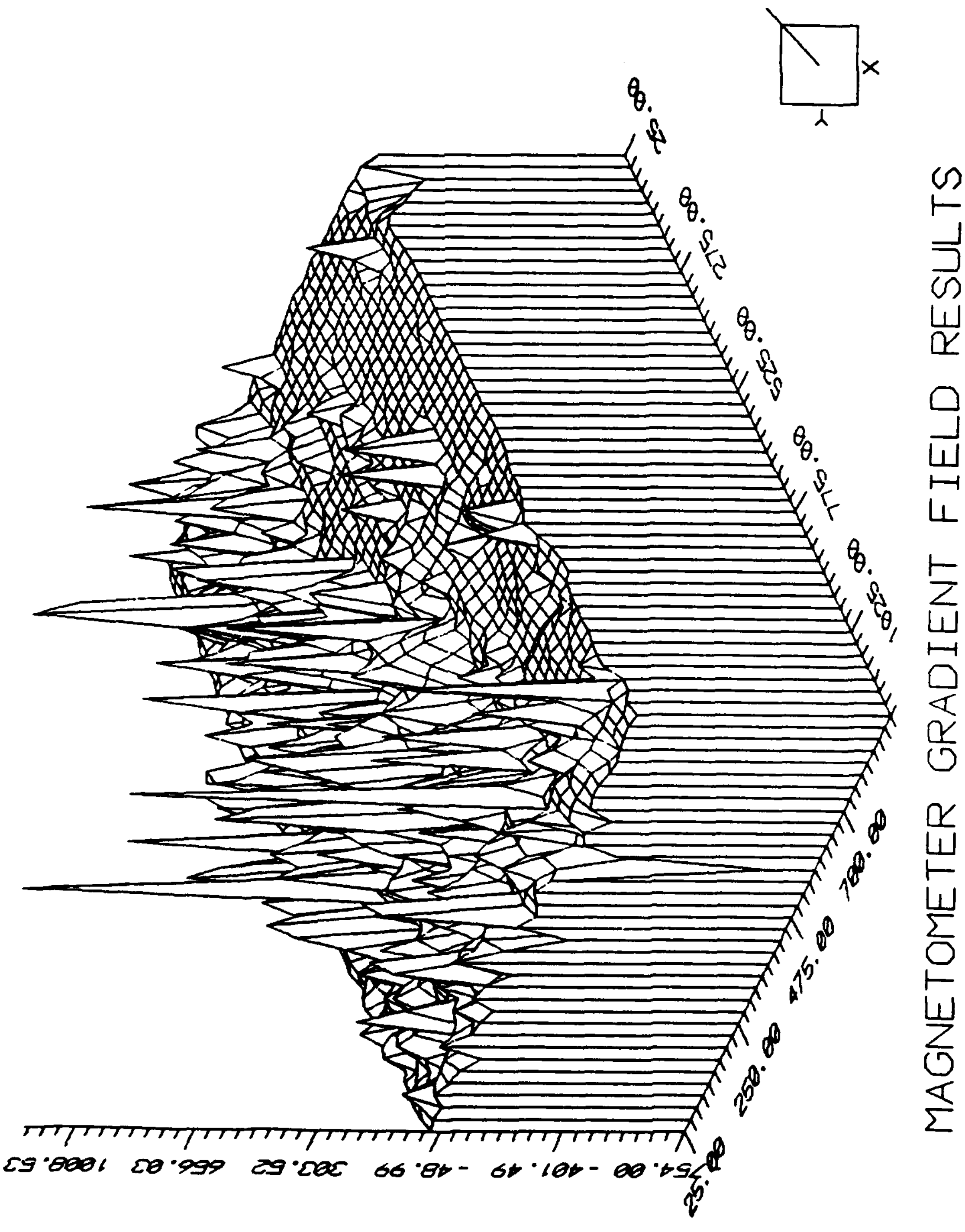
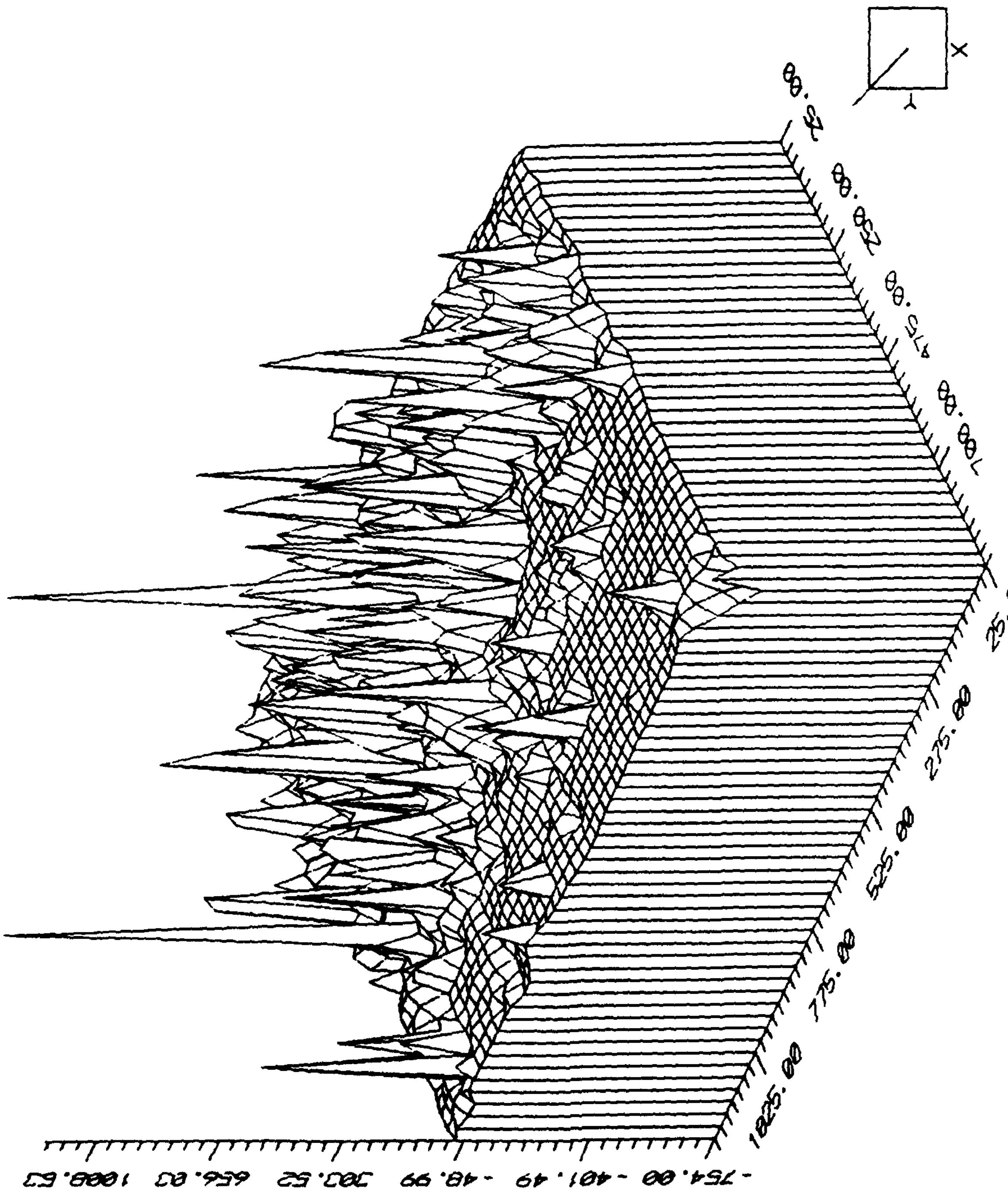
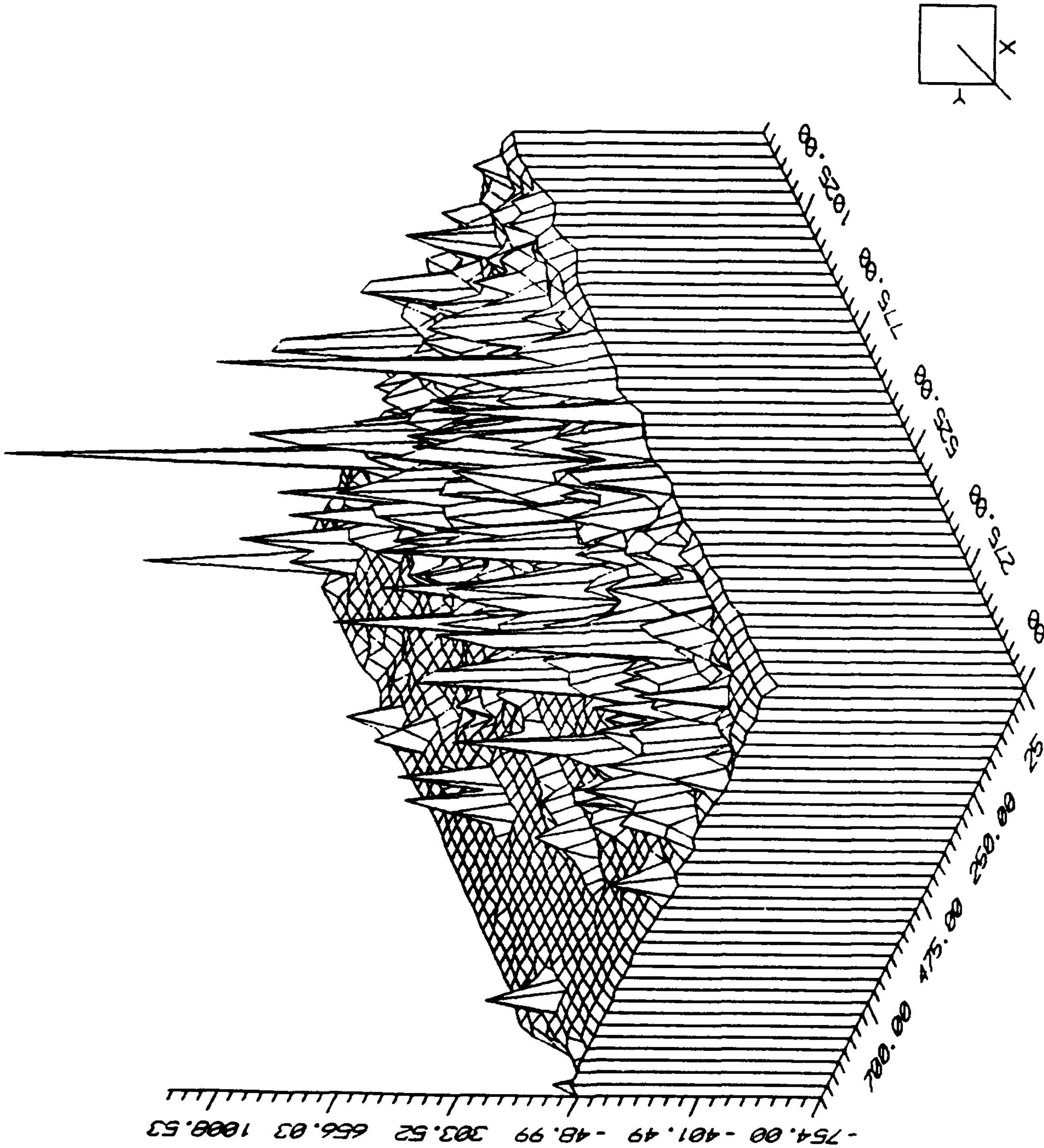

MAGNETOMETER GRADIENT FIELD RESULTS
X
Y
25.00
250.00
475.00
700.00
275.00
525.00
775.00
1025.00
-754.00
-401.49
-48.99
303.52
656.03
1008.53

FIGURE 10



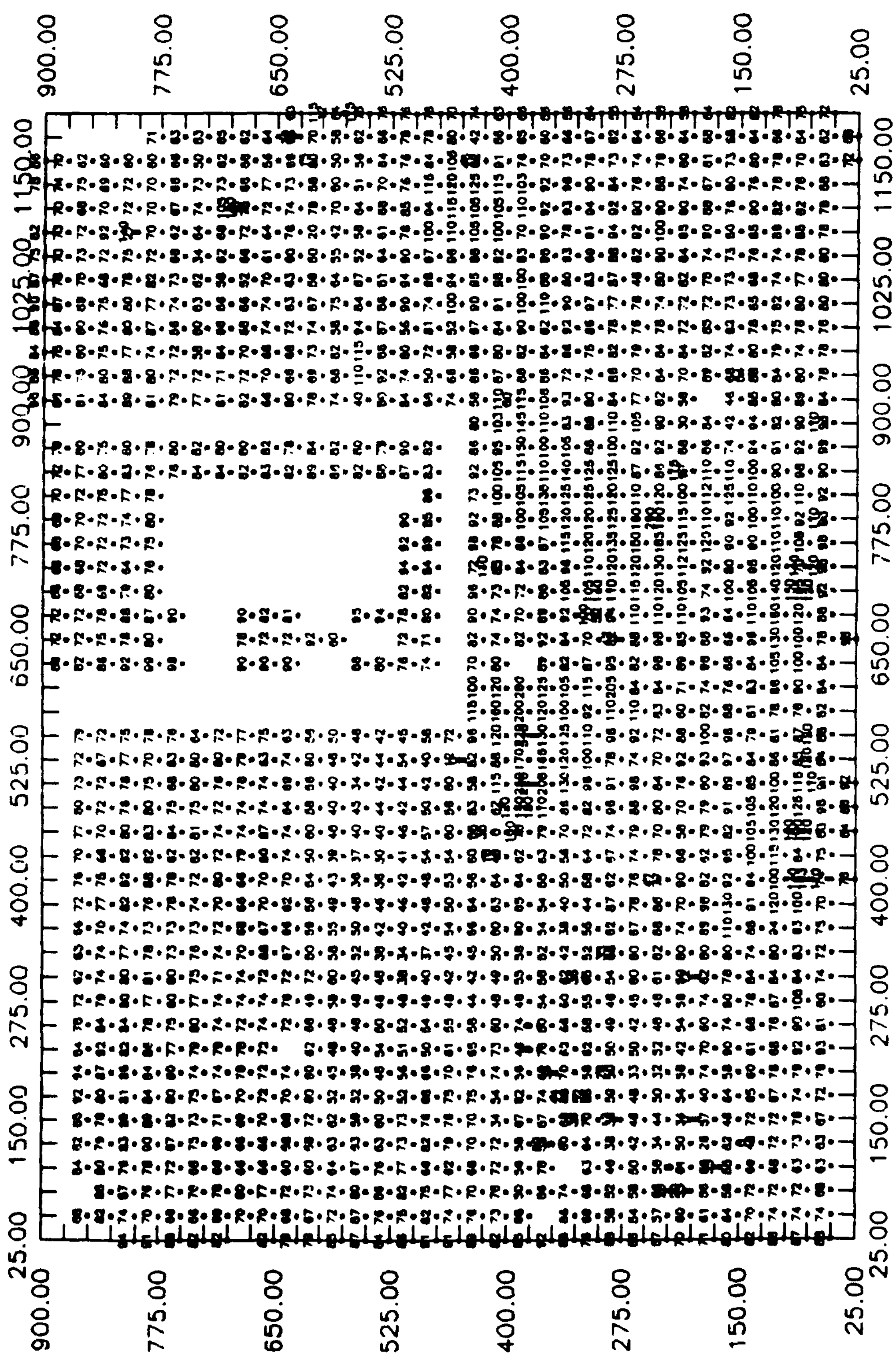
MAGNETOMETER GRADIENT FIELD RESULTS

FIGURE 11



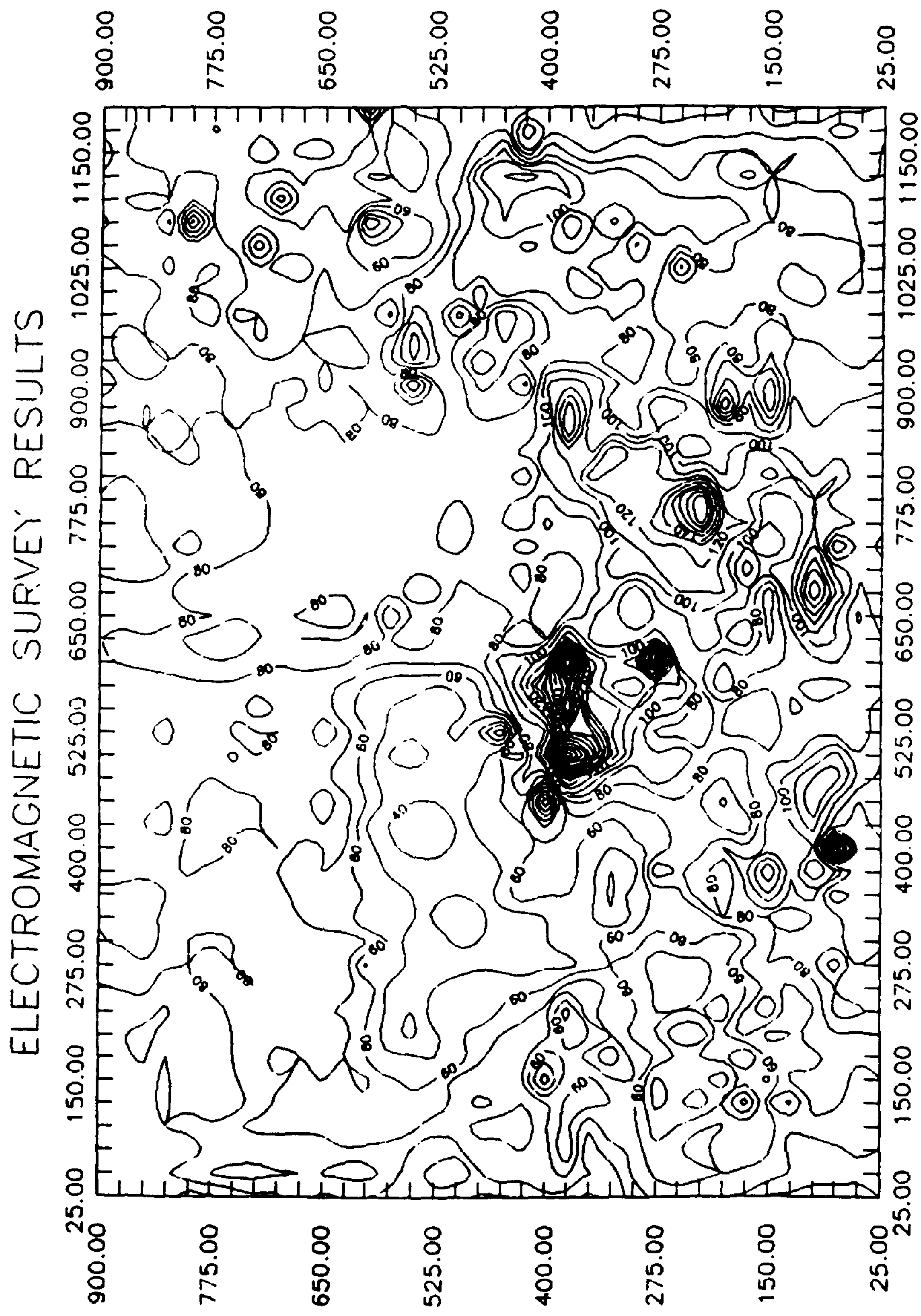
MAGNETOMETER GRADIENT FIELD RESULTS

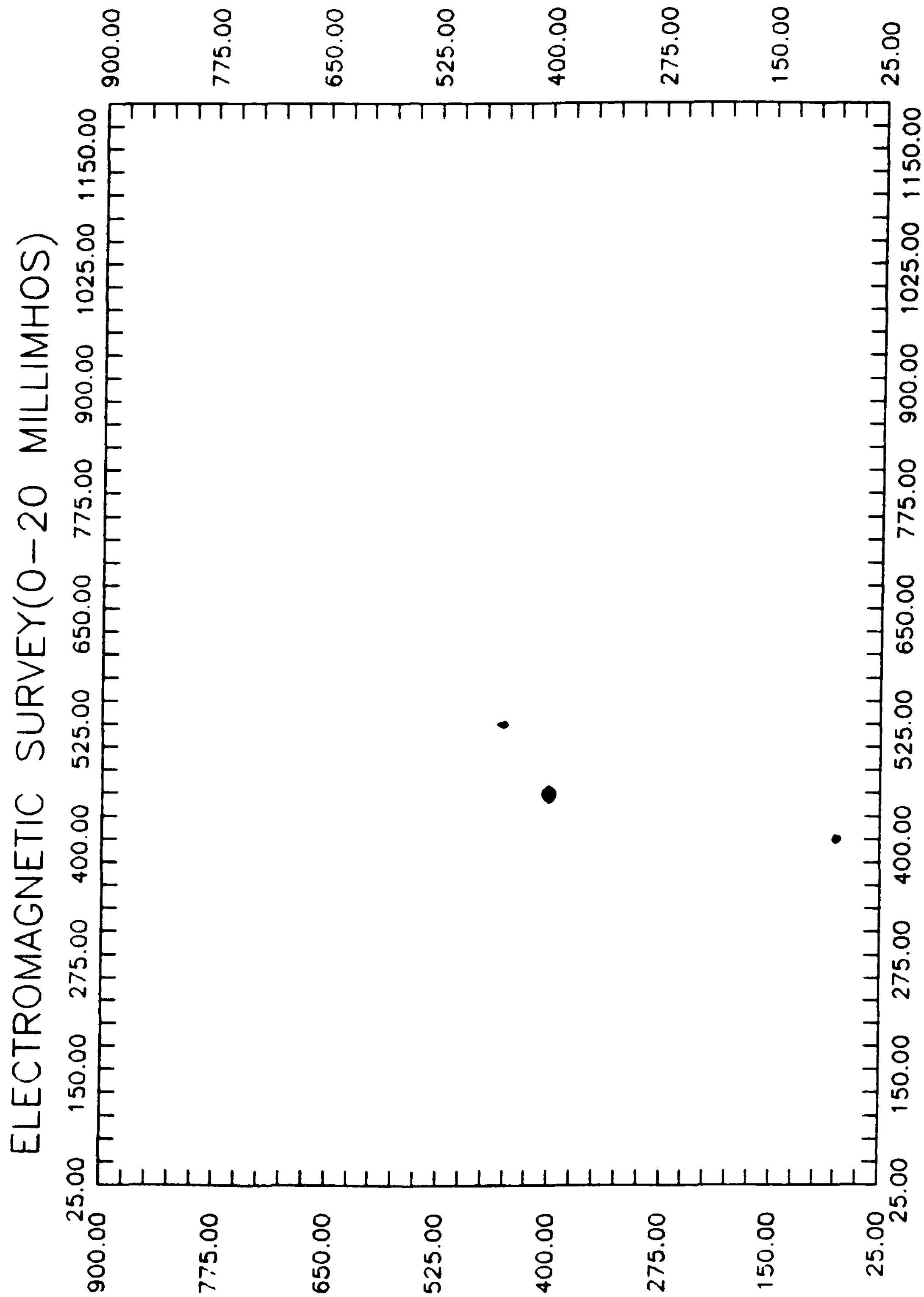
FIGURE 12



ELECTROMAGNETIC SURVEY MAPPING POINTS

FIGURE 13

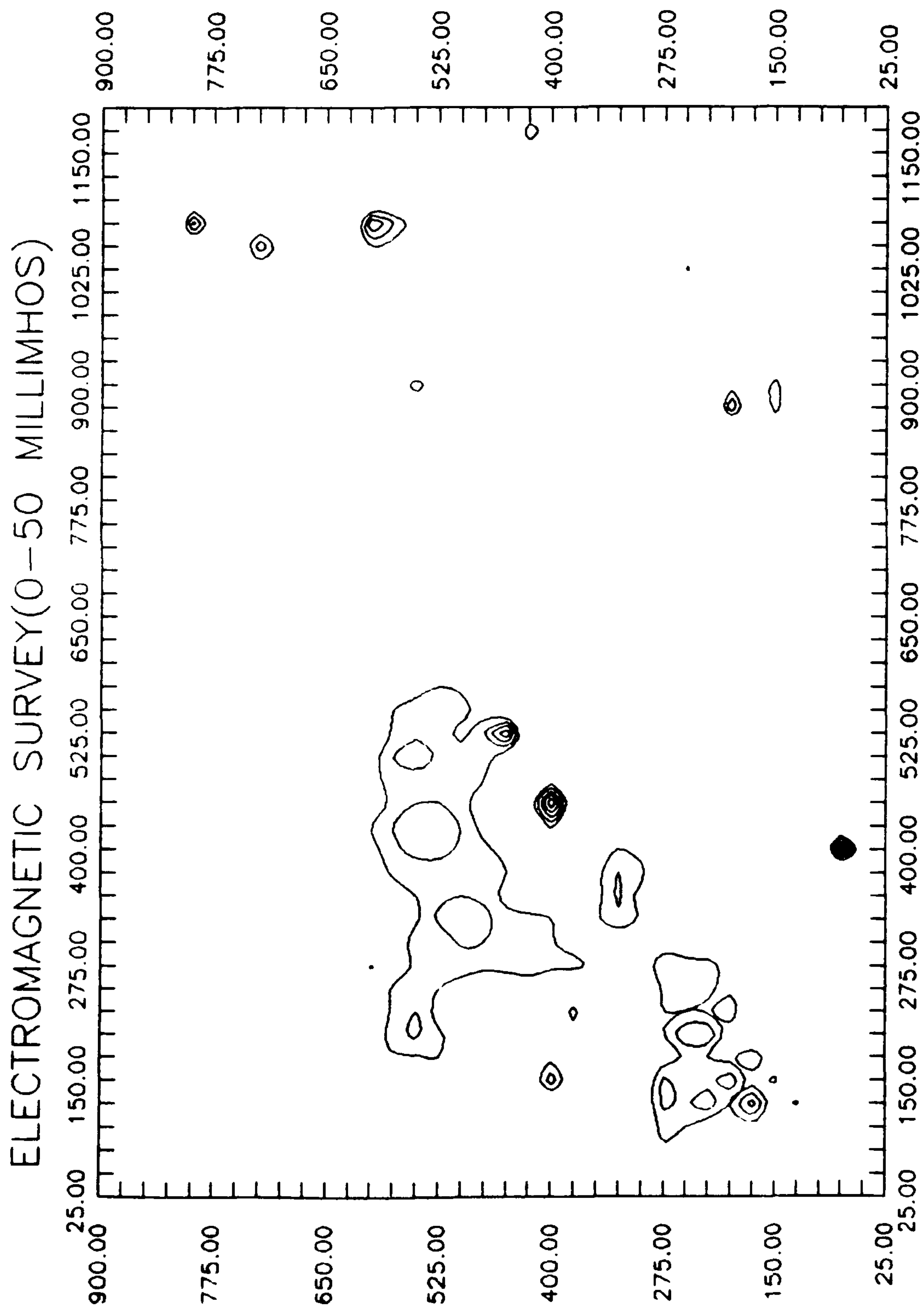

ELECTROMAGNETIC SURVEY RESULTS
25.00
150.00
275.00
400.00
525.00
650.00
775.00
900.00
1025.00
1150.00
900.00
775.00
650.00
525.00
400.00
275.00
150.00
25.00



ELECTROMAGNETIC SURVEY(0–20 MILLIMHOS)
25.00
150.00
275.00
400.00
525.00
650.00
775.00
900.00
1025.00
1150.00
900.00
775.00
650.00
525.00
400.00
275.00
150.00
25.00

FIGURE 14

FIGURE 15



ELECTROMAGNETIC SURVEY(0−50 MILLIMHOS)
25.00
150.00
275.00
400.00
525.00
650.00
775.00
900.00
1025.00
1150.00

FIGURE 16

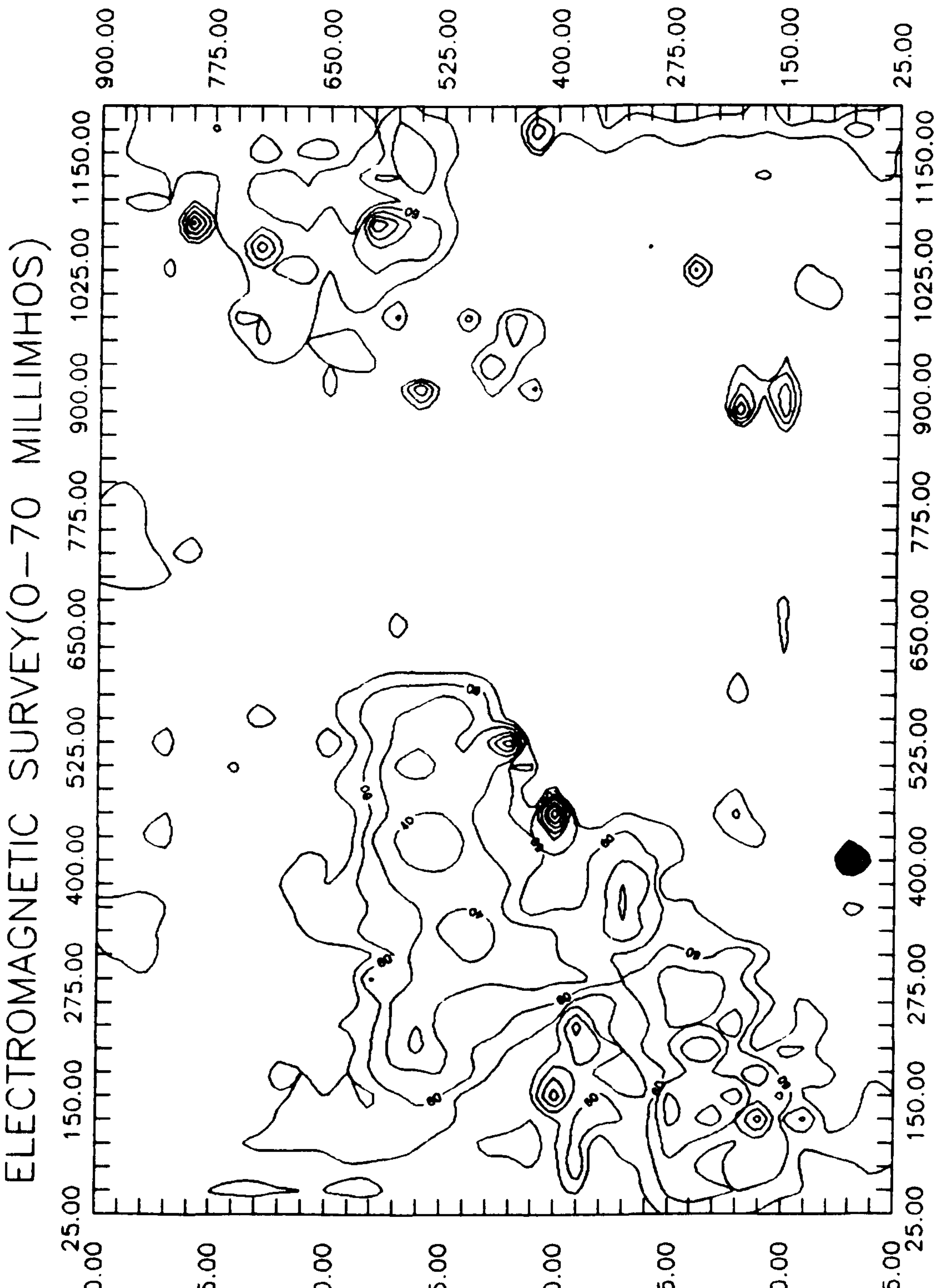

ELECTROMAGNETIC SURVEY(0–70 MILLIMHOS)
25.00 150.00 275.00 400.00 525.00 650.00 775.00 900.00 1025.00 1150.00
900.00 775.00 650.00 525.00 400.00 275.00 150.00 25.00

FIGURE 17

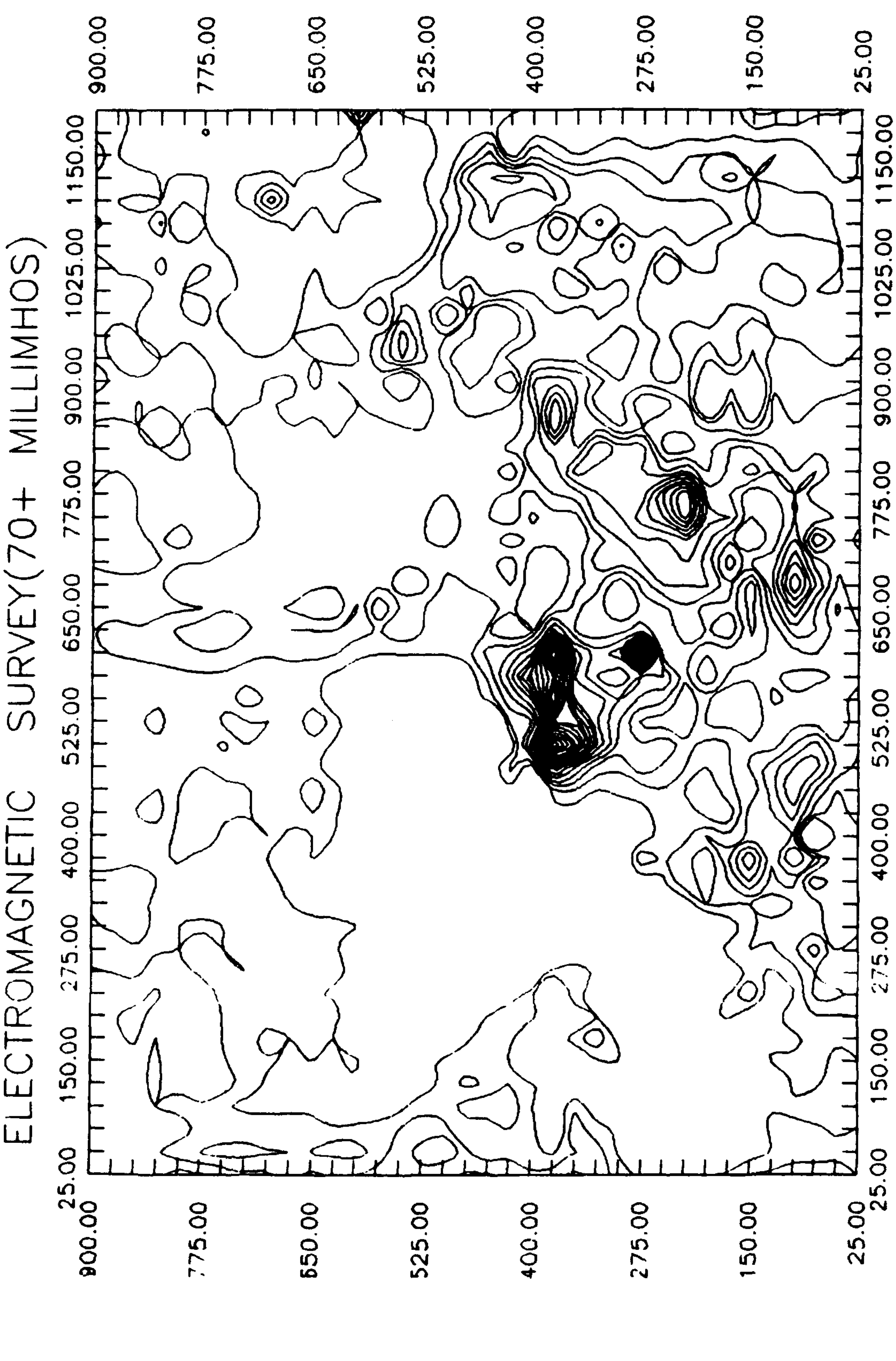
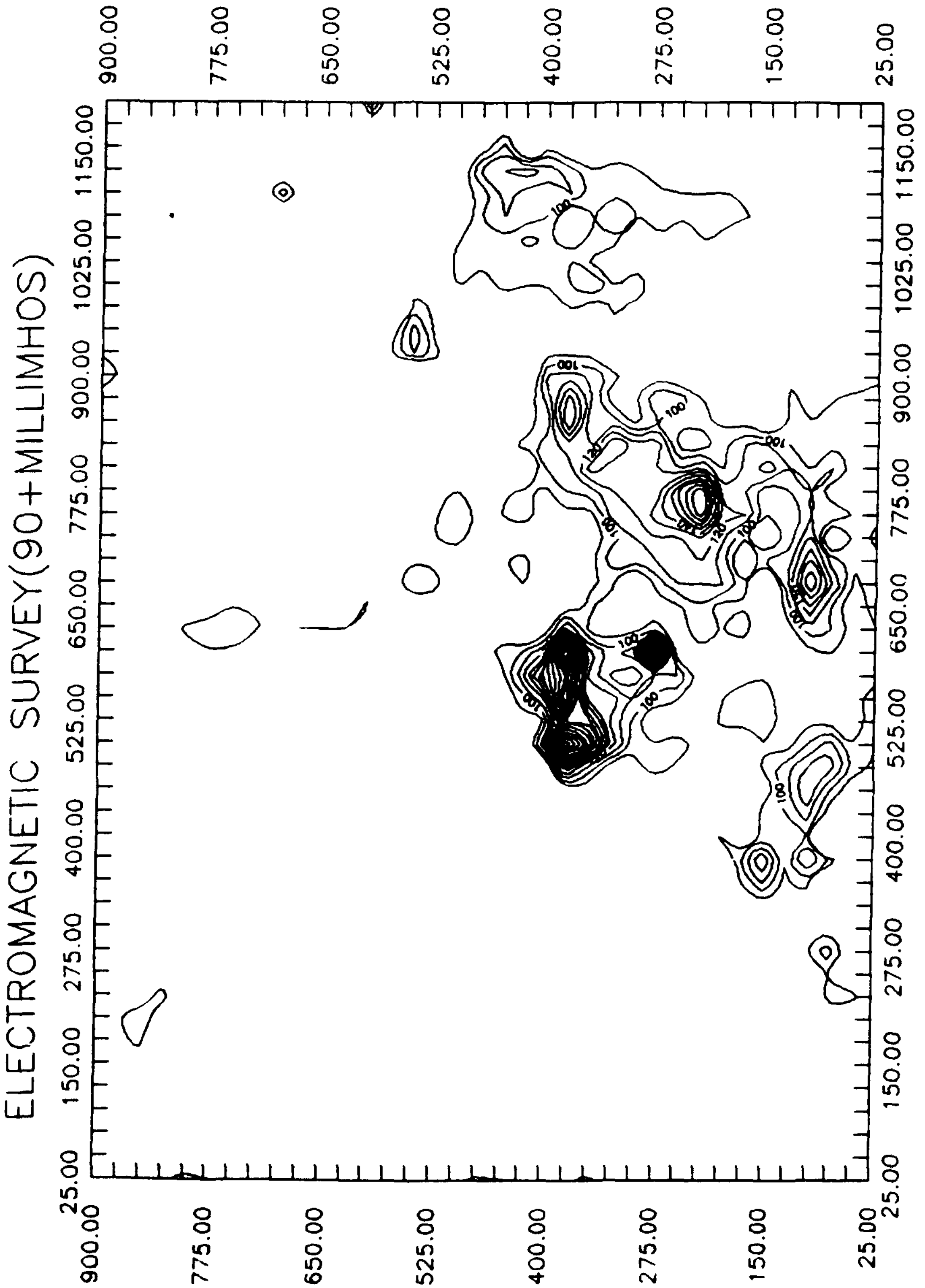

ELECTROMAGNETIC SURVEY(70+ MILLIMHOS)
25.00
150.00
275.00
400.00
525.00
650.00
775.00
900.00
1025.00
1150.00
900.00
775.00
650.00
525.00
400.00
275.00
150.00
25.00

FIGURE 18



ELECTROMAGNETIC SURVEY(90+MILLIMHOS)
25.00
150.00
275.00
400.00
525.00
650.00
775.00
900.00
1025.00
1150.00
100
120

FIGURE 19

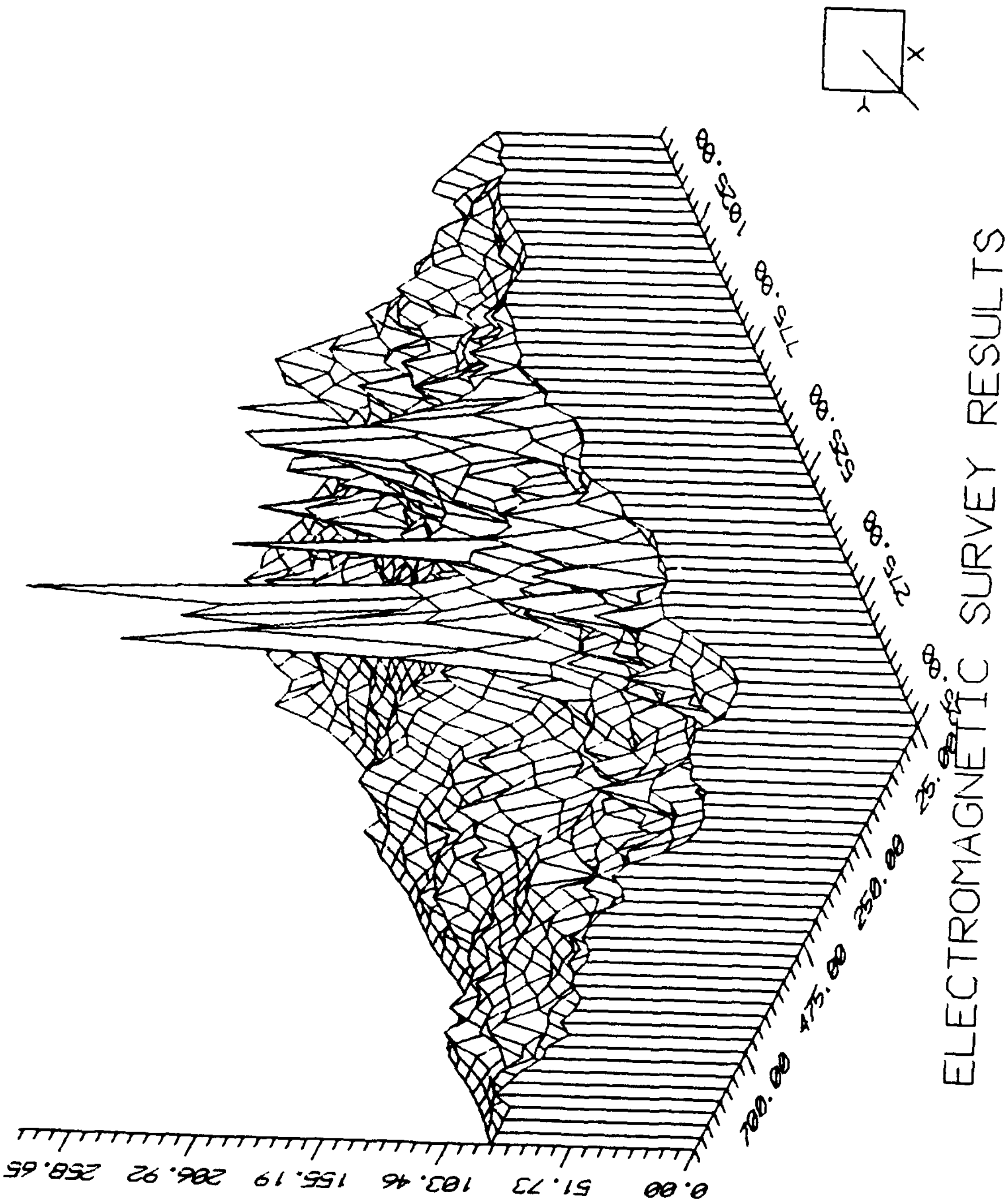
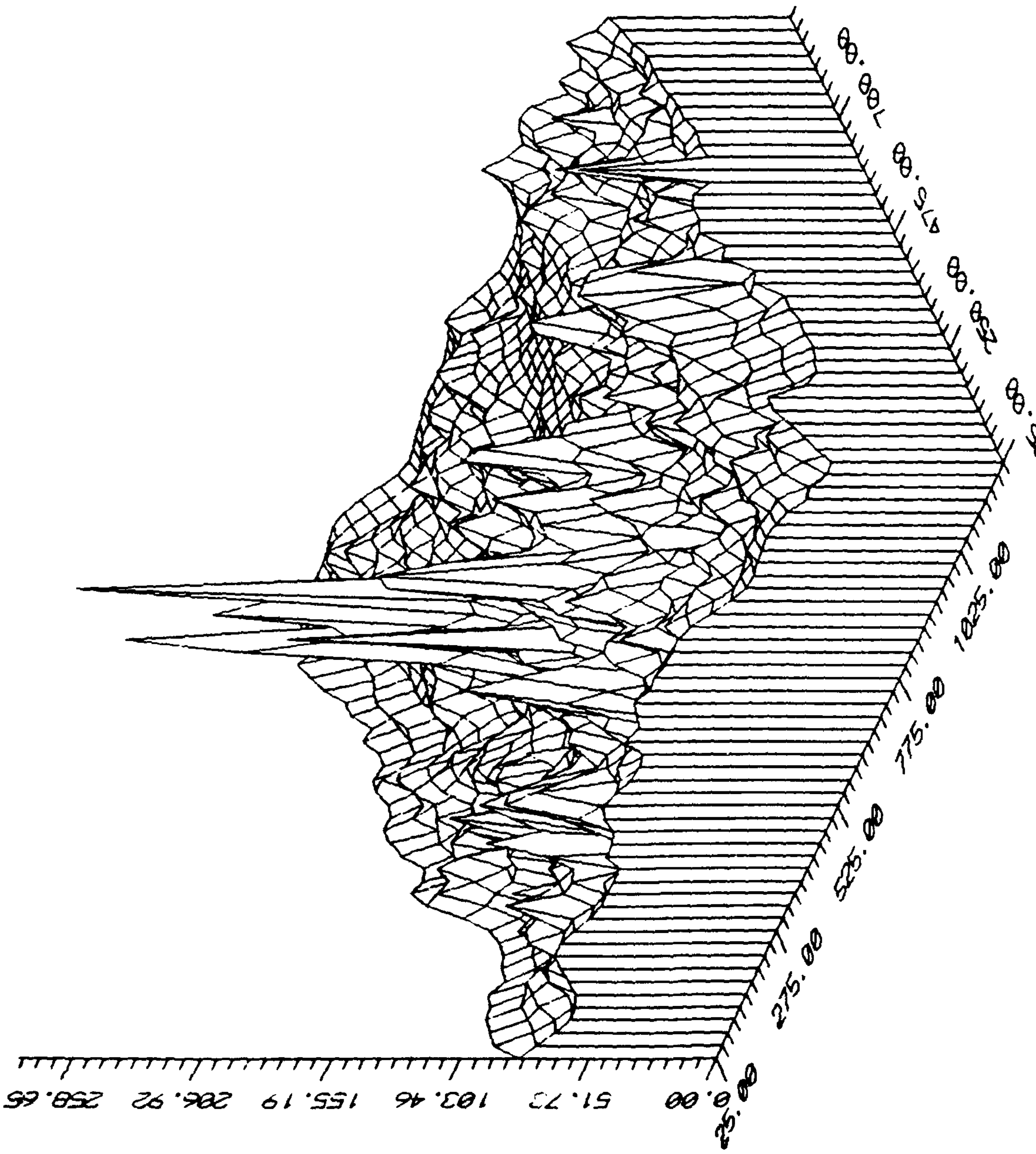

ELECTROMAGNETIC SURVEY RESULTS
X
Y
0.00
51.73
103.46
155.19
206.92
258.65
25.00
250.00
475.00
700.00
275.00
525.00
775.00
1025.00

FIGURE 20



ELECTROMAGNETIC SURVEY RESULTS

FIGURE 21

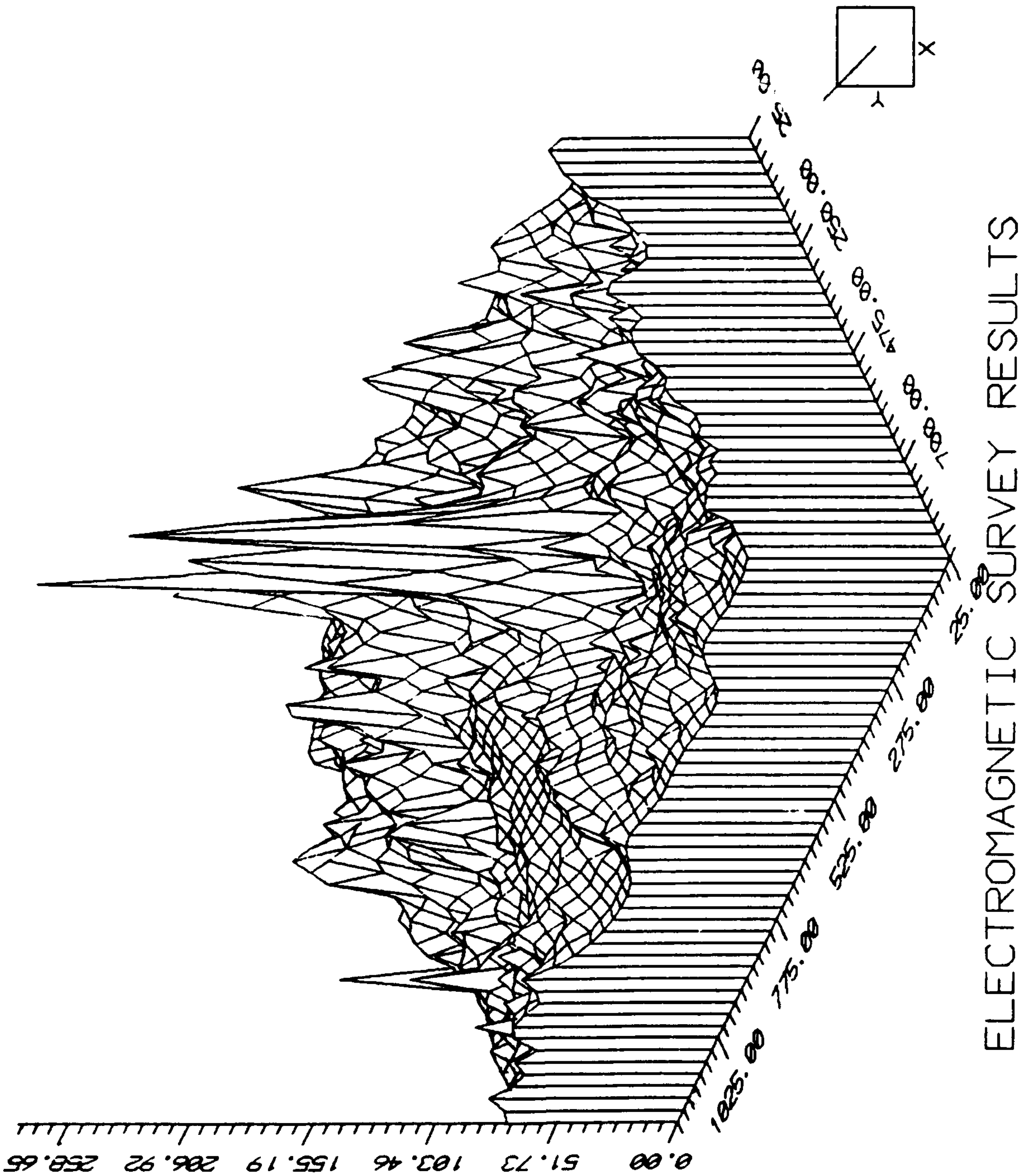
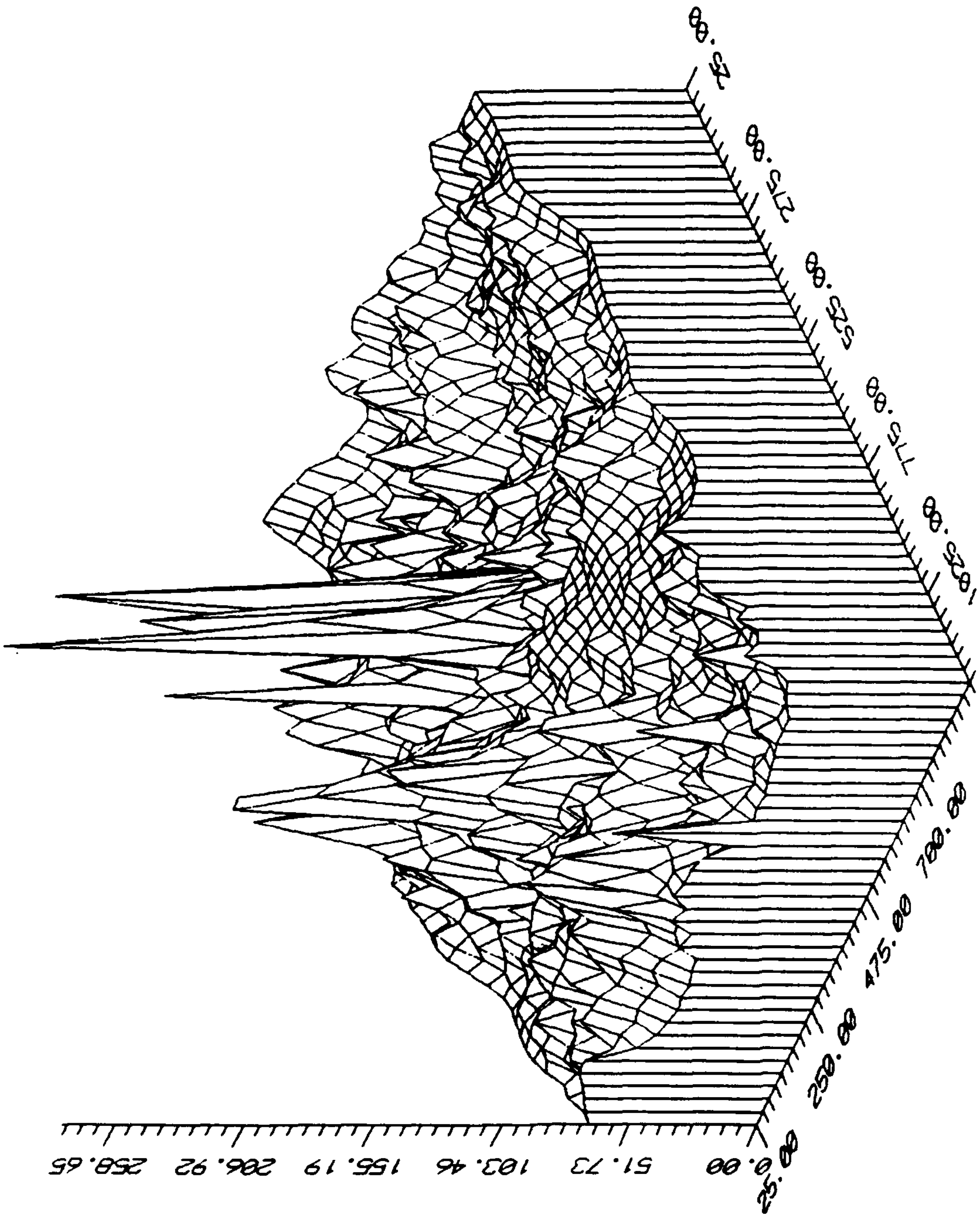

ELECTROMAGNETIC SURVEY RESULTS
0.00
51.73
103.46
155.19
206.92
258.65
1025.00
775.00
525.00
275.00
25.00
700.00
475.00
250.00
X
Y

FIGURE 22



ELECTROMAGNETIC SURVEY RESULTS

FIGURE 23

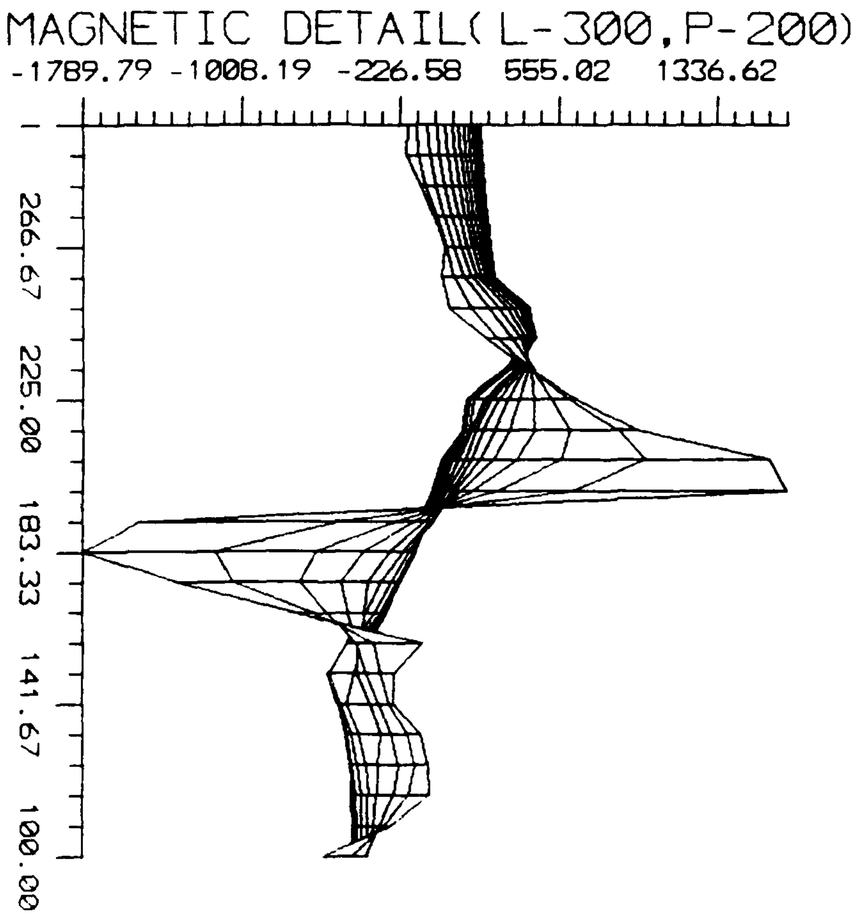
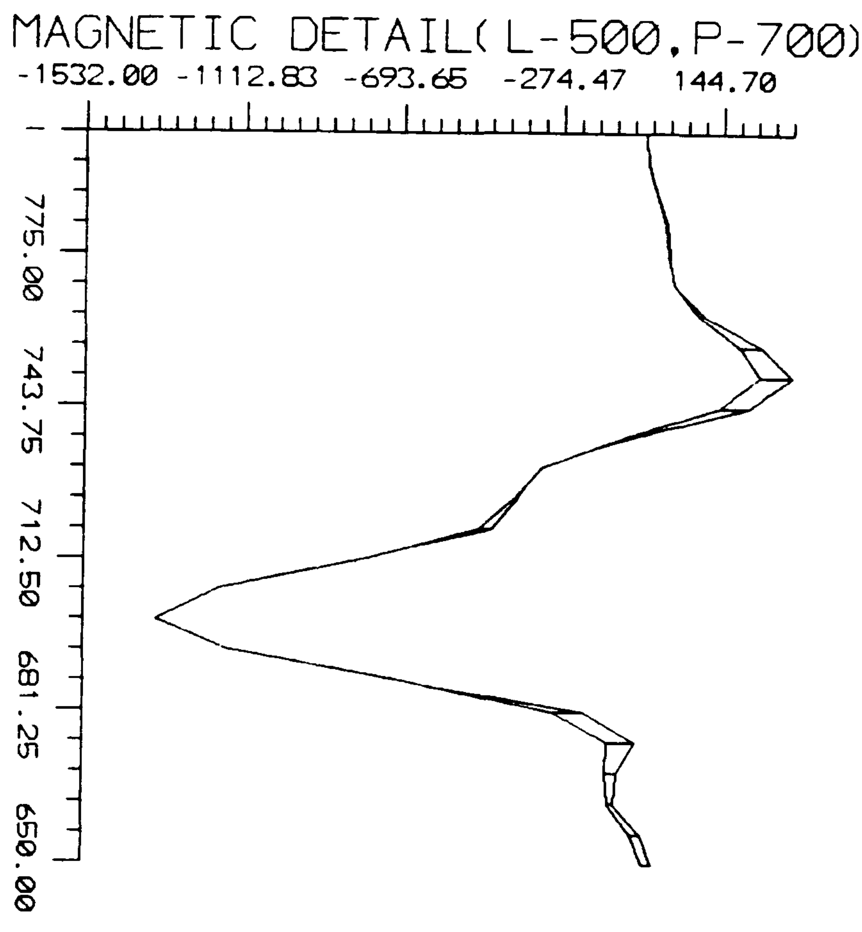
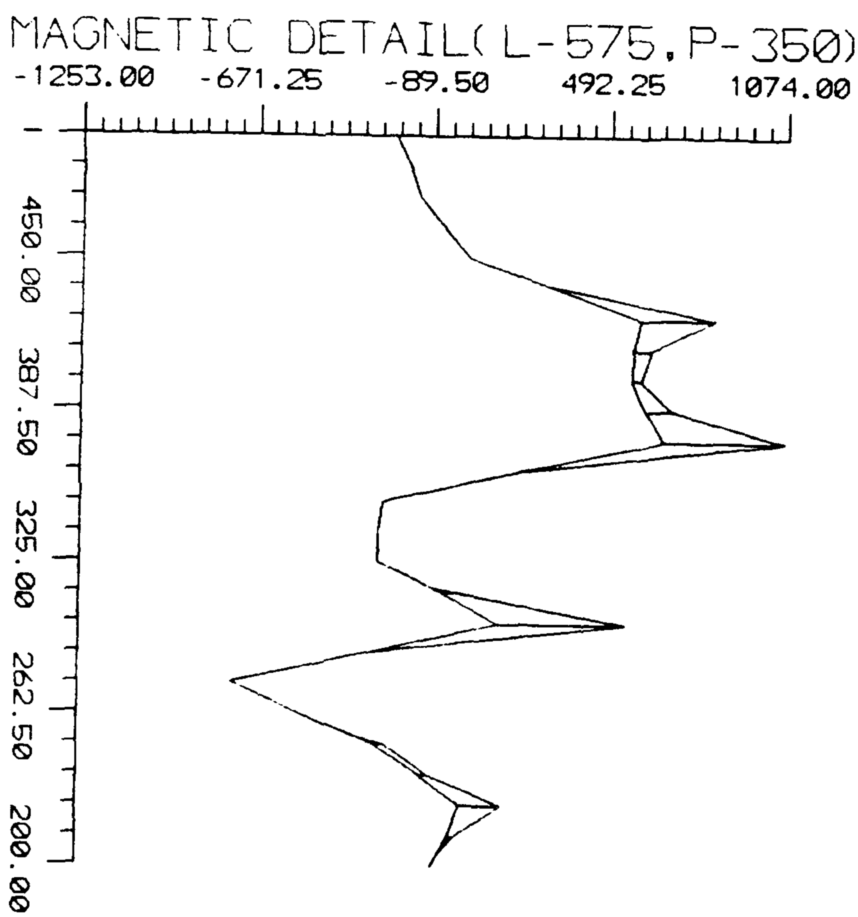

MAGNETIC DETAIL(L-300,P-200)
-1789.79 -1008.19 -226.58 555.02 1336.62
266.67
225.00
183.33
141.67
100.00

FIGURE 24



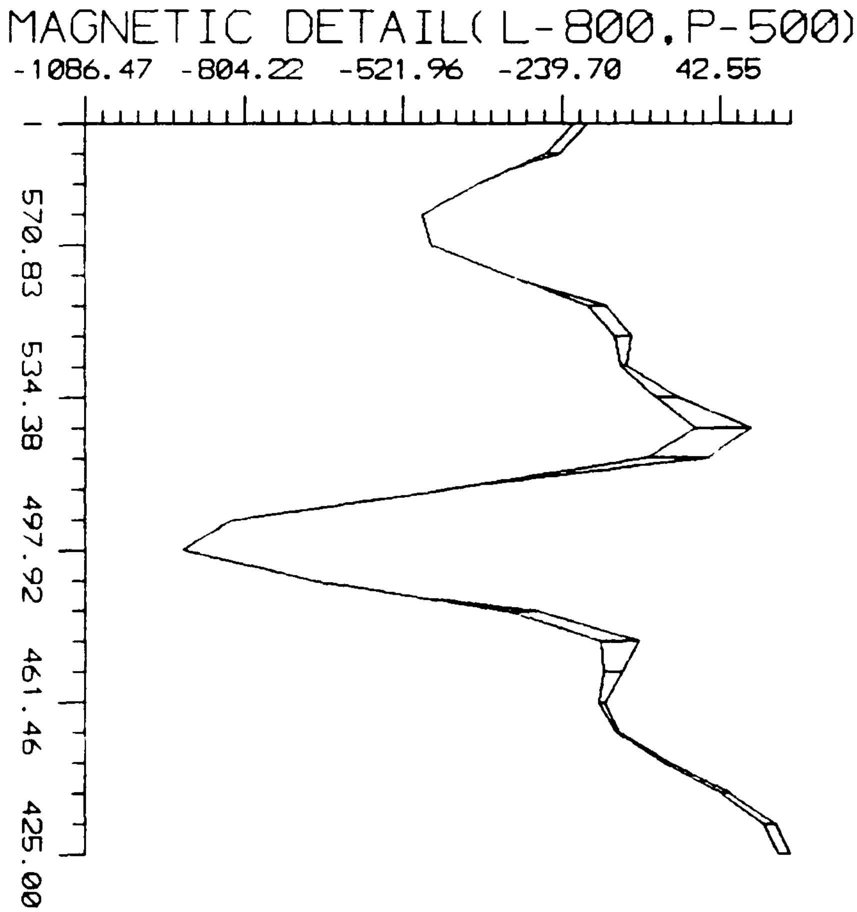
MAGNETIC DETAIL(L-500,P-700)
-1532.00 -1112.83 -693.65 -274.47 144.70
775.00
743.75
712.50
681.25
650.00

FIGURE 25



MAGNETIC DETAIL(L-575,P-350)
-1253.00
-671.25
-89.50
492.25
1074.00
450.00
387.50
325.00
262.50
200.00

FIGURE 26



MAGNETIC DETAIL(L-800, P-500)
-1086.47 -804.22 -521.96 -239.70 42.55
570.83
534.38
497.92
461.46
425.00

FIGURE 27

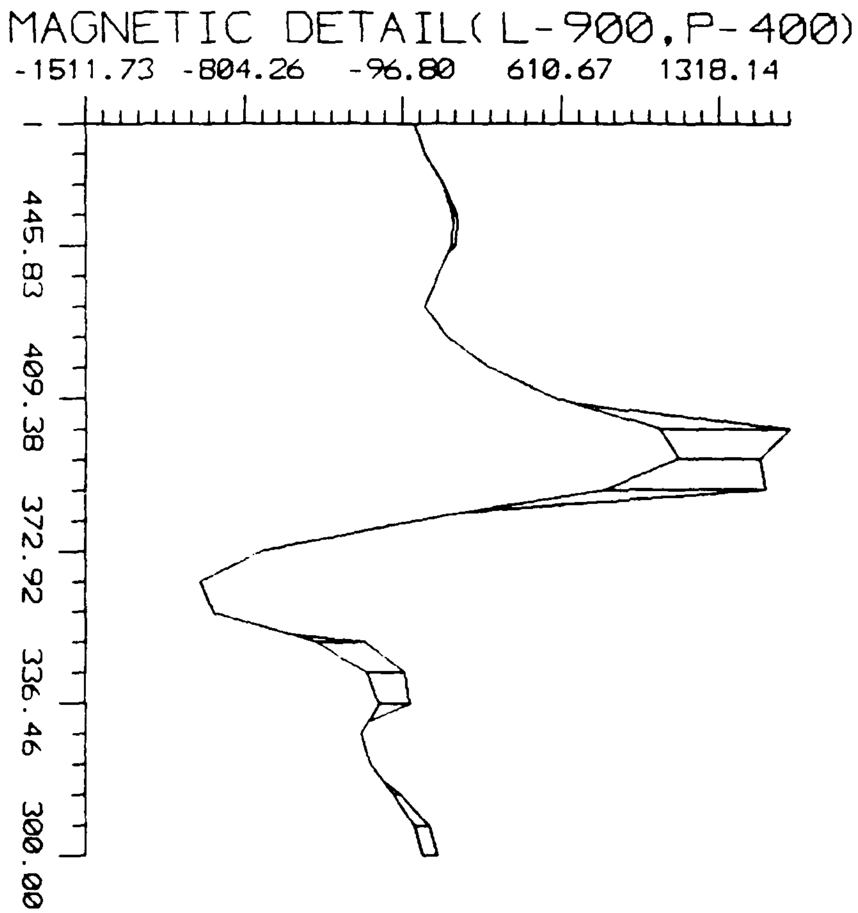

MAGNETIC DETAIL(L-900, P-400)
-1511.73 -804.26 -96.80 610.67 1318.14
445.83
409.38
372.92
336.46
300.00

FIGURE 28

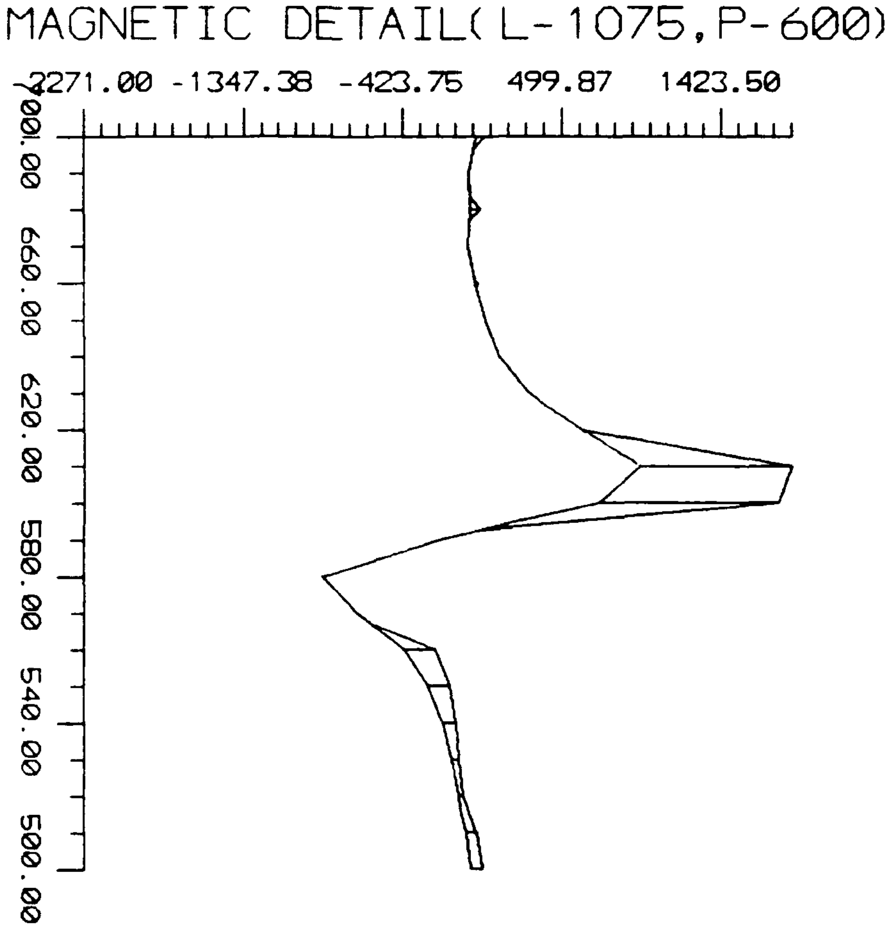

MAGNETIC DETAIL(L-1075,P-600)
-2271.00 -1347.38 -423.75 499.87 1423.50
700.00
660.00
620.00
580.00
540.00
500.00

FIGURE 29

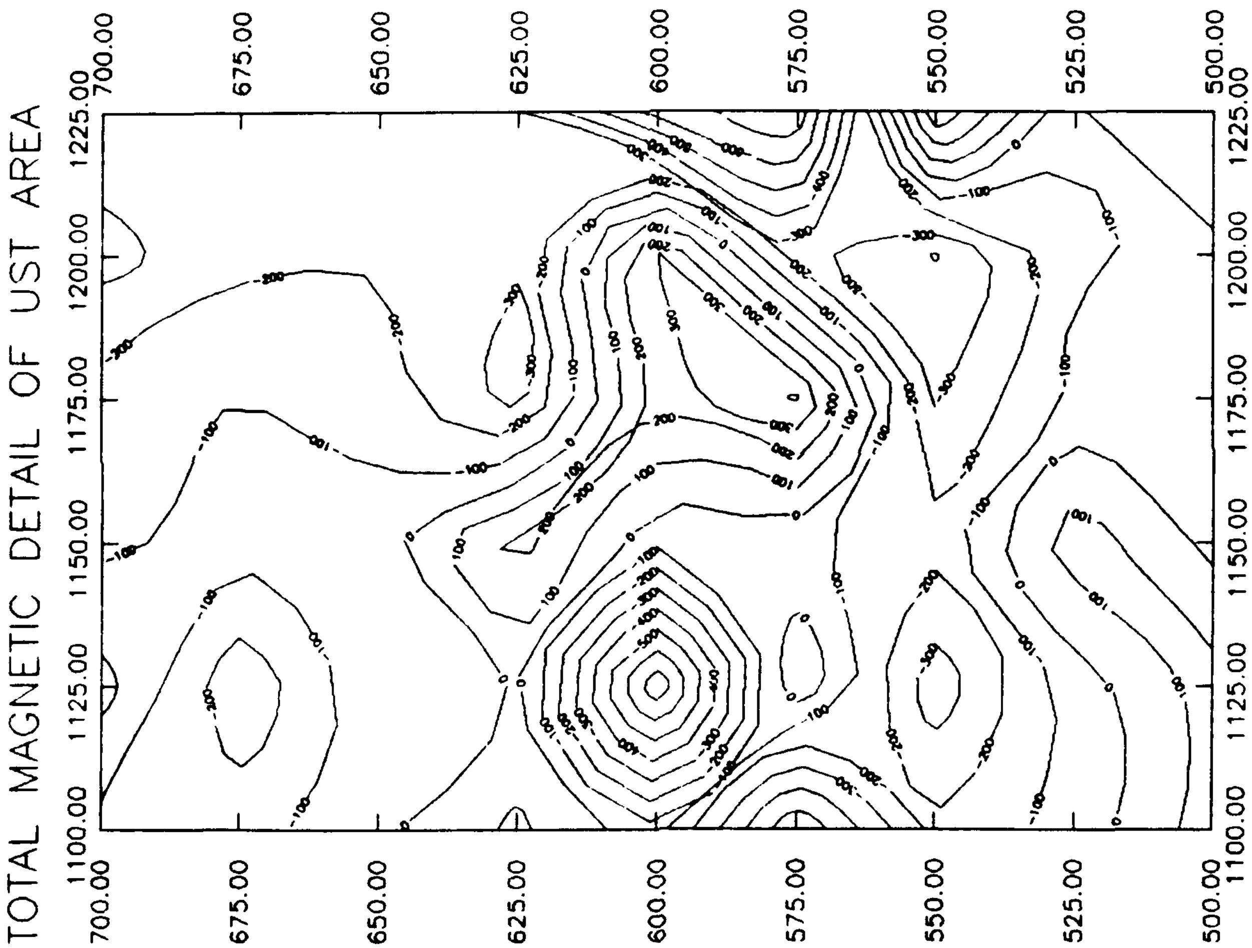
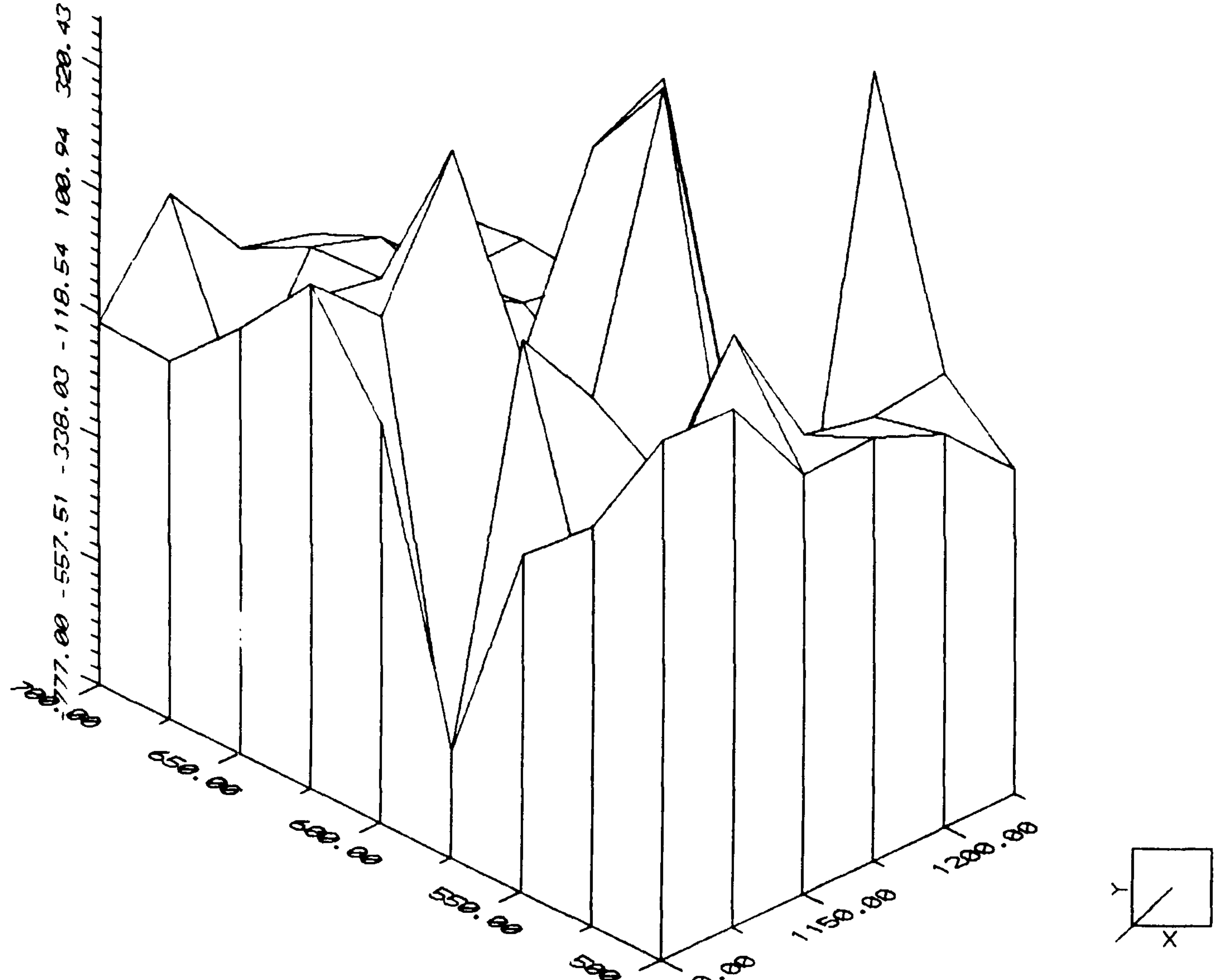
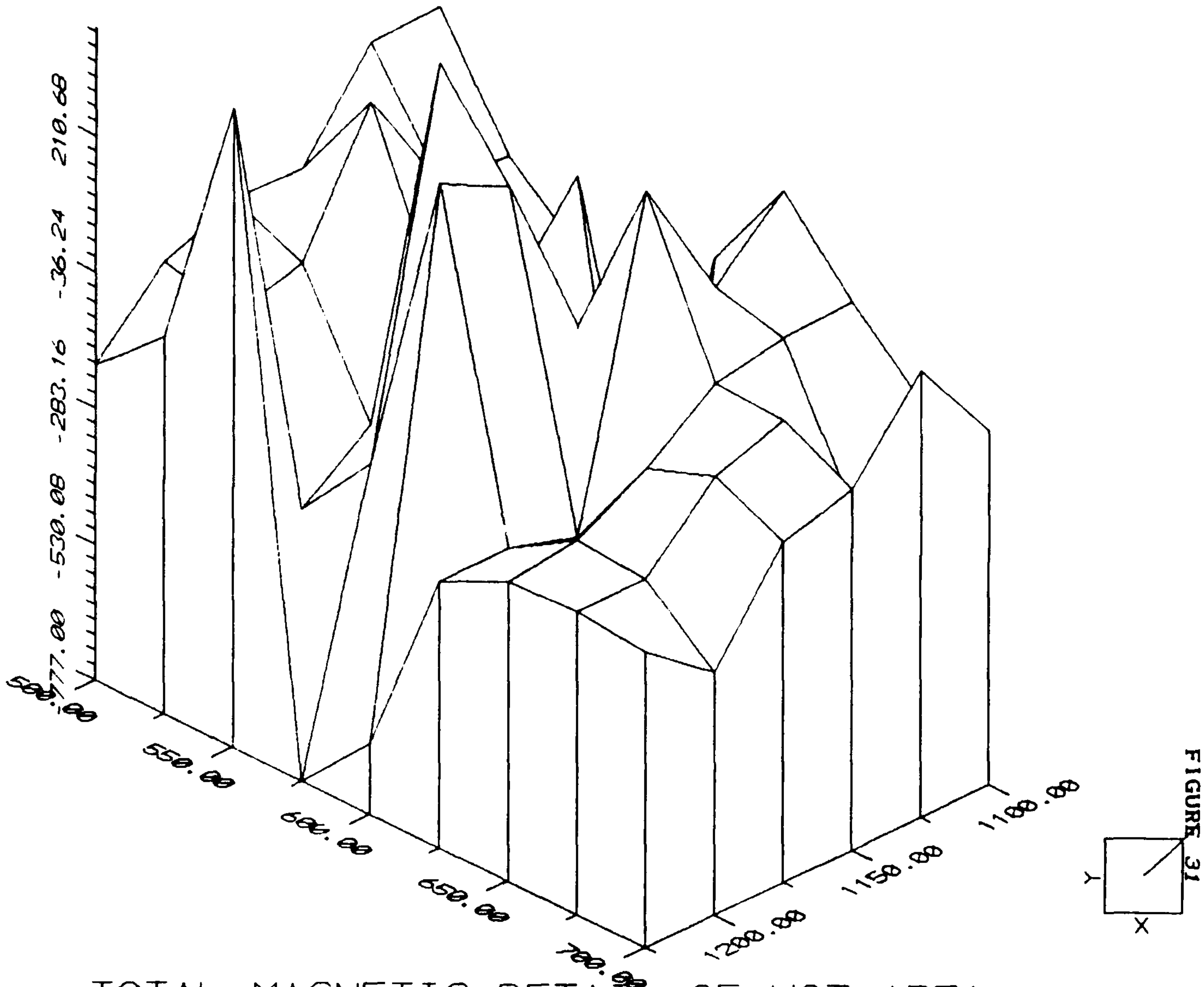

TOTAL MAGNETIC DETAIL OF UST AREA
1100.00
1125.00
1150.00
1175.00
1200.00
1225.00
700.00
675.00
650.00
625.00
600.00
575.00
550.00
525.00
500.00

FIGURE 30



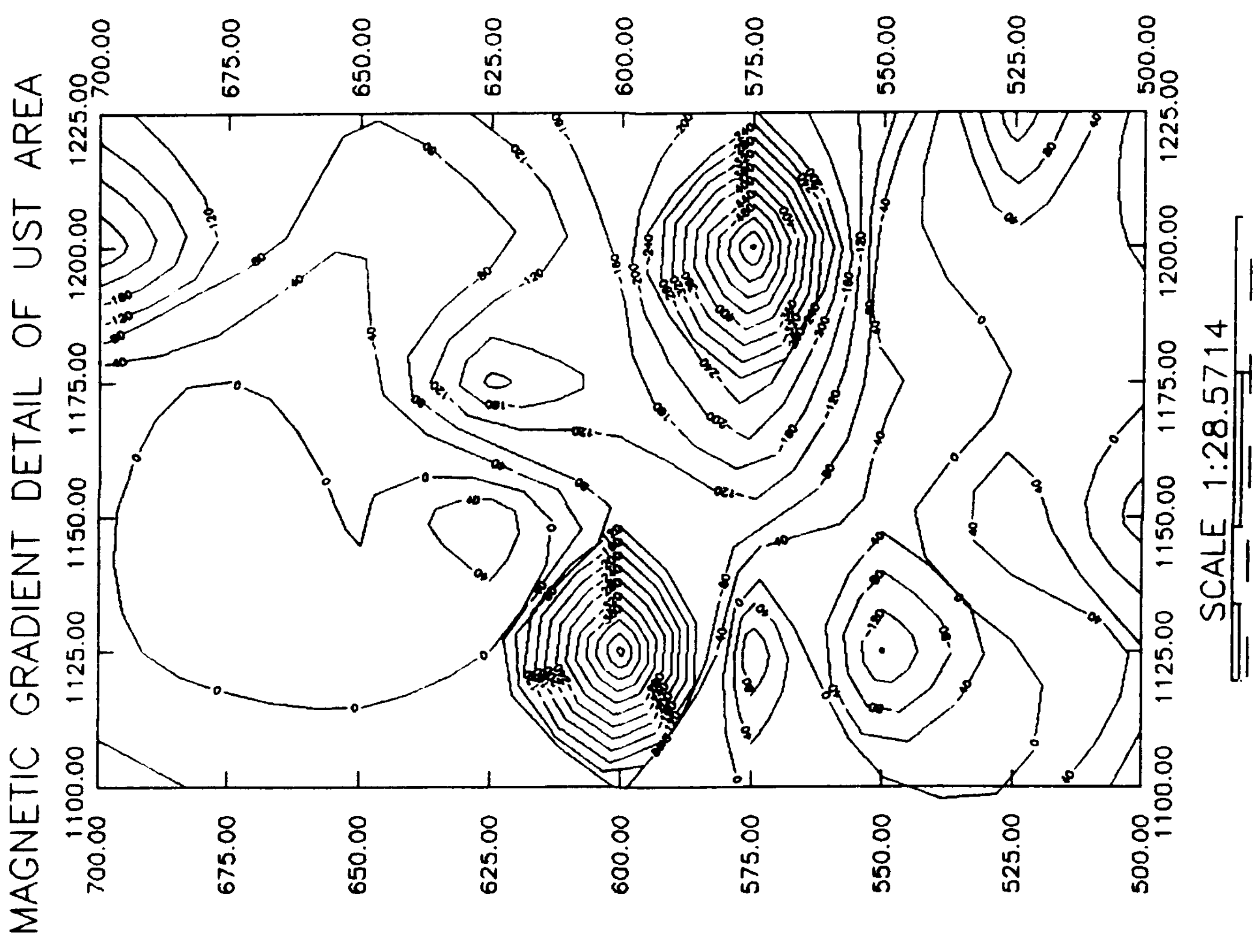
TOTAL MAGNETIC DETAIL UST AREA



TOTAL MAGNETIC DETAIL OF UST AREA

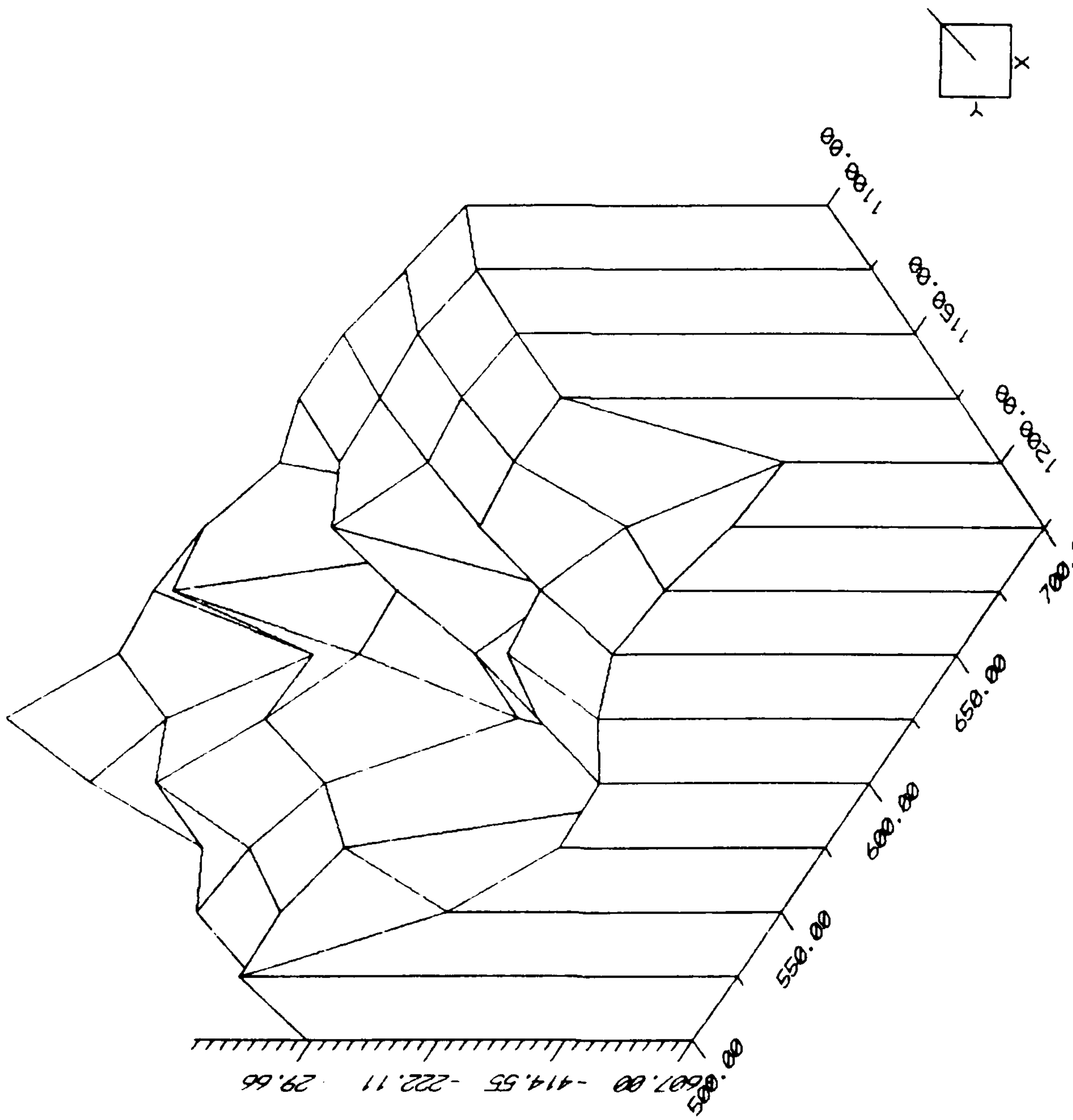
FIGURE 31

FIGURE 32



MAGNETIC GRADIENT DETAIL OF UST AREA
1100.00
1125.00
1150.00
1175.00
1200.00
1225.00
700.00
675.00
650.00
625.00
600.00
575.00
550.00
525.00
500.00
SCALE 1:28.5714

FIGURE 33



MAGNETIC GRADIENT DETAIL OF UST AREA

FIGURE 34

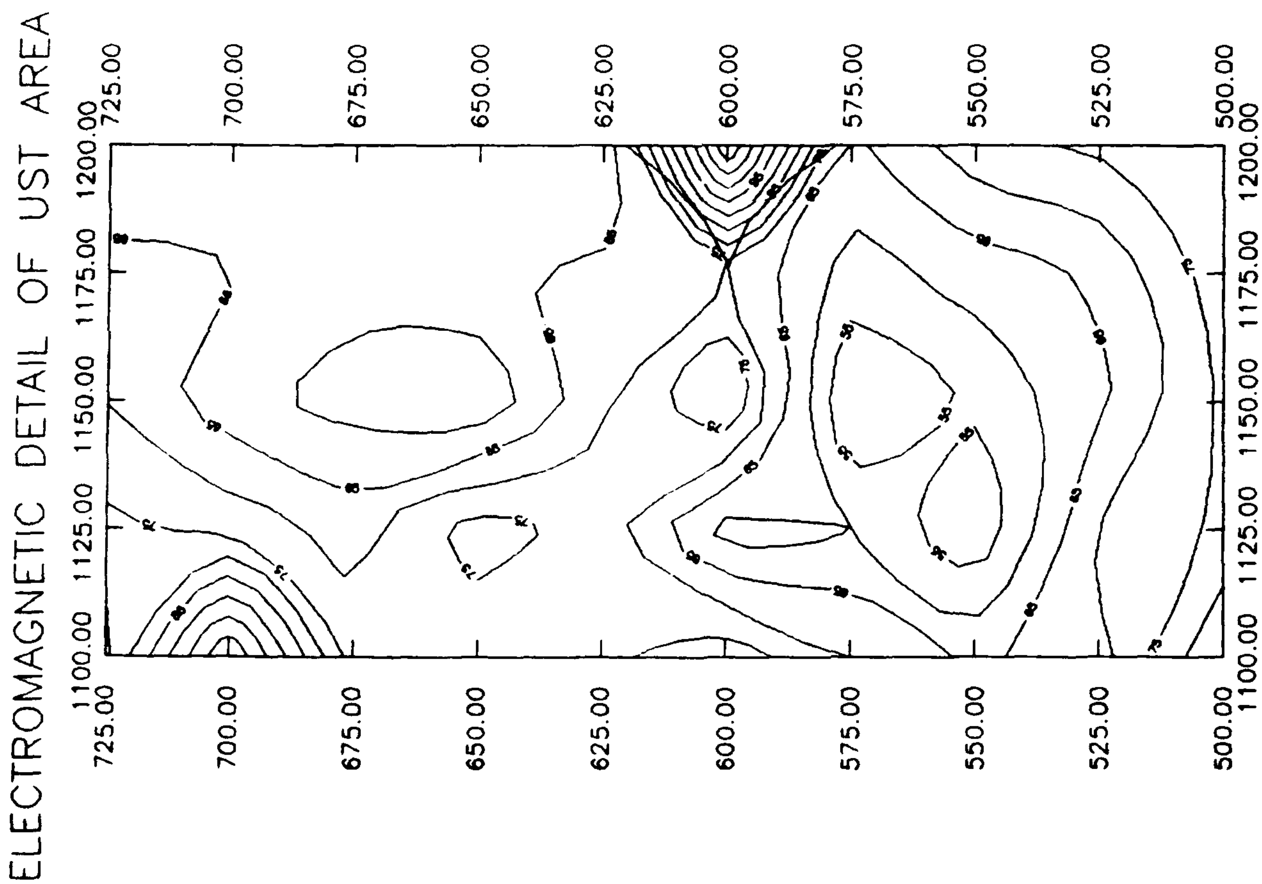

ELECTROMAGNETIC DETAIL OF UST AREA
725.00
700.00
675.00
650.00
625.00
600.00
575.00
550.00
525.00
500.00
1100.00
1125.00
1150.00
1175.00
1200.00

FIGURE 35

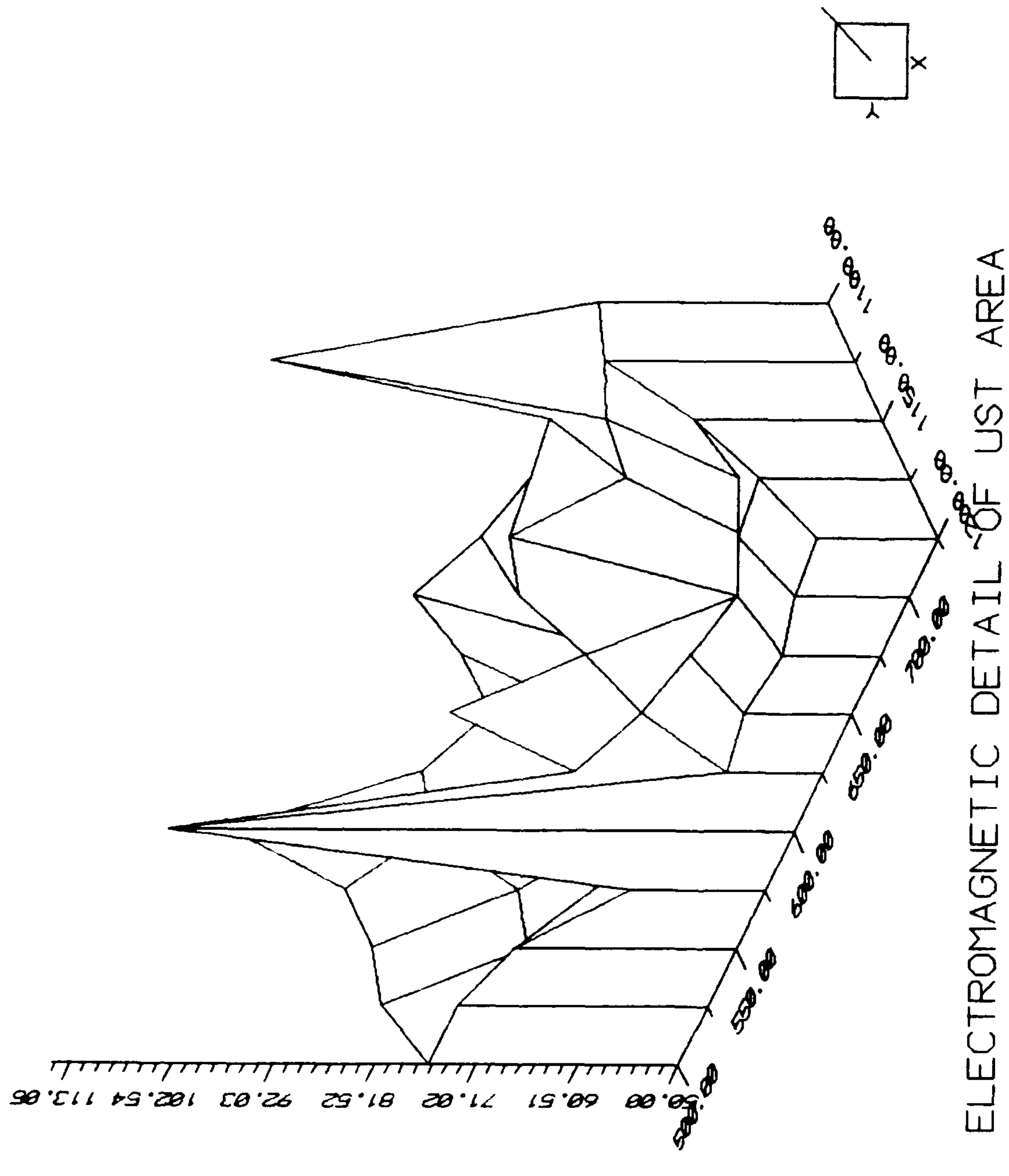
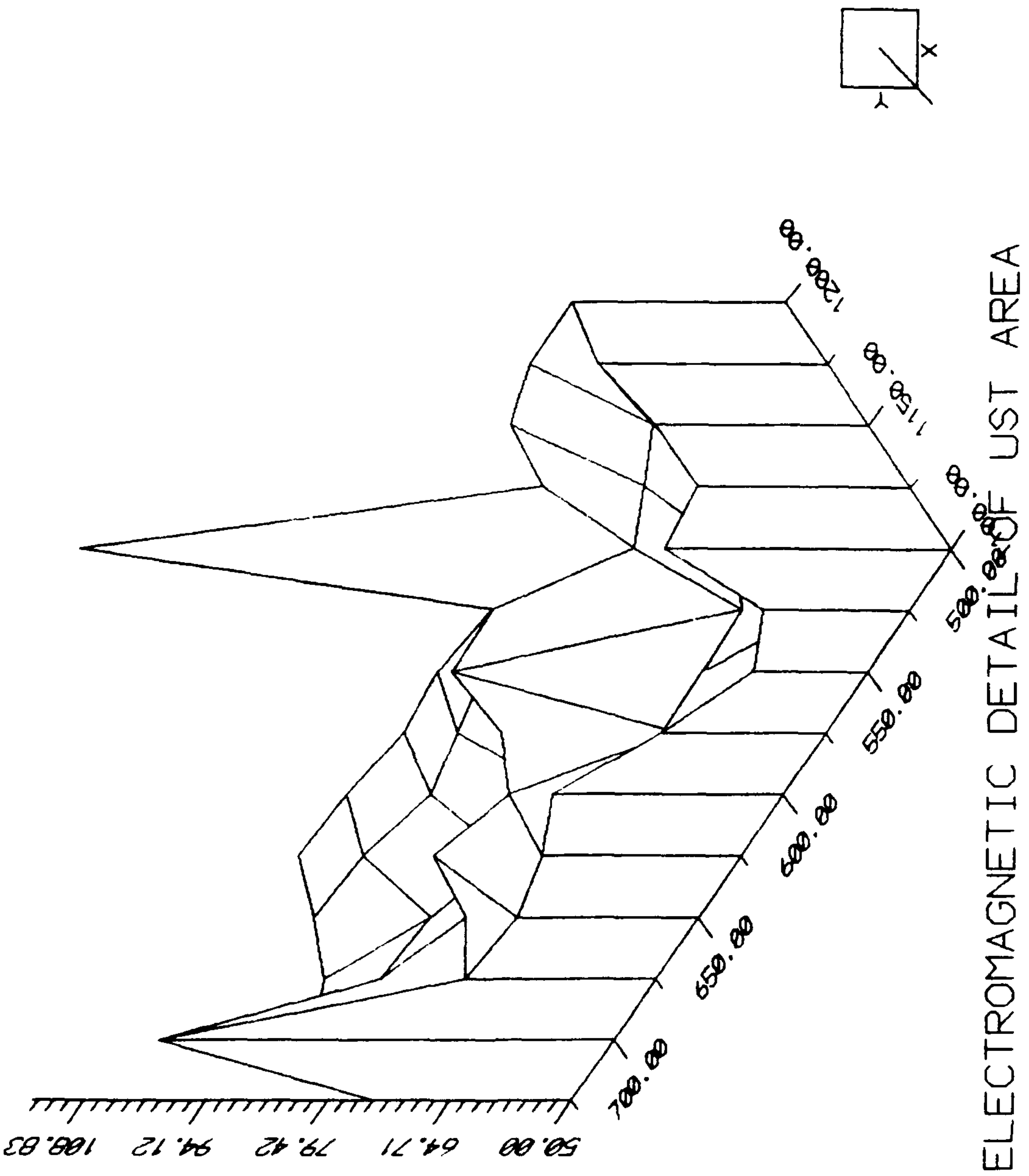
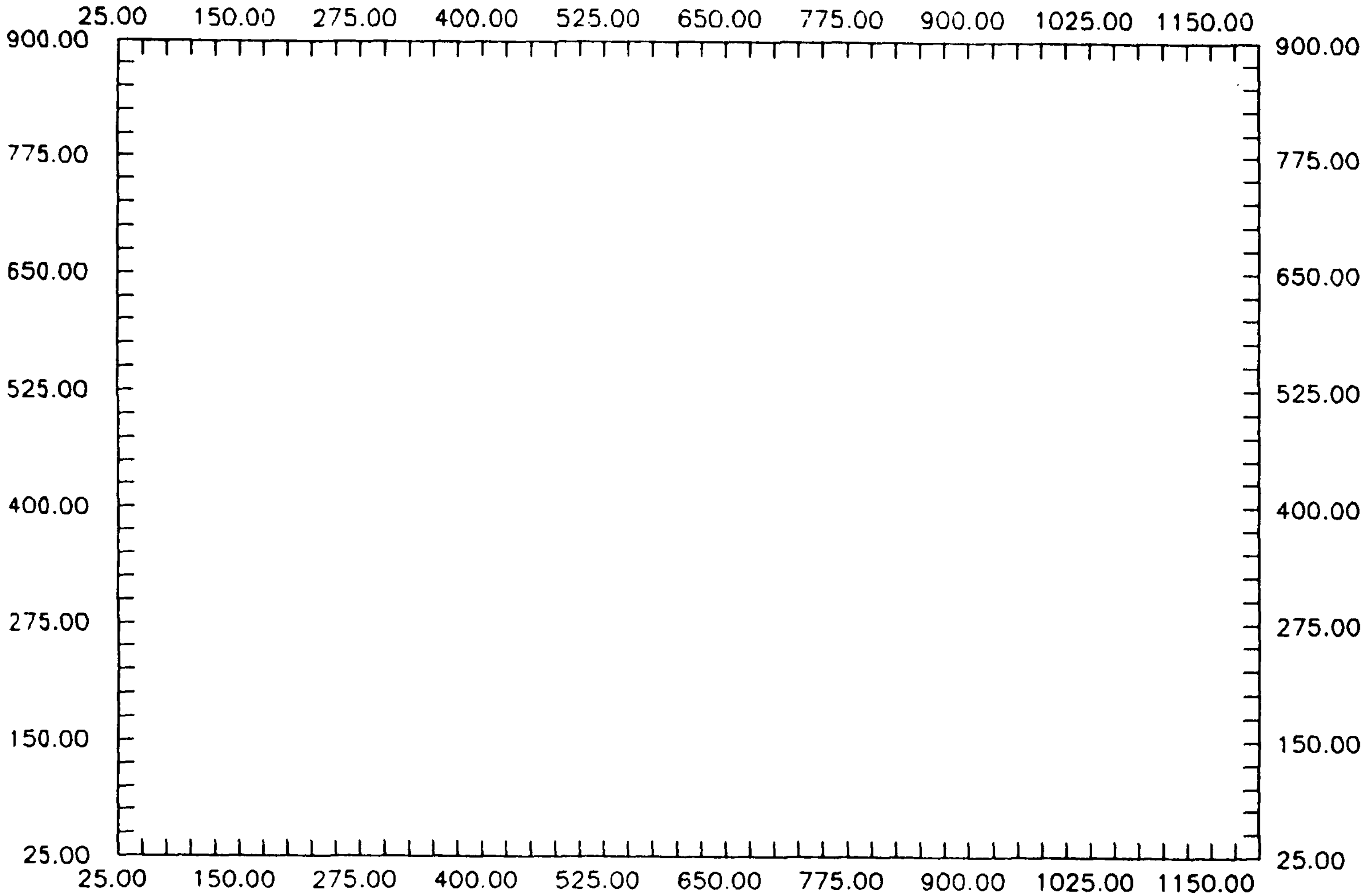

ELECTROMAGNETIC DETAIL OF UST AREA
50.00 60.51 71.02 81.52 92.03 102.54 113.05
550.00
600.00
650.00
700.00
X
Y

FIGURE 36


ELECTROMAGNETIC DETAIL OF UST AREA
X
Y
1200.00
1150.00
500.00
550.00
600.00
650.00
700.00
50.00
64.71
79.42
94.12
108.83

GENERALIZED DATA POINT LOCATION PLAT



APPENDIX D

ANALYTICAL DATA BASE

GROUND-WATER SAMPLES

FORMER BASE LANDFILL

ELLINGTON AFB SITE 01 GROUNDWATER

SAMPLE NUMBER:	01-FD06-A	01-MW01-A	01-MW02-A	01-MW03-A	01-MW04-A	01-MW05-A
NOTES:						
LOCATION:						
DEPTH:						
DESCRIPTION:	DUP MW05 A					
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/25/90	01/25/90	01/25/90	01/23/90	01/23/90	01/25/90

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB   SITE 01 GROUNDWATER

SAMPLE NUMBER:	01-FD06-A	01-MW01-A	01-MW02-A	01-MW03-A	01-MW04-A	01-MW05-A
NOTES:						
LOCATION:						
DEPTH:						
DESCRIPTION:	DUP MW05-A					
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/25/90	01/25/90	01/25/90	01/23/90	01/23/90	01/25/90

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB SITE 01 GROUNDWATER

SAMPLE NUMBER:	01 FD06 A	01 MW01 A	01 MW02 A	01 MW03 A	01 MW04 A	01 MW05 A
NOTES:						
LOCATION:						
DEPTH:						
DESCRIPTION:	DUP MW05 A					
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/25/90	01/25/90	01/25/90	01/25/90	01/25/90	01/25/90

*** ACIDS ***

PF CAS NO COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB SITE 01 GROUNDWATER

SAMPLE NUMBER:		01-FD06-A	01-MW01-A	01-MW02-A	01-MW03-A	01-MW04-A	01-MW05-A
NOTES:							
LOCATION:							
DEPTH:							
DESCRIPTION:		DUP MW05-A					
UNITS:		UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:		01/25/90	01/25/90	01/25/90	01/23/90	01/23/90	01/25/90

*** PESTICIDES ***

PP	CAS NO	COMPOUND	01-FD06-A	01-MW01-A	01-MW02-A	01-MW03-A	01-MW04-A	01-MW05-A
	319-84-6	ALPHA BHC		0.037 J				
	72-43-5	METHOXYCHLOR						0.022 J

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB SITE 01 GROUNDWATER

SAMPLE NUMBER:		01 FD06 A	01 MW01 A	01 MW02 A	01 MW03 A	01-MW04-A	01 MW05 A
NOTES:							
LOCATION:							
DEPTH:							
DESCRIPTION:		DUP MW05 A					
UNITS:		UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:		01/25/90	01/25/90	01/25/90	01/23/90	01/23/90	01/25/90

*** INORGANICS ***

PP	CAS NO	COMPOUND	01 FD06 A	01 MW01 A	01 MW02 A	01 MW03 A	01-MW04-A	01 MW05 A
1		ALUMINUM					2910	
4		BARIUM				517		
5		BERYLLIUM					[1.3]	
7		CALCIUM	181000	176000	78400	90700	153000	104000
8		CHROMIUM					[7.9]	
11		IRON					3710	
12		LEAD			10.6			
14		MANGANESE		255			498	
16		NICKEL					[12.1]	
23		VANADIUM					[10.8]	

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB SITE 01 GROUNDWATER

SAMPLE NUMBER:			01 FD06 A	01 MW01 A	01-MW02-A	01 MW03 A	01-MW04-A	01-MW05-A
NOTES:								
LOCATION:								
DEPTH:								
DESCRIPTION:			DUP MW05 A					
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	MG/L
DATE SAMPLED:			01/25/90	01/25/90	01/25/90	01/25/90	01/25/90	01/25/90
*** GEOCHEMICAL PARAMETERS ***								
PP	CAS NO	COMPOUND						
		PETROLEUM HYDROCARBONS	ND	ND	ND	ND	ND	0.9 J

SURFACE SOIL SAMPLES

FORMER BASE LANDFILL

R-48-05-0-016H

ELLINGTON AFB   SITE 01 SURFACE SOIL

SAMPLE NUMBER:	01 FD01 A	01 SS01 A	01 SS02 A	01 SS03 A
NOTES:	NA	NA	NA	NA
LOCATION:				
DEPTH:	SURFACE	SURFACE	SURFACE	SURFACE
DESCRIPTION:	DUP EAST LF	WEST LF	CENTRAL LF	EAST LF
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	01/17/90	01/17/90	01/17/90	01/17/90

*** VOLATILES ***

FF   CAS NO   COMPOUND

NO PARAMETERS FOR THIS CATEGORY

2-1

NOTES :
J   APPROXIMATE VALUE
[ ]   APPROXIMATE VALUE
ND   NOT DETECTED
NA   NOT ANALYZED

[illegible] SITE 01 SURFACE SOIL

SAMPLE NUMBER:			01 [illegible] A	01 SS01 A	01 SS02 A	01 SS03 A
NOTES:						
LOCATION:						
DEPTH:			SURFACE	SURFACE	SURFACE	SURFACE
DESCRIPTION:			DUP EAST LF	WEST LF	CENTRAL LF	EAST LF
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			01/17/90	01/17/90	01/17/90	01/17/90

*** BASE NEUTRALS ***

PP	CAS NO	COMPOUND				
66B	85-68-7	BUTYL BENZYL PHTHALATE	4.0J			
1B	83-32-9	ACENAPHTHENE	540J			250J
78B	120-12-7	ANTHRACENE	1100J			520J
72B	56-55-3	BENZO(A)ANTHRACENE	3200J		800	1500J
74B	205-99-2	BENZO(B)FLUORANTHENE	2700		800	1700
	207-08-9	BENZO(K)FLUORANTHENE	2600J		930	1100J
73B	50-32-8	BENZO(A)PYRENE	2700J		1000	1300J
76B	218-01-9	CHRYSENE	3000		860	1500
39B	206-44-0	FLUORANTHENE	5400		1500	3100
80B	86-73-7	FLUORENE	[illegible]0J			[illegible]0J
83B	193-39-5	INDENO(1,2,3-CD)PYRENE	1700J			
55B	91-20-3	NAPHTHALENE	140J			
81B	85-01-8	PHENANTHRENE	4100		510J	2700
84B	129-00-0	PYRENE	4600		1200	2500
	132-64-9	DIBENZOFURAN	240J			

NOTES : J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB   SITE 01 SURFACE SOIL

SAMPLE NUMBER:	01 FB05 A	01 SS01 A	01 SS02 A	01 [illegible] A
NOTES:				
LOCATION:				
DEPTH:	SURFACE	SURFACE	SURFACE	SURFACE
DESCRIPTION:	DUE EAST LF	WEST LF	CENTRAL LF	EAST LF
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	01/17/90	01/17/90	01/17/90	01/17/90

*** ACIDS ***

PP   CAS NO   COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

[illegible] AFB SITE 01 SURFACE SOIL

SAMPLE NUMBER:			01 [illegible] A	01 SS01 A	01 SS02 A	01 [illegible] A
NOTES:						
LOCATION:						
DEPTH:						
DESCRIPTION:			SURFACE DUP EAST LF	SURFACE WEST LF	SURFACE CENTRAL LF	SURFACE EAST LF
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			01/17/90	01/17/90	01/17/90	01/17/90

*** PESTICIDES ***

PP	CAS NO	COMPOUND	01 [illegible] A	01 SS01 A	01 SS02 A	01 [illegible] A
[illegible]	50 29 3	4,4 DDT				
	72 54 8	4,4 DDD	111			101
[illegible]	[illegible] 55 [illegible]	4,4 DDE	1.1			

NOTES : J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB SITE 01 SURFACE SOIL

SAMPLE NUMBER:			01 FD05 A	01 SS01 A	01 SS02 A	01 SS03 A
NOTES:						
LOCATION:						
DEPTH:			SURFACE	SURFACE	SURFACE	SURFACE
DESCRIPTION:			DUP EAST LF	WEST LF	CENTRAL LF	EAST LF
UNITS:			MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:			01/17/90	01/17/90	01/17/90	01/17/90

*** INORGANICS ***

PP	CAS NO	COMPOUND	01 FD05 A	01 SS01 A	01 SS02 A	01 SS03 A
1		ALUMINUM	9500J	7250J	6010J	[illegible]
3		ARSENIC	[illegible]	4.4	3.5J	2.9J
4		BARIUM	125J	302J	141J	115J
7		CALCIUM	[illegible]	29600	39500	6460J
8		CHROMIUM	10.4	13.4	16.0	12.2
11		IRON	[illegible]	7410	6700J	10600
12		LEAD	26.1	125	141	18.9
13		MAGNESIUM	1860	2720	1480	2000
14		MANGANESE	114	152	111J	91.8
15		MERCURY	[0.09]	[0.10]	[0.19]	[0.06]
17		POTASSIUM	[566]	[670]	[492]	[334]
20		SODIUM	[109]	[233]	[253]	[125]
24		ZINC		150	180J	

NOTES : J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 SURFACE SOIL

SAMPLE NUMBER:	01 FD05 A	01 SS01 A	01 SS02 A	01 SS03 A
NOTES:				
LOCATION:				
DEPTH:				
DESCRIPTION:	SURFACE DUP EAST LF	SURFACE WEST LF	SURFACE CENTRAL LF	SURFACE EAST LF
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	01/17/90	01/17/90	01/17/90	01/17/90

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND				
		PETROLEUM HYDROCARBONS	ND	ND	ND	ND

SUBSURFACE SOIL SAMPLES

FORMER BASE LANDFILL

R-48-05-0-016H

ELLINGTON AFB   SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01-FD02-A	01-SB01A-A	01-SB01B-A	01-SB02A-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
NOTES:							
LOCATION:							
DEPTH:	18'-22'	16'-18'	26'-28'	16'-18'	8'-10'	12'-14'	4'-6'
DESCRIPTION:	DUP 05B-A						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/21/89	12/13/89	12/13/89	12/14/89	12/13/89	12/13/89	12/12/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

3-1

ELLINGTON AFB - SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01-FD02-A	01-SB01A-A	01-SB01B-A	01-SB02A-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
NOTES:							
LOCATION:							
DEPTH:	18'-22'	16'-18'	26'-28'	16'-18'	8'-10'	12'-14'	4'-6'
DESCRIPTION:	DUP 05B-A						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/21/89	12/13/89	12/13/89	12/14/89	12/13/89	12/13/89	12/12/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01-FD02-A	01-SB01A-A	01-SB01B-A	01-SB02A-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
NOTES:							
LOCATION:							
DEPTH:	18'-22'	16'-18'	26'-28'	16'-18'	8'-10'	12'-14'	4'-6'
DESCRIPTION:	DUP 05B-A						
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/21/89	12/13/89	12/13/89	12/14/89	12/13/89	12/13/89	12/12/89

*** ACIDS ***

PP	CAS NO	COMPOUND	01-FD02-A	01-SB01A-A	01-SB01B-A	01-SB02A-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
65A	108-95-2	PHENOL	22J						

NOTES :
J AFPROXIMATE VALUE
[] AFPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 SUBSURFACE SOIL

			01-FD02-A	01-SB01A-A	01-SB01B-A	01-SB02A-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
SAMPLE NUMBER:			01-FD02-A	01-SB01A-A	01-SB01B-A	01-SB02A-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
NOTES:									
LOCATION:									
DEPTH:			18'-22'	16'-18'	26'-28'	16'-18'	8'-10'	12'-14'	4'-6'
DESCRIPTION:			DUP 05B A						
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			12/21/89	12/13/89	12/13/89	12/14/89	12/13/89	12/13/89	12/12/89
*** PESTICIDES ***									
PP	CAS NO	COMPOUND							
100P	76-44-8	HEPTACHLOR	13J					21	

NOTES : J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB   SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:			01-FD02-A	01-SB01A-A	01-SB01B-A	01-SB02A-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
NOTES:									
LOCATION:									
DEPTH:			18'-22'	16'-18'	26'-28'	16'-18'	8'-10'	12'-14'	4'-6'
DESCRIPTION:			DUP 05B-A						
UNITS:			MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:			12/21/89	12/13/89	12/13/89	12/14/89	12/13/89	12/13/89	12/12/89
*** INORGANICS ***									
PP	CAS NO	COMPOUND							
1		ALUMINUM	1840	9080	1960	849	5780	3530	9590
3		ARSENIC	1.9	3.9	[0.66]	[0.51]		[1.8]	5.0
4		BARIUM	7.4	97.9	[22.3]	[11.3]	74.4	136	106
5		BERYLLIUM		[0.82]			[0.55]	[0.32]	[0.90]
7		CALCIUM	358	38000	20000		1240		
8		CHROMIUM	2.4	10.1J					
9		COBALT	1.9	[4.9]					22.0
10		COPPER		8.9	[1.7]		[2.6]	[2.1]	[5.6]
11		IRON	3400	16000	2920	1430	3800	4010	130
12		LEAD	2.4	8.2	2.5	1.8	3.6	2.8	15.8
13		MAGNESIUM		3460	[1030]		1150	1250	1470
14		MANGANESE	41.7	474	108	57.3	12.4	452	540
15		MERCURY	0.33	[0.14]	[0.15]	[0.19]	[0.18]	[0.19]	0.20
16		NICKEL		12.3	[4.3]	[3.6]	[5.5]	[5.5]	16.2
17		POTASSIUM		1400	[210]	[45.6]	320	[407]	[687]
23		VANADIUM	5.2	20.1	[3.8]	[3.5]	[3.9]	[7.5]	20.9
24		ZINC		29.0J			12.1J		15.6J

NOTES :
J   APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01-FD02-A	01-SB01A-A	01-SB01B-A	01-SB02A-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
NOTES:							
LOCATION:							
DEPTH:	18'-22'	16'-18'	26'-28'	16'-18'	8'-10'	12'-14'	4'-6'
DESCRIPTION:	DUP 05B-A						
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	12/21/89	12/13/89	12/13/89	12/14/89	12/13/89	12/13/89	12/12/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND							
		PETROLEUM HYDROCARBONS	ND	ND	ND	ND	ND	ND	ND

ELLINGTON AFB - SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01-SB04B-A	01-SB05A-A	01-SB05B-A
NOTES:			
LOCATION:			
DEPTH:	12'-14'	10'-12'	18'-22'
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/12/89	12/21/89	12/21/89

*** VOLATILES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01-SB04B-A	01-SB05A-A	01-SB05B-A
NOTES:			
LOCATION:			
DEPTH:	12'-14'	10'-12'	18'-22'
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/12/89	12/21/89	12/21/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01-SB04B-A	01-SB05A-A	01-SB05B-A
NOTES:			
LOCATION:			
DEPTH:	12-14	10-12	18-22
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/12/89	12/21/89	12/21/89

*** ACIDS ***

PP	CAS NO	COMPOUND			
65A	108-95-2	PHENOL			

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01-SB04B-A	01-SB05A-A	01-SB05B-A
NOTES:			
LOCATION:			
DEPTH:	12'-14'	10'-12'	18'-22'
DESCRIPTION:			
UNITS:	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/12/89	12/21/89	12/21/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND
100P	76-44-8	HEPTACHLOR

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

FILINGTON AFB   SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:			01-SB04B-A	01 SB05A A	01-SB05B-A
NOTES:					
LOCATION:					
DEPTH:			12'-14	10'-12'	18'-22'
DESCRIPTION:					
UNITS:			MG/KG	MG/KG	MG/KG
DATE SAMPLED:			12/12/89	12/21/89	12/21/89
*** INORGANICS ***					
PP	CAS NO	COMPOUND			
1		ALUMINUM	3060	6370	948
3		ARSENIC	[0.36]		
4		BARIUM	[23.5]	35.1	6.8
5		BERYLLIUM			
7		CALCIUM		831	
8		CHROMIUM		7.0	
9		COBALT		2.6	
10		COPPER		4.8	2.0
11		IRON	3400	6360	1600
12		LEAD	3.4	4.2	2.0
13		MAGNESIUM	[852]		
14		MANGANESE	57.4	38.6	16.3
15		MERCURY	0.28	0.34	0.21
16		NICKEL	[5.6]	11.1	2.9
17		POTASSIUM	[251]	874	156
23		VANADIUM	[5.3]	6.5	2.2
24		ZINC			

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB SITE 01 SUBSURFACE SOIL

SAMPLE NUMBER:	01 SB04B A	01 SB05A A	01 SB05B A
NOTES:			
LOCATION:			
DEPTH:	12 14	10 12'	18' 22'
DESCRIPTION:			
UNITS:	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	12/12/89	12/21/89	12/21/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND			
		PETROLEUM HYDROCARBONS	ND	ND	ND

GROUND-WATER SAMPLES

POL STORAGE AREA

R-48-05-0-016H

ELLINGTON AFB - SITE 02 GROUNDWATER

			02-MW07-A	02-MW08-A	02-MW09-A	02-MW10-A
SAMPLE NUMBER:			02-MW07-A	02-MW08-A	02-MW09-A	02-MW10-A
NOTES:						
LOCATION:						
DEPTH:						
DESCRIPTION:						
UNITS:			UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			01/22/90	01/22/90	01/24/90	01/22/90
*** VOLATILES ***						
PP	CAS NO	COMPOUND				
38V	100-41-4	ETHYLBENZENE				6 J
	95-47-6	TOTAL XYLENES				23 J
	100-42-5	STYRENE				10 J
7V	108-90-7	CHLOROBENZENE				6 J

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 GROUNDWATER

SAMPLE NUMBER:	02 MW07 A	02 MW08-A	02-MW09 A	02 MW10 A
NOTES:				
LOCATION:				
DEPTH:				
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/22/90	01/22/90	01/24/90	01/22/90

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 GROUNDWATER

SAMPLE NUMBER:	02 MW07 A	02 MW08 A	02 MW09 A	02 MW10 A
NOTES:				
LOCATION:				
DEPTH:				
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/22/90	01/22/90	01/24/90	01/22/90

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 GROUNDWATER

SAMPLE NUMBER:	02-MW07-A	02-MW08-A	02-MW09-A	02-MW10-A
NOTES:	NA	NA	NA	NA
LOCATION:				
DEPTH:				
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/22/90	01/22/90	01/24/90	01/22/90

*** PESTICIDES ***

FP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB   SITE 02 GROUNDWATER

SAMPLE NUMBER:	02-MW07-A	02-MW08-A	02-MW09-A	02-MW10-A
NOTES:	NA	NA	NA	NA
LOCATION:				
DEPTH:				
DESCRIPTION:				
UNITS:	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/22/90	01/22/90	01/24/90	01/22/90

*** INORGANICS ***

FP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB SITE 02 GROUNDWATER

SAMPLE NUMBER:		02-MW07-A	02-MW08-A	02-MW09-A	02-MW10-A
NOTES:					
LOCATION:					
DEPTH:					
DESCRIPTION:					
UNITS:		MG/L	MG/L	MG/L	MG/L
DATE SAMPLED:		01/22/90	01/22/90	01/24/90	01/22/90
*** GEOCHEMICAL PARAMETERS ***					
PP CAS NO	COMPOUND				
	PETROLEUM HYDROCARBONS	ND	ND	ND	ND

SUBSURFACE SOIL SAMPLES

POL STORAGE AREA

R-48-05-0-016H

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-FD01-A	02-FD03-A	02-FD04-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A
NOTES:							
LOCATION:							
DEPTH:	18'-22'	16'-20'	8'-10'	0'-2'	8'-10'	16'-18'	0'-2'
DESCRIPTION:	DUP 11C-A	DUP 08C-A	DUP 10A-A				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/18/89	01/13/90	01/16/90	01/12/90	01/12/90	01/12/90	01/13/90

*** VOLATILES ***

PP	CAS NO	COMPOUND
	67-64-1	ACETONE
	78-93-3	2-BUTANONE
	108-10-1	4-METHYL-2-PENTANONE
4V	71-43-2	BENZENE
38V	100-41-4	ETHYLBENZENE
	95-47-6	TOTAL XYLENES
	100-42-5	STYRENE
7V	108-90-7	CHLOROBENZENE
44V	75-09-2	METHYLENE CHLORIDE
32V	78-87-5	1,2-DICHLOROPROPANE

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:			02-FD01-A	02-FD03-A	02-FD04-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A
NOTES:			NA			NA	NA		NA
LOCATION:									
DEPTH:			18'-22'	16'-20'	8'-10'	0'-2'	8'-10'	16'-18'	0'-2'
DESCRIPTION:			DUP 11C-A	DUP 08C-A	DUP 10A-A				
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			12/18/89	01/13/90	01/16/90	01/12/90	01/12/90	01/12/90	01/13/90
*** BASE/NEUTRALS ***									
PP	CAS NO	COMPOUND							
55B	91-20-3	NAPHTHALENE			110J				
	91-57-6	2-METHYLNAPHTHALENE			340J				

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-FD01-A	02-FD03-A	02-FD04-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A
NOTES:	NA			NA	NA		NA
LOCATION:							
DEPTH:	18'-22'	16'-20'	8'-10'	0'-2'	8'-10'	16'-18'	0'-2'
DESCRIPTION:	DUP 11C-A	DUP 08C-A	DUP 10A-A				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/18/89	01/13/90	01/16/90	01/12/90	01/12/90	01/12/90	01/13/90

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-FD01-A	02-FD03-A	02-FD04-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:							
DEPTH:	18'-22'	16'-20'	8'-10'	0'-2'	8'-10'	16'-18'	0'-2'
DESCRIPTION:	DUP 11C-A	DUP 08C-A	DUP 10A-A				
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/18/89	01/13/90	01/16/90	01/12/90	01/12/90	01/12/90	01/13/90

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-FD01-A	02-FD03-A	02-FD04-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:							
DEPTH:	18'-22'	16'-20'	8'-10'	0'-2'	8'-10'	16'-18'	0'-2'
DESCRIPTION:	DUP 11C-A	DUPLICATE	DUPLICATE				
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	12/18/89	01/13/90	01/16/90	01/12/90	01/12/90	01/12/90	01/13/90

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-FD01-A	02-FD03-A	02-FD04-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A
NOTES:							
LOCATION:							
DEPTH:	18'-22'	16'-20'	8'-10'	0'-2'	8'-10'	16'-18'	0'-2'
DESCRIPTION:	DUP 11C-A	DUP 08C-A	DUP 10A-A				
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	12/18/89	01/13/90	01/16/90	01/12/90	01/12/90	01/12/90	01/13/90

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND							
		PETROLEUM HYDROCARBONS	ND	ND	99	ND	ND	ND	ND

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

			02-SB08B-A	02-SB08C-A	02-SB09A-A	02 SB09B-A	02-SB09C-A	02-SB10A-A	02-SB10B-A
SAMPLE NUMBER:			02-SB08B-A	02-SB08C-A	02-SB09A-A	02 SB09B-A	02-SB09C-A	02-SB10A-A	02-SB10B-A
NOTES:									
LOCATION:									
DEPTH:			8'-10'	16'-20'	2'-4'	9'-11'	21'-23'	8'-10'	20'-22'
DESCRIPTION:									
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			01/13/90	01/13/90	01/15/90	01/15/90	01/15/90	01/16/90	01/16/90
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE							
	78-93-3	2-BUTANONE							
	108-10-1	4-METHYL-2-PENTANONE							
4V	71-43-2	BENZENE							
38V	100-41-4	ETHYLBENZENE							
	95-47-6	TOTAL XYLENES						66J	
	100-42-5	STYRENE							
7V	108-90-7	CHLOROBENZENE							
44V	75-09-2	METHYLENE CHLORIDE							
32V	78-87-5	1,2-DICHLOROPROPANE							

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:			02-SB08B-A	02-SB08C-A	02-SB09A-A	02-SB09B-A	02-SB09C-A	02-SB10A-A	02-SB10B-A
NOTES:			NA		NA	NA			NA
LOCATION:									
DEPTH:			8'-10'	16'-20'	2'-4'	9'-11'	21'-23'	8'-10'	20'-22'
DESCRIPTION:									
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			01/13/90	01/13/90	01/15/90	01/15/90	01/15/90	01/16/90	01/16/90
*** BASE/NEUTRALS ***									
FP	CAS NO	COMPOUND							
55B	91-20-3	NAPHTHALENE							
	91-57-6	2-METHYLNAPHTHALENE						150J	

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB08B-A	02-SB08C-A	02-SB09A-A	02-SB09B-A	02-SB09C-A	02-SB10A-A	02-SB10B-A
NOTES:	NA		NA	NA			NA
LOCATION:							
DEPTH:	8'-10'	16'-20'	2'-4'	9'-11'	21'-23'	8'-10'	20'-22'
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	01/13/90	01/13/90	01/15/90	01/15/90	01/15/90	01/16/90	01/16/90

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [ ] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB08B-A	02-SB08C-A	02-SB09A-A	02-SB09B-A	02-SB09C-A	02-SB10A-A	02-SB10B-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:							
DEPTH:	8'-10'	16'-20'	2'-4'	9'-11'	21'-23'	8'-10'	20'-22'
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	01/13/90	01/13/90	01/15/90	01/15/90	01/15/90	01/16/90	01/16/90

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB08B-A	02-SB08C-A	02-SB09A-A	02-SB09B-A	02-SB09C-A	02-SB10A-A	02-SB10B-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:							
DEPTH:	8'-10'	16'-20'	2'-4'	9'-11'	21'-23'	8'-10'	20'-22'
DESCRIPTION:							
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	01/13/90	01/13/90	01/15/90	01/15/90	01/15/90	01/16/90	01/16/90

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:			02-SB08B-A	02-SB08C-A	02-SB09A-A	02-SB09B-A	02-SB09C-A	02-SB10A-A	02-SB10B-A
NOTES:									
LOCATION:									
DEPTH:			8'-10'	16'-20'	2'-4'	9'-11'	21'-23'	8'-10'	20'-22'
DESCRIPTION:									
UNITS:			MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:			01/13/90	01/13/90	01/15/90	01/15/90	01/15/90	01/16/90	01/16/90
*** GEOCHEMICAL PARAMETERS ***									
FP	CAS NO	COMPOUND							
		PETROLEUM HYDROCARBONS	ND	ND	ND	ND	ND	99	ND

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:									
NOTES:			02-SB11A-A	02-SB11B-A	02-SB11C-A	02-SB12A-A	02-SB12B-A	02-SB12C-A	02-SB13A-A
LOCATION:									
DEPTH:			0'-2'	4'-6'	18'-22'	0'-2'	6'-8'	20'-22'	0'-2'
DESCRIPTION:									
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/19/89
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE							160
	78-93-3	2-BUTANONE							
	108-10-1	4-METHYL-2-PENTANONE							
4V	71-43-2	BENZENE							180J
38V	100-41-4	ETHYLBENZENE							210J
	95-47-6	TOTAL XYLENES							240J
	100-42-5	STYRENE							
7V	108-90-7	CHLOROBENZENE							
44V	75-09-2	METHYLENE CHLORIDE							
32V	78-87-5	1,2-DICHLOROPROPANE							

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB11A-A	02-SB11B-A	02-SB11C-A	02-SB12A-A	02-SB12B-A	02-SB12C-A	02-SB13A-A
NOTES:	NA		NA		NA	NA	NA
LOCATION:							
DEPTH:	0'-2'	4'-6'	18'-22'	0'-2'	6'-8'	20'-22'	0'-2'
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/19/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND
55B	91-20-3	NAPHTHALENE
	91-57-6	2-METHYLNAPHTHALENE

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB11A-A	02-SB11B-A	02-SB11C-A	02-SB12A-A	02-SB12B-A	02-SB12C-A	02-SB13A-A
NOTES:	NA		NA		NA	NA	NA
LOCATION:							
DEPTH:	0'-2'	4'-6'	18'-22'	0'-2'	6'-8'	20'-22'	0'-2'
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/19/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB11A-A	02-SB11B-A	02-SB11C-A	02-SB12A-A	02-SB12B-A	02-SB12C-A	02-SB13A-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:							
DEPTH:	0'-2'	4'-6'	18'-22'	0'-2'	6'-8'	20'-22'	0'-2'
DESCRIPTION:							
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/19/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB11A-A	02-SB11B-A	02-SB11C-A	02-SB12A-A	02-SB12B-A	02-SB12C-A	02-SB13A-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:							
DEPTH:	0'-2'	4'-6'	18'-22'	0'-2'	6'-8'	20'-22'	0'-2'
DESCRIPTION:							
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/19/89

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:			02-SB11A-A	02-SB11B-A	02-SB11C-A	02-SB12A-A	02-SB12B-A	02-SB12C-A	02-SB13A-A
NOTES:									
LOCATION:									
DEPTH:			0'-2'	4'-6'	18'-22'	0'-2'	6'-8'	20'-22'	0'-2'
DESCRIPTION:									
UNITS:			MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:			12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/19/89
*** GEOCHEMICAL PARAMETERS ***									
PP	CAS NO	COMPOUND							
		PETROLEUM HYDROCARBONS	ND	ND	ND	ND	ND	ND	132

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

			02-SB13B-A	02-SB13C-A	02-SB14A-A	02-SB14B-A	02-SB14C-A
SAMPLE NUMBER:			02-SB13B-A	02-SB13C-A	02-SB14A-A	02-SB14B-A	02-SB14C-A
NOTES:							
LOCATION:							
DEPTH:			4'-6'	20'-22'	0'-2'	6'-8	18'-20'
DESCRIPTION:							
UNITS:			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:			12/19/89	12/19/89	12/19/89	12/19/89	12/19/89

*** VOLATILES ***

PP	CAS NO	COMPOUND	02-SB13B-A	02-SB13C-A	02-SB14A-A	02-SB14B-A	02-SB14C-A
	67-64-1	ACETONE			250J		
	78-93-3	2-BUTANONE			41J		
	108-10-1	4-METHYL-2-PENTANONE		4J			
4V	71-43-2	BENZENE					
38V	100-41-4	ETHYLBENZENE	13000J	3J			
	95-47-6	TOTAL XYLENES		12J			
	100-42-5	STYRENE		5J			
7V	108-90-7	CHLOROBENZENE		1J			
44V	75-09-2	METHYLENE CHLORIDE	6100J				
32V	78-87-5	1,2-DICHLOROPROPANE		1J			

NOTES :
J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02 SB13B-A	02 SB13C-A	02-SB14A-A	02 SB14B A	02 SB14C-A
NOTES:		NA		NA	NA
LOCATION:					
DEPTH:	4'-6'	20'-22'	0'-2'	6'-8'	18'-20'
DESCRIPTION:					
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/19/89	12/19/89	12/19/89	12/19/89	12/19/89

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND	02 SB13B-A	02 SB13C-A	02-SB14A-A	02 SB14B A	02 SB14C-A
55B	91-20-3	NAPHTHALENE	200J				
	91-57-6	2-METHYLNAPHTHALENE	640				

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB13B-A	02-SB13C-A	02-SB1[illegible]-A	02-SB14B-A	02-SB14C-A
NOTES:		NA		NA	NA
LOCATION:					
DEPTH:	4'-6'	20'-22'	0'-2'	6'-8'	18'-20'
DESCRIPTION:					
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/19/89	12/19/89	12/19/89	12/19/89	12/19/89

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB13B-A	02-SB13C-A	02-SB14A-A	02-SB14B-A	02-SB14C-A
NOTES:	NA	NA	NA	NA	NA
LOCATION:					
DEPTH:	4-6'	20-22'	0-2'	6-8'	18-20'
DESCRIPTION:					
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
DATE SAMPLED:	12/19/89	12/19/89	12/19/89	12/19/89	12/19/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:	02-SB13B-A	02-SB13C-A	02-SB14A-A	02-SB14B-A	02-SB14C-A
NOTES:	NA	NA	NA	NA	NA
LOCATION:					
DEPTH:	4'-6'	20'-22'	0'-2'	6'-8'	18'-20'
DESCRIPTION:					
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:	12/19/89	12/19/89	12/19/89	12/19/89	12/19/89

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 SUBSURFACE SOIL

SAMPLE NUMBER:			02-SB13B-A	02-SB13C-A	02-SB14A-A	02-SB14B-A	02-SB14C-A
NOTES:							
LOCATION:							
DEPTH:			4'-6'	20'-22'	0'-2'	6'-8	18'-20'
DESCRIPTION:							
UNITS:			MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
DATE SAMPLED:			12/19/89	12/19/89	12/19/89	12/19/89	12/19/89
*** GEOCHEMICAL PARAMETERS ***							
PP	CAS NO	COMPOUND					
		PETROLEUM HYDROCARBONS	ND	ND	ND	ND	ND

BLANK SAMPLES

FORMER BASE LANDFILL

ELLINGTON AFB - SITE 01 BLANKS

SAMPLE NUMBER:			01-FB01 A	01-FB02-A	01-FB03-A	01-FB04-A	01-FB10-A	01-FB11-A	01-RB01-A
NOTES:									
LOCATION:			HPLC	MUNICIPAL	HPLC	MUNICIPAL	HPLC	LF HYDRANT	
DEPTH:									
DESCRIPTION:			FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/14/89	12/14/89	12/21/89	12/21/89	01/24/90	01/24/90	12/12/89
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE		85					
	78-93-3	2-BUTANONE						110	76
	591-78-6	2-HEXANONE							27
4V	71-43-2	BENZENE					8		
23V	67-66-3	CHLOROFORM						33	
44V	75-09-2	METHYLENE CHLORIDE					14	21	
47V	75-25-2	BROMOFORM		30				21	
48V	75-27-4	BROMODICHLOROMETHANE		15		16		41	
51V	124-48-1	CHLORODIBROMOMETHANE		36		33		44	
	75-15-0	CARBON DISULFIDE							

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 BLANKS

SAMPLE NUMBER:			01-FB01-A	01-FB02-A	01-FB03-A	01-FB04-A	01-FB10-A	01-FB11-A	01-RB01-A
NOTES:									
LOCATION:			HPLC	MUNICIPAL	HPLC	MUNICIPAL	HPLC	LF HYDRANT	
DEPTH:									
DESCRIPTION:			FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/14/89	12/14/89	12/21/89	12/21/89	01/24/90	01/24/90	12/12/89
*** BASE/NEUTRALS ***									
PP	CAS NO	COMPOUND							
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE					1		
84B	129-00-0	PYRENE			99				

NOTES : J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

6-2

ELLINGTON FB SITE 01 BLANKS

SAMPLE NUMBER:			01 FB01 A	01 FB02 A	01-FB03 A	01 FB04 A	01 FB10 A	01 FB11 A	01-RB01-A
NOTES:									
LOCATION:			HPLC	MUNICIPAL	HPLC	MUNICIPAL	HPLC	LF HYDRANT	
DEPTH:									
DESCRIPTION:			FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/14/89	12/14/89	12/21/89	12/21/89	01/24/90	01/24/90	12/12/89
*** ACIDS ***									
PP	CAS NO	COMPOUND							
64A	87-86-5	PENTACHLOROPHENOL			230				

NOTES :
J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB   SITE 01 BLANKS

SAMPLE NUMBER:	01-FR01-A	01-FR02-A	01-FR03-A	01-FR04-A	01-FR10-A	01-FR11-A	01-RB01-A
NOTES:							
LOCATION:	HPLC	MUNICIPAL	HPLC	MUNICIPAL	HPLC	LF HYDRANT	
DEPTH:							
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/14/89	12/14/89	12/21/89	12/21/89	01/24/90	01/24/90	12/12/89

*** PESTICIDES ***

PP	CAS NO	COMPOUND
104P	319-86-8	DELTA BHC
105P	58-89-9	GAMMA BHC
100P	76-44-8	HEPTACHLOR

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 BLANKS

SAMPLE NUMBER:			01-FB01-A	01-FB02-A	01-FB03-A	01-FB04-A	01-FB10-A	01-FB11-A	01-RB01-A
NOTES:									
LOCATION:			HFLC	MUNICIPAL	HFLC	MUNICIPAL	HFLC	LF HYDRANT	
DEPTH:									
DESCRIPTION:			FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/14/89	12/14/89	12/21/89	12/21/89	01/24/90	01/24/90	12/12/89
*** INORGANICS ***									
PP	CAS NO	COMPOUND							
1		ALUMINUM							[8.8]
3		ARSENIC			0.18				
4		BARIUM						[93.4]	
5		BERYLLIUM			0.44	0.35			
7		CALCIUM	[93]	[85.9]			[711]	14400	[198]
8		CHROMIUM	[1.3]	[1.6]					
9		COBALT					[6.9]	[9.8]	
11		IRON					[29.0]	106	[2.2]
12		LEAD		[0.14]		0.33		[1.7]	
13		MAGNESIUM	[75.7]					[4230]	74.0
14		MANGANESE						16.5	
15		MERCURY					0.21	0.25	
17		POTASSIUM						[1110]	
19		SILVER							
20		SODIUM	[139]	[198]		96.3		100000	[100]
23		VANADIUM			1.1				[1.8]
24		ZINC	[2.3]	[2.0]		1.0		195	

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 BLANKS

SAMPLE NUMBER:	01-FB01-A	01-FB02-A	01-FB03-A	01-FB04-A	01-FB10-A	01-FB11-A	01-RB01-A
NOTES:							
LOCATION:	HPLC	MUNICIPAL	HPLC	MUNICIPAL	HPLC	LF HYDRANT	
DEPTH:							
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE
UNITS:	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
DATE SAMPLED:	12/14/89	12/14/89	12/21/89	12/21/89	01/24/90	01/24/90	12/12/89

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND							
		PETROLEUM HYDROCARBONS	ND	ND	ND	ND	ND	ND	ND

ELLINGTON AFB - SITE 01 BLANKS

SAMPLE NUMBER:			01-RB03-A	01-RB13-A	01-TB01-A	01-TB03-A	01-TB04-A	01-TB09-A
NOTES:								
LOCATION:								
DEPTH:								
DESCRIPTION:			RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/14/89	01/25/90	12/13/89	12/14/89	12/21/89	01/25/90
*** VOLATILES ***								
PP	CAS NO	COMPOUND						
	67-64-1	ACETONE						
	78-93-3	2-BUTANONE						
	591-78-6	2-HEXANONE						
4V	71-43-2	BENZENE		10				10
23V	67-66-3	CHLOROFORM			33	36	40	53
44V	75-09-2	METHYLENE CHLORIDE		13	19	19		22
47V	75-25-2	BROMOFORM						
48V	75-27-4	BROMODICHLOROMETHANE						
51V	124-48-1	CHLORODIBROMOMETHANE						
	75-15-0	CARBON DISULFIDE		67				

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB   SITE 01 BLANKS

SAMPLE NUMBER:			01-RB03-A	01-RB13-A	01-TB01-A	01-TB03-A	01-TB04-A	01-TB09-A
NOTES:					NA	NA	NA	NA
LOCATION:								
DEPTH:								
DESCRIPTION:			RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/14/89	01/25/90	12/13/89	12/14/89	12/21/89	01/25/90
*** BASE/NEUTRALS ***								
PP	CAS NO	COMPOUND						
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE						
84B	129-00-0	PYRENE						

NOTES :
J   APPROXIMATE VALUE
[]   APPROXIMATE VALUE
ND   NOT DETECTED
NA   NOT ANALYZED

ELLINGTON AFB - SITE 01 BLANKS

SAMPLE NUMBER:		01-RB03-A	01-RB13-A	01-TB01-A	01-TB03-A	01-TB04-A	01-TB09-A
NOTES:				NA	NA	NA	NA
LOCATION:							
DEPTH:							
DESCRIPTION:		RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:		UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:		12/14/89	01/25/90	12/13/89	12/14/89	12/21/89	01/25/90

ACIDS

PP	CAS NO	COMPOUND					
64A	87-86-5	PENTACHLOROPHENOL					

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 01 BLANKS

SAMPLE NUMBER:			01-RB03-A	01-RB13-A	01-TB01-A	01-TB03-A	01-TB04-A	01-TB09-A
NOTES:					NA	NA	NA	NA
LOCATION:								
DEPTH:								
DESCRIPTION:			RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			12/14/89	01/25/90	12/13/89	12/14/89	12/21/89	01/25/90
*** PESTICIDES ***								
PP	CAS NO	COMPOUND						
104P	319-86-8	DELTA BHC		0.072				
105P	58-89-9	GAMMA BHC		0.14				
100P	76-44-8	HEPTACHLOR		0.18				

NOTES : J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 01 BLANKS

	01-RB03-A	01-RR13-A	01-TB01-A	01-TB03-A	01-TB04-A	01-TB09-A
SAMPLE NUMBER:	01-RB03 A	01-RR13 A	01-TB01-A	01-TB03 A	01-TB04-A	01-TB09-A
NOTES:			NA	NA	NA	NA
LOCATION:						
DEPTH:						
DESCRIPTION:	RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	12/14/89	01/25/90	12/13/89	12/14/89	12/21/89	01/25/90

*** INORGANICS ***

PP	CAS NO	COMPOUND	01-RB03 A	01-RR13 A	01-TB01-A	01-TB03 A	01-TB04-A	01-TB09-A
1		ALUMINUM						
3		ARSENIC						
4		BARIUM						
5		BERYLLIUM						
7		CALCIUM	[83.9]	[1770]				
8		CHROMIUM	[1.1]					
9		COBALT		[8.4]				
11		IRON		[52.0]				
12		LEAD	[0.14]	[0.80]				
13		MAGNESIUM						
14		MANGANESE						
15		MERCURY						
17		POTASSIUM						
19		SILVER		[6.9]				
20		SODIUM		[540]				
23		VANADIUM						
24		ZINC	[2.4]	898				

NOTES : J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB   SITE 01 BLANKS

SAMPLE NUMBER:			01-RB03-A	01-RB13-A	01-TB01-A	01-TB03-A	01-TB04-A	01-TB09-A
NOTES:					NA	NA	NA	NA
LOCATION:								
DEPTH:								
DESCRIPTION:			RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:			MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
DATE SAMPLED:			12/14/89	01/25/90	12/13/89	12/14/89	12/21/89	01/25/90
*** GEOCHEMICAL PARAMETERS ***								
PF	CAS NO	COMPOUND						
		PETROLEUM HYDROCARBONS	ND	ND				

6-12

BLANK SAMPLES

POL STORAGE AREA

ELLINGTON AFB - SITE 02 BLANKS

		SAMPLE NUMBER:	02-FB05-A	02-FB06-A	02-FB07-A	02-FB08-A	02-FB09-A	02-RB05-A	02-RB07-A
		NOTES:							
		LOCATION:	HFLC	MUNICIPAL	HFLC	MUNICIPAL	FOL SPIGOT		
		DEPTH:							
		DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE	RINSATE
		UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
		DATE SAMPLED:	01/13/90	01/13/90	01/16/90	01/16/90	01/24/90	12/19/89	01/12/90
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE	24						
	78-93-3	2-BUTANONE							
	591-78-6	2-HEXANONE							
4V	71-43-2	BENZENE	15						17
86V	108-88-3	TOLUENE					10		
38V	100-41-4	ETHYLBENZENE					16		
	95-47-6	TOTAL XYLENES					5		
7V	108-90-7	CHLOROBENZENE		18			37		
29V	75-35-4	1,1-DICHLOROETHENE							
23V	67-66-3	CHLOROFORM		20					
44V	75-09-2	METHYLENE CHLORIDE	12			24	36		
47V	75-25-2	BROMOFORM		15			23		
48V	75-27-4	BROMODICHLOROMETHANE				22	14		
51V	124-48-1	CHLORODIBROMOMETHANE		32		21	9		
	75-15-0	CARBON DISULFIDE				34	15		
	108-05-4	VINYL ACETATE		23					

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 BLANKS

SAMPLE NUMBER:			02-FB05-A	02-FB06-A	02-FB07-A	02-FB08-A	02-FB09-A	02-RB05-A	02-RB07-A
NOTES:									
LOCATION:			WELL	MUNICIPAL	WELL	MUNICIPAL	POL SPIGOT		
DEPTH:									
DESCRIPTION:			FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE	RINSATE
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			01/13/90	01/13/90	01/16/90	01/16/90	01/24/90	12/19/89	01/12/90
*** BASE/NEUTRALS ***									
PP	CAS NO	COMPOUND							
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE					1	8	
55B	91-20-3	NAPHTHALENE					1		

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

7-2

ELLINGTON AFB - SITE 02 BLANKS

SAMPLE NUMBER:	02-FB05-A	02-FB06-A	02-FB07-A	02-FB08-A	02-FB09-A	02-RB05-A	02-RB07-A
NOTES:							
LOCATION:	HELC	MUNICIPAL	HELC	MUNICIPAL	FOL SPIGOT		
DEPTH:							
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE	RINSATE
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/13/90	01/13/90	01/16/90	01/16/90	01/24/90	12/19/89	01/12/90

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 BLANKS

SAMPLE NUMBER:	02-FB05-A	02-FB06-A	02-FB07-A	02-FB08-A	02-FB09-A	02-RB05-A	02-RB07-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:	HFLC	MUNICIPAL	HFLC	MUNICIPAL	POL SPIGOT		
DEPTH:							
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE	RINSATE
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/13/90	01/13/90	01/16/90	01/16/90	01/24/90	12/19/89	01/12/90

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 BLANKS

SAMPLE NUMBER:	02-FB05A-A	02-FB06A-A	02-FB07-A	02-FB08-A	02-FB09-A	02-RB05-A	02-RB07-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:	HELP	MUNICIPAL	HELP	MUNICIPAL	POL SPIGOT		
DEPTH:							
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE	RINSATE
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/13/90	01/13/90	01/16/90	01/16/90	01/24/90	12/19/89	01/12/90

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

7-5

NOTES :
J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 BLANKS

SAMPLE NUMBER:	02-FB05-A	02-FB06-A	02-FB07-A	02-FB08-A	02-FB09-A	02-RB05-A	02-RB07-A
NOTES:							
LOCATION:	HPLC	MUNICIPAL	HPLC	MUNICIPAL	POL SPIGOT		
DEPTH:							
DESCRIPTION:	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	RINSATE	RINSATE
UNITS:	UG/L	MG/L	MG/L	MG/L	UG/L	MG/L	MG/L
DATE SAMPLED:	01/13/90	01/13/90	01/16/90	01/16/90	01/24/90	12/19/89	01/12/90

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND							
		PETROLEUM HYDROCARBONS	ND	ND	ND	ND	ND	23	ND

7-6

ELLINGTON AFB - SITE 02 BLANKS

			02-RB09 A	02 RB11 A	02 TB03 A	02 TB05 A	02-TB06-A	02-TB07 A	02-TB08-A
SAMPLE NUMBER:			02-RB09 A	02 RB11 A	02 TB03 A	02 TB05 A	02-TB06-A	02-TB07 A	02-TB08-A
NOTES:									
LOCATION:									
DEPTH:									
DESCRIPTION:			RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:			UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:			01/15/90	01/22/90	12/19/89	01/12/90	01/16/90	01/22/90	01/24/90
*** VOLATILES ***									
PP	CAS NO	COMPOUND							
	67-64-1	ACETONE						23	
	78-93-3	2-BUTANONE						6	
	591-78-6	2-HEXANONE							19
4V	71-43-2	BENZENE		8				9	9
86V	108-88-3	TOLUENE						8	
38V	100-41-4	ETHYLBENZENE							5
	95-47-6	TOTAL XYLENES							
7V	108-90-7	CHLOROBENZENE							
29V	75-35-4	1,1-DICHLOROETHENE						9	
23V	67-66-3	CHLOROFORM			20	40	51	30	31
44V	75-09-2	METHYLENE CHLORIDE		14				18	18
47V	75-25-2	BROMOFORM							
48V	75-27-4	BROMODICHLOROMETHANE							
51V	124-48-1	CHLORODIBROMOMETHANE							
	75-15-0	CARBON DISULFIDE		85					15
	108-05-4	VINYL ACETATE							

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 BLANKS

		02-RB09-A	02-RB11-A	02-TB03-A	02-TB05-A	02-TB06-A	02-TB07-A	02-TB08-A
SAMPLE NUMBER:		02-RB09-A	02-RB11-A	02-TB03-A	02-TB05-A	02-TB06-A	02-TB07-A	02-TB08-A
NOTES:				NA	NA	NA	NA	NA
LOCATION:								
DEPTH:								
DESCRIPTION:		RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:		UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:		01/15/90	01/22/90	12/19/89	01/12/90	01/16/90	01/22/90	01/24/90

*** BASE/NEUTRALS ***

PP	CAS NO	COMPOUND	02-RB09-A	02-RB11-A	02-TB03-A	02-TB05-A	02-TB06-A	02-TB07-A	02-TB08-A
66B	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE		2					
55B	91-20-3	NAPHTHALENE							

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB - SITE 02 BLANKS

SAMPLE NUMBER:	02-RB09-A	02-RB11-A	02-TB03-A	02-TB05-A	02-TB06-A	02-TB07-A	02-TB08-A
NOTES:			NA	NA	NA	NA	NA
LOCATION:							
DEPTH:							
DESCRIPTION:	RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/15/90	01/22/90	12/19/89	01/12/90	01/16/90	01/22/90	01/24/90

*** ACIDS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

7-9

NOTES :
J APPROXIMATE VALUE
[] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 BLANKS

SAMPLE NUMBER:	02-RB09-A	02-RB11-A	02-TB03-A	02-TB05-A	02-TB06-A	02-TB07-A	02-TB08-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:							
DEPTH:							
DESCRIPTION:	RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/15/90	01/22/90	12/19/89	01/12/90	01/16/90	01/22/90	01/24/90

*** PESTICIDES ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
J APPROXIMATE VALUE
[ ] APPROXIMATE VALUE
ND NOT DETECTED
NA NOT ANALYZED

ELLINGTON AFB - SITE 02 BLANKS

SAMPLE NUMBER:	02-RB09-A	02-RB11-A	02-TB03-A	02-TB05-A	02-TB06-A	02-TB07-A	02-TB08-A
NOTES:	NA	NA	NA	NA	NA	NA	NA
LOCATION:							
DEPTH:							
DESCRIPTION:	RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
DATE SAMPLED:	01/15/90	01/22/90	12/19/89	01/12/90	01/16/90	01/22/90	01/24/90

*** INORGANICS ***

PP	CAS NO	COMPOUND

NO PARAMETERS FOR THIS CATEGORY

NOTES :
- J APPROXIMATE VALUE
- [] APPROXIMATE VALUE
- ND NOT DETECTED
- NA NOT ANALYZED

ELLINGTON AFB   SITE 02 BLANKS

SAMPLE NUMBER:		02-RB09-A	02-RB11-A	02-TB03-A	02-TB05-A	02-TB06-A	02-TB07-A	02-TB08-A
NOTES:				NA	NA	NA	NA	NA
LOCATION:								
DEPTH:								
DESCRIPTION:		RINSATE	RINSATE	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
UNITS:		MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
DATE SAMPLED:		01/15/90	01/22/90	12/19/89	01/12/90	01/16/90	01/22/90	01/24/90

*** GEOCHEMICAL PARAMETERS ***

PP	CAS NO	COMPOUND	02-RB09-A	02-RB11-A	02-TB03-A	02-TB05-A	02-TB06-A	02-TB07-A	02-TB08-A
		PETROLEUM HYDROCARBONS	ND	ND					

APPENDIX E

DATA VALIDATION REPORTS

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-49-0-3-174

TO:	LINDA STEAKLEY	DATE:	APRIL 18, 1990
FROM:	DEB SCHEIB	CC:	FILE

SUBJECT: ORGANIC DATA VALIDATION - VOA/BNA/P&P
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB1

SAMPLES:

SOIL

01-FB01-A	01-SB03B-A	02-SB11B-A
01-FB02-A	01-SB04A-A	02-SB11C-A
01-RB01-A	01-SB04B-A	02-SB12A-A
01-RB03-A	01-TB01-A	02-SB12B-A
01-SB01A-A	01-TB03-A	02-SB12C-A
01-SB01B-A	02-FD01-A	01-SB02-A
01-SB03A-A	02-SB11A-A	

NUS Laboratories analyzed 14 soil samples (including one field duplicate pair) and 6 aqueous quality control samples for Target Compound List (TCL) volatiles. In addition, thirteen samples were analyzed for semivolatile compounds and eleven were analyzed for pesticide /PCBs. Included with this sample set are two field blanks, two rinsate blanks and two trip blanks.

The data were reviewed with reference to the EPA "Functional Guidelines for Organic Data Validation", and the Hazardous Waste Remedial Action Program's (HAZWRAP) "Requirements for Quality Control of Analytical Data". These analyses were performed under HAZWRAP Level C QA/QC requirements and were evaluated based on the following criteria:

- Holding times
- GC/MS tuning and mass calibration
- Laboratory and field blank analyses
- Initial and continuing calibration
- Surrogate spike recovery
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Field duplicate precision
- Internal standards performance
- Detection limits

The data package was complete as submitted. Surrogate spike recovery and internal standards performance met contract required criteria. Results which did not meet quality control criteria are discussed below.

Volatile Fraction

The aromatic compound seven-day holding time allowance was exceeded by 4-5 days for samples 02-FD01-A, 02-SB11B-A, 02-SB12A-A, 02-SB12B-A and 02-SB12C-A. Detection Limits (DLs) for aromatic compounds in these samples are qualified as estimated, "UJ".

Sample 02-SB12A-A was reanalyzed beyond volatile compound holding time allowances. Only the reanalysis data was submitted as part of the data package. All results for this sample are considered to be estimated. Positive results are qualified "J"; DLs are qualified "UJ".

Instrument 4500B failed to meet GC/MS tuning and mass calibration criteria on 12/15/89. Only field quality control samples were analyzed on that date; no reanalyses were performed. No qualifications were made as field quality control samples are not qualified for any non-compliance. The sample data as reported is considered to be useable for purposes of evaluating the extent of blank contamination.

The following contaminants were detected in trip, field, rinsate and laboratory method blank analyses in the maximum concentrations indicated:

contaminant	maximum concentration (ug/kg)
benzene	8
bromodichloromethane	15
bromoform	30
bromomethane	2
chloromethane	1
chloroform	39
dibromochloromethane	36
1,1-dichloroethene	1
total-1,2-dichloroethene	2
trans-1,3-dichloropropane	1
2-hexanone	27
1,1,2,2-tetrachloroethane	1
1,1,1-trichloroethane	1
1,1,2-trichloroethane	3
vinyl acetate	1
common contaminant	
acetone	85
2-butanone	76
methylene chloride	19
toluene	3

Action levels of ten times the maximum amount of common lab contaminant and five times the maximum amount of other contaminants were used to evaluate the data. Sample size and moisture content adjustments were considered prior to application of the action levels. No qualifications were made for bromodichloromethane, dichlorobromomethane, bromoform, 2-hexanone, chloromethane, bromomethane, 1,1-dichloroethene and total-1,2-dichloroethene as no positive results were reported for these compounds. Sample contaminant concentrations below the Contract Required Quantitation Limit (CRQL) have been deleted. Sample contaminant concentrations above the CRQL but within the action level are qualified "U", as undetected.

The Percent Relative Standard Deviation (%RSD) for the initial calibration of 2-butanone exceeded 50%. No qualifications were made, however, as only field quality control samples were affected.

Initial calibrations for bromomethane, chloroethane and methylene chloride exceeded the exceeded ±30% RSD quality control limit. No qualifications were made for bromomethane as only field quality control samples were affected. No qualifications were made for chloroethane as no positive results were reported for this compound. All results for methylene chloride were previously qualified "U" on the basis of blank contamination; no further action was taken.

Some continuing calibration Percent Differences (%Ds) for acetone, cis-1,3-dichloropropene, trans-1,3-dichloropropene, carbon disulfide and 2-butanone exceeded 50%. No positive results were reported for these compounds in affected samples. DLs are qualified as estimated, "UJ".

Some continuing calibration %Ds for several compounds exceeded the ±25% quality control limit. No qualifications were made, however, as no positive results were reported for these compounds in affected samples.

The Relative Percent Differences (RPDs) for methylene chloride and acetone exceeded the 50% field duplicate quality criteria for soils. Results for these compounds in both samples have been previously qualified "U" based on blank contamination. No further actions were taken as this occurrence is felt to be attributable to varying levels of laboratory contamination and is not due to field duplicate imprecision.

Several unknown Tentatively Identified Compounds (TICs) were detected in blanks analyzed with this sample set. Sample results for these unknowns which are less than five times the maximum amount of TIC detected have been stricken (crossed-out) on the Form I-VOA TIC reports.

Semivolatile Fraction

Laboratory method blank analyses yielded a maximum amount of 35 ug/kg of the common laboratory contaminant di-n-butyl phthalate. A corresponding 350 ug/kg action level was used to evaluate the data. Sample size and moisture content adjustments were considered prior to application of the action level. Sample contaminant concentrations below the CRQL have been deleted. Sample contaminant concentrations above the CRQL but within the action level are qualified "U", as undetected.

The 30% RSD initial calibration criteria was exceeded for 4-chloroaniline, 3-nitroaniline, 2,4-dinitrophenol, 4-nitroaniline, bis(2-chloroethoxy)methane, 2-methylphthalene, 2,6-dinitrotoluene, 4-chlorophenyl-phenylether, fluorene, and pyrene. No qualifications were made as no positive results were reported for these compounds.

The continuing calibration Response Factor (RF) for 4-nitrophenol was below the 0.05 quality control limit. Only sample 01-SB01B-A was affected. The DL for 4-nitrophenol in this sample is qualified as unreliable, "R".

Some continuing calibration %Ds for di-n-butylphthalate and butylbenzylphthalate exceeded 50%. No qualifications were made as only field quality control samples were affected.

The ± 25 %D quality control criteria was exceeded for the continuing calibrations of several compounds. No qualifications were made as no positive results were reported for these compounds in the affected samples.

Percent recoveries (%R) for 4-nitrophenol and 2,4-dinitrotoluene exceeded quality control limits for the Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis of sample 01-SB02-A. No qualifications were made as no positive results were reported for this sample.

Several TICs were detected in associated blank analyses. A summary of the maximum amounts of TIC contaminants found follows:

Contaminant (RT)	Max. Amount Found (ug/kg)
2,5-dimethyl-2-hexene	180
2,5-dimethyl-3-hexene	240
2,3,6-trimethyl heptane	830
aldol condensation product	37000
2,3-dimethyl heptane	1700
2,4-dimethyl heptane	190
2,5-dimethyl heptane	220

(continued)

2,6-dimethyl heptane	780
3,4-dimethyl heptane	310
3,5-dimethyl heptane	2300
2,2,4-trimethyl pentane	130
2,3,4-trimethyl pentane	2100
4-(1-methylethyl)-heptane	660
5,5-dimethyl-2-furanone	540
dimethyl-2-pentene isomer	260
1-methylethyl acetic acid (ester)	1600
4-methylethyl acetic acid (ester)	140
2,6-dimethyl heptane	350
2-methyl octane	220
3-methyl octane	1300
2-butoxy ethanol	1300
2-ethyhexyl hexanedioic acid (ester)	65000

Several unknowns and alkanes were also detected. Sample results less than five times the maximum amounts of TIC contaminants shown above have been stricken (crossed-out) on the Form I-BNA TIC reports.

Pesticide/PCB Fraction

Sample 01-SB04B-A was extracted six days beyond holding time allowances. No positive results were reported. DLs for this sample are qualified as estimated, "UJ".

DATA SUMMARY

TABLE A

DATA SUMMARY FORM: V O L A T I L E S 1

Site Name: Ellington Air Force Base (SDG EAFBI) SOIL SAMPLES (ug/Kg)

Case #: EAFBI Sampling Date(s): 12/12/89 - 12/14/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/

CRQL	Sample No.	CI-EB01-A	CI-EB02-A	CI-RB01-A	CI-RB02-A	CI-SS01A-A	CI-SS01B-A	[illegible]	CI-SS03G-A	CI-SS04[illegible]
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	% Moisture	-	-	-		20	15	10	20	14
	Location	-	-	-	-	16'-18'	26'-28'	8'-10'	12'-14'	4'-6'
	Date Sampled	12/14/89	12/14/89	12/12/89	12/14/89	12/13/89	12/13/89	12/13/89	12/13/89	12/13/[illegible]
	Date Analyzed	12/15/89	12/15/89	12/15/89	12/15/89	12/15/89	12/15/89	12/15/89	12/1[illegible]/89	12/1[illegible]
	COMPOUND	FIELD BLANK HPLC	FIELD BLANK MUNICIPAL	Rinsate Blank	Rinsate Blank					
10	Chloromethane									
10	Bromomethane									
10	Vinyl Chloride									
10	Chloroethane									
5	Methylene Chloride					88 U	91 U	110 U	62 U	47
10	Acetone		85						UJ	
5	Carbon Disulfide									
5	1,1-Dichloroethene									
5	1,1-Dichloroethane									
5	Total-1,2-Dichloroethene									
5	Chloroform					12 U	15 U			15
5	1,2-Dichloroethane									
10	2-Butanone			76						
5	1,1,1-Trichloroethane									
5	Carbon Tetrachloride									
10	Vinyl Acetate									
5	Bromodichloromethane		15							

CRDL = Contract Required Detection Limit

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Tabulated by Pat Brush

Verified by Deb Scheib

DATA SUMMARY FORM: V O L A T I L E S 2

Site Name: Ellington Air Force Base

SOIL SAMPLES
(ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/12/89 - 12/14/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moistur

CRQL	Sample No.	01-FB01-A	01-FB02-A	01-RB01-A	01-RB03-A	01-SB01A-A	01-SB01B-A	01-SB03A-A	01-SB03B-A	01-SB04
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	% Moisture	-	-	-	-	20	15	12	20	14
	Location	-	-	-	-	16'-18'	26'-28'	8'-10'	12'-14'	4'-6
	Date Sampled	12/14/89	12/14/89	12/12/89	12/14/89	12/13/89	12/13/89	12/13/89	12/13/89	12/12
	Date Analyzed	12/15/89	12/15/89	12/15/89	12/15/89	12/15/89	12/15/89	12/15/89	12/16/89	12/16
	COMPOUND	HPLC Water	Municipal Water	Rinsate Blank	Rinsate Blank					
5	1,2-Dichloropropane									
5	Cis-1,3-Dichloropropene									
5	Trichloroethene								UJ	
5	Dibromochloromethane		36							
5	1,1,2-Trichloroethane									
5	Benzene									
5	Trans-1,3-Dichloropropene									
5	Bromoform		30						UJ	
10	4-Methyl-2-pentanone									
10	2-Hexanone			27						
5	Tetrachloroethene									
5	1,1,2,2-Tetrachloroethane									
5	Toluene									
5	Chlorobenzene									
5	Ethylbenzene									
5	Styrene									
5	Total Xylenes									

CRQL = Contract Required Quantitation Limit

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DATA SUMMARY FORM: B N A S 1

Site Name: Ellington Air Force Base

Case #: EAFB1 Sampling Date(s): 12/12/89-12/14/89

SOIL SAMPLES
(ug/Kg)

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/

BLANKS: 01-FB01-A, 01-FB02-A, 01-RB01-A, 01-RB03-A

CRQL	Sample No.	01-FB01-A	01-FB02-A	01-RB01-A	01-RB03-A	01-SB01A-A	01-SB01B-A	01-SB03A-A	01-SB03B-A	01-SB04
	Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	% Moisture	-	-	-	-	20	15	17	20	14
	Location	HPLC Water	[illegible]	Rinsate	Rinsate	16'-18'	26'-28'	8'-10'	12'-14'	4'-6'
	Date Sampled	12/14/89	12/14/89	12/12/89	12/14/89	12/13/89	12/13/89	12/13/89	12/13/89	12/12/89
	Date Analyzed	1/4/90	1/4/89	1/4/90	1/4/90	1/3/90	1/4/90	1/4/90	1/4/90	1/3/90
	Date Extracted	12/19/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89
330	Phenol									
330	bis(2-Chloroethyl)ether									
330	2-Chlorophenol									
330	1,3-Dichlorobenzene									
330	1,4-Dichlorobenzene									
330	Benzyl Alcohol									
330	1,2-Dichlorobenzene									
330	2-Methylphenol									
330	bis(2-Chloroisopropyl)ether									
330	4-Methylphenol									
330	N-Nitroso-di-n-propylamine									
330	Hexachloroethane									
330	Nitrobenzene									
330	Isophorone									
330	2-Nitrophenol									
330	2,4-Dimethylphenol									
1600	Benzoic Acid									
330	bis(2-Chloroethoxy)methane									
330	2,4-Dichlorophenol									
330	1,2,4-Trichlorobenzene									
330	Naphthalene									
330	4-Chloroaniline									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

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DATA SUMMARY FORM: B N A S 2

Site Name: Ellington Air Force Base

Case #: EAFB1 **Sampling Date(s):** 12/12/89-12/14/89

SOIL SAMPLES
(ug/Kg)

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/10

BLANKS

CRQL	Sample No.	01-FB01-A	01-FB02-A	01-GB01-A	01-GB03-A	01-SB01A-A	01-SB015-A	01-SB0?A-A	01-SC03G-A	01-SB?4?
	Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	% Moisture	-	-		-	20	15	17	30	14
	Location	HPLC Water	Municipal	Rinsate	Rinsate	16'-18'	26'-28'	8'-10'	12'-14'	4'-6'
	Date Sampled	12/14/89	12/14/89	12/12/89	12/14/89	12/12/89	12/13/89	12/13/89	12/13/89	12/12/8[illegible]
	Date Analyzed	1/4/90	1/4/90	1/4/90	1/4/90	1/3/90	1/4/90	1/4/90	1/4/90	1/3/9[illegible]
	Date Extracted	12/18/89	12/18/89	12/19/89	12/19/89	12/19/89	12/19/89	12/19/89	12/19/89	12/19/8[illegible]
330	Hexachlorobutadiene									
330	4-Chloro-3-methylphenol									
330	2-Methylnaphthalene									
330	Hexachlorocyclopentadiene									
330	2,4,6-Trichlorophenol									
1600	2,4,5-Trichlorophenol									
330	2-Chloronaphthalene									
1600	2-Nitroaniline									
330	Dimethylphthalate									
330	Acenaphthylene									
330	2,6-Dinitrotoluene									
1600	3-Nitroaniline									
330	Acenaphthene									
1600	2,4-Dinitrophenol									
1600	4-Nitrophenol						R			
330	Dibenzofuran									
330	2,4-Dinitrotoluene									
330	Diethylphthalate									
330	4-Chlorophenyl-phenylether									
330	Fluorene									
1600	4-Nitroaniline									
1600	4,6-Dinitro-2-methylphenol									

CRQL = Contract Required Quantitation Limit

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DATA SUMMARY FORM: B N A S 3

Site Name: Ellingsh[illegible]

SOIL SAMPLES
(ug/Kg)

Case #: [illegible] Sampling Date(s): 12/12/89 - 12/14/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)

BLANKS

CRQL										
	Sample No.	01-FB01-A	01-FB02-A	01-RB01-A	01-RB03-A	01-SS01-A	01-SS01-B	01-SS03-A	01-SS03-B	01-SS04
	Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	% Moisture	-		-	-	20	15	17	20	14
	Location	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Date Sampled	12/14/89	12/14/89	12/12/89	12/14/89	12/1?/89	12/13/89	12/13/89	12/13/89	12/12/
	Date Analyzed	1/4/90	1/4/90	1/4/90	1/4/90	1/?/90	1/4/90	1/4/90	1/4/90	1/3/
	Date Extracted	12/18/89	12/18/89	12/18/89	12/18/90	12/18/89	12/18/89	12/18/89	12/18/89	12/18/
330	N-Nitrosodiphenylamine									
330	4-Bromophenyl-phenylether									
330	Hexachlorobenzene									
1600	Pentachlorophenol									
330	Phenanthrene									
330	Anthracene									
330	Di-n-butylphthalate									
330	Fluoranthene									
330	Pyrene									
330	Butylbenzylphthalate									
1600	3,3-Dichlorobenzidine									
330	Benzo(a)anthracene									
330	Chrysene									
330	bis(2-Ethylhexyl)phthalate									
330	Di-n-octylphthalate									
330	Benzo(b)fluoranthene									
330	Benzo(k)fluoranthene									
330	Benzo(a)pyrene									
330	Indeno(1,2,3-cd)pyrene									
330	Dibenz(a,h)anthracene									
330	Benzo(g,h,i)perylene									

CRQL = Contract Required Quantitation Limit

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DATA SUMMARY FORM: P E S T I C I D E S A N D P C B S

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base

Case #: EAFB1 Sampling Date(s): ______

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100)

BLANKS: 01-FB01-A, 01-FB02-A, 01-RB01-A, 01-RB03-A

CRQL	Sample No.	01-FB01-A	01-FB02-A	01-RB01-A	01-RB03-A	01-SB01A-A	01-SB01B-A	01-SB03A-A	01-SB03B-A	01-SB04A-A
	Dilution Factor	1.000	1.000	1.000	1.000	1.000	5.00	1.000	2.00	1.000
	% Moisture	-	-	-	-	20	15	17	20	14
	Location	HPLC Water	Municipal	Rinsate	Rinsate	16'-18'	26'-28'	8'-10'	12'-14'	4'-6'
	Date Sampled	12/14/89	12/14/89	12/13/89	12/14/89	12/13/89	12/13/89	12/13/89	12/13/89	12/12/89
	Date Analyzed	1/16/90	1/12/90	1/12/90	1/12/90	1/12/90	1/12/90	1/12/90	1/16/90	1/16/90
	Date Extracted	12/19/89	12/19/89	12/24/89	12/19/89	12/19/89	12/19/89	12/19/89	12/19/89	12/19/89
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor								21	
8	Aldrin									
8	Heptachlor Epoxide									
8	Endosulfan I									
16	Dieldrin									
16	4,4'-DDE									
16	Endrin									
16	Endosulfan II									
16	4,4'-DDD									
16	Endosulfan Sulfate									
16	4,4'-DDT									
80	Methoxychlor									
16	Endrin ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

DATA SUMMARY FORM: V O L A T I L E S 1

Site Name: Ellington Air Force Base (SOG EAFB1) **SOIL SAMPLES** (ug/Kg)

Case #: EAFB1 **Sampling Date(s):** 12/13/89 - 12/18/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture

CRQL	Sample No.	D1-SB4B-A		C1-TB4-A		C1-TBC3-A		C2-FD01-A		C2-SB1C-A		C2-SB1A-A		C2-SB1B-A			
	Dilution Factor	1.00		1.00		1.00		1.00		1.00		1.00		1.00			
	% Moisture	33		-		-		18		17		29		14			
	Location	12'-14'		-		-		18-22'		18-22'		[illegible]		4'-6'			
	Date Sampled	12/13/89		12/13/89		12/14/89		12/18/89		12/18/89		12/18/89		12/18/89			
	Date Analyzed	12/16/89		12/15/89		12/15/89		12/20/89		12/22/89		12/22/89		12/20/89			
	COMPOUND			Trip Blank		Trip Blank		Field Dup for SB1C-A									
10	Chloromethane																
10	Bromomethane																
10	Vinyl Chloride																
10	Chloroethane																
5	Methylene Chloride	61	U	19		19		42	U	21	U	28	U	16	U		
10	Acetone							38	U	19	U	170	U	110	U		
5	Carbon Disulfide														UJ		
5	1,1 Dichloroethene																
5	1,1-Dichloroethane																
5	Total-1,2-Dichloroethene																
5	Chloroform	19	U	33		36		17	U	13	U	22	U				
5	1,2-Dichloroethane																
10	2-Butanone											16	U				
5	1,1,1-Trichloroethane																
5	Carbon Tetrachloride																
10	Vinyl Acetate																
5	Bromodichloromethane																

CRDL = Contract Required Detection Limit

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DATA SUMMARY FORM: VOLATILES 2

Site Name: Ellsworth Air Force Base

SOIL SAMPLES
(ug/Kg)

Case #: 21721 Sampling Date(s): 12/12/89-12/18/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture

CRQL	Sample No.	D1-SB04B-A	C1-T3C1-A	C1-T3C3-A	D2-FD01A	D2-SB11C-A	D2-SB11A-A	D2-SB11B-A		
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
	% Moisture	22	-	-	18	17	29	24		
	Location	12'-14'	-	-	18'-22'	18'-22'	0'-2'	4'-6'		
	Date Sampled	12/12/89	12/13/89	12/14/89	12/18/89	12/18/89	12/18/89	12/18/89		
	Date Analyzed	12/16/89	12/15/89	12/15/89	12/22/89	12/22/89	12/22/89	12/30/89		
	COMPOUND		Trip Blank	Trip Blank	Field Dup for SB11C-A					
5	1,2-Dichloropropane									
5	Cis-1,3-Dichloropropene									
5	Trichloroethene									
5	Dibromochloromethane									
5	1,1,2-Trichloroethane									
5	Benzene				UJ			12 U		
5	Trans-1,3-Dichloropropene				~~UJ~~	UJ	UJ	UJ		
5	Bromoform					UJ	UJ			
10	4-Methyl-2-pentanone									
10	2-Hexanone									
5	Tetrachloroethene									
5	1,1,2,2-Tetrachloroethane									
5	Toluene				UJ			UJ		
5	Chlorobenzene				UJ			UJ		
5	Ethylbenzene				UJ			UJ		
5	Styrene				UJ			UJ		
5	Total Xylenes				UJ			UJ		

CRQL = Contract Required Quantitation Limit

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DATA SUMMARY FORM: B N A S 2

Site Name: Ellington Air Force Base

SOIL SAMPLES
(ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/12/89 - 12/18/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1

CRQL										
	Sample No.	01-SG04B-A	01-TB01-A	01-TB05-A	02-FD01-A	02-SB11C-A	02-SB11B-A	02-SB11B-A		
	Dilution Factor	1.00						1.00		
	% Moisture	33						34		
	Location	12'-14'						4'-6'		
	Date Sampled	12/12/89						12/18/89		
	Date Analyzed	1/3/90						1/4/90		
	Date Extracted	12/18/89						12/21/89		
330	Hexachlorobutadiene									
330	4-Chloro-3-methylphenol									
330	2-Methylnaphthalene									
330	Hexachlorocyclopentadiene		not	not	not	not	not			
330	2,4,6-Trichlorophenol		analyzed	analyzed	analyzed	analyzed	analyzed			
1600	2,4,5-Trichlorophenol									
330	2-Chloronaphthalene									
1600	2-Nitroaniline									
330	Dimethylphthalate									
330	Acenaphthylene									
330	2,6-Dinitrotoluene									
1600	3-Nitroaniline									
330	Acenaphthene									
1600	2,4-Dinitrophenol									
1600	4-Nitrophenol									
330	Dibenzofuran									
330	2,4-Dinitrotoluene									
330	Diethylphthalate									
330	4-Chlorophenyl-phenylether									
330	Fluorene									
1600	4-Nitroaniline									
1600	4,6-Dinitro-2-methylphenol									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

revised 12/88

DATA SUMMARY FORM: B N A S 1

Site Name: Ellington Air Force Base

SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/12/89 - 12/18/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1

CRQL	Sample No.	01-SB04B-A	01-TB01-A	01-TB03-A	02-F001A	02-SB11C-A	02-SB11A-A	02-SB11B-A		
	Dilution Factor	1.000						1.000		
	% Moisture	22						24		
	Location	12'-14'						4'-6'		
	Date Sampled	12/12/89						12/15/89		
	Date Analyzed	1/3/90						1/4/90		
	Date Extracted	12/18/89						12/21/89		
330	Phenol									
330	bis(2-Chloroethyl)ether									
330	2-Chlorophenol									
330	1,3-Dichlorobenzene		not	not	not	not	not			
330	1,4-Dichlorobenzene		analyzed	analyzed	analyzed	analyzed	analyzed			
330	Benzyl Alcohol									
330	1,2-Dichlorobenzene									
330	2-Methylphenol									
330	bis(2-Chloroisopropyl)ether									
330	4-Methylphenol									
330	N-Nitroso-di-n-propylamine									
330	Hexachloroethane									
330	Nitrobenzene									
330	Isophorone									
330	2-Nitrophenol									
330	2,4-Dimethylphenol									
1600	Benzoic Acid									
330	bis(2-Chloroethoxy)methane									
330	2,4-Dichlorophenol									
330	1,2,4-Trichlorobenzene									
330	Naphthalene									
330	4-Chloroaniline									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION:

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DATA SUMMARY FORM: B N A S 3

Site Name: Ellington Air Force Base

SOIL SAMPLES (ug/Kg)

Case #: EHF31 Sampling Date(s): 12/12/89 - 12/18/89

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moisture)

CRQL	Sample No.	01-SB04B A	01-TB01-A	01-TB02-A	02-FD01-A	02-SB11C-A	02-SB11A-A	[illegible]	
	Dilution Factor	1.000						1.000	
	% Moisture	22						24	
	Location	12'-14'						4'-6'	
	Date Sampled	12/13/89						12/15/89	
	Date Analyzed	1/3/90						1/4/90	
	Date Extracted	12/14/89						12/21/89	
330	N-Nitrosodiphenylamine								
330	4-Bromophenyl-phenylether								
330	Hexachlorobenzene								
1600	Pentachlorophenol		not	not	not	not	not		
330	Phenanthrene		analyzed	analyzed	analyzed	analyzed	analyzed		
330	Anthracene								
330	Di-n-butylphthalate								
330	Fluoranthene								
330	Pyrene								
330	Butylbenzylphthalate								
1600	3,3-Dichlorobenzidine								
330	Benzo(a)anthracene								
330	Chrysene								
330	bis(2-Ethylhexyl)phthalate								
330	Di-n-octylphthalate								
330	Benzo(b)fluoranthene								
330	Benzo(k)fluoranthene								
330	Benzo(a)pyrene								
330	Indeno(1,2,3-cd)pyrene								
330	Dibenz(a,h)anthracene								
330	Benzo(g,h,i)perylene								

CRQL = Contract Required Quantitation Limit

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DATA SUMMARY FORM: P E S T I C I D E S A N D P C B S

Site Name: Ellington Air Force Base

Case #: EAFGI Sampling Date(s): ______

SOIL SAMPLES
(ug/Kg)

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL	Sample No.	01-SB04B-A		01-TB01-A		01-TB03-A		02-F001-A		02-SB11C-A		02-SB11A-A		02-SB11B-A					
	Dilution Factor	1.000																	
	% Moisture	22																	
	Location	12'-14'																	
	Date Sampled	12/12/89																	
	Date Analyzed	1/12/90																	
	Date Extracted	12/28/89																	
8	alpha-BHC		UJ																
8	beta-BHC		UJ																
8	delta-BHC		UJ																
8	Gamma-BHC (Lindane)		UJ																
8	Heptachlor		UJ																
8	Aldrin		UJ																
8	Heptachlor Epoxide		UJ	not		not		not		not		not		not					
8	Endosulfan I		UJ	analyzed		analyzed		analyzed		analyzed		analyzed		analyzed					
16	Dieldrin		UJ																
16	4,4'-DDE		UJ																
16	Endrin		UJ																
16	Endosulfan II		UJ																
16	4,4'-DDD		UJ																
16	Endosulfan Sulfate		UJ																
16	4,4'-DDT		UJ																
80	Methoxychlor		UJ																
16	Endrin ketone		UJ																
80	Alpha-Chlordane		UJ																
80	Gamma-Chlordane		UJ																
160	Toxaphene		UJ																
80	Aroclor-1016		UJ																
80	Aroclor-1221		UJ																
80	Aroclor-1232		UJ																
80	Aroclor-1242		UJ																
80	Aroclor-1248		UJ																
160	Aroclor-1254		UJ																
160	Aroclor-1260		UJ																

CRQL = Contract Required Quantitation Limit

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DATA SUMMARY FORM: VOLATILES 1

SOIL SAMPLES (ug/Kg)

Site Name: Ellington [illegible]

Case #: [illegible] Sampling Date(s): 12/14/89 - 12/18/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)

CRQL	Sample No.	CR-0313A A	[illegible] A	[illegible] A	[illegible] A				
	Dilution Factor	1.00	1.00	1.00	1.00				
	% Moisture	28	30	14	17				
	Location	[illegible]	[illegible]	[illegible]	[illegible]				
	Date Sampled	12/18/89	12/18/89	12/15/89	12/14/89				
	Date Analyzed	1/12/90	12/30/89	12/30/89	12/15/89				
	COMPOUND	REANALYSIS*							
10	Chloromethane	UJ							
10	Bromomethane	UJ							
10	Vinyl Chloride	UJ							
10	Chloroethane	UJ							
5	Methylene Chloride	13 U	23 U	20 U	22 U				
10	Acetone	87 U	160 U						
5	Carbon Disulfide	UJ		UJ					
5	1,1-Dichloroethene	UJ							
5	1,1-Dichloroethane	UJ							
5	Total-1,2-Dichloroethene	UJ							
5	Chloroform	18 U		12 U					
5	1,2-Dichloroethane	UJ							
10	2-Butanone	29 U							
5	1,1,1-Trichloroethane	UJ							
5	Carbon Tetrachloride	UJ							
10	Vinyl Acetate	UJ							
5	Bromodichloromethane	UJ							

CRQL = Contract Required Detection Limit

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* original results not submitted

DATA SUMMARY FORM: VOLATILES 2

SOIL SAMPLES
(ug/Kg)

Site Name: [illegible]

Case #: [illegible] Sampling Date(s): 12/19/89, 12/18/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moistu

CRQL	Sample No.	[illegible]		[illegible]		[illegible]		[illegible]	
	Dilution Factor	1.00		1.00		1.00		1.00	
	% Moisture	[illegible]		[illegible]		18		[illegible]	
	Location	[illegible]		[illegible]		[illegible]		[illegible]	
	Date Sampled	12/19/89		12/18/89		12/18/89		12/19/89	
	Date Analyzed	[illegible]		[illegible]		[illegible]		[illegible]	
	COMPOUND	Re-analysis							
5	1,2-Dichloropropane		UJ						
5	Cis-1,3-Dichloropropene		UJ						
5	Trichloroethene		UJ						UJ
5	Dibromochloromethane		UJ						
5	1,1,2-Trichloroethane		UJ						
5	Benzene	18	U		UJ		UJ		
5	Trans-1,3-Dichloropropene		UJ		UJ		UJ		UJ
5	Bromoform		UJ						
10	4-Methyl-2-pentanone		UJ						
10	2-Hexanone		UJ						
5	Tetrachloroethene		UJ						
5	1,1,2,2-Tetrachloroethane		UJ						
5	Toluene		UJ		UJ		UJ		
5	Chlorobenzene		UJ		UJ		UJ		
5	Ethylbenzene		UJ		UJ		UJ		
5	Styrene		UJ		UJ		UJ		
5	Total Xylenes		UJ		UJ		UJ		

CRQL = Contract Required Quantitation Limit

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DATA SUMMARY FORM: B N A S 1

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base

Case #: EAFBL Sampling Date(s): 12/14/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)

CRQL	Sample No.	02-SB12A-A	02-SB12B-A	02-SB12C-A	01-SB02-A					
	Dilution Factor	1.0			1.000					
	% Moisture	28			17					
	Location	0'-2'			16'-18'					
	Date Sampled	12/18/89			12/14/89					
	Date Analyzed	1/4/90			1/4/90					
	Date Extracted	12/21/89			12/18/89					
330	Phenol									
330	bis(2-Chloroethyl)ether									
330	2-Chlorophenol									
330	1,3-Dichlorobenzene		not	not						
330	1,4-Dichlorobenzene		analyzed	analyzed						
330	Benzyl Alcohol									
330	1,2-Dichlorobenzene									
330	2-Methylphenol									
330	bis(2-Chloroisopropyl)ether									
330	4-Methylphenol									
330	N-Nitroso-di-n-propylamine									
330	Hexachloroethane									
330	Nitrobenzene									
330	Isophorone									
330	2-Nitrophenol									
330	2,4-Dimethylphenol									
1600	Benzoic Acid									
330	bis(2-Chloroethoxy)methane									
330	2,4-Dichlorophenol									
330	1,2,4-Trichlorobenzene									
330	Naphthalene									
330	4-Chloroaniline									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIOI

revised 12/88

DATA SUMMARY FORM: B N A S 2

Site Name: Ellington Air Force Base

Case #: EAFGL Sampling Date(s): 12/14/89

SOIL SAMPLES
(ug/Kg)

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1

CRQL	Sample No.	02-SB12A-A	02-SB2B-A	02-SB2C-A	01-SB02-A					
	Dilution Factor	1.0			1.000					
	% Moisture	28			17					
	Location	0'-2'			16'-18'					
	Date Sampled	12/18/89			12/14/89					
	Date Analyzed	1/4/90			1/4/90					
	Date Extracted	12/21/89			12/18/89					
330	Hexachlorobutadiene									
330	4-Chloro-3-methylphenol									
330	2-Methylnaphthalene									
330	Hexachlorocyclopentadiene		not	not						
330	2,4,6-Trichlorophenol		analyzed	analyzed						
1600	2,4,5-Trichlorophenol									
330	2-Chloronaphthalene									
1600	2-Nitroaniline									
330	Dimethylphthalate									
330	Acenaphthylene									
330	2,6-Dinitrotoluene									
1600	3-Nitroaniline									
330	Acenaphthene									
1600	2,4-Dinitrophenol									
1600	4-Nitrophenol									
330	Dibenzofuran									
330	2,4-Dinitrotoluene									
330	Diethylphthalate									
330	4-Chlorophenyl-phenylether									
330	Fluorene									
1600	4-Nitroaniline									
1600	4,6-Dinitro-2-methylphenol									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

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DATA SUMMARY FORM: B N A S 3

Site Name: Ellington Air Force Base

Case #: EAFB1 Sampling Date(s): 12/14/89

SOIL SAMPLES
(ug/Kg)

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture

CRQL	Sample No.	02-SB12A-A	02-SB12B-A	02-SB12C-A	01-SB02-A					
	Dilution Factor	1.0			1.000					
	% Moisture	28			17					
	Location	0'-2'			16'-18'					
	Date Sampled	12/19/89			12/14/89					
	Date Analyzed	1/4/90			1/4/90					
	Date Extracted	12/21/89			12/18/89					
330	N-Nitrosodiphenylamine									
330	4-Bromophenyl-phenylether									
330	Hexachlorobenzene									
1600	Pentachlorophenol		not	not						
330	Phenanthrene		analyzed	analyzed						
330	Anthracene									
330	Di-n-butylphthalate									
330	Fluoranthene									
330	Pyrene									
330	Butylbenzylphthalate									
1600	3,3-Dichlorobenzidine									
330	Benzo(a)anthracene									
330	Chrysene									
330	bis(2-Ethylhexyl)phthalate									
330	Di-n-octylphthalate									
330	Benzo(b)fluoranthene									
330	Benzo(k)fluoranthene									
330	Benzo(a)pyrene									
330	Indeno(1,2,3-cd)pyrene									
330	Dibenz(a,h)anthracene									
330	Benzo(g,h,i)perylene									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIO

DATA SUMMARY FORM: P E S T I C I D E S AND P C B S

Site Name: Ellington Air Force Base

Case #: EAFB1 Sampling Date(s): ______

SOIL SAMPLES
(ug/Kg)

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL	Sample No.	02-SB12A-A	02-SB12B-A	02-SB12C-A	01-SB02-A					
	Dilution Factor				1.000					
	% Moisture				17					
	Location				16'-18'					
	Date Sampled				12/14/89					
	Date Analyzed				1/12/90					
	Date Extracted				12/19/89					
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor	not analyzed	not analyzed	not analyzed						
8	Aldrin									
8	Heptachlor Epoxide									
8	Endosulfan I									
16	Dieldrin									
16	4,4'-DDE									
16	Endrin									
16	Endosulfan II									
16	4,4'-DDD									
16	Endosulfan Sulfate									
16	4,4'-DDT									
80	Methoxychlor									
16	Endrin ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-49-0-4-130

TO: LINDA STEAKLEY

DATE: APRIL 18, 1990

FROM: DEB SCHEIB DAS

CC: FILE

SUBJECT: ORGANIC DATA VALIDATION - VOA/BNA/P&P
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB2

SAMPLES:

WATER

01-FD02-A	02-SB13C-A	01-TB04-A
01-SB05A-A	01-SB14A-A	02-RB05-A
01-SB05B-A	01-SB14B-A	RB06-A
01-SB13A-A	01-SB14C-A	FB04-A
01-SB13B-A	02-TB03-A	FB03-A

NUS Laboratories analyzed 9 soil samples (including one field duplicate pair) and 6 aqueous quality control samples for Target Compound List (TCL) volatiles. In addition, nine samples were analyzed for TCL semivolatile compounds and six samples were analyzed for pesticide /PCBs. Included with this sample set are two field blanks, two rinsate blanks and two trip blanks.

The data were reviewed with reference to the EPA "Functional Guidelines for Organic Data Validation", and the Hazardous Waste Remedial Action Program's (HAZWRAP) "Requirements for Quality Control of Analytical Data". These analyses were performed under HAZWRAP Level C QA/QC requirements and were evaluated based on the following criteria:

- Holding times
- GC/MS tuning and mass calibration
- Laboratory and field blank analyses
- Initial and continuing calibration
- Surrogate spike recovery
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Field duplicate precision
- Internal standards performance
- Detection limits

The data package was complete as submitted. GC/MS tuning and mass calibration, internal standards performance and surrogate spike recoveries met contract required criteria. Results which did not meet quality control criteria are discussed below.

Volatile Fraction

The aromatic compound seven-day holding time allowance was exceeded by 1 day for samples 01-FD02-A, 01-SB05A-A and 01-SB05B-A. No qualifications were made as this occurrence is felt to have negligible impact on soils.

The seven-day aromatic holding time allowance was exceeded by several days for the following samples:

02-SB13A-A	02-TB03-A	RB06-A
02-SB13C-A	01-TB04-A	
02-SB14C-A	FB04-A	

In addition, the fourteen-day volatile compound holding time allowance was exceeded by several days for the reanalysis of the following:

02-SB13B-A	02-SB14B-A
02-SB13C-A	02-SB14C-A
02-SB14A-A	FB03-A

No qualifications were made for field quality control samples as these are not qualified for any non-compliance as per validation protocol. Positive results and Detection Limits (DLs) for affected compounds in affected samples are qualified as estimated "J" and "UJ", respectively.

The following contaminants were detected in trip, field, rinsate and laboratory method blank analyses in the maximum concentrations indicated:

contaminant	maximum concentration (ug/kg)
benzene	8
bromodichloromethane	16
bromomethane	2
chloromethane	1
chloroform	40
dibromochloromethane	33
1,1-dichloroethene	1
total-1,2-dichloroethene	2
trans-1,3-dichloropropane	1
2-hexanone	1
1,1,2,2-tetrachloroethane	1
1,1,1-trichloroethane	1
1,1,2-trichloroethane	3
vinyl acetate	1

(continued)

common contaminant	maximum concentration (ug/kg)
acetone	16
2-butanone	3
methylene chloride	17
toluene	3

Action levels of ten times the maximum amount of common lab contaminant and five times the maximum amount of other contaminants were used to evaluate the data. Sample size and moisture content adjustments were considered prior to application of the action levels. No qualifications were made for bromomethane, 1,1-dichloroethene, total-1,2-dichloroethene, trans-1,3-dichloropropene, 1,1,1-trichloroethane, vinyl acetate and toluene as no positive results were reported for these compounds. Sample contaminant concentrations below the Contract Required Quantitation Limit (CRQL) have been deleted. Sample contaminant concentrations above the CRQL but within the action level are qualified "U", as undetected.

The average Relative Response Factor (RRF) for the initial calibration of 2-butanone was below the 0.05 quality control limit. Only the reanalysis of sample 02-SB13B-A was affected. The DL for 2-butanone in this sample is qualified as unrelaible. "R".

Percent Relative Standard Deviations (%RSDs) for the initial calibration of chloroethane, methylene chloride, acetone and total xylenes exceeded the 30% quality control criteria. No qualifications were made for acetone as only field quality control samples were affected. No qualifications were made for chloroethane or total xylenes as no positive results were reported for these compounds in affected samples. The positive result reported for methylene chloride in the reanalysis of sample 02-SB13-B-A was previously qualified as estimated based on holding times. No further action was taken.

Some continuing calibration Percent Differences (%Ds) for trans-1,3-dichloropropene, carbon disulfide and total xylenes exceeded 50%. DLs for these compounds in affected samples are qualified as estimated, "UJ". The positive result for acetone in sample 02-SB14A-A was previously qualified as estimated, "J", based on holding times.

Some continuing calibration %Ds for several compounds exceeded the ±25% quality control limit. No qualifications were made, however, as no positive results were reported for these compounds in affected samples.

The Tentatively Identified Compounds (TICs) 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113) and methylcyclopentane were detected in blanks analyzed with this sample set. Several unknowns and alkanes were also detected. No qualifications were made as no TICs occurring in the blanks occurred in the samples.

Semivolatile Fraction

The following contaminants were detected in laboratory method and field quality control blank analyses in the maximum concentrations indicated:

contaminant	maximum concentration (ug/kg)
pentachlorophenol	230
pyrene	99

common contaminant	maximum concentration (ug/kg)
bis(2-ethylhexyl)phthalate	16

Action levels of ten times the maximum amount of common lab contaminant and five times the maximum amount of other contaminants were used to evaluate the data. Sample size and moisture content adjustments were considered prior to application of the action levels. No qualifications were made for pentachlorophenol and pyrene as no positive results were reported for these compounds. Bis(2-ethylhexyl)phthalate results below the CRQL have been deleted.

The 30% RSD initial calibration criteria and the ± 25% D continuing calibration criteria was exceeded for several compounds. No qualifications were made, however, as no positive results were reported for the affected compounds.

Sample 01-SB05B-A was determined to be free of semivolatile contamination, however, phenol and bis(2-ethylhexyl)phthalate were detected in the field duplicate. No action was taken as the presence of bis(2-ethylhexyl)phthalate is felt to be attributable to blank contamination and the concentration for phenol is well below the CRQL for soils.

Positive results for phenol and naphthalene are qualified as estimated, "J", as they are below the CRQL.

Several TICs were detected in associated blank analyses. A summary of the maximum amounts of TIC contaminants found follows:

Contaminant (RT)	Max. Amount Found (ug/kg)
2,5-dimethyl-2-hexene	180
2,3,6-trimethyl heptane	240
aldol condensation product	4100

(continued)

2,3-dimethyl heptane	610
3,4-dimethyl heptane	310
3,5-dimethyl heptane	180
2,3,4-trimethyl pentane	770
4-(1-methylethyl)-heptane	660
5,5-dimethyl-2-furanone	560
3-methyl octane	210
4-methyl octane	200
2-butoxy ethanol	1100

Several unknowns were also detected. Sample results less than five times the maximum amounts of TIC contaminants shown above have been stricken (crossed-out) on the Form I-BNA TIC reports.

Pesticide/PCB Fraction

The Matrix Spike (MS) recovery for heptachlor fell below quality limits in the MS/MSD analysis of sample 01-FD02-A. No qualifications were made as the Matrix Spike Duplicate (MSD) recovery for heptachlor was acceptable.

Samples 02-SB05B-A and 01-FD02-A constitute a field duplicate pair. Results for heptachlor exceeded the 50% Relative Percent Difference (RPD) field duplicate criteria for soils. The positive result for heptachlor in sample 01-FD02-A is qualified as estimated "J". The DL in sample 02-SB05B-A is qualified "UJ".

DAS:O-EAFB2

DATA SUMMARY

TABLE A

DATA SUMMARY FORM: VOLATILES 1

SOIL SAMPLES (ug/Kg)

Site Name: Ellington Air Force Base (SDG. EAFB2)

Case #: EAFB1 Sampling Date(s): 12/19/89 12/21/89

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moisture)/100

CRQL	Sample No.	01-FD02-A		01-SB05B-A		01-SB05A-A				02-SB13B-A		02-SB13A-A		02-SB13C-A			
	Dilution Factor	1.00		1.00		1.00				200		0.200		1.00			
	% Moisture	17		17		14				27		29		20			
	Location	18'-22'		18'-22'		10'-12'				4'-6'		0'-2'		20'-22'			
	Date Sampled	12/21/89		12/21/89		12/21/89				12/19/89		12/19/89		12/19/89			
	Date Analyzed	12/29/89		12/29/89		12/29/89				1/12/90		12/30/89		1/4/89			
	COMPOUND	- FIELD DUPLICATE PAIR -								Re-Analysis				REANALYSIS			
10	Chloromethane										UJ			1	U		
10	Bromomethane										UJ				UJ		
10	Vinyl Chloride										UJ				UJ		
10	Chloroethane										UJ				UJ		
5	Methylene Chloride	21	U	21	U	16	U			6100	J	25	U	19	U		
10	Acetone										UJ	160			UJ		
5	Carbon Disulfide										UJ		UJ		UJ		
5	1,1-Dichloroethene										UJ				UJ		
5	1,1-Dichloroethane										UJ				UJ		
5	Total-1,2-Dichloroethene										UJ				UJ		
5	Chloroform	27	U	23	U						UJ			4	U		
5	1,2-Dichloroethane										UJ				UJ		
10	2-Butanone										R				UJ		
5	1,1,1-Trichloroethane										UJ				UJ		
5	Carbon Tetrachloride										UJ				UJ		
10	Vinyl Acetate										UJ				UJ		
5	Bromodichloromethane										UJ			3	U		

CRDL = Contract Required Detection Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: V O L A T I L E S 2

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDG EAFB2)

Case #: EAFB1 Sampling Date(s): 12/19/89 - 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1

CRQL	Sample No.	01-FD02-A	01-SB03B-A	01-SB05A-A		D2-SB13B-A	D2-SB13A-A	D2-SB13C-A		
	Dilution Factor	1.00	1.00	1.00		260	0.200	1.00		
	% Moisture	17	17	14		37	29	30		
	Location	18'-22'	18'-22'	10'-12'		4'-6'	0'-2'	20'-22'		
	Date Sampled	12/21/89	12/21/89	12/21/89		12/19/89	12/19/89	12/19/89		
	Date Analyzed	12/29/89	12/29/89	12/29/89		1/12/90	12/30/89	1 /89		
	COMPOUND	-FIELD DUPLICATE PAIR-				Re-Analysis				
5	1,2-Dichloropropane					UJ		1 J		
5	Cis-1,3-Dichloropropene					UJ		UJ		
5	Trichloroethene					UJ		UJ		
5	Dibromochloromethane					UJ		1 U		
5	1,1,2-Trichloroethane					UJ		7 U		
5	Benzene					2100 U	180 J	12 U		
5	Trans-1,3-Dichloropropene	UJ	UJ	UJ		UJ	UJ	UJ		
5	Bromoform					UJ		UJ		
10	4-Methyl-2-pentanone					UJ		4 J		
10	2-Hexanone					UJ		7 U		
5	Tetrachloroethene					UJ		UJ		
5	1,1,2,2-Tetrachloroethane					UJ		2 U		
5	Toluene					UJ	UJ	UJ		
5	Chlorobenzene					UJ	UJ	1 J		
5	Ethylbenzene					13,000 J	210 J	3 J		
5	Styrene					UJ	UJ	5 J		
5	Total Xylenes					UJ	240 J	12 J		

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

revised 12/88

DATA SUMMARY FORM: B N A S 1

Site Name: Ellington Air Force Base

SOIL SAMPLES
(ug/Kg)

Case #: EAFBL Sampling Date(s): 12/19/89 - 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1

FIELD DUPLICATE PAIR

CRQL	Sample No.	01-FD02-A	01-SB05B-A	01-SB05A-A		02-SB13B-A	02-SB13A-A	02-SB13C-A		
	Dilution Factor	1.000	1.000	1.000		1.000				
	% Moisture	17	17	14		27				
	Location	18'-22'	18'-22'	10'-12'		4'-6'				
	Date Sampled	12/21/89	12/21/89	12/21/89		12/19/89				
	Date Analyzed	1/9/90	1/9/90	1/4/90		1/4/90				
	Date Extracted	12/27/89	12/27/89	12/27/89		12/21/89				
330	Phenol	22 J								
330	bis(2-Chloroethyl)ether									
330	2-Chlorophenol									
330	1,3-Dichlorobenzene						not	not		
330	1,4-Dichlorobenzene						analyzed	analyzed		
330	Benzyl Alcohol									
330	1,2-Dichlorobenzene									
330	2-Methylphenol									
330	bis(2-Chloroisopropyl)ether									
330	4-Methylphenol									
330	N-Nitroso-di-n-propylamine									
330	Hexachloroethane									
330	Nitrobenzene									
330	Isophorone									
330	2-Nitrophenol									
330	2,4-Dimethylphenol									
1600	Benzoic Acid									
330	bis(2-Chloroethoxy)methane									
330	2,4-Dichlorophenol									
330	1,2,4-Trichlorobenzene									
330	Naphthalene					200 J				
330	4-Chloroaniline									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

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DATA SUMMARY FORM: B N A S 2

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDG EAFB2)

Case #: EAFB1 Sampling Date(s): 12/19/89 - 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/10(

FIELD DUPLICATE PAIR (01-FD02-A, 01-SB05B-A)

CRQL	Sample No.	01-FD02-A	01-SB05B-A	01-SB05A-A		02-SB13B-A	02-SB13A-A	02-SB13C-A		
	Dilution Factor	1.000	1.000	1.000		1.000				
	% Moisture	17	17	14		27				
	Location	18'-22'	18'-22'	10'-12'		4'-6'				
	Date Sampled	12/21/89	12/21/89	12/21/89		12/19/89				
	Date Analyzed	1/9/90	1/9/90	1/4/90		1/4/90				
	Date Extracted	12/27/89	12/27/89	12/27/89		12/21/89				
330	Hexachlorobutadiene									
330	4-Chloro-3-methylphenol									
330	2-Methylnaphthalene					640				
330	Hexachlorocyclopentadiene									
330	2,4,6-Trichlorophenol						not analyzed	not analyzed		
1600	2,4,5-Trichlorophenol									
330	2-Chloronaphthalene									
1600	2-Nitroaniline									
330	Dimethylphthalate									
330	Acenaphthylene									
330	2,6-Dinitrotoluene									
1600	3-Nitroaniline									
330	Acenaphthene									
1600	2,4-Dinitrophenol									
1600	4-Nitrophenol									
330	Dibenzofuran									
330	2,4-Dinitrotoluene									
330	Diethylphthalate									
330	4-Chlorophenyl-phenylether									
330	Fluorene									
1600	4-Nitroaniline									
1600	4,6-Dinitro-2-methylphenol									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

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DATA SUMMARY FORM: B N A S 3

Site Name: Ellington Air Force Base

SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/19/89 - 12/21/89

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moisture)/1

FIELD DUPLICATE

CRQL	Sample No.	01-FD02-A	01-SB05B-A	01-SB05A-A		02-SB13B-A	02-SB13A-A	02-SB13A-A		
	Dilution Factor	1.000	1.000	1.000		1.000				
	% Moisture	17	17	14		27				
	Location	18'-22'	18'-22'	10'-12'		4'-6'				
	Date Sampled	12/21/89	12/21/89	12/21/89		12/19/89				
	Date Analyzed	1/9/90	1/9/90	1/4/90		1/4/90				
	Date Extracted	12/27/89 Dup for SB05B	12/27/89	12/27/89		12/21/89				
330	N-Nitrosodiphenylamine									
330	4-Bromophenyl-phenylether									
330	Hexachlorobenzene									
1600	Pentachlorophenol									
330	Phenanthrene									
330	Anthracene						[illegible]	[illegible]		
330	Di-n-butylphthalate						[illegible]	[illegible]		
330	Fluoranthene									
330	Pyrene									
330	Butylbenzylphthalate									
1600	3,3-Dichlorobenzidine									
330	Benzo(a)anthracene									
330	Chrysene									
330	bis(2-Ethylhexyl)phthalate									
330	Di-n-octylphthalate									
330	Benzo(b)fluoranthene									
330	Benzo(k)fluoranthene									
330	Benzo(a)pyrene									
330	Indeno(1,2,3-cd)pyrene									
330	Dibenz(a,h)anthracene									
330	Benzo(g,h,i)perylene									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

revised 12/88

DATA SUMMARY FORM: P E S T I C I D E S   A N D   P C B S

Site Name: Ellington Air Force Base (SDG EAFB2) SOIL SAMPLES

(ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/19 - 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL	COMPOUND	01-FD02-A	01-SB05B-A	01-SB05A-A		02-SB13B-A	02-SB13A-A	02-SB13C-A		
	Dilution Factor	1.0	1.0	1.0						
	% Moisture	17	17	14						
	Location	FIELD DUPLICATE PAIR								
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor	13 J	UJ							
8	Aldrin					not analyzed	not analyzed	not analyzed		
8	Heptachlor Epoxide									
8	Endosulfan I									
16	Dieldrin									
16	4,4'-DDE									
16	Endrin									
16	Endosulfan II									
16	4,4'-DDD									
16	Endosulfan Sulfate									
16	4,4'-DDT									
80	Methoxychlor									
16	Endrin ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

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DATA SUMMARY FORM: V O L A T I L E S 1

Site Name: Ellington Air Force Base (SDG EAFB2) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 **Sampling Date(s):** 12/19/89 - 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL	Sample No.	02-SB14A-A		02-SB14B-A	02-SB14C-A		02-TBC3-A	01-TB04-A	02-RB05-A	
	Dilution Factor	1.00		1.00	1.00		1.00	1.00	1 20	
	% Moisture	26		27	22		-	-	-	
	Location	0'-2'		6'-8'	18'-20'		-	-	-	
	Date Sampled	12/19/89		12/19/89	12/19/89		12/19/89	12/21/89	12/19/89	
	Date Analyzed	1/12/90		1/12/90	12/30/89		1/2/90	1/2/90	12/20 - 1/2	
	COMPOUND	Re-Analysis		Re-Analysis			TRIP Blank	TRIP Blank	Rinsate Blank	
10	Chloromethane	UJ		UJ						
10	Bromomethane	UJ		UJ						
10	Vinyl Chloride	UJ		UJ						
10	Chloroethane	UJ		UJ						
5	Methylene Chloride	UJ		UJ						
10	Acetone	250 J		UJ	18 U					
5	Carbon Disulfide	UJ		UJ						
5	1,1-Dichloroethene	UJ		UJ	UJ					
5	1,1-Dichloroethane	UJ		UJ						
5	Total-1,2-Dichloroethene	UJ		UJ						
5	Chloroform	UJ		UJ						
5	1,2-Dichloroethane	UJ		UJ	17 U		20	40		
10	2-Butanone	41 J		UJ						
5	1,1,1-Trichloroethane	UJ		UJ						
5	Carbon Tetrachloride	UJ		UJ						
10	Vinyl Acetate	UJ		UJ						
5	Bromodichloromethane	UJ		UJ						

CRDL = Contract Required Detection Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: V O L A T I L E S 2

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDGEAFB2)

Case #: EAFB1 Sampling Date(s): 12/19/89 - 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1

CRQL	Sample No.	D2-SB14A-A		D2-SB14B-A	D2-SB14C-A		D2-TB03-A	D1-TB04-A	D2-RB05-A	
	Dilution Factor	1.00		1.00	1.00		1.00	1.00	1.00	
	% Moisture	26		22	22		-	-	-	
	Location	0'-2'		6'-8'	18'-20'		-	-	-	
	Date Sampled	12/19/89		12/19/89	12/19/89		12/19/89	12/21/89	12/19/89	
	Date Analyzed	1/12/90		1/12/90	12/30/89		1/12/90	1/12/90	12/20/89	
	COMPOUND	Re Analysis		Re Analysis			Trip Blank	Trip Blank	Rinsate Blank	
5	1,2-Dichloropropane	UJ		UJ						
5	Cis-1,3-Dichloropropene	UJ		UJ						
5	Trichloroethene	UJ		UJ						
5	Dibromochloromethane	UJ		UJ						
5	1,1,2-Trichloroethane	UJ		UJ						
5	Benzene	13 U		UJ	UJ					
5	Trans-1,3-Dichloropropene	UJ		UJ	UJ					
5	Bromoform	UJ		UJ						
10	4-Methyl-2-pentanone	UJ		UJ						
10	2-Hexanone	UJ		UJ						
5	Tetrachloroethene	UJ		UJ						
5	1,1,2,2-Tetrachloroethane	UJ		UJ						
5	Toluene	UJ		UJ	UJ					
5	Chlorobenzene	UJ		UJ	UJ					
5	Ethylbenzene	UJ		UJ	UJ					
5	Styrene	UJ		UJ	UJ					
5	Total Xylenes	UJ		UJ	UJ					

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

revised 12/88

DATA SUMMARY FORM: B N A S 1

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDG EAFB2)

Case #: EAFGI Sampling Date(s): 12/19/89

Rinsate Blank

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1(

CRQL	Sample No.	02-SB19A-A		02-SB14B-A	02-SB14C-A		01-TB03-A	01-TB04-A	02-RB05-A	
	Dilution Factor	1.000							1.000	
	% Moisture	26							-	
	Location	0'-2'								
	Date Sampled	12/19/89							12/19/89	
	Date Analyzed	1/4/90							1/4/90	
	Date Extracted	12/21/89					trip blank	trip blank	12/21/89	
330	Phenol									
330	bis(2-Chloroethyl)ether									
330	2-Chlorophenol									
330	1,3-Dichlorobenzene									
330	1,4-Dichlorobenzene						not	not		
330	Benzyl Alcohol			not	not		analyzed	analyzed		
330	1,2-Dichlorobenzene			analyzed	analyzed					
330	2-Methylphenol									
330	bis(2-Chloroisopropyl)ether									
330	4-Methylphenol									
330	N-Nitroso-di-n-propylamine									
330	Hexachloroethane									
330	Nitrobenzene									
330	Isophorone									
330	2-Nitrophenol									
330	2,4-Dimethylphenol									
1600	Benzoic Acid									
330	bis(2-Chloroethoxy)methane									
330	2,4-Dichlorophenol									
330	1,2,4-Trichlorobenzene									
330	Naphthalene									
330	4-Chloroaniline									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: B N A S 2

Site Name: Ellington Air Force Base (EDGEAFB2) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/19/89

Rinsate Blank

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/10

CRQL	Sample No.	02-SB14A-A	02-SB14B-A	02-SB14C-A	01-TB03-A	01-TB04-A	02-RB05-A
	Dilution Factor	1.000					1.000
	% Moisture	26					–
	Location	0'-2'					
	Date Sampled	12/19/89					12/19/89
	Date Analyzed	1/4/90					1/4/90
	Date Extracted	12/21/89			trip blank	trip blank	12/21/89
330	Hexachlorobutadiene						
330	4-Chloro-3-methylphenol						
330	2-Methylnaphthalene						
330	Hexachlorocyclopentadiene						
330	2,4,6-Trichlorophenol						
1600	2,4,5-Trichlorophenol						
330	2-Chloronaphthalene		not	not	not	not	
1600	2-Nitroaniline		analyzed	analyzed	analyzed	analyzed	
330	Dimethylphthalate						
330	Acenaphthylene						
330	2,6-Dinitrotoluene						
1600	3-Nitroaniline						
330	Acenaphthene						
1600	2,4-Dinitrophenol						
1600	4-Nitrophenol						
330	Dibenzofuran						
330	2,4-Dinitrotoluene						
330	Diethylphthalate						
330	4-Chlorophenyl-phenylether						
330	Fluorene						
1600	4-Nitroaniline						
1600	4,6-Dinitro-2-methylphenol						

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: B N A S 3

Site Name: Ellington Air Force Base (EDG-EAFB2) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/19/89

Rinsate Blank

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/

CRQL	Sample No.	02-SB14A-A		02-SB14B-A	02-SB14C-A		01-TB03-A	01-TB04-A	02-RB05-A	
	Dilution Factor	1.000							1.000	
	% Moisture	26								
	Location	0'-2'							-	
	Date Sampled	12/19/89							12/19/89	
	Date Analyzed	1/4/90							1/4/90	
	Date Extracted	12/21/89					trip blank	trip blank	12/21/89	
330	N-Nitrosodiphenylamine									
330	4-Bromophenyl-phenylether									
330	Hexachlorobenzene									
1600	Pentachlorophenol									
330	Phenanthrene									
330	Anthracene									
330	Di-n-butylphthalate			not analyzed	not analyzed		not analyzed	not analyzed		
330	Fluoranthene									
330	Pyrene									
330	Butylbenzylphthalate									
1600	3,3-Dichlorobenzidine									
330	Benzo(a)anthracene									
330	Chrysene									
330	bis(2-Ethylhexyl)phthalate									
330	Di-n-octylphthalate								8	
330	Benzo(b)fluoranthene									
330	Benzo(k)fluoranthene									
330	Benzo(a)pyrene									
330	Indeno(1,2,3-cd)pyrene									
330	Dibenz(a,h)anthracene									
330	Benzo(g,h,i)perylene									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIO[N]

revised 12/88

DATA SUMMARY FORM: P E S T I C I D E S A N D P C B S

Site Name: Ellington Air Force Base (SDG EAFB2) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/19-12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL	Sample No.	02-SB14A-A		02-SB14B-A	02-SB14C-A		01-TB05-A	01-TB04-A	02-RB05-A	
	Dilution Factor									
	% Moisture									
	Location									
	COMPOUND									
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor									
8	Aldrin	not analyzed		not analyzed	not analyzed		not analyzed	not analyzed	not analyzed	
8	Heptachlor Epoxide									
8	Endosulfan I									
16	Dieldrin									
16	4,4'-DDE									
16	Endrin									
16	Endosulfan II									
16	4,4'-DDD									
16	Endosulfan Sulfate									
16	4,4'-DDT									
80	Methoxychlor									
16	Endrin ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: VOLATILES

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDGEAFB2)

Case #: EAFB1 Sampling Date(s): 12/21/89

wht?

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100

CRQL									
	Sample No.	RBC6-A	FBC4-A		FB03-A				
	Dilution Factor	10.0	1.00		1.00				
	% Moisture		–		–				
	Location	–	–						
	Date Sampled	12/21/89	12/21/89		12/21/89				
	Date Analyzed	1/2/90	1/2/90		1/12/90				
CRQL	COMPOUND	Rinsate Blank	Municipal Water		HPLC Water Re-analysis	wht			
10	Chloromethane								
10	Bromomethane								
10	Vinyl Chloride								
10	Chloroethane								
5	Methylene Chloride								
10	Acetone								
5	Carbon Disulfide								
5	1,1-Dichloroethene								
5	1,1-Dichloroethane								
5	Total 1,2-Dichloroethene								
5	Chloroform								
5	1,2-Dichloroethane								
10	2-Butanone								
5	1,1,1-Trichloroethane								
5	Carbon Tetrachloride								
10	Vinyl Acetate								
5	Bromodichloromethane		16						

CRDL = Contract Required Detection Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: V O L A T I L E S 2

Site Name: Ellington Air Force Base (SPG EAFB2) **SOIL SAMPLES (ug/Kg)**

Case #: SAFGI **Sampling Date(s):** 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/

CRQL		BBCK-A	FB04-A		FB03-A					
	Sample No.	BBCK-A	FB04-A		FB03-A					
	Dilution Factor	10.0	1.00		1.00					
	% Moisture	-	-		-					
	Location	-	-		-					
	Date Sampled	12/21/89	12/21/89		12/21/89					
	Date Analyzed	1/2/90	1/2/90		1/12/90					
CRQL	COMPOUND	Rigsite Blank	Municipal Water		HPLC Water					
5	1,2-Dichloropropane									
5	Cis-1,3-Dichloropropene									
5	Trichloroethene									
5	Dibromochloromethane		33							
5	1,1,2-Trichloroethane									
5	Benzene									
5	Trans-1,3-Dichloropropene									
5	Bromoform									
10	4-Methyl-2-pentanone									
10	2-Hexanone									
5	Tetrachloroethene									
5	1,1,2,2-Tetrachloroethane									
5	Toluene									
5	Chlorobenzene									
5	Ethylbenzene									
5	Styrene									
5	Total Xylenes									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

revised 12/88

DATA SUMMARY FORM: B N A S 1

Site Name: Ellington Air Force Base

Case #: EAFB1 Sampling Date(s): 12/21/89

SOIL SAMPLES
(ug/Kg)

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/10

CRQL										
	Sample No.	BB06-A	FB04-A		FB03-A					
	Dilution Factor	1.000	1.000		1.000					
	% Moisture	–	–							
	Location	Rinsate	Field Blank		FIELD BLANK					
	Date Sampled	12/21/89	12/21/89		12/21/89					
	Date Analyzed	1/9/90	1/9/90		1/9/90					
	Date Extracted	12/27/89	12/27/89		12/27/89					
330	Phenol									
330	bis(2-Chloroethyl)ether									
330	2-Chlorophenol									
330	1,3-Dichlorobenzene									
330	1,4-Dichlorobenzene									
330	Benzyl Alcohol									
330	1,2-Dichlorobenzene									
330	2-Methylphenol									
330	bis(2-Chloroisopropyl)ether									
330	4-Methylphenol									
330	N-Nitroso-di-n-propylamine									
330	Hexachloroethane									
330	Nitrobenzene									
330	Isophorone									
330	2-Nitrophenol									
330	2,4-Dimethylphenol									
1600	Benzoic Acid									
330	bis(2-Chloroethoxy)methane									
330	2,4-Dichlorophenol									
330	1,2,4-Trichlorobenzene									
330	Naphthalene									
330	4-Chloroaniline									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: B N A S 2

Site Name: Ellington Air Force Base (SDGEAFB2) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL										
	Sample No.	BB06-A	FB04-A		FB03-A					
	Dilution Factor	1.000	1.000		1.000					
	% Moisture	-	-		-					
	Location	Rinsate	Field Blank		FIELD BLANK					
	Date Sampled	12/21/89	12/21/89		12/21/89					
	Date Analyzed	1/9/90	1/9/90		1/9/90					
	Date Extracted	12/27/89	12/27/89		12/27/89					
330	Hexachlorobutadiene									
330	4-Chloro-3-methylphenol									
330	2-Methylnaphthalene									
330	Hexachlorocyclopentadiene									
330	2,4,6-Trichlorophenol									
1600	2,4,5-Trichlorophenol									
330	2-Chloronaphthalene									
1600	2-Nitroaniline									
330	Dimethylphthalate									
330	Acenaphthylene									
330	2,6-Dinitrotoluene									
1600	3-Nitroaniline									
330	Acenaphthene									
1600	2,4-Dinitrophenol									
1600	4-Nitrophenol									
330	Dibenzofuran									
330	2,4-Dinitrotoluene									
330	Diethylphthalate									
330	4-Chlorophenyl-phenylether									
330	Fluorene									
1600	4-Nitroaniline									
1600	4,6-Dinitro-2-methylphenol									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: P E S T I C I D E S A N D P C B S

Site Name: ELLINGTON AIR FORCE BASE (SDG EAFB2) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/21/99

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL	Sample No.	RB06-A	FB04-A		FB03-A					
	Dilution Factor	1.0	1.0		1.0					
	% Moisture	—	—		—					
	Location									
CRQL	COMPOUND									
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor									
8	Aldrin									
8	Heptachlor Epoxide									
8	Endosulfan I									
16	Dieldrin									
16	4,4'-DDE									
16	Endrin									
16	Endosulfan II									
16	4,4'-DDD									
16	Endosulfan Sulfate									
16	4,4'-DDT									
80	Methoxychlor									
16	Endrin ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: B N A S 3

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base

Case #: EAFB1 Sampling Date(s): 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100

CRQL	Sample No.	RB06-A	FB04-A		FB03-A					
	Dilution Factor	1.000	1.000		1.000					
	% Moisture	–	–		–					
	Location	Rinsate	Field Blank		Field Blank					
	Date Sampled	12/21/89	12/21/89		12/21/89					
	Date Analyzed	1/9/90	1/9/90		1/9/90					
	Date Extracted	12/27/89	12/27/89		12/27/89					
330	N-Nitrosodiphenylamine									
330	4-Bromophenyl-phenylether									
330	Hexachlorobenzene									
1600	Pentachlorophenol				230					
330	Phenanthrene									
330	Anthracene									
330	Di-n-butylphthalate									
330	Fluoranthene									
330	Pyrene				99					
330	Butylbenzylphthalate									
1600	3,3-Dichlorobenzidine									
330	Benzo(a)anthracene									
330	Chrysene									
330	bis(2-Ethylhexyl)phthalate									
330	Di-n-octylphthalate									
330	Benzo(b)fluoranthene									
330	Benzo(k)fluoranthene									
330	Benzo(a)pyrene									
330	Indeno(1,2,3-cd)pyrene									
330	Dibenz(a,h)anthracene									
330	Benzo(g,h,i)perylene									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: PESTICIDES AND PCBS

Site Name: ELLINGTON AIR FORCE BASE (SAS EAFB2) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 12/21/89

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL	Sample No.	RB06-A	FB04-A		FB03-A					
	Dilution Factor	1.0	1.0		1.0					
	% Moisture	—	—		—					
	Location									
CRQL	COMPOUND									
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor									
8	Aldrin									
8	Heptachlor Epoxide									
8	Endosulfan I									
16	Dieldrin									
16	4,4'-DDE									
16	Endrin									
16	Endosulfan II									
16	4,4'-DDD									
16	Endosulfan Sulfate									
16	4,4'-DDT									
80	Methoxychlor									
16	Endrin ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-49-0-3-160

TO:	LINDA STEAKLEY	DATE:	MARCH 29, 1990
FROM:	D. A. SCHEIB	CC:	AMY HUBBARD

SUBJECT: INORGANIC DATA VALIDATION - METALS
METALS AND PETROLEUM HYDROCARBONS
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1
SDG EAFB4

SAMPLES:

WATER

01-MW03-A	01-MW02-A
01-MW04-A	01-MW05-A
01-FB10-A	01-FD05-A
01-FB11-A	01-RB13-A
01-MW01-A	

NUS Laboratories analyzed 6 water samples (including one pair of field duplicates) and three associated aqueous quality control samples taken from the Ellington Air Force Base for TAL Metals and Petroleum Hydrocarbons. Data from these samples were evaluated under the following HAZWRAP Level C QA/QC criteria:

- Holding Times
- Interference Check Samples
- o - Matrix and Analytical Spike Results
- Initial and Continuing Calibration
- Laboratory and Field Duplicates
- o - Laboratory and Field Blank Analyses
- Laboratory Check Samples
- Serial Dilutions
- Detection Limits

o Indicates that quality control criteria were not met for this parameter.

TAL Metals

Blanks

Cobalt, iron, mercury, barium, calcium, lead, magnesium, manganese, potassium, sodium, silver, and zinc were found in laboratory and field quality control blanks. Positive results less than 5 times the highest blank concentrations are qualified, "U", as undetected.

Matrix Spikes

Matrix spike recoveries for silver were below the ±25% quality control limit. Therefore, detection limits reported for silver are qualified as unreliable, "R".

Petroleum Hydrocarbons

Samples 01-MW05-A and 01-FD05-A constitute a field duplicate pair. No petroleum hydrocarbons were detected for sample 01-FD05-A, however, a concentration of 0.9 ng/l was reported for sample 01-HW05-A. This positive result has been qualified as estimated, "J" due to lack of precision for field duplicate results.

/bpk

TABLE 1 - METALS

SUMMARY OF QUALIFIERS AFTER DATA VALIDATION
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB4

Analyte	Sample No.	Positive	Undetected	Bias	Comment
Cobalt	All	U		High	1
Iron	All, except 01-MW04-A	U		High	1
Mercury	01-MW03-A, 01-MW01-A, 01-MW02-A	U		High	1
Barium	All, except 01-MW03-A	U		High	1
Lead	All, except 01-MW02-A	U		High	1
Magnesium	All	U		High	1
Manganese	01-MW03-A, 01-MW02-A	U		High	1
Potassium	All	U		High	1
Sodium	All	U		High	1
Zinc	All	U		High	1
Silver	01-MW03-A, 01-MW02-A	U		High	1
	01-MW04-A, 01-MW01-A, 01-MW05-A, 01-FD05-A		R	N/A	2

Comments

1. Blank contamination.
2. Low matrix spike recovery.

Note

Aqueous quality control samples (field blanks) are not qualified on the basis of blank contamination or any other non-compliance.

DATA SUMMARY

TABLE A

DATA SUMMARY FORM: I N O R G A N I C S

Site Name: Ellington Air Force Base SDG EAFB4 WATER SAMPLES
(ug/L)

Case #: EAFBL Sampling Date(s): 1/23 - 1/25/90

•Due to dilution, sample quantitation limit is affected
See dilution table for specifics.

CRDL	Lab No.	H15605		H15606		H15614		H15615		H15931		H15932		H15933		H15934		H15935	
	Sample No.	01-MW03-A		01-MW04-A		01-FB10-A		01-FB11-A		01-MW01-A		01-MW02-A		01-MW05-A		01-FD05-A		01-RB13-A	
	Dilution Factor	-				-		-		-		-		-		-		-	
	Location	.				HPLC Water		LF Hydrant		.		-		-		Dup for 01-MW05-A		Rinsate	
	Date Sampled	1/23/90		1/23/90		1/24/90		1/24/90		1/25/90		1/25/90		1/25/90		1/25/90		1/25/90	
	Date Analyzed	2/2/90		2/2/90		2/2/90		2/2/90		2/2/90		2/2/90		2/2/90		2/2/90		2/2/90	
CRDL	ANALYTE																		
200	Aluminum			2910															
60	Antimony																		
10	*Arsenic																		
200	Barium	517		224	U			[93.4]		[176]	U	[151]	U	266	U	266	U		
5	Beryllium			[1.3]															
5	*Cadmium																		
5000	Calcium	40700		153000		[711]		14400		176000		78400		104000		101000		[1720]	
10	*Chromium			[7.9]															
50	Cobalt	[7.3]	U	[10.6]	U	[6.9]		[9.8]				[6.7]	U	[8.9]	U	[9.6]	U	[8.4]	
25	Copper																		
100	Iron	[22.0]	U	3710		[29.0]		106		[26.0]	U	[24.0]	U	[26.0]	U	[23.0]	U	[52.0]	
5	*Lead	[1.3]	U	[2.5]	U			[1.7]		[0.70]	U	10.6		[1.2]	U	[0.70]	U	[0.80]	
5000	Magnesium	14300	U	20000	U			[4230]		11100	U	13200	U	11100	U	11000	U		
15	Manganese	[14.7]	U	498				16.5		255		32.8	U						
0.2	Mercury	0.21	U			0.21		0.25		[0.11]	U	[0.11]	U						
40	*Nickel			[12.1]															
5000	Potassium	[540]	U	[1250]	U			[1110]		[1240]	U	[620]	U	[700]	U	[660]	U		
5	Selenium																		
10	Silver	[7.6]	U		R						R	[9.6]	U		R		R.	[6.9]	
5000	Sodium	29100	U	61100	U			100000		55600	U	33700	U	22200	U	22100	U	[540]	
10	Thallium																		
50	Vanadium			[10.8]															
20	Zinc	[11.8]	U	[14.6]	U			195		80.5	U	[9.4]	U	[7.9]	U	[11.0]	U	898	
10	~~*Cyanide~~																		

CRDL = Contract Required Detection Limit *Action Level Exists SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM:

Site Name: EAFB1 - Ellington Air Force Base

WATER SAMPLES

Case #: EAFB-4 Sampling Date: 1/23 - 1/26/90

Lab No.		H0115931	H0115932	H0115605	H0115606	H0115933	H0115934	H0115611	H0115602	H0115603
	Sample_No.	01·MW01·A	01·MW02·A	01·MW03·A	01·MW04·A	01·MW05·A	01·FD05·A	02·MW09·A	02·MW07·A	02·MW08·,
	Dilution Factor	–	–	–	–	–	–	–	–	–
	Date Sampled	1/25/90	1/25/90	1/23/90	1/23/90	1/25/90	1/26/90	1/24/90	1/22/90	1/22/9
	Date Analyzed									
						— Field Duplicate Pair —				
CRDL	COMPOUND									
0.2mg/l	Petroleum Hydrocarbons					0.9 J				

Tabulated by D.H. Scheib 3/28/90

DATA SUMMARY FORM:

Site Name: EAFB1 - Ellington Air Force Base

WATER SAMPLES

Case #: EAFB-4 Sampling Date: 1/23 - 1/26/90

	Lab No.	H0115604	H0115612	H0115614	H0115615	H0115609	H0115935			
	Sample No.	02-MW110-A	02-FB09-A	01-FB10-A	01-FB11-A	02-RB11-A	01-RB13-A			
	Dilution Factor	—	—	—	—	—	—			
	Date Sampled	1/22/90	1/24/90	1/24/90	1/24/90	1/23/90	1/26/90			
	Date Analyzed									
	COMPOUND		Pol spigot	HPLC water	Landfill Hydrant	Rinsate Blank	Rinsate Blank			
<0.2mg/l	Petroleum Hydrocarbons									

Tabulated by D.A. Schultz 3/28/90

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-49-4-0-117

TO: LINDA STEAKELY

DATE: APRIL 18, 1990

FROM: D. A. SCHEIB DAS

CC: FILE

SUBJECT: ORGANIC DATA VALIDATION - VOA/BNA/P&P
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB4

SAMPLES:

Water

01-FB10-A	01-MW03-A	02-MW108-A
01-FB11-A	01-RB13-A	02-MW110-A
01-FD05-A	01-TB09-A	02-RB11-A
01-MW05-A	02-FB09-A	02-TB07-A
01-MW01-A	02-MW07-A	02-TB08-A
01-MW02-A	02-MW09-A	01-MW04-A

NUS Laboratories analyzed 10 water samples (including one pair of field duplicates and 8 aqueous quality control samples for Target Compound List (TCL) volatile and semivolatile compounds. Nine samples were also analyzed for pesticides and PCBs. Included in this sample set are three field blanks, two rinsate blanks and three trip blanks.

The data were reviewed with reference to the EPA "Functional Guidelines for Organic Data Validation" and the Hazardous Waste Remedial Action Programs's (HAZWRAP) "Requirements for Quality Control of Analytical Data". Analyses were conducted and are evaluated under the following HAZWRAP Level C QA/QC criteria:

- Holding times
- GC/MS tuning and mass calibration
- Laboratory blank analyses
- Initial and continuing calibration
- Internal standards performance
- Surrogate spike recovery
- Matrix Spike/Matrix Spike Duplicate results
- Field duplicate precision
- Detection limits

The data package was complete as submitted. GC/MS tuning and mass calibration and internal standards performance met contract required criteria. Data which did not meet quality criteria are discussed below.

Volatile Fraction

The seven-day holding time allowance for aromatic compounds was exceeded by five days for the following samples:

01-MW01-A	01-MW04-A	01-MW107-A
01-MW02-A	01-MW05-A	01-MW108-A
02-MW03-A	02-MW09-A	02-MW110-A

Positive results and detection limits for aromatic compounds in affected samples are qualified as estimated, "J" and "UJ", respectively.

The following contaminants were detected in trip, field, rinsate and laboratory method blank analyses in the maximum concentrations indicated:

contaminant	maximum concentration (ug/L)
benzene	16
bromodichloromethane	41
bromoform	21
carbon disulfide	85
chloroform	53
dibromochloromethane	44
1,1,-dichloroethane	16
ethylbenzene	5
2-hexanone	19
4-methyl-2-pentanone	4
1,1,1-trichloroethane	11
total xylenes	37
common contaminant	
acetone	23
2-butanone	110
methylene chloride	23
toluene	16

Action levels of ten times the maximum amount of common lab contaminant and five times the maximum amount of other contaminants detected were used to evaluate the data. Sample contaminant concentrations below the Contract Required Quantitation Limit (CRQL) have been deleted. Sample contaminant concentrations above the CRQL but within the action level are qualified "U", as undetected.

Initial calibration Percent Relative Standard Deviation (%RSD) for chloroethane exceeded 50%. Detection limits for chloroethane in affected samples are qualified as estimated, "UJ".

Initial calibration %RSDs for total xylenes and carbon disulfide exceeded the 30% quality control criteria. Affected sample data was not qualified further as results for these compounds were already qualified "U" based on blank contamination.

The continuing calibration Percent Difference (%D) for vinyl acetate exceeded 50%. Detection limits for vinyl acetate in affected samples are qualified as estimated, "UJ". The continuing calibration %D for acetone exceeded 50%, however, no qualifications were made to detection limits for acetone were previously raised (via use of the "U" qualifier) due to blank contamination.

Some continuing calibration %Ds for acetone, carbon disulfide, vinyl acetate, tetrachloroethane, total xylenes and chloromethane exceeded the ± 25% quality limit. No qualifications for acetone, carbon disulfide and total xylenes were made as affected results for these compounds were already qualified "U" based on blank contamination. No qualifications for vinyl acetate, tetrachloroethane and chloromethane were made as no positive results were reported for these compounds.

Percent Recoveries (%R) for 1,1-dichloroethene and trichloroethene exceeded matrix spike/matrix spike duplicate quality control criteria. No qualifications were made as no positive results were reported for these compounds.

Relative Percent Differences (RPDs) for benzene and carbon disulfide exceeded the 30% quality limit for waters for the field duplicate analyses of samples 01-MW05-A and 01-FD05-A. No qualifications were made as these occurrences are felt to be attributable to blank contamination and not field duplicate imprecision.

A maximum concentration of 44 ug/L 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113) was detected at a TIC in blanks analyzed with this sample set. Several unknown compounds were also detected in the blanks. All sample TIC results for Freon 113 were less than the corresponding 220 ug/L action-level and have been stricken (crossed-out) on the Form I-VOA TIC reports. No unknowns occurring in the blanks occurred in the samples.

Semivolatile Fraction

Maximum concentrations of 1 ug/L naphthalene and 2 ug/L of the common blank contaminant bis(2-ethylhexyl) phthalate were detected in field and rinsate blank analyses. No qualifications were made as no positive sample results were reported for these compounds.

Some %Ds for the continuing calibration of several compounds failed to meet the ± 25% quality criteria. No qualifications were made as no positive sample results were reported for the affected compounds.

The Percent Recovery (%R) for the surrogate 2-fluorobiphenyl was below acceptable limits in sample 01-MW02-A. No qualification based on this single occurrence is required.

A maximum concentration of 5.8 ug/L cyclohexanone and several unknowns were detected in blanks analyzed with this sample set. None of these particular TICs were found in the samples, hence, no qualifications were made.

Pesticide/PCB Fraction

Delta-BHC, gamma-BHC (lindane) and heptachlor were detected in the rinsate blank. No qualifications were made as no positive sample results were reported for these compounds.

Positive results for alpha-BHC and methoxychlor are qualified "J", as estimated, as they are below the CRQL.

DATA SUMMARY

TABLE A

DATA SUMMARY FORM: V O L A T I L E S 1

Site Name: Ellington Air Force Base (SDG EAFB3)

SOIL SAMPLES
(ug/Kg)

Case #: EAFB1 Sampling Date(s): 1/12 - 1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/10(

CRQL	Sample No.	D2-FB05A-A	D2-FB06A-A	D2-FB07-A	D2-FB08-A	D2-FD03-A	D2-SB08C-A	D2-FD04-A	D2-SB10A-A	D2-RB07
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	% Moisture	-	-	-	-	24	24	22	21	-
	Location	HPLC	Municipal	HPLC	Municipal	16'-20'	16'-20'	8'-10'	8'-10'	Binsite
	Date Sampled	1/13/90	1/13/90	1/16/90	1/16/90	1/13/90	1/13/90	1/16/90	1/16/90	1/12/90
	Date Analyzed	1/17/90	1/17/90	1/19/90	1/19/90	1/17/90	1/17/90	1/27/90	1/30/90	1/17/90
CRQL	COMPOUND	field blank	field blank	field blank	field blank	- FIELD DUP. PAIR -		- FIELD DUP. PAIR -		
10	Chloromethane									
10	Bromomethane									
10	Vinyl Chloride									
10	Chloroethane					UJ	UJ	UJ		
5	Methylene Chloride	12				93 U	150 U	25 U	18 U	
10	Acetone	24				24 U	38 U			
5	Carbon Disulfide									
5	1,1-Dichloroethene									
5	1,1-Dichloroethane									
5	Total-1,2-Dichloroethene									
5	Chloroform		20		24	8 U	11 U	14 U		
5	1,2-Dichloroethane									
10	2-Butanone									
5	1,1,1-Trichloroethane									
5	Carbon Tetrachloride									
10	Vinyl Acetate		23							
5	Bromodichloromethane				21					

CRDL = Contract Required Detection Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: V O L A T I L E S 2

Site Name: Ellington Air Force Base (SDG EAFB3) SOIL SAMPLES (ug/Kg)

Case #: EAFB I Sampling Date(s): 1/12 - 1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/10

CRQL	Sample No.	02-FB05A-A	02-FB06A-A	02-FB07-A	02-FB08-A	02-FD03-A	02-SB08C-A	02-FD04-A	02-SB1DA-A	02-RB07
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	% Moisture	-	-	-	-	24	24	22	21	-
	Location	HPLC Water	Municipal	HPLC	Municipal	16'-20'	16'-20'	8'-10'	8'-10'	Rinsate
	Date Sampled	1/13/90	1/13/90	1/16/90	1/16/90	1/13/90	1/13/90	1/16/90	1/16/90	1/12/90
	Date Analyzed	1/17/90	1/17/90	1/19/90	1/19/90	1/17/90	1/17/90	1/27/90	1/30/90	1/17/90
CRQL	COMPOUND	Field blank	Field blank	Field blank	Field Blank	— FIELD DUP. PAIR		— FIELD DUP. PAIR —		
5	1,2-Dichloropropane									
5	Cis-1,3-Dichloropropene									
5	Trichloroethene									
5	Dibromochloromethane		32		34					
5	1,1,2-Trichloroethane									
5	Benzene	15				20 U	23 U	10 U	9 U	
5	Trans-1,3-Dichloropropene									
5	Bromoform		15		22					
10	4-Methyl-2-pentanone									
10	2-Hexanone									17
5	Tetrachloroethene									
5	1,1,2,2-Tetrachloroethane									
5	Toluene									
5	Chlorobenzene		18							
5	Ethylbenzene							UJ	66 J	
5	Styrene									
5	Total Xylenes									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: B N A S 1

Site Name: Ellington Air Force Base SDG EAFB3

Case #: EAFB1 Sampling Date(s): 1/12-1/16/90

SOIL SAMPLES (ug/Kg)

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moisture)/10

CRQL		field blank	field blank	field blank	field blank	field dup. pair	field dup. pair	field dup. pair	field dup. pair	
	Sample No.	D2-FB05A-A	D2-FB06A-A	D2-FB07-A	D2-FB08-A	D2-FD03-A	D2-SB08C-A	D2-FD04-A	D2-SB10A-A	D2-RB07-[illegible]
	Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	% Moisture	-	-	-	-	24	24	22	24	-
	Location	HPLC	Municipal	HPLC	Municipal	16'-20'	16'-20'	8'-10'	8'-10'	Biosafe
	Date Sampled	1/13/90	1/13/90	1/16/90	1/16/90	1/13/90	1/13/90	1/16/90	1/16/90	1/12/90
	Date Analyzed	1/20/90	1/20/90	1/24/90	1/24/90	1/19/90	1/19/90	1/24/90	1/23/90	1/19/90
	Date Extracted	1/17/90	1/17/90	1/23/90	1/23/90	1/17/90	1/17/90	1/23/90	1/23/90	1/17/90
330	Phenol									
330	bis(2-Chloroethyl)ether									
330	2-Chlorophenol									
330	1,3-Dichlorobenzene									
330	1,4-Dichlorobenzene									
330	Benzyl Alcohol									
330	1,2-Dichlorobenzene									
330	2-Methylphenol									
330	bis(2-Chloroisopropyl)ether									
330	4-Methylphenol									
330	N-Nitroso-di-n-propylamine									
330	Hexachloroethane									
330	Nitrobenzene									
330	Isophorone									
330	2-Nitrophenol									
330	2,4-Dimethylphenol									
1600	Benzoic Acid									
330	bis(2-Chloroethoxy)methane									
330	2,4-Dichlorophenol									
330	1,2,4-Trichlorobenzene									
330	Naphthalene									
330	4-Chloroaniline							110 J		

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: B N A S 2

Site Name: Ellington Air Force Base SDG (EAFB3)

SOIL SAMPLES (ug/Kg)

Case #: EAFG1 Sampling Date(s): 1/12 - 1/16/90

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL		field blank	field blank	field blank	field blank	field dup. pair	field dup. pair	field dup. pair	field dup. pair	
	Sample No.	02-FB05A-A	02-FB06A-A	02-FB07-A	02-FB08-A	02-FD03-A	02-SB08C-A	02-FD04-A	02-SB10A-A	02-RB07-A
	Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	% Moisture	-	-	-	-	24	24	22	24	-
	Location	HPLC	Municipal	HPLC	Municipal	16'-20'	16'-20'	8'-10'	8'-10'	Rinsate
	Date Sampled	1/13/90	1/13/90	1/16/90	1/16/90	1/13/90	1/13/90	1/16/90	1/16/90	1/12/90
	Date Analyzed	1/20/90	1/20/90	1/24/90	1/24/90	1/19/90	1/19/90	1/24/90	1/23/90	1/19/90
	Date Extracted	1/17/90	1/17/90	1/23/90	1/23/90	1/17/90	1/17/90	1/23/90	1/23/90	1/17/90
330	Hexachlorobutadiene									
330	4-Chloro-3-methylphenol									
330	2-Methylnaphthalene							340 J	150 J	
330	Hexachlorocyclopentadiene									
330	2,4,6-Trichlorophenol									
1600	2,4,5-Trichlorophenol									
330	2-Chloronaphthalene									
1600	2-Nitroaniline									
330	Dimethylphthalate									
330	Acenaphthylene									
330	2,6-Dinitrotoluene									
1600	3-Nitroaniline									
330	Acenaphthene									
1600	2,4-Dinitrophenol									
1600	4-Nitrophenol									
330	Dibenzofuran									
330	2,4-Dinitrotoluene									
330	Diethylphthalate									
330	4-Chlorophenyl-phenylether									
330	Fluorene									
1600	4-Nitroaniline									
1600	4,6-Dinitro-2-methylphenol									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: B N A S 3

Site Name: Ellington Air Force Base (SDG EAFG3) SOIL SAMPLES (ug/Kg)

Case #: EAFG1 Sampling Date(s): 1/12 - 1/16/90

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moisture)/10

CRQL		field blank	field blank	field blank	field blank	field dup. pair	field dup. pair	field dup. pair	field dup. pair	
	Sample No.	02-FB05A-A	02-FB06A-A	02-FB07-A	02-FB08-A	02-FD03-A	02-SB03C-A	02-FD04-A	02-SB10A-A	02-RB02-
	Dilution Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	% Moisture	-	-	-	-	24	24	22	24	-
	Location	HPLC	Municipal	HPLC	Municipal	16'-20'	16'-20'	8'-10'	8'-10'	Binsate
	Date Sampled	1/13/90	1/13/90	1/16/90	1/16/90	1/13/90	1/13/90	1/16/90	1/16/90	1/12/90
	Date Analyzed	1/20/90	1/20/90	1/24/90	1/24/90	1/19/90	1/19/90	1/24/90	1/23/90	1/19/90
	Date Extracted	1/17/90	1/17/90	1/23/90	1/23/90	1/17/90	1/17/90	1/23/90	1/23/90	1/17/90
330	N-Nitrosodiphenylamine									
330	4-Bromophenyl-phenylether									
330	Hexachlorobenzene									
1600	Pentachlorophenol									
330	Phenanthrene									
330	Anthracene									
330	Di-n-butylphthalate									
330	Fluoranthene									
330	Pyrene									
330	Butylbenzylphthalate									
1600	3,3-Dichlorobenzidine									
330	Benzo(a)anthracene									
330	Chrysene									
330	bis(2-Ethylhexyl)phthalate									
330	Di-n-octylphthalate									
330	Benzo(b)fluoranthene									
330	Benzo(k)fluoranthene									
330	Benzo(a)pyrene									
330	Indeno(1,2,3-cd)pyrene									
330	Dibenz(a,h)anthracene									
330	Benzo(g,h,i)perylene									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: P E S T I C I D E S A N D P C B S

Site Name: Ellington Air Force Base (SDG EAFB3)

SOIL SAMPLES
(ug/Kg)

Case #: EAFB1 Sampling Date: 1/12-1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((1 - % moisture)/100)

CRQL	Sample_No.	field blank 02-FB05A-A	field blank 02-FB06A-A	field blank 02-FB07-A	field blank 02-FB08-A	field dup. pair 02-FD03-A	field dup. pair 02-SB08C-A	02-FD04-A	02-SB10A-A	02-RB07-A
	Dilution_Factor									
	% Moisture									
	DATE SAMPLED									
	DATE RECEIVED									
	DATE ANALYZED									
	COMPOUND									
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor									
8	Aldrin									
8	Heptachlor_Epoxide	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed
8	Endosulfan_I									
16	Dieldrin									
16	4,4'-DDE									
16	Endrin									
16	Endosulfan_II									
16	4,4'-DDD									
16	Endosulfan_Sulfate									
16	4,4'-DDT									
80	Methoxychlor									
16	Endrin_ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract_Required_Quantitation_Limit • Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: VOLATILES 1

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington (Air Force Base (EAFB 3)

Case #: EAFB1 Sampling Date(s): 1/12 - 1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1(

CRQL	Sample No.	D2-RB09-A	D2-SB07A-A	D2-SB07B-A	D2-SB07C-A	D2-SB08A-A	D2-SB08B-A	D2-SB09A-A	D2-SB09B-A	D2-SB10B-
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	% Moisture	--	29	26	18	30	26	30	25	24
	Location	Rinsate	0'-2'	8'-10'	16'-18'	0'-2'	8'-10'	2'-4'	9'-11'	20'-22'
	Date Sampled	1/15/90	1/12/90	1/12/90	1/12/90	1/13/90	1/13/90	1/15/90	1/15/90	1/16/90
	Date Analyzed	1/19/90	1/16/90	1/16/90	1/16/90	1/16/90	1/16/90	1/18/90	1/18/90	1/19/90
CRQL	COMPOUND	rinsate blank								
10	Chloromethane									
10	Bromomethane									
10	Vinyl Chloride									
10	Chloroethane		UJ	UJ	UJ	UJ	UJ	UJ	UJ	
5	Methylene Chloride		150 U	120 U	150 U	75 U	210 U	79 U	66 U	27
10	Acetone			21 U	16 U		48 U	220 U	23 U	
5	Carbon Disulfide									
5	1,1-Dichloroethene									
5	1,1-Dichloroethane									
5	Total-1,2-Dichloroethene									
5	Chloroform		10 U	9 U	12 U					8
5	1,2-Dichloroethane									
10	2-Butanone		21 U					43 U		
5	1,1,1-Trichloroethane									
5	Carbon Tetrachloride									
10	Vinyl Acetate									
5	Bromodichloromethane									

CRDL = Contract Required Detection Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: V O L A T I L E S 2

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDG EAFB3)

Case #: EAFB1 Sampling Date(s): 1/12 - 1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/10

CRQL	Sample No.	D2-RB09-A	D2-SB07A-A	D2-SB07B-A	D2-SB07C-A	D2-SB08A-A	D2-SB08B-A	D2-SB09A-A	D2-SB09B-A	D2-SB10B-
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	% Moisture	–	29	26	18	30	26	30	25	24
	Location	Rinsate	0'-2'	8'-10'	16'-18'	0'-2'	8'-10'	2'-4'	9'-11'	20'-22'
	Date Sampled	1/15/90	1/12/90	1/12/90	1/12/90	1/13/90	1/13/90	1/15/90	1/15/90	1/16/90
	Date Analyzed	1/19/90	1/16/90	1/16/90	1/16/90	1/16/90	1/16/90	1/18/90	1/18/90	1/19/90
	COMPOUND	rinsate blank								
5	1,2-Dichloropropane									
5	Cis-1,3-Dichloropropene									
5	Trichloroethene									
5	Dibromochloromethane									
5	1,1,2-Trichloroethane									
5	Benzene									
5	Trans-1,3-Dichloropropene		14 U	9 U	10 U	16 U	14 U	21 U	16 U	21 U
5	Bromoform									
10	4-Methyl-2-pentanone									
10	2-Hexanone									
5	Tetrachloroethene									
5	1,1,2,2-Tetrachloroethane									
5	Toluene									
5	Chlorobenzene							18 U		
5	Ethylbenzene									
5	Styrene									
5	Total Xylenes									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM: B N A S 1

Site Name: Ellington Air Force Base (SDG EAFB3) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 1/12-1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/

CRQL	Sample No.	02-RB09-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A	02-SB08B-A	02-SB09A-A	02-SB09B-A	02-SB10A-
	Dilution Factor	1.000			1.000					
	% Moisture	-			18					
	Location	Rinsate			16'-18'					
	Date Sampled	1/15/90			1/12/90					
	Date Analyzed	1/24/90			1/19/90					
	Date Extracted	1/23/90			1/17/90					
330	Phenol									
330	bis(2-Chloroethyl)ether									
330	2-Chlorophenol									
330	1,3-Dichlorobenzene									
330	1,4-Dichlorobenzene		not	not		not	not	not	not	not
330	Benzyl Alcohol		analyzed	analyzed		analyzed	analyzed	analyzed	analyzed	analyzed
330	1,2-Dichlorobenzene									
330	2-Methylphenol									
330	bis(2-Chloroisopropyl)ether									
330	4-Methylphenol									
330	N-Nitroso-di-n-propylamine									
330	Hexachloroethane									
330	Nitrobenzene									
330	Isophorone									
330	2-Nitrophenol									
330	2,4-Dimethylphenol									
1600	Benzoic Acid									
330	bis(2-Chloroethoxy)methane									
330	2,4-Dichlorophenol									
330	1,2,4-Trichlorobenzene									
330	Naphthalene									
330	4-Chloroaniline									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIO

revised 12/88

DATA SUMMARY FORM: B N A S 2

Site Name: Ellington Air Force Base (SDG EAFG3)

Case #: EAFG1 Sampling Date(s): 1/12-1/16/90

SOIL SAMPLES
(ug/Kg)

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1(

CRQL	Sample No.	02-RB09-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A	02-SB08B-A	02-SB09A-A	02-SB09B-A	02-SB10B-A
	Dilution Factor	1.000			1.000					
	% Moisture	-			18					
	Location	Rinsate			16'-18'					
	Date Sampled	1/15/90			1/12/90					
	Date Analyzed	1/24/90			1/19/90					
	Date Extracted	1/23/90			1/17/90					
330	Hexachlorobutadiene									
330	4-Chloro-3-methylphenol									
330	2-Methylnaphthalene									
330	Hexachlorocyclopentadiene									
330	2,4,6-Trichlorophenol									
1600	2,4,5-Trichlorophenol									
330	2-Chloronaphthalene									
1600	2-Nitroaniline									
330	Dimethylphthalate									
330	Acenaphthylene									
330	2,6-Dinitrotoluene									
1600	3-Nitroaniline									
330	Acenaphthene									
1600	2,4-Dinitrophenol									
1600	4-Nitrophenol									
330	Dibenzofuran									
330	2,4-Dinitrotoluene									
330	Diethylphthalate									
330	4-Chlorophenyl-phenylether									
330	Fluorene									
1600	4-Nitroaniline									
1600	4,6-Dinitro-2-methylphenol									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

revised 12/88

DATA SUMMARY FORM: B N A S 3

Site Name: Ellington Air Force Base (SDG EAFB3)

SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 1/12 - 1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/

CRQL		02-RB04-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A	02-SB08B-A	02-SB09A-A	02-SB09B-A	02-SB10
	Sample No.	02-RB04-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A	02-SB08B-A	02-SB09A-A	02-SB09B-A	02-SB10
	Dilution Factor	1.000			1.000					
	% Moisture	-			18					
	Location	Rinsate			16'-18'					
	Date Sampled	1/15/90			1/12/90					
	Date Analyzed	1/24/90			1/19/90					
	Date Extracted	1/23/90			1/17/90					
330	N-Nitrosodiphenylamine									
330	4-Bromophenyl-phenylether									
330	Hexachlorobenzene									
1600	Pentachlorophenol									
330	Phenanthrene									
330	Anthracene									
330	Di-n-butylphthalate									
330	Fluoranthene									
330	Pyrene									
330	Butylbenzylphthalate									
1600	3,3-Dichlorobenzidine									
330	Benzo(a)anthracene									
330	Chrysene									
330	bis(2-Ethylhexyl)phthalate									
330	Di-n-octylphthalate									
330	Benzo(b)fluoranthene									
330	Benzo(k)fluoranthene									
330	Benzo(a)pyrene									
330	Indeno(1,2,3-cd)pyrene									
330	Dibenz(a,h)anthracene									
330	Benzo(g,h,i)perylene									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIO

revised 12/88

DATA SUMMARY FORM: P E S T I C I D E S A N D P C B S

Site Name: Ellington Air Force Base (SOG EAFB3) SOIL SAMPLES
(ug/Kg)

Case #: EAFB1 Sampling Date: 1/12 – 1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((1 - % moisture)/100)

CRQL	Sample_No.	02-RB09-A	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A	02-SB08B-A	02-SB09A-A	02-SB09B-A	02-SB10B-A
	Dilution_Factor									
	% Moisture									
	DATE SAMPLED									
	DATE RECEIVED									
	DATE ANALYZED									
	COMPOUND									
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor									
8	Aldrin									
8	Heptachlor_Epoxide	not	not	not	not	not	not	not	not	not
8	Endosulfan_I	analyzed	analyzed	analyzed	analyzed	analyzed	analyzed	analyzed	analyzed	analyzed
16	Dieldrin									
16	4,4'-DDE									
16	Endrin									
16	Endosulfan_II									
16	4,4'-DDD									
16	Endosulfan_Sulfate									
16	4,4'-DDT									
80	Methoxychlor									
16	Endrin_ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: V O L A T I L E S 1

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDG EAFB3)

Case #: EAFB1 Sampling Date(s): 1/12-1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/1

CRQL	Sample No.	D2-SB05C-A		D2-TB05-A		D2-TB06-A		01-FD05-AE		01-SS01-AE		01-SS01-AW		01-SS01-AC					
	Dilution Factor	1.00		1.00		1.00													
	% Moisture	17		-		-													
	Location	21'-23'		TRIP		TRIP													
	Date Sampled	1/15/90		1/12/90		1/16/90													
	Date Analyzed	1/24/90		1/17/90		1/19/90													
CRQL	COMPOUND			trip blank		trip blank													
10	Chloromethane																		
10	Bromomethane																		
10	Vinyl Chloride																		
10	Chloroethane																		
5	Methylene Chloride	16	U					not		not		not		not					
10	Acetone	17	U					analyzed		analyzed		analyzed		analyzed					
5	Carbon Disulfide		UJ																
5	1,1-Dichloroethene																		
5	1,1-Dichloroethane																		
5	Total-1,2-Dichloroethene																		
5	Chloroform	12	U	40		51													
5	1,2-Dichloroethane																		
10	2-Butanone																		
5	1,1,1-Trichloroethane																		
5	Carbon Tetrachloride																		
10	Vinyl Acetate																		
5	Bromodichloromethane																		

CRDL = Contract Required Detection Limit

SEE NARRATIVE FOR CODE DEFINITION

revised 12/88

DATA SUMMARY FORM: V O L A T I L E S 2

Site Name: Ellington Air Force Base (SDG EAFB3) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 1/12 - 1/16/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/

CRQL	Sample No.	02-SB09C-A	02-TB05-A	02-TB06-A	01.FD05.AE	01.SS01.AE	01.SS01.AW	01.SS01.AO
	Dilution Factor	1.00	1.00	1.00				
	% Moisture	17	-	-				
	Location	21'-23'	TRIP	TRIP				
	Date Sampled	1/15/90	1/12/90	1/16/90				
	Date Analyzed	1/24/90	1/17/90	1/19/90				
	COMPOUND							
5	1,2-Dichloropropane							
5	Cis-1,3-Dichloropropene							
5	Trichloroethene							
5	Dibromochloromethane							
5	1,1,2-Trichloroethane							
5	Benzene	15 U						
5	Trans-1,3-Dichloropropene							
5	Bromoform							
10	4-Methyl-2-pentanone							
10	2-Hexanone							
5	Tetrachloroethene							
5	1,1,2,2-Tetrachloroethane							
5	Toluene							
5	Chlorobenzene							
5	Ethylbenzene							
5	Styrene							
5	Total Xylenes	UJ						

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITION

revised 12/88

DATA SUMMARY FORM: B N A S 1

Site Name: Ellington Air Force Base SDG EAFB3 SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 1/12-1/17/90

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moistur

CRQL	Sample No.	02-SB09C-A	02-TB05-A	02-TB06-A	01-FD05-AE	01-SS01-AE	01-SS01-AW	01-SS01-AC	
	Dilution Factor	1.000			2.00	2.00	2.00	2.00	
	% Moisture	17			16	16	14	14	
	Location	21'-23'			Dup. 01-SS01-AE	EAST LANDFILL	WEST LF	CNT LF	
	Date Sampled	1115190			1117190	1117190	1117190	1117190	
	Date Analyzed	1123190			1129190	1129190	1129190	1129190	
	Date Extracted	1123190			1123190	1123190	1123190	1123190	
330	Phenol								
330	bis(2-Chloroethyl)ether								
330	2-Chlorophenol								
330	1,3-Dichlorobenzene								
330	1,4-Dichlorobenzene								
330	Benzyl Alcohol								
330	1,2-Dichlorobenzene		not	not					
330	2-Methylphenol		analyzed	analyzed					
330	bis(2-Chloroisopropyl)ether								
330	4-Methylphenol								
330	N-Nitroso-di-n-propylamine								
330	Hexachloroethane								
330	Nitrobenzene								
330	Isophorone								
330	2-Nitrophenol								
330	2,4-Dimethylphenol								
1600	Benzoic Acid								
330	bis(2-Chloroethoxy)methane								
330	2,4-Dichlorophenol								
330	1,2,4-Trichlorobenzene								
330	Naphthalene				190 J				
330	4-Chloroaniline								

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITI

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DATA SUMMARY FORM: B N A S 2

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDG EAFB3)

Case #: EAFB1 Sampling Date(s): 1/12-1/17/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moisture)/

CRQL	Sample No.	02-SB09C-A	02-TB05-A	02-TB06-A	01-FD05-A	01-SS01-AE	01-SS01-AW	01-SS01-AC	
	Dilution Factor	1.000			2.00	2.00	2.00	2.00	
	% Moisture	12			16	16	14	14	
	Location	21'-23'			Dup 01-SS01-AE	EAST LF	WEST LF	CNT LF	
	Date Sampled	1/15/90			1/17/90	1/17/90	1/17/90	1/17/90	
	Date Analyzed	1/23/90			1/29/90	1/25/90	1/29/90	1/29/90	
	Date Extracted	1/23/90			1/23/90	1/23/90	1/23/90	1/23/90	
330	Hexachlorobutadiene								
330	4-Chloro-3-methylphenol								
330	2-Methylnaphthalene								
330	Hexachlorocyclopentadiene								
330	2,4,6-Trichlorophenol								
1600	2,4,5-Trichlorophenol								
330	2-Chloronaphthalene								
1600	2-Nitroaniline								
330	Dimethylphthalate								
330	Acenaphthylene								
330	2,6-Dinitrotoluene								
1600	3-Nitroaniline								
330	Acenaphthene				560 J	250 J			
1600	2,4-Dinitrophenol								
1600	4-Nitrophenol								
330	Dibenzofuran				240 J				
330	2,4-Dinitrotoluene								
330	Diethylphthalate								
330	4-Chlorophenyl-phenylether								
330	Fluorene				560 J	270 J			
1600	4-Nitroaniline								
1600	4,6-Dinitro-2-methylphenol								

CRQL = Contract Required Quantitation Limit

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DATA SUMMARY FORM: B N A S 3

SOIL SAMPLES
(ug/Kg)

Site Name: Ellington Air Force Base (SDG EAFB3)

Case #: EAFB1 **Sampling Date(s):** 1/15 - 1/17/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor) / ((100 - % moistur

CRQL	Sample No.	02-SB09C-A	02-TB05-A	02-TB06-A	01-FD05-AE	01-SS01-AE	01-SS01-AW	01-SS01-AC	
	Dilution Factor	1.000			2.00	2.00	2.00	2.00	
	% Moisture	17			16	16	14	14	
	Location	21'-23'			Dup of AE	EAST LF	WEST LF	CNT LF	
	Date Sampled	1/15/90			1/17/90	1/17/90	1/17/90	1/17/90	
	Date Analyzed	1/23/90			1/29/90	1/29/90	1/29/90	1/29/90	
	Date Extracted	1/23/90			1/23/90	1/23/90	1/23/90	1/23/90	
330	N-Nitrosodiphenylamine								
330	4-Bromophenyl-phenylether								
330	Hexachlorobenzene								
1600	Pentachlorophenol								
330	Phenanthrene				4200	2300			
330	Anthracene				1100 J	520 J		510 J	
330	Di-n-butylphthalate								
330	Fluoranthene				5400	3300		1500	
330	Pyrene				4600	2500		1200	
330	Butylbenzylphthalate				420 J				
1600	3,3-Dichlorobenzidine								
330	Benzo(a)anthracene				3200 J	1500 J		800	
330	Chrysene				3000	1500		860	
330	bis(2-Ethylhexyl)phthalate								
330	Di-n-octylphthalate								
330	Benzo(b)fluoranthene				2300	1300		880	
330	Benzo(k)fluoranthene				2600 J	1100 J		930	
330	Benzo(a)pyrene				2700 J	1300 J		1000	
330	Indeno(1,2,3-cd)pyrene				1700 J	UJ			
330	Dibenz(a,h)anthracene								
330	Benzo(g,h,i)perylene								

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITI

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DATA SUMMARY FORM: PESTICIDES AND PCBS

Site Name: Ellington Air Force Base (SDC EAFB3) SOIL SAMPLES (ug/Kg)

Case #: EAFB1 Sampling Date(s): 1/15-1/17/90

To calculate sample quantitation limit: (CRQL * Dilution Factor) / ((100 - % moisture)/100)

CRQL	Sample No.	02-SB05-A	02-TB05-A	02-TB06-A	01-FD05AE	01-SS01-AE	01-SS01-AW	01-SS01-AC		
	Dilution Factor				1.000	1.000	1.000	1.000		
	% Moisture				16	16	14	14		
	Location				East LF	East LF	West LF	Central LF		
	Date Sampled				1/17/90	1/17/90	1/17/90	1/17/90		
	Date Analyzed				1/22/90	1/22/90	1/22/90	1/22/90		
	Date Extracted				1/22/90 Dup 01-SS01-AE	1/22/90	1/22/90	1/22/90		
8	alpha-BHC									
8	beta-BHC									
8	delta-BHC									
8	Gamma-BHC (Lindane)									
8	Heptachlor									
8	Aldrin									
8	Heptachlor Epoxide	not	not	not						
8	Endosulfan I	analyzed	analyzed	analyzed						
16	Dieldrin									
16	4,4'-DDE									
16	Endrin				12 J					
16	Endosulfan II							UJ		
16	4,4'-DDD									
16	Endosulfan Sulfate				11 J					
16	4,4'-DDT									
80	Methoxychlor					10 J				
16	Endrin ketone									
80	Alpha-Chlordane									
80	Gamma-Chlordane									
160	Toxaphene									
80	Aroclor-1016									
80	Aroclor-1221									
80	Aroclor-1232									
80	Aroclor-1242									
80	Aroclor-1248									
160	Aroclor-1254									
160	Aroclor-1260									

CRQL = Contract Required Quantitation Limit

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

NUS CORPORATION

INTERNAL CORRESPONDENCE

TO:	LINDA STEAKLEY		C-49-0-3-173
FROM:	D. A. SCHEIB DAS	DATE:	MARCH 30, 1990
		CC:	AMY HUBBARD

SUBJECT: INORGANIC DATA VALIDATION - PETROLEUM HYDROCARBONS
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB3

SAMPLES:

SOIL

02-SB07A-A	02-SB09B-A	01-FD05-A
02-SB07B-A	02-SB09C-A	02-FB05-A (HPLC)
02-SB07C-A	02-SB10A-A	02-FB06-A (MUNIC.)
02-SB08A-A	02-FD04-A	02-FB07-A (HPLC)
02-SB08B-A	02-SB10B-A	02-FB08-A (MUNIC.)
02-SB08C-A	01-SS01-A	02-RB07-A
02-FD08-A	01-SS02-A	02-RB09-A
02-SB09A-A	01-2203-A	

NUS Laboratories analyzed 17 soil samples (including three pairs of field duplicates) and 6 associated aqueous quality control samples taken from the Ellington Air Force base for Petroleum Hydrocarbons. Data from these samples were evaluated under HAZWRAP Level C QA/QC criteria.

Petroleum Hydrocarbons

All analyses met quality control criteria. Twenty samples were determined to be free of petroleum hydrocarbon contamination. Three samples were found to contain the following concentrations:

Sample	Amount
02-SB10A-A	99 mg/kg
02-FD04 *	99 mg/kg
01-SS02-A	220 mg/kg

* Field duplicate to 02-SB10A-A

/bpkl

DATA SUMMARY

TABLE A

DATA SUMMARY FORM:

Site Name: EAFBI- Ellington Air Force Base SOIL [redacted] SAMPLES

SDG ~~Case~~ #: EAFB-3 Sampling Date: 1/12 - 1/15/90

Lab No.	H0114374	H0114375	H0114379	H0114376	H0114377	H0114380	H0114381	H0114622	H0114623
Sample_No.	02-SB07A-A	02-SB07B-A	02-SB07C-A	02-SB08A-A	02-SB08B-A	02-SB08C-A	02-FD03-A	02-SB09A-A	02-SB09B-A
Dilution Factor	—	—	—	—	—	—	—	—	—
Date Sampled	1/12/90	1/12/90	1/14/90	1/13/90	1/13/90	1/13/90	1/13/90	1/15/90	1/15/90
Date Analyzed									
						-Field Duplicate	Pair-		
COMPOUND									
(2) m Kg Petroleum Hydrocarbons									

DATA SUMMARY FORM:

Site Name: EAFBI- Ellington Air Force Base SOIL [redacted] SAMPLES

SDG #: EAFB-3 Sampling Date: 1/12 - 1/15/90

Lab No.	H0114625	H0114628	H0114629	H0114624	H0114634	H0114635	H0114638	H0114639	H0114383
Sample No.	02·SB07C·A	02·SB10A·A	02·FD04·A	02·SB10B·A	01·SS01·A	01·SS02·A	01·SS03·A	01·FD05·A	02·FB05·A
Dilution Factor	—	—	—	—	—	—			
Date Sampled	1/15/90	1/16/90	1/16/90	1/16/90	1/17/90	1/17/90	1/17/90	1/13/90	1/13/90
Date Analyzed									
					WESTERN THIRD OF LF	CENTRAL THIRD OF LF	EASTERN THIRD OF LF —FIED DUP.	PAIR ——	NRC Water
COMPOUND									
(2)m/Kg Petroleum Hydrocarbons		99	99			220			

DATA SUMMARY FORM:

Site Name: EAFBI- Ellington Air Force Base SOIL [redacted] SAMPLES

SDG Case #: EAFB-3 Sampling Date: 1/12-1/15/90

Lab No.	H0114384	H0114631	H0114632	H0114382	H0114630				
Sample No.	02-FB06-A	02-FB07-A	02-FB08-A	02-RB07-A	02-RB09-A				
Dilution Factor	–								
Date Sampled	1/13/90	1/16/90	1/16/90	1/12/90	1/15/90				
Date Analyzed									
COMPOUND	Munic. Water	HPLC	Municipal Water	Rinsate Blank	Rinsate Blank				
(2)mg/Kg Petroleum Hydrocarbons									

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-49-4-0-87

TO:	**LINDA STEAKLEY**	**DATE:**	**APRIL 18, 1990**
FROM:	**D. A. SCHEIB** DAS	**COPIES:**	**AMY HUBBARD**

SUBJECT: ORGANIC DATA VALIDATION - VOA/BNA/P&P
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB3

SAMPLES:

Soil

02F0B-5A-A	02-RB09-A	02-SB09C-1
02FB06A-A	02-SB07A-A	02-TB05-A
02-FB07-A	02-SB07B-A	02-TB06-A
02-FB08-A	02-SB07C-A	01-FD05-A
02-FD03-A	02-SB08A-A	01-SS01-AE
02-SB08C-A	02-SB08B-A	01-SS01-AW
02-FD04-A	02-SB09A-A	01-SS02-AC
02-SB10A-A	02-SB09B-A	
02-RB07-A	02-SB10B-A	

The twenty-five samples comprising this set consist of 17 soils (including three field duplicate pairs) and 8 aqueous quality control samples. All Target Compound List (TCL) analyses were conducted by NUS Laboratories. Twenty-one samples were analyzed for volatile compounds, fifteen for semivolatiles and four for pesticides and PCBs. Included in this sample set are four field blanks, two rinsate blanks and two trip blanks.

The data were reviewed with reference to the EPA "Functional Guidelines for Organic Data Validation" and the Hazardous Waste Remedial Action Program's (HAZWRAP) "Requirements for Quality Control of Analytical Data". The analyses were conducted under HAZWRAP Level C QA/QC requirements and were validated according to the following criteria:

- Holding times
- GC/MS tuning and mass calibration
- Laboratory and field blank analyses
- Initial and continuing calibration
- Internal standards performance
- Surrogate spike recovery
- Matrix Spike/Matrix Spike Duplicate results
- Field duplicate precision
- Detection limits

The data package was complete as submitted. GC/MS tuning and mass calibration surrogate spike recoveries and internal standards performance met contract required criteria. Data which did not meet quality criteria are discussed below.

Volatile Fraction

The seven-day aromatic compound holding time allowance was exceeded by four days for sample 02-FD04-A and by two days for sample 02-SB09C-A. No qualifications were made as these occurrences have negligible impact on soil matrix samples.

The following contaminants were detected in trip, field, rinsate and laboratory method blank analyses in the maximum concentrations indicated:

contaminant	maximum concentration (mg/kg)
benzene	15
bromoform	22
bromodichloromethane	21
carbon disulfide	7
chlorobenzene	18
chloroform	51
dibromochloromethane	34
2-hexanone	17
4-methyl-2-pentanone	4
1,1,1-trichloroethane	38
vinyl acetate	23
common contaminant	
acetone	41
2-butanone	18
methylene chloride	37
toluene	4

Action levels of ten times the maximum amount of common lab contaminant and five times the maximum amount of other contaminants detected were used to evaluate the data.

No qualifications were made for bromoform, bromodichloromethane, carbon disulfide, chlorobenzene, dibromochloromethane, 2-hexanone, 1,1,1-trichloroethane, 4-methyl-2-pentanone and vinyl acetate as no positive sample results were reported for these compounds. Sample contaminant concentrations for the remaining affected compounds which were above Contract Required Quantitation Limit (CRQL) but within the action level are qualified "U", as undetected. Affected sample contaminant concentrations below the CRQL have been detected.

The average Response Factor (RF) for the initial calibration of 2-butanone was below the 0.050 quality control limit. No qualifications were made as only field quality control samples were affected (field quality control samples are not qualified for any non-compliance).

Initial calibration Percent Relative Standard Deviations (%RSDs) for chloroethane, acetone, carbon disulfide and total xylenes exceeded 50%. Detection Limits (DLs) for these compounds in affected samples were qualified as estimated "UJ". The 30% RSD quality criteria was exceeded for total xylenes, chloroethane and acetone, however, no qualifications were made as no positive sample results were reported for these compounds.

Some continuing calibration Percent Differences (%Ds) for total xylenes, acetone, 2-butanone and 2-hexanone exceeded 50%. Detection limits for acetone, 2-butanone and 2-hexanone were not qualified as the DLs for these compounds were previously raised (via the use of a "U" qualifier) due to blank contamination. No qualifications were made for total xylenes as only field quality control samples were affected.

The ± 25 %D continuing calibration quality control criteria was exceeded for the following compounds:

acetone	chloromethane	4-methyl-2-pentanone
bromoform	bromomethane	1,1,2,2-tetrachloroethane
2-hexanone	tetrachloroethene	total xylenes
2-butanone	vinyl acetate	carbon disulfide

No qualifications were made as no positive results were reported for these compounds in affected samples.

The field duplicate Relative Percent Difference (RPD) for ethylbenzene exceeded the 50% quality criteria for soils. The positive result reported for ethylbenzene in sample 01-SB10A-A is estimated, "J". The detection limit for ethylbenzene in the field duplicate sample 02-FD04-A is qualified as estimated, "UJ".

Maximum concentrations of 49 ug/kg 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), 72 ug/kg 2-propanol and 44 ug/kg hexamethylcyclotrisiloxane were detected in blanks analyzed with this sample set. Several unknowns were also detected. No qualifications were made as none of these TICs were detected in the samples.

Semivolatile Fraction

Sample 02-SB09C-A was extracted one day beyond the holding time allowance. The data for this sample was not qualified as the impact of this occurrence is negligible for BNAs in soils.

The ± 25 %D continuing calibration quality control criteria was exceeded for the following compounds:

2-nitroaniline	2,4-dinitrophenol	diethylphthalate
2,6-dinitrotoluene	dibenzofuran	4-nitrophenol
2,4,5-trichlorophenol	fluorene	dimethylphthalate
hexachloroethane	benzoic acid	

bis (2-chloroethoxy)methane 4,6-dinitro-2-methylphenol

No qualifications were made as no positive results were reported for these compounds in affected samples.

The Percent Recoveries (%Rs) for 2,4-dinitrotoluene, pyrene and pentachlorophenol were less than 10% for the matrix spike (MS) analysis of sample 01-SS01-AC. MS recoveries for 1,4-dichlorobenzene, N-nitroso-di-n-propylamine and 1,2,4-trichlorobenzene fell beneath the ± 25% acceptance limits. No qualifications were made, however, as all recoveries for the matrix spike duplicate (MSD) analysis of this sample met quality control criteria. These occurrences and the associated non-compliant RPDs are felt to be sample specific and do not affect the rest of the data.

The %R for 2,4-dinitrotoluene exceeded the ± 25% quality limit in the MS analysis of sample 02-SB09C-A. No qualifications were made as all MSD quality criteria were met.

Samples 02-SB10A-A and 02-FD04-A constitute a field duplicate pair. Results for naphthalene and 2-methylnaphthalene exceeded the 50% RPD quality criteria for soils. No qualifications were made, however, as the results for these two compounds are below the CRQL.

Samples 01-SS01-AE and 01-FD05-AE constitute a field duplicate pair. Results for the following compounds exceeded the 50% RPD quality criteria for soils:

naphthalene	butylbenzylphthalate
dibenzofuran	benzo(a)pyrene
acenaphthene	benzo(k)fluoranthene
fluorene	indeno(1,2,3,cd)pyrene
anthracene	benzo(a)anthracene

Results for naphthalene and dibenzofuran were not qualified as both reported concentrations are less than the CRQL. Positive results in these two samples reported for the remaining compounds are qualified as estimated, "J". The detection limits for butylbenzylphthalate and indeno(1,2,3 cd)pyrene are qualified as estimated, "UJ".

Positive results for naphthalene, 2-methylnaphthalene, dibenzofuran and phenanthrene are qualified as estimated, "J", as they are below the CRQL.

No semivolatile TICs were detected in blanks analyzed with this sample set.

Pesticide/PCB Fraction

The DBC surrogate Percent Recovery (%R) was below the 20 - 150% advisory limits for sample 01-SS01-ACNT. No qualifications were made as this occurrence is felt to be sample specific and also because this sample was used for matrix spike/matrix spike duplicate analyses which also yielded low surrogate recoveries.

MS recoveries for gamma-BHC and 4,4'-DDT and MS/MSD recoveries for endrin were below the ± 25% quality limit. 01-SS01-ACNT sample results for endrin are qualified as estimated "UJ".

Positive results for 4,4'-DDE, 4,4'-DDD and 4,4'-DDT are qualified as estimated, "J", as they are below the CRQL.

DATA SUMMARY

TABLE A

DATA SUMMARY FORM: V O L A T I L E S 1

Site Name: Ellington Air Force Base (DC EAFB4)

WATER SAMPLES
(ug/L)

Case #: EAFB1 Sampling Date: 1/22/90 1/25/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor)

	Lab No.	H115614	H115615	H115934	H115933	H115931	H115932	H115605	H115935	H115936
	Sample No.	D1-FB10-A	D1-FB11-A	D1-FD05-A	D1-MW05-A	D1-MW01-A	D1-MW02-A	D1-MW03-1	D1-RB13-A	D1-TB09-A
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Location	HPLC Water	Landfill Hydrant							
CRQL	COMPOUND	field blank	field blank	- FIELD DU	PLICATE PAIR -				rinsate blank	trip blank
10	Chloromethane									
10	Bromomethane									
10	*Vinyl Chloride									
10	Chloroethane									
5	*Methylene Chloride	14	21	13 U	13 U	15 U	14 U	15 UJ	13	22
10	Acetone									
5	Carbon Disulfide					70 U	150 U		67	
5	*1,1-Dichloroethene									
5	1,1-Dichloroethane									
5	*Total-1,2-Dichloroethene									
5	Chloroform		33							53
5	*1,2-Dichloroethane									
10	*2-Butanone		110							
5	*1,1,1-Trichloroethane									
5	*Carbon Tetrachloride									
10	Vinyl Acetate			UJ	UJ	UJ	UJ			
5	Bromodichloromethane		41							

CRQL = Contract Required Quantitation Limit

* Action Level Exists

SEE NARRATIVE FOR CODE DEFINITIONS

Tabulated by Pat Brush Verified by D.A. Schultz

DATA SUMMARY FORM: V O L A T I L E S 2

WATER SAMPLES
(ug/L)

Site Name: Ellington Air Force Base (SDG EAFB4)

Case #: EAFB1 **Sampling Date:** 1/22-1/25/90

To calculate sample quantitation limit
(CRQL * Dilution Factor)

CRQL	Sample_No.	DI-FB10-A		DI-FB11-A		DI-FD05-A		DI-MW15-A		DI-MW01-A		DI-MW02-A		DI-MW03-A		DI-RB13-A		DI-TB09-A	
	Dilution_Factor	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
	Location	HPLC Water		Landfill Hydrant															
	COMPOUND	field blank		field blank		- FIELD DUPLICATE PAIR -										rinsate blank		trip blank	
5	*1,2-Dichloropropane																		
5	Cis-1,3-Dichloropropene																		
5	Trichloroethene																		
5	Dibromochloromethane			44															
5	1,1,2-Trichloroethane																		
5	*Benzene	8						10	U		UJ	8	U	9	U	10		10	
5	Trans-1,3-Dichloropropene																		
5	Bromoform			21															
10	4-Methyl-2-pentanone									13	U								
10	2-Hexanone									23	U								
5	*Tetrachloroethene																		
5	1,1,2,2-Tetrachloroethane																		
5	*Toluene								UJ		UJ		UJ		UJ				
5	*Chlorobenzene								UJ		UJ		UJ		UJ				
5	*Ethylbenzene								UJ		UJ		UJ		UJ				
5	*Styrene								UJ		UJ		UJ		UJ				
5	*Total Xylenes								UJ		UJ		UJ		UJ				

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: B N A S 1

WATER SAMPLES
(ug/L)

Site Name: Ellington Air Force Base (SDG EAFG4)

Case #: EAFG1 Sampling Date: 11/22/90 1/25/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor)

CRQL	Sample_No.	01-FB10-A	01-FB11-A	01-FD05-A	01-MW05-A	01-MW01-A	01-MW02-A	01-MW03-A	01-RB13-A	01-TB09-A
	Dilution_Factor	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	
	Location	HPLC Water	Landfill Hydrant							
	COMPOUND	field blank	field blank	-FIELD DUPLI	CATE MIR-				rinsate blank	trip blank
10	Phenol									
10	bis(2-Chloroethyl)ether									
10	2-Chlorophenol									
10	*1,3-Dichlorobenzene									
10	*1,4-Dichlorobenzene									
10	Benzyl Alcohol									
10	1,2-Dichlorobenzene									
10	2-Methylphenol									not
10	bis(2-Chloroisopropyl)ether									analyzed
10	4-Methylphenol									
10	N-Nitroso-di-n-propylamine									
10	Hexachloroethane									
10	Nitrobenzene									
10	Isophorone									
10	2-Nitrophenol									
10	2,4-Dimethylphenol									
50	Benzoic Acid									
10	bis(2-Chloroethoxy)methane									
10	2,4-Dichlorophenol									
10	1,2,4-Trichlorobenzene									
10	Naphthalene									
10	4-Chloroaniline									

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE NARRATIVE FOR CODE DEFINITIONS

DATA SUMMARY FORM: B N A S 2

Site Name: Ellington Air Force Base SDG EAFB4

Case #: EAFB1 Sampling Date: 1/22/90-1/25/90

WATER SAMPLES
(ug/L)

To calculate sample quantitation limit:
(CRQL * Dilution Factor)

CRQL	Sample_No.	01-FB10-A	01-FB11-A	01-FD05-A	01-MW05-A	01-MW01-A	01-MW02-A	01-MW03-A	01-RB13-A	01-TB09-A
	Dilution_Factor	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	
	Location	HPLC Water	Landfill Hydrant							
	COMPOUND	field blank	field blank	-FIELD DUPLICATE PAIR-					rinsate blank	trip blank
10	Hexachlorobutadiene									
10	4-Chloro-3-methylphenol									
10	2-Methylnaphthalene									
10	Hexachlorocyclopentadiene									
10	2,4,6-Trichlorophenol									
50	2,4,5-Trichlorophenol									
10	2-Chloronaphthalene									
50	2-Nitroaniline									
10	Dimethyl phthalate									not
10	Acenaphthylene									analyzed
10	2,6-Dinitrotoluene									
50	3-Nitroaniline									
10	Acenaphthene									
50	2,4-Dinitrophenol									
50	4-Nitrophenol									
10	Dibenzofuran									
10	2,4-Dinitrotoluene									
10	Diethylphthalate									
10	4-Chlorophenyl-phenylether									
10	Fluorene									
50	4-Nitroaniline									
50	4,6-Dinitro-2-methylphenol									

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: B N A S 3

Site Name: Ellington Air Force Base (SDG EAFB4)

WATER SAMPLES
(ug/L)

Case #: 24FBL Sampling Date: 1/22/90 - 1/25/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor)

CRQL	Sample_No.	01-FB10-A	01-FB11-A	01-FD05-A	01-MW05-A	01-MW11-A	01-MW07-A	01-MW13-A	01-RB13-A	01-TB09-A
	Dilution_Factor	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	
	Location	HPLC Water	Landfill Hydrant							
	COMPOUND	Field blank	Field blank	- FIELD DUPLI	CATE PAIR -				rinsate blank	trip blank
10	N-Nitrosodiphenylamine									
10	4-Bromophenyl-phenylether									
10	*Hexachlorobenzene									
50	*Pentachlorophenol									
10	Phenanthrene									not
10	Anthracene									analyzed
10	Di-n-butylphthalate									
10	Fluoranthene									
10	Pyrene									
10	Butylbenzylphthalate									
20	3,3-Dichlorobenzidine									
10	Benzo(a)anthracene									
10	Chrysene									
10	bis(2-Ethylhexyl)phthalate									
10	Di-n-octyl phthalate									
10	Benzo(b)fluoranthene									
10	Benzo(k)fluoranthene									
10	Benzo(a)pyrene									
10	Indeno(1,2,3-cd)pyrene									
10	Dibenz(a,h)anthracene									
10	Benzo(g,h,i)perylene									

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: PESTICIDES AND PCBS

Site Name: Ellington Air Force Base (ECFB4-SDG)

WATER SAMPLES
(ug/L)

Case #: EAFB1 Sampling Date: 1/22/90 - 1/25/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor)

CRQL	Sample_No. / Dilution_Factor / Location / COMPOUND	01-FB10-A	01-FB11-A	01-FD05-A	01-MW05-A	01-MW01-A	01-MW02-A	01-MW03-A	01-RB13-A	01-TB09-A
	Dilution_Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Location	HPLC Water	Landfill Hydrant							
		Field blank	field blank	- FIELD DUPL	ICATE PAIR -				rinsate blank	trip blank
0.05	alpha-BHC					0.037 J				
0.05	beta-BHC									
0.05	delta-BHC								0.022	
0.05	*Gamma-BHC_(Lindane)								0.14	
0.05	*Heptachlor								0.18	
0.05	Aldrin									not
0.05	Heptachlor_Epoxide									analyzed
0.05	Endosulfan_I									
0.10	Dieldrin									
0.10	4,4'-DDE									
0.10	*Endrin									
0.10	Endosulfan_II									
0.10	4,4'-DDD									
0.10	Endosulfan_Sulfate									
0.10	4,4'-DDT									
0.5	*Methoxychlor				0.022 J					
0.10	Endrin_ketone									
0.5	*Alpha-Chlordane									
0.5	*Gamma-Chlordane									
1.0	*Toxaphene									
0.5	*Aroclor-1016									
0.5	*Aroclor-1221									
0.5	*Aroclor-1232									
0.5	*Aroclor-1242									
0.5	*Aroclor-1248									
1.0	*Aroclor-1254									
1.0	*Aroclor-1260									

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: V O L A T I L E S 1

WATER SAMPLES
(ug/L)

Site Name: Ellington Air Force Base (SDG EAFB4)

Case #: EAFB1 Sampling Date: 1/22-1/25/90

To calculate sample quantitation limit (CRQL * Dilution Factor)

	Lab No.	H115612	H115602	H115611	H115613	H115604	H115609	H115610	H115613	H115606
	Sample No.	02-FB09-A	02-MW107A	02-MW109-A	02-MW108-A	02-MW110-A	02-RB11-A	02-TB07-A	02-TB08-A	01-MW04-A
	Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Location	POL Spigot								
CRQL	COMPOUND	field blank					rinsate blank	trip blank	trip blank	
10	Chloromethane									
10	Bromomethane									
10	*Vinyl Chloride									
10	Chloroethane		UJ		UJ					UJ
5	*Methylene Chloride	23	15 U	12 U	15 U	12 U	14	18	18	15 U
10	Acetone		12 U					23		
5	Carbon Disulfide		160 U	150 U	80 U	130 U	85		15	
5	*1,1-Dichloroethene							9		
5	1,1-Dichloroethane									
5	*Total-1,2-Dichloroethene									
5	Chloroform	36						30	31	
5	*1,2-Dichloroethane									
10	*2-Butanone							6		
5	*1,1,1-Trichloroethane									
5	*Carbon Tetrachloride									
10	Vinyl Acetate									
5	Bromodichloromethane	9								

CRQL = Contract Required Quantitation Limit * Action Level Exists SEE NARRATIVE FOR CODE DEFINITIONS

DATA SUMMARY FORM: VOLATILES 2

WATER SAMPLES
(ug/L)

Site Name: Ellington Air Force Base (EDG EAFB4)

Case #: EAFB1 **Sampling Date:** 1/22-1/25/90

To calculate sample quantitation limit: (CRQL * Dilution Factor)

CRQL	Sample_No.	D2-FB09-A	D2-MW10A	D2-MW09-A	D2-MW108-A	D2-MW110-A	D2-RB11-A	D2-TB07-A	D2-TB08-A	D1-MW04-A
	Dilution_Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Location	POL Spigot fieldblank					rinsate blank	trip blank	trip blank	
	COMPOUND									
5	*1,2-Dichloropropane									
5	Cis-1,3-Dichloropropene									
5	Trichloroethene									
5	Dibromochloromethane	15								
5	1,1,2-Trichloroethane									
5	*Benzene	10	13 U	11 U	12 U	7 U	8	9	9	12 U
5	Trans-1,3-Dichloropropene									
5	Bromoform	14								
10	4-Methyl-2-pentanone									
10	2-Hexanone					16 U			19	
5	*Tetrachloroethene									
5	1,1,2,2-Tetrachloroethane									
5	*Toluene	16	UJ	UJ	UJ	UJ		8		UJ
5	*Chlorobenzene		UJ	UJ	UJ	6 J				UJ
5	*Ethylbenzene	5	UJ	UJ	UJ	6 J			5	UJ
5	*Styrene		UJ	UJ	UJ	10 J				UJ
5	*Total Xylenes	37	UJ	UJ	UJ	23 J				UJ

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: B N A S 1

Site Name: Ellington Air Force Base (SDG EAFB3)

Case #: EAFB1 Sampling Date: 11/22/90 11/25/90

WATER SAMPLES
(ug/L)

To calculate sample quantitation limit:
(CRQL * Dilution Factor)

	Sample_No.	02-FB09-A	02-mw107-A	02-mw09-A	02-mw108-A	02-mw110-A	02-RB11-A	02-TB07-A	02-TB08-A	01-mw04A
	Dilution_Factor	0.500	0.500	0.500	0.500	0.500	0.500			0.500
	Location	PCL Spigot fieldblank					rinsate blank	tripblank	tripblank	
CRQL	COMPOUND									
10	Phenol									
10	bis(2-Chloroethyl)ether									
10	2-Chlorophenol									
10	*1,3-Dichlorobenzene									
10	*1,4-Dichlorobenzene									
10	Benzyl Alcohol									
10	1,2-Dichlorobenzene									
10	2-Methylphenol							not	not	
10	bis(2-Chloroisopropyl)ether							analyzed	analyzed	
10	4-Methylphenol									
10	N-Nitroso-di-n-propylamine									
10	Hexachloroethane									
10	Nitrobenzene									
10	Isophorone									
10	2-Nitrophenol									
10	2,4-Dimethylphenol									
50	Benzoic Acid									
10	bis(2-Chloroethoxy)methane									
10	2,4-Dichlorophenol									
10	1,2,4-Trichlorobenzene									
10	Naphthalene	1								
10	4-Chloroaniline									

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: B N A S 2

WATER SAMPLES
(ug/L)

Site Name: Ellington Air Force Base SDG EHFB4

Case #: EHFB1 Sampling Date: 11/22/90 - 11/25/90

To calculate sample quantitation limit
(CRQL * Dilution Factor)

CRQL	Sample_No.	02-FB09-A	02-MW101-A	02-MW09-A	02-MW108-A	02-MW110-A	02-RB11-A	02-TB07-A	02-TB08-A	01-MW04-A
	Dilution_Factor	0.500	0.500	0.500	0.500	0.500	0.500			0.500
	Location	POL spigot								
	COMPOUND	field blank					rinsate blank	trip blank	trip blank	
10	Hexachlorobutadiene									
10	4-Chloro-3-methylphenol									
10	2-Methylnaphthalene									
10	Hexachlorocyclopentadiene									
10	2,4,6-Trichlorophenol									
50	2,4,5-Trichlorophenol									
10	2-Chloronaphthalene									
50	2-Nitroaniline							not	not	
10	Dimethyl phthalate							analyzed	analyzed	
10	Acenaphthylene									
10	2,6-Dinitrotoluene									
50	3-Nitroaniline									
10	Acenaphthene									
50	2,4-Dinitrophenol									
50	4-Nitrophenol									
10	Dibenzofuran									
10	2,4-Dinitrotoluene									
10	Diethylphthalate									
10	4-Chlorophenyl-phenylether									
10	Fluorene									
50	4-Nitroaniline									
50	4,6-Dinitro-2-methylphenol									

CRQL = Contract_Required_Quantitation_Limit • Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: B N A S 3

Site Name: Ellington Air Force Base (SDG EAFB4)

WATER SAMPLES
(ug/L)

Case #: EAFB1 Sampling Date: 1/22/90 - 1/25/90

To calculate sample quantitation limit:
(CRQL * Dilution Factor)

CRQL	Sample_No.	02-FB09-A	02-MW107-A	02-MW109-A	02-MW108-A	02-MW110-A	02-RB11-A	02-TB07-A	02-TB08-A	01-MW04-A
	Dilution_Factor	0.500	0.500	0.500	0.500	0.500	0.500			0.500
	Location	POL Spigot Field blank					rinsate blank	trip blank	trip blank	
CRQL	COMPOUND									
10	N-Nitrosodiphenylamine									
10	4-Bromophenyl-phenylether									
10	*Hexachlorobenzene									
50	*Pentachlorophenol									
10	Phenanthrene									
10	Anthracene									
10	Di-n-butylphthalate							not	not	
10	Fluoranthene							analyzed	analyzed	
10	Pyrene									
10	Butylbenzylphthalate									
20	3,3-Dichlorobenzidine									
10	Benzo(a)anthracene									
10	Chrysene									
10	bis(2-Ethylhexyl)phthalate	1					2			
10	Di-n-octyl phthalate									
10	Benzo(b)fluoranthene									
10	Benzo(k)fluoranthene									
10	Benzo(a)pyrene									
10	Indeno(1,2,3-cd)pyrene									
10	Dibenz(a,h)anthracene									
10	Benzo(g,h,i)perylene									

CRQL = Contract_Required_Quantitation_Limit * Action_Level_Exists SEE_NARRATIVE_FOR_CODE_DEFINITIONS

DATA SUMMARY FORM: P E S T I C I D E S   A N D   P C B S

Site Name: Ellington Air Force Base SDG EAFB4   **WATER SAMPLES** (ug/L)

Case #: EAFB1   Sampling Date: 11/22/90 11/25/90

To calculate sample quantitation limit: (CRQL * Dilution Factor)

CRQL	Sample_No.	02-FB09-A	02-MW107-A	02-MW09-A	02-MW108-A	02-MW10-A	02-RB11-A	02-TB07-A	02-TB08-A	01-MW04-A
	Dilution_Factor									1.00
	Location	field blank					rinsate blank	trip blank	trip blank	
CRQL	COMPOUND									
0.05	alpha-BHC									
0.05	beta-BHC									
0.05	delta-BHC									
0.05	*Gamma-BHC_(Lindane)									
0.05	*Heptachlor									
0.05	Aldrin									
0.05	Heptachlor_Epoxide	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed	not analyzed	
0.05	Endosulfan_I									
0.10	Dieldrin									
0.10	4,4'-DDE									
0.10	*Endrin									
0.10	Endosulfan_II									
0.10	4,4'-DDD									
0.10	Endosulfan_Sulfate									
0.10	4,4'-DDT									
0.5	*Methoxychlor									
0.10	Endrin_ketone									
0.5	*Alpha-Chlordane									
0.5	*Gamma-Chlordane									
1.0	*Toxaphene									
0.5	*Aroclor-1016									
0.5	*Aroclor-1221									
0.5	*Aroclor-1232									
0.5	*Aroclor-1242									
0.5	*Aroclor-1248									
1.0	*Aroclor-1254									
1.0	*Aroclor-1260									

CRQL = Contract_Required_Quantitation_Limit   * Action_Level_Exists   SEE_NARRATIVE_FOR_CODE_DEFINITIONS

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-49-4-0-111

TO:	LINDA STEAKLEY	DATE:	APRIL 18, 1990
FROM:	DEB SCHEIB	COPIES:	FILE

SUBJECT: INORGANIC DATA VALIDATION -
METALS AND PETROLEUM HYDROCARBONS
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB2

SAMPLES:

Soil

01-SB05A-A	02-SB13A-A	02-RB05-A
01-SBO5B-A	02-SB13B-A	
01-FD02-A	02-SB13C-A	
01-FB03-A (HPLC)	02-SB14-A	
FB04-A (MUNIC.)	02-SB14B-A	
RB06-A	02-SB14C-A	

NUS Laboratories analyzed 3 soil samples (including one pair of field duplicates) and 3 associated aqueous quality control samples for Target Analyte List (TAL) metals and Petroleum Hydrocarbons. Seven additional samples were analyzed for Petroleum Hydrocarbons only. Data from these samples were analyzed and evaluated under the following HAZWRAP Level C QA/QC criteria:

- Holding times
* - Initial and continuing calibration
* - Laboratory and field blank analyses
- Laboratory Control Sample analyses
- Interference Check Sample analyses
- Serial dilutions
* - Matrix and analytical spike results
- Laboratory and field duplicates
- Detection limits

* Indicates that quality control criteria were not met for this parameter.

TAL Metals

The 0.1 Percent Recovery (%R) for the continuing calibration of magnesium was far below the ± 10% quality control limits. Positive results reported for magnesium are qualified as unreliable, "R".

Following are maximum concentrations of analytes found in laboratory and field quality control blanks:

analyte	maximum concentration (mg/kg)
aluminum	14.2
arsenic	0.23
beryllium	2.6
calcium	71.1
lead	0.33
selenium	2.2
sodium	96.3
zinc	4.3

Positive sample results less than five times the highest blank concentration are qualified "U", as undetected.

The 136 %R for zinc in the ICP CRDL Standard analysis exceeded the ± 20% advised limit. No qualifications were made as all results for this analyte have been previously qualified "U" due to blank contamination.

The 43 %R for antimony was below the ± 25% quality limit for matrix spike analyses. Detection limits for antimony are qualified as estimated, "UJ".

Petroleum Hydrocarbons

Petroleum hydrocarbons were detected in two samples, however, 23 mg/kg was detected in the associated rinsate blank. The petroleum hydrocarbon result for sample 02-SB13B-A is qualified "U", undetected. The result for sample 02-SB13A-A is not qualified as it is above the 115 mg/kg action-level based on blank contamination.

DATA SUMMARY

TABLE A

DATA SUMMARY FORM: I N O R G A N I C S

Site Name: EAFB - Ellington Airforce Base (SDGEAFB2)

SOIL SAMPLES (mg/Kg)

Case #: EAFB1 Sampling Date(s): 12/21/89

*Due to dilution, sample quantitation limit is affected. See dilution table for specifics.

CRDL	Lab No.	H12889		H12890		H12891		H12894		H12895		H12896	
	Sample No.	01-SB05A-A		01-SB05B-A		01-FD02		FB03-A		FB04-A		RB06-A	
	Dilution Factor	-		-		-		-		-		-	
	% Solids	85.5		82.3		82.1		0		0		0	
	Location												
	Date Sampled	12/21/89		12/21/89		12/21/89		12/21/89		12/21/89		12/21/89	
	Date Analyzed												
RDL	ANALYTE			— Field Duplicate Pair —				field blank HPLC		field blank Munc.		rinsate blank	
40	Aluminum	6370		948		1840							
12	Antimony		UJ		UJ		UJ						
2	Arsenic	0.69	U	1.5	U	1.9		0.18				0.23	
40	Barium	35.1		6.8		7.4							
1	Beryllium	0.63	U	0.60	U	0.66	U	0.44		0.35		0.47	
1	Cadmium												
1000	Calcium	831		224	U	358						71.1	
2	Chromium	7.0				2.4							
10	Cobalt	2.6				1.9							
5	Copper	4.8		2.0									
20	Iron	6360		1600		3400							
1	*Lead	4.2		2.0		2.4				0.33			
1000	Magnesium	1470	R	333	R	501	R						
3	Manganese	38.6		16.3		41.7							
0.2	Mercury	0.34		0.21		0.33							
8	Nickel	11.1		2.9									
1000	Potassium	874		156									
1	Selenium					0.35	U					0.29	
2	Silver												
1000	Sodium									96.3			
2	Thallium												
10	Vanadium	6.5		2.2		5.2		1.1					
4	Zinc	16.9	U	5.6	U	7.8	U			1.0		3.7	
2	~~Cyanide~~												

CRDL = Contract Required Detection Limit

*Action Level Exists

SEE NARRATIVE FOR CODE DEFINITIONS

revised 12/88

DATA SUMMARY FORM:

Site Name: EAFB - Ellington Airforce Base (SDGEAFB2) **SOIL SAMPLES**

Case #: EAFB1 **Sampling Date:** 12/21/89

Sample_No.	01-SB05-A	01-SB05B-A	01-FD02-A	FB03-A	FB04-A	RB06-A			
Dilution_Factor	1.0	1.0	1.0	1.0	1.0	1.0			
% Moisture	14.5	17.7	17.9	—	—	—			
Date Sampled									
Date Analyzed									
		-FIELD DUPLICATE PAIR-		FIELD BLANK HPLC	FIELD BLANK MUNIC.	RINSATE BLANK			
<20 mg/Kg Petroleum Hydrocarbons									

DATA SUMMARY FORM:

Site Name: ELLINGTON AIR FORCE BASE (SDGEAFB2) SOIL SAMPLES

Case #: EAFB1 Sampling Date: 12/19 - 12/21/89

Sample_No.	01-SB05A-A	01-SB05B-A	01-FD02-A	01-FB03-A	01-FB04-A	01-RB06-A	02-SB13A-A	02-SB13B-A	02-SB13C-A
Dilution_Factor									
% Moisture	14.5	17.7	—	—	—	—	29.1	27.4	20.0
Date Sampled	12-21-89	12-21-89	12-21-89	12-21-89	12-21-89	12-21-89	12-19-89	12-19-89	12-19-89
Date Analyzed									
pH	7.16	7.62	7.94	—	—	—	7.49	7.65	8.50
20 mg/Kg petroleum hydrocarbons							132	84 U	—

Tabulated by D. Lesko

Verified by D.A. Scheets

DATA SUMMARY FORM:

Site Name: Ellington Air Force Base (SDGEAFB2) SOIL SAMPLES

Case #: EAFB1 Sampling Date: 12/19 - 12/21/89

	Sample_No.	02-SB14A-A	02-SB14B-A	02-SB14C-A	02-RB00-A					
	Dilution_Factor									
	% Moisture	26.9	27.2	22.8	—					
	Date Sampled	12-19-89	12-19-89	12-19-89	12-19-89					
	Date Analyzed									
	pH	7.67	8.10	8.16	—					
20	mg/Kg petroleum hydrocarbons				23					

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-49-0-3-

TO:	**LINDA STEAKLEY**	**DATE:**	**APRIL 18, 1990**
FROM:	**D. A. SCHEIB** DAS	**CC:**	**FILE**

SUBJECT: INORGANIC DATA VALIDATION - PETROLEUM HYDROCARBONS
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB1

SAMPLES:

WATER

01-SB01A-A	01-SB04B-A	02-SB12B-A
01-SB01B-A	01-SB11A-A	02-SB12C-A
01-SB02A-A	01-SB11B-A	01-FB01-A
01-SB03A-A	02-SB11C-A	01-FB02-A
01-SB03B-A	02-FD01-A	01-RB01-A
01-SB04A-A	02-SB12A-A	01-RB03-A

NUS Laboratories analyzed 16 water samples (including one pair of field duplicates) and two associated aqueous quality control samples for Petroleum Hydrocarbons. Data from these samples were evaluated under HAZWRAP Level C QA/QC criteria.

Petroleum Hydrocarbons

All analyses met quality control criteria. No petroleum hydrocarbons were detected.

DAS: PHCEAFB1

DATA SUMMARY

TABLE A

DATA SUMMARY FORM:

Site Name: EAFB - Ellington Air Force Base (SDGEAFBI) SOIL SAMPLES

Case #: EAFBI Sampling Date: 12/12 - 12/18/89

Sample_No.	01·SB01A·A	01·SB01B·A	01·SB02A·A	01·SB03A·A	01·SB03B·A	01·SB04A·A	01·SB04B·A	02·SB11A·A	02·SB11B·A
Dilution_Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
% Moisture	20.0	15.2	17.2	17.7	20.3	14.4	22.1	29.5	24.4
Date Sampled	12/13/89	12/13/89	12/14/89	12/13/89	12/13/89	12/12/89	12/12/89	12/18/89	12/18/89
Date Analyzed									
pH	7.84	8.13	7.71	7.79	7.53	8.53	7.67	7.54	7.67
<20 mg/Kg Petroleum Hydrocarbons*									

* Note: Detection limits vary proportionately with percent moisture.

Tabulated by D.A. Scheib. Verified by SLA

DATA SUMMARY FORM:

Site Name: EAFB - Ellington Air Force Base (SDGEAFB1) **SOIL SAMPLES**

Case #: EAFB1 **Sampling Date:** 12/14- 12/18/89

FIELD DUP. PAIR

Sample_No.	02-SB11C-A	02-FD01-A	02-SB12A-A	02-SB12B-A	02-SB12C-A	01-TB01-A	01-TB03-A	01-FB01-A	01-FB02-A
Dilution_Factor	1.0	1.0	1.0	1.0	1.0			1.0	1.0
% Moisture	17.0	18.2	28.8	30.3	18.6			–	–
Date Sampled	12/18/89	12/18/89	12/18/89	12/18/89	12/18/89			12/14/89	12/14/89
Date Analyzed									
pH	8.37	8.43	7.38	7.98	8.54			6.60	9.48
								HPLC WATER	MUNICIPAL
						not analyzed	not analyzed		

DATA SUMMARY FORM:

Site Name: EAFB- Ellington Air Force Base (SDG EAFB1) SOIL SAMPLES

Case #: EAFB1 Sampling Date: 12/12 - 12/14/89

Sample_No.	01·RB04·A	01·RB03·A							
Dilution_Factor	1.0	1.0							
% Moisture	—	—							
Date Sampled	12/12/89	12/14/89							
Date Analyzed									
pH	7.04	6.90							
<20 mg/Kg PETROLEUM HYDROCARBONS									

NUS CORPORATION

INTERNAL CORRESPONDENCE

C-49-0-3-138

TO: LINDA STEAKLEY **DATE:** MARCH 26, 1990

FROM: THOMAS JACKMAN **CC:** AMY HUBBARD

SUBJECT: INORGANIC DATA VALIDATION-METALS
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1
SDG NO. EAFB1

SAMPLE NOS.

SOIL -	01-SB04A-A	01-SB03A-A
	01-SB04B-A	01-SB03B-A
	01-SB01A-A	01-SB02-A
	01-SB01B-A	
BLANKS -	01-RB01-A	01-FB01-A
	01-RB03-A	01-FB02-A

NUS Laboratories analyzed 7 soil samples plus 2 rinsate blanks and 2 field blanks from Ellington Air Force Base for TAL Metals, pH and Percent Moisture under the following HAZWRAP Level C QA/QC criteria:

- Holding Times
- Interference Check Samples
- o - Matrix and Analytical Spike Results
- o - Laboratory and Fieldd Blank Analyses
- Initial and Continuing Calibration
- Laboratory and Field Duplicates
- Laboratory Check Samples
- Serial Dilutions
- Detection Limits

o Indicates that quality control criteria were not met for this parameter.

TAL METALS
Blanks
Aluminum, calcium, iron, magnesium, sodium, lead, zinc and chromium were found in laboratory, rinsate and field blanks. Positive results less than 5 times the highest blank concentrations are qualified as "U", undetected.

Matrix Spikes
Matrix spike recoveries for antimony were below the 75% quality control limit. Therefore, positive results are qualified "J", biased low, and detection limits are qualified "UJ", biased low.

C-49-0-3-138
Linda Steakley
Page 2

TABLE 1
SUMMARY OF QUALIFIERS AFTER DATA VALIDATION
ELLINGTON AIR FORCE BASE, CASE EAFB1, SDG EAFB1

Analyte	Soil Sample No.	Positive	Undetected	Bias	Comment
Antimony	01-SB01B-A, 01-SB02-A		UJ	Low	1
Calcium	01-SB04A-A, 01-SB04B-A 01-SB03B-A, 01-SB02-A	U		High	2
Chromium	01-SB04A-A, 01-SB04B-A 01-SB01B-A, 01-SB03A-A 01-SB03B-A, 01-SB02-A	U		High	2
	01-SB01A-A	J		High	1
Magnesium	01-SB02-A	U		High	1
Sodium	ALL	U		High	2
Zinc	01-SB04B-A, 01-SB01B-A 01-SB03B-A, 01-SB02-A	U		High	2
	01-SB04A-A, 01-SB01A-A 01-SB03A-A	J			4

1. Low matrix spike recovery.
2. Laboratory, rinsate and/or field blank contamination.
3. Relative percent difference (RPDs) for laboratory duplicates exceeded the 35% quality control limit for soils.
4. Absolute difference for laboratory duplicate exceeds 2 times the CRDL quality control limit for soils.

DATA SUMMARY

TABLE A

DATA SUMMARY FORM: I N O R G A N I C S

Site Name: Ellington Air Force Base

SOIL SAMPLES
(mg/Kg)

Case #: 9AFB1 Sampling Date(s): ____________

•Due to dilution, sample quantitation limit is affected.
See dilution table for specifics.

CRDL	Sample No.	DI-FB02-A									
	Dilution Factor	-									
	% Solids	-									
	Location	Municipal									
	Date Sampled	12/14/89									
	Date Analyzed	1/8/90									
CRDL	ANALYTE	Field Blank									
40	Aluminum										
12	Antimony										
2	Arsenic										
40	Barium										
1	Beryllium										
1	Cadmium										
1000	Calcium	[95.6]									
2	Chromium	[1.6]									
10	Cobalt										
5	Copper										
20	Iron										
1	*Lead	[0.14]									
1000	Magnesium										
3	Manganese										
0.2	Mercury										
8	Nickel										
1000	Potassium										
1	Selenium										
2	Silver										
1000	Sodium	[198]									
2	Thallium										
10	Vanadium										
4	Zinc	[2.0]									
2	Cyanide										

CRDL = Contract Required Detection Limit *Action Level Exists SEE NARRATIVE FOR CODE DEFINITIONS

DATA SUMMARY FORM: INORGANICS

SOIL SAMPLES
(mg/Kg)

Site Name: Ellington Air Force Base

Case #: EAF31 Sampling Date(s): 12/12/89 - 12/14/89

+Due to dilution, sample quantitation limit is affected. See dilution table for specifics.

CRDL	Sample No.	01-SB04A-A	01-SB04B-A	01-RB01-A	01-SB01A-A	01-SB01B-A	01-SB03A-A	01-SB03B-A	01-SB02A-A	01-RB03-A	01-FB01-A
	Dilution Factor	-	-		-	-	-	-	-	-	-
	% Solids	85.6	72.9	-	80.0	84.8	83.3	79.7	82.8	-	-
	Location	4'-6'	12'-14'		16'-18'	26'-28'	8'-10'	12'-14'	16'-18'	-	HPLC
	Date Sampled	12/12/89	12/12/89	12/13/89	12/13/89	12/13/89	12/13/89	12/13/89	12/14/89	12/14/89	12/14/89
	Date Analyzed	1/18/90	1/18/90	1/18/90	1/18/90	1/18/90	1/12/90	1/18/90	1/18/90	1/18/90	1/18/90
	ANALYTE			Rinsate						Rinsate	Field Blank
40	Aluminum	9590	3060	[8.8]	4080	1960	5280	3530	849		
12	Antimony					[1.5] UJ			UJ		
2	Arsenic	5.0	[0.36]		3.9	[0.66]		[1.8]	[0.51]		
40	Barium	106	[23.5]		97.9	[22.3]	74.4	136	[1.3]		
1	Beryllium	[0.90]			[0.82]		[0.55]	[0.32]			
1	Cadmium										
1000	Calcium	[950] U	[913] U	[198]	36000	20,000	1240	[674] U	[205] U	[83.4]	[93]
2	Chromium	7.4 U	3.2 U		10.1	3.2 U	5.9 U	4.9 U	[1.6] U	[1.1]	[1.3]
10	Cobalt	22.0			[4.9]						
5	Copper	[5.6]			8.9	[1.7]	[2.6]	[2.1]			
20	Iron	130	3400	[2.2]	16000	2920	3800	4010	1430		
1	*Lead	15.8	3.4		9.2	2.5	3.6	2.8	1.8	[0.14]	
1000	Magnesium	1470	[852]	74.0	3460	[1030]	1150	1250	[352] U		[25.7]
3	Manganese	540	57.4		474	108	12.4	452	57.3		
0.2	Mercury	0.20	0.28		[0.14]	[0.15]	[0.18]	[0.19]	[0.19]		
8	Nickel	16.2	[5.6]		13.3	[4.3]	[5.5]	[5.5]	[3.6]		
1000	Potassium	[687]	[251]		1400	[210]	320	[407]	[45.6]		
1	Selenium										
2	Silver										
1000	Sodium	[473] U	[409] U	[100]	[519] U	[259] U	[216] U	[321] U	[192] U		[139]
2	Thallium										
10	Vanadium	20.9	[5.3]		20.1	[3.8]	[3.9]	[2.5]	[3.5]		
4	Zinc	15.6 J	11.0 U	[1.8]	29.0 J	10.0 U	12.1 J	11.8 U	5.2 U	[2.4]	[2.3]
2	Cyanide										

CRDL = Contract Required Detection Limit

*Action Level Exists

SEE NARRATIVE FOR CODE DEFINITIONS

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NUS CORPORATION

INTERNAL CORRESPONDENCE

TO:	LINDA STEAKLEY	C-49-0-3-137
FROM:	THOMAS JACKMAN	DATE: MARCH 26, 1990
		CC: AMY HUBBARD
SUBJECT:	INORGANIC DATA VALIDATION-METALS ELLINGTON AIR FORCE BASE CASE NO. EAFB1 SDG EAFB3	

SAMPLE NOS.

SOIL -	01-SS01-AW	01-2201-AE
	01-SS01-AC	01-FD05-AE

NUS Laboratories analyzed 4 soil samples including 1 pair of field duplicates from Ellington Air Force Base for TAL Metals, Petroleum Hydrocarbons, pH and Percent Moisture under the following HAZWRAP Level C QA/QC criteria:

- Holding Times
- Interference Check Samples
- o - Matrix and Analytical Spike Results
- o - Laboratory and Field Blank Analyses
- Initial and Continuing Calibration
- o - Laboratory and Field Duplicates
- Laboratory Check Samples
- Serial Dilutions
- Detection Limits

o Indicates that quality control criteria were not met for this parameter.

TAL METALS

Blanks

Antimony, beryllium, cadmium, cobalt, copper, vanadium, zinc, and nickel were found in laboratory blanks. Positive results less than 5 times the highest blank concentrations are qualified as "U", undetected.

Matrix Spikes

Matrix spike recoveries for antimony and zinc were below the 30% quality control limit. Therefore, positive results are qualified "J", biased low and detection limits are qualified "R", unreliable.

Matrix spike recoveries for manganese and copper were below the 75% quality control limit. Therefore, positive results are qualified "J", biased low.

Matrix spike recoveries for arsenic exceeded the 125% quality control limit. Therefore, positive results are qualified "J", biased high.

Laboratory duplicates

The relative percent differences (RPDs) of laboratory duplicates for aluminum, barium and iron exceeded the 35% quality control limit for soil samples. Therefore, positive results not previously qualified because of blank contamination are qualified "J", estimated.

Field Duplicates

The RPDs of field duplicates for arsenic and calcium exceeded the 50% quality control limit for soil samples. Therefore, positive results for the duplicate pairs are qualified "J", estimated.

/bpk

TABLE 1
SUMMARY OF QUALIFIERS AFTER DATA VALIDATION
ELLINGTON AIR FORCE BASE
CASE NO. EAFB1, SDG EAFB3

Analyte	Soil Sample No.	Positive	Undetected	Bias	Comment
Aluminum	ALL	J			2 (54.3)
Antimony	01-SS01-AC		R	Low	1 (25.4)
Arsenic	ALL	J			5
	01-SS01-AC	J		High	3 (125.1)
	01-SS01-AE,01-FD05-AE	J			4 (182.1)
Barium	ALL	J			2 (97.8)
Beryllium	ALL	U		High	6
Cadmium	ALL	U		High	6
Calcium	01-SS01-AE,01-FD05-AE	J			4 (169.2)
Cobalt	ALL	U		High	6
Copper	ALL	U		High	6
	01-SS01-AC	J			1 (30.2)
Iron	01-SS01-AC	J			2 (47.0)
Manganese	01-SS01-AC	J		Low	1 (64.8)
Nickel	ALL	U		High	6
Vanadium	ALL	U		High	6
Zinc	01-SS01-AC	J		Low	1 (6.7)
	01-SS01-AE,01-FD05-AE	U		High	6

Comments:
1. Low matrix spike recoveries.
2. RPDs for laboratory duplicates exceeded 35% quality control limit for soils.
3. High matrix spike recoveries.
4. RPDs for field duplicates exceeded the 50% quality control limit for soils.
5. Laboratory blank contamination.
6. Field duplicate pair results were less than 5 times the CRDL for soils.

DATA SUMMARY

TABLE A

DATA SUMMARY FORM: I N O R G A N I C S

Site Name: Ellington Air Force Base SDG EAFB3 SOIL SAMPLES (mg/Kg)

Case #: EAFB1 Sampling Date(s): ______

*Due to dilution, sample quantitation limit is affected. See dilution table for specifics.

CRDL	Sample No.	01-SS01-AW		01-SS01-AC		01-SS01-AE		01-F005-AE	
	Dilution Factor	-		-		-		-	
	% Solids	85.8		85.6		84.0		83.1	
	Location	West LF		Central LF		East LF		East LF	
	Date Sampled	11/7/90		11/7/90		11/7/90		11/7/90	
	Date Analyzed	11/24/90		11/24/90		11/24/90		11/24/90	
CRDL	ANALYTE							Dup for 01-SS01-AE	
40	Aluminum	7250	J	6010	J	13500	J	9500	J
12	Antimony			1.6	R				
2	Arsenic	4.4		3.5	J	2.9	J	62.0	J
40	Barium	302	J	141	J	115	J	125	J
1	Beryllium	1.3	U	1.2	U	1.3	U	1.5	U
1	Cadmium	1.8	U	2.1	U	0.75	U	0.87	U
1000	Calcium	29600		39900		6460	J	1330	J
2	Chromium	13.4		16.0		12.2		10.4	
10	Cobalt	4.4	U	4.1	U	4.2	U	4.6	U
5	Copper	30.9	U	54.3	U	14.6	U	13.4	U
20	Iron	7410		6700	J	10600		7330	
1	*Lead	125		141		18.9		26.1	
1000	Magnesium	2220		1480		2000		1860	
3	Manganese	152		111	J	41.8		116	
0.2	Mercury	[0.10]		[0.19]		[0.06]		[0.08]	
8	Nickel	15.1	U	12.3	U	10.5	U	7.5	U
1000	Potassium	[678]		[492]		[934]		[566]	
1	Selenium								
2	Silver								
1000	Sodium	[233]		[253]		[125]		[109]	
2	Thallium								
10	Vanadium	12.9	U	12.9	U	17.5	U	16.8	U
4	Zinc	150		180	J	42.0	U	65.0	U
2	Cyanide								

CRDL = Contract Required Detection Limit *Action Level Exists SEE NARRATIVE FOR CODE DEFINITIONS

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APPENDIX F

RISK ASSESSMENT DATA

TOXICITY PROFILES

TOXICITY PROFILES

ACETONE (Clement Associates, Inc., 1985)

Health Effects

Acetone has not been tested in a carcinogenicity bioassay but gave negative results in skin painting tests and was not mutagenic in the Ames assay. No studies on animals for teratogenicity or reproductive toxicity have been done, but acetone was negative in a chicken egg injection study for teratogenicity.

Acetone is generally regarded as having a low toxicity and therefore has not been extensively studied. Prolonged inhalation of high concentrations may produce irritation of the respiratory tract, coughing, headache, drowsiness, incoordination, and in severe cases, coma.

In animal studies, rats consuming doses of 18 mg/kg/day for 4 months showed reduced food consumption and growth. In behavioral studies, rats exposed to 14,200 mg/m^3 acetone for 4 hours/day, 5 days/week for 2 weeks showed modified avoidance and escape behavior after one exposure, but no changes after subsequent exposures. At 37,800 mg/m^3, altered responses were noted throughout the 2-week exposure period. No chronic health hazards have been associated with exposure to acetone.

Toxicity to Wildlife and Domestic Animals

The toxicity of acetone to aquatic organisms is low. The LC_{50} value for sunfish was reported to be 14.2 g/liter, and the threshold concentration for immobilization of Daphnia magna was reported to be over 9 g/liter.

No information on the toxicity of acetone to terrestrial wildlife or domestic animals was available.

ARSENIC (Clement Associates, Inc., 1985)

Health Effects

Arsenic has been implicated in the production of skin cancer in humans. There is also extensive evidence that inhalation of arsenic compounds causes lung cancer in workers. Arsenic compounds cause chromosome damage in animals, and humans exposed to arsenic compounds have been reported to have an elevated incidence of chromosome aberrations. Arsenic compounds have been reported to be teratogenic, fetotoxic, and embryotoxic in several animal species, and an increased incidence of multiple malformations among children born to women occupationally exposed to arsenic has been reported. Arsenic compounds also cause noncancerous, possibly precancerous, skin changes in exposed individuals. Several cases of progressive polyneuropathy involving motor and sensory nerves and particularly affecting the extremities and myelinated long-axon neurons have been reported in individuals occupationally exposed to inorganic arsenic. Polyneuropathies have also been reported after the ingestion of arsenic-contaminated foods.

Toxicity to Wildlife and Domestic Animals

Various inorganic forms of arsenic appear to have similar levels of toxicity; they all seem to be much more toxic than organic forms. Acute toxicity to adult freshwater animals occurs at levels of arsenic trioxide as low as 812 µg/liter and at levels as low as 40 µg/liter in early life stages of aquatic organisms. Acute toxicity to saltwater fish occurs at levels around 15 mg/liter, while some invertebrates are affected at much lower levels (508 µg/liter). Arsenic toxicity does not appear to increase greatly with chronic exposure, and it does not seem that arsenic is bioconcentrated to a great degree.

Arsenic poisoning is a rare but not uncommon toxic syndrome among domestic animals. Arsenic causes hyperemia and edema of the gastrointestinal tract, hemorrhage of the cardiac serosal surfaces and peritoneum, and pulmonary congestion and edema; and it may cause liver necrosis. Arsenic toxicity to terrestrial wildlife was not reported in the literature reviewed.

BENZENE (Clement Associates, Inc., 1985)

Health Effects

Benzene is a recognized human carcinogen. Several epidemiological studies provided sufficient evidence of a causal relationship between benzene exposure and leukemia in humans. Benzene is a known inducer of aplastic anemia in humans, with a latent period of up to 10 years. It produces leukopenia and thrombocytopenia, which may progress to ancytopenia. Similar adverse effects on the blood-cell-producing system occur in animals exposed to benzene. In both humans and animals, benzene exposure is associated with chromosomal damage, although it is not mutagenic in microorganisms. Benzene was fetotoxic and caused embryo lethality in experimental animals.

Exposure to very high concentrations of benzene [about 20,000 ppm (66,000 mg/m^3) in air] can be fatal within minutes. The prominent signs are central nervous system depression and convulsions, with death usually following as a consequence of cardiovascular collapse. Milder exposure can produce vertigo, drowsiness, headache, nausea, and eventually unconsciousness if exposure continues. Deaths from cardiac sensitization and cardiac arrhythmias have also been reported after exposure to unknown concentrations. Although most benzene hazards are associated with inhalation exposure, dermal absorption of liquid benzene may occur, and prolonged or repeated skin contact may produce blistering, erythema, and a dry, scaly dermatitis.

Toxicity to Wildlife and Domestic Animals

The EC_{50} values for benzene in a variety of invertebrate and vertebrate freshwater aquatic species range from 5,300 µg/liter to 386,000 µg/liter. However, only values for the rainbow trout (5,300 µg/liter) were obtained from a flow-through test and were based on measured concentrations. Results based on unmeasured concentrations in static tests are likely to underestimate toxicity for relatively volatile compounds like benzene. A chronic test with *Daphnia magna* was incomplete, with no adverse effects observed at test concentrations as high as 98,000 µg/liter.

For saltwater species, acute values for one fish and five invertebrate species range from 10,900 µg/liter to 924,000 µg/liter. Freshwater and saltwater plant species that have been studied exhibit toxic effects at benzene concentrations ranging from 20,000 µg/liter to 525,000 µg/liter.

2-BUTANONE (METHYL ETHYL KETONE [MEK]) (Clement Associates, Inc., 1985)

Health Effects

MEK has not been adequately tested for carcinogenicity and has produced only equivocal evidence of mutagenicity in a few bacterial assays. MEK has been reported to cause retarded fetal development and some teratogenic effects (acaudia, imperforate anus, and brachygnathia) at air concentrations of 9,000 mg/m^3. MEK is of relatively low toxicity but at high doses it affects the nervous system and causes irritation of the eyes, nose, and skin. The oral LD_{50} value for the rat was 2,750 mg/kg.

Although MEK is not strongly neurotoxic alone, it apparently strongly potentiates the neurotoxicity of n-hexane, and n-hexanone (methyl n-isobutyl ketone).

Toxicity to Wildlife and Domestic Animals

Only limited information was available on the toxicity of MEK to wildlife. LC_{50} concentrations for two freshwater fishes were around 5,600 µg/liter. MEK was toxic to brine shrimp at LC_{50} levels of 1,950 mg/liter.

No information on the toxicity of MEK to terrestrial wildlife or domestic animals was available.

BUTYLBENZYLPHTHALATE (BBP) (USEPA, September 1, 1989)

Health Effects

Butylbenzylphthalate (BBP) is reported to cause reductions in body weight and increases in liver weight in rats fed 1,000 to 1,400 mg/kg/day. Significant reductions in bone marrow cell count were also observed in rats fed 1,400 mg/kg/day. BBP is a Class C carcinogen, based on increases in mononuclear cell leukemia in female rats, however the response in male rats was inconclusive and there was no such response reported in mice.

Toxicity to Wildlife and Domestic Animals

No information on the toxicity of BBP to terrestrial wildlife or domestic animals was available.

CHLOROBENZENE (Clement Associates, Inc., 1985)

Health Effects

A study of the carcinogenicity of chlorobenzene was recently completed by the National Toxicology Program and preliminary results show that chlorobenzene caused neoplastic nodules in the liver of male rats but was not carcinogenic in female rats or in mice.

Occupational studies suggest that chronic exposure to monochlorobenzene vapor may cause blood dyscrasia, hyperlipidemia, and cardiac dysfunction in humans. Like many organic solvents, monochlorobenzene is a central nervous system depressant in overexposed humans, but no chronic neurotoxic effects have been reported. Animals exposed to chlorobenzene have exhibited liver and kidney damage and atrophy of the seminiferous tubules in the testes. The oral LD_{50} value for rats was 2,910 mg/kg.

Toxicity to Wildlife and Domestic Animals

Chlorobenzene was acutely toxic to fish at levels greater than 25 mg/liter and to aquatic invertebrates at levels greater than 10 mg/liter. No chronic studies on the toxicity of chlorobenzene to aquatic life were found in the literature reviewed. Monochlorobenzene was shown to have a bioaccumulation factor of about 1,000 in freshwater species. No studies on terrestrial wildlife or domestic animals were reported in the literature reviewed.

4,4'-DDT (Clement Associates, Inc. ,1985)

Health Effects

DDT, DDE, and DDD have been shown to be carcinogenic to mice, primarily causing liver tumors, but also causing lung tumors and lymphomas. DDT does not appear to be mutagenic, but it has caused chromosomal damage. There is no evidence that DDT is a teratogen; but it a reproductive toxin, causing reduced fertility, reduced growth of offspring, and fetal mortality.

Chronic exposure to DDT causes a number of adverse effects, especially to the liver and central nervous system (CNS). DDT induces various microsomal enzymes and therefore probably affects the metabolism of steroid hormones and exogenous chemicals. Other effects on the liver include hypertrophy of the parenchymal cells and increased fat deposition. In the CNS, exposure to DDT causes behavioral effects such as decreased aggression and decreased conditional reflexes. Acute exposure to large doses or chronic exposure to lower doses causes seizures. The oral LD_{50} is between 113 and 450 mg/kg for the rat and is generally higher for other animals.

DDT, DDD, and DDE are bioconcentrated and stored in the adipose tissues of most animals.

Toxicity to Wildlife and Domestic Animals

DDT has been extensively studied in freshwater invertebrates and fishes and is quite toxic to most species. The range of toxicities was 0.18 to 1,800 µg/liter and the freshwater final acute value for DDT and its isomers was determined by EPA to be 1.1 µg/liter. Saltwater species were somewhat more sensitive to DDT; the saltwater final acute value for the DDT isomers was 0.13 µg/liter. Only one chronic toxicity test on aquatic species was reported. This test indicated that the acute-chronic ratio for DDT might be high (65 in the reported study), but the data were insufficient to allow calculation of a final acute-chronic ratio. DDT, DDD, and DDE are bioconcentrated by a factor of 10^3 to 10^5.

DDT, DDD, DDE and the other persistent organochlorine pesticides are primarily responsible for the great decrease in the reproductive capabilities and consequently in the populations of fish-eating birds, such as the bald eagle, brown pelican, and osprey. DDT has also been shown to decrease the populations of numerous other species of waterbirds, raptors, and passerines significantly.

ETHYLBENZENE (Clement Associates, Inc., 1985)

Health Effects

Ethylbenzene has been selected by the National Toxicology Program to be tested for possible carcinogenicity, although negative results were obtained in mutagenicity assays in Salmonella typhimurium and Saccharomyces cerevisiae. There is recent animal evidence that ethylbenzene causes adverse reproductive effects. Ethylbenzene is a skin irritant, and its vapor is irritating to the eyes at a concentration of 200 ppm (870 mg/m^3) and above. When experimental animals were exposed to ethylbenzene by inhalation, 7 hours/day for 6 months, adverse effects were produced at concentrations of 600 ppm (2,610 mg/m^3) and above, but not at 400 ppm (1,740 mg/m^3). At 600 ppm, rats and guinea pigs showed slight changes in liver weight, and monkeys and rabbits experienced histopathologic changes in the testes. Similar effects on the liver and kidney were observed in rats fed ethylbenzene at 4-8 and 680 mg/kg/day for 6 months.

Toxicity to Wildlife and Domestic Animals

Ethylbenzene was accurately toxic to freshwater species at levels greater than 32 mg/liter. No chronic toxicity was reported, but the highest test dose (440 µg/liter) was only one-hundredth of the 96-hour LC_{50} for the particular species being tested. No studies on the bioaccumulation of ethylbenzene were reported in the information reviewed, but a bioconcentration factor of 95 was calculated using the log octanol/water partition coefficient. No information on the toxicity of ethylbenzene to domestic animals and terrestrial wildlife was found in the sources reviewed.

LEAD (Clement Associates, Inc., 1985)

Health Effects

There is evidence that several lead salts are carcinogenic in mice or rats, causing tumors of the kidneys after either oral or parenteral administration. Data concerning the carcinogenicity of lead in humans are inconclusive. The available data are not sufficient to evaluate the carcinogenicity of organic lead compounds or metallic lead. There is equivocal evidence that exposure to lead causes genotoxicity in humans and animals. The available evidence indicates that lead presents a hazard to reproduction and exerts a toxic effect on conception, pregnancy, and the fetus in humans and experimental animals.

Many lead compounds are sufficiently soluble in body fluids to be toxic. Exposure of humans or experimental animals to lead can result in toxic effects in the brain and central nervous system, the peripheral nervous system, the kidneys, and the hematopoietic system. Chronic exposure to inorganic lead by ingestion or inhalation can cause lead encephalopathy, and severe cases can result in permanent brain damage. Lead poisoning may cause peripheral neuropathy in adults and children, and permanent learning disabilities that are clinically undetectable in children may be caused by exposure to relatively low levels. Short-term exposure to lead can cause reversible kidney damage, but prolonged exposure at high concentrations may result in progressive kidney damage and possibly kidney failure. Anemia, due to inhibition of hemoglobin synthesis and a reduction in the life span of circulating red blood cells, is an early manifestation of lead poisoning. Several studies with experimental animals suggest that lead may interfere with various aspects of the immune response.

Toxicity to Wildlife and Domestic Animals

Freshwater vertebrates and invertebrates are more sensitive to lead in soft water than in hard water. At a hardness of about 50 mg/liter $CaCO_3$, the median effect concentrations for nine families range from 140 mg/liter to 236,600 mg/liter. Chronic values for Daphnia magna and the rainbow trout are 12.26 and 83.08 mg/liter, respectively, at a hardness of about 50 mg/liter. Acute-chronic ratios calculated for three freshwater species ranged from 18 to 62. Bioconcentration factors, ranging from 42 for young brook trout to 1,700 for a snail, were reported. Freshwater algae show an inhibition of growth at concentrations about 500 mg/liter.

Acute values for twelve saltwater species range from 476 mg/liter for the common mussel to 27,000 mg/liter for the softshell clam. Chronic exposure to lead causes adverse effects in mysid shrimp at 37 mg/liter, but not at 17 mg/liter. The acute-chronic ratio for this species is 118. Reported bioconcentration factors range from

17.5 for the quahog clam to 2,570 for the blue mussel. Saltwater algae are adversely affected at concentrations as low as 15.8 mg/liter.

Although lead is known to occur in the tissue of many free-living wild animals, including birds, mammals, fishes, and invertebrates, reports of poisoning usually involve waterfowl. There is evidence that lead, at concentrations occasionally found near roadsides and smelters, can eliminate or reduce populations of bacteria and fungi on leaf surfaces and in soil. Many of these microorganisms play key roles in the decomposer food chain.

Cases of lead poisoning have been reported for a variety of domestic animals, including cattle, horses, dogs, and cats. Several types of anthropogenic sources are cited as the source of lead in these reports. Because of their curiosity and their indiscriminate eating habits, cattle experience the greatest incidence of lead toxicity among domestic animals.

MERCURY (Clement Associates, Inc., 1985)

Health Effects

When administered by intraperitoneal injection, metallic mercury produces implantation site sarcomas in rats. No other studies were found connecting mercury exposure with carcinogenic effects in animals or humans. Several mercury compounds exhibit a variety of genotoxic effects in eukaryotes. In general, organic mercury compounds are more toxic than inorganic compounds. Although brain damage due to prenatal exposure to methylmercury has occurred in human populations, no conclusive evidence is available to suggest that mercury causes anatomical defects in humans. Embryotoxicity and teratogenicity of methylmercury has been reported for a variety of experimental animals. Mercuric chloride is reported to be teratogenic in experimental animals. No conclusive results concerning the teratogenic effects of mercury vapor are available.

In humans, alkyl mercury compounds pass through the blood brain barrier and the placenta very rapidly, in contrast to inorganic mercury compounds. Major target organs are the central and peripheral nervous systems, and the kidney. Methylmercury is particularly hazardous because of the difficulty of eliminating it from the body. In experimental animals, organic mercury compounds can produce toxic effects in the gastrointestinal tract, pancreas, liver, heart, and gonads, with involvement of the endocrine, immunocompetent, and central nervous systems.

Elemental mercury is not highly toxic as an acute poison. However, inhalation of high concentrations of mercury vapor can cause pneumonitis, bronchitis, chest pains, dyspnea, coughing, stomatitis, gingivitis, salivation, and diarrhea. Soluble mercuric salts are highly poisonous on ingestion, with oral LD_{50} values of 20 to 60 mg/kg reported. Mercurous compounds are less toxic when administered orally. Acute exposure to mercury compounds at high concentrations causes a variety of gastrointentinal symptoms and severe anuria with uremia. Signs and symptoms associated with chronic exposure involve the central nervous system and include behavioral and neurological disturbances.

Toxicity to Wildlife and Domestic Animals

The toxicity of mercury compounds has been tested in a wide variety of aquatic organisms. Although methylmercury appears to be more toxic than inorganic mercuric salts, few acute or chronic toxicity tests have been conducted with it. Among freshwater species, the 96-hour LC_{50} values for inorganic mercuric salts range from 0.02 µg/liter for crayfish to 2,000 µg/liter for caddisfly larvae. Acute values for methylmercuric compounds and other mercury compounds are only available for fishes. In rainbow trout, methylmercuric chloride is about ten times more toxic to rainbow trout than mercuric chloride, which is acutely toxic at about 300 µg/liter at 10°C. Methylmercury is the most chronically toxic of the tested compounds, with chronic values for Daphnia magna and brook trout of 1.00 and 0.52 µg/liter, respectively. The acute-chronic ratio for Daphnia magna is 3.2.

Mean acute values for saltwater species range from 3.5 to 1,680 µg/liter. In general, molluscs and crustaceans are more sensitive than fish to the acute toxic effects of mercury. A life-cycle experiment with the mysid shrimp showed that inorganic mercury at a concentration of 1.6 µg/liter significantly influences time of appearance of first brood, time of first spawn, and productivity. The acute-chronic ratio for the mysid shrimp is 2.9.

Chronic dietary exposure of chickens to mercuric chloride at growth inhibitory levels causes immune suppression, with a differential reduction effect on specific immunoglobulins.

METHYLENE CHLORIDE (Clement Associates, Inc., 1985)

Health Effects

Methylene chloride is currently under review by the National Toxicology Program. Preliminary results indicate that it produced an increased incidence of lung and liver tumors in mice and mammary tumors in females and male rats. In a chronic inhalation study, male rats exhibited an increased incidence of sarcomas in the ventral neck region. However, the authors suggested that the relevance and toxicological significance of this finding were uncertain in light of available toxicity data. Methylene chloride is reported to be mutagenic in bacterial test systems. It also has produced positive results in the Fischer rat embryo cell-transformation tests. However, it has been suggested that the observed cell-transforming capability may have been due to impurities in the test material. There is no conclusive evidence that methylene chloride can produce teratogenic effects.

In humans, direct contact with methylene chloride produces eye, respiratory passage, and skin irritation. Mild poisonings due to inhalation exposure produce somnolence, lassitude, numbness and tingling of the limbs, anorexia, and lightheadedness, followed by rapid and complete recovery. More severe poisonings generally involve correspondingly greater disturbances of the central and peripheral nervous systems. Methylene chloride also has acute toxic effects on the heart, including the induction of arrhythmia. Fatalities reportedly due to methylene chloride exposure have been attributed to cardiac injury and heart failure. Methylene chloride is metabolized to carbon monoxide in vivo, and levels of carboxyhemoglobin the blood are elevated after acute exposure. In experimental animals, methylene chloride is reported to cause kidney and liver damage, convulsions, and distal paresis. An oral LD_{50} value of 2,136 mg/kg, and an inhalation LC_{50} value cf 88,000 mg/m^3/30 minutes are reported for the rat.

Toxicity to Wildlife and Domestic Animals

Very little information concerning the toxicity of methylene chloride to domestic animals and wildlife exists. Acute values for the freshwater species Daphnia magna, the fathead minnow, and the bluegill are 224,000, 193,000 and 224,000 µg/liter, respectively. Acute values for the saltwater species, mysid shrimp and sheepshead minnow, are 256,000 and 331,000 µg/liter, respectively. No data concerning chronic toxicity are available. The 96-hour EC_{50} values for both freshwater and saltwater algae are greater than the highest test concentration, 662,000 µg/liter.

NAPHTHALENE (Clements Associates, Inc., 1985)

Health Effects

There are no epidemiological or case studies available suggesting that naphthalene is carcinogenic in humans. This compound is not generally considered to be carcinogenic in experimental animals. However, there is equivocal evidence suggesting weak carcinogenic activity in rats after subcutaneous injection. Naphthalene is reported to produce DNA damage in mice after intraperitoneal injection. Retarded cranial ossification and heart development are reported among offspring of rats injected intraperitoneally with naphthalene on days 1 to 15 of gestation.

Little information concerning acute and chronic toxic effects is available. Inhalation exposure to naphthalene may cause headache, loss of appetite, nausea, and kidney damage in humans and experimental animals. Acute hemolytic effects are reportedly caused by ingestion or inhalation or relatively large quantities of naphthalene. Optical neuritis, injuries to the cornea, and opacities of the lens also may result after inhalation exposure or ingestion. Naphthalene is a mild eye irritant in rabbits, and cataracts can be induced after oral administration. Application to the skin produces erythema and slight edema in rabbits. Somnolence and changes in motor activity are observed after ingestion of naphthalene by rats and mice. Oral LD_{50} values of 1,250 mg/kg and 580 mg/kg are reported for the rat and the mouse, respectively.

Toxicity to Wildlife and Domestic Animals

The median effect concentrations for freshwater invertebrate species and three fish species are all reported to be greater than 2,300 µg/liter. Acute values reported for saltwater polychaete, oyster, and shrimp species are all greater than 2,350 µg/liter. A chronic value of 620 µg/liter and an acute-chronic ratio of 11 is reported for the fathead minnow, a freshwater species. No chronic values are available for saltwater species. Freshwater algae appear to be less sensitive to the effects of naphthalene than animal species. No information concerning saltwater plant species is available. The weighted average bioconcentration factors for the edible portion of all freshwater and estuarine aquatic organisms consumed by Americans is 10.5.

POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) (ATSDR, October 1989)

Health Effects

Much of the epidemiological work done on PAHs has centered on persons exposed to coke oven emissions. However, no studies were located regarding cancer in humans after either inhalational or oral exposure to PAHs. Reports of skin tumors in some individuals exposed to PAH mixtures lends support to their potential for carcinogenicity in humans. Animal inhalation studies with benzo(a)pyrene have reported respiratory tract tumors, and other studies have demonstrated the ability of several PAHs to induce skin tumors. Minor hepatic effects have been observed in animals following oral exposure, and kidney microsomal carboxylesterase activity was moderately induced in rats at doses of 50 to 150 mg/kg for 4 days. The major target organs in animals appears to be the hematopoietic and lymphoid systems.

Toxicity to Wildlife and Domestic Animals

No information on the toxicity of PAHs to terrestrial wildlife or domestic animals was available.

STYRENE (EPA, September 30, 1985)

Health Effects

Most long-term bioassays reported excessive mortality in test animals and equivocal results for tumor formation. There are inadequate data to indicate that styrene is a human carcinogen (Class C); however, an increased incidence of lymphatic and hematopoietic tissue tumors have been observed. The acute toxicity of styrene is low; an acute oral LD_{50} of 5,000 mg/kg was reported for rats. Styrene was found to be fatal in rats at doses of 8,000 mg/kg. At levels of 400 to 667 mg/kg/day, 5 days/week for 6 months, decreased growth rates and increased liver and kidney weights were observed.

Toxicity to Wildlife and Domestic Animals

Dogs fed 400 to 600 mg/kg/day for 560 days showed minimal histopathologic effects on the liver and hematologic effects. No information on the toxicity of styrene to aquatic life or to wildlife were available.

XYLENES (Clement Associates, Inc., 1985)

Health Effects

The National Toxicology Program (NTP) tested xylene for carcinogenicity by administering it orally to rats and mice. Xylene does not appear to be carcinogenic in rats. Results have not been reported for mice. Xylene was not found to be mutagenic or teratogenic in a battery of short-term assays, but has caused fetotoxicity in rats and mice. Acute exposure to rather high levels of xylene affects the central nervous system and irritates the mucous membranes. There is limited evidence of effects on other organ systems, but it was not possible to attribute these effects solely to xylene as other solvents were present. The oral LD_{50} value of xylene in rats is 5,000 mg/kg.

Toxicity to Wildlife and Domestic Animals

Xylene adversely affected adult trout at concentrations as low as 3.6 mg/liter in a continuous flow system and trout fry avoided xylene at concentrations greater than 0.1 mg/liter. The LC_{50} value in adult trout was determined to be 13.5 mg/liter. LC_{50} values for other freshwater fish were around 30 mg/liter in a static system, which probably underestimated toxicity. Only a few studies have been done on the toxicity of xylene to saltwater species. These indicated that the m- and o-xylene isomers probably have similar toxicities and are probably less toxic than p-xylene, and that saltwater species are generally more susceptible than freshwater species to the detrimental effects of xylene (LC_{50} = 10 mg/liter for m- and o-xylene and LC_{50} = 2 mg/liter for p-xylene). However, it should be stressed that these generalizations are based on limited data.

No information on the toxicity of xylenes to terrestrial wildlife and domestic animals was available. However, because of the low acute toxicity of xylenes it is unlikely that they would be toxic to wild of domestic birds or animals.

ZINC (Clement Associates, Inc., 1985)

Health Effects

Testicular tumors have been produced in rats and chickens when zinc salts are injected intratesticularly, but not when other routes of administration are used. Zinc may be indirectly important with regard to cancer since its presence seems to be necessary for the growth of tumors. Laboratory studies suggest that although zinc-deficient animals may be more susceptible to chemical induction of cancer, tumor growth is slower in these animals. There is no evidence that zinc deficiency has any etiological role in human cancer. There are no data available to suggest that zinc is mutagenic or teratogenic in animals or humans.

Zinc is an essential trace element that is involved in enzyme functions, protein synthesis, and carbohydrate metabolism. Ingestion of excessive amounts of zinc may cause fever, vomiting, stomach cramps, and diarrhea. Fumes of freshly formed zinc oxide can penetrate deep into the alveoli and cause metal fume fever. Zinc oxide dust does not produce this disorder. Contact with zinc chloride can cause skin and eye irritation. Inhalation of mists or fumes may irritate the respiratory and gastrointestinal tracts. Zinc in excess of 0.25 percent in the diet of rats causes growth retardation, hypochromic anemia, and defective mineralization of bone. No zinc toxicity is observed at dietary levels below 0.2')ercent.

Studies with animals and humans indicate that metabolic changes may occur due to the interaction of zinc and other metals in the diet. Exposure to cadmium can cause changes in the distribution of zinc, with increases in the liver and kidneys, organs where cadmium also accumulates. Excessive intake of zinc may cause copper deficiencies and result in anemia. Interaction of zinc with iron or lead may also lead to changes that are not produced when the metals are ingested individually.

Toxicity to Wildlife and Domestic Animals

Zinc produces acute toxicity in freshwater organisms over a range of concentrations from 90 to 58,100 µg/liter and appears to be less toxic in harder water. Acute toxicity is similar for freshwater fish and invertebrates. Chronic toxicity values range from 47 to 852 µg/liter and appear to be relatively unaffected by hardness. A final acute-chronic ratio for freshwater species of 3.0 has been reported. Although most freshwater plants appear to be insensitive to zinc, one species, the alga Selenastrum capricornutum, exhibited toxic effects at concentrations from 30 to 700 µg/liter. Reported acute toxicity values range from 2,730 to 83,000 µg/liter for saltwater fish and from 166 to 55,000 µg/liter for invertebrate saltwater species. Zinc produces chronic toxicity in the mysid shrimp at 166 µg/liter. The final acute-chronic ratio for saltwater species is 3.0. Toxic effects are observed in saltwater plant species at zinc concentrations of 50 to 25,000 µg/liter. Bioconcentration factors of edible portions of aquatic organisms range from 43 for the soft-shell clam to 16,700 for the oyster.

Zinc poisoning has occurred in cattle. In one outbreak, poisoning was caused by food accidentally contaminated with zinc at a concentration of 20 g/kg. An estimated intake of 140 g of zinc per cow per day for about 2 days was reported. The exposed cows exhibited severe enteritis, and some died or had to be slaughtered. Postmortem findings showed severe pulmonary emphysema with changes in the myocardium, kidneys, and liver. Zinc concentrations in the liver were extremely high. Based on relatively limited data, some researchers have speculated that exposure to excessive amounts of zinc may constitute a hazard to horses. Laboratory studies and findings in foals living near lead-zinc smelters suggest that excessive exposure to zinc may produce bone changes, joint afflictions, and lameness. In pigs given dietary zinc at concentrations greater than 1,000 mg/kg, decreased food intake and weight gain were observed. At dietary levels greater than 2,000 mg/kg, deaths occurred as soon as 2 weeks after exposure. Severe gastrointestinal changes and brain damage, both of which were accompanied by hemorrhages, were observed, as well as changes in the joints. High concentrations of zinc were found in the liver.

RISK ASSESSMENT CALCULATIONS

GROUND-WATER EXPOSURES

POL STORAGE AREA

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 1
SUBJECT: Ingestion of Water		CHECKED BY: (5-22-90)	DATE: 5/15/90

Purpose: To estimate exposures to contaminants in drinking water

Assumptions: A 70 kg adult ingests 2 L/day
A 35 kg adolescent ingests 1.5 L/day
A 10 kg child ingests 1.0 L/day

Relevant Equations:

$$\text{Dose} = \frac{C \times IR \times EF \times ED}{BW \times LT \times 365}$$

where: C = contaminant concentration in groundwater (mg/L)
IR = ingestion rate (L/day)
EF = exposure frequency (days/yr)
ED = exposure duration (yr)
BW = body weight (kg)
LT = lifetime (yr)
365 = conversion factor (days/yr)

Sample Calculation:

for xylenes in groundwater at a concentration of 23 µg/L

Adults:

$$\text{Dose} = \frac{(0.023\ mg/L)(2\ L/day)(1)}{70\ kg} = 6.57 \times 10^{-4}\ mg/kg\text{-}day\ ✓$$

Adolescents:

$$\text{Dose} = \frac{(0.023\ mg/L)(1.5\ L/day)(1)}{35\ kg} = 9.86 \times 10^{-4}\ mg/kg\text{-}day\ ✓$$

for carcinogens, the above calculation would include a factor of $\left(\frac{70\,yr}{70\,yr}\right)$, or 1.

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NUS CORPORATION AND SUBSIDIARIES			**STANDARD CALCULATION SHEET**
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 4
SUBJECT: Exposures to Volatiles During Showering		CHECKED BY: (5-22-90)	DATE: 5/15/90

Purpose: This model will be used to estimate inhalational exposures from volatiles and semivolatiles in groundwater during showering.

Relevant Equations:

$$IEX = \frac{S \times IR \times EF \times ED}{BW \times LT \times Ra \times 10^6} \left[D_s + \exp(-Ra\, D_t)/Ra - \exp(Ra\,(D_s - D_t))/Ra \right]$$

where: S = volatile organic chemical generation rate ($\mu g/m^3/min$)
IR = inhalation rate (L/min)
BW = body weight (kg)
D_s = shower duration (min)
D_t = total duration in shower area (min)
Ra = air exchange rate (min^{-1})
EF = exposure frequency ($days^{-1}$)
ED = exposure duration (yr)
LT = lifetime (yr)

The following supplementary calculations are also needed:

$$S = \frac{C_{wd} \times FR}{SV}$$

where: C_{wd} = Contaminant concentration leaving water droplet ($\mu g/L$)
FR = shower flow rate (L/min)
SV - shower room air volume (m^3)

$$C_{wd} = C_{wo}\left[1 - \exp(-K_{al}\, t_s / 60\, d)\right]$$

where: C_{wo} = Contaminant concentration in water ($\mu g/L$)
K_{al} = adjusted overall mass transfer coefficient (cm/hr)
t_s = shower droplet drop time (sec)*
d = shower droplet diameter (mm)*

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* Units cancel as follows: $\frac{6}{d}$ is the term that accounts for available mass transfer surface area:

$$\left(\frac{6}{d\ \cancel{mm}}\right)\left(K_{aL}\ \frac{\cancel{cm}}{\cancel{hr}}\right)\left(10\ \frac{\cancel{mm}}{\cancel{cm}}\right)\left(t_s\ \cancel{sec}\right)\left(\frac{\cancel{hr}}{3600\ \cancel{sec}}\right)$$

$$K_{aL} = K_L\,(T_1\,m_s\,/\,T_s\,m_1)^{-0.5}$$

where: K_L = overall mass transfer coefficient (cm/hr)
T_1 = calibration water temperature (°K) of K_L
T_s = Shower water temperature (°K)
m_1 = water viscosity at T_1 (cp)
m_s = water viscosity at T_s (cp)

$$K_L = \left[\frac{1}{K_\ell} + \frac{RT}{H\,K_g}\right]^{-1}$$

where: K_ℓ = liquid film mass transfer coefficient (cm/hr)
K_g = gas phase mass transfer coefficient (cm/hr)
T = temperature for which Henry's law constant is estimated (°K)
R = Ideal Gas Constant (atm-m³/mol °K)
H = Henry's law constant (atm-m³/mol)

The following values are used as input parameters:

IR = 14 L/min
BW = 70 kg
D_s = 15 min
D_t = 20 min
R_a = 8.3×10^{-3} min^{-1} (½ volume hr)
FR = 10 L/min
SV = 12 m³
d = 1 mm
t_s = 2 sec

T_1 = 293°K (20°C)
T_s = 318°K (45°C)
m_1 = 0.982
m_s = 0.616
T = 293°K
R = 8.2×10^{-5} atm-m³/mol °K
$K_\ell = 20\ \frac{cm}{hr}\sqrt{\frac{44}{MW}}$ based on CO_2
$K_g = 3000\ \frac{cm}{hr}\sqrt{\frac{18}{MW}}$ based on H_2O

Reference: Foster and Chrostowski, 1987.

Sample Calculation:

Noncarcinogen; an average annual dose:
for ethylbenzene

Molecular weight (MW) = 106.16

Henry's Law Constant (H) = 6.6×10^{-3} atm-m^3/mol

$$K_\ell = 20 \frac{cm}{hr} \sqrt{\frac{44}{106.16}} = 12.87 \text{ cm/hr} \checkmark$$

$$K_g = 3000 \frac{cm}{hr} \sqrt{\frac{18}{106.16}} = 1235.31 \text{ cm/hr} \checkmark$$

$$K_L = \left[\frac{1}{K_\ell} + \frac{RT}{H K_g}\right]^{-1}$$

$$K_L = \left[\frac{1}{12.87 \frac{cm}{hr}} + \frac{(8.2\times10^{-5} \text{atm-m}^3/\text{mol-}^\circ K)(293^\circ K)}{(6.6\times10^{-3} \text{atm-m}^3/\text{mol})(1235.31 \frac{cm}{hr})}\right]^{-1}$$

$$K_L = \left[0.0777 \text{ hr/cm} + 2.947\times10^{-3} \text{ hr/cm}\right]^{-1}$$

$$K_L = 12.4 \text{ cm/hr} \checkmark$$

$$K_{aL} = K_L \left[\frac{T_1 \; m_s}{T_s \; m_1}\right]^{-0.5}$$

$$K_{aL} = 12.4 \frac{cm}{hr} \left[\frac{(293^\circ K)(0.616 \text{ cp})}{(318^\circ K)(0.982 \text{ cp})}\right]^{-0.5}$$

$$K_{aL} = 16.31 \text{ cm/hr} \checkmark$$

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NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 4 OF 4
SUBJECT: Exposures to Volatiles During Showering		CHECKED BY: (5-22-90)	DATE: 5/15/90

$$C_{wd} = C_{wo}\left[1 - \exp\left(-K_{aL}\ t_s / 60\ d\right)\right]$$

C_{wo} = groundwater concentration = 6 μg/L

$$C_{wd} = 6\ \frac{\mu g}{L}\left[1 - \exp\left(\frac{-(16.31\ cm/hr)(2\ sec)(10\ mm/cm)6}{(1\ mm)(3600\ sec/hr)}\right)\right]$$

$$C_{wd} = 6\ \frac{\mu g}{L}\left(0.419\right) = 2.5\ \mu g/L\ ✓$$

$$S = \frac{C_{wd} \times FR}{SV}$$

$$S = \left(2.5\frac{\mu g}{L}\right)\left(10\frac{L}{min}\right)\left(\frac{1}{12\,m^3}\right) = 2.08\ \mu g/m^3/min\ ✓$$

$$Dose = \frac{S \times IR}{BW \times Ra \times 10^6}\left[Ds + \exp(-Ra\,Dt)/Ra - \exp(Ra\,(Ds - Dt))/Ra\right]$$

$$Dose = \frac{\left(2.08\frac{\mu g}{m^3}\right)\left(14\frac{L}{min}\right)}{(70\,kg)(8.3\times10^{-3}\,min^{-1})(10^6)}\left[(15\,min) + \frac{\exp((-8.3\times10^{-3}\,min^{-1})(20\,min))}{8.3\times10^{-3}\,min^{-1}} - \frac{\exp(8.3\times10^{-3}\,min^{-1}(15\,min - 20\,min))}{8.3\times10^{-3}\,min^{-1}}\right]$$

$$Dose = (5.01\times10^{-5})(1.4695)\ mg/kg\text{-}day$$

$$Dose = 7.4\times10^{-5}\ mg/kg\text{-}day\ ✓$$

A time-weighted average annual dose for a carcinogen would be multiplied by a factor of $\left(\frac{70\,yr}{70\,yr}\right)$, or 1.

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 2
SUBJECT: Dermal Absorption During Showering		CHECKED BY: [initials] (5-22-90)	DATE: 5/15/90

Purpose: To estimate dermal exposures during showering/bathing

Assumptions: Everyone bathes/showers every day

Dermal permeability constant of water is 8×10^{-4} cm/hr; also for dissolved contaminants

Exposed skin surface area = 19,400 cm^2 - adults (70kg)
14,900 cm^2 - adolescents (35kg)
7280 cm^2 - children (10 kg)

Exposure time = 15 min/day (0.25 hr/day)

Relevant Equations.

for noncarcinogens) an average annual dose

$$DEX = \frac{C \times AV \times PC \times ET \times EF}{BW \times 10^3 \times 365}$$

where: C = contaminant concentration in groundwater (mg/L)
AV = available skin surface area (cm^2)
PC = dermal permeability constant of water (cm/hr)
ET = exposure time (0.25 hr/day)
EF = exposure frequency (hr/day)
BW = body weight (kg)
10^3 = conversion factor (cm^3/L)
365 = conversion factor (day/yr)

for carcinogens; a time-weighted average annual dose

$$DEX = \frac{C \times AV \times PC \times ET \times EF \times ED}{BW \times LT \times 10^3 \times 365}$$

where: ED = exposure duration (yr)
LT = lifetime (yr)

NUS CORPORATION AND SUBSIDIARIES		*STANDARD CALCULATION SHEET*	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 2 OF 2
SUBJECT: Dermal Absorption During Showering		CHECKED BY: [signature] (5-22-90)	DATE: 5/15/90

Sample Calculations:

Noncarcinogen; an average annual dose:

for ethylbenzene at a concentration of 6 μg/L (Site 2)

$$DEX = \frac{\left(6\,\frac{\mu g}{L}\right)\left(14{,}400\ cm^2\right)\left(8\times10^{-4}\,\frac{cm}{hr}\right)\left(0.25\,\frac{hr}{day}\right)\left(365\,\frac{day}{yr}\right)}{\left(35\ kg\right)\left(10^3\,\frac{cm^3}{L}\right)\left(365\,\frac{day}{yr}\right)}\left(\frac{mg}{10^3\,\mu g}\right)$$

$$DEX = 5.1\times10^{-7}\ mg/kg\text{-}day\ \checkmark$$

Carcinogen; a time-weighted average annual dose:

for benzo(a)anthracene at a concentration of 2.4×10^{-4} mg/L (Site 1):

$$DEX = \frac{\left(2.4\times10^{-4}\,\frac{mg}{L}\right)\left(19{,}400\ cm^2\right)\left(8\times10^{-4}\,\frac{cm}{hr}\right)\left(0.25\,\frac{hr}{day}\right)\left(365\,\frac{day}{yr}\right)\left(70\ yr\right)}{\left(70\ kg\right)\left(10^3\,\frac{cm^3}{L}\right)\left(70\ yr\right)\left(365\,\frac{day}{yr}\right)}$$

$$DEX = 1.3\times10^{-8}\ mg/kg\text{-}day\ \checkmark$$

NUS 158A REVISED 0285

RISK ASSESSMENT SPREADSHEET - EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

SITE NAME: ELLINGTON AFB SITE ?
LOCATION: HOUSTON, TEXAS
DATE: 05/15/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 1 - MAXIMUM GROUNDWATER CONCENTRATIONS (ADULT)

REFERENCES: EPA, DECEMBER 1989
FOSTER AND CHROSTOWSKI, 1987

INGESTION: IEX = (C x IR x EF x ED)/(BW x LT x 365)

WHERE:
C = GROUNDWATER CONCENTRATION (MG/L)
IR = INGESTION RATE (LITERS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

INHALATION: IEX = (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds-Dt))/Ra)

WHERE:
S = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
IR = INHALATION RATE (LITERS/MIN)
Ds = SHOWER DURATION (MIN)
Ra = AIR EXCHANGE RATE (1/MIN)
Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
BW = BODY WEIGHT (KG)
SV = SHOWER ROOM AIR VOLUME (M**3)
R = IDEAL GAS LAW CONSTANT (ATM-M**3/MOL K)

DERMAL CONTACT: DEX = (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

WHERE:
C = GROUNDWATER CONCENTRATION (MG/L)
PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)
ET = EXPOSURE TIME (HRS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

ENTER INPUT PARAMETERS:

INGESTION: ADULT EXPOSURE

IR:	2	CONVERSION FACTOR =	2.857e-2
EF:	365		
ED:	70		
BW:	70		
LT:	70		

DERMAL CONTACT: ADULT EXPOSURE

PC:	8e-4	CONVERSION FACTOR =	5.543e-5
AV:	19400		
ET:	.25		
EF:	365		
ED:	70		
BW:	70		
LT:	70		

INHALATION: ADULT EXPOSURE

IR:	14	d:	1
BW:	70	Ts:	2
Ds:	15	T1:	293
Dt:	20	Ts:	318
Ra:	.0083	M1:	.982
SV:	12	M2:	.615
ED:	70	T:	293
R:	.000082	FR:	10
EF:	1	LT:	70

RISK ASSESSMENT SPREADSHEET HOUSEHOLD USE OF GROUNDWATER--PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 2 MAXIMUM GROUNDWATER CONCENTRATIONS (CONT.)
CALCULATE DOSES:

CHEMICAL	GW CONC (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KA)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Ethylbenzene	.006	105.15	[illegible]	[illegible]	[illegible]571e-4	[illegible]	5.18[illegible]
Xylenes	.023	106.15	4.37e-3	1.6010e1	9.957e-4	4.411e-4	1.958e-6
Styrene	.01	104.14	2.28e-3	1.5408e1	4.286e-4	1.857e-4	8.514e-7
Chlorobenzene	.006	112.56	3.58e-3	1.5777e1	2.571e-4	1.116e-4	5.109e-7
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
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				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 2 - MAXIMUM GROUNDWATER CONCENTRATION - [illegible]
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING.	REFERENCE DOSE INH.	HAZARD IND ING./DERM	HAZARD IND. INH	HAZARD INDEX
Ethylbenzene	2.53[illegible]e-4	1.35[illegible]e-4	1e-1		[illegible]e-3	0	[illegible]e-3
Xylenes	9.877e-4	4.411e-4	2e0	4e-1	4.938e-4	1.10[illegible]e-3	1.596e-3
Styrene	4.294e-4	1.862e-4	2e-1		2.147e-3	0	2.147e-3
Chlorobenzene	2.577e-4	1.116e-4	3e-2	5e-[illegible]	8.588e-3	2.[illegible]e-2	[illegible]e-2
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					1.381e-2	2.341e-2	[illegible].722e-2

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE FOUR)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM GROUNDWATER CONCENTRATIONS - ADULT
CALCULATE INCREMENTAL CANCER RISK:

CHEMICAL	TIME WEIGHTED ING & DERM DOSE	TIME WEIGHTED INHALATION DOSE	CANCER SLOPE FACTOR ING	CANCER SLOPE FACTOR INH	CANCER RISK ING/DERM	CANCER RISK INH	CANCER RISK
Ethylbenzene	1.718e-4	7.428e-5			0	0	0
Xylenes	6.584e-4	2.807e-4			0	0	0
Styrene	2.863e-4	1.185e-4			0	0	0
Chlorobenzene	1.718e-4	7.899e-5			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
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	0	0			0	0	0
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	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL RISK					0	0	0

RISK ASSESSMENT SPREADSHEET EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

SITE NAME: ELLINGTON AFB SITE 2
LOCATION: HOUSTON, TEXAS
DATE: 05/15/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 2 - MAXIMUM GROUNDWATER CONCENTRATIONS (YOUTH)

REFERENCES: EPA, DECEMBER 1989
FOSTER AND CHROSTOWSKI, 1987

INGESTION: IEX = (C x IR x EF x ED)/(BW x LT x 365)

WHERE:
- C = GROUNDWATER CONCENTRATION (MG/L)
- IR = INGESTION RATE (LITERS/DAY)
- EF = EXPOSURE FREQUENCY (DAYS/YEAR)
- ED = EXPOSURE DURATION (YEARS)
- BW = BODY WEIGHT (KG)
- LT = LIFETIME (YEARS)

INHALATION: IEX = (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds-Dt))/Ra)

WHERE:
- S = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
- IR = INHALATION RATE (LITERS/MIN)
- Ds = SHOWER DURATION (MIN)
- Ra = AIR EXCHANGE RATE (1/MIN)
- Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
- BW = BODY WEIGHT (KG)
- SV = SHOWER ROOM AIR VOLUME (m**3)
- R = IDEAL GAS LAW CONSTANT (ATM-M**3/MOL K)

DERMAL CONTACT: DEX = (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

WHERE:
- C = GROUNDWATER CONCENTRATION (MG/L)
- PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
- AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)
- ET = EXPOSURE TIME (HRS/DAY)
- EF = EXPOSURE FREQUENCY (DAYS/YEAR)
- ED = EXPOSURE DURATION (YEARS)
- BW = BODY WEIGHT (KG)
- LT = LIFETIME (YEARS)

ENTER INPUT PARAMETERS:

INGESTION: YOUTH EXPOSURE

IR:	1.5	CONVERSION FACTOR =	4.286e-2
EF:	365		
ED:	N/A		
BW:	35		
LT:	N/A		

DERMAL CONTACT: YOUTH EXPOSURE

PC:	8e-4	CONVERSION FACTOR =	8.514e-5
AV:	14900		
ET:	.25		
EF:	365		
ED:	N/A		
BW:	35		
LT:	N/A		

INHALATION: YOUTH EXPOSURE

IR:	15	J:	1
BW:	35	Ts:	2
Ds:	15	Tl:	293
Dt:	20	Ts:	318
Ra:	.0083	M1:	.982
SV:	12	M2:	.518
ED:	N/A	T:	.37
R:	.000082	FR:	10
EF:	1	LT:	N/A

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 2 MAXIMUM GROUNDWATER CONCENTRATIONS (SOUTH)
CALCULATE DOSES:

CHEMICAL	GW CONC. (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KAL)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Ethylbenzene	.006	106.16	[illegible]e-3	1.[illegible]e1	2.571e-4	1.15[illegible]e-4	5.109e-7
Xylenes	.023	106.16	4.32e-3	1.6010e1	9.957e-4	4.411e-4	1.958e-6
Styrene	.01	104.14	2.28e-3	1.5400e1	4.286e-4	1.862e-4	8.514e-7
Chlorobenzene	.006	112.56	3.58e-3	1.5[illegible]e1	2.571e-4	1.116e-4	5.109e-7
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RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 2 MAXIMUM GROUNDWATER CONCENTRATIONS (SOUTH)
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING.	REFERENCE DOSE INH.	HAZARD IND ING./DERM	HAZARD IND. INH.	HAZARD INDEX
Ethylbenzene	2.577e-4	1.167e-4	1e-1		2.577e-3	0	2.577e-3
Xylenes	9.877e-4	4.411e-4	2e0	4e-1	4.938e-4	1.10[illegible]e-3	1.596e-3
Styrene	4.294e-4	1.962e-4	2e-1		2.147e-3	0	2.147e-3
Chlorobenzene	2.577e-4	1.116e-4	3e-2	5e-3	8.589e-3	2.[illegible]1e-2	3.090e-2
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
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	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					1.381e-2	2.341e-2	3.722e-2

RISK ASSESSMENT SPREADSHEET EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

SITE NAME: ELLINGTON AFB - SITE 2
LOCATION: HOUSTON, TEXAS
DATE: 05/15/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 3 MAXIMUM GROUNDWATER CONCENTRATIONS (CHILD)

REFERENCES: EPA, DECEMBER 1989
FOSTER AND CHROSTOWSKI, 1987

INGESTION: IEX = (C x IR x EF x ED)/(BW x LT x 365)

WHERE:
- C = GROUNDWATER CONCENTRATION (MG/L)
- IR = INGESTION RATE (LITERS/DAY)
- *EF = EXPOSURE FREQUENCY (DAYS/YEAR)*
- ED = EXPOSURE DURATION (YEARS)
- BW = BODY WEIGHT (KG)
- LT = LIFETIME (YEARS)

INHALATION: IEX = (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds-Dt))/Ra)

WHERE:
- S = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
- IR = INHALATION RATE (LITERS/MIN)
- *Ds = SHOWER DURATION (MIN)*
- Ra = AIR EXCHANGE RATE (1/MIN)
- Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
- BW = BODY WEIGHT (KG)
- SV = SHOWER ROOM AIR VOLUME (m**3)
- R = IDEAL GAS LAW CONSTANT (ATM M**3/MOL K)

DERMAL CONTACT: DEX = (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

WHERE:
- C = GROUNDWATER CONCENTRATION (MG/L)
- PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
- *AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)*
- ET = EXPOSURE TIME (HRS/DAY)
- EF = EXPOSURE FREQUENCY (DAYS/YEAR)
- ED = EXPOSURE DURATION (YEARS)
- BW = BODY WEIGHT (KG)
- LT = LIFETIME (YEARS)

ENTER INPUT PARAMETERS:

INGESTION: CHILD EXPOSURE

IR:	1	CONVERSION FACTOR =	1e 1
EF:	365		
ED:	N/A		
BW:	10		
LT:	N/A		

DERMAL CONTACT: CHILD EXPOSURE

PC:	8e-4	CONVERSION FACTOR =	1.456e 4
AV:	7290		
ET:	.25		
EF:	365		
ED:	N/A		
BW:	10		
LT:	N/A		

INHALATION: CHILD EXPOSURE

IR:	8	d:	1
BW:	10	Ts:	2
Ds:	15	T1:	293
Dt:	20	Ts:	318
Ra:	.0083	M1:	.992
SV:	12	M2:	.615
ED:	N/A	T:	297
R:	.000082	FR:	10
EF:	1	LT:	N/A

RISK ASSESSMENT SPREADSHEET HOUSEHOLD USE OF GROUNDWATER (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER [illegible] MAXIMUM GROUNDWATER CONCENTRATIONS [illegible]
CALCULATE DOSES:

CHEMICAL	GW CONC. (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KAL)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Ethylbenzene	[illegible]	10[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]
Xylenes	.02[illegible]	106.16	4.[illegible]e [illegible]	1.[illegible]210e1	[illegible]e [illegible]	0	3.749e 6
Styrene	.01	104.14	2.29e [illegible]	1.[illegible]408e1	[illegible]e [illegible]	0	1.455e 6
Chlorobenzene	.005	112.56	[illegible].58e [illegible]	1.5[illegible]e1	[illegible]e 4	0	8.[illegible]e [illegible]
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0
				0	0	0	0

RISK ASSESSMENT SPREADSHEET HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 7 MAXIMUM GROUNDWATER CONCENTRATIONS (MG/L)
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING.	REFERENCE DOSE INH.	HAZARD IND ING.-DERM	HAZARD ING. INH	HAZARD INDEX
Ethylbenzene	5.809e-4	0	1e-1		[illegible].809e-3	0	[illegible].809e-3
Xylenes	2.303e-3	0	2e0	4e-1	1.152e-3	0	1.152e-3
Styrene	1.001e-3	0	2e-1		5.007e-3	0	5.007e-3
Chlorobenzene	6.009e-4	0	3e-2	5e-3	2.003e-2	0	2.003e-2
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					3.220e-2	0	3.22e-2

GROUND-WATER EXPOSURES
(LEACHING SCENARIO)

FORMER BASE LANDFILL

NUS CORPORATION AND SUBSIDIARIES			*STANDARD CALCULATION SHEET*
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 1
SUBJECT: Leaching of Contaminants from Soil		CHECKED BY: [illegible] (5-22-90)	DATE: 5/18/90

Purpose: To evaluate effects of contaminated soil on groundwater

Assumptions: Infiltrating precipitation leaches chemicals from soil at a rate proportional to their solubility and their concentration

Equation: $C_{leachate} = 2.21 \times 10^{-3} \, C_{soil}^{0.678} \, S^{0.373}$

where S = solubility (ppm)
C_{soil} = contam. concentration in soil (ppm)

(USEPA, November 13, 1986)
"Organic Leachate Model"

Sample Calculation

for benzo(a) pyrene in soil at a concentration of 2 mg/kg: (site 1)

$$C_{leachate} = (2.21 \times 10^{-3})(2)^{0.678}(0.0038)^{0.373}$$

$$C_{leachate} = 4.42 \times 10^{-4} \text{ mg/L} \checkmark$$

NUS 155A REVISED 0285

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 2
SUBJECT: Dilution of Leachate in Saturated Zone		CHECKED BY: AJH (5-22-90)	DATE: 5/18/90

Purpose: To evaluate dilution effects as leachate mixes with groundwater

Assumptions: Leachate is generated according to the Organic Leachate Model (USEPA, November 13, 1986)

Dilution occurs as leachate enters the saturated zone.

Infiltration rate is ~5 inches/yr (~12 cm/yr)

Darcy Groundwater Velocity is 2700 cm/yr

This effect occurs over the entire length of the site perpendicular to groundwater flow (Site 1 = 365 m ; Site 2 = 150 m)

Mixing zone is the entire saturated thickness, ~38 m

Relevant Equation:

$$C_o = \frac{C_{leachate} \cdot q \times L}{V_d \times m}$$ (Donigian et al., November 1983)

where: $C_{leachate}$ = concentration generated by OLM
q = recharge rate (cm/yr)
L = length of site perpendicular to groundwater flow direction (m)
V_d = Darcy groundwater velocity (cm/yr)
m = effective aquifer thickness for mixing (m)

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 2 OF 2
SUBJECT: Dilution of Leachate in Saturated Zone		CHECKED BY: (5-22-90)	DATE: 5/18/90

Sample Calculation.

for benzo(a)pyrene in leachate at a concentration of 4.42×10^{-4} mg/L (Site 1):

$$C_o = \frac{\left(4.42 \times 10^{-4} \frac{mg}{L}\right)\left(12 \frac{cm}{yr}\right)\left(365 m\right)}{\left(5300 \frac{cm}{yr}\right)\left(4.5 m\right)} = 8.1 \times 10^{-5} \text{ mg/L} \checkmark$$

NUS 156A REVISED 0285

RISK ASSESSMENT SPREADSHEET - EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

SITE NAME: ELLINGTON AFB - SITE 1
LOCATION: HOUSTON, TEXAS
DATE: 05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SOIL CONCENTRATIONS (ADULTS)

REFERENCES: EPA, DECEMBER 1989
FOSTER AND CHROSTOWSKI, 1987

INGESTION: IEX = (C x IR x EF x ED)/(BW x LT x 365)

WHERE:
C = GROUNDWATER CONCENTRATION (MG/L)
IR = INGESTION RATE (LITERS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

DERMAL CONTACT: DEX = (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

WHERE:
C = GROUNDWATER CONCENTRATION (MG/L)
PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)
ET = EXPOSURE TIME (HRS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

INHALATION: IEX = (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds-Dt))/Ra)

WHERE:
S = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
IR = INHALATION RATE (LITERS/MIN)
Ds = SHOWER DURATION (MIN)
Ra = AIR EXCHANGE RATE (1/MIN)
Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
BW = BODY WEIGHT (KG)
SV = SHOWER ROOM AIR VOLUME (m**3)
R = IDEAL GAS LAW CONSTANT (ATM M**3/MOL/K)

ORGANIC LEACHATE MODEL:

C leachate = 2.21e-3 * C soil**0.678 * Solubility**0.373

LINKAGE MODEL

C aquifer = C leachate * Q * L / M / Vd

ENTER INPUT PARAMETERS:

INGESTION: ADULT EXPOSURE

IR:	2	CONVERSION	2.857e-2
EF:	365	FACTOR =	
ED:	70		
BW:	70		
LT:	70		

DERMAL CONTACT: ADULT EXPOSURE

PC:	8e-4	CONVERSION	5.547e-5
AV:	19400	FACTOR =	
ET:	.25		
EF:	365		
ED:	70		
BW:	70		
LT:	70		

INHALATION: ADULT EXPOSURE

IR:	14	d:	1
BW:	70	Ts:	2
Ds:	15	T1:	293
Dt:	20	Ts:	318
Ra:	.0003	M1:	.982
SV:	12	M2:	.616
ED:	70	T:	293
R:	.000082	FP:	10
EF:	1	LT:	70

LINKAGE MODEL:

Q:	12	Annual Infiltration (cm/yr)
L:	365	Length of the Waste Deposit Parallel to Groundwater Flow (m)
M:	4.5	Thickness of the Saturated Zone (m)
Vd:	5300	Darcy Groundwater Velocity (cm/year)

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE TWO)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SOIL CONCENTRATIONS (ADULTS)
CALCULATE DOSES:

CHEMICAL	SOURCE CONC. (MG/KG)	SOLUBILITY (MG/L)	REC. CONC. (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KAI)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Acetone		690000	0	58.08	[illegible]	2.7584e0	0	0	0
2-Butanone		353000	0	72.1	2.08e-5	1.5760e0	0	0	0
Benzene		1780	0	78.12	5.5e-3	1.8984e1	0	0	0
Ethylbenzene		152	0	106.16	6.6e-3	1.6317e1	0	0	0
Xylenes		197	0	106.16	4.33e-3	1.6810e1	0	0	0
Styrene		300	0	104.14	2.28e-3	1.5408e1	0	0	0
Chlorobenzene		500	0	112.56	3.58e-3	1.5373e1	0	0	0
Methylene chloride		8200	0	84.94	2.03e-3	1.6855e1	0	0	0
Butylbenzylphthalate	.29	2.9	2.608e-4	312	8.3e-6	3.169e-1	7.452e-6	8.088e-8	1.446e-8
Benzo(a)anthracene	2.35	.0057	1.054e-4	228.28	1e-6	4.594e-2	3.012e-6	4.759e-9	5.843e-9
Benzo(b)fluoranthene	1.8	.014	1.230e-4	252.3	1.22e-5	5.103e-1	3.515e-6	6.123e-9	6.819e-9
Benzo(k)fluoranthene	1.85	.0043	8.069e-5	252.3	3.87e-5	1.4705e0	2.305e-6	1.139e-7	4.472e-9
Benzo(a)pyrene	2	.0038	8.123e-5	252	4.9e-7	2.147e-2	2.321e-6	1.715e-9	4.503e-9
Indeno(1,2,3-cd)pyrene	.93	.00053	2.318e-5	276.3	6.95e-8	2.913e-3	6.624e-7	6.64e-11	1.285e-9
Naphthalene	.18	31.7	4.606e-4	128.2	4.6e-4	9.9792e0	1.316e-5	3.846e-6	2.553e-8
4,4'-DDT	.01	.0055	2.568e-6	354.5	1.58e-5	5.500e-1	7.336e-8	1.377e-9	1.42e-10
Arsenic	72.4		0	74.92		0	0	0	0
Lead	141		0	207.19		0	0	0	0
Mercury	.19		0			0	0	0	0
Zinc	180		0	65.38		0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0

RISK ASSESSMENT SPREADSHEET   HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SOIL CONCENTRATIONS (ADULTS)
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING.	REFERENCE DOSE INH.	HAZARD IND ING./DERM	HAZARD IND. INH	HAZARD INDEX
Acetone	0	0	1e-1		0	0	0
2-Butanone	0	0	5e-2	9e-2	0	0	0
Benzene	0	0			0	0	0
Ethylbenzene	0	0	1e-1		0	0	0
Xylenes	0	0	2e0	4e-1	0	0	0
Styrene	0	0	2e-1		0	0	0
Chlorobenzene	0	0	[illegible]e-2	5e-3	0	0	0
Methylene chloride	0	0	6e-2	9e-1	0	0	0
Butylbenzylphthalate	7.467e-6	8.088e-8	2e-1		3.733e-5	0	3.733e-5
Benzo(a)anthracene	3.818e-6	4.759e-9			0	0	0
Benzo(b)fluoranthene	3.522e-6	6.123e-8			0	0	0
Benzo(k)fluoranthene	2.318e-6	1.139e-7			0	0	0
Benzo(a)pyrene	2.325e-6	1.715e-9			0	0	0
Indeno(1,2,3-cd)pyrene	6.636e-7	6.64e-11			0	0	0
Naphthalene	1.319e-5	3.846e-6	4e-3		3.297e-3	0	3.297e-3
4,4'-DDT	7.350e-8	1.322e-9	5e-4		1.470e-4	0	1.470e-4
Arsenic	0	0	1e-3		0	0	0
Lead	0	0	1.4e-3		0	0	0
Mercury	0	0	3e-4		0	0	0
Zinc	0	0	2e-1		0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					3.491e-3	0	3.481e-3

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE FOUR)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SOIL CONCENTRATIONS (ADULTS)
CALCULATE INCREMENTAL CANCER RISK:

CHEMICAL	TIME WEIGHTED ING & DERM DOSE	TIME-WEIGHTED INHALATION DOSE	CANCER SLOPE FACTOR ING	CANCER SLOPE FACTOR INH	CANCER RISK ING/DERM	CANCER RISK INH	CANCER RISK
Acetone	0	0			0	0	0
2-Butanone	0	0			0	0	0
Benzene	0	0	2.9e-2	2.9e-2	0	0	0
Ethylbenzene	0	0			0	0	0
Xylenes	0	0			0	0	0
Styrene	0	0			0	0	0
Chlorobenzene	0	0			0	0	0
Methylene chloride	0	0	7.5e-3	1.2e-7	0	0	0
Butylbenzylphthalate	7.467e-6	8.088e-8			0	0	0
Benzo(a)anthracene	3.019e-6	4.759e-9	1.5e-1	8.2e-2	4.527e-7	3.90e-10	4.530e-7
Benzo(b)fluoranthene	3.522e-6	6.123e-8	9.2e-1	4.9e-1	3.240e-6	3.000e-8	3.270e-6
Benzo(k)fluoranthene	2.310e-6	1.139e-7	7.6e-1	4e-1	1.755e-6	4.556e-8	1.801e-6
Benzo(a)pyrene	2.325e-6	1.715e-9	1.15e1	6.1e0	2.674e-5	1.046e-8	2.675e-5
Indeno(1,2,3-cd)pyrene	6.636e-7	6.64e-11	2e-1	1e-1	1.327e-7	6.64e-12	1.327e-7
Naphthalene	1.319e-5	2.846e-6			0	0	0
4,4'-DDT	7.350e-8	1.377e-9	3.4e-1	3.4e-1	2.499e-8	4.69e-10	2.546e-8
Arsenic	0	0		5e1	0	0	0
Lead	0	0			0	0	0
Mercury	0	0			0	0	0
Zinc	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL RISK					3.235e-5	8.689e-8	3.244e-5

RISK ASSESSMENT SPREADSHEET   EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

SITE NAME: ELLINGTON AFB SITE 1
LOCATION: HOUSTON, TEXAS
DATE: 05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 2   MAXIMUM SOIL CONCENTRATIONS (YOUTH)

REFERENCES: EPA, DECEMBER 1989
FOSTER AND CHROSTOWSKI, 1987

INGESTION: IEX = (C x IR x EF x ED)/(BW x LT x 365)

WHERE:
C = GROUNDWATER CONCENTRATION (MG/L)
IR = INGESTION RATE (LITERS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

DERMAL CONTACT: DEX = (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

WHERE:
C = GROUNDWATER CONCENTRATION (MG/L)
PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)
ET = EXPOSURE TIME (HRS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

INHALATION: IEX = (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds Dt))/Ra)

WHERE:
S = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
IR = INHALATION RATE (LITERS/MIN)
Ds = SHOWER DURATION (MIN)
Ra = AIR EXCHANGE RATE (1/MIN)
Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
BW = BODY WEIGHT (KG)
SV = SHOWER ROOM AIR VOLUME (M**3)
R = IDEAL GAS LAW CONSTANT (ATM-M**3/MOL/K)

ORGANIC LEACHATE MODEL:

C leachate = 2.21e-3 * C soil**0.678 * Solubility**0.373

LINKAGE MODEL

C aquifer = C leachate * Q * L / M / Vd

ENTER INPUT PARAMETERS:

INGESTION: YOUTH EXPOSURE

IR:	1.5	CONVERSION FACTOR =	4.286e-2
EF:	365		
ED:	N/A		
BW:	35		
LT:	N/A		

DERMAL CONTACT: YOUTH EXPOSURE

PC:	8e-4	CONVERSION FACTOR =	4.257e-5
AV:	14900		
ET:	.25		
EF:	365		
ED:	N/A		
BW:	70		
LT:	N/A		

INHALATION: YOUTH EXPOSURE

IR:	11	S:	1
BW:	35	Ts:	2
Ds:	15	T1:	293
Dt:	20	Ts:	318
Ra:	.0083	M1:	.982
SV:	12	M2:	.515
ED:	N/A	T:	293
R:	.000082	FR:	10
EF:	1	LT:	N/A

LINKAGE MODEL:

Q:	12	Annual Infiltration (cm/yr)
L:	365	Length of the Waste Deposit Parallel to Groundwater Flow (m)
M:	4.5	Thickness of the Saturated Zone (m)
Vd:	5300	Darcy Groundwater Velocity (cm/year)

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE TWO)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 2 MAXIMUM SOIL CONCENTRATIONS (YOUTH)
CALCULATE DOSES:

CHEMICAL	SOURCE CONC. (MG/KG)	SOLUBILITY (MG/L)	REC. CONC. (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KAI)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Acetone		600000	0	58.08	7.43e-5	2.7584e0	0	0	0
2-Butanone		353000	0	72.1	2.08e-5	1.5760e0	0	0	0
Benzene		1780	0	78.12	5.5e-3	1.8884e1	0	0	0
Ethylbenzene		152	0	106.16	6.6e-3	1.6317e1	0	0	0
Xylenes		187	0	106.16	4.33e-3	1.6010e1	0	0	0
Styrene		300	0	104.14	2.28e-3	1.5408e1	0	0	0
Chlorobenzene		500	0	112.56	3.58e-3	1.5373e1	0	0	0
Methylene chloride		8200	0	84.94	2.03e-3	1.6855e1	0	0	0
Butylbenzylphthalate	.29	2.9	2.600e-4	312	8.3e-6	3.169e-1	1.118e-5	1.271e-7	1.110e-8
Benzo(a)anthracene	2.35	.0057	1.054e-4	228.28	1e-6	4.594e-2	4.518e-6	7.479e-9	4.488e-9
Benzo(b)fluoranthene	1.8	.014	1.230e-4	252.3	1.22e-5	5.103e-1	5.272e-6	9.622e-8	5.237e-9
Benzo(k)fluoranthene	1.85	.0043	8.069e-5	252.3	3.87e-5	1.4705e0	3.458e-6	1.790e-7	3.435e-9
Benzo(a)pyrene	2	.0038	8.123e-5	252	4.9e-7	2.147e-2	3.481e-6	2.694e-9	3.458e-9
Indeno(1,2,3-cd)pyrene	.93	.00053	2.318e-5	276.3	6.95e-8	2.913e-3	9.935e-7	1.04e-10	9.87e-10
Naphthalene	.18	31.7	4.606e-4	128.2	4.6e-4	9.9792e0	1.974e-5	6.044e-6	1.961e-8
4,4'-DDT	.01	.0055	2.568e-6	354.5	1.58e-5	5.500e-1	1.100e-7	2.163e-9	1.09e-10
Arsenic	32.4		0	74.92		0	0	0	0
Lead	141		0	207.19		0	0	0	0
Mercury	.19		0			0	0	0	0
Zinc	100		0	65.38		0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 2 - MAXIMUM SOIL CONCENTRATIONS (ADULT)
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING	REFERENCE DOSE INH.	HAZARD IND ING./DERM	HAZARD IND. INH.	HAZARD INDEX
Acetone	0	0	1e-1		0	0	0
2-Butanone	0	0	5e-2	9e-2	0	0	0
Benzene	0	0			0	0	0
Ethylbenzene	0	0	1e-1		0	0	0
Xylenes	0	0	2e0	4e-1	0	0	0
Styrene	0	0	2e-1		0	0	0
Chlorobenzene	0	0	2e-2	5e-3	0	0	0
Methylene chloride	0	0	6e-2	9e-1	0	0	0
Butylbenzylphthalate	1.119e-5	1.271e-7	2e-1		5.595e-5	0	5.595e-5
Benzo(a)anthracene	4.522e-6	7.479e-9			0	0	0
Benzo(b)fluoranthene	5.277e-6	9.622e-8			0	0	0
Benzo(k)fluoranthene	3.461e-6	1.790e-7			0	0	0
Benzo(a)pyrene	3.405e-6	2.694e-9			0	0	0
Indeno(1,2,3-cd)pyrene	9.945e-7	1.04e-10			0	0	0
Naphthalene	1.976e-5	6.044e-6	4e-3		4.940e-3	0	4.940e-3
4,4'-DDT	1.102e-7	2.165e-9	5e-4		2.205e-4	0	2.205e-4
Arsenic	0	0	1e-3		0	0	0
Lead	0	0	1.4e-3		0	0	0
Mercury	0	0	3e-4		0	0	0
Zinc	0	0	2e-1		0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					5.216e-3	0	5.216e-3

RISK ASSESSMENT SPREADSHEET - EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

SITE NAME: ELLINGTON AFB - SITE 1
LOCATION: HOUSTON, TEXAS
DATE: 05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 3 - MAXIMUM SOIL CONCENTRATIONS (CHILD)

REFERENCES: EPA, DECEMBER 1989
FOSTER AND CHROSTOWSKI, 1987

INGESTION: IEX = (C x IR x EF x ED)/(BW x LT x 365)

WHERE: C = GROUNDWATER CONCENTRATION (MG/L)
IR = INGESTION RATE (LITERS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

DERMAL CONTACT: DEX = (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

WHERE: C = GROUNDWATER CONCENTRATION (MG/L)
PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)
ET = EXPOSURE TIME (HRS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

INHALATION: IEX = (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds-Dt))/Ra)

WHERE: S = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
IR = INHALATION RATE (LITERS/MIN)
Ds = SHOWER DURATION (MIN)
Ra = AIR EXCHANGE RATE (1/MIN)
Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
BW = BODY WEIGHT (KG)
SV = SHOWER ROOM AIR VOLUME (m**3)
R = IDEAL GAS LAW CONSTANT (ATM M**3/MOL K)

ORGANIC LEACHATE MODEL:

C leachate = 2.11e-3 * C soil**0.678 * Solubility**0.373

LINKAGE MODEL

C aquifer = C leachate * Q * L / M / Vd

ENTER INPUT PARAMETERS:

INGESTION: CHILD EXPOSURE

IR:	1	CONVERSION FACTOR =	1e 1
EF:	365		
ED:	N/A		
BW:	10		
LT:	N/A		

DERMAL CONTACT: CHILD EXPOSURE

PC:	8e 4	CONVERSION FACTOR =	1.456e 4
AV:	7280		
ET:	.25		
EF:	365		
ED:	N/A		
BW:	10		
LT:	N/A		

INHALATION: CHILD EXPOSURE

IR:	8	d:	1
BW:	10	Ts:	2
Ds:	15	T1:	293
Dt:	20	Ts:	318
Ra:	.0083	M1:	.982
SV:	12	M2:	.616
ED:	N/A	T:	293
R:	.000082	FR:	10
EF:	1	LT:	N/A

LINKAGE MODEL:

Q:	12	Annual Infiltration (cm/yr)
L:	365	Length of the Waste Deposit Parallel to Groundwater Flow (m)
M:	4.5	Thickness of the Saturated Zone (m)
Vd:	5700	Darcy Groundwater Velocity (cm/year)

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE TWO)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 3 MAXIMUM SOIL CONCENTRATIONS (CHILD)
CALCULATE DOSES:

CHEMICAL	SOURCE CONC. (MG/KG)	SOLUBILITY (MG/L)	PEC. CONC. (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KAL)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Acetone		680000	0	58.08	7.43e-5	2.7584e0	0	0	0
2-Butanone		353000	0	72.1	2.08e-5	1.5760e0	0	0	0
Benzene		1780	0	78.12	5.5e-3	1.8884e1	0	0	0
Ethylbenzene		152	0	106.16	6.6e-3	1.6317e1	0	0	0
Xylenes		187	0	106.16	4.33e-3	1.6810e1	0	0	0
Styrene		300	0	104.14	2.28e-3	1.5408e1	0	0	0
Chlorobenzene		500	0	112.56	3.58e-3	1.5377e1	0	0	0
Methylene chloride		8200	0	84.94	2.03e-3	1.6855e1	0	0	0
Butylbenzylphthalate	.29	2.9	2.490e-4	312	9.7e-6	3.169e-1	2.490e-5	0	3.626e-8
Benzo(a)anthracene	2.35	.0057	1.006e-4	228.28	1e-6	4.594e-2	1.006e-5	0	1.465e-8
Benzo(b)fluoranthene	1.8	.014	1.174e-4	252.3	1.22e-5	5.103e-1	1.174e-5	0	1.710e-8
Benzo(k)fluoranthene	1.85	.0043	7.704e-5	252.3	3.87e-5	1.4705e0	7.704e-6	0	1.122e-8
Benzo(a)pyrene	2	.0038	7.755e-5	252	4.9e-7	2.147e-2	7.756e-6	0	1.129e-8
Indeno(1,2,3-cd)pyrene	.97	.00053	2.213e-5	276.3	6.95e-8	2.913e-3	2.213e-6	0	3.223e-9
Naphthalene	.18	31.7	4.398e-4	128.2	4.6e-4	9.9792e0	4.398e-5	0	6.403e-8
4,4'-DDT	.01	.0055	2.451e-6	354.5	1.58e-5	5.500e-1	2.451e-7	0	3.57e-10
Arsenic	32.4		0	74.92		0	0	0	0
Lead	141		0	207.19		0	0	0	0
Mercury	.19		0			0	0	0	0
Zinc	180		0	65.38		0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0

RISK ASSESSMENT SPREADSHEET HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 3 - MAXIMUM SOIL CONCENTRATIONS (CHILD)
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING	REFERENCE DOSE INH.	HAZARD IND ING./DERM	HAZARD IND. INH.	HAZARD INDEX
Acetone	0	0	1e-1		0	0	0
2-Butanone	0	0	5e-2	9e-2	0	0	0
Benzene	0	0			0	0	0
Ethylbenzene	0	0	1e-1		0	0	0
Xylenes	0	0	2e0	4e-1	0	0	0
Styrene	0	0	2e-1		0	0	0
Chlorobenzene	0	0	2e-2	5e-3	0	0	0
Methylene chloride	0	0	6e	9e-1	0	0	0
Butylbenzylphthalate	2.494e-5	0	2e-1		1.247e-4	0	1.247e-4
Benzo(a)anthracene	1.000e-5	0			0	0	0
Benzo(b)fluoranthene	1.176e-5	0			0	0	0
Benzo(k)fluoranthene	7.715e-6	0			0	0	0
Benzo(a)pyrene	7.767e-6	0			0	0	0
Indeno(1,2,3-cd)pyrene	2.217e-6	0			0	0	0
Naphthalene	4.404e-5	0	4e-3		1.101e-2	0	1.101e-2
4,4'-DDT	2.455e-7	0	5e-4		4.910e-4	0	4.910e-4
Arsenic	0	0	1e-3		0	0	0
Lead	0	0	1.4e-3		0	0	0
Mercury	0	0	3e-4		0	0	0
Zinc	0	0	2e-1		0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					1.163e-2	0	1.163e-2

GROUND-WATER EXPOSURES
(LEACHING SCENARIO)

POL STORAGE AREA

R-48-05-0-016H

RISK ASSESSMENT SPREADSHEET - EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

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SITE NAME:      ELLINGTON AFB - SITE 2
LOCATION:       HOUSTON, TEXAS
DATE:           05/16/90
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HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 1   MAXIMUM SOIL CONCENTRATIONS (ADULT)

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REFERENCES:     EPA, DECEMBER 1989
                FOSTER AND CHROSTOWSKI, 1987

INGESTION:      IEX  =  (C x IR x EF x ED)/(BW x LT x 365)

                WHERE:  C  = GROUNDWATER CONCENTRATION (MG/L)
                        IR = INGESTION RATE (LITERS/DAY)
                        EF = EXPOSURE FREQUENCY (DAYS/YEAR)
                        ED = EXPOSURE DURATION (YEARS)
                        BW = BODY WEIGHT (KG)
                        LT = LIFETIME (YEARS)

DERMAL CONTACT: DEX  =  (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

                WHERE:  C  = GROUNDWATER CONCENTRATION (MG/L)
                        PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
                        AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)
                        ET = EXPOSURE TIME (HRS/DAY)
                        EF = EXPOSURE FREQUENCY (DAYS/YEAR)
                        ED = EXPOSURE DURATION (YEARS)
                        BW = BODY WEIGHT (KG)
                        LT = LIFETIME (YEARS)

INHALATION:     IEX  =  (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds-Dt))/Ra)

                WHERE:  S  = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
                        IR = INHALATION RATE (LITERS/MIN)
                        Ds = SHOWER DURATION (MIN)
                        Ra = AIR EXCHANGE RATE (1/MIN)
                        Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
                        BW = BODY WEIGHT (KG)
                        SV = SHOWER ROOM AIR VOLUME (m**3)
                        R  = IDEAL GAS LAW CONSTANT (ATM-M**3/MOL-K)

ORGANIC LEACHATE MODEL:

        C leachate = 2.21e-3 * C soil**0.678 * Solubility**0.373

LINKAGE MODEL

        C aquifer = C leachate * Q * L / M / Vd
```

ENTER INPUT PARAMETERS:

```
INGESTION:   ADULT EXPOSURE                             DERMAL CONTACT.   YOUTH EXPOSURE

    IR:        2     CONVERSION    2.857e-2                 PC:      8e-4     CONVERSION    5.547e-5
    EF:      365     FACTOR =                               AV:     19400     FACTOR =
    ED:       70                                            ET:       .25
    BW:       70                                            EF:       365
    LT:       70                                            ED:        70
                                                            BW:        70
                                                            LT:        70

INHALATION:  ADULT EXPOSURE

    IR:       14     d:       1
    BW:       70     Ts:      2      LINKAGE MODEL:
    Ds:       15     T1:    293
    Dt:       20     Ts:    318          Q:     12   Annual Infiltration (cm/yr)
    Ra:    .0003     M1:   .992          L:    150   Length of the Waste Deposit Parallel to Groundwater Flow (m)
    SV:       12     M2:   .616          M:    3.5   Thickness of the Saturated Zone (m)
    ED:       70     T:     293          Vd:  3600   Darcy Groundwater Velocity (m/year)
    R:   .000082     FR:     10
    EF:        1     LT:     70
```

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1   MAXIMUM SOIL CONCENTRATIONS (ADULT)
CALCULATE DOSES:

CHEMICAL	SOURCE CONC. (MG/KG)	SOLUBILITY (MG/L)	REC. CONC. (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KAI)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Acetone	.25	680000	1.848e-2	58.08	3.43e-5	2.7584e0	5.279e-4	4.789e-5	1.024e-6
2-Butanone	.041	353000	4.247e-3	72.1	2.08e-5	1.5760e0	1.213e-4	6.414e-6	2.354e-7
Benzene	.004	1780	1.219e-4	78.12	5.5e-3	1.8884e1	3.482e-6	1.680e-6	6.755e-9
Ethylbenzene	13	152	1.171e-2	106.16	6.6e-3	1.6317e1	3.344e-4	1.449e-4	6.488e-7
Xylenes	.24	187	8.443e-4	106.16	4.33e-3	1.6010e1	2.412e-5	1.030e-5	4.680e-8
Styrene	.005	300	7.297e-5	104.14	2.28e-3	1.5400e1	2.085e-6	8.649e-7	4.045e-9
Chlorobenzene	.001	500	2.965e-5	112.56	3.58e-3	1.5373e1	8.471e-7	3.500e-7	1.643e-9
Methylene chloride	6.1	8200	3.102e-2	84.94	2.03e-3	1.6955e1	8.862e-4	3.934e-4	1.719e-6
Butylbenzylphthalate		2.9	0	312	.0000083	3.169e-1	0	0	0
Benzo(a)anthracene		.0057	0	228.28	1e-6	4.594e-2	0	0	0
Benzo(b)fluoranthene		.014	0	252.3	.0000122	5.103e-1	0	0	0
Benzo(k)fluoranthene		.0043	0	252.3	3.87e-5	1.4705e0	0	0	0
Benzo(a)pyrene		.0038	0	252	.0000005	2.147e-2	0	0	0
Indeno(1,2,3-cd)pyrene		.00053	0	276.3	.0000001	2.913e-3	0	0	0
Naphthalene	.2	31.7	3.848e-4	128.2	4.6e-4	9.9792e0	1.100e-5	3.213e-6	2.133e-8
4,4'-DDT		.0055	0	354.5	.0000158	5.500e-1	0	0	0
Arsenic			0	74.92		0	0	0	0
Lead			0	207.19		0	0	0	0
Mercury			0			0	0	0	0
Zinc			0	65.38		0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SOIL CONCENTRATIONS (ADULT)
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING.	REFERENCE DOSE INH.	HAZARD IND ING./DERM	HAZARD IND. INH.	HAZARD INDEX
Acetone	5.289e-4	4.789e-5	1e-1		5.289e-3	0	5.289e-3
2-Butanone	1.216e-4	6.414e-6	5e-2	9e-2	2.432e-3	7.126e-5	2.503e-3
Benzene	3.489e-6	1.680e-6			0	0	0
Ethylbenzene	3.351e-4	1.449e-4	1e-1		3.351e-3	0	3.351e-3
Xylenes	2.417e-5	1.030e-5	2e0	4e-1	1.208e-5	2.576e-5	3.784e-5
Styrene	2.089e-6	8.649e-7	2e1		1.044e-7	0	1.044e-7
Chlorobenzene	8.488e-7	3.508e-7	2e-2	5e-3	4.244e-5	7.016e-5	1.126e-4
Methylene chloride	8.879e-4	3.934e-4	6e-2	9e-1	1.480e-2	4.371e-4	1.524e-2
Butylbenzylphthalate	0	0	.2		0	0	0
Benzo(a)anthracene	0	0			0	0	0
Benzo(b)fluoranthene	0	0			0	0	0
Benzo(k)fluoranthene	0	0			0	0	0
Benzo(a)pyrene	0	0			0	0	0
Indeno(1,2,3-cd)pyrene	0	0			0	0	0
Naphthalene	1.102e-5	3.213e-6	4e-3		2.754e-3	0	2.754e-3
4,4'-DDT	0	0	.0005		0	0	0
Arsenic	0	0	1e-3		0	0	0
Lead	0	0	1.4e-3		0	0	0
Mercury	0	0	.0003		0	0	0
Zinc	0	0	2e-1		0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
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	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					2.868e-2	6.043e-4	2.928e-2

RISK ASSESSMENT SPREADSHEET   EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

SITE NAME: ELLINGTON AFB - SITE 2
LOCATION: HOUSTON, TEXAS
DATE: 05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 2 - MAXIMUM SOIL CONCENTRATIONS (YOUTH)

REFERENCES: EPA, DECEMBER 1989
FOSTER AND CHROSTOWSKI, 1987

INGESTION: IEX = (C x IR x EF x ED)/(BW x LT x 365)

WHERE: C = GROUNDWATER CONCENTRATION (MG/L)
IR = INGESTION RATE (LITERS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

DERMAL CONTACT: DEX = (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

WHERE: C = GROUNDWATER CONCENTRATION (MG/L)
PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)
ET = EXPOSURE TIME (HRS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

INHALATION: IEX = (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds-Dt))/Ra)

WHERE: S = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
IR = INHALATION RATE (LITERS/MIN)
Ds = SHOWER DURATION (MIN)
Ra = AIR EXCHANGE RATE (1/MIN)
Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
BW = BODY WEIGHT (KG)
SV = SHOWER ROOM AIR VOLUME (m**3)
R = IDEAL GAS LAW CONSTANT (ATM-M**3/MOL-K)

ORGANIC LEACHATE MODEL:

C leachate = 2.21e-3 * C soil**0.678 * Solubility**0.373

LINKAGE MODEL

C aquifer = C leachate * Q * L / M / Vd

ENTER INPUT PARAMETERS:

INGESTION: YOUTH EXPOSURE

IR:	1.5	CONVERSION FACTOR =	4.286e-2
EF:	365		
ED:	N/A		
BW:	35		
LT:	N/A		

DERMAL CONTACT: YOUTH EXPOSURE

PC:	8e-4	CONVERSION FACTOR =	8.514e-5
AV:	14900		
ET:	.25		
EF:	365		
ED:	N/A		
BW:	35		
LT:	N/A		

INHALATION: YOUTH EXPOSURE

IR:	11	d:	1
BW:	35	Ts:	2
Ds:	15	Tl:	293
Dt:	20	Ts:	318
Ra:	.0083	M1:	.982
SV:	12	M2:	.616
ED:	N/A	T:	293
R:	.000082	FR:	10
EF:	1	LT:	N/A

LINKAGE MODEL:

Q:	12	Annual Infiltration (cm/yr)
L:	150	Length of the Waste Deposit Parallel to Groundwater Flow (m)
M:	7.5	Thickness of the Saturated Zone (m)
Vd:	3600	Darcy Groundwater Velocity (cm/year)

RISK ASSESSMENT SPREADSHEET   HOUSEHOLD USE OF GROUNDWATER (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 2 - MAXIMUM SOIL CONCENTRATIONS (YOUTH)
CALCULATE DOSES:

CHEMICAL	SOURCE CON. (MG/KG)	SOLUBILITY (MG/L)	REC. CONC. (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KA1)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Acetone	.25	600000	1.048e 2	58.08	3.43e-5	2.7584e0	7.919e-4	7.526e 5	1.573e-6
2-Butanone	.041	353000	4.247e 3	72.1	2.00e-5	1.5760e0	1.820e-4	1.000e 5	3.616e-7
Benzene	.004	1780	1.219e 4	78.12	5.5e-3	1.0884e1	5.223e 6	2.640e 6	1.030e 8
Ethylbenzene	13	152	1.171e 2	106.16	6.6e-3	1.6317e1	5.016e-4	2.277e-4	9.966e-7
Xylenes	.24	187	8.443e 4	106.16	4.33e 3	1.6010e1	3.618e 5	1.619e-5	7.100e-8
Styrene	.005	300	7.297e 5	104.14	2.28e 3	1.5400e1	3.127e-6	1.359e-6	6.213e-9
Chlorobenzene	.001	500	2.965e 5	112.56	3.58e 3	1.5373e1	1.271e-6	5.512e-7	2.524e-9
Methylene chloride	6.1	8200	3.102e 2	84.94	2.03e 3	1.6855e1	1.329e 3	6.182e 4	2.641e-6
Butylbenzylphthalate		2.9	0	312	.0000083	3.169e-1	0	0	0
Benzo(a)anthracene		.0057	0	228.28	1e-6	4.594e 2	0	0	0
Benzo(b)fluoranthene		.014	0	252.3	.0000122	5.103e 1	0	0	0
Benzo(k)fluoranthene		.0043	0	252.3	3.87e-5	1.4705e0	0	0	0
Benzo(a)pyrene		.0038	0	252	.0000005	2.147e-2	0	0	0
Indeno(1,2,3-cd)pyrene		.00053	0	276.3	.0000001	2.913e-3	0	0	0
Naphthalene	.2	31.7	2.848e 4	128.2	4.6e-4	9.9792e0	1.649e-5	5.050e 6	3.277e-8
4,4'-DDT		.0055	0	354.5	.0000158	5.500e-1	0	0	0
Arsenic			0	74.92		0	0	0	0
Lead			0	207.19		0	0	0	0
Mercury			0			0	0	0	0
Zinc			0	65.38		0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 2 MAXIMUM SOIL CONCENTRATIONS (YOUTH)
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING.	REFERENCE DOSE INH.	HAZARD IND ING./DERM	HAZARD IND. INH.	HAZARD INDEX
Acetone	2.934e-4	7.526e-5	1e-1		2.934e-3	0	7.734e-3
2-Butanone	1.824e-4	1.000e-5	5e-2	9e-2	3.648e-3	1.120e-4	3.759e-3
Benzene	5.237e-6	2.640e-6			0	0	0
Ethylbenzene	5.026e-4	2.277e-4	1e-1		5.026e-3	0	5.026e-3
Xylenes	3.625e-5	1.619e-5	2e0	4e-1	1.813e-5	4.048e-5	5.860e-5
Styrene	3.134e-6	1.359e-6	2e-1		1.567e-7	0	1.567e-7
Chlorobenzene	1.273e-6	5.512e-7	2e-2	5e-3	6.366e-5	1.102e-4	1.739e-4
Methylene chloride	1.332e-3	6.182e-4	6e-2	9e-1	2.220e-2	6.869e-4	2.289e-2
Butylbenzylphthalate	0	0	2		0	0	0
Benzo(a)anthracene	0	0			0	0	0
Benzo(b)fluoranthene	0	0			0	0	0
Benzo(k)fluoranthene	0	0			0	0	0
Benzo(a)pyrene	0	0			0	0	0
Indeno(1,2,3-cd)pyrene	0	0			0	0	0
Naphthalene	1.653e-5	5.050e-6	4e-3		4.132e-3	0	4.132e-3
4,4'-DDT	0	0	.0005		0	0	0
Arsenic	0	0	1e-3		0	0	0
Lead	0	0	1.4e-3		0	0	0
Mercury	0	0	.0003		0	0	0
Zinc	0	0	2e-1		0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					4.302e-2	9.496e-4	4.397e-2

RISK ASSESSMENT SPREADSHEET - EXPOSURES THROUGH HOUSEHOLD USE OF GROUNDWATER

SITE NAME: ELLINGTON AFB - SITE 2
LOCATION: HOUSTON, TEXAS
DATE: 05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY ON THE FOLLOWING SPREADSHEETS. THREE EXPOSURE ROUTES ARE CONSIDERED: INGESTION OF GROUNDWATER, INHALATION OF VOLATILES DURING SHOWERING/BATHING, AND DERMAL CONTACT WHILE SHOWERING/BATHING. ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 3 - MAXIMUM SOIL CONCENTRATIONS (CHILD)

REFERENCES: EPA, DECEMBER 1989
FOSTER AND CHROSTOWSKI, 1987

INGESTION: IEX = (C x IR x EF x ED)/(BW x LT x 365)

WHERE: C = GROUNDWATER CONCENTRATION (MG/L)
IR = INGESTION RATE (LITERS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

DERMAL CONTACT: DEX = (C x PC x AV x ET x EF x ED)/(BW x LT x 1000 x 365)

WHERE: C = GROUNDWATER CONCENTRATION (MG/L)
PC = THE PERMEABILITY CONSTANT OF WATER (CM/HR)
AV = THE SKIN SURFACE AREA AVAILABLE FOR CONTACT (CM**2)
ET = EXPOSURE TIME (HRS/DAY)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

INHALATION: IEX = (S x IR x EF x ED)/(BW x LT x Ra x 1E6)x(Ds + EXP(-Ra x Dt)/Ra - EXP(Ra x (Ds-Dt))/Ra)

WHERE: S = VOLATILE ORGANIC CHEMICAL GENERATION RATE (UG/CUBIC METER/MIN)
IR = INHALATION RATE (LITERS/MIN)
Ds = SHOWER DURATION (MIN)
Ra = AIR EXCHANGE RATE (1/MIN)
Dt = TOTAL DURATION IN SHOWER ROOM (MIN)
BW = BODY WEIGHT (KG)
SV = SHOWER ROOM AIR VOLUME (m**3)
R = IDEAL GAS LAW CONSTANT (ATM-M**3/MOL K)

ORGANIC LEACHATE MODEL:

C leachate = 2.21e-3 * C soil**0.678 * Solubility**0.373

LINKAGE MODEL

C aquifer = C leachate * Q * L / M / Vd

ENTER INPUT PARAMETERS:

INGESTION: CHILD EXPOSURE

IR:	1	CONVERSION	1e 1
EF:	365	FACTOR =	
ED:	N/A		
BW:	10		
LT:	N/A		

DERMAL CONTACT: CHILD EXPOSURE

PC:	8e-4	CONVERSION	1.456e 4
AV:	7280	FACTOR =	
ET:	.25		
EF:	365		
ED:	N/A		
BW:	10		
LT:	N/A		

INHALATION: CHILD EXPOSURE

IR:	8	d:	1
BW:	10	Ts:	2
Ds:	15	T1:	293
Dt:	20	Ts:	318
Ra:	.0083	M1:	.982
SV:	12	M2:	.616
ED:	N/A	T:	293
R:	.000082	FR:	10
EF:	1	LT:	N/A

LINKAGE MODEL:

Q:	12	Annual Infiltration (cm/yr)
L:	150	Length of the Waste Deposit Parallel to Groundwater Flow (m)
M:	3.5	Thickness of the Saturated Zone (m)
Vd:	3600	Darcy Groundwater Velocity (cm/year)

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 3 MAXIMUM SOIL CONCENTRATIONS (CHILD)
CALCULATE DOSES:

CHEMICAL	SOURCE CONC. (MG/KG)	SOLUBILITY (MG/L)	REC. CONC. (MG/L)	MOLECULAR WEIGHT	HENRYS LAW CONSTANT	MASS TRANSFER COEFFICIENT (KAL)	INGESTION DOSE	INHALATION DOSE	DERMAL DOSE
Acetone	.25	680000	1.848e-3	58.08	3.43e-5	2.7584e0	1.848e-3	0	2.690e-6
2-Butanone	.041	353000	4.247e-3	72.1	2.08e-5	1.5760e0	4.247e-4	0	6.184e-7
Benzene	.004	1780	1.219e-4	78.12	5.5e-3	1.8884e1	1.219e-5	0	1.774e-8
Ethylbenzene	13	152	1.171e-2	106.16	6.6e-3	1.6317e1	1.171e-3	0	1.704e-6
Xylenes	.24	187	8.443e-4	106.16	4.33e-3	1.6010e1	8.447e-5	0	1.229e-7
Styrene	.005	300	7.297e-5	104.14	2.28e-3	1.5408e1	7.297e-6	0	1.062e-8
Chlorobenzene	.001	500	2.965e-5	112.56	3.58e-3	1.5373e1	2.965e-6	0	4.317e-9
Methylene chloride	6.1	8200	3.102e-2	84.94	2.03e-3	1.6855e1	3.102e-3	0	4.516e-6
Butylbenzylphthalate		2.9	0	312	.0000083	3.169e-1	0	0	0
Benzo(a)anthracene		.0057	0	228.28	1e-6	4.594e-2	0	0	0
Benzo(b)fluoranthene		.014	0	252.3	.0000122	5.103e-1	0	0	0
Benzo(k)fluoranthene		.0043	0	252.3	3.87e-5	1.4705e0	0	0	0
Benzo(a)pyrene		.0038	0	252	.0000005	2.147e-2	0	0	0
Indeno(1,2,3-cd)pyrene		.00053	0	276.3	.0000001	2.913e-3	0	0	0
Naphthalene	.2	31.7	3.848e-4	128.2	4.6e-4	9.9792e0	3.848e-5	0	5.603e-8
4,4'-DDT		.0055	0	354.5	.0000158	5.500e-1	0	0	0
Arsenic			0	74.92		0	0	0	0
Lead			0	207.19		0	0	0	0
Mercury			0			0	0	0	0
Zinc			0	65.38		0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0
			0			0	0	0	0

RISK ASSESSMENT SPREADSHEET - HOUSEHOLD USE OF GROUNDWATER (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 3 MAXIMUM SOIL CONCENTRATIONS (CHILD)
CALCULATE HAZARD INDICES:

CHEMICAL	ING+DERM DOSE	INHALATION DOSE	REFERENCE DOSE ING.	REFERENCE DOSE INH.	HAZARD IND ING./DERM	HAZARD IND. INH.	HAZARD INDEX
Acetone	1.850e-3	0	1e-1		1.850e-2	0	1.850e-2
2-Butanone	4.253e-4	0	5e-2	9e-2	8.506e-3	0	8.506e-3
Benzene	1.220e-5	0			0	0	0
Ethylbenzene	1.172e-3	0	1e-1		1.172e-2	0	1.172e-2
Xylenes	8.455e-5	0	2e0	4e-1	4.227e-5	0	4.227e-5
Styrene	7.308e-6	0	2e1		3.654e-7	0	3.654e-7
Chlorobenzene	2.969e-6	0	2e-2	5e-3	1.485e-4	0	1.485e-4
Methylene chloride	3.106e-3	0	6e-2	9e-1	5.177e-2	0	5.177e-2
Butylbenzylphthalate	0	0			0	0	0
Benzo(a)anthracene	0	0			0	0	0
Benzo(b)fluoranthene	0	0			0	0	0
Benzo(k)fluoranthene	0	0			0	0	0
Benzo(a)pyrene	0	0			0	0	0
Indeno(1,2,3-cd)pyrene	0	0			0	0	0
Naphthalene	3.854e-5	0	4e-3		9.635e-3	0	9.635e-3
4,4'-DDT	0	0	.0005		0	0	0
Arsenic	0	0	1e-3		0	0	0
Lead	0	0	1.4e-3		0	0	0
Mercury	0	0	.0003		0	0	0
Zinc	0	0	2e-1		0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
	0	0			0	0	0
TOTAL HAZARD INDEX					1.003e-1	0	1.003e-1

FUGITIVE DUST EMISSIONS

FORMER BASE LANDFILL

R-48-05-0-016H

NUS CORPORATION AND SUBSIDIARIES			**STANDARD CALCULATION SHEET**
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 6
SUBJECT: Fugitive Dust Emissions		CHECKED BY: (5-22-90)	DATE: 5/18/90

Purpose: To estimate exposures resulting from fugitive dust emissions from surface/near-surface soils

Assumptions: Receptors of concern are located ~300m from either of the 2 sites (at base boundary).

For Site 1, assume maximum contaminant concentrations (east. LF samples) are similar over entire eastern portion of the landfill ($18600 m^2$)

For Site 2, assume maximum contaminant concentrations in 0-2' samples are similar over entire site (without any concrete) ($11600 m^2$)

Assume 20 days/month as frequency of disturbance (days with wind and no rain)

Assume 50% vegetative cover

Receptors are exposed 24 hr/day to dust both inside and outside homes.
Exposure occurs 6 days/wk (312 days/yr)

Relevant Equations: (Cowherd et al., 1984)

$$E_{10} = \frac{0.83\, f\, P(u_+)(1-V)}{\left(\frac{PE}{50}\right)^2}$$

where E_{10} = emission rate of respirable particulates (mg/m^2-hr)
f = frequency of disturbance ($month^{-1}$)
u_+ = fastest wind speed (m/sec)
$P(u_+)$ = erosion potential (g/m^2)
V = fraction of area covered by vegetation
PE = Thornthwaite's precipitation/evaporation index

NUS 166A REVISED 0285

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 2 OF 6
SUBJECT: Fugitive Dust Emissions		CHECKED BY: [signature] (5-22-90)	DATE: 5/18/90

Intermediate Equations:

$$P(u_+) = 6.7\ (u^+ - u_t)$$

where u_t = erosion threshold wind speed at a height of 7 m (m/sec)

$$u_t = \frac{u_{*t}}{0.4} \ln\left(\frac{z}{z_0}\right)$$

where u_{*t} = friction velocity (m/sec)
z = height above surface (cm)
z_0 = roughness height (cm)

Determine Emission Rates:

$$R_{10} = \alpha E_{10} A$$

where R_{10} = emission rate of contaminant as PM_{10} (g/sec)
α = mass fraction of contaminant in PM_{10} emissions
A = source extent (m^2)

Determine Dispersion:

$$\chi = Q_I f_I$$

where χ = respirable concentration ($\mu g/m^3$)
Q_I = wind erosion scaling factor (g/sec)

$$Q_I = \frac{R_{10}}{P_R}$$

f_I = unscaled concentration from App. D.

NUS 155A REVISED 0285

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 3 OF 6
SUBJECT: Fugitive Dust Emissions		CHECKED BY: (5-22-90)	DATE: 5/18/90

Determine Doses:

$$IEX = \frac{C \times IR \times ET \times EF \times ED \times ABS}{BW \times LT \times 365}$$

where: C = contaminant concentration (χ) (mg/m^3)
IR = inhalation rate (m^3/hr)
ET = exposure time (hr/day)
EF = exposure frequency (days/yr)
ED = exposure duration (yr)
ABS = absorption fraction
ABS = 0.125 for respiratory tract deposition
0.625 for gastrointestinal tract deposition
BW = body weight (kg)
LT = lifetime (yr)
365 = conversion factor (days/yr)

Sample calculations:

$$U_t = \frac{U_{*t}}{0.4} \ln\left(\frac{z}{z_0}\right)$$

assuming particle size of 0.5 mm, from Fig 3-4, U_{*t} = 48 cm/sec

$$U_t = \frac{0.48\,\frac{m}{sec}}{0.4} \ln\left(\frac{700\text{ cm}}{1\text{ cm}}\right)$$

$$U_t = 7.86 \text{ m/sec} \checkmark$$

$$P(U+) = 6.7\,(U^+ - U_t)$$

from Table 4-1, U^+ = 23.7 m/sec for Port Arthur, TX

$$P(U+) = 6.7\,(23.7 - 7.86)$$

$$P(U+) = 106.1 \text{ g/m}^2 \checkmark$$

NUS 155A REVISED 0285

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 4 OF 6
SUBJECT: Fugitive Dust Emissions		CHECKED BY: (5-22-90)	DATE: 5/18/90

$$E_{10} = \frac{0.83\,(f)\,(P(u+))\,(1-V)}{\left(\frac{PE}{50}\right)^2}$$

PE = 83, from Fig 4-2

$$E_{10} = \frac{0.83\,(20/\text{month})\,(106.1\ g/m^2)\,(1-0.5)}{\left(\frac{83}{50}\right)^2}$$

$E_{10} =$ 320 mg/m^2-hr ✓

need E_{10} in g/m^2-sec

so, $\left(\frac{320\ mg}{m^2\text{-}hr}\right)\left(\frac{hr}{3600\ sec}\right)\left(\frac{g}{10^3\ mg}\right) = 8.89 \times 10^{-5}\ g/m^2\text{-sec}$ ✓

$R_{10}\left(\frac{kg}{sec}\right) = (\alpha)\left(E_{10}\ \frac{g}{m^2 sec}\right)(A\ m^2)$

for napnthalene at a concentration of 0.18 mg/kg (Site 1)

$R_{10} = \left(\frac{0.18\ mg}{kg}\right)\left(\frac{g}{10^3\ mg}\right)\left(\frac{kg}{10^3\ g}\right)\left(\frac{8.89 \times 10^{-5}\ g}{m^2\text{-}sec}\right)(18600\ m^2) = 2.98 \times 10^{-7}\ \frac{g}{sec}$ ✓

$Q_I = \frac{R_{10}}{P_R}$ from Fig 4-5 and 4-7, $P_R = 0.182$

$Q_I = \frac{2.98 \times 10^{-7}\ g/sec}{0.182} = 1.63 \times 10^{-6}\ g/sec$ ✓

$\chi = f_I\, Q_I$ from p. D-21, $f_I = 1.474$ (max)

$\chi = (1.474)(1.63 \times 10^{-6}\ g/sec) = 2.41 \times 10^{-6}\ \mu g/m^3$ ✓

NUS 155A REVISED 0285

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 5 OF 6
SUBJECT: Fugitive Dust Emissions		CHECKED BY: (5-22-90)	DATE: 5/18/90

for QI in g/sec, χ is in $\mu g/m^3$

A total dose (ingestion and inhalation) for a youth (35 kg)

$$IEX = \frac{C \times IR \times ET \times EF}{BW \times 365}$$

$$IEX = \frac{\left(2.41 \times 10^{-6} \frac{\mu g}{m^3}\right)\left(\frac{mg}{10^3 \mu g}\right)\left(0.43 \frac{m^3}{hr}\right)\left(24 \frac{hr}{day}\right)\left(312 \frac{day}{yr}\right)}{(35\ kg)\left(365 \frac{day}{yr}\right)}$$

$IEX = 6.07 \times 10^{-10}$ mg/kg-day ✓

Must now account for absorption in lungs (0.125) and GI tract (0.625):

Total Dose = $6.07 \times 10^{-10} \frac{mg}{kg\text{-}day} (0.125 + 0.625) = 4.55 \times 10^{-10}$ mg/kg-day ✓

To calculate Hazard Quotient:

$$HQ = \frac{Dose}{RfD} = \frac{Dose_{ing}}{RfD_{ing}} + \frac{Dose_{inh}}{RfD_{inh}}$$

$$HQ = 6.07 \times 10^{-10} \frac{mg}{kg\text{-}day} \left(\frac{0.625}{4 \times 10^{-3}}\right) = 9.48 \times 10^{-8}$$ ✓

for carcinogen, calculate a lifetime dose / risk:

benzo(a)pyrene at concentration of 2 mg/kg (Site 1)

$$R_{10} = \left(2\,\frac{mg}{kg}\right)\left(\frac{g}{10^3 mg}\right)\left(\frac{kg}{10^3 g}\right)\left(8.89\times10^{-5}\,\frac{g}{m^2\text{-}sec}\right)\left(18600\,m^2\right) = 3.31\times10^{-6}\,\frac{g}{sec}\ ✓$$

$$Q_I = \frac{3.31\times10^{-6}\,g/sec}{0.182} = 1.82\times10^{-5}\,g/sec\ ✓$$

$$\chi = (1.474)(1.82\times10^{-5}\,g/sec) = 2.68\times10^{-5}\,\mu g/m^3\ ✓$$

for adult:

$$IEX = \frac{\left(2.68\times10^{-5}\,\frac{\mu g}{m^3}\right)\left(\frac{mg}{10^3\mu g}\right)\left(0.83\,\frac{m^3}{hr}\right)\left(24\,\frac{hr}{day}\right)\left(312\,\frac{day}{yr}\right)\left(70\,yr\right)}{(70\,kg)\left(365\,\frac{day}{yr}\right)(70\,yr)}$$

$$IEX = 6.51\times10^{-9}\ mg/kg\text{-}day\ ✓$$

Accounting for absorption in lungs (0.125) + GI tract (0.625):

Risk = CSF x dose

Risk = $CSF_{ing} \times dose_{ing} + CSF_{inh} \times dose_{inh}$

$$Risk = \left(11.5\,\frac{kg\text{-}day}{mg}\right)\left(6.51\times10^{-9}\,\frac{mg}{kg\text{-}day}\right)(0.625) + \left(6.1\,\frac{kg\text{-}day}{mg}\right)\left(6.51\times10^{-9}\,\frac{mg}{kg\text{-}day}\right)(0.125)$$

$$Risk = 5.17\times10^{-8}\ ✓$$

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST

SITE NAME:	ELLINGTON AFB - SITE 1
LOCATION:	HOUSTON, TEXAS
DATE:	05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURE THROUGH INHALATION OF FUGITIVE DUST IS CONSIDERED.

EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS

REFERENCES: COWHERD, ET AL., 1984

RELEVANT EQUATIONS:

E10 = 0.83*F*P(U+)*(1-V)/PE/50)**2

UT = U*ln(7/zo)/0.4

P(U+) = 6.7*(U+ - UT)

R10 = ALPHA*E10*A

X = Q*Fi

Q = R10/PR

F =	20	(EVENTS/MONTH)
V =	.5	(DECIMAL FRACTION)
U+ =	23.7	(M/SEC)
PE =	83	(DIMENSIONLESS)
UT =	7.861296	(M/SEC)
A =	18600	(SQ M)
PP =	.182	(DIMENSIONLESS)
Fi =	1.474	(UG/G/CU M/SEC)

IEX = (X x IR x ET x EF x ED)/(BW x LT x 365)

WHERE:
- X = THE DOWNWIND AIR CONCENTRATION (MG/CU M)
- IR = THE INHALATION RATE (CU M/HR)
- ET = THE EXPOSURE TIME (HRS/DAY)
- EF = THE EXPOSURE FREQUENCY (DAYS/YEAR)
- ED = THE EXPOSURE DURATION (YEARS)
- BW = THE RECEPTOR BODY WEIGTH (KG)
- LT = THE RECEPTOR LIFETIME (YEARS)
- 365 = A CONVERSION FACTOR (DAYS/YEAR)

IR1 (YOUTH):	.43	ED:	70
IR2 (ADULT):	.83	LT:	70
ET:	24	AF1: *	.125
EF:	312	AF2: *	.625
BW1 (YOUTH):	35		
BW2 (ADULT):	70		

* THE ABSORPTION FRACTIONS ACCOUNT FOR DEPOSITION IN THE GASTROINTESTINAL VERSUS THE RESPIRATORY TRACT

INTERMEDIATE CALCULATIONS:

P(U+) = 106.1193
E10 = 8.879e-5

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST (PAGE TWO)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS
CALCULATE DOSES:

CHEMICAL	C (UG/KG)	ALPHA (MASS FRACTION)	P10 (G/S)	X (UG/M3)	TOTAL DOSE (MG/KG/DAY) YOUTH	TOTAL DOSE (MG/KG/DAY) ADULT	TOTAL DOSE (MG/KG/DAY) TIME-WEIGHTED
Acetone		0	0	0	0	0	0
2-Butanone		0	0	0	0	0	0
Benzene		0	0	0	0	0	0
Ethylbenzene		0	0	0	0	0	0
Xylenes		0	0	0	0	0	0
Styrene		0	0	0	0	0	0
Chlorobenzene		0	0	0	0	0	0
Methylene chloride		0	0	0	0	0	0
Butylbenzylphthalate	290	2.9e-7	4.789e-7	3.879e-6	9.78e-10	9.44e-10	9.44e-10
Benzo(a)anthracene	2350	2.35e-6	3.881e-6	3.143e-5	7.922e-9	7.646e-9	7.646e-9
Benzo(b)fluoranthene	1800	1.8e-6	2.973e-6	2.407e-5	6.068e-9	5.856e-9	5.856e-9
Benzo(k)fluoranthene	1850	1.85e-6	3.055e-6	2.474e-5	6.236e-9	6.019e-9	6.019e-9
Benzo(a)pyrene	2000	2e-6	3.303e-6	2.675e-5	6.742e-9	6.507e-9	6.507e-9
Indeno(1,2,3-cd)pyrene	930	9.3e-7	1.536e-6	1.244e-5	3.135e-9	3.026e-9	3.026e-9
Naphthalene	180	1.8e-7	2.973e-7	2.407e-6	6.07e-10	5.86e-10	5.86e-10
4,4'-DDT	10	1e-8	1.651e-8	1.337e-7	3.37e-11	3.25e-11	3.25e-11
Arsenic	32400	3.24e-5	5.351e-5	4.333e-4	1.092e-7	1.054e-7	1.054e-7
Lead	141000	1.41e-4	2.329e-4	1.886e-3	4.753e-7	4.587e-7	4.587e-7
Mercury	190	1.9e-7	3.138e-7	2.541e-6	6.41e-10	6.18e-10	6.18e-10
Zinc	180000	1.8e-4	2.973e-4	2.407e-3	6.068e-7	5.856e-7	5.856e-7
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST (PAGE THREE)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS
CALCULATE HAZARD INDICES AND CANCER RISKS:

CHEMICAL	DOSE YOUTH	DOSE ADULT	DOSE TIME-WEIGHTED	RFD (INHAL) (MG/KG/DAY)	RFD (INGES) (MG/KG/DAY)	CSF (INGES) (KG-DAY/MG)	CSF (INHAL) (KG DAY/MG)	HAZARD INDEX YOUTH	HAZARD INDEX ADULT	CANCER RISK ADULT
Acetone	0	0	0		1e-1			0	0	0
2-Butanone	0	0	0	9e-2	5e-2			0	0	0
Benzene	0	0	0			2.9e-2	2.9e-2	0	0	0
Ethylbenzene	0	0	0		1e-1			0	0	0
Xylenes	0	0	0	4e-1	2e0			0	0	0
Styrene	0	0	0		2e1			0	0	0
Chlorobenzene	0	0	0	5e-3	2e-2			0	0	0
Methylene chloride	0	0	0	9e-1	6e-2	7.5e-3	[illegible]	0	0	0
Butylbenzylphthalate	9.78e-10	9.44e-10	9.44e-10		2e-1			3.055e-9	2.948e-9	0
Benzo(a)anthracene	7.922e-9	7.646e-9	7.646e-9			1.5e-1	8.2e-2	0	0	7.95e-10
Benzo(b)fluoranthene	6.068e-9	5.856e-9	5.856e-9			9.2e-1	4.9e-1	0	0	3.726e-9
Benzo(k)fluoranthene	6.236e-9	6.019e-9	6.019e-9			7.6e-1	4e-1	0	0	3.160e-9
Benzo(a)pyrene	6.742e-9	6.507e-9	6.507e-9			1.15e1	6.1e0	0	0	5.173e-8
Indeno(1,2,3-cd)pyrene	3.135e-9	3.026e-9	3.026e-9			2e-1	1e-1	0	0	4.16e-10
Naphthalene	6.07e-10	5.86e-10	5.85e-10		4e-3			9.481e-8	9.150e-8	0
4,4'-DDT	3.37e-11	3.25e-11	3.25e-11		5e-4	3.4e-1	3.4e-1	4.214e-8	4.067e-8	8.30e-12
Arsenic	1.092e-7	1.054e-7	1.054e-7		1e-3		5e1	6.826e-5	6.588e-5	6.588e-7
Lead	4.753e-7	4.587e-7	4.587e-7		1.4e-3			2.122e-4	2.048e-4	0
Mercury	6.41e-10	6.18e-10	6.18e-10		3e-4			1.334e-6	1.288e-6	0
Zinc	6.068e-7	5.856e-7	5.856e-7		2e-1			1.896e-6	1.830e-6	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
TOTAL								2.838e-4	2.739e-4	7.187e-7

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST

SITE NAME: ELLINGTON AFB - SITE 1
LOCATION: HOUSTON, TEXAS
DATE: 05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURE THROUGH INHALATION OF FUGITIVE DUST IS CONSIDERED.

EXPOSURE SCENARIO NUMBER 1A - MAXIMUM SURFACE SOIL CONCENTRATIONS (CHILD)

REFERENCES: COWHERD, ET AL., 1984

RELEVANT EQUATIONS: E10 = 0.83*F*P(U+)*(1-V)/PE/50)**2

UT = U*ln(7/Zo)/0.4

P(U+) = 6.7*(U+ - UT)

R10 = ALPHA*E10*A

X = Q*F1

Q = R10/PR

F =	20	(EVENTS/MONTH)
V =	.5	(DECIMAL FRACTION)
U+ =	21.7	(M/SEC)
PE =	83	(DIMENSIONLESS)
UT =	7.851295	(M/SEC)
A =	18600	(SQ M)
PR =	.192	(DIMENSIONLESS)
F1 =	1.474	(UG/G/CU M/SEC)

IEX = (X x IR x ET x EF x ED)/(BW x LT x 365)

WHERE: X = THE DOWNWIND AIR CONCENTRATION (MG/CU M)
IR = THE INHALATION RATE (CU M/HR)
ET = THE EXPOSURE TIME (HRS/DAY)
EF = THE EXPOSURE FREQUENCY (DAYS/YEAR)
ED = THE EXPOSURE DURATION (YEARS)
BW = THE RECEPTOR BODY WEIGTH (KG)
LT = THE RECEPTOR LIFETIME (YEARS)
365 = A CONVERSION FACTOR (DAYS/YEAR)

IR1 (CHILD):	.12	ED:	70
IR2 (ADULT):	.83	LT:	70
ET:	24	AF1: *	.125
EF:	312	AF2: *	.625
BW1 (CHILD):	10		
BW2 (ADULT):	70		

* THE ABSORPTION FRACTIONS ACCOUNT FOR DEPOSITION IN THE GASTROINTESTINAL VERSUS THE RESPIRATORY TRACT

INTERMEDIATE CALCULATIONS:

P(U+) = 106.1193
E10 = 8.879e-5

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST (PAGE TWO)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1A - MAXIMUM SURFACE SOIL CONCENTRATIONS (CHILD)
CALCULATE DOSES:

CHEMICAL	C (UG/KG)	ALPHA (MASS FRACTION)	R10 (G/S)	X (UG/M3)	TOTAL DOSE (MG/KG/DAY) CHILD	TOTAL DOSE (MG/KG/DAY) ADULT	TOTAL DOSE (MG/KG/DAY) TIME-WEIGHTED
Acetone		0	0	0	0	0	0
2-Butanone		0	0	0	0	0	0
Benzene		0	0	0	0	0	0
Ethylbenzene		0	0	0	0	0	0
Xylenes		0	0	0	0	0	0
Styrene		0	0	0	0	0	0
Chlorobenzene		0	0	0	0	0	0
Methylene chloride		0	0	0	0	0	0
Butylbenzylphthalate	290	2.9e-7	4.789e-7	3.879e-6	9.55e-10	9.44e-10	9.44e-10
Benzo(a)anthracene	2350	2.35e-6	3.881e-5	3.143e-5	7.738e-9	7.646e-9	7.646e-9
Benzo(b)fluoranthene	1800	1.8e-6	2.973e-6	2.407e-5	5.927e-9	5.856e-9	5.856e-9
Benzo(k)fluoranthene	1850	1.85e-6	3.055e-6	2.474e-5	6.091e-9	6.019e-9	6.019e-9
Benzo(a)pyrene	2000	2e-6	3.307e-6	2.675e-5	6.585e-9	6.507e-9	6.507e-9
Indeno(1,2,3-cd)pyrene	930	9.3e-7	1.535e-6	1.244e-5	3.062e-9	3.026e-9	3.026e-9
Naphthalene	180	1.8e-7	2.973e-7	2.407e-6	5.93e-10	5.86e-10	5.86e-10
4,4'-DDT	10	1e-8	1.651e-8	1.337e-7	3.29e-11	3.25e-11	3.25e-11
Arsenic	32400	3.24e-5	5.351e-5	4.333e-4	1.067e-7	1.054e-7	1.054e-7
Lead	141000	1.41e-4	2.329e-4	1.886e-3	4.643e-7	4.587e-7	4.587e-7
Mercury	190	1.9e-7	3.139e-7	2.541e-6	6.26e-10	6.18e-10	6.18e-10
Zinc	180000	1.8e-4	2.973e-4	2.407e-3	5.927e-7	5.856e-7	5.856e-7
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST (FAGE THREE)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1A - MAXIMUM SURFACE SOIL CONCENTRATIONS (CHILD)
CALCULATE HAZARD INDICES AND CANCER RISKS:

CHEMICAL	DOSE CHILD	DOSE ADULT	DOSE TIME-WEIGHTED	RFD (INHAL) (MG/KG/DAY)	RFD (INGES) (MG/KG/DAY)	CSF (INGES) (KG DAY/MG)	CSF (INHAL) (KG DAY/MG)	HAZARD INDEX CHILD	HAZARD INDEX ADULT	CANCER RISK ADULT
Acetone	0	0	0		1e 1			0	0	0
2-Butanone	0	0	0	9e 2	5e 2			0	0	0
Benzene	0	0	0			2.9e 2	2.9e 2	0	0	0
Ethylbenzene	0	0	0		1e 1			0	0	0
Xylenes	0	0	0	4e 1	2e0			0	0	0
Styrene	0	0	0		2e1			0	0	0
Chlorobenzene	0	0	0	5e-3	2e-2			0	0	0
Methylene chloride	0	0	0	9e 1	6e 2	7.5e 3	1.2e 3	0	0	0
Butylbenzylphthalate	9.55e-10	9.44e-10	9.44e-10		2e 1			2.984e 9	2.948e 9	0
Benzo(a)anthracene	7.738e-9	7.646e-9	7.646e-9			1.5e 1	8.2e 2	0	0	7.95e-10
Benzo(b)fluoranthene	5.927e-9	5.856e-9	5.856e-9			9.2e 1	4.9e 1	0	0	3.726e-9
Benzo(k)fluoranthene	6.091e-9	6.019e-9	6.019e-9			7.6e-1	4e 1	0	0	3.160e-9
Benzo(a)pyrene	6.585e-9	6.507e-9	6.507e-9			1.15e1	6.1e0	0	0	5.173e-8
Indeno(1,2,3-cd)pyrene	3.062e-9	3.026e-9	3.026e-9			2e 1	1e 1	0	0	4.16e-10
Naphthalene	5.93e-10	5.86e-10	5.86e-10		4e-3			9.261e 8	9.150e 8	0
4,4'-DDT	3.29e-11	3.25e-11	3.25e 11		5e-4	3.4e 1	2.4e 1	4.116e 8	4.067e 8	8.30e-12
Arsenic	1.067e-7	1.054e-7	1.054e 7		1e-3		5e1	6.668e-5	6.588e 5	6.588e-7
Lead	4.643e-7	4.587e-7	4.587e-7		1.4e 3			2.073e 4	2.048e 4	0
Mercury	6.25e-10	6.18e-10	6.18e-10		3e-4			1.283e 6	1.288e 6	0
Zinc	5.927e-7	5.856e-7	5.856e 7		2e-1			1.852e 6	1.830e 6	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
TOTAL								2.772e-4	2.739e 4	7.187e-7

FUGITIVE DUST EMISSIONS

POL STORAGE AREA

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST

SITE NAME: ELLINGTON AFB - SITE 2
LOCATION: HOUSTON, TEXAS
DATE: 05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURE THROUGH INHALATION OF FUGITIVE DUST IS CONSIDERED.

EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS

REFERENCES: COWHERD, ET AL., 1984

RELEVANT EQUATIONS:

E10 = 0.83*F*P(U+)*(1-V)/(PE/50)**2

UT = U*ln(Z/Zo)/0.4

P(U+) = 6.7*(U+ - UT)

R10 = ALPHA*E10*A

X = Q*F1

Q = R10/PR

F =	20	(EVENTS/MONTH)
V =	.5	(DECIMAL FRACTION)
U+ =	21.7	(M/SEC)
FE =	93	(DIMENSIONLESS)
UT =	7.961296	(M/SEC)
A =	11500	(SQ M)
PR =	.102	(DIMENSIONLESS)
F1 =	1.474	(UG/G/CU M/SEC)

IEX = (X x IR x ET x EF x ED)/(BW x LT x 365)

WHERE: X = THE DOWNWIND AIR CONCENTRATION (MG/CU M)
IR = THE INHALATION RATE (CU M/HR)
ET = THE EXPOSURE TIME (HRS/DAY)
EF = THE EXPOSURE FREQUENCY (DAYS/YEAR)
ED = THE EXPOSURE DURATION (YEARS)
BW = THE RECEPTOR BODY WEIGTH (KG)
LT = THE RECEPTOR LIFETIME (YEARS)
365 = A CONVERSION FACTOR (DAYS/YEAR)

IR1 (YOUTH):	.47	ED:	70
IR2 (ADULT):	.83	LT:	70
ET:	24	AF1: *	.125
EF:	312	AF2: *	.625
BW1 (YOUTH):	35		
BW2 (ADULT):	70		

* THE ABSORPTION FRACTIONS ACCOUNT FOR DEPOSITION IN THE GASTROINTESTINAL VERSUS THE RESPIRATORY TRACT

INTERMEDIATE CALCULATIONS:

P(U+) = 106.1193
E10 = 8.879e-5

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS
CALCULATE DOSES:

CHEMICAL	C (UG/KG)	ALPHA (MASS FRACTION)	FIR (G/S)	X (UG/M3)	TOTAL DOSE (MG/KG/DAY) YOUTH	TOTAL DOSE (MG/KG/DAY) ADULT	TOTAL DOSE (MG/KG/DAY) TIME-WEIGHTED
Acetone	250	2.5e-7	2.575e-7	2.085e-6	5.26e-10	5.07e-10	5.07e-10
2-Butanone	41	4.1e-8	4.223e-9	3.420e-7	8.62e-11	8.32e-11	8.32e-11
Benzene	180	1.8e-7	1.854e-7	1.501e-6	3.78e-10	3.65e-10	3.65e-10
Ethylbenzene	210	2.1e-7	2.163e-7	1.752e-6	4.41e-10	4.26e-10	4.26e-10
Xylenes	240	2.4e-7	2.472e-7	2.002e-6	5.05e-10	4.87e-10	4.87e-10
Styrene		0	0	0	0	0	0
Chlorobenzene		0	0	0	0	0	0
Methylene chloride		0	0	0	0	0	0
Butylbenzylphthalate		0	0	0	0	0	0
Benzo(a)anthracene		0	0	0	0	0	0
Benzo(b)fluoranthene		0	0	0	0	0	0
Benzo(k)fluoranthene		0	0	0	0	0	0
Benzo(a)pyrene		0	0	0	0	0	0
Indeno(1,2,3-cd)pyrene		0	0	0	0	0	0
Naphthalene		0	0	0	0	0	0
4,4'-DDT		0	0	0	0	0	0
Arsenic		0	0	0	0	0	0
Lead		0	0	0	0	0	0
Mercury		0	0	0	0	0	0
Zinc		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS
CALCULATE HAZARD INDICES AND CANCER RISKS:

CHEMICAL	DOSE YOUTH	DOSE ADULT	DOSE TIME-WEIGHTED	RFD (INHAL) (MG/KG/DAY)	RFD (INGES) (MG/KG/DAY)	CSF (INGES) (KG DAY/MG)	CSF (INHAL) (KG DAY/MG)	HAZARD INDEX YOUTH	HAZARD INDEX ADULT	CANCER RISK ADULT
Acetone	5.26e-10	5.07e-10	5.07e-10		1e-1			5.295e-9	5.178e-9	0
2-Butanone	8.62e-11	8.32e-11	8.32e-11	9e-2	5e-2			1.197e-9	1.155e-9	0
Benzene	3.78e-10	3.65e-10	3.65e-10			2.9e-2	2.9e-2	0	0	7.94e-12
Ethylbenzene	4.41e-10	4.26e-10	4.26e-10		1e-1			2.759e-9	2.663e-9	0
Xylenes	5.05e-10	4.87e-10	4.87e-10	4e-1	2e0			3.15e-10	3.04e-10	0
Styrene	0	0	0		2e1			0	0	0
Chlorobenzene	0	0	0	5e-3	2e-2			0	0	0
Methylene chloride	0	0	0	9e-1	6e-2	7.5e-3	1.2e-3	0	0	0
Butylbenzylphthalate	0	0	0		2e-1			0	0	0
Benzo(a)anthracene	0	0	0			1.5e-1	8.2e-2	0	0	0
Benzo(b)fluoranthene	0	0	0			9.2e-1	4.9e-1	0	0	0
Benzo(k)fluoranthene	0	0	0			7.5e-1	4e-1	0	0	0
Benzo(a)pyrene	0	0	0			1.15e1	6.1e0	0	0	0
Indeno(1,2,3-cd)pyrene	0	0	0			2e-1	1e-1	0	0	0
Naphthalene	0	0	0		4e-3			0	0	0
4,4'-DDT	0	0	0		5e-4	3.4e-1	3.4e-1	0	0	0
Arsenic	0	0	0		1e-3		5e1	0	0	0
Lead	0	0	0		1.4e-3			0	0	0
Mercury	0	0	0		3e-4			0	0	0
Zinc	0	0	0		2e-1			0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
TOTAL								7.557e-9	7.293e-9	7.94e-12

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST

SITE NAME: ELLINGTON AFB - SITE 2
LOCATION: HOUSTON, TEXAS
DATE: 05/16/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURE THROUGH INHALATION OF FUGITIVE DUST IS CONSIDERED.

EXPOSURE SCENARIO NUMBER 1A - MAXIMUM SURFACE SOIL CONCENTRATIONS (CHILD)

REFERENCES: COWHERD, ET AL., 1984

RELEVANT EQUATIONS:

E10 = 0.036*F*P(U+)*(1-V)/PE/50)**2

UT = U*ln(Z/Zo)/0.4

P(U+) = 6.7*(U+ - UT)

R10 = ALPHA*E10*A

X = Q*Fi

Q = R10/PR

F =	20	(EVENTS MONTH)
V =	.5	(DECIMAL FRACTION)
U+ =	21.7	(M/SEC)
PE =	83	(DIMENSIONLESS)
UT =	7.861295	(M/SEC)
A =	11600	(SQ M)
PF =	.182	(DIMENSIONLESS)
Fi =	1.474	(UG/G/CU M/SEC)

IEX = (X x IR x ET x EF x ED)/(BW x LT x 365)

WHERE: X = THE DOWNWIND AIR CONCENTRATION (MG/CU M)
IR = THE INHALATION RATE (CU M/HR)
ET = THE EXPOSURE TIME (HRS/DAY)
EF = THE EXPOSURE FREQUENCY (DAYS/YEAR)
ED = THE EXPOSURE DURATION (YEARS)
BW = THE RECEPTOR BODY WEIGTH (KG)
LT = THE RECEPTOR LIFETIME (YEARS)
365 = A CONVERSION FACTOR (DAYS/YEAR)

IR1 (CHILD):	.12	ED:	70
IR2 (ADULT):	.83	LT:	70
ET:	24	AF1: *	.125
EF:	312	AF2: *	.625
BW1 (CHILD):	10		
BW2 (ADULT):	70		

* THE ABSORPTION FRACTIONS ACCOUNT FOR DEPOSITION IN THE GASTROINTESTINAL VERSUS THE RESPIRATORY TRACT

INTERMEDIATE CALCULATIONS:

P(U+) = 106.1193
E10 = 8.879e-5

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1A - MAXIMUM SURFACE SOIL CONCENTRATIONS (CHILD)
CALCULATE DOSES:

CHEMICAL	C (UG/KG)	ALPHA (MASS FRACTION)	P10 (G/S)	X (UG/M3)	TOTAL DOSE (MG/KG/DAY) CHILD	TOTAL DOSE (MG/KG/DAY) ADULT	TOTAL DOSE (MG/KG/DAY) TIME-WEIGHTED
Acetone	250	2.5e-7	2.525e-7	2.085e-6	5.13e-10	5.07e-10	5.07e-10
2-Butanone	41	4.1e-8	4.223e-8	3.420e-7	8.42e-11	8.32e-11	8.32e-11
Benzene	180	1.8e-7	1.854e-7	1.501e-6	3.70e-10	3.65e-10	3.65e-10
Ethylbenzene	210	2.1e-7	2.163e-7	1.752e-6	4.31e-10	4.26e-10	4.26e-10
Xylenes	240	2.4e-7	2.472e-7	2.002e-6	4.93e-10	4.87e-10	4.87e-10
Styrene		0	0	0	0	0	0
Chlorobenzene		0	0	0	0	0	0
Methylene chloride		0	0	0	0	0	0
Butylbenzylphthalate		0	0	0	0	0	0
Benzo(a)anthracene		0	0	0	0	0	0
Benzo(b)fluoranthene		0	0	0	0	0	0
Benzo(k)fluoranthene		0	0	0	0	0	0
Benzo(a)pyrene		0	0	0	0	0	0
Indeno(1,2,3-cd)pyrene		0	0	0	0	0	0
Naphthalene		0	0	0	0	0	0
4,4'-DDT		0	0	0	0	0	0
Arsenic		0	0	0	0	0	0
Lead		0	0	0	0	0	0
Mercury		0	0	0	0	0	0
Zinc		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0
		0	0	0	0	0	0

RISK ASSESSMENT SPREADSHEET - INHALATION OF FUGITIVE DUST (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1A - MAXIMUM SURFACE SOIL CONCENTRATIONS (CHILD)
CALCULATE HAZARD INDICES AND CANCER RISKS:

CHEMICAL	DOSE CHILD	DOSE ADULT	DOSE TIME-WEIGHTED	RFD (INHAL) (MG/KG/DAY)	RFD (INGES) (MG/KG/DAY)	CSF (INGES) (KG DAY/MG)	CSF (INHAL) (KG DAY/MG)	HAZARD INDEX CHILD	HAZARD INDEX ADULT	CANCER RISK ADULT
Acetone	5.13e-10	5.07e-10	5.07e-10		1e-1			3.289e-9	3.178e-9	0
2-Butanone	8.42e-11	8.32e-11	8.32e-11	9e-2	5e-2			1.169e-9	1.155e-9	0
Benzene	3.78e-10	3.65e-10	3.65e-10			2.9e-2	2.9e-2	0	0	7.94e-12
Ethylbenzene	4.31e-10	4.26e-10	4.26e-10		1e-1			2.695e-9	2.663e-9	0
Xylenes	4.93e-10	4.87e-10	4.87e-10	4e-1	2e0			3.88e-10	3.84e-10	0
Styrene	0	0	0		2e1			0	0	0
Chlorobenzene	0	0	0	5e-3	2e-2			0	0	0
Methylene chloride	0	0	0	9e-1	6e-2	7.5e-3	1.2e-[illegible]	0	0	0
Butylbenzylphthalate	0	0	0		2e-1			0	0	0
Benzo(a)anthracene	0	0	0			1.5e-1	8.2e-2	0	0	0
Benzo(b)fluoranthene	0	0	0			9.2e-1	4.9e-1	0	0	0
Benzo(k)fluoranthene	0	0	0			7.6e-1	4e-1	0	0	0
Benzo(a)pyrene	0	0	0			1.15e1	6.1e0	0	0	0
Indeno(1,2,3-cd)pyrene	0	0	0			2e-1	1e-1	0	0	0
Naphthalene	0	0	0		4e-3			0	0	0
4,4'-DDT	0	0	0		5e-4	3.4e-1	3.4e-1	0	0	0
Arsenic	0	0	0		1e-3		5e1	0	0	0
Lead	0	0	0		1.4e-3			0	0	0
Mercury	0	0	0		3e-4			0	0	0
Zinc	0	0	0		2e-1			0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
	0	0	0					0	0	0
TOTAL								7.381e-9	7.293e-9	7.94e-12

DERMAL CONTACT WITH SOIL

FORMER BASE LANDFILL

CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 2
SUBJECT: Dermal Contact with Soil		CHECKED BY: (5-22-90)	DATE: 5/15/90

Purpose: To evaluate exposures resulting from casual contact with soil

Assumptions: Base personnel come in contact with contaminated soil 12 times/yr, for 40 yr

Exposed surface area = 2948 cm^2

Soil adherence factor = 1.45 mg/cm^2

Absorption is as follows: volatiles = 0.10
semivolatiles = 0.05
Pesticides = 0.0
Metals = 0

Body weight = 70 kg
Lifetime = 70 yr

Relevant Equations

An average annual dose, for noncarcinogens:

$$DEX. = \frac{C \times AV \times AF \times ABS \times EF}{BW \times 365 \times 10^6}$$

where: C = contaminant concentration in soil (mg/kg)
AV = available skin area for contact (cm^2/day)
AF = soil adherence factor (mg/cm^2)
ABS = Absorption factor (decimal fraction)
EF = exposure frequency (day/yr)
BW = body weight (kg)
365 = conversion factor (days/yr)
10^6 = conversion factor (mg/kg)

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 2 OF 2
SUBJECT: Dermal contact with Soil		CHECKED BY: GJH (5-22-90)	DATE: 5/15/90

Determine a time-weighted average lifetime dose, for carcinogens:

$$DEX = \frac{C \times AV \times AF \times ABS \times EF \times ED}{BW \times LT \times 365 \times 10^6}$$

where: ED = exposure duration (yr)
LT = lifetime (yr)

Sample Calculations:

Noncarcinogen:

for naphthalene at a concentration of 180 µg/kg:

$$DEX = \frac{(0.180\ mg/kg)(2948\ cm^2/day)(1.45\ mg/cm^2)(0.05)(12\ day/yr)}{(70\ kg)(365\ day/yr)(10^6\ mg/kg)}$$

DEX = 1.81×10^{-8} mg/kg-day ✓

Carcinogens:

for benzene at a concentration of 180 µg/kg:

$$DEX = \frac{\left(0.180\frac{mg}{kg}\right)\left(2948\frac{cm^2}{day}\right)\left(1.45\frac{mg}{cm^2}\right)(0.10)\left(12\frac{day}{yr}\right)(40\ yr)}{(70\ kg)(70\ yr)\left(365\frac{day}{yr}\right)\left(10^6\frac{mg}{kg}\right)}$$

DEX = 2.06×10^{-8} mg/kg-day ✓

NUS 155A REVISED 0285

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: ELLINGTON AFB SITE [illegible]
LOCATION: HOUSTON, TEXAS
DATE: 05/15/90

EXPOSURE SCENARIO NUMBER 1 - MAXIMUM CONTAMINANT CONCENTRATIONS IN SURFACE SOIL

RELEVANT EQUATIONS: DEI = (C × SA × AF × ABS × EF × ED)/(BW × AT × LT × [illegible])

ASSUMPTIONS: ADULT:

C	= CONCENTRATION IN SOIL (MG/KG)		
SA	= EXPOSED SURFACE AREA OF SKIN (SQ CM/DAY):		2?40
AF	= ADHERENCE FACTOR (MG/SQ CM):		1.4?
ABS	= ABSORPTION FRACTION: (DECIMAL FRACTION)	VOCS:	.1
		PNAS/PESTICIDES:	.05
		PCBS:	.0?
EF1	= YOUTH EXPOSURE FREQUENCY (DAYS/YEAR)		0
EF2	= ADULT EXPOSURE FREQUENCY (DAYS/YEAR):		12
ED	= ADULT EXPOSURE DURATION (YEARS):		10
BW1	= BODY WEIGHT ADOLESCENT (KG):		[illegible]
BW2	= BODY WEIGHT ADULT (KG):		[illegible]
AT	= AVERAGING TIME (DAYS/YEAR):		?65
LT	= LIFETIME (YEARS):		[illegible]

DETERMINE CONVERSION FACTORS:
DEI = (C)*(1MG/1000 UG)*(SA SQ CM)*(AF MG/SQ CM)*(ABS)*(EF DAYS/YEAR)/(AT DAYS/YEAR)/(BW KG)/(1 KG/1E6 MG)

DOSEyouth = (CF1)*(C)*(ABS)	CF1 = 0	* ED AND LT ARE USED FOR CARCINOGENIC RISK CALCULATION ONLY.
DOSEadult = (CF2)*(C)*(ABS)	CF2 = 2.009e 9	(NOT USED IN CONVERSION FACTORS)

G-2

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM CONTAMINANT CONCENTRATIONS IN SURFACE SOIL
CALCULATE DOSES:

CHEMICAL	C (UG KG)	ABSORPTION FRACTION	YOUTH DOSE (MG KG/DAY)	ADULT DOSE (MG/KG DAY)	TIME-WEIGHTED DOSE (MG KG/DAY)	RFD (MG/KG-DAY)	CSF (KG DAY/MG)
Acetone		.1	0	0	0	1e-1	
2-Butanone		.1	0	0	0	5e-2	
Benzene		.1	0	0	0		2.9e-2
Ethylbenzene		.1	0	0	0	1e-1	
Xylenes		.1	0	0	0	2e0	
Styrene		.1	0	0	0	2e1	
Chlorobenzene		.1	0	0	0	2e-2	
Methylene chloride		.1	0	0	0	6e-2	7.5e-3
Butylbenzylphthalate	290	.05	0	2.911e-8	1.663e-8	2e-1	
Benzo(a)anthracene	2350	.05	0	2.359e-7	1.348e-7		1.5e-1
Benzo(b)fluoranthene	1800	.05	0	1.807e-7	1.033e-7		9.2e-1
Benzo(k)fluoranthene	1850	.05	0	1.857e-7	1.061e-7		7.4e-1
Benzo(a)pyrene	2000	.05	0	2.008e-7	1.147e-7		1.15e1
Indeno(1,2,3-cd)pyrene	930	.05	0	9.336e-8	5.335e-8		2e-1
Naphthalene	190	.05	0	1.887e-8	1.033e-8	4e-3	
4,4'-DDT	10	.05	0	1.004e-9	5.74e-10	5e-4	3.4e-1
Arsenic	32400	0	0	0	0	1e-3	
Lead	141000	0	0	0	0	1.4e-3	
Mercury	190	0	0	0	0	3e-4	
Zinc	180000	0	0	0	0	2e-1	
			0	0	0		
			0	0	0		
			0	0	0		
			0	0	0		
			0	0	0		
			0	0	0		
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			0	0	0		
			0	0	0		

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PHASE THREE)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM CONTAMINANT CONCENTRATIONS IN [illegible]
DETERMINE HAZARD INDICES AND CANCER RISK

CHEMICAL	HAZARD INDEX YOUTH	HAZARD INDEX ADULT	CANCER RISK LIFETIME
Acetone	0	0	0
2-Butanone	0	0	0
Benzene	0	0	0
Ethylbenzene	0	0	0
Xylenes	0	0	0
Styrene	0	0	0
Chlorobenzene	0	0	0
Methylene chloride	0	0	0
Butylbenzylphthalate	0	1.454e 7	0
Benzo(a)anthracene	0	0	2.822e 8
Benzo(b)fluoranthene	0	0	9.499e 9
Benzo(k)fluoranthene	0	0	8.865e 9
Benzo(a)pyrene	0	0	1.319e 6
Indeno(1,2,3-cd)pyrene	0	0	1.867e 9
Naphthalene	0	4.517e 6	0
4,4'-DDT	0	2.889e 5	[illegible]
Arsenic	0	0	0
Lead	0	0	0
Mercury	0	0	0
Zinc	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
TOTAL	0	[illegible].678e-5	1.526e-6

DERMAL CONTACT WITH SOIL

POL STORAGE AREA

RISK ASSESSMENT SPREADSHEET DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: ELLINGTON AFB SITE 2
LOCATION: HOUSTON, TEXAS
DATE: 05 15 90

EXPOSURE SCENARIO NUMBER 1 MAXIMUM NEAR SURFACE SOIL CONCENTRATIONS

RELEVANT EQUATIONS: DEI = (C SA AF ABS EF ED) (BW AT LT 1E6)

ASSUMPTIONS: ADULT:

C	= CONCENTRATION IN SOIL (MG KG)		
SA	= EXPOSED SURFACE AREA OF SKIN (SQ CM DAY):		[illegible]
AF	= ADHERENCE FACTOR (MG SQ CM):		[illegible]
ABS	= ABSORPTION FRACTION: (DECIMAL FRACTION)	VOCS:	[illegible]
		PNAS PESTICIDES:	05
		PCBS:	[illegible]
EF1	= YOUTH EXPOSURE FREQUENCY (DAYS YEAR):		[illegible]
EF2	= ADULT EXPOSURE FREQUENCY (DAYS YEAR):		[illegible]
ED	= ADULT EXPOSURE DURATION (YEARS):		40
BW1	= BODY WEIGHT ADOLESCENT (KG):		[illegible]
BW2	= BODY WEIGHT ADULT (KG):		[illegible]
AT	= AVERAGING TIME (DAYS YEAR):		[illegible]
LT	= LIFETIME (YEARS):		[illegible]

DETERMINE CONVERSION FACTORS:
DEI = (C)*(1MG/1000 UG)*(SA SQ CM)*(AF MG SQ CM)*(ABS)*(EF DAYS YEAR)/(AT DAYS YEAR)/(BW KG)*(1 KG 1E6 MG)

DOSEyouth = (CF1)*(C)*(ABS)	CF1 =	0	* ED AND LT ARE USED FOR CARCINOGENIC RISK CALCULATION ONLY.
DOSEadult = (CF2)*(C)*(ABS)	CF2 =	[illegible].000e [illegible]	(NOT USED IN CONVERSION FACTORS)

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM NEAR SURFACE SOIL CONCENTRATIONS
CALCULATE DOSES:

CHEMICAL	C (UG/KG)	ABSORPTION FRACTION	YOUTH DOSE (MG/KG/DAY)	ADULT DOSE (MG/KG/DAY)	TIME-WEIGHTED DOSE (MG/KG/DAY)	RFD (MG/KG/DAY)	SF (KG-DAY/MG)
Acetone	50	.1	0	5.81[illegible]e-9	2.968e-9	1e-1	
2-Butanone	41	.1	0	9.271e-9	4.784e-9	5e-2	
Benzene	180	.1	0	3.514e-9	2.055e-8		[illegible]
Ethylbenzene	210	.1	0	4.216e-8	2.409e-8	1e-1	
Xylenes	240	.1	0	4.818e-8	2.753e-8	2e0	
Styrene		.1	0	0	0	2e-1	
Chlorobenzene		.1	0	0	0	2e-2	
Methylene chloride		.1	0	0	0	6e-2	7.5e-3
Butylbenzylphthalate		.05	0	0	0	2e-1	
Benzo(a)anthracene		.05	0	0	0		1.5e-1
Benzo(b)fluoranthene		.05	0	0	0		9.2e-1
Benzo(k)fluoranthene		.05	0	0	0		7.6e-1
Benzo(a)pyrene		.05	0	0	0		1.15e1
Indeno(1,2,3-cd)pyrene		.05	0	0	0		2e-1
Naphthalene		.05	0	0	0	4e-3	
4,4'-DDT		.05	0	0	0	5e-4	3.4e-1
Arsenic		0	0	0	0	1e-3	
Lead		0	0	0	0	1.4e-3	
Mercury		0	0	0	0	3e-4	
Zinc		0	0	0	0	2e-1	
			0	0	0		
			0	0	0		
			0	0	0		
			0	0	0		
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			0	0	0		
			0	0	0		

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM NEAR SURFACE SOIL CONCENTRATIONS
DETERMINE HAZARD INDICES AND CANCER RISK:

CHEMICAL	HAZARD INDEX YOUTH	HAZARD INDEX ADULT	CANCER RISK LIFETIME
Acetone	0	5.819e-7	0
2-Butanone	0	1.544e-7	0
Benzene	0	0	5.99e-10
Ethylbenzene	0	4.216e-7	0
Xylenes	0	2.409e-8	0
Styrene	0	0	0
Chlorobenzene	0	0	0
Methylene chloride	0	0	0
Butylbenzylphthalate	0	0	0
Benzo(a)anthracene	0	0	0
Benzo(b)fluoranthene	0	0	0
Benzo(k)fluoranthene	0	0	0
Benzo(a)pyrene	0	0	0
Indeno(1,2,3-cd)pyrene	0	0	0
Naphthalene	0	0	0
4,4'-DDT	0	0	0
Arsenic	0	0	0
Lead	0	0	0
Mercury	0	0	0
Zinc	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
TOTAL	0	1.112e-6	5.99e-10

INCIDENTAL INGESTION OF SOIL

FORMER BASE LANDFILL

R-48-05-0-016H

NUS CORPORATION AND SUBSIDIARIES			**STANDARD CALCULATION SHEET**
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 2
SUBJECT: Incidental Ingestion of Soil		CHECKED BY: (5-22-90)	DATE: 5/15/90

Purpose: To evaluate exposures resulting from incidental ingestion of soil

Assumptions: Base personnel come in contact with contaminated soil 12 time/yr for 40 years

A person ingests 10mg soil per event

100% of ingested contaminant is absorbed in gastrointestinal tract.

Relevant Equations:

An average annual dose, for noncarcinogens:

$$(1) \quad IEX. = \frac{C \times IR \times ABS \times EF}{BW \times 365 \times 10^6}$$

where:
- C = Contaminant concentration in soil (mg/kg)
- IR = ingestion rate (mg / event)
- ABS = absorption factor (decimal fraction)
- EF = exposure frequency (events/yr)
- BW = body weight (kg)
- 365 = conversion factor (days/yr)

Determine a time-weighted average lifetime dose for carcinogens:

$$(2) \quad IEX. = \frac{C \times IR \times ABS \times EF \times ED}{BW \times LT \times 365 \times 10^6}$$

where:
- ED = exposure duration (yr)
- LT = lifetime (yr)

NUS 155A REVISED 0285

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 2 OF 2
SUBJECT: Incidental Ingestion of soil		CHECKED BY: AEH (5-22-90)	DATE: 5/15/90

Sample calculations:

Noncarcinogen:

for naphthalene at concentration of 180 µg/kg (Site 1):

$$IEX = \frac{(0.180\ mg/kg)(10\ mg/event)(1)(12\ event/yr)}{(70\ kg)(365\ day/yr)(10^6\ mg/kg)}$$

$$IEX = 5.45 \times 10^{-10}\ mg/kg\text{-}day \checkmark$$

Carcinogen:

for benzene at concentration of 180 µg/kg (Site 2):

$$IEX = \frac{(0.180\ mg/kg)(10\ mg/event)(1)(12\ event/yr)(40\ yr)}{(70\ kg)(365\ day/yr)(10^6\ mg/kg)(70\ yr)}$$

$$IEX = 4.53 \times 10^{-10}\ mg/kg\text{-}day \checkmark$$

NUS 156A REVISED 0285

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: ELLINGTON AFB - SITE 1
LOCATION: HOUSTON, TEXAS
DATE: 05/15/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH PICA INGESTION ARE CONSIDERED.
ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS

REFERENCE: EPA, DECEMBER 1989

RELEVANT EQUATION: (EI = (C x IR x EF x ED)/(BW x LT x 365 x 1E6)

WHERE:
C = MEAN CONCENTRATION IN SOIL SAMPLE (MG/KG)
IR = SOIL INGESTION RATE (MG/EVENT)
EF = EXPOSURE FREQUENCY (EVENTS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

ENTER INPUT PARAMETERS:

ADULT:		YOUTH:	
IR:	10	IR:	0
EF:	12	EF:	0
ED:	40	ED:	0
BW:	70	BW:	0
LT:	70	LT:	0

DETERMINE CONVERSION FACTORS:

ADULT:		YOUTH:	
CF:	4.697e-9 (AVG ANNUAL DOSE)	CF:	0 (AVG ANNUAL DOSE)

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS
CALCULATE DOSES:

CHEMICAL	C (MG/KG)	YOUTH DOSE (MG/KG DAY)	ADULT DOSE (MG/KG/DAY)	TIME-WEIGHTED DOSE (MG/KG/DAY)	RFD (MG/KG/DAY)	CSF (KG-DAY/MG)
Acetone		0	0	0	1e 1	
2-Butanone		0	0	0	5e 2	
Benzene		0	0	0		2.9e 2
Ethylbenzene		0	0	0	1e-1	
Xylenes		0	0	0	2e0	
Styrene		0	0	0	2e1	
Chlorobenzene		0	0	0	2e-2	
Methylene chloride		0	0	0	6e 2	7.5e 3
Butylbenzylphthalate	.29	0	1.362e 9	7.78e-10	2e 1	
Benzo(a)anthracene	2.35	0	1.104e 8	6.307e-9		1.5e 1
Benzo(b)fluoranthene	1.8	0	8.454e-9	4.831e-9		9.2e-1
Benzo(k)fluoranthene	1.85	0	8.689e-9	4.965e 9		7.6e-1
Benzo(a)pyrene	2	0	9.393e-9	5.368e-9		1.15e1
Indeno(1,2,3-cd)pyrene	.93	0	4.368e-9	2.496e-9		2e-1
Naphthalene	.18	0	8.45e-10	4.83e-10	4e 3	
4,4'-DDT	.01	0	4.70e-11	2.68e-11	5e 4	3.4e 1
Arsenic	32.4	0	1.522e 7	8.696e-8	1e 3	
Lead	141	0	6.622e-7	3.784e-7	1.4e 3	
Mercury	.19	0	8.92e-10	5.10e-10	3e 4	
Zinc	180	0	8.454e-7	4.831e-7	2e-1	
		0	0	0		
		0	0	0		
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		0	0	0		
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		0	0	0		
		0	0	0		

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE THREE)
ELLINGTON AFB - SITE 1
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM SURFACE SOIL CONCENTRATIONS
DETERMINE HAZARD INDICES AND CANCER RISK:

CHEMICAL	HAZARD INDEX ADOLESCENT	HAZARD INDEX ADULT	CANCER RISK LIFETIME
Acetone	0	0	0
2-Butanone	0	0	0
Benzene	0	0	0
Ethylbenzene	0	0	0
Xylenes	0	0	0
Styrene	0	0	0
Chlorobenzene	0	0	0
Methylene chloride	0	0	0
Butylbenzylphthalate	0	6.810e-9	0
Benzo(a)anthracene	0	0	9.46e-10
Benzo(b)fluoranthene	0	0	4.444e-9
Benzo(k)fluoranthene	0	0	3.773e-9
Benzo(a)pyrene	0	0	6.173e-8
Indeno(1,2,3-cd)pyrene	0	0	4.99e-10
Naphthalene	0	2.114e-7	0
4,4'-DDT	0	9.593e-8	9.12e-12
Arsenic	0	1.522e-4	0
Lead	0	4.778e-4	0
Mercury	0	2.975e-6	0
Zinc	0	4.227e-6	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
TOTAL	0	6.727e-4	7.140e-8

INCIDENTAL INGESTION OF SOIL

POL STORAGE AREA

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: ELLINGTON AFB - SITE 2
LOCATION: HOUSTON, TEXAS
DATE: 05/15/90

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH PICA INGESTION ARE CONSIDERED.
ASSUMPTIONS ARE OUTLINED BELOW.

EXPOSURE SCENARIO NUMBER 1 - MAXIMUM NEAR-SURFACE CONCENTRATIONS

REFERENCE: EPA, DECEMBER 1989

RELEVANT EQUATION: IEX = (C x IR x EF x ED)/(BW x LT x 365 x 1E6)

WHERE:
C = MEAN CONCENTRATION IN SOIL SAMPLE (MG/KG)
IR = SOIL INGESTION RATE (MG/EVENT)
EF = EXPOSURE FREQUENCY (EVENTS/YEAR)
ED = EXPOSURE DURATION (YEARS)
BW = BODY WEIGHT (KG)
LT = LIFETIME (YEARS)

ENTER INPUT PARAMETERS:

ADULT:		YOUTH:	
IR:	10	IR:	0
EF:	12	EF:	0
ED:	40	ED:	0
BW:	70	BW:	0
LT:	70	LT:	0

DETERMINE CONVERSION FACTORS:

ADULT:
CF: 4.697e-9 (AVG ANNUAL DOSE)

YOUTH:
CF: 0 (AVG ANNUAL DOSE)

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RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM NEAR SURFACE CONCENTRATIONS
CALCULATE DOSES:

CHEMICAL	C (MG/KG)	YOUTH DOSE (MG/KG-DAY)	ADULT DOSE (MG/KG/DAY)	TIME-WEIGHTED DOSE (MG/KG/DAY)	RFD (MG/KG/DAY)	CSF (KG-DAY/MG)
Acetone	.25	0	1.174e-9	6.71e-10	1e-1	
2-Butanone	.041	0	1.93e-10	1.10e-10	5e-2	
Benzene	.18	0	9.45e-10	4.83e-10		2.9e-2
Ethylbenzene	.21	0	9.86e-10	5.64e-10	1e-1	
Xylenes	.24	0	1.127e-9	6.44e-10	2e0	
Styrene		0	0	0	2e1	
Chlorobenzene		0	0	0	2e-2	
Methylene chloride		0	0	0	6e-2	7.5e-3
Butylbenzylphthalate		0	0	0	2e-1	
Benzo(a)anthracene		0	0	0		1.5e-1
Benzo(b)fluoranthene		0	0	0		9.2e-1
Benzo(k)fluoranthene		0	0	0		7.6e-1
Benzo(a)pyrene		0	0	0		1.15e1
Indeno(1,2,3-cd)pyrene		0	0	0		2e-1
Naphthalene		0	0	0	4e-3	
4,4'-DDT		0	0	0	5e-4	3.4e-1
Arsenic		0	0	0	1e-3	
Lead		0	0	0	1.4e-3	
Mercury		0	0	0	3e-4	
Zinc		0	0	0	2e-1	
		0	0	0		
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		0	0	0		
		0	0	0		

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE THREE)
ELLINGTON AFB - SITE 2
EXPOSURE SCENARIO NUMBER 1 - MAXIMUM NEAR SURFACE CONCENTRATIONS
DETERMINE HAZARD INDICES AND CANCER RISK:

CHEMICAL	HAZARD INDEX ADOLESCENT	HAZARD INDEX ADULT	CANCER RISK LIFETIME
Acetone	0	1.174e-8	0
2-Butanone	0	[illegible].851e-9	0
Benzene	0	0	1.40e-11
Ethylbenzene	0	9.863e-9	0
Xylenes	0	5.64e-10	0
Styrene	0	0	0
Chlorobenzene	0	0	0
Methylene chloride	0	0	0
Butylbenzylphthalate	0	0	0
Benzo(a)anthracene	0	0	0
Benzo(b)fluoranthene	0	0	0
Benzo(k)fluoranthene	0	0	0
Benzo(a)pyrene	0	0	0
Indeno(1,2,3-cd)pyrene	0	0	0
Naphthalene	0	0	0
4,4'-DDT	0	0	0
Arsenic	0	0	0
Lead	0	0	0
Mercury	0	0	0
Zinc	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
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	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
TOTAL	0	2.682e-8	1.40e-11

RETARDATION FACTORS

NUS CORPORATION AND SUBSIDIARIES		STANDARD CALCULATION SHEET	
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 1 OF 3
SUBJECT: Contaminant Travel times		CHECKED BY: (5-22-90)	DATE: 5/21/90

Purpose: To determine contaminant travel times to a hypothetical receptor well ~ 1 mile downgradient of either site

Approach:

1. Determine interstitial pore velocity of groundwater

$$V_i = \frac{KI}{n}$$

V_i = interstitial pore velocity of groundwater (ft/day)
K = hydraulic conductivity (ft/day)
I = hydraulic gradient (ft/ft)
n = effective porosity (dimensionless)

2. Determine retardation factors

$$R = 1 + \frac{\rho}{n} f_{oc} K_{oc}$$

R = retardation factor (dimensionless)
ρ = soil bulk density (g/cm^3)
n = porosity
f_{oc} = fractional organic carbon content (g orgcarbon/g soil)
K_{oc} = soil/sediment adsorption coefficient
(μg/g org.carbon / $\mu g/cm^3$ H_2O)

3. Determine contaminant velocity:

$$V_c = V_{gw}/R = V_i/R$$

V_c = contaminant velocity (ft/day)

4. Determine contaminant travel time:

$$t_c = X/V_c$$

t_c = travel time (days)
X = distance to well (feet)

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NUS CORPORATION AND SUBSIDIARIES	STANDARD CALCULATION SHEET

CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 2 OF 3
SUBJECT: Contaminant Travel Times		CHECKED BY: (5-22-90)	DATE: 5/21/90

Sample Calculations:

Assume V_i = 5300 cm/yr

$$5300 \frac{cm}{yr} \left| \frac{yr}{365\,day} \right| \frac{in}{2.54\,cm} \left| \frac{ft}{12\,in} \right. = 0.48\ ft/day$$

Assume foc = 0.01
ρ = 2.7 g/cm^3
n = 0.35

Chemical	Koc (µg / g org carbon / µg/L)
acetone	9.2
2-butanone	17
benzene	65
ethylbenzene	1100
xylenes	248
styrene	417
chlorobenzene	330
methylene chloride	8.8
butylbenzylphthalate	170,000
benzo(a)anthracene	200,000
benzo(b)fluoranthene	550,000
benzo(a)pyrene	550,000
indeno (1,2,3-cd) pyrene	1.6×10^6
napthalene	940
4,4'-DDT	3.9×10^6
benzo	

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ellington AFB	FILE NO.: 363M	BY: AEH	PAGE 3 OF 3
SUBJECT:		CHECKED BY: GH (5-22-90)	DATE: 5/21/90

acetone:

$$R = 1 + \frac{2.7\ g/cm^3}{0.35}\left(\frac{0.01\ g}{g}\right)\left(\frac{9.2\ \mu g/g}{\mu g/cm^3}\right) = 1.7\ \checkmark$$

similarly:

Chemical	R	Contaminant Velocity (ft/day)*
acetone	1.7	0.28
2-butanone	2.3	0.21
benzene	6.0	0.08
ethylbenzene	86	5.6×10^{-3}
xylenes	20	2.4×10^{-2}
styrene	33	1.4×10^{-2}
chlorobenzene	26	1.8×10^{-2}
methylene chloride	1.7	0.28
butylbenzylphthalate	13100	3.7×10^{-5}
benzo(a)anthracene	15400	3.1×10^{-5}
benzo(b)fluoranthene	42400	1.1×10^{-5}
benzo(a)pyrene	42400	1.1×10^{-5}
indeno(1,2,3-cd) pyrene	123,000	3.9×10^{-6}
naphthalene	74	6.5×10^{-3}
4,4'-DDT	301,000	1.6×10^{-6}

* contaminant velocity = V_i / R

The distance to a receptor well is ~1 mile (5280 ft)

$t_{acetone}$ = 5280 ft / 0.28 ft/day = 18,857 days

> 52 yr. ✓

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APPENDIX G

REGULATORY AGENCY CORRESPONDENCE
REGARDING
ELLINGTON FIELD (ANG)
SITE INVESTIGATION

- MINUTES FOR REGULATORY REVIEW MEETING
- NGB REQUEST FOR COMMENTS

MEETING MINUTES
DRAFT SITE INVESTIGATION REPORT REGULATORY REVIEW MEETING
147TH FIGHTER INTERCEPTOR GROUP
TEXAS AIR NATIONAL GUARD
ELLINGTON FIELD
HOUSTON, TEXAS

DATE OF MEETING: October 3, 1990

PLACE OF MEETING: Ellington Field, Houston, Texas

Persons attending:

Name	Affiliation	Telephone
Bob Allen	Harris County Poll. Cont.	(713) 920-2831
Larry Basilio	NUS Corporation	(713) 492-1888
Steve Fleming	HAZWRAP	(615) 435-3254
Shanon Goldberg	HAZWRAP	(615) 435-3310
Maj. Sheila F. Hooten	147 CES, Ellington	(713) 929-2781
Amy Hubbard	NUS Corporation	(412) 788-1080
Paul R. Nelson	City of Houston (Utilities)	(713) 525-9855
Col. Tom Shellshear	147 FIG/DCS	(713) 929-2403
Linda Steakley	NUS Corporation	(713) 492-1888
Don Williams	NGB/DEVR	(301) 981-8159

Morning Meeting/Site Tour

On Wednesday, October 3, 1990, a meeting was held among ANG, HAZWRAP, NUS and regulatory agency personnel. Mr. Williams, of the NGB, provided a brief overview of the purpose of the meeting, which was to review comments received from regulatory agency personnel and to discuss the scope of work for determining the extent of contamination at the POL site. Ms. L. Steakley, of NUS Corporation, was introduced. Ms. Steakley summarized the results and recommendations of the Site Investigation (SI) and reviewed the proposed Remedial Investigation (RI) work to be performed at the POL site. A discussion ensued concerning the recommendation to prepare a Decision Document (DD) proposing no further action at the landfill, as well as proper abandonment of existing ground-water monitor wells. The fate of one UST remaining at the landfill was also discussed.

An RI of the POL site was proposed to further investigate the extent of contamination discovered during the SI. Items outlined were:

- The schedule for remediation activities
- The criteria under which the site would be remediated
- Community Relations Plan (CRP)
- The role of regulatory agency review of documents

A DD will be written for the Fuel System Repair Shop (FSRS) and the Former Base Landfill by NUS.

NUS' management of disposal of containerized materials generated during the SI was discussed.

A site tour of the POL site was conducted by Major S. Hooten. Major Hooten answered questions concerning the historical account of activities at the site.

Afternoon Meeting

In the afternoon session, representatives of ANG, HAZWRAP, and NUS met to discuss, in general terms, the scope of work necessary to define the extent of contamination at the POL site. After significant open discussion and brainstorming about how to most appropriately define the extent of contamination at the POL site, the eight tasks indicated below were tentatively agreed upon. These tasks were developed assuming the site will be remediated in accordance with the UST program cleanup guidelines instead of the CERCLA/IRP criteria. Refer to Attachment 1, POL Site Map, for the general location of proposed wells and borings.

1. Place two monitor wells on the eastern edge of the POL to determine if offsite migration has occurred.

2. Two soil borings will be placed near the east fuel standpipes.

3. One soil boring will be placed in the center of the former cul-de-sac.

4. Five soil borings will be placed around the rail track to determine the extent of contamination on the north, west, and south boundaries, which occurred during tank car loading and unloading operations.

5. Up to three soil samples will be collected from each boring. One at the top of ground water and up to two more, based on field evidence of contamination.

6. Soil samples will be analyzed for TPH. If concentrations are less than 100 ppm, BTEX will also be run on that sample.

7. Monitor well and east fuel stand borings sample analysis will be done on 24-hour or 48-hour turnaround, if possible.

8. If perimeter samples (indicated by * on Attachment 1) are clean, then the RI will continue with interior borings to define extent of rail track contamination. If perimeter samples indicate contamination, another meeting will be held to determine further action.

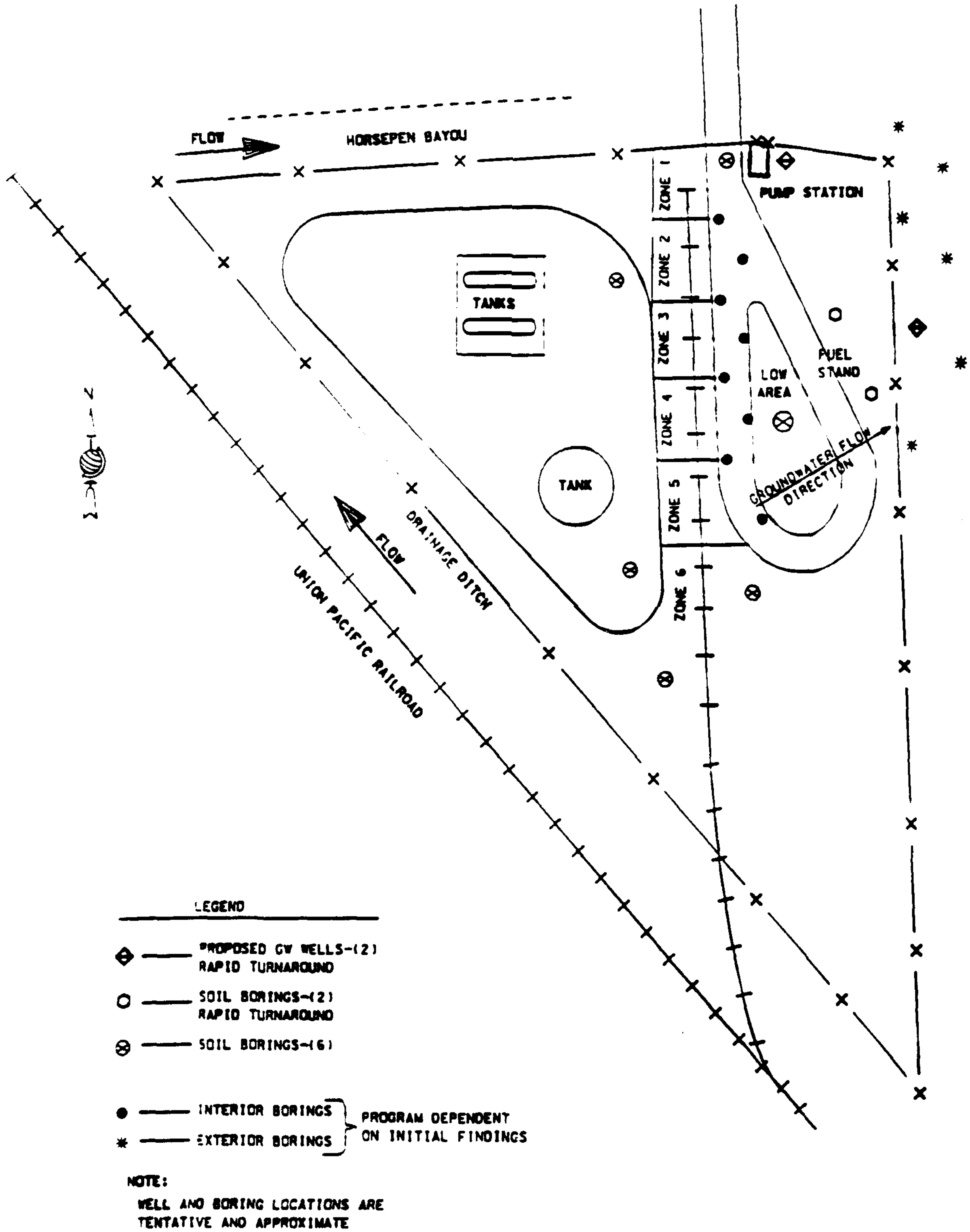
The following items were also outlined:

- Deliverables to be attached to the final SI report
- Distribution of meeting minutes
- Draft RI work plan schedule

Submitted by:

Linda G. Steakley
NUS Corporation

ATTACHMENT 1



DRAWN BY	J. ATKINSON	FIGURE POL STORAGE AREA ELLINGTON FIELD (ANG) HOUSTON, TEXAS	NUS CORPORATION A Halliburton Company
DATE:	OCTOBER 1990		
GEOLOGIST:	L. BASILIO		
DATE:	OCTOBER 1990		
CAD DWG. NO.	3630[illegible].DGN	SCALE: 1" = 80'	NUS DWG. NO. 3630-GA11	REV. 0	

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NUS CORPORATION
HOUSTON, TEXAS

13 NOV 1990

Ms. Susan Bredehoeft
Texas Water Commission
5144 East Sam Houston Parkway North
Houston, Texas 77015

Dear Ms. Bredehoeft

A regulatory review meeting was held at the 147th Fighter Interceptor Group, Ellington Field, Houston on October 3, 1990 to receive comments on the Site Investigation Report and to scope additional activities necessary for remedial investigation at the POL storage area. Representatives from your office, the Texas Air Control Board, Texas Department of Health, and the Harris County Pollution Control Department were invited to attend. Minutes of the meeting are attached for your use.

The purpose of this letter is to summarize proposed actions for the disposition of each site prior to finalizing the SI report.

Results of soil and groundwater sampling and a preliminary risk assessment at the Former Base Landfill concluded that no significant risks to human health exist as a result of minor contamination at this site. A no further action Decision Document will be prepared for site closure. In addition, the monitoring wells will be abandoned according to TWC procedures and a deed restriction will be recorded. Master plan documents will clearly indicate future use of this site as open space.

Results of soil sampling at the POL Storage Area indicated total petroleum hydrocarbon (TPH) contamination in soils of concentrations which exceed TWC clean closure criteria. The extent of contamination is not known. No contaminants were detected in groundwater that exceed Maximum Contaminant Levels or Drinking Water Health Advisories. A preliminary risk assessment concluded that no significant risks to human health exist at this site. The NGB will continue investigation of soils and remediate, if necessary, according to cleanup criteria stated in the "Guidance Manual for LPST Cleanups in Texas, Texas Water Commission, Petroleum Storage Tank Division, January 1990". Results of findings from additional field work will be evaluated to determine whether cleanup will be required.

The Preliminary Assessment (Records Search) identified a third site near the Fuel System Repair Shop. Additional information has been obtained regarding the spill incident to provide sufficient rationale to close out the site via Decision Document.

During the conduct of field work, several drums of SI derived waste were stored pending results of sample analyses. These wastes will be managed in accordance with SI report Section 2.1.8.

Please coordinate your review with a representative from the Petroleum Storage Tank Division and provide us with your written comments as soon as possible so that we can finalize the SI report.

If you have any questions, please call Mr. Don Williams, NGB Project Manager, at (301) 981-8159.

Sincerely

RONALD M. WATSON, Chief
Environmental Division

cc: Mr. Steve Fleming/HAZWRAP
Ms. Linda Steakely/NUS Houston
Maj Sheila Hooten/147FIG/DE
Mr. Bob Allen/Harris County