



# THE MEMPHIS DEPOT TENNESSEE

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## ADMINISTRATIVE RECORD COVER SHEET

AR File Number 281

# *DEFENSE DEPOT MEMPHIS*

## **DUNN FIELD GEOPHYSICAL SURVEY WORK**

**January-February 1998**



*OHM Corporation*



**received**  
FEB 9 1998**OHM Remediation  
Services Corp.**  
A Subsidiary of OHM Corporation

# TECHNICAL MEMORANDUM

*5445 Triangle Parkway, Suite 400, Norcross, Georgia**OHM Project No. 20022*

**To:** John W. Rollyson, P.E., Area Engineer  
USACE/Tennessee Area Office

**From:** Stephen Offner, P.G., OHM/Norcross

**PC:** Dorothy Richards, USACE/Huntsville  
Dana Conkin, USACE/Tennessee Area Office  
Angelo Liberatore, OHM/Norcross

Glenn L. Kaden, DDMT  
John Lore, OHM/Norcross

**Re:** Results of the Geophysical Investigation  
Dunn Field, Defense Depot, Memphis, Tennessee  
Contract No. DACA45-96-D-0014  
Delivery Order No. 0007

**Date:** January 6, 1998

On December 18 and 19, 1997, OHM's subcontractor, NAEVA Geophysics, Inc. of Charlottesville, Virginia, conducted an EM-31 and EM-61 geophysical investigation at Dunn Field, DDMT. This investigation was conducted in accordance with the scope of work outlined in the OHM letter to the USACE, dated December 10, 1997.

The area of investigation is a corridor approximately 1450 feet long by 50 feet wide along the northwest portion of the site, where OHM will be performing intrusive activities associated with the installation of the interim groundwater remediation system. This corridor corresponds to the western and northern boundaries of Area II identified in the Archives Search Report (ASR), dated January 1995. A copy of the Figure 11 from the ASR which details the Dunn Field disposal and storage sites is included as *Attachment A*. The purpose of the investigation was to identify unexplained subsurface geophysical anomalies that could potentially represent covered pits/trenches and/or burial sites within the referenced area.

Two separate grid areas (identified as Area 1 and Area 2) were established to investigate the referenced area. Area 1 is located along the northwestern boundary of the northwest portion of Dunn Field. Area 2 is located along the western boundary of the northwestern portion of the site. The report of the investigation findings, as prepared by NAEVA, is included as *Attachment B*. The report includes the technical approach, methodologies used, QA/QC procedures, survey results and conclusions, and supporting graphics.

According to the findings, there were multiple unexplained anomalies in Area 1 that appear to fall in close proximity to the proposed pipeline trench. These anomalies appear in a contiguous area from the proposed location of soil boring SB-013 (NAEVA station 100N) to the approximate midway location between proposed boring SB-015 and SB-016 (NAEVA station 350N). This area is approximately 250 feet in length (see Attachment B).

In Area 2, there are unexplained anomalies located on or near the proposed pipeline trench, that appear to resemble a former trench feature that has been filled with moderate amounts of buried metal. This area of concern in Area 2 begins near the midway point between proposed boring locations SB-005 and SB-006 (NAEVA station 260N) and continuous through the location of proposed boring SB-008 (NAEVA station 500N). This area of concern appears to correspond with the location of burial site no. 12 (see Attachment A) identified in the ASR as being the disposal site of sulphuric/hydrochloric acid in 1967. In addition, there are isolated, smaller anomalies located near the proposed pipeline trench from NAEVA station 510N through 620N (see Attachment B).

In conclusion, there are unexplained subsurface anomalies located in the area of the proposed pipeline trench and groundwater recovery wells. Based on this information, an addendum to the Site Specific Health and Safety Plan is forthcoming from OHM addressing intrusive work in the identified areas of the subsurface anomalies.

# ATTACHMENT A

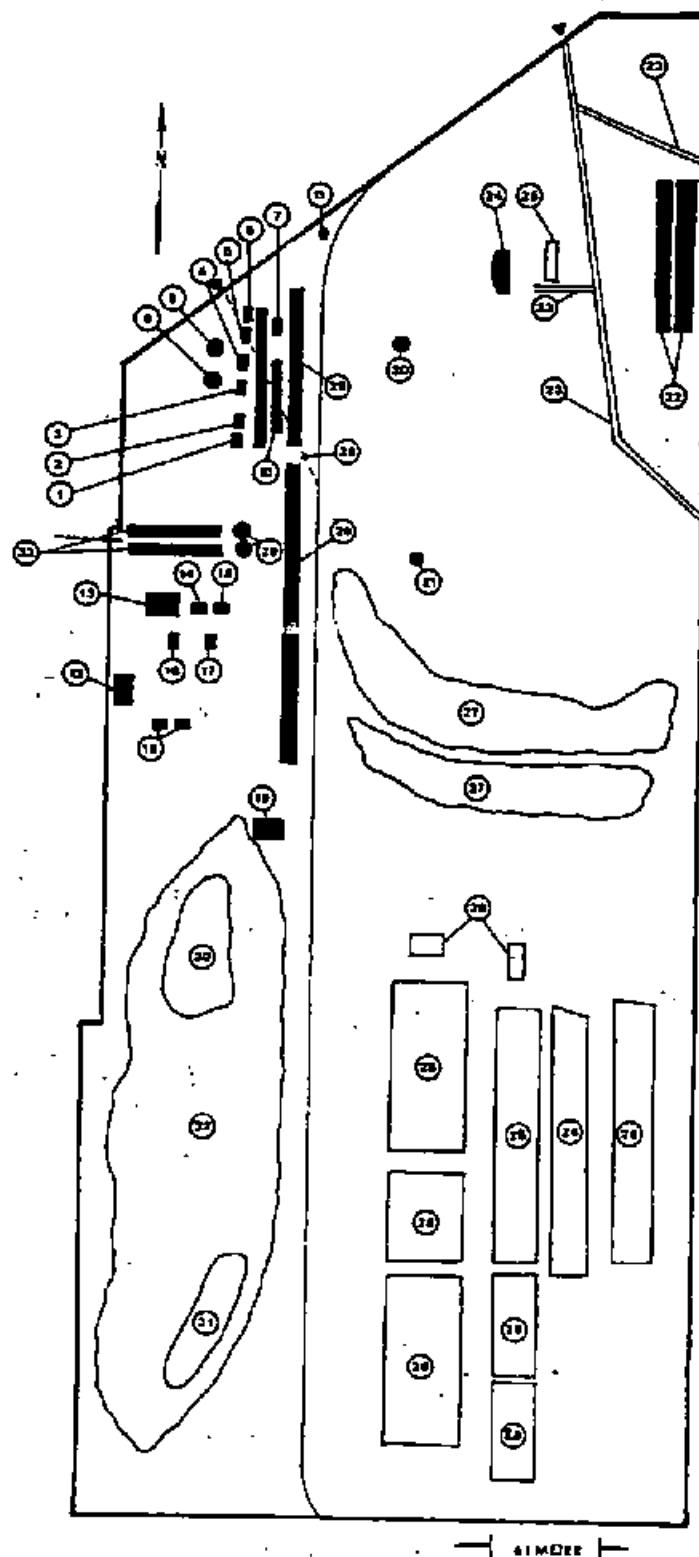


Fig. 11 Dunn Field Disposal and Storage Sites  
(See Table 7 for Descriptions of Sites)

THAMA-G.1/VTB2-7.1

5/5/82

Table 7. Description of Dunn Field Disposal and Storage Sites  
(Locations of Sites are Shown on Fig. 11)

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Location

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Burial Sites

- |    |   |
|----|---|
| 1  | Training sets, nine each, mustard and Lewisite, 1955  |
| 2  | 7 pounds (lbs) ammonium hydroxide, 1 gal glacial acetic acid, 1955                                      |
| 3  | 3,000 quarts (qt) chemicals, 5 cubic feet (ft <sup>3</sup> ) ortho-tolidine dihydrochloride, 1955       |
| 4  | Thirteen 55-gal drums oil, grease, and paint, date unknown  |
| 5  | Thirty-two 55-gal drums oil, grease, and thinner, 1955  |
| 6  | 3 ft <sup>3</sup> methyl bromide, 1955  |
| 7  | 40,037 units ointment (eye), 1955   |
| 8  | 1,700 bottles fuming nitric acid, 1954  |
| 9  | 3,768 1-gal cans methyl bromide, 1954   |
| 10 | Ashes and metal refuse from burning pit, 1955   |
| 11 | 1,433 1-ounce (oz) bottles trichloroacetic acid, 1965   |
| 12 | Sulphuric/hydrochloric acids, 1967  |
| 13 | 32 cubic yards mixed chemicals and acid, 900 lbs detergent, 7,000 lbs aluminum sulphate, 200 lbs sodium |
| 14 | Sodium, 1968  |
| 15 | Sodium phosphate, 1968  |
| 16 | Acid, 1969  |
| 17 | Herbicide, cleaning compound, medical supplies, 1969  |
| 18 | Acid, date unknown  |
| 19 | Hardware (nuts and bolts)   |
| 22 | XXCC3 impregnite  |
| 29 | Food supplies   |
| 30 | Burial site prior to bauxite storage; foods, construction debris burned; 1948                           |
| 33 | 14 burial pits containing sodium phosphate, sodium, acid, medical supplies, chlorinated lime; 1970      |

Burn Sites

- |    |  |
|----|--|
| 21 | Sanitary waste, smoke pots, CN canisters |
| 31 | Old burn area, 1946                      |

Table 7. Description of Dunn Field Disposal and Storage Sites  
(Locations of Sites are Shown on Fig. 11)  
(Continued, Page 2 of 2)

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Location

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Storage Sites

25	Pesticide storage
27	Bauxite
28	Fluorspar
32	Bauxite, 1942-72

Other Sites

20	Asphalt dump
23	Open drain ditches
24	Pistol range
26	Buried drainpipe

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# ATTACHMENT B

### Subsurface Geophysical Surveys

GPR  
MAGNETICS  
ELECTROMAGNETICS  
SEISMICS  
RESISTIVITY  
UTILITY LOCATION  
BOREHOLE LOGGING  
BOREHOLE CAMERA  
STAFF SUPPORT

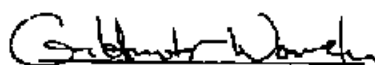
## Results of Geophysical Investigation

**Memphis Defense Depot**  
**Memphis, Tennessee**

Prepared for: **OHM Remediation Services Corp.**  
**Norcross, Georgia**

Dates of Investigation: December 18-19, 1997

Prepared by:



G. Hunter Ware  
Senior Geophysicist



Doug Lam  
Geologist

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Figure 8	Area 2 EM-61 Bottom Coil Contour Map

Appendix A Area 1 Repeated Lines

Appendix B Area 2 Repeated Lines

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## MEMPHIS DEFENSE DEPOT MEMPHIS, TENNESSEE

### Introduction

OHM Remediation Services Corp. contracted NAEVA Geophysics to conduct a geophysical investigation at the Memphis Defense Depot in Memphis, Tennessee. The area of investigation was a corridor approximately 1400 feet by 50 feet in the Northwest corner of the Depot, where a proposed pipeline is to be buried. The objectives of the investigation were to identify geophysical anomalies that could represent covered pits, trenches, or burial sites.

The area of investigation is bordered on the north and west sides by a chain-link fence and to the northeast by a single track railroad spur. Power poles with overhead electric ran parallel to the fencelines and two larger high tension towers crossed the southernmost portion of the western area. Numerous steel monitor wells were located within the survey area.

Field work was conducted on December 18<sup>th</sup> and 19<sup>th</sup>, 1997. Site orientation and discussions with Steve Offner concerning survey boundaries, line spacing and cultural features took place the morning of the 18<sup>th</sup>. That morning and afternoon, lines were established and marked across the area, and a grid/culture map was prepared. Geophysical surveying with the EM-31 was conducted during 18<sup>th</sup> and 19<sup>th</sup>, while surveying with the EM-61 was conducted on the 19<sup>th</sup>.

### Survey Grid

Two separate grids (Area 1 and Area 2) were established to investigate the proposed trench line (Figures 1 and 5). Area 1 is the northern-most grid with survey lines oriented in a northeast direction corresponding to the bearing of the proposed trench line in this area. Coordinates 100E + 100N were established to correspond with the wooden stake labeled "PIN" marking the principle turning point of the proposed trench. Line 100E was run coincident with the center line of the trench. Control stations were marked with pin flags at 100 foot intervals and with paint at 50 foot intervals along lines spaced 10 feet apart.

Area 2 was the southern-most grid, with survey lines oriented in an approximate north direction. Lines were established at 10 foot spacings, with control stations marked at 50 foot

south of the high voltage power line) to 1000N (10 feet north of the "PIN" at principle bend in the proposed trenchline). Line 100E of Area 2 follows wooden stakes spaced 100 feet apart along the proposed trench to approximately 625N, where the proposed trench takes a small deviation to the west.

### Methods

Non-intrusive surveys of the AOC were conducted utilizing a Geonics EM-31 and EM-61. The Geonics EM-31 is an electromagnetic frequency domain instrument primarily used to measure ground conductivity. Anomalous changes in conductivity could represent areas containing buried waste. The Geonics EM-61 is an electromagnetic instrument designed to detect shallow ferrous and non-ferrous metallic objects with good spacial resolution. EM-61 anomalies could represent metal objects incorporated within buried waste materials.

The EM-31 measures the quadrature (conductivity) and in-phase components of the induced electromagnetic field, which are recorded simultaneously. The quadrature is a measure of electrical conductivity, expressed in units of milliSiemens/meter. Electrical conductivity in this case is a function of permeability, conductivity of included soil moisture, degree of saturation and compaction, and subsurface material type. While absolute values of terrain conductivity are not usually diagnostic, their spatial variations are important in identifying areas containing foreign material or disturbed material. The in-phase component is primarily used to detect buried metal, using relative units of parts per thousand (ppt). A negative response is most commonly expected over areas containing shallow buried metal debris although a positive response can be exhibited. The EM-31 was operated in vertical dipole mode, with readings collected at 5-foot intervals along lines spaced 5 feet apart. Fiducial markers were tied to the data at control stations to accurately locate the data along lines.

The EM-61 system is a time domain metal detector with very high sensitivity and resolution much greater than the EM-31. The system consists of two air-cored coils, each 1 meter in diameter. Secondary voltages induced in both coils are measured in millivolts. The coils are arranged so that the larger coil (EM source and receiver) lies 40 cm below the second receiver coil. Because the upper coil is less sensitive than the lower coil, only the lower coil data was used for this investigation. The system was operated in the wheel mode, where

distance along profiles is recorded by an internal odometer markers were also entered into the data at control stations to further ensure accuracy. Data was collected every 0.67 feet along lines spaced 5 feet apart.

### Geophysical Data Processing

Data collected with the EM-31/61 were transferred from the palmtop computer and polycorder to a laptop PC for processing with Geonics Dat 31/61 software. Data were reviewed initially as profiles, where distances were adjusted to fiducial marks, and then prepared for contouring using Golden's Surfer program. Contour maps were created using a variety of contour intervals to determine the most effective presentation. For the EM-31, a contour interval of 5 milliSiemens/meter (mS/m) was selected for the quadrature data, providing good definition of detected features. An interval of 2 parts per thousand (ppt) was selected to present in-phase data. A contour interval of 5 millivolts (mV) was selected for the EM-61 data to show all significant features while staying above the noise level.

### Quality Assurance/Quality Control

Calibration checks of the geophysical instruments were performed each morning before initiation of surveying in an area free of cultural interference. For the EM-31, calibration was done in accordance with the manufacturers recommendations. Repeats of line 110E in Area 1 and line 100E in Area 2 were run and plotted in profile and are provided in Appendices A and B.

Initial calibration of the EM-61 on the morning of the 18<sup>th</sup> revealed a problem with background levels of the bottom coil. Additionally, a test run over a 12 lb. iron sphere failed to show the expected response. The survey was suspended until another instrument could be delivered to the site the following day. The replacement EM-61 was checked for calibration on the morning of the 19<sup>th</sup> and showed proper background zeroing and response over the test object. Repeats of a portion of line 100E in Area 1 and line 105E in Area 2 were measured and are provided in Appendix A and B.

## Survey Results

### Area 1

The EM-31 conductivity and in-phase data (Figures 2 and 3) defined several anomalies that cannot be explained by cultural features. One such anomaly, most outstanding in the conductivity data, is centered at 110E + 285N and fall close to the proposed trench line. The remainder of the unexplained anomalies are small and are located off the proposed trench line. No larger features that could represent trenches or pits are evident in the data.

The EM-31 data clearly shows evidence of several cultural features such as the fenceline along the north side of the area, a railroad spur, monitor wells, and a concrete pipeline crossing at approximately 230N. Refer to Figure 1 for identification of all known cultural features.

The EM-61 data (Figure 4) shows significantly large areas of buried metal. There are two areas within the south half of the survey block of elevated response in the EM-61 data that are poorly resolved or not evident in the EM-31 data. The first area is located on lines 110E to 140E between stations 120N and 220N. The second area is located on lines 100E to 140E between stations 270N and 350N. Because there is poor correlation in these areas between the EM-61 and the EM-31, it is reasoned that these areas may be characterized by small shallow buried metallic objects. The majority of the buried metal appears to be to the southeast, or off of the proposed pipeline.

The northeastern half of the survey area appears to be much cleaner with only a few small scattered anomalies. Two of the larger anomalies that are proximal to the trench line are centered at 105E + 380N and at 95E + 590N. All of the cultural features mentioned in the EM-31 data are also clearly evident in the EM-61 data.

### Area 2

The EM-31 conductivity and in-phase data (Figures 6 and 7) identified two outstanding anomalies that cannot be explained. The first anomaly is evident on lines 120E to 140E from stations 260N to 310N. The second and largest anomaly was resolved on lines 80E to 110E from stations 280N to 500N. This feature looks suspiciously like a trench filled with moderate amounts of buried metal.

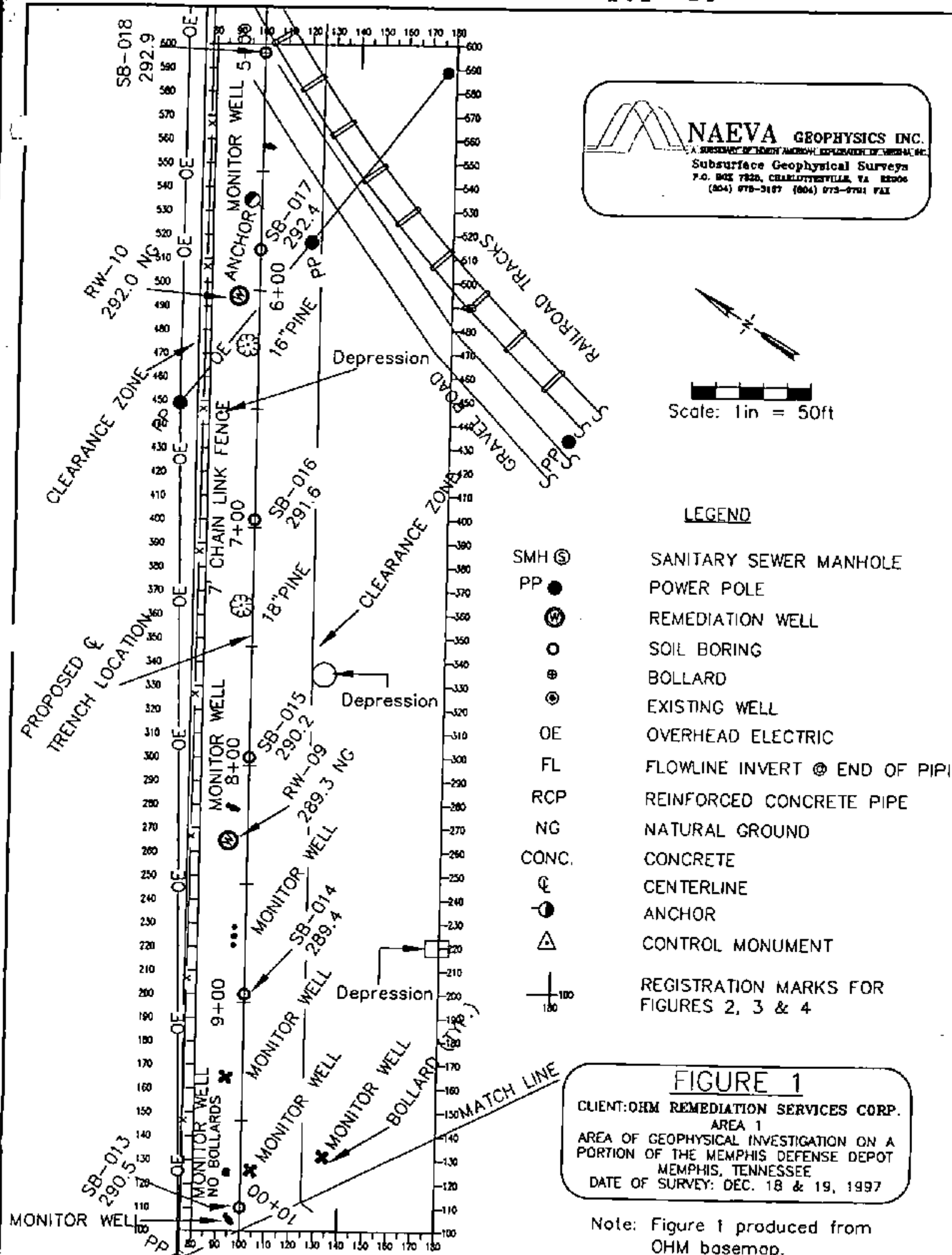
EM-31 conductivity data (Figure 6) shows several cultural features such as the fenceline and the powerline towers. On line 140E from stations 340N to 450N several small alternating highs and lows in the data are due to periodic high frequency noise. The source of this noise is unknown but may be related to high voltage powerlines in the vicinity.

The EM-61 data (Figure 8), as with the EM-31 data, clearly defined the trench-like feature discussed above. The other outstanding anomaly mentioned in the EM-31 data was not defined with the EM-61 as it falls just outside the limits of the data. There are several discrete anomalies, defined with the EM-61 data, that are evidence of buried metallic objects, and that were not defined in the EM-31 data. Again, several cultural features are apparent in the contoured data, particularly the monitor wells.

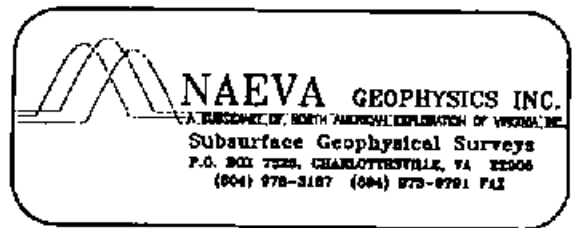
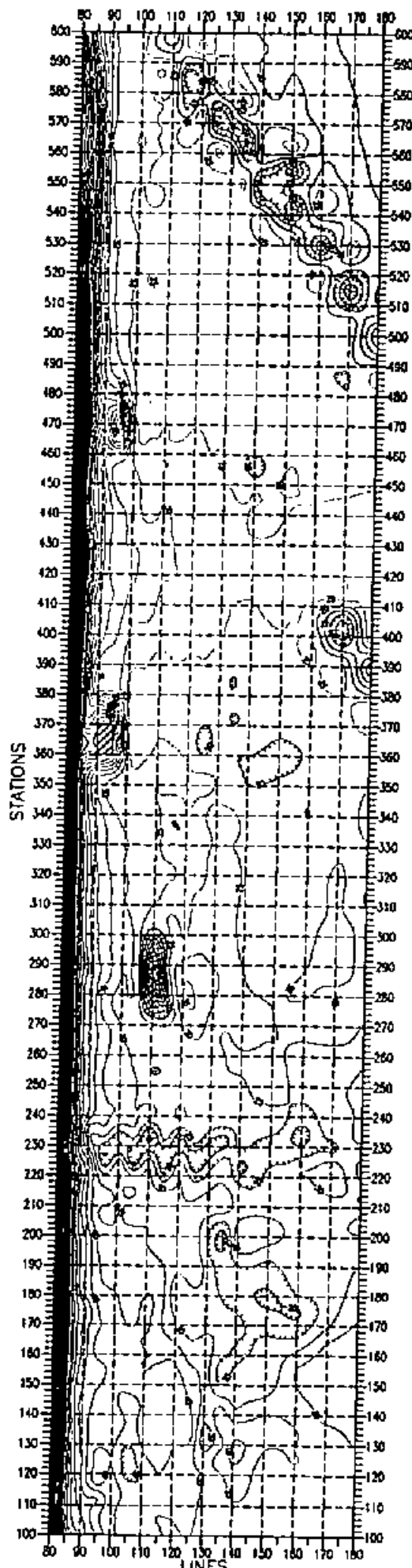
### Conclusion

There are multiple targets in Area 1 that fall along the proposed pipeline path. Although no large trench-like feature was defined, smaller anomalies may need to be considered as potential areas of concern.

In Area 2, a large trench-like anomaly is defined in both the EM-61 and EM-31 data and can be considered likely to contain buried metallic objects. As in Area 1, there are multiple targets that fall along the proposed pipeline path that may potentially interfere with excavations. It should be noted that the proposed scope of work was to define relatively large areas of buried metal objects not small discrete objects and that the line spacing used for this survey (5 feet) is inadequate to resolve all small discrete objects, which are clearly present.








CONTOUR INTERVAL: 5 mS/m

Range	Color
< 0	Cyan
0 - 20	Blue
25 - 70	Green
75 - 120	Red
> 120	Magenta

Legend

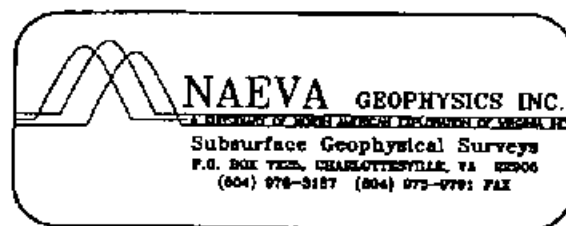
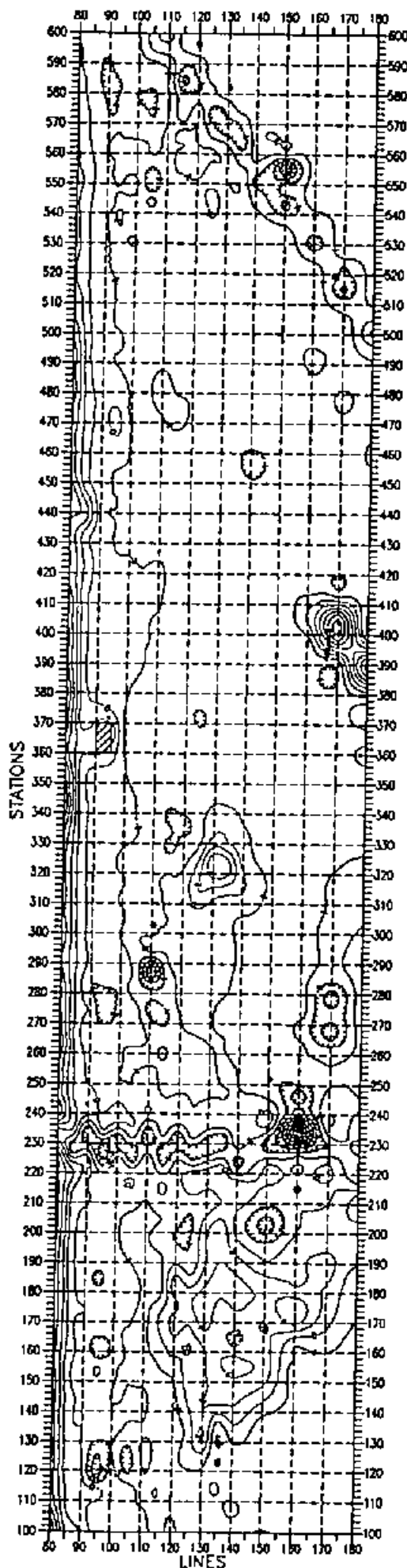
 Not Surveyed



Scale: 1in = 50ft

**FIGURE 2**


CLIENT: OHM REMEDIATION SERVICES CORP.  
 AREA 1  
 EM-31 TERRAIN CONDUCTIVITY CONTOURS  
 MEMPHIS DEFENSE DEPOT  
 MEMPHIS, TENNESSEE  
 DATE OF SURVEY: DEC. 18 & 19, 1997

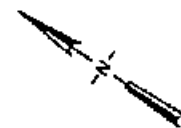


CONTOUR INTERVAL: 2 ppt

Range	Color
< 0	Blue
0 - 4	Green
> 4	Red

Legend

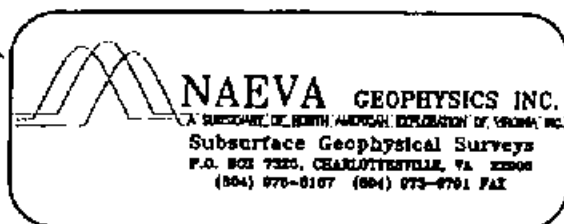
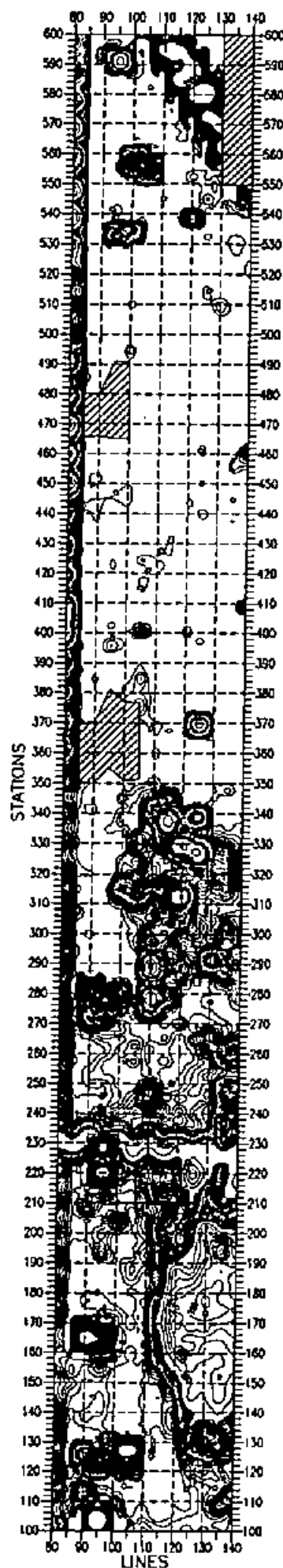
 Not Surveyed



Scale: 1 in = 50 ft


**FIGURE 3**

CLIENT: OHM REMEDIATION SERVICES CORP.  
 AREA 1  
 EM-31 INPHASE CONTOURS  
 MEMPHIS DEFENSE DEPOT  
 MEMPHIS, TENNESSEE  
 DATE OF SURVEY: DEC. 18 & 19, 1997



Range (mS/m)	Contour Interval (mS/m)	Color
0 - 45	5	Blue
50 - 95	5	Green
100 - 145	5	Red
> 145	100	Magenta

#### Legend

 Not Surveyed



Scale: 1in = 50ft

#### FIGURE 4

CLIENT: OHM REMEDIATION SERVICES CORP.  
 AREA 1  
 EM-61 BOTTOM COIL DATA CONTOURS  
 MEMPHIS DEFENSE DEPOT  
 MEMPHIS, TENNESSEE  
 DATE OF SURVEY: DEC. 18 & 19, 1997

## LEGEND

SMH (S)	SANITARY SEWER MANHOLE
PP	POWER POLE
(W)	REMEDIATION WELL
(O)	SOIL BORING
(+)	BOLLARD
(O)	EXISTING WELL
OE	OVERHEAD ELECTRIC
FL	FLOWLINE INVERT @ END OF
RCP	REINFORCED CONCRETE PIPE
NG	NATURAL GROUND
CONC.	CONCRETE
(C)	CENTERLINE
(A)	ANCHOR
(Δ)	CONTROL MONUMENT
REGISTRATION MARKS FOR FIGURES 6, 7 & 8	

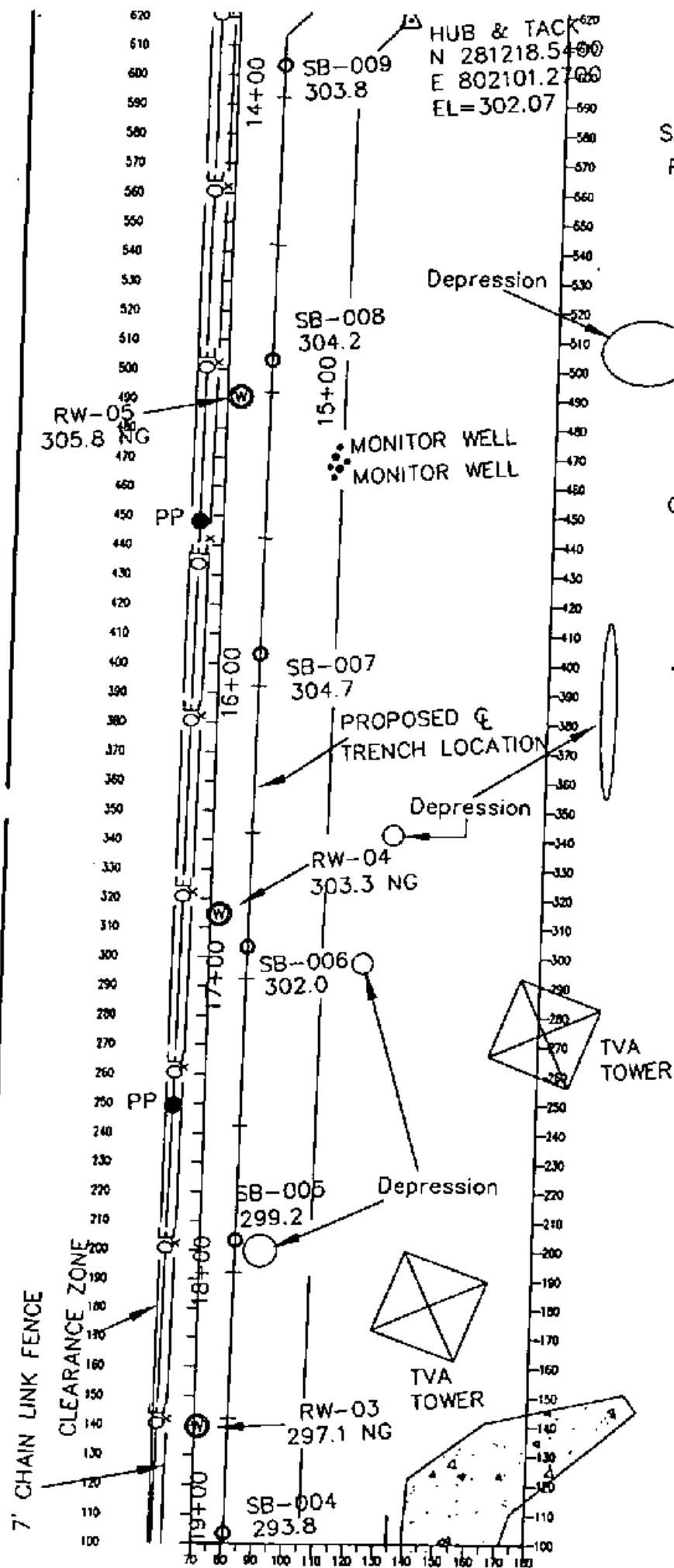
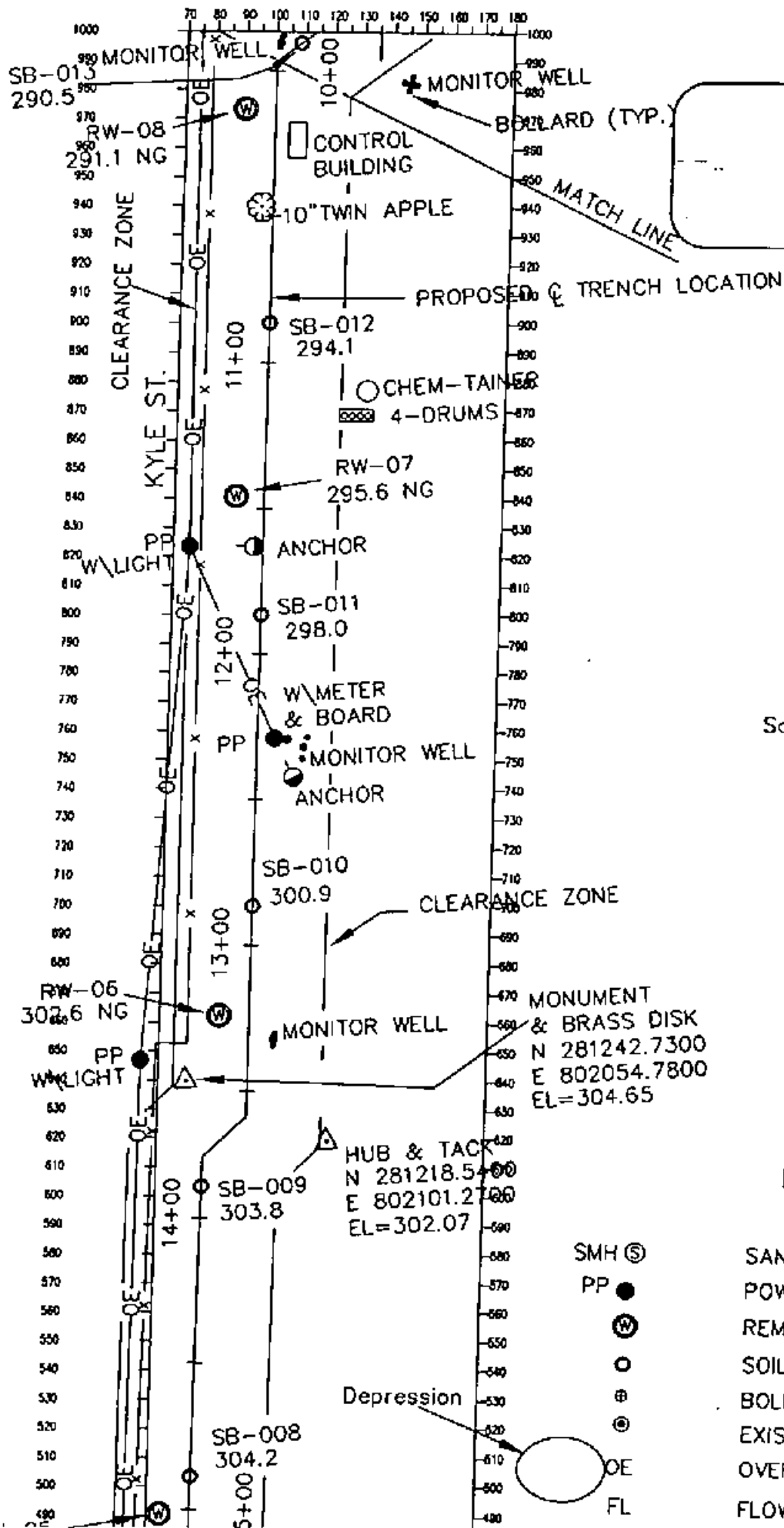


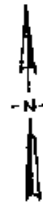
FIGURE 5

CLIENT: OHM REMEDIATION SERVICES CORP.  
 AREA 2  
 AREA OF GEOPHYSICAL INVESTIGATION ON A  
 PORTION OF THE MEMPHIS DEFENSE DEPOT  
 MEMPHIS, TENNESSEE  
 DATE OF SURVEY: DEC. 18 & 19, 1997

Note: Figure 5 produced from  
 OHM basemap.



**NAEVA GEOPHYSICS INC.**  
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Subsurface Geophysical Surveys  
P.O. BOX 7825, CHARLOTTESVILLE, VA 22908  
(804) 578-3187 (804) 975-8791 FAX



Scale: 1 in = 50 ft

LEGEND

- |         |                            |
|---------|----------------------------|
| SMH (S) | SANITARY SEWER MANHOLE     |
| PP (●)  | POWER POLE                 |
| (W)     | REMEDIAION WELL            |
| (○)     | SOIL BORING                |
| (⊕)     | BOLLARD                    |
| (⊙)     | EXISTING WELL              |
| OE (○)  | OVERHEAD ELECTRIC          |
| FL (—)  | FLOWLINE INVERT @ END OF P |

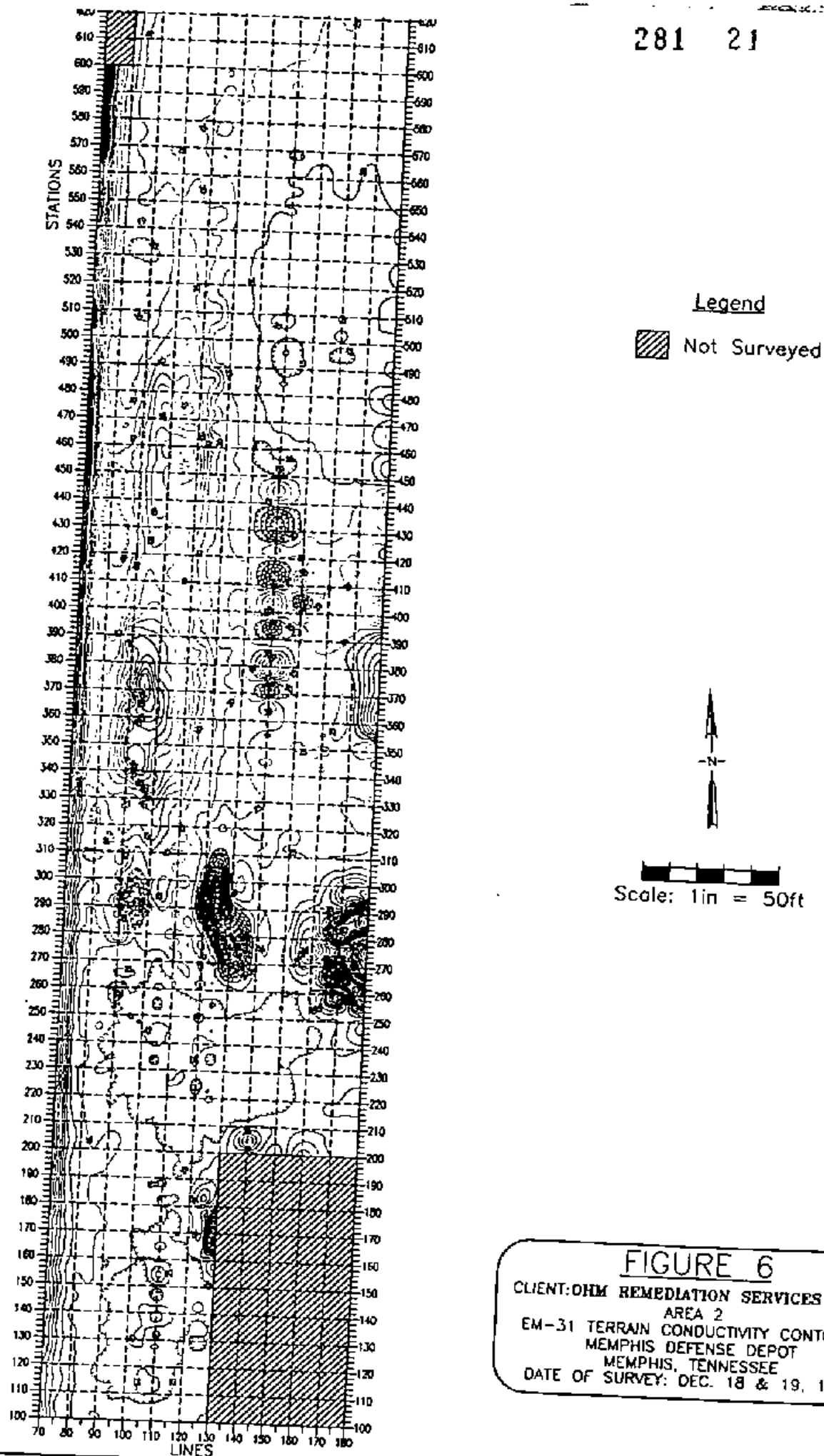
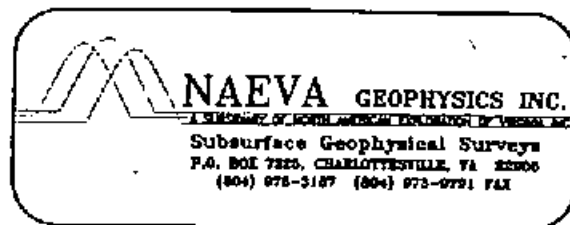
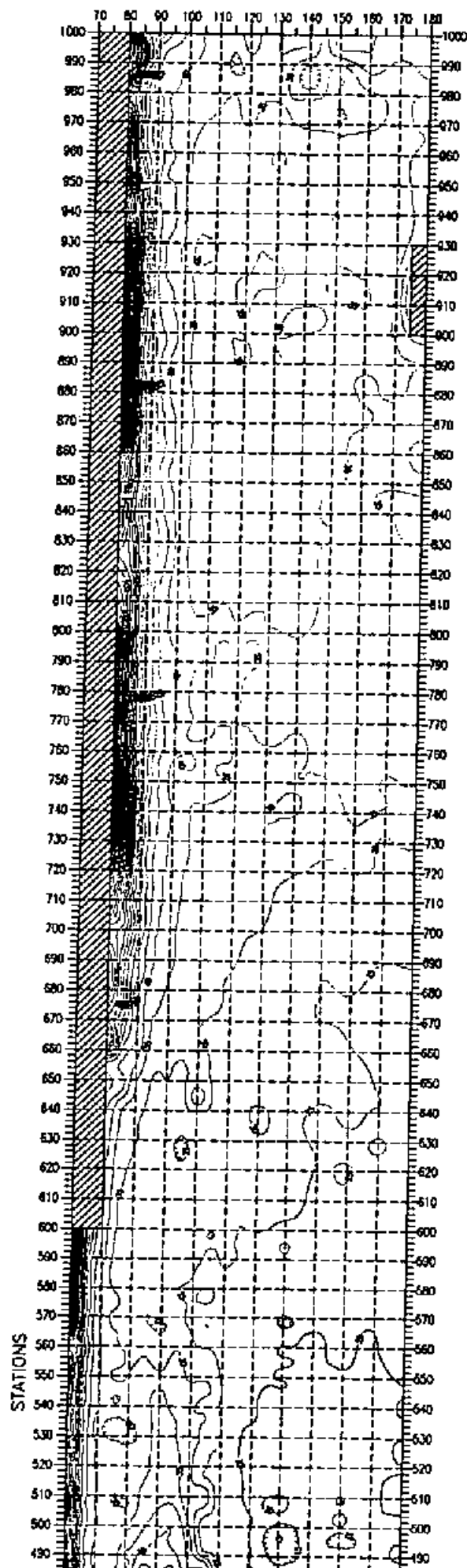


FIGURE 6


CLIENT: OHM REMEDIATION SERVICES CORP.  
AREA 2  
EM-31 TERRAIN CONDUCTIVITY CONTOURS  
MEMPHIS DEFENSE DEPOT  
MEMPHIS, TENNESSEE  
DATE OF SURVEY: DEC. 18 & 19, 1997

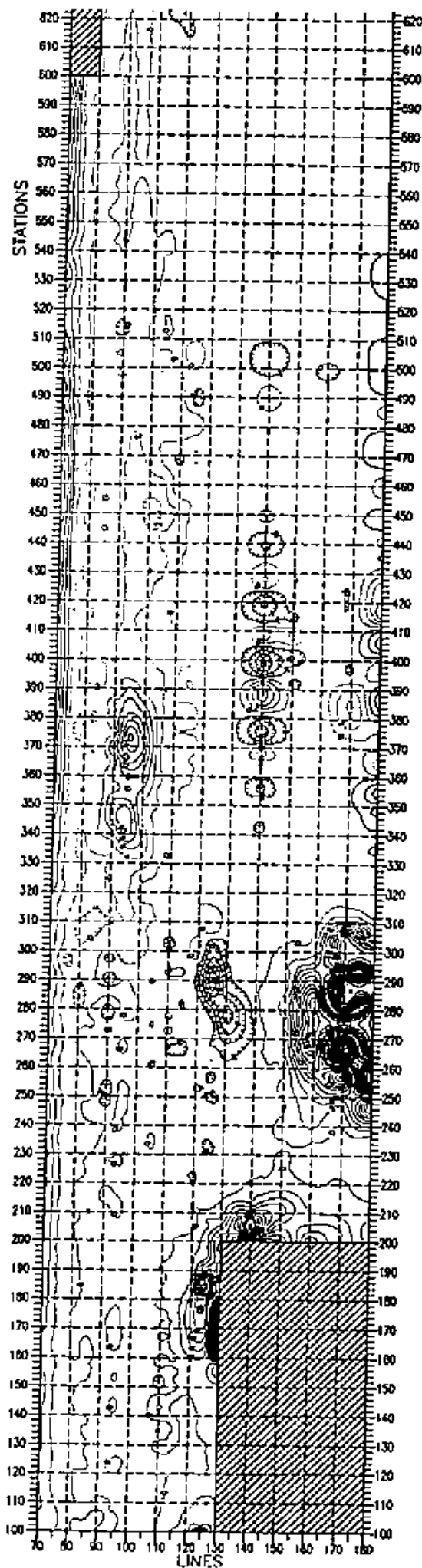


CONTOUR INTERVAL: 5 mS/m


<u>Range</u>	<u>Color</u>
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0 - 20	Blue
25 - 70	Green
75 - 120	Red
> 120	Magenta

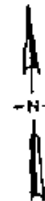
Legend

 Not Surveyed



Legend

 Not Surveyed

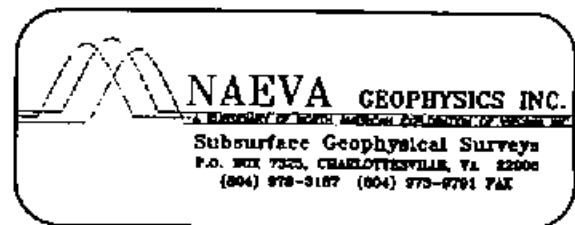
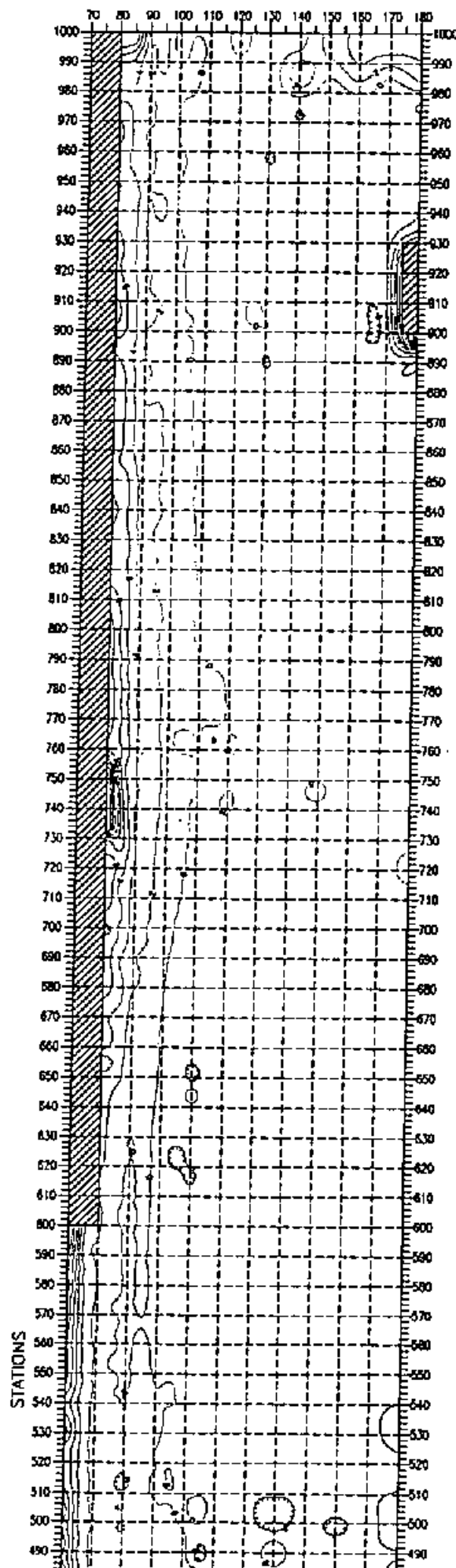


Scale: 1in = 50ft

**FIGURE 7**

CLIENT: OHM REMEDIATION SERVICES CORP.  
 AREA 2  
 EM-31 INPHASE CONTOURS  
 MEMPHIS DEFENSE DEPOT  
 MEMPHIS, TENNESSEE  
 DATE OF SURVEY: DEC. 18 & 19, 1997




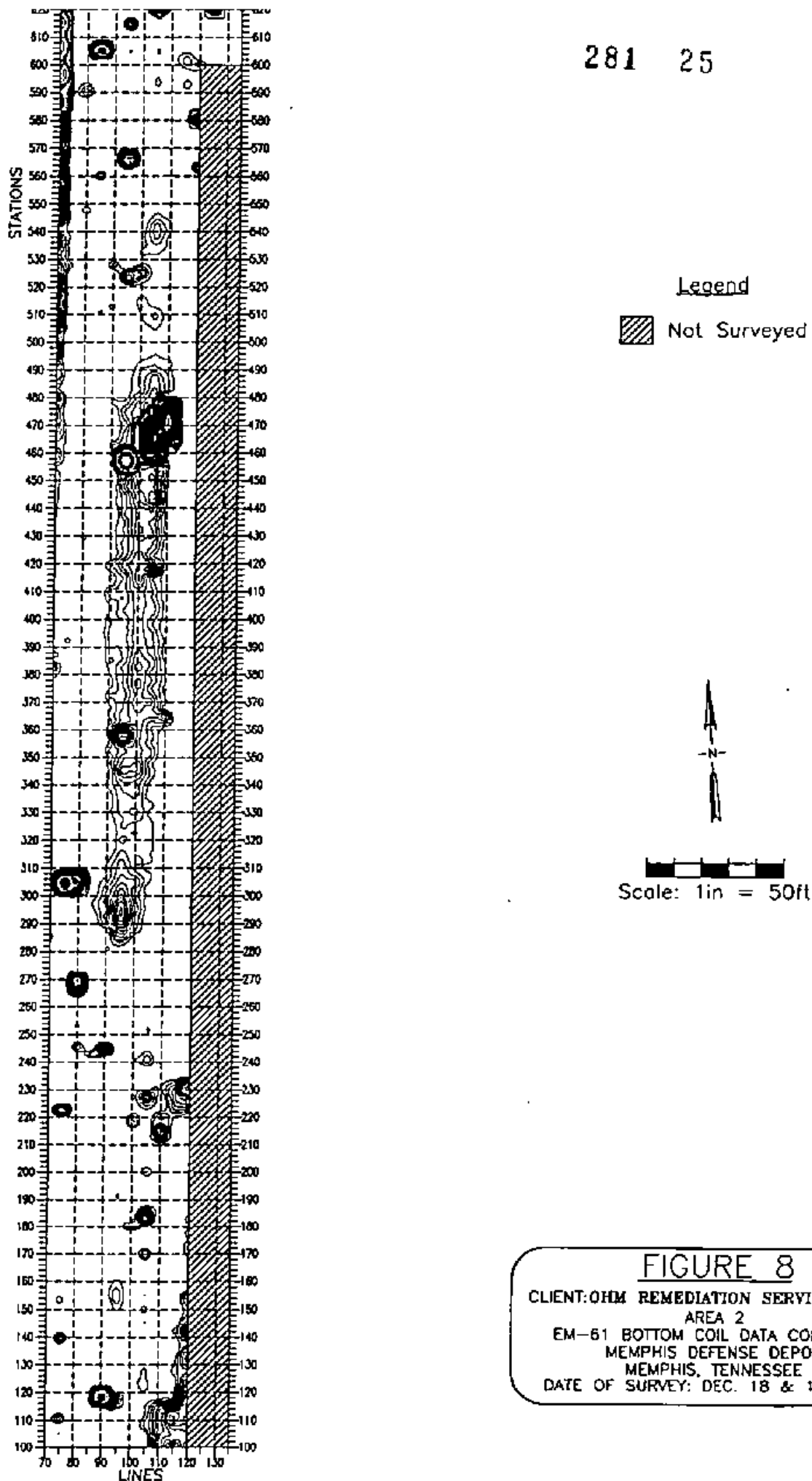


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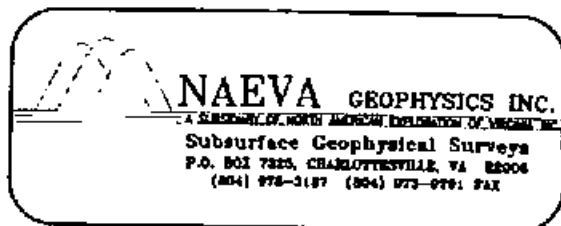
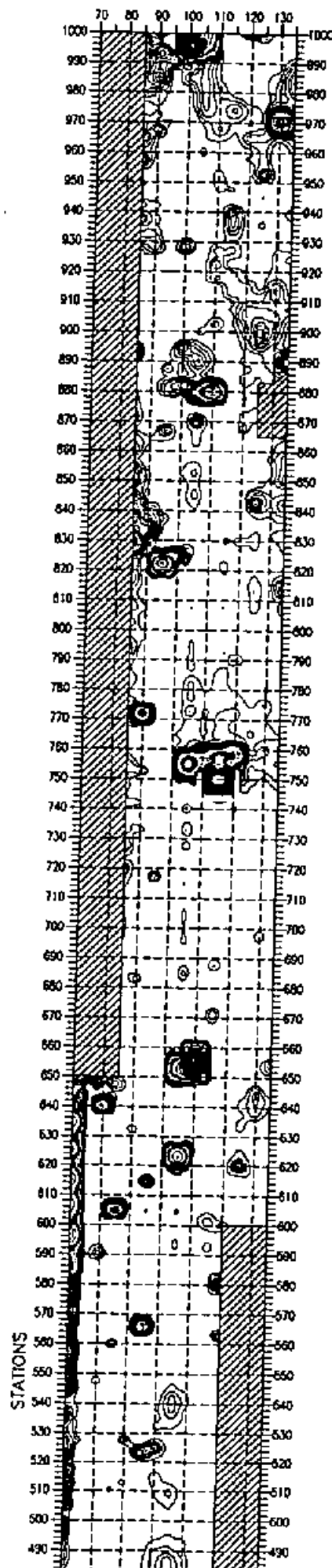
Range	Color
< 0	Blue
0 - 4	Green
6 - 12	Red
> 12	Magenta

Legend

 Not Surveyed


**FIGURE 8**

CLIENT: OHM REMEDIATION SERVICES CORP.  
AREA 2  
EM-61 BOTTOM COIL DATA CONTOURS  
MEMPHIS DEFENSE DEPOT  
MEMPHIS, TENNESSEE  
DATE OF SURVEY: DEC. 18 & 19, 1997



<u>Range (mS/m)</u>	<u>Contour Interval (mS/m)</u>	<u>Color</u>
0 - 45	5	Blue
50 - 95	5	Green
100 - 145	5	Red
> 145	100	Magenta

Legend

 Not Surveyed

**FINAL PAGE**

**ADMINISTRATIVE RECORD**

**FINAL PAGE**

**FINAL PAGE**

**ADMINISTRATIVE RECORD**

**FINAL PAGE**