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FINAL REPORT REGARDING MAGNETOMETER AND GROUND PENETRATING RADAR SURVEY NTC ORLANDO FL

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FINAL REPORT

MAGNETOMETER AND GROUND PENETRATING RADAR SURVEY

NAVAL TRAINING CENTER McCOY ANNEX SITES

ORLANDO, FLORIDA

Prepared For:

AJT & ASSOCIATES, INC.
CAPE CANAVERAL, FLORIDA

NOVEMBER 1994

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EXECUTIVE SUMMARY

A geophysical investigation was conducted over a 13-day period from October 23 to November 11, 1994, at the Naval Training Center (NTC), McCoy Annex in Orlando, Florida. The investigation was conducted in two areas; Area 1 (consisting of four separate areas along a metallic chain-link fence) and Area 2 (an area around a pond). The purpose of the investigation was to determine the existence and location of buried unexploded ordinances (UXOs) in the two areas. The investigation was conducted using two geophysical techniques: magnetometry and ground penetrating radar (GPR). The purpose of the magnetometer survey was to identify the location of buried ferromagnetic objects (UXOs). The purpose of the GPR survey was to help determine the depth of burial and size of the ferromagnetic objects identified during the magnetometer survey.

The magnetic data was continuously collected along parallel transects spaced 5 feet (ft) apart. The magnetic data was corrected for diurnal (time) variations. Results are presented for Area 2 as total magnetic field values contoured on a 10-gamma interval. Magnetic data collected in Area 1 is presented as profiles of the total magnetic field. It was not possible to contour the magnetic data collected within Area 1 because of the interference effects of the nearby metallic chain-link fence.

The GPR survey was collected on parallel transects spaced 5 ft apart. Additional GPR transects were performed in the areas where UXOs were suspected to be present, based on the results from the magnetic survey. Ground position of GPR anomalies, both inside and outside of the areas where magnetic anomalies were present were indicated on the ground surface using survey pin flags and are presented on the site maps included in this final report. The estimated depth and position of the GPR anomalies that occurred within the areas of elevated magnetic readings are provided in tabular form.

Results from the investigation indicate that UXOs may be present in both Area 1 and Area 2. The highest concentration of suspected UXOs appears to be near the pond in Area 2.

1.0 INTRODUCTION

1.1 Background

AJT & Associates, Inc. (AJT) has been requested by the United States Navy to provide recommendations concerning the removal of suspected UXOs from two areas within the Naval Training Center (NTC), McCoy Annex in Orlando, Florida. Based on information provided by AJT, Area 1 is a suspected historical burn and demolition area for UXOs which was later used as a landfill. Area 2 is a suspected historical dump location for metallic debris and ordnance. According to historical records, the pond now present within Area 2 was much larger in the past and was subsequently partially filled with debris. An integrated geophysical investigation using magnetometry and ground penetrating radar (GPR) techniques was conducted to help identify and define the presence, location, and characteristics of suspected UXOs in both Areas.

1.2 Purpose

The purpose of this investigation was to utilize non-intrusive geophysical techniques to help determine the existence and location of buried UXOs and/or residue within the two areas of investigation.

1.3 Scope of Work

Subsurface Detection Investigations, Inc. (SDII) implemented the following scope of work to complete this investigation:

- Mobilize to the project site and perform the magnetometer and GPR surveys throughout Area 1 and Area 2;

- Analyze the results of the magnetometer survey and perform additional GPR transects to characterize subsurface conditions in the portions of the site where magnetic anomalies were observed;
- Indicate the location of the GPR anomalies in the field;
- Demobilize from the project site and perform additional reduction and analysis of field data; and
- Provide a final report summarizing the geophysical methods, field procedures, and results of the investigation.

1.4 Site Description

The project site consists of two areas located within the NTC, McCoy Annex in Orlando, Florida (Figure 1). Area 1 is located near the southeast corner of the McCoy Annex (Figure 2) adjacent to the bunker fence line. Area 1 consists of four portions of the bunker fence line (Figure 3) and are designated at Fence 1A (1,950 ft in length), Fence 2A (690 ft in length), Fence 3A (450 ft in length), and Fence 4A (500 ft in length). Area 2 is located at the northeast corner of the McCoy Annex (Figure 2). A pond is present within Area 2 and the southern portion of the area was wooded. Access to the geophysical equipment was limited in both the pond and woodland-covered portions of Area 2 (Figure 4). Ground covering across the majority of each of the areas consisted of either short grass or bare soil. Based on the regional geologic setting and previous SDII experience in the geographic area of the project site, near-surface soils consist of sand.

2.0 METHODOLOGY

2.1 Equipment and Principles

2.1.1 Magnetometer

A magnetometer measures the intensity of the total magnetic field in the area around the sensor. Typically, the measurement is made using either a fluxgate or proton-precessional type magnetometer. The primary difference between the two magnetometers is that the measurement of the total magnetic field by a proton-precessional magnetometer is independent of the orientation of the instrument, while the measured value of the total magnetic field by a fluxgate magnetometer will vary with orientation.

In environmental and engineering applications, the primary use of a magnetometer is to evaluate perturbations in the magnetic field of the earth that are caused by subsurface anomalies. Perturbations in the total magnetic field caused by subsurface anomalies are the result of a complex relationship between the object and the magnetic field of the earth. The relationship is complex because the total field registered by the instrument is a vectorial representation of three factors which affect the magnitude of the response; (1) The ambient magnetic field of the earth, (2) The inductive contribution from the object, and (3) Any contributions to the total field by remanent or permanent magnetization. Accordingly, the observed intensity of the total field is dependant upon the position of the measuring device within the source field caused by the anomaly. The magnitude of the magnetic field of the earth is typically measured in gammas. The magnitude of the magnetic field in central Florida ranges from 45,000 to 50,000 gammas (Dobrin, 1988).

The total intensity of the earths magnetic field varies both spatially and temporally. Temporal variations are caused by distortions of the magnetic field by solar winds. Temporal variations are classified as either daily (diurnal), micro-pulsations (seconds to tens of minutes), or as solar storms which can last several days. Diurnal variations occur during daylight hours. The absolute magnitude and time rate of change of the variations, however, are not predicable. Diurnal variations can cause changes in the earth's ambient magnetic field to 100 gammas. Micropulsations are typically a relativity short-term phenomenon and their occurrence is random. Typical magnitude of changes caused micropulsations is in the range of 0.1 to 10's of gammas. The occurrence and duration of solar storms is also relatively unpredictable. Such storms can last one to several days and exhibit magnetic field variations of up to several 100 gammas.

In environmental or engineering applications, temporal variations are considered as noise sources which interfere with the measurements of interest. Depending upon the precision requirements of a study, temporal variations can be recorded by: (1) a second magnetometer placed at a fixed base station which records data on a preprogrammed time interval or (2) revisiting the same location on a site at a regularly timed basis (usually every 1 to 2 hours) using the same magnetometer as for the survey. Data collected during the survey can then be corrected to remove the effects of temporal variations.

Spatial variations in the earth's magnetic field are caused by the localized occurrence of magnetized minerals, iron objects, or cultural features of interest. Such variations cause two types of magnetism; induced and remanent (or permanent). Induced magnetization refers to the action of the material in enhancing the earth's magnetic field as the material itself acts as a magnet. The magnitude of the induced field is directly proportional to the strength of the ambient field and the ability of the material to act as a magnet (magnetic susceptibility). Remanent (with rocks) or permanent (with metals) magnetization is the magnetic field caused by the object or material independent of the ambient earth's magnetic field. The magnetic field variations caused by metal objects such as shell casings (UXOs) are a combination of both induced and permanent magnetization.

A proton processional magnetometer (EG&G Geometrics, Inc. G-822L Cesium Vapor Magnetometer) was used for this survey. This magnetometer and has an effective sensitivity of 0.01 gammas.

The magnetic data was recorded on a field computer using a proprietary software program. At the beginning of each transect line, the length and direction of the transect were entered into the computer. Data was acquired in a continuous acquisition mode. In the continuous data acquisition mode, data is collected ten times every second. To create a contour map, a data station point is created every second by averaging the ten total magnetic field values. The separation distance between each data station point ranged from 3.5 to 4 ft.

The position of data station point within a transect is done by linear interpolation, in which the total distance of the transect line is divided by the number of data station points. A constant rate of travel along the transect lines is assumed . To assist in the precision of the location of the data station points, fiducial marks are electronically placed in the magnetic data during the survey. Fiducial marks are points of known distance along the transect lines. During the process of positioning of the data station points, the fiducial marks are used as part of the linear interpolation calculations.

2.1.2 Ground Penetrating Radar

GPR is an electromagnetic geophysical method that detects interfaces between subsurface materials with differing dielectric constants. The GPR system consists of an antenna which houses the transmitter and receiver; a profiling recorder which processes the received signal and produces a graphic display of the data; and a video display unit which processes and transmits the output signal to a color video display and tape recorder.

The transmitter radiates repetitive short-duration electromagnetic (EM) waves into the earth from an antenna moving across the ground surface. These radar waves are reflected back to the receiver by interfaces between materials with different dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant between the materials, the conductivity of the material which the wave is travelling through, and the frequency of the signal. Subsurface features which commonly cause such reflections are: 1) natural geologic conditions such as changes in sediment composition, bedding and cementation horizons, voids, and water content; or 2) unnatural changes to the subsurface such as disturbed soils, soil backfill, buried debris, tanks, pipelines, and utilities. The profiling recorder processes the signal from the receiver and produces a continuous cross section of the subsurface interface reflections, referred to as reflectors.

GPR data is output from the recorder as strip charts which present the data as a continuous profile. A GPR survey is conducted along transects which are measured paths along which the GPR antenna is moved. During a survey marks are placed in the data by the operator at designated points along the GPR transects. These marks allow for a correlation between the GPR data on the strip charts and the position of the GPR antenna on the ground. The GPR data can also be electronically recorded for future analysis using Radan™, a computer data processing program.

Subsurface features such as buried debris are characterized by : (1) The occurrence of multiple high-amplitude GPR reflectors at varying depths with varying diameters and (2) A discontinuity in subsurface reflectors suspected to be associated with soil horizons. Subsurface features such as small cylinders (UXOs) are characterized by : (1) A relatively high-amplitude reflection of the GPR signal, (2) A parabolic shape to the GPR signal when the GPR antenna is crossed in a perpendicular direction to the short axis of the feature, and (3) The occurrence of the parabolic-shaped reflector at similar depth and with a similar same diameter on a minimum of three consecutive and parallel GPR transect lines.

Depth of investigation of the GPR signal is highly site-specific and is limited by signal attenuation (absorption) in the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivities such as clays and brackish groundwater, and lowest in relatively low-conductivity materials such as dry sand or rock. Depth of investigation is also dependent on the antenna transmitting frequency. Depth of investigation generally increases as transmitting frequency decreases; however, the ability to resolve smaller subsurface features is diminished as frequency is decreased.

The GPR antenna used on this project is internally shielded from above-ground interference sources. Accordingly, the GPR response is not affected by overhead power lines, metallic buildings, or nearby objects.

2.2 Field Procedures

2.2.1 Establishment of Transects and Survey Reference Points

Prior to the commencement of the geophysical surveys, transects were established in each of the study areas (Figures 3 and 5). Reference points were established in both areas so that anomalies determined during the magnetic and GPR surveys could be identified at a later date. In Area 1, posts for the metallic fence were measured to be 10 ft apart and were used as the reference points for the survey (Figure 3). In Area 2, four permanent wooded stakes were positioned at four corners of a 250 by 250-foot square within the area. In addition, distances to the two most western stakes were taken to the respect of more permanent land marks. The landmarks used to reference Area 2 were the light for a welcome sign, a sewer pipe, and two survey markers (green-painted nails) hammered into the centerline of Daetwyler Drive (Figure 4).

In Area 1, survey transects were orientated parallel to the fence lines. By orientating the transect lines parallel to the fencelines, the impact on the total magnetic field response caused by the metallic fences upon each individual transect line was near-constant. Transects were established using a fiberglass measuring tape on 5-foot centers and marked on the ground surface using spray paint.

In Area 2, 5-foot parallel east-west trending transects were orientated on a 320 by 250-foot grid centered about the pond (Figure 4). Additional north-south trending transects were performed across the pond to increase areal coverage. Additional transects spaced 10 ft apart were established to the east and west of the 320 by 250-foot grid. The purpose of the additional transects was to help define the lateral boundaries of subsurface anomalies detected near the edges of the initial survey area.

2.2.2 Magnetometer Survey

The magnetic survey was performed by a two-person crew carrying the magnetometer equipment throughout the accessible areas of the project site along the pre-determined transect lines (Figure 4). In the pond-covered portion of Area 2, the magnetometer equipment and operator were towed across the pond in a small boat constructed completely of fiberglass. Because the boat was constructed of fiberglass, there was no addition to the total magnetic field response created by the boat.

Temporal corrections were made from a base station located at Station Number 0,0 - Area 2 (Figure 4) on approximate two-hour intervals. All data was corrected to a station value of 48,466 gammas which was established on the first day of the survey. The typical range in base station values used for the temporal corrections was less than 10 to 30 gammas. The correction factor for magnetic field data collected between each 2 hour interval was determined using a linear interpolation between the two field readings. For example, if two sequential base station readings were 48,500 and 48,525 gammas, a correction factor of +5 gammas would be applied to data collected 24 minutes after the first base station reading, +10 gammas for readings collected 48 minutes after, etc.

2.2.3 Magnetic Data Analysis

Magnetometer data was reduced using LOTUS™ and contoured using SURFER™ software programs. LOTUS™ was used to correct the data for temporal variations and to prepare the data for contouring. LOTUS™ was also used to provide the profiles of total magnetic field values for each transect within Area 1. The contour maps for Area 2 were created in SURFER™ using the Kriging method. Kriging is a geostatistical gridding method that determines the value and position of a contour line by calculating a weighted average between a particular data point and the surrounding data points. The selected contouring method controls only the positioning of the contour lines and does not affect the absolute value of the data at a particular point.

2.2.4 Ground Penetrating Radar Survey

The GPR survey was conducted using a two-person crew. A Geophysical Survey Systems, Inc. (GSSI) SIR System-3 GPR recorder system was used for the survey. A 500 mega-Hertz (mHz) antenna was utilized during the land-based portion of the survey and a 300 mHz antenna was for the portion of the survey conducted across the pond. Initial GPR survey tests determined that a 100 nano-second (ns) time range (for the 500 mHz antenna) and a 200 ns time range (for the 300 mHz antenna) provided the optimum depth of investigation and resolution of the data to determine the presence of buried objects.

Parallel transects with 5-foot spacings were performed across accessible portions of each of the areas. In Area 1, transects were orientated parallel to the to the bunker fence line (Figure 3). In Area 2, transects were orientated in an east-west direction (Figure 5). The survey grid was constructed using a fiberglass measuring tape and indicated on the land surface using spray paint. In the event that a suspicious subsurface anomaly was encountered, additional transects were performed parallel and perpendicular to the initial transect. Transects were performed in at least two directions across a suspicious anomaly to increase the probability of crossing the short axis of the object which provides a more definitive signal in the data.

The GPR investigation was performed by an SDII technician pulling the antenna along the transect lines. Approximately 35,890 linear ft of GPR data was collected during the investigation. The GPR data were produced during the investigation on a continuous strip chart printer. The GPR data were in final form and required no further data reduction procedures to begin interpretation and analysis. In addition, the GPR data was electronically recorded for later review using Radan™, a computer program used to analyze GPR data.

3.0 RESULTS

3.1 Magnetometer Survey

3.1.1 Area 1

Analysis of the magnetic data from Area 1 indicates that the total magnetic field readings collected along the transects 5 and 10 ft away from the metallic fencelines were significantly impacted by the presence of the metallic fences. The majority of the magnetic data collected along these transects was uninterpretable for the purposes of this investigation. Data collected along the remaining transects indicates that a strong magnetic field gradient which decreases away from the fencelines is present. The magnetic data collected along these transects was interpretable; however, the data could not be contoured because of the presence of the strong magnetic field gradient. Alternatively, the magnetic data is presented as a profile of total magnetic field values versus distance for each transect. Magnetic data profiles are presented in Appendix 1.

Analysis of the magnetic data profiles indicate the occurrence of several areas where a significant variation in the total magnetic field response was observed which was not attributable to the presence of the metallic fence. Significant variations were considered to be in such areas where a sharp break in the trend of the magnetic data was observed. Such areas are indicated on the data profiles provided in Appendix 1 and are shown on Figure 3. Several of the apparent magnetic anomalies appear to be associated with buried pipelines (discussed further in Section 3.2.2).

3.1.2 Area 2

Total magnetic field values across Area 2 ranged from 43,019 to 50,568 gammas. The apparent background total magnetic field value, where ferromagnetic objects appear not to be present, was 48,450 gammas. A contour map of the total magnetic field values for Area 2 is presented on Figure 4. Maximum and minimum values are provided in several areas to facilitate interpretation of the contour map. Results from the survey indicate that ferromagnetic objects may be present in several areas. The highest concentrations of suspected ferromagnetic objects appear to be in the areas near and within the pond.

Several magnetic anomalies, which occurred with a linear orientation, were observed in the eastern and southern portions of the Area. Based on the linear orientation of the magnetic anomalies and the GPR results (discussed in Section 3.2.2), the magnetic anomalies are at least in part associated with suspected buried metallic pipelines.

3.2 Ground Penetrating Radar Survey

The results of the GPR survey indicated that the depth of investigation in both of the study areas ranged from 10 to 12 ft below land surface. The depth of investigation is based upon the generally accepted two-way travel time for unsaturated and saturated sand (4-5 nano-seconds and 8-10 nano-seconds per foot, respectively; GSSI, 1987). The depth of investigation was limited by signal attenuation due to soil and surface conditions across the study areas. Objects deeper than 10 to 12 ft would not have been detected by the GPR survey.

The estimated depth of suspected buried objects which are located within the areas of magnetic anomalies are provided in Tables 1 and 2. The estimated burial depth is calculated by determining the travel time between the top of the suspected buried object and the GPR reflector associated with the ground surface. To determine the actual depth, the travel time is divided by the appropriate GPR signal velocity for the type of soil material through which the GPR signal is passing.

3.2.1 Area 1

Numerous subsurface anomalies, possibly associated with buried objects, were present within the surveyed portions of Area 1 (Figure 3). Suspected buried pipelines appeared to be present along fencelines A1, A3, and A5. The approximate depth and location of suspected buried objects that occurred at or near areas of magnetic anomalies are provided in Table 1. In several of the areas, the suspected buried objects, appeared as a collection of debris rather than as a singular object. In the description of such areas in Table 1, the apparent center and range in burial depth are provided. The occurrence of suspected buried objects in areas where no magnetic anomalies were observed may indicate that the suspected objects are associated with either non-metallic buried debris or tree roots. An example of annotated GPR data showing a suspected pipeline and suspected buried debris along GPR transect 1A-1B (Figure 3) is provided in Appendix 2.

3.2.2 Area 2

Numerous subsurface anomalies, possibly associated with buried objects, were present within the surveyed portions of Area 2 (Figure 5). The location, estimated length and/or lateral extent of suspected buried objects were indicated on the ground surface using survey pin flags. Suspected buried pipelines appeared to be present in the areas north, east and south of the pond (Figure 5). An apparently discontinous pipeline which crossed GPR transect line 2A-2B is present south of the pond. The northern end of the suspected pipeline was exposed at land surface at the time of the SDII field investigation. A correlation between the GPR results (showing the occurrence of areas of suspected buried objects) and the magnetic survey results (showing the areas where background total magnetic field values were exceeded by more than 10 gammas) is provided in Figure 6. The approximate depth and location of suspected buried objects that occur at or near the areas of magnetic anomalies are provided in Table 2. GPR anomaly numbers 22, 23 and 24 occur both in the pond and within magnetic anomaly areas (Figure 6).

Magnetic anomalies areas were present along approximately 60 percent of the perimeter of the pond (Figures 4 and 6). However, relatively few suspected buried objects were detected by the GPR survey in these areas (Figure 5). As shown in Figure 5, it was not possible to conduct the GPR survey, due to the presence of dense aquatic vegetation, to within 5 to 10 ft of the majority of the pond shoreline. Based on the presence of the magnetic anomalies, it is suspected that buried metallic objects are present in the shoreline areas not accessible to the GPR survey.

In several of the areas, the suspected buried objects, appeared to occur as a collection of debris rather than as a singular object. In the description of such areas in Table 2, the apparent center and range in burial depth are provided. The occurrence of suspected buried objects in areas where no magnetic anomalies were observed may indicate that the suspected objects are associated with non-metallic buried debris or tree roots. An example of annotated GPR data showing suspected buried debris along GPR transect 2A-2B (Figure 6) is provided in Appendix 2. An example of annotated GPR data showing a suspected single buried object along GPR transect 3A-3B (Figure 6) is also provided in Appendix 2.

4.0 LIMITATIONS

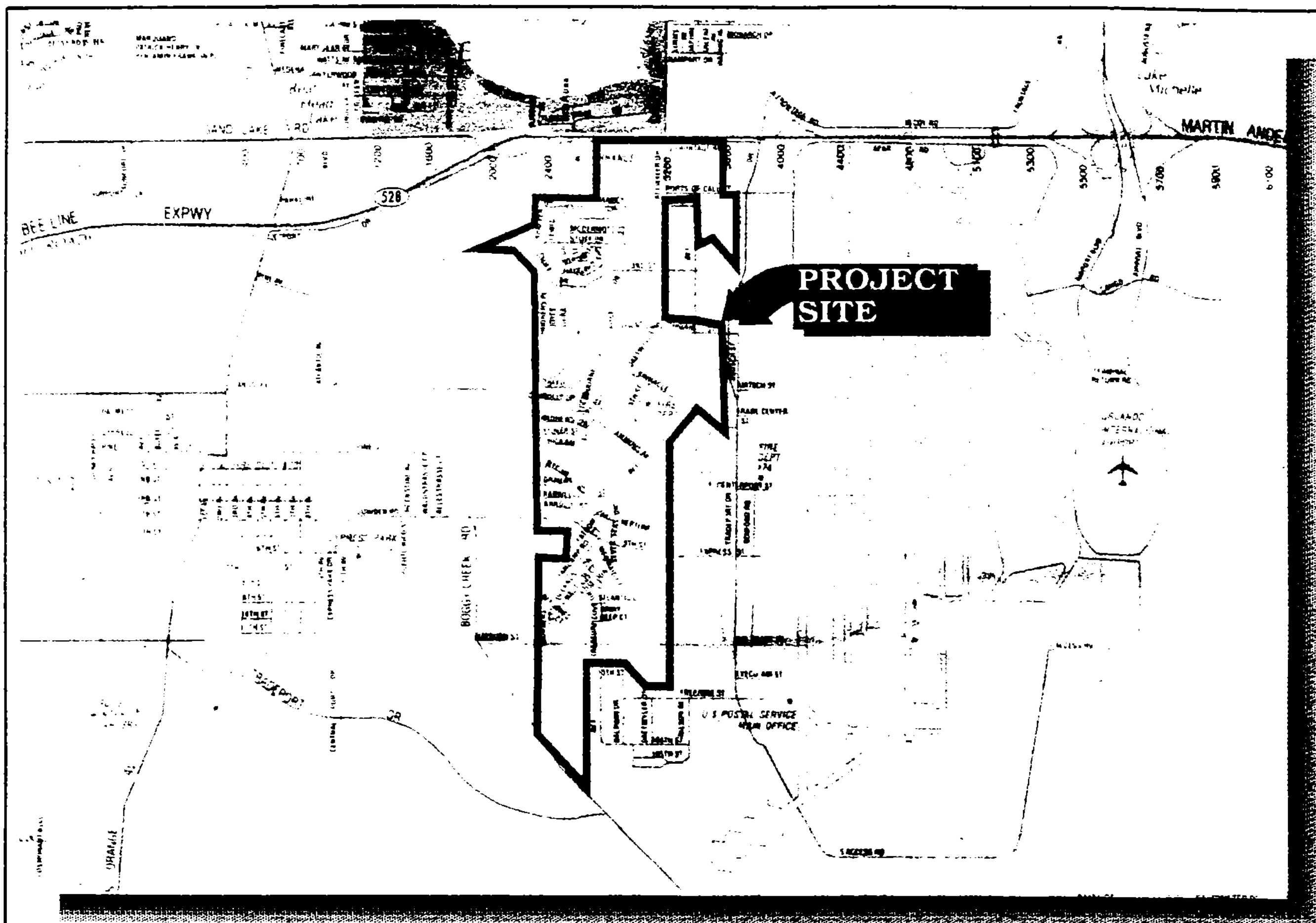
The geophysical assessment of this site is based on our professional evaluation of the geophysical data gathered and our experience with the properties of magnetometry and ground penetrating radar in the geological setting of the project site. The geophysical evaluation rendered in this reports meets the standards of care of our profession. No other warranty or representation, either expressed or implied, is included or intended.

5.0 REFERENCES

Dobrin, M. B. and Savit, C. H., 1988. Introduction to Geophysical Prospecting, Fourth Edition. MacGraw-Hill, Inc.

Geophysical Survey Systems, Inc., 1987. Operations Manual Subsurface Interface Radar SIR System-3.

FIGURES



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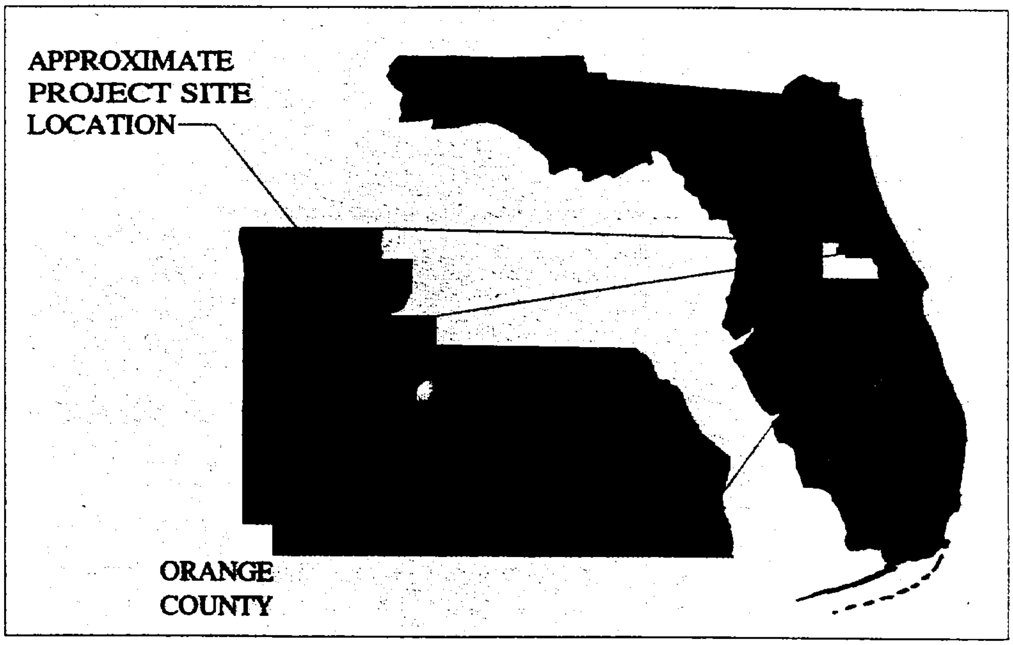
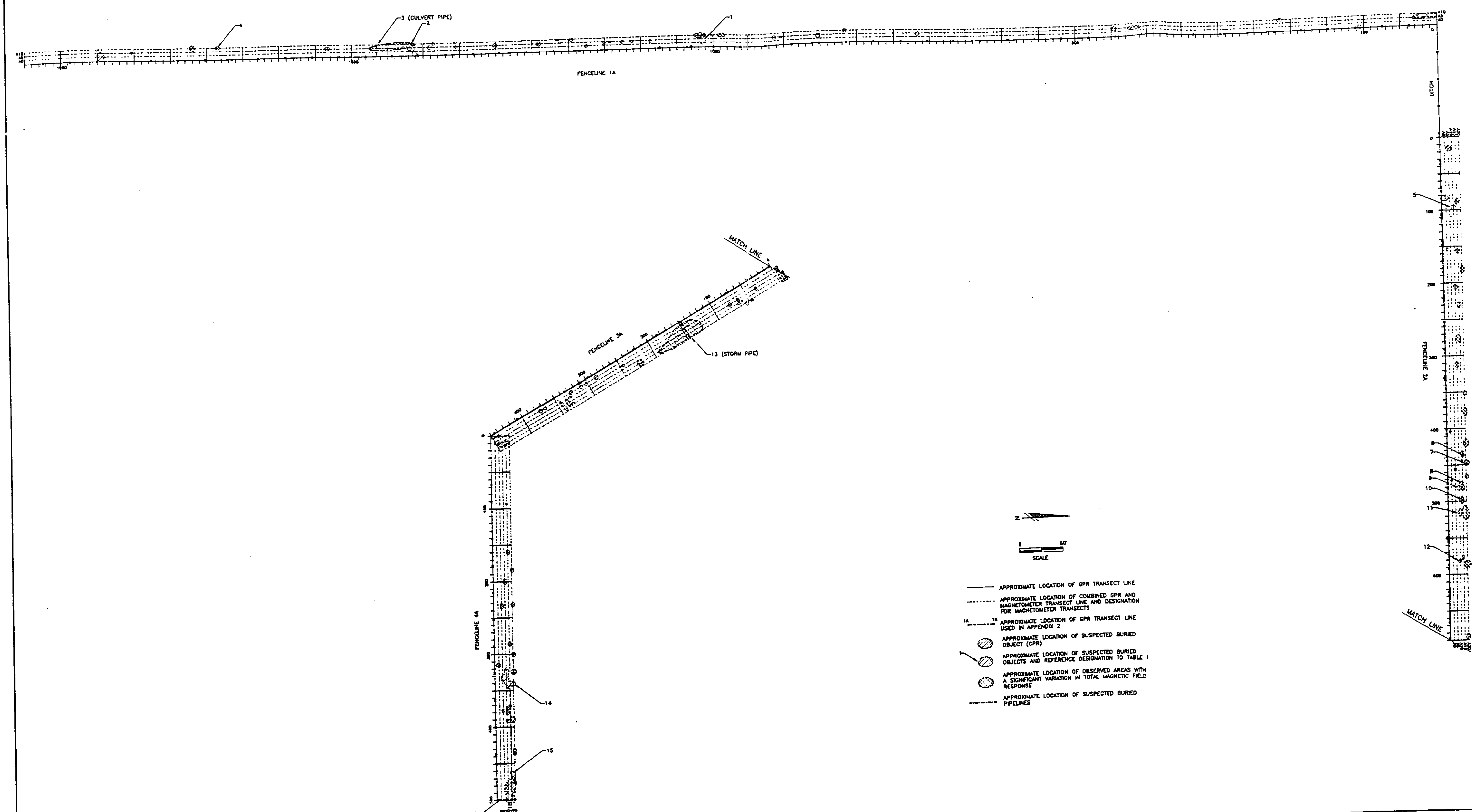
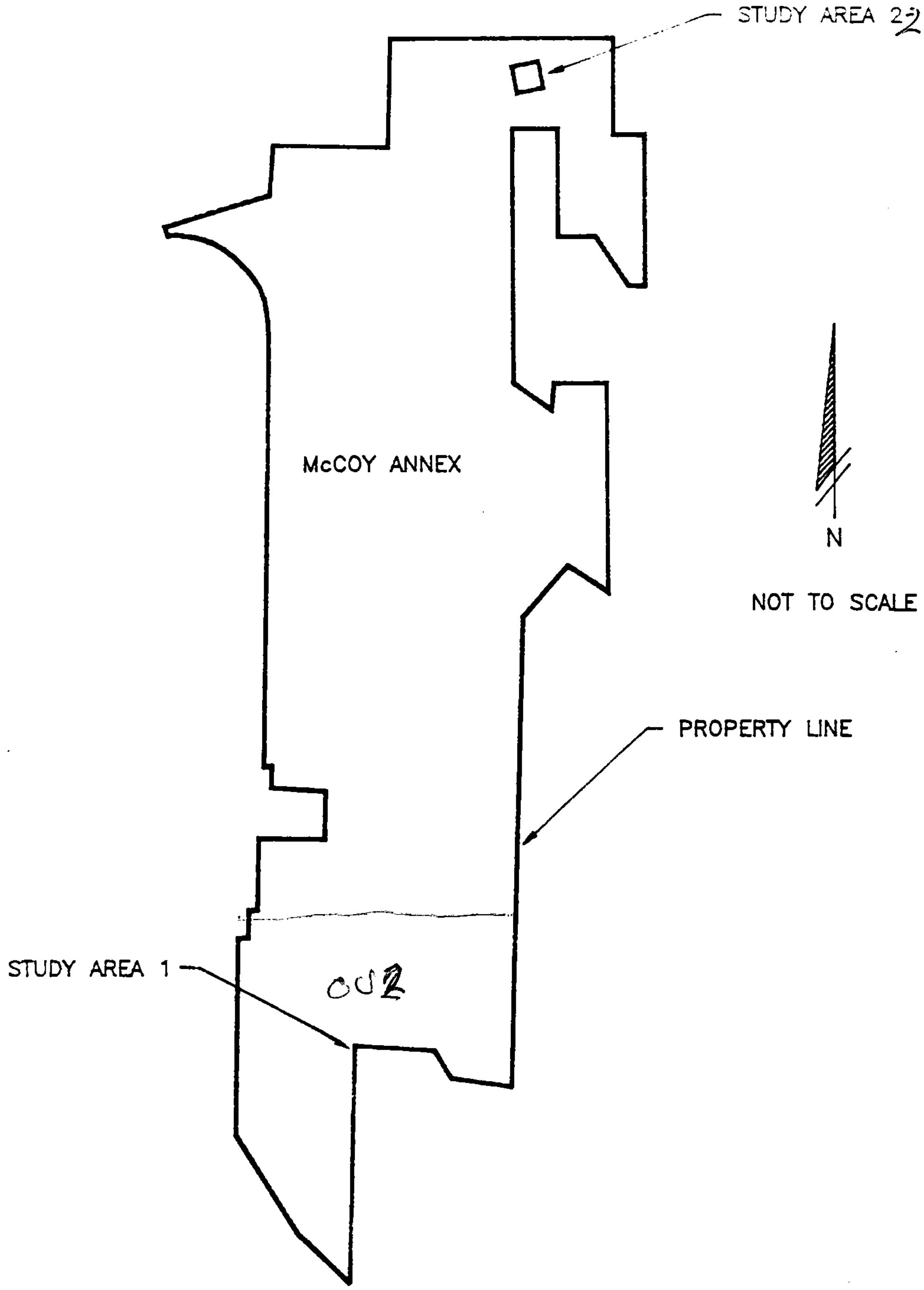


AJT & ASSOCIATES, INC. CAPE CANAVERAL, FL	SDII	PROJECT SITE LOCATION MAP NAVAL TRAINING CENTER McCOY ANNEX SITES ORLANDO, FLORDA			
		DESIGNED BY: JEB	PROJECT NO.: 94829		FIGURE
		CHECKED BY: MJW	DRAWING NO.: LOC		1
		DRAWN BY: RBT	DATE: 11/17/94		



AJT & ASSOCIATES, INC. CAPE CANAVERAL, FLORIDA	SDII SUBSURFACE DETECTION INVESTIGATIONS INCORPORATED	STUDY AREA 1 SITE PLAN SHOWING AREAS OF SUSPECTED BURIED OBJECTS (GPR) AND AREAS OF SIGNIFICANT VARIATION IN TOTAL MAGNETIC FIELD RESPONSE NAVAL TRAINING CENTER – McCOY ANNEX SITES ORLANDO, FLORIDA	
Designed By: JEB	Proj. No: 94829	Fig. No. 3	
Checked By: MJW	Date: 11/21/94		
Drawn By: RBT	Drawing No.: FEN		



AJT &
ASSOCIATES, INC.
CAPE CANAVERAL, FL

SDII
SUBSURFACE
DETECTION
INVESTIGATIONS
INCORPORATED

SITE LOCATION MAP SHOWING STUDY AREAS
1 & 2 IN RELATION TO PROPERY LINE
NAVAL TRAINING CENTER – McCOY ANNEX SITES
ORLANDO, FLORIDA

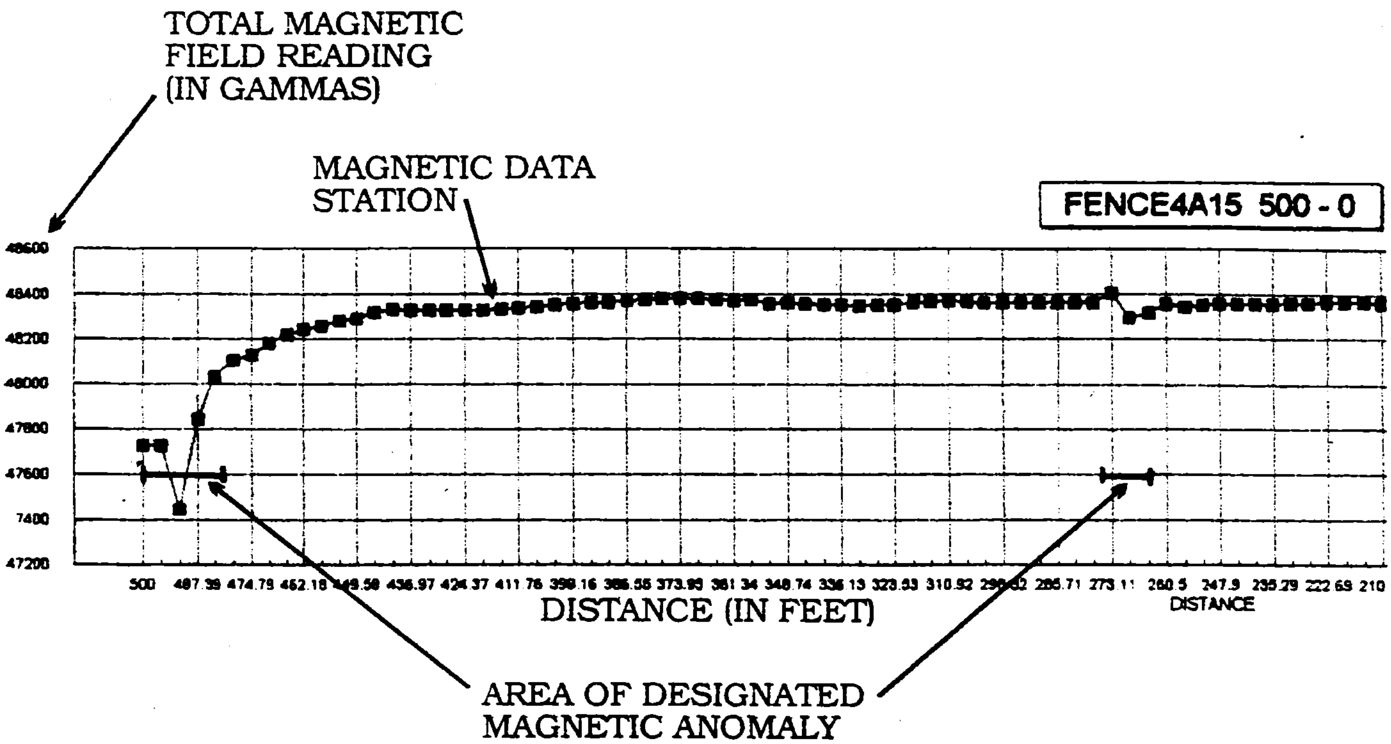
DESIGNED BY:	JEB	PROJECT NO.:	94829	FIGURE
CHECKED BY:	MJW	DRAWING NO.:	L2	2
DRAWN BY:	RBT	DATE:	11/21/94	

TABLE 1

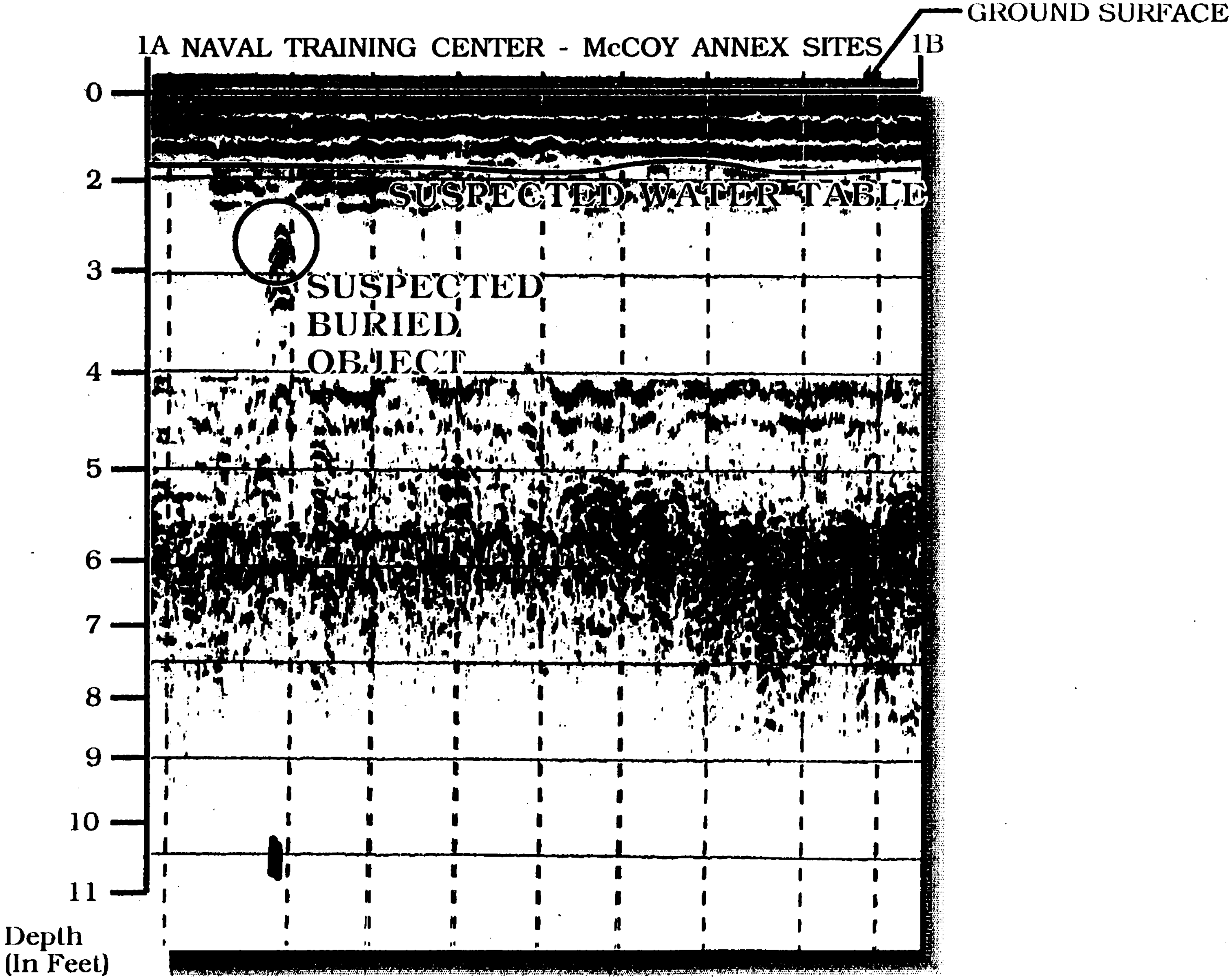
Depth and Location of Designated Suspected Buried Objects in Areas of Magnetic Anomalies
Area 1

FENCE LINE	ID	APPROXIMATE DEPTH (in feet)	CENTER POSITION OF SUSPECTED BURIED OBJECT(S)
1A	1	2.0	915 ft, Lines A0 - A10
	2	2.0	1318 ft, Line A10
	3	1.5	1365 ft, Lines A0 - A10
	4	4.0	1587 ft, Line A10
2A	5	2.5	95 ft, Line A10
	6	8.0	436 ft, Line A15
	7	8.0	448 ft, Line A20
	8	8.0	473 ft, Line A15
	9	8.0	482 ft, Line A10
	10	2.0	469 ft, Line A15
	11	8.0	513 ft, Line A10
	12	2.0	582 ft, Line A10
3A	13	2.6	145 ft, Lines A0 - A20
4A	14	5.0 - 8.0	333 ft, Line A10
	15	6.0 - 8.0	473 ft, Line A20
	16	2.5	500 ft, Lines A0 - A20

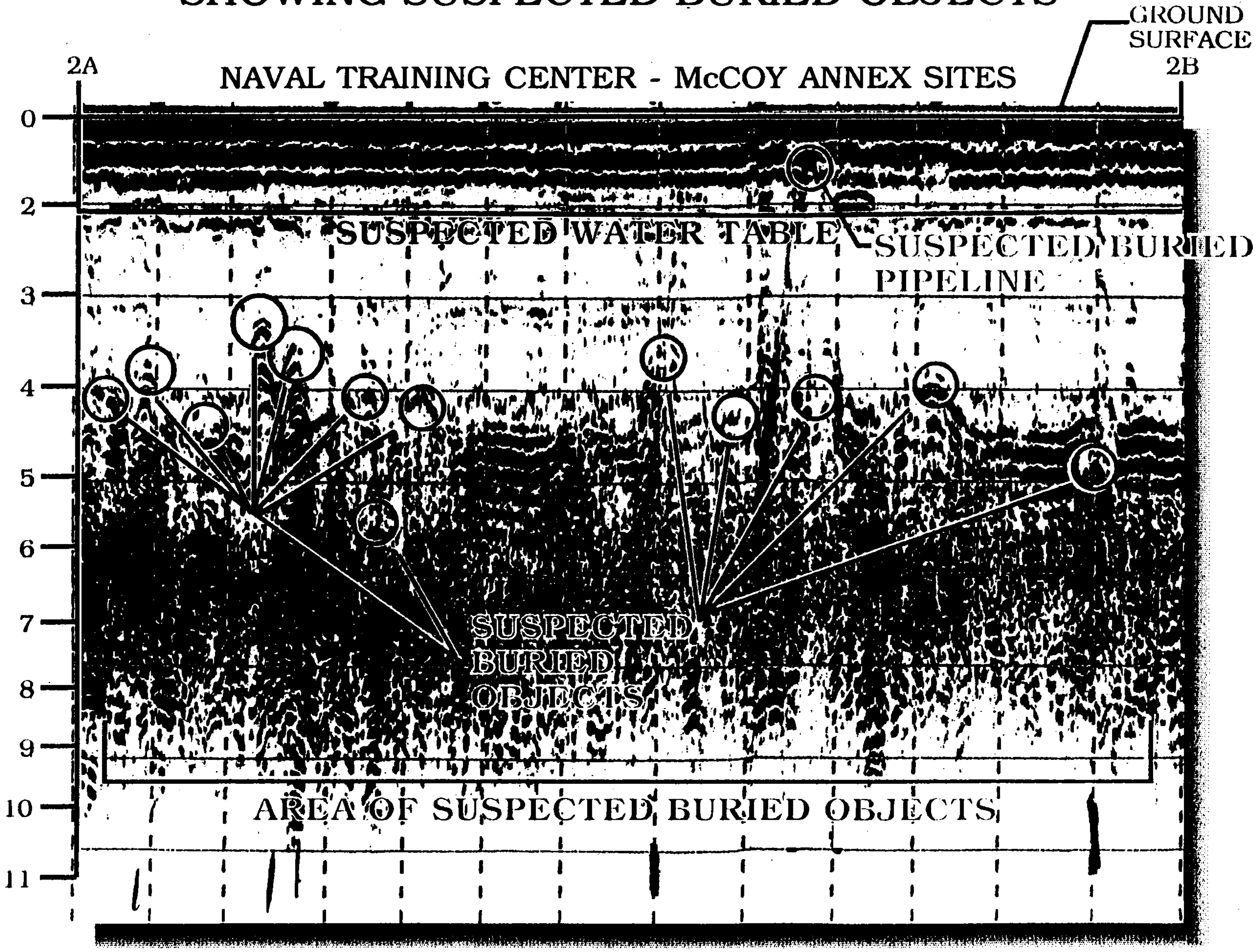
Explanatory Diagram for Area 1 Magnetic Data Profiles



APPENDIX 2
GPR TRANSECT LINE 3A - 3B
SHOWING SUSPECTED BURIED OBJECT



APPENDIX 2
GPR TRANSECT LINE 2A - 2B
SHOWING SUSPECTED BURIED OBJECTS



APPENDIX 2
GPR TRANSECT LINE 1A - 1B
SHOWNG SUSPECTED BURIED OBJECTS