



**Final Report
Geophysical Survey
UST Detection/Delineation
400 Area
Fort Monmouth, NJ
Enviroscan Project Number 060421a**

**Prepared For: US Army, Fort Monmouth
Prepared By: Enviroscan, Inc.
September 3, 2004**





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Mr. Douglas Guenther
US Army, Fort Monmouth
Director of Public Works
ATTN: SELFM-PW-EV-Building 173
Fort Monmouth, NJ 07703

RE: Geophysical Survey
UST Detection/Delineation
400 Area
Fort Monmouth, NJ
Enviroscan Project Number 060421a

Dear Mr. Guenther:

Pursuant to our proposal dated June 17, 2004, Enviroscan, Inc. (Enviroscan) has completed a geophysical survey of the above-referenced site. The methods and results of the survey are described below. Fieldwork for the survey was completed on June 21 through 23, and August 3 through 4, 2004.

Survey Purpose and Site Description

The purpose of the survey was to detect and delineate possible underground storage tanks (USTs) and/or buried debris beneath the site. The first component of the field effort involved an electromagnetic (EM) terrain conductivity/metal detector survey of the entire site. Ground penetrating radar (GPR) scanning was then performed in order to further characterize specific targets and areas identified in the EM survey.

The area surveyed (Figure 1) was located in the 400 Area of the Main Post of Fort Monmouth, NJ. The site encompassed open mowed fields extending south-southeast from Parker's Creek to Tilly Avenue. South of Allen Avenue, the fields were populated with various buildings and other structures (see Figures 1, 2, and 3).



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Survey Methods

For the first phase of the geophysical survey, Enviroscan conducted an EM mapping of the survey area. EM instruments employ an electromagnetic transmitter coil to induce an electric current in the earth. This current creates a secondary electromagnetic field that is measured by a receiver coil, and has strength proportional to the bulk electrical conductivity or terrain conductivity of the subsurface materials. The subsurface terrain conductivity measured by an EM instrument is primarily sensitive to the mineralogy of the earth materials (e.g. sand vs. clay) and the moisture content and chemistry of the intergranular porosity.

In addition, some EM instruments can record the amplitude ratio between the primary (transmitted) electromagnetic field and the secondary field from electrical currents in the subsurface. These inphase data are a measure of the metallic content of the materials in the vicinity of the instrument. Therefore, where interference from metallic structures or debris (e.g. buildings, utilities, fences, etc.) is expected, simultaneous recording of terrain conductivities and inphase data allows identification of stations where the terrain conductivity reflects the presence of metallic interference rather than soil or rock conditions or features.

A Geonics, Ltd. EM-31 terrain conductivity meter with vertical dipole coil orientation was used to collect terrain conductivity readings at approximately 5-foot stationing along EM survey profiles spaced approximately 10 feet apart (see Figure 1). At each survey station, terrain conductivity (in millimhos/meter or mmho/m) and inphase response (in parts per thousand or ppt) were automatically digitally recorded using an Omnidata Polycorder. The vertical dipole EM-31 instrument was employed since it is sensitive to conductivity anomalies to depths of approximately 25 feet, with peak sensitivity between 4 and 12 feet (see Appendix A).

The actual location of each EM measurement station was digitally recorded using a backpack-mounted Trimble Pathfinder global positioning system (GPS) receiver in contact with four to seven position-fixing satellites. The GPS positions were differentially corrected using data from a community base station in Sandy Hook, NJ. The resulting differential GPS (DGPS) positions have a nominal accuracy of better than 3 feet (+/-). Base map information was obtained from a geo-referenced, orthographically-corrected US Geological Survey (USGS) aerial photograph obtained from Terraserver.



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The EM inphase and terrain conductivity data were contoured using the statistical kriging routine in SURFER for WINDOWS by Golden Software. The terrain conductivity and inphase response contours are depicted in Figures 2 and 3, respectively.

During the EM field survey, the entire site was carefully examined for surficial targets or sources of possible EM anomalies such as parked cars, utility structures (e.g. manholes, valves, hydrants) signs, tables, etc. The locations of these targets were recorded using GPS as the survey progressed, and are depicted on Figures 2 and 3.

Following contouring and posting of visible targets, the EM data were examined for strong, laterally-restricted anomalies, not associated with obvious surficial sources, of the type consistent with potential undocumented USTs. Although the EM data do display, in all areas, many long, linear anomalies (colored “stripes”) of the type associated with buried utilities, no isolated anomalies of the type potentially associated with USTs were observed. One exception may be the very large, strong anomaly in the far northeastern corner of the site in the field north of Hazen Drive. This anomaly is exactly centered on a “Tank” depicted on the basemap supplied by the client. There is currently no tank, nor any other surficial structure, in this area, and it is not specified whether the mapped (former) tank was a UST or aboveground storage tank (AST). However, the presence of this anomaly indicates that this tank or some remnant of it certainly remains underground. Throughout the rest of the site, the complexity of anomalies in and around buildings and other structures suggested the possibility that USTs could exist, but with their EM anomalies obscured by obvious surficial sources. Therefore, all accessible areas of the site were surveyed using GPR, which is relatively insensitive to surficial sources of interference.

GPR systems produce cross-sectional images of subsurface features and layers by continuously emitting pulses of radar frequency energy from a scanning antenna as it is towed along a survey profile. The radar pulses are reflected by interfaces between materials with differing dielectric properties. The reflections return to the antenna and are displayed on a video monitor as a continuous cross section in real time. Since the electrical properties of metallic tanks, pipes, and wastes are often distinctly different from soil and backfill materials, metallic targets produce dramatic and characteristic reflections. Fiberglass, plastic, concrete, and terra-cotta targets as well as subsurface voids, rock surfaces, soil type changes, and concentrations of many types of non-metallic wastes also produce recognizable, but less dramatic reflections.



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To scan the site, a GSSI SIR-2000 GPR controller with a 400 MegaHertz (MHz) scanning transducer was towed behind a survey vehicle or by hand along profiles spaced approximately five feet apart. The GPR profiles were examined in the field as the survey progressed to identify any high-amplitude parabolic anomalies of the type expected for a cylindrical UST.

Results

The results of the EM survey are shown on Figures 2 and 3. Both the terrain conductivity and inphase data (Figures 2 and 3 respectively) display long, linear, orthogonal anomalies of the type consistent with underground utilities. The presence of these inferred utilities was confirmed with GPR. Only a single location produced laterally-restricted, high-amplitude, parabolic reflections of the type consistent with UST. This location lies on the northern side of a former building (T-409) between Allen Avenue and Hazen Drive. The footprint of the inferred target was GPS-surveyed, and is depicted on Figures 2 and 3. In addition, this target was flagged in the field, and pointed-out to the client's representative in the field for independent location surveying. Finally, note that although no parabolic reflections of the type associated with standard horizontal cylindrical USTs were observed in the GPR profiles from the field north of Hazen Drive, the presence of a large EM anomaly centered on the mapped location of a former tank suggests that the tank or its remnants (possibly including product piping) still exists beneath the site.

Limitations

The geophysical survey described above was completed using standard and/or routinely accepted practices of the geophysical industry and equipment representing the best available technology. Enviroscan does not accept responsibility for survey limitations due to inherent technological limitations or site-specific conditions. However, we make every effort to identify and notify the client of such limitations or conditions.



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We have appreciated this opportunity to work with you again. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,
Enviroscan, Inc.

Timothy D. Bechtel, Ph.D., P.G.
Principal Geophysicist

Technical Review By:
Enviroscan, Inc.

Felicia Kegel Bechtel, M.Sc., P.G.
President

enc.: Figure 1: EM Survey Data Coverage
Figure 2: EM-31 Terrain Conductivity Data
Figure 3: EM-31 Inphase Response Data
Appendix A: EM-31 Vertical Dipole Mode Depth Response



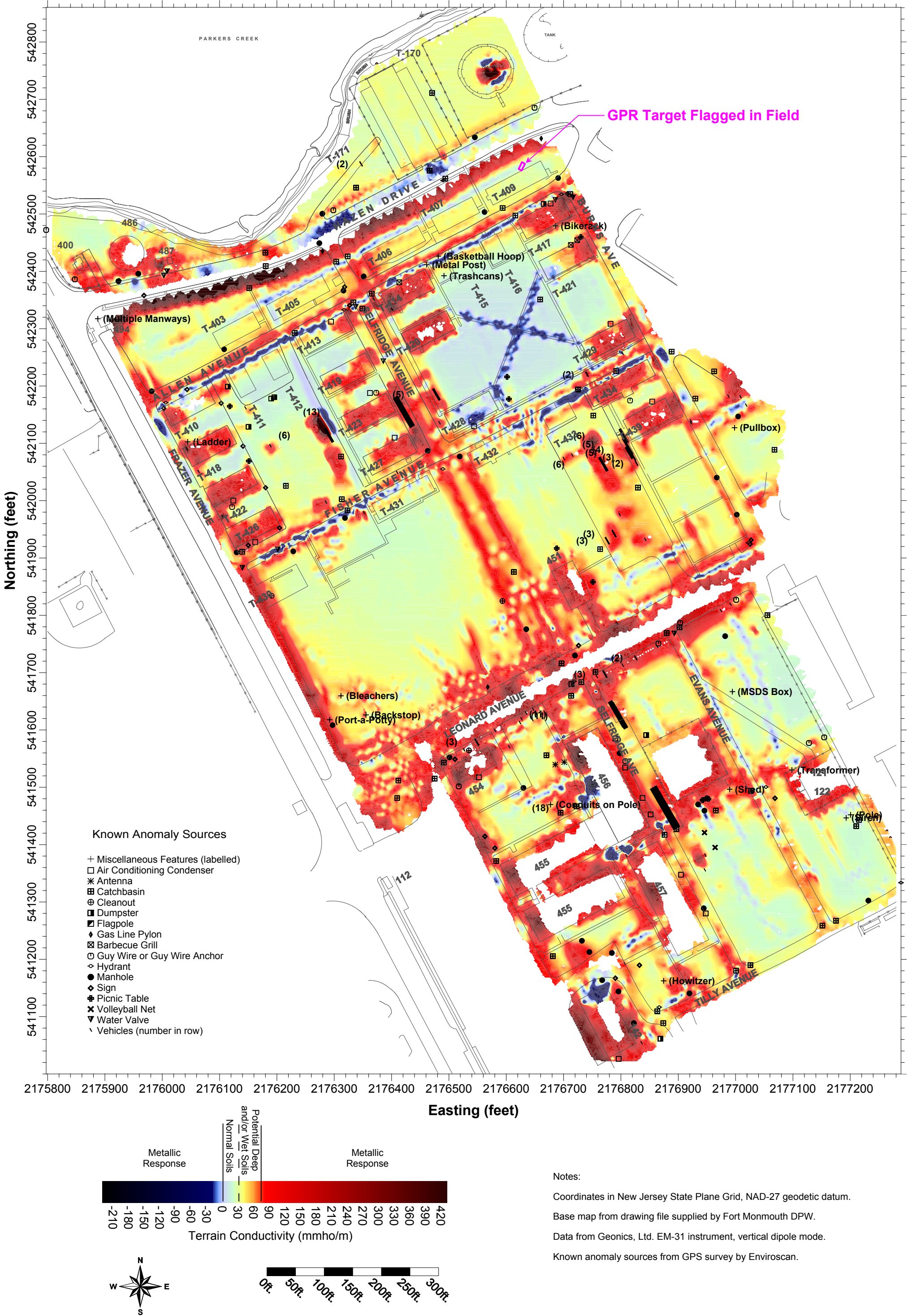


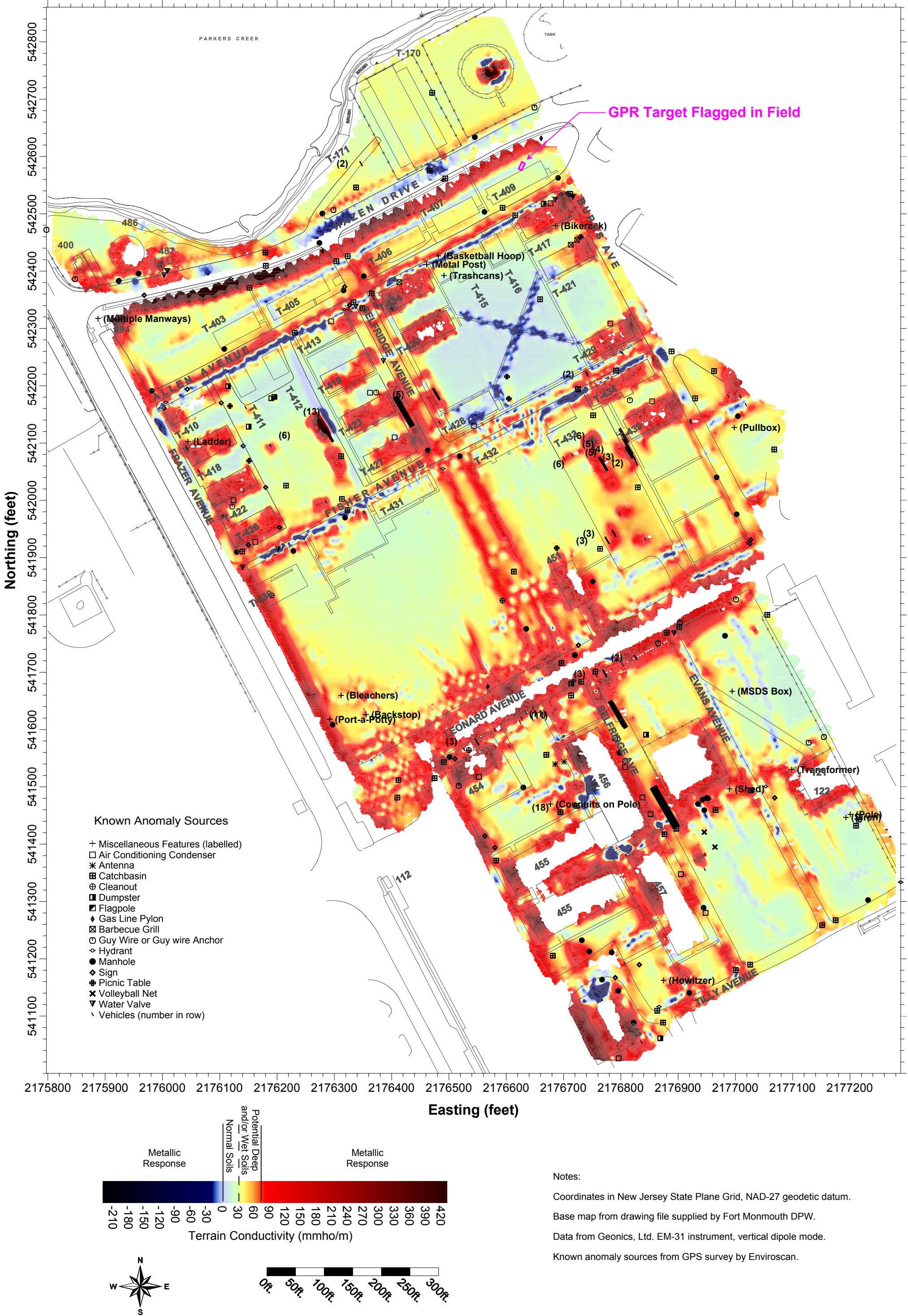
Figure 2

EM-31 Terrain
Conductivity Data

400 Area
Fort Monmouth, NJ

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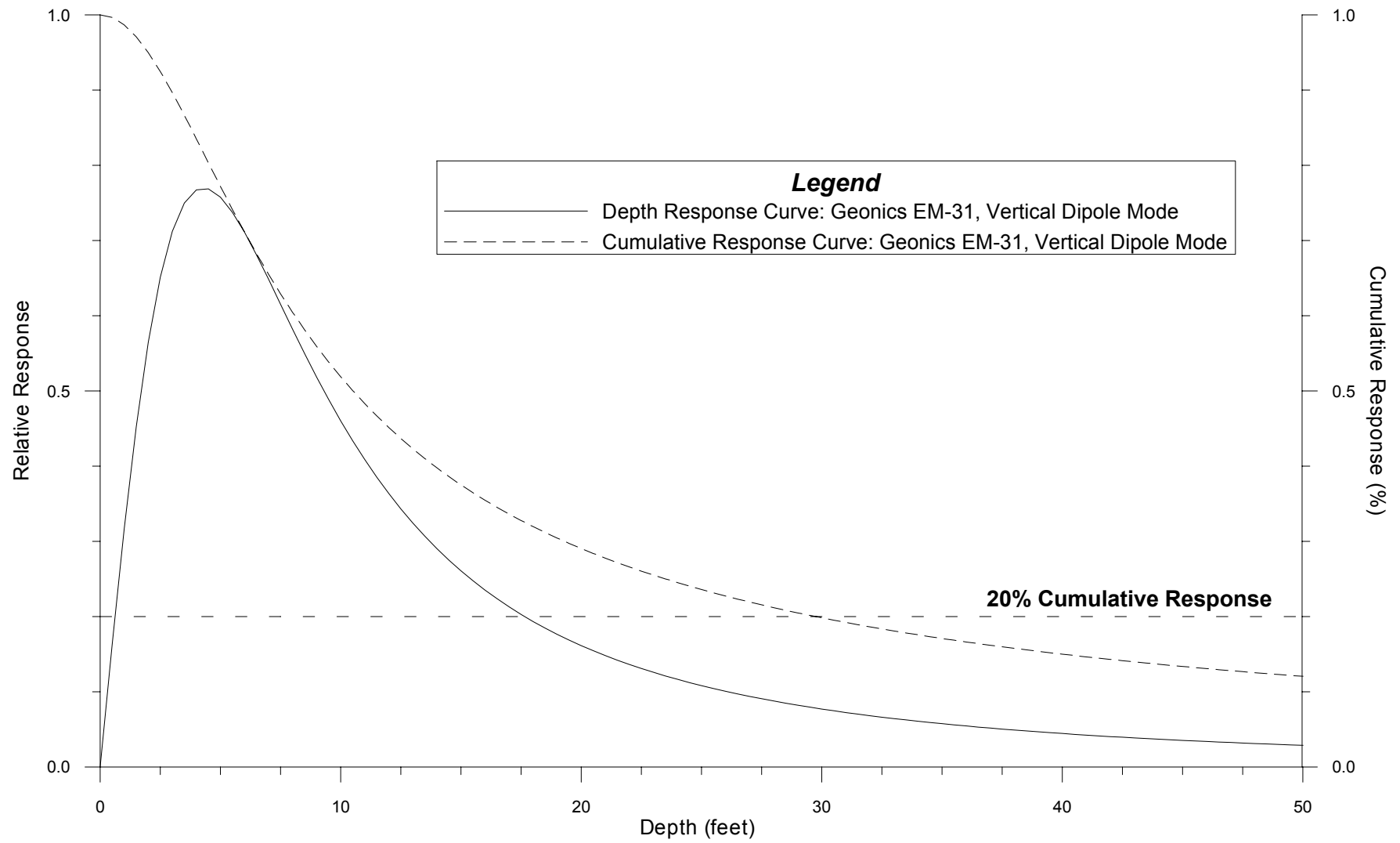




Appendix A

EM-31 Vertical Dipole Mode Depth Response





EM-31 Vertical Dipole Mode Depth Response

Revised 01/2001

