



**Final Report
Geophysical Survey
Buried UST/Metallic Debris Detection/Delineation
Two Areas, Approximately One Acre Each
Fort Monmouth, NJ
Enviroscan Project Number 080443**

**Prepared For: US Army, Fort Monmouth
Prepared By: Enviroscan, Inc.
September 24, 2004**





September 24, 2004

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

RE: Geophysical Survey
Buried UST/Metallic Debris Detection/Delineation
Two Areas, Approximately One Acre Each
Fort Monmouth, NJ
Enviroscan Project Number 080443

Dear Mr. Guenther:

Pursuant to our proposal dated August 26, 2004, Enviroscan, Inc. (Enviroscan) has completed a geophysical survey of the above-referenced site on September 11, 2004. The purpose of the survey was to determine whether there is evidence of buried metallic underground storage tanks (USTs) beneath two client-designated areas measuring approximately one acre each. The first survey area was conducted in and around an asphalt parking lot located just south of Building 208 across Barker Circle (see Figure 1). All former structures in this area (i.e. PNCO Club, Building S-580) have been demolished, and the site was flat, paved over with asphalt, and open at the time of the field survey. The second survey area was located immediately to the west of Building 287 in the parking lot and grassy sections (see Figure 3). Note that Enviroscan performed scanning over all accessible portions of this survey area, but the presence of many parked vehicles at the time of the survey prevented a complete survey of the area from being accomplished.



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Methods

In order to ensure detection of the widest possible range of feature types, the geophysical survey was completed using standard and/or routinely accepted practices of the geophysical industry and equipment representing the best available technology, including:

- a Geonics EM-61 electromagnetic detector;
- a Fisher TW-6 electromagnetic (EM) pipe and cable locator/tracer; and
- a GSSI SIR-2000 ground penetrating radar (GPR) system.

Descriptions and scopes of work for each technique are described below.

EM-61

Since the Building S-580 survey area was open and accessible, Enviroscan performed an EM survey using a Geonics, Ltd. EM-61 instrument in order to detect and delineate areas of concern. The EM-61 uses a one-meter by ½-meter coil to transmit 150 electromagnetic pulses per second into the ground at each measurement station. A second transmitter coil is used to narrowly focus the pulses, making the instrument relatively insensitive to overhead and/or nearby sources of electromagnetic interference such as buildings, fences, power lines, surficial debris, and atmospheric electromagnetic activity. During the off-time between transmitted pulses, a receiver coil measures the decay of transient electrical currents induced by the transmitted pulses. Electrical currents in moderately conductive earth materials (e.g. electrolytic soils) dissipate rapidly, leaving the more prolonged currents due to buried metallic objects. The EM-61 measures the surficial electrical potential due to the prolonged subsurface currents, providing a digital read-out of the relative metallic content of the subsurface. Note that the EM-61 focusing coil minimizes (but does not entirely eliminate) the response from surficial metallic reinforcing bars or debris that would mask the presence of deeper metal from standard EM, magnetic, metal detector, or GPR instruments.



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To complete the EM-61 survey, a system of parallel profiles spaced approximately 4 feet apart (depicted as rows of tiny crosses in Figure 1) were scanned by hand-towing the trailer-mounted EM-61 across all accessible areas of the site. EM-61 station measurements were automatically recorded at one-second intervals along each profile (for an average station spacing of approximately 2 to 3 feet). Location control was maintained using a backpack-mounted GPS receiver (Trimble Pathfinder PRO-XRS with TCS1 data logger) synchronized to the EM-61 polycorder. The GPS positions were differentially corrected relative to a fixed-position community base station located in Trenton, NJ. The resulting differential GPS (DGPS) positions have an accuracy of better than 2 feet.

Results of the EM-61 scanning are depicted as contours of the individual EM-61 station measurements in Figure 2. The contours represent the differential coil response and therefore depict subsurface metal with increasing positive values (in millivolts or mV). The contours were calculated using the kriging algorithm in SURFER by Golden Software.

TW-6

Due to the presence of the parked vehicles in the asphalted parking lot located just west of Building 287, Enviroscan did not employ the EM-61 instrument as was done in the S-580 Building survey area. Instead Enviroscan utilized a Fisher TW-6 EM instrument to scan the survey area. In pipe and cable search mode, the TW-6 is essentially a deep-sensing metal detector that detects any highly electrically conductive materials (e.g. metals) by creating an electromagnetic field with a transmitting coil. A receiving coil at a fixed separation from the transmitter measures the field strength. As the instrument is swept along the ground surface, subsurface metallic bodies distort the transmitted field. The change in field strength/orientation is sensed by the receiver, setting off an audible alarm and/or causing deflection of an analog meter. The TW-6 can nominally detect a 2-inch metal pipe to a depth of 8 feet and a 10-inch metal pipe to a depth of 14 feet. In pipe and cable tracing mode, the TW-6 transmitter can be coupled directly (conductively) to exposed portions of a metallic pipe, cable, or wire, or inductively to a subsurface metallic utility with known location and orientation. The transmitter remains stationary and energizes or excites the metallic utility to be traced with an 81.92-kilohertz signal that can be traced at the ground surface using the mobile TW-6 receiver wand or probe.



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GPR

GPR scanning was performed over all EM-61 and TW-6 anomalies using GSSI SIR-2000 GPR controller with an internal hard drive and a color display, and both a high-frequency, high-resolution 500 megaHertz (MHz) antenna or transducer, and a lower-frequency, deep-penetrating 200 MHz transducer. 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 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.

Results

Building S-580 Survey Area

The EM-61 survey results shown in Figure 2 depict the presence of several areas with a response of 8 millivolts (mV) or above, which are highlighted by a hatched black contour line. The overall survey results indicate a relatively normal response across the majority of the survey area, with the exception of an area showing elevated metallic response in the northwestern portion of the parking lot. This area of elevated response, highlighted by a solid turquoise line, likely represents the former Building S-580 location. GPR scanning was performed in the vicinity of the Predicted Location of the 1000-Gallon UST, but no anomaly indicative of a UST was observed – possibly because the area scanned with GPR might have still been within the former building footprint. It is possible that the UST exists further to the west; however, because this area is densely vegetated, scanning could not be performed at the time of the survey. In addition to highlighting the former building structure, the EM-61 results also indicate the presence of four suspected underground utilities, all which have been labeled on Figure 2. Note also that the regions of elevated metallic response located along the entire northern boundary (near the road) are probably related to underground utilities.



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Building 287 Survey Area

The geophysical survey boundary near Building 287 is highlighted with a green solid line on Figure 3. Note that scanning near and under parked vehicles was not possible. Results of the TW-6 scanning in this area indicated only one metallic anomaly, the limits of which have been highlighted by a solid turquoise line. GPR scanning over this anomalous area detected an anomaly with the high-amplitude, parabolic-shaped characteristics typical of a UST; however, the anomaly is only about 2 feet in width and roughly 15 to 20 feet in length – which is not typical of a UST. Therefore, the anomaly is probably associated with either an underground utility, or with an area of recent excavation immediately adjacent to the anomaly to the northeast, under the parked vehicles. Note that no anomalies were detected with either GPR or the TW-6 in the vicinity of the Predicted 2000-Gallon UST.



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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.

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

Sincerely,

Enviroscan, Inc.



Steven R. Snyder
Geophysics Project Manager

Technical Review By:

Enviroscan, Inc.



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

enc.: Figure 1: Geophysical Survey Data Coverage, Building S-580
Figure 2: EM-61 Differential Response Data Contours, Building S-580
Figure 3: Geophysical Survey Results, Building 287



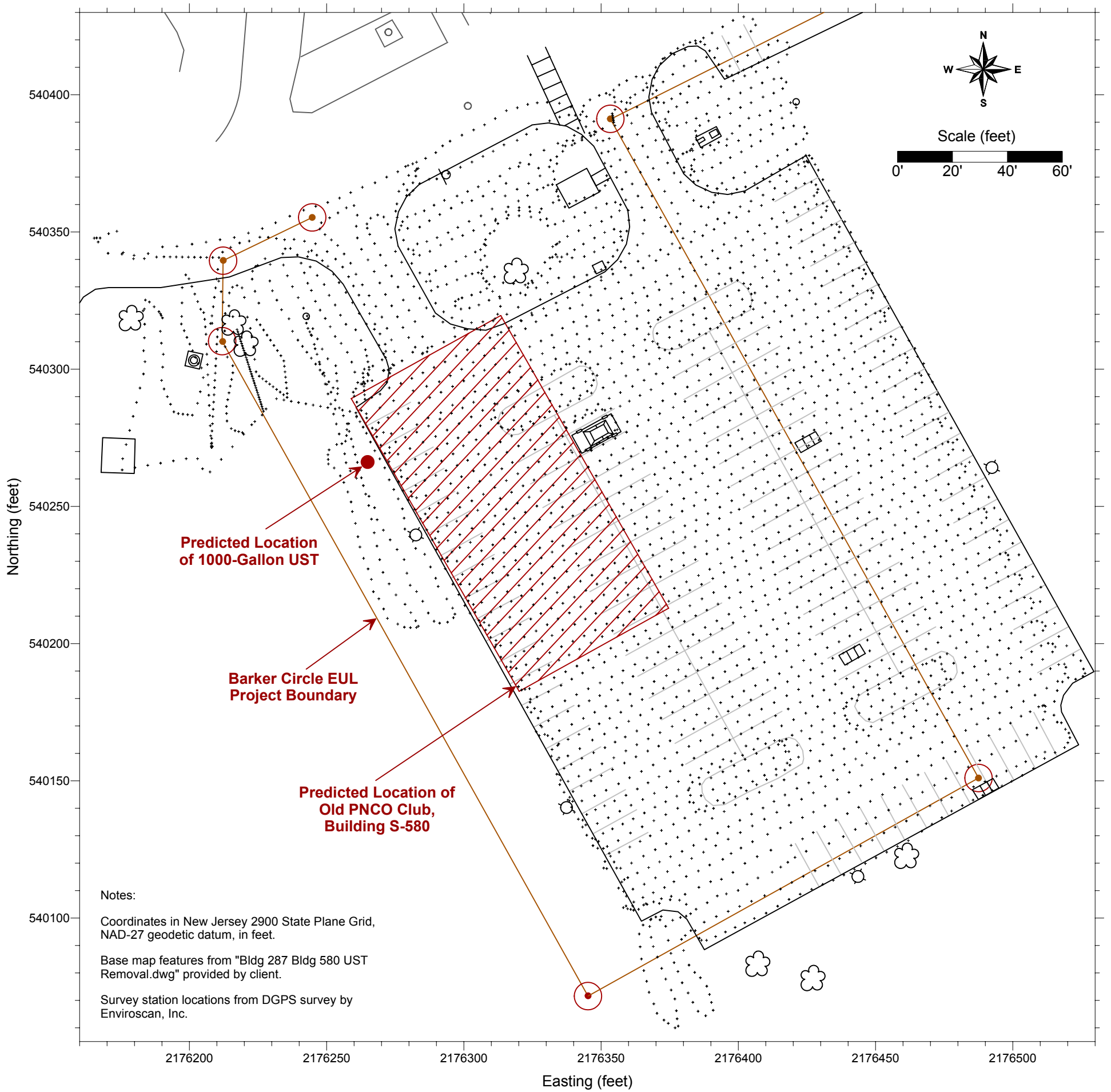


Figure 1

**Former Location of PNCO Club
Building S-580
Fort Monmouth, NJ**

**Geophysical Survey
Data Coverage
Building S-580**

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Rev. 09/24/04**



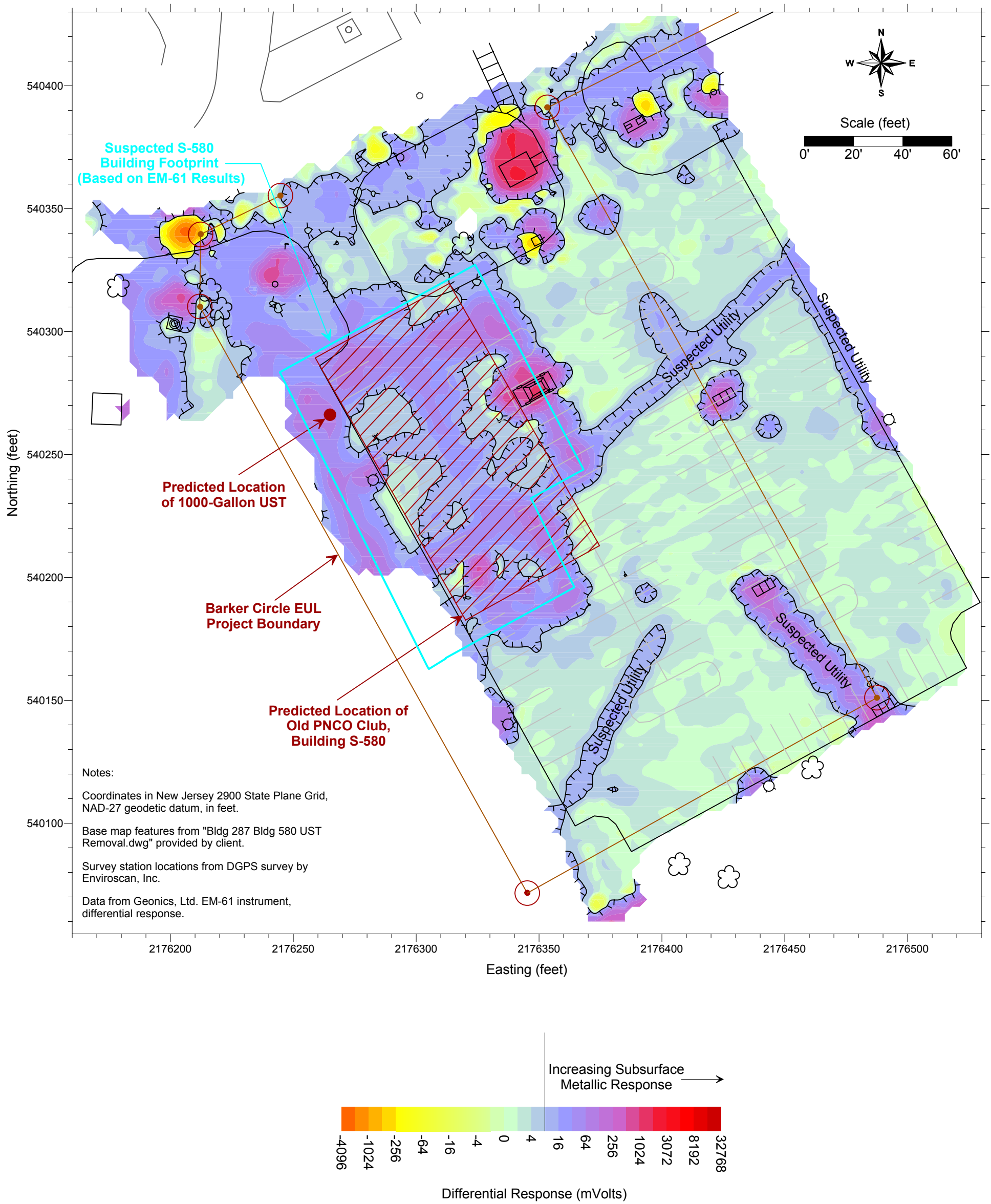


Figure 2

**Former Location of PNCO Club,
 Building S-580
 Fort Monmouth, NJ**

**EM-61 Differential Response
 Data Contours
 Building S-580**

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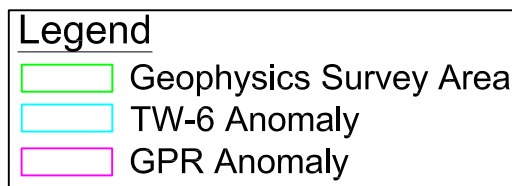
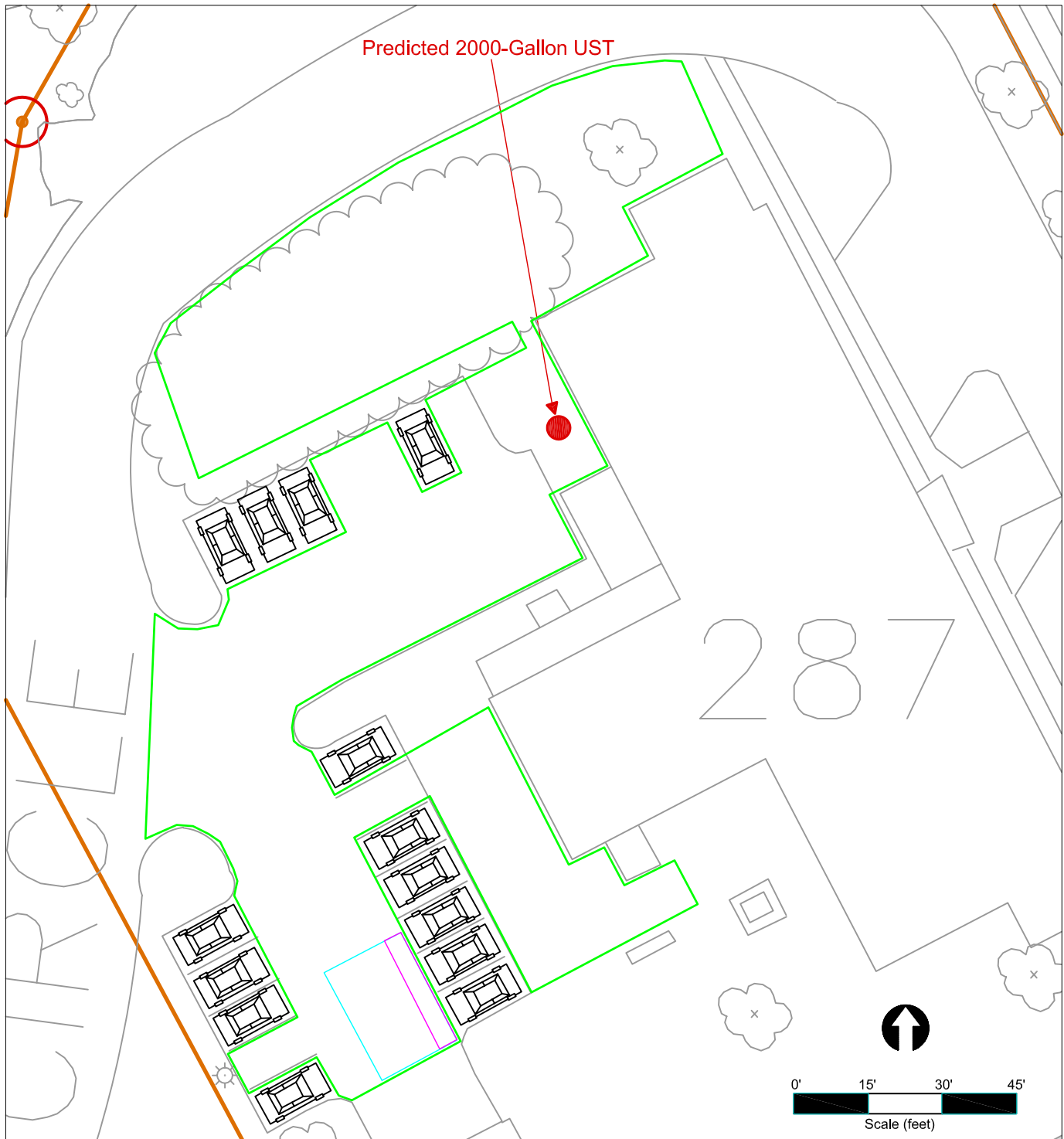


Figure 3

**Geophysical Survey
Results
Building 287**

**Building 287
Fort Monmouth, NJ**