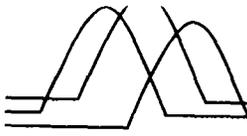


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RESULTS OF GEOPHYSICAL INVESTIGATION NS NORFOLK VA
8/14/2002
NAEVA GEOPHYSICS, INC



NAEVA GEOPHYSICS INC.

THE LEADER IN SUBSURFACE DETECTION

Subsurface Geophysical Surveys

GPR
MAGNETICS
ELECTROMAGNETICS
SEISMICS
RESISTIVITY
UTILITY LOCATION
UXO DETECTION
BOREHOLE CAMERA
STAFF SUPPORT

Results of Geophysical Investigation

Joint Forces Staff College Building SC-124
Hampton Boulevard
Norfolk Naval Station
Norfolk, Virginia

Prepared for: **CH2M Hill**
Herndon, Virginia

Dates of Investigation: August 14, 15 & 26, 2002

Prepared by:

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**Results of Geophysical Investigation
Joint Forces Staff College Building SC-124
Hampton Boulevard
Norfolk Naval Station
Norfolk, Virginia**

Introduction On August 14, 15 and 26, 2002, NAEVA Geophysics Inc. conducted a geophysical investigation at the Joint Forces Staff College Building SC-124 located on Hampton Boulevard at the Norfolk Naval Station in Norfolk, Virginia. The purpose of the investigation was to identify possible underground storage tanks (USTs) that may exist at the site, as well as any UST-related piping that may be associated with these tanks. The area of investigation included an area approximately 200 by 310 feet in size covering the northwest, southwest, and southeast sides of the building (see Figure 1).

Methods The equipment selected for this investigation included a Geonics EM-61 time-domain metal-detector, a Fisher TW-6 Pipe and Cable Locator (an electromagnetic metal-detector), a Sensors & Software Noggin 500 ground-penetrating radar (GPR) unit, and an Ashtech Z-FX Surveyor RTK (Real Time Kinematic) GPS system.

The EM-61 induces an electromagnetic field and measures the response of both ferrous and non-ferrous metallic objects using a two-coil receiver system. This system allows for the suppression of near-surface and above ground responses from that of more deeply buried objects. Measurements are expressed in millivolts.

A grid of northeast-southwest traverses was established across the area of investigation at 5-foot intervals. EM-61 data were then collected at .64-foot intervals along these lines. These data were processed on-site and used to generate a contour map (Figure 1) that was examined for anomalies that may represent USTs.

The TW-6 metal-detector was used in a reconnaissance investigation of the area for evidence of buried metal objects. The metal-detector was used to investigate areas that were too small or confined for effective EM-61 data collection. These areas included the areas between the chain-link fence and the building wall on the northwest and southeast sides of the building. The TW-6 was also used to investigate areas where EM-61

reinforced concrete pad (possibly a former sidewalk) corresponding to the anomaly.

Anomaly 2 was a rectangular shape approximately five feet wide and 25 feet long. This anomaly was located between Anomaly 1 and the building, slightly to the southeast. GPR profiles collected over this anomaly were similar to those collected over Anomaly 1 (see Figure 2). NAEVA suspects that this anomaly is also caused by a reinforced concrete pad in the subsurface.

Anomaly 3 appeared as a large, multi-lobed anomaly on the data contour map, but follow-up with the metal-detector identified several smaller metal anomalies spread throughout the area. Two small rectangular anomalies, one two feet by three feet in size, the other two feet by five feet in size were identified, as well as a number of small circular anomalies less than two feet in diameter. A long linear anomaly was also identified running southeast from the building, then making a 90-degree turn to the southwest. Much of the area was found to have very small metal anomalies in the subsurface, or larger, very weak anomalies, indicating that a fair amount of metal was present in the soil, without significant concentrations. GPR profiles collected over the small rectangular anomalies did not indicate the presence of any regular shapes in the subsurface. Profiles collected over the linear anomaly indicated a small hyperbolic reflector (see Figure 3). This is consistent with the presence of a cylindrical utility line in the subsurface.

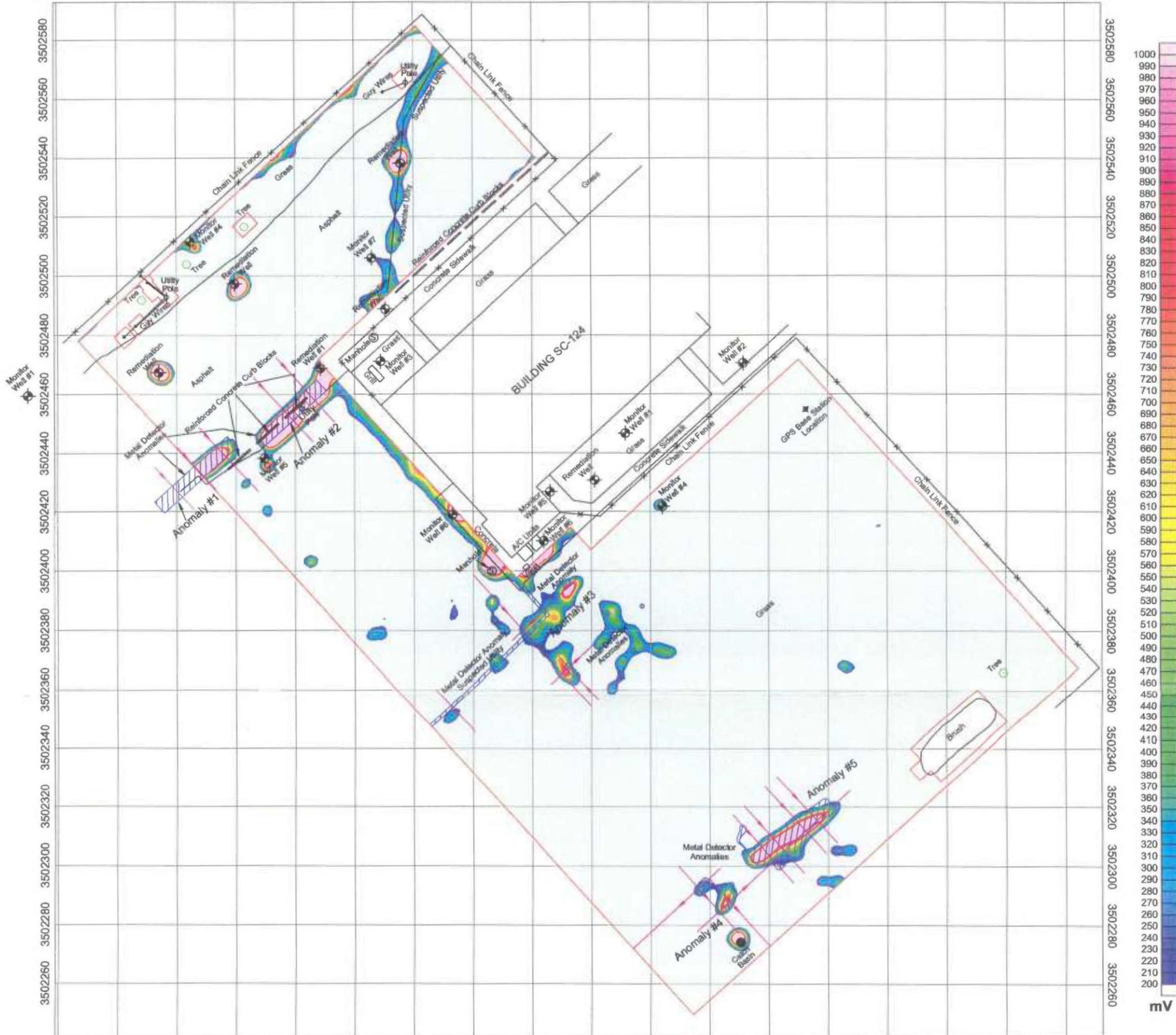
At Anomaly location 4, two separate smaller anomalies were identified with the TW-6 metal-detector. The two anomalies were irregular in shape. One anomaly was approximately five feet by three feet in size, the other approximately five feet by ten feet. GPR profiles collected over these anomalies did not indicate the presence of any reflectors consistent with a UST or other regularly shaped object in the subsurface (see Figure 3).

Metal Anomaly 5 was a large irregularly shaped anomaly, approximately 30 feet long and 10 feet wide. Each side of the anomaly was irregular in outline except for the northwest side, which was straight. Multiple GPR profiles collected over the anomaly did not indicate the presence of any regularly shaped objects (see Figure 4)

NAEVA suggests that the identified metal anomalies without any clear cause may simply represent buried scrap metal or building debris. If further characterization of the sources of these anomalies is required NAEVA can only recommend their careful excavation. No other evidence of possible USTs was identified anywhere within the areas of investigation. All other metal anomalies identified on the contour map

were correlated to cultural items exposed at the surface, such as monitoring wells, fences, or manholes. Table 1 lists locations of all monitoring wells. The surface traces of detected features were painted on the ground using pink paint and/or marked with pink pin flags.

12121900 12121920 12121940 12121960 12121980 12122000 12122020 12122040 12122060 12122080 12122100 12122120 12122140 12122160 12122180 12122200 12122220 12122240



12121900 12121920 12121940 12121960 12121980 12122000 12122020 12122040 12122060 12122080 12122100 12122120 12122140 12122160 12122180 12122200 12122220 12122240

Legend

-  Area of Investigation
-  Metal Detector Anomaly
-  Ground Penetrating Radar (GPR) Line with Direction of Traverse

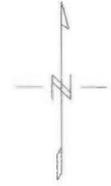
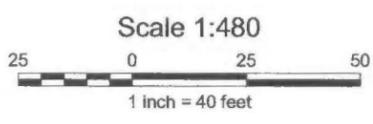


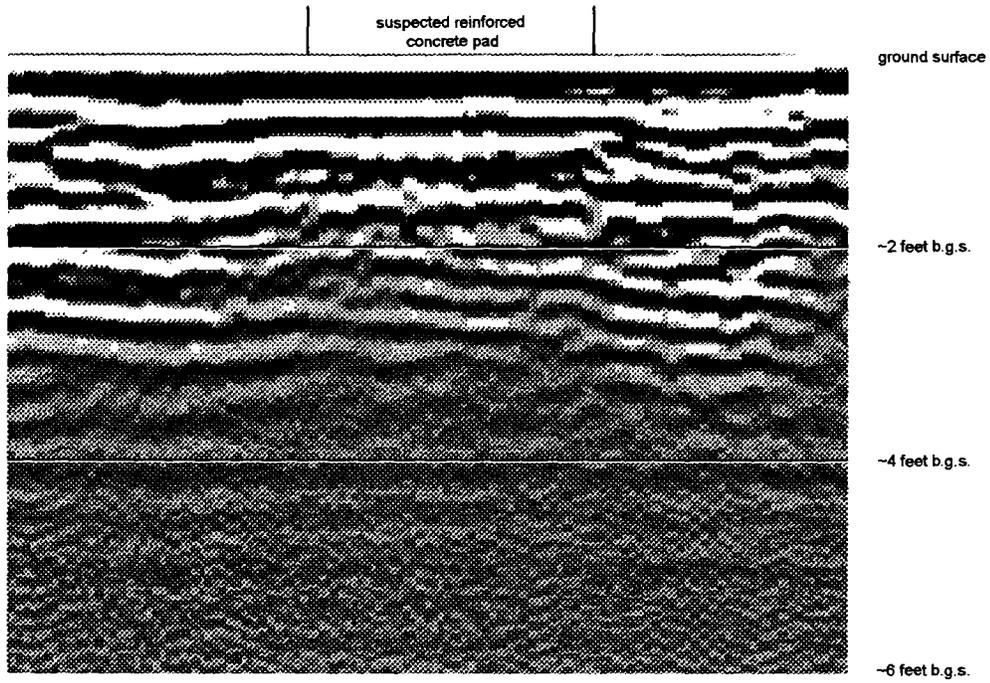
Figure 1



CH2M Hill
 EM61 Bottom Coil Contours Depicting Area of Investigation and Cultural Features
 Joint Forces Staff College Building SC-124 - Norfolk Naval Station
 Norfolk, Virginia
 Dates of Survey: August 14 & 15, 2002

Figure 2: Sample GPR Profiles, Anomalies 1 & 2
Joint Forces Staff College
Norfolk Naval Station, Norfolk, VA

NW-SE GPR Profile Across
Anomaly 1



NW-SE GPR Profile across
Anomaly 2

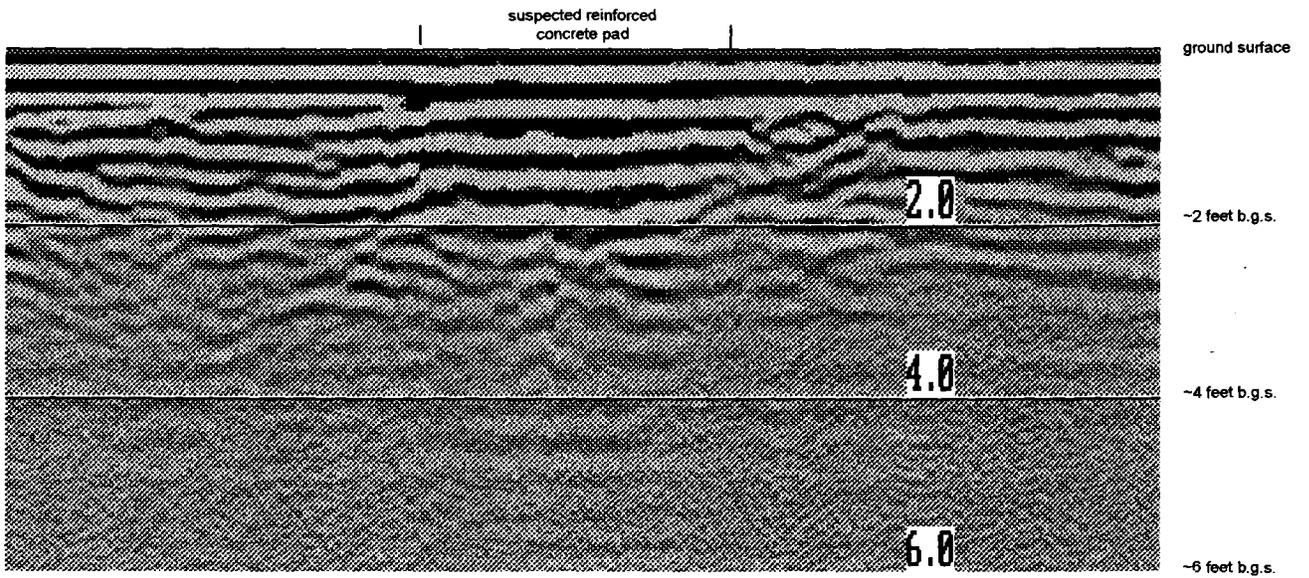
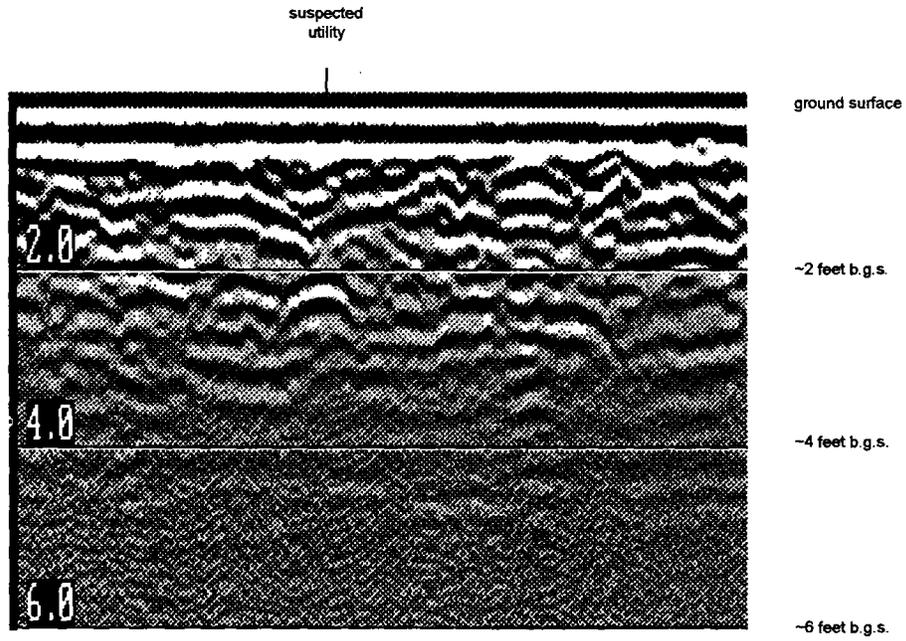


Figure 3: Sample GPR Profiles, Anomalies 3 & 4
Joint Forces Staff College
Norfolk Naval Station, Norfolk, VA

NW-SE GPR Profile Across
Anomaly 3



NW-SE GPR Profile across
Anomaly 4

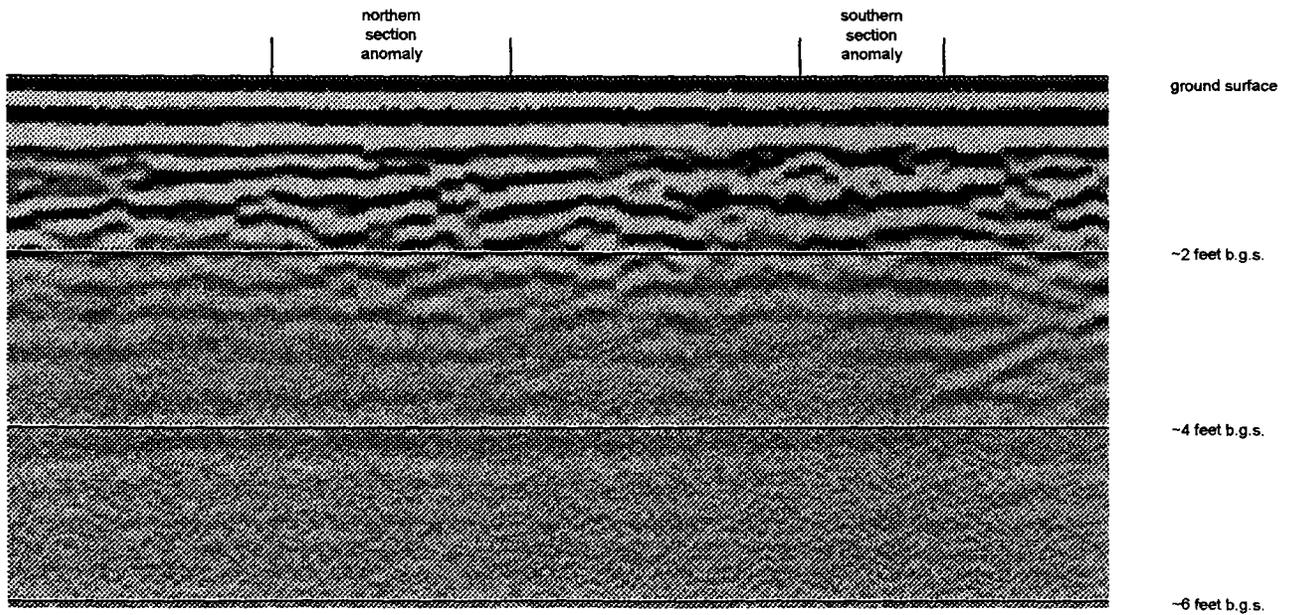


Figure 4: Sample GPR Profiles, Anomaly 5
Joint Forces Staff College
Norfolk Naval Station, Norfolk, VA

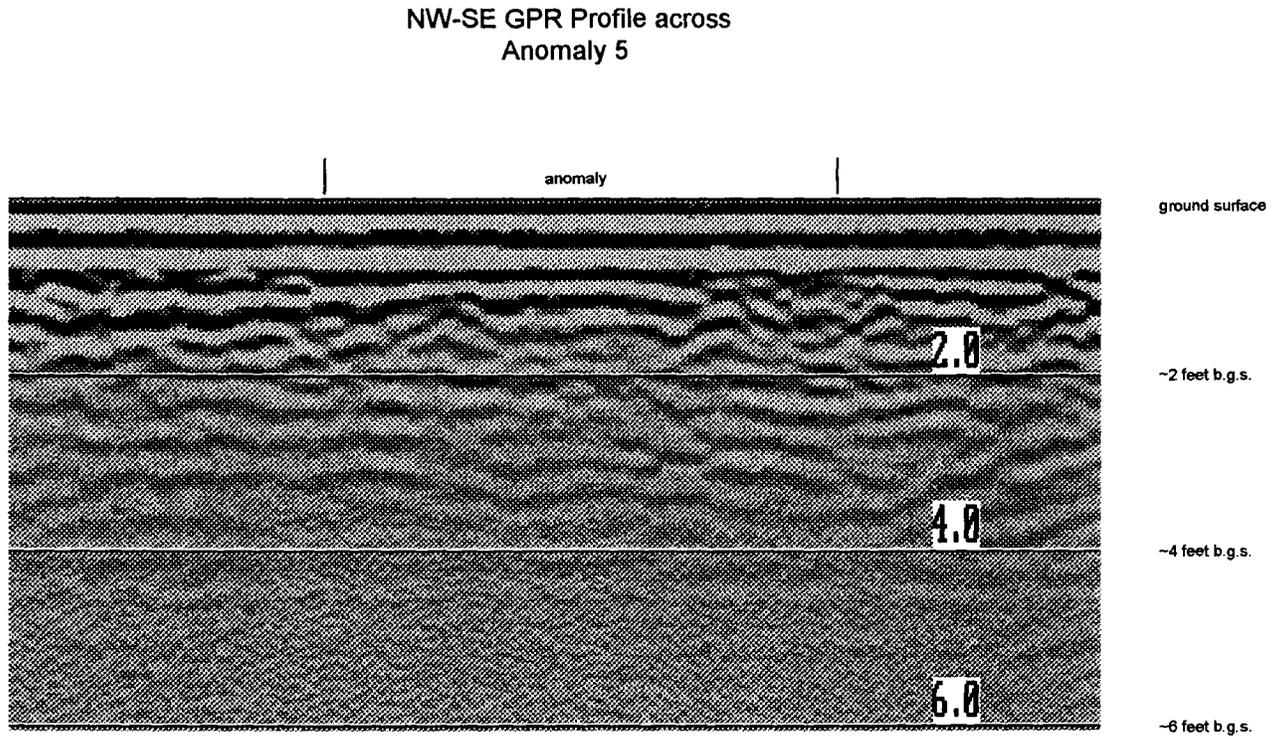


Table 1
Monitor Well Locations
Joint Forces Staff College Building SC-124 - Norfolk Naval Station

Description	State Plane Easting NAD83	State Plane Northing NAD83	Longitude (W) WGS84 (DDMMSS)	Latitude (N) WGS84 (DDMMSS)
Base Location	12122152.2521	3502453.1821	76.18.47.07773	36.55.18.15427
RMW #1	12121988.4787	3502468.8647	76.18.49.08960	36.55.18.34680
RMW no label	12122015.7590	3502538.3272	76.18.48.73392	36.55.19.02720
RMW no label	12122010.4145	3502488.8202	76.18.48.81384	36.55.18.53904
RMW no label	12121959.5149	3502497.3284	76.18.49.43808	36.55.18.63480
RMW no label	12122081.1766	3502430.7334	76.18.47.95920	36.55.17.94864
MW1	12121890.0970	3502459.5208	76.18.50.30352	36.55.18.27696
MW1	12122091.5669	3502446.7069	76.18.47.82672	36.55.18.10416
MW2	12122132.0855	3502469.7879	76.18.47.32128	36.55.18.32304
MW3	12122008.7769	3502471.1558	76.18.48.83904	36.55.18.36480
MW4	12121944.5654	3502511.5495	76.18.49.61808	36.55.18.77880
MW4	12122104.1342	3502421.7237	76.18.47.67912	36.55.17.85432
MW5	12122066.0658	3502426.6687	76.18.48.14640	36.55.17.91192
MW5	12121969.6531	3502438.3471	76.18.49.33008	36.55.18.04944
MW6	12122063.1906	3502409.4127	76.18.48.18672	36.55.17.74200
MW6	12122033.0285	3502418.9110	76.18.48.55536	36.55.17.84280
MW7	12122005.8048	3502506.0485	76.18.48.86568	36.55.18.71040

RMW = Remediation Monitor Well

MW = Monitor Well

Appendix A
Site-Specific Health and Safety Plan

Naval Station Norfolk CTO-262 - Site-Specific Health and Safety Plan

This checklist must be used in conjunction with the Master HASP. This checklist is intended for use by CH2M HILL employees only. All CH2M HILL employees performing tasks under this checklist must read and sign both this checklist and the Master HASP and agree to abide by their provisions (see EMPLOYEE SIGNOFF attached to the checklist).

Site: Building SC124, Naval Station Norfolk, near Joint Forces Staff College, off of Hampton Boulevard.

Location(s): Approximate 1 acre parcel of land surrounding Building SC-124 and former Building SC-413.

This document shall be maintained on site with the Master Health and Safety Plan. It will include as attachments from the Work Plan a site map and the site characterization and objectives for this site.

The procedures described in the Master Health and Safety Plan will be followed unless otherwise specified in this Site-Specific Health and Safety Plan.

1. HAZWOPER-Regulated Tasks

- | | |
|---|---|
| <input type="checkbox"/> Test pit and excavation | <input type="checkbox"/> Groundwater sampling |
| <input type="checkbox"/> Soil boring installation | <input type="checkbox"/> Aquifer testing |
| <input type="checkbox"/> Hollow stem boring | <input type="checkbox"/> Hydrologic measurements |
| <input checked="" type="checkbox"/> Geophysical surveys | <input type="checkbox"/> Surface water sampling |
| <input type="checkbox"/> Hand augering | <input type="checkbox"/> Biota sampling |
| <input type="checkbox"/> Subsurface soil sampling | <input type="checkbox"/> Investigation-derived waste (drum) sampling and disposal |
| <input type="checkbox"/> Surface soil sampling | <input type="checkbox"/> Observation of loading of material for offsite disposal |
| <input type="checkbox"/> Soil gas surveys | <input type="checkbox"/> Oversight of remediation and construction |
| <input type="checkbox"/> Sediment sampling | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> Monitoring well/drive point installation | |
| <input type="checkbox"/> Monitoring well abandonment | |

2. Hazards of Concern (Check as many as are applicable. Refer to Section 3 of Master H&S Plan for control measures):

- Heat stress
- Cold stress
- Buried utilities, drums, tanks
- Inadequate illumination
- Drilling
- Heavy equipment
- Working near water
- Flying debris
- Gas cylinders
- Noise
- Slip, trip, or fall hazards
- Back injury
- Confined space entry
- Trenches, excavations
- Protruding objects
- Vehicle traffic
- Ladders, scaffolds
- Fire
- Working on water
- Snakes or insects
- Poison ivy, oak, sumac
- Ticks
- Radiological
- Other _____

3. Contaminants of Concern (List if known. Refer to Table 3.8 of the Master HSP)

_____	_____	_____
_____	_____	_____

4. Personnel (List CH2M HILL field team members and telephone numbers):

Field team leader(s)	Erica Mathews 757-460-3734 x43
Site safety coordinator(s)	Erica Mathews (cell) 757-373-3943
Field team members	Naeva Geophysics, Inc. (Karen Lemley, Rob Gimpel)

5. Contractors/Subcontractors

- Procedures as per Master HASP
- Other _____

Name: To be added _____
Contact: To be added _____
Telephone: To be added _____

6. Level of personal protective equipment (PPE) required: D
Refer to Table 5.1 of Master HASP, CH2M HILL SOPs, and Respiratory Protection, Section 2 of the Site Safety Notebook.

7. Air monitoring instruments to be used (refer to Master HSP for action levels):

_____ OVM 10.6 _____ FID
_____ CGI _____ Dust monitor
_____ O₂ _____ PID

8. Decontamination procedures:

_____ As per Section 7 of Master HASP
_____ Other: As described in the EBS Investigation Work Plan.

9. List any other deviations or variations from the Master HASP: None

10. Emergency Response : See page 37 of Master HASP.

11. Map to hospital: See Figure 12-1 Master HASP (immediately after pg. 37).

12. Emergency Contacts: See pg. 37 of Master HASP

13. Approval. This prepared site-specific checklist must be approved by John Longo/NJO or authorized representative

Name: _____ Title: _____

14. Employee Signoff. All CH2M HILL employees working at the site must sign the attached Employee Signoff for the checklist as well as for the Master HASP.

