

**DRAFT**  
**Geophysical Investigation Report**  
**Great Lakes Naval Training Center**  
**Great Lakes, Illinois**



**Northern Division**  
**Naval Facilities Engineering Command**  
**Contract No. N62472-90-D-1298**  
**Contract Task Order 0019**

August 1994

DRAFT

GEOPHYSICAL INVESTIGATION REPORT  
for  
SITE #7, RTC SILKSCREENING SHOP  
GREAT LAKES NAVAL TRAINING CENTER

Submitted to:  
U.S. Navy - Northern Division  
Environmental Branch, Code 18  
Naval Facilities Engineering Command  
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**DESIGN COORDINATION & REVIEW - COMMENTS**

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 DSN 792-2744

Date:  
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Project Title and Location:  
 Draft Geophysical Investigation Report, RTC Silkscreening  
 Shop, NTC Great Lakes, IL; N62467-90-D-1298, CTO #0019

Type Review:

Dwg. # or Par. #	COMMENTS	REVIEW ACTION
pg 1-1, sect 1.1	It does not appear that the objective of the work was accomplished. The objective of the work was to "determine, through non-intrusive geophysical techniques, if buried tanks and/or pipes are present beneath the site." By only performing a portion of the geophysical survey (GPR), real conclusions cannot be made.	
pg 1-1, sect 1.2	The site description needs to include a discussion of where all the utilities are located at or near the site.	
fig 2-1	Locate the utilities on this drawing. How did the utilities that ran east to west just north of the "PARKED TRUCK" affect the GPR readout and the interpretation of the data? How did the other utilities affect the GPR readout and the interpretation of the data?	
pg 1-1, sect 1.3	Identify and locate the limits of the petroleum-like product on Figure 2-1	
pg 1-2, sect 1.3	The last sentence reads, "The purpose of this investigation was to use non-intrusive methods to determine whether buried tanks and/or pipes may be present beneath the site." I would like to emphasize the word "may". This statement is not consistent with the real scope of this effort, "to determine, through non-intrusive geophysical techniques, if buried tanks and/or pipes are (with emphasis) present beneath the site." Please review the SOW and coordinate with the RPM as to why a magnetometer (Goenics EM61 or similar) or other geophysical survey instrument was not brought out to the site to verify if the "potential metallic anomalies" were or were not actual tanks or contaminant plumes.	
pg 2-1, sect 2.1	Why was the GPR chosen for the geophysical survey? What limitations and advantages does this technique have over other geophysical survey techniques? How was it determined that GPR was the most appropriate technique to use (such as what soil types were expected at this site; clay, sand, etc., and how did the soil types affect the decision to go with GPR)?	

**DESIGN COORDINATION & REVIEW - COMMENTS**

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Comments by / Code / Phone: Ken Barnes/Code 930/(708) 688-4197, DSN 792-4197, FAX DSN 792-2744		<b>Date:</b> 22 September 1994
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<b>Dwg. # or Par. #</b>	<b>COMMENTS</b>	<b>REVIEW ACTION</b>
pg 4-1, second paragraph	What further investigations are warranted to identify the potential metallic objects and the potential moisture areas? EM survey, magnetometer survey, borings, cone penetrometer, SCAPS, etc.?	

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## EXECUTIVE SUMMARY

A Ground-Penetrating Radar (GPR) investigation was conducted at Site #7, RTC Silkscreening Shop, on Saturday, July 16, 1994. This report describes the site as encountered on that day, the equipment used for this investigation, and the procedures followed to collect and analyze the data.

Analysis of the GPR data revealed a group of anomalies in adjacent data paths having radar signature strength sufficient to indicate a potential buried metallic object or objects. Because none of these anomalies shows a typical tank signature, we cannot be conclusive in identification. We believe further investigation of this area should be conducted. Another group of anomalies was also observed in the data. These anomalies have a weaker radar signature and are believed to be related to a localized difference in moisture content in the soils. The type of material causing this moisture change cannot be determined from the GPR data.

## **1.0 STATEMENT OF OBJECTIVES**

This report summarizes the additional non-intrusive investigatory work performed under CTO #0019, Site Inspection for Site #7 - the Recruit Training Center (RTC) Silk Screening Shop, located at the Great Lakes Naval Training Center (NTC), Great Lakes, Illinois. The Site Inspection was initiated as a result of a 1986 Initial Assessment Study (IAS) at the NTC, which identified Site #7 as one of several parcels requiring further evaluation. The need for the additional work described in this report was based on field conditions encountered during a 1992 cleanup action which involved the excavation and removal of contaminated soils affected by an above-ground storage tank (AST) spill.

### **1.1 PROJECT SCOPE AND OBJECTIVES**

The objective of the additional scope of work was to determine, through non-intrusive geophysical techniques, if buried tanks and/or pipes are present beneath the site. According to Navy representatives, the site may have been the location of a World War II-vintage gas station. As requested by the U.S. Navy, proposed work included a site visit, records search, a geophysical survey, and the generation of this report detailing the investigation results.

### **1.2 SITE DESCRIPTION**

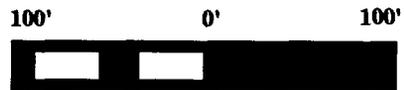
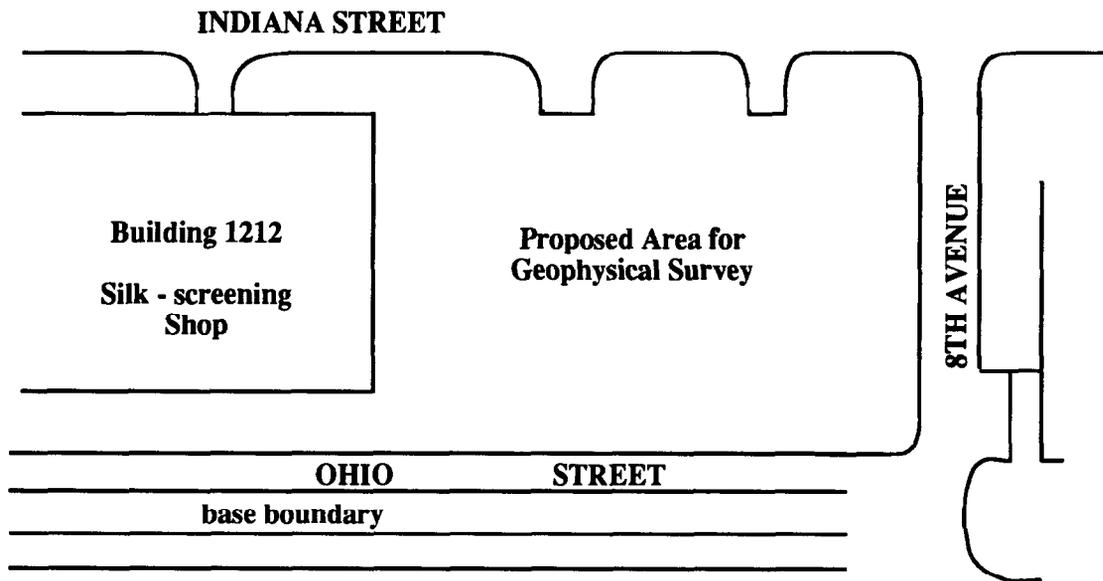
The site is presently used as a parking lot and a storage area for miscellaneous equipment. It is bounded on the south by Building 1212, on the west by Indiana Street, on the north by 8th Avenue, and on the east by Ohio Street (refer to Figure 1-1 for site features map).

The site is primarily covered with asphalt and serves as a parking lot. Two fuel ASTs are located in a fenced area near Ohio Street, across from the former silk-screening shop drain. The specific parts of the site investigated may be divided into three areas: (1) an area bounded by a wooden stockade-type fence having an irregular soil, rubble, and debris surface; (2) an asphalt paved area south of the ASTs; and (3) the asphalt parking lot west of the fenced area and building 1209. The north wall of the RTC Silkscreening Shop is the southern boundary of the site. The western limits were determined by equipment and vehicles parked along the western-most line of parking stalls in the parking lot. The south edge of 8th Avenue was the northern limit of the investigation.

A concrete vault housing steam pipes is located between the AST area and Ohio Street. Underground steam lines reportedly run in a north-south and east-west direction from the vault.

### **1.3 SITE BACKGROUND**

On June 23, 1992, a spill occurred at a gasoline AST located near Site #7. During the excavation and removal of the gasoline-contaminated soils, a petroleum-like product was encountered at approximately 2 feet below grade, halting the cleanup operation. The



Scale  
(Approximate)

**RUST** ENVIRONMENT &  
INFRASTRUCTURE

**FIGURE 1-1**  
**SITE LOCATION MAP**  
**CTO #19 - SITE #7, RTC SILKSCREENING SHOP**  
**GREAT LAKES NAVAL TRAINING CENTER**

partially-excavated area was then backfilled with clean material. According to a Navy memorandum dated July 29, 1992, the site area may have been the location of a vintage World War II gasoline station.

On July 29, 1992, the Navy requested the Halliburton NUS Team to investigate the presence of the subsurface petroleum-like product as part of the Site #7 Site Inspection being conducted under CTO #0019. The purpose of this investigation was to use non-intrusive methods to determine whether buried tanks and/or pipes may be present beneath the site.

#### **1.4 SITE VISIT**

A one-day site visit was performed on June 28, 1994 by the Halliburton NUS Team Project Manager and a geophysical scientist. The site visit included a visual inspection of the physical features of Site #7 and the surrounding area and an assessment of site conditions relative to the geophysical survey.

During the site visit, the Halliburton NUS Team interviewed Navy personnel familiar with the site. The information provided by the Navy personnel was speculative, as none of the personnel was present during the operation of a gas station at this location. However, the reported information indicated that underground storage tanks (USTs) may be buried in the north-central part of the existing parking lot. Navy personnel could not locate documents or drawings related to the presence or locations of the suspected USTs.

The assessment of the site relative to the geophysical survey indicated that the majority of the site, consisting of a paved parking lot, is readily accessible with GPR. However, three areas of the site were identified as not conducive to GPR in their present condition. These include:

- 1) the area surrounded by the wooden stockade fences which is covered with a combination of metallic debris, some logs and piles of wood chips, and two large trailers;
- 2) the basin beneath the fuel storage tanks, because of standing water and the likelihood of reinforcing steel in the concrete slab; and
- 3) the vaulted area along the east side of the site, because of reinforcing steel, multiple reflectors, and materials stored inside this vault, which will prevent GPR from gathering interpretable data from the top surface. In addition, an investigation from inside the vault would not yield good results because the multiple layers of reinforcing steel in the walls and floors will prevent the GPR signal from penetrating beyond the outer surface of the walls and floor.

## 2.0 GEOPHYSICAL SURVEY

The GPR investigation was performed at Site #7 on July 16, 1994. The parking lot and the fenced area had been cleared of vehicles and other equipment by Navy personnel to allow the GPR investigation to proceed in these areas. Before the investigation started, a grid system was established at the site to reference the GPR data to the site boundary and on-site structures.

### 2.1 EQUIPMENT

The specific equipment used for this investigation was a SIR System-8 manufactured by Geophysical Survey Systems, Inc. The system consists of a control unit, transducer (radar transmitter, receiver and antenna), and graphic chart recorder. The equipment operates on 12 volts DC.

Radar transducers operating at different frequencies and wavelengths can be used with this equipment. In general, lower transducer frequencies will yield greater depth of penetration of the radar signal, while higher frequencies, although not able to penetrate the earth as deeply, give the greatest resolution. This greater resolution gives the high-frequency transducer the ability to discriminate between closely spaced objects and interfaces.

Two different transducers, with the following frequencies were used at this site: a 500 MHz ( $500 \times 10^6$  Hz) unit and a 300 MHz ( $300 \times 10^6$  Hz) unit. In operation, a brief pulse of electromagnetic energy (2 nanoseconds ( $2 \times 10^{-9}$  seconds) in wavelength for the 500 MHz, and 3 nanoseconds ( $3 \times 10^{-9}$  seconds) in wavelength for the 300 MHz) is directed into the earth. When this energy encounters an interface between two materials of differing dielectric properties, a portion of the energy is reflected back to the transducer. The reflected energy is received by the transducer and processed within the control unit, where it is amplified and the time differential between initial transmission of the electromagnetic pulse and the reception of the reflected wave is determined. The electromagnetic wave travels through the medium at a velocity dependent upon its dielectric characteristics, so the time differential can be converted into depth. This requires knowledge of the dielectric constant of the medium or, more commonly, on-site determination of the depth of a visible radar target. The electromagnetic pulse is repeated at a rate of 50 KHz ( $50 \times 10^3$  Hz), and the resultant stream of radar data is sent to the chart recorder where a continuous hard copy of the data is produced.

At the control unit, the operator has an oscilloscope display upon which the reflected wave form can be continuously monitored. Controls are also available to enable the operator to adjust and optimize the output on the graphic chart recorder. The equipment operates on 12 volts DC that was taken from the support vehicle on site.

## 2.2 PROCEDURES

Investigation of this site was performed with two transducers of different frequency. GPR survey lines were run as shown in Figure 2-1 with both a 500 MHz and a 300 MHz transducer. Both transducers were hand towed across the site with the person towing applying an electronic marker into the data at a predetermined interval. This marker occurs in the chart data and provides positioning reference along the scan line.

The 500 MHz transducer gathered data to a maximum depth of approximately 45 nanoseconds (approximately seven feet). Because better depth penetration was desired, the 300 MHz transducer was also used on most of the same lines. The 300 MHz transducer gathered data from as deep as 60 nanoseconds (approximately nine feet). Depth information is given in time (nanoseconds). This is appropriate with the lack of detailed dielectric information or identification in the field of a GPR target at a known depth. For the purpose of this report, an average dielectric of 12 was used. This translates to a pulse velocity (two-way) of seven nanoseconds per foot.

The GPR data lines in each area were referenced to the grid established. This grid was based on the north wall of the RTC Silkscreening Shop, the west stockade-type fence and the west wall of building 1209. The extent and location of the GPR survey lines are shown in Figure 2-1.

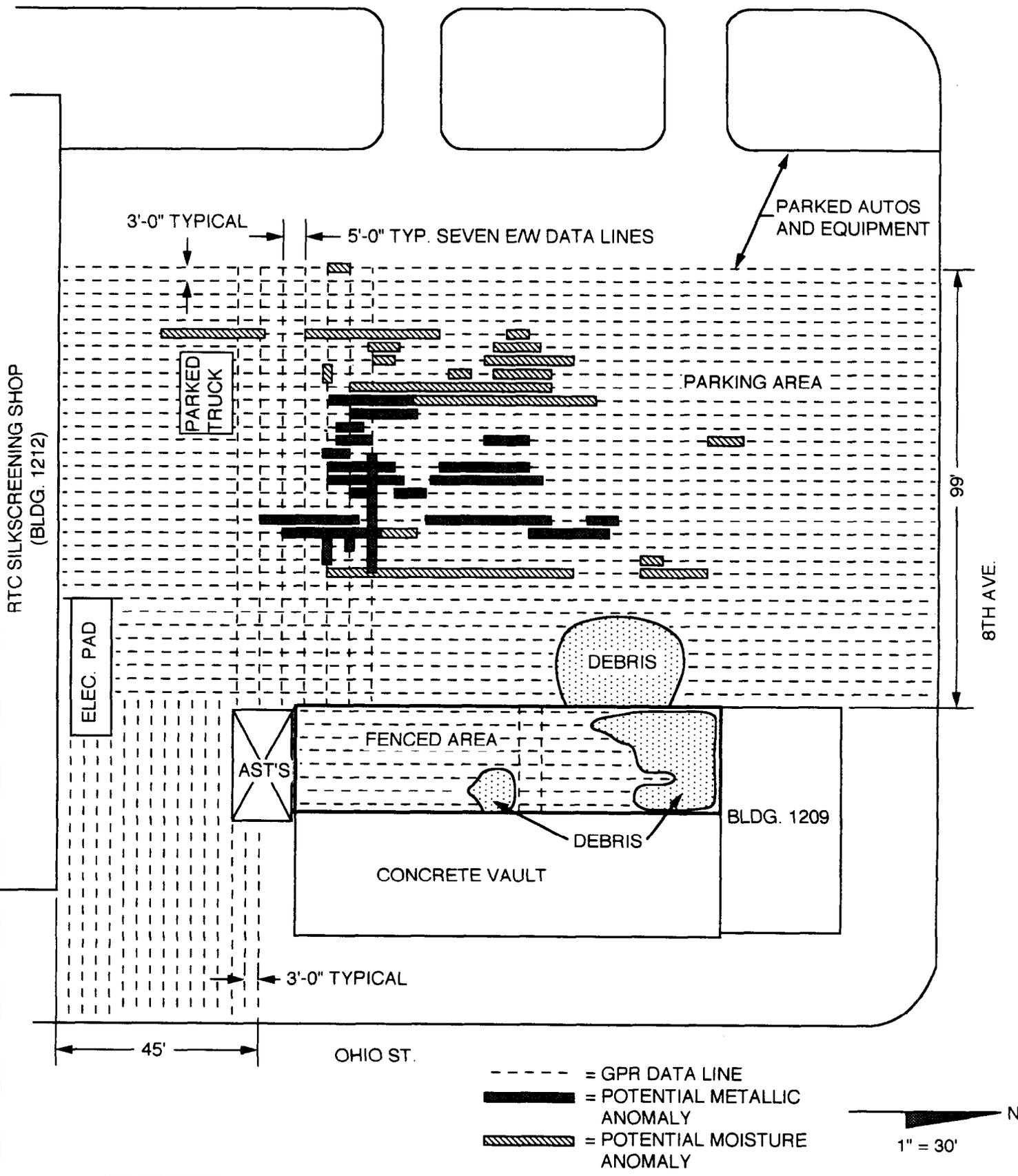


FIGURE 2-1  
 GROUND PENETRATING RADAR DATA  
 CTO #19 - SITE #7, RTC SILKSCREENING SHOP  
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### 3.0 DATA EVALUATION

The results of the geophysical survey were initially interpreted based on the identification of very strong signature anomalies (indicative of metallic objects) in the GPR data, and the collaboration of the presence of these signature anomalies from both the 500 MHz and 300 MHz runs. Subsequent analysis assessed any reoccurring signatures of interfaces visible in the data. Signatures having similar characteristics were plotted over their respective data line to reveal patterns in the data. The data interpretation also incorporated any pertinent information revealed during the records search concerning possible past operations at the site, particularly the existence of a gasoline station and possible associated underground storage tank locations.

#### 4.0 SUMMARY AND CONCLUSIONS

All of the area scanned by the GPR equipment and all anomalies identified in the data are shown in Figure 2-1. The interval of the data lines was such that nearly any buried metallic tank would be encountered by at least two data passes.

Analysis of the GPR data reveals a group of anomalies in adjacent data paths having radar signature strength sufficient to indicate a potential buried metallic object or objects. Because none of these anomalies shows a typical tank signature, we cannot be conclusive in identification. We believe that further investigation of this area is warranted.

Another group of anomalies was also observed in the data gathered with the 500 MHz transducer. These anomalies are of similar signature, have a weaker radar signature than those described above, and are potentially related to a localized difference in moisture content in the soils. The type of material causing this moisture change cannot be determined from the GPR data. However, changes in the soil type or subsurface chemical contamination are potential causes.

Other anomalies were seen in the data that could be described as trash or rubble placed or left here during construction of the surrounding facilities. These anomalies occur in the GPR data as a weak signal on a single pass. A more frequent occurrence of signatures related to rubble are seen in the data taken in the fenced area alongside the concrete vault. This is probably material contained in the backfill of the excavation for the vault. The locations of these anomalies were not compiled.