



February 9, 2015

Mr. Richard Garrett, LG
Catlin Engineers and Scientists, Inc.
P.O. Box 10279
Wilmington, NC 28404-0279

RE: State Project: U-3315
 WBS Element: 35781.1.1
 County: Pitt
 Description: Stantonsburg Road/Tenth St. Connector from Memorial Dr. (US 13) to
 Evans St.

**Subject: Project 15821004.00, Report on Geophysical Surveys
 Parcel 129, Marie S. Williams Property, Greenville, North Carolina**

Dear Mr. Garrett:

SCHNABEL ENGINEERING SOUTH, PC (Schnabel) is pleased to present this report on the geophysical surveys we performed on the subject property. The report includes two 11x17 inch color figures and four 8.5x11 inch color figures. This study was performed in accordance with our proposal for Geophysical Surveys to Locate Possible USTs, dated January 20, 2015, as approved by Ben Ashba (Catlin Engineers and Scientists, Inc.) on January 23, 2015.

INTRODUCTION

The field work described in this report was performed on January 27, 2015 and January 28, 2015, by Schnabel. The purpose of the geophysical surveys was to evaluate the potential presence of metal underground storage tanks (USTs) and vent pipes in the accessible areas of the NCDOT right-of-way and/or easement at Parcel 129. Photographs of the property are included on Figure 1. The property is located in the northeast quadrant of the intersection of South Memorial Drive (US 13 / NC 43 / NC 11) and South Village Drive in Greenville, NC.

The geophysical surveys consisted of an electromagnetic (EM) induction survey and a ground penetrating radar (GPR) survey. The EM survey was performed using a Geonics EM61-MK2 (EM61) instrument. The EM61 is a time domain metal detector that stores data digitally for later processing and review. Sensitivity to metallic objects is dependent on the size, depth, and orientation of the buried object and the amount of noise (i.e. response from spurious metallic objects) in the area. The EM61 can generally observe a single

buried 55 gallon drum at a depth of 10 feet or less. The EM61 makes measurements by creating multiple electromagnetic pulses and then measuring the response from metallic objects over time after each pulse is generated. We measure and record the response at several time increments after each pulse to help evaluate relative size and depth of metallic objects in the subsurface.

The GPR survey was performed over selected EM61 anomalies using a Geophysical Survey Systems SIR-3000 system equipped with a 400 MHz antenna to further evaluate EM responses that could indicate a potential UST. The depth penetration of the GPR signal, when using a 400 MHz antenna, is normally limited to 6 feet or less.

Photographs of the equipment used are shown on Figure 2.

FIELD METHODOLOGY

We obtained locations of geophysical data points using a sub-meter Trimble Pro-XRS differential global positioning system (DGPS). References to direction and location in this report are based on the US State Plane 1983 System, North Carolina 3200 Zone, using the NAD 83 datum, with units in US survey feet. We also recorded the locations of existing site features (signs, guy wire, etc.) with the DGPS for later correlation with the geophysical data and a site plan provided by the NCDOT.

The EM61 data were collected along parallel survey lines spaced approximately 2.5 feet apart. The EM61 and DGPS data were recorded digitally using a field computer and later transferred to a desktop computer for data processing. The GPR data were collected along survey lines spaced approximately one to two feet apart in orthogonal directions over anomalous EM readings not attributed to cultural features. The GPR data were reviewed in the field to evaluate the possible presence of USTs. The GPR data also were recorded digitally and later transferred to a desktop computer for further review.

DISCUSSION OF RESULTS

The contoured EM61 data collected over Parcel 129 and the GPR survey area locations are shown on Figure 3, EM61 Early Time Gate Response, and Figure 4, EM61 Differential Response. We were not able to access some small areas in the westernmost portions of the planned survey area due to the presence of bushes, large metal signs, etc. Areas outside the colored, contoured EM61 data were not surveyed. Early time data refer to the response measured at a short time after the initial EM pulse is generated. Early time data typically contain responses from all metal objects, small or large and shallow or deep, within the sensitivity range of the instrument. Differential data represent the difference in response between the top and bottom coils of the EM61 instrument at a later time after the initial pulse than early time data. Differential data naturally tend to filter out the effect of surface and very shallowly buried metallic objects. Typically, the differential response emphasizes anomalies from deeper and larger objects such as USTs.

Most of the planned survey area was covered by reinforced concrete, and this typically results in responses from deeper buried objects being masked. We therefore collected GPR data over most of the EM survey area on Parcel 129, as shown on Figures 3 and 4, due to the presence of the reinforced concrete. The GPR data indicated the presence of five known USTs, as shown on Figures 3 and 4. Identification of suspected Known UST Nos. 1 through 5 was made in accordance with the rating

categories provided by the NCDOT in their letter, dated May 19, 2009, entitled "Geophysical Surveys to Identify USTs".

Example GPR images from lines oriented over the marked locations of Probable UST Nos. 1 through 5 are shown on Figure 5. The GPR data suggest the tops of Known UST Nos. 1 through 5 are approximately 4 to 5 feet below ground surface. Known UST Nos. 1 through 4 are about 8 feet in diameter and about 16 feet long, equivalent to the capacity of a 6,000 gallon UST. Known UST No. 5 is about 8 feet in diameter and about 26.5 feet long, equivalent to the capacity of a 10,000 gallon UST. Photographs of the approximate locations of the known USTs that were marked in the field are included on Figure 6. The GPR data collected along parallel north-south lines between the western ends of the USTs and a group of exposed vertical vent pipes, which are located in a grassy area west of the USTs, suggest the horizontal, buried portion of the vent pipes are located between the ends of the tanks and the exposed vent pipes. These GPR data did not show clear reflections from each pipe that would allow us to trace their specific locations. However, the data from each of these GPR lines did show a group of anomalies, and the lateral extent of the anomalies appears narrower on GPR lines located closer to the exposed vertical vent pipes. We collected GPR data on the north, west, and south sides of the exposed vent pipes, and did not observe GPR reflections that could indicate buried pipes in those areas. The possible area in which the horizontal, buried portions of the vent pipes are located is shown on Figures 3 and 4.

CONCLUSIONS

As shown in Figures 3 and 4, the EM data we collected over Parcel 129 did not cover a portion of the planned survey area due to the presence of bushes, large metal signs, etc. within the planned survey area. The EM data include responses from several visible metallic objects at grade (e.g. water meters, other utilities, etc.).

The geophysical data indicate the presence of five known USTs partially within the proposed construction easement on Parcel 129. The EM and GPR data suggest Known UST Nos. 1 through 4 are about the size of a 6,000-gallon capacity UST. The EM and GPR data also suggest Known UST No. 5 is about the size of a 10,000-gallon capacity UST. The tops of Known UST Nos. 1 through 5 are about 4 to 5 feet below ground surface.

LIMITATIONS

These services have been performed and this report prepared for Catlin Engineers and Scientists, Inc. and the North Carolina Department of Transportation in accordance with generally accepted guidelines for conducting geophysical surveys. It is generally recognized that the results of geophysical surveys are non-unique and may not represent actual subsurface conditions.

We appreciate the opportunity to have provided these services. Please call if you need additional information or have any questions.

Sincerely,

SCHNABEL ENGINEERING SOUTH, PC



James W. Whitt, LG
Senior Staff Geophysicist



Joel C. Daniel, LG
Senior Geophysicist

JWW:JCD:GDR

Attachments: Figures (6)

CC: Gordon Box - NCDOT

FILE: G:\2015\GREENSBORO\15821004.00_CATLIN_GREENVILLE_UST_SURVEYS_(U-3315)\03-SE PRODUCTS\03-REPORTS\02-FINAL\SCHNABEL GEOPHYSICAL REPORT ON PARCEL 129 (U-3315) - FINAL - GDR COMMENTS.DOCX

Attachments:

- Figure 1 - Parcel 129 Site Photos
- Figure 2 - Photos of Geophysical Equipment Used
- Figure 3 - EM61 Early Time Gate Response
- Figure 4 - EM61 Differential Response
- Figure 5 - Parcel 129 Example GPR Images
- Figure 6 - Parcel 129 Photos of Known UST Locations



Parcel 129 (Marie S. Williams Property), looking east



Parcel 129 (Marie S. Williams Property), looking southeast



Geonics EM61-MK2 Metal Detector with Trimble DGPS Unit



GSSI SIR-3000 Ground-Penetrating Radar with 400 MHz Antenna

Note: Stock photographs – not taken on site.

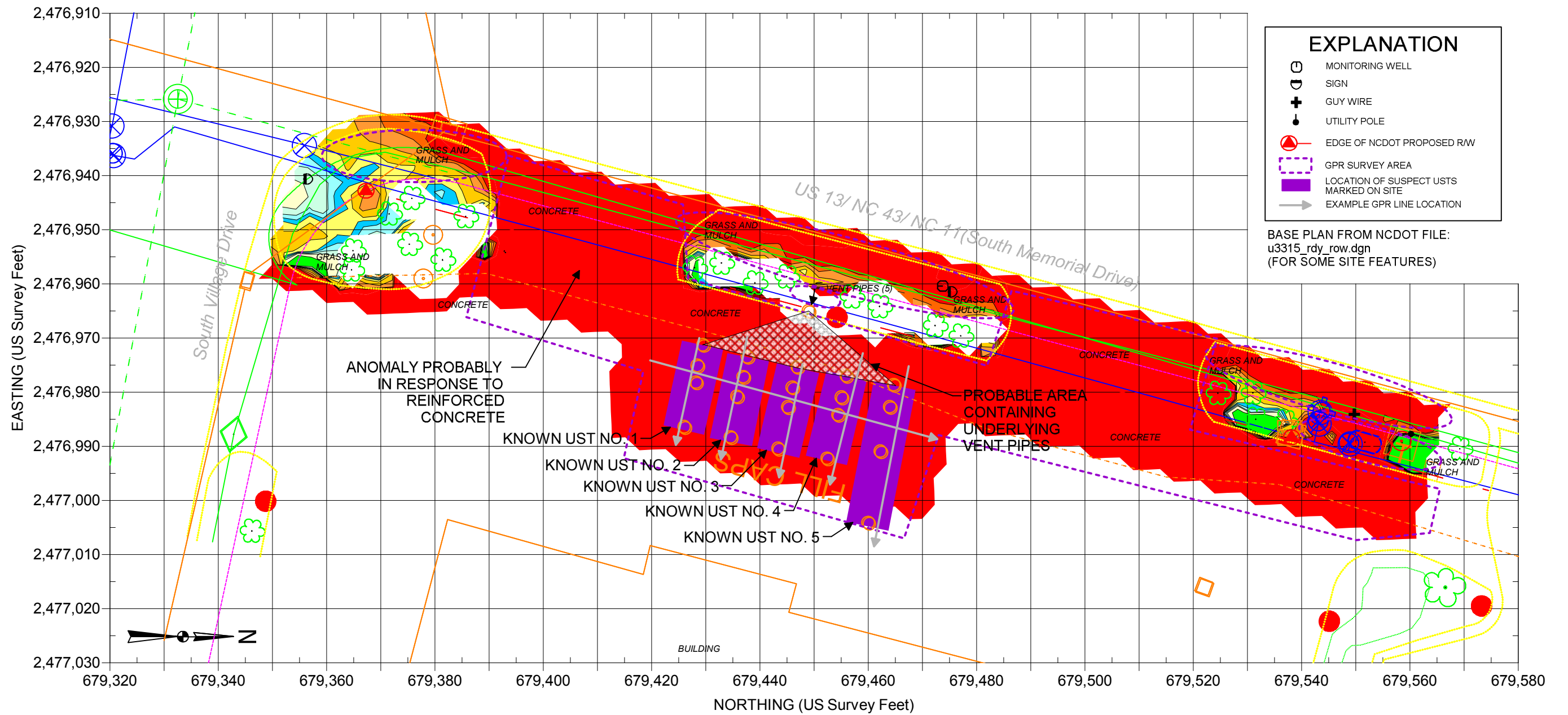


STATE PROJECT U-3315
NC DEPT. OF TRANSPORTATION
PITT CO., NORTH CAROLINA
PROJECT NO. 15821004.00

PHOTOS OF
GEOPHYSICAL
EQUIPMENT USED

FIGURE 2

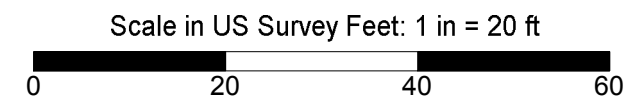
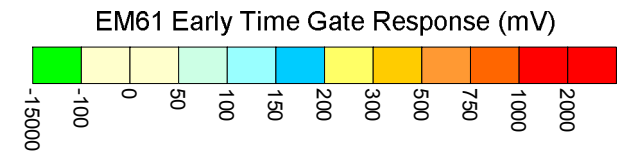
PARCEL 129



EXPLANATION

- MONITORING WELL
- SIGN
- GUY WIRE
- UTILITY POLE
- EDGE OF NCDOT PROPOSED R/W
- GPR SURVEY AREA
- LOCATION OF SUSPECT USTs MARKED ON SITE
- EXAMPLE GPR LINE LOCATION

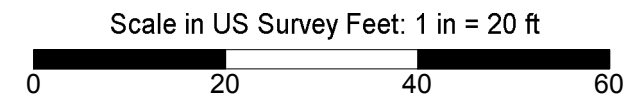
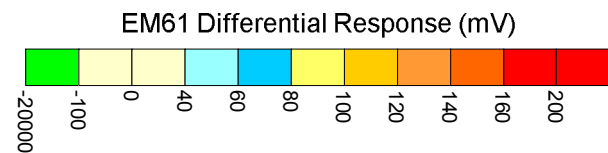
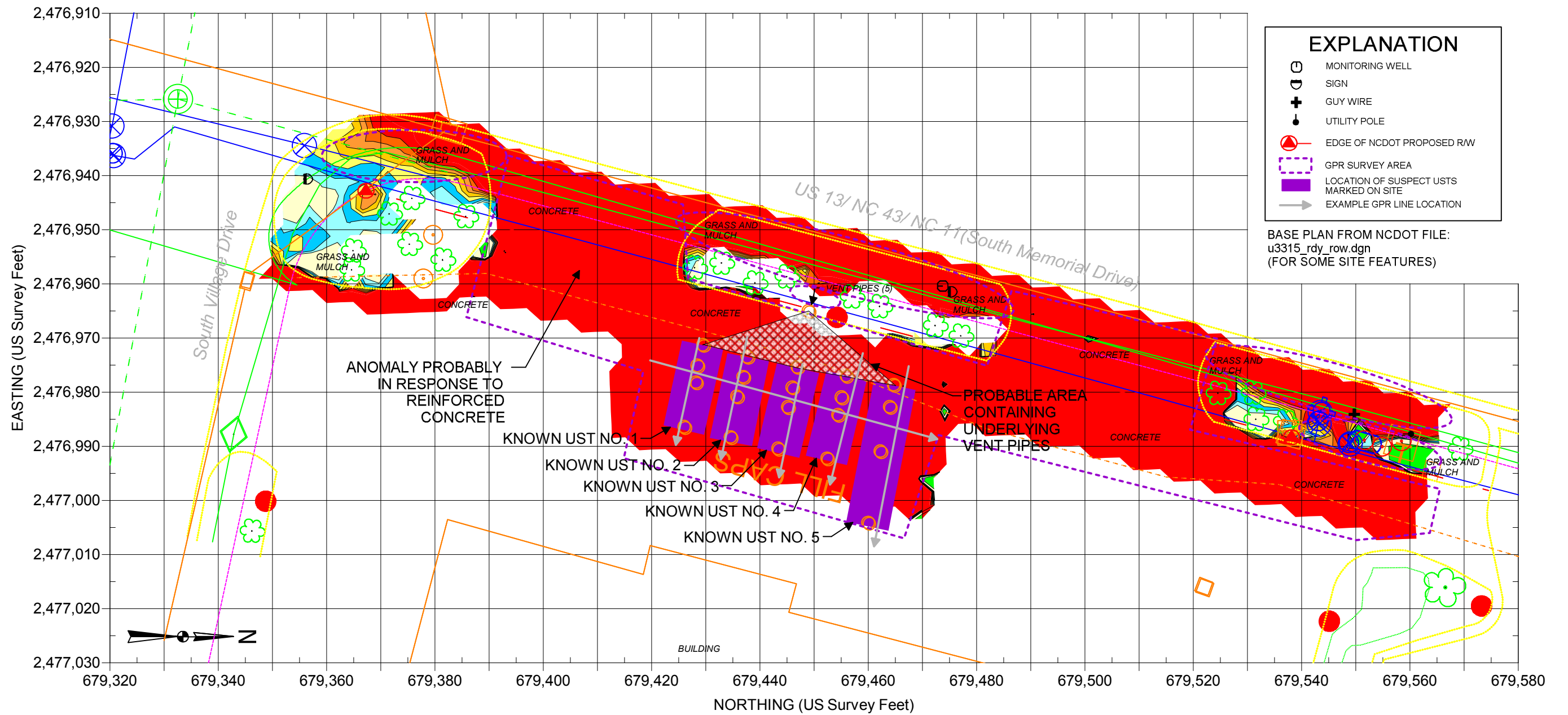
BASE PLAN FROM NCDOT FILE:
u3315_rdy_row.dgn
(FOR SOME SITE FEATURES)



Note: The contour plot shows the earliest and more sensitive time gate of the EM61 bottom coil/channel in millivolts (mV). The EM data were collected on January 27, 2015, using a Geonics EM61-MK2 instrument. Positioning for the EM61 survey was provided using a submeter Trimble ProXRS DGPS system. Coordinates are in the US State Plane 1983 System, North Carolina Zone 3200, using the NAD 1983 datum. GPR data were acquired on January 27 and January 28, 2015, using a Geophysical Survey Systems SIR 3000 equipped with a 400 MHz antenna.

	<p>STATE PROJECT U-3315 NC DEPARTMENT OF TRANSPORTATION PITT COUNTY, NC PROJECT NO. 15821004.00</p>	<p>EM61 EARLY TIME GATE RESPONSE</p> <p>FIGURE 3</p>
--	---	--

PARCEL 129



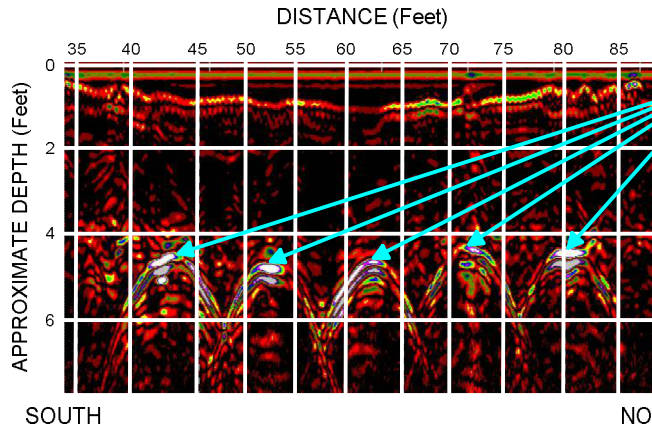
Note: The contour plot shows the difference, in millivolts (mV), between the readings from the top and bottom coils of the EM61. The difference is taken to reduce the effect of shallow metal objects and emphasize anomalies caused by deeper metallic objects, such as drums and tanks. The EM data were collected on January 27, 2015, using a Geonics EM61-MK2 instrument. Positioning for the EM61 survey was provided using a submeter Trimble ProXRS DGPS system. Coordinates are in the US State Plane 1983 System, North Carolina 3200 Zone, using the NAD 1983 datum. GPR data were acquired on January 27 and January 28, 2015, using a Geophysical Survey Systems SIR 3000 equipped with a 400 MHz antenna.



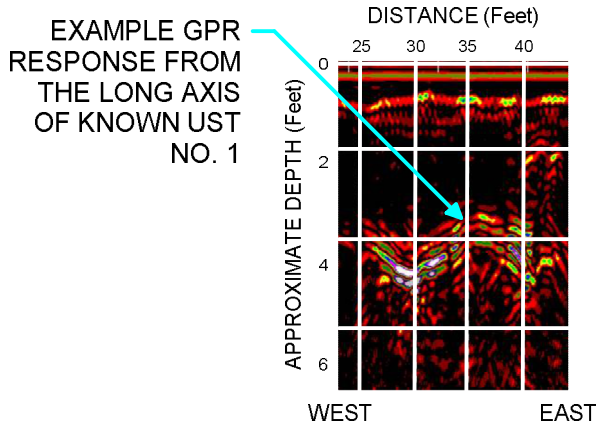
STATE PROJECT U-3315
NC DEPARTMENT OF TRANSPORTATION
PITT COUNTY, NC
PROJECT NO. 15821004.00

EM61
DIFFERENTIAL
RESPONSE

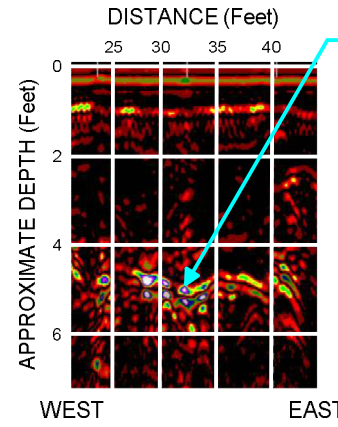
FIGURE 4



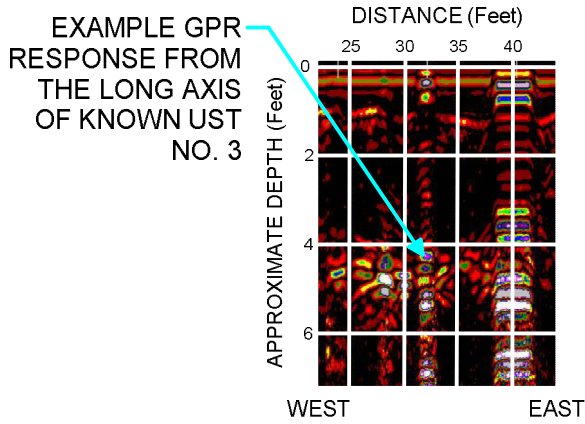
EXAMPLE GPR RESPONSE FROM THE SHORT AXES OF KNOWN UST NOS. 1 - 5



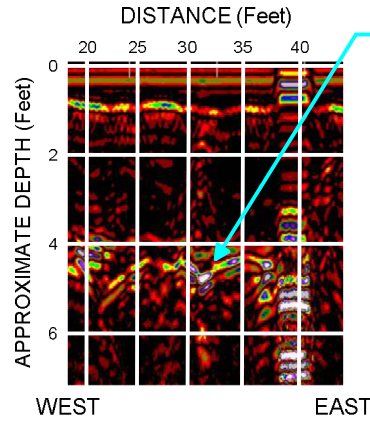
EXAMPLE GPR RESPONSE FROM THE LONG AXIS OF KNOWN UST NO. 1



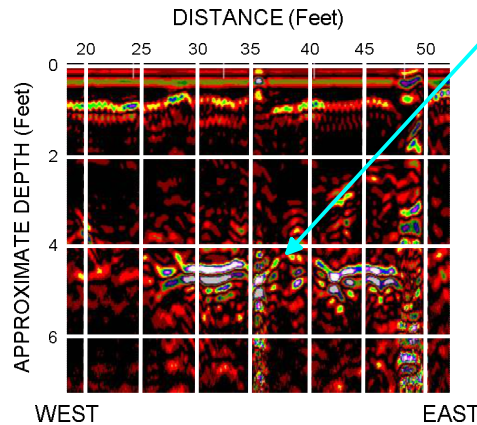
EXAMPLE GPR RESPONSE FROM THE LONG AXIS OF KNOWN UST NO. 2



EXAMPLE GPR RESPONSE FROM THE LONG AXIS OF KNOWN UST NO. 3



EXAMPLE GPR RESPONSE FROM THE LONG AXIS OF KNOWN UST NO. 4



EXAMPLE GPR RESPONSE FROM THE LONG AXIS OF KNOWN UST NO. 5



STATE PROJECT U-3315
 NC DEPARTMENT OF TRANSPORTATION
 PITT COUNTY, NC
 PROJECT NO. 11821014.33

PARCEL 129 EXAMPLE
 GPR IMAGES

FIGURE 5



Parcel 129 (Marie S. Williams Property), looking east. Photo shows approximate marked locations of Known UST Nos. 1, 2, and 3 (shown from right to left respectively) near southernmost structure on Parcel 129.



Parcel 129 (Marie S. Williams Property), looking east. Photo shows approximate marked locations of Known UST Nos. 4 and 5 (shown from right to left respectively) near southernmost structure on Parcel 129.