



PRELIMINARY SITE ASSESSMENT

**ARCHIE L. KING, SUCCESSOR TRUSTEES (PARCEL #9)
517 and 517 ½ Capital Boulevard
Raleigh, North Carolina
State Project: B-5121 & B-5317
WBS Element: 42263.1.1
F&R Project #66T-0097**

August 21, 2015

Prepared for:

**North Carolina Department of Transportation
Geotechnical Engineering Unit
1020 Birch Ridge Drive
Raleigh, NC 27610**



FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

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August 21, 2015

**North Carolina Department of Transportation
Geotechnical Engineering Unit**
1020 Birch Ridge Drive
Raleigh, North Carolina 27610

Attn.: Mr. Terry Fox, L.G.
GeoEnvironmental Project Manager

Re: State Project: B-5121 & B-5317
WBS Element: 42263.1.1
BR 277 on US 70/US 401/NC 50 (Capital Blvd.) over Peace Street
BR 213 on US 70/NC 50 (Wade Ave.) over US 401 (Capital Blvd.)

**Subject: Preliminary Site Assessment
Parcel #9 – Archie L. King (Raleigh Hitch, Inc. and Former King’s Auto Service)**
517 Capital Blvd and 517 ½ Capital Boulevard
Raleigh, North Carolina
F&R Project #66T-0097

Dear Mr. Fox:

Froehling and Robertson, Inc. (F&R) has completed the authorized Preliminary Site Assessment at the Archie L. King, Successor Trustees property located in Raleigh, North Carolina. The work was performed in general accordance with F&R’s Proposal No. 1666-00058, dated May 19, 2015. Notice to Proceed was issued to F&R on June 25, 2015. This report documents our field activities, presents the results of laboratory analysis and provides estimated quantities of petroleum impacted soils.

Please do not hesitate to contact us if you should have any questions regarding this report.

Sincerely,

FROEHLING & ROBERTSON, INC.

DocuSigned by:
Benjamin A. Whitley
E425D6E8C23545B...

Benjamin A. Whitley, P.E.
Project Engineer



DocuSigned by:
Michael Sabodish
B4FED45203C345C...

Michael S. Sabodish, Jr., Ph.D, P.E.
Engineering and Remediation Services Manager



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Preliminary Site Assessment Report
Archie L. King, Successor Trustees Property (Parcel #9)
Raleigh, Wake County, North Carolina
F&R Project No. 66T-0097

1.0 Introduction

Froehling and Robertson, Inc. (F&R) has prepared this Preliminary Site Assessment (PSA) Report to document soil assessment activities performed at the Margie M. Fuller Property addressed as 517 Capital Boulevard in Raleigh, Wake County, North Carolina. The site is located on the west side of Capital Boulevard, near the southwest quadrant of the Capital Boulevard and Peace Street intersection, as shown in Appendix I, Figures 1 and 2. As indicated in the Request for Technical and Cost Proposal (RFTCP), two businesses operate at the property: Raleigh Hitch (517 Capital Boulevard), and Harrison Automotive (517 ½ Capital Boulevard). The RFP also describes 517 ½ Capital Boulevard as the Former Kings Auto Service. According to the NCDENR UST Section registry, one 1,000-gallon UST and petroleum contaminated soil was removed in 1991. Groundwater Incident # 09029 was assigned to the facility in 1991. The site was remediated and closed out in September 1992. NCDOT is planning to acquire this property in its entirety.

The PSA was performed in general accordance with F&R's Proposal No. 1666-00058, dated May 19, 2015 with Notice to Proceed issued to F&R by the NCDOT on June 25, 2015. The purpose of this report is to document field activities, present the results of laboratory analysis, and provide estimated quantities of petroleum impacted soils.

As outlined by the NCDOT in their RFTCP, acquisition of right-of-way is necessary for the Peace Street Bridge, Wade Avenue Bridge and Capital Boulevard improvements in Raleigh (See Figure No. 3). As such, the NCDOT requested a PSA be performed to assess the possibility of encountering petroleum impacted soil from known or unknown USTs which may exist/existed at the project site.

The existing on-site structure is one-story in height with a full basement. The building is constructed of concrete masonry unit block with steel framing, and features three roll-up garage doors on the eastern side of the building, and an automotive repair shop with three roll-up garage doors at the western side of the building. Raleigh Hitch occupies the main (upper) floor of the building, which is accessed by Capital Boulevard on the eastern side of the property. Harrison Automotive occupies the basement portion of the building, which is accessed via West



Johnson Street to the south. The remainder of the site consists of an asphalt and concrete paved parking lot. The site is bordered to the north by Unique Motor Sports; to the east by Capital Boulevard; to the south by gravel and asphalt paved parking also owned by Archie L. King, Successor Trustees; to the west by a car wash and a vacant office building. Photos detailing existing site features are attached as Appendix IV of this report.

2.0 Geophysical Survey

Prior to F&R's soil assessment activities, Pyramid Environmental & Engineering, P.C. (Pyramid) conducted a geophysical survey of the project site to locate suspect metal underground storage tanks (USTs) in the accessible areas of the site. The geophysical work was conducted from June 26 to July 6, 2015, and with the exception of the building footprint, was performed within the property boundaries.

The geophysical investigation consisted of electromagnetic (EM) induction surveys using a Geonics EM61 instrument. Ground-penetrating radar (GPR) investigations of selected EM61 anomalies were investigated using a Geophysical Survey Systems UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. The EM61 data was collected along parallel survey lines spaced approximately five feet apart. The data was reviewed in the field to evaluate the possible presence of USTs and later transferred to a desktop computer for further review. Data was collected over most of the planned survey site with the exception of the building footprint and areas immediately adjacent to metallic objects and other obstacles (such as vehicles). Due to inaccessible areas and extensive metallic interference associated with reinforced concrete and vehicles, only the eastern portion of the property was included in the EM survey. The remaining areas of the property were investigated with GPR.

Pyramid identified one possible UST east of the building. The GPR data indicates a distinct hyperbolic reflector that is characteristic of the width of a UST. Pyramid estimates the possible UST has a diameter of 6 feet, a length of 10 feet and is approximately 3.5 to 4 feet below the ground surface. The complete geophysical report is attached as Appendix II.

During the site assessment activities, the property owners informed F&R that a water line beneath the sidewalk ruptured several years ago at the site of the possible UST identified by Pyramid. They explained the repair included the installation of a vault surrounding the water line, which may be the object identified during the GPR survey.



3.0 Site Assessment Activities

F&R visited the site on July 30 and 31, 2015 to perform the Preliminary Site Assessment. The assessment consisted of advancing 15 borings into the soils at the project site using direct-push technology (Geoprobe). Borings B-1 through B-10 were advanced on the eastern portion of the site, while Borings B-11 through B-15 were advanced on the western portion of the property (Appendix I, Figure 3). Boring locations were determined by F&R staff based on the results of the geophysical survey, site features and proposed construction activities. The borings were generally advanced to the proposed depth of 10 feet bgs, with the exception of Borings B-3 through B-6, which were advanced to the proposed depth of 12 feet bgs around the possible UST. However, Borings B-10, B-11 and B-12 were terminated at 7 to 8 feet bgs, on a layer of very dense sand.

Soil sample cores from the borings were collected in disposable, 4-foot long acetate sleeves. The soil samples were visually/manually classified and screened in the field using a photo-ionization detector (PID) for evidence of petroleum hydrocarbons. Evaluation of VOC concentrations were performed using a MiniRae 2000 PID which produces results in parts per million (ppm). A representative soil sample was collected from one foot sections of each sleeve and placed in a re-sealable plastic bag. The vapors were then allowed to equilibrate in the headspace of the bag for approximately ten minutes prior to measurement with the PID. The measurements were collected by placing the probe tip into the headspace of the bag. PID measurements can be found in the Geoprobe Logs in Appendix III, as well as in Table 1 in Section 5.0 below.

The soil sample which exhibited the highest PID concentration or the sample at boring termination was submitted for laboratory analysis for diesel range organics (DRO), gasoline range organics (GRO), Total BTEX (benzene, toluene, ethylbenzene and xylenes), 16 PAHs (polycyclic aromatic hydrocarbons) and BaP (Benzo(a)pyrene) by Ultraviolet Fluorescence (UVF) technology (QROS QED Hydrocarbon Analyzer).

The samples were collected in laboratory-supplied sample containers, placed in a cooler with ice, and shipped via UPS to QROS in Wilmington, North Carolina following standard chain-of-custody procedures.



4.0 Subsurface Conditions

As indicated in the attached Geoprobe Logs (Appendix III), subsurface conditions from existing ground surface to boring termination primarily included various layers of moist, tan to red-brown fine to medium sandy silt (USCS – ML), silty and/or sandy clay (USCS – CL), silty fine to medium sand (USCS – SM), and fine to coarse sand (USCS – SP). Borings B-1, B-2 and B-7 through B-15 were terminated at the proposed depth of 10 feet bgs. However, Borings B-10, B-11 and B-12 were terminated at 7 to 8 feet bgs, where Geoprobe refusal was encountered in a layer of very dense sand. Borings B-3 through B-6 were located adjacent to the possible UST identified by Pyramid, and were therefore advanced to a depth of 12 feet bgs.

PID readings did not exceed 1.7 ppm, and petroleum odors and/or groundwater were not observed during field screening or sample collection activities.

5.0 Analytical Results

As shown in the following table, petroleum hydrocarbons identified as DRO were encountered in the soil samples collected from the fifteen boring locations advanced at the site, at depths from 1 feet bgs (B-7) to 11 feet bgs (B-6). The laboratory results indicate that the DRO concentrations ranged from 0.13 mg/kg (B-13) to 1,710 mg/kg (B-11). DRO concentrations above the NCDENR Action Level of 10 mg/kg were detected in eight of the fifteen samples submitted (B-4, B-7 through B-12, and B-14).

The laboratory analytical results indicate concentrations of the Sum of 16 PAHs above the method detection limit (MDL), but below the NCDENR Action Level of 7,041.14 mg/kg in each sample submitted, with the exception of the samples collected at Borings B-3 and B-13. In addition, Benzo(a)pyrene (BaP) was detected in samples B-4 through B-10, and B-12 above the MDL, but below the NCDENR Soil-to-Water MSCC of 0.096 mg/kg. However, BaP was detected in B-14 at a concentration of 0.53 mg/kg, which is above the NCDENR Soil-to-Water MSCC.

The soil analytical results are summarized in Table 1 below. The laboratory analytical results can also be found in the attached Appendix V of this report.



**Table 1
Soil Sampling Analytical Results**

Sample ID	Sample Date	Sample Depth (ft bgs)	PID Reading (ppm)	GRO (mg/kg)	DRO (mg/kg)	TPH (mg/kg)	Total BTEX (mg/kg)	Total Aromatics (mg/kg)	16 EPA PAHs (mg/kg)	BaP (mg/kg)
B-1	7/30/15	7-8	1.5	< 0.5	1.2	1.2	< 0.99	1.2	0.12	< 0.01
B-2		7-8	1.5	< 0.53	0.44	0.44	< 1.1	0.44	0.05	< 0.011
B-3		8-9	1.6	< 0.53	0.21	0.21	< 1.1	< 0.16	< 0.02	< 0.011
B-4		8-9	1.6	< 0.65	19.6	19.6	< 1.3	18.1	0.86	0.01
B-5		5-6	1.7	< 0.52	6.3	6.3	< 0.52	6.2	0.3	0.004
B-6		10-11	1.4	< 0.53	0.42	0.42	< 1.1	0.42	0.05	0.006
B-7	7/31/15	1-2	1.1	< 6.7	239.5	239.5	< 6.7	138.8	5.3	0.043
B-8		5-6	1.1	< 6.8	266.5	266.5	< 6.8	148.6	5.7	0.068
B-9		4-5	1.1	< 0.63	64.9	64.9	< 1.3	58	2.7	0.015
B-10		6-7	0.8	< 7.5	180.1	180.1	< 15	170.3	8	0.16
B-11		1-2	1.1	< 41.8	1,710	1,710	< 83.6	1,342	63	< 0.84
B-12		4-6	1.3	< 0.68	13.9	13.9	< 1.4	7.3	0.27	0.014
B-13		6-7	1.2	< 0.2	0.13	0.13	< 0.41	< 0.07	< 0.008	< 0.004
B-14		8-10	0.7	< 7.9	104.2	104.2	< 7.9	97.1	17.2	0.53
B-15	7-8	0.9	< 0.59	1.4	1.4	< 0.59	1.4	0.14	< 0.012	
NC DENR Action Level				10	10	10	13.8	NSE	7,041.41	0.096

Samples shown in bold exceed the NCDENR Action Level as outlined in the NCDENR, DWM, UST Section Guidelines
 ppm = parts per million
 GRO = Gasoline Range Organics
 DRO = Diesel Range Organics
 TPH = Total Petroleum Hydrocarbons
 BTEX = Benzene, Toluene, Ethylbenzene and Xylenes
 NSE = No Standard Exists

6.0 Conclusions and Recommendations

F&R conducted a PSA at the Archie L. King, Successor Trustees Property located at 517 Capital Boulevard in Raleigh, Wake County, North Carolina. A geophysical investigation was performed by Pyramid Environmental & Engineering to investigate the existence of unknown/known USTs at the site. Based on the results of the geophysical survey, it was determined that one possible UST was present east of the building.

Fifteen Geoprobe borings were advanced on this parcel during the assessment, where grading activities are proposed in association with the Peace Street Bridge, Wade Avenue Bridge and Capital Boulevard improvements. Due to NCDOT's total acquisition of this property, F&R advanced the borings within the parcel boundaries. Based on the results of laboratory testing and observed PID readings, petroleum impacted soils were found at concentrations above the



NCDENR Action Level of 10 mg/kg within the areas evaluated. Therefore, it is estimated that petroleum impacted soils, at concentrations above the NCDENR Action Level, are present at the following areas:

- Area 1: In the vicinity of Boring B-4, from existing ground surface to a depth of at least nine feet bgs;
- Area 2: In the vicinity of Borings B-7 through B-10 from existing ground surface to a depth of at least ten feet bgs; and
- Area 3: In the vicinity of Borings B-11, B-12 and B-14, from existing ground surface to a depth of at least ten feet bgs.

During site reconnaissance activities, F&R was informed by the property owner that a former UST was removed on the western portion of the property near boring location B-14. Based upon the information provided in the RFP, it is possible that this area is the location of the former UST.

No below grade utilities appear on the proposed improvement plans. However, a realignment is depicted on the construction plans, which will extend Capital Boulevard onto the eastern portion of the property. This construction will likely require re-grading of the existing ground surface and demolition of the existing structure. For the purpose of this assessment, we have estimated the following approximate petroleum-impacted areas:

- Area 1: 420.1 square feet, extending to a depth of nine feet bgs;
- Area 2: 2,981.0 square feet, extending to a depth of ten feet bgs; and
- Area 3: 3,776.5 square feet, extending to a depth of ten feet bgs.

These areas account for impacted soils that may be generated during re-grading activities and for unknown below grade utilities that may be installed during construction. The areas were determined by averaging distances between the property boundaries and the existing edge of pavement on the construction drawings, and do not include the footprint area of the building located on the property (Appendix I, Figure 4).



Table 2
Approximate Volume of Petroleum Impacted Soil

Excavation Location (As Shown on Figure 4)	L x W x D (feet)	Soil Volume (cubic feet)	Soil Volume (tons)
Area 1 (vicinity of B-4)	L x W varies (420.1 SF) X 9' depth	3,780.9	226.9
Area 2 (vicinity of B-7 through B-10)	L x W varies (2,981.0 SF) X 10' depth	29,810.0	1,788.6
Area 3 (vicinity of B-11, B-12 and B-14)	L x W varies (3,776.5 SF) X 10' depth	37,765.0	2,265.9
Soil Volume (assuming a soil density of 120 pcf)		Total	4,281.4

It should be noted that a delineation of the soil contamination was not performed, as this was not included in the proposed scope of work. The above estimates are based on interpretations of soil analytical results, PID readings and our experience with petroleum UST releases. In order to generate estimated quantities of petroleum impacted soils, we have inferred that the contamination has occurred between the existing ground surface and the sample collection depth. The amount of impacted soil can only be determined after excavation or by advancing additional borings and performing additional laboratory analysis to possibly delineate the extents (horizontal and vertical) of contamination.

7.0 Limitations

These services have been performed, under authorization of the North Carolina Department of Transportation for specific application on this project. These services have been performed in accordance with generally accepted environmental and hydrogeological practices. No other warranty, expressed or implied is made. As with any subsurface investigation, actual conditions exist only at the precise locations from which samples were taken. Certain inferences are based on the results of sampling and related testing to form a professional opinion of conditions in areas beyond those from which samples were taken. Our conclusions and recommendations are based upon information provided to us by others, our sampling and testing results and our site observations. We have not verified the completeness or accuracy of the information provided by others, unless otherwise noted. Our observations are based upon conditions readily visible at the site at the time of our site visits.

Froehling & Robertson, Inc. by virtue of providing the services described in this report, does not



assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state or federal public agencies any conditions at the site that may present a potential danger to public health, safety or the environment. In areas that require notification of local, state, or federal public agencies as required by law, it is the Client's responsibility to so notify.



APPENDIX I

Figure No. 1 – SITE VICINITY MAP

Figure No. 2 – TOPOGRAPHIC MAP

Figure No. 3 – LABORATORY RESULTS & BORING LOCATION PLAN

Figure No. 4 – ESTIMATED EXTENTS OF SOIL CONTAMINATION

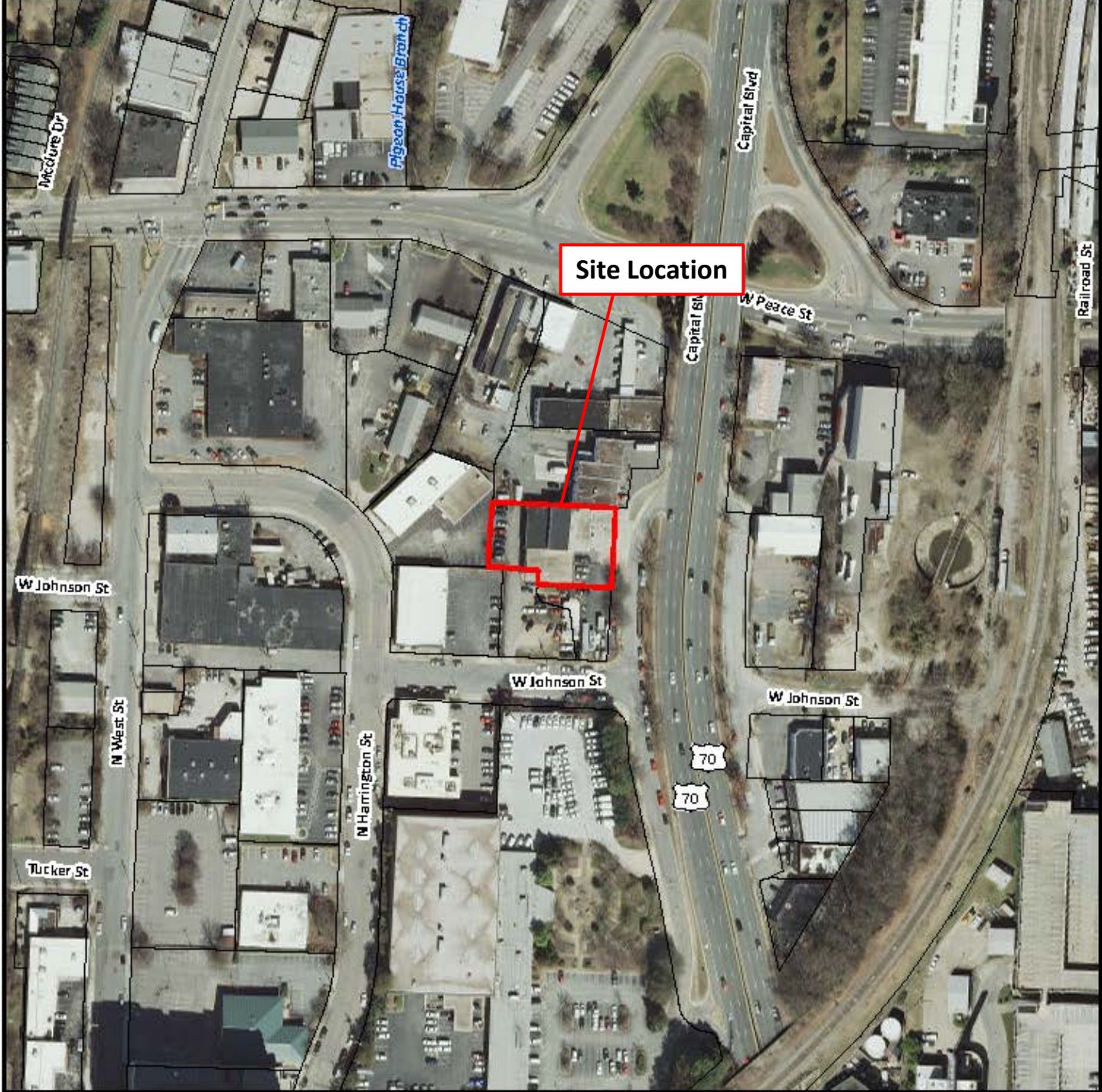
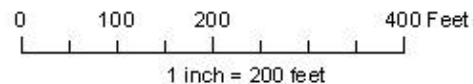


Image Courtesy of Wake County iMaps



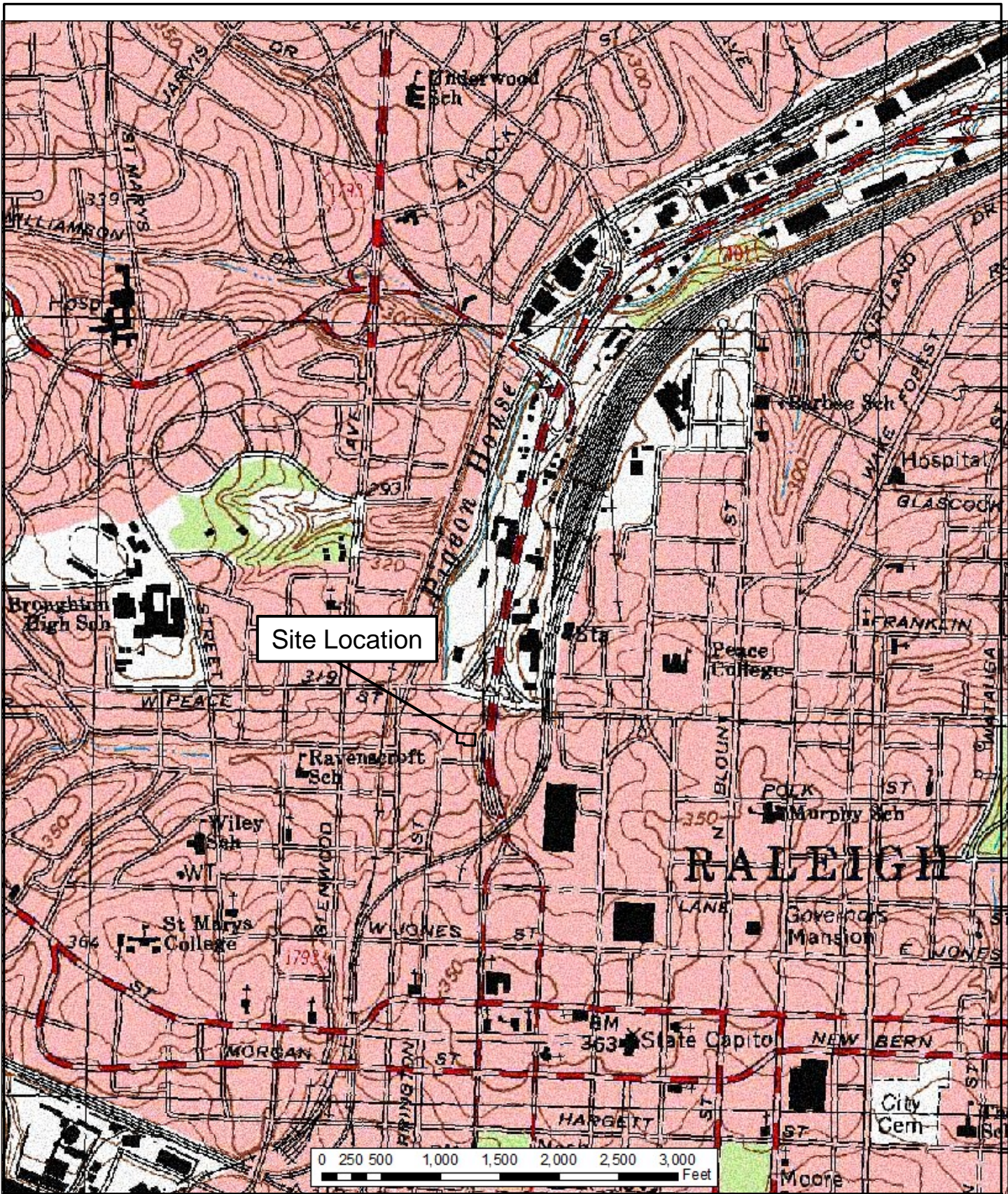
SITE VICINITY MAP

North ▲



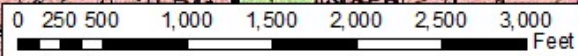
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CLIENT: NCDOT		FIGURE No.: 1
PROJECT: B-5121 & B-5317, Archie L. King, Successor Trustees, NCDOT Parcel #9		
LOCATION: Raleigh, Wake County, North Carolina		
F&R PROJECT No.: 66T-0097		
DRAWN BY: B. Whitley		
DATE: August 2015	SCALE: 1" = 200'	



Site Location

RALEIGH



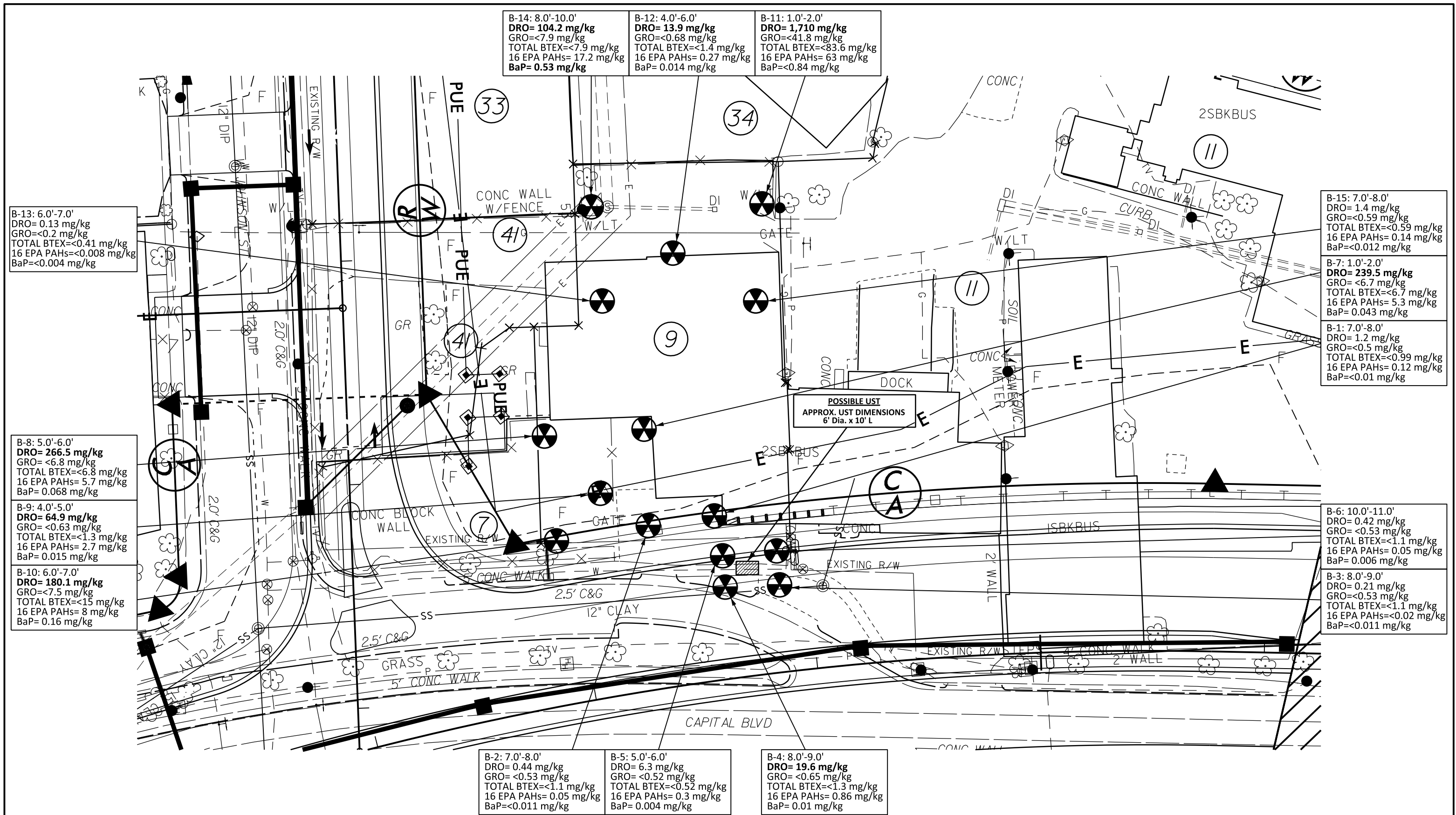
TOPOGRAPHIC MAP - RALEIGH, NC

North

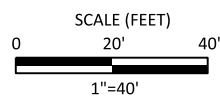


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CLIENT: NCDOT		FIGURE No.: 2
PROJECT: B-5121 & B-5317, Archie L. King, Successor Trustees, NCDOT Parcel #9		
LOCATION: Raleigh, Wake County, North Carolina		
F&R PROJECT No.: 66T-0097		
DRAWN BY: B. Whitley		
DATE: August 2015	SCALE: As Shown	



NAD 83/NSRS 2007



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LEGEND

- Approximate Geoprobe Boring Location
- Samples Shown in Bold Exceed the NCDENR Action Level as Outlined in the NCDENR, DWM, UST Section Guideline

LABORATORY RESULTS & BORING LOCATION PLAN

CLIENT: NCDOT		FIGURE No.: 3
PROJECT: B-5121/B-5317 Archie L. King (Parcel #9)		
LOCATION: Raleigh, Wake, County, North Carolina		
F&R PROJECT No.: 66T-0097		
DRAWN BY: T. T. Walker	CHECKED BY: M. Sabodish, P.E.	
DATE: August 2015	SCALE: 1"=40'	

AREA 3:
Estimated Extents of Soil Contamination
 L x W varies (3,776.5 SF)
 x 10' depth= 2,265.9 tons

B-14: 8.0'-10.0' DRO= 104.2 mg/kg GRO=<7.9 mg/kg TOTAL BTEX=<7.9 mg/kg 16 EPA PAHs= 17.2 mg/kg BaP= 0.53 mg/kg	B-12: 4.0'-6.0' DRO= 13.9 mg/kg GRO=<0.68 mg/kg TOTAL BTEX=<1.4 mg/kg 16 EPA PAHs= 0.27 mg/kg BaP= 0.014 mg/kg	B-11: 1.0'-2.0' DRO= 1,710 mg/kg GRO=<41.8 mg/kg TOTAL BTEX=<83.6 mg/kg 16 EPA PAHs= 63 mg/kg BaP=<0.84 mg/kg
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B-13: 6.0'-7.0'
DRO= 0.13 mg/kg
GRO=<0.2 mg/kg
TOTAL BTEX=<0.41 mg/kg
16 EPA PAHs=<0.008 mg/kg
BaP=<0.004 mg/kg

B-15: 7.0'-8.0'
DRO= 1.4 mg/kg
GRO=<0.59 mg/kg
TOTAL BTEX=<0.59 mg/kg
16 EPA PAHs= 0.14 mg/kg
BaP=<0.012 mg/kg

B-7: 1.0'-2.0'
DRO= 239.5 mg/kg
GRO= <6.7 mg/kg
TOTAL BTEX=<6.7 mg/kg
16 EPA PAHs= 5.3 mg/kg
BaP= 0.043 mg/kg

B-1: 7.0'-8.0'
DRO= 1.2 mg/kg
GRO=<0.5 mg/kg
TOTAL BTEX=<0.99 mg/kg
16 EPA PAHs= 0.12 mg/kg
BaP=<0.01 mg/kg

B-8: 5.0'-6.0'
DRO= 266.5 mg/kg
GRO= <6.8 mg/kg
TOTAL BTEX=<6.8 mg/kg
16 EPA PAHs= 5.7 mg/kg
BaP= 0.068 mg/kg

B-9: 4.0'-5.0'
DRO= 64.9 mg/kg
GRO= <0.63 mg/kg
TOTAL BTEX=<1.3 mg/kg
16 EPA PAHs= 2.7 mg/kg
BaP= 0.015 mg/kg

B-10: 6.0'-7.0'
DRO= 180.1 mg/kg
GRO=<7.5 mg/kg
TOTAL BTEX=<15 mg/kg
16 EPA PAHs= 8 mg/kg
BaP= 0.16 mg/kg

B-6: 10.0'-11.0'
DRO= 0.42 mg/kg
GRO= <0.53 mg/kg
TOTAL BTEX=<1.1 mg/kg
16 EPA PAHs= 0.05 mg/kg
BaP= 0.006 mg/kg

B-3: 8.0'-9.0'
DRO= 0.21 mg/kg
GRO=<0.53 mg/kg
TOTAL BTEX=<1.1 mg/kg
16 EPA PAHs=<0.02 mg/kg
BaP=<0.011 mg/kg

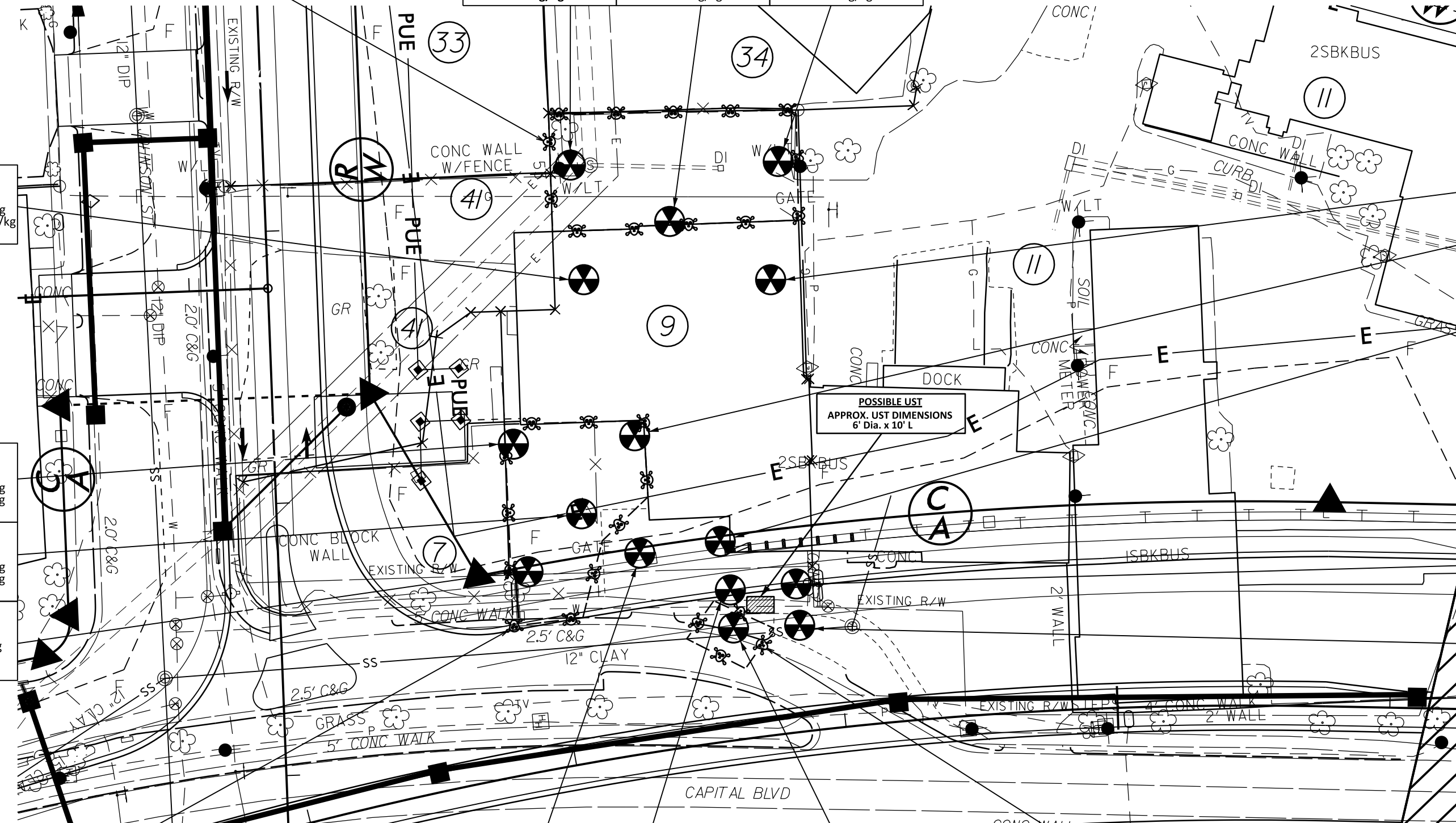
AREA 2:
Estimated Extents of Soil Contamination
 L x W varies (2,981.0 SF)
 x 10' depth= 1,788.6 tons

B-2: 7.0'-8.0'
DRO= 0.44 mg/kg
GRO= <0.53 mg/kg
TOTAL BTEX=<1.1 mg/kg
16 EPA PAHs= 0.05 mg/kg
BaP=<0.011 mg/kg

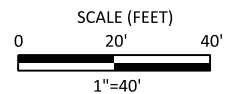
B-5: 5.0'-6.0'
DRO= 6.3 mg/kg
GRO= <0.52 mg/kg
TOTAL BTEX=<0.52 mg/kg
16 EPA PAHs= 0.3 mg/kg
BaP= 0.004 mg/kg

B-4: 8.0'-9.0'
DRO= 19.6 mg/kg
GRO= <0.65 mg/kg
TOTAL BTEX=<1.3 mg/kg
16 EPA PAHs= 0.86 mg/kg
BaP= 0.01 mg/kg

AREA 1:
Estimated Extents of Soil Contamination
 L x W varies (420.1 SF)
 x 9' depth= 226.9 tons



NAD 83/NSRS 2007



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LEGEND
 Approximate Geoprobe Boring Location
Samples Shown in Bold Exceed the NCDENR Action Level as Outlined in the NCDENR, DWM, UST Section Guideline

ESTIMATED EXTENTS OF SOIL CONTAMINATION	
CLIENT: NCDOT	
PROJECT: B-5121/B-5317 Archie L. King (Parcel #9)	
LOCATION: Raleigh, Wake County, North Carolina	
F&R PROJECT No.: 66T-0097	
DRAWN BY: T. T. Walker	CHECKED BY: M. Sabodish, P.E.
DATE: August 2015	SCALE: 1"=40'
FIGURE No.: 4	



APPENDIX II

GEOPHYSICAL REPORT PREPARED BY PYRAMID



PYRAMID ENVIRONMENTAL & ENGINEERING
(PROJECT 2015-176)

GEOPHYSICAL SURVEY

**METALLIC UST INVESTIGATION:
PARCEL 9 – ARCHIE L. KING
NCDOT PROJECT B-5121/B5317
(WBS 42263.1.1)**

517 CAPITAL BLVD., RALEIGH, WAKE COUNTY, NC

JULY 15, 2015

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C257: GEOLOGY C1251: ENGINEERING

GEOPHYSICAL INVESTIGATION REPORT
Parcel 9 – Archie L. King
Raleigh, Wake County, North Carolina

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LIST OF ACRONYMS

CADD	Computer Assisted Drafting and Design
DF	Dual Frequency
EM.....	Electromagnetic
GPR.....	Ground Penetrating Radar
GPS	Global Positioning System
NCDOT.....	North Carolina Department of Transportation
ROW	Right-of-Way
SVE.....	Soil Vapor Extraction
UST	Underground Storage Tank

EXECUTIVE SUMMARY

Project Description: Pyramid Environmental conducted a geophysical investigation for Froehling & Robertson (F&R) at Parcel 9, located at 517 Capital Blvd., Raleigh, NC. The survey was part of a North Carolina Department of Transportation (NCDOT) Right-of-Way (ROW) investigation (NCDOT Project B-5121/B-5317). F&R directed Pyramid as to the geophysical survey boundaries at the project site, which were designed to include all accessible portions of the property due to its designation by the NCDOT as a total take. Conducted from June 26 to July 6, 2015, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

Geophysical Results: EM surveys were only performed across a portion of the parcel due to significant metallic interference. GPR scans were performed in a grid-like fashion across the entire parcel. A single feature was recorded by the GPR survey that was suggestive of a UST. Distinct hyperbolic and laterally defined reflectors were observed on the east side of the repair shop building near the roadway. The GPR scans resulted in the classification of this feature as a possible metallic UST. The possible UST was approximately 6 feet wide and 10 feet long at a depth of approximately 3.5-4.0 feet below the ground surface. No evidence of additional USTs was observed in any of the remaining GPR transects. Collectively, the geophysical data recorded evidence of one possible metallic UST at the property.

INTRODUCTION

Pyramid Environmental conducted a geophysical investigation for Froehling & Robertson (F&R) at Parcel 9, located at 517 Capital Blvd., Raleigh, NC. The survey was part of a North Carolina Department of Transportation (NCDOT) Right-of-Way (ROW) investigation (NCDOT Project B-5121/B-5317). F&R directed Pyramid as to the geophysical survey boundaries at the project site, which were designed to include all accessible portions of the property due to its designation by the NCDOT as a total take. Conducted from June 26 to July 6, 2015, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

The site included an auto repair building surrounded by reinforced concrete and asphalt parking areas. The survey area included portions of the property on both the east and west sides of the auto repair building. It should be noted that some areas of Parcel 9 were inaccessible due to parked vehicles and stacked inventory. Because of the inaccessible areas and the extensive metallic interference associated with reinforced concrete and vehicles, only the east portion of the parcel was included in the EM survey. The remaining areas of interest were investigated solely with GPR. Aerial photographs showing the survey area boundaries and ground-level photographs are shown in **Figure 1**.

FIELD METHODOLOGY

The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. Pyramid collected the EM data using a Geonics EM61 metal detector integrated with a Trimble AG-114 GPS antenna. The integrated GPS system allows the location of the instrument to be recorded in real-time during data collection, resulting in an EM data set that geo-referenced and can be

overlain on aerial photographs and CADD drawings. A boundary grid was established around the perimeter of the site with marks every 10 feet to maintain orientation of the instrument throughout the survey and assure complete coverage of the area.

According to the instrument specifications, the EM61 can detect a metal drum down to a maximum depth of approximately 8 feet. Smaller objects (1-foot or less in size) can be detected to a maximum depth of 4 to 5 feet. The EM61 data were digitally collected at approximately 0.8 foot intervals along north-south trending or east-west trending, generally parallel survey lines spaced five feet apart. The data were downloaded to a computer and reviewed in the field and office using the Geonics NAV61 and Surfer for Windows Version 11.0 software programs.

GPR data were acquired across the majority of the parcel at defined intervals on July 1 & 6, 2015, using a Geophysical Survey Systems, Inc. (GSSI) UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. Data were collected both in grid-like fashion across the reinforced concrete as well as along formal transect lines across EM features. The GPR data were viewed in real time using a vertical scan of 512 samples, at a rate of 48 scans per second. GPR data were viewed down to a maximum depth of approximately 10 feet, based on dielectric constants calculated by the DF unit in the field during the reconnaissance scans. GPR transects were saved to the hard drive of the DF unit for post-processing and figure generation.

Pyramid's classifications of USTs for the purposes of this report are based directly on the geophysical UST ratings provided to us by the NCDOT. These ratings are as follows:

Geophysical Surveys for Underground Storage Tanks on NCDOT Projects

High Confidence	Intermediate Confidence	Low Confidence	No Confidence
Known UST Active tank - spatial location, orientation, and approximate depth determined by geophysics.	Probable UST Sufficient geophysical data from both magnetic and radar surveys that is characteristic of a tank. Interpretation may be supported by physical evidence such as fill/vent pipe, metal cover plate, asphalt/concrete patch, etc.	Possible UST Sufficient geophysical data from either magnetic or radar surveys that is characteristic of a tank. Additional data is not sufficient enough to confirm or deny the presence of a UST.	Anomaly noted but not characteristic of a UST. Should be noted in the text and may be called out in the figures at the geophysicist's discretion.

DISCUSSION OF RESULTS

Discussion of EM Results

A contour plot of the EM61 results obtained across the survey area at the property is presented in **Figure 2**. Each EM anomaly is numbered for reference to the figure. The following table presents the list of EM anomalies and the cause of the metallic response, if known:

LIST OF METALLIC ANOMALIES IDENTIFIED BY EM SURVEY

Metallic Anomaly #	Cause of Anomaly	Investigated with GPR
1	Vehicle	
2	Vehicle	
3	Reinforced Concrete	✓
4	1 Possible UST	✓

As mentioned previously, an EM survey was only performed on the east portion of the parcel due to extensive zones of reinforced concrete and parked vehicles throughout the property. The results of the EM survey that was performed predominantly recorded metallic interference associated with reinforced concrete and vehicles (Anomaly #1, #2

and #3). Follow-up GPR survey scans (discussed below) identified an isolated feature below the reinforced concrete on the east side of the repair shop.

Discussion of GPR Results

Figure 3 presents the locations of the formal GPR transects performed at the property, as well as select transect images. A total of 52 formal GPR transects were performed at the property. The GPR transects were performed in a grid-like fashion oriented in both the east-west and north-south direction to provide a comprehensive analysis of the subsurface below the reinforced concrete and adjacent to vehicles. The majority of the GPR scans did not record any significant structures other than the rebar in the concrete and several suspected utilities/conduits. However, one feature was recorded on the east side of the repair shop that was suggestive of a UST.

GPR transect 11 encountered a distinct hyperbolic reflector to the east of the repair shop that is characteristic of the width of a UST. Subsequently, transects 17 and 18 were also performed at the location of this feature, and verified distinct lateral reflectors and the hyperbolic shape typical of a UST. The significant metallic interference due to the surrounding reinforced concrete results in the classification of this feature as a possible metallic UST. The possible UST was approximately 6 feet wide and 10 feet long at a depth of approximately 3.5-4.0 feet below the ground surface. No evidence of additional USTs was observed in any of the remaining GPR transects.

Collectively, the geophysical data recorded evidence of one possible metallic UST at the property.

SUMMARY & CONCLUSIONS

Our evaluation of the EM61 and GPR data collected at Parcel 9 in Raleigh, Wake County, North Carolina, provides the following summary and conclusions:

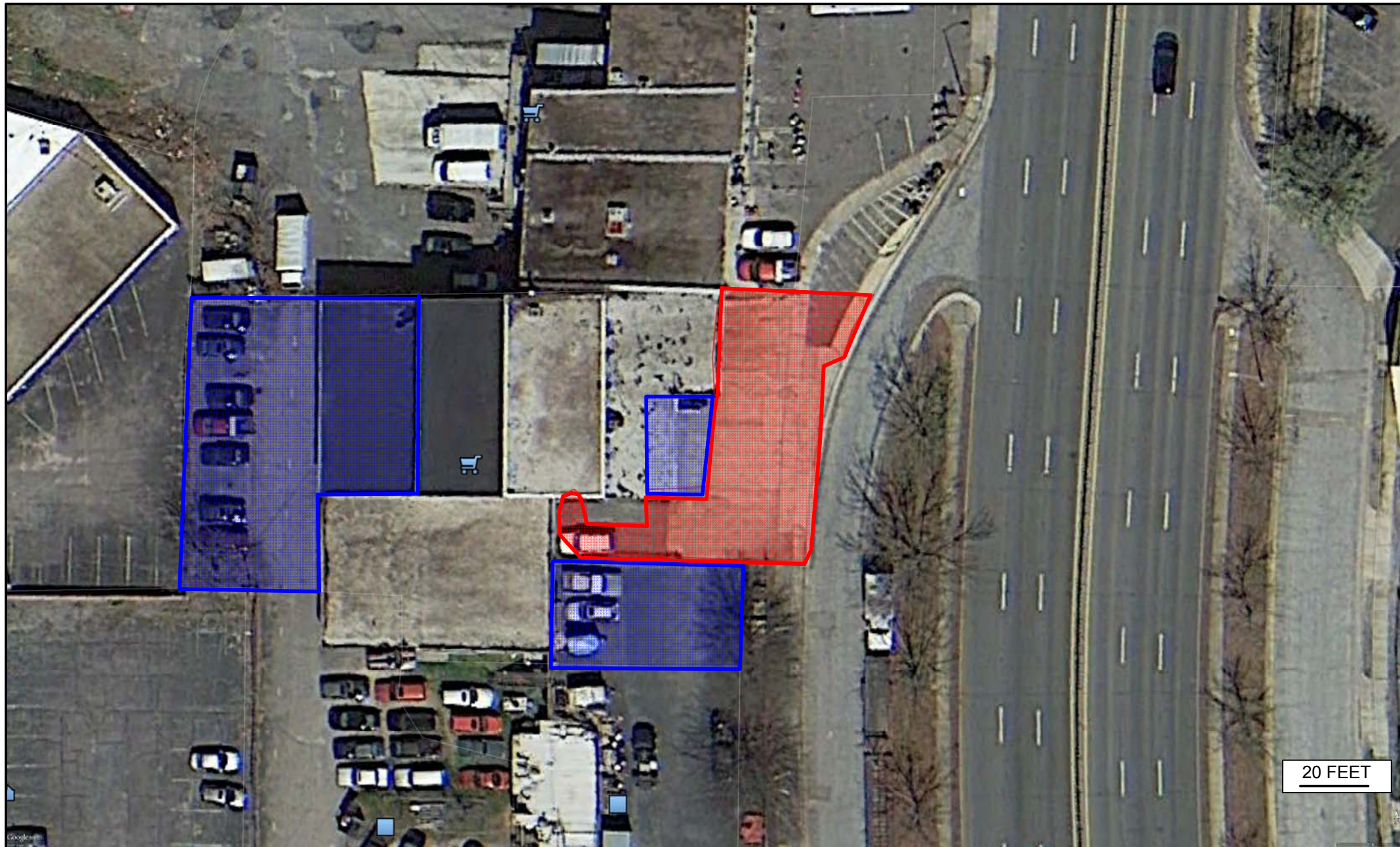
- The EM61 and GPR surveys provided reliable results for the detection of metallic USTs within the accessible portions of the geophysical survey area.
- EM surveys were only performed across a portion of the parcel due to significant metallic interference. GPR scans were performed in a grid-like fashion across the entire parcel.
- A single feature was recorded by the GPS survey that was suggestive of a UST. Distinct hyperbolic and laterally defined reflectors were observed on the east side of the repair shop building near the roadway. The GPR scans resulted in the classification of this feature as a possible metallic UST.
 - The possible UST was approximately 6 feet wide and 10 feet long at a depth of approximately 3.5-4.0 feet below the ground surface.
 - No evidence of additional USTs was observed in any of the remaining GPR transects.
- Collectively, the geophysical data recorded evidence of one possible metallic UST at the property.

LIMITATIONS

Geophysical surveys have been performed and this report prepared for F&R in accordance with generally accepted guidelines for EM61 and GPR surveys. It is generally recognized that the results of the EM61 and GPR surveys are non-unique and may not represent actual subsurface conditions. The EM61 and GPR results obtained for this project have not conclusively determined the definitive presence or absence of metallic USTs, but that the evidence collected is sufficient to result in the conclusions made in this report. Additionally, it should be understood that areas containing extensive

vegetation, reinforced concrete, or other restrictions to the accessibility of the geophysical instruments could not be fully investigated.

N ↑




APPROXIMATE BOUNDARIES OF GEOPHYSICAL SURVEY AREAS.
 BLUE AREAS REPRESENT GPR ONLY DUE TO SIGNIFICANT METALLIC INTERFERENCE



View of North Survey Area
 (Facing Approximately North)

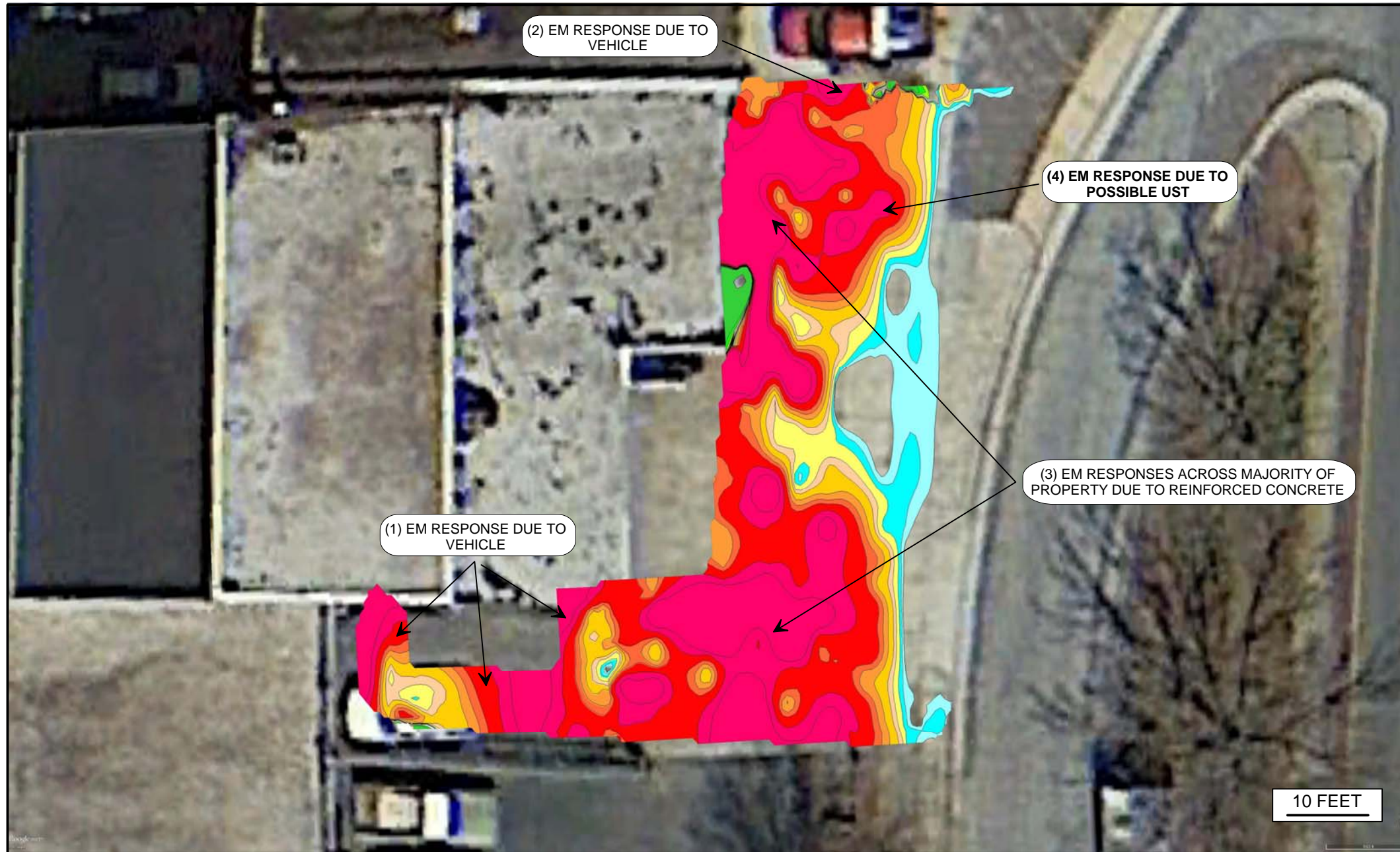


View of Survey Area
 (Facing Approximately West)

TITLE		PARCEL 9 - 517 CAPITAL BLVD. GEOPHYSICAL SURVEY BOUNDARIES AND SITE PHOTOGRAPHS	
PROJECT		METALLIC UST INVESTIGATION NCDOT B-5121/B-5317, RALEIGH, NC	
		503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	7/6/2015	CLIENT	FROEHLING & ROBERTSON
PYRAMID PROJECT #:	2015-176	FIGURE 1	



Parcel 9 - EM61 Differential Results (EM not performed on south or west sides due to interference)

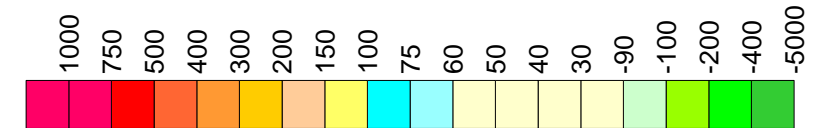



Locations of metallic anomalies detected by the EM61 survey. Numbers correspond to descriptive Table in report. GPR scans were performed across select EM anomalies as well as across all portions of the south and west sides of Parcel 9 due to significant metallic interference.

EVIDENCE OF ONE POSSIBLE METALLIC UST OBSERVED

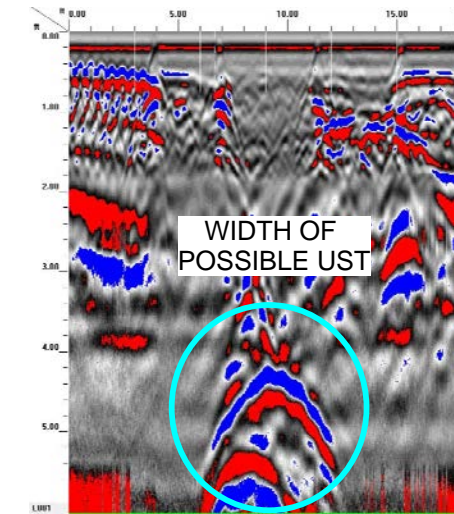
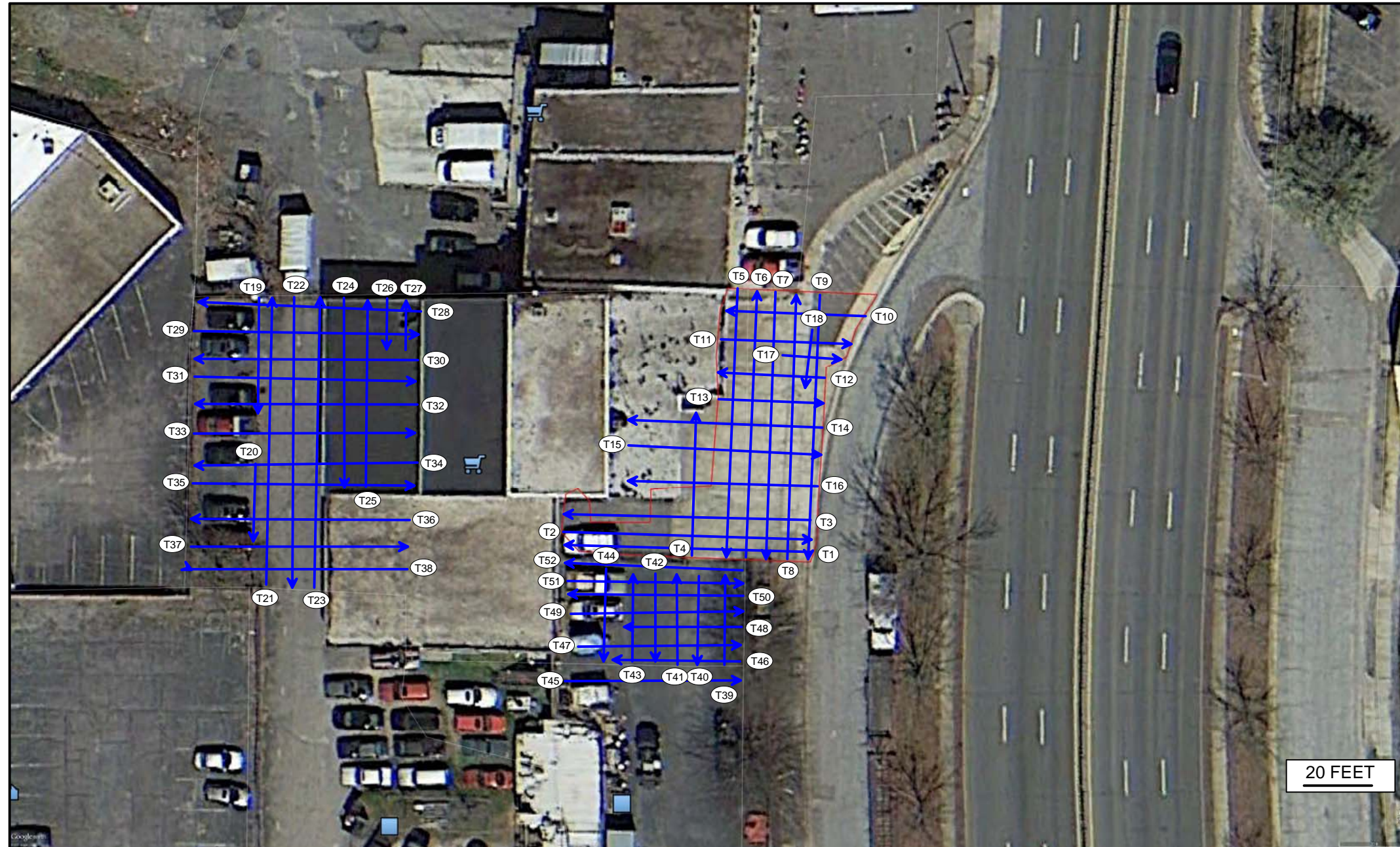
The contour plot shows the differential results of the EM61 instrument in millivolts (mV). The EM61 data were collected on June 29, 2015, using a Geonics EM61 instrument. Ground penetrating radar (GPR) data were collected on July 1, 2015, using a GSSI UtilityScan DF unit with a dual frequency 300/800 MHz antenna.

EM61 Metal Detection Response (millivolts)

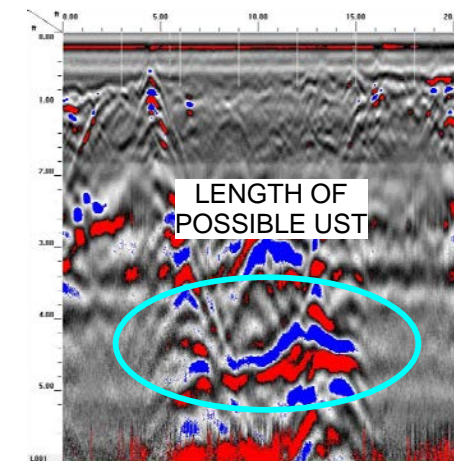


TITLE	PARCEL 9 - 517 CAPITAL BLVD. EM 61 RESULTS CONTOUR MAP	
PROJECT	METALLIC UST INVESTIGATION NCDOT PROJECT B-5121/B-5317 (42263.1.1)	
	 503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	7/6/2015	CLIENT FROEHLING & ROBERTSON
PYRAMID PROJECT #:	2015-176	FIGURE 2

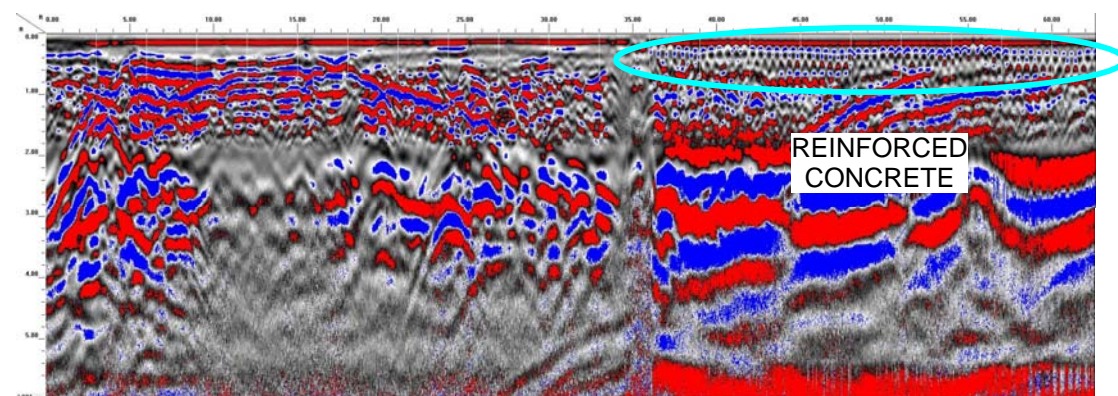
Approximate Locations of GPR Transects



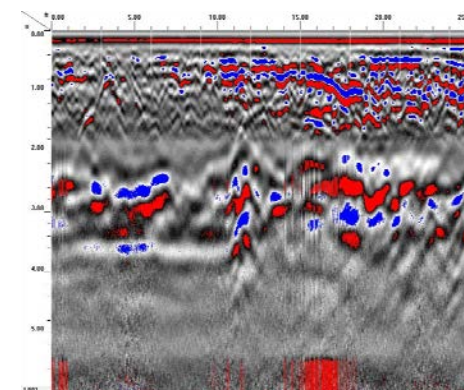
GPR Transect 17 (T17)




GPR Transect 18 (T18)



GPR Transect 31 (T31)



GPR Transect 49 (T49)

TITLE	PARCEL 9 - 517 CAPITAL BLVD. GPR TRANSECT LOCATIONS AND SELECT IMAGES	
PROJECT	METALLIC UST INVESTIGATION NCDOT B-5121/B-5317, RALEIGH, NC	
	 503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	7/6/2015	CLIENT FROEHLING & ROBERTSON
PYRAMID PROJECT #:	2015-176	FIGURE 3


N ↑



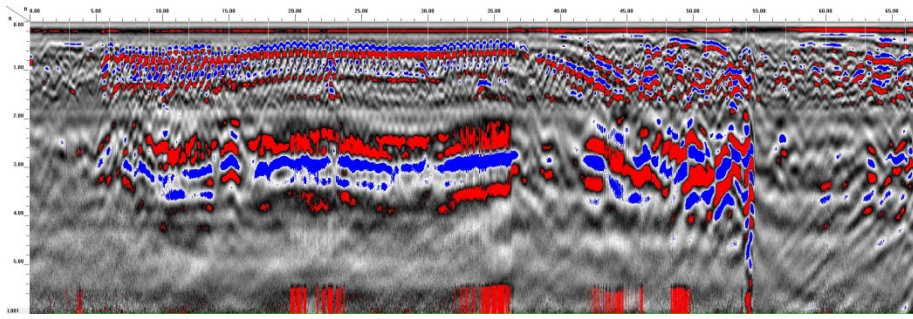
APPROXIMATE LOCATION OF POSSIBLE METALLIC UST.



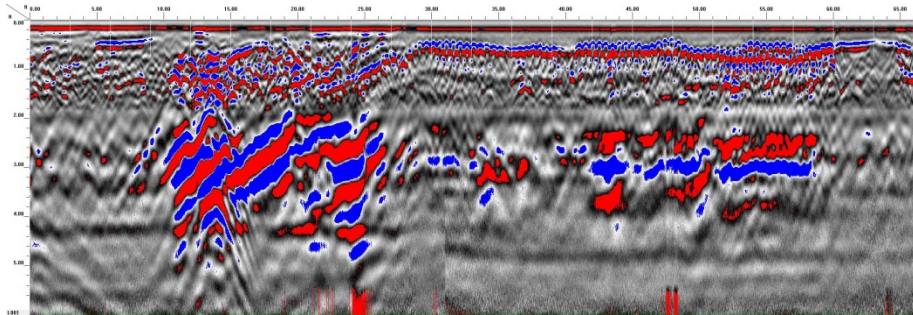
Approximate Location of Possible UST

TITLE	PARCEL 9 - 517 CAPITAL BLVD. APPROXIMATE LOCATION OF POSSIBLE UST	
PROJECT	METALLIC UST INVESTIGATION NCDOT B-5121/B-5317, RALEIGH, NC	
	 503 INDUSTRIAL AVENUE GREENSBORO, NC 27460 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	
DATE	7/6/2015	CLIENT FROEHLING & ROBERTSON
PYRAMID PROJECT #:	2015-176	FIGURE 4

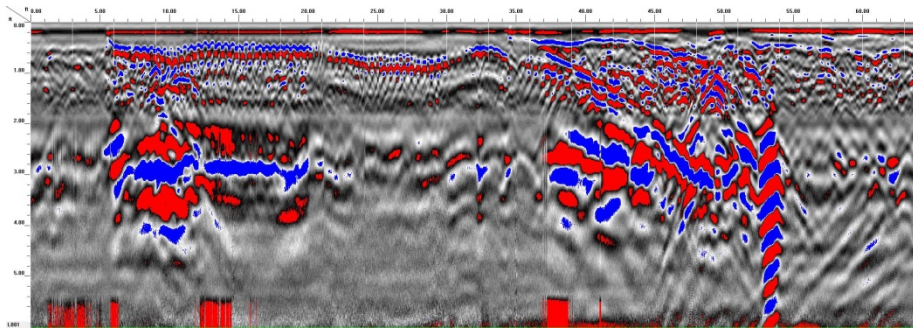
Appendix A – GPR Transects



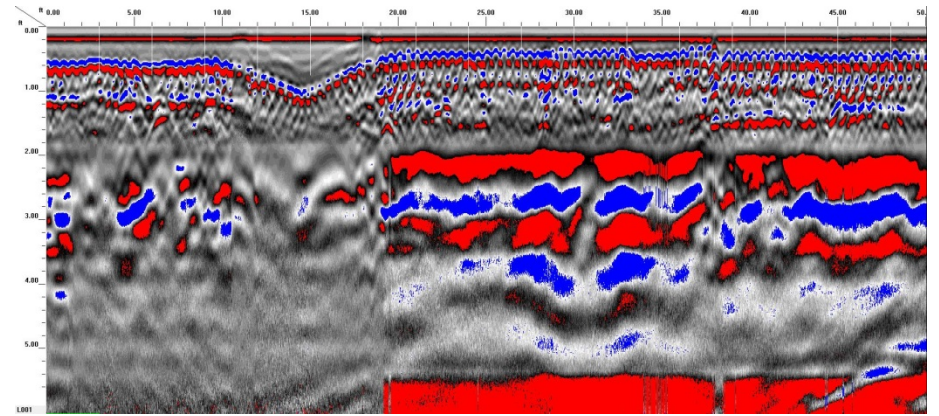
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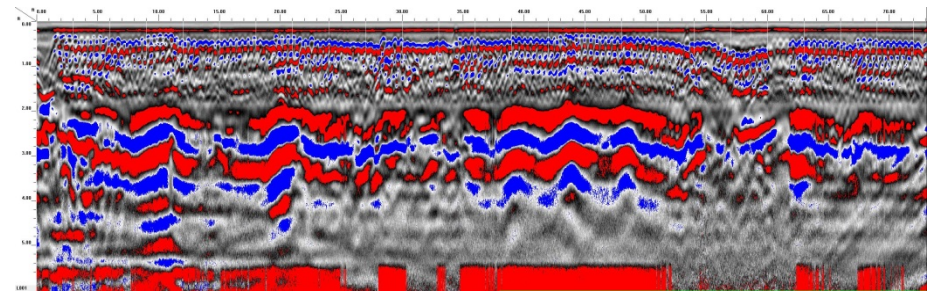
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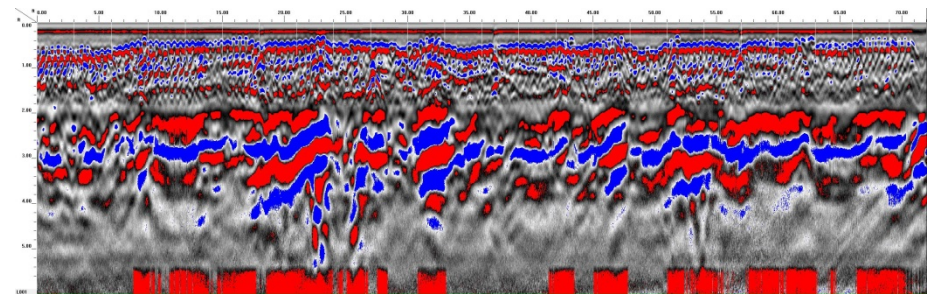
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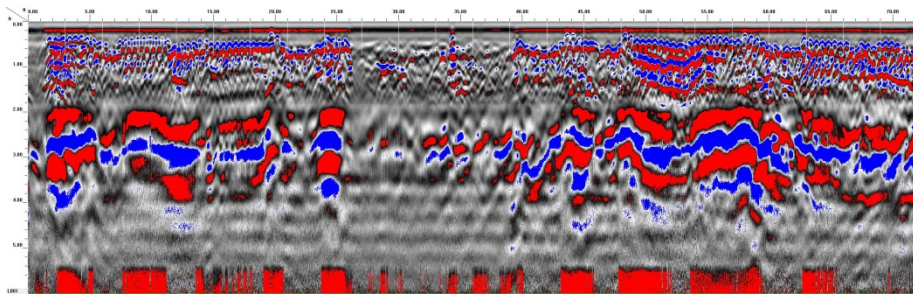
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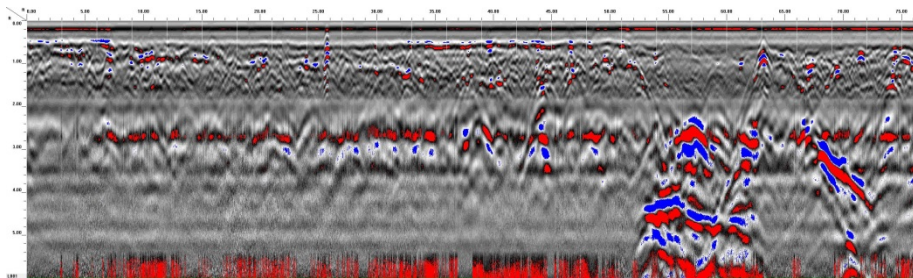
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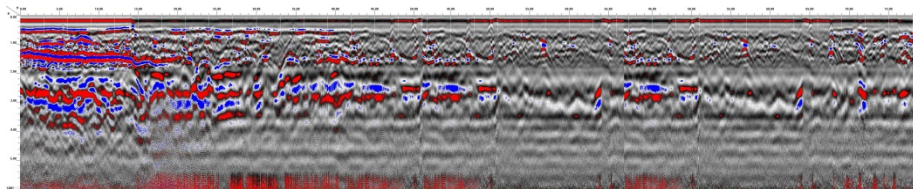
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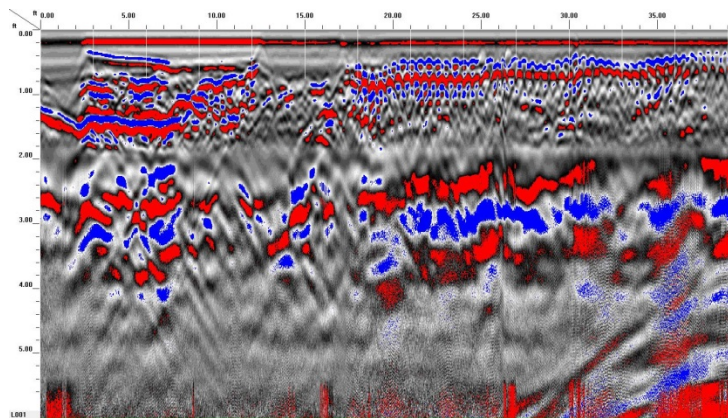
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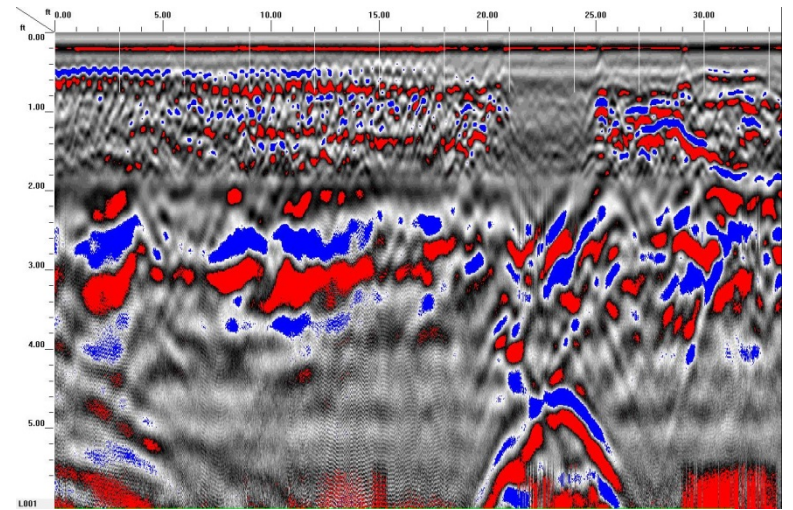
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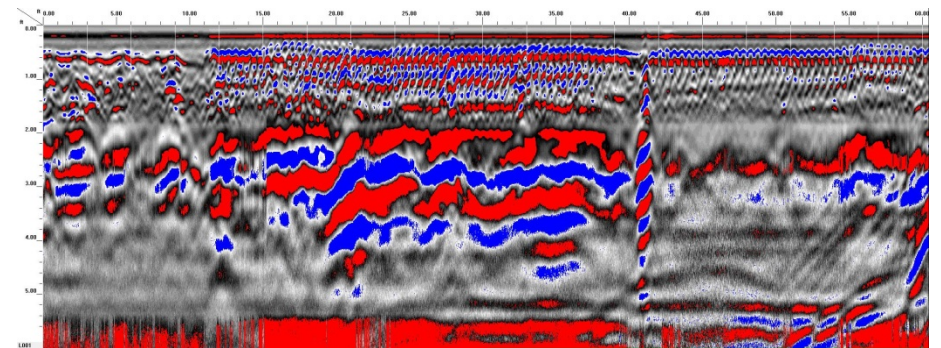
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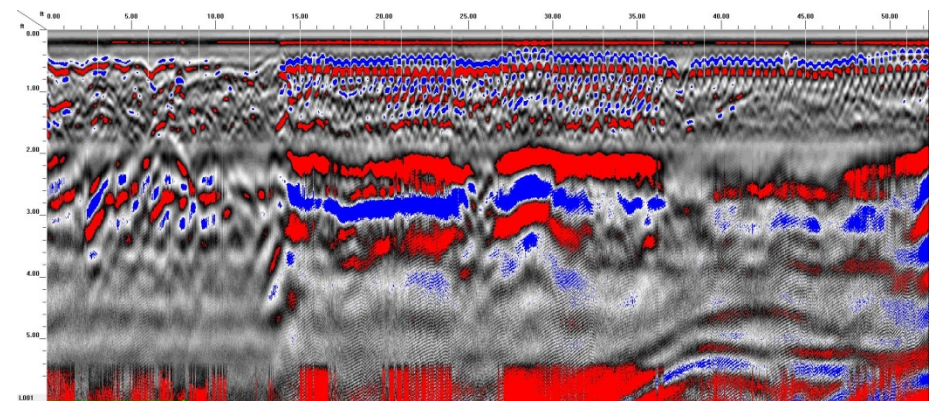
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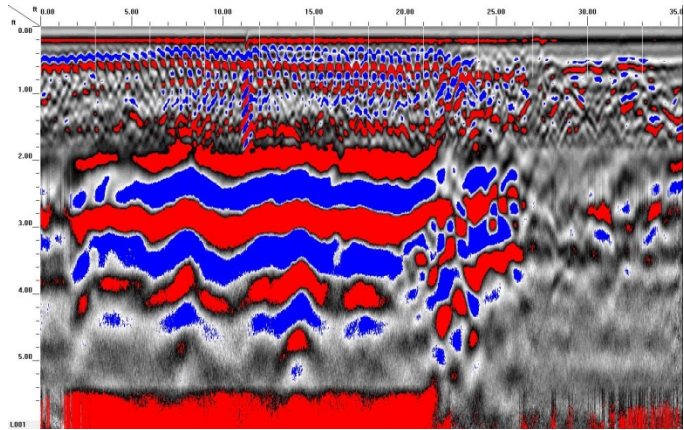
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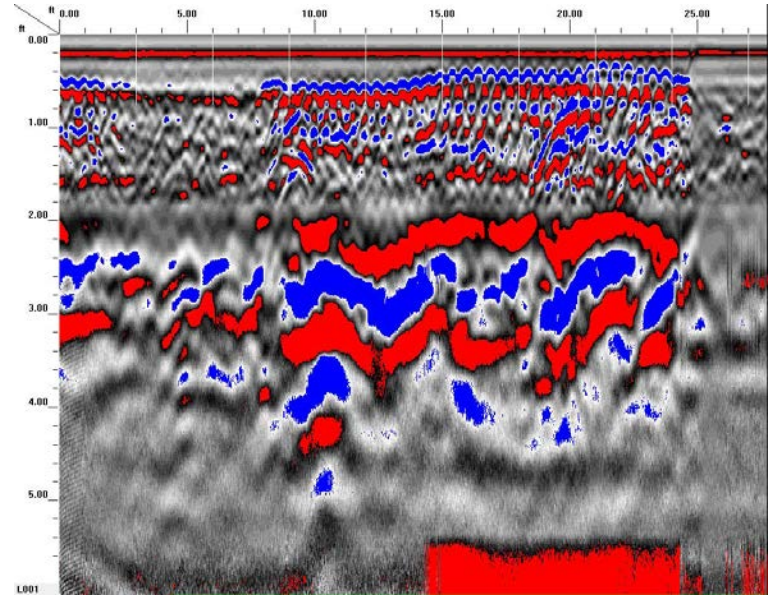
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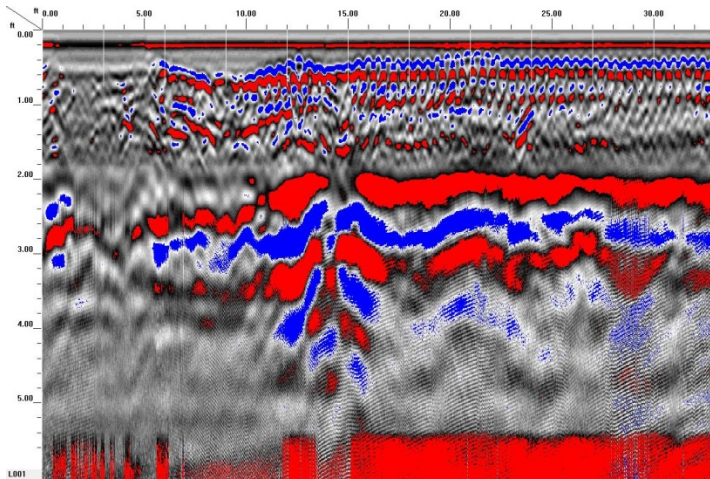
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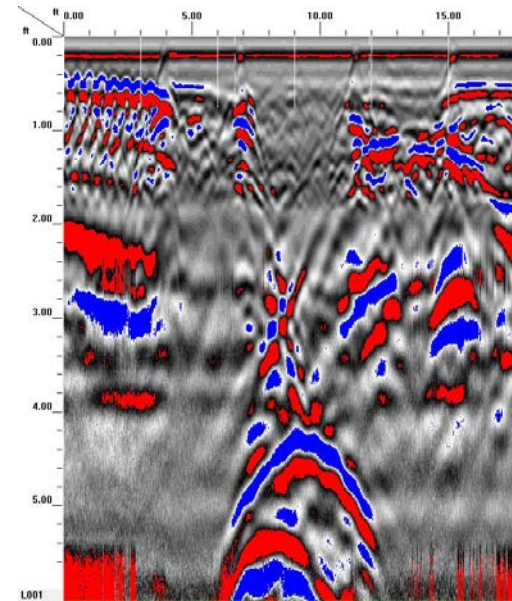
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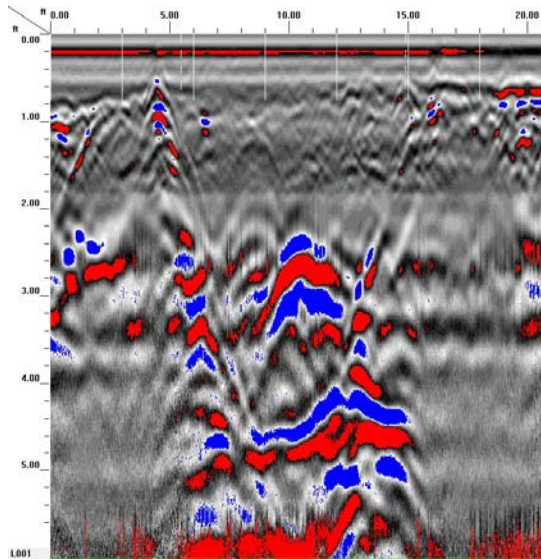
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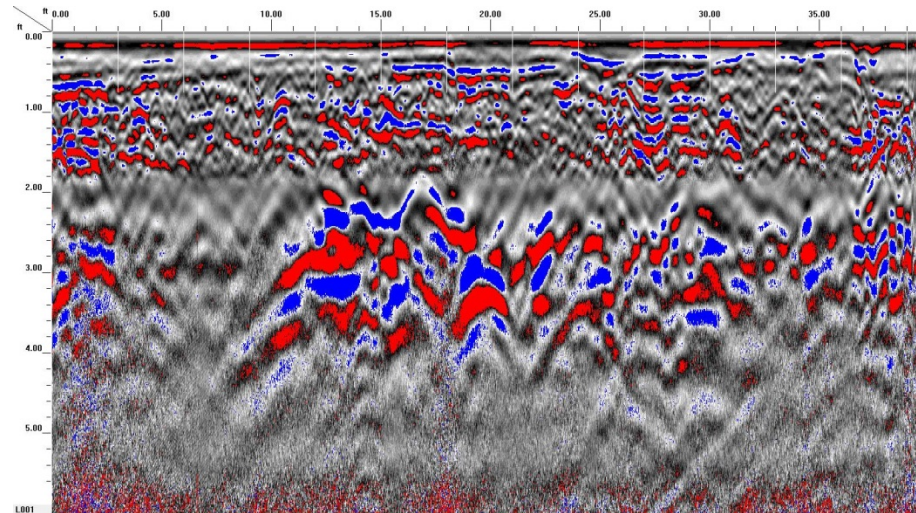
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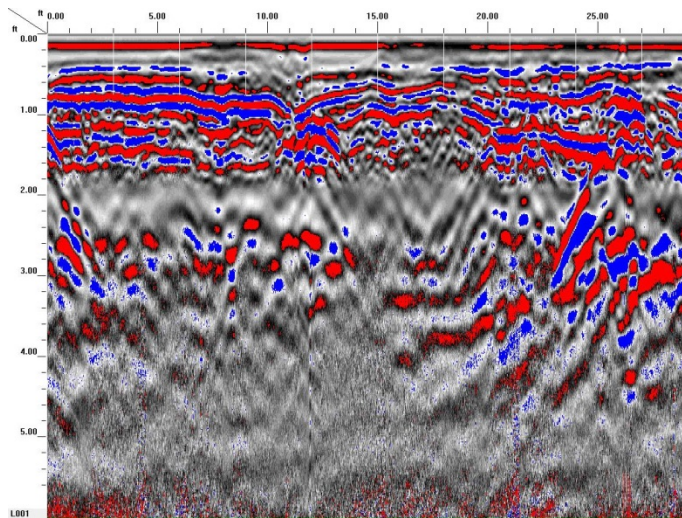
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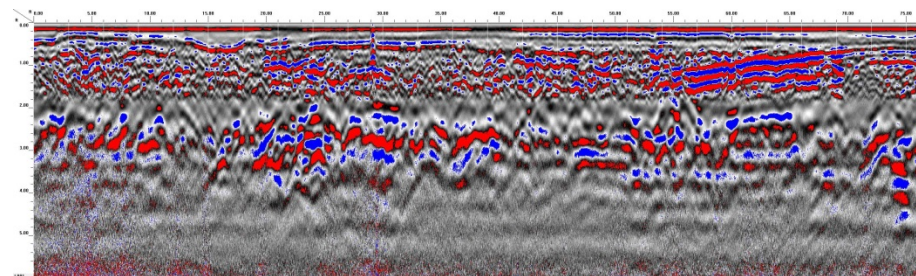
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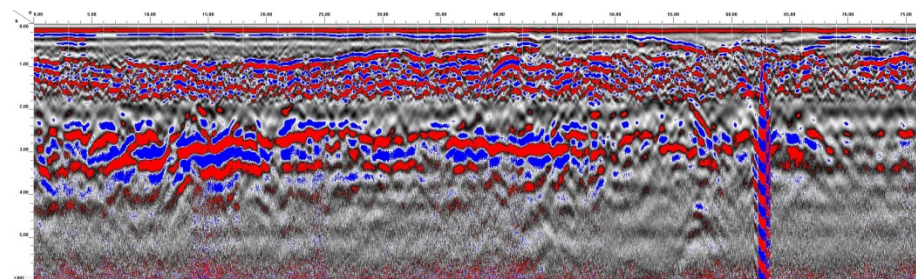
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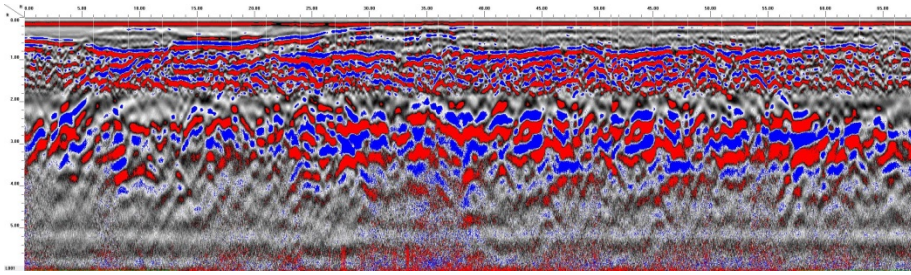
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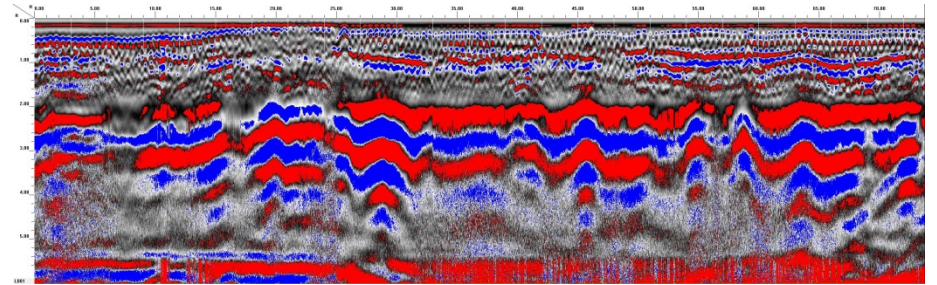
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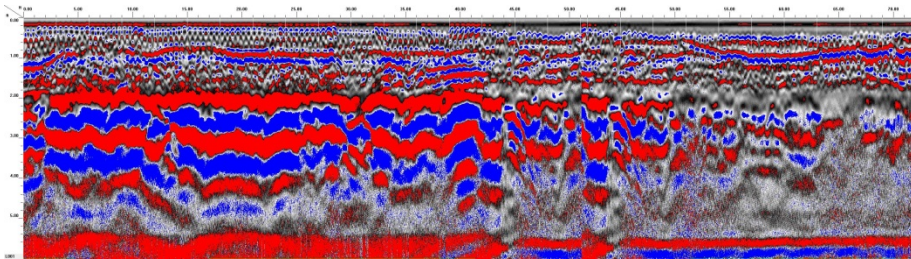
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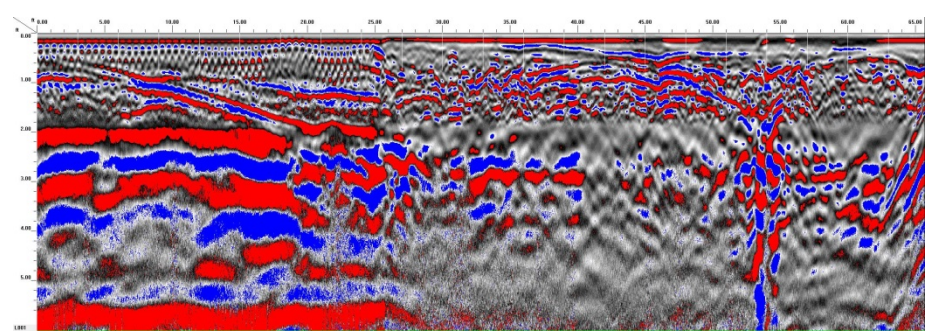
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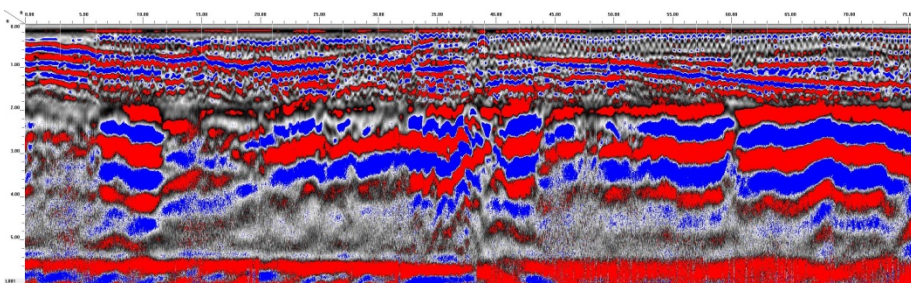
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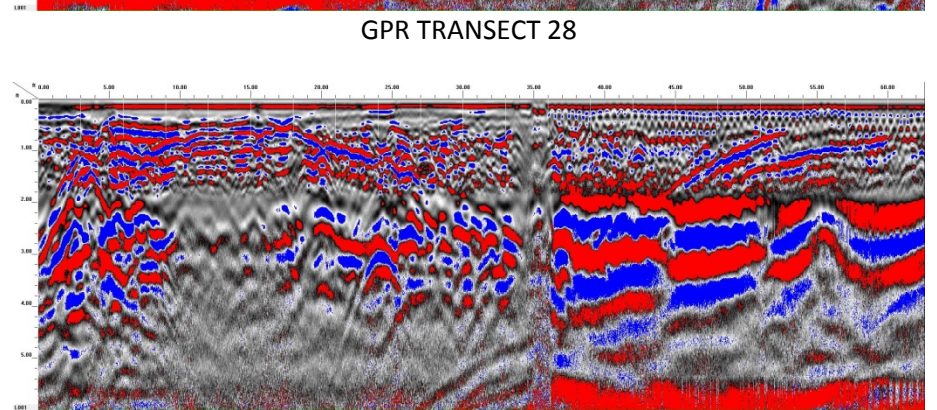
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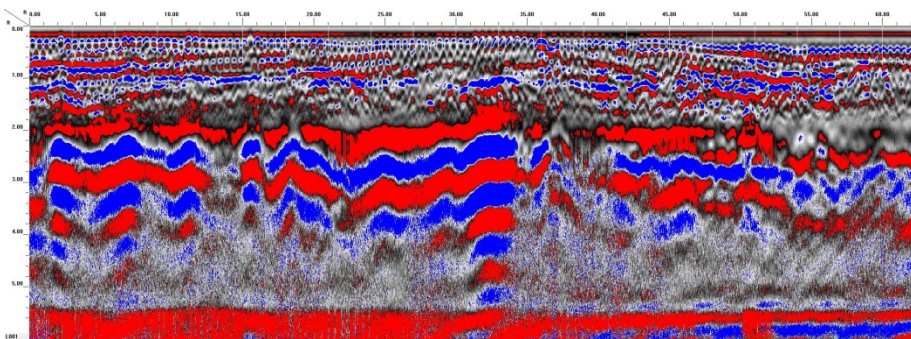
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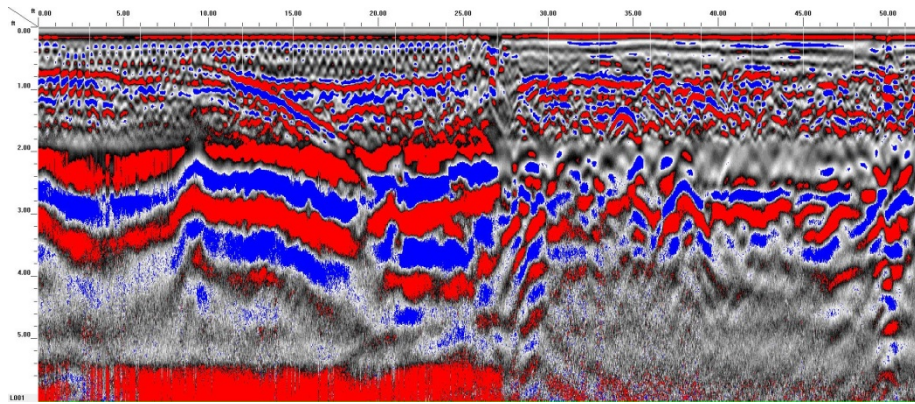
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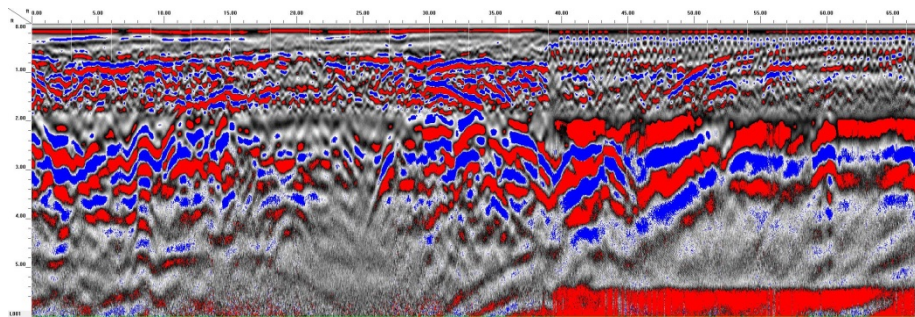
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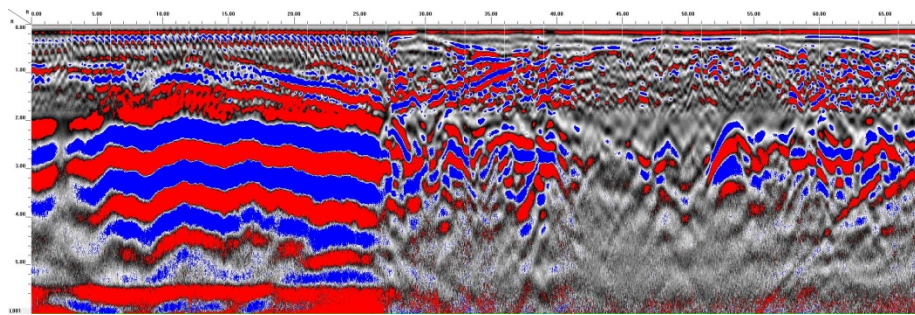
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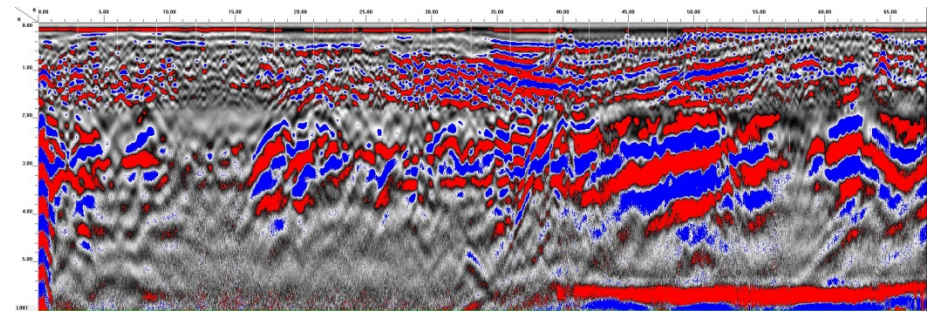
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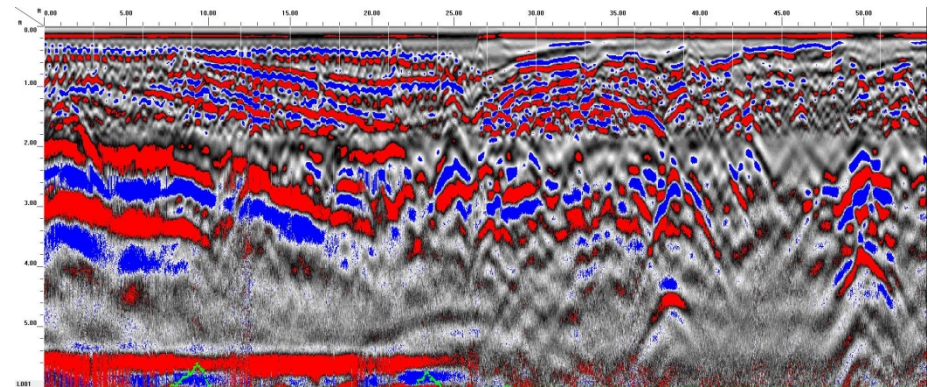
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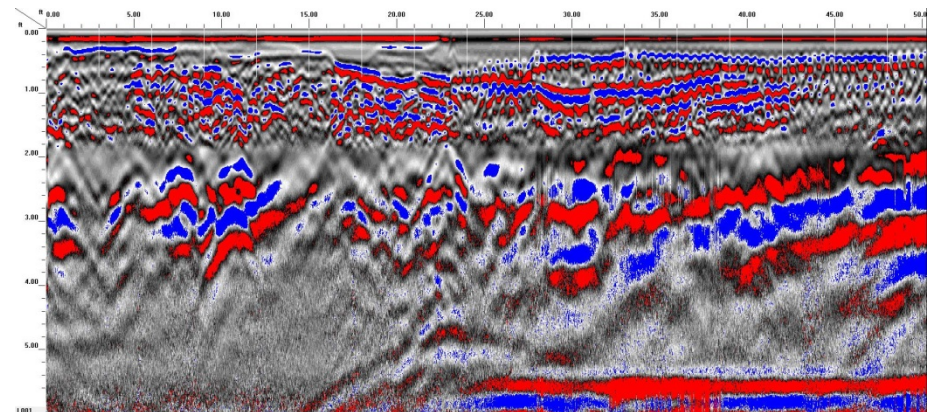
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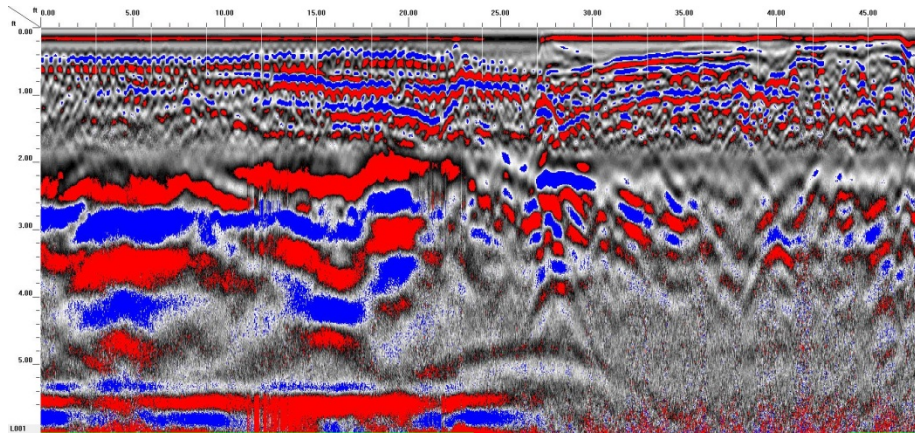
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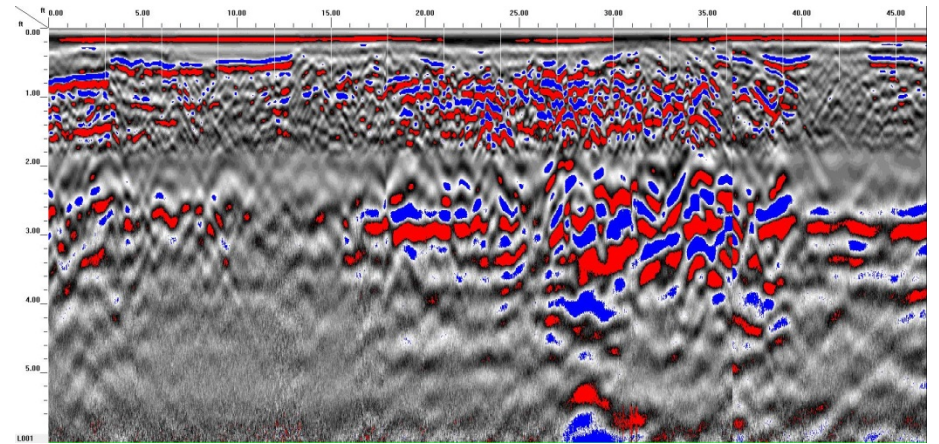
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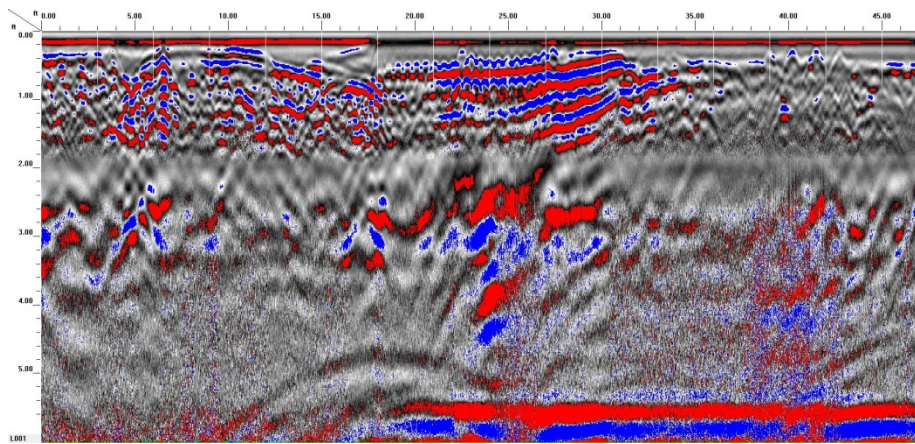
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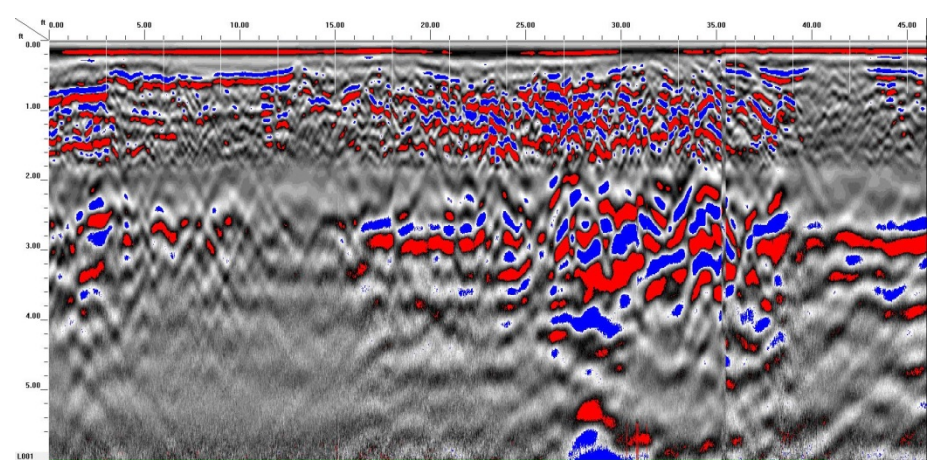
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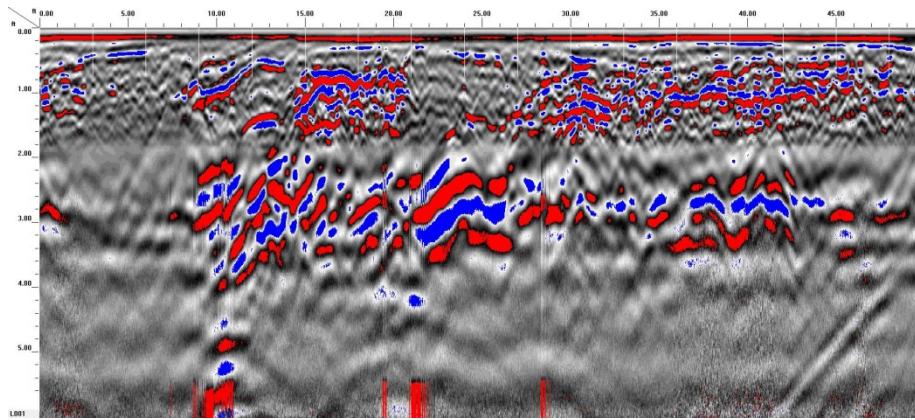
GPR TRANSECT 38



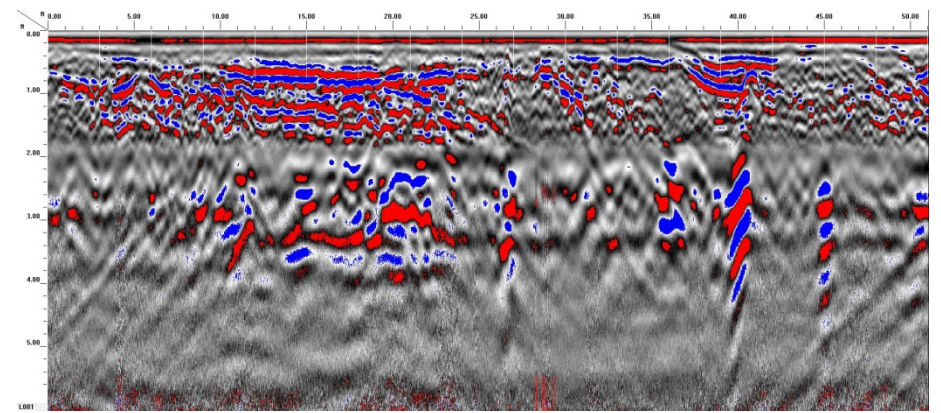
GPR TRANSECT 37



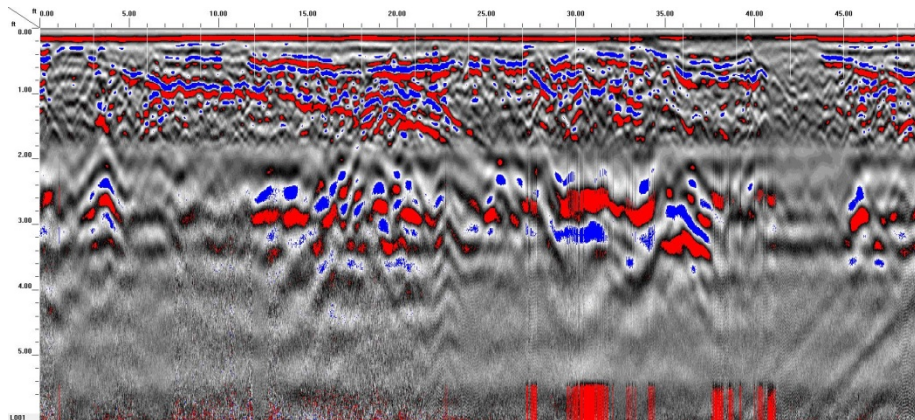
GPR TRANSECT 39



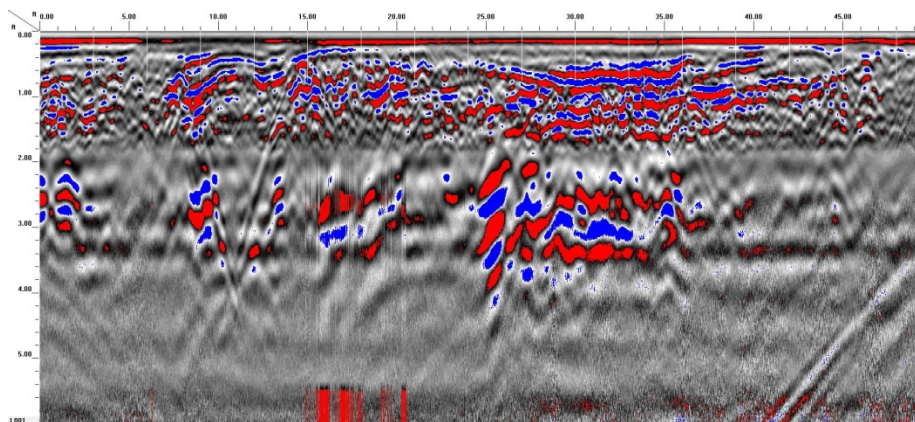
GPR TRANSECT 40



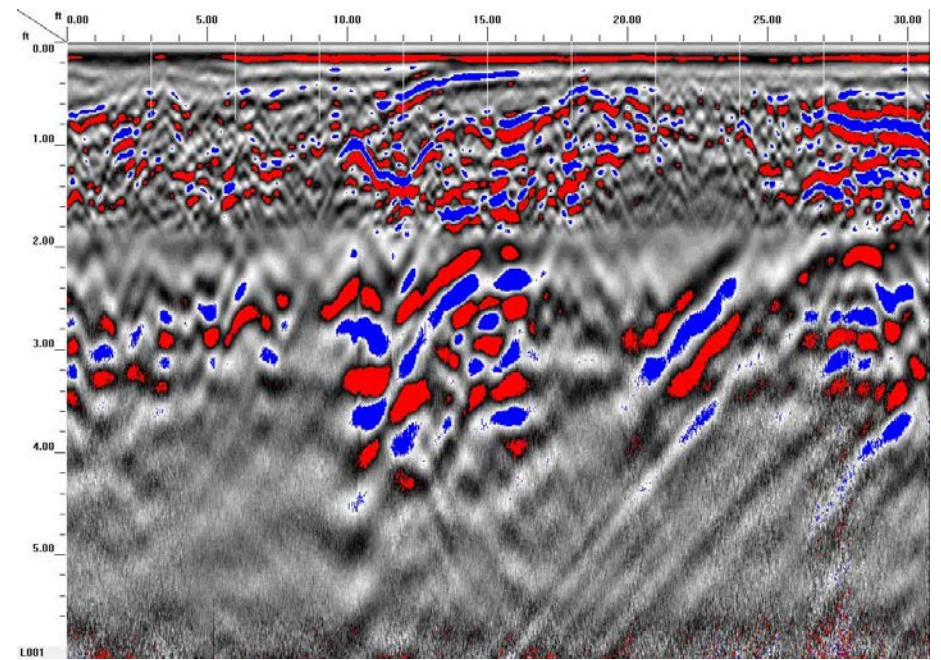
GPR TRANSECT 43



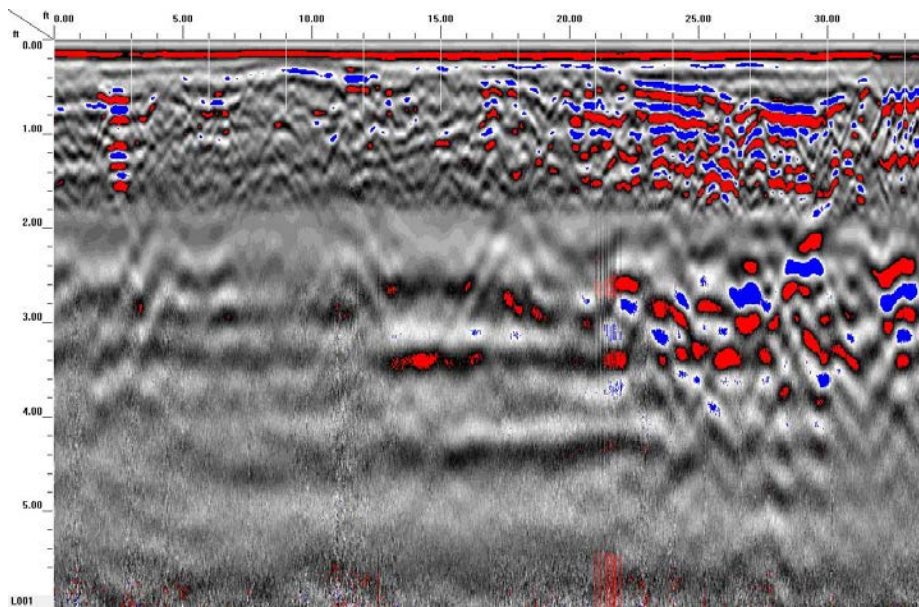
GPR TRANSECT 41



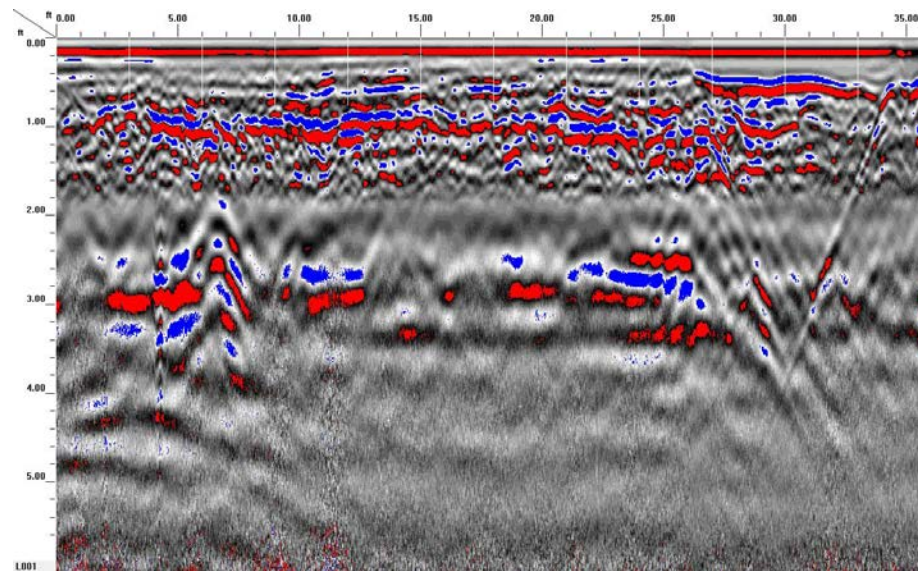
GPR TRANSECT 42



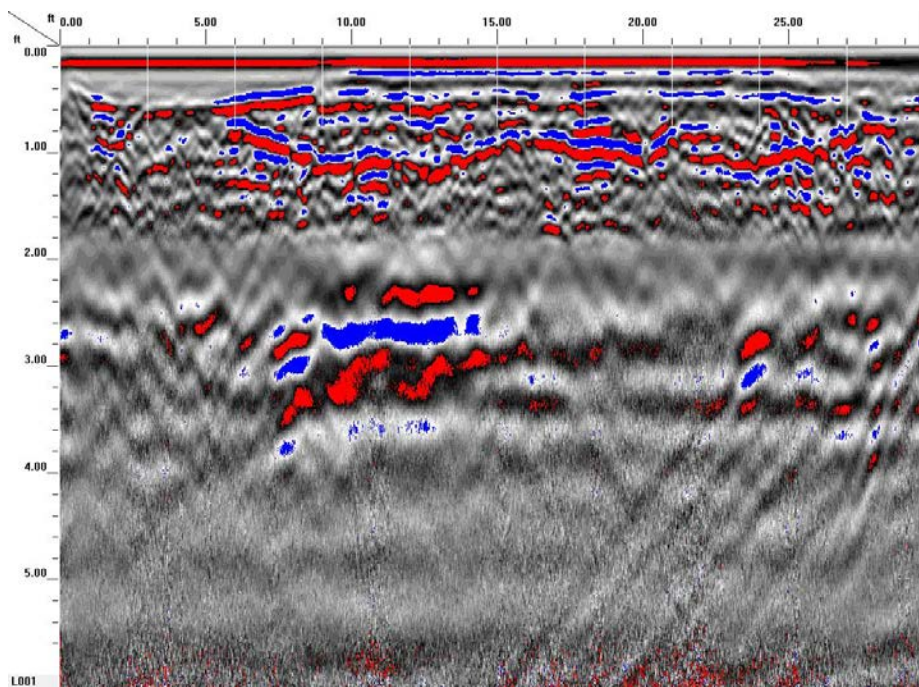
GPR TRANSECT 44



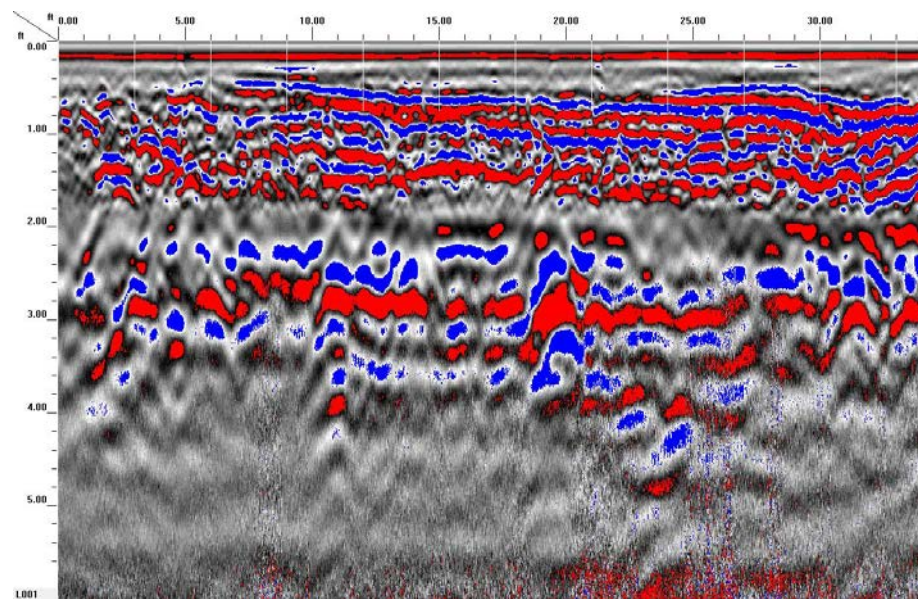
GPR TRANSECT 45



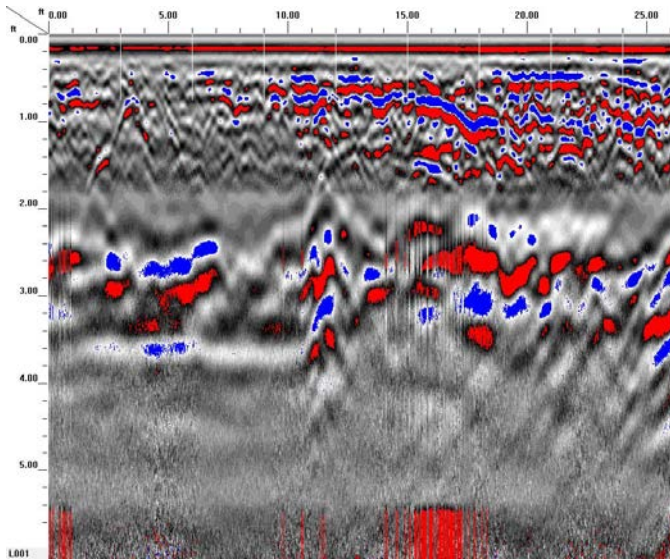
GPR TRANSECT 47



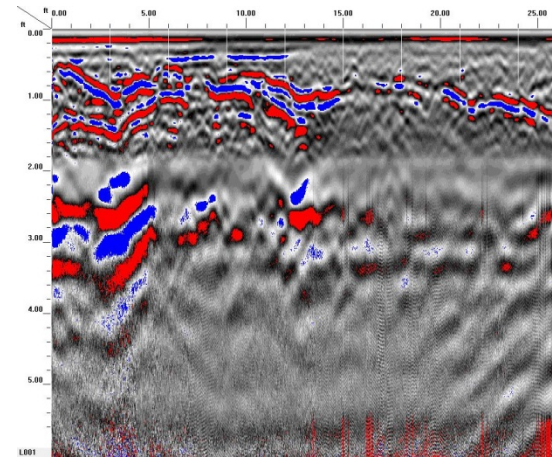
GPR TRANSECT 46



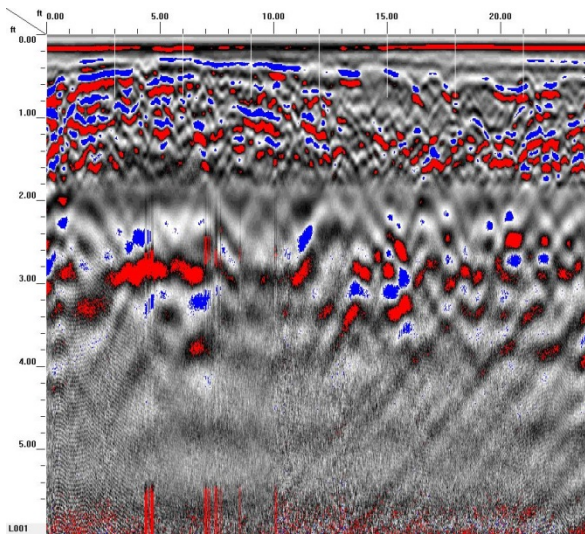
GPR TRANSECT 48



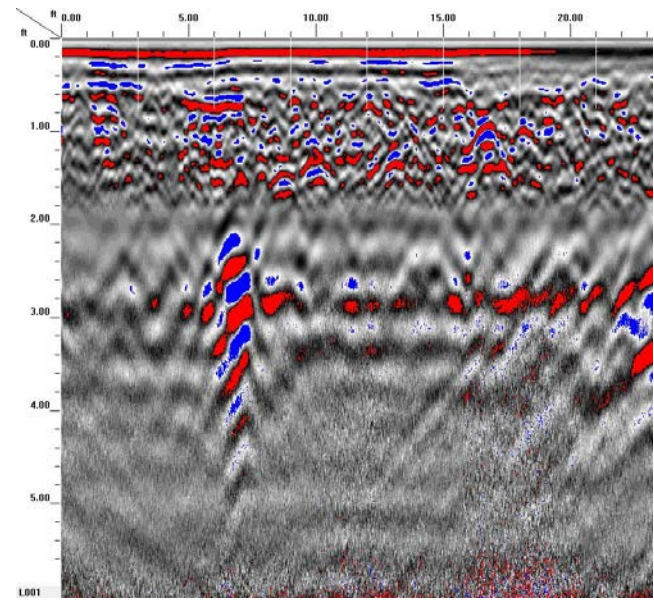
GPR TRANSECT 49



GPR TRANSECT 51



GPR TRANSECT 50



GPR TRANSECT 52



APPENDIX III
GEOPROBE LOGS



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 10.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Concrete	0.0	1.4	Petroleum Odors not Observed in Boring
		Moist, Brown, Fine Sandy SILT (ML)	1.0	1.5	
			2.0	1.4	
	3.0	Moist, Brown, Fine Sandy Silty CLAY (CL)	3.0	1.2	
	4.0	Moist, Brown, Fine Sandy CLAY (CL)	4.0	1.4	
			5.0	1.0	
	6.0	Moist, Tan-Black, Silty Fine SAND (SM)	6.0	1.4	
	7.0	Moist, Tan, Medium to Coarse SAND (SP)	7.0	1.5*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	8.0	Moist, Tan, Medium Sandy CLAY (CL)	8.0	0.8	
			9.0	0.7	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 10.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Concrete	0.0	0.8	Petroleum Odors not Observed in Boring
		Moist, Brown, Fine Sandy SILT (ML)	1.0	1.0	
			2.0	0.8	
			3.0	1.1	
	4.0	Moist, Gray, Fine to Medium SAND (SP)	4.0	1.4	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	5.0	Moist, Tan, Fine to Medium Sandy SILT (ML)	5.0	1.4	
	6.0	Moist, Tan-Gray, Sandy CLAY CL	6.0	1.5	
			7.0	1.5*	
			8.0	1.3	
	9.0	Moist, Tan, Fine Sandy SILT (ML)	9.0	1.3	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 12.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
		Asphalt			Petroleum Odors not Observed in Boring
	1.0	Moist, Brown, Fine Sandy SILT (ML)	1.0	1.4	
			2.0	1.3	
			3.0	1.0	
	4.0	Moist, Black, Silty Medium to Coarse SAND (SM)	4.0	1.6	
	5.0	Wet, Tan, Fine to Medium Sandy Silty CLAY (CL)	5.0	1.3	
	6.0	Moist, Tan-Gray, Silty Sandy CLAY (CL)	6.0	1.2	
	7.0	Moist, Tan-Gray, Sandy Silty CLAY (CL)	7.0	1.5	
	8.0	Moist, Tan-Gray, Fine Sandy SILT (ML)	8.0	1.6	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
			9.0	1.2	
	10.0	Moist, Tan-Gray, Medium Sandy SILT (ML)	10.0	1.0	
	11.0	Moist, Tan, Medium Sandy CLAY (CL)	11.0	1.2	
	12.0	Geoprobe Boring Terminated at 12 feet.	12.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 12.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Concrete	0.0	1.1	Petroleum Odors not Observed in Boring
		Moist, Tan-Gray, Silty Medium to Coarse SAND (SM)			
	1.0	Moist, Dark Brown and Gray, Fine Sandy SILT (ML)	1.0	1.2	
			2.0	1.2	
	3.0	Moist, Brown, Fine to Medium Sandy SILT (ML)	3.0	1.3	
	4.0	Moist, Tan and Black, Silty Fine to Medium SAND (SM)	4.0	1.6	
	5.0	Moist, Tan, Medium to Coarse SAND (SP)	5.0	1.6	
	6.0	Moist, Tan and Gray, Sandy Silty CLAY (CL)	6.0	1.3	
	7.0	Moist, Medium to Coarse Sandy CLAY (CL)	7.0	1.1	
	8.0	Moist, Tan and Brown, Medium Sandy CLAY (CL)	8.0	1.6*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	9.0	Moist, Tan and Brown, Medium Sandy SILT (ML)	9.0	1.1	
			10.0	1.2	
			11.0	1.1	
	12.0	Geoprobe Boring Terminated at 12 feet.	12.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 12.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Concrete	0.0	0.9	Petroleum Odors not Observed in Boring
		Moist, Tan, Fine Sandy Silty CLAY (CL)	1.0	1.2	
	2.0	Moist, Brown, Medium Sandy SILT (ML)	2.0	1.5	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
			3.0	1.7	
	4.0	Moist, Tan-Red, Fine Sandy SILT (ML)	4.0	1.6	
	5.0	Moist, Brown, Medium Sandy SILT (ML)	5.0	1.7*	
	6.0	Moist, Tan, Medium to Coarse Sandy CLAY (CL)	6.0	1.3	
			7.0	1.4	
			8.0	1.3	
	9.0	Moist, Tan, Medium Sandy CLAY (CL)	9.0	1.2	
	10.0	Moist, Tan, Medium Sandy SILT (ML)	10.0	1.2	
	11.0	Moist, Tan, Medium SAND (SP)	11.0	1.2	
	12.0	Geoprobe Boring Terminated at 12 feet.	12.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ_F&R.GDT_8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 12.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks	
	0.2	Concrete	0.0	0.9	Petroleum Odors not Observed in Boring	
		Moist, Brown, Fine Sandy SILT (ML)				
			2.0	1.2		
	4.0	Moist, Tan, Medium to Coarse SAND (SP)	4.0	1.4		
			6.0	1.3		
	6.0	Moist, Tan, Medium to Coarse Sandy CLAY (CL)	6.0	1.3		
			8.0	1.2		
	8.0	Moist, Tan-Gray, Silty CLAY (CL)	8.0	1.2		
			9.0	1.3		
	9.0	Moist, Tan-Gray, Fine Sandy Silty CLAY (CL)	9.0	1.3		
			10.0	1.4*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP	
	10.0	Moist, Tan, Medium Sandy CLAY (CL)	10.0	1.4*		
			11.0	0.9		
	11.0	Moist, Tan, Medium SAND (SP)	11.0	0.9		
			12.0			
	12.0	Geoprobe Boring Terminated at 12 feet.				

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 10.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/31/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.7	Petroleum Odors not Observed in Boring
		Moist, Tan, Fine To Medium Sandy CLAY (CL)	1.0	1.1*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
			2.0	0.4	
			3.0	0.5	
	4.0	Moist, Red-Brown, Fine Sandy SILT (ML)	4.0	0.3	
	5.0	Moist, Red-Brown, Sandy Silty CLAY (CL)	5.0	0.2	
			6.0	0.7	
	7.0	Moist, Red-Tan, Fine to Medium Sandy SILT (ML)	7.0	0.3	
			8.0	0.3	
	9.0	Moist, Tan, Fine to Coarse SAND (SP)	9.0	0.7	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 10.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.8	Petroleum Odors not Observed in Boring
		Moist, Tan, Fine to Coarse Sandy CLAY (CL)			
	1.0	Moist, Tan, Fine to Medium Sandy Silty CLAY (CL)	1.0	1.0	
			2.0	1.1	
	3.0	Moist, Red-Tan, Medium to Coarse Sandy Silty CLAY (CL)	3.0	1.0	
	4.0	Moist, Red-Tan, Fine to Medium Sandy SILT (ML)	4.0	1.0	
	5.0	Wet, Tan, Medium Sandy CLAY (CL)	5.0	1.1*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	6.0	Moist, Red-Tan, Fine to Medium Sandy SILT (ML)	6.0	1.0	
	8.0	Moist, Red-Tan, Fine to Coarse Sandy SILT (ML)	8.0	0.8	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 10.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/31/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks	
	0.2	Asphalt	0.0	0.8	Petroleum Odors not Observed in Boring	
		Moist, Red-Tan, Sandy CLAY (CL)				
	1.0	Moist, Tan, Fine Sandy SILT (ML)	1.0	0.9		
	2.0	Moist, Tan, Fine Sandy Silty CLAY (CL)	2.0	1.0		
	3.0	Moist, Tan, Fine Sandy SILT (ML)	3.0	0.9		
	4.0	Moist, Red-Tan, Fine Sandy CLAY (CL) and Medium Gray Sand (SP)	4.0	1.1*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP	
	5.0	Moist, Tan and Black, Medium SAND (SP)	5.0	1.0		
	6.0	Moist, Tan, Medium Sandy CLAY (CL)	6.0	0.9		
	7.0	Moist, Tan, Silty CLAY (CL)	7.0	0.8		
			8.0	0.9		
	9.0	Moist, Tan, Sandy CLAY (CL)	9.0	0.9		
	10.0	Geoprobe Boring Terminated at 10 feet.				

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 7.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.7	Petroleum Odors not Observed in Boring
		Dry, Tan, Medium to Coarse Sandy CLAY (CL)	1.0	0.7	
	2.0	Moist, Tan, Fine Sandy SILT (ML)	2.0	0.6	
	3.0	Moist, Tan, Fine Sandy CLAY (CL)	3.0	0.7	
	4.0	Moist, Tan, Medium SAND (SP)	4.0	0.6	
	5.0	Moist, Tan-Gray, Medium Sandy CLAY (CL)	5.0	0.7	
			6.0	0.8*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	7.0	Geoprobe Boring Terminated on Very Dense SANDS at 7 feet.			

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 7.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/31/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.9	Petroleum Odors not Observed in Boring
		Moist, Gray, Fine to Medium Sandy SILT (ML)			
	1.0	Moist, Gray, Medium to Coarse SAND (SP)	1.0	1.1*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	2.0	Moist, Gray, Medium to Coarse Sandy CLAY (CL)	2.0	0.8	
	4.0	Moist, Tan, Fine to Medium SAND (SP)	4.0	0.4	
			6.0	0.8	
	7.0	Geoprobe Boring Terminated on Very Dense SANDS at 7 feet.	7.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 8.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Asphalt	0.0	0.8	Petroleum Odors not Observed in Boring
		Moist, Gray, Medium to Coarse SAND (SP)			
	2.0	Moist, Tan, Medium Sandy CLAY (CL)	2.0	0.7	
	4.0	Moist, Tan-Brown, Medium SAND (SP)	4.0	1.3*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
			6.0	0.9	
	8.0	Geoprobe Boring Terminated on Very Dense SANDS at 8 feet.	8.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 10.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/31/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Concrete	0.0	1.1	Petroleum Odors not Observed in Boring
		Moist, Tan, Fine Sandy Silty CLAY (CL)	1.0	0.9	
	2.0	Moist, Tan, Fine Sandy SILT (ML)	2.0	0.9	
			3.0	1.0	
			4.0	0.8	
			5.0	1.0	
			6.0	1.2*	
	7.0	Moist, Tan, Silty Fine SAND (SM)	7.0	1.1	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
			8.0	1.1	
			9.0	1.0	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 10.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Surficial Organic Soil	0.0	0.7	Petroleum Odors not Observed in Boring
		Moist, Gray-Tan, Fine to Medium SAND with Gravel (SP)			
	2.0	Moist, Tan-Orange, Medium Sandy CLAY (CL)	2.0	0.6	
	4.0	Moist, Brown, Medium Sandy CLAY (CL)	4.0	0.4	
	6.0	Moist, Brown, Medium to Coarse Sandy CLAY (CL)	6.0	0.6	
			8.0	0.7*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ F&R.GDT 8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



Project No: 66T-0097

Elevation: Existing Ground Surface

Drilling Method: Geoprobe

Client: NCDOT

Total Depth: 10.0'

Hammer Type: N/A

Project: B-5121/B-5317 Archie L. King (Parcel #9)

Boring Location: See Plan

Date Drilled: 7/30/15

City/State: Raleigh, NC

Driller: Regional Probing Services

Elevation	Depth	Description of Materials (Classification)	*Sample Depth (feet)	PID (ppm)	Remarks
	0.2	Concrete	0.0	0.9	Petroleum Odors not Observed in Boring
		Moist, Tan, Silty CLAY (CL)			
	1.0	Moist, Tan, Fine Sandy SILT (ML)	1.0	0.8	
			2.0	0.7	
	3.0	Moist, Tan, Silty Fine SAND (SM)	3.0	0.7	
			4.0	0.7	
	4.0	Moist, Tan, Fine Sandy SILT (ML)	4.0	0.7	
			5.0	0.9	
			6.0	0.5	
	7.0	Moist, Tan, Fine Sandy Silty CLAY (CL)	7.0	0.9*	*Sample Submitted for Laboratory Analysis for TPH, DRO/GRO, Total BTEX, 16 PAHs, and BaP
	8.0	Moist, Tan, Medium to Coarse Sandy SILT (ML)	8.0	0.8	
	9.0	Moist, Tan, Fine to Medium SAND (SP)	9.0	0.6	
	10.0	Geoprobe Boring Terminated at 10 feet.	10.0		

GEOPROBE_LOG_B5121_GEOENV_GEOPROBEBORELOG_PARCEL9.GPJ_F&R.GDT_8/21/15

*Geoprobe soil samples were collected by continuous push of a 2 inch ID stainless steel barrel containing a 4 foot long acetate collection sleeve. The 4 foot long soil sample sleeves were cut open and the soil was separated into 1 foot long sample intervals.



APPENDIX IV

SITE PHOTOS

B-1



Photo #1: A view of Boring B-1, facing west.



B-2

Photo #2: A view of Boring B-2, facing north.



Photo #3: A view of the location of the possible UST, and Borings B-3 through B-6, facing northeast.



Photo #4: A view of Boring B-7, facing west.



Photo #5: A view of Borings B-8 and B-9, facing southwest.



Photo #6: A view of Borings B-9 and B-10, facing north.



B-11

Photo #7: A view of Boring B-11, facing north.



B-12

Photo #8: A view of Boring B-12, facing east.



B-13

Photo #9: A view of Boring B-13, facing east.



B-14

Photo #10: A view of Boring B-14, facing west.



B-15

Photo #11: A view of Boring B-15, facing north.



APPENDIX V

LABORATORY ANALYTICAL RESULTS



Hydrocarbon Analysis Results

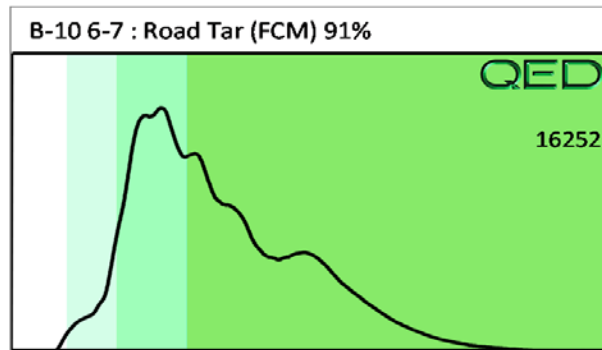
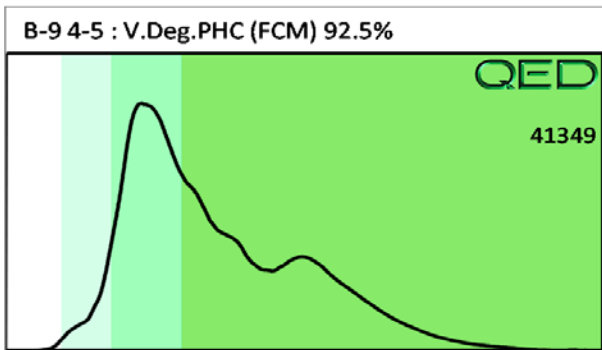
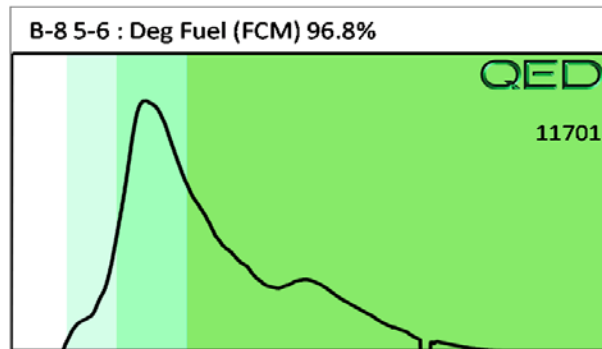
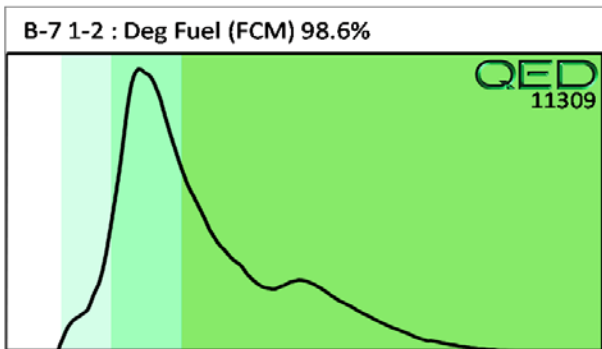
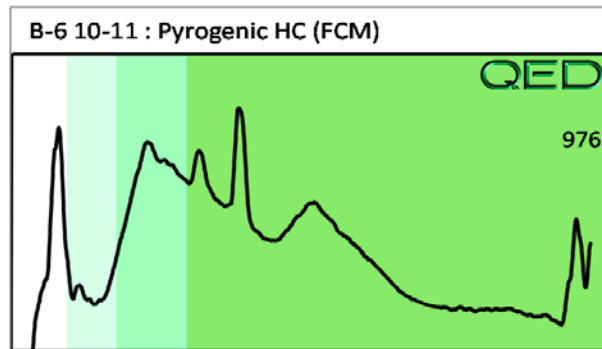
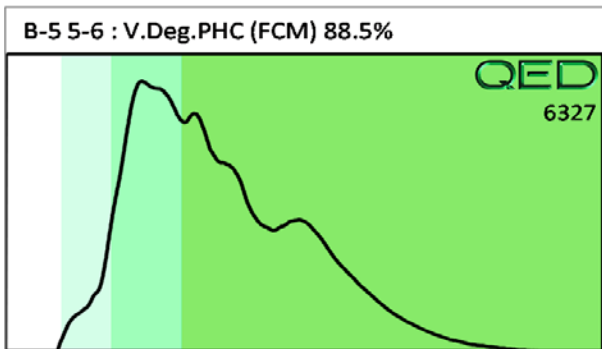
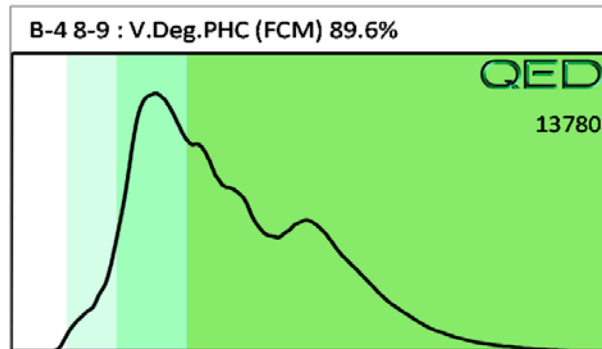
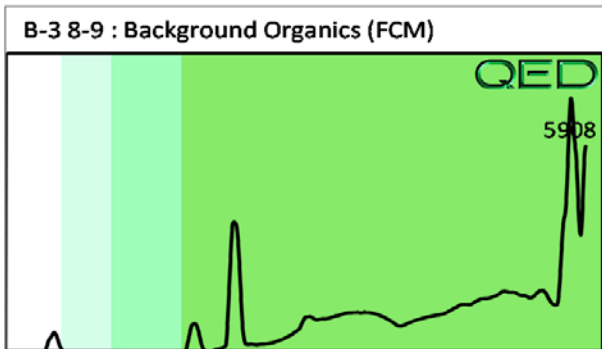
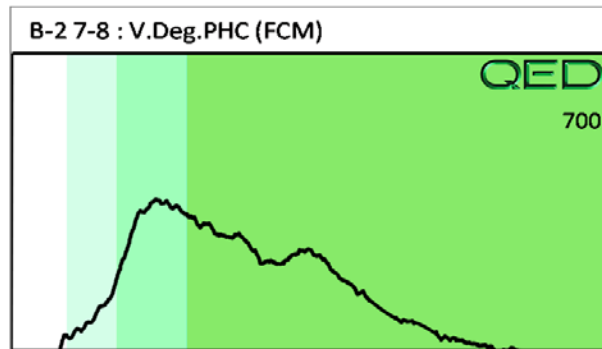
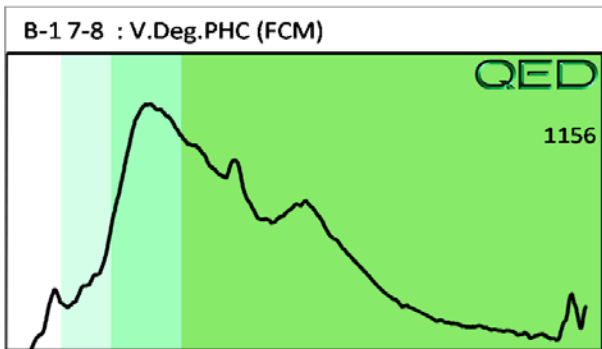
Client: F&R Address: Contact: Ben Whitley Project: NCDOT B-5121/B-5317	Samples taken Thursday, July 30, 2015 Samples extracted Thursday, July 30, 2015 Samples analysed Monday, August 03, 2015 Operator King
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Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	Ratios			HC Fingerprint Match
										% light	% mid	% heavy	
s	B-1 7-8	19.8	<0.99	<0.5	1.2	1.2	1.2	0.12	<0.01	0	88.8	11.2	V.Deg.PHC (FCM)
s	B-2 7-8	21.1	<1.1	<0.53	0.44	0.44	0.44	0.05	<0.011	0	86.6	13.4	V.Deg.PHC (FCM)
s	B-3 8-9	21.1	<1.1	<0.53	0.21	0.21	<0.16	<0.02	<0.011	0	0	100	Background Organics (FCM)
s	B-4 8-9	26.0	<1.3	<0.65	19.6	19.6	18.1	0.86	0.01	0	89.1	10.9	V.Deg.PHC (FCM) 89.6%
s	B-5 5-6	21.0	<0.52	<0.52	6.3	6.3	6.2	0.3	0.004	0	88.4	11.6	V.Deg.PHC (FCM) 88.5%
s	B-6 10-11	21.3	<1.1	<0.53	0.42	0.42	0.42	0.05	0.006	0	65.9	34.1	Pyrogenic HC (FCM)
s	B-7 1-2	268.3	<6.7	<6.7	239.5	239.5	138.8	5.3	0.043	0	93.8	6.2	Deg Fuel (FCM) 98.6%
s	B-8 5-6	272.6	<6.8	<6.8	266.5	266.5	148.6	5.7	0.068	0	93.3	6.7	Deg Fuel (FCM) 96.8%
s	B-9 4-5	25.0	<1.3	<0.63	64.9	64.9	58	2.7	0.015	0	92.3	7.7	V.Deg.PHC (FCM) 92.5%
s	B-10 6-7	299.1	<15	<7.5	180.1	180.1	170.3	8	0.16	0	90.9	9.1	Road Tar (FCM) 91%
Initial Calibrator QC check			OK			Final FCM QC Check			OK			89.9%	

Results generated by a QED HC-1 analyser. Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values are not corrected for moisture or stone content

Fingerprints provide a tentative hydrocarbon identification. The abbreviations are:- FCM = Results calculated using Fundamental Calibration Mode : % = confidence for sample fingerprint match to library

(SBS) or (LBS) = Site Specific or Library Background Subtraction applied to result : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate present





Hydrocarbon Analysis Results

Client: F&R
 Address:
 Contact: Ben Whitley
 Project: NCDOT B-5121/B-5317

Samples taken: Friday, July 31, 2015
 Samples extracted: Friday, July 31, 2015
 Samples analysed: Monday, August 03, 2015

Operator: King

Matrix	Sample ID	Dilution used	BTEX (C6 - C9)	GRO (C5 - C10)	DRO (C10 - C35)	TPH (C5 - C35)	Total Aromatics (C10-C35)	16 EPA PAHs	BaP	Ratios			HC Fingerprint Match
										% light	% mid	% heavy	
s	B-11 1-2	1671.3	<83.6	<41.8	1710	1710	1342	63	<0.84	0	93.6	6.4	Road Tar (FCM) 93.3% B
s	B-12 4-6	27.1	<1.4	<0.68	13.9	13.9	7.3	0.27	0.014	0	92.3	7.7	Deg Fuel (FCM) 92.4%
s	B-13 6-7	8.1	<0.41	<0.2	0.13	0.13	<0.07	<0.008	<0.004	0	65.3	34.7	Pet.Hyd Traces 72.3%
s	B-14 8-10	315.9	<7.9	<7.9	104.2	104.2	97.1	17.2	0.53	0	86.6	13.4	V.Deg.PHC (FCM) 86.6%
s	B-15 7-8	23.4	<0.59	<0.59	1.4	1.4	1.4	0.14	<0.012	0	88.1	11.9	V.Deg.PHC (PFM) (FCM)
Initial Calibrator QC check			OK			Final FCM QC Check			OK			101.0%	

Results generated by a QED HC-1 analyser. Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values are not corrected for moisture or stone content
 Fingerprints provide a tentative hydrocarbon identification. The abbreviations are:- FCM = Results calculated using Fundamental Calibration Mode : % = confidence for sample fingerprint match to library
 (SBS) or (LBS) = Site Specific or Library Background Subtraction applied to result : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate present



Chain of Custody Record and Analytical Request Form

Sample ID	Sample Collection		Initials	TAT Requested		
	QED UVF	Date		Time	24 Hour	48 Hour
B-1	7-8	7-30-15	1410	BKW	13.1	X
B-2	7-8		1425		12.3	
B-3	8-9		1445		12.3	
B-4	8-9		1510		10.0	
B-5	5-6		1530		12.4	
B-6	10-11		1600		12.2	
B-7	1-2	7-31-15	900		12.6	
B-8	5-6		915		12.4	
B-9	4-5		930		10.4	
B-10	6-7		940		11.3	
B-11	1-2		1055		11.5	
B-12	4-6		1100		9.6	
B-13	6-7		1120		12.3	
B-14	8-10		1145		10.7	
B-15	7-8		1205		11.1	

Client: F&F

Contact: Bon Whitley

Phone: 919-630-5661

Email: bwhitley@fandri.com

Project Reference: NL DOT B-5121 / B-5317

Each sample will be analyzed for total BTEX, GRO, DRO, TPH and PAH

Each sample will generate a fingerprint representative of the petroleum product within the samples. Electronic data will be submitted to the email above.

1371
Parcel 243
123
1000
124
125
126
127
128

<u>F&F</u>	<u>7-31-15</u>	<u>UPS</u>	<u>7-31-15</u>
Relinquished by	Date/Time	Accepted by	Date/Time
		<u>King</u>	<u>8/1/15</u>
Relinquished by	Date/Time	Accepted by	Date/Time
Relinquished by	Date/Time	Accepted by	Date/Time

SHIP TO:
 QROS, LLC
 420 Raleigh Street, Suite E
 Wilmington, NC 28412

Hannah King
hannahk@grosllc.com
 (704)-654-7391

ATTENTION

When shipping, please DO NOT submerge sample vials in ice or water. This is to avoid dilution errors and contamination. To keep the samples cool we suggest using a freezer pack or a bag of ice sealed that will not leak.

SINCE



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