

Prepared for:

North Carolina Department of Transportation

Geotechnical Engineering Unit

GeoEnvironmental Section

1589 Mail Service Center

Raleigh, North Carolina, 27699-1589

Preliminary Site Assessment Report

Amicus Investments LLC., Property

Parcel # 28

207 North J.K. Powell Blvd.

Whiteville, Columbus County, North Carolina

US 701 Bypass (Madison St-Powell Blvd) from SR 1437 (Virgil Ave) to US 74/76

TIP Number: R-5020B

WBS Element: 41499.1.3



Apex Companies, LLC

(dba Apex Engineering, PC)

10610 Metromont Parkway, Suite 206

Charlotte, North Carolina 28269

Prepared by:

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Troy L. Holzschuh

Assistant Project Manager

Reviewed by:

DocuSigned by:

A handwritten signature in black ink that reads 'Eric J. Wysong'.

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Eric Wysong, L.G.

Project Manager

NC Geologist License No. 2581



November 21, 2018

not considered final unless all signatures are completed

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1.0 INTRODUCTION

This report presents the results of a Preliminary Site Assessment (PSA) for the North Carolina Department of Transportation (NCDOT) Parcel 28 performed by Apex Companies, LLC (Apex) (dba Apex Engineering, PC) on behalf of the NCDOT. The subject site of this PSA report will be affected by the widening of J.K. Powell Blvd. (US 701 Bypass) from Virgil Ave. to US 74/76. The Site is comprised of one parcel and is located at 207 North J.K. Powell Boulevard and is identified as Parcel 28, Amicus Investments, LLC., Property, within the NCDOT R-5020B design project. The property is located at the southwest corner of the intersection of North J.K. Powell Boulevard and West Burkhead Street in Whiteville, Columbus County, North Carolina, as shown in the attached Site Location Map (**Figure 1**). The site investigation was conducted in accordance with Apex Company's Technical and Cost proposal dated May 15, 2018.

NCDOT contracted Apex to perform the PSA within the proposed right-of-way (ROW) and/or easement of the Parcel 28 Property due to the potential presence of contamination at the site and the possibility that excavation and grading may occur within the area. The PSA was performed to evaluate if soils have been impacted as a result of past and present uses of the property within the proposed investigation area, if buried underground storage tanks (USTs) are present in the area of investigation, and if groundwater is impacted.

The following report presents the results of an electromagnetic (EM) and ground penetrating radar (GPR) geophysical survey to identify potential USTs in the investigation area and it describes the subsurface field investigation at the site. The report includes the evaluation of field screening, as well as field and laboratory analyses with regards to the presence or absence of soil and groundwater contamination within the area of investigation across Parcel 28. **Appendix A** includes a Photograph log for the site.

1.1 Site History

Parcel 28 has been identified with the address of 207 North J.K. Powell Boulevard. The property owner is listed as Amicus Investments, LLC. Currently the site operates as a Speedway gas station and convenience store. Based on a search of the North Carolina Department of Environmental Quality (NCDEQ) UST database registry, four registered tanks were identified for the 207 North J.K. Powell Boulevard site. Two 6,000-gallon gasoline mixture USTs and two 12,000-gallon capacity gasoline mixture USTs were reportedly installed on October 31, 2001. Fuel ports associated with USTs were noted during field activities. Additionally, the geophysical survey verified four USTs on site. The UST Facility ID number associated with this site is 0-036342. Apex personnel also reviewed the NCDEQ Incident Management Database and no groundwater incidents are associated with this parcel.

1.2 Site Description

The site is located in a mixed commercial and residential area of Whiteville, Columbus County, North Carolina. The property is currently operating as a Speedway gas station and convenience store and is developed with a one-story brick structure located in the west central portion of the parcel. A canopy that covers eight fuel dispensers is located in the central portion of the parcel. The rest of the parcel is covered with paved asphalt and concrete. West Burkhead Street borders the parcel to the north with residential properties located just beyond. Additional residential properties border the site to the west. The property is bordered by J.K. Powell Boulevard to the east followed by the 701 Car Wash and Family Dollar. Carrier Service borders the site to the south. As previously stated the geophysical survey identified four GPR anomalies characteristic of USTs in the investigation area.

2.0 GEOLOGY

2.1 Regional Geology

Parcel 28, the Amicus Investments, LLC., property, is located within the Coastal Plain Physiographic Province. The Coastal Plain is the largest physiographic province in the state, covering about 45% of the land area. According to the US Geological Survey Hydrogeological framework of the North Carolina coastal plain, the geology consists of eastward-dipping and eastward-thickening series of sedimentary strata which range in age from Holocene to Cretaceous. The most common sediment types are sand and clay, although a significant amount of limestone occurs in the southern part of the Coastal Plain. The Site overlies surficial sediments (to approximately 30 to 40 feet below land surface), the PeeDee Confining Unit (approximately 10 feet thick in this area), and the Late Cretaceous age PeeDee Formation. The PeeDee Formation is named for exposures along the great PeeDee River, and it preserves belemnites and foraminifera fossils dating from the Late Cretaceous. It generally consists of marine sand, clayey sand and clay (M.D. Winner Jr. and R.W. Coble, 1996, *Hydrogeologic Framework of the North Carolina Coastal Plain, Regional Aquifer-System Analysis – Northern Atlantic Coastal Plain*, USGS Professional Paper 1404-1).

2.2 Site Geology

Site geology was observed through the drilling and sampling of seven direct push technology (DPT) soil borings (P28-SB1 through P28-SB7) onsite, from which a total of fifteen soil samples were collected for field screening and analysis. **Figure 2** presents the boring locations and site layout. Borings did not exceed a total depth of five feet below ground surface (bgs) since that depth was the maximum excavation depth for proposed drainage features. Soil consisting predominantly of brown sandy clay to brown to orange sandy clayey silt was observed across the parcel. Borings on the site intercepted groundwater at depths of approximately four to five

feet bgs. According to the topographical maps found on the Columbus County Geographic Information System (GIS) site, the parcel slopes from northeast to southwest. The closest surface water body is Mollie Branch west of the site. Based on the surface topography and locations of nearby streams, the general direction of shallow groundwater flow at the site is expected to be west towards Mollie Branch or possibly south-southwest toward the intersection of Mollie Branch and Soules Swamp. Boring logs are presented in **Appendix B**.

3.0 FIELD ACTIVITIES

3.1 Preliminary Activities

Prior to commencing field sampling activities at the site, several tasks were accomplished in preparation for the subsurface investigation. A Health and Safety Plan (HASP) was prepared to include the site-specific health and safety information necessary for the field activities. North Carolina-One Call was contacted on May 25, 2018 to report the proposed drilling activities and notify affected utilities. Apex subcontracted Pyramid Environmental & Engineering, PC (Pyramid) to locate subsurface utilities and other subsurface drilling hazards as well as to perform a geophysical survey. Carolina Soil Investigations, LLC (CSI) of Olin, North Carolina was retained by Apex to perform the DPT borings for soil sampling. REDLAB, LLC (REDLAB) provided an ultraviolet fluorescence (UVF) Hydrocarbon Analyzer and Eastern Solutions provided a calibrated Flame Ionization/Photoionization Detector (FID/PID).

3.2 Site Reconnaissance

Apex personnel performed a site reconnaissance on June 5, 2018. During the site reconnaissance, the area was visually examined for the presence of potential USTs or areas/obstructions that could potentially affect the subsurface investigation. The proposed boring locations were marked based on the site inspection and geophysical survey results. Apex personnel also used the site visit as an opportunity to contact the property manager/owner to inform them of upcoming field activities.

3.3 Geophysics Survey Results

The geophysical survey of the site was conducted from May 30, 2018 to June 5, 2018. Pyramid performed an EM induction metal survey followed by a GPR survey. A copy of the Geophysical Report is presented in **Appendix C**. A total of ten suspected EM anomalies were identified. These areas were associated with reinforced concrete, possible utilities, signs and known USTs. Two of the anomalies were investigated further with the GPR method. Results of GPR scans verified the presence of reinforced concrete and the presence and orientation of the four USTs. Results of GPR scans confirmed that the four known USTs are located in the east central

portion of the parcel in a tank bed 45 feet long and 39 feet wide. The UST locations are depicted on **Figure 2**.

3.4 Well Survey

No water supply or groundwater monitoring wells were observed on Parcel 28.

3.5 Soil Sampling

Apex conducted drilling activities at the site on June 6, 2018. The purpose of soil sampling was to determine if a release of petroleum or other volatile organic chemicals had occurred within the investigation area, and if so, to estimate the volume of impacted soil that might require special handling during construction activities. Apex drilling subcontractor, CSI, advanced seven DPT soil borings within the proposed investigation area. These seven boring locations were placed on the north and south sides of the UST bed and in a linear pattern along the eastern and north-northeast parcel boundaries to maximize the likelihood of identifying potential soil contamination that might exist in the area of future construction activities. **Figure 2** presents the Site Map with boring locations and site structures.

Soil sampling was performed utilizing hand auger and direct push methods accompanied by field screening of volatile organic vapors with the FID/PID unit and onsite quantitative analyses with the UVF Hydrocarbon Analyzer. One to two intervals of the soil boring exhibiting the most elevated FID/PID readings were selected for onsite quantitative analysis of total petroleum hydrocarbons (TPH) in soil using the REDLAB UVF Hydrocarbon Analyzer. The analysis was performed onsite by Troy Holzschuh, a certified REDLAB UVF technician with Apex. The UVF results were generated concurrent with soil boring activities so that rapid assessment could be utilized for strategic boring placement.

3.6 Groundwater Sampling

Groundwater was encountered on site at depths ranging from four to five feet bgs. Contamination was not evident based on FID/PID field screening or UVF hydrocarbon analysis of soils immediately above the water table, at the water table surface, or just below the water table surface (to maximum depth of five feet bgs) . Based on the absence of contamination in shallow saturated soils, temporary wells were not installed, and groundwater samples were not collected.

4.0 SAMPLING RESULTS

Based on FID/PID field screening and onsite UVF hydrocarbon analysis from the June 2018 soil sampling there is evidence of limited, minor petroleum hydrocarbon contamination within the area of investigation on Parcel 28.

Elevated FID readings, above ten parts per million (ppm), were observed in one of the soil borings (P28-SB2). The FID readings at or above the water table ranged from non-detectable to 126 ppm. Elevated PID readings were not observed above 10 ppm in any soil samples. The FID/PID field screening results are provided on the boring logs in **Appendix B**.

Soil samples which exhibited elevated PID and/or FID readings were analyzed using the UVF for the presence of TPH gasoline range organics (GRO) and diesel range organics (DRO). These analytical results are provided in **Table 1**. The instrument generated tables and chromatographs are found in **Appendix D**. **Figure 3** presents the TPH-GRO and TPH-DRO results at each soil boring.

Based on the UVF analyses, TPH-GRO was not detected above the instrument detection limits in soil samples from Parcel 28. Detectable low levels of TPH-DRO were identified in five soil samples (including a duplicate) on Parcel 28. TPH-DRO concentrations ranged from below detectable levels to 27.7 milligram per kilogram (mg/kg) at sample P28-SB1. TPH-GRO concentrations did not exceed the regulatory action level of 50 mg/kg and the TPH-DRO concentrations did not exceed its regulatory action level of 100 mg/kg in any samples.

5.0 CONCLUSIONS

Based on site observations, field screening of organic vapors in soil, and onsite UVF analysis, very limited, minor petroleum impacts to soil was identified. However, none of the soil samples analyzed for TPH by the UVF instrument exceeded the NCDEQ Action level of 50 mg/kg for TPH-GRO or the NCDEQ Action level of 100 mg/kg for TPH-DRO.

The following summary is based upon Apex's evaluation of field observations, field screening, and onsite quantitative analyses of soil samples collected from the Site on June 6, 2018.

- Results of the geophysical survey verified the presence and orientation of four anomalies characteristic of known, registered USTs at the site. The location of the USTs are depicted on **Figure 2**.

- Seven soil borings were advanced onsite, and a total of fifteen soil samples were collected for screening and analysis. Soil samples collected from each boring were screened with an FID/PID unit and were analyzed in the field using a REDLAB UVF Hydrocarbon Analyzer.
- PID readings ranged from non-detectable to below 10 ppm in soil. FID readings ranged from non-detectable to 126 ppm.
- Soil samples analyzed using the UVF did contain TPH-GRO concentrations above the instrument detection limit, which was also below the NCDEQ Action level of 50 mg/kg.
- Soil samples analyzed using the UVF did not contain TPH-DRO concentrations above the NCDEQ Action level of 100 mg/kg.

6.0 RECOMMENDATIONS

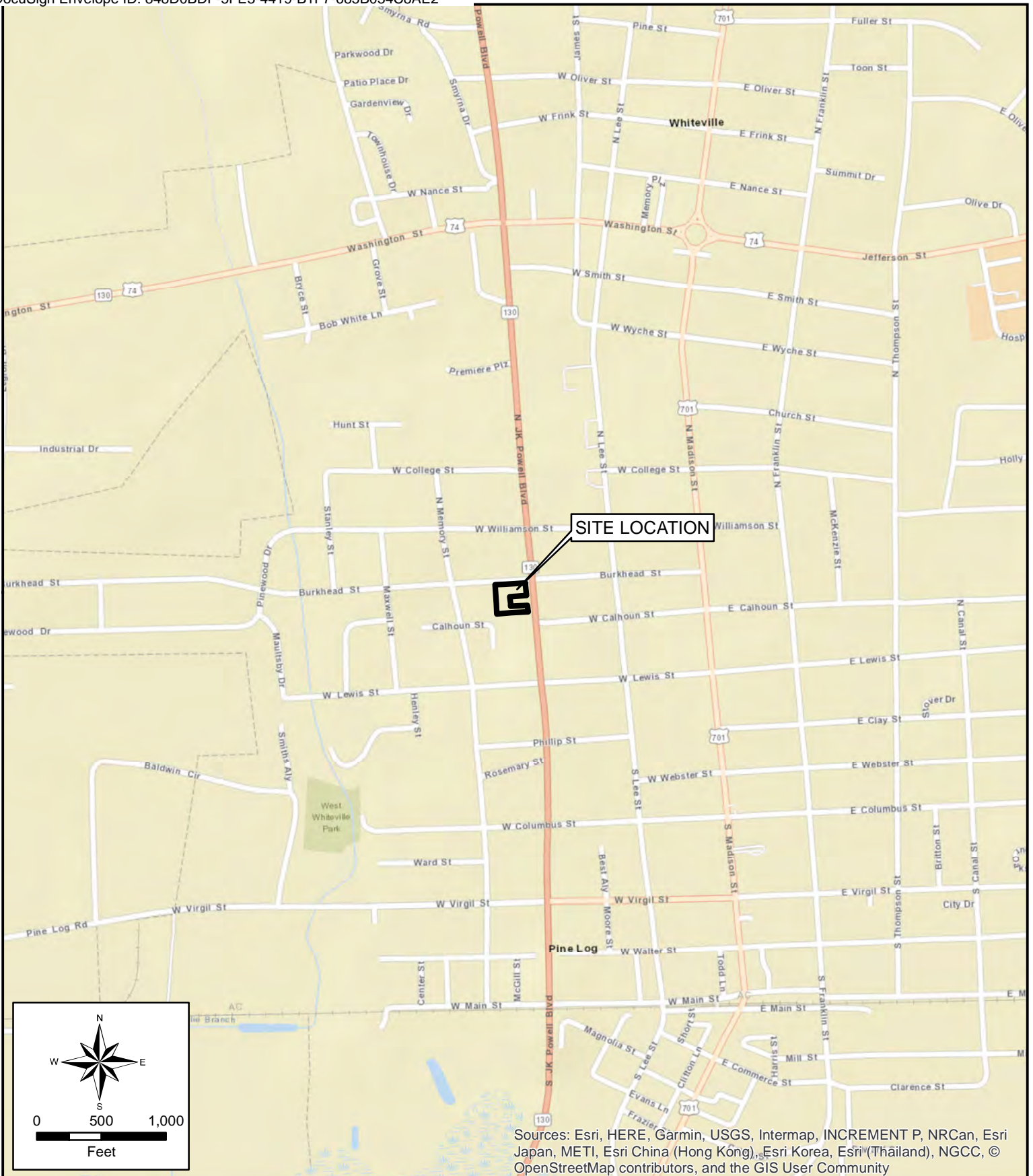
Based on these PSA results, the eastern portion of the subject parcel is designed as a fill area and the northern portion is designed as a cut area. The drainage features are planned to be installed in both areas of Parcel 28. Soil and groundwater contamination was not noted in the design area, however due to shallow groundwater the drainage features will likely encounter groundwater. Groundwater could be encountered as shallow as four feet bgs. NCDOT should be prepared to dewater and containerize groundwater if contamination is encountered in the saturated zone during construction activities. Additionally, two 6,000-gallon capacity USTs and two 12,000-gallon capacity USTs were verified to be within the eastern portion of the designed construction area. Apex recommends that these USTs be excavated prior to construction activities.

TABLES

Table 1
UVF Onsite Hydrocarbon Analytical Soil Data from June 2018
R-5020B, Parcel 28, Amicus Investments LLC Property
Whiteville, Columbus County, North Carolina

Sample ID Number	Sample Date	Sample Depth (ft bgs)	GRO (mg/kg) (C5-C10)	DRO (mg/kg) (C10-C35)
SOIL				
NCDEQ Action Level in mg/kg			50	100
P28-SB1	6/6/2018	3 -3.5	<0.63	27.7
P28-SB1	6/6/2018	4.5 - 5	<0.57	6.7
P28-SB2	6/6/2018	2 - 3	<0.43	0.67
P28-SB2*	6/6/2018	4.5 - 5	<0.81	1.1
P28-SB3	6/6/2018	2 - 3	<0.53	<0.53
P28-SB3	6/6/2018	4.5 - 5	<0.29	<0.29
P28-SB4	6/6/2018	2.5 - 3	<0.28	<0.28
P28-SB4	6/6/2018	4.5 - 5	<0.3	<0.3
P28-SB5	6/6/2018	2 - 3	<0.26	<0.26
P28-SB5	6/6/2018	4 - 5	<0.26	<0.26
P28-SB6	6/6/2018	3 - 4	<0.2	<0.2
P28-SB6	6/6/2018	4 - 5	<0.31	<0.31
P28-SB7	6/6/2018	3 - 4	<0.2	<0.2
P28-SB7	6/6/2018	4 - 5	<0.17	<0.17
P28-DUP-1	6/6/2018	---	<0.81	0.81
NOTES: (mg/kg) = Milligrams per kilogram * = Duplicate sample was collected GRO = Gasoline Range Organics DRO = Diesel Range Organics ft bgs = feet below ground surface TPH - GRO values in exceedance of NCDEQ Action Level of 50 mg/kg are shown in Bold TPH - DRO values in exceedance of NCDEQ Action Level of 100 mg/kg are shown in Bold				

FIGURES



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

CHECK BY: TH
DRAWN BY: SP
DATE: 7/6/2018
SCALE: AS SHOWN
CAD NO.: NCDOT-001
PRJ NO.: NCDOT-001

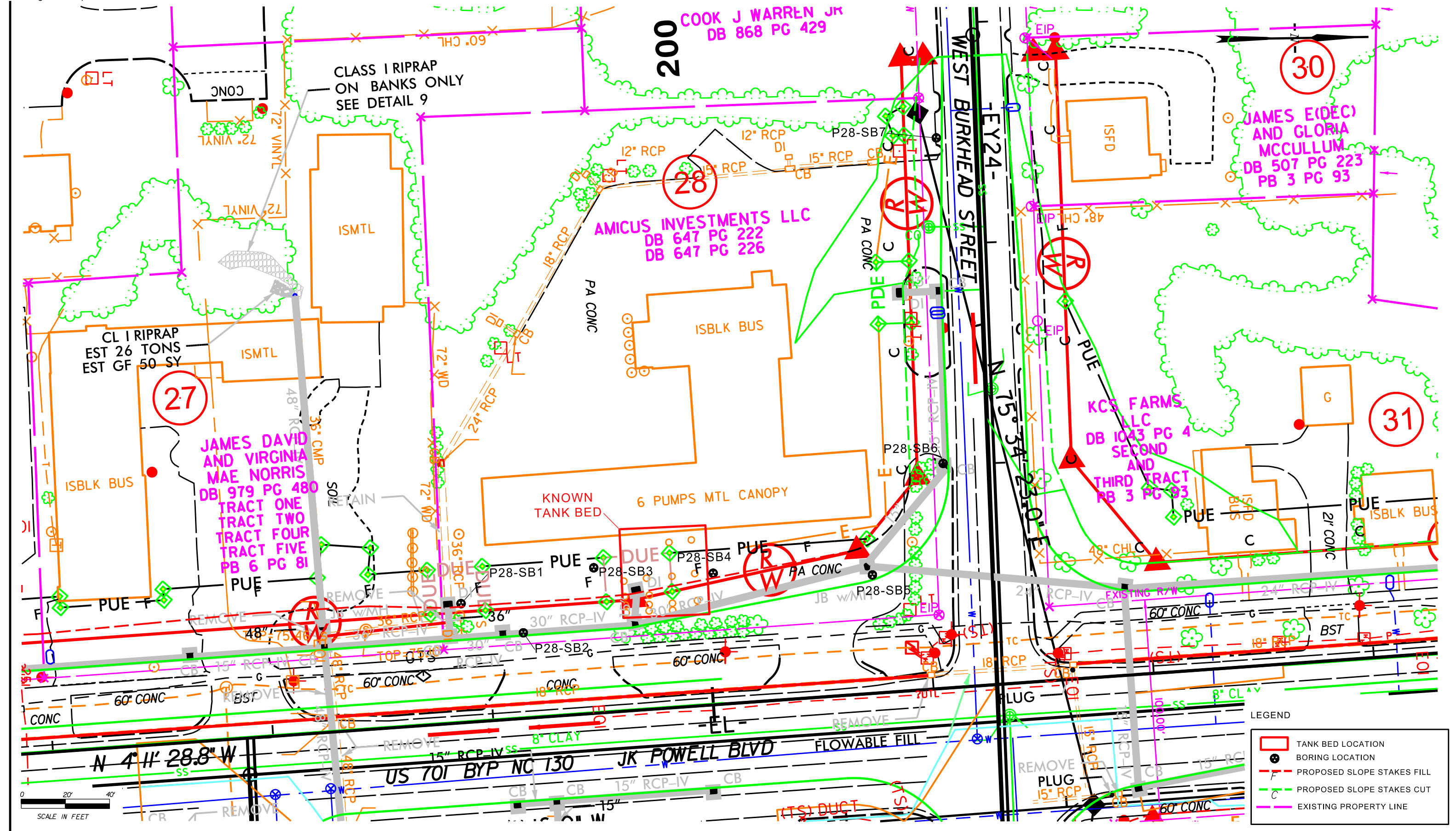
SITE LOCATION MAP

PARCEL #28
207 N. JK POWELL BOULEVARD
WHITEVILLE, NORTH CAROLINA



FIGURE

1



LEGEND

- TANK BED LOCATION
- BORING LOCATION
- F PROPOSED SLOPE STAKES FILL
- C PROPOSED SLOPE STAKES CUT
- EXISTING PROPERTY LINE



FIGURE 2
PARCEL 028
207 N. JK. POWELL BLVD
SITE MAP WITH SOIL BORING
LOCATIONS

Date:	7/3/18	R-5020B US 701 BYPASS COLUMBUS COUNTY
Proj. #	NCDOT-001	
pc_028_fig 2.dgn		Project Title:
CAD File:		Client:
Approx. Scale:	1" = 40'	Drawn by:
		Client:

Sample Identification	P28-SB4
Sample Depth (Feet bgs)	2.5-3
TPH GRO (mg/kg)	<0.28
THP DRO (mg/kg)	<0.28
Sample Depth (Feet bgs)	4.5-5
TPH GRO (mg/kg)	<0.3
THP DRO (mg/kg)	<0.3

Sample Identification	P28-SB3
Sample Depth (Feet bgs)	2-3
TPH GRO (mg/kg)	<0.53
THP DRO (mg/kg)	<0.53
Sample Depth (Feet bgs)	4.5-5
TPH GRO (mg/kg)	<0.29
THP DRO (mg/kg)	<0.29

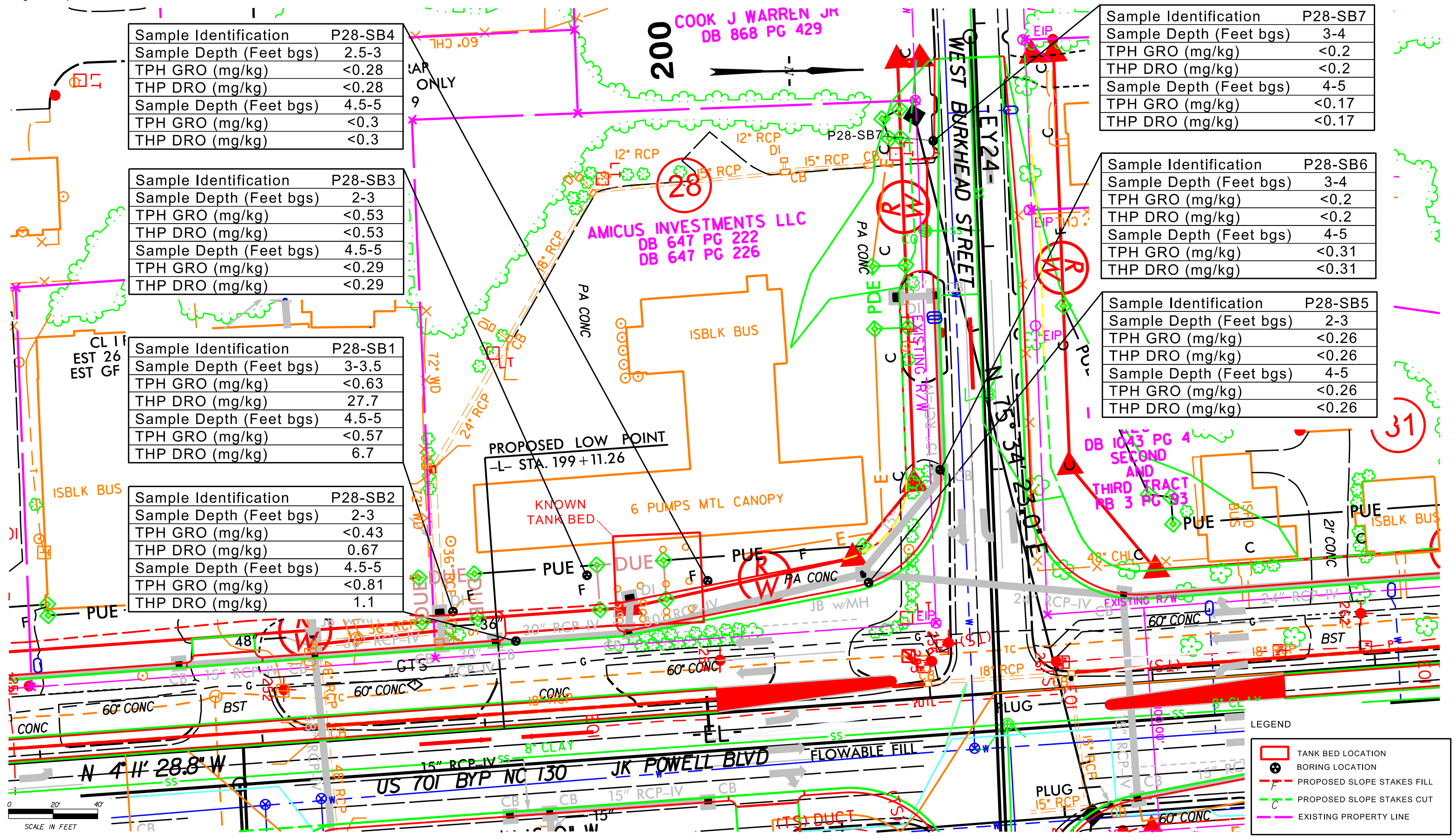
Sample Identification	P28-SB1
Sample Depth (Feet bgs)	3-3.5
TPH GRO (mg/kg)	<0.63
THP DRO (mg/kg)	27.7
Sample Depth (Feet bgs)	4.5-5
TPH GRO (mg/kg)	<0.57
THP DRO (mg/kg)	6.7

Sample Identification	P28-SB2
Sample Depth (Feet bgs)	2-3
TPH GRO (mg/kg)	<0.43
THP DRO (mg/kg)	0.67
Sample Depth (Feet bgs)	4.5-5
TPH GRO (mg/kg)	<0.81
THP DRO (mg/kg)	1.1

Sample Identification	P28-SB7
Sample Depth (Feet bgs)	3-4
TPH GRO (mg/kg)	<0.2
THP DRO (mg/kg)	<0.2
Sample Depth (Feet bgs)	4-5
TPH GRO (mg/kg)	<0.17
THP DRO (mg/kg)	<0.17

Sample Identification	P28-SB6
Sample Depth (Feet bgs)	3-4
TPH GRO (mg/kg)	<0.2
THP DRO (mg/kg)	<0.2
Sample Depth (Feet bgs)	4-5
TPH GRO (mg/kg)	<0.31
THP DRO (mg/kg)	<0.31

Sample Identification	P28-SB5
Sample Depth (Feet bgs)	2-3
TPH GRO (mg/kg)	<0.26
THP DRO (mg/kg)	<0.26
Sample Depth (Feet bgs)	4-5
TPH GRO (mg/kg)	<0.26
THP DRO (mg/kg)	<0.26



LEGEND

- TANK BED LOCATION
- ⊙ BORING LOCATION
- F PROPOSED SLOPE STAKES FILL
- C PROPOSED SLOPE STAKES CUT
- EXISTING PROPERTY LINE



FIGURE 3
PARCEL 028
207 N. JK. POWELL BLVD
ONSITE UVF HYDROCARBON ANALYSIS RESULTS - SOIL
 6/6/18

Date:	7/3/18	R-5020B US 701 BYPASS COLUMBUS COUNTY					
Proj. #	NCDOT-001						
pc_028_fig 3.dgn		Project Title:					
CAD File:		Approx. Scale:	1" = 40'	Drawn by:	MJO	Client:	NC DOT

APPENDIX A
PHOTOGRAPH LOG



Photo 1

Overview of site prior to preliminary site assessment activities as seen from JK Powell Blvd.



Photo 2

View of mobile lab equipment used to analyze soil samples.

10610 Metromont Pkwy
Suite 206
Charlotte, NC 28269



WBS 41499.1.3
PROCESSED TLH
DATE June 2018

PHOTOGRAPHIC LOG
PSA Field Activities
Parcel 28
Amicus Investments LLC Property
Whiteville, NC



Photo 3

Photo of CSI breaking through the concrete so they can hand clear for utilities.



Photo 4

Photo of CSI personnel hand auger a boring location adjacent to the UST tank basin

10610 Metromont Pkwy
Suite 206
Charlotte, NC 28269



WBS	41499.1.3
PROCESSED	TLH
DATE	June 2018

PHOTOGRAPHIC LOG
PSA Field Activities
Parcel 28
Amicus Investments LLC Property
Whiteville, NC

APPENDIX B
BORING LOGS



Apex Companies, LLC

Boring Log

Boring/Well No.: P28-SB1	Site Name: Parcel 28
Date: 6/6/18	Location: Whiteville, Columbus County, NC
Job No.: NCDOT-001	Sample Method: Hand Auger and Direct Push
Apex Rep: Thomas Fisher	Drilling Method: Hand Auger and Direct Push
Drilling Company: Carolina Soil Investigations	Driller Name/Cert #: Danny Summers/2579

Remarks:

Depth BLS)	(ft)	FID Reading (ppm)	PID Reading (ppm)	Lab Sample ID	Soil/Lithologic Description
1		1	2		0-4' Grass-Brown silty SAND , loose.
2					
3		1	2		
4		2	3		
5		3	3		4'-5' Light brown silty SAND , saturated.
6					Boring terminated at 5 feet.
7					
8					
9					
10					
11					
12					
13					
14					

WELL CONSTRUCTION DETAILS (If Applicable)

Well Type/Diameter:	Outer Casing Interval:
Total Depth:	Outer Casing Diameter:
Screen Interval:	Bentonite Interval:
Sand Interval:	Slot Size:
Grout Interval:	Static Water Level:



Apex Companies, LLC

Boring Log

Boring/Well No.: P28-SB2	Site Name: Parcel 28
Date: 6/6/18	Location: Whiteville, Columbus County, NC
Job No.: NCDOT-001	Sample Method: Hand Auger and Direct Push
Apex Rep: Thomas Fisher	Drilling Method: Hand Auger and Direct Push
Drilling Company: Carolina Soil Investigations	Driller Name/Cert #: Danny Summers/2579

Remarks:

Depth BLS)	(ft)	FID Reading (ppm)	PID Reading (ppm)	Lab Sample ID	Soil/Lithologic Description
					0-3' Concrete-Light brown SAND .
1		105	7		
2					
		126	7		3'-5' Light brown sandy CLAY , saturated at 4'.
3					
4		24	5		
		10	4		Boring terminated at 5 feet.
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

WELL CONSTRUCTION DETAILS (If Applicable)

Well Type/Diameter:	Outer Casing Interval:
Total Depth:	Outer Casing Diameter:
Screen Interval:	Bentonite Interval:
Sand Interval:	Slot Size:
Grout Interval:	Static Water Level:



Apex Companies, LLC

Boring Log

Boring/Well No.: P28-SB3	Site Name: Parcel 28
Date: 6/6/18	Location: Whiteville, Columbus County, NC
Job No.: NCDOT-001	Sample Method: Hand Auger and Direct Push
Apex Rep: Thomas Fisher	Drilling Method: Hand Auger and Direct Push
Drilling Company: Carolina Soil Investigations	Driller Name/Cert #: Danny Summers/2579

Remarks:

Depth BLS)	(ft)	FID Reading (ppm)	PID Reading (ppm)	Lab Sample ID	Soil/Lithologic Description
1		3	2		0-3' Concrete-Light brown SAND .
2					
3		5	3		
4		6	2		3'-5' Reddish gray fine sandy CLAY , very stiff, saturated at 4'.
5		5	2		
6					Boring terminated at 5 feet.
7					
8					
9					
10					
11					
12					
13					
14					

WELL CONSTRUCTION DETAILS (If Applicable)

Well Type/Diameter:	Outer Casing Interval:
Total Depth:	Outer Casing Diameter:
Screen Interval:	Bentonite Interval:
Sand Interval:	Slot Size:
Grout Interval:	Static Water Level:



Apex Companies, LLC

Boring Log

Boring/Well No.: P28-SB4	Site Name: Parcel 28
Date: 6/6/18	Location: Whiteville, Columbus County, NC
Job No.: NCDOT-001	Sample Method: Hand Auger and Direct Push
Apex Rep: Thomas Fisher	Drilling Method: Hand Auger and Direct Push
Drilling Company: Carolina Soil Investigations	Driller Name/Cert #: Danny Summers/2579

Remarks:

Depth (ft) BLS)	FID Reading (ppm)	PID Reading (ppm)	Lab Sample ID	Soil/Lithologic Description
1	0	0		0-1' Grass-Brown sandy SILT
2				1'-2.5' Tan silty SAND , loose
3	0	0		2.5'-3.5' Brownish orange clayey SILT , slightly plastic, stiff.
4	0	0		3.5'-5' Reddish orange and gray CLAY , plastic, stiff.
5	0	0		
				Boring terminated at 5 feet.
6				
7				
8				
9				
10				
11				
12				
13				
14				

WELL CONSTRUCTION DETAILS (If Applicable)

Well Type/Diameter:	Outer Casing Interval:
Total Depth:	Outer Casing Diameter:
Screen Interval:	Bentonite Interval:
Sand Interval:	Slot Size:
Grout Interval:	Static Water Level:



Apex Companies, LLC

Boring Log

Boring/Well No.: P28-SB4	Site Name: Parcel 28
Date: 6/6/18	Location: Whiteville, Columbus County, NC
Job No.: NCDOT-001	Sample Method: Hand Auger and Direct Push
Apex Rep: Thomas Fisher	Drilling Method: Hand Auger and Direct Push
Drilling Company: Carolina Soil Investigations	Driller Name/Cert #: Danny Summers/2579

Remarks:

Depth (ft) BLS)	FID Reading (ppm)	PID Reading (ppm)	Lab Sample ID	Soil/Lithologic Description
1	0	0		0-1' Grass-Tan silty SAND , loose.
2				1'-2.5' Tan silty SAND , loose.
3	0	0		2.5'-3.5' Brownish orange clayey SILT , slightly plastic, stiff.
4	0	0		3.5'-5' Reddish orange and gray CLAY , plastic, stiff, saturated at 4.5'.
5	0	0		Boring terminated at 5 feet.
6				
7				
8				
9				
10				
11				
12				
13				
14				

WELL CONSTRUCTION DETAILS (If Applicable)

Well Type/Diameter:	Outer Casing Interval:
Total Depth:	Outer Casing Diameter:
Screen Interval:	Bentonite Interval:
Sand Interval:	Slot Size:
Grout Interval:	Static Water Level:



Apex Companies, LLC

Boring Log

Boring/Well No.: P28-SB6	Site Name: Parcel 28
Date: 6/6/18	Location: Whiteville, Columbus County, NC
Job No.: NCDOT-001	Sample Method: Hand Auger and Direct Push
Apex Rep: Thomas Fisher	Drilling Method: Hand Auger and Direct Push
Drilling Company: Carolina Soil Investigations	Driller Name/Cert #: Danny Summers/2579

Remarks:

Depth BLS)	(ft)	FID Reading (ppm)	PID Reading (ppm)	Lab Sample ID	Soil/Lithologic Description
					0-2' Grass-Brownish orange clayey SAND .
1		0	0		
2					
					2'-5' Brownish orange CLAY , plastic, stiff, saturated at 4.5'
3		0	0		
4		0	0		
5		0	0		
					Boring terminated at 5 feet.
6					
7					
8					
9					
10					
11					
12					
13					
14					

WELL CONSTRUCTION DETAILS (If Applicable)

Well Type/Diameter:	Outer Casing Interval:
Total Depth:	Outer Casing Diameter:
Screen Interval:	Bentonite Interval:
Sand Interval:	Slot Size:
Grout Interval:	Static Water Level:



Apex Companies, LLC

Boring Log

Boring/Well No.: P28-SB7	Site Name: Parcel 28
Date: 6/6/18	Location: Whiteville, Columbus County, NC
Job No.: NCDOT-001	Sample Method: Hand Auger and Direct Push
Apex Rep: Thomas Fisher	Drilling Method: Hand Auger and Direct Push
Drilling Company: Carolina Soil Investigations	Driller Name/Cert #: Danny Summers/2579

Remarks:

Depth BLS)	(ft)	FID Reading (ppm)	PID Reading (ppm)	Lab Sample ID	Soil/Lithologic Description
1		0	0		0-0.5' Grass-Dark brown silty SAND , loose. 0.5'-2.5' Tan silty SAND , loose.
2					
3		0	0		2.5'-5' Reddish orange and gray sandy CLAY , plastic, stiff.
4		0	0		
5		0	0		
6					Boring terminated at 5 feet.
7					
8					
9					
10					
11					
12					
13					
14					

WELL CONSTRUCTION DETAILS (If Applicable)

Well Type/Diameter:	Outer Casing Interval:
Total Depth:	Outer Casing Diameter:
Screen Interval:	Bentonite Interval:
Sand Interval:	Slot Size:
Grout Interval:	Static Water Level:

APPENDIX C
GEOPHYSICAL REPORT



PYRAMID GEOPHYSICAL SERVICES
(PROJECT 2018-139)

GEOPHYSICAL SURVEY

METALLIC UST INVESTIGATION:
PARCEL 28
NCDOT PROJECT R-5020B (41499.1.3)

207 N. JK POWELL BLVD., WHITEVILLE, NC

JUNE 20, 2018

Report prepared for: Katie Lippard
Apex Companies, LLC
1071 Pemberton Hill Rd., Suite 203
Apex, NC 27502

Prepared by: _____

A handwritten signature in black ink, appearing to read "E. Cross".

Eric C. Cross, P.G.
NC License #2181

Reviewed by: _____

A handwritten signature in black ink, appearing to read "Doug Canavello".

Douglas A. Canavello, P.G.
NC License #1066

503 INDUSTRIAL AVENUE, GREENSBORO, NC 27406

P: 336.335.3174 F: 336.691.0648

C257: GEOLOGY C1251: ENGINEERING

GEOPHYSICAL INVESTIGATION REPORT
Parcel 28 – 207 N. JK Powell Blvd.
Whiteville, Columbus County, North Carolina

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- Figure 2 – Parcel 28 EM61 Results Contour Map
- Figure 3 – Parcel 28 GPR Transect Locations and Select Images
- Figure 4 – Parcel 28 Location and Area of Four Known USTs
- Figure 5 – Overlay of Geophysical Survey Boundaries and Four Known USTs on NCDOT Engineering Plans

Appendices

- Appendix A – GPR Transect Images

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
UST	Underground Storage Tank

EXECUTIVE SUMMARY

Project Description: Pyramid Environmental conducted a geophysical investigation for Apex Companies, LLC at Parcel 28, located at 207 N. JK Powell Blvd., in Whiteville, NC. The survey was part of an NCDOT Right-of-Way (ROW) investigation (NCDOT Project R-5020B). The survey was designed to extend from the existing edge of pavement into the proposed ROW and/or easements, whichever distance was greater. Conducted from May 30 – June 1, 2018, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

Geophysical Results: The site was an active service station with a known UST pit located within the survey area, suspected to contain four known USTs. The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. A total of four EM anomalies were identified. The majority of the EM anomalies were directly attributed to visible cultural features at the ground surface. Extensive GPR was performed across areas suspected to contain reinforced concrete as well as the known USTs. GPR recorded four distinct hyperbolic reflectors and four isolated lateral reflectors that are characteristic of USTs. These features were recorded over the four known, active USTs. The USTs are in an area that is 45 feet long and 39 feet wide. The GPR transects verified the presence of metal reinforcement in the concrete and the presence of possible utilities. No evidence of unknown, metallic underground storage tanks (USTs) was found beneath the reinforcement outside of the known UST pit. Collectively, the geophysical data recorded evidence of four known metallic USTs at Parcel 28. No evidence of unknown USTs was recorded.

INTRODUCTION

Pyramid Environmental conducted a geophysical investigation for Apex Companies, LLC at Parcel 28, located at 207 N. JK Powell Blvd., in Whiteville, NC. The survey was part of an NCDOT Right-of-Way (ROW) investigation (NCDOT Project R-5020B). The survey was designed to extend from the existing edge of pavement into the proposed ROW and/or easements, whichever distance was greater. Conducted from May 30 – June 1, 2018, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

The site included an active gas station surrounded by concrete surfaces and grass medians. The UST pit containing the active tanks supplying fuel to the pumps at the service station was located within the survey area, east of the pump island. Field observations of fill ports suggested that four known USTs were located within the UST pit. An aerial photograph 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 is 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 15.0 software programs.

GPR data were acquired across select EM anomalies on June 1, 2018, using a Geophysical Survey Systems, Inc. (GSSI) UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. Data were collected both in reconnaissance fashion 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 6 feet, based on dielectric constants calculated by the DF unit in the field during the reconnaissance scans. GPR transects across specific anomalies 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 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 in 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	Sign/Utility	
2	Reinforced Concrete	☑
3	Known UST Pit	☑
4	Sign	

Two of the EM anomalies were directly attributed to visible cultural features at the ground surface, including signs, a utility and a known UST pit. The majority of the site was covered by apparent reinforced concrete. Additionally, the known USTs supplying fuel to the station were located within the survey area, east of the pump island. Extensive GPR scans were performed in a grid-like fashion across the suspected reinforced concrete to verify the presence of metal reinforcement and confirm that no other metal structures were present beneath the reinforcement. GPR was also performed across the known UST pit to verify the number and orientation of the known USTs.

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 forty-five GPR transects were performed at the site across the reinforced concrete and the known USTs. All of the transect images are included in **Appendix A**. GPR Transects 22-26 and 37-39 recorded four discreet hyperbolic reflectors and four isolated high-amplitude lateral reflectors, respectively, that are characteristic of metallic USTs. These reflectors were recorded over the four known, active USTs. The four tanks are located in an area that is 45 feet long and 39 feet wide. **Figure 4** provides the location and area of the known metallic USTs overlain on an aerial.

The GPR transects verified the presence of metal reinforcement in the concrete and the presence of possible utilities. No evidence of unknown, metallic underground storage tanks (USTs) was found beneath the reinforcement outside of the known UST pit.

Collectively, the geophysical data recorded evidence of four known metallic USTs at Parcel 28. No evidence of unknown USTs was recorded. **Figure 5** provides an overlay of the geophysical survey area and the locations of the known USTs onto the NCDOT MicroStation engineering plans for reference.

SUMMARY & CONCLUSIONS

Pyramid's evaluation of the EM61 and GPR data collected at Parcel 28 in Whiteville, 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.
- The site was an active service station with a known UST pit located within the survey area, suspected to contain four known USTs.
- The majority of the EM anomalies were directly attributed to visible cultural features at the ground surface.
- Extensive GPR was performed across areas suspected to contain reinforced concrete as well as the known USTs.
- GPR recorded four distinct hyperbolic reflectors and four isolated lateral reflectors that are characteristic of USTs. These features were recorded over the four known, active USTs.
- The USTs are in an area that is 45 feet long and 39 feet wide.
- The GPR transects verified the presence of metal reinforcement in the concrete and the presence of possible utilities. No evidence of unknown, metallic underground storage tanks (USTs) was found beneath the reinforcement.
- Collectively, the geophysical data recorded evidence of four known metallic USTs at Parcel 28. No evidence of unknown USTs was recorded.

LIMITATIONS

Geophysical surveys have been performed and this report was prepared for Apex Companies, LLC 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 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.

APPROXIMATE BOUNDARIES OF GEOPHYSICAL SURVEY AREA



View of Survey Area
(Facing Approximately West)



View of Survey Area
(Facing Approximately South)



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PROJECT
PARCEL 28
WHITEVILLE, NORTH CAROLINA
NCDOT PROJECT R-5020B

TITLE
PARCEL 28 - GEOPHYSICAL SURVEY
BOUNDARIES AND SITE PHOTOGRAPHS

DATE
5/30/2018

PYRAMID PROJECT #:
2018-139

CLIENT
Apex Companies, LLC

FIGURE 1

EM61 METAL DETECTION RESULTS



EVIDENCE OF FOUR KNOWN METALLIC USTs OBSERVED.

The contour plot shows the differential results of the EM61 instrument in millivolts (mV). The differential results focus on larger metallic objects such as USTs and drums. The EM61 data were collected on May 30, 2018, using a Geonics EM61 instrument. Verification GPR data were collected using a GSSI UtilityScan DF instrument with a dual frequency 300/800 MHz antenna on June 1, 2018.

EM61 Metal Detection Response (millivolts)



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PROJECT
PARCEL 28
WHITEVILLE, NORTH CAROLINA
NCDOT PROJECT R-5020B

TITLE
**PARCEL 28 - EM61 METAL DETECTION
CONTOUR MAP**

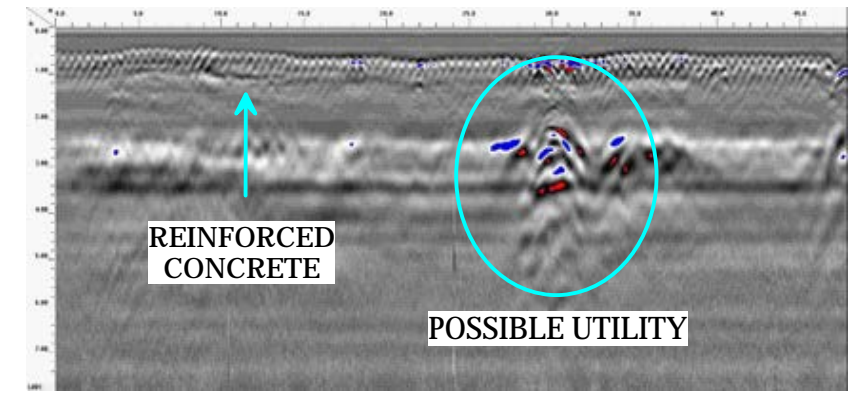
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PYRAMID PROJECT #:
2018-139

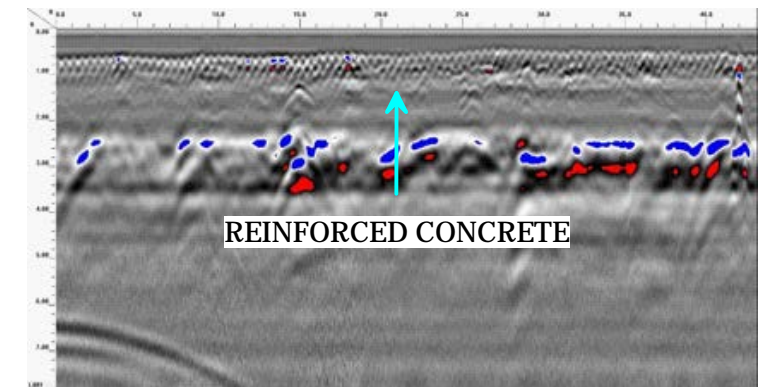
CLIENT
Apex Companies, LLC

FIGURE 2

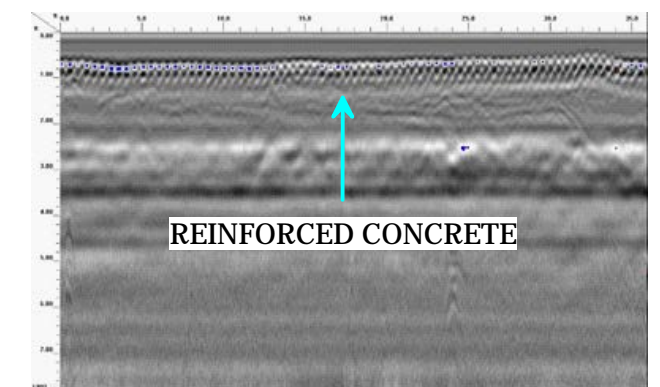
LOCATIONS OF GPR TRANSECTS



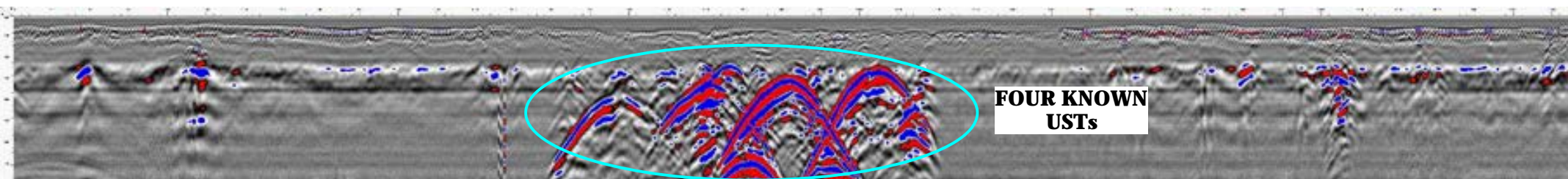
GPR TRANSECT 1 (T1)



GPR TRANSECT 9 (T9)



GPR TRANSECT 30 (T30)



GPR TRANSECT 25 (T25)



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PROJECT
PARCEL 28
WHITEVILLE, NORTH CAROLINA
NCDOT PROJECT R-5020B

TITLE
**PARCEL 28 - GPR TRANSECT LOCATIONS
AND SELECT IMAGES**

DATE
6/1/2018
PYRAMID PROJECT #:
2018-139

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FIGURE 3

LOCATION OF FOUR KNOWN USTs



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PROJECT
PARCEL 28
WHITEVILLE, NORTH CAROLINA
NCDOT PROJECT R-5020B

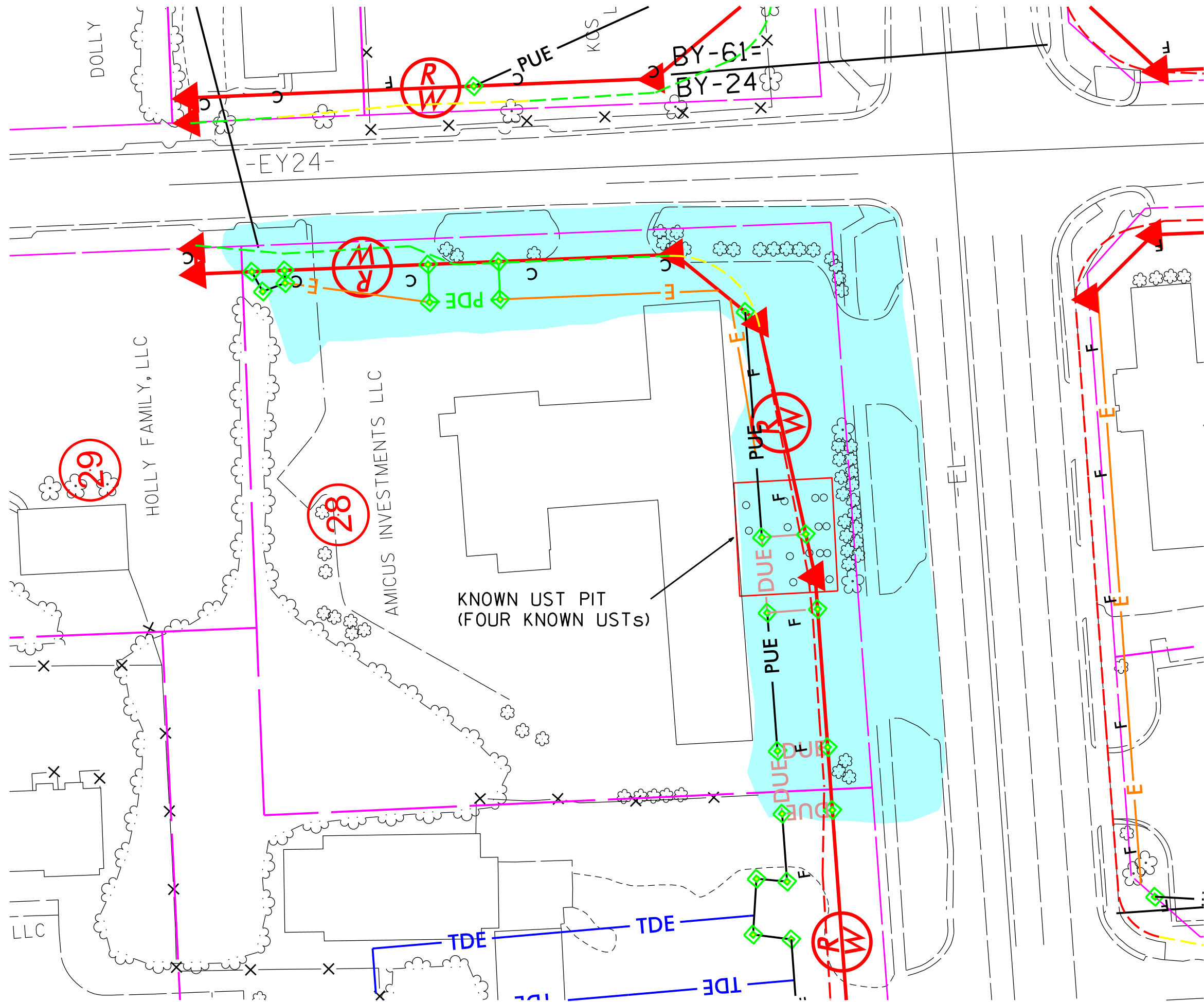
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DATE
 6/1/2018

PYRAMID PROJECT #:
 2018-139

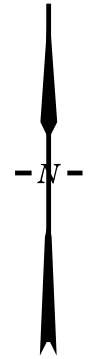
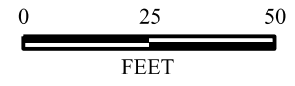
CLIENT
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FIGURE 4



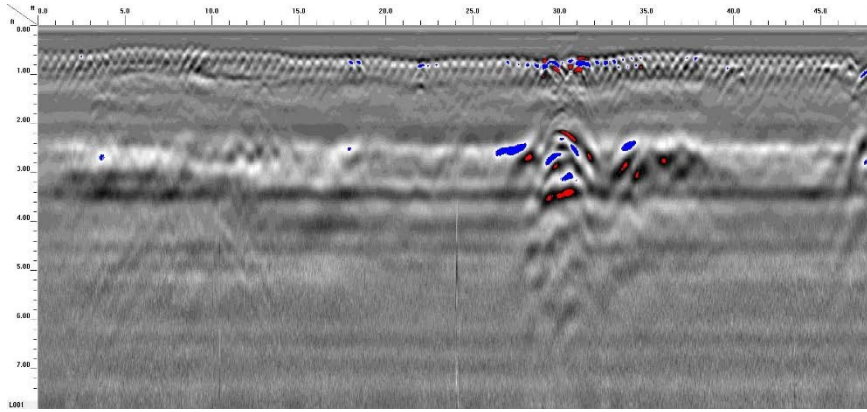
LEGEND

- EXISTING ROW
- EXISTING PROPERTY BOUNDARY
- PROPOSED ROW LINE
- TEMPORARY CONSTRUCTION EASEMENT
- PDE — PROPOSED PERMANENT DRAINAGE
- PUE — PROPOSED PERMANENT UTILITY
- - - PROPOSED SS CUT LINE
- - - PROPOSED SS FILL LINE
- GEOPHYSICAL SURVEY AREA
- KNOWN METALLIC UST

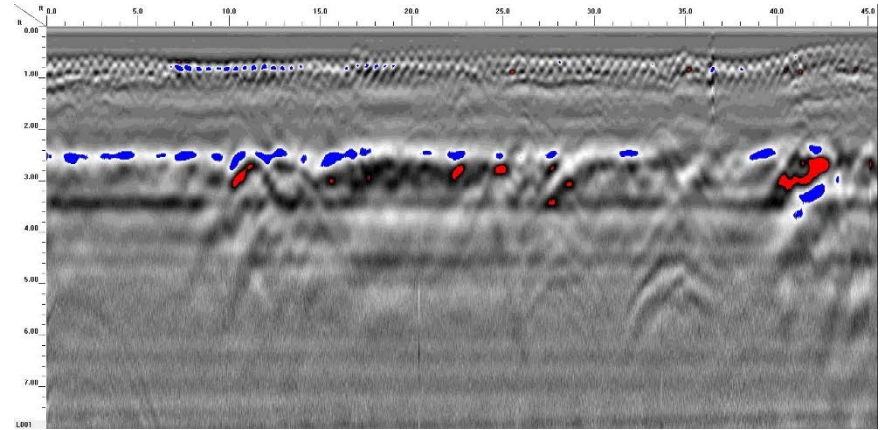


TITLE OVERLAY OF GEOPHYSICAL SURVEY BOUNDARIES AND FOUR KNOWN USTs ON NCDOT ENGINEERING PLANS	
PROJECT PARCEL 28 WHITEVILLE, NORTH CAROLINA NCDOT PROJECT W-5020B	
	503 INDUSTRIAL AVENUE GREENSBORO, NC 27406 336.335.3174 (p) 336.691.0648 (f) License # C1251 Eng. / #C257 Geology
DATE: 06-26-2018	REVISION NO. 0
PYRAMID PROJECT NO. 2018-139	FIGURE NO. 5

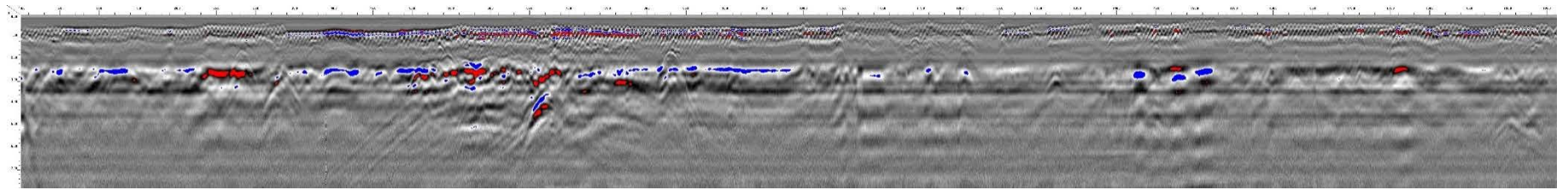
Appendix A – GPR Transect Images



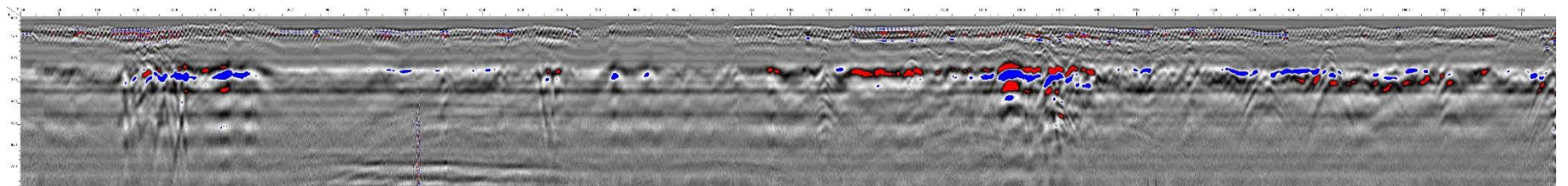
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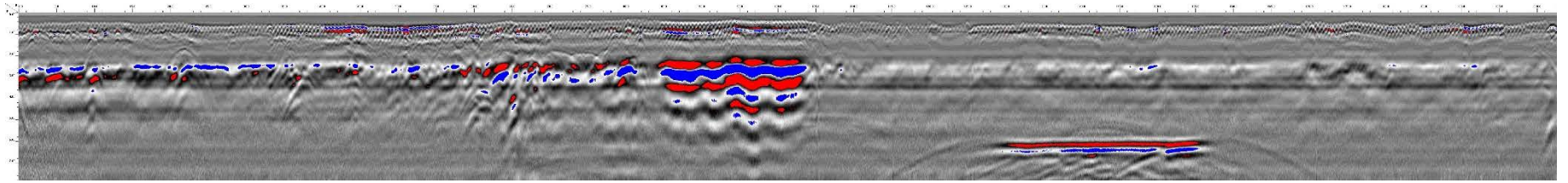
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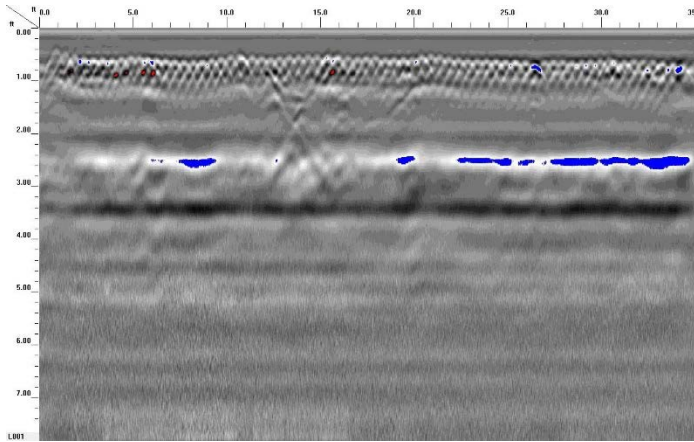
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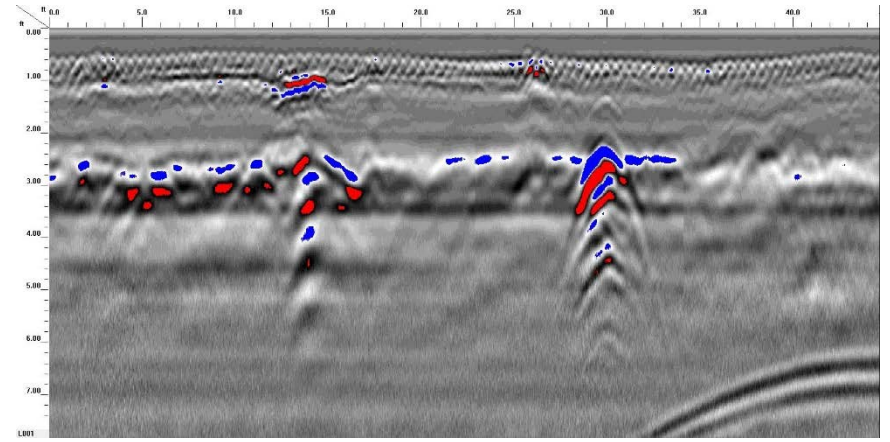
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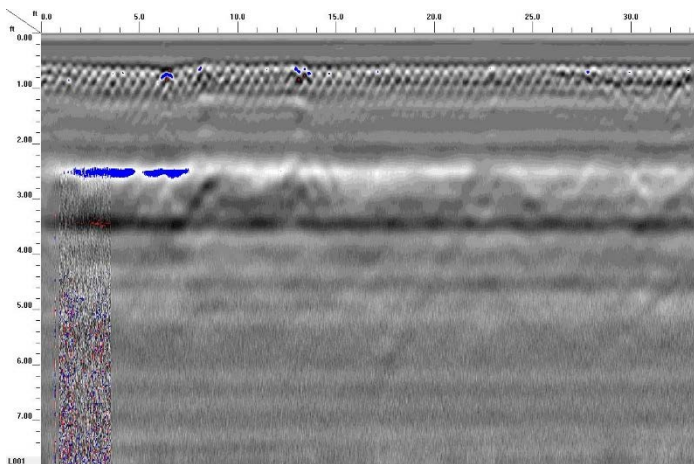
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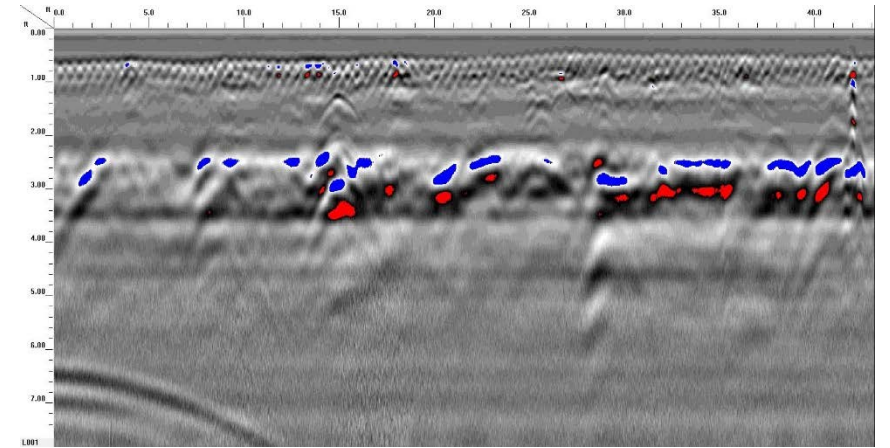
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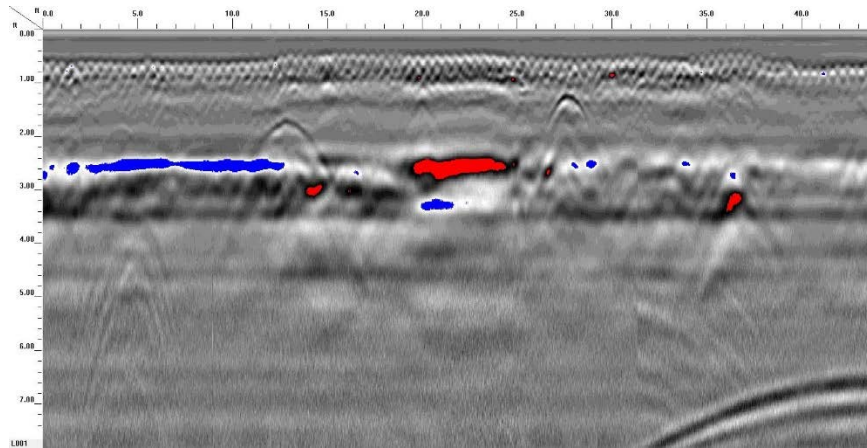
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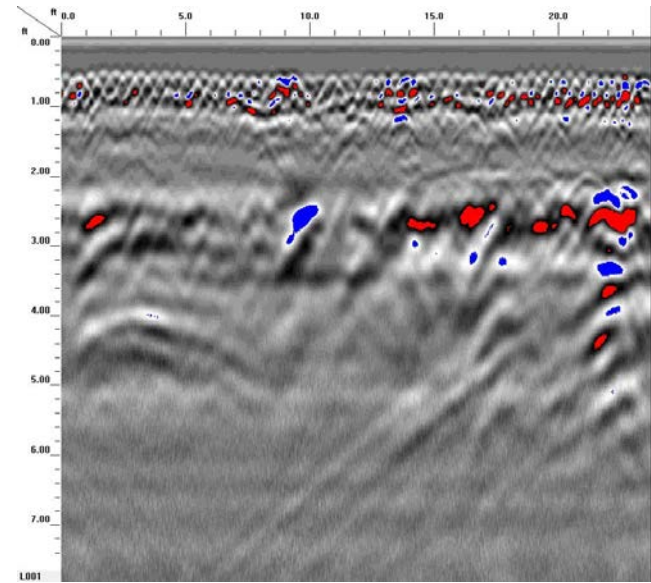
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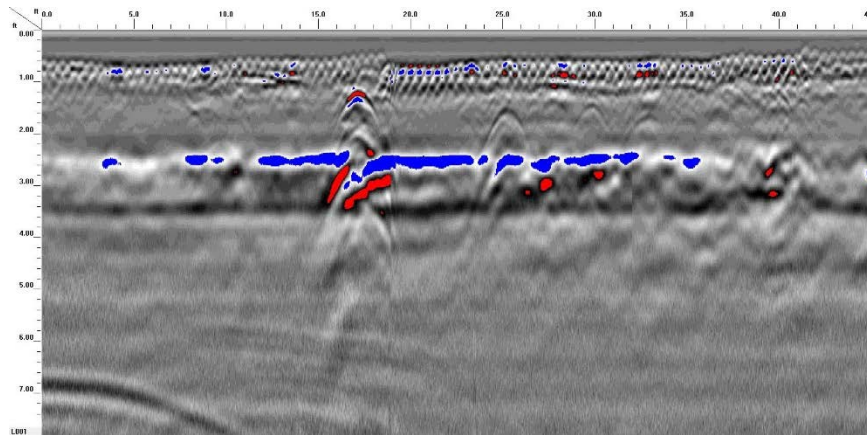
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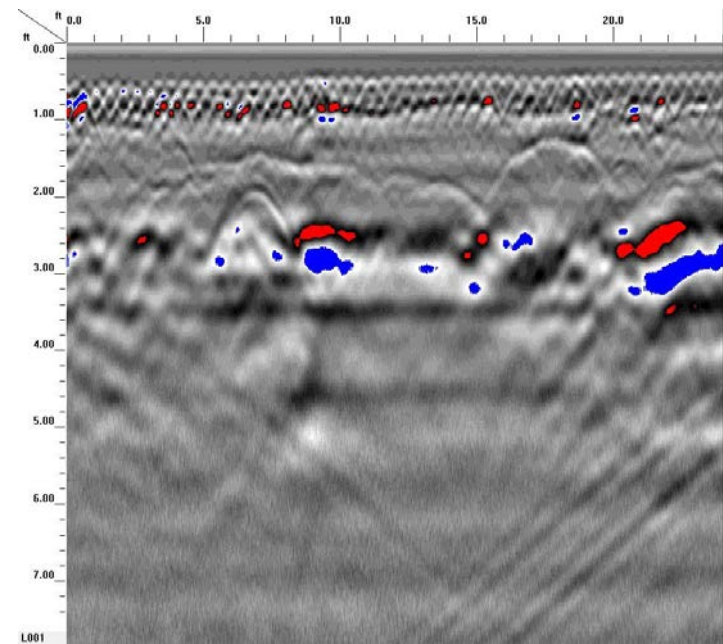
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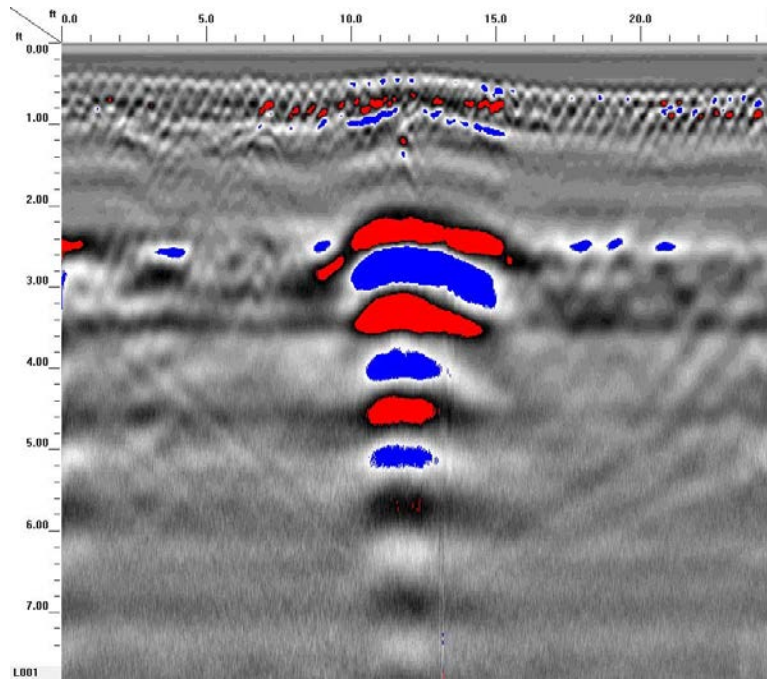
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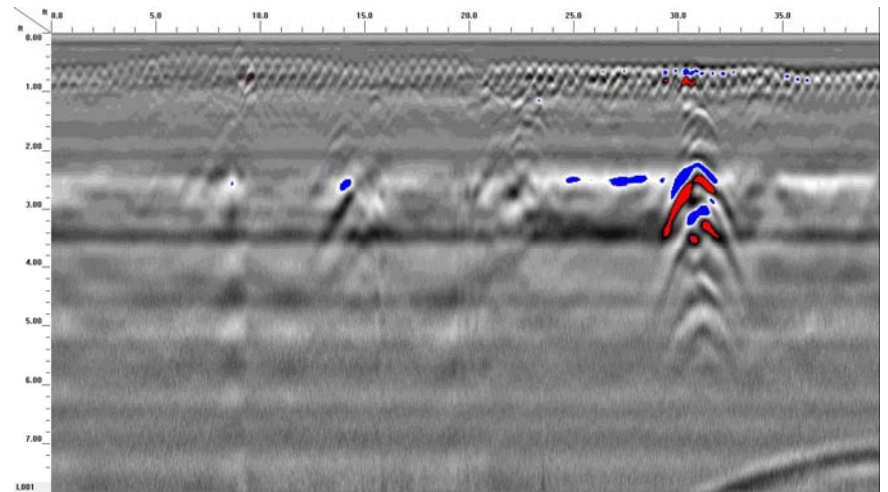
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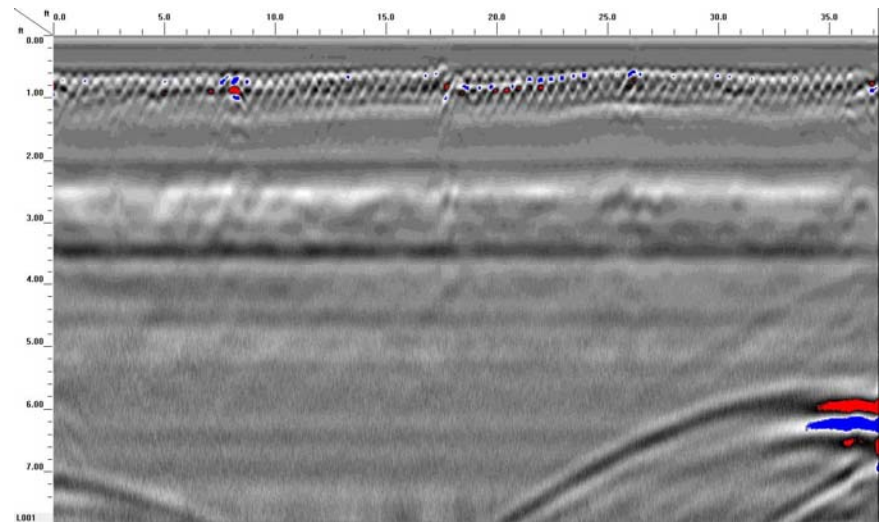
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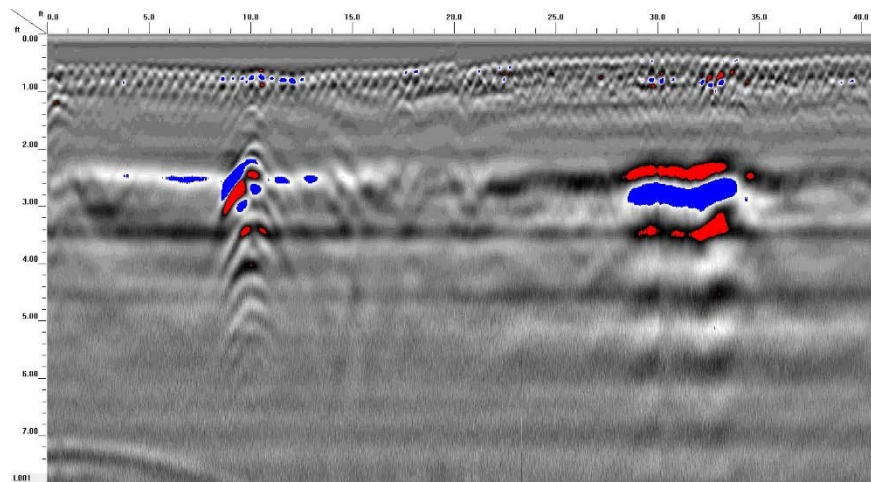
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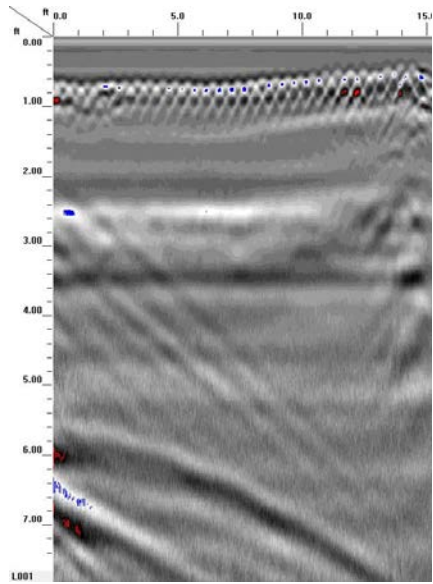
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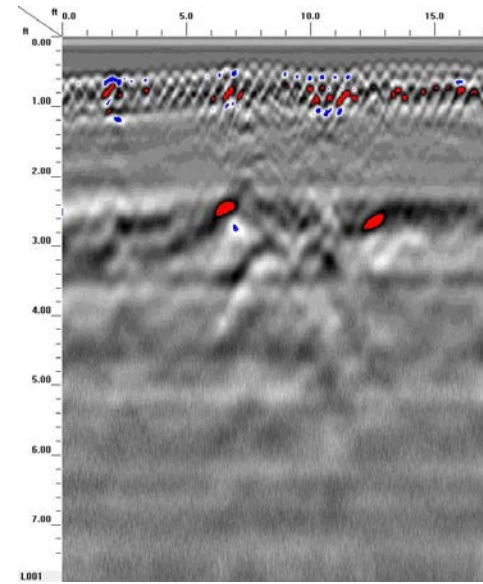
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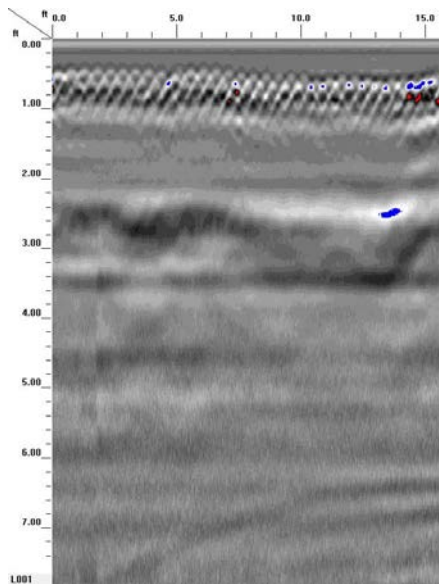
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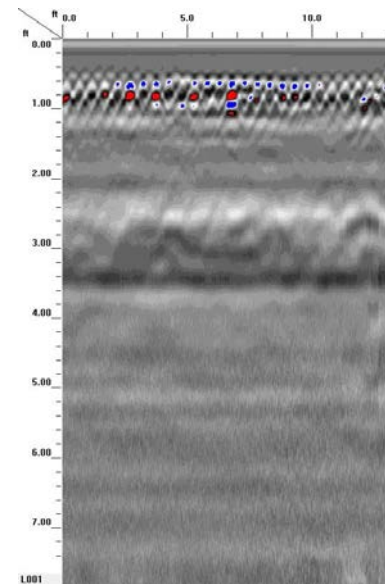
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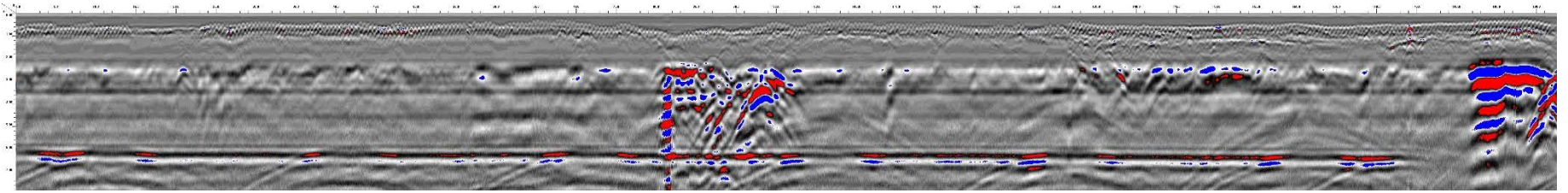
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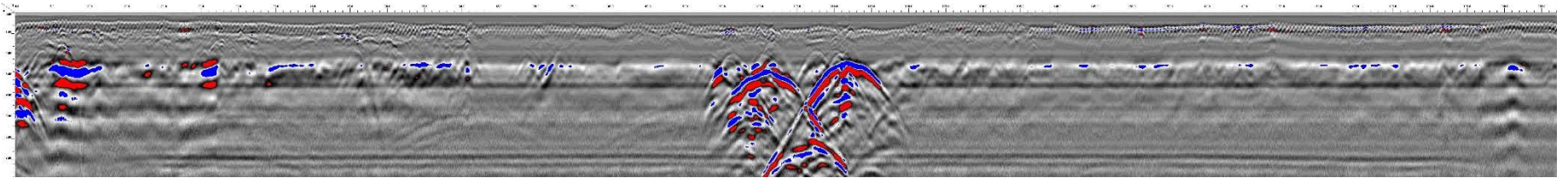
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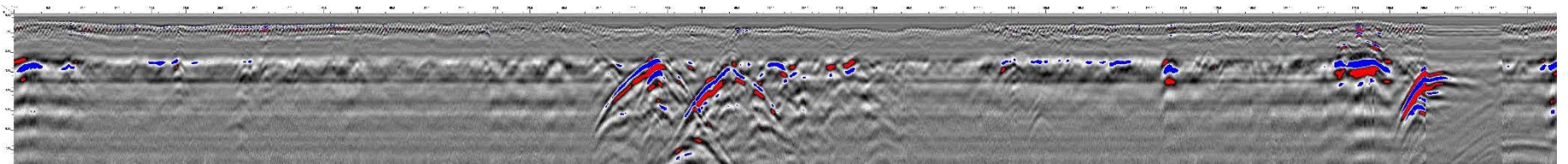
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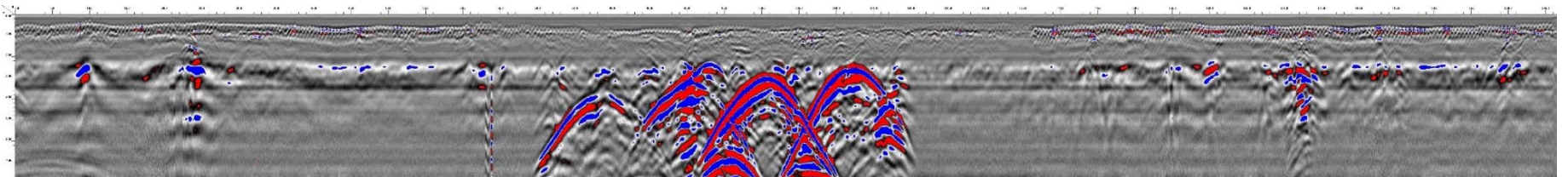
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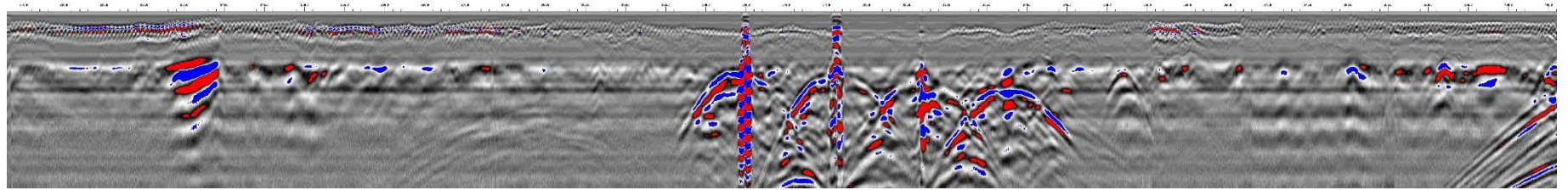
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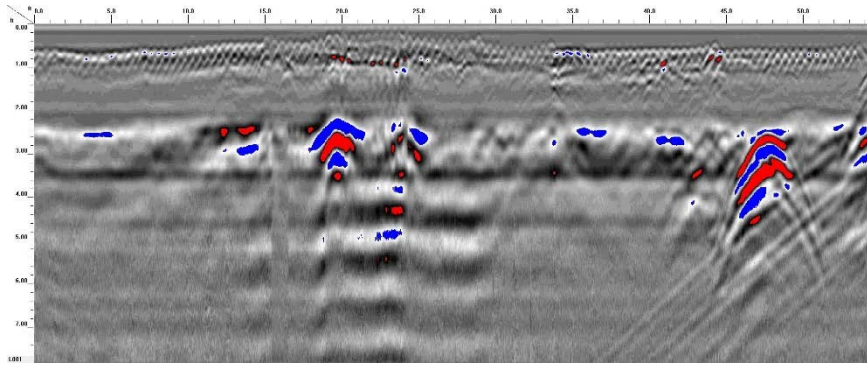
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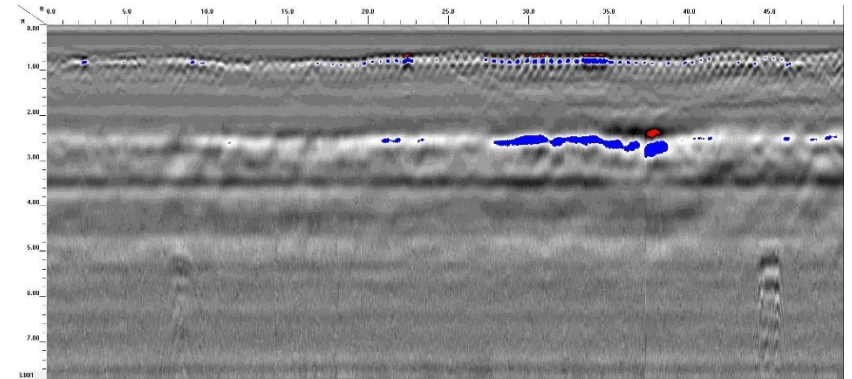
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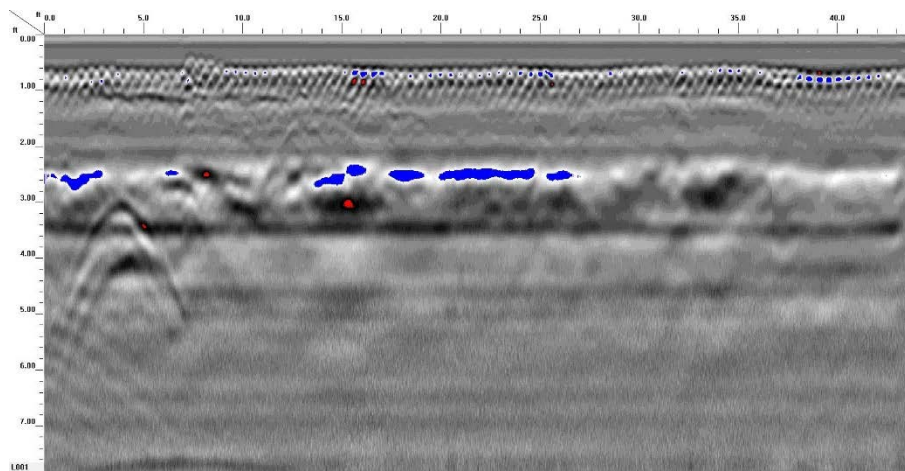
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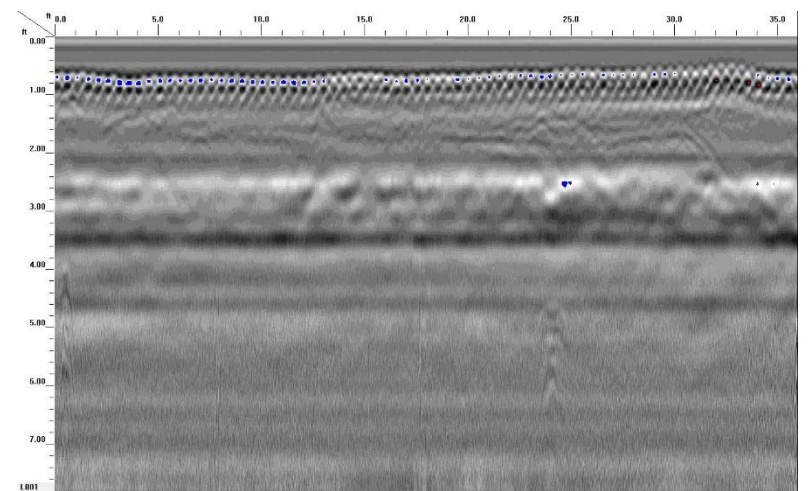
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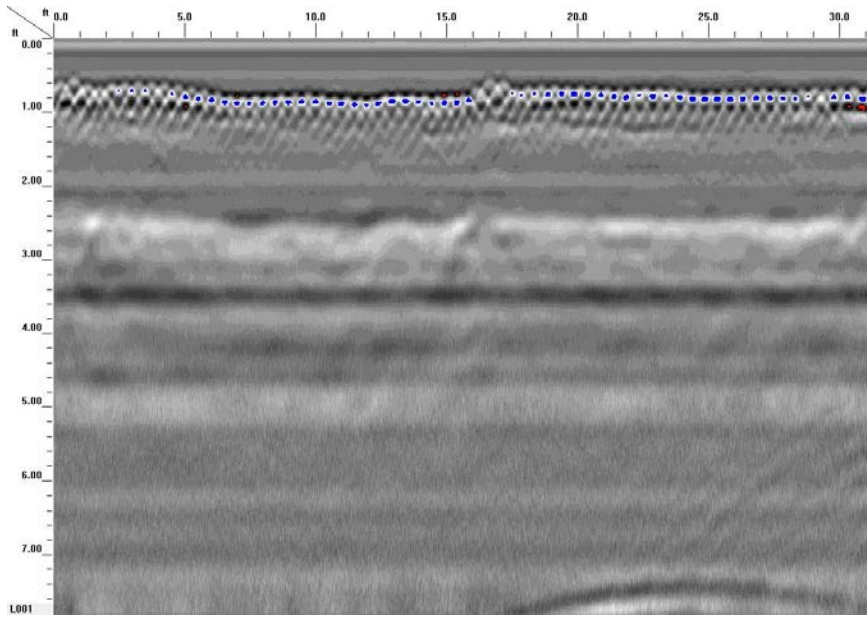
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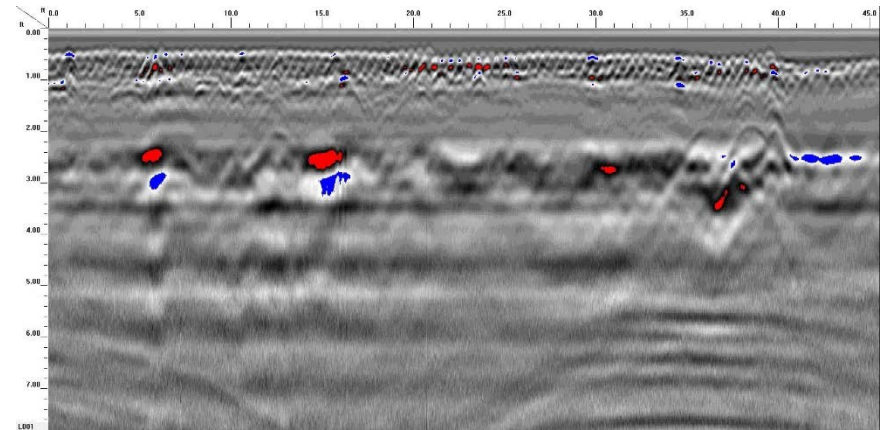
Transect 28



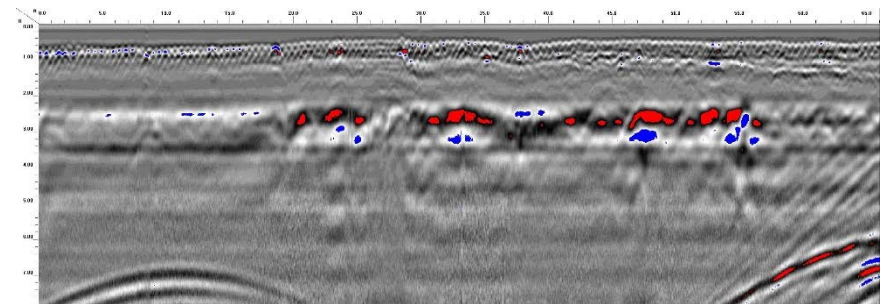
Transect 30



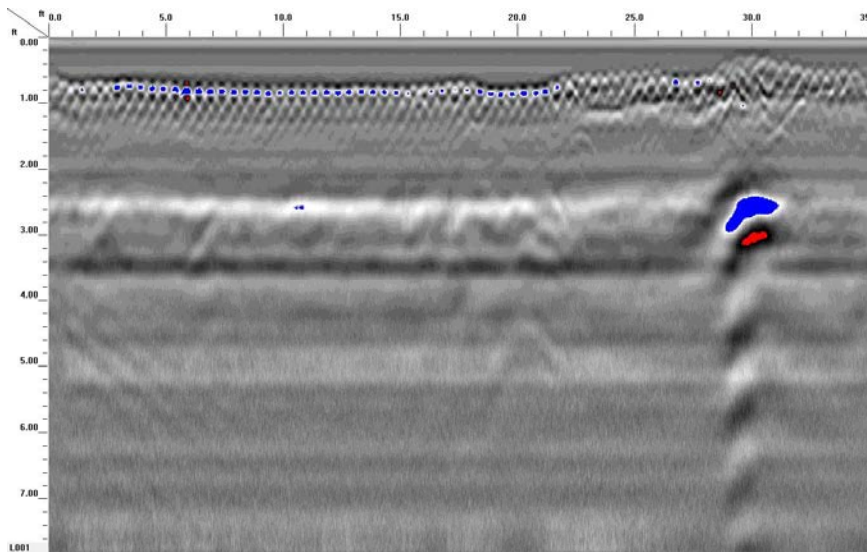
Transect 31



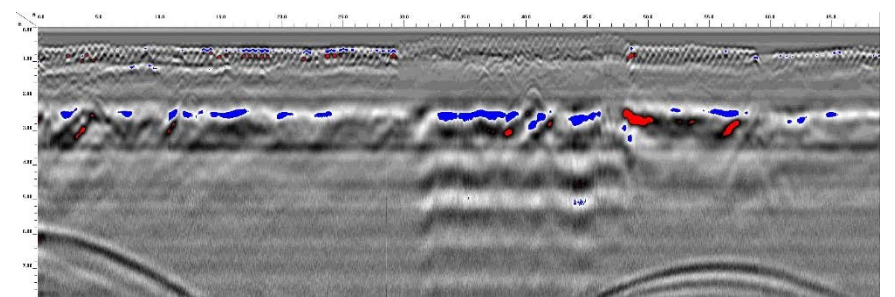
Transect 33



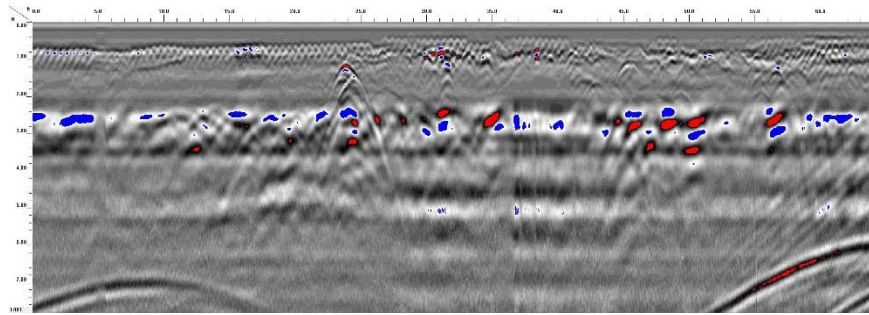
Transect 34



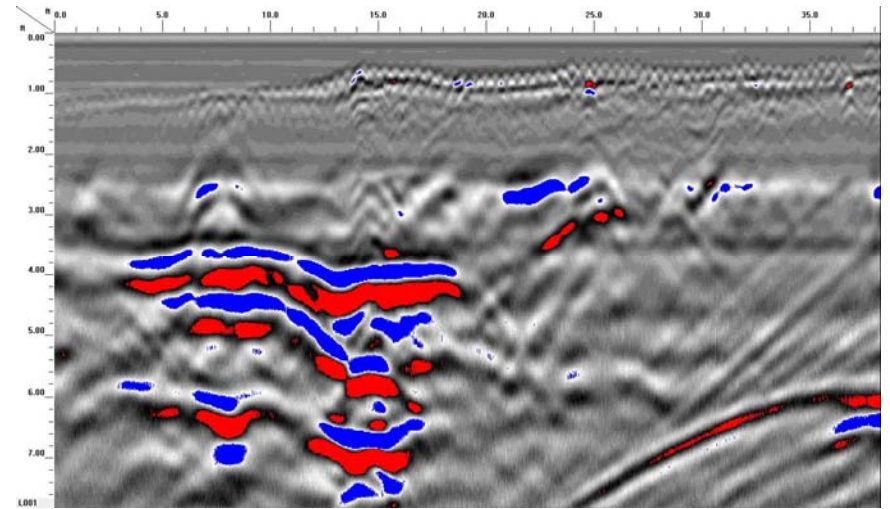
Transect 32



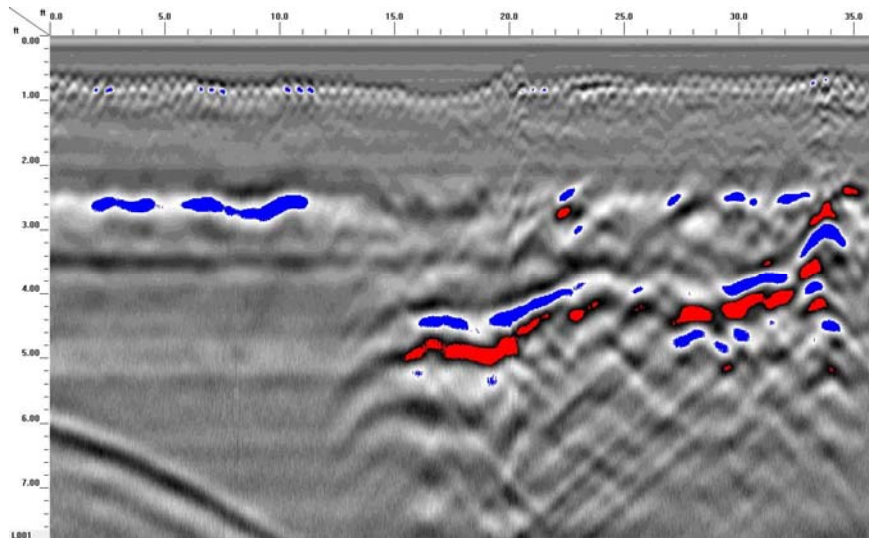
Transect 35



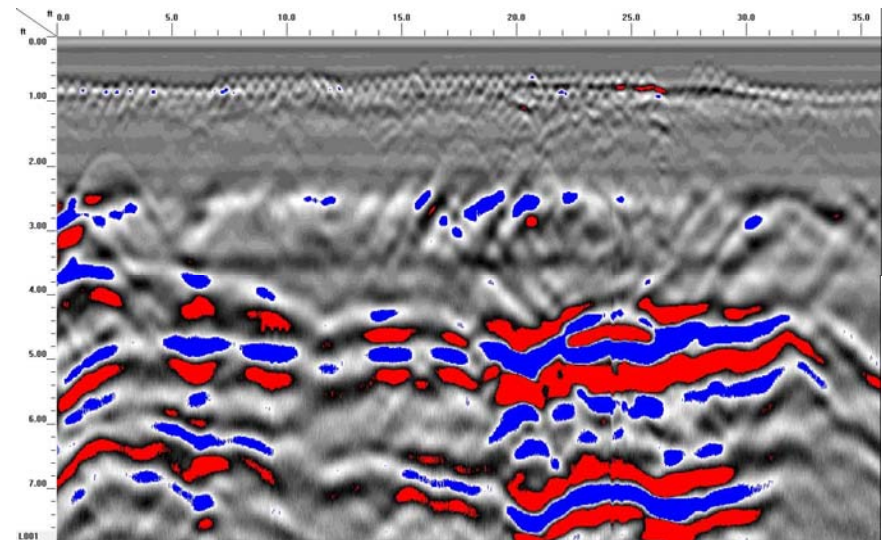
Transect 36



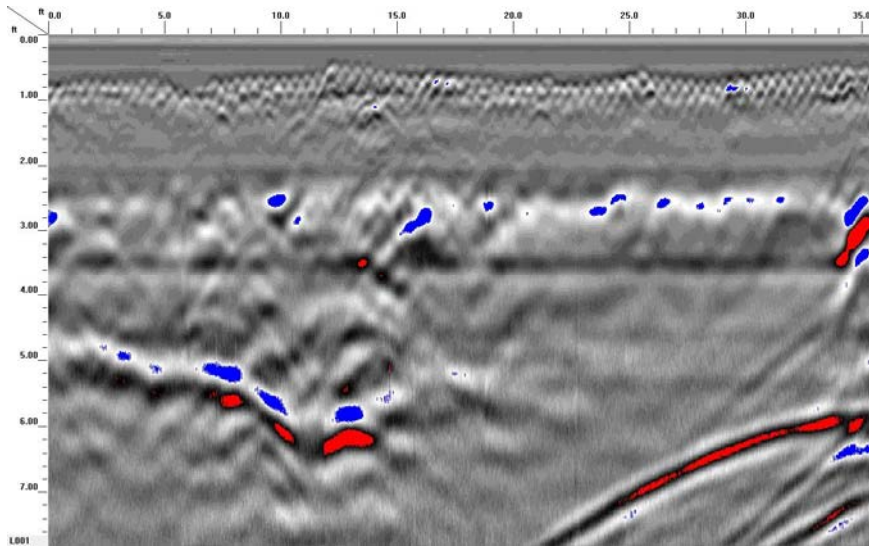
Transect 38



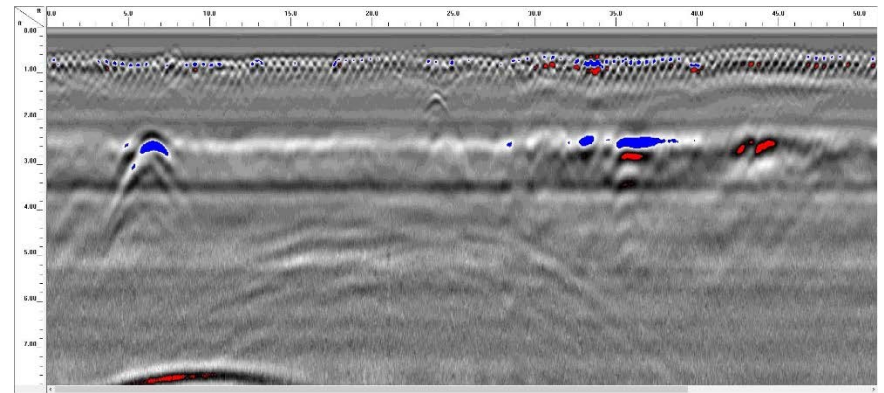
Transect 37



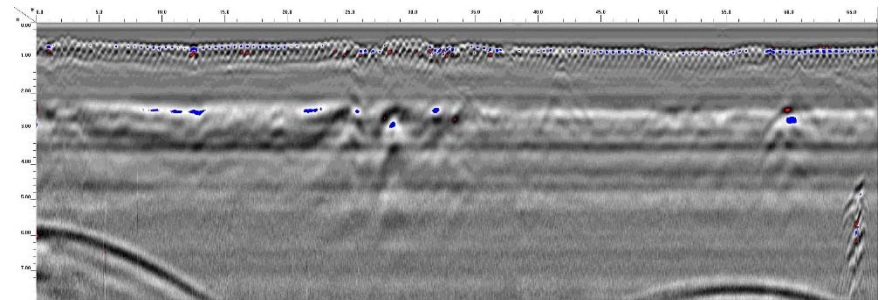
Transect 39



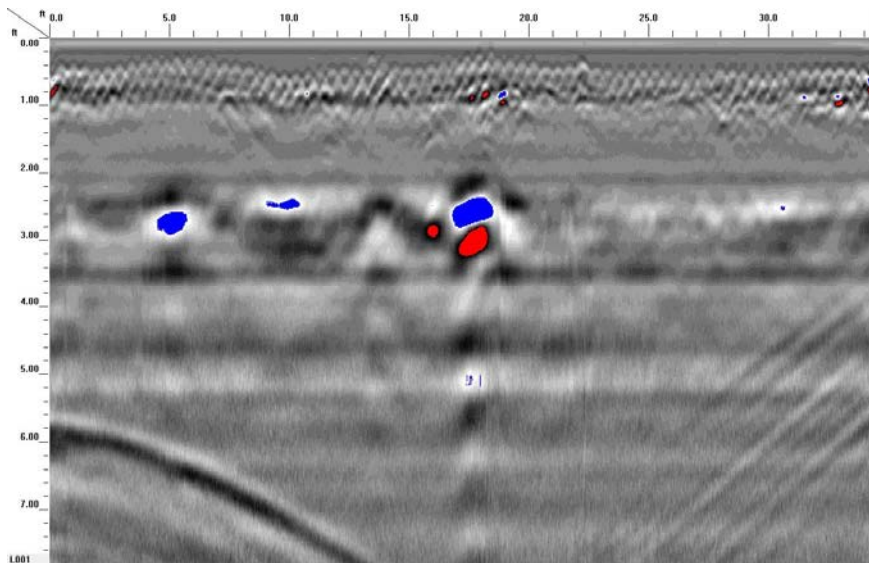
Transect 40



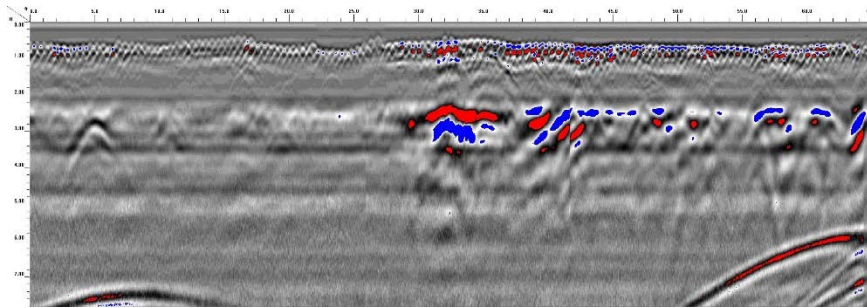
Transect 42



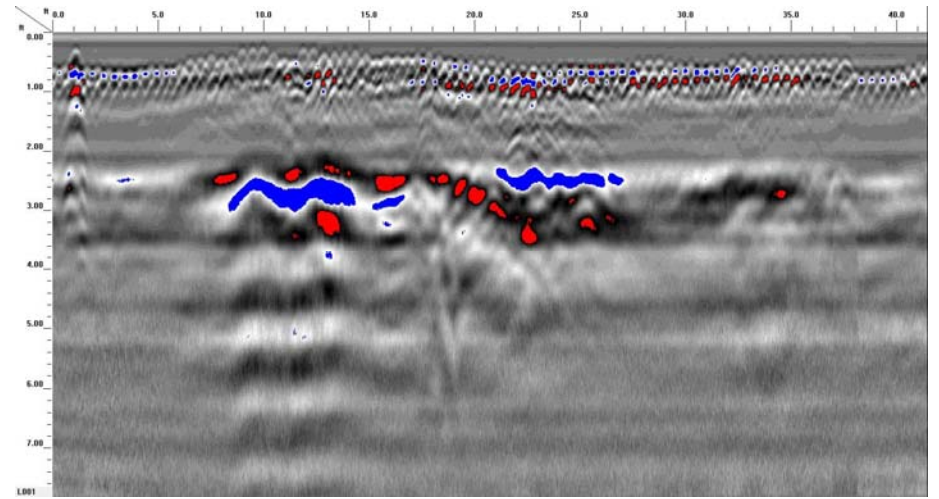
Transect 43



Transect 41



Transect 44



Transect 45

APPENDIX D
HYDROCARBON ANALYSIS RESULTS



Hydrocarbon Analysis Results

Client: NCDOT
Address: Parcel 28

Samples taken Wednesday, June 6, 2018
Samples extracted Wednesday, June 6, 2018
Samples analysed Wednesday, June 6, 2018

Contact: Craig Haden

Operator Troy L. Holzschuh

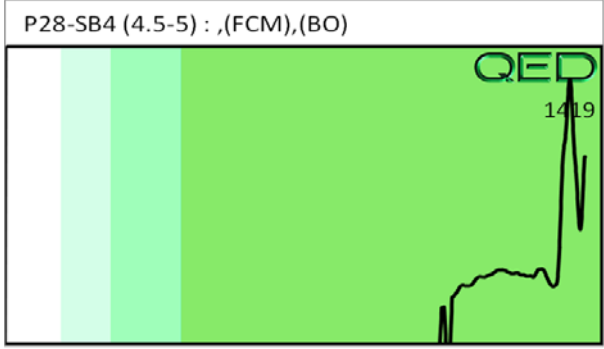
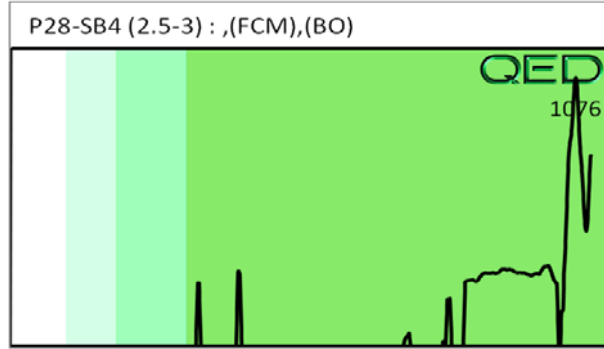
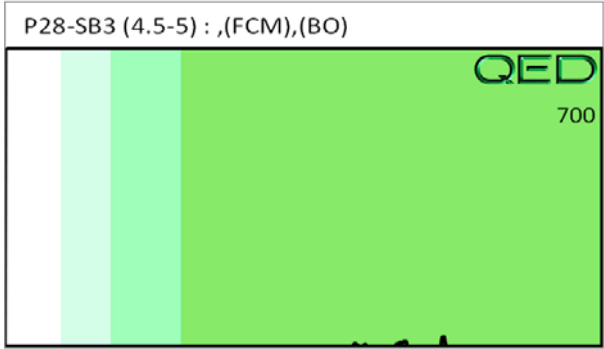
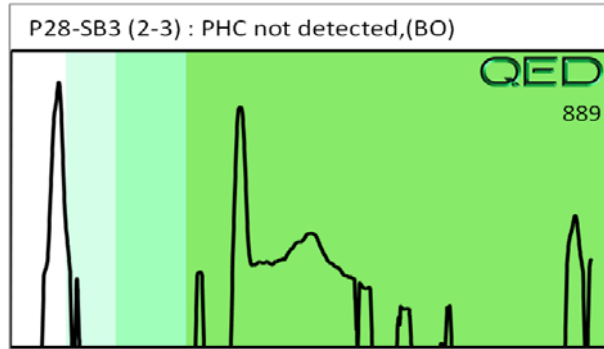
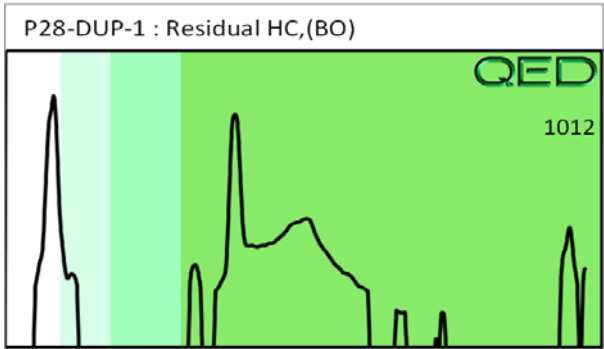
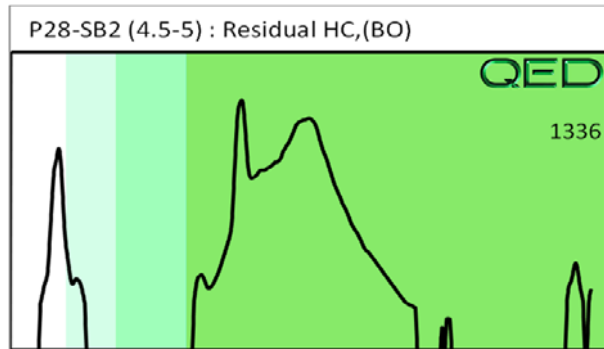
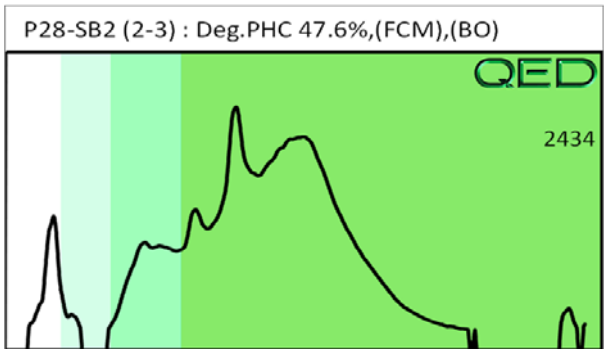
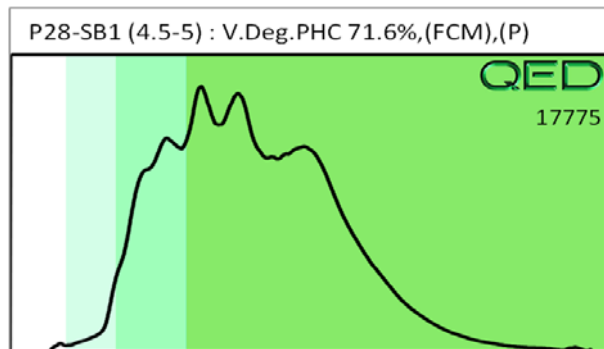
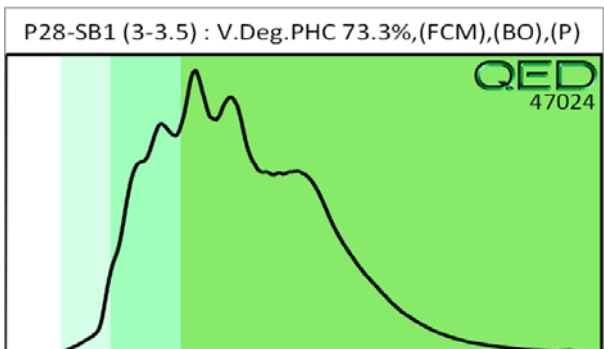
Project: R-5020B Whiteville

											F03640		
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	P28-SB1 (3-3.5)	25.0	<0.63	<0.63	27.7	27.7	22.8	1.2	0.09	0	61.5	38.5	V.Deg.PHC 73.3%,(FCM),(BO),(P)
s	P28-SB1 (4.5-5)	22.6	<0.57	<0.57	6.7	6.7	6.6	0.35	<0.028	0	57.7	42.3	V.Deg.PHC 71.6%,(FCM),(P)
s	P28-SB2 (2-3)	17.3	<0.43	<0.43	0.67	0.67	0.39	<0.14	<0.017	0	47.2	52.8	Deg.PHC 47.6%,(FCM),(BO)
s	P28-SB2 (4.5-5)	32.5	<0.81	<0.81	1.1	1.1	1.1	<0.26	<0.033	0	0	100	Residual HC,(BO)
s	P28-DUP-1	32.5	<0.81	<0.81	0.81	0.81	0.51	<0.26	<0.033	0	0	100	Residual HC,(BO)
s	P28-SB3 (2-3)	21.1	<0.53	<0.53	<0.53	<0.53	<0.11	<0.17	<0.021	0	0	100	PHC not detected,(BO)
s	P28-SB3 (4.5-5)	11.5	<0.29	<0.29	<0.29	<0.29	<0.06	<0.09	<0.011	0	0	0	,(FCM),(BO)
s	P28-SB4 (2.5-3)	11.2	<0.28	<0.28	<0.28	<0.28	<0.06	<0.09	<0.011	0	0	0	,(FCM),(BO)
s	P28-SB4 (4.5-5)	12.2	<0.3	<0.3	<0.3	<0.3	<0.06	<0.1	<0.012	0	0	0	,(FCM),(BO)
Initial Calibrator QC check			OK			Final FCM QC Check			OK			90.5 %	

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



QED**QROS****Hydrocarbon Analysis Results**

Client: NCDOT
Address: Parcel 28

Samples taken Wednesday, June 6, 2018
Samples extracted Wednesday, June 6, 2018
Samples analysed Wednesday, June 6, 2018

Contact: Craig Haden

Operator Troy L. Holzschuh

Project: R-5020B Whiteville

										F03640			
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	P28-SB5 (2-3)	10.2	<0.26	<0.26	<0.26	<0.26	<0.05	<0.08	<0.01	0	0	0	,(FCM),(BO)
s	P28-SB5 (4-5)	10.5	<0.26	<0.26	<0.26	<0.26	<0.05	<0.08	<0.011	0	0	0	,(FCM),(BO)
s	P28-SB6 (3-4)	7.8	<0.2	<0.2	<0.2	<0.2	<0.04	<0.06	<0.008	0	0	0	,(FCM),(BO)
s	P28-SB6 (4-5)	12.3	<0.31	<0.31	<0.31	<0.31	<0.06	<0.1	<0.012	0	0	0	,(FCM),(BO)
s	P28-SB7 (2-3)	7.9	<0.2	<0.2	<0.2	<0.2	<0.04	<0.06	<0.008	0	0	0	,(FCM)
s	P28-SB7 (4-5)	6.7	<0.17	<0.17	<0.17	<0.17	<0.03	<0.05	<0.007	0	0	0	#DIV/0!
Initial Calibrator QC check			OK			Final FCM QC Check			OK			104.7 %	

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

