PRELIMINARY SITE ASSESSMENT

SR 1100 (BRAWLEY SCHOOL ROAD) IMPROVEMENTS
TIP NO. R-3833C, WBS NO. 34554.2.4

NCDOT PARCEL NO. 46
OWNER: RUSHER OIL CO.
108 BRAWLEY SCHOOL ROAD
MOORESVILLE, IREDELL COUNTY, NORTH CAROLINA

PREPARED FOR:
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
C/O STANTEC
801 JONES FRANKLIN ROAD SUITE 300
RALEIGH NORTH CAROLINA 27606-3394

PREPARED BY:
FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
CARY, NC 27513

PROJECT NUMBER: G18063.02
OCTOBER 27, 2019

FALCON ENGINEERING

October 27, 2019

Mr. A. Dean Sarvis PE
Stantec
801 Jones Franklin Road, Suite 300
Raleigh, North Carolina 27606-3394

Re: **Preliminary Site Assessment**
SR 1100 (Brawley School Road) Improvements
TIP No. R-3833C, WBS No. 34554.2.4
NCDOT Parcel No. 46
Owner: Rusher Oil Co.
108 Brawley School Road
Mooresville, Iredell County, North Carolina

Dear: Mr. Sarvis:

Falcon is pleased to present the following Preliminary Site Assessment in support of the above-mentioned Project. Specifically, Falcon sampled soil in proximity to the project limits on this parcel in general accordance with the approved scope of work. This parcel is an active gas station with two known USTs. Soils requiring remediation or special handling during construction were not identified. Areas of elevated conductivity that did not correspond to buried utilities and which may indicate coal ash were not identified on this parcel

Falcon recommends if drums, additional USTs, above ground storage tanks (ASTs), petroleum odors or sheen are observed during any excavation associated with any property involved in the project that all work in the vicinity stop until further assessment takes place. Further assessment can include but is not limited to; sampling the soil and groundwater, excavation, and proper handling and disposal of contaminated soils and groundwater.

Please review this report and advise us if you have any questions or concerns. We appreciate this opportunity to provide services to you and look forward to partnering with you on future projects. If you have any questions, please give Falcon a call at (919) 871-0800.

Sincerely,
FALCON ENGINEERING, INC.

Christopher J. Burkhardt
Environmental Services Manager

Jeremy R. Hamm, PE
Geotechnical Services Manager

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LIST OF FIGURES AND ATTACHMENTS

SECTION 1: INTRODUCTION

1.1 DESCRIPTION

Falcon Engineering, Inc. (Falcon) has completed a Preliminary Site Assessment of NCDOT TIP No. R-3833C Parcel No. 46. Parcel No. 46 is addressed as 108 Brawley School Road, Mooresville, Iredell County, North Carolina. NCDOT is proposing to improve SR 1100 (Brawley School Road) from SR 1116 (Talbert Road) to 1,000' east of US 21, including improvements to a number of intersecting roads and driveways throughout this corridor. The limits of the assessment are between the existing edge of NCDOT maintained pavement (within the existing NCDOT ROW) where accessible, and the proposed NCDOT ROW and/or easement (whichever boundary represents the largest area). Boring locations were placed in the vicinity of proposed excavations for drainage features, utilities, and roadway/ditch cuts to determine if soils requiring remediation or special handling were present where excavation was planned to take place.

1.2 SCOPE OF WORK

Falcon's scope of work included coordination of; public and private utility location near the proposed borings, geophysical surveys, collecting soil samples with a geoprobe, and laboratory analysis. Samples were analyzed for petroleum via UVF technology.

SECTION 2: HISTORY

2.1 PARCEL USAGE

Falcon performed a Phase I Environmental Site Assessment (ESA) for R-3833C under Project No G18063.01 dated March 2019. The ESA identified this parcel as a Recognized Environmental Condition (REC) based on the parcel's history as an active gas station. The UST database lists one 10,000-gallon and one 20,000-gallon UST registered to Rushco at this address. A UST pit and vent pipes were observed adjacent to the north edge of the existing pavement for Brawley School Road and south of the metal canopy that covers the dispensers. This facility is not in a database that reports spills or releases.

This facility was also identified as part of the permitted Brawley School Road Coal Ash Structural Fill site. Falcon reviewed available information from The North Carolina Department of Environmental Quality (NCDEQ) Mooresville Regional Office. The State file contained an Acknowledgment and Consent form dated February 27, 1995. This form documents the landowner's (at the time) consent to the use of coal combustion by-products as structural fill and estimates the volume of coal combustion by-products at 100,000 tons. The State file also included a Structural Fill Notification from Duke Power Company dated February 28, 1995. The Notification states; "*The proposed project will utilize approximately 60,000 cubic yards of fly ash in a structural fill application to develop the property for marketing. The property is located at the intersection of US highway 21 and State Road 1100 (Brawley School Road) in Iredell County.*" A Map of the limits of the permitted site was included in the state file. The map indicates this parcel is within the limits of the fill site. However, the exact amount of coal ash used and where it was placed within the limits of the fill site is unknown. This parcel is considered a REC based on the potential to disturb coal ash during construction as well as the potential for an unknown or unreported release from the on-site USTs.

2.2 FACILITY IDENTIFICATION NUMBER

Facility Identification Number 00-0-0000036623 was identified for this parcel.

2.3 GROUNDWATER INCIDENT NUMBER

A Groundwater Incident Number was not identified for this parcel.

SECTION 3: SITE OBSERVATIONS

3.1 GROUNDWATER MONITORING WELLS

Groundwater monitoring wells (MWs) were not observed on this parcel.

3.2 ACTIVE USTS

Active USTs were observed within the project limits at this parcel. This parcel is listed in the UST Database under Rushco Food Store, Rushco Market #17, and Rushco 17. The database lists one 10,000-gallon and one 20,000-gallon UST registered to the facility. A UST pit and vent pipes were observed adjacent to the north edge of the existing pavement for Brawley School Road and south of the metal canopy that covers the dispensers.

3.3 FEATURES APPARENT BEYOND ROW/EASEMENT

Additional USTs, monitoring wells, remediation systems, or hydraulic lifts were not observed within the project limits.

SECTION 4: METHODOLOGY

4.1 GEOPHYSICS

Pyramid Geophysical Services (Pyramid) was subcontracted to perform a geophysical survey of the assessment area. The assessment area consists of the property frontage between the existing edge of NCDOT maintained pavement (within the existing NCDOT ROW) where accessible, and the proposed NCDOT ROW and/or easement (whichever boundary represents the largest area). The survey was used to locate private utility lines, as well as possible indications of USTs, and/or their pits.

The geophysical investigation for metallic USTs consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. Pyramid collected the EM data using a Geonics EM61-MK2 (EM61) metal detector integrated with a Geode External GPS/GLONASS receiver. 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 georeferenced and can be overlain on aerial photographs and CADD drawings.

GPR data was acquired across select EM anomalies (where identified), using a Geophysical Survey Systems, Inc. (GSSI) UtilityScan DF unit equipped with a dual frequency 300/800 MHz antenna. Pyramid marked their findings on the surface with paint. 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 to obtain adequate coverage.

Pyramid also utilized electromagnetic geophysical methods to delineate the horizontal extents of suspected coal combustion by-product (ash) at the subject property. Specifically, Pyramid utilized a Geonics EM31-MK1 (EM31) ground conductivity meter which measures apparent ground conductivity and metal detection down to a maximum depth of 17 feet below ground surface. The EM31 instrument was coupled to a Trimble AG-114 GPS unit to record the position of the EM data to sub-meter accuracy during the survey.

The EM31 method determines electrical properties of the earth materials by inducing electromagnetic currents in the ground and measuring the secondary magnetic field produced by these currents. An alternating current is generated in the transmitter coil located at one end of the instrument. The secondary magnetic field, which is produced by currents through the earth, induces a corresponding alternating current in the receiver coil located at the opposite end of the instrument. The instrument runs at an operating frequency of 9.8 kilohertz (kHz).

After compensating for the primary field, which can be computed from the relative positions and orientations of both coils, the magnitude and relative phase of the secondary field are measured. These measurements are then converted to components of in-phase and 90 degrees out-of-phase (quadrature) with the transmitted field. The out-of-phase or quadrature component, using certain simple assumptions, is converted to a measurement of apparent ground conductivity in millisiemens per meter (mS/m). These conductivity values can be used to

infer changes related to anomalous subsurface deposits such as coal ash. The in-phase component responds to high conductive areas (above 100 mS/m) or to areas containing metallic objects and debris and the values are expressed in terms of relative units or parts per thousand. Therefore, the in-phase data can be used to identify areas that may contain buried metallic material across areas recording lower conductivity values.

A series of transects were performed using the EM31 instrument generally spaced 10 feet apart and extending typically parallel to the direction of Brawley School Road. Subsequent to the initial data collection, Pyramid collected additional reconnaissance EM data along transects at a coarser spacing in the north-central portion of the survey area. Following the field survey, data were downloaded and processed using TrackMaker31 EM processing software, and a contour map of conductivity was generated using Surfer 16.0 contouring software (see Figure 2). Copies of the full Geophysical Reports for the metallic USTs as well as the report for suspected coal ash is included in the Attachments.

4.2 BORINGS

Regional Probing was subcontracted to advance soil borings using direct push technology. Regional Probing used a truck mounted Geoprobe® 5410 unit mounted on an off-road modified Ford F350 Diesel 4x4. The unit has auger-capabilities and is equipped with a GH-42 soil-probing hammer, with 21,700 pounds of down force and 28,900 pounds of retraction force. The unit has an on-board tank for decontaminating the geoprobe rods before advancing the probe at each sample location.

4.3 SAMPLE PROTOCOL

Prior to initiating sample collection Falcon contacted NC One Call and requested public utility locations be marked around the proposed sample locations. Sampling was in general accordance with the NC Department of Environmental Quality (DEQ) Division of Waste Management's (DWM) "Guidelines for Site Checks, Tank Closure, and Initial Response and Abatement for UST Releases" (March 1, 2007 Version Change 9 – February 1, 2019) guidance document. Sampling strategy was derived based upon the project scope and objectives as outlined above. Red Lab, LLC was selected to perform the UVF laboratory analytical analysis. Appropriate sterile containers were received by Falcon from Red Lab prior to beginning the fieldwork. The containers were labeled appropriately.

A Minirae 3000 photoionization detector (PID) was used to field screen samples for volatile organics to determine if a release had occurred. The instrument was calibrated per manufacturer instructions prior to use. Falcon staff bagged composite soil samples of each boring in approximately two-foot sections. Representative samples were placed in a sealed plastic bag for approximately 10 minutes to allow soil hydrocarbons to reach equilibrium within the headspace prior to scanning with the PID. One sample per boring was collected from the depth of the proposed cut or from the section above the depth of cut with the highest PID reading.

To avoid cross contamination, a new unused pair of non-powdered nitrile gloves was worn while extracting each sample. Samples were placed in the appropriate laboratory provided containers. The labels on each container were then completed so that each provided the date and time of sampling, method of analysis, sample collector, preservative used and sampling location identification. Samples were placed in an ice filled cooler and transported to the lab. Appropriate chain-of-custody procedures, including the completion of necessary forms, were followed.

SECTION 5: RESULTS

5.1 GEOPHYSICS

The underground storage tank (UST) geophysical investigation was performed on August 11 and 12, 2019 to investigate for the presence of unknown, metallic USTs beneath the survey area. The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. A total of thirteen EM anomalies were identified. The majority of the EM anomalies were directly attributed to visible cultural features at the ground surface. Two known USTs were present just south of the pump islands; these known USTs were investigated with GPR to verify their sizes and orientations. The sizes and orientations of the USTs were confirmed with GPR and are, from west to east, as follows: The westernmost UST (Known UST #1) measured approximately 24.5 feet long by 12 feet wide and the easternmost UST (Known UST #2) measured approximately 26.5 feet long by 13 feet wide.

GPR was also performed across an area containing significant metallic interference associated with vehicles and the pump islands on the site. No additional significant buried structures were identified. Collectively, the geophysical data recorded evidence of two known USTs within the geophysical survey area at Parcel No. 46. Evidence of unknown USTs was not recorded.

The suspected coal ash geophysical investigation was performed prior to the metallic UST investigation. A contour map of the EM31 quadrature results (conductivity) is presented on Page 11 of the Attached Geophysical Report. It was expected that the presence of buried ash would result in a significant increase in ground conductivity relative to the surrounding native soil. The contour map shows a wide range of conductivity values across the various parcels investigated within the larger R-3833C Study Area.

Pyramid analyzed the locations of buried metal utility lines using the MicroStation files provided by NCDOT. These metal utility lines can result in conductivity increases that are unrelated to geologic conditions. The metal utility lines have been extracted from the MicroStation file and overlain on the conductivity results for reference. The majority of the metal utility lines are running parallel to the roadways in the road shoulders, and clearly show linear increases in conductivity at the locations of the utilities.

Review of the collective conductivity results indicate that background soil conditions are generally represented by conductivity values ranging from approximately 5 to 30 mS/m. Negative conductivity values are typically indicative of surface metal objects such as signs, light poles, vehicles, and other objects. These features can generally be ignored for the purposes of analyzing possible buried coal ash.

Specific to coal ash, Pyramid examined areas where conductivity values increased to approximately 30 mS/m and higher. Analysis of the locations of buried metal utilities indicate that the majority of the zones where elevated conductivity was observed correlate to the locations of utilities. Areas of elevated conductivity that did not correspond to buried utilities and which may indicate coal ash were not identified on this parcel.

5.2 SAMPLE DATA

Falcon and our subcontractor advanced seven borings (B-01 through B-07) to the proposed excavation depth of the drainage features, utilities, or roadway/ditch cut being assessed. Groundwater was not observed. Please see the Boring Location Plan in the attachments for a visual depiction of the boring locations. The coordinates (latitude and longitude) that correspond to the boring locations are shown below in Table No. 1 Boring Coordinates.

TABLE NO. 1 BORING COORDINATES

Boring	Latitude	Longitude
B-01	35.579193	-80.8413846
B-02	35.5791856	-80.841287
B-03	35.5791983	-80.8410928
B-04	35.5791938	-80.8408796
B-05	35.5791881	-80.8404893
B-06	35.5792834	-80.8403851
B-07	35.5795235	-80.8402856

The PID screening results are presented in Table No. 2 PID Readings. Borings were field screened with a PID for evidence of volatile organics in sections as indicated in Table No. 2. Falcon selected soil samples based on the field screening results and the needs of the project. Red Lab analyzed the selected samples and their full analytical report is attached. The results of the laboratory analysis are shown in Table No. 3 Summary of UVF Soil Sampling Results.

Petroleum hydrocarbons above State Action Levels were not detected in the samples.

TABLE NO. 2 PID READINGS

Boring	Depth BGS*	PID**
B-01	0-2	1.4
	2-4	1.8
	4-6	1.8
	6-8	1.9
	8-10	1.9
	10-11.2	**2.1**
B-02	0-2	2.4
	2-4	1.5
	4-6	**2.4**
B-03	0-2.5	1.9
	2.5-5	2.1
	5-7.5	2.3
	7.5-10	**2.9**
B-04	0-2.5	1.7
	2.5-5	1.7
	5-7.5	1.7
	7.5-10	**1.8**
B-05	0-2	1.0
	2-4	1.3
	4-6	**2.6**
B-06	0-2	1.4
	2-4	1.8
	4-6	**1.8**
B-07	0-2.5	1.5
	2.5-5	**1.5**

*BGS = Depth below ground surface in feet
**PID readings are in parts per million
Samples shown in **bold** were selected for analysis

TABLE NO. 3 SUMMARY OF UVF SOIL SAMPLING RESULTS

Sample ID	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	
B-01	26.9	<0.67	<0.67	0.67	0.67	0.32	<0.22	<0.027	0	63.2	36.8
B-02	14.5	<0.36	<0.36	0.36	0.36	0.23	<0.12	<0.015	0	24.8	75.2
B-03	15.2	<0.76	0.46	7.9	8.4	0.71	<0.12	<0.015	92.1	6.9	1
B-04	14.3	<0.36	<0.36	6.9	6.9	0.39	<0.11	<0.014	0	75.7	24.3
B-05	15.3	<0.38	<0.38	8.5	8.5	4.1	0.43	<0.015	0	72.5	27.5
B-06	16.7	<0.42	<0.42	0.42	0.42	0.22	<0.13	<0.017	0	55.3	44.7
B-07	18.1	<0.45	<0.45	3.5	3.5	1.7	0.18	<0.018	0	70.5	29.5

Results reported in mg/kg (milligrams per kilogram)

5.3 SAMPLE OBSERVATIONS

Obvious visual indications of a release (stained soils, odors, or oily sheen) or suspect coal ash was not observed. Table No. 4 Soil Observations lists visual soil observations of color and texture.

TABLE NO. 4 SOIL OBSERVATIONS

Sample ID	Depth	Color	Soil Type
B-01	0.0-2.0	Brown Red	Silty Clay (A-7) w/ trace Rock Frags
	2.0-4.0	Brown Red	Slightly Sandy Silty Clay (A-6)
	4.0-6.0	Brown Red	Sandy Clayey Silt (A-4) w/ trace Mica
	6.0-8.0	Brown Red	Sandy Clayey Silt (A-4) w/ trace Mica
	10.0-12.0	Red Brown	Silty Clay (A-7) w/ trace Mica
B-02	0.0-2.0	Brown Red	Silty Clay (A-7) w/ trace Mica
	2.0-4.0	Brown Red	Clayey Silt (A-7) w/ trace Mica
	4.0-6.0	Red Brown	Sandy Clayey Silt (A-4) w/ trace Mica
B-03	0.0-2.5	Red Brown	Silty Clay (A-7) w/ trace Mica
	2.5-5.0	Red Brown	Clayey Silt (A-5) w/ trace Mica
	5.0-7.5	Red Brown	Sandy Clayey Silt (A-4) w/ trace Mica
	7.5-10.0	Brown Red	Sandy Clayey Silt (A-4) w/ trace Mica
B-04	0.0-2.5	Brown Red	Silty Clay (A-7)
	2.5-5.0	Red Brown	Clayey Silt (A-5)
	5.0-7.5	Red Brown	Sandy Clayey Silt (A-4) w/ trace Mica
	7.5-10.0	Brown Red	Sandy Clayey Silt (A-4) w/ trace Mica
B-05	0.0-2.0	Brown	Silty Clay (A-7) w/ trace Rock Frags
	2.0-4.0	Brown	Clayey Silt (A-5) w/ trace Rock Frags
	4.0-6.0	Brown Red	Sandy Clayey Silt (A-4) w/ trace Mica
B-06	0.0-2.0	Brown	Silty Clay (A-7) w/ trace Organics
	2.0-4.0	Brown	Clayey Silt (A-5) w/ trace Mica
	4.0-6.0	Red	Sandy Clayey Silt (A-5) w/ trace Mica
B-07	0.0-2.5	Brown Red	Sandy Silty Clay (A-6) w/ trace Rock Frags
	2.5-5.0	Red	Sandy Clayey Silt (A-4) w/ trace Rock Frags

Depth is in feet below ground surface

5.4 QUANTITIES CALCULATIONS

Soils requiring quantity calculations were not identified.

SECTION 6: CONCLUSIONS

6.1 INTERPRETATION OF RESULTS

This Preliminary Site Assessment was performed to evaluate the soils in proximity to the project limits on this parcel for the presence of petroleum hydrocarbons and suspect coal ash. The findings are as follows:

- Soil sampling completed on the parcel did not identify contaminants in the soil sampled at levels requiring remediation.
- Geophysical conductivity testing did not identify suspect coal ash on the parcel.

6.2 GEOPHYSICS

The geophysical data recorded evidence of two known USTs within the geophysical survey area at Parcel No. 46. Evidence of unknown USTs was not recorded. Falcon does not anticipate USTs will be encountered within the project limits on this parcel during construction. Areas of elevated conductivity that did not correspond to buried utilities and which may indicate coal ash were not identified on this parcel.

6.3 SAMPLING

Sampling results did not identify contaminants in the soil which require remediation in the areas sampled. Based on past project experience, Falcon does not anticipate soil remediation or special handling and disposal will be required during construction on this parcel.

6.4 QUANTITIES

Soils requiring quantities calculations were not identified.

SECTION 7: RECOMMENDATIONS

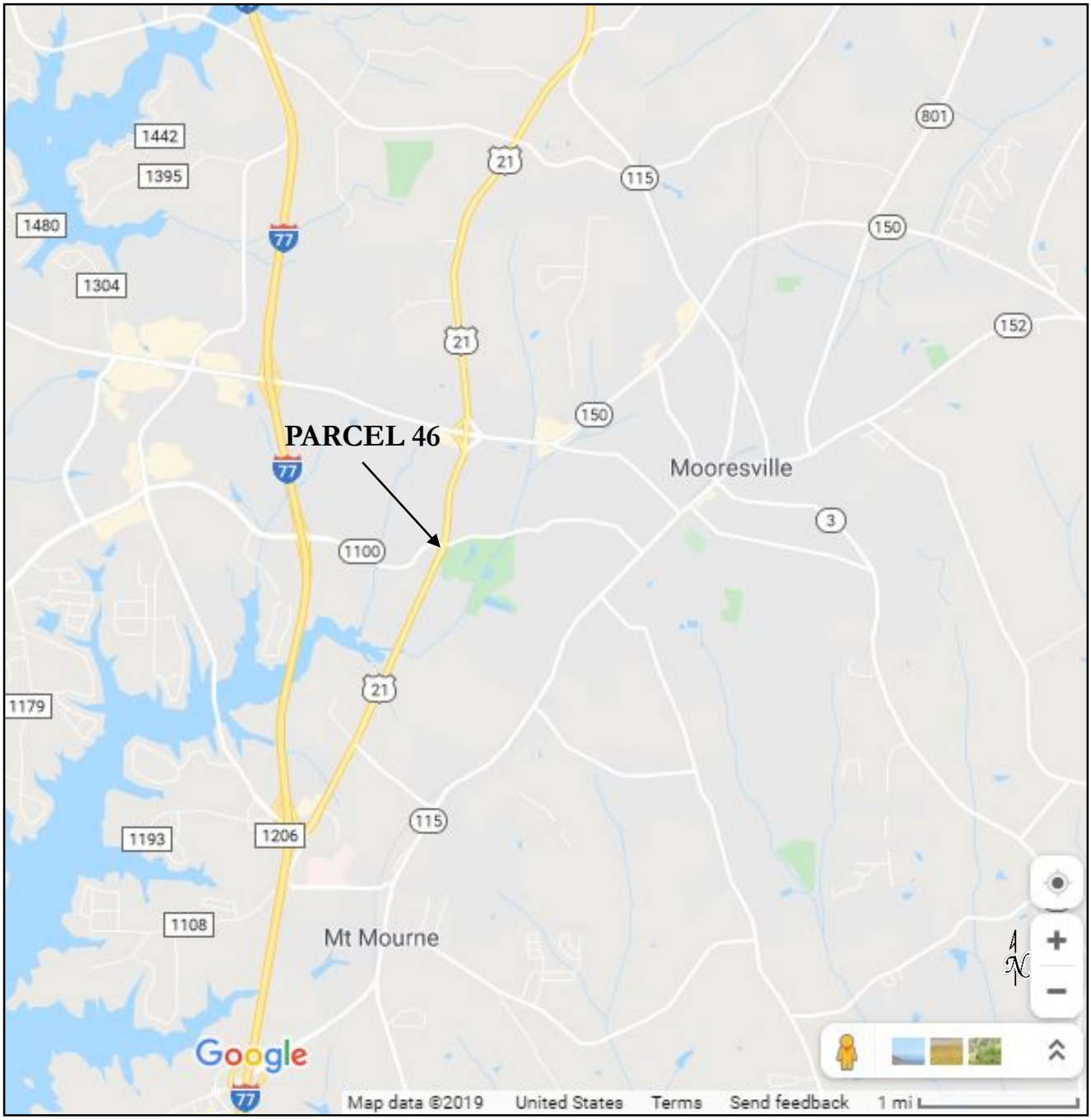
7.1 ADDITIONAL SAMPLING

Contaminants above the Industrial / Commercial Soil Cleanup Levels were not identified; therefore, additional assessment is not warranted at this time. Falcon recommends if drums, additional USTs, above ground storage tanks (ASTs), petroleum odors or sheen are observed during any excavation associated with any property involved in the project that all work in the vicinity stop until further assessment takes place. Further assessment can include but is not limited to; sampling the soil and groundwater, excavation, and proper handling and disposal of contaminated soils and groundwater.

7.2 SPECIAL HANDLING OF IMPACTED SOIL

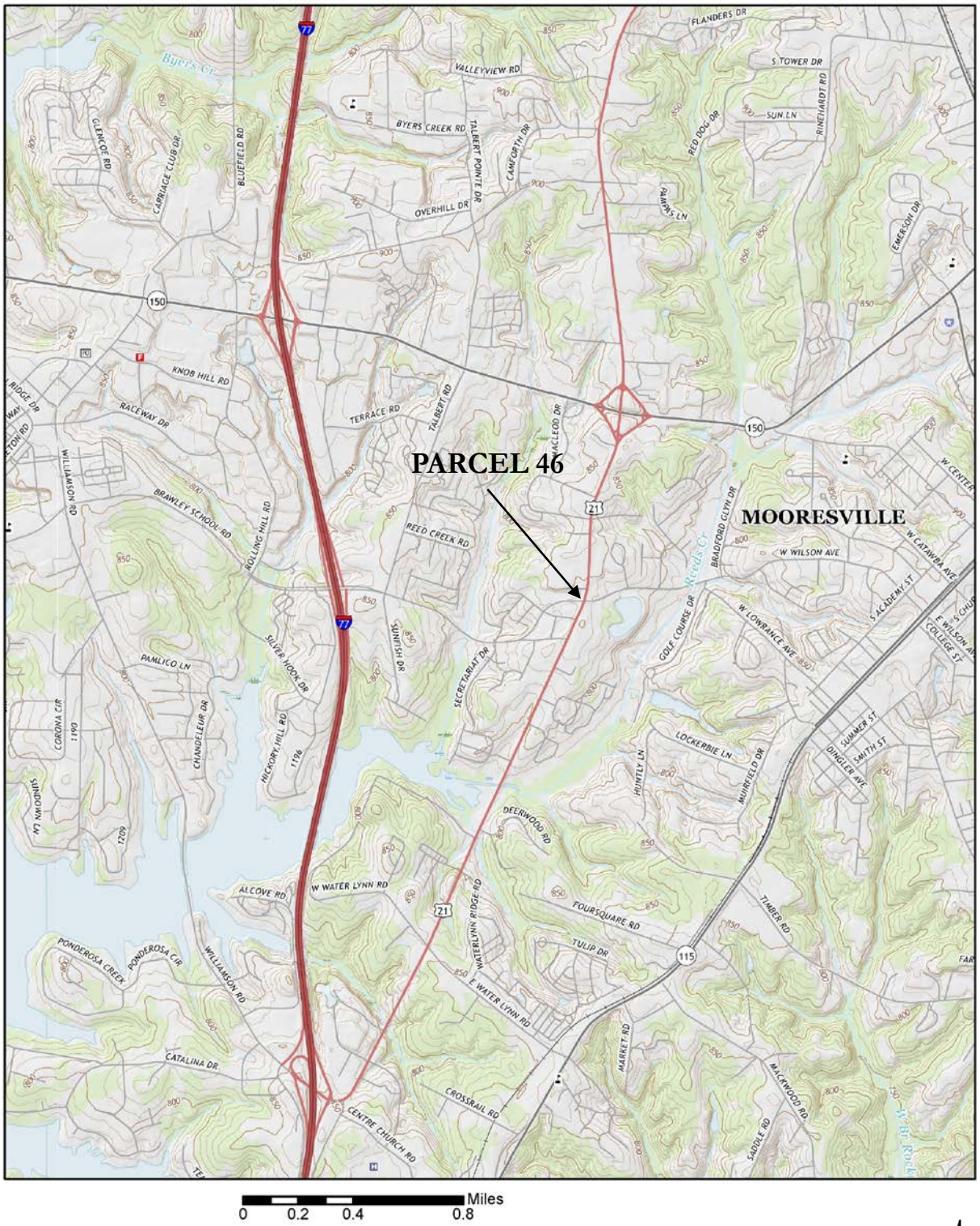
Soils requiring special handling were not identified. If suspect contaminated soils are encountered during construction Falcon and the NCDOT GeoEnvironmental Group should be contacted for proper handling instructions.

NCDOT R-3833C (SR 1100 Improvements)
Preliminary Site Assessment
Parcel 46 Vicinity Map



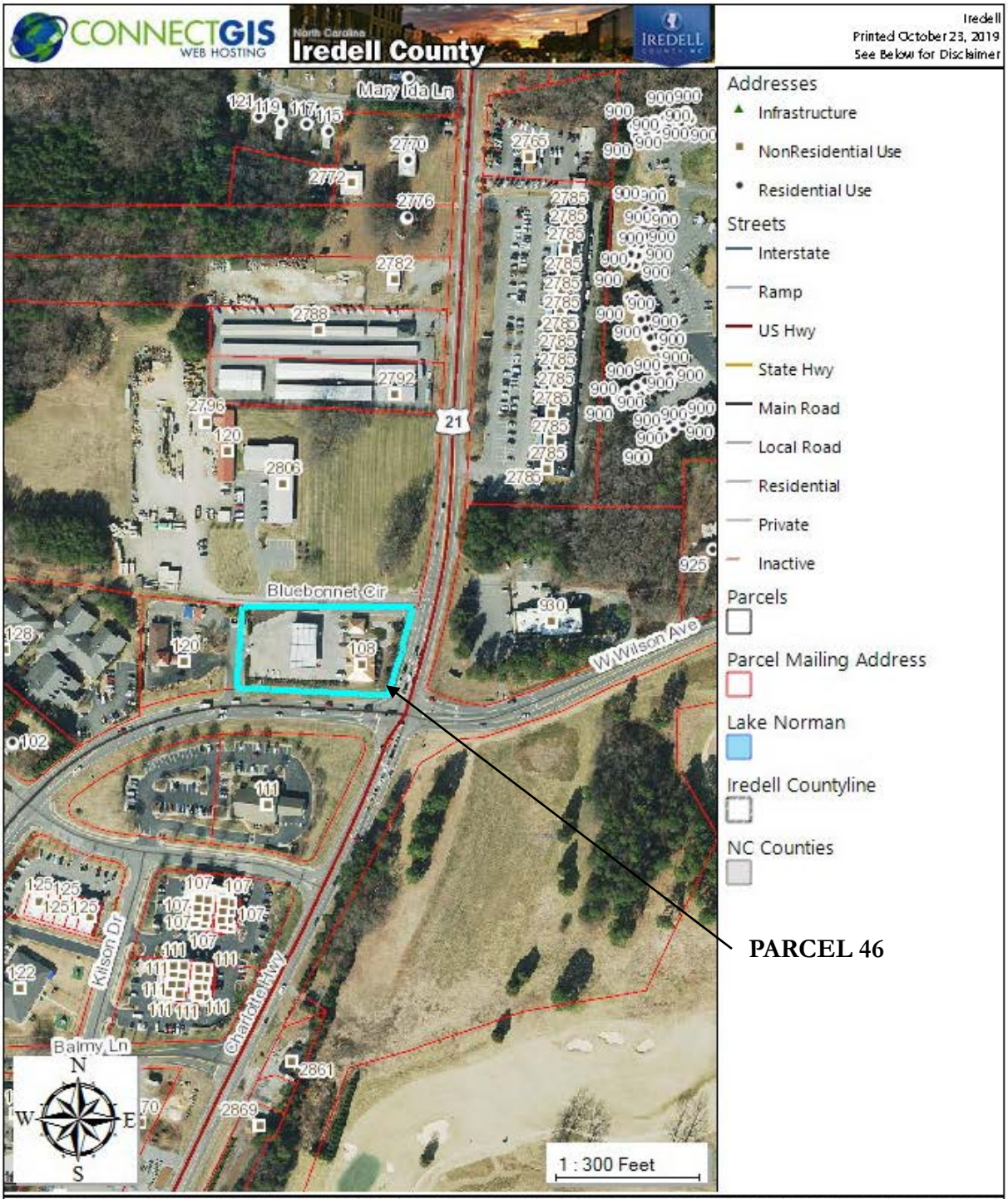
Project No.: G18063.02
Date: October 2019
Source: Google Maps

NCDOT R-3833C (SR 1100 Improvements)
Preliminary Site Assessment
Parcel 46 Topographic Map



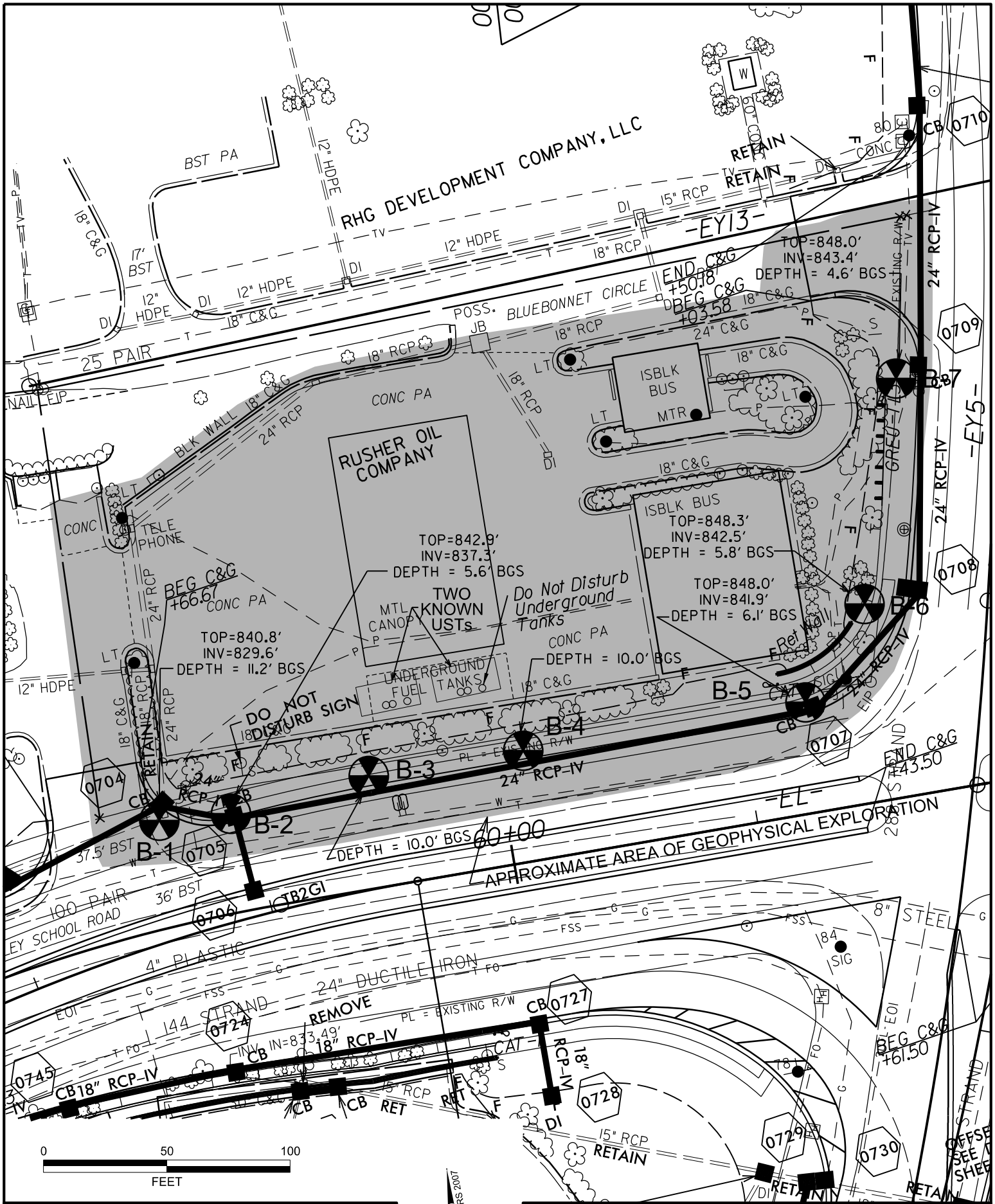
Project No.: G18063.02
Date: October 2019
Source: "Mooresville, NC" 2016 USGS Topographic Map

NCDOT R-3833C (SR 1100 Improvements)
Preliminary Site Assessment
Parcel 46 Location Map



The maps prepared for this website are generated from recorded deeds, plats, and other public records. Users of these maps are hereby notified that the information provided herein should be verified. Iredell County assumes no legal responsibilities for any of the information contained on this site. Users are advised that the use of any of this information is at their own risk. All maps on this site were prepared using a 1000â€™ Grid based upon the North Carolina State Plane Coordinate System from the 1983 North American Datum. The delinquent real property tax overlay is updated monthly. The information presented is not intended to be used or relied upon as official notice of tax liens. For additional information regarding delinquent taxes, contact the Iredell County Tax Collector's Office.

Project No.: G18063.02
Date: October 2019
Source: Iredell County GIS Website



NOTES:

- BGS = BELOW GROUND SURFACE

NAD 83 NSRS 2007

FALCON ENGINEERING

FALCON ENGINEERING, INC.
1210 TRINITY ROAD, SUITE 110
RALEIGH, NC 27607

PHONE: 919.871.0800
FAX: 919.871.0803

BORING LOCATION PLAN

BRAWLEY SCHOOL ROAD
PARCEL 46 - RUSHER OIL CO.
IREDELL / NORTH CAROLINA
WBS NO.:34554.2.4 | TIP NO.: R-3833C
FALCON PROJECT NO. G18063.02

NCDOT R-3833C (SR 1100 Improvements)
Preliminary Site Assessment
Parcel 46 Site Photographs

Photograph No. 1: General view of the Rushco UST Pit and Vent Pipes.

Photograph No. 2: General view of Boring B-01.

NCDOT R-3833C (SR 1100 Improvements)
Preliminary Site Assessment
Parcel 46 Site Photographs

Photograph No. 3: General view of Boring B-02.

Photograph No. 4: General view of Boring B-03.

NCDOT R-3833C (SR 1100 Improvements)
Preliminary Site Assessment
Parcel 46 Site Photographs

Photograph No. 5: General view of Boring B-04.

Photograph No. 6: General view of Boring B-05.

NCDOT R-3833C (SR 1100 Improvements)
Preliminary Site Assessment
Parcel 46 Site Photographs

Photograph No. 7: General view of Boring B-06.

Photograph No. 8: General view of Boring B-07.

QED

AQROS

Hydrocarbon Analysis Results

Client: FALCON
Address: 1210 TRINITY RD SUITE 110
CARY, NC 27513

Contact: C. Burkhardt

Project: G18063

Samples taken 10/14 - 10/15/2019
Samples extracted 10/14 - 10/15/2019
Samples analysed Wednesday, October 16, 2019

Operator Harry Wooten

U00904

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
										C5 - C10	C10 - C18	C18	
s	B01	26.9	<0.67	<0.67	0.67	0.67	0.32	<0.22	<0.027	0	63.2	36.8	Deg Fuel 74.4%,(FCM)
s	B02	14.5	<0.36	<0.36	0.36	0.36	0.23	<0.12	<0.015	0	24.8	75.2	V.Deg.PHC 74%,(FCM)
s	B03	15.2	<0.76	0.46	7.9	8.4	0.71	<0.12	<0.015	92.1	6.9	1	Deg.Fuel 81.2%,(FCM)
s	B04	14.3	<0.36	<0.36	6.9	6.9	0.39	<0.11	<0.014	0	75.7	24.3	Waste Oil 80.3%,(FCM)
s	B05	15.3	<0.38	<0.38	8.5	8.5	4.1	0.43	<0.015	0	72.5	27.5	Road Tar 77.5%,(FCM),(BO)
s	B06	16.7	<0.42	<0.42	0.42	0.42	0.22	<0.13	<0.017	0	55.3	44.7	Deg Fuel 71.9%,(FCM)
s	B07	18.1	<0.45	<0.45	3.5	3.5	1.7	0.18	<0.018	0	70.5	29.5	Road Tar 76.8%,(FCM)

Initial Calibrator QC check OK

Final FCM QC Check OK 101.1 %

Concentration values in mg/kg for soil samples and mg/L for water samples. Soil values uncorrected for moisture or stone content. Fingerprints provide a tentative hydrocarbon identification.

Abbreviations :- FCM = Results calculated using Fundamental Calibration Mode : % = confidence of hydrocarbon identification : (PFM) = Poor Fingerprint Match : (T) = Turbid : (P) = Particulate detected

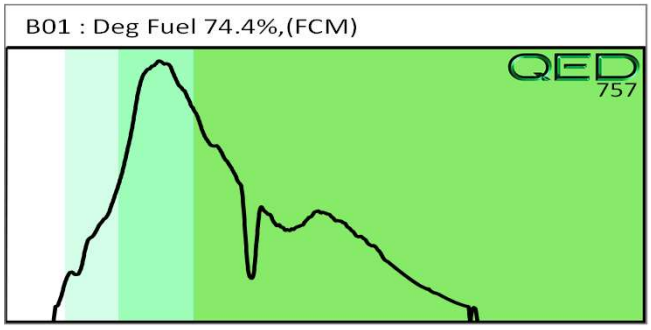
B = Blank Drift : (SBS)/(LBS) = Site Specific or Library Background Subtraction applied to result : (BO) = Background Organics detected : (OCR) = Outside cal range : (M) = Modifed Result.

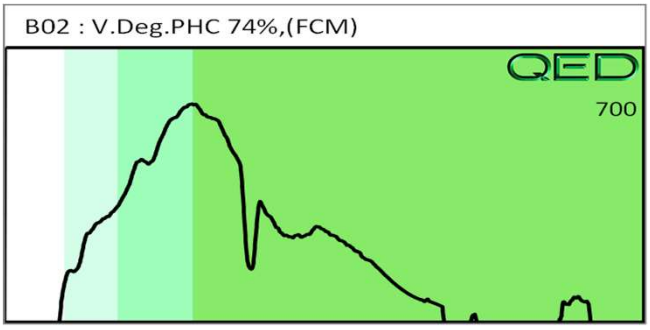
% Ratios estimated aromatic carbon number proportions : HC = Hydrocarbon : PHC = Petroleum HC : FP = Fingerprint only. **Data generated by HC-1 Analyser**

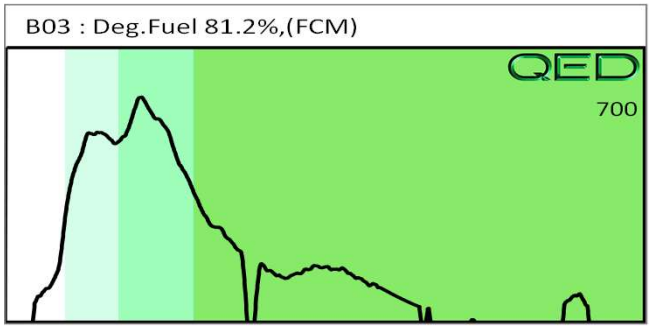
QED Hydrocarbon Fingerprints

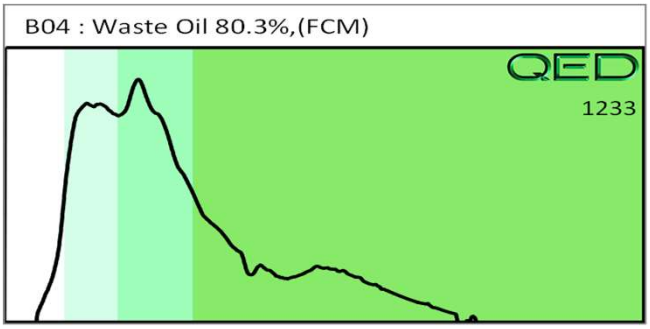
Project: G18063

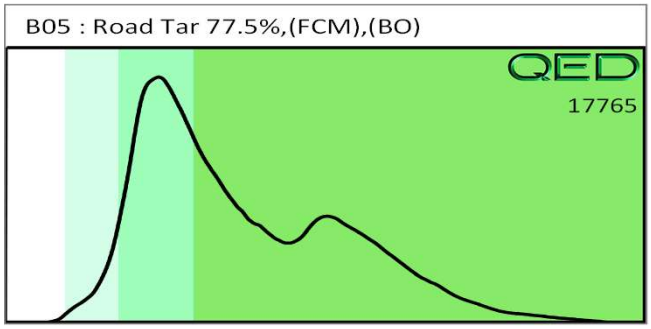
Wednesday, October 16, 2019

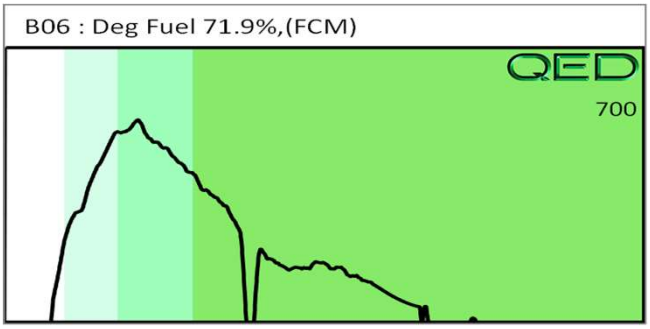


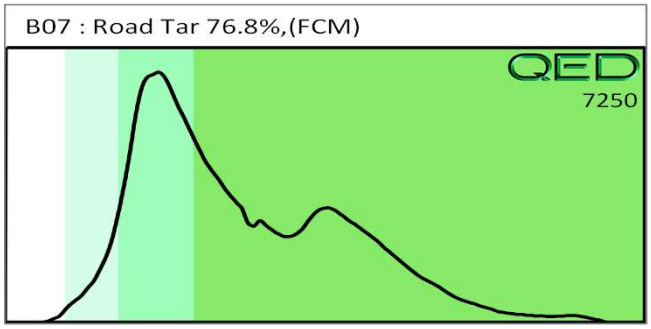












PYRAMID GEOPHYSICAL SERVICES
(PROJECT 2019-260)

GEOPHYSICAL SURVEY

METALLIC UST INVESTIGATION:
PARCEL 46
NCDOT PROJECT R-3833C

108 BRAWLEY SCHOOL ROAD, MOORESVILLE, NC

September 6, 2019

Report prepared for: **Christopher J. Burkhardt, PWS**
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C257: GEOLOGY C1251: ENGINEERING

GEOPHYSICAL INVESTIGATION REPORT
Parcel 46 - 108 Brawley School Road
Mooresville, Iredell County, North Carolina

Table of Contents

Figures

Appendices

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 Falcon Engineers at Parcel 46, located at 108 Brawley School Road in Mooresville, NC. The survey was part of an NCDOT Right-of-Way (ROW) investigation (NCDOT Project R-3833C). 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 August 11-12, 2019, the geophysical investigation was performed to determine if unknown, metallic underground storage tanks (USTs) were present beneath the survey area.

Geophysical Results: The geophysical investigation consisted of electromagnetic (EM) induction-metal detection and ground penetrating radar (GPR) surveys. A total of thirteen EM anomalies were identified. The majority of the EM anomalies were directly attributed to visible cultural features at the ground surface. Two known USTs were present just south of the pump islands; these known USTs were investigated with GPR to verify their sizes and orientations. The sizes and orientations of the USTs were confirmed with GPR and are, from west to east, as follows: The westernmost UST (Known UST #1) was approximately 24.5 feet long by 12 feet wide and the easternmost UST (Known UST #2) was approximately 26.5 feet long by 13 feet wide.

GPR was also performed across an area containing significant metallic interference associated with vehicles and the pump islands on the site. No additional significant buried structures were identified. Collectively, the geophysical data recorded evidence of two known USTs within the geophysical survey area at Parcel 46. No evidence of unknown USTs was recorded.

INTRODUCTION

Pyramid Environmental conducted a geophysical investigation for Falcon Engineers at Parcel 46, located at 108 Brawley School Road in Mooresville, NC. The survey was part of an NCDOT Right-of-Way (ROW) investigation (NCDOT Project R-3833C). 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 August 11-12, 2019, 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, grass, and asphalt surfaces. Two known USTs were observed within the geophysical survey area during the investigation, just south of the pump islands. The area underneath the canopy, where the pump islands are located, was investigated with GPR only, as the canopy interfered with the GPS antenna utilized by the EM instrument. 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-MK2 (EM61) metal detector integrated with a Geode External GPS/GLONASS receiver. 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 August 12, 2019, using a Geophysical Survey Systems, Inc. (GSSI) SIR 4000 controller equipped with a 350 MHz HS 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	Vehicles	✓
2	Drop Inlets	
3	Gate	
4	Vehicles/Pump Islands	✓
5	Drop Inlets	
6	Sign	
7	Manhole	
8	Vehicles	✓
9	Building	
10	Known Utility	✓
11	**Two Known USTs**/Vent Pipes/ Reinforced Concrete	✓
12	Signs	
13	Hydrant	

The majority of the EM anomalies were directly attributed to visible cultural features at the ground surface, including vehicles, drop inlets, a gate, pump islands, signs, a manhole, a building, two known USTs, vent pipes, and a hydrant. EM Anomalies 1, 4, and 8 were associated with vehicles, as well as pump islands (EM Anomaly 4), and were investigated with GPR to confirm that the interference caused by these surface features did not obscure any significant buried structures such as USTs. EM anomaly 10 was in the location of a known utility and was investigated to confirm that the anomaly was a result of this utility. EM Anomaly 11 was associated with two known USTs, and their vent pipes, and were investigated with GPR to confirm the sizes and orientations of the 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. All of the transect images are included in **Appendix A**. A total of twenty-two formal GPR transects were performed at the site.

GPR Transects 1-12 were performed in a grid-like fashion across EM Anomaly 4. These transects showed discrete hyperbolic anomalies consistent with buried pipes (i.e., utilities and supply lines) but did not show evidence of more significant structures such as USTs.

GPR Transect 13 was performed across EM Anomaly 10 and confirmed the presence of a known buried utility and that the EM anomaly observed in this area is a result of this known utility.

GPR Transects 14-21 were performed across areas associated with vehicle interference (EM Anomalies 1 and 8). Some of these transects showed small, discrete hyperbolic anomalies consistent with potential utilities or small buried debris. None of these transects showed any evidence of more significant structures such as USTs.

GPR Transect 22 was performed across the width of one of the known USTs (Known UST #2) at the site (EM Anomaly 11). This transect showed a large, high-amplitude hyperbolic anomaly consistent with the width of a UST. A second transect was performed across the width of the other known (Known UST #1), but the file was corrupted and is not included in this report. The sizes and orientations of the USTs were confirmed with GPR and are, from west to east, as follows: The westernmost UST (Known UST #1) was approximately 24.5 feet long by 12 feet wide and the easternmost UST (Known UST #2) was approximately 26.5 feet long by 13 feet wide. **Figure 4** provides the locations and sizes of the two known USTs overlain on an aerial, along with ground-level photographs. This transect also confirmed the presence of reinforcement within the concrete slab.

Collectively, the geophysical data recorded evidence of two known USTs within the survey area at Parcel 46. No evidence of unknown USTs was recorded. **Figure 5** provides an

overlay of the metal detection results and the locations of the two known USTs on the NCDOT MicroStation engineering plans for reference.

SUMMARY & CONCLUSIONS

Pyramid's evaluation of the EM61 and GPR data collected at Parcel 46 in Mooresville, North Carolina, provides the following summary and conclusions:

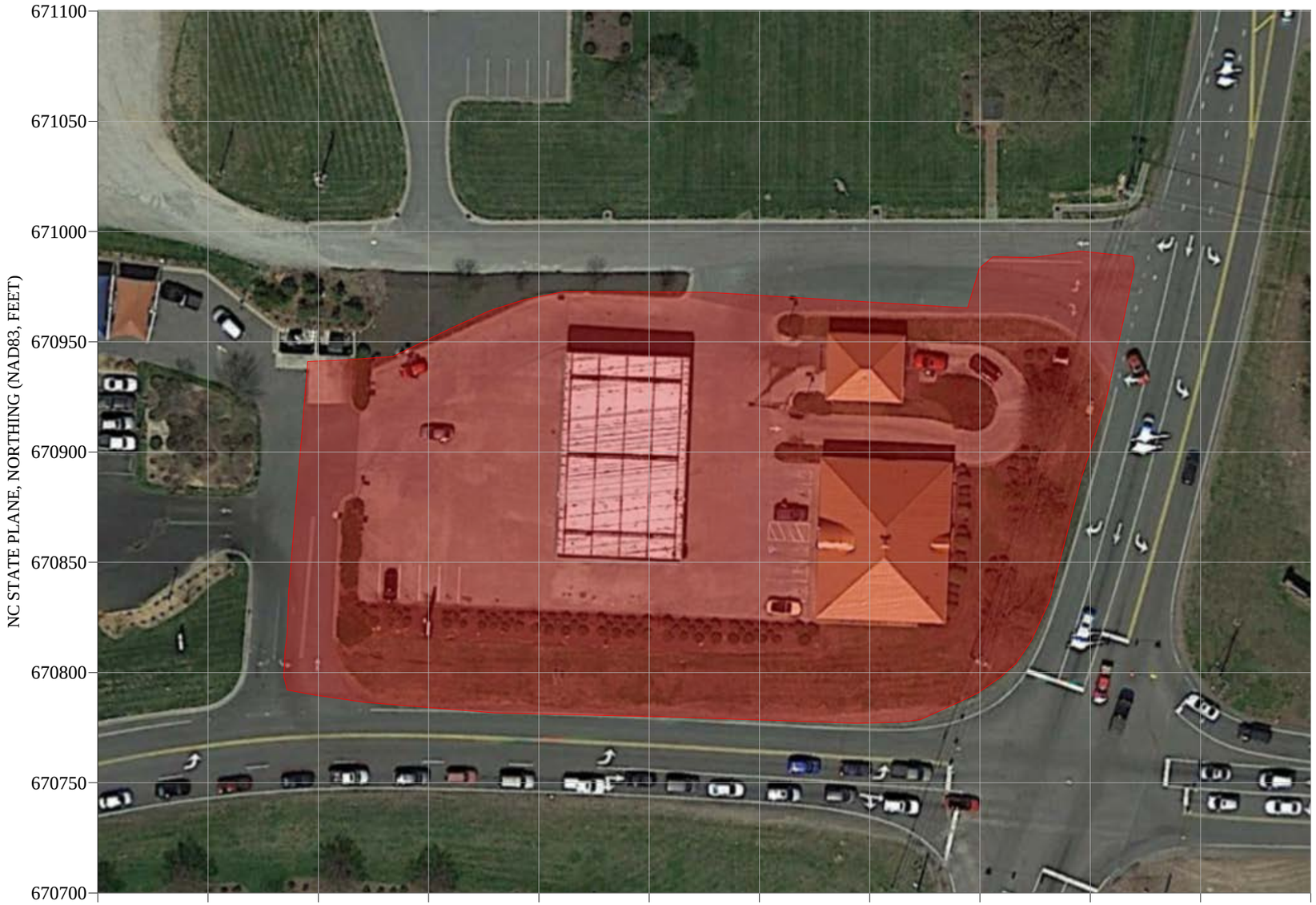
- The EM61 and GPR surveys provided reliable results for the detection of metallic USTs within the accessible portions of the geophysical survey area.
- The majority of the EM anomalies were directly attributed to visible cultural features at the ground surface.
- Two known USTs were present just south of the pump islands; these known USTs were investigated with GPR to verify their sizes and orientations.
- The sizes and orientations of the USTs were confirmed with GPR and are, from west to east, as follows: The westernmost UST (Known UST #1) was approximately 24.5 feet long by 12 feet wide and the easternmost UST (Known UST #2) was approximately 26.5 feet long by 13 feet wide.
- GPR was also performed across an area containing significant metallic interference associated with, a known buried utility, vehicles, and the pump islands on the site. No additional significant buried structures were identified.
- Collectively, the geophysical data recorded evidence of two known USTs within the geophysical survey area at Parcel 46. No evidence of unknown USTs was recorded.

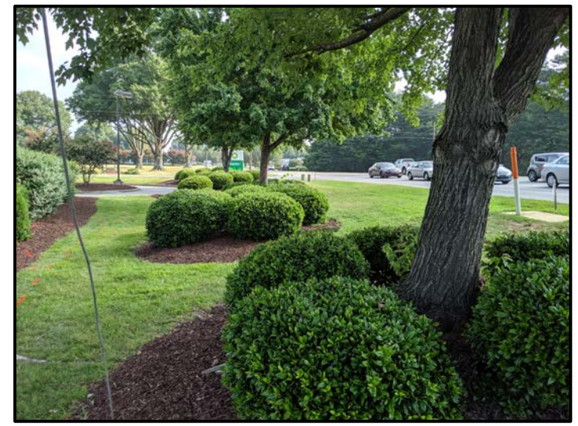
LIMITATIONS

Geophysical surveys have been performed and this report was prepared for Falcon Engineers 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





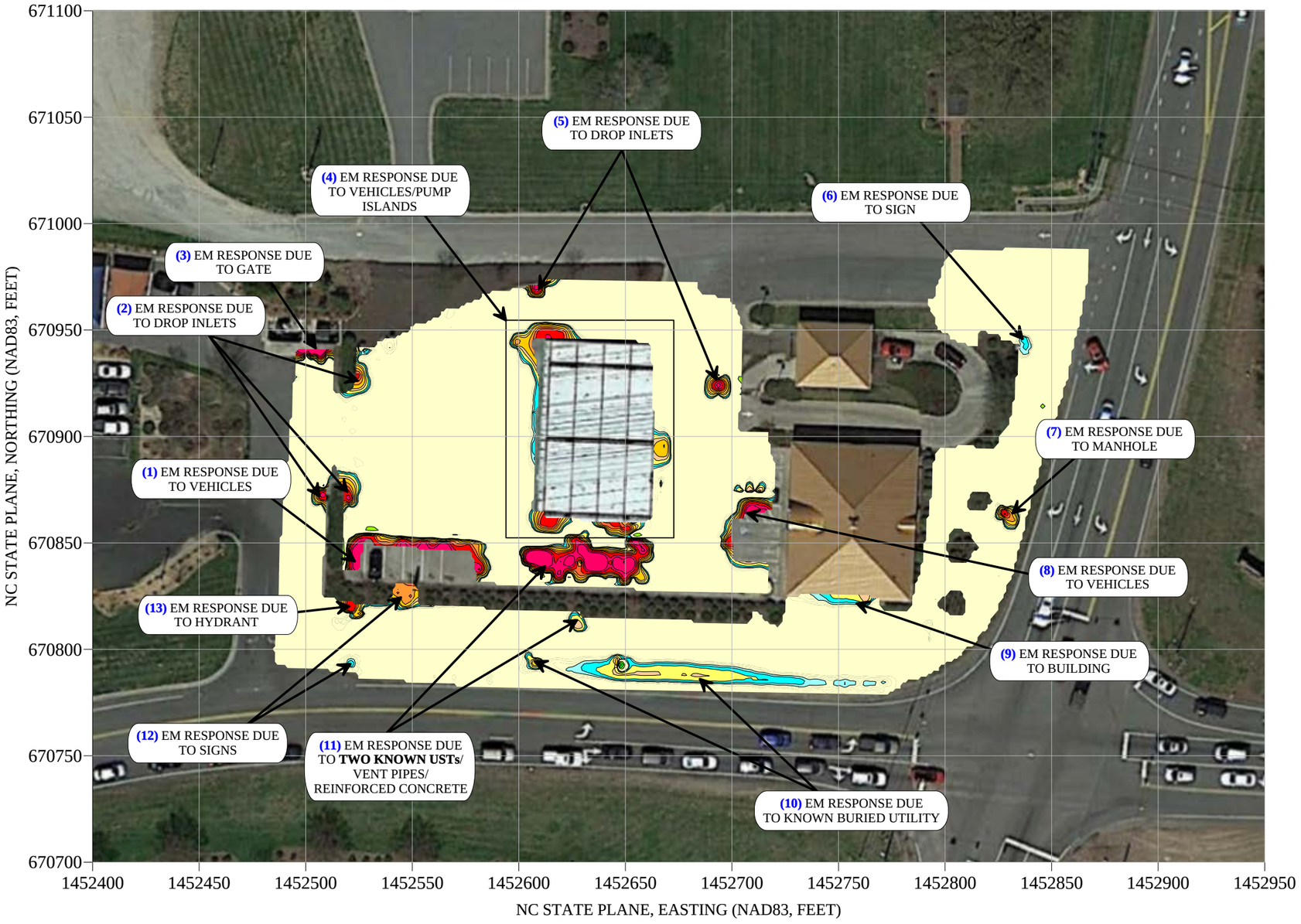
View of Survey Area
(Facing Approximately North)

View of Survey Area
(Facing Approximately West)

N

PYRAMID GEOPHYSICS 503 INDUSTRIAL AVENUE GREENSBORO, NC 27406 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	PROJECT PARCEL 46 MOORESVILLE, NORTH CAROLINA NCDOT PROJECT R-3833C	TITLE PARCEL 46 - GEOPHYSICAL SURVEY BOUNDARIES AND SITE PHOTOGRAPHS	DATE 9/3/2019 PYRAMID PROJECT #: 2019-260	CLIENT FALCON ENGINEERS **FIGURE 1**

EM61 METAL DETECTION RESULTS



EVIDENCE OF TWO KNOWN USTs OBSERVED. NO EVIDENCE OF UNKNOWN METALLIC USTs WAS 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 EM data were collected on August 11, 2019, using a Geonics EM61-MK2 instrument. Verification GPR data were collected using a GSSI SIR 4000 controller equipped with a 350 MHz antenna on August 12, 2019.

EM61 Metal Detection Response (millivolts)

N

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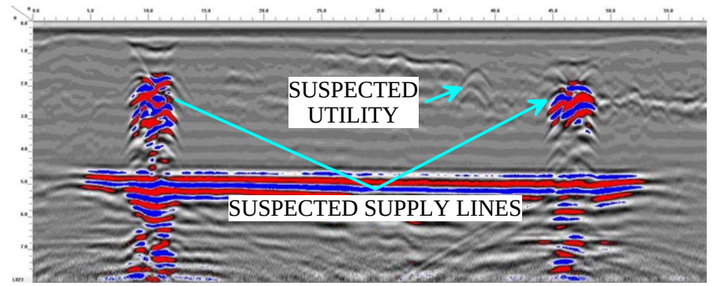
PROJECT: PARCEL 46 MOORESVILLE, NORTH CAROLINA NCDOT PROJECT R-3833C	TITLE: PARCEL 46 - EM61 METAL DETECTION CONTOUR MAP	DATE: 9/3/2019	CLIENT: FALCON ENGINEERS
		PYRAMID PROJECT #: 2019-260	**FIGURE 2**

LOCATIONS OF GPR TRANSECTS



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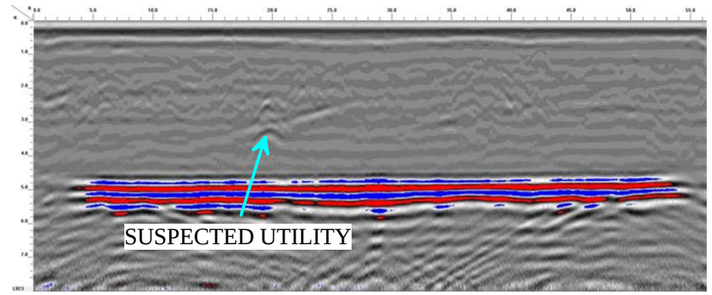

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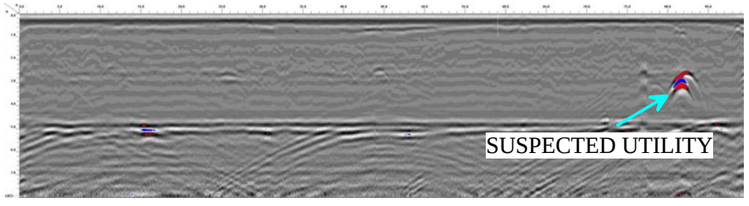
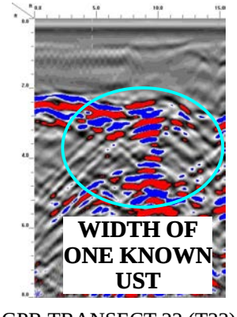


GPR TRANSECT 9 (T9)



GPR TRANSECT 22 (T22)

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PYRAMID GEOPHYSICS 503 INDUSTRIAL AVENUE GREENSBORO, NC 27406 (336) 335-3174 (p) (336) 691-0648 (f) License # C1251 Eng. / License # C257 Geology	PROJECT PARCEL 46 MOORESVILLE, NORTH CAROLINA NCDOT PROJECT R-3833C	TITLE PARCEL 46 - GPR TRANSECT LOCATIONS AND SELECT IMAGES	DATE 9/3/2019 PYRAMID PROJECT #: 2019-260	CLIENT FALCON ENGINEERS **FIGURE 3**

LOCATIONS OF TWO KNOWN USTs

View of Known UST #1 Facing Approximately West

View of Known UST #2 Facing Approximately East

N

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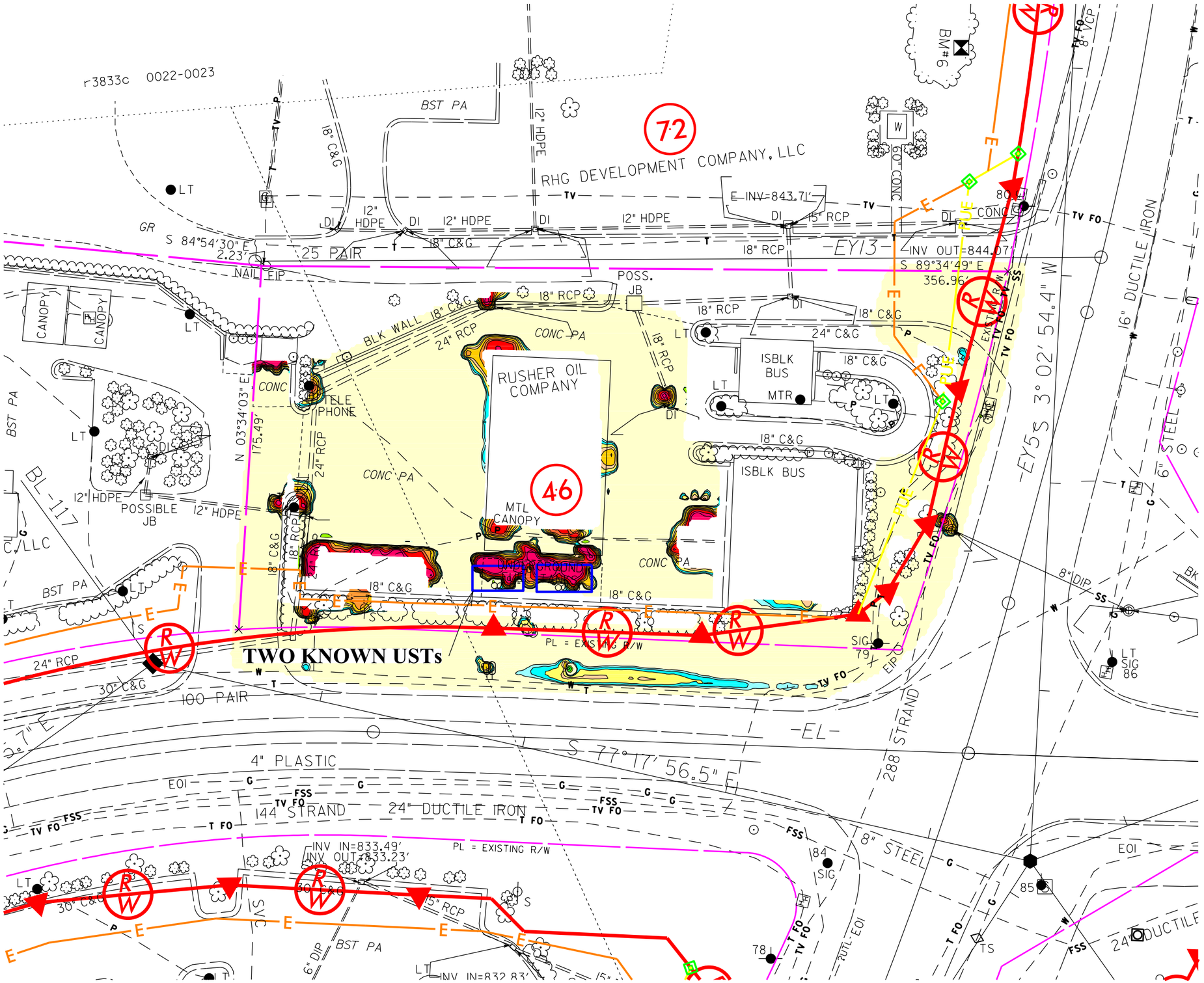
PROJECT: PARCEL 46 MOORESVILLE, NORTH CAROLINA NCDOT PROJECT R-3833C	TITLE: PARCEL 46 - LOCATIONS AND SIZES OF TWO KNOWN USTs	DATE: 9/3/2019	CLIENT: FALCON ENGINEERS
		PYRAMID PROJECT #: 2019-260	**FIGURE 4**



LEGEND

- EXISTING ROW
- EXISTING PROPERTY BOUNDARY
- PROPOSED ROW LINE
- TEMPORARY CONSTRUCTION EASEMENT
- PROPOSED PERMANENT UTILITY EASEMENT
- PROPOSED SS CUT LINE
- PROPOSED SS FILL LINE
- KNOWN UST

MILLIVOLTS (mV)

1000 750 500 400 300 200 150 100 75 60 50 40 30 -90 -100 -200 -400 -5000

N

0 25 50
FEET

TITLE: OVERLAY OF METAL DETECTION RESULTS AND TWO KNOWN USTs ON NCDOT ENGINEERING PLANS

PROJECT: PARCEL 46
MOORESVILLE, NORTH CAROLINA
NCDOT PROJECT R-3833C

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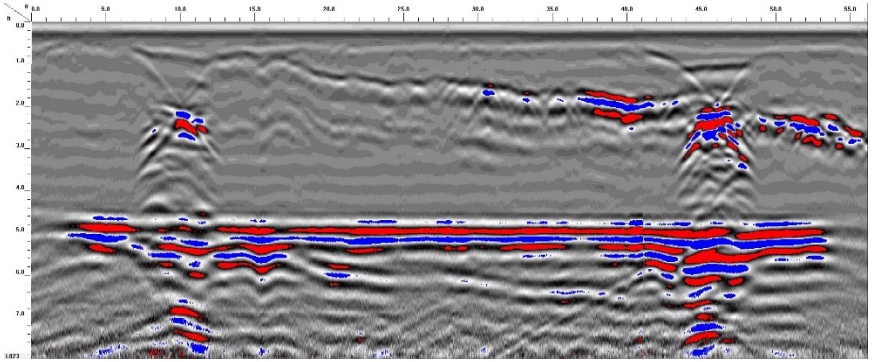
License # C1251 Eng. / #C257 Geology

DATE: 09-06-2019	REVISION NO. 0
PYRAMID PROJECT NO. 2019-260	FIGURE NO. 5

Appendix A – GPR Transect Images



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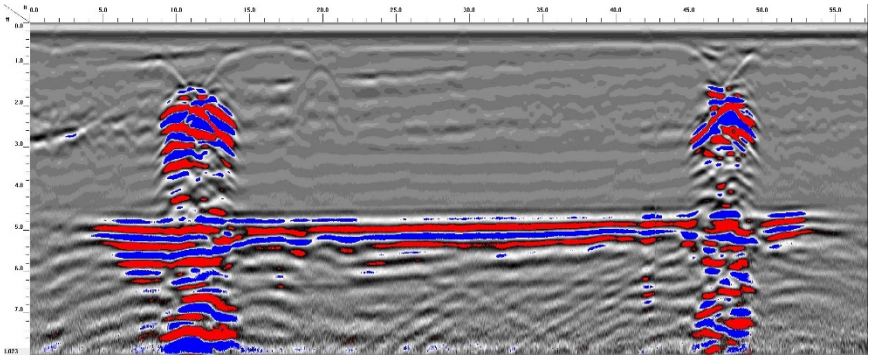

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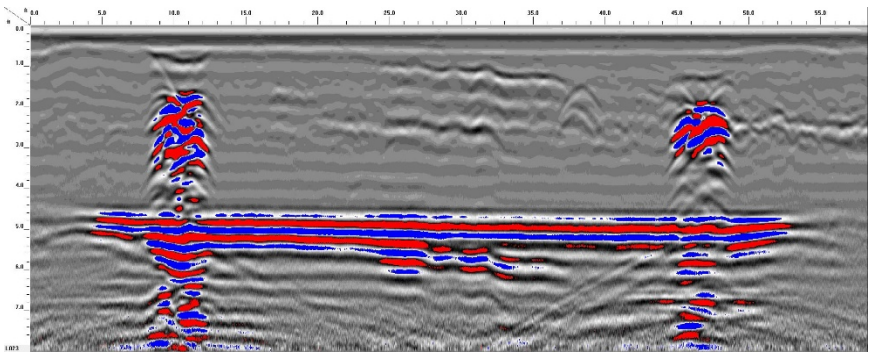

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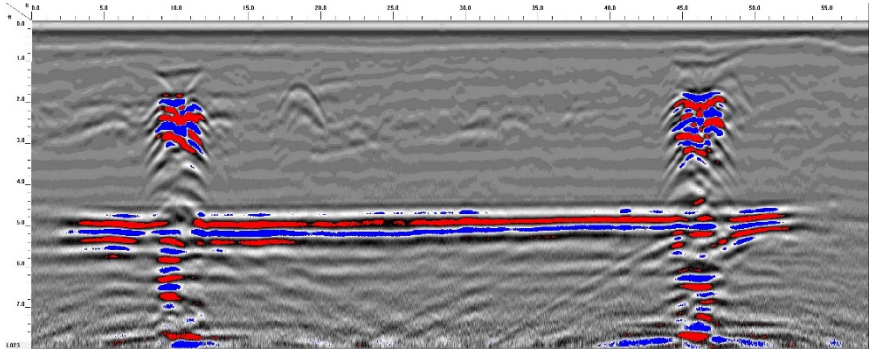

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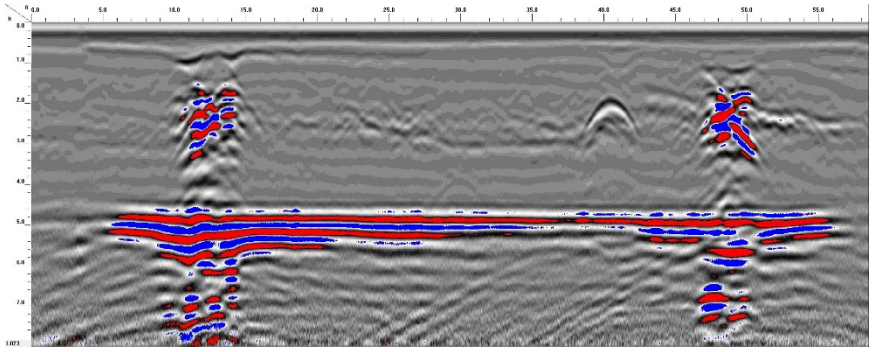

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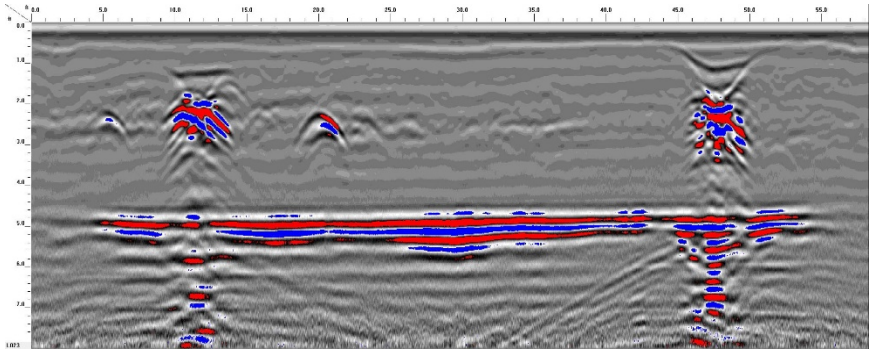

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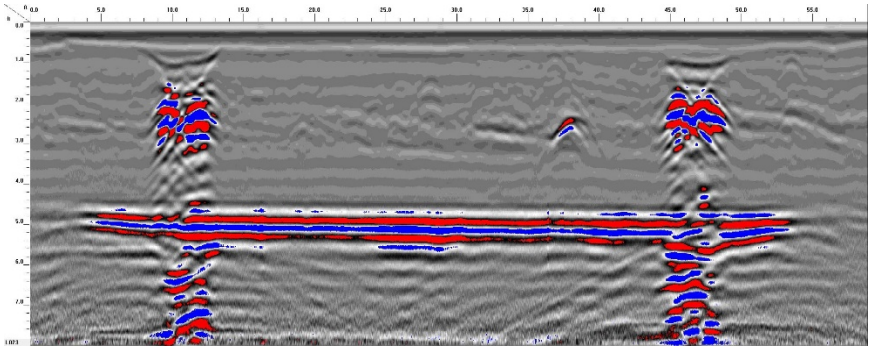

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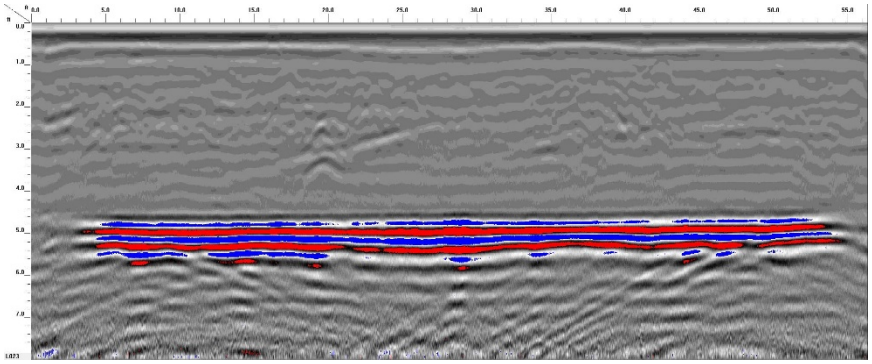

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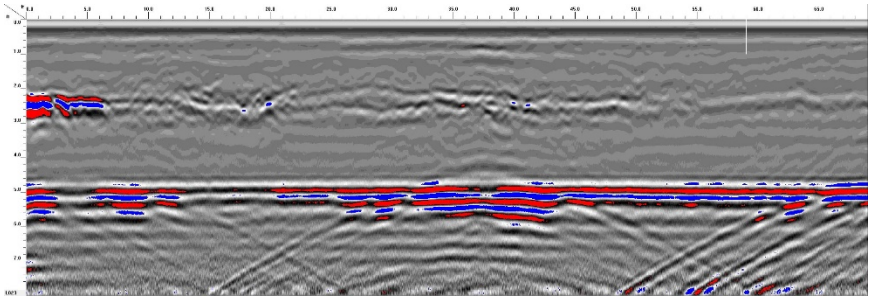

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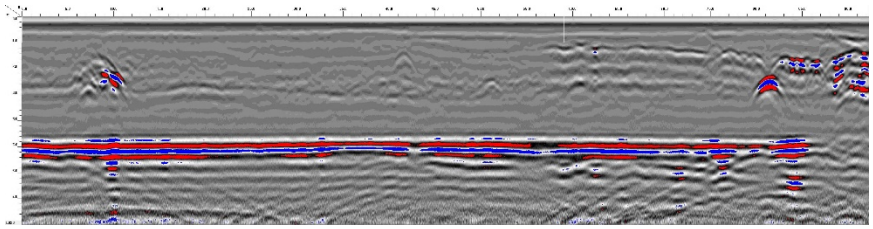

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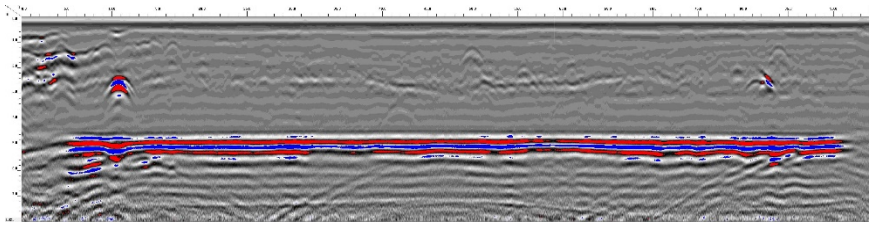

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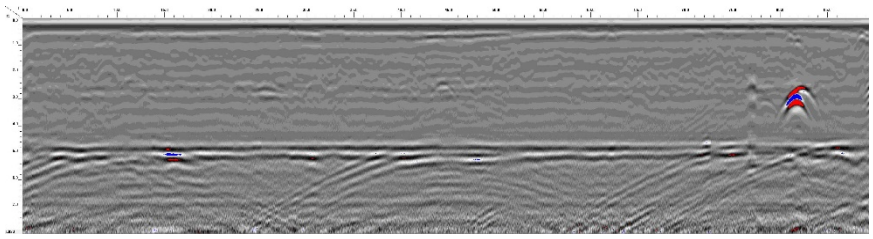

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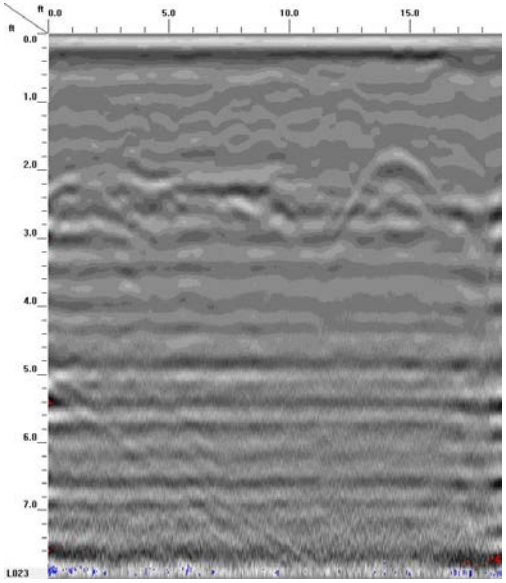

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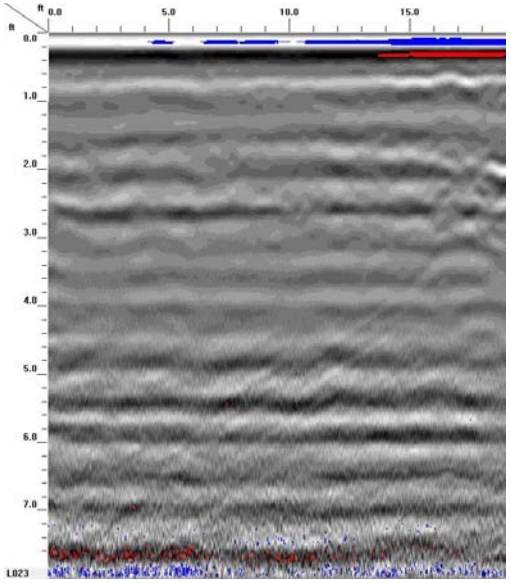
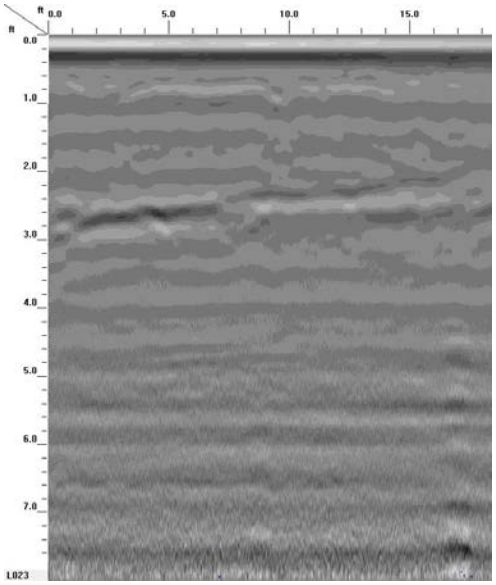


GPR TRANSECT 15



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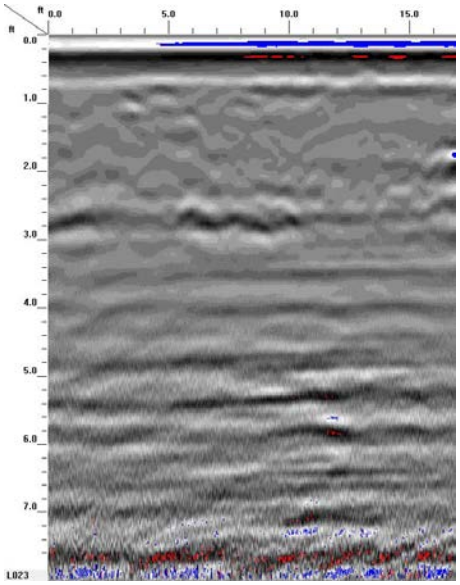

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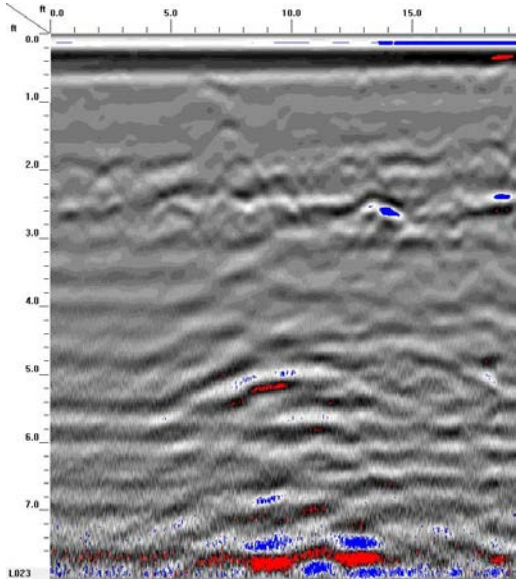
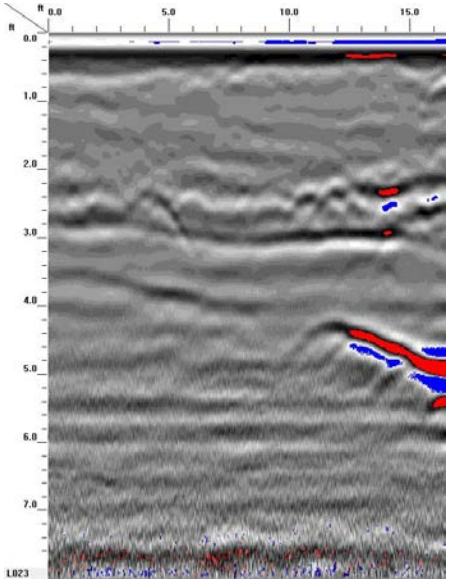


GPR TRANSECT 17



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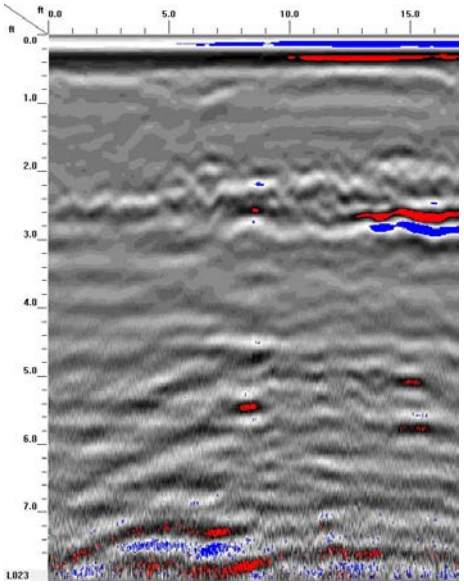
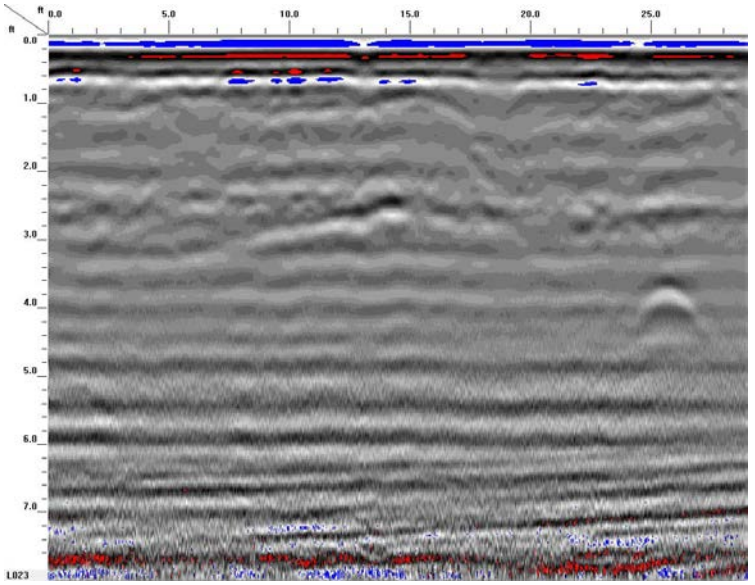


GPR TRANSECT 18



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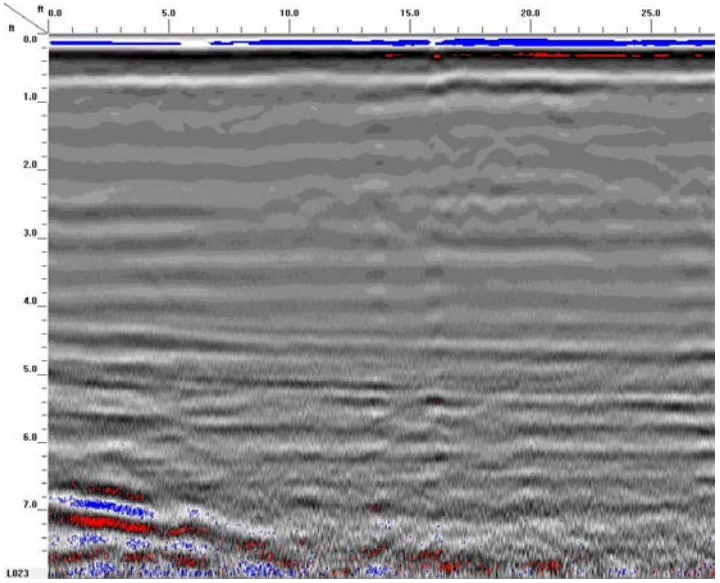
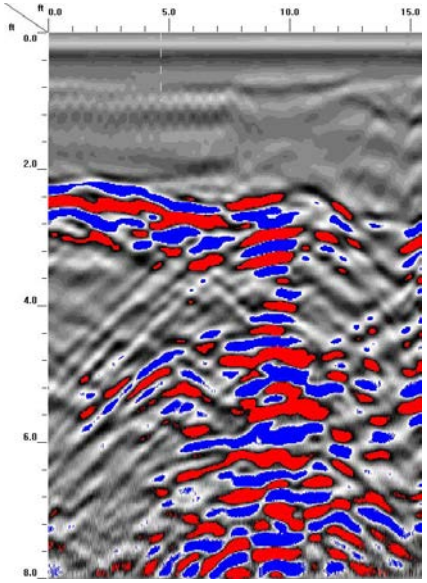


GPR TRANSECT 21



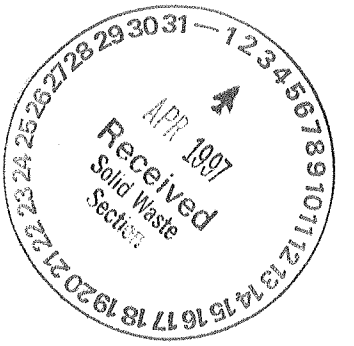
GPR TRANSECT 22

Duke Project As Listed On The NC Solid Waste Section's List of All Coal Ash Structural Fills:

Iredell; Brawley School Road;
Duke Power (L Evans); Duke Power; Marlo Corporation;
March, 1995; May 1, 1995;

Duke Power Company
Electric System Support
13339 Hagers Ferry Road
Huntersville, NC 28078-7929

DUKE POWER



March 31, 1997

William Hocutt
North Carolina Department of Environment,
Health and Natural Resources
Solid Waste Section
P.O. Box 27687
Raleigh, NC 27611-7687

SUBJECT: Structural Fill Closure Requirement
Record Number: 006021

Mr. Hocutt:

In accordance with Section .1706(d) of the Solid Waste Management Rules for the Beneficial Use of Coal Combustion By-Products, please find attached "Closure Certifications" for all of the coal ash structural fill projects conducted by Duke Power Company as listed on the NC Solid Waste Section's "List of All Coal Ash Structural Fills". In addition, a copy of the "Recordation Statement" for each project is also included. Please note that the "Recordation Statement" is a requirement of the land owner and is being provided by Duke Power as a courtesy/service to the land owner.

The information attached will supersede the closure certifications previously submitted on January 2, 1997. Therefore, the previously submitted closure information should be deleted from your file(s) and replaced with the attached.

If you have any questions concerning these documents, please contact me at 704-875-5956.

Larry D. Evans

L. D. Evans, CHMM
Scientist
Environmental Division - Waste Management

LDE/E03972

Attachments

RDDAVIS
CONSULTING
ENGINEERS

December 12, 1995

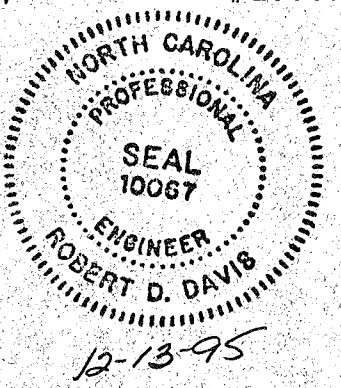
Re: Certificate of Compliance

This document shall serve as notice that property owned by Floyd Greene and William Grigg, located on Brawley School Road (known as the Brawley School Road Retail Site) has been developed with coal ash provided by Duke Power Company.

Whereas, this document is provided as evidence of compliance with all the requirements of Solid Waste Regulation Section 1700 and specifically to meet Section 1706 Closure of Structural Fill Facilities, part (d).

(9)

Robert D. Davis, P.E. N.C. #10067



12-13-95

P.O. Box 471851 • Charlotte, NC 28247-1851 • (704) 544-2223

BK0973PG0647

FILED
IREDELL COUNTY
96 FEB -2 AM 11:43

1/2

NORTH CAROLINA

IREDELL COUNTY

000139

BRENDA D. BELL
REGISTER OF DEEDS

ACKNOWLEDGMENT AND CONSENT

The undersigned, Marlo Corporation, a North Carolina corporation, and Monticello-Jefferson Corp., a North Carolina Corporation, in accordance with the provisions of N.C.G.S 130A-294 and 15A NCAC 13B.1703, acknowledge that they are the owners of the real property located in Davidson Township, Iredell County, North Carolina, and more specifically described on Schedule A attached hereto.

The undersigned further acknowledge and consent to the use of coal combustion by-products as structural fill on the real property described on Schedule A. The volume of coal combustion by-products placed on this property is estimated to be 102,578 tons.

The undersigned further agree to record this document as required by 15A NCAC 13B.1707.

IN WITNESS WHEREOF, Marlo Corporation has caused this instrument to be signed in its corporate name by its President and attested by its Secretary with its corporate seal to be hereunto affixed, and Monticello-Jefferson Corp. has caused this instrument to be signed in its corporate name by its President and attested by its Secretary with its corporate seal to be hereunto affixed, this 22nd day of January, 1996.

MARLO CORPORATION

BY: _____ President

(CORPORATE SEAL)

ATTEST: _____ Secretary

MONTICELLO-JEFFERSON CORP.

BY: _____ President

(CORPORATE SEAL)

ATTEST: _____ Secretary

Prepared by and returned to William E. Neel, Attorney, Mooresville, NC.

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

March 3, 1995

Mr. Larry D. Evans, Scientist
Electric System Support
Duke Power Company
13339 Hagers Ferry Road
Huntersville, NC 28078-7929

Subject: Coal Fly Ash Structural Fill at Brawley School Road Near Mooresville, NC in Iredell County Scheduled to Begin in Early March, 1995.

We are in receipt of your February 28, 1995 proposal for constructing the subject structural fill beginning as soon as possible and planned for completion by May 1, 1995. The information submitted satisfies the requirements for coal ash structural fill activities as set forth in Solid Waste Management Rules 15A NCAC 13B Section .1700 concerning beneficial use of coal combustion by-products.

We appreciate the additional information supplied by you to Bill Hocutt on March 3, 1995 about the french drain shown on your construction drawing. Our concern was that this might involve a perennial stream. That would have at least required additional separation of the fly ash from the stream. We are satisfied with the five feet of earthen cover since you state that any water at that location would arise from precipitation run-off and that the specified five feet cover was for the entire length of the french drain. You further stated that this did not involve ground water flowing through the site.

(over)

P.O. Box 27687, Raleigh, North Carolina 27611-7687 Telephone 919-733-4996 FAX 919-715-3605

As previously agreed to between Duke Power and the Solid Waste Management Division, Duke Power is accepting the responsibility of informing the landowner(s) of their responsibility should any groundwater contamination occur due to this structural fill activity.

Sincerely,

James C. Coffey

James C. Coffey
Permitting Branch Supervisor
Solid Waste Section

cc: Julian Foscue
Anthony Foster
Bill Hocutt
John P. Nerison, P.E.
Larry S. Harper

Duke Power Company
Electric System Support
13339 Hagers Ferry Road
Huntersville, NC 28078-7929

DUKE POWER

February 28, 1995

William Hocutt
North Carolina Department of Environment,
Health and Natural Resources
Solid Waste Section
401 Oberline Road
Suite 150
Raleigh, N. C. 27605

SUBJECT: Structural Fill Notification
Brawley School Road Property
Marlo Corporation & Grigg Investment
File: GS-707.02 (Fossil)

Mr. Hocutt:

In accordance with Section .1706 of the Solid Waste Management Rules (Requirements For Beneficial Use Of Coal Combustion By-Products), please find attached the required written notification for the referenced structural fill project. Included in the notification are construction plans required for coal combustion by-products applications greater than 10,000 cubic yards.

If you have any questions concerning the notification, please contact me at 704-875-5956.

Larry D. Evans

L. D. Evans, Scientist
Environmental Protection - Waste Management

LDE/D029519

Attachments

STRUCTURAL FILL NOTIFICATION

Duke Power Company
Brawley School Road Property
Marlo Corporation & Grigg Investment

The proposed project will utilize approximately 60,000 cubic yards of fly ash in a structural fill application to develop the property for marketing. The property is located at the intersection of US highway 21 and State Road 1100 (Brawley School Road) in Iredell County as indicated on the attached USGS map (Mooresville Quanrangle, North Carolina - 7.5 minute series). The project is scheduled to commence as soon as possible and to be completed on May 1, 1995. The fly ash will be supplied from Duke Power's Marshall Steam Station located on Highway 150 in eastern Catawba County at the following address:

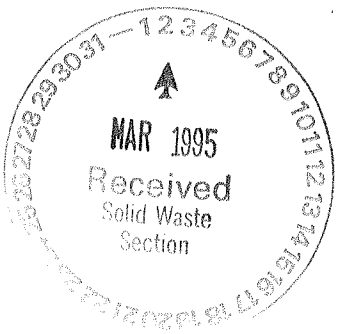
Duke Power Company
Marshall Steam Station
PO Box 210
Terrell, N.C. 28682

Larry Evans will serve as the Generator Contact and can be contacted at:

Larry Evans
Duke Power Company
13339 Hagers Ferry Road (MG03A5)
Huntersville, N.C. 28078-7929
Phone: 704-875-5956

The following documents are attached:

- Signed statement of acknowledgement and consent from property owner
- TCLP data and certification
- USGS Topographic map showing location of project
- Construction Plans



I certify that the TCLP analysis is representative of the fly ash to be used for this project.

Larry D. Evans

Larry D. Evans

HAZARDOUS WASTE SAMPLE RESULTS
APPLIED SCIENCE CENTER

STATION : Marshall

SAMPLE ID. : Marshall U-1 ash Leach

LAB.SERV. #: 9402095

TCLP Leach

ANALYSIS	RESULT		LIMIT	
AG:	< 0.20	mg/l	5.0	mg/l
BA:	0.47	mg/l	100	mg/l
CD:	< 0.03	mg/l	1.0	mg/l
CR:	0.77	mg/l	5.0	mg/l
PB:	< 1.0	mg/l	5.0	mg/l
AS:	< 0.10	mg/l	5.0	mg/l
SE:	0.27	mg/l	1.0	mg/l
HG:	< 0.001	mg/l	0.2	mg/l
NI:	NR	mg/l	134	mg/l
TL:	NR	mg/l	130	mg/l
% ASH:	NR	%	NO LIMIT	
BTU:	NR	BTU/lb	NO LIMIT	
TOT. S	NR	% wt.	NO LIMIT	
TOT. CL	NR	% wt.	NO LIMIT	
FLASH PT.	NR	Deg. F	< 140 Deg. F	
pH:	NR	Value	<2.0 or >12.5	
% WATER	NR	% wt.	NO LIMIT	

N/R: NOT REQUESTED.
* EXCEEDS RCRA LIMITS.

NORTH CAROLINA

IREDELL COUNTY

ACKNOWLEDGMENT AND CONSENT

The undersigned, Marlo Corporation, a North Carolina corporation, and William G. Grigg and wife, Jacqulinn O. Grigg, in accordance with the provisions of N.C.G.S 130A-294 and 15A NCAC 13B.1703, acknowledge that they are the owners of the real property located in Davidson Township, Iredell County, North Carolina, and more specifically described on Schedule A attached hereto.

The undersigned further acknowledge and consent to the use of coal combustion by-products as structural fill on the real property described on Schedule A. The volume of coal combustion by-products placed on this property is estimated to be 100,000 tons.

The undersigned further agree to record this document as required by 15A NCAC 13B.1707.

IN WITNESS WHEREOF, said individual parties have hereunto set their hand and said corporate party has caused this instrument to be signed in its corporate name by its President and attested with its corporate seal, this 27th day of February 1995.

MARLO CORPORATION

BY: _____
President

(CORPORATE SEAL)

ATTEST: Jennifer D. Robinson
Secretary

NORTH CAROLINA, IREDELL COUNTY.

I, Marcia K. Long, a Notary Public of the County and State aforesaid, certify that Jennifer D. Robinson personally came before me this day and acknowledged that she is _____ Secretary of Marlo Corporation, a North Carolina corporation, and that by authority duly given and as the act of the corporation, the foregoing instrument was signed in its name by its _____ President, sealed with its corporate seal and attested by her as its _____ Secretary. Witness my hand and official stamp or seal, this 27th day of February 1995.

Marcia K. Long
Notary Public

My Commission Expires:

11-6-98

NORTH CAROLINA, IREDELL COUNTY.

I, Marcia K. Long, a Notary Public of the County and State aforesaid, certify that William G. Grigg and wife, Jacqulinn O. Grigg, personally appeared before me this day and acknowledged the execution of the foregoing instrument. Witness my hand and official stamp or seal, this 27th day of February 1995.

Marcia K. Long
Notary Public

My Commission Expires:

11-6-98

NORTH CAROLINA. IREDELL COUNTY.

William G. Grigg (SEAL)

Jacqulinn O. Grigg (SEAL)

Schedule A

TRACT ONE:

BEGINNING at an existing iron pin in the line of Judith A. Lattavo, the northwest corner of First Church of the Nazarene of Mooresville, N.C., Inc. as described in Deed Book 882, page 79, Iredell County Registry; thence with the line of Lattavo North 84 deg. 33 min. 11 sec. West 1,708.29 feet to a point in the center of a creek, Lattavo corner; thence with center of creek South 19 deg.18 min. 37 sec. West 7.27 feet to a point in said creek; thence North 84 deg. 47 min. 23 sec. West 197.89 feet to an iron pin, Mary B. Hager corner; thence with Mary B. Hager line South 05 deg. 42 min. 37 sec. West 957 feet to a point in center of State Road No. 1100, Mary B. Hager corner; thence with center of State Road No. 1100 South 49 deg. 48 min. 12 sec. East 90.52 feet to a point in center of bridge on State Road No. 1100; thence South 55 deg. 25 min. 20 sec. East 122.28 feet to a nail in center of State Road No. 1100; thence South 60 deg. 34 min. 11 sec. East 60 feet to a nail in center of State Road No. 1100; thence South 67 deg. 29 min. 23 sec. East 50.85 feet to an iron pin at the south edge of pavement on State Road No. 1100; thence South 60 deg. 27 min. 52 sec. East 258.24 feet to an iron pin on the south side of State Road No. 1100, a corner of John C. Craver; thence with Craver line North 57 deg. 36 min. 11 sec. East 325.88 feet to an iron pin on the north side of State Road No. 1100, Craver corner; thence North 71 deg. 42 min. 28 sec. East 458.70 feet to an iron pin, Craver corner; thence with Craver line South 79 deg. 47 min. 32 sec. East 458.70 feet to an iron pin, Craver corner; thence North 76 deg. 12 min. 28 sec. East 301.13 feet to an iron pin in line of First Church of the Nazarene of Mooresville, N. C., Inc., Craver corner; thence with church line North 03 deg. 22 min. 39 sec. East 110 feet to an existing iron pin, Church corner; thence North 03 deg. 47 min. 32 sec. East 673.54 feet to the point of Beginning, containing 43.046 acres, more or less.

TRACT TWO:

BEGINNING at an existing iron pin in the western line of First Church of the Nazarene of Mooresville, Inc., the southeast corner of Miriam Hobbs Cooke et al (formerly Edith M. Hobbs) corner; thence with the line of the First Church of the Nazarene of Mooresville, Inc. South 03 deg. 22 min. 39 sec. West 155 feet passing over a concrete monument in the west edge of the right of way of U. S. Highway No. 21 to a point in the paved portion of N. C. State Road No. 1100 (Brawley School Road); thence with the pavement for State Road No. 1100 South 87 deg. 35 min. 41 sec. West 300.31 feet to a p.k. nail in pavement for State Road No. 1100; thence continuing with pavement for State Road No. 1100 South 87 deg. 52 min. 22 sec. West 461.37 feet to a p.k. nail in the pavement for State Road No. 1100; thence continuing with the pavement in State Road No. 1100 South 87 deg. 48 min. 47 sec. West 535.71 feet to a point in the pavement for State Road No. 1100, a corner of John C. Craver in the line of Miriam Hobbs Cooke, et al; thence with the line of Miriam Hobbs Cooke, et al North 57 deg. 36 min. 11 sec. East 150.09 feet to an iron pin, a corner of Miriam Hobbs Cooke et al; thence continuing with Miriam Hobbs Cooke, et al line North 71 deg. 42 min. 28 sec. East 458.70 feet to an iron pin, a corner of Miriam Hobbs Cooke, et al; thence continuing with Miriam Hobbs Cooke, et al line South 79 deg. 47 min. 32 sec. East 458.70 feet to an iron pin, a corner of Miriam Hobbs Cooke, et al; thence with line of Miriam Hobbs Cooke, et al North 76 deg. 12 min. 28 sec. East 301.13 feet to the beginning corner, containing 3.882 acres, more or less.

TRACT THREE:

BEGINNING at a point marked by a concrete monument, which monument marks the northwesternmost corner of the fifty-third tract described in the deed to Burlington Industries, Inc. from Mooresville Mills dated April 16, 1955, and being recorded in Deed Book 259, page 408, et seq., in the office of the Register of Deeds of Iredell County, North Carolina; and running from said

margin of land owned by Hobbs 944.50 feet to an iron pin in the center of the road, Floyd Harwell's corner in the original line; thence North 70 degrees 49 minutes 40 seconds East 74 feet, more or less, to a point in the centerline of U. S. Highway No. 21; thence northerly along the centerline of U. S. Highway No. 21, 1,000 feet, more or less, to a point on the northern margin of the original fifth-third tract as described in said deeds; thence South 89 degrees 15 minutes 40 seconds West along the northern margin of the original fifty-third tract 404 feet, more or less, to the point and place of beginning.

3930
650 000
FEET
3931
3932
32'30"
3933
3934
4855 III SW
(LAKE NORMAN NORTH)
3936
3937
35'
3938
TERRELL 6 MI.
3939
3940
Work
Creek
LAKE
NORMAN
Williamson Chapel
4 LANE
Davidson
Creek
Radio
Tower
Pumping
Sta
Community
Ch
Cem
Centre Ch
Reeds
Creek
Mt Mourne
SOUTHERN
PIPELINES
Drive-in
Theater
Golf
Course
Foursquare Ch
Filtration
Plant
Water
Tanks
BM 830
Substation
PIPELINE
Rocky
West
Branch
Substation
Dunbar Sch
SUMMER ST
ACADEMY
WILSON
MILL
CHURCH
BROAD
CENTER
Library
Industrial
Filtration
Plant
Radio
Tower
1104
1107
1181
1108
1191
1109
1190
1100
1305
1116
1160
1121
1135
115
1136
1138
1137
1128
1125
1117
150
1306
152
800
850
900
750
700

SCALE 1:24 000

0 1 MILE

3000 4000 5000 6000 7000 FEET

0 1 KILOMETER

INTERVAL 10 FEET

TIC VERTICAL DATUM OF 1929

NATIONAL MAP ACCURACY STANDARDS
J. S. GEOLOGICAL SURVEY
0225, OR RESTON, VIRGINIA 22092
MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

N. C.

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface

Secondary highway, hard surface

Light-duty road, hard or improved surface

Unimproved road

Interstate Route U. S. Route State Route

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1988

MOORESVILLE, N. C.

35080-E7-TF-024

PHOTOINSPECTED 1983

1969

DMA 4855 III SE—SERIES V842

GENERAL NOTES

1) THE PROPOSED PROJECT IS LOCATED ON THE MOORESVILLE SIDE ON USGS MAP. THE PROJECT WILL ALLOW THE PROPERTY TO BE MARKETED.
2) START CONSTRUCTION: MARCH 1, 1995
COMPLETE CONSTRUCTION: MAY 1, 1995
3) APPROXIMATELY 60,000 CY'S OF FLY ASH ARE NEEDED TO COMPLETE THE PROJECT.
4) COAL COMBUSTION BY-PRODUCT GENERATOR:
DUKE POWER COMPANY
MARSHALL STEAM STATION
PWR.# BOX 210
TERRELL, N.C. 28682
LARRY D. EVANS
(704)875-5956
5) FLY ASH SHALL BE PLACED IN 12" MAXIMUM LIFT THICKNESSES.
6) FLY ASH SHALL BE PLACED AT OR NEAR OPTIMUM MOISTURE CONTENT AND COMPACTED TO 95% OF THE STANDARD PROCTOR.
7) FIELD DENSITY TESTS SHALL BE TAKEN FOR EACH 2500 CY OF FLY ASH PLACED.
8) HAUL TRUCKS SHALL BE COVERED DURING TRANSPORT TO PREVENT FLY ASH FROM BLOWING OUT ON THE HIGHWAY AND CREATING A NUISANCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING UP ANY SPILLAGE.
9) SOIL COVER OVER ASH SHALL BE GRASSED AS INDICATED ON RETAIL SHEETS.
10) THE ASH SEDIMENTATION POND IS SIZED PER THE REQUIREMENTS OF THE N.C. EROSION CONTROL MANUAL. OUTLET PROJECTION IS PROVED SUCH THAT ZERO DISCHARGE OF FLY ASH PARTICLES FROM THE SITE OCCURS. SPECIFIC GRAVITY OF FLY ASH PARTICLES IS 2.55.
11) AT CLOSURE, THE SEDIMENTATION POND SHALL BE EMPTIED OF WATER, FILLED WITH COMPACTED ASH, COVERED WITH SOIL AND GRASSED.
12) PLACEMENT OF ASH IS IN ACCORDANCE WITH N.C. SOLID WASTE REGULATIONS SECTION 1700 "REQUIREMENTS FOR BENEFICIAL USE OF COAL COMBUSTION BY PRODUCTS".
13) COAL COMBUSTION BY-PRODUCTS USED AS A STRUCTURAL FILL SHALL NO BE PLACED:
A. WITHIN 50 HORIZONTAL FEET OF A JURISDICTIONAL WETLAND UNLESS AFTER CONSIDERATION OF THE CHEMICAL AND PHYSICAL IMPACT ON THE WETLAND, THE U.S. CORPS OF ENGINEERS ISSUES A PERMIT OR WAIVER FOR THE FILL:
B. WITHIN 50 HORIZONTAL FEET OF THE TOP OF THE BANK OF A PERENNIAL STREAM OR OTHER SURFACE WATER BODY:
C. WITHIN TWO FEET OF THE SEASONAL HIGH GROUND WATER TABLE:
D. WITHIN 100 HORIZONTAL FEET OF ANY SOURCE OF DRINKING WATER, SUCH AS A WELL, SPRING OR OTHER GROUNDWATER SOURCE OF DRINKING WATER:
E. WITHIN A AREA SUBJECT TO A ONE-HUNDRED YEAR FLOOD, UNLESS IT CAN BE DEMONSTRATED TO THE DIVISION THAT THE FACILITY WILL BE PROTECTED FROM INUNDATION, AND WASHOUT, AND THE FLOW OF WATER IS NOT RESTRICTED AND THE STORAGE VOLUME OF THE FLOOD PLAIN WILL NOT BE SIGNIFICANTLY REDUCED:
F. WITHIN 25 FEET OF ANY PROPERTY BOUNDARY:
G. WITHIN 25 FEET OF A BEDROCK OUTCROP.

GENERAL NOTES:

1. TOPOGRAPHIC SURVEY FURNISHED BY Piedmont Dynamics Corp.
2. SOIL TYPES: SANDY SILTS - HYDROLOGIC GROUP C
3. ALL CONSTRUCTION TO MEET STATE AND LOCAL STANDARDS.
4. OWNER/DEVELOPERS:

FLOYD GREENE
MARLO CORPORATION
P.O. BOX 1144
MOORESVILLE, NC 28115

WILLIAM CRIGG
WILLIAM G. CRIGG INVESTMENTS
RT. 9, BOX 519
MOORESVILLE, NC 28115

CONSTRUCTION SEQUENCE - BRAWLEY SCHOOL ROAD RETAIL SITE

1. OBTAIN PLAN APPROVAL FROM N.C. DEPARTMENT OF HEALTH AND NATURAL RESOURCES, AND LAND QUALITY SECTION AND ANY OTHER APPLICABLE PERMITS.
2. HOLD A PRECONSTRUCTION CONFERENCE WITH NCDHNR-LQ AT LEAST ONCE A WEEK PRIOR TO BEGINNING CONSTRUCTION.
3. CLEAR ONLY AS REQUIRED TO INSTALL SEDIMENT BASINS, AND CONSTRUCTION ENTRANCES.
4. HAVE EROSION CONTROL DEVICES INSPECTED BY NCDHNR-LQ.
5. CLEAR AND GRUB SITE.
6. GRADE ACCORDING TO CONTRACT DOCUMENTS.
7. GRASS OR OTHERWISE STABILIZE ALL DISTURBED AREAS.
8. REMOVE ALL OR ANY EROSION CONTROL DEVICES BY PERMISSION FROM NCDHNR-LQ.
9. AFTER REMOVAL OF EACH AND ALL DEVICES, RESHAPE AREAS AND GRASS OR OTHERWISE STABILIZE.
10. ALL EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH NCDHNR-LQ "EROSION SEDIMENT CONTROL PLANNING AND DESIGN MANUAL", LATEST EDITION.
11. ALL EROSION DEVICES TO BE INSPECTED WEEKLY AND AFTER EACH RAINFALL. NEEDED REPAIRS ARE TO BE MADE IMMEDIATELY.

SEDIMENT BASIN NOTES:

1. DIMENSIONS SHOWN FOR BASIN #1 ARE BASED ON 2.5:1 SIDE SLOPES.
2. ELEVATIONS AND EXACT LOCATION ON BASIN #1, TO BE FIELD SET TO MAXIMIZE EFFICIENCY.
3. SHAPES OF BASINS MAY BE MODIFIED TO FIT TERRAIN; VOLUMES SHALL HOLD.
4. ALL DESIGN PARAMETERS ARE TO BE MAINTAINED.
5. REMOVE SILT IN BASIN #1 WHEN SILT REACHES TOP OF STONE AROUND RISER.
6. ANTI-SEEP COLLARS IN BASIN #1 NOT TO BE LOCATED WITHIN 2.0' OF A PIPE JOINT.

SEDIMENT BASIN TO BE AS SHOWN
ON RESIDENTIAL PLANS AS APPROVED
BY NCDEHNR-LQ - SEE SHEETS 3&4 OF 20 ATTACHED

DENUDED AREA
781,374 sq. ft.
17.93 acres

DRAINAGE AREA1
1,337,135 sq. ft.
30.69 acres

EMERGENCY SPILLWAY

POND AREA SEDIMENT BASIN #1
44,145 sq. ft.
1.01 acres

HW 4 INV = 787.0

65 LF 48" RCP
US INV. = 808.0
DS INV. = 787.24

MH - 3
INV = 787.24
RIM = 802.50
5' DIA. MH MIN

DI 2 - INV = 808.5
RIM = 818.70
5' DIA. MH MIN

65 LF 48" RCP
US INV. = 810.5
DS INV. = 808.50

DI 1 INV = 810.5
RIM = 817.70
5' DIA. MH MIN

65 LF 48" RCP
US INV. = 787.24
DS INV. = 787.00

SPOIL AREA
GRADE TO DRAIN

SWALE LINED WITH NORTH AMERICAN GREEN C125 OR EQUAL

FFE 829.67

FFE 831.67

FFE 834.00

FFE 834.00

S. R. 1117

Brawley School Road

U.S. Highway #21

North

1 inch = 60 ft.

NOTES:
STRIPPINGS TO BE USED IN SLOPES OUTSIDE OF 45 DEGREES AND PLACED UNDER DEEP PARKING AREA FILLS AS APPROVED BY SOILS ENGINEER.
ALL FINNISHED GRADES SHOWN ARE TOP OF PAVEMENT/SLAB - ASSUME 8" FOR SUBGRADE.
VOLUMES SHOWN AT LEFT ARE CALCULATED FROM PROPOSED GRADES SHOWN TO EXISTING GROUND. NO ALLOWANCES HAVE BEEN MADE FOR STRIPPINGS OR SHRINKAGE. NO WARRENTIES ARE MADE OR IMPLIED FOR ACCURACY. CONTRACTOR TO MAKE INDEPENDENT VOLUME ANALISIS

Site Volume Table: Unadjusted

Site	Stratum	Surf1	Surf2	Cut	Fill	Net	Method
duke	new	eg	new	108610	162378	53768 (F)	Grid

NORTH CAROLINA PROFESSIONAL SEAL 10067 ENGINEER ROBERT D. DAVIS
2/23/95

Mario Corporation
and William G. Grigg Investments
Mooresville NC 28115
(704) 664-6353

1:5 MIN — COMPACTED EARTH SURFACE CAP
FLYASH
VARIES
EXISTING EARTH
5'- COMPACTED EARTH
FRENCH DRAIN

SECTION A-A
Not to Scale

Project Location Map

RD DAVIS CONSULTING ENGINEERS
6401 CARMEL ROAD
SUITE 110
P.O. BOX 471851
CHLT. N.C. 28247-1851
704-544-2223 - FAX 544-9976

Owner(s)
MARLO CORPORATION
&
GRIGG INVESTMENTS

Project
BRAWLEY SCHOOL RD PROPERTY
MIXED USE SUBDIVISION

Sheet Title
RETAIL SITE
REVISED GRADING PLAN
DUKE POWER FLYASH

RDD
ENGINEER
RDD
Drawn By
2-20-95
Date Drawn
ECPLAN2.DWG
CADD Dwg. Name
VIEW; PLOT1
Revisions
No ____ Date ____
No ____ Date ____
No ____ Date ____
No ____ Date ____
Issue Date 2-23-95

Project Number
121.001

Sheet Of
C1 2

6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT

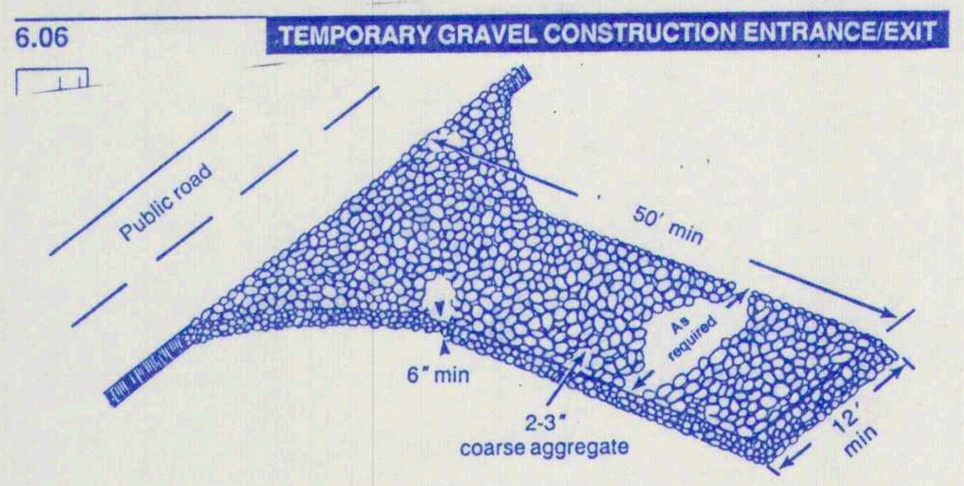


Figure 6.06a Gravel entrance/exit keeps sediment from leaving the construction site (modified from Va SWCC).

Maintenance Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2-inch stone. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary. Immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.

Construction Specifications

1. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade it.
2. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.
3. Provide drainage to carry water to a sediment trap or other suitable outlet.
4. Use geotextile fabrics because they improve stability of the foundation in locations subject to seepage or high water table.

6.41 OUTLET STABILIZATION STRUCTURE

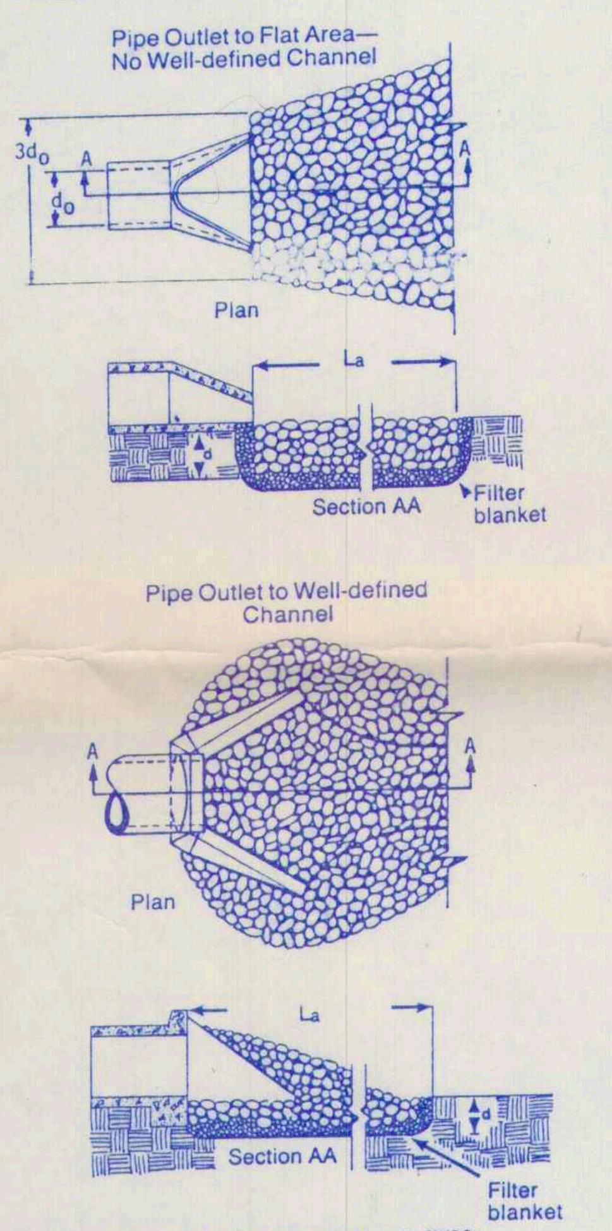


Figure 6.41c Riprap outlet protection (modified from Va SWCC).

Notes

1. L_a is the length of the riprap apron.
2. d = 1.5 times the maximum stone diameter but not less than 6".
3. In a well-defined channel extend the apron up the channel banks to an elevation of 6" above the maximum tailwater depth or to the top of the bank, whichever is less.
4. A filter blanket or filter fabric should be installed between the riprap and soil foundation.

Construction Specifications

1. Ensure that the subgrade for the filter and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.
2. The riprap and gravel filter must conform to the specified grading limits shown on the plans.
3. Filter cloth, when used, must meet design requirements and be properly protected from punching or tearing during installation. Repair any damage by removing the riprap and placing another piece of filter cloth over the damaged area. All connecting joints should overlap a minimum of 1 ft. If the damage is extensive, replace the entire filter cloth.
4. Riprap may be placed by equipment, but take care to avoid damaging the filter.
5. The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.
6. Riprap may be field stone or rough quarry stone. It should be hard, angular, highly weather-resistant and well graded.
7. Construct the apron on zero grade with no overfall at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.
8. Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.
9. Immediately after construction, stabilize all disturbed areas with vegetation (Practices 6.10, *Temporary Seeding*, and 6.11, *Permanent Seeding*).

Maintenance Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

OUTLET STRUCTURE CHART

	Qo	do	Vo	d50	d	La	W
HW4	121	48"	9.6fps	0.4'	0.9'	22'	12.8'
SED BAS.	14	18"	5.5	0.4'	0.9'	20	9.5'

6.32 TEMPORARY SLOPE DRAINS

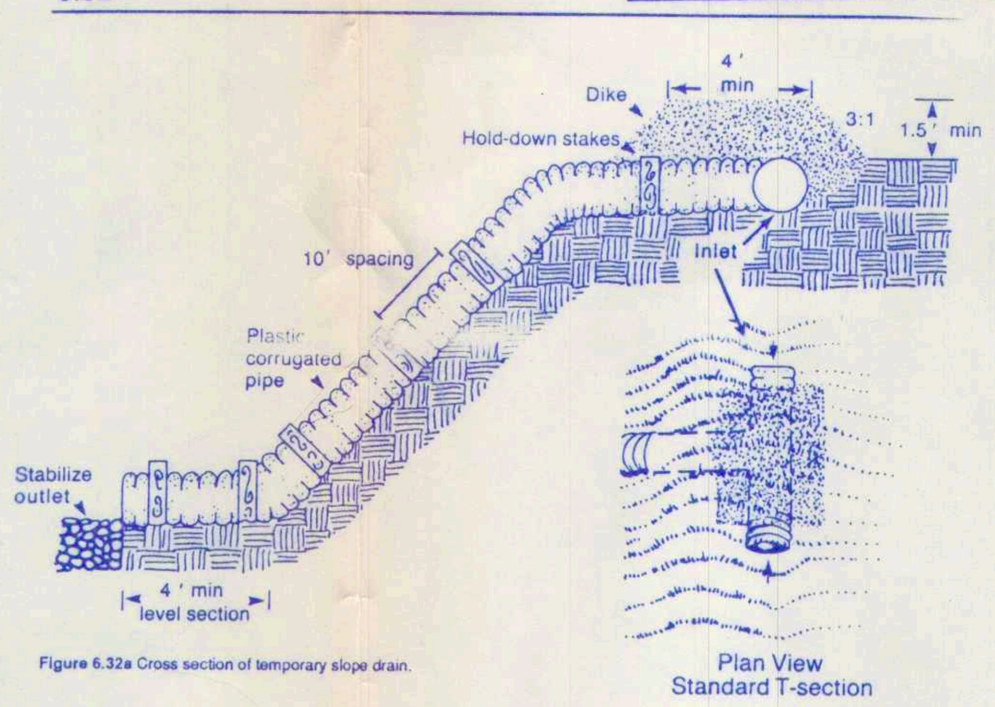


Figure 6.32a Cross section of temporary slope drain.

Entrance—Construct the entrance to the slope drain of a standard flared-end section of pipe with a minimum 6-inch metal toe plate (Figure 6.32a). Make all fittings watertight. A standard T-section fitting may also be used at the inlet.

Temporary diversion—Generally, use an earthen diversion with a dike ridge to direct surface runoff into the temporary slope drain. Make the height of the ridge over the drain conduit a minimum of 1.5 foot and at least 6 inches higher than the adjoining ridge on either side. The lowest point of the diversion ridge should be a minimum of 1 ft above the top of the drain so that design flow can freely enter the pipe.

Outlet protection—Protect the outlet of the slope drain from erosion (Practice 6.41, *Outlet Stabilization Structure*).

Construction Specifications A common failure of slope drains is caused by water saturating the soil and seeping along the pipe. This creates voids from consolidation and piping and causes washouts. Proper backfilling around and under the pipe "haunches" with stable soil material and hand compacting in 6-inch lifts to achieve firm contact between the pipe and the soil at all points will eliminate this type of failure.

1. Place slope drains on undisturbed soil or well-compacted fill at locations and elevations shown on the plans.
2. Slightly slope the section of pipe under the dike toward its outlet.
3. Hand tamp the soil under and around the entrance section in lifts not to exceed 6 inches.
4. Ensure that fill over the drain at the top of the slope has minimum dimensions of 1.5 ft depth, 4 ft top width, and 3:1 side slopes.
5. Ensure that all slope drain connections are watertight.
6. Ensure that all fill material is well-compacted. Securely fasten the exposed section of the drain with grommets or stakes spaced no more than 10 ft apart.
7. Extend the drain beyond the toe of the slope and adequately protect the outlet from erosion.
8. Make the settled, compacted dike ridge no less than 1 ft above the top of the pipe at every point.
9. Immediately stabilize all disturbed areas following construction.

Maintenance Inspect the slope drain and supporting diversion after every rainfall and promptly make necessary repairs. When the protected area has been permanently stabilized, temporary measures may be removed, materials disposed of properly, and all disturbed areas stabilized appropriately.

6.81 SUBSURFACE DRAIN

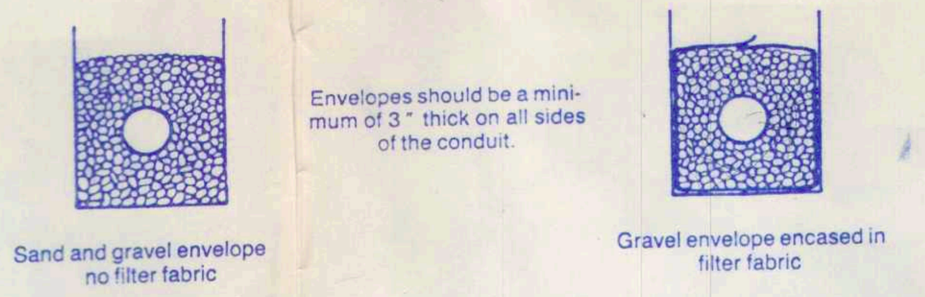


Figure 6.81e Drainage envelopes and filters (modified from USDA-SCS).

Outlet—Ensure that the outlet of a drain empties into a channel or other watercourse above the normal water level.

Use outlet pipe of corrugated metal, cast iron, steel pipe, or heavy-duty plastic without perforations and at least 10 ft long. Do not use an envelope or filter material around the outlet pipe, and bury at least two-thirds of the pipe length.

When outlet velocities exceed those allowable for the receiving stream, outlet protection must be provided (*Reference: Outlet Protection*).

Secure an animal guard to the outlet end of the pipe to keep out rodents.

Material—Acceptable materials for subsurface drains include perforated, continuous closed-joint conduits of corrugated plastic, corrugated metal, concrete, and bituminized fiber. Ensure that the strength and durability of the pipe meet the requirements of the site and are in keeping with the appropriate ASTM specification for the materials used.

Construction Specifications

1. Dig a trench to grade 3 inches below the design bottom elevation of the pipe to accommodate the envelope or filter material.
2. Stabilize any soft, yielding soils under the drain with gravel or other suitable material.
3. Lay pipe on the design grade and elevation avoiding reverse grade or low spots.
4. Do not use damaged, deformed, warped, or otherwise unsuitable pipe.
5. Place envelope or filter material around pipe with at least 3 inches of material on all sides.
6. Ensure that gravel for envelopes around flexible pipe does not exceed 3/4 inch in size to prevent damage to the pipe.
7. Place filter cloth over gravel envelopes to prevent movement of soil into the gravel.
8. Backfill immediately after placement of the pipe. Ensure that the backfill material does not contain rocks or other sharp objects and place it in the trench in a manner that will not damage or displace the pipe. Overfill the trench slightly to allow for settlement.
9. For the outlet section of the drain, use at least 10 ft of nonperforated corrugated metal, cast iron, steel, or heavy-duty plastic pipe. Cover at least two-thirds of the pipe length with well-compacted soil.
10. Keep the settled fill over the pipe outlet slightly higher than the surrounding ground to prevent erosion and wash-out from surface runoff.
11. Place a suitable animal guard securely over the pipe outlet to keep out rodents.
12. Cap the upper end of each drain with a standard cap made for this purpose or with concrete or other suitable material to prevent soil from entering the open end.

Maintenance A properly designed and installed subsurface drain requires little maintenance. However, check drains periodically and especially after heavy rains to see that they are operating properly. Keep the outlets free of sediment and other debris, and keep the animal guard in place and functional. Investigate any wet areas along the line for possible cave-in due to vehicle traffic, blockage by roots, or other problems. Make all needed repairs promptly.

6.62 SEDIMENT FENCE (SILT FENCE)

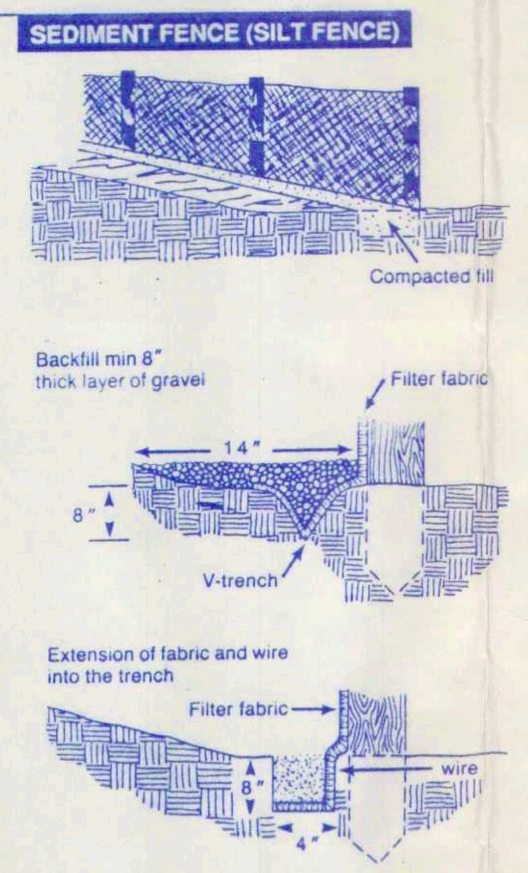


Figure 6.62a Installation detail of a sediment fence.

Construction Specifications

MATERIALS

1. Use a synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn, which is certified by the manufacturer or supplier as conforming to the requirements shown in Table 6.62b.

Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120° F.

2. Ensure that posts for sediment fences are either 4-inch diameter pine, 2-inch diameter oak, or 1.33 lb/linear ft steel with a minimum length of 4 ft. Make sure that steel posts have projections to facilitate fastening the fabric.
3. For reinforcement of standard strength filter fabric, use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.

Table 6.62b Specifications For Sediment Fence Fabric

Physical Property	Requirements
Filtering Efficiency	85% (min)
Tensile Strength at 20% (max.) Elongation	Standard Strength- 30 lb/lin in (min) Extra Strength- 50 lb/lin in (min)
Slurry Flow Rate	0.3 gal/sq ft/min (min)

CONSTRUCTION

1. Construct the sediment barrier of standard strength or extra strength synthetic filter fabrics.
2. Ensure that the height of the sediment fence does not exceed 18 inches above the ground surface. (Higher fences may impound volumes of water sufficient to cause failure of the structure.)
3. Construct the filter fabric from a continuous roll cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the filter cloth only at a support post with overlap to the next post.
4. Support standard strength filter fabric by wire mesh fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long or tie wires. Extend the wire mesh support to the bottom of the trench.
5. When a wire mesh support fence is used, space posts a maximum of 8 ft apart. Support posts should be driven securely into the ground to a minimum of 18 inches.
6. Extra strength filter fabric with 6-ft post spacing does not require wire mesh support fence. Staple or wire the filter fabric directly to posts.
7. Excavate a trench approximately 4 inches wide and 8 inches deep along the proposed line of posts and upslope from the barrier (Figure 6.62a).
8. Backfill the trench with compacted soil or gravel placed over the filter fabric.
9. Do not attach filter fabric to existing trees.

Maintenance Inspect sediment fences at least once a week and after each rainfall. Make any required repairs immediately.

Should the fabric of a sediment fence collapse, tear, decompose or become ineffective, replace it promptly. Replace burlap every 60 days.

Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.

Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized.

6.50 EXCAVATED DROP INLET PROTECTION (Temporary)

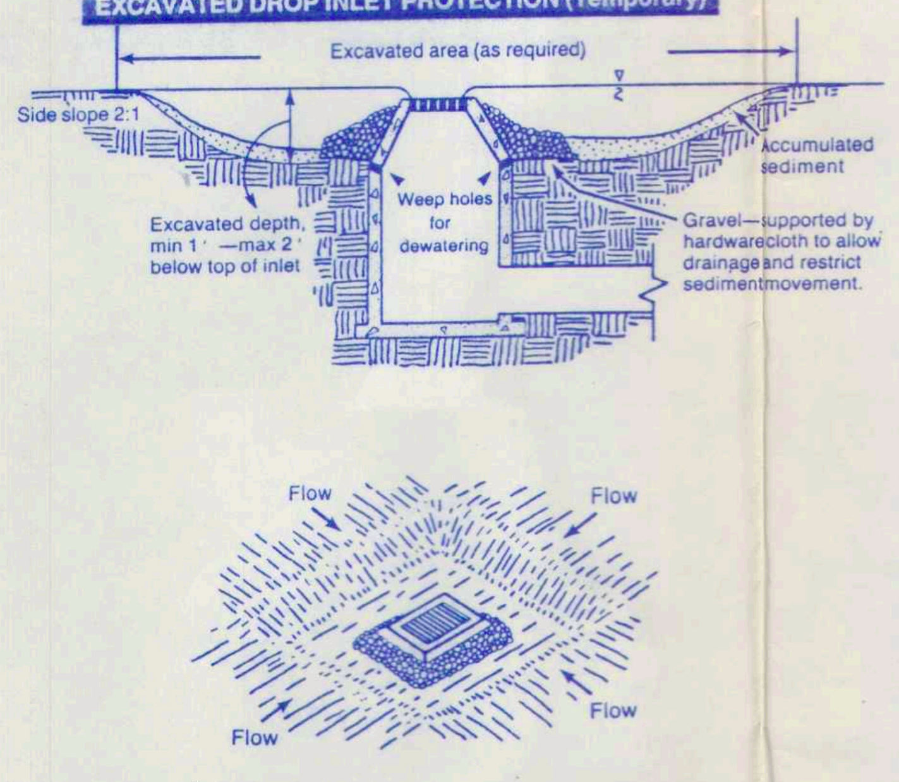


Figure 6.50a Excavated drop inlet protection.

Construction Specifications

1. Clear the area of all debris that might hinder excavation and disposal of spoil.
2. Grade the approach to the inlet uniformly.
3. Protect weep holes by gravel.
4. When the contributing drainage area has been permanently stabilized, seal weep holes, fill the basin with stable soil to final grading elevations, compact it properly, and stabilize.

Maintenance Inspect, clean, and properly maintain the excavated basin after every storm until the contributing drainage area has been permanently stabilized. To provide satisfactory basin storage, remove sediment when the volume of the basin has been reduced by one-half. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize it appropriately.

ROCK DAM

Construction Specifications

1. Clear the areas under the embankment and strip it of roots and other objectionable material. Clear the reservoir area to facilitate sediment removal.
2. Excavate a cutoff trench a minimum of 2 ft deep and 2 ft wide with 1:1 side slopes under the total length of the dam at its centerline. Line the trench with extra-strength filter fabric before backfilling with rock. Apply filter fabric under the rockfill embankment, from the upstream edge of the keyway to the downstream edge of the apron. Overlap filter material a minimum of 1 ft at all joints, with the upstream strip laid over the downstream strip.
3. Construct the embankment with well-graded rock and gravel to the size and dimensions shown on the drawings. It is important that rock abutments be at least 2 ft higher than the spillway crest and at least 1 ft higher than the downstream face of the dam, all the way to the toe, to prevent scour and erosion at the abutments.
4. Sediment-laden water from the construction site should be diverted into the basin reservoir at the furthest area from the dam.
5. Construct the rock dam before the basin area is cleared to minimize sediment yield from construction of the basin. Stabilize immediately all areas disturbed during the construction of the dam except the sediment pool (*References: Surface Stabilization*).
6. Safety—Sediment basins should be considered dangerous because they attract children. Steep side slopes should be avoided. Fences with warning signs may be needed if trespassing is likely. All state and local requirements must be followed.

Maintenance Check sediment basins after each rainfall. Remove sediment and restore original volume when sediment accumulates to about one-half the design volume.

Check the structure for erosion, piping, and rock displacement after each significant rainstorm and repair immediately.

Remove the structure and any unstable sediment immediately after the construction site has been permanently stabilized. Smooth the basin site to blend with the surrounding area and stabilize. All water and sediment should be removed from the basin prior to dam removal. Sediment should be placed in designated disposal areas and not allowed to flow into streams or drainageways during structure removal.

TEMPORARY ROCK DAM

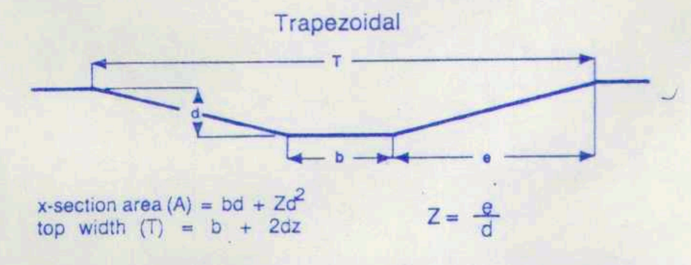
DRAINAGE AREA	10.00 AC
RUNOFF COEFF.(C)	0.4
10YR INTENSITY	7.0 IN/HR
10YR DISCARGE	28.00 CFS
DENUDED AREA	10.00 AC
STORAGE REQUIRED	18,000 CF
STORAGE PROVIDED	18,843 CF
TOP OF DAM/BERM	106.00
WIER ELEVATION	104.00
BOTTOM OF BASIN	100.00 (DATUM)
WIER WIDTH	10.00 FT
DRIVING HEAD	1.00 FT
BASIN SIDE SLOPES	2:1
BASIN DIMENSIONS	50'X 100' BOTT.
EMBANKMENT WIDTH	5.00 FT
EMBANKMENT SLOPES	2:1 upstream 3:1 downstream

WIER CALCULATION

Q=CwLH^(3/2)

Q = DISCHARGE (CFS)
Cw = WIER COEFF. (3.0)
L = WIER LENGTH (FT)
H = DRIVING HEAD (FT)

6.30 GRASS-LINED CHANNELS



Z = 3
b = 8
d = 2

x-section area (A) = bd + Zd²
top width (T) = b + 2dz
Z = e/d

Drainage—Install subsurface drains in locations with high water tables or seepage problems that would inhibit establishment of vegetation in the channel. Stone channel bottom lining may be needed where prolonged low flow is anticipated.

Outlets—Evaluate the outlets of all channels for carrying capacity and stability and protect them from erosion by limiting the exit velocity (Practice 6.41, *Outlet Stabilization Structure*).

Sedimentation protection—Protect permanent grass channels from sediment produced in the watershed, especially during the construction period. This can be accomplished by the effective use of diversions, sediment traps, protected side inlets, and vegetative filter strips along the channel.

Construction Specifications

1. Remove all trees, brush, stumps, and other objectionable material from the foundation area and dispose of properly.
2. Excavate the channel and shape it to neat lines and dimensions shown on the plans plus a 0.2-ft overcut around the channel perimeter to allow for bulking during seedbed preparations and sod buildup.
3. Remove and properly dispose of all excess soil so that surface water may enter the channel freely.
4. The procedure used to establish grass in the channel will depend upon the severity of the conditions and selection of species. Protect the channel with mulch or a temporary liner sufficent to withstand anticipated velocities during the establishment period (*Appendix 8.05*).

Maintenance During the establishment period, check grass-lined channels after every rainfall. After grass is established, periodically check the channel; check it after every heavy rainfall event. Immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes. Remove all significant sediment accumulations to maintain the designed carrying capacity. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel (Practice 6.11, *Permanent Seeding*).

6.20 TEMPORARY DIVERSIONS

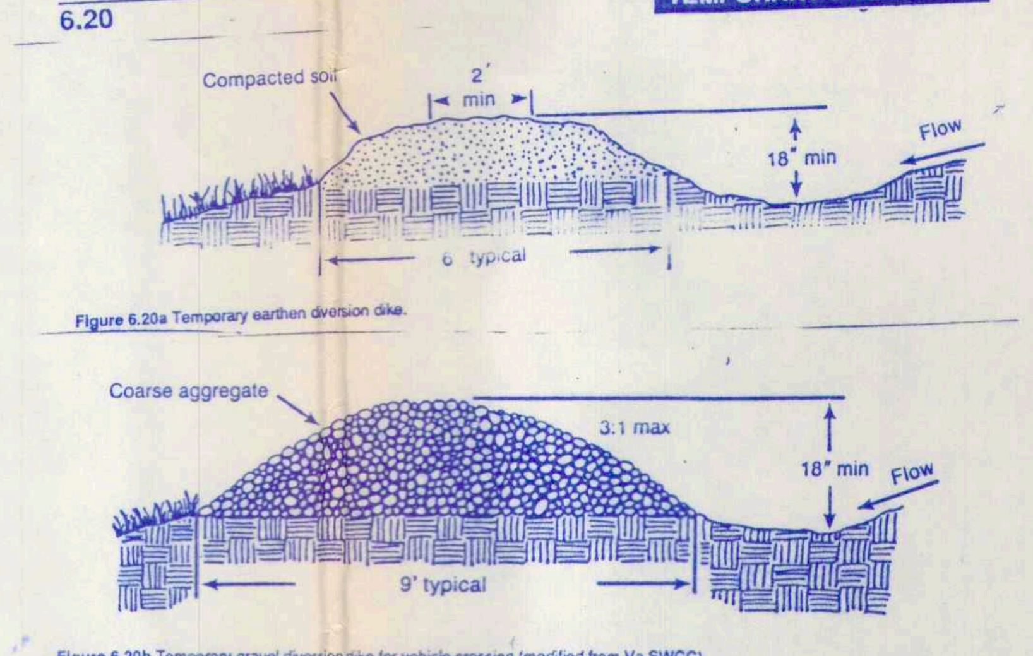


Figure 6.20a Temporary earthen diversion dike.

Figure 6.20b Temporary gravel diversion dike for vehicle crossing (modified from Va SWCC).

Construction Specifications

1. Remove and properly dispose of all trees, brush, stumps, and other objectionable material.
2. Ensure that the minimum constructed cross section meets all design requirements.
3. Ensure that the top of the dike is not lower at any point than the design elevation plus the specified settlement.
4. Provide sufficient room around diversions to permit machine regrading and cleanout.
5. Vegetate the ridge immediately after construction, unless it will remain in place less than 30 working days.

Maintenance Inspect temporary diversions once a week and after every rainfall. Immediately remove sediment from the flow area and repair the diversion ridge. Carefully check outlets and make timely repairs as needed. When the area protected is permanently stabilized, remove the ridge and the channel to blend with the natural ground level and appropriately stabilize it.

Table 6.10a Temporary Seeding Recommendations for Late Winter and Early Spring

Seeding mixture

Species	Rate (lb/acre)
Rye (grain)	120
Annual lespedeza (Kobe in Piedmont and Coastal Plain, Korean in Mountains)	50

Omit annual lespedeza when duration of temporary cover is not to extend beyond June.

Seeding dates
Mountains—Above 2500 ft: Feb. 15 - May 15
Below 2500 ft: Feb. 1 - May 1
Piedmont—Jan. 1 - May 1
Coastal Plain—Dec. 1 - Apr. 15

Soil amendments
Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

Mulch
Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance
Refertilize if growth is not fully adequate. Reseed, refertilize and mulch immediately following erosion or other damage.

Table 6.11n Seeding No. 4P for: Gentle Slopes, Soils Somewhat Warmer or Drier than 3P, or with Physical Limitations; High Maintenance

Seeding mixture

Species[1]	Rate (lb/acre)
Blend of 50% KY-31 tall fescue and 50% mixture of two or more turf-type tall fescues	200-250
or	
Blend of three or more turf-type tall fescues	200-250

Seeding dates

	Best	Possible
Fall:	Aug. 25 - Sept. 15	Aug. 20 - Oct. 25
Winter:	—	Feb. 1 - Mar. 31

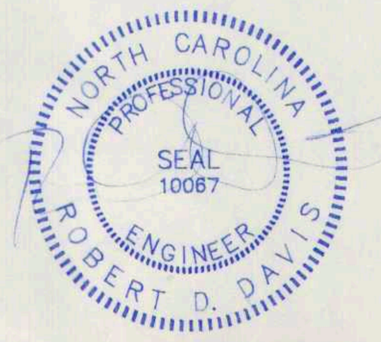
For quality turf avoid spring seeding. Where grading is completed during late winter or spring, an alternative is to seed 30 lb/acre Kobe lespedeza, keep mowed, prepare seedbed, and seed permanent mixture between Aug. 25 and Sept. 15.

Soil amendments
Apply lime and fertilizer according to soil tests, or apply 4,000 lb/acre ground agricultural limestone and 1,000 lb/acre 10-10-10 fertilizer.

Mulch
Apply 4,000 lb/acre grain straw or equivalent cover of another suitable mulch. Anchor straw by tacking with asphalt, roving, or netting or by crimping with a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

Maintenance
Fertilize according to soil tests or apply 40 lb/acre nitrogen in Jan. or Feb., 40 lb in Sept., and 40 lb in Nov., from a 12-4-8, 16-4-8, or similar turf fertilizer. Avoid fertilizer applications during warm weather, as this increases stand losses to disease. Reseed, fertilize, and mulch damaged areas immediately. Mow to a height of 2.5-3.5 inches as needed.

[1]Refer to *Appendix 8.02* for botanical names.



PRELIMINARY DRAWINGS DO NOT USE FOR CONSTRUCTION

RDDAVIS CONSULTING ENGINEERS

Owner: MARLO CORPORATION & GRIGG INVESTMENTS

Project: BRAWLEY SCHOOL RD PROPERTY MIXED USE SUBDIVISION RETAIL AREA

Sheet Title: SITE PREP DETAILS

ENGINEER	RDD
Drawn By	RDD
Date Drawn	8-26-93
CADD Dwg. Name	DETAILS.DWG
Revisions	VIEW: PLOT1
No. 2	Date 2/20/95
Issue Date	~~8-30-93~~ 2/23/95
Project Number	121.001
Sheet	C2
Of	2