

ROUTE SR2366 PROJECT 17BP.5.R.79 COUNTY OF Wake STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

RIGHT OF WAY ENCROACHMENT AGREEMENT

-AND-

PRIMARY AND SECONDARY HIGHWAYS

Public Service Co. of North Carolina, Inc A South
Carolina Co., dba Dominion Energy North Carolina

THIS AGREEMENT, made and entered into this the 4th day of November 20 21 by and between the Department of Transportation, party of the first part; and Public Service Company of North Carolina, Incorporated A South Carolina Company, dba Dominion Energy North Carolina party of the second part,

W I T N E S S E T H

THAT WHEREAS, the party of the second part desires to encroach on the right of way of the public road designated as Route(s) As above, located approximately 0.1 mile southwest of junction with US64

with the construction and/or erection of: Buried gas line relocated farther away from bridge to resolve conflicts and abandonment and/or removal of existing buried gas line within conflict zone with NCDOT PROJECT: 17BP.5.R.79

WHEREAS, it is to the material advantage of the party of the second part to effect this encroachment, and the party of the first part in the exercise of authority conferred upon it by statute, is willing to permit the encroachment within the limits of the right of way as indicated, subject to the conditions of this agreement;

NOW, THEREFORE, IT IS AGREED that the party of the first part hereby grants to the party of the second part the right and privilege to make this encroachment as shown on attached plan sheet(s), specifications and special provisions which are made a part hereof upon the following conditions, to wit:

That the installation, operation, and maintenance of the above described facility will be accomplished in accordance with the party of the first part's latest POLICIES AND PROCEDURES FOR ACCOMMODATING UTILITIES ON HIGHWAY RIGHTS-OF-WAY, and such revisions and amendments thereto as may be in effect at the date of this agreement. Information as to these policies and procedures may be obtained from the Division Engineer or State Utility Agent of the party of the first part.

That the said party of the second part binds and obligates himself to install and maintain the encroaching facility in such safe and proper condition that it will not interfere with or endanger travel upon said highway, nor obstruct nor interfere with the proper maintenance thereof, to reimburse the party of the first part for the cost incurred for any repairs or maintenance to its roadways and structures necessary due to the installation and existence of the facilities of the party of the second part, and if at any time the party of the first part shall require the removal of or changes in the location of the said facilities, that the said party of the second part binds himself, his successors and assigns, to promptly remove or alter the said facilities, in order to conform to the said requirement, without any cost to the party of the first part.

That the party of the second part agrees to provide during construction and any subsequent maintenance proper signs, signal lights, flagmen and other warning devices for the protection of traffic in conformance with the latest Manual on Uniform Traffic Control Devices for Streets and Highways and Amendments or Supplements thereto. Information as to the above rules and regulations may be obtained from the Division Engineer of the party of the first part.

That the party of the second part hereby agrees to indemnify and save harmless the party of the first part from all damages and claims for damage that may arise by reason of the installation and maintenance of this encroachment.

That the party of the second part agrees to restore all areas disturbed during installation and maintenance to the satisfaction of the Division Engineer of the party of the first part. The party of the second part agrees to exercise every reasonable precaution during construction and maintenance to prevent eroding of soil; silting or pollution of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces or other property; or pollution of the air. There shall be compliance with applicable rules and regulations of the North Carolina Division of Environmental Management, North Carolina Sedimentation Control Commission, and with ordinances and regulations of various counties, municipalities and other official agencies relating to pollution prevention and control. When any installation or maintenance operation disturbs the ground surface and existing ground cover, the party of the second part agrees to remove and replace the sod or otherwise reestablish the grass cover to meet the satisfaction of the Division Engineer of the party of the first part.

That the party of the second part agrees to assume the actual cost of any inspection of the work considered to be necessary by the Division Engineer of the party of the first part.

That the party of the second part agrees to have available at the construction site, at all times during construction, a copy of this agreement showing evidence of approval by the party of the first part. The party of the first part reserves the right to stop all work unless evidence of approval can be shown.

Provided the work contained in this agreement is being performed on a completed highway open to traffic; the party of the second part agrees to give written notice to the Division Engineer of the party of the first part when all work contained herein has been completed. Unless specifically requested by the party of the first part, written notice of completion of work on highway projects under construction will not be required.

That in the case of noncompliance with the terms of this agreement by the party of the second part, the party of the first part reserves the right to stop all work until the facility has been brought into compliance or removed from the right of way at no cost to the party of the first part.

That it is agreed by both parties that this agreement shall become void if actual construction of the work contemplated herein is not begun within one (1) year from the date of authorization by the party of the first part unless written waiver is secured by the party of the second part from the party of the first part.

During the performance of this contract, the second party, for itself, its assignees and successors in interest (hereinafter referred to as the "contractor"), agrees as follows:

- a. Compliance with Regulations: The contractor shall comply with the Regulations relative to nondiscrimination in Federally-assisted programs of the U. S. Department of Transportation, Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.
- b. Nondiscrimination: The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials

and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

- c. Solicitations for Subcontracts, including Procurements of Materials and Equipment: In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.
- d. Information and Reports: The contractor shall provide all information and reports required by the Regulations, or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Department of Transportation or the Federal Highway Administration to be pertinent to ascertain compliance with such Regulations or directives. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to the Department of Transportation, or the Federal Highway Administration as appropriate, and shall set forth what efforts it has made to obtain the information.
- e. Sanctions for Noncompliance: In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the Department of Transportation shall impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to,
 - (1) withholding of payments to the contractor under the contract until the contractor complies, and/or
 - (2) cancellation, termination or suspension of the contract, in whole or in part.
- f. Incorporation of Provisions: The contractor shall include the provisions of paragraphs "a" through "f" in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the Department of Transportation or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the Department of Transportation to enter into such litigation to protect the interests of the State, and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

R/W (161) : Party of the Second Part certifies that this agreement is true and accurate copy of the form R/W (161) incorporating all revisions to date.

IN WITNESS WHEREOF, each of the parties to this agreement has caused the same to be executed the day and year first above written.

DEPARTMENT OF TRANSPORTATION

BY:

Donald W. Proper

DIVISION ENGINEER UTILITIES ENGINEER

DIVISION 5

Nakima Bogan

Nakima Bogan

Engineering Specialist III
Second Party

ATTEST OR WITNESS:

Meagan Whitney Waldrop

Meagan Whitney Waldrop

Project Engineering Supervisor

INSTRUCTIONS

When the applicant is a corporation or a municipality, this agreement must have the corporate seal and be attested by the corporation secretary or by the empowered city official, unless a waiver of corporate seal and attestation by the secretary or by the empowered City official is on file in the Raleigh office of the Manager of Right of Way. In the space provided in this agreement for execution, the name of the corporation or municipality shall be typed above the name, and title of all persons signing the agreement should be typed directly below their signature.

When the applicant is not a corporation, then his signature must be witnessed by one person. The address should be included in this agreement and the names of all persons signing the agreement should be typed directly below their signature.

This agreement must be accompanied, in the form of an attachment, by plans or drawings showing the following applicable information:

1. All roadways and ramps.
2. Right of way lines and where applicable, the control of access lines.
3. Location of the existing and/or proposed encroachment.
4. Length, size and type of encroachment.
5. Method of installation.
6. Dimensions showing the distance from the encroachment to edge of pavement, shoulders, etc.
7. Location by highway survey station number. If station number cannot be obtained, location should be shown by distance from some identifiable point, such as a bridge, road, intersection, etc. (To assist in preparation of the encroachment plan, the Department's roadway plans may be seen at the various Highway Division Offices, or at the Raleigh office.)
8. Drainage structures or bridges if affected by encroachment (show vertical and horizontal dimensions from encroachment to nearest part of structure).
9. Method of attachment to drainage structures or bridges.
10. Manhole design.
11. On underground utilities, the depth of bury under all traveled lanes, shoulders, ditches, sidewalks, etc.
12. Length, size and type of encasement where required.
13. On underground crossings, notation as to method of crossing - boring and jacking, open cut, etc.
14. Location of vents.

GENERAL REQUIREMENTS

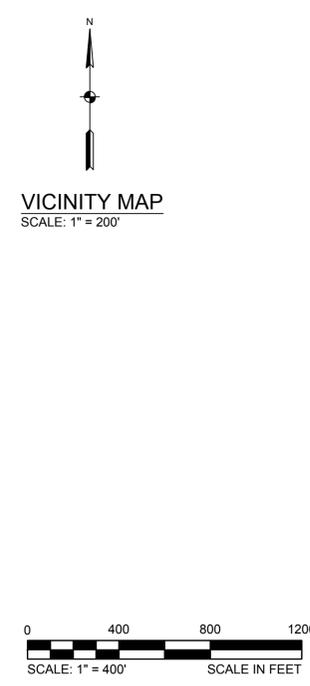
1. Any attachment to a bridge or other drainage structure must be approved by the Head of Structure Design in Raleigh prior to submission of encroachment agreement to the Division Engineer.
2. All crossings should be as near as possible normal to the centerline of the highway.
3. Minimum vertical clearances of overhead wires and cables above all roadways must conform to clearances set out in the National Electric Safety Code.
4. Encasements shall extend from ditch line to ditch line in cut sections and 5' beyond toe of slopes in fill sections.
5. All vents should be extended to the right of way line or as otherwise required by the Department.
6. All pipe encasements as to material and strength shall meet the standards and specifications of the Department.
7. Any special provisions or specifications as to the performance of the work or the method of construction that may be required by the Department must be shown on a separate sheet attached to encroachment agreement provided that such information cannot be shown on plans or drawings.
8. The Department's Division Engineer should be given notice by the applicant prior to actual starting of installation included in this agreement.

OLD BATTLE BRIDGE ROAD HDD CROSSING

WAKE COUNTY, NORTH CAROLINA

SHEET INDEX	
PAGE NO.	DESCRIPTION
1	COVER SHEET & VICINITY MAP
2	CONSTRUCTION NOTES
3-4	HDD PLAN & PROFILE
5	GEOTECHNICAL PLAN & PROFILE
6	HDD PIPE STRESS & IR ANALYSIS
7	KEY TO BORE LOGS
8	BORE LOGS

HDD ENTRY: 35° 47' 54.15" N, 78° 24' 18.86" W HDD EXIT: 35° 48' 02.51" N, 78° 24' 10.31" W



LEGEND (SHEETS 1, 3 - 5)

PROPOSED PIPELINE	— G — G —
APPROXIMATE LAY DOWN ALIGNMENT/PROFILE	- - - - -
EXISTING GAS PIPELINE	— G(B) —
EXISTING WATER PIPELINE	— W(B) —
EXISTING BURIED CABLE	— TV(B) —
EXISTING OVERHEAD TELE/ELECTRICAL	— E-T —
EXISTING BURIED ELECTRICAL	— E(B) —
EXISTING SEWER PIPELINE	— > SS(C) —
EXISTING FIBER OPTIC LINE	— F0 —
EXISTING TELEPHONE LINE	— T(B) —
EXISTING DRAIN LINE	— D —
EXISTING FENCE LINE	— □ — □ —
EXISTING ROW	— — — — —
EXISTING PROPERTY LINE	— - - - -
EXISTING EASEMENT	— - - - -
PROPOSED OVERHEAD LINE	— OVHD —
PROPOSED BURIED TELEPHONE LINE	— T(B) —
PROPOSED FIBER OPTIC LINE	— F0 —
TEMPORARY WORKSPACE	[Hatched Area]
EXISTING MAJOR CONTOURS	— 100 —
EXISTING MINOR CONTOURS	- - - - -
GEOTECHNICAL BORING LOCATION	— ⊕ —
PROPOSED SILT FENCE	— SF — SF —
PROPOSED CONSTRUCTION ENTRANCE	[Gate Symbol]

GENERAL CONSTRUCTION NOTES:

- ALL INFORMATION CONCERNING TYPE AND LOCATION OF UNDERGROUND UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATIONS AS TO TYPE AND LOCATION OF UNDERGROUND UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO. THE CONTRACTOR SHALL VERIFY LOCATION OF UNDERGROUND PIPELINES, CONDUITS, AND STRUCTURES BY CONTACTING OWNERS OF UNDERGROUND UTILITIES OR BY EXCAVATING IN ADVANCE OF CONSTRUCTION. CONTRACTOR SHALL CALL 811 A MINIMUM OF 3 FULL WORKING DAYS PRIOR TO BEGINNING CONSTRUCTION. CONTRACTOR SHALL PROVIDE A DOMINION ENERGY REPRESENTATIVE A COPY OF CLEARANCES PRIOR TO PROCEEDING WITH CONSTRUCTION.
- CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF EXISTING FACILITIES PRIOR TO CONSTRUCTION OF PROPOSED FACILITIES. ANY DAMAGE TO EXISTING FACILITIES, INCLUDING PUBLIC OR PRIVATE UTILITIES, INCURRED AS A RESULT OF CONSTRUCTION OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE.
- CONSTRUCTION WORKSPACE LIMITS TO BE SPECIFIED AS NOTED ON RESPECTIVE ALIGNMENT SHEET.
- EXISTING GAS LINE SHALL BE KEPT OPERATIONAL DURING NEW CONSTRUCTION.
- BASEMAP COORDINATE SYSTEM: NORTH CAROLINA STATE PLANES; NAD83 DATUM, US FOOT.

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ISSUED FOR CONSTRUCTION

REFERENCE DRAWINGS		WORK ORDERS		REVISIONS				ENGINEERING RECORD			DOMINION ENERGY NORTH CAROLINA		LINE NUMBER:										
DRAWING NUMBER	REV	DRAWING DESCRIPTION	WO NUMBER	NO	DESCRIPTION	DATE	BY	CHECK	DRAWN BY:	CHECKED BY:	SURVEYOR:	ENGR MNGR:	CONSTR MNGR:	SECTION:	ELEVATION:	LAT:	LONG:	CITY	COUNTY	STATE	DRAWING NUMBER	SHEET	REVISION
									JSP	RAP	JAB			T	R			WAKE	WAKE	NORTH CAROLINA	1	1	0
THE INFORMATION AND CONCEPTS CONTAINED IN THIS DOCUMENT ARE CONFIDENTIAL AND THE PROPERTY OF DOMINION ENERGY AND/OR THE CLIENT IDENTIFIED. DUPLICATION OR USE OF THIS INFORMATION AND/OR CONSTRUCTION OF SYSTEMS BASED ON THIS DOCUMENT ARE STRICTLY PROHIBITED WITHOUT WRITTEN AUTHORIZATION FROM DOMINION ENERGY.														SCALE: AS SHOWN									

CONSTRUCTION NOTES

- THE REQUIREMENT OF AN HDD INSTALLATION ARE MORE FULLY DESCRIBED IN OWNER STANDARD PRACTICE 2-15-01. ALL HDD CONSTRUCTION OPERATIONS SHALL BE IN ACCORDANCE WITH STANDARD PRACTICE 2-15-01. THE STANDARD PRACTICE WILL SUPERSEDE THESE NOTES, IF DISCREPANCIES EXIST.
- CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES WITHIN THE CONSTRUCTION AREA.
- CONTRACTOR SHALL CALL NORTH CAROLINA 811 UTILITY LOCATION SERVICE PRIOR TO CONSTRUCTION.
- CONTRACTOR IS RESPONSIBLE FOR ALL LOSSES AND REPAIRS OCCASIONED BY DAMAGE TO UNDERGROUND FACILITIES/UTILITIES RESULTING FROM THEIR WORK.
- CONTRACTOR SHALL AT ALL TIMES PROVIDE AND MAINTAIN INSTRUMENTATION WHICH WILL ACCURATELY LOCATE THE PILOT HOLE, MEASURE DRILL STRING AXIAL AND TORSIONAL LOADS, AND MEASURE DRILLING FLUID DISCHARGE RATE AND PRESSURE. THE OWNER AND/OR THEIR SITE REPRESENTATIVE SHALL HAVE ACCESS TO SAID INSTRUMENTATION AND THEIR READINGS AT ALL TIMES. A LOG OF ALL RECORDED READINGS SHALL BE MAINTAINED AND WILL BECOME PART OF THE "AS-BUILT" INFORMATION DEVELOPED BY THE CONTRACTOR AND SUBMITTED TO THE OWNER.
- THE PILOT HOLE SHALL BE DRILLED ALONG THE PATH SHOWN ON THE DRAWINGS WITHIN THE FOLLOWING TOLERANCES:
 - HORIZONTAL: +/- 5 FEET FROM DESIGN CENTERLINE
 - VERTICAL: + 2 FEET TO -10 FEET FROM DESIGN PROFILE (THE HDD DRILL PATH MAY BE UP TO 10 FEET LOWER THAN THAT WHICH IS DEPICTED AND UP TO 2 FEET HIGHER THAN THAT WHICH IS DEPICTED)

HOWEVER, IN ALL CASES, THE 25 FOOT MINIMUM CLEARANCE FROM THE BOTTOM OF THE CREEK SHALL TAKE PRECEDENCE OVER THE LISTED TOLERANCES. REGARDLESS OF TOLERANCES ACHIEVED, NO PILOT HOLE WILL BE ACCEPTED IF IT WILL RESULT IN ANY OF THE PIPELINE BEING INSTALLED IN VIOLATION OF THE 25 FOOT CLEARANCE OF THE BOTTOM OF THE CREEK. ADDITIONALLY, CONCERN FOR ADJACENT UTILITIES AND/OR STRUCTURES SHALL TAKE PRECEDENCE OVER THE LISTED TOLERANCES. LISTING OF TOLERANCES DOES NOT RELIEVE THE CONTRACTOR FROM RESPONSIBILITY FOR SAFE OPERATIONS OR DAMAGE TO ADJACENT UTILITIES AND STRUCTURES.
- CURVES SHOULD BE DRILLED AT A RADIUS EQUAL TO OR GREATER THAN THAT LISTED ON THE DRAWINGS. HOWEVER, IN THE EVENT THAT A STEERING CORRECTION IS NEEDED AND A TIGHTER RADIUS MUST BE CONSTRUCTED TO STAY WITHIN ALIGNMENT TOLERANCES, THE MINIMUM THREE JOINT RADIUS SHALL BE 550 FEET. THE DRILLED RADIUS WILL BE CALCULATED OVER ANY THREE OR MORE JOINT SEGMENTS USING THE FOLLOWING FORMULA:
 - $R = L / A * 57.296$

WHERE:
 R = DRILLED RADIUS OVER LENGTH (L)
 L = LENGTH DRILLED, NO LESS THAN 75 FEET AND NO GREATER THAN 100 FEET
 A = TOTAL CHANGE IN ANGLE OVER LENGTH (L)

- AT THE COMPLETION OF THE PILOT HOLE DRILLING, THE CONTRACTOR SHALL PROVIDE A TABULATION OF COORDINATES, REFERENCED TO THE DRILLED ENTRY POINT, WHICH ACCURATELY DESCRIBES THE LOCATION OF THE PILOT HOLE. THIS TABULATION SHALL BE IN ADDITION TO THE LOG OF RECORDED READINGS REQUIRED IN ACCORDANCE WITH NOTE 4.
- THE MAXIMUM ALLOWABLE TENSILE LOAD IMPOSED ON THE PULL SECTION SHALL BE EQUAL TO 90% OF THE PRODUCT OF THE SPECIFIED MINIMUM YIELD STRENGTH OF THE PIPE AND THE AREA OF THE PIPE SECTION. IF MORE THAN ONE VALUE IS INVOLVED FOR A GIVEN PULL SECTION, THE LESSER SHALL GOVERN.
- A SWIVEL SHALL BE USED TO CONNECT THE PULL SECTION TO THE REMAINING ASSEMBLY TO MINIMIZE TORSIONAL STRESS IMPOSED ON THE SECTION.
- THE PULL SECTION SHALL BE SUPPORTED AS IT PROCEEDS DURING PULLBACK SO THAT IT MOVES FREELY AND THE PIPE AND COATING ARE NOT DAMAGED.
- THE PULL SECTION SHALL BE INSTALLED IN THE REAMED HOLE IN SUCH A MANNER THAT EXTERNAL PRESSURES ARE MINIMIZED. THE PULL SECTION MAY BE BALLASTED INTERNALLY WITH WATER TO HELP REDUCE PULLING STRESSES. CONTRACTOR TO UTILIZE TENSOMETER OR EQUIVALENT TO MONITOR AND ENSURE PULL FORCES DO NOT EXCEED MAXIMUM ALLOWABLE PULL FORCE STATED WITHIN THE PIPE STRESS ANALYSIS. ANY DAMAGE TO THE PIPE RESULTING FROM EXTERNAL PRESSURE OR EXCESSIVE STRESSES DURING INSTALLATION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- BUOYANCY MODIFICATION SHALL BE USED AT THE DISCRETION OF THE CONTRACTOR. ANY BUOYANCY MODIFICATION PROCEDURE PROPOSED FOR USE SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO USE. NO PROCEDURE SHALL BE USED WHICH HAS NOT BEEN APPROVED BY THE ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO THE PULL SECTION RESULTING FROM BUOYANCY MODIFICATION.
- IF THE PULL SECTION IS CORROSION COATED, IT SHALL BE INSPECTED FOR HOLIDAYS WITH A HOLIDAY DETECTOR AS IT ENTERS THE HOLE. ANY COATING DAMAGE FOUND SHALL BE REPAIRED.
- THE COMPOSITION OF ALL DRILLING FLUIDS PROPOSED FOR USE SHALL BE SUBMITTED TO THE OWNER FOR REVIEW AND APPROVAL. NO FLUID WILL BE APPROVED OR UTILIZED THAT DOES NOT COMPLY WITH PERMIT REQUIREMENTS AND ENVIRONMENTAL REGULATIONS.
- CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING, TRANSPORTING, AND STORING ANY WATER REQUIRED FOR DRILLING FLUIDS.
- CONTRACTOR SHALL MAXIMIZE RECIRCULATION OF DRILLING FLUID SURFACE RETURNS. CONTRACTOR SHALL PROVIDE SOLIDS CONTROL AND FLUID CLEANING EQUIPMENT OF A CONFIGURATION AND CAPACITY THAT CAN PROCESS SURFACE RETURNS AND PRODUCE DRILLING FLUID WITH APPROPRIATE PROPERTIES AND FOR REMOVAL OF EXCESS CUTTINGS FROM THE FLUID.
- DISPOSAL OF EXCESS DRILLING FLUIDS IS THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE CONDUCTED IN COMPLIANCE WITH OWNER POLICIES AND PROCEDURES, ALL ENVIRONMENTAL REGULATIONS, RIGHT-OF-WAY AND WORKSPACE AGREEMENTS, AND PERMIT REQUIREMENTS. DRILLING FLUID DISPOSAL PROCEDURES PROPOSED FOR USE SHALL BE SUBMITTED TO THE OWNER FOR APPROVAL TWO WEEKS PRIOR TO CONSTRUCTION.
- CONTRACTOR SHALL EMPLOY HIS BEST EFFORTS TO MAINTAIN FULL ANNULAR CIRCULATION OF DRILLING FLUIDS. DRILLING FLUID RETURNS AT LOCATIONS OTHER THAN THE ENTRY AND EXIT POINTS SHALL BE MINIMIZED. IN THE EVENT THAT ANNULAR CIRCULATION IS LOST, THE CONTRACTOR SHALL TAKE IMMEDIATE STEPS TO RESTORE CIRCULATION. IF INADVERTENT SURFACE RETURNS OF DRILLING FLUIDS OCCUR, THEY SHALL BE IMMEDIATELY CONTAINED, COLLECTED, AND REMOVED/DISPOSED IN ACCORDANCE WITH OWNER POLICIES AND I.R. CONTINGENCY PLAN.
- THE CONTRACTOR SHALL COMPLY WITH THE WRITTEN INADVERTENT RETURNS (IR) CONTINGENCY PLAN PROVIDED BY THE OWNER AND SHALL SUBMIT TO THE OWNER A LIST OF ON-SITE CONTAINMENT EQUIPMENT AND SDS SHEETS FOR ALL DRILLING FLUID ADDITIVES TO BE INCLUDED IN THE IR PLAN FOUR WEEKS PRIOR TO PRODUCTION. THE PLAN SHALL ADDRESS, BUT NOT BE LIMITED TO, THE FOLLOWING ITEMS:
 - IDENTIFICATION OF AREAS REQUIRING PROTECTION (STREAMS, WETLANDS, PONDS, RESTRICTED PROPERTY, ETC.);
 - DESCRIPTION OF THE METHOD(S) THAT WILL BE USED TO LOCATE INADVERTENT RETURNS WHEN THEY OCCUR;
 - DESCRIPTION OF THE METHOD(S) THAT WILL BE USED TO CONTAIN, COLLECT, AND REMOVE/DISPOSE OF THE INADVERTENT RETURNS;
 - METHOD TO RESTORE AREAS ONTO WHICH INADVERTENT RETURNS WERE CONTAINED.

- IF THE AMOUNT OF INADVERTENT RETURNS EXCEEDS THE CAPACITY OF THE CONTAINMENT, DRILLING OPERATIONS SHALL BE SUSPENDED UNTIL THE VOLUME OF INADVERTENT RETURNS CAN BE MANAGED WITHOUT EXCEEDING THE CAPACITY OF THE CONTAINMENT.
- THE HDD CONSTRUCTION SHOULD BE OBSERVED ON A FULL-TIME BASIS BY A REPRESENTATIVE OF THE ENGINEER.
- INADVERTENT RETURNS ANALYSIS IS BASED ON A 250GPM MUD PUMP OUTPUT TO ACCOUNT FOR A MUD MOTOR, WITH 4 INCH ROD AND COLLAR DIAMETERS, THE USE OF A DRILL ROD LARGER THAN 4 INCHES AND DRILL BIT LARGER THAN 8 INCHES COULD RESULT IN PRESSURE ISSUES AND AN INADVERTENT FLUID RETURN NEAR THE EXIT. IF THE CONTRACTOR IS TO USE DRILL PARAMETERS OTHER THAN WHAT IS ASSUMED IN THE INADVERTENT RETURNS ANALYSIS, ANOTHER ANALYSIS SHOULD BE PERFORMED WITH THE UPDATED DRILL PARAMETERS PRIOR TO CONSTRUCTION.
- BASED ON THE GEOTECHNICAL BORE DATA AND ASSUMED LITHOLOGY THE HDD BORE WILL LIKELY TRANSITION FROM WEATHERED ROCK TO SOLID GRANITE DURING A VERTICAL CURVE. THE CONTRACTOR SHOULD BE AWARE OF AND PREPARE FOR ANY STEERING CHALLENGES THAT RESULTS FROM THIS CHANGE OF LITHOLOGY.
- PIPE STRESS CALCULATIONS ASSUME THE PIPE WILL BE BALLASTED DURING THE PULLBACK OPERATION. PIPE STRESS CALCULATIONS USING UNBALLASTED CONDITIONS RESULTED IN PREDICTED PULL STRESSES EXCEEDING 90% OF THE ALLOWABLE STRESS ASSUMING A FACTOR OR SAFETY OF 2. THEREFORE THE CONTRACTOR IS TO BALLAST THE PIPE DURING PULLBACK AND IF THE CONTRACTOR DEVIATES FROM THIS RECOMMENDATION THEY SHALL CONSULT WITH THE OWNER AND ENGINEER OF RECORD PRIOR TO CONSTRUCTION AND TAKE MEASURES TO LIMIT THE PULL FORCES TO LESS THAN 90% OF ALLOWABLE.

SITE CONDITIONS (GEOLOGY NOTES AND SUBSURFACE SOILS)

THE PROPOSED CROSSING SITE IS LOCATED IN THE LATE PALEOZOIC AGED INTRUSIVE TERRAINE OF THE PIEDMONT PHISOGRAPHIC PROVINCE OF CENTRAL NORTH CAROLINA. LATE PALEOZOIC INTRUSIONS ARE MAINLY COMPOSED OF THE IGNEOUS ROCK GRANITE AND GRANODIORITE. THESE ROCKS INTRUDED AS GIANT BLOBS OF MOLTEN ROCK DURING THE FORMATION OF THE APPALACHIAN MOUNTAIN CHAIN. THE MOLTEN BLOCKS COOLED SLOWLY AT DEPTH AND WERE LATER EXPOSED AS A RESULT OF EROSION OF THE OVERLYING BEDROCK.

THE GEOLOGY AT THE PROPOSED CROSSING LOCATION HAS BEEN MAPPED AS FOLIATED TO MASSIVE GRANITE ROCK. GRANITE IS A MASSIVE IGNEOUS ROCK WITH A CRYSTALLINE TEXTURE CONTAINING FELDSPAR, QUARTZ, AND ONE OR MORE DARK IRON SILICATE OR FERROMAGNESIAN MINERALS, USUALLY BIOTITE OR HORNBLENDE.

THE MAJOR SOIL GROUPS ENCOUNTERED DURING THE FIELD EVALUATION ARE DESCRIBED HERE IN THE GENERAL ORDER OF THEIR OCCURRENCE. MORE DETAILED DESCRIPTIONS OF THE SOILS ENCOUNTERED IN THE BORINGS, INCLUDING FIELD GEO-MECHANICAL DATA, SUCH AS DRIVEN SAMPLER BLOW COUNTS, ARE PRESENTED ON THE BORING LOGS (SHEETS 7 AND 8). GEOTECHNICAL PLAN AND PROFILE SHEETS SHOWING THE BORINGS PERFORMED FOR EACH CROSSING WITH RESPECT TO THE EXISTING GROUND (TOPOGRAPHIC SURVEY) AND THE PROPOSED DRILL PATH IS PROVIDED ON SHEET 5.

SURFACE MATERIALS: THE BORINGS WERE DRILLED WITHIN EXISTING ASPHALT PAVED AREAS OF GREEN LEVEL WEST ROAD AND ENCOUNTERED UP TO APPROXIMATELY 6 INCHES OF ASPHALT PAVING AT THE GROUND SURFACE.

FILL MATERIALS: BENEATH THE SURFACE MATERIALS, THE BORINGS ENCOUNTERED EXISTING FILL MATERIALS CONSISTING OF LIGHT BROWN, LIGHT GRAY AND LIGHT BROWNISH GRAY, MEDIUM DENSE TO DENSE FINE TO COARSE GRAINED SILTY SAND (USCS - SM) ANDY CLAYEY SAND (USCS - SC). THE FILL MATERIALS EXTENDED TO FOUR FEET BELOW THE GROUND SURFACE (BGS) AND 3.5 FEET BGS IN THE TWO BORINGS DRILLED AS PART OF THIS INVESTIGATION.

ALLUVIAL SOILS: BENEATH THE FILL MATERIALS, ALLUVIAL DEPOSITS CONSISTING OF VERY LOOSE TO MEDIUM DENSE, LIGHT GRAY AND DARK GRAY, SILTY SAND (USCS - SM) AND WELL GRADED SAND WITH SILT (USCS - SW-SM) WERE ENCOUNTERED. THE ALLUVIAL DEPOSITS EXTENDED TO APPROXIMATELY 6 FEET BGS AND 16.5 FEET BGS IN THE TWO BORINGS DRILLED AS PART OF THIS INVESTIGATION.

RESIDUAL SOILS: BENEATH THE ALLUVIAL SOILS IN BORING OBB-1, RESIDUAL SOILS ASSOCIATED WITH THE PHYSICAL AND CHEMICAL BREAKDOWN OF THE UNDERLYING BEDROCK WERE ENCOUNTERED. THE RESIDUAL SOILS ENCOUNTERED CONSISTED OF LOOSE TO VERY DENSE, PALE OLIVE TO YELLOW, FINE TO COARSE GRAINED SILTY SAND (USCS - SM). THE RESIDUAL SOILS GRADED INTO WEATHERED ROCK AT DEPTHS OF APPROXIMATELY 28.5 FEET BGS WHERE ENCOUNTERED.

WEATHERED ROCK: WEATHERED ROCK, DEFINED BY MATERIALS IN WHICH AUGER REFUSAL WAS NOT ENOUNTERED BUT SPLIT SPOON SAMPLER REFUSAL WAS ENCOUNTERED, WAS OBSERVED IN EACH BORING. THESE MATERIALS WERE SAMPLED AS VERY DENSE, YELLOW FINE TO COARSE SILTY SAND. BORING OBB-1 WAS TERMINATED IN THE WEATHERED ROCK AT A DEPTH OF APPROXIMATELY 35.2 FEET BGS.

BEDROCK: BENEATH THE ALLUVIAL SOILS IN BORING OBB-2, INTACT BEDROCK CONSISTING OF WHITE, PINK AND BLACK, SLIGHTLY WEATHERED, STRONG (R4), MASSIVE MEDIUM- TO COARSE-GRAINED GRANITE WAS ENCOUNTERED. RECOVERY VALUES OF THE SAMPLED ROCK RANGED FROM 88% TO 100%. ROCK QUALITY DESIGNATIONS (RQD) VALUES RANGED FROM 97% TO 100% INDICATING EXCELLENT QUALITY ROCK. UNCONFINED COMPRESSIVE STRENGTH VALUES GREATER THAN 12,000 PSI WERE RECORDED ON TESTED SAMPLES. THE BEDROCK CORED WAS CONSISTENT WITH THE MATERIALS DESCRIBED ON THE BEDROCK GEOLOGY MAP AT THIS LOCATION.

GROUNDWATER

GROUNDWATER WAS OBSERVED DURING EXPLORATION DRILLING AT A DEPTH OF APPROXIMATELY 4 FEET BELOW EXISTING GROUND SURFACE.

REFERENCES

- THE GEOLOGY OF NORTH CAROLINA - <https://ncdenr.maps.arcgis.com/apps/MapSeries/index.html?appid=0a7ccd9394734ff6aa2434d2528dd1f12>

LIMITATIONS

- THE HDD DESIGNS PRESENTED ON THESE DRAWINGS SHALL BE REVIEWED BY THE OWNER AND HDD CONTRACTOR PRIOR TO CONSTRUCTION. SHOULD THE CONTRACTOR DEVIATE FROM THE DESIGN DEPICTED IN THIS DRAWING SET IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ANY ADDITIONAL INFORMATION (INCLUDING, BUT NOT LIMITED TO, GEOTECHNICAL DATA) THAT IS NECESSARY AND TO PERFORM ADDITIONAL ANALYSIS AS REQUIRED TO ACCOMMODATE THEIR REVISED PLAN.
- THIS WORK WAS PERFORMED IN A MANNER CONSISTENT WITH THAT LEVEL OF CARE AND SKILL ORDINARILY EXERCISED BY OTHER MEMBERS OF KLEINFELDER'S PROFESSION PRACTICING IN THE SAME LOCALITY, UNDER SIMILAR CONDITIONS AND AT THE DATE THE SERVICES ARE PROVIDED. KLEINFELDER MAKES NO OTHER REPRESENTATION, GUARANTEE OR WARRANTY, EXPRESS OR IMPLIED, REGARDING THE SERVICES, COMMUNICATION (ORAL OR WRITTEN), PLANS, OPINION, OR INSTRUMENT OF SERVICE PROVIDED.
- DESCRIPTIONS CONTAINED IN THESE PLANS ARE BASED ON OUR FIELD OBSERVATIONS AND SUBSURFACE EXPLORATIONS, LIMITED LABORATORY TESTS, AND OUR PRESENT KNOWLEDGE OF THE PROPOSED CONSTRUCTION. IT IS POSSIBLE THAT SOIL OR GROUNDWATER CONDITIONS COULD VARY BETWEEN OR BEYOND THE POINTS EXPLORED. THE DESCRIPTIONS PRESENTED IN THESE PLANS ARE FOR THE EXCLUSIVE USE OF THE CLIENT AND THEIR DESIGNATED CONTRACTORS AND ARE ONLY APPLICABLE TO THE SPECIFIC SITE REFERENCED. THE DESCRIPTIONS ARE NOT TO BE EXTRAPOLATED TO OTHER PROJECTS.
- THE SUBSURFACE CONDITIONS DESCRIBED IN THIS DRAWING SET ARE ONLY APPLICABLE TO THE POINTS OF EXPLORATION.
- IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO SELECT THE CONSTRUCTION MEANS AND METHODS (I.E., TYPE OF DRILLING FLUID, PUMPING RATE FOR FLUID, TOOLING SELECTION, RATE OF ADVANCEMENT, DRILLING FLUID CONTAINMENT, INADVERTENT FLUID RELEASE CONTINGENCY PLANNING, ETC.).

PAD NOTES

- THE CONTRACTOR IS RESPONSIBLE FOR THEIR MEANS AND METHODS AND TO ANCHOR THEIR EQUIPMENT DURING CONSTRUCTION.
- EROSION AND SEDIMENT CONTROL IS NOT DEPICTED ON THESE DRAWINGS. THE HDD CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING EROSION AND SEDIMENT CONTROL DEVICES IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS.
- GRADING DESIGN IS BY OTHERS.
- TEMPORARY EXCAVATIONS SHALL BE IN ACCORDANCE WITH OSHA REQUIREMENTS.
- THE CONTRACTOR SHALL RESTORE THE SITE GRADING AND VEGETATION TO ITS FORMER CONDITION AT THE COMPLETION OF WORK.

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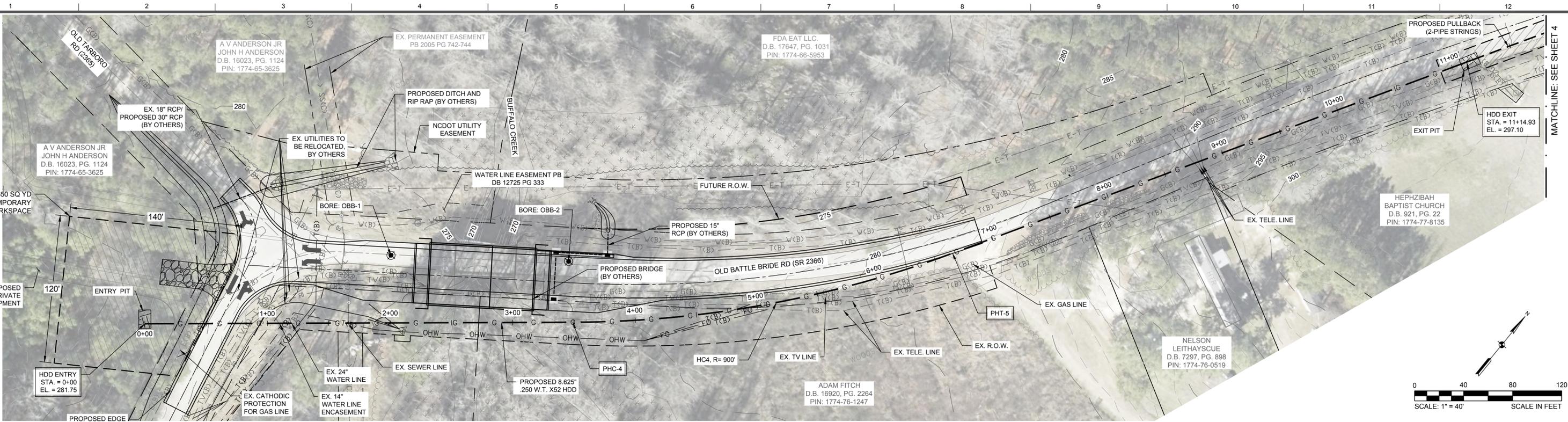

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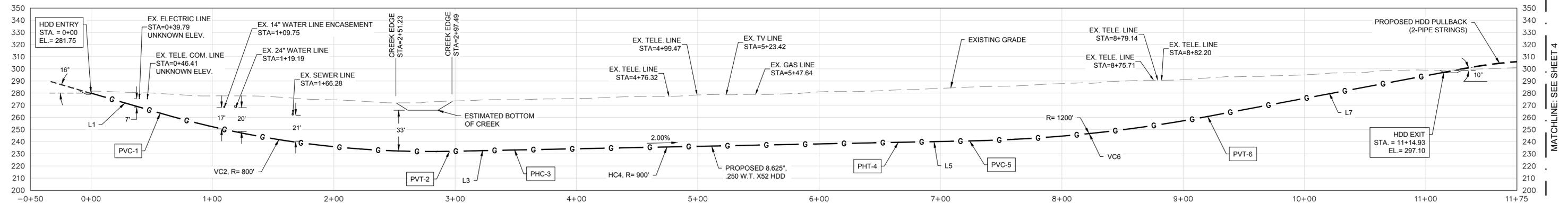
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										CHECKED BY: RAP
										PROJECT ENGR: JAB
										SURVEYOR:
										ENGR MNGR:
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FACILITY:		CONSTRUCTION NOTES														
TITLE:		WAKE COUNTY, NORTH CAROLINA														
DESCRIPTION:																
ADDRESS:		CITY:		COUNTY:		STATE:										
		T		WAKE		NORTH CAROLINA										
ELEVATION:		LAT:		LONG:		DRAWING NUMBER		SHEET								
SCALE: AS SHOWN						2		REVISION								
								0								



PROPOSED HDD PLAN
TOTAL BORE LENGTH: 1125'



PROPOSED HDD PROFILE
TOTAL BORE LENGTH: 1125'

LINE/CURVE DATA			
SEGMENT	LENGTH	RADIUS	DELTA
L1	59.4'		
VC2	241.4'	800'	17.3°
L3	53.4'		
HC4	316.5'	900'	20.1°
L5	58.8'		
VC6	197.4'	1200'	9.4°
L7	198.1'		
TOTAL	1125.0'		

DRILL DATA				
DATA POINT	STATION	ELEVATION	NORTHING	EASTING
HDD ENTRY	0+00	281.75	746031.5572	2176369.1024
PVC-1	0+57.08	263.48	746067.9129	2176413.1068
PVT-2	2+95.49	232.09	746219.7623	2176596.9028
PHC-3	3+48.89	233.16	746253.7754	2176638.0717
PHT-4	6+65.32	239.48	746493.6291	2176841.9503
PVC-5	7+24.05	240.65	746544.3441	2176871.5773
PVT-6	9+20.16	260.77	746713.6767	2176970.4991
HDD EXIT	11+14.93	297.10	746881.8522	2177068.7449

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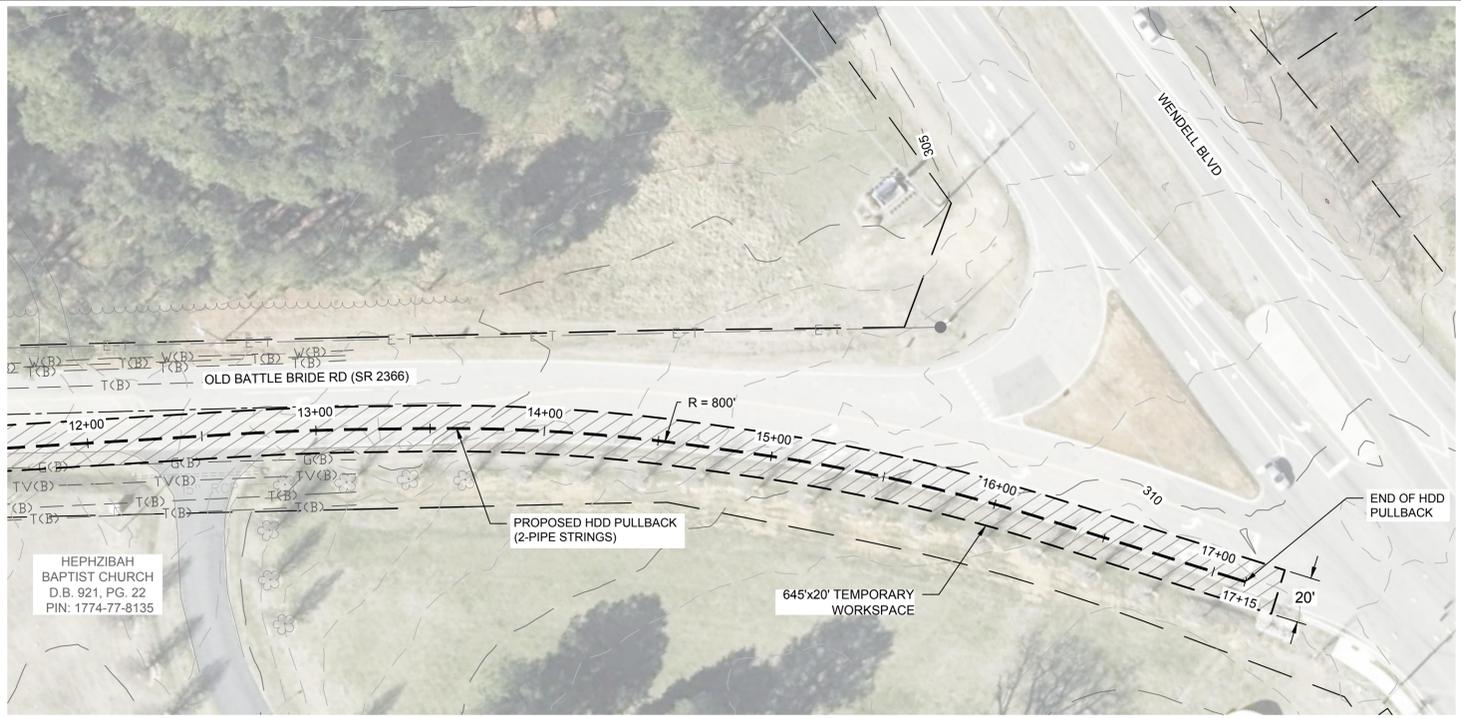
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NOTE:
BASEMAP COORDINATE SYSTEM: NORTH CAROLINA STATE PLANE; NAD83 DATUM, US FOOT.

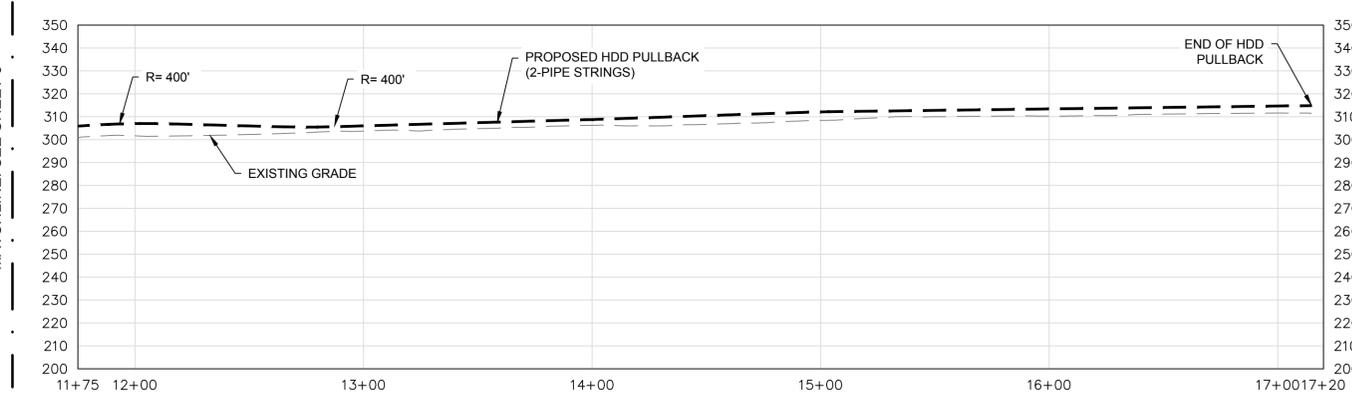
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									JSP	RAP	JAB				

		LINE NUMBER: FACILITY: TITLE: DESCRIPTION: ADDRESS:	
DOMINION ENERGY NORTH CAROLINA		OLD BATTLE BRIDGE ROAD HDD CROSSING HDD PLAN & PROFILE WAKE COUNTY, NORTH CAROLINA	
SECTION:	T R	CITY:	
ELEVATION:		COUNTY:	WAKE
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		SHEET:	3
		REVISION:	0



PROPOSED HDD PLAN
TOTAL BORE LENGTH: 1125'



PROPOSED HDD PROFILE
TOTAL BORE LENGTH: 1125'

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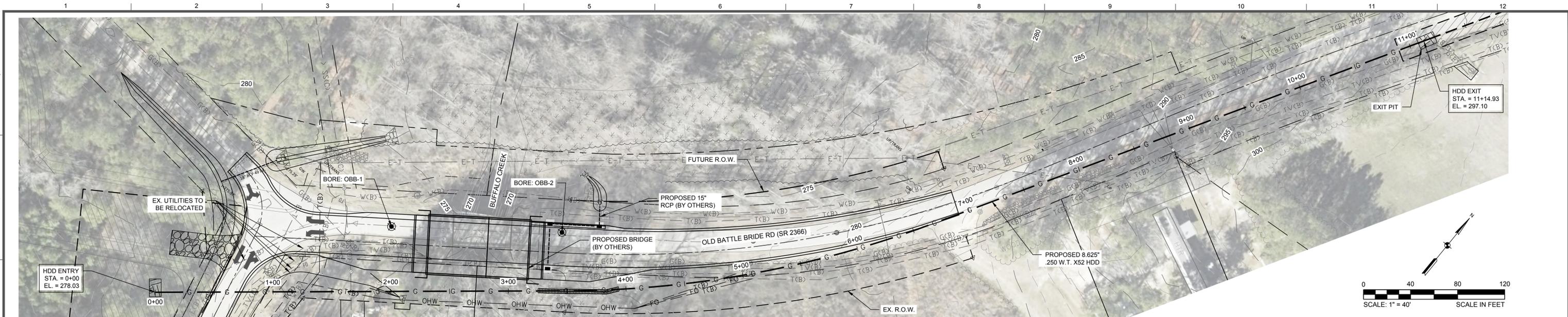


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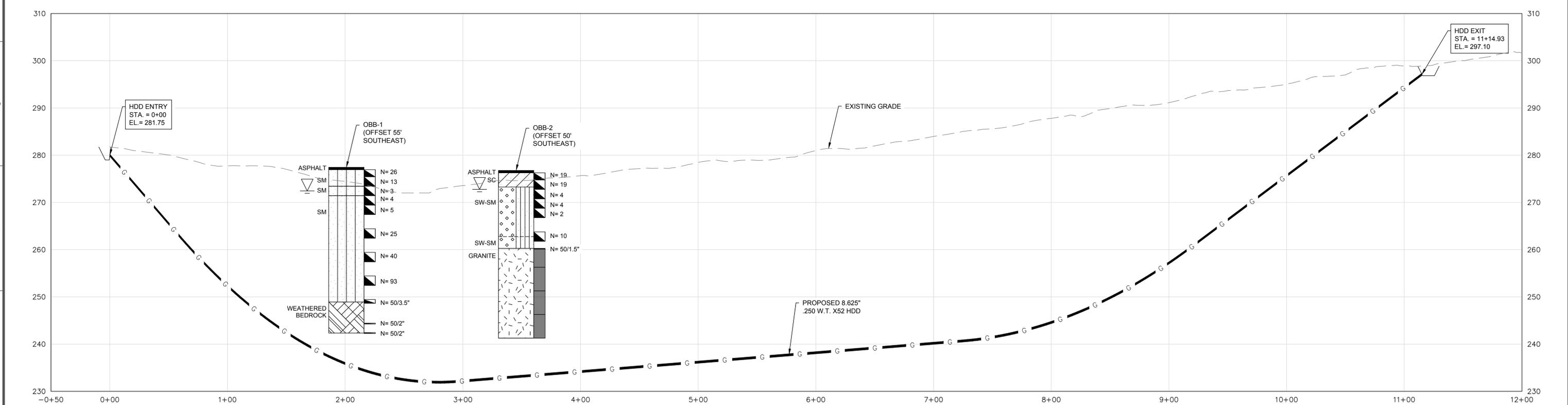
LINE NUMBER:			
FACILITY: OLD BATTLE BRIDGE ROAD HDD CROSSING			
TITLE: HDD PLAN & PROFILE			
DESCRIPTION: WAKE COUNTY, NORTH CAROLINA			
ADDRESS:			
CITY	COUNTY	STATE	
WAKE	WAKE	NORTH CAROLINA	
DRAWING NUMBER		SHEET	REVISION
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 LAYOUT: PLAN & PROFILE 2
 CAD FILE: C:\working\kleinfelder\download\99883\old_battle_bridge_road_hdd_design_sheets.dwg



GEOTECHNICAL INVESTIGATION PLAN



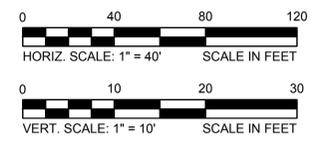
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NOTE: SEE SHEETS 7-8 FOR ADDITIONAL BORE INFORMATION.

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TITLE: GEOTECHNICAL PLAN & PROFILE
DESCRIPTION: WAKE COUNTY, NORTH CAROLINA
ADDRESS:

CITY: COUNTY: WAKE STATE: NORTH CAROLINA

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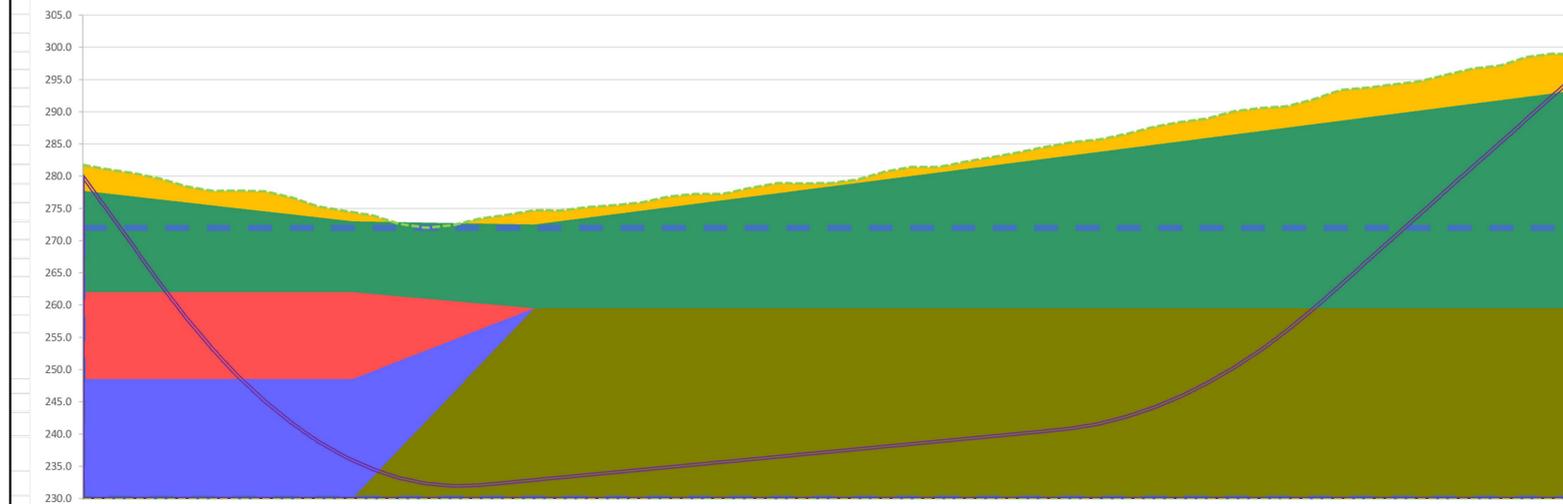
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SOIL LITHOLOGY AND PROPERTIES IN ANALYSIS

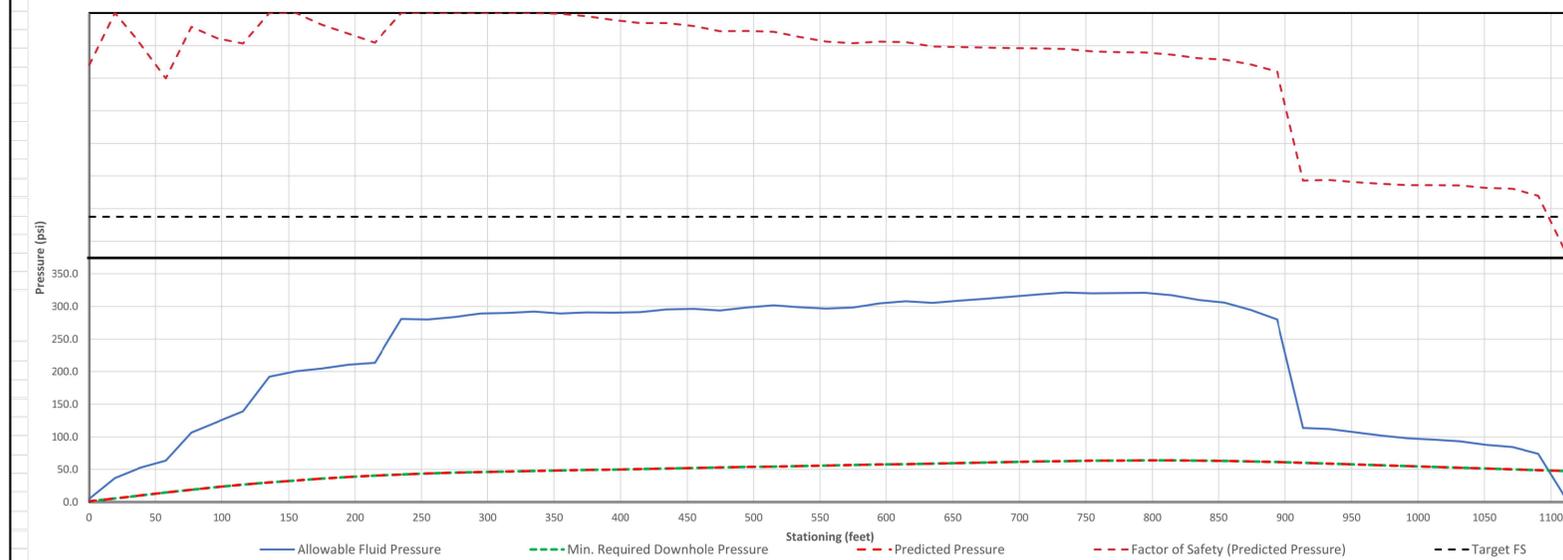
Layer	Layer Description	Avg. N60-Value	Moist Unit Weight (pcf)	Buoyant Unit Weight (pcf)	Internal Friction Angle (deg)	Cohesion (psf)	Elastic Modulus (ksf)	Poisson's Ratio	Shear Modulus (ksf)
1	Silty Sand (SM)	19	115	53	31	50	150	0.28	59
2	WG Sand (SW)	5	105	43	30	0	200	0.23	82
3	Silty Sand (SM)	50	140	78	38	50	336	0.45	116
4	PG Sand (SP)	50	135	73	39	0	650	0.45	224
5	PG Gravel (GP)	50	135	73	40	0	1344	0.40	480

NOTES FOR HYDRAULIC FRACTURING ANALYSIS PRESSURE CHART

- ALLOWABLE BOREHOLE PRESSURE FOR THE ANTICIPATED HDD PILOT WAS EVALUATED USING THE DELFT GEOTECHNICS EQUATION AS PRESENTED IN NASTT'S "HORIZONTAL DIRECTIONAL DRILLING GOOD PRACTICES GUIDELINES," FOURTH EDITION, BY THE HDD CONSORTIUM (2017), AND USING THE APPROACH OUTLINED BY BENNETT, R. D., WALLIN, K. (2008).
- THE EVALUATION IS BASED ON EQUIPMENT AND DRILLING FLUIDS PROVIDED BY THE CONTRACTOR.
- IF THE CONTRACTOR ELECTS TO CHANGE EQUIPMENT OR DRILLING FLUID PROPERTIES, THE ANALYSIS SHOULD BE CHECKED AND MODIFIED AS APPROPRIATE.
- ANALYSIS WAS BASED ON:
 - A. ENTRY ANGLE OF 16 DEGREES.
 - B. EXIT ANGLE OF 10 DEGREES.
 - C. A PILOT HOLE DIAMETER OF 8 INCHES.
 - D. A DRILL ROD DIAMETER OF 4 INCHES.
 - E. A MUD PUMP OUTPUT OF UP TO 250 GALLONS PER MINUTE.
 - F. A MUD UNIT WEIGHT OF 12 POUNDS PER GALLON.
 - G. TARGET UP-HOLE FLUID VELOCITIES IN THIS ANALYSIS ARE APPROXIMATELY 128 FEET PER MINUTE.
 - H. CHANGES IN THE DRILLING FLUID PROPERTIES AND DRILLING EQUIPMENT WILL AFFECT THE ANALYSIS RESULTS.
 - I. A FACTOR OF 2 WAS APPLIED TO CALCULATE THE RADIUS OF THE PLASTIC ZONE USING THE DELFT EQUATION.
- PREDICTED FRILLING FLUID PRESSURE CURVES ARE APPROXIMATE AND WERE DEVELOPED USING DRILLING FLUID RHEOLOGY FORMULAS AND SEVERAL HDD DRILLING RULES OF THUMB. THIS ASSUMES THE HDD DRILL CUTTINGS ARE BEING PROPERLY REMOVED FROM THE DRILLING FLUID, AS RECOMMENDED IN THE HDD GOOD PRACTICES GUIDELINES. IF THE DRILLING FLUID IS HEAVILY LOADED WITH SOIL, THE PRESSURES CAN BE HIGHER. IF SOLIDS ARE ALLOWED TO BUILD UP IN THE HDD BORE HOLE DURING DRILLING, THE PREDICTED PRESSURES CAN EXCEED ESTIMATES, WHICH CAN LEAD TO INADVERTENT RETURNS TO THE GROUND SURFACE.
- ALL HDD DRILLING AND PIPELINE INSTALLATION SHOULD BE PERFORMED IN GENERAL ACCORDANCE WITH THE "HORIZONTAL DIRECTIONAL DRILLING GOOD PRACTICES GUIDELINES," FOURTH EDITION, BY THE HDD CONSORTIUM (2017).
- THE CONTRACTOR SHALL TAKE NECESSARY MEASURES TO CONTAIN ANY INADVERTENT RETURNS IN THE EVENT THAT THEY OCCUR. IF THE CONTRACTOR IS DRILLING IN ACCORDANCE WITH THE HORIZONTAL DIRECTIONAL DRILLING GOOD PRACTICES GUIDELINES, THE PRESSURE SHOULD BE SIMILAR TO THOSE DEPICTED. HOWEVER, IF THE CONTRACTOR DOES NOT KEEP A CLEAN HOLE IN ACCORDANCE WITH THIS REFERENCE, THERE IS AN INCREASED RISK OF INADVERTENT RETURNS.



HYDROFRACTURE RISK ANALYSIS FOR THE PILOT BORE OF THE OLD BATTLE BRIDGE ROAD



PIPE STRESS ANALYSIS

Pipe Specifications

Pipe Material	Steel
Pipe Nominal Diameter	8.625 in.
Pipe Wall Thickness	0.25 inch
Specified Minimum Yield Strength	52000 psi
Max. Allowable Operating Pressure	100 psi

Results of Pullback Pipe Calculations

Estimated Pull Force	21,000 lb
Max. Allowable Pull Force (FS = 2)	29,278 lb
Check Pull Force	Pass

Drill Path Details

Total Drill Length	1,125 ft
Min. Design Radius	800 ft

Check Pipe Stress Iterations

PIPE STRESS CALCS GOOD

Installation Assumptions

Assumed Drill Hole Diameter	12.9375 in
Ballast Pipe?	Yes
Pullback Direction	High to Low Station (Descending)
Min. Allowable Bend Radius	550 ft
Min. Radius Based On	200% of Min. Bend Radius

Point	Tensile Stress		Bending Stress		Hoop Stress		Tensile and Bending Combo		Check Tensile, Bending, and Hoop Stress Combo	
	(psi)	check	(psi)	Check	psi	Check	Combo	Check	Combo	Check
A (Start of Pullback)	764	Pass	0	Pass	0	Pass	0	Pass	0.0	Pass
B (End of Segment 7)	1141	Pass	0	Pass	69	Pass	0	Pass	0.0	Pass
C (End of Segment 6)	1472	Pass	8376	Pass	443	Pass	0	Pass	0.1	Pass
D (End of Segment 5)	1595	Pass	0	Pass	455	Pass	0	Pass	0.0	Pass
E (End of Segment 4)	2261	Pass	11336	Pass	523	Pass	0	Pass	0.1	Pass
F (End of Segment 3)	2370	Pass	0	Pass	534	Pass	0	Pass	0.0	Pass
G (End of Segment 2)	3036	Pass	12773	Pass	206	Pass	0	Pass	0.1	Pass
H (End of Segment 1)	3185	Pass	0	Pass	19	Pass	0	Pass	0.0	Pass

REFERENCE LIMIT	46800 psi	38083 psi	14365 psi			
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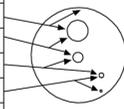
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GRAIN SIZE			
DESCRIPTION	SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders	>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles	3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse 3/4 - 3 in. (19 - 76.2 mm.)	3/4 - 3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine #4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse #10 - #4	0.075 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium #40 - #10	0.017 - 0.075 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
fine #200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized	
Fines	Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT			MOISTURE CONTENT		CEMENTATION	
Term of Use	Amount		Description	Field Test	Description	Field Test
Trace	Secondary Constituent is Fine Grained		Dry	Absence of moisture, dusty, dry to the touch	Weakly	Crumbles or breaks with handling or slight finger pressure
	Secondary Constituent is Coarse Grained		Moist	Damp but no visible water	Moderately	Crumbles or breaks with considerable finger pressure
With	<5%	<15%	Wet	Visible free water, usually soil is below water table	Strongly	Will not crumble or break with finger pressure
Modifier	≥15%	≥30%				

CONSISTENCY - FINE-GRAINED SOIL				
CONSISTENCY	SPT - N ₆₀ (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q _u) (psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25 ≤ PP < 0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5 ≤ PP < 1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1 ≤ PP < 2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2 ≤ PP < 4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4 ≤ PP	>8000	Thumbnail will not indent soil.

REACTION WITH HYDROCHLORIC ACID	
DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL				
APPARENT DENSITY	SPT-N ₆₀ (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

PLASTICITY				
DESCRIPTION	LL	Either the LL or the PI (or both) may be used to describe the soil plasticity. The ranges of numbers shown here do not imply that the LL ranges correlate with the PI ranges for all soils.	PI	
Non-Plastic	NP		NP	< 15
Low	< 30			15 - 25
Medium	30 - 50			> 25
High	> 50			

STRUCTURE	
DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slack-sided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay, note thickness.

ANGULARITY	
DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.



PROJECT NO.: 20210009.001A
 DRAWN BY:
 CHECKED BY:
 DATE:

SOIL DESCRIPTION KEY
 DENC: Trenchless Technology Design
 Multiple Locations
 Raleigh, NC

INFILLING TYPE			
NAME	ABBR	NAME	ABBR
Albite	Al	Muscovite	Mus
Apatite	Ap	None	No
Biotite	Bi	Pyrite	Py
Clay	Cl	Quartz	Qz
Calcite	Ca	Sand	Sd
Chlorite	Ch	Sericite	Ser
Epidote	Ep	Silt	Si
Iron Oxide	Fe	Talc	Ta
Manganese	Mn	Unknown	Uk

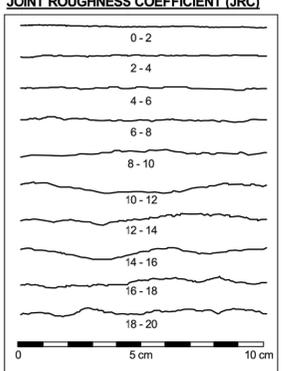
DENSITY/SPACING OF DISCONTINUITIES	
DESCRIPTION	SPACING CRITERIA
Unfractured	>6 ft. (>1.83 meters)
Slightly Fractured	2 - 6 ft. (0.61 - 1.83 meters)
Moderately Fractured	8 in - 2 ft. (203.20 - 609.60 mm)
Highly Fractured	2 - 8 in (50.80 - 203.30 mm)
Intensely Fractured	<2 in (<50.80 mm)

ADDITIONAL TEXTURAL ADJECTIVES	
DESCRIPTION	RECOGNITION
Pit (Pitted)	Pinhole to 0.03 ft. (3/8 in.) (>1 to 10 mm.) openings.
Vug (Vuggy)	Small openings (usually lined with crystals) ranging in diameter from 0.03 ft. (3/8 in.) to 0.33 ft. (4 in.) (10 to 100 mm.)
Cavity	An opening larger than 0.33 ft. (4 in.) (100 mm.), size descriptions are required, and adjectives such as small, large, etc., may be used to indicate cell-like form.
Honeycombed	If numerous enough that only thin walls separate individual pits or vugs, this term further describes the preceding nomenclature to indicate cell-like form.
Vesicle (Vesicular)	Small openings in volcanic rocks of variable shape and size formed by entrapped gas bubbles during solidification.

ADDITIONAL TEXTURAL ADJECTIVES	
DESCRIPTION	CRITERIA
Unweathered	No evidence of chemical / mechanical alteration; rings with hammer blow.
Slightly Weathered	Slight discoloration on surface; slight alteration along discontinuities; <10% rock volume altered.
Moderately Weathered	Discoloring evident; surface pitted and alteration penetration well below surface; Weathering "halos" evident; 10-50% rock altered.
Highly Weathered	Entire mass discolored; Alteration pervading most rock, some slight weathering pockets; some minerals may be leached out.
Decomposed	Rock reduced to soil with relic rock texture/structure. Generally molded and crumbled by hand.

RELATIVE HARDNESS / STRENGTH DESCRIPTIONS			
GRADE	UCS (Mpa)	FIELD TEST	
R0	Extremely Weak	0.25 - 1.0	Indented by thumbnail
R1	Very Weak	1.0 - 5.0	Crumbles under firm blows of geological hammer, can be peeled by a pocket knife.
R2	Weak	5.0 - 25	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer. Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of a geological hammer.
R3	Medium Strong	25 - 50	Specimen requires more than one blow of geological hammer to fracture it.
R4	Strong	50 - 100	Specimen requires many blows of geological hammer to fracture it.
R5	Very Strong	100 - 250	Specimen can only be chipped with a geological hammer.
R6	Extremely Strong	> 250	

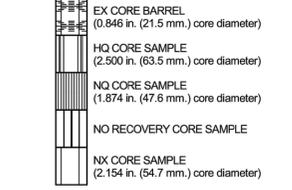
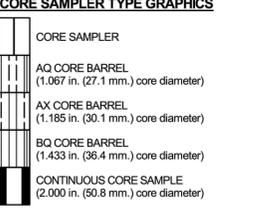
ROCK QUALITY DESIGNATION (RQD)	
DESCRIPTION	RQD (%)
Very Poor	0 - 25
Poor	25 - 50
Fair	50 - 75
Good	75 - 90
Excellent	90 - 100



APERTURE	
DESCRIPTION	CRITERIA [in (mm)]
Tight	<0.04 (<1)
Open	0.04 - 0.20 (1 - 5)
Wide	>0.20 (>5)

BEDDING CHARACTERISTICS	
DESCRIPTION	Thickness [in (mm)]
Very Thick Bedded	>36 (>915)
Thick Bedded	12 - 36 (305 - 915)
Moderately Bedded	4 - 12 (102 - 305)
Thin Bedded	1 - 4 (25 - 102)
Very Thin Bedded	0.4 - 1 (10 - 25)
Laminated	0.1 - 0.4 (2.5 - 10)
Thinly Laminated	<0.1 (<2.5)

Bedding Planes: Planes dividing the individual layers, beds, or stratigraphy of rocks.
 Joint: Fracture in rock, generally more or less vertical or traverse to bedding.
 Seam: Applies to bedding plane with unspecified degree of weather.



PROJECT NO.: 20210009.001A
 DRAWN BY:
 CHECKED BY:
 DATE:

ROCK DESCRIPTION KEY
 DENC: Trenchless Technology Design
 Multiple Locations
 Raleigh, NC

CALL 72 HOURS BEFORE YOU DIG

NORTH CAROLINA ONE-CALL CENTER
 1-800-632-4949

3200 Gateway Centre Blvd., Suite 100
 Morrisville, NC 27560
 Phone: 919-755-5011
 www.kleinfelder.com

ISSUED FOR CONSTRUCTION

REFERENCE DRAWINGS				WORK ORDERS				REVISIONS				ENGINEERING RECORD			
DRAWING NUMBER	REV	DRAWING DESCRIPTION	WO NUMBER	DESCRIPTION	NO	DESCRIPTION	DATE	BY	CHECK	DRAWN BY: JSP	CHECKED BY: RAP	PROJECT ENGR: JAB	SURVEYOR:	ENGR MNGR:	CONSTR MNGR:

DOMINION ENERGY NORTH CAROLINA

LINE NUMBER:	OLD BATTLE BRIDGE ROAD HDD CROSSING		
FACILITY:	KEY TO BORE LOGS		
TITLE:	WAKE COUNTY, NORTH CAROLINA		
DESCRIPTION:			
ADDRESS:			
CITY:	COUNTY:	STATE:	
WAKE	WAKE	NORTH CAROLINA	
DRAWING NUMBER		SHEET	REVISION
		7	0

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WORKFORCE SAFETY PLAN

FOR ENCROACHMENT ACTIVITIES: COVID-19

EFFORTS THE N.C. TRANSPORTATION INDUSTRY IS TAKING TO STOP THE SPREAD OF COVID-19

The North Carolina Department of Transportation (NCDOT) and their partners expect all parties involved in the delivery of transportation projects to abide by the guidelines issued from the Centers for Disease Control and Prevention (CDC) and the North Carolina Department of Health and Human Services (NCDHHS).

Response to COVID-19 is rapidly evolving; new information and guidelines may be issued from the CDC, NCDHHS, or other state or federal agencies. NCDOT and their partners should review the current CDC and NCDHHS guidance, including the resources listed at the end of this document, for up-to-date information on how to respond to COVID-19. Additional guidelines may be issued by state or federal agencies that should be followed in addition to the guidance included in this document.

Though certain Americans with Disabilities Act (ADA) requirements have been relaxed in response to the pandemic, employers must still maintain all information about employee illness as a confidential medical record in compliance with the ADA. If an employee is suspected of having or tests positive for COVID-19, it is essential that management keep the identity of the employee and details related to the employee's health confidential.

Below are precautions required by NCDOT and from encroaching parties and their contractors performing construction within NCDOT Rights of Way. The term employee refers to any person on a job site within NCDOT right of way for the purpose of constructing or inspecting the work related to construction of a facility under an approved encroachment agreement and where that employee may or may not be under employment by or under contract to NCDOT.

EMPLOYEE WELLNESS

- If an employee has not yet reported to work and develops any COVID-19 symptoms (i.e. fever, coughing, or shortness of breath) — STAY HOME and immediately:
 - Call a health care provider
 - Self-Isolate
 - Communicate with your supervisor
 - Remain calm and follow all instructions from your health care provider
- Employees who appear to have acute respiratory illness symptoms (i.e. cough, shortness of breath) upon arrival to work, or become sick during the day, should be separated from others and sent home immediately. The potentially affected employees should immediately follow the steps outlined above, which includes immediately contacting a health care provider.
- Should an employee show symptoms of acute respiratory illness or be diagnosed with COVID-19, all other employees who have worked in close proximity to the affected employee during the last 14

days and all encroachment points of contact indicated at the end of this plan should be notified of potential exposure to the disease without identifying the affected employee.

- Consideration should be given to employees at “High Risk” of severe illness from COVID-19, who, per NCDHHS, include employees:
 - Over 65 years of age, **OR**
 - With underlying health conditions including heart disease, lung disease, or diabetes, **OR**
 - With weakened immune system
- “High Risk” Employees should be given the opportunity to discuss alternate work arrangements/duties with their employer or take leave according to their company policies.
- For guidance on confirmed positive tests for COVID-19, refer to the most recent version of the “COVID-19 Guidance for Employees on Encroachment Job Sites within NCDOT Right of Way” located on last page of this plan.

PERSONAL HYGIENE

- Clean hands often by washing with soap and water for 20 seconds. If soap and water are not available and hands are not visibly dirty, an alcohol-based hand sanitizer that contains 60%-95% alcohol may be used.
- Avoid touching your eyes, nose, mouth, or other parts of your face.
- Do not breathe, cough, or sneeze on another person or into the open air. Employees should cover their noses and mouth with a tissue when coughing or sneezing (or an elbow or shoulder if no tissue is available).
- A facemask for covering nose and mouth is encouraged on the job site.
- Appropriate gloves are encouraged while performing functions of the job.

CLEANING/DISINFECTING

- Wash stations and/or hand sanitizer are encouraged on each project site.
- Appropriate cleaning staff should clean frequently touched surfaces and objects with disinfectants at a minimum of once per day.
 - Office/buildings: door knobs, light switches, phones, computers/keyboards, copy machines, elevator buttons, toilets, faucets, sinks, countertops, paper towel dispensers, desktops, handrails, folders, vending machines, counters, tables, cabinets/knobs, etc.
 - Shop Yard/Jobsite: vehicle/equipment door handles, keys, gear shifts, steering wheel/operator controls and levers, fuel pump dispensers, touch points on machinery, etc.
 - Electronic equipment: cell phones, computers, keyboards, etc.
- Appropriate cleaning staff should sanitize/disinfect facilities and work areas after persons suspected/confirmed to have COVID-19 have been in the facility or work area.

- It is recommended to close off access to areas used by the ill persons and wait as long as practical, 24 hours if possible, before beginning cleaning and disinfection to minimize potential for exposure to respiratory droplets. Open outside doors and windows to increase air circulation in the area if possible.
- Appropriate cleaning staff should clean and disinfect all areas used by the ill persons, focusing especially on frequently touched surfaces.

GENERAL

- Increase communication measures between all parties regarding schedule, daily activities, etc. to reduce/minimize worker exposure in accordance with but not limited to the requirements below.
- Minimize on-site personnel such as subcontractors, work crews, QC personnel, and inspection staff to those required for that day's activities. If work is postponed or cancelled, immediately notify appropriate parties.
- Practice "Social Distancing" whenever feasible. Social Distancing is designed to limit the spread of a disease by reducing the opportunities for close contact between people. All personnel have the responsibility to remind each other to stay 6 feet or more apart. Examples of Social Distancing include:
 - Reducing face-to-face exposure by using conference calls and video conferencing
 - If an in-person meeting is absolutely required and cannot be rescheduled or attended remotely, the meeting is limited to a maximum of 10 people while maintaining Social Distancing of 6 feet or more.
 - Avoiding unnecessary travel
- Do not congregate at lunch or breaks. Bringing your lunch is encouraged.
- No communal coolers or drink stations are allowed. Supervisors should confirm with employees prior to beginning work for appropriate hydration and nutrition availability to employees for the duration of the employee's shift and without direct contact with others on the job site.
- First line of communication should be by phone, rather than in-person.
- Do not shake hands.
- Do not share iPads, tablets, pens, or clipboards for signing or any other purpose. Take pictures as proof of attendance at meetings.
- Sharing of Personal Protective Equipment (PPE) is strictly prohibited.
- Vehicles, equipment, and tools
 - Limit the number of people riding in a vehicle together.
 - Wipe down and disinfect vehicles after each trip.
 - As much as possible, do not share tools or equipment. If a tool or piece of equipment must be shared, the parts of it that are touched should be sanitized between uses.

RETURN TO WORK

- The following criteria must be followed for an employee who is tested for Covid-19, or asked to self-quarantine by health officials, or has contact with another employee with a positive test result to return to work:
 - at least a 14-day quarantine; **OR**
 - release by a health care provider.
- In accordance with CDC guidance, the following criteria must be followed for an employee with a positive test result to return to work:
 - at least 14 days from positive test notification; **AND**
 - at least 3 days (72 hours) have passed since recovery defined as resolution of fever without the use of fever-reducing medications and improvement in respiratory symptoms (e.g., cough, shortness of breath); **AND**
 - at least 7 days have passed since symptoms first appeared.

NCDOT may require certification of fitness to work from a health care provider.

ADDITIONAL RESOURCES

NCDOT and their partners should review the CDC and NCDHHS resources listed below for up-to-date information on how to respond to COVID-19. Additional guidelines may be issued by state or federal agencies that should be followed in addition to the guidelines included in this document.

- NCDHHS COVID-19 Resources:
 - <https://www.ncdhhs.gov/divisions/public-health/coronavirus-disease-2019-covid-19-response-north-carolina>
- NCOSHR Communicable Disease Emergency Policy
 - <https://oshr.nc.gov/policies-forms/workplace-wellness/communicable-disease-emergency>
- OSHA Guidance on Preparing Workplaces for COVID-19
 - <https://www.osha.gov/Publications/OSHA3990.pdf>
- CDC COVID-19 Resources:
 - <https://www.cdc.gov/coronavirus/2019-ncov/index.html>

AGREEMENT

The encroaching party shall adhere to the requirements of this plan in order to continue work under their approved encroachment agreement. Violations to this plan could result in the violating entity not being allowed to continue work or all work ceasing as determined by the NCDOT District Engineer or Resident Engineer.

PROJECT POINTS OF CONTACT

NCDOT

Name: _____

Phone #: _____

Encroaching Party (Primary Contact)

Name: _____

Phone #: (919) 367-2705 _____

**Primary Contractor to Encroaching Party
(Point of Contact)**

Name: _____

Phone #: _____

COVID-19 Guidance for Employees on Encroachment Job sites within NCDOT Right of Way				
Relationship to Confirmed POSITIVE Test		CONTACT GROUP		
		What YOU Should Do	What your CREW Should Do <i>Exposure within 6' and longer than 10 minutes</i>	What PROJECT SITE Personnel Should Do <i>No exposure within 6' and longer than 10 minutes</i>
Employee		Notify your supervisor Self-quarantine for 14 days	Advise of POSITIVE test without identifying the affected employee* Directly exposed crew self-quarantine for 14 days Continue hygiene & disinfecting measures	Advise of POSITIVE test without identifying the affected employee* Site personnel without direct contact may continue onsite work or follow their company policy Continue hygiene & disinfecting measures
Direct Contact <i>Interaction with an infected person within 6' and longer than 10 minutes</i>		Self-quarantine for 14 days	Advise of POSITIVE test without identifying the affected employee* Crew may continue onsite work or follow their company policy Continue hygiene & disinfecting measures	Advise of POSITIVE test * Continue hygiene & disinfecting measures
Secondary Contact		You may continue onsite work or follow your company policy Continue hygiene & disinfecting measures	Continue hygiene & disinfecting measures	Continue hygiene & disinfecting measures
Two or more Persons Removed from Contact		Continue hygiene & disinfecting measures	Continue hygiene & disinfecting measures	Continue hygiene & disinfecting measures
*Notification Protocol <i>(Comply with HIPAA & ADA confidentiality requirements)</i>	NCDOT employee / agent tests POSITIVE	NCDOT District Engineer/Resident Engineer notifies Encroaching Party's primary point of contact and Contractor Point of Contact, CDC and, if Resident Engineer has oversight for the job site, FHWA any Consultant Firms working for NCDOT Encroaching party representative notifies other Contractors, Sub-Contractors and Suppliers with exposed Employees		
	Encroaching Party or Contract crew member on job site tests POSITIVE	Encroaching party representative or Contractor point of contact notifies appropriate NCDOT District Engineer or Resident Engineer and all other Contractors, Sub-Contractors and Suppliers with exposed Employees NCDOT notifies CDC, and as appropriate, FHWA and any Consultant Firms working for NCDOT		