DIVISION 2
SITE WORK

02753 SUBMERSIBLE PUMP LIFT STATION

GENERAL

This section includes all pumps, piping; fittings, valves, structures and other appurtenances that form an integral part of a submersible pump lift station. All work shall be accomplished in a neat, workmanlike manner meeting the requirements of the City of Fayetteville Public Works Commission. PWC shall be supplied with shop drawings of all equipment and materials for approval prior to installation. The Contractor shall supply six (6) sets of O & M Manuals, for the lift station, including support literature, shop drawings and O & M instructions before final approval and acceptance of the operational station. The lift station start up shall be performed by a qualified factory representative capable of supervising PWC's personnel in proper operation and maintenance.

SUBMITTALS

Prior to fabrication, pump station equipment suppliers shall submit six (6) copies of submittal data for review and approval by PWC. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cut sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), and hydraulic brake horsepower (BHP). Electrical components used in the motor and liquid level control shall be fully described. The electrical ladder logic drawings shall illustrate motor and liquid level control circuits to the extent necessary to validate function and integration of circuits to form a complete working system. Shop drawings for pre-engineered stations shall provide layout of mechanical equipment and contractor piping connections.

SUBMERSIBLE PUMPS

The pumps shall be non-clog, explosion proof, submersible units capable of passing a three-inch (3") sphere. Pumps shall be specifically designed to handle raw, unscreened sanitary sewage and shall be selected to perform under following operating conditions:

Myers Pump Performance		
	Present	**Future**
Target Operating Point	900 gpm @ 93' TDH	1247 gpm @ 110' TDH
Maximum Pump Speed	1750 RPM	1750 RPM (Impeller change required for future)
Horse Power	60	60

(Flygt) Xylem Pump Performance		
	Present	**Future**
Target Operating Point	900 gpm @ 94'	1400 gpm @ 106' TDH
Maximum Pump Speed	1750 RPM	1750 RPM (Impeller change required for future)
Horse Power	60	60

Fairbanks Morse Pump Performance		
	Present	**Future**
Target Operating Point	950 gpm @ 96'	1250 @ 103'
Maximum Pump Speed	1750 RPM	1770 RPM (w/ impeller change)
Horse Power	60	60

Pump discharge diameter shall be as noted on the plan drawings.

The pump shall be provided with an oil-filled cast iron, watertight enclosure sealed with O-rings. Heat sensors shall be attached to the windings and shall be wired for auto-shut off. The pump motor shall be provided with tandem seal arrangements incorporating two completely separate seals. Each seal shall be held in contact by its own spring system. The seal faces shall be tungsten carbide. The mechanical seal chamber shall be oil filled and equipped with a moisture detection device. The pump shall rotate on a minimum of two bearings permanently lubricated but capable of being re-greased, suitable for a minimum L10 bearing life of 40,000 hours.

All areas of the pump casing and volute, which are exposed to sewage, shall be constructed of cast iron meeting the requirements of ASTM A-48, Class 30.

The pumps shall be provided a rigid discharge base-elbow to support the total weight of the pumping unit. The base shall be bolted directly to the wet well floor with a 90° elbow having a 125-pound ANSI flange discharging vertically.

Pumps shall be Myers, Fairbanks Morse or Flygt (Xylem).

IMPELLER

The impeller shall be two vane one piece, single suction, enclosed, non-clog, and ductile iron. The impeller shall be of a radial flow design with well-rounded leading vane edges and thick hydrofoil shape with large openings. The impeller shall be balanced and secured to a straight fit on the shaft by means of a key and fastener. The impeller waterways and clearance between the impeller periphery and volute cutwater shall be capable of passing a 3-inch sphere. The impeller is to be matched to a constant velocity equalizing pressure volute.

MOTORS

Each submersible solids handling pump shall be driven by a completely sealed, electric submersible squirrel cage induction motor with the following characteristics:

	Motor Performance
Horsepower	60
Service Factor	Varies
RPM	1750 – 1770
Voltage / Phase	460 volt/3 phase

The motor nameplate horsepower rating shall not exceed the brake horsepower requirements of the specified head and capacity conditions. The motor shall be UL listed for Class 1, Division 1, Group C and D explosion-proof hazardous locations. The windings and leads shall be insulated with moisture-resistant Class F insulation and shall be designed along with the motor, for continuous duty. The motor shaft shall be one piece 416 stainless steel along with all appurtenant hardware. The rotor shall be dynamically balanced to meet NEMA vibration limits. Heavy duty lifting lugs shall be cast into the motor housing and shall be of adequate strength to lift the entire pump and motor assembly.

AUTOMATIC PUMP CONTROLS

1. General Requirements
   a. Refer to Chapter 9, Specification Section 13446 – Remote Telemetry, Lift Stations of PWC's Permit Design Manual for additional requirements.
   b. Refer to Chapter 9, Specification Section 16231 – Emergency Power Systems of PWC's Permit Design Manual for additional requirements.
   c. Refer to Chapter 9, Specification Section 16010 - Electrical of PWC's Permit Design Manual for additional requirements.
   d. Refer to applicable detail drawings contained within PWC's Permit Design Manual for additional requirements.
2. Functional Requirements
   a. The pump control panel shall be provided with an alarm horn, a remote mounted alarm light, and an alarm silence pushbutton. Remote Pump Control Panel Alarm Horn Disable/Enable contacts shall be provided from the RTU to control alarm horn actuation. The pump control panel shall annunciate all alarm and failure conditions on the inside dead front mounting panel. Only the High Wetwell Level Alarm shall cause the alarm horn and remote mounted alarm light to annunciate.
   b. Each pump shall be provided with a HAND-OFF-AUTO switch on the pump control panel. The pumps shall not run in the OFF position and run in HAND position. In AUTO position, the pumps shall operate as follows:
      i. On rising liquid level in the wetwell, a float switch shall start the lead pump. As the liquid level continues to rise, the second float switch shall start the lag pump.

The pump(s) will continue to operate until the liquid level recedes to the level of a third float switch which shall stop all pumps. A fourth float switch shall actuate the high level alarm within the pump control panel, should the liquid level rise above the lag pump cut-on elevation. A fifth float switch shall be routed through the pump control panel to the RTU and shall actuate at the same level that the pump control panel's high level alarm float switch actuates.

ii. The pumps shall automatically alternate between the lead and lag starts by means of an alternator relay in the pump control panel.

iii. Remote RTU Control Enable and Start/Stop Command contacts shall be provided for each pump. When enabled, the RTU shall provide remote pump control of each pump and override any automatic control functions excluding safety and equipment protection interlocks.

iv. On a restoration of power after loss event a timer(s) shall prevent simultaneous starting of pumps.

3. Pump Control Panel

a. A Pump Control Panel for each lift station shall be shipped to the site, completely pre- wired, pre-assembled and ready for service. The control panel enclosure shall be NEMA-
4X stainless steel with a continuous hinged and pad-lockable door. The enclosure shall have a back mounting panel and a front inside hinged panel to make the control panel "dead-front" when outside door is open. The panel shall be UL508A and NEC 409 labeled and shall include the following as a minimum:

i. Multi-colored wires (or equivalent marking) shall be provided to facilitate trouble shooting. Refer to Division 16 – Electrical for wire color standards.

ii. Motor control shall be provided by a full voltage non-reversing (FVNR), reduced voltage auto-transformer (RVAT), or reduced voltage solid state starter (RVSS). Reduced voltage starters shall be capable of starting the motor under all expected load conditions. RVSS starters shall include a bypass contact in case of electronics failure. A combination type starter shall be provided for each pump motor, labeled "PUMP 1", "PUMP 2", etc. The starter for each motor shall be provided with under-voltage release and quick-trip ambient-compensated overload protection for each leg. Starter shall be Cutler-Hammer, Allen-Bradley, Square D, GE, or Siemens.

iii. Phase monitoring capability which shall override and stop the normal operation of the pumps.

iv. Automatic pump alternator relay as manufactured by TimeMark or equal.

v. Individual timers (0-999 sec.) for each pump to prevent pumps from starting at the same time on restoration of power after loss of power.

vi. A NEMA 3R transformer with a minimum rating of 3 KVA shall be provided mounted to the exterior of the pump control panel for supplying 120/240 VAC single phase loads. The transformer shall be provided with a secondary

circuit breaker within the pump control panel. Branch circuit breakers shall be provided within the pump control panel for the follow loads as a minimum:

a) Pump controls

b) GFCI receptacle mounted on equipment rack (20A CB).

c) RTU control panel (15A CB)

d) Generator controls / battery charger

e) Generator heater

f) Spare 20A circuit breaker (800 watt minimum)

vii. The following controls shall be mounted on the exterior of the pump control panel:

a) Power Available white indicator light

b) NEMA 4X Alarm horn with adjustable volume. Alarm horn shall be by Edwards, Federal Signal, or equal.

viii. The following controls shall be mounted on the front inside panel of the pump control panel:

a) Hand-Off-Auto selector switch for each pump

b) Pump Running red indicator light for each pump

c) Pump Running Hours elapsed time meter for each pump. Meters shall be 6 digits with rear mounted reset.

d) Pump Motor Overload Alarm amber indicator light for each pump

e) Pump Motor High Temp Alarm amber indicator light for each pump

f) Moisture Intrusion Alarm amber indicator light for each pump (submersible pumps only)

g) High Wetwell Level Alarm amber indicator light

h) Loss of Phase Alarm amber indicator light

ix. The control panel shall have dry contact relay outputs to connect to the SCADA System RTU Panel. The outputs shall be as follows:

a) All pump off level

b) Lead pump on level

c) Lag pump on level

d) High level alarm

e) Loss of phase

f) Generator running

g) Pump 1 running

h) Pump 1 common failure

i) Pump 2 running

j) Pump 2 common failure

k) Pump 1 in auto

l) Pump 2 in auto

m) Refer to Specification 13446 Remote Telemetry, Lift Stations for signal interface requirements Pages 17 - 18), and Remote Telemetry Unit (RTU) Control Panel Construction Drawing (Sheet 4 of 4).

x. The pump control panel shall accept dry contacts (control inputs) from the SCADA System RTU. Refer to Specification 13446 Remote Telemetry, Lift Stations for signal interface requirements (Page 18), and Remote Telemetry Unit (RTU) Control Panel Construction Drawing (Sheet 4 of 4). The inputs shall be as follows:

a) Pump 1 start/stop command

b) Pump 1 RTU control enable

c) Pump 2 start/stop command

d) Pump 2 RTU control enable

e) Pump Control Panel alarm horn disable/enable

f) Spare

xi. All necessary internal wiring separation, relays, intrinsic safety barriers, etc. to provide an intrinsically safe operation for a Class I Division 1 Hazardous Area wetwell shall be provided. All signals provided to the RTU through the pump control panel from a hazardous area shall be provided with barriers eliminating the requirement for intrinsically safe wiring of that signal.

4. Standby Power Source: The generation unit and transfer switch shall provide control interface signals to the pump control panel and remote telemetry unit as specified therein.

a. Refer to Chapter 9, Specification Section 13446 – Remote Telemetry, Lift Stations of PWC's Permit Design Manual for additional requirements.

b. Refer to Chapter 9, Specification Section 16231 – Emergency Power Systems of PWC's Permit Design Manual for additional requirements.

c. Refer to Chapter 9, Specification Section 16010 - Electrical of PWC's Permit Design Manual for additional requirements.

d. Refer to applicable detail drawings contained within PWC's Permit Design Manual for additional requirements.

5. Appurtenances

a. The Pump Station shall be controlled as indicated in Specification 16912 Duplex pump station control panel

b. A stainless steel equipment rack shall be provided to mount the electrical panels

(e.g. meter base, main service disconnect, pump control panel, remote telemetry panel, etc.). The rack shall include a sun/rain shield and a concrete personnel pad. The pump control panel remote alarm light shall be mounted on the sun/rain shield at a location approved by PWC. The alarm light shall be a NEMA 4X red strobe light as manufactured by Edwards, Federal Signal, or equal. Refer to the detail drawings provided within PWC's *Permit Design Manual* for additional requirements.

c. The lift station site shall be provided with area lighting. The lighting shall meet the requirements of the local power company and should be sited as shown on the drawings.

PUMP REMOVAL / REPLACEMENT SYSTEM

The pump assembly shall be provided with a guide "rail" system to permit ease of installation and removal. The system shall consist of two - 2-inch, or recommended by manufacturer, diameter continuous stainless steel guide rail pipes and appropriate sized stainless steel cables. The guide rails shall align the pump with the discharge elbow as it is lowered into place. A rail guide bracket shall be used to support and align the rails at the top of the sump. The lift station hatch opening shall be sized to allow for removal of pumps from wetwell via the guide rail system.

The pump shall be raised and lowered into position by a telescopic hoist assembly. The telescopic hoist shall extend a minimum of five-feet above the wet well access hatch when in the upright position and shall be secured by a pin-lock device. The hoist shall be located in a manner that permits the removal of either pump and shall allow full three hundred sixty degree rotation for direct loading into a service vehicle. The hoist shall be located on the wet well's slab, or located on its own foundation, provided the requirements of this specification are met. The hoist shall have a rated capacity of not less than 1,600 pounds. The stainless steel lifting cables shall be arranged to allow connection to the hoist for pump installation or removal.

VALVES AND PIPING

1. Ductile Iron Pipe and Fittings

   All piping in the lift station wetwell and valve vault shall be ductile iron, Class 53, AWWA/ANSI C115/A21.15. Flanges shall be Class 125, ANSI B16.1. Piping interior surfaces shall be coated with ceramic epoxy lining as specified in Section 09802 "Special Coatings – Ceramic". Exterior piping surfaces shall be shop primed. All flange gaskets shall be 1/8-inch full-face serrated rubber material.

2. Gate Valves

   Each pump shall be equipped with a resilient wedge gate valve to allow both pumps to be isolated from the force main. Valve shall pass 3" spherical solids. Gate valves shall be ductile iron body resilient wedge type rated for 250 psig working pressure gate valves and shall conform to AWWA C-515 and NSF 61. Valve body shall have flanged end connections drilled to 125 pound standard. Valves for aboveground use or installed inside vaults shall be NRS design with handwheel. Valves shall open by turning in a

counterclockwise direction. The handwheel shall have an arrow cut in the metal, indicating the direction of opening. Valves shall have a clear waterway equal to the full nominal diameter of the valve. All valves shall be tested for leakage and distortion in strict accordance with the latest revision of AWWA Specification C-500. All gate valves shall be manufactured in strict accordance with the latest specifications of the AWWA. Valves shall be manufactured by: Mueller Company, Clow Corporation, American Darling Company, or approved equal. Certification shall be furnished to PWC by the manufacturer that all valves meet project specifications. Where specified on plans, resilient valves shall be supplied with gearing. Valves installed in a vertical position shall have spur gearing and bevel gearing for valves installed in a horizontal position.

Valve boxes shall be installed as specified in SECTION 02660, WATER DISTRIBUTION.

3. Check Valves

Each pump shall be equipped with a full flow type check valve with flanged ends and fitted with an external lever and spring. Each valve shall be capable of passing a 3" spherical solid. Valve clapper shall be cast iron, and shall swing completely clear of waterway when valve is full open. The seating shall be by a resilient field replaceable ring on the valve disc contacting a bronze or stainless seat ring in the valve body. Hinge pin shall be of 18 8 stainless steel construction and shall be utilized with bronze bushings and packing type seal. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve ends for use in above-ground or vault installations shall be flanged end connections drilled to 125 pound standard. Valve shall be rated at 175 psi water working pressure, 350 psi hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

4. By-Pass Pumping Valves and Piping

All Lift Stations shall have a By-Pass Pumping Assembly incorporated into the force main piping downstream from valve vaults or common header piping. By-Pass Pumping Assemblies shall be installed according to plan drawings and details with materials as specified in SECTION 02732, SEWAGE FORCE MAINS. Valve boxes shall be installed as specified in SECTION 02660, WATER DISTRIBUTION.

WET WELL/VALVE VAULT

The wet well and valve pit structures shall be precast concrete sections with a coal tar epoxy interior coating. The structures shall be manufactured and installed in accordance with ASTM C-890, ASTM C-891, ASTM C-913 and ASTM C-478. Joints between precast sections shall be sealed with one-inch diameter butyl rubber sealant conforming to SS-S-00210-A and AASHTO-198. Flexible rubber pipe wall penetrations and/or connections shall be in accordance with ASTM C-923. The wet well shall be watertight. The wet well base shall be manufactured specifically for direct mounting to an open top manhole and shall be provided with all mounting hardware and anchor bolts.

The minimum wet well diameter shall be as indicated on drawings, and the minimum valve vault shall be five (5) feet.

Access hatches shall be provided as shown on the drawings and shall be sized to allow for removal of pumps from wetwell utilizing the guide rail lift out system. Hatches shall be 3/16-inch aluminum checker plate with a stainless steel hardware frame. The frame shall be 1/4-inch thick aluminum reinforcement cast into the concrete top. The hatch shall be designed for H-2O loading and shall provide for a latch with locking device.

The cable junction box shall be provided in an NEMA 3 or NEMA 4 enclosure mounted outside of the wet well.

SITE LIGHTING

The lift station site shall be provided with area lighting. The lighting shall meet the requirements of the local power company and should be sited as shown on the drawings.

SITE FENCING

The lift station site shall be fenced as shown on the drawings. Fencing shall be installed as specified in SECTION 02831, CHAIN LINK FENCING.

SITE ACCESS

Site access to the lift station shall be provided by a gravel access drive/parking area. The drive shall be a minimum of 10-feet wide and shall be oriented as shown on the plans. It shall consist of a minimum of 6 inches compacted ABC stone base. The drive shall be graded to drain and shall be installed in such a way as to minimize the runoff and erosion potential. Parking area shall be of sufficient size for a vactor truck to turn around during wet well cleaning.

WATER SERVICE

Each lift station site shall be provided with a source of water for routine maintenance purposes. If possible, a fire hydrant shall be located adjacent to the lift station site to facilitate filling of the wet well during lift station start up.

A one (1) inch water service with a standard PWC meter box, a reduced pressure backflow preventer, and a yard hydrant shall be installed at each lift station. The meter shall be installed inside the easement or right-of-way, in accordance with PWC standards. The meter box shall be in accordance with PWC standards. The reduced pressure backflow preventer shall be installed within 100' of the tap on the main and inside the lift station fencing unless the distance exceeds 100'. A non-freeze 1" yard hydrant shall be provided, located as shown on the approved site plan. The yard hydrant shall be installed in accordance with the Yard Hydrant standard detail.

INSTALLATION

Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Immediately after off-loading, contractor shall inspect pumps and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all equipment serial numbers and parts lists with shipping documentation. Notify the appropriate manufacturer's representative of any unacceptable conditions noted with shipper.

Install, level, align, and lubricate pumps and all related equipment as required by the manufacturer. Equipment installation shall be in accordance with written instructions supplied by the respective manufacturer.

FIELD QUALITY CONTROL

Prior to acceptance by PWC, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

After construction debris and foreign material has been removed from the wet well, the contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

The Contractor shall co-ordinate station start-up with pump manufacturer's technical representative. The representative or factory service technician shall inspect the completed installation and calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

OPERATION AND MAINTENANCE MANUALS

Installation shall be in accordance with written instructions provided by the pump equipment supplier. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

Documentation shall be specific to the pump station and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied. Support data for all equipment supplied shall be provided by those supplying the equipment, and included into the O&M manual. Instructions shall include the following as a

minimum:

a. Functional description of each major component, complete with operating instructions.
b. Instructions for operating pumps and pump controls in all modes of operation.
c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.
d. Support data for all components shall be incorporated into the O&M Manual.
e. As-built electrical schematic diagram of the pump station circuits shall illustrate pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.
f. As-built mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

QUALITY ASSURANCE

Upon request from PWC, pre-engineered pump station suppliers shall prove financial stability and ability to produce the pump system within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long- term customer service and product support.

MANUFACTURER'S WARRANTY

The contractor shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.

All equipment, apparatus, and parts furnished shall be warranted for one (1) year, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease,

packing, gaskets, O-rings, etc. The pump manufacturer shall be solely responsible for warranty of the pumps and all related equipment. The pump shaft seal shall be warranted for a minimum of four (4) years from date of shipment. Should the seal fail within the first year, the manufacturer shall furnish a new seal, without charge to owner, F.O.B. factory. The warranty replacement cost for seals after the first year will be pro-rated as follows:

Failure Within	Percent New Price
2 years	25%
3 years	50%
4 years	75%

Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.

DIVISION 2
SITE WORK

02831 – CHAIN LINK FENCING

GENERAL

It is the intent of this specification to provide for the installation of chain link fencing and/or gates, at the locations specified on the plans and within the Contract Documents. The fencing and/or gates shall be constructed of materials specified or indicated on the Drawings. The intent and purpose of these specifications is to require a complete and satisfactory installation in every respect. Any defect in material or workmanship shall be cause for the replacement and correction of such defect as directed by the Public Works Commission.

REFERENCES

The following ASTM Standards are incorporated by reference into this specification. The latest edition of the reference shall be used.

A.	F 1043	Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
B.	F 934	Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials
C.	A 123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
D.	A 121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
E.	A 392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
F.	F 626	Standard Specification for Fence Fittings
G.	A 641	Standard Specification for Zinc x2013; Coated (Galvanized) Carbon Steel Wire
H.	A 809	Standard Specification for Aluminum-Coated (Aluminized) Carbon Steel Wire
I.	B 211	Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire

In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

MATERIALS

All chain link fencing requirements shall be in accordance with the North Carolina Department of Transportation's (NCDOT) Standard Specification for Roads and Structures (most recent edition) and the requirements herein. In case of conflicting requirements between this specification and the NCDOT requirements, this specification will govern.

FABRIC

Chain link fence fabric shall be number 9 gauge aluminized, continuously woven wire, two (2) inch uniform square mesh without knots or ties, except for knuckling and barbing. Chain link fence fabric shall be galvanized steel or aluminum. Both the top and bottom edges of the fabric shall be barbed unless

otherwise specified within the Contract Documents. Galvanized steel fabric shall have a Class D coating. Polyvinyl coated fabric shall be Type IV Class A or B, and the vinyl coating shall be a standard color in accordance with ASTM F934 and as approved by the Public Works Commission.

The chain link fence fabric shall be fastened to each line post with number 9 gauge fabric bands spaced 18 inches apart, and to the top rail with number 9 gauge wire spaced 24 inches apart.

The Contractor shall not piece together a number of short pieces of fence fabric.

FRAMEWORK

The Contractor shall furnish either galvanized steel fence framework or aluminum alloy fence framework. The Contractor shall utilize the same type of fabric and framework throughout the Work. If galvanized steel framework is to be utilized, the chain link fence fabric shall be either galvanized steel or aluminum coated steel, unless otherwise specified. All posts and other appurtenances used in construction shall be hot-dipped, galvanized with a minimum of 1.8 oz. per square foot surface. The framework shall be as specified herein and in accordance with Public Works Commission standard details. All posts shall have a dome cap that prevents moisture from entering the post.

Line Posts:

Steel H posts shall have minimum yield strength of 45,000 psi and a minimum weight of 3.26 pounds per foot. Steel posts shall be galvanized in accordance with ASTM F 1043, with a Type A coating. All steel posts shall be Schedule 40.

Aluminum H posts shall weigh a minimum of 1.25 pounds per foot. Aluminum posts shall be a minimum of two (2) inches in diameter.

Line posts shall be a minimum of 2-1/2" in diameter, unless otherwise specified.

Intermediate posts shall be evenly spaced, with a maximum spacing of ten (10) feet on center.

Vinyl coated posts shall have a fusion bonded vinyl coating a minimum of six (6) mils thick. The vinyl coating shall be a standard color in accordance with ASTM F934 and as approved by the Public Works Commission.

Top and Brace Rail:

The top rail shall be Schedule 40 steel, a minimum of 1-5/8" in diameter. All top rails shall be furnished with suitable metal connections to securely fasten them to the posts. The minimum length of top rails shall be 15 feet. The completed top rain assembly shall form a continuous rail passing through the top fittings of the line posts.

Brace rails shall be installed midway between the top post on the ground, and extend from the terminal post to the first adjacent line posts, unless otherwise specified or directed by the Public Works Commission. The brace rails shall be securely fastened to the posts, and trussed from the line post back to the terminal post with a minimum 3/8" diameter round rod. The round rod shall be furnished with a turnbuckle, to adjust the tension.

Terminal Posts:

Terminal posts shall be a minimum of 2-1/2" in diameter. Terminal posts at gates shall be a minimum of four (4) inches in diameter. All terminal posts shall be Schedule 40.

Gate Frames:

The vertical gate frames shall be Schedule 40, minimum two (2) inches in diameter. The top and bottom rail shall be Schedule 40, minimum 1-5/8" in diameter.

Tension Wire:

Tension wire for use with galvanized steel fencing and framework shall be number 7 gauge, zinc coated, and installed six (6) inches above grade. The tension wire shall be fastened to the fence fabric with aluminum rings, a minimum of 24 inches on center, and shall be fastened to each post.

Tension wire for use with aluminum or aluminum coated chain link fabric shall be solid aluminum wire with a minimum diameter of 0.192 inches. The solid aluminum wire shall be in accordance with ASTM B211 and shall have a minimum breaking strength of 1,200 pounds per foot and a minimum elongation of 10%. The tension wire shall be fastened to the fence fabric with aluminum rings, a minimum of 24 inches on center, and shall be fastened to each post.

BARBED WIRE

Barbed wire shall be provided as indicated in the Contract Documents and as directed by the Public Works Commission. All barbed wire shall be in accordance with ASTM A121, unless otherwise indicated herein. The Contractor shall utilize the same type of barbed wire throughout the Work.

The barbed wire shall be galvanized steel or aluminum coated steel. Where aluminum chain link fabric is being utilized, galvanized steel barbed wire shall not be used.

All barbed wire shall have 4 point barbs spaced a maximum of five (5) inches apart. The use of single strand barbed wire is not acceptable.

Two strand galvanized steel barbed wire shall be fabricated from 12-1/2 gauge strand wire, with four (4) point galvanized steel number 14 gauge barbs. The barbed wire shall be standard grade, with a Class 3 coating on the wire and a Class 1 coating on the barbs.

Two strand aluminum coated steel barbed wire shall be fabricated from 12-1/2 gauge aluminum coated steel wire, with the four (4) point barbs being either number 14 gauge aluminum coated steel or aluminum alloy wire.

Extension Arms:

Extension arms shall be galvanized steel or aluminum alloy, and shall match the material of the framework. Each extension arm shall carry three (3) strands of barbed wire, approximately 12 inches out from the fence line. The extension arms shall have self-locking grooves to securely fasten the barbed wire. The extension arm shall be capable of supporting a minimum of 400 pounds vertical dead load from the tip of the arm.

GATES

Gates shall be furnished with the same fabric as the fence. Hinges for the gates shall allow the gate to open 180 degrees. A latch and drop rod shall be furnished for securing the gate. Each gate section shall be trussed with a minimum 3/8" diameter round rod. The round rod shall be furnished with a turnbuckle, to adjust the tension.

The Public Works Commission shall furnish the chain and lock for securing the gate.

FITTINGS, HARDWARE, MISCELLANEOUS ITEMS

All fittings, hardware, and miscellaneous items shall be in accordance with the applicable ASTM specification, the terms and conditions of this specification, and as indicated in the table below. All fittings, hardware, and miscellaneous items shall be galvanized in accordance with the applicable ASTM specification. Vinyl coated fittings, hardware, and miscellaneous items shall be galvanized steel or aluminum coated steel (in accordance with this specification) and shall have a bonded vinyl coating. The minimum thickness of the vinyl coating shall be six (6) mils. For vinyl coated tension wire, rings, and tie wires, the minimum thickness shall be 10 mils.

Item	Gauge or Diameter, inch	Coating, oz/sf	Coating, oz/sf, Aluminu	Remarks
Tie wires, steel	9	0.90	0.40	For fastening chain link fabric and tension wire to tubular sections or to roll formed steel line posts.
Tie wires, Aluminum	6	-	-	Alloy 1350-H19 or approved equal.
Clips, steel wire	7	0.90	-	For fastening chain link fabric and tension wire to H- posts.
Hog rings, steel	12	0.80	0.40	For fastening chain link fabric to tension wire.
Hog rings, aluminum	9	-	-	Alloy 1350-H19 or approved equal.
Tension (stretcher) bars, steel	3/16 x 3/4	1.50	-	For connection of 1 3/4" or 2" fabric to end, gate and corner posts for fabric heights over 5 ft.
Tension (stretcher) bars, steel	3/16 x 5/8	1.50	-	For connection of 1 3/4" or 2" fabric to end, gate and corner posts for fabric heights up to 5 ft.
Tension (stretcher) bars, steel	1/4 x 3/8	1.50	-	For connection of 1" fabric to end, gate, and corner posts.
Post and line caps	-	1.30	-	For installation on top of posts to guard against moisture.
Rail and brace ends (pressed steel or cast iron)	-	1.30	-	-
Top rail steel sleeves	0.051	1.30	-	For rail connections. Shall be fabricated to prevent movement along the rail.
Tension band	14	1.30	-	For fastening tension bar to posts.
Brace band	12	1.30	-	For fastening rail to posts.
Barbed wire extension arms (pressed steel or cast				Shall be fitted with clips or slots for

iron)	14	1.30	-	attaching the barbed wire to the arms.
Hinges, latches	-	2.00	-	-

PRIVACY SLATS

Privacy slats for lift station fencing and gates shall be extruded aluminum with gloss baked enamel finish. Color shall be selected by Owner from Contractor provided samples.

INSTALLATION

Installation shall be made in accordance with the requirements outlined herein and the manufacturer's recommendations. The fence shall be erected on a prepared surface to the lines and grades indicated on the plans. The Contractor shall only clear what is necessary to erect a clear fence line. The Contractor shall grade along the fence line to ensure that no obstructions to proper drainage are created. The Contractor shall install the fence to conform to the general contour of the ground. The bottom of the fabric shall be as close to the ground as possible, unless otherwise directed by the Public Works Commission.

The height of the fence and/or gates shall be as indicated in the Contract Documents, match existing fence height, or as directed by the Public Works Commission. The use of barbed wire will be as specified in the Contract Documents or as directed by the Public Works Commission.

POSTS

All posts shall be set plumb and in alignment into a 36-inch minimum depth concrete footing of proper size and shape so as to furnish sufficient support to withstand any strain or shock ordinarily brought to bear on a fence of this character. The concrete shall have a minimum compressive strength of 3,000 psi (in accordance with ASTM C-94) and the foundations a minimum of four (4) times the diameter of the post. The concrete shall be compacted to be free of voids. The top of the concrete shall be troweled smooth and sloped to drain away from the posts. The Contractor shall allow the concrete to cure a minimum of three (3) days before placing any load on the post.

For straight runs of fence, brace posts shall be installed no more than 500 feet apart.

FABRIC

The Contractor shall install the chain link fence fabric to the end, gate, corner, or brace posts with stretcher bars and stretcher bar bands. The fabric shall be fastened to each post with wire fasteners spaced and wound as specified by the manufacturer. The fabric shall be fastened to the tension wire utilizing the specified rings at the specified intervals, or weave the tension wire through the fabric.

The fabric and barbed wire shall be stretched to the proper tension as recommended by the manufacturer and securely fastened to the framework members to result in a straight fence line without sagging. Tension shall be applied by utilizing mechanical fence stretchers designed for this purpose. The bottom of the fabric shall be held as uniformly as is practicable to the finished grade.

The Contractor shall connect rolls of chain link fabric by field weaving, provided that field weaving is identical in appearance and strength as machine weaving completed in a factory.

The Contractor shall install barbed wire with sufficient tension to prevent any vertical movement of the barbed wire. Splicing of the barbed wire shall only be completed at end, gate, or corner posts.

REPAIR OF GALVANIZED SURFACES

Repair galvanized surfaces that are abraded or damaged at any time after the application of zinc coating. Surfaces to be repaired shall be clean, dry and free of oil, grease, pre-existing paint, corrosion and rust. Surface to be repaired shall be blast-cleaned to SSPC-SP 10 (near white). If circumstances do not allow the use of blast or power tool cleaning, the Contractor shall utilize hand tools to clean the surface to SSPC-SP 2 (removal or loose rust, mil scale, or paint to the degree specified, utilizing hand chipping, scrapping, sanding, and wire brushing). Regardless of the method used to prepare the surface, the preparation shall extend into the undamaged galvanized coating.

The Contractor shall brush or spray apply the zinc repair paint in accordance with the manufacturer's instructions. Paint shall be applied in two (2) coats, to achieve a minimum total dry film thickness of three (3) mils. The Contractor shall allow for the repair to properly cure in accordance with the manufacturer's instructions.

The Contractor shall apply the zinc repair paint when:

- the air/steel temperature is 40°F and rising,
- steel temperature shall be 5°F above the dew point, and
- relative humidity shall be 85% or less.

The Contractor shall follow the zinc repair paint manufacturer's recommendations if they are more restrictive than those listed above.

The Contractor shall follow paint manufacturers written instructions on storage temperatures, mixing application, continuous agitation and pot life. No thinners are to be used when applying organic zinc repair paint by brush or roller.

Excessive damage to galvanized surfaces as determined by the Public Works Commission is cause for rejection. The Contractor shall replace or re-galvanize rejected galvanized material, as determined by the Public Works Commission.

— END OF SECTION —

DIVISION 2
SITE WORK

02931 SOD

GENERAL

Restoration of existing lawn areas outside of the public right-of-way disturbed by construction activities shall be by installation of new sod. Restoration and sod shall be performed as soon as practical, but the time period between initial disturbance, the utility installation and sod placement shall not exceed 60 days. Sod is defined as blocks, squares, strips of turf grass and adhering soil used for vegetative planting. Sodding and preparation of the sod bed shall be performed by an experienced landscape subcontractor specializing in this type of operation unless otherwise approved by the Owner in writing.

The Contractor shall adhere to the standards set forth by the American Association of Nurseryman and the Associated Landscape Contractors of America. All personnel shall be appropriately trained with regard to the degree of involvement so to assure the Owner of the highest level of workmanship. Sod species suitable in this area are hybrid bermuda, centipede and zoysia; however the sod placed for each individual's lawn shall be the same species of sod as existing. Sodding may be performed at any time of the year except frozen sod shall not be placed nor shall sod be placed on frozen ground. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the successful establishment and growth of a vigorous, disease free and weed free sod lawn.

MATERIAL

Materials, equipment and products incorporated in the work shall be approved by the Owner. The Contractor shall submit a list of the proposed materials with samples, if required. Package materials should be delivered in unopened original containers showing weight, analysis and name of manufacturer. The Contractor shall protect the material from deterioration.

Sod shall contain 95 percent permanent grass; not more than five (5) percent weeds and undesirable grasses, good texture and free from obnoxious grasses, roots, stones and foreign materials. Sod shall be uniformly 1 ½ to 2 inches thick with a well developed fibrous root mat system in topsoil with clean cut edges. The sod shall be sufficiently dense and cut to the minimum required thickness such that if the sod is suspended by one corner, the sod will not tear apart. The sod shall be recently mowed to a height of not more than three (3) inches prior to harvest. The sod shall be supplied and maintained in a healthy condition as evidence by the grass being a normal green color in appearance, dense, and free from insects, pests, disease or injury. Sod shall be delivered to the job site within 24 hours after being cut and shall be installed with 24 hours after delivery. Any sod which is torn, broken or too dry will be rejected.

SOIL BED PREPARATION

Before landscape construction is to begin, the site shall be cleaned and disposed of brush, rubbish, stones, gravel and other foreign material within the area to be landscaped. Exposed ground surfaces disturbed during construction activities shall be graded to the original contours (allowing for the thickness of the sod) or as in

the case of an altered contour such as a fill slope, graded as directed by the Owner to finish grade, or typical cross section. The sod bed shall be excavate to such a depth that after sod placement the top of the sod shall be flush with surrounding grade or contours. Rake areas to be sodded smooth, free from unsightly variations, bumps, ridges or depressions. Do not start work until conditions are satisfactory and do not work during increment or impending increment weather.

The surface area to receive sod shall contain a minimum of four (4) inches of good, fertile, friable, organic natural topsoil loam as a base for laying the sod. Topsoil shall be free of clumps, brush, sticks, weeds, stones, roots, trash or other objectionable material. Contractor shall insure all topsoil to be free of plants or plant parts of quackgrass, johnson grass, nut sedge, poison ivy or other noxious weeds. The Contractor shall furnish and supplement the existing topsoil at no additional costs to the Owner providing a minimum 4 inch thickness as specified. Soil preparation shall not be performed in frozen or extremely wet conditions. The finished topsoil bed shall be uniform in grade, with a yard like appearance. All changes in grade shall have a smooth, rounded peaks and valleys.

The soil shall be scarified or otherwise loosened to a depth of not less than five (5) inches and all clods shall be broken. The top four (4) inches shall be worked into an acceptable smooth, friable and uniformly fine texture sod bed by use of soil pulverizes, drags, harrows or by other methods approved by the Owner. Commercial grade fertilizer (8% nitrogen, 8% phosphate, 8% potash) shall be applied at a rate of 20 pounds per 100 square feet, super-phosphate at 12 pounds per 1,000 square feet and lime (dolomite limestone containing not less than 85% total carbamates) shall be applied at a rate of 25 pounds per 1,000 square feet or at a rate recommended for the type of sod being placed. Apply soil amendments within 24 hours after raking topsoil base surface and not more than 48 hours prior to laying sod. Mix thoroughly a minimum depth into the upper four (4) inches of topsoil and lightly water to aid in dissipation. Sod placement shall not begin until the soil preparation is inspected and approved by the Owner. During application of soil amendment fertilizer etc., adequate precautions shall be taken to prevent damage to existing features such as traffic, structures, landscape, trees, vegetation, utilities or any other appurtenances. The Contractor shall be required to repair or clean any damages.

PLACING SOD

The Contractor and his landscape subcontractor shall coordinate the placing of the sod to begin within 24 hours after the topsoil base preparation is completed and accepted by the Owner. Sod shall be brought to the site as near to the time of placing as possible. Store sod in the shade, and keep watered particularly in extreme hot and dry condition to insure vitality and to prevent the dropping off of soil during handling. During wet weather, the sod shall be allowed to dry sufficiently to prevent tearing. Handling shall be done in a manner which will prevent tearing, breaking, drying or other damage. Carefully place sod in rows with the longer side perpendicular to slopes and the ends staggered in each successive row in a brick-like pattern. Butt the ends and sides together tightly and do not overlap or stretch the sod. Do not leave any voids or gaps. Unavoidable gaps shall be closed with small pieces of torn or broken sod if kept moist and approved by the Owner. After the sod is laid, irrigate thoroughly to allow water to penetrate a minimum six (6) inches into the soil below the sod. Sod shall not be placed when the atmospheric temperature is below 32°F.

Tamp and roll completed with a manual roller or approved equipment to eliminate minor irregularities and to form close contact with the soil bed immediately after placing and watering. The type of rolling and tamping equipment to be used shall be submitted to the Owner for approval prior to construction. On steep slopes 3:1

(horizontal and vertical) or greater, in drainage ditches or any areas where sod slipping may occur, anchor sod with approved wooden stakes (½"x ¾" x 12") or staples spaced not over two (2) feet apart in any direction and/or in sufficient number to prevent slippage or displacement. The anchors shall be driven flush with the surface of the sod. The wide flat side of the stake shall be driven parallel to the slope. Staking shall be done concurrently with sod placement and prior to tamping. Sod shall be laid with the long horizontal edge of the strips parallel to the contour starting at the bottom of the slope. The edge of the sod shall be turned slightly in the ground at the top of a slope and a layer of earth placed over it and compacted so as to conduct the surface water over and onto the top of the sod. Upon completion of the above described work, the surface of the sodded areas shall coincide with the finished grade and not exceed ¼" plus or minus variation to adjoining grade or proposed contour. Extreme care shall be taken to prevent the installed sod from being torn or displaced.

MAINTENANCE

The Contractor shall, at no additional cost to the Owner, make whatever arrangements necessary to insure an adequate supply of water to meet the needs of this Contract. The Contractor shall supply water of suitable quality and purity to sustain and encourage vigorous plant growth, and supply all equipment for proper delivery and application to planted areas. Water obtained from a PWC fire hydrant shall be metered and properly protected with an approved backflow prevention device. PWC must inspect and approved any connections to their water system to include the proposed water application and storage equipment. The Contractor shall not use private resident's water. The Contractor is solely responsible to provide watering of the sod. The method of application of water shall be approved by the Owner. Limit watering to early morning or late afternoon to enable to soil to absorb maximum amount of water.

Maintenance shall begin immediately after sodding operation. The Contractor shall maintain all sodded areas until sod is firmly established and as outlined below. Maintenance will include watering, fertilizer, pest control, soil amendments, disease control, erosion repair, mowing, protecting turf area from traffic (i.e. temporary fences, barriers, signs, etc.) and replacement of any dead or damaged sod.

Watering

- Water lawn areas once a day with a minimum ½ inch water for the first three (3) weeks after area sodded.
- After the three (3) week period, water twice a week with a ¾ inch of water each time unless a comparable amount of rainfall has occurred.
- Make weekly inspections to determine moisture content of soil and supplement the above watering schedule as needed.
- Excessive runoff puddling and wilting shall be prevented.

Fertilizer and Pest Control

- Evenly spread fertilizer composite at a rate of 40 pounds per 5,000 square feet or as recommended by the manufacturer. Fertilizer shall not be applied until two (2) weeks after initial placement of the sod or prior to the advent of winter dormancy.
- Treat areas of weed and insect infestation as recommended by the treatment manufacturer.

Mowing

- The Contractor shall do mowing operations, (in yards not being mowed by residents) until provisional acceptance.
- Mowing shall be done only when the grass is dry with a rotary type mower having a blade height set not lower than one and one half (1½) inches nor higher than three (3) inches.
- Mowing operations shall be conducted at intervals, which insure grass height does not exceed four (4) inches between mowing.
- The Contractor shall complete at least one mowing operation before the work will be considered for provisional acceptance.

The Contractor shall protect and not allow access of vehicular traffic into any newly sodded areas and shall repair any damaged turf to original grade. Maintenance shall continue for a period of 90 days after placement or until provisional acceptance by the Owner. A written record shall be furnished to the Owner of the maintenance work performed. At least two weeks shall elapse after chemical control is applied before a request of inspection.

ACCEPTANCE

Fifteen (15) days prior to the end of the 90 day maintenance period, the Contractor shall make a written request to the Owner for an inspection and provisional acceptance of the sod. Failure to notify the Owner will not relieve the Contractor of the maintenance provisions required and the Contractor will continue to be responsible for the maintenance of the sod.

Replacement of dead sod shall be performed within seven (7) days after notification by the Owner and the maintenance period for these areas or individual lawns shall be extended for the 90 day maintenance period. Failure to replace dead sod within the specified seven (7) day period will result in the Owner having the work performed and deducting the cost from the Contract; however, the Contractor shall be responsible for the maintenance.

Final acceptance will be given upon satisfactory contract performance exhibited at final inspection and acceptance. Sodded areas are to be fully rooted prior to acceptance. The Owner shall be the sole judge as to whether or not the lawns are acceptable. Should any deficiencies be disclosed at final inspection, the Contractor shall make the necessary corrections in a timely manner and request re-inspection.

GUARANTEE

The Contractor shall guarantee a dense, vigorous stand of turf free of weeds, disease, pests or any dead areas more than one half of a square foot in size for a period of 90 days from initial placement or replacement whichever is greater. Total dead area shall not exceed one percent (1%) of total square footage for each individual resident's lawn.

DIVISION 2
SITE WORK

02933 LAWNS AND GRASSES (SEEDING)

GENERAL

All exposed ground surfaces that have been disturbed during construction shall be graded to original contours as practicable, shaped to drain, and free of trash and debris. Grassing shall be accomplished as soon as practicable after sections of work are completed. Seeding and/or planting shall be performed by an experienced subcontractor specializing in this type of operation, unless otherwise approved by the Public Works Commission in writing. Disturbed sections shall not exceed one mile, without prior approval by the Public Works Commission. Grassing shall be in accordance with the Contract Documents.

PREPARATION OF THE SOIL

The surface area to receive seed shall contain a minimum of four (4) inches of good, fertile, friable, organic natural topsoil loam as a base for spreading the seed. Topsoil shall be free of clumps, brush, sticks, weeds, stones, roots, trash or other objectionable material. Contractor shall insure all topsoil to be free of plants or plant parts of quackgrass, johnson grass, nut sedge, poison ivy or other noxious weeds. The Contractor shall furnish and supplement the existing topsoil at no additional costs to the Public Works Commission providing a minimum 4 inch thickness as specified. Soil preparation shall not be performed in frozen or extremely wet conditions. The finished topsoil bed shall be uniform in grade, with a yard like appearance. All changes in grade shall have a smooth, rounded peaks and valleys.

The topsoil shall be loosened and mixed to the depth of four inches (4"). Suitable equipment (cultipackers, harrows, drags) meeting the approval of the Public Works Commission shall be used. This operation shall be accomplished by cutting on one (1) foot centers parallel to the contour of the slopes. On slopes that are steeper than 2:1, both depth preparation and degree of smoothness may be reduced, if approved by the Public Works Commission, but in all cases the slope surface shall be scarified groove, trenched or punctured so as to provide a textural plane of cut forming pockets, ridges, or trenches in which seeding material can lodge. Soil preparation shall not be performed when the soil is frozen, extremely wet or in an otherwise unfavorable working condition. The soil shall be free of any substance that might inhibit plant growth. Assistance of the local agricultural agent is recommended.

Lime shall be applied at the rate of 1/2 tons per acre. 10-20-20 commercial fertilizer shall be applied at the rate of 1,000 pounds per acre and well worked in to the top four inches (4") of top

soil. If hydroseeding, use 500 pounds of 10-10-10 fertilizer on slopes steeper than 1/2 horizontal to 1 vertical.

SEED MIXTURE AND SOWING THE SEED

Seed shall be seed certified to be the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures and pure live seed. The producer's seed label shall indicate it the minimum percent of pure live seed (which shall be 82.45 for Bermuda, 88 for Rye Grain), the minimum percent of germination in hard seed and maximum percent of weed seed (no more than 1 percent for Bermuda, 0.5 percent for Rye Grain). Seed shall be labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable State seed laws. Seed that has become wet, moldy, or otherwise damaged will not be acceptable.

The following seed mixture shall be used:

	POUNDS OF SEED PER ACRE			
	K-31 Fescue	Grain Rye	Common Bermuda	Centipede
April 15 - Sept. 1	75	-	60 (hulled)	5
Aug. 15 - Nov. 15	120	-	25 (hulled)	5
Nov. 1 - April 1	120	120	25 (un-hulled)	5

Note: If there are differences in the seed mixture between the mixture stated in these specifications and that which is specified as part of an approved Erosion Control Plan, the seed mixture specified in the erosion control plan shall take precedence.

Where construction crosses a pasture that has been grassed, the Contractor shall re-seed the area with the same type of grass as found on the site. All highway rights-of-way, and private yards disturbed shall also be re-seeded or with the same type of grass previously found. The seed mixture specification shall be used as a guide and the Contractor is charged with the responsibility of seeding areas with the proper type of grass that matches the existing.

Seed shall be broadcast uniformly by hand or by approved sowing equipment. One half of the seed shall be sown in one direction and the remaining shall be sown at right angles to the first. Do not seed when the wind velocity exceeds five (5) miles per hour. Rake lightly into top 1/8 inch of the soil prior to compacting, with a roller not exceeding 100 pounds.

All seeded areas will be mulched with two (2) tons per acre of small grain straw or wood cellulose fiber spread uniformly, approximately 1/4 of ground should be visible to avoid smothering seedlings. Asphalt emulsion (ASTM D-977 and ASTM D-2028) shall be used to anchor the straw applied at 150 gallons per ton of straw, or crimped to stabilize. Asphalt emulsion shall be required from November 1st to March 31st. The Contractor shall take sufficient precautions to prevent mulch from entering drainage structures through displacement by wind, water or other causes and promptly remove any blockage which may occur.

SPECIAL CONSIDERATIONS

Shrubbery shall be expertly removed and carefully preserved for replanting, unless otherwise directed by the Public Works Commission adequate earth ball shall be removed to guard against damage to the root system. Shrubbery shall be replanted only after all construction is complete. The excavation made for replanting shall be six inches (6") larger in every dimension than the root ball removed. This additional space shall be filled with a mixture of one half topsoil and one half peat moss. Care shall be taken to set the top of the ball slightly above or flush with the surrounding surface. Any shrubbery damaged or that dies shall be replaced with an equal or better plant material at the Contractor's expense.

MAINTENANCE

The Contractor shall protect and maintain grassed areas as necessary to establish a uniform turf composed of the grasses specified. The Contractor shall re-seed any bare areas and repair all eroded areas.

Watering of seeded areas will be required during periods of dry weather to promote maximum growth. The Contractor shall supplement natural rainfall to insure a minimum of one (1) inch of rainfall weekly.

Maintenance of lawns begins immediately after the area is planted and continues for the period required to establish acceptable lawns, but not less than sixty (60) days after initial seeding, or until provisional acceptance by Owner. Maintain seeded areas by watering, fertilizing, mowing, weeding and other operations such as rolling, re-grading, replanting, aerating, and mulching as required to establish an acceptable lawn free of eroded or bare areas.

ACCEPTANCE

Fifteen (15) days prior to the end of the sixty (60) day maintenance period, the Contractor shall make a written request to the Owner for an inspection and provisional acceptance of the seeded area. Failure to notify the Owner will not relieve the Contractor of the maintenance provisions required and the Contractor will continue to be responsible for the maintenance of the seeded area.

Replacement of dead seed area(s) shall be performed within seven (7) days after notification by the Public Works Commission and the maintenance period for these areas or individual lawns shall be extended for an additional sixty (60) day maintenance period. Failure to replace seeded area(s) within the specified seven (7) day period will result in the Owner having the work performed and deducting the cost from the Contract; however, the Contractor shall be responsible for the maintenance.

Final acceptance will be given upon satisfactory contract performance exhibited at final inspection and acceptance. Seeded areas are to be fully rooted prior to acceptance. The Owner shall be the sole judge as to whether or not the lawns are acceptable. Should any deficiencies be disclosed at final inspection, the Contractor shall make the necessary corrections in a timely manner and request re-inspection.

Payment to the Contractor for seeding areas will be approved once the seed has been established and meets the requirements of this paragraph of this specification.

GUARANTEE

The Contractor shall guarantee a stand of turf is considered acceptable when a live vigorous stand of permanent grass is established with growing sprouts visible at the surface showing not less than 9 seedlings of permanent grass at least 2 inches long in each square foot, and where no gaps larger than 4 inches in diameter occur anywhere in the lawn area. Permanent grass is defined as Common Bermuda, Centipede, and Fescue.

DIVISION 2
SITE WORK

02934 SEEDING WETLANDS

GENERAL

All exposed ground surfaces that have been disturbed during construction shall be graded to original contours, reasonably smooth, and free of trash and debris. Grassing shall be accomplished as soon as practicable after sections of work are completed. Seeding shall be performed by an experienced subcontractor specializing in this type of operation, unless otherwise approved by the Engineer in writing. Disturbed sections shall not exceed one half mile, without prior approval by the Engineer. Grassing shall be in accordance with the following specifications:

PREPARATION OF THE SOIL

The topsoil shall be loosened and mixed to the depth of 4" to 8". Suitable equipment meeting the approval of the Engineer shall be used. The soil shall be free of clay lumps, brush, weeds, stones, roots, stumps or any other substance that might inhibit plant growth. Assistance of the local agricultural agent is recommended.

Provide agricultural lime at rate required to bring soil acidity to slightly acid - ph 6, according to soil test report.

Lime and fertilizer shall be applied uniformly and mixed with the soil during seedbed preparation. Apply 10-20-10 commercial fertilizers at the rate of 20-lbs./1000 s.f. for warm season mix and 10-20-10 commercial fertilizer at a rate of 20 lbs./1000 s.f. for cool season mix.

Apply 10-10-10 commercial fertilizers at the rate of 20-lbs./1000 s.f. for temporary cover crops. In addition, provide 15-lbs./1000 s.f. of superphosphate.

The following is for the warm season mix:

a. All warm grass seed shall be debearded or conditioned by brushing to create a product nearly the same as debearding. This does not apply to Switchgrass.

b. Disk two times to break-up crop residue and dirt clods prior to seeding.

c. Pack soil to create a firm seedbed with a cultipacker or roller.

d. If a rain shower should fall after the seedbed is prepared but before planting break-up any crust formation.

e. Seeding shall be installed to a depth of 1/4" utilizing a rangeland drill or conventional grass

drills. It is extremely important that seed not be planted deeper than 1/2" depth. Do not disc or harrow after seeding. This will put the seed too deep. A Brillion seeder will be acceptable.

The following seed mixture shall be used:

Dates	Types	Rate
April 1 - July 15	***Warm Season Mix*** Switchgrass, Cave-in-rock, Alamo Smartweed; and Japanese Millet or Sorghum Sudan Grass Hybrids (Mow prior to maturity)	 8 pls #/acre or 4 oz./1000 s.f. 2 bulk #/acre or 1 oz./1000 s.f. 20-lb/acre or ½ lbs/1000 s.f.
July 16 - Sept 1	Temporary crop of Japanese Millet or Sorghum Sudan Grass Hybrids (To be followed by permanent mixture)	20-lb/acre or ½ lbs/1000 s.f.
Sept 2 - Nov 1	***Cool Season Mix*** Reed Canary Grass	12 bulk #/acre or 6 oz./1000 s.f.
	Smartweed	2 bulk #/acre or 1 oz./1000 s.f.
Nov 2 - March 31	Temporary Crop of Wheat (To be followed by permanent mixture	40 lbs/acre

All highway rights-of-way, and private yards disturbed shall also be re-seeded or sodded with the same type of grass previously found. The seed mixture specification shall be used as a guide and the Contractor is charged with the responsibility of seeding areas with the proper type of grass existing.

Seed shall be broadcast uniformly by hand or by approved sowing equipment. One half of the seed shall be sown in one direction and the remaining shall be sown at right angles to the first. Do not seed when the wind velocity exceeds 5 miles per hour. Rake lightly into top 1/8 inch of the soil prior to compacting, with a roller not exceeding 100 pounds.

All seeded areas will be mulched with 75 pounds to 100-lbs./1000 s.f. of clean wheat straw, spread uniformly, approximately 1/4 of ground should be visible to avoid smothering seedlings. If hydro-seeded, use virgin paper mulch only. The Contractor shall take sufficient precautions to prevent mulch from entering drainage structures through displacement by wind; water or other causes and

promptly remove any blockage, which may occur.

MAINTENANCE AND GUARANTEE

The Contractor shall protect and maintain grassed areas as necessary to establish a uniform turf composed of the grasses specified. The Contractor shall re-seed any bare areas and repair all eroded areas.

Maintain seeded areas by watering, fertilizing, mowing, weeding, and other operations such as rolling, regrading, replanting, aerating, mulching as required to establish an acceptable lawn free of eroded or bare areas.

ACCEPTANCE

The Contractor shall guarantee a stand of turf is considered acceptable when a live vigorous stand of permanent grass is established with growing sprouts visible at the surface showing not less than 9 seedlings of permanent grass at least 2 inches long in each square foot, and where no gaps larger than 4 inches in diameter occur anywhere in the seeded area.

DIVISION 2
SITE WORK

03301 CONCRETE CONSTRUCTION (UTILITY)

GENERAL

Concrete construction specified in this section shall be applicable to all "site work" and is not intended to cover general building specifications. The concrete work shall include all furnishing, hauling, fine grading and subgrade, form work, etc. and all incidentals necessary for completion of the work as it pertains.

MATERIALS

Concrete

The Contractor shall furnish and place concrete in strict accordance with the requirements of ACI 318. Ready-mixed concrete from an approved mixing plan shall be used throughout the work and conform to the requirements of ASTM C-94 for batch, mixing, and transporting. Concrete shall be in accordance with the following requirements:

A. Under Ground - Regular Weight Concrete

28-day compressive strength	3000 psi
Coarse aggregate	1 ½" max. size stone
Slump	2" minimum, 4" maximum
Air Entrainment	No requirement

B. Walls, Slabs, Sidewalks, Curb and Gutter - Regular Weight Concrete

28-day compressive strength	3000 psi
Coarse aggregate	3/4" max. size stone
Slump	2" minimum, 4" maximum
Air Entrainment	5 more or less 1

The Contractor shall submit for approval mix designs, designed and tested by an approved testing laboratory, following the requirements of ACI 318 for each class of concrete to be used on this project. Mix designs in excess of one year old shall be verified. The Contractor will be responsible for all costs involved in the mix design. Material suppliers and material proportions incorporated in the mix design and certification shall not change without written permission from the Owner.

Admixtures used to produce entrained or air shall be sulforated hydrocarbons or neutralized vinsol resins conforming to ASTM C-260. Calcium chloride, other accelerators, or "anti-freeze" shall not be used without written approval by the Owner.

Reinforcing Steel

Reinforcing bars shall be new billet stock and shall conform to ASTM A-615, Grade 60. Bars shall be deformed to conform to ASTM A-305. The Contractor shall check and submit for approval four (4) sets of shop and erection drawings prepared by the fabricator. Reinforcement detailing and placement shall conform to ACI 318. All reinforcing bars shall be tied in place according to approved erection drawings, using bar supports and accessories conforming to ACI 315. Laps or splices shall conform to ACI 318, and consist of the following minimum dimensions:

Tension Splices	36 Bar Diameters
Compression Splices	30 Bar Diameters

All reinforcing bars shall be tagged and stored in such manner as to be readily available at the time needed. Tag mark substitutions will not be made.

Welded wire mesh fabric reinforcing shall conform to the requirements of ASTM A-185. Lap splices shall be at least one full mesh plus 2" staggered to avoid continuous laps in either direction and securely wired or clipped.

GRADING

The Contractor shall use every effort to observe any possible misalignments in line or grade and will call such to the attention of the Owner promptly. The Contractor is cautioned that he shall be responsible for any damage to utility lines caused by his negligence. The Owner or his representative shall then inspect the forms and if approved, pouring operations may begin. Where unstable material to a depth required to provide a stable subgrade at no additional cost to the Owner.

FORM WORK

Metal forms shall be used throughout the work except for short, odd length sections and in accordance with Chapter 4, ACI 301 and ACI 347. Earth cuts may be used as forms for unexposed vertical surfaces on footings, provided the soil and workmanship allow an accurate and curable excavation. Forms shall be kept in good condition at all times. Any forms which have become out of shape or otherwise unsuitable shall be removed from the work. Forms shall be of such section and design that they will adequately support the concrete and any construction equipment used in the work. Form sections shall be provided with interlocking joints to insure that the forms are tightly jointed together free from movement. Forms shall be held in place by metal pins, not less than eighteen (18) inches in length, with fastenings of metal and wedges to insure a correct, rigid setting.

Forms shall be of the dimension required for the designed cross-section shown on the plans. Built up sections to attain the required depth will not be permitted.

Forms shall be set true to the lines and grades established by the Owner or as indicated on the plans.

Forms shall be held rigidly in position and shall be of sufficient strength to resist springing out of line when concrete is placed.

PLACING CONCRETE

Prior to placing concrete, the subgrade shall be moistened and the contact side of the forms shall be cleaned and coated with a heavy oil. The Contractor shall not place any concrete without the forms, reinforcing steel and subgrade are inspected and approved by the Engineer. Placing of concrete is to be in accordance with ACI 304. Water shall be removed from excavation before placing concrete and flowing water shall be diverted without washing over freshly deposited concrete.

Concrete shall be placed is as not to disturb concrete already in place and in such a manner as to require the minimum amount of lateral movement. Concrete shall be deposited in the forms without segregation. A tremie shall be used when the fall exceeds five (5) feet. Care shall be taken not to upset any forms during the concreting operations. Any concrete showing misalignment due to form movement shall be removed and replaced at no additional costs to the Owner.

All concrete shall be consolidated in accordance with ACI 309. Mechanical vibrators shall be operated by experienced workmen. Spading and rodding may be required to supplement mechanical vibration. Consolidation shall be adequate to remove any voids and after removal of the forms, no honeycomb shall be present. Should any honeycomb be present, the Owner shall determine if the honeycomb is of a minor nature, the voids may be filled with mortar as approved by the Owner.

All concrete within forms shall be brought to true section by the use of an approved straight edge and shall be tamped with straight edge to bring mortar to the surface, after which it shall be floated smooth by means of wood floats. No steel floats will be permitted. After true surface of section has been obtained, and after initial set has taken place, the entire surface shall be brushed with a dampened brush. All joints and all exposed edges shall be rounded off with approved jointing and edging tools. The type of finish required will be specified in the specific item of work specified or indicated on the drawings. All exposed surfaces of retaining walls, structures, etc. shall be given a Class 2 finish with ¼ inch chamfered edges.

No more concrete shall be laid than can be properly finished and covered during the daylight, unless adequate artificial light satisfactory to the Owner is provided.

Immediately after finishing operations have been completed, the entire surface of the concrete shall be sprayed. The use of liquid retarding agents shall conform to standards specified by current AASHTO or ASTM Specifications.

Cold weather concreting is to be in accordance with ACI 306 and hot weather concreting is to be in accordance with ACI 305. Concreting shall be done when weather conditions are favorable unless otherwise directed by the Owner. Concrete operations shall be discontinued when the temperature of 40 degrees Fahrenheit is reached on a falling thermometer. No concreting shall be attempted when local weather bureaus indicate temperatures below freezing within the ensuing 24 hours unless proper precautions are made to protect concrete by covering with straw or other thermal insulation satisfactory to the Owner. The Contractor shall be responsible for the quality and strength of the concrete laid during cold weather or hot weather and any concrete damaged by frost action or freezing shall be removed and replaced as directed by the Owner at the Contractor's expense.

Forms shall not be removed from the concrete until after 7 days, unless approved by the Owner. The Contractor shall apply a curing compound or provide measures to maintain moisture for proper curing at his expense, if early form removal is approved. Immediately after the forms have been removed, all honeycomb areas shall be repaired (with one part cement and two parts sand) and earth backfill material shall be placed adjacent to the finished concrete and smoothed off to prevent an accumulation of standing water, subgrade saturation or under wash in the event of rain.

Both pedestrian and vehicle traffic shall be excluded from crossing the concrete for a period of approximately 14 days by erection and maintenance of suitable barricades. Contractor shall be responsible for any damage resulting from traffic within the 14 day period and he shall remove and replace any concrete damaged as directed by the Owner.

Any construction debris present shall be removed in order to keep the site neat.

MASONRY MATERIALS

Brick shall be in accordance with ASTM C-32 Grade MS laid in full beds of mortar with shove joints.

Concrete masonry blocks shall be in accordance with ASTM C-139. Blocks shall be at least 5", but not more than 8" in thickness nor less than 8" in length and of such shape that the joints can be effectively sealed and bonded with cement mortar.

Cement mortar for brick work shall be in accordance with ASTM C-270, Type M. Use Type IIA cement in accordance with ASTM C-150.

TESTING

The requirements of ACI318 shall be used to control the evaluation of all concrete strengths. The strength is to be checked during construction by four (4) cylinders at the option and cost of the Owner, of which 1 shall be broken at 7 days, 2 at 28 days. If the specified strength is not achieved in 28 days, 1 reserved shall be stored and broken as specified by the Owner. Cylinders shall be made

and stored in accordance with ASTM C-13. Cylinders shall be for each day pour in excess of 10 cubic yards of each different type of concrete, as determined by the Owner. All additional expenses required because of the failure of the materials to meet routine testing requirements, or poorly scheduled concrete deliveries, shall be borne by the Contractor.

DIVISION 2
SITE WORK

09801 ANTI-MICROBIAL ADMIXTURE

GENERAL

All reinforced concrete precast manholes shall include a liquid anti-microbial admixture to render the concrete uninhabitable for bacterial growth. The admixture shall be included in the fabrication of the manhole by an approved concrete precast manhole manufacturer. Coatings applied to the interior walls of the manhole shall not be acceptable.

Further, all field mixed mortar, utilized in concrete precast manholes, shall include the anti-microbial admixture. The intent and purpose of this specification is to render all concrete and/or mortar within sanitary sewer service uninhabitable for bacterial growth. Any defects shall be cause for the replacement and correction of such defect as directed by the Public Works Commission, at no expense to the Public Works Commission.

RELATED SECTIONS

A. 02730 – Sanitary Sewer Systems
B. 02732 – Sewage Force Mains

REFERENCES

A. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections
B. ASTM C1443 – Standard Specification for Precast Reinforced Concrete Pipe
C. ASTM C1577 – Standard Specification for Precast Reinforced Concrete Pipe

SUBMITTALS

All submittals shall be provided in accordance with the Contract Documents, and the requirements outlined herein. The Contractor shall submit, in accordance with the Contract Documents, product data, certifications, and product data, to include the following:

1. U.S. Environmental Protection Agency (EPA) registration number.
2. Documentation that the product has a minimum of 10 years of successful prevention of microbial induced corrosion in sanitary sewers.
3. Documentation that the precast facility is certified by the anti-microbial manufacturer.
4. Documentation from the precast facility stating that the correct amount and correct mixing procedure was followed for all anti-microbial concrete.

QUALITY ASSURANCE

A color identifier shall be applied to the interior of each concrete piece fabricated with the anti-microbial admixture. Each piece shall also be plainly stenciled with the name of the anti-microbial admixture on the exterior of each piece.

MATERIALS

All manholes shall conform to PWC standard specifications and details, unless otherwise approved in writing by the Public Works Commission. All concrete and mortar utilized in the construction of the manholes shall contain an anti-microbial admixture.

Anti-Microbial Admixture:

The liquid anti-microbial admixture shall be used in accordance with the manufacturer's recommendations. The amount of the admixture shall be included in the total water content of the concrete or mortar mix design. The admixture shall be added to the concrete or mortar mix water, to ensure even distribution of the admixture throughout the concrete or mortar mix. When properly prepared, the anti-microbial admixture shall render the concrete or mortar uninhabitable for bacterial growth.

The anti-microbial admixture shall be ConShield or approved equal. The ConShield liquid anti-microbial admixture can be obtained from ConShield Technologies, Inc. or an approved precast facility.

Field Repairs:

Field repairs to the precast concrete or mortar shall be in accordance with the admixture manufacturer's recommendations. All field repairs shall be completed in accordance with PWC requirements.

ACCEPTANCE

Acceptance of the concrete and mortar with the anti-microbial admixture shall be based on conformance with the requirements herein, the Public Works Commission's review of the installed manhole, and results of all testing.

DIVISION 2
SITE WORK

09802 SPECIAL COATINGS - CERAMIC EPOXY

GENERAL

The interior surfaces of all ductile iron pipe and fittings shall be full coated with a ceramic epoxy lining. The ceramic epoxy lining shall be applied to ductile iron pipe free of any other interior lining material. The finish coat shall be applied to yield a minimum dry film thickness of 40 mils for a complete lining.

MATERIALS

The lining material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quarts pigment.

The epoxy material shall meet the following minimum performance requirements:

Permeability Rating: 0.00 perms when tested according to ASTM E-96 Procedure A with a test duration of 30 days.

ASTM 6-95 Cathodic Disbandment: 1.5 volts at 77° F.

ASTM B-117 Salt Spray: 0.00 undercutting after one year.

Immersion Testing ASTM D-714	Duration
20% Sulfuric Acid	1 Year
25% Sodium Hydroxide at 140° F	1 Year
160° F Distilled Water	1 Year
120° F Tap Water	1 Year

The above requirements shall be verified and tested by an approved testing laboratory. Copies of the laboratory test showing that the lining conforms to the specifications shall be furnished to the Engineer, certified by the Supplier.

APPLICATION OF LININGS

Surface Preparation: All interior barrel and joint surface areas which will be exposed to the sewer liquids and gases shall be prepared for lining by removing all laitance form oil and other loose, foreign or deleterious materials which would adversely affect the bond of the lining compound of the pipe surface. All areas to receive the protective coating shall be abrasive blasted using compressed air

nozzles with sand or grit media. The entire surface to be lined shall be struck with blast media so that all rust, loose oxides, etc., are removed from the surface. Any area where rust appears before lining must be re-blasted.

Qualification of Applicator and Workmen:

The lining shall be applied by a competent firm with a five year history of lining sewer pipe. The workmen employed by the applicator shall be experienced and competent in the application and inspection of the lining compound to be applied. The Owner shall have the right to require the applicator to furnish bonds covering proper performance and guaranteeing the payment of all obligations arising as a result of improper materials and workmanship.

Equipment: All application equipment shall be as recommended by the suppliers of the lining compound.

Application Technique: After the surface has been thoroughly prepared for application, the interior of the pipe shall be coated with the ceramic epoxy to a minimum dry film thickness of 40 mils. No lining shall take place when the substrate or ambient temperature is below 40° F. The surface must be dry and dust free. The number of coats of lining material applied shall be as recommended by the lining manufacturer, but in no case shall it be applied above the dry film thickness per coat recommended by the lining manufacturer. The time between coats shall be that specified by the lining manufacturer.

Repair: All damaged areas or test areas shall be repaired in accordance with the manufacturer's recommendation, so that the repaired areas are equal to the undamaged lined areas in all respects.

Inspection: All pipe linings shall be checked for thickness using a magnetic film thickness gauge, the thickness testing shall be done in accordance with the method outlined in SSPC-PA-2 film thickness rating. The interior linings shall also be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired as noted above.

Markings: Each joint, manhole unit, or pipe bend special shall be marked with the date of application of the coating system, the date of inspection, and the numerical sequence of application on that date.

Shipping and Handling: Equipment used to handle and transport the lined pipe shall be suitably designed and operated not to damage the lining. Any damage which does occur shall be repaired prior to the installation of the pipe in accordance with the manufacturer's recommendations, so the repaired area is equal to the undamaged lining in all respects.

SECTION 13446
REMOTE TELEMETRY, LIFT STATIONS

PART 1 – GENERAL:

1.01 THE REQUIREMENT

A. The Contractor shall provide, through the services of a single Control Systems Integrator, all components, system installation services, as well as all required and specified ancillary services, in connection with providing remote telemetry at lift stations as specified herein. The Contractor shall provide all materials and services necessary to provide the functions indicated, whether specifically mentioned or not.

B. The Contractor shall be ultimately responsible for installation of the lift station remote telemetry. However, the Control System Integrator will include such services within the scope of his subcontract to provide for installation of the lift station remote telemetry as specified. The Control System Integrator shall also coordinate this work with the Contractor to ensure that the proper control system interfaces, site preparation, and equipment installation and testing services are provided.

C. The Contractor's responsibilities, as distinct from the Control System Integrator's responsibilities, shall be to provide all additional materials and work necessary to supplement the materials and work provided by the Control System Integrator; thereby satisfying all requirements specified within this section.

D. The Contractor shall be responsible for coordinating interfaces between Remote Telemetry System equipment provided under the Remote Telemetry System specification sections and the equipment provided under other sections of the specifications. The Contractor shall verify and coordinate space requirements, process equipment power supply and voltage, process equipment control power supply and voltage, compatibility of control signals, details of equipment installation and interconnection. Coordination shall include distribution of approved shop drawings to all vendors, subcontractors, etc., involved in the control interface. Likewise, the Contractor shall ensure that instrumentation and control devices provided under other sections of the specifications are compatible and of the same quality and characteristics as similar devices specified herin.

1.02 SCOPE

A. Lift stations shall be provided with remote monitoring and control through the provision of Remote Telemetry Units (RTUs). Each lift station RTU shall communicate to PWC's existing remote SCADA system. RTUs shall be constructed in accordance with the specifications herein and the applicable detail drawings provided within PWC's

Permit Design Manual. The RTU shall be provided to interface with the lift station's pump control panel, ATS, generator, and other miscellaneous controls as specified herein.

B. PWC shall provide configuration and programming of their existing remote SCADA system to poll, monitor, and provide remote control of the lift station via the RTU and radio transmission system provided by the Contractor. The Contractor shall not be responsible for providing repeater sites for radio communications or for antenna support structures in excess of 70 feet to meet performance requirements. Installed equipment provided by the Contractor is limited to the lift station site.

C. A radio path survey shall be conducted and submitted for approval for the radio communications. A fade margin of 25dB shall be provided for remote communications to the PWC's existing system. Provide all necessary transmission components (i.e. antennas, antenna support structures, low loss cables, etc.) necessary to meet this requirement. Communications shall utilize the PWC's existing licensed frequencies.

D. The following major items of supply shall be provided:

1. Furnish and install RTU as specified
2. Radio Path Survey
3. Interfacing with control panels provided by other equipment suppliers under this contract
4. Furnish and install radio communications from the lift station RTU to PWCs existing remote SCADA system.
5. Programming of RTU PLC functions
6. Coordinate RTU programming withPWC for compliance with PWC's standards and interface with their existing remote SCADA system at the Central Station location.
7. Configuration and testing of the complete system at the lift station.

E. Software programming of new system components shall utilize the PWC's existing licensed versions of programming and configuration software. Where this is not possible and a new software version or product is required, the product shall be submitted for approval by PWC.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Lift Station Specifications

1. Refer to the equipment and controls specified within the following applicable lift station specifications:

a. Specification Section 02753 Submersible Pump Lift Station
b. Specification Section 02754 Self-Priming Lift Station

B. Division 16 - Electrical

1. The following work shall be provided under Division 16 – Electrical:

a. Conduit, raceways, and installation of wire and cable for all Remote Telemetry system signal wiring, grounding systems, special cables and network cables except as noted.
b. Remote Telemetry system signal field wire.
c. Final wire preparation and termination of field wires to Remote Telemetry system equipment as directed by the Control System Integrator.
d. Grounding systems for all Remote Telemetry system equipment.
e. Mounting of Remote Telemetry system electrical enclosures (i.e. control panels, TVSS boxes, etc.) with exclusion of antennas.

2. The Control System Integrator shall provide all termination information for the Remote Telemetry system equipment, to support equipment terminations provided under Division 16. This information shall be provided within 10 days of equipment arrival onsite or as required by the project schedule. The information shall be in the form of drawings and termination lists, showing complete termination information (to/from panels, terminal numbers, terminal block locations, signal types, voltages, etc.).

1.04 CODES AND STANDARDS:

A The Remote Telemetry System shall comply with the following codes and standards as well as any others within the specifications and drawings. In the event of any conflict between these codes, regulations, standards, and Contract Documents, the most restrictive shall apply.

1. Applicable federal, state, county, and municipal code requirements.

2. Applicable standards of the National Fire Protection Association (NFPA)

a. National Electrical Code (NEC).
b. National Electric Safety Code

3. Applicable standards of the Underwriter's Laboratories, Inc. (U.L.)

a. UL 508A Industrial Control Panels

1.05 SUBMITTALS:

A Every submittal shall have a separate section entitled "Requested Deviations from Remote Telemetry System Specifications" which shall clearly define and explain all deviations and exceptions to this specification and corresponding drawings detailing the remote telemetry system requirements.

B. Hardware Submittal

1. Provide data / specification sheets for each component listing all model numbers, optional, and ancillary devices that are being provided.
2. Provide control panel drawings in accordance with the detail shown within the NFPA 79 for typical drawings. The following drawing types shall be provided:

a. Cabinet assembly and layout Drawings to scale. These shall include both front and interior layouts.
b. Panel wiring diagrams showing all interconnecting wiring and components. The wiring diagrams shall be in ladder logic. Show all wire numbers, terminal block designations, components tags, component make/model, and PLC addresses.

B. Radio Path Survey Report Submittal: The Control System Integrator shall conduct a radio path survey, using field RF measurements at each site, to determine antenna type, location, bearing, and height to achieve specified signal strength. Antenna height, types, cable types, and lengths shall be established to provide minimum specified performance requirements. In addition, the report shall provide the following:

a. Survey methods used and assumptions taken
b. Signal strengths using approved wireless equipment and a listing of equipment at each site required to achieve the results. The final installed equipment configuration shall be taken into account to include losses due to lightning protection and additional connectors, cables, etc.
c. Mounting instructions for antennas at each site (coordinates, elevation, bearing, cable length, etc.)
d. Path reports giving a summary of results

C. Software Submittal

1. The software submittal shall include a PLC program listing which shall include the following minimum information:

   a. Project Identification
   b. PLC Identification
   c. Revision tracking to include date last revised, programmer, and organization, and contact info
   d. PLC configuration and addressing including tag/variable names.
   e. Program functional identification and description with functional explanation of logical functional blocks of ladder logic. Functional blocks shall be broken down into signal processing, alarms, individual equipment logic, subroutines, and communications processing at a minimum.

2. The software submittal shall include configuration files for any electronically configured equipment (e.g. radio).

E. Testing Documentation Submittal

1. Testing documentation shall be submitted documenting the acceptable completion of system testing. The testing documentation shall demonstrate that the Control System Integrator has designed and configured a system that meets the specifications and drawing requirements. The documents for the test plan shall be structured so that the PWC understands what the inputs were, what the predicted outputs should be, and what the actual outputs were.

2. The complete test plan should include but not be limited to the following:

   a. 100 percent I/O point test including all spare points based upon the previously submitted System I/O list.
   b. Functional and Control strategy tests.
   c. Communications tests.
   d. Specification and drawing conformance.

F. Operational and Maintenance Manuals

1. Prior to installation of any equipment onsite, preliminary O&M manuals shall have been submitted and approved. No installation of equipment shall be permitted without the Contractor maintaining an updated version of these preliminary O&M manuals available on demand by PWC or the Engineer.

2. Preliminary O&M manuals shall contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards, and equipment layouts in order to enable the Contractor to proceed with the detailed site preparation for all equipment.

3. After all field changes or corrections made during installation and field check out have been completed, then all system supplier documentation shall be revised to reflect the "as installed, corrected, and accepted" condition of the system and final record copies of O&M manuals for the system shall be provided to PWC and Engineer for approval.

4. Final system documentation shall be provided in 3-hole type binders of archival quality (e.g. slant D or elliptical binding, vinyl with metal hinge or extra heavy weight vinyl, etc.) with a binding no larger than 3". Materials shall be printed on 8.5" x 11" or 11" x 17" paper. Drawings shall be either folded to fit within an 8.5" x 11" binder or in an 11" x 17" three-hole binder. Each binder shall include 15% spare space for the addition of future material.

5. Where electronic documentation is available, either by purchase through the manufacture or via Internet download, it shall be organized and provided on CD or DVD. All CAD drawings and office software type documents prepared by the Control System Integrator or one of their subcontractors shall be organized and provided on CD or DVD. Electronic documentation formats shall Adobe .pdf, AutoCAD, and Microsoft Office documents, HTML, or as approved by the Engineer or PWC.

6. All electronic media (i.e. software, electronic documentation, configuration files/reports, etc.) shall be provided with two backup copies on CD or DVD.

7. Operation and Maintenance manuals shall include but not be limited to the following:

    a. Manufacturer standard O&M manuals for all equipment and software f furnished.

    a. Custom O&M information describing the specific configuration of equipment and software, and the operation and maintenance requirements for this particular project.

    c. All modifications to manufacturer standard equipment and/or components shall be clearly identified and shown on the drawings and schematics. All information contained therein shall apply specifically to

d. the equipment furnished and shall only include instructions that are applicable.

e. Complete approved copies of all submittals required within this specification.

1.06 Control System Integrator

A The Control System Integrator shall be regularly engaged in the detailed design, fabrication, installation, and startup of Remote Telemetry Systems for water and wastewater treatment facilities. Any Control System Integrator that has been subject to litigation or the assessment of liquidated damages for nonperformance on any project within the last five calendar years shall not be acceptable.

B. Where specific manufacturers and/or models of major hardware or software products (PLC, radio equipment, etc.) are specified to be used on this project, the Control System Integrator shall have completed at least one project using that specified hardware or software.

C. The Control System Integrator shall have field service staff located within 150 miles from the city of Fayetteville.

D. The PWC shall have the right of access to the Control System Integrator's facilities and the facilities of their equipment suppliers to inspect materials and parts; witness inspections, tests and work in progress; and examine applicable design documents, records and certifications during any stage of design, fabrication and tests. The Control System Integrator and their equipment suppliers shall furnish office space, supplies and services required for these surveillance activities.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. All materials, equipment, and devices shall, as a minimum, meet the requirements of UL, where UL Standards are established for those items, and the requirements of NFPA-70. These items shall have the U.L. label. All items shall be new unless specified or indicated otherwise.

B. Field equipment, including remote telemetry equipment and control enclosures, may be subjected to wind, rain, lightning, and corrosives in the environment, with ambient temperatures from -20 to 40 degrees C and relative humidity from 10 to 95 percent. All

supports, brackets and interconnecting hardware shall be aluminum, 316 stainless steel, or as shown on the installation detail drawings.

C. The Contractor shall be responsible for providing a signal transmission system free from electrical interference that would be detrimental to the proper functioning of the remote telemetry equipment.

D. The Contractor shall be responsible for coordinating signal types and transmission requirements between the various parties providing equipment for the lift station under this Contract. This shall include, but not be limited to, distribution of appropriate shop drawings among the equipment suppliers, the electrical subcontractor, and the Control System Integrator.

2.02 FUNCTIONAL REQUIREMENTS

A. The RTU shall monitor and control equipment as shown on the drawings as specified herein. RTUs shall communicate using MODBUS protocol over 158.76 MHz radios to PWC's existing remote SCADA system.

B. Three contiguous memory areas shall be provided within the RTU PLC for remote monitoring and control. One shall be provided for the monitoring of all monitored, values, statuses, and alarms and another shall be provided for all control commands. A third shall be provided for setpoints which may or may not be changed remotely. The configuration of these memory areas shall be coordinated with PWC to match a standard configuration used by their existing remote SCADA system.

C. Provision shall be made in the RTU PLC logic to suppress nuisance alarms and control actions by the use of adjustable time delays where needed. Initial settings for time delays shall be 10 seconds (range 0-999 seconds). In addition, process logic shall be used to suppress any alarms that are not applicable due to associated process or equipment status.

D. PLC processor statuses and communications faults shall be monitored and generate alarms.

E. The PLC shall store runtime values for all motorized equipment. The initial runtime values shall not automatically be assumed to be zero and shall be capable of being set / reset to a specified value.

F. Pump Fail-to-Start alarms shall be generated by the RTU if the Pump Run Status signal is not received by the PLC after an adjustable time delay (0-999 seconds, initial setting: 30 seconds) of issuing a Pump Start Command and a Pump RTU Control Enable.

G. Pump Fail-to-Stop alarms shall be generated by the RTU if the Pump Run Status signal is received by the PLC after an adjustable time delay (0-999 seconds, initial setting: 30 seconds) of issuing a Pump Stop Command and a Pump RTU Control Enable.

H. Pump Local Control Failure alarm shall be generated by the RTU if the Lead Pump On Level signal and one Pump Run Status signal is not received or if the Lag Pump On Level signal and two Pump Run Status signals are not received or if the Hig Level Alarm signal and two Pump Run Status signals are not received by the PLC after an adjustable time delay (0-999 seconds, initial setting: 60 seconds). Disable alarms for modes when a pump is not available for local control.

I. The RTU shall provide remote manual start/stop control of each pump when the Pump RTU Control Enable is remotely commanded. Remote manual control shall be interlocked to stop pumps on All Pumps Off Level signal.

J. Generator/ATS Failure alarm shall be generated if the Generator Run Status signal is not received after an adjustable time delay (0-999 seconds, initial setting: 60 seconds) while receiving a RTU Power Fail or Loss of Phase signal.

K. The RTU shall provide remote horn silence control of the lift station's pump control panel alarm horn. The output from the PLC shall be de-energized to disable the pump control panel's alarm circuit and silence the horn.

L. The RTU shall time and date stamp the actuation of the Operator Log pushbutton on the front of the RTU. The last 7 operator logs shall be kept in memory for remote monitoring.

2.03 REMOTE TELEMETRY UNITS (RTUs)

A. Refer to applicable detail drawings contained within PWC's *Permit Design Manual* for additional requirements on the design, construction, and installation of RTUs.

B. RTU PLCs shall be provided as specified no exceptions except as specified herein. As an acceptable alternate to the radio and PLC makes and models specified, Data Flow Systems may equivalent equipment that will interface with PWC's existing Data Flow System remote SCADA system.

C. PLCs shall be provided with a programming port in addition to the radio communications port. The programming port shall be RS232 serial or Ethernet.

2.04 CONTROL ENCLOSURES

A. Control enclosures (RTUs, cabinets, panels, boxes, etc.) shall be formed or welded construction, reinforced with Unistrut, Powerstrut, or equal to facilitate mounting of internal components or equipment. Enclosures with any dimension 36 inches or greater shall be provided with removable lifting lugs designed to facilitate safe moving and lifting of the panel during installation. No screws or bolts shall protrude through from the interior enclosure.

A. Enclosures shall be NEMA 4X stainless steel, aluminum, or fiberglass, All stainless steel and aluminum enclosures shall be polished to a No. 4 finish.

B. Enclosures shall be fitted with pad-lockable latch kits. Door latches shall be all stainless steel, single handle latch or fast operating clamp assemblies (quick release), which do not require bolts or screws to secure. Gaskets shall be polyurethane.

C. Enclosures shall provide mounting for radios, PLCs, power supplies, control equipment, input / output subsystems, panel mounted equipment, and appurtenances. Ample space shall be provided between equipment to facilitate servicing and cooling. Enclosures shall be sized to adequately dissipate heat generated by equipment mounted inside the panel.

D. The temperature inside each RTU enclosure shall be continuously monitored, and shall generate an alarm to the nearest PLC if the temperature rises to an adjustable, preset high temperature.

E. Enclosures shall be prefabricated cabinets and panels by Hoffman, Rittal, or Vynckier. The Contractor may optionally provide enclosures custom fabricated by a reputable panel fabrication shop acceptable to the Engineer.

2.05 UNINTERUPTIBLE DC POWER SUPPLY

A RTUs shall be provided with an uninterruptible DC power supply to provide power conversion and backup power in the event of utility power failure. During normal operation, the power supply shall convert 120 VAC to the required DC voltages (12v, 24v) and provide a maintenance charge to the batteries. On power failure the batteries shall provide power. A separate DC-DC power converter may be required if the power supply does not provide 24 VDC for controls and 12 VDC for the radio. The uninterruptible DC power supply shall include, but not be limited to the following:

1. Battery charging circuit.
2. Status lights indicating operating mode and battery charge.
3. Dry contact output for power failure, wired into the RTU/PLC I/O to represent primary power status.

4. Dry contact output for low battery, wired into the RTU/PLC I/O.
5. Battery backup power shall be provided for a minimum of 4 hours.

2.06 CONTROL OPERATORS

A Control operators such as pushbuttons (PB), selector switches (SS), and pilot lights (PL) shall be Cutler-Hammer/Westinghouse Type E34, Square D Company Type SK, or equal. Control operators shall be 30.5 mm, round, heavy-duty, oil tight NEMA 4X corrosion resistant. Pushbuttons shall be non-illuminated, spring release type. Pushbuttons shall include a full guard.

2.07 LIGHTNING PROTECTION AND/OR TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

A. Lighting protection and TVSS shall be provided to protect all electronic equipment from multiple lighting strikes, power surges, and adverse conditions on all antenna cables and power feeds.

B. INSTALLATION AND GROUNDING OF LIGHTNING PROTECTORS SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

C. Lightning protectors for coaxial antenna cable shall be as provided by Polyphaser or equal. Lighting protectors shall be matched to the individual requirements of the equipment they are protecting. Lighting protectors shall include, but not be limited to the following requirements:

1. Weatherized housing meeting the requirements of IEC 60529, IPC67, and Bellcore #TA-NWT-000487 Procedure 4.11, Wind Driven (120 mph) Rain Intrusion.
2. Operating Conditions: -30°C to 60°C, ≤95% Relative Humidity
3. Turn On Time: 4ns for 2kV/ns
4. Maximum Surge: 20kA IEC 61000-4-5 8/20μs waveform
5. Throughput Energy: ≤500μJ for 3kA, 8/20μs waveform
6. Operating Voltage/Current: Matched to device
7. When installed to protect a control panel the lightning protector shall be mounted outside of the control panel in close proximity.

D. AC line TVSS shall be mounted inside of the equipment's enclosure where practical. In other locations, the TVSS shall be mounted immediately adjacent to the protected device in a NEMA 4X enclosure. Each TVSS shall have the capability to withstand repeated surge currents of at least 20,000 amps peak at 8 x 20 microsecond wave. Performance shall be equal and reliable for surges of either polarity. TVSS devices for power shall be Edco, Phoenix Contact, or approved equal.

2.08 ANTENNAS

A. Yagi antennas shall be provided for RTU communications back to PWC's existing remote SCADA system. Yagi antennas shall include but not be limited to the following features:

1. Frequency: 158.76 MHz
2. 9 dBd gain
3. Corrosion resistant and weatherproof design
4. Welded aluminum construction with stainless steel hardware
5. U-bolt mounting up to a 2.125" mast diameter
6. 120 mph wind velocity

2.09 ANTENNA TRANSMISSION CABLES

A Antenna transmission cable systems shall be designed to provide a maximum line loss of 3dB from radio to antenna. Performance requirements of antenna transmission cable systems specified herein or as shown on drawings shall be increased as needed to meet this requirement.

B. A single coaxial transmission cable shall be provided from the radio to the lightning protector and from there to the antenna. Where required short flexible jumpers of low-VSWR cable shall be provided to connect to the radio and/or antenna. Coaxial cable shall be provided as follows:

1. Flexible jumper cables:

   a) Low-VSWR high performance pre-manufactured jumper cable
   b) Maximum length of 6 feet
   c) Type N connectors
   d) Shall be Andrew Heliax premium cable assembly or approved equal

2. Total transmission length less than 100' or as specified or show on contract documents:

   a) 1/2", foam dielectric, 50 ohm, type N connectors
   b) Shall be: Andrew, Heliax, LDF4-50A or approved equal

C. Antenna transmission cable accessories (hangers, cable ground kits, connectors, weather-proofing kits, etc.) shall be provided by Andrew or approved equal. Accessories shall be furnished and installed as recommended by the manufacture for the design conditions specified.

2.10 ANTENNA SUPPORT STRUCTURES

A Antenna support structures (towers, masts, etc.) shall be provided and installed at each lift station. The Control System Integrator shall provide and install antenna support structures at each site, and provide and install all antennas, lightning protection, coaxial cables, supports, hardware, system components and accessories to provide a complete transmission system for the wireless radio equipment.

B. Antenna support structures are to have an overall structural height to provide the antenna mounted at a minimum height of 15' and as required for reliable communications. The structures shall be designed to accommodate the scheduled antenna loads. The structure shall be designed for wind and ice loading in accordance with North Carolina Building Code which adopts the 2000 International Building Code. Refer to figure 1609 of the IBC for 3 second gust wind speeds per specific site location.

C. The Control System Integrator shall coordinate the installation of the antennas and their support structures with PWC and in keeping with the findings of the radio path study. Structure locations shall be chosen at each site to provide acceptable aesthetics, and ease of maintenance. Structures should be installed to avoid power lines and other dangers and obstacles. All antenna support structure locations shall be submitted and approved by PWC and Engineer.

D. Antenna support structures shall consist of a tower sections joined together to provide the necessary height for reliable communications. Each tower location shall be selected for height based on the minimum heights specified and the results of the radio survey. The tower shall be self supporting, corrosion resistant sectional towers, designed by ROHN or approved equal. At a minimum antenna support structures shall consist of the following:

1. ROHN 25AG top section with an adjustable mast set into the section to support the antenna.
2. 12-1/2" equilateral triangle zigzag design with double bolted joints
3. Hot dip galvanized high strength steel tube tower section(s) that have been completely immersed in molten zinc after construction.
4. Transmission line support
5. Each tower shall be installed with a concrete foundation which has been designed and certified for intended application by a licensed structural engineer registered in the state of installation. For installations where there is only a top tower section, the foundation shall include a sleeve for the mast to set into to provide additional mast support.
6. Direct connection to the site grounding system
7. Copper materials shall not come into direct contact with galvanized steel. Stainless steel shall be used where required as a barrier.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Properly store, adequately protect, and carefully handle equipment and materials to prevent damage before and during installation. Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations. Replace damaged or defective items.

B. All software and configuration programs shall be complete and tested prior to the respective equipment being shipped to site.

C. All outdoor equipment and enclosures shall be grounded using the practice defined in Section 800.40 of the National Electric Code.

D. Radio signal transmission cables shall be a single continuous run between equipment with the exception of pre-manufactured short flexible jumpers for final equipment termination.

E. All outdoor radio transmission cable connections shall be water-proofed using the appropriate UV resistant cable water-proofing kit as manufactured by 3M or approved equal.

3.02 TESTING, GENERAL REQUIREMENTS

A. The Control System Integrator shall test all equipment hardware and software at the factory prior to shipment.

B. The Contractor shall require the Control System Integrator to coordinate all of his testing with himself, all affected subcontractors, and PWC.

C. The Engineer reserves the right to test or retest all specified functions whether or not explicitly stated in the prior approved test procedures. The Engineer's decision shall be final regarding the acceptability and completeness of all testing.

D. All specified signals and RTU functions shall be field tested from their primary actuation or process measurement to the radio transmission of RTU memory registers to PWC's existing remote SCADA system. The Control System Integrator shall coordinate with PWC and their existing remote SCADA system to be used in the testing of the lift station remote telemetry.

3.03 SYSTEM ACCEPTANCE TEST (SAT)

A. The Control System Integrator shall perform an unwitnessed test to completely test the system in preparation for the witnessed test by PWC and the Engineer. The Control System Integrator shall submit a letter certifying that the system has been completely tested successfully and is ready for witnessing by PWC and the Engineer. Within 2 weeks of receiving the letter the witnessed test shall be scheduled.

B. After all functions have been tested and all corrections made, the system shall operate continuously for 15 days without failure before this test will be considered successful.

C. As part of the list station Remote Telemetry System testing, all system input and output signals shall be tested to verify that these signals are correctly transmitted from the field equipment (CP's, starters, valves, instruments, switches, etc.) through the wireless and other network media to the existing HMI computer screens at the PWC's facilities.

3.04 WARRANTY:

A. The warranty period for this system shall be for one year and shall begin upon acceptance of the completed lift station by PWC. During this warranty period, the Control System Integrator shall provide, at no additional cost to the PWC, the services of a trained, competent, field service engineer who shall arrive on site within 36 hours of notification by the PWC or Engineer, to repair and/or replace any faulty device or equipment supplied by the Control System Integrator as part of the lift station Remote Telemetry System. All preventive and corrective activities shall be documented with service reports, which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed, and list materials used. A copy of all service reports shall be delivered to the PWC on or before the next business day.

B. The Control System Integrator shall be capable of providing, after the warranty period for this system expires, a 1-year renewable service contract whereby a trained, competent field service engineer shall arrive on site within 36 hours of notification by the PWC. Information relative to charges for such service and availability of such service shall be submitted to the PWC and the Engineer.

PART 4 –REMOTE TELEMETRY INPUT / OUTPUT SCHEDULE

4.01 The following table lists required remote telemetry inputs and outputs (I/O).

1. Input / Output types are as follows:

    a. DI - Discrete Input (dry contact to RTU)
    b. DO - Discrete Output (dry contact from RTU)

4.2 The following notes apply to the Remote Telemetry I/O Schedule.

1. This output is normally energized to enable the alarm horn.

Duplex Lift station Remote Telemetry Input / Output Schedule						
To Control Panel	**From Equipment**	**Type**	**Description**	**Open State**	**Close State**	**Notes**
RTU	Internal	DI	Operator Site Login	Ok	Log	
RTU	Internal	DI	RTU Power Fail	Alarm	Ok	
RTU	Internal	DI	RTU Trouble Alarm (Low Batt or Hi Temp)	Ok	Alarm	
RTU	PUMP:CP	DI	All Pump Off Level	Off Level		
RTU	PUMP:CP	DI	Lead Pump On Level		Lead Start	
RTU	PUMP:CP	DI	Lag Pump On Level		Lag Start	
RTU	PUMP:CP	DI	High Level Alarm	Ok	Alarm	
RTU	PUMP:CP	DI	Loss of Phase	Ok	Alarm	
RTU	PUMP:CP	DI	Generator Running	Off	On	
RTU	PUMP:CP	DI	Pump 1 Running	Off	On	
RTU	PUMP:CP	DI	Pump 1 Common Failure	Ok	Alarm	
RTU	PUMP:CP	DI	Pump 2 Running	Off	On	
RTU	PUMP:CP	DI	Pump 2 Common Failure	Ok	Alarm	
RTU	PUMP:CP	DI	Pump 1 in Auto	Manual	Auto	
RTU	PUMP:CP	DI	Pump 2 in Auto	Manual	Auto	
RTU	PUMP:CP	DI	Prewired Spare			
RTU	PUMP:CP	DO	Pump 1 Start/Stop Command	Stop	Start	
RTU	PUMP:CP	DO	Pump 1 RTU Control Enabled	Disable	Enable	
RTU	PUMP:CP	DO	Pump 2 Start/Stop Command	Stop	Start	
RTU	PUMP:CP	DO	Pump 2 RTU Control Enabled	Disable	Enable	
RTU	PUMP:CP	DO	Alarm Horn Silence	Disable	Enable	1
RTU	PUMP:CP	DO	Prewired Spare			

Triplex Lift station Remote Telemetry Input / Output Schedule						
To Control Panel	**From Equipment**	**Type**	**Description**	**Open State**	**Close State**	**Notes**
RTU	internal	DI	Operator Site Login	Ok	Log	
RTU	internal	DI	RTU Power Fail	Alarm	Ok	
RTU	PUMP:CP	DI	RTU Trouble Alarm (Low Batt or Hi Temp)	Ok	Alarm	
RTU	PUMP:CP	DI	All Pump Off Level	Off Level		
RTU	PUMP:CP	DI	Lead Pump On Level		Lead Start	
RTU	PUMP:CP	DI	Lag Pump On Level		Lag Start	

RTU	LSHH	DI	High Level Alarm	Ok	Alarm	
RTU	PUMP:CP	DI	Loss of Phase	Ok	Alarm	
RTU	PUMP:CP	DI	Generator Running	Off	On	
RTU	PUMP:CP	DI	Pump 1 Running	Off	On	
RTU	PUMP:CP	DI	Pump 1 Common Failure	Ok	Alarm	
RTU	PUMP:CP	DI	Pump 2 Running	Off	On	
RTU	PUMP:CP	DI	Pump 2 Common Failure	Ok	Alarm	
RTU	PUMP:CP	DI	Pump 3 Running	Off	On	
RTU	PUMP:CP	DI	Pump 3 Common Failure	Ok	Alarm	
RTU	PUMP:CP	DI	Lag-Lag Pump On Level		Lag-Lag Start	
RTU	PUMP:CP	DO	Pump 1 Start/Stop Command	Stop	Start	
RTU	PUMP:CP	DO	Pump 1 RTU Control Enabled	Disable	Enable	
RTU	PUMP:CP	DO	Pump 2 Start/Stop Command	Stop	Start	
RTU	PUMP:CP	DO	Pump 2 RTU Control Enabled	Disable	Enable	
RTU	PUMP:CP	DO	Pump 3 Start/Stop Command	Stop	Start	
RTU	PUMP:CP	DO	Pump 3 RTU Control Enabled	Disable	Enable	
RTU	PUMP:CP	DO	Alarm Horn Silence	Enable	Disable	1

*****END OF SECTION*****

SECTION 16010
ELECTRICAL LIFT STATIONS

PART I - GENERAL

1.1 THE REQUIREMENT

A. Furnish all labor, materials, equipment and incidentals required for a complete electrical installation for the Work associated with the Contract Documents, as hereinafter specified and shown on the Drawings. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost. All workmanship shall be of the highest quality; sub-standard work will be rejected.

B. Certain equipment will be furnished as specified in other sections of these Specifications which will require mounting and wiring thereto and/or complete installation as indicated. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, lighting, communication systems, instrumentation, wiring, and control systems as indicated on the Drawings and/or as specified herein..

C. Provide complete grounding systems for all equipment and structures as required by the National Electric Code (NEC), as specified herein, shown on the contract documents, and as required for specific pieces of equipment per manufacturer.

D. The work shall include complete testing of all equipment and wiring at the completion of the work arid making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment.

E. Electrical work shall conform to the construction schedule and progress of other trades. All power interruptions to existing equipment shall be at the PWC's convenience. Each interruption shall have prior approval.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Mount and wire control panels and process instruments furnished under other Divisions of these Specifications unless specifically stated otherwise. For process instrumentation, furnish and install all conduit, wire and interconnections between primary elements, transmitters, local indicators, surge protection devices and receivers.

B. Mount and wire electric heaters, and heat tracing furnished under other Sections of this Specification.

C. Lift Station Specifications

1. Refer to the equipment and controls specified within the following applicable lift station specifications:
   a. Section 02753 Submersible Pump Lift Station
   b. Section 02754 Self-Priming Lift Station

D. Remote Telemetry

1. Refer to the equipment and controls specified within the Specification Section 13446 Remote Telemetry, Lift Stations.

E. Automatic Transfer Switch

1. Refer to the equipment and controls specified within the Specification Section 16619 Automatic Transfer Switch.

F. Standby Generator

1. Refer to the equipment and controls specified within the Specification Section 16622 Standby Generator.

G. Duplex Pump Station Control Center

1. Refer to equipment and controls specified within the Specification Section 16912 Duplex Pump Station Control Center

H. Additional related sections include but are not necessarily limited to the following:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1- General Requirements.
3. Section 03301- Concrete Construction.

1.3 CODES AND STANDARDS:

A. The electrical system and associated equipment shall comply with the following codes and standards as well as any others within the specifications and drawings.

1. Applicable federal, state, county, and municipal code requirements.

2. PWC Water Resources Manual for the Design and Construction of Water and Wastewater System Extensions.

3. Applicable standards of the National Fire Protection Association (NFPA)
   a. National Electrical Code (NEC).

b. National Electric Safety Code

4. American Iron and Steel Institute {AISI):

a. Steel Products Manual - Stainless and Heat Resisting Steel.

5. American Society for Testing and Materials (ASTM):

a. A36, Specification for Structural Steel.
b. Al53, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
c. D698, The Moisture-Density Relations of Soils using a 5.5 LB Rammer and a 12-inch Drop.

6. Factory Mutual System (FM):

   a. A Guide to Equipment, Materials and Services.

7. Institute of Electrical and Electronics Engineers (IEEE):

   a. 141, Recommended Practice for Electrical Power Distribution for Industrial Plants.
   b. 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

8. National Electrical Manufacturers Association (NEMA):

   a. 250, Enclosures for Electrical Equipment (1000 V Maximum)
   b. 1CS 6, Enclosures for Industrial Control and Systems

9. National Fire Protection Association (NFPA):

   a. 70, National Electrical Code (NEC).
   b. 70E, Standard for Electric Safety in the Workplace
   c. 79, Electrical Standard for Industrial Machinery
   d. 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities

10. Underwriters Laboratories. Inc (UL):

   a. 508, Industrial Control Equipment
   b. 508A, Industrial Control Panels
   c. 698, Industrial Control Equipment for Use in Hazardous Locations.

B. When a specific code or standard has not been cited, the applicable codes and standards of the following code-making authorities and standards organizations shall apply:

1. American Association of State Highway and Transportation Officials (AASHTO).
2. American Iron and Steel Institute (AISI).
3. American National Standard Institute (ANSI).
4. American Society for Testing and Materials (ASTM).
5. ETL Testing Laboratories, Inc (Eli).
6. Insulated Cable Engineers Association (ICEA).
7. Institute of Electrical and Electronic Engineers (IEEE).
8. Illuminating Engineering Society of North America (IES).
9. Instrument Society of America (ISA).
10. Lightning Protection Institute (LPI).
11. National Electrical Manufacturers Association (NEMA).
12. National Fire Protection Association (NFPA).
13. Occupational, Health and Safety Administration (OSHA).
14. Underwriters Laboratories Inc (UL).

C. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, drawings and specifications, or within either document itself, the more stringent condition shall govern.

1.4 AREA CLASSIFICATIONS

A. Outdoor Areas: Those locations on the project site where the equipment is normally exposed to wind, dust, rain, snow, etc. Outdoor areas include areas protected by a roof or rain/ sun shields but not enclosed within four walls of a structure. Outdoor locations may contain wet, corrosive and hazardous areas:

1. Corrosive and hazardous areas are specified herein or identified on the Drawings. Areas not identified as such shall be considered wet.

B. Indoor Areas: Those locations on the project site where the equipment is normally protected from wind, dust, rain, snow, etc. Indoor locations may contain unclassified, damp, wet, corrosive and hazardous areas:

1. Damp, wet, corrosive and hazardous areas are specified herein or identified on the Drawings. Areas not identified as such, but provided with heating shall be considered unclassified. Areas not identified as such, but provided without heating shall be considered damp.

C. Hazardous Locations:

1. Hazardous locations shall be as defined in NFPA 70 NEC, NFPA 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities, and other applicable standards or codes governing the classification of a particular type of facility or location. In addition, areas are classified as shown on drawings and as follows:

a. Class I Division 2 areas are identified on Drawings and at the following locations:

1) Residential Only Wastewater (Sewer) Pump Station Wetwells. Systems of 5 or less residences are not classified as a hazardous location.
2) Wastewater Pump Station Drywells.
3) Dry areas of enclosed wastewater piping (i.e. valve vaults, meter vaults, etc.).

b. Class I Division 1 areas are identified on Drawings and at the following locations:

4) Wastewater Pump Station Wetwells.

1.5 SUBMITTALS:

A. Every submittal with any deviations or exceptions from Contract Documents shall have a separate section entitled "Requested Deviations from Electrical System Specifications" which shall clearly define and explain all deviations and exceptions to this specification and corresponding drawings detailing the electrical system requirements.

B. Shop Drawings:

1. Shop drawings shall be arranged and labeled according to specifications section and/ or contract documents.
2. Submit shop drawings prior to purchase or fabrication of equipment. See individual specification sections for specific requirements.
3. Prior to submittals of shop drawings, coordinate electrical equipment, particularly motor control equipment, control panels, and instrumentation, with all applicable equipment and systems interfacing that equipment.
4. Submittals shall be made in the following combinations:

a. Conduits, busway, wireway, cable tray, ductbank details, wire and cable 600 V and below, boxes, fittings, and wiring devices.
b. Motor control centers and control equipment, low voltage switchboards, safety switches, dry-type (specialty) transformers, panelboards, power factor correction capacitors, grounding.
c. Lamps, interior lighting, exterior building lighting, site lighting.
d. Provide a conductor identification schedule for all power, control, communication and protective circuits. The schedule shall include the following information:

1) Conductor identification number.
2) Conductor size.
3) Number of conductors.
4) Type of conductor.
5) Size of conductor.
6) Size of conductor usage descriptions.
7) Conductor run (to and from).
8) Conduit size and type.

5. For each product, clearly identify manufacturer by name.

6. Provide manufacturer's technical information on products to be used, including:
   a. Product descriptive bulletin.
   b. Electrical data pertinent to the project and necessary to assure compliance with Specifications and Drawings.
   c. Equipment dimensions, where applicable.
   d. Evidence that the products submitted meet the requirements of the standards referenced.

7. When general data sheets are provided as part of the submittal, specifically identify the products to be used on this project.
8. Ensure that all submittals clearly indicate the equipment is UL or ETL listed or is constructed utilizing UL or ETL listed or UL recognized components. Where a UL standard has not been established, clearly identify that no UL standard exists for that equipment.
9. For all equipment, provide manufacturer's installation instructions.

C. Two copies of manufacturer's warranties.

D. When a quality standard has been established by identification of a specific manufacturer or catalog number, submittals for proposed alternates and substitutions shall include:

1. Alternate and substitute equipment cross-referenced to the equipment it is replacing. Submittal shall be marked to show how differences will be accommodated.
2. Calculations and other detail data to allow determination of alternate and substitute equipment equivalency to the equipment it is replacing. Data supplied shall allow detailed comparison of all significant characteristics upon which the design equipment is based.
3. Dimensioned drawings, of the same or larger scale as the Contract Drawings, for all alternate and substitute equipment which differs in size, configuration, service accessibility or in any significant way from the equipment it is replacing.

   a. Complete system layout except that portion which is identical to the Contract Document Drawings.
   b. Redesign and modifications to all work required by the alternate or substitute equipment.

E. Operation and Maintenance Manuals: Shall be submitted according to the individual specification section, contract drawings and/or contract documents.

F. Record Drawings:

1. The Contractor shall maintain a marked up set of Contract Document Drawings showing actual installed circuit numbers, conduit sizes, cable tray routing, number of conductors, conductor sizes (other than #12) and

all other deviations from the design drawings.

2. All underground conduit and concealed items shall be dimensioned on the Drawings from permanent, visible, building features.
3. Provide actual motor size, starter size, and heater size, along with all other protective equipment for all motor circuits as part of the one-line record drawings.
4. Revise all conductor identification and circuit schedules to indicate as installed conditions.

1.6 DELIVERY, STORAGE. AND HANDLING

A. The Contractor shall unload and handle materials using methods, rigging, and equipment that will prevent damage to the materials. Care shall be used to prevent damage to painted and galvanized surfaces.

1. Bare wire rope slings shall not be used for unloading and handling materials and equipment, except with the specific written permission of the Engineer.

B. Stored equipment and materials shall be adequately supported and protected to prevent damage.

F. Stored materials and equipment shall not be allowed to contact the ground.

2. Equipment and materials which incorporate electrical equipment or which have finished painted surfaces, and other items which would be damaged by outdoor exposure, shall be stored indoors.

a. Provide covering and shielding for all equipment to protect from damage.
b. When such storage would present an unreasonable building space or volume requirement, the equipment or materials may, when acceptable to the Engineer, be stored under weatherproof coverings on shoring or platforms.

3. All small loose items that could be easily lost, stolen, broken, or misused shall not be stored on open platforms or shoring.

4. All storage methods and schedules shall be acceptable to the Engineer.

C. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage-either inside or on top of enclosures.

D. Project nameplates on electrical equipment to prevent defacing.

E. Repair, restore or replace damaged, corroded and rejected items at no additional cost to the PWC.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS:

A. In accordance with North Carolina Building Code Council, all electrical utilization equipment famished and installed under this Contract, including all electrical instrumentation and equipment control panels, instrument devices, power distribution equipment, electric valve actuators, and miscellaneous electrical devices, shall bear the label of a North Carolina approved nationally recognized testing laboratory (NRTL). The label shall convey the laboratory's declaration of the equipment safety and suitability for intended use on this project. A list of the approved testing laboratories per equipment type is available at the following web address:

www.ncdoi.com/OSFM/Engineering/BCC/engineering_bcc_third_party.asp

B. Shop Fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established. When equipment is shop fabricated for the project, the electrical devices and enclosures utilized shall be UL or ETL listed and labeled or shall be UL recognized.

C. Outdoor equipment may be subjected to wind, rain, lightning, and corrosives in the environment with ambient temperatures from -20 to 40 degrees C and relative humidity from 10 to 95 percent. All supports, brackets and interconnecting hardware shall be aluminum, 304 or 316 stainless steel or as shown on the installation detail drawings.

D. Trade names and catalog numbers may be used in the Drawings or Specifications to establish quality standards and basics of design.

E. Layout dimensions will vary between manufacturers and the layout area indicated on the drawings is based on typical values. Contractor shall review the contract drawings, the manufacturer's layout drawings and installation requirements, and make any modifications required for proper installation subject to acceptance by Engineer.

F. Shop or Factory Finishes: Interiors of other painted equipment shall be either white or light gray.

G. Enclosures for use with Electrical Equipment shall be provided as follows unless specifically shown or specified elsewhere in the Contract Documents:

1. NEMA 12: Use in unclassified indoor locations.

2. NEMA 3R: Use with non-electronic equipment in wet outdoor locations protected from weather by means of a roof or rain/sun shield as approved by the Engineer.

3. NEMA 4:

   a. Use in wet indoor locations.
   b. Use in wet outdoor locations. Enclosed electronic equipment shall be provided with rain/ sun shields.

4. NEMA 4X: Use in all corrosive locations.

   a. Nonmetallic enclosures shall not be used in areas subject to physical damage or sun without approval by the Engineer.
   b. Outdoor locations for enclosed electronic equipment shall be provided with rain/ sun shields.

5. NEMA 7: Use in all Class I Division {1} {2}, Group {A}, {B}, {C}, {D} locations.

   a. Unless other enclosures are approved and UL listed for the application.

6. NEMA 9: Use in all Class II. Division {1} {2}, Group {E} {F} {G} and Class III, Division {1} {2} locations.

   a. Unless other enclosures are approved and UL listed for the application.

7. Exceptions:
   a. As modified in other specification sections.
   b. As otherwise indicated on the Drawings.

2.2 WIRE AND CABLE

A. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years. It is intended to be standard equipment of proven performance as manufactured by the Okonite Company. BICC Industrial Cable Company (Cablec), or approved equal. Wire and cable shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings. Only one manufacturer for each cable type shall be permitted.

B. 600 Volt Power Wire and Cable: 600 volt power cable and wire shall consist of stranded copper conductor with insulation rated THHN, 90°C for wet locations and THWN, 75°C for dry locations, 600 volt cable and wire for below grade

service entrances or below grade runs between structures shall consist of stranded, copper conductor with insulation rated XHHN-2, 90°C for wet or dry locations. Conductors shall be tin or alloy coated, stranded copper per ASTM-B8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG. Uncoated conductors shall only be allowed if specifically accepted by the Engineer. 600 volt individual power wire and cable shall be Okoseal-N as manufactured by the Okonite Company, BICC industrial Cable Company (Cablec) equivalent, or approved equal. Multi-conductor power cables shall be Okoseal-N Type TC Cable as manufactured by the Okonite Company, BICC Industrial Cable Company (Cablec) equivalent, or approved equal.

C. 600 Volt Control Cable: 600 volt control cable shall consist of stranded, copper conductor with insulation rated THHN, 90° C for dry locations and THWN, 75° C for wet locations. The individual conductors of the multiple conductor cable shall be color coded for proper identification. Color coding shall be equal to ICEA S-68-514, Table K-I. Cables shall meet requirements of IEEE-383. Conductors shall be tin or alloy coated, stranded copper per ASTM B-8 and B 33 or B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be No. 14 AWG. Uncoated conductors shall only be allowed if specifically accepted by the Engineer. 600 volt individual conductor control wire shall be Okoseal-N as manufactured by the Okonite Company. BICC Industrial Cable Company (Cablec) equivalent, or approved equal. Multi-conductor control cable shall be Okoseal-N Type TC Cable as manufactured by the Okonite Company, BICC Industrial Cable Company (Cablec) equivalent, or approved equal.

D. Lighting and Receptacle Wire and Cable: The lighting and receptacle branch circuit wire shall consist of stranded, copper conductors with insulation rated THHN, 90°C for wet locations and THWN, 75°C for dry locations. Conductors shall be tin or alloy coated, stranded copper per ASTM-B8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG. Uncoated conductors shall only be allowed if specifically accepted by the Engineer. Lighting and receptacle cables and wire shall be Okoseal-N as manufactured by the Okonite Company, BICC Industrial Cable Company (Cablec) equivalent, or approved equal.

E. Instrumentation Cable: The instrumentation cable for analog signals shall be individually shielded twisted pair cable (TSP) or individually shielded twisted multi-pair cable (M#TSP, where # = number of pairs). Conductors shall be tin or alloy coated, soft, annealed copper, 16 AWG minimum with a minimum of 19 strands with 600 volt insulation rated for 75°C. Pairs shall have 100% coverage foil shields with an 18 AWG tinned copper drain wire. Outer jackets shall be chromed PVC. The instrumentation cable shall be Belden 8719 or Okonite Okoseal-N Type P-OS hit single pair applications and Okonite Okoseal-N Type SP-OS for multiple pair applications, or approved equal.

.3 CONDUIT AND RACEWAYS

A. Rigid Steel Conduit (RGS): Rigid steel conduit shall be heavy wall hot-dip galvanized, shall conform to ANSI C80.1, and shall be manufactured in accordance with UL 6.

B Liquidtight Flexible Metal Conduit: Liquidtight flexible metal conduit shall be hot dip galvanized steel, shall be covered with a moisture-proof polyvinyl chloride jacket, and shall be UL labeled. Refer to PVC-Coated Rigid Steel Conduit for fittings, condulets, and mounting accessories in non indoor dry areas.

C. Rigid Nonmetallic Conduit (PVC): PVC conduit shall be heavy wall, Schedule 80, UL labeled for aboveground and underground uses, and shall conform to NEMA TC 2 and UL 651. PVC conduit shall be rated for direct sunlight exposure, 90°C wire and fire retardant with low smoke emission.

U. PVC-Coated Rigid Steel Conduit (RGS-PVC): The conduit shall be rigid steel. Before the PVC coating is applied, the hot dip galvanized surfaces shall be coated with a primer to obtain a bond between the steel substrate and the coating. The PVC coating shall be bonded to the primed outer surface of the conduit. The bond on conduit and fittings shall be stronger than the tensile strength of the PVC coating. The thickness of the PVC coating shall be at least 40 mils.

A chemically cured two-part urethane coating, at a nominal 2 mil thickness, shall be applied to the interior of all conduit and fittings. The coating shall be sufficiently flexible to permit field bending the conduit without cracking or flaking of the coating.

Every female conduit opening shall have a PVC sleeve extending one conduit diameter or 2 inches, whichever is less, beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit before coating. The wall thickness of the sleeve shall be at least 40 mils.

All fittings, condulets, mounting hardware, and accessories shall be PVC coated. All hallow conduit fittings shall be coated with the interior urethane coating

described above. The screw heads on condulets shall be encapsulated by the manufacturer with a corrosion-resistant material.

PVC coated rigid steel conduit shall be manufactured by Ocal, Perma-Cote, Robroy, or approved equal.

2.4 BURIED ELECTRICAL WARNING TAPE

A. All buried conduits, wire, and ductbanks shall be provided with warning tape. Warning tape shall be constructed of 3.5 mils thick x 6 inches wide polyethylene

with a magnetic layer, have a tensile strength of 1750 psi, and have a continuous preprinted permanently imbedded warning message.

2.5 JUNCTION BOXES, PULL BOXES. AN GUTTERS

A. Indoor boxes (larger than switch. receptacle, or fixture type) and gutters shall be constructed of sheet steel, shall be galvanized after fabrication, and shall be rigidly supported by hot-dip galvanized hardware and framing materials, including nuts and bolts.

B. Indoor boxes and gutters in corrosive or wet areas indicated on the drawings and outdoor boxes and gutters shall be NEMA Type 4X, ABS or stainless steel and shall be rigidly supported by PVC coated or stainless steel framing materials. Mounting hardware, which includes nuts, bolts, and anchors, shall be stainless steel. All damaged coatings shall be repaired according to the manufacturer's instructions.

C. Bolt on box covers with any dimension larger than 3 feet or heavier than 25 lbs shall have rigid handles. Covers larger than 3 by 4 feet shall be split.

2.6 DISCONNECT/ SAFETY SWITCHES

A. Unless otherwise specified or shown, each disconnect switch shall be 3 pole, nonfusible, 600 volts, with a continuous current rating as indicated on the drawings.

B. Switches shall be NEMA Type HD, heavy duty, single throw, externally operated, fused or non-fused as required. Switches shall have high conductivity copper, visible blades; nonteasible, positive, quick make, quick break mechanisms; and switch assembly plus operating handle as an integral part of the enclosure base. Each switch shall have a handle whose position is easily recognizable and which can be locked in the "Off" position. The "On" and "Off" positions shall be clearly marked. Switches shall have defeat able door interlocks that prevent the door from being opened while the operating handle is in the "On" position.

C. Disconnect Switches shall be provided in following enclosures as a minimum based on their location, Multiple ratings of enclosures may apply.

I. Indoor dry areas: NEMA 1A
2. Indoor damp areas: NEMA 12
   Corrosive or indoor wet process areas: NEMA 4X 304 stainless steel or non-metallic
4. Outdoor areas: NEMA 12/3R with exterior rain/ sun shield that covers back of enclosure and extends at least 18 inches from sides and front; otherwise NEMA 4X in outdoor areas.
5. Hazardous areas: suitable for the Class, Division, and Group to suit the application.

D. A complete set of fuses for all switches shall be furnished and installed as required. Time current characteristic curves of fuses serving motors or connected in series with circuit breakers shall be coordinated for proper operation. Fuses shall have voltage rating not less than the circuit voltage. When equipment is shop fabricated for the Project, the electrical devices and enclosures utilized shall be UL or ETL listed and labeled or shall be CL recognized.

E. Switches shall be manufactured by Square D. Cutler-Hammer, General Electric, or approved equal.

2.7 SEPARATELY ENCLOSED CIRCUIT BREAKERS

A. Unless otherwise specified or shown, circuit breakers shall be 3 pole, 480 volt, molded case circuit breakers of not less than 25,000 amperes interrupting rating at 480 volts AC, complete with thermal and instantaneous trip elements.

B. Breaker enclosures shall have NEMA designations appropriate for the locations where they will be installed. NEMA Type 4X stainless steel enclosures shall be provided for outdoor locations. Each breaker shall be manually operated with a quick make, quick break, trip free toggle mechanism. Bimetallic thermal elements shall withstand sustained overloads and short circuit currents without injury and without affecting calibration.

C. Circuit breakers shall have an operating handle as an integral part of the enclosure base. Each circuit breaker shall have a handle whose position is easily recognizable and which can be locked in the "Off" position. The "On" and "Off" positions shall be clearly marked. Circuit Breakers shall have defeatable door interlocks that prevent the door from being opened while the operating handle is in the "On" position.

D. Circuit breakers shall be provided in following enclosures as a minimum based on their location. Multiple ratings of enclosures may apply.

1. Indoor dry areas: NEMA 1A
2. Indoor damp areas: NEMA 12
3. Corrosive or indoor wet process areas: NEMA 4X 304 stainless steel or non-metallic
4. Outdoor areas: NEMA 12/3R with exterior rain/ sun shield that covers back of enclosure and extends at least 18 inches from sides and front; otherwise NEMA 4X in outdoor areas.
5. Hazardous areas: suitable for the Class, Division, and Group to suit the application.

E. Circuit Breakers shall be manufactured by Square D. Cutler-Hammer, General Electric, or approved equal.

2.8 PANELBOARDS

A. Each lighting or power panel shall be a dead front. 120/240 volt, single phase or 120/208 volt, or 277/480 volt three phase panelboard with circuit breakers in accordance with the drawings and as specified.

B. Cabinet: The panel shall have a flush-mounted or surface-mounted enclosure with a NEMA designation appropriate for the location where it will be installed. The enclosure shall have a door with latch and lock. At the completion of the contract, a neatly printed or typed directory listing the panel and circuit identities shall be mounted inside the door.

C Circuit Breakers: Circuit breakers shill be thermal magnetic, bolt in, individually front replaceable, and shall indicate "On" "Off", and "Tripped". Breakers indicated as multiple pole shall be common trip type. Breakers up to 240 volts shall have interrupting ratings not less than 22,000 amperes. Breakers for 277 volts shall have interrupting ratings not less than 25,000 amperes. Breakers for 480 volts shall be rated 600 volts, with interrupting ratings not less than 25,000 amperes at 480 volts. Handle clips to prevent casual operation of breakers shall be provided for 10 percent (at least two) of the breakers and applied to the circuits directed.

D Buses: The panel shall have main and neutral buses insulated from the cabinet and a ground bus. Buses shall be copper, with ampere ratings and main lugs or breaker as indicated. The ground bus shall be similar to a neutral bus and shall have a good ground connection to the cabinet, a removable bond to the neutral bus, clamp type lugs for the ground cable in each supply conduit, and connections for a ground cable in each load conduit.

E. Panelboards shall be manufactured by Square D. Cutler-Hammer. General Electric, or approved equal.

2.9 LIGHTING AND AUXILIARY POWER TRANSFORMERS

A. Separately mounted transformers shall be provided in the phases, kVA, and voltages indicated on the drawings. Transformers shall be self air cooled, dry type, wall or floor mounted, and enclosed for wiring in conduit. Transformers installed outdoors shall be weatherproof. Transformers shall have at least two full capacity voltage taps. Transformers shall meet NEMA TP I guidelines for energy efficiency. Outdoor transformers shall be stainless steel encapsulated.

2.10 POWER CENTERS

A. Power centers shall consist of a primary breaker, a 480-120/240 volt or 480-120/208 volt transformer, a secondary breaker, and a distribution panelboard in a NEMA Type 3R enclosure. Transmitter and circuit breaker configuration and ratings shall be as indicated on the drawings.

B. Transformers: Transformers shall be self-cooled, dry type. Transformers shall have at least two full capacity voltage taps.

C. Circuit Breakers: Circuit breakers shall be thermal-magnetic, bolt in, individually front replaceable, and shall indicate "On", "Off" and "Tripped". Breakers and provisions for future breakers shall be provided in the quantities, poles, and ampere ratings indicated on the drawings. Breakers shall be single pole, 20 amperes, except as indicated otherwise.

2.11 LIGHTING

A. Refer to light fixture schedule on the drawings.

2.12 OUTDOOR ELECTRICAL EQUIPMENT RACKS

A. Refer to outdoor equipment rack detail drawing.

PART 3— EXECUTION

3.1 POWER AND SERVICE ENTRANCE

A. Contractor shall consult the local electric utility regarding their service installation requirements, and shall furnish the service equipment in compliance with these requirements. Contractor shall install all power service equipment components except for components installed by the utility as directed in the utility service installation requirements.

B. Power service equipment to be furnished by Contractor shall include, but is not limited to, meter board, meter socket, meter test cabinet, meter transformer cabinet, disconnecting means, grounding materials, riser conduits, and other service entrance fittings required by the utility and for compliance with local codes and regulations.

C. Contractor shall also provide trenching and backfill, conduits, service cables, and other underground service entrance fittings required by the utility for underground service installation.

D. A weatherhead shall be provided on each service riser conduit.

3.2 INSTALLATION

A. Equipment shall be installed in accordance with the requirements of the NEC.

B. Coordinate the installation of electrical equipment with other trades.

1. Arrange for the building in of equipment during structure construction.
2. Where equipment cannot be built-in during construction, arrange for sleeves, box-outs, openings, etc., as required to allow installation of equipment after structure construction is complete.

C. Verify that equipment will fit layouts indicated.

D. Equipment Dimensions and Clearances:

1. Do not use equipment that exceeds the indicated dimensions, except as approved in writing by the Engineer.
2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.

E. Install equipment in accordance with the manufacturer's instructions.

F. Equipment Access:

1. Install equipment so it is readily accessible for operation and maintenance.
2. Equipment shall not be blocked or concealed.
3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.

G. Equipment shall be installed plumbed, square and true with the structure construction and shall be securely fastened.

H. Outdoor wall-mounted equipment shall be provided with corrosion-resistant spacers to maintain 1/4 inch separation between the equipment and the wall.

I. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.

J. Equipment fabricated from aluminum shall notbeplaced in direct contact with earth or concrete.

K. Provide all necessary anchoring devices and supports:

1. Use supports as detailed on the Drawings and as specified. Where not detailed on the Drawings or specified, use supports and anchoring devices rated for the equipment load and as recommended by the manufacturer.
2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.
3. Hardware shall be malleable type, corrosion resistant and shall be supported by heavily plated machine screws or brass, bronze or stainless steel bolts.
4. Do not cut, or weld to, building structural members.
5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure-mounting surface is properly braced to accept mounting of external equipment.

L. Contractor shall verify exact rough-in location and dimensions for connection to electrical items furnished by others.

1. Shop drawings shall be secured from those furnishing the equipment.
2. Proceeding without proper information may require the Contractor to remove and replace work that does not meet the conditions imposed by the equipment supplied, at no cost to the Owner.
3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the Engineer.
4. Should any cutting and patching be required on account of failure of the Contractor to coordinate penetrations, such cutting and patching shall be done at the sole expense of the Contractor.

    a. Contractor shall not endanger the stability of any structural member by cutting, Digging, chasing, or drilling and shall not, at any time, cut or alter the work without the Engineer's written consent.

        i. Provide additional reinforcing if required.
        ii. Cutting shall be done neatly using proper tools and methods.

    b. Subsequent patching to restore walls, ceilings, or floors to their original condition shall be done by workmen skilled in their particular field.

M. Provide concrete foundations or pads required for electrical equipment as indicated or specified.
    1. Floor-mounted equipment shall be mounted on a four (4) inch high concrete housekeeping pad. Pad shall be poured on top of the finished floor or slab.

N. To avoid interference with structural members and equipment of other trades, it may be necessary to adjust the intended location of electrical equipment. Unless specifically dimensioned or detailed, the Contractor may, at his discretion, make minor adjustments in equipment location without obtaining the Engineer's approval. Deviations in equipment location that are specifically dimensioned or detailed, or exceed those defined above require the Engineer's prior approval.

O. Device Mounting Schedule:

    1. Dimensions are to center of item unless otherwise indicated.

    2. Mounting heights as indicated below unless otherwise indicated on the Contract Drawings:

        a. Light switch: 48 IN.
        b. Receptacle in all other locations: 48 IN.
        c. Disconnect/ Safety switch: 54 IN.
        d. Panelboard (to top): 72 IN.
        e. Motor starter: 54 IN.

f. Pushbutton motor control station: 48 IN.

3.3 CABLE INSTALLATION

A. General Except as otherwise specified or indicated on the drawings. cable shall be installed according to the following procedures, taking care to protect the cable and to avoid linking the conductors, cutting or puncturing the jacket, contamination by oil or grease, or any other damage.

1. Stranded conductor cable shall be terminated by lugs or pressure type connectors. Wrapping stranded cables around screw type terminals is not acceptable.

2. Stranded conductor cable shall be spliced by crimp type connectors. Twist-on wire connectors may be used for splicing solid cable and for terminations at lighting fixtures.

3. Splices shall be made only at readily accessible locations.

4. Cable terminations and splices shall be made as recommended by the cable manufacturer for the particular cable and service conditions. All shielded cable stress cone terminations shall be IEEE Class 1 molded rubber type. Shielded cable splices shall be tape or molded rubber type as required. Shielded cable splices and stress cone terminations shall made by qualified splicers. Materials shall be by 3M Company, Plymouth/Bishop, Raychem Electric Power Products, or approved equal.

5. Cable shall not be pulled tight against bushings nor pressed heavily against enclosures.

6. Cable-pulling lubricant shall be compatible with all cable jackets: shall not contain wax, grease, or silicone; and shall be Polywater "Type J".

7. Spare cable ends shall be taped, coiled, and identified.

8. Cables shall not be bent to a radius less than the minimum recommended by the manufacturer.

9. All cables in one conduit, over I loot long, or with any bends, shall be pulled in or out simultaneously.

10. Circuits shall not be combined to reduce conduit requirements unless acceptable to Engineer.

B. Underground Cable Pulling Procedure: Care shall be taken to prevent excessive physical stresses that would cause mechanical damage to cables during pulling.

3.4 CONDUIT INSTALLATION.

A. Contractor shall be responsible for routing all conduits. This shall include all conduits indicated on the one-lines, riser diagrams, and home-runs shown on the plan drawings. Conduits shall be routed as defined in these specifications. Where conduit routing is shown on plans, it shall be considered a general guideline and shall be field verified to avoid interferences.

B. Except as otherwise specified or indicated on the drawings, conduit installation and identification shall be completed according to the following procedures.

C. Installation of Interior and Exposed Exterior Conduit. This section covers the installation of conduit inside structures, above and below grade, and in exposed outdoor locations. In general, conduit inside structures shall be concealed. Large conduit and conduit stubs may be exposed unless otherwise specified or indicated on the drawings. No conduit shall be exposed in water chambers unless so indicated on the drawings.

D. Unless otherwise indicated on the drawings, Contractor shall be responsible for routing the conduit to meet the following installation requirements:

1. Conduit installed in all exposed indoor locations, except corrosive areas indicated on the drawings, and in floor slabs, walls, and ceilings of hazardous (classified) locations, shall be intermediate metal. Exposed conduit shall be rigidly supported by hot-dip galvanized hardware and framing materials, including nuts and bolts.

2. Conduit installed in floor slabs and walls in non-hazardous locations shall be rigid Schedule 80 PVC.

3. Conduit installed in all exposed outdoor locations shallbePVC-coated rigid steel, rigidly supported by PVC-coated framing materials. Mounting hardware, which includes nuts, bolts, and anchors, shall be stainless steel. All damaged coatings shall be repaired according to the manufacturer's instructions.

4. Final connections to dry type transformers, to motors without flexible cords, and to other equipment with rotating or moving parts shall be liquidtight flexible metal conduit with watertight connectors installed without sharp bends and in the minimum lengths required by the application, but not longer than 6 feet unless otherwise acceptable to

Engineer.

5. Terminations and connections of rigid steel and intermediate metal conduit shall be taper threaded. Conduits shall be reamed free of burrs and shall be terminated with conduit bushings.
6. Exposed conduit shall be installed either parallel or perpendicular to structural members and surfaces.

7. Two or more conduits in the same general routing shall be parallel, with symmetrical bends.

8. Rigid Schedule 80 PVC conduit shall have supports and provisions for expansion as required by NEC Article 352.

9. Metallic conduit connections to sheet metal enclosures shall be securely fastened by locknuts inside and outside.

10. Rigid Schedule 80 PVC conduit shall be secured to sheet metal device boxes using a male terminal adapter with a locknut inside or by using a box adapter inserted through the knockout and cemented into a coupling.

11. Conduits in walls or slabs, which have reinforcement in both faces, shall be installed between the reinforcing steel. In slabs with only a single layer of reinforcing steel, conduits shall be placed under the reinforcement. Conduits larger than 1/3 of the slab thickness shall be concrete encased under the slab.

12. Conduits that cross structural joints where structural movement is allowed shall be fitted with concretetight and watertight expansion/deflection couplings, suitable for use with metallic conduits and rigid Schedule 40 PVC conduits. The couplings shall be Appleton Type DF, Crouse-Hinds Type XD, O-Z Type DX, or approved equal.

13. Conduit shall be clear of structural openings and indicated future openings.

14. Conduits shall be capped during construction to prevent entrance of dirt, trash, and water.

15. Exposed conduit stubs for future use shall be terminated with galvanized pipe caps.

16. Concealed conduit for future use shall be terminated in equipment or fitted with couplings plugged flush with structural surfaces.

17. Where the drawings indicate future duplication of equipment wired hereunder, concealed portions of conduits for future equipment shall be provided.

18. Conduit shall not be routed across the surface of a floor or walkway unless approved by PWC.

19. PVC-coated rigid steel conduit shallbethreaded and installed as recommended by the conduit manufacturer's installation procedure using appropriate tools.

20. All conduits that enter enclosures shall be terminated with acceptable fittings that will not affect the NEMA rating of the enclosure.

21. Nonmetallic conduit, which turns out of concrete slabs or walls, shall be connected to a 90 degree elbow of PVC-coated rigid steel conduit before it emerges.

22. Power conductors to and from adjustable frequency drives shall be installed in steel conduit.

E. Underground Conduit Installation. All excavation, backfilling, and concrete work shall conform to the respective sections of these specifications. Underground conduit shall conform to the following requirements:

1. All underground conduits shall be concrete encased as indicated on drawings, within 15 feet of building entrances and under and within 5 feet of roadways.

2. Concrete encased conduit shall be Schedule 40 PVC. Conduits shall have end bells where terminated at walls. All joints shall be solvent welded in accordance with the recommendations of the manufacturer.

3. Underground conduits indicated not to be concrete encased shall be rigid Schedule 80 PVC.

4. Underground conduit bend radius shall be at least 2 feet at vertical risers and at least 3 feet elsewhere.

5. Underground conduits and conduit banks shall have at least 2 feet of earth cover, except where indicated otherwise.

6. Underground nonmetallic conduits, which turn out of concrete or earth in outdoor locations, shall be connected to 90 degree elbows of PVC-coated rigid steel conduit before they emerge.

7. Conduits not encased in concrete and passing through walls, which have one side in contact with earth, shall be sealed watertight with special rubber-gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.

8. Underground conduits shall be sloped to drain to handholes / manholes.

9. Instrument cables shall be separated the maximum possible distance from all power wiring in pull-boxes, manholes, and handholes.

F. Sealing of Conduits. After cable has been installed and connected, conduit ends shall be sealed by forcing non-hardening sealing compound into the conduits to a depth at least equal to the conduit diameter. This method shall be used for sealing all conduits at handholes, manholes, electrical enclosures with connecting conduit routed below grade, and for 1 inch and larger conduit connections to equipment.

1. Conduits entering hazardous (classified) areas and submersible or explosion proof enclosures shall have Appleton "Type ESU" or Crouse-Hinds "EYS" scaling fittings with sealing compound.

G. Reuse of Existing Conduits. Existing conduits may be reused subject to the concurrence of Engineer and compliance with the following requirements:

1. A wire brush shall be pulled through the conduit to remove any loose debris.

2. A mandrel shall be pulled through the conduit to remove sharp edges and burrs.

3.5 GROUNDING AND BONDING

A. Ground Rods: Ground rods shall be rolled to a commercially round shape from welded copper clad steel manufactured by the molten welding process or by die electro formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000 pounds per square inch (psi) and an elastic limit of 49,000 psi. The rods shall be not less than 3/4 inch in diameter by 10 feet in length; and the proportion or copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.013 inch at any point on the rod.

B. Fittings: Grounding connections to equipment shall be bolted. Cable end connections may be made by use of the crucible weld process or bolted type connectors. Bolted type connectors for this application shall consist of corrosion resistant copper alloy with silicone bronze bolts, nuts and lockwashers which are designed for this purpose.

C. Grounding Conductors: A green, insulated equipment grounding conductor, which shall be separate from the electrical system neutral conductor, shall be furnished and installed for all circuits. Equipment grounding conductors shall be furnished and installed in all conduits. Use of conduits as the NEC required equipment grounding conductor is not acceptable. Where specified or shown, a copper strap shall be furnished and installed as the grounding conductor.

D. The maximum resistance to ground of a driven ground rod shall not exceed 10 ohms under normally dry conditions. Where the resistance obtained with one (1) ground rod exceeds 10 ohms, additional ground rods shall be installed not less than 10 feet on centers. Except where specifically indicated otherwise, all exposed noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in nonmetallic raceways and neutral conductors of wiring systems shall be grounded.

E. The ground connection shall be made at the main service equipment and shall be extended to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection. If there is not suitable metallic water service to the facility, the ground connection shall be made to the driven ground rods on the exterior of the building.

F. Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

G. Equipment grounds shall be solid and continuous from a connection at earth to all distribution panelboards. Ground connections at panelboards, outlets, equipment, and apparatus shall be made in an approved and permanent manner.

H. Metal surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.

I. Main ground grid shall be provided for each structure and interconnecting structure grids consisting of driven ground rods. The ground rods shall be driven deep enough to obtain a ground resistance of not more than 10 ohms and shall interconnected by the use of copper cable bus (3" strap minimum), or a bare copper conductor sized to the largest service entrance ground, welded to the rods by the crucible weld process. The grounding cables shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the ground system and shall enter the buildings and structure from the outside and shall be connected to steel structures, and equipment as described in this Section and as required to provide a complete grounding system.

J. Grounding conductors shall be continuous between points of connection; splices shall not be permitted. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in metal raceway. The raceway shall be bonded to the grounding system. Connections to ground rods shall be exposed to permit maintenance and inspection for continuity and effectiveness of grounding system. Where subsurface conditions do not permit

use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.

K. Conduit which enters equipment such as motor controls, instrument and control panels, and similar equipment shall be bonded to the ground bus, where provided, and as otherwise required by the NEC.

3.6 IDENTIFICATION.

A. Cable. Except for lighting and receptacle circuits, each individual wire in power, control, indication, and instrumentation circuits shall be provided with identification markers at the point of termination. The wire markers shall be of the heat-shrinkable tube type, with custom typed identification numbers. The wire numbers shall be as indicated on the equipment manufacturer's drawings. The wire markers shall be positioned to be readily visible for inspection. Power wires shall be color coded with electrical tape or colored wire jacket: white-N, black. and red for 120/240 volt, 3-wire; and gray-N, brown, orange and yellow for 480/277 volt, 4-wire circuits.

B. Pump Control Panels. Panels shall be provided with nameplates identifying the related equipment. Pilot controls and indicating lights shall have engraved or etched legends ("start", "stop", etc.) as indicated on the drawings. Nameplates shall be laminated black-over-white plastic, with 1/8 inch engraved letters, and shall be securely fastened with stainless steel screws to the motor starters.

C. Circuit Breakers. Circuit breakers shall be provided with nameplates identifying related equipment. Nameplates shall be laminated black-over-white plastic, with 1/8 inch engraved letters, and shall be securely fastened with stainless steel screws to the circuit breakers.

D. Disconnect Switches. All switches shall have front cover-mounted permanent nameplates that include switch type, manufacturer's name and catalog number, and horsepower [kW] rating. An additional nameplate, engraved or etched, laminated black-over-white plastic, with 1/8 inch letters, shall be provided to identify the associated equipment. Both nameplates shall be securely fastened with stainless steel screws to the enclosure.

E. Arc Flash Hazard Labels. Lighting panels, power panels, power centers, and meter socket enclosures shall be provided with permanent labels warning the risk of arc flash and shock hazard. Labels shall be designed in accordance with ANSI Z535.4-1998, NFPA 70E, and shall include the following:

WARNING
Arc Flash and Shock Hazard

Appropriate personal protection equipment (PPE) required.
SEE NFPA 70E. Equipment must be accessed by qualified personnel only.

Turn off all power sources prior to working on or inside equipment.

3.7 FIELD QUALITY CONTROL

A. Equipment furnished under this Contract for use on future work and all concealed equipment, including conduits, shall be dimensioned, on the record drawings, from visible and permanent building features.

B. After installation, all equipment shall be tested as recommended by the manufacturer.

C. Verify all components are operational.

D. Perform ground-fault performance testing as required by NEC Article 230-95 (c).

E. Test Equipment Interface:

1. Verify systems coordination and operation.

F. Set all adjustable trip protective devices as required for system protection and coordination.

G. Verify all system and equipment ground continuity.

H. Adjust installed equipment for proper operation of all electrical and mechanical components.

I. Replace equipment and systems found inoperative or defective and re-test.

1. If equipment or system fails re-test, replace it with products that conform to Contract Documents.
2. Continue remedial measures and re-tests until satisfactory results are obtained.
3. Remedial measures and re-tests willbedone at no cost to the PWC.

J. Tests shall be performed in the presence of the Engineer.

1. Tests shall be scheduled with the Engineer and Owner, a minimum of two (2) weeks in advance.
2. Required certificates of testing or review shall be presented to the Engineer upon completion of the tests.

K. At Completion of Installation:

1. Test to ensure all equipment is free of short circuits and improper grounds.
2. Test to ensure all equipment is operational.

3.8 CLEANING

A. Clean dirt and debris from all surfaces.

B. Apply touch-up paint as required to repair scratches, etc.

C. Replace nameplates damaged during installation.

D. Thoroughly vacuum the interior of all enclosures to remove dirt and debris.

3.9 DEMONSTRATION

A. Demonstrate equipment in accordance with Contract and Bidding Requirements.

B. PWC to provide a final inspection and approval to ensure equipment, quality of workmanship, and installation are in accordance with PWC's published design standards.

SECTION 16619
AUTOMATIC TRANSFER SWITCH

PART I GENERAL

1.01 WORK INCLUDED

A. Legion Road Lift Station
Standby Power Automatic Transfer Switch

1.02 REFERENCES

A. UL 1008

1.03 SUBMITTALS

A. Provide shop submittals including catalog and fabrication information. Provide as part of Engine Generator Package.

PART 2 PRODUCTS

2.01 AUTOMATIC TRANSFER SWITCH

A. Furnish and install where shown on the accompanying plans the complete load transfer switch and accessories. The bidder is cautioned to make sure that all equipment necessary for the satisfactory operation of the generator and switch are included in the bid. The function of this switch is to AUTOMATICALLY switch load to the generator and back to commercial power. Transfer switch shall be furnished in the engine generator package. The transfer switch shall bring wiring to terminal block switch control to start generator and transfer load and to retransfer load and deenergize generator.

B. The load transfer switch shall be manufactured by Russelectric, Zenith, Detroit, Onan or Asco.

C. The transfer switch shall have a rating of 250 amperes at a normal and alternate source of 277/480 volts, 3 phase, 60 Hertz, 4 wire.

D. The transfer switch shall be capable of switching all classes of load and shall be rated for continuous duty when installed in a non-ventilated enclosure constructed in accordance with Underwriter's Laboratories, Inc. Standard UL-1008.

E. The transfer switch shall be 4 pole double throw, actuated by a single electric operator momentarily energized and connected to the transfer mechanism by a simple overcenter type linkage with a total transfer time not to exceed one-half second. The transfer switch shall be capable of transferring successfully in either direction with 70% of rated voltage applied to the switch terminals. The neutral switching contact shall be on the same shaft as the main contacts.

F. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in position in both the normal and emergency position without the use of hooks, latches, magnets or springs and shall be silver-tungsten alloy protected by arcing contacts with magnetic blowouts on each pole. Interlocked molded case circuit breakers or contactors are not acceptable.

G. The transfer switch shall be equipped with a manual mechanical operator that is designed to prevent injury to the operating personnel if the electrical operator should suddenly become energized during manual transfer. The manual operator shall provide the same contact - to- contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.

H. Sequence of Operation: Engine starting contacts shall be provided to start the generating plant if any phase of the normal source drops below 80% of rated voltage after a non-adjustable time delay period of 3 seconds to allow for momentary dips. The transfer switch shall transfer to emergency as soon as the voltage and frequency have reached 90% of rated voltage and adjustable time delay period of 0-30 minutes shall delay transfer to normal power until it has had time to stabilize. If the emergency power source shall fail during the time delay period, the time delay shall be bypassed and the switch shall return immediately to the normal source. After the switch has retransferred to normal, the engine generator shall be allowed to operate at no load for an adjustable period of time (0-5 minutes) to allow it to cool before shutdown. A manual switch shall be mounted on the cabinet door to indicate the switch position. Two auxiliary contacts rated 25 amperes, 120 volts, shall be mounted on the main shaft; one closed on normal, the other closed on emergency. Provide pilot light to indicate switch position on the door.

I. For proper system coordination, the manufacturer of the transfer switch shall verify that his switch is listed by Underwriter's Laboratories, Inc. at the time of the bid opening, under UL-1008 with a withstand and closing rating at least equal to the interrupting rating of the circuit breaker and/or fuse specified by the Engineer to protect the circuit.

J. When conducting temperature rise tests to Paragraph 17 of UL-1008, the manufacturer shall include post endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload endurance tests.

K. In addition to the above, the transfer switch must have a short circuit withstand capability in excess of the UL minimum requirement for 200 ampere switch of 22,000 RMS amperes symmetrical at 480 volts, when coordinated with circuit breakers.

L. To establish conformance with the above, the manufacturer must produce certified test reports from an independent testing laboratory (factory tests not acceptable) to verify that identical samples have been subjected to three phase short circuit currents at 480 VAC for a minimum of 3 cycles duration without contact damage or contact welding and without the use of current limiting fuse protection.

Oscillograph traces are to be supplied to verify that the test parameters have been met. Product submitted (exact rating of poles, etc.) must be product manufactured for at least 5 years so performance record is established (UL listing required).

M. The transfer switch shall be housed in a NEMA 4 Stainless Steel enclosure suitable for rack mounting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide automatic transfer switch to be field installed adjacent to the main distribution breaker arrangement in NEMA 4 Stainless Steel enclosure.

B. Interconnect all commercial power failure alarms, etc.

C. Provide NEMA rated hubs for all conduit terminations.

D. Provide 3/4" conduit with 4# 14 AWG wires Cu. THHN/THWN from ATS to generator control panel.

*****END OF SECTION*****

SECTION 16621
PACKAGE ENGINE GENERATOR SET

The standby generator shall be furnished and installed for the new Pinewood Drive lift pump station as part of the general contract at the locations shown on the drawings and as specified herein with all accessories and transfer panels as required.

PART 1 GENERAL

1.01 It is the purpose and intent of this specification to obtain for the Owner a complete operating standby electric generating set, including all the accessories and appurtenant equipment necessary to a reliable system. Evidence of a satisfactory installation of similar equipment within a reasonable distance shall be furnished on request. The system shall be built, tested and shipped by the manufacturer of the alternator, who has been regularly engaged in the source of supply and one responsibility. The performance of the electric plant series and automatic transfer switch shall have been certified by an independent testing laboratory as to the plant's full power rating, voltage, and frequency regulation and shall be warranted under a written and published factory warranty for five years against defects in material and factory workmanship. The generator system shall be UL 2200 listed.

1.02 Dealer assembled units will not be accepted. The supplier shall have available complete parts and service departments employing full time, factory authorized and factory trained personnel, devoted exclusively to this service, an located within a reasonable distance of the installation site. Service shall be by a factory trained representative in operation and service of the system. A copy of the factory test shall be furnished with the unit.

Permanent engine generators are as follows:

#1	150kw	277/480 VAC	Three Phase

1.03 The Contractor shall furnish and install a Caterpillar D-150-8 or equal by MTU or Cummins/Onan standby electric generating set. The set shall consist of a water cooled, diesel fuel unit, rated as above. The set shall be a package of new and current equipment, complete with all standard equipment including, but not limited to, the following:

A. ENGINE

1. The engine shall be diesel fueled, 4 cycle, water-cooled with mounted radiator, fan and pump. It shall have 4 cylinders inline or V design and a minimum displacement of 402.8 cu. in 6.6 Liters for 150 KW and a bhp to generated rated kw with all appurtenant equipment at its operated speed of 1800 rpm.

2. Overhead valve design. Hard faced exhaust valves with rotators shall be provided. Lubrication shall be full pressure as suplied by a positive displacement lube oil pump.

The engine shall have an air cleaner and oil filter with replaceable elements, and a carburetor for the fuel specified with all required accessories. Engine speed shall be governed by an electronic governor to maintain 2% from no-load to full-load alternator output. The engine shall have a 24 volt battery charger DC alternator with transistorized voltage regulator. Remote starting shall be by a 24 volt, solenoid shift, electric starter. Engine shall be sized for maximum 15% voltage dip with all motors starting.

Also provide engine lube oil and 50% ethylene glycol antifreeze solution, water jacket heater, tank type 1000 watts, 120 volts, automatic shut-off of jacket heater when engine is running.

B. **ENGINE COOLING SYSTEM:** The radiator fan shall direct the air flow from the engine outward through the radiator, with horizontal air discharge. A duct system and motor operated louver shall vent the air on to the exterior as shown on the plans. These louvers and the intake air louvers shall be relay operated at the generator control cabinet. The fan shall be driven directly from the engine crankshaft or through V-belt drive. The radiator shall have sufficient capacity to dissipate not less than the total British thermal units per hour rejected by the engine to the cooling system at 100 percent rated load in 40 degrees F. ambient, and against a static restriction of 0.5 inches of water as may be imposed by louvers, ductwork, etc. Cooling section shall have a tube and fin type core which shall consist of copper or copper base alloy tubes with nonferrous fins. The radiator shall be protected by a strong grill or metal bar guard on the exterior, and the fan shielded with a metal canopy. Filler caps shall be designed for pressure relief prior to removal. A thermostatic control valve shall be installed in the jacket water system of the engine to maintain the water system temperature of the engine. The thermostatic valve shall be standard modulating type with self-contained thermostats. The valve shall be capable of passing the water flow as determined by the manufacturer without excessive pressure drop across the valve. The valve shall be provided with one or more interchangeable thermostatic elements. The elements shall be nonadjustable type and the operating temperature shall be set at the temperature recommended by the engine manufacturer. The valve shall be designed so that in event of the thermostatic element failure, water will be able to flow through the engine. Engine shall be delivered with anti-freeze for protection at 10 degrees Fahrenheit.

C. **ENGINE CONTROL PANEL**

1. The microprocessor based combination standard circuit board control panel and output box shall be unit mounted and shall be built, tested and shock

mounted by the manufacturer of the alternator. It shall be capable of starting the engine manually at the control panel or from a remote closing relay, stopping on opening the relay, and shall contain the following instruments:

a. oil pressure gauge
b. Battery charger rate ammeter
c. Water temperature gauge
d. RUN-STOP-REMOTE selector switch
e. 60 - 75 second cranking limiter
f. Adjustable printed circuit modular engine monitor with individual emergency fault lights and alarm terminals to signal actuation of low speed, overspeed, or overcrank safeties.
g. Complete printed solid state engine start controls and terminals.
h. AC voltmeter
i. AC ammeter
j. Voltmeter-ammeter selector switch
k. Frequency meter
l. Voltage adjusting rheostat
m. Running time meter
n. Panel lights
o. Manual reset overload protection (field circuit breaker)
p. Low fuel level alarm @ 25%

Provide for remote alarm/communication interconnection for:

a. Generator "run"
b. Generator "Fail to Start"
c. Generator Low Fuel Alarm

Provide relay output box with relays to provide the above dry contact Signals to a remote telemetry panel input.

2. There shall be one main line molded case, three pole 230 VAC single throw service entrance rated circuit breaker with a trip setting of 150 amperes three phase at 104 degrees F. (40 degrees C) ambient temperature. This rating shall include at least 25% additional capacity for overload and operating temperature rise over 104 degrees F (40 degrees C). It shall operate both manually for normal switching functions and automatically during short circuit conditions.

The circuit breaker shall meet standards established by Underwriters Laboratories, National Electric Manufacturers Association, and National Electric Code.

Generator circuit breakers shall be Service Entrance Rated and enclosed in an output box.

Access for all controls and equipment shall be from the side. No access shall be required from the end of the generator.

D. ALTERNATOR

1. The alternator shall be broad range, 12 lead reconnectable, 4 pole, revolving field type with rotating exciter and solid state voltage regulator. No commutator or commutator brushes shall be allowed. It shall be directly connected to insure permanent alignment. Voltage regulation shall be within plus or minus 2% of rated voltage from no to full load. A rheostat shall provide plus or minus 5% voltage adjustment. Stable alternator operation conditions shall be re-established within 2 seconds following any sudden change in load between no load and full or between full load to no load. Stable alternator operations is defined as frequency variation not exceeding plus or minus 0.5% and voltage variation plus or minus 1% of their mean value for constant loads from no load to full load. Temperature rise shall be within rating as defined by NEMA MG 1 -22.40. Insulation shall be Class F as defined by NEMA-MG- 1.65.

E. RATING

1. The rating of the electric set shall be based on operation of the set when equipped with all necessary operating accessories. The electric set shall be rated and capable of producing 150 KW188 KVA at 0.8 power factor for standby power service.

F. ELECTRIC PLANT MOUNTING

1. The plant shall be set on vibration isolators, cushion mounted on welded structural steel skid base which shall provide suitable mounting to any level surface. Provide at least six spring type isolators for the unit.

G. AUTOMATIC TRANSFER SWITCH: Automatic transer switch shall be furnished with the generator package and designed for rack mounting. Coordinate load transfer switches. See specifications section 16619.

H. BATTERIES AND CHARGER

1. An automatic "float" type battery charger shall be provided to maintain the batteries at normal capacity and to recharge batteries after cranking. The

charger shall be 120 volts input with 24 volt output. It shall include AC compensation, current limit, DC ammeter, voltmeter to show battery voltage, equalizing switch, fused AC input and DC output, complete isolation of AC input and DC output and be designed as not to discharge the battery in event of failure.

2. The battery charger shall be capable of recharging completely discharged battery in a maximum of 8 hours. The charger shall bear Underwriter's Laboratory label.

3. Batteries shall be lead acid type.

4. Capacity shall be for at least 3 cranking cycles (each cycle consisting of 3 each 10 second cranks with 5 second rest period between each crank).

5. Provide box to completely enclose the battery rack assembly. It shall have ventilation holes and removable cover.

I. MISCELLANEOUS EQUIPMENT

1. Provide an electric water jacket heater with the generator set. It shall have an adjustable temperature setting and capable of keeping the engine water temperature at a constant 120 degrees F. during the coldest winter weather. The heater shall be suitable for operation on 120 volts, single phase AC power.

2. Provide circuit breaker at the generator to provide overload and short circuit protection for the generator.

3. Provide ultra - critical level special type stainless steel silencer and complete exhaust system. Silencer shall reduce total engine exhaust noise by by 35 – 45 db. Provide insulation of muffler and exhaust system. Silencer shall be supplied for mounting within the generator set enclosure. Unit shall be complete as side in/end out type with discharge tailpipe, raincap and all required stainless steel hardware. A stainless steel flexible exhaust connection shall connect the engine exhaust outlet to the silencer.

4. Install permanent type anti-rust, anti-freeze to 20 degrees below zero.

J. FUEL SUPPLY.

1. Provide a solenoid valve in the supply line wired to prevent fuel from flooding the engine. Include day tank if necessary with sufficient tank capacity to provide adequate fuel source. Mount within enclosure.

2. Provide overspill containment vessel on the fill valve.

K. GENERATOR ENCLOSURE:

The weatherproof enclosure shall be all aluminum, primed and painted with the manufacturer's standard outdoor finish. Hinged access doors shall be provided as required for the operation and maintenance of the set. Provide a radiator core guard. The doors to the unit shall be lockable. In addition, the following shall be provided:

Enclosure and all other items to be designed and built by engine manufacturer as an integral part of the entire generator set and be designed to perform without overheating in the ambient specified.

Enclosure shall include sound attenuation 65.5 db at 23 feet and shall be of 12 gauge construction and suitability reinforced to be vibration free.

Side and rear panels to be completely and simply removable to allow major service accessibility. Panels shall be double wall 12 GA and aluminum.

Baked enamel, moisture cured polyurethane, or catalyzed epoxy finish with primer and finish coat to be painted before assembly. All fasteners to be rust resistant.

Catches shall be provided to hold the doors in the open position.

Unit shall have sufficient guards to prevent entrance of small animals, rodents, etc.

Batteries and charger shall fit inside the enclosure alongside the engine.

Units shall have coolant and oil drains outside the unit to facilitate maintenance. Each drain line is to have a high quality valve located near the fluid source, and a cap or plug on the outer end.

Fuel filters shall be inside the base perimeter and located so spilled fuel cannot fall on hot parts of engine of generator. A cleanable primary fuel strainer shall be used to collect water and sediment between tank and main engine fuel filter.

Crankcase fume disposal shall terminate in front of the radiator or into the intake manifold to prevent oil from being blown around.

All oil and coolant drains shall be piped to the exterior of the skid and be include a valve and cap at the base.

L. SUBBASE FUEL TANK

1. A 550 gallon capacity (60 hours at ¾ load) subbase fuel tank shall be provided for the 150 KW unit. This tank shall be installed under the generator set and shall be designed to properly support the generator set, weatherproof enclosure and all associated accessory equipment. The subbase fuel tank shall be of double wall construction to provide inherent tank rupture containment, supplied complete with rupture alarm provisions. The subbase fuel tnak shall be supplied complete with level gauge, low fuel level alarm, vent cap, lockable fill cap, generator set fuel line-connections, and both inner and outer tank drain provisions. The inner tank shall be constructed of formed 3/16 inch mild steel with all seams being double welded. Outer tank shall be of ¼ inch mild steel with generator mounting surface to be 3/8 inch steel treadplate. Suitable mounting provisions for generator set shall be provided as an integral part of the subbase fuel tank.

2. The subbase fuel tank shall have a maximum height of 24 inches. If the fuel tank is larger that the generator footprint, it shall extend off the front of the generator. Any metal extending from beyond the generator footprint shall be crowned to facilitate water run off.

3. The subbase fuel tank shall have an overspill container on the fill valve.

M. Provide concrete mounting slab to be 6 inches around the generator footprint with a 1 inch chamfer. Provide 6 inch slab with # 4 rebar @ 6" on center each way. Provide 4000 psi. concrete.

N. TESTING - OPERATION –MAINTENANCE-WARRANTY

1. Before the equipment is installed, a dealer certified test log of the generator set showing a minimum of ¾ hour testing with ½ hour at 100% rated load continuously shall be submitted to purchaser. Normal preliminary engine and generator tests shall have been performed before unit assembly.

2. Operational test of the system shall be conducted by a representative of the manufacturer of this equipment in the presence of the specifying engineer, the Owner and the operating personnel. It shall be demonstrated during this test that the complete system performs at the specified setting. A full load bank test shall be conducted at 100% rated load. Also, that with all motors running from commercial power, the commercial power is to be disconnected and the generator will be tested to assume the load. Coordinate the resetting of time

delay switches as required. After completing all test and making all adjustments, the test run of the generator shall continue for a 4 hour period. This 4 hour period run shall be with a 100% full load bank for testing. Testing shall be in accordance with NFPA 110 Chapter #7.13.

3. The engine-generator set bidder shall be authorized dealer of the engine manufacturer, and shall be fully qualified and authorized to provide service and parts for both the engine and generator at any time during the day of night. Availability of parts and service will be a factor in making the award. Packagers not having local service, assembly and engine parts inventory will not be considered.

4. The units offered under these specifications shall be covered by the manufacturer's 5 year warranty or guarantee on new machines.

5. All components, including batteries, chargers, transfer switches, etc. shall be provided to contractor (or Owner as applicable) by the engine generator dealer in his package to insure proper coordination of all components. Purchase of components by contractor thru other sources shall not be allowed.

6. Prior to the final acceptance, the manufacturer shall supply three (3) copies of complete instruction manuals to the owner. The manuals shall include operation and maintenance procedures, complete parts lists, dimensional drawings, unit wiring diagrams and schematics, and interconnection wiring drawings.

7. Prior to final acceptance, the manufacturer shall provide comprehensive training to the owner's designated personnel. Training shall cover, but not be limited to, operation, maintenance and troubleshooting of the equipment.

0. FACTORY PROTOTYPE MODEL TESTS

1. The power system consisting of prime mover, generator and all necessary controls must be tested as a complete system on representative engineering prototype models. The tests, being potentially damaging to the equipment tested, must not be performed on equipment sold, but on separate prototype models. A certificate certifying that this prototype testing has been accomplished, shall be submitted along with submittal data for approval.

   a. Maximum power level (maximum kW).

   b. Maximum motor starting capacity (maximum KVA)

   c. Structural soundness.

d. Torsigraph analysis per MIL-STD 7.50B, method 504.2. A torsional analysis shall be calculated using data from actual tests by the generator set manufacturer to verify freedom from torsional stresses within ± 10% of rated speed. Results shall be made available to engineer for inspection upon request. Actual torsional fatigue test must be performed on the complete prototype generator set. Calculations based on engine and generator data separately are not acceptable.

e. Engine-alternator cooling air flow

f. Transient response and steady-state governing

g. Alternator temperature rise by embedded thermocouplers and by resistance method per NEMA MG 1 -22.40.

h. Harmonic analysis and voltage wave form deviation per MIL-STD705B, method 601.4.

i. Three phase short circuit test for mechanical and electrical strength. With system operating at rated volts, amps, power factor, and speed the generator terminals must be short circuited ten (10) times on all three phases for a duration of thirty seconds. Generator set must build up and perform normally without manual interventions of any kind such as re-setting of circuit breakers or other tripping devices when the short circuit is removed.

j. Failure mode test for voltage regulator. With generator set operating at no load, rated speed and voltage, the AC sensing circuit to the regulator must be disconnected for a period of at least one hour. The generator set must be fully operative after test, and without evidence of any kind of damage.

k. Endurance testing at rated load and speed is required without significant damage or failures of electrical or mechanical components occurring.

P. FACTORY PRODUCTION MODEL TESTS

1. Before shipment of the equipment, the generator set and system, components shall be tested under rated load and power factor for performance and proper functioning of control and interfacing circuits. Testing at unity power factor only (resistance banks only) is not acceptable, since kW output is affected by the higher generator efficiency at unity power factor, and the KVAR for motor starting and regulation is not correctable between unity and rated power factor. Other tests shall include:

a. Single step load per NFPA 76A.

b. Transient response and steady state governing
c. Alternator temperature rise by resistance method
d. Functional compatibility between gen-set controls and transfer switch controls (start, transfer, retransfer, stop, with all time delays)
e. Fuel consumption.

Q. INFORMATION REQUIRED FOR SPECIFIED STANDBY SYSTEMS

1. Certified final factory test report shall be provided to the engineer, certifying this unit's full power rating, stability, voltage and frequency regulation. Complete operating instructions and maintenance manuals with parts list. A factory trained representative shall consult with contractor during installation and start-up. He shall fully instruct Owner's personnel as to correct operating and testing procedures. Furnish 10 sets of catalog cuts and wiring diagrams for Architect/Engineer's approval.

2. Equipment furnished shall be equal in every way to that specification herein, including quality, operation, and function. The equipment spacing, mounts, electrical wiring, ventilation equipment, fuel and exhaust components have all been sized and designed around the equipment. Verify all work with the equipment manufacturer.

R. MAINTENANCE CONTRACT

1. The engine generator supplier shall offer an optional maintenance contract covering one year of operation of the engine generator set. The service contract shall provide for semi-annual inspections and two annual oil and filter changes, labor and materials included.

   The Owner, at his discretion, may exercise the option to purchase this contract up to 90 days after acceptance of the generator set. Cost for this contract shall not be included in the price bid for this project, but, if said option, is requested by the owner, the owner will separately enter into such maintenance contract and pay for it outside of this project.

S. FUEL

1. Provide fuel tank completely full upon Generator acceptance. Provide all fuel for testing. Diesel fuel shall be treated with an alchohol-free additive to disperse water and clean injectors.

2. A copy of the load test report shall be sent to the Engineer and the Owner,

END OF SECTION

SECTION 16912
DUPLEX PUMP STATION CONTROL CENTER

PART 1 GENERAL:

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Locations of pump station control center equipment and extent of work is shown on the drawings.

B. Furnish and install all equipment necessary to provide a complete station control system as specified herein and shown on the drawings.

1.03 REVISE BELOW AS REQUIRED

A. Refer to other Division-16 specifications for requirements related to instrumentation and basic electrical materials and methods.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The control center manufacturer shall have at least five years of successful experience in the manufacturing and operation of such equipment. Pump station control centers shall be a standard product of the manufacturer. Manufacturer with less than the required years of experience shall provide a bond equal to the cost of the equipment pro-rated to the difference in years experience versus years experience required.

B. Certified Factory Test: Upon completion of the control center assembly, a factory test shall be conducted to determine the proper function of the equipment as designed. All functions of the system shall be tested. A certified report shall be prepared by the manufacturer. The Engineer shall be allowed to observe the test.

C. The completed control center shall be UL certified and have affixed the proper label.

D. Initial Start-up and Field Testing: Upon completion of the equipment installation, the manufacturer's factory-trained representative shall visit the project for not more than one 8-hour day to inspect the equipment for proper installation and then to initially start the

equipment, making necessary tests so as to insure the proper operation of the equipment.

1.05 SUBMITTALS

A. Shop Drawings shall be submitted according to the requirements of Division-1 specifications.

B. Operation and Maintenance Manuals shall be submitted according to the requirements of Division-1 specifications.

PART 2 PRODUCTS

2.01 GENERAL

A. The general equipment stipulations shall apply to all equipment furnished under this section.

2.02 LIFT STATION ELECTRICAL AND CONTROLS

A. General Requirements

1. Refer to *Chapter 9 Specification 13446 – Remote Telemetry, Lift Stations* of PWC's *Permit Design Manual* for additional requirements.
2. Refer to *Chapter 9 Division 16 - Electrical* of PWC's *Permit Design Manu*al for additional requirements.
3. Refer to applicable detail drawings contained within PWC's *Permit Design Manual* for additional requirements.
4. The main power feed to all pump stations shall be equipped with an above-grade, fused disconnect switch.
5. Electrical and instrumentation/control systems and components shall be located such that they may be disconnected from outside a wetwell.
6. The pump supplier shall provide the pump control panel and accessory equipment. The Contractor shall install the controls as shown on the Drawings and manufacturer's instructions. The control system shall include all motor starters, alternator, relay, level control switches, control panel, circuit breakers, alarm apparatus, and internal wiring. Controls and pumps shall be covered by same warranty.
7. Enclosures for electrical and control components for the pump station shall be located outside of the wet well and in a location such that they are readily accessible, ensure maximum electrical and personnel safety, and are protected

from damage due to vehicular traffic and flooding.

8. If not housed, electrical enclosures shall have a minimum NEMA 3R rating unless stated otherwise. NEMA 4X enclosures shall be used in locations where the potential for flooding and the development and accumulation of corrosive gases exist. **This Pump Control Panel shall be Nema 4-X stainless steel.**

9. All conduits entering enclosures from below grade shall be sealed to prevent moisture intrusion.

10. All conduits and wire routed from or through a hazardous area shall be sealed or provided with an air gap in accordance with approved hazardous area wiring methods contained within NFPA 70 National Electric Code. Where an air gap is used to prevent hazardous atmosphere from entering conduits, that cable shall be outdoor rated (wet area and UV resistant). Where hazardous area seals are used, the seal shall be located such that it will not be disturbed during routine operation and maintenance functions at the wet well for a Class I, Division 1 location.

11. PWC's lock-out/tag-out procedures shall be considered in the design of all electrical enclosures and disconnects to be installed at the pump station.

B. Functional Requirements

1. The pump control panel shall be provided with an alarm horn, a remote mounted alarm light, and an alarm silence pushbutton. Remote RTU Alarm Silence contacts shall be provided to disable the alarm horn. The pump control panel shall annunciate all alarm and failure conditions.

2. Each pump shall be provided with a HAND-OFF-AUTO switch on the pump control panel. The pumps shall not run in the OFF position and run in HAND position. In AUTO position, the pumps shall operate as follows:

   a. On rising liquid level in the wetwell, a float switch shall start the lead pump. As the liquid level continues to rise, the second float switch shall start the lag pump. The pump(s) will continue to operate until the liquid level recedes to the level of a third float switch which shall stop all pumps. A fourth float switch shall actuate the high level alarm within the pump control panel, should the liquid level rise above the lag pump cut-on elevation. A fifth float switch shall be routed through the pump control panel to the RTU and shall actuate at the same level that the pump control panel's high level alarm float switch actuates.

   b. The pumps shall automatically alternate between the lead and lag starts by means of an alternator relay in the pump control panel.

   c. Remote RTU Control Enable and Start/Stop Command contacts shall be provided for each pump. When enabled, the RTU shall provide remote pump control of each pump and override any automatic control functions excluding safety and equipment protection interlocks.

d. PWC shall be contacted as to which of the following control options shall be provided within the pump control panel.

a) Option 1: On a restoration of power after loss event a timer(s) shall prevent simultaneous starting of pumps.

b) Option 2: A remote Lag Pump Disable contact shall be provided from the automatic transfer switch to the pump control panel to prevent the lag pump from starting/running while on standby generator power.

C. Pump Control Panel

1. A Pump Control Panel for each lift station shall be shipped to the site, completely pre-wired, pre-assembled and ready for service. The control panel enclosure shall be NEMA-4X stainless steel with a continuous hinged and pad-lockable door. The enclosure shall have a back mounting panel and a front inside hinged panel to make the control panel "dead-front" when outside door is open. The panel shall be UL508A and NEC 409 labeled and shall include the following as a minimum:

2. Multi-colored wires (or equivalent marking) shall be provided to facilitate trouble shooting. Refer to Division 16 – Electrical for wire color standards.

3. Motor control shall be provided by a soft start reduced voltage solid state starter (RVSS). Reduced voltage starters shall be capable of starting the motor under all expected load conditions. RVSS starters shall include a bypass contact in case of electronics failure. A combination type starter shall be provided for each pump motor, labeled "PUMP 1", "PUMP 2", etc. The starter for each motor shall be provided with under-voltage release and quick-trip ambient-compensated overload protection for each leg. Starter shall be Cutler-Hammer, Allen-Bradley, Square D, GE, or Siemens. Provide bypass contactors for across the line starting.

4. Phase monitoring capability which shall override and stop the normal operation of the pumps.

5. Automatic pump alternator relay as manufactured by TimeMark or equal.

6. Individual timers (0-999 sec.) for each pump to prevent pumps from starting at the same time on restoration of power after loss of power.

7. A NEMA 3R transformer with a minimum rating of 3 KVA shall be provided mounted to the exterior of the pump control panel for supplying 120/240 VAC single phase loads. The transformer shall be provided with a secondary circuit breakers within the pump control panel. Branch circuit breakers shall be provided within the pump control panel for the follow loads as a minimum:

a) Pump controls

b) GFCI receptacle mounted on equipment rack (20A CB).

c) RTU control panel (15A CB)

d) Generator controls / battery charger

e) Generator heater

f) Spare 20A circuit breaker (800 watt minimum)

8. The following controls shall be mounted on the exterior of the pump control panel:

a) Power Available white indicator light

b) NEMA 4X Alarm horn with adjustable volume. Alarm horn shall be by Edwards, Federal Signal, or equal.

9. The following controls shall be mounted on the front inside panel of the pump control panel:

a) Hand-Off-Auto selector switch for each pump

b) Pump Running red indicator light for each pump

c) Pump Running Hours elapsed time meter for each pump. Meters shall be 6 digits with rear mounted reset.

d) Pump Motor Overload Alarm amber indicator light for each pump

e) Pump Motor High Temp Alarm amber indicator light for each pump

f) Moisture Intrusion Alarm amber indicator light for each pump (submersible pumps only)

g) High Wetwell Level Alarm amber indicator light

h) Loss of Phase Alarm amber indicator light

10. Refer to Specification 13446 Remote Telemetry, Lift Stations for signal interface requirements.

11. All necessary internal wiring separation, relays, intrinsic safety barriers, etc. to provide an intrinsically safe operation for a Class I Division 1 Hazardous Area wetwell shall be provided. All signals provided to the RTU through the pump control panel from a hazardous area shall be provided with barriers eliminating the requirement for intrinsically safe wiring of that signal.

D. Standby Power Source

1. The lift station shall be connected to an automatically activated stand-by power generation source with automatic reset. (See Section 16622)

2. The generation unit shall be capable of powering the pump motors' starting current, electrical systems, instrumentation/controls and alarm systems, and other auxiliary equipment as may be necessary to provide for the safe and effective operation of the pump station.

3. The generation unit shall have the appropriate power rating to start and

continuously operate under all connected loads.

4. The generation unit shall be protected from operating conditions that would result in damage.

5. The generation unit shall be protected from damage when restoration of the power supply occurs.

6. The generating unit shall be located in a building structure or otherwise protected from the weather elements and shall be adequately ventilated.

7. The generation unit shall be provided with on-site fuel storage. In no case shall the fuel storage be less than that needed to operate the generating unit for 24 continuous hours.

8. PWC shall be contacted as to which of the following generator sizing options shall be provided.

   a) Option 1: The generator shall have the capacity to run all pumps with staggered starting.

9. The generation unit and transfer switch shall provide control interface signals to the pump control panel and remote telemetry unit as specified therein.

E. Appurtenances

1. Primary level sensing shall be with an analog pressure level sensing transducer.

The sensor shall be an automatic quadruplex differential ssetpoint controller responding to levels as shown on the plans. The DIN-Rail mounted controller shall provide indication and adjustment of the operating setpoints via a LCD/keypad interface without the need for tools. The controller shall be powered by 24 VDC which shall also supply power for the analog sensor's excitation and for activation of the I/O module's discrete inputs. The module's discrete inputs shall be configurable as sourcing inputs. The Controller shall contain one analog input which shall be used for the level-sensing transducer input. The Controller shall allow the operator to scale the analog inputs to meet the applications requirements. The Controller shall contain four independent relay outputs. The outputs shall be rated for 8 amps DC/ 10 amps AC. The Controller shall be UL/UCL listed and FM approved.

The Controller's displayed process level shall be field adjustable to nominally coincide with the user's specified range tto a maximum of 35 feet. The Controller shall provide four independent differential control states which operate in a Pump-Down (ie. tank emptying) mode. Each of the control stages shall be provided with an On and Off setpoint. Setpoint adjustments shall be made via the

Controllers's LCD/Keypad. The On and Off setpoints shall be adjustable in increments of on-tenth of a foot.

The Controller shall contain Status/Adjustment, Information, Setpoint Alaarm and calibration displays. The Status/Adjustment displays shall show the present wet well level and the respective staage's On or Off setpoint. The information screens shall show the Active/Inactive Inputs and Outputs. The Setpoint Alarm screens shall notify the operator in case of Setpoint Inversion (ie. the On setpoint and Off ssetpoint levels are incorrect. ..the On is below the Off). The calibration displays shall allow the operator/field-technician to adjust the controller's displayed level to nominally coincide with analog sensor's maximum range.

The Controller shall be a Contegra Model CA-400 or approved equal.

2. Backup float switches shall be of the mercury-tube type, encapsulated in polyurethane or vinyl floats. The units shall be waterproof, shockproof, explosion-proof and equipped with sufficient UV resistant submersible cable to extend to the control panel from the wetwell without splicing. Float switches shall be suspended in the wetwell on a suitable rack or rail of stainless steel construction. Float switches shall be unaffected by flows, etc., entering the wetwell. Any required weights shall be provided. Two sets of float switch shall be provided. Each set shall be suspended separately in the wetwell, so that removal of either does not affect the operation of the other set. Both sets of float switches shall have their cables routed to the pump control panel. One set shall be connected to terminals within the panel; the other (backup) set shall be labeled and left coiled in the bottom of the control panel with sufficient cable to reach anywhere within the panel. Each set of float switches shall provide for the following signals as a minimum:

3. All Pump Stop Level
   a. Lead Pump Start Level
   b. Lag Pump Start Level
   c. Lag-Lag Pump Start Level (Triplex Lift Stations Only)
   d. Pump Control Panel High Level Alarm
   e. RTU High Level Alarm

4. An equipment rack shall be provided to mount the electrical panels (e.g. meter base, main service disconnect, pump control panel, remote telemetry panel, etc.). The rack shall include a sun/rain shield and a concrete personnel pad. The pump control panel remote alarm light shall be mounted on the sun/rain shield at a location approved by PWC. The alarm light shall be a NEMA 4X red strobe light as manufactured by Edwards, Federal Signal, or equal. Refer to the detail drawings provided within PWC's *Permit Design Manual* for additional requirements.

5. The lift station site shall be provided with area lighting. The lighting shall meet the requirements of the local power company and should be sited as shown on the drawings.

PART 3 EXECUTION

METHODS

3.01 All controls and wiring shall be furnished and installed in accordance with the NEC and any applicable State and local codes.

3.02 ASSEMBLY

A. All interior components shall be mounted on a panelboard which shall be mounted within the enclosure.

PART 3 EXECUTION

METHODS

3.01 All controls and wiring shall be furnished and installed in accordance with the NEC and any applicable State and local codes.

3.02 ASSEMBLY

A. All interior components shall be mounted on a panelboard which shall be mounted within the enclosure.

B. All control equipment shall be operational and all lights visible on the interior door. Holes cut through the interior door shall be located and cut by the manufacturer of the control center, with care taken to prevent rough edges. The interior door shall be of such strength, thickness, and bracing (as required by enclosure manufacturer) to prevent any

significant sagging or flexing after the holes have been cut and the equipment mounted.

C. The pump station control center shall be fully assembled and tested prior to shipment. Isolation between the high level and low level signals shall be provided in the enclosure if required.

*****END OF SECTION*****

APPENDIX A

PWC
Fayetteville's
HOMETOWN UTILITY

FAYETTEVILLE PUBLIC WORKS COMMISSION
955 OLD WILMINGTON RD
P.O. BOX 1089
FAYETTEVILLE, NORTH CAROLINA 28302-1089
TELEPHONE (910) 483-1401
WWW.FAYPWC.COM

February 6, 2017

Mr. Joseph E. Glass
Public Works Commission
955 Old Wilmington Road
Fayetteville, NC 28301

Re: Engineering Plans and Specifications Approval
Wastewater Collection System Expansion
Legion Road Outfall
Cumberland County
Permit # PWC2017-S005

Dear Mr. Glass:

In accordance with your application, the Public Works Commission of the City of Fayetteville, on behalf of the State of NC Environmental Management Commission, has assigned **Permit# PWC2017-S006,** effective **February 6, 2017** to the addressee for the construction, operation and maintenance of the subject wastewater collection system extension as described in the application for **Legion Road Outfall**

This permit shall be effective for 24 months from the date of issuance, or until revoked and shall be subject to the conditions and limitations as specified below:

1. The enclosed Authorization to Construct shall be posted at the primary entrance of the job site throughout construction.

2. The project shall be constructed in accordance with the approved application, engineering plans, and the Public Works Commission standards, specifications, Local Permitting Ordinance on behalf of the State of NC Environmental Management Commission and other applicable Laws, Rules, and Regulations. Permission is hereby granted to **Public Works Commission** for the construction of **352' of 8" Gravity Main and 10,234' of 12" Gravity Main to discharge 0 GPD** of collected domestic wastewater into the City of Fayetteville existing sewer system, pursuant to the application received and in conformity with 15A NCAC 2H .0200, PWC's Design Manual minimum design criteria as applicable, and any other supporting data subsequently filed and approved by the Public Works Commission.

3. The sewage and wastewater collected by this system shall be treated in the City of Fayetteville Public Works Commission **Rockfish Waste Water Treatment Facility (Permit No. NC0050105),** prior to being discharged into the receiving stream.

4. This permit shall become voidable unless the wastewater collection facilities are constructed in accordance with the conditions of this permit, PWC's Design Manual, applicable State rules and regulations, and other supporting material, unless specifically mentioned herein. **This permit is not transferable.**

5. This permit shall be effective only with respect to the nature and volume of wastes described in the application and other supporting data.

6. An engineer currently registered to practice in this state must verify that construction has been completed in accordance with the approved plans. It is your responsibility to furnish the Public Works Commission with a copy of the Engineer's Certification affixed with his/her seal immediately upon completion of construction. Failure to furnish this verification will delay final approval for the project. The most recent version of the required Certification forms can be found within the PWC Design Manual.

7. **Prior to receiving any water meters for use on the above referenced project, PWC must have received and approved:**
   - ☐ **The Engineer's Certification;**
   - ☐ **As Built Drawings;**
   - ☐ **The PWC project coordinator's final inspection report;**
   - ☐ **The developer's "Statement of Total Project Cost" summary;** (The developer's "Statement of Total Project Cost" summary can be found as an exhibit in the Utility Extension Agreement with PWC.)

If any parts, requirements or limitations contained in this permit are unacceptable, you have 30 days following receipt of this permit to request an adjudicatory hearing. This request must be in the form of a written petition, conforming to the Public Works Commission Ordinance and filed with the Public Works Commission, Water Resources Engineering Department, at 955 Old Wilmington Road, Fayetteville NC 28301. This permit shall be final and binding, unless such petition has been filed.

We are enclosing one (1) set of approved plans for construction. The project must comply with all permit requirements as contained herein, all requirements found in the Public Works Commission Design Manual and all regulations related to the Environmental Management Commission.

If you have any questions regarding this matter, please contact Mr. John Allen at (910) 223-4734.

Sincerely,
PUBLIC WORKS COMMISSION

Joseph E. Glass, P.E.
Water Resources Engineer/Manager

Enclosures
DS-14918
cc: **Jeffrey B Reitzel., PE -Moorman Kizer & Reitzel**
Project File

DWR

Division of Water Resources

State of North Carolina
Department of Environmental Quality
Division of Water Resources

Flow Tracking/Acceptance for Sewer Extension Applications
(FTSE 04-16)

Entity Requesting Allocation: Public Works Commission

Project Name for which flow is being requested: Legion Hills Outfall and New Pinewood Drive Lift Station

More than one FTSE may be required for a single project if the owner of the WWTP is not responsible for all pump stations along the route of the proposed wastewater flow.

I. Complete this section only if you are the owner of the wastewater treatment plant.

a. WWTP Facility Name: Rockfish Wastewater Treatment Facility
b. WWTP Facility Permit #: NPDES NC0050105

	All flows are in MGD
c. WWTP facility's permitted flow	21.0
d. Estimated obligated flow not yet tributary to the WWTP	2.7476
e. WWTP facility's actual avg. flow	14.9
f. Total flow for this specific request	0
g. Total actual and obligated flows to the facility	17.6476
h. Percent of permitted flow used	84.04

II. Complete this section for each pump station you are responsible for along the route of this proposed wastewater flow.

List pump stations located between the project connection point and the WWTP:

Pump Station (Name or Number)	Firm Capacity, * MGD	(A) Design Average Daily Flow** (Firm / pf), MGD	(B) Approx. Current Avg. Daily Flow, MGD	(C) Obligated, Not Yet Tributary Daily Flow, MGD	(D)=(B+C) Total Current Flow Plus Obligated Flow	(E)=(A-D) Available Capacity***

*** The Firm Capacity of any pump station is defined as the maximum pumped flow that can be achieved with the largest pump taken out of service.**

**** Design Average Daily Flow is the firm capacity of the pump station divided by a peaking factor (pf) not less than 2.5.**

***** A Planning Assessment Addendum shall be attached for each pump station located between the project connection point and the WWTP where the Available Capacity is ≤ 0.**

Downstream Facility Name (Sewer): PWC/Fayetteville Collection System

Downstream Permit Number: WQCS00007

III. Certification Statement:

I Joseph E. Glass, P.E. certify to the best of my knowledge that the addition of the volume of wastewater to be permitted in this project has been evaluated along the route to the receiving wastewater treatment facility and that the flow from this project is not anticipated to cause any capacity related sanitary sewer overflows or overburden any downstream pump station en route to the receiving treatment plant under normal circumstances, given the implementation of the planned improvements identified in the planning assessment where applicable. This analysis has been performed in accordance with local established policies and procedures using the best available data. This certification applies to those items listed above in Sections I and II plus all attached planning assessment addendums for which I am the responsible party. Signature of this form indicates acceptance of this wastewater flow.

Joseph E. Glass 2-3-17

Signing Official Signature *Date*

APPENDIX B

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2015-00893** County: **Cumberland** U.S.G.S. Quad: **NC-HOPE MILLS**

GENERAL PERMIT (REGIONAL AND NATIONWIDE) VERIFICATION

Permittee: **City of Fayetteville, Public Works Commission**
C/o Mr. Joseph Glass
Address: **965 Old Wilmington Road**
Fayetteville, North Carolina 28301
Telephone Number: **910.483.1382**

Size (acres) **5**
Nearest Waterway **Little Rockfish Creek**
USGS HUC **3030004**
Nearest Town **Fayetteville**
River Basin **Upper Cape Fear. North Carolina.**
Coordinates Latitude: **34.9909**
Longitude: **-78.9274**

Location description: **The project begins to the west of Catalpa Circle off Beechwood Street and going northwest around the Pinewood Lakers neighborhood, crossing Highway 162 and continuing northeast and terminating on the backside of Baldwin School Park and Town Street, just northwest of Ireland Drive. The above coordinates are for Impact #1.**

Description of projects area and activity: **The project will eliminate two Public Works sewage lift stations, as well as one private station, and provide a gravity sewer outfall to the sewershed tributary to the project area. The overall project consists of the construction of a 12' gravity sewer outfall and Pinewood lift station. Specifically, there are ten proposed impact sites with temporary impacts to wetlands totaling 1.7 acres, which includes permanent conversion impacts for the maintenance corridor totaling 0.49 acres and, also, temporary impacts to 86 linear feet of UT to Little Rockfish Creek. Mitigation for conversion impacts will occur at a 1:1 ratio, in-kind, with NCDMS for riparian impacts of 0.49 acres within the 03030004 HUC.**

Applicable Law: ☒ Section 404 (Clean Water Act, 33 USC 1344)
☐ Section 10 (Rivers and Harbors Act, 33 USC 403)

Authorization: Regional General Permit Number or Nationwide Permit Number: **NWP 12**
SEE ATTACHED RGP or NWP GENERAL, REGIONAL AND SPECIAL CONDITIONS

Your work is authorized by the above referenced permit provided it is accomplished in strict accordance with the attached conditions and your submitted application and attached information dated 05 March 2015. Any violation of the attached conditions or deviation from your submitted plans may subject the permittee to a stop work order, a restoration order, a Class I administrative penalty, and/or appropriate legal action.

This verification will remain valid until the expiration date identified below unless the nationwide authorization is modified, suspended or revoked. If, prior to the expiration date identified below, the nationwide permit authorization is reissued and/or modified, this verification will remain valid until the expiration date identified below, provided it complies with all requirements of the modified nationwide permit. If the nationwide permit authorization expires or is suspended, revoked, or is modified, such that the activity would no longer comply with the terms and conditions of the nationwide permit, activities which have commenced (i.e., are under construction) or are under contract to commence in reliance upon the nationwide permit, will remain authorized provided the activity is completed within twelve months of the date of the nationwide permit's expiration, modification or revocation, unless discretionary authority has been exercised on a case-by-case basis to modify, suspend or revoke the authorization.

Activities subject to Section 404 (as indicated above) may also require an individual Section 401 Water Quality Certification. You should contact the NC Division of Water Resources (telephone 919-807-6300) to determine Section 401 requirements.

For activities occurring within the twenty coastal counties subject to regulation under the Coastal Area Management Act (CAMA), prior to beginning work you must contact the N.C. Division of Coastal Management in Wilmington, NC, at (910) 796-7215.

This Department of the Army verification does not relieve the permittee of the responsibility to obtain any other required Federal, State or local approvals/permits.

If there are any questions regarding this verification, any of the conditions of the Permit, or the Corps of Engineers regulatory program, please contact **Emily Greer at 910-251-4567 or Emily.C.Greer@usace.army.mil**.

SAW-2015-00893

Corps Regulatory Official: GREER.EMILY.C.1385325300 Digitally signed by GREER.EMILY.C.1385325300 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=GREER.EMILY.C.1385325300 Date: 2015.05.15 17:54:06 -04'00' Date: **1 May 2015**

Expiration Date of Verification: **18 March 2017**

Determination of Jurisdiction:

A. ☒ Based on preliminary information, there appear to be waters of the US including wetlands within the above described project area. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331).

B. ☐ There are Navigable Waters of the United States within the above described project area subject to the permit requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

C. ☐ There are waters of the US and/or wetlands within the above described project area subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

D. ☐ The jurisdictional areas within the above described project area have been identified under a previous action. Please reference jurisdictional determination issued . Action ID: **SAW-** .

Basis For Determination: Onsite waterbodies exhibit an Ordinary High Water Mark as indicated by changes in soil character and absence of terrestrial vegetation and is hydrologically connected to the Cape Fear River. This site also exhibits areas that meet the wetland criteria as described in the 1987 Corps Wetland Delineation Manual and the Atlantic and Gulf Coastal Plain Regional Supplement to the 1987 Wetland Delineation Manual. The site is adjacent to the Cape Fear River, just beyond the end of its Section 10 designation, placing the site under Section 404 jurisdiction.

Remarks: See Special Conditions. Desktop PJD conducted.

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B and C above).

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801
Phone: (404) 562-5137

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **NA**.
It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

SAW-2015-00893

Corps Regulatory Official: GREER.EMILY.C.1385325300 Digitally signed by GREER.EMILY.C.1385325300 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=GREER.EMILY.C.1385325300 Date: 2015.05.15 17:55:58 -04'00'

Emily Greer

Date of JD: **1 May 2015**
Expiration Date of JD: **NA**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at http://regulatory.usacesurvey.com/.

SAW-2015-00893

Copy furnished:

Agent: Deborah Shirley

Soil and Environmental Consultants, PA

Electronically furnished

SPECIAL CONDITIONS

COMPENSATORY MITIGATION: Mitigation will occur at a 1:1 ratio for conversion of 0.50 acres of bottomland hardwood wetlands to emergent wetlands within the maintenance corridor. Riparian credits will be secured with NC Division of Mitigation Services within the 03030004 HUC. Reference Mitigation Reservation Letter dated 05 March 2015, attached.

CONSTRUCTION PLANS: All work authorized by this permit must be performed in strict compliance with the attached plans, which are a part of this permit. Any modification to these plans must be approved by the US Army Corps of Engineers (USACE) prior to implementation.

MAINTAIN CIRCULATION AND FLOW OF WATERS: Except as specified in the plans attached to this permit, no excavation, fill or mechanized land-clearing activities shall take place at any time in the construction or maintenance of this project, in such a manner as to impair normal flows and circulation patterns within waters or wetlands or to reduce the reach of waters or wetlands.

WATER CONTAMINATION: All mechanized equipment will be regularly inspected and maintained to prevent contamination of waters and wetlands from fuels, lubricants, hydraulic fluids, or other toxic materials. In the event of a spill of petroleum products or any other hazardous waste, the permittee shall immediately report it to the N.C. Division of Water Quality at (919) 733-3300 or (800) 858-0368 and provisions of the North Carolina Oil Pollution and Hazardous Substances Control Act will be followed.

NOTIFICATION OF CONSTRUCTION COMMENCEMENT AND COMPLETION: The permittee shall advise the Corps in writing prior to beginning the work authorized by this permit and again upon completion of the work authorized by this permit.

SILT-FENCING: The permittee shall employ all sedimentation and erosion control measures necessary to prevent an increase in sedimentation or turbidity within waters and wetlands outside the permit area. This shall include, but is not limited to, the immediate installation of silt fencing or similar appropriate devices around all areas subject to soil disturbance or the movement of earthen fill, and the immediate stabilization of all disturbed areas. Additionally, the project must remain in full compliance with all aspects of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statutes Chapter 113A Article 4).

TEMPORARY IMPACTS RESTORATION MEASURES: Temporary discharge of excavated or fill material into wetlands and waters of the United States will be for the absolute minimum period of time necessary to accomplish the work. All authorized temporary wetland, stream, and tributary impacts will be returned to pre-disturbance grade and contour, and re-vegetated. In wetland areas where pipeline installation via trenching is authorized, wetland topsoil will be segregated from the underlying subsoil, and the top 6 to 12 inches of the trench will be backfilled with topsoil from the trench.

Prior to construction within any jurisdictional areas, the permittee must correctly install silt fencing (with or without safety fencing) parallel with the utility line corridor, on both sides of the jurisdictional crossing. This barrier is to serve both as an erosion control measure and a visual identifier of the limits of construction within any jurisdictional area. The permittee must maintain the fencing, at minimum, until the wetlands have re-vegetated and stabilized.

Action ID Number: SAW-2015-00893 **County:** Cumberland

Permittee: City of Fayetteville Public Works Commission
c/o Mr. Joseph Glass

Project Name: Legion Hills Outfall and Pinewood Lift Station / Fayetteville PWC / NWP

Date Verification Issued: 1 May 2015

Project Manager: Emily Greer

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

US ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT
Attn: Emily Greer

Please note that your permitted activity is subject to a compliance inspection by a U. S. Army Corps of Engineers representative. Failure to comply with any terms or conditions of this authorization may result in the Corps suspending, modifying or revoking the authorization and/or issuing a Class I administrative penalty, or initiating other appropriate legal action.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and condition of the said permit, and required mitigation was completed in accordance with the permit conditions.

_____ _____

Signature of Permittee **Date**

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **City of Fayetteville, Public Works Commission, c/o Joseph Glass**	File Number: **SAW-2015-00893**	Date: **1 May 2015**

Attached is:	See Section below
☐ INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
☐ PROFFERED PERMIT (Standard Permit or Letter of permission)	B
☐ PERMIT DENIAL	C
☐ APPROVED JURISDICTIONAL DETERMINATION	D
☒ PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact:
District Engineer, Wilmington Regulatory Division, Attn: Emily Greer **69 Darlington Avenue** **Wilmington, NC 28403** **910.251.4567**	Mr. Jason Steele, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

	Date:	Telephone number:
_____ Signature of appellant or agent.		

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, Attn: Emily Greer, 69 Darlington Avenue, Wilmington, North Carolina 28403

For Permit denials, Proffered Permits and approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801
Phone: (404) 562-5137

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): May 1, 2015

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD: City of Fayetteville, Public Works Commission c/o Joseph Glass, 965 Old Wilmington Road, Fayetteville, NC 28301

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington, Legion Hills Outfall and Pinewood Lift Station / Fayettville PWC / NWP, SAW-2015-00893

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: NC County/parish/borough: Cumberland City: Fayetteville
Center coordinates of site (lat/long in degree decimal format): Lat. 34.9909° **Pick List**, Long. -78.9274° **Pick List**.
Universal Transverse Mercator:
Name of nearest water body: Little Rockfish Creek

Identify (estimate) amount of waters in the review area:
Non-wetland waters: 86 linear feet: 4 width (ft) and/or acres.
Cowardin Class: Riverine
Stream Flow: Perennial
Wetlands: 0.49 acres.
Cowardin Class: Palustrine, forested

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal:
Non-Tidal:

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLIES):
☒ Office (Desk) Determination. Date: 23 April 2015
☐ Field Determination. Date(s):

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: Maps, plans.
- ☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☒ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24k Fayetteville, NC.
- ☒ USDA Natural Resources Conservation Service Soil Survey. Citation: Cumberland County Soil Survey.
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)
- ☒ Photographs: ☒ Aerial (Name & Date): Google Earth 2014.
  or ☐ Other (Name & Date): .
- ☐ Previous determination(s). File no. and date of response letter: .
- ☐ Other information (please specify): .

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

GREER.EMILY.C.1385325300 Digitally signed by GREER.EMILY.C.1385325300 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=GREER.EMILY.C.1385325300 Date: 2015.05.15 17:58:10 -04'00'

Signature and date of
Regulatory Project Manager
(REQUIRED)

Signature and date of
person requesting preliminary JD
(REQUIRED, unless obtaining
the signature is impracticable)

NCDENR

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Ecosystem Enhancement Program

Donald R. van der Vaart
Secretary

March 5, 2015

Joseph Glass
Fayetteville Public Works Commission
965 Old Wilmington Road
Fayetteville, NC 28301

Expiration of Acceptance: September 5, 2015

Project: Legion Hills Outfall and New Pinewood Lift Station

County: Cumberland

The purpose of this letter is to notify you that the North Carolina Ecosystem Enhancement Program (NCEEP) is willing to accept payment for compensatory mitigation for impacts associated with the above referenced project as indicated in the table below. Please note that this decision does not assure that participation in the NCEEP will be approved by the permit issuing agencies as mitigation for project impacts. It is the responsibility of the applicant to contact these agencies to determine if payment to the NCEEP will be approved. You must also comply with all other state, federal or local government permits, regulations or authorizations associated with the proposed activity including SL 2009-337: An Act to Promote the Use of Compensatory Mitigation Banks as amended by S.L. 2011-343.

This acceptance is valid for six months from the date of this letter and is not transferable. **If we have not received a copy of the issued 404 Permit/401 Certification/CAMA permit within this time frame, this acceptance will expire.** It is the applicant's responsibility to send copies of the permits to NCEEP. Once NCEEP receives a copy of the permit(s) an invoice will be issued based on the required mitigation in that permit and payment must be made prior to conducting the authorized work. The amount of the In-Lieu Fee to be paid to NCEEP by an applicant is calculated based upon the Fee Schedule and policies listed at www.nceep.net.

Based on the information supplied by you in your request to use the NCEEP, the impacts that may require compensatory mitigation are summarized in the following table. The amount of mitigation required and assigned to NCEEP for this impact is determined by permitting agencies and may exceed the impact amounts shown below.

	River Basin	CU Location	Stream (feet)			Wetlands (acres)			Buffer I (Sq. Ft.)	Buffer II (Sq. Ft.)
			Cold	Cool	Warm	Riparian	Non-Riparian	Coastal Marsh		
Impact	Cape Fear	03030004	0	0	0	0.50	0	0	0	0

Upon receipt of payment, EEP will take responsibility for providing the compensatory mitigation. The mitigation will be performed in accordance with the N.C. Department of Environment and Natural Resources' Ecosystem Enhancement Program In-Lieu Fee Instrument dated July 28, 2010.

Thank you for your interest in the NCEEP. If you have any questions or need additional information, please contact Kelly Williams at (919) 707-8915.

Sincerely,

James B Stanfill

James B Stanfill
Asset Management Supervisor

cc: Emily Greer, USACE-Wilmington
Deborah Shirley, agent

U.S. ARMY CORPS OF ENGINEERS
Wilmington District
Compensatory Mitigation Responsibility Transfer Form

Permittee: City of Fayetteville, Public Works Commission **Action ID:** SAW-2015-00893
Project Name: Legion Hills Outfall and Pinewood Lift Station **County:** Cumberland

Instructions to Permittee: The Permittee must provide a copy of this form to the Mitigation Sponsor, either an approved Mitigation Bank or the North Carolina Ecosystem Enhancement Program (NCEEP), who will then sign the form to verify the transfer of the mitigation responsibility. Once the Sponsor has signed this form, it is the Permittee's responsibility to ensure that to the U.S. Army Corps of Engineers (USACE) Project Manager identified on page two is in receipt of a signed copy of this form before conducting authorized impacts, unless otherwise specified below. If more than one mitigation Sponsor will be used to provide the mitigation associated with the permit, or if the impacts and/or the mitigation will occur in more than one 8-digit Hydrologic Unit Code (HUC), multiple forms will be attached to the permit, and the separate forms for each Sponsor and/or HUC must be provided to the appropriate mitigation Sponsors.

Instructions to Sponsor: The Sponsor must verify that the mitigation requirements (credits) shown below are available at the identified site. By signing below, the Sponsor is accepting full responsibility for the identified mitigation, regardless of whether or not they have received payment from the Permittee. Once the form is signed, the Sponsor must update the bank ledger and provide a copy of the signed form and the updated bank ledger to the Permittee, the USACE Project Manager, and the Wilmington District Mitigation Office (see contact information on page 2). The Sponsor must also comply with all reporting requirements established in their authorizing instrument.

Permitted Impacts and Compensatory Mitigation Requirements:

Permitted Impacts Requiring Mitigation* **8-digit HUC and Basin:** 03030004, Cape Fear River Basin

Stream Impacts (linear feet)			Wetland Impacts (acres)			
Warm	Cool	Cold	Riparian Riverine	Riparian Non-Riverine	Non-Riparian	Coastal
				0.5		

*If more than one mitigation sponsor will be used for the permit, only include impacts to be mitigated by this sponsor.

Compensatory Mitigation Requirements: **8-digit HUC and Basin:** 03030004, Cape Fear River Basin

Stream Mitigation (credits)			Wetland Mitigation (credits)			
Warm	Cool	Cold	Riparian Riverine	Riparian Non-Riverine	Non-Riparian	Coastal
				0.5		

Mitigation Site Debited: The Great Dismal Swamp Restoration Bank- Timberlake Farm Site
(List the name of the bank to be debited. For umbrella banks, also list the specific site. For NCEEP, list NCEEP. If the NCEEP acceptance letter identifies a specific site, also list the specific site to be debited).

Section to be completed by the Mitigation Sponsor

Statement of Mitigation Liability Acceptance: I, the undersigned, verify that I am authorized to approve mitigation transactions for the Mitigation Sponsor shown below, and I certify that the Sponsor agrees to accept full responsibility for providing the mitigation identified in this document (see the table above), associated with the USACE Permittee and Action ID number shown. I also verify that released credits (and/or advance credits for NCEEP), as approved by the USACE, are currently available at the mitigation site identified above. Further, I understand that if the Sponsor fails to provide the required compensatory mitigation, the USACE Wilmington District Engineer may pursue measures against the Sponsor to ensure compliance associated with the mitigation requirements.

Mitigation Sponsor Name:_____

Name of Sponsor's Authorized Representative:_____

_____ _____
Signature of Sponsor's Authorized Representative **Date of Signature**

USACE Wilmington District
Compensatory Mitigation Responsibility Transfer Form, Page 2

Conditions for Transfer of Compensatory Mitigation Credit:

- Once this document has been signed by the Mitigation Sponsor and the USACE is in receipt of the signed form, the Permittee is no longer responsible for providing the mitigation identified in this form, though the Permittee remains responsible for any other mitigation requirements stated in the permit conditions.
- Construction within jurisdictional areas authorized by the permit identified on page one of this form can begin only after the USACE is in receipt of a copy of this document signed by the Sponsor, confirming that the Sponsor has accepted responsibility for providing the mitigation requirements listed herein. For authorized impacts conducted by the North Carolina Department of Transportation (NCDOT), construction within jurisdictional areas may proceed upon permit issuance; however, a copy of this form signed by the Sponsor must be provided to the USACE within 30 days of permit issuance. NCDOT remains fully responsible for the mitigation until the USACE has received this form, confirming that the Sponsor has accepted responsibility for providing the mitigation requirements listed herein.
- Signed copies of this document must be retained by the Permittee, Mitigation Sponsor, and in the USACE administrative records for both the permit and the Bank/ILF Instrument. It is the Permittee's responsibility to ensure that the USACE Project Manager (address below) is provided with a signed copy of this form.
- If changes are proposed to the type, amount, or location of mitigation after this form has been signed and returned to the USACE, the Sponsor must obtain case-by-case approval from the USACE Project Manager and/or North Carolina Interagency Review Team (NCIRT). If approved, higher mitigation ratios may be applied, as per current District guidance and a new version of this form must be completed and included in the USACE administrative records for both the permit and the Bank/ILF Instrument.

Comments/Additional Conditions: NA

This form is not valid unless signed below by the USACE Project Manager and by the Mitigation Sponsor on Page 1. ***Once signed, the Sponsor should provide copies of this form along with an updated bank ledger to: 1) the Permittee, 2) the USACE Project Manager at the address below, and 3) the Wilmington District Mitigation Office, Attn: Todd Tugwell, 11405 Falls of Neuse Road, Wake Forest, NC 27587 (email: todd.tugwell@usace.army.mil).*** Questions regarding this form or any of the permit conditions may be directed to the USACE Project Manager below.

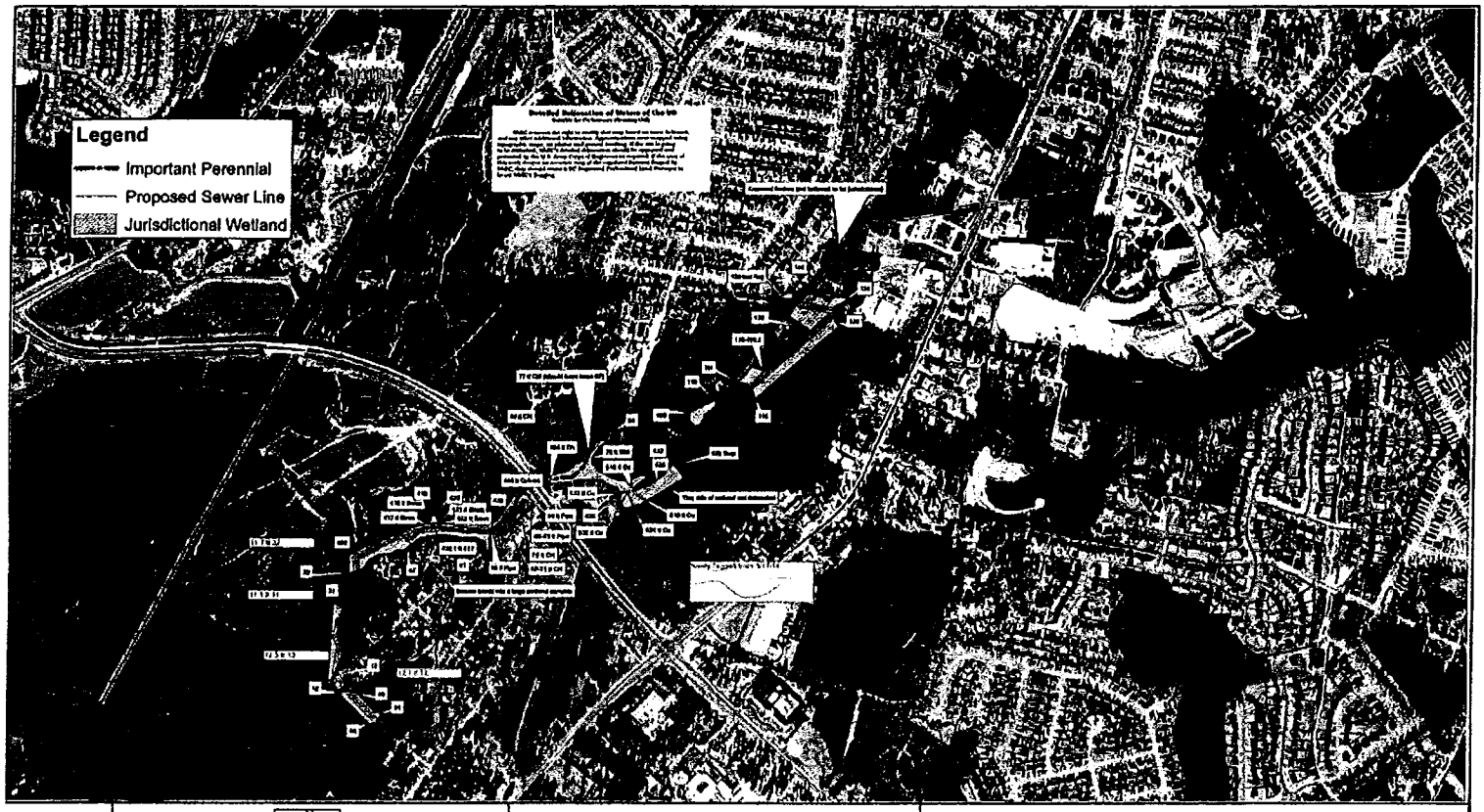
USACE Project Manager: Emily Greer
USACE Field Office: Wilmington Regulatory Field Office
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403
Email: **emily.c.greer@usace.army.mil**

GREER.EMILY.C.1385325300 Digitally signed by GREER.EMILY.C.1385325300
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=GREER.EMILY.C.1385325300
Date: 2015.05.15 18:01:56 -04'00'

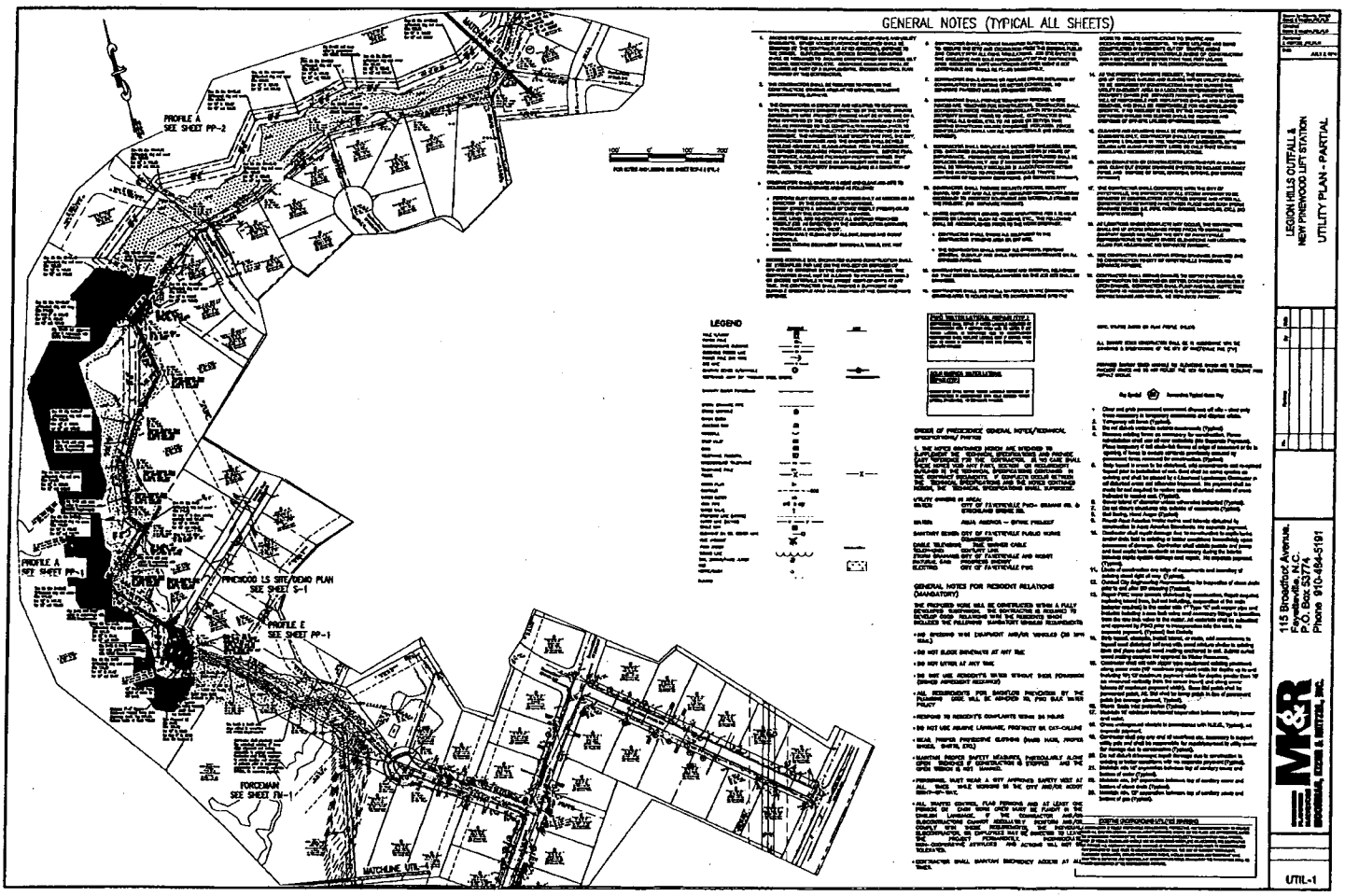
USACE Project Manager Signature

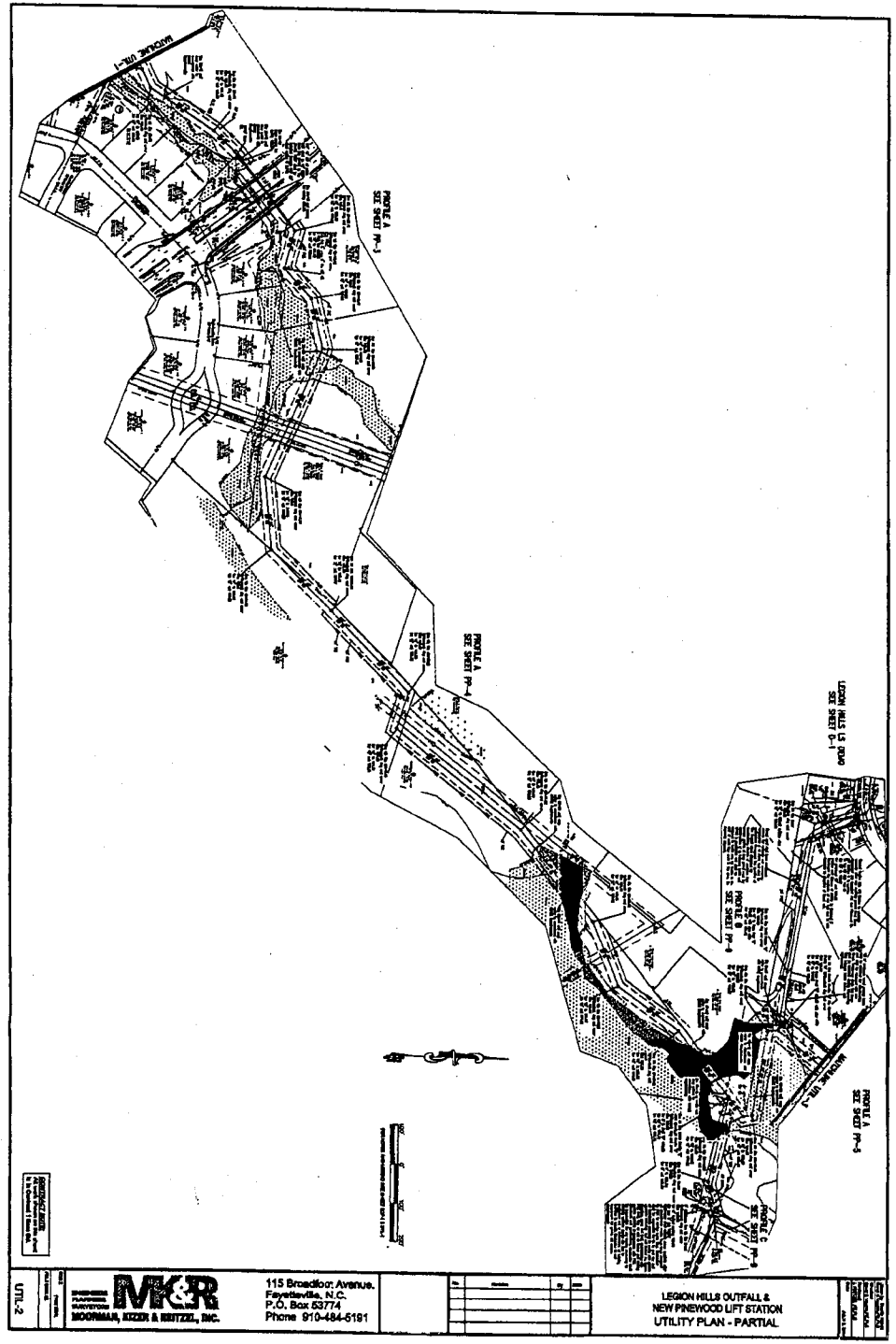
May 1, 2015
Date of Signature

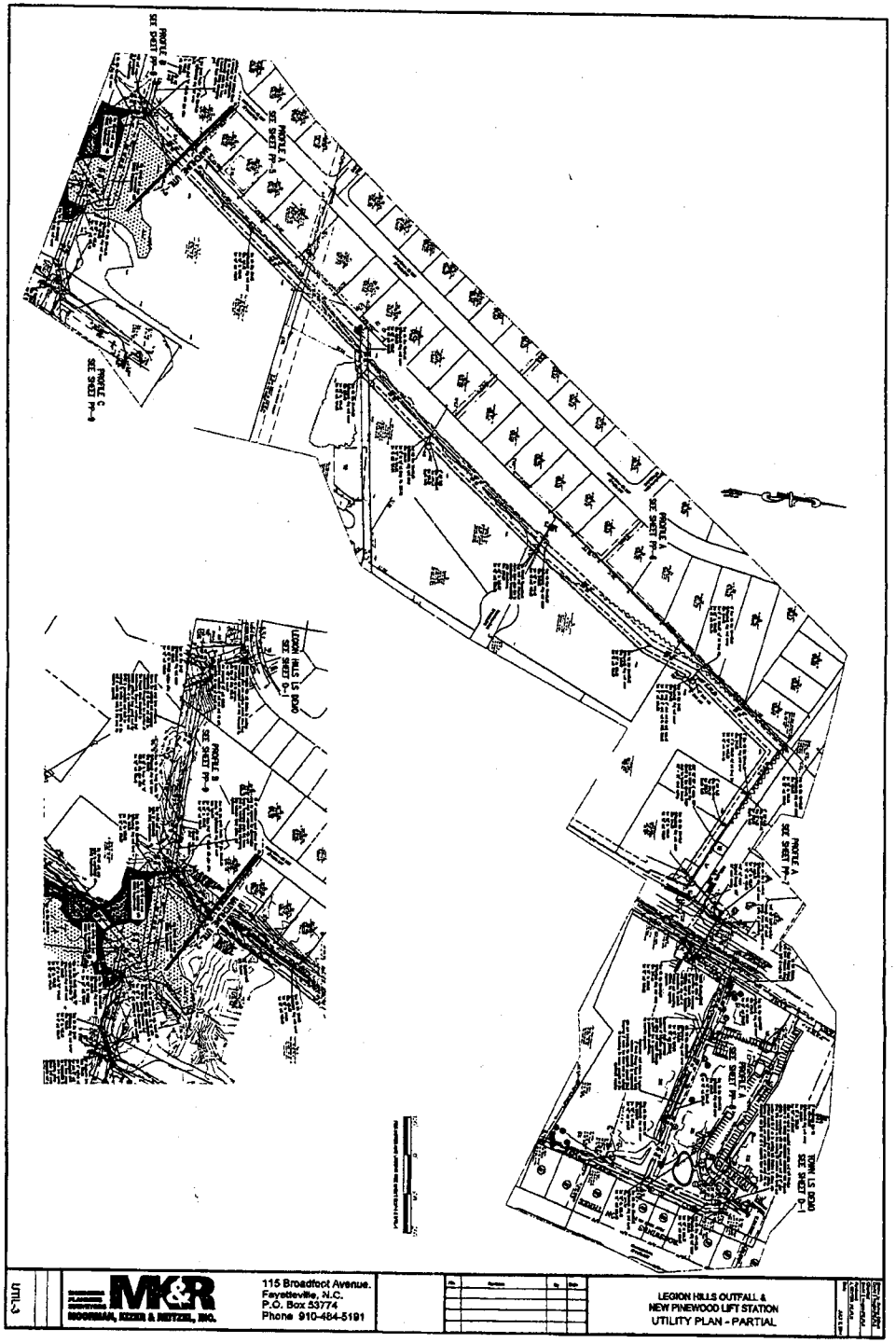
Current Wilmington District mitigation guidance, including information on mitigation ratios, functional assessments, and mitigation bank location and availability, and credit classifications (including stream temperature and wetland groupings) is available at http://ribits.usace.army.mil.



Project No. 12283.WI	N W E S 0 350 700 1,050 1,400 Feet	Field Sketch Map Legion Rd. Sewer Line Site Cumberland Co., NC	S&EC Soil & Environmental Consultants, PA
Project Mgr.: SB			
Scale: 1" = 350'			
3/17/14			


GENERAL NOTES (TYPICAL ALL SHEETS)
LEGEND
PROFILE A
SEE SHEET PP-2
PROFILE A
SEE SHEET PP-1
PINEWOOD LS SITE/ROAD PLAN
SEE SHEET S-1
PROFILE E
SEE SHEET PP-1
FORCEMAIN
SEE SHEET FM-1
WATERLINE UTIL-1
LEGION HILLS OUTFALL A
NEW PINEWOOD LIFT STATION
UTILITY PLAN - PARTIAL
115 Broadfoot Avenue
P.O. Box 53717
Phone 910-484-5161
UTIL-1


MOORMAN, KIZZER & REITZEL, INC.
115 Broadfoot Avenue.
Fayetteville, N.C.
P.O. Box 53774
Phone 910-484-5191
LEGION HILLS OUTFALL &
NEW PINEWOOD LIFT STATION
UTILITY PLAN - PARTIAL
UTIL-2

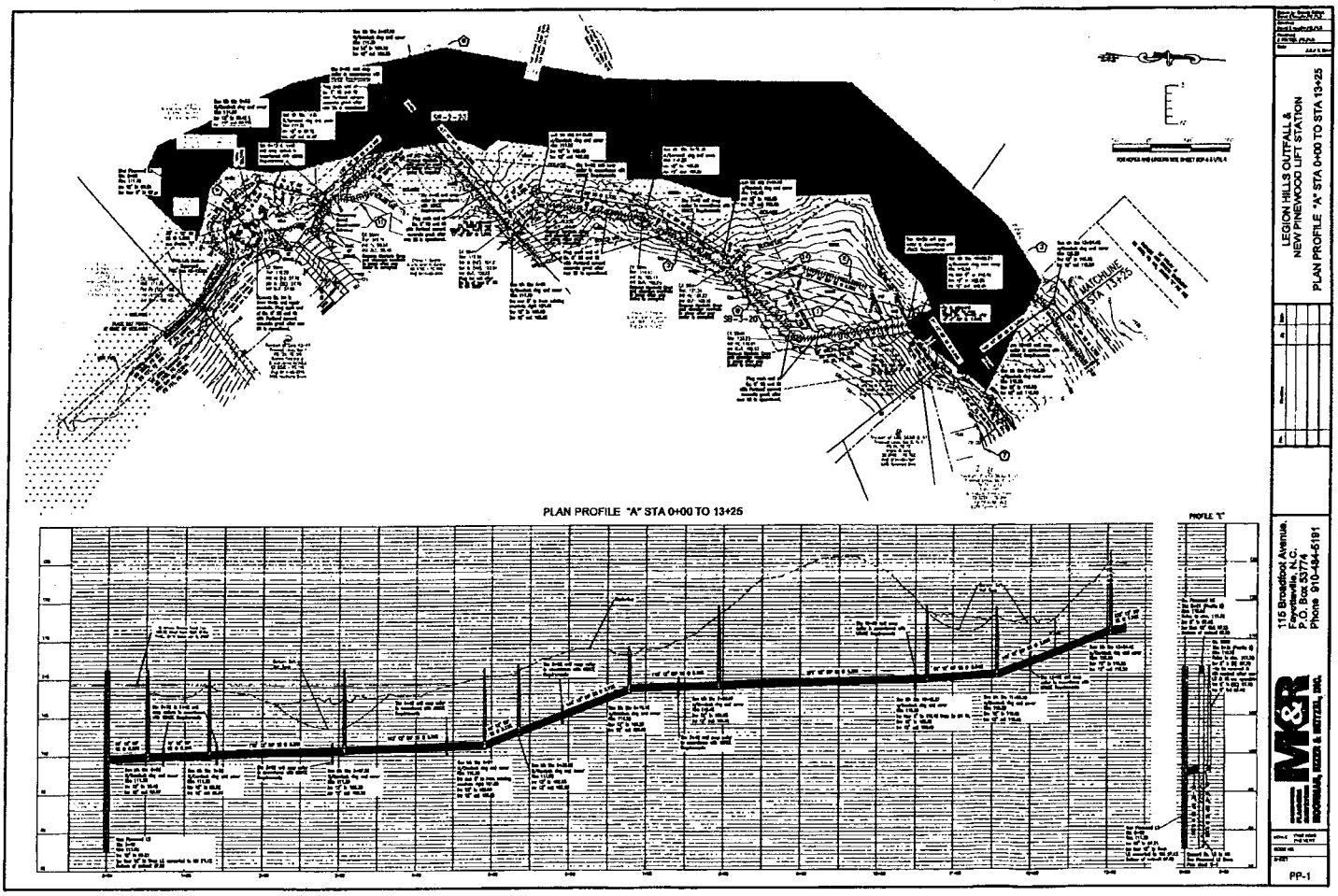


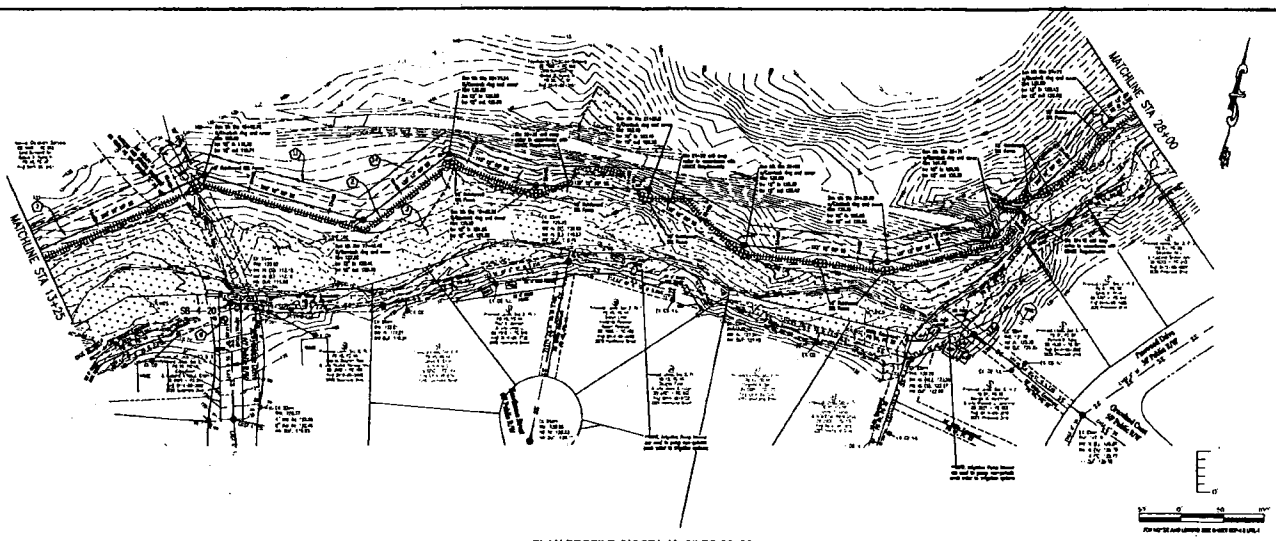
UTIL-3

M&R
MOORMAN, KIZER & REITZEL, INC.

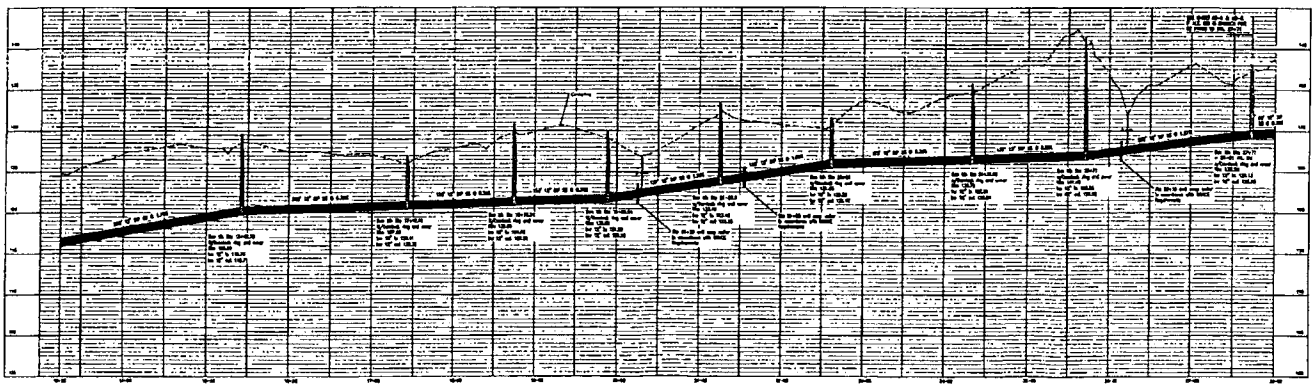
115 Broadfoot Avenue.
Fayetteville, N.C.
P.O. Box 53774
Phone 910-484-5191

LEGION HILLS OUTFALL &
NEW PINEWOOD LIFT STATION
UTILITY PLAN - PARTIAL


PLAN PROFILE "A" STA 0+00 TO 13+25
PROFILE "C"
LEGION HILLS OUTFALL &
NEW PINEWOOD LIFT STATION
PLAN PROFILE "A" STA 0+00 TO STA 13+25
115 Broadfoot Avenue,
Fayetteville, N.C.
P.O. Box 53774
Phone 910-484-5191
M&R
MOORMAN, KIZER & REITZEL, INC.
PP-1



PLAN PROFILE "A" STA 13+25 TO 28+00

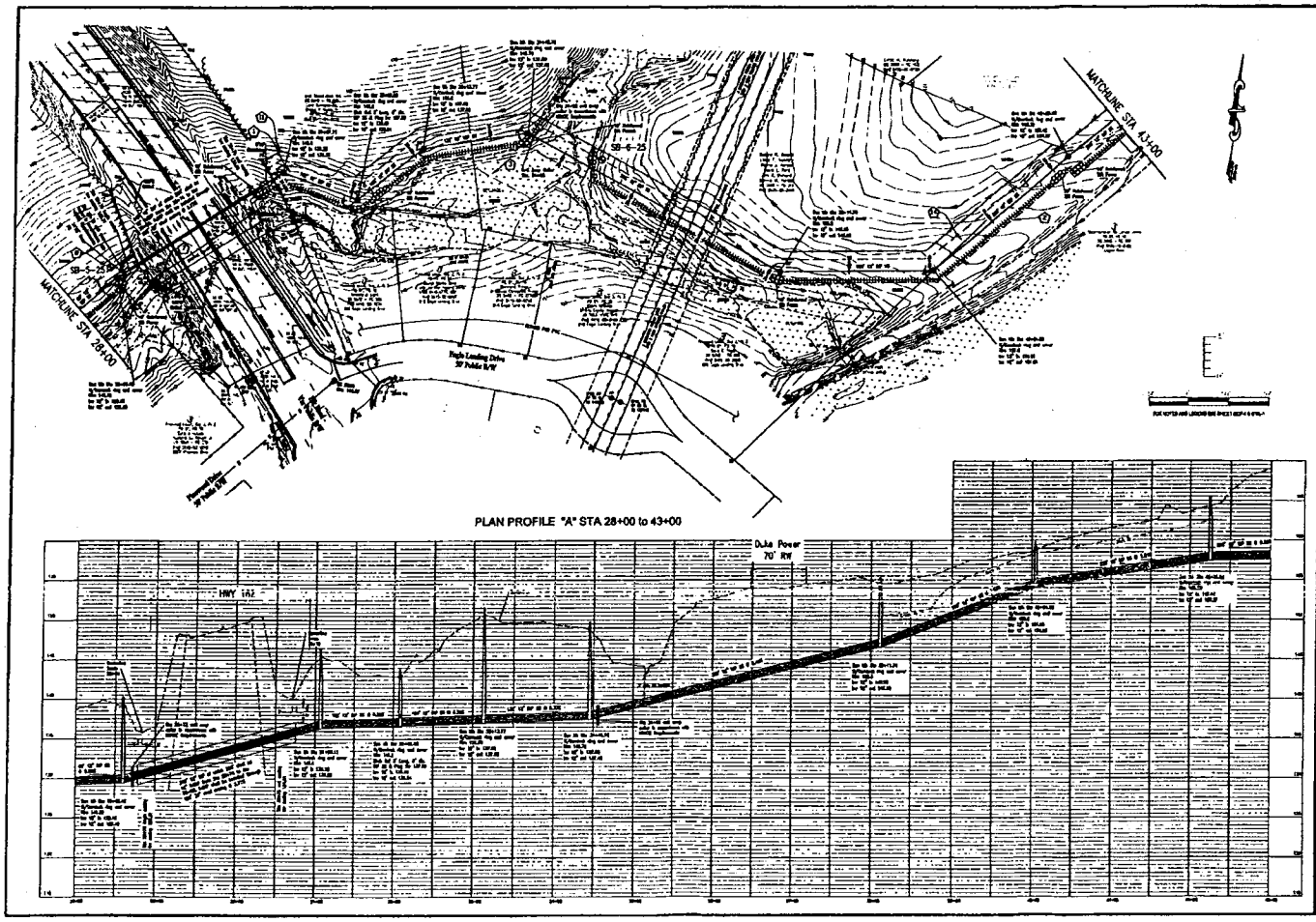


LEGION HILLS OUTFALL &
NEW PINEWOOD LIFT STATION
PLAN PROFILE "A" STA 13+25 TO 28+00

115 Broadfoot Avenue,
Fayetteville, N.C.
P.O. Box 53774
Phone 910-484-5191

M&R
MOORMAN, KIZER & REITZEL, INC.

PP-2



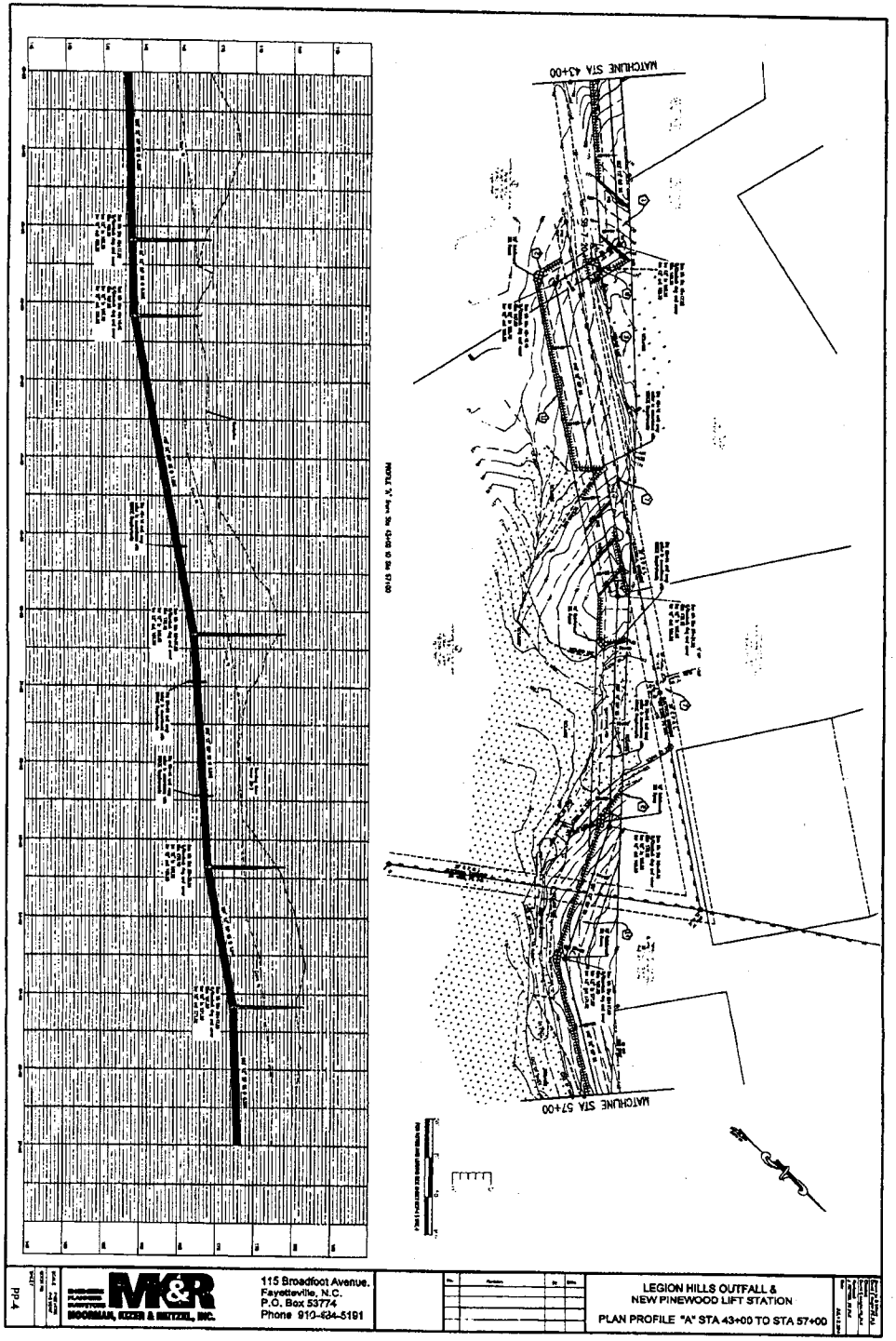
PLAN PROFILE "A" STA 28+00 to 43+00

LEGION HILLS OUTFALL &
NEW PINEWOOD LIFT STATION
PLAN PROFILE "A" STA 28+00 to 43+00

115 Broadfoot Avenue
Fayetteville N.C.
P.O. Box 55774
Phone 910-484-5191

MOORMAN, KIZER & REITZEL, INC.

PP-3

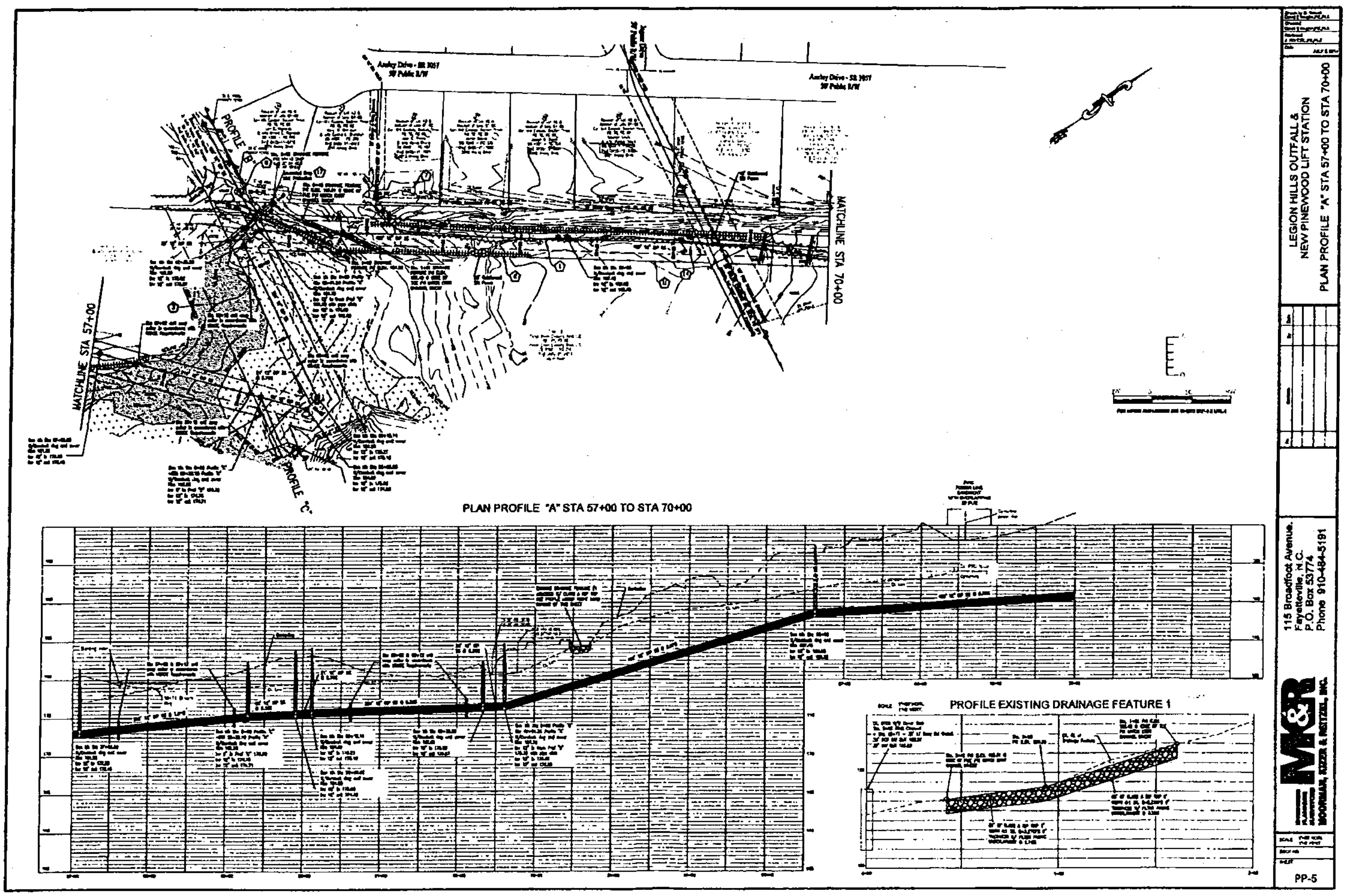


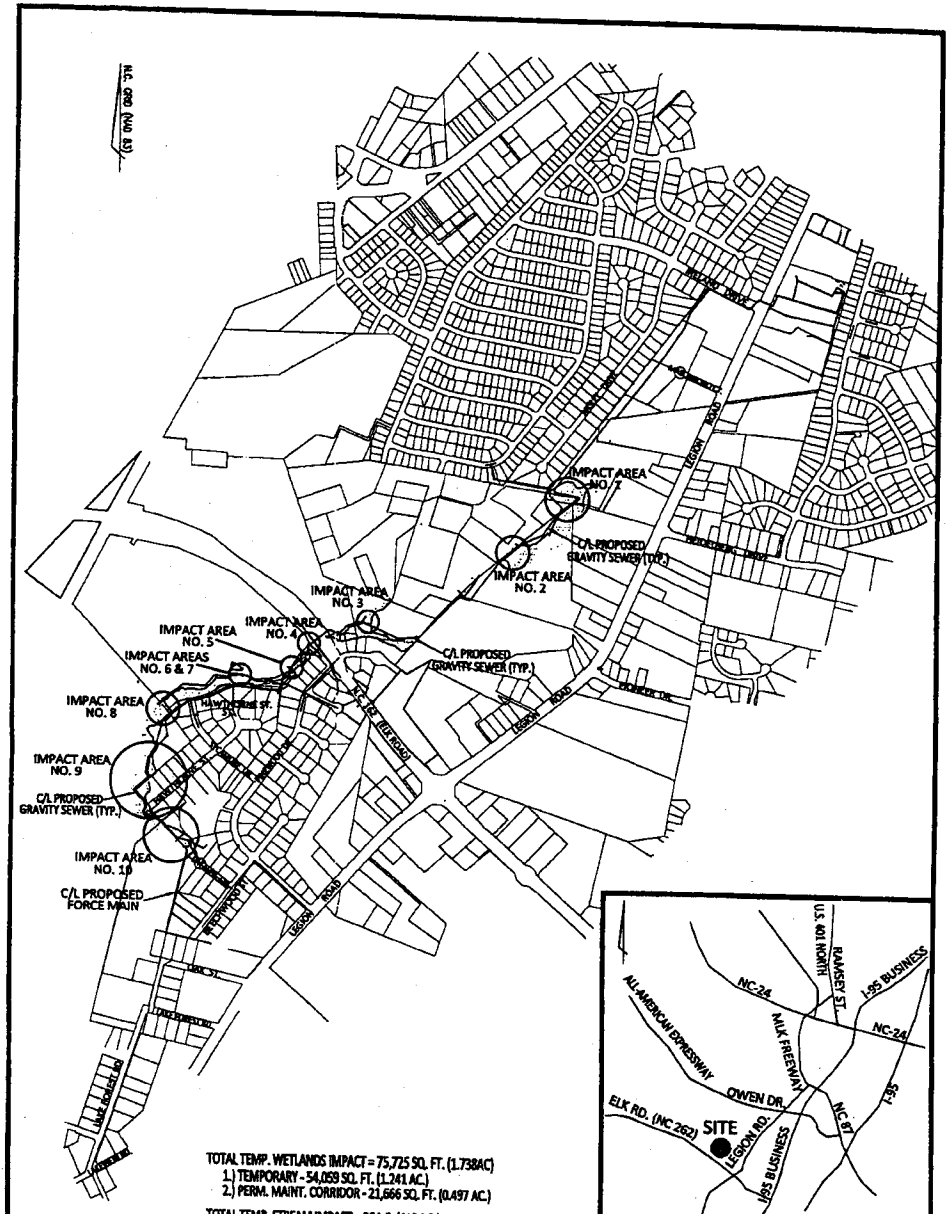
M&R
ENGINEERING
PLANNING
SURVEYING
MOORMAN, KIZER & REITZEL, INC.
115 Broadfoot Avenue.
Fayetteville, N.C.
P.O. Box 53774
Phone 910-634-5181

LEGION HILLS OUTFALL &
NEW PINEWOOD LIFT STATION

PLAN PROFILE "A" STA 43+00 TO STA 57+00

P04


PLAN PROFILE "A" STA 57+00 TO STA 70+00
PROFILE EXISTING DRAINAGE FEATURE 1
MATCHLINE STA 57+00
MATCHLINE STA 70+00
PROFILE "C"
LEGION HILLS OUTFALL &
NEW PINEWOOD LIFT STATION
PLAN PROFILE "A" STA 57+00 TO STA 70+00
115 Broadfoot Avenue,
Fayetteville, N.C.
P.O. Box 53774
Phone 910-484-5191
MK&R
MOORMAN, KIZER & REITZEL, INC.
PP-5



SHEET 1 OF 11

"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."

Name: _____

Title: _____

Date: _____

OVERALL SITE WETLAND IMPACTS FOR LEGION ROAD SEWER OUTFALL UTILITY INSTALLATIONS

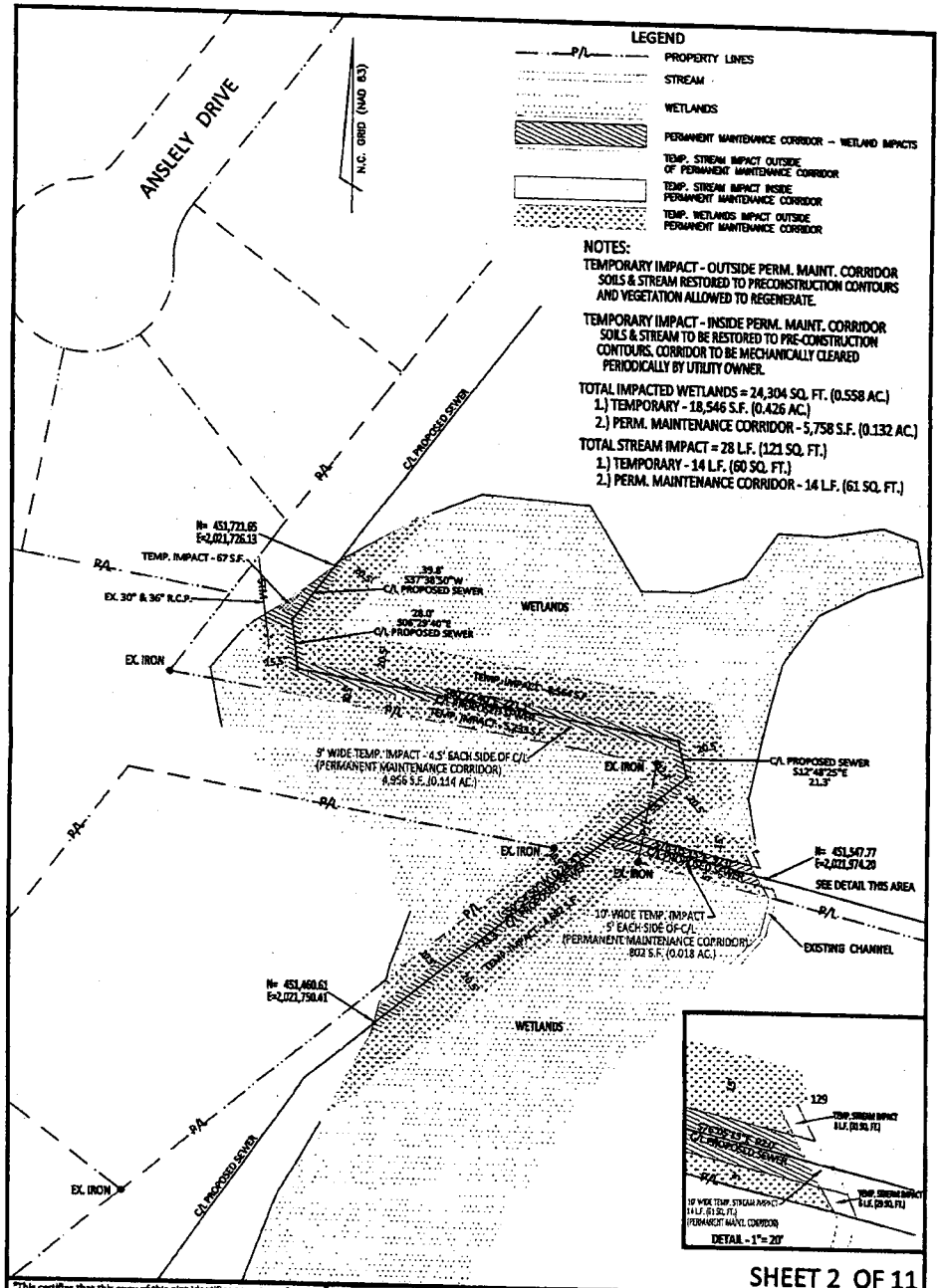
71st TWP. CUMBERLAND CO., N.C.

SCALE: 1" = 800' JANUARY 30 , 2015

-800 -400 0 800 1600 2400

NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDALL S. WILLIAMS

N.C. PROFESSIONAL SURVEYOR NO. L-3307



SHEET 2 OF 11

"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."

Name: _____

Title: _____

Date: _____

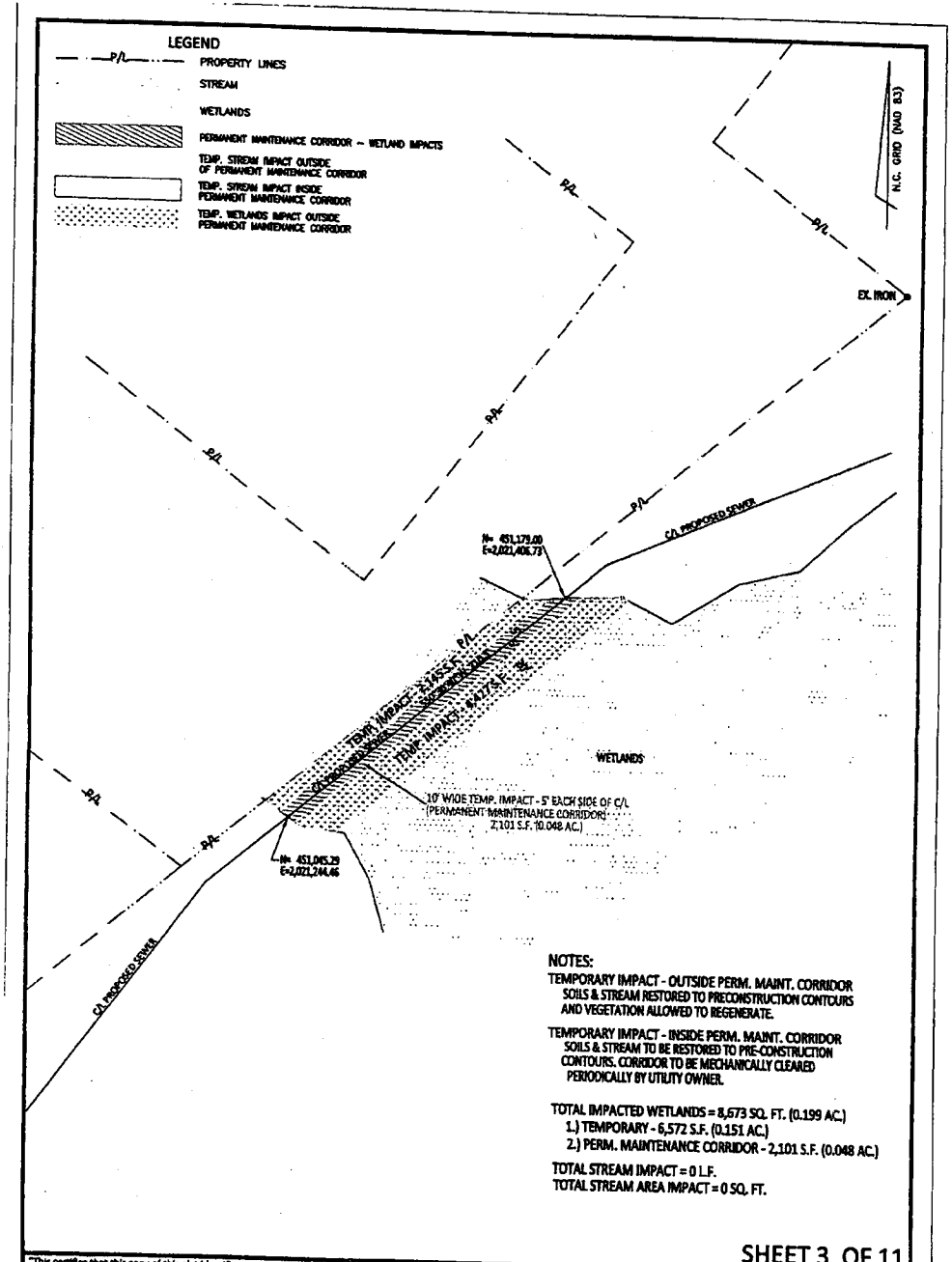
IMPACT AREA NO. 1
FOR
LEGION ROAD SEWER OUTFALL UTILITY INSTALLATIONS

71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 30, 2015

-50 -25 0 50 100 150

NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDALL S. WILLIAMS

N.C. PROFESSIONAL SURVEYOR NO. L-3307



NOTES:

TEMPORARY IMPACT - OUTSIDE PERM. MAINT. CORRIDOR SOILS & STREAM RESTORED TO PRECONSTRUCTION CONTOURS AND VEGETATION ALLOWED TO REGENERATE.

TEMPORARY IMPACT - INSIDE PERM. MAINT. CORRIDOR SOILS & STREAM TO BE RESTORED TO PRE-CONSTRUCTION CONTOURS. CORRIDOR TO BE MECHANICALLY CLEARED PERIODICALLY BY UTILITY OWNER.

TOTAL IMPACTED WETLANDS = 8,673 SQ. FT. (0.199 AC.)
1.) TEMPORARY - 6,572 S.F. (0.151 AC.)
2.) PERM. MAINTENANCE CORRIDOR - 2,101 S.F. (0.048 AC.)

TOTAL STREAM IMPACT = 0 L.F.
TOTAL STREAM AREA IMPACT = 0 SQ. FT.

"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."

Name: _____

Title: _____

Date: _____

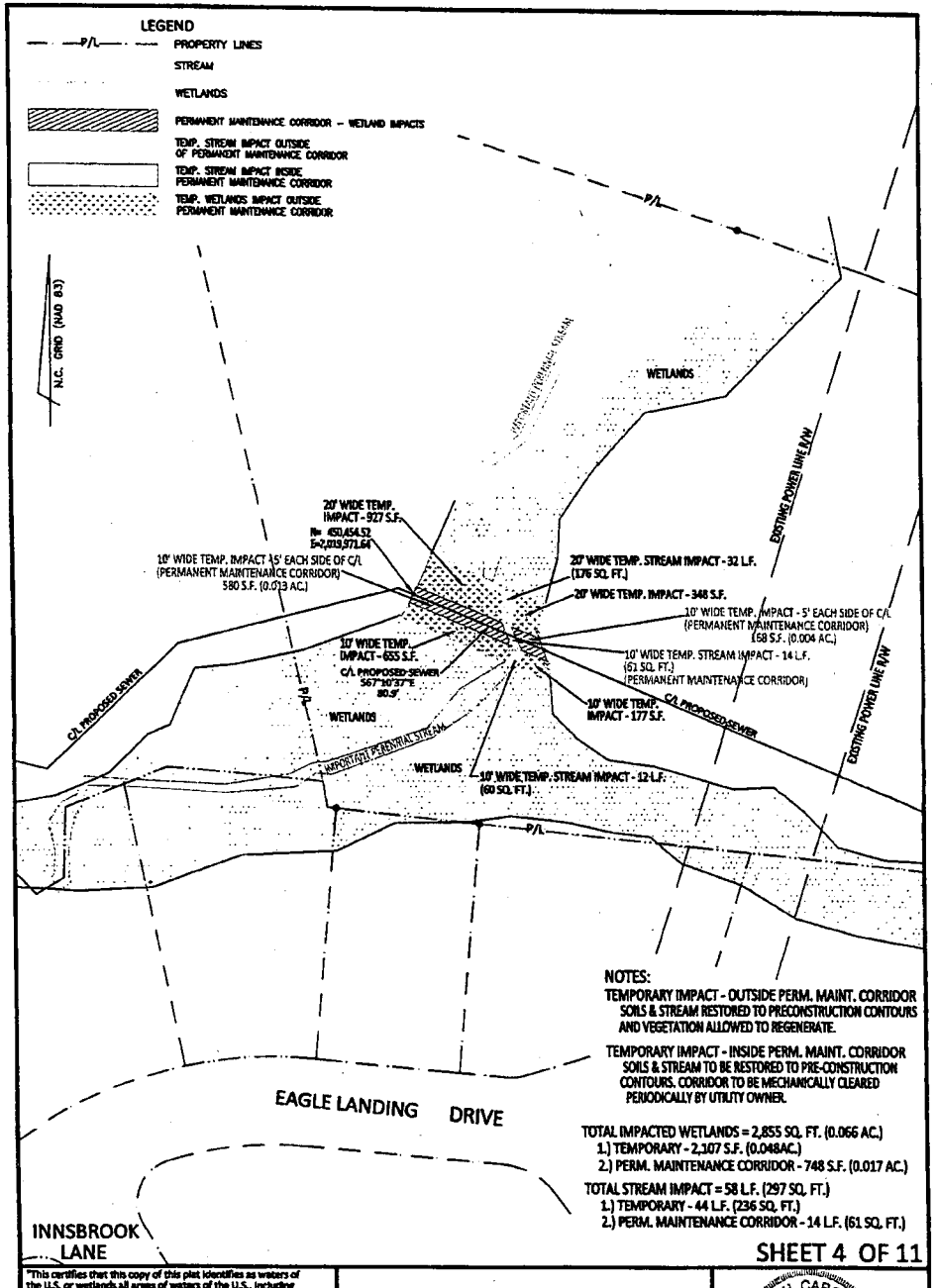
IMPACT AREA NO. 2
FOR
LEGION ROAD SEWER OUTFALL UTILITY INSTALLATIONS

71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 26, 2015

-50 -25 0 50 100 150

NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDALL S. WILLIAMS

N.C. PROFESSIONAL SURVEYOR NO. L-3307



NOTES:

TEMPORARY IMPACT - OUTSIDE PERM. MAINT. CORRIDOR SOILS & STREAM RESTORED TO PRECONSTRUCTION CONTOURS AND VEGETATION ALLOWED TO REGENERATE.

TEMPORARY IMPACT - INSIDE PERM. MAINT. CORRIDOR SOILS & STREAM TO BE RESTORED TO PRE-CONSTRUCTION CONTOURS. CORRIDOR TO BE MECHANICALLY CLEARED PERIODICALLY BY UTILITY OWNER.

TOTAL IMPACTED WETLANDS = 2,855 SQ. FT. (0.066 AC.)
1.) TEMPORARY - 2,107 S.F. (0.048AC.)
2.) PERM. MAINTENANCE CORRIDOR - 748 S.F. (0.017 AC.)

TOTAL STREAM IMPACT = 58 L.F. (297 SQ. FT.)
1.) TEMPORARY - 44 L.F. (236 SQ. FT.)
2.) PERM. MAINTENANCE CORRIDOR - 14 L.F. (61 SQ. FT.)

SHEET 4 OF 11

"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."

Name: _____

Title: _____

Date: _____

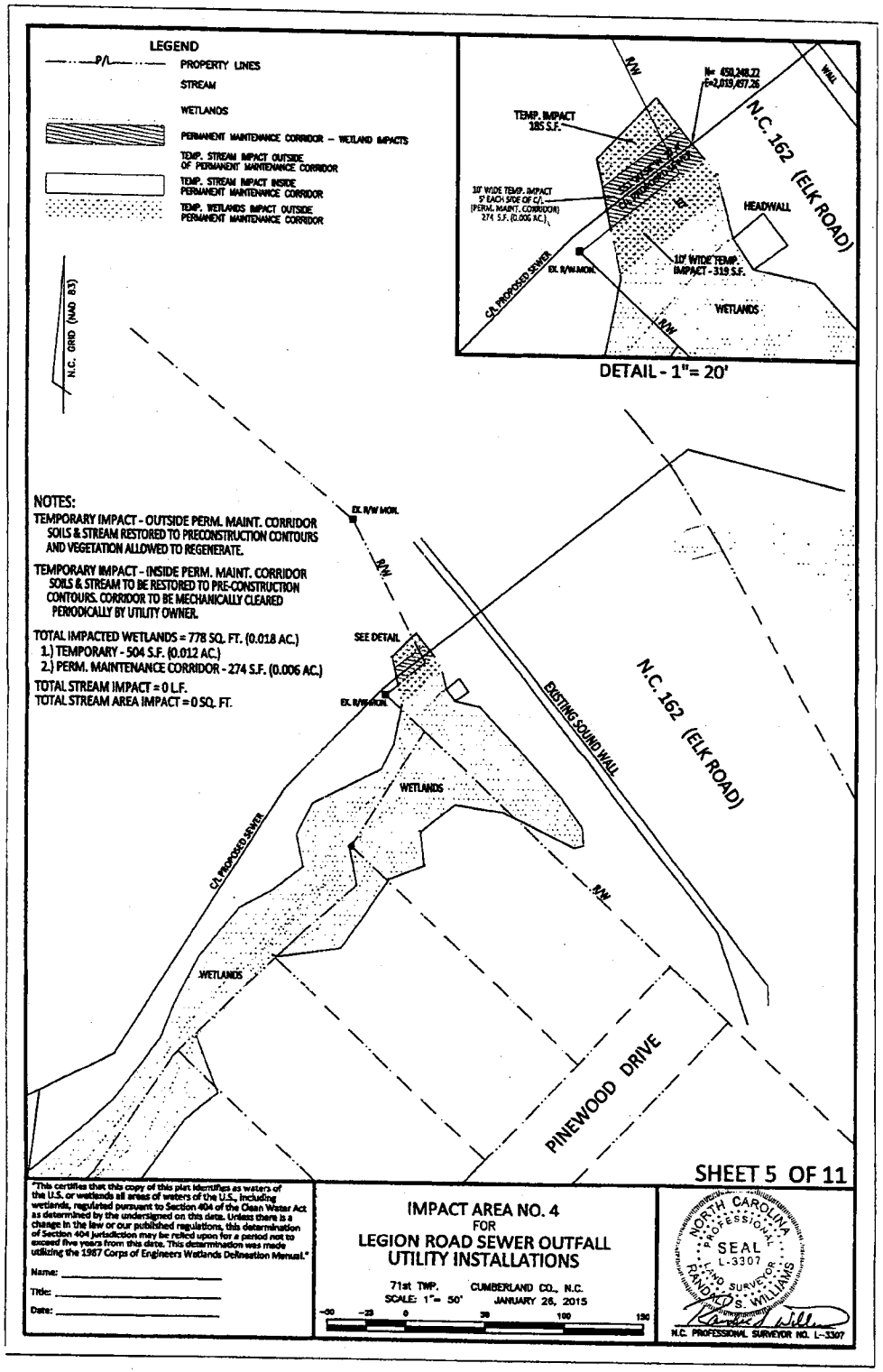
IMPACT AREA NO. 3
FOR
LEGION ROAD SEWER OUTFALL
UTILITY INSTALLATIONS

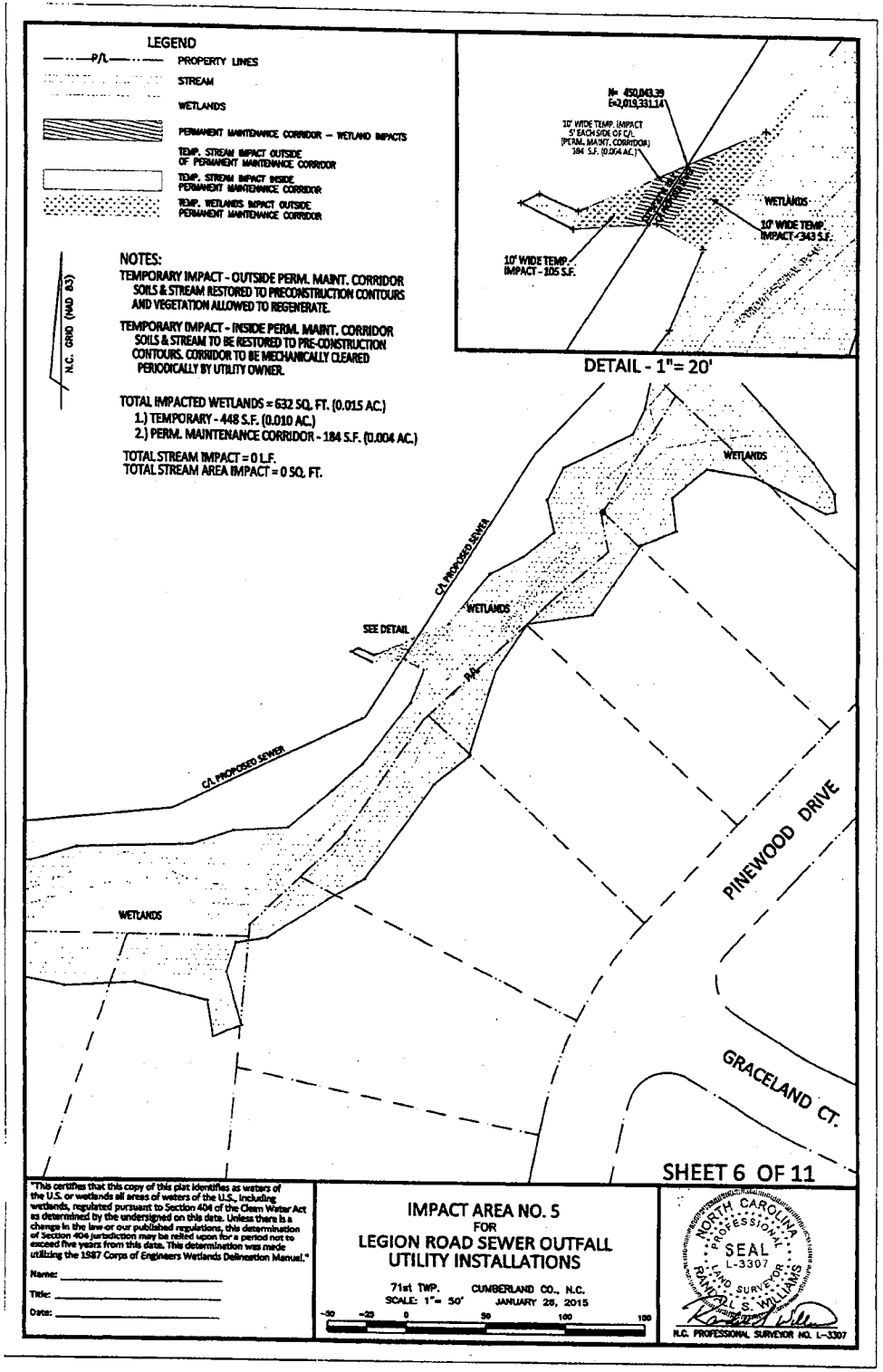
71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 26, 2015

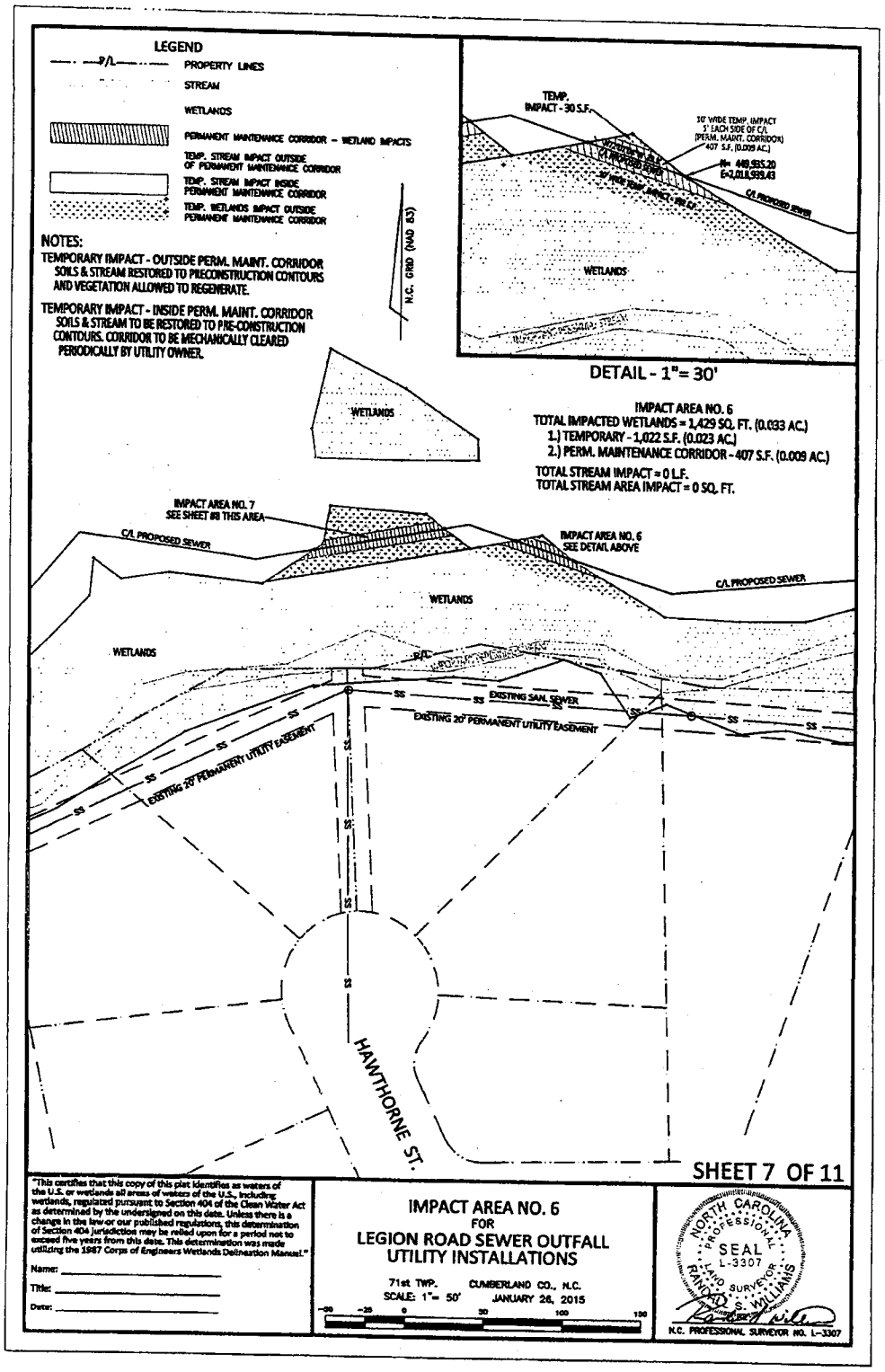
-50 -25 0 50 100 150

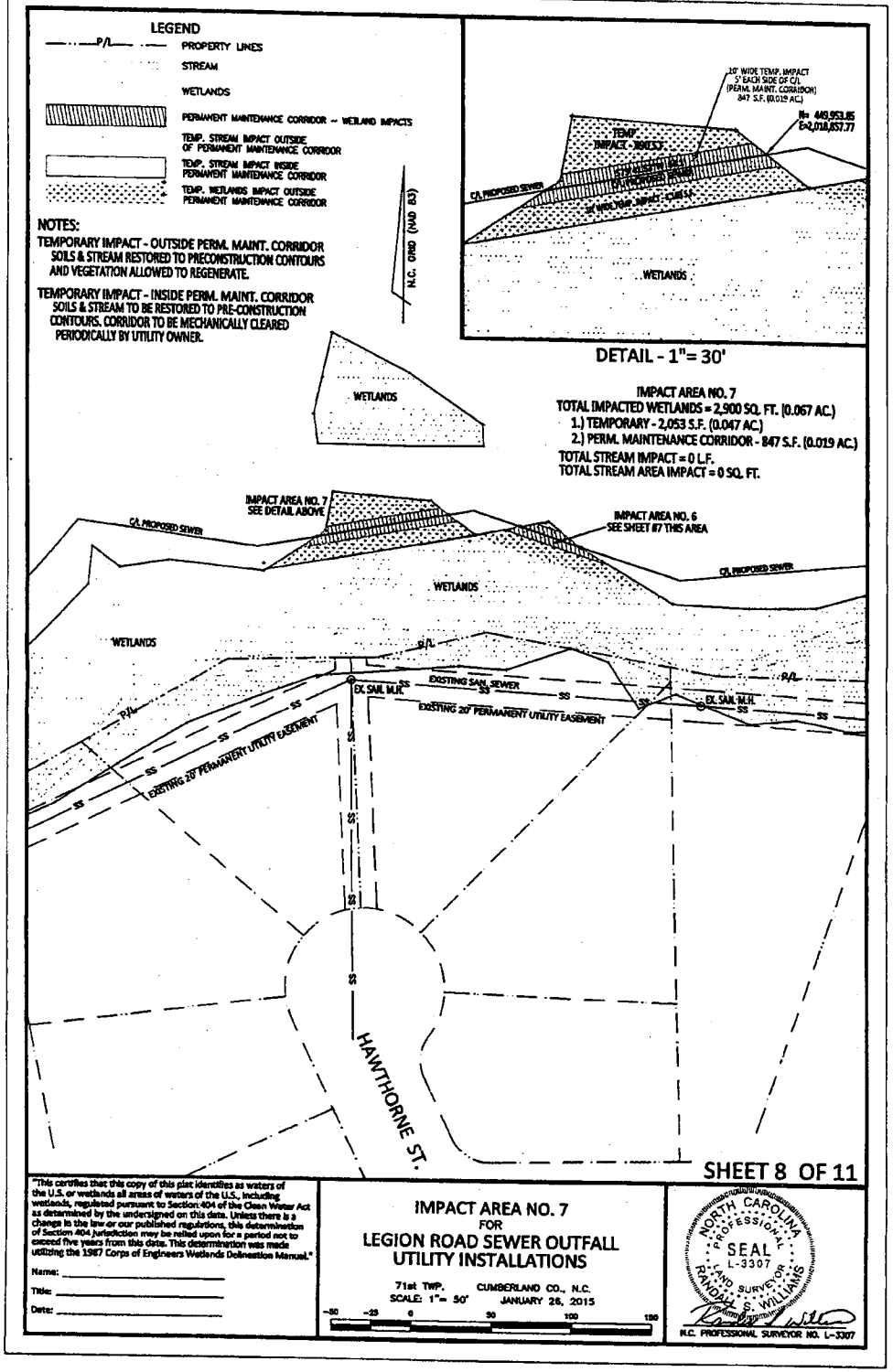
NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDALL S. WILLIAMS

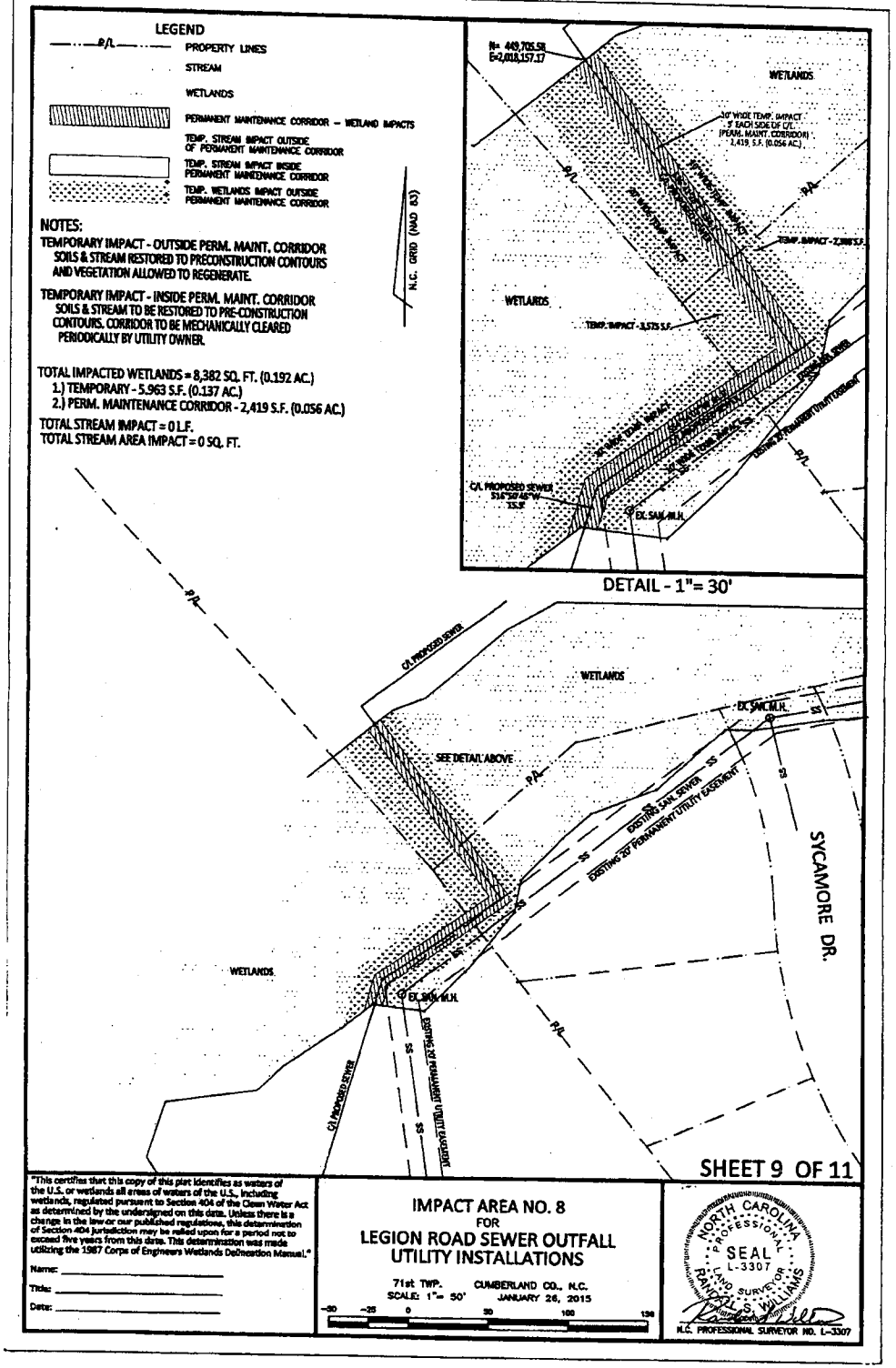
N.C. PROFESSIONAL SURVEYOR NO. L-3307


LEGEND
P/L
PROPERTY LINES
STREAM
WETLANDS
PERMANENT MAINTENANCE CORRIDOR – WETLAND IMPACTS
TEMP. STREAM IMPACT OUTSIDE OF PERMANENT MAINTENANCE CORRIDOR
TEMP. STREAM IMPACT INSIDE PERMANENT MAINTENANCE CORRIDOR
TEMP. WETLANDS IMPACT OUTSIDE PERMANENT MAINTENANCE CORRIDOR
N.C. GRID (NAD 83)
N= 450,248.22
E=2,019,497.26
TEMP. IMPACT 185 S.F.
10' WIDE TEMP. IMPACT 5' EACH SIDE OF C/L (PERM. MAINT. CORRIDOR) 274 S.F. (0.006 AC.)
HEADWALL
10' WIDE TEMP. IMPACT - 319 S.F.
EX. R/W MON.
C/L PROPOSED SEWER
WETLANDS
R/W
WALL
N.C. 162 (ELK ROAD)
DETAIL - 1"= 20'
NOTES:
TEMPORARY IMPACT - OUTSIDE PERM. MAINT. CORRIDOR SOILS & STREAM RESTORED TO PRECONSTRUCTION CONTOURS AND VEGETATION ALLOWED TO REGENERATE.
TEMPORARY IMPACT - INSIDE PERM. MAINT. CORRIDOR SOILS & STREAM TO BE RESTORED TO PRE-CONSTRUCTION CONTOURS. CORRIDOR TO BE MECHANICALLY CLEARED PERIODICALLY BY UTILITY OWNER.
TOTAL IMPACTED WETLANDS = 778 SQ. FT. (0.018 AC.)
1.) TEMPORARY - 504 S.F. (0.012 AC.)
2.) PERM. MAINTENANCE CORRIDOR - 274 S.F. (0.006 AC.)
TOTAL STREAM IMPACT = 0 L.F.
TOTAL STREAM AREA IMPACT = 0 SQ. FT.
EX. R/W MON.
SEE DETAIL
EX. R/W MON.
R/W
EXISTING SOUND WALL
N.C. 162 (ELK ROAD)
WETLANDS
C/L PROPOSED SEWER
R/W
WETLANDS
PINEWOOD DRIVE
SHEET 5 OF 11
"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."
Name:
Title:
Date:
IMPACT AREA NO. 4
FOR
LEGION ROAD SEWER OUTFALL
UTILITY INSTALLATIONS
71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 26, 2015
-50 -25 0 50 100 150
NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDY S. WILLIAMS
N.C. PROFESSIONAL SURVEYOR NO. L-3307

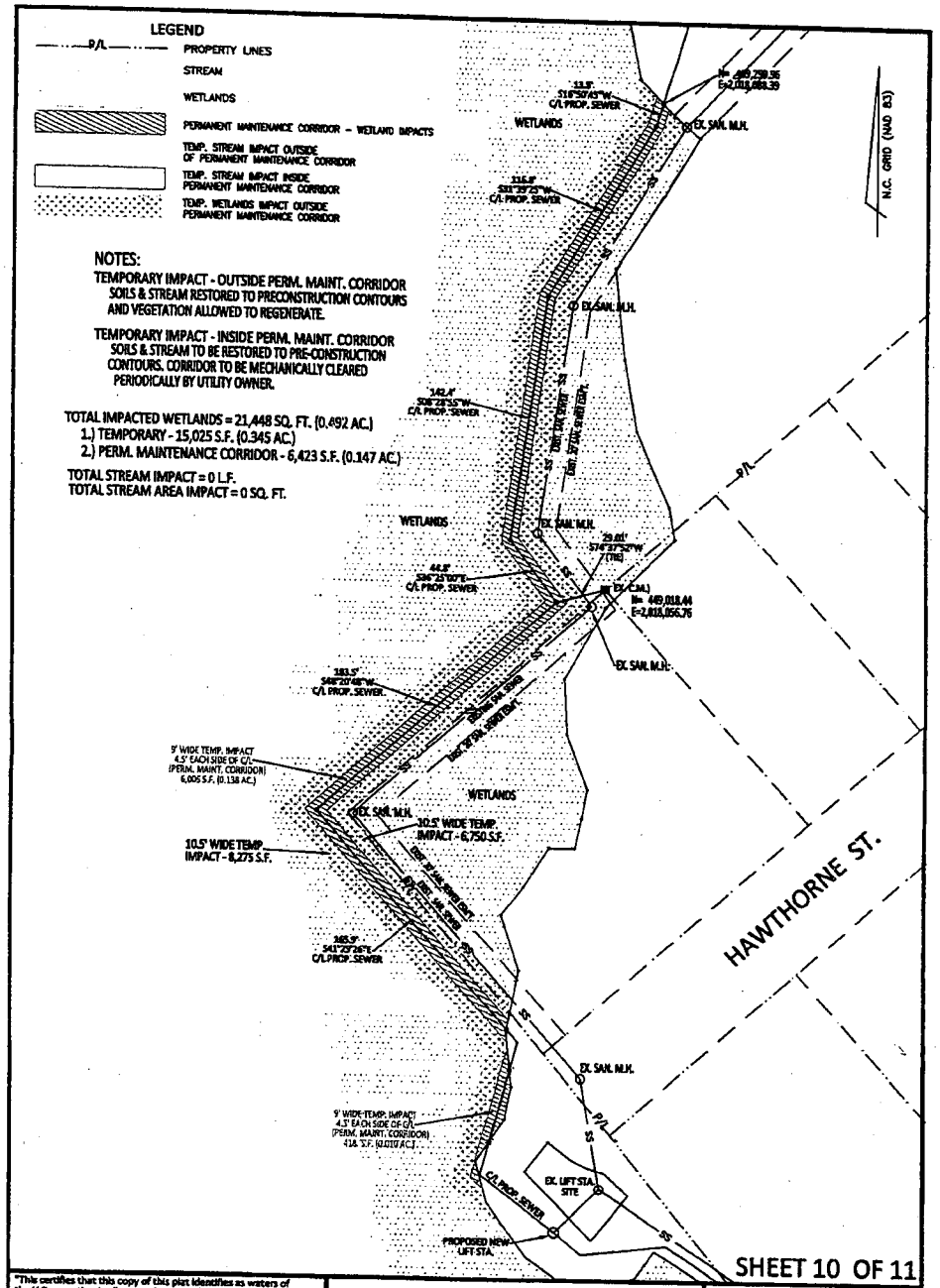

LEGEND
P/L
PROPERTY LINES
STREAM
WETLANDS
PERMANENT MAINTENANCE CORRIDOR – WETLAND IMPACTS
TEMP. STREAM IMPACT OUTSIDE OF PERMANENT MAINTENANCE CORRIDOR
TEMP. STREAM IMPACT INSIDE PERMANENT MAINTENANCE CORRIDOR
TEMP. WETLANDS IMPACT OUTSIDE PERMANENT MAINTENANCE CORRIDOR
N.C. GRID (NAD 83)
NOTES:
TEMPORARY IMPACT - OUTSIDE PERM. MAINT. CORRIDOR SOILS & STREAM RESTORED TO PRECONSTRUCTION CONTOURS AND VEGETATION ALLOWED TO REGENERATE.
TEMPORARY IMPACT - INSIDE PERM. MAINT. CORRIDOR SOILS & STREAM TO BE RESTORED TO PRE-CONSTRUCTION CONTOURS. CORRIDOR TO BE MECHANICALLY CLEARED PERIODICALLY BY UTILITY OWNER.
TOTAL IMPACTED WETLANDS = 632 SQ. FT. (0.015 AC.)
1.) TEMPORARY - 448 S.F. (0.010 AC.)
2.) PERM. MAINTENANCE CORRIDOR - 184 S.F. (0.004 AC.)
TOTAL STREAM IMPACT = 0 L.F.
TOTAL STREAM AREA IMPACT = 0 SQ. FT.
N= 450,843.39
E=2,019,331.14'
10' WIDE TEMP. IMPACT 5' EACH SIDE OF C/L (PERM. MAINT. CORRIDOR) 184 S.F. (0.004 AC.)
WETLANDS
10' WIDE TEMP. IMPACT - 343 S.F.
10' WIDE TEMP. IMPACT - 105 S.F.
PROPOSED PERMANENT 20' R/W
DETAIL - 1"= 20'
WETLANDS
C/L PROPOSED SEWER
SEE DETAIL
WETLANDS
P/L
C/L PROPOSED SEWER
WETLANDS
PINEWOOD DRIVE
GRACELAND CT.
SHEET 6 OF 11
"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."
Name:
Title:
Date:
IMPACT AREA NO. 5
FOR
LEGION ROAD SEWER OUTFALL
UTILITY INSTALLATIONS
71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 26, 2015
-50 -25 0 50 100 150
NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDALL S. WILLIAMS
N.C. PROFESSIONAL SURVEYOR NO. L-3307


LEGEND
P/L
PROPERTY LINES
STREAM
WETLANDS
PERMANENT MAINTENANCE CORRIDOR – WETLAND IMPACTS
TEMP. STREAM IMPACT OUTSIDE OF PERMANENT MAINTENANCE CORRIDOR
TEMP. STREAM IMPACT INSIDE PERMANENT MAINTENANCE CORRIDOR
TEMP. WETLANDS IMPACT OUTSIDE PERMANENT MAINTENANCE CORRIDOR
NOTES:
TEMPORARY IMPACT - OUTSIDE PERM. MAINT. CORRIDOR SOILS & STREAM RESTORED TO PRECONSTRUCTION CONTOURS AND VEGETATION ALLOWED TO REGENERATE.
TEMPORARY IMPACT - INSIDE PERM. MAINT. CORRIDOR SOILS & STREAM TO BE RESTORED TO PRE-CONSTRUCTION CONTOURS. CORRIDOR TO BE MECHANICALLY CLEARED PERIODICALLY BY UTILITY OWNER.
N.C. GRID (NAD 83)
TEMP. IMPACT - 30 S.F.
10' WIDE TEMP. IMPACT 5' EACH SIDE OF C/L (PERM. MAINT. CORRIDOR) 407 S.F. (0.009 AC.)
C/L PROPOSED SEWER
30' WIDE TEMP. IMPACT - 900 S.F.
WETLANDS
DETAIL - 1"= 30'
WETLANDS
IMPACT AREA NO. 6
TOTAL IMPACTED WETLANDS = 1,429 SQ. FT. (0.033 AC.)
1.) TEMPORARY - 1,022 S.F. (0.023 AC.)
2.) PERM. MAINTENANCE CORRIDOR - 407 S.F. (0.009 AC.)
TOTAL STREAM IMPACT = 0 L.F.
TOTAL STREAM AREA IMPACT = 0 SQ. FT.
IMPACT AREA NO. 7 SEE SHEET #8 THIS AREA
C/L PROPOSED SEWER
IMPACT AREA NO. 6 SEE DETAIL ABOVE
C/L PROPOSED SEWER
WETLANDS
WETLANDS
P/L
EXISTING SAN. SEWER
EXISTING 20' PERMANENT UTILITY EASEMENT
EXISTING 20' PERMANENT UTILITY EASEMENT
SS
HAWTHORNE ST.
SHEET 7 OF 11
"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."
Name:
Title:
Date:
IMPACT AREA NO. 6
FOR
LEGION ROAD SEWER OUTFALL
UTILITY INSTALLATIONS
71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 26, 2015
-50 -25 0 50 100 150
NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDY S. WILLIAMS
N.C. PROFESSIONAL SURVEYOR NO. L-3307


LEGEND
P/L PROPERTY LINES
STREAM
WETLANDS
PERMANENT MAINTENANCE CORRIDOR -- WETLAND IMPACTS
TEMP. STREAM IMPACT OUTSIDE OF PERMANENT MAINTENANCE CORRIDOR
TEMP. STREAM IMPACT INSIDE PERMANENT MAINTENANCE CORRIDOR
TEMP. WETLANDS IMPACT OUTSIDE PERMANENT MAINTENANCE CORRIDOR
NOTES:
TEMPORARY IMPACT - OUTSIDE PERM. MAINT. CORRIDOR SOILS & STREAM RESTORED TO PRECONSTRUCTION CONTOURS AND VEGETATION ALLOWED TO REGENERATE.
TEMPORARY IMPACT - INSIDE PERM. MAINT. CORRIDOR SOILS & STREAM TO BE RESTORED TO PRE-CONSTRUCTION CONTOURS. CORRIDOR TO BE MECHANICALLY CLEARED PERIODICALLY BY UTILITY OWNER.
N.C. GRID (NAD 83)
10' WIDE TEMP. IMPACT 5' EACH SIDE OF C/L (PERM. MAINT. CORRIDOR) 847 S.F. (0.019 AC.)
N= 449,953.85
E=2,018,857.77
TEMP. IMPACT - 1,053 S.F.
C/L PROPOSED SEWER
WETLANDS
DETAIL - 1"= 30'
WETLANDS
IMPACT AREA NO. 7
TOTAL IMPACTED WETLANDS = 2,900 SQ. FT. (0.067 AC.)
1.) TEMPORARY - 2,053 S.F. (0.047 AC.)
2.) PERM. MAINTENANCE CORRIDOR - 847 S.F. (0.019 AC.)
TOTAL STREAM IMPACT = 0 L.F.
TOTAL STREAM AREA IMPACT = 0 SQ. FT.
IMPACT AREA NO. 7 SEE DETAIL ABOVE
C/L PROPOSED SEWER
IMPACT AREA NO. 6 SEE SHEET #7 THIS AREA
C/L PROPOSED SEWER
WETLANDS
WETLANDS
P/L
EX. SAN. M.H.
EXISTING SAN. SEWER
SS
EX. SAN. M.H.
P/L
EXISTING 20' PERMANENT UTILITY EASEMENT
EXISTING 20' PERMANENT UTILITY EASEMENT
HAWTHORNE ST.
SHEET 8 OF 11
"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."
Name:
Title:
Date:
IMPACT AREA NO. 7
FOR
LEGION ROAD SEWER OUTFALL
UTILITY INSTALLATIONS
71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 26, 2015
-50 -25 0 50 100 150
NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDAL S. WILLIAMS
N.C. PROFESSIONAL SURVEYOR NO. L-3307


LEGEND
P/L
PROPERTY LINES
STREAM
WETLANDS
PERMANENT MAINTENANCE CORRIDOR – WETLAND IMPACTS
TEMP. STREAM IMPACT OUTSIDE OF PERMANENT MAINTENANCE CORRIDOR
TEMP. STREAM IMPACT INSIDE PERMANENT MAINTENANCE CORRIDOR
TEMP. WETLANDS IMPACT OUTSIDE PERMANENT MAINTENANCE CORRIDOR
N.C. GRID (NAD 83)
NOTES:
TEMPORARY IMPACT - OUTSIDE PERM. MAINT. CORRIDOR SOILS & STREAM RESTORED TO PRECONSTRUCTION CONTOURS AND VEGETATION ALLOWED TO REGENERATE.
TEMPORARY IMPACT - INSIDE PERM. MAINT. CORRIDOR SOILS & STREAM TO BE RESTORED TO PRE-CONSTRUCTION CONTOURS. CORRIDOR TO BE MECHANICALLY CLEARED PERIODICALLY BY UTILITY OWNER.
TOTAL IMPACTED WETLANDS = 8,382 SQ. FT. (0.192 AC.)
1.) TEMPORARY - 5,963 S.F. (0.137 AC.)
2.) PERM. MAINTENANCE CORRIDOR - 2,419 S.F. (0.056 AC.)
TOTAL STREAM IMPACT = 0 L.F.
TOTAL STREAM AREA IMPACT = 0 SQ. FT.
N= 449,705.58
E=2,018,157.17
WETLANDS
30' WIDE TEMP. IMPACT 5' EACH SIDE OF C/L (PERM. MAINT. CORRIDOR) 2,419 S.F. (0.056 AC.)
TEMP. IMPACT - 2,388 S.F.
TEMP. IMPACT - 3,575 S.F.
EXISTING 20' PERMANENT UTILITY EASEMENT
C/L PROPOSED SEWER S16°26'48"W 33.8'
EX. SAN. M.H.
DETAIL - 1"= 30'
C/L PROPOSED SEWER
WETLANDS
EX. SAN. M.H.
SEE DETAIL ABOVE
EXISTING SAN. SEWER
EXISTING 20' PERMANENT UTILITY EASEMENT
SYCAMORE DR.
WETLANDS
EX. SAN. M.H.
EXISTING 20' PERMANENT UTILITY EASEMENT
C/L PROPOSED SEWER
"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."
Name:
Title:
Date:
IMPACT AREA NO. 8
FOR
LEGION ROAD SEWER OUTFALL UTILITY INSTALLATIONS
71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 26, 2015
-50 -25 0 50 100 150
NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDAL S. WILLIAMS
N.C. PROFESSIONAL SURVEYOR NO. L-3307

SHEET 9 OF 11



SHEET 10 OF 11

"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."

Name: _____

Title: _____

Date: _____

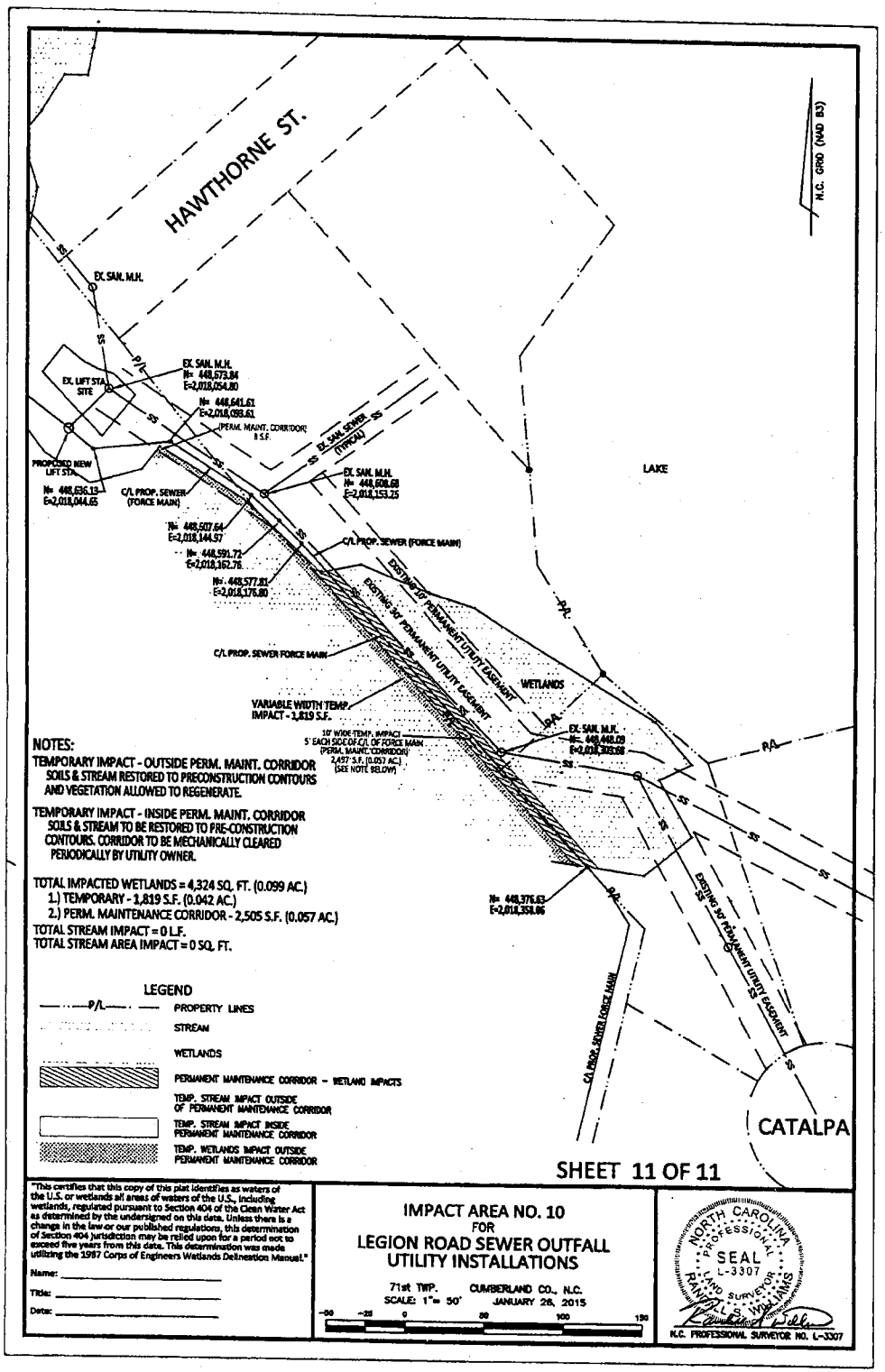
IMPACT AREA NO. 9
FOR
LEGION ROAD SEWER OUTFALL UTILITY INSTALLATIONS

71st TWP. CUMBERLAND CO., N.C.
SCALE: 1" = 50' JANUARY 30, 2015

-50 -25 0 50 100 150

NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDALL E. WILLIAMS

N.C. PROFESSIONAL SURVEYOR NO. L-3307



NOTES:

TEMPORARY IMPACT - OUTSIDE PERM. MAINT. CORRIDOR SOILS & STREAM RESTORED TO PRECONSTRUCTION CONTOURS AND VEGETATION ALLOWED TO REGENERATE.

TEMPORARY IMPACT - INSIDE PERM. MAINT. CORRIDOR SOILS & STREAM TO BE RESTORED TO PRE-CONSTRUCTION CONTOURS. CORRIDOR TO BE MECHANICALLY CLEARED PERIODICALLY BY UTILITY OWNER.

TOTAL IMPACTED WETLANDS = 4,324 SQ. FT. (0.099 AC.)
1.) TEMPORARY - 1,819 S.F. (0.042 AC.)
2.) PERM. MAINTENANCE CORRIDOR - 2,505 S.F. (0.057 AC.)
TOTAL STREAM IMPACT = 0 L.F.
TOTAL STREAM AREA IMPACT = 0 SQ. FT.

LEGEND

- P/L — PROPERTY LINES
- STREAM
- WETLANDS
- PERMANENT MAINTENANCE CORRIDOR – WETLAND IMPACTS
- TEMP. STREAM IMPACT OUTSIDE OF PERMANENT MAINTENANCE CORRIDOR
- TEMP. STREAM IMPACT INSIDE PERMANENT MAINTENANCE CORRIDOR
- TEMP. WETLANDS IMPACT OUTSIDE PERMANENT MAINTENANCE CORRIDOR

"This certifies that this copy of this plat identifies as waters of the U.S. or wetlands all areas of waters of the U.S., including wetlands, regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. This determination was made utilizing the 1987 Corps of Engineers Wetlands Delineation Manual."

Name: _____

Title: _____

Date: _____

IMPACT AREA NO. 10
FOR
LEGION ROAD SEWER OUTFALL UTILITY INSTALLATIONS

71st TWP. CUMBERLAND CO., N.C.
SCALE: 1"= 50' JANUARY 26, 2015

-50 -25 0 50 100 150

NORTH CAROLINA PROFESSIONAL SEAL L-3307 LAND SURVEYOR RANDALL S. WILLIAMS

N.C. PROFESSIONAL SURVEYOR NO. L-3307

APPENDIX C

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

July 22, 2015

LETTER OF APPROVAL

City of Fayetteville PWC
Joseph E Glass, Water Resources Engineer Manager
955 Old Wilmington Road
Fayetteville, NC 28301

RE: Project Name: Legion Road Outfall & New Pinewood LS
Acres Approved: 10.7
Project ID: CUMBE-2015-209
County: Cumberland, City: Fayetteville
Address: Pinewood Dr.
River Basin: Cape Fear
Stream Classification: Other
Submitted By: David Vaughn
Date Received by LQS: June 23, 2015
Plan Type: Utilities

Dear Mr. Glass:

This office has reviewed the subject erosion and sedimentation control plan. We find the plan to be acceptable and hereby issue this Letter of Approval. The enclosed Certificate of Approval must be posted at the job site. This plan approval shall expire three (3) years following the date of approval, if no land-disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0129.

Please be aware that your project will be covered by the enclosed NPDES Construction Stormwater General Permit NCG010000. Please become familiar with all the requirements and conditions of this permit in order to achieve compliance.

Title 15A NCAC 4B .0118(a) requires that a copy of the approved erosion control plan be on file at the job site. Also, this letter gives the notice required by G.S. 113A-61.1(a) of our right of periodic inspection to insure compliance with the approved plan.

Division of Energy, Mineral, and Land Resources
Energy Section • Geological Survey Section • Land Quality Section
225 Green St, Suite 714 Fayetteville, NC 28301• Phone: 910-433-3300 • FAX: 910-486-0707
Internet: http://portal.ncdenr.org/web/lr/

APPENDIX D

Transportation

PAT McCRORY
Governor

NICHOLAS J. TENNYSON
Secretary

March 30, 2016

Mr. Joe Glass, PE, Water Resources Engineer/Manager
Public Works Commission
ATTN: Mr. John Prevette
Post Office Box 1089
Fayetteville, NC 28302

SUBJECT: Encroachment Agreement on SR 1132 (Legion Road) for the installation of 100'± of 12" Φ sanitary sewer line encased in 100'± of 30" Φ steel casing with various appurtenances (Sequence #26-063-16).

Dear Sir:

Attached is an approved R/W form 16.1 and plans for the installation of 100'± of 12" Φ sanitary sewer line encased in 100'± of 30" Φ steel casing by bore and jack method with various appurtenances on SR 1132 (Legion Road) in the City of Fayetteville in Cumberland County as shown on the attached plans (PWC encroachment #18243).

Location:

Route	**At a point**	**Towards**
SR 1132	67'± north of the intersection of SR 1132 (Legion Road) and SR 3301 (Ireland Drive)	The east

This encroachment is approved subject to the following:

1. Mr. Bill Hammond, Highway Maintenance Engineer at (910) 486-1421 and Mr. Troy L. Baker, Senior Assistant District Engineer at (910) 486-1496 shall be notified a minimum of three (3) days before construction is to begin.
2. Traffic will be maintained and proper signs, signal lights, flagmen and other warning devices will be provided for the protection of traffic, in conformance with the latest **MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS.** All contractor personnel will be required to wear a class II ANSI approved safety vest while working within the DOT right of way.
3. **All lanes of traffic on SR 1132 (Legion Road) are to be open during the hours of 6:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. No lane of traffic shall be closed on holidays, special events, or as directed by the engineer. Traffic shall be maintained at all times.**
4. The contractor shall not begin construction until after all traffic control and erosion control devices have been installed to the satisfaction of the District Engineer.

5. **The proposed utilities shall be constructed under all existing culverts and/or the future extension of existing culverts. Two (2) feet minimum separation shall be maintained between the proposed water line(s) and all existing culverts at all locations.**

6. Any asphalt that is damaged as a result of construction shall be repaired at the encroaching party's expense. An NCDOT approved asphalt mix shall be used for all repairs within NCDOT rights of way. Contact Mr. Troy L. Baker, Senior Assistant District Engineer for acceptance of asphalt mix designs.

7. **All fill areas/backfill shall be compacted to 95% density in accordance with AASHTO T99 as modified by the North Carolina Department of Transportation. All material to a depth of 8 inches below the finished surface shall be compacted to a density equal to at least 100% of that obtained by compacting a sample of the material in accordance with AASHTO T99 as modified by the department. The subgrade shall be compacted at a moisture content which is approximately that required to produce the maximum density indicated by the above test method. The contractor shall dry or add moisture to the subgrade when required to provide a uniformly compacted and acceptable subgrade. The trench backfill material shall meet the Statewide Borrow criteria. The trench should be backfilled in accordance with Section 300-7 of the latest NCDOT Standard Specifications for Roads and Structures and Amendments or Supplementals thereto.**

8. All utility facilities, including but not limited to manholes, valve boxes, meter boxes, splice boxes, junction boxes, vaults, and covers within NCDOT right of way shall have been designed for HS-20 loading. A listing of currently approved manholes, valve boxes, and vaults is available at the following site: https://apps.dot.state.ns.us.vendor/approvedproducts . If any proposed structure is not of a design pre-approved by NCDOT, the encroaching party shall submit details and calculations designed by a Professional Engineer registered in North Carolina for approval prior to construction.

9. All utility access points, including but not limited to manholes, splice boxes, junction boxes, and vaults shall be located outside of the right of way line. Manholes, splice boxes, junction boxes, and vaults shall not be placed in the ditch line, side slopes of the ditches, or in the pavement. All manholes, splice boxes, junction boxes, vaults, and covers shall be flush with the ground when located within the vehicle recovery area.

10. The party of the second part agrees to provide traffic control devices, lane closures, road closures, positive protection and/or any other warning or positive protection devices necessary for the safety of motorists and workers during construction and any subsequent maintenance. This shall be performed in conformance with the latest **NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures** and Amendments or Supplementals thereto. When there is no guidance provided in the Roadway Standard Drawings or Specifications, comply with the **Manual on Uniform Traffic Control Devices for Streets and Highways** and Amendment or Supplemental thereto. Information as to the above rules and regulations may be obtained from the Division Engineer of the party of the first part. **All contractor personnel will be required to wear a class II ANSI approved safety vest while working within the DOT right of way.**

11. Disturbed areas shall have an established stand of vegetation according to the attached specifications for erosion control.
12. A copy of this agreement and letter of approval will be required to be available at the construction site at all times.
13. Written notice of the completion of the work will be furnished to the District Engineer, P. O. Box 1150, Fayetteville, North Carolina 28302, when the work has been completed.
14. SDR-26 PVC pipe shall not be used on NCDOT Rights of Way for lines under pressure.
15. The Contractor shall comply with all OSHA requirements and provide a competent person on site to supervise excavation at all times. Please be reminded that all OSHA Standards regarding trenching and shoring should be strictly adhered to.
16. No material storage shall be allowed along the shoulders of the roadway, and during non-working hours, equipment shall be parked as close to the right of way line as possible and shall be properly barricaded so that no equipment obstruction shall be within the Clear Recovery Area. No parking or material storage shall be allowed along the shoulders of any state maintained roadway.
17. The Department of Transportation does not guarantee the right of way on this road, nor will it be responsible for any claim for damages brought by any property owner by reason of the installation.
18. The encroaching party shall comply with all applicable federal, state, and local environmental regulations, and shall obtain all necessary federal, state, and local environmental permits, including but not limited to, those related to sediment control, storm water, wetland, streams, endangered species, and historical sites.
19. Excavation within 500 feet of a signalized intersection will require notification by the party of the second part to the Division Traffic Engineer at telephone number 910-486-1452. All traffic signal or detection cables must be located prior to excavation.
20. **Trenching, bore pits and/or other excavations shall not be left overnight. The contractor shall comply with all OSHA requirements and provide a competent person on site to supervise excavation at all times.**
21. Excavations inside the theoretical 1:1 slope from the existing edge of pavement to the bottom of the nearest excavation wall should be made in accordance with the following conditions:
22. The trench backfill material should meet the Statewide Borrow Criteria. The trench should be backfilled in accordance with Section 300-7of the latest NCDOT Standard Specifications for Roads and Structures, which basically requires the backfill material to be placed in layers not to exceed 6 inches loose and compacted at least 95% of the density obtained by compacting a sample in accordance with AASHTO T99 as modified by the NCDOT.

23. All trench excavation inside the limits of the theoretical 1:1 slope, as defined by the policy, should be completely backfilled and compacted at the end of each construction day. No portion of the trench shall be left open overnight.

24. Any work requiring equipment or personnel within 5' of the edge of travel lane of an undivided facility and within 10' of the edge of any travel lane of a divided facility shall require a lane closure with appropriate tapers.

25. Drainage structures shall not be blocked with excavation materials. Any drainage structure disturbed or damaged shall be restored to its original condition as directed by the District Engineer.

26. Any disturbed guardrail shall be reset according to the applicable standard or as directed by the District Engineer.

27. All driveways altered during construction shall be returned to a state comparable with the condition of the driveways prior to construction.

28. All roadway signs which are removed which are removed due to construction shall be reinstalled as soon as possible.

29. Any proposed driveway connections onto NCDOT roadways will require an approved driveway permit. The approval of this Two Party encroachment (RW 16.1) does not constitute approval of any proposed driveway connections. For further information, contact Mr. Troy L. Baker, Senior Assistant District Engineer at (910) 486-1496.

30. Excavated areas adjacent to pavement having more than a 2" drop shall be safed up at a 6:1 or flatter slope and designated by appropriate delineation during periods of inactivity, including, but not limited to, night and weekend hours. Excavated material shall not be placed on the roadway at any time.

31. **NCDOT reserves the right to further limit, restrict, or suspend operations within the Right of Way if, in the opinion of NCDOT, safety or traffic conditions warrant such action.**

32. It shall be the responsibility of the encroaching party to determine the location of other utilities within the encroachment area. The encroaching party shall be responsible for notifying other utility owners and providing protection and safeguards to prevent damage or interruption to existing facilities and to maintain accessibility to existing utilities.

33. **A qualified NCDOT inspector should be on site at all times during construction. The encroaching party should be required to reimburse NCDOT for the cost of providing the inspector. If NCDOT cannot supply an inspector, the encroaching party (not the utility contractor) should make arrangements to have a qualified inspector under the supervision of a Professional Engineer registered in North Carolina, on site at all times. The Registered Engineer should be required to certify that the utility was installed in accordance with the encroachment agreement and that the backfill material meets the Statewide Borrow Criteria.**

34. All temporary and final paving markings are the responsibility of the encroaching party. Final pavement markings and sign plans shall be submitted to the Division Traffic Engineer at telephone number 910-486-1452 for review and approval.

35. Any utility marker required shall be as close to the right of way line as possible. If it is not feasible to install markers at or near the right of way line, written approval specific to this site shall be obtained from the District Engineer.

36. The pavement marking contractor is required to have at least one member of every pavement marking crew that is working on the project, preferably the Crew Supervisor, be certified through the NCDOT Pavement Marking Technician Certification Process. For more information please contact the Work Zone Traffic Control Unit at (919) 773-2800 or http://www.ncdot.org/doh/preconstruct/wztc/"

37. Prior to installing pavement markings, contact Mr. Kent Langdon with the NCDOT Division Six Traffic Services Unit at 910-486-1452 to review the proposed pavement-marking layout. This notification should take place a minimum of 48 hours in advance of the pavement marking installation.

38. Failure to contact the Traffic Services Unit to review the pavement-marking layout prior to installation may result in the removal and reinstallation of the markings at the expense of the Permittee.

NCDOT WORK ZONE TRAFFIC CONTROL QUALIFICATIONS AND TRAINING PROGRAM

This program requires qualified and trained Work Zone Flaggers in every flagging operation (July 2010) and qualified and trained Work Zone Traffic Control Supervisors on Significant Projects (July 2011). It is intended for the program to include anyone working within NCDOT Right of Way including work associated with NCDOT construction and encroachment agreements as well as all NCDOT operations.

Training for this certification will be provided by NCDOT approved training sources and/or private entities that have been pre-approved to train themselves. Additional information will be provided as this program progresses. If you have questions, visit our web site at www.ncdot.org/~wzte, or contact Stuart Bourne, PE with NCDOT Traffic Management Unit at (919) 662-4338 or sbourne@ncdot.gov.

If further information or assistance is needed in reference to this project, please feel free to call Mr. Randy K. Wise, PE, District Engineer at (910) 486-1496.

Sincerely,

Greg W. Burns, PE
Division Engineer

GWB:tlb

cc: Mr. Randy K. Wise, PE, District Engineer, w/attachments
Mr. Bill Hammond, PE, Highway Maintenance Engineer, w/attachment

TRAFFIC CONTROL AND WORK ZONE SAFETY

The Contractor shall maintain traffic during construction and provide, install, and maintain all traffic control devices in accordance with these project guidelines, the Project Special Provisions, North Carolina Department of Transportation Standard Specifications for Roads and Structures 2012, and the current edition of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor shall utilize complete and proper traffic controls and traffic control devices during all operations. All traffic control and traffic control devices required for any operation shall be functional and in place prior to the commencement of that operation. Signs for temporary operations shall be removed during periods of inactivity. The Contractor is required to leave the project in a manner that will be safe to the traveling public and which will not impede motorists.

Traffic movements through lane closures on roads with two way traffic shall be controlled by flaggers stationed at each end of the work zone. In situations where sight distance is limited, the Contractor shall provide additional means of controlling traffic, including, but not limited to, two-way radios, pilot vehicles, or additional flaggers. Flaggers shall be competent personnel, adequately trained in flagging procedures, and furnished with proper safety devices and equipment, including, but not limited to, safety vests and stop/slow paddles.

All personnel when working in traffic areas or areas in close proximity to traffic shall wear an approved safety vest, or shirt or jacket which meets the color requirements of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor shall comply with all applicable Federal, State, and local laws, ordinances, and regulations governing safety, health, and sanitation, and shall provide all safeguards, safety devices, and protective equipment, and shall take any other needed actions, on his own responsibility that are reasonably necessary to protect the life and health of employees on the job and the safety of the public, and to protect property in connection with the performance of the work covered by the contract.

Failure to comply with any of the requirements for safety and traffic control of this contract shall result in suspension of work as provided in subarticle 108-7(2) of the Standard Specifications.

SPECIFICATIONS FOR EROSION CONTROL

The Contractor shall seed all disturbed areas as directed by the Engineer, in accordance with Section 1660 of the Standard Specifications. Seeding and mulching shall immediately follow shoulder construction operations and in no case shall shoulder construction operations exceed seeding and mulching operations by more than two weeks without written permission of the Engineer. Failure to meet this requirement shall be cause to cease all operations until it can be met.

Seeding and Mulching: (East)

The kinds of seed and fertilizer, and the rates of application of seed, fertilizer, and limestone, shall be as stated below. During periods of overlapping dates, the kind of seed to be used shall be determined by the Engineer. All rates are in pounds per acre.

The kinds of seed and fertilizer, and the rates of application of seed, fertilizer, and limestone, shall be as stated below. During periods of overlapping dates, the kind of seed to be used shall be determined. All rates are in pounds per acre.

All Roadway Areas

March 1 - August 31		**September 1 - February 28**	
50#	Tall Fescue	50#	Tall Fescue
10#	Centipede	10#	Centipede
25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)
500#	Fertilizer	500#	Fertilizer
4000#	Limestone	4000#	Limestone

Waste and Borrow Locations

March 1 – August 31		**September 1 - February 28**	
75#	Tall Fescue	75#	Tall Fescue
25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)
500#	Fertilizer	500#	Fertilizer
4000#	Limestone	4000#	Limestone

Note: 50# of Bahiagrass may be substituted for either Centipede or Bermudagrass only upon Engineer's request.

Approved Tall Fescue Cultivars

2nd Millennium	Duster	Magellan	Rendition
Avenger	Endeavor	Masterpiece	Scorpion
Barlexas	Escalade	Matador	Shelby
Barlexas II	Falcon II, III, IV & V	Matador GT	Signia
Barrera	Fidelity	Millennium	Silverstar
Barrington	Finesse II	Montauk	Southern Choice II
Biltmore	Firebird	Mustang 3	Stetson
Bingo	Focus	Olympic Gold	Tarheel
Bravo	Grande II	Padre	Titan Ltd
Cayenne	Greenkeeper	Paraiso	Titanium
Chapel Hill	Greystone	Picasso	Tomahawk
Chesapeake	Inferno	Piedmont	Tacer
Constitution	Justice	Pure Gold	Trooper
Chipper	Jaguar 3	Prospect	Turbo
Coronado	Kalahari	Quest	Ultimate
Coyote	Kentucky 31	Rebel Exeda	Watchdog
Davinci	Kitty Hawk	Rebel Sentry	Wolfpack
Dynasty	Kitty Hawk 2000	Regiment II	
Dominion	Lexington	Rembrandt	

On cut and fill slopes 2:1 or steeper Centipede shall be applied at the rate of 5 pounds per acre and add 20# of Sericea Lespedeza from January 1 - December 31.

Fertilizer shall be 10-20-20 analysis. A different analysis of fertilizer may be used provided the 1-2-2 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as a 10-20-20 analysis and as directed.

All areas seeded and mulched shall be tacked with asphalt. Crimping of straw in lieu of asphalt tack shall not be allowed on this project.

CRIMPING STRAW MULCH

Crimping shall be required on this project adjacent to any section of roadway where traffic is to be maintained or allowed during construction. In areas within six feet of the edge of pavement, straw is to be applied and then crimped. After the crimping operation is complete, an additional application of straw shall be applied and immediately tacked with a sufficient amount of undiluted emulsified asphalt.

Straw mulch shall be of sufficient length and quality to withstand the crimping operation.

Crimping equipment including power source shall be subject to the approval of the Engineer providing that maximum spacing of crimper blades shall not exceed 8".

Within seven (7) calendar days to fourteen (14) calendar days of completion of any phase of grading, all disturbed areas shall be planted or otherwise provided with temporary or permanent ground cover, devices, or structures sufficient to restrain erosion. The Erosion and Sediment Control plan will identify the areas that require seven (7) and/or fourteen (14) calendar day ground stabilization. The Contractor is herein advised to follow all current regulations set forth by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Water Quality (DWQ) as defined in the *General Stormwater Permit for Construction Activities NCG-010000*.

Special Provisions

Untrenched Construction

Under no condition shall jetting or wet boring, with water, or utility pipelines or encasements under pavements be allowed.

Boring and Jacking

Smooth wall or spiral weld steel pipe may be jacked through dry bores slightly larger than the pipe bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of the encasement pipe shall be butt-welded to the section previously jacked into place. Encasements shall extend at shoulder sections as shown on Attachment # 2. Encasements shall extend to a point outside of the 1:1 projection from three (3) feet behind curbs to the bottom of the nearest pit excavation wall in curb and gutter sections as shown on Attachment # 3.

If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe at ten (10) foot centers and the voids filled with 1:3 Portland Cement Grout at sufficient pressure to prevent settlement in the roadway.

In the event an obstruction is encountered during boring and jacking operations, the auger is to be withdrawn and the excessive pipe is to be cut off, capped and filled with 1:3 Portland Cement Grout at sufficient pressure to fill all voids before moving to another site.

Size and wall thickness (3' min. to 10' max. cover) of smooth wall or spiral welded encasement pipe for boring and jacking is as follows:

Pipe Sizes (O.D.)	Wall Thickness
4' to 12-3/4"	0.188
16" to 24"	0.250
30"	0.312
36"	0.375
48"	0.500

The Engineer on record is responsible for the encasement pipe design for cover greater than 10'.

Materials, joints, protective coating, grouting, wall thickness of carrier pipe, welds and cathodic protection shall be in accordance with the applicable industry or governmental codes, as well as the specifications of the Department of Transportation.

Casing pipe shall be sealed at the ends to prevent flowing water and debris from entering the annular space between the casing and the carrier. Plug with concrete, brick link seal, or other material approved by the District Engineer. Ensure drainage of encasement by leaving a 1 inch diameter weep hole in the seal of the lower end of the encasement.

Pump or place flowable fill into the annular void between the carrier pipe and casing pipe 36 inches or larger.

The grade of the top of the pipe or casing within rights-of-way should provide minimum bury as follows:

A.	Longitudinal installations	3'
B.	Crossings under roadways	3' (Below travel surface)
C.	Crossings under ditches (Paved & unpaved)	2'

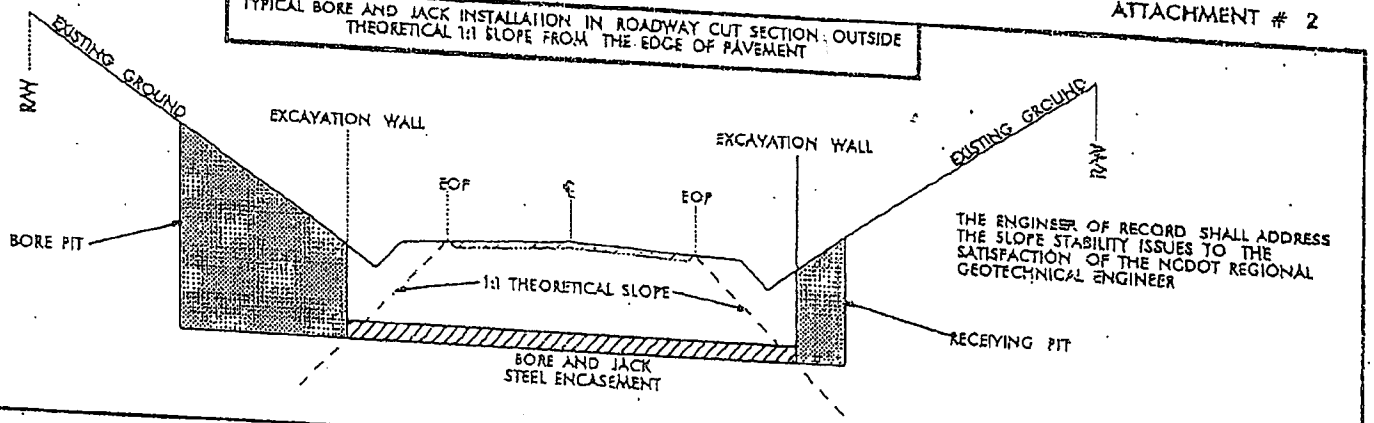
Pipelines carrying flammable, corrosive, expansive energized or unstable transmittants must comply with State, Federal and Utility Codes. In no case shall the depth of bury be less than as indicated above.

REV. 3/11/09

SHOULDER SECTIONS

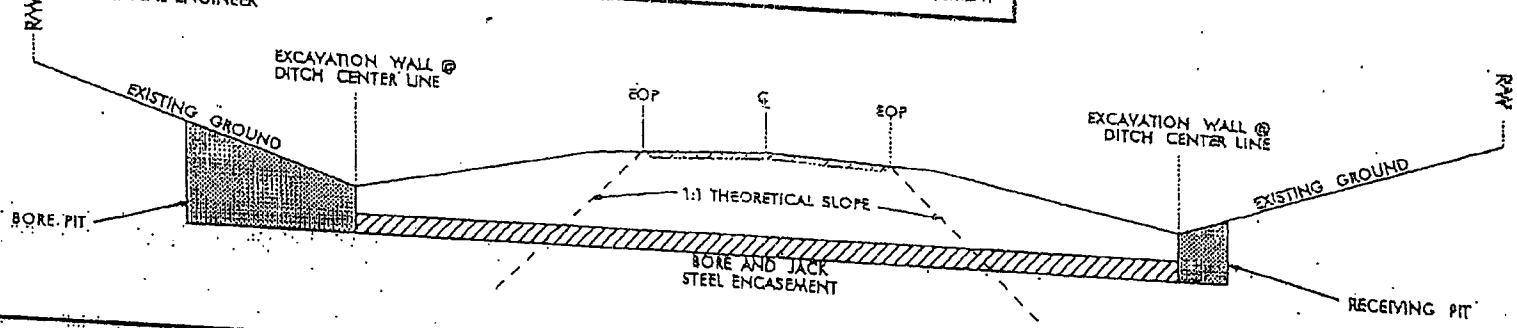
ATTACHMENT # 2

TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION OUTSIDE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT



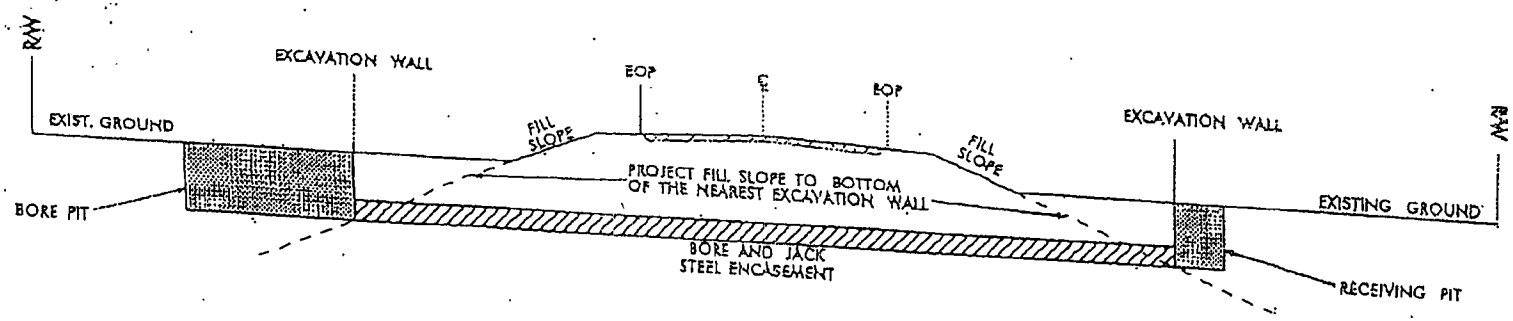
THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER

TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION WITH DITCHES OUTSIDE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT



THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER

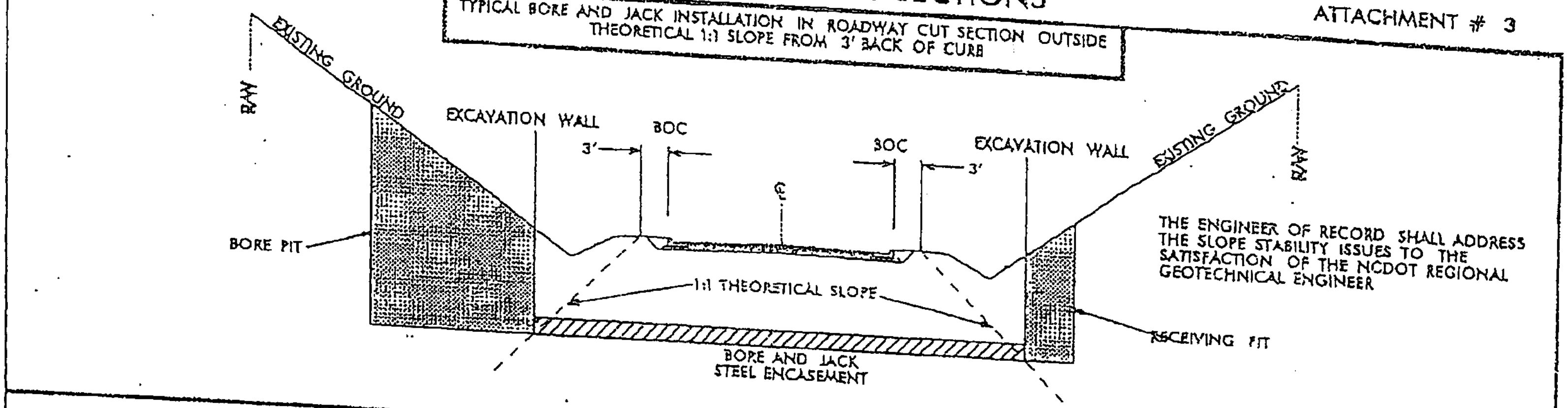
TYPICAL BORE AND JACK INSTALLATION IN ROADWAY IN FILL SECTION

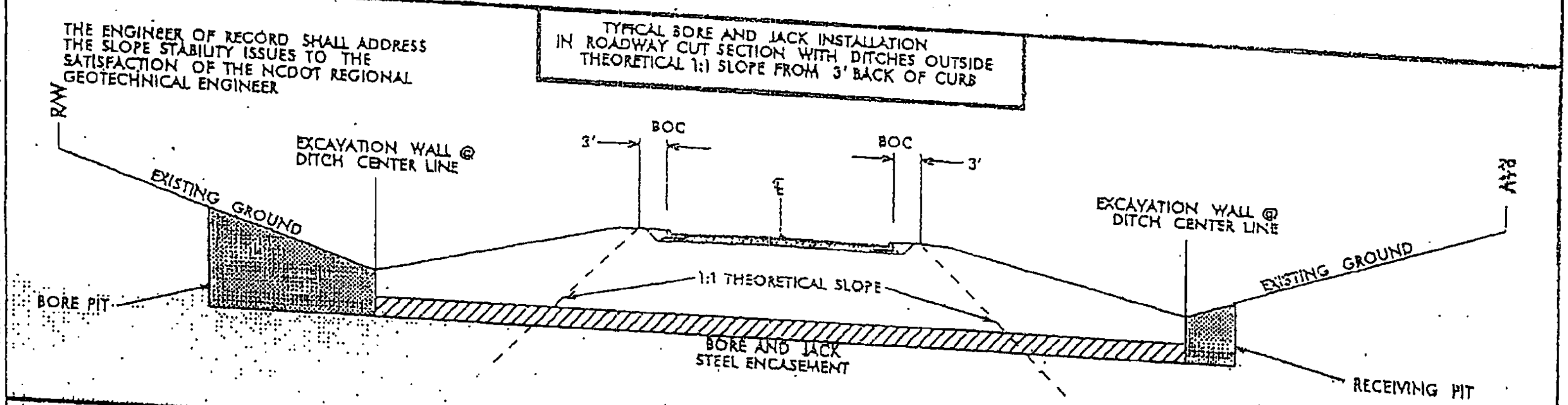


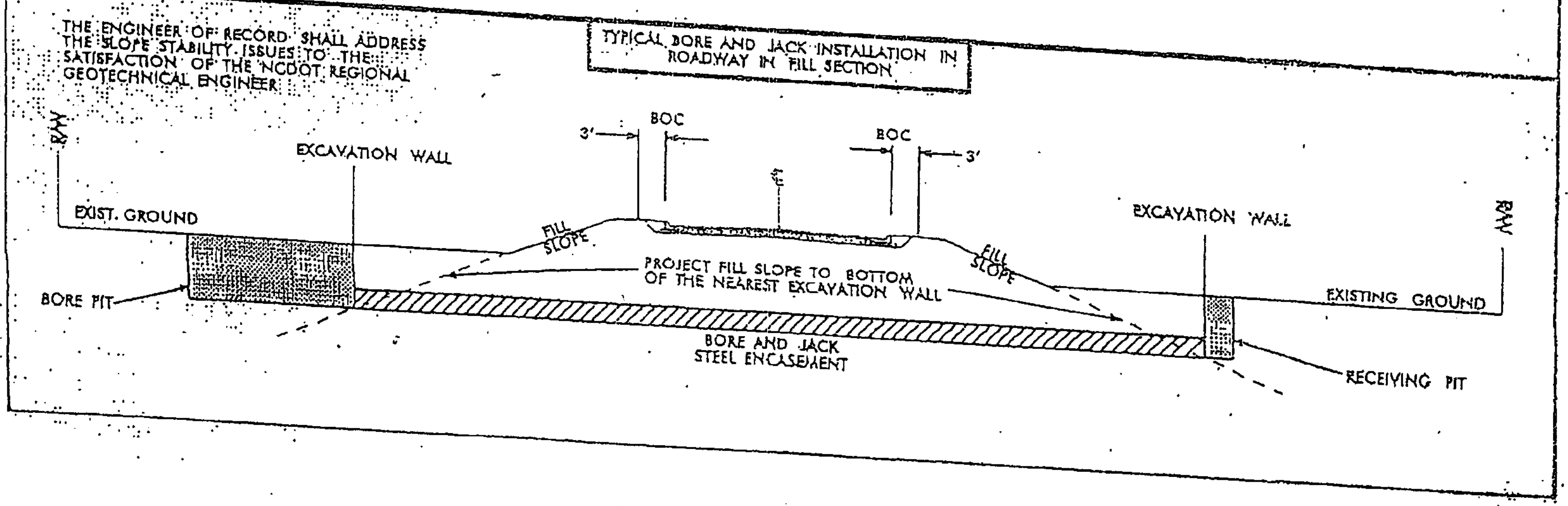
Rev. 3/1/06

CURB AND GUTTER SECTIONS

ATTACHMENT # 3







REV.

PUBLIC WORKS COMMISSION
OF THE CITY OF FAYETTEVILLE
ELECTRIC & WATER UTILITIES

955 OLD WILMINGTON RD
P.O. BOX 1089
FAYETTEVILLE, NORTH CAROLINA 28302-1089
TELEPHONE (910) 483-1401
WWW.FAYPWC.COM

January 7, 2016

Randy K. Wise, P.E.
District Engineer
Department of Transportation
Post Office Box 1150
Fayetteville, North Carolina 28302

SUBJECT: LEGION ROAD SEWER IMPROVEMENTS
Erosion Control for PWC Encr #18243
12" DI Sewer Main on SR 1132 (Legion Rd)
for PWC Drawing AS-149180O

Dear Mr. Wise:

This letter is to acknowledge that the above referenced activity will disturb less than one acre. Therefore, an approved erosion and sediment control plan from NCDENR is not required. However, appropriate measures will be implemented during construction to prevent erosion and offsite sedimentation.

If there are further questions, please contact John Prevette (223-4409) or Sam Powers (223-4370).

Very truly yours,
PUBLIC WORKS COMMISSION

Joseph E. Glass

Joseph E. Glass, P.E.
Water Resources Engineer/Manager

JG:jep
Enclosures
cc: Business Planning

30 MARCH

DIVISION 6-DISTRICT 2

THIS AGREEMENT, made and entered into this the 7 day of JAN 20 16 by and between the Department of Transportation, party of the first part; and Public Works Commission of Fayetteville, North Carolina party of the second part,

WITNESSETH

THAT WHEREAS, the party of the second part desires to encroach on the right of way of the public road designated as Route(s) SR 1132 (Legion Rd), located 67' north of the intersection of SR 3301 and SR 1132

with the construction and/or erection of: 100' of 12" RJDI in 24" steel casing installed across the right-of-way by jack and bore as shown on PWC Drawing AS-14918OO

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:

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: M.W. B

DIVISION ENGINEER

ATTEST OR WITNESS:

Venus C Durant

Venus C. Durant

Sr. Executive Assistant

Public Works Commission Fayetteville, N.C.

D. W. Trego

David W. Trego
General Manager
Second Party

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.

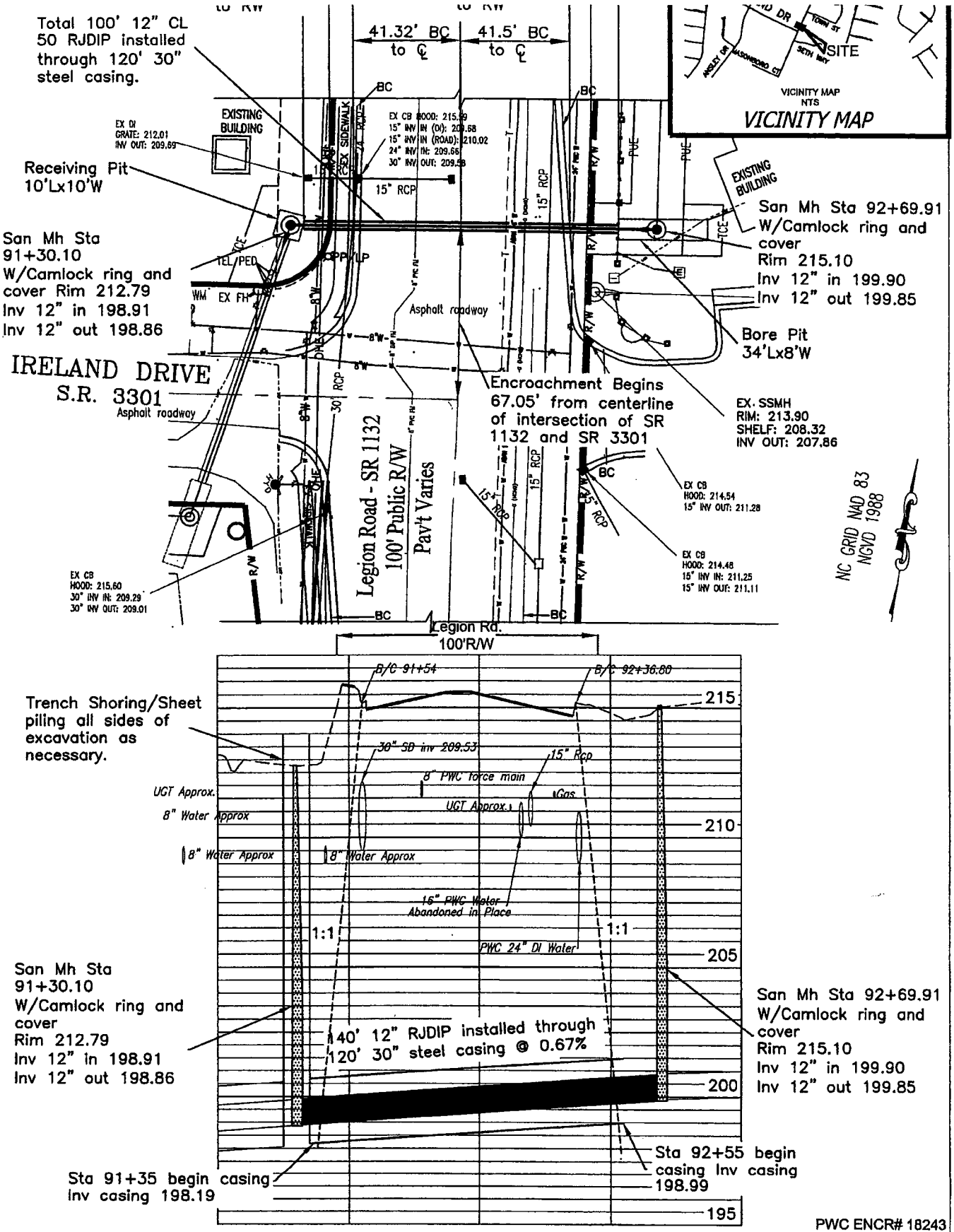
When the applicant is not a corporation, then his signature must be witnessed by one person. The address should be included in this agreement and the names of all persons signing the agreement should be typed directly below their signature.

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



PWC ENCR# 18243

Based on a partial survey by:
MOORMAN, KIZER & REITZEL, INC.
115 BROADFOOT AVE.
FAYETTEVILLE, N.C. 28305

THIS MAP IS NOT A CERTIFIED SURVEY AND HAS NOT BEEN REVIEWED BY A LOCAL GOVERNMENT

5'

SYM	DESCRIPTION	BY
	REVISIONS	

PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE, N.C.

MOORMAN, KIZER & REITZEL, INC.

Transportation

PAT McCRORY
Governor

NICHOLAS J. TENNYSON
Secretary

March 30, 2016

Mr. Joe Glass, PE, Water Resources Engineer/Manager
Public Works Commission
ATTN: Mr. John Prevette
Post Office Box 1089
Fayetteville, NC 28302

SUBJECT: Encroachment Agreement on NC Highway 162 (Elk Road) for the installation of 166'± of 12" Φ sanitary sewer line encased in 166'± of 30" Φ steel casing with various appurtenances (Sequence #26-066-16).

Dear Sir:

Attached is an approved R/W form 16.1 and plans for the installation of 166'± of 12" Φ sanitary sewer line encased in 166'± of 30" Φ steel casing by bore and jack method with various appurtenances on NC Highway 162 (Elk Road) in the City of Fayetteville in Cumberland County as shown on the attached plans (PWC encroachment #18241).

Location:

Route	**At a point**	**Towards**
NC 162	0.3 miles± northwest of the intersection of NC Highway 162 (Elk Road) and SR 1132 (Legion Road)	

This encroachment is approved subject to the following:

1. Mr. Bill Hammond, Highway Maintenance Engineer at (910) 486-1421 and Mr. Troy L. Baker, Senior Assistant District Engineer at (910) 486-1496 shall be notified a minimum of three (3) days before construction is to begin.
2. Traffic will be maintained and proper signs, signal lights, flagmen and other warning devices will be provided for the protection of traffic, in conformance with the latest **MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS.** All contractor personnel will be required to wear a class II ANSI approved safety vest while working within the DOT right of way.
3. **All lanes of traffic on NC Highway 162 (Elk Road) are to be open during the hours of 6:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. No lane of traffic shall be closed on holidays, special events, or as directed by the engineer. Traffic shall be maintained at all times.**
4. The contractor shall not begin construction until after all traffic control and erosion control devices have been installed to the satisfaction of the District Engineer.

5. **The proposed utilities shall be constructed under all existing culverts and/or the future extension of existing culverts. Two (2) feet minimum separation shall be maintained between the proposed water line(s) and all existing culverts at all locations.**

6. Any asphalt that is damaged as a result of construction shall be repaired at the encroaching party's expense. An NCDOT approved asphalt mix shall be used for all repairs within NCDOT rights of way. Contact Mr. Troy L. Baker, Senior Assistant District Engineer for acceptance of asphalt mix designs.

7. **All fill areas/backfill shall be compacted to 95% density in accordance with AASHTO T99 as modified by the North Carolina Department of Transportation. All material to a depth of 8 inches below the finished surface shall be compacted to a density equal to at least 100% of that obtained by compacting a sample of the material in accordance with AASHTO T99 as modified by the department. The subgrade shall be compacted at a moisture content which is approximately that required to produce the maximum density indicated by the above test method. The contractor shall dry or add moisture to the subgrade when required to provide a uniformly compacted and acceptable subgrade. The trench backfill material shall meet the Statewide Borrow criteria. The trench should be backfilled in accordance with Section 300-7 of the latest NCDOT Standard Specifications for Roads and Structures and Amendments or Supplementals thereto.**

8. All utility facilities, including but not limited to manholes, valve boxes, meter boxes, splice boxes, junction boxes, vaults, and covers within NCDOT right of way shall have been designed for HS-20 loading. A listing of currently approved manholes, valve boxes, and vaults is available at the following site: https://apps.dot.state.ns.us.vendor/approvedproducts . If any proposed structure is not of a design pre-approved by NCDOT, the encroaching party shall submit details and calculations designed by a Professional Engineer registered in North Carolina for approval prior to construction.

9. All utility access points, including but not limited to manholes, splice boxes, junction boxes, and vaults shall be located outside of the right of way line. Manholes, splice boxes, junction boxes, and vaults shall not be placed in the ditch line, side slopes of the ditches, or in the pavement. All manholes, splice boxes, junction boxes, vaults, and covers shall be flush with the ground when located within the vehicle recovery area.

10. The party of the second part agrees to provide traffic control devices, lane closures, road closures, positive protection and/or any other warning or positive protection devices necessary for the safety of motorists and workers during construction and any subsequent maintenance. This shall be performed in conformance with the latest **NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures** and Amendments or Supplementals thereto. When there is no guidance provided in the Roadway Standard Drawings or Specifications, comply with the **Manual on Uniform Traffic Control Devices for Streets and Highways** and Amendment or Supplemental thereto. Information as to the above rules and regulations may be obtained from the Division Engineer of the party of the first part. **All contractor personnel will be required to wear a class II ANSI approved safety vest while working within the DOT right of way.**

11. Disturbed areas shall have an established stand of vegetation according to the attached specifications for erosion control.
12. A copy of this agreement and letter of approval will be required to be available at the construction site at all times.
13. Written notice of the completion of the work will be furnished to the District Engineer, P. O. Box 1150, Fayetteville, North Carolina 28302, when the work has been completed.
14. SDR-26 PVC pipe shall not be used on NCDOT Rights of Way for lines under pressure.
15. The Contractor shall comply with all OSHA requirements and provide a competent person on site to supervise excavation at all times. Please be reminded that all OSHA Standards regarding trenching and shoring should be strictly adhered to.
16. No material storage shall be allowed along the shoulders of the roadway, and during non-working hours, equipment shall be parked as close to the right of way line as possible and shall be properly barricaded so that no equipment obstruction shall be within the Clear Recovery Area. No parking or material storage shall be allowed along the shoulders of any state maintained roadway.
17. The Department of Transportation does not guarantee the right of way on this road, nor will it be responsible for any claim for damages brought by any property owner by reason of the installation.
18. The encroaching party shall comply with all applicable federal, state, and local environmental regulations, and shall obtain all necessary federal, state, and local environmental permits, including but not limited to, those related to sediment control, storm water, wetland, streams, endangered species, and historical sites.
19. Excavation within 500 feet of a signalized intersection will require notification by the party of the second part to the Division Traffic Engineer at telephone number 910-486-1452. All traffic signal or detection cables must be located prior to excavation.
20. **Trenching, bore pits and/or other excavations shall not be left overnight. The contractor shall comply with all OSHA requirements and provide a competent person on site to supervise excavation at all times.**
21. Excavations inside the theoretical 1:1 slope from the existing edge of pavement to the bottom of the nearest excavation wall should be made in accordance with the following conditions:
22. The trench backfill material should meet the Statewide Borrow Criteria. The trench should be backfilled in accordance with Section 300-7of the latest NCDOT Standard Specifications for Roads and Structures, which basically requires the backfill material to be placed in layers not to exceed 6 inches loose and compacted at least 95% of the density obtained by compacting a sample in accordance with AASHTO T99 as modified by the NCDOT.

23. All trench excavation inside the limits of the theoretical 1:1 slope, as defined by the policy, should be completely backfilled and compacted at the end of each construction day. No portion of the trench shall be left open overnight.

24. Any work requiring equipment or personnel within 5' of the edge of travel lane of an undivided facility and within 10' of the edge of any travel lane of a divided facility shall require a lane closure with appropriate tapers.

25. Drainage structures shall not be blocked with excavation materials. Any drainage structure disturbed or damaged shall be restored to its original condition as directed by the District Engineer.

26. Any disturbed guardrail shall be reset according to the applicable standard or as directed by the District Engineer.

27. All driveways altered during construction shall be returned to a state comparable with the condition of the driveways prior to construction.

28. All roadway signs which are removed which are removed due to construction shall be reinstalled as soon as possible.

29. Any proposed driveway connections onto NCDOT roadways will require an approved driveway permit. The approval of this Two Party encroachment (RW 16.1) does not constitute approval of any proposed driveway connections. For further information, contact Mr. Troy L. Baker, Senior Assistant District Engineer at (910) 486-1496.

30. Excavated areas adjacent to pavement having more than a 2" drop shall be safed up at a 6:1 or flatter slope and designated by appropriate delineation during periods of inactivity, including, but not limited to, night and weekend hours. Excavated material shall not be placed on the roadway at any time.

31. **NCDOT reserves the right to further limit, restrict, or suspend operations within the Right of Way if, in the opinion of NCDOT, safety or traffic conditions warrant such action.**

32. It shall be the responsibility of the encroaching party to determine the location of other utilities within the encroachment area. The encroaching party shall be responsible for notifying other utility owners and providing protection and safeguards to prevent damage or interruption to existing facilities and to maintain accessibility to existing utilities.

33. **A qualified NCDOT inspector should be on site at all times during construction. The encroaching party should be required to reimburse NCDOT for the cost of providing the inspector. If NCDOT cannot supply an inspector, the encroaching party (not the utility contractor) should make arrangements to have a qualified inspector under the supervision of a Professional Engineer registered in North Carolina, on site at all times. The Registered Engineer should be required to certify that the utility was installed in accordance with the encroachment agreement and that the backfill material meets the Statewide Borrow Criteria.**

34. All temporary and final paving markings are the responsibility of the encroaching party. Final pavement markings and sign plans shall be submitted to the Division Traffic Engineer at telephone number 910-486-1452 for review and approval.
35. Any utility marker required shall be as close to the right of way line as possible. If it is not feasible to install markers at or near the right of way line, written approval specific to this site shall be obtained from the District Engineer.
36. The pavement marking contractor is required to have at least one member of every pavement marking crew that is working on the project, preferably the Crew Supervisor, be certified through the NCDOT Pavement Marking Technician Certification Process. For more information please contact the Work Zone Traffic Control Unit at (919) 773-2800 or http://www.ncdot.org/doh/preconstruct/wztc/"
37. Prior to installing pavement markings, contact Mr. Kent Langdon with the NCDOT Division Six Traffic Services Unit at 910-486-1452 to review the proposed pavement-marking layout. This notification should take place a minimum of 48 hours in advance of the pavement marking installation.
38. Failure to contact the Traffic Services Unit to review the pavement-marking layout prior to installation may result in the removal and reinstallation of the markings at the expense of the Permittee.

NCDOT WORK ZONE TRAFFIC CONTROL QUALIFICATIONS AND TRAINING PROGRAM

This program requires qualified and trained Work Zone Flaggers in every flagging operation (July 2010) and qualified and trained Work Zone Traffic Control Supervisors on Significant Projects (July 2011). It is intended for the program to include anyone working within NCDOT Right of Way including work associated with NCDOT construction and encroachment agreements as well as all NCDOT operations.

Training for this certification will be provided by NCDOT approved training sources and/or private entities that have been pre-approved to train themselves. Additional information will be provided as this program progresses. If you have questions, visit our web site at www.ncdot.org/~wztc, or contact Stuart Bourne, PE with NCDOT Traffic Management Unit at (919) 662-4338 or sbourne@ncdot.gov.

If further information or assistance is needed in reference to this project, please feel free to call Mr. Randy K. Wise, PE, District Engineer at (910) 486-1496.

Sincerely,

Greg W. Burns, PE
Division Engineer

GWB:tlb

cc: Mr. Randy K. Wise, PE, District Engineer, w/attachments
Mr. Bill Hammond, PE, Highway Maintenance Engineer, w/attachment

TRAFFIC CONTROL AND WORK ZONE SAFETY

The Contractor shall maintain traffic during construction and provide, install, and maintain all traffic control devices in accordance with these project guidelines, the Project Special Provisions, North Carolina Department of Transportation Standard Specifications for Roads and Structures 2012, and the current edition of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor shall utilize complete and proper traffic controls and traffic control devices during all operations. All traffic control and traffic control devices required for any operation shall be functional and in place prior to the commencement of that operation. Signs for temporary operations shall be removed during periods of inactivity. The Contractor is required to leave the project in a manner that will be safe to the traveling public and which will not impede motorists.

Traffic movements through lane closures on roads with two way traffic shall be controlled by flaggers stationed at each end of the work zone. In situations where sight distance is limited, the Contractor shall provide additional means of controlling traffic, including, but not limited to, two-way radios, pilot vehicles, or additional flaggers. Flaggers shall be competent personnel, adequately trained in flagging procedures, and furnished with proper safety devices and equipment, including, but not limited to, safety vests and stop/slow paddles.

All personnel when working in traffic areas or areas in close proximity to traffic shall wear an approved safety vest, or shirt or jacket which meets the color requirements of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor shall comply with all applicable Federal, State, and local laws, ordinances, and regulations governing safety, health, and sanitation, and shall provide all safeguards, safety devices, and protective equipment, and shall take any other needed actions, on his own responsibility that are reasonably necessary to protect the life and health of employees on the job and the safety of the public, and to protect property in connection with the performance of the work covered by the contract.

Failure to comply with any of the requirements for safety and traffic control of this contract shall result in suspension of work as provided in subarticle 108-7(2) of the Standard Specifications.

SPECIFICATIONS FOR EROSION CONTROL

The Contractor shall seed all disturbed areas as directed by the Engineer, in accordance with Section 1660 of the Standard Specifications. Seeding and mulching shall immediately follow shoulder construction operations and in no case shall shoulder construction operations exceed seeding and mulching operations by more than two weeks without written permission of the Engineer. Failure to meet this requirement shall be cause to cease all operations until it can be met.

Seeding and Mulching: (East)

The kinds of seed and fertilizer, and the rates of application of seed, fertilizer, and limestone, shall be as stated below. During periods of overlapping dates, the kind of seed to be used shall be determined by the Engineer. All rates are in pounds per acre.

The kinds of seed and fertilizer, and the rates of application of seed, fertilizer, and limestone, shall be as stated below. During periods of overlapping dates, the kind of seed to be used shall be determined. All rates are in pounds per acre.

All Roadway Areas

March 1 - August 31		**September 1 - February 28**	
50#	Tall Fescue	50#	Tall Fescue
10#	Centipede	10#	Centipede
25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)
500#	Fertilizer	500#	Fertilizer
4000#	Limestone	4000#	Limestone

Waste and Borrow Locations

March 1 – August 31		**September 1 - February 28**	
75#	Tall Fescue	75#	Tall Fescue
25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)
500#	Fertilizer	500#	Fertilizer
4000#	Limestone	4000#	Limestone

Note: 50# of Bahiagrass may be substituted for either Centipede or Bermudagrass only upon Engineer's request.

Approved Tall Fescue Cultivars

2nd Millennium	Duster	Magellan	Rendition
Avenger	Endeavor	Masterpiece	Scorpion
Barlexas	Escalade	Matador	Shelby
Barlexas II	Falcon II, III, IV & V	Matador GT	Signia
Barrera	Fidelity	Millennium	Silverstar
Barrington	Finesse II	Montauk	Southern Choice II
Biltmore	Firebird	Mustang 3	Stetson
Bingo	Focus	Olympic Gold	Tarheel
Bravo	Grande II	Padre	Titan Ltd
Cayenne	Greenkeeper	Paraiso	Titanium
Chapel Hill	Greystone	Picasso	Tomahawk
Chesapeake	Inferno	Piedmont	Tacer
Constitution	Justice	Pure Gold	Trooper
Chipper	Jaguar 3	Prospect	Turbo
Coronado	Kalahari	Quest	Ultimate
Coyote	Kentucky 31	Rebel Exeda	Watchdog
Davinci	Kitty Hawk	Rebel Sentry	Wolfpack
Dynasty	Kitty Hawk 2000	Regiment II	
Dominion	Lexington	Rembrandt	

On cut and fill slopes 2:1 or steeper Centipede shall be applied at the rate of 5 pounds per acre and add 20# of Sericea Lespedeza from January 1 - December 31.

Fertilizer shall be 10-20-20 analysis. A different analysis of fertilizer may be used provided the 1-2-2 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as a 10-20-20 analysis and as directed.

All areas seeded and mulched shall be tacked with asphalt. Crimping of straw in lieu of asphalt tack shall not be allowed on this project.

CRIMPING STRAW MULCH

Crimping shall be required on this project adjacent to any section of roadway where traffic is to be maintained or allowed during construction. In areas within six feet of the edge of pavement, straw is to be applied and then crimped. After the crimping operation is complete, an additional application of straw shall be applied and immediately tacked with a sufficient amount of undiluted emulsified asphalt.

Straw mulch shall be of sufficient length and quality to withstand the crimping operation.

Crimping equipment including power source shall be subject to the approval of the Engineer providing that maximum spacing of crimper blades shall not exceed 8".

Within seven (7) calendar days to fourteen (14) calendar days of completion of any phase of grading, all disturbed areas shall be planted or otherwise provided with temporary or permanent ground cover, devices, or structures sufficient to restrain erosion. The Erosion and Sediment Control plan will identify the areas that require seven (7) and/or fourteen (14) calendar day ground stabilization. The Contractor is herein advised to follow all current regulations set forth by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Water Quality (DWQ) as defined in the *General Stormwater Permit for Construction Activities NCG-010000.*

Attachment # 1

Special Provisions

Untrenched Construction

Under no condition shall jetting or wet boring, with water, or utility pipelines or encasements under pavements be allowed.

Boring and Jacking

Smooth wall or spiral weld steel pipe may be jacked through dry bores slightly larger than the pipe bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of the encasement pipe shall be butt-welded to the section previously jacked into place. Encasements shall extend at shoulder sections as shown on Attachment # 2. Encasements shall extend to a point outside of the 1:1 projection from three (3) feet behind curbs to the bottom of the nearest pit excavation wall in curb and gutter sections as shown on Attachment # 3.

If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe at ten (10) foot centers and the voids filled with 1:3 Portland Cement Grout at sufficient pressure to prevent settlement in the roadway.

In the event an obstruction is encountered during boring and jacking operations, the auger is to be withdrawn and the excessive pipe is to be cut off, capped and filled with 1:3 Portland Cement Grout at sufficient pressure to fill all voids before moving to another site.

Size and wall thickness (3' min. to 10' max. cover) of smooth wall or spiral welded encasement pipe for boring and jacking is as follows:

Pipe Sizes (O.D.)	Wall Thickness
4' to 12-3/4"	0.188
16" to 24"	0.250
30"	0.312
36"	0.375
48"	0.500

The Engineer on record is responsible for the encasement pipe design for cover greater than 10'.

Materials, joints, protective coating, grouting, wall thickness of carrier pipe, welds and cathodic protection shall be in accordance with the applicable industry or governmental codes, as well as the specifications of the Department of Transportation.

Casing pipe shall be sealed at the ends to prevent flowing water and debris from entering the annular space between the casing and the carrier. Plug with concrete, brick link seal, or other material approved by the District Engineer. Ensure drainage of encasement by leaving a 1 inch diameter weep hole in the seal of the lower end of the encasement.

Pump or place flowable fill into the annular void between the carrier pipe and casing pipe 36 inches or larger.

The grade of the top of the pipe or casing within rights-of-way should provide minimum bury as follows:

A.	Longitudinal installations	3'
B.	Crossings under roadways	3' (Below travel surface)
C.	Crossings under ditches (Paved & unpaved)	2'

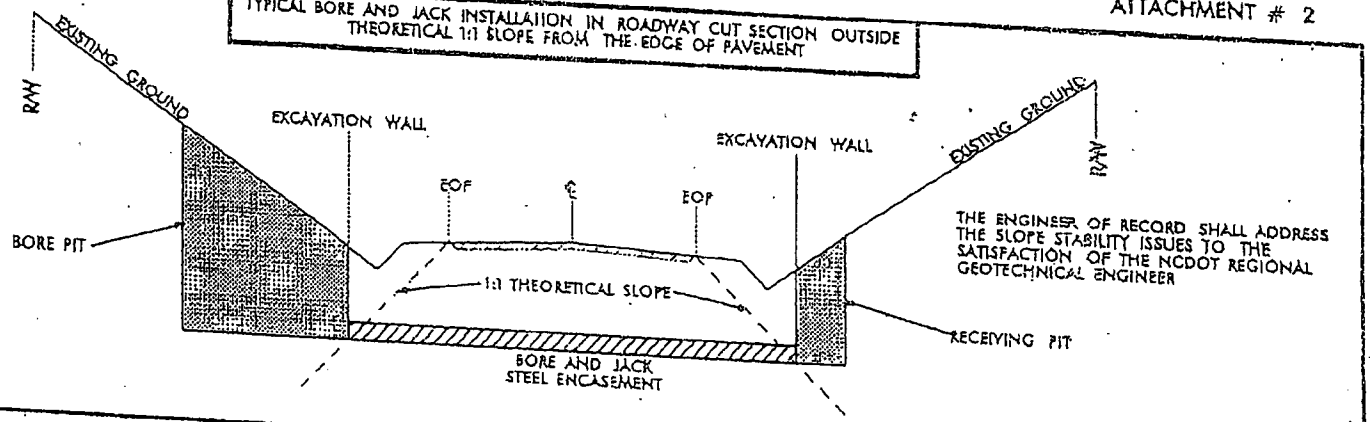
Pipelines carrying flammable, corrosive, expansive energized or unstable transmittants must comply with State, Federal and Utility Codes. In no case shall the depth of bury be less than as indicated above.

REV. 3/11/09

SHOULDER SECTIONS

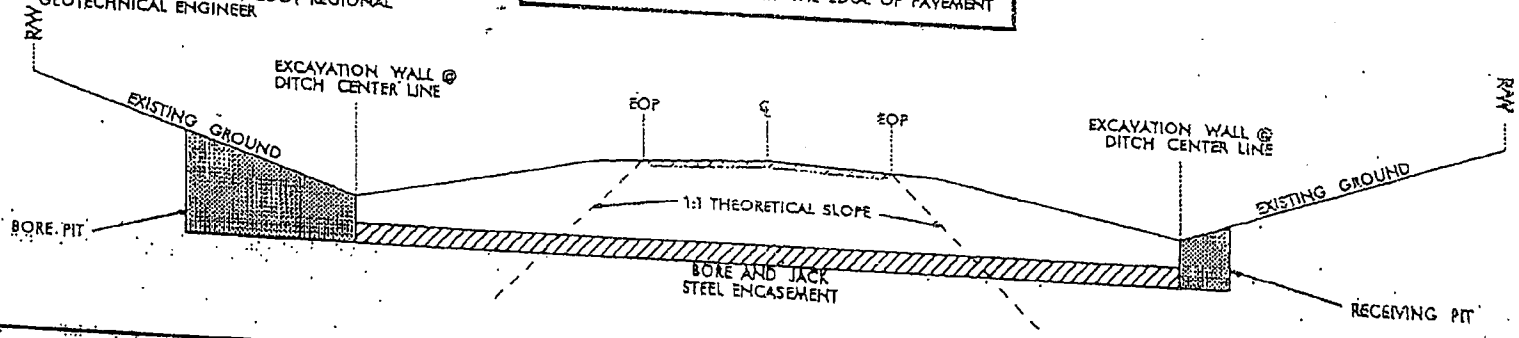
ATTACHMENT # 2

TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION OUTSIDE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT



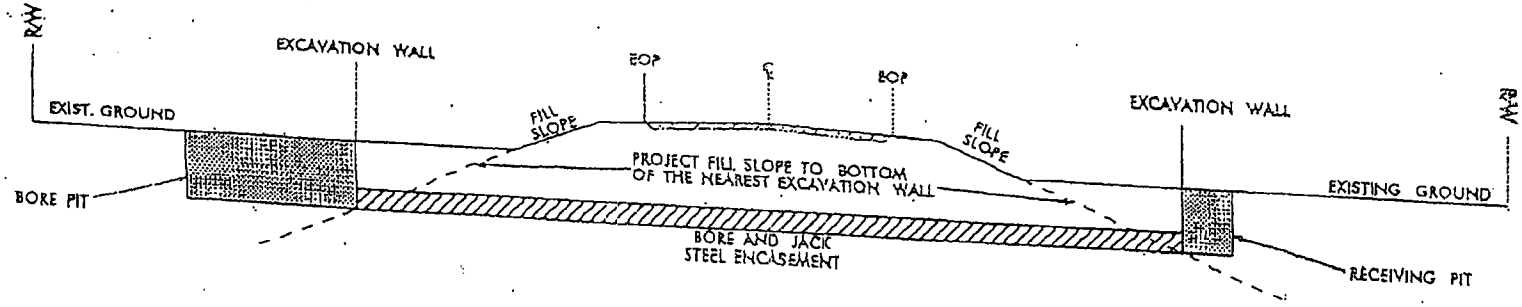
THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER

TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION WITH DITCHES OUTSIDE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT



THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER

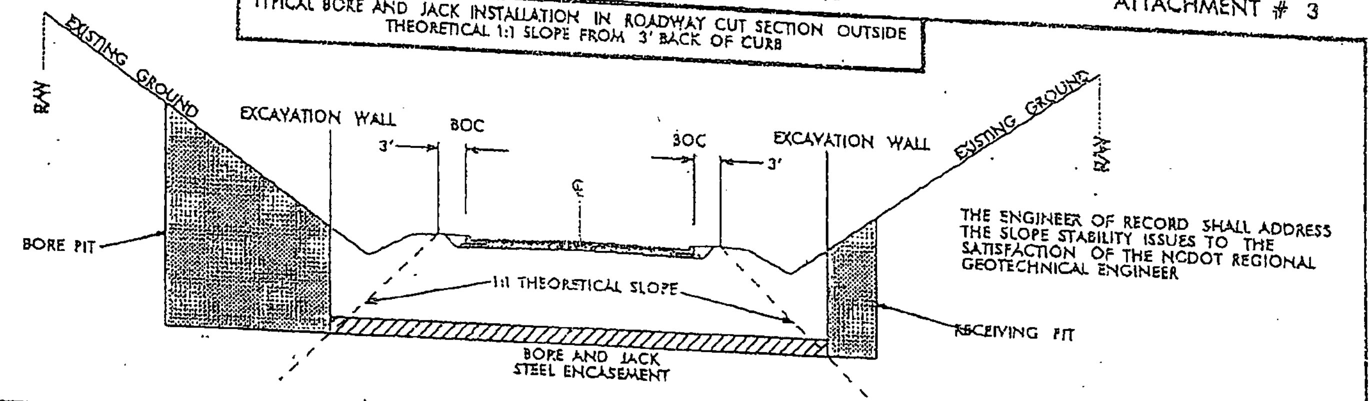
TYPICAL BORE AND JACK INSTALLATION IN ROADWAY IN FILL SECTION



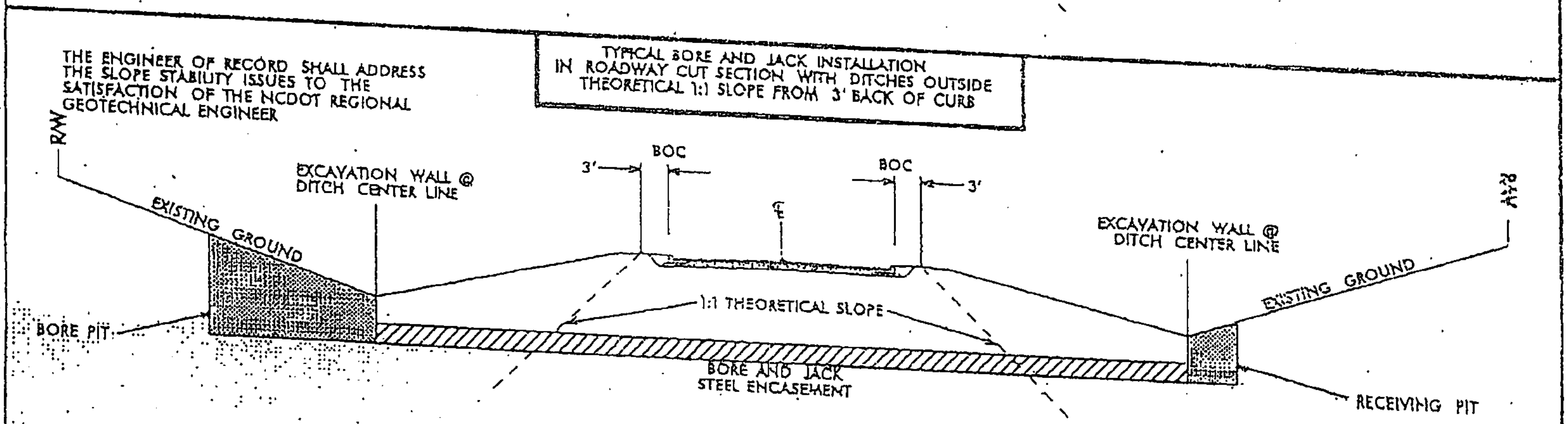
Rev. 3/1/09

CURB AND GUTTER SECTIONS

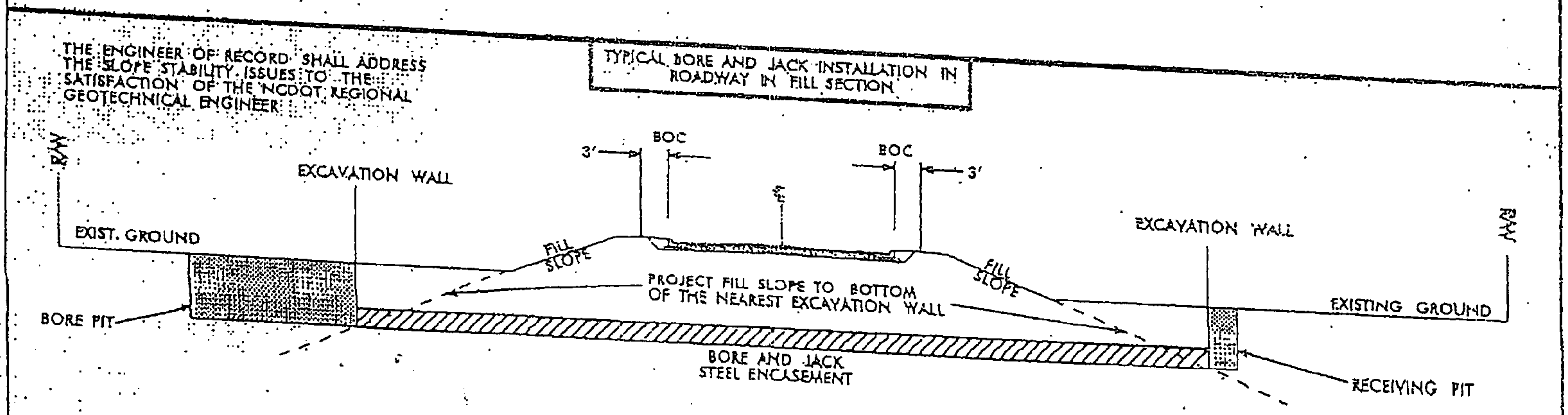
ATTACHMENT # 3



TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION OUTSIDE THEORETICAL 1:1 SLOPE FROM 3' BACK OF CURB



TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION WITH DITCHES OUTSIDE THEORETICAL 1:1 SLOPE FROM 3' BACK OF CURB



TYPICAL BORE AND JACK INSTALLATION IN ROADWAY IN FILL SECTION

REV. 3/11/02

PUBLIC WORKS COMMISSION
OF THE CITY OF FAYETTEVILLE
ELECTRIC & WATER UTILITIES

955 OLD WILMINGTON RD
P.O. BOX 1089
FAYETTEVILLE, NORTH CAROLINA 28302-1089
TELEPHONE (910) 483-1401
WWW.FAYPWC.COM

January 7, 2016

Randy K. Wise, P.E.
District Engineer
Department of Transportation
Post Office Box 1150
Fayetteville, North Carolina 28302

SUBJECT: LEGION ROAD SEWER IMPROVEMENTS
Erosion Control for PWC Encr #18241
12" DI Sewer Main on HWY 162 (Elk Road)
for PWC Drawing AS-14918MM

Dear Mr. Wise:

This letter is to acknowledge that the above referenced activity will disturb less than one acre. Therefore, an approved erosion and sediment control plan from NCDENR is not required. However, appropriate measures will be implemented during construction to prevent erosion and offsite sedimentation.

If there are further questions, please contact John Prevette (223-4409) or Sam Powers (223-4370).

Very truly yours,
PUBLIC WORKS COMMISSION

Joseph E. Glass, P.E.
Water Resources Engineer/Manager

JG:jep
Enclosures
cc: Business Planning

DIVISION 6-DISTRICT 2

THIS AGREEMENT, made and entered into this the 7 day of JAN 20 16 by and between the Department of Transportation, party of the first part; and Public Works Commission of Fayetteville, North Carolina party of the second part,

WITNESSETH

THAT WHEREAS, the party of the second part desires to encroach on the right of way of the public road designated as Route(s) HWY 162 (Elk Road) , located 0.3 miles northwest of the intersection of HWY 162 and SR 1132

with the construction and/or erection of: 166' of 12" RJDI in 24" steel casing installed across the right-of-way by jack and bore as shown on PWC Drawing AS-14918MM

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:

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: M.W. [signature] TS

DIVISION ENGINEER

ATTEST OR WITNESS:

Venus C. Durant

Sr. Executive Assistant

Public Works Commission Fayetteville, N.C.

D.W. Trego

David W. Trego
General Manager
Second Party

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.

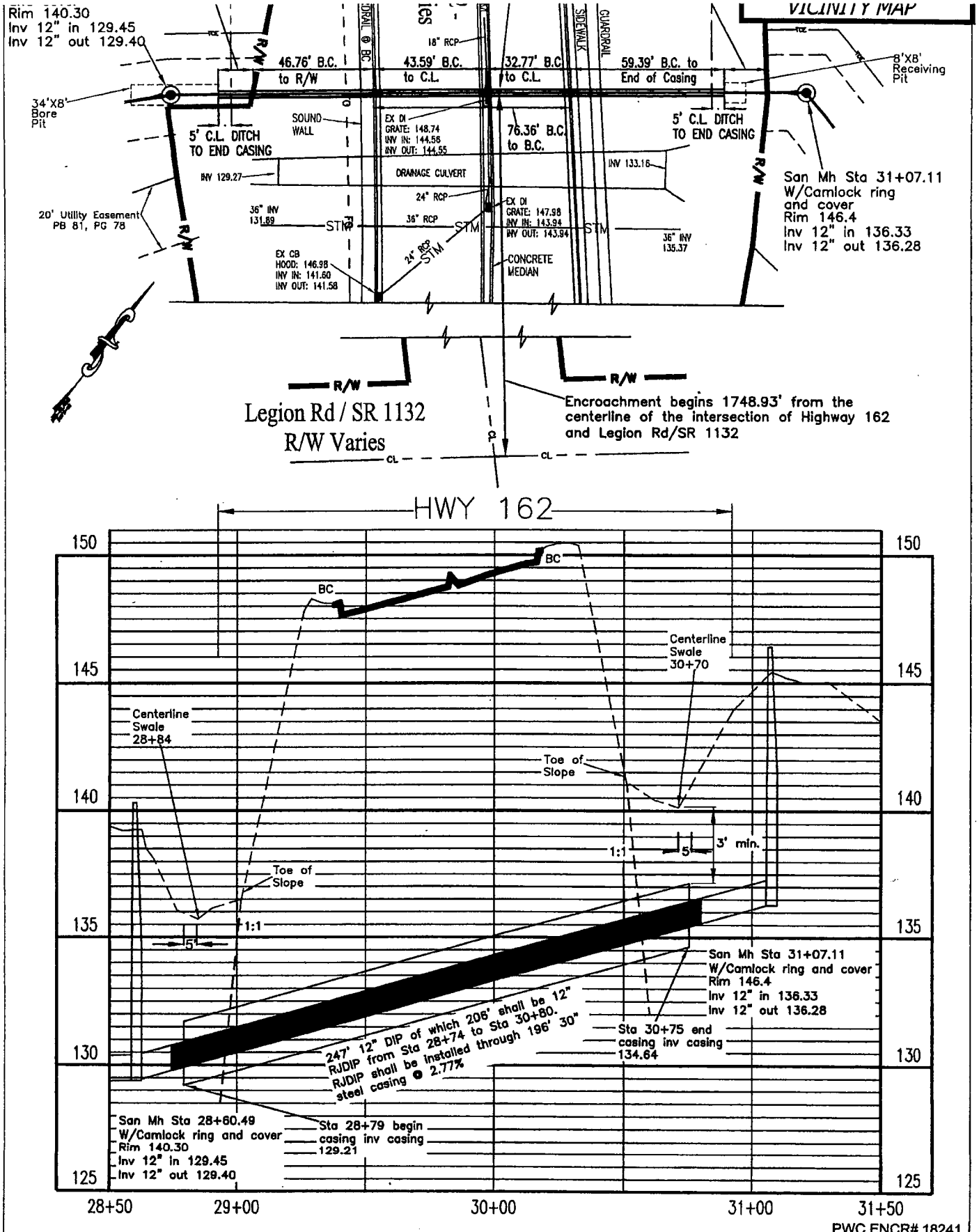
When the applicant is not a corporation, then his signature must be witnessed by one person. The address should be included in this agreement and the names of all persons signing the agreement should be typed directly below their signature.

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



PWC ENCR# 18241

Based on a partial survey by:
MOORMAN, KIZER & REITZEL, INC.
115 BROADFOOT AVE.
FAYETTEVILLE, N.C. 28305

This map is not a certified survey and has

5'

SYM	DESCRIPTION	BY
	REVISIONS	

PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE, N.C.

MOORMAN, KIZER & REITZEL, INC.

Transportation

PAT McCRORY
Governor

NICHOLAS J. TENNYSON
Secretary

March 30, 2016

Mr. Joe Glass, PE, Water Resources Engineer/Manager
Public Works Commission
ATTN: Mr. John Prevette
Post Office Box 1089
Fayetteville, NC 28302

SUBJECT: Encroachment Agreement on SR 3301 (Ireland Drive) for the installation of 89'± of 12" Φ sanitary sewer line encased in 89'± of 24" Φ steel casing with various appurtenances (Sequence #26-064-16).

Dear Sir:

Attached is an approved R/W form 16.1 and plans for the installation of 89'± of 12" Φ sanitary sewer line encased in 89'± of 24" Φ steel casing by bore and jack method with various appurtenances on SR 3301 (Ireland Drive) in the City of Fayetteville in Cumberland County as shown on the attached plans (PWC encroachment #18242).

Location:

Route	**At a point**	**Towards**
SR 3301	87'± northwest of the intersection of SR 3301 (Ireland Drive) and SR 1132 (Legion Road)	The northeast

This encroachment is approved subject to the following:

1. Mr. Bill Hammond, Highway Maintenance Engineer at (910) 486-1421 and Mr. Troy L. Baker, Senior Assistant District Engineer at (910) 486-1496 shall be notified a minimum of three (3) days before construction is to begin.
2. Traffic will be maintained and proper signs, signal lights, flagmen and other warning devices will be provided for the protection of traffic, in conformance with the latest **MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS.** All contractor personnel will be required to wear a class II ANSI approved safety vest while working within the DOT right of way.
3. **All lanes of traffic on SR 3301 (Ireland Drive) are to be open during the hours of 6:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. No lane of traffic shall be closed on holidays, special events, or as directed by the engineer. Traffic shall be maintained at all times.**
4. The contractor shall not begin construction until after all traffic control and erosion control devices have been installed to the satisfaction of the District Engineer.

State of North Carolina | Department of Transportation | NCDOT Division Six / District Two
600 Southern Avenue | P.O. Box 1150 | Fayetteville, NC 28302
Phone (910) 486-1496 Fax (910) 437-2529

5. **The proposed utilities shall be constructed under all existing culverts and/or the future extension of existing culverts. Two (2) feet minimum separation shall be maintained between the proposed water line(s) and all existing culverts at all locations.**

6. **The installation of the proposed sanitary sewer lines, sanitary sewer manholes and/or associated appurtenances within the rights of way of SR 3301 (Ireland Drive) shall not be permitted as part of this encroachment agreement.**

7. Any excavation and/or grading within the rights of way of SR 3301 (Ireland Drive) shall be done in accordance with the latest **NCDOT Standard Specifications for Roads and Structures, Polocies and Procedures for Accommodating Utilities on Highway Rights of Way** and Amendments or Supplementals thereto. Necessary precautions shall be taken and grading methods shall be used that will minimize erosion, siltation and pollution throughout the excavating/grading operations; and vegetation cover shall be established promptly after excavating/grading operations.

8. Any asphalt that is damaged as a result of construction shall be repaired at the encroaching party's expense. An NCDOT approved asphalt mix shall be used for all repairs within NCDOT rights of way. Contact Mr. Troy L. Baker, Senior Assistant District Engineer for acceptance of asphalt mix designs.

9. **All fill areas/backfill shall be compacted to 95% density in accordance with AASHTO T99 as modified by the North Carolina Department of Transportation. All material to a depth of 8 inches below the finished surface shall be compacted to a density equal to at least 100% of that obtained by compacting a sample of the material in accordance with AASHTO T99 as modified by the department. The subgrade shall be compacted at a moisture content which is approximately that required to produce the maximum density indicated by the above test method. The contractor shall dry or add moisture to the subgrade when required to provide a uniformly compacted and acceptable subgrade. The trench backfill material shall meet the Statewide Borrow criteria. The trench should be backfilled in accordance with Section 300-7 of the latest NCDOT Standard Specifications for Roads and Structures and Amendments or Supplementals thereto.**

10. All utility facilities, including but not limited to manholes, valve boxes, meter boxes, splice boxes, junction boxes, vaults, and covers within NCDOT right of way shall have been designed for HS-20 loading. A listing of currently approved manholes, valve boxes, and vaults is available at the following site: https://apps.dot.state.ns.us.vendor/approvedproducts . If any proposed structure is not of a design pre-approved by NCDOT, the encroaching party shall submit details and calculations designed by a Professional Engineer registered in North Carolina for approval prior to construction.

11. All utility access points, including but not limited to manholes, splice boxes, junction boxes, and vaults shall be located outside of the right of way line. Manholes, splice boxes, junction boxes, and vaults shall not be placed in the ditch line, side slopes of the ditches, or in the pavement. All manholes, splice boxes, junction boxes, vaults, and covers shall be flush with the ground when located within the vehicle recovery area.

12. The party of the second part agrees to provide traffic control devices, lane closures, road closures, positive protection and/or any other warning or positive protection devices necessary for the safety of motorists and workers during construction and any subsequent maintenance. This shall be performed in conformance with the latest **NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures** and Amendments or Supplementals thereto. When there is no guidance provided in the Roadway Standard Drawings or Specifications, comply with the **Manual on Uniform Traffic Control Devices for Streets and Highways** and Amendment or Supplemental thereto. Information as to the above rules and regulations may be obtained from the Division Engineer of the party of the first part. **All contractor personnel will be required to wear a class II ANSI approved safety vest while working within the DOT right of way.**
13. Disturbed areas shall have an established stand of vegetation according to the attached specifications for erosion control.
14. A copy of this agreement and letter of approval will be required to be available at the construction site at all times.
15. Written notice of the completion of the work will be furnished to the District Engineer, P. O. Box 1150, Fayetteville, North Carolina 28302, when the work has been completed.
16. SDR-26 PVC pipe shall not be used on NCDOT Rights of Way for lines under pressure.
17. The Contractor shall comply with all OSHA requirements and provide a competent person on site to supervise excavation at all times. Please be reminded that all OSHA Standards regarding trenching and shoring should be strictly adhered to.
18. No material storage shall be allowed along the shoulders of the roadway, and during non-working hours, equipment shall be parked as close to the right of way line as possible and shall be properly barricaded so that no equipment obstruction shall be within the Clear Recovery Area. No parking or material storage shall be allowed along the shoulders of any state maintained roadway.
19. The Department of Transportation does not guarantee the right of way on this road, nor will it be responsible for any claim for damages brought by any property owner by reason of the installation.
20. The encroaching party shall comply with all applicable federal, state, and local environmental regulations, and shall obtain all necessary federal, state, and local environmental permits, including but not limited to, those related to sediment control, storm water, wetland, streams, endangered species, and historical sites.
21. Excavation within 500 feet of a signalized intersection will require notification by the party of the second part to the Division Traffic Engineer at telephone number 910-486-1452. All traffic signal or detection cables must be located prior to excavation.
22. **Trenching, bore pits and/or other excavations shall not be left overnight. The contractor shall comply with all OSHA requirements and provide a competent person on site to supervise excavation at all times.**

23. Excavations inside the theoretical 1:1 slope from the existing edge of pavement to the bottom of the nearest excavation wall should be made in accordance with the following conditions:

24. The trench backfill material should meet the Statewide Borrow Criteria. The trench should be backfilled in accordance with Section 300-7of the latest NCDOT Standard Specifications for Roads and Structures, which basically requires the backfill material to be placed in layers not to exceed 6 inches loose and compacted at least 95% of the density obtained by compacting a sample in accordance with AASHTO T99 as modified by the NCDOT.

25. All trench excavation inside the limits of the theoretical 1:1 slope, as defined by the policy, should be completely backfilled and compacted at the end of each construction day. No portion of the trench shall be left open overnight.

26. Any work requiring equipment or personnel within 5' of the edge of travel lane of an undivided facility and within 10' of the edge of any travel lane of a divided facility shall require a lane closure with appropriate tapers.

27. Drainage structures shall not be blocked with excavation materials. Any drainage structure disturbed or damaged shall be restored to its original condition as directed by the District Engineer.

28. Any disturbed guardrail shall be reset according to the applicable standard or as directed by the District Engineer.

29. All driveways altered during construction shall be returned to a state comparable with the condition of the driveways prior to construction.

30. All roadway signs which are removed which are removed due to construction shall be reinstalled as soon as possible.

31. Any proposed driveway connections onto NCDOT roadways will require an approved driveway permit. The approval of this Two Party encroachment (RW 16.1) does not constitute approval of any proposed driveway connections. For further information, contact Mr. Troy L. Baker, Senior Assistant District Engineer at (910) 486-1496.

32. Excavated areas adjacent to pavement having more than a 2" drop shall be safed up at a 6:1 or flatter slope and designated by appropriate delineation during periods of inactivity, including, but not limited to, night and weekend hours. Excavated material shall not be placed on the roadway at any time.

33. **NCDOT reserves the right to further limit, restrict, or suspend operations within the Right of Way if, in the opinion of NCDOT, safety or traffic conditions warrant such action.**

34. It shall be the responsibility of the encroaching party to determine the location of other utilities within the encroachment area. The encroaching party shall be responsible for notifying other utility owners and providing protection and safeguards to prevent damage or interruption to existing facilities and to maintain accessibility to existing utilities.

35. **A qualified NCDOT inspector should be on site at all times during construction. The encroaching party should be required to reimburse NCDOT for the cost of providing the inspector. If NCDOT cannot supply an inspector, the encroaching party (not the utility contractor) should make arrangements to have a qualified inspector under the supervision of a Professional Engineer registered in North Carolina, on site at all times. The Registered Engineer should be required to certify that the utility was installed in accordance with the encroachment agreement and that the backfill material meets the Statewide Borrow Criteria.**
36. All temporary and final paving markings are the responsibility of the encroaching party. Final pavement markings and sign plans shall be submitted to the Division Traffic Engineer at telephone number 910-486-1452 for review and approval.
37. Any utility marker required shall be as close to the right of way line as possible. If it is not feasible to install markers at or near the right of way line, written approval specific to this site shall be obtained from the District Engineer.
38. The pavement marking contractor is required to have at least one member of every pavement marking crew that is working on the project, preferably the Crew Supervisor, be certified through the NCDOT Pavement Marking Technician Certification Process. For more information please contact the Work Zone Traffic Control Unit at (919) 773-2800 or http://www.ncdot.org/doh/preconstruct/wztc/"
39. Prior to installing pavement markings, contact Mr. Kent Langdon with the NCDOT Division Six Traffic Services Unit at 910-486-1452 to review the proposed pavement-marking layout. This notification should take place a minimum of 48 hours in advance of the pavement marking installation.
40. Failure to contact the Traffic Services Unit to review the pavement-marking layout prior to installation may result in the removal and reinstallation of the markings at the expense of the Permittee.

NCDOT WORK ZONE TRAFFIC CONTROL QUALIFICATIONS AND TRAINING PROGRAM

This program requires qualified and trained Work Zone Flaggers in every flagging operation (July 2010) and qualified and trained Work Zone Traffic Control Supervisors on Significant Projects (July 2011). It is intended for the program to include anyone working within NCDOT Right of Way including work associated with NCDOT construction and encroachment agreements as well as all NCDOT operations.

Training for this certification will be provided by NCDOT approved training sources and/or private entities that have been pre-approved to train themselves. Additional information will be provided as this program progresses. If you have questions, visit our web site at www.ncdot.org/~wztc, or contact Stuart Bourne, PE with NCDOT Traffic Management Unit at (919) 662-4338 or sbourne@ncdot.gov.

If further information or assistance is needed in reference to this project, please feel free to call Mr. Randy K. Wise, PE, District Engineer at (910) 486-1496.

Sincerely,

Greg W. Burns, PE
Division Engineer

GWB:tlb

cc: Mr. Randy K. Wise, PE, District Engineer, w/attachments
Mr. Bill Hammond, PE, Highway Maintenance Engineer, w/attachment

TRAFFIC CONTROL AND WORK ZONE SAFETY

The Contractor shall maintain traffic during construction and provide, install, and maintain all traffic control devices in accordance with these project guidelines, the Project Special Provisions, North Carolina Department of Transportation Standard Specifications for Roads and Structures 2012, and the current edition of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor shall utilize complete and proper traffic controls and traffic control devices during all operations. All traffic control and traffic control devices required for any operation shall be functional and in place prior to the commencement of that operation. Signs for temporary operations shall be removed during periods of inactivity. The Contractor is required to leave the project in a manner that will be safe to the traveling public and which will not impede motorists.

Traffic movements through lane closures on roads with two way traffic shall be controlled by flaggers stationed at each end of the work zone. In situations where sight distance is limited, the Contractor shall provide additional means of controlling traffic, including, but not limited to, two-way radios, pilot vehicles, or additional flaggers. Flaggers shall be competent personnel, adequately trained in flagging procedures, and furnished with proper safety devices and equipment, including, but not limited to, safety vests and stop/slow paddles.

All personnel when working in traffic areas or areas in close proximity to traffic shall wear an approved safety vest, or shirt or jacket which meets the color requirements of the Manual of Uniform Traffic Control Devices (MUTCD).

The Contractor shall comply with all applicable Federal, State, and local laws, ordinances, and regulations governing safety, health, and sanitation, and shall provide all safeguards, safety devices, and protective equipment, and shall take any other needed actions, on his own responsibility that are reasonably necessary to protect the life and health of employees on the job and the safety of the public, and to protect property in connection with the performance of the work covered by the contract.

Failure to comply with any of the requirements for safety and traffic control of this contract shall result in suspension of work as provided in subarticle 108-7(2) of the Standard Specifications.

SPECIFICATIONS FOR EROSION CONTROL

The Contractor shall seed all disturbed areas as directed by the Engineer, in accordance with Section 1660 of the Standard Specifications. Seeding and mulching shall immediately follow shoulder construction operations and in no case shall shoulder construction operations exceed seeding and mulching operations by more than two weeks without written permission of the Engineer. Failure to meet this requirement shall be cause to cease all operations until it can be met.

Seeding and Mulching: (East)

The kinds of seed and fertilizer, and the rates of application of seed, fertilizer, and limestone, shall be as stated below. During periods of overlapping dates, the kind of seed to be used shall be determined by the Engineer. All rates are in pounds per acre.

The kinds of seed and fertilizer, and the rates of application of seed, fertilizer, and limestone, shall be as stated below. During periods of overlapping dates, the kind of seed to be used shall be determined. All rates are in pounds per acre.

All Roadway Areas

March 1 - August 31		**September 1 - February 28**	
50#	Tall Fescue	50#	Tall Fescue
10#	Centipede	10#	Centipede
25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)
500#	Fertilizer	500#	Fertilizer
4000#	Limestone	4000#	Limestone

Waste and Borrow Locations

March 1 – August 31		**September 1 - February 28**	
75#	Tall Fescue	75#	Tall Fescue
25#	Bermudagrass (hulled)	35#	Bermudagrass (unhulled)
500#	Fertilizer	500#	Fertilizer
4000#	Limestone	4000#	Limestone

Note: 50# of Bahiagrass may be substituted for either Centipede or Bermudagrass only upon Engineer's request.

Approved Tall Fescue Cultivars

2nd Millennium	Duster	Magellan	Rendition
Avenger	Endeavor	Masterpiece	Scorpion
Barlexas	Escalade	Matador	Shelby
Barlexas II	Falcon II, III, IV & V	Matador GT	Signia
Barrera	Fidelity	Millennium	Silverstar
Barrington	Finesse II	Montauk	Southern Choice II
Biltmore	Firebird	Mustang 3	Stetson
Bingo	Focus	Olympic Gold	Tarheel
Bravo	Grande II	Padre	Titan Ltd
Cayenne	Greenkeeper	Paraiso	Titanium
Chapel Hill	Greystone	Picasso	Tomahawk
Chesapeake	Inferno	Piedmont	Tacer
Constitution	Justice	Pure Gold	Trooper
Chipper	Jaguar 3	Prospect	Turbo
Coronado	Kalahari	Quest	Ultimate
Coyote	Kentucky 31	Rebel Exeda	Watchdog
Davinci	Kitty Hawk	Rebel Sentry	Wolfpack
Dynasty	Kitty Hawk 2000	Regiment II	
Dominion	Lexington	Rembrandt	

On cut and fill slopes 2:1 or steeper Centipede shall be applied at the rate of 5 pounds per acre and add 20# of Sericea Lespedeza from January 1 - December 31.

Fertilizer shall be 10-20-20 analysis. A different analysis of fertilizer may be used provided the 1-2-2 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as a 10-20-20 analysis and as directed.

All areas seeded and mulched shall be tacked with asphalt. Crimping of straw in lieu of asphalt tack shall not be allowed on this project.

CRIMPING STRAW MULCH

Crimping shall be required on this project adjacent to any section of roadway where traffic is to be maintained or allowed during construction. In areas within six feet of the edge of pavement, straw is to be applied and then crimped. After the crimping operation is complete, an additional application of straw shall be applied and immediately tacked with a sufficient amount of undiluted emulsified asphalt.

Straw mulch shall be of sufficient length and quality to withstand the crimping operation.

Crimping equipment including power source shall be subject to the approval of the Engineer providing that maximum spacing of crimper blades shall not exceed 8".

Within seven (7) calendar days to fourteen (14) calendar days of completion of any phase of grading, all disturbed areas shall be planted or otherwise provided with temporary or permanent ground cover, devices, or structures sufficient to restrain erosion. The Erosion and Sediment Control plan will identify the areas that require seven (7) and/or fourteen (14) calendar day ground stabilization. The Contractor is herein advised to follow all current regulations set forth by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Water Quality (DWQ) as defined in the *General Stormwater Permit for Construction Activities NCG-010000.*

Attachment # 1

Special Provisions

Untrenched Construction

Under no condition shall jetting or wet boring, with water, or utility pipelines or encasements under pavements be allowed.

Boring and Jacking

Smooth wall or spiral weld steel pipe may be jacked through dry bores slightly larger than the pipe bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of the encasement pipe shall be butt-welded to the section previously jacked into place. Encasements shall extend at shoulder sections as shown on Attachment # 2. Encasements shall extend to a point outside of the 1:1 projection from three (3) feet behind curbs to the bottom of the nearest pit excavation wall in curb and gutter sections as shown on Attachment # 3.

If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe at ten (10) foot centers and the voids filled with 1:3 Portland Cement Grout at sufficient pressure to prevent settlement in the roadway.

In the event an obstruction is encountered during boring and jacking operations, the auger is to be withdrawn and the excessive pipe is to be cut off, capped and filled with 1:3 Portland Cement Grout at sufficient pressure to fill all voids before moving to another site.

Size and wall thickness (3' min. to 10' max. cover) of smooth wall or spiral welded encasement pipe for boring and jacking is as follows:

Pipe Sizes (O.D.)	Wall Thickness
4' to 12-3/4"	0.188
16" to 24"	0.250
30"	0.312
36"	0.375
48"	0.500

The Engineer on record is responsible for the encasement pipe design for cover greater than 10'.

Materials, joints, protective coating, grouting, wall thickness of carrier pipe, welds and cathodic protection shall be in accordance with the applicable industry or governmental codes, as well as the specifications of the Department of Transportation.

Casing pipe shall be sealed at the ends to prevent flowing water and debris from entering the annular space between the casing and the carrier. Plug with concrete, brick link seal, or other material approved by the District Engineer. Ensure drainage of encasement by leaving a 1 inch diameter weep hole in the seal of the lower end of the encasement.

Pump or place flowable fill into the annular void between the carrier pipe and casing pipe 36 inches or larger.

The grade of the top of the pipe or casing within rights-of-way should provide minimum bury as follows:

A.	Longitudinal installations	3'
B.	Crossings under roadways	3' (Below travel surface)
C.	Crossings under ditches (Paved & unpaved)	2'

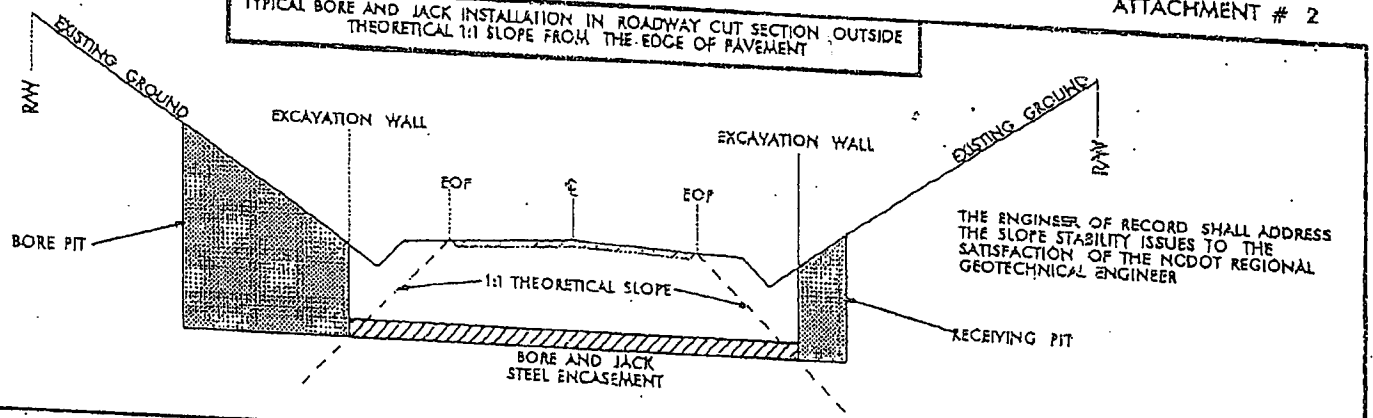
Pipelines carrying flammable, corrosive, expansive energized or unstable transmittants must comply with State, Federal and Utility Codes. In no case shall the depth of bury be less than as indicated above.

REV. 3/11/09

SHOULDER SECTIONS

ATTACHMENT # 2

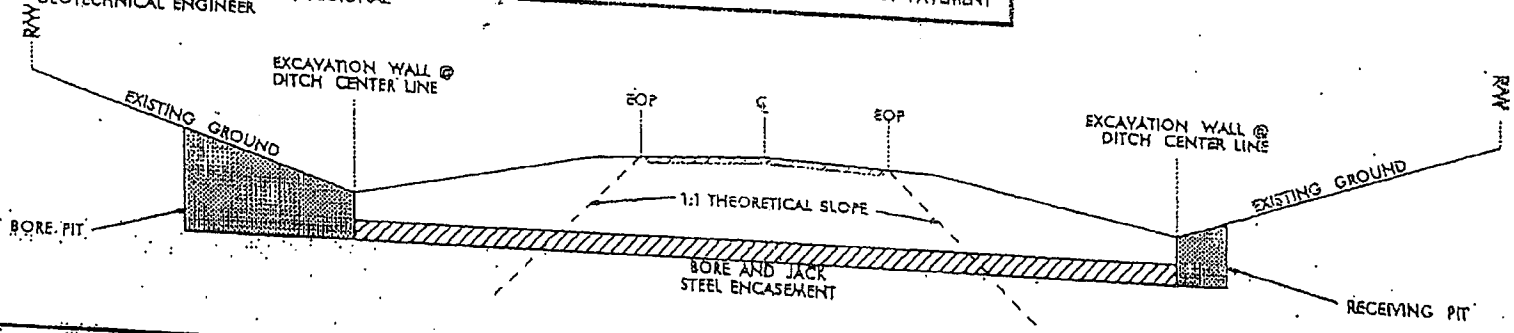
TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION OUTSIDE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT



THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER

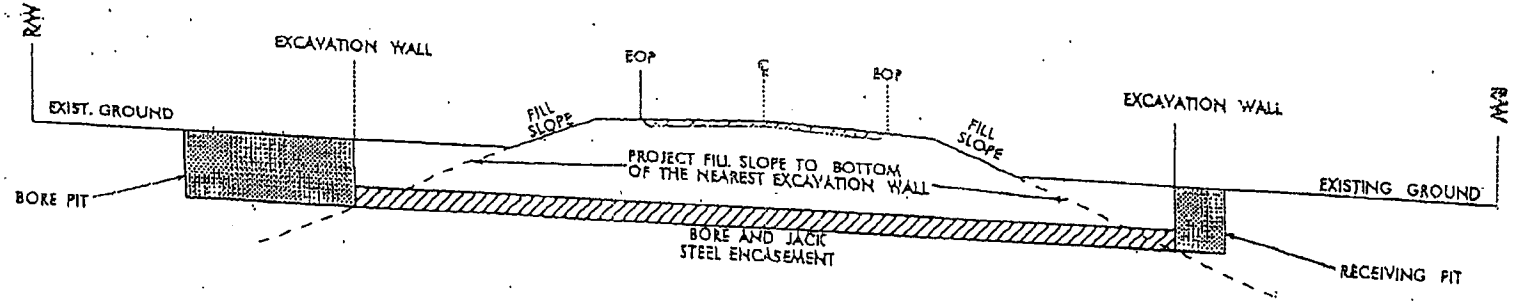
TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION WITH DITCHES OUTSIDE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT

THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER



THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER

TYPICAL BORE AND JACK INSTALLATION IN ROADWAY IN FILL SECTION

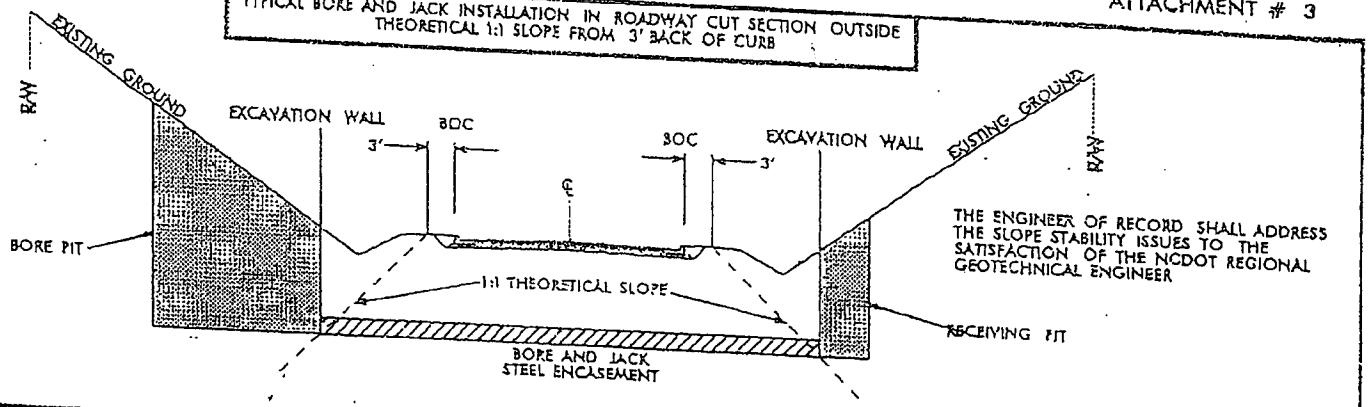


Rev. 3/1/09

CURB AND GUTTER SECTIONS

ATTACHMENT # 3

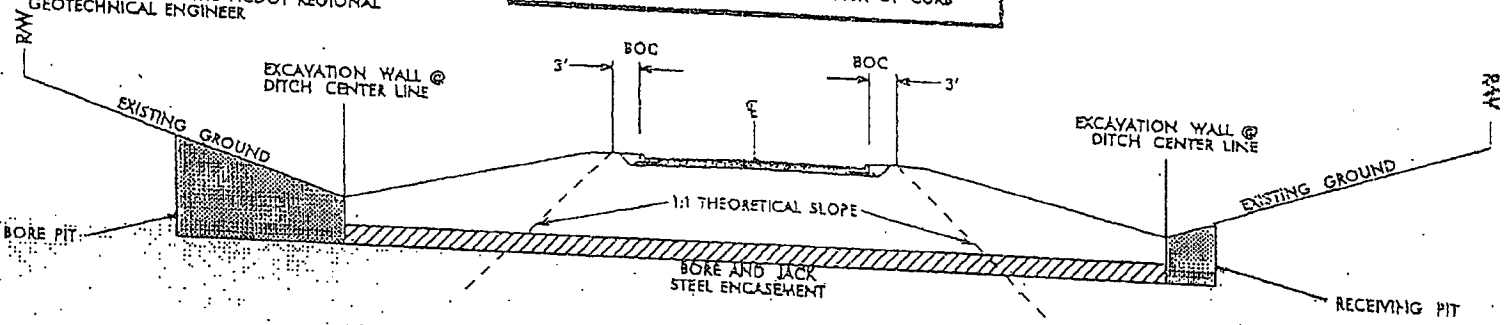
TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION OUTSIDE THEORETICAL 1:1 SLOPE FROM 3' BACK OF CURB



THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER

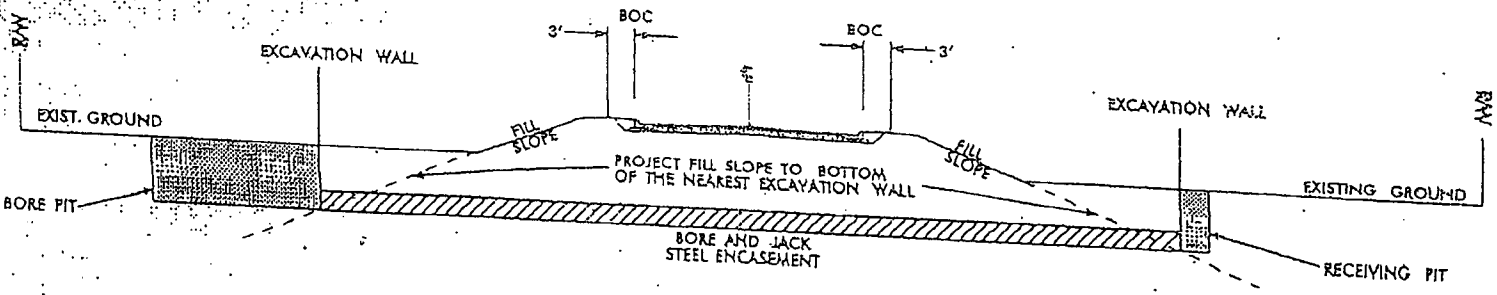
TYPICAL BORE AND JACK INSTALLATION IN ROADWAY CUT SECTION WITH DITCHES OUTSIDE THEORETICAL 1:1 SLOPE FROM 3' BACK OF CURB

THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER



TYPICAL BORE AND JACK INSTALLATION IN ROADWAY IN FILL SECTION

THE ENGINEER OF RECORD SHALL ADDRESS THE SLOPE STABILITY ISSUES TO THE SATISFACTION OF THE NCDOT REGIONAL GEOTECHNICAL ENGINEER



REV. 9/16/09

PUBLIC WORKS COMMISSION
OF THE CITY OF FAYETTEVILLE
ELECTRIC & WATER UTILITIES

955 OLD WILMINGTON RD
P.O. BOX 1089
FAYETTEVILLE, NORTH CAROLINA 28302-1089
TELEPHONE (910) 483-1401
WWW.FAYPWC.COM

January 7, 2016

Randy K. Wise, P.E.
District Engineer
Department of Transportation
Post Office Box 1150
Fayetteville, North Carolina 28302

SUBJECT: LEGION ROAD SEWER IMPROVEMENTS
Erosion Control for PWC Encr #18242
12" DI Sewer Main on SR 3301 (Ireland Dr)
for PWC Drawing AS-14918NN

Dear Mr. Wise:

This letter is to acknowledge that the above referenced activity will disturb less than one acre. Therefore, an approved erosion and sediment control plan from NCDENR is not required. However, appropriate measures will be implemented during construction to prevent erosion and offsite sedimentation.

If there are further questions, please contact John Prevette (223-4409) or Sam Powers (223-4370).

Very truly yours,
PUBLIC WORKS COMMISSION

Joseph E. Glass

Joseph E. Glass, P.E.
Water Resources Engineer/Manager

JG:jep
Enclosures
cc: Business Planning

TW

DIVISION 6-DISTRICT 2

THIS AGREEMENT, made and entered into this the 30 day of MARCH 20 16 by and between the Department of Transportation, party of the first part; and Public Works Commission of Fayetteville, North Carolina party of the second part,

WITNESSETH

THAT WHEREAS, the party of the second part desires to encroach on the right of way of the public road designated as Route(s) SR 3301 (Ireland Drive) , located 87' northwest of the intersection of SR 3301 and SR 1132

with the construction and/or erection of: 89' of 12" RJDI in 24" steel casing installed across the right-of-way by jack and bore; and a 500' long open trench parallel to the right-of-way (the centerline of which will be approx. 5' outside of the right-of-way) for installation of 12" DI sewer main; shown on PWC Drawing AS-14918NN

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:

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: _____
DIVISION ENGINEER

ATTEST OR WITNESS:

_____
Venus C. Durant

Sr. Executive Assistant

Public Works Commission Fayetteville, N.C.

_____
David W. Trego
General Manager
Second Party

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.

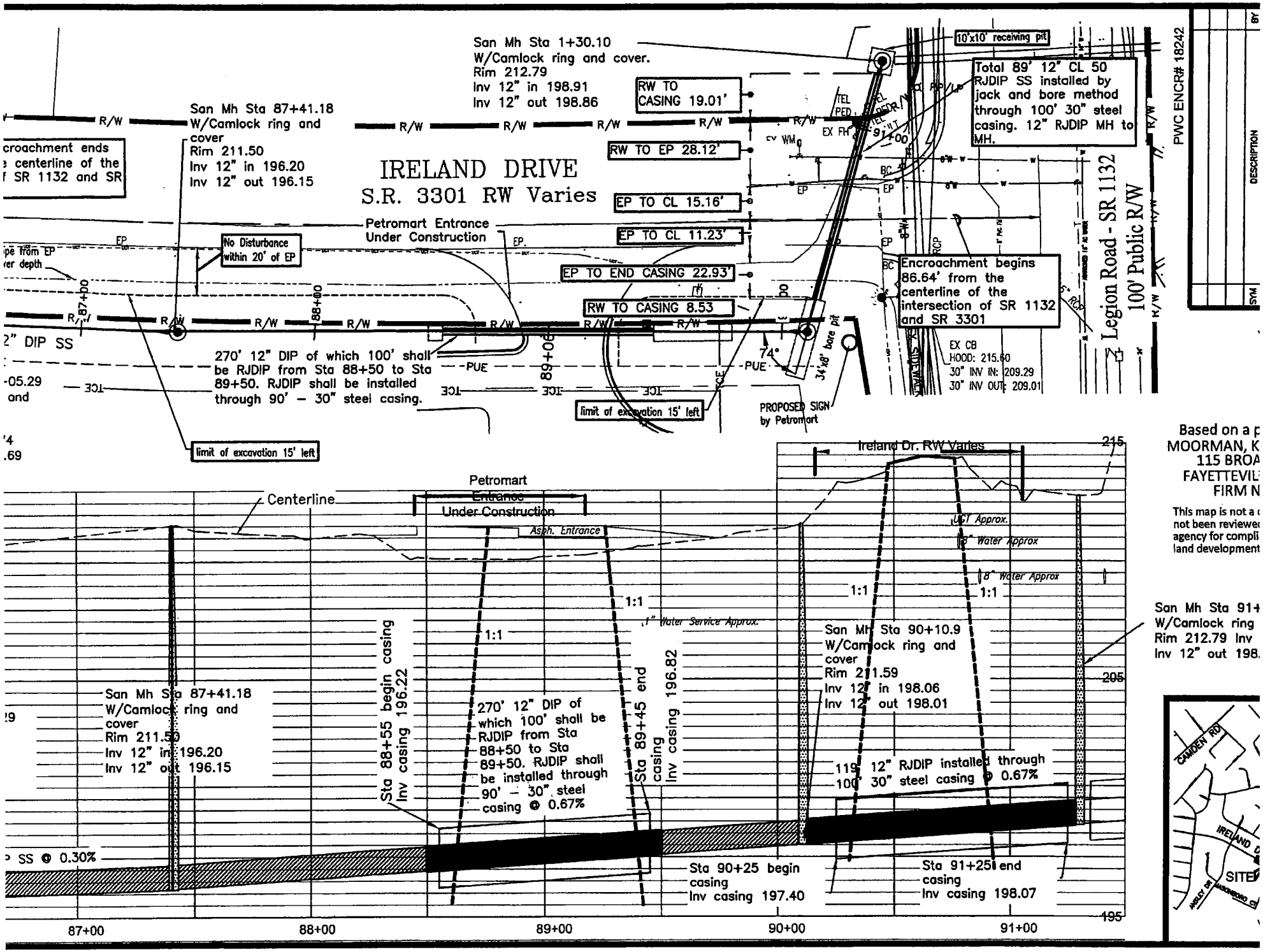
When the applicant is not a corporation, then his signature must be witnessed by one person. The address should be included in this agreement and the names of all persons signing the agreement should be typed directly below their signature.

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


San Mh Sta 1+30.10
W/Camlock ring and cover.
Rim 212.79
Inv 12" in 198.91
Inv 12" out 198.86
RW TO CASING 19.01'
RW TO EP 28.12'
EP TO CL 15.16'
EP TO CL 11.23'
EP TO END CASING 22.93'
RW TO CASING 8.53'
10'x10' receiving pit
Total 89' 12" CL 50 RJDIP SS installed by jack and bore method through 100' 30" steel casing. 12" RJDIP MH to MH.
PWC ENCR# 18242
DESCRIPTION
San Mh Sta 87+41.18
W/Camlock ring and cover
Rim 211.50
Inv 12" in 196.20
Inv 12" out 196.15
IRELAND DRIVE
S.R. 3301 RW Varies
Petromart Entrance
Under Construction
No Disturbance within 20' of EP
croachment ends
centerline of the
SR 1132 and SR
270' 12" DIP of which 100' shall be RJDIP from Sta 88+50 to Sta 89+50. RJDIP shall be installed through 90' – 30" steel casing.
limit of excavation 15' left
limit of excavation 15' left
PROPOSED SIGN by Petromart
Encroachment begins 86.64' from the centerline of the intersection of SR 1132 and SR 3301
EX CB
HOOD: 215.60
30" INV IN: 209.29
30" INV OUT: 209.01
Legion Road - SR 1132
100' Public R/W
34"x8' bore pit
74°
Ireland Dr. RW Varies
Centerline
Petromart Entrance Under Construction
Asph. Entrance
UGT Approx.
8" Water Approx
8" Water Approx
1" Water Service Approx.
1:1
1:1
1:1
1:1
San Mh Sta 87+41.18
W/Camlock ring and cover
Rim 211.50
Inv 12" in 196.20
Inv 12" out 196.15
Sta 88+55 begin casing
Inv casing 196.22
270' 12" DIP of which 100' shall be RJDIP from Sta 88+50 to Sta 89+50. RJDIP shall be installed through 90' – 30" steel casing @ 0.67%
Sta 89+45 end casing
Inv casing 196.82
San Mh Sta 90+10.9
W/Camlock ring and cover
Rim 211.59
Inv 12" in 198.06
Inv 12" out 198.01
119' 12" RJDIP installed through 100' 30" steel casing @ 0.67%
SS @ 0.30%
Sta 90+25 begin casing
Inv casing 197.40
Sta 91+25 end casing
Inv casing 198.07
San Mh Sta 91+
W/Camlock ring
Rim 212.79 Inv
Inv 12" out 198.
215
205
195
87+00
88+00
89+00
90+00
91+00
Based on a p
MOORMAN, K
115 BROA
FAYETTEVIL
FIRM N
This map is not a
not been reviewe
agency for compli
land developmen
CAMDEN RD
IRELAND
SITE
WESLEY DR
DESIGNERO CT

APPENDIX E

DUKE ENERGY.

Duke Energy Corporation
3308 N.C. Highway 5
Aberdeen, NC 28315
910-944-5363

January 26, 2017

John E. Prevette III, PLS, EI
Fayetteville Public Works Commission – Water Resources
955 Old Wilmington Road
Fayetteville, NC 28301

Re: Fayetteville- Fayetteville Dupont Switching Station 115kV, Str.# 226-227 / Legion Road Outfall & New Pinewood LS, Duke Energy Power Line Easement Sanitary Sewer Encroachment, Sheet # 1 of 1, Rev. 1 and Legion Hills Outfall & New Pinewood Lift Station Utility Plan-Partial, Sheet UTIL-2

Dear Mr. Prevette,

This office has reviewed the design by Moorman, Kizer & Reitzel, Inc. for the City of Fayetteville Public Works Commission, entitled "Legion Road Outfall & New Pinewood LS, Duke Energy Power Line Easement Sanitary Sewer Encroachment". The drawing reviewed is sheet 1 of 1, Rev.1 entitled "Revised Tie Lines from pole to edge PWC Esm't" dated January 19, 2017 & drawing entitled "Legion Hills Outfall & New Pinewood Lift Station Utility Plan-Partial, sheet UTIL-2, dated September 2015. We find these plans to be acceptable, and in compliance with the attached rights-of-way guidelines and restrictions, therefore, Duke Energy Transmission does not object to the use of the right of way as shown by these drawings. This plan approval, by Duke Energy Transmission, shall expire one (1) year from the date of this letter. If the project has not commenced by January 26, 2018, an additional plan review will be required by Duke Energy Transmission at that time.

In summary, the following details Duke Energy comments.

- Contractors operating any and all equipment should be instructed not to operate within 25ft of the poles, towers, or other electrical structures including guy anchors. All slopes shall be 4:1 or less. No spoil dirt is to be placed within the rights-of-way limits unless previously approved by Duke Energy.
- Any proposed easements must not cross closer than 25' to Duke Energy's electrical structures including, but not limited to poles, towers, and guy anchors.
- All underground facilities, such as, but not limited to, storm water pipes and domestic water line pipes, must be capable of a heavy equipment load bearing weight of 80,000 lbs. Duke Energy will not be responsible for damages to these installed facilities.
- Any damage to the transmission line or its associated structures, related to this project, and/or claims due to the damage, is the responsibility of the developer/owner.
- We have not reviewed, and therefore have not approved, any other plans than what is referenced above. Duke Energy restrictions prohibit trees that exceed 12 feet at maturity or lights that exceed 12 feet, within the rights-of-way limits. Vegetation that exceeds 12 feet in height is subject to removal by Duke Energy. Additionally, irrigation systems and signs are not permitted.

DUKE ENERGY.

Duke Energy Corporation
3308 N.C. Highway 5
Aberdeen, NC 28315
910-944-5363

- This letter only addresses issues related to the Duke Energy's transmission line easement. If required, you must obtain additional easements, approvals, or permits from the underlying property owners or other applicable agencies.

Duke Energy also offers these additional comments to ensure that other potential conflicts are not created during or after construction:

- If there are design changes to any drawings that involve the right of way, Duke Energy requires a review of the changes for compliance with the rights-of-way guidelines.
- Proper clearances must be maintained at all times. If any transmission line modification by Duke Energy is required to maintain proper clearances, the cost will be the responsibility of the developer/owner. Any such line modifications must be approved and scheduled, through Duke Energy well in advance of the project start date.
- All current and future property owners are required to adhere to the most current version of the Duke Energy rights-of-way guidelines and restrictions.
- Requesting party shall install & maintain as shown on as foresaid plans, a minimum width gate of sixteen (16) foot at each side of the perimeter fence with interlocking locks for adequate ingress/egress for Duke Energy. Duke Energy WB locks can be supplied upon request.
- Duke Energy heavy equipment access must not be restricted during construction of this project due to grading or other activity.
- Please do not use Duke Energy right-of-way for stock piling any materials during construction.
- Please contact me prior to the start of this project to attend any pre-construction meetings.

In not objecting to the use of the right-of-way for use as shown on the drawings, Duke Energy is not relinquishing the right to control and maintain the right-of-way as specified in the recorded agreements. Any damages to the transmission lines or its associated structures, and claims caused by the damage, is the responsibility of the developer/contractor. It is the responsibility of the contractors/owners to ensure that all work performed in the proximity of the transmission lines complies with all applicable laws and regulations, including but not limited to the National Electric Safety Code ("**NESC**"), the Overhead High-Voltage Line Safety Act ("**OHVLSA**"), and the Occupational Safety and Health Act ("**OSHA**"), and that all persons working near the transmission lines are made aware of the inherent safety hazards associated with this transmission line.

I have attached a copy of the right-of-way restrictions and Duke Energy Safety brochure entitled " Look Up & Live".

Please note that this approval is based in part on the accuracy of the information you have supplied on the plans. You are responsible for indicating the correct location of the Duke R/W and its associated electrical structures along with the correct width of the Duke Energy rights-of-way limits. These plans were originally approved on 12-10-15, reviewed & reapproved due to not commencing construction within the original one (1) year time allotment.

DUKE ENERGY.

Duke Energy Corporation
3308 N.C. Highway 5
Aberdeen, NC 28315
910-944-5363

Thank you for the opportunity to work with you on this project. If you have any questions, please feel free to contact me at 910-944-5363.

Sincerely,

Robbie James
R/W Asset Protection Specialist

Enclosures: R/W Restrictions, Safety Brochure
Reference: ETS # 20170024

APPENDIX F

APPENDIX G

FROEHLING & ROBERTSON, INC.

Report of Subsurface Exploration and Geotechnical Engineering Evaluation

LEGION ROAD SEWER OUTFALL
Hope Mills, North Carolina
F&R Project No. 66S-0210

Prepared For:

ENGINEERS
PLANNERS
SURVEYORS
M&R
MOORMAN, KIZER & REITZEL, INC.

115 Broadfoot Avenue
Fayetteville, North Carolina 28305

Prepared By:
Froehling & Robertson, Inc.
310 Hubert Street
Raleigh, North Carolina 27603

October 17, 2014

SINCE
1881

FROEHLING & ROBERTSON, INC.
Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603
T 919.828.3441 I F 919.828.5751
NC License #F-0266

October 17, 2014

Mr. David E. Vaughn, PE, PLS
Moorman, Kizer & Reitzel, Inc.
115 Broadfoot Avenue
Fayetteville, North Carolina 28305

Subject: Report of Subsurface Exploration & Geotechnical Engineering Evaluation
Legion Road Sewer Outfall
Hope Mills, North Carolina
F&R Project No. 66S-0210

Dear Mr. Vaughn:

Froehling & Robertson, Inc. (F&R) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the above-referenced project in Hope Mills, North Carolina. Our services were performed in general accordance with F&R's Proposal No. 1566-00149 dated July 16, 2014. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and general subsurface conditions, and presents our geotechnical evaluations and recommendations for design and construction of the project.

We have enjoyed working with you on this project, and we are prepared to assist you with the recommended quality assurance observation and testing services during construction. Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,
FROEHLING & ROBERTSON, INC.

Patrick Alton

W. Patrick Alton, P.E.
Geotechnical Services Manager

NORTH CAROLINA PROFESSIONAL SEAL 033758 ENGINEER W. PATRICK ALTON 10/17/14

Daul K. Schaefer

Daniel K. Schaefer, P.E.
Raleigh Branch Manager

TABLE OF CONTENTS

APPENDICES

EXECUTIVE SUMMARY

This Executive Summary is provided as a brief overview of our geotechnical engineering evaluation performed for this project and is not intended to replace more-detailed information contained elsewhere in this report. As an overview, this summary inherently omits details that could be very important to the proper application of the provided geotechnical design and construction recommendations. This report should be read in its entirety prior to implementation into design and construction.

- *The subsurface exploration consisted of performing 12 widely-spaced soil test borings to depths ranging from 10 to 30 feet below the existing ground surface.*
- *The borings predominantly encountered very loose to medium dense sand, silty sand, and clayey sand (USCS-SP, SM & SC). Soft to stiff moderate to highly plastic silty clay (CH) was encountered in 5 of the 12 borings at depths typically ranging from 12 to 17 feet. The average thickness of this clay layer was about 5 feet. Very soft to soft, low to moderately plastic organic silts and clays (OL & OH) were encountered in 5 of the 12 borings at depths typically ranging from 2 to 8 feet. The thickness of this organic layer varied from 0.5 to 10 feet.*
- *Typically, the soil samples obtained were described as wet and saturated; therefore, wet and saturated soils will likely be encountered depending upon the time of year utility installation is performed and drying of wet and saturated soils will likely be required.*
- *At completion of drilling, groundwater was encountered in all of the borings at depths ranging from 0 to 28 feet. After a stabilization period of approximately 24-hours, groundwater readings were attempted in 8 of the 12 borings and groundwater was encountered in 4 of the borings at depths ranging from 1.8 to 13 feet. However, borehole cave-in depths ranged from 1 to 18 feet, which could be an indicator of the groundwater depth. Therefore, groundwater will likely be encountered during utility installation throughout the site and dewatering will likely be required.*
- *The lower plasticity soils encountered at the project site (SP, SM, SC & CL) are considered suitable for use as structural fill material; however, they are moisture sensitive and it is recommended that earthwork activities be performed during the seasonally dryer months (typically May to October) when weather conditions are more-conducive to moisture conditioning. The highly-plastic clayey soils (CH) and organic soils (OL & OH) are generally considered poor material for use as structural fill because they can be difficult to properly place and compact. In addition, the organic soils can cause long term settlement issues. It is generally recommended that these soil types be used in non-structural areas or wasted.*
- *It is anticipated that the manholes and sewer lines will typically bear in wet to saturated, very loose to loose sands and very soft to very stiff clays. In the areas of borings B-1 and B-2, the bearing materials will likely consist of organic silts. As such, we anticipate that wide-spread subgrade repairs (pipe bedding) and dewatering will be necessary to install manholes and sewer lines in open-cut areas.*
- *It is anticipated that bore and jack casings will typically be installed through wet to saturated, loose sands. As such, it is not anticipated that hard/difficult materials will be encountered during bore and jack activities. Due to the anticipated excavation depth to the casing invert elevations and dimensions of the entry and receiving pits, temporary shoring and dewatering will likely be required.*

1.0 PURPOSE & SCOPE OF SERVICES

The purpose of the subsurface exploration and geotechnical engineering evaluation was to explore the subsurface conditions in the area of the proposed sewer alignment and to provide geotechnical engineering recommendations that can be used during the design and construction phases of the project.

F&R's scope of services included the following:

- Completion of 12 widely-spaced soil test borings to depths ranging from 10 to 30 feet below the existing ground surface;
- Preparation of typed boring bogs and development of subsurface profiles;
- Performing geotechnical laboratory testing on representative soil samples;
- Performing a geotechnical engineering evaluation of the subsurface conditions with regard to their suitability for the proposed construction; and
- Preparation of this report by professional engineers.

2.0 PROJECT INFORMATION

We understand that the proposed construction will consist of the installation of a new sewer line in a primarily residential area. The sewer line generally begins near the intersection of Catalpa Circle and Beechwood Street in Hope Mills, North Carolina. The sewer line then runs northwest towards the end of Hawthorne Street, northeast towards the end of Sycamore Drive, and then east towards Elk Road. The sewer line in this area is generally located in wooded areas behind the existing residences. After the line crosses Elk Road, the line continues to run east behind the existing residences along Eagle Landing Drive and then northeast towards and along Harvey Lillie Avenue and Ansley Drive. The sewer line then turns east along Ireland Drive and crosses Legion Road before ending near the intersection of Marchbanks Place and Crosswinds Drive. See Figure No. 1 – Site Vicinity Map included in the appendix. A significant portion of the sewer alignment between Catalpa Circle and Ansley Drive is located in wetlands areas.

Based on our review of the preliminary 90% plans received on September 30, 2014, it appears that about 2,000 feet of the proposed sewer line between station 0+00 and 28+00 will likely be installed using pipe bursting methods, and open-cut construction methods will primarily be used beyond 28+00. The depth of the open-cut line will range from approximately 4 to 5 feet (near station 26+15 and 35+15) to 22 feet (near station 79+00) below the existing ground surface. We also understand that bore and jack techniques will be used in the following areas:

- Under Elk Road from station 28+79 to 30+75 (area of boring B-5);
- Under the entrance to the proposed Petromart from station 88+55 to 89+45 (area of boring B-10);
- Under Ireland Drive from station 90+25 to 91+25 (area of boring B-10); and
- Under Legion Road from station 91+35 to 92+55 (area of boring B-10).

The elevation of the casing in the bore and jack areas ranges from 129.21 to 134.64 feet under Elk Road; 196.22 to 196.82 feet under the Petromart entrance; 197.40 to 198.07 under Ireland Drive; and 198.19 to 198.99 under Legion Road. The entry pits are indicated to have plan dimensions of 8' x 24' and the receiving pits are indicated to have plan dimensions of 10' x 10'.

3.0 EXPLORATION PROCEDURES

3.1 SUBSURFACE EXPLORATION

F&R advanced a total of 12 traditional soil test borings as part of this exploration at the approximate locations selected by MKR and shown on the Boring Location Plans presented as Figure Nos. 2 through 5 in Appendix I. The borings were advanced to depths ranging from 10 to 30 feet. The test boring locations were surveyed in the field by MKR. Ground surface elevations at the boring locations were interpolated from the 90% plans. Given these methods of determination, the boring locations and ground surface elevations should only be considered approximate.

The test borings were advanced by an ATV-mounted drill rig using 2-1/4" inside diameter (I.D.) hollow stem augers for borehole stabilization. Representative soil samples were obtained using a standard two-inch, outside-diameter (O.D.), split-barrel sampler in general accordance with ASTM D 1586, Penetration Test and Split-Barrel Sampling of Soils (Standard Penetration Test).

The number of blows required to drive the split-barrel sampler three, consecutive 6-inch increments with an automatic hammer is recorded, and the blows of the last two 6-inch increments are added to obtain the Standard Penetration Test (SPT) N-values representing the penetration resistance of the soil. Standard Penetration Tests were performed almost continuously to a depth of 10 feet and at a nominal interval of approximately 5 feet thereafter. Groundwater level measurements were typically attempted at the termination of drilling and again after a stabilization period of approximately 24-hours had elapsed after completion of drilling.

A representative portion of the soil was obtained from each SPT sample, sealed in an eight-ounce glass jar, labeled, and transported to our laboratory for classification and analysis by a geotechnical engineer. The soil samples were classified in general accordance with the Unified Soil Classification System (USCS), using visual-manual identification procedures (ASTM D2488). A boring log for each test boring is presented in Appendix II.

3.2 LABORATORY TESTING

At the request of MKR, F&R obtained two bulk soil samples from the auger cuttings from borings B-5 and B-10 for standard proctor testing. These samples were also subjected to routine geotechnical index testing consisting of natural moisture content, sieve analysis (materials finer than #200 sieve only), and/or Atterberg Limits determinations. The purpose of the index testing was to aid in our classification of the soil samples and development of engineering recommendations. The laboratory testing was performed in general accordance with applicable ASTM standards. The laboratory test results are summarized below and are presented in Appendix III of this report.

Sample Location (Boring No.)	Sample Depth (ft)	Natural Moisture Content (%)	Atterberg Limits		Grain Size Distribution Percent Passing		USCS Soil Class.
			LL	PI	#4	#200 (% fines)	
B-5	0 – 10	22.0	0	NP	0	10	SP-SM
B-10	0.5 – 12	8.0	0	NP	0	8	SP-SM

4.0 REGIONAL GEOLOGY & SUBSURFACE CONDITIONS

4.1 REGIONAL GEOLOGY

The referenced site is located within the Coastal Plain Province of North Carolina. The Coastal Plain Province is a broad, flat plain with widely-spaced and low-rolling hills where the near-surface soils have their origin from the deposition of sediments several million years ago during the period that the ocean receded from this area to its present location along the Atlantic coast. It is noted that the coastal plain soils vary in thickness from only a few feet along the western border (one to two counties north and west of the site) to over ten thousand feet in some areas along the coast. Our test borings were terminated in Coastal Plain soils.

According to the *Geologic Map of North Carolina (1985)*, the site is specifically located within an area mapped as Cretaceous-period deposits and is comprised of sedimentary deposits that appear to be located within both the Cape Fear Formation and the Black Creek Formation. The Cape Fear Formation is described as yellowish-gray to blue-gray, mottled red to yellowish-orange sandstone and sandy mudstone with graded and laterally continuous bedding. Blocky clay, faint cross-bedding and feldspar and mica are common. The Black Creek Formation is described as clay deposits that vary in color from gray to black with layers of fine sand.

4.2 SUBSURFACE CONDITIONS

4.2.1 General

The subsurface conditions discussed in the following paragraphs and those shown on the attached boring logs represent an estimate of the subsurface conditions based on an interpretation of the boring data using normally-accepted, geotechnical engineering judgments. Although individual soil test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times. Subsurface profiles have been prepared from the boring data to graphically illustrate the subsurface conditions encountered at the site. The subsurface profiles are presented as Figure Nos. 6 and 7 in Appendix I. Strata breaks designated on the boring logs and subsurface profiles

represent approximate boundaries between soil types. The transition from one soil type to another may be gradual or occur between soil samples. This section of the report provides a general discussion of subsurface conditions encountered within explored areas of the project site. More-detailed descriptions of the subsurface conditions at the individual boring locations are presented on the Boring Logs provided in Appendix II.

4.2.2 Surficial Materials

Surficial Organic Soils were encountered at 5 of the 12 borings from the ground surface to a depth of generally 1 to 5 inches. The Surficial Organic Soils generally consisted of dark-colored soil material containing roots, fibrous matter, and/or other organic components, and is generally unsuitable for engineering purposes. F&R has not performed any laboratory testing to determine the organic content or other horticultural properties of the observed Surficial Organic Soil materials. Therefore, the term *Surficial Organic Soil* is not intended to indicate suitability for landscaping and/or other purposes. The Surficial Organic Soil depths provided in this report are based on driller observations and should be considered approximate. We note that the transition from Surficial Organic Soil to underlying materials may be gradual, and therefore the observation and measurement of the Surficial Organic Soil depths is subjective. Actual Surficial Organic Soil depths should be expected to vary.

Asphalt was encountered at the surface of borings B-4 and B-12 and was measured to be approximately 2 to 3 inches. Gravel was encountered at the surface of boring B-1 and was measured to be approximately 3 to 4 inches.

4.2.3 Existing Fill

Possible existing fill was encountered below the asphalt in boring B-12 and extended to boring termination at a depth of 10 feet. The possible fill consisted of silty sand (USCS classification SM) and contained trace amounts of gravel. The fill soils exhibited SPT N-values ranging from 7 to 11 blows per foot (bpf). N-values of less than 4 bpf are generally indicative of fill with poor compaction while N-values of 5 to 8 bpf are generally indicative of fill with moderate compaction. Well-compacted structural fill would generally be expected to exhibit N-values of 9

bpf or greater. Based on the N-values obtained, it appears the fill was typically moderately to well compacted.

4.2.4 Native Soils

In a majority of the borings, the native soils typically consisted of silty and clayey sand (USCS-SM & SC) and low plasticity sandy clay (CL). The consistency of the soils generally ranged from very loose to loose for the sands and very soft to very stiff for the clays.

Soft to very hard, moderate to highly plastic, black clays (CH) were encountered in 5 of the 12 borings at depths typically ranging from 12 to 17 feet. Where this layer was fully penetrated, the thickness ranged from approximately 2.5 to 8 feet with an average thickness of approximately 5 feet.

Very soft to soft, low to moderately plastic, black organic silts and clays (OL & OH) were encountered in 5 of the 12 borings at depths typically ranging from 2 to 8 feet. Where this layer was fully penetrated, the thickness ranged from approximately 0.5 to 10 feet with an average thickness of approximately 3.5 feet. See the table below for a summary of the organic materials encountered:

Boring	Organic Soil Depths (ft)	Thickness of Layer (ft)	Description of Organics
B-1	4.5 – 8	3.5	Intermittent layers of wood
B-1	8 – 12	4	Black organic SILT (OL), similar to MUCK
B-2	2 – 12	10	Black organic SILT (OL), similar to MUCK
B-3	2 – 3.5	1.5	Silty SAND (SM) w/roots & wood fragments
B-4	3 – 3.5	0.5	Black organic CLAY (OH), similar to MUCK
B-4	6.5 – 7.0	0.5	6" layer of wood
B-6	22 – 25	3+	Black organic CLAY (OH)

4.3 Soil Moisture and Groundwater Conditions

Typically, the soil samples were described as wet to saturated for the full depth of the borings throughout the site and are indicated in the following table:

Boring	Wet/Saturated Soil Depths	Boring Termination Depth (ft.)
B-1	Entire boring depth	30.0
B-2	Entire boring depth	20.0
B-3	Entire boring depth	20.0
B-4	Entire boring depth	20.0
B-5	Entire boring depth	25.0
B-6	6 feet to bottom of boring	25.0
B-7	3.5 feet to bottom of boring	20.0
B-8	3.5 feet to bottom of boring	20.0
B-9	8.5 feet to bottom of boring	20.0
B-10	3.5 feet to bottom of boring	25.0
B-11	3.5 feet to bottom of boring	25.0
B-12	Entire boring depth	10.0

Groundwater level measurements were attempted in the test borings immediately upon completion of drilling, and groundwater was encountered in all of the borings at depths ranging from 0 to 28 feet. After a stabilization period of approximately 24-hours, groundwater level measurements were attempted in borings B-1 and B-5 through B-11. Groundwater was encountered after 24-hours in borings B-1, B-5, B-6, and B-10 at depths ranging from 1.8 to 13 feet below the ground surface. Borings B-7, B-8, B-9, and B-11 were dry after a stabilization period of approximately 24 hours. However, cave-in depths were recorded in borings B-7, B-8, B-9, and B-11 at depths ranging from 1 to 18 feet. Cave-in depths can sometimes be an indicator of the groundwater table.

It should also be noted that soil moisture and groundwater levels fluctuate depending upon seasonal factors such as precipitation and temperature. As such, soil moisture and groundwater conditions at other times may vary from those described in this report. Due to the presence of

relatively impervious silty/clayey soils noted on the project site, trapped or perched water conditions should be anticipated during periods of inclement weather and during seasonally wet periods.

5.0 ENGINEERING EVALUATION AND RECOMMENDATIONS

5.1 GENERAL

The conclusions and recommendations contained in this section of the report are based upon the results of the 12 soil test borings performed by F&R, laboratory test results, our experience with similar projects and subsurface conditions, and the limited information provided to us regarding the proposed development. It is our opinion that the subsurface conditions encountered at the project site are generally suitable for the proposed development from a geotechnical engineering perspective provided the recommendations presented in subsequent sections of this report are followed throughout the design and construction phases of this project.

The predominant soil types encountered consisted of silty and clayey sand (USCS - SM & SC) and low plasticity sandy clay (CL). However, layers of moderate to highly-plastic clays (CH), and low to moderately plastic organic silts and clays (OL & OH) were encountered in 8 of the 12 borings at depths ranging from 2 to 17 feet. Where the layer was penetrated, the thickness ranged from about 0.5 to 10 feet. These soils are moisture sensitive and can become unstable under normal construction traffic and in the presence of excess moisture. The organic soils can also cause long-term settlement problems.

Wet and saturated soils were encountered throughout all of the borings. Due to the moisture sensitivity of the on-site soils and potential for wet and saturated conditions, it is typically recommended that earthwork operations be performed during the seasonally-drier months (typically May to October) when weather conditions are more conducive to moisture conditioning of earth fill (*e.g.,* drying of wet soils or wetting of dry soils) and achieving proper compaction of structural fill. If earthwork is performed during the seasonally wet months, additional repair (*i.e.,* drying of wet soils) will likely be required. It is expected that a majority of the excavated soils from

utility trenches will be wet and saturated and require drying in order to be successfully used as compacted structural fill.

As previously indicated, groundwater was encountered in all of the borings at depths ranging from 0 to 28 feet. Therefore, wet and saturated soil conditions and groundwater will likely be encountered throughout the construction area, and dewatering measures will likely be required such as sump pumping or well points.

5.2 MANHOLE FOUNDATION AND SEWER LINE SUPPORT

Based on our review of the preliminary 90% plans, it appears that about 2,000 feet of the proposed sewer line between station 0+00 and 28+00 will likely be installed using pipe bursting methods, and open-cut construction methods will primarily be used beyond 28+00. The depth of the open-cut portion of the line will range from approximately 4 to 5 feet (near station 26+15 and 35+15) to 22 feet (near station 79+00) below the existing ground surface. At these depths, it is anticipated that the manholes and sewer lines will typically bear in wet to saturated, very loose to loose sands and very soft to very stiff clays. In the areas of borings B-1 and B-2, the bearing materials will likely consist of organic silts. As such, we anticipate that wide-spread subgrade repairs and dewatering will be necessary to install manholes and sewer lines in the open-cut areas.

We recommend that a qualified geotechnical engineer or his representative evaluate all of the trench and manhole bearing grades prior to sewer line or manhole placement. If soft or otherwise unsuitable soils are encountered at the trench or manhole bearing level, undercutting and repair of the bearing grades will likely be required and should be performed as directed by the project geotechnical engineer. Depending upon the consistency of the bearing materials, some undercutting may be recommended but would likely not exceed approximately 2 to 3 feet with a minimum undercut depth of approximately 6 to 12 inches. The depth of the undercut should be determined at the time of construction and would be dependent upon the thickness of material required beneath the pipe to create a stable bedding for the pipe or manhole and a stable working platform for workers. The undercut soils should be replaced with clean washed #57 stone encased in geotextile filter fabric (Mirafi 140N or

equivalent) to keep the washed stone clean, which would also aid in sump pumping out of the washed stone to help maintain lowered groundwater during pipe installation and backfilling operations. To minimize the undercut depth where very soft or very loose materials exist, a layer of rip rap or surge stone may also be recommended prior to placement of the fabric-encase washed stone layer.

5.3 BORE AND JACK PITS

As previously indicated, the sewer line will be installed using bore and jack methods at the following areas:

- Under Elk Road from station 28+79 to 30+75 (area of boring B-5);
- Under the entrance to the proposed Petromart from station 88+55 to 89+45 (area of boring B-10);
- Under Ireland Drive from station 90+25 to 91+25 (area of boring B-10); and
- Under Legion Road from station 91+35 to 92+55 (area of boring B-10).

At these locations, a 30" steel casing will be bored and jacked into place through which a 12" ductile iron pipe will be installed. The elevation of the casing in the bore and jack areas ranges from 129.21 to 134.64 feet under Elk Road (depth of 6 to 17 feet); 196.22 to 196.82 feet under the Petromart entrance (depth of 14 feet); 197.40 to 198.07 under Ireland Drive (depth of 15 to 16 feet); and 198.19 to 198.99 under Legion Road (depth of 15 to 17 feet). The entry pits are indicated to have plan dimensions of 8' x 24', and the receiving pits are indicated to have plan dimensions of 10' x 10'.

Based on the results of the test borings, it is anticipated the casings will typically be installed through wet to saturated, loose sands. As such, it is not anticipated that hard/difficult materials will be encountered during bore and jack activities.

Due to the anticipated excavation depth to the casing invert elevation and dimensions of the entry and receiving pits, temporary shoring will likely be required as will be discussed in a subsequent section of this report.

It should be noted that groundwater was encountered in borings B-5 and B-10 (located near the bore and jack areas) at depths of 1.8 and 13 feet, respectively, which is approximately 3 to 11 feet above the bottom of the casing. Dewatering measures will likely be required such as sump pumping or well points. Dewatering will be discussed in a subsequent section of this report.

5.4 Excavation Characteristics

Based on the results of the soil test borings, we anticipate that the sewer line open-cut excavations will be in soils that can be readily excavated using conventional backhoes and tracked excavators. A majority of the soils encountered consisted of very loose to loose silty and clayey sands and very soft to very stiff sandy clays. Due to the location of portions of the proposed sewer line adjacent to existing roads, shored/braced excavations will likely be required to prevent caving of the sides of the excavation.

5.5 Structural Fill Placement and Compaction

It is expected that the low-plasticity on-site cut soils will be suitable for use as structural fill material provided they are at a moisture content suitable to achieve proper compaction and are stable during compaction and at final subgrade. Low to moderately plastic soils are generally considered fair to good materials for use as structural earth fill. As previously indicated, moderate to highly plastic clays (CH) were encountered in 5 of the 12 borings, and low to moderately plastic organic silts and clays (OL & OH) were encountered in 5 of the 12 borings. These soils are considered poorer materials for re-use as structural fill because they can become unstable and be difficult to properly place and compact. It is generally recommended that these soils be used in non-structural areas or wasted. As previously indicated, some of the cuts soils will likely be wet or saturated. Depending upon the cut depths and site conditions at the time of construction, some soils will likely require moisture conditioning (*e.g.*, drying of wet soils or wetting of dry soils) prior to use as structural fill. As such, it is recommended that earthwork be performed during the summer months when the weather conditions are more conducive to moisture conditioning of fill materials.

All structural earth fill should be compacted at a moisture content within ±3 percent of the optimum moisture content and placed in loose lifts not exceeding 8 inches. All structural earth fill (*i.e.,* fill placed in roads and driveways) should be compacted to at least 95 percent of the Standard Proctor maximum dry density as determined by ASTM D-698 and 100 percent in the top 12 inches. Structural earth fill placed in non-structural/grassy areas should be compacted to at least 92 percent of the standard Proctor maximum dry density. The corresponding cross-section of the area removed (asphalt, concrete, or gravel) should be replaced per the original section.

All structural fill material should be placed and compacted under the full-time control and supervision of a qualified geotechnical engineer or engineering technician working under the direction of the geotechnical engineer. The placement and compaction of all fill material should be tested at frequent intervals in order to confirm that the recommended degree of compaction is achieved.

As previously stated, the on-site soils have sufficient silt/clay content to render them moisture sensitive. The on-site soils will become unstable (*i.e.,* pump and rut) during normal construction activities when in the presence of excess moisture. Soils with a moisture content greater than three percent above the optimum moisture content are generally considered to have excessive moisture. During earthwork and construction activities, surface-water runoff must be drained away from construction areas to prevent water from ponding on or saturating the soils within excavations or on subgrades.

Exposure to the environment may weaken the soils at the bearing level if excavations remain open for long periods of time. The bearing surface should be level or suitably-benched and free of loose soil, ponded water, and debris. If the bearing soils are softened by surface water intrusion, subsurface seepage or exposure, the softened soils should be removed from the excavation immediately prior to placement of stone, concrete, or other pipe bedding materials.

5.6 DEWATERING

As previously mentioned, groundwater was encountered in all of the borings at depths ranging from 0 to 28 feet. Therefore, depending upon the prevailing weather conditions at the time of construction, groundwater may be encountered at other areas of the site and at higher elevations than described in this report.

We anticipate that dewatering can be handled by simple sump techniques. If however, the volume of groundwater is too great for this method, a system utilizing a series of well points strategically placed around the construction area may be required. The dewatering system to be used should be selected and designed by the contractor.

5.7 TEMPORARY EXCAVATION RECOMMENDATIONS

Due to excavation depths reaching approximately 22 feet and to limit disturbance to the neighboring properties and roads, we anticipate that the excavations will require temporary shoring. Trench boxes or internally-braced excavations are anticipated; however, the type of excavation stabilization or shoring system used should be selected and designed by the contractor.

Mass excavations and other excavations required for construction of this project should be performed in accordance with the United States Department of Labor, Occupational Safety and Health Administration (OSHA) guidelines (29 CFR 1926, Subpart P, Excavations), or other applicable jurisdictional codes for permissible temporary side-slope ratios and/or shoring requirements. The OSHA guidelines require daily inspections of excavations, adjacent areas and protective systems by a "competent person" for evidence of situations that could result in cave-ins, indications of failure of a protective system, or other hazardous conditions. All excavated soils, equipment, building supplies, etc., should be placed away from the edges of excavations at a distance equaling or exceeding the depth of the excavation. F&R cautions that the actual excavation slopes will need to be evaluated frequently each day by the "competent person" and flatter slopes or the use of shoring may be required to maintain a safe excavation depending upon excavation-specific circumstances. The contractor is responsible for providing

the "competent person" and all aspects of site excavation safety. F&R can evaluate specific excavation slope situations if we are informed and requested by the owner, designer, or contractor's "competent person".

6.0 CONTINUATION OF SERVICES

As previously discussed, the Geotechnical Engineer of Record should be retained to monitor and test earthwork activities. It should be noted that the actual soil conditions at the various subgrade levels and bearing grades will vary across this site and thus the presence of the Geotechnical Engineer and/or his representative during construction will serve to validate the subsurface conditions and recommendations presented in this report.

We recommend that F&R be employed to monitor the earthwork and utility construction, and to report that the recommendations contained in this report are completed in a satisfactory manner. Our continued involvement on the project will aid in the proper implementation of the recommendations discussed herein. The following is a recommended scope of services:

- Review of project plans and construction specifications to verify that the recommendations presented in this report have been properly interpreted and implemented;
- Observe the earthwork process to document that subsurface conditions encountered during construction are consistent with the conditions anticipated in this report;
- Observe the subgrade conditions before installing sewer lines and manholes and before placing structural fill; and
- Observe the placement and compaction of structural fill and backfill, and perform laboratory and field compaction testing of the fill.

7.0 LIMITATIONS

This report has been prepared for the exclusive use of Moorman, Kizer & Reitzel, Inc. and/or their agents, for specific application to the referenced project in accordance with generally-accepted soil and foundation engineering practices. No other warranty, express or implied, is made. Our evaluations and recommendations are based on design information furnished to us, the data obtained from the subsurface exploration program, and generally-accepted geotechnical engineering practices. The evaluations and recommendations do not reflect variations in

subsurface conditions which could exist intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our recommendations based upon our on-site observations of the conditions.

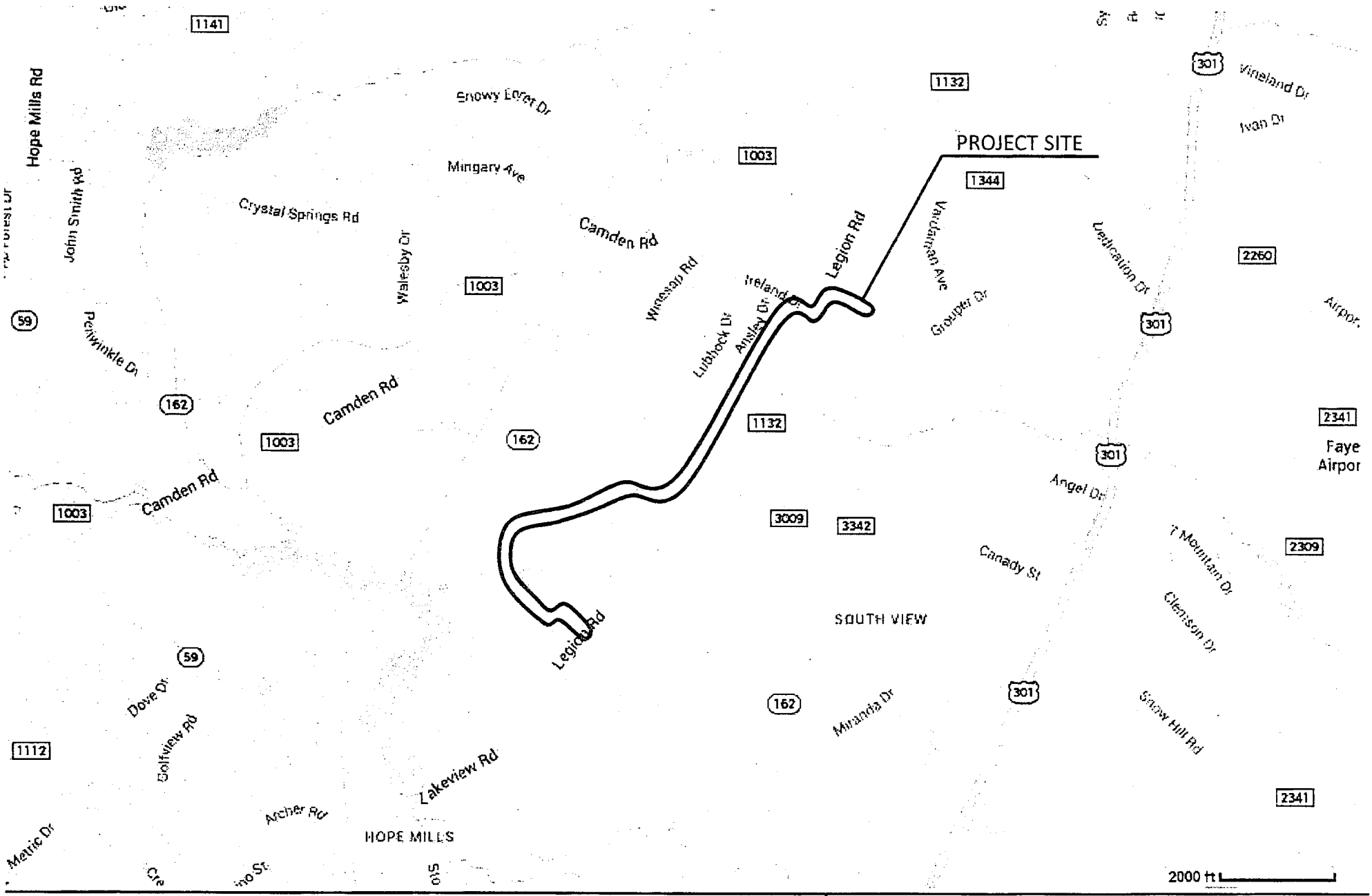
There are important limitations to this and all geotechnical studies. Some of these limitations are discussed in the information prepared by ASFE, which is included in Appendix IV. We ask that you please review this information.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should evaluate earthwork activities to observe that the conditions anticipated in design actually exist. Otherwise, we assume no responsibility for construction compliance with the design concepts, specifications, or recommendations.

In the event that changes are made in the proposed construction, the recommendations presented in the report shall not be considered valid unless the changes are reviewed by our firm and conclusions of this report modified and/or verified in writing. If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid.

APPENDIX I

FIGURES



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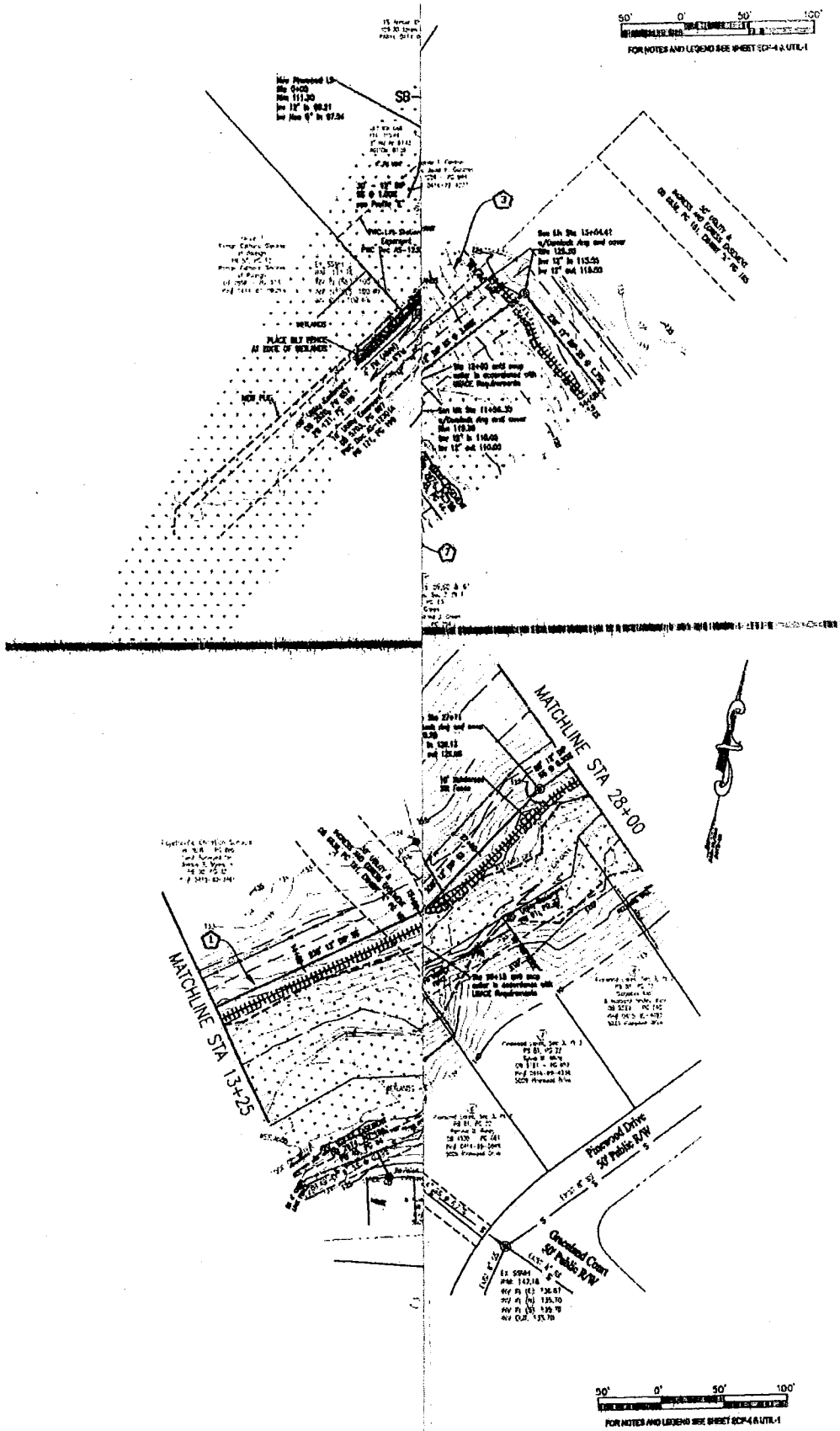
SITE VICINITY MAP

CLIENT: Moorman, Kizer & Reitzel, Inc.		
PROJECT: Legion Road Outfall		
LOCATION: Hope Mills, North Carolina		
F&R PROJECT No: 665-0210		FIGURE No.: 1
DRAWN BY: D. Racey	CHECKED BY: P. Alton, P.E.	
DATE: October 2014	SCALE: As shown	

ION PLAN – FIGURE NO. 2



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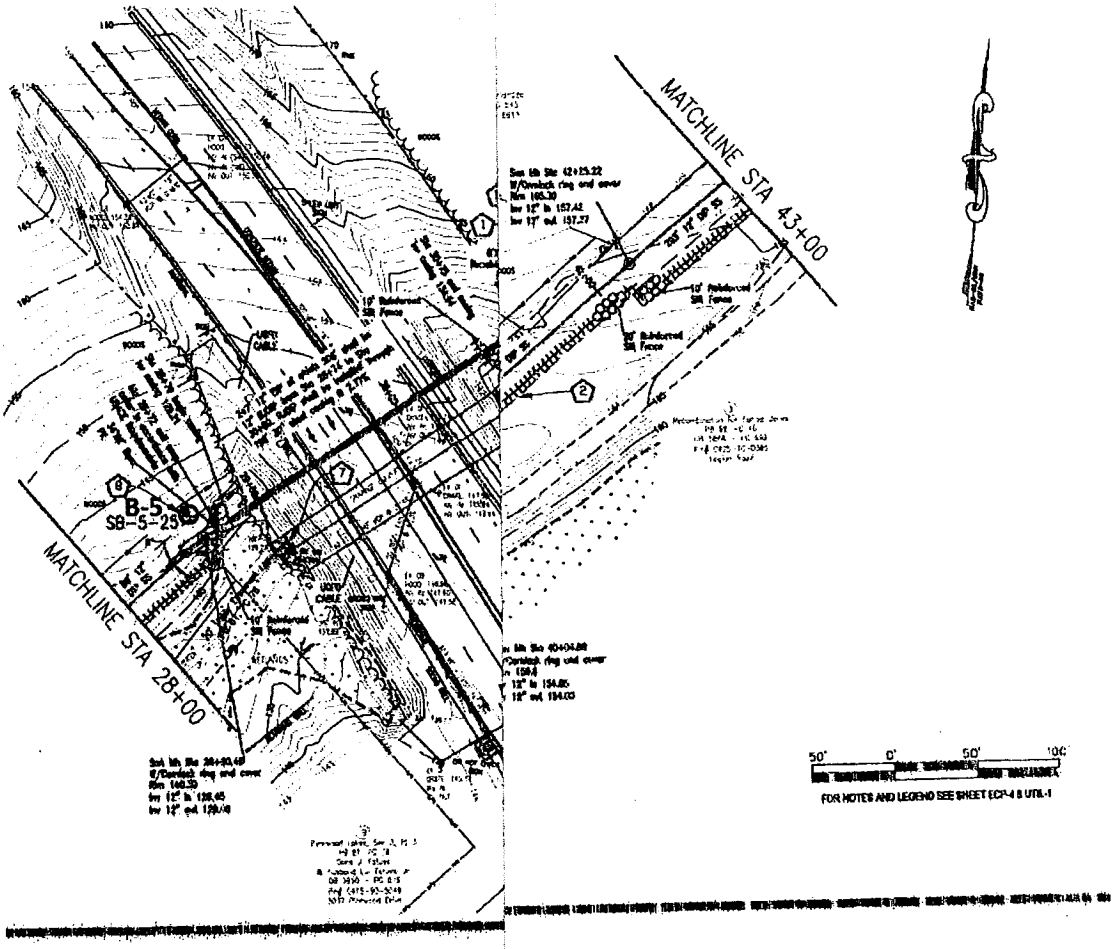

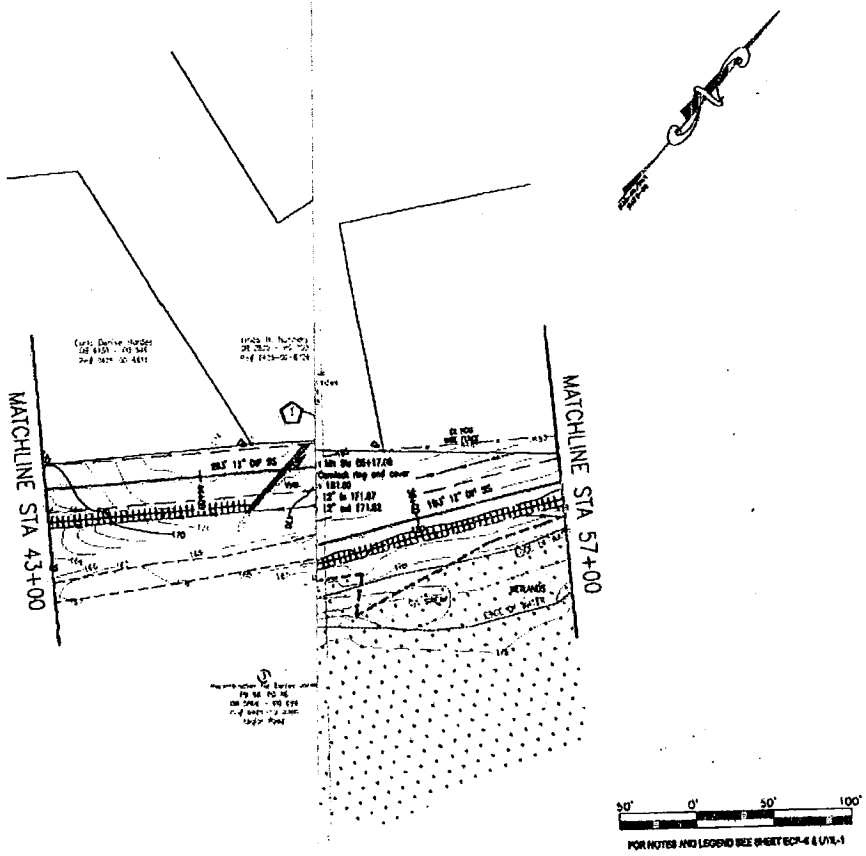

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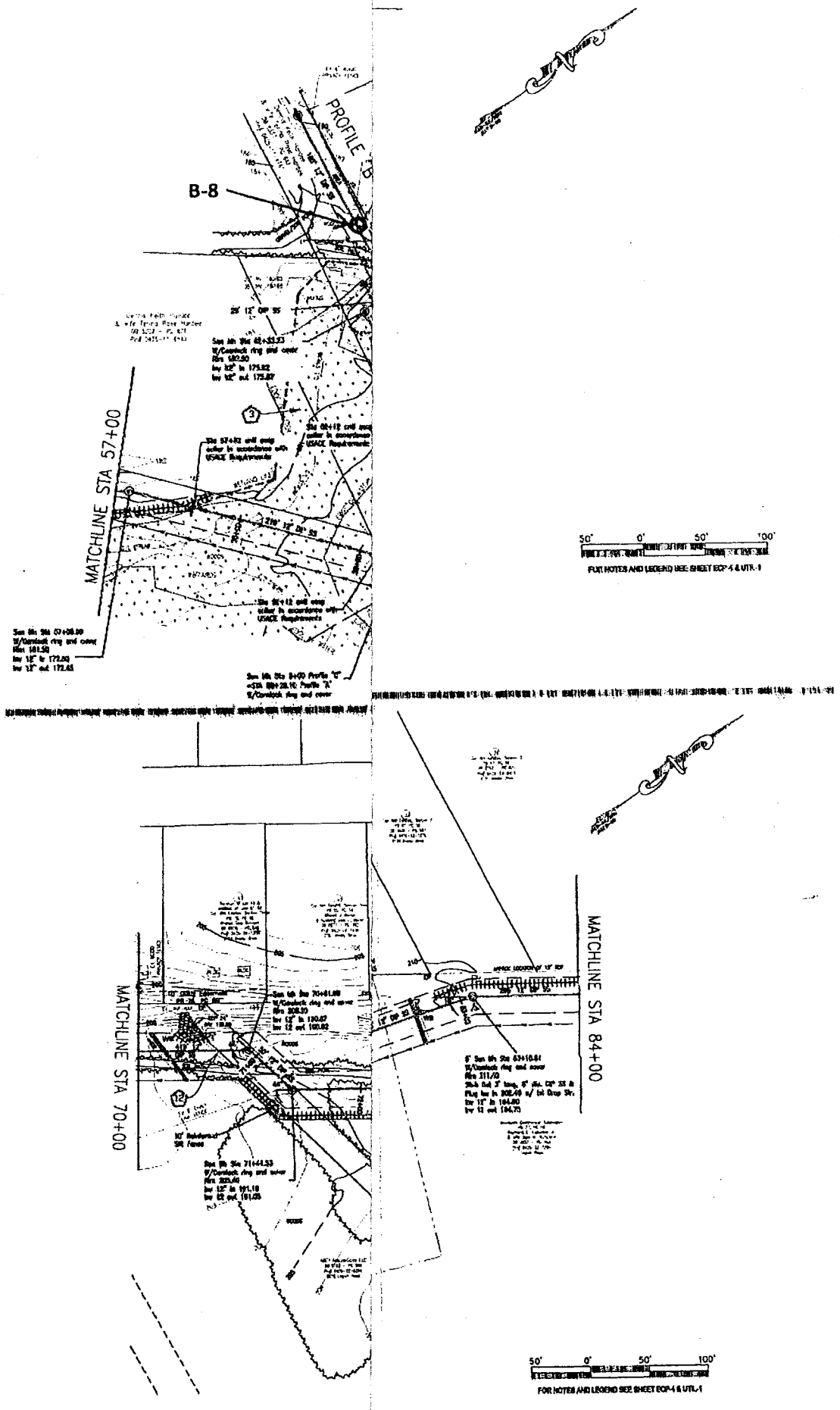

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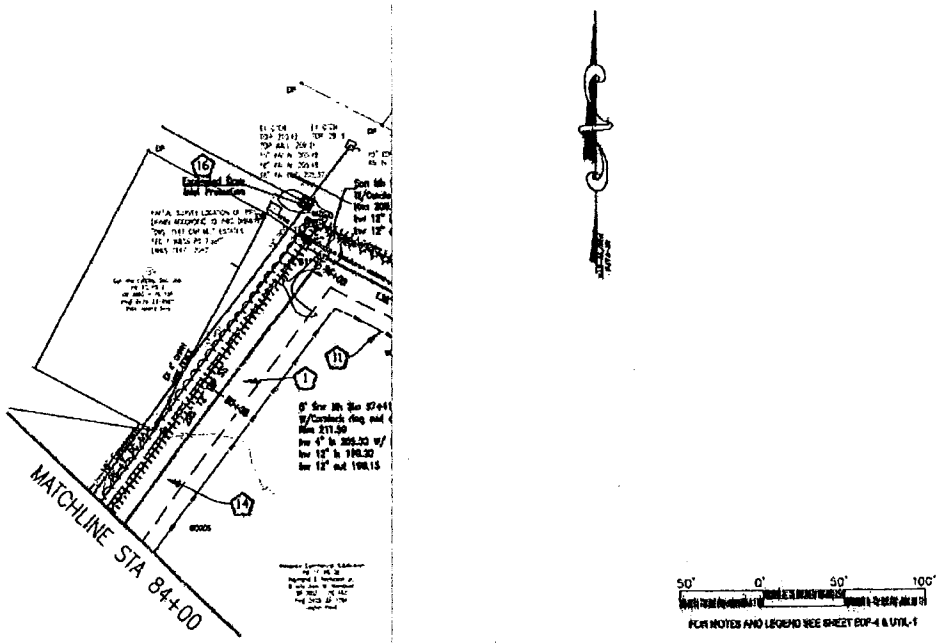

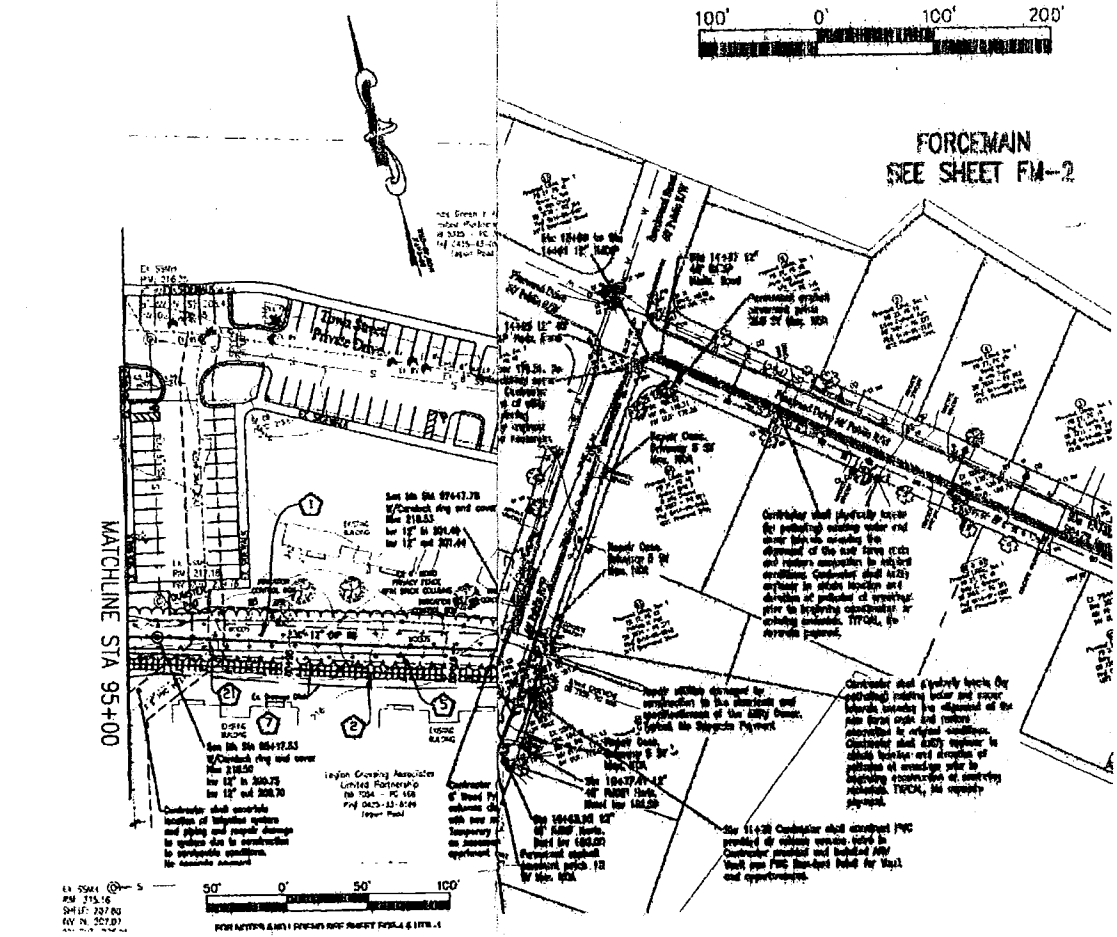

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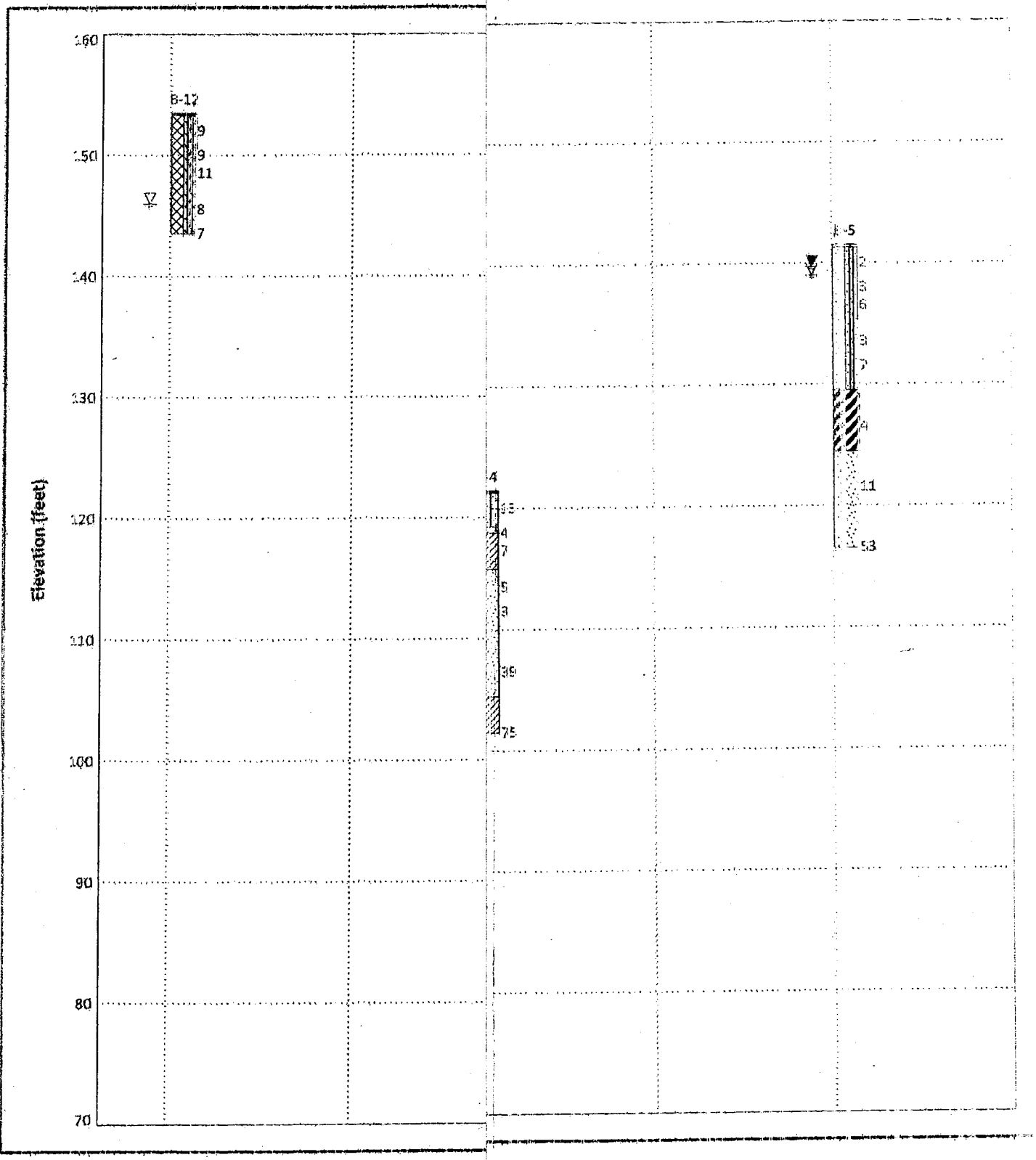
SUBSURFACE PROFILE

Plot Based on Elevation

Profile Name: Figure No. 6

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC



ELEV LANDSCAPE 11X17 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

FROEHLING & ROBERTS

SUBSURFACE PROFILE

Plot Based on Elevation

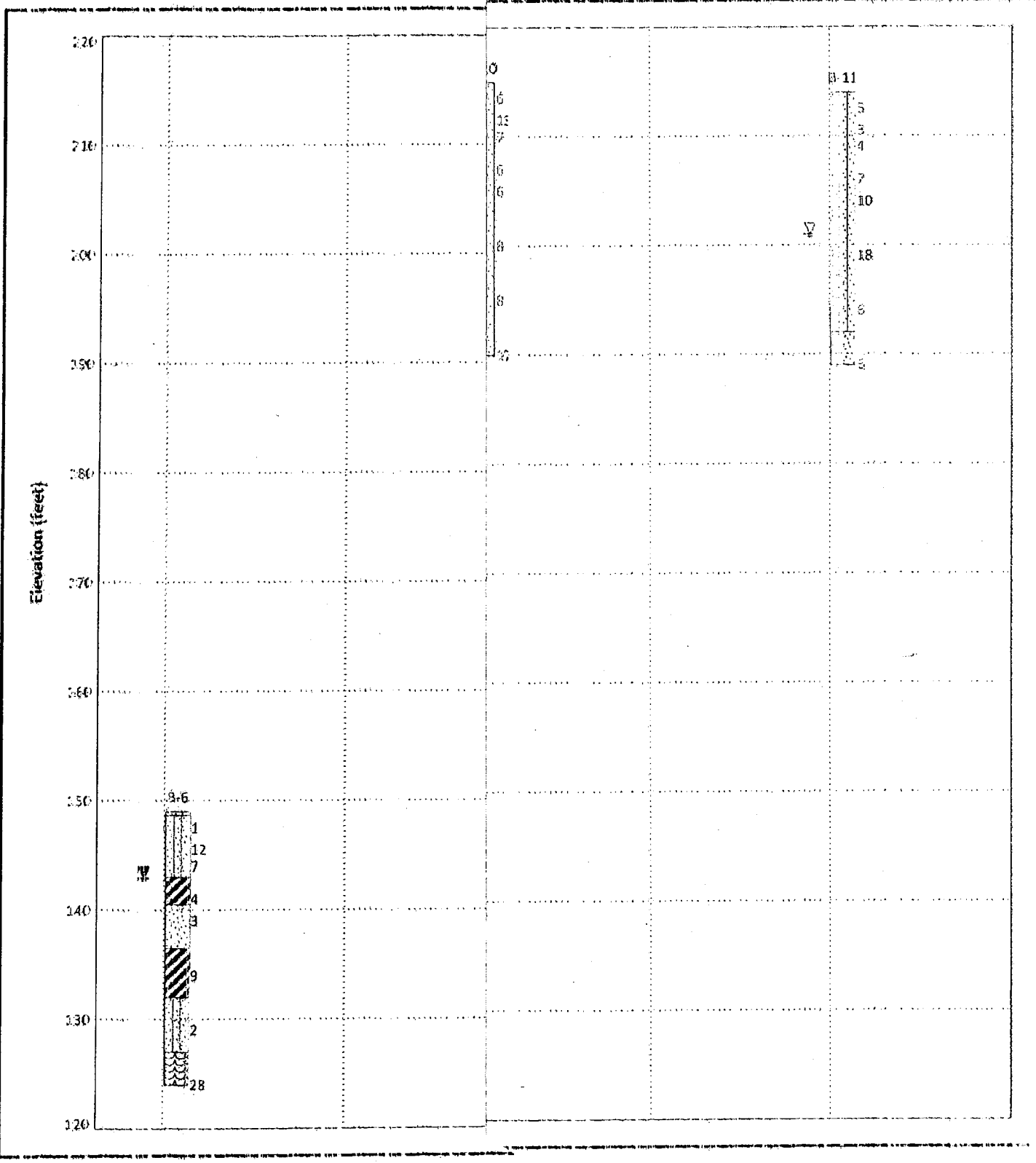
Profile Name: Figure No. 1

Project No: 665-0210

Client: Moorman Kizer & Reitzel, Inc.

Project: Legion Road Outfall

City/State: Hope Mills, NC



ELEV LANDSCAPE 12X17 665-0210 BORING LOGS.GPJ F&R.GDT 10/25/16

APPENDIX II

BORING LOGS

KEY TO SOIL CLASSIFICATION

Correlation of Penetration Resistance with Relative Density and Consistency

Sands and Gravels		Silts and Clays	
No. of Blows, N	Relative Density	No. of Blows, N	Relative Density
0 - 4	Very loose	0 - 2	Very soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium dense	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
Over 50	Very dense	16 - 30	Very stiff
		31 - 50	Hard
		Over 50	Very hard

Particle Size Identification

(Unified Classification System)

Boulders:	Diameter exceeds 12-in. (300-mm)
Cobbles:	3-in. (75-mm) to 12-in. (300-mm) diameter
Gravel:	**Coarse** - ¾-in. (19-mm) to 3 in. (75-mm) diameter **Fine** - No. 4 (4.75-mm) sieve to ¾-in. (19-mm) diameter
Sand:	**Coarse** – No. 10 (2.0-mm) to No. 4 (4.76 mm) sieve **Medium** – No. 40 (0.425-mm) to No. 10 (2.0-mm) sieve **Fine** - No. 200 (0.075-mm) to No. 40 (0.425-mm) sieve
Silt and Clay:	Less than No. 200 (0.075-mm) sieve

Modifiers

The modifiers provide our estimate of the amount of silt, clay or sand size particles in the soil sample

Approximate Content	Modifiers
≤ 5%:	Trace
5% to 12%:	Slightly silty, slightly clayey, slightly sandy
12% to 30%:	Silty, clayey, sandy
30% to 50%:	Very silty, very clayey, very sandy

Field Moisture Description	
Saturated:	Usually liquid; very wet, usually from below the groundwater table
Wet:	Semisolid; requires drying to attain optimum moisture
Moist:	Solid; at or near optimum moisture
Dry:	Requires additional water to attain optimum moisture

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UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISION				TYPICAL NAMES
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve	CLEAN GRAVEL (little or no fines)		GW	Well graded gravels
			GP	Poorly graded gravels
	GRAVELS with fines		GM	Silty gravels
			GC	Clayey gravels
SANDS More than 50% of coarse fraction smaller than No. 4 sieve	CLEAN SAND (little or no fines)		SW	Well graded sands
			SP	Poorly graded sands
	SAND with fines		SM	Silty sands, sand/silt mixtures
			SC	Clayey sands, sand/clay mixtures
SILTS AND CLAYS Liquid Limit is less than 50			ML	Inorganic silts, sandy and clayey silts with slightly plasticity
			CL	Sandy or silty clays of low to medium plasticity
			OL	Organic silts of low plasticity
SILTS AND CLAYS Liquid Limit is greater than 50			MH	Inorganic silts, sandy micaceous or clayey elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils
MISCELLANEOUS MATERIALS				PWR (Partially Weathered Rock)
				Rock
				Asphalt
				ABC Stone
				Concrete
				Surficial Organic Soil

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FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-1 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 108.0 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/25/14
Driller: J. Gilchrist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
107.7	0.3	GRAVEL	5-2-3	0.0	5	GROUNDWATER DATA:
107.0	1.0	ALLUVIAL: Loose, wet, brown & black, silty medium to fine SAND (SM), with trace organics.		1.5		0 Hrs.: 28.0' inside HSA
				2.0		0 Hrs.: Dry inside PVC
			3-4-3		7	24 Hrs.: 2.5' inside PVC
		Firm, saturated, gray & brown, silty medium to fine sandy CLAY (CL), with trace organics, layers of wood from 4.5'-8.0'.	WOH-1-50/5"	3.5		
				4.9	100+	
			12-6-2	6.5		
				8.0	8	
100.0	8.0	Soft, saturated, black, organic SILT (OL).		8.5		
			2-2-1		3	
				10.0		
96.0	12.0	COASTAL PLAIN: Firm to hard, wet, gray, very sandy CLAY (CL), trace gravel.				
			WOH-3-5	13.5		
				15.0	8	
				18.5		
			3-10-15		25	
				20.0		
				23.5		
			23-37-49		86	
				25.0		
				28.5		
			12-21-27		48	
78.0	30.0	Boring Terminated at 30.0 feet.		30.0		

BORING LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-2 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 107.5 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/29/14
Driller: S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
107.1	0.4	SURFICIAL ORGANIC SOILS	1-1-1	0.0	2	GROUNDWATER DATA:
		ALLUVIAL: Very loose, wet, clayey, silty medium to fine SAND (SM), with trace organics.		1.5		0 Hrs.: 5.1' inside HSA
105.5	2.0			2.0		0 Hrs.: 0.0'/cave @ 2.0'
		Very soft, wet to saturated, black, organic SILT (OL) & layers of wood.	WOH-WOH-1		1	Boring backfilled upon completion.
			8-8-4	3.5	12	
				5.0		
			2-1-0	6.5	1	
				8.0		
			1-0-1	8.5	1	
				10.0		
95.5	12.0	COASTAL PLAIN: Soft to stiff, wet, gray, clayey medium to fine SAND (SC).	2-2-1	13.5	3	
				15.0		
			7-6-7	18.5	13	
87.5	20.0	Boring Terminated at 20.0 feet.		20.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

SINCE

FROEHLING & ROBERTSON, INC.

1881

BORING LOG

Boring: B-3 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 121.5 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 10/1/14
Driller: D. Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
121.4	0.1	SURFICIAL ORGANIC SOILS	1-2-5	0.0	7	GROUNDWATER DATA:
		ALLUVIAL: Loose, wet, brown & black, silty medium to fine SAND (SM), slightly organic from 2.0'-3.5'.		1.5		0 Hrs.: 11.5' inside HSA
			2-3-4	2.0		0 Hrs.: 4.0'
					7	Boring backfilled upon completion.
118.0 ▽	3.5	COASTAL PLAIN: Loose, wet, orange-brown, clayey medium to fine SAND (SC).	1-2-4	3.5		
				5.0	6	
115.5	6.0	Medium dense to dense, saturated, orange, slightly silty medium to fine SAND (SP).	5-5-10	6.5		
				8.0	15	
			14-22-25	8.5		
				10.0	47	
109.5	12.0	Very stiff to hard, wet, gray, silty CLAY (CH).	6-7-11	13.5		
				15.0	18	
			10-19-30	18.5		
101.5	20.0	Boring Terminated at 20.0 feet.		20.0	49	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-4 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 121.5 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/26/14
Driller: J. Gilchrist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
121.3	0.2	ASPHALT	4-6-7	0.0		GROUNDWATER DATA:
		ALLUVIAL: Medium dense, wet, brown, silty medium to fine SAND (SM).		1.5	13	0 Hrs.: 11.0' inside HSA
			5-2-2	2.0		0 Hrs.: 8.5'/cave @ 9.0'
118.5	3.0				4	Boring backfilled upon completion.
118.0	3.5	Soft, wet, black, organic CLAY (OH).	2-3-4	3.5		
		Firm, wet, gray, very sandy CLAY (CL), with trace organics.		5.0	7	
115.0	6.5		3-2-3	6.5		
		COASTAL PLAIN: Very loose to dense, saturated, orange & gray, slightly silty SAND (SP), with layer of wood from 6.5'-7.0'.		8.0	5	
			2-1-2	8.5		
				10.0	3	
			12-20-19	13.5		
				15.0	39	
104.5	17.0	Very hard, wet, gray, very sandy CLAY (CL).				
			16-28-47	18.5		
101.5	20.0			20.0	75	
		Boring Terminated at 20.0 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-5 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 141.5 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 10/2/14
Driller: D. Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
141.3	0.2	SURFICIAL ORGANIC SOILS	1-1-1	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very loose to loose, wet to saturated, brown to yellow-tan, medium to fine SAND (SP/SM), with trace organics, slightly silty.		1.5	2	0 Hrs.: 7.4' inside HSA
			1-1-2	2.0		0 Hrs.: 2.5'/cave @ 8.1'
				3.5	3	24 Hrs.: 1.8'/cave @ 2.0'
			2-3-3	5.0	6	
				6.5		
			3-2-1	8.0	3	
			2-2-5	8.5		
				10.0	7	
129.5	12.0	Soft, wet, brown-gray, silty CLAY (CH).				
			3-2-2	13.5		
				15.0	4	
124.5	17.0	Medium dense to very dense, saturated to wet, orange to purple-brown, slightly silty medium to fine SAND (SP).				
			2-5-6	18.5		
				20.0	11	
			8-16-37	23.5		
116.5	25.0	Boring Terminated at 25.0 feet.		25.0	53	

BORING_LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-6 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 149.0 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 10/2/14
Driller: S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
148.7	0.3	SURFICIAL ORGANIC SOILS	WOH-WOH-1	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very loose to medium dense, moist, brown to orange-brown, silty medium to fine SAND (SM), with trace organics.		1.5	1	0 Hrs.: 11.1' inside HSA
			5-6-6	2.0		0 Hrs.: 6.1'/cave @ 7.3'
				3.5	12	24 Hrs.: 6.0'/cave @ 8.2'
			6-4-3	5.0	7	
143.0 ▼	6.0	Soft, wet, gray, silty CLAY (CH).		6.5		
			2-2-2	8.0	4	
140.5	8.5	Very loose, saturated, tan-gray, slightly silty medium to fine SAND (SP).	3-2-1	8.5		
				10.0	3	
136.5	12.5	Stiff, wet, dark gray, medium to fine sandy, silty CLAY (CH).	2-4-5	13.5		
				15.0	9	
132.0	17.0	Very loose, saturated, gray, silty fine SAND (SM), with trace mica.	1-1-1	18.5		
				20.0	2	
127.0	22.0	Very stiff, wet, black, organic CLAY (OH).	7-11-17	23.5		
				25.0	28	
124.0	25.0	Boring Terminated at 25.0 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-7 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 168.0 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/26/14
Driller: J. Gilchrist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
167.6	0.4	SURFICIAL ORGANIC SOILS	1-3-3	0.0	6	GROUNDWATER DATA:
		COASTAL PLAIN: Very loose to loose, moist to wet, brown & black, silty medium to fine SAND (SM), with trace organics.		1.5		0 Hrs.: 8.0' inside HSA
			1-2-2	2.0	4	0 Hrs.: Dry/cave @ 3.5'
		Wet at 3.5'	3-2-2	3.5	4	24 Hrs.: Dry/cave @ 1.0'
				5.0		
162.0	6.0	Medium dense, wet, brown-orange, clayey medium to fine SAND (SC).	5-5-6	6.5	11	
				8.0		
159.5	8.5	Very loose, saturated, orange, fine to medium SAND (SP).	2-1-1	8.5	2	
				10.0		
156.0	12.0	Firm, wet, maroon, silty CLAY (CH).				
			2-2-4	13.5	6	
				15.0		
151.0	17.0	Loose, saturated, purple-tan, clayey medium to fine SAND (SC).				
			2-3-4	18.5	7	
148.0	20.0	Boring Terminated at 20.0 feet.		20.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-8 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 185.5 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/26/14
Driller: J. Gilchrist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		COASTAL PLAIN: Loose to medium dense, moist to saturated, brown, gray & orange, silty medium to fine SAND (SM), trace organics 0-3.5', wet at 3.5', saturated at 6.5'.	3-4-4	0.0	8	GROUNDWATER DATA: 0 Hrs.: 3.5' inside HSA 0 Hrs.: 4.0'/cave @ 4.5' 24 Hrs.: Dry/cave @ 2.8'
				1.5		
			8-10-9	2.0	19	
				3.5		
			3-5-3		8	
				5.0		
				6.5		
			7-10-15		25	
				8.0		
				8.5		
			8-10-10		20	
				10.0		
				13.5		
			4-3-3		6	
				15.0		
168.5	17.0	Stiff, wet, dark gray, silty CLAY (CH).				
				18.5		
			3-4-5		9	
165.5	20.0	Boring Terminated at 20.0 feet.		20.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG_66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-9 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 215.0 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/26/14
Driller: J. Gilchrist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		COASTAL PLAIN: Loose to medium dense, moist to saturated, silty medium to fine SAND (SM), with trace organics from 0.0'-1.5' & 8.5'-10.0', trace gravel from 0.0'-1.5', wet at 8.5', saturated at 18.5'.	6-3-3	0.0	6	GROUNDWATER DATA: 0 Hrs.: 17.0' inside HSA 0 Hrs.: Dry/cave @ 16.5' 24 Hrs.: Dry/cave @ 18.0'
				1.5		
			3-4-4	2.0	8	
			4-3-3	3.5	6	
				5.0		
			3-4-5	6.5	9	
				8.0		
			3-4-4	8.5	8	
				10.0		
			7-9-12	13.5	21	
				15.0		
			3-3-4	18.5	7	
195.0	20.0	Boring Terminated at 20.0 feet.		20.0		

BORING_LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-10 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 215.0 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/25/14
Driller: J. Gilchrist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		COASTAL PLAIN: Loose to medium dense, moist to wet, brown, orange & gray, medium to fine SAND (SP/SM), with trace organics from 0.0-5.0', wet at 3.5', slightly silty.	1-3-3	0.0	6	GROUNDWATER DATA: 0 Hrs.: 13.0' inside HSA 0 Hrs.: 13.0'/cave @ 19.0' 24 Hrs.: 13.0'/cave @ 14.5'
				1.5		
			5-7-6	2.0	13	
			3-4-3	3.5	7	
				5.0		
			3-3-3	6.5	6	
				8.0		
			3-3-3	8.5	6	
				10.0		
			4-5-3	13.5	8	
				15.0		
			3-3-5	18.5	8	
				20.0		
			7-8-9	23.5	17	
190.0	25.0	Boring Terminated at 25.0 feet.		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-11 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 214.0 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/25/14
Driller: J. Gilchrist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		COASTAL PLAIN: Very loose to medium dense, moist to wet, brown & tan, silty medium to fine SAND (SM), with trace organics from 0.0'-5.0', wet at 3.5'.	1-2-3	0.0	5	GROUNDWATER DATA: 0 Hrs.: 14.0' inside HSA 0 Hrs.: 13.0'/cave @ 14.5' 24 Hrs.: Dry/cave @ 9.0'
				1.5		
			1-1-2	2.0	3	
			2-2-2	3.5	4	
				5.0		
			3-3-4	6.5	7	
				8.0		
			4-4-6	8.5	10	
				10.0		
			4-9-9	13.5	18	
				15.0		
			2-2-4	18.5	6	
				20.0		
192.0	22.0	Loose, saturated, light gray, medium to fine SAND (SP).	WOH-2-4	23.5	6	
189.0	25.0	Boring Terminated at 25.0 feet.		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 66S-0210 BORING LOGS.GPJ F&R.GDT 10/15/14

SINCE 1881

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-12 (1 of 1)

Project No: 66S-0210
Client: Moorman, Kizer & Reitzel, Inc.
Project: Legion Road Outfall
City/State: Hope Mills, NC

Elevation: 153.5 ±
Total Depth: 10.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/25/14
Driller: J. Gilchrist

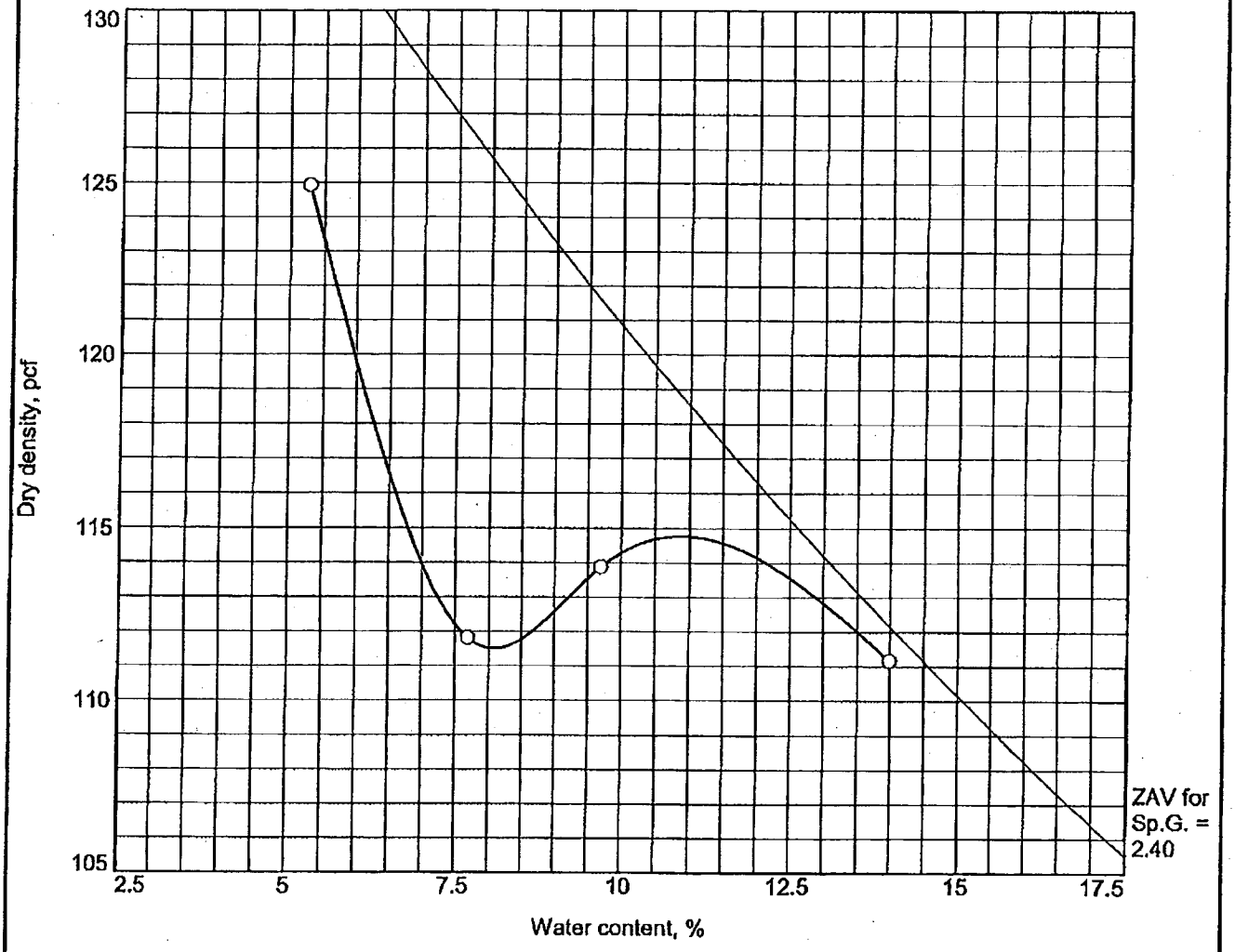
Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
153.3	0.2	ASPHALT	3-4-5	0.0	9	GROUNDWATER DATA:
		POSSIBLE FILL: Loose to medium dense, wet, brown to orange-brown & gray, silty coarse to fine SAND (SM), with thin clay layers & trace gravel.		1.5		0 Hrs.: Dry inside HSA
			5-4-5	2.0	9	0 Hrs.: 7.5'
				3.5		Boring backfilled upon completion.
			5-5-6	5.0	11	
				6.5		
			3-3-5	8.0	8	
				8.5		
			4-3-4		7	
143.5	10.0	Boring Terminated at 10.0 feet.		10.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

APPENDIX III

LABORATORY TEST RESULTS

MOISTURE DENSITY RELATIONSHIP For Curve No. 118791



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0-10	SP-SM		22	2.4	0	NP	0	10

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 124.9 pcf Optimum moisture = 5.3 %	Tan Silty Sand

Project No. 66S0210 Client: Moorman, Kizer, & Reitzel, Inc.
Project: Legion Road Sewer
Date: 10/8/14
○ Location: B-5, Sample Number: 118791

Remarks:

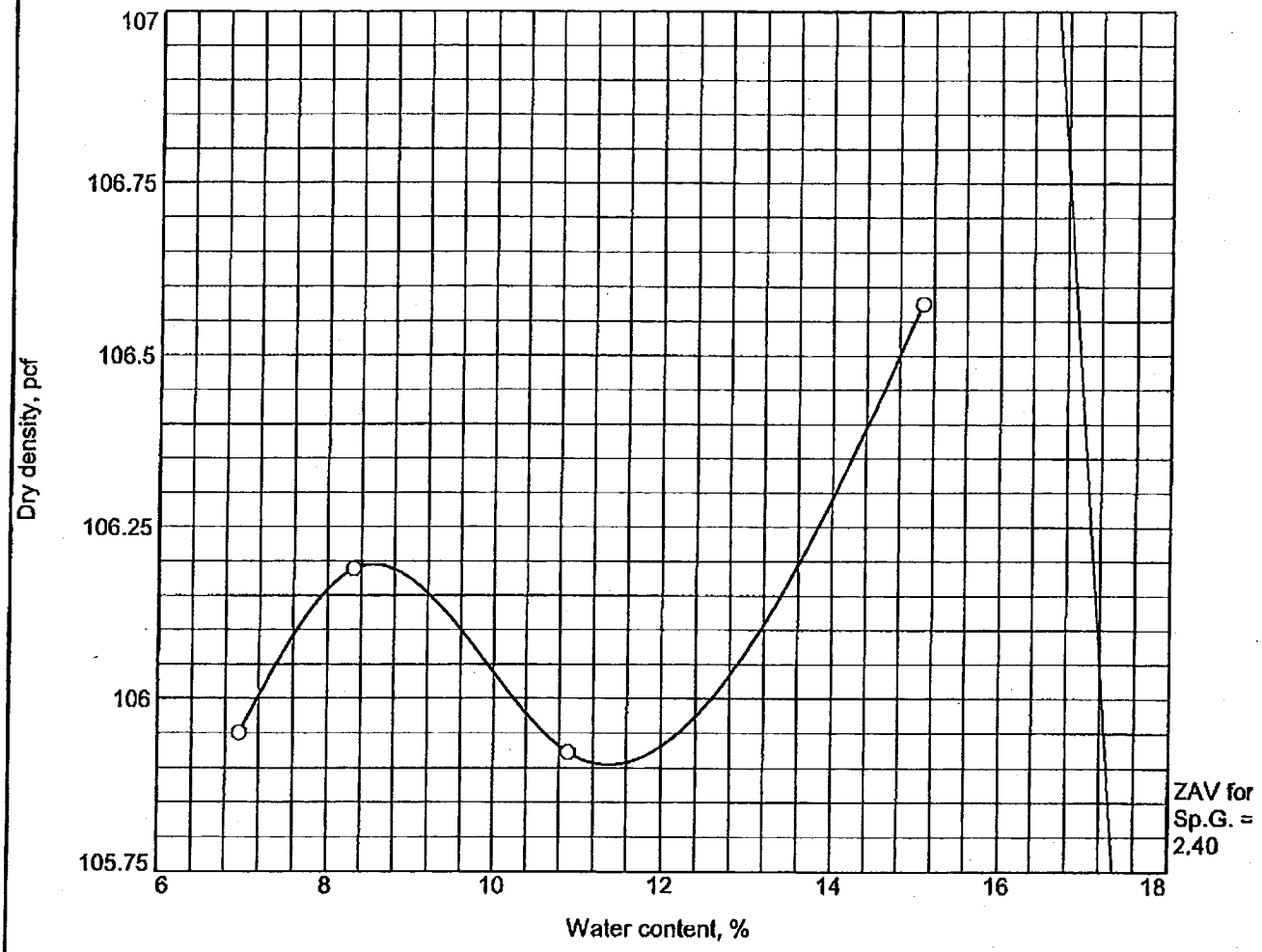
Sp. gr. for ZAV is an assumed value.

FROEHLING & ROBERTSON, INC.

Figure 1

Tested By: A Boltz Checked By: N Magnum

MOISTURE DENSITY RELATIONSHIP For Curve No. 118792



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.5-12	SP-SM		8	2.4	-	NP	0	8

Sp. gr. for ZAV is an assumed value.

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 106.6 pcf Optimum moisture = 15.1 %	Tan Brown Silty Sand

Project No. 66S0210 **Client:** Moorman, Kizer, & Reitzel, Inc.
Project: Legion Road Sewer
Date: 10/6/14
○ **Location:** B10 **Sample Number:** 118792

Remarks:

FROEHLING & ROBERTSON, INC.

Figure 2

Tested By: N Magnum

APPENDIX IV

ASFE DOCUMENT

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/The Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

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